



Northwest Atlantic

Fisheries Organization

Serial No. N7070

NAFO SCR Doc. 20/024

SCIENTIFIC COUNCIL MEETING - JUNE 2020

NAFO STACFEN Report 2019

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Abstract

The Marine Environmental Data Section (MEDS) of the Oceans Science Branch of Fisheries and Oceans Canada serves as the Regional Environmental Data Center for NAFO. As part of this role, MEDS provides an annual inventory of environmental data collected in the NAFO Convention Area to the NAFO subcommittee for the environment (STACFEN), including 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 previous calendar year. Reporting includes data and information from NAFO member countries where these are provided to the data center.

Introduction

The Marine Environmental Data Section (MEDS) of the Oceans Science Branch of Fisheries and Oceans Canada (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 the International Commission for the Northwest Atlantic (ICNAF), and was subsequently formalized in 1975, by which time the Canadian Oceanographic Data Centre (CODC) had become the Marine Environmental Data Service (MEDS). MEDS underwent several name changes from 2005 to 2017, 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 yearly meetings in May and June requires the submission to MEDS of a completed oceanographic inventory form for data collected in the previous calendar year, and oceanographic data pertinent to the NAFO Convention Area, for all stations occupied in the years prior to the meetings. 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, and 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

A variety of oceanographic surface, near-surface, and subsurface observations are made every day in the NAFO Convention Area by ship-borne instruments and autonomous devices, including vertical profiles of parameters such as temperature, salinity, oxygen, nutrients and other chemical and biological variables. 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 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 (GTS) of the World Meteorological Organization Information System, and from NOAA's Geostationary Operational Environmental Satellite system. 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) and the ICES Oceanographic database. The delayed mode data generally take months to years to process from the time a cruise is completed or 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 they 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

Table 1 and Table 2 below summarize data received by MEDS for the NAFO Convention Area (NCA) in 2019. These refer to the more detailed platform-specific figures and tables at the end of this report. Table and figure numbers in these two tables differ for some platform types, as slightly different groupings of data (e.g., by variable type, sampling type, platform type, real-time vs. delayed mode, or source) are used to maximize clarity in the platform-specific figures and tables.

Due to time constraints, delayed-mode CTD data provided in May 2020 by the Spanish Institute of Oceanography and DFO Northwest Atlantic Fisheries Organization could not be included in this report, and so only appear in the tables and figures below if they were transmitted in real-time on the GTS. These data will be included in next year's report.

Table 1. Data observed in NAFO Convention Area in 2019

Data Type	Platform Type	Counts/Duration	Table #	Figure #
Oceanographic profiles	Autonomous drifting (Argo)	4348* profiles from 184 platforms	3	1
	Moorings (Viking)	1151* profiles from 6 platforms**	3	1
	Gliders	3038* profiles from 11 platforms	3	1
	Ship	3226 profiles (826 CTD; 1830 CTD*; and 570 XBT* profiles) from at least 21 ships	4	2
Surface/near-surface observations	Ship (thermosalinograph)	12904* obs. from 1 ship	4	4
	Drifting buoys	307473* obs. from 184 buoys	6	4
	Moored buoys	242445* obs. from 20 buoys**	6	4
	Fixed platforms	60312* obs. from 3 platforms	6	4
	Water level gauges	12 sites, avg. ~1 year each	7	4

*Data formatted for real-time transmission

**all Canadian wave buoys described in this report measure waves, and the moorings measuring CTD oceanographic profiles in this table are also equipped with surface buoys measuring waves

Table 2. Data observed prior to 2018 in NAFO Convention Area and acquired between January 2019 and May 2020

Data Type	Platform Type	Counts/Duration	Table #	Figure #
Oceanographic profiles	Ship	8996 profiles (3869 CTD + 1258 bottle + 175 XBT profiles) from 17 ships	5	3

*Data formatted for real-time transmission

Description

Oceanographic profiles

Argo (Figure 1, Table 3)

Argo is an international program which started in 2000 and which aims to deploy profiling floats on a 3 by 3 degree grid in the oceans of the world. Each profiling float samples and reports temperature and salinity from 2000 m to the surface every 10 days; pilots are also currently underway for deep Argo floats capable of sampling to 6000 m. Additionally, biogeochemical-Argo floats report oxygen, nitrate, pH, chlorophyll-a, suspended particles, and downwelling irradiance in addition to temperature and salinity. Data are distributed on the GTS within 12 hours of collection and made available on two mirrored Global servers located in France and in the USA.

MEDS carries out data management for Argo Canada profilers, from instrument to publication to the GTS and global servers. MEDS also decodes and stores all Argo data circulating on the GTS. Over 4000 Argo profiling floats owned by multiple countries are currently sampling the world's oceans.

Autonomous profiling floats programmed with sampling patterns other than a maximum sampling depth of 2000 m (or deeper for Deep Argo) and reporting interval of 10 d are often designated Argo-equivalent. In 2019, no Argo-equivalent floats reported within the NCA.

Gliders (Figure 1, Table 3)

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. MEDS regularly acquires data from the gliders owned by the Coastal Environmental Observation Technology and Research (CEOTR) group (headquartered at Dalhousie University) and creates messages for transmission on the GTS after performing automatic quality control. The full data set can be accessed from CEOTR.

Mammals (Figure 1, Table 3)

Among data decoded and acquired from the GTS by MEDS 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.

Ships (Figures 2 and 3, Table 4)

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, helicopters 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, GTSP QC manual) prior to transmission on the GTS (if within 30 days of observation) and ingestion in the archive.

MEDS decodes and stores all ship based data circulating on the GTS, either CTD or XBT, including data sampled by ships of opportunity. MEDS further receives delayed mode data from DFO institutes: Northwest Atlantic Fisheries Centre (NAFC), Bedford Institute of Oceanography (BIO), Maurice-Lamontagne Institute (MLI), St. Andrews' Biological Station, Gulf Fisheries Center (GFC, indirectly through BIO or MLI), Institute of Ocean Sciences (IOS) and the Freshwater Institute (FWI). MEDS ingests the data after conversion and visual quality assurance.

MEDS receives delayed mode data from foreign institutes, for example the Spanish Institute of Oceanography, either directly or through BIO. MEDS also periodically queries the World Ocean Database and ICES Oceanographic Database for additional data in the NAFO Convention Area (NCA). Due to time restrictions in the preparation of the report, these sources of data could not be included in this year's report.

Near-surface observations

Moored buoys and fixed stations (Figure 4, Table 6)

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. MEDS also acquires, in delayed mode, data from wave measuring buoys deployed near offshore oil and gas sites as per NEB Guidelines.

BIO, NAFC, and MLI maintain surface buoys, most of which are equipped with subsurface moored instruments such as ADCPs (see mooring section) and a CTD profiler. Those buoys are informally known as “Viking” buoys. MEDS transmitted data from the CTD profiler those buoys on the GTS in 2019. The data can otherwise be requested from MLI, NAFC, BIO.

A number of U.S. 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, such as the National Estuarine Research Reserve System, the University of North Carolina (including the Coastal Ocean Research and Monitoring Program) and the Chesapeake Bay Interpretive Buoy System. Their data management is coordinated by NOAA's National Data Buoy Center. Their positions are typically near the coast.

Drifting buoys (Figure 4, Table 6)

MEDS decodes and stores all drifting buoy data circulating on the GTS. 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 4, Table 5)

MEDS decodes and stores all thermosalinograph data circulating on the GTS. In 2019, one ships (from Canada) reported thermosalinograph data in the NCA.

Water level gauges (Figure 4, Table 7)

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

Activities under the DFO Atlantic Zone Monitoring Program (AZMP) 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 physical, chemical and biological data. MEDS archives physical oceanographic data from the AZMP (as outlined in the preceding sections), and also maintains program information and publications at <http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/azmp-pmza/index-eng.html>.

Offshore Oil and Gas Environmental Monitoring Data

As mentioned in the near-surface observations section, MEDS acquires, in delayed mode, monitoring physical oceanographic data collected near offshore oil and gas sites as per NEB Guidelines. No data submissions were received in 2019.

Data Access

- *Argo*: Real-time data are sent to the global data centers within 12 hours of collection; data are also updated in delayed mode. Global Argo data can be downloaded from various sources, as described at http://www.argo.ucsd.edu/Argo_data_and.html.
- *Real-time oceanographic data*: Real-time oceanographic profiles from the GTS and other sources, as well as US coastal mooring and 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). 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>).

- *Canadian bottle and plankton data*: Data are available from the BioChem Database (<https://www.dfo-mpo.gc.ca/science/data-donnees/biochem/index-eng.html>).
- *Delayed-mode Canadian oceanographic profiles*: Data are exchanged bilaterally with 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.
- *Drifting buoy equatorial moored buoy data from the GTS*: These 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 buoys*: 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 levels*: 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>) and MLI (<https://slgo.ca/app-sgdo/en/accueil.html>) depending on the site locations.
- *Gliders*: Full resolution glider data from measured by CEOTR can be accessed from their website : <http://ceotr.ocean.dal.ca/>. Information on DFO glider deployments can be accessed from the "Everyone's Glider Observations" website: <https://www.ego-network.org/dokuwiki/doku.php> and the data can be accessed from : <https://www.ego-network.org/dokuwiki/doku.php?id=public:dataaccess>.
- *Marine mammals*: Observations from sensors mounted on marine mammals can be accessed from the MEOP website : <http://www.meop.net/>
- *Other MEDS data*: Canadian oceanographic data and global drifting buoy data can be requested through this form: <http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/request-commande/form-eng.asp>.

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.)

Boyer, T.P., J. I. Antonov, O. K. Baranova, C. Coleman, H. E. Garcia, A. Grodsky, D. R. Johnson, R. A. Locarnini, A. V. Mishonov, T.D. O'Brien, C.R. Paver, J.R. Reagan, D. Seidov, I. V. Smolyar, and M. M. Zweng, 2013: World Ocean Database 2013, NOAA Atlas NESDIS 72, S. Levitus, Ed., A. Mishonov, Technical Ed.; Silver Spring, MD, 209 pp., <http://doi.org/10.7289/V5NZ85MT>

Figures and Tables

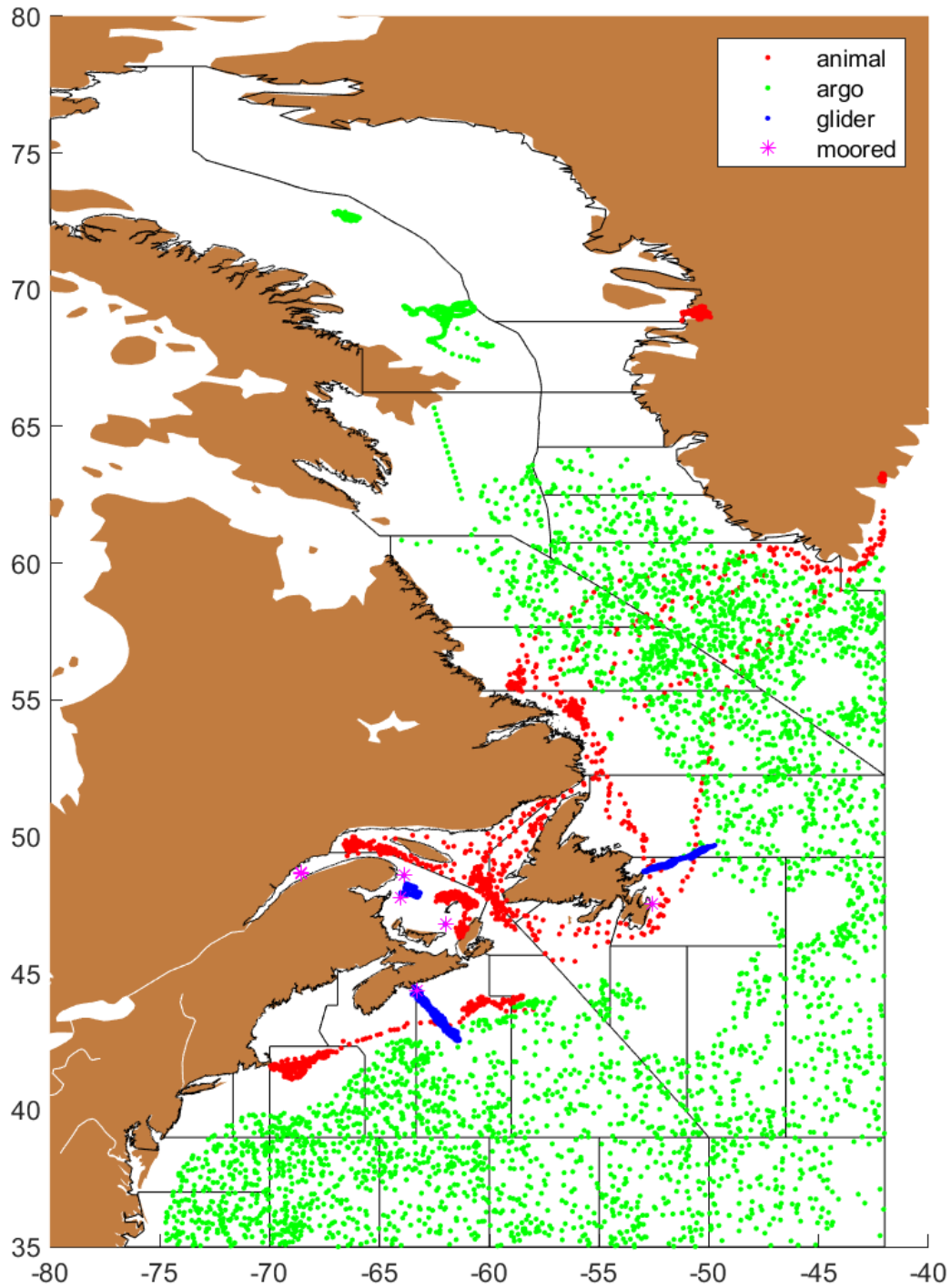


Figure 1. Position of profiles sampled by autonomous platforms in 2019

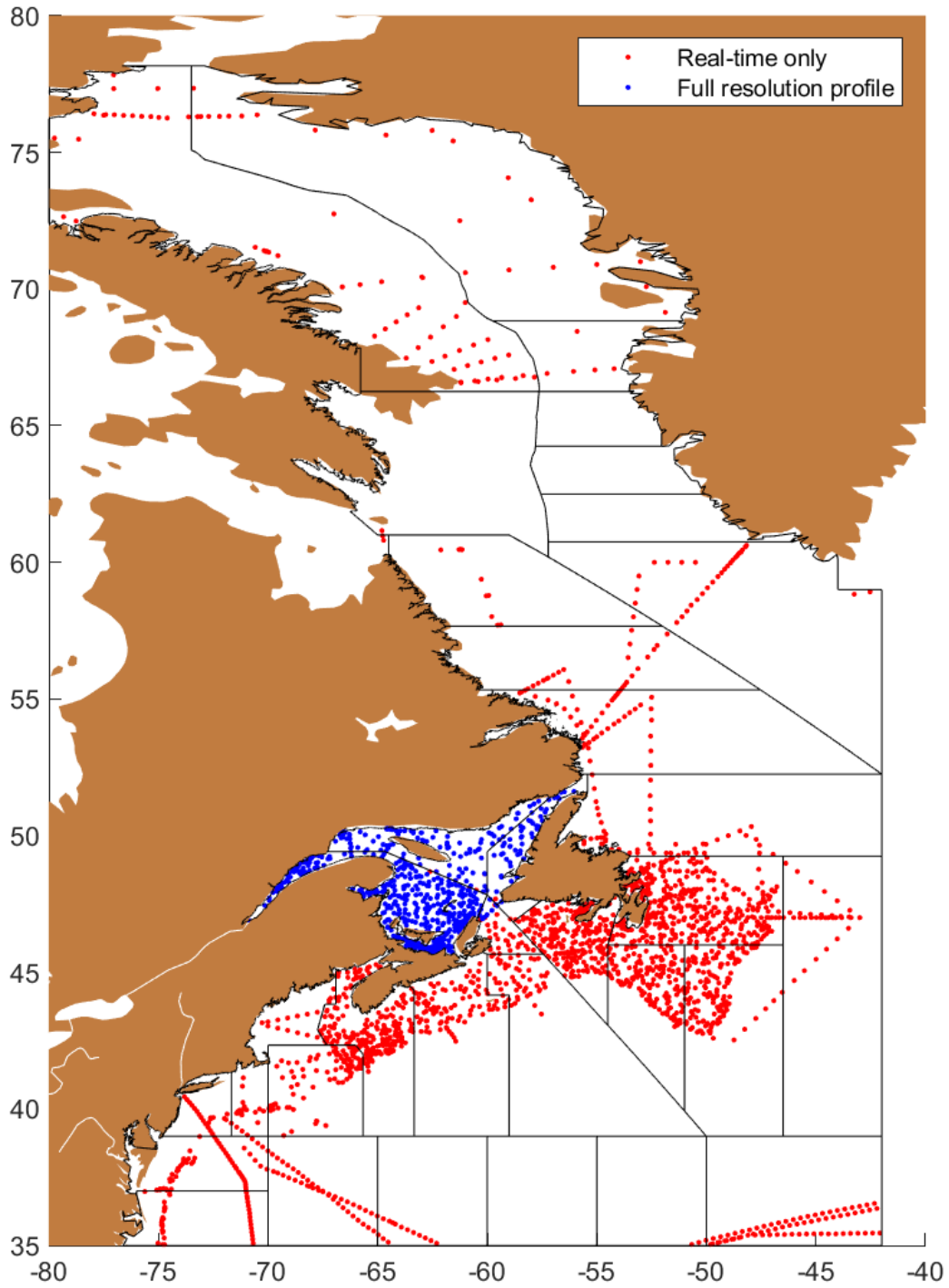


Figure 2. Position of profiles sampled by ships in 2019. NAFC and IEO data for 2019 are still being processed by MEDS, and may be missing or shown as real-time only.

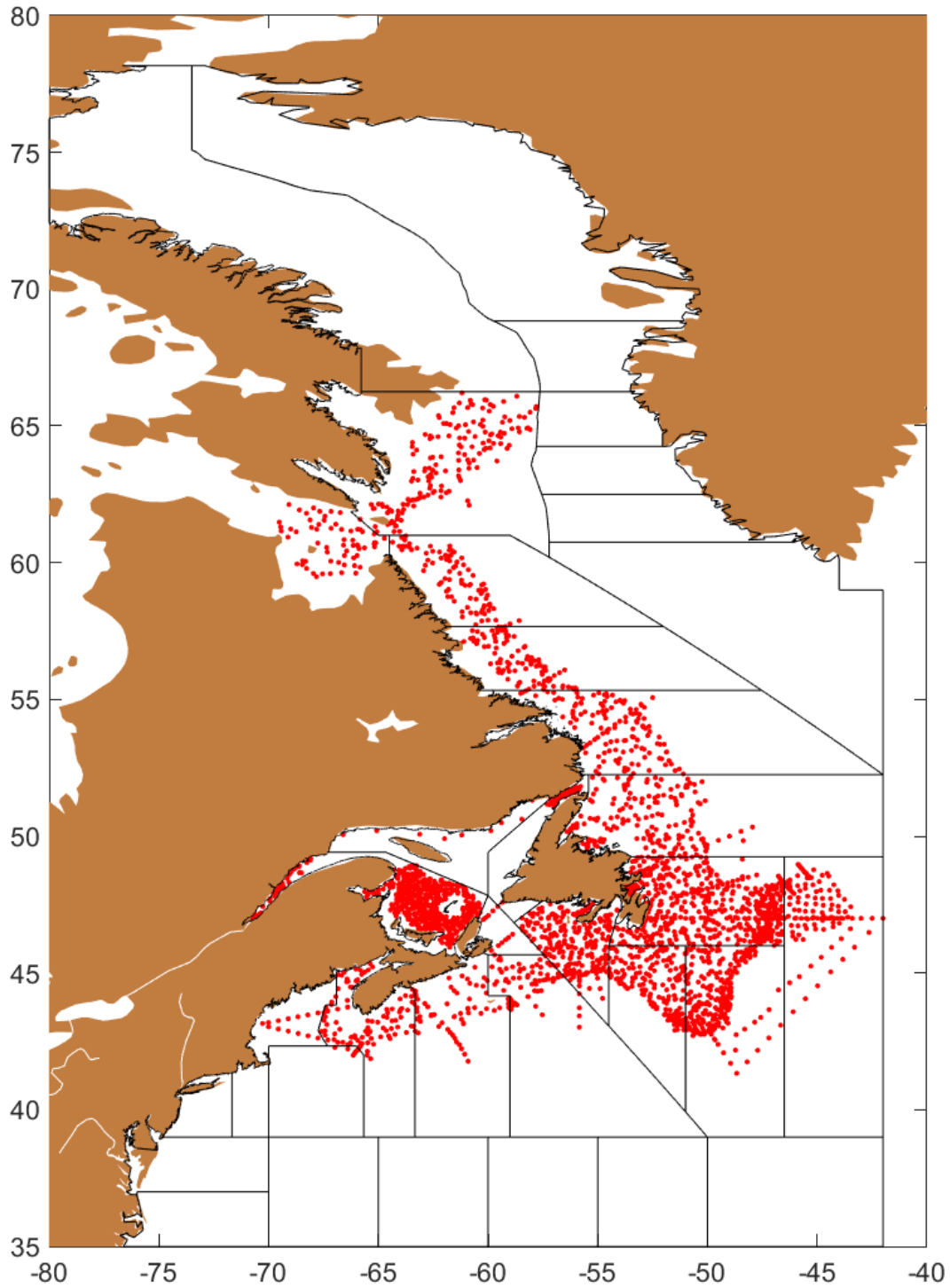


Figure 3. Position of profiles sampled by ships before 2019 and acquired in 2019/2020

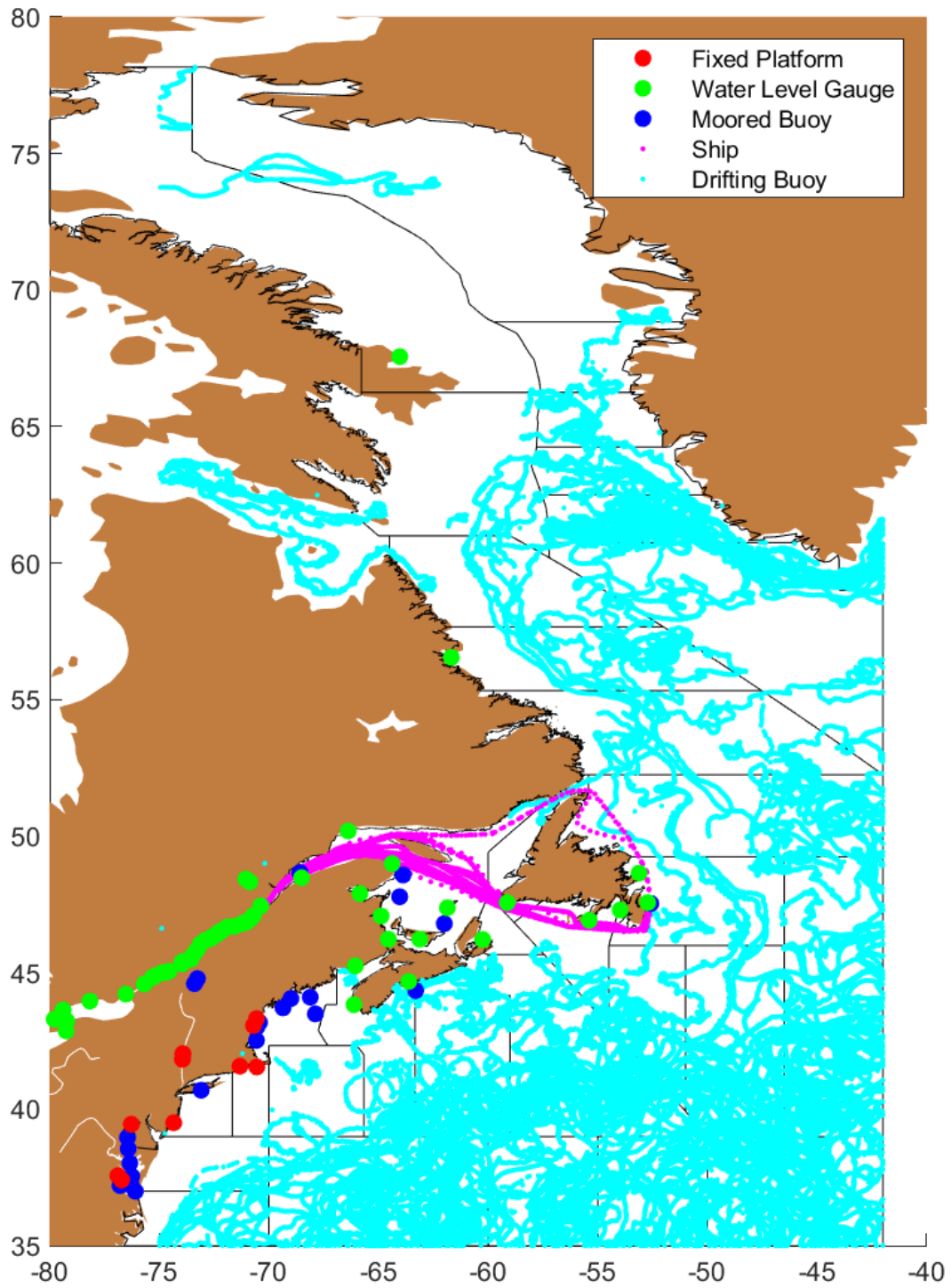


Figure 4. Position of near surface observations made in 2019

Table 3. Real-time temperature and /or salinity profiles from autonomous platforms collected and processed in 2019

Platform Type	Platform Name	Country	WMO ID	Reporting Period (months)	Profiles	NAFO Subareas
moored	PMZA-RIKI**	Canada	4400481	Jun-Nov	367	4T
moored	IML-BA**	Canada	4400483	Jun-Sep	154	4T
moored	AZMP-ESG**	Canada	4400484	May-Oct	181	4T
moored	AZMP-VAS**	Canada	4400485	Jun-Nov	200	4T
moored	AZMP-STA27**	Canada	4400486	Jun-Oct	246	3L
moored	AZMP-HLX**	Canada	4400487	Jan-Jan	3	4W
glider	SEA019	Canada	4800925	Mar-Nov	265	4W
glider	SEA021	Canada	4800926	Feb-Oct	396	4W
glider	SEA032	Canada	4800937	Jan-Feb	90	4W
glider	SEA022	Canada	4800993	Jun-Oct	364	4W 4X
glider	SEA024	Canada	4800994	Jun-Dec	1213	3K 3L 4W 4X
glider	SEA019	Canada	4800925	Oct-Nov	13	4W
glider	SEA021	Canada	4800926	Sep-Oct	25	4W
glider	SEA022	Canada	4800993	Jul-Oct	38	4W
glider	SEA024	Canada	4800994	Jun-Dec	385	3K 3L 4W 4X
glider	Fundy	Canada	4800999	Jun-Jul	183	4T
glider	PearlDiver	Canada	6801735	Dec-	66	2J
argo		USA	3901219	Jan-Dec	24	6F 6G
argo		Germany	3901601	Jan-Dec	34	4X 5Ze6B 6C 6D
argo		Germany	3901602	Jan-Dec	33	3N 3O 4Vs6G 6H
argo		Germany	3901603	Mar-Dec	28	4Vs4W 6E 6F 6G
argo		Germany	3901604	Jan-May	11	6D 6E
argo		Germany	3901637	Jan-Dec	30	3M 3N 4Vs6H
argo		Germany	3901638	Jan-Dec	37	3N 4Vs4W 6E 6F 6G 6H
argo		Germany	3901639	Jan-Dec	31	4W 4X
argo		Germany	3901640	Jan-Dec	37	3M 3N 3O 4Vs4W 6E 6F 6G 6H
argo		Germany	3901641	Jan-Dec	37	4W 4X 5Ze6B 6C 6D 6E
argo		Germany	3901642	Jan-Oct	30	3N 4Vs4W 4X 5Ze6D 6E 6H

argo	Germany	3901654	Jul-Oct	9	6F 6G
argo	Germany	3901656	Jan-Dec	30	6B 6C 6D 6E 6F
argo	Germany	3901657	Apr-Nov	24	4X 5Ze6D 6E
argo	Germany	3901659	Jan-May	5	6H
argo	Germany	3901660	Jan-Jun	6	1F
argo	Germany	3901665	Jan-Apr	12	1F
argo	Germany	3901667	Jan-Jul	14	1F 2G
argo	Germany	3901668	Jan-Dec	53	1F 2G 2H
argo	Germany	3901669	Jan-Dec	54	1F 2H
argo	France	3901856	Aug-Sep	4	6D
argo	USA	4901462	Jan-Jan	1	3N
argo	USA	4901467	Jan-Mar	7	6G 6H
argo	USA	4901594	Jan-Dec	38	3N 3O 4Vs6G 6H
argo	USA	4901621	Apr-Dec	26	4W 4X 5Ze5Zw6B 6D 6E
argo	USA	4901630	Jan-Jul	20	6F 6G 6H
argo	USA	4901631	Jan-Dec	36	4W 4X 5Ze6D 6E
argo	USA	4901699	Aug-Dec	12	6F 6G
argo	USA	4901702	Apr-Nov	13	6F
argo	USA	4901704	Jan-Jan	5	3K
argo	USA	4901721	Mar-Dec	30	3N 3O 4Vs4W 6B 6C 6D 6E 6H
argo	Canada	4901747	Jan-Dec	36	1F 2G 2H 2J
argo	Canada	4901765	Jan-Oct	15	4Vs4W 6D 6E 6F
argo	Canada	4901779	May-Jul	5	1F
argo	Canada	4901788	Jan-Dec	37	4W 4X 5Ze5Zw6B 6C 6D 6E
argo	Canada	4901798	Jan-Dec	36	3N 4Vs4W 4X 6B 6D 6E 6H
argo	Canada	4901806	Jul-Sep	8	0A
argo	Canada	4901813	Jan-Sep	17	6D 6E 6F
argo	Canada	4901817	Jan-Mar	8	1F
argo	USA	4902099	Jan-Dec	36	4X 5Ze6B 6C 6D
argo	USA	4902102	Apr-Dec	22	6B 6C 6D
argo	USA	4902107	Feb-Feb	1	3K
argo	USA	4902109	Jun-Oct	11	6C 6D 6E
argo	USA	4902111	Jul-Dec	17	4Vs4W 6B 6C 6D 6E
argo	USA	4902112	Jan-Dec	35	3N 4Vs4W 6B 6C 6D 6E 6H
argo	USA	4902114	May-Dec	24	3O 4Vs4W 6B 6C 6D 6E 6F 6G

argo	USA	4902116	Jan-May	5	2J 3K
argo	USA	4902118	May-Dec	23	1E 1F 2G
argo	USA	4902119	Aug-Dec	15	1E 1F
argo	USA	4902120	Jan-Dec	37	4Vs4W 6E 6F 6G
argo	USA	4902122	Jan-Oct	16	5Ze5Zw6C
argo	USA	4902337	Jan-Dec	36	4W 4X 6D 6E 6F 6G
argo	USA	4902344	Jan-Dec	35	4W 4X 5Ze6B 6C 6D 6E
argo	USA	4902346	Jan-Dec	37	4Vs4W 4X 5Ze6D 6E 6F
argo	USA	4902347	Jan-Feb	5	3M 3N
argo	USA	4902348	Jan-Dec	40	3O 3Ps4Vs4W 4X 5Ze
argo	Canada	4902391	Jan-May	12	4W 6B 6C 6D 6E
argo	Canada	4902392	Jan-Dec	35	3N 4Vs4W 4X 6D 6E 6F 6H
argo	Canada	4902393	Jan-Aug	21	6F 6G 6H
argo	Canada	4902394	Jan-Dec	35	4Vs4W 4X 5Ze5Zw6A 6B 6C 6D 6E 6F
argo	Canada	4902395	Jan-Dec	35	1F 2G 2H 2J
argo	Canada	4902397	Jan-Nov	32	1F 2H 2J
argo	Canada	4902398	Jan-Feb	3	3K 3M
argo	Canada	4902399	Jan-Dec	37	2J 3K
argo	Canada	4902400	Jan-Dec	30	3L 3M
argo	Canada	4902409	Jan-Dec	36	1F
argo	Canada	4902410	Jan-Dec	35	2H 2J 3K 3L 3M
argo	Canada	4902412	Jan-Nov	32	3K 3L 3M 3N
argo	Canada	4902419	Jan-Dec	31	0B 1D 1E 2G
argo	Canada	4902420	Jan-Feb	5	3M
argo	Canada	4902422	Jan-Dec	37	0B 1E 1F 2G 2H
argo	Canada	4902423	Jan-Mar	7	1F
argo	Canada	4902424	Jan-Dec	33	2J 3K 3L 3M
argo	Canada	4902438	Jan-Dec	36	2H 2J
argo	Canada	4902439	Jan-Dec	36	1F 2G 2H
argo	Canada	4902440	Jan-Dec	37	3M 3N 4Vs4W 4X 5Ze6B 6D 6E 6F
argo	Canada	4902441	Jan-Dec	36	3O 3Ps4Vs
argo	Canada	4902442	Jan-Dec	37	3O 4Vs4W 4X 6D 6E 6F
argo	Canada	4902450	Jan-Aug	23	1F
argo	Canada	4902452	Jan-Dec	37	1F 2J
argo	Canada	4902453	Jan-Aug	24	5Ze5Zw6A 6B 6C

argo	Canada	4902455	Jan-Dec	37	4Vs4W 4X 5Ze6D 6E 6F
argo	Canada	4902456	Jan-Dec	34	3M 3N 3O 4Vs6G 6H
argo	Canada	4902457	Jan-Jul	20	3Ps4Vs4W
argo	Canada	4902458	Jan-Mar	6	3N
argo	Canada	4902467	Apr-Dec	27	4Vs4W
argo	Canada	4902468	Jun-Dec	22	2H 2J 3K
argo	Canada	4902469	Jun-Dec	20	1F 2G 2H
argo	Canada	4902470	Apr-Dec	27	4Vs4W
argo	Canada	4902471	Jun-Dec	21	1F
argo	Canada	4902477	Jun-Dec	21	1F
argo	Canada	4902478	Jun-Dec	20	1F 2G 2H
argo	Canada	4902479	Jun-Dec	21	1F 2G 2H
argo	Canada	4902480	Jun-Dec	21	1F
argo	Canada	4902481	Jun-Dec	22	1F 2H 2J
argo	Canada	4902487	Jun-Dec	21	1F 2H
argo	Canada	4902488	Jun-Dec	19	1F 2G 2H
argo	Canada	4902489	Sep-Dec	12	1F 2H 2J
argo	Canada	4902495	Sep-Dec	11	1F
argo	Canada	4902496	Nov-Dec	4	3M
argo	Canada	4902497	Nov-Dec	4	3M
argo	Canada	4902498	Dec-Dec	3	3N
argo	Canada	4902499	Dec-Dec	3	3N
argo	USA	4902910	Sep-Dec	12	4Vs4W 4X 6C 6D
argo	USA	4902911	Mar-Dec	30	4W 4X 5Ze6B 6C 6D 6E
argo	USA	4902912	Jan-Dec	65	6B 6C 6D
argo	USA	4902913	Jan-Dec	20	6E 6G 6H
argo	USA	4902918	Jan-Oct	25	3K 3M 6H
argo	USA	4902927	Mar-Dec	30	4W 4X 5Ze5Zw6A 6B 6C 6D 6E
argo	USA	4902928	Jan-Oct	30	4W 4X 6D 6E
argo	USA	4903035	Jan-Dec	37	3N 4Vs4W 5Ze6B 6D 6E 6H
argo	USA	4903036	Jan-Dec	37	3N 3O 4Vs6F 6G 6H
argo	USA	4903042	Sep-Dec	12	6B 6C 6D
argo	USA	4903047	Jan-Dec	22	4W 6C 6D 6E 6F
argo	USA	4903048	Jan-Dec	37	3N 4Vs4W 4X 6D 6E
argo	USA	4903049	Jan-Dec	35	4X 5Ze5Zw6B 6C 6E

argo	USA	4903260	Nov-Dec	7	5Ze5Zw
argo	USA	5903390	Jan-Jan	1	1F
argo	USA	5903395	Jan-Jun	17	1D 1E 1F 2G
argo	USA	5904176	Mar-Dec	30	1E 1F 2G 2H 2J 3K
argo	USA	5904771	Jan-Dec	31	2J 3K
argo	USA	5904772	Jan-Dec	29	2G 2H 2J 3K 3L 3M
argo	UK	6901147	Mar-Jul	2	1F
argo	UK	6901149	Jan-Jan	1	1F
argo	UK	6901167	Dec-Dec	2	1F
argo	UK	6901169	Jan-Dec	36	1E 1F
argo	UK	6901171	Jan-Dec	27	1F 2G 2H 2J 3K 3L 3M
argo	UK	6901173	Jan-Dec	18	3K 3M
argo	UK	6901178	Jan-Dec	37	0B 1E 1F 2G 2H
argo	UK	6901190	Jan-Dec	36	0B 2G 2H 2J 3K 3L 3M
argo	UK	6901192	May-Aug	9	1F
argo	UK	6901194	May-Dec	25	0B 1D 1E 1F
argo	UK	6901207	Oct-Dec	9	1D 1E 1F
argo	France	6901564	May-Jul	7	1D 1E 1F
argo	France	6901566	Jan-Aug	21	2G 2H 2J 3K 3L
argo	France	6901568	Jan-Mar	8	2J 3K
argo	France	6901719	Aug-Dec	14	1E 1F
argo	France	6901721	Jan-Dec	35	2G 2H 2J 3K 3M
argo	France	6901722	Jan-Dec	37	1F 2J
argo	France	6901723	Feb-Jul	7	1F
argo	France	6901726	Jan-Apr	10	3K 3M
argo	France	6901751	Jan-Dec	36	1F 2H 2J
argo	France	6901753	Jan-Jan	3	3M
argo	France	6901754	Jan-Oct	26	2G 2H 2J 3K 3L 3M
argo	Germany	6901911	Jan-Mar	9	0B 1E 2G
argo	Ireland	6901921	Nov-Dec	7	1F
argo	Germany	6902632	Jan-Sep	18	3N 3O 4Vs6G 6H
argo	Germany	6902633	Jan-May	15	3M
argo	Germany	6902634	Jan-Nov	25	4Vs4W 6D 6E 6F
argo	Germany	6902635	Jan-Nov	31	3M 3N 4Vs6G 6H
argo	France	6902659	Feb-Dec	20	3M 6H
argo	France	6902661	Jan-Dec	26	3M 3N 6G 6H

argo	France	6902684	Aug-Dec	15	1E 1F
argo	France	6902686	Jan-Dec	37	1F 2H
argo	France	6902694	Nov-Dec	6	1E 1F
argo	France	6902696	Jan-May	7	3K 3M
argo	France	6902697	Aug-Sep	2	1F
argo	France	6902707	Jan-Dec	37	2J 3K 3L 3M 3N
argo	France	6902708	Jan-Feb	4	2J
argo	France	6902709	Jan-Dec	36	0B 1E 1F 2G 2H 2J 3K 3L 3M
argo	France	6902727	Jul-Nov	104	0A
argo	France	6902728	Feb-Mar	7	1F
argo	France	6902752	Jun-Jun	1	1F
argo	France	6902753	Jan-Dec	37	0B 1D 2G 2H 2J 3K
argo	France	6902754	Apr-Dec	26	1F
argo	France	6902755	Jan-Dec	35	0B 1D 1E 1F
argo	France	6902756	Jul-Dec	17	0B 1D 1E 1F
argo	France	6902787	Oct-Dec	9	1D 1E 1F
argo	France	6902789	Dec-Dec	2	1F
argo	France	6902794	Jan-Jan	2	3K
argo	France	6902796	Aug-Aug	1	1F
argo	France	6902802	Jan-Dec	37	1F
argo	France	6902862	Jan-Dec	19	2J 3K 3M
argo	France	6902863	Jan-Dec	32	2J 3K 3M
argo	France	6902864	Jan-Jun	11	3K 3M
argo	France	6902865	Jan-Dec	26	2J 3K 3M
argo	France	6902881	Aug-Sep	4	1F
argo	France	6902896	Feb-May	15	0B
argo	France	6902897	Jan-Oct	82	0A
argo	France	6902952	Jul-Nov	110	0A 1A
argo	France	6902953	Jan-Jul	22	0A
argo	France	6902967	Jul-Nov	110	0A
argo	Germany	7900527	Jun-Dec	14	2J 3K 3M
argo	Germany	7900528	Jun-Dec	11	3K 3M
animal		9901124	Jan-Feb	77	4Vs4W
animal		9901125	Jan-May	382	4W 4X 5Ze
animal		9901221	Mar-May	180	1F 2G 2H 2J 3K 4R 4S 4T

animal	9901222	Mar-Jun	203	1F 2H 2J 3K 3L 3Pn3Ps4R 4S 4T
animal	9901223	Mar-May	183	1F 2H 2J 3K 3Pn4R 4S 4T 4Vn
animal	9901224	Mar-Jun	193	1F 2G 2H 2J 3K 3L 3Pn3Ps4R 4S 4Vn
animal	9901225	Mar-Jun	217	1F 2H 2J 3K 3L 3Pn3Ps4R 4S 4Vn
animal	9901246	Jul-Dec	425	4T
animal	9901248	Jul-Nov	377	1A
animal	9901249	Jul-Dec	418	1A
animal	9901250	Jul-Dec	557	1A

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

**Moorings equipped with fixed profiling CTDs, mounted with Viking buoys. Deployments were seasonal and the full data are available at the MLI.

Table 4. Oceanographic profiles collected by ships in 2019

Platform	Country	Mission	First Date	Last Date	CTD	CTD RT*	XBT	XBT RT*	Bottle	TS G**	NAFO Sub-areas
Viola M. Davidson	CAN		20190212	20191217	0	9	0	0	0	0	4X
Alfred Needler	CAN		20190212	20191105	0	1098	0	13	0	0	3L 3N 3O 3Pn3P s4Vn4 Vs4W 4X 5Y 5Ze
C-GCGP		184119002	20190304	20190313	103	0	0	0	0	0	3Pn4R 4S 4T 4Vn
Tubul	USA		20190321	20190322	0	0	0	24	0	0	6H
Leim		18L019003	20190406	20190411	8	0	0	0	0	0	4T
Hudson	CAN		20190409	20190423	0	61	0	0	0	0	4Vn4V s4W 4X 5Y 5Ze
Beluga II		18BP19004	20190412	20191213	32	0	0	0	0	0	4T
Teleost	CAN		20190412	20190520	0	81	0	55	0	0	3K 3L 3M
Leim		18L019005	20190421	20190506	40	0	0	0	0	0	4S
Vladykov	CAN		20190427	20191015	0	119	0	0	0	0	3K 3L 3Ps
Oceanex Connaigra	CA		20190101	20191231	0	0	0	0	0	12 90 4	3K 3L 3Pn3P s4R 4S 4T 4Vn
Nuka Arctica	FRA		20190429	20190429	0	2	0	0	0	0	1F
Various Small Vessels		18VA19668	20190509	20191004	6	0	0	0	0	0	4T
Leim		18L019011	20190511	20190519	7	0	0	0	0	0	4S
L'Alliance		18K819001	20190521	20190821	29	0	0	0	0	0	4T
Teleost	CAN	18TL19009	20190526	20190615	144	0	0	0	0	0	3Pn4R 4S 4T 4Vn
Chicago Express	USA		20190530	20190716	0	0	0	49	0	0	6G 6H

Amundsen	CAN		20190601	20190904	0	200	0	0	0	0	0A 0B 1A 1B 1F 2G 2H 2J 4R 4T 4Vn4 W
Maersk Vilnius	USA		20190610	20190814	0	0	0	70	0	0	5Zw6A 6B 6D 6E
Teleost	CAN		20190627	20190713	0	86	0	56	0	0	2H 2J 3K 3L 3M
Leim		18L019016	20190628	20190705	19	0	0	0	0	0	4T
Okeanos Explorer	USA		20190703	20190816	0	0	0	196	0	0	4X 5Ze5Z w6A 6B 6C
Leim		18L019023	20190707	20190726	21	0	0	0	0	0	4T
M. Perley	CAN	18MU19040	20190723	20190805	54	7	0	0	0	0	4T
Leim		18L019021	20190730	20190816	86	0	0	0	0	0	4T
unknown	CAN, USA		20190731	20191030	0	5	0	67	0	0	3L 3Ps4V s4W 6A 6B 6C
Frederick G. Creed	CAN	18FC19033	20190808	20190823	11	0	0	0	0	0	4R
M. Perley	CAN	18MU19008	20190815	20190819	21	0	0	0	0	0	4T
Teleost	CAN	18TL19036	20190815	20190903	65	1	0	0	0	0	4R 4S 4T 4Vn
Teleost	CAN	18TL19021	20190906	20191001	123	0	0	0	0	0	4T 4Vn
Leim	CAN	18L019047	20190916	20190922	8	0	0	0	0	0	4T
M. Perley	CAN	18MU19001	20190921	20191010	18	0	0	0	0	0	4T
Leim	CAN	18L019050	20191001	20191009	20	0	0	0	0	0	4T
M. Perley	CAN	18MU19142	20191016	20191030	11	0	0	0	0	0	4T
Coriolis II	CAN		20191021	20191106	0	78	0	0	0	0	3Pn4R 4S 4T 4Vn
James Cook	CAN		20191117	20191209	0	83	0	40	0	0	3K 3L 3M 3N 3O 3Ps

* 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.

**TSG counts are not number of profiles, but number of point thermosalinograph observations

Dates are of first and last data reports within the NAFO Convention Area.
Additional full resolution CTD profiles from some of these cruises were received at MEDS but could not be ingested and counted in time for this report



Table 5. Pre-2019 temperature (XBT) and/or salinity (CTD, bottle) profile data collected aboard ships, entered or updated in 2018/2019

Platform	Mission Number	First Date	Last Date	CTD	Bottle	XBT	NAFO_Subareas
Hudson	18HU07033	20070802	20070809	61	0	0	4Vs4W
Alfred Needler	18NE10002	20100311	20100330	72	0	0	4Vs4W
Teleost	18TL13124	20130308	20130308	0	1	0	3L
Teleost	18TL13113	20130403	20130409	0	2	0	3L
Teleost	18TL13114	20130410	20130429	0	74	0	3K 3L 3M 3N 3O 3Ps
Teleost	18TL13115	20130510	20130510	0	1	0	3L
Alfred Needler	18NE13433	20130514	20130514	0	1	0	3L
Teleost	18TL13116	20130527	20130527	0	1	0	3L
Vladykov	18VD13014	20130613	20130624	0	2	0	3L
Alfred Needler	18NE13435	20130621	20130621	0	1	0	3L
Hudson	18HU13021	20130628	20130705	42	0	0	3L 3M 4W
Teleost	18TL13117	20130709	20130728	0	64	0	2H 2J 3K 3L 3M
Vladykov	18VD13023	20130813	20130813	0	1	0	3L
Alfred Needler	18NE13438	20131001	20131001	0	1	0	3L
Alfred Needler	18NE13439	20131015	20131015	0	1	0	3L
Hudson	18HU13113	20131118	20131208	0	78	0	2J 3K 3L 3M 3N 3O 3Ps
Teleost	18TL14127	20140203	20140203	0	1	0	3L
Teleost	18TL14129	20140411	20140429	0	66	0	3K 3L 3M 3N 3O 3Ps
Teleost	18TL14130	20140511	20140511	0	1	0	3L
Hudson	18HU14007	20140516	20140516	0	1	0	3L
Teleost	18TL14131	20140525	20140525	0	1	0	3L
Alfred Needler	18NE14447	20140619	20140619	0	1	0	3L
Teleost	18TL14140	20140623	20140623	0	1	0	3L
Teleost	18TL14132	20140709	20140728	0	72	0	2H 2J 3K 3L 3M
Vladykov	18VD14033	20140814	20140814	0	1	0	3L
Hudson	18HU14114	20141116	20141207	0	69	0	2J 3K 3L 3M 3N 3O
Teleost	18TL14141	20141221	20141221	0	1	0	3L
Teleost	18TL15142	20150121	20150121	0	1	0	3L
Teleost	18TL15143	20150202	20150202	0	1	0	3L

Teleost	18TL15155	20150320	20150320	0	1	0	3L
Teleost	18TL15144	20150410	20150427	0	71	0	3L 3M 3N 3O 3Ps
Teleost	18TL15146	20150511	20150511	0	1	0	3L
Alfred Needler	18NE15453	20150526	20150526	0	1	0	3L
Alfred Needler	18NE15455	20150619	20150619	0	1	0	3L
Teleost	18TL15148	20150709	20150727	0	78	0	2H 2J 3K 3L 3M
Vladykov	18VD15046	20150813	20150813	0	1	0	3L
Alfred Needler	18NE15457	20150920	20150920	0	1	0	3L
Alfred Needler	18NE15458	20151002	20151002	0	1	0	3L
Alfred Needler	18NE15459	20151010	20151010	0	1	0	3L
Hudson	18HU15115	20151115	20151206	0	93	0	2J 3K 3L 3M 3N 3O 3Ps
Teleost	18TL16168	20160211	20160211	0	1	0	3L
Teleost	18TL16157	20160401	20160406	0	7	0	3L 3Ps
Vladykov	18VD16053	20160415	20160415	0	1	0	3L
Teleost	18TL16169	20160510	20160510	0	1	0	3L
Teleost	18TL16159	20160511	20160517	0	28	0	3L 3M
Teleost	18TL16171	20160608	20160616	0	2	0	3L
Teleost	18TL16172	20160621	20160621	0	1	0	3L
Teleost	18TL16160	20160708	20160728	0	57	0	2J 3K 3L 3M
Inquisitor	18QM16619	20160815	20160815	0	1	0	3L
Alfred Needler	18NE16464	20160825	20160825	0	1	0	3L
Alfred Needler	18NE16465	20160909	20160909	0	1	0	3L
Alfred Needler	18NE16466	20160927	20160927	0	1	0	3L
Teleost	18TL16164	20161106	20161106	0	1	0	3L
Hudson	18HU16116	20161113	20161120	0	30	0	3L 3N 3O 3Ps
Alfred Needler	18NE16470	20161122	20161122	0	1	0	3L
Alfred Needler	18NE16471	20161202	20161206	0	2	0	3L
Teleost	18TL16166	20161206	20161206	0	1	0	3L
Alfred Needler	18NE16472	20161215	20161215	0	1	0	3L

Teleost	18TL17173	20170406	20170423	0	77	0	3K 3L 3M 3N 3O 3Ps
Teleost	18TL17174	20170501	20170501	0	1	0	3L
Alfred Needler	18NE17480	20170603	20170603	0	1	0	3L
Alfred Needler	18NE17481	20170617	20170617	0	1	0	3L
Alfred Needler	18NE17482	20170622	20170622	0	1	0	3L
Teleost	18TL17176	20170708	20170728	0	80	0	2G 2H 2J 3K 3L 3M
Jean Mathieu	182P17001	20170710	20170922	350	0	0	4T
Alfred Needler	18NE17484	20170925	20170925	0	1	0	3L
Alfred Needler	18NE17486	20171023	20171023	0	1	0	3L
Alfred Needler	18NE17487	20171025	20171106	0	2	0	3L
Fugro Discovery	PADS17009	20171111	20171216	0	44	0	2J 3K 3L 3M
Alfred Needler	18NE17488	20171121	20171121	0	1	0	3L
Hudson	18HU18118	20180112	20181211	290	72	33	3K 3L 3M 3N 3O 3Pn3Ps4Vn4Vs4W 4X 5Y 5Ze
Various Small Vessels	18VA18669	20180116	20181211	25	0	0	4T 4W 4X
Various Small Vessels	18VA18666	20180207	20181221	25	0	0	4T 4W 4X
Multiple Ships	1.89E+08	20180312	20181206	32	0	0	4T
Hudson	18HU18004	20180406	20180423	85	0	0	3Pn3Ps4Vn4Vs4W 4X 5Y 5Ze
Teleost	18TL18185	20180406	20180424	69	55	42	3K 3L 3M 3N 3O 3Ps
Alfred Needler	18NE18493	20180414	20180418	2	0	2	3L 3Ps
Teleost	18TL18186	20180426	20180501	11	1	0	3L
Alfred Needler	18NE18494	20180427	20180507	78	0	0	3L 3Ps
Teleost	18TL18187	20180502	20180522	38	1	43	3K 3L
Alfred Needler	18NE18495	20180510	20180519	82	0	8	3L 3Ps4Vs
Teleost	18TL18194	20180524	20180604	56	0	0	3L 3O
Alfred Needler	18NE18496	20180525	20180605	63	0	5	3L 3N 3O 3Ps

Vladykov	18VD18092	20180527	20180602	16	0	0	3Ps
Vizconde de Eza	29VE180602	20180602	20180621	107	0	0	3N 3O
Alfred Needler	18NE18497	20180606	20180618	94	2	2	3L 3N 3O
Teleost	18TL18195	20180606	20180618	81	0	2	3L 3N
Leim	18LO18020	20180619	20180625	14	0	0	4T
Alfred Needler	18NE18498	20180620	20180621	6	0	0	3L
Vizconde de Eza	29VE180626	20180626	20180723	74	0	0	3L 3M
Colvert	18ZG18043	20180630	20181009	64	0	0	4T
Colvert	18ZG18032	20180705	20181027	67	0	0	4T
Vladykov	18VD18095	20180706	20180706	1	0	0	3L
Teleost	18TL18023	20180714	20180728	84	0	0	4W 4X 5Y 5Ze
Coriolis II	18OL18011	20180715	20180802	0	81	0	2G 2H 2J 3K 3L 3M
Kildir	1.88E+08	20180716	20180920	34	0	0	4T
L'Alliance	18K818001	20180717	20181015	43	0	0	4T
Jean Mathieu	182P18001	20180719	20180916	352	0	0	4T
Aqviq	18QQ18113	20180722	20180901	307	0	0	0B 2G 3K
Vladykov	18VD18097	20180725	20180801	13	0	0	3L
Vizconde de Eza	29VE180730	20180730	20180819	93	0	0	3L
Vladykov	18VD18098	20180803	20180805	10	0	0	3L
Various Small Vessels	18VA18668	20180806	20180806	1	0	0	4T
Leim	18LO18029	20180811	20180814	24	0	0	4T
Vladykov	18VD18100	20180817	20180819	15	0	0	3L
Vladykov	18VD18101	20180826	20180828	12	0	0	3K
Alfred Needler	18NE18499	20180830	20180910	44	0	7	3L 4R
Vladykov	18VD18102	20180907	20180916	20	0	0	3K
Alfred Needler	18NE18500	20180912	20180925	79	1	8	3L 3N 3O
Hudson	18HU18030	20180915	20181005	105	0	0	3Pn3Ps4Vn4Vs4W 4X 5Y 5Ze
Vladykov	18VD18103	20180923	20180926	17	0	0	3L
Kildir	1.88E+08	20180925	20180927	64	0	0	4T
Alfred Needler	18NE18501	20180926	20181009	95	0	1	3L 3N 3O

Vladykov	18VD18104	20181003	20181003	2	0	0	3L
Alfred Needler	18NE18502	20181010	20181023	69	0	6	3L
Teleost	18TL18189	20181011	20181118	149	0	3	2H 2J 3L
Vladykov	18VD18105	20181015	20181015	2	1	0	3L
Frederick G. Creed	18FC18046	20181018	20181108	11	0	0	4R 4S 4T
Vladykov	18VD18106	20181020	20181028	3	0	0	3L
Leim	18LO18055	20181022	20181101	8	0	0	4T
Alfred Needler	18NE18503	20181024	20181103	60	0	2	3K 3L
Teleost	18TL18190	20181026	20181104	59	0	0	2H 2J
Alfred Needler	18NE18504	20181108	20181121	20	0	2	3K 3L
Teleost	18TL18191	20181109	20181119	23	0	3	2J
Alfred Needler	18NE18505	20181121	20181128	27	0	3	2J 3K
Teleost	18TL18192	20181122	20181203	58	0	1	2J 3K
Teleost	18TL18193	20181207	20181218	61	1	2	2J 3K 3L

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

Table 6. Real-time surface water, air, atmospheric parameters and wave* data from buoys, collected and processed in 2019

Country	Type	Name	ID	Reporting Period	Profiles	NAFO Subareas
USA	Fixed Platform	Coastal Marine Lab, New Castle, NH	CMLN3	Jul-Dec	2484	5Y
USA	Fixed Platform	Jacques Cousteau Reserve, NJ	JCTN4	Jan-Dec	23218	6A
USA	Fixed Platform	T-Wharf Bottom, Narragansett Bay Reserve, RI	NAQR1	Jan-Dec	34610	5Zw
USA	Fixed Platform	Menauhant, Waquoit Bay Reserve, MA	WAQM3	Jan-Dec	28224	5Zw
USA	Moored Buoy	Massachusetts Bay	4400029	Jan-Dec	8575	5Y
USA	Moored Buoy	Western Maine Shelf	4400030	Jan-Dec	8600	5Y
USA	Moored Buoy	Central Maine Shelf	4400032	Jan-Dec	8189	5Y
USA	Moored Buoy	Penobscot Bay	4400033	Jan-Dec	8595	5Y
USA	Moored Buoy	Eastern Maine Shelf	4400034	Jan-Dec	8601	5Y
USA	Moored Buoy	Jordan Basin	4400037	Jan-Dec	7833	5Y
USA	Moored Buoy	Potomac, MD	4400042	Jan-Dec	46862	6B
USA	Moored Buoy	Stingray Point, VA	4400058	Feb-Dec	18432	6B
USA	Moored Buoy	Gooses Reef, MD	4400062	May-Dec	22360	6B
USA	Moored Buoy	Annapolis, MD	4400063	May-Dec	39336	6B
USA	Moored Buoy	First Landing, VA	4400064	Jan-Dec	7573	6B
USA	Moored Buoy	Great South Bay	4400069	May-Dec	10911	6A
USA	Moored Buoy	York Spit, VA	4400072	Jan-Dec	7323	6B
USA	Moored Buoy	CO2 Gulf of Maine Buoy	4400073	Jul-Dec	1061	5Y
Canada	Moored Buoy*	East Scotia Slope	4400137	Jan- Dec	8232	4W
Canada	Moored Buoy*	Banquerau Banks	4400139	Jan-Dec	8116	4Vs
Canada	Moored Buoy*	La Have Bank	4400150	Jan-Dec	8179	4X
Canada	Moored Buoy*	Halifax Harbour	4400258	Jan-Dec	7885	4W
Canada	Moored Buoy*	Mont-Louis	4500138	May-Dec	5782	4S
USA	Drifting Buoy		2101547	Aug-Aug	1	4S
UK	Drifting Buoy		3100735	Jun-Aug	964	6D 6E
USA	Drifting Buoy		3201560	Jan-Apr	1748	6F 6G 6H

USA	Drifting Buoy	4100538	Jun-Dec	3305	4Vs4W 6D 6E 6F 6G
	Drifting Buoy	4101529	Dec-Dec	124	6E
	Drifting Buoy	4101532	Jan-Apr	1200	3M 3N 6H
	Drifting Buoy	4101533	Jan-Mar	1243	2J 3K
	Drifting Buoy	4101535	Jan-Feb	624	3M 3N 3O 4Vs4W 6G
	Drifting Buoy	4101539	Jan-Jul	4426	3M 3N 4Vs6D 6E 6F 6H
USA	Drifting Buoy	4101541	Jan-Aug	2425	6D 6E 6F 6G
USA	Drifting Buoy	4101544	Apr-Jun	1242	6H
USA	Drifting Buoy	4101546	Sep-Dec	2652	3M 3N 4Vs6F 6G 6H
USA	Drifting Buoy	4101548	Mar-Apr	251	6G 6H
	Drifting Buoy	4101560	Jan-Mar	812	6H
	Drifting Buoy	4101562	Apr-May	28	6G
	Drifting Buoy	4101567	Jan-Oct	5434	3M 3N 3O 4Vs6G 6H
	Drifting Buoy	4101568	Jan-Oct	2893	6F 6G 6H
	Drifting Buoy	4101573	Jan-Apr	2096	3N 3O 4Vs6F 6G 6H
	Drifting Buoy	4101574	Sep-Dec	2313	4X 5Ze5Zw6B 6C 6D 6E 6F 6G
	Drifting Buoy	4101575	Jan-May	2298	3M 3N 3O 4Vs4W 6E 6F
USA	Drifting Buoy	4101586	Jan-Aug	4363	3M 3N 3O 4Vs4W 4X 6E 6F 6G 6H
	Drifting Buoy	4101623	Jan-Dec	8742	1F 2G 2H 2J
	Drifting Buoy	4101624	May-Dec	5258	0B 1E 1F 2G 2H 2J 3K
	Drifting Buoy	4101625	Feb-Aug	3798	1B 1C 1D 1E 1F
	Drifting Buoy	4101627	Oct-Dec	2047	1D 1E 1F
USA	Drifting Buoy	4101637	Jan-Feb	1044	3M 3N 6F 6G 6H
USA	Drifting Buoy	4101647	Jan-Mar	1418	3N 4Vs6F 6G 6H
USA	Drifting Buoy	4101649	Jan-Sep	2523	4Vs4W 4X 6D 6E 6F 6G
USA	Drifting Buoy	4101650	Dec-Dec	524	6G 6H
USA	Drifting Buoy	4101663	Dec-Dec	464	1E 1F
USA	Drifting Buoy	4101690	Jun-Oct	3539	2J 3K 3L 3M 3N

France	Drifting Buoy	4101702	Jun-Nov	3127	4Vs4W 6C 6D 6E 6F
	Drifting Buoy	4101713	Jan-Sep	2943	6D 6E 6F
	Drifting Buoy	4101719	Apr-Jun	1315	6G
	Drifting Buoy	4101720	Jan-Dec	8242	3M 3N 3O 3Ps4Vs6H
	Drifting Buoy	4101721	Jan-Sep	2793	3N 3O 4Vs6F 6G 6H
France	Drifting Buoy	4101742	Jan-Feb	1324	3M 3N 3O 4Vs4W 6D 6E 6H
USA	Drifting Buoy	4201512	May-Sep	1677	6B 6C 6D
USA	Drifting Buoy	4201517	Jan-Apr	1170	3N 3O 4Vs5Ze6D 6H
USA	Drifting Buoy	4201527	Jan-May	2352	4W 4X 6B 6C 6D 6E
USA	Drifting Buoy	4201545	May-Sep	2558	4Vs6B 6C 6D 6E 6F 6G 6H
USA	Drifting Buoy	4201554	Jun-Sep	2461	3M 3N 3O 4Vs4W 6D 6E
USA	Drifting Buoy	4201556	May-Dec	5326	3N 3O 4Vs4W 4X 6B 6C 6D 6E
USA	Drifting Buoy	4201557	Jan-Feb	1283	3M 3N 3O 4Vs4W 4X 6B 6C 6D 6E 6F 6G 6H
USA	Drifting Buoy	4201558	Jan-Sep	5354	3M 3N 3O 4Vs4W 6B 6C 6D 6E 6H
USA	Drifting Buoy	4201559	Jan-Jul	4217	3O 4Vs4W 4X 5Ze6B 6C 6D 6E
	Drifting Buoy	4400501	May-Jun	396	3M
	Drifting Buoy	4400502	May-Jul	184	3K 3M
	Drifting Buoy	4400503	May-Jul	1151	3K 3L 3M 3N
	Drifting Buoy	4400504	May-Sep	2505	3L 3O
	Drifting Buoy	4400505	May-Sep	2502	3L
USA	Drifting Buoy	4400906	Nov-Nov	94	6F
	Drifting Buoy	4401503	Jan-Mar	1688	4Vs6F 6G
France	Drifting Buoy	4401527	Jan-Apr	1112	6G 6H
France	Drifting Buoy	4401531	Jan-Apr	1763	3M 3N 3O 4Vs6F 6G 6H
	Drifting Buoy	4401540	Jan-Apr	1074	6F 6G 6H
	Drifting Buoy	4401542	Oct-Dec	1397	5Ze6B 6C 6D 6E
	Drifting Buoy	4401544	Jan-Mar	1546	3N 6G 6H

	Drifting Buoy	4401557	Dec-Dec	176	6H
	Drifting Buoy	4401563	Dec-Dec	680	6G 6H
	Drifting Buoy	4401567	Jan-Jan	629	1F 2J
	Drifting Buoy	4401568	Jan-Feb	990	3K 3M
	Drifting Buoy	4401569	Jan-May	2493	1F 2J 3K
	Drifting Buoy	4401572	Jan-Jun	3490	3L 3M 3N 3O 4Vs
	Drifting Buoy	4401573	Jan-Feb	1143	3K 3M 3N
	Drifting Buoy	4401575	Feb-Dec	7260	3K 3L 3M
	Drifting Buoy	4401577	Jun-Aug	1376	3M
	Drifting Buoy	4401578	Jun-Jul	705	3M 3N
	Drifting Buoy	4401580	Aug-Nov	2059	3K 3L 3M
	Drifting Buoy	4401581	Aug-Dec	3164	3M 3N 3O 4Vs4W 6G 6H
	Drifting Buoy	4401582	Aug-Oct	1299	3M 3N 3O
	Drifting Buoy	4401583	Aug-Sep	541	3O 4Vs
	Drifting Buoy	4401584	Aug-Aug	27	3O
Canada	Drifting Buoy	4401611	Jan-Oct	5788	3K 3M 3N 3O 4Vs4W 6H
USA	Drifting Buoy	4401756	Jan-Jul	134	3K 3M
USA	Drifting Buoy	4401786	Dec-Dec	115	1F
USA	Drifting Buoy	4401787	Jan-Feb	322	6H
USA	Drifting Buoy	4401813	Nov-Dec	380	6F
USA	Drifting Buoy	4401816	Jan-Jun	1159	3O 4Vs4W 4X 6D 6E 6H
	Drifting Buoy	4401821	Aug-Sep	2550	0B
	Drifting Buoy	4401822	Nov-Dec	3074	2G
	Drifting Buoy	4401825	Sep-Dec	2304	3O 3Ps4Vn4Vs4W
	Drifting Buoy	4401826	Sep-Dec	2225	0A 1A 3O 4Vs
	Drifting Buoy	4401827	Sep-Dec	842	3Ps4Vs4X
	Drifting Buoy	4401828	Dec-Dec	497	3K
	Drifting Buoy	4401829	Dec-Dec	475	3K 3L
	Drifting Buoy	4401830	Dec-Dec	430	3L 3N
USA	Drifting Buoy	4401845	Feb-Dec	6911	3M 3N 3O 4Vs4W 4X 6B 6C 6D 6E
USA	Drifting Buoy	4401846	Feb-Jul	3094	5Ze
USA	Drifting Buoy	4401893	May-Nov	3930	2J 3K 3L
USA	Drifting Buoy	4401894	Jun-Dec	5016	2J 3K 3L 3N 3O

	Drifting Buoy	4402510	Jan-Dec	8145	3M 3N 3O 4Vs4W
	Drifting Buoy	4402511	Jan-Jul	3022	3M 3N 3O 4Vs4W 6H
	Drifting Buoy	4402512	Jan-Feb	690	3M
	Drifting Buoy	4402514	May-Aug	1670	4W
	Drifting Buoy	4402516	May-Aug	1670	4X
	Drifting Buoy	4402517	May-Nov	3875	3M 3N 3O 4Vs4W 4X 6H
	Drifting Buoy	4402521	May-Sep	2428	4W
	Drifting Buoy	4402526	May-Jul	3002	4Vs4W
	Drifting Buoy	4402681	Nov-Dec	869	4Vn4Vs4W
	Drifting Buoy	4402684	Nov-Dec	1133	4Vs4W
	Drifting Buoy	4402685	Nov-Dec	1249	4Vs4W
	Drifting Buoy	4402686	Nov-Dec	1604	4Vs4W
	Drifting Buoy	4402687	Nov-Dec	1133	4Vs4W 4X
	Drifting Buoy	4402688	Nov-Dec	1133	4W 4X
	Drifting Buoy	4402689	Nov-Dec	1133	4W 4X 5Ze
	Drifting Buoy	4402690	Dec-Dec	276	4X
	Drifting Buoy	4402691	Dec-Dec	276	4X
	Drifting Buoy	4402704	Dec-Dec	254	4X
	Drifting Buoy	4402705	Dec-Dec	223	4X
	Drifting Buoy	4402706	Dec-Dec	651	4X
	Drifting Buoy	4402707	Dec-Dec	200	4X
Canada	Drifting Buoy	4700539	Jul-Nov	2398	4Vs4W 6B 6C 6D 6E 6F
	Drifting Buoy	4700546	Dec-Dec	211	6F 6G
	Drifting Buoy	4700552	Jan-Jan	605	3K 3L 3M
Canada	Drifting Buoy	4700584	Aug-Sep	502	6D 6E 6F
	Drifting Buoy	4701675	Jan-Jan	149	3M
	Drifting Buoy	4700552	Jan-Jan	1	3K
Canada	Drifting Buoy	4800770	Aug-Aug	65	1F
Canada	Drifting Buoy	4802504	Jun-Jun	365	0A 1A
USA	Drifting Buoy	6202679	Nov-Dec	1322	1E 1F
	Drifting Buoy	6203529	Nov-Dec	950	4W 4X 6B 6C 6D 6E 6F
USA	Drifting Buoy	6203564	Sep-Dec	2318	0B 1D 1E 1F 2G
USA	Drifting Buoy	6203566	Sep-Dec	2405	0B 1C 1D 1E 1F

USA	Drifting Buoy	6203571	Aug-Dec	3074	1A 1B 1C 1D 1E 1F
USA	Drifting Buoy	6203574	Oct-Dec	2109	0B 1D 1E 1F 2G
USA	Drifting Buoy	6203576	May-Dec	5348	0B 1D 1E 1F 2G 2H 2J 3K 4R 4S
USA	Drifting Buoy	6203578	Oct-Dec	2121	0A 0B 1B 1C 1D 1E 1F
USA	Drifting Buoy	6203584	Oct-Dec	1569	0B 1C 1D 1E 1F
	Drifting Buoy	6203602	Jan-Jan	260	0B
	Drifting Buoy	6203707	Feb-Feb	2	6H
	Drifting Buoy	6301562	Jun-Dec	4336	1F 2G 2H 2J
	Drifting Buoy	6301563	May-Nov	4462	0B 1E 1F 2G 2H 2J 3K
USA	Drifting Buoy	6401531	Jan-Jan	465	1F
USA	Drifting Buoy	6401539	Jan-Dec	6343	0B 2G 2H 2J 3K
USA	Drifting Buoy	6401544	Jan-Jan	369	1E 1F
	Drifting Buoy	6401572	Mar-May	1259	1F
USA	Drifting Buoy	6401783	Dec-Dec	684	1E 1F
	Drifting Buoy	6401809	Nov-Dec	644	1E 1F
	Drifting Buoy	6401810	Nov-Dec	607	0B 1E 1F
	Drifting Buoy	6401811	Nov-Dec	622	1E 1F
	Drifting Buoy	6401812	Nov-Dec	615	0B 1E 1F
	Drifting Buoy	6401813	Nov-Dec	597	1E 1F
	Drifting Buoy	6401814	Nov-Dec	636	0B 1E 1F
	Drifting Buoy	6401815	Nov-Dec	603	1E 1F
	Drifting Buoy	6401816	Nov-Dec	639	1E 1F
	Drifting Buoy	6401817	Nov-Dec	625	1E 1F
	Drifting Buoy	6401818	Dec-Dec	627	0B 1E 1F
	Drifting Buoy	6401819	Nov-Dec	615	1E 1F
	Drifting Buoy	6401820	Nov-Dec	620	1E 1F
	Drifting Buoy	6401821	Nov-Dec	614	1E 1F
	Drifting Buoy	6401822	Nov-Dec	622	1E 1F
	Drifting Buoy	6401823	Nov-Dec	633	1E 1F
	Drifting Buoy	6401824	Nov-Dec	591	1E 1F
	Drifting Buoy	6402505	Nov-Dec	595	1E 1F
	Drifting Buoy	6402506	Nov-Dec	575	1E 1F
	Drifting Buoy	6402507	Nov-Dec	619	1E 1F

Drifting Buoy	6402508	Nov-Dec	641	1E 1F
Drifting Buoy	6402509	Nov-Dec	639	1E 1F
Drifting Buoy	6402510	Nov-Dec	606	1E 1F
Drifting Buoy	6402511	Nov-Dec	615	1E 1F
Drifting Buoy	6402512	Nov-Dec	637	1E 1F
Drifting Buoy	6402513	Nov-Dec	628	1E 1F
Drifting Buoy	6402514	Nov-Dec	618	1E 1F
Drifting Buoy	6402515	Nov-Dec	632	1E 1F
Drifting Buoy	6402516	Nov-Dec	626	0B 1E 1F
Drifting Buoy	6402517	Nov-Dec	631	0B 1E 1F
Drifting Buoy	6402518	Nov-Dec	614	1E 1F
Drifting Buoy	6402519	Nov-Dec	637	1E 1F
Drifting Buoy	6402520	Nov-Dec	621	1E 1F
Drifting Buoy	6402521	Nov-Dec	623	1E 1F
Drifting Buoy	6402522	Nov-Dec	635	0B 1E 1F
Drifting Buoy	6402523	Nov-Dec	641	1E 1F
Drifting Buoy	6402524	Nov-Dec	620	1E 1F
Drifting Buoy	6402525	Nov-Dec	631	1E 1F
Drifting Buoy	6402526	Nov-Dec	613	1E 1F
Drifting Buoy	6402527	Nov-Dec	643	1E 1F
Drifting Buoy	6402528	Nov-Dec	627	1E 1F
Drifting Buoy	6402529	Nov-Dec	606	1E 1F
Drifting Buoy	6402530	Nov-Dec	618	1E 1F
Drifting Buoy	6402531	Dec-Dec	637	1E 1F 2G
Drifting Buoy	6402532	Nov-Dec	633	1C 1D 1E 1F
Drifting Buoy	6402533	Nov-Dec	639	1E 1F
Drifting Buoy	6402534	Nov-Dec	628	1D 1E 1F
Drifting Buoy	6402535	Nov-Dec	643	1E 1F
Drifting Buoy	6402536	Nov-Dec	639	1E 1F
Drifting Buoy	6402537	Nov-Dec	636	1D 1E 1F
Drifting Buoy	6402538	Nov-Dec	612	1D 1E 1F
Drifting Buoy	6501555	Jan-Feb	1237	1C
Canada Drifting Buoy	6801735	Dec-Dec	109	2J 3K

*Buoys marked by this symbol also measure waves
Dates are of first and last data reports within the NAFO Convention Area
Viking buoys are not shown in this table; see Table 3

Table 7. Water level data collected in 2019

Station ID	Name	Reporting period (months)	Longitude (W)	Latitude (N)	NAFO Sub-Area
65	Saint John	Jan-Dec	66.063	45.251	4X
365	Yarmouth	Jan-Dec	66.1167	43.8333	-
491	Bedford Institute	Jan-Dec	63.6167	44.6833	4W
612	North Sydney	Jan-Dec	60.25	46.2167	-
665	Port aux Basques	Jan-Dec	59.1333	47.5667	-
755	St. Lawrence	Mar-Dec	55.3901	46.9168	-
835	Argentia	Jan-Dec	53.9833	47.3	3Ps
905	St. John's	Jan-Dec	52.7167	47.5667	-
990	Bonavista	Jan-Dec	53.115	48.651	-
1430	Nain	Jan-Jul	61.6833	56.55	-
1700	Charlottetown	Jan-Dec	63.1167	46.2333	4T
1805	Shediac Bay	Jan-Dec	64.546	46.227	4T
1970	Cap-aux-Meules	Jan-Dec	61.8573	47.3789	-
2000	Lower Escuminac	Jan-Dec	64.8833	47.0833	4T
2145	Belledune	Jan-Dec	65.85	47.9	-
2330	Rivière-au-Renard	Jan-Dec	64.3805	48.997	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
3075	Banc du Cap Brûlé	Jan-Nov	70.710833	47.0895	4T
3100	Saint-Francois Île d'Orléans	Jan-Dec	70.8082	46.9965	4T
3110	Saint-Laurent île d'Orléans	Jan-Dec	71.0033	46.8582	4T
3248	Vieux-Québec	Jan-Dec	71.2019	46.8111	-
3980	Qikiqtarjuaq	Jul-Dec	64.031752	67.56052	0A