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NAFO STACFEN Report 2016

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Abstract

The Marine Environmental Data Section (MEDS) of the Oceans Science branch, as the Regional Environmental Data Center for NAFO, is required to provide an annual inventory of environmental data collected in the NAFO Convention Area to the NAFO subcommittee for the environment (STACFEN). Inventories and maps of physical oceanographic observations such as ocean profiles, near surface thermosalinographs, drifting buoys, currents, waves, tides and water level measurements for the calendar year 2016 are included.

It is important for STACFEN to encourage members to send data and information to the designated data center in order to get significant return for NAFO member countries.

Introduction

The Marine Environmental Data Section (MEDS) of the Oceans Science branch of DFO acts as Regional Environmental Data Center for NAFO. This role began in 1965 when the Canadian Oceanographic Data Centre started providing data management functions to ICNAF, and was subsequently formalized in 1975 by which time the CODC had become the Marine Environmental Data Service (MEDS). MEDS underwent several name changes from 2005 to 2016, it was known in the interim under acronyms such as ISDM and OSD.

In order for MEDS to carry out its responsibility of reporting to the Scientific Council, the Designated National Representatives selected by STACFEN are requested to provide MEDS with all marine environmental data collected in the Northwest Atlantic for the preceding years.

Provision of a meaningful report to the Council for its meeting in June 2017 required the submission to MEDS of a completed oceanographic inventory form for data collected in 2016, and oceanographic data pertinent to the NAFO Convention Area, for all stations occupied in the year prior to 2016. The

data of highest priority are those from the standard sections and stations, as described in NAFO SCR DOC., No. 1, Serial N 1432, 9p.

Data that have been formatted and archived at MEDS are available to all members on request, or are available from DFO institutes. Requests can be made by telephone (613) 990-6065, by e-mail to info@dfo-mpo.gc.ca, by completing an on-line order form on the MEDS web site at http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/request-commande/form-eng.asp or by writing to Oceans Science branch, Fisheries and Oceans Canada, 12th Floor, 200 Kent St., Ottawa, Ont. Canada K1A 0E6.

Data Processing and Management

In the NAFO Convention Area, a variety of oceanographic surface, near-surface and subsurface observations, including vertical profiles of parameters such as temperature, salinity, oxygen, nutrients and other chemical and biological variables, are being made every day by ships borne instruments and autonomous devices. The Marine Environmental Data Section (MEDS) of the Oceans Science Branch of DFO receives these data either in real-time or delayed mode.

Real-time or near real-time data are acquired either directly from instruments (for instance, Argo Canada profilers), from research ships or ships of opportunity, from universities, from DFO research institutes, from the Global Telecommunication System of the World Meteorological Organization and the NOAA's Geostationary Satellite Server. Some real-time data transmitted over satellite or low bandwidth communications are pre-formatted in a way that reduces their vertical resolution or significant figures. Such data receive some form of quality control but generally do not benefit from the calibration made possible after a cruise or an instrument's recovery (in the case of moored equipment or remote controlled devices).

Delayed mode data are acquired through exchanges with research institutes, universities and other ocean databases, such as the World Ocean Database (WOD, NOAA & WDS) and the ICES Oceanographic database. The delayed mode data generally takes from months to years to process after a cruise is over or after an instrument has been recovered. For this reason, MEDS continually receives delayed mode data from years preceding the previous observation years and must also query the aforementioned international databases (ICES, WOD) for observational periods covering a number of years.

Most real-time data are subject to be replaced with a delayed mode version when available, and even delayed mode data are sometimes subject to recalibration, at which point it must be updated in the archives.

Data processing at MEDS begins by reformatting files from their original formats into a common format. Quality control is carried out by a combination of specially designed software and trained personnel. The quality control has four main functions. The first is to check and ensure that each data message is properly formatted, units are standardized, and parameter range checks are performed. The second is to identify any duplication, and select the best version based on data type, source of the data, and general qualities in analysis and reporting of the observations. The third is to identify and correct date/time and geographical positioning errors using computer tests and visual inspection of the track for each cruise. The final quality control procedure uses a series of algorithms to find and flag common instrument failures found in profiles or series of subsurface measurements. These algorithms depend on data, platform and/or observation program type.

Data Summary

The data collected in the NAFO Convention Area (NCA) can be grouped by a number of ways (variable type, sampling type, platform type, real-time vs. delayed mode, source, etc.). To facilitate table and geographical representation, the categorization behind tables and figures differs slightly. The following table summarizes counts for 2016 by data type with a correspondence to the figures (p. 8-10) and tables (p. 11-23) where more information can be found.

Data observed in NAFO Convention Area in 2016 and acquired in 2016 and from January to May 2017

Data Type	Platform Type	Counts/Duration	Table #	Figure #
Oceanographic profiles	autonomous platforms	7107* profiles from 146 platforms	1	1
	Ship	5847 profiles (2973 CTD; 1093 CTD*; 110 bottle and 671 XBT profiles) from 19 ships	2	2a
Surface/near-surface observations	ship (thermosalinograph)	15665* obs. from 2 ships	2	3
	drifting buoys	688423* obs. from 198 buoys	3	3
	moored buoys	167633* obs. from 26 buoys**	3	3
	fixed platforms	101438* obs. from 3 platforms	3	3
	water level gauges	22 sites, avg. ~1 year each	5	3
Sub-surface observations	Moored current-meter, CTD, thermograph, ADCP	19 time series, ~314 days each	4	4a

*Data formatted for real-time transmission

**all Canadian wave buoys described in this report measure waves

Data observed prior to 2016 in NAFO Convention Area and acquired in 2016 and from January to May 2017

Data Type	Platform Type	Counts/Duration	Table #	Figure #
Oceanographic profiles	Ship	2876 profiles (2686 CTD + 190 bottle** profiles) from 11 ships	2	2b
Sub-surface observations	Moored thermograph	18 time series, ~434 days each	4	4b

*Data formatted for real-time transmission

**The amount of bottle data profiles measured prior to 2016 and loaded in BioChem in 2016 could not be fully assessed

Description

Oceanographic profiles

Argo (figure 1, table 1)

Argo is an international program which started in 2000 with aims to deploy profiling floats on a 3 by 3 degree grid in the oceans of the world. Each profiling float samples and reports both temperature and salinity from 2000 m to the surface every 10 days. Some of the floats also report oxygen. Data are distributed on the Global Telecommunications System (GTS) of WMO within 24 hours of collection and made available on two mirror Global servers located in France and in the USA.

MEDS performs the data management duties of Argo Canada profilers from instrument to the GTS and global servers. MEDS also decodes and stores all Argo data circulating on the GTS. Over 3900 Argo profiling floats are currently sampling the world oceans. The distribution of profiles measured by floats operated by four countries (26% Canada, 28% USA, 20% France, 16% Germany, 6% UK and Norway 4%) in the NCA, in 2016, highlights the success of Argo as an international project.

Argo-equivalent (figure 1, table 1)

Autonomous profiling floats who do not follow the aforementioned Argo sampling pattern are often designated Argo-equivalent. In 2016, two floats belonging to the Alamo program of the Woods Hole Oceanographic Institute drifted through the shelf-slope area. Alamo floats are air-deployed and smaller than typical Argo floats; they can sample the ocean either in rapid seesaw or daily profile mode. Two non-Argo profilers from Canada also too samples in the NCA in 2016; both were NOVA floats. One had a different CTD than commonly used in the Argo program and was deployed in the Labrador Sea, the other had been deployed in the Gulf of St. Lawrence in 2015 and reported until Jan 15 2016.

Gliders (figure 1, table 1)

Underwater gliders are autonomous underwater vehicles following saw tooth-like profiles in the ocean while measuring various parameters, during missions that can last months and extend over thousands of kilometers.

DFO regularly acquires data from the Ocean Tracking Network (headquartered at Dalhousie University) owned gliders, both active in NCA, and MEDS creates messages for transmission on the GTS after performing automatic quality control. MEDS also decodes and stores all glider data circulating on the GTS. Exceptionally this year, the Ocean Tracking Network deployed a glider in the

southern Gulf of St. Lawrence, off Cap d'Espoir (Québec), with the goal to detect whales with a passive digital monitoring instrument all the while measuring physical parameters and chlorophyll.

Mammals (figure 1, table 1)
Among data decoded by MEDS from the GTS are real-time data transmitted by the Sea Mammal Research Units of University of St Andrews (Scotland). These data are measured by tags featuring miniaturized CTD sensors attached to marine mammals and transmitting oceanographic data in real-time when the animals surface. These devices are used by a variety of researchers worldwide. In 2016 a few observations were made in and around Disko Bay (Greenland) by 3 animals.

Ships (figures 2a & 2b, table 2)
MEDS receives real-time (within 30 days of observation) messages containing temperature and salinity profile data (either from CTD or XBT) from various Canadian Coast Guard ships, helicopter or opportunity vessels performing research or monitoring activities. The messages are sometimes sent from the ships or shortly after the ship's return. The data are quality controlled (see reference, GTSPP QC manual) prior to transmission on the GTS (if within 30 days of observation) or ingestion in the archive.

MEDS decodes and stores all ship based data circulating on the GTS, either CTD or XBT. Some of this data are sampled by ships of opportunity

MEDS further receives delayed mode data from DFO institutes: Northwest Atlantic Fisheries Centre, Bedford Institute of Oceanography (BIO), Maurice-Lamontagne Institute (MLI), St. Andrews' Biological Station, Gulf Fisheries Center (GFC, indirectly through BIO or MLI) and the Freshwater Institute (FWI), which it then ingests after conversion and visual quality assurance.

MEDS also receives delayed mode data from foreign institutes and queries the World Ocean Database and ICES Oceanographic Database for additional data in the NAFO Convention Area (NCA). This year, MEDS also downloaded data from the Spanish Institute of Oceanography which had been made available on SeaDataNet, upon notification. Comparisons are made between various sources to ensure always store the most recently calibrated data and with the most available number of fields.

<u>Near-surface observations</u>

Moored buoys and fixed stations (figure 3, table 3)
MEDS continuously acquires data from meteorological buoys in Canadian waters equipped with ocean data acquisition systems. These buoys belong to Environment and Climate Change Canada (Meteorological Service of Canada) and measure wind velocity, air and water temperature, pressure and wave spectral energy with estimated period and significant wave height. All data are currently acquired via the Geostationary Operational Environmental Satellite (GOES), on which the buoys transmit, but in some situations the data is acquired in delayed-mode or from the GTS. The wave data has quality flags assigned by a combination of automated algorithms and a visual inspection of the spectral shape.

MEDS also acquires, in delayed mode, data from wave measuring buoys deployed collected near offshore oil and gas sites as per NEB Guidelines. Data submissions from a wave buoy location for years 2012-2013 were archived at MEDS.

The MLI maintains a network of surface buoys, sometimes with subsurface moored instruments such as ADCPs (see mooring section).

A number of US moored buoys and fixed stations in the NCA transmit data on the GTS, and those are

also acquired by MEDS. The stations belong to various institutions but their data management is coordinated by NOAA's National Data Buoy Center. Their positions are typically near the coast.

Drifting buoys (figure 3, table 3)
MEDS decodes and stores all drifting buoy data circulating on the GTS. Like in Argo, these buoys are deployed by various countries. Most buoys are designed for the Surface Velocity Program and are drogued at 15 m depth. The data reported are temperature and sometimes salinity. The buoy calculated displacement, over time, provides an estimation of currents at the drogued depth.

Thermosalinographs (figure 3, table 2)
MEDS decodes and stores all thermosalinograph data circulating on the GTS. In 2016, only two ships reported thermosalinograph data in the NCA.

Sub-surface moorings (figures 4a-4b, table 4)
Current meters and other instruments such as CTDs and thermistors have been deployed in the NCA along mooring lines, under the surface, for many years. Depending on location, the data are processed and archived by the BIO or MLI.

Water level gauges (figure 3, table 5)
MEDS processes and archives observed water level data collected from the gauge network maintained by the Canadian Hydrographic Service (CHS), plus a few stations operated by Environment and Climate Canada (Water Survey of Canada). Over 2 million new observations are archived every month.

Other Activities

Atlantic Zone Monitoring Program

The DFO Atlantic Zone Monitoring Program (AZMP) activities include regular sampling at 5 fixed stations and 16 standard sections, various monitoring and survey activities and research cruises in the AZMP area to collect other physical, chemical and biological data. MEDS continues to build and maintain the AZMP web site: http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/azmp-pmza/index-eng.html.

The wealth of data and information on the site includes:

- Physical and chemical data from 1999 to the present such as CTD, bottle and bathythermograph measurements
- Climate indices showing long term trends of physical variables in the water and atmosphere.

The data collected as part of AZMP is also compiled in figures and tables pertaining to ship observations. A climate index of area vs. bottom temperature-range distribution of bottom waters calculated for four NAFO sub-areas (4X, 4W, 4Vn, 4Vs), for the Northern Gulf and Magdalen Shallows, is made available along with other climate indices on the AZMP website.

Aquatic Invasive Species (AIS)

Aquatic Invasive Species are a major threat to Canada's fisheries and aquaculture industry and have been entering Canadian waters for centuries but never as rapidly as today. Every decade, some 15 alien species establish themselves in our coastal or inland waters. In the absence of their natural predators, the most aggressive of them spread rapidly. They can radically alter habitat, rendering it inhospitable for native species. The zebra mussel and sea lamprey are examples of such species that have greatly affected the Great Lakes.

The most effective approach to dealing with this threat involves managing the pathways through which invasive species enter and spread through Canadian waters. For aquatic species these pathways are shipping, recreational and commercial boating, the use of live bait, the aquarium/water garden trade, live food fish, unauthorized introductions and transfers, and canals and water diversions. The shipping pathway is considered the largest single source of new aquatic invasive species. Ballast water that is taken on in foreign ports, for ship stability and safety at sea, is discharged in Canadian waters, along with undesirable "hitchhikers" - foreign species ranging from bacteria to larger organisms.

The Canadian Aquatic Invasive Species database and web application was developed in 2004-5. The main objective was to provide a geo-referenced repository for all invasive species observations gathered in Canada by DFO scientists, provincial departments, other federal or municipal departments and the general public. The second objective was to create a decision making tool that would allow the production of augmented value products that would illustrate trends and movements over time and various locations and thus allow the department to be proactive rather than reactive to observations made.

Currently there is data from the Great Lakes, the Maritimes and some from the Vancouver area. Most of the data are observations of location name, long-lat, species name, date, and any metadata provided. It was not possible at the time of this report to obtain counts of new observations added in 2016.

Offshore Oil and Gas Environmental Monitoring Data

MEDS also acquires, in delayed mode, monitoring physical oceanographic data collected near offshore oil and gas sites as per NEB Guidelines. Data submissions from years contained 2012-2013 wave buoy data at one location, and ice and environmental reports/summaries from 2015-2016 at five locations. The wave data are ingested in the MEDS wave archives and are reported in table 4.

Data Access

Argo data are sent to the global data centers within 24 hours of collection and a national website (http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/Argo/index-eng.html) presents products and statistics on Argo Canada profilers along with links to the data.

GTS-decoded or otherwise acquired real-time oceanographic profiles, US costal mooring and US fixed platform data from the GTS are forwarded three times a week to the Global Temperature Salinity Profile Programme's Continuously Managed Database (https://www.nodc.noaa.gov/GTSPP/access_data) and to the Copernicus Environment Monitoring Service where they are made available in "near real time in situ" products (http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_GLO_NRT_OBSERVATIONS_013_030). The GTS thermosalinograph data are forwarded to the Global Ocean Surface Underway Data archive (http://www.gosud.org). The latter two databases are harvested by the EMODnet Physics

portal (http://emodnet-physics.eu/Map).

Delayed-mode Canadian oceanographic profile data are exchanged bilaterally with the ICES Oceanographic Database (http://www.ices.dk/marine-data/data-portals/Pages/ocean.aspx) and the World Ocean Database (https://www.nodc.noaa.gov/OC5/WOD/pr_wod.html). Synchronization is however a work in progress and one may need to allow from months to more than a year for Canadian data to become available from these databases after it has been collected.

Selected ocean profiles along AZMP sections can be viewed and downloaded from the AZMP website (http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/azmp-pmza/index-eng.html). MEDS sends updates of data acquired to DFO research institutes on a monthly basis. Canadian oceanographic profiles data can otherwise always be requested through this form: http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/request-commande/form-eng.asp.

GTS-decoded drifting buoy and equatorial moored buoy data are sent to the US NOAA National Centers for Environmental Information Ocean Archive System on a yearly basis (https://www.nodc.noaa.gov/cgi-bin/OAS/prd/text/query).

Canadian moored buoy data are made available on a national website within days of collection (updates on business days): http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/waves-vagues/index-eng.htm.

Canadian water level data are available from two national websites: http://waterlevels.gc.ca/ (last 24 hours) and http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/twl-mne/index-eng.htm (validated, historical). Relevant stations data are shared with international initiatives such as the Permanent Service for Mean Sea Level, Global Sea Level Observing System and IOC Sea Level Station Monitoring facility.

Canadian moorings data are available from BIO (http://www.bio.gc.ca/science/data-donnees/base/index-en.php) or MLI (https://slgo.ca/app-sgdo/en/accueil.html) depending on the site locations.

Aquatic Invasive Species data can be queried through an application (https://inter-j01.dfo-mpo.gc.ca/ais-eae/) or viewed as a geoportal gallery (http://geoportal.gc.ca/eng/Gallery/MapProfile/3).

References

List of NAFO Standard Oceanographic Sections and Stations. The reprint of NAFO SCR DOC., NO. 1, Serial N1432, 9p. Printed and distributed by: NAFO, P.O. Box 638, Dartmouth, Nova Scotia, Canada B2Y 3Y9.

GTSPP Real-Time Quality Control Manual First Revised Edition. UNESCO-IOC 2010. (IOC Manuals and Guides No. 22, Revised Edition.) (IOC/2010/MG/22Rev.)

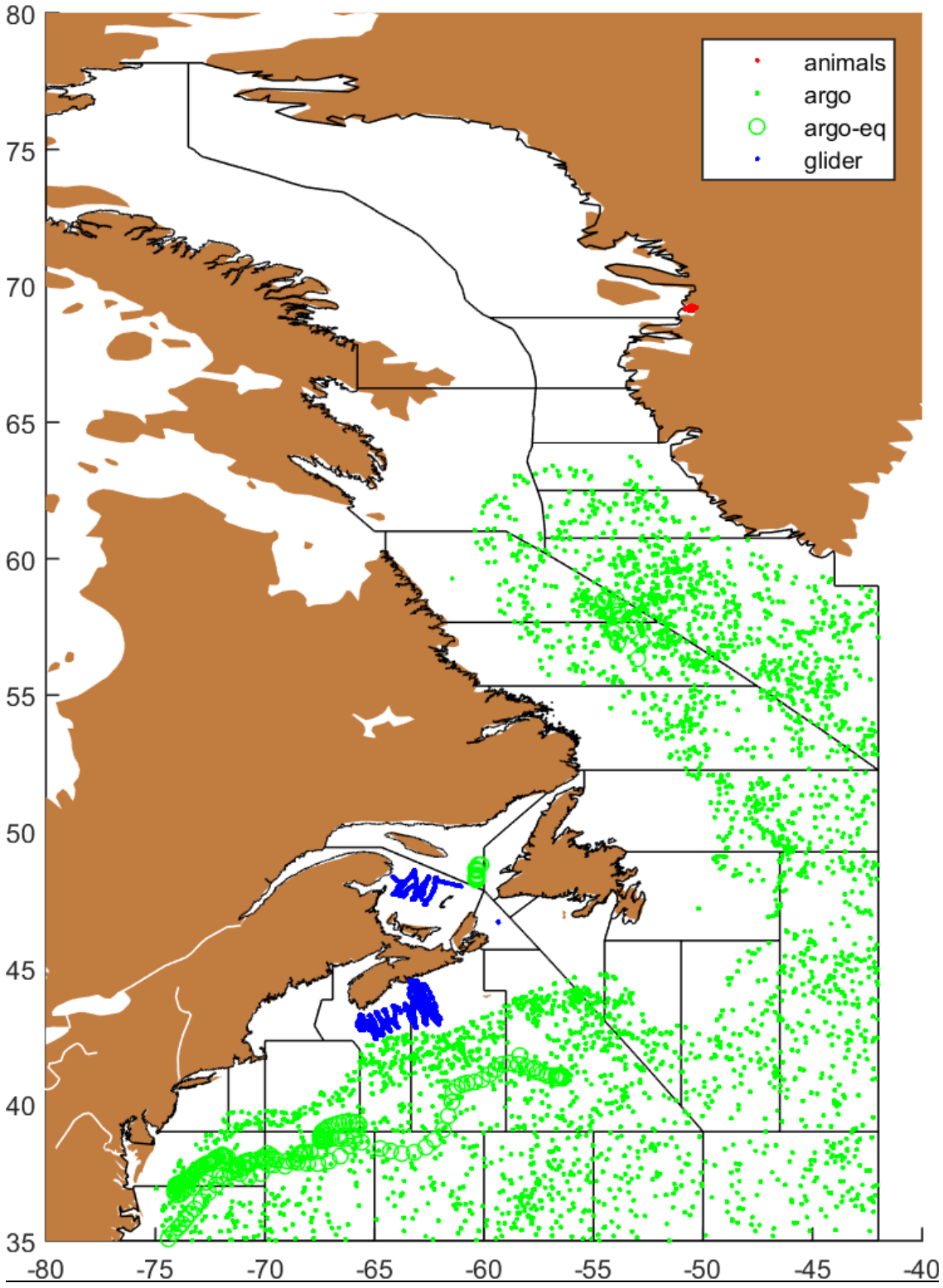

Fig. 1. Position of profiles sampled by autonomous platforms in 2016 and acquired in 2016

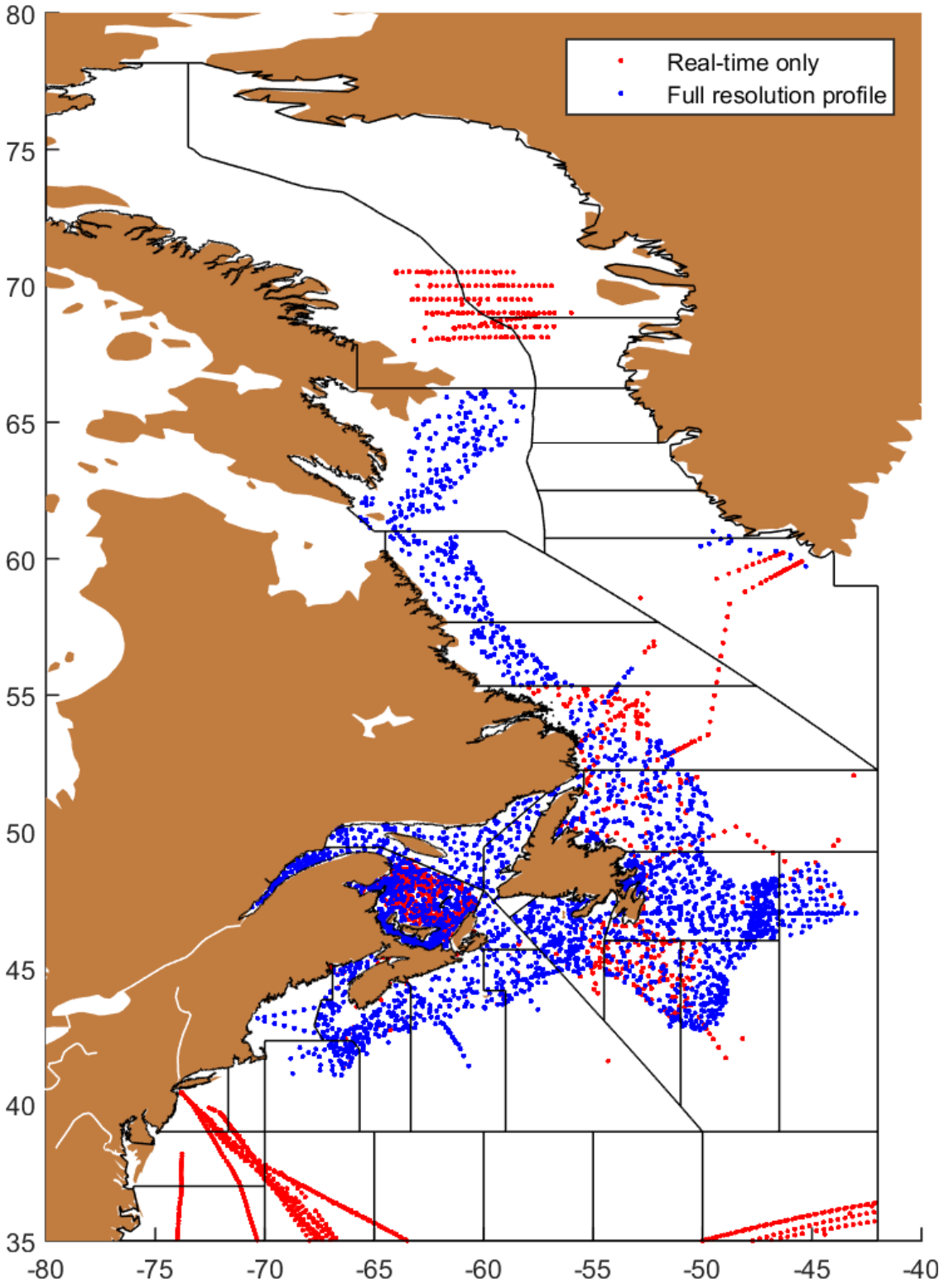

Fig. 2a. Position of profiles sampled by ships in 2016 and acquired in 2016/2017

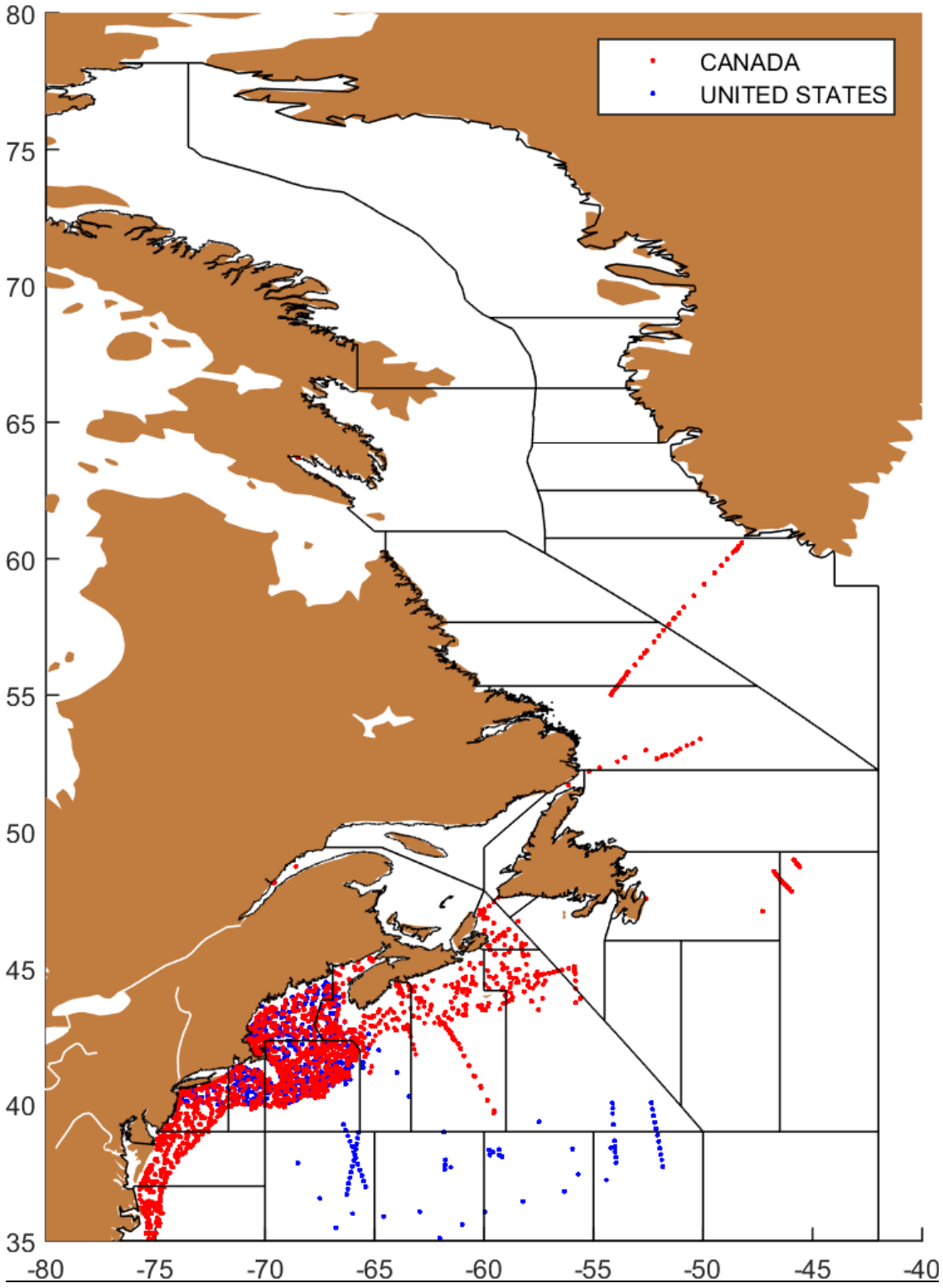

Fig. 2b. Position of profiles sampled by ships before 2016 and acquired in 2016/2017

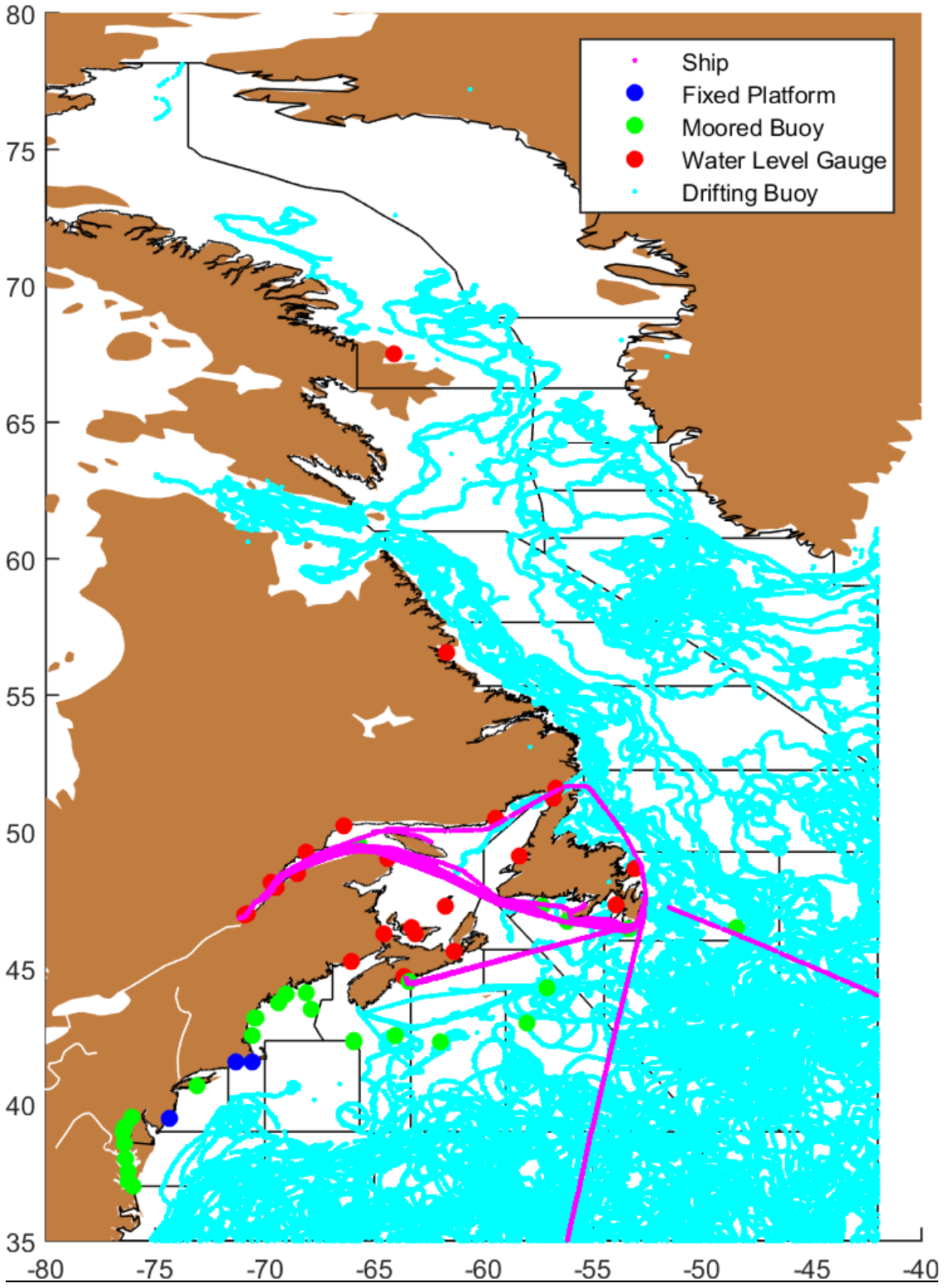

Fig. 3. Position of near surface observations made in 2016 and acquired in 2016/2017. Only water level gauges with coordinates inside NAFO Sub-areas are shown. Nearby gauges are listed in table 6.

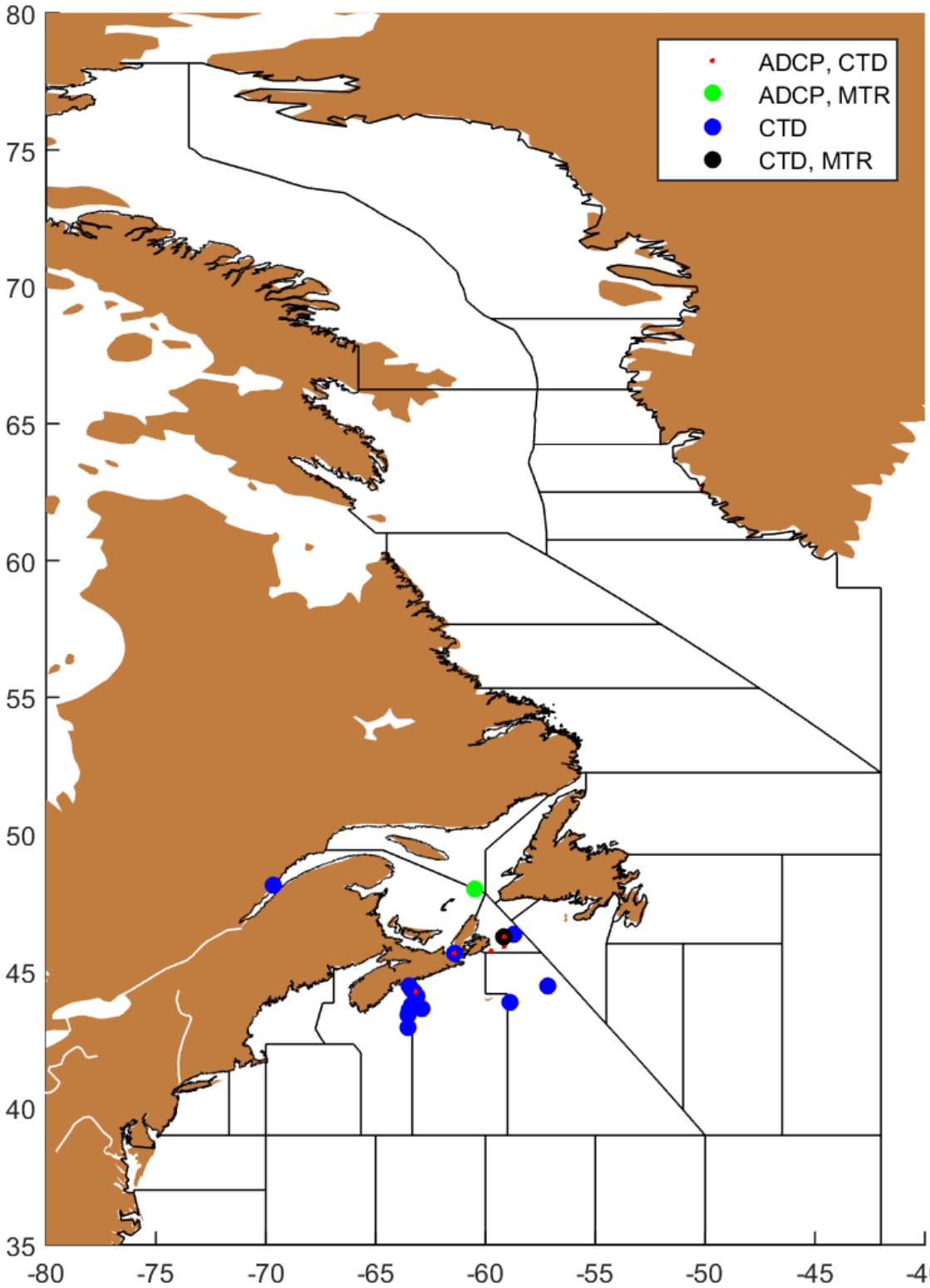

Fig. 4a. Position of moorings with subsurface instruments whose data measured in 2016 were processed in 2016/2017 (MTR=Thermistor, CTD=Conductivity-Temperature-Depth, ADCP = Acoustic Doppler Current Profiler)

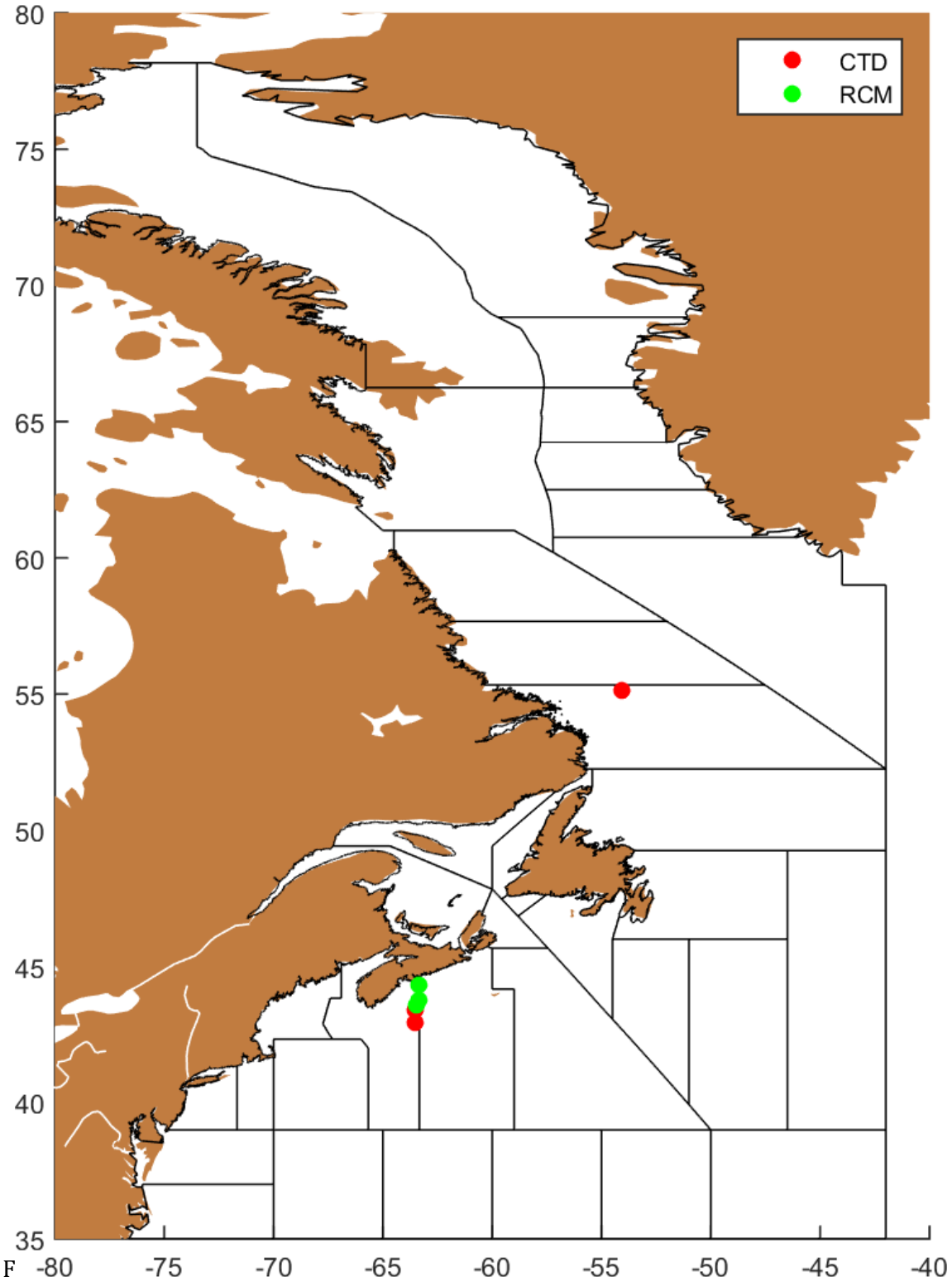

Fig. 4b. Position of moorings with subsurface instruments whose data measured before 2016 were processed in 2016/2017 (CTD=Conductivity-Temperature-Depth, RCM = Rotor Current meter)

Table 1: Real-time temperature and /or salinity profiles from autonomous platforms collected and processed in 2016

Platform Type	Platform Name	Country	WMO ID	Reporting period (months)	Profiles	NAFO Subareas
glider	OTN200	Canada	48922	Jan-Nov	3264	4W 4X
glider	OTN201	Canada	48923	Jul-Oct	347	4T 4Vn
argo		France	1901208	Jan-Feb	4	6H
argo		France	1901210	Jan-Jan	2	1F
argo		France	1901217	Jan-Dec	36	1F 2J 3K
argo		UK	1901294	Jan-Dec	36	2G 2H 2J 3K 3L 3M
argo		USA	1901534	Jan-Jan	2	6C
argo		USA	1901597	Mar-Nov	27	3M 3N
argo		Germany	3901601	Oct-Dec	8	4Vs
argo		Germany	3901602	Oct-Dec	9	4W 4X 5Ze
argo		Germany	3901603	Nov-Dec	5	4W
argo		Germany	3901604	Nov-Dec	5	4W 4X 5Ze
argo		Germany	3901605	Oct-Dec	8	4Vs4W 4X 5Ze
argo		USA	4901057	Jan-Dec	29	3M 3N 4Vs6G
argo		Canada	4901192	Jan-Dec	35	1F 2H 2J
argo		Canada	4901193	Jan-Feb	4	2H 2J
argo		Canada	4901198	Jan-Dec	36	3K 3L 3M 3N
argo		USA	4901285	Jan-Dec	34	3O 4Vs6F 6G
argo		USA	4901287	Jan-Jan	2	6C
argo		USA	4901298	Jan-Jun	7	3M 3N
argo		USA	4901400	Jan-Dec	29	4Vs4W 6E 6F
argo		Germany	4901417	Jan-Dec	37	1E 1F 2G 2H
argo		Germany	4901418	Jan-Dec	34	1F 2J 3K
argo		Germany	4901419	Jan-Dec	36	1F 2G
argo		USA	4901462	Jan-Dec	34	3M 3N 3O 4Vs6G
argo		USA	4901466	Jan-Dec	27	4Vs6F 6G 6H
argo		USA	4901467	Feb-Dec	29	4Vs4X 6D 6E 6F
argo		USA	4901591	Jan-Dec	36	4Vs4W 4X 5Ze5Zw6F
argo		USA	4901594	Jan-Dec	35	4W 4X 6D 6E 6F
argo		USA	4901621	Jan-Dec	27	4W 4X 6D 6E 6F
argo		USA	4901628	Jan-Dec	16	6C
argo		USA	4901631	Jan-Dec	36	4Vs6E 6F 6G 6H
argo		USA	4901699	Aug-Dec	13	3M 6H
argo		USA	4901701	Jan-Feb	6	6H
argo		USA	4901704	Jan-Dec	35	3M 3N 6G 6H
argo		USA	4901705	Jan-May	15	6G 6H
argo		USA	4901707	Jan-Nov	51	3N 3O 4Vs6F 6G
argo		Canada	4901744	Jan-Aug	20	2H 2J 3K
argo		Canada	4901745	Jan-Dec	36	3O 4Vs4W 4X 5Ze6D

argo		Canada	4901747	Jan-Dec	36	1F 2H 2J
argo		Canada	4901748	Jan-Nov	31	2G 2H 2J 3K 3M
argo		Canada	4901750	Jan-Oct	31	2J 3K 3L 3M 3N
argo		Canada	4901751	Jan-Aug	23	1F 2G 2H
argo		Canada	4901752	Jan-Aug	23	2H 2J 3K 3M
argo		Canada	4901755	Jan-Dec	28	4Vs6F 6G
argo		Canada	4901762	Jan-Dec	36	3N 3O 3Ps4Vs
argo		Canada	4901763	Jan-Dec	35	4Vs4W 4X 6B 6D 6E 6F
argo		Canada	4901780	Jan-Dec	17	2G 2H 2J 3K
argo		Canada	4901782	Jan-Nov	33	0B 1E 1F 2G 2H
argo		Canada	4901783	Jan-Dec	35	1F 2H 2J
argo		Canada	4901787	Jan-Dec	37	3N 3O 3Ps4Vs4W
argo		Canada	4901788	Jan-Dec	35	3N 3O 4Vs4W
argo-eq		Canada	4901789	Jan-Jan	17	4S
argo		Canada	4901798	Jan-Dec	33	4W 4X 5Ze6B 6C 6D 6E
argo		Canada	4901807	Jan-Jul	20	3O 3Ps4Vs
argo		Canada	4901809	May-Dec	24	1F 2H
argo		Canada	4901812	Apr-Dec	26	4Vs4W 4X
argo		Canada	4901813	Apr-Dec	25	4Vs4W 4X
argo		Canada	4901814	May-Dec	23	4W 4X 5Ze5Zw6A
argo		Canada	4901815	May-Dec	23	4W 4X 5Ze5Zw6B
argo		Canada	4901816	May-Dec	23	4W 4X 5Ze5Zw6B
argo		Canada	4901817	May-Dec	24	1E 1F 2G 2H
argo		Canada	4901827	Aug-Dec	14	4W 4X
argo		Canada	4901828	Nov-Dec	5	3N 3O
argo		USA	4902099	Jan-Dec	36	3Ps4Vs4W 4X 6E
argo		USA	4902100	Jan-Dec	36	3O 3Ps4Vs
argo		USA	4902102	Jan-Oct	27	4X 5Ze5Zw6A 6B 6C 6D
argo		USA	4902103	May-Dec	17	3M
argo		USA	4902105	May-Nov	6	6H
argo		USA	4902107	Aug-Dec	15	3M
argo		USA	4902108	Mar-Sep	18	4W 4X 6B 6C 6D 6F
argo		USA	4902109	Mar-Dec	30	6B 6C 6D
argo		USA	4902111	Apr-Oct	16	6B 6C 6D 6E
argo		USA	4902121	Jul-Dec	9	6G 6H
argo		USA	4902122	Nov-Dec	4	6H
argo-eq	(Alamo)	USA	4902131	Feb-May	88	4Vs4W 5Ze6B 6C 6D 6E
argo-eq	(Alamo)	USA	4902263	Oct-Dec	77	6B 6C 6D
argo		USA	4902338	Jul-Sep	5	6H
argo		USA	4902339	Oct-Dec	5	6H
argo		USA	4902340	Nov-Nov	1	6H
argo		USA	4902346	Sep-Sep	5	4W
argo		USA	4902347	Sep-Dec	15	4Vs4W 4X

argo		USA	4902348	Sep-Dec	14	3Ps4Vs
argo		Canada	4902381	Nov-Dec	4	3N
argo		Canada	4902382	Nov-Dec	4	3N
argo		Canada	4902383	May-Dec	23	1F 2G 2H
argo		Canada	4902384	May-Oct	17	1F 2H
argo		Canada	4902386	May-May	2	1F
argo-eq	(NAMI)	Canada	4902387	May-Sep	10	2G 2H
argo		USA	5903390	Jan-Dec	36	1F 2J
argo		USA	5903399	Jan-Dec	9	3M
argo		USA	5903889	Jan-Dec	27	4Vs4W 6B 6C 6D 6E 6F
argo		USA	5904001	Jan-Jan	1	6D
argo		USA	5904175	Sep-Dec	12	1E 1F
argo		USA	5904769	Jun-Dec	42	3M 3N
argo		USA	5904770	Sep-Sep	4	3K
argo		USA	5904772	May-Sep	10	1F
argo		USA	5904773	May-Dec	23	2J 3K
argo		Norway	5904988	Apr-Dec	54	0B 1E 1F 2G 2H
argo		Norway	5904989	Jan-Dec	75	1D 1E 1F 2G 2H
argo		UK	6900446	Apr-Dec	15	1F
argo		UK	6900448	Jan-Dec	35	1F
argo		France	6900910	Aug-Dec	16	4Vs6F 6G
argo		France	6900973	Jan-Sep	11	1F
argo		France	6901022	Jun-Dec	19	1E 1F 2G 2H 2J
argo		France	6901023	Apr-Dec	26	1F
argo		France	6901026	Jul-Nov	12	1D 1E 1F
argo		France	6901030	Jan-Dec	33	2G 2H 2J 3K 3M
argo		UK	6901147	Jan-Dec	35	1F 2G 2H 2J
argo		UK	6901149	Jan-Dec	36	1F 2H
argo		UK	6901172	Mar-Dec	30	1E 1F 2G 2H 2J 3K 3L 3M
argo		France	6901448	Jul-Dec	16	3M 3N 6H
argo		France	6901480	Jan-Dec	78	1E 1F 2G 2H
argo		France	6901485	Jan-Mar	10	2H 2J 3K
argo		France	6901486	Jan-Dec	72	1F 2G 2H
argo		France	6901508	Jan-May	16	3M 3N
argo		France	6901524	Jan-Jan	2	1F
argo		France	6901525	Jan-Sep	56	3M 3N
argo		France	6901527	Jan-Aug	58	1F 2J
argo		France	6901568	Oct-Oct	2	1F
argo		France	6901589	Jan-Dec	36	2H 2J 3K
argo		France	6901646	Oct-Oct	2	1F
argo		France	6901751	May-Dec	25	0B 1D 1E 1F 2G
argo		France	6901758	Jan-Nov	21	3K 3M
argo		Germany	6902563	Jan-Dec	35	4Vs4W 6E 6F 6G

argo	Germany	6902564	Jan-Dec	34	5Zw6B 6C 6D
argo	Germany	6902565	Feb-Dec	8	6F 6G
argo	Germany	6902566	Jan-Dec	36	4Vs4W 6F 6G
argo	Germany	6902567	Jan-Oct	27	3M 3N 4Vs6G 6H
argo	Germany	6902584	Jan-Dec	37	0B 1D 1E 2G
argo	Germany	6902586	Jan-Nov	9	1E 1F
argo	Germany	6902589	Jan-May	14	2J 3K
argo	Germany	6902632	Jan-Dec	35	4W 4X 5Ze5Zw6B 6C
argo	Germany	6902633	Jan-Dec	35	4W 4X 5Ze5Zw6A 6B 6C 6D
argo	Germany	6902634	Jan-Dec	35	4W 4X 5Ze
argo	Germany	6902635	Jan-Dec	35	3O 3Ps4Vs4W
argo	Germany	6902636	Jan-Dec	35	3N 4Vs4X 5Ze6A 6B 6C 6D 6E 6F 6G
argo	Germany	6902643	Apr-Jun	7	3K 3M
argo	Germany	6902644	May-May	1	3K
argo	France	6902659	Jan-Sep	27	3K 3L 3M
argo	France	6902660	Jan-Dec	37	1E 1F 2G
argo	France	6902702	Aug-Nov	11	3K
argo	France	6902703	Aug-Nov	11	1F 2J 3K
animals	UK	9900787	Jan-Apr	55	1A
animals	UK	9900788	Apr-May	4	1A
animals	UK	9900887	Aug-Dec	31	1A

*Dates are of first and last data reports within the NAFO Convention Area; when empty, reporting period was from January through December.

Table 2: 2016 Temperature (XBT) and/or salinity (CTD, bottle) profile and surface (thermosalinograph: TSG) data collected aboard ships, processed in 2016 and from Jan-May 2017

Platform_Name	Country	Cruise Number	First Date**	Last Date**	CTD	Bottle	XBT	TSG	NAFO_Subareas
Oceanex Connaigra	Canada		20160101	20161231	0	0	0	14272	3K 3L 3M 3N 3Pn3Ps4R 4S 4T 4Vn4Vs4W 4X
Sigma-T	Canada	18VA16667	20160106	20161221	50	50	0	0	4W
Sigma-T	Canada	18VA16666	20160108	20161220	7	7	0	0	4W
Maersk Vilnius	USA		20160120	20161221	0	0	175*	0	5Zw 6A 6B 6D 6E
George R. Pearkes	Canada	18GP16002	20160121	20160121	2	0	0	0	3L
Beluga II / others	Canada	189016001	20160123	20161212	52	67	0	0	4T
Oleander	USA		20160130	20161218	0	0	242*	0	6A 6B 6D
Cma Cgm Racine	USA		20160202	20160203	0	0	18*	0	6H
Viola M. Davidson	Canada	18VA16669	20160202	20161213	12	12	0	0	4X
Teleost	Canada	18TL16168	20160211	20160211	2	0	0	0	3L
Teleost	Canada	18TL16002	20160223	20160310	3*	39	0	0	4W 4X 5Ze
Arian	USA		20160227	20160227	0	0	34*	0	6B 6C
Martha L. Black / Edward Cornwallis	Canada	189016004	20160301	20160314	73	69	0	0	4R 4S 4T 4Vn
Teleost	Canada	18TL16003	20160311	20160325	43*	65	0	0	4W 4X 5Y
Teleost	Canada	18TL16157	20160401	20160411	71	0	0	0	3L 3Ps
Skogafoss	USA		20160405	20160406	0	0	8*	0	3K 3L 3M
Hudson	Canada	18HU16003	20160409	20160425	52+3*	47	0	0	4Vn 4Vs 4W 4X 5Ze
Teleost	Canada	18TL16158	20160412	20160425	78	0	0	0	3Ps
Vladykov	Canada	18VD16053	20160415	20160415	2	0	0	0	3L
Vladykov	Canada	18VD16054	20160426	20160426	1	0	0	0	3L
Teleost	Canada		20160428	20160509	117*	0	2*	0	3L 3N 3O 3Ps
Leim	Canada	18LO16009	20160501	20160512	29	0	0	0	4S
Hudson	Canada	18HU16006	20160502	20160524	1	36	0	0	2H 2J 3L 3Pn 4Vn 4W
Teleost	Canada	18TL16169	20160510	20160510	1	0	0	0	3L
Celtic Explorer	Canada/ Ireland	45CE16006	20160511	20160511	1	0	0	0	3L
Teleost	Canada	18TL16159	20160511	20160524	95	0	0	0	3L 3M 3N

Maria S. Meran	Germany		20160512	20160528	67*	0	0	0	1F 2H 2J 3L
Cap Breton	Canada	18VA16668	20160512	20161001	5	5	0	0	4T
(manual)	Canada	187F16001	20160513	20161028	0	82	0	0	4T
L'Alliance	Canada	18K816001	20160524	20161006	24	0	0	0	4T
Teleost	Canada	18TL16170	20160525	20160607	86	0	0	0	3L 3N
Vladykov	Canada	18VD16056	20160530	20160602	10	0	0	0	3Ps
Vizconde de Eza	Spain	29VE160531	20160531	20160618	56	0	0	0	3N 3O
Coriolis II	Canada	18OL16015	20160601	20160626	179	108	0	0	3Pn4R 4S 4T 4Vn
Amundsen	Canada		20160605	20160710	201*	0	0	0	0A 1A 1B 1F 4R
Teleost	Canada	18TL16171	20160608	20160616	57+1*	0	1*	0	3L 3O
Vladykov	Canada	18VD16057	20160612	20160618	11+1*	0	0	0	3L
Teleost	Canada	18TL16172	20160617	20160621	9	0	0	0	3L
James Clark Ross	UK		20160622	20160624	0	0	0	0	6H
Vizconde de Eza	Spain	29VE160624	20160624	20160721	63	0	0	0	3L 3M
Alfred Needler	Canada	18NE16016	20160628	20160815	126*	250	0	0	4Vn4Vs4W 4X 5Y 5Ze
Vladykov	Canada	18VD16058	20160706	20160716	9+1*	0	0	0	3K 3L
Teleost	Canada	18TL16160+	20160708	20160728	82*	0	54*	0	2J 3K 3L 3M
Jean-Mathieu	Canada		20160710	20161004	337*	0	0	0	4T
M. Perley	Canada	18MU16018	20160712	20160806	108	0	0	0	4T
Cma Cgm Rabelais	USA		20160716	20161120	0	0	38*	0	6H
Aqviq	Canada	18QQ16111	20160722	20160831	254+6*	0	0	0	0B 2G
Pourquoi Pas	France		20160727	20160807	2*	0	0	1393	3K 3L 3O 4Vs6F
Vladykov	Canada	18VD16060	20160727	20160814	42	0	0	0	3L
Vizconde de Eza	Spain	29VE160728	20160728	20160817	95	0	0	0	3L 3M
Frederick G. Creed	Canada	18FC16011	20160729	20160817	13	0	0	0	4S 4T
Teleost	Canada	18TL16037	20160802	20160901	108	80	0	0	4R 4S 4T 4Vn
M. Perley	Canada	18MU16021	20160811	20160817	41	0	0	0	4T
Leim	Canada	18LO16039	20160812	20160815	8	0	0	0	4T
Shamook	Canada	18OK16619	20160815	20160815	4	0	0	0	3L
Vladykov	Canada	18VD16061	20160817	20160821	25	0	0	0	3L
Frederick G. Creed	Canada	18FC16035	20160819	20160827	33	0	0	0	4T

Leim	Canada	18LO16008	20160820	20160828	15	0	0	0	4T
Alfred Needler	Canada	18NE16464	20160821	20160825	9	0	0	0	3L
L'Alliance	Canada	18K816041	20160822	20160825	5	0	0	0	4T
Vladykov	Canada	18VD16062	20160827	20160909	21	0	0	0	3K
Alfred Needler	Canada	18NE16465	20160829	20160909	35+2*	0	0	0	3L 3Ps
M. Perley	Canada	18MU16023	20160904	20160914	14	0	0	0	4T
Teleost	Canada	18TL16161	20160907	20160928	161	0	0	0	4T
Cma Cgm Moliere	USA		20160911	20160912	0	0	26*	0	6G 6H
Alfred Needler	Canada		20160915	20160915	0	0	1*	0	3L
Hudson	Canada	18HU16027	20160915	20161006	100+1*	91	0	0	3Pn3Ps4Vn4Vs 4W 4X 5Y 5Ze
Alfred Needler	Canada	18NE16466	20160916	20160927	55+1*	0	3*	0	3L 3O
Vladykov	Canada	18VD16063	20160918	20160923	23+1*	0	0	0	3L
Vladykov	Canada	18VD16064	20160926	20161003	22+2*	0	0	0	3L
Alfred Needler	Canada	18NE16467	20160928	20161009	53+1*	0	0	0	3L 3N 3O
M. Perley	Canada	18MU16028	20160930	20161016	11	0	0	0	4T
Teleost	Canada	18TL16162	20161004	20161010	17	0	0	0	2H 3L
L'Alliance	Canada	18K816049	20161011	20161012	4	0	0	0	4T
Alfred Needler	Canada	18NE16468	20161014	20161014	1	0	0	0	3L
Teleost	Canada	18TL16163	20161014	20161023	72	0	0	0	2H
Hudson	Canada	18HU16050	20161016	20161103	149	89	0	0	3Pn4R 4S 4T 4Vn
Vladykov	Canada	18VD16066	20161021	20161025	5	0	0	0	3L
Teleost	Canada		20161024	20161105	49*	0	1*	0	2J
Alfred Needler	Canada	18NE16469	20161028	20161108	54	0	0	0	3L 3N 3O
Prometheus Leader	USA		20161029	20161030	0	0	51*	0	6A 6B 6C
Frederick G. Creed	Canada	18FC16047	20161030	20161110	6	0	0	0	4R 4S
Teleost	Canada	18TL16164+	20161106	20161106	1	0	0	0	3L
Walther Herwig III	Germany	06NI16400	20161106	20161111	13	13	0	0	1E 1F
Teleost	Canada	18TL16165	20161110	20161122	66+2*	0	0	0	2J 3K 3L
Alfred Needler	Canada	18NE16470	20161110	20161122	87	0	0	0	3L
Hudson	Canada	18HU16116+	20161113	20161120	36*	0	13*	0	3L 3N 3O 3Ps
Alfred Needler	Canada	18NE16471	20161123	20161206	44+2*	0	0	0	3L

Teleost	Canada	18TL16166	20161124	20161206	78	0	0	0	2J 3K 3L
Teleost	Canada	18TL16167	20161207	20161215	42+3*	0	3*	0	3K 3L
Alfred Needler	Canada	18NE16472	20161208	20161216	41+3*	0	1*	0	3K 3L

* Messages formatted for transmission on the GTS. These messages are of lower vertical resolution and uncalibrated versions of the data, to be replaced in the future.
** Dates are of first and last data reports within the NAFO Convention Area.
+ Additional full resolution CTD profiles from these cruises were received at MEDS but could not be ingested and counted in time for this report

Table 3: Pre-2016 temperature (XBT) and/or salinity (CTD, bottle) profile data collected aboard ships, processed in 2016

Platform Name	Country	Cruise Number	First Date**	Last Date**	CTD	Bottle	NAFO Subareas
Gordon Gunter	USA	33GG15006	20151012	20151025	123	0	4X 5Y 5Ze5Zw6A 6B
Hudson	Canada	18HU15030	20150920	20151011	116	107	3Pn3Ps4Vn4Vs4W 4X 5Y 5Ze
Henry B. Bigelow	USA	33HH15006	20150902	20151105	375	0	4X 5Y 5Ze5Zw6A 6B 6C
(manual)	Canada	18VA15099	20150818	20150821	18	0	0B
Henry B. Bigelow	USA	33HH15005	20150813	20150820	22	0	6A 6B 6C
Henry B. Bigelow	USA	33HH15003	20150611	20150701	52	0	4X 5Ze5Zw
Hugh R. Sharp	USA	33H515001	20150528	20150616	54	0	5Ze
Henry B. Bigelow	USA	33HH15002	20150519	20150602	167	0	4X 5Y 5Ze5Zw6A 6B 6C
Eagle Eye II	USA	335J15001	20150518	20150518	2	0	6C
Hudson	Canada	18HU15004	20150417	20150427	57	55	3Ps4Vn4Vs4W 4X 5Ze
Henry B. Bigelow	USA	33HH15001	20150314	20150507	378	0	4X 5Y 5Ze5Zw6A 6B 6C
Brooke	USA	334B14827	20141103	20141115	125	0	4X 5Y 5Ze5Zw6A
Henry B. Bigelow	USA	33HH14826	20140923	20141113	245	0	4X 5Y 5Ze5Zw6A
Hugh R. Sharp	USA	33H514825	20140905	20140912	24	0	5Y 5Ze5Zw
Hugh R. Sharp	USA	33H514823	20140708	20140724	65	0	5Ze
Hudson	Canada	18HU14017	20140630	20140713	40	0	2J 3L 3M 4W
Knorr	USA	316N14021	20140502	20140502	3	0	5Zw
Henry B. Bigelow	USA	33HH14822	20140411	20140531	245	0	4X 5Y 5Ze5Zw6A
Gordon Gunter	USA	33GG14821	20140311	20140422	80	0	4X 5Ze5Zw6A
Hudson	Canada	18HU13008	20130507	20130528	69	28	1F 2H 2J 3K 3L 4R 4W 4X
Knorr	USA	316N12019	20120815	20120816	3	0	5Zw
Alfred Needler	Canada	18NE09027	20090701	20090728	203	0	4Vn4Vs4W 4X 5Y
Knorr	USA	316N07849	20070210	20070321	71	0	4Vs5Ze6D 6E 6F 6G
Fogo Isle	Canada	18FL91054	19910731	19910807	8	0	4T
Albatross IV	USA	31A482650	19820815	19820815	1	0	5Ze
Albatross IV	USA	31A481951	19810928	19811004	2	0	4X
Dawson	Canada	18DA69046	19690814	19690814	12	0	4X
Dawson	Canada	18DA69035	19690702	19690710	26	0	4X

** Dates are of first and last data reports within the NAFO Convention Area

Table 4: Real-time surface water, air, atmospheric parameters and wave* data from buoys, collected and processed in 2016 and from Jan-May 2017

Platform Type	Name	Country	WMO / other ID	First Date**	Last Date**	NAFO Subareas
Fixed Platform	Buoy 126, Jacques Cousteau Reserve, NJ	USA	JCTN4	20160101	20161231	6A
Fixed Platform	Buoy 126, Jacques Cousteau Reserve, NJ	USA	NAQR1	20160101	20161231	5Zw
Fixed Platform	Menauhant, Waquoit Bay Reserve, MA	USA	WAQM3	20160101	20161231	5Zw
Moored Buoy	Buoy N01 – Northeast Channels*	USA	44024	20160101	20161231	4X
Moored Buoy	Buoy A01 – Massachussetts Bay*	USA	44029	20160101	20161231	5Y
Moored Buoy	Buoy B01 – Western Maine Shelf*	USA	44030	20160101	20161231	5Y
Moored Buoy	Buoy E01 – Central Maine Shelf*	USA	44032	20160101	20161231	5Y
Moored Buoy	Buoy F01 – Penobscot Bay*	USA	44033	20160101	20161231	5Y
Moored Buoy	Bupy I01 – Eastern Maine Shelf*	USA	44034	20160101	20161231	5Y
Moored Buoy	Buoy M1 – Jordan Basin*	USA	44037	20160101	20161231	5Y
Moored Buoy	Potomac, MD*	USA	44042	20160101	20161231	6B
Moored Buoy	Patapsco, MD*	USA	44043	20160324	20161205	6B
Moored Buoy	-	France	44050	20160125	20160125	3Ps
Moored Buoy	Susquehanna, MD	USA	44057	20160312	20161128	6B
Moored Buoy	Stingray Point, VA*	USA	44058	20160101	20161021	6B
Moored Buoy	Gooses Reef, MD*	USA	44062	20160101	20161231	6B
Moored Buoy	Annapolis, MD*	USA	44063	20160324	20161205	6B
Moored Buoy	First Landing, VA*	USA	44064	20160101	20161214	6B
Moored Buoy	Great South Bay	USA	44069	20160101	20161231	6A
Moored Buoy	York Spit, VA	USA	44072	20160722	20161231	6B
Moored Buoy	East Scotian Slope*	Canada	44137	20160101	20161231	4W
Moored Buoy	Banquereau Bank*	Canada	44139	20160101	20161231	4Vs
Moored Buoy	Laurentian Fan*	Canada	44141	20160101	20161231	4Vs
Moored Buoy	La Have Bank*	Canada	44150	20160101	20161231	4X
Moored Buoy	Nickerson Bank*	Canada	44251	20160101	20161231	3L
Moored Buoy	NE Burgeo Bank*	Canada	44255	20160101	20161126	3Ps
Moored Buoy	Halifax Harbour*	Canada	44258	20160112	20160211	4W
Moored Buoy	Mont-Louis*	Canada	45138	20160506	20161106	4S
Moored Buoy	Terra Nova FPSO*	Canada	WEL448	20120101	20131231	3L
Drifting Buoy	-	USA	13520	20160826	20160830	6E
Drifting Buoy	-	USA	13521	20160919	20161228	6G 6H
Drifting Buoy	-	USA	13598	20160218	20160618	6D 6E
Drifting Buoy	-	USA	13601	20160627	20170101	6D 6E 6F
Drifting Buoy	-	USA	13602	20160806	20170101	6E 6F 6G
Drifting Buoy	-	USA	13618	20160305	20160729	6G 6H
Drifting Buoy	-	USA	13636	20160129	20161228	3M 3N 4Vs6G 6H
Drifting Buoy	-	USA	13637	20161021	20161231	3M 3N 3O 4Vs6F 6G

Drifting Buoy	-	USA	13909	20160905	20161217	3M 3N 3O 4Vs6E 6F 6G
Drifting Buoy	-	-	25575	20160607	20161212	0B 1D 1E 1F 2G 2H 2J
Drifting Buoy	-	France	25617	20160714	20160919	1F
Drifting Buoy	-	-	4101502	20160622	20160826	3O 3Ps4Vs4W 4X 6B 6D 6E
Drifting Buoy	-	-	4101503	20161125	20161215	6B 6C 6D 6E
Drifting Buoy	-	-	4101505	20160729	20161226	4W 6B 6C 6D 6E 6F
Drifting Buoy	-	-	4101506	20161203	20161231	6B 6C 6D 6E
Drifting Buoy	-	-	4101507	20160924	20161231	4Vs4W 6B 6C 6D 6E 6F
Drifting Buoy	-	-	4101509	20160703	20160709	6C
Drifting Buoy	-	-	4101510	20161001	20161231	3M 3N 3O 4Vs4W 6B 6C 6D 6E 6F 6G 6H
Drifting Buoy	-	-	4101512	20161201	20161231	4Vs4W 4X 6B 6C 6D 6E
Drifting Buoy	-	France	4101700	20160517	20161231	4Vs6F 6G 6H
Drifting Buoy	-	USA	41506	20160131	20160811	4Vs4W 6B 6C 6D 6E 6F 6G
Drifting Buoy	-	USA	41510	20160915	20161231	6G 6H
Drifting Buoy	-	USA	41571	20160101	20160127	6C 6D
Drifting Buoy	-	USA	41572	20160523	20160912	3M 3N 3O 4Vs6E 6F 6G
Drifting Buoy	-	USA	41575	20161229	20161231	6C
Drifting Buoy	-	USA	41590	20160123	20161114	3M 3N 4Vs6B 6C 6D 6E 6F 6H
Drifting Buoy	-	USA	41594	20160514	20160729	3M 3N 3O 4Vs6E 6F 6G
Drifting Buoy	-	USA	41597	20161010	20161231	6F 6G
Drifting Buoy	-	USA	41606	20160101	20160713	3N 4Vs4W 4X 5Ze6D 6E 6F 6G 6H
Drifting Buoy	-	USA	41622	20160101	20160529	6H
Drifting Buoy	-	USA	41623	20160902	20161117	3M 3N 6G 6H
Drifting Buoy	-	USA	41646	20160101	20160201	6G 6H
Drifting Buoy	-	USA	41679	20160902	20161204	4W 6B 6C 6D 6E 6F
Drifting Buoy	-	USA	41685	20160922	20161209	6B 6C 6D
Drifting Buoy	-	USA	41691	20161026	20161231	4Vs6E 6F 6G
Drifting Buoy	-	USA	41705	20160101	20160107	3M 3N
Drifting Buoy	-	USA	41706	20160118	20160330	6F 6G 6H
Drifting Buoy	-	USA	41709	20160505	20160705	6C 6D
Drifting Buoy	-	France	41729	20160101	20161231	3M 3N 3O 4Vs4W 6D 6E 6F 6G
Drifting Buoy	-	USA	41925	20160101	20160320	3M 3N 4Vs6F 6G 6H
Drifting Buoy	-	USA	41934	20160104	20161026	6D 6E
Drifting Buoy	-	USA	41936	20160629	20161126	3M 3N 6F 6G 6H
Drifting Buoy	-	USA	41940	20160924	20161127	6G 6H
Drifting Buoy	-	USA	41943	20160831	20160905	6F
Drifting Buoy	-	USA	41972	20160322	20160630	6H

Drifting Buoy	-	USA	41974	20160812	20161231	6F 6G 6H
Drifting Buoy	-	USA	41981	20160101	20160227	3M 3N 4Vs6F 6G 6H
Drifting Buoy	-	-	4201500	20161022	20161109	6B 6C 6D
Drifting Buoy	-	USA	42505	20160320	20160919	3M 3N 4Vs6B 6C 6D 6E 6F 6G 6H
Drifting Buoy	-	USA	43553	20160305	20160722	4Vs4W 4X 5Ze5Zw6A 6B 6C 6D 6E 6F 6G
Drifting Buoy	-	USA	43554	20160124	20160126	6C
Drifting Buoy	-	USA	43555	20160101	20160207	3M 6H
Drifting Buoy	-	USA	43558	20160514	20161027	3N 4Vs4W 4X 6B 6C 6D 6E 6G 6H
Drifting Buoy	-	USA	43565	20160101	20160512	3N 3O 4Vs6G 6H
Drifting Buoy	-	France	4401500	20160325	20161231	6D 6E 6F 6G
Drifting Buoy	-	France	4401501	20160324	20161213	3M 3N 3O 4Vs6E 6F 6G 6H
Drifting Buoy	-	France	4401502	20160519	20160625	6B 6C 6D
Drifting Buoy	-	France	4401503	20160324	20160712	4W 6E 6F
Drifting Buoy	-	-	4401507	20160518	20160523	1F
Drifting Buoy	-	-	4401508	20160520	20160607	1F 3K
Drifting Buoy	-	-	4401510	20160529	20160604	3M 3N 5Ze
Drifting Buoy	-	-	4401517	20160522	20160601	3K
Drifting Buoy	-	-	4401518	20160519	20160520	1F
Drifting Buoy	-	-	4401519	20160518	20160604	1F
Drifting Buoy	-	-	4401522	20160522	20160606	3K
Drifting Buoy	-	-	4401523	20160529	20160602	3M
Drifting Buoy	-	-	4401524	20160518	20160610	1F
Drifting Buoy	-	-	4401528	20160905	20161231	3M 3N 3O 4Vs6E 6F 6G 6H
Drifting Buoy	-	-	4401530	20160901	20161231	6C 6D 6E
Drifting Buoy	-	-	4401532	20160914	20161231	6B 6C 6D 6E
Drifting Buoy	-	-	4401534	20160905	20161231	6E 6F
Drifting Buoy	-	-	4401536	20161005	20161231	3K 3L 3M
Drifting Buoy	-	France	4401550	20160519	20161231	3M
Drifting Buoy	-	France	4401551	20160526	20160530	3M
Drifting Buoy	-	France	4401552	20160517	20161231	4Vs6F 6G 6H
Drifting Buoy	-	France	4401553	20160808	20161231	1F
Drifting Buoy	-	France	4401554	20160808	20161211	1F
Drifting Buoy	-	France	4401555	20160808	20161231	3K 3L 3M
Drifting Buoy	-	Canada	4401601	20160512	20161231	1E 1F 2G 2H
Drifting Buoy	-	Canada	4401602	20160512	20161231	0B 1D 1E 1F 2G 2H 2J 3K 3L 4R
Drifting Buoy	-	Canada	4401603	20160512	20161231	1E 1F
Drifting Buoy	-	Canada	4401604	20160511	20161231	1E 1F 2H
Drifting Buoy	-	Canada	4401605	20160511	20161231	1F 2H 2J
Drifting Buoy	-	Canada	4401606	20161008	20161231	2G 2H 2J 3K
Drifting Buoy	-	Canada	4401607	20161008	20161231	2G 2H

Drifting Buoy	-	Canada	4401608	20160702	20161231	0A 0B 1B 1C 2G 2H
Drifting Buoy	-	Canada	4401609	20161008	20161231	2G 2H 2J 3K 4R 4S
Drifting Buoy	-	Canada	4401612	20160723	20161231	2J 3K 3L 3O
Drifting Buoy	-	Canada	4401613	20161008	20161231	2G 2H 2J 3K
Drifting Buoy	-	Canada	4401614	20160805	20160807	0B
Drifting Buoy	-	Canada	4401616	20161008	20161231	2G 2H 2J 3K 3L
Drifting Buoy	-	Canada	4401618	20160706	20161129	0A 0B
Drifting Buoy	-	Canada	4401619	20160728	20161231	0B 2G 2H 2J
Drifting Buoy	-	Canada	4401620	20160709	20161231	0A 0B 1A 1B
Drifting Buoy	-	Canada	4401621	20161030	20161031	3Ps
Drifting Buoy	-	Canada	4401622	20161008	20161231	0B 2G 2H 2J 3K
Drifting Buoy	-	Canada	4401623	20160606	20160606	2J
Drifting Buoy	-	Canada	4401625	20160723	20161231	2J 3K 3L 3Ps
Drifting Buoy	-	Canada	4401627	20160728	20161226	0B 2G
Drifting Buoy	-	Canada	4401628	20161008	20161231	2G 2H 2J 3K
Drifting Buoy	-	Canada	4401629	20160701	20161231	0A 0B 1A 2G
Drifting Buoy	-	Canada	4401630	20161008	20161231	2G 2H 2J
Drifting Buoy	-	Canada	4401631	20161008	20161231	2G 2H 2J 3K 3L
Drifting Buoy	-	Canada	4401632	20160725	20160928	2J 3K
Drifting Buoy	-	Canada	4401633	20161008	20161231	2G 2H 2J 3K 3L 3N
Drifting Buoy	-	Canada	4401634	20160724	20161231	2J 3K 3L 3M 3N
Drifting Buoy	-	Canada	4401635	20160728	20161231	0B 2G 2H 2J 3K
Drifting Buoy	-	Canada	4401636	20161008	20161231	2G 2H 2J
Drifting Buoy	-	Canada	4401637	20161002	20161231	2G 2H 2J 3K 4R 4S
Drifting Buoy	-	USA	44501	20160107	20160522	1F 2J 3K 3L 3M 3N
Drifting Buoy	-	USA	44502	20160501	20160811	3L 3M
Drifting Buoy	-	USA	44503	20160503	20160707	3K 3L 3M 3N
Drifting Buoy	-	USA	44507	20160625	20160731	3K 3L 3M
Drifting Buoy	-	USA	44509	20160304	20160729	3L 3N 3O 3Ps4Vs
Drifting Buoy	-	USA	44510	20160513	20161231	3L 3N 3O
Drifting Buoy	-	USA	44511	20160513	20160809	3L 3N
Drifting Buoy	-	USA	44515	20160101	20160211	1F 2J 3K 3M
Drifting Buoy	-	USA	44516	20160101	20160123	3M
Drifting Buoy	-	USA	44521	20160101	20160227	3M 3N 3O 4Vs4W 6F
Drifting Buoy	-	USA	44557	20160101	20160307	3M 3N 6H
Drifting Buoy	-	USA	44558	20160817	20161015	6F 6H
Drifting Buoy	-	France	44601	20160512	20160524	1E 1F
Drifting Buoy	-	USA	44602	20160512	20160524	1E 1F
Drifting Buoy	-	France	44603	20160512	20160524	1E 1F
Drifting Buoy	-	France	44604	20160511	20160524	1E 1F
Drifting Buoy	-	France	44605	20160511	20160524	1F
Drifting Buoy	-	UK	44625	20160101	20160124	1F
Drifting Buoy	-	Canada	44670	20160101	20161231	3K 3L 3N 3O 3Pn3Ps4Vn

Drifting Buoy	-	France	44739	20160419	20160421	6H
Drifting Buoy	-	UK	44762	20160101	20160103	3M
Drifting Buoy	-	USA	44765	20160101	20160321	3M
Drifting Buoy	-	UK	44766	20160101	20160323	3M 3N 3O
Drifting Buoy	-	France	44768	20160109	20160124	6H
Drifting Buoy	-	USA	44769	20160101	20160623	6B 6C 6D 6E
Drifting Buoy	-	USA	44772	20160101	20160317	1F 2J 3K
Drifting Buoy	-	USA	44773	20160104	20160106	3K
Drifting Buoy	-	UK	44774	20160114	20160120	6H
Drifting Buoy	-	UK	44775	20160730	20161231	4Vs4W 6B 6C 6D 6E 6F 6G 6H
Drifting Buoy	-	UK	44777	20160101	20161231	3L 3N 3O 3Ps4Vs4W
Drifting Buoy	-	France	44778	20160101	20160209	6H
Drifting Buoy	-	France	44779	20160101	20161108	3K 3L 3M 3N 3O 3Ps4Vn4Vs
Drifting Buoy	-	USA	44831	20160307	20160313	6G
Drifting Buoy	-	USA	44843	20160320	20160421	6H
Drifting Buoy	-	France	44858	20160329	20160407	3N
Drifting Buoy	-	France	44873	20160407	20161019	6H
Drifting Buoy	-	France	44874	20160201	20160224	3M
Drifting Buoy	-	France	44875	20161112	20161231	6H
Drifting Buoy	-	USA	44882	20160502	20160509	6H
Drifting Buoy	-	USA	44887	20160101	20160123	6H
Drifting Buoy	-	USA	44889	20160815	20161121	6G 6H
Drifting Buoy	-	USA	44896	20160217	20160524	6G 6H
Drifting Buoy	-	USA	44901	20160217	20160830	3K 3M 3N 3O
Drifting Buoy	-	USA	44902	20160217	20160524	3M 3N 3O
Drifting Buoy	-	USA	44903	20160217	20160226	3M
Drifting Buoy	-	USA	44904	20160225	20160226	3M
Drifting Buoy	-	USA	44905	20160222	20161214	3M 3N 3O 4Vs4W 4X 5Ze5Zw6A 6B 6D 6E 6F 6H
Drifting Buoy	-	-	4701653	20160808	20160823	0A
Drifting Buoy	-	-	4701655	20161212	20161212	0A
Drifting Buoy	-	-	4701656	20161216	20161220	0A
Drifting Buoy	-	USA	47503	20160117	20160131	1F
Drifting Buoy	-	Canada	47539	20160101	20160511	3L 3M 3N 3O
Drifting Buoy	-	Canada	47540	20160101	20160515	1F 2J 3K 3L 3M 3N
Drifting Buoy	-	Canada	47546	20160101	20161231	3L 3N 3O 3Ps4Vs
Drifting Buoy	-	Canada	47549	20160101	20160528	3K 3L 3M 3N 3O 4Vs
Drifting Buoy	-	Canada	47551	20160101	20161231	2G 2H 2J 3K 3L 3N 3O
Drifting Buoy	-	Canada	47552	20160101	20161231	0A
Drifting Buoy	-	USA	47555	20160101	20161231	3L 3N 3O
Drifting Buoy	-	Canada	47557	20160101	20160406	3K 3L 3M 3N

Drifting Buoy	-	USA	47560	20160101	20160225	3K 3L 3M 3N
Drifting Buoy	-	Canada	47562	20160101	20160404	1F 2J 3K
Drifting Buoy	-	Canada	47567	20160101	20160428	3K 3L 3M 3N
Drifting Buoy	-	Canada	47568	20160101	20160411	3L 3M 3N 3O
Drifting Buoy	-	Canada	47569	20160101	20160307	3L 3M 3N 3O
Drifting Buoy	-	-	47574	20160101	20161221	3K 3L 3M 3N 3O
Drifting Buoy	-	Canada	47584	20160101	20160813	3K 3L 3M 3N 3O
Drifting Buoy	-	Canada	47589	20160101	20161222	0A
Drifting Buoy	-	France	48664	20160726	20161122	0A 1A
Drifting Buoy	-	USA	54555	20160424	20160424	5Ze
Drifting Buoy	-	-	6203506	20160822	20161213	1F 2J 3K
Drifting Buoy	-	France	62500	20160101	20160218	1F
Drifting Buoy	-	France	62513	20160101	20160124	1F
Drifting Buoy	-	UK	62713	20160623	20161020	3M 3N 3O 4Vs6E 6F
Drifting Buoy	-	UK	62714	20160225	20160812	3M 3N 6G 6H
Drifting Buoy	-	USA	62728	20160419	20160628	6H
Drifting Buoy	-	USA	63923	20161218	20161227	1F
Drifting Buoy	-	France	64526	20160101	20161231	0B 1C 1D 1E 1F 2G 2H
Drifting Buoy	-	France	64668	20160202	20160208	1F
Drifting Buoy	-	France	6501551	20160513	20161231	1F 2G 2H
Drifting Buoy	-	France	6501552	20160513	20161231	1E 1F 2G 2H
Drifting Buoy	-	France	6501553	20160513	20161231	1F 2G 2H
Drifting Buoy	-	France	6501555	20160711	20161231	1C 1D
Drifting Buoy	-	France	6501556	20160719	20161231	1E 1F
Drifting Buoy	-	France	6501558	20160713	20161231	0B 1E 1F 2G
Drifting Buoy	-	France	65511	20160101	20160128	0B 1C 1D
Drifting Buoy	-	France	65514	20160101	20160404	1F 2H 2J 3K
Drifting Buoy	-	France	65515	20160101	20160224	1F 2G 2H
Drifting Buoy	-	France	65601	20160101	20160830	1C 1D 1E 1F 2G
Drifting Buoy	-	France	65603	20160101	20161020	1B

*Buoys marked by this symbol also measure waves

** Dates are of first and last data reports within the NAFO Convention Area

Table 5: Mooring data processed in 2016

Mooring Name / Project	Longitude (ºW)	Latitude (ºN)	First Date	Last Date	Instruments	NAFO Sub-Area
Old Harry	60.498300	48.000000	20160607	20161031	ADCP, MTR	4T
Tadoussac	69.673083	48.121733	20160519	20160930	CTD	4T
St. Anns Bank	59.330482	46.129887	20150924	20160924	CTD, ADCP	4Vn
St. Anns Bank	59.141283	46.255217	20150923	20160924	CTD, MTR	4Vn
St. Anns Bank	59.140645	46.250503	20150923	20160924	CTD, ADCP	4Vn
St. Anns Bank	59.741798	45.741415	20150924	20160923	CTD, ADCP	4Vn
St. Anns Bank	59.025913	46.32595	20150923	20160923	CTD, ADCP	4Vn
St. Anns Bank	59.142088	45.899475	20150923	20160923	CTD, ADCP	4Vn
Laurentian Channel AMAR	57.184182	44.462385	20150922	20160921	CTD	4Vs
NS Current (~OTN2)	63.170332	44.248238	20150524	20160916	ADCP, CTD	4W
OTN HFX245	63.49955	42.91625	20140612	20150813	CTD	4X
Hamilton Bank	54.084967	55.119458	20110511	20120605	RCM	2J
OTN HFX126	63.36444	43.75333	20130528	20140612	CTD	4X
OTN HFX153	63.44739	43.57	20130518	20140612	CTD	4X
OTN HFX180	63.5	43.38471	20130518	20140612	CTD	4X
OTN HFX245	63.5	42.91635	20130518	20140612	CTD	4X
OTN HFX028	63.3612	44.32333	20150420	20150503	CTD	4X
Strait of Canso	61.425383	45.651167	20151103	20160502	CTD	4T
Strait of Canso	61.425752	45.649558	20151102	20160502	CTD	4T
Strait of Canso	61.427488	45.65196	20151102	20160502	ADCP, CTD	4T
Hamilton Bank	54.092015	55.11974	20120605	20130519	RCM	2J
Hamilton Bank	54.08364	55.113867	20130511	20140514	RCM	2J
St. Anns Bank AMAR	58.727683	46.3554	20150617	20160501	CTD	4Vn
The Gully AMAR	58.909742	43.858787	20150523	20160423	CTD	4Vs
OTN HFX048	63.23096	44.20579	20150420	20160422	CTD	4W
OTN HFX069	63.10277	44.08662	20150420	20160422	CTD	4W
OTN HFX097	63.18874	43.91318	20150420	20160422	CTD	4W
OTN HFX008	63.48747	44.43822	20131030	20150420	CTD	4X
OTN HFX028	63.36093	44.32302	20131023	20150420	CTD	4X
OTN HFX048	63.23135	44.20696	20131023	20150420	CTD	4W
OTN HFX069	63.10097	44.08804	20131023	20150420	CTD	4W
OTN HFX097	63.18886	43.91359	20131023	20150420	CTD	4W
The Gully AMAR	62.868317	43.608713	20150524	20160419	CTD	4W
OTN HFX126	63.36436	43.75289	20140612	20151118	CTD	4X
OTN HFX153	63.44726	43.56965	20140612	20151118	CTD	4X
OTN HFX180	63.49852	43.38328	20140612	20151118	CTD	4X

Table 6: Water level data collected in 2016

Number	Name	Reporting period (months)	Longitude	Latitude	NAFO Subarea
65	Saint John	Jan-Dec	66.0630	45.2510	4X
365	Yarmouth	Jan-Dec	66.1167	43.8333	-
491	Bedford Institute	Jan-Dec	63.6167	44.6833	4W
612	North Sydney	Jan-Dec	60.2500	46.2167	-
665	Port aux Basques	Jan-Dec	59.1333	47.5667	-
755	St. Lawrence	Jan-Dec	55.3901	46.9168	-
835	Argentia	Mar-Dec	53.9833	47.3000	3Ps
905	St. John's	Jan-Dec	52.7167	47.5667	-
990	Bonavista	Jan-Dec	53.1150	48.6510	-
1430	Nain	Jan-Dec	61.6833	56.5500	-
1700	Charlottetown	Jan-Dec	63.1167	46.2333	4T
1805	Shediac Bay	Jan-Dec	64.5460	46.2270	4T
2000	Lower Escuminac	Jan-Dec	64.8833	47.0833	4T
2145	Belledune	Jan-Dec	65.8500	47.9000	-
1970	Cap-aux-Meules	Jan-Dec	61.8573	47.3789	-
2330	Rivière-au-Renard	Jan-Dec	64.3805	48.9970	4T
2780	Sept-Îles	Jan-Dec	66.3768	50.1948	-
2985	Rimouski	Jan-Dec	68.5137	48.4783	4T
3057	Saint-Joseph-de-la-Rive	Jan-Dec	70.3655	47.4488	4T
3100	Saint-Francois Île d'Orléans	Jan-Dec	70.8082	46.9965	4T
3248	Vieux-Québec	Jan-Dec	71.2019	46.8111	-
3980	Qikiqtarjuaq	Jan-Dec	64.0667	67.5167	0A