



**Milne Inlet Freshwater
Fish Health Program
2024 Report**

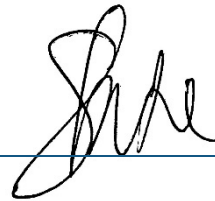
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Milne Inlet Freshwater Fish Health 2024 Program

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EXECUTIVE SUMMARY

The Mary River Project, owned and operated by Baffinland Iron Mines Corporation (Baffinland), is a high-grade iron ore mining operation located in the Qikiqtani Region of northern Baffin Island, Nunavut. Open pit mining, including pit bench development, ore haulage and stockpiling, and the crushing and screening of high-grade iron ore, commenced at the Mary River Project in mid-September 2014. During early years of mine operation (i.e., 2015 to 2017), the Project produced and transported up to 4.2 million tonnes per annum (Mtpa) of crushed and screened iron ore. Production increased between 2018 and 2024, during which time the Project was permitted to produce and transport up to 6 Mtpa to Milne Port. A proposal was made to double production to 12 Mt per year as part of the Phase II expansion, the review process for which involved extensive consultation with neighboring communities including Mittimatalik (Pond Inlet). During discussions with the community of Pond Inlet, the overall health of arctic charr (*Salvelinus alpinus*) within the freshwater environment was raised, as charr are culturally and nutritionally significant to Inuit. From these discussions, a requirement was included in the Baffinland Iron Mines Corporation Project Certificate (i.e., Condition 48(a)) that stipulated a plan be developed to evaluate the health of arctic charr in Milne Inlet as part of the Milne Inlet Freshwater Fish Health Monitoring Program (the Program). The project has since reverted back to the original Early Revenue Phase permitted amount of 4.2 Mtpa.

This report and its findings, in concert with its appended components including documentation of consultation and partnership with the Mittimatalik Hunters and Trappers Organization (MHTO), and all monitoring data pertaining to the presence and health of arctic charr in lakes within the watershed proximal to the mine, tote road, and Milne Inlet Port project development areas, satisfies Condition 48(a) of the Project Certificate. It was designed in coordination with the community to monitor the health of arctic charr populations proximate to Baffinland's Milne-Port Operations. Field sampling in 2024 represented the third year of data collection for the program, with sampling also completed in 2021 and 2022 by Minnow Environmental Inc. (Minnow) in collaboration with community members from the MHTO, the Qikiqtani Inuit Association (QIA), and the Hamlet of Pond Inlet. Qurluktuk and Ikaluit lakes were sampled in 2024; however, due to weather constraints, sampling was not conducted at Tugaat Lake (previously sampled in 2021 and 2022).

Water collected from the littoral zones of both study lakes during August 2024 indicated that concentrations of all assessed analytes were below Canadian Water Quality Guidelines for the Protection of Aquatic Life. Aqueous total mercury was below detection limits (<0.000026 mg/L) in both lakes. Based on water chemistry, each lake is classified as oligotrophic, which is common for Arctic lakes.



Arctic charr were caught by gillnetting from the two study lakes in 2024. Consistent with previous years, arctic charr was the only fish species captured in both Qurluktuk Lake ($n = 39$) and Ikaluit Lake ($n = 37$). Despite Qurluktuk Lake having a slightly higher total catch, catch-per-unit-effort (CPUE) was greater in Ikaluit Lake (11.4 fish/100 metre/hour [m·hr], compared to 0.74 fish/100 m·hr). CPUE in Ikaluit Lake was higher and CPUE in Qurluktuk Lake was lower in 2024 compared to 2022 (i.e., 1.00 fish/100 m·hr and 4.53 fish/100 m·hr, respectively), likely attributable to factors such as weather, net set locations, time of day of sampling, and annual climate variability.

In 2021 and 2022, the life history strategy of captured arctic charr was assumed based on growth patterns (i.e., resident fish were older-at-size indicating slower growth). To expand on the assessment of life history strategy in 2024, otolith microchemistry was completed on 20 arctic charr from Qurluktuk Lake using laser ablation. Of the otoliths analyzed, 19 individuals displayed an anadromous life history strategy (i.e., migration to the marine environment at least once), while only one individual exhibited a resident life history (i.e., no evidence of marine migration). Age-at-first marine migration among anadromous individuals ranged from three to 14 years, with an average age of nine years. The number of resident individuals captured from Qurluktuk Lake was lower in 2024 than in 2022 (i.e., one vs. six), assuming residents were accurately identified using growth patterns in 2022.

In 2024, Inuit team members had to depart prior to the processing of all fish. Minnow biologists applied Inuit Qaujimagatuqangit (IQ), as shared by experienced hunters and trappers to classify fish life history strategy by visual assessments to compare with otolith microchemistry results. Through visual assessment, 12 out of 20 fish were identified as residents, however, none of these matched the resident individual identified by otolith microchemistry analysis. Inaccuracy in classification by visual assessments was considered to be influenced by the absence of Inuit collaborators to support incorporation of IQ into visual assessments during fish processing, in addition to handling effects on fish prior to assessment (e.g., phenotypic changes due to freezing and thawing).

Life history strategy classifications were determined from the otolith microchemistry for fish classification in subsequent analyses. The single resident fish identified in Qurluktuk Lake was not included in the health analyses in 2024 since the sex was undetermined; however, it was included in the tissue analysis.

Female arctic charr from Qurluktuk Lake were older, longer, and heavier than those sampled from Ikaluit Lake in 2024. The single male fish sampled from Qurluktuk Lake, was within the range of age, body weight, and length of male fish sampled from Ikaluit Lake in 2024.



Growth (i.e., length-at-age) of female arctic charr was higher in Qurluktuk Lake than Ikaluit Lake in 2024, which is inconsistent with results from 2022 where a larger proportion of individuals in Qurluktuk Lake exhibited a resident life history in 2022 (i.e., six suspected residents in 2022 versus one in 2024). Energy storage endpoints were assessed in 2024, where relative liver weight was significantly lower in female Qurluktuk Lake charr compared to Ikaluit Lake but there was no significant difference in body condition (i.e., weight-at-length). Weight-at-age and relative gonad weight, were both significantly greater in females from Qurluktuk Lake than Ikaluit Lake in 2024. Female arctic charr from Qurluktuk Lake expended more energy on reproductive tissues (i.e., higher relative gonad weight), diverting it from storage in the liver (i.e., lower relative liver weight).

Temporal trends in health endpoints in Qurluktuk Lake were compared across the three post-mining sampling years and pre-mining literature data. While some metrics such as length and body condition were higher in recent years, confounding factors, particularly the varying ratios of anadromous to resident individuals, limit definitive conclusions. Data from Ikaluit Lake (2022 to 2024) showed no significant differences in female health indicators and only a minor difference in male body condition, suggesting stable conditions.

Mercury concentrations in fish muscle and liver tissue from both lakes were generally below Health Canada consumption guidelines (i.e., 0.5 mg/kg ww), with only one liver sample, from the resident individual, from Qurluktuk Lake exceeding the limit. Fewer mercury guideline exceedances were observed in fish tissues from Qurluktuk Lake in 2024 than in previous years, where there were several muscle and liver samples above the guideline, all from fish that were assumed to demonstrate resident life histories. These findings are consistent with the literature about the influence of life history on mercury concentrations in arctic charr, which indicates that anadromous individuals are typically faster growing than their resident counterparts, and consequently have lower tissue mercury concentrations (i.e., growth dilution). As in 2022, mean mercury concentrations were higher in the tissues of Qurluktuk fish than Ikaluit fish. Iron naturally occurs in fish tissues and the concentrations in fish tissues from both lakes were within safe dietary limits and consistent with the nutritional information provided by Health Canada, such that consumption of several kilograms of fish would be required to exceed the Health Canada recommendation of a daily upper limit of iron intake of 45 mg/day (2023). Arsenic (in its non-toxic arsenobetaine form), cadmium, copper, and selenium exceeded Health Canada benchmarks in some tissue samples, but reflect natural conditions in the study lakes and are considered a product of the local geochemistry and fish physiology.

The 2024 Program built on previous years' efforts to evaluate the health of arctic charr populations in lakes near Baffinland's Milne Port Operations. Overall, findings suggest that charr populations



are healthy, with fish health endpoints generally within expected natural ranges compared to historical data and contaminant concentrations in fish tissues below Health Canada guidelines. Observed variations between lakes and over time are likely attributable to natural ecological differences, including differences in life history strategies. This study fulfills Condition 48(a) of the Project Certificate and reflects meaningful collaboration with community partners, including the MHTO. The findings of the 2024 Milne Inlet Freshwater Fish Health Monitoring Program in concert with results from previous years, indicate that fish health, tissue contaminants, and water quality remain stable and within previously observed ranges, with no consistent patterns of change pre or post-mining.

Given the lack of consistent patterns and the slow-growing nature of arctic charr, if future sampling is conducted it would fall on a triennial basis rather than annually. This frequency would maintain effective long-term monitoring while reducing the intensity of field efforts and unnecessary harvesting and is in alignment with Federal Environmental Effects Monitoring timelines. Results from the Milne Inlet Freshwater Fish Health Program will be presented to determine a path forward for potential future monitoring in alignment with the perspectives of the MHTO and Baffinland.



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ACRONYMS AND ABBREVIATIONS

ALS – ALS Environmental
ANCOVA – Analysis of Covariance
ANOVA – Analysis of Variance
Baffinland – Baffinland Iron Mines Corporation
BCWQG – British Columbia Water Quality Guidelines
BIM – Baffinland Iron Mines
CCME – Canadian Council of Ministers of the Environment
COC – Chain-of-Custody
CPUE – Catch-per-Unit-Effort
CRC ICPMS – Collision/Reaction Cell Inductively Coupled Plasma Mass Spectrometry
CVAAS – Cold Vapour-Atomic Absorption Spectroscopy
CWQG – Canadian Water Quality Guidelines
DFO – Fisheries and Oceans Canada
DOC – Dissolved Organic Carbon
DQO – Data Quality Objectives
DQR – Data Quality Review
EEM – Environmental Effects Monitoring
GPS – Global Positioning System
hr – Hour
IKLL – Ikaluit Lake
IQ – Inuit Qaujimajatuqangit
JHA – Job Hazard Analysis
LA-ICP – Laser Ablation Inductively Coupled Plasma Mass Spectrometry
LRL – Laboratory Reporting Limit
m – metre
MCT – Measures of Central Tendency
MDD – Minimum Detectable Difference
MHTO – Mittimatalik Hunters and Trappers Organization
Minnow – Minnow Environmental Inc.
MOD – Magnitude of Difference
Mtpa – Million Tonnes per Annum
M-W – Mann-Whitney
NIST – National Institute of Standards and Technology
The Program – The Milne Inlet Freshwater Fish Health Program



QIA – Qikiqtani Inuit Association

TDS – Total Dissolved Solids

TKN – Total Kjeldahl Nitrogen

TOC – Total Organic Carbon

TSS – Total Suspended Solids

QA/QC – Quality Assurance / Quality Control

QURL – Qurluktuk Lake

UTM – Universal Transverse Mercator

WQG – Water Quality Guidelines



1 INTRODUCTION

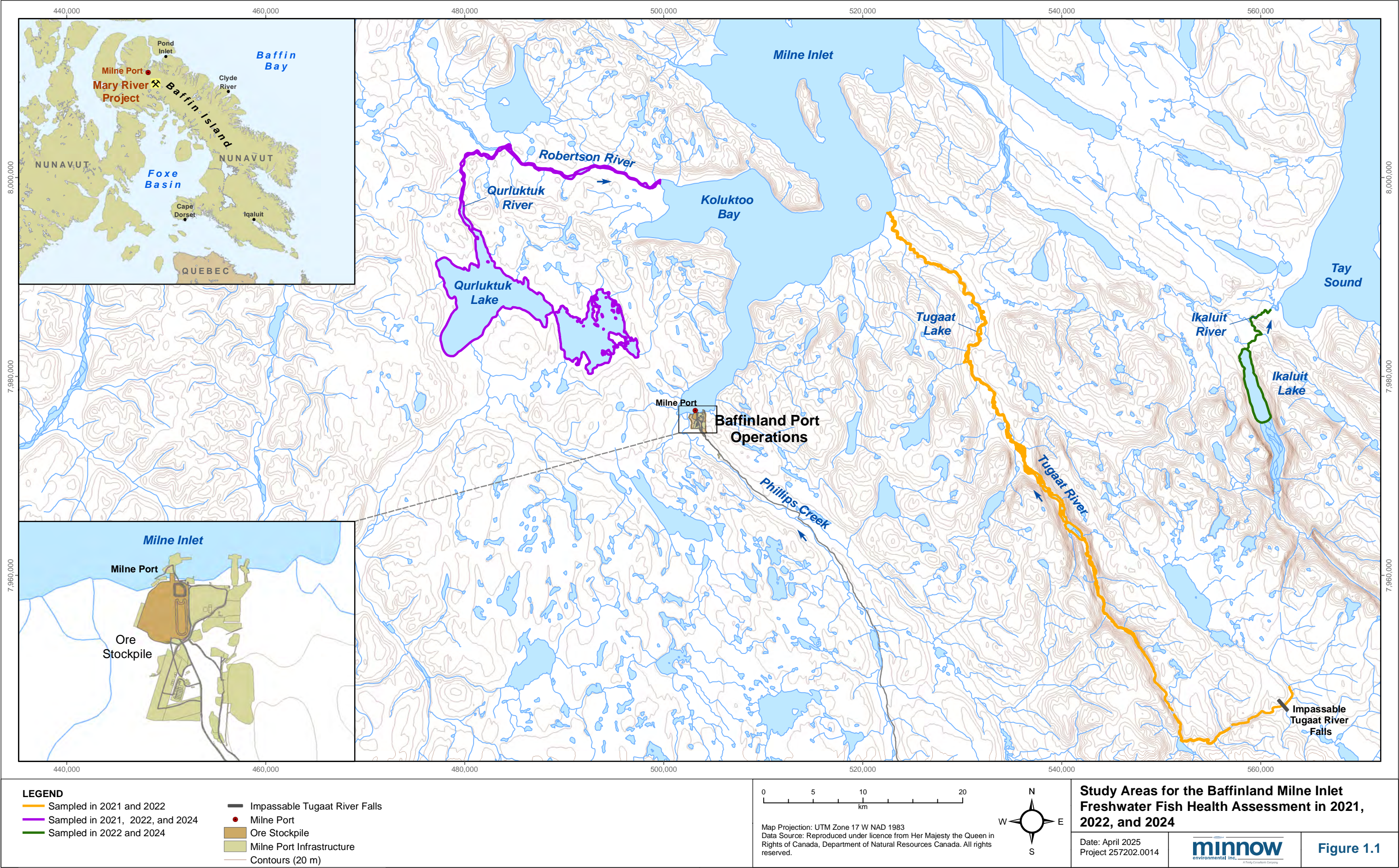
1.1 Project Background

The Mary River Project, owned and operated by Baffinland Iron Mines Corporation (Baffinland), is a high-grade iron ore mining operation located in the Qikiqtani Region of northern Baffin Island, Nunavut (Figure 1.1). Open pit mining, including pit bench development, ore haulage and stockpiling, and the crushing and screening of high-grade iron ore, commenced at the Mary River Project in mid-September 2014. Crushed and screened ore is transported by truck to Milne Port, which is located approximately 100 kilometres (km) north of the mine site. At Milne Port, the ore is stockpiled before being loaded onto bulk carrier ships for transport to international markets during the summer ice-free period. No milling or additional ore processing is conducted on-site, and thus no tailings are produced at the Mary River Project. All waste rock generated at the Project is deposited at a waste rock stockpile facility at the mine site. During early years of mine operation (i.e., 2015 to 2017), the Project produced and transported up to 4.2 million tonnes per annum (Mtpa) of crushed and screened iron ore. Production increased between 2018 and 2024, during which time the Project was permitted to produce and transport up to 6 Mtpa to Milne Port.

In 2018, a proposal was made to double production to 12 Mt per year as part of the Phase II expansion, the review process for which involved extensive consultation with neighboring communities including Mittimatalik (Pond Inlet). This proposal was denied in November 2022 by the Federal Minister; however, engagement associated with this process continued with the local communities and hunters and trappers. Part of the original expansion review process involved extensive consultation with neighboring communities, including Mittimatalik (Pond Inlet). During discussions with the community of Pond Inlet (Appendix A), the overall health of arctic charr (*Salvelinus alpinus*) within the freshwater environment proximal to Milne Port was raised as a concern, as charr are culturally and nutritionally significant to Inuit. From these discussions a requirement of Baffinland Iron Mines Corporation (Baffinland) was added to the Project Certificate, which stipulated a plan be developed for a Milne Inlet Freshwater Fish Health Program.

The Milne Inlet Freshwater Fish Health Program (the Program) serves to satisfy Term and Condition 48(a) of the Project Certificate for the Baffinland Mary River Project. Condition 48(a) of the Project Certificate stipulates that “the Proponent shall develop plans to conduct additional surveys for the presence of arctic charr in freshwater bodies and ongoing monitoring of arctic charr health where applicable, within watersheds proximal to the mine, tote road, and Milne Inlet Port project development areas, including but not limited to Phillips Creek,





Tugaat Lake and Qurluktuk Lake. The Proponent shall consult with the Mittimatalik Hunters and Trappers Organization (MHTO) regarding the design, timing, and location of the proposed surveys and ongoing monitoring.”



1.2 Monitoring Background

1.2.1 Arctic Charr

Arctic charr (Photo 1.1) are culturally and nutritionally significant to Inuit, and are widely distributed across the Arctic, occupying the most northerly range of any freshwater fish species (Scott and Crossman 1973). Arctic charr can exhibit one of three life history strategies: landlocked, resident, and migratory/anadromous (Power 2008). Landlocked charr inhabit in lakes where there is no access to the marine environment. In contrast, resident charr have access to the marine environment but choose not to migrate, while anadromous (i.e., searun, migratory) have access to the marine environment and undertake seasonal migrations during the open water period. All lakes included in the Program have access to the marine environment. For the purposes of this report a 'resident' charr refers to an individual that has never migrated to the marine environment, while an 'anadromous' charr refers to an individual that has migrated at least once¹. They are elongate members of the *Salmonidae* family, with an average length between 381 and 457 mm (Scott and Crossman 1973). There is substantial variability in arctic charr colour, ranging from silver to a vibrant orange, especially during spawning. Charr typically spawn in September or October, coinciding with the return of anadromous individuals to the freshwater environment. Spawning occurs in freshwater, over gravel or on rocky shoals in lakes or in deep river pools. Male fish establish and guard territories, while females prepare the nest. Typically, anadromous females produce between 3,000 and 5,000 eggs and spawn every two to three years (see Roux et al. 2011).

1.2.2 Program Development

Following the requirements of Condition 48(a) in the Project Certificate, Baffinland initiated the Program in January 2021. A proposed study design was developed to assess the health of arctic charr in lakes near Milne Inlet that were identified as significant by the community (i.e., Tugaat and Qurluktuk lakes; Figure 1.1; Appendix A). This design was presented for feedback during the first community engagement meeting of the program on February 18, 2021 (Appendix A). The meeting was held virtually between Baffinland, Minnow Environmental Inc. (Minnow), and the MHTO (Appendix A). The goal of that meeting was to gather comments specifically on study objectives, sampling locations, and design. The primary outcomes from this meeting included:

- the addition of Ikaluit Lake to the program (Figure 1.1);

¹ Arctic charr life history is plastic; individuals may exhibit a resident life history for many years and then shift to a migratory life history.





Photo 1.1: Arctic Charr (*Salvelinus alpinus*), sampled from Tugaat Lake North Baffin Island, 2021

- the expression of interest in the mercury and iron concentrations in charr tissue from study lakes from a consumption/human health perspective; and
- the refinement of the proposed program objectives and study design.

Although mercury is not a contaminant associated with mining, hauling, shipping, or dust generation from the mine, it is a global pollutant which comes to the Arctic through long range air transport. Mercury bio accumulates through the food web and so has been identified as a contaminant of concern in the Arctic. Following conversations with the MHTO the study approach was established such that the Tugaat River (Tugaat Lake; Figure 1.1, Photo 1.2), the Ikaluit River (Ikaluit Lake; Figure 1.1, Photo 1.3), and the Robertson River (Qurluktuk Lake; Figure 1.1, Photo 1.4) would be sampled to assess arctic charr health.

1.2.3 Study Areas

Tugaat Lake (surface area = 0.33 km²; Figure 1.1) represents a widening of the Tugaat River which flows into Milne Inlet approximately 120 km southwest of the community of Pond Inlet and provides critical overwintering habitat for the Tugaat River population of arctic charr. A waterfall upstream of Tugaat Lake (Figure 1.1) acts as a migration barrier to/from the larger lakes present upstream in the watershed (DFO 2004). A mark-recapture study undertaken in 1980 indicated that the population was being over-exploited. Subsequently, Fisheries and Oceans Canada (DFO) and the MHTO decided to decrease the yearly arctic charr quota in 1985 from 1,400 kg to 1,000 kg, and in 1993, it was recommended that the commercial fishery be closed, and, since then, records indicate a recovery of the population (DFO 2004). The MHTO maintains two cabins on the shores of Tugaat Lake for subsistence fishing.

Ikaluit Lake is an oblong lake (surface area = ~9.1 km²; Figure 1.1) approximately 90 km southwest of Pond Inlet that flows into Tay Sound via the Ikaluit River. The lake has been an important area for commercial and subsistence fishing since the 1960's. An assessment of the commercial harvest in 1989 revealed that the stock was not overexploited at the time of the survey, and a provisional quota of 2,300 kg was recommended (DFO 1998).

Qurluktuk Lake is a large lake (surface area = ~93.8 km²; Figure 1.1) located northwest of Baffinland's Milne Port Operations that flows into Koluktoo Bay. The lake is the largest in the watershed and provides important overwintering habitat for the Robertson River arctic charr population. Prior to 1978, a commercial fishery existed on the Robertson River with an annual harvest quota of 4,536 kg; however, at the time of a 1979 report, it was revealed that a decision had been made by the Inuit of Pond Inlet to leave this area primarily to sport fishing, and to concentrate their subsistence fishing efforts to the Tugaat River fishery (DFO 1979).





Photo 1.2: Tugaat Lake, North Baffin Island, 2021



Photo 1.3: Ikaluit Lake, North Baffin Island, 2024



Photo 1.4: Qurluktuk Lake, North Baffin Island, 2024

1.2.4 Final Study Design

The final study design targeted the three lakes identified during consultation, which were to be sampled in late summer (August). Supporting water and sediment samples from the lakes were to be collected concurrently. A target sample size of 40 arctic charr per lake (i.e., 20 males, 20 females) was established prior to the survey. Arctic charr were to be collected using gillnets, dispatched in the field, and transferred to the mine site for processing. In addition to standard measurements, aging structures (i.e., otoliths and pectoral fin rays) and tissues (i.e., muscle and liver) were to be collected for aging and metals analysis, respectively. Health endpoints of interest were to include:

- length-frequency distribution;
- age-frequency distribution;
- age;
- fork length;
- body weight;
- length-at-age (i.e., growth);
- weight-at-age (i.e., growth); and
- condition.

1.2.5 2021 Summary

The 2021 field collection took place on August 16 and 17 in Tugaat Lake and August 18 and 19 in Qurluktuk Lake with a representative of the Qikiqtani Inuit Association [QIA]), two representatives from Minnow, and one representative from the community of Pond Inlet. Due to unsafe helicopter travel conditions related to weather, Ikaluit Lake was not sampled in 2021.

Arctic charr were captured using bottom-set gillnets (102 mm and 127 mm [i.e., 4" and 5"] mesh; 45 m in length) which were deployed in a non-randomized design, targeting areas of the lake which were familiar to the representative from Pond Inlet. In Tugaat Lake, 46 fish were captured, eight of which were juveniles and released alive upon removal from nets. In total, eight net sets were deployed and catch-per-unit-effort (CPUE) for these net sets ranged from 0 to 17.50 fish/hour. Of the 38 adult fish retained, 11 were female, 24 were male, and three were undeveloped adults (Minnow 2023). In Qurluktuk Lake, 39 fish were captured, of which 15 were juveniles and released upon removal from the nets. Catch rates were comparatively lower in Qurluktuk Lake than Tugaat Lake, with CPUE ranging from 0 to 2.32 fish/hour. Of the 24 adult



charr that were collected from Qurluktuk Lake, 7 were female, 13 were male, and 4 were undeveloped adults (Minnow 2023).

Health indicators (i.e., survival, body size, energy usage, energy storage) were calculated separately for males and females and spatially compared between Qurluktuk and Tugaat lakes. Briefly, both males and females sampled from Qurluktuk Lake were older, longer, and heavier than those collected from Tugaat Lake, while relative gonad weight for both males and females sampled in Tugaat Lake were greater than from those collected in Qurluktuk Lake. Differences in relative egg weight and fecundity for females sampled across waterbodies were not significant, nor were differences in condition for either males or females (Minnow 2023).

Fish tissue analysis was also undertaken on a subset of sampled arctic charr, focused particularly on mercury concentrations in muscle and liver tissues as they relate to safe consumption guidelines, and compared spatially between lakes. Analyses revealed that mean concentrations of mercury in muscle and liver tissue of arctic charr from both lakes were below the Health Canada consumption guideline of 0.5 mg/kg wet weight (Minnow 2023). Further, mercury concentrations in both muscle and liver tissue from charr collected from Qurluktuk Lake were greater than from those collected from Tugaat Lake, though this was not surprising given the observed differences in age and size of charr between the lakes (i.e., charr from Qurluktuk Lake were larger and older than charr from Tugaat Lake; Minnow 2023).

1.2.6 2022 Summary

Field collection took place between August 19 and 24 in Tugaat, Qurluktuk, and Ikaluit lakes. Sampling efforts were completed by representatives from Pond Inlet, the MHTO, and the QIA as well as two representatives from Baffinland, and two representatives from Minnow.

Arctic charr were captured using bottom-set gillnets (102 mm and 127 mm [i.e., 4" and 5"] mesh; 45 m in length) which were deployed in a non-randomized design, targeting areas of the lakes which were familiar to the community elder and MHTO representative, who pointed out inuksuit indicating rich fishing areas.

In 2022, total catch was greatest in in Tugaat Lake (n = 93), followed by Qurluktuk Lake (n = 57), and Ikaluit Lake (n = 40; Minnow 2023). However, CPUE was the highest in Ikaluit Lake (4.53 fish/100 m*hr) followed Tugaat Lake (1.75 fish/100 fish/100 m*hr) then Qurluktuk Lake (1.00 fish/100 m*hr; Minnow 2023).

Growth as represented by either total body weight or fork length relative to age, suggested that there are mixed sub-populations of resident and anadromous individuals co-existing in the study lakes, a common structure in arctic charr populations (Young et al. 2021). As such, pooled analysis comprising individuals of different life history strategies, such as the Qurluktuk



Lake sample (which featured six older, likely resident individuals) produced unrealistic statistical trends such as negative growth relationships.

Arctic charr captured in Ikaluit Lake, especially males, were significantly longer and heavier (mean = 58.5 cm and 2,385 g) than charr captured in either Qurluktuk Lake (mean = 51.8 cm and 1,424 g) or Tugaat Lake (mean = 46.7 cm and 1156 g). Charr captured in Ikaluit Lake were also younger on average than charr captured in Qurluktuk Lake, and males had higher growth rates suggesting a greater proportion of the Ikaluit charr were anadromous. Arctic charr captured in Tugaat Lake were significantly younger than charr captured in either of the other study lakes.

Energy storage varied greatly within and between lakes, indicating that charr within the area do not spawn yearly (Dutil 1986), have different life history strategies (resident vs anadromous), and/or that migration/spawning timing relative to sampling timing may be different among the study lakes. Condition in male charr was not significantly different between lakes in 2022; however, females were significantly heavier at length in Tugaat Lake compared to both Qurluktuk and Ikaluit lakes and significantly heavier at length in Qurluktuk Lake compared to Ikaluit Lake.

Temporal trends for both Qurluktuk and Tugaat lakes indicated that both male and female arctic charr sampled in 2022 were significantly younger, shorter, and lighter than charr described in the historical data. Growth varied significantly depending on the years and sexes compared; however, the 2022 and 2021 data for males and the 2022 data for females from Qurluktuk Lake and 2022 data for males in Tugaat Lake indicated that condition was significantly greater (heavier at length) than those from historic sampling events.

For all lakes, mean mercury concentration in muscle tissue was below Health Canada's Human Health consumption guideline for fish (0.5 mg/kg dw; CFIA 2015), and across lakes was highest in Qurluktuk Lake, followed by Ikaluit Lake and then Tugaat Lake. Total mercury concentrations in arctic charr muscle relative to length demonstrate a relationship of increasing mercury concentrations with size/age and individuals identified as likely to be resident arctic charr in 2022 (characterized by slower growth rates) in Qurluktuk Lake also had the highest concentrations of mercury of all sampled fish. Although no consumption guideline exist for iron concentrations in fish tissue, Health Canada does recommend fish as a good natural source of iron with a daily upper limit of iron intake of 45 mg/day (2023). The iron concentrations in both muscle and liver tissues reported were well below this limit, assuming a standard serving size of 75 g.

1.3 2024 Objectives

Following engagement with project partners, Inuit community members, and the MHTO, program objectives were reviewed, and the following primary objectives were identified for 2024:

1. collect fish health samples from all three study lakes;



2. continue to assess status of fish health in the chosen study lakes for comparison in future studies;
3. continue to compare fish health from before and after the initiation of mining operations in lakes proximal to the mine, tote road, and Milne Inlet Port identified as significant by community partners;
4. continue to monitor fish tissue metal concentrations, specifically iron and mercury as identified by MHTO;
5. complete an assessment of arctic charr life history in Qurluktuk Lake to elucidate sub-populations and improve interpretation of fish health endpoint results; and,
6. continue to engage with the MHTO regarding the results, design, timing, and location of monitoring.



2 METHODS

2.1 General Overview

The Program was designed to monitor the health of arctic charr populations proximate to Baffinland's Milne Port Operations as identified by the local community. The 2024 program included assessment of water quality, and collection and sampling adult arctic charr for fish health endpoints². Sampling was conducted within two lakes³ in 2024 that are situated along river systems that flow into Milne Inlet, including Qurluktuk Lake (QURL) and Ikaluit Lake (IQLL) lakes (Figure 1.1). Sampling was completed by Minnow in collaboration with community members from the MHTO, the QIA, and the Hamlet of Pond Inlet. The study was implemented from August 26 to 28, 2024 (Appendix Photos E.1 to E.5).

2.2 Field Program Safety

Prior to the first field day, the team reviewed the Job Hazard Analysis (JHA) and discussed planned fishing locations and techniques. All lakes were accessed via helicopter from the Milne Port Site.

Field safety was a priority for this program, and several precautionary measures were implemented during the field study to maintain safety of the field crew and address potential safety incidents. For example, during sampling at each lake, a second boat and motor was stationed at the shore together with a second set of crew members in the event of any mechanical and/or safety issues (e.g., man overboard, or capsizing) with the primary sampling vessel/crew members. Each vessel was also outfitted with a boat safety kit that, in addition to standard boat safety items, included survival gear that could be used in the event of an inability to depart from the sampling area for an extended period (e.g., >24 hours). All personnel wore personal floatation devices on the water, and the team had at least two modes of communication (e.g., radio, InReach, or satellite phone) for check-ins and emergency communication with Baffinland personnel at the mine site and/or port facility. No field-related injuries or safety incidents occurred throughout the duration of the field program.

² The Program has previously included sediment sampling; however, this was deemed unnecessary for the 2024 study due to low sediment accumulation rates in these lakes.

³ The study design included a third study lake (Tugaat Lake); however, weather conditions for helicopter transport were unfavorable for the duration of the program, and teams were unable to make it to all three lakes. Ikaluit and Qurluktuk lakes were prioritized because there was only one year of prior data from Ikaluit Lake, and there was a proposed additional research question (i.e., elucidation of sub-population life histories) for investigation at Qurluktuk Lake.



2.3 Water Chemistry Data Collection

2.3.1 Sample Collection and Laboratory Analysis

One set of water chemistry samples was collected from each of Qurluktuk and Ikaluit lakes in 2024 concurrent with fish sampling (Figures 2.1 and 2.2). Water samples were collected below the water surface, to avoid capturing floating material. At each study location, water was filled by hand directly into pre-labelled sample bottles. For samples requiring preservation, chemical preservatives were added to the samples before capping the bottles, or for sample bottles that were pre-dosed with chemical preservatives, the bottle was filled using a sample transferred from a separate bottle. Following collection, water chemistry samples were placed into coolers in the field and held at 4°C at the Mary River Milne Port and/or Mine Site prior to shipment to the analytical laboratory.

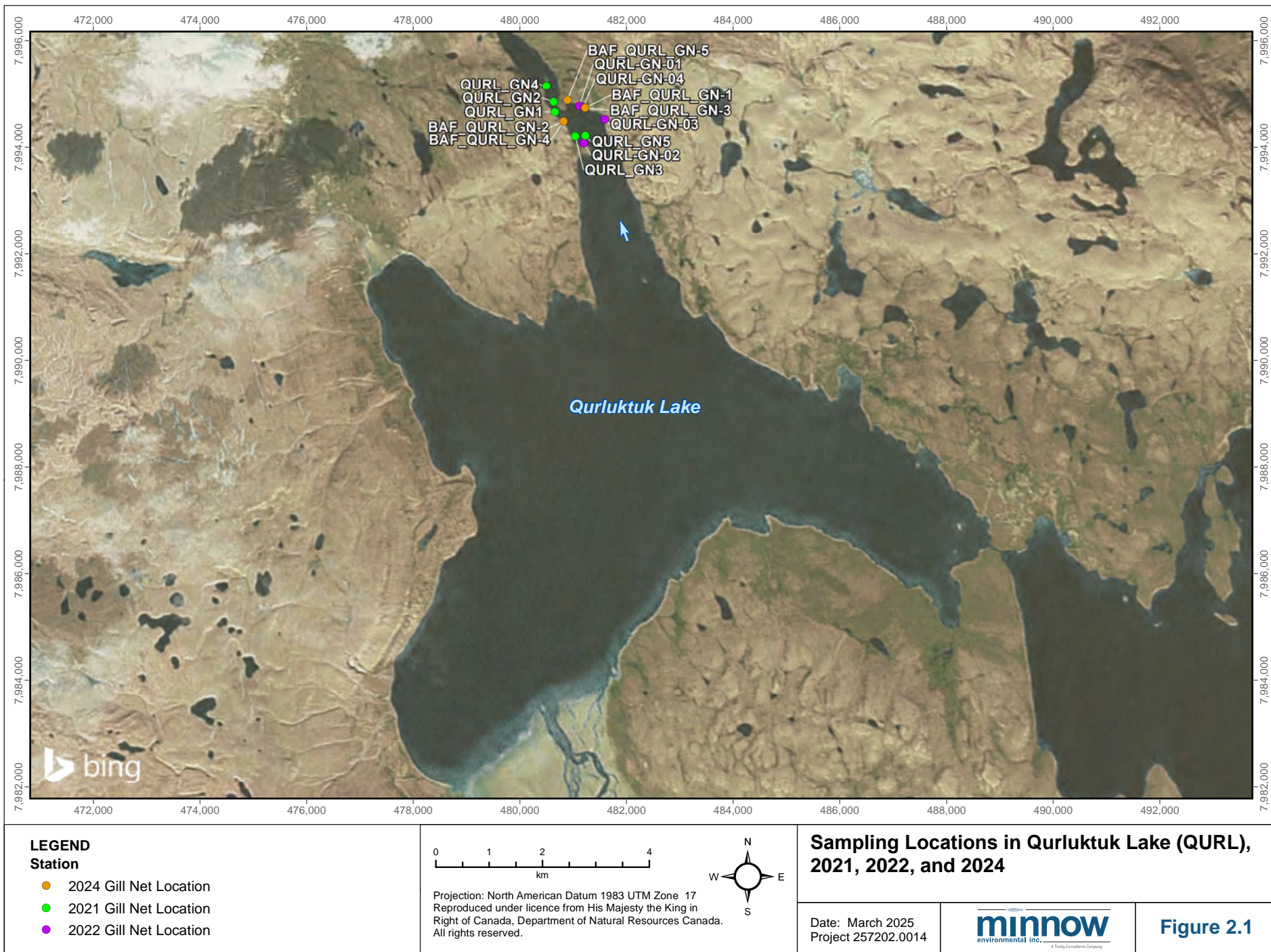
Water chemistry samples were shipped on ice to ALS Environmental (ALS; Waterloo, Ontario) for analysis of pH, conductivity, hardness, total suspended solids (TSS), total dissolved solids (TDS), anions (alkalinity, bromide, chloride, sulphate), nutrients (ammonia, nitrate, nitrite, total Kjeldahl nitrogen [TKN], total phosphorus), dissolved and total organic carbon (DOC and TOC, respectively), mercury, total and dissolved metals, and phenols using standard laboratory methods.⁴ The laboratories operated by ALS are accredited by the Canadian Association for Laboratory Accreditation Inc. The water chemistry sample shipment was accompanied by a chain-of-custody (COC) form, a list of expected Laboratory Reporting Limits (LRLs), and laboratory quality assurance/quality control (QA/QC) requirements.

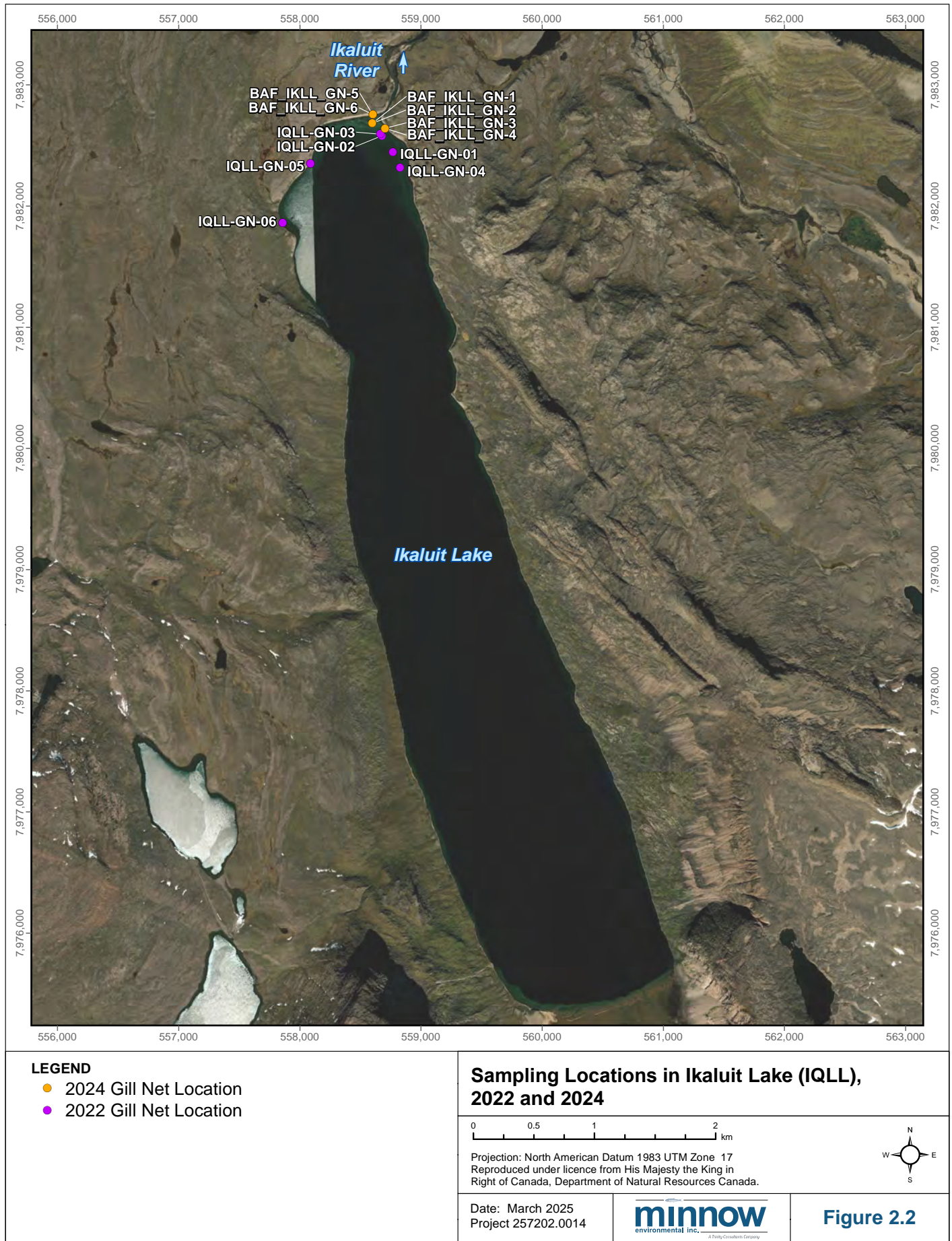
2.3.2 Data Analysis

Following lab analysis, water quality data were electronically tabulated and subjected to internal data quality review (DQR) protocols to ensure data of appropriate quality for use and interpretation (Appendix B). Water chemistry data were compared to applicable water quality guidelines (WQG), including the Canadian Water Quality Guidelines (CWQG; CCME 1999, 2022) or, for parameters with no CWQG, the most conservative (i.e., lowest) criterion available from established Ontario Provincial Water Quality Objectives (PWQO; OMOEE 1994) or British Columbia Water Quality Guidelines (BCWQG; BCMOE 2006, 2022). Water quality guidelines are abbreviated simply as 'WQG' in this report, although some of the values presented may represent water quality 'objectives.' For WQGs that are hardness dependent, the hardness of the individual

⁴ The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by the United States Environmental Protection Agency, American Public Health Association Standard Methods, ASTM International, International Organization for Standards, Environment Canada, British Columbia Ministry of Environment (BCENV), and Ontario Ministry of Environment.







sample was used to calculate the WQG for the specific parameter according to established formulae.

2.4 Fish Data Collection

2.4.1 Overview

The primary purpose of the fish collection component of the Program was to collect tissue (i.e., muscle and liver), aging structures (i.e., sagittal otoliths and pectoral fin), and microchemistry samples (i.e., otoliths), as well as morphometric (i.e., length and weight) and biological (i.e., sex and maturity) data to provide information on the population, age, and metal concentrations in tissue of fish being consumed by local Inuit communities. The target sample size for the study was a total of 40 arctic charr (20 female and 20 male) collected from each study lake. Fish sampling was conducted using gill nets under a Fisheries and Oceans Canada (DFO) License to Collect Fish for Scientific Purposes (License no. S-24/25-1060-NU; Appendix F).

2.4.2 Sample Collection

Gill netting was the sole method used to capture arctic charr for the 2024 study. Consistent with previous work, fishing was conducted using 45 m nets with 102 mm and 127 mm mesh (i.e., 4" and 5") length. Gill nets were deployed for approximately one and 24 hour durations⁵. Gill nets were shore-set⁶ at the bottom of the lakes. Sampling locations were chosen based on habitat characteristics preferred by the target species (i.e., presence of gravel, cobble, and/or boulders and near inlet and outlets of the lake) and prior site knowledge provided by MHTO (Figures 2.1 and 2.2). Upon retrieval of each gill net, all captured fish⁷ were carefully removed, identified, and enumerated. This program targeted adult arctic charr (i.e., individuals > 35 cm) and would typically involve the release of juveniles and/or other bycatch; however, following the wishes of Inuit team members, no captured fish were released⁸. A maximum of 40 individual arctic charr (20 female and 20 male) from each lake were euthanized by a decisive blow to the head and retained for detailed assessment. For each gill net set, information including date, duration of sampling (set and lift time), sampling depth, Global Positioning System (GPS) Universal Transverse Mercator (UTM) coordinates, and habitat notes were recorded.

⁵ Teams began with one hour sets in each waterbody to gauge productivity before moving on to longer set times.

⁶ Setting nets from shore was the suggestion of the MHTO representative based on experience fishing in these lakes.

⁷ Arctic charr is the only identified large-bodied fish species in the study lakes.

⁸ While no fish were intentionally released, there were instances where juvenile fish escaped during removal from the net.



2.4.3 Sample Processing

Adult arctic charr (i.e., >35 cm) that were euthanized and retained for sampling were placed in a cooler in the field and later transferred to a fridge and/or freezer at Milne Port or the Mary River Mine Site for storage until processing could be completed. Fish processing was generally completed the day following sampling, or as soon as possible. Processing included photographing (Appendix Photos D.1 to D.58), measurement of total and fork lengths to the nearest millimetre (mm) using a standard measuring board, and measurement of total body weight using appropriately sized Pesola™ spring scales (e.g., 500 g, 1,000 g, 5,000 g, 10,000 g). The scale was selected so that the weight of the fish was near the top of the scale's range to ensure a measurement resolution near 1%. Clean implements (cutting boards, filet knives, and tweezers) were used for each fish dissection. Upon the opening of the body cavity with a ventral incision, sex was assigned, gonads and liver tissue were removed from each fish and weighed to the nearest milligram (mg) using an analytical balance with a surrounding draft shield. A skinless, boneless muscle fillet sample was also collected. After tissue samples were removed from the fish and weights were taken, liver, and muscle tissue samples were individually placed in pre-labeled WhirlPak™ bags and stored in a freezer at the Mary River Mine Site until shipment to an analytical laboratory. Age structures (i.e., sagittal otoliths and pectoral fins) were removed from each fish, wrapped in waxed paper, and placed inside a pre-labeled envelope. Once all measurements, tissue collections, and observations were complete, the remaining carcass and any other tissue separated from the fish during dissection were discarded.

2.4.4 Laboratory Analysis

2.4.4.1 Tissue Chemistry

Upon completion of the field study, fish tissue (liver and muscle) from the subsample of fish for tissue chemistry analysis was shipped frozen (on ice) to ALS (Waterloo, Ontario). The tissue chemistry sample shipment was accompanied by a COC, a list of expected LRLs, and laboratory QA/QC requirements (Appendix B). At the laboratory, the samples were freeze-dried prior to analysis to allow reporting of parameter concentrations on a wet and dry weight basis. The tissue chemistry samples were analyzed for metal, non-metal, and metalloid parameters typically included in a Collision Reaction Cell Inductively Coupled Plasma Mass Spectrometry (CRC ICPMS) scan, as well as percent moisture. Mercury was measured by Cold Vapour-Atomic Absorption Spectroscopy (CVAAS).

2.4.4.2 Age Determination

Aging structures were shipped frozen (on ice) to North/South Consultants Incorporated (North/South; Winnipeg, Manitoba) for determination of fish ages. For fish sampled from



Qurluktuk Lake, one otolith was retained for microchemical analyses, while the other (if recovered) was used for aging. A COC was included with the shipment. At the laboratory, otoliths were the primary aging structure used and were prepared by cleaning and embedding them in epoxy. After the epoxy cured overnight, the otoliths were sectioned using a diamond-blade saw set to low speed. Each otolith was mounted on a glass slide using a mounting medium and examined under a compound microscope using transmitted light to determine fish age. For each structure, the age and edge condition were recorded along with a confidence rating for the age determination. A secondary age reading was completed by another individual from the lab for internal QA/QC purposes to ensure accuracy (see Appendix B).

2.4.4.3 Otolith Microchemistry

Sagittal otoliths were extracted from all adult arctic charr collected from Qurluktuk Lake, one otolith from each fish was placed in 1 mL plastic cryovials for shipment to TrichAnalytics Incorporated (Trich; Victoria, British Columbia). Upon arrival, each otolith was cleaned with distilled water and embedded in epoxy within plastic base molds (dimensions: 5 mm × 5 mm × 15 mm). Once cured overnight, the epoxy blocks were sectioned through the otolith core and polished using a series of lapping papers from coarse to fine grit to achieve a uniform surface. Final polishing was completed using a 0.25 µm diamond suspension on a polishing pad to remove fine surface scratches. Otoliths were then mounted on microscope slides using double-sided tape and placed in the laser ablation chamber.

Elemental analyses were performed using laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). Each otolith was analyzed along a single ablation transect (i.e., edge to core to edge, where possible) using standardized laser settings (i.e., 40% power, 20 Hz repetition rate, 5 µm/s scan speed, and a 30 µm spot size). Pre-ablation images were taken to document otolith positioning, and post-ablation images were captured to align with the elemental data (Appendix Photos D.59 to D.78). The laser transects proceeded from left to right in accordance with post-ablation images.

Otoliths were analyzed for ⁷Li, ²⁴Mg, ⁵⁵Mn, ⁶⁶Zn, ⁸⁸Sr, and ¹³⁷Ba, which were corrected to 40% Ca (or 400,000 ppm Ca), to account for variation in ablation yield. Changes in elemental concentrations along the ablation line were used to infer life history traits (see Section 2.4.6).

Each sample set was bracketed by multiple ablations (i.e., >3) of National Institute of Standards and Technology (NIST) SRM 612, a certified silicate glass reference material provided by the National Institute of Standards and Technology. Blanks were not run between samples; instead, the background counts per second were measured during the first 10 seconds of each run and used to calculate detection limits based on a signal-to-noise ratio of 3.



2.4.5 Collection of IQ and Knowledge Blending

The project's Inuit partners are experienced hunters and trappers, who can determine the recent migration history of arctic charr using various visual (e.g., body colour and shape and flesh colour) and other sensory cues (e.g., taste and smell). When they were present during fish collection and processing, they indicated which fish were searun or resident noting features such as colouration and body shape of the fish⁹. Charr that have recently migrated from the marine environment typically display a silvery colour and a more muscular or lean body shape (Photo 2.1), although the duration for which these characteristics are retained following migration back to freshwater is. During the spawning season (i.e., September and/or October), searun charr undergo a morphological transformation, displaying brighter colours. Accordingly, the timing of collection is important to interpret visual cues that indicate recent migration history. Additionally, since Arctic charr can complete multiple migrations throughout their lives and do not necessarily migrate every year (Scott and Crossman 1973), visual cues may not be informative of whether an individual has migrated in the past.

2.4.6 Data Analysis

Fish catch data were electronically tabulated and subjected to internal QA/QC procedures for accuracy of the data entry. Fish catch data for the study areas were summarized according to total catch and total CPUE for each lake. Gill netting CPUE was calculated as the number of fish captured per 100 m²·hr⁻¹ of net deployed as follows:

$$\text{CPUE} = \text{No. of fish captured} / ((\text{Fishing Time [hr]} * (\text{Net Length [m]})) / 100)$$

For arctic charr endpoints (age, body length, and weight) summary statistics, including sample size, mean, standard deviation, standard error, minimum, median, and maximum, were calculated.

Statistical analysis differed depending on the endpoint of interest, and included comparison of measures of central tendency, examination of frequency distribution, analysis of variance, and analysis of covariance. All statistical comparisons between areas were tested at a significance level of $\alpha = 0.1$ using R version 4.2.2. Magnitude of Difference (MOD) was calculated using the following equation:

$$\text{MOD (\%)} = \frac{\text{MCT}_A - \text{MCT}_B}{\text{MCT}_B} \times 100\% \text{ (Equation 1),}$$

where MCT_A and MCT_B are the measures of central tendency for a given area and/or year.

⁹ Due to flight schedules between Mary River and Pond Inlet, the Inuit team members had to return home prior to the processing of the fish from Qurluktuk Lake in 2024, so the designations were completed by Minnow and Baffinland, based on the qualitative descriptors they provided.





Photo 2.1: Examples of [A] Anadromous and [B] Resident Arctic Charr Based on Physical Characteristics

Statistical comparisons of endpoints without a covariate (e.g., fork length) were conducted using a one-way analysis of variance (ANOVA) if the assumptions of normality and homogeneity of variances were met. The assumptions were tested using a Shapiro-Wilk's Test and Levene's test, respectively at $\alpha = 0.05$. Data were \log_{10} -transformed as necessary to meet assumptions. When the assumption of normality was met but not the assumption of homogeneity of variances, a t-test for unequal variances was used (Ruxton 2006). In cases where both assumptions were not met, analysis was conducted using a Kruskal-Wallis test. Post-hoc comparisons were conducted using Tukey-adjusted p-values for all pairwise contrasts. For each comparison, the magnitude of difference was calculated with Equation 1 using means for untransformed data, geometric means for \log_{10} -transformed data and medians for non-parametric tests. Each endpoint was plotted with a boxplot.

Statistical comparisons of endpoints with a covariate (e.g., condition) were conducted using Analysis of Covariance (ANCOVA) with \log_{10} -transformed data. Data was visually inspected to confirm sufficient overlap of the covariate between areas. If necessary, analysis was conducted on the entire dataset and a subset of the dataset with sufficient overlap. Statistical outliers were defined as observations with Studentized residuals with magnitude > 4 (Environment Canada 2012). Statistical analyses were reported for comparisons with and without the outliers to assess the influence of the outlier on statistical significance and the magnitude of difference. Significant interactions between the area and the covariate (i.e., the assumption of homogeneity of regression slopes between areas) in the ANCOVA were assessed using $\alpha = 0.05$. When the interaction term was significant, the coefficients of determination (R^2) of the interaction model and parallel slope model were compared to assess whether the slopes were practically significant. If the R^2 was > 0.8 and within 0.02 between the two models the interaction model and parallel slope models were considered practically the same (Environment Canada 2012) and the ANCOVA proceeded with the parallel slope model. When the interaction could not be removed by comparison of R^2 values the interaction model was selected. When the interaction model was selected, the magnitude of difference was calculated separately using predicted means at the minimum and maximum values of the overlap in covariate values between areas. When the interaction term was not significant, the interaction term was removed from the model and the parallel slope ANCOVA model was fit. Magnitude of difference was then calculated using the adjusted mean at the mean covariate value. When the covariate was not a significant predictor of the response variable in the parallel slope ANCOVA model the analysis proceeded as described above for endpoints without a covariate. For meaningful interpretation, the covariate in an ANCOVA model should be spread across many values. For covariates with discrete values, such as age, this is not always possible.



In ANCOVA models where age was used as a covariate and had limited variability (e.g., <3 age groups), an ANOVA at each age class was conducted instead.

A power analysis to estimate minimum detectable difference (MDD) using $\alpha=\beta=0.1$ was conducted for each endpoint using either the coefficient of variation (pooled standard deviation divided by reference mean) for untransformed data or the pooled standard deviation of regression residuals for \log_{10} -transformed data and reported as a percentage difference relative to the reference mean. The MDD percentage was reported as both a percentage increase, and a percentage decrease because MDD differs with respect to the direction of \log_{10} -transformed measures. The MDD calculations for the Mann-Whitney (M-W) test were estimated based on a two-sample t-test using sample sizes multiplied by 0.864. The 0.864 value is the lower bound of the asymptotic relative efficiency of the Mann-Whitney test and the two-sample t-test (Hodges and Lehmann 1956). Using the same approach, the minimum sample sizes needed to detect percent differences ranging from negative to positive 100% were calculated. The estimated sample sizes were divided by 0.864 for non-parametric tests.

Upon receipt of laboratory results (i.e., water chemistry, tissue metals, aging, and otolith microchemistry), a data quality review (DQR) was performed. This included the assessment of field precision, laboratory precision, and laboratory accuracy against data quality objectives (DQOs) established at the outset of the project (Appendix B). A minimum of 10% of the analyses represented quality control samples. In instances where the DQR revealed potential issues with data quality, results were verified with the laboratory and corrective measures were taken if necessary. Data collected for the Program in 2024 were of acceptable quality as characterized by appropriate LRLs, good detectability, negligible analyte concentration in method blank samples, good laboratory precision, and good laboratory accuracy (see Appendix B for details).

Concentrations of metals in edible muscle tissue were screened against relevant benchmarks (Table 2.1). Spatial differences in mercury and iron tissue concentrations¹⁰ were examined using similar methods as those described above. Briefly, ANCOVA with \log_{10} -transformed data was used, as length is commonly a significant covariate in fish metals analysis with \log_{10} -transformed data. Data was visually inspected to confirm sufficient overlap of the covariate between areas. If necessary, analysis was conducted on the entire dataset and a subset of the dataset with sufficient overlap. Statistical outliers were defined as observations with Studentized residuals with magnitude >4 (Environment Canada 2012). Statistical analyses were reported for

¹⁰ Mercury and iron were chosen as these were identified by the community during consultation (Appendix A).



Table 2.1: Consumption Benchmarks for Metals in Fish Tissue (mg/kg wet weight)

Substance	Tolerable Daily Intake	Fish Benchmarks (mg/kg) Based on		
	(mg/kg day) ^a	6.5 g/day ^b	21.8 g/day ^c	111 g/day ^d
Aluminum	0.0004 ^e	0.862	0.257	0.0505
Antimony	0.0004 ^e	0.862	0.257	0.0505
Arsenic	1.8 ^f	0.0598	0.0178	0.00350
Barium	0.2 ^{f,h}	431	128	25.2
Beryllium	0.002 ^{f,h}	4.31	1.28	0.252
Boron	0.2 ^e	431	128	25.2
Cadmium	0.0005 ^{e,h}	1.08	0.321	0.0631
Chromium	0.0022 ^{f,h}	4.74	1.41	0.277
Copper	0.005 ^{e,h}	10.8	3.21	0.631
Lead	0.005 ^f	10.8	3.21	0.631
Manganese	0.025 ^{f,h}	53.9	16.1	3.15
Mercury	0.0003 ^f	0.646	0.193	0.0378
Molybdenum	0.005 ^e	10.8	3.21	0.631
Nickel ^g	0.0013 ^{e,h}	2.80	0.835	0.164
Selenium	0.005 ^{f,h}	10.8	3.21	0.631
Silver	0.005 ^f	10.8	3.21	0.631
Strontium	0.6 ^f	1,292	385	75.7
Uranium	0.0006 ^{e,h}	1.29	0.385	0.0757
Vanadium	0.009 ^e	19.4	5.78	1.14
Zinc	0.3 ^{e,h}	646	193	37.8

 Selected benchmark.

^a Where values were reported by both IRIS (2020) and Health Canada (2021), the lowest value was used to derive a conservative benchmark.

^b USEPA (1997) mean consumption rate for general population; mean value for anglers is 8.0 g/day, 95th percentile for anglers is 25 g/day.

^c Upper limit consumption rate for Canadian population based on high caloric intake (OHM 1990). Also the highest consumption level considered in development of fish advisories in Ontario.

^d Health Canada (2010) consumption rate for screening level risk assessments, from Richardson (1997). Exceeds the average value for fishing subsistence populations (70g/day; USEPA 1997).

^e IRIS (2020).

^f Health Canada (2021).

^g Based on nickel chloride.

^h Most conservative concentration (tolerable daily intakes are defined on an age-group specific basis).

comparisons with and without the outliers to assess the influence of the outlier on statistical significance and the magnitude of difference.

The otolith microchemistry data were used to designate individuals from Qurluktuk Lake as either resident or anadromous. Elemental profiles were plotted and visually examined for rapid changes in element concentration ratios across the otolith transect (Appendix Figures D.1 to D.20). Fish age was estimated by manually enumerating seasonal peaks in Ca-corrected ^{55}Mn and ^{66}Zn , which are known to fluctuate annually (e.g., Halden et al. 2000). Life history strategy was inferred by examining changes in ^{88}Sr profiles. Water strontium concentrations are typically higher in the marine environment compared to freshwater, therefore anadromous individuals show a period of steady ^{88}Sr followed by a sudden increase or peak, followed by peaks representing seasonal migrations, whereas resident individuals display steady ^{88}Sr across the entire otolith transect (Brown and Severin 2009). For example, Figure 2.3 shows ^{88}Sr and ^{66}Zn profiles overlaid on the post-ablation photograph of a 14-year-old anadromous arctic charr. This individual first migrated to the marine environment at age 8, as indicated by the initial increase in ^{88}Sr , followed by six distinct marine migration-associated ^{88}Sr peaks. Fourteen seasonal peaks in ^{66}Zn correspond to the estimated age of the fish.

2.4.7 Historical Data Comparisons

The initial step required for the historical data analysis included extraction of historical fish measurements from DFO reports (i.e., Moshenko 1981, Read 2004)¹¹. Summary information presented in the DFO reports (i.e., mean length and weight for various size and age intervals) was reviewed, and for any intervals that included a single individual or two individuals in which an accompanying standard deviation was presented, individual age, fork length, and body weight data were extracted for the comparative analyses (Appendix Tables D.1 and D.2). Fish measurement data collected from both 2021, 2022, and 2024 were compared to information from historical studies based on evaluation of plotted data and statistics using the methods described above. Based on the information available from the historical reports, the endpoints examined for the measurement data included fork length, body weight, growth (i.e., length-at-age relationship), and/or condition (i.e., length-at-weight relationship). These endpoints were analyzed separately for males and females in comparisons between data collected in 2021, 2022, 2024, and historically to assess for adverse Project-related effects on health arctic charr since the commencement of port operations. No historical fish tissue chemistry data were available.

¹¹ Historical data for comparison to fish captured at Qurluktuk Lake in 2021, 2022, and 2024 were from charr captured in the Robertson River in 1979, and thus could include charr that overwintered in waterbodies other than Qurluktuk Lake.



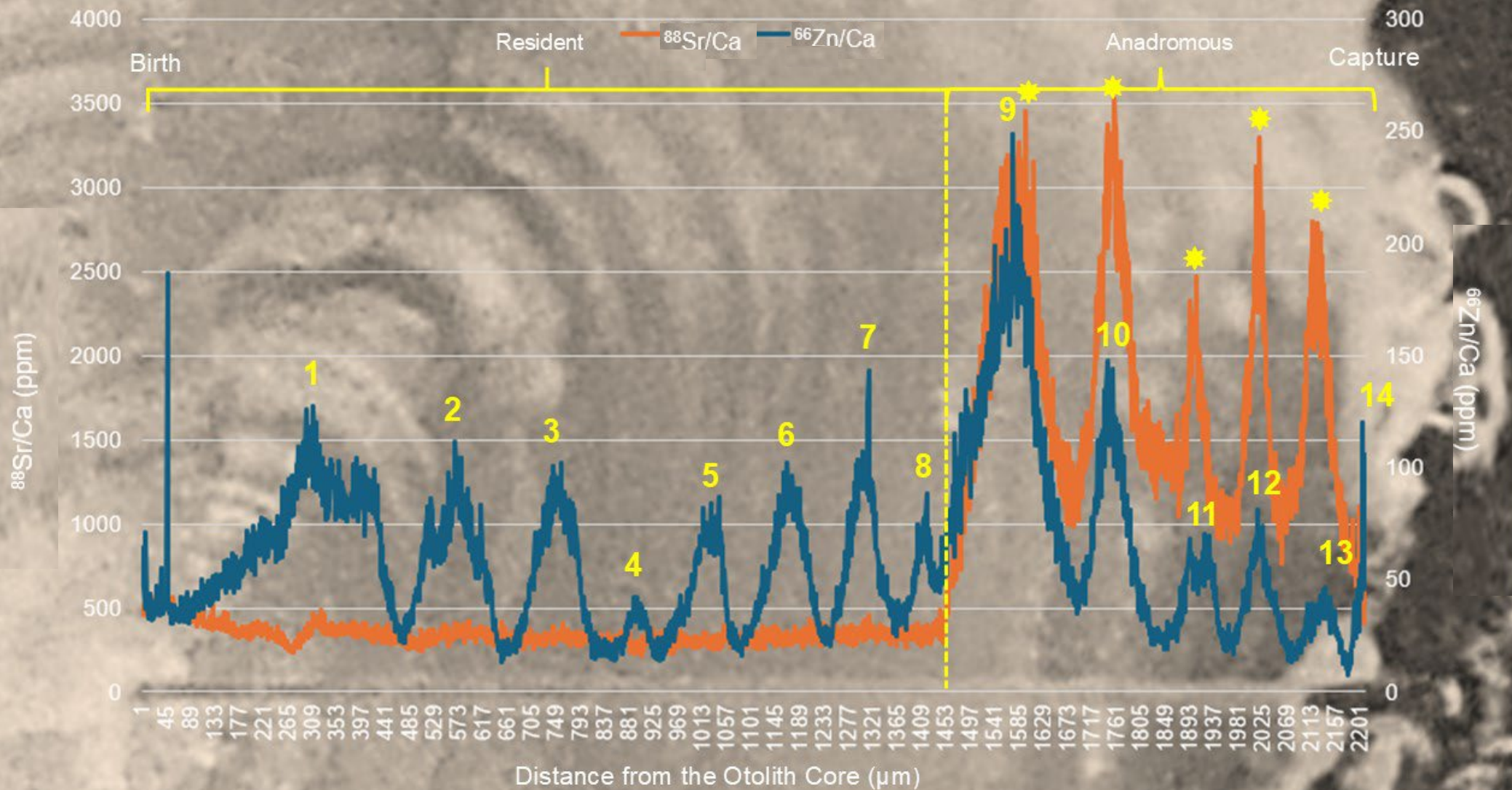


Figure 2.3: Ratios of ^{88}Sr and ^{66}Zn to Calcium along a Core to Edge Transect of an Arctic Charr Otolith Overlain on a Post-Ablation Cross-Section of the Otolith to Assess Life History

Notes: the x-axis represents the core-to-edge laser ablation transect; the yellow numbers denote annual peaks in ^{66}Zn (indicating age); yellow asterisks denote peaks in ^{88}Sr (indicating marine migration); yellow dashed line represents life history shift from resident to anadromous.

3 RESULTS

3.1 Water Chemistry

Water samples collected from the littoral zones of each of the study lakes during August 2024 revealed that all assessed analytes were below the Canadian Council of Ministers of the Environment (CCME) guidelines. Total mercury was below detection limits (<0.000026 mg/L; Appendix Table C.1) in both lakes. While total iron was below detection limits (<0.01 mg/L) in Qurluktuk Lake, and detectable in Ikaluit Lake (0.01 mg/L; Appendix Table C.1). Based on water chemistry, each lake can be classified as oligotrophic, which is common for Arctic lakes.

3.2 Arctic Charr

3.2.1 Catch

Arctic charr was the only species captured in each of the study lakes (Appendix Table D.3). Total catch was greater in Qurluktuk Lake ($n = 39$) than in Ikaluit Lake ($n = 37$; Table 3.1). However, CPUE was higher in Ikaluit Lake (11.4 fish/100 m²·hr) than in Qurluktuk Lake (0.74 fish/100 m²·hr; Table 3.1). In 2024, CPUE was lower than in 2022 for Qurluktuk Lake, but higher for Ikaluit Lake (Table 3.1, Appendix Table D.3); variability in CPUE can be attributed to many things such as weather at the time of study, locations chosen for net deployment, the use of overnight versus daytime sets, and inter-annual climatic factors (e.g., wet years versus dry years).

3.2.2 Life History Assessment

Variability in length-age relationships observed in arctic charr from Qurluktuk Lake in each of 2021 and 2022 suggested that the sampled fish likely represented both resident and anadromous sub-populations. Specifically, a cluster of six individuals sampled in 2022 exhibited notably slower growth, as indicated by their position on a length-at-age plot (Minnow 2023). When all individuals were included in a single linear length-at-age regression, there was not a good fit and the slope of the regression line was negative, contrary to expectations for growing fish. However, when the data were partitioned to separate the slow-growing individuals from the rest of the sample, both groups displayed positive length–age relationships with positive slopes, indicating differing growth rates and life history strategies.

To determine the life history of sampled fish within Qurluktuk Lake, microchemistry of otoliths from 20 adult arctic charr sampled in 2024 were analyzed using LA-ICP-MS. Of the 20 fish, otolith microchemistry results from 19 individuals showed ⁸⁸Sr:Ca ratios consistent with a migratory life history (Figure 3.1, Appendix Figures D.1 through D.20). Specifically, the data revealed a period of time, starting at emergence (represented by the distance from the otolith core) where ⁸⁸Sr:Ca ratios remained stable, followed by predictable distinct peaks in ⁸⁸Sr:Ca ratios,



Table 3.1: Gill Net Total Catch and Catch-Per-Unit-Effort (CPUE) for Arctic Charr by Lake, Milne Inlet Freshwater Fish Health Monitoring Program, August 2021, 2022, and 2024

Total Catch	Lake	2021	2022	2024
	Tugaat Lake	46	93	-
	Qurluktuk Lake	39	57	39
	Ikaluit Lake	-	40	37
Catch-per-Unit-Effort	Lake	2021	2022	2024
	Tugaat Lake	9.33	1.75	-
	Qurluktuk Lake	0.97	1.00	0.74
	Ikaluit Lake	-	4.53	11.4

Note: CPUE = (# of fish / 100 m of gill net * hr). "-" indicates no sampling was completed.

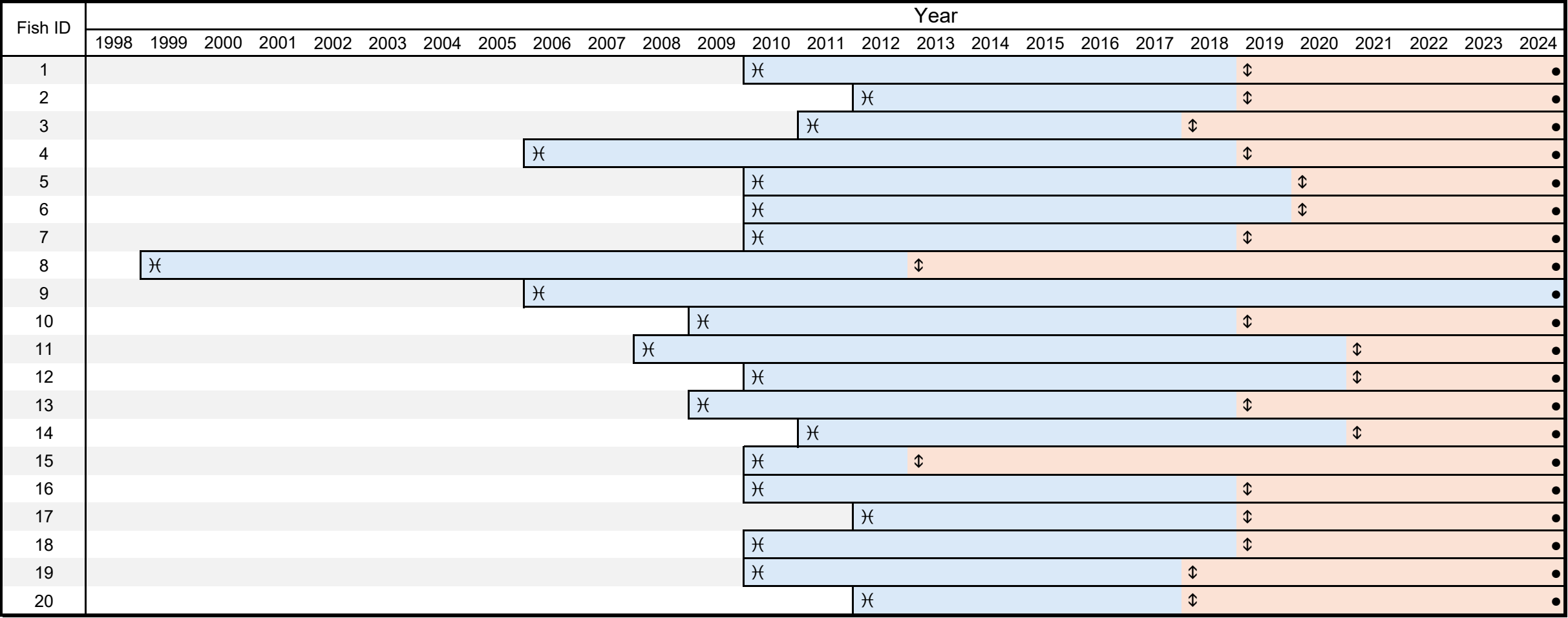


Figure 3.1: Qurluktuk Lake Arctic Charr Anadromy Assessment; Milne Inlet Freshwater Fish Health Program, 2024

- Resident Life History Strategy.
- Anadromous Life History Strategy.

Notes: "X" indicates the an individual's birth. "↕" indicates an individual's first migration. "•" indicates sampling the individual.

indicating annual migrations to the marine environment (e.g., Figure 2.3). In contrast, the otolith microchemistry results from a single fish (*QURL_AC_09*; Figure 3.1, Appendix Figure D.9) exhibited consistently low and stable $^{88}\text{Sr}:\text{Ca}$ ratios throughout its life, indicating that it never migrated to the marine environment.

Age at first migration varied among the Qurluktuk Lake anadromous fish, with individuals completing their first migration as early as three years old and as late as 14 years old (Figure 3.1). The average age at first migration was nine years. Each of the anadromous fish migrated annually following their first migration, based on the coupling of $^{88}\text{Sr}:\text{Ca}$ and $^{66}\text{Zn}:\text{Ca}$ peaks (Appendix Figures D.1 to D.8, D.10 to D.20).

The visual assessment of the charr based on IQ designated 12 of 20 individuals as residents (Appendix Table D.4). Notably, the IQ-based designated group of resident fish did not include the individual designated as a resident using otolith microchemistry (Figure 3.1, Appendix Table D.4). Lack of agreement between life history strategy determination methods is likely a product of how the visual assessments were conducted. Inuit team members described the characteristics of resident vs anadromous charr to the Minnow team members (see Section 2.4.5), but unfortunately due to flight schedules, they had to leave site prior to the processing of the fish from Qurluktuk Lake and were not present to contribute directly to the designations. As such, the designations were made by Minnow and Baffinland staff attempting to apply IQ. Additionally, fish were frozen and thawed prior to processing, which can cause phenotypic changes to IQ-based indicators of recent marine migration (e.g., colour; Ottestad et al. 2011). Given these factors, combined with the high quality of microchemistry data and robustness of the method, the microchemical designations were used to assign fish as resident or anadromous in further data analyses.

3.2.3 Health

3.2.3.1 2024 Results

In 2024, 20 adult arctic charr (1 male, 18 female, 1 of undetermined sex) from Qurluktuk Lake and 37 adult arctic charr (7 male, 14 female, 16 undetermined sex) from Ikaluit Lake were assessed for fish health endpoints (Table 3.2, Appendix Table D.4). Ages ranged from 8 to 25 years in Qurluktuk Lake and from 7 to 16 years in Ikaluit Lake (Table 3.2). On average, female charr from Qurluktuk Lake were older than those from Ikaluit Lake, with median ages of 14 and 12 years, respectively. The single male charr from Qurluktuk Lake was 15 years old (Table 3.2). Since only one male charr was captured from Qurluktuk Lake in 2024, spatial comparisons to Ikaluit Lake and temporal comparisons to earlier sampling years in Qurluktuk Lake could not be completed.



Table 3.2: Summary Statistics of Fish Health Endpoints for Adult Arctic Charr from Qurluktuk and Ikaluit Lakes, Milne Inlet Freshwater Fish Health Monitoring Program, Historical, 2021, 2022, and 2024

Lake	Time	Sex	Endpoint	Mean	SD	SE	Minimum	Median	Maximum
Qurluktuk	Historical ^a	Male	Age	20.6	4.64	1.55	14.0	22.0	28.0
			Total Length (cm)	-	-	-	-	-	-
			Fork Length (cm)	72.8	9.27	2.48	58.3	75.5	84.8
			Body Weight (g)	4,011	1,534	410	2,000	3,975	6,100
			Gonad Weight (g)	-	-	-	-	-	-
			Liver Weight (g)	-	-	-	-	-	-
		Female	Age	16.9	4.09	1.02	11.0	16.0	24.0
			Total Length (cm)	-	-	-	-	-	-
			Fork Length (cm)	62.0	11.8	2.52	42.8	60.5	79.5
			Body Weight (g)	2,380	1,156	247	800	2,400	4,500
			Gonad Weight (g)	-	-	-	-	-	-
			Liver Weight (g)	-	-	-	-	-	-
	2021	Male	Age	16.9	2.97	0.857	14.0	15.5	23.0
			Total Length (cm)	79.6	6.67	1.92	69.3	78.5	90.1
			Fork Length (cm)	76.0	6.23	1.80	65.7	75.0	85.6
			Body Weight (g)	5,142	1,293	373	3,600	4,850	7,200
			Gonad Weight (g)	103	39.4	11.4	58.4	96.4	181
			Liver Weight (g)	59.2	22.4	6.46	33.5	49.5	97.1
		Female	Age	15.3	3.30	1.25	10.0	15.0	21.0
			Total Length (cm)	69.9	8.96	3.38	55.0	70.8	80.5
			Fork Length (cm)	66.4	8.71	3.29	51.7	66.5	76.6
			Body Weight (g)	3,344	1,151	435	1,560	3,800	4,600
			Gonad Weight (g)	425	306	116	6.43	560	720
			Liver Weight (g)	49.8	20.0	7.55	27.5	40.5	72.8
	2022	Male	Age	12.5	0.707	0.500	12.0	12.5	13.0
			Total Length (cm)	52.1	7.21	5.10	47.0	52.1	57.2
			Fork Length (cm)	49.0	6.86	4.85	44.1	49.0	53.8
			Body Weight (g)	1,358	767	542	815	1,358	1,900
			Gonad Weight (g)	1.15	0.774	0.547	0.602	1.15	1.70
			Liver Weight (g)	26.0	20.3	14.4	11.6	26.0	40.4
		Female	Age	12.7	3.92	1.09	6.00	13.0	20.0
			Total Length (cm)	57.9	10.3	2.86	38.7	56.5	78.6
			Fork Length (cm)	54.8	10.2	2.82	36.2	53.0	75.2
			Body Weight (g)	2,064	1,154	320	410	1,780	4,550
			Gonad Weight (g)	58.5	113	31.4	1.72	10.5	380
			Liver Weight (g)	40.5	29.8	8.26	6.68	35.4	120
	2024	Male	Age	15.0	-	-	15.0	15.0	15.0
			Total Length (cm)	67.8	-	-	67.8	67.8	67.8
			Fork Length (cm)	61.3	-	-	61.3	61.3	61.3
			Body Weight (g)	2,300	-	-	2,300	2,300	2,300
			Gonad Weight (g)	46.3	-	-	46.3	46.3	46.3
			Liver Weight (g)	20.3	-	-	20.3	20.3	20.3
		Female	Age	14.4	2.79	0.657	12.0	14.0	25.0
			Total Length (cm)	66.4	4.84	1.14	59.8	65.4	78.6
			Fork Length (cm)	62.8	4.80	1.13	57.0	61.8	75.0
			Body Weight (g)	2,642	654	154	1,591	2,542	4,350
			Gonad Weight (g)	362	136	31.9	194	325	692
			Liver Weight (g)	31.8	9.83	2.32	18.9	29.6	56.3
Ikaluit	2022	Male	Age	11.5	2.22	0.444	7.00	12.0	16.0
			Total Length (cm)	62.8	7.80	1.56	44.8	63.5	79.1
			Fork Length (cm)	59.3	7.51	1.50	42.4	59.8	75.2
			Body Weight (g)	2,452	887	177	850	2,350	4,400
			Gonad Weight (g)	44.3	36.7	7.35	0.639	47.8	98.5
			Liver Weight (g)	34.1	12.1	2.43	13.3	34.7	66.0
		Female	Age	11.2	2.96	0.854	6.00	12.0	16.0
			Total Length (cm)	57.9	5.68	1.64	46.0	58.4	67.3
			Fork Length (cm)	54.8	5.68	1.64	43.2	55.2	63.8
			Body Weight (g)	1,782	515	149	920	1,700	2,750
			Gonad Weight (g)	148	132	38.1	1.91	172	345
			Liver Weight (g)	32.9	14.5	4.18	13.5	30.2	68.9
	2024	Male	Age	11.9	1.95	0.738	9.00	12.0	14.0
			Total Length (cm)	61.9	6.83	2.58	52.0	64.4	68.0
			Fork Length (cm)	58.5	6.22	2.35	49.4	60.5	64.0
			Body Weight (g)	2,164	671	254	1,280	2,200	2,850
			Gonad Weight (g)	43.7	41.8	15.8	1.50	53.1	102
			Liver Weight (g)	30.4	11.9	4.50	11.7	32.3	48.5
		Female	Age	11.9	2.67	0.715	7.00	11.5	16.0
			Total Length (cm)	55.9	4.76	1.27	48.6	56.0	63.4
			Fork Length (cm)	52.8	4.47	1.20	45.5	53.3	59.5
			Body Weight (g)	1,648	469	125	1,025	1,550	2,500
			Gonad Weight (g)	109	107	28.5	6.28	77.0	303
			Liver Weight (g)	34.5	12.7	3.40	14.2	34.8	52.4

Note: "-" indicates no data. SD = standard deviation. SE = standard error.
^aHistorical fish data are from Fisheries and Oceans (DFO) reports (i.e., Moshenko 1981, Read 2004)

Female arctic charr captured from Qurluktuk and Ikaluit lakes in 2024 ranged from 57 to 75 cm and 46 to 60 cm in fork length, and from 1,591 to 4,350 g and 1,025 to 2,500 g in body weight, Qurluktuk and Ikaluit lakes, respectively (Figure 3.2, Table 3.2). Female arctic charr captured in Qurluktuk Lake in 2024 were significantly longer and heavier than those captured in Ikaluit Lake (Figure 3.2, Appendix Table D.5). The single male arctic charr captured from Qurluktuk Lake had a fork length of 61 cm and a body weight of 2,300 g, which were within the range of Ikaluit Lake male charr fork length (i.e., 49 to 64 cm) and body weight (i.e., 1,280 to 2,850 g; Table 3.2, Appendix Table D.4).

The resident individual (i.e., QURL_AC_09), aged 18 years, was older than the median age for Qurluktuk Lake fish, but was the shortest and lightest among adults from both lakes. This is consistent with expectations, as resident individuals typically do not grow as large or as quickly their anadromous counterparts (e.g., Swanson et al. 2011).

Gonad weight in female arctic charr ranged from 194 to 692 g in Qurluktuk Lake and from 6.3 to 303 g in Ikaluit Lake (Table 3.2). Liver weights ranged from 19 to 56 g and 14 to 52 g in Qurluktuk and Ikaluit lakes, respectively. The single male charr from Qurluktuk Lake had a gonad and liver weights of 46 g and 23 g, respectively, both of which fell within the ranges observed for males from Ikaluit Lake (gonad weight range of 12 to 49 g; liver weight range of 1.5 to 102 g; Table 3.2).

Growth, as measured by fork length relative to age (length-at-age), was higher in Qurluktuk Lake than in Ikaluit Lake (Figure 3.2, Appendix Table D.5). Several factors can influence growth in arctic charr, including water temperature, resource availability, and life history strategy (Grenier and Tallman 2021). Assessment of anadromy based on IQ, indicated that the Ikaluit Lake sampling included both resident and anadromous (i.e., six and 31, respectively; Appendix Table D.3), which may have confounded growth comparisons. Further, two female fish from Ikaluit Lake exhibited length-at-age patterns (i.e., shorter-at-age), similar to the resident charr excluded from the Qurluktuk Lake analysis (Figure 3.2); however, assessment of life history strategies of Ikaluit Lake fish have not been evaluated with supporting otolith microchemical analysis.

Other energy use endpoints including weight-at-age and relative gonad weight were also both significantly higher in females from Qurluktuk Lake than Ikaluit Lake in 2024 (Figure 3.2, Appendix Table D.5). In terms of energy storage, there was no significant difference in female charr body condition (weight-at-length) between lakes in 2024; however, relative liver weight was significantly higher in female charr from Ikaluit Lake than Qurluktuk Lake (Figure 3.2, Appendix Table D.5). These differences in relative gonad weight (i.e., greater in Qurluktuk) and liver weight (i.e., greater in Ikaluit) likely reflect differing energy allocation strategies. The data suggest that females from Qurluktuk Lake invested more energy into reproductive



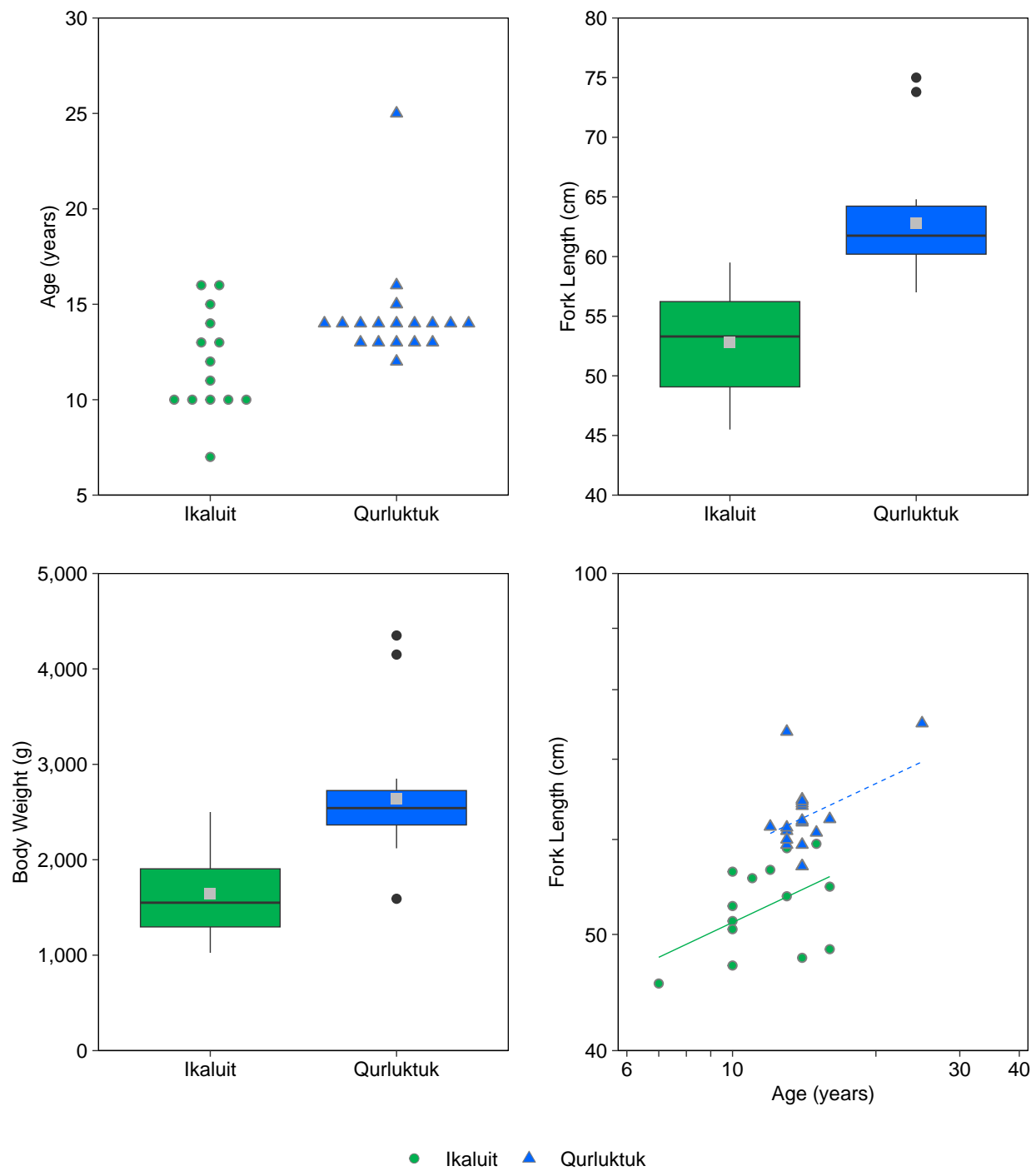


Figure 3.2: Fish Health Endpoints of Female Arctic Charr, Milne Inlet, August 2024

Note: Scatterplot x- and y-axes are log10-scaled. Outliers removed from the analysis are plotted as an X.

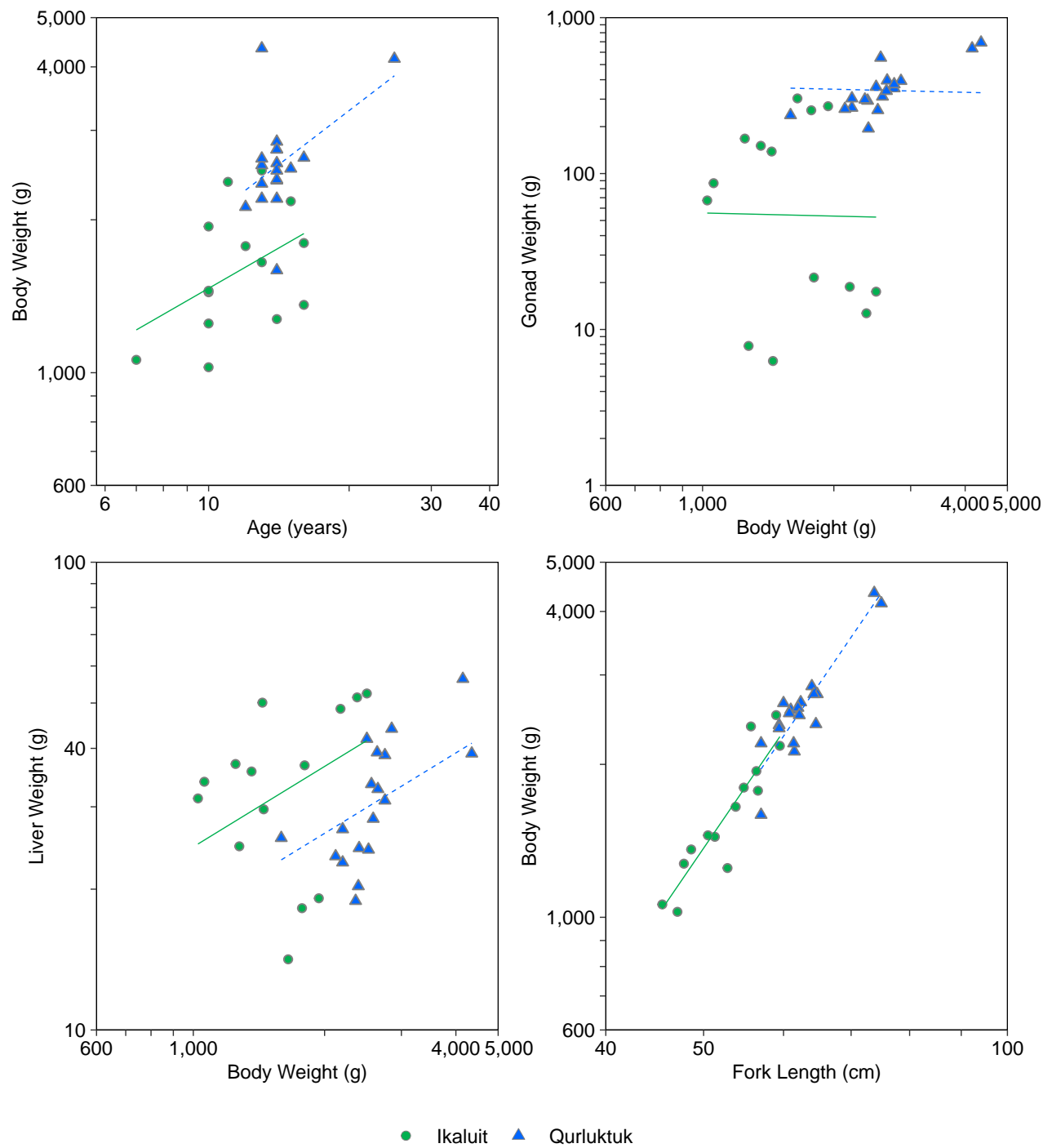


Figure 3.2: Fish Health Endpoints of Female Arctic Charr, Milne Inlet, August 2024

Note: Scatterplot x- and y-axes are log₁₀-scaled. Outliers removed from the analysis are plotted as an X.

tissues, while females from Ikaluit Lake stored more energy in the liver. This discrepancy may result from differences in spawning timing between the lakes or variations in the proportion of spawners sampled in 2024. Two distinct clusters are apparent in Ikaluit Lake gonad weight relative to body weight (Figure 3.2), suggesting a mix of spawning (higher relative gonad size) and non spawning (lower relative gonad size) individuals, while only a single cluster was apparent in Qurluktuk Lake (that followed a similar relationship of gonad to body weight as spawning individuals in Ikaluit Lake; Figure 3.2).

3.2.3.2 Temporal Health Trends

3.2.3.2.1 Qurluktuk Lake


Life history strategy (i.e., anadromous vs. resident) can influence health endpoints such as growth and condition. Otolith microchemistry analyses conducted on the 2024 samples confirmed the presence of both resident and anadromous fish in Qurluktuk Lake. However, individuals from previous years could not be definitively categorized as either resident or anadromous. As such, fish exhibiting both life history strategies were included in the analysis. However, temporal trends should be interpreted with caution given that the proportions of sampled fish exhibiting each life history strategy appear to vary annually. For example, only one individual captured in 2024 exhibited a resident life history strategy (Figure 3.1), whereas based on length-age relationships, at least six individuals captured in 2022 were considered likely to have exhibited a resident strategy (Minnow 2023).


Female charr sampled in 2021 and 2024 were significantly heavier-at-age than those sampled historically (i.e., prior to mining operations; Tables 3.2 and 3.3, Figure 3.3). Additionally, female charr sampled in 2021, 2022, and 2024 had higher body condition (i.e., heavier-at-length) than their historical counterparts (Table 3.3). However, since anadromous fish typically exhibit better body condition than resident fish, the proportion of anadromous individuals may represent a significant confounding factor. While some significant differences were observed between contemporary (2021 to 2024) and historical samples for specific health endpoints, no endpoint showed a consistent, significant difference across all three contemporary years, except for higher body condition. Further, there were differences between contemporary sampling years for some endpoints (e.g., length and weight), but these were not consistent across years, suggesting that differences are a product of natural variability. Temporal comparisons of male health endpoints were not conducted using 2024 data, as only one male was captured from Qurluktuk Lake.




Table 3.3: Comparison of Health Endpoints in Female Adult Arctic Charr, Qurluktuk Lake, Milne Inlet Freshwater Fish Health Monitoring Program, Historical to 2024

Sex	Indicator	Endpoint	Variables		Sample Size				Test			ANCOVA Statistics			Summary Statistics ^b				
									Statistical Test	Shapiro Wilk's P-Value	Levene's Test P-Value	Interaction Model	Parallel Slope Model	Covariate Value for Comparisons ^a					
			Response	Covariate	Historical	2021	2022	2024				Interaction <i>p</i> -value	Covariate <i>p</i> -value		Statistic	Historical	2021	2022	2024
Female	Survival/Recruitment	Length-Frequency Distribution	Fork Length (cm)	-	22	7	13	18	K-S	-	-	-	-	-	0	-	-	-	-
		Age-Frequency Distribution	Age (years)	-	16	7	13	18	K-S	-	-	-	-	-	0	-	-	-	-
	Survival	Age	log10[Age (years)]	-	16	7	13	18	ANOVA	0.069	0.037	-	-	-	Geometric Mean	16.5	15.0	12.1	14.2
	Body Size	Fork Length	Fork Length (cm)	-	22	7	13	18	ANOVA	0.20	0.0010	-	-	-	Mean	62.0	66.4	54.8	62.8
		Body Weight	Body Weight (g)	-	22	7	13	18	ANOVA	0.077	0.062	-	-	-	Mean	2,380	3,344	2,064	2,642
	Energy Usage	Length-at-age	log10[Fork Length (cm)]	log10[Age (years)]	16	7	13	18	ANCOVA	-	-	0.124	<0.001	14.4	Adjusted Mean	57.4	65.0	57.2	62.9
		Weight-at-age	log10[Body Weight (g)]	log10[Age (years)]	16	7	13	18	ANCOVA	-	-	0.260	<0.001	14.4	Adjusted Mean	1,797	3,035	2,070	2,604
	Energy Storage	Condition	log10[Body Weight (g)]	log10[Fork Length (cm)]	22	7	13	18	ANCOVA	-	-	0.363	<0.001	60.4	Adjusted Mean	2,043	2,466	2,434	2,322

 Shading indicates an area p-value less than 0.1 or an interaction p-value less than 0.05.

 Indicates a Magnitude of Difference (MOD) outside of applicable Critical Effect Size (i.e., ±25% for all endpoints with the exception of ±10% for condition).

 Covariate P-value > 0.05

Notes: ns = non-significant. "-" indicates the value is not applicable. ANCOVA = analysis of covariance. K-S = Kolmogorov–Smirnov.

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.


^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted means of the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction (i.e., different slopes) occurs.


^c MOD = (MCT_{historical} - MCT_{recent}/ MCT_{recent}) x 100


^d Minimum detectable effect size (see methods section of report for formula).

Table 3.3: Comparison of Health Endpoints in Female Adult Arctic Charr, Qurluktuk Lake, Milne Inlet Freshwater Fish Health Monitoring Program, Historical to 2024

Sex	Indicator	Endpoint	Variables		Sample Size				Test <i>P</i> -value (Location)	Historical vs. 2021				Historical vs. 2022			
										P-Value	Magnitude of Difference (%) ^c	Estimated Minimum Detectable Difference with $\alpha=\beta=0.1^d$		P-Value	Magnitude of Difference (%) ^c	Estimated Minimum Detectable Difference with $\alpha=\beta=0.1^d$	
			Response	Covariate	Historical	2021	2022	2024				Increase	Decrease			Increase	Decrease
Female	Survival/Recruitment	Length-Frequency Distribution	Fork Length (cm)	-	22	7	13	18	-	0.379	ns	-	-	0.128	ns	-	-
		Age-Frequency Distribution	Age (years)	-	16	7	13	18	-	0.666	ns	-	-	0.044	-46	-	-
	Survival	Age	log10[Age (years)]	-	16	7	13	18	0.013	0.821	ns	33	-25	0.007	-27	33	-25
	Body Size	Fork Length	Fork Length (cm)	-	22	7	13	18	0.042	0.706	ns	17	-17	0.145	ns	17	-17
		Body Weight	Body Weight (g)	-	22	7	13	18	0.064	0.147	ns	47	-47	0.816	ns	47	-47
	Energy Usage	Length-at-age	log10[Fork Length (cm)]	log10[Age (years)]	16	7	13	18	0.022	0.113	ns	15	-13	1.000	ns	15	-13
		Weight-at-age	log10[Body Weight (g)]	log10[Age (years)]	16	7	13	18	0.010	0.023	69	58	-37	0.813	ns	58	-37
	Energy Storage	Condition	log10[Body Weight (g)]	log10[Fork Length (cm)]	22	7	13	18	0.005	0.044	21	19	-16	0.019	19	19	-16

 Shading indicates an area p-value less than 0.1 or an interaction p-value less than 0.05.

 Indicates a Magnitude of Difference (MOD) outside of applicable Critical Effect Size (i.e., ±25% for all endpoints with the exception of ±10% for condition).

 Covariate P-value > 0.05

Notes: ns = non-significant. "-" indicates the value is not applicable. ANCOVA = analysis of covariance. K-S = Kolmogorov–Smirnov.

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted means of the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction (i.e., different slopes) occurs.

^c MOD = (MCT_{historical} - MCT_{recent}/ MCT_{recent}) x 100

^d Minimum detectable effect size (see methods section of report for formula).

Table 3.3: Comparison of Health Endpoints in Female Adult Arctic Charr, Qurluktuk Lake, Milne Inlet Freshwater Fish Health Monitoring Program, Historical to 2024

Sex	Indicator	Endpoint	Variables		Sample Size				Historical vs. 2024				2021 vs. 2022			
									P-Value	Magnitude of Difference (%) ^c	Estimated Minimum Detectable Difference with $\alpha=\beta=0.1^d$		P-Value	Magnitude of Difference (%) ^c	Estimated Minimum Detectable Difference with $\alpha=\beta=0.1^d$	
			Response	Covariate	Historical	2021	2022	2024			Increase	Decrease			Increase	Decrease
Female	Survival/Recruitment	Length-Frequency Distribution	Fork Length (cm)	-	22	7	13	18	0.021	45	-	-	0.036	-63	-	-
		Age-Frequency Distribution	Age (years)	-	16	7	13	18	0.005	-52	-	-	0.138	ns	-	-
	Survival	Age	log10[Age (years)]	-	16	7	13	18	0.296	ns	33	-25	0.250	ns	33	-25
	Body Size	Fork Length	Fork Length (cm)	-	22	7	13	18	0.992	ns	17	-17	0.054	-18	16	-16
		Body Weight	Body Weight (g)	-	22	7	13	18	0.852	ns	47	-47	0.049	-38	34	-34
	Energy Usage	Length-at-age	log10[Fork Length (cm)]	log10[Age (years)]	16	7	13	18	0.140	ns	15	-13	0.128	ns	15	-13
		Weight-at-age	log10[Body Weight (g)]	log10[Age (years)]	16	7	13	18	0.044	45	58	-37	0.186	ns	58	-37
	Energy Storage	Condition	log10[Body Weight (g)]	log10[Fork Length (cm)]	22	7	13	18	0.067	14	19	-16	0.998	ns	19	-16

Shading indicates an area p-value less than 0.1 or an interaction p-value less than 0.05.

Indicates a Magnitude of Difference (MOD) outside of applicable Critical Effect Size (i.e., ±25% for all endpoints with the exception of ±10% for condition).

Covariate P-value > 0.05

Notes: ns = non-significant. "-" indicates the value is not applicable. ANCOVA = analysis of covariance. K-S = Kolmogorov–Smirnov.

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.


^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted means of the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction (i.e., different slopes) occurs.


^c MOD = (MCT_{historical} - MCT_{recent}/ MCT_{recent}) x 100


^d Minimum detectable effect size (see methods section of report for formula).

Table 3.3: Comparison of Health Endpoints in Female Adult Arctic Charr, Qurluktuk Lake, Milne Inlet Freshwater Fish Health Monitoring Program, Historical to 2024

Sex	Indicator	Endpoint	Variables		Sample Size				2021 vs. 2024				2022 vs. 2024			
									P-Value	Magnitude of Difference (%) ^c	Estimated Minimum Detectable Difference with $\alpha=\beta=0.1^d$		P-Value	Magnitude of Difference (%) ^c	Estimated Minimum Detectable Difference with $\alpha=\beta=0.1^d$	
			Response	Covariate	Historical	2021	2022	2024			Increase	Decrease			Increase	Decrease
Female	Survival/Recruitment	Length-Frequency Distribution	Fork Length (cm)	-	22	7	13	18	0.174	ns	-	-	<0.001	77	-	-
		Age-Frequency Distribution	Age (years)	-	16	7	13	18	0.025	-55	-	-	0.037	41	-	-
	Survival	Age	log10[Age (years)]	-	16	7	13	18	0.962	ns	33	-25	0.274	ns	33	-25
	Body Size	Fork Length	Fork Length (cm)	-	22	7	13	18	0.833	ns	16	-16	0.103	ns	19	-19
		Body Weight	Body Weight (g)	-	22	7	13	18	0.426	ns	34	-34	0.418	ns	55	-55
	Energy Usage	Length-at-age	log10[Fork Length (cm)]	log10[Age (years)]	16	7	13	18	0.928	ns	15	-13	0.149	ns	15	-13
		Weight-at-age	log10[Body Weight (g)]	log10[Age (years)]	16	7	13	18	0.810	ns	58	-37	0.397	ns	58	-37
	Energy Storage	Condition	log10[Body Weight (g)]	log10[Fork Length (cm)]	22	7	13	18	0.830	ns	19	-16	0.866	ns	19	-16

 Shading indicates an area p-value less than 0.1 or an interaction p-value less than 0.05.

 Indicates a Magnitude of Difference (MOD) outside of applicable Critical Effect Size (i.e., ±25% for all endpoints with the exception of ±10% for condition).

 Covariate P-value > 0.05

Notes: ns = non-significant. "-" indicates the value is not applicable. ANCOVA = analysis of covariance. K-S = Kolmogorov–Smirnov.

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted means of the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction (i.e., different slopes) occurs.

^c MOD = (MCT_{historical} - MCT_{recent}/ MCT_{recent}) x 100

^d Minimum detectable effect size (see methods section of report for formula).

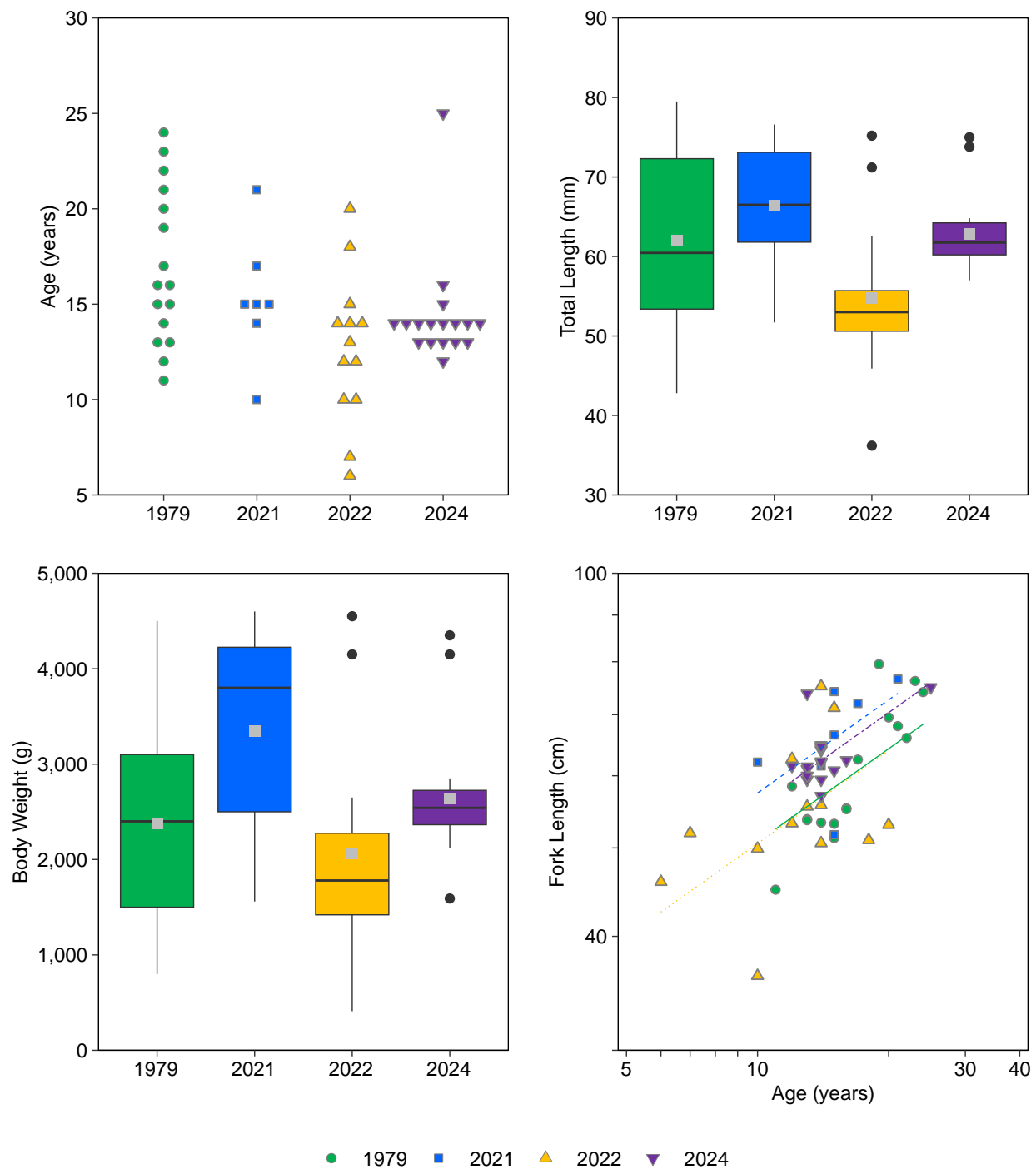


Figure 3.3: Fish Health Endpoints of Female Adult Arctic Charr, Qurluktuk Lake, Milne Inlet Freshwater Fish Health Monitoring Program, Historical, 2021, 2022, and 2024

Notes: Scatterplot x- and y-axes are log10-scaled. Outliers removed from the analysis are plotted as an X. The 1979 data represent the historical dataset from Moshenko (1979).

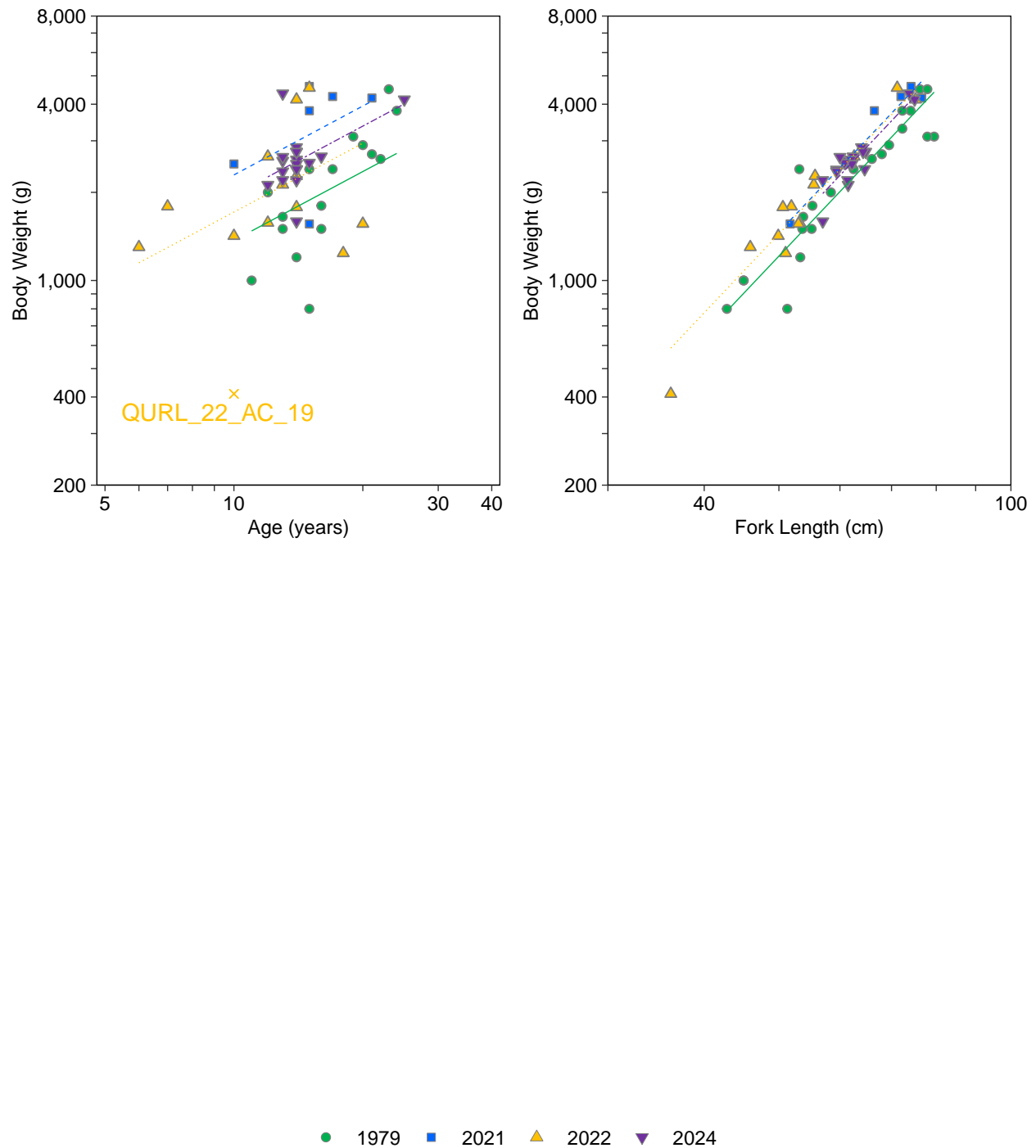


Figure 3.3: Fish Health Endpoints of Female Adult Arctic Charr, Qurluktuk Lake, Milne Inlet Freshwater Fish Health Monitoring Program, Historical, 2021, 2022, and 2024

Notes: Scatterplot x- and y-axes are log₁₀-scaled. Outliers removed from the analysis are plotted as an X. The 1979 data represent the historical dataset from Moshenko (1979).

3.2.3.2.2 Ikaluit Lake

Publicly available historical (i.e., pre-mining operations) data for Ikaluit Lake were not accessible, so temporal comparisons could not be made between contemporary and historical fish endpoint data. Comparison of health endpoints between 2022 and 2024 for female and male charr (Table 3.4, Figures 3.4 and 3.5) indicated no significant differences between 2022 and 2024 in any female health endpoints (Table 3.4, Figure 3.4). There was a statistically significant difference in male body condition between 2022 and 2024 in Ikaluit Lake where fish in 2024 had lower condition than 2022 (Table 3.4, Figure 3.5). This difference was small (Magnitude of Difference [MOD] = 7.4%) and represents natural variability.

3.2.3.2.3 Summary

Data collected both historically and during the current program include a mix of both resident and anadromous arctic charr. While anthropogenic activities can affect fish health endpoints, the differences in health endpoints observed between the historical and contemporary sampling periods, are likely due to methodological changes (e.g., changes in gill net size and sampling location) and/or sample bias (e.g., ratio of resident and anadromous fish). Additionally, the historical data used for comparison with Qurluktuk Lake in 2021, 2022, and 2024, were collected from the Robertson River, which connects Qurluktuk Lake to Milne Inlet. It is therefore possible that all the fish in the historical dataset were anadromous, unlike the 2021, 2022, and 2024 samples, which likely included varying ratios of resident and anadromous fish. As previously noted, health endpoints such as body condition (length relative to weight) and growth (length or weight relative to age) can vary significantly between resident and anadromous individuals (Young et al. 2021), which contributed to the observed differences in these endpoints between contemporary and historical samples.

3.2.4 Fish Tissue

Elevated mercury concentrations in large-bodied fish species of the Arctic are not uncommon, even in the absence of local point sources of contamination. The majority of mercury in Arctic ecosystems originates from long-range atmospheric deposition from anthropogenic sources (e.g., coal combustion), which is transported northward by prevailing air currents and deposited in lakes and on landscapes. Historically, the tundra acted as a sink for elemental mercury; however, with enhanced permafrost thawing due to climate change, mercury that was once sequestered has become more bioavailable for methylation (see Lehnherr 2014). Additionally, the slow growth rates and long lifespans of some Arctic fishes contribute to the bioaccumulation of mercury over extended periods, resulting in elevated concentrations (see Lehnherr 2014).



Table 3.4: Comparison of Health Endpoints in Adult Arctic Charr, Ikaluit Lake, Milne Inlet Freshwater Fish Health Monitoring Program, 2022 and 2024

Sex	Indicator	Endpoint	Variables		Sample Size		Test			ANCOVA Statistics			Summary Statistics ^b			Test <i>P</i> -value (Location)	2022 vs. 2024		
							Statistical Test	Shapiro Wilk's P-Value	Levene's Test P-Value	Interaction Model	Parallel Slope Model	Covariate Value for Comparisons ^a					Magnitude of Difference (%) ^c	Estimated Minimum Detectable Difference with α=β=0.1	
			Response	Covariate	2022	2024				Interaction <i>p</i> -value	Covariate <i>p</i> -value		Statistic	2022	2024			Increase	Decrease
Male	Survival/Recruitment	Length-Frequency Distribution	Fork Length (cm)	-	25	7	K-S	-	-	-	-	-	0	-	-	0.851	ns	-	-
		Age-Frequency Distribution	Age (years)	-	25	7	K-S	-	-	-	-	-	0	-	-	0.907	ns	-	-
	Survival	Age	Age (years)	-	25	7	tequal	0.30	0.91	-	-	-	Mean	11.5	11.9	0.687	ns	13	-13
	Body Size	Fork Length	Fork Length (cm)	-	25	7	tequal	0.80	0.58	-	-	-	Mean	59.3	58.5	0.805	ns	8.3	-8.3
		Body Weight	Body Weight (g)	-	25	7	tequal	0.52	0.58	-	-	-	Mean	2,452	2,164	0.434	ns	23	-23
	Energy Usage	Length-at-age	log10[Fork Length (cm)]	log10[Age (years)]	25	7	ANCOVA	-	-	0.445	<0.001	11.4	Adjusted Mean	59.0	57.5	0.566	ns	7.1	-6.7
		Weight-at-age	log10[Body Weight (g)]	log10[Age (years)]	25	7	ANCOVA	-	-	0.494	0.004	11.4	Adjusted Mean	2,316	2,005	0.311	ns	24	-20
	Energy Storage	Condition	log10[Body Weight (g)]	log10[Fork Length (cm)]	25	7	ANCOVA	-	-	0.873	<0.001	58.7	Adjusted Mean	2,282	2,114	0.069	-7.4	6.6	-6.2
Female	Survival/Recruitment	Length-Frequency Distribution	Fork Length (cm)	-	12	14	K-S	-	-	-	-	-	0	-	-	0.537	ns	-	-
		Age-Frequency Distribution	Age (years)	-	12	14	K-S	-	-	-	-	-	0	-	-	0.846	ns	-	-
	Survival/Recruitment	Age-Frequency Distribution	Age (years)	-	12	14	K-S	-	-	-	-	-	0	-	-	0.846	ns	-	-
	Body Size	Fork Length	Fork Length (cm)	-	12	14	tequal	0.81	0.46	-	-	-	Mean	54.8	52.8	0.325	ns	10	-10
		Body Weight	Body Weight (g)	-	12	14	tequal	0.62	0.87	-	-	-	Mean	1,782	1,648	0.496	ns	30	-30
	Energy Usage	Length-at-age	log10[Fork Length (cm)]	log10[Age (years)]	12	14	ANCOVA	-	-	0.323	0.001	11.3	Adjusted Mean	55.0	52.3	0.113	ns	8.9	-8.2
		Weight-at-age	log10[Body Weight (g)]	log10[Age (years)]	12	14	ANCOVA	-	-	0.697	0.004	11.3	Adjusted Mean	1,752	1,556	0.239	ns	31	-24
	Energy Storage	Condition	log10[Body Weight (g)]	log10[Fork Length (cm)]	12	14	ANCOVA	-	-	0.502	<0.001	53.5	Adjusted Mean	1,621	1,664	0.525	ns	12	-11

Shading indicates an area p-value less than 0.1 or an interaction p-value less than 0.05.

Indicates a Magnitude of Difference (MOD) outside of applicable Critical Effect Size (i.e., ±25% for all endpoints with the exception of ±10% for condition).

Covariate P-value > 0.05.

Notes: ns = non-significant. "-" indicates the value is not applicable. ANCOVA = analysis of covariance. K-S = Kolmogorov–Smirnov.

^a The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

^b The median, mean (geometric mean for log₁₀-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted means of the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction (i.e., different slopes) occurs.

^c Magnitude of Difference (MOD) = (MCT2022 - MCT2024/ MCT2024) x 100

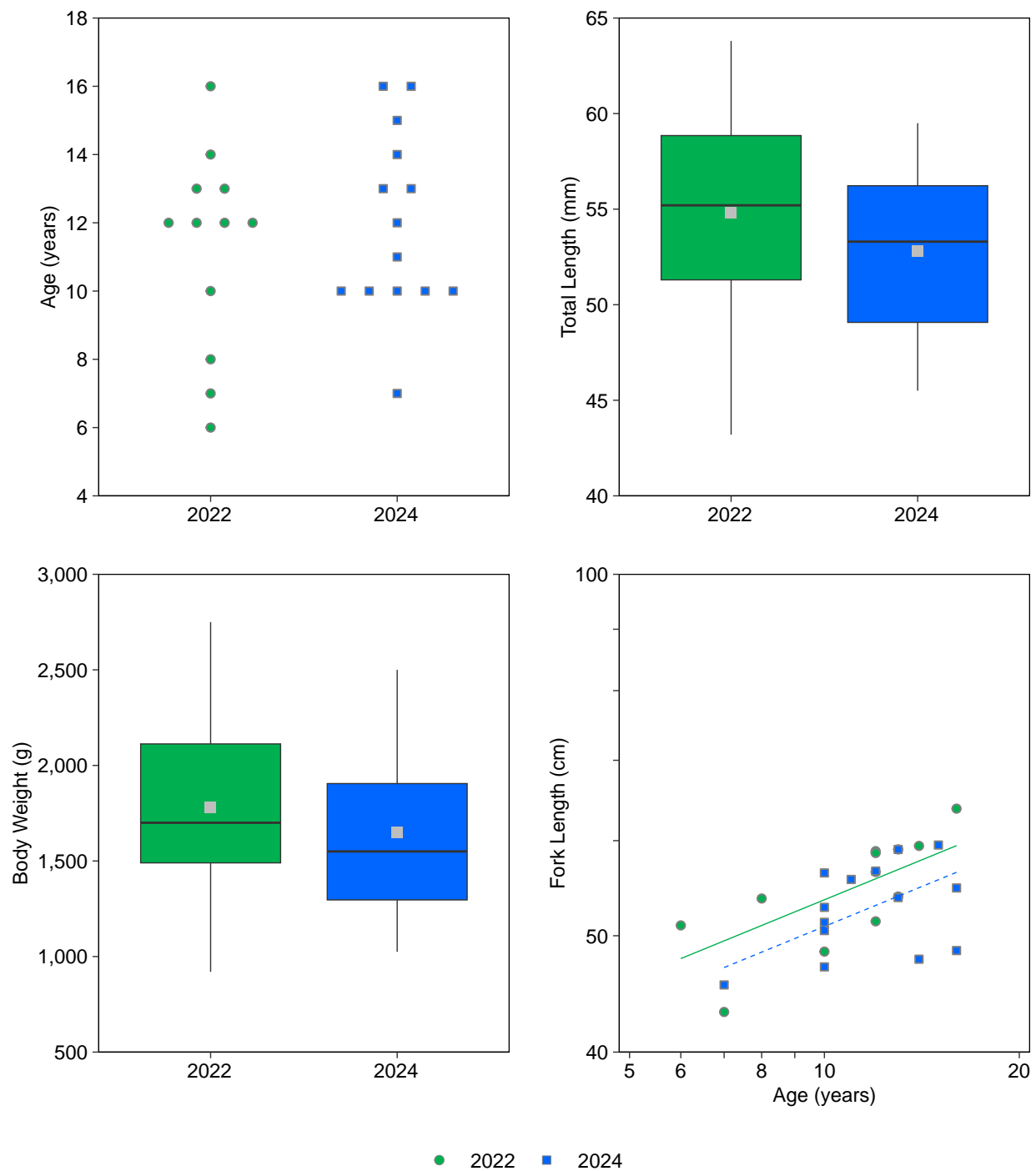


Figure 3.4: Fish Health Endpoints of Female Adult Arctic Charr, Ikaluit Lake, Milne Inlet Freshwater Fish Health Monitoring Program, 2022 and 2024

Notes: Scatterplot x- and y-axes are log₁₀-scaled.

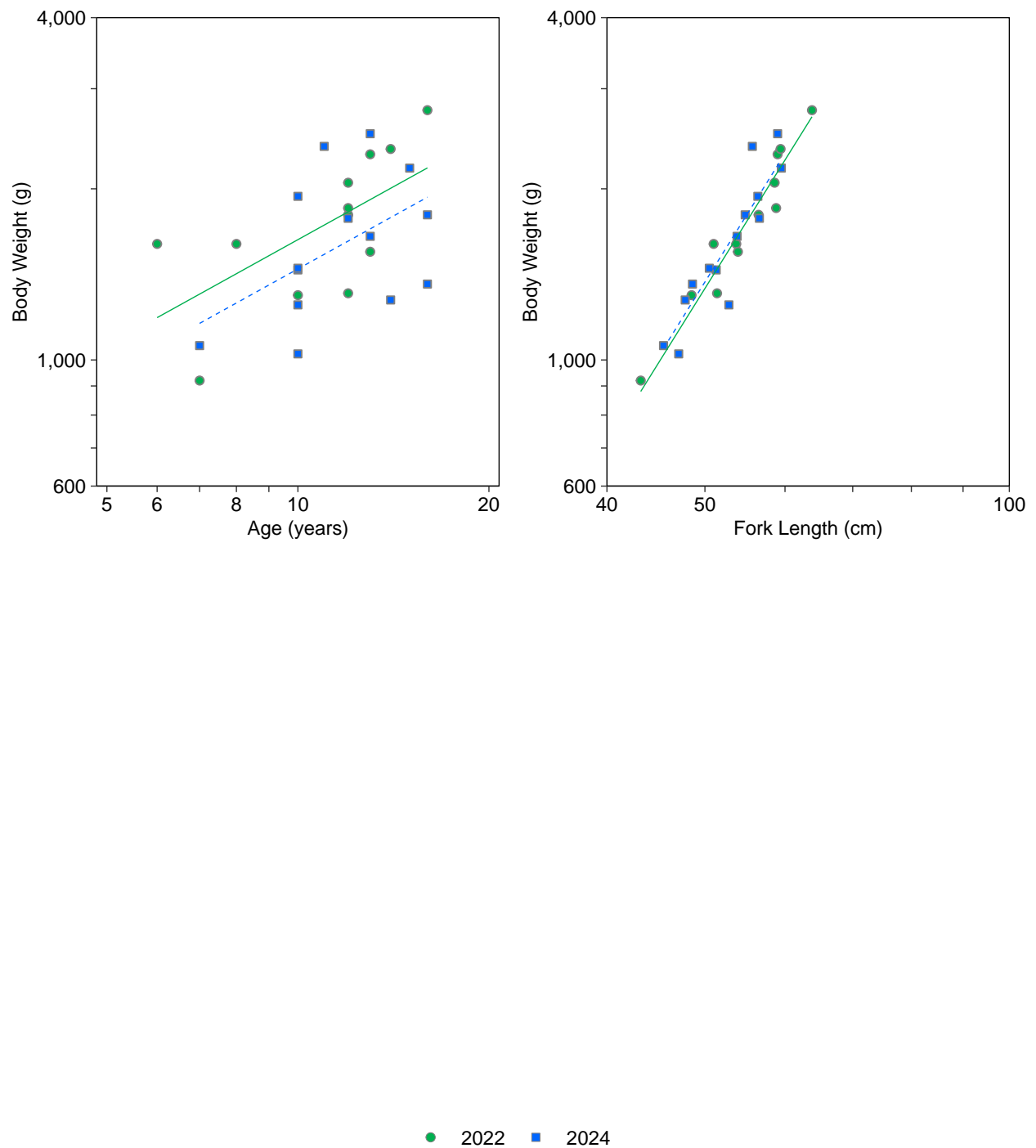


Figure 3.4: Fish Health Endpoints of Female Adult Arctic Charr, Ikaluit Lake, Milne Inlet Freshwater Fish Health Monitoring Program, 2022 and 2024

Notes: Scatterplot x- and y-axes are log10-scaled.

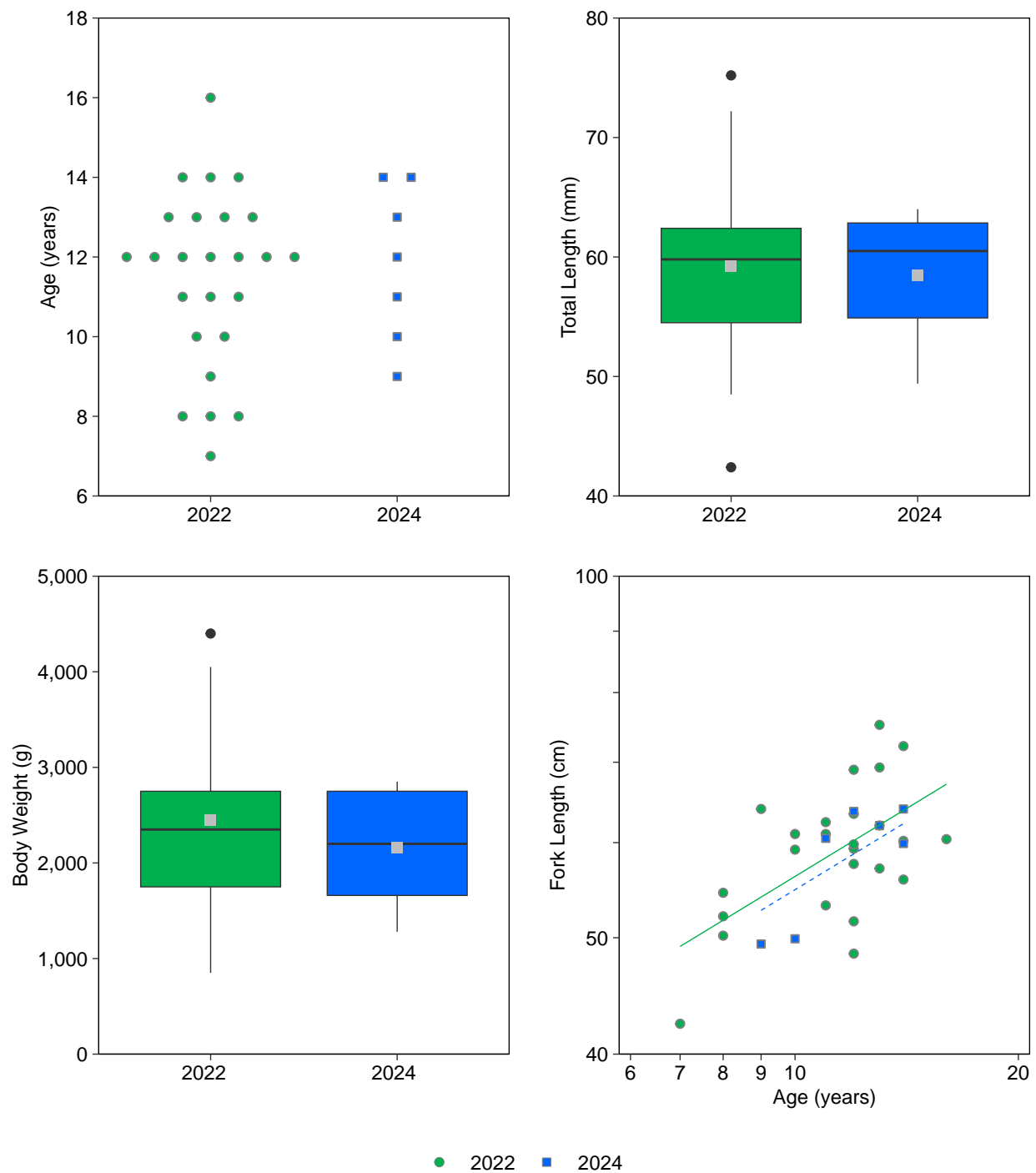


Figure 3.5: Fish Health Endpoints of Male Adult Arctic Charr, Ikaluit Lake, Milne Inlet Freshwater Fish Health Monitoring Program, 2022 and 2024

Notes: Scatterplot x- and y-axes are log₁₀-scaled.

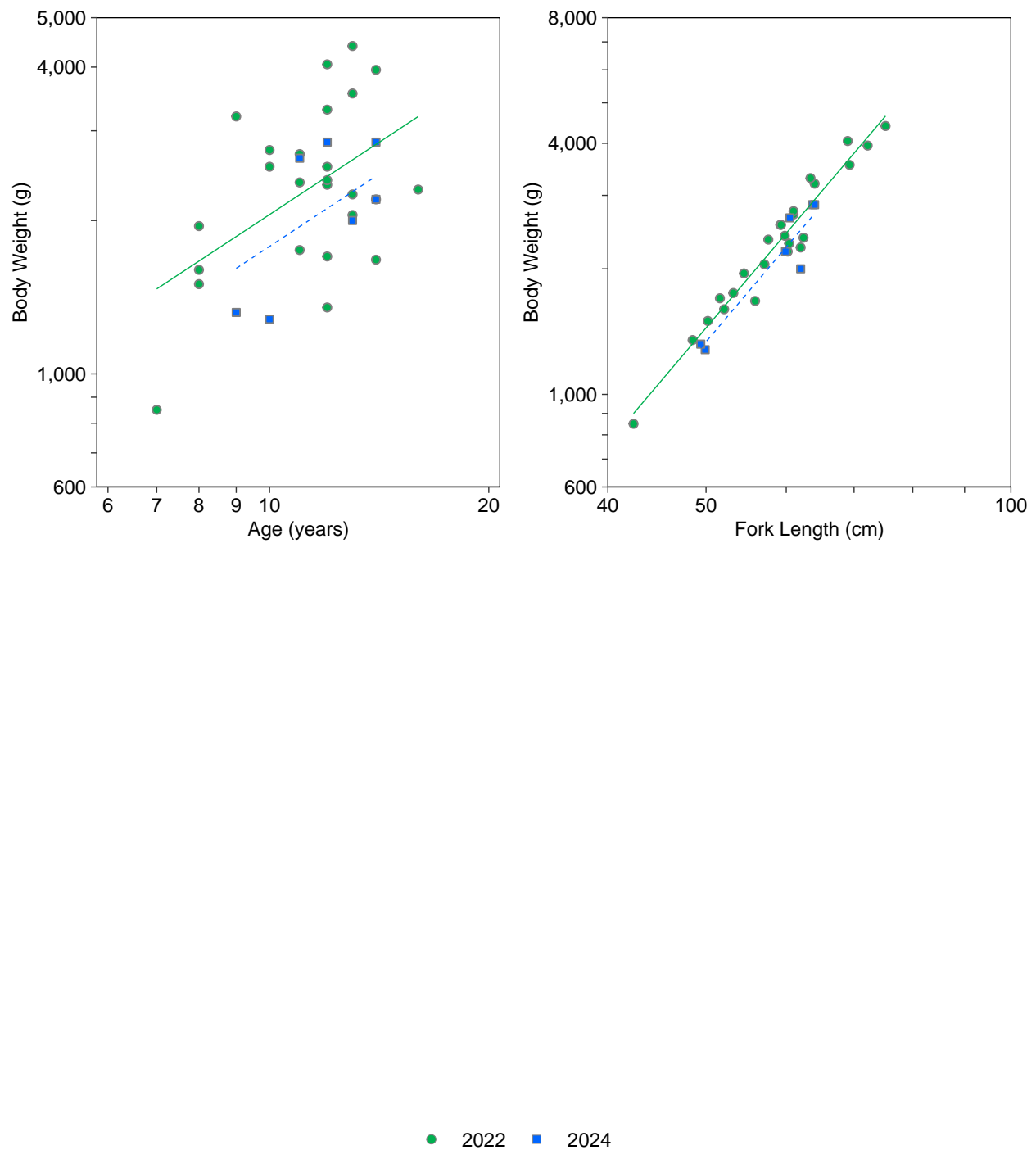


Figure 3.5: Fish Health Endpoints of Male Adult Arctic Charr, Ikaluit Lake, Milne Inlet Freshwater Fish Health Monitoring Program, 2022 and 2024

Notes: Scatterplot x- and y-axes are log10-scaled.

For both Qurluktuk and Ikaluit lakes in 2024, mean mercury concentrations in muscle and liver tissue of sampled arctic charr were below Maximum Allowable Mercury Concentration in Fish for Commercial Sale (0.5 mg/kg ww; CFIA 2015; Appendix Tables D.7 and D.8). In Ikaluit Lake, none of the fish muscle or liver tissue samples exceeded the consumption guideline (Figure 3.6, Appendix Tables D.7 and D.8). In Qurluktuk Lake, however, one liver sample exceeded the consumption guideline (Figure 3.6; Appendix Tables D.7 and D.8), and one muscle tissue concentration was just under the guideline. Both the liver and muscle samples with the highest mercury concentrations belonged to the single resident individual captured in Qurluktuk Lake (i.e., QURL_AC_09). This finding supports previous interpretations that elevated mercury concentrations in charr from Qurluktuk Lake are a product of differences in life history strategy (Minnow 2023).

Consistent with 2022 results, charr mean muscle mercury concentrations were significantly higher in Qurluktuk Lake than in Ikaluit Lake in 2024 when outliers were included in the analysis; however, when removed there was no significant difference (Figure 3.6, Appendix Table D.6; Minnow 2023). The two outliers in the analysis were the only resident individual (i.e., QURL_AC_09) and the oldest individual (i.e., 25 years of age) captured in 2024, which is consistent known relationships between life history strategy (Swanson 2011) and age (Mason et al. 2000) and mercury concentration. Liver mercury concentrations were also significantly higher in Qurluktuk Lake in 2024, which contrasts with the 2022 findings, where liver mercury was greater in Ikaluit Lake fish (Figure 3.6, Appendix Table D.6; Minnow 2023). This change may reflect differences in resource allocation or different proportions of life history strategies between the two populations. As described in Section 3.2.3.1, relative liver size was significantly greater in females from Ikaluit Lake, whereas females from Qurluktuk Lake exhibited higher relative gonad weight (Appendix Table D.13). These patterns suggest that females sampled in Qurluktuk Lake invested more energy into reproduction at the time of the 2024 sampling, potentially leading to reduced liver mass due to lipid mobilization. Since methylmercury is primarily associated with protein-rich tissue rather than fat (Bloom 1992), this reduction in liver size could result in higher mercury concentrations. Conversely, the larger livers in Ikaluit Lake females may reflect greater lipid storage in the absence of reproductive investment, leading to a dilution of mercury concentrations within liver tissue.

Iron concentrations in arctic charr tissues were also examined, although no consumption guideline is available¹². Health Canada recommends a daily upper limit of iron intake of 45 mg/day (2006).

¹² Iron was identified during consultation as an analyte of interest in fish tissues.



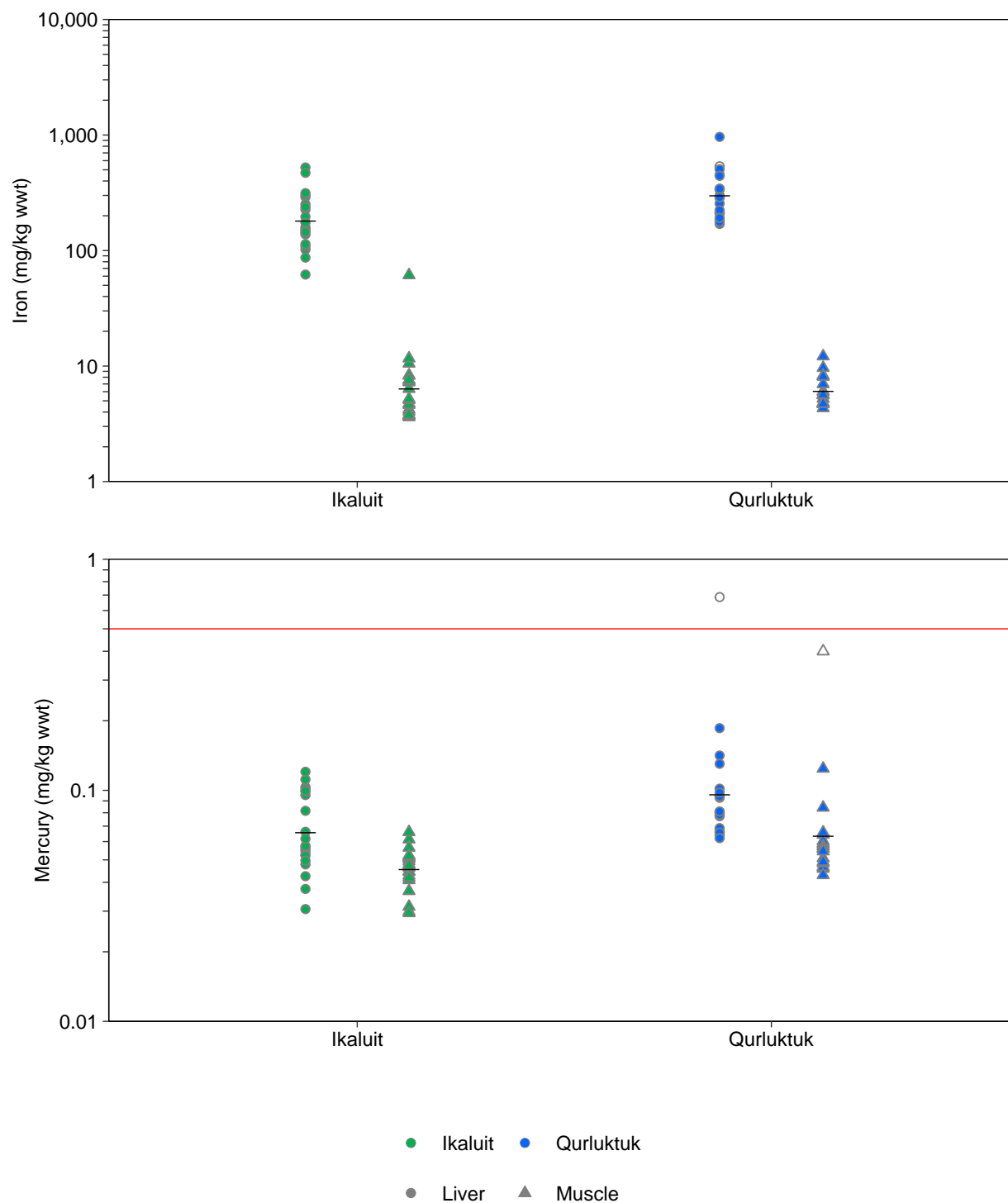


Figure 3.6: Iron and Mercury Concentrations (mg/kg ww) in Arctic Charr Muscle and Liver, Qurluktuk and Ikaluit Lakes, Milne Inlet Freshwater Fish Health Monitoring Program, 2024

Note: Black bars denote geometric means. Red solid line represents the Maximum Allowable Mercury Concentration in Fish for Commercial Sale (0.5 mg/kg ww). Open symbols represent resident fish.

The iron concentrations in both muscle and liver tissues reported here are consistent with the nutritional information provided by Health Canada for raw arctic charr and well below the recommended limit, assuming an average portion size of 75 g (Health Canada 2025; Figure 3.6; Appendix Table D.7 and D.8). To consume the recommended limit of iron per day, one would need to eat between 5 and 7 kg of fish muscle or 175 to 350 g of liver (e.g., 6 to 12 whole livers). Fish, especially organ meat (e.g., livers), are considered an excellent source of iron, an essential nutrient that must be acquired through diet (Health Canada 2006). Unlike in 2022, mean muscle and liver iron concentration were higher in Qurluktuk Lake than Ikaluit Lake, although the difference in muscle tissue was not statistically significant (Figure 3.6, Appendix Table D.6; Minnow 2023). Similar to mercury, the difference in liver iron concentrations between the lakes could be due to varying relative liver sizes.

Several exceedances of Health Canada consumption benchmarks for arsenic, cadmium¹³, copper, and selenium were observed in both muscle and liver tissues of arctic charr collected from Qurluktuk and Ikaluit Lakes in 2024 (Appendix Tables D.7 and D.8). Additional exceedances were noted for chromium¹⁴ in muscle tissue and for manganese, silver, and zinc in liver tissue. Detection limits for aluminum and nickel were above the Health Canada benchmarks, so whether these metals exceeded guidelines could not be determined. No other metals had concentrations consistently above benchmarks (Appendix Tables D.7 and D.8).

Elevated arsenic concentrations are commonly associated with arsenobetaine, a non-toxic organic form found in marine organisms, which poses little risk to aquatic life or consumers (Eisler 1988). While exceedances of cadmium, copper, and selenium were recorded, these concentrations likely reflect natural conditions in the study lakes and are considered a product of the local geochemistry and fish physiology. Selenium and cadmium are also bioaccumulative, and can be affected by fish age and growth, although less predictably than mercury (Maret et al. 2010). Selenium is an essential micronutrient, and traditional foods, particularly those of marine origin, are naturally rich in selenium (Lemire et al. 2015). Moreover, organic forms of selenium found in food are generally less toxic than inorganic forms found in supplements, occupational settings, or drinking water (Rayman 2012).

3.3 Ongoing Consultation and Bridging Knowledge Systems

A component of the Milne Inlet Freshwater Fish Health Monitoring Program is to engage with the MHTO regarding the design, timing, and location of the proposed surveys and ongoing monitoring. The program approach was inspired by the Mi'kmaq concept of Two-Eyed

¹³ Only one fish from Ikaluit Lake had a cadmium muscle concentration exceeding guidelines (Appendix Table D.15).

¹⁴ Only one fish from Ikaluit Lake had a chromium muscle concentration exceeding guidelines (Appendix Table D.15)



Seeing, by integrating Inuit Qaujimagatuqangit (IQ) and western science. Throughout various meetings held among project partners, shared knowledge has helped to guide not only identification of project objectives, but also the study design (e.g., location of study lakes), sampling framework (e.g., where in each lake to sample), and the interpretation of results (e.g., how to identify a “healthy” fish and what endpoints are of concern). Moreover, ongoing conversations will facilitate an adaptive approach to this program which will help to secure its long-term success, and its relevance to the MHTO.

To date, the main objectives of this program have focused on health endpoints for arctic charr such as survival (age), growth (size relative to age), condition (length relative to weight), and tissue quality as it relates to consumption. Inuit Qaujimagatuqangit has helped to define these objectives and the following outlines contributions to the study:

- Two lakes (Tugaat Lake and Qurluktuk Lake) were initially identified as important sources of the subsistence fishery for community members. Community feedback identified a third lake (Ikaluit Lake) which was added to the program.
- During initial discussions with the MHTO, mercury and iron tissue concentrations were identified as analytes of concern in fish tissue.
- To facilitate an integrated approach, crews were made up of individuals who brought a combination of IQ and western science to the project.
- During the field program, members holding IQ identified appropriate locations where fishing should occur within the study lakes.

During fish processing in 2022 there were some charr that the community partners had no interest in keeping for human (nor animal) consumption. Several community members communicated that these particular fish, referred to by some as “unhealthy,” could be identified by slight nuances in appearance and smell. Pairing these and other qualitative descriptors (e.g., texture or color, based on the experience of hunters and trappers) with fish attributes such as age and length may facilitate a more holistic picture of charr health from the study areas and help to ensure that community members can have confidence in consuming the fish.

- During discussions with the MHTO, members expressed the need for increased transparency for all fish data which were included in the 2022 report as well as this report (Minnow 2023; Appendix D).
- During discussions with the MHTO, members expressed interest in the study evaluating whether the arctic charr are acceptable for consumption. In response, Minnow (2023)



and this report included a screening of all tissue data collected with available consumption values (see Table 2.2 and Appendix D).

Ongoing knowledge sharing, and the bridging of knowledge systems, is a tremendous tool which will only help to fortify this program, build relationships among project partners, and ensure the long-term success and value of these monitoring efforts for the Inuit community.



4 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

This report and its findings, in concert with its appended components including documentation of consultation and partnership with the MHTO, and all monitoring data pertaining to the presence and health of arctic charr in freshwater bodies within watersheds proximal to the mine, tote road, and Milne Inlet Port project development areas, satisfies condition 48(a) of the Project Certificate. It was designed in coordination with the community to monitor the health of arctic charr populations proximate to Baffinland's Milne Port Operations. The 2024 program included assessment of water chemistry, adult arctic charr health and tissue quality in Qurluktuk and Ikaluit lakes as well as otolith microchemistry for adult arctic charr from Qurluktuk Lake. Sampling was completed in 2024 by Minnow in collaboration with community members from the MHTO, the QIA, and the Hamlet of Pond Inlet. Conclusions of the 2024 arctic charr monitoring are summarized as follows:

- All analytes in littoral water samples were below Canadian Water Quality Guidelines for aquatic life. Total mercury and total iron were below detection limits in Qurluktuk Lake. Total iron was detectable in Ikaluit Lake (0.10 mg/L). Both lakes are oligotrophic, consistent with most Arctic lakes.
- A total of 39 (20 adults), and 37 (37 adults) were collected from Qurluktuk and Ikaluit lakes, respectively. Catch-per-unit-effort Ikaluit Lake (11.4 fish/100 m²·hr) than Qurluktuk Lake (0.74 fish/100 m²·hr), but both were lower than in 2022 and can be influenced by other factors such as weather, net-set locations, and timing.
- Otolith microchemistry was used to evaluate the life history strategy for the 20 adult charr captured from Qurluktuk Lake in 2024. Of the 20 fish, 19 completed at least one marine migration in their lifetimes, with first marine migration occurring between three and fourteen years of age. There were fewer resident individuals captured in 2024 than 2022 (i.e., one vs six), based on presumed life histories. Visual assessments by biologists (i.e., not Inuit) misclassified 12 fish as residents in 2024, showing poor agreement with the otolith microchemistry results, which identified only one resident individual.
- Female arctic charr from Qurluktuk Lake were older, longer, and heavier than those from Ikaluit Lake in 2024. Only one male fish was captured from Qurluktuk Lake in 2024, which fell within the ranges for age, length, and weight for male fish captured from Ikaluit Lake in 2024. Female growth (i.e., length-at-age) was higher in Qurluktuk Lake in 2024, which



is inconsistent with the 2022 results, and likely driven by the portion of anadromous individuals sampled in a given year.

- In 2024, female arctic charr liver weight was lower in Qurluktuk Lake than Ikaluit Lake, while relative gonad weight and weight-at-age were higher in Qurluktuk Lake, and body condition (weight-at-length) was similar between lakes. The disparity in relative gonad weight and relative liver weight between lakes indicates a difference in energy allocation at the time of sampling. There were no consistent patterns in the results.
- Some Qurluktuk Lake female charr health metrics (i.e., age, weight-at-age, and condition) were higher compared to pre-mining years; however, variable life history strategies complicate temporal comparisons. Ikaluit Lake charr male and female endpoints showed no significant differences between 2022 and 2024 except for male condition, indicating consistent charr health in this lake.
- Mercury concentrations in fish muscle and liver tissues were below Health Canada consumption guidelines (0.5 mg/kg) except for the liver from the single resident fish from Qurluktuk Lake in 2024. There were fewer mercury tissue consumption guideline exceedances in 2024 compared with previous years, which is likely a product of sampling fewer resident individuals in 2024. Consistent with 2022, charr tissue mercury concentrations were typically higher in fish from Qurluktuk Lake than Ikaluit Lake. Iron concentrations in charr tissue in fish from both lakes in 2024 were well within safe dietary limits as designated by Health Canada. Some fish tissue samples exceeded Health Canada benchmarks for arsenic, cadmium, copper, and selenium in 2024, but these reflect natural Arctic background levels.

4.2 Recommendations

The findings of the 2024 Milne Inlet Freshwater Fish Health Monitoring Program in concert with results from previous years, indicate that fish health, tissue contaminants, and water quality remain stable and within previously observed ranges, with no consistent patterns of change pre- or post-mining. Given the consistency of results across years, along with community feedback and logistical considerations, several recommendations are proposed to improve the efficiency, relevance, and community value of future monitoring, should it occur¹⁵ including:

1. Increase Community Ownership and Integration

¹⁵ While recommendations for future monitoring are presented, it should be noted that given that the 12 Mt per year Phase II expansion will not occur, requirements for monitoring associated with the application and review process for that expansion are being reevaluated, which may influence further recommendations for continuation of monitoring as part of the Program.



Work with the MHTO and Hamlet of Pond Inlet to explore integrating sampling with existing community activities, such as the annual spring fishing derby at Ikaluit Lake. This approach would strengthen community leadership, reduce disruptions, and support culturally appropriate, on-the-land sampling while responding to local interest in contaminant levels during different seasons.

2. A Shift to Triennial Monitoring Cycles

Transition the intensive field program to a three-year cycle to reduce unnecessary fish mortalities, and ensure resource-efficient long-term monitoring. This timing would also remain consistent with broader Environmental Effects Monitoring (EEM) standards in Canada.

3. Inclusion of Otolith Microchemistry

As there was poor agreement between the otolith microchemical and visual anadromy assessments, it is recommended to include microchemistry on future field programs to confirm different life histories and to have Inuit IQ holders complete the visual assessments directly, reducing confounding effects in comparative temporal and spatial analyses of fish endpoints.

4. Presentation of findings to the MHTO

Results from the Milne Inlet Freshwater Fish Health Program should be presented to determine a path forward for future monitoring in alignment with the perspectives of the MHTO and Baffinland.



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**APPENDIX A
ENGAGEMENT
DOCUMENTATION**

APPENDIX A ENGAGEMENT RECORD

A1 INTRODUCTION1

A2 AGREEMENTS WITH INDIGENOUS PEOPLES.....2

A3 IDENTIFICATION OF STAKEHOLDERS AND APPROACH TO COMMUNITY INVOLVEMENT3

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TABLE A.1 SUMMARY OF ENGAGEMENT ACTIVITIES RELATED TO MILNE INLET FRESHWATER FISH HEALTH PROGRAM

APPENDIX A.5 CONSULTATION MATERIALS, PRESENTATIONS, AND MEETING NOTES



A1 INTRODUCTION

Baffinland Iron Mines Corporation (Baffinland) carries out public consultation and engagement to support the Milne Inlet Freshwater Fish Health Program (the Project) planning and design, evaluation, and continuous improvement of community involvement throughout the project cycle. As part of this ongoing consultation and engagement, activities have been undertaken to specifically engage, establish a dialogue, generate feedback, and report on progress related to the development of the project. This appendix describes Baffinland's agreements with Indigenous Peoples and general approach to community involvement. Engagement timing, participation, and meetings are summarized, and engagement materials are provided.



A2 AGREEMENTS WITH INDIGENOUS PEOPLES

The Milne Inlet Freshwater Fish Health Program serves to satisfy Term and Condition 48(a) required on the Project Certificate for the Baffinland Mary River Project. Condition 48(a) of the Project Certificate stipulates that “the Proponent shall develop plans to conduct additional surveys for the presence of arctic charr in freshwater bodies and ongoing monitoring of arctic charr health where applicable, within watersheds proximal to the mine, tote road, and Milne Inlet Port project development areas, including but not limited to Phillips Creek, Tugaat and Qurluktuk. The Proponent shall consult with the Mittimatalik Hunters and Trappers Organization (MHTO) regarding the design, timing, and location of the proposed surveys and ongoing monitoring.”



A3 IDENTIFICATION OF STAKEHOLDERS AND APPROACH TO COMMUNITY INVOLVEMENT

Public consultation and engagement occur on an annual basis to provide updates on the Mary River Project progress, initiatives, and future work plans. This framework provides for involvement activities that will be carried out to share information on any unforeseen changes to the Project (e.g., temporary closure or production slow downs).

Baffinland's engagement framework identifies Indigenous partners involved in the Project as the Mittimatalik Hunters and Trappers Organization, the Qikiqtani Inuit Association, and representatives from the community of Pond Inlet.



A4 ENGAGEMENT ACTIVITIES RELATED TO THE MILNE INLET FRESHWATER FISH HEALTH PROGRAM

Engagement activities specifically related to the Project have been undertaken since 2021. Consultation to date has focused on program design, timing, and location of the proposed surveys and ongoing monitoring, and the Project has benefited from a two-eyed seeing approach, by incorporating Inuit Qaujimajatuqangit (IQ) and western science shared by Baffinland and Minnow Environmental Inc. (Minnow). Throughout various engagement activities held among project partners, shared knowledge has helped to guide not only identification of project objectives, but also the study design (e.g., location of study lakes), sampling framework (e.g., where in each lake to sample), and the interpretation of results (e.g., how to identify a “healthy” fish, what endpoints are of concern). Moreover, all field data collection has been done in partnership between Inuit and non-Inuit partners.

Documentation of engagement activities, including consultation materials, presentations, and meeting notes, are available for reference in Appendix A-1.



Table A.1: Summary of Engagement Activities Related to Milne Inlet Freshwater Fish Health Program

Year	Date	Topic	Participants	Reference
2021	18-Feb	Meeting of project partners to discuss initial study design	Baffinland Participants: Connor Devereaux, Lou Kamermans, Chris Murray, Krista Johnson MHTO Participants: Eric Ootoova, Peter Aglak, Elijah Panipakoocho, Caleb Sangoya, Kaugjak Komangapik, Enookie Inuarak Minnow Environmental Participants: Samantha Burke, Paul Lepage	A.5.1
2021	17-Mar	Summary of project questions and objectives following initial community consultation	Communication from Baffinland representatives to MHTO representatives.	A.5.2
2022	27-Jun	Summary of proposed project activities for 2022	Communication from Baffinland representatives to MHTO representatives.	A.5.3
2023	14-Mar	Meeting request to discuss program results and reporting	Communication from Baffinland representatives to MHTO representatives.	A.5.4
2023	27-Mar	Meeting of project partners to discuss 2022 results and reporting	Baffinland Participants: Connor Devereaux, Todd Swenson, Tabitha (Tapisa) Kasarnak, Genevieve Morinville MHTO Participants: Enookie Inuarak, Jonathan Pitseolak, Joshua Katsak Minnow Environmental Participants: Samantha Burke, Preston Lennox, Jess Tester, and Kim Connors	A.5.5
2023	27-Mar	Presentation to discuss 2022 results and reporting	Communication from Minnow Environmental representatives to Baffinland and MHTO representatives.	A.5.6
2023	28-Mar	Meeting of MHTO board and Baffinland	Baffinland Participants: Tabitha (Tapisa) Kasarnak MHTO Participants: Jennifer Innuaraq, Enookie Innuaraq, (vice-chairperson), Jonathan Pitseolak, Peter Aglak, Daniel Quassa, David Qamaniq (chairperson), Marlene Aqqiaruq	A.5.7
2023	5-Apr	Meeting of project partners to discuss 2022 results and reporting	Baffinland Participants: Connor Devereaux, Todd Swenson, Tabitha (Tapisa) Kasarnak, Genevieve Morinville MHTO Participants: Enookie Inuarak, Jonathan Pitseolak, Joshua Katsak Minnow Environmental Participants: Preston Lennox, Jess Tester, and Kim Connors	A.5.8

Note: MHTO – Mittimatalik Hunters and Trappers Organization.

APPENDIX A.5
Consultation Materials,
Presentations, and Meeting
Notes

APPENDIX A.5.1
Meeting of Project Partners
to Discuss Initial Study
Design



Title: Milne Inlet Freshwater Fish Monitoring Program

Date: February 18, 2021

Purpose: initial MHTO input on study design

Group/Organization: MHTO, Baffinland, Minnow

Meeting Location: Conference Call

Present:

MHTO

Eric Ootoova (EO)
Enookie Inuarak (EI)
Peter Aglak (PA)
Elijah Panipakoocho (EP)
Caleb Sangoya (CS)
Kaugjak Komangapik (KK)

Baffinland

Lou Kamermans (LK)
Chris Murray (CM)
Krista Johnson (KJ)
Connor Devereaux (CD)

Minnow

Paul LePage (PL)
Samantha Burke (SB)

Meeting Chair: Lou Kamermans

Summary of New Action Items

ID	Responsibility	Item	Due Date
Action Item #1	BIM (LK)	Send MHTO Map	Feb 26, 2021
Action Item #2	MHTO	Identify two lakes of interest on map provided by BIM (connected to Action Item #1)	March 5, 2021
Action Item #3	Minnow	Consult internal risk assessors to determine what can be defined as an unhealthy	March 12, 2021

		amount of iron in fish/ can be deemed as unhealthy for human consumption.	
Action Item #4	BIM/Minnow	Develop list of questions re: study design. Provide to the MHTO for further input.	Mar 12, 2021
Action Item #5	MHTO	Discuss questions provided by BIM/Minnow with MHTO members, and provide BIM with additional input. (attached to Action Item #4)	TBD

Meeting Notes

LK: There were a number a questions that we have that we would like to get input on to help us design the program. I appreciate everyone taking time to meet with us to discuss the program. We have discussed it for 6 months, but it is something that has been part of our Project Certificate (PC) for some time. What is in the PC is a requirement for us to conduct arctic char health monitoring, and there are specific waterbodies listed that are meant to be part of this program, and that includes Philips Creek, Tugaat River, and Qurluktuk Lake. This meeting is the first meeting regarding the design of an arctic char health monitoring program – we are looking to explore ideas and get your thoughts on what you see this program looking like, and the questions you would like answered.

LK: I would like to go through the agenda – would like to go over our proposal and would like to ask questions. Once we get through this, we would like to discuss potential MHTO involvement, or community involvement in the program, and what that could look like in 2021, and then there are other logistics to discuss (i.e. planning). We can then have final thoughts on the meeting.

LK: Before I pass it off to Paul from Minnow, does anyone have anything they would like to add to the agenda?

EO: I want to ask one of two questions. You know the rivers coming out of Ikaluit Lake, one river to Phillips Creek, other close to... there are a couple of lakes that follows the river. I know the sediments in that river flows directly to those lakes, I am proposing that those lakes be included in the monitoring programs.



KK: The wildlife up here, they don't stay in all the same waterbodies, and they do migrate to other communities.

LK: to Eric's first point, probably best – we should talk about this first. Maybe after this meeting I could send you a map of the area (**Action Item #1**) and you can outline what two water bodies you are talking about so we know what ones you are exactly referencing (**Action Item #2**).

EP: How long is the research project going to be running?

LK: At this point, I will pass it over to Paul to provide an overview of what we are thinking. Like I said, this first meeting – we do not have all details worked out. We want to talk to MHTO first before we put something together.

CS: Will BIM be doing a study on whether the Pond Inlet area wildlife are gaining or losing arctic char?

LK: This would not be covered by this project. This program is looking at arctic char health in freshwater waterbodies closer to the Project.

CS: Will you be researching why the char are leaving the area? Will we be using traditional knowledge?

KK: Question – if you start monitoring, are you able to work with people who know Inuit knowledge so you can work better together? It would be much easier to resolve issue of fish and fisheries and all that. That would be an excellent idea – we need to work together on this.

EO: We can report on what needs to be reported on after we go through agenda. Let's go through agenda first and move on.

LK: I will pass it over to Paul, who will explain the program and our thoughts. We will then go into discussion.

PL: [*provided introduction of self and freshwater experience*]. Excited to work with you on this project. I also have Samantha with me – she will be helping with project as well. As Lou mentioned, the purpose of this meeting is for us to get an idea on what the MHTO would like to see in the program – what methods, what IQ that can be incorporated into the program. I will run through questions here, but feel free to add in.



PL: One of the questions we want to try to get is deciding on what we are trying to answer here – what are your key concerns with regards to freshwater fish health? Some examples might be: are you interested in changes in fish condition? Is the mine affecting fish? What types of fish are you most interested in? Arctic Char? On top of that, you mentioned two other lakes, on the Tugaat River and the Qurluktuk Lake and Ikaluit Lake areas, are there traditional areas that you would like us to focus on?

EP: Need to look at Kuluktoo Bay and all the other lakes and fish in the area.

CS: Does not believe that BIM is obligated to do anything outside of the Project area (i.e. Tugaat, Kuluktoo Bay, or Ikaluit River).

PL: Are there some areas that you feel are being impacted more than others?

CS: Mary River Lake and [Qinngua?] ... are the most affected by the Project. The other members are saying the whole area is affected as well due to haul trucks and ships.

CS: Can you explain why the fish are leaving the area?

PL: I don't have information right now on this.

LK: We have always monitored waterbodies close to the Project, and especially around the mine site (i.e. Camp Lake, Sheardown Lake), and so that is covered by existing monitoring programs. What we want to talk about here is a program that would be specific to Milne Port, and to investigate char health specifically in waterbodies that are not close to Milne, but not far either (i.e. Tugaat and Qurluktuk). This program, even though it is focused on health, and health of char, we could also, depending on what program looks like, be able to report on how many fish we are seeing in those waterbodies. A concern that has been raised is that fish in the general area are unhealthy – we want to look further into this.

EP: We have heard that there is too much iron, you can have health problems. What level of iron in char is considered unhealthy for human consumption?

PL: There are no guidelines that I am aware of – iron is an essential element. We can look into this and bring it to our risk assessors and provide you with this answer (**Action Item #3**). We can collect fish and take tissue samples to determine this. What we can do in this study on fish health is collect fish this year and future years, we could compare fish health measurements to those collected before the mine was there.



KK: Do you have baseline data for before BIM started operations?

PL: Yes – we do have some. DFO did some studies, and they did provide some data we can use. We can ask for more data.

EP: Requesting information on when arctic char will be unhealthy to eat.

PL: From this monitoring we will be able to get a better idea of this, and we will pass it along to you.

CS: [Indecipherable].

LK: PC amended for Early Revenue Phase. Not sure how this Term and Condition got added. We have not done what is called for in it, and we are trying to get it done now.

EI: For this Term and Condition 48(a), it is a must do. If this monitoring is going to proceed, will BIM be open to third-party monitors? For example, MHTO can appoint someone to do the monitoring? And the follow up question to this is, can the report be given to the MHTO and BIM at the same time before the MEWG happens?

LK: I see this program as being our responsibility to implement, and what we are proposing is that we work closely with the MHTO. We want you to tell us what the team should look like, and to help us build the design of the study and be part of the data review. This would mean the MHTO would get the report before it goes to the working groups. This would be more of a collaborative partnership, so the team in the field could be a biologist from Minnow, and depending what we are able to do with COVID-19 restrictions, we can have an MHTO member to be in the field if desired, and someone from the community staffed as well. If the MHTO is interested in running something independent from us, you can always use some of the funding from the Community-Based Monitoring Fund to look at fish in area.

PL: Because we want this to be a collaborative initiative, if there is information you would like to share with us, such as baseline data to include in the data, we are happy to include and use such data in our study. And as we collect data, we will share with you as well.

CS: Asking if BIM has done baseline studies for the lakes near Mary River and Milne Inlet, and have you been approved by DFO to deal with those fish?

PL: We apply for fish collection permit through DFO every year. We try to not kill the fish. Near the port, Golder has been doing the studies there, so I am presuming they get the permits there as well. I do work by the mine site. I am not familiar with the port baseline



studies. For this study, we will have to get a permit by DFO which will go to the MHTO when it is issued.

PL: Another question I have is on fishing methods. From your experience, what is the best way to catch the fish? Are there any methods that you would like us to use that would be successful for this program?

EO: Would make fish ladders to count fish individually.

PL: In your experience, when was the best time for sampling fish that were migrating up to those lakes?

EO: It is obvious when fish are going to migrate back to lake, this has to do with water levels in the river. All the char collect near mouth of the river while migrating to the lake.

CS The MHTO is going to hold their own meeting to discuss this matter and will get back to Baffinland.

LK: This sounds really helpful. Would we be able to provide questions and have them translated so that we get all the information we need to put something together? (**Action Item # 4**).

CS: During our meeting, according to what people have been saying about changes in arctic char in Mary River and Milne area, separate from the actual mining process or proposal.

EI: Won't make any more statements. We will hold off fish study until after the Final Hearing for the Phase 2 Proposal.

LK: What we are trying to do with this program is for the project that is already operating – investigating of current impacts of Project. We would like to keep moving things forward if you are willing to work with us. To do this program in the summer, we need to do a lot of planning up front. I know the Phase 2 review is still happening, but this project is not dependent on Phase 2 – it is to investigate impacts of current project on environment. We are hoping that, if your meeting could happen, and if we could have questions answered, we would like to provide you with direct study design some time in March to get your input on it. We need to plan all of this well before we go into the field (August of this year).

PL: This is not intended to be a one-time study – we could have a set frequency of monitoring. It could be repeated again in the future at the frequency that MHTO would like to see go ahead.

EO: Throughout the past BIM went ahead and did all kinds of monitoring and surveying without letting the community know, especially the MHTO. Such as flying around with helicopters, exploration, flying above water. Why are you asking MHTO about fish monitoring right now? What is making you do this now?

LK: On this specifically, it was raised by the MHTO in September [2020] and we made a commitment to do this work. This is a new program we are developing. We have involved the MHTO with previous programs. I know Elijah was very helpful in setting up our terrestrial monitoring and Bruce Head monitoring program. We are trying to keep that relationship going. We hope you are willing to work with us.

PL: Most of my questions regarding the study design have been answered. We will directly send you the questions so you can provide further input. If we are comfortable with that, we can move onto next part of agenda.

Community Involvement

PL: As we start to communicate more, what is your preference for how this is done. Are you comfortable with communications through email? Or meetings like this while we develop the design?

KK: *[expressed she did not feel the MHTO Chair's question regarding why we are proposing to do this study was adequately answered].*

LK: We talked about this with the MHTO this past September 2020, and we had to wait until the next open-water season to study the char. This is why we are doing it now. I know there is a lot happening with Phase 2, but whether it was happening or not, this is when the meeting would be to talk about this.

KK: Which year in September did you have this meeting?

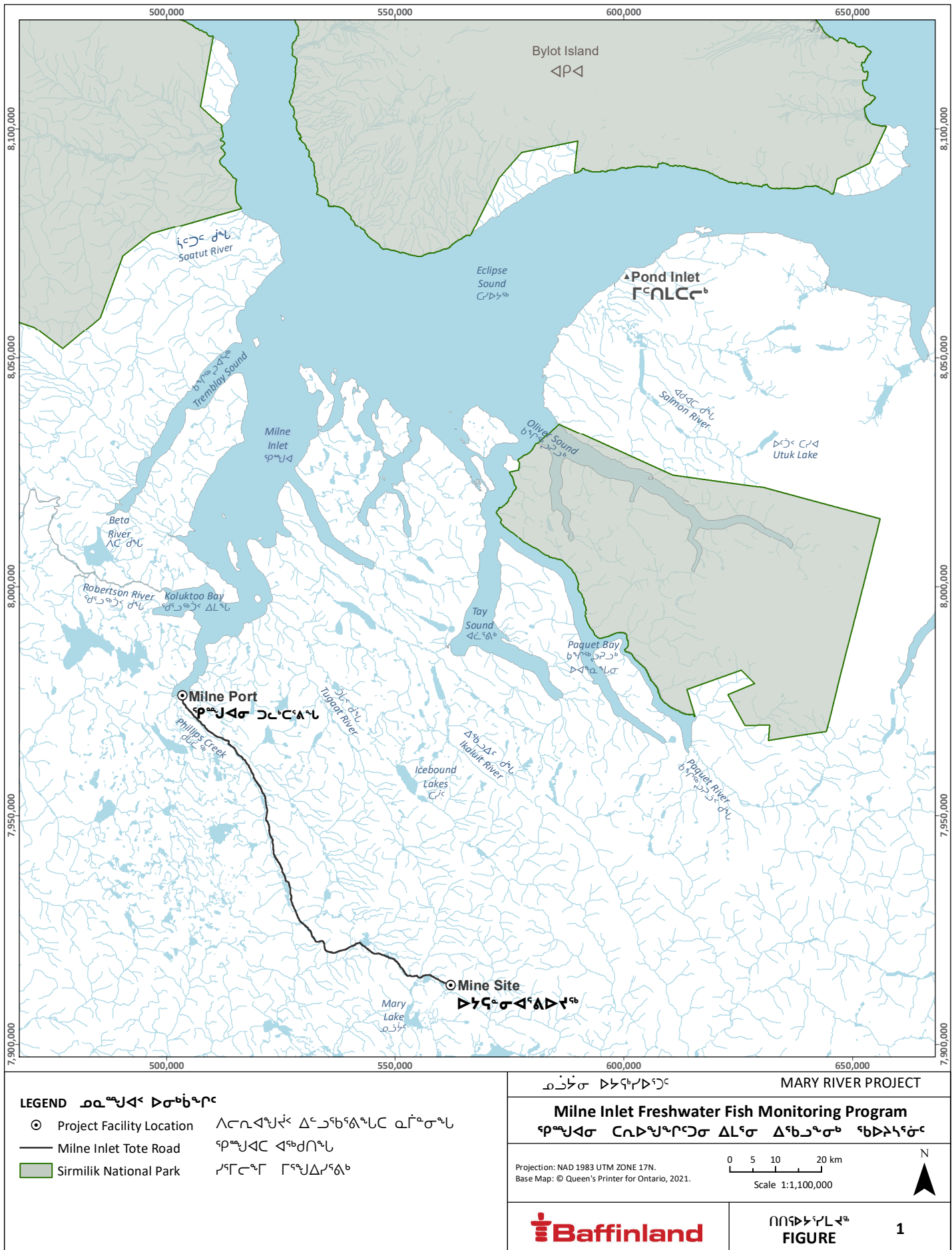
LK: It was this past September, 2020. We had previously talked about these plans with the MHTO to carry out a program. We also said that we would look at some of the same things as part of community-based monitoring back in 2019, but this didn't come together as we thought it would. What matters is we want to do the work now, and we would like to work with the MHTO to do it. We are looking for your guidance to put this program together.

EO: MHTO will discuss questions provided on the study design and get back to you (**Action Item #5**).



LK: We would be happy to put this together, and I will probably provide a map as well so you can outline those two lakes you were talking about earlier on in the meeting, and we will wait for your feedback.

DRAFT



APPENDIX A.5.2
Summary of Project
Questions and
Objectives Following
Initial Consultation

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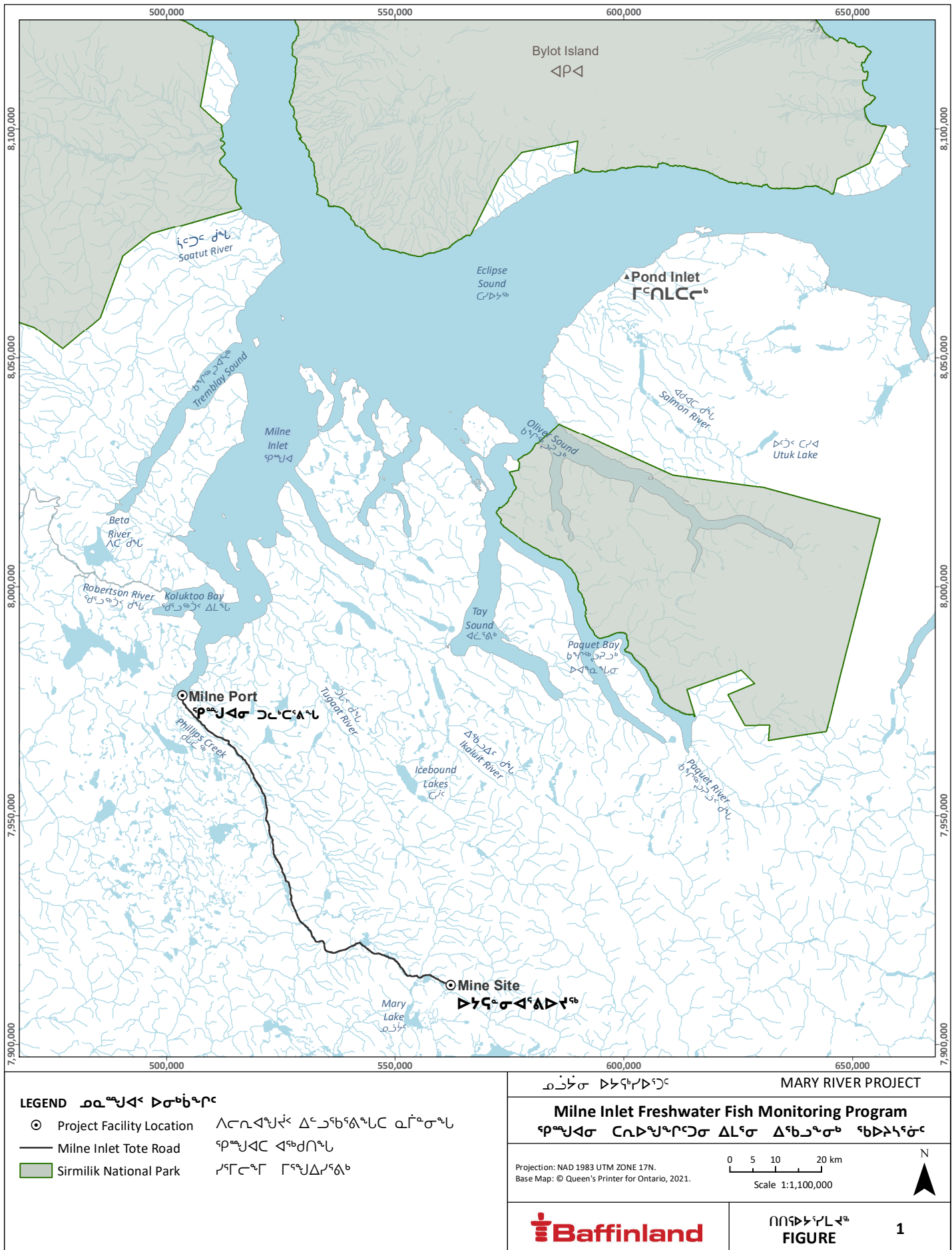
#	Discussion Item Description	Confirmation of Baffinland/Minnow Understanding of Discussion Outcome	Outstanding Questions Baffinland/Minnow is Seeking Information from MHTO to Incorporate into Study Design
1	Key questions to address for the fish health monitoring study	<p>Under the Project Certificate Term and Condition 48(a), the NIRB recommended that Baffinland undertake a study in or near Milne Inlet which would monitor the health of arctic char, and outlined the importance of consulting with the MHTO prior to commencing this work to determine the design, timing, and locations to undertake such monitoring.</p> <p>During the meeting, the MHTO representatives indicated the questions they would like to address for Milne Inlet Freshwater Fish Health Monitoring included:</p> <p>1) is the health of fish being affected by Baffinland port operations in a manner that is reducing the population size?</p> <p>2) what are the concentrations of iron in fish tissues, and are the concentrations of iron high enough in fish tissue to affect Inuit consuming these fish?</p>	Does the MHTO agree with the proposed study questions?
2	Target fish species and life stage used for the study	In freshwater lakes and rivers near the port, we understood that MHTO feels that arctic char are the most important fish species and should be the species used for monitoring effects on fish health. Because they are an important country food, the adult stage of sea run arctic char should be monitored. Please confirm that arctic char are the best fish for the study.	Does the MHTO agree with the proposed target fish species? If no, what other fish should be considered?
3	Freshwater study areas of interest associated with Milne Inlet	Tugaat, Qurluqtuk, and Ikaluit river systems were suggested by MHTO as good study areas. During our meeting, the MHTO discussed two lakes near the Baffinland Port area that may be of interest for monitoring.	Can the MHTO indicate where these two waterbodies are located on a map so that they may be included in the study (Action Item #2 in meeting minutes, map attached, initially provided via email on March 2 nd).

4	Timing of field sampling	<p>The MHTO indicated that arctic char will congregate near the mouth of rivers in the marine areas before migrating up to freshwater lakes, at which time it will be obvious due to predator activity and other signs. The MHTO noted that normally the migration will happen in response to water levels in the river. The MHTO stated that they were going to have their own meeting to discuss timing.</p> <p>Mr. Kamermans indicated that it was important to determine a time for the field study in order for Baffinland to make plans well ahead of time. For example, to allow enough time for fishing permits to be issued, plan for equipment, and to schedule people for the study.</p>	<p>Previous studies by DFO showed that mid-August is the peak char migration for the Tugaat system at Milne Inlet.</p> <p>Does the MHTO feel that this timing is appropriate and acceptable?</p> <p>Does the MHTO think another sampling timeframe would be more appropriate?</p>
5	Numbers of Fish Collected for the Study	<p>The question of numbers of fish to be collected for the study had not been presented to MHTO during the meeting. Baffinland/Minnow is proposing that 40 fish, 20 males and 20 females, be collected and sacrificed from each study area for the study. This number of fish was based on the protocols recommended for the Canada Environmental Effects Monitoring (EEM) program for metal mines. Please see questions by Baffinland/Minnow regarding fish numbers needed for the study.</p>	<p>Would MHTO approve of the collection of at least 40 arctic char from each study area for the study? If using up to three study areas, this would mean the total collection of 120 fish for the study.</p>
6	Methods for fish sample collection	<p>The MHTO indicated that previous char studies had installed a fish ladder in the rivers to be able to catch fish. The use of fish ladders may have been used to support DFO studies in the past.</p> <p>In the meeting, the MHTO had questions regarding what equipment was required for the study. Baffinland has gill nets that could be used to collect fish for the study (mesh sizes of 4 inches and 5 inches). If sampling on lakes, Baffinland can provide and transport the required boats, motor, and gas to be able to set and retrieve the gill nets at the study areas.</p>	<p>Does the MHTO feel that using large mesh gill nets (owned/provided by Baffinland) would be an appropriate and successful sampling technique? These nets would be set in lakes of each river system of interest to MHTO (e.g., Tugaat Lake, Qurluqtuk Lake, Ikaluit Lake).</p> <p>Are there opportunities to use IQ for the sampling of fish that you would like to have in the study design? Can you provide some examples so that we can include these methods in the study?</p> <p>If MHTO is comfortable with using gill nets for the study, is it okay to set the gill nets overnight, or does the MHTO feel this would result in too many fish being caught and dying (for example, more than 40 fish caught in nets left overnight)?</p> <p>Due to the remote location of the sampling sites, helicopters are the most efficient way to get to the sampling areas. Would this be acceptable to the</p>

			MHTO? And if so, could the MHTO please provide guidance on best practices as to not disturb wildlife (e.g., timing, flight paths, areas to avoid)?
7	Fish measurements and data collection	<p>The general measurements of fish health and fish tissue chemistry were discussed with MHTO during the meeting. However, the question of actual fish measurements had not been presented to MHTO during the meeting.</p> <p>Baffinland/Minnow is proposing that measurements of fish length, fish weight, age, liver size, ovary/testes size, female number of eggs and egg weight, and fish tissues for chemistry analysis be collected from up to 40 fish (as appropriate depending on fish sex) at each study area. The use of these measurements is based on the protocols recommended for the Canada Environmental Effects Monitoring (EEM) program for metal mines. Please see questions by Baffinland/Minnow regarding fish numbers needed for the study.</p>	<p>Does the MHTO agree with the collection of the measurements proposed? Are there additional measurements from arctic char that MHTO would like to have included in the study?</p> <p>Baffinland/Minnow are proposing the collection of muscle tissue for chemistry analysis. Are there types of fish tissue other than muscle tissue that are consumed by MHTO/community members that the MHTO would like to see analyzed for the study? For example, liver?</p> <p>For the fish tissue chemistry analysis, in addition to iron, are there other metals or chemicals that the MHTO like to have analyzed (e.g., mercury)?</p> <p>Because only a small amount of tissue will be sampled from each fish for the study, there will be a considerable amount of fish leftover from the sampling. Does the MHTO think that the community could make use of the leftover fish from the study (after collecting measurements and some tissues, the remainder of the fish may be able to be frozen and provided to the community if deemed edible by people)?</p>

8	How the data from the field study will be assessed	<p>The question of how the information from the study will be assessed will be dependent upon what questions the study is designed to address (Question #1 above). During the meeting, the MHTO was not asked about how the information from the field study will be used and reported.</p> <p>Baffinland/Minnow suggested that we can use the information collected in the study to compare to information collected before the Baffinland port facility was constructed. In this way, we can look at how the port operations may have affected fish health in the river systems near the port. This before and after comparison will be possible for fish population health measures such as growth (size of fish at a certain age) and condition (how 'fat' fish are) by comparing the recent data to historical information collected by DFO. We are not sure it will be possible to do a similar before and after comparison for fish tissue chemistry and other health measures because these types of information may not have been collected in the past (e.g., by DFO or for baseline studies) or perhaps these data are not publicly available. Baffinland/Minnow will ask DFO if they can provide all data from past studies for us to use in our study.</p> <p>The study that is designed by MHTO and Baffinland/Minnow will also be used as the basis for tracking changes in fish health and tissue chemistry over time, and in that way, the program will assess if conditions are getting better or not for fish in the area of the port.</p>	<p>The fish health measures that could be included in the study are: 1) fish growth (size of fish at a given age in years); 2) reproductive capacity (gonad size, number and size of eggs produced by females); 3) energy storage (liver size, body condition); and 4) occurrence of physical abnormalities and parasites that may indicate stress to fish because of the Baffinland port operations.</p> <p>Does MHTO agree with the evaluation of the fish health measures indicated above? Are there traditional fish health measures that MHTO would also like to see included?</p> <p>Does the MHTO have arctic char measurements information from in the past (baseline) for Tugaat, Qurluqtuk, and Ikaluit river systems that could be shared with Baffinland to be included in the study?</p> <p>For fish tissue chemistry, Baffinland/Minnow propose to analyze samples for total metals (including iron). Does MHTO agree with this analysis?</p> <p>Does the MHTO have arctic char tissue chemistry information from in the past (baseline) for Tugaat, Qurluqtuk, and Ikaluit river systems that could be shared with Baffinland to be included in the study?</p> <p>Does the MHTO know of any historical tissue samples from before operations that could be assessed now for tissue chemistry?</p>
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9	Study team composition	<p>During the meeting, the MHTO expressed interest in having local involvement in the fish sampling study, which Baffinland/Minnow wholly support (as long as COVID-19 restrictions at the time of sampling will allow for this). In addition, a greater role for MHTO and community involvement in field studies and reporting is envisioned by Baffinland/Minnow in the future.</p> <p>The fish health monitoring program is Baffinland's responsibility to implement, but we want to work closely with the MHTO. This means that the MHTO will get reports to provide review and input before they go out to the working groups.</p> <p>If the MHTO is interested in running something independent from Baffinland, the MHTO can always use some of the funding from the Community-Based Monitoring Fund to look at fish in area.</p>	<p>Baffinland feels this should be a collaborative project, including personnel from Baffinland, Minnow, MHTO and potentially the community as well. The field team can be a biologist from Minnow, and depending on what is possible based on COVID-10 restrictions, an MHTO member and possibly a community member.</p> <p>Does the MHTO support this team structure?</p> <p>Can the MHTO recommend members who are experienced at fishing and would like to participate in the project? The use of IQ would be highly valued for the field study.</p>
10	Frequency of the monitoring program	<p>The intent of this monitoring is to examine current impacts of the Baffinland operations on the health of fish in freshwater habitats of the Milne Inlet area, as well as to track changes in possible effects to fish at these areas over time. In addition to the study that we would like to carry out in 2021, we would like to suggest a frequency of monitoring for the study so we can track changes over time.</p>	<p>Canada's Environmental Effects Monitoring (EEM) program assesses fish health at mine sites every three years. This allows time to assess potential effects, discuss the implications of these effects, and potentially modify the study to examine outstanding questions. Is conducting the study every three years an acceptable frequency for the MHTO?</p>



APPENDIX A.5.3
Summary of Proposed
Project Activities for 2022

[illegible][illegible]

2022 Milne Inlet Freshwater Fish Health Assessment

Baffinland plans to conduct a second year of sampling for the Milne Inlet Freshwater Fish Health Assessment in 2022 to meet Term and Condition 48(a) under the Project Certificate for the Mary River Project. The goal of this assessment is to determine potential impacts of Baffinland's Milne Inlet port operations on the health of arctic charr that use freshwater systems that drain into Milne Inlet near the port. The same sampling plan used following consultation with MHTO in February 2021 will be used for the fish health assessment in 2022. This plan includes sampling arctic charr from up to three river systems, including Tugaat River, Robertson/Qurluktuk River, and Ikaluit River, in 2022 for measurements to assess growth, reproduction, and overall condition of adult sea-run arctic charr. In addition, tissues of these fish will be assessed for concentrations of metals including iron and mercury to determine possible effects on fish health as well as to evaluate risks to humans consuming fish collected from the river systems sampled for the study. The fish health information collected in 2022 will be compared to available information collected in the 1970s and 1990s, well before the construction and operation of the Baffinland port facility, to determine potential impacts of the port operation on arctic charr health in freshwater systems of Milne Inlet.

Baffinland welcomes receiving input from the Community of Pond Inlet and MHTO concerning the sampling approach used for the fish health assessment prior to the initiation of the 2022 field study. In addition, at the discretion of MHTO, Baffinland welcomes the presence and participation of an MHTO representative during the field study. Based on current resources, Baffinland has scheduled the field study to be conducted over an approximately one week to ten-day period between August 9th and 22nd 2022. The ideal field study crew would include the MHTO representative, a QIA representative, a Baffinland representative, and a member from Minnow Environmental Inc., who are the consultants that Baffinland has contracted to assist with this work. The field study will include setting gill nets from a small inflatable boat and transferring captured arctic charr to a laboratory located at the Mary River Project mine site for measurements, dissections, and tissue chemistry sample collection. The field study crew members will be housed at the Sailivik Camp at the Baffinland mine site, and will travel by helicopter to the Milne Inlet sampling sites. If weather conditions do not allow travel to the Milne Inlet sampling sites on any given day, the MHTO representative is welcome to participate in fish sampling conducted at the Mary River Project mine site.

APPENDIX A.5.4
Meeting Request to Discuss
Program Results and
Reporting



March 14, 2023

Mr. David Qamaniq
Mittimatalik Hunters and Trappers Organization
Pond Inlet, NU
pond@baffinhnto.ca

Dear Mr. Qamaniq,

Baffinland Iron Mines Corporation (Baffinland) is requesting a meeting with the Mittimatalik Hunters and Trappers Organization (MHTO) at your earliest convenience to facilitate continued discussions/feedback on the ongoing fish health monitoring program in freshwater bodies north of Milne Inlet, as required under Project Certificate No. 005 (PC) Term and Condition 48(a). Baffinland has retained Minnow Environmental (Minnow) to support the collection of field data alongside the MHTO and provide technical support for data interpretation. The purpose of the meeting will be to continue collaborating with the MHTO to gain their feedback and perspectives on the ongoing fish health monitoring program completed at freshwater bodies near Baffinland's Milne Inlet Port. In this meeting, we would like to get your input on the following:

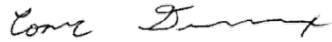
Key Questions for the fish health monitoring study;

1. What is the ideal frequency and timing for future implementation of this study?
2. What are the characteristics of a healthy fish?
3. Is there any information that has not been collected that you think would be meaningful in helping to assess fish health?
4. Does the MHTO see any potential ways to integrate Inuit Qaujimajatuqangit into the sampling for this program (e.g., determining whether a fish is sea-run)?

Based on this meeting, Minnow will incorporate the feedback from the MHTO into 2022 data analyses and subsequent reporting efforts. If suggestions are provided on the study design for future data collection, an amended study design will be drafted and provided to the MHTO for review. Our overall goal is to work collaboratively with the MHTO to refine the project questions to better understand Arctic char health in the freshwater bodies of interest to the community of Pond Inlet, and that meets the expectations of relevant groups involved and Project Certificate Term and Condition 48(a).

We look forward to hearing from you on when we can meet to further discuss a mutually agreeable path forward.

Qujannamiik,



Connor Devereaux
Environmental Manager

c.c Jennifer Innuaq, MHTO Manager
 Lou Kamermans, Senior Director, Sustainable
 Development
 Katie Babin, Environmental Superintendent
 Todd Swenson, Environmental Superintendent
 Natalie O'Grady, Environmental Engagement Lead
 Genevieve Morinville, Manager Environmental, Social and Governance

APPENDIX A.5.5
Meeting of Project Partners
to Discuss 2022 Results
and Reporting



CONFIDENTIAL MEETING (IE FOR INTERNAL TRACKING PURPOSES ONLY): [NO]

Meeting Date: March 27, 2023

Time: 2pm

Meeting Type: Milne Inlet Freshwater Fish Health Program

Meeting Location: Virtual (MHTO in Pond Inlet)

Baffinland Participants Present:

Connor Devereaux

Todd Swenson

Tabitha (Tapisa) Kasarnak

Genevieve Morinville

Other Participants (provide affiliation):

MHTO: Enookie Inuarak, Jonathan Pitseolak, Joshua Katsak

Minnow: Preston Lennox, Jess Tester, and Kim Connors

Interpreter: Lizzie Phillip-Qanatsiaq – Interpreter

Meeting Description: Input of MHTO on reporting of 2021 and 2022 analyses from fish sampling completed in 3 freshwater lakes

IIBA/ICA Relevance: n/a; Mary River Project Certificate Term and Condition 48(a)

Project Phase: PIPE and PIPR (2021 and 2022 sampling)

Photo Waivers Required: n/a

Photo Waivers Recorded: n/a

Comment Tracker and Follow-up Actions

Comment #	Comment	Follow-up Required	Due Date
1	Provide raw data to the MHTO	BIM committed to providing raw data in report	April 30, 2023
2			
3			
4			
5			

Start of Meeting: 2pm

- Enookie Inuarak
- Peter Aglak
- David Qamaniq

Tabitha Kasarnak (BIM) – Interpreter

Minnow – Samantha Burkner, Jess Tester, and Kim Connors

Baffinland – Connor, Todd Swenson and Genevieve Morinville

Samantha gives presentation of slides.

Question 1

Enookie - You mentioned no pre-development metals data – do you have any backup data to show on this?

Sam- we have data from DFO data on fish health data, fish weight, and condition, but not concentration of metals in the fish.

Question 2: I understand DFO does not have data but do you have data?

Sam – we have 2021 and 2022 data and as far as I know, we will be including the raw data in the reports for what we collected.

Does this answer your question?

Enookie – yes, thank you.

David – we should have data available. Not ok that there wasn't any data collected before

Enookie – are you able to share the raw data with the MHTO?

Connor – we will provide the raw data to the MHTO before end of April 2023

David Q – I wonder why we have to wait to get these reports? Why wait a month?

Connor – once we receive the lab results, we need to do the lab analysis, it is standard practice that we will include the raw data with the analysis. **(Action 1)**

David Q – why would we wait for 2021 data? that has been a year. We can redistribute the 2021 memo that was previously shared. **(ACTION)**

Sam resumes going through slides Program Objectives

APPENDIX A.5.6
Presentation to Discuss
2022 Results and Reporting

Baffinland Milne Inlet Freshwater Fish Health Program

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TBD, 2023

Samantha Burke

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- [illegible]

- [illegible]



- Endpoints: $\Delta r^{\text{c}} \Delta \lambda^{\text{c}}$:

2. Collect data on freshwater Arctic char fish health to be used as existing conditions for monitoring during operations

[illegible]

- Above endpoints ፍፅረኛ ዓላማዎች ሲሆኑ
- Tissue metals (e.g., mercury, iron) ምሳሌዎች ካልፍራንስ (ጥፋት ለሆኑት ንጥረ ነገሮች)
- Liver, gonads (ovary and testes), fecundity ስርዓት፣ ፍፃሜ ምግባር (ፍፃሜ ምግባር ለሆኑት ፍፃሜዎች)

2021 Field Season 2021 ᓄᓇᓕᓕᓐᓇᓐ

- Field program took place August 12 through 19
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- The team included Tom Williamson (Qikiqtani Inuit Association representative), Robert Aglak (Mittimatalik Hunters and Trappers Organization, representative), Sam Burke (Minnow) and Paul LePage (Minnow)
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Tom
ᓇᓇᓐ

Sam
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Robert
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Paul
ᓇᓇᓐ

2021 Field Season 2021 ጠቅላይ ልማት

- Following a safety briefing, the team discussed fishing locations prior to sampling
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Crew Discussing Potential Sampling Locations at Mary River Mine Site

ፍሰት ሰሌዳ ለመፍጠር ለመቻል ሲታሰብ

2021 Field Season – Tugaat Lake 2021 ᓄᓇᓂᓄᓐ - ᐅᓂᓐ ᑕᓯᓐ

- Fishing occurred at Tugaat lake on August 16 and 17 using 4" and 5" mesh gillnets
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>ᐅᓐᑕᓂᓄᓐ ᐅᓂᓐᑕᓂᓄᓐ
- 38 adult char (11 female, 24 male, 3 undeveloped) were captured and brought back to the Mary River Mine Site for processing

38 ᐱᓂᐅᓂᓄᓐᑕᓂᓄᓐ ᑕᓂᐅᓐᑕᓂᓄᓐ (11 ᐃᓐᑕᓂᓄᓐ, 24 ᐃᓐᑕᓂᓄᓐ, ᐃᓂᓄᓐ 3
ᐃᓐᑕᓂᓄᓐᑕᓂᓄᓐ) ᐱᓂᐅᓂᓄᓐ ᓄᓂᓄᓐ ᓄᐃᓐᑕᓂᓄᓐᑕᓂᓄᓐ ᓐᑕᓂᓄᓐᑕᓂᓄᓐᑕᓂᓄᓐ



Paul and Robert Setting Nets
on Tugaat Lake

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ᑕᓯᓐ



Robert and Tom Holding Char from Tugaat Lake

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ᐃᓐᑕᓂᓄᓐ ᐅᓂᓐ ᑕᓯᓐᑕᓂᓄᓐᑕᓂᓄᓐ

- Fish measured for total and fork length to nearest millimeter
- ልክጋጅ ስጋናጭርጋረጭር ስጋረጭር ልክጋጅ ስጋረጭር ልክጋጅ ስጋረጭር ልክጋጅ
- Fish weighed to the nearest gram
- ልክጋጅ ስጋረጭር ስጋረጭር ስጋረጭር
- Sex determined, examined for parasites and other abnormalities
 - Abnormalities were uncommon
 - Some fish had parasites, which is normal for char populations
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 - ልክጋጅ ስጋረጭር ስጋረጭር ስጋረጭር
 - ልክጋጅ ስጋረጭር ስጋረጭር ስጋረጭር (ስጋረጭር ስጋረጭር) ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር
- Otoliths removed
- ስጋረጭር ስጋረጭር ስጋረጭር
- Liver removed and weighed
- ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር
- Gonads removed and weighed
- ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር
- Samples collected: ስጋረጭር ስጋረጭር
 - Dorsal muscle tissue (metals) ስጋረጭር (ስጋረጭር)
 - Liver tissue (metals) ስጋረጭር ስጋረጭር (ስጋረጭር)
 - Female gonads (egg count) ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር ስጋረጭር
 - Otoliths (age determination)
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Paul and Robert Processing Fish at Mary River

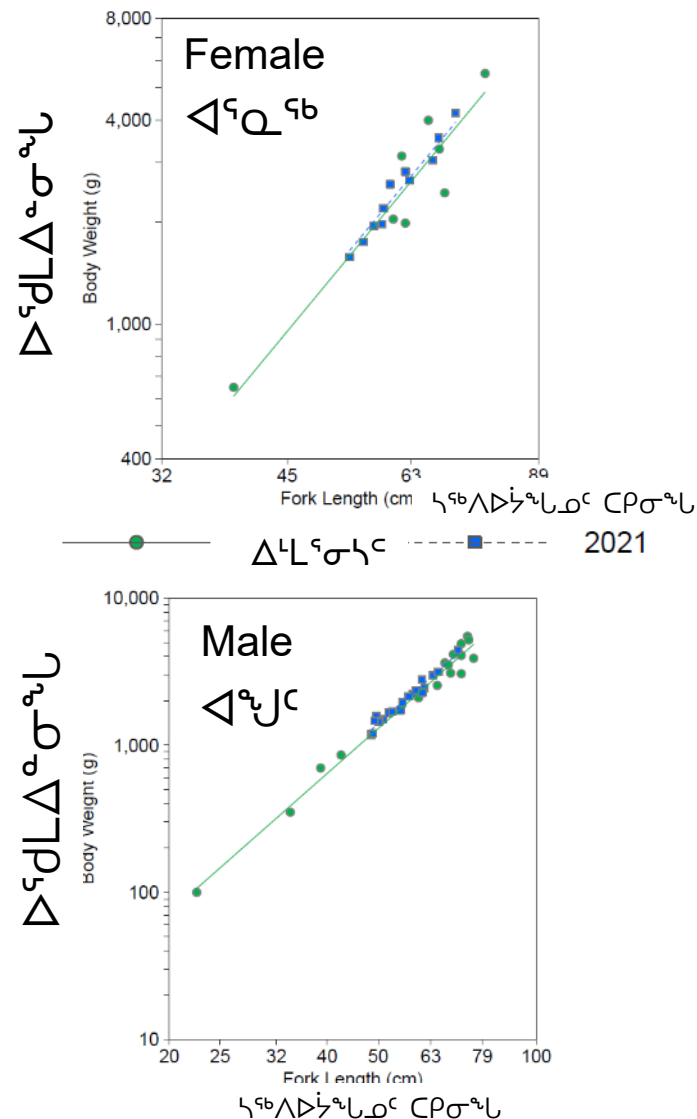
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2021 Findings – Tugaat Lake (Before-After)

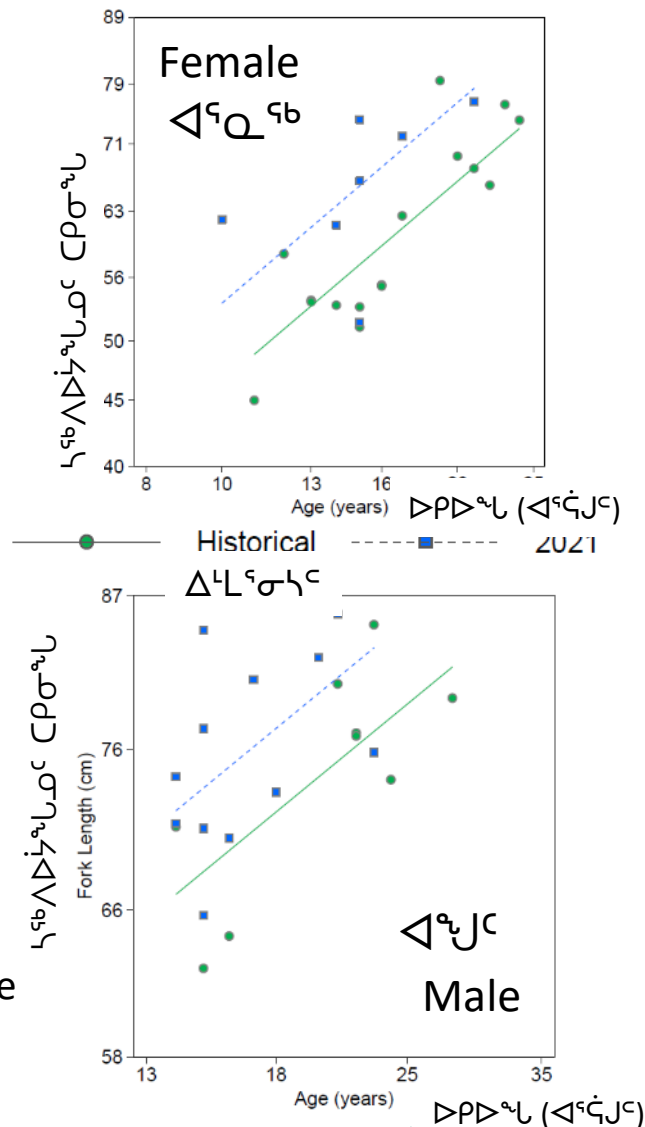
12

2021 ᖃᐅᔨᔭᐅᔪᑦ - ᐅᑖᑦ ᑕᔪᓐᓴᑦ (ᐱᔪᐱᖃᖃᑎᓐᓴᔪᑦ-ᔪᓐᓴᑦᐅᑦ) 2021

- Body Condition (weight-at-length) ᑎᒥᓐᑕ ᖃᐅᐱᑦᓴᑦᓴᑦᑦᑦ
 - Female Arctic char caught in August 2021 weighed 12% less at the same length than female char caught historically in August (1975 - 1996)
 - ᐱᖃᐱᑦ ᑕᐱᐅᖃᐅᑕᑦ ᐱᖃᐅᐱᑦ ᐱᖃᐅᐱᑦᐅᑦ ᐱᖃᔪᔪᑦ 2021-ᒥ ᐅᖃᓐᓴᖃᐅᑕᐅᖃᐅᑦ 12% ᐅᑖᑦᐅᑦᑎᖃ ᑕᔪᓐᓴᖃᖃᑎᓐᓴᑦᐅᑦ ᐱᖃᐅᐱᑦ ᑕᐱᐅᖃᐅᑕᐅᑦ ᐱᖃᐅᐱᑦᐅᑦ ᐱᖃᔪᔪᑦ (1975 - 1996)
 - Male Arctic char no significant difference between 2021 and historical
 - ᐱᖃᐅᐱᑦ ᑕᐱᐅᖃᐅᑕᑦ ᐱᖃᔪᔪᑦᐅᑦᐅᑦᐅᑦᐅᑦᐅᑦᐅᑦ ᑕᖃᐅᐱᑦ 2021 ᐱᖃᐅᐱᑦ ᖃᖃᓴᑦᐅᑦᐅᑦ
- Data overlap ᖃᐅᔨᔭᐅᑎᐱᑦᑦ ᐅᖃᖃᑦᑕ
- No consistent trend between male and female fish ᑕᔪᓐᓴᖃᖃᑎᓐᓴᔪᑦ ᖃᐅᐱᑦᓴᑦᓴᑦᓴᑦᓴᑦᓴᑦᓴᑦᓴᑦ ᑕᖃᐅᐱᑦ ᐱᖃᐅᐱᑦ ᐱᖃᐅᐱᑦ ᐱᖃᐅᐱᑦ



- Growth (length-at-age) $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$
($\Delta P_{\text{age}} - \Delta P_{\text{historical}}$)
 - Male Arctic char captured in 2021 were significantly larger at age (8%) those captured historically (1975 – 1996)
 - $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ 2021- ΔP_{age} $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ (8%)
 $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ (1975-1996)
- Female Arctic char captured in 2021 were significantly larger at age (15%) those captured historically (1975 – 1996)
- $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ 2021- ΔP_{age} $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ (15%)
 $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ (1975-1996)
- Both male and female Arctic char from Qurluktuk Lake were longer at age in 2021
- $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ $\Delta P_{\text{age}} < \Delta P_{\text{historical}}$ 2021- ΔP_{age}



2021-ፖ ፕላንፖረት - ካለፍካንፕረት ማጥፋት

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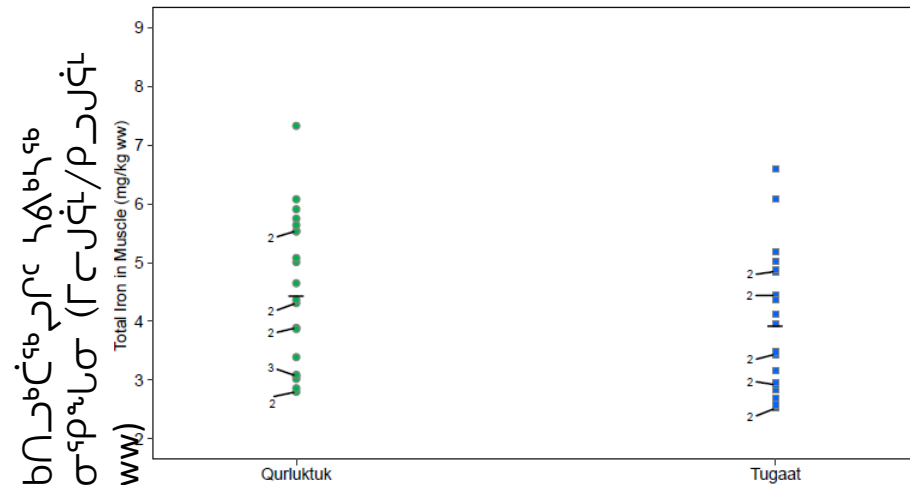


Figure 2: Iron Concentration (mg/kg) in Arctic Char Muscle, 2021

Note: Black bars indicate geometric means. Numbers indicate overlapping points.

[illegible]

[illegible]

2022 Field Season – Ikaluit Lake 2022 ᓄᓇᓂᓄᓐ - ᐃᑦᓇᓇᑦ ᑕᓯᓴ

- Crews were able to sample Ikaluit Lake in August of 2022
- ᐃᑦᓇᓇᓇᓂᓄᓐ ᑦᓇᓇᓂᓄᓐ ᓄᓇᓂᓄᓐ ᐃᑦᓇᓇᑦ ᑕᓯᓴ 2022-ᓂ
- Fishing occurred on August 19 using 4" and 5" mesh gillnets
- ᐃᑦᓇᓇᓇᓂᓄᓐ ᐃᓂᓂᓄᓐ 19-ᓂ ᐃᓂᓂᓄᓐ 4" ᐃᓂᓂᓄᓐ 5" >ᓂᓂᓄᓐ ᓂᓂᓂᓄᓐ
- 40 adult Arctic char were captured (28 male, 12 female)



Team Setting Nets on Ikaluit Lake

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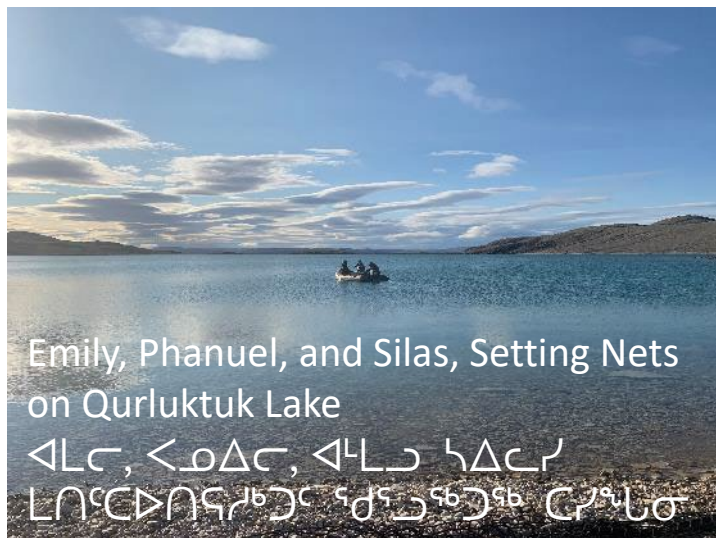
Phanuel and Silas Checking Nets at Ikaluit Lake

ᐃᓂᓂᓄᓐ ᐃᓂᓂᓄᓐ ᓄᓇᓂᓄᓐ ᐃᑦᓇᓇᑦ ᑕᓯᓴ

2022 Field Season – Qurluktuk and Tugaat Lakes 2022

ᑭᓄᓐᓂᓐᓂᓐ - ᓄᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ

- Crews returned to Tugaat and Qurluktuk Lakes in 2022
- ᐱᓕᓕᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ 2022-ᓂ
- Fishing occurred on August 21 and 22 in Tugaat Lake and August 23 and 24 in Qurluktuk Lake using 4" and 5" mesh gillnets
- ᑭᓄᓐᓂᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ 21-ᓂ 22-ᓂ ᑭᓄᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ 23-ᓂ 24-ᓂ ᓄᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ 4" ᑭᓄᓐᓂᓐᓂᓐ 5" ᑭᓄᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ
- In Tugaat Lake 40 adult Arctic char were collected (18 male, 22 female)
- ᑭᓄᓐᓂᓐᓂᓐ 40-ᓂ ᑭᓄᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ (18 ᑭᓄᓐᓂᓐ, 22 ᑭᓄᓐᓂᓐ)
- In Qurluktuk Lake 31 adult char were collected (18 male, 13 female)
- ᓄᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ 31-ᓂ ᑭᓄᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ ᑭᓄᓐᓂᓐᓂᓐ (18 ᑭᓄᓐᓂᓐ, 13 ᑭᓄᓐᓂᓐ)



Qujannamiik!

ᓴᓂᓴᓂᓴᓂ !



APPENDIX A.5.7
Meeting of MHTO Board and
Baffinland

CONFIDENTIAL MEETING (IE FOR INTERNAL TRACKING PURPOSES ONLY): [YES]

Meeting Date: March 28, 2023

Time: 7pm

Meeting Type: MHTO Board Meeting

Meeting Location: Pond Inlet

Baffinland Participants Present:

Tabitha Kasarnak (Tapisa K.)

Other Participants (provide affiliation):

MHTO:

Jennifer Innuaq, Enookie Innuaq, (vice-chairperson), Jonathan Pitseolak, Peter Aglak, Daniel Quassa, David Qamaniq (chairperson), Marlene Aqqiaruq

Interpreter: None required

Meeting Description: Regular Meeting

Meeting commenced at 7:15

David: thank you for coming. Peter Aglak opening prayers, Thank you Peter

Delegation: Tapisa Kasarnak, Baffinland

Tapisa K.: I am here on behalf of Baffinland Milne Inlet Freshwater fish program.

Enookie I.: MHTO community research the fish studies conducted the presentation

David Q.: The Qurluktuq study , Phanuel heard only from him, Silas Katsak, and Phanuel's son only reported.

Peter A.: I have never heard any reports of the study conducted.

Jonathan P.: the fish in general they're asking about that, and to include the specialist, trace metals from historical data should be included. ****DFO confirmed to Baffinland via email that no historical metals data exists for the 3 lakes sampled****

David Q: the reports should have page numbers so when we have questions we can refer to it., We were told how much consumption is required by Health Canada. During zoom meeting issues were discussed

Enookie I.: The operations of the monitoring how is the MHTO think about it, in the summer they go to the lakes and use gillnets and they go back to Mary River. They do lab analysis and the fish is just thrown out, and the fish that go into the sea are also sampled. We want the reporting of the monitoring, we want to see the raw data. April 30 is when the report will be distributed. The monitoring about the fish to keep them alive, what else we want to see in the fish don't contain minerals and mercury for trace

metals, this was from the NIRB conditions, as long as the char we eat don't have any metals or mercury. And if they can have a lab here in Pond Inlet, questions raised by MHTO there should be included. There are also surveys at Milne Inlet using gillnets. We would want reports on seagoing fish.

Peter A.: the fish doesn't have to be thrown out. Give them back to Pond Inlet. The fish that don't go to sea are the best fish. They have to use gloves if conducting the surveys because they leave hand prints.

David Q.: Board members want to include people from the MHTO. Fish should have a tagging device, the ones that were tagged with a device had hand prints, the ones that were tagged, some came from Inuvik, as long as they use gloves for the tagging devices.

APPENDIX A.5.8
Meeting of Project Partners
to Discuss 2022 Results and
Reporting



CONFIDENTIAL MEETING (IE FOR INTERNAL TRACKING PURPOSES ONLY): [NO]

Meeting Date: April 5, 2023

Time: 3pm

Meeting Type: Milne Inlet Freshwater Fish Health Program

Meeting Location: Virtual (MHTO in Pond Inlet)

Baffinland Participants Present:

Connor Devereaux

Todd Swenson

Tabitha (Tapisa) Kasarnak

Genevieve Morinville

Other Participants (provide affiliation):

MHTO: Enookie Inuarak, Jonathan Pitseolak, Joshua Katsak

Minnow: Preston Lennox, Jess Tester, and Kim Connors

Interpreter: Lizzie Phillip-Qanatsiaq – Interpreter

Meeting Description: Input of MHTO on reporting of 2021 and 2022 analyses from fish sampling completed in 3 freshwater lakes

IIBA/ICA Relevance: n/a; Mary River Project Certificate Term and Condition 48(a)

Project Phase: PIPE and PIPR (2021 and 2022 sampling)

Photo Waivers Required: n/a

Photo Waivers Recorded: n/a

Comment Tracker and Follow-up Actions

Comment #	Comment	Follow-up Required	Due Date
1	Minnow to include raw data for 2021 and 2022 sampling years in report		April 30, 2023
2	MHTO does not want any fish to be wasted if edible for humans or dog		
3	MHTO does not like catch and release. This leaves fingerprints on the fish and it's not good for fish.		

4			
5			

Start of Meeting: 3:15pm

- Enookie Inuarak
- Jonathan Pitseolak
- Joshua Katsak

Lizzie Phillip-Qanatsiaq – Interpreter

Minnow – Preston Lennox, Jess Tester, and Kim Connors

Baffinland – Connor, Todd Swenson and Genevieve Morinville

Connor – we will provide the 2021 and 2022 raw data along with the 2022 report.

Minnow – we will provide it all in the same report.

Connor – We recognize the importance for developing a plan for fish sharing for all of our programs including marine and freshwater environment. As part of this review, there is a good lead into some of our questions that we had for you.

The first question we have – in the field, or at time of sampling, how could we determine when fish is healthy in the field

Enookie – you can know the difference between sick and healthy. Over what was caught over the summer in. they caught fish and it was sick and not edible.

Minnow – can you give descriptors, was it smaller? colour, or shape? or texture? what are the descriptors?

Joshua Katsak -

Joshua – we know fish our lifetime. it's our tradition. we can recognize from the first catch. like farming, fish preparation, drying. etc. when you catch a fish, and you're a fisherman all your life. the first thing you notice is the colour and the shape. when they're in the lake, the fish is healthy. when they go through the river, the head gets bigger and body smaller, once in ocean, their head is way smaller because they're not getting enough nutrients. but over the summer, most recently this summer. one of the fish. we cache some of the fish and then get it back after the winter. ask Inuit, that's our tradition. we're Inuit and we've been hunting for hundreds of years. that's it.

Minnow – thank you for the clarification. That was helpful.

Enookie- once you catch a fish, you'll know right away. last year, we caught a fish and froze it so he could have it when the time comes. after thawing it, after preparing it, the skin wasn't attached to the fat, and the fat was very easy to remove. it was different and still cooked it and ate it. most of the family had stomach problems. I think the fish was sick.

Connor – was that with the 2022 program?

Enookie: this was just a family gathering with a family trip. Not through the program.

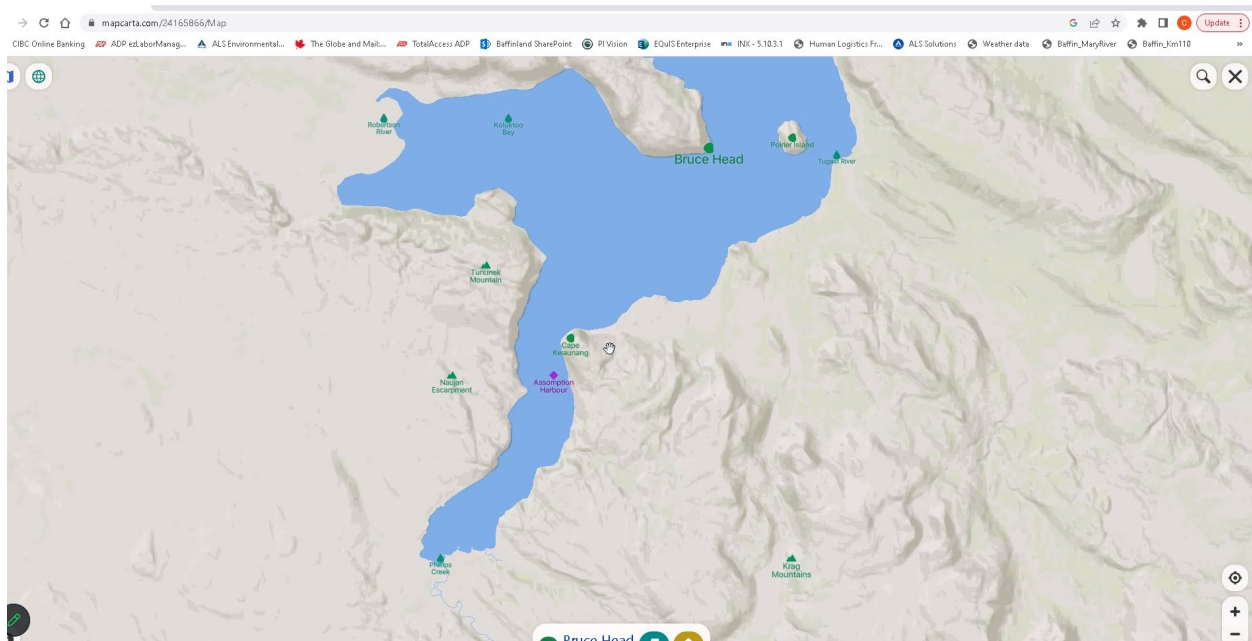
Joshua – these fish sampling areas that we've been doing since last year. we like to get all of the data and everything that is being collected. what if the database that we have. if it looks healthy, we're going to eat it anyway. if the fish is not edible, we're collecting all of the data but not getting the data. we're going to make sure we're eating healthy fish, not scary fish. there are 4 main lakes from the river. when they travel from ocean to river and to those 4 lakes, I think we need to get all of those 4 lakes. Qurluktuq river, and then the 4 other major lakes. they are all connected to Qurluktuq lake when they go back for the winter.

Also, back in 1962, before the exploration people came, they built a cabin at Milne inlet to see if there was a mine site in the area. that cabin has been there ever since. in that area, there used to be a lot of fish and it was their fishing spot. there used to be a lot of fish but now not so much. That's it for now.

Jonathan – the fish . the river used to flow from the pond to the ocean. ships were still around but no mine at the time. a little pond farther up. he wants more research for cleaning and not environmental damage to go on. for healthy food. no more depletion. more working for health. need more for future generation. now they are very dirty. that's it for him today. he may have more to say later.

Connor – thank you for your insight. we also monitor in the marine environment.

Below screenshot was sent to Erica (BCLO in Pond Inlet) for printing and was shared with the MHTO. Tapisa subsequently shared the map with input from MHTO participants.



Enookie? – we want to continue monitoring. it's better to deal directly with the community. they were expecting to get all of the monitoring in the Pond Inlet area for fish that go from lake to the ocean, or back to river, then lake. those are the fish that we need to eat.

Tapisa – will send the map.

Enookie – will need to meet in person for long term purposes. we had pushed for char to be monitored because we eat them. they are part of our important diet. and we wanted to make sure that they were not impacted with different iron, and what not. the studies you have started are the freshwater. some people eat them, but not as much as the ones that go to the ocean. I know you guys do some sampling in Milne Inlet during the summer. are we also going to see the data from those fish?

Genevieve – yes, we are going through reporting right now. we will be including all of the raw data, we've also included past data as hard copies to the MHTO, and also past reports on a USB stick.

Joshua –

Over the summer, there are 4 lakes that come through from the ocean. there was an old man that netted. he didn't most of us can't even recognize in the ocean what lake the fish comes from. and there's not much anymore. Those are the fish that we want monitored. those that go to lake and those that go to the ocean.

BIM: What are the 4 areas?

Connor- how frequently do you want the program run? What seasons and how often?

MHTO (Joshua Katsak) – qurluktuk river, in that area, when the fish are going back to the lakes, that little Qurluktuk river, that little pond has so many fish when they're taking a rest. it can be at end of august, early septemebr for that waterbody. that pond used to overflow with a lot of fish. not as much now because we have less narwhal, less seal, and we have to do monitoring every year just so that we're not feeding our community bad fish or sick fish before they go extinct or even what if we're eating dangerous fish. it's our food.

Connor – can we take a break?

I think on our end, I think we're good. I'll just ask minnow if they're good. we'll have more meetings on future programs.

10 min health break or what

we'll sign back on at 4:30pm.

Connor – we're back. any more questions?

We're good.

We'll have the report with raw data and analyses done before April 30, we will be sending that directly to the MHTO, and including it in the NIRB annual report.

Enookie – another comment – do you catch and release?

Minnow - we did not last year during our program because the folks we were with said we shouldn't put them back. is this consistent with MHTO?

Enookie – no we don't like the catch and release monitoring. you can have fingerprints, and hands can be printed to the fish skin.

Minnow – thank you for confirming this.

Enookie – also the fish, don't throw away the fish. some may be edible, if not it could be good for dog food.

Jonathan – thank you. one of the guys that went with MHTO members . you guys can correct. he felt he was rushed. if it's an Inuit culture, it shouldn't be rushed. he wants to do it properly. he wanted to cache them, once he knew they were going to be thrown out. we would rather they are given to the dogs, or given to the community.

Connor – from our understanding, some fish were cached. we will make sure this year that we consider these requests. If I can, I do have a follow-up question –

Minnow – thank you for that feedback. we will make sure that our staff are trained to have that understanding.

Connor – we can wrap it up. thank you again for the valuable feedback and insights.

Meeting ended at ~4:40pm

APPENDIX B
DATA QUALITY REVIEW

APPENDIX B DATA QUALITY REVIEW

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B1 INTRODUCTION

B1.1 Background

A variety of factors can influence the physical, chemical, and biological measurements made in an environmental study and thus affect the accuracy and/or precision of the data. Depending on their magnitude, inaccuracy and/or imprecision have the potential to affect the reliability of conclusions made from data; therefore, it is important to ensure that programs incorporate appropriate steps to control non-natural sources of data variability (i.e., minimize variability that does not reflect authentic spatial and temporal variability in the environment) and thus assure the quality of the data. Data quality as a concept is meaningful only when it relates to the intended use of the data. That is, one must know the context in which the data will be interpreted in order to establish a relevant basis for judging whether or not the data set is adequate. A data quality review (DQR) involves the comparison of field and laboratory measurement performance to Data Quality Objectives (DQOs) established for a particular study, such as evaluation of Laboratory Reporting Limits (LRL), blank sample data, data precision (based on field and laboratory duplicate samples), and data accuracy (based on matrix spike recoveries and/or analysis of standards or certified reference materials). Trusted analytical laboratories certified by the Canadian Association for Laboratory Accreditation (CALA) or the National Environmental Laboratory Accreditation Program (NELAP), with a rigorous internal quality assurance program, were selected to ensure the highest possible data quality. Data quality objectives were established *a priori* to reflect reasonable and achievable performance expectations. Programs involving many samples and analytes may sometimes yield results that exceed DQOs, which is particularly true for multielement scans, as the analytical conditions are not necessarily optimal for every element included in the scan. Generally, scan results may be considered acceptable if no more than 20% of the parameters fail to meet DQOs. Overall, the intent of a DQR is not to reject any measurement that did not meet a DQO, but to ensure that any questionable data received more scrutiny to determine what effect, if any, this had on interpretation of results within the context of the project.

B1.2 Types of Quality Control Samples

DQR was conducted on all laboratory data collected as part of the Baffinland Milne Inlet Freshwater Fish Health 2024 program and involves the examination of analytical results associated with several types of Quality Control (QC) samples collected (or prepared) in the field and laboratory. General QC samples collected for this project, and a description of each, include the following:



- **Laboratory Reporting Limits** are the lowest achievable concentrations for individual parameters that the laboratory can detect using specified methods. Achieving satisfactory LRLs is important when comparing concentrations to guidelines for that medium. If detection limits are above the guideline, no accurate interpretation of the data can be made. Consistency is also important for LRLs when taking consecutive samples. Changes in LRLs between reports can affect summary calculations and also introduce confounding factors when assessing trends. LRLs were screened against guidelines and between samples.
- **Field Duplicates** are replicate samples collected from a randomly selected field station using identical collection and handling methods that are then analyzed separately in the laboratory. For fish tissue samples, the field duplicate samples represent two different samples taken from the same randomly selected fish. The duplicate samples are handled and analyzed in an identical manner in the laboratory. The data from field replicate samples reflect natural variability, as well as the variability associated with sample collection methods, and therefore provide a measure of field precision.
- **Laboratory Duplicates** are replicate sub-samples created in the laboratory from randomly selected field samples which are sub-sampled and then analyzed independently using identical analytical methods. For fish tissue, laboratory duplicates represent separate aliquots of material collected after sample homogenization. The laboratory duplicate sample results reflect any variability introduced during laboratory sample handling and analysis and thus provide a measure of laboratory precision.
- **Laboratory Control Samples** are created in the laboratory to have a known analyte concentration in a matrix free of interferences. The sample results are compared to the target results to confirm that the analytical method is accurate in a purified reference sample. The results are reported as the percent of the known concentration that was recovered in the analysis.



B2 WATER CHEMISTRY

B2.1 Laboratory Reporting Limits

The analytical laboratory reports included one ALS report from 2024 (Ikaluit and Qurluktuk Lakes; BF2400295; Appendix G). Within this report, analytes for which one or more results were below the LRL were identified. The range of reported LRLs for these analytes were then assessed relative to existing water quality guidelines (WQGs), including Canadian Water Quality Guidelines (CCME 1999, 2017) and Ontario Provincial Water Quality Objectives (OMOE 1994; Appendix Table B.1¹). For analytes with results below the LRL, all reported LRLs were lower than applicable guidelines. Therefore, the achieved LRLs were appropriate for this study.

B2.2 Laboratory Blanks

Method blank (MB) samples were analyzed in the ALS Laboratory Report (BF2400295; Appendix G). Of the 100 reported MB results, all met the laboratory DQO, indicating no inadvertent contamination within the laboratory.

B2.3 Laboratory Data Precision

Laboratory duplicate samples were used to evaluate laboratory precision within the water chemistry report from ALS (BF2400295; Appendix G). All of the 97 duplicate pair results met the laboratory DQO of <25% indicating excellent laboratory analytical precision.

B2.4 Data Accuracy

Data accuracy was evaluated based on results of Laboratory Control Samples (LCS) and Matrix Spike (MS) samples within the ALS Laboratory Reports (BF2400295; Appendix G). All of calculable 98 LCS individual analyte results and 66 MS individual analyte results met the laboratory DQO. As all LCS and MS results met the laboratory DQO, the accuracy achieved by the laboratory in this study is considered acceptable.

B2.5 Hold Times

The recommended hold times for chlorophyll-a and pheophytin-a (BF2400295; Appendix G) were exceeded prior to sample receipt by the laboratory. The recommended hold time for both chlorophyll-a and pheophytin-a were exceeded by one day in two samples each (BF2400295; Appendix G). Although effort is made to ensure the timely shipping of field

¹ Tables only include constituents with at least one result below the LRL or where the LRL was above guidelines. This applies to all other LRL tables for this report.



samples, due to the remote nature of the sampling site, samples may take longer than usual to arrive at the laboratory leading to hold time exceedances. Overall, hold time exceedances were limited and are not expected to impact data interpretation.

B2.6 Data Quality Statement

Water chemistry data collected for the 2024 Milne Inlet Study were of acceptable quality as characterized by good detectability, appropriate LRLs, negligible analyte concentrations in MBs, good laboratory precision and accuracy, and few hold time exceedances. Overall, the water quality data can be used with a good level of confidence for interpretation.



B3 FISH TISSUE CHEMISTRY

B3.1 Laboratory Reporting Limits

The analytical ALS laboratory reports for fish tissue chemistry included one report from 2024 (Ikaluit and Qurluktuk Lakes; WT2437881; Appendix G). Within this report, analytes for which one or more results were below the LRL were identified. The range of reported LRLs for these analytes were assessed relative to existing fish consumption guidelines for human health, including Health Canada (2010), IRIS (2010), and the Canadian Food Inspection Agency guideline for mercury (CFIA 2015; Appendix Table B.2). For analytes with results below the LRL, all reported LRLs were lower than applicable consumption guidelines. Overall, the achieved LRLs were appropriate for this study.

B3.2 Laboratory Blanks

Method Blank samples were analyzed in the ALS Laboratory Report (WT2437881; Appendix G). Of the 180 reported MB results, one result for arsenic did not meet the laboratory DQO. However, the result was lower than the LRL but was five times the blank level and was considered a reliable result. Since all other MB samples met the DQO, these laboratory flags had a negligible impact on data reliability.

B3.3 Data Precision

Laboratory duplicate samples were used to evaluate laboratory precision within the fish tissue chemistry report from ALS (WT2437881; Appendix G). Of the 180 duplicate pair results, only two results including one for calcium and chromium did not meet the laboratory DQO due to sample heterogeneity (WT2437881; Appendix G). Since only 1.11% of laboratory duplicate samples did not meet the laboratory DQO, laboratory analytical precision was considered acceptable for this study.

Field sampling precision looks at relative percent difference (RPD), calculated as follows:

$$RPD = \frac{|R1 - R2|}{(|R1 + R2|/2)} * 100$$

Where R1 is the value of the original (“parent”) sample and R2 is the value of the duplicate sample, with the absolute difference and sum of the two samples used. RPDs cannot be calculated if both values are below the LRL. If the original and duplicate sample have the same value, then the RPD is 0%.

There are two applicable DQOs for field duplicates:



1. Each RPD comparison between the original and duplicate result should be $\leq 25\%$; and,
2. Within each original and duplicate pairing (i.e., each duplicate pair), fewer than 20% of the total comparisons should be above the 25% DQO.

A total of 11 sets of field duplicate samples were collected to assess field sampling precision (Appendix Table B.3). All duplicate samples were collected during the 2024 fish tissue monitoring (WT2437881; Appendix G). Duplicate samples consisted of five muscle and six liver duplicate sets. Several RPDs could not be calculated as both analyte concentrations were below the LRL. Of the 11 field duplicate sets, four sets had $>20\%$ of analyte comparisons in exceedance of the RPD DQO (25%; Appendix Table B.3). However, of the 269 total individual duplicate comparison, only 49 ($<20\%$ of all comparisons) did not meet the DQO. Therefore, field duplicate samples of fish tissue were considered to have acceptable field precision and reproducibility for the purposes of this study.

B3.4 Data Accuracy

Data accuracy was evaluated based on results of MS and LCS samples. Of the 175 MS results, five results (2.86% of all results) marginally exceeded the laboratory DQO due to heterogenous analyte background in sample or sample matrix effects. Of the 180 LCS results, six results (3.33% of all results) were below the laboratory DQO, however the lab determined the results are considered reliable (WT2437881; Appendix G). As most MS and LCS samples met the laboratory DQO, laboratory data accuracy was considered acceptable for this study.

B3.5 Hold Times

Recommended hold times for the fish tissue chemistry samples were exceeded for mercury in 92 results (WT2437881; Appendix G). For samples identified as being analyzed outside of recommended holding times, measurement uncertainties may be increased and will be taken into consideration when interpreting results.

B3.6 Data Quality Statement

Fish tissue chemistry data collected for the 2024 Milne Inlet Study were of good quality as characterized by appropriate LRLs, excellent laboratory precision, low laboratory contamination, and good laboratory accuracy. Overall, fish tissue chemistry data can be used with a high level of confidence in the derivation of conclusions for the 2024 Milne Inlet Study.



B4 FISH AGING

B4.1 Data Accuracy

Fish aging was completed by North/South Consultants in 2024 (North/South Lab Report; Appendix G). Aging structures for 2024 included a combination of otoliths (preferred aging structure) and fin rays. In 2024, a total of 50 otolith and seven fin ray aging samples from Ikaluit and Qurluktuk Lakes were submitted to North/South Consultants. A laboratory analyst assigned an age and confidence index to each sample. Of these 57 samples, 10% (i.e., 8 samples) of the samples were reprocessed by a second analyst for quality control purposes. Original and reassessed age estimates were the same except for two samples (one year different; Appendix Table B.4), and all samples were within the laboratory DQO. Therefore, accuracy achieved by the laboratory is acceptable for this study.



B5 Otolith Microchemistry

B5.1 Laboratory Reporting Limits

The analytical Trich laboratory report for otolith microchemistry included one report from 2024 (Qurluktuk Lake; # 2024-724; Appendix G). Within this report, the range of reported LRLs were assessed relative to sample results. All of the 62,976 individual results for each analyte (lithium, magnesium, manganese, zinc, strontium, and barium) were above the detection limits achieved by the lab (Appendix Table B.5). Therefore, LRL were appropriate for this study.

B5.2 B5.2 Other Concerns

Due to the shape of the otoliths, it was difficult for the laboratory to expose both edges during analysis, therefore some ablation lines went from core to edge, instead of edge to core to edge. Age estimation derived chemically was compared to fish ages estimated by counting otolith annuli (See section B.4). A total of 10 chemically derived age estimates were different from annuli ages, of which eight were different by 1 year and met the DQO (± 1 year; Appendix Table B.6). Three ages were different by 2 years and will be considered during data interpretation (Appendix Table B.6).

Additionally, two samples (BA-QURL-AC-OT-08-Aug-28, and BA-QURL-AC-OT-09-Aug-28; see laboratory report 2024-724; Appendix G) were re-analyzed using a different ablation path due to the original path being incomplete. The age estimates for four fish were also reanalyzed based on re-examination of photos and chemistry. Overall, otolith microchemistry data can be used with a high level of confidence in the derivation of conclusion for the 2024 Milne Inlet Study.



B6 DATA QUALITY REVIEW SUMMARY

Data collected for the 2024 Milne Inlet Study were of acceptable quality as characterized by appropriate LRLs, good detectability, negligible analyte concentration in MB samples, good laboratory precision, and good laboratory accuracy. Field sampling precision, as measured by RPD in field duplicate pairs, was low in fish tissue chemistry samples, reflecting natural variability. Sources of variation will be considered during data interpretation. Recommended hold time exceedances were isolated to three analytes for water and fish tissue chemistry samples; however, when these results were compared to results from samples collected at the same area, no observable differences were apparent. As such, hold time exceedances had a negligible effect on data interpretation. For samples identified as being analyzed outside of recommended holding times, measurement uncertainties may be increased and will be taken into consideration when interpreting results. Fish aging samples showed good laboratory accuracy, with all samples meeting the laboratory DQO. Overall, data collected as part of the 2024 Milne Inlet Study can be used with a high level of confidence in the derivation of conclusions.



Table B.1: Laboratory Reporting Limits (LRLs) for Water Chemistry Samples, Baffinland Milne Inlet, 2024

Constituent	Units	CCME WQG		PWQO	Range of LRLs	No LRLs > Guideline	No. Sample Results < LRL
		Long-term	Short-term				
Physical Tests							
Phenols, total (4AAP)	mg/L	-	-	-	0.00100	-	2 (100%)
Total Suspended Solids	mg/L	-	-	-	1.00	-	2 (100%)
Anions, Nutrients, and Organics							
Ammonia, Total (as N)	mg/L	0.172	-	1.67	0.00500	0	1 (50%)
Bromide (Br)	mg/L	-	-	-	0.100	-	2 (100%)
Nitrate (as N)	mg/L	3.00	124	-	0.0200	0	1 (50%)
Nitrite (as N)	mg/L	0.0600	-	-	0.0100	0	2 (100%)
Phosphorus (P)-Dissolved	mg/L	-	-	-	0.0500	-	2 (100%)
Phosphorus (P)-Total	mg/L	-	-	-	0.00200 to 0.0500	-	2 (50%)
Total Metals							
Antimony (Sb)	mg/L	-	-	0.0200	0.000100	0	2 (100%)
Arsenic (As)	mg/L	0.00500	-	0.00500	0.000100	0	2 (100%)
Beryllium (Be)	mg/L	-	-	0.0110	0.0000200	0	2 (100%)
Bismuth (Bi)	mg/L	-	-	-	0.0000500	-	2 (100%)
Boron (B)	mg/L	1.50	29.0	0.200	0.0100	0	2 (100%)
Cadmium (Cd)	mg/L	0.0000400	0.000160	0.000100	0.00000500	0	1 (50%)
Cesium (Cs)	mg/L	-	-	-	0.0000100	-	2 (100%)
Chromium (Cr)	mg/L	0.00100	-	0.00100	0.000500	0	2 (100%)
Cobalt (Co)	mg/L	-	-	0.000900	0.000100	0	2 (100%)
Copper (Cu)	mg/L	0.00200	-	0.00100	0.000500	0	1 (50%)
Iron (Fe)	mg/L	0.300	-	0.300	0.0100	0	1 (50%)
Lead (Pb)	mg/L	0.00100	-	0.00100	0.0000500	0	2 (100%)
Lithium (Li)	mg/L	-	-	-	0.00100	-	1 (50%)
Mercury (Hg)	mg/L	0.0000260	-	-	0.00000500	0	2 (100%)
Nickel (Ni)	mg/L	0.0250	-	0.0250	0.000500	0	2 (100%)
Selenium (Se)	mg/L	0.00100	-	0.100	0.0000500	0	2 (100%)
Silver (Ag)	mg/L	0.000250	-	0.000100	0.0000100	0	2 (100%)
Sulphur (S)	mg/L	-	-	-	0.500	-	1 (50%)
Tellurium (Te)	mg/L	-	-	-	0.000200	-	2 (100%)
Thallium (Tl)	mg/L	0.000800	-	0.000300	0.0000100	0	2 (100%)
Thorium (Th)	mg/L	-	-	-	0.000100	-	2 (100%)
Tin (Sn)	mg/L	-	-	-	0.000100	-	2 (100%)
Titanium (Ti)	mg/L	-	-	-	0.000300	-	1 (50%)
Tungsten (W)	mg/L	-	-	0.0300	0.000100	0	2 (100%)
Vanadium (V)	mg/L	-	-	0.00600	0.000500	0	2 (100%)
Zinc (Zn)	mg/L	-	-	0.0200	0.00300	0	2 (100%)
Zirconium (Zr)	mg/L	-	-	0.00400	0.000200	0	2 (100%)
Dissolved Metals							
Antimony (Sb)	mg/L	-	-	-	0.000100	-	2 (100%)
Arsenic (As)	mg/L	-	-	-	0.000100	-	2 (100%)
Beryllium (Be)	mg/L	-	-	-	0.0000200	-	2 (100%)
Bismuth (Bi)	mg/L	-	-	-	0.0000500	-	2 (100%)
Boron (B)	mg/L	-	-	-	0.0100	-	2 (100%)
Cadmium (Cd)	mg/L	-	-	-	0.00000500	-	1 (50%)
Cesium (Cs)	mg/L	-	-	-	0.0000100	-	2 (100%)
Chromium (Cr)	mg/L	-	-	-	0.000500	-	2 (100%)
Cobalt (Co)	mg/L	-	-	-	0.000100	-	2 (100%)
Iron (Fe)	mg/L	-	-	-	0.0100	-	2 (100%)
Lead (Pb)	mg/L	-	-	-	0.0000500	-	2 (100%)
Lithium (Li)	mg/L	-	-	-	0.00100	-	1 (50%)
Mercury (Hg)	mg/L	-	-	0.000200	0.00000500	0	2 (100%)
Nickel (Ni)	mg/L	-	-	-	0.000500	-	2 (100%)
Selenium (Se)	mg/L	-	-	-	0.0000500	-	2 (100%)
Silver (Ag)	mg/L	-	-	-	0.0000100	-	2 (100%)
Sulphur (S)	mg/L	-	-	-	0.500	-	1 (50%)
Tellurium (Te)	mg/L	-	-	-	0.000200	-	2 (100%)
Thallium (Tl)	mg/L	-	-	-	0.0000100	-	2 (100%)
Thorium (Th)	mg/L	-	-	-	0.000100	-	2 (100%)
Tin (Sn)	mg/L	-	-	-	0.000100	-	2 (100%)
Titanium (Ti)	mg/L	-	-	-	0.000300	-	2 (100%)
Tungsten (W)	mg/L	-	-	-	0.000100	-	2 (100%)
Vanadium (V)	mg/L	-	-	-	0.000500	-	2 (100%)
Zinc (Zn)	mg/L	0.00315	0.0166	-	0.00100	0	1 (50%)
Zirconium (Zr)	mg/L	-	-	-	0.000300	-	2 (100%)

Notes: Total number of samples in 2024 was two (2), which included one sample from each of Qurluktuk Lake and Ikaluit Lake (collected in 2024; report BF2400295). "-" indicates no applicable guideline. Only constituents with at least one sample < LRL are displayed.

Table B.2: Laboratory Reporting Limits (LRLs) for Fish Tissue Chemistry Samples, Baffinland Milne Inlet, 2024

Constituent	Units	Consumption Guidelines ^a	Range of LRLs	No. of Sample Results < LRL
Metals				
Aluminum (Al)	mg/kg	-	2	84(91.3%)
Antimony (Sb)	mg/kg	0.00040 ^b	0.010	88(95.7%)
Barium (Ba)	mg/kg	0.20 ^{b,c}	0.10	85(92.4%)
Beryllium (Be)	mg/kg	0.0020 ^b	0.010	91(98.9%)
Bismuth (Bi)	mg/kg	-	0.010	92(100%)
Boron (B)	mg/kg	0.0175 ^c	1.0	75(81.5%)
Cadmium (Cd)	mg/kg	0.0010 ^{b,c}	0.005	1(1.1%)
Chromium (Cr)	mg/kg	0.0030 ^c	0.05	76(82.6%)
Cobalt (Co)	mg/kg	-	0.020	21(22.8%)
Lead (Pb)	mg/kg	0.0036 ^c	0.0	32(34.8%)
Lithium (Li)	mg/kg	-	0.5	91(98.9%)
Manganese (Mn)	mg/kg	0.122 ^{c,d}	0.50	45(48.9%)
Mercury (Hg)	mg/kg	0.05 ^e	0.03	0(0%)
Molybdenum (Mo)	mg/kg ww	0.0050 ^b	0.020	46(50%)
Nickel (Ni)	mg/kg	0.0011 ^{c,f}	0.20	85(92.4%)
Silver (Ag)	mg/kg	0.005 ^b	0	47.8%
Strontium (Sr)	mg/kg	378.4 ^b	0	9(9.8%)
Tellurium (Te)	mg/kg	-	0.100	92(100%)
Tin (Sn)	mg/kg	-	0.10	91(98.9%)
Uranium (U)	mg/kg	0.00060 ^c	0.0200	91(98.9%)
Vanadium (V)	mg/kg	-	0.10	51(55.4%)
Zirconium (Zr)	mg/kg	-	0.30	92(100%)

Notes: Total number of samples for 2024 was 92, which included 11 fish tissue quality field duplicate samples. Only analytes for which at least one result was < LRL are displayed. Table displays combined LRLs for muscle and liver results. mg/lg = milligrams per kilogram. mg/kg ww = milligrams per kilogram wet weight. "-" indicates no applicable guideline.

^a For more information regarding consumption guidelines refer to Table 2.2.

^b IRIS (2020).

^c Health Canada (2010).

^d Most conservative concentration (tolerable daily intakes are defined on an age-group specific basis).

^e Human health consumption guideline for muscle tissue in fish (CFIA 2015).

^f Based on nickel chloride.

Table B.3: Field Duplicate Results for Analysis of Fish Tissue Samples, Baffinland Milne Inlet, 2024

Constituent	Units	ALS Report Number WT2437881 - Ikaluit Lake																	
		27-Aug-24																	
		BA-IKLL-AC-LIV-12-AUG-27			BA-IKLL-AC-LIV-22-AUG-27			BA-IKLL-AC-LIV-31-AUG-27			BA-IKLL-AC-MUS-12-AUG-27			BA-IKLL-AC-MUS-22-AUG-27			BA-IKLL-AC-MUS-31-AUG-27		
		Replicate 1	Replicate 2	RPD ^a	Replicate 1	Replicate 2	RPD ^a	Replicate 1	Replicate 2	RPD ^a	Replicate 1	Replicate 2	RPD ^a	Replicate 1	Replicate 2	RPD ^a	Replicate 1	Replicate 2	RPD ^a
Moisture	%	63.6	62.9	1	67.6	67.5	0	60.1	60.3	0	74	74.2	0	71.9	72.2	0.42	73.6	73.9	0.4
Aluminum (Al)	mg/kg	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	-	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0
Antimony (Sb)	mg/kg	<0.010	<0.010	0	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Arsenic (As)	mg/kg	3.46	3.3	5	1.94	1.96	1	2.65	2.52	5	1.98	2.2	11	2.61	2.24	14.18	2.99	3.36	12
Barium (Ba)	mg/kg	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	0	0.17	0.110	35
Beryllium (Be)	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Bismuth (Bi)	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Boron (B)	mg/kg	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-
Cadmium (Cd)	mg/kg	1.36	1.35	1	1.5	1.38	8	1.32	1.36	3	0.022	0.0147	33	0.0417	0.0178	57	0.0546	0.0301	45
Calcium (Ca)	mg/kg	117	103	12	106	120	13	68	76	12	144	140	3	151	144	5	138	131	5
Chromium (Cr)	mg/kg	<0.050	<0.050	0	<0.050	<0.050	0	<0.050	<0.050	0	<0.050	<0.050	0	<0.050	<0.050	0	<0.050	0.233	366
Cobalt (Co)	mg/kg	0.134	0.119	11	0.202	0.168	17	0.291	0.263	-	<0.020	<0.020	0	0.021	0.119	467	0.043	<0.020	53
Copper (Cu)	mg/kg	19.4000	22.3	15	72.6000	62.2	14	55.7000	48.4	-	1.6900	2.2	30	3.1400	2.32	26	1.7600	2.86	63
Iron (Fe)	mg/kg	379	352	7	472	467	1	400	415	4	16.2	16.3	1	37.4	24.9	33	17.5	25	43
Lead (Pb)	mg/kg	0.033	<0.020	39	0.091	0.044	52	0.038	0.025	34	0.108	0.02	81	<0.020	<0.020	-	<0.020	<0.020	0
Lithium (Li)	mg/kg	<0.50	<0.50	0	<0.50	<0.50	0	<0.50	<0.50	-	<0.50	<0.50	0	<0.50	<0.50	-	<0.50	<0.50	0
Magnesium (Mg)	mg/kg	487	443	-	491	490	-	422	405	-	1430	1310	-	1140	1230	-	1430	1240	-
Manganese (Mn)	mg/kg	3.12	3.14	0.6	2.37	2.72	14.8	3	3.07	2.3	<0.50	<0.50	0.0	<0.50	<0.50	0.0	<0.50	<0.50	0.0
Mercury (Hg)	mg/kg	0.15	0.15	0.0	0.344	0.356	3.5	0.131	0.126	3.8	0.141	0.146	3.5	0.201	0.172	14.4	0.162	0.148	8.6
Molybdenum (Mo)	mg/kg ww	0.559	0.574	3	0.676	0.563	17	0.671	0.685	2	<0.020	<0.020	0	<0.020	<0.020	0	<0.020	<0.020	0
Nickel (Ni)	mg/kg	<0.20	<0.20	0	<0.20	<0.20	0	<0.20	<0.20	-	<0.20	<0.20	0	<0.20	<0.20	-	<0.20	<0.20	0
Phosphorus (P)	mg/kg	9580	8890	-	9620	9000	-	8400	7930	-	11500	11600	-	9540	10400	-	11000	10800	-
Potassium (K)	mg/kg	7,800	7,080	9.2	8,230	7,940	3.5	6,780	6,490	4.3	17,600	17,800	1.1	14,100	15,800	12.1	16,700	15,900	4.79
Rubidium (Rb)	mg/kg	3	3	7.5	4	4	0.0	3	3	1.2	5	5	4.7	5	5	8.1	5	5	11.5
Selenium (Se)	mg/kg	7.46	7.34	1.6	6.08	5.91	2.8	9.78	9.87	0.92	1.48	1.46	1.4	1.39	1.37	1.4	1.34	1.26	6.0
Sodium (Na)	mg/kg	0.503	0.58	15.3	1.76	1.6	-	1.58	1.46	7.6	<0.0050	<0.0050	0.0	<0.0050	<0.0050	0.0	<0.0050	<0.0050	0.0
Silver (Ag)	mg/kg	3090	3110	1	2990	2990	0	2180	2330	7	886	1020	15	1550	952	39	1040	1100	6
Strontium (Sr)	mg/kg	0.52	0.38	27	0.21	0.22	5	0.25	0.26	4	0.2	0.21	5	0.23	0.16	30	0.2	0.21	5
Tellurium (Te)	mg/kg	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-
Thallium (Tl)	mg/kg	0.0217	0.0186	14	0.0182	0.0165	9	0.0264	0.0233	-	0.0046	0.0045	2	0.0066	0.0062	6	0.0075	0.0047	37
Tin (Sn)	mg/kg	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0
Uranium (U)	mg/kg	<0.020	<0.020	-	<0.020	<0.020	0	<0.020	<0.020	-	<0.020	<0.020	0	<0.020	<0.020	-	<0.020	<0.020	0
Vanadium (V)	mg/kg	<0.10	<0.10	-	0.29	0.25	-	0.14	0.13	-	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-
Zinc (Zn)	mg/kg	89.9	90.3	0	98.8	106	7	82.9	82.9	-	16	16.1	1	17.1	14.8	13	15.9	16.9	6
Zirconium (Zr)	mg/kg	<0.30	<0.30	-	<0.30	<0.30	-	<0.30	<0.30	-	<0.30	<0.30	-	<0.30	<0.30	-	<0.30	<0.30	-

Did not meet the data quality objective of ≤ 25% relative percent difference (RPD).
Notes: mg/kg = milligrams per kilogram. mg/kg ww = milligrams per kilogram wet weight. "-" indicates RPD was not calculated.

^a RPD = Relative Percent Difference. If results were both below the Laboratory Reporting Limit (<LRL), RPD was not calculated. If one results was <LRL, the value of the LRL was used.

Table B.3: Field Duplicate Results for Analysis of Fish Tissue Samples, Baffinland Milne Inlet, 2024

Constituent	Units	ALS Report Number WT2437881 - Qurluktuk Lake														
		30-Aug-24														
		BA-QURL-AC-LI-05-AUG-29			BA-QURL-AC-LI-15-AUG-30			BA-QURL-AC-MUS-05-AUG-29			BA-QURL-AC-MUS-15-AUG-30			QURL-22-AC-20-LIV-X		
		Replicate 1	Replicate 2	RPD ^a	Replicate 1	Replicate 2	RPD ^a	Replicate 1	Replicate 2	RPD ^a	Replicate 1	Replicate 2	RPD ^a	Replicate 1	Replicate 2	RPD ^a
Moisture	%	81	79.9	1	77.5	77.5	0.00	78.4	78.9	0.6	77.9	78.5	1	68.6	54.1	21
Aluminum (Al)	mg/kg	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	3	50	<2.0	<2.0	0	<0.40	<1.0	150
Antimony (Sb)	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.0020	<0.0020	-
Arsenic (As)	mg/kg	2.08	1.94	7	2.16	2.3	6.48	2.23	1.96	12	2	2.51	26	0.179	0.256	43
Barium (Ba)	mg/kg	<0.10	<0.10	-	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0	<0.010	0.014	40
Beryllium (Be)	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.0020	<0.0020	-
Bismuth (Bi)	mg/kg	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.0020	<0.0020	-
Boron (B)	mg/kg	1.7	1.2	-	<1.0	<1.0	-	1	<1.0	-	<1.0	<1.0	-	<0.20	<0.20	-
Cadmium (Cd)	mg/kg	4.22	4.9	16	8.07	9.23	14	0.009	0.0087	3	0.0138	0.0134	3	0.443	0.469	6
Calcium (Ca)	mg/kg	584	502	14	331	714	116	248	138	44	177	180	2	35.5	51.8	46
Cesium (Cs)	mg/kg	<0.050	<0.050	0	<0.050	<0.050	0	<0.050	<0.050	0	<0.050	0.088	76	0.0074	0.0062	16
Chromium (Cr)	mg/kg	0.173	0.195	13	0.19	0.242	27	0.025	<0.020	20	0.133	<0.020	85	<0.010	<0.040	300
Cobalt (Co)	mg/kg	6.4500	6.61	2	9.0600	10.6	17	3.1600	2.17	31	1.9500	2.12	9	0.0719	0.0871	21
Copper (Cu)	mg/kg	974	1080	11	1330	1500	13	27.9	19.8	29	21.4	17.3	19	13.6	16.9	24
Iron (Fe)	mg/kg	0.074	0.042	43	0.047	0.119	-	<0.020	0.03	50	<0.020	0.027	35	180	170	6
Lead (Pb)	mg/kg	<0.50	<0.50	0	<0.50	<0.50	-	<0.50	<0.50	0	<0.50	<0.50	0	0.0056	<0.010	79
Lithium (Li)	mg/kg	1080	1090	-	1100	1260	-	1210	1210	-	1110	1350	-	<0.10	<0.10	-
Magnesium (Mg)	mg/kg	5.17	5.86	13.3	4.78	5.73	19.9	<0.50	<0.50	0.0	<0.50	<0.50	0.0	134	150	11.9
Manganese (Mn)	mg/kg	0.346	0.346	0.0	0.579	0.503	13.1	0.212	0.239	12.7	0.381	0.413	8.4	0.569	0.718	26
Mercury (Hg)	mg/kg ww	0.348	0.351	1	0.486	0.51	5	<0.020	<0.020	0	<0.020	<0.020	0	0.0695	0.0803	16
Molybdenum (Mo)	mg/kg	<0.20	<0.20	0	<0.20	<0.20	-	<0.20	<0.20	0	<0.20	<0.20	0	0.129	0.140	9
Nickel (Ni)	mg/kg	18400	20500	-	19000	21100	-	10100	10300	-	9220	10500	-	<0.040	0.047	18
Phosphorus (P)	mg/kg	16,200	15,900	1.9	15,100	16,800	11.3	16,600	17,300	4.22	14,700	16,900	15.0	2540	3270	28.7
Potassium (K)	mg/kg	9	10	1.8	7	8	12.2	8	8	8.2	7	8	14.18	2740	2420	11.7
Rubidium (Rb)	mg/kg	3.21	3.23	0.6	4.15	4.61	11.1	1.2	1.24	3.3	1.13	1.34	18.6	1.16	1.03	11.2
Selenium (Se)	mg/kg	0.0486	0.0484	0.4	0.135	0.161	19.3	<0.0050	<0.0050	0.0	0.0122	0.0294	141.0	1.03	1.27	23.3
Sodium (Na)	mg/kg	7400	6780	8	5030	5160	3	1720	1640	5	3190	2730	14	941	914	3
Strontium (Sr)	mg/kg	0.47	0.39	17	0.24	0.67	179	0.21	<0.10	52	0.1	0.1	0	0.060	0.091	52
Tellurium (Te)	mg/kg	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-	<0.0040	<0.0040	-
Thallium (Tl)	mg/kg	0.114	0.113	1	0.152	0.16	5	0.0114	0.0153	34	0.0102	0.0103	1	0.00420	0.00485	15
Tin (Sn)	mg/kg	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0	0.053	0.133	151
Uranium (U)	mg/kg	<0.020	<0.020	0	<0.020	<0.020	-	<0.020	<0.020	0	<0.020	<0.020	0	0.00059	0.00092	56
Vanadium (V)	mg/kg	0.21	0.24	-	0.39	0.46	-	<0.10	<0.10	-	<0.10	<0.10	0	0.037	0.055	49
Zinc (Zn)	mg/kg	127	140	10	167	208	25	15.4	14.2	8	15.4	15.6	1	26.0	39.9	53
Zirconium (Zr)	mg/kg	<0.30	<0.30	-	<0.30	<0.30	-	<0.30	<0.30	-	<0.30	<0.30	-	<0.040	<0.040	-

Did not meet the data quality objective of ≤ 30% relative percent difference (RPD).
Notes: mg/kg = milligrams per kilogram. mg/kg ww = milligrams per kilogram wet weight. "-" indicates RPD was not calculated.

^a RPD = Relative Percent Difference. If results were both below the Laboratory Reporting Limit (<LRL), RPD was not calculated. If one results was <LRL, the value of the LRL was used.

Table B.4: Age Estimates for Arctic Char, Baffinland Milne Inlet, 2024

Location	Date	Aging Structures	Species	Fish #	Age	Con. Index	QA/QC	Original Age - QA/QC Age
IKLL	27-Aug-24	OT	ARCH	1	10	G	10	0
IKLL	27-Aug-24	OT	ARCH	2	14	G	13	1
IKLL	27-Aug-24	OT	ARCH	3	11	G	11	0
IKLL	28-Aug-24	FR	ARCH	36	7	G	7	0
IKLL	28-Aug-24	OT	ARCH	37	14	G	14	0
QURL	28-Aug-24	OT	ARCH	1	15	G	15	0
QURL	28-Aug-24	OT	ARCH	2	13	G	12	1
QURL	28-Aug-24	OT	ARCH	3	13	G	13	0

Notes: Only samples with quality assurance/quality control (QA/QC) age are displayed (i.e., 10% of samples submitted to North/South Consultants in 2024). Confidence index (Con. Index): G = Good, F = Fair. ARCH = arctic charr. OT = otolith.

Table B.5: Laboratory Reporting Limits (LRLs) for Otolith Microchemistry Analysis, Baffinland Milne Inlet, 2024

Constituent	Units	LRL Achieved	Number of Sample Results <LRL
Lithium-7	ppm	0.097 to 0.513	0 (0%)
Magnesium-24	ppm	0.149 to 0.403	0 (0%)
Manganese-55	ppm	0.051 to 0.183	0 (0%)
Zinc-66	ppm	0.458 to 1.550	0 (0%)
Strontium-88	ppm	0.001 to 0.494	0 (0%)
Barium-137	ppm	0.003 to 0.021	0 (0%)

Note: Total number of samples for 2024 was 20. ppm = parts per million.

Table B.6: Age Estimate Comparison Between Chemically Derived Ages and Visually Derived Ages, Baffinland Milne Inlet, 2024

Sample ID	Otolith Microchemistry Analyses		Otolith Age Assessment	Age Difference
	Laser Ablation Method	Estimated Age (based on chemistry)		
BA-QURL-AC-OT-01-Aug-28	Core to edge	14	15	±1
BA-QURL-AC-OT-02-Aug-28	Edge to core to edge	12	13	±1
BA-QURL-AC-OT-03-Aug-28	Edge to core to edge	13	13	0
BA-QURL-AC-OT-04-Aug-28	Core to edge	18	16	±2
BA-QURL-AC-OT-05-Aug-28	Edge to core to edge	14	14	0
BA-QURL-AC-OT-06-Aug-28	Core to edge	14	14	0
BA-QURL-AC-OT-07-Aug-28	Edge to core to edge	14	14	0
BA-QURL-AC-OT-08-Aug-28	Core to edge	25	25	0
BA-QURL-AC-OT-09-Aug-28	Core to edge	18	18	0
BA-QURL-AC-OT-10-Aug-28	Edge to core to edge	15	13	±2
BA-QURL-AC-OT-11-Aug-28	Edge to core to edge	16	15	±1
BA-QURL-AC-OT-12-Aug-28	Core to edge	14	14	0
BA-QURL-AC-OT-13-Aug-28	Core to edge	15	14	±1
BA-QURL-AC-OT-14-Aug-28	Edge to core to edge	13	14	±1
BA-QURL-AC-OT-15-Aug-28	Core to edge	14	13	±1
BA-QURL-AC-OT-16-Aug-28	Edge to core to edge	14	14	0
BA-QURL-AC-OT-17-Aug-28	Edge to core to edge	12	12	0
BA-QURL-AC-OT-18-Aug-28	Edge to core to edge	14	13	±1
BA-QURL-AC-OT-19-Aug-28	Edge to core to edge	14	14	0
BA-QURL-AC-OT-20-Aug-28	Core to edge	12	14	±2

APPENDIX C

WATER DATA

Table C.1: Water Quality Screening, Milne Inlet Freshwater Fish Health Monitoring Program, 2021, 2022 and 2024

Parameter	Units	CCME Guidelines		Ikaluit Lake	Qurluktuk Lake	Ikaluit Lake	Tugaat Lake	Qurluktuk Lake	Tugaat Lake	Qurluktuk Lake
		Long-term chronic	Short-term acute	26-Aug-24	26-Aug-24	19-Aug-22	21-Aug-22	23-Aug-22	17-Aug-21	18-Aug-21
Alkalinity, Total (as CaCO3)	mg/L	-	-	7.3	78.1	8	65.3	77.5	31.9	88.3
Ammonia, Total (as N)	mg/L	0.343 to 1.54	-	<0.005	0.0057	<0.01	<0.01	<0.01	<0.01	<0.01
Bromide (Br)	mg/L	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chloride (Cl)	mg/L	120	640	1.07	1.27	0.85	1.01	1.49	0.98	1.73
Chlorophyll a	ug/L	-	-	1.45	0.623	1.48	1.41	1.18	0.46	0.11
Conductivity	uS/cm	-	-	21.5	167	21.6	72.8	171	58.8	176
Dissolved Organic Carbon	mg/L	-	-	1.65	1.51	1.21	1.88	1.17	6.88	2
Hardness (as CaCO3)	mg/L	-	-	7.92	80.9	8.38	33.6	87.1	27.1	87.9
Nitrate (as N)	mg/L	3	124	0.05	<0.02	0.048	0.039	<0.02	0.043	<0.02
Nitrite (as N)	mg/L	0.06	-	<0.01	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005
Lab pH	pH units	6.5 - 9.0	-	7.65	8.05	7.28	7.74	8.02	7.74	8.26
Phaeophytin a	ug/L	-	-	0.373	0.13	1.14	1.26	0.49	0.44	0.56
Phenols (4AAP)	mg/L	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Phosphorus, Total	mg/L	-	-	0.0025	0.0024	0.0047	0.0216	<0.003	0.0048	<0.003
Sulphate	mg/L	-	-	0.86	6.19	0.7	0.8	7.05	0.74	7.87
Temperature, Field	°C	-	-	7	8.3	-	-	-	6	-
Total Dissolved Solids	mg/L	-	-	21	100	21	65	96	19	88
Total Kjeldahl Nitrogen	mg/L	-	-	0.126	0.115	0.101	0.126	0.056	0.07	0.06
Total Organic Carbon	mg/L	-	-	1.27	1.28	1.86	2.02	0.98	1.68	1.61
Total Suspended Solids	mg/L	-	-	<1	<1	<2	20.7	3	2	<2
Turbidity	NTU	-	-	0.31	0.41	0.41	3.4	2.4	1	0.35
Aluminum (Al)-Total	mg/L	0.1	-	0.0144	0.0068	0.0202	0.0596	0.0065	0.0512	0.0063
Antimony (Sb)-Total	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic (As)-Total	mg/L	0.005	-	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Barium (Ba)-Total	mg/L	-	-	0.019	0.00217	0.0193	0.0143	0.00216	0.00986	0.00234
Beryllium (Be)-Total	mg/L	-	-	<0.00002	<0.00002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bismuth (Bi)-Total	mg/L	-	-	<0.00005	<0.00005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron (B)-Total	mg/L	1.5	29	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium (Cd)-Total	mg/L	0.00400 to 0.00030	0.0160 to 0.0001	0.0000084	<0.000005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Calcium (Ca)-Total	mg/L	-	-	2.05	24.1	1.99	6.92	24.1	5.84	25.9
Cesium (Cs)-Total	mg/L	-	-	<0.00001	<0.00001	-	-	-	-	-
Chromium (Cr)-Total	mg/L	0.001	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt (Co)-Total	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper (Cu)-Total	mg/L	0.00200 to 0.0021	-	0.00084	<0.0005	0.00076	0.00108	0.00071	0.00078	<0.0005
Iron (Fe)-Total	mg/L	0.3	-	0.01	<0.01	<0.03	0.1	<0.03	0.054	<0.03
Lead (Pb)-Total	mg/L	0.0100 to 0.0027	-	<0.00005	<0.00005	<0.00005	0.000164	<0.00005	0.000085	<0.00005
Lithium (Li)-Total	mg/L	-	-	<0.001	0.0012	<0.001	<0.001	0.0018	<0.001	0.0018
Magnesium (Mg)-Total	mg/L	-	-	0.728	5.21	0.73	3.92	5.85	3.12	5.47
Manganese (Mn)-Total	mg/L	-	-	0.0005	0.00068	0.000774	0.00424	0.00113	0.00183	0.000958
Mercury (Hg)-Total	mg/L	0.000026	-	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Molybdenum (Mo)-Total	mg/L	0.073	-	0.000225	0.0001	0.000204	0.000285	0.000087	0.00036	0.000103
Nickel (Ni)-Total	mg/L	0.0250 to 0.0867	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Potassium (K)-Total	mg/L	-	-	0.376	0.317	0.34	0.41	0.23	0.38	0.24
Rubidium (Rb)-Total	mg/L	-	-	0.00104	0.00023	-	-	-	-	-
Selenium (Se)-Total	mg/L	0.001	-	<0.00005	<0.00005	<0.001	<0.001	<0.001	<0.001	<0.001
Silicon (Si)-Total	mg/L	-	-	0.38	0.36	0.38	0.84	0.28	0.5	0.31
Silver (Ag)-Total	mg/L	0.00025	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium (Na)-Total	mg/L	-	-	0.632	0.617	0.6	0.791	1.02	0.704	0.806
Strontium (Sr)-Total	mg/L	-	-	0.00575	0.058	0.00587	0.0089	0.0604	0.00635	0.0606
Sulfur (S)-Total	mg/L	-	-	<0.5	2.15	-	-	-	-	-
Tellurium (Te)-Total	mg/L	-	-	<0.0002	<0.0002	-	-	-	-	-
Thallium (Tl)-Total	mg/L	0.0008	-	<0.00001	<0.00001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Thorium (Th)-Total	mg/L	-	-	<0.0001	<0.0001	-	-	-	-	-
Tin (Sn)-Total	mg/L	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium (Ti)-Total	mg/L	-	-	0.00038	<0.0003	<0.01	<0.01	<0.01	<0.01	<0.01
Tungsten (W)-Total	mg/L	-	-	<0.0001	<0.0001	-	-	-	-	-
Uranium (U)-Total	mg/L	0.015	0.033	0.000379	0.000456	0.000384	0.0019	0.000163	0.0027	0.000308
Vanadium (V)-Total	mg/L	-	-	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc (Zn)-Total	mg/L	-	-	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Zirconium (Zr)-Total	mg/L	-	-	<0.0002	<0.0002	<0.0001	0.00012	<0.0001	-	-

Indicates value greater than the long-term average Canadian Water Quality Guidelines.

Indicates value greater than the short-term maximum Canadian Water Quality Guidelines.

Note: "-" indicates no available data or guideline. Field temperature and pH were not taken in 2022 and 2021, for guideline calculation purposes these values were estimated using 2024 values.

APPENDIX D

FISH DATA

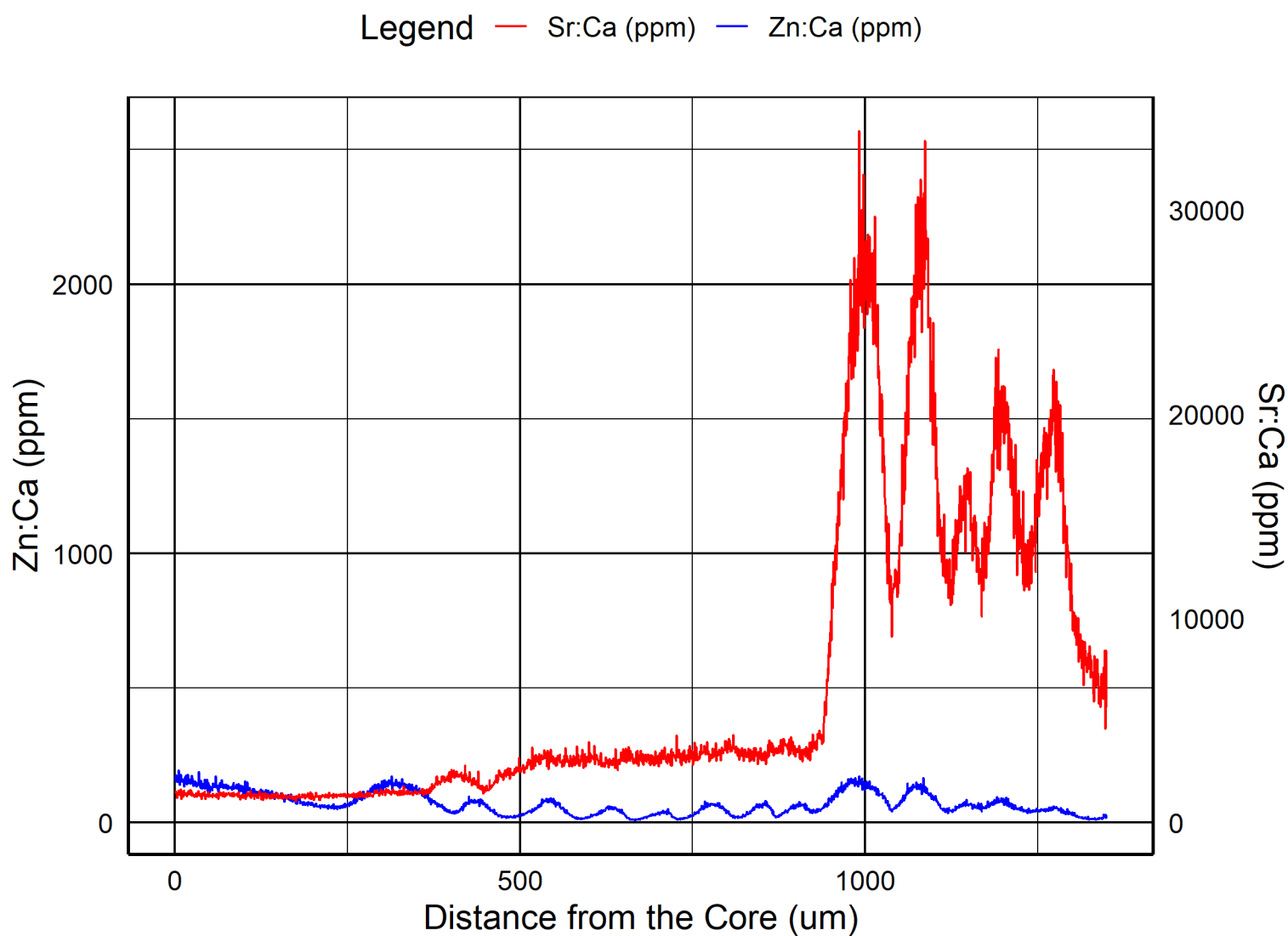


Figure D.1: Zn:Ca and Sr:Ca ratios from the Otolith of QURL_AC_01, from Qurluktuk Lake, 2024; LA-ICPMS Scan from Core to Edge

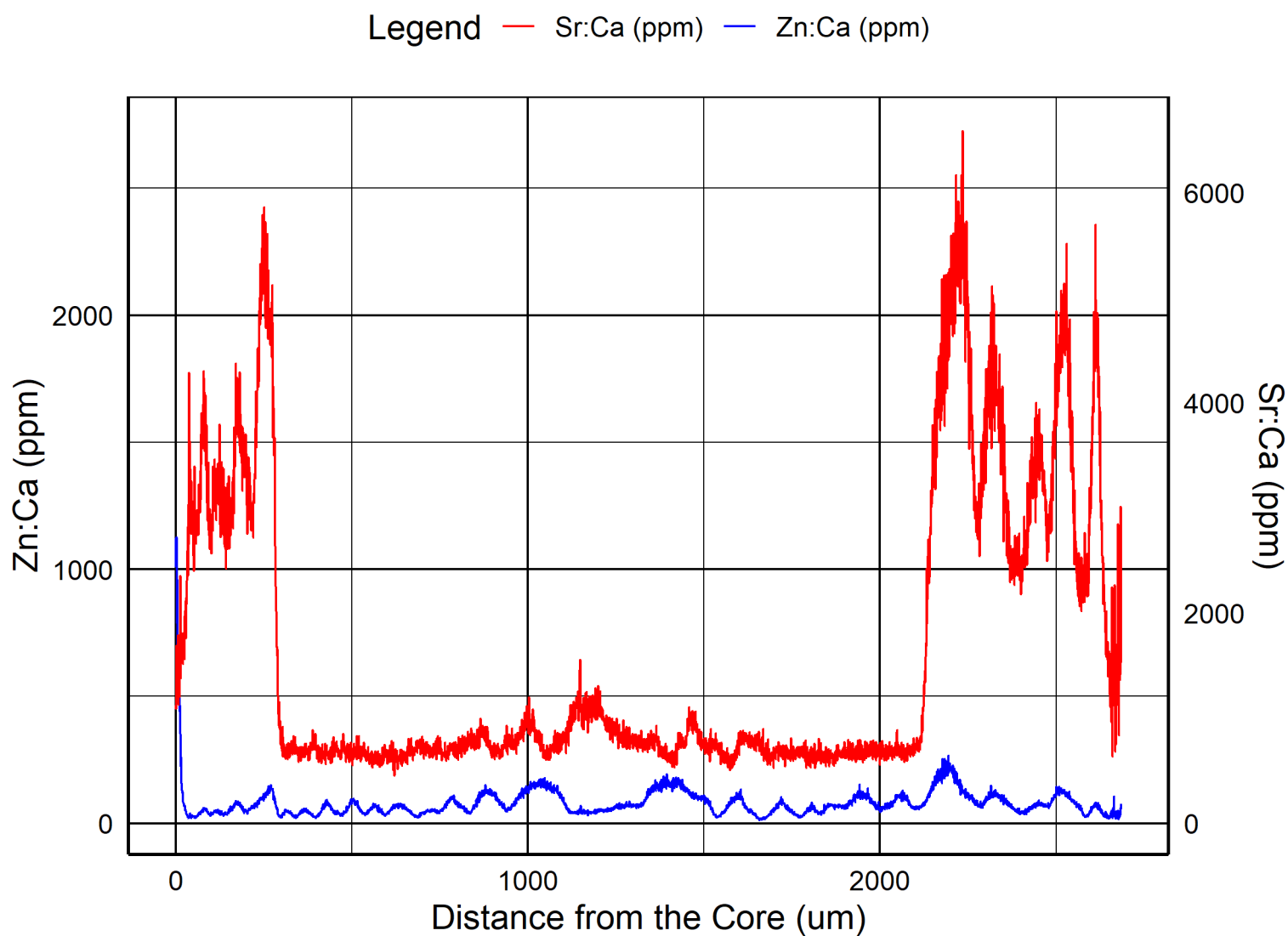


Figure D.2: Zn:Ca and Sr:Ca ratios from the Otolith of QURL_AC_02, from Qurluktuk Lake, 2024; LA-ICPMS Scan from Edge to Core to Edge

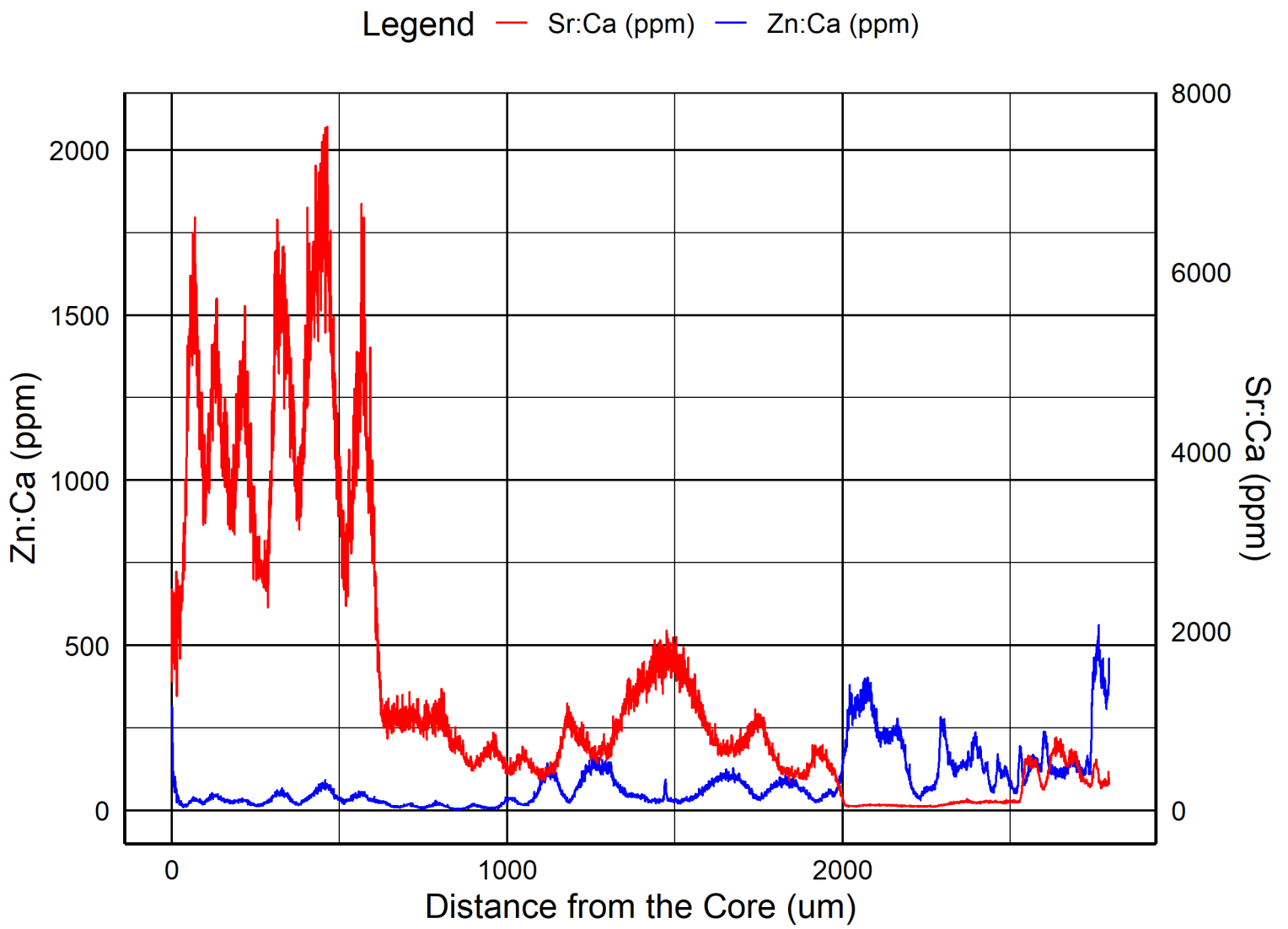


Figure D.3: Zn:Ca and Sr:Ca ratios from the Otolith of QURL_AC_03, from Qurluktuk Lake, 2024; LA-ICPMS Scan from Edge to Core to Edge

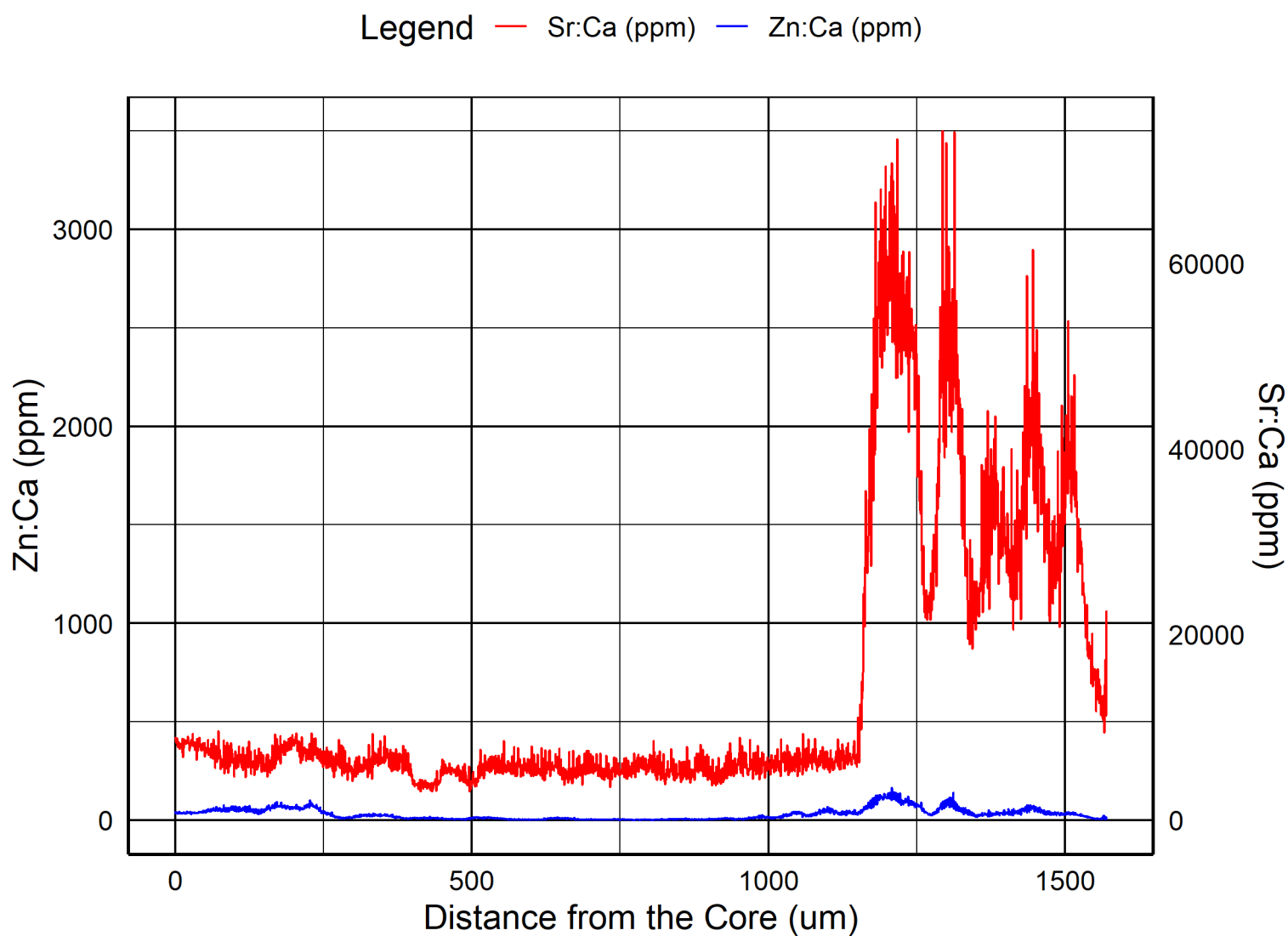


Figure D.4: Zn:Ca and Sr:Ca ratios from the Otolith of QURL_AC_04, from Qurluktuk Lake, 2024; LA-ICPMS Scan from Core to Edge