Anguniaqvia Niqiqyuam Marine Protected Area Coastal Monitoring: Synthesis of 2017-2021 Summer and Winter Field Programs

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Fisheries and Oceans Canada
Arctic Region
Freshwater Institute
501 University Crescent
Winnipeg, MB
R3T 2N6

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1. Fisheries and Oceans Canada
Arctic Region
Freshwater Institute
501 University Crescent
Winnipeg, MB
R3T 2N6

2. Paulatuk Hunters and Trappers Committee
P.O Box 39
Paulatuk, NT
X0E 1N0

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ABSTRACT

M[c]Nicholl, D.G. Christie, L.R., Dunmall, K.M., Illasiak, S., Ruben, N., Illasiak, D., Green, B., Green, T., Green, N., Ruben, R., Illasiak, J., Ruben, B.S., Ruben R. and The Paulatuk Hunters and Trappers Committee. 2024. *Anguniaqvia Niqiqyuam* Marine Protected Area Coastal Monitoring: Synthesis of 2017-2021 Summer and Winter Field Programs. Can. Tech. Rep. Fish. Aquat. Sci. 3595: xiv + 103 p.

Since the designation of the *Anguniaqvia Niqiqyuam* Marine Protected Area (ANMPA) in 2016, biologists from Fisheries and Oceans Canada and rightsholders from the community of Paulatuk have built upon existing baseline coastal knowledge to develop an annual community-led coastal monitoring program during both the open water and ice-covered seasons. This program, known as Arctic Coast, has been co-developed to assess environmental and biological indicators within the ANMPA, with a focus on coastal fishes, including their trophic linkages and habitat associations. Annual community-led open water field programs were conducted between 2017-2021, while an ice-covered field programs was piloted in 2019 and continued annually between 2020-2021. Among these years of sampling, environmental indicators relevant to core oceanography, ice and snow, and benthic habitat were collected and are summarized in this report. Biological and food web indicators with respect to coastal fishes, their life history and trophic linkages, and biodiversity of zooplankton and benthic epifauna are also summarized from 2017 and 2021. The aim of this report is to summarize coastal ecological information gathered among these years across indicators such that it may be used to address knowledge gaps and assist with guiding management and monitoring decisions for the ANMPA.

RÉSUMÉ

McNicholl, D.G. Christie, L.R., Dunmall, K.M., Illasiak, S., Ruben, N., Illasiak, D., Green, B., Green, T., Green, N., Ruben, R., Illasiak, J., Ruben, B.S., Ruben R. and The Paulatuk Hunters and Trappers Committee. 2024. *Anguniaqvia Niqiqyuam* Marine Protected Area Coastal Monitoring: Synthesis of 2017-2021 Summer and Winter Field Programs. Can. Tech. Rep. Fish. Aquat. Sci. 3595: xiv + 103 p.

Depuis que la zone de protection marine d'*Anguniaqvia Niqiqyuam* (ZPMAN) a été désignée en 2016, des biologistes de Pêches et Océans Canada et des titulaires de droits du village de Paulatuk se sont appuyés sur les connaissances côtières de base existantes pour élaborer un programme annuel de suivi côtier dirigé par la communauté pendant la saison des eaux libres et la saison des glaces. Ce programme, connu sous le nom d'Arctic Coast, a été élaboré conjointement pour évaluer des indicateurs environnementaux et biologiques dans la ZPMAN, en mettant l'accent sur les poissons côtiers, y compris leurs liens trophiques et leurs associations d'habitats. Un programme de terrain dirigé par la communauté a été mené chaque année pendant la saison des eaux libres entre 2017 et 2021, tandis qu'un programme de terrain a été mis à l'essai pendant la saison des glaces en 2019 et s'est poursuivi en 2020 et 2021. L'échantillonnage effectué au cours de ces années a permis de recueillir des données sur des indicateurs environnementaux relatifs à l'océanographie de base, à la glace, à la neige et à l'habitat benthique qui sont résumées dans le présent rapport. Des données sur des indicateurs relatifs à la biologie et au réseau trophique des poissons côtiers (leur cycle de vie et leurs liens trophiques) ainsi que la biodiversité du zooplancton et de l'épifaune benthique sont également résumées pour les années 2017 à 2021. L'objectif de ce rapport est de résumer les données écologiques côtières recueillies au cours de ces années pour l'ensemble des indicateurs afin qu'elles puissent être utilisées pour combler les lacunes en matière de connaissances et contribuer à orienter les décisions de gestion et de suivi pour la ZPMAN.

ABBREVIATIONS

DFO – Fisheries and Oceans Canada
PHTC – Paulatuk Hunters and Trappers Committee
ANMPA- *Anguniaqvia Niqiqyuam* Marine Protected Area
MPA – Marine protected area
ISR – Inuvialuit Settlement Region
FJMC – Fisheries Joint Management Committee
BREA – Beaufort Regional Environmental Assessment
BREA-MFP – Beaufort Regional Environmental Assessment – Marine Fishes Project
CBS-MEA – Coastal Beaufort Sea – Marine Ecosystem Assessment
CROW – Canadian Rangers Ocean Watch
CO – Conservation objective
CSAS – Canadian Science Advisory Secretariat

1.0 INTRODUCTION

The effects of climate change have been pervasive throughout the Arctic environment, and have occurred at an accelerated rate in coastal ecosystems (Boyce et al., 2022; Huntington et al., 2020). Approximately 70% of the coastal habitats in Canada are found within Inuit Nunangat, yet this biologically and culturally significant habitat remains largely under-studied. In particular, the transitional zones between marine and freshwater systems represent critical habitat for many migrating and foraging species in the summer (Steiner et al., 2015; M^c^Nicholl et al. 2021). Transitional zones are also more sensitive to climate-driven change such as erosion, sea-ice loss, and storm events (Steiner et al., 2015), which are an added challenge for species that inhabit these regions. There is an inherent challenge in separating ecological changes that are associated with natural variability versus those that are driven by climate change. This is further compounded by the accelerated rate of change associated with climate change in a region as vast and generally data-limited as the Canadian Arctic.

The designation of Marine Protected Areas (MPAs) serves to identify and protect culturally or ecologically important areas in Canadian waters, and is a critical tool for mitigating the effects of climate change in the Arctic. A network of MPAs and Other Effective area-based Conservation Measures (OECMs), or marine refuges, are increasingly important to contribute to preserving northern ecosystems under rapidly changing conditions (Bryndum-Buchholz et al., 2022). The designation of such spaces is essential for reducing the extent of biodiversity loss, maintaining resilience of traditional and culturally important areas, and limiting the impact of anthropogenic activities. Canada has committed to the ambitious target of protecting 30% of its ocean in a conservation network by 2030, which will require the designation of new areas while also supporting existing MPAs.

Indicators are developed for each MPA in order to assess changing conditions in relation to specific conservation objectives (DFO 2015). Depending on the nature of each MPA, these indicators may include environmental, biological and socio-economic components, resulting in a complex set of parameters and multiple forms of data. The combination of these indicators may then be used to provide the environmental context for the area, local ecology and integrity, and identify potential stressors and threats that are likely to develop in future years.

1.1 The *Anguniaqvia Niqiqyuam* Marine Protected Area

In the Darnley Bay area of the Beaufort Sea, the *Anguniaqvia Niqiqyuam* Marine Protected Area (ANMPA) became the second MPA to be designated in the Canadian Arctic in 2016 (Figure 1). The ANMPA is located on the western side of Darnley Bay, a southern embayment found in the Amundsen Gulf. It is found within the Inuvialuit Settlement Region (ISR), and is in close proximity to the hamlet of Paulatuk, NT. The ANMPA holds substantive cultural, socio-economical, and ecological significance to the community of Paulatuk, who rely heavily on this area for subsistence harvest (KAVIK-AXYS 2012). The identification of the initial area of interest was led by Inuvialuit co-management partners in 2010 (Paulic et al. 2012), who have continued to play a critical role in continued monitoring and research in the ANMPA in subsequent years. It is also the first MPA with conservation objectives that have been identified using local Indigenous knowledge (DFO 2015).

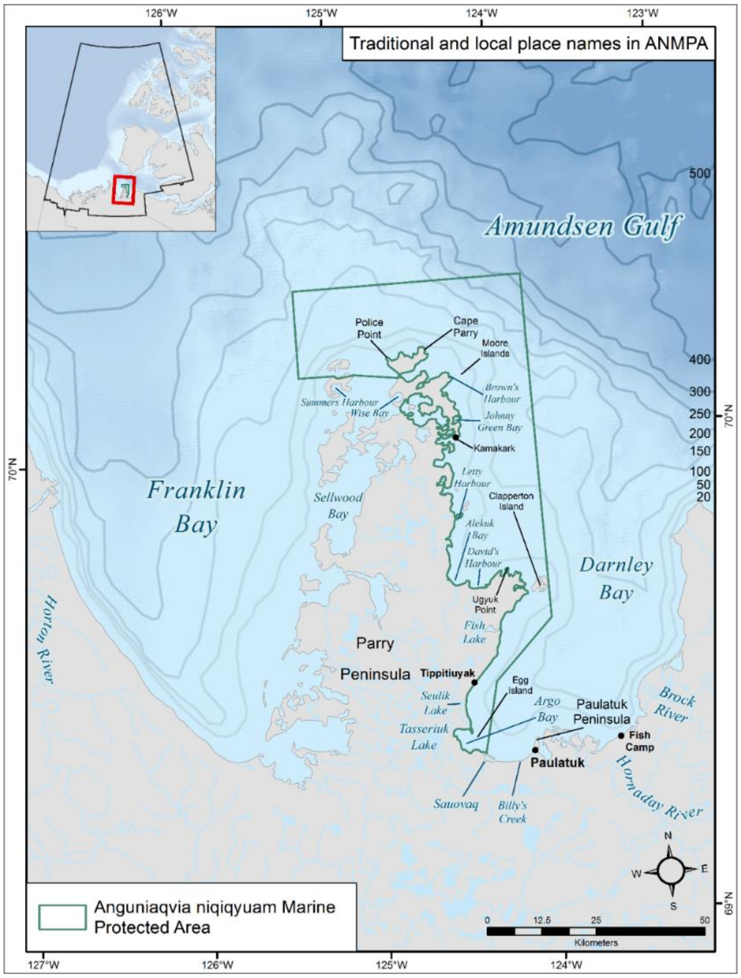

Figure 1. Map of traditional and local place names in the *Anguniaqvia Niqiqyuam* Marine Protected Area. Map created by J. Friesen and local place names provided by the ANMPA Working Group. Bathymetry adapted from the IBCAO by M. Ouellette. Base map obtained from Open Government Portal (Ehrman et al. 2022).

The conservation objectives for the ANMPA are:

- To maintain the integrity of the marine environment offshore of the Cape Parry Migratory Bird Sanctuary so that it is productive and allows for higher trophic level feeding by ensuring that the Cape Parry polynyas and associated sea-ice habitat, and the role of key prey species (e.g., Arctic cod), are not disrupted by human activities.

- To maintain the habitat to support populations of key species (such as beluga whales, Arctic char, and ringed and bearded seals).

Arctic char (*Salvelinus alpinus*), broad whitefish (*Coregonus nasus*), Beluga whales (*Delphinapterus leucas*) and seals commonly use the ANMPA as a migratory corridor and for foraging (Paulic et al., 2012), and are frequently harvested by the residents of Paulatuk during the summer months.

Research and monitoring is ongoing in the ANMPA to assess trends in identified indicators for key species and their habitats, and to address data gaps to better understand ecosystem processes. Ehrman et al. 2022 summarizes the selection, criteria, process, three-tiered indicator concept and integration into MPA networks. Indicators in their simplest form must be able to identify change, and determine if the conservation objectives are being met (DFO 2015). The three-tiered indicator concept summarized for the ANMPA includes 1) indicators of background environmental context, 2) indicators of biological and food web integrity, and 3) indicators of pressures and threats (Ehrman et al. 2022). Table 1 provides a list of these indicators and corresponding position in this three-tiered concept. This report is organized by the indicators identified in Ehrman et al. 2022, in order to make available data and information gathered by the Arctic Coast program accessible to stakeholders. Summarizing relevant information in this way is important for identifying linkages among indicators, understanding the complexities of monitoring Arctic protected areas, and highlighting where knowledge gaps may exist.

Table 1. List of potential indicators for the ANMPA identified in Ehrman et al. 2022, and associated three-tiered category. Indicators that have relevant information summarized in this report are identified with a ✓.

Background of Environmental Context	**Indicator**	**Relevant information in this report**
	Core oceanographic parameters and nutrient concentrations	✓
	Ice structures, snow and ice thickness, and ice break-up/freeze-up timing	✓
	Benthic habitat distributions	✓
	Coastal change	n/a
	Freshwater inputs and terrestrial linkages	n/a
Biological and Food Web Integrity	Trophic links and energetic transfer	✓
	Ice-associated, under-ice, and open-water primary producers	n/a
	Zooplankton community composition, structure, and function	✓
	Benthic invertebrate community composition, structure and function	✓
	Offshore fish community composition, structure, and function	n/a
	Inshore fish community composition, structure, and function	✓
	Key forage fish relative abundance and biomass	✓
	Anadromous fish relative abundance, habitat use, and population structure	✓
	Occurrence and timing of potentially colonizing species	✓
	Marine bird presence/absence and prey items	n/a
	Marine mammal presence/absence, timing, habitat use, and group composition	n/a
Pressures and Threats	Anthropogenic underwater noise	n/a
	Contaminant concentrations in the environment and in marine mammals	n/a
	Other threat considerations	n/a

1.2 Arctic Coast

The ANMPA coastal survey was first piloted in 2012 by DFO Science at the request of the PHTC to characterize baseline coastal fish species diversity, biological characteristics, and habitat associations. Baseline surveys including the one conducted in 2012, have been integrated into a DFO Science-led program called "Arctic Coast". This program has been designed so it may be applied to multiple coastal communities in the Canadian Arctic and was developed through past sampling efforts in the ANMPA in 2014 to 2016 (McNicholl et al., 2017a), Coronation Gulf in 2017 (McNicholl et al., 2019), in Sachs Harbour 2018 (McNicholl et al., 2019) and among Hudson Bay communities between 2020 and 2021 (Christie et al. 2023). The goal of the early sampling years 2012-2017 was to replicate and refine methods used in other locations so in subsequent years (2018-2021) the program could be community-led. Information gained from these efforts will facilitate future spatial comparison of fish diversity, changes in abundance and linkages to their environment. Standardized sampling methods developed through this study can be used to interpret changes at the local scale, relative to those observed throughout coastal communities in the Inuvialuit Settlement Region and the Canadian Arctic.

The objectives of the field programs conducted between 2017 and 2021 were to:

1) Collect coastal fishes at standardized sites in the ANMPA to describe species diversity and abundance relative to one another, and collect sub-samples (otoliths, muscle tissue, and stomachs) for follow-on analyses;

2) Examine and interpret environmental data collected from the water column (depth, temperature, salinity, pH, turbidity, and dissolved oxygen) at standardized sites in the ANMPA to assess nearshore coastal habitats and identify changes;

3) Collect and identify invertebrates collected from benthos and from fish stomachs throughout the ANMPA to describe invertebrate species diversity;

4) Enhance capacity of community-based technicians by providing additional field and technical skills to support community leadership in research and monitoring;

5) Examine data collected among years of sampling, and between open water and ice-covered seasons to assess spatial and temporal trends in the coastal environment;

This program was developed as an ecosystem-level approach to coastal monitoring that encompasses multiple trophic levels and environmental parameters at different times of the year. These efforts will complement other ongoing research programs in the area (Canadian Beaufort Sea: Marine Ecosystem Assessment (CBS-MEA), stock assessment of Arctic char, Arctic Salmon, Canadian Rangers Ocean Watch (CROW), and monitoring of marine mammals such as beluga and ringed seals.

1.3 Integration of Indicators

1.3.1 Research and monitoring

The Arctic Coast coastal survey was designed to have two stages, an initial baseline research stage and a monitoring phase so that protocols were developed with the information gathered through the initial research and then applied to ensure consistent data collection spatially and temporally. Prior to 2012, there was little published information available regarding the community of coastal fishes and their habitat associations within the ANMPA, particularly those outside of traditional harvest locations. Baseline research conducted in the ANMPA between 2012 and 2014-2016 addressed knowledge gaps that were used to identify ecological indicators essential for monitoring. These knowledge gaps included the community composition of fishes, their habitat associations (i.e., core oceanography, benthic habitat), prey availably and fish diet, and the extent of seasonal and temporal variation among those indicators. The research phase also included testing equipment and piloting protocols that were most effective for long-term community-based monitoring. As a result, during the research phases of the program, in each new location or season, there was a greater effort of sampling and more gear types employed to determine which were most practical for community use and addressing each specific indicator.

The integration of indicators into the monitoring protocols of this survey was developed over time as the coastal survey transitioned from baseline research between 2014-2017, to community-led monitoring in 2018. Overlap between community-based monitors from previous years and DFO biologists was required to train new technicians and build capacity for community-led monitoring. Additionally, input and support from the Paulatuk Hunters and Trappers Committee (PHTC) was essential in order to ensure that the data collected adequately addressed the indicators identified through the 2020 CSAS process (Ehrman et al., 2022). This report summarizes the data gathered by each indicator, so that the information is easily accessible and links among indicators can be identified to assess trends.

1.4 Community Leadership

The relationship between the Paulatuk Hunters and Trappers Committee (PHTC) and DFO Science represents a longstanding, unique collaborative structure for research and monitoring. Any research program (DFO or others) must receive support directly from the PHTC, and the study objectives must align with a community concern or link more broadly to priorities identified by the PHTC, as well as Inuvialuit co-management entities (Joint Secretariat). DFO scientists are expected to regularly engage with the PHTC, initially to show how their research addresses a community concern (e.g., presence of new or unusual species, condition, or abundance of subsistence species), provide results updates and participate in subsequent consultations. Once there is support, baseline research may be conducted by researchers, the community, or both, then is reported back to the PHTC. Over time, this process may result into long-term community-led monitoring projects. The evolution of Arctic Coast has followed this process and the resulting ecological data are summarized in detail in this report.

1.5 Environmental Indicators

1.5.1 Core oceanography

Oceanographic conditions, circulation, and characteristics of the water column influence every aspect of marine biota and their habitat use. Darnley Bay is considered a productive environment that attracts a variety of marine mammals, seabirds, fishes, and invertebrates (Ehrman et al., 2022), all of which are influenced by oceanography. Monitoring core oceanographic parameters is necessary in order to understand the habitat preferences of coastal species, and identify if an ecological change may be occurring in response to changing conditions. Key parameters such as temperature and salinity impact coastal fishes and invertebrates at all life-history stages, and must be documented in order to determine if an observed biological change is in response to an environmental shift.

The collection of core oceanographic data has been maintained throughout the Arctic Coast coastal monitoring program in the ANMPA during each year of sampling (McNicholl et al., 2017a). This report summarizes core oceanographic parameters such as temperature and salinity at depth between 2017 and 2021 that were collected using standardized monitoring protocols. In addition to monitoring, this report summarizes baseline research that was conducted in order to address knowledge gaps associated with the nearshore (< 20 meters depth) environment of the ANMPA and the characteristics of the water column. The combination of consistent monitoring and conducting pilot research studies allowed this program to assess oceanographic conditions at spatial and temporal scales, as well as develop new tools for monitoring that may be applied by the program in future years.

1.5.2 Ice and snow

The formation, extent, and break up of sea ice impacts the movement of marine species throughout the year, and determines the extent of the summer foraging season for coastal species in the Arctic. Ice can form barriers to species transiting through marine spaces (Loseto et al., 2006) or serve as important habitat for the early life history stages of forage fishes (LeBlanc et al., 2020). In the ANMPA specifically, there has been a shift in the timing of ice breakup and formation, such that break-up is occurring in mid- or late-June opposed to mid- or late-July and freeze-up has shifted from mid-October to early November (Gully et al., 2023). Understanding the spatial coverage of sea ice, thickness and under-ice conditions are key to monitoring change, yet the logistical challenges associated with working in the winter have limited the extent of baseline research that could be conducted during this season.

Baseline ice-covered surveys were conducted in the ANMPA to complement ecological data gathered during the open water season with Arctic Coast, but also pre-existing programs such as the Canadian Rangers Ocean Watch (CROW) that was already operating on an annual basis in several coastal communities, including Paulatuk. This report summarizes baseline research that was gathered during the pilot years of this study (2019) and subsequent years of sampling as protocols were refined into an annual winter monitoring program.

1.5.3 Benthic habitat

Physical features of the ocean floor such as depth, sediment class, and presence of macroalgae are key components of the benthic habitat, yet there are substantive knowledge gaps that exist in the Canadian Arctic. Coastal areas in particular are undergoing accelerated change as a result of increased erosion, sedimentation, and are particularly sensitive to anthropogenic activity (Tanguy et al., 2023). Benthic composition (sediment type and class) directly influences the biodiversity of lower trophic species, and potentially leads to concentrated areas of invertebrates and/or fishes which attracts higher trophic species such as marine mammals or sea birds. Additionally, coastal environments support large beds of macroalgae, which serve as valuable rearing habitat for fishes at their early life history stages. Understanding the benthic ecology of coastal environments is necessary in order to better interpret the drivers of change, particularly those impacting multiple trophic levels.

Benthic information is limited for the ANMPA, and more extensive studies are needed to fully address knowledge gaps related to bathymetry, extent of habitat forming macroalgae, and sediment composition. The Arctic Coast survey was able to provide baseline information of the substratum type in previous surveys (McNicholl et al., 2017a); however, much of this information was gathered in the context of collecting fishes (e.g., depth, presence/absence macroalgae) with a limited focus on the benthos. This report summarizes the information gathered from the development of protocols designed to better understand the benthos of the ANMPA, and incorporate them into the Arctic Coast annual monitoring program.

1.6 Biological and food web indicators

1.6.1 Zooplankton

In Arctic ecosystems, zooplankton represent the most crucial energetic link between primary producers and consumers in the marine environment. As zooplankton consume primary producers, such as phytoplankton, they are able to concentrate energy that is directly consumed by both lower and upper trophic species, thus representing a pivotal role in the food web. Similarly, because zooplankton are so tightly linked to consumers, they serve as a useful indicator for change, particularly for planktivores such as fishes, bowhead whale, seals and some species of sea birds. Monitoring assemblages of zooplankton is of particular importance, given that current oceanographic conditions may lead to a shift in smaller-sized species of zooplankton, potentially leading to a negative impact on their predators (Hopcroft et al., 2005).

Information on zooplankton assemblages and contribution to the diet of coastal fishes is limited in the coastal areas of the ANMPA. Much of the knowledge gained in the ANMPA has been at depths > 20 meters offshore, or in adjacent waters (Darnis et al., 2008; Niemi et al., 2020) such as Franklin Bay or the Amundsen Gulf. The information summarized in this report was gathered during Arctic Coast surveys in order to address this knowledge gap associated with the coastal environment. Although much of the information on zooplankton was gathered from the stomach contents of fishes, the combination of plankton biodiversity and contribution to diet will serve as an important indicator for change within the ANMPA.

1.6.2 Benthic epifauna

Benthic epifauna are an important component of Arctic coastal ecosystems for carbon storage and as prey base for mid- to high-trophic marine species (Bluhm & Gradinger, 2008; Trueman et al., 2014). Biodiversity of benthic invertebrates of the Canadian Arctic are not well documented in nearshore environments (< 20 meters depth), yet represent an important energetic linkage among trophic levels, and among freshwater and marine systems with respect to anadromous species, such as Arctic char. These benthic species are also sensitive to anthropogenic and climate-driven disturbances (i.e., erosion) that may alter community assemblages and/or coupling with pelagic primary productivity. Therefore, the community of benthic epifauna is a useful indicator of change among Arctic coastal communities, including those found in the Darnley Bay ANMPA.

Baseline information on community composition and biodiversity of benthic epifauna is available from surveys conducted by DFO (BREA-MFP; CBS-MEA) and the PHTC (KAVIK AXYS Inc., 2012); however, there is consensus among rightsholders that more information is required (Ehrman et al., 2022). The benthic information summarized in this report includes pilot sampling efforts first tested in 2017 and subsequent sampling up to 2021 completed by Arctic Coast community-based monitors. These data represent an expansion upon a coastal monitoring program that was originally focused on fishes, to include lower trophic species, including benthic epifauna.

1.6.3 Fishes

Forage fishes

Forage fishes represent strong ecological indicators as a key prey source for upper-trophic level predators and life history characteristics that are sensitive to environmental change. The assessment of key forage fishes are summarized in this report based on parameters identified in the CSAS process (Ehrman et al., 2022), specifically with respect to their distribution and abundance. Abundance and life history information gathered among Arctic Coast surveys may be used to interpret the foraging behaviour among upper-trophic level species, and potential shifts in distribution. Given that the forage fishes present in the inshore habitats of the ANMPA are either evasive or episodic, it is not possible to calculate relative abundance and biomass as it is on offshore vessels that have equipment to quantify such data. However, parameters relevant to long term monitoring such as spawning characteristics and trophic linkages to anadromous species are summarized in this report.

The most abundant forage fish species found within the inshore areas of the ANMPA is capelin (*Mallotus villosus*). The consistent presence of this forage fish species in coastal areas of the ANMPA represent an important prey base and energetic link between the offshore marine environment and anadromous species that forage in coastal habitats each summer. Capelin have been well documented in the ANMPA, and local ecological knowledge of this species indicates that they have been spawning within Darnley Bay for several decades (McNicholl et al., 2017b). Other forage fishes documented among Arctic Coast surveys include rainbow smelt (*Osmerus mordax*), Pacific sandlance (*Ammodytes hexapterus*) and ninespine stickleback (*Pugnus pugnus*); however, their occurrences were sporadic among years of sampling or their abundance was documented within the stomach contents of piscivorous fishes such as Arctic char. Therefore, identifying trends with respect to their spawning characteristics and relative abundance is not possible in this report. Arctic cod are well documented in the offshore areas of the ANMPA (McNicholl et al., 2020), and are considered an important prey species, yet they are not discussed in this report, given that they were not captured in any of the Arctic Coast ANMPA sampling programs. Despite some knowledge gaps associated with ANMPA forage fishes, it is possible to identify trends in the spawning characteristics of capelin, and trophic linkages to anadromous Arctic char, based on the contribution of the forage fishes identified here, to their diet.

Anadromous fishes
Anadromous fishes represent key species of cultural and ecological importance for which the conservation objectives of the ANMPA were designed to preserve. Both Arctic char and broad whitefish have been listed as key species of interest by the ANMPA Working Group (Ehrman et al., 2022), and are a focal species for community-led monitoring programs specific to Darnley Bay. Although the Arctic Coast monitoring program has not exclusively focused on these anadromous fishes, information relevant to managing their habitat and population was gathered within the ANMPA, where substantive knowledge gaps still remain with respect to their ecology. Understanding their habitat use, foraging behaviour, distribution, and life history characteristics are critical in order to meet conservation objectives (Section 1.1).

Among fish species found in Darnley Bay, Arctic char (Iqalukpik) are the most studied, specifically stocks associated with the Hornaday and Brock River (Harris et al., 2016; Harwood & Babaluk, 2014; KAVIK-AXYS 2012). Within the ANMPA, information is still limited with respect to the habitat use and diet of Arctic char given that much of prior research efforts have been dedicated to the management of Hornaday Arctic char.

Broad whitefish are identified as a key subsistence species by the ANMPA Working Group, though there has been less information gathered with respect to their habitat use and ecology, relative to Arctic char. In the Inuvialuit Settlement Region, broad whitefish are known as "whitefish" or Aanaarliq (Inuvialuktun-Sallirmiutun) (Coad and Reist 2018) and, like char, are desirable for consumption as fillets or made into dry-fish (pipsii). This species is most commonly caught in the summer season while it is foraging in the marine environment, but may also be caught in nearby lakes in the fall and winter (KAVIK-AXYS 2012). Community-led field projects have been run by the PHTC with respect to the distribution and movement of broad whitefish associated with Billy's Creek at the southern end of Darnley Bay from 2018-2021. Additionally, as a component of Arctic char monitoring at Tippitiuyak (Tippi), whitefish have been sampled opportunistically to complement work conducted by DFO stock assessment (Ehrman et al. 2022). The distribution of broad whitefish has been documented in freshwater sites connected to the Hornaday River, Brock River, Argo Bay, and Bennett Point; however, all records within the ANMPA are south of Bennett Point (McNicholl et al. 2020). Given that this species typically forages in the benthic zone of soft sediment habitats it is not unexpected that, as the habitat changes to include more rock towards the northern end of Cape Parry, there are fewer occurrences.

2.0 METHODS

2.1 Sampling area

Field programs were conducted in Argo Bay, Bennett Point and Brown's Harbour (Figure 2), between 2017 and 2021. Table 2 provides a summary of which programs were carried out among these years, and in which seasons.

Table 2. Summary of the field programs conducted in the ANMPA at Argo Bay, Bennett Point and Brown's Harbour between 2017 and 2021.

		2017	2018	2019	2020	2021
Argo Bay	Ice-covered	n/a	n/a	✓	✓	✓
	Open water	✓	✓	✓	✓	✓
Bennett Point	Ice-covered	n/a	n/a	n/a	✓	✓
	Open water	n/a	n/a	✓	✓	n/a
Brown's Harbour	Ice-covered	n/a	n/a	n/a	n/a	✓
	Open water	n/a	n/a	n/a	n/a	n/a

Argo Bay is a traditional fishing location at the southern end of the ANMPA. This site was first sampled in 2016, and has continued to be surveyed each year. The focus in 2017 and 2018 was to enhance capacity and training for field operations to be community-led, and the fieldwork has been successfully community-led since 2018. In 2019 the program expanded to include sampling at Bennett Point, replicating work that had been completed in 2012, 2014 and 2015. The transition to a community-led field program increased capacity to expand to more field sites, such as Bennett Point, and Brown's Harbour in the winter of 2021 (Table 2).

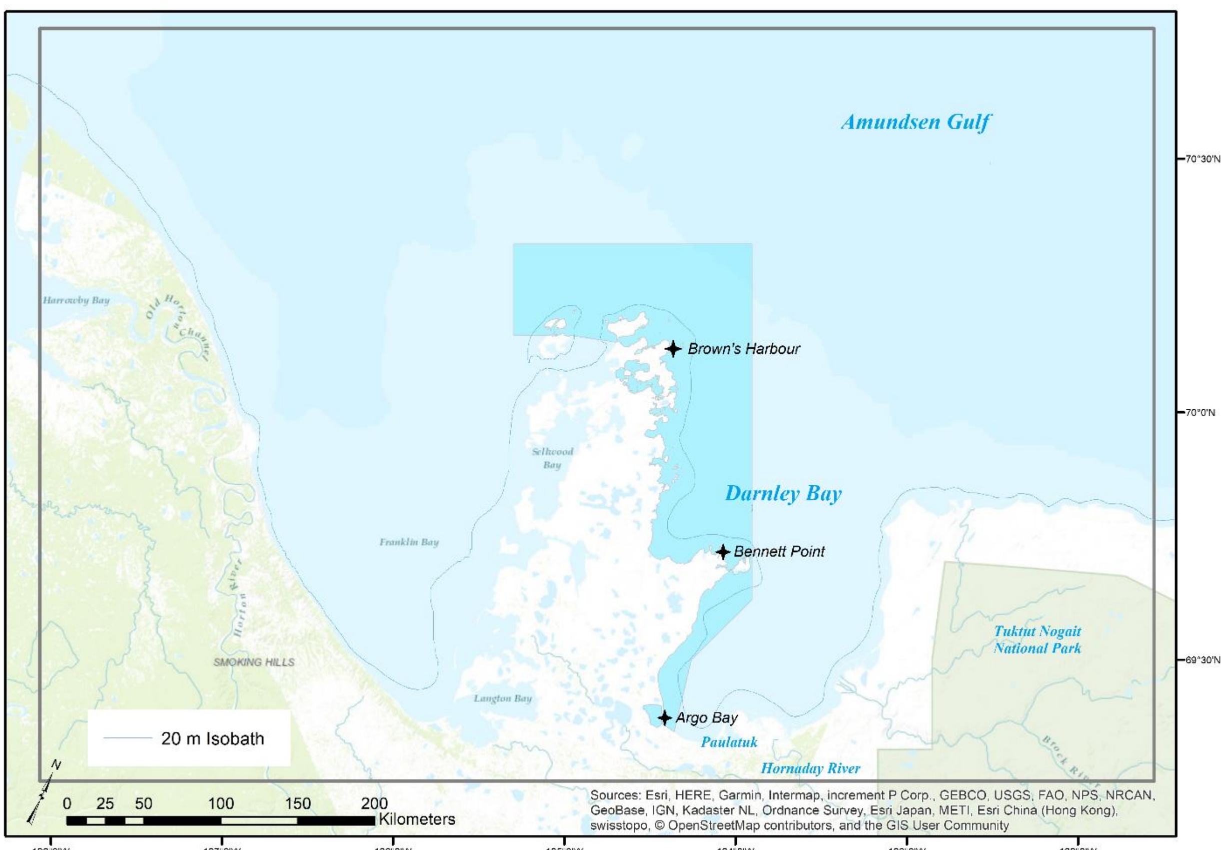

Figure 2. Map of Darnley Bay and the ANMPA is indicated in dark blue on the western side of the bay. The coastal habitat is delineated by the 20 meter depth isobath line.

2.2 Community consultation

Each year the Arctic Coast field program followed an annual process in order to ensure research objectives and field logistics aligned with the priorities of the community of Paulatuk (Figure 3). Regular reporting on project progress, and consultation with the PHTC in particular, was required in order to ensure field logistics were feasible and monitoring objectives were being met. Similarly, co-management partners, such as the Fisheries Joint Management Committee (FJMC), required program updates upon completion of each field season and formal presentation each year in January at their annual meeting (held in-person in Winnipeg, or virtual). During this annual meeting, proposals for funding support are submitted for consideration to the FJMC, in order to continue research and monitoring activities each year.

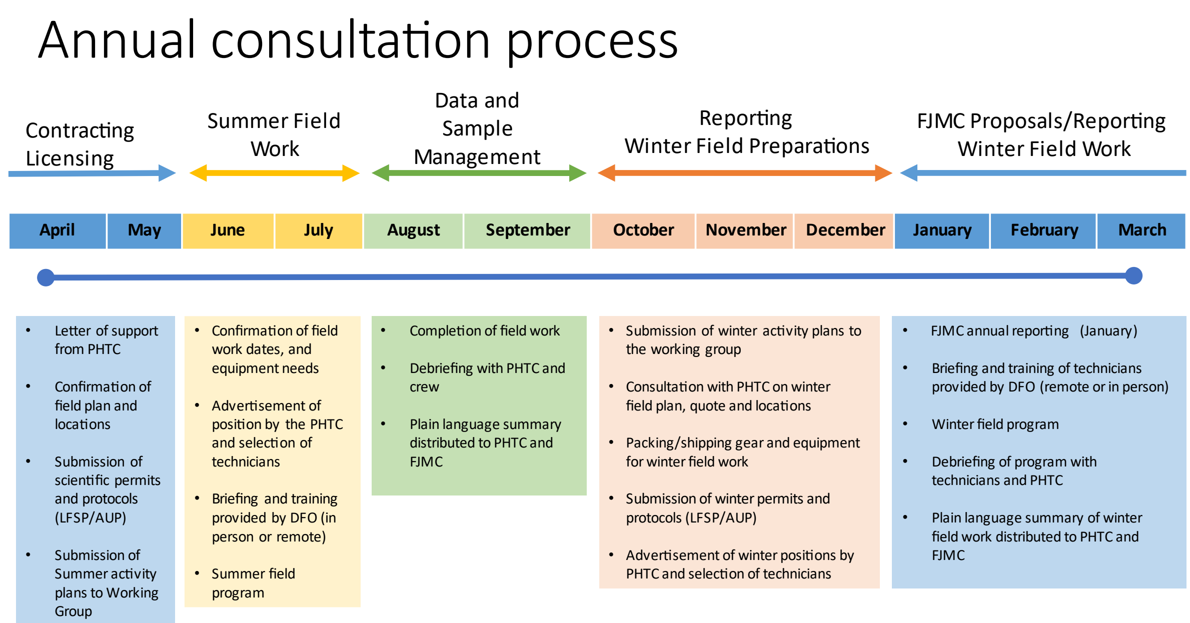

Figure 3. General outline of the annual consultation process with the PHTC including engagement, fieldwork, reporting, and proposals submitted to the FJMC.

Among field programs conducted between 2017 and 2021, several consultations were required that included both the PHTC and the FJMC. Plain language summaries were created at the end of each field program and distributed to collaborators and co-management partners; these are summarized in Appendix G. Specific dates and description of engagements are summarized in Appendix H.

2.3 Environmental Indicators

2.3.1 Core oceanography

Water profile baseline research

Baseline research on core oceanography, which began in 2012 (M^{c}Nicholl et al. 2017a), was expanded in 2017 to include water column profiles in addition to *in situ* environmental data collected at netting locations. Although environmental data collected in previous programs provided valuable information specific to fish habitat preferences, it could not address knowledge gaps specific to characteristics of the water column (e.g., mixing, stratification). Although these data are available from surveys conducted by offshore programs (BREA-MFP, CBS-MEA), there was limited information available for inshore sites (< 20 m depth) within the ANMPA.

Transects were conducted during the baseline research survey at Billy's Creek, Argo Bay and at Tippi on July 8th and 12th, 2017 (Figure 4). Sites nearest the shore were approximately 1–5 m in depth, and subsequent sites were chosen based on increasing depth, away from shore. The objective was to obtain at least three sites along a transect of increasing depth in order to generate a projection of oceanographic conditions using data collected from 5 m, 10 m, 15 m, 20 m depths. A YSI Sonde (6920 V2-2) water profiler (equipped with temperature, dissolved oxygen, conductivity, pH and turbidity sensors; accuracy of sensors available in Appendix C) was used at multiple sites. Site selection was dependent on wind and wave height. When conditions allowed, it was possible to collect readings at 1 m depth intervals, up to a maximum depth of 14.5 m. The YSI was deployed over the side of the boat lowered at a speed of approximately 1 m/s and *in situ* measurements were recorded manually at each meter depth until reaching < 1 m off the bottom depth. Data collected along these transects were compiled to produce projections of changing environmental conditions with depth using Ocean Data View 5.1.5.

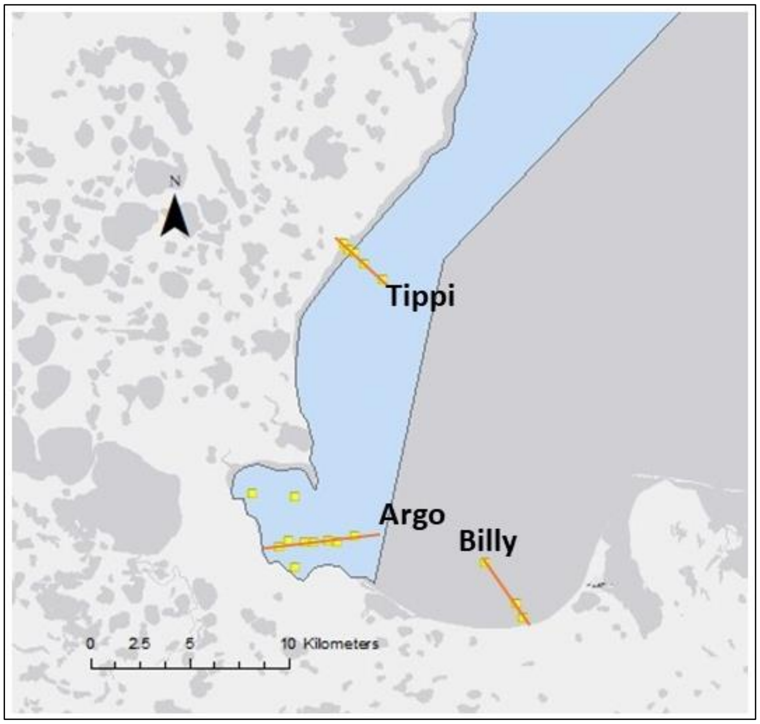

Figure 4. Sites where YSI Sonde (6920 V2-2) were deployed (yellow squares) in the ANMPA and adjacent areas to collect *in situ* temperature, salinity, dissolved oxygen saturation, pH and turbidity at each 1 m vertical depth increment. All measurements were taken on July 8th and 12th, 2017 and from three transects (Tippi, Argo and Billy); data gathered from these casts is presented in Appendix C.

In 2017, Tidbit (HOBO® Tidbit v2 Temp-UTBI-001) and/or conductivity-temperature data loggers (HOBO® conductivity/temperature logger) were attached to fishing gear to record data every 15 min. The HOBO® conductivity-temperature loggers were only capable of collecting conductivity data (µS/cm) and were not designed to collect practical salinity units (PSU), which is normally collected by offshore research programs. In order to collect data that could be comparable to those collected by other DFO-led research programs in the area, the HOBO® conductivity-temperature loggers were discontinued from the Arctic Coast program and replaced with loggers that could collect salinity data without being converted from conductivity. In 2018, Seametrics® CT2X temperature/salinity loggers were incorporated into the Arctic Coast program as a standardized method for collecting temperature-salinity data among locations. These loggers could collect salinity data (PSU) in real time, and are therefore an improvement from loggers used in previous years where variability could be introduced into the data when converting conductivity units to salinity. Specifications for each of the loggers including their accuracy, resolution and range can be found in Appendix C. These loggers were either new, or calibrated within the last 24 months.

Temperature-salinity data were collected from each net set between 2018 and 2021 to compare inshore environmental conditions among locations and years. One CT2X logger was secured to each net, recording date, time, temperature (ºC), salinity (PSU), and total dissolved solids (TDS) every 15 minutes over a continuous time interval until they were terminated by DFO biologists in Winnipeg at a later date. The logger was oriented on the maximum depth of the net if the net was positioned on a slope or from shore. Once data were retrieved from the logger software (Aqua4Plus Pro), the time series of the data were used to verify soak time, and level of effort for each net, and used to calculate mean temperature and salinity ($\pm$ SD) over the total soak time for each net (Appendix B).

In 2020, moorings were assembled using the same loggers (CT2X, HOBO® U22 or Tidbit) to monitor changing temperature and bottom temperature-salinity over the duration of the field program. Moorings were deployed at stations previously sampled during the summer and winter programs, to assess the extent of potential mixing over time at Bennett Point and Argo Bay at a location with a maximum of 15 meters in depth. Three temperature loggers (TidbiT® v2 Temp-UTBI-001 in 2020; HOBO® U22 in 2021) were attached to a line at 5 m, 10 m and 15 m depth intervals, and a CT2X Seametrics® logger was also attached at the 15 m interval, or bottom depth. Temperature was compared between the 15 m HOBO® logger and CT2X temperature-salinity logger to validate accuracy between loggers. A unpaired Wilcoxon rank sum test was used to compare if the logger readings were significantly different ($p < 0.05$) at the mooring. In the event that temperature readings were significantly different between devices, only the HOBO® U22 measurements were plotted in order to be comparable to the other HOBO® U22 loggers on the line. The mooring was deployed during the first day of each field program at each location (Argo Bay or Bennett Point) and left to record ocean conditions over the duration of the field program (approximately 2 weeks). Due to the presence of ice at Bennett Point during summer in 2020, community-based technicians positioned the nets and mooring in a sheltered area of the point at the deepest location possible, to minimize the risk of damage to the equipment. On the final day of the program, moorings were picked up, dried, and shipped back to DFO-Winnipeg to download data and recalibrate if required.

2.3.2 Ice and snow

Baseline research

The Arctic Coast winter field season in 2019 was the first ice-covered survey for the program. Field protocols for this year were designed to extend efforts from open water field surveys, guided by those developed by the Canadian Rangers Ocean Watch (CROW). The objective of CROW is to collaborate with the Department of National Defense-Canadian Rangers to collect climate related data during their routine patrols. These data include ice thickness measurements, snow depth, under-ice core oceanography, and, in some cases, plankton tows. The protocols established by CROW were developed into a community-based monitoring program after methods were piloted in the field and approved through consultation with the PHTC. Community-based monitors, chosen by the PHTC, traveled to a pre-selected site in the ANMPA once a week, when weather permitted, to collect both environmental data and fishes from under the sea ice. Parameter and site selection was co-designed by Arctic Coast and the PHTC, with guidance from CROW, who had led winter fieldwork in the ANMPA in previous years. These included variables such as snow depth, ice thickness, freeboard, under-ice temperature, and salinity.

Two community-based monitors travelled to conduct fieldwork at a predetermined site (Figure 5) once a week between January 17th to March 22nd, 2019. Evaluation of field protocols and gear was completed with the two technicians, two additional community hires, and two DFO-biologists from March 9th to 12th, 2019. Weekly monitors travelled to a site in Argo Bay

(69.392731 N; -124.458944 W), where summer fish occurrence and environmental data had been collected in years prior. Technicians were asked to use a 10 inch auger blade to drill two holes approximately 2 m apart. In their data book, the monitors recorded date, waypoint, time, wind speed, wind direction, snow depth, ice thickness, freeboard (distance between the top of the water to the top of the ice), and bottom depth. At the request of the PHTC, local observations were also recorded by community-based monitors such as changes to snow ridges, flaw-leads along well-traveled routes, and emergence of seals up on the ice. Two time lapse cameras (Reconyx® Hyperfire2 Covert) were stationed facing the ANMPA to record images of changing sea ice conditions up until breakup. Both cameras recorded images and air temperature every four hours.

Once measurements on the ice were recorded, two CT2X temperature/conductivity loggers were deployed into the first auger hole. The first logger was deployed to the seafloor and the second was lowered until it was approximately 1 meter underneath the bottom of the sea ice. Both devices were pre-programmed prior to field work to record temperature (°C), conductivity (µS/cm), salinity (PSU), and total dissolved solids (TDS; mg/L) every 15 minutes until the end of the project. The specifications of this device are presented in Appendix C.

Once the loggers had been deployed, they were left to record data for a minimum of one hour. While the loggers were recording data, the monitors would set up an ice fishing shelter and with a second auger hole they used a lure and line to try to capture fish. Monitors were instructed to allow the loggers at least an hour to record data, however if weather conditions were favourable, they would stay up to 3 hours collecting fishes. If fishes were collected, they were brought onto the ice, frozen whole, and all fishes for that day were placed in a plastic sample bag with the date, location and number of fishes recorded on the bag. These samples were then brought back to the PHTC to be frozen and eventually shipped to Winnipeg for processing at the end of the project. Whole fishes would be identified to species level and processed at the DFO Freshwater Institute in Winnipeg for basic biological data (i.e., weight, length, sex, maturity) and sub-sampled for follow-on analyses (i.e., otoliths, stomach, muscle tissue). First order data from these fishes, such as species, biological data and age, are presented in this report.

Between March 9th and 12th, 2019, DFO biologists participated in field operations to assess the feasibility of winter monitoring protocols. This included the regular weekly monitoring operations, and use of additional equipment such as a water profiler (RBR) provided by CROW. Collaboration between Arctic Coast and CROW allowed for additional water profiles to be completed during the week protocols were assessed by DFO staff. Water profile data collected by the RBR was interpreted and summarized by members of the CROW program following completion of both projects.

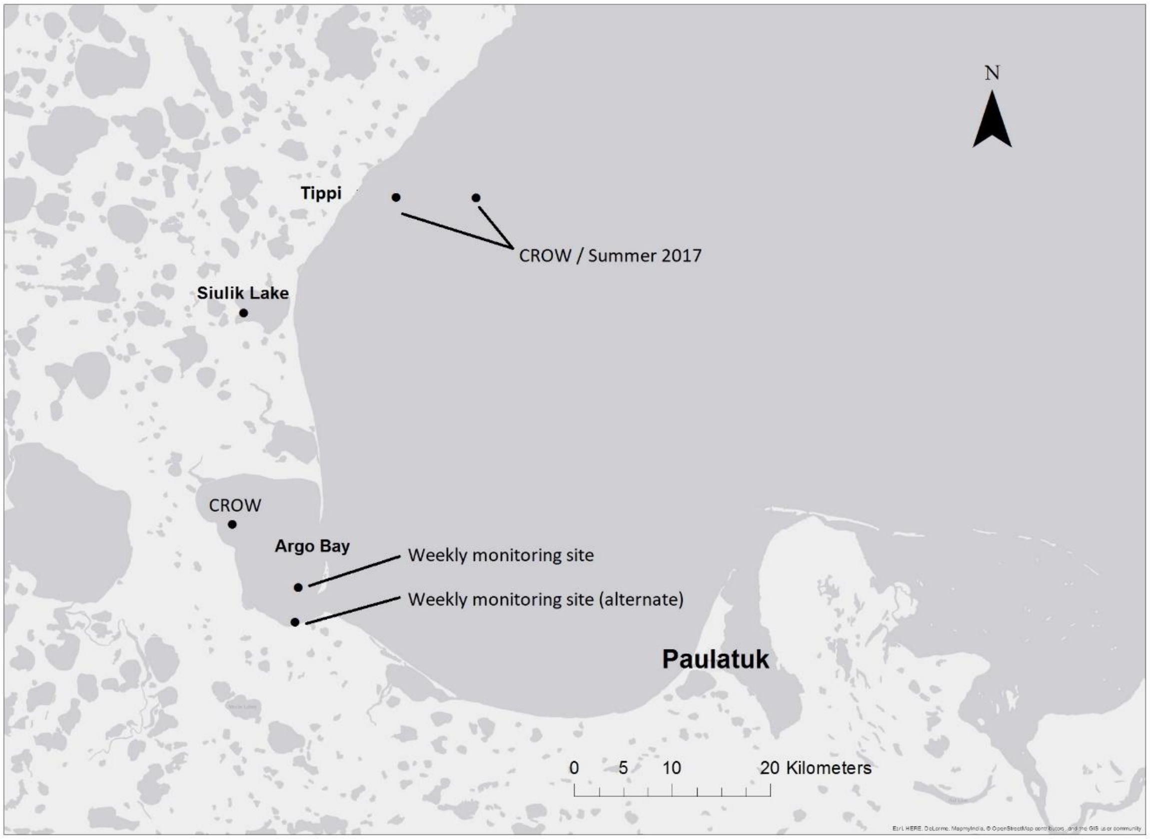

Figure 5. Locations of Arctic Coast winter sites during pilot year of winter fieldwork (Argo Bay sites were only replicated by CROW in 2018, not in 2019).

The stations sampled in 2019 during the Arctic Coast winter field program are shown in Figure 5. One station in Argo Bay was visited by community-based monitors each week for the duration of the program, and an alternate was selected if time allowed to collect winter data at one of the shore-based summer sampling sites. Additional sites were completed in March, when DFO biologists participated in fieldwork, including a freshwater site at the request of the PHTC and sites that had been previously sampled by CROW.

Monitoring

After baseline research conducted in 2019, the Arctic Coast ANMPA winter field work operated as a community-based monitoring program each subsequent year. Protocols developed during the research phase of the program were used by monitors at Argo Bay and Bennett Point in 2020, and at Argo Bay, Bennett Point and Brown's Harbour in 2021. Each year of sampling increased the capacity to increase winter monitoring across the ANMPA, by building upon training that had been completed in the previous year.

In 2020 monitors travelled to Argo Bay and Bennett once a week between January 24th, 2020 and March 24th, 2020 to collect environmental and biological data. Each site was monitored by a crew made up of two monitors, in which the field lead had been trained in person by DFO biologists during the 2019 season. Following the protocols developed in 2019, crews would travel to their site once a week to collect data on ice thickness, snow depth, under-ice environmental conditions and collect fishes by lure and line. The same methods were followed in the winter of 2021, in which the program expanded to also include Brown's Harbour and two more winter monitors. Fieldwork was conducted weekly in 2021 between January 20th, and March 26th at Argo Bay and Bennett Point. Given the distance required to travel to Brown's Harbour (approximately 90 km), the PHTC recommended that only one trip be made to that location where technicians would collect data every day within a week, rather than weekly trips at the more accessible locations within the ANMPA. The camera deployed at Brown's Harbour was securely attached high above the ground on a permanent structure (cabin used by the community) allowing for minimal interference from wildlife or weather. During this field program, timelapse cameras were set up at all three locations, facing the ocean. For the purposes of this report "break-up" was determined by the date in which pans of ice in view visibly shifted away from the shoreline and "freeze-up" was once the area was covered in ice and open water was no longer visible.

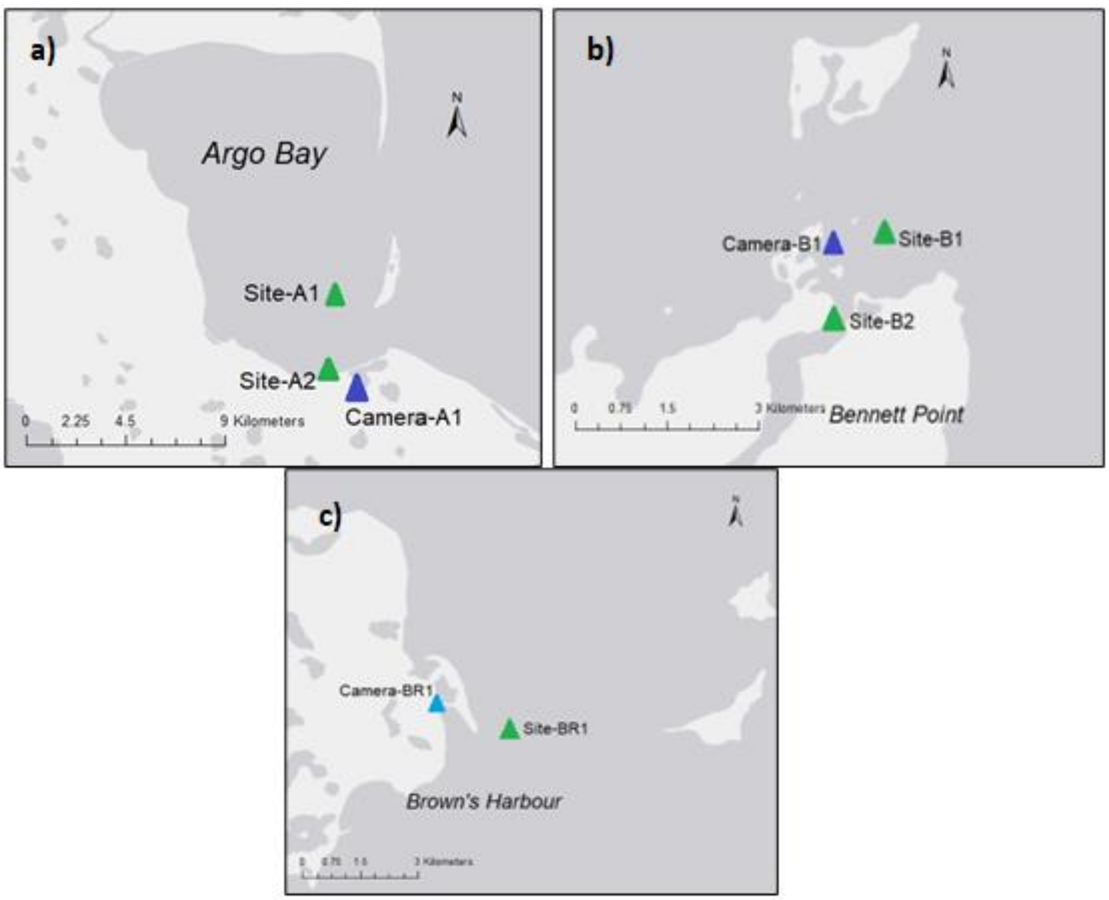

Figure 6. Winter monitoring sites selected following fieldwork and consultations with the PHTC at Argo Bay (a), Bennett Point (b), and Brown's Harbour (c). Long-term sites sampled each year (green triangle) and location on timelapse camera (blue triangle are indicated on the map).

2.3.3 Benthic habitat

Information on the benthic habitat was gathered using physical sampling in the summer sampling season and imaging during the winter season. The purpose of benthic sampling was to assess the habitat characteristics from the perspective of the fishes present, and create an inventory of invertebrate biodiversity present in the coastal environment. Few assessments of this kind had been conducted within the ANMPA at depths < 20 meters, therefore the knowledge gained from these protocols was aimed to address knowledge gaps of the species present and provide recommendations for more extensive sampling if needed.

Benthic grabs were first piloted in the summer of 2017 in Argo Bay, to determine if they could be incorporated into the long-term monitoring protocol. Two pieces of gear were tested in 2017, a dredge (15.2 cm x 20.3 cm, weighing approximately 13.6 kg) and a petite ponar grab (Wildco® 15.2 x 15.2 cm sample area, weighing approximately 6.8 kg). Depending on the substratum type, the dredge could be most appropriate for pebble to soft sediment substrata, where the ponar grab is best designed only for sandy to soft sediment substrata. Although the dredge has a greater range of habitat types, it must be dragged along the seafloor and thus more difficult to quantify the sampling area compared to the ponar grab. Input from community-based technicians was also taken into account, resulting in the ponar grab as the sampling method of choice. Ponar grab and/or dredge sites were conducted at the maximum depth of each of the YSI stations and summarized in Appendix D.

Under-ice footage of the seafloor was first collected during the 2020 winter field program. The aim of this protocol was to investigate the presence or absence of benthic organisms using video, and validate the substratum class that had been assigned to that site during physical sampling in the summer. At each pre-determined station, two holes were made in the ice; one hole was used to deploy the temperature-salinity loggers and a benthic camera was submerged in the second hole. Custom-made camera housings were made out of a plastic box with two pieces of rebar (46 cm long, weighing approximately 350 g each) fastened to each side, such that the camera would be positioned approximately 20 cm above the seafloor once it touched the bottom. Inside the housing, a GoPro® (Hero Silver 7) was mounted with an underwater light to illuminate the seafloor under the sea ice. The unit was slowly lowered vertically through the hole, while attached to rope, at a rate of approximately 1 m/s until touching the bottom. Once the technician felt the camera on the bottom, they held it in place for at least 1 min to let any sediment that had been disturbed by the rebar settle. The camera was then raised slowly out of the auger hole and turned off to maintain battery life. At a later date, the videos were sent to DFO biologists and viewed to confirm substratum class, identify presence or absence of organisms, and to condense footage into videos to be shared with northern partners as research summaries, or to isolate stills to be used in future reports.

2.4 Biological and food web integrity indicators

2.4.1. Zooplankton

In 2020, standardized protocols for zooplankton collection were incorporated into monitoring protocols for the ANMPA. During the 2020 field program, five tows were completed at Argo Bay, and five tows were completed at Bennett Point. The purpose of these zooplankton tows was to determine the extent of prey taxa available to fishes and baseline food web stable isotope ratios for pelagic prey taxa. A small plankton net (200 µm mesh, 50 cm mouth diameter, 220 cm long) was used. The net was deployed to the maximum water depth (< 15 m), and retrieved to the surface at a rate of 1 m/second, to collect pelagic invertebrates and/or larval fishes. The net was rinsed with sea water, and the contents were frozen in Nalgene® vials (10% buffered formalin) for identification during subsequent laboratory analyses. Frozen samples were shipped to the Freshwater Institute in Winnipeg and stored at -20°C until they could be processed. Preserved samples were shipped to the University of Waterloo Environmental Isotope Laboratory to be thawed, sorted and identified to the lowest possible taxonomic level prior to homogenization for stable isotope analyses.

The feasibility of conducting tows was dependent on the weather conditions and the ability to steadily tow or pull up the net at a consistent rate. These protocols had been previously used in Sachs Harbour (McNicholl et al., 2019) and were incorporated into other Arctic Coast community-based field programs in 2020 (Christie et al., 2023). Prior to incorporating plankton tows into the 2020 ANMPA field program, field monitors tested the equipment during training with DFO biologists in summer 2018 and 2019 to confirm it was feasible to incorporate this protocol into their sampling regime. Given the small scale of this sampling effort, it was not possible to compare relative abundance, or to calculate biomass estimates for the coastal environment, but prey taxa identified to the lowest possible level during the 2019 sampling program at Bennett Point are summarized in this report. Additionally, sampling efforts were designed with the intent of collecting pteropods such as *Limacina helicina*, which could provide a baseline for ocean acidification if collected in the appropriate quantities (Seibel et al., 2012). In previous coastal surveys at Bennet Point, *L. helicina* had been observed in the water column during fish sampling efforts (McNicholl et al., 2017a).

2.4.2 Benthic epifauna

The purpose of collecting data on benthic epifauna was to create an inventory of potential prey items relative to the fish population, and provide species and location data for a largely understudied area of coastal Arctic ecology. Invertebrate species biodiversity data from these sampling programs in the ANMPA, relative to other coastal habitats in the western Canadian Arctic, are summarized in greater detail in Bilous et al. (2022).

Benthic epifauna were collected in 2017, 2020, and 2021, and sorted to the lowest possible taxonomic level. Organisms were sorted from the dredge using a bucket sieve (2000 µm mesh) and were then frozen to be identified during subsequent laboratory analyses. Additionally, a sample of sediment was collected from the dredge pull at each station to identify the substrate class and be used for future analyses at a later date.

2.4.3 Fishes

The fishes collected from each gillnet were identified using taxonomic keys in the field or in the lab if necessary, although this was only required for new occurrences (Coad and Reist 2018). Fishes were then processed in the field for basic biological information (e.g., length, sex, maturity, species) and dissected for samples (age structures, stomach, muscle and DNA) that would be analyzed at a later date. A maximum of n = 30 individuals from each species were dead-sampled, after which they were measured and live released. Muscle and stomach samples were frozen whole and shipped back to the Freshwater Institute in Winnipeg for future analyses of fish diet. Subsequent sampling from 2018-2020, was led by community-based monitors who completed annual monitoring of two predetermined gillnetting sites (shore-based, and deep net), seining, and fish processing.

Inshore fish community

The inshore fish community was sampled to investigate if fish community composition varied among sampling years (2017-2021), locations (Argo Bay and Bennett Point), or seasonally in summer and winter. Specific locations of each species among all sampling years up to 2019 are described in detail with associated habitat preferences in M^cNicholl et al. (2020), and are not presented here; however, fishing effort from gillnets and corresponding depth, temperature and salinity data are presented in Appendix B.

Fish were collected in 2017 using six panel multi-mesh gillnets (25, 38, 64, 89, 114, 140 mm stretch; 10 m x 1.5 deep panels), two types of beach seines (3/16" delta mesh, 5 m long x 1.2 wide and custom 61 m x 1.8 m wide with 3/8" square nylon netting) and with a fyke net (1.7 m high x 1.8 m wide, 3.7 m long trap, 15.2 m long wings on either side) between July 5^{th} and 13^{th}, 2017. Initially, the gillnets were set for a maximum of 2 hours before they were checked. Once it was determined that nets could be set up to 24 hours without mass mortality of fish, soak times were increased with the permission of the PHTC. Net placement and effort was guided by the recommendations of the community-based technicians, and nets were placed to avoid interference with subsistence harvest of Arctic char and broad whitefish. Overall, 24 net sets were completed over the duration of the field program, and 5 seining efforts were conducted to assess if larval fishes were present (Appendix B). The fyke net was set a total of 8 times at two primary locations along the shoreline that successfully collected fishes in 2016 (M^cNicholl et al. 2017a). After 2017 only gillnets and 5 meter long beach seines were used to collect fishes during the open water season.

Forage fishes

Stomach content analysis from coastal fish provides information on forage fish spawning and characteristics which is documented and summarized in this report. Both parameters have been identified as indicators for the coastal environment (Ehrman et al. 2022) by DFO and the PHTC, additional information is summarized here with respect to the timing and abundance of species found spawning, and number of individuals and biomass found in the stomach contents of piscivorous species. Given that capelin display sexual dimorphism during spawning periods (pronounced anal fin, ribbed lateral line and black operculum among males), it was possible to identify sex visually and determine the proportion of males to females in each sampling year. Although the methods used in the Arctic Coast field program are not targeted to forage fishes specifically, valuable information can be derived from these parameters in order to better understand the coastal food web of the ANMPA.

Anadromous fishes

The habitat preferences of anadromous fishes, including Arctic char and broad whitefish were documented during each sampling season by collecting environmental data at the time of capture. Depth, temperature, and salinity were recorded using depth sounders and environmental loggers (Section 3.1.1) on the nets and used to determine the conditions that each species may be found. These *in situ* conditions were used to infer the habitat preferences of these key anadromous species within the ANMPA. These ranges are based on compiled maximum and minimum values collected among 2017 - 2021 summer field programs.

With permission from the PHTC, up to n = 30 Arctic char and broad whitefish were dead-sampled and processed among the 2017 – 2021 summer field programs to collect basic biological data (i.e., length, sex, maturity, age) and samples for follow-on analyses (ageing, stomach contents, stable isotope analyses).

Fish ages were obtained using whole dried otoliths at the Freshwater Institute in Winnipeg. Otoliths were aged by examining a sagittal section, and using the break and burn method (Zhu et al., 2015). Only ages from individuals that could be determined with a high level of confidence by two independent readers are provided in this report.

Stable isotopes and stomach content data are not presented in depth in this report but have been processed to contributed to future primary publications. The results from these analyses were used to address knowledge gaps associated with life history charateristics, habitat use, and diet of Arctic char within the ANMPA.

There are other anadromous fish species that are present and documented in the ANMPA with the Arctic Coast program; however, details with respect to their role as ecological indicators are not presented in this report as they are either rare in the ANMPA or not identified as a key indicator species by the ANMPA Working Group. Such species include Arctic cisco, lake whitefish, and dolly varden; however summaries of their basic biological characteristics are summarized in Appendix A.

Occurrence and timing of potential range expansion of species

Assessing the biodiversity of fishes and their abundance relative to one another is a primary objective of the Arctic Coast program, which includes documenting potentially colonizing species. The increasing occurrence of a novel species into a new region outside its known distribution may serve as an indicator for documenting change. Before a species can be identified as novel, however, baseline information of a given species distribution is required. The biodiversity of ANMPA fishes found within or adjacent to the MPA has been summarized in M^cNicholl et al. 2020, which serves as a baseline for assessing unusual occurrences as new, rare, or expanding. Among field programs conducted through 2017 to 2021, the biodiversity data collected among nearshore monitoring sites was used to identify novel species. The establishment or introduction of new species has been identified as a priority by the ANMPA Working Group, specifically with respect to the expansion of Pacific salmon throughout the Inuvialuit Settlement Region in recent years (Dunmall and Reist, 2018). Although salmon are not targeted specifically by the Arctic Coast monitoring program in the ANMPA, understanding the timing of their arrival and their occurrence within Darnley Bay is of special interest to the program. Arctic Salmon is a DFO-led community based program that is affiliated with Arctic Coast, thus information collected by monitoring efforts within the ANMPA can be used to inform the potential range-expansion of Pacific salmon in the Canadian Arctic.

3.0 RESULTS

3.1 Environmental Indicators

3.1.1 Core oceanography

Baseline research

Water profile data was collected at 19 sites between July 8th and 13th in 2017 among three transects completed across Argo Bay (Figure 7), perpendicular to shore from Billy's Creek (Figure 8) and from Tippi (Figure 9). Appendix D provides data from all sites for temperature (ºC), dissolved oxygen saturation (% DO_{sat}), pH, and turbidity (NTU). Due to a malfunction with the salinity probe, there are no salinity values available from these sites.

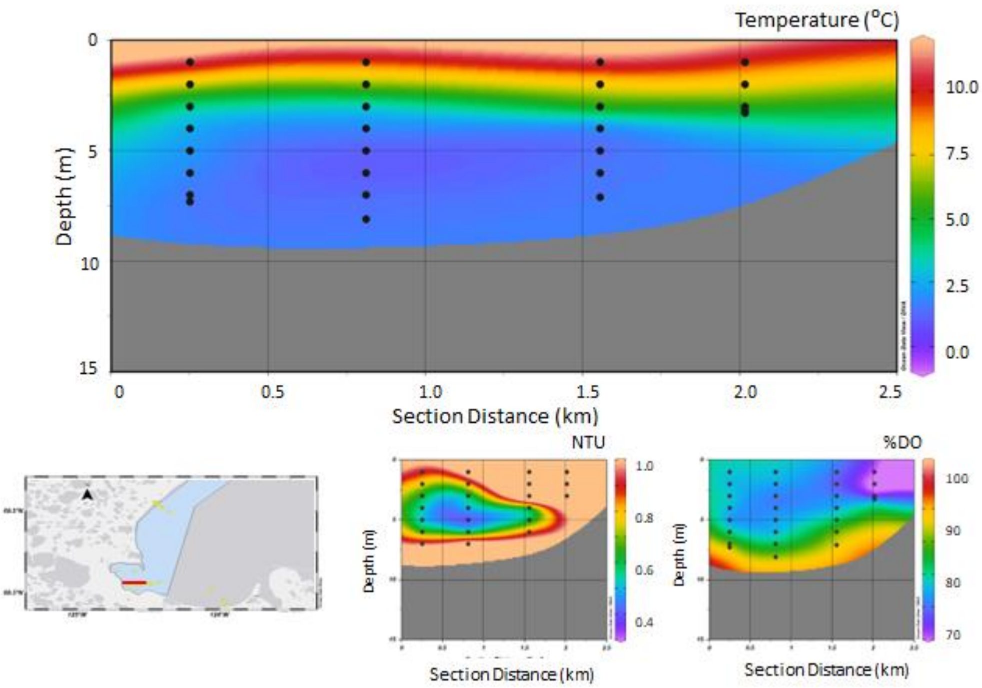

Figure 7. Argo Bay cross section of water column properties for a) temperature, b) turbidity (NTU) and dissolved oxygen saturation (% DO_{sat}). Specific values for each site can be found in Appendix D. Section distance starts at the west side of Argo Bay and ends on the west side of Egg Island.

Argo Bay displayed some characteristics of stratification based on the water profiles shown in Figure 7. Temperature was warmest in the upper 2 meters of the water column, where maximum sea surface temperatures were as high as 11.0°C. The thermocline could be found between 2 and 4 m where temperatures dropped rapidly from 10.9°C to 1.3°C. Sea floor temperatures > 5 m depth were consistently below 2°C among sites across Argo Bay, where the maximum depth was recorded at 8.6 m. These temperature data suggest that there was limited vertical mixing among water masses within Argo Bay when the transect was completed. This was also evidenced by a layer of less turbid water in the mid-section of the water column relative to sea surface and sea floor. Dissolved oxygen saturation (% DO_{sat}) was consistently >70% throughout the water column, although the shallow nearshore waters were nearly completely saturated with oxygen (> 90%), while offshore waters decreased to near 70% saturation.

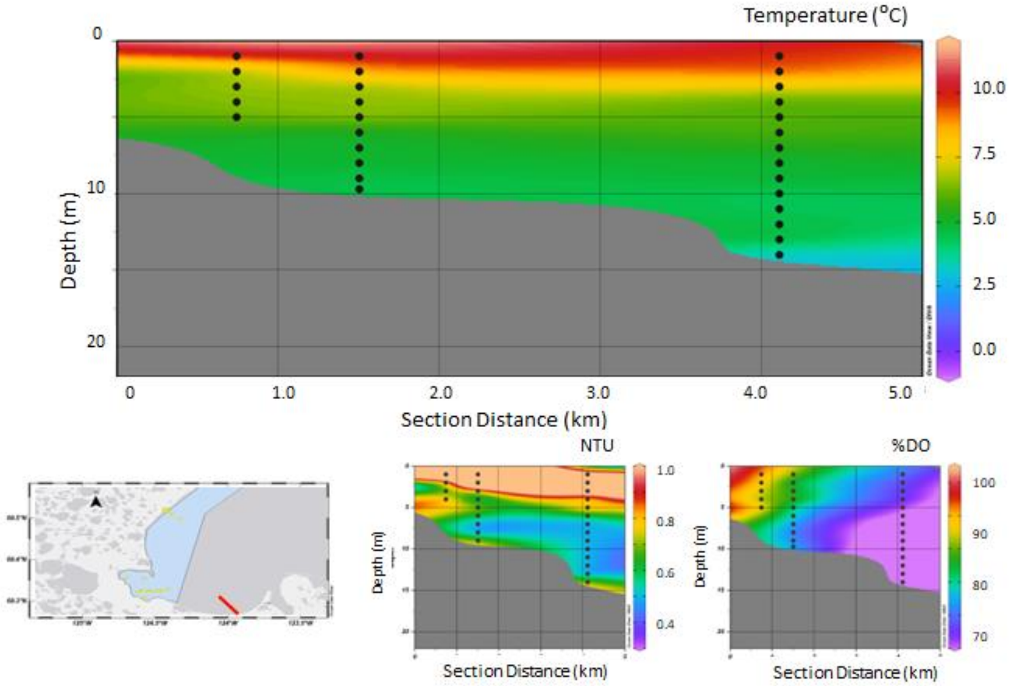

Figure 8. Billy's Creek cross section of water column properties for a) temperature, b) turbidity (NTU) and dissolved oxygen saturation (%DO_{sat}). Specific values for each site can be found in Appendix D. Section distance starts closest to shore and increases with depth towards the centre of Darnley Bay.

There was evidence of water stratification among the stations conducted along the Billy's Creek transect (Figure 8). In total, 29 readings were taken among three sites along the transect where the maximum depth ranged from 5 m to 14.3 m. The ocean surface reached a maximum of 10.1°C, while temperatures dropped below the thermocline (2-5 m) to a minimum recorded temperature of 3.3°C at the deepest point of the transect. Dissolved oxygen saturation steadily decreased from 95% at the station closest to shore to 65% at the deepest part of the transect, farthest from shore. Turbidity was highest in the upper portion of the water column (1-3 m), while the clearer, less turbid water could be found a depth (> 3 m), regardless of distance from shore.

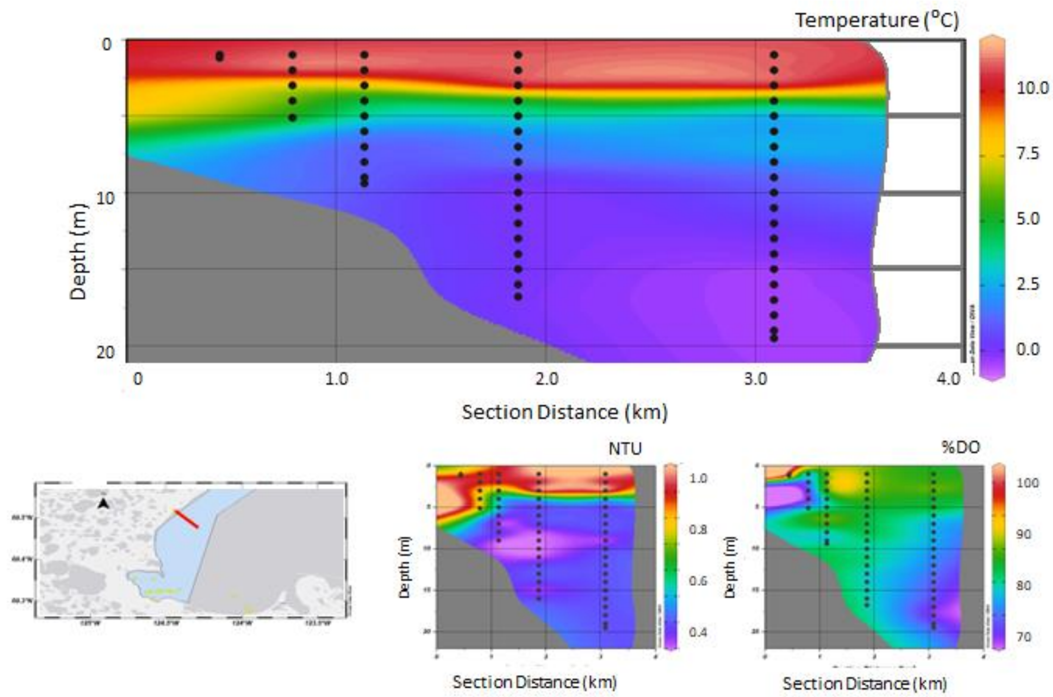

Figure 9. Tippi cross section of water column properties for a) temperature, b) turbidity (NTU) and dissolved oxygen saturation (%DO_{sat}). Specific values for each site can be found in Appendix D stations begin closest to shore and increases with depth towards the centre of Darnley Bay. White sections represent segment of the transect without data. Section distance starts closest to shore and increases with depth towards the centre of Darnley Bay.

The Tippi transect displayed the most substantial separation of water masses relative to the other transects, evidenced by colder water at depth off the slope. There were a total of 57 readings taken along this transect at 5 stations which ranged from 1.2 to 19.5 m depth. The thermocline was present between 3 and 4 m below the surface, where temperatures drastically dropped from 10°C to 5°C. Below 5 m, a mass of cold water was present across stations, where the minimum recorded temperature (-0.5°C) was observed at the maximum depth of 19.5 m. Dissolved oxygen saturation was above 75% among all stations, regardless of depth or distance from shore. Turbidity was highest above the thermocline, while clearer water was present below 5 m where the water was also substantially colder.

The transects conducted during the 2017 baseline research survey indicate that the southern end of Argo Bay is generally warmer and marine influence is more gradual, relative to Tippi, located north of Argo Bay. At Tippi, the maximum depth drops off substantially, resulting in a clear distinction of warmer, and more turbid coastal water near shore and colder, less turbid marine water off the slope. This is the opposite of what was seen at Billy’s Creek, where the slope was much more gradual and water temperatures were generally warmer. Within Argo Bay, both warm water and cold water masses were present, thus meeting the habitat preferences of deep-water marine species at its maximum depth, and coastal anadromous species that could be found in the upper portion of the water column, or inshore.

CT2X Logger data from nets

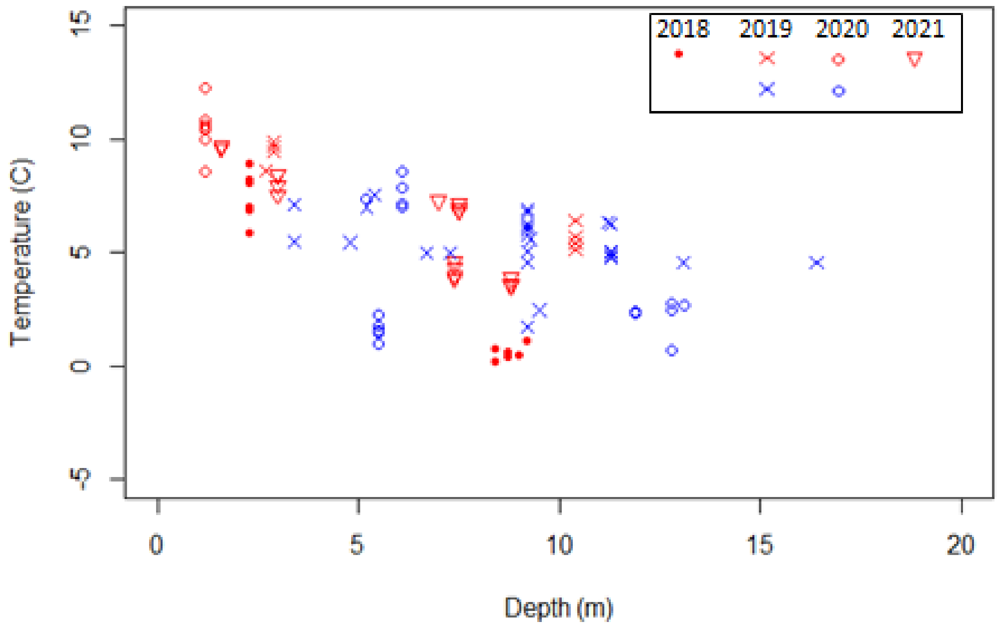

Figure 10. Mean temperature obtained from each net set among 2018 to 2021 programs in Argo Bay (red) and Bennett Point (blue).

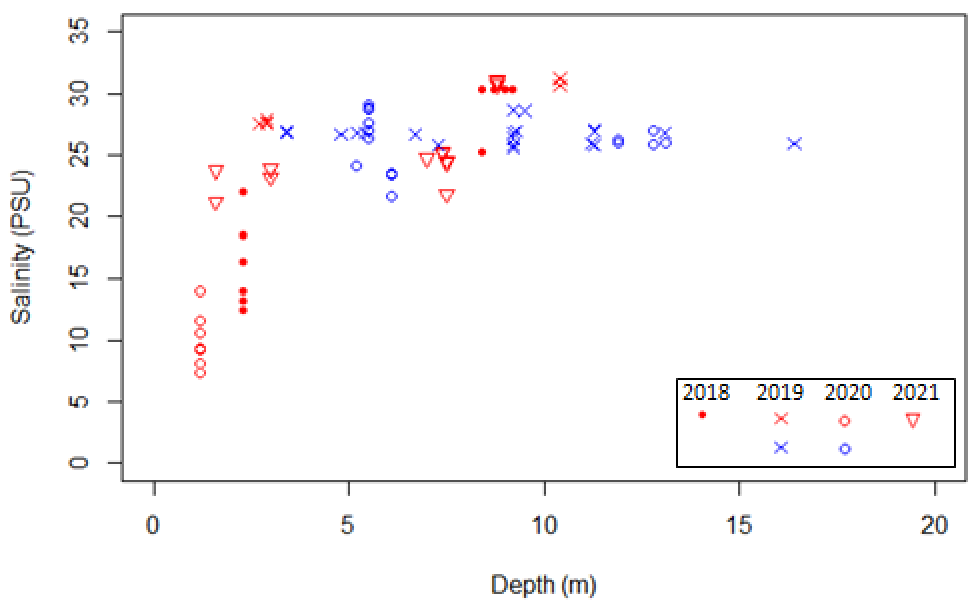

Figure 11. Mean salinity obtained from each net set among 2018 to 2021 programs in Argo Bay (red) and Bennett Point (blue).

Figures 10 and 11 compile mean temperature and salinity among all nets set between 2018 and 2021. Generally, temperature was higher on average in Argo Bay relative to Bennett Point. This is likely due to greater fishing efforts at sites < 5 m depth in Argo Bay, whereas sites were typically deeper at Bennett Point. This was also reflected in mean salinity where all of the Bennett Point readings were above 21.0, regardless of sampling year. A clear increase in salinity with respect to depth was apparent among Argo Bay sites, where the lowest salinity was recorded at shore-based sites (7.4) in 2020. It is expected that overall salinity is lower on average in Argo Bay relative to Bennett Point, given that the Argo Bay sites are more connected to freshwater sources such as adjacent lagoons and lakes.

Mooring measurements

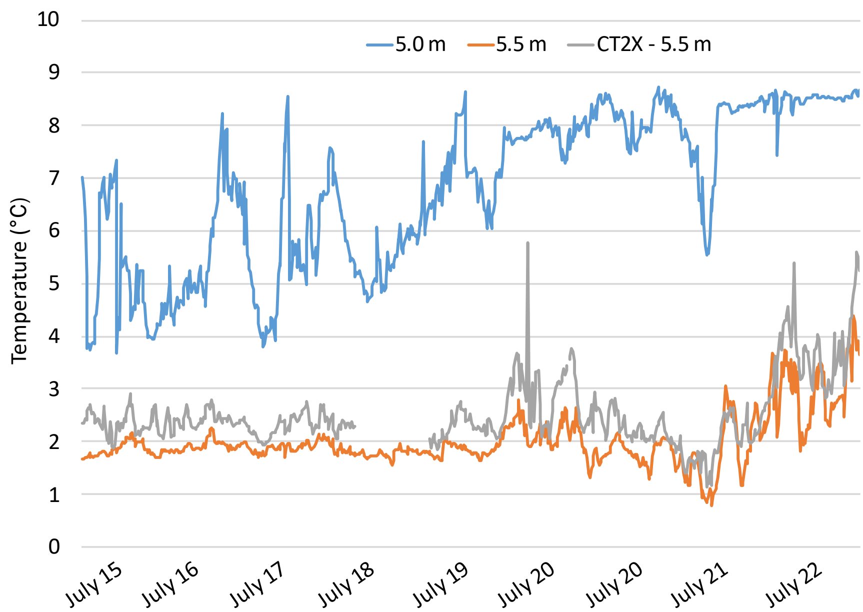

Figure 12. Summary of temperature data collected from the mooring stationed at Bennett Point (69.72116 N; -124.081865 W) from July 15th to July 22nd, 2020. The site had a bottom depth of 5.5 m.

Figures 12 and 13 summarize the mooring data that were gathered at Bennett Point and Argo Bay in the summer of 2020, respectively. The results of the t-test between the bottom temperatures measured by the HOBO U22 logger versus the CT2X Seametrics® logger were significantly different (p = < 0.05), thus the readings are not comparable. Figure 12 shows that the overall trend for the CT2X logger was similar to that of the U22 logger, but the CT2X logger recorded generally warmer temperatures and was possibly more sensitive to changing conditions. Among HOBO loggers, there was a clear difference between the loggers positioned at 5 meter, 10 m and 15 m intervals. The maximum depth was only 5.5 meters, therefore the loggers positioned at 10 m and 15 m, did not reflect the depths intended. The logger positioned at 5 m and bottom logger (5.5 m) were able to capture the variability of temperature within the water column, ranging from 8.7°C at it's warmest point to 0.8°C at its coldest.

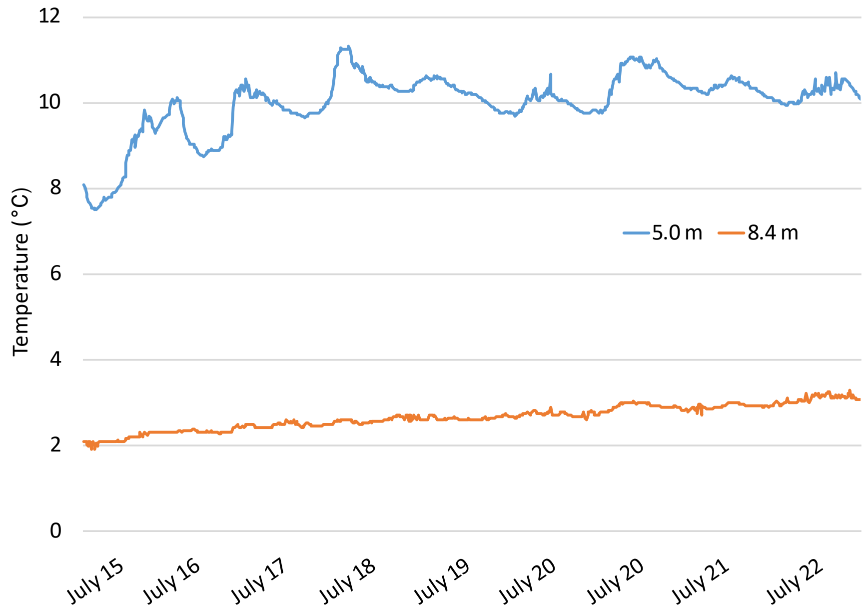

Figure 13. Summary of temperature data (HOBO U22) collected from the mooring stationed at Argo Bay (69.392731 N; -124.458944 W) from July 14th to July 23rd, 2020. The site had a bottom depth of 8.4 m.

The mooring that was stationed in Argo Bay from July 14th to July 23rd, 2020 at a maximum depth of 8.4 m was successful at capturing the differences in mean temperature and variability within the water column. Similar to the mooring at Bennett Point, the Argo Bay mooring was anchored at a site that was < 15 m depth, therefore the mooring line was likely at an angle rather than giving a vertical profile, and therefore not possible to define a specific depth for each sensor on the mooring line. The bottom temperature logger exhibited the most consistent mean temperature and lowest variability. The logger closest to the surface recorded the warmest temperatures, which is consistent with temperatures recorded between 0-2 m depths in 2017.

Table 3. Average (+ SD) temperature data recorded in Argo Bay (July 14th – 23rd), and Bennett Point (July 15th – 22th) in 2020, and in Argo Bay in August (4th – 10th), and September (3rd – 8th) in 2021. Temperature data were recorded with HOBO U22 loggers at three points in the water column. Average (+ SD) salinity data were recorded with CT2X Seametrics® loggers at the bottom of the mooring during this time period.

Location	Depth interval	2020 - July	2021 - August	2021 - September
Argo Bay	Top	10.0 + 0.7 °C	9.4 + 1.0 °C	7.8 + 0.5 °C
	Middle	4.6°C + 1.6 °C	9.4 + 1.0 °C	7.9 + 0.4 °C
	Bottom	2.4°C + 0.5 °C	9.2 +1.0 °C	8.0 + 0.4 °C
	Bottom Salinity	n/a	26.7 + 3.2 PSU	26.7 + 3.7 PSU
Bennett Point	Top	6.8 + 1.5 °C	n/a	n/a
	Middle	4.3 + 1.7 °C	n/a	n/a
	Bottom	2.0 + 0.5 °C	n/a	n/a
	Bottom Salinity	25.9 + 2.1 PSU	n/a	n/a

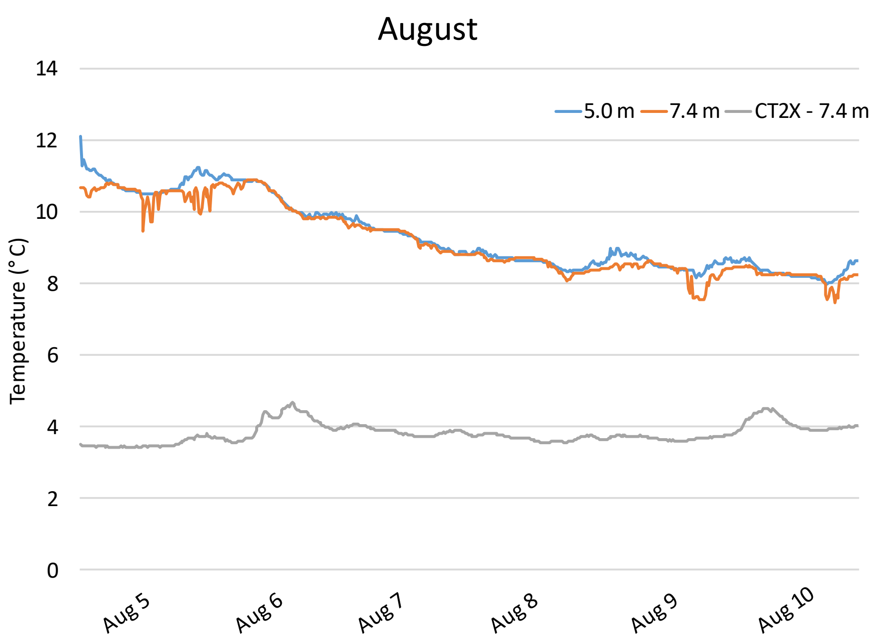

Figure 14. Summary of temperature data collected from the mooring stationed at Argo Bay (A1; 69.392731 N; -124.458944 W) from August 4th – 10th, 2021. The site had a bottom depth of 7.4 m. Temperature data gathered from the HOBO U22 loggers are presented in blue and orange; CT2X temperature data are presented in grey.

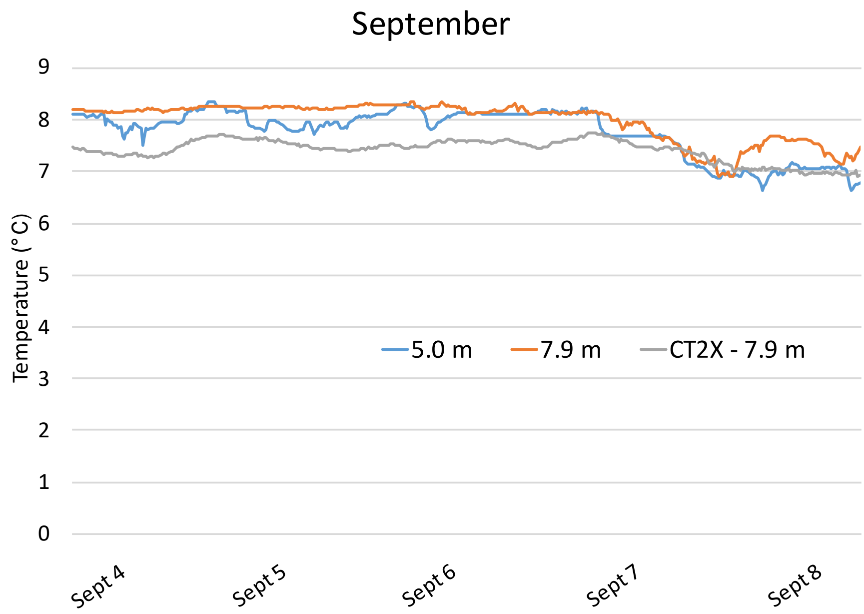

Figure 15. Summary of temperature data collected from the mooring stationed at Argo Bay (A1; 69.392731 N; -124.458944 W) from September 3rd – 8th, 2021. The site had a bottom depth of 7.9 m. Temperature data gathered from the HOBO U22 loggers are presented in blue and orange; CT2X temperature data are presented in grey.

Unlike the mooring deployed in 2020, the data collected from similar moorings in 2021did not clearly display different depth-specific temperatures within the water profile of Argo Bay (Table 3). Although the maximum depth was similar (7.9 m), it is possible that there was more mixing within the water column during these deployments in 2021, compared to the 2020 deployment where there was clearer separation among top, middle and bottom depth intervals. Based on observations made by the field leads, winds were much stronger in August and September (typically gusting to 50km/hr) relative to July, and at depths < 10 m, it's likely that this contributed to the homogeneous temperatures at the mooring site. In Figure 14 the temperature recorded by the CT2X logger is considerably lower than the other U22 loggers during the August deployment, but remains consistent with bottom temperatures observed in Argo Bay at a similar depth in 2017. The deployment later that year in September (Figure 15) also displayed characteristics of mixing (homogenous temperatures with depth), and there were no noteworthy differences observed among all loggers, including the CT2X logger . Mean water temperature in September was generally lower than that recorded in August (Table 3).

3.1.2 Ice and snow

Timelapse cameras

Timelapse images of the sea ice and breakup were captured every four hours starting March 10th, 2019 until July 16th, 2019. Images taken at the beginning and end of the time lapse period are shown in Figure 16. The images taken during this time period indicate that breakup began at the beginning of June (Figure 16b) such that ice began to break free from the shoreline by June 13th, 2019. By the second week of July, all ice was clear from Argo Bay.

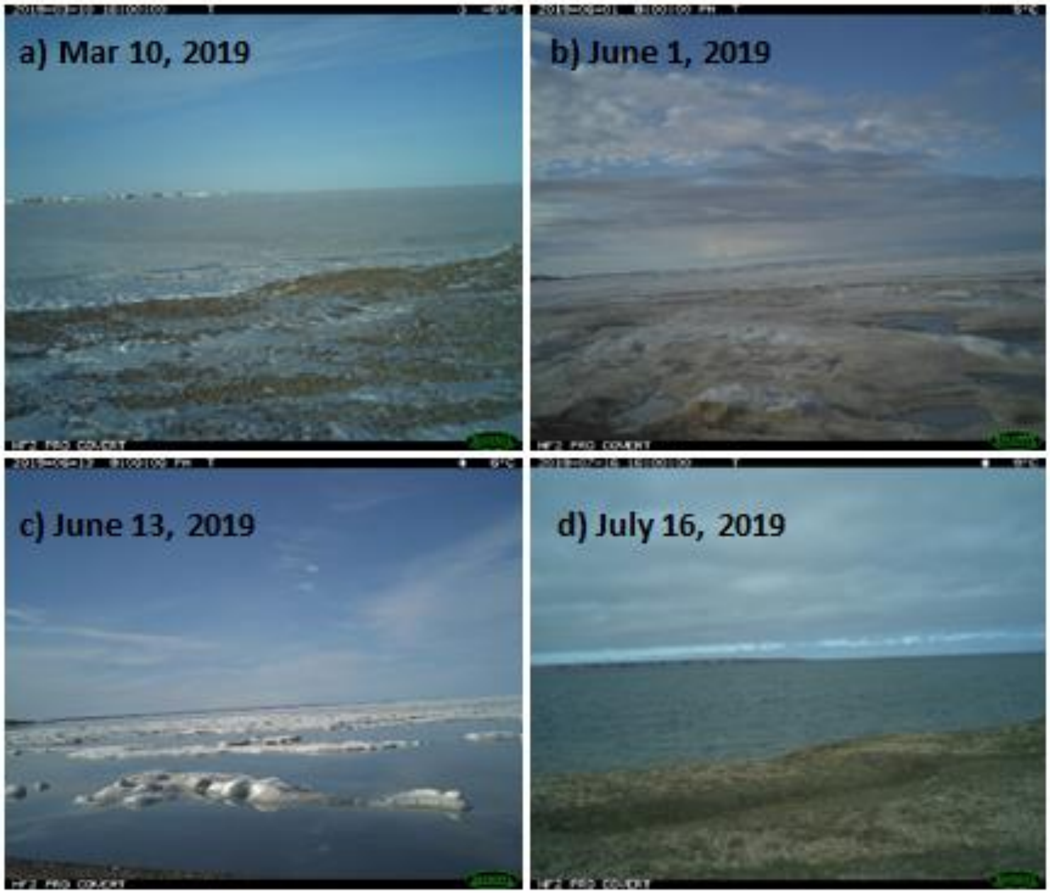

Figure 16. Timelapse camera images taken in Argo Bay (March 10th – July 16th, 2019).

In the winter of 2021, timelapse cameras were set up in Argo Bay and Brown's Harbour to capture images every hour from deployment date until retrieval date. In Argo Bay, the camera was deployed from January 20th, 2021 until June 30th, 2021. The images in Figure 17 indicate that ice began to break away from the shoreline in the second week of June (Figure 17c) and ice was free from the shore by the end of June. The Argo Bay camera was disturbed by a bear in late June, therefore there are no images available of the area completely ice free. At Brown's Harbour (Figure 18), the timelapse camera was deployed for approximately a full year (March 2nd, 2021 – February 27th, 2022) with an image captured once every hour. The Brown's Harbour camera was consistent with the one stationed at Argo Bay, such that warming and ice break up away from the shoreline began in the second week of June, but also that ice had dissipated by July 20th, 2021. Unlike previous years, this camera was able to record images of freeze up at Brown's Harbour, first evident on November 8th, 2021 (Figure 18d).

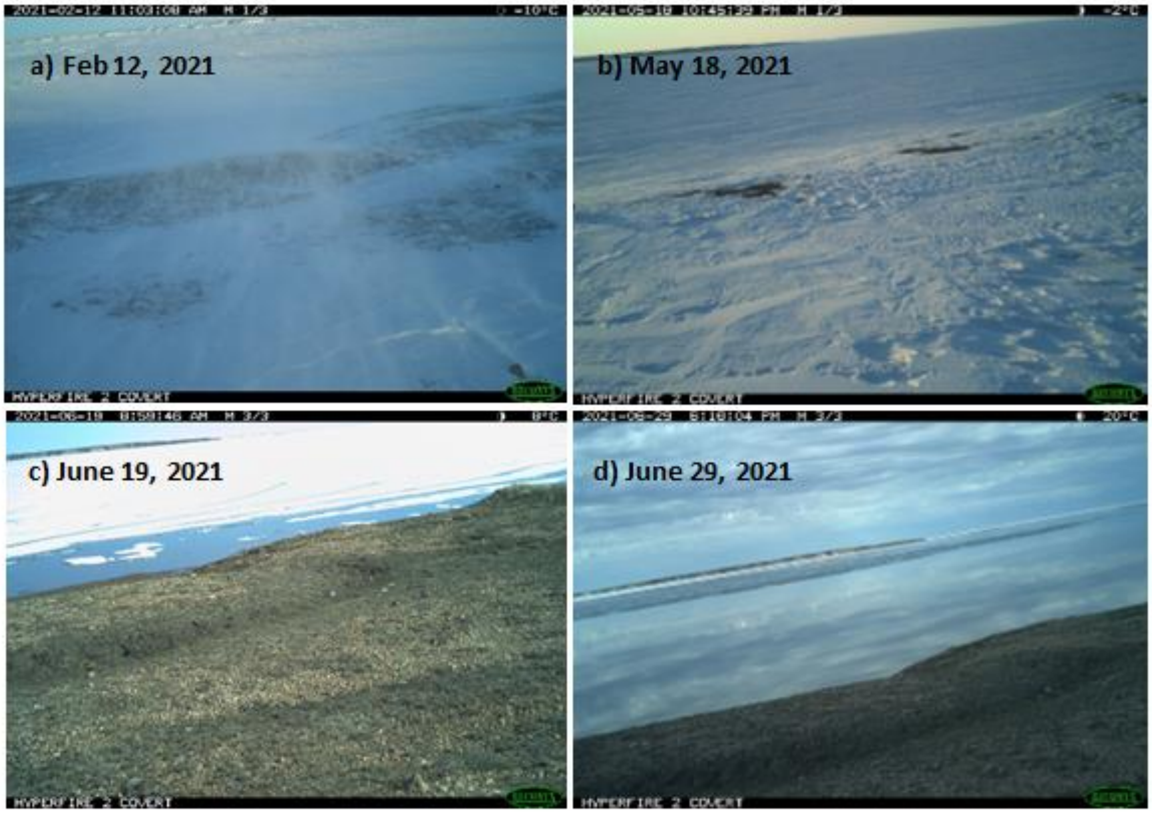

Figure 17. Timelapse camera images taken in Argo Bay (February 12th and June 29th, 2021)

Figure 18. Timelapse camera images taken at Brown's Harbour (March 2nd to November 8th, 2021).

Ice-covered baseline research
Arctic Coast began the first winter pilot field program in 2019 to test protocols and develop standardized sampling for subsequent years. Community-based monitors travelled out to their pre-selected site in Argo Bay approximately once a week (weather permitting) and recorded snow depth, ice thickness, and freeboard depth. Figure 19 provides a summary of these data collected during the 2019 field program between January 17th and March 22nd, 2019. On average in 2019 the snow depth was 24.0 ± 7.6 cm, with a maximum record of 31.0 cm. Mean ice thickness (± SD) was 90.5 ± 10.2 cm throughout the sampling season and freeboard was 7.0 ± 10.8 cm.

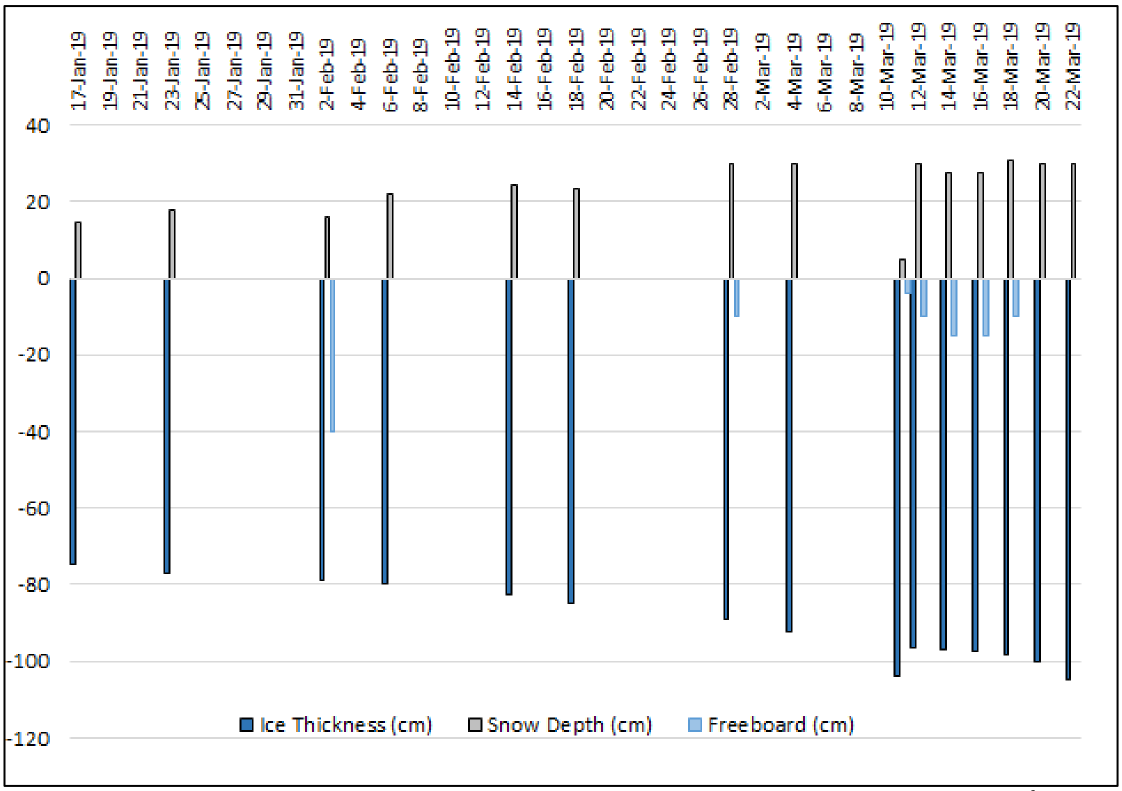

Figure 19. Ice thickness and snow depth measurements recorded between January 17th and March 22nd, 2019 in Argo Bay.

In 2020, winter fieldwork began on January 24th and continued approximately once per week until March 24th. Technicians gathered data on snow depth and ice thickness in Argo Bay at the same location as in 2019, and also for the first year at Bennett Point. These data are summarized in Figure 20. Ice was generally thicker at Bennett Point (138.9 ± 13.8 cm) relative to Argo Bay (115.2 ± 13.7 cm) and there was no noteworthy difference in snow depth between locations (< 30 cm among all sampling sites). Average freeboard measured at Bennett Point and Argo Bay was 9.6 ± 2.9 cm and 7.5 ± 1.4 cm respectively.

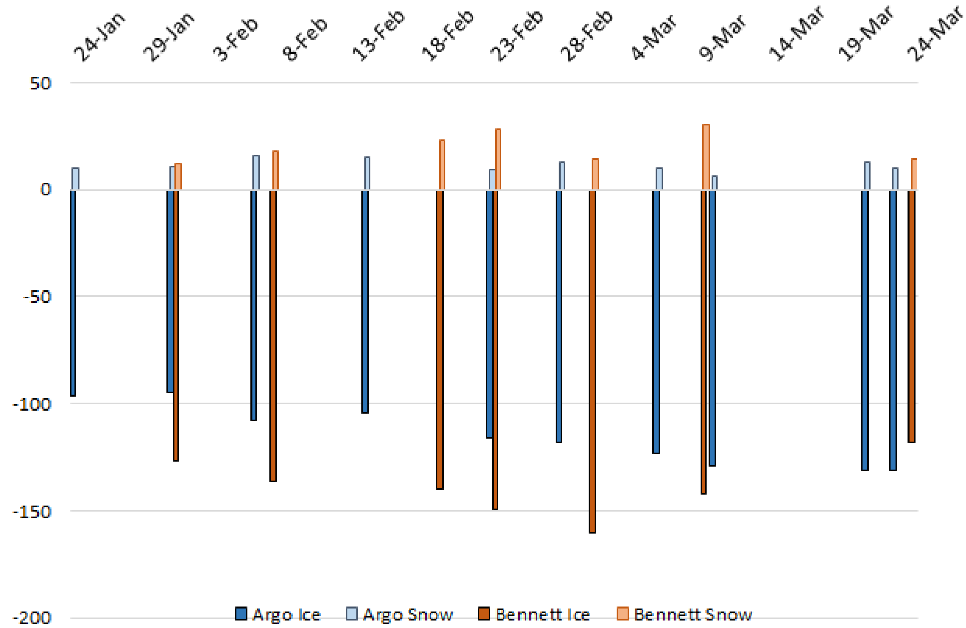

Figure 20. Ice thickness and snow depth measurements recorded between January 24th and March 24th 2020 at Bennett Point and Argo Bay in the ANMPA.

The winter field program in 2021 was the third consecutive winter sampling season carried out by Arctic Coast community-based technicians. Sampling at Brown's Harbour was included this year (one trip; March 20th, 2021), while Argo Bay and Bennett Point were sampled approximately once a week between January 20th and March 26th, 2021. The average ice thickness at Bennett Point was (128.4 $\pm$ 18.5 cm) and (116.1 $\pm$ 17.6 cm) at Argo Bay. The maximum recorded ice thickness was at Brown's Harbour (150 cm). Average snow depth at Argo Bay was 8.6 $\pm$ 3.2 cm, Bennett Point was 7.3 $\pm$ 2.4 cm, and the single record at Brown's Harbour was 5 cm. Among locations average freeboard was 6.0 $\pm$ 2.5 cm in Argo Bay, 9.5 $\pm$ 2.1 cm at Bennett Point and 12.7 cm at Brown's Harbour. These results are summarized in Figure 21.

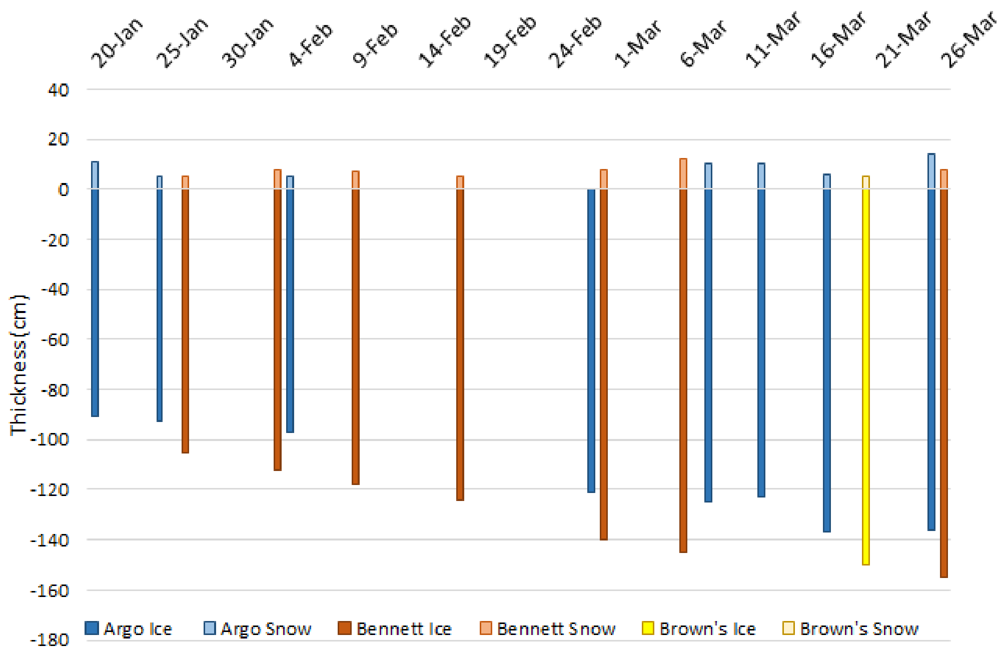

Figure 21. Ice thickness and snow depth measurements recorded between January 20th and March 26th 2021 at Argo Bay, Bennett Point and Brown's Harbour in the ANMPA.

Under-ice oceanography

The temperature and salinity measurements recorded at the Argo Bay site are shown in Figure 22. Generally, the temperature of the water was colder under the ice than at the sea floor. This is expected, given that water immediately under the ice is kept at lower temperatures relative to the bottom.

Mean salinity (±SD) at the site was 30.7 ± 0.9 PSU over the course of the field program (2019 to 2021); Interestingly, the temperature and salinity measurements at 1 m below the surface (under-ice) and at the seafloor (8.5 m bottom depth) showed remarkable consistency with each other in 2019, suggesting the water column was well-mixed and stable. However, in 2020 and 2021 there were greater differences between near-surface and bottom measurements of temperature and salinity. It is possible there were temperature swings more during these winters that led to sporadic periods of melting and re-freezing of sea ice. In 2020 and 2021 temperature and salinity measurements showed more variability overall (regardless of the position of the loggers) compared to 2019, although water temperatures were still consistently at or near the freezing point (-1.5 to -1.9°C) regardless of their depth.

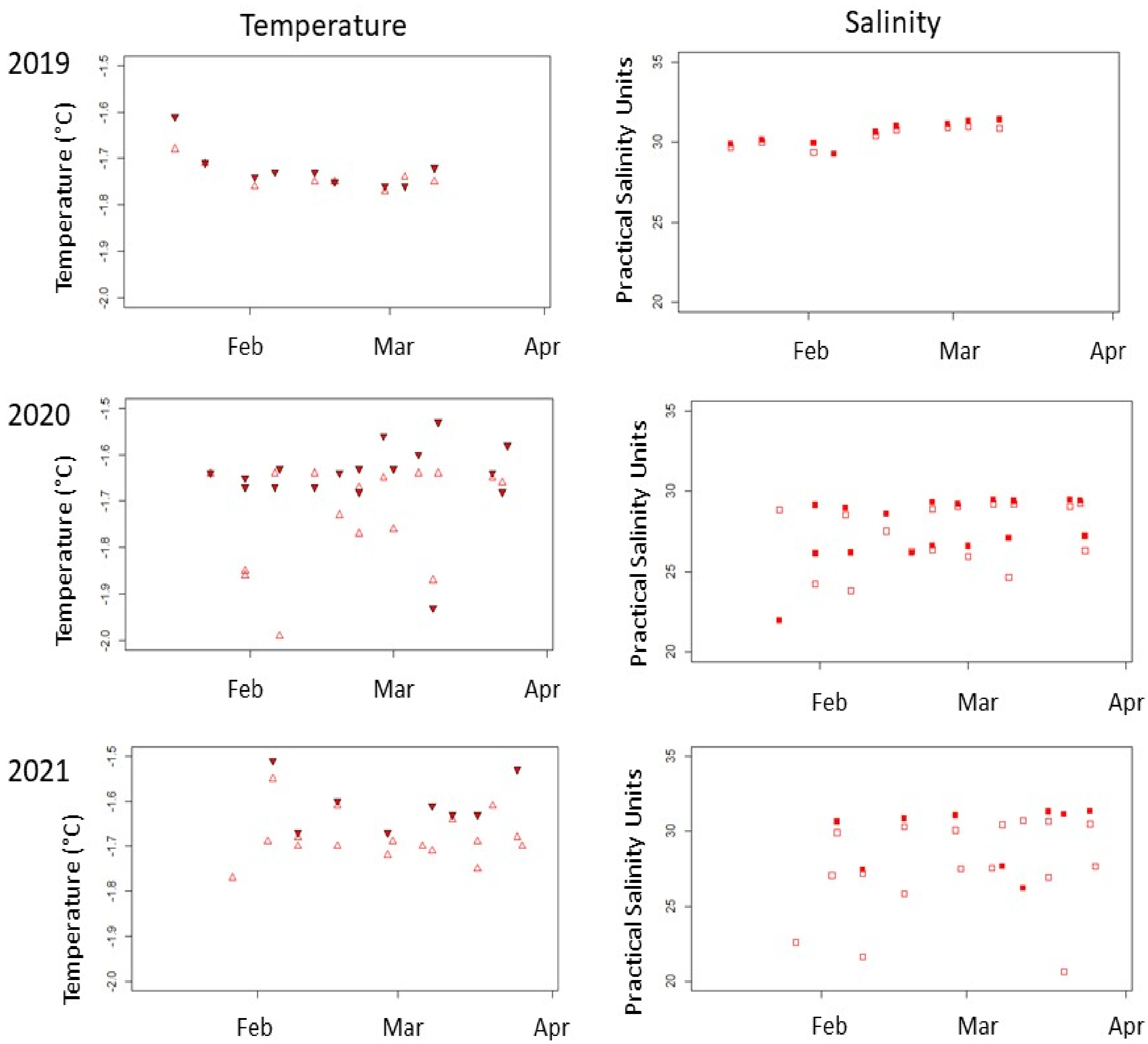

Figure 22. Mean temperature (°C) and Salinity (PSU) recorded at each site visit throughout the course of the winter field program in Argo Bay from 2019 to 2021 from CT2X loggers deployed 1 m under the surface (open shapes) and at the sea floor (closed shapes).

In Argo Bay under-ice temperature was relatively consistent throughout the years, while salinity had more variation. In 2019, there was only one crew deploying measurements under the ice, while effort increased in 2020 and 2021 due to more favorable weather and training that had been completed in the previous year. Among all years of monitoring at Argo Bay, mean temperature ranged from -1.51 to -1.85°C regardless of the position of the loggers (immediately under the ice or at the sea floor at 8.5 m depth).

3.1.3 Benthic habitat

Baseline information on habitat and invertebrates was first conducted during the 2017 survey in Argo Bay. A total of 21 sites were sampled using a bottom dredge and 4 were sampled using the ponar grab between depths of 1 to 20 m. The extent of benthic sampling during the baseline research phase of this protocol is shown in Figure 23. The benthic dredge was used more extensively during this program due to the change in habitat substratum outside of Argo Bay. Generally, north of Argo Bay the substratum transitioned from soft (silt to sand) to hard (pebble to bedrock) habitat types, therefore the dredge was selected to provide a more ubiquitous sampling method for that year. At each benthic site, the YSI sonde was also deployed to collect complementary oceanographic that are summarized in Appendix D.

Benthic sampling effort expanded gradually from 2020-2021 as baseline data were gathered and feasibility of sampling was tested with input from community-based monitors.

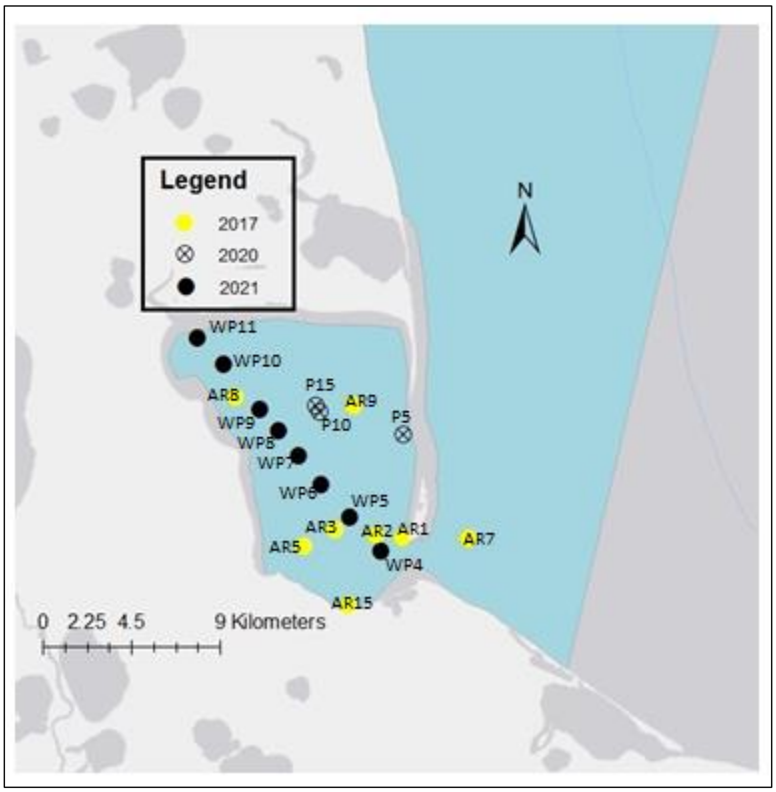

Figure 23. Map of benthic sampling effort among summer sampling seasons 2017, 2020 and 2021. Site specific data is available in Appendix D.

The 2020 and 2021 sampling years confirmed that Argo Bay was composed primarily of soft substrata as it was initially classified in 2017. Figure 24 is an image of this habitat that was taken from a GoPro® at one of the sampling sites, indicating that the substrata is relatively homogeneous in that area. The samples obtained from the ponar grab at each of these locations have been processed to determine the extent of invertebrate biodiversity and are summarized in section 3.2.2 of this report. The sediment samples have been preserved and archived at the Freshwater Institute in Winnipeg for follow-on analyses at a later date.

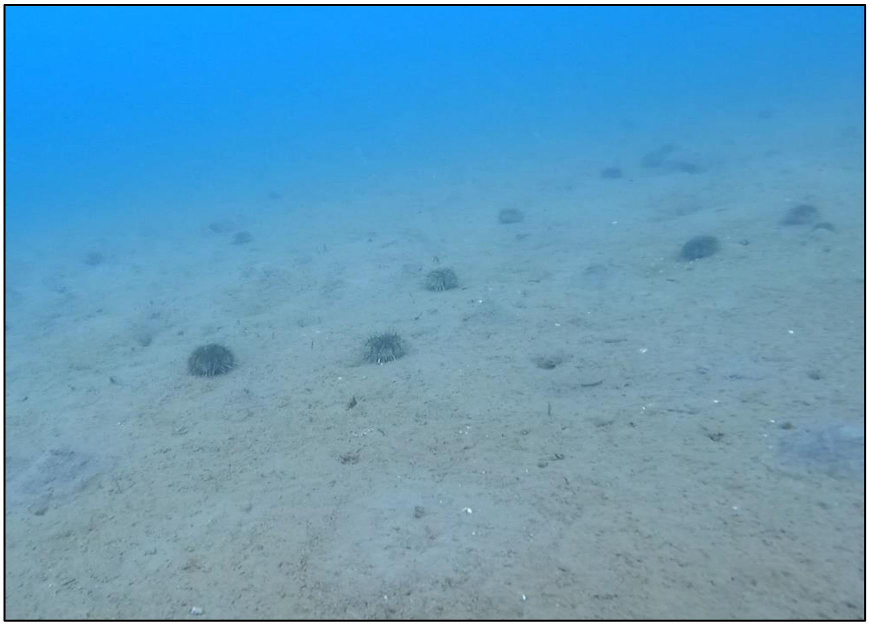

Figure 24. Image of the benthic habitat in Argo Bay July 2022, and presence of invertebrates such as green sea urchins (photo: K. Gully).

Although no samples were gathered at Bennett Point in 2019, or 2020, video footage collected during the winter field season and summer of 2019 also confirmed that Bennett is primarily bedrock or cobble substratum. Since Bennett Point is composed of a hard substrate, it is not possible to gather samples with a ponar grab, and field crews dedicate their sampling effort to collecting plankton instead. The samples of sediment collected among 2017, 2020 and 2021 field programs are to be used for follow-on analyses at a later date.

3.2 Biological and Food Web Integrity Indicators

3.2.1 Zooplankton

In 2019, zooplankton tows were piloted at Bennett Point in the ANMPA. A total of two vertical tows, and one horizontal tow (2 m depth; approximately 10 m long) were carried out at the locations on July 15th, 2019. The locations of these three tows are shown in Figure 26. The composition of these samples is summarized below in Figure 25, species and individual counts from these tows is also provided in Appendix F. In total 5372 individuals were identified from 13 distinct taxonomic groups, in which Copepoda made up the greatest proportion of these individuals. *Thysanoessa sp*. was the signal most abundant prey taxa (Euphausiacea), in which n = 1067 individuals were identified in a single sample.

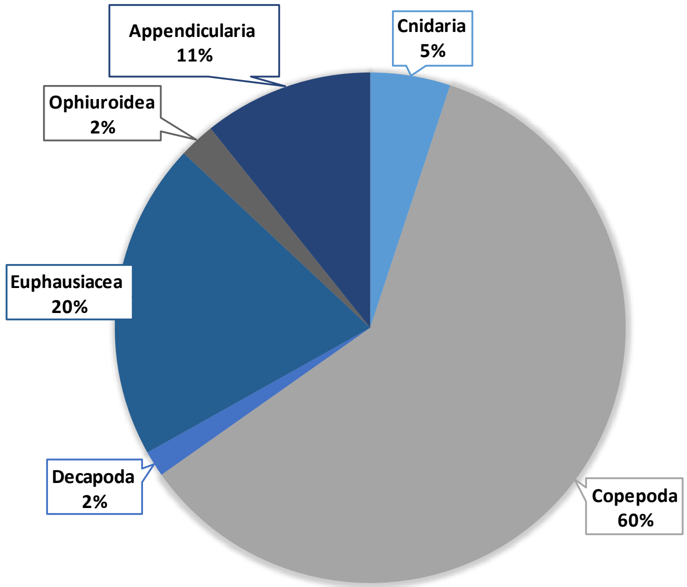

Figure 25. Percent composition of taxonomic groups obtained from vertical plankton tows carried out on July 15th 2019 at Bennett Point.

Vertical plankton tows were successfully conducted in 2020 at both Bennett Point and Argo Bay. Five tows were conducted at Bennett Point between July 18th and 19th, and five tows were completed on July 21st at Argo Bay. The depth and location of each tow during this field season is shown in Figure 25. At Bennett Point, tows were completed between 5.5 and 15 m, at four sites. There were two tows completed at the 5.5 m depth site, which was also the same site as the mooring. In Argo Bay, five tows were completed between 5 to 8.5 m depths. Samples were collected from both locations, filtered, preserved, and shipped to the Freshwater Institute in Winnipeg for processing at a later date.

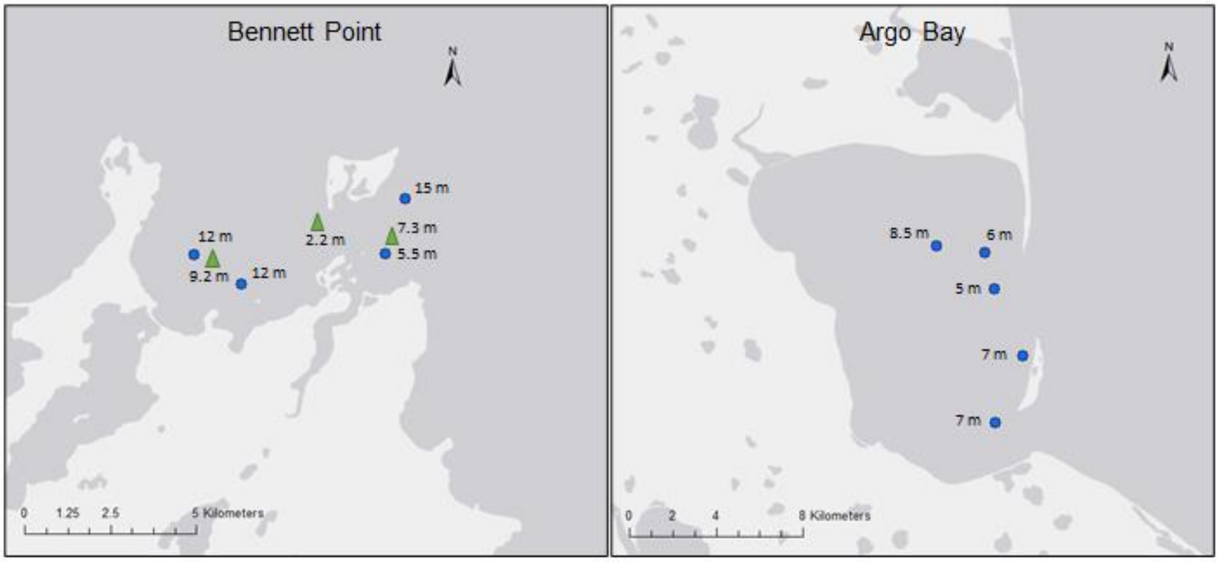

Figure 26. Locations of plankton tows at Bennett Point and Argo Bay within the ANMPA. In 2019 tows (green triangle) were conducted on July 15th, 2019 and in 2020 (blue circles) vertical tows were collected between July 18th and 21, 2020. Specific depths at each site are indicated, coordinates for each site are listed in Appendix F.

The samples obtained from the 2020 sampling effort were used to establish a baseline for stable isotope ratios of zooplankton in the nearshore environment. During this summer, a total of ten vertical tows were completed between depths of 5 and 12 m (Appendix F).

Stable isotope ratios of $\delta^{13}C$ and $\delta^{15}N$ were obtained from the bulk samples of each tow to serve as a baseline for food web analysis among all species at a later date. It is not possible in this report to examine the zooplankton taxa that are contributing to these values. Rather, they represent a baseline for the potential range of basal carbon source and trophic position in the pelagic environment for low trophic species in future studies.

3.2.2 Benthic epifauna

In 2017, bulk samples of invertebrates were collected between July 8th and 9th (Figure 28). Among the 21 stations sampled for habitat using a benthic dredge, only 43% (n = 9) contained invertebrates that separated from sediment using a bucket sieve. From these samples, 40 different species were identified among nine different classes. The single most abundant species found in among sampling sites, particularly in Argo Bay, was *Cistenides granulate*, a member of the family Pectinariidae, more commonly known as comb worms (Figure 27). *Astarte borealis*, *Macoma balthica*, *Musculus discors*, and *Mya truncata* made up 94% of all bivalves collected, and were most abundant within Argo Bay. The largest single individual invertebrate with the largest biomass (8.2 g) was an *Ascidia sp.*, or tunicate, collected in Argo Bay at 8.1 m depth. The community composition of these samples has been explored in greater depth in Bilous et al. 2022.

Figure 27. Bulk sample from benthic dredge collected in Argo Bay, predominantly made up of *Cistenides granulate*, or their disposed casings (Photo: K. Dunmall).

Invertebrates collected during the 2020 season were sent to the University of Waterloo to be processed for stable isotopes, therefore there is limited taxonomic information available from the 2020 sampling year. However, in 2021, more extensive sampling was carried out by technicians across Argo Bay at eight stations. The composition of these samples is summarized below in Figure 28, species and individual counts and respective biomass from these grabs also provided in Appendix F. A total of 42 individuals were collected from eight different species. The most abundant of these species was *Macoma calcarea*, a bivalve that is common in coastal Arctic habitats.

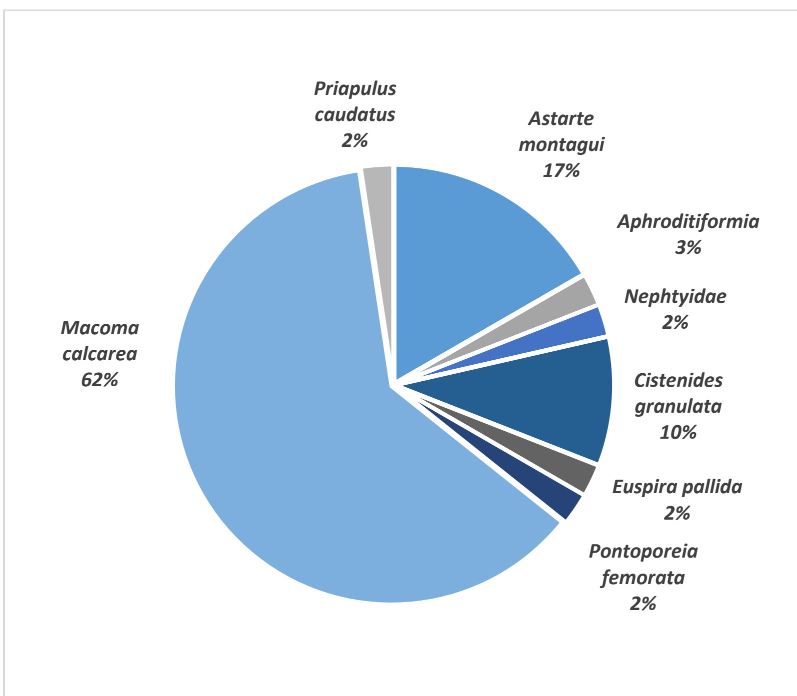

Figure 28. Percent composition of taxonomic groups obtained from petite ponar grabs collected among 8 stations in Argo Bay in 2021 between 3.4 and 8.9 m depth.

3.2.3 Fishes

Summer

The composition of inshore fish biodiversity is summarized in Figure 29 among the 2017-2020 sampling years for Argo Bay. In 2017, the program was designed as baseline survey of the area, therefore there was a greater level of fishing effort, and more variety of sampling techniques in order to determine the best methods for monitoring. After 2017, protocols were adapted to focus on monitoring, and minimize mortalities by only using gillnets and seine nets, therefore the total number of fishes collected was reduced. As a result, number of fishes captured was greater in 2017 relative to subsequent years, yet total biodiversity was comparable. This was most apparent with respect to the larger number of capelin collected in 2017 relative to other years, which could be collected easily with dip nets and a shore-based fyke net. Despite differences in sampling methods, biodiversity of the species captured was high for a coastal Arctic location (von Biela et al., 2023) in which Arctic flounder (*Pleuronectes glacialis*), starry flounder (*Platichthys stellatus*), broad whitefish (*Coregonus nasus*), and shorthorn sculpin (*Myoxocephalus scorpius*) were the most frequently captured. Among sampling years between 2017 and 2020, Arctic flounder was consistently the most abundant. Anadromous fishes such as Arctic char and Arctic cisco were also caught every year in Argo Bay using multi-mesh gillnets. Their relative abundance did not appear to differ among years of sampling. In 2019, the first known record Bering wolffish was observed for the coastal Canadian Beaufort Sea and first record for the ANMPA. This species is considered to be a rare endemic, given that it's distribution extends from the Bering Sea to Coronation Gulf and its preference for soft-bottomed coastal habitats are consistent with Argo Bay (McNicholl et al. 2021).

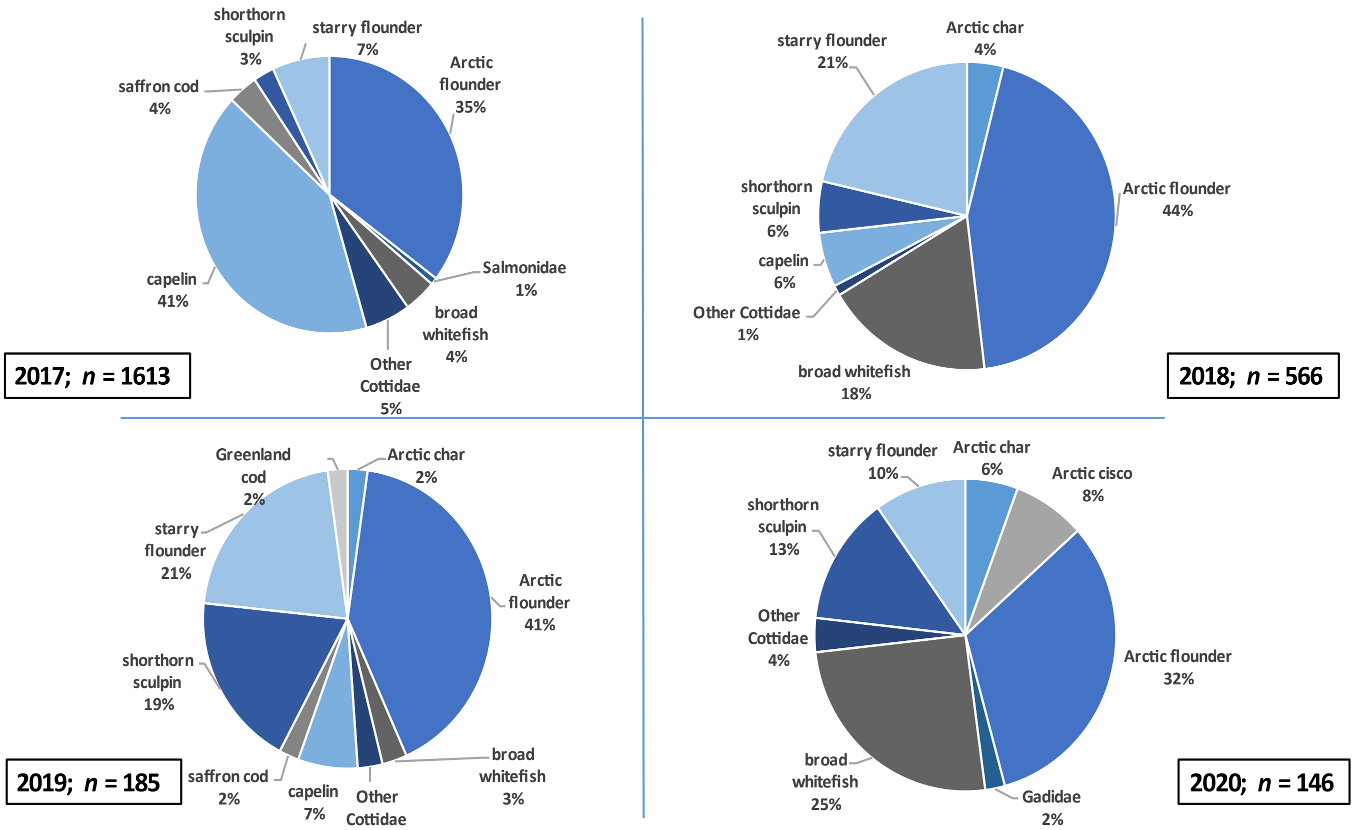

Figure 29. Community composition of inshore fishes collected in Argo Bay in July between 2017-2020. Total number of fishes collected are presented below each chart. Species that represented < 2% and could not be combined by family are excluded; specific catch data are available in Appendix B.

In 2021, field work was conducted in Argo Bay from August 4th – 10th, and from September 3rd – 8th. Argo Bay had not been sampled in August since 2016, and had never been sampled in September (Figure 30). Total biodiversity was comparable between the sampling weeks such that ten species were captured in August and twelve were captured in September. The number of species observed was also comparable to 2016, despite the level of effort and sampling gear used during this survey was greater as a baseline survey (McNicholl et al. 2017a). In September, broad whitefish was most abundant species present in Argo Bay whereas Arctic flounder was the most abundant in August and in July of all previous sampling years. Additionally, a Bering wolffish was captured on September 7th, 2021, at the same location as the individual captured in 2019 (McNicholl et al., 2021). The wolffish captured in 2021 represents the second observation in the ANMPA and the coastal Beaufort Sea. Community-based monitors successfully live-released this individual after capture. During this same season, a lake whitefish was observed in Argo Bay, the first observation of this species among years of sampling for this program. Although lake whitefish are present in freshwater habitats surrounding Darnley Bay, they are less commonly observed in the marine environment (McNicholl et al. 2020).

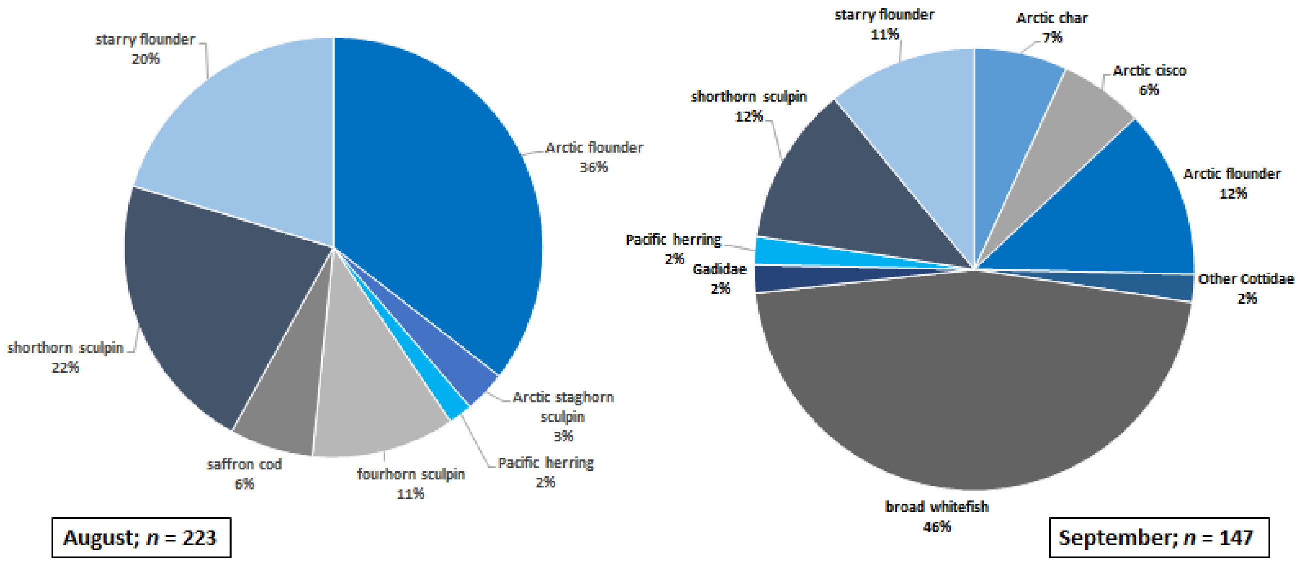

Figure 30. Community composition of inshore fishes collected in Argo Bay in August and September 2021. The total number of fishes collected in each month are displayed below each chart. Species that represented < 2% and could not be combined by family were excluded; specific catch data are available in Appendix B.

At Bennett Point, field programs were conducted simultaneously at Argo Bay in July 2019 – 2020 (Figure 31). The timing of sampling and level of effort were comparable between the 2019 and 2020 sampling years at Bennett Point, in which community-based monitors followed standardized protocols. Among years of sampling, eight species were documented at Bennett Point, in which shorthorn sculpin, capelin, Greenland cod (*Gadus ogac*) and starry flounder were most abundant. The most noteworthy difference between years is the high abundance of capelin in 2019 relative to 2020. Similar to previous years of sampling at this location, spawning shoals of capelin were observed where several hundred may be captured at a time if they came into contact with gillnets (McNicholl et al. 2017a). Although no capelin were observed in 2020, local observations indicate that spawning shoals were present at other sites within the ANMPA. Anadromous fishes such as Arctic cisco and Arctic char were only observed in 2019, and the first record of a banded gunnel for the Canadian Beaufort Sea was recorded during this survey on July 27th, 2019. Relative to 2019, biodiversity was lower in 2020 despite comparable level of effort, replication of sampling sites, and timing of sampling.

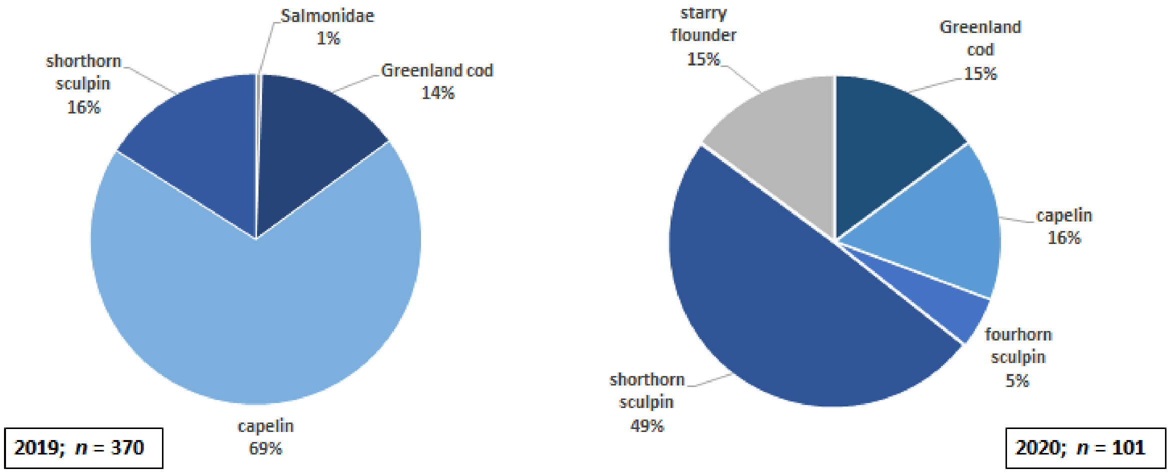

Figure 31. Community composition of inshore fishes collected at Bennett Point in July between 2019-2020. Total number of fishes collected are presented below each chart. Species that represented < 2% and could not be combined by family were excluded; specific catch data are available in Appendix B.

Ice-covered

During the winter sampling programs, fishes were opportunistically sampled by angling underneath the ice at pre-determined sites. Generally, the abundance of fishes and biodiversity was less than the summer seasons as a result of gear type and reduced level of effort, but also likely due to the presence of fewer anadromous species, as they overwinter in freshwater during the winter. Figure 32 summarizes the proportion of species and number of individuals captured between 2019 and 2021 in Argo Bay during the weekly sampling program held between January and March. Highest biodiversity and abundance was observed in 2019, which included a week of baseline research in which DFO biologists also participated in sampling with community-based monitors. Among all sampling years, the community of fishes was composed of gadids (saffron and Greenland cod) and cottids (fourhorn sculpin and shorthorn sculpin). Between the 2020 and 2021 winter sampling conducted at Bennett Point, only one shorthorn sculpin was captured in 2020, and no fishes were captured at Brown's Harbour or Bennett Point in 2021.

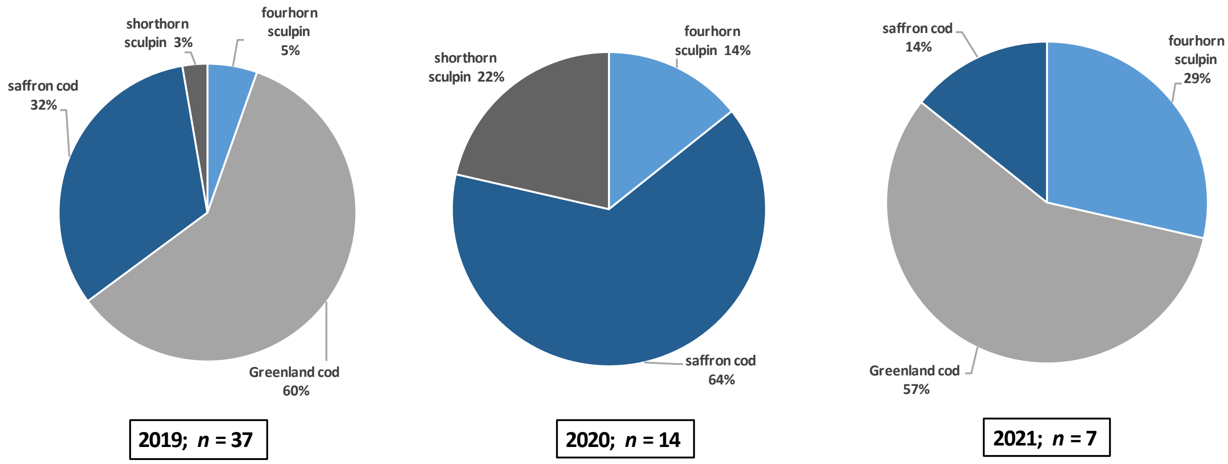

Figure 32. Community composition of inshore fishes collected during the winter months in Argo Bay between 2019-2021. Total number of fishes collected are presented below each chart. Species that represented < 2% and could not be combined by family were excluded; specific catch data are available in Appendix B.

Key forage fish relative abundance and biomass

The inshore community of forage fishes is dominated by capelin and Pacific sandlance. There are no known occurrences of Arctic cod in the inshore habitat (< 20 m) of the ANMPA (McNicholl et al. 2020), therefore capelin and Pacific sandlance are considered to be the primary prey taxa available to predators foraging in the coastal areas of the ANMPA. Local knowledge indicates that spawning shoals of capelin are typically observed spawning each year (Figure 33), most frequently in July at one or more locations within the ANMPA (McNicholl et al. 2017b). Since the beginning of DFO-led coastal fish surveys, capelin have been captured each year (2012, 2014 to 2020) with the exception of 2021 where they were only observed visually by members of the PHTC in July, 2021 at Billy’s Creek.

Figure 33. Capelin spawning on Egg Island in Argo Bay, July 11th, 2017 (Photo: D. M^{c}Nicholl).

The proportion of male to female capelin in each year is shown in Figure 34. The number of capelin collected in a given year is highly variable, and dependent if sampling gear came into contact with highly mobile spawning shoals. Although capelin were observed most years, the most significant years of collection were from July 14th to 25th in 2014 at Bennett Point, July 10th to 12th in 2017 at Argo Bay, and July 13th to 19th 2019 at Bennett Point. Among the three most significant years of collections, the proportion of males:females was greater in 2017 (594:64) at Argo Bay while the proportion of females:males was greater in 2014 (178:91) and 2019 (50:17) at Bennett Point.

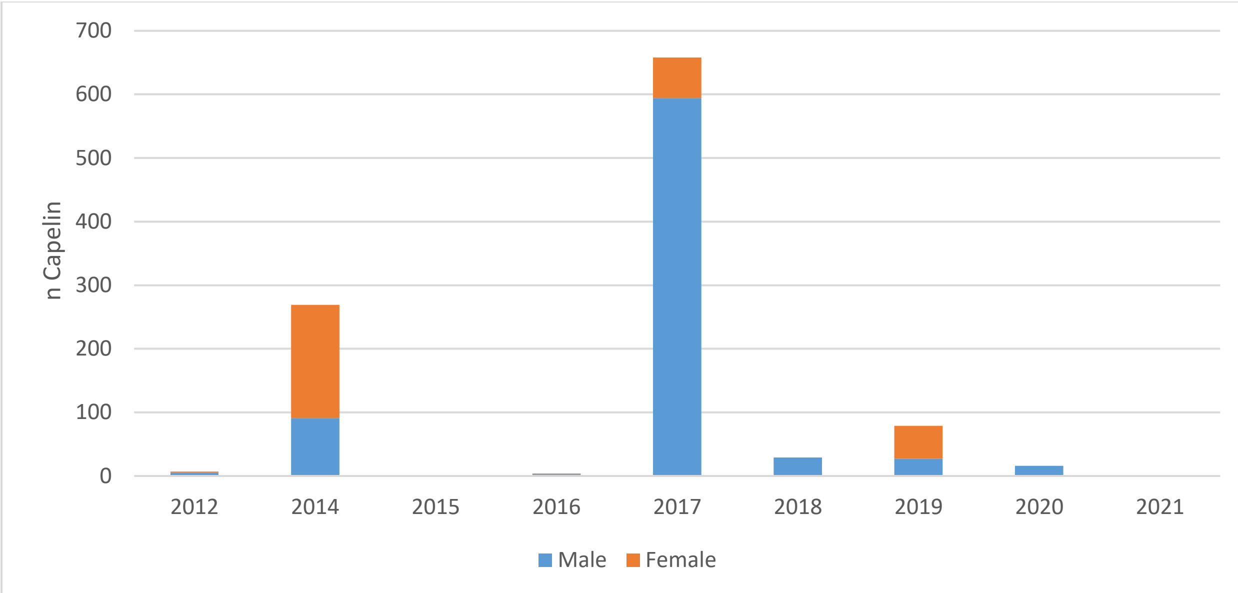

Figure 34. Proportion of male and female capelin sexed among sampling years within the ANMPA. capelin were only observed at Bennett Point in 2012, 2014, 2018, 2020), and Argo Bay in 2016 and 2017. In 2019 capelin were collected at both Bennett Point (*n* = 67) and Argo Bay (*n* = 12) between July 13th and 19th.

The presence of forage fishes other than capelin were documented; however, in less abundance given they were primarily observed within the stomach contents of processed fishes. Among all sampling years only one individual was captured by a seine net in Argo Bay on July 19th, 2020. The gear type used among field programs was not well suited to collecting sandlance, yet they were observed by field crews at Brown's Harbour forming small schools in 2015, and are frequently observed in the stomach contents of piscivorous fishes (Figure 35).

Figure 35. Pacific sandlance among stomach contents of a starry flounder captured at Bennett Point in July 2014 (Photo: D. McNicholl).

Forage fishes were documented in the stomach contents of fishes processed between 2017 and 2021, and are summarized in Table 4. The most prominent forage fishes found in stomach contents were Pacific sandlance and capelin. Invertebrates contributed to stomach contents; however, they are not presented here. Forage fishes were only present in the stomach contents of shorthorn sculpin, starry flounder, and Arctic char, and were not observed in the stomachs of any other species processed. Among years of sampling, the key forage fishes identified in this report (Pacific sandlance, capelin, Arctic cod, rainbow smelt) were only observed among predators captured in Argo Bay. Among the total number of stomachs processed in a given year, there were relatively few forage fishes that could be identified to species level. Sandlance and capelin were the dominant prey taxa observed, and there was only one record of an Arctic cod in the stomach contents of a starry flounder. There were no rainbow smelt found in the stomach contents of processed fishes, or ninespine stickleback.

Table 4. Summary of forage fishes identified in coastal fish stomachs processed among 2017-2021 summer field programs. Each predator, prey taxa, number of individual prey and the percent each forage fish contributed to the total stomach contents mass are summarized.

Year	**Total *n* stomachs processed that year**	**Location**	**Consumer Species containing forage fish taxa**	**Prey present in stomach**	***n* prey individuals**	**% of total gut contents**
2017	55	Argo Bay	shorthorn sculpin	Pacific sandlance	1	19.8
			shorthorn sculpin	Pacific sandlance	1	14.9
			shorthorn sculpin	Pacific sandlance	1	100
			shorthorn sculpin	Pacific sandlance	1	100
2018	37	Argo Bay	Arctic char	Pacific sandlance	1	16.9
			Arctic char	Pacific sandlance	8	14.8
			Arctic char	capelin	1	14.4
			Arctic char	capelin	3	100
			starry flounder	Arctic cod	1	45.2
2019	60	Argo Bay	starry flounder	Pacific sandlance	3	52.7
			starry flounder	Pacific sandlance	9	40.5
			starry flounder	Pacific sandlance	4	52.2
			starry flounder	Pacific sandlance	1	59.8
2020	80	Argo Bay	starry flounder	capelin	2	61.1
			starry flounder	capelin	2	84.3
			starry flounder	Pacific sandlance	2	50.8
			starry flounder	capelin	3	79.7
			starry flounder	Pacific sandlance	1	48.1
			Arctic char	Pacific sandlance	4	35.0
			Arctic char	Pacific sandlance;capelin	1;1	1.7;64.2
			shorthorn sculpin	Pacific sandlance	1	16.1
2021	83	Argo Bay	Arctic char	capelin	10	39.2

Juvenile fishes are an important prey base for predatory fishes, and serve a similar functional role as other forage fish species. Although details on the contribution of young-of-year fishes to coastal fish diet are not presented here, their importance as a prey base to anadromous fishes such as Arctic char is recognized. Young-of-year saffron cod and broad whitefish recorded in high abundance during the 2016 coastal survey, in the inshore areas of Argo Bay (McNicholl et al. 2017a). Throughout years of sampling, there were many cases of unidentifiable fish remains present in the stomachs of Argo Bay fishes, and it is possible that such early life history fishes contributed to the diet of higher-trophic predators.

Anadromous fish relative abundance, habitat use, and population structure

Arctic char and broad whitefish were represented each year of sampling in the ANMPA between 2017 and 2021. Both species were more abundant in Argo Bay relative to Bennett Point among sampling years, and local knowledge indicates that both were observed at Tippi during these years of sampling (Table 5).

Table 5. Proportion of Arctic char and broad whitefish relative to all other species captured during that season.

Year	**Location**	***n* total catch**	**Arctic char *n* (%)**	**broad whitefish *n* (%)**
2017	Argo Bay	1613	9 (< 0.5%)	62 (3.8%)
2018	Argo Bay	566	22 (3.5%)	102 (18.0%)
2019	Argo Bay	185	4 (2.2%)	5 (2.7%)
	Bennett Point	370	1 (0.3%)	0
2020	Argo Bay	146	8 (5.5%)	36 (24.7%)
	Bennett Point	101	0	0
2021	Argo Bay	370	13 (3.5%)	69 (18.6%)

The habitat preferences of Arctic char and broad whitefish are consistent with previous years of sampling in that they may tolerate a relatively wide temperature and salinity range, but are only caught in inshore areas of the ANMPA. In Argo Bay field programs carried out in the summers of 2017 through 2021, Arctic char were captured at depths < 4 m, at temperatures between 5.9 and 11.3°C, and salinities between 8.1 and 27.7 PSU. There was only one record of an Arctic char at Bennett Point between 2017 and 2021. This individual was caught at a depth of 6.7 m, during a set where the average (+/- SD) temperature and salinity were 5.0 +/- 0.1°C and 26.7 +/- 0.0 PSU respectively. Broad whitefish was only captured in Argo Bay between 2017 and 2021, and were not observed during the surveys at Bennett Point. Their habitat preferences were similar to those previously documented (McNicholl et al. 2020), such that they were only caught in shore-based nets set at < 4 m depth, when temperatures were between 5.9°C and 11.3°C. The maximum salinity for broad whitefish was recorded at 27.7 PSU in the summer of 2019.

Basic biological data was collected from Arctic char between 2017 and 2021. Life history information compiled between 2017 and 2021 and summarized in figures 36 and 37. Figure 36a provides counts of the ratio of male char (*n* = 18) to female char (*n* =20) collected in Argo Bay. The fork length data presented in Figure 36a for Arctic char do not suggest a dominant size class among the individuals captured, but do represent a relatively wide range of sizes (155 to 774 mm). There was a relatively low number of fish aged in this study (*n* < 100), and therefore difficult to distinguish any distinct age classes or average maximum length-at-age based on the individuals provided. There was a range of ages observed (Figure 36a) among the individuals processed (age 3+ to 12+), accounting for smaller individuals that are not often targeted for subsistence. Among these individuals the mean fork length (± SD) was 426.8 ± 120.5 mm, and mean mass (± SD) was 946.5 ± 828.6 g. Arctic Coast surveys conducted in the ANMPA between 2012 and 2016 collected fewer Arctic char (*n* = 5), with a mean fork length (± SD) of 565.3 ± 166.0 mm and were between the ages of 5+ and 11+ (McNicholl et al. 2017a).

Basic biological data were collected from broad whitefish between 2017 and 2021 (*n* =115) in Argo Bay (Figure 36b). The results presented in Figure 36b indicate that males made up 63.5% (*n* = 73) of the total number of individuals (*n* = 115), whereas females made up 36.5% (*n* = 42). The fork length distribution of these broad whitefish indicate comparable sizes between males and females, with the majority of individuals between 450 and 550 mm, and an absolute range of 385 to 660 mm. Among these individuals, the mean fork length (± SD) was 472.8 ± 62.5 mm, mean mass (± SD) was 1294.2 ± 497.3 grams. Figure 37b summaries the ages of all broad whitefish collected between 2017 and 2021, relative to their fork length. The broad whitefish aged among the 2017 and 2021 programs were between 2+ and 25+ years old. Efforts from previous years found the maximum age of broad whitefish to be 20+ (McNicholl et al. 2017a), therefore we provide an update here to the maximum age of ANMPA broad whitefish. The maximum age at length for this species was between 450 and 550 mm fork length for the individuals measured during these years, which remained consistent from broad whitefish collected during the 2012-2016 field programs (McNicholl et al. 2017a).

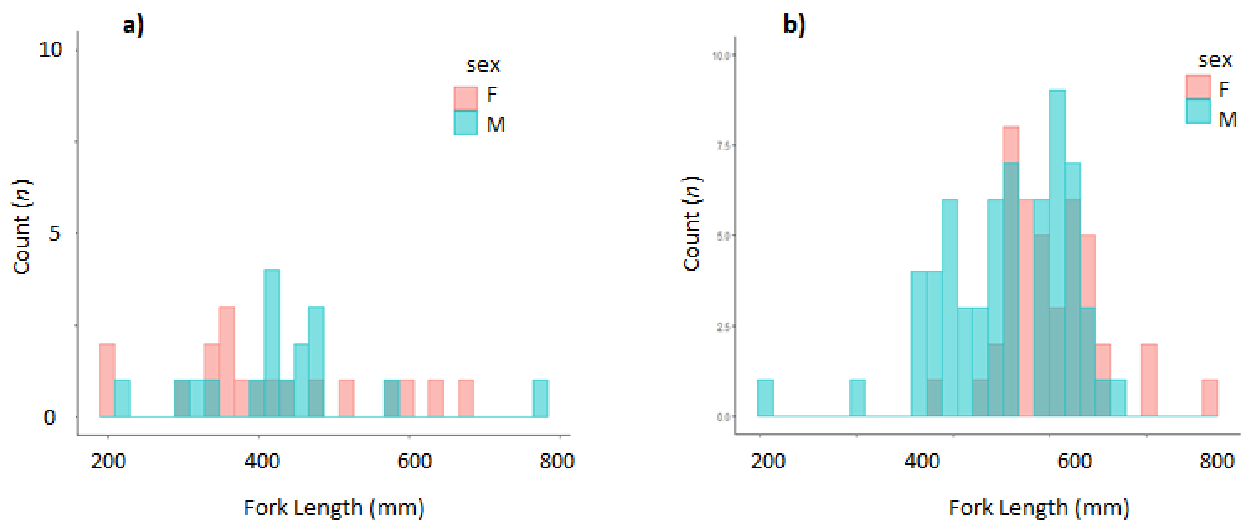

Figure 36. Frequency of Arctic char (a) and broad whitefish (b) size classes captured in Argo Bay among 2017-2021 field programs. Histograms are separated by sexes for both Arctic char (*n* = 37) and broad whitefish (*n* = 115).

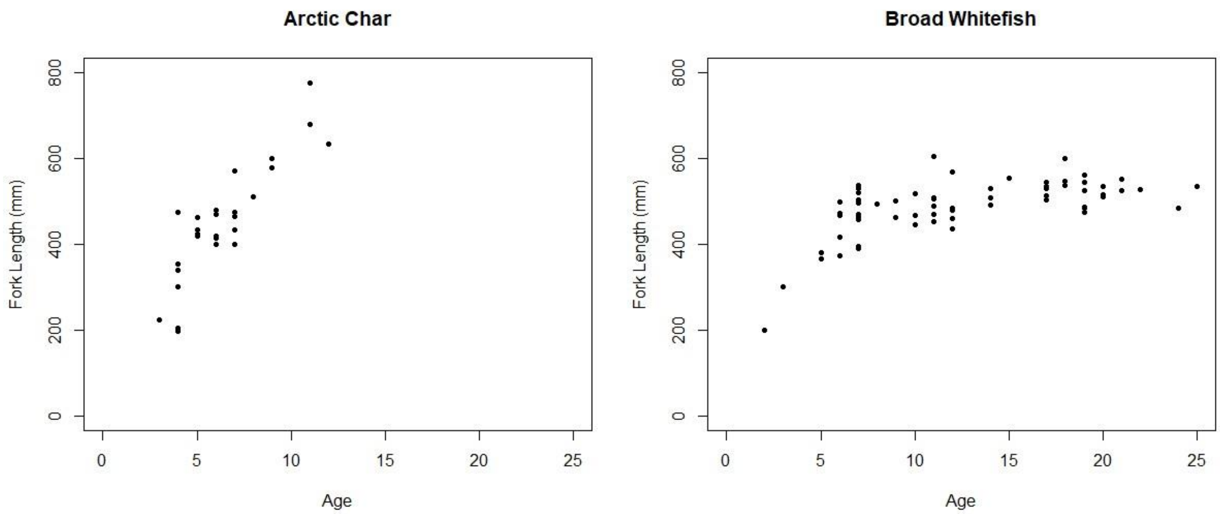

Figure 37. Age versus fork length of (a) Arctic char (n = 37) and (b) broad whitefish (n = 115) captured in Argo Bay among 2017-2021 field programs.

The diet of ANMPA Arctic char was examined using a combination of stomach contents and stable isotope ratios between 2017 and 2021. The results of their stomach contents indicate that fishes and larger pelagic invertebrates (i.e., amphipods) had the greatest contribution to diet. Stomach content data specific to forage fishes is summarized in section 3.2.5 (capelin and Pacific sandlance), though not all fish could be identified to species level in their contents. Figure 38 summarizes the percent contribution of all prey taxa, based on wet weight of individual prey taxa relative to total stomach content weight of the Arctic char processed between 2017 and 2021. Among years of sampling there were few char stomachs that were full (n = 24), therefore the percent contribution of prey wet weight to total weight of contents was summarized here for all years. Capelin made up the largest contribution to Arctic char diet, particularly in 2018 and 2020, while other prey taxa such as amphipods and other fishes (including sandlances) were found in stomach contents consistently among sampling years.

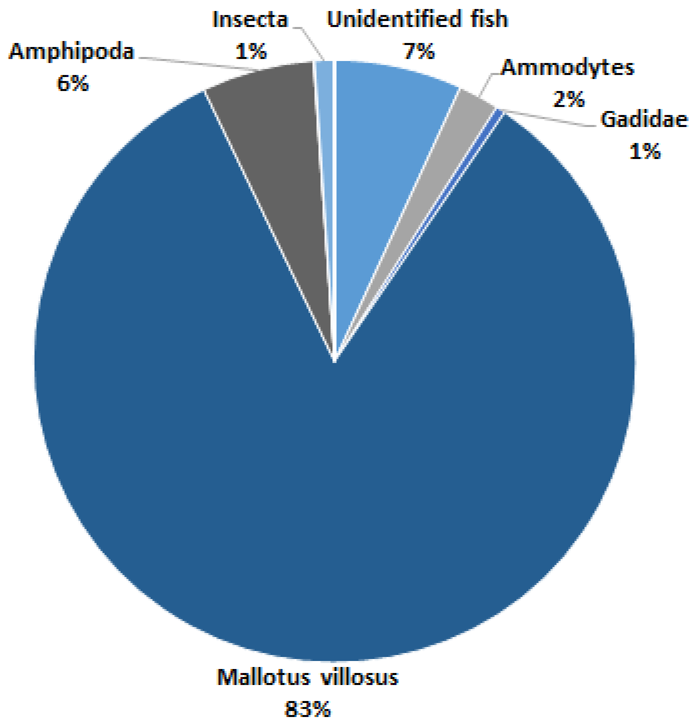

Figure 38. Percent contribution of prey items to stomach contents of Arctic char collected between 2017 and 2021 (*n* = 24). Prey items that represented < 2% of total contribution to diet were excluded, but can be found in Appendix F.

Stable isotope data collected from the same individuals showed a wide range of $\delta^{13}C$ and $\delta^{15}N$ ratios, likely a result of different size classes captured (Figure 39). These ratios represent diet synthesized into muscle tissue over approximately 30 days (Fry, 2007), and therefore reflective of prey consumed early in the summer (June-July). Mean $\delta^{13}C$ (-23.41 $\pm$ 1.49 ‰) among all Arctic char examined here indicates marine-based prey items make up a substantial contribution to diet, evidenced by low $\delta^{13}C$ ratios. Mean $\delta^{15}N$ (12.69 $\pm$ 2.52 ‰) and wide range of $\delta^{15}N$ ratios collected from Arctic char suggests that some individuals are occupying a different trophic position than others. Generally, $\delta^{15}N$ ratios increase with fork length of the Arctic char examined in this study, such that smaller individuals were foraging at a lower trophic level relative to larger ones (Figure 40).

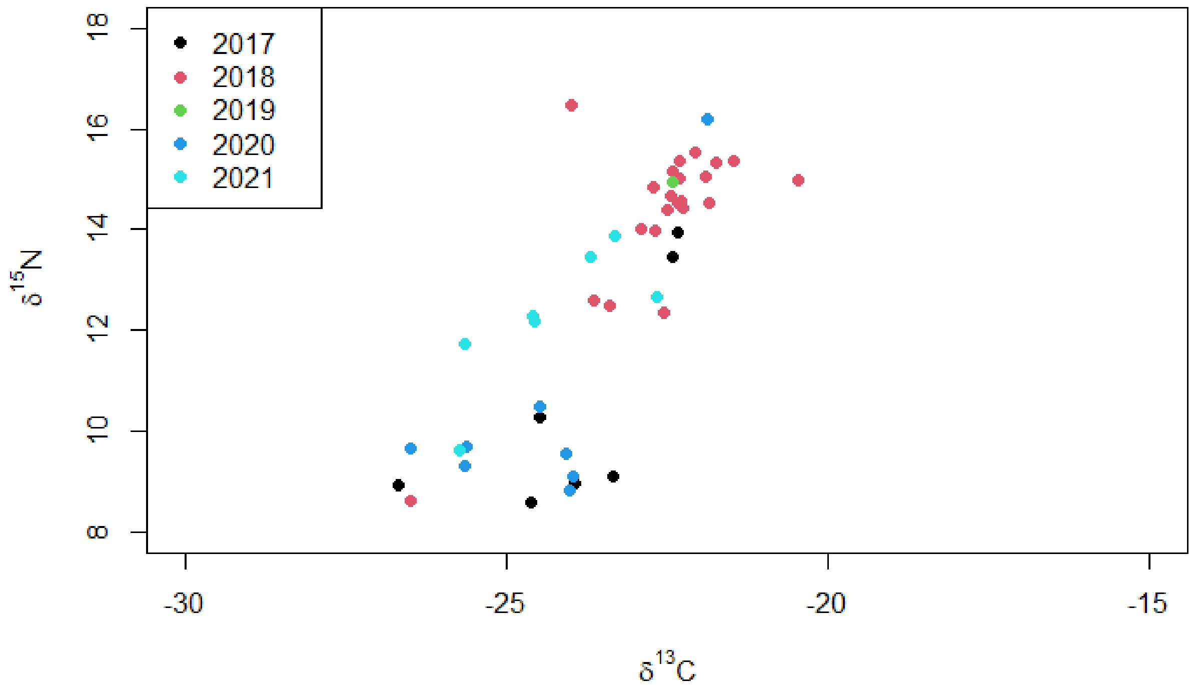

Figure 39. Stable isotope ratios of δ^{13}C and δ^{15}N obtained from Arctic char muscle tissue in the summers 2017 (n = 7), 2018 (n = 22), 2019 (n = 1), 2020 (n = 8) and 2021 (n = 7).

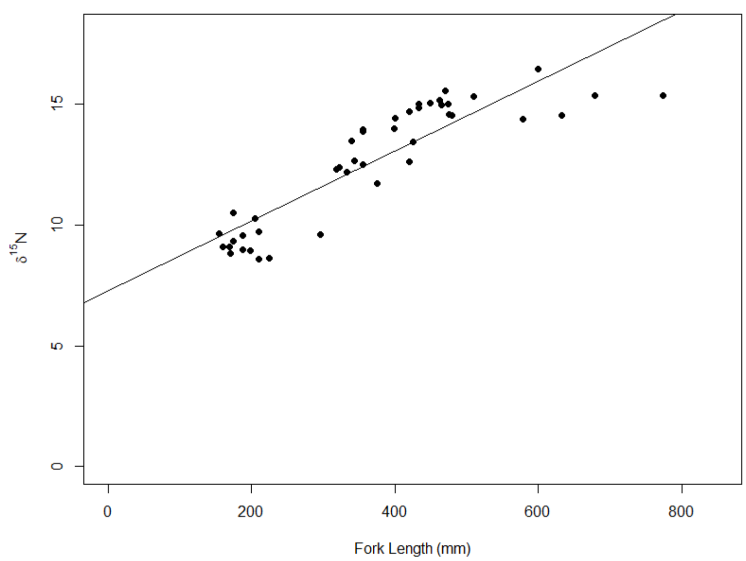

Figure 40. Relationship between δ^{15}N (‰) and fork length of Arctic char that were sampled between 2017 and 2021 in Argo Bay.

The diet of broad whitefish in Argo Bay was examined using a combination of stomach contents and stable isotope data collected from individuals between 2017 and 2021. Figure 41 summarizes the percent contribution of the wet weight of each prey taxa to diet among all individuals collected. Relative to other coastal fishes, flies (Diptera *spp.*) made up a substantial proportion of the total wet weight of stomach contents analyzed. Freshwater invertebrates, namely chironomids, were consistently present in the stomach contents of whitefish among sampling years, while marine invertebrates were also present (e.g., amphipods, bivalves, copepods). The relatively even proportions of marine and freshwater associated prey resulted in a very diverse list of prey items found in the stomachs of broad whitefish.

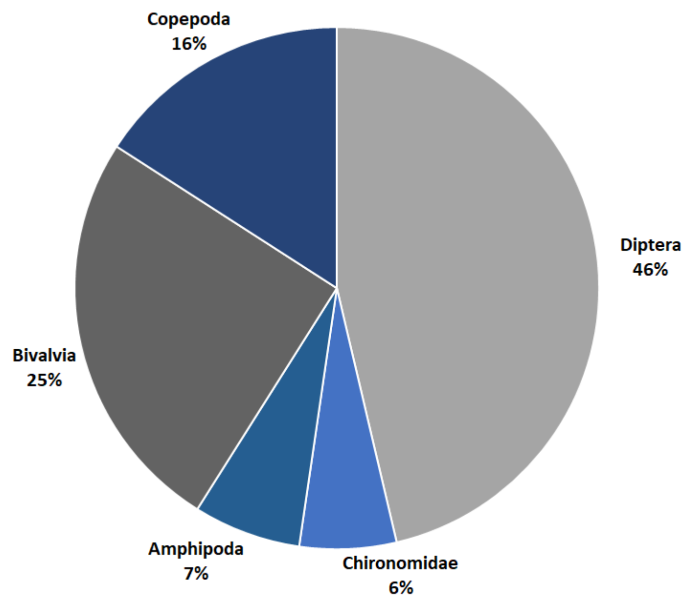

Figure 41. Percent contribution of prey items to stomach contents of broad whitefish collected between 2017 and 2021 (n = 24). Prey items that represented < 2% of total contribution to diet were excluded, but can be found in Appendix F.

The breadth of prey sources is also reflected in the wide $\delta^{13}C$ range obtained from these individuals (-27.9 to -17.9 ‰), with a mean ($\pm$SD) of -23.91 $\pm$ 2.20 ‰ (Figure 42). These results suggest that broad whitefish in Argo Bay utilize both freshwater and marine associated prey, potentially moving in between both habitats throughout the summer season. The stable isotopes reflect a period of approximately 30 days of feeding, and despite some variation of catch date, there does not appear to be a significant difference in $\delta^{13}C$ values among years. The mean $\delta^{15}N$ ($\pm$ SD) of 8.58 $\pm$ 0.72 ‰ suggests that all individuals examined in this study fed a similar trophic position, given the relatively low variability in $\delta^{15}N$ values. Unlike Arctic char, the broad whitefish examined in Argo Bay did not show a dramatic shift in $\delta^{15}N$ ratios in response to increasing size. This is supported by the stomach contents, which suggests that freshwater invertebrates (i.e., Diptera *spp*. and chironomids) and pelagic zooplankton (i.e., amphipods and copepods) are the primary prey items for broad whitefish throughout their life history.

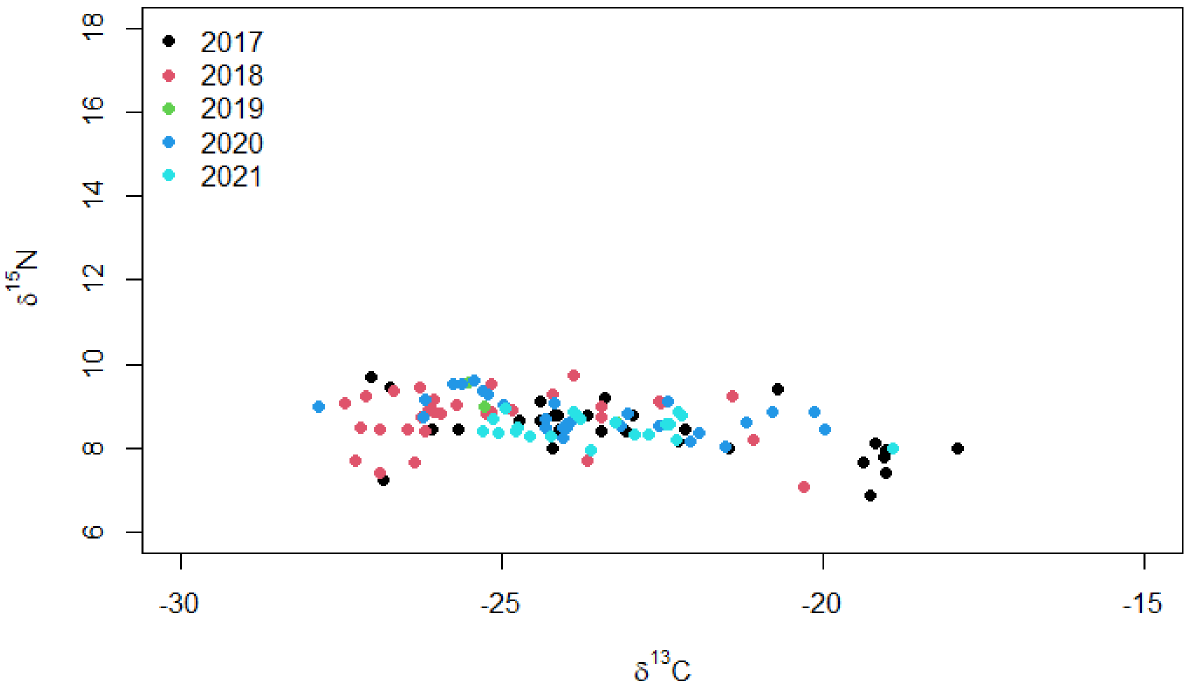

Figure 42. Stable isotope ratios of $\delta^{13}C$ and $\delta^{15}N$ obtained from broad whitefish muscle tissue in the summers of 2017 (n = 29), 2018 (n = 32), 2019 (n = 3), 2020 (n = 30) and 2021 (n = 22).

Occurrence and timing of potentially colonizing species

There were no records of potentially colonizing species documented among the 2017 through 2021 Arctic Coast field programs. However, the environmental information gathered throughout field programs in the nearshore may be useful for assessing potentially suitable habitats and for monitoring the movement and distribution of potentially colonizing species (i.e., Pacific salmon) in future years.

4.0 DISCUSSION

The Arctic Coast community-led field program has evolved from initial baseline research conducted prior to the establishment of the ANMPA (McNicholl et al. 2017a), into a continually expanding community-led monitoring program. Our aim in this report is to present coastal ecological data spanning across five years, in open water and ice-covered seasons, and to integrate knowledge among trophic levels and habitat associations using the indicators identified for the MPA (Ehrman et al. 2022). Over time, standardized monitoring protocols have been tested and integrated into a core monitoring program used by community partners. While these protocols are used to gather key ecological data on indicators each year (i.e., biodiversity of fishes, temperature and salinity data, ice thickness), there have also been opportunities to advance research, in addition to monitoring, to better understand the drivers of observed changes.

Since the development of the Arctic Coast program, additional sites were included, more extensive collections of lower trophic species (i.e., benthic epifauna, plankton) were completed, and habitat data collections was expanded in the summer and winter months through increased effort and number of community monitors trained.

4.1 Environmental Indicators

Environmental indicators including oceanography, ice phenology (ice and snow), and benthic habitat are the core components of coastal ecology, and influence every aspect of marine life in the coastal habitat. These parameters dictate the habitat preferences of species, and drive interactions within and among trophic levels. An understanding of these components and their temporal and spatial variability is necessary in order to manage and conserve the marine life that is present.

4.1.1 Core oceanography

Information on core oceanography in Darnley Bay and adjacent Amundsen Gulf has been gathered intermittently over several decades (Ehrman et al. 2022). The information presented in this report provides more focused information on the nearshore environment that has been largely understudied leading up to the designation of the ANMPA. Previous surveys have indicated a distinct environmental change from the northern end of Cape Parry that is influenced more by Amundsen Gulf, relative to the warmer more sheltered environment at the southern end of Darnley Bay (McNicholl et al. 2017a). The results of the data presented here provide additional information to support this diversity of habitats, such that the habitat south of Bennett Point is influenced more by nearby rivers and lakes, relative to the nearshore environment north of Bennett Point where there are fewer linkages to the freshwater environment and greater influence from marine waters of the Amundsen Gulf.

Based on the difference between the 2020 and 2021 Argo Bay mooring data, there appear to be considerable changes in the water column during the summer to fall seasonal shift. Further research is needed to determine the extent of mixing within Argo Bay especially in the fall, and if this also occurs in other parts of the ANMPA such as Bennett Point and Brown's Harbour. Based on observations made by the field leads, winds were much stronger in August and September (typically gusting to 50km/hr) relative to July, and at depths < 10 meters, it is likely that this contributed to the homogeneous temperature at the mooring site.

There was an unexpected difference between bottom temperatures recorded by the HOBO U22 loggers and the Seametrics® CT2X loggers in Argo Bay in 2020 and 2021. It is likely that the sensor of the CT2X logger was buried in sediment on these occasions, preventing an accurate water temperature reading. This was most apparent in Argo Bay in 2021 (Figure 14) where the CT2X logger records were substantially colder than the HOBO loggers, and displayed minimal variation. In September of 2021 the temperature recorded by the CT2X loggers was more comparable to the HOBO loggers, suggesting that the temperature recorded in August of that year did not reflect water temperature. Modifications to the moorings in future deployments are required to prevent variation in data caused by mooring lines that are too long for the station, and sensors reading temperature of the sediment rather than water temperature. Consistent calibration of each logger following use in the field will also contribute to more accurate readings.

Oceanographic data from the winter months gathered among the 2019-2021 field programs represents an important baseline for a time of the year that is largely understudied throughout the Arctic. Through a collaboration with the CROW program, the Arctic Coast survey was able to successfully collect data at the same locations in the summer and winter months that may be used to determine the extent of temporal variability in the nearshore environment.

4.1.2 Ice and snow

Understanding the dynamics of ice and snow were piloted and incorporated into the long-term monitoring objectives of the Arctic Coast program in 2019, and have continued to be community-led in the ANMPA. These aspects of the environment influence productivity, and migratory species such as beluga and anadromous fishes. Snow and ice dynamics are also a safety concern for the community of Paulatuk for traveling on their traditional hunting and fishing grounds. Monitoring changing ice and snow is necessary for understanding the rate of change in the coastal environment. Information gathered among winter programs can be used to complement ongoing programs including CROW, and provide ground-truthing to sea ice analyses at a larger scale that are limited to satellite data alone.

Among years of sampling, ice thickness was generally higher at Bennett Point and Brown's Harbour relative to Argo Bay. The maximum ice thickness among the 2019, 2020 and 2021 sampling years was recorded at Bennett Point (160 cm) on March 1st 2020 and minimum thickness was recorded in Argo Bay (74.5 cm) on January 17th, 2019. Bennett Point and Brown's Harbour are exposed more to large pans of ice pushing up against the nearshore environment from Amundsen Gulf, relative to Argo Bay at the southern end where it is shallower and more sheltered. Maximum snow depth among 2019 (31.0 cm), 2020 (16.0 cm) and 2021 (14.0 cm) sampling years was observed in Argo Bay for each year of sampling. There are significant knowledge gaps with respect to snow and its influence on ice phenology in the ANMPA, which require further baseline studies.

Timelapse images provided insight into the dynamics of ice breakup date and variation between the southern (Argo Bay) and northern (Brown's Harbour) regions of the ANMPA. Between the initial deployment date in 2019 to 2021, the optimal positions of the cameras were determined in order to best record images of the study sites. Given that the scale at which the cameras record break-up and freeze-up date is small, it is not interchangeable with the break-up/freeze-up described in (Gully et al. 2023). These images, however, may be used to ground-truth satellite images of Darnley Bay sea ice concentration and extent in future analyses. These images complement ongoing research in the area and link more broadly to understanding sea ice change in the ANMPA (Gully et al. 2023).

4.1.3 Benthic habitat

The primary objectives of sampling the benthic habitat and associated epifauna were to test protocols, gather baseline data on habitat types and determine the equipment best suited for multi-year community-led monitoring. By 2021, enough samples had been gathered in order to select specific sites for monitoring to maximize spatial coverage, and overlap among sampling years.

Following the 2021 sampling year, a protocol and sites for repeated sampling were developed and incorporated into the long-term sampling plan for the Argo Bay crew. The objective is to collect samples from five sites in Argo Bay (sediment, and invertebrates) using the petite ponar grab and monitor the composition of benthic biodiversity, and potential change in the sediment size and class. Both components serve as a valuable indicator of ecological change with respect to the coastal food web, and the impacts of erosion to the nearshore environment.

4.2 Biological and food web integrity indicators

4.2.1 Zooplankton

Baseline information on nearshore zooplankton biodiversity was successfully piloted in 2019 at Bennett Point, and repeated in 2020. It was not possible in this report to examine baseline stable isotope values in this report; these data will contribute to future publications that examine the food web more closely. The combination of information gained from stomach content analyses from fish stomachs, and baseline information on pelagic biodiversity obtained from plankton tows, can be used to address knowledge gaps related to the coastal food web.

4.2.2 Benthic epifauna

The varying methods used among the 2017-2021 sampling years served as an opportunity to trial different sampling methods, and gather baseline data on benthic epifauna such that a protocol could be developed for long-term monitoring. Given that different gear types were used in the results presented here (dredge and ponar grab), it is difficult to make conclusive statements regarding the temporal differences in species composition. Although the 2017 year was dominated by comb worms (*C. granulate*) it is likely a reflection of the dredge scraping the surface of the sediment where the worms reside. This is a different result from the subsequent sampling years in 2020 and 2021, where the bivalve *M. calcarea* was the most abundant species, which are found deeper in the sediment and more easily collected with a ponar grab. The results from the 2020 and 2021 sampling seasons will serve as a baseline for the biodiversity of benthic epifauna in Argo Bay, as well as the basis for standardized sampling using a ponar grab in future community-based monitoring efforts with Arctic Coast.

4.2.3 Fishes

Among the summer sampling seasons presented here, biodiversity was greatest in Argo Bay, relative to Bennett Point. The total number of species observed was highest in the 2019 Argo Bay season, where fourteen species were observed, which was considerably higher than the eight species observed at Bennett Point during the same season. Occasional rare occurrences such as the Bering wolffish, banded gunnel and lake whitefish, indicate that there are likely to be other rare species that have not been documented in the ANMPA, particularly those not targeted for subsistence.

After protocols were developed in 2017 for consistent sampling, the abundance of fishes was comparable among subsequent years of sampling. There is an exception with 2018 in which Arctic flounder and starry flounder were substantially abundant (n = 365 in total) in Argo Bay, relative to 2019, 2020, and the programs conducted in 2021. Similarly in years where spawning shoals of capelin were captured, such as in 2019 at Bennett Point, the total number of fishes captured during that season were relatively higher compared to other years where capelin were not captured.

Biodiversity and abundance of fishes varied spatially and temporally among years of coastal sampling within the ANMPA. Total biodiversity was highest in Argo Bay during the July 2019 survey in which fourteen species were documented, and total abundance was greatest in 2017 where *n* = 1613 fishes were captured; however, this was largely the result of piloting different sampling gear and the presence of capelin. Given that a greater number of species were observed with standardized gillnet and seining in 2019, compared to 2017, it does not appear that the change in effort and gear type used in baseline assessments is under-representing observed biodiversity in Argo Bay. Biodiversity and abundance of fishes was lower at Bennett Point overall, relative to Argo Bay. This is consistent with previous sampling programs conducted in 2014 and 2015 at Bennett Point (M^{c}Nicholl et al. 2017a).

Biodiversity and abundance was lowest during the ice covered months relative to the open water season. This could be in part to differences in gear type given that only hook and lure (jigging) are used during the ice-covered period. The difference in biodiversity may also be because anadromous species are not present in coastal environments during the ice covered season and some marine species are overwintering in deeper-water (Coad and Reist 2018).

The seasonal and spatially differences in the fish community indicate that the habitat use and biodiversity in the ANMPA is highly dynamic throughout the year. Monitoring during both open water and ice-covered seasons is necessary to understand the conditions required by species and to monitor for change.

Key forage fish relative abundance and biomass

The spawning characteristics of capelin can provide an indication whether peak spawning has occurred, and the duration of a spawning period. Capelin form sex-specific aggregations, such that males separate from females prior to spawning and move into inshore areas and wait until conditions are optimal to release eggs (Davoren et al., 2006). Typically if the proportion of males is greater than the number of females observed, it is likely that peak spawning has not yet occurred, yet if the number of females observed is greater or equal to the number of males, it is likely that peak spawning is underway.

Since the proportion of males was greater in Argo Bay in 2017, it is possible that peak spawning had not yet occurred and females could still be aggregating offshore. Given the regional differences among spawning shoals within the ANMPA, the time and duration of spawning likely varies among sites. In the 2014 and 2019 seasons, it is possible that capelin were within or near peak spawning season at Bennett Point given the number of females was greater than the males that were accounted for in the shoal. This is expected in response to environmental differences between the northern end of the MPA (colder, more saline, bedrock) and the southern end (warmer, less saline, sandy substrates). The sandy substratum, and warmer conditions in Argo Bay are generally more preferable for egg development, therefore it is possible that the capelin spawning season is longer in the south of the ANMPA relative to the northern edge of Cape Parry. Further efforts and observation are required in order to better understand spawning characteristics of capelin within the ANMPA, and if their behaviour differs from that of southern populations.

Substantive knowledge gaps still remain with respect to Pacific sandlance. They are a benthic dwelling species, known to bury themselves in soft sediments to escape capture. This made collection of these species difficult with the seine nets or gillnets used, despite mesh sizes small enough to collect them. Future studies directed at collecting sandlance are needed in order to better understand their life history and habitat preferences in Darnley Bay.

Anadromous fishes

The results summarized here provide information on ANMPA anadromous fish habitat use and diet within the ANMPA, which were identified as the primary knowledge gaps the CSAS process held in 2020 (Ehrman et al. 2022). The diet of Arctic char and broad whitefish require further analyses in order to determine year-to-year variation and the extent of trophic interactions with other species, using both stomach contents and stable isotopes. The dietary information provided here indicates unique foraging behaviours for Arctic char and broad whitefish that should be explored in greater depth. Further monitoring and application of environmental data will provide a more comprehensive investigation of habitat use that can be applied more broadly to the conservation objectives established for the ANMPA.

Relative to the Arctic char stock assessment program in Darnley Bay (Gallagher et al., 2017), substantially fewer Arctic char were processed for analyses (n < 30 per year) from the Arctic Coast program, yet the data that were obtained are useful for understanding individuals present in the ANMPA given much of the knowledge of Arctic char in Darnley Bay has been gathered from outside of the MPA. The relatively equal proportion of males to females in this sample size differs from char collected for stock assessment, where males typically outnumber females (Gallagher et al., 2017), however, given the small sample size it is not possible to make any substantive claims specific to sex ratio.

Potentially colonizing species

As of 2019, Pacific salmon have been documented in freshwater locations connected to the ANMPA by local fishers and are likely transiting through the MPA in the fall (Dunmall et al., 2021; Chila et al., 2022). Many knowledge gaps still exist with respect to habitat use and requirements of salmon in the Darnley Bay area, as well as their possible interactions with co-occurring species. The information gathered by the Arctic Coast monitoring program will provide a baseline for how endemic fishes might respond to an increasing presence of salmon in future years. Specific information of the state of ANMPA fish biodiversity, including fishes collected in this program are summarized in McNicholl et al., 2020, while the interpretation of the unusual occurrences of the Bering wolffish and banded gunnel are discussed in McNicholl et al., 2021.

4.3 Connectivity Among Indicators and Programs

Indicators are necessary in order to document change in Arctic coastal environments, and require extensive baseline research and monitoring across habitats and trophic levels. The indicators summarized in this report were identified by key stakeholders in DFO, academia, and co-management partners including the PHTC (Ehrman et al., 2022). Although there have been many years of sampling with respect to Arctic Coast, and many other DFO and community-led field programs in the ANMPA since its establishment, there have been few dedicated specifically to synthesizing information across trophic levels and seasons in order to interpret the difference between large scale ecological change and natural variability.

Understanding observed changes or trends in monitoring MPAs, such as the ANMPA, comes from linkages among programs. Monitoring one indicator is not enough to capture the complexity of a changing environment in response to a stressor as ubiquitous as climate change. Data available in reports such as this must be used to draw correlations among existing and future programs, and examine drivers of change in a wider context. Greater understanding of ecological change will come from research and monitoring among connected sites, at a spatial scale that is larger than the ANMPA alone. Connecting indicators among programs (DFO, academia, community-led) will require frequent review as more information is gathered over time and during a time where Arctic coastal habitats are changing at an accelerated rate (Huntington et al., 2020; Ehrman et al., 2022).

4.4 Key Synergies and Efficiencies for Sampling Programs

4.4.1 Community leadership

The iterative process in which the Arctic Coast research program was developed with the PHTC, is a unique relationship between DFO Science and co-management partners to support research and monitoring in an MPA. Consultations with the PHTC and co-management partners allowed for research objectives to be framed around a community concern, baseline research programs would be reviewed by the PHTC, and if approved, pilot studies could be conducted. The collaboration among DFO Science, academics, community-based technicians and the PHTC in the development of a long-term monitoring program allowed for input to be given at every stage of the program. This included the concern itself, sampling locations, frequency of sampling, methods for sampling, and resulting interpretation of data. Because of this relationship, the project has grown over the years to not only determine baseline coastal biodiversity and habitat characteristics, but their respective natural variability, such that indicators of change may be identified and parameters best used to monitor them may be selected. Additionally, this program has highlighted community leadership whereby the community-based technicians are training new technicians. This leadership was highlighted in 2020-2021 when DFO staff were not able to travel due to COVID-19 restrictions.

5.0 CONCLUSION

The continuity of coastal monitoring in the ANMPA has been an essential component of developing standardized protocols in order to assess coastal ecological trends in the region. The knowledge gained with respect to the environmental and ecological indicators summarized in this report could not have been possible without the dedication of field crews and the guidance of co-management partners. Baseline data presented here serves as a foundation to address questions raised by the community of Paulatuk, and determine the most effective parameters to monitor change in the ANMPA, and more broadly among coastal communities in the Canadian Arctic.

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APPENDIX A – Biological data of fishes

Table A1. Basic biology of fishes captured among 2017-2018 Arctic Coast summer field programs. Mean total length includes individuals dissected and live released in the field; mass data were obtained from dissected individuals (total, liver, gonad); where $n \leq 2$ individuals were captured the range of values is shown instead of the mean.

Year	Date Range	Location	Species	*n* total (live released)	Mean age ± SD	Mean total length ± SD (mm)	Mean mass ± SD (g)	Liver mass ± SD (g)	Gonad mass ± SD (g)
2017	July 5th - 13th	Argo Bay	capelin (*Mallotus villosus*)	658 (0)	n/a	162.2 ± 10.8	27.0 ± 6.2	0.5 ± 0.2	2.9 ± 2.6
			Arctic flounder (*Liopsetta glacialis*)	561 (529)	6.6 ± 4.0	192.7 ± 55.6	103.3 ± 94.7	1.9 ± 1.6	3.9 ± 4.5
			starry flounder (*Platichthys stellatus*)	110 (85)	5.6 ± 4.4	201.3 ± 73.3	144.5 ± 153.2	3.4 ± 3.0	4.4 ± 6.4
			broad whitefish (*Coregonus nasus*)	62 (33)	10.0 ± 6.3	460.5 ± 100.1	1171.2 ± 577.9	15.0 ± 9.7	35.7 ± 48.7
			saffron cod (*Eleginus gracilis*)	57	2.2 ± 2.1	133.6 ± 118.6	68.4 ± 134.9	8.5 ± 4.0	4.1 ± 2.8
			shorthorn sculpin (*Myoxocephalus scorpius*)	40	3.9 ± 1.4	234.2 ± 66.0	174.0 ± 116.1	6.3 ± 5.5	4.6 ± 4.4
			Fourhorn sculpin (*Myoxocephalus quadricornis*)	15	4.5 ± 1.5	233.7 ± 33.9	121.3 ± 63.6	3.3 ± 2.1	2.2 ± 2.3
			Arctic char (*Salvelinus alpinus*)	9 (2)	4.6 ± 2.0	284.4 ± 138.7	375.3 ± 694.9	7.7 ± 13.6	26.1 ± 51.0
			Arctic cisco (*Coregonus autumnalis*)	7 (2)	5.0 ± 0.0	416.1 ± 17.5	765.8 ± 45.0	9.7 ± 2.3	4.2 ± 3.0
			Pacific herring (*Clupea pallasii*)	7	9.0 ± 1.8	323.3 ± 22.1	278.0 ± 60.5	3.3 ± 1.0	17.5 ± 15.3
			Arctic staghorn sculpin (*Gymnocanthus tricuspis)*	4	6.5 ± 4.0	162.0 ± 58.2	58.3 ± 49.2	2.0 ± 1.3	1.3 ± 0.9
			Arctic shanny (*Stichaeus punctatus*)	1	2	65.0	1.2	<0.1	<0.1
2018	July 3rd – 18th	Argo Bay	Arctic flounder (*Liopsetta glacialis*)	246 (214)	8.8 ± 2.3	234.8 ± 45.7	257.2 ± 88.7	10.0 ± 0.0	9.6 ± 1.8
			starry flounder (*Platichthys stellatus*)	119 (88)	8.0 ± 1.9	255.8 ± 37.9	256.8 ± 85.0	n/a	n/a
			broad whitefish (*Coregonus nasus*)	102 (70)	13.8 ± 5.4	499.2 ± 70.7	1578.9 ± 541.6	27.5 ± 12.6	57.3 ± 45.1
			shorthorn sculpin (*Myoxocephalus scorpius*)	30	4.4 ± 1.8	257.7 ± 51.7	195.4 ± 97.4	n/a	n/a
			capelin (*Mallotus villosus*)	32 (1)	3.3 ± 0.5	153.4 ± 6.8	23.3 ± 2.6	0.2 ± 0.0	0.6 ± 1.3
			Arctic char (*Salvelinus alpinus*)	22	6.6 ± 2.5	493.5 ± 129.6	1086.9 ± 923.2	27.4 ± 25.8	14.31 ± 7.8
			Arctic staghorn sculpin (*Gymnocanthus tricuspis)*	5	3.0 ± 0.0	128.2 ± 17.9	25.5 ± 12.8	0.7 ± 0.6	0.8 ± 0.5
			Pacific herring (*Clupea pallasii*)	5	5 ± 0.0	329.5 ± 20.5	300.0 ± 45.5	n/a	30.0 ± 0.5
			saffron cod (*Eleginus gracilis*)	3	9.3 ± 2.5	405.7 ± 38.4	423.3 ± 135.8	n/a	n/a
			Arctic cisco (*Coregonus autumnalis*)	2	4 - 5	353.0 – 408.0	360.0 – 700.0	n/a	n/a
			fourhorn sculpin (*Myoxocephalus quadricornis*)	1	5	230.0	90.0	n/a	n/a

Table A2. Basic biology of fishes captured among 2019 Arctic Coast field programs. Mean total length includes individuals dissected and live released in the field; mass data were obtained from dissected individuals (total, liver, gonad); where $n \leq 2$ individuals were captured the range of values is shown instead of the mean.

Year	**Date Range**	**Location**	**Species**	***n* total (live released)**	**Mean age ± SD**	**Mean total length ± SD (mm)**	**Mean mass ± SD (g)**	**Liver mass ± SD (g)**	**Gonad mass ± SD (g)**
2019	January 17th – March 22nd	Argo Bay	Greenland cod (*Gadus ogac*)	20	n/a	329.9 ± 55.2	502.7 ± 314.4	15.1 ± 16.7	105.2 ± 68.9
			saffron cod (*Eleginus gracilis*)	12	n/a	349.3 ± 46.2	250.8 ± 90.1	4.2 ± 2.7	12.9 ± 16.7
			fourhorn sculpin (*Myoxocephalus quadricornis*)	2	n/a	235.0 - 260	149 - 203	5.2 – 7.3	0.7 – 2.8
			shorthorn sculpin (*Myoxocephalus scorpius*)	1	n/a	242	176	3.4	0.9
		Siulik Lake	lake trout	7	n/a	492.1 ± 95.3	n/a	7.0 ± 3.3	11.1 ± 16.8
	July 13th – July 27th	Argo Bay	Arctic flounder (*Liopsetta glacialis*)	74 (52)	14.0 ± 4.7	237.0 ± 41.5	283.6 ± 70.3	n/a	n/a
			starry flounder (*Platichthys stellatus*)	38 (27)	9.6 ± 6.2	190.3 ± 47.1	213.3 ± 49.2	n/a	n/a
			capelin (*Mallotus villosus*)	12	n/a	n/a	n/a	n/a	n/a
			shorthorn sculpin (*Myoxocephalus scorpius*)	34 (5)	5.2 ± 1.4	279.4 ± 51.3	260.5 ± 154.8	13.5 ± 6.1	14 ± 6.3
			broad whitefish (*Coregonus nasus*)	5	13 ± 6.1	528.6 ± 19.7	1304 ± 264.6	18.0 ± 8.4	53.3 ± 66.5
			saffron cod (*Eleginus gracilis*)	4	7 ± 1.6	373.2 ± 25.3	297.5 ± 26.3	n/a	n/a
			Arctic char (*Salvelinus alpinus*)	4	6 ± 1.4	429 ± 163.0	956.9 ± 888.7	36.7 ± 37.9	n/a
			fourhorn sculpin (*Myoxocephalus quadricornis*)	3	6 ± 0.0	246.7 ± 20.2	168.9 ± 28.3	7.5 ± 4.3	n/a
			Greenland cod (*Gadus ogac*)	4	4.5	328.8 ± 55.4	347.5 ± 198.9	13.3 ± 5.8	n/a
			Arctic cisco (*Coregonus autumnalis*)	2	5 - 14	350.0 - 450	370.0 – 890.0	10.0 – 20.0	n/a
			Arctic staghorn sculpin (*Gymnocanthus tricuspis)*	2	4	141.0 – 150.0	32.5 – 35.1	0.2 – 0.6	0.6 – 0.8
			Pacific herring (*Clupea pallasii*)	1	10	360.0	300.0	n/a	10.0
			Bering wolffish	1	8	501.0	1441.0	68.4	5.9
			lake whitefish	1	7	436	740.0	10.0	n/a
2019		Bennett Point	capelin (*Mallotus villosus*)	251	n/a	162.2 ± 9.0	24.2 ± 4.2	0.2 ± 0.1	3.1 ± 2.9
			shorthorn sculpin (*Myoxocephalus scorpius*)	57 (28)	n/a	255.3 ± 64.2	178.0 ± 147.4	3.5 ± 2.6	9.1 ± 7.3
			Greenland cod (*Gadus ogac*)	52 (22)	n/a	283.5 ± 73.8	340.3 ± 244.1	12.5 ± 6.8	13.8 ± 8.1
			starry flounder (*Platichthys stellatus*)	5	n/a	297.8 ± 69.1	294.0 ± 121.8	n/a	n/a
			Pacific herring (*Clupea pallasii*)	1	n/a	227.0	90.0	< 1.0	< 1.0
			Arctic char (*Salvelinus alpinus*)	1	n/a	640.0	1450	30.0	< 1.0
			Arctic cisco (*Coregonus autumnalis*)	1	n/a	374.0	420.0	< 1.0	< 1.0
			banded gunnel	1	n/a	144.0	8.1	0.04	0.01

First occurrence of a banded gunnel in the ANMPA, individual was frozen and processed at FWI, fishes that had organs < 1.0g in mass could not be accurately weighed in the field and are indicated with a (-). * Capelin were collected in 2019 in Argo Bay but only counted by field crews, therefore there is no corresponding biological data. Lake trout were captured by jigging through an ice hole and were used for subsistence, however length and organ data was obtained.

Table A3. Basic biology of fishes captured among 2020 Arctic Coast field programs. Mean total length includes individuals dissected and live released in the field; mass data were obtained from dissected individuals (total, liver, gonad); where $n \leq 2$ individuals were captured the range of values is shown instead of the mean.

Year	**Date Range**	**Location**	**Species**	***n* total (live released)**	**Mean age ± SD**	**Mean total length ± SD (mm)**	**Mean mass ± SD (g)**	**Liver mass ± SD (g)**	**Gonad mass ± SD (g)**
2020	February 12th – March 23rd	Argo Bay	saffron cod (*Eleginus gracilis*)	11	7.2 ± 2.3	323.7 ± 58.1	233.5 ± 77.7	2.5 ± 2.0	6.4 ± 5.2
			fourhorn sculpin (*Myoxocephalus quadricornis*)	2	6	204.0 – 275.0	83.0 – 220.0	2.0 - 4.4	1.1 – 5.2
				3	6.3 ± 2.1	251.2 ± 50.5	186.5 ± 99.4	2.8 ± 1.9	3.5 ± 3.8
		Bennett Point	shorthorn sculpin (*Myoxocephalus scorpius*)	1	8	215	112	1.4	2.5
	July 15th – July 23rd	Argo Bay	Arctic flounder (*Liopsetta glacialis*)	46 (11)	11.9 ± 4.0	244.3 ± 50.1	241 ± 123.9	6.5 ± 4.8	9.7 ± 5.5
			broad whitefish (*Coregonus nasus*)	36 (6)	9.4 ± 3.4	513.3 ± 35.1	1295.0 ± 359.9	17.7 ± 7.7	32.1 ± 29.6
			shorthorn sculpin (*Myoxocephalus scorpius*)	19	4.6 ± 1.0	253.7 ± 40.6	168.4 ± 91.5	n/a	12.9 ± 4.9
			starry flounder (*Platichthys stellatus*)	14	12.4 ± 6.1	274.1 ± 70.0	293.8 ± 153.7	6.7 ± 5.1	10.1 ± 9.9
			Arctic cisco (*Coregonus autumnalis*)	11	5.3 ± 0.8	357.3 ± 30.7	413.6 ± 44.8	n/a	n/a
			Arctic char (*Salvelinus alpinus*)	8	4 ± 1.3	235.2 ± 134.4	232.2 ± 512.5	4.5 ± 10.3	1.3 ± 3.5
			Pacific herring (*Clupea pallasii*)	2	9	310 - 340	30 - 220	n/a	n/a
			fourhorn sculpin (*Myoxocephalus quadricornis*)	1	n/a	240.0	30.0	n/a	n/a
			Greenland cod (*Gadus ogac*)	1	4	450.0	840.0	20.0	50.0
			Arctic staghorn sculpin (*Gymnocanthus tricuspis)*	1	6	130.0	25.6	0.3	0.7
		Bennett Point	shorthorn sculpin (*Myoxocephalus scorpius*)	35 (3)	5.2 ± 1.2	214.9 ± 97.3	136.2 ± 97.3	0.7 ± 0.3	7.6 ± 6.7
			capelin (*Mallotus villosus*)	16	3.1 ± 0.6	146.6 ± 5.6	21.8 ± 2.3	0.1 ± 0.1	0.2 ± 0.1
			Greenland cod (*Gadus ogac*)	9	5.1 ± 2.0	300.1 ± 120.9	418.4 ± 444.3	n/a	18.1 ± 14.7
			fourhorn sculpin (*Myoxocephalus quadricornis*)	3	11.5 ± 3.5	332.0 ± 17.4	486.7 ± 73.7	n/a	13.3 ± 5.8
			starry flounder (*Platichthys stellatus*)	1	8	275.0	290.0	n/a	n/a

Table A4. Basic biology of fishes captured among 2021 Arctic Coast field programs. Mean total length includes individuals dissected and live released in the field; mass data were obtained from dissected individuals (total, liver, gonad); where $n \leq 2$ individuals were captured the range of values is shown instead of the mean.

Year	**Date Range**	**Location**	**Species**	***n* total (live released)**	**Mean age ± SD**	**Mean total length ± SD (mm)**	**Mean mass ± SD (g)**	**Liver mass ± SD (g)**	**Gonad mass ± SD (g)**
2021	March 9th - March 17th	Argo Bay	Greenland cod (*Gadus ogac*)	4	n/a	334.5 ± 47.9	518.8 ± 244.8	6.1 ± 3.7	103.7 ± 54.5
			fourhorn sculpin (*Myoxocephalus quadricornis*)	1	n/a	241.0	165.0	8.0	3.1
			shorthorn sculpin (*Myoxocephalus scorpius*)	1	n/a	275.0	220.0	5.8	6.9
			saffron cod (*Eleginus gracilis*)	1	n/a	355.0	295.0	4.1	4.4
	August 4th – August 10th		Arctic flounder (*Liopsetta glacialis*)	77 (70)	n/a	260.8 ± 13.8	240 ± 53.2	n/a	n/a
			shorthorn sculpin (*Myoxocephalus scorpius*)	47 (33)	n/a	256.9 ± 25.9	210.0 ± 85.0	n/a	n/a
			starry flounder (*Platichthys stellatus*)	44 (39)	n/a	242.9 ± 45.3	296.0 ± 65.4	n/a	n/a
			fourhorn sculpin (*Myoxocephalus quadricornis*)	24 (18)	n/a	246.9 ± 48.2	145.0 ± 45.0	n/a	n/a
			saffron cod (*Eleginus gracilis*)	14 (2)	n/a	356.4 ± 53.5	309.2 ± 118.2	n/a	n/a
			Arctic staghorn sculpin (*Gymnocanthus tricuspis)*	7 (2)	n/a	201.4 ± 40.5	97.3 ± 50.0	n/a	n/a
			Pacific herring (*Clupea pallasii*)	4	n/a	341.0 ± 4.5	287.5 ± 9.6	n/a	n/a
			Arctic char (*Salvelinus alpinus*)	3	4.7 ± 1.5	397.0 ± 48.7	620.0 ± 168.2	n/a	n/a
			broad whitefish (*Coregonus nasus*)	2	5 - 6	390 - 422	400 - 520	n/a	n/a
			Greenland cod (*Gadus ogac*)	1	n/a	325.0	290.0	n/a	n/a
	September 3rd – September 8th		broad whitefish (*Coregonus nasus*)	67 (47)	7.5 ± 2.1	430.1 ± 35.1	934.5 ± 346.2	n/a	13.6 ± 12.1
			Arctic flounder (*Liopsetta glacialis*)	18 (10)	n/a	257.9 ± 29.7	223.8 ± 114.6	n/a	11.7 ± 4.1
			shorthorn sculpin (*Myoxocephalus scorpius*)	17	n/a	250.4 ± 53.1	170.4 ± 78.9	n/a	n/a
			starry flounder (*Platichthys stellatus*)	16 (1)	n/a	263.3 ± 30.9	271.4 ± 97.5	n/a	n/a
			Arctic char (*Salvelinus alpinus*)	10 (6)	5.0 ± 0.0	354.6 ± 31.9	380.0 ± 118.9	n/a	n/a
			Arctic cisco (*Coregonus autumnalis*)	9	n/a	403.7 ± 20.8	632.2 ± 91.8	n/a	n/a
			Pacific herring (*Clupea pallasii*)	3	n/a	292.3 ± 58.3	216.7 ± 118.5	n/a	n/a
			Arctic staghorn sculpin (*Gymnocanthus tricuspis)*	2	n/a	135.0 – 235.0	32.0 – 160.0	n/a	n/a
			bering wolffish (*Anarhichas orientalis)*	1 (1)	n/a	n/a	n/a	n/a	n/a
			fourhorn sculpin (*Myoxocephalus quadricornis*)	1	n/a	267.0	200.0	n/a	n/a
			Greenland cod (*Gadus ogac*)	1	n/a	154.0	33.6	n/a	n/a

APPENDIX B - Fishing effort

Table B1. List of nets deployed in Argo Bay during the 2017 nearshore survey. Total fishing soak time for each net and their specific location is provided. Depth is provided as the maximum at the time of deployment, temperature and salinity have been provided as the mean and standard deviation (±SD) during the sampling period. Gear type (6 panel gill net = GN, trap net = TR) are indicated for each effort. Temperature and salinity were recorded with the HOBO® temperature/conductivity loggers, salinity was only measured in ppt. Totals for each species and net are summarized in bold.

Set #	Gear Type	Date Set (Y/M/D)	Effort (hr:min)	Latitude (DD)	Longitude (DD)	Depth (m)	Mean Temperature (°C) +/- SD	Mean Salinity (ppt) +/- SD	Arctic char	Arctic cisco	Arctic flounder	Arctic staghorn sculpin	broad whitefish	capelin	fourhorn sculpin	Pacific herring	saffron cod	shorthorn sculpin	starry flounder	**Total**
1	GN	5-Jul-2017	4:38	69.22.522	-124.27045	11.9	n/a	n/a	0	0	0	0	0	0	0	0	0	0	0	**0**
2	GN	5-Jul-2017	5:12	69.21.732	-124.27.182	3.9	n/a	n/a	1	0	22	0	7	0	3	3	0	0	6	**42**
3	TR	5-Jul-2017	22:41	69.22.137	-124.30.011	1.5	7.0 +/- 1.2	17.0 +/- 2.5	0	0	8	0	0	0	0	0	19	1	4	**32**
4	GN	5-Jul-2017	18:36	69.22.522	-124.27045	11.9	n/a	n/a	0	0	0	0	0	0	0	0	0	0	0	**0**
5	GN	6-Jul-2017	24:11	69.22.137	-124.30.011	1.5	8.8 +/- 0.6	14.4 +/- 2.3	0	0	15	0	0	0	0	0	5	1	1	**22**
6	GN	6-Jul-2017	6:59	69.23.360	-124.26.609	11.2	n/a	n/a	0	0	0	1	0	0	0	0	0	3	0	**4**
7	GN	6-Jul-2017	4:27	69.21.732	-124.27.182	3.9	n/a	n/a	1	1	22	0	10	0	2	2	0	0	8	**46**
8	GN	6-Jul-2017	16:35	69.23.360	-124.26.609	11.2	n/a	n/a	0	0	0	0	0	0	1	0	1	1	0	**3**
9	GN	7-Jul-2017	8:18	69.23.504	-124.27.405	13.4	n/a	n/a	0	0	0	0	0	0	0	0	0	0	0	**0**
10	GN	7-Jul-2017	15:10	69.23.523	-124.27.392	14.5	n/a	n/a	0	0	0	0	0	0	1	0	0	1	0	**2**
11	TR	7-Jul-2017	8:35	69.22.137	-124.30.011	1.5	10.4 +/- 0.9	15.7 +/- 1.1	0	0	34	0	1	0	0	0	3	0	10	**48**
12	TR	7-Jul-2017	14:30	69.22.137	-124.30.011	1.5	9.6 +/- 2.2	15.7 +/- 1.8	0	0	18	0	1	0	0	0	1	0	2	**22**
13	GN	8-Jul-2017	3:55	69.21.709	-124.27.771	3.2	n/a	n/a	3	0	29	0	2	0	0	0	0	0	15	**49**
14	TR	8-Jul-2017	7:08	69.22.137	-124.30.011	1.5	9.4 +/- 2.0	16.1 +/- 2.0	0	0	13	0	0	0	0	0	4	1	0	**18**
15	TR	8-Jul-2017	5:22	69.22.428	-124.24.476	9.5	n/a	n/a	0	0	0	0	0	0	0	0	0	0	0	**0**
16	GN	8-Jul-2017	24:52	69.23.983	-124.31.053	11.5	n/a	n/a	0	0	0	0	0	0	0	0	0	6	1	**7**
17	TR	8-Jul-2017	25:48	69.22.137	-124.30.011	1.5	11.5 +/- 0.9	15.6 +/- 0.5	0	0	24	0	0	0	0	0	6	0	0	**30**
18	GN	9-Jul-2017	4:19	69.21.760	-124.26.812	1.8	n/a	n/a	2	0	36	0	3	0	0	0	0	0	7	**48**
19	TR	9-Jul-2017	16:17	69.22.045	-124.29.664	1.5	12.5 +/- 0.5	13.0 +/- 2.9	0	0	77	0	4	0	0	0	3	0	1	**85**
20	GN	9-Jul-2017	40:14	69.23.227	-124.29.943	9.3	n/a	n/a	0	0	0	3	0	0	8	0	2	25	0	**38**
21	GN	10-Jul-2017	4:41	69.21.728	-124.27.642	2.6	n/a	n/a	1	4	46	0	14	611	0	0	4	1	8	**689**
22	TR	10-Jul-2017	31:06	69.22.045	-124.29.664	1.5	12.5 +/- 0.9	15.4 +/- 1.1	0	0	3	0	0	0	0	0	0	0	0	**3**
23	GN	12-Jul-2017	3:36	69.21.735	-124.27.517	2.6	10.6 +/- 0.3	16.2 +/- 0.4	0	2	152	0	15	10	0	0	5	0	26	**210**
24	GN	13-Jul-2017	2:53	69.21.735	-124.27.517	2.6	11.3 +/- 0.2	16.7 +/- 0.1	1	0	43	0	4	0	0	2	2	0	19	**71**
									9	**7**	**542**	**4**	**61**	**621**	**15**	**7**	**55**	**40**	**108**	**1469**

Table B2. List of nets deployed in Argo Bay, and Paulatuk harbour (training) during the 2018 community-led field program. Total fishing soak time for each net and their specific location is provided, each set used a 6 panel, multi-mesh gill net Depth is provided as the maximum at the time of deployment, temperature and salinity have been provided as the mean and standard deviation (±SD) during the sampling period. Totals for each species and net are summarized in bold.

Set #	Site	Date Set (D/M/Y)	Effort (hr:min)	Latitude (DD)	Longitude (DD)	Depth (m)	Mean Temperature (°C) +/- SD	Mean Salinity (psu) +/- SD	Arctic char	Arctic cisco	Arctic flounder	Arctic staghorn sculpin	broad whitefish	capelin	fourhorn sculpin	Pacific herring	saffron cod	shorthorn sculpin	starry flounder	**Total**
1	Paulatuk	3-Jul-2018	1:15	69.38147	-124.047	1.0	n/a	n/a	0	0	2	0	0	0	0	0	0	0	1	**3**
2	Paulatuk	3-Jul-2018	2:09	69.36636	-124.056	1.4	7.0 +/- 0.2	4.2 +/- 0.1	0	0	173	0	0	0	0	0	0	0	11	**184**
3	Paulatuk	4-Jul-2018	0:45	69.33967	-124.029	1.9	8.7 +/- 0.0	4.2 +/- 0.0	0	0	177	0	0	0	0	19	0	0	14	**210**
4	Argo	9-Jul-2018	15:25	69.39234	-124.456	8.4	0.2 +/- 0.0	30.4 +/- 0.0	0	0	0	0	0	0	0	0	0	2	0	**2**
5	Argo	10-Jul-2018	16:15	69.36163	-124.461	2.3	5.9 +/- 1.8	18.4 +/- 3.9	4	0	15	0	21	2	0	1	1	0	14	**58**
6	Argo	11-Jul-2018	24:41	69.39208	-124.456	8.7	0.4 +/- 0.0	30.4 +/- 0.0	0	0	0	0	0	0	0	0	0	4	0	**4**
7	Argo	11-Jul-2018	3:20	69.36163	-124.461	2.3	8.2 +/- 0.2	12.5 +/- 0.2	2	0	19	0	21	0	0	0	1	0	11	**54**
8	Argo	12-Jul-2018	2:05	69.36163	-124.461	2.3	6.9 +/- 0.2	13.2 +/- 0.0	1	0	28	0	7	2	0	1	0	0	14	**53**
9	Argo	12-Jul-2018	22:30	69.3921	-124.457	9.0	0.5 +/- 0.0	30.4 +/- 0.0	0	0	0	1	0	0	0	0	0	2	0	**3**
10	Argo	13-Jul-2018	5:15	69.36163	-124.461	2.3	7.0 +/- 0.5	13.9 +/- 0.9	8	0	49	0	7	0	1	0	1	0	22	**88**
11	Argo	13-Jul-2018	22:20	69.39209	-124.456	8.7	0.6 +/- 0.0	30.4 +/- 0.0	0	0	0	0	0	0	0	0	0	4	0	**4**
12	Argo	14-Jul-2018	24:30	69.39166	-124.456	8.4	0.8 +/- 0.1	25.3 +/- 4.9	0	0	0	1	0	0	0	1	0	8	0	**10**
13	Argo	14-Jul-2018	4:15	69.36163	-124.461	2.3	8.1 +/- 0.4	16.3 +/- 1.6	2	2	37	0	11	0	0	1	0	0	15	**68**
16	Argo	15-Jul-2018	3:11	69.36163	-124.461	2.3	5.9 +/- 0.6	22.0 +/- 1.0	1	0	45	0	11	28	0	0	0	0	20	**104**
17	Argo	16-Jul-2018	7:08	69.39085	-124.457	9.2	1.1 +/- 0.1	30.4 +/- 0.0	0	0	0	0	0	0	0	0	0	4	0	**4**
18	Argo	16-Jul-2018	6:55	69.36163	-124.461	2.3	8.9 +/- 1.3	18.5 +/- 2.1	4	0	51	0	24	0	0	0	0	0	23	**102**
19	Argo	16-Jul-2018	36:07	69.39085	-124.457	9.2	1.1 +/- 0.0	30.4 +/- 0.0	0	0	0	3	0	0	0	0	0	5	0	**8**
									22	**2**	**596**	**5**	**102**	**32**	**1**	**23**	**3**	**29**	**145**	**959**

Table B3. List of nets deployed in Argo Bay during the 2019 community-led field program. Total fishing soak time for each net and their specific location is provided, each set used a 6 panel, multi-mesh gill net. Depth is provided as the maximum at the time of deployment, temperature and salinity have been provided as the mean and standard deviation (±SD) during the sampling period. Totals for each species and net are summarized in bold.

Set #	Date Set (D/M/Y)	Effort (hr:min)	Latitude (DD)	Longitude (DD)	Depth (m)	Mean Temperature (°C) +/- SD	Mean Salinity (psu) +/- SD	Arctic char	Arctic cisco	Arctic flounder	Arctic staghorn sculpin	broad whitefish	Bering wolffish	capelin	fourhorn sculpin	Greenland cod	lake whitefish	Pacific herring	saffron cod	shorthorn sculpin	starry flounder	**Total**
1	7/16/2019	14:53	69.39218	-124.456223	10.4	5.2 +/- 0.1	31.2 +/- 0.1	0	0	0	0	0	0	0	1	0	0	0	0	5	0	**6**
2	7/17/2019	9:53	69.36226	-124.452463	2.7	8.6 +/- 0.2	27.5 +/- 0.1	1	0	23	0	0	0	2	0	0	0	0	0	1	14	**41**
3	7/17/2019	29:34	69.39218	-124.456223	10.4	5.4 +/- 0.1	31.2 +/- 0.1	0	0	3	0	0	0	0	1	1	0	0	0	9	0	**14**
4	7/18/2019	5:35	69.36164	-124.459631	2.9	9.5 +/- 0.1	27.5 +/- 0.1	1	1	15	0	3	0	10	0	0	0	0	0	0	6	**36**
5	7/18/2019	32:05	69.39218	-124.456223	10.4	5.7 +/- 0.2	31.3 +/- 0.1	0	0	3	2	0	0	0	1	0	0	1	1	8	0	**16**
6	7/20/2019	7:17	69.36164	-124.459631	2.9	9.9 +/- 0.2	27.7 +/- 0.1	2	0	5	0	2	0	0	0	0	1	0	0	0	2	**12**
7	7/20/2019	51:26	69.39218	-124.456223	10.4	6.4 +/- 0.6	30.6 +/- 1.2	0	1	19	0	0	1	0	0	3	0	0	3	11	8	**46**
8	7/22/2019	4:19	69.36164	-124.459631	2.9	9.7 +/- 0.1	27.9 +/- 0.1	0	0	6	0	0	0	0	0	0	0	0	0	0	8	**14**
								4	**2**	**74**	**2**	**5**	**1**	**12**	**3**	**4**	**1**	**1**	**4**	**34**	**38**	**185**

Table B4. List of nets deployed in Bennett Point during the 2019 community-led field program. Total fishing soak time for each net and their specific location is provided, each set used a 6 panel, multi-mesh gill net. Depth is provided as the maximum at the time of deployment, temperature and salinity have been provided as the mean and standard deviation (±SD) during the sampling period. Totals for each species and net are summarized in bold.

Set #	Date Set (D/M/Y)	Effort (hr:min)	Latitude (DD)	Longitude (DD)	Depth (m)	Mean Temperature (°C) +/- SD	Mean Salinity (psu) +/- SD	Arctic char	Arctic cisco	banded gunnel	capelin	Greenland cod	Pacific herring	shorthorn sculpin	starry flounder	**Total**
1	7/13/2019	03:09	69.71836	-124.184477	6.7	5.0 +/- 0.1	26.66 +/- 0.03	1	0	0	60	0	1	1	0	**63**
2	7/13/2019	2:52	69.72395	-124.178441	16.4	4.6 +/- 0.0	25.89 +/- 0.02	0	0	0	0	0	0	0	0	**0**
3	7/13/2019	14:47	69.71713	-124.118706	7.3	5.0 +/- 0.1	25.79 +/- 0.03	0	0	0	0	5	0	1	0	**6**
4	7/14/2019	4:30	69.71687	-124.087108	4.8	5.5 +/- 0.1	26.64 +/- 0.02	0	0	0	0	0	0	2	0	**2**
5	7/14/2019	3:33	69.7171	-124.118206	9.2	4.6 +/- 1.1	26.37 +/- 1.12	0	0	0	0	1	0	0	0	**1**
6	7/14/2019	18:05	69.72594	-124.093738	13.1	4.6 +/- 0.1	26.77 +/- 0.05	0	0	0	6	2	0	0	0	**8**
7	7/14/2019	20:47	69.7171	-124.118206	9.2	5.1 +/- 0.4	25.82 +/- 0.07	0	0	0	0	0	0	0	0	**0**
8	7/15/2019	5:17	69.7171	-124.118206	9.5	2.5 +/- 0.1	28.60 +/- 0.05	0	0	0	0	0	0	5	0	**5**
9	7/15/2019	4:28	69.72631	-124.093418	11.3	4.8 +/- 0.11	26.89 +/- 0.03	0	0	0	183	0	0	0	0	**183**
10	7/15/2019	10:27	69.7171	-124.118206	9.2	1.7 +/- 0.1	28.69 +/- 0.07	0	0	0	0	0	0	0	0	**0**
11	7/17/2019	20:04	69.7171	-124.118206	9.2	5.8 +/- 0.1	25.8 +/- 0.1	0	0	0	0	3	0	5	0	**8**
12	7/17/2019	20:20	69.72631	-124.093418	11.3	5.0 +/- 0.4	26.9 +/- 0.1	0	0	0	0	2	0	4	0	**6**
13	7/18/2019	23:45	69.7171	-124.118206	9.2	6.0 +/- 0.3	25.8 +/- 0.1	0	0	0	0	1	0	3	0	**4**
14	7/18/2019	23:40	69.72631	-124.093418	11.3	5.0 +/- 0.1	26.9 +/- 0.0	0	0	0	0	0	0	2	0	**2**
15	7/19/2019	23:14	69.7171	-124.118206	9.2	6.3 +/- 0.1	25.8 +/- 0.0	0	0	0	0	5	0	4	0	**9**
16	7/19/2019	2:35	69.6785	-124.039064	5.2	7.0 +/- 0.1	26.8 +/- 0.0	0	1	0	1	0	0	1	0	**3**
17	7/19/2019	17:41	69.72631	-124.093418	11.3	4.9 +/- 0.2	27.0 +/- 0.0	0	0	0	0	3	0	2	0	**5**
18	7/20/2019	36:30	69.7171	-124.118206	9.2	6.1 +/- 0.3	25.8 +/- 1.5	0	0	0	0	5	0	0	0	**5**
19	7/20/2019	6:21	69.71653	-124.139359	5.4	7.6 +/- 0.2	26.8 +/- 0.0	0	0	0	0	0	0	12	2	**14**
20	7/20/2019	41:00	69.7171	-124.118206	9.3	5.6 +/- 0.6	26.9 +/- 0.1	0	0	0	0	5	0	0	0	**5**
21	7/22/2019	12:26	69.72631	-124.093418	11.3	6.3 +/- 0.1	25.8 +/- 0.0	0	0	0	0	0	0	1	0	**1**
22	7/22/2019	10:10	69.72588	-124.094985	3.4	5.5 +/- 0.6	26.90 +/- 0.1	0	0	0	0	0	0	1	0	**1**
23	7/22/2019	15:50	69.7171	-124.118206	9.2	n/a	n/a	0	0	0	0	7	0	4	0	**11**
24	7/23/2019	21:45	69.7171	-124.118206	9.2	6.8 +/- 0.2	25.5 +/- 2.8	0	0	0	0	1	0	3	0	**4**
25	7/23/2019	21:22	69.72017	-124.144973	3.4	7.1 +/- 0.3	26.8 +/- 2.8	0	0	0	1	0	0	0	3	**4**

26	7/24/2019	58:49	69.72631	-124.093418	11.2	6.3 +/- 0.5	25.9 +/- 0.1	0	0	1	0	7	0	5	0	**13**
27	7/24/2019	12:34	69.7171	-124.118206	9.2	6.9 +/- 0.2	26.8 +/- 0.1	0	0	0	0	4	0	2	0	**6**
								1	**1**	**1**	**251**	**51**	**1**	**58**	**5**	**369**

Table B5 - List of nets deployed in Argo Bay 2020 during the community-led field program. Total fishing soak time for each net and their specific location is provided, each set used a 6 panel, multi-mesh gill net. Depth is provided as the maximum at the time of deployment, temperature and salinity have been provided as the mean and standard deviation (+SD) during the sampling period. Totals for each species and net are summarized in bold.

Set #	Date Set (D/M/Y)	Effort (hr:min)	Latitude (DD)	Longitude (DD)	Depth (m)	Mean Temperature (°C) +/- SD	Mean Salinity (psu) +/- SD	Arctic char	Arctic cisco	Arctic flounder	Arctic staghorn sculpin	broad whitefish	fourhorn sculpin	Greenland cod	Pacific herring	shorthorn sculpin	starry flounder	**Total**
1	15/07/2020	4:56	69.3626	-124.449453	1.2	8.6 +/- 0.3	9.3 +/- 0.3	0	0	4	0	12	0	0	0	0	6	**22**
2	15/07/2020	10:07	69.3827	-124.448898	8.7	1.4 +/- 0.7	11.8 +/- 0.4	0	0	0	0	0	0	0	0	0	0	**0**
3	16/07/2020	4:48	69.3626	-124.449453	1.2	10.5 +/- 0.6	10.6 +/- 0.4	3	1	2	0	11	0	0	0	0	2	**19**
4	16/07/2020	14:26	69.3827	-124.448898	8.7	- 0.2 +/- 0.8	12.6 +/- 0.3	0	0	0	1	0	1	0	0	2	0	**4**
5	17/07/2020	9:00	69.3626	-124.449453	1.2	10.9 +/- 0.5	9.3 +/- 0.0	1	0	9	0	7	0	0	0	0	4	**21**
6	16/07/2020	23:26	69.3827	-124.448898	8.7	-1.2 +/- 0.5	11.6 +/- 0.2	0	0	0	0	0	0	1	0	1	0	**2**
7	18/07/2020	7:08	69.3626	-124.449453	1.2	10.5 +/- 0.2	8.1 +/- 0.0	1	1	0	0	0	0	0	0	0	0	**2**
8	17/07/2020	24:00	69.3827	-124.448898	8.7	-1.2 +/- 0.9	13.2 +/- 0.4	0	0	1	0	0	0	0	0	3	0	**4**
9	18/07/2020	24:56	69.3827	-124.448898	8.7	0.2 +/- 1.0	15.9 +/- 0.5	0	0	0	0	0	0	0	0	0	0	**0**
10	19/07/2020	6:33	69.3626	-124.449453	1.2	10.0 +/- 0.1	11.5 +/- 0.1	3	5	9	0	0	0	0	0	0	2	**19**
11	20/07/2020	4:25	69.3626	-124.449453	1.2	12.3 +/- 0.2	7.4 +/- 0.2	0	1	10	0	0	0	0	0	0	0	**11**
12	20/07/2020	7:05	69.3827	-124.448898	8.7	1.5 +/- 0.1	16.7 +/- 0.1	0	0	0	0	0	0	0	0	4	0	**4**
13	21/07/2020	1:56	69.3626	-124.449453	1.2	10.6 +/- 0.0	13.9 +/- 0.1	0	2	11	0	6	0	0	1	0	0	**20**
14	20/07/2020	21:24	69.3827	-124.448898	8.7	1.9 +/- 0.6	16.9 +/- 1.5	0	1	0	0	0	0	0	0	5	0	**6**
15	21/07/2020	24:52	69.3827	-124.448898	8.7	2.2 +/- 0.2	14.1 +/- 0.1	0	0	0	0	0	0	0	1	4	0	**5**
								8	**11**	**46**	**1**	**36**	**1**	**1**	**2**	**19**	**14**	**139**

Table B6 - List of nets deployed at Bennett Point 2020 during the community-led field program. Total fishing soak time for each net and their specific location is provided, each set used a 6 panel, multi-mesh gill net. Depth is provided as a range at the time of deployment (MDT), temperature and salinity have been provided as the mean and standard deviation (SD) during the sampling period.

Set #	Date Set (D/M/Y)	Effort (hr:min)	Latitude (DD)	Longitude (DD)	Depth (m)	Mean Temperature (°C) +/- SD	Mean Salinity +/- SD (psu)	capelin	fourhorn sculpin	Greenland cod	shorthorn sculpin	starry flounder	**Total**
1	15/07/2020	17:13	69.72073	-124.082644	5.5	2.2 +/- 0.2	27.0 +/- 2.5	15	0	1	7	0	**23**
2	15/07/2020	49:10	69.71827	-124.11991	11.9	2.3 +/- 0.2	26.0 +/- 0.2	0	0	0	1	0	**1**
3	16/07/2020	12:50	69.72073	-124.082644	5.5	1.8 +/- 0.1	26.4 +/- 1.6	0	0	0	2	0	**2**
4	16/07/2020	19:15	69.72073	-124.082644	5.5	1.6 +/- 0.2	28.8 +/- 0.3	1	0	0	0	0	**1**
5	17/07/2020	10:02	69.71827	-124.11991	11.9	2.4 +/- 0.1	26.2 +/- 0.1	0	0	0	0	0	**0**
6	17/07/2020	10:18	69.72073	-124.082644	5.5	1.7 +/- 0.2	28.8 +/- 0.1	0	0	2	3	0	**5**
7	17/07/2020	15:25	69.71906	-124.117793	12.8	0.7 +/- 0.3	27.0 +/- 0.2	0	0	1	1	0	**2**
8	18/07/2020	9:00	69.72073	-124.082644	5.5	1.5 +/- 0.1	27.6 +/- 2.2	0	0	0	2	0	**2**
9	18/07/2020	21:30	69.71906	-124.117793	12.8	2.5 +/- 0.4	25.9 +/- 0.3	0	0	0	1	0	**1**
10	18/07/2020	21:26	69.72073	-124.082644	5.5	1.5 +/- 0.2	28.7 +/- 0.6	0	0	0	1	0	**1**
11	19/07/2020	8:24	69.72622	-124.079593	12.8	2.8 +/- 0.5	25.8 +/- 0.2	0	1	1	3	0	**5**
12	19/07/2020	2:33	69.72073	-124.082644	5.5	1.0 +/- 0.1	29.2 +/- 0.0	0	0	0	0	0	**0**
13	19/07/2020	5:03	69.71711	-124.089459	6.1	7.1 +/- 0.3	23.5 +/- 0.7	0	0	0	4	0	**4**
14	19/07/2020	63:00	69.72622	-124.079593	13.1	2.7 +/- 0.9	26.0 +/- 0.5	0	0	2	3	0	**5**
15	19/07/2020	18:21	69.71711	-124.089459	6.1	7.2 +/- 0.4	23.4 +/- 0.6	0	2	2	9	1	**14**
16	20/07/2020	27:00	69.71711	-124.089459	6.1	7.8 +/- 0.8	23.4 +/- 1.2	0	2	5	6	12	**25**
17	21/07/2020	15:50	69.71711	-124.089459	6.1	8.6 +/- 0.1	21.7 +/- 0.4	0	0	1	6	2	**9**
18	22/07/2020	32:30	69.72737	-124.089364	5.2	7.4 +/- 1.0	24.1 +/- 2.2	0	0	0	1	0	**1**
								16	**5**	**15**	**50**	**15**	**101**

Table B7 - List of nets deployed in Argo Bay during the community-led field program. Total fishing soak time for each net and their specific location is provided, each set used a 6 panel, multi-mesh gill net. Depth is provided as a range at the time of deployment (MDT), temperature and salinity have been provided as the mean and standard deviation (SD) during the sampling period.

Set #	Date Set (D/M/Y)	Effort (hr:min)	Latitude (DD)	Longitude (DD)	Depth (m)	Mean Temperature (°C) +/- SD	Mean Salinity (psu) +/- SD	Arctic char	Arctic cisco	Arctic flounder	Arctic staghorn sculpin	Bering wolffish	broad whitefish	fourhorn sculpin	Greenland cod	Pacific herring	saffron cod	shorthorn sculpin	starry flounder	**Total**
1	4/8/2021	15:10	69.37124	-124.456444	7.4	4.0 +/- 0.1	25.2 +/- 0.1	0	0	1	0	0	0	14	0	0	0	0	0	**15**
2	5/8/2021	53:25	69.3626	-124.449453	1.6	9.7 +/- 0.7	21.2 +/- 3.4	2	0	47	0	0	2	0	0	0	3	3	5	**62**
3	5/8/2021	8:05	69.37124	-124.456444	7.4	4.3 +/- 1.0	25.1 +/- 0.5	0	0	0	0	0	0	0	1	1	0	0	0	**2**
4	7/8/2021	19:55	69.37124	-124.456444	7.4	3.9 +/- 0.3	25.3 +/- 0.0	0	0	4	2	0	0	0	0	0	2	0	0	**8**
5	8/8/2021	4:00	69.37124	-124.456444	7.4	4.6 +/- 0.5	25.2 +/- 0.3	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6	3/9/2021	27:50	69.37252	-124.45741	7.5	6.9 +/- 0.1	24.5 +/- 0.0	0	0	1	1	0	0	0	0	2	0	2	7	**13**
7	4/9/2021	2:45	69.3626	-124.449453	3	8.0 +/- 0.1	23.9 +/- 0.1	7	5	4	0	0	22	0	0	0	0	0	0	**38**
8	4/9/2021	23:43	69.37252	-124.45741	7.5	7.2 +/- 0.1	24.4 +/- 1.1	0	0	1	1	0	0	0	0	1	1	2	1	**7**
9	4/9/2021	5:25	69.3626	-124.449453	3	8.4 +/- 0.1	24.0 +/- 0.0	3	0	4	0	0	12	0	0	0	0	0	0	**19**
10	5/9/2021	53:43	69.37252	-124.45741	7	7.3 +/- 0.1	24.7 +/- 1.9	0	0	0	0	1	0	0	1	0	1	7	5	**15**
11	5/9/2021	5:28	69.3626	-124.449453	3	8.5 +/- 0.1	23.9 +/- 0.1	0	4	3	0	0	32	1	0	0	0	0	3	**43**
12	6/9/2021	2:30	69.3626	-124.449453	3	7.5 +/- 0.2	23.2 +/- 0.1	0	0	2	0	0	1	0	0	0	0	0	0	**3**
13	7/9/2021	15:10	69.37252	-124.45741	7.5	6.8 +/- 0.2	21.8 +/- 0.1	0	0	3	0	0	0	0	0	0	0	6	0	**9**
14	4/8/2021	19:13	69.3626	-124.449453	8.8	3.5 +/- 0.1	31.1 +/- 0.1	0	0	0	0	0	0	0	0	0	0	5	0	**5**
15	5/8/2021	58:15	69.36724	-124.495872	1.6	9.6 +/- 0.8	23.8 +/- 0.2	1	0	0	0	0	0	2	0	3	7	10	17	**40**
16	5/8/2021	58:15	69.3626	-124.449453	8.8	3.9 +/- 0.3	30.9 +/- 0.9	0	0	0	1	0	0	3	0	0	0	4	0	**8**
17	7/8/2021	42:54	69.3626	-124.449453	8.8	3.6 +/- 0.1	30.7 +/- 0.9	0	0	25	4	0	0	5	0	0	2	25	22	**83**
								13	**9**	**95**	**9**	**1**	**69**	**25**	**2**	**7**	**16**	**64**	**60**	**370**

Table B8. Seining effort among 2017 – 2021 sampling years in Argo Bay. All seining was completed with a 3/16" delta mesh, 5 m long x 1.2 wide seine or a custom seine 61 m x 1.8 m wide with 3/8" square nylon netting. Total number of fish taxa are summarized in bold.

Set #	Year	Date	Gear	Latitude (DD)	Longitude (DD)	Cottidae spp.	ninespine stickleback	Arctic flounder	starry flounder	broad whitefish	rainbow smelt	saffron cod	Pacific sandlance	Shorthorn sculpin	**Total**
S1	2017	10-Jul	Seine	69.21.762	-124.26.57	1	0	1	1	0	0	0	0	0	**3**
S2	2017	10-Jul	Seine	69.21.738	-124.26.597	0	0	0	0	0	0	0	0	0	**0**
S3	2017	10-Jul	Seine	69.21.778	-124.26.613	0	0	3	0	0	0	0	0	0	**3**
S4	2017	10-Jul	Custom Seine	69.21.758	-124.26.777	27	0	5	0	0	7	0	0	0	**39**
S5	2017	10-Jul	Custom Seine	69.22.136	-124.30.033	40	0	10	2	1	7	2	0	0	**62**
S1	2018	14-Jul	Seine	69.36912	-124.50106	0	0	1	0	0	0	0	0	0	**1**
S2	2018	14-Jul	Seine	69.369616	-124.50216	0	0	1	0	0	0	0	0	1	**2**
S1	2020	19-Jul	Seine	69.362254	-124.441476	1	0	0	0	0	0	0	1	0	**2**
S2	2020	20-Jul	Seine	69.362254	-124.441476	3	0	0	0	0	0	2	0	0	**5**
S1	2021	6-Sep	Seine	69.362254	-124.44148	5	1	0	0	0	0	0	0	0	**6**
S2	2021	5-Sep	Seine	69.408898	-124.52731	0	0	0	0	0	0	0	0	0	**0**
						77	**1**	**21**	**3**	**1**	**14**	**4**	**1**	**1**	**123**

APPENDIX C – Specifications of probes

Table C1. Summary of the accuracy and range of YSI 6920 V2-2 probes used in the 2017 transects.

Sensor/Parameter	Units	Accuracy	Resolution	Range
Temperature	°C	± 0.15°C	0.01°C	-5 to 50°C
pH	pH	± 0.2 pH units	0.01 pH units	0 to 14 pH units
Dissolved oxygen	% saturation	± 1.0 % of reading	0.1 %	0 to 500%
Conductivity	mS/cm	± 0.5 % of reading	0.1 ± mS/cm	0 to 100 mS/cm
Turbidity	NTU	± 2.0% of reading	0.1 FNU	0 to 1000 NTU

Table C2. Summary of accuracy and range of data loggers used among Arctic Coast surveys between 2017 and 2021.

Gear	Sensor/Parameter	Units	Accuracy	Resolution	Range
HOBO® Conductivity Logger U24-002-C	Temperature	°C	± 0.1°C	± 0.01°C	5 to 35°C
	Conductivity	µS/cm	± 50 µS/cm	± 2 µS/cm	5000 to 55,000 µS/cm
Seametrics CT2X Logger	Temperature	°C	± 0.25°C	± 0.1°C	-5 to 40˚C
	Salinity	PSU	±0.5% of reading	0.001 PSU	2 to 42 PSU
HOBO® Water temperature Pro v2 Data Logger U22-001	Temperature	°C	± 0.21°C	± 0.02°C	-40 to 50°C
HOBO®Tidbit v2 Temp-UTBI-001	Temperature	°C	± 0.21°C	± 0.02°C	-0 to 30°C

APPENDIX D – Oceanographic and benthic data

Table D1. Data obtained at each YSI station collected among three transects (Argo, Tippi and Billy) on July 8th and 12th, 2017.

Date	Transect	YSI station	Latitude (DD)	Longitude (DD)	Time	Maximum Depth (m)	Depth (m)	Temperature (°C)	NTU	%DO
8-Jul-17	ARG	1	69.373188	-124.43471	15:51	3.3	1	8.4	1	81.4
8-Jul-17	ARG	1	69.373188	-124.43471	15:51	3.3	2	4.64	0.6	79.6
8-Jul-17	ARG	1	69.373188	-124.43471	15:51	3.3	3	3.68	0.5	82.2
8-Jul-17	ARG	1	69.373188	-124.43471	15:51	3.3	3.3	3.23	n/a	87.6
8-Jul-17	ARG	2	69.373720	-124.44664	16:10	7.1	1	10.92	1	83
8-Jul-17	ARG	2	69.373720	-124.44664	16:10	7.1	2	4.56	0.6	81.5
8-Jul-17	ARG	2	69.373720	-124.44664	16:10	7.1	3	2.68	0.5	82.6
8-Jul-17	ARG	2	69.373720	-124.44664	16:10	7.1	4	1.28	0.4	82.4
8-Jul-17	ARG	2	69.373720	-124.44664	16:10	7.1	5	1.59	0.6	85.2
8-Jul-17	ARG	2	69.373720	-124.44664	16:10	7.1	6	1.67	0.9	91.3
8-Jul-17	ARG	2	69.373720	-124.44664	16:10	7.1	7.1	1.62	n/a	92.7
8-Jul-17	ARG	3	69.374338	-124.46575	16:14	8.1	1	9.34	1.1	83.4
8-Jul-17	ARG	3	69.374338	-124.46575	16:14	8.1	2	6.66	0.8	82.7
8-Jul-17	ARG	3	69.374338	-124.46575	16:14	8.1	3	2.88	0.5	80.2
8-Jul-17	ARG	3	69.374338	-124.46575	16:14	8.1	4	2.1	0.6	81.2
8-Jul-17	ARG	3	69.374338	-124.46575	16:14	8.1	5	1.15	0.4	82.5
8-Jul-17	ARG	3	69.374338	-124.46575	16:14	8.1	6	0.9	0.4	82.4
8-Jul-17	ARG	3	69.374338	-124.46575	16:14	8.1	7	1.47	1.2	85.6
8-Jul-17	ARG	3	69.374338	-124.46575	16:14	8.1	8.1	1.5	n/a	91.4
8-Jul-17	ARG	4	69.373700	-124.41534	11:33	3.7	1	8.24	1.3	105.5
8-Jul-17	ARG	4	69.373700	-124.41534	11:33	3.7	2	8.81	1.1	101.2
8-Jul-17	ARG	4	69.373700	-124.41534	11:33	3.7	3	8.8	1.1	96.9
8-Jul-17	ARG	4	69.373700	-124.41534	11:33	3.7	3.7	7.56	0.9	94.5
8-Jul-17	ARG	5	69.373110	-124.40426	11:46	6.3	1	8.22	1.3	84.3
8-Jul-17	ARG	5	69.373110	-124.40426	11:46	6.3	2	8.66	1.3	83.6
8-Jul-17	ARG	5	69.373110	-124.40426	11:46	6.3	3	8.46	0.9	82.8
8-Jul-17	ARG	5	69.373110	-124.40426	11:46	6.3	4	6.17	0.7	81.1
8-Jul-17	ARG	5	69.373110	-124.40426	11:46	6.3	5	2.7	0.7	80.6
8-Jul-17	ARG	5	69.373110	-124.40426	11:46	6.3	6	0.44	0.9	80
8-Jul-17	ARG	5	69.373110	-124.40426	11:46	6.3	6.3	0.45	n/a	81.4
8-Jul-17	ARG	6	69.375649	-124.38057	15:18	6.3	1	7.4	0.9	82.2
8-Jul-17	ARG	6	69.375649	-124.38057	15:18	6.3	2	9.05	0.9	82.6
8-Jul-17	ARG	6	69.375649	-124.38057	15:18	6.3	3	8.84	0.9	82.2
8-Jul-17	ARG	6	69.375649	-124.38057	15:18	6.3	4	3.64	0.5	78.4
8-Jul-17	ARG	6	69.375649	-124.38057	15:18	6.3	5	3.16	0.4	79.9
8-Jul-17	ARG	6	69.375649	-124.38057	15:18	6.3	6.3	3.29	n/a	81.6
8-Jul-17	ARG	7	69.371802	-124.47965	16:27	7.3	1	10.83	0.9	83.8

8-Jul-17	ARG	7	69.371802	-124.47965	16:27	7.3	2	7.43	0.8	82.6
8-Jul-17	ARG	7	69.371802	-124.47965	16:27	7.3	3	3.6	0.6	84.4
8-Jul-17	ARG	7	69.371802	-124.47965	16:27	7.3	4	2.59	0.6	83.6
8-Jul-17	ARG	7	69.371802	-124.47965	16:27	7.3	5	2.29	0.5	81.3
8-Jul-17	ARG	7	69.371802	-124.47965	16:27	7.3	6	1.93	0.6	84.6
8-Jul-17	ARG	7	69.371802	-124.47965	16:27	7.3	7	1.59	1	90.2
8-Jul-17	ARG	7	69.371802	-124.47965	16:27	7.3	7.3	1.61	n/a	92.7
8-Jul-17	ARG	8	69.395868	-124.51122	17:34	6.3	1	10.2	0.8	101.6
8-Jul-17	ARG	8	69.395868	-124.51122	17:34	6.3	2	8.7	0.9	102.3
8-Jul-17	ARG	8	69.395868	-124.51122	17:34	6.3	3	3.87	0.5	100.8
8-Jul-17	ARG	8	69.395868	-124.51122	17:34	6.3	4	2.35	0.4	100.3
8-Jul-17	ARG	8	69.395868	-124.51122	17:34	6.3	5	1.34	0.4	107.9
8-Jul-17	ARG	8	69.395868	-124.51122	17:34	6.3	6.3	1.78	1	120
8-Jul-17	ARG	9	69.394436	-124.45732	18:28	8.6	1	10.52	0.8	97.1
8-Jul-17	ARG	9	69.394436	-124.45732	18:28	8.6	2	6.89	0.7	94.6
8-Jul-17	ARG	9	69.394436	-124.45732	18:28	8.6	3	3.83	0.6	94.5
8-Jul-17	ARG	9	69.394436	-124.45732	18:28	8.6	4	2.42	0.4	96.2
8-Jul-17	ARG	9	69.394436	-124.45732	18:28	8.6	5	0.95	0.4	95.7
8-Jul-17	ARG	9	69.394436	-124.45732	18:28	8.6	6	0.83	0.6	94.7
8-Jul-17	ARG	9	69.394436	-124.45732	18:28	8.6	7	1.32	1	102
8-Jul-17	ARG	9	69.394436	-124.45732	18:28	8.6	8	1.32	1	106.3
8-Jul-17	ARG	9	69.394436	-124.45732	18:28	8.6	8.6	1.33	n/a	108
9-Jul-17	TIP	10	69.508453	-124.38585	11:01	1.2	1	10.71	0.8	101.1
9-Jul-17	TIP	10	69.508453	-124.38585	11:01	1.2	1.2	10.76	0.9	98
9-Jul-17	TIP	11	69.504008	-124.37341	11:30	9.4	1	11.08	0.9	93.7
9-Jul-17	TIP	11	69.504008	-124.37341	11:30	9.4	2	10.9	0.9	93.1
9-Jul-17	TIP	11	69.504008	-124.37341	11:30	9.4	3	7.58	0.7	91.2
9-Jul-17	TIP	11	69.504008	-124.37341	11:30	9.4	4	4.55	0.5	86.4
9-Jul-17	TIP	11	69.504008	-124.37341	11:30	9.4	5	3.49	0.5	83.9
9-Jul-17	TIP	11	69.504008	-124.37341	11:30	9.4	6	1.9	0.4	90
9-Jul-17	TIP	11	69.504008	-124.37341	11:30	9.4	7	1.09	0.3	89.1
9-Jul-17	TIP	11	69.504008	-124.37341	11:30	9.4	8	1.07	0.4	84.2
9-Jul-17	TIP	11	69.504008	-124.37341	11:30	9.4	9	1.03	0.3	83.2
9-Jul-17	TIP	11	69.504008	-124.37341	11:30	9.4	9.4	1.02	n/a	85.8
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	1	11.04	1	90.6
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	2	10.95	0.9	90.9
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	3	10.64	1	90
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	4	5.06	0.5	89
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	5	3.7	0.4	87.7
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	6	2.29	0.4	87
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	7	1.6	0.4	86.6

9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	8	1.43	0.3	87
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	9	0.2	0.3	85.5
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	10	0.01	0.3	84.5
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	11	0.05	0.3	85.5
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	12	0.07	0.4	85.1
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	13	0.1	0.4	84
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	14	0.11	0.4	84.1
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	15	0.09	0.3	84.5
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	16	0.08	0.4	84.3
9-Jul-17	TIP	12	69.49901	-124.36095	11:38	16.8	16.8	0	n/a	84.7
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	1	11.1	1	88.6
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	2	11	0.9	89.2
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	3	10.77	1	90.3
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	4	5.11	0.5	87.2
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	5	2.65	0.4	87.5
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	6	2.35	0.4	84.6
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	7	2.72	0.4	82.7
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	8	1.93	0.4	82.6
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	9	1.15	0.3	82.6
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	10	0.91	0.4	81.9
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	11	0.58	0.4	81.2
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	12	0.34	0.4	80.8
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	13	-0.04	0.4	80
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	14	-0.05	0.4	79.6
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	15	-0.52	0.4	78.8
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	16	-0.39	0.4	79
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	17	-0.46	0.4	77.4
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	18	-0.44	0.4	76
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	19	-0.45	0.4	79.4
9-Jul-17	TIP	13	69.491795	-124.33729	12:24	19.5	19.5	-0.47	0.4	79.5
9-Jul-17	TIP	14	69.505883	-124.38042	13:26	5.1	1	11.12	0.9	77.5
9-Jul-17	TIP	14	69.505883	-124.38042	13:26	5.1	2	11.14	0.9	77.8
9-Jul-17	TIP	14	69.505883	-124.38042	13:26	5.1	3	7.3	0.8	77.5
9-Jul-17	TIP	14	69.505883	-124.38042	13:26	5.1	4	6.36	0.8	76.4
9-Jul-17	TIP	14	69.505883	-124.38042	13:26	5.1	5.1	5.3	0.8	83.9
9-Jul-17	TIP	15	69.362293	-124.45957	10:45	2.2	1	11.82	8	93.5
9-Jul-17	TIP	15	69.362293	-124.45957	10:45	2.2	2	11.77	7.4	89.7
9-Jul-17	TIP	15	69.362293	-124.45957	10:45	2.2	2.2	11.59	n/a	87.3
13-Jul-17	BIL	17	69.336685	-124.16787	11:00	5	1	9.75	1.5	95.8
13-Jul-17	BIL	17	69.336685	-124.16787	11:00	5	2	7.04	0.8	94.2
13-Jul-17	BIL	17	69.336685	-124.16787	11:00	5	3	6.72	0.7	92.7

13-Jul-17	BIL	17	69.336685	-124.16787	11:00	5	4	6.48	0.8	91.6
13-Jul-17	BIL	17	69.336685	-124.16787	11:00	5	5	6.13	n/a	93.4
13-Jul-17	BIL	18	69.343059	-124.17589	11:13	9.7	1	10.09	1.5	90.7
13-Jul-17	BIL	18	69.343059	-124.17589	11:13	9.7	2	8.72	1.5	88
13-Jul-17	BIL	18	69.343059	-124.17589	11:13	9.7	3	6.9	0.8	88.3
13-Jul-17	BIL	18	69.343059	-124.17589	11:13	9.7	4	6.58	0.6	88.7
13-Jul-17	BIL	18	69.343059	-124.17589	11:13	9.7	5	6.4	0.7	85.5
13-Jul-17	BIL	18	69.343059	-124.17589	11:13	9.7	6	5.24	0.6	84.2
13-Jul-17	BIL	18	69.343059	-124.17589	11:13	9.7	7	5	0.5	82.2
13-Jul-17	BIL	18	69.343059	-124.17589	11:13	9.7	8	4.91	0.5	81.1
13-Jul-17	BIL	18	69.343059	-124.17589	11:13	9.7	9	4.59	0.7	81.5
13-Jul-17	BIL	18	69.343059	-124.17589	11:13	9.7	9.7	4.53	n/a	82.3
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	1	9.7	1.1	80
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	2	9.18	1.8	78.7
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	3	7.49	1.2	77.8
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	4	6.18	0.8	77.5
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	5	6.01	0.8	75.7
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	6	5.83	0.6	74.1
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	7	5.36	0.5	71.9
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	8	4.93	0.5	71.1
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	9	4.84	0.5	70.1
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	10	4.43	0.5	68.9
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	11	4.41	0.5	67.4
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	12	4.53	0.5	66.3
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	13	4.47	0.5	65
13-Jul-17	BIL	19	69.361911	-124.21552	11:43	14.3	14	3.26	0.7	68.1
12-Jul-17	ARG	20	69.373188	-124.43471	14:43	3.2	1	11.02	2.1	69.7
12-Jul-17	ARG	20	69.373188	-124.43471	14:43	3.2	2	10.87	2.4	67.9
12-Jul-17	ARG	20	69.373188	-124.43471	14:43	3.2	3	7.08	2.1	67.6
12-Jul-17	ARG	20	69.373188	-124.43471	14:43	3.2	3.2	6.49	n/a	78.4
12-Jul-17	ARG	21	69.37372	-124.44664	12:17	6.9	1	10.91	2.1	77.2
12-Jul-17	ARG	21	69.37372	-124.44664	12:17	6.9	2	10.89	2.5	77
12-Jul-17	ARG	21	69.37372	-124.44664	12:17	6.9	3	8.59	2.5	79.7

Table D2. Summary of benthic samples collected among Arctic Coast programs in 2017, 2020, and 2021. Site coordinates, and gear type used in each sampling effort are provided.

Date	Year	Location	Site	Latitude	Longitude	Depth (m)	Gear	Sediment Description
8-Jul-17	2017	Argo	AR9	69.394436	-124.4573	8.6	Dredge	Mud/silt
8-Jul-17	2017	Argo	AR2	69.37372	-124.4466	7.1	Dredge	Mud/silt
8-Jul-17	2017	Argo	AR7	69.371802	-124.4797	7.3	Dredge	Mud/silt
8-Jul-17	2017	Argo	AR5	69.37311	-124.4043	6.3	Dredge	Mud/silt
8-Jul-17	2017	Argo	AR8	69.395868	-124.5112	6.3	Dredge	Mud/silt
8-Jul-17	2017	Argo	AR3	69.374338	-124.4658	8.1	Dredge	Mud/silt
8-Jul-17	2017	Argo	AR1	69.373188	-124.4347	3.3	Dredge	Mud/silt
9-Jul-17	2017	Argo	AR15	69.362293	-124.4596	2.2	Dredge	Mud/silt
19-Jul-20	2020	Argo	P5	69.389699	-124.434027	5	Ponar	Mud/silt
19-Jul-20	2020	Argo	P10	69.393327	-124.472469	10	Ponar	Mud/silt
19-Jul-20	2020	Argo	P15	69.394391	-124474375	15	Ponar	Mud/silt
9-Aug-21	2021	Argo	WP6	69.381756	-124.471922	9.5	Ponar	Mud/silt
9-Aug-21	2021	Argo	WP5	69.376433	-124.459032	8.9	Ponar	Mud/silt
9-Aug-21	2021	Argo	WP4	69.371051	-124.444499	6.2	Ponar	Mud/silt
4-Sep-21	2021	Argo	WP11	69.4052	-124.528475	3.4	Ponar	Mud/silt
4-Sep-21	2021	Argo	WP10	69.40108	-124.516448	7.4	Ponar	Mud/silt
4-Sep-21	2021	Argo	WP9	69.393773	-124.499757	8.2	Ponar	Mud/silt
4-Sep-21	2021	Argo	WP8	69.39031	-124.491251	9.2	Ponar	Mud/silt
4-Sep-21	2021	Argo	WP7	69.386289	-124.481978	8.0	Ponar	Mud/silt

APPENDIX E – Winter data

Table E1. Date, time and locations of winter field work conducted among 2019 – 2021 Arctic Coast programs, and associated snow and ice data during each sampling event.

Date	Year	Location	Time	Site	Latitude	Longitude	Ice Thickness (cm)	Snow Depth (cm)	Freeboard (cm)	Bottom Depth (m)
17-Jan-19	2019	Argo	13:10	A1	69.39454	-124.511029	74.5	14.7	0	8.5
23-Jan-19	2019	Argo	13:05	A1	69.39454	-124.511029	77	18	0	8.5
2-Feb-19	2019	Argo	12:45	A1	69.39454	-124.511029	79	16	40	8.5
6-Feb-19	2019	Argo	13:02	A1	69.39454	-124.511029	80	21.8	0	8.5
14-Feb-19	2019	Argo	12:35	A1	69.39454	-124.511029	82.5	24.5	0	8.5
18-Feb-19	2019	Argo	11:55	A1	69.39454	-124.511029	85	23.5	0	8.5
28-Feb-19	2019	Argo	11:45	A1	69.39454	-124.511029	89	30	10	8.5
4-Mar-19	2019	Argo	12:00	A1	69.39454	-124.511029	92.5	30	0	8.5
10-Mar-19	2019	Argo	9:27	A1	69.39454	-124.511029	96	30	10	8.5
10-Mar-19	2019	Argo	12:31	n/a	69.39454	-124.511029	128	10	14	8.5
10-Mar-19	2019	Argo	14:10	A2	69.36304	-124.453812	141	0	13	3
11-Mar-19	2019	Tippi	10:42	CMPA5	69.49988	-124.360895	119	4.5	8	15
11-Mar-19	2019	Tippi	11:44	CMPA6	69.49962	-124.287623	n/a	14	n/a	20
11-Mar-19	2019	Siulik Lake	14:22	n/a	69.46266	-124.500983	104	5	4	2
12-Mar-19	2019	Argo	12:45	A1	69.39454	-124.511029	96.3	30	10	8.5
14-Mar-19	2019	Argo	11:25	A1	69.39454	-124.511029	97	27.5	15	8.5
16-Mar-19	2019	Argo	12:05	A1	69.39454	-124.511029	97.3	27.5	15	8.5
18-Mar-19	2019	Argo	13:15	A1	69.39454	-124.511029	98.3	31	10	8.5
20-Mar-19	2019	Argo	13:10	A1	69.39454	-124.511029	100	30	0	8.5
22-Mar-19	2019	Argo	N/A	A1	69.39454	-124.511029	105	30	0	8.5
24-Jan	2020	Argo	12:09	A1	69.39273	-124.458944	96	10	8	7.7
31-Jan	2020	Argo	12:12	A1	69.39273	-124.458944	95	11	6	8.5
31-Jan	2020	Bennett	13:30	BP1	69.72116	-124.081865	127	12	8.4	8.2
6-Feb	2020	Argo	12:20	A1	69.39454	-124.511029	108	16	7	8.5
7-Feb	2020	Bennett	13:40	BP1	69.72116	-124.081865	136	18	5	8.2
14-Feb	2020	Argo	11:34	A1	69.39454	-124.511029	104	15	7	8.5
19-Feb	2020	Bennett	14:05	BP1	69.72116	-124.081865	140	23	10	8.2
23-Feb	2020	Argo	13:30	A1	69.39454	-124.511029	116	9	6	8.5
23-Feb	2020	Bennett	N/A	BP1	69.72116	-124.081865	149	28	10	8.2
28-Feb	2020	Argo	12:00	A1	69.39454	-124.511029	118	13	9	8.5
1-Mar	2020	Bennett	15:00	BP1	69.72116	-124.081865	160	14	13	8.2
6-Mar	2020	Argo	14:30	A1	69.39454	-124.511029	123	10	6	8.5
9-Mar	2020	Bennett	16:21	BP1	69.72116	-124.081865	142	30	13	8.2

10-Mar	2020	Argo	11:50	A1	69.39454	-124.511029	129	6	7	8.5
21-Mar	2020	Argo	12:25	A1	69.39454	-124.511029	131	13	10	8.5
23-Mar	2020	Argo	11:58	A1	69.39454	-124.511029	131.5	10	9	8.5
24-Mar	2020	Bennett	19:48	BP1	69.72116	-124.081865	118	14	8	n/a
20-Jan	2021	Argo	13:10	A1	69.37806	-124.459167	91	11	6	8.5
25-Jan	2021	Argo	n/a	A1	69.37806	-124.459167	92.5	5	2	n/a
27-Jan	2021	Bennett	13:30	BP1	69.72116	-124.081865	105	5	8	8.2
3-Feb	2021	Bennett	14:21	BP1	69.72116	-124.081865	112	8	11	8.2
4-Feb	2021	Argo	13:24	A1	69.37806	-124.459167	97	5	2	8.5
9-Feb	2021	Argo	14:39	A1	69.37806	-124.459167	97	n/a	2	8.5
9-Feb	2021	Bennett	13:00	BP1	69.72116	-124.081865	118	7	8	8.2
17-Feb	2021	Argo	12:39	A1	69.37806	-124.459167	114	n/a	6	8.5
17-Feb	2021	Bennett	12:30	BP1	69.72116	-124.081865	124	5	10	8.2
27-Feb	2021	Argo	13:39	A1	69.37806	-124.459167	121	n/a	7	8.5
28-Feb	2021	Bennett	13:10	BP1	69.72116	-124.081865	140	8	11	8.2
6-Mar	2021	Bennett	11:00	BP1	69.72116	-124.081865	145	12	6	8.2
8-Mar	2021	Argo	14:24	A1	69.37806	-124.459167	125	10	8	8.5
12-Mar	2021	Argo	11:39	A1	69.37806	-124.459167	123	10	8	8.5
17-Mar	2021	Argo	11:54	A1	69.37806	-124.459167	137	6	8	8.5
20-Mar	2021	Browns	15:32	BH1	70.12553	-124.375181	150	5	12.7	8.1
25-Mar	2021	Argo	16:39	A1	69.37806	-124.459167	136	14	7	8.5
26-Mar	2021	Bennett	n/a	BP1	69.72116	-124.081865	155	8	9	8.5

APPENDIX F – Invertebrate Data

Table F1. Counts of taxa identified to the lowest possible taxonomic level, in plankton tows conducted on July 15th, 2019 at Bennett Point with one horizontal tow (P1; 2.2 m depth), and two vertical tows (P2 ; 9.2 m depth and P3; 7.3 m depth respectively).

				P1 (*n*)	**P2 (*n*)**	**P3 (*n*)**
Cnidaria	Trachymedusae	Rhopalonematidae	*Aglantha ditigale*	0	0	3
	Anthoathecata	Corynidae	*Sarsia princeps*	0	0	1
		Anthoathecata	*Anthoathecata* young medusae	43	8	52
	Leptothecata	Campanulariidae	*Obelia longissima* medusae	17	32	112
	Cnidaria			0	1	0
Polychaeta	Polynoidae		Polynoidae larvae	2	9	8
	Spionidae		Spionidae larvae	0	1	0
	Polychaeta		Polychaeta trochophores	0	4	0
Mollusca	Gastropoda	Clionidae	*Clione limacina*	0	1	0
Colembolla				1	0	1
Copepoda	Calanoida	Acartiidae	*Acartia longiremis*	32	6	75
			Acartia sp. copepodites	216	188	0
		Centropagidae	cf Centropagidae sp. copepodite stage	268	96	925
		Temoridae	*Eurytemora herdmani*	8	4	9
			cf *Temoridae* sp copepodites	164	94	0
		Calanoida	Calanoida nauplii stage	512	284	0
			Calanoida copepodite stage	92	170	0
	Cyclopoida	Oithonidae	*Oithona similis*	0	0	2
	Harpacticoida	Harpacticidae	*Harpacticus uniremis*	0	0	5
			Harpacticus sp.	8	0	0
			Zaus sp.	1	0	2
		Miraciidae	*Amonardia arctica*	8	1	2

		Tisbidae	*Tisbe furcata*	9	4	1
			Tisbe sp.	1	2	0
	Harpacticoida			1	2	0
Cirripedia	Balanidae		*Balanus* sp. nauplii	0	0	4
Decapoda	Brachyura	Oregoniidae	*Hyas coarctatus* zoea stage	44	28	15
Euphausiacea	Euphausiidae		*Thysanoessa* sp. calyptopis & nauplii stages	0	0	1067
Arachnida	Acari	Prostigmata		0	0	1
		Oribatida		0	1	0
Echnioidea	Strongylocentrotidae		Strongylocentrotidae pluteus stage	0	0	28
Ophiuroidea	Ophiuridae		Ophiuridae ophiopluteus stage	7	92	22
Chaetognatha	Sagittoidea	Sagittidae	*Parasagitta elegans*	0	1	4
Chordata	Appendicularia	Oikopleuridae	*Oikopleura (Vexillaria) labradoriensis*	4	3	2
		Fritillariidae	*Fritillaria borealis*	120	126	315

Table F2. Summary of benthic epifauna collected in 2017 and 2021 in Argo Bay and corresponding location information. Individual counts of each species are presented (*n*) and biomass per species/per sample is presented in grams.

Station	**Date**	**Depth (m)**	**Latitude (DD)**	**Longitude (DD)**	**Phylum**	**Class**	**Family**	**Scientific names**	***n***	**Biomass (g)**
AR9	8-July-2017	8.6	69.394436	-124.457322	Mollusca	Bivalvia	Mytilidae	*Mytilus sp.*	1	0.6597
AR9	8-July-2017	8.6	69.394436	-124.457322	Mollusca	Gastropoda	Mangeliidae	*Propebela turricula*	1	0.0712
AR9	8-July-2017	8.6	69.394436	-124.457322	Mollusca	Gastropoda	Cylichnidae	*Cylichna alba*	67	3.4274
AR9	8-July-2017	8.6	69.394436	-124.457322	Mollusca	Bivalvia	Astartidae	*Astarte montagui*	11	2.1811
AR9	8-July-2017	8.6	69.394436	-124.457322	Mollusca	Bivalvia	Astartidae	*Astarte sp.*	61	3.3164
AR9	8-July-2017	8.6	69.394436	-124.457322	Mollusca	Bivalvia	Astartidae	*Astarte borealis*	4	0.4956
AR9	8-July-2017	8.6	69.394436	-124.457322	Arthropoda	Malacostraca	Pontoporeiidae	*Pontoporeia femorata*	11	0.0723
AR9	8-July-2017	8.6	69.394436	-124.457322	Annelida	Polychaeta	Pectinariidae	*Cistenides granulata*	33	0.5607
AR9	8-July-2017	8.6	69.394436	-124.457322	Arthropoda	Malacostraca	Gammaridae	*Gammarus sp. (parts)*	1	0.0036
AR9	8-July-2017	8.6	69.394436	-124.457322	Bryozoa	Gymnolaemata	Alcyonidiidae	*Alcyonidium disciforme*	1	1.1913
AR9	8-July-2017	8.6	69.394436	-124.457322	Arthropoda	Malacostraca	Diastylidae	*Diastylis nucella*	1	0.0162
AR2	8-July-2017	7.1	69.37372	-124.446636	Mollusca	Bivalvia	Cardiidae	*Ciliatocardium ciliatum*	6	0.8815
AR2	8-July-2017	7.1	69.37372	-124.446636	Mollusca	Gastropoda	Mangeliidae	*Propebela turricula*	1	0.0439
AR2	8-July-2017	7.1	69.37372	-124.446636	Mollusca	Gastropoda	Cancellariidae	*Admete viridula*	15	3.2179
AR2	8-July-2017	7.1	69.37372	-124.446636	Mollusca	Gastropoda	Naticidae	*Cryptonatica affinis*	1	0.1541
AR2	8-July-2017	7.1	69.37372	-124.446636	Mollusca	Gastropoda	Littorinidae	*Lacuna crassior*	1	0.0452
AR2	8-July-2017	7.1	69.37372	-124.446636	Bryozoa	Gymnolaemata	Hippothoidae	*Celleporella hyalina*	1	0.001
AR2	8-July-2017	7.1	69.37372	-124.446636	Arthropoda	Malacostraca	Diastylidae	*Diastylis nucella*	1	0.0015
AR2	8-July-2017	7.1	69.37372	-124.446636	Mollusca	Bivalvia	Mytilidae	*Musculus discors*	6	0.3453
AR2	8-July-2017	7.1	69.37372	-124.446636	Mollusca	Bivalvia	Astartidae	*Astarte sp.*	33	1.6658
AR2	8-July-2017	7.1	69.37372	-124.446636	Mollusca	Gastropoda	Cylichnidae	*Cylichna alba*	2	0.0943
AR2	8-July-2017	7.1	69.37372	-124.446636	Mollusca	Bivalvia	Hiatellidae	*Hiatella arctica*	2	0.1172
AR2	8-July-2017	7.1	69.37372	-124.446636	Mollusca	Bivalvia	Myidae	*Mya truncata*	5	0.3089
AR2	8-July-2017	7.1	69.37372	-124.446636	Mollusca	Bivalvia	Astartidae	*Astarte borealis*	46	2.6661
AR2	8-July-2017	7.1	69.37372	-124.446636	Mollusca	Gastropoda	Mangeliidae	*Curtitoma sp.*	3	0.0915
AR7	8-July-2017	6.3	69.371802	-124.479654	Mollusca	Bivalvia	Mytilidae	*Musculus discors*	40	2.2508
AR7	8-July-2017	6.3	69.371802	-124.479654	Mollusca	Bivalvia	Astartidae	*Astarte borealis*	41	5.3945

AR7	8-July-2017	6.3	69.371802	-124.479654	Mollusca	Bivalvia	Cardiidae	*Ciliatocardium ciliatum*	3	0.2102
AR7	8-July-2017	6.3	69.371802	-124.479654	Mollusca	Bivalvia	Astartidae	*Astarte sp.*	2	0.0128
AR7	8-July-2017	6.3	69.371802	-124.479654	Mollusca	Bivalvia	Myidae	*Mya truncata*	33	1.6203
AR7	8-July-2017	6.3	69.371802	-124.479654	Mollusca	Gastropoda	Mangeliidae	*Propebela turricula*	16	2.1569
AR7	8-July-2017	6.3	69.371802	-124.479654	Mollusca	Gastropoda	Mangeliidae	*Curtitoma violacea*	4	0.5734
AR7	8-July-2017	6.3	69.371802	-124.479654	Mollusca	Gastropoda	Philinidae	*Philine lima*	4	0.0635
AR7	8-July-2017	6.3	69.371802	-124.479654	Bryozoa	Gymnolaemata	Alcyonidiidae	*Alcyonidium disciforme*	1	3.3867
AR7	8-July-2017	6.3	69.371802	-124.479654	Echinodermata	Holothuroidea	Myriotrochidae	*Myriotrochus rinkii*	3	0.1625
AR7	8-July-2017	6.3	69.371802	-124.479654	Arthropoda	Malacostraca	Pontoporeiidae	*Pontoporeia femorata*	5	0.0479
AR7	8-July-2017	6.3	69.371802	-124.479654	Arthropoda	Malacostraca	Eusiridae	*Rhachotropis aculeata*	1	0.0481
AR7	8-July-2017	6.3	69.371802	-124.479654	Annelida	Polychaeta	Pectinariidae	*Cistenides granulata*	22	0.6892
AR7	8-July-2017	6.3	69.371802	-124.479654	Bryozoa	Gymnolaemata	Eucrateidae	*Eucratea loricata*	1	0.0016
AR7	8-July-2017	6.3	69.371802	-124.479654	Arthropoda	Malacostraca	Diastylidae	*Diastylidae spp.A*	2	0.0075
AR7	8-July-2017	6.3	69.371802	-124.479654	Arthropoda	Malacostraca	Diastylidae	*Diastylis nucella*	3	0.0193
AR5	8-July-2017	6.3	69.37311	-124.404263	Echinodermata	Holothuroidea	Myriotrochidae	*Myriotrochus rinkii*	1	0.0235
AR5	8-July-2017	6.3	69.37311	-124.404263	Mollusca	Bivalvia	Tellinidae	*Macoma balthica*	1	0.0024
AR8	8-July-2017	6.3	69.395868	-124.511216	Mollusca	Bivalvia	Astartidae	*Astarte borealis*	49	6.4079
AR8	8-July-2017	6.3	69.395868	-124.511216	Mollusca	Bivalvia	Myidae	*Mya truncata*	6	0.2138
AR8	8-July-2017	6.3	69.395868	-124.511216	Mollusca	Bivalvia	Hiatellidae	*Hiatella arctica*	6	0.1966
AR8	8-July-2017	6.3	69.395868	-124.511216	Mollusca	Bivalvia	Mytilidae	*Musculus discors*	2	0.1449
AR8	8-July-2017	6.3	69.395868	-124.511216	Mollusca	Bivalvia	Cardiidae	*Ciliatocardium ciliatum*	1	0.0149
AR8	8-July-2017	6.3	69.395868	-124.511216	Mollusca	Bivalvia	Tellinidae	*Macoma balthica*	1	0.0465
AR8	8-July-2017	6.3	69.395868	-124.511216	Mollusca	Gastropoda	Cylichnidae	*Cylichna alba*	5	0.1523
AR8	8-July-2017	6.3	69.395868	-124.511216	Bryozoa	Stenolaemata	Lichenoporidae	*Lichenopora sp.*	1	0.0043
AR8	8-July-2017	6.3	69.395868	-124.511216	Annelida	Polychaeta	Pectinariidae	*Cistenides granulata*	1	0.1099
AR8	8-July-2017	6.3	69.395868	-124.511216	Echinodermata	Holothuroidea	Myriotrochidae	*Myriotrochus rinkii*	5	0.2963
AR8	8-July-2017	6.3	69.395868	-124.511216	Arthropoda	Malacostraca	Pontoporeiidae	*Pontoporeia femorata*	1	0.0051
AR8	8-July-2017	6.3	69.395868	-124.511216	Arthropoda	Malacostraca	Thoridae	*Eualus sp.*	1	0.1697
AR8	8-July-2017	6.3	69.395868	-124.511216	Arthropoda	Malacostraca		*Amphipoda (parts)*	1	0.0061
AR3	8-July-2017	8.1	69.374338	-124.465754	Annelida	Polychaeta	Pectinariidae	*Cistenides granulata*	323	1.8675
AR3	8-July-2017	8.1	69.374338	-124.465754	Chordata	Ascidiacea	Ascidiidae	*Ascidia sp.*	1	8.1682
AR3	8-July-2017	8.1	69.374338	-124.465754	Mollusca	Bivalvia	Mytilidae	*Musculus discors*	28	0.5392

AR3	8-July-2017	8.1	69.374338	-124.465754	Mollusca	Bivalvia	Astartidae	*Astarte borealis*	59	4.194
AR3	8-July-2017	8.1	69.374338	-124.465754	Mollusca	Gastropoda	Cylichnidae	*Cylichna alba*	18	0.4769
AR3	8-July-2017	8.1	69.374338	-124.465754	Mollusca	Bivalvia	Myidae	*Mya truncata*	11	0.2016
AR3	8-July-2017	8.1	69.374338	-124.465754	Mollusca	Bivalvia	Hiatellidae	*Hiatella arctica*	7	0.1269
AR3	8-July-2017	8.1	69.374338	-124.465754	Bryozoa	Gymnolaemata	Alcyonidiidae	*Alcyonidium disciforme*	1	3.0307
AR3	8-July-2017	8.1	69.374338	-124.465754	Bryozoa	Gymnolaemata	Eucrateidae	*Eucratea loricata*	1	0.0085
AR3	8-July-2017	8.1	69.374338	-124.465754	Arthropoda	Malacostraca	Pontoporeiidae	*Pontoporeia femorata*	3	0.0378
AR3	8-July-2017	8.1	69.374338	-124.465754	Arthropoda	Malacostraca	Tryphosidae	*Tryphosidae spp.*	1	0.0054
AR3	8-July-2017	8.1	69.374338	-124.465754	Arthropoda	Malacostraca	Eusiridae	*Rhachotropis aculeata*	1	0.0405
AR3	8-July-2017	8.1	69.374338	-124.465754	Arthropoda	Malacostraca	Oedicerotidae	*Monoculodes longirostris*	1	0.0184
AR1	8-July-2017	3.3	69.373188	-124.434713	Annelida	Polychaeta	Pectinariidae	*Cistenides granulata*	1	0.0364
AR1	8-July-2017	3.3	69.373188	-124.434713	Arthropoda	Malacostraca	Atylidae	*Atylidae spp. (parts)*	1	0.0376
AR1	8-July-2017	3.3	69.373188	-124.434713	Mollusca	Bivalvia	Mytilidae	*Mytilus sp.*	1	0.0383
AR1	8-July-2017	3.3	69.373188	-124.434713	Mollusca	Bivalvia	Myidae	*Mya truncata*	2	0.0712
AR1	8-July-2017	3.3	69.373188	-124.434713	Mollusca	Bivalvia	Tellinidae	*Macoma balthica*	1	0.1763
WP4	9-Aug-2021	6.2	69.371051	-124.444499	Annelida	Polychaeta	Nephtyidae	*Nephtyidae*	1	0.0578
WP5	8-Aug-2021	8.9	69.376433	-124.459032	Annelida	Polychaeta	Pectinariidae	*Cistenides granulata*	2	0.075
WP5	8-Aug-2021	8.9	69.376433	-124.459032	Mollusca	Bivalvia	Tellinidae	*Macoma calcarea*	1	0.062
WP5	8-Aug-2021	8.9	69.376433	-124.459032	Mollusca	Bivalvia	Astartidae	*Astarte montagui*	4	0.4345
WP5	8-Aug-2021	8.9	69.376433	-124.459032	Mollusca	Gastropoda	Naticidae	*Euspira pallida*	1	1.9333
WP5	8-Aug-2021	8.9	69.376433	-124.459032	Arthropoda	Malacostraca	Pontoporeiidae	*Pontoporeia femorata*	1	0.0048
WP10	4-Sept-2021	7.4	69.40108	-124.516448	Mollusca	Bivalvia	Tellinidae	*Macoma calcarea*	16	2.2201
WP10	4-Sept-2021	7.4	69.40108	-124.516448	Priapulida	n/a	Priapulidae	*Priapulus caudatus*	1	0.0484
WP11	4-Sept-2021	3.4	69.4052	-124.528475	Annelida	Polychaeta	Pectinariidae	*Cistenides granulata*	2	0.2960
WP11	4-Sept-2021	3.4	69.4052	-124.528475	Mollusca	Bivalvia	Tellinidae	*Macoma calcarea*	1	0.0392

APPENDIX G – Plain language summaries

Darnley Bay Coastal Fish Survey - July 3rd - 18th, 2018

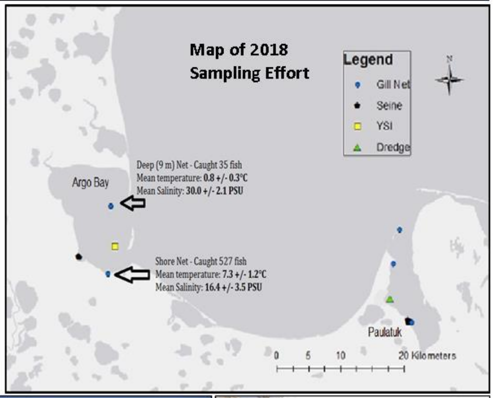
Darcy McNicholl & Karen Dunmall, Fisheries and Oceans Canada

The field program this year was conducted in Argo Bay, in the Anguniaqvia Niqiqyuam Marine Protected Area (ANMPA). The objectives of the coastal survey this year were to:

- Assess Biodiversity and abundance of coastal fish, and whether it differs from previous years.
- Monitor habitat parameters associated with fish (salinity, temperature) and compare to prior sampling years.
- Collect invertebrates and sediment when possible.
- Collect samples to study fish diet and use samples to monitor changing fish habitat and interactions.
- Develop the field work into a community-led annual monitoring program for the MPA.

Fishes were collected using 6 panel multi-mesh gill nets, samples from dead sampled fishes have been received by DFO and are currently being processed for further analyses. A total of 17 nets were set, and 5 seine hauls were conducted.

Species	Total	Dead Sampled	Live Released
Arctic Char	22	22	0
Arctic Cisco	2	2	0
Arctic Flounder	598	34	564
Arctic Staghorn Sculpin	5	5	0
Broad Whitefish	102	32	70
Capelin	32	31	1
Fourhorn Sculpin	1	1	0
Pacific Herring	23	23	0
Saffron Cod	3	3	0
Shorthorn Sculpin	30	30	0
Starry Flounder	145	32	113
Total	**962**	**214**	**748**



Technicians: B. Green, S. Illasiak with K. Hansen-Craik and D. McNicholl

Brandon Green and Steve Illasiak processing fish for samples and recording biological data

Seine haul to collect larval fish and small invertebrates in Argo Bay

Steve Illasiak (field camp lead) with an Arctic Char in the Argo Bay lab tent

This is the first year that the Darnley Bay Coastal Fish Survey has operated as a community-run field program. D. McNicholl and K. Hansen-Craik provided instruction and training from July 3rd-6th for community-based technicians, S. Illasiak and B. Green, who successfully conducted the field work independently from July 9th-18th. The dedication of these technicians to the nearshore fish survey has enabled greater local capacity to monitor the ANMPA and has allowed the field work to become a community-run monitoring program. Data on fishes, samples and habitat loggers were collected by the technicians and are currently being analyzed at DFO-Winnipeg. We are grateful for the support of the Fisheries Joint Management Committee, DFO-Inuvik, The Joint Secretariat Marine Protected Area Coordinator (K. Hansen Craik), and the Paulatuk Hunters and Trappers Committee. Finally, we thank the community of Paulatuk for their involvement and support over the years.

Fisheries and Oceans Canada   Pêches et Océans Canada

Darcy.McNicholl@dfo-mpo.gc.ca
(204) 983-5287

Figure G1. Plain language summary of fieldwork completed between July 3rd and 18th, 2018.

Arctic Coast - Winter Survey of the ANMPA

Darcy McNicholl & Karen Dunmall, Fisheries and Oceans Canada

The baseline winter survey was conducted in Argo Bay, in the Anguniaqvia Niqiqyuam Marine Protected Area (ANMPA). The objectives of the coastal survey this year (Jan 17th to March 22nd, 2019) were to:

- Begin development of a community-led approach for winter research by testing methods and equipment
- Complete a baseline survey of winter habitat under the sea ice in the ANMPA
- Collect data on ice thickness, snow depth, temperature (air and water) and salinity (saltiness)
- Collect fish under the ice to better understand seasonal habitat use
- Investigate fish diet in the winter and compare with summer samples
- Collaborate with Canadian Rangers Ocean Watch (CROW) to gather environmental data

Key Findings

- Technicians successfully completed weekly stations (14 days) where they collected habitat information, video and fishes (Steve Illasiak and Nelson Ruben)
- 6 survey stations were completed in March with DFO-Biologists and two additional technicians (Noel Green and Terrence Green). Fish, video and oceanographic information were collected under the ice
- 47 fish were collected by weekly monitors (Greenland Cod, Saffron Cod and Sculpins) which will be used to compare with diets of the same species collected in the summer
- 2 time lapse cameras have been set up to take pictures of ice breakup every day until the summer season

Measuring ice thickness, snow depth and water level

Nelson Ruben, Noel Green, and Terrance Green, with DFO biologists in March

Terrance Green with water profiler to measure under ice habitat

Greenland (Rock) Cod and Saffron (Tom) Cod collected under the ice in Argo Bay

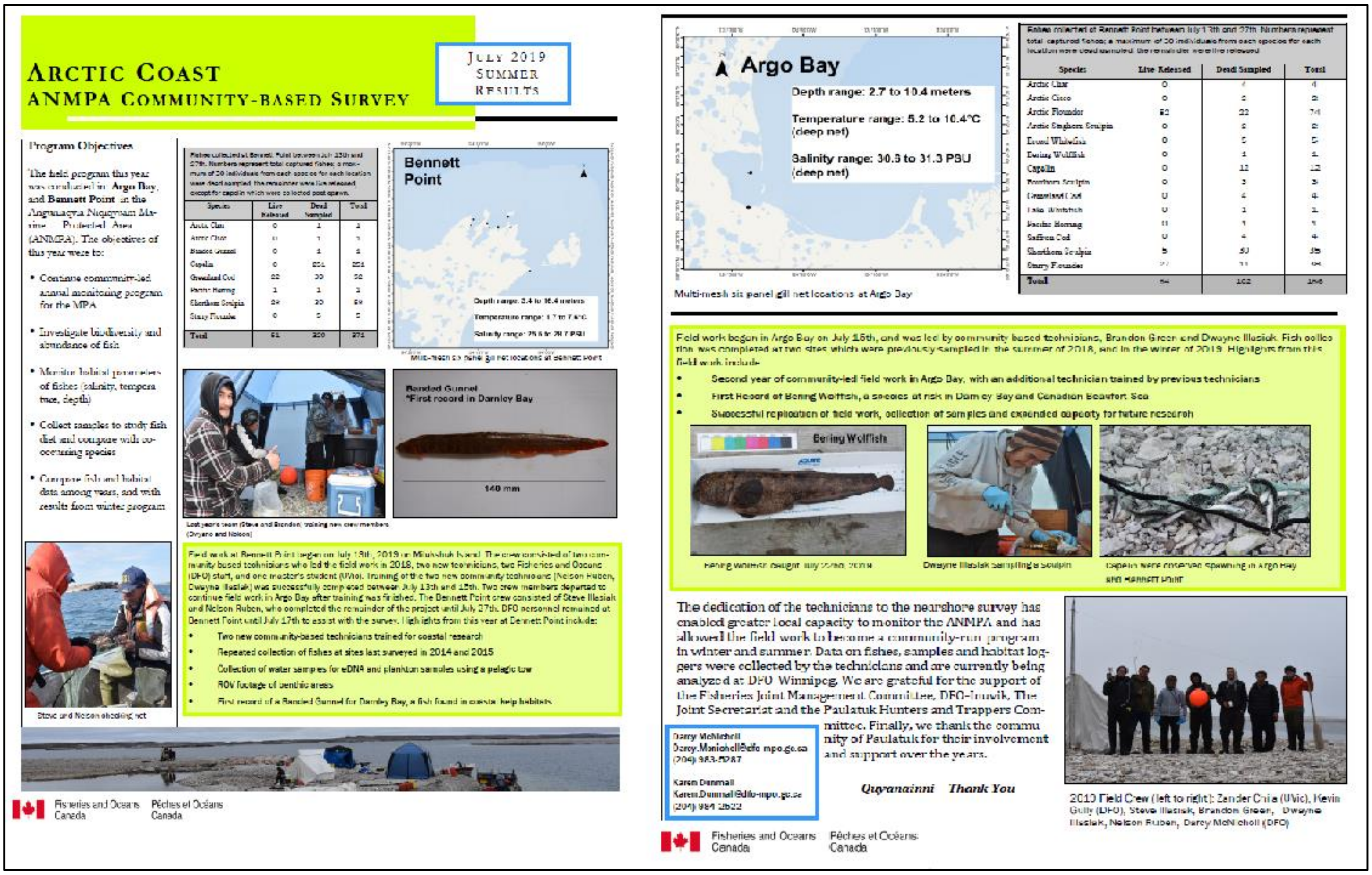
Prior to this project, there was little knowledge of fish biodiversity and their associated habitat during the winter in the ANMPA. Through collaboration with CROW and the PHTC, we now have more information about the ecology of fishes in the winter and can compare it to our summer research. As a baseline survey, this was a successful year for gathering information, testing methods, and building the capacity for it to be community-led next year, similar to our summer fish survey. We are grateful for the support of the Fisheries Joint Management Committee, DFO-Inuvik, The Joint Secretariat, and the Paulatuk Hunters and Trappers Committee. We thank Mike Dempsey (DFO) for his contribution to the project, and each of the community-based technicians (Steve Illasiak, Nelson Ruben, Noel Green and Terrence Green) who participated in the field work. Finally, we thank the community of Paulatuk for their involvement and support over the years.

Fisheries and Oceans Canada / Pêches et Océans Canada

Karen.Dunmall@dfo-mpo.gc.ca
(204) 984-2522

Darcy.McNicholl@dfo-mpo.gc.ca
(204) 983-5287

Figure G2. Plain language summary of fieldwork completed between January 17th and March 22nd, 2019.



Arctic Coast
ANMPA Community-based Survey

July 2019 Summer Results

Program Objectives

The field program this year was conducted in **Argo Bay**, and **Bennett Point** in the Anguniaqvia Niqiqyuam Marine Protected Area (ANMPA). The objectives of this year were to:

- Continue community-led annual monitoring program for the MPA
- Investigate biodiversity and abundance of fish
- Monitor habitat parameters of fishes (salinity, temperature, depth)
- Collect samples to study fish diet and compare with co-occurring species
- Compare fish and habitat data among years, and with results from winter program

Fishes collected at Bennett Point between July 13th and 27th. Numbers represent total captured fishes; a maximum of 30 individuals from each species for each location were dead sampled, the remainder were live released, except for capelin which were collected post spawn.

Species	Live Released	Dead Sampled	Total
Arctic Char	0	1	1
Arctic Cisco	0	1	1
Banded Gunnel	0	1	1
Capelin	0	221	221
Greenland Cod	22	30	52
Pacific Herring	1	1	2
Shorthorn Sculpin	29	30	59
Starry Flounder	0	5	5
Total	51	220	271

Bennett Point

Depth range: 2.4 to 16.4 meters

Temperature range: 1.7 to 7.6°C

Salinity range: 25.5 to 28.7 PSU

Multi-mesh six panel gill net locations at Bennett Point

Last year's team (Steve and Brandon) training new crew members (Dwyane and Nelson)

Banded Gunnel
*First record in Darnley Bay

140 mm

Steve and Nelson checking net

Field work at Bennett Point began on July 13th, 2019 on Miluhshuk Island. The crew consisted of two community based technicians who led the field work in 2018, two new technicians, two Fisheries and Oceans (DFO) staff, and one master's student (UVic). Training of the two new community technicians (Nelson Ruben, Dwayne Illasiak) was successfully completed between July 13th and 15th. Two crew members departed to continue field work in Argo Bay after training was finished. The Bennett Point crew consisted of Steve Illasiak and Nelson Ruben, who completed the remainder of the project until July 27th. DFO personnel remained at Bennett Point until July 17th to assist with the survey. Highlights from this year at Bennett Point include:

- Two new community-based technicians trained for coastal research
- Repeated collection of fishes at sites last surveyed in 2014 and 2015
- Collection of water samples for eDNA and plankton samples using a pelagic tow
- ROV footage of benthic areas
- First record of a Banded Gunnel for Darnley Bay, a fish found in coastal kelp habitats

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Argo Bay

Depth range: 2.7 to 10.4 meters

Temperature range: 5.2 to 10.4°C (deep net)

Salinity range: 30.6 to 31.3 PSU (deep net)

Multi-mesh six panel gill net locations at Argo Bay

Fishes collected at Bennett Point between July 13th and 27th. Numbers represent total captured fishes; a maximum of 30 individuals from each species for each location were dead sampled, the remainder were live released.

Species	Live Released	Dead Sampled	Total
Arctic Char	0	4	4
Arctic Cisco	0	2	2
Arctic Flounder	52	22	74
Arctic Staghorn Sculpin	0	2	2
Broad Whitefish	0	5	5
Bering Wolffish	0	1	1
Capelin	0	12	12
Fourhorn Sculpin	0	3	3
Greenland Cod	0	4	4
Lake Whitefish	0	1	1
Pacific Herring	0	1	1
Saffron Cod	0	4	4
Shorthorn Sculpin	5	30	35
Starry Flounder	27	11	38
Total	84	102	186

Field work began in Argo Bay on July 15th, and was led by community based technicians, Brandon Green and Dwayne Illasiak. Fish collection was completed at two sites which were previously sampled in the summer of 2018, and in the winter of 2019. Highlights from this field work include:

- Second year of community-led field work in Argo Bay, with an additional technician trained by previous technicians
- First Record of Bering Wolffish, a species at risk in Darnley Bay and Canadian Beaufort Sea
- Successful replication of field work, collection of samples and expanded capacity for future research

Bering Wolffish

Bering Wolffish caught July 22nd, 2019

Dwayne Illasiak sampling a Sculpin

Capelin were observed spawning in Argo Bay and Bennett Point

The dedication of the technicians to the nearshore survey has enabled greater local capacity to monitor the ANMPA and has allowed the field work to become a community-run program in winter and summer. Data on fishes, samples and habitat loggers were collected by the technicians and are currently being analyzed at DFO Winnipeg. We are grateful for the support of the Fisheries Joint Management Committee, DFO-Inuvik, The Joint Secretariat and the Paulatuk Hunters and Trappers Committee. Finally, we thank the community of Paulatuk for their involvement and support over the years.

Quyanainni Thank You

Darcy McNicholl
Darcy.Mcnicholl@dfo-mpo.gc.ca
(204) 983-5287

Karen Dunmall
Karen.Dunmall@dfo-mpo.gc.ca
(204) 984-2622

2019 Field Crew (left to right): Zander Chila (UVic), Kevin Gully (DFO), Steve Illasiak, Brandon Green, Dwayne Illasiak, Nelson Ruben, Darcy McNicholl (DFO)

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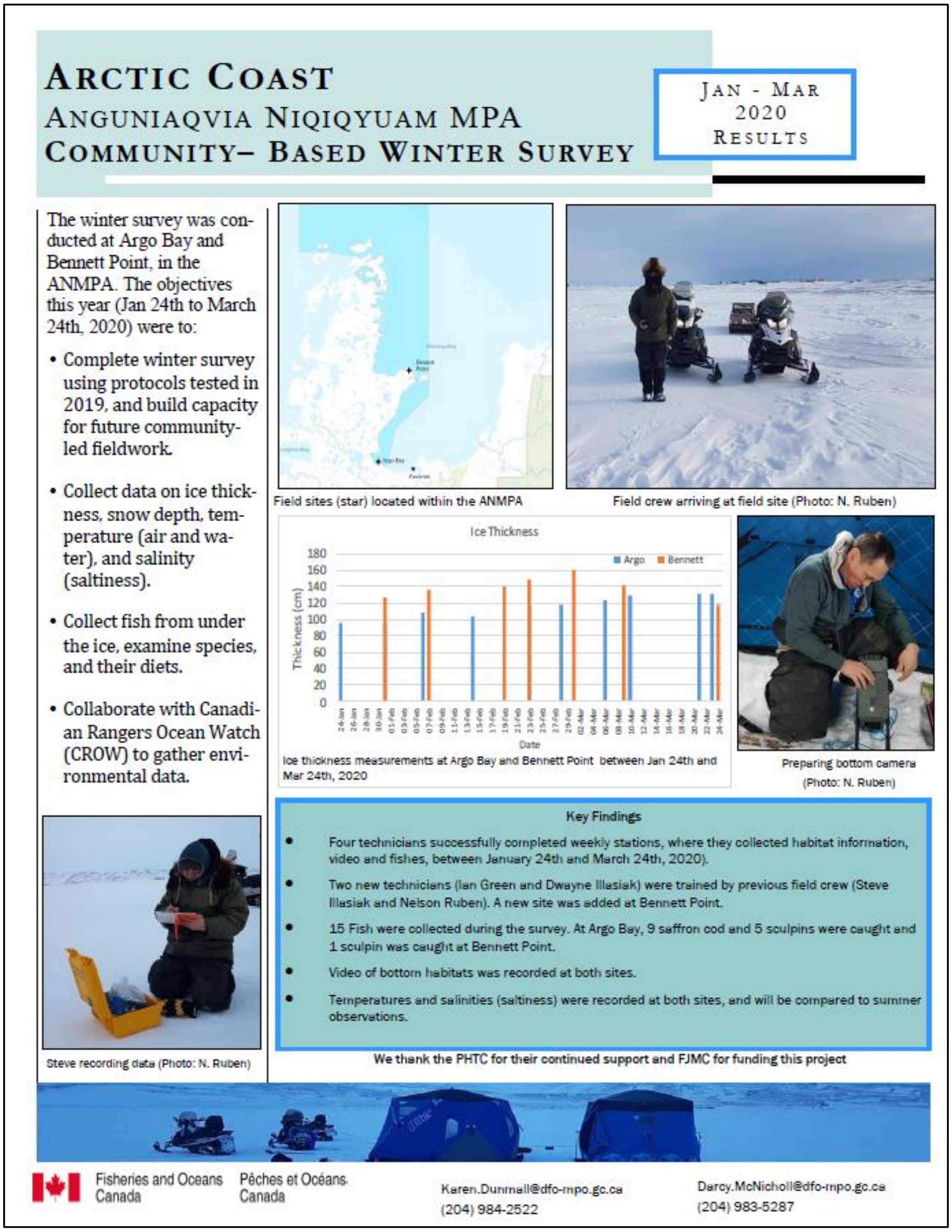
Figure G3. Plain language summary of fieldwork completed between July 13th and 27th, 2019.



ARCTIC COAST
ANGUNIAQVIA NIQIQYUAM MPA
COMMUNITY– BASED WINTER SURVEY

JAN - MAR
2020
RESULTS

The winter survey was conducted at Argo Bay and Bennett Point, in the ANMPA. The objectives this year (Jan 24th to March 24th, 2020) were to:

- Complete winter survey using protocols tested in 2019, and build capacity for future community-led fieldwork.
- Collect data on ice thickness, snow depth, temperature (air and water), and salinity (saltiness).
- Collect fish from under the ice, examine species, and their diets.
- Collaborate with Canadian Rangers Ocean Watch (CROW) to gather environmental data.

Field sites (star) located within the ANMPA

Field crew arriving at field site (Photo: N. Ruben)

Ice thickness measurements at Argo Bay and Bennett Point between Jan 24th and Mar 24th, 2020

Preparing bottom camera (Photo: N. Ruben)

Steve recording data (Photo: N. Ruben)

Key Findings

- Four technicians successfully completed weekly stations, where they collected habitat information, video and fishes, between January 24th and March 24th, 2020).
- Two new technicians (Ian Green and Dwayne Illasiak) were trained by previous field crew (Steve Illasiak and Nelson Ruben). A new site was added at Bennett Point.
- 15 Fish were collected during the survey. At Argo Bay, 9 saffron cod and 5 sculpins were caught and 1 sculpin was caught at Bennett Point.
- Video of bottom habitats was recorded at both sites.
- Temperatures and salinities (saltiness) were recorded at both sites, and will be compared to summer observations.

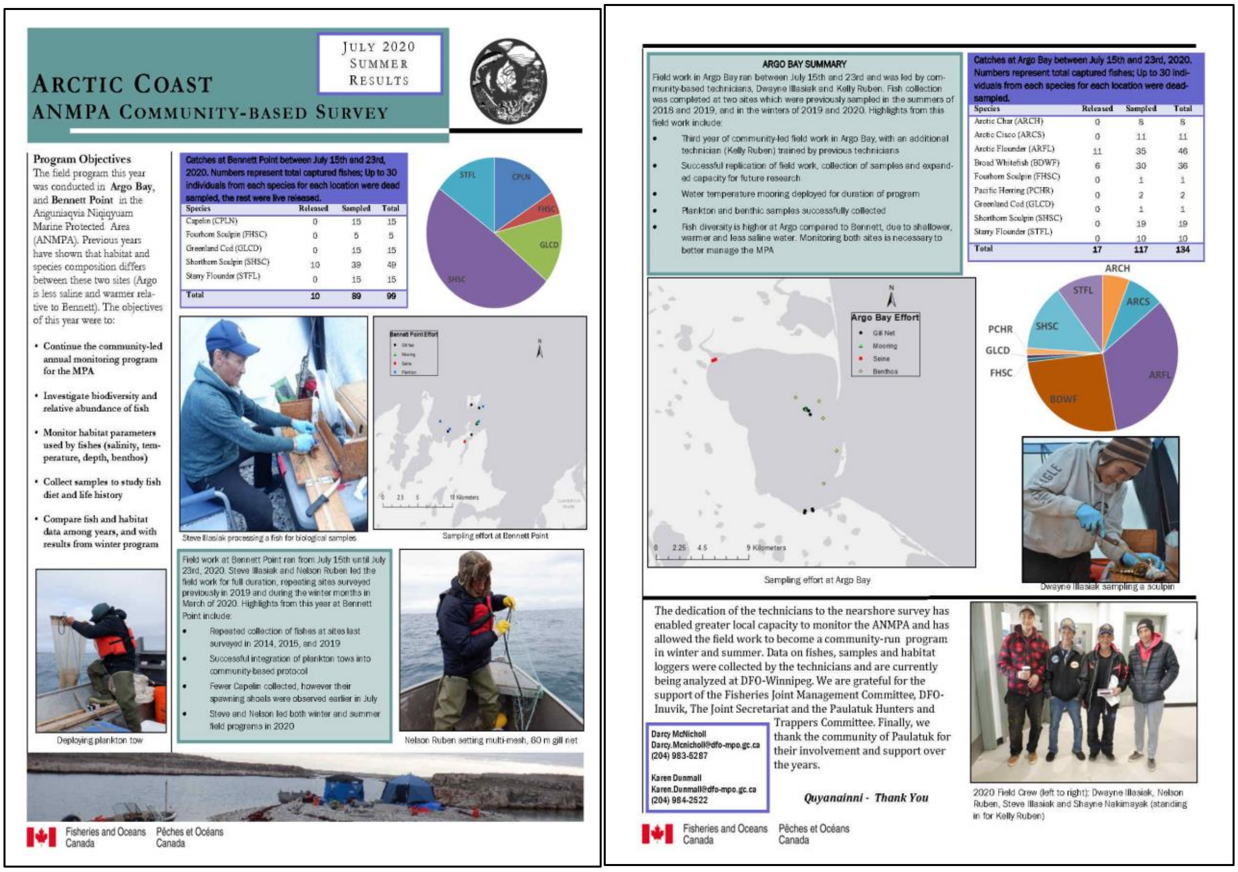
We thank the PHTC for their continued support and FJMC for funding this project

Fisheries and Oceans Canada | Pêches et Océans Canada

Karen.Dunmall@dfo-mpo.gc.ca
(204) 984-2522

Darcy.McNicholl@dfo-mpo.gc.ca
(204) 983-5287

Figure G4. Plain language summary of fieldwork completed between January 24th and March 24th, 2020.



Arctic Coast
ANMPA Community-based Survey

July 2020
Summer
Results

Program Objectives

The field program this year was conducted in **Argo Bay**, and **Bennett Point** in the Anguniaqvia Niqiqyuam Marine Protected Area (ANMPA). Previous years have shown that habitat and species composition differs between these two sites (Argo is less saline and warmer relative to Bennett). The objectives of this year were to:

- **Continue the community-led annual monitoring program for the MPA**
- **Investigate biodiversity and relative abundance of fish**
- **Monitor habitat parameters used by fishes (salinity, temperature, depth, benthos)**
- **Collect samples to study fish diet and life history**
- **Compare fish and habitat data among years, and with results from winter program**

Catches at Bennett Point between July 15th and 23rd, 2020. Numbers represent total captured fishes; Up to 30 individuals from each species for each location were dead sampled, the rest were live released.

Species	Released	Sampled	Total
Capelin (CPLN)	0	15	15
Fourhorn Sculpin (FHSC)	0	5	5
Greenland Cod (GLCD)	0	15	15
Shorthorn Sculpin (SHSC)	10	39	49
Starry Flounder (STFL)	0	15	15
Total	**10**	**89**	**99**

Steve Illasiak processing a fish for biological samples

Sampling effort at Bennett Point

Field work at Bennett Point ran from July 15th until July 23rd, 2020. Steve Illasiak and Nelson Ruben led the field work for full duration, repeating sites surveyed previously in 2019 and during the winter months in March of 2020. Highlights from this year at Bennett Point include:

- Repeated collection of fishes at sites last surveyed in 2014, 2015, and 2019
- Successful integration of plankton tows into community-based protocol
- Fewer Capelin collected, however their spawning shoals were observed earlier in July
- Steve and Nelson led both winter and summer field programs in 2020

Deploying plankton tow

Nelson Ruben setting multi-mesh, 60 m gill net

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ARGO BAY SUMMARY

Field work in Argo Bay ran between July 15th and 23rd and was led by community-based technicians, Dwayne Illasiak and Kelly Ruben. Fish collection was completed at two sites which were previously sampled in the summers of 2018 and 2019, and in the winters of 2019 and 2020. Highlights from this field work include:

- Third year of community-led field work in Argo Bay, with an additional technician (Kelly Ruben) trained by previous technicians
- Successful replication of field work, collection of samples and expanded capacity for future research
- Water temperature mooring deployed for duration of program
- Plankton and benthic samples successfully collected
- Fish diversity is higher at Argo compared to Bennett, due to shallower, warmer and less saline water. Monitoring both sites is necessary to better manage the MPA

Catches at Argo Bay between July 15th and 23rd, 2020. Numbers represent total captured fishes; Up to 30 individuals from each species for each location were dead-sampled.

Species	Released	Sampled	Total
Arctic Char (ARCH)	0	8	8
Arctic Cisco (ARCS)	0	11	11
Arctic Flounder (ARFL)	11	35	46
Broad Whitefish (BDWF)	6	30	36
Fourhorn Sculpin (FHSC)	0	1	1
Pacific Herring (PCHR)	0	2	2
Greenland Cod (GLCD)	0	1	1
Shorthorn Sculpin (SHSC)	0	19	19
Starry Flounder (STFL)	0	10	10
Total	**17**	**117**	**134**

Sampling effort at Argo Bay

Dwayne Illasiak sampling a sculpin

The dedication of the technicians to the nearshore survey has enabled greater local capacity to monitor the ANMPA and has allowed the field work to become a community-run program in winter and summer. Data on fishes, samples and habitat loggers were collected by the technicians and are currently being analyzed at DFO-Winnipeg. We are grateful for the support of the Fisheries Joint Management Committee, DFO-Inuvik, The Joint Secretariat and the Paulatuk Hunters and Trappers Committee. Finally, we thank the community of Paulatuk for their involvement and support over the years.

Darcy McNicholl
Darcy.Mcnicholl@dfo-mpo.gc.ca
(204) 983-5287

Karen Dunmall
Karen.Dunmall@dfo-mpo.gc.ca
(204) 984-2522

Quyanainni - Thank You

2020 Field Crew (left to right): Dwayne Illasiak, Nelson Ruben, Steve Illasiak and Shayne Nakimayak (standing in for Kelly Ruben)

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Figure G5. Plain language summary of fieldwork completed between July 15th and 23rd, 2020.

ARCTIC COAST
ANGUNIAQVIA NIQIQYUAM MPA
COMMUNITY– BASED WINTER

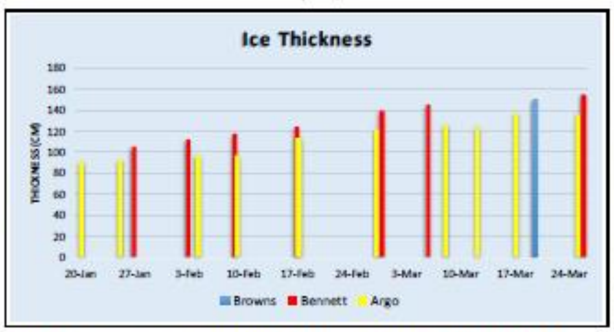
JAN - MAR 2021 RESULTS

The winter survey was conducted at Argo Bay, Bennett Point, and Brown's Harbour in the ANMPA. The objectives this year (Jan 20th to March 26th, 2021) were to:

- Complete winter survey using established protocols, and build capacity for future community-led fieldwork.
- Collect data on ice thickness, snow depth, temperature (air and water), and under-ice data salinity (saltiness), and benthic community.
- Collect fish from under the ice, examine species, and their diets.
- Coordinate data collection with Canadian Rangers Ocean Watch (CROW) to gather environmental data.

Field sites located within the ANMPA (blue)

Putting temperature-salinity loggers under the ice



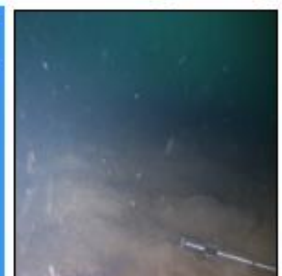
Ice thickness measurements in the ANMPA between Jan 20th and Mar 26th, 2021.

Greenland Cod caught ice-fishing

Observing ridges at Brown's Harbour

Key Findings

- Four technicians successfully completed weekly stations, where they collected habitat information, video and fishes.
- Two new technicians were trained, they completed two stations at Brown's Harbour
- Temperature-salinity loggers collected data under the ice at all three sites (at 1 meter below the ice and at the sea floor)
- Set up 3 time-lapse cameras, and collected under-ice video
- Fishes captured: 4 Greenland Cod, 1 Saffron Cod, 3 Fourhorn Sculpins



Bottom video of zooplankton

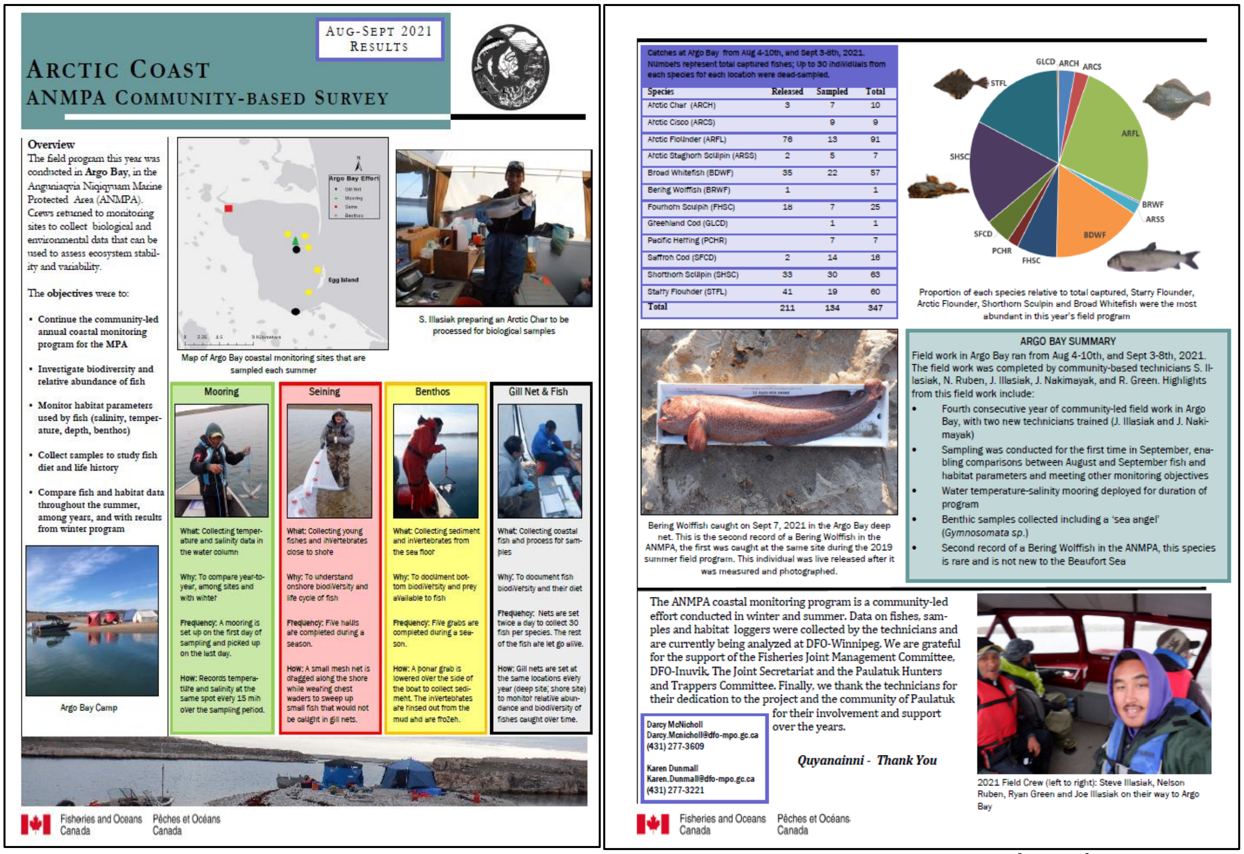
We thank the Paulatuk Hunters and Trappers Committee for their continued support, and Steve Illasiak, Nelson Ruben, Dwayne Illasiak, Ian Green, Brandon Green and Codey Felix for their hard work! Funding was provided by FJMC and the DFO Marine Conservation Target program.

Fisheries and Oceans Canada Pêches et Océans Canada

Karen.Dunmall@dfo-mpo.gc.ca
(431) 277-3221

Darcy.McNicholl@dfo-mpo.gc.ca
(431) 277-3609

Figure G6. Plain language summary of fieldwork completed between January 20th and March 26th, 2021.



Aug-Sept 2021 Results

Arctic Coast ANMPA Community-based Survey

Overview

The field program this year was conducted in **Argo Bay**, in the Anguniaqvia Niqiqyuam Marine Protected Area (ANMPA). Crews returned to monitoring sites to collect biological and environmental data that can be used to assess ecosystem stability and variability.

The **objectives** were to:

- Continue the community-led annual coastal monitoring program for the **MPA**
- Investigate biodiversity and relative abundance of fish
- Monitor habitat parameters used by fish (salinity, temperature, depth, benthos)
- Collect samples to study fish diet and life history
- Compare fish and habitat data throughout the summer, among years, and with results from winter program

Argo Bay Effort: Gill Net, Mooring, Seine, Benthos; Egg Island; 0 2.25 4.5 9 Kilometers

Map of Argo Bay coastal monitoring sites that are sampled each summer

S. Illasiak preparing an Arctic Char to be processed for biological samples

Argo Bay Camp

Mooring

What: Collecting temperature and salinity data in the water column

Why: To compare year-to-year, among sites and with winter

Frequency: A mooring is set up on the first day of sampling and picked up on the last day.

How: Records temperature and salinity at the same spot every 15 min over the sampling period.

Seining

What: Collecting young fishes and invertebrates close to shore

Why: To understand onshore biodiversity and life cycle of fish

Frequency: Five hauls are completed during a season.

How: A small mesh net is dragged along the shore while wearing chest waders to sweep up small fish that would not be caught in gill nets.

Benthos

What: Collecting sediment and invertebrates from the sea floor

Why: To document bottom biodiversity and prey available to fish

Frequency: Five grabs are completed during a season.

How: A ponar grab is lowered over the side of the boat to collect sediment. The invertebrates are rinsed out from the mud and are frozen.

Gill Net & Fish

What: Collecting coastal fish and process for samples

Why: To document fish biodiversity and their diet

Frequency: Nets are set twice a day to collect 30 fish per species. The rest of the fish are let go alive.

How: Gill nets are set at the same locations every year (deep site; shore site) to monitor relative abundance and biodiversity of fishes caught over time.

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Catches at Argo Bay from Aug 4-10th, and Sept 3-8th, 2021. Numbers represent total captured fishes; Up to 30 individuals from each species for each location were dead-sampled.

Species	Released	Sampled	Total
Arctic Char (ARCH)	3	7	10
Arctic Cisco (ARCS)		9	9
Arctic Flounder (ARFL)	78	13	91
Arctic Staghorn Sculpin (ARSS)	2	5	7
Broad Whitefish (BDWF)	35	22	57
Bering Wolffish (BRWF)	1		1
Fourhorn Sculpin (FHSC)	18	7	25
Greenland Cod (GLCD)		1	1
Pacific Herring (PCHR)		7	7
Saffron Cod (SFCD)	2	14	16
Shorthorn Sculpin (SHSC)	33	30	63
Starry Flounder (STFL)	41	19	60
Total	211	134	347

GLCD ARCH ARCS STFL ARFL SHSC BRWF ARSS SFCD PCHR FHSC BDWF

Proportion of each species relative to total captured, Starry Flounder, Arctic Flounder, Shorthorn Sculpin and Broad Whitefish were the most abundant in this year's field program

Bering Wolffish caught on Sept 7, 2021 in the Argo Bay deep net. This is the second record of a Bering Wolffish in the ANMPA, the first was caught at the same site during the 2019 summer field program. This individual was live released after it was measured and photographed.

ARGO BAY SUMMARY

Field work in Argo Bay ran from Aug 4-10th, and Sept 3-8th, 2021. The field work was completed by community-based technicians S. Illasiak, N. Ruben, J. Illasiak, J. Nakimayak, and R. Green. Highlights from this field work include:

- Fourth consecutive year of community-led field work in Argo Bay, with two new technicians trained (J. Illasiak and J. Nakimayak)
- Sampling was conducted for the first time in September, enabling comparisons between August and September fish and habitat parameters and meeting other monitoring objectives
- Water temperature-salinity mooring deployed for duration of program
- Benthic samples collected including a 'sea angel' (*Gymnosomata sp.*)
- Second record of a Bering Wolffish in the ANMPA, this species is rare and is not new to the Beaufort Sea

The ANMPA coastal monitoring program is a community-led effort conducted in winter and summer. Data on fishes, samples and habitat loggers were collected by the technicians and are currently being analyzed at DFO-Winnipeg. We are grateful for the support of the Fisheries Joint Management Committee, DFO-Inuvik, The Joint Secretariat and the Paulatuk Hunters and Trappers Committee. Finally, we thank the technicians for their dedication to the project and the community of Paulatuk for their involvement and support over the years.

Darcy McNicholl
Darcy.Mcnicholl@dfo-mpo.gc.ca
(431) 277-3609

Karen Dunmall
Karen.Dunmall@dfo-mpo.gc.ca
(431) 277-3221

Quyanainni - Thank You

2021 Field Crew (left to right): Steve Illasiak, Nelson Ruben, Ryan Green and Joe Illasiak on their way to Argo Bay

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Figure G7. Plain language summary of fieldwork completed between August 4^{th} -10^{th}, and September 3^{rd} – 8^{th}, 2021.

APPENDIX H – Engagements with Paulatuk Hunters and Trappers Committee (2017-2021)

Table H1. Community consultations or engagements between DFO-Science and the Paulatuk Hunters and Trappers Committee.

Date	Participants	Description	Location	Outcome
January 2017	FJMC DFO-Science PHTC	Annual presentations	Winnipeg	Funding approved for summer field work
April 5th, 2017	PHTC	Arctic Coast program requests support remotely for summer field work at monthly general meeting as an agenda item	Paulatuk	Support received April 7th, 2017
June 30th – July 14th 2017	PHTC DFO-Science Field Crew	Summer field work, in-person training at field camp	ANMPA	Field work completed
July 26th , 2017	DFO-Science	Plain language summary distributed to PHTC and FJMC		Reporting to stakeholders completed
January 2018	FJMC DFO-Science PHTC	Annual presentations and proposals	Winnipeg	Funding approved for summer field work and baseline winter research
May 9, 2018	PHTC	Arctic Coast requests support remotely for summer field work		Support received
July 3rd-6th, 2018	DFO-Science Joint Secretariat Field Crew	Arctic Coast and MPA Coordinator (Joint Secretariate) provide in person review of protocols and transition to community-led fieldwork	Paulatuk	Field crew from previous years trained new technicians; first field season led by community-based technicians. Joint Secretariat MPA coordinator participated in training of Arctic Coast protocols
July 9-18th, 2018	Field Crew	Field program completed by community-based technicians	ANMPA-Argo Bay	Fieldwork completed

August 16th, 2018	DFO-Science	Plain language summary distributed to PHTC, FJMC, and stakeholders		Reporting to stakeholders completed
November 29th, 2018	DFO-Science CROW PHTC	Consultation with PHTC, CROW and Arctic Coast regarding winter fieldwork	Paulatuk	Approved protocols and sites for Arctic Coast winter fieldwork, and identified opportunities for linkages with CROW
January 2019	FJMC DFO-Science PHTC	Annual presentations and proposals	Winnipeg	Funding approved for 2019 summer fieldwork and 2020 winter research
January 17th – March 22nd, 2019	Field Crew DFO-Science	Winter fieldwork started using protocols based on CROW and working with DFO-Science to pilot new methods for Arctic Coast (March 8-13th, 2019)	ANMPA – Argo Bay, Tippi	First Arctic Coast winter fieldwork completed, built upon established methods from CROW but over a longer time period
March 26th, 2019	DFO-Science	Plain language summary of winter 2019 fieldwork distributed to PHTC, FJMC, and stakeholders		Reporting to stakeholders completed
May 2, 2019	PHTC DFO-Science	Arctic Coast requests support remotely for summer field work		Support received
July 13th-27th, 2019	DFO-Science PHTC	Summer fieldwork completed by DFO-Science and community-based technicians. DFO participated July 13-19th, to provide in-person training.	ANMPA – Bennett Point and Argo Bay	Field technicians from previous years provided training to new group of technicians. DFO provided in-person support for first few days of the field program
October 21st, 2019	DFO-Science	Plain language summary of 2019 field work distributed.		Reporting to stakeholders completed
January 23rd, 2020	FJMC DFO-Science PHTC	Annual presentations and proposals	Winnipeg	Funding approved for 2020 summer and (2020/2021) winter fieldwork.
January 24th – March 24th, 2020	PHTC DFO-Science	Winter fieldwork in the ANMPA carried out by community-based	ANMPA – Argo Bay	Second year of winter field work, completed without DFO staff present (emerging COVID-19 restrictions did

		monitors using protocols tested in 2019.	and Bennett Point	not affect fieldwork as it was already community-run)
April 7th, 2020	DFO-Science	Plain language summary of 2020 winter fieldwork distributed		Reporting to stakeholders completed
May 20th, 2020	PHTC DFO-Science	Arctic Coast requests support remotely for summer and fieldwork		Support received to carry out community-led fieldwork (in accordance with travel restrictions)
July 15th-23rd, 2020	DFO-Science PHTC	Summer fieldwork completed by community-based technicians.	ANMPA – Bennett Point and Argo Bay	Summer fieldwork completed; no in-person support from DFO required. Protocols and instruction provided remotely
September 2nd, 2020	DFO-Science	Plain language summary of 2020 summer fieldwork distributed.		Reporting to stakeholders completed
January 26th, 2021	FJMC DFO-Science PHTC	Annual results presentations and proposals	Winnipeg	Funding approved for 2021 summer and (2021/2022) winter fieldwork.
January 20th – March 26th, 2021	PHTC DFO-Science	Winter fieldwork in the ANMPA carried out by community-based monitors.	ANMPA – Argo Bay, Bennett Point and Brown's Harbour	Third year of winter fieldwork. No travel required by DFO staff, support and instructions provided remotely.
May 5th, 2021	DFO-Science	Plain language summary of 2021 winter fieldwork distributed		Reporting to stakeholders completed
May 6th, 2021	DFO-Science PHTC	Arctic Coast requests support remotely for summer and fieldwork		Support received to carry out community-led fieldwork (in accordance with travel restrictions)
August 4th-10th; September 3rd - 8th, 2021	DFO-Science PHTC	Summer fieldwork completed by community-based technicians.	ANMPA – Argo Bay	Summer fieldwork completed; no in-person support from DFO required. Protocols and instruction provided remotely

August 31st, 2021	DFO-Science PHTC	Meeting with PHTC regarding field logistics	Virtual	Coordination on monitoring and research objectives
November 1st, 2021	DFO-Science	Plain language summary of 2021 summer fieldwork distributed		Reporting to stakeholders completed

APPENDIX I – Scientific permits and licenses

Freshwater Institute Animal Care Committee – Animal Use Protocols:

FWI-ACC-2017-016
FWI-ACC-2018-021
FWI-ACC-2019-028
FWI-ACC-2020-04 (winter)
FWI-ACC-2020-034 (summer)
FWI-ACC-2021-05 (winter)
FWI-ACC-2021-054 (summer)

Licenses to fish for scientific purposes:

S-17-18-3011
S-18-19-3018
S-19-20-1057
S-20-21-2009
S-21-22-3031