Darnley Bay Nearshore Fish Survey: Synthesis of 2012 and 2014–2016 Field Programs

Darcy G. McNicholl, James D. Johnson, and James D. Reist

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

2017

Canadian Technical Report of
Fisheries and Aquatic Sciences 3229

Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

Canadian Technical Report of Fisheries and Aquatic Sciences

Technical reports contain scientific and technical information that contribute to existing knowledge but that are not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter, and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences. Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is indexed in the data base Aquatic Sciences and Fisheries Abstracts. Numbers 1-456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457-714 were issued as Department of the Environment, Fisheries and Marine Service, Research and Development Directorate Technical Reports. Numbers 715-924 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925. Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport technique canadien des sciences halieutiques et aquatiques

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. Il n’y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c’est-à-dire les sciences halieutiques et aquatiques. Les rapports techniques peuvent être cités comme des publications intégrales. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports techniques sont indexés dans la base de données Aquatic Sciences and Fisheries Abstracts. Les numéros 1 à 456 de cette série ont été publiés à titre de rapports techniques de l’Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l’Environnement. Les numéros 715 à 924 ont été publiés à titre de rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l’Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925. Les rapports techniques sont produits à l’échelon régional, mais numérotés à l’échelon national. Les demandes de rapports seront satisfaites par l'établissement d’origine dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

Canadian Technical Report of
Fisheries and Aquatic Sciences 3229

2017

DARNLEY BAY NEARSHORE FISH SURVEY: SYNTHESIS OF 2012 AND 2014–2016 FIELD PROGRAMS

Darcy G. M^{c}Nicholl, James D. Johnson and James D. Reist

Department of Fisheries and Oceans Canada
Freshwater Institute
501 University Crescent
R3T 2N6 Winnipeg MB

Cat. No. Fs 97-6/3229E-PDF ISBN 978-0-660-20506-9 ISSN-electronic 1488-5379

This publication should be cited as follows:

M^{c}Nicholl, D.G., Johnson, J.D., and Reist, J.D. 2017. Darnley Bay nearshore survey: synthesis of 2012 and 2014–2016 field programs. Can. Tech. Rep. Fish. Aquat. Sci. 3229: ix + 101 p.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

M[c]Nicholl, D.G., Johnson, J.D., and Reist, J.D. 2017. Darnley Bay nearshore survey: synthesis of 2012 and 2014–2016 field programs. Can. Tech. Rep. Fish. Aquat. Sci. 3229: ix + 101 p.

Sampling of coastal fishes was conducted in Darnley Bay in the summer of 2012, and in 2014 to 2016 in order to establish baseline information on the community composition of nearshore fishes and identify their habitat associations within the Anguniaqvia Niqiqyuam Marine Protected Area. Surveys were conducted at three remote field locations (Bennett Point, 69°72’84” N, 124°08’90” W; Brown’s Harbour, 70°12’05” N, 124°38’95” W; and Argo Bay, 69[o]23’37” N, 124[o]27’48” W) where fishes were collected and processed for basic biological data (i.e., length, weight, and age). The results of species collected, their biological information and environmental characteristics at their location of capture (i.e., depth, salinity and temperature) are presented in this report. Overall 18 species were identified among surveys, in which species diversity and abundance was greatest in Argo Bay (16 species; total fish captured n=1315). Species composition varied, such that depending on the year either Saffron Cod (*Eleginus gracilis* (Tilesius, 1810)), Capelin (*Mallotus villosus*, Müller, 1776) or Shorthorn Sculplin (*Myoxocephalus scorpius*, Linnaeus, 1758) were most abundant in 2012, 2014 and 2015, respectively, or by location where juvenile Broad Whitefish were most abundant (*Coregonus nasus*, Pallas 1776) in Argo Bay in 2016. Generally, the southern-most region of Darnley Bay (Argo Bay) was warmer and less saline than the northern sites (Bennett Point and Brown’s Harbour) on the Cape Parry peninsula.

RÉSUMÉ

Des échantillonnages de poissons côtiers ont été effectués dans la baie Darnley à l’été 2012 et de 2014 à 2016 afin d’établir des données de référence sur la composition de la communauté des poissons côtiers et pour déterminer leurs rapports avec les habitats dans la zone de protection marine de Anguniaqvia Niqiqyuam. Des relevés ont été effectués à trois endroits isolés (à Bennett Point, 69° 72’ 84” N, 124° 08’ 90” O; à Browns Harbour, 70° 12’ 05” N, 124° 38’ 95” O; et dans la baie Argo, 69° 23’ 37” N, 124° 27’ 48” O), où les poissons ont été prélevés et traités afin de recueillir des données biologiques fondamentales (c.-à-d. longueur, poids et âge). Les résultats concernant les espèces prélevées, leurs données biologiques et les caractéristiques environnementales de l’emplacement de prise (c.-à-d. profondeur, salinité et température) figurent dans ce rapport. Dans l’ensemble, 18 espèces sont recensées par les relevés, indiquant que la diversité la plus élevée et l’abondance la plus forte se trouvent dans la baie Argo, avec 16 espèces et un total de 1 315 poissons capturés. La composition taxonomique des espèces varie selon l’année retenue; ainsi, le navaga jaune (*Eleginus gracilis* [Tilesius, 1810]), le capelan (*Mallotus villosus*, Müller, 1776) et le chaboisseau à épines courtes (*Myoxocephalus scorpius*, Linnaeus, 1758) étaient les plus abondants en 2012, 2014 et 2015 respectivement, ou selon l’endroit où le corégone tschir juvénile était le plus abondant (*Coregonus nasus*, Pallas 1776) dans la baie Argo en 2016. Règle générale, la partie la plus au sud de la baie Darnley, soit la baie Argo, présentait des eaux plus chaudes et moins salines que les parties plus au nord (Bennett Point et Browns Harbour) de la péninsule Parry.

1.0 INTRODUCTION

Darnley Bay is located in the western Canadian Arctic and was designated as a Marine Protected Area (Anguniaqvia Niqiqyuam MPA) under the *Oceans Act* in November 2016. This region contains two Ecologically and Biologically Significant Areas (EBSAs) yet little is known about ecosystem structure and habitat use of the species present. The Darnley Bay nearshore survey was developed to 1) support community-based environmental monitoring, 2) examine coastal-offshore linkages with the Beaufort Sea Regional Environmental Assessment (BREA) Marine Fishes Project, 3) provide information relevant to the development of the MPA, and 4) establish a marine location linked to the ongoing Arctic Coastal Ecosystem Studies (ACES) programs in the Mackenzie estuary. This survey was first conducted in 2012 and was completed in subsequent programs (2014–2016) that focused on acquiring baseline knowledge of coastal fishes, their trophic relationships, and habitat characteristics.

The 2012 sampling season was conducted for two weeks in July at Bennett Point, in which environmental loggers and a variety of sampling gear were deployed in order to determine the abundance and composition of coastal fishes. Subsequent programs in 2014 and 2015 were conducted at Bennett Point and Brown's Harbour, located on the northern end of Cape Parry, and in 2016 at Argo Bay, located in the southern end of Darnley Bay. Information collected over multiple field programs provides information regarding species abundance and diversity among multiple years and identifies possible environmental gradients within the MPA. Detailed investigations of the coastal margins within the Anguniaqvia Niqiqyuam Area Marine Protected Area (ANMPA) are limited and require further investigation of regional biota and their habitat associations. Results of the field programs suggest community structure differs from the northern end of the bay (Brown's Harbour) to the southern end (Argo Bay), which is reflected by habitat characteristics and species diversity.

Information synthesized from the nearshore program will contribute to a greater understanding of the coastal community within the MPA, but also to ongoing Fisheries and Oceans (DFO) programs such as community-based coastal monitoring and Arctic Char stock assessment.

1.1 PROGRAM OBJECTIVES

1) Develop baseline biological and community structure of fishes found in the ANMPA.

2) Determine species, sex, maturity and age information of coastal fishes present.

3) Obtain environmental and habitat information (i.e., depth, temperature and salinity) of coastal sites within the ANMPA.

2.0 METHODS

2.1 STUDY AREA

The Darnley Bay nearshore survey focused primarily on the western side of the bay, at three coastal sites found on the Cape Parry Peninsula (Figure 1). Sites were selected within the MPA based on variation in habitat characteristics (e.g., low lying shoreline versus coastal bluffs and proximity to river discharge) and accessibility.

The Hornaday River and Brock River are the two primary river systems that drain into the bay and support anadromous fishes such as Arctic Char (*Salvelinus alpinus*). Although the Hornaday River and Pearce Point EBSAs are not included within the MPA, they influence salinity, sediment transport and temperature within the bay and are important features used by anadromous fishes. These fishes are of particular significance for subsistence harvests by community members of Paulatuk, located at the southern end of the bay. The western side of Darnley Bay is considered to be an ecologically significant marine habitat for coastal fishes as a migratory corridor and for well-established kelp and coralline algae communities. In 2012, a coastal survey was conducted at Bennett Point from July 19th to July 27th in order to survey the abundance and composition of coastal fishes. This expanded into subsequent field surveys in subsequent years to characterize the habitat at multiple locations within the ANMPA and collect baseline data on fish composition, habitat and temporal variability. In 2014 and 2015 two locations were surveyed by repeating methods used in 2012; at Bennett Point sampling occurred from July 13th to July 20th in 2014 and July 24th to July 28th in 2015, and at Brown's Harbour from July 21st to August 1st in 2014 and July 10th to July 24th in 2015. During the 2016 field program, sampling was conducted in Argo Bay from July 27th until August 10th. Field program locations and other relevant areas are shown in Figure 1.

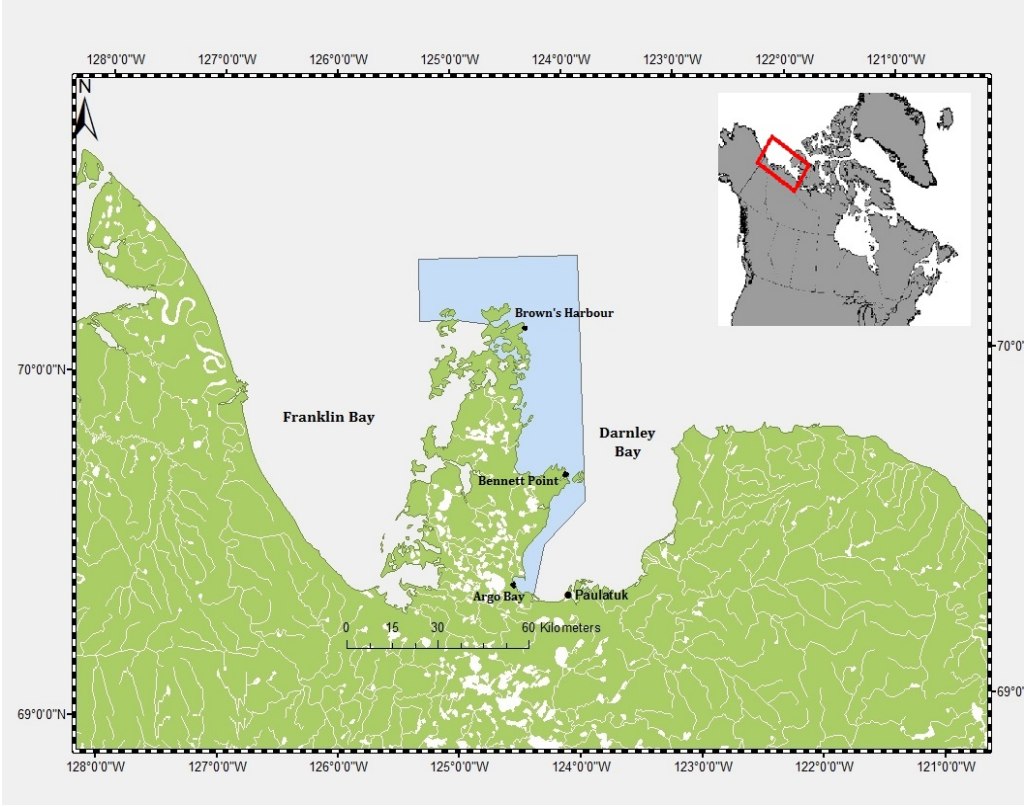

Figure 1. Map of the Darnley Bay area and sampling locations: Bennett Point (2012, 2014, 2015), Brown's Harbour (2014, 2015) and Argo Bay (2016). The area of the MPA is indicated in blue.

2.2 SAMPLING OF COASTAL FISHES

The survey of coastal fishes was designed to sample the greatest variety of habitats and identify the species of fishes present. Prior to the 2012 field program, there had been no coastal fish surveys conducted within the proposed marine protected area. The original sampling design aimed to sample fishes with increasing depth starting from shore, with equivalent fishing effort. However, environmental conditions at the time of sampling influenced the sampling design and only sites where nets could be safely deployed and retrieved were set by the field crew.

2.2.1 NET DEPLOYMENT

The sampling of coastal fishes was conducted using a variety of methods. Methods included gill netting (commonly used for subsistence), seining and trap netting. The type of equipment used and duration of net sets were aimed to minimize mortality so successful live release was possible once the target number of fishes were collected for each species (n=30). Variety in sampling gear allowed for a wide range of species and size distributions to be captured in order to best describe species composition and diversity in Darnley Bay.

Specifications of Sampling Gear*:*

Gill nets
60 m sinking nets – 6 panels (10 m each), stitched together; 25, 38, 64, 89, 114, 140 mm (1, 1.5, 2.5, 3.5, 4.5 and 5.5 inch) stretched mesh; 3/8" float line and #40 lead line (1 lb per 12 feet or ~16.5 lbs per net). All meshes multifilament nylon 210 D/3.

20 m sinking – single panel; 25 mm (1") mesh; 12.5 mm (½") float line and #60 lead line. Monofilament.

Trap nets
Fyke nets; funnel mouth leading to each cod-end trap is supported by a stainless steel frame (1.7 m high by 1.8 m wide). Traps are 3.7 m long and 0.9 m on a side. Five internal stainless steel frames and two throats (15 x 25 cm). Meshes are 1.25 cm dark grey knotless nylon mesh. Wings and leads are equipped with zippers (1.7 m deep; 15.2 m sections).

Minnow traps
Galvanized steel 6.35 mm (¼") mesh with steel wire.

Purse Seine
Purse seine made up with 3/16" delta mesh; center bag = 1.2 x 1.2 x 0.6 m and stake loops on corners.

Duration of net sets were determined at each field location by initially setting for a few hours (2–3 hours) and gradually increasing effort if mortality was low. This minimized mortality of subsistence fishes (e.g., Arctic Char) and increased success of live release if the target number of species for dead sampling had been met. If catch per unit effort was low at a given site, duration of net sets increased, while trap nets could be set for more than 24 hours at a time since the rate of mortality was low relative to gill nets. Location of sets was determined while in the field based on weather conditions and accessibility from shore. These locations were chosen to capture a variety of depths, substratum types and proximity to shore and to assess species diversity under different environmental conditions.

Trap nets were set in shallow, sheltered locations near shore to minimize exposure to wind forcing or wave activity coming off the bay. These sites were limited in Brown's Harbour as the primary substratum consisted of bed rock while Bennett Point and Argo Bay offered more sheltered locations with varying substrate types (cobble, sand or silt). Once the net was set, it was checked at least every 24 hours; fishes required for sampling were collected while remaining fishes were measured and live released.

Beach seining was conducted in nearshore habitats where depths did not exceed 1.5 m. Seining was only conducted during 2012 at Bennett Point and in the 2016 field program in Argo Bay, in order to assess the diversity of fishes present in lagoons connected to the marine environment. Minnow traps were also used in shallow locations wherever possible, with the purpose of catching forage fishes.

2.2.2 PROCESSING OF FISH SAMPLES

Among the fishes collected during the field programs a subset of the individuals captured was dead-sampled for further analysis (n=30 if possible for each species), all other fishes were live released. However, if fish died while in the net they were processed for biological samples or frozen in bulk for follow-on analysis at the DFO Freshwater Institute in Winnipeg.

Fishes selected for processing were taken to camp immediately after collection to be measured, weighed and tissues sub-sampled and preserved. These tissues included a sample of dorsal muscle (frozen for stable isotope analysis), stomachs (frozen) and for select species, a fin clip was taken for genetics analysis (preserved in 95% ethanol). Otoliths were also taken from each processed fish so they could be aged at the Freshwater Institute in Winnipeg. Processed tissues were shipped to the Freshwater Institute in Winnipeg for analysis of stable isotopes, and stomach contents in future research.

2.3 TEMPERATURE AND SALINITY

Water temperature and distribution of salinity in Darnley Bay is heavily influenced by the distribution of ice in the Amundsen Gulf and to a lesser degree, the Hornaday and Brock rivers. Unlike coastal habitats of the ANMPA located within the Mackenzie Delta estuary, Darnley Bay is a marine ecosystem, supporting species adapted to higher salinities. Water temperature and salinity measurements that were collected on the CCGS *Nahidik* in 2008 (W. Williams, DFO unpubl. data) indicate that water was generally warmer and less saline at the southern-most end of the bay, and became colder and more saline as measurements were taken closer to the Amundsen Gulf. However, water temperature and salinity characteristics are unknown for the nearshore region of the MPA, and it is unknown whether these environmental characteristics vary along the coast of Cape Parry.

Tidbit (TidbiT® v2 Temp-UTBI-001) and Conductivity-Temperature data loggers (Hobo conductivity Pro V2 logger) were deployed during each year of the survey to collect time-series temperature and salinity data at different locations and depths to determine habitat characteristics of the species collected. In 2012 and 2014, loggers were only attached to gill nets. During sampling conducted in 2015 and 2016, loggers were attached to nets as well as moored at one location. Depending on the logger, and if it was attached to a net or moored, temperature and salinity data was collected every 5–30 min.

3.0 RESULTS

3.1 FISHES

3.1.1 SAMPLING EFFORT

Sampling in 2012 was only conducted at Bennett Point from July 19th–27th. Gill nets were primarily shore-based, and were placed to cover the greatest variety of habitat conditions (silt, sand, or cobble substrates), but placement was generally dependent on ability to travel safely to sites. The results of sampling effort for each gill net set, depth and temperature (where

applicable) are summarized in Table 1. The trap net was placed at one location and checked on three different occasions. This net was set in a location that was sheltered from off shore wind forcing and anchored in sandy substrate where depth did not exceed the height of the trap net. The results of sampling effort for each net set are summarized in Table 2. The locations of net placements are shown in Figure 2.

The 2014 field program again sampled at Bennett Point from July 13th–18th, repeating set locations from 2012 (Figure 2). Additionally, gill nets were set offshore in deeper waters to determine if the relative abundance of species differed from the onshore sets in 2012. A trap net was stationed at the same location as in 2012, as well as in a second location in a sheltered embayment. Brown's Harbour was sampled for the first time during this survey using the same gear type from previous years, and sampling initially with shore-based sets and only setting in deeper water if weather conditions permitted (Table 3). Wind and wave action at this location proved to be much more challenging, thus sampling was limited to days when the weather was calm. The trap net was set at two different locations; however this proved to be an inadequate method at this site since there were limited locations to shelter the net from wave action (Table 4).

Table 1. List of gill nets deployed at Bennett Point in 2012 during the nearshore survey. Total fishing effort for each net and their specific location is provided. Depth is provided as a range at the time of deployment (MDT), temperature and conductivity have been provided as the mean and standard deviation (SD) during the sampling period.

Net	Date(s) Set	Time Set	Time Lifted	Effort (hr:min)	Latitude DD	Longitude DD	Depth (m)	Mean Temp (ºC) +/- SD
1	July 19	19:55	22:20	2:25	69.7262	-124.09160	0–12.2	-
2	July 19	20:10	22:30	2:20	69.7222	-124.08940	5.2–8.2	-
3	July 19–20	22:20	10:30	12:10	69.7262	-124.09160	0–12.2	-
4	July 19–20	22:30	11:20	12:50	69.7222	-124.08940	5.2–8.2	-
5	July 20	15:30	20:30	5:00	69.6966	-124.04190	1.5–5.2	8.3 +/- 0.2
6	July 20	15:50	20:50	5:00	69.7199	-124.06900	7.6–13.7	-
7	July 20	16:00	21:00	5:00	69.7261	-124.08430	3.6–7.6	8.9 +/- 0.6
8	July 20–21	20:35	12:00	15:25	69.6966	-124.04190	1.5–5.2	7.7 +/- 0.8
9	July 20–21	20:55	11:00	14:05	69.7199	-124.06900	7.6–13.7	2.5 +/- 0.8
10	July 20–21	21:00	11:30	14:30	69.7261	-124.08430	3.7–7.6	8.2 +/- 0.7
11	July 21	12:20	19:00	6:40	69.6781	-124.03980	1.8–4.6	8.5 +/- 0.3
12	July 21–22	12:30	8:20	19:50	69.6773	-124.03440	5.5–5.8	8.5 +/- 0.4
13	July 21–22	13:00	20:55	31:55	69.6857	-124.05270	1.8–3.4	8.9 +/- 0.3
14	July 21–22	19:00	20:35	25:35	69.6781	-124.03980	1.8–4.6	-
15	July 23	15:15	22:50	7:35	69.724	-124.18390	2.4–6.1	-
16	July 23	16:05	23:10	7:05	69.7267	-124.19340	2.4–7.3	8.5 +/- 0.7
17	July 24–25	19:35	13:40	18:05	69.6786	-124.03510	2.7–5.2	6.9 +/- 0.7
18	July 24–25	19:50	13:05	17:15	69.6853	-124.05140	2.4–3.7	7.7 +/- 0.1
19	July 26–27	16:30	15:10	22:40	69.6786	-124.03510	1.5–5.2	8.0 +/- 0.1
20	July 26–27	16:30	15:10	22:40	69.7262	-124.09160	0–12.2	6.8 +/- 0.3
			-	-	-	-	-	-
			-	-	-	-	-	-

Table 2. Trap net effort (MDT) in 2012 at Bennet Point in Darnley Bay, maximum depth for all efforts does not exceed 1.5 m.

Net Set	Date Set	Time Set	Date Lifted	Time Lifted	Effort (hr:min)	Latitude DD	Longitude DD
1	July 24	19:15	July 25	12:00	17:15	69.6838	-124.0533
2	July 25	12:00	July 26	15:10	27:10	69.6838	-124.0533
3	July 26	15:10	July 27	12:00	21:10	69.6838	-124.0533

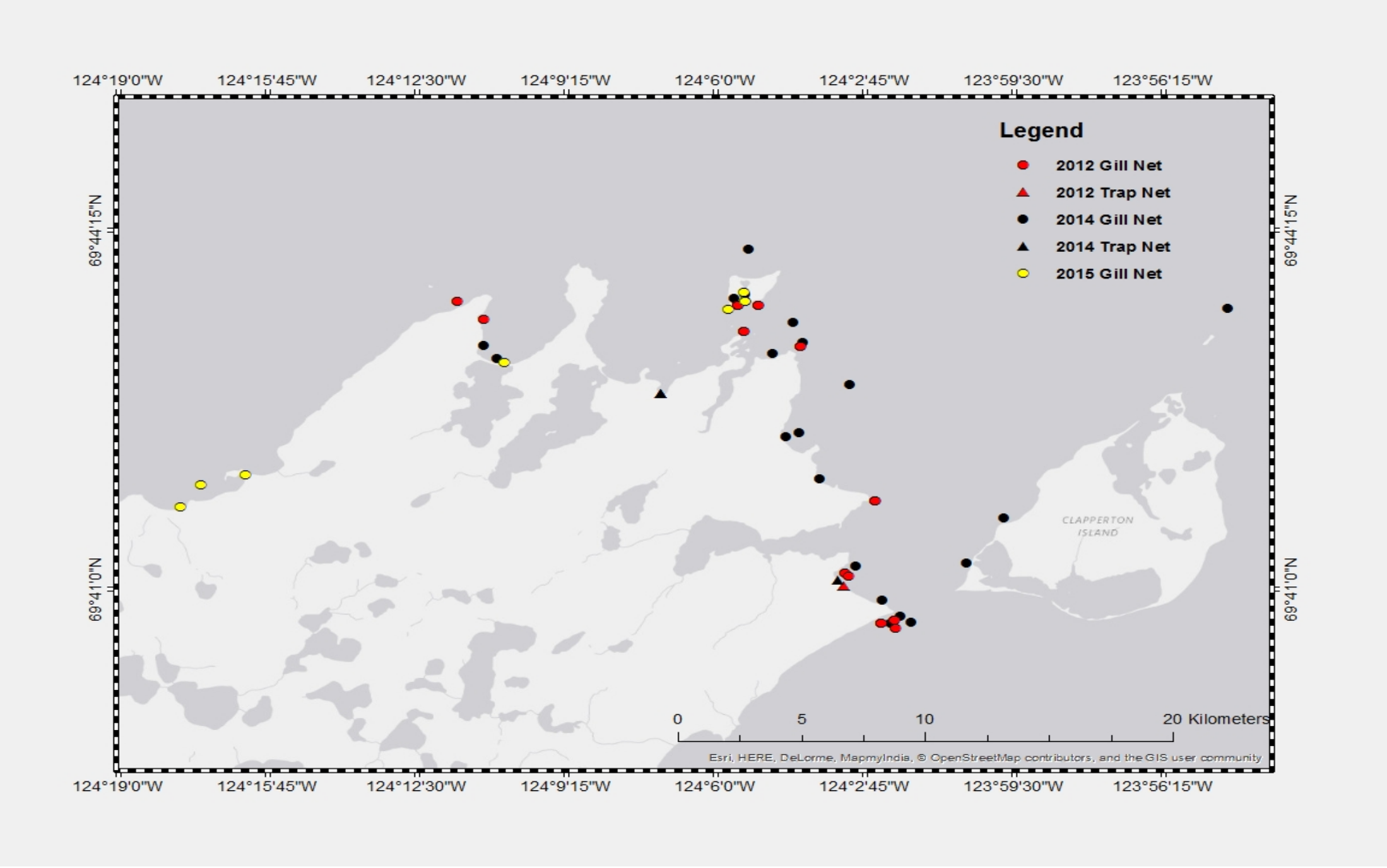

Figure 2. Map of sampling effort at Bennet Point in 2012 (red), 2014 (black) and 2015 (yellow). Gear type is indicated as a dot for gill nets and a triangle for trap nets.

Table 3. List of nets deployed at Bennett Point and Brown's Harbour in 2014 during the nearshore survey. Total fishing effort for each net and their specific location is provided. 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. All nets used were 6-panel, multi-mesh nets with the exception of a few 1.5 inch monofilament nets that are indicated in parentheses.

Net	Date(s) Set	Time Set	Time Lifted	Effort (hr:min)	Latitude DD	Longitude DD	Depth Range (m)	Mean Temp (ºC) +/- SD	Mean Salinity (ppt) +/- SD
Bennett Point									
1	July 13	17:36	22:30	04:54	69.72573	-123.91383	3.0–11.9	-	-
2	July 13	17:56	22:44	04:48	69.71727	-125.22583	2.4–7.3	-	-
3 (1.5)	July 13	18:17	22:51	04:34	69.71497	-125.30550	0.9–6.1	6.3 +/- 1.7	26.0 +/- 0.7
4	July 13–14	22:35	15:44	17:09	69.72618	-125.38550	6.4	0.5 +/- 1.5	28.7 +/- 0.8
5 (1.5)	July 13–14	23:05	16:02	16:57	69.71817	-124.17902	8.2	0.9 +/- 1.6	26.4 +/- 1.5
6	July 13–14	23:17	16:17	17:00	69.72013	-124.18365	6.7	-	-
7	July 14	13:12	22:58	07:46	69.72429	-124.04060	22.3–25.0	-1.3 +/- 0.1	30.6 +/- 0.3
8	July 14	13:25	22:23	07:58	69.72118	-124.03689	18.9–25.0	-1.5 +/- 0.1	-
9	July 14–15	23:05	14:03	14:54	69.71385	-124.05059	23.2–26.2	-1.4 +/- 0.1	30.5 +/- 0.4
10	July 14–15	23:55	14:30	14:35	69.73385	-124.06047	18.9–19.2	-1.3 +/- 0.1	29.9 +/- 0.1
11 (1.5)	July 15	00:23	11:50	11:27	69.68103	-124.07557	3.6	-	-
12	July 15	00:51	12:21	11:30	69.67904	-124.07141	0.9–5.5	-	-
13	July 15	1:01	12:56	11:55	69.68747	-124.08906	-	-	-
14 (1.5)	July 15	13:05	00:25	11:20	69.70043	-124.06047	-	-	-
15	July 15–16	13:16	00:32	11:16	69.70618	-124.07557	1.8–5.9	6.5 +/- 1.3	25.2 +/- 0.7
16	July 15–16	13:22	00:41	11:19	69.70663	-124.07141	9.4–11.3	6.7 +/- 1.1	28.1 +/- 0.2
17	July 16	1:07	17:30	16:23	69.72845	-124.08906	-	-	-
18	July 16	1:15	17:45	16:30	69.72675	-124.09124	-	-	-
23	July 17	15:38	23:00	07:22	69.71842	-124.07896	1.5–5.8	-	-
24	July 17	15:55	23:27	07:32	69.69342	-123.99456	1.8–3.5	-	-
25 (1.5)	July 17–18	16:05	23:42	07:37	69.68696	-124.00735	1.1–2.7	-	-
26	July 17–18	16:15	00:28	08:13	69.67936	-124.03513	2.6–5.0	-	-
27	July 17–18	16:44	1:04	08:20	69.67904	-124.03119	5.2–5.8	-	-

Net	Date(s) Set	Time Set	Time Lifted	Effort (hr:min)	Latitude DD	Longitude DD	Depth Range (m)	Mean Temp (ºC) +/- SD	Mean Salinity (ppt) +/- SD
Brown's Harbour									
1	July 20–21	18:57	10:04	15:07	70.12051	-124.38951	2.4–3.9	-	-
2	July 20–21	19:11	10:20	15:09	70.11344	-124.42067	0.6–8.5	-	-
3	July 20–21	19:21	10:30	15:09	70.10090	-124.42263	0.6–7.3	-	-
4	July 21–22	15:14	12:30	21:16	70.12586	-124.32159	1.8–3.2	-	-
5	July 21–22	15:30	12:40	21:10	70.12683	-124.31009	1.8–6.8	8.0 +/- 0.5	23.4 +/- 0.4
6	July 21–22	15:45	12:50	21:05	70.13080	-124.30430	0.5–1.7	-	-
7	July 21–22	17:27	12:20	18:53	70.12617	-124.37244	1.8–3.5	-	-
8	July 21–22	17:35	12:09	18:34	70.12624	-124.38032	1.8–6.1	-	-
9	July 22–23	13:00	12:06	23:06	70.13420	-124.31748	5.7–8.7	-	-
10	July 22–23	13:10	12:26	23:16	70.13477	-124.31302	1.5–3.2	7.9 +/- 0.2	23.5 +/- 0.2
11	July 22–23	13:15	12:30	23:15	70.14001	-124.38978	2.4–3.2	-	-
12	July 22–23	13:25	12:50	23:25	70.13244	-124.39029	-	-	-
15	July 23–24	15:10	15:31	24:21	70.08282	-124.390702	1.8–5.6	3.3 +/- 0.6	26.7 +/- 0.3
16	July 23–24	15:20	15:17	23:57	70.08585	-124.397158	2.4–6.8	-	-
17	July 23–24	15:38	14:32	22:54	70.10038	-124.400193	-	-	-
18	July 23–24	15:54	14:51	22:57	70.10081	-124.409766	1.5–5.8	-	-
19	July 23–24	16:10	15:47	23:37	70.10619	-124.446904	1.7–3.5	-	-
20	July 24–25	18:50	13:32	18:42	70.13345	-124.471491	0.6–1.8	-	-
21	July 24–25	19:10	14:00	18:50	70.13082	-124.480022	1.8–3.0	-	-
22	July 24–25	19:26	15:44	20:18	70.13347	-124.491942	2.4–4.7	-	-
23	July 24–25	19:36	15:59	20:23	70.13610	-124.514081	0.9–6.8	-	-
24	July 24–25	21:00	13:30	16:30	70.13552	-124.453046	0.6–2.8	-	-
26	July 25	8:57	20:28	35:31	70.12553	-124.375181	6.7	-	-
27	July 26	9:04	20:34	11:30	70.12467	-124.378844	4.5	-	-
28	July 26–27	15:13	12:05	20:52	70.12119	-124.399848	7.7	-	-
29	July 26–27	15:21	11:52	20:31	70.11773	-124.401608	-	1.6 +/- 0.2	27.2 +/- 0.1
30	July 26–27	20:06	12:34	16:28	70.13645	-124.387342	0.6–2.5	-	-
31	July 26–27	20:13	12:42	16:29	70.13188	-124.380254	0.6–4.1	-	-
32	July 27	12:53	21:25	32:32	70.14283	-124.390099	1.8–9.2	-	-
33	July 27	13:07	21:36	32:29	70.14382	-124.40408	4.6	-	-
34	July 27–28	19:00	20:47	25:47	70.11972	-124.361301	26.3	-	-
35	July 27–28	19:20	21:15	25:55	70.13799	-124.377512	5.0–5.8	-	-
36	July 29–30	13:40	11:41	22:01	70.12372	-124.302534	26.2	-	-
37	July 29–30	14:02	12:00	21:58	70.13275	-124.288047	20.3–36.0	-	-

Table 4. Trap net effort (MDT) in 2014 at Bennett Point and Brown's Harbour in Darnley Bay, maximum depth for all efforts does not exceed 1.5 m.

Net Set	Date(s) Set	Time Set (hr:min)	Time Lifted (hr:min)	Effort (hr:min)	Latitude DD	Longitude DD
Bennett Point						
19	July 15–16	22:50	19:30	20:40	69.71282	-124.11972
20	July 15–16	23:06	19:40	20:34	69.71282	-124.11972
21	July 16–17	19:30	12:54	17:24	69.71282	-124.11972
22	July 16–17	19:40	12:54	17:14	69.71282	-124.11972
28	July 17–18	17:15	15:59	27:05	69.68457	-124.05530
Brown's Harbour						
13	July 20–21	20:26	14:30	18:04	70.09866	-124.43788
14	July 21–23	14:30	-	-	70.09866	-124.43788
25	July 24–27	19:47	20:15	24:28	70.13170	-124.49362

Brown's Harbour and Bennett Point were surveyed again in the summer of 2015 (Figure 3). Brown's Harbour was surveyed for a longer period of time in an attempt to sample a location where Capelin potentially spawn (Belina Bay; 70.14048, -124.68658), based on observations made by members of the community of Paulatuk. However, weather conditions were unfavourable (gusts up to 60 km/hr and swells on the ocean) during this sampling season, and much of the sampling that was conducted was limited close to shore and within a short distance of base camp (Table 5). Nets that were set in embayments sheltered from wind forcing off the Amundsen Gulf were the most successful. Relative to surveys conducted in previous years or at Bennett Point, species diversity and abundance was the lowest at Brown's Harbour in 2015. Trap nets were set in Belina Bay (Table 6), where Capelin had been locally observed, however rough water prevented the net from sitting properly to effectively collect fishes as it had in the previous survey at Bennett Point. One Capelin was collected in the net; however the relative abundance of Capelin at Brown's Harbour remains uncertain since sampling was restricted.

In 2016 sampling was conducted at Argo Bay from July 28th to August 10th (Figure 4). During this time conditions were much more favourable and the nets were generally more sheltered from offshore wind than at Bennett Point and Brown's Harbour. Gill nets (Table 7) and trap nets (Table 8) were deployed at many locations; however much of the sampling was done along a transect from the southern-most end of the bay towards the north. The shoreline along the western side of the bay was shallow, and restricted boat access depending on the tide. Locations for shore-based sets were chosen based on the recommendation of local fishers, to avoid interference with subsistence harvesting.

Table 5. List of nets deployed at Brown's Harbour and Bennett Point in 2015 during the nearshore survey. Total fishing effort for each net and their specific location is provided. 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. All nets used were 6-panel, multi-mesh nets with the exception of a few 1.5inch monofilament nets that are indicated in parentheses.

Net	Date(s) Set	Time Set (hr:min)	Time Lifted (hr:min)	Effort (hr:min)	Latitude DD	Longitude DD	Depth (m)	Mean Temp (ºC) +/- SD	Mean Salinity (ppt) +/- SD
Brown's Harbour									
2 (1.5)	July 11–14	15:20	18:24	75:24	70.14543	-124.57349	4.9–5.8	-	-
3	July 11–13	21:23	22:19	48:39	70.12790	-124.38220	2.8–7.1	6.1 +/- 1.4	25.2 +/- 0.7
4	July 11–14	21:32	15:32	75:32	70.11376	-124.41393	1.5–3.5	-	-
5	July 13–15	14:38	13:14	47:24	70.13123	-124.38228	0.6–1.9	5.7 +/- 0.3	25.5 +/- 0.5
6	July 14–15	22:17	13:23	14:57	70.13267	-124.38229	0.6–3.1	-	-
7	July 15–16	13:14	12:10	22:56	70.13123	-124.38228	0.6–1.9	4.7 +/- 0.2	25.7 +/- 0.1
8	July 15–16	13:42	12:22	22:40	70.13267	-124.38229	0.6–3.1	-	-
9	July 15–19	15:58	12:38	74:20	70.12097	-124.30823	17.5–20.5	-0.9 +/- 0.4	28.7 +/- 0.3
12	July 16–17	12:16	11:32	23:16	70.13123	-124.38228	0.6–1.9	5.4 +/- 0.2	25.5 +/- 0.1
13	July 16–17	12:22	11:49	23:27	70.13267	-124.38229	0.6–3.1	-	-
15 (1.5)	July 16–19	17:36	14:13	69:23	70.10695	-124.44398	0.6–12.8	-	-
16	July 16–19	17:46	13:33	67:13	70.10995	-124.40543	4.6–10.6	-	-
17	July 17–18	11:40	11:27	23:47	70.13123	-124.38228	0.6–1.9	6.1 +/- 0.2	25.3 +/- 0.1
18	July 17–18	12:11	11:35	23:24	70.13054	-124.38786	0.6–2.3	-	-
19	July 18–20	11:30	11:29	47:59	70.13123	-124.38228	0.6–1.9	5.9 +/- 0.8	25.2 +/- 0.4
20	July 18–20	12:03	11:39	47:24	70.13054	-124.38786	0.6–2.3	-	-
22	July 19–22	13:45	11:11	70:34	70.12515	-124.33309	14.8–19.8	-1.4 +- 0.1	29.3 +/- 0.1
23	July 20–21	11:29	13:02	25:33	70.13123	-124.38228	0.6–1.9	7.3 +/- 0.7	24.7 +/- 0.3
24	July 20–21	11:40	13:21	25:41	70.13054	-124.38786	0.6–2.3	-	-
26	July 20–21	20:08	21:41	25:33	70.11179	-124.40330	8.3–10.2	-	-
27	July 21–22	13:06	12:31	23:25	70.13123	-124.38228	0.6–1.9	6.5 +/- 0.5	24.9 +/- 0.2
28	July 21–22	13:27	12:54	23:27	70.13054	-124.38786	0.6–2.3	-	-
30	July 21-22	21:50	12:08	14:18	70.11734	-124.39194	8.7–13.6	-	-
31	July 22–23	11:49	11:43	23:54	70.12772	-124.36324	13.4–15.1	-0.8 +/- 0.3	29.2 +/- 0.1

Net	Date(s) Set	Time Set (hr:min)	Time Lifted (hr:min)	Effort (hr:min)	Latitude DD	Longitude DD	Depth (m)	Mean Temp (ºC) +/- SD	Mean Salinity (ppt) +/- SD
32	July 22–23	12:17	11:30	23:13	70.11864	-124.39153	8.5–8.7	-	-
33	July 22–23	12:33	12:16	23:43	70.13123	-124.38228	0.6–1.9	4.0 +/- 1.0	26.1 +/- 0.4
34	July 22–23	12:55	12:41	23:46	70.13054	-124.38786	0.6–2.3	-	-
35	July 23–24	12:16	11:39	23:23	70.13123	-124.38228	0.6–1.9	3.0 +/- 0.7	26.5 +/- 0.2
36	July 23–24	12:41	11:49	23:08	70.13054	-124.38786	0.6–2.3	-	-
Bennett Point									
1	July 25	0:32	12:46	12:14	69.72678	-124.08918	0.6–11.6	-	-
2	July 25–26	11:52	17:11	29:19	69.71748	-124.17644	3.3–6.2	-	-
3	July 25–26	12:11	12:07	23:56	69.70050	-124.27045	4.7–5.4	6.1 +/- 1.4	25.2 +/- 0.7
4	July 25–26	12:21	12:23	23:58	69.69571	-124.29382	2.3–3.1	-	-
5	July 25–26	12:51	13:13	24:22	69.72678	-124.08918	0.6–11.6	-	-
6	July 26–27	13:23	20:22	31:59	69.72678	-124.08918	0.6–11.6	-	-
7	July 26–27	17:39	11:44	18:05	69.69906	-124.28624	5.0–9.2	1.2 +/- 0.1	27.9 +/- 0.1
8	July 26–27	17:47	11:59	18:12	64.71441	-124.11773	4.4–7.3	-	-
9	July 26–27	18:00	12:09	18:09	69.72548	-124.09538	5.0–18.7	-	-
10	July 27	12:27	20:43	8:16	69.72812	-124.08942	3.5–6.6	-	-

Table 6. Trap net effort (MDT) in 2015 at Brown's Harbour in Darnley Bay, maximum depth for all efforts does not exceed 1.5 m.

Net Set	Date(s) Set	Time Set (hr:min)	Time Lifted (hr:min)	Effort (hr:min)	Latitude DD	Longitude DD
1	July 11–14	14:49	17:55	75:06	70.14048	-124.68658
11	July 15–19	19:25	11:43	87:42	70.12094	-124.31062

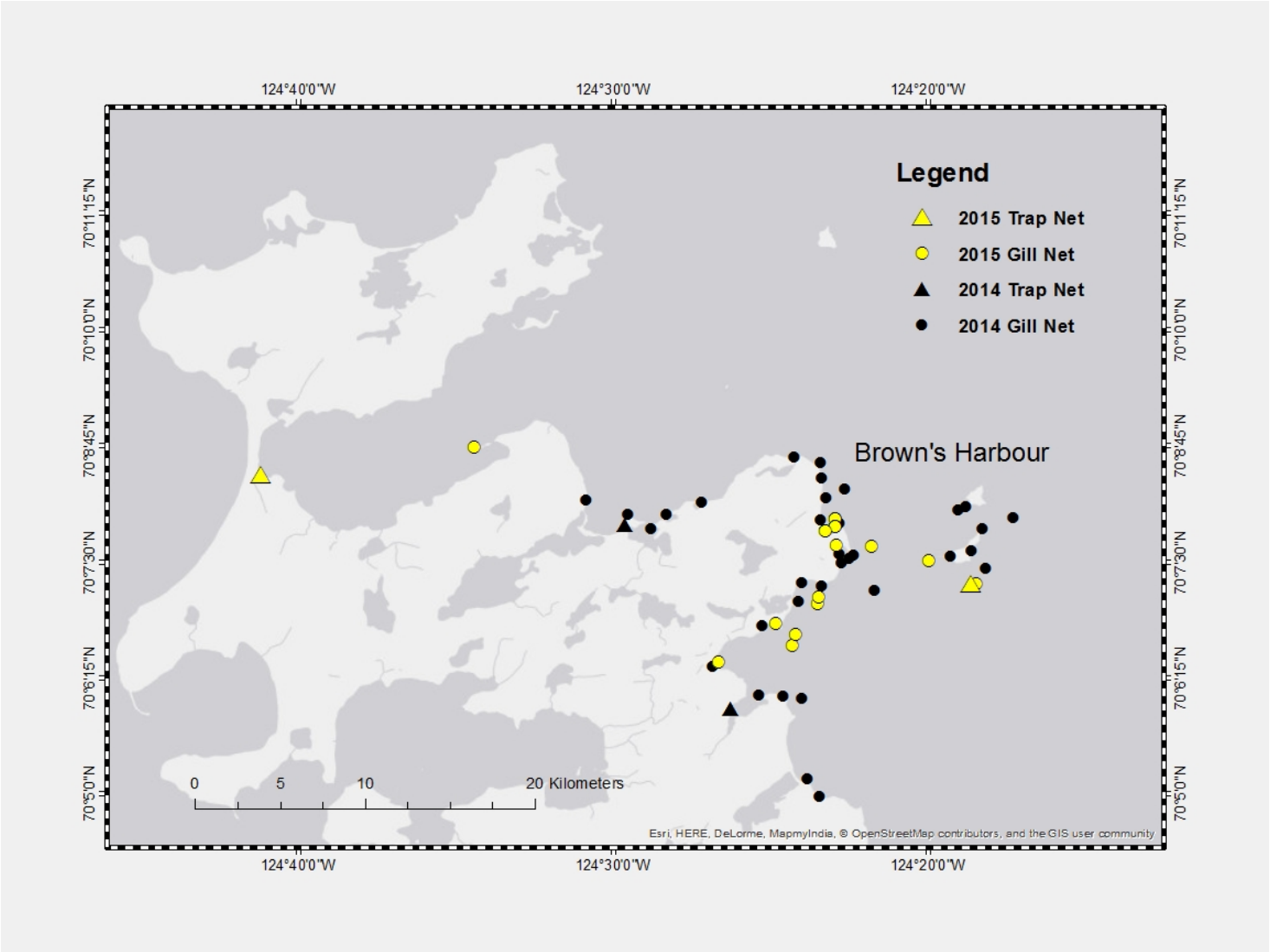

Figure 3. Map of sampling effort from 2014 (black) and 2015 (yellow) at Brown's Harbour. Gear type is indicated by a circle for gill nets and a triangle for trap nets.

Table 7. List of nets deployed at Argo Bay in 2016 during the nearshore survey. Total fishing effort for each net and their specific location is provided. Depth is at the time of deployment, temperature and salinity have been provided as the mean and standard deviation (SD) during the sampling period.

Net	Date(s) Set	Time Set	Time Lifted	Effort (hr:min)	Latitude DD	Longitude DD	Depth (m)	Mean Temp (ºC) +/- SD	Mean Salinity (ppt) +/- SD
1	July 28	9:33	11:40	2:07	69.36227	-124.45235	2.2	7.3 +/- 0.2	-
2	July 28	10:07	12:06	1:59	69.36715	-124.49438	2.4	8.2 +/- 0.2	-
3	July 28	11:57	15:30	3:33	69.36227	-124.45235	1.4	7.7 +/- 0.4	-
4	July 28	12:16	15:40	3:24	69.36192	-124.45532	4.5	6.8 +/- 1.5	18.4 +/- 0.5
5	July 28	12:44	15:55	3:11	69.36715	-124.49438	2.3	8.6 +/- 0.2	-
6	July 29	10:36	14:23	3:47	69.36343	-124.45303	4.2	9.1 +/- 0.2	-
7	July 29	10:46	14:28	3:42	69.36462	-124.45357	5.7	8.6 +/- 0.2	-
8	July 29	11:00	14:53	3:53	69.36163	-124.45965	2.5	8.6 +/- 0.3	19.1 +/- 0.1
11	July 30	9:16	21:37	12:21	69.36715	-124.49438	2.3	10.8 +/- 0.2	-
12	July 30	9:27	21:05	11:38	69.36548	-124.45315	6.4	10.2 +/- 0.2	-
13	July 30	9:34	21:19	11:45	69.36633	-124.45387	6.5	9.5 +/- 0.7	18.6 +/- 0.1
14	July 30	9:42	21:48	12:06	69.36715	-124.45462	6.6	10.0 +/- 0.3	-
17	July 30	11:13	20:55	9:42	69.37300	-124.42897	3.6	8.2 +/- 0.5	-
18	July 31	11:11	17:28	6:17	69.36773	-124.45507	6.5	8.0 +/- 0.2	15.3 +/- 0.7
19	July 31	11:14	17:22	6:08	69.36892	-124.45473	6.8	8.3 +/- 0.3	-
20	July 31	11:18	17:15	5:57	69.36998	-124.45455	6.9	7.5 +/- 1.4	-
21	July 31	11:22	17:10	5:48	69.37098	-124.45403	7.2	8.4 +/- 0.5	-
24	Aug 1	8:54	20:33	11:39	69.37217	-124.45328	7.4	9.0 +/- 0.6	-
25	Aug 1	8:58	20:46	11:48	69.37323	-124.45165	7.5	8.6 +/- 1.3	-
26	Aug 1	9:01	20:59	11:58	69.37412	-124.45020	7.7	6.8 +/- 0.2	19.3 +/- 0.1
27	Aug 1	9:04	21:05	12:01	69.37512	-124.44915	7.9	8.4 +/- 1.2	-
30	Aug 2	17:17	22:13	4:56	69.40603	-124.46182	5.7	9.8 +/- 0.1	-
31	Aug 2	17:23	22:20	4:57	69.40632	-124.46797	3.9	10.1 +/- 0.3	19.1 +/- 0.3
32	Aug 2	19:49	19:20	23:29	69.37578	-124.44887	8.2	9.8 +/- 0.6	-
33	Aug 2–3	19:52	20:08	24:16	69.37710	-124.45005	8.4	9.2 +/- 0.8	-
34	Aug 3–4	20:02	10:51	14:49	69.37872	-124.45082	8.4	7.2 +/- 0.3	18.7 +/- 0.3
35	Aug 3–4	20:05	11:11	15:06	69.37988	-124.45112	9.6	9.1 +/- 0.7	-
37	Aug 4	11:33	21:38	10:05	69.38117	-124.45228	8.6	8.2 +/- 0.6	-
38	Aug 4	11:35	21:42	10:07	69.38260	-124.45317	9.1	6.8 +/- 0.1	18.6 +/- 0.0
39	Aug 4	11:46	21:54	10:08	69.40963	-124.45267	0.8	9.5 +/- 0.9	-
40	Aug 4	11:54	21:51	9:57	69.40848	-124.45182	1.7	9.6 +/- 0.1	-
41	Aug 5	11:25	19:30	8:05	69.36163	-124.45965	2.3	9.1 +/- 0.9	-
42	Aug 5	11:44	19:46	8:02	69.38372	-124.45505	8.4	4.9 +/- 1.9	-
43	Aug 5	11:49	19:54	8:05	69.38485	-124.45390	8.3	7.3 +/- 0.1	19.0 +/- 0.2
44	Aug 5	11:53	19:59	8:06	69.38647	-124.45375	8.3	9.0 +/- 0.8	-

Net	Date(s) Set	Time Set	Time Lifted	Effort (hr:min)	Latitude DD	Longitude DD	Depth (m)	Mean Temp (ºC) +/- SD	Mean Salinity (ppt) +/- SD
49	Aug 6	11:47	19:12	7:25	69.38728	-124.45330	8.4	8.5 +/- 0.1	-
50	Aug 6	11:50	19:27	7:37	69.38853	-124.45398	8.4	7.2 +/- 0.1	19.1 +/- 0.1
51	Aug 6	11:52	19:33	7:41	69.38950	-124.45482	8.4	6.7 +/- 1.5	-
52	Aug 6	12:02	19:46	7:44	69.36163	-124.45965	2.6	10.2 +/- 0.3	-
60	Aug 7	12:05	20:10	8:05	69.39075	-124.45517	8.6	8.2 +/- 0.3	-
61	Aug 7	12:07	20:04	7:57	69.39195	-124.45567	8.6	8.1 +/- 0.2	19.3 +/- 0.1
62	Aug 7	12:11	19:59	7:48	69.39352	-124.45627	8.4	9.5 +/- 0.1	-
63	Aug 7	12:23	20:34	8:11	69.36720	-124.49437	2.3	10.4 +/- 0.2	-
65	Aug 9	11:30	22:10	10:40	69.39443	-124.45342	8.4	10.2 +/- 0.2	-
66	Aug 9	11:40	22:22	10:42	69.39635	-124.45310	8.5	10.0 +/- 0.1	-
67	Aug 9	11:47	22:30	10:43	69.39812	-124.45278	8.9	9.8 +/- 0.2	18.7 +/- 0.2
68	Aug 9	11:49	22:45	10:56	69.39952	-124.45292	7.9	10.2 +/- 0.1	-
71	Aug 10	12:38	17:29	4:51	69.40063	-124.45250	7.4	10.4 +/- 0.2	-
72	Aug 10	12:41	-	-	69.40140	-124.45305	7.2	10.4 +/- 1.5	18.7 +/- 0.1

Table 8. Trap net effort in 2016 at Argo Bay in Darnley Bay, maximum depth for all efforts does not exceed 1.5 m. Temperature and salinity are provided as the mean standard deviation (SD).

Net Set	Date(s) Set	Time Set (hr:min)	Time Lifted (hr:min)	Effort (hr:min)	Latitude DD	Longitude DD	Mean Temp (ºC) +/- SD	Mean Salinity (ppt) +/- SD
10	July 29–30	14:10	9:50	19:40	69.36742	-124.49475	10.5 +/- 0.4	19.1 +/- 0.1
15	July 30–31	10:10	11:28	25:18	69.36742	-124.49475	10.4 +/- 0.4	18.7 +/- 0.1
22	July 31–Aug 1	11:41	9:10	21:29	69.36742	-124.49475	9.8 +/- 0.4	18.4 +/- 0.1
28	Aug 1–3	10:17	22:30	36:13	69.40480	-124.54440	10.5 +/- 0.7	18.2 +/- 0.2
36	Aug 3–4	23:08	11:28	12:20	69.36887	-124.50007	9.4 +/- 0.6	18.0 +/- 0.1
45	Aug 5–6	11:30	12:31	25:01	69.36887	-124.50007	8.9 +/- 0.3	17.5 +/- 0.1
59	Aug 6–7	14:29	12:35	22:06	69.36887	-124.50007	-	-
64	Aug 7	12:35	20:52	8:17	69.36887	-124.50007	9.7 +/- 1.4	-
69	Aug 7–9	20:52	12:15	15:23	69.36887	-124.50007	10.2 +/- 0.3	-
70	Aug 9–10	12:15	12:52	24:37	69.36887	-124.50007	11.4 +/- 0.8	-
73	Aug 10	12:52	-	-	69.36887	-124.50007	-	-

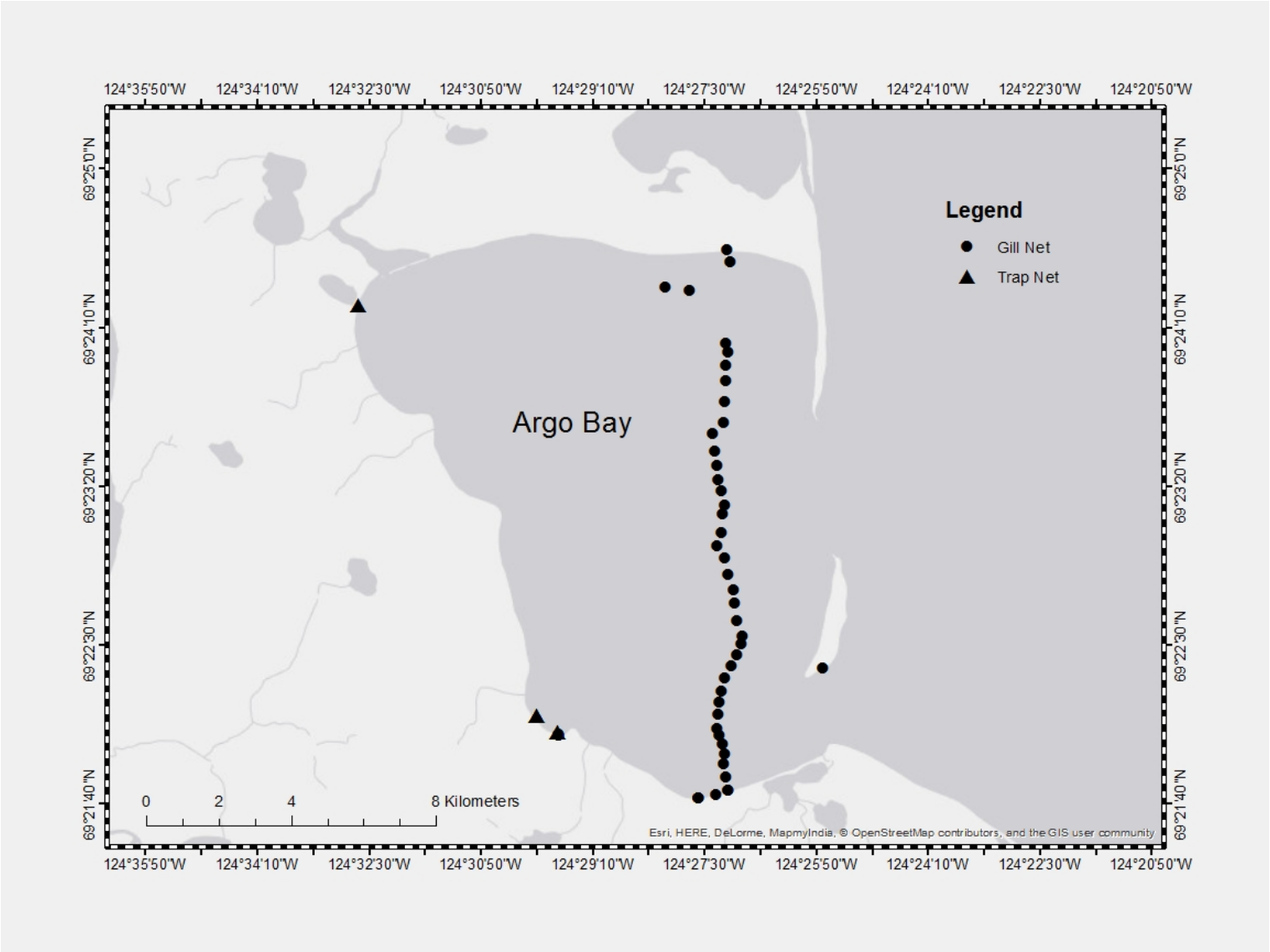

Figure 4. Map of Argo Bay sampling effort from July–August of 2016. Gear type is indicated by a circle for gill nets and a triangle for trap nets.

3.1.2 SPECIES DIVERSITY AND ABUNDANCE

In 2012 at Bennett Point the most abundant species observed was Saffron Cod (*Eleginus gracilis*). These individuals were primarily collected with a trap net (n= 225). Starry Flounder (*Platichthys stellatus*), Greenland Cod (*Gadus ogac*), Arctic Staghorn Sculpin (*Gymnocanthus tricuspis*) and Pacific Herring (*Clupea pallasii*) were relatively abundant while fewer individuals were collected from other species such as Arctic Flounder (*Pleuronectes glacialis*), Capelin (*Mallotus villosus*), Fourhorn Sculpin (*Myoxocephalus quadricornis*), Arctic Char, Arctic Cisco (*Coregonus autumnalis*) and Shorthorn Sculpin (*Myoxocephalus scorpius*). Seining was also conducted from shore, however few fishes were collected (Table 15). Overall, 13 species were collected during this survey (Table 9). This information set the baseline for species diversity and relative abundance to which subsequent surveys were compared.

The results of the 2014 Bennet Point survey indicate that the relative abundance and diversity of species differed from that of the 2012 field program (Table 10). Unlike the 2012 survey, Capelin were the most abundant species, followed by Starry Flounder and anadromous fishes such as Arctic Char and Broad Whitefish. Species diversity observed during this survey reflected that of 2012 (13 species identified); however many of the species observed were in low abundance. While Saffron Cod were collected in the greatest numbers in 2012, only two individuals were observed in 2014, despite repeated sampling at the same location and same season as in the previous program. Starry Flounder were consistently observed in both years of sampling, but Arctic Staghorn Sculpin, Greenland Cod and Pacific Herring were observed in larger numbers in 2012 relative to 2014. These results suggest that abundance and diversity of fishes may differ among years. Some variation however, may also be attributed to sea ice dynamics and ability to sample if conditions were unfavourable. The high abundance of Capelin collected during this survey was significant, because it confirmed that this sub-Arctic associated forage fish was spawning in Darnley Bay, an event that has rarely been documented in the western Canadian Arctic.

Table 9. Summary of species collected for each net set during the 2012 field program at Bennett Point. Set number and gear type (gill net = GN, trap net = TR) are provided for each effort. The total number of individuals for each net and for each species are indicated in bold. (ARCH = Arctic Char; ARCI = Arctic Cisco; ARFL = Arctic Flounder; ARSH = Arctic Shanny; ARSS = Arctic Staghorn Sculpin; BRWH = Broad Whitefish; CAP = Capelin; FOSC = Fourhorn Sculpin; GRCO = Greenland Cod; NIST = Ninespine Stickleback; PAHE = Pacific Herring; SACO = Saffron Cod; SHSC = Shorthorn Sculpin; STFL = Starry Flounder).

Set #	Gear Type	Effort (hr:min)	ARCH	ARCI	ARFL	ARSS	BRWH	CAP	FOSC	GRCO	NIST	PAHE	SACO	SHSC	STFL	Total
1	GN	2:25								3						**3**
2	GN	2:20								1			3			**4**
3	GN	12:10								11						**11**
4	GN	12:50				4				1				1		**6**
5	GN	5:00				1							1		2	**4**
6	GN	5:00														**0**
7	GN	5:00				1										**1**
8	GN	15:25	1			2		1	1	1			3		1	**10**
9	GN	14:05				1										**1**
10	GN	14:30				1				4						**5**
11	GN	6:40													2	**2**
12	GN	19:50			1	2			1				3		3	**10**
13	GN	31:55			1	1		1	1			4	17		6	**31**
14	GN	25:35			1	2			2			1	14		5	**25**
15	GN	7:35														**0**
16	GN	7:05														**0**
17	GN	18:05			1			4				9	7		6	**27**
18	GN	17:15	1					1					9		2	**13**
19	GN	22:40				1				1		1	15		5	**23**
20	GN	22:40				4				2						**6**
Lift 1	TR	17:15	1	1			1				1		43		5	**52**
Lift 2	TR	27:10		2	3							1	231		16	**253**
Lift 3	TR	21:10			2								167		7	**176**
		Total	**3**	**3**	**9**	**20**	**1**	**7**	**5**	**24**	**1**	**16**	**513**	**1**	**60**	**663**

Table 10. Summary of species collected for each net set during the 2014 field program at Bennett Point. Set number and gear type (gill net = GN, 1.5 inch monofilament mesh = GN*, trap net = TR) are provided for each effort. The total number of individuals for each net and for each species are indicated in bold. (ARCH = Arctic Char; ARFL = Arctic Flounder; ARSH = Arctic Shanny; ARSS = Arctic Staghorn Sculpin; BRWH = Broad Whitefish; CAP = Capelin; FOSC = Fourhorn Sculpin; GRCO = Greenland Cod; PAHE = Pacific Herring; RISC = Ribbed Sculpin; SACO = Saffron Cod; SHSC = Shorthorn Sculpin; STFL = Starry Flounder).

Set #	Gear Type	Effort (hr:min)	ARCH	ARFL	ARSH	ARSS	BRWH	CAP	FOSC	GRCO	PAHE	RISC	SACO	SHSC	STFL	**Total**
1	GN	4:54														**0**
2	GN	4:48														**0**
3	GN*	4:34														**0**
4	GN	17:09												1		**1**
5	GN*	16:57														**0**
6	GN	17:00	1				6	1								**8**
7	GN	7:46														**0**
8	GN	7:58														**0**
9	GN	14:54														**0**
10	GN	14:35														**0**
11	GN*	11:27														**0**
12	GN	11:30													2	**2**
13	GN	11:55	5					6			2	1				**14**
14	GN*	11:20														**0**
15	GN	11:16														**0**
16	GN	11:19														**0**
17	GN	16:23														**0**
18	GN	16:30												2	3	**5**
19	TR	20:40						48								**48**
20	TR	20:34						89								**89**
21	TR	17:24				1		118								**119**
22	TR	17:14						6		1						**7**
23	GN	7:22	1					2								**3**
24	GN	7:32	1						1		1			2	6	**11**
25	GN*	7:37	3													**3**
26	GN	8:13												1		**1**
27	GN	8:20			1											**1**
28	TR	27:05		2			3						2			**7**
Min #1	MN	46:21														**0**
Min#2	MN	16:35				1										**1**
		Total	**11**	**2**	**1**	**2**	**9**	**270**	**1**	**1**	**3**	**1**	**2**	**6**	**11**	**320**

Table 11. Summary of species collected for each net set during the 2014 field program at Brown's Harbour. Set number and gear type (gill net = GN, 1.5 inch monofilament mesh = GN*, trap net = TR) are provided for each effort. The total number of individuals for each net and for each species are indicated in bold. (ARCH = Arctic Char; ARCI = Arctic Cisco; ARSS = Arctic Staghorn Sculpin; CAP = Capelin; FOSC = Fourhorn Sculpin; GRCO = Greenland Cod; RISC = Ribbed Sculpin; SACO = Saffron Cod; SHSC = Shorthorn Sculpin; ATSL = Atlantic Spiny Lumpsucker).

Set #	Gear Type	Effort (hr:min)	ARCH	ARCI	ARSS	CAP	FOSC	GRCO	RISC	SACO	SHSC	ATSL	**Total**
1	GN	15:07											**0**
2	GN	15:09											**0**
3	GN*	15:09						9			5		**14**
4	GN*	21:16											**0**
5	GN	21:10											**0**
6	GN	21:05						1					**1**
7	GN	18:53	1					2					**3**
8	GN	18:34			1			2			3		**6**
9	GN	23:06						1			9		**10**
10	GN	23:16											**0**
11	GN	23:15						1			1		**2**
12	GN*	23:25					2						**2**
13	TR	18:04											**0**
14	TR	-								1			**1**
15	GN*	24:21						2			1		**3**
16	GN	23:57		1				3					**4**
17	GN	22:54											**0**
18	GN	22:57		2							4		**6**
19	GN	23:37		1		2		1			2		**6**
20	GN*	18:42					1						**1**
21	GN	18:50				1	6						**7**
22	GN	20:18						2					**2**
23	GN*	20:23									2		**2**
24	GN	16:30		1			1						**2**
25	TR	24:28											**0**
26	GN*	35:31						1			5		**6**
27	GN*	11:30						1					**1**
28	GN	20:52						1			4		**5**
29	GN	20:31									1		**1**
30	GN	16:28						1			1		**2**
31	GN	16:29									1		**1**
32	GN	32:32						1			2		**3**
33	GN	32:29									2		**2**
34	GN	25:47											**0**
35	GN	25:55											**0**
36	GN	22:01			1				1			1	**3**
37	GN	21:58											**0**
		Total	**1**	**5**	**2**	**3**	**10**	**29**	**1**	**1**	**43**	**1**	**96**

There had been no coastal fish survey conducted at Brown's Harbour prior to 2014, therefore all the information was new for the Darnley Bay area and provided a baseline to compare among sites and future years of sampling. Contrary to what was observed at Bennett Point in 2012 and 2014, Shorthorn Sculpin were the most abundant species sampled at Brown's Harbour, followed by Greenland Cod (Table 11). Species diversity was relatively low at this location (10 species), and many of those species had also been observed at Bennett Point. However, some species that are generally associated with the offshore environment were observed at Brown's Harbour at depths <30 m, such as the Atlantic Spiny Lumpsucker (*Eumicrotremus spinosus*) and the Ribbed Sculpin (*Triglops pingelii*). Prior to this field programme there are few to no observations of these species in the coastal environment. This suggests that the northernmost area of Cape Parry may represent a transitional zone from the coastal nearshore habitat to the shelf of the Amundsen Gulf. Unlike Bennett Point, no flounders were observed at Brown's Harbour, while the abundance of sculpins was greater (Shorthorn Sculpin, Fourhorn Sculpin, Arctic Staghorn Sculpin and Ribbed Sculpin). Anadromous species such as Arctic Char and Arctic Cisco were also present at Brown's Harbour; however they were in lower abundance relative to Bennett Point.

In 2015 the abundance of Shorthorn Sculpin was greatest at Brown's Harbour (Table 12), which was also consistent with the previous year of sampling at this location. Additionally, Fourhorn Sculpin were also higher in abundance relative to both years of sampling at Bennett Point. Anadromous Arctic Char and Arctic Cisco were also observed at Brown's Harbour as they had been in 2014, and the absence of flounders was also consistent with that of the previous year.

Sampling was repeated at Bennett Point in 2015 in order to compare to the results of 2012 and 2014. Generally, abundances were low, however this is likely a reflection of sampling effort (14 days at Brown's Harbour; 4 days at Bennett Point). Despite limited sampling effort, species diversity (10 species) was greater at Bennett Point relative to Brown's Harbour (8 species), with Shorthorn Sculpin as the most abundant species (Table 13). Fourhorn Sculpin was the next most collected species, which differed from previous years with fewer occurrences. Similar to previous surveys, Starry Flounder, Arctic Flounder and Pacific Herring were present at Bennett Point, but not at Brown's Harbour.

Argo Bay was surveyed in the summer of 2016, at a location frequently used in the summer for subsistence harvests by the community members of Paulatuk (Table 14). This included gill netting, trap nets and seining from shore (Table 15). Fish abundance and diversity (16 species) was greatest in Argo Bay relative to all previous surveys at Bennett Point and Brown's Harbour. Abundances were high relative to previous sampling locations for flounders (Starry Flounder and Arctic Flounder), Saffron Cod, Sculpin (Shorthorn Sculpin, Arctic Staghorn Sculpin and Fourhorn Sculpin) and anadromous fishes (Arctic Cisco, Arctic Char and Broad Whitefish (*Coregonus nasus*)), particularly juvenile Broad Whitefish (presented separately in Table 16). Few juvenile or young-of-year fishes had been observed at Bennett Point or Brown's Harbour, whereas Argo Bay appears to serve as an important habitat for rearing Broad Whitefish. Additionally, the Arctic Shanny (*Stichaeus punctatus*), a species with few observations in the coastal Beaufort Sea and the Slender Eelblenny (*Lumpenus fabricii*), a species with no prior recorded observations in Darnley Bay, were found. Unlike previous surveys, freshwater adapted species such as the Ninespine Stickleback (*Pungitius pungitius*), were observed at nearshore sites

in Argo Bay in relatively high numbers. Relative to Bennett Point and Brown's Harbour, Argo Bay appears to support both euryhaline and stenohaline adapted fishes, contributing to its higher overall species diversity.

Table 12. Summary of species collected for each net set during the 2015 field program at Brown's Harbour. Set number and gear type (gill net = GN, 1.5 inch monofilament mesh = GN*, minnow trap = MIN and trap net = TR) are provided for each effort. The total number of individuals for each net and for each species are indicated in bold. (ARCH = Arctic Char; ARCI = Arctic Cisco; ARSS = Arctic Staghorn Sculpin; CAP = Capelin; FOSC = Fourhorn Sculpin; GRCO = Greenland Cod; SHSC = Shorthorn Sculpin; TWSC = Twohorn Sculpin).

Set #	Gear Type	Effort (hr:min)	ARCH	ARCI	ARSS	CAP	FOSC	GRCO	SHSC	TWSC	**Total**
1	TR	75:06				1				1	**2**
2	GN*	75:24									**0**
3	GN	48:39						6	19		**25**
4	GN	75:32							5		**5**
5	GN	47:24		1			2		1		**4**
6	GN	14:57							4		**4**
7	GN	22:56		3			2				**5**
8	GN	22:40									**0**
9	GN	74:20									**0**
11	TR	87:42							2		**2**
12	GN	23:16	1				1				**2**
13	GN	23:27							2		**2**
15	GN*	69:23							1		**1**
16	GN	67:13							10		**10**
17	GN	23:47									**0**
18	GN	23:24					8		1		**9**
19	GN	47:59		1			2				**3**
20	GN	47:24					3		1		**4**
22	GN	70:34			1						**1**
23	GN	25:33					1				**1**
24	GN	25:41		1			5				**6**
25	MIN	21:39									**0**
26	GN	25:33									**0**
27	GN	23:25					3	2	3		**8**
28	GN	23:27					2				**2**
29	MIN	23:20									**0**
30	GN	14:18									**0**
31	GN	23:54									**0**
32	GN	23:13							1		**1**
33	GN	23:43		5			2		3		**10**
34	GN	23:46					2		2		**4**
35	GN	23:23					1		1		**2**
36	GN	23:08					3		6		**9**
		Total	**1**	**11**	**1**	**1**	**37**	**8**	**62**	**1**	**122**

Table 13. Summary of species collected for each net set during the 2015 field program at Bennett Point. Set number and gear type (gill net = GN) are provided for each effort. The total number of individuals for each net and for each species are indicated in bold. (ARCH = Arctic Char; ARFL = Arctic Flounder; ARSS = Arctic Staghorn Sculpin; FOSC = Fourhorn Sculpin; GRCO = Greenland Cod; PAHE = Pacific Herring; RISC = Ribbed Sculpin; SACO = Saffron Cod; SHSC = Shorthorn Sculpin; STFL = Starry Flounder).

Set #	Gear Type	Effort (hr:min)	ARCH	ARFL	ARSS	FOSC	GRCO	PAHE	RISC	SACO	SHSC	STFL	**Total**
1	GN	12:14					1						**1**
2	GN	29:19	2			1	1			2	2	1	**9**
3	GN	23:56		1		1					5	2	**9**
4	GN	23:58									6		**6**
5	GN	24:22					1				2		**3**
6	GN	31:59					1				4		**5**
7	GN	18:05					3	1			7		**11**
8	GN	18:12					3			1	3		**7**
9	GN	18:09							1		2		**3**
10	GN	8:16			1		1						**2**
		Total	**2**	**1**	**1**	**2**	**11**	**1**	**1**	**3**	**31**	**3**	**56**

Table 14. Summary of species collected for each net set during the 2016 field program at Argo Bay. Set number and gear type (gill net = GN, 1.5 inch monofilament mesh = GN*, trap net = TR) are provided for each effort. The total number of individuals for each net and for each species are indicated in bold. (ARCH = Arctic Char; ARCI = Arctic Cisco; ARFL = Arctic Flounder; ARSH = Arctic Shanny; ARSS = Arctic Staghorn Sculpin; BRWH = Broad Whitefish; CAP = Capelin; FOSC = Fourhorn Sculpin; GRCO = Greenland Cod; NIST = Ninespine Stickleback; PAHE = Pacific Herring; RISC = Ribbed Sculpin; SACO = Saffron Cod; SHSC = Shorthorn Sculpin; SLEE = Slender Eelblenny; STFL = Starry Flounder).

Set #	Gear Type	Effort (hr:min)	ARCH	ARCI	ARFL	ARSH	ARSS	BRWH	CAP	FOSC	GRCO	NIST	PAHE	RISC	SACO	SHSC	SLEE	STFL	**Total**
1	GN	2:07			7													2	**9**
2	GN	1:59			4			1										2	**7**
3	GN	3:33			3													6	**9**
4	GN	3:24			2													2	**4**
5	GN	3:11			2			2											**4**
6	GN	3:47			2													1	**3**
7	GN	3:42			3														**3**
8	GN	3:53	1		31			1										27	**60**
10	TR	19:40			5			140				1			4				**150**
11	GN*	12:21		1															**1**
12	GN	11:38			20					2			2		2			4	**30**
13	GN	11:45			24					1			1		3	2		2	**33**
14	GN	12:06			10					1					4	1			**16**
15	TR	25:18			1			123	1										**125**
17	GN	9:42																3	**3**
18	GN	6:17			10					2									**12**
19	GN	6:08			8										2	1			**11**
20	GN	5:57			14					1					3				**18**
21	GN	5:48			3											1			**4**
22	TR	21:29																	**0**
24	GN	11:39			20					1					2	5		1	**29**
25	GN	11:48			5		1				1				1	1			**9**
26	GN	11:58			9										4	1			**14**
27	GN	12:01			8		1			1					1	4			**15**
28	TR	12:13																	**0**
30	GN	4:56			3										3			9	**15**
31	GN	4:57			4										4			3	**11**
32	GN	23:29			13		8				1			1	21	9		1	**54**

Set #	Gear Type	Effort (hr:min)	ARCH	ARCI	ARFL	ARSH	ARSS	BRWH	CAP	FOSC	GRCO	NIST	PAHE	RISC	SACO	SHSC	SLEE	STFL	**Total**
33	GN	24:16			5		5			2					7	14		13	**46**
34	GN	14:49			2		6			1					22	3	1	1	**36**
35	GN	15:06			3		12			3					5	9			**32**
36	TR	12:20				1			1										**2**
38	GN	10:05					1				1					1		1	**4**
38	GN	10:07			1										6	2			**9**
39	GN	10:08			1														**1**
40	GN	9:57																3	**3**
41	GN	8:05		4	2														**6**
42	GN	8:02			4					1					5				**10**
43	GN	8:05			4					1					1			1	**7**
45	TR	25:01																	**0**
44	GN	8:06			1										2			1	**4**
49	GN	7:25			1											3			**4**
50	GN	7:37			1					1						2			**4**
51	GN	7:41														5			**5**
52	GN	7:44		1	6													1	**8**
59	TR	22:06		2	7			2	1									2	**14**
60	GN	8:05					1			1					1				**3**
61	GN	7:57			1					3						1			**5**
62	GN	7:48			1														**1**
63	GN	8:11		5	6										4			11	**26**
64	TR	8:17			2			52											**54**
65	GN	10:40			8		1			3					20	2		6	**40**
66	GN	10:42			9										13			3	**25**
67	GN	10:43			6		1			2					4			6	**19**
68	GN	10:56			3					5					3	1		1	**13**
69	TR	15:23		3				22											**25**
70	TR	0:37			1			144	2		2	1			8	1			**159**
71	GN	4:51					1											1	**2**
72	GN	-			1													3	**4**
73	TR	-			2			35											**37**
		Total	**1**	**16**	**289**	**1**	**38**	**522**	**5**	**32**	**5**	**2**	**3**	**1**	**155**	**69**	**1**	**117**	**1257**

Table 15. Seining effort for 2012 and 2016 conducted at Bennett Point and Argo Bay. Data includes number of hauls conducted at the same location on a given day. All seine hauls were conducted from shore. (NIST = Ninespine Stickleback; ARFL = Arctic Flounder; STFL = Starry Flounder; BRWH = Broad Whitefish).

Year	Date	# of Hauls	Location	Latitude DD	Longitude DD	Cottidae spp.	NIST	ARFL	STFL	BRWH	Unknown Larvae
2012	21-Jul	3	Bennett	-	-	0	0	0	0	0	0
2016	05-Aug	3	Argo	69.533888	-124.561111	143	6	5	9	1	0
2016	06-Aug	5	Argo	69.403333	-124.500000	110	35	1	2	1	2

Among the years of sampling in Darnley Bay, species diversity and abundance varied by location and year. In total, 18 species were collected by the Darnley Bay nearshore survey. Although sampling effort and location varied at Bennett Point, Brown's Harbour and Argo Bay, these results also indicate that there are differences in species diversity among sites.

3.1.3 BASIC BIOLOGICAL CHARACTERISTICS

Standard sampling protocol was followed each year in order to determine length, weight, sex, sexual maturity and subsample tissues. Data presented in Table 16 summarize the basic morphological characteristics of the species collected, including both live released and dead-sampled individuals.

Table 16. Catch data and basic biology of fishes captured during the Darnley Bay nearshore survey. Mean total length includes individuals measured in the field and live released; mass (total, liver and gonad) data were obtained from dead-sampled individuals.

Year	Site	Species	n total (live released)	Mean Total Length +/- SD (mm)	Mean Mass ± SD (g)	Liver Mass ± SD (g)	Gonad Mass ± SD (g)
2012	Bennett Point	Saffron Cod (*Eleginus gracilis*)	513 (467)	359.1 +/- 34.7	318.9 +/- 101.3	-	5.7 +/- 2.6
		Starry Flounder (*Platichthys stellatus*)	60 (38)	314.9 +/- 44.3	410.9 +/- 169.9	-	11.2 +/- 10.4
		Greenland Cod (*Gadus ogac*)	24	251.7 +/- 63.6	187.3 +/- 155.1	-	5.7 +/- 7.2
		Arctic Staghorn Sculpin (*Gymnocanthus tricuspis)*	20	214.9 +/- 79.4	110 +/- 118.8	-	2.8 +/- 3.4
		Pacific Herring (*Clupea pallasii*)	16	326.6 +/- 15.5	364.1 +/- 38.2	-	11.8 +/- 6.4
		Arctic Flounder (*Liopsetta glacialis*)	9	163.6 +/- 44.9	66.7 +/- 52.6	-	2.6 +/- 1.6
		Capelin (*Mallotus villosus*)	7	138.4 +/- 8.7	19.3 +/- 3.1	-	1.8 +/- 2.8
		Fourhorn Sculpin (*Myoxocephalus quadricornis*)	5	245.8 +/- 64.7	189.6 +/- 131.7	-	5.0 +/- 4.4
		Arctic Char (*Salvelinus alpinus*)	3 (2)	516.3 +/- 110.1	2069	-	11.7
		Arctic Cisco (*Coregonus autumnalis*)	3	314.3 +/- 9.3	366 +/- 17.7	-	2.9 +/- 3.6
		Shorthorn Sculpin (*Myoxocephalus scorpius*)	1	272.0	197.0	-	6.9
		Ninespine Stickleback (*Pungitius pungitius*)	1	-	-	-	-
2014	Bennett Point	Capelin (*Mallotus villosus*)	270 (2)	137.3 +/- 11.4	14.7 +/- 12.5		1.5 +/- 1.4
		Arctic Char (*Salvelinus alpinus*)	11 (10)	624.9 +/- 55.4	1576.0 +/- 569.6	-	8.9 +/- 11.4
		Starry Flounder (*Platichthys stellatus*)	11	307.1 +/- 47.1	411.5 +/- 204.3	-	12.9 +/- 13.1
		Broad Whitefish (*Coregonus nasus*)	9	445.9 +/- 74.0	710 +/- 275.5	-	4.8 +/- 8.3
		Shorthorn Sculpin (*Myoxocephalus scorpius*)	6	214 +/- 57.2	117.3 +/- 82.3	-	2.9 +/- 2.3
		Pacific Herring (*Clupea pallasii*)	3	367.7 +/- 2.5	390.3 +/- 13.6	-	7.1 +/- 0.4
		Arctic Flounder (*Liopsetta glacialis*)	2	142.5 +/- 94.0	75.0 +/- 99.0	-	-
		Arctic Staghorn Sculpin (*Gymnocanthus tricuspis)*	2	83.0 +/- 7.1	6.5 +/- 2.1	-	-
		Saffron Cod (*Eleginus gracilis*)	2	374.5 +/- 51.6	334.0 +/- 111.7	-	7.6 +/- 5.7
		Arctic Shanny (*Stichaeus punctatus*)	1	-	-	-	-
		Fourhorn Sculpin (*Myoxocephalus quadricornis*)	1	229.0	107.4	-	3.1
		Greenland Cod (*Gadus ogac*)	1	419.0	813.9	-	24.7
		Ribbed Sculpin (*Triglops pingelii*)	1	139.0	16.5	-	0.3

Year	Site	Species	n total (live released)	Mean Total Length +/- SD (mm)	Mean Mass ± SD (g)	Liver Mass ± SD (g)	Gonad Mass ± SD (g)
	Brown's Harbour	Shorthorn Sculpin (*Myoxocephalus scorpius*)	43 (9)	228.3 +/- 65.8	155.1 +/- 118.3	-	4.9 +/- 5.4
		Greenland Cod (*Gadus ogac*)	29	240.6 +/- 103.2	236.1 +/- 330.0	-	7.1 +/- 10.5
		Fourhorn Sculpin (*Myoxocephalus quadricornis*)	10	193.6 +/- 94.7	124.6 +/- 149.9	-	14.4 +/- 6.0
		Arctic Cisco (*Coregonus autumnalis*)	5	427.6 +/- 32.8	743.0 +/- 238.5	-	11.2 +/- 9.8
		Capelin (*Mallotus villosus*)	3	147.5 +/- 2.1	19.4 +/- 0.0	-	0.2 +/- 0.2
		Arctic Staghorn Sculpin (*Gymnocanthus tricuspis)*	2	197.0 +/- 35.4	98.0 +/- 55.2	-	3.7 +/- 0.9
		Arctic Char (*Salvelinus alpinus*)	1 (1)	605	-	-	-
		Atlantic Spiny Lumpsucker (*Eumicrotremus spinosus)*	1	102	59.4	-	-
		Ribbed Sculpin (*Triglops pingelii*)	1	116	12.8	-	-
		Saffron Cod (*Eleginus gracilis*)	1	-	-	-	-
2015	**Bennett Point**	Shorthorn Sculpin (*Myoxocephalus scorpius*)	31 (31)	196.9 +/- 59.2	-	-	-
		Greenland Cod (*Gadus ogac*)	11	231.0 +/- 71.7	207.5 +/- 201.0	4.6 +/- 4.1	5.8 +/- 7.2
		Saffron Cod (*Eleginus gracilis*)	3	362.0 +/- 37.3	314 +/- 76.9	6.9 +/- 1.5	11.2 +/- 4.1
		Starry Flounder (*Platichthys stellatus*)	3	258 +/- 70.5	256.3 +/- 199.0	3.6 +/- 2.8	6.3 +/- 9.6
		Arctic Cisco (*Coregonus autumnalis*)	2	377.0 +/- 24.0	434.0 +/- 75.0	10.7 +/- 8.1	3.0 +/- 1.9
		Fourhorn Sculpin (*Myoxocephalus quadricornis*)	2	247.5 +/- 46.0	-	-	-
		Arctic Flounder (*Liopsetta glacialis*)	1	177.0	286.60	7.6	14
		Arctic Staghorn Sculpin (*Gymnocanthus tricuspis)*	1	135.0	26.30	0.4	0.4
		Pacific Herring (*Clupea pallasii*)	1	387.0	446.5	7.8	9.9
		Ribbed Sculpin (*Triglops pingelii*)	1	101.0	8.9	0.7	1.2
	Brown's Harbour	Shorthorn Sculpin (*Myoxocephalus scorpius*)	62 (17)	226.4 +/- 63.0	173.2 +/- 84.5	9.6 ± 3.4	6.6 +/- 3.4
		Fourhorn Sculpin (*Myoxocephalus quadricornis*)	37	226.4 +/- 77.9	173.2 +/- 138.7	9.6 +/- 8.3	6.6 +/- 5.5
		Arctic Cisco (*Coregonus autumnalis*)	11	375.3 +/- 20.4	437.5 +/- 96.5	8.6 +/- 3.6	2.2 +/- 1.5
		Greenland Cod (*Gadus ogac*)	8	261.2 +/- 70.2	131.0 +/- 137.1	4.3 +/- 3.5	3.8 +/- 3.7
		Arctic Char (*Salvelinus alpinus*)	1	719.0	2713.5	79.0	13.0
		Arctic Staghorn Sculpin (*Gymnocanthus tricuspis)*	1	142.0	31.9	1.6	1.2
		Capelin (*Mallotus villosus*)	1	137.0	16.7	-	0.2
		Twohorn Sculpin **(***Icelus bicornis*)	1	64.0	1.5	-	-

Year	Site	Species	n total (live released)	Mean Total Length +/- SD (mm)	Mean Mass ± SD (g)	Liver Mass ± SD (g)	Gonad Mass ± SD (g)
2016	Argo Bay	Broad Whitefish (Juvenile; *Coregonus nasus*)	498	56.5 +/- 11.7	1.6 +/- 2.4	-	-
		Arctic Flounder (*Liopsetta glacialis*)	295 (253)	236.2 +/- 54.5	226.3 +/- 99.9	6.9 +/- 3.6	9.3 +/- 5.8
		Saffron cod (*Eleginus gracilis*)	155 (42)	253.6 +/- 95.6	193.3 +/- 153.2	8.1 +/- 7.2	5.7 +/- 5.8
		Starry Flounder (*Platichthys stellatus*)	127 (84)	242.4 +/- 64.1	299.9 +/- 122.1	11.9 +/- 6.4	7.5 +/- 7.1
		Shorthorn Sculpin (*Myoxocephalus scorpius*)	69 (36)	240 +/- 60.9	168.6 +/- 93.1	5.8 +/- 4.6	4.4 +/- 4.0
		Ninespine Stickleback (*Pungitius pungitius*)	43	40.6 +/- 13.3	-	-	-
		Arctic Staghorn Sculpin (*Gymnocanthus tricuspis)*	38 (5)	320.7 +/- 33.4	427.7 +/- 31.6	10.3 +/- 1.6	4.0 +/- 1.7
		Fourhorn Sculpin (*Myoxocephalus quadricornis*)	32	212.1 +/- 53.2	108.9 +/- 72.2	6.2 +/- 8.9	4.1 +/- 3.4
		Broad Whitefish (*Coregonus nasus*)	25 (3)	483.9 +/- 77.9	986 +/- 405.6	11.0 +/- 6.9	22.6 +/- 45.2
		Arctic Cisco (*Coregonus autumnalis*)	16	320.7 +/- 109.3	427.7 +/- 294.4	10.3 +/- 7.0	4.0 +/- 4.5
		Capelin (*Mallotus villosus*)	5	147.4 +/- 18.2	18.4 +/- 7.7	-	-
		Greenland Cod (*Gadus ogac*)	5	215.8 +/- 119.5	213.6 +/- 284.6	18.6 +/- 4.1	25.7 +/- 7.3
		Pacific Herring (*Clupea pallasii*)	3	295.7 +/- 5.5	212.3 +/- 15.4	3.8 +/- 0.1	3.5 +/- 0.6
		Arctic Char (*Salvelinus alpinus*)	1	436.0	860.9	18.5	0.8
		Arctic Shanny (*Stichaeus punctatus*)	1	77	2.2	-	-
		Ribbed Sculpin (*Triglops pingelii*)	1	119.0	-	-	-
		Slender Eelblenny (*Lumpenus fabricii*)	1	224.0	23.0	-	-

Total length differed in some species with respect to year of sampling or by location. Juvenile or young-of-year fishes were collected in higher abundance in Argo Bay, relative to Bennett Point and Brown's Harbour, particularly Broad Whitefish and Saffron Cod (Table 16). Juvenile Broad Whitefish were highly abundant in Argo Bay, collected using trap nets and beach seines deployed from shore.

Among the fishes selected for sub-sampling and dissection few were observed with ripe or spent gonads among sampling sites and years (Table 17). At Bennett Point and Brown's Harbour, only Capelin displayed characteristics of spawning in July of 2012, 2014 and 2015, where eggs were also observed adhered to sediments in 2014. Given that Capelin migrate from offshore waters during the summer to spawn on coastal beaches or demersally in deeper water (Carscadden et al. 2013), it may be assumed that the Capelin observed during these coastal surveys were current-year spawners. In Argo Bay, in August of 2016 Fourhorn Sculpin displayed characteristics of spawning (e.g., breeding spots), and 30% of observed males were spent.

Table 17. Sex ratio information and maturity status of fishes collected in Darnley Bay 2012, 2014–2016 among the three sampling locations (Brown's Harbour, Bennett Point and Argo Bay). Ratio of males to females is indicated as M:F for each status of maturity, no resting individuals were identified among the years of sampling. Sex and maturity information is not included for live released individuals or individuals preserved as voucher specimens because these were not dissected. Maturity codes are provided in Appendix E.

Year	Site	Species	Sex (M:F)	Maturity				
				Unknown	Immature	Mature	Ripe	Spent
2012	Bennett Point	Saffron Cod	11:25	1	10:15	1:10	-	-
		Starry Flounder	10:12	-	8:4	2:8	-	-
		Greenland Cod	14:10	-	14:4	0:6	-	-
		Arctic Staghorn Sculpin	6:11	-	1:5	5:6	-	-
		Pacific Herring	8:8	-	2:1	6:7	-	-
		Arctic Flounder	0:7	2	-	0:7	-	-
		Capelin	5:2	-	-	1:0	4:2	-
		Fourhorn Sculpin	0:5	-	0:1	0:4	-	-
		Arctic Char	0:1	-	-	0:1	-	-
		Arctic Cisco	2:1	-	-	2:1	-	-
		Shorthorn Sculpin	0:1	-	-	0:1	-	-
2014	Bennett Point	Capelin	85:178	-	-	-	6:3	14:0
		Arctic Char	1:1	-	-	1:1	-	-
		Starry Flounder	4:7	-	0:2	4:5	-	-
		Broad Whitefish	6:3	-	6:1	0:2	-	-
		Shorthorn Sculpin	2:4	-	1:1	1:3	-	-
		Pacific Herring	1:2	-	-	1:2	-	-
		Arctic Flounder	0:1	1	-	0:1	-	-
		Arctic Staghorn Sculpin	-	2	-	-	-	-
		Saffron Cod	1:1	-	-	1:1	-	-
		Fourhorn Sculpin	0:1	-	-	0:1	-	-
		Greenland Cod	1:0	-	-	1:0	-	-
		Ribbed Sculpin	1:0	-	-	1:0	-	-
	Brown's Harbour	Shorthorn Sculpin	8:25	1	5:8	3:17	-	-
		Greenland Cod	16:12	1	13:9	3:3	-	-
		Fourhorn Sculpin	1:1	6	-	1:3	-	-
		Arctic Cisco	2:3	-	-	3:2	-	-
		Capelin	3:0	-	-	-	3:0	-
		Arctic Staghorn Sculpin	0:2	-	-	0:2	-	-

Year	Site	Species	Sex (M:F)	Maturity				
				Unknown	Immature	Mature	Ripe	Spent
2015	Bennett Point	Greenland Cod	3:8	-	3:5	0:3	-	-
		Saffron Cod	2:1	-	-	2:1	-	-
		Starry Flounder	0:1	2	-	0:1	-	-
		Arctic Cisco	1:1	-	-	1:1	-	-
		Arctic Flounder	0:1	-	-	0:1	-	-
		Arctic Staghorn Sculpin	0:1	-	-	0:1	-	-
		Pacific Herring	0:1	-	-	0:1	-	-
		Ribbed Sculpin	0:1	-	-	0:1	-	-
	Brown's Harbour	Shorthorn Sculpin	18:26	1	8:11	10:15	-	-
		Fourhorn Sculpin	13:10	1	5:2	8:14	-	-
		Arctic Cisco	6:5	-	2:1	4:4	-	-
		Greenland Cod	4:4	-	4:3	0:1	-	-
		Arctic Char	1:0	-	-	1:0	-	-
		Arctic Staghorn Sculpin	0:1	-	-	0:1	-	-
		Capelin	1:0	-	-	-	1:0	-
2016	Argo Bay	Arctic Flounder	3:31	1	3:10	0:1	-	-
		Saffron Cod	43:41	-	43:41	-	-	-
		Starry Flounder	19:12	-	7:12	12:0	-	-
		Shorthorn Sculpin	24:8	-	6:6	17:2	-	1:0
		Arctic Staghorn Sculpin	22:9	-	12:3	10:6	-	-
		Fourhorn Sculpin	20:11	-	12:8	2:3	-	6:0
		Broad Whitefish	16:6	498	16:2	1:0	1:2	0:2
		Arctic Cisco	9:6	-	6:2	0:4	1:0	-
		Capelin	3:1	-	-	-	1:0	1:0
		Greenland Cod	2:0	-	2:0	-	-	-
		Pacific Herring	3:0	-	-	3:0	-	-
		Arctic Char	1:0	-	1:0	-	-	-
		Ribbed Sculpin	1:0	-	1:0	-	-	-

Variation in size among locations and years of sampling are shown in Figures 5 to 17 for each species. Species that were collected in low abundance (n<5) among years are not displayed.

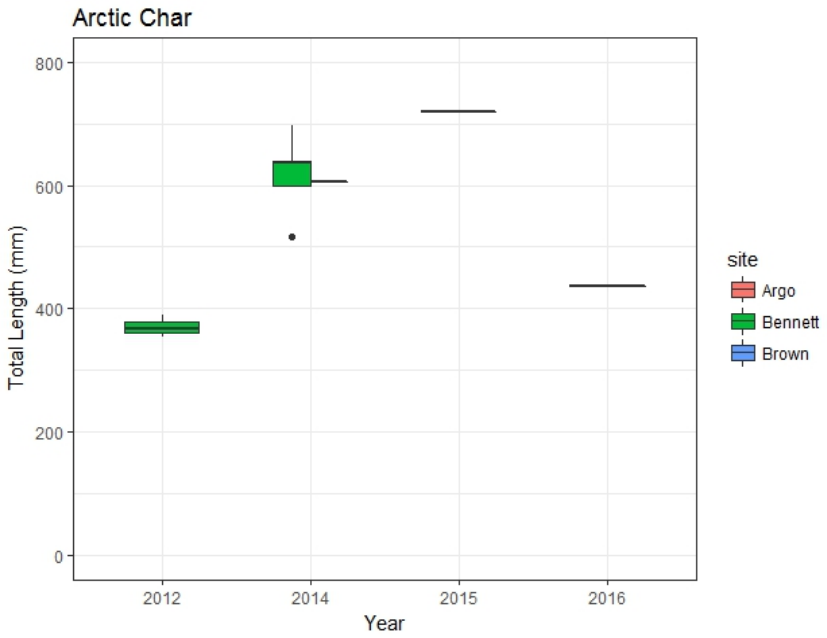

Figure 5. Summary of total lengths of Arctic Char obtained among field programs in 2012 at Bennett Point (n=3), in 2014 at Bennett Point (n=11) and Brown's Harbour (n=1), in 2015 at Brown's Harbour (n=1) and in 2016 at Argo Bay (n=1). Boxplots display the upper and lower quartiles, median and whiskers, representing maximum and minimum values.

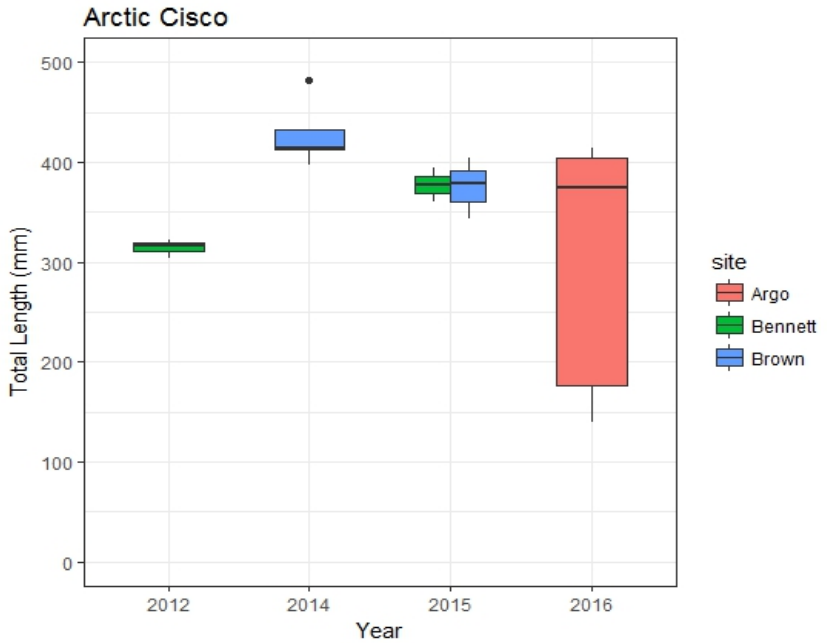

Figure 6. Summary of total lengths of Arctic Cisco obtained among field programs in 2012 at Bennett Point (n=3), in 2014 at Brown's Harbour (n=5), in 2015 at Bennett Point (n=2) and Brown's Harbour (n=11) and in 2016 at Argo Bay (n=16). Boxplots display the upper and lower quartiles, median and whiskers, representing maximum and minimum values.

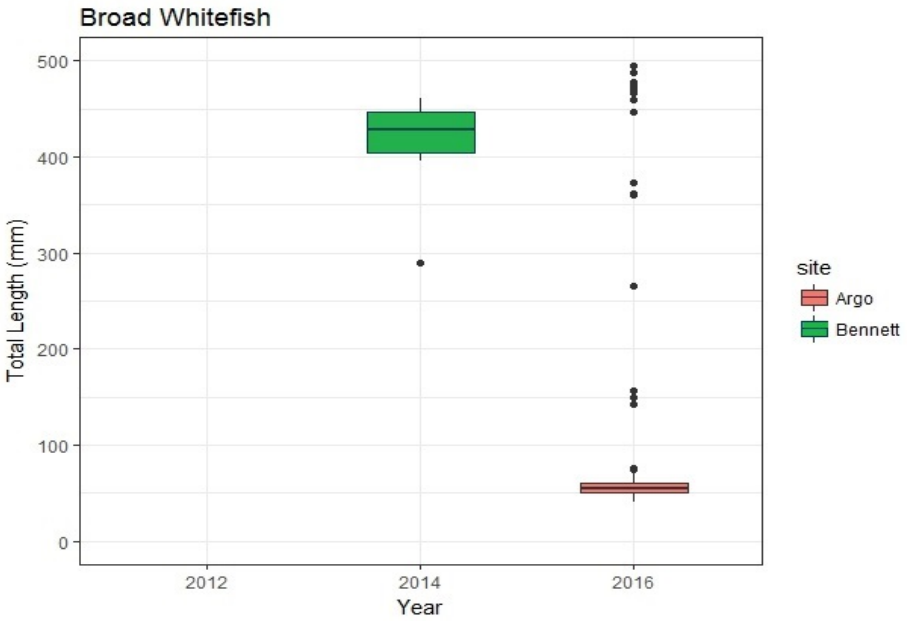

Figure 7. Summary of total lengths of Broad Whitefish obtained among field programs in 2014 at Bennett Point (n=9) and in 2016 at Argo Bay (n=523), including juveniles (n=498). Boxplots display the upper and lower quartiles, median and whiskers, representing maximum and minimum values.

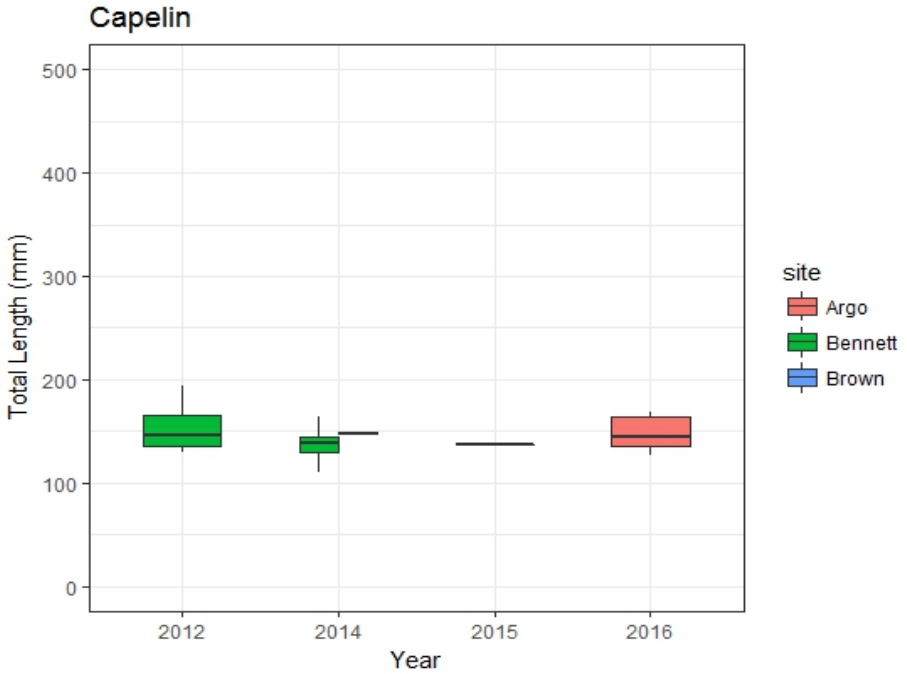

Figure 8. Summary of total lengths of Capelin obtained among field programs in 2012 at Bennett Point (n=7), in 2014 at Bennett Point (n=270) and at Brown's Harbour (n=3), in 2015 at Brown's Harbour (n=1) and in 2016 at Argo Bay (n=5). Boxplots display the upper and lower quartiles, median and whiskers, representing maximum and minimum values.

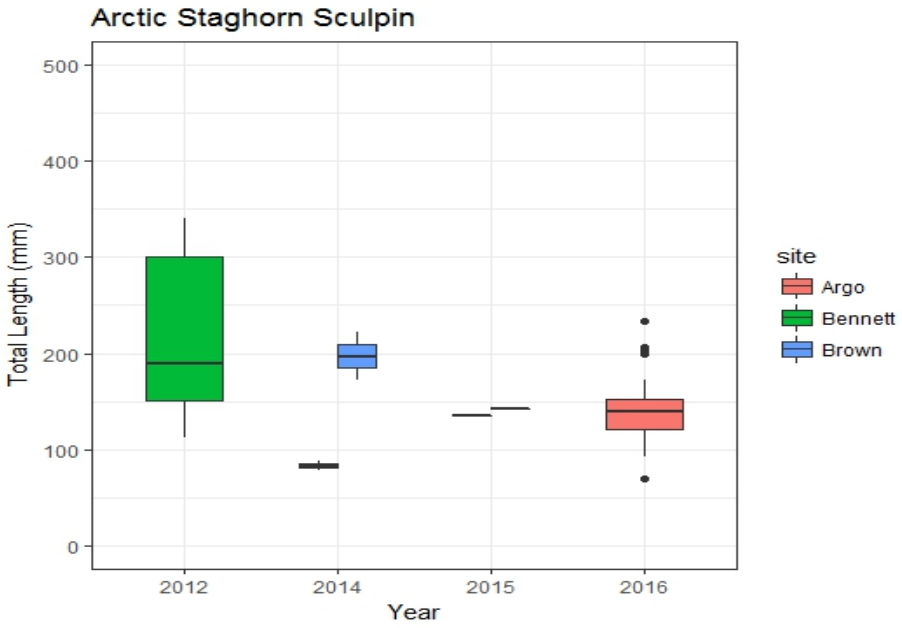

Figure 9. Summary of total lengths of Arctic Staghorn Sculpin obtained among field programs in 2012 at Bennett Point (n=20), in 2014 at Bennett Point (n=2) and Brown's Harbour (n=2), in 2015 at Bennett Point (n=1) and Brown's Harbour (n=1) and in 2016 at Argo Bay (n=38). Boxplots display the upper and lower quartiles, median and whiskers, representing maximum and minimum values.

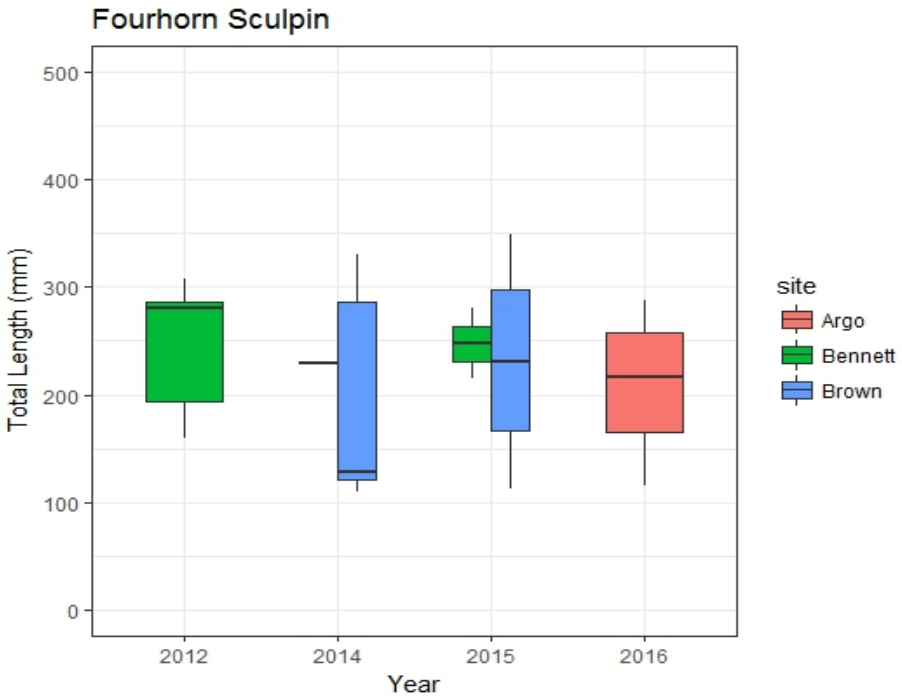

Figure 10. Summary of total lengths of Fourhorn Sculpin obtained among field programs in 2012 at Bennett Point (n=5), in 2014 at Bennett Point (n=1) and at Brown's Harbour (n=10), in 2015 at Bennett Point (n=2) and Brown's Harbour (n=37), and in 2016 at Argo Bay (n=32). Boxplots display the upper and lower quartiles, median and whiskers, representing maximum and minimum values.

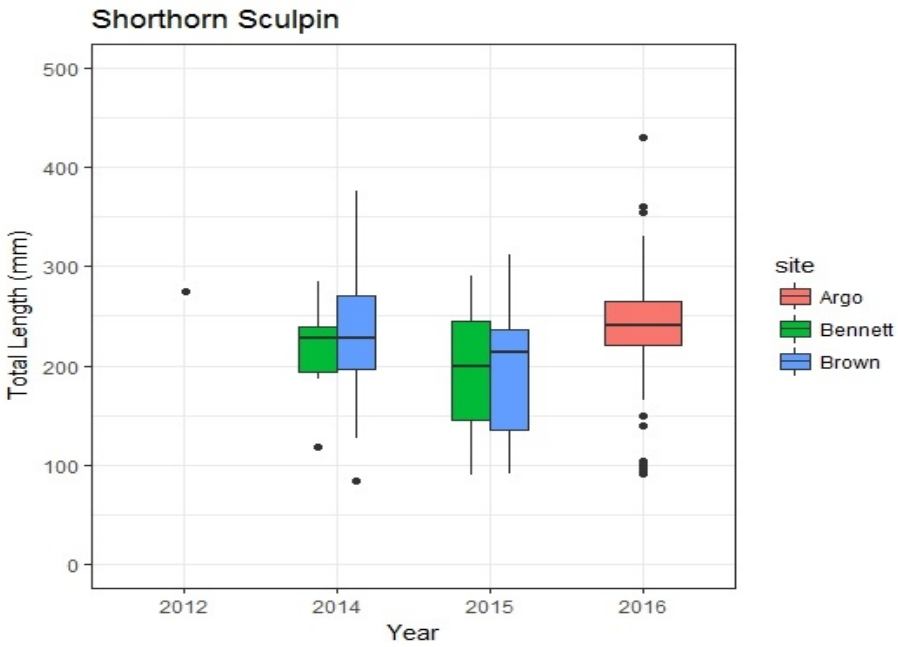

Figure 11. Summary of total lengths of Shorthorn Sculpin obtained among field programs in 2012 at Bennett Point (n=1), in 2014 at Bennett Point (n=6) and Brown's Harbour (n=43), in 2015 at Bennett Point (n=31) and Brown's Harbour (n=62), and in 2016 at Argo Bay (n=69). Boxplots display the upper and lower quartiles, median and whiskers, representing maximum and minimum values.

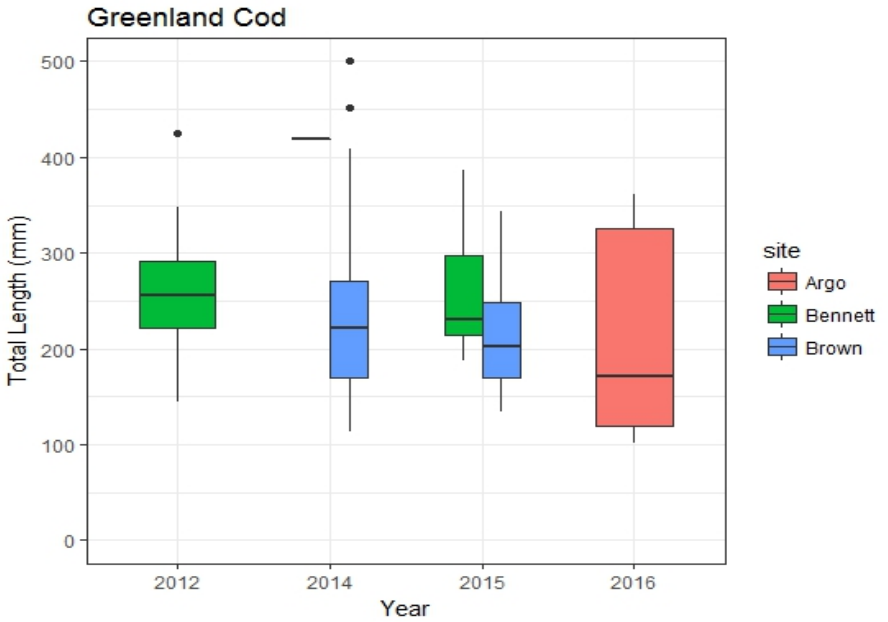

Figure 12. Summary of total lengths of Greenland Cod obtained among field programs at Bennet Point (2012, n=24; 2014, n=1; 2015, n=11), Brown's Harbour (2014, n=29; 2015, n=8), and Argo Bay (2016, n=5). Boxplots display the upper and lower quartiles, median and whiskers, representing maximum and minimum values.

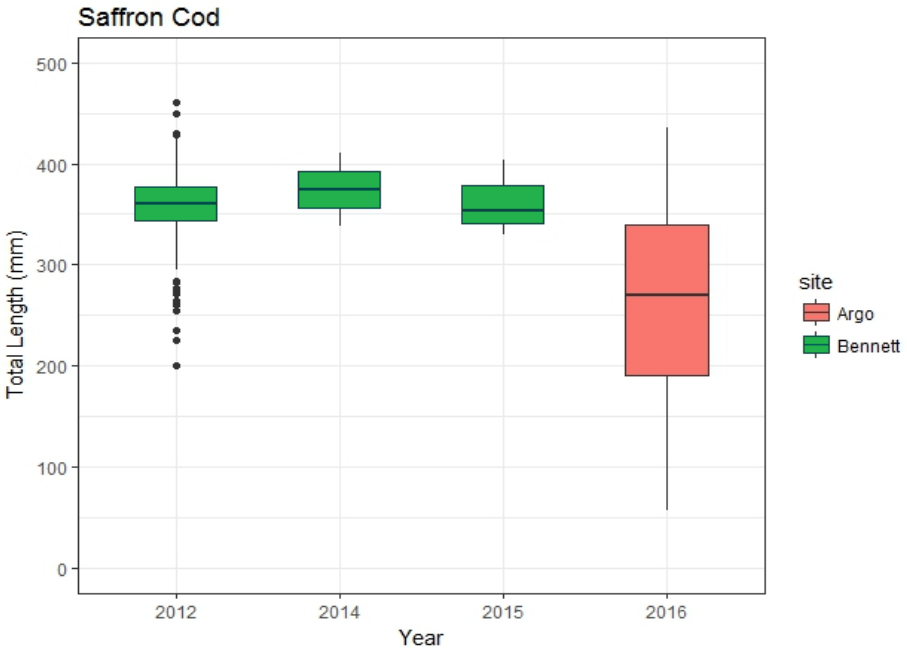

Figure 13. Summary of total lengths of Saffron Cod obtained among field programs in 2012 at Bennett Point (n=513), in 2014 at Bennett Point (n=2) and Brown's Harbour (n=1), in 2015 at Bennett Point (n=3), and in 2016 at Argo Bay (n=155). Boxplots display the upper and lower quartiles, median and whiskers, representing maximum and minimum values.

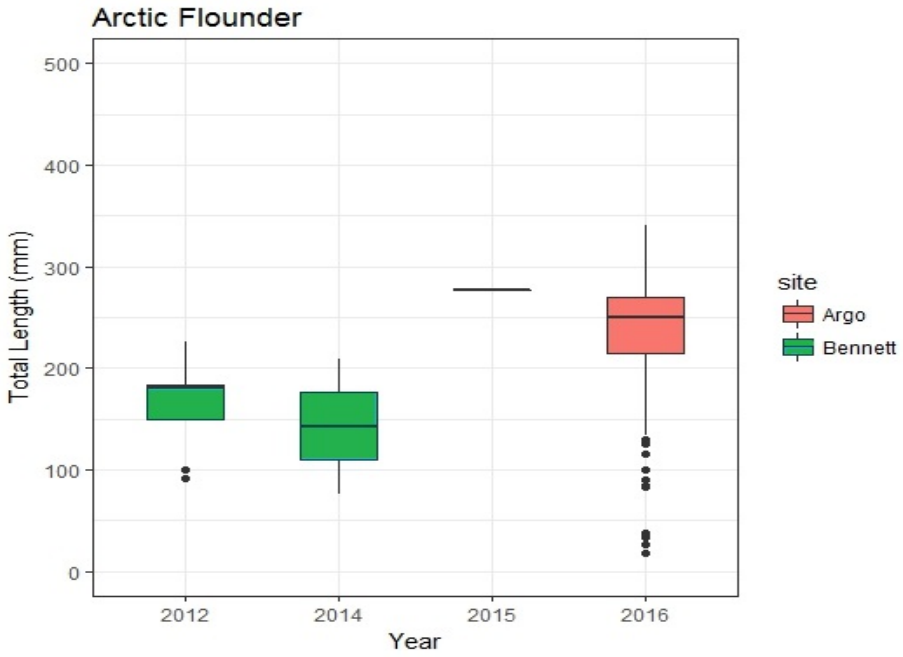

Figure14 . Summary of total lengths of Arctic Flounder obtained among field programs in 2012 at Bennett Point (n=9), in 2014 at Bennett Point (n=2), in 2015 at Bennett Point (n=1) and in 2016 at Argo Bay (n=295). Boxplots display the upper and lower quartiles, median and whiskers, representing maximum and minimum values.

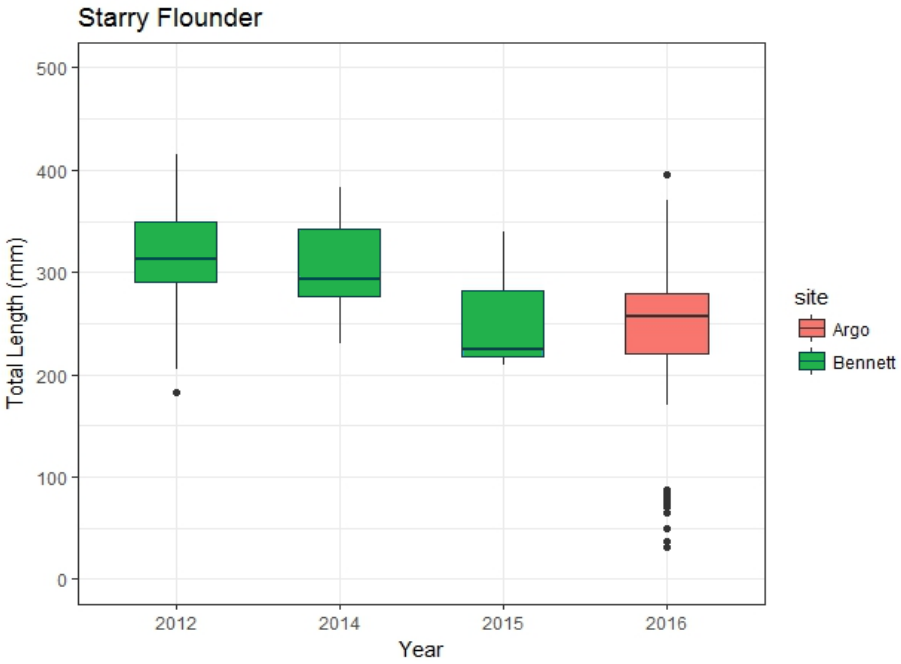

Figure 15. Summary of total lengths of Starry Flounder obtained among field programs in 2012 at Bennett Point (n=60), in 2014 at Bennett Point (n=11), in 2015 at Bennett Point (n=3), and in 2016 at Argo Bay (n=127). Boxplots display the upper and lower quartiles, median and whiskers, representing maximum and minimum values.

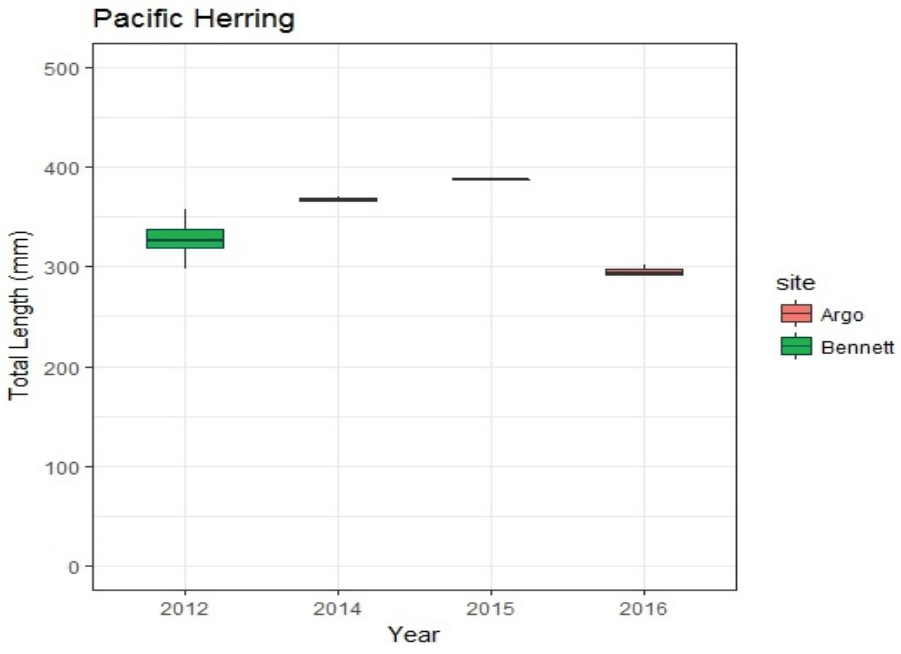

Figure 16. Summary of total lengths of Pacific Herring obtained among field programs in 2012 at Bennett Point (n=16), in 2014 at Bennett Point (n=3), in 2015 at Bennett Point (n=1), and in 2016 at Argo Bay (n=3). Boxplots display the upper and lower quartiles, median and whiskers, representing maximum and minimum values.

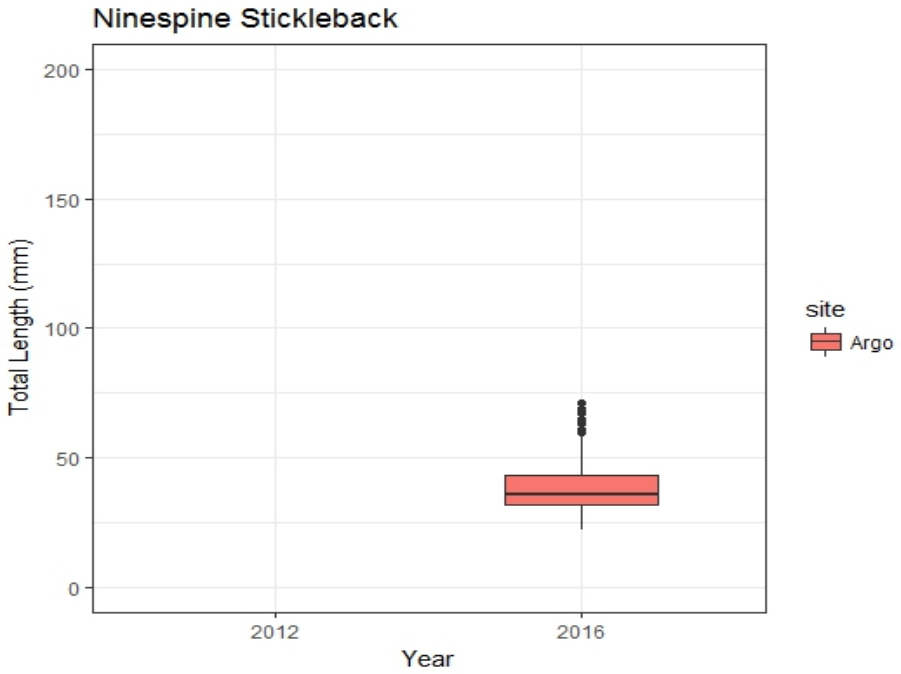

Figure 17. Summary of total lengths of Ninespine Stickleback collected among field programs, in which lengths were only obtained from Argo Bay in 2016 (n=43). Boxplots display the upper and lower quartiles, median and whiskers, representing maximum and minimum values.

3.1.4 FISH AGES

Ages were determined for fishes at the Freshwater Institute in Winnipeg. Fishes were primarily aged by examining a section of the saggital otolith (using the break and burn method), with the exception of Capelin which were aged as whole otoliths following methods developed by Hedeholm et al. (2010). Figures 18 to 30 describe the age-length relationship among compiled data from 2012 and 2014 for 13 different species. Increasing total length with respect to age was observed among species with larger sample sizes, while these patterns were less apparent among individuals where n < 10. Only ages from individuals that could be determined with a high level of confidence by two independent readers are provided.

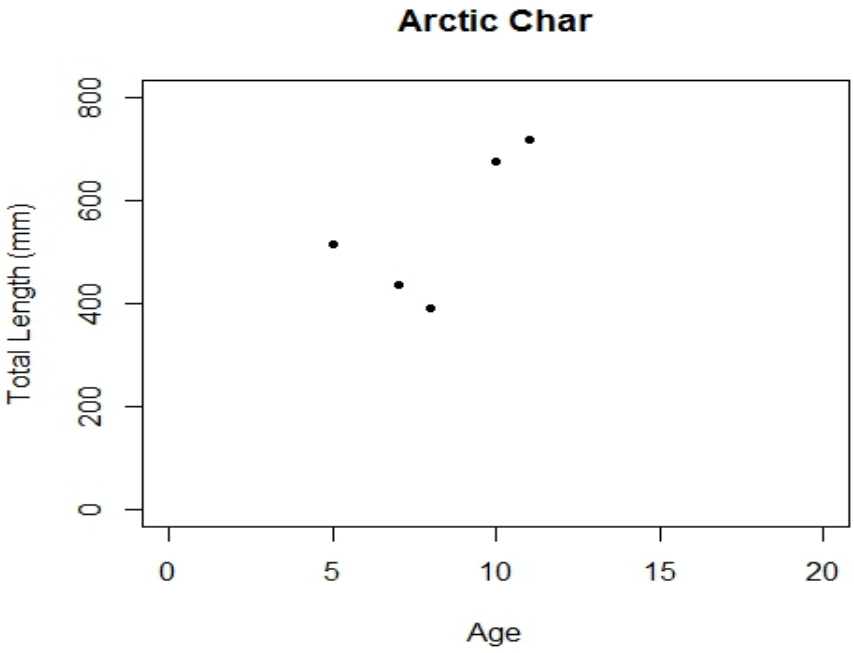

Figure 18. Total length (mm) at age of Arctic Char collected at Bennett Point (2012, n=1; 2014, n=2), Brown's Harbour (2015, n=1) and Argo Bay (2016, n=1).

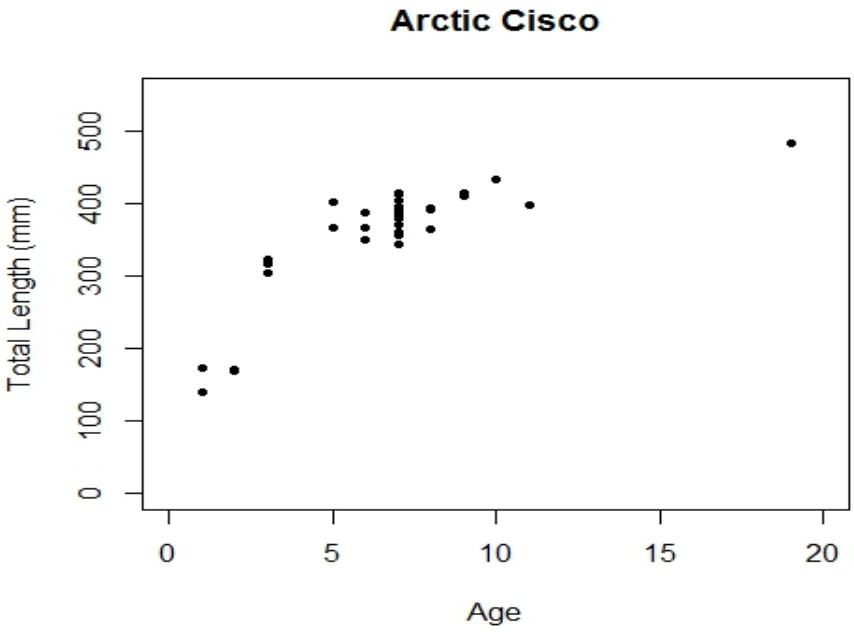

Figure 19. Total length (mm) at age of Arctic Cisco collected at Bennett Point (2012, n=3; 2015, n=2), Brown's Harbour (2014, n=5; 2015, n=11) and Argo Bay (2016, n=15).

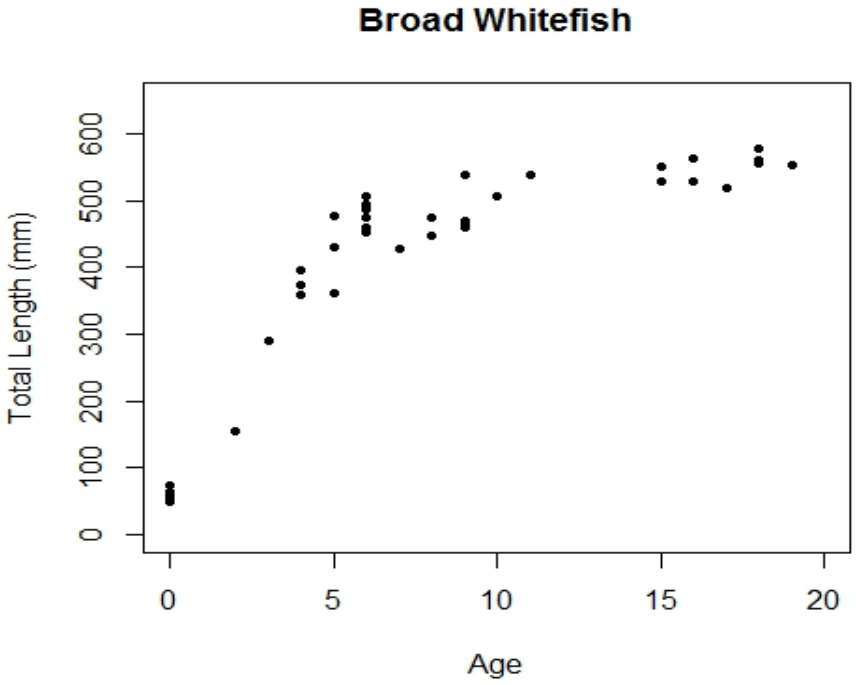

Figure 20. Total length (mm) at age of Broad Whitefish collected at Bennett Point (2014, n=9) and Argo Bay (2016, n=54).

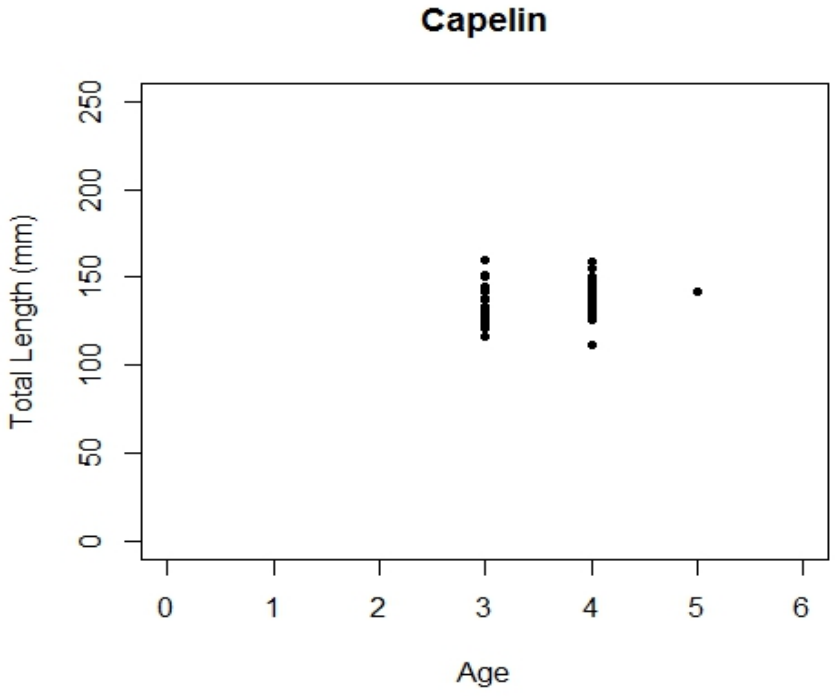

Figure 21. Total length (mm) at age of Capelin collected at Bennett Point (2012, n=6; 2014, n=42) and Brown's Harbour (2015, n=1).

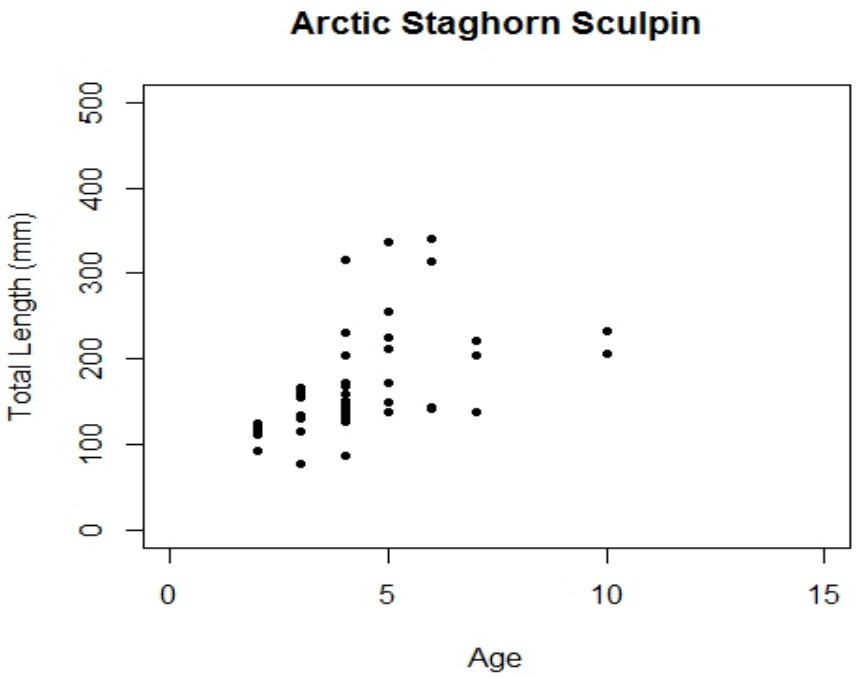

Figure 22. Total length (mm) at age of Arctic Staghorn Sculpin collected at Bennett Point (2012, n=20; 2014, n=2; 2015, n=1), Brown's Harbour (2014, n=2; 2015, n=1) and Argo Bay (2016, n=32).

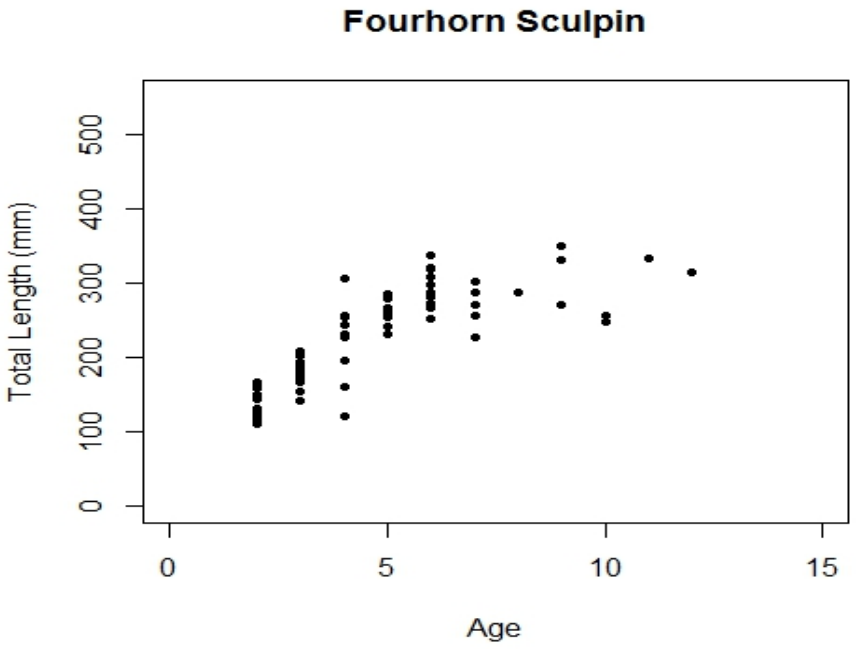

Figure 23. Total length (mm) at age of Fourhorn Sculpin collected at Bennett Point (2012, n=5; 2014, n=1), Brown's Harbour (2014, n=10; 2015, n=30) and Argo Bay (2016, n=31).

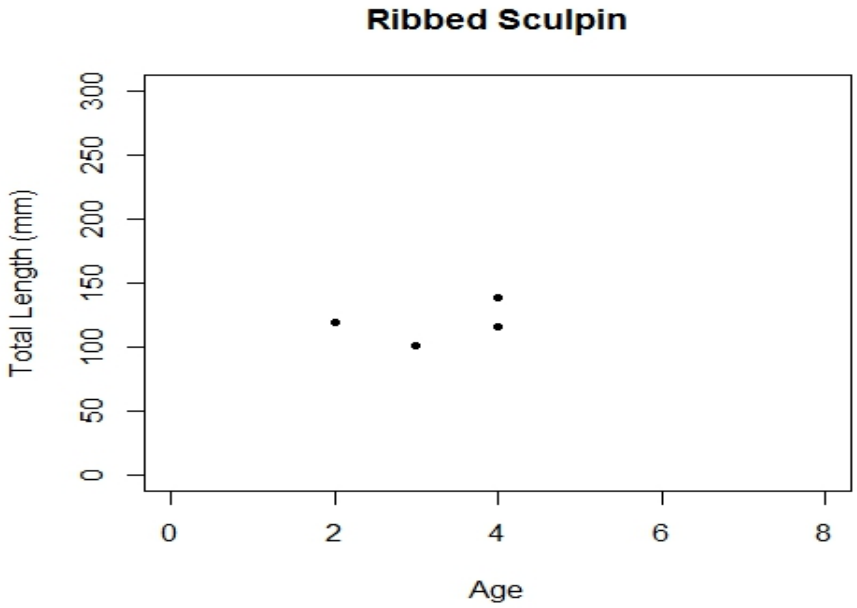

Figure 24. Total length (mm) at age of Ribbed Sculpin collected at Bennett Point (2014, n=1), Brown's Harbour (2014, n=1; 2015, n=1) and Argo Bay (2016, n=1).

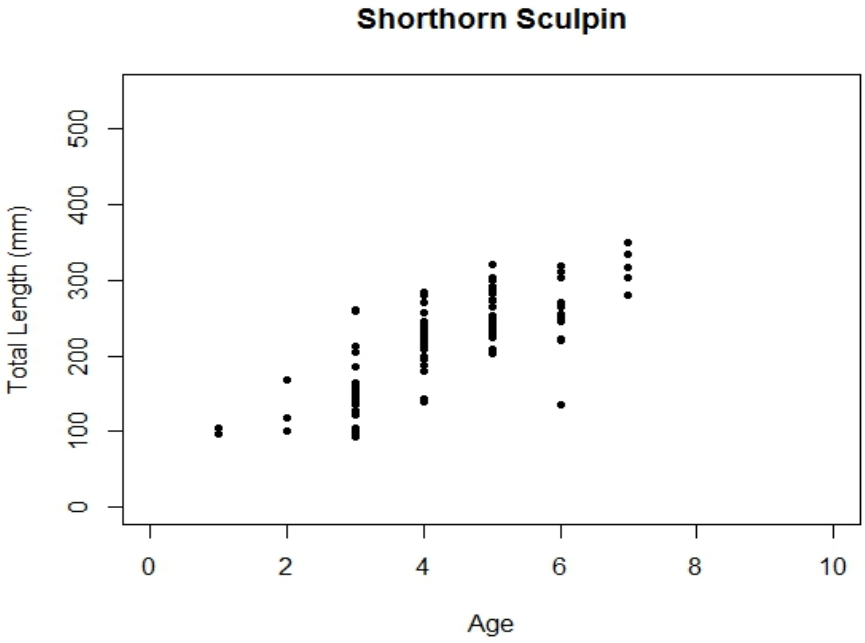

Figure 25. Total length (mm) at age of Shorthorn Sculpin collected at Bennett Point (2012, n=1; 2014, n=6), Brown's Harbour (2014, n=33; 2015, n=45) and Argo Bay (2016, n=32).

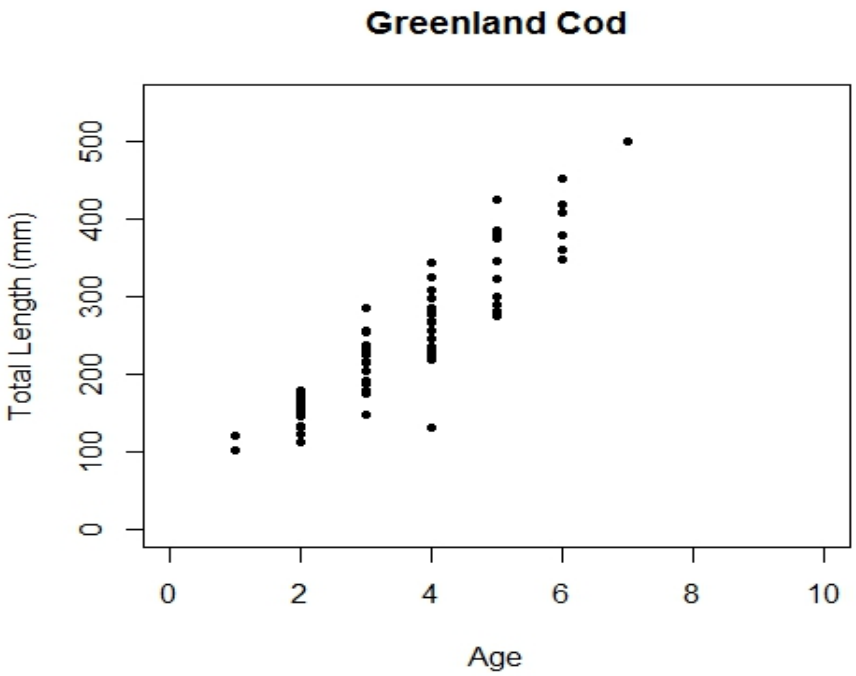

Figure 26. Total length (mm) at age of Greenland Cod collected at Bennett Point (2012, n=24; 2014, n=1; 2015, n=11), Brown's Harbour (2014, n=29; 2015, n=8) and Argo Bay (2016, n=4).

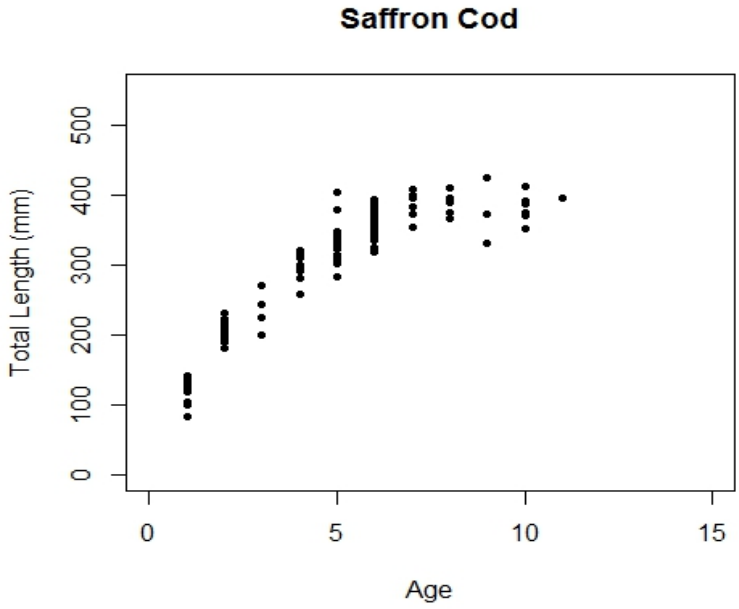

Figure 27. Total length (mm) at age of Saffron Cod collected at Bennett Point (2012, n=37; 2014, n=2; 2015, n=3) and Argo Bay (2016, n=85).

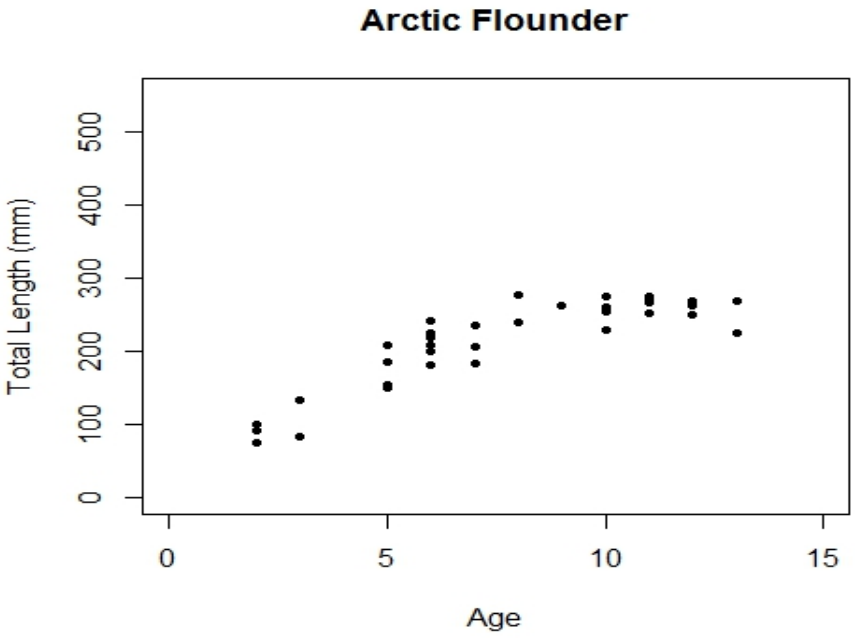

Figure 28. Total length (mm) at age of Arctic Flounder collected at Bennett Point (2012, n=9; 2014, n=2; 2015, n=1) and Argo Bay (2016, n=35).

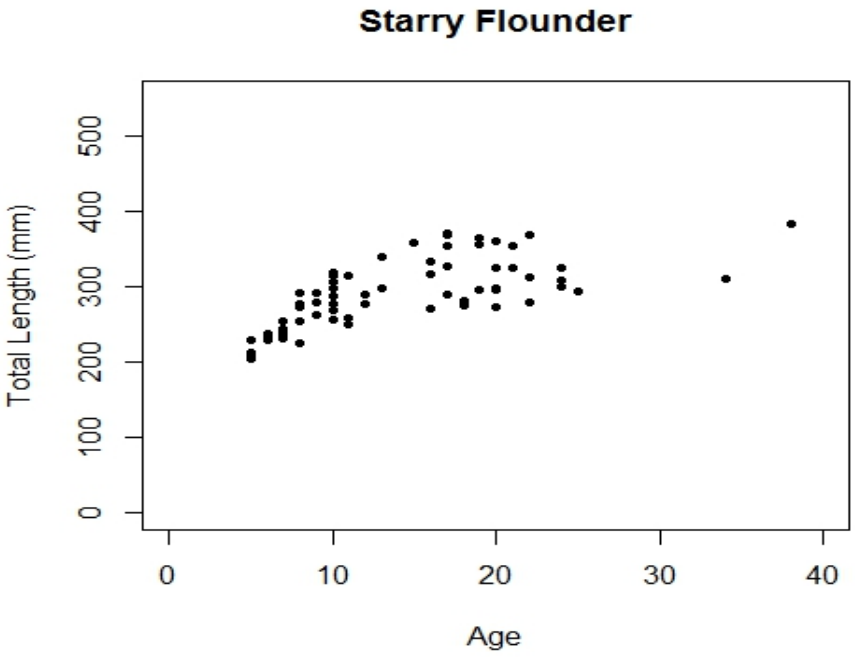

Figure 29. Total length (mm) at age of Starry Flounder collected at Bennett Point (2012, n=22; 2014, n=11; 2015, n=3) and Argo Bay (2016, n=32).

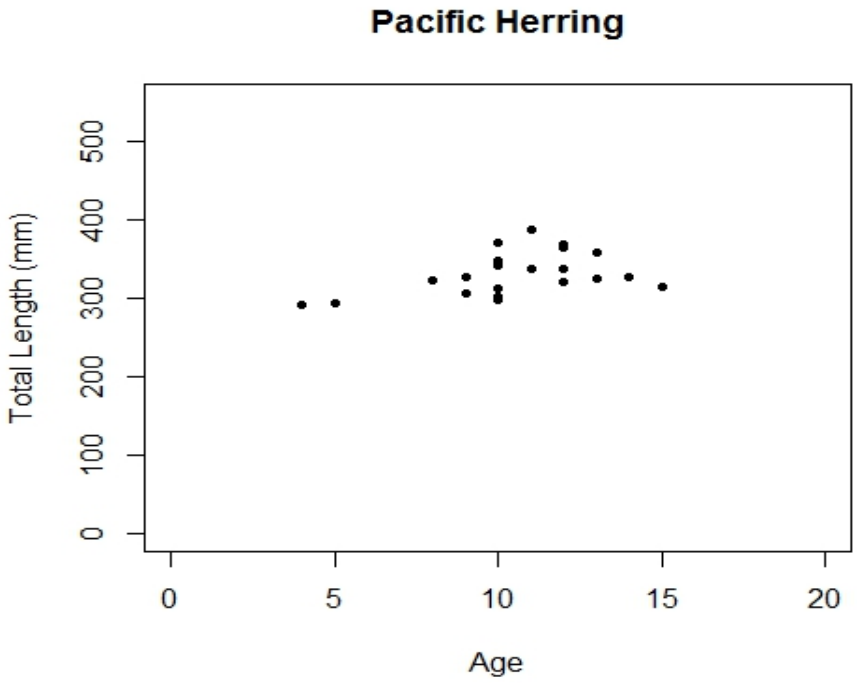

Figure 30. Total length (mm) at age of Pacific Herring collected at Bennett Point (2012, n=15; 2014, n=3; 2015, n=1) and Argo Bay (2016, n=3).

3.2 TEMPERATURE AND SALINITY

Temperature and salinity (ppt) were obtained from loggers (HOBO Conductivity V2 Pro) attached to nets at the time of sampling. The same loggers were also placed nearshore for the duration of the field program at Bennett Point and Brown's Harbour in 2015, and at Argo Bay in 2016 (Figures 31–33). These data provide *in situ* conditions at the time of capture and identify habitat gradients present among three sites located within the ANMPA.

The time of recorded temperature and salinity may vary from the time the net was set (delay in when logger began recording data, versus time of net set); only time series data that clearly represented when the logger was submerged were used. Detailed time series data obtained from loggers attached to a net for all years of sampling are provided in Appendix A.

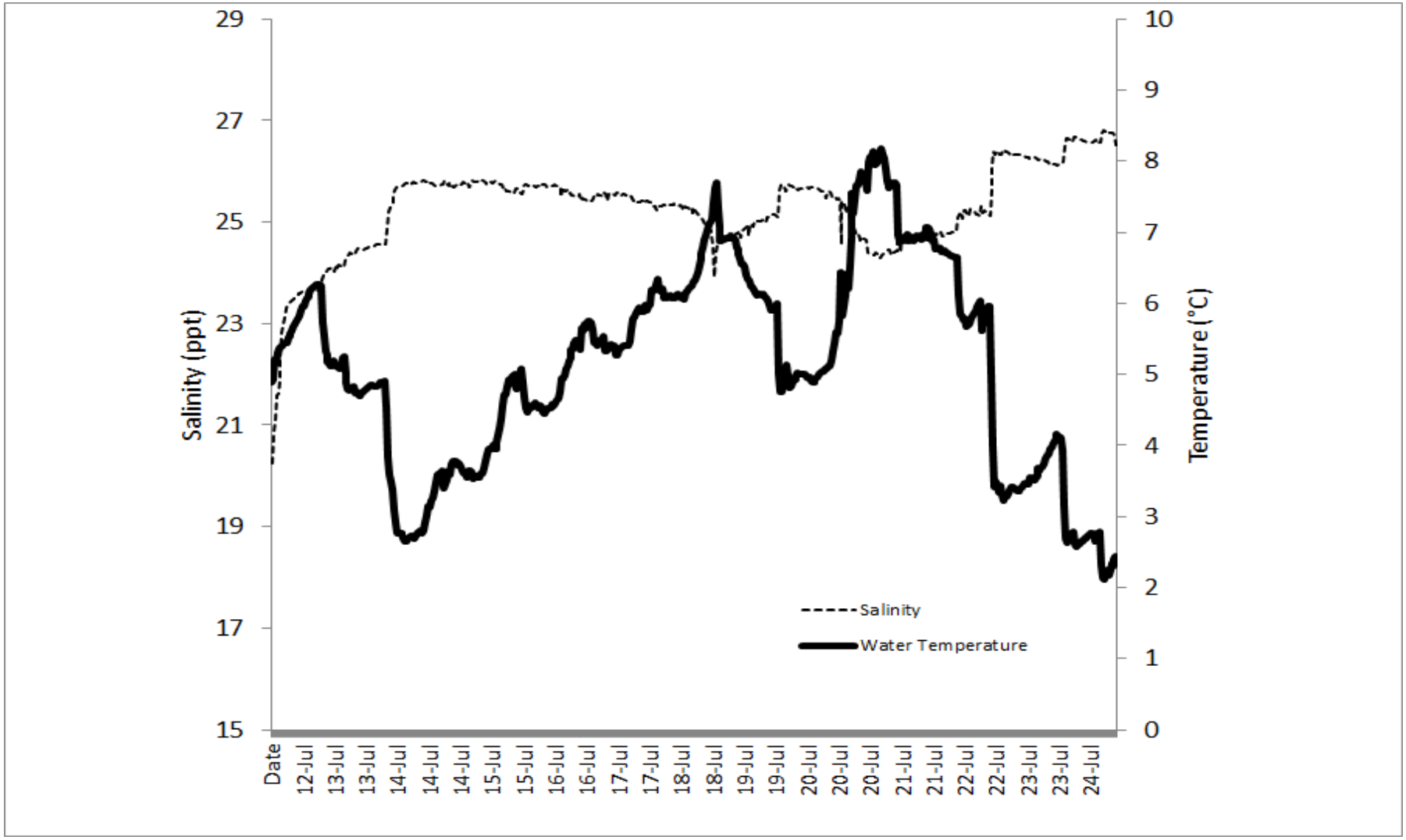

Figure 31. Time series data of water temperature and salinity obtained from Brown's Harbour, July 11 to July 24, 2015. The logger was placed at a depth of 5.0 m for the duration of the series.

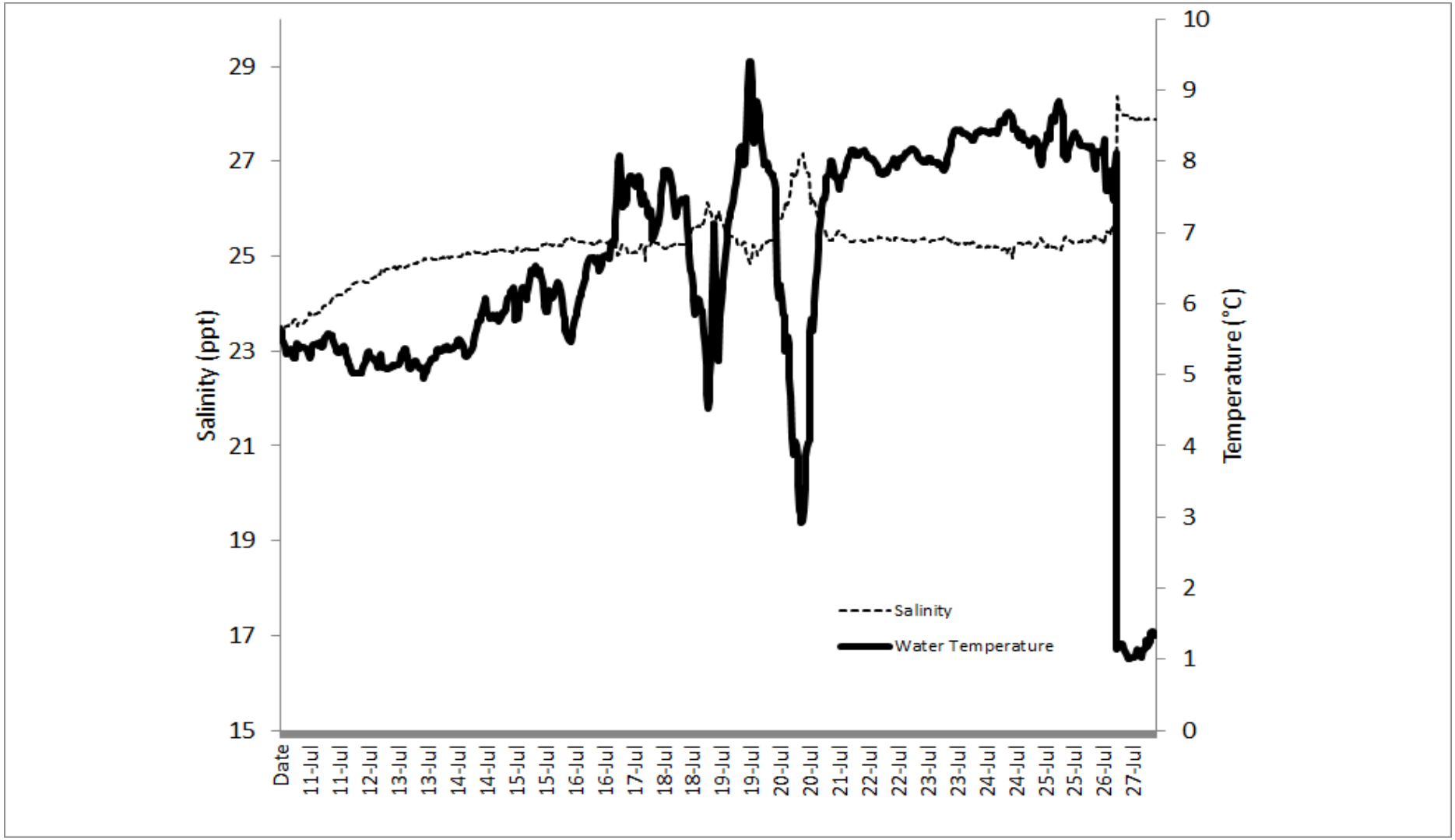

Figure 32. Time series data of water temperature and salinity obtained from Bennett Point, July 11to July 27, 2015. The logger was placed at a depth of 3.7 m for the duration of the series.

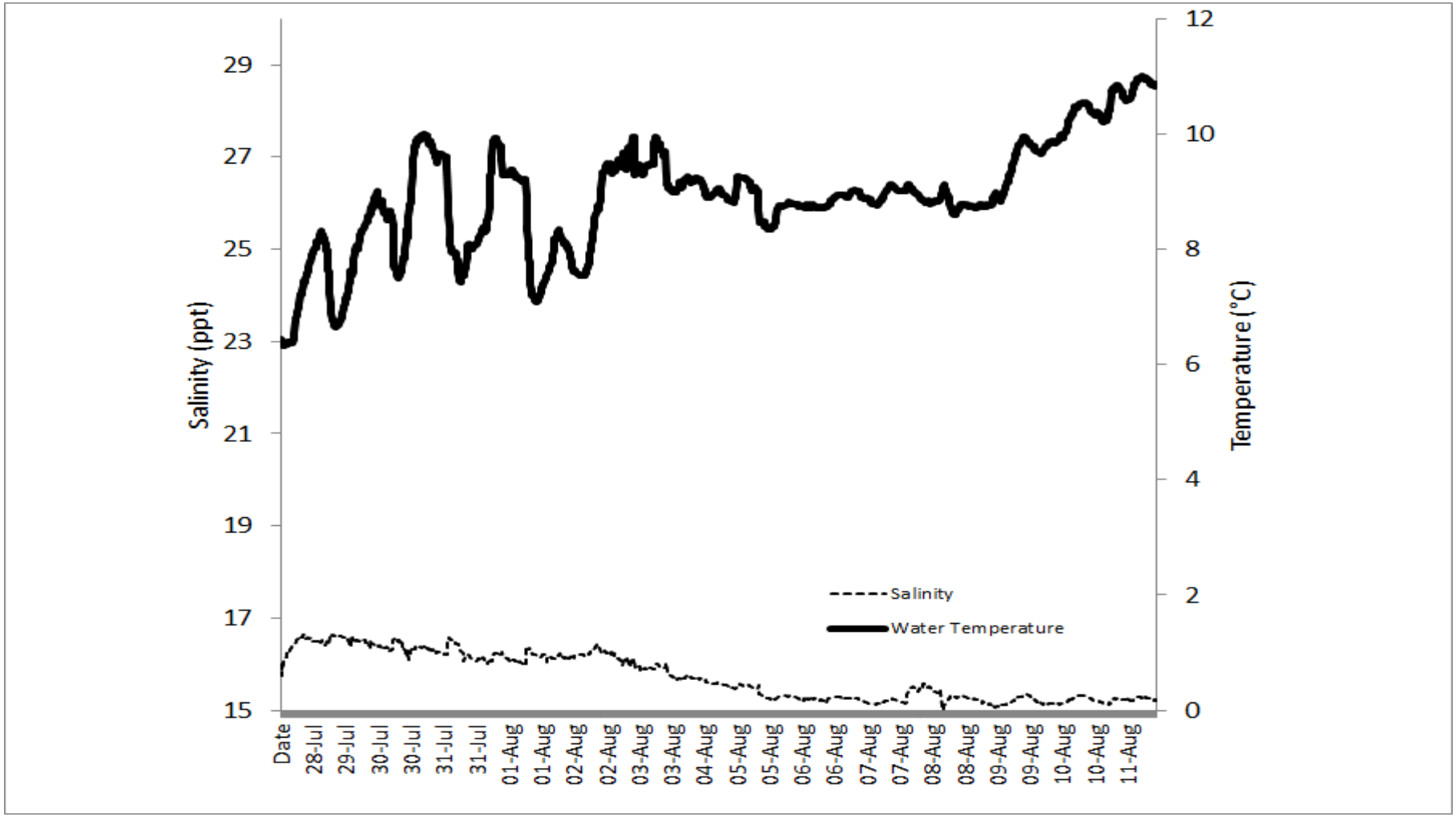

Figure 33. Time series data of water temperature and salinity obtained from Argo Bay, July 28 to August 11, 2016. The logger was placed at a depth of 6.7 m for the duration of this series.

Argo Bay was generally warmer and less saline than were either Bennett Point or Brown's Harbour. Given that the southern end of the bay is shallower and is influenced less by the Amundsen Gulf it is to be expected that the more northern regions of Cape Parry are colder and more saline due to upwelling or wind forcing. Although Bennett Point lies between Brown's Harbour and Argo Bay, in 2015 this site displayed greater variation in water temperature than at Brown's Harbour, potentially due to pulses of cold water. It is uncertain if the variation in temperature and salinity is consistent among sites, or if sites such as Bennett Point are susceptible to abrupt changes in environmental conditions.

4.0 DISCUSSION

4.1 FISHES

Coastal regions of the Canadian Arctic support important linkages between freshwater and marine fishes, yet information on basic life history and biological characteristics in these regions is limited. The Darnley Bay nearshore survey has provided basic life history information on coastal fishes in a marine embayment of the Beaufort Sea. Many previous studies of these species have been conducted in an estuarine environment (e.g., the Mackenzie Delta), but understanding their biology in a marine system will be crucial for the future development of coastal marine protected areas in the Canadian Arctic.

4.1.1 Salmonidae

Arctic Char (*Salvelinus alpinus*)

Arctic Char are a culturally important species for the community of Paulatuk, and an important anadromous predator in the coastal marine system. In the summer, char migrate from the freshwater environment to forage in the marine system (Johnson 1980; Harwood 2009). The stock of char in Darnley Bay is dominated by the Hornaday River population, although mixing does occur with the smaller, Brock River population (Harris et al. 2016). Among the combined years and locations of sampling in Darnley Bay (excluding seine hauls), Arctic Char made up <1% of the total catch among fishes. The survey design aimed to minimize mortalities of Arctic Char given that this species is harvested at the mouth of the Hornaday River, Lessard Creek, and Tipititiukak for subsistence by the community of Paulatuk. Therefore, 71% of the individuals captured were live released.

Age and Length

The greatest number of Arctic Char were collected in 2014 at Bennett Point (n=11) between July 14th and 17th. However, char were observed in lower abundances at all three locations. Mean total length ($\pm$ SD) among individuals captured was 593.9 $\pm$ 90.0 mm, and ranged from ages 5+ to 10+. Previous studies of Arctic Char in the Hornaday River suggest that the majority of fishes harvested range from ages 5+ to 9+ and rarely exceed age 13+ (Harwood 2009). Sample sizes among the sites were too low to observe any significant differences in size and age among regions.

Sex and Maturity

Few Arctic Char were dead sampled in this study (n=5); however among those observed the ratio of males to females was relatively even (1.6:1; Table 17). The fishes observed were primarily mature (80%) with the exception of one immature male. Hornaday River Arctic Char migrate upstream in August to spawn (Harwood 2009), thus it would be unlikely to observe char with spawning or spent characteristics in the marine environment in July. Among the individuals that were sampled, ages ranged from 5+ to 11+.

Habitat Associations

Sample sizes of Arctic Char were too low to determine if any significant variation in habitat use was present among sites. However, with the data available Arctic Char were observed at depths between 0.6 m and 6.7 m. Temperature and salinity data where char were collected is limited among years of sampling, such that only 4 of the 11 nets contained an environmental logger. The mean temperature (± SD) observed at sites where Arctic Char were collected was 7.7 ± 0.1 ºC at Bennett Point (2012 only), 6.9 ± 0.5 ºC at Brown's Harbour (2015 only) and 8.6 ± 0.3 ºC in Argo Bay. Char were collected at mean salinity (±SD) of 19.1 ± 0.1 ppt in Argo Bay and 25.5 ± 0.1 ppt at Brown's Harbour. The maximum and minimum water temperature and salinities at which char were collected in the ANMPA was 5.1–9.1 ºC and 18.9–25.6 ppt, respectively. Given that Arctic Char are an anadromous species, they are expected to have a high tolerance to variation in salinity.

Arctic Cisco (*Coregonus autumnalis*)

Arctic Cisco occupy a wide variety of inshore habitats of the Beaufort Sea (Bond 1982) and appear to tolerate a wider range of salinities than other coregonids (Galbraith and Hunter 1975). However, there have been few studies of this species in the Canadian Beaufort Sea outside the Mackenzie Delta estuary. In Darnley Bay, Arctic Cisco were observed in Argo Bay, Bennett Point and Brown's Harbour during each year of sampling, and made up 1.5% of the total catch of fishes among years. Arctic Ciscos appeared to be most abundant in Argo Bay where 43% of all observed individuals were collected.

Age and Length

The mean total length (±SD) observed for Arctic Cisco among years of sampling was 353.9 ± 82.3 mm where few fishes were <170 mm. Previous studies (Bond 1982) observed Arctic Cisco ranging from age 0+ to 11+. However in the present study the maximum observed age was 19+. The maximum age observed using otoliths from Arctic Cisco is 21+ (Craig and Mann 1974), indicating that Darnley Bay cisco fall within the biological range. The majority of the fishes observed among years of sampling were between age 3+ and age 9+.

Sex and Maturity

All of the ciscoes collected in this study were dead sampled and 97% had their sex and maturity determined. The sex ratio of males to females was slightly higher for males 1.4:1, and there appears to be no significant difference in the sex ratio among sites. Among males, 48% were immature, 38% were mature, while 9.5% were spent (n=2 collected in August 2016). Females were primarily mature 73%, with the exception of a few immature individuals. Although spawning in the Mackenzie Delta occurs in late September, Arctic Cisco begin their migration

into rivers as early as late July (Percy 1975). It is unknown if Arctic Cisco in Darnley Bay display different spawning characteristics than those in the Mackenzie Delta.

Habitat Associations

Arctic Cisco were found at all three sampling locations and were collected during every year of sampling. This is a known euryhaline species, and it can therefore be expected that it would occur in a range of coastal habitats within the ANMPA. Among years of sampling, Arctic Cisco were observed at depths between 0.6 m and 6.8 m. Temperature data were not collected for this species at Bennett Point; however at the sites where data are available mean temperature (± SD) was 6.4 ± 0.9 °C at Brown's Harbour and 10.1 ± 0.6 °C in Argo Bay. Cisco were collected at mean salinity (± SD) of 25.6 ± 0.4 ppt at Brown's Harbour; no salinity data are available for Argo Bay or Bennett Point where cisco were collected. Among all sampling sites, Arctic Cisco were collected at water temperatures between 3.2–7.7 °C and salinities between 23.9–26.4 ppt.

Broad Whitefish (*Coregonus nasus*)

Broad Whitefish are an ecologically and commercially important species throughout the Mackenzie Delta and Beaufort Sea coast (Reist and Bond 1988). The ecology and characteristics of these species have been extensively studied in estuarine environments (i.e., the Mackenzie Delta), however there is little knowledge of life history and habitat use of this anadromous species in the marine environment. In Darnley Bay Broad Whitefish made up 21.2% of the total catch of fish among surveys, which was primarily composed of juvenile individuals collected in Argo Bay (n=498).

Age and Length

The vast majority of the observed Broad Whitefish in Argo Bay were young-of-year (age 0+) with a mean total length (±SD) of 56.1 ± 10.0 mm, while adult individuals were 464.2 ± 93.8 mm among years. The age and rates of growth differ among Mackenzie Delta populations and those of the Coppermine River, such that Coppermine individuals display greater longevity (Muth 1969). Fishes collected in the Mackenzie River rarely exceed age 11+ (Muth 1969), while individuals in other regions have been observed up to age 18+ (Muth 1969; Bond and Erickson 1987). In Darnley Bay ages ranged from 0+ to 19+.

Sex and Maturity

Among adult individuals, the ratio of males to females was 2.6:1. Among mature females in Argo Bay, current-year spawners (n=2) and spent individuals (n=2) were observed. Males were 92% immature, and only one current-year spawner and one spent individual were observed.

Habitat Associations

Broad Whitefish are an anadromous species found in freshwater and estuarine environments. In Darnley Bay this species was only found in Argo Bay and Bennett Point at depths up to 6.7 m, but was primarily seen at depths <3.0 m. The surrounding mean water temperature (± SD) at sampling locations was 9.7 ± 1.1 °C and mean salinity was 19.0 ± 0.2 ppt in Argo Bay. There was no water temperature or conductivity recorded in associated nets at Bennett Point. The minimum and maximum observed water temperature observed for this species was between 7.0–12.8 °C and salinities were 18.5–19.7 ppt.

4.1.2 Osmeridae

Capelin (*Mallotus villosus*)
Capelin are a circumpolar forage fish species, found throughout the North Atlantic and to a lesser extent in the Canadian Arctic. In the Beaufort Sea, occurrences of Capelin have been rare and infrequent with the exception of Darnley Bay where aggregations were observed offshore (McNicholl et al. 2016). Local observations suggest that they also form large spawning aggregations on-shore. Among years of sampling Capelin made up 11.4% of fishes collected, most of which were collected at Bennett Point between July 14–17th, 2014 in a trap net (n=261). Capelin were observed at Brown's Harbour, Bennett Point and Argo Bay during each year of sampling.

Age and Length
Capelin are one of the shortest-lived species observed in Darnley Bay, reaching reproductive maturity at age 2+ and rarely exceeding age 5+ using whole otoliths and aging protocol developed by Hedeholm et al. (2010). Mean total length observed among years was 137.5 $\pm$ 11.5 mm in which males were larger on average than females. Previous studies suggest that capelin rarely exceed age 6+ (Carscadden et al. 2013) and in Darnley Bay the maximum observed age was 5+, where individuals were primarily between ages 3+ and 4+.

Sex and Maturity
All Capelin observed during the Darnley Bay nearshore survey were mature, current-year spawners, 64.4% of which were female. These individuals, particularly at Bennett Point were spawning, evidenced by eggs adhered to nets and sediments and spent males (n=6).

Habitat Associations
Capelin in Darnley Bay were primarily collected in trap nets set at <1.5 m depth, but were also observed at depths up to 6.7 m. Mean temperature of the surrounding water where Capelin were collected at Bennett Point was 7.8 $\pm$ 0.8 °C and 10.4 $\pm$ 1.0 °C in Argo Bay. Minimum and maximum salinity ranged from 17.8 ppt to 26.3 ppt at Argo Bay and Bennett Point, respectively. There was no temperature or salinity data recorded at Brown's Harbour.

4.1.3 Cottidae

Arctic Staghorn Sculpin (*Gymnocanthus tricuspis*)
Arctic Staghorn Sculpin is an abundant and widespread species found throughout the Arctic. They have been observed throughout the nearshore environment (Frugé et al. 1989) but in higher abundance offshore (Galbraith and Hunter 1975; Majewski et al. 2017) of the western Canadian Arctic. In Darnley Bay, Arctic Staghorn Sculpin were observed in 2012 and 2014–2016 at all three sampling locations. This species made up 2.5% of the total catch among years of sampling and was most abundant in 2012 at Bennett Point (n=20) and in 2016 in Argo Bay (n=38).

Age and Length
The mean total length ($\pm$SD) of Arctic Staghorn Sculpin compiled from all years was 163.1 $\pm$ 61.5 mm. The largest observed total length recorded during these years was 340 mm and the minimum was 70 mm. Among the individuals aged, Arctic Staghorn Sculpin in Darnley Bay

ranged from age 2+ to 10+. Knowledge is limited regarding the age-length distribution of this species, and less so in the western Canadian Arctic.

Sex and Maturity
The male to female sex ratio of dead sampled individuals was relatively even (1.2:1) among years. Among males, 53% were current-year spawners, many of which displayed colourful breeding spots. Among females, 70% were sexually mature.

Habitat Associations
This cottid species has a circumpolar distribution, is capable of tolerating fluctuations in temperature and salinity and can be found at depths from 0–240 m (Andriyashev 1954; Fechhelm et al. 1984). In the in-shore habitat of Darnley Bay, this species was collected from shore-based sets <1.0 m up to 26.2 m depths at offshore sites. Arctic Staghorn Sculpin were found at a mean temperature (±SD) of 9.0 ± 1.0 °C in Argo Bay, 7.5 ± 2.0 °C at Bennett Point, and -1.4 ± 0.1 °C at Brown's Harbour (only obtained for one net set). The mean salinity at which this species was collected varied from 18.7 ± 0.3 ppt at Argo Bay, 25.1 ± 0.1 ppt at Bennett Point to 29.3 ± 0.1 ppt at Brown's Harbour.

Fourhorn Sculpin (*Myoxocephalus quadricornis*)
Fourhorn sculpin are a widely distributed cottid species, found throughout the Beaufort Sea coastal region (Kendel et al. 1975; Bond and Erickson 1987). In Darnley Bay, Fourhorn Sculpin were observed during each year of sampling and at all sampling sites. They made up 3.5% of the total catch of fishes, and were most abundant at Brown's Harbour (n=47) and in Argo Bay (n=32).

Age and Length
The mean total length (±SD) observed among Fourhorn Sculpins was 219.0 ± 70.0 mm, with a maximum of 349 mm. In the Beaufort Sea, Fourhorn Sculpins can reach lengths up to 456 mm (Bond and Erickson 1992). This species has been observed at a maximum age of 14+ (Hugg 1996), while in this study, individuals ranged from age 2+ to 12+.

Sex and Maturity
Among adult individuals, there was a relatively even number of males (49%) to females (51%). Among males, 50% were immature, while the remaining individuals were either mature (32%) or spent (18%). Females were primarily mature (69%), while the remainder were immature (31%).

Habitat Associations
Fourhorn Sculpin were collected during each year of sampling and were found in Argo Bay, at Bennett Point and Brown's Harbour and were observed at depths between 0.6 m and 9.6 m. The mean water temperature (± SD) of the three sites where Fourhorn Sculpin were collected was 8.6 ± 1.4 °C, 7.8 ± 1.2 °C and 7.1 ± 1.0 °C at Argo Bay, Bennett Point and Brown's Harbour, respectively. Fourhorn Sculpin are known to tolerate a wide range of salinities (3–35 ppt), and even inhabit freshwater (Dickman 1995). The mean salinities where Fourhorn Sculpin were captured were 18.4 ± 1.4 ppt in Argo Bay, 25.2 ± 0.7 ppt at Bennett Point and 25.5 ± 0.6 ppt at Brown's Harbour. Among all locations the minimum and maximum observed water temperature

and salinity where Fourhorn Sculpin were collected was 2.1–10.4 °C and 15.0–26.8 ppt, respectively.

Shorthorn Sculpin (*Myoxocephalus scorpius*)

Shorthorn Sculpin is a benthic species, commonly found throughout coastal waters of the Beaufort Sea. In Darnley Bay Shorthorn Sculpin were observed in Argo Bay, Bennett Point and were most abundant at Brown's Harbour. Among all fishes collected over the years of sampling, Shorthorn Sculpin made up 8% of the total catch.

Age and Length

Mean total length (±SD) of Shorthorn Sculpin in Darnley Bay was 217.7 ± 64.8 mm and the maximum length was 430 mm. There is limited knowledge of the age distribution of this species in the Canadian Arctic. In Darnley Bay, the individuals aged were between 2+ to 12+, however most of the individuals were between age 3+ and 6+.

Sex and Maturity

There were relatively even numbers of male (45%) and female (55%) Shorthorn Sculpins observed in Darnley Bay. Among males 38% were immature, 60% were mature and 2% were spent, while 41% of females were immature and 59% were mature. In some cases mature individuals were observed with breeding spots or colouration, and were likely current year spawners.

Habitat Associations

Shorthorn Sculpin are benthic cottids, associated with rocky bottoms and seaweed beds. In Darnley Bay Shorthorn Sculpin were most abundant at Brown's Harbour which was primarily bedrock with extensive kelp coverage, as well as Argo Bay which was predominantly sand and/or silt. This species was collected at a wide depth range, from shore-based sets up to 36.0 m. In Argo Bay Shorthorn Sculpins were collected at a mean water temperature (±SD) of 8.9 ± 1.3 ºC, 5.5 ± 3.8 ºC at Bennett Point and 5.7 ± 3.2 ºC at Brown's Harbour. Mean salinity (±SD) was 18.9 ± 0.3 ppt in Argo Bay, 27.3 ± 1.8 ppt at Bennett Point and 25.7 ± 1.2 ppt at Brown's Harbour where Shorthorn Sculpin were collected. Among all sampling sites, Shorthorn Sculpin were observed in water temperature between 1.2 ºC and 14.8 ºC and salinities between 18.6 ppt and 29.2 ppt.

Ribbed Sculpin (*Triglops pingelii)*

Knowledge of basic biology and habitat associations of Ribbed Sculpin in the Canadian Beaufort Sea is limited. They have been observed on the Beaufort Sea shelf, but in relatively low abundance (Rand and Logerwell 2011; Majewski et al. 2017). Ribbed Sculpin were observed at Brown's Harbour, Bennett Point and in Argo Bay, however they made up only 0.2% of the total catch (n=4).

Age and Length

Ribbed Sculpin rarely exceed 200 mm total length (Pietsch 1993) and did not exceed 140 mm total length in Darnley Bay. Mean total length (±SD) observed among individuals was 118.8 ± 15.6 mm. Few studies have examined the age of this species, however in this study Ribbed Sculpin were between ages 2+ and 4+.

Sex and Maturity
There was an even number of male to female Ribbed Sculpin collected among field programs (1:1). Among those individuals both females were mature, while one male was mature and the other immature.

Habitat Characteristics
Generally, this species was observed in deep-water sets, and was collected between 8.2 m and 26.2 m depths. Temperature was only recorded for one site in Argo Bay, at which a Ribbed Sculpin was collected. The mean surrounding water temperature (±SD) was 9.8 ± 0.6 °C during the sampling effort. There was no salinity data recorded at sites where Ribbed Sculpin were collected.

4.1.4 Gadidae

Greenland Cod (*Gadus ogac*)
Greenland Cod are ubiquitous throughout the Canadian Arctic, however in the Beaufort Sea capture records generally appear to be limited to east of the Mackenzie River (Hunter et al. 1984). Despite their relatively high abundance throughout the Arctic, knowledge of their life history characteristics in the Beaufort Sea is limited. Among all fishes collected, Greenland Cod made up 3.1% of the total fish catch and, although Greenland Cod were collected at all three sampling sites, they were most abundant at Brown's Harbour (n=37).

Age and Length
The mean total length (±SD) for Greenland Cod collected in Darnley Bay was 245.1 ± 86.5 mm, in which the largest individual was 500 mm. This species is known to grow as large as 770 mm (Nielsen 1992). Greenland Cod have been observed as old as 12+ in Hudson Bay (Mikhail and Welch 1989), while in this study individuals ranged from age 1+ to 7+.

Sex and Maturity
There were relatively even numbers of male and female Greenland Cod observed in this study (54% and 46%, respectively). Among males, 90% were immature while 62% of females were immature. The remaining individuals were mature but not current-year spawners.

Habitat Associations
Greenland Cod are generally considered to be a demersal, marine species (Bond and Erickson 1987) and have primarily been observed on the coasts of the Beaufort Sea. In Darnley Bay Greenland Cod were collected at depths <1.0 m and up to 12.2 m. In Argo Bay they were observed at mean water temperatures (± SD) of 9.5 ± 1.4 °C, 6.5 ± 2.7 °C at Bennett Point and 5.7 ± 3.3 °C at Brown's Harbour. Mean salinity (± SD) at the sites Greenland Cod were collected was 27.9 ± 0.1 ppt at Bennett Point and 25.6 ± 1.0 ppt at Brown's Harbour, while there was no salinity data collected where Greenland Cod occurred in Argo Bay. Among all sampling sites in Darnley Bay, Greenland Cod were observed between 1.0 °C and 14.8 °C water temperature and salinities between 24.2 ppt and 28.4 ppt.

Saffron Cod (*Eleginus gracilis*)
Saffron Cod are widely distributed throughout the coastal Beaufort Sea and the North Pacific. In Darnley Bay this species was very abundant at Bennett Point and Argo Bay, but only one individual was observed at Brown's Harbour. Additionally, among years of sampling, Saffron Cod were the most abundant species observed at Bennett Point in 2012, but few were observed in 2014 and 2015. Overall, Saffron Cod made up 27% of the total catch of fishes among years of sampling.

Age and Length
The lengths of Saffron Cod collected on the Beaufort Sea coast have been known to produce bimodal distributions due to the presence of distinct age classes (Bond and Erickson 1987; Johnson 1995). Although no distinct bimodal distributions were present among Darnley Bay Saffron Cod, a wide range of sizes were observed in Argo Bay (58 mm to 435 mm total length). Mean total length (±SD) of all Saffron Cod collected among years was 328.1 ± 76.5 mm. Observed fishes ranged from age 1+ to age 11+ in Darnley Bay, while the maximum age of this species is 15+ (Fadeev 2005).

Sex and Maturity
Among the Saffron Cod collected during this survey, 54% were female and 46% were male; both sexes were primarily immature (82% and 93%, respectively).

Habitat Associations
Saffron Cod in Darnley Bay were generally collected in shallow water, between 1.5 m and 9.2 m depths. In Argo Bay they were collected at a mean water temperature (±SD) of 9.0 ± 1.5 °C, and 8.0 ± 0.6 °C at Bennett Point. The largest collection of Saffron Cod occurred at Bennett Point using a shore-based trap net (n=231 in one haul), set in a sheltered embayment with a predominately sandy substratum. Mean salinity (±SD) where Saffron Cod were collected was 18.9 ± 0.3 ppt in Argo Bay, while no salinity data is available for Bennett Point and Brown's Harbour during sampling efforts.

4.1.5 Pleuronectidae

Arctic Flounder (*Liopsetta glacialis*)
Arctic Flounder are a common species found throughout the coastal Beaufort Sea in estuarine environments (Bond 1982). They overwinter offshore and return to inshore, coastal regions following the breakup of sea ice in the spring and are abundant in close proximity to rivers (Bond and Erickson 1992). In Darnley Bay, Arctic Flounder were observed at Argo Bay and Bennett Point but were not observed at Brown's Harbour. Arctic Flounder made up 12% of the total catch among years of sampling, primarily in Argo Bay where n=295 individuals were caught.

Age and Length
Among years of sampling the mean total length (± SD) for Arctic Flounder was 233.5 ± 56.1 mm. The maximum observed length was 354 mm, and the smallest observed individuals were young-of-year collected in seine nets in 2016 with a minimum length of 18 mm. There is limited

knowledge of age-length relationships of Arctic Flounder, despite their high abundance in coastal regions. In this study the fishes that were aged (n=9) ranged from age 1+ to age 31+.

Sex and Maturity
The majority of dissected Arctic Flounder were female, a ratio of 1:13.3, while 4 individuals were young-of-year and could not be identified. Among females, 86% were immature and all dissected males were immature.

Habitat Associations
The Arctic Flounder is strictly associated with the coastal habitat, occasionally enters river systems (Bond 1982), and is a benthic, shallow-water species. In Darnley Bay Arctic Flounder have been observed at depths between 0.8 m and 9.6 m. At Bennett Point the mean water temperature (±SD) where Arctic Flounder were collected was 7.6 ± 1.3 °C while at Argo Bay mean temperature was 8.9 ± 1.3 °C. The surrounding salinities during these sampling periods were 25.2 ± 0.7 ppt at Bennett Point and 18.7 ± 1.0 ppt at Argo Bay. Among all locations that Arctic Flounder were collected, water temperatures ranged between 2.6 °C and 14.8 °C and salinities between 18.1 ppt and 26.1 ppt. It is possible that no Arctic Flounder were observed at Brown's Harbour because the benthos was primarily bedrock, while the bottom substrate of Argo Bay was primarily sand and/or silt.

Starry Flounder (*Platichthys stellatus*)
Starry Flounder are a coastal species, ubiquitous throughout Pacific and Arctic oceans and common throughout the coastal Beaufort Sea (Bond 1982; Bond and Erickson 1992). In Darnley Bay, Starry Flounder were only collected in Argo Bay where they were most abundant and at Bennett Point, and were not observed at Brown's Harbour. Overall, Starry Flounder made up 8% of the total catch of Darnley Bay fishes.

Age and Length
Starry Flounder collected among surveys averaged 268.0 ± 67.0 mm total length (±SD) and the largest individual was 415 mm. Starry Flounder rarely exceed 500 mm (Hugg 1996), but have been recorded to be as large as 910 mm total length (Eschmeyer et al. 1983). Starry Flounder rarely exceed age 24+ among North Pacific individuals (Campana 1984; Armstrong 1996); however the oldest recorded individual in Darnley Bay was 38+, while the youngest was age 5+. Few studies have examined the age of Arctic Starry Flounders relative to those in boreal waters, where life history strategies may differ.

Sex and Maturity
Among adult fishes, 51% were male and 49% were female. Among immature individuals, females represented 56% and immature males represented 45% of the catch.

Habitat Associations.
Starry Flounder were absent from Brown's Harbour, a site dominated by kelp and bedrock. However this species, as well as Arctic Flounder, were abundant in Argo Bay which was dominated by sand and silt. Starry Flounder were collected in shore-based nets <1 m depth, up to deep-water sets at 8.9 m depths. At Bennett Point, Starry Flounder were captured at a mean water temperature (±SD) of 7.8 ± 0.9 °C and at 9.1 ± 1.1 °C in Argo Bay. Mean salinities at

these locations were 18.8 ± 0.3 ppt in Argo Bay and 25.2 ± 0.7 ppt at Bennett Point. Among all sampling sites in Darnley Bay, Starry Flounder were observed at water temperatures between 6.6 °C and 10.2 °C, and salinities between 18.1 ppt and 26.0 ppt.

4.1.6 Clupeidae

Pacific Herring (***Clupea pallasii***)
Pacific Herring are found widely throughout the coastal Beaufort Sea during the summer, and are found in embayments when they overwinter (Liverpool Bay; Bond and Erickson 1992). In Darnley Bay, Pacific Herring were only captured in Argo Bay and at Bennett Point. Overall abundance was low, such that Pacific Herring made up 0.9% of the total catch of fishes among surveys.

Age and Length
Among the individuals observed, mean total length (±SD) was 330.6 ± 26.0 mm, and the largest individual was 387 mm. Pacific Herring have been known to be as large as 460 mm (Lamb and Edgell 1986), but are generally less than 300 mm fork length (Bond and Erickson 1992). Ages of individuals collected in Darnley Bay ranged from 4+ to 15+, but this species has been observed to be as old as age 19+ (Morrow 1980).

Sex and Maturity
There was an even sex ratio of males to females (1.1:1) among Pacific Herring collected in Darnley Bay. Individuals observed in Tuktoyaktuk Harbour were considered to be part of a spawning population at lengths greater than 250 mm fork length (Bond 1982). 83% of males and 91% of females were mature.

Habitat Associations
Pacific Herring are a pelagic species, found in coastal bays of the Beaufort Sea where they forage, spawn and overwinter (Bond and Erickson 1992). In Darnley Bay Pacific Herring were observed to depths up to 9.2 m using shore-based nets. In nets set in Argo Bay, mean temperature (± SD) where Pacific Herring occurred was 9.9 ± 0.5 °C and 6.4 ± 3.2 °C at Bennett Point. Mean salinities at these locations were 18.6 ± 0.1 ppt in Argo Bay and 27.9 ± 0.1 ppt at Bennett Point. The maximum and minimum water temperature and salinity where Pacific Herring were collected among all sites in Darnley Bay were 1.0 °C and 10.4 °C, and 18.5 ppt and 28.4 ppt, respectively.

4.1.7 Stichaeidae

Arctic Shanny (*Stichaeus punctatus*)
The Arctic Shanny is a circumpolar demersal, marine species and is found in some regions of the North Pacific (Farwell et al. 1976). There have been few observations of this species in the Beaufort Sea, and it has rarely been observed in Darnley Bay. Among years of sampling, this species was only observed twice – one individual at Bennett Point in 2014 and one in Argo Bay in 2016. These individuals were frozen whole as voucher specimens, and thus were not dissected for age, sex or maturity.

Age and Length
Length data is only available for the individual collected in 2016, which was 77 mm. This species is known to reach a total length of up to 150 mm and rarely exceeds age 16+ (Keats et al. 1993).

Habitat Associations
At Bennett Point, although this species was collected with a gill net set at a maximum depth of 5.8 m, it was caught amongst the mass of macroalgae hauled in with the net. It is possible that this species utilizes the kelp and algal habitat within the marine protected area and is rarely observed. In Argo Bay, this species was collected in a shore-based trap net, at a site dominated by sandy substrates. At this site, the mean temperature (± SD) was 9.4 ± 0.6 °C and mean salinity was 18.0 ± 0.1 ppt.

Ninespine Stickleback (*Pungitius pungitius*)
Ninespine Stickleback are generally associated with freshwater, but may also display anadromous characteristics (Riede 2004). In Darnley Bay 98% of the individuals collected were in Argo Bay. They were collected using a seine net at locations with linkages to freshwater systems. Overall, Ninespine Stickleback made up 1.8% of the total catch of fishes during this study. These individuals were not dissected for sex, age or maturity but were measured and frozen whole.

Age and Length
The mean total length (±SD) for Ninespine Stickleback collected in Darnley Bay was 40.6 ± 13.3 mm. This species generally does not exceed age 5+ (Morrow 1980).

Habitat Associations
The Ninespine Stickleback in Argo Bay were collected in shallow embayments connected to freshwater sources. The mean water temperature (± SD) at one of the locations where these individuals were collected was 11.2 ± 1.2 °C and mean salinity was 19.1 ± 0.1 ppt (collected at <1.0 m depths).

4.1.8 Other Fishes
Some species collected during the nearshore survey were observed in low abundance (i.e., n=1) and were preserved as voucher specimens. These species are of interest for species diversity within the marine protected area, and as indicators for environmental gradients and community composition shifts within the ANMPA.

Slender Eelblenny (*Lumpenus fabricii*)
There was one Slender Eelblenny collected in Argo Bay in August of 2016. This is the first record of this species inside the bay, however this species is also present in the Amundsen Gulf but rarely observed. This individual was 224 mm total length and was preserved as a voucher specimen, therefore its age, sex and maturity are unknown. It was collected at a depth of 8.4 m, with mean surrounding water temperature of 7.2 ± 0.3 °C and salinity of 18.7 ± 0.3 ppt for the duration of the set.

Atlantic Spiny Lumpsucker (*Eumicrotremus spinosus*)
An individual Atlantic Spiny Lumpsucker was collected in a deep-water set at 26.2 m depth at Brown's Harbour, however no temperature or salinity data were recorded. There are few observations of this species nearshore, and they are generally associated with the Beaufort Sea Shelf and slope. This individual was 102 mm total length, and preserved as a voucher specimen.

Twohorn Sculpin (*Icelus bicornis*)
One individual was collected at Brown's Harbour in a shore-based trap net in July of 2015. It was 64 mm total length and was the only recorded individual among the years of sampling. No temperature or salinity data were recorded at the time of capture.

5.0 CONCLUSION

The newly established ANMPA supports a diverse community of coastal fishes and displays an environmental gradient between offshore and estuarine waters. However, significant knowledge gaps still exist concerning the interactions among sympatric fishes, their life history characteristics and habitat associations throughout the year. Both marine and anadromous fishes were observed in the nearshore environment, representing both offshore and freshwater linkages to this coastal region. Understanding the abundance and diversity of species present during the summer is important for establishing baselines of distribution and foraging behavior, and these aspects are likely to be influenced in the future as conditions in the Arctic continue to change with climate.

These field programs have identified variation in habitats utilized by fishes from the northern-most end of Cape Parry (Brown's Harbour) relative to the southern end of the bay (Argo Bay). Fish diversity, and life history also vary at the regional level within the MPA, evidenced by differences in species abundances and life history stages among sites. These data suggest that Argo Bay supports juvenile fishes, namely Broad Whitefish, and may also serve as spawning and rearing habitat for other species. There were inadequate sample sizes of species collected among years and locations to test for significant differences in total length and age by location. Future research aimed at investigating age classes of select species within Darnley Bay, and linkages with connected water masses may provide insight if multiple populations of fish co-occur in the marine environment of the MPA. This information can be used in the development of future monitoring in the ANMPA and characterization of specific indicators within the ecosystem. Additionally, there is limited knowledge of the importance of coastal embayments for ecosystem function in the Canadian Arctic and if the characteristics of fishes present in Darnley Bay differ from individuals of the same species found in other estuarine environments (i.e., the Mackenzie Delta).

6.0 ACKNOWLEDGEMENTS

This project was supported by Government of Canada funding (BREA, ESRF, IGS, PERD, NCP), NSERC (G. Davoren Discovery Grant) and the University of Manitoba Faculty of Graduate Studies (D. McNicholl). This project recognizes the support from the Fisheries Joint Management Committee, and Polar Continental Shelf Program for their funding and logistical support among years of sampling.

The field program would not have been possible without the support and logistical advice from the Paulatuk Hunters and Trappers Committee, and the community members of Paulatuk. Successful collection of fishes and data would not have been possible without field personnel throughout years of sampling (M. Lowdon, D. Boguski, C. Giraldo-Lopez, A. Majewski, J. Myshrall) and community-based technicians (M. Wolki, S. Illasiak and B. Green).

7.0 REFERENCES

Andriyashev, A. P. 1954. Fishes of the Northern Seas of the USSR. [Ryby severnykh morei SSSR. Akademii Nauk SSSR, Opredeliteli po Faune SSSR 53, Izdatel'stvo Akademii nauk SSSR, Moskva-Leningrad, 566 p., translated from Russian by Israel Program for Scientific Translations, Jerusalem. 617 p.

Armstrong, R.H. 1996. Alaska's fish: a guide to selected species. Alaska Northwest Books, Seattle. 96 p.

Bond, W.A. 1982. A study of the fish resources of Tuktoyaktuk Harbour, southern Beaufort Sea coast, with special reference to life histories of anadromous coregonids. Can. Tech. Rep. Fish. Aquat. Sci. 1119: 90 p.

Bond, W.A., and Erickson, R.N. 1987. Fishery data from Phillips Bay, Yukon, 1985. Can. Data Rep. Fish. Aquat. Sci. 635: 39 p.

Bond, W.A., and Erickson, R.N. 1992. Fishery data from the Anderson River estuary, Northwest Territories, 1990. Can. Manuscr. Rep. Fish. Aquat. Sci. 2171: 46 p.

Carscadden, J.E., Gjøsæter, H., and Vilhjálmsson, H. 2013. Recruitment in the Barents Sea, Icelandic, and eastern Newfoundland/Labrador capelin (*Mallotus villosus*) stocks. Prog. Oceanogr. 114:84–96. doi: 10.1016/j.pocean.2013.05.006.

Campana, S.E. 1984. Microstructural growth patterns in the otoliths of larval and juvenile starry flounder, *Platichthys stellatus*. Can. J. Zoo. 62: 1507–1512.

Craig, P.C., and Mann, G.J. 1974. Life history and distribution of the arctic cisco (*Coregonus autumnalis*) along the Beaufort Sea coastline in Alaska and the Yukon Territory. Arctic Gas Biol. Rep. Ser. 20(4): 33 p.

Dickman, M. 1995. An isolated population of fourhorn sculpins (*Myoxocephalus quadricornis*, family Cottidae) in a hypersaline high arctic Canadian lake. Hydrobiologia 312: 27–35.

Eschmeyer, W.N., Herald, E.S., and Hammann, H. 1983. A field guide to Pacific coast fishes of North America. Houghton Mifflin Company, Boston. 336 p.

Fadeev, N.S. 2005. Guide to biology and fisheries of fishes of the North Pacific Ocean. Vladivostok, TINRO-Center. 366 p.

Farwell, M.K., Green, J.M., and Pepper, V.A. 1976. Distribution and known life history of *Stichaeus punctatus* in the Northwest Atlantic. Copeia 3: 598–602.

Fechhelm, R.G., Craig, P.C., Baker, J. S., and Gallaway, B.J. 1984. Fish distribution and use of nearshore waters in the northeastern Chukchi Sea. Environmental Assessment of the Alaskan Continental Shelf. US Department of Commerce, NOAA, OCSEAP Final Report 32: 121–297.

Frugé, D.J., Wiswar, D.W., Dugan, L.J., and Palmer, D.E. 1989. Fish population characteristics of Arctic National Wildlife Refuge coastal water, summer 1988. U.S. Fish and Wildlife Service. Alaska Fisheries Progress Report, Fairbanks, Alaska.

Galbraith, D.F., and Hunter, J.G. 1975. Fishes of offshore waters and Tuktoyaktuk vicinity. Beaufort Sea Project, Tech. Rep. 7: 47 p.

Harris, L.N., Boguski, D.A., Gallagher,C.P., and Howland, K.L. 2016. Genetic stock identification and relative contribution of Arctic Char (*Salvelinus alpinus*) from the Hornaday and Brock rivers to subsistence fisheries in Darnley bay, Northwest Territories. Arctic 69: 231–245. doi: 10.14430/arctic4578.

Harwood, L.A. 2009. Status of anadromous Arctic charr (*Salvelinus alpinus*) of the Hornaday River, Northwest Territories, as assessed through harvest based sampling of the subsistence fishery, August–September 1990–2007. Can. Manuscr. Rep. Fish. Aquat. Sci. 2890: 33 p.

Hedeholm, R., Grønkjær, P., and Rysgaard, S. 2010. Variation in size and growth of West Greenland capelin (*Mallotus villosus*) along latitudinal gradients. ICES J. Mar. Sci. 67: 1128–1137.

Hugg, D.O. 1996. MAPFISH georeferenced mapping database. Freshwater and estuarine fishes of North America. Life Science Software. Dennis O. and Steven Hugg, 1278 Turkey Point Road, Edgewater, Maryland.

Hunter, J.G., Leach, S.T., McAllister, D.E., and Steigerwald, M.B. 1984. A distributional atlas of the records of marine fishes of Arctic Canada in the National Museums of Canada and Arctic Biological Station. Syllogeus 52:1–35.

Johnson, L. 1980. The Arctic charr, *Salvelinus alpinus*. *In* Salmonid fishes of the genus *Salvelinus*. *Edited by* E.K. Balon. Dr. W. Junk Publishers, The Hague. pp. 15–98.

Johnson, J. 1995. Description and comparison of two populations of saffron cod (*Eleginus gracilis*) from western Canadian Arctic coastal waters. Thesis (M.Sc.) University of Manitoba, Winnipeg, Man. 133 p.

Keats, D.W., Steele, D.H., Green, J.M., and Martel, G.M. 1993. Diet and population size structure of the Arctic shanny, *Stichaeus punctatus* (Pisces: *Stichaeidae*), at sites in eastern Newfoundland and the eastern Arctic. Env. Biol. Fishes 37: 173–180.

Kendel, R.E., Johnston, R.A.C., Lobsiger, U., and Kozak, M.D. 1975. Fishes of the Yukon coast. Beaufort Sea Project, Tech. Rep. No. 6. Beaufort Sea Project Office, Victoria, B.C. 114 p.

Lamb, A., and Edgell, P. 1986. Coastal fishes of the Pacific northwest. Harbour Publishing Co. Ltd., B.C. 224 p.

Majewski, A.R., Atchison, S., MacPhee, S., Eert, J., Niemi, A., Michel, C., and Reist, J.D. 2017. Marine fish community structure and habitat associations on the Canadian Beaufort shelf and slope. Deep Sea Res. Part I Oceanogr. Res. Pap. 121:169–182.

McNicholl, D.G., Walkusz, W., Davoren, G.K., Majewski, A.R., and Reist, J.D. 2016. Dietary characteristics of co-occurring polar cod (*Boreogadus saida*) and capelin (*Mallotus villosus*) in the Canadian Arctic, Darnley Bay. Polar Biol. 39:1099–1108. doi: 10.1007/s00300-015-1834-5.

Mikhail, M.Y., and Welch, H.E. 1989. Biology of Greenland cod, *Gadus ogac*, at Saqvaqjuac, northwest coast of Hudson Bay. Environ. Biol. Fish. 26: 49–62.

Morrow, J.E. 1980. The freshwater fishes of Alaska. University of. B.C. Animal Resources Ecology Library. 248 p.

Muth, K.M. 1969. Age and growth of Broad Whitefish, *Coregonus nasus*, in the Mackenzie and Coppermine rivers, NWT. J. Fish. Res. Board Can. 26: 2252–2256.

Nielsen, J.R. 1992. Growth of Greenland cod, *Gadus ogac*, in the Nunk area of West Greenland. ICES CM/1992/G:32. International Council for the Exploration of the Sea, Copenhagen.

Percy, R. 1975. Fishes of the outer Mackenzie Delta. Beaufort Sea Project, Tech. Rep. 8: vi + 114 p.

Pietsch, T.W. 1993. Systematics and distribution of cottid fishes of the genus *Triglops* Reinhardt (Teleostei: Scorpaeniformes). Zool. J. Linn. Soc.109: 335–393.

Rand, K.M., and Logerwell, E.A. 2011. The first demersal trawl survey of benthic fish and invertebrates in the Beaufort Sea since the late 1970s. Polar Biol. 34: 475–488.

Reist, J.D., and Bond, W.A. 1988. Life history characteristics of migratory coregonids of the lower Mackenzie River, Northwest Territories, Canada. Finnish Fish. Res. 9: 133–144.

Riede, K. 2004. Global register of migratory species - from global to regional scales. Final Report of the R&D-Projekt 808 05 081. Federal Agency for Nature Conservation, Bonn, Germany. 329 p.

APPENDIX A – TEMPERATURE AND CONDUCTIVITY OF 2012 NET SETS

During the 2012 field program HOBO Conductivity V2 Pro loggers were placed on nets during the sampling effort. Unfortunately, not all nets have temperature and conductivity data, however, loggers were placed at random on nets to acquire information on the environmental conditions at that time.

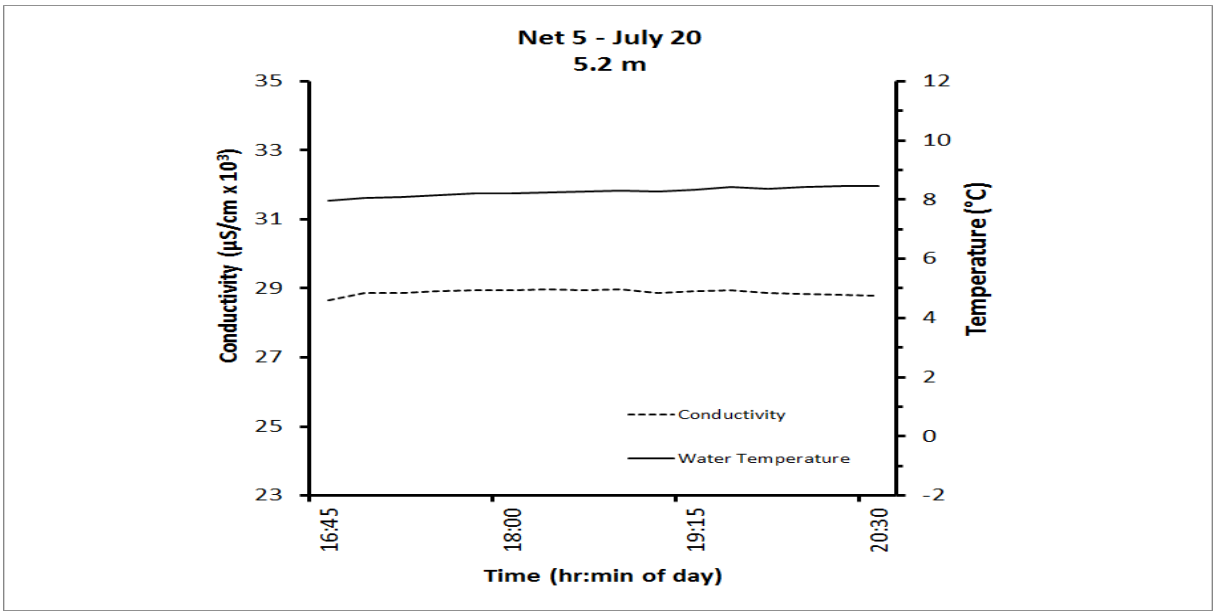

Figure A.1. Net #5 time series, from the time of net set until net was lifted, of water temperature and conductivity from Bennett Point, 2012. Fishes were collected using a shore-based trap net. Species collected for this effort: Saffron Cod (n=1), Arctic Staghorn Sculpin (n=1) and Starry Flounder (n=2).

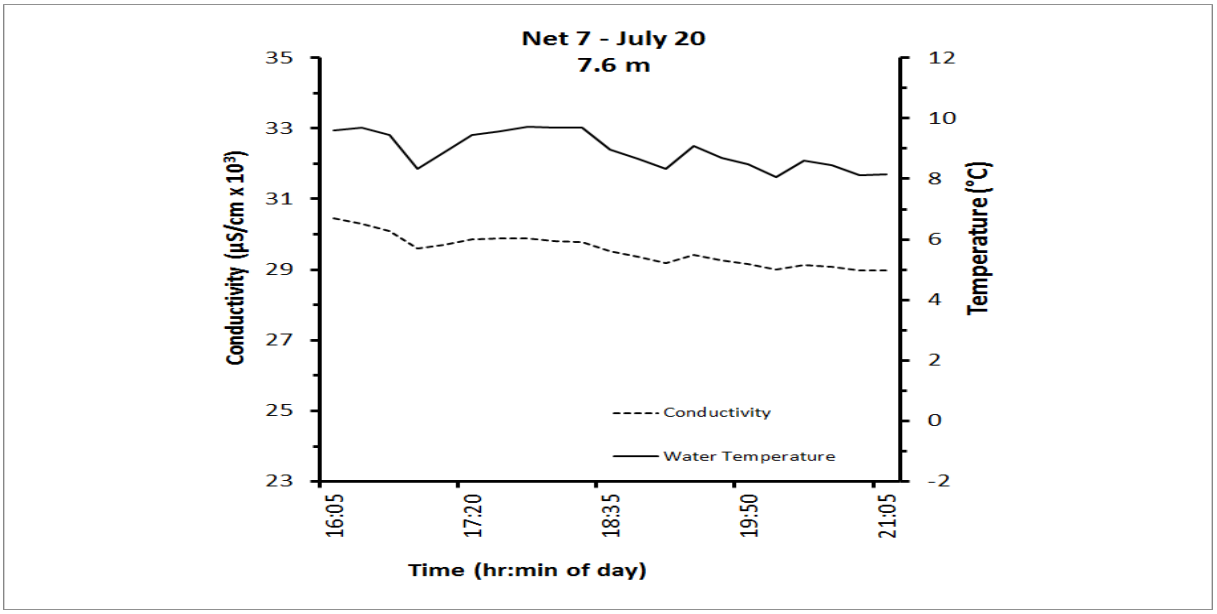

Figure A.2. Net #7 time series, from the time of net set until net was lifted, of water temperature and conductivity from Bennett Point, 2012. Fishes were collected using a shore-based trap net. Species collected for this effort: Arctic Staghorn Sculpin (n=1).

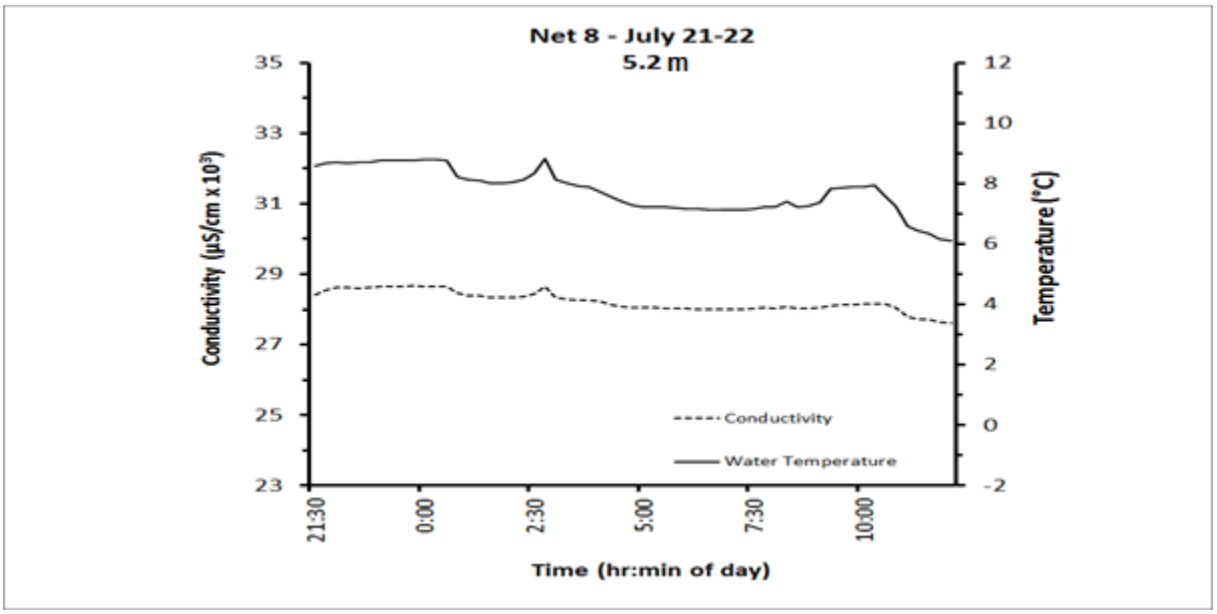

Figure A.3. Net #8 time series, from the time of net set until net was lifted, of water temperature and conductivity from Bennett Point, 2012. Fishes were collected using a shore-based trap net. Species collected for this effort: Arctic Staghorn Sculpin (n=2), Capelin (n=1), Fourhorn Sculpin (n=1), Greenland Cod (n=1), Saffron Cod (n=3) and Starry Flounder (n=1).

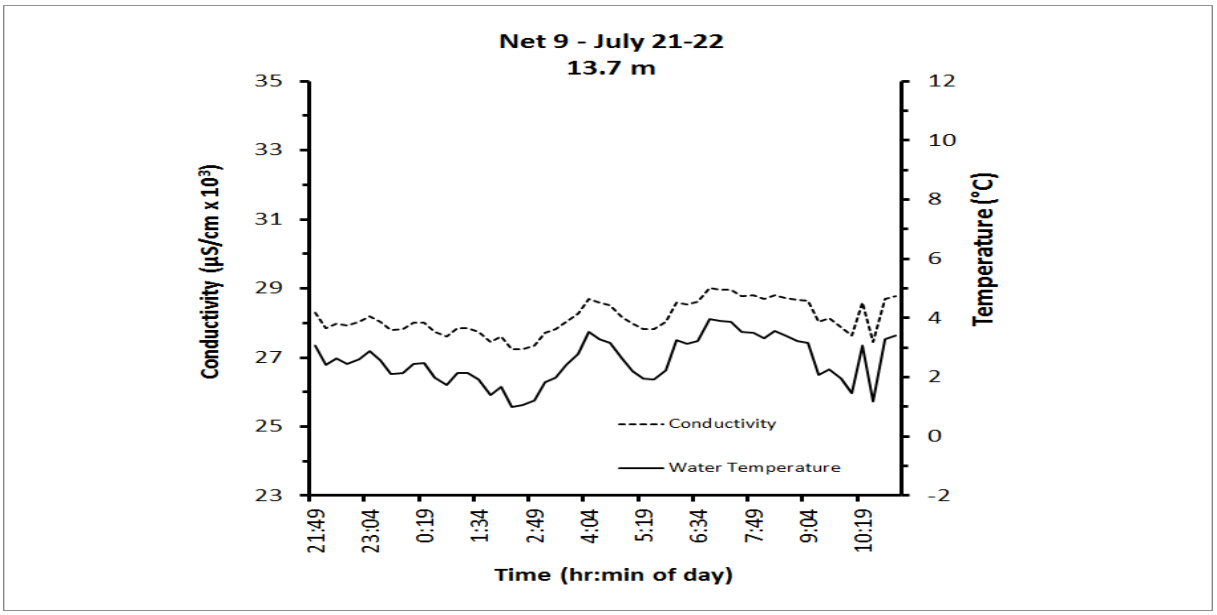

Figure A.4. Net #9 time series, from the time of net set until net was lifted, of water temperature and conductivity from Bennett Point, 2012. Fishes were collected using a multi-mesh, 6 panel gill net. Species collected for this effort: Arctic Staghorn Sculpin (n=1).

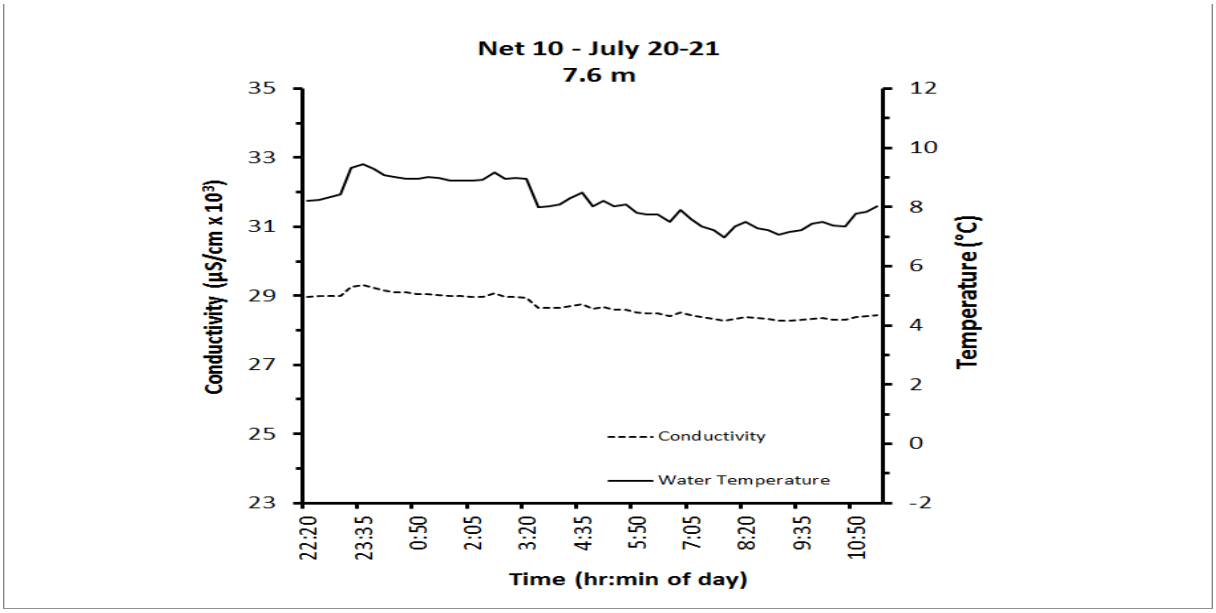

Figure A.5. Net #10 time series, from the time of net set until net was lifted, of water temperature and conductivity from Bennett Point, 2012. Fishes were collected using a multi-mesh, 6 panel gill net. Species collected for this effort: Arctic Staghorn Sculpin (n=1) and Greenland Cod (n=4).

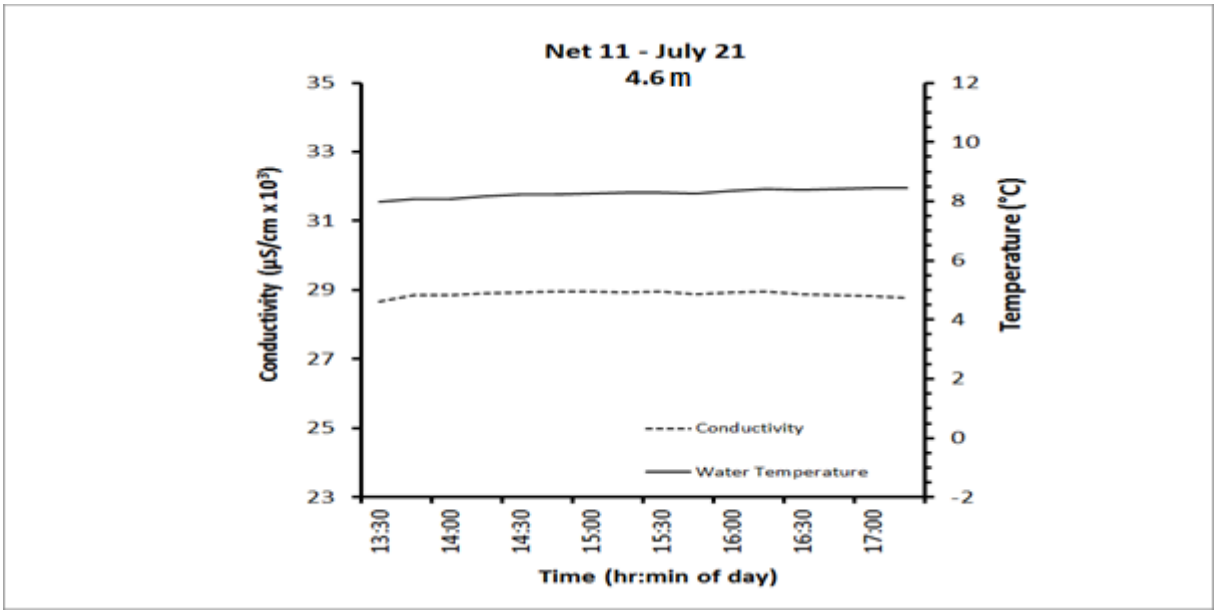

Figure A.6. Net #11 time series, from the time of net set until net was lifted, of water temperature and conductivity from Bennett Point, 2012. Fishes were collected using a multi-mesh, 6 panel gill net. Species collected for this effort: Starry Flounder (n=2).

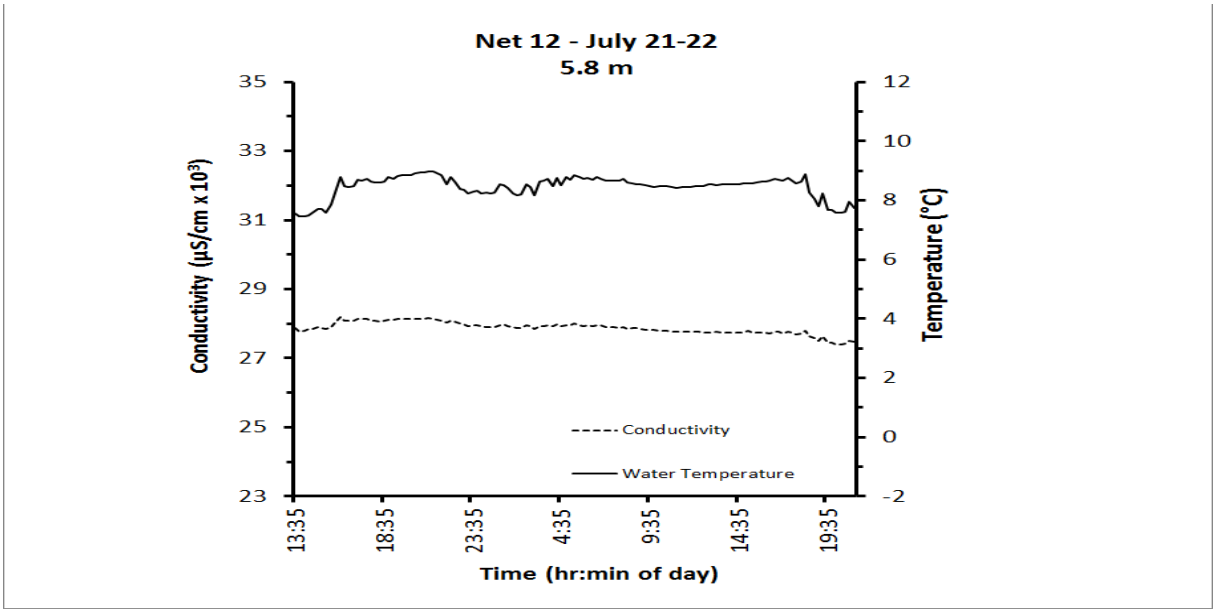

Figure A.7. Net #12 time series, from the time of net set until net was lifted, of water temperature and conductivity from Bennett Point. Fishes were collected using a multi-mesh, 6 panel gill net. Species collected for this effort: Arctic Flounder (n=1), Arctic Staghorn Sculpin (n=2), Fourhorn Sculpin (n=1), Saffron Cod (n=3) and Starry Flounder (n=3).

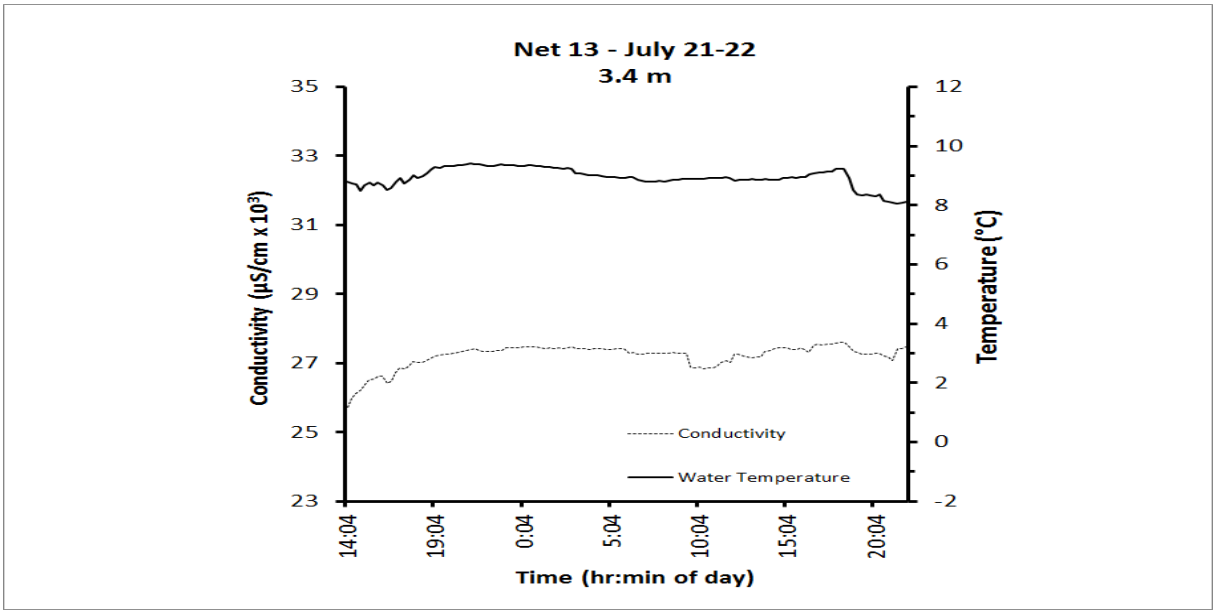

Figure A.8. Net #13 time series, from the time of net set until net was lifted, of water temperature and conductivity from Bennett Point, 2012. Fishes were collected using a multi-mesh, 6 panel gill net. Species collected for this effort: Arctic Flounder (n=1), Arctic Staghorn Sculpin (n=1), Capelin (n=1), Fourhorn Sculpin (n=1), Pacific Herring (n=4), Saffron Cod (n=5) and Starry Flounder (n=6).

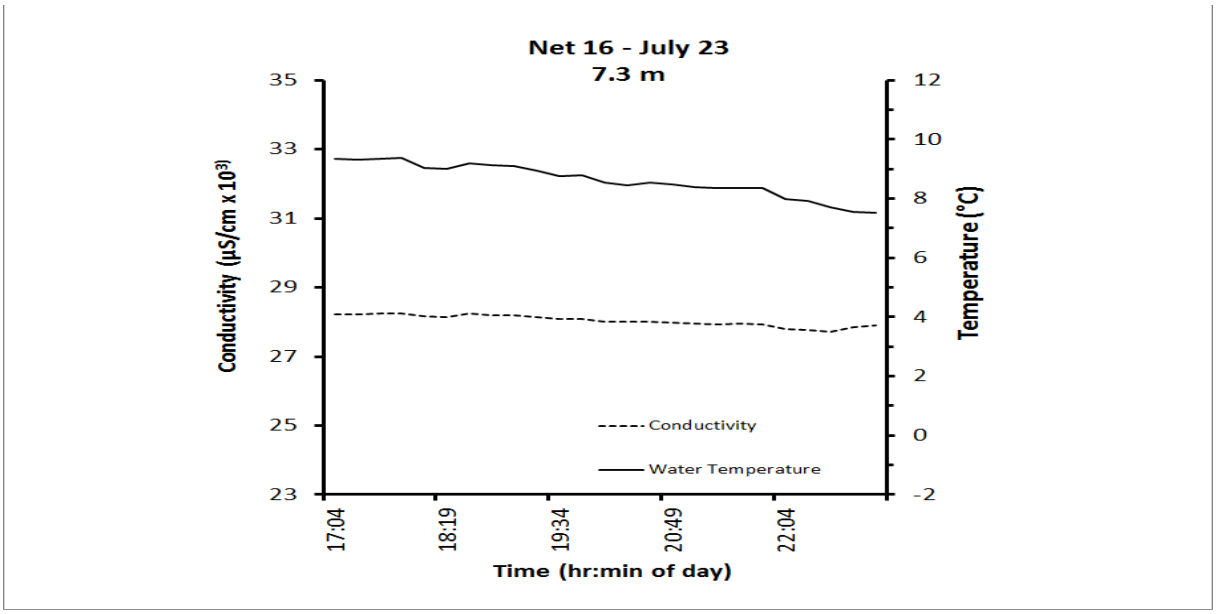

Figure A.9. Net #16 time series, from the time of net set until net was lifted, of water temperature and conductivity from Bennett Point, 2012. Fishes were collected using a multi-mesh, 6 panel gill net. Species collected for this effort: Cottidae sp. (n=2).

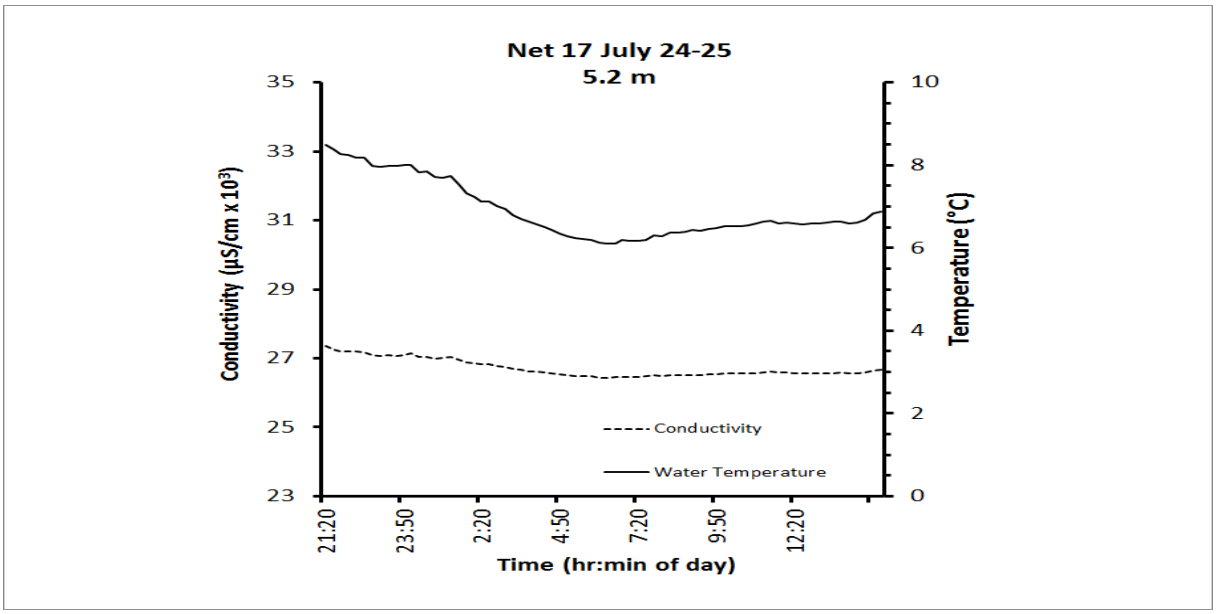

Figure A.10. Net #17 time series, from the time of net set until net was lifted, of water temperature and conductivity from Bennett Point, 2012. Fishes were collected using a multi-mesh, 6 panel gill net. Species collected for this effort: Arctic Flounder (n=1), Capelin (n=4), Pacific Herring (n=9) and Saffron Cod (n=1).

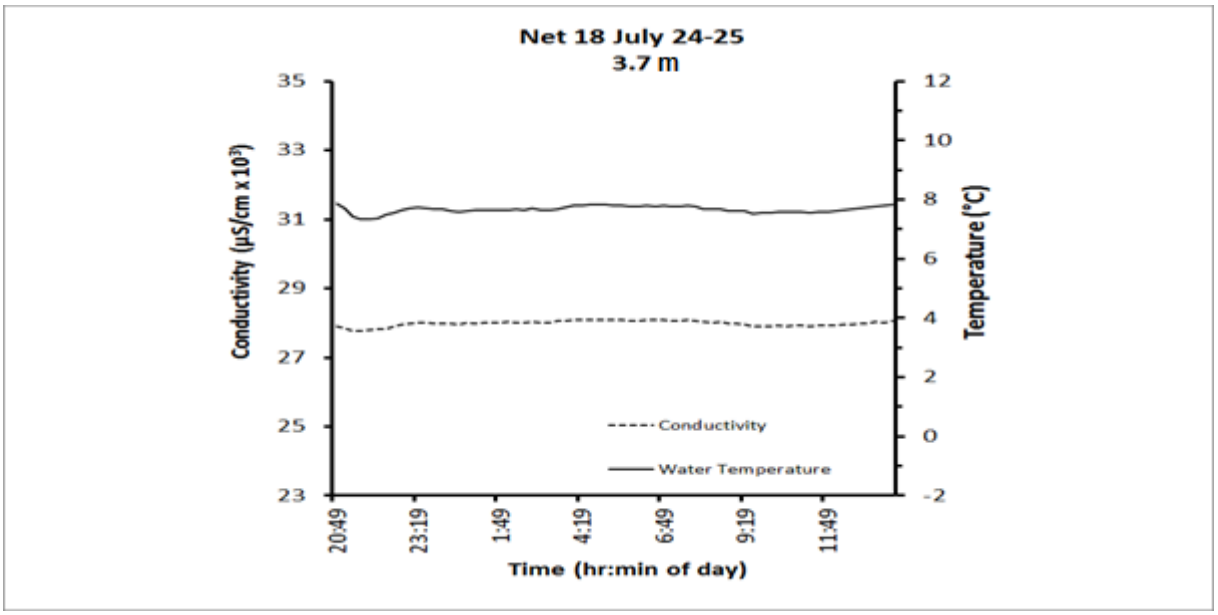

Figure A.11. Net #18 time series, from the time of net set until net was lifted, of water temperature and conductivity from Bennett Point, 2012. Fishes were collected using a multi-mesh, 6 panel gill net. Species collected for this effort: Arctic Char (n=1), Capelin (n=1) and Saffron Cod (n=2).

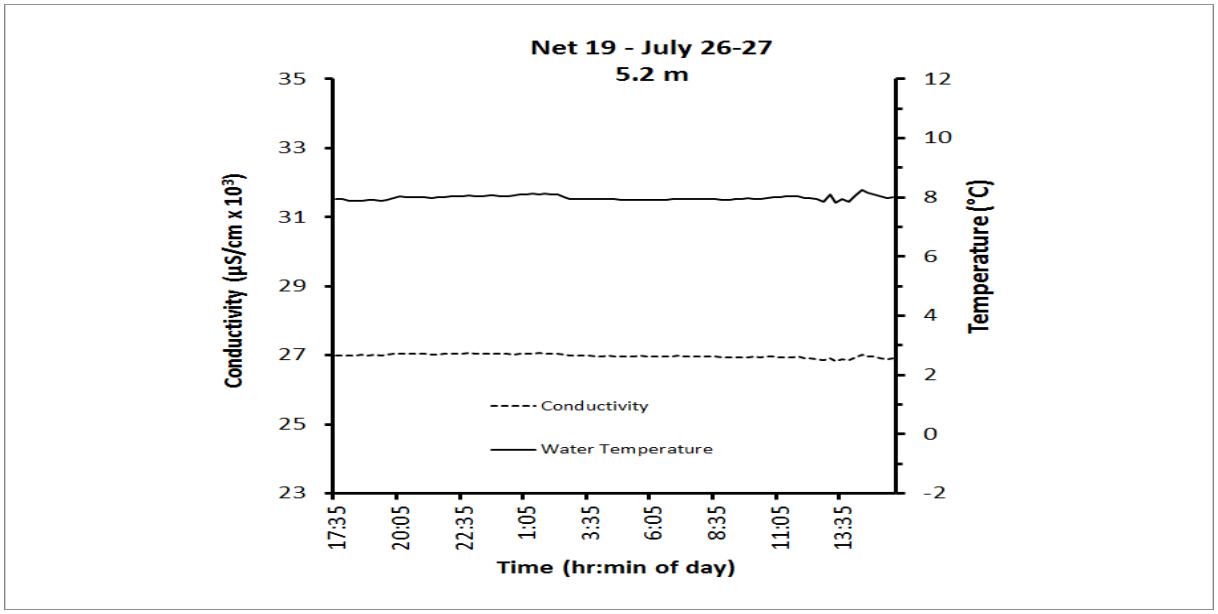

Figure A.12. Net #19 time series, from the time of net set until net was lifted, of water temperature and conductivity from Bennett Point, 2012. Fishes were collected using a multi-mesh, 6 panel gill net. Species collected for this effort: Arctic Staghorn Sculpin (n=1), Greenland Cod (n=1), Pacific Herring (n=1) and Saffron Cod (n=2).

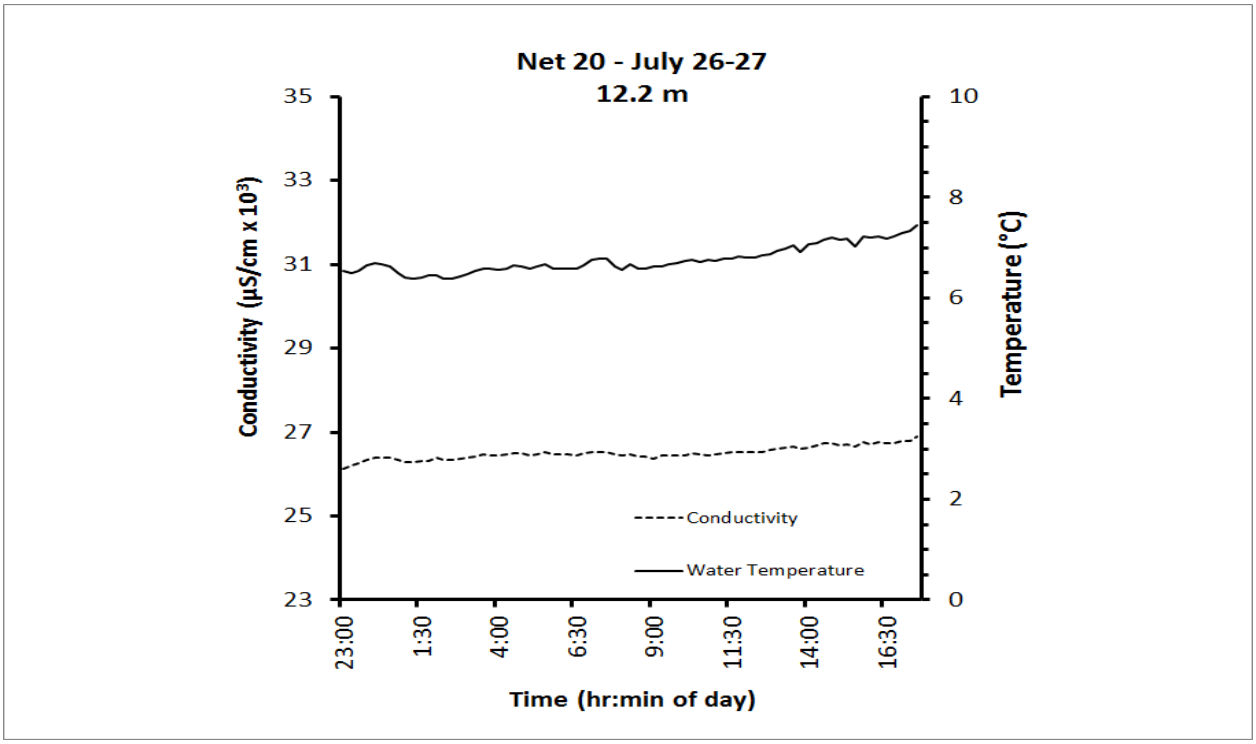

Figure A.13. Net #20 time series, from the time of net set until net was lifted, of water temperature and conductivity from Bennett Point, 2012. Fishes were collected using a 60 m, multi-mesh, 6 panel gill net. Species collected for this effort: Arctic Staghorn Sculpin (n=4) and Greenland Cod (n=2).

APPENDIX B – TEMPERATURE AND SALINITY OF 2014 NET SETS

Starting in 2014, and in subsequent years loggers were used that recorded temperature and salinity. These were used to develop time series plots (Figures B.1–B.15) of environmental conditions during periods of sampling.

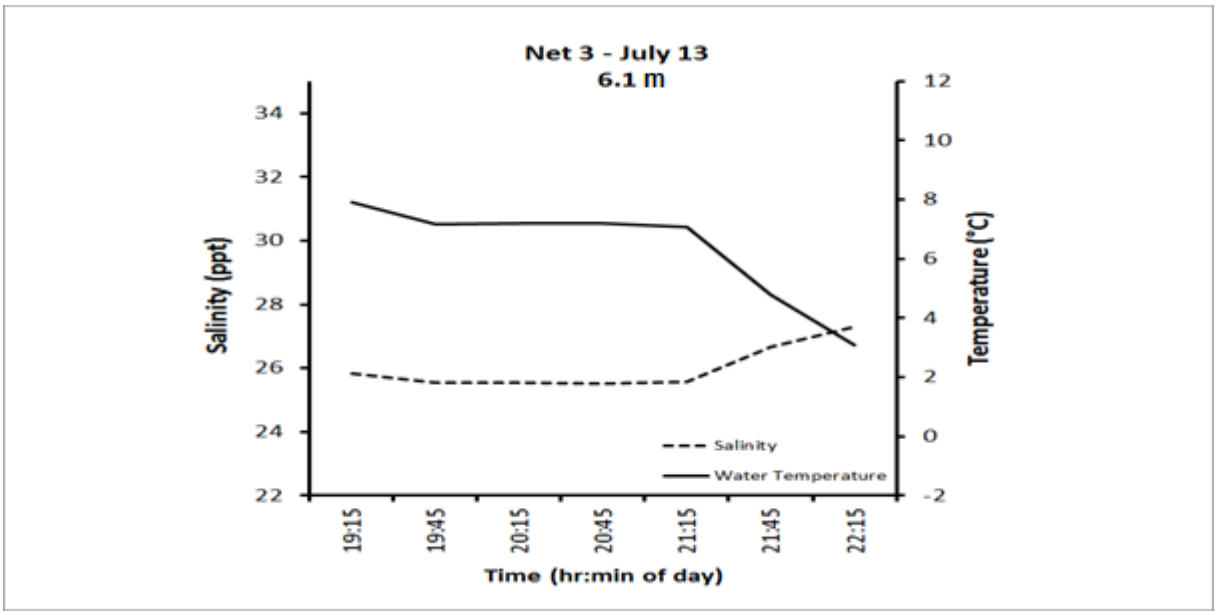

Figure B.1. Net #3 time series data of water temperature and salinity from Bennett Point, 2014 using a 60 m, 1.5 inch monofilament gill net. No fishes were collected during this effort.

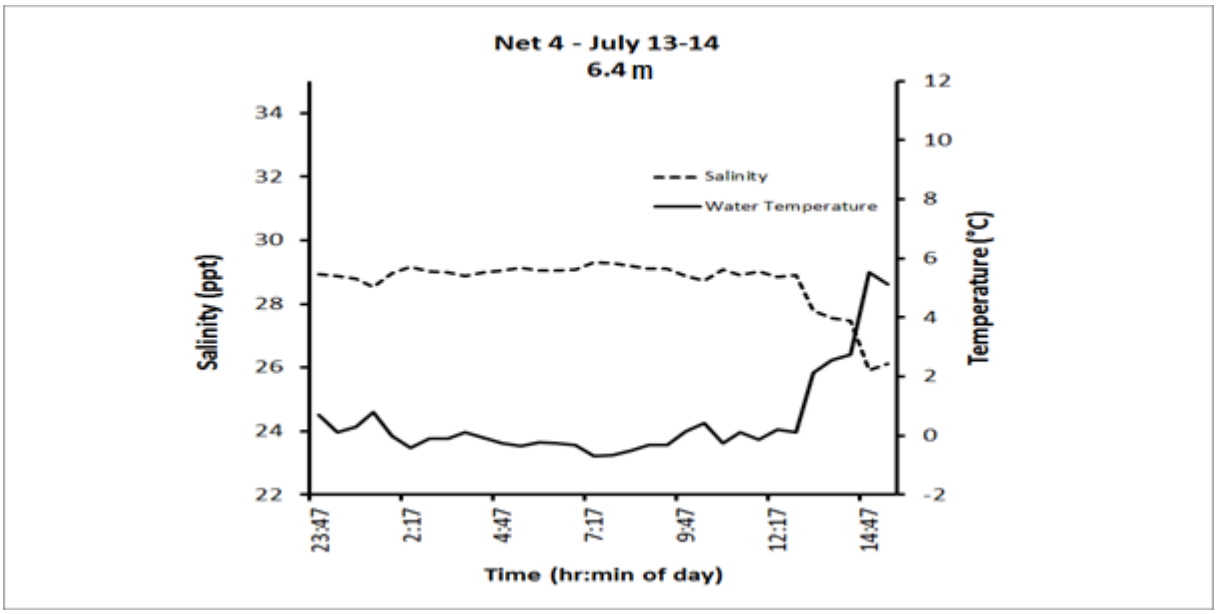

Figure B.2. Net #4 time series data of water temperature and salinity from Bennett Point, 2014 using a 60 m, 6 panel, multi-mesh gill net. Species collected during this effort: Shorthorn Sculpin (n=1).

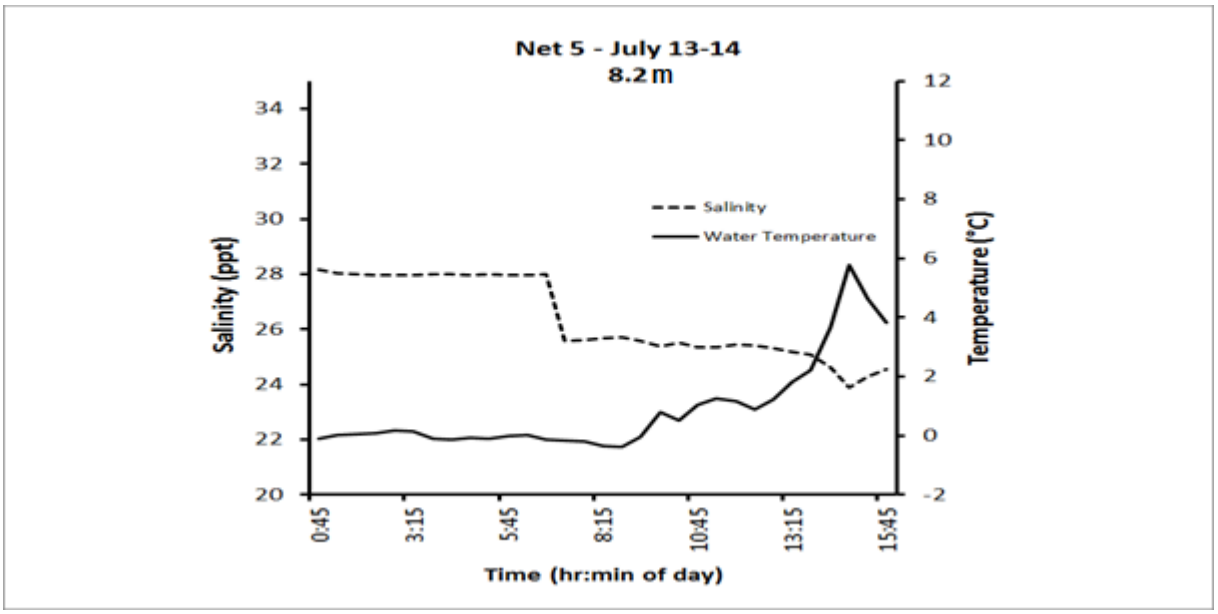

Figure B.3. Net #5 time series data of water temperature and salinity from Bennett Point, 2014 using a 60 m, 1.5 inch monofilament gill net. No species were collected during this effort.

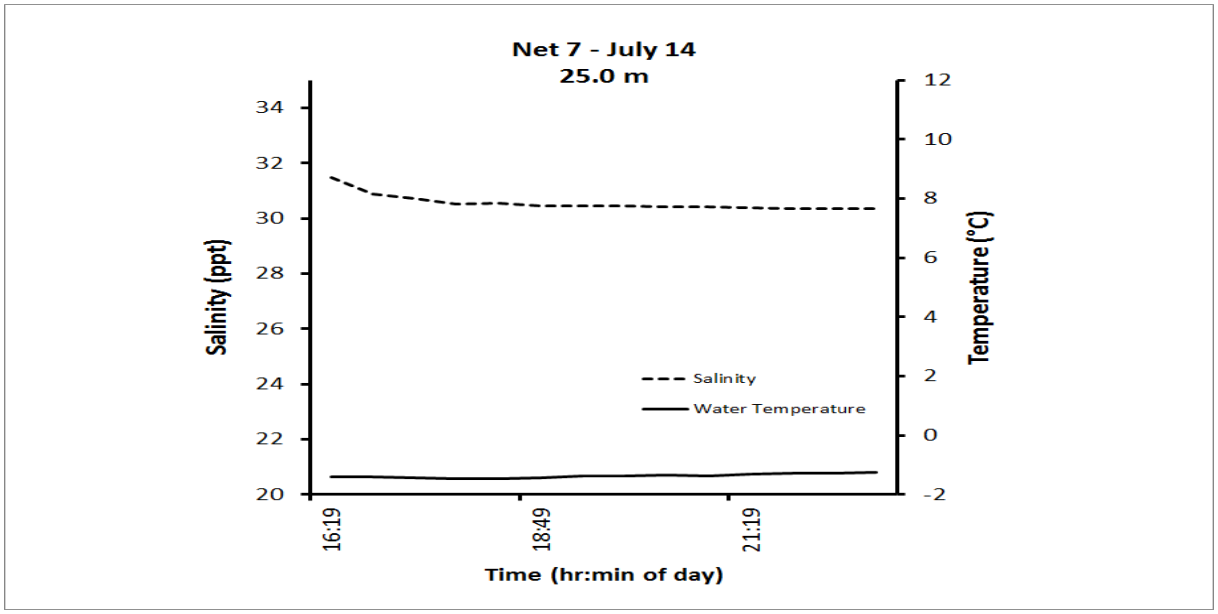

Figure B.4. Net #7 time series data of water temperature and salinity from Bennett Point, 2014 using a 60 m, 6 panel, multi-mesh gill net. No species were collected during this effort.

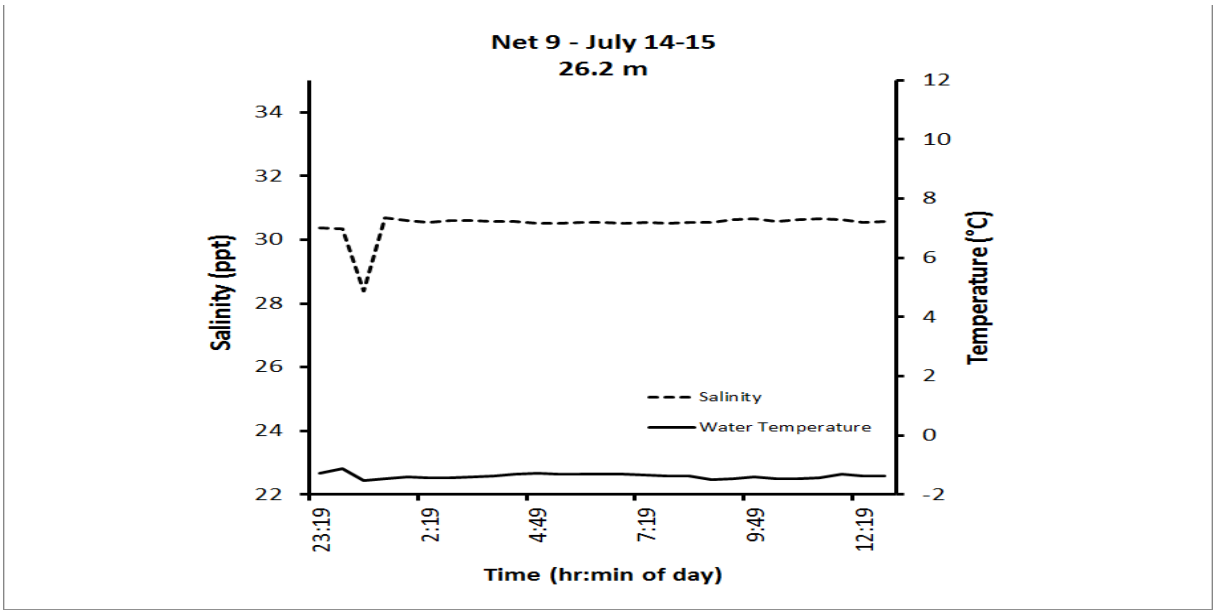

Figure B.5. Net #9 time series data of water temperature and salinity from Bennett Point, 2014 using a 60 m, 6 panel, multi-mesh gill net. No species were collected during this effort.

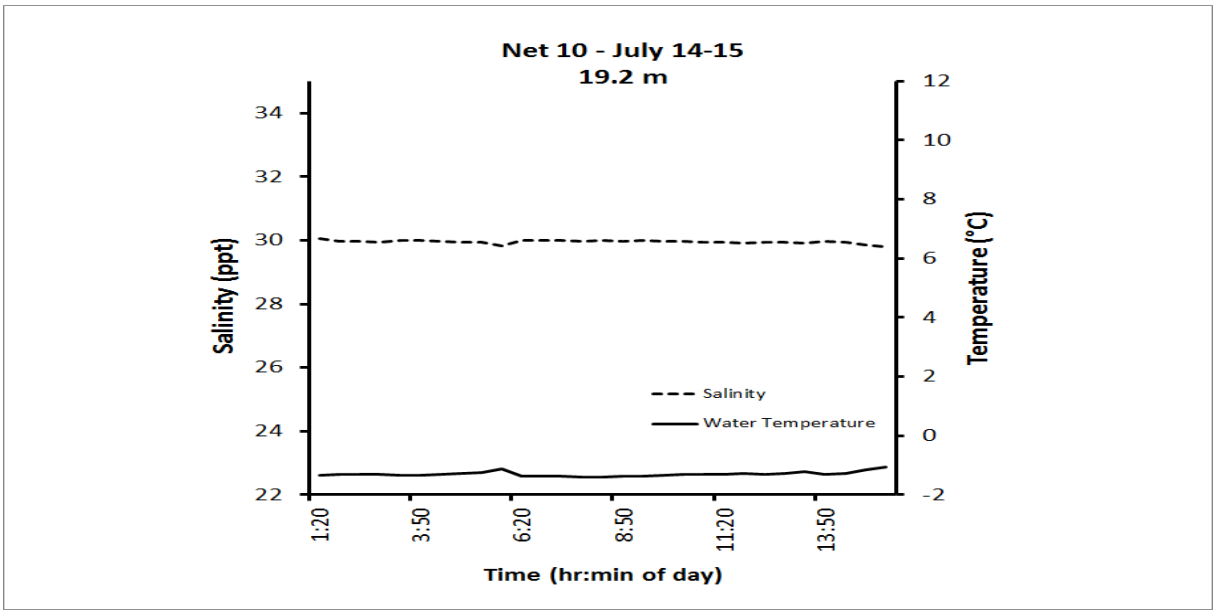

Figure B.6. Net #10 time series data of water temperature and salinity from Bennett Point, 2014 using a 60 m, 6 panel, multi-mesh gill net. No species were collected during this effort.

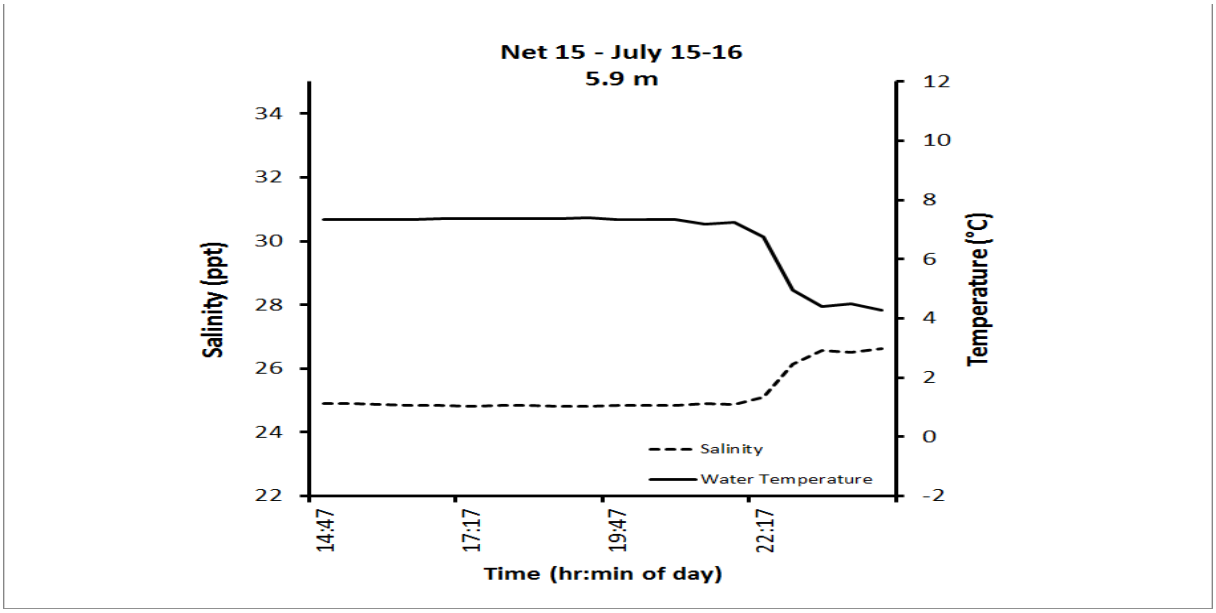

Figure B .7. Net #15 time series data of water temperature and salinity from Bennett Point, 2014 using a 60 m, 6 panel, multi-mesh gill net. No species were collected during this effort.

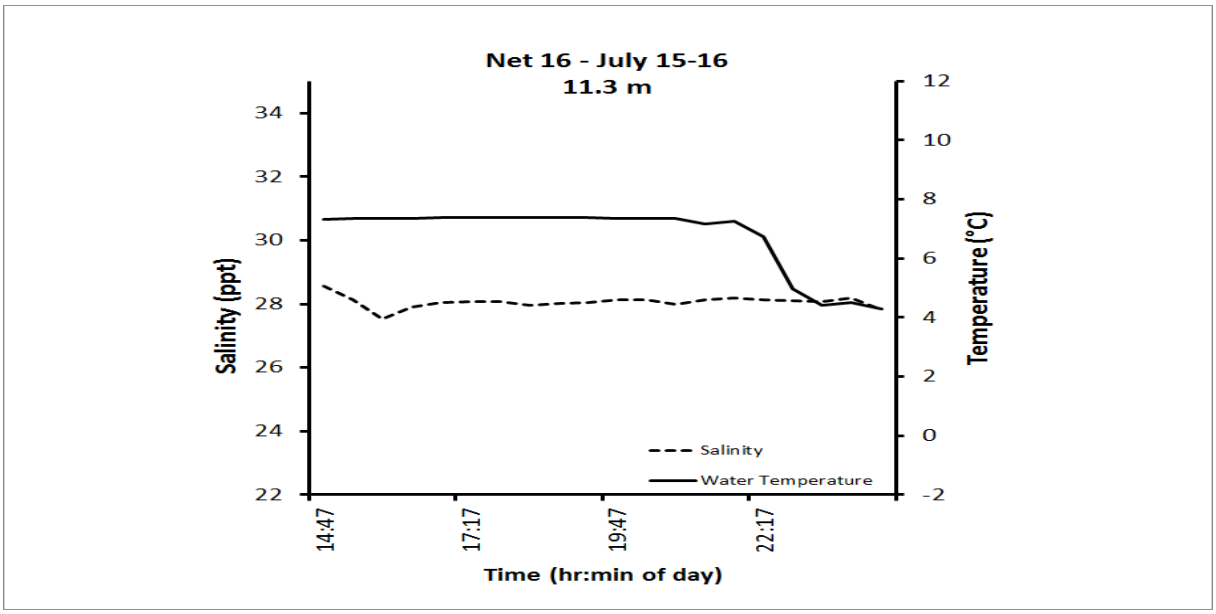

Figure B.8. Net #16 time series data of water temperature and salinity from Bennett Point, 2014 using a 60 m, 6 panel, multi-mesh gill net. No species were collected during this effort.

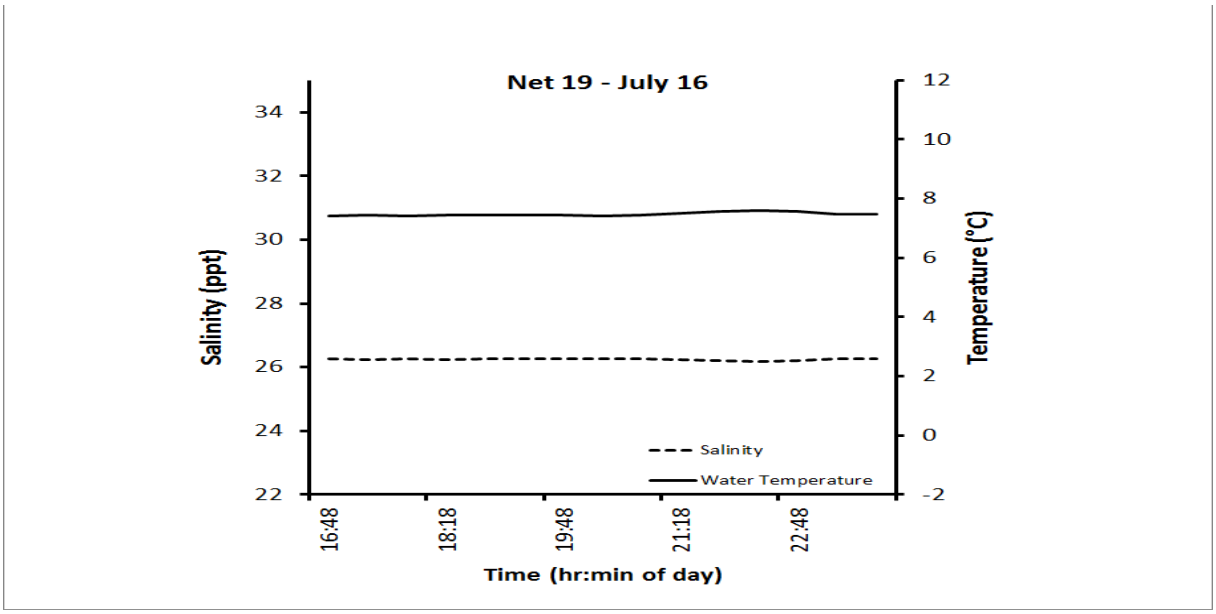

Figure B.9. Net #19 time series data of water temperature and salinity from Bennett Point, 2014 using a trap net. Species collected for this effort: Capelin (n=46).

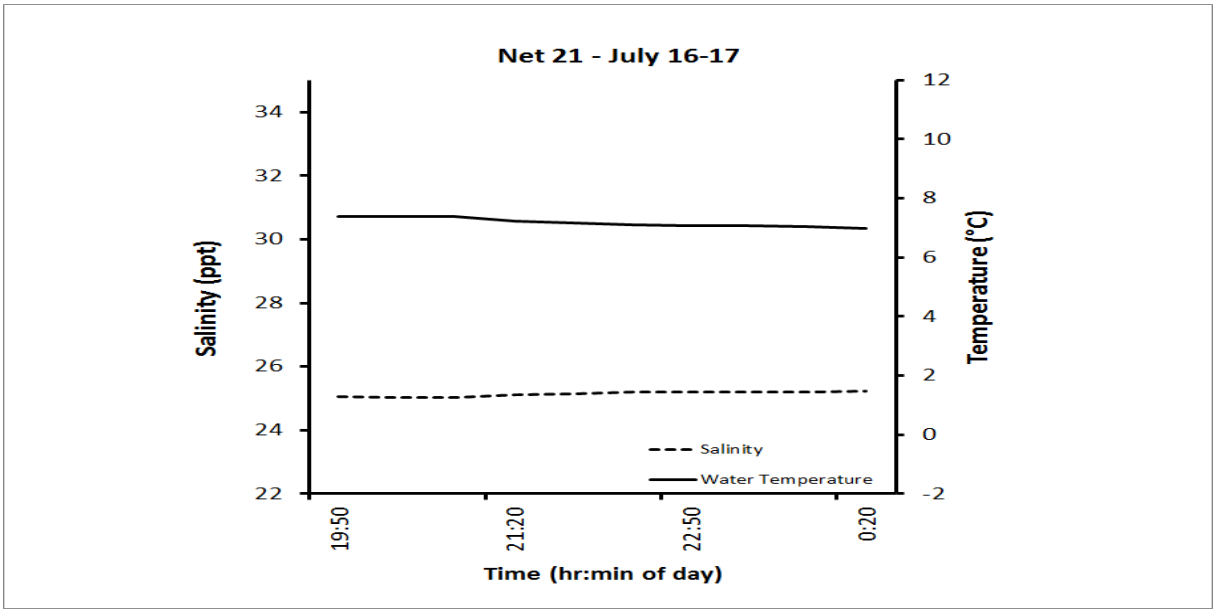

Figure B.10. Net #21 time series data of water temperature and salinity from Bennett Point, 2014 using a trap net. Species collected for this effort: Arctic Staghorn Sculpin (n=1) and Capelin (n=118).

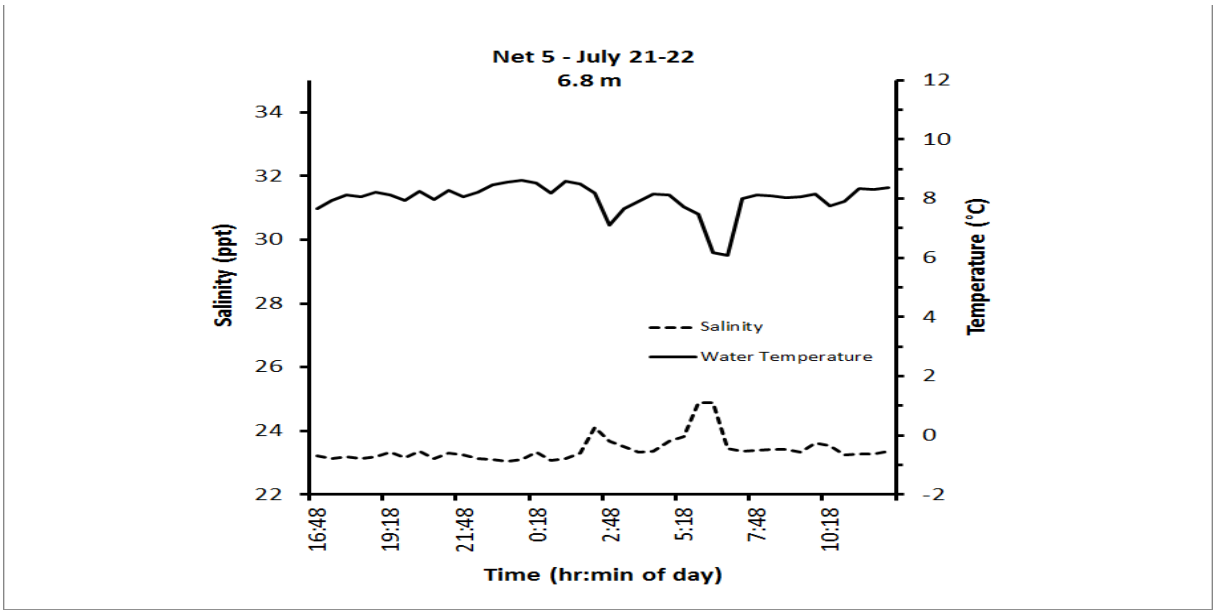

Figure B.11. Net #5 time series data of water temperature and salinity from Brown's Harbour, 2014 using a 60 m, 6 panel, multi-mesh gill net. No species were sampled during this effort.

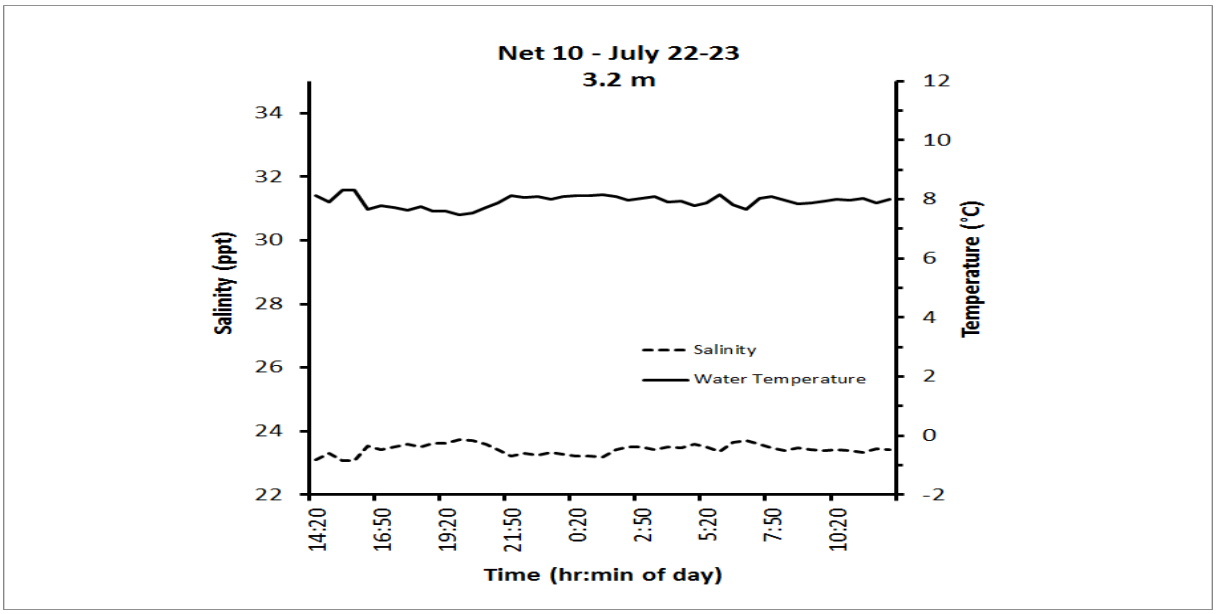

Figure B.12. Net #10 time series data of water temperature and salinity from Brown's Harbour, 2014 using a 60 m, 6 panel, multi-mesh gill net. No species were sampled during this effort.

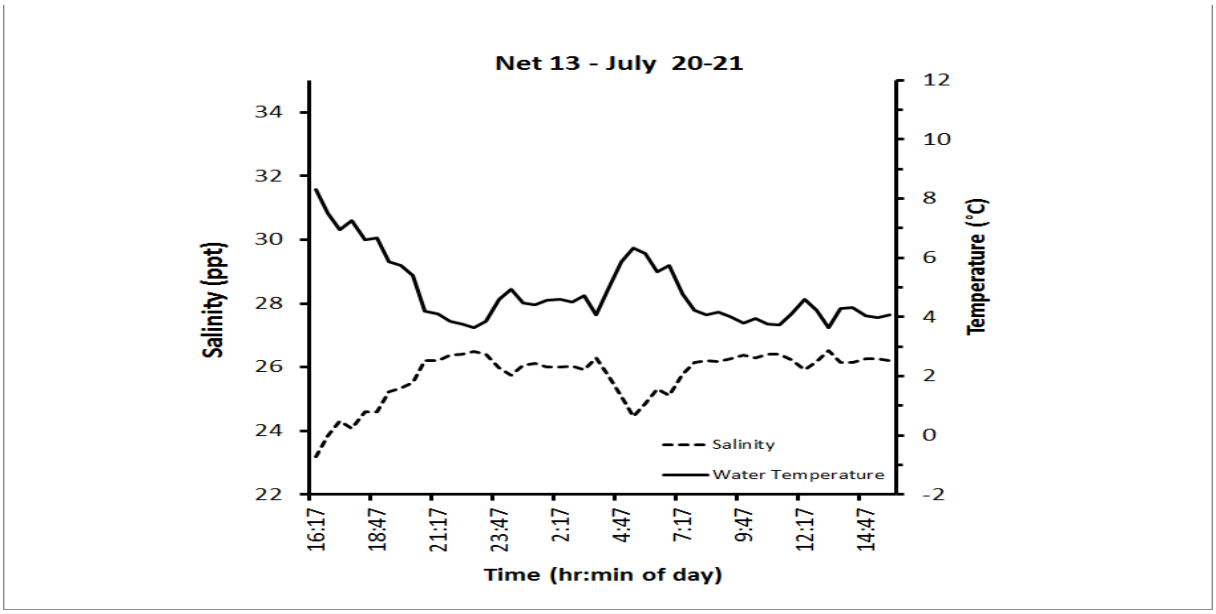

Figure B.13. Net #13 time series data of water temperature and salinity from Brown's Harbour, 2014 using a trap net. No species were sampled during this effort.

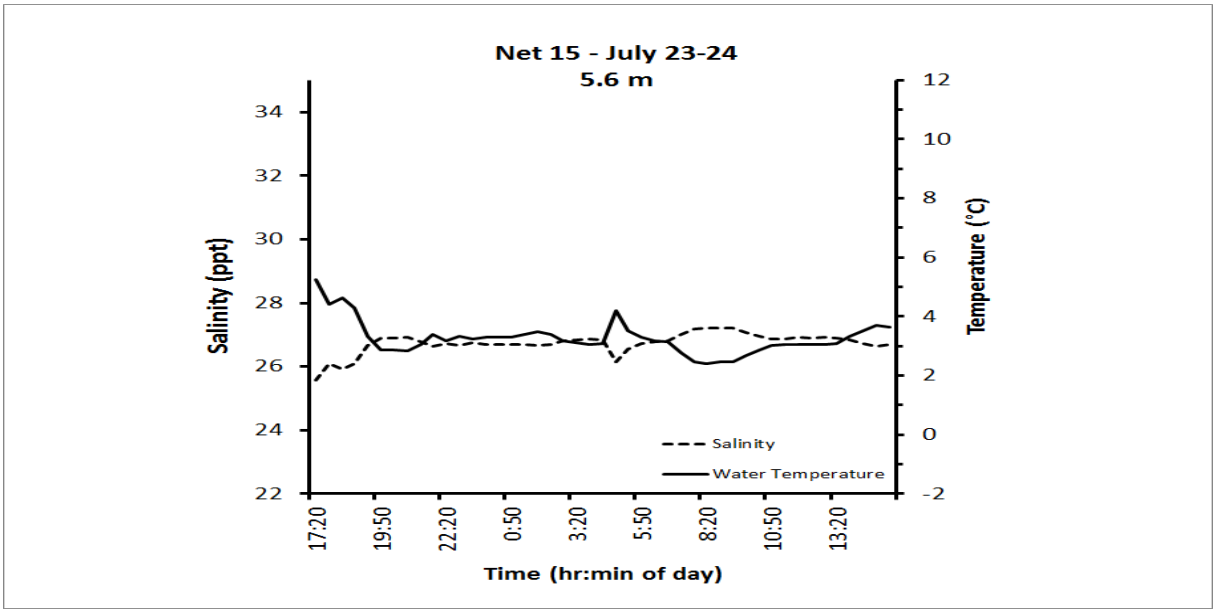

Figure B.14. Net #15 time series data of water temperature and salinity from Brown's Harbour, 2014 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Greenland Cod (n=2) and Shorthorn Sculpin (n=1).

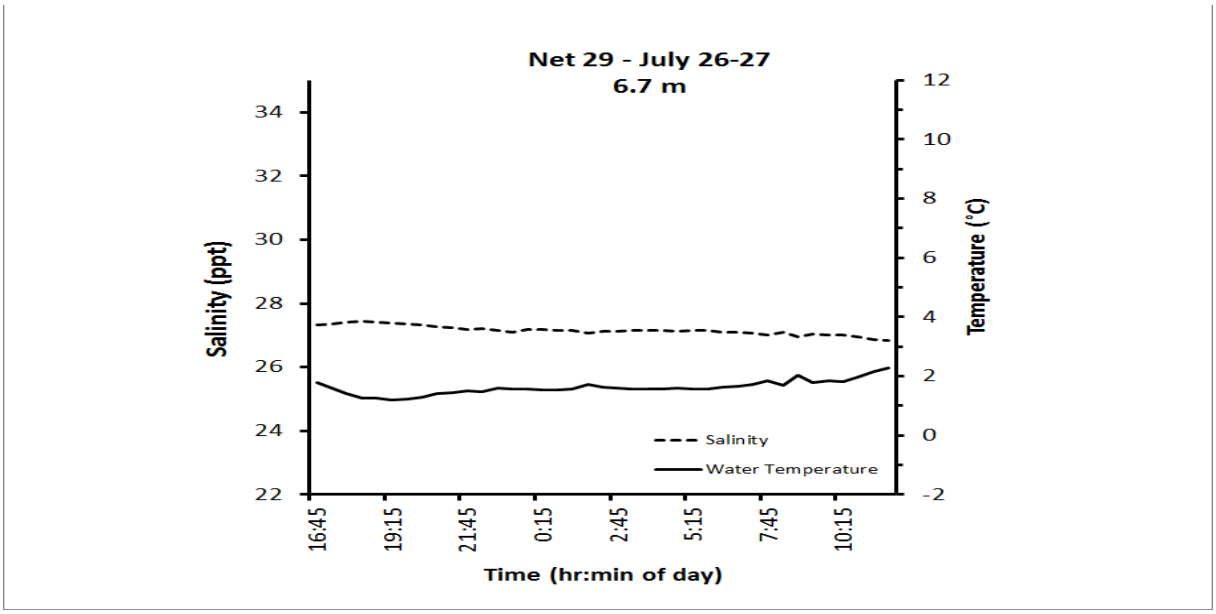

Figure B.15. Net #29 time series data of water temperature and salinity from Brown's Harbour, 2014, using a 60m, 6 panel, multi-mesh gill net. Species sampled during this effort: Shorthorn Sculpin (n=1).

APPENDIX C – TEMPERATURE AND SALINITY OF 2015 NET SETS

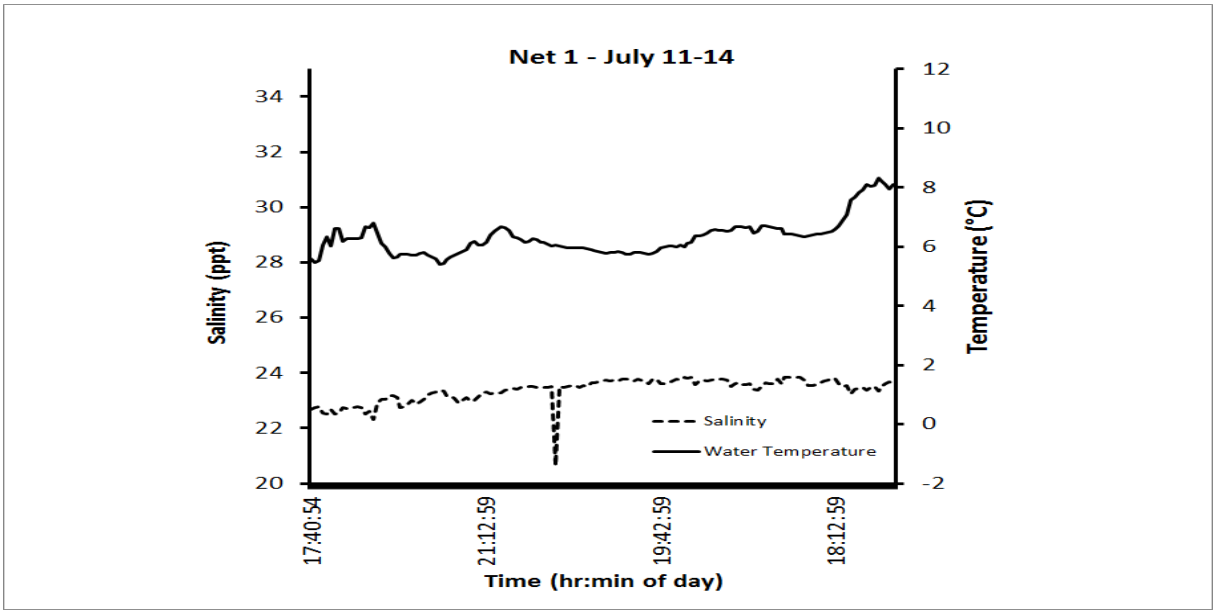

Figure C.1. Net #1 time series data of water temperature and salinity from Brown's Harbour, 2015 using a trap net. Species sampled during this effort: Capelin (n=1), Greenland Cod (n=1), Twohorn Sculpin (n=1) and Cottidae sp. (n=1; damaged while in net and could not be identified).

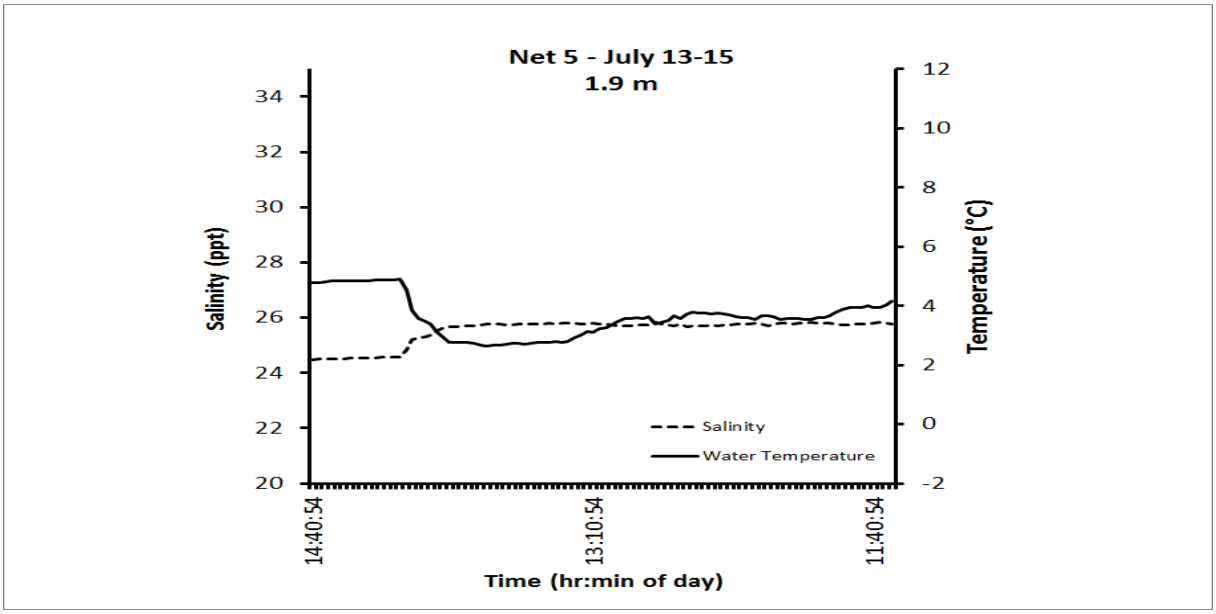

Figure C.2. Net #5 time series data of water temperature and salinity from Brown's Harbour, 2015 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Cisco (n=1), Fourhorn Sculpin (n=2), Greenland Cod (n=1) and Shorthorn Sculpin (n=3).

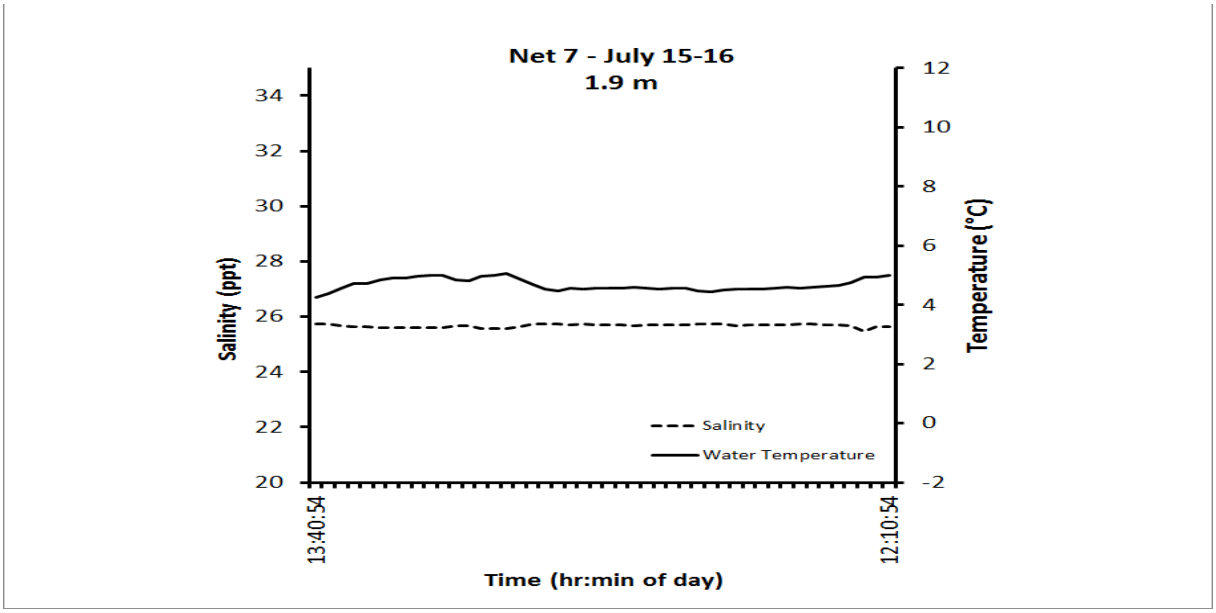

Figure C.3. Net #7 time series data of water temperature and salinity from Brown's Harbour, 2015 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Cisco (n=3), Fourhorn Sculpin (n=2), Greenland Cod (n=3), Pacific Herring (n=1) and Shorthorn Sculpin (n=7).

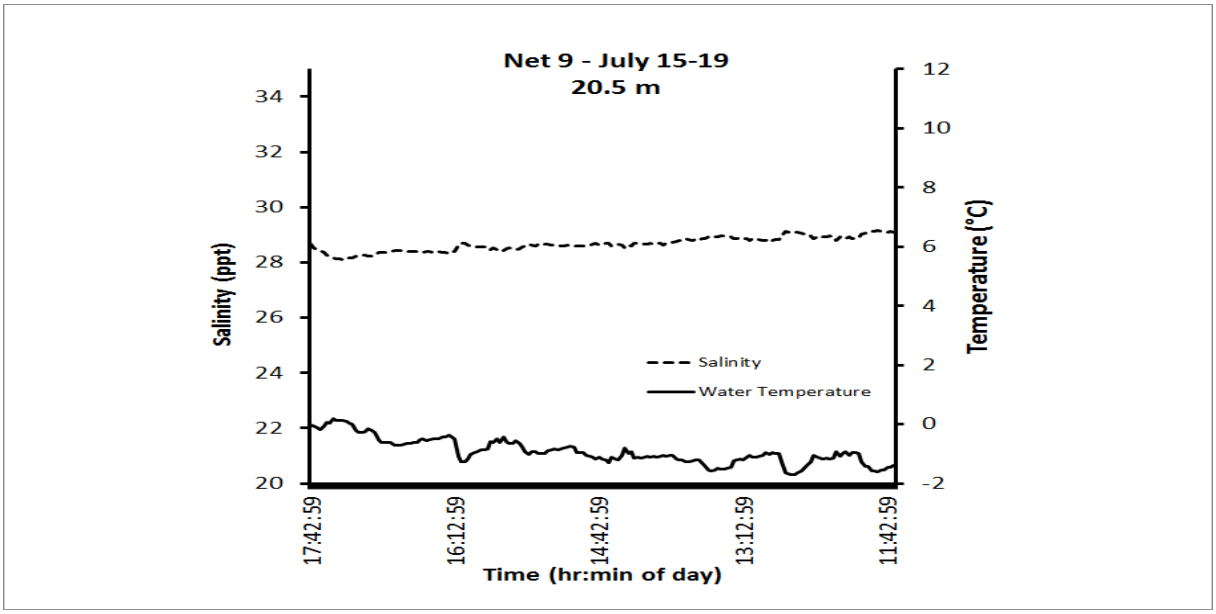

Figure C.4. Net #9 time series data of water temperature and salinity from Brown's Harbour, 2015 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Ribbed Sculpin (n=1) and Shorthorn Sculpin (n=2).

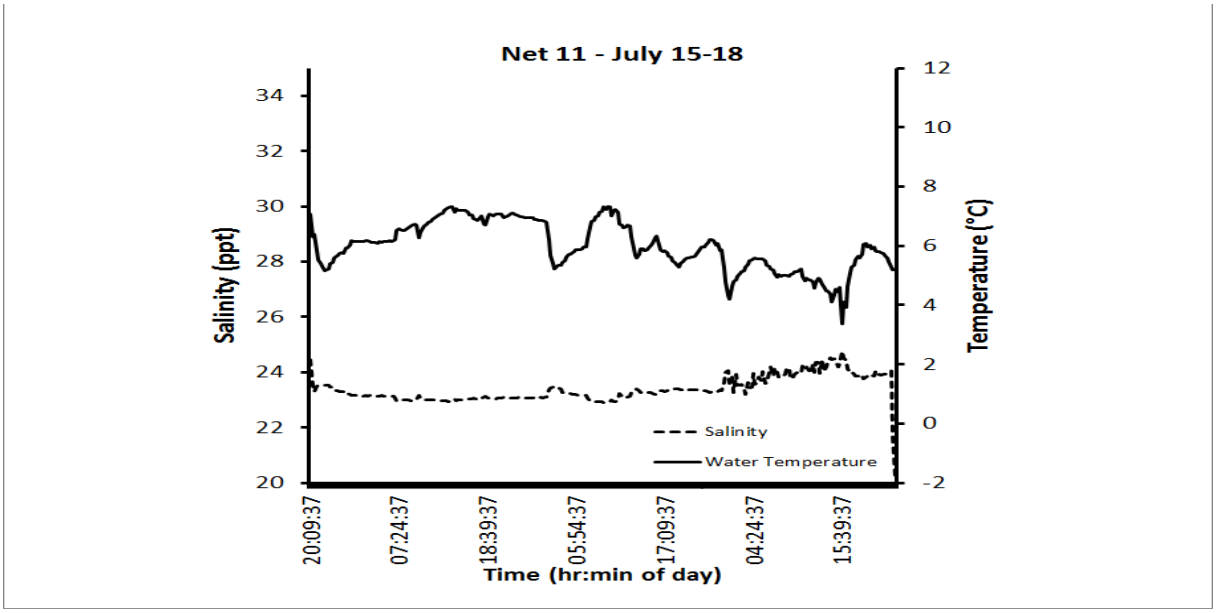

Figure C.5. Net #11 time series data of water temperature and salinity from Brown's Harbour, 2015 using a trap net. Species sampled during this effort: Shorthorn Sculpin (n=2).

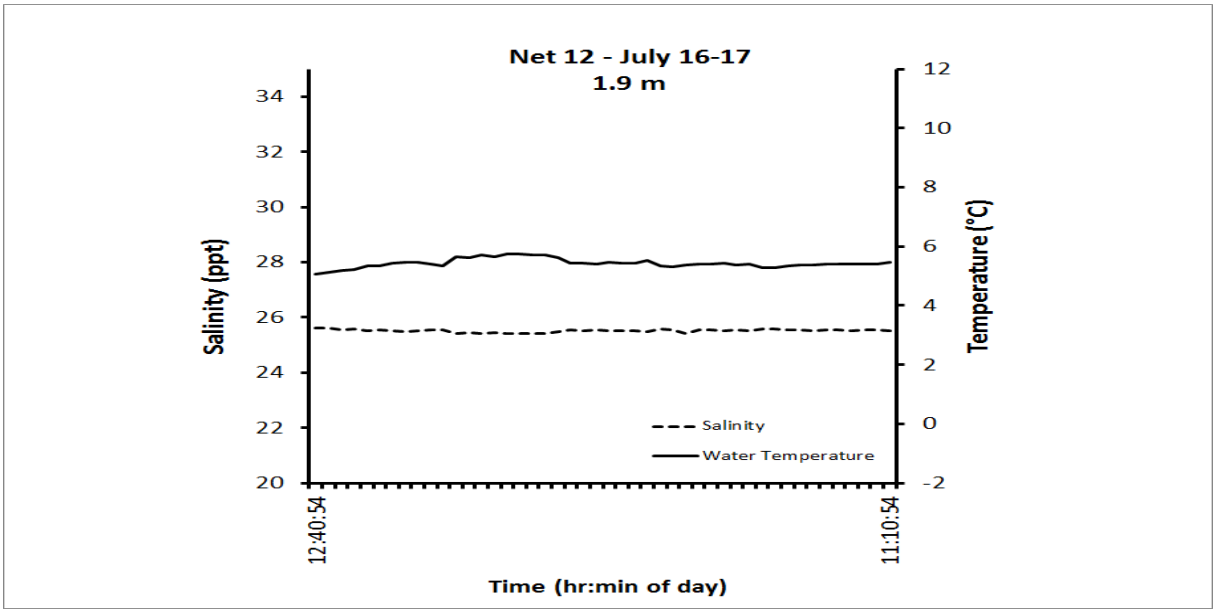

Figure C.6. Net #12 time series data of water temperature and salinity from Brown's Harbour, 2015 using a 60m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Char (n=1) and Fourhorn Sculpin (n=1).

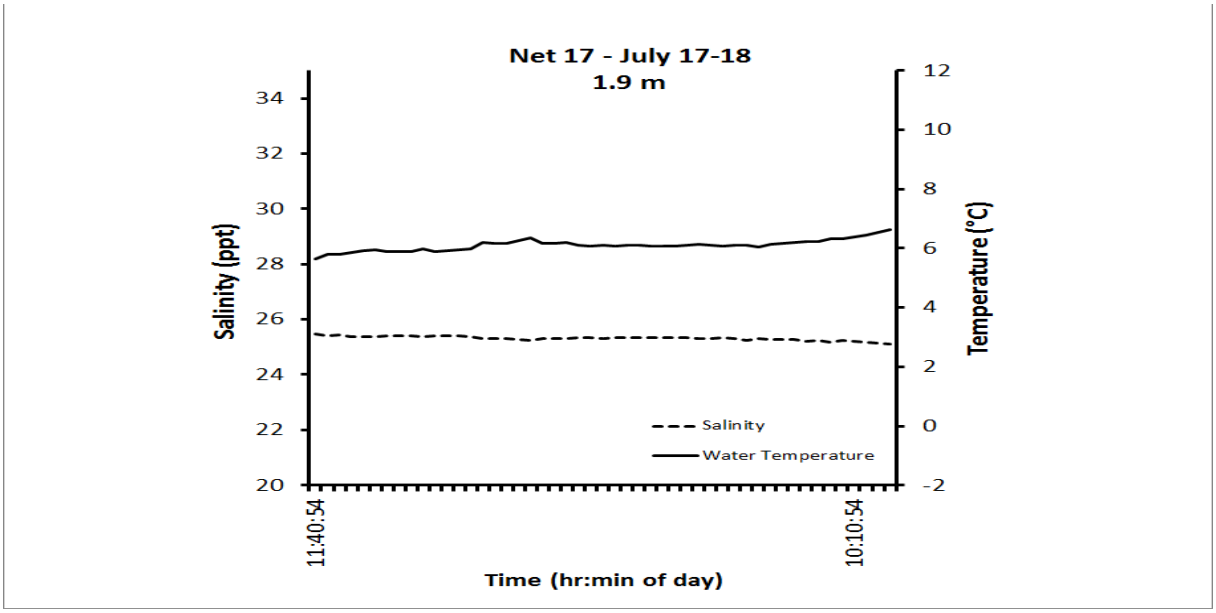

Figure C.7. Net #17 time series data of water temperature and salinity from Brown's Harbour, 2015 using a 60 m, 6 panel, multi-mesh gill net. No species were sampled during this effort.

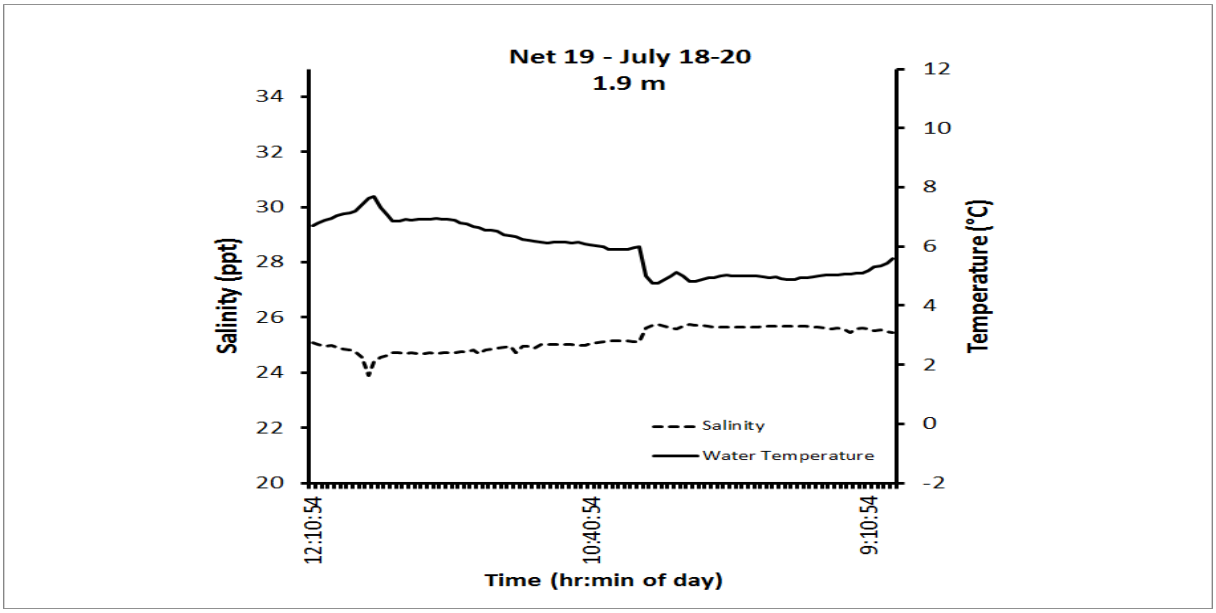

Figure C.8. Net #19 time series data of water temperature and salinity from Brown's Harbour, 2015 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Cisco (n=1) and Fourhorn Sculpin (n=2).

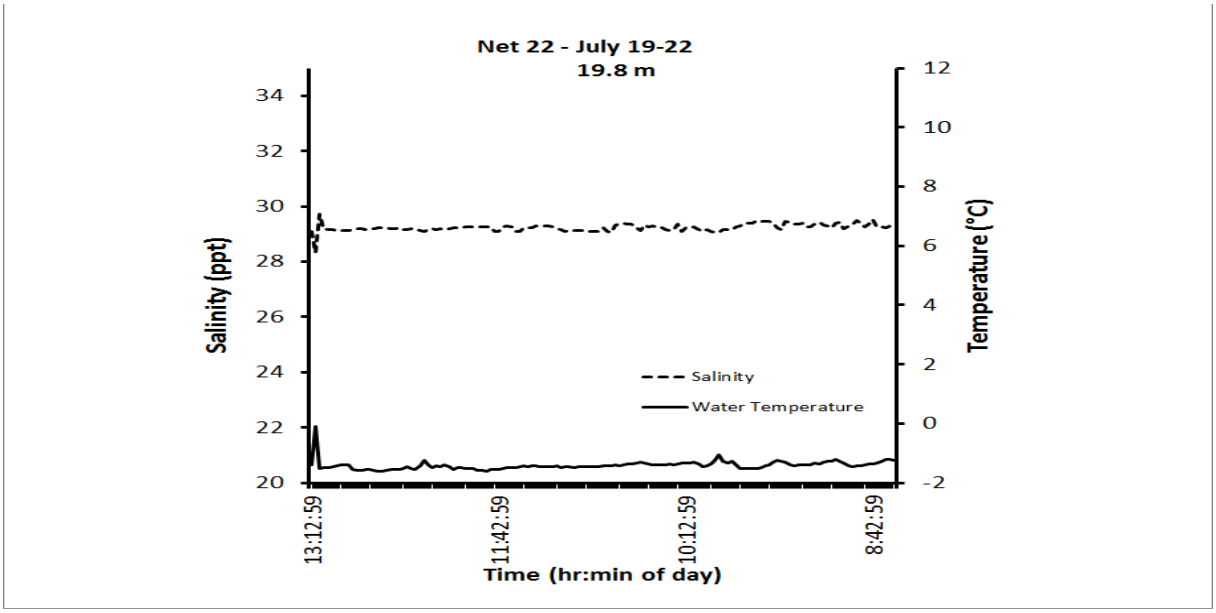

Figure C.9. Net #22 time series data of water temperature and salinity from Brown's Harbour, 2015 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Staghorn Sculpin (n=1).

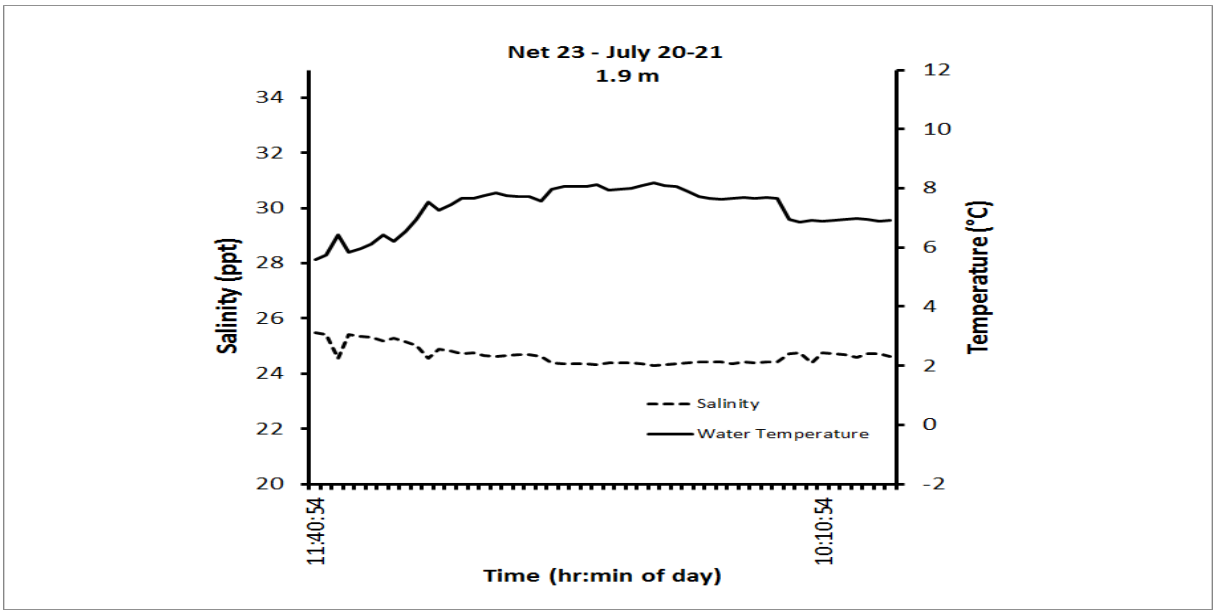

Figure C.10. Net #23 time series data of water temperature and salinity from Brown's Harbour, 2015 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Fourhorn Sculpin (n=1).

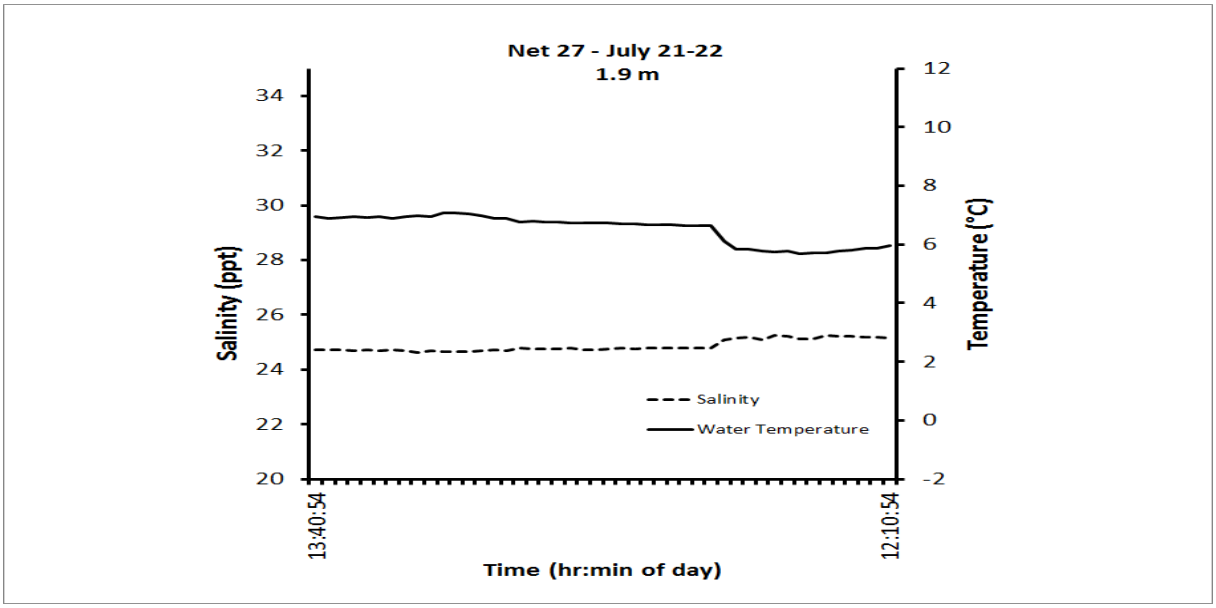

Figure C.11. Net #27 time series data of water temperature and salinity from Brown's Harbour, 2015 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Fourhorn Sculpin (n=3), Greenland Cod (n=2) and Shorthorn Sculpin (n=3).

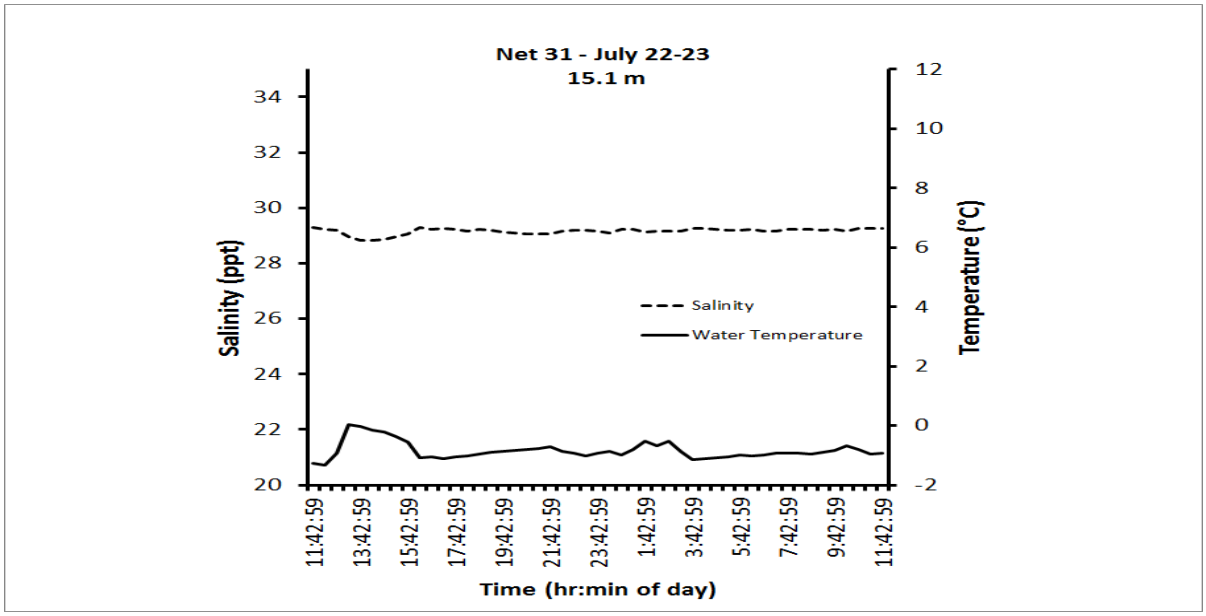

Figure C.12. Net #31 time series data of water temperature and salinity from Brown's Harbour, 2015 using a 60 m, 6 panel, multi-mesh gill net. No species were sampled during this effort.

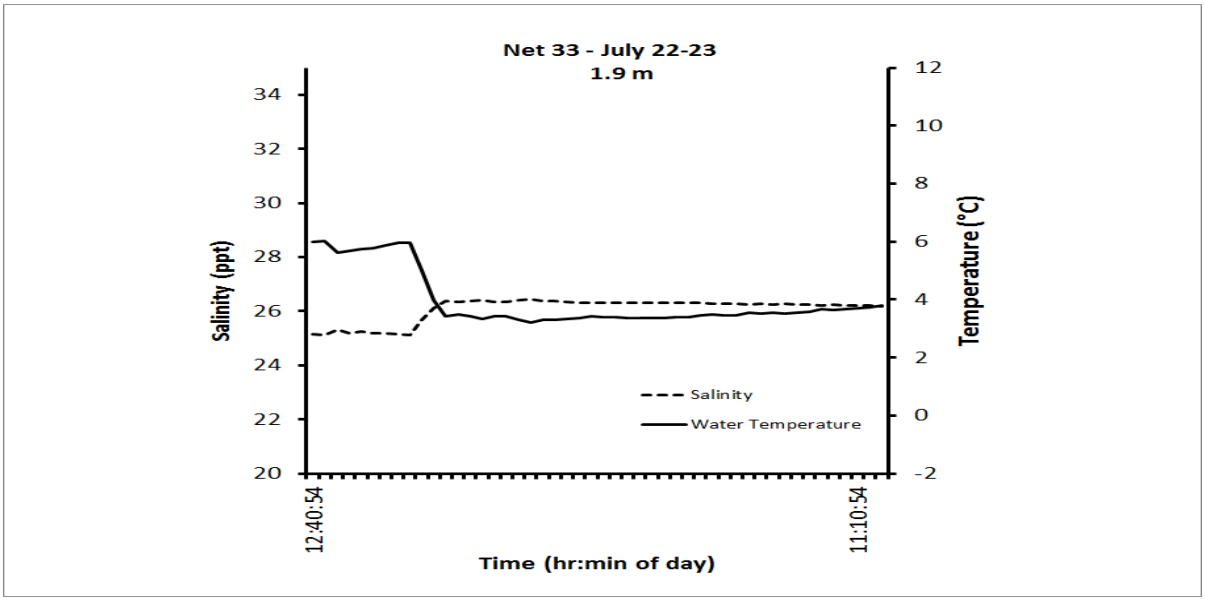

Figure C.13. Net #33 time series data of water temperature and salinity from Brown's Harbour, 2015 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Cisco (n=5), Fourhorn Sculpin (n=2) and Shorthorn Sculpin (n=3).

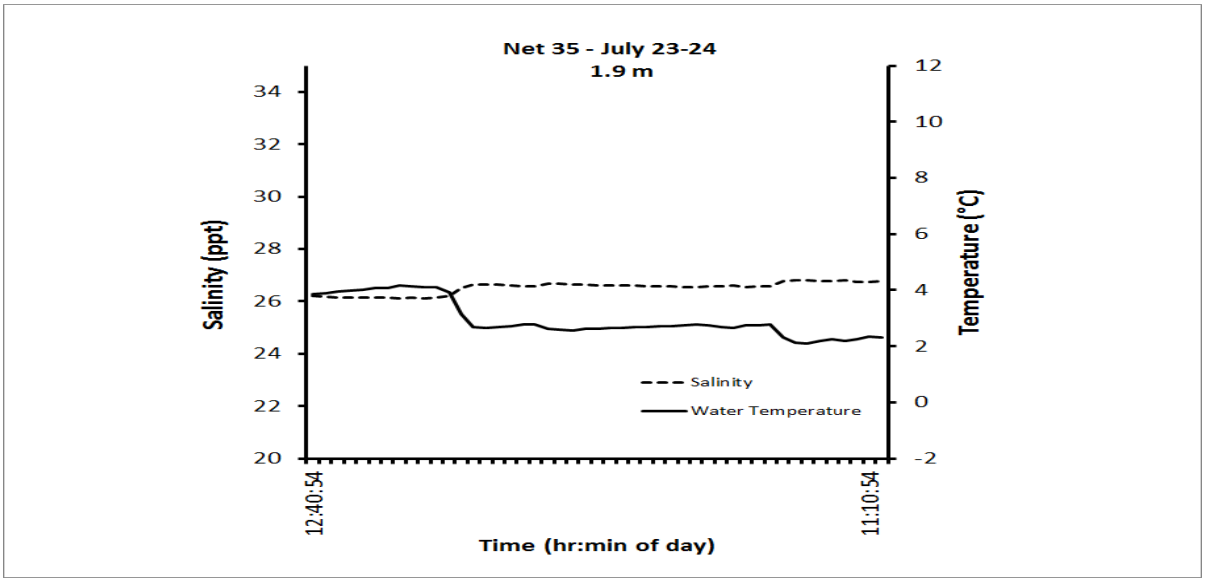

Figure C.14. Net #35 time series data of water temperature and salinity from Brown's Harbour, 2015 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Fourhorn Sculpin (n=1) and Shorthorn Sculpin (n=1).

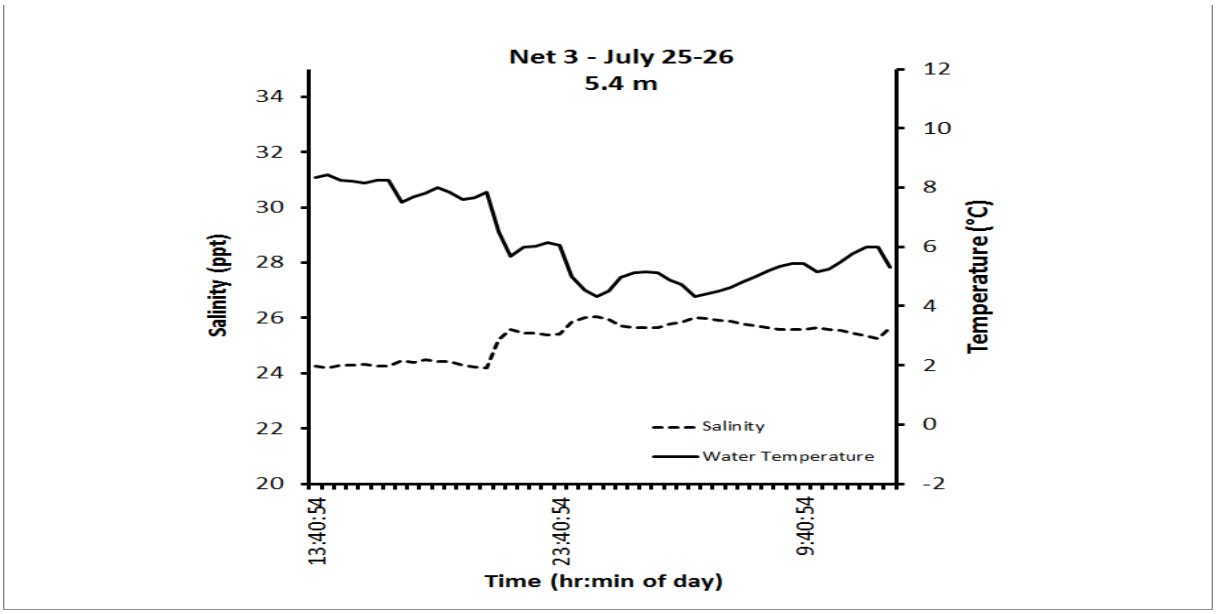

Figure C.15. Net #3 time series data of water temperature and salinity from Bennett Point, 2015 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Flounder (n=1), Fourhorn Sculpin (n=1), Shorthorn Sculpin (n=4) and Starry Flounder (n=2).

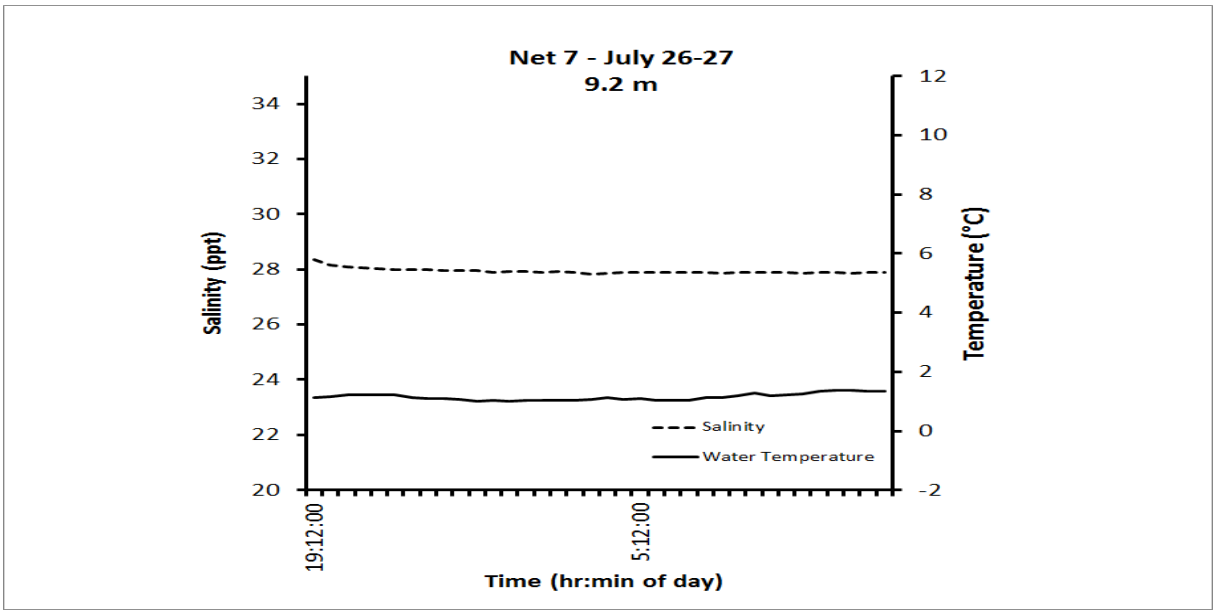

Figure C.16. Net #7 time series data of water temperature and salinity from Bennett Point, 2015 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Greenland Cod (n=3), Pacific Herring (n=1) and Shorthorn Sculpin (n=7).

APPENDIX D – TEMPERATURE AND SALINITY OF 2016 NET SETS

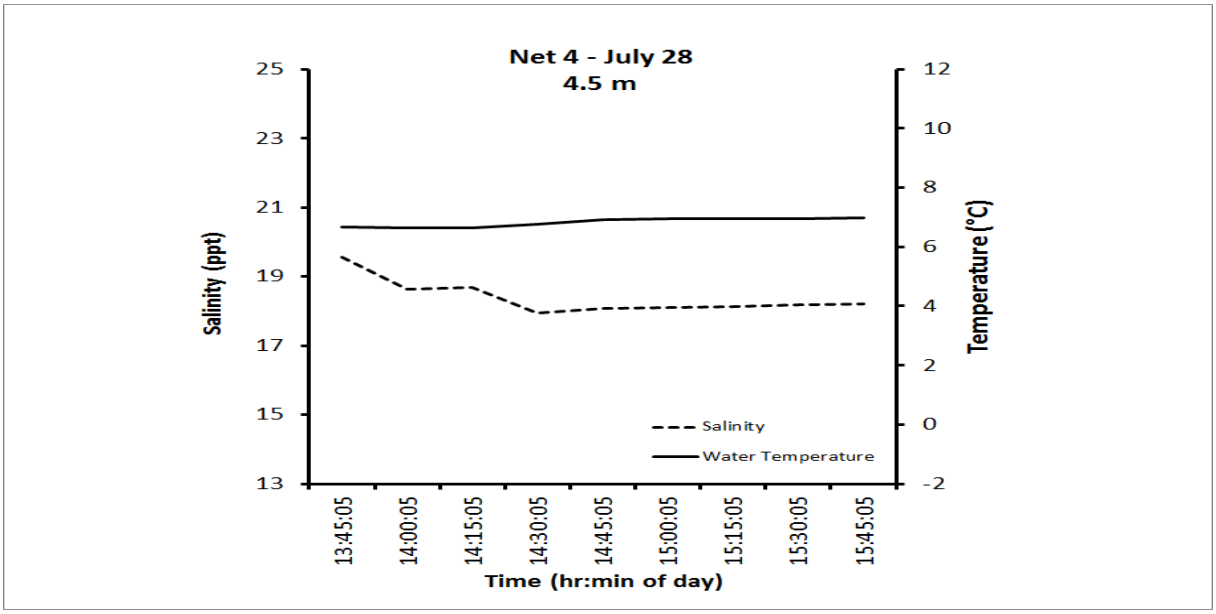

Figure D.1. Net #4 time series data of water temperature and salinity from Argo Bay, 2016 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Flounder (n=2) and Starry Flounder (n=2).

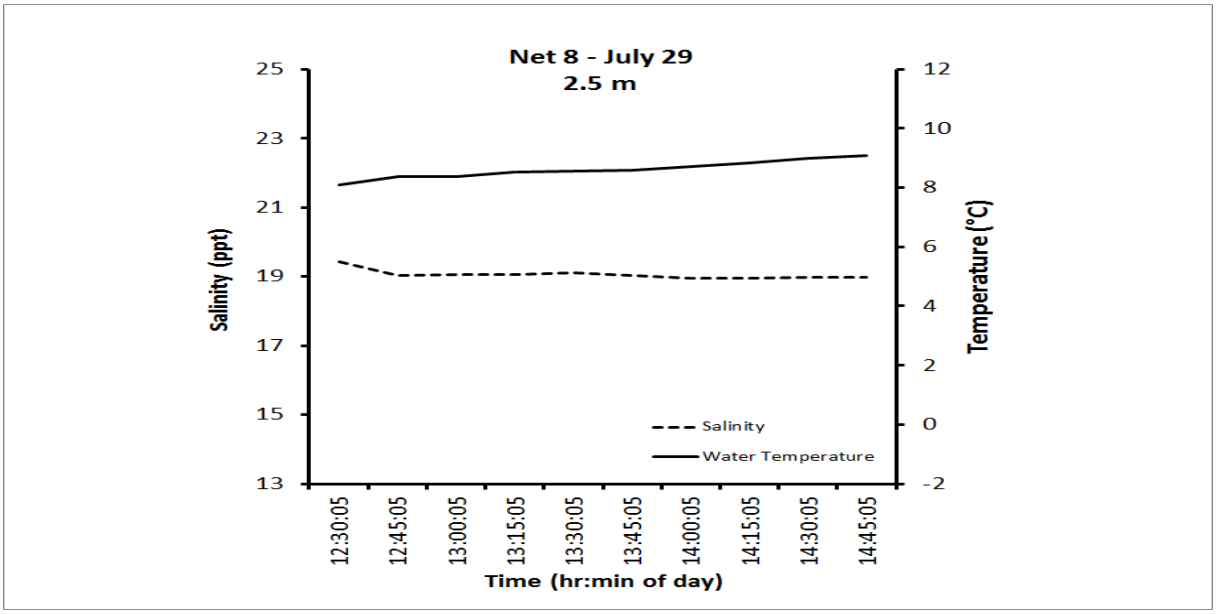

Figure D.2. Net #8 time series data of water temperature and salinity from Argo Bay, 2016 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Char (n=1), Arctic Flounder (n=31), Broad Whitefish (n=1) and Starry Flounder (n=27).

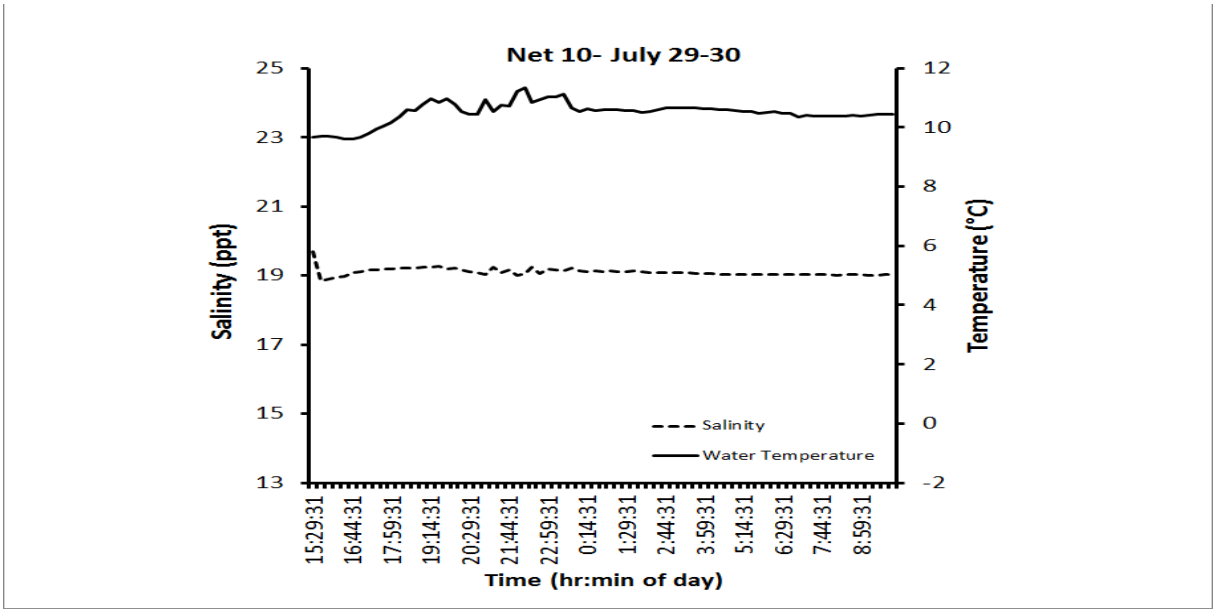

Figure D.3. Net #10 time series data of water temperature and salinity from Argo Bay, 2016 using a trap net. Species sampled during this effort: Arctic Flounder (n=5), Broad Whitefish (juvenile; n=140), Ninespine Stickleback (n=1) and Saffron Cod (n=4).

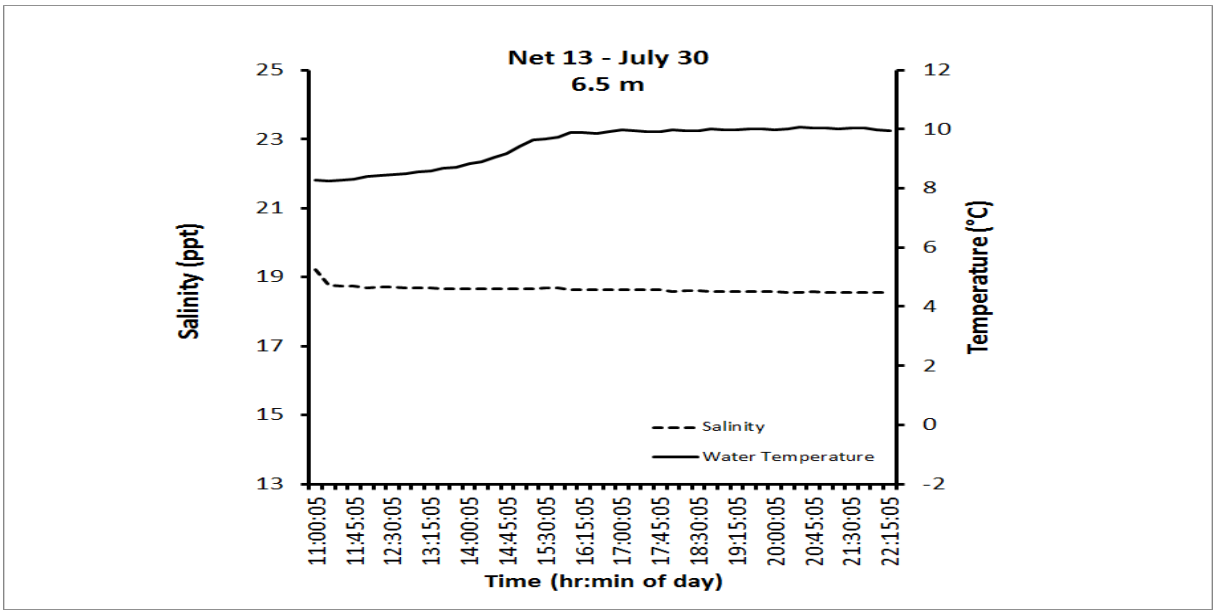

Figure D.4. Net #13 time series data of water temperature and salinity from Argo Bay, 2016 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Flounder (n=24), Fourhorn Sculpin (n=1), Pacific Herring (n=2), Saffron Cod (n=3), Shorthorn Sculpin (n=2) and Starry Flounder (n=2).

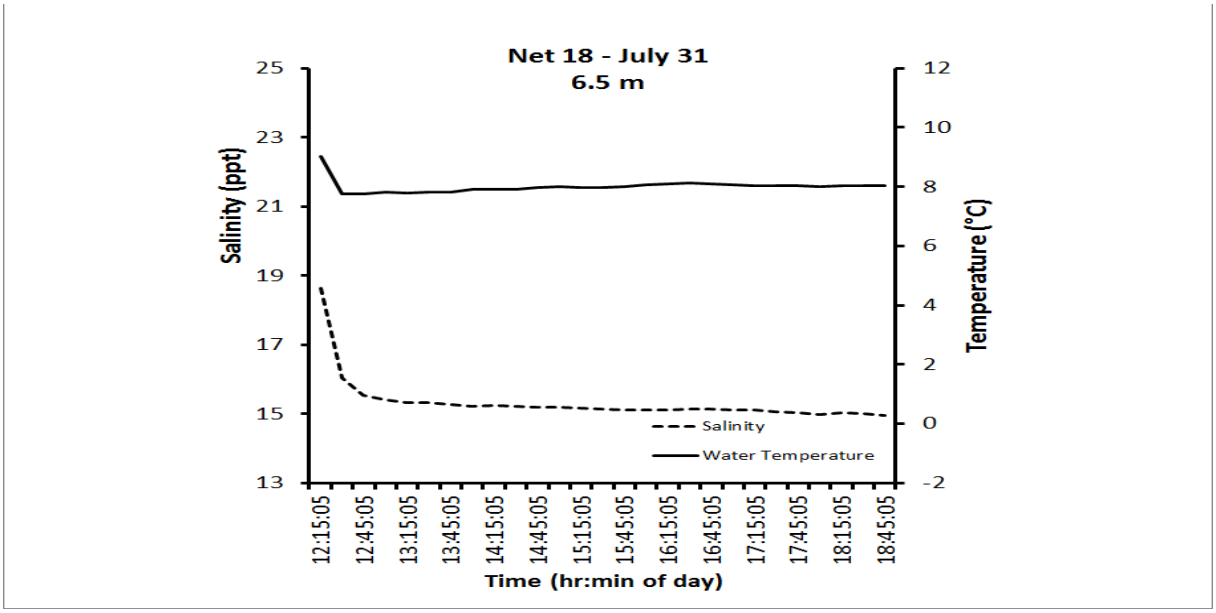

Figure D.5. Net #18 time series data of water temperature and salinity from Argo Bay, 2016 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Flounder (n=10) and Fourhorn Sculpin (n=2).

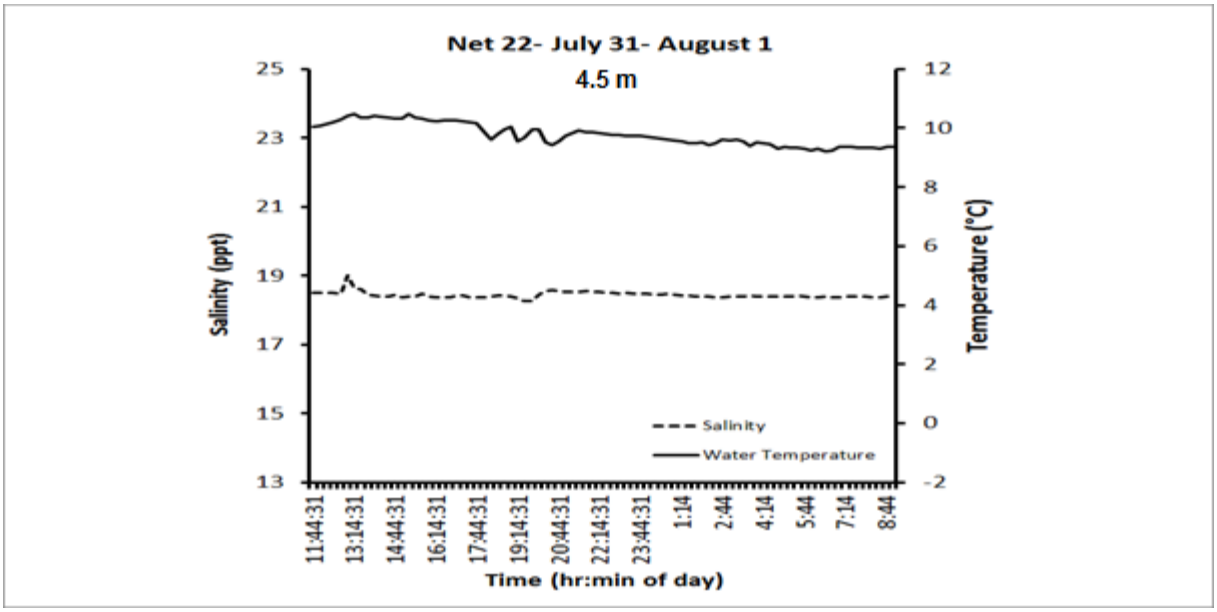

Figure D.6. Net #22 time series data of water temperature and salinity from Argo Bay, 2016 using a 60 m, 6 panel, multi-mesh gill net. No species were sampled during this effort.

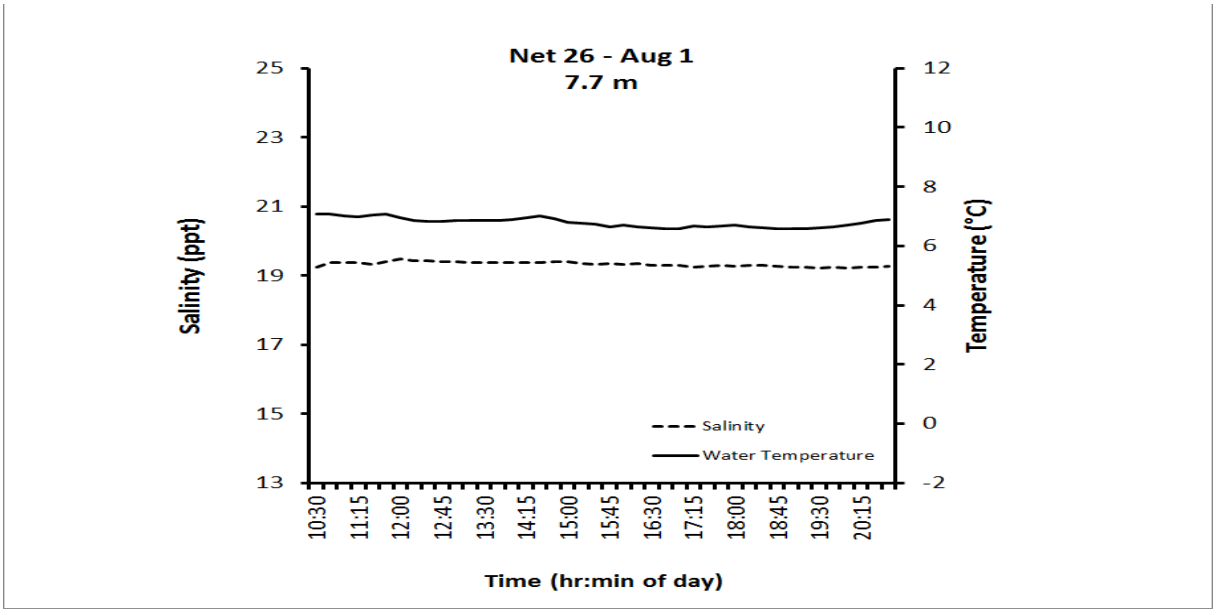

Figure D.7. Net #26 time series data of water temperature and salinity from Argo Bay, 2016 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Flounder (n=9), Saffron Cod (n=4) and Shorthorn Sculpin (n=1).

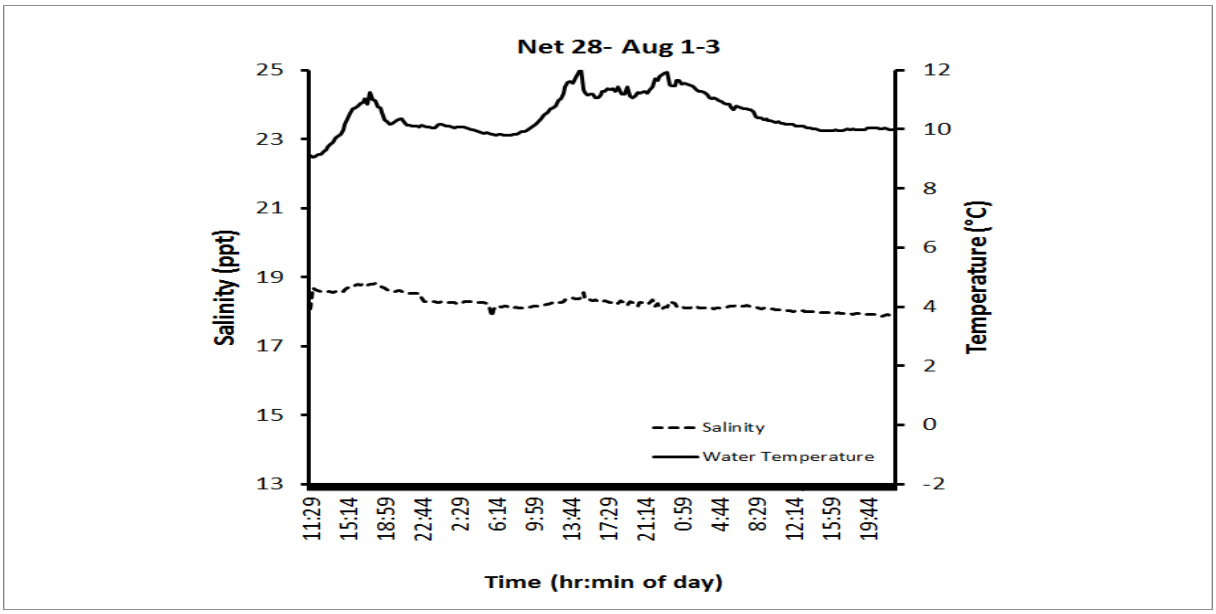

Figure D.8. Net #28 time series data of water temperature and salinity from Argo Bay, 2016 using a trap net. No species were sampled during this effort.

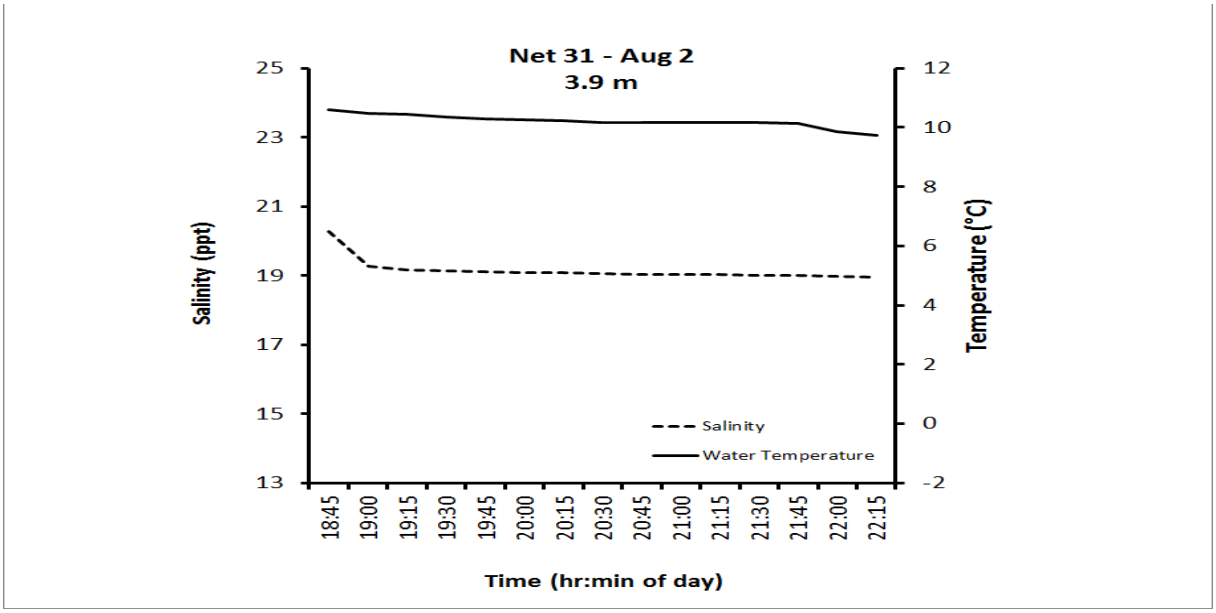

Figure D.9. Net #31 time series data of water temperature and salinity from Argo Bay, 2016 using a 60m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Flounder (n=4), Saffron Cod (n=4) and Starry Flounder (n=3).

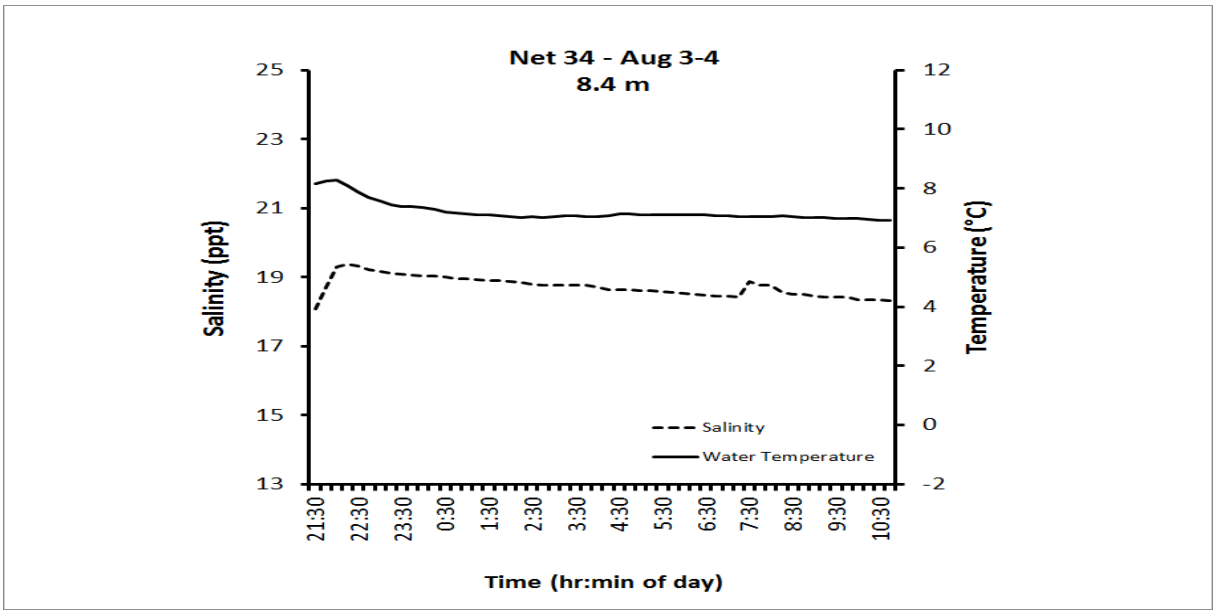

Figure D.10. Net #34 time series data of water temperature and salinity from Argo Bay, 2016 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Flounder (n=2), Arctic Staghorn Sculpin (n=6), Fourhorn Sculpin (n=1), Saffron Cod (n=22), Shorthorn Sculpin (n=3), Slender Eelblenny (n=1) and Starry Flounder (n=1).

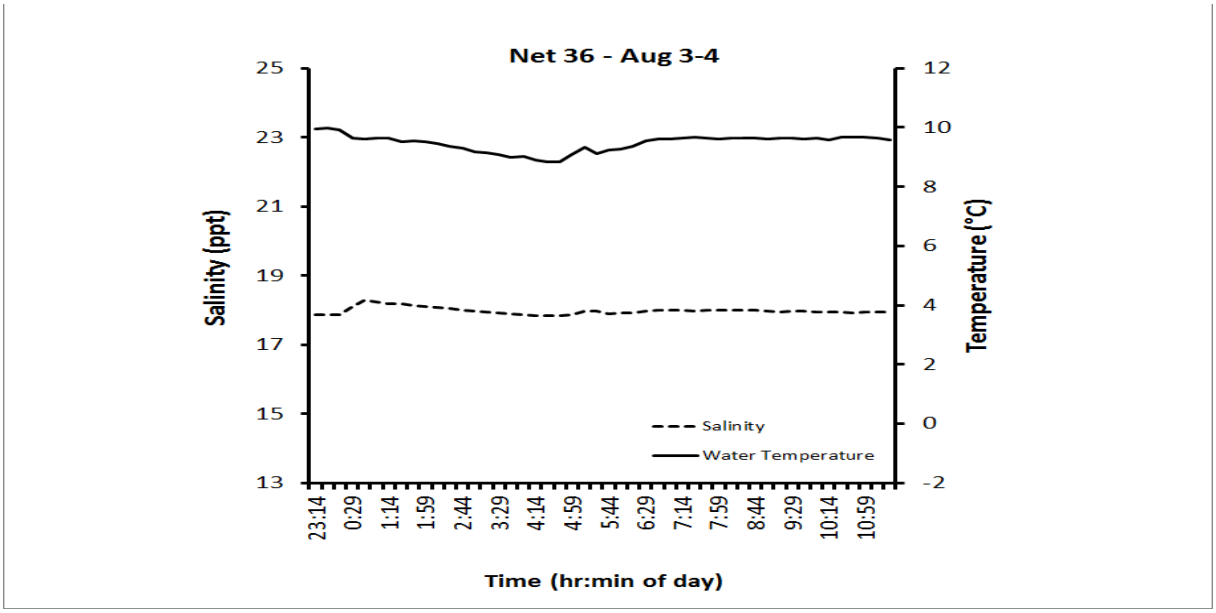

Figure D.11. Net #36 time series data of water temperature and salinity from Argo Bay, 2016 using a trap net. Species sampled during this effort: Arctic Shanny (n=1) and Capelin (n=1).

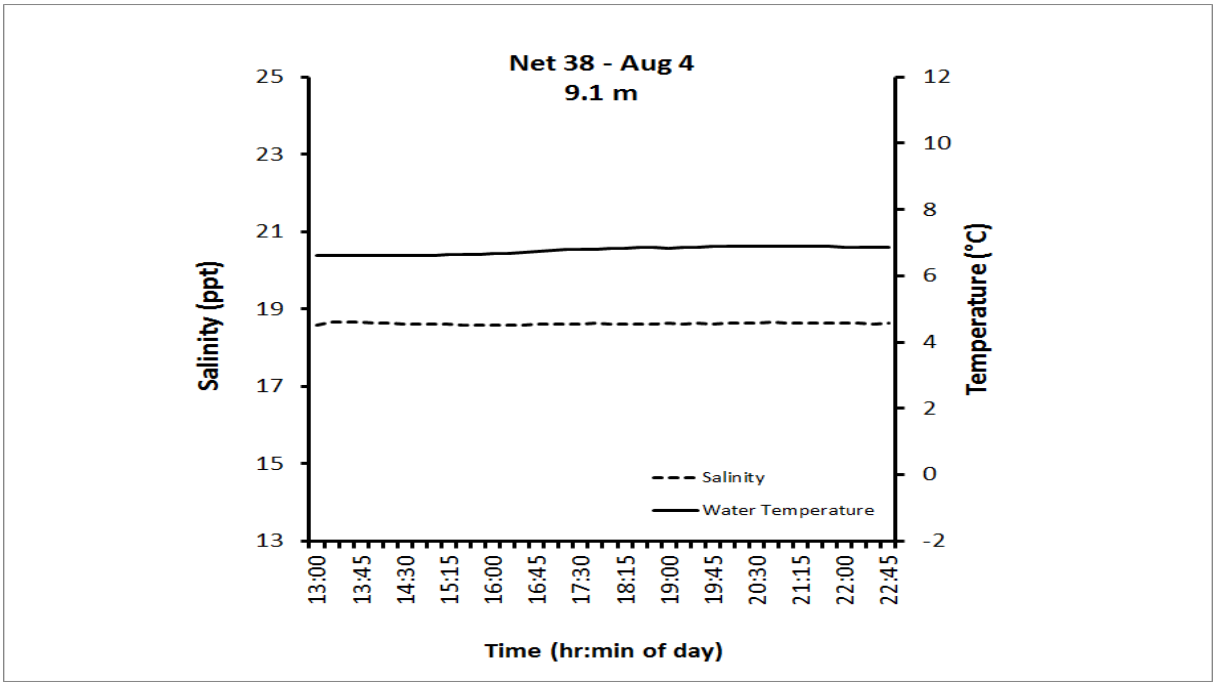

Figure D.12. Net #38 time series data of water temperature and salinity from Argo Bay, 2016 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Flounder (n=1), Saffron Cod (n=6) and Shorthorn Sculpin (n=2).

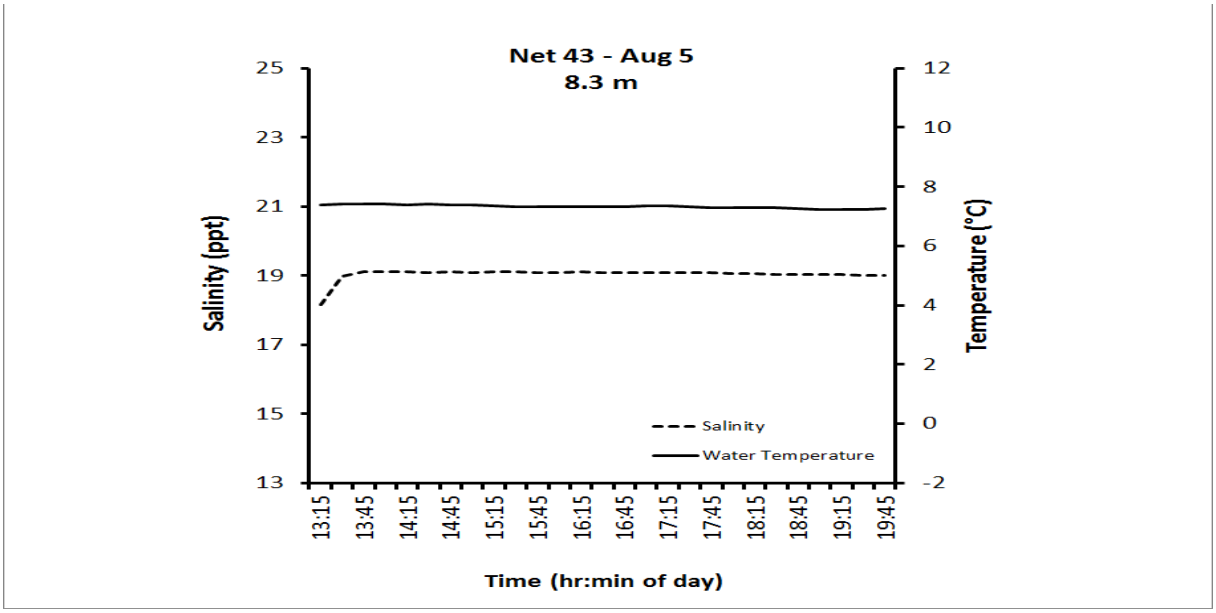

Figure D.13. Net #43 time series data of water temperature and salinity from Argo Bay, 2016 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Flounder (n=4), Fourhorn Sculpin (n=1), Saffron Cod (n=1) and Starry Flounder (n=1).

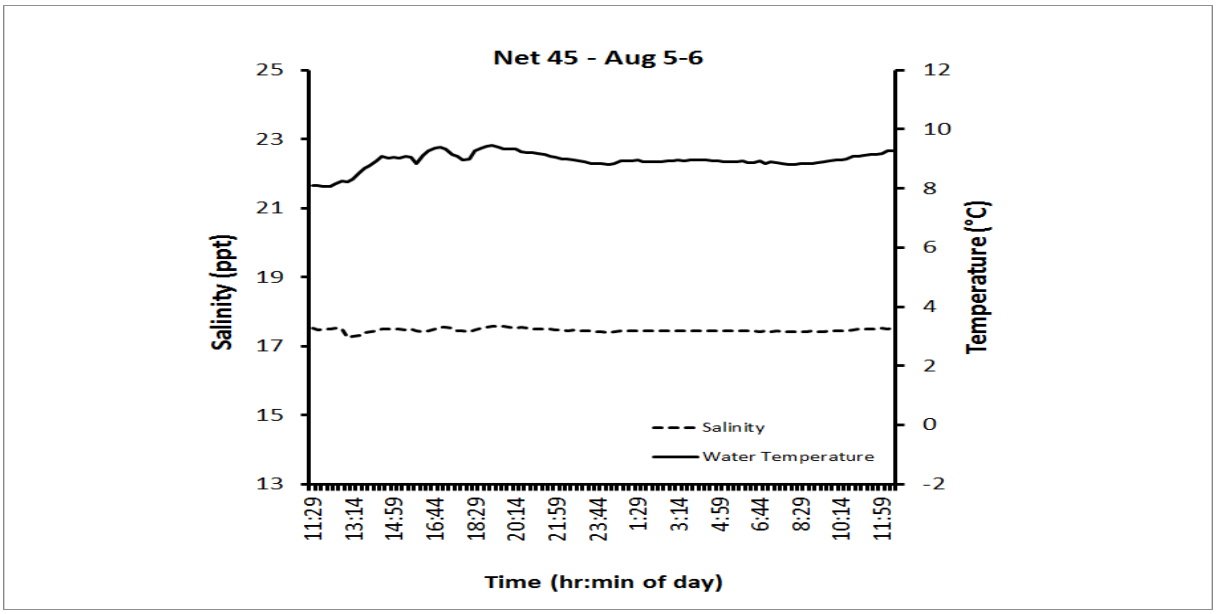

Figure D.14. Net #45 time series data of water temperature and salinity from Argo Bay, 2016 using a trap net. No species were collected during this sampling effort.

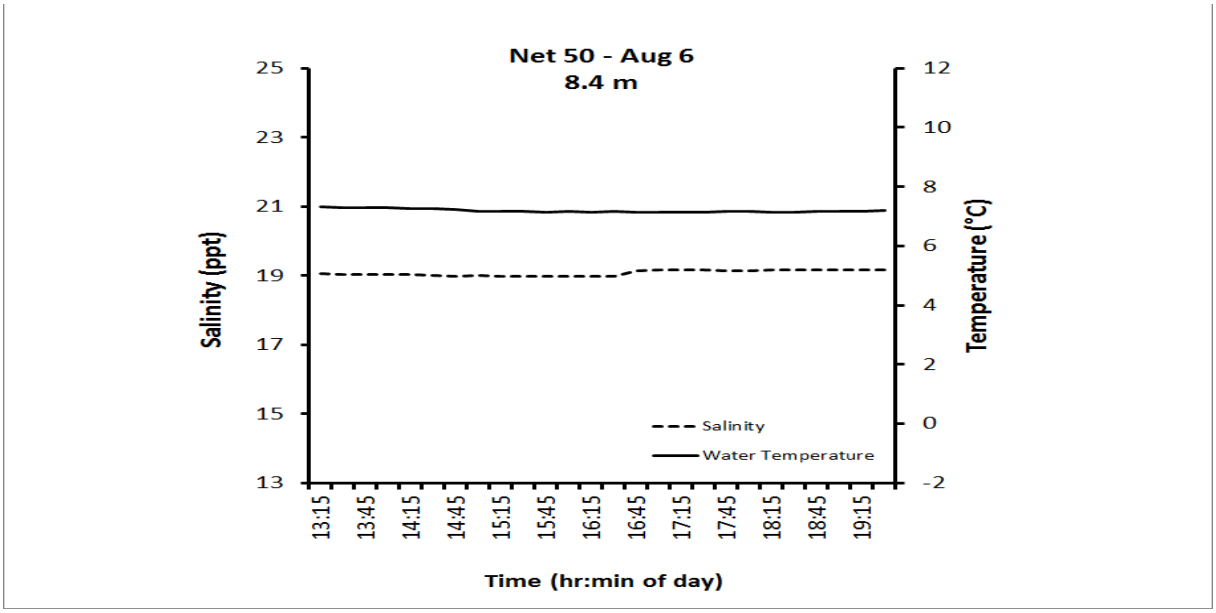

Figure D.15. Net #50 time series data of water temperature and salinity from Argo Bay, 2016 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Flounder (n=1), Fourhorn Sculpin (n=1) and Shorthorn Sculpin (n=2).

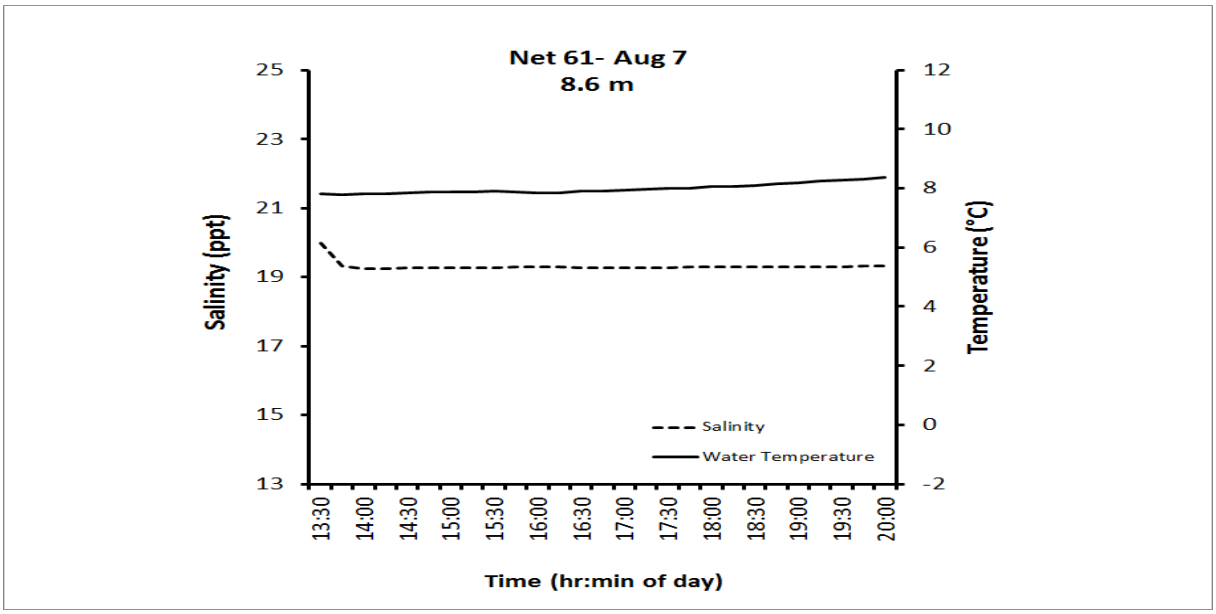

Figure D.16. Net #61 time series data of water temperature and salinity from Argo Bay, 2016 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Flounder (n=1), Fourhorn Sculpin (n=3) and Shorthorn Sculpin (n=1).

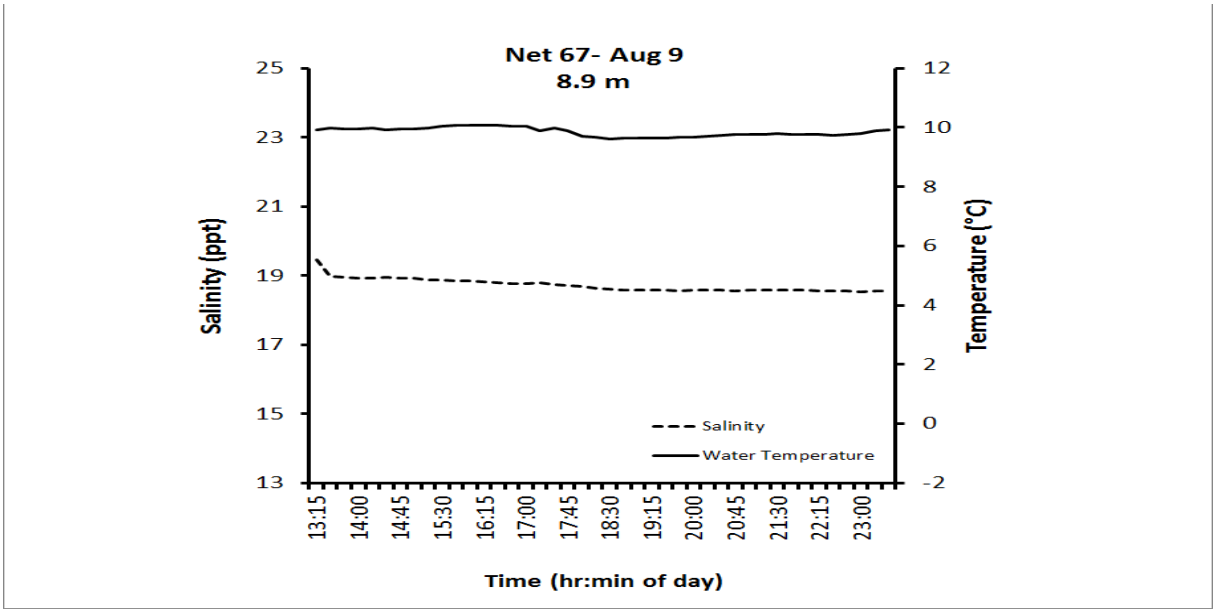

Figure D.17. Net #67 time series data of water temperature and salinity from Argo Bay, 2016 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Flounder (n=6), Arctic Staghorn Sculpin (n=1), Fourhorn Sculpin (n=2), Saffron Cod (n=4) and Starry Flounder (n=6).

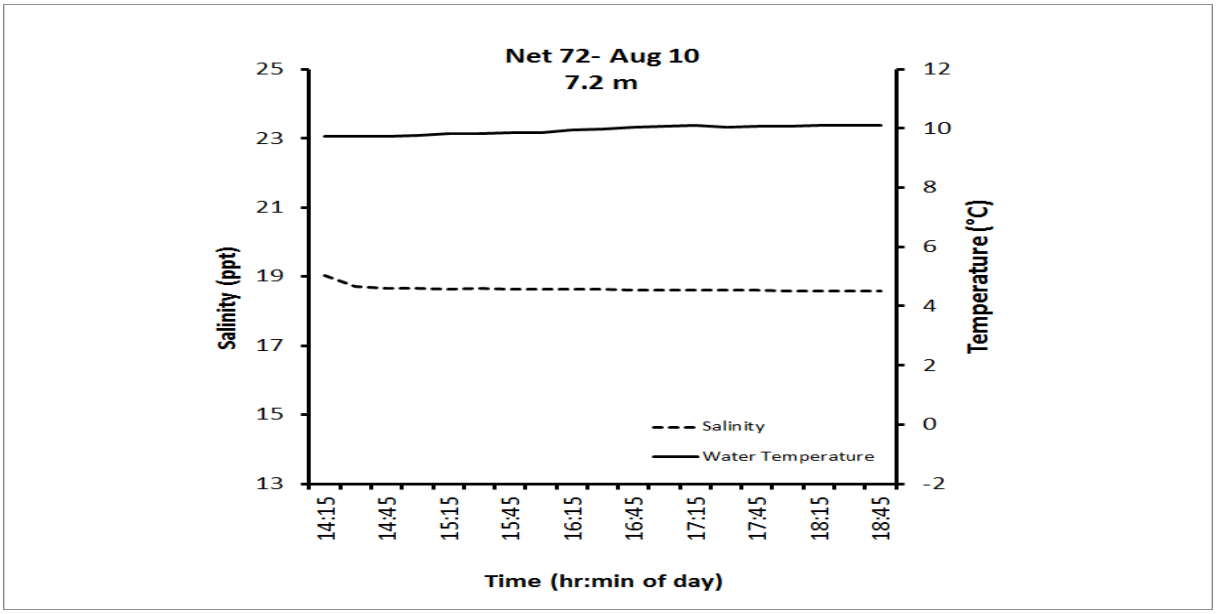

Figure D.18. Net #72 time series data of water temperature and salinity from Argo Bay, 2016 using a 60 m, 6 panel, multi-mesh gill net. Species sampled during this effort: Arctic Flounder (n=1) and Starry Flounder (n=3).

APPENDIX E- MATURITY CODES OF FISHES

Maturity State	Female (2)		Male (1)	
	Code	Description	Code	Description
Immature	1	- Ovaries granular in texture - Hard and triangular in shape - Up to full length of body cavity - Membrane full - Eggs distinguishable	6	- Testes long and thin - Tubular and scalloped shape - Up to full body length - Putty-like firmness
Mature	2	- Current year spawner - Ovary fills body cavity - Eggs near full size but not loose - Eggs not expelled by pressure	7	- Current year spawner - Testes large and lobate - White to purplish color - Centers may be fluid - Milt not expelled by pressure
Ripe	3	- Ovaries fill body cavity - Eggs full size and transparent - Eggs expelled by slight pressure	8	- Testes full size - White and lobate - Milt expelled by slight pressure
Spent	4	- Spawning complete - Ovaries ruptured and flaccid - Developing oocytes visible - Some retained eggs	9	- Spawning complete - Testes flaccid with some milt - Blood vessels obvious - Testes violet-pink in color
Resting	5	- Ovary 40-50% of body cavity - Membrane thin, loose, and semi-transparent - Healed from spawning - Developing oocytes apparent with few atretic eggs - Some eggs may be retained in body cavity	10	- Testes tubular, less lobate - Healed from spawning - No fluid in center - Usually full length - Mottled and purplish in color
Female or Male				
Unknown	0	- Cannot be sexed - Gonads long or short and thin - Transparent and translucent	11	- Resting fish - Spawning complete, gonads not regenerated - Sexing not possible