Arctic Ocean - I - 2023
Cruise number 2023007009

RV Kronprins Haakon

Longyearbyen - Longyearbyen

June 1 - June 21, 2023

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Contents

1. Summary

The NPI-AO1-2023 cruise planned to do a transect from N 84° 32’ E 018° 46’ to N 81° 30’, E 031° 00’ in the Nansen basin and cover parts of the established transect through the Nansen and Amundsen basins. Along the transect, there were 5 ice stations and 21 CTD casts planned. Some of the CTD stations also had some net hauls. The sea ice was very dense in the latter part of May and in June. It was thick and extended to Svalbard’s northern shores at the start of the cruise on 1st June 2023. We therefore decided to try to get to the Nansen basin via central northern the Fram Strait since any other route seemed impossible. We based the judgment on reports from RV Kronprins Haakon cruise in late May that met very heavy ice north of Svalbard and on satellite images. We worked our way north along W 004° - W 001°. 4th June we met heavy ice at N 80° and there was little or no progress. After trying to find leads all day we gave up reaching the Nansen Basin via Fram Strait at 23:00 4th June.

Since there was no sign of improvement in the ice conditions, we decided to make an ice station using the template from the original cruise plan. An ice station consisted of different CTD casts and water collection for oceanographic, biological, toxicological, and plastic samples. We took ice cores for biological, toxicological, and ice physics measurements, as well as air samples for airborne contaminants and plastic. We also measured ice thickness and did microstructure profiling of the water masses below the sea ice with a MSS. An ice station normally lasted for 36 hours. Since we had no plan to work in the Fram Strait we had not applied for permission to work in Danish/Greenland economic zone and the ice station had to be established in Norwegian waters, at N 79°16’ W 001° 40’. In preparation for the fact that we might not be able to reach the Nansen Basin at all, and to open up for a working opportunity in the Fram Strait, we sent an application for a research license in the Danish/Greenland economic zone. We were granted permission 9th June from the Danish/ Greenlandic authorities.

We had not given up reaching the Nansen basin and steamed to a new ice station further east to be closer to Svalbard's northwestern corner. The ice station was established 9th June in the morning at N 80° 01’ E 002° 48’. Due to no improvement of the ice conditions north of Svalbard we decided late 10th June to give up reaching the Nansen basin and concentrate on the Fram Strait transect. The arctic outflow is most prominent west of approximately W 0003° and, hence, we targeted our efforts to west of W 003°. Our plan was to take CTDs at every degree along N 78° 50’ to as far west as possible and establish 2 ice stations at W 006° 30’ and W 004° with an option of an additional one at W 002° if time allowed.

An ice station was established at N 78° 46' W 006° 11'. Due to a large ice floe we were not able to get closer to the intended position. After completing the ice station, we steamed west and reached N 78° 48’ E 007° 52’ early morning 14th June. We took our westernmost CTD with water collection for oceanographic, biological, toxicological, and plastic samples there. After completing the CTD station we continued east with CTD casts at W 007°, W 006° and W 005°. The ice conditions improved slightly, and we made relatively good headway between the CTD stations. We established a new ice station at N 78° 46' W 004° 0' 15th June. After completing the ice station, we continued east with CTDs and one last ice station over deep water at N 78° 58' W 002° 8'. After completion, we took CTDs at W 001°, W 000°, E 001°, E 002°. En route to Longyearbyen we also took a CTD for microplastic at N 78° 25' E00 7° 5'.

Despite not being able to reach the Nansen basin and perform the planned sampling schedule, we were able to collect valuable data along the NPI Fram Strait Arctic Outflow Observatory transect. The data gathered will serve as important information to the long-term timeseries for the not so frequently sampled late spring/early summer season.

2. Data availability

The data collected during the cruise are made available through the Norwegian Polar Data Centre at https://data.npolar.no/. The "Arbeidskatalog" from RV Kronprins Haakon is copied to \\npdata\PROJECT\Arctic Ocean Cruises\Workspace.

Measurements from different disciplines are published as separate datasets with separate DOIs, but all measurements from the cruise are linked with the common tag NPI-AO1-2023.

3. Survey area

The cruise was in the Fram Strait region, which is the largest gateway to the Arctic Ocean and the only gateway allowing deep water exchange. In the upper layers, Atlantic water flows northward in the West Spitsbergen Current along the Svalbard continental slope, while polar water and sea ice is transported southward in the East Greenland Current over the Greenland shelf and shelf slope. With most sampling taking place along N 78°50' in the western and central parts of the strait the collected data mainly covers the southward flux of Arctic freshwater and sea ice as well as various recirculating branches of Atlantic water at depth.

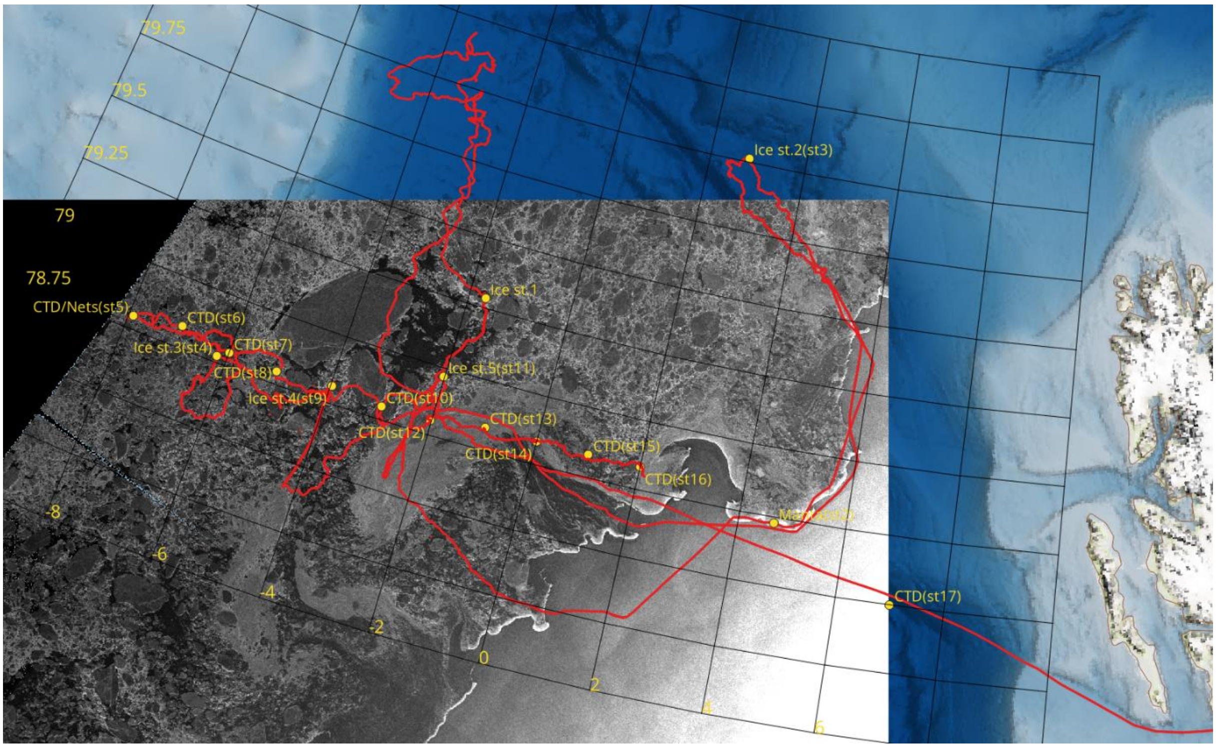


Figure 1. Map with the cruise track and the established ice and CTD stations overlaid on a typical satellite image of the ice (11th June). The multifaceted features west of the prominent white line (the ice edge) is sea ice drifting in a southwestward general direction. The large floe at N 79° W 004° is about 55 km long.

4. Activity Reports

4.1 Sea ice physics

*Dmitry V. Divine, NPI and Cora Hoppe, UiT*4.1.1 Ice observations from the bridge (ASSIST)

Regular sea ice observations using ASSIST protocol (see https://cryo.met.no/en/icewatch) were made by D.V. Divine, R. Krapp, C. Hoppe, A. Nikolopoulos, J. Sortland and O. Schneider while RV KPH was in the ice-covered waters.

Sea ice conditions were observed on average every three hours, except for the nighttime between midnight and 7:00, from the observation deck of RV KPH. The observations were skipped during sea ice stations, though corrections to ASSIST observations were introduced based on direct measurements made on ice stations. Various sea ice parameters including sea ice types, floe sizes, snow cover, ridges etc. were recorded along with ship data (position, speed, and heading) and meteorological data (air and water temperature, air pressure, wind speed and direction, and humidity). Digital photos were taken with each observation (3 photos, looking out towards port, bow, and starboard. In total MMM observations were made during the cruise while RV KPH was in the ice zone.

Preliminary results below show changes in observed sea ice concentrations along the cruise track (Figure 2).

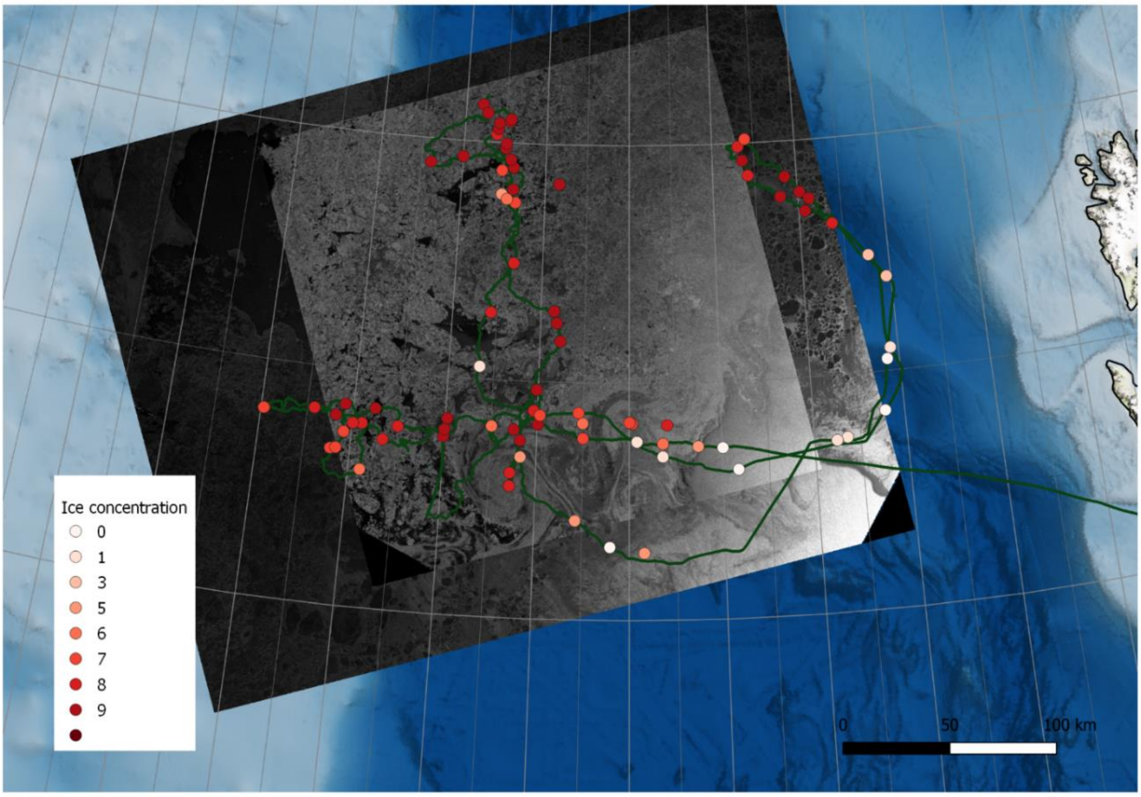


Figure 2. Changes in observed sea ice concentrations along the cruise track

4.1.2 Summary table of activities of the ice physics group on Ice stations

For specific details on each activity see respective dedicated sections.

Table 1. Overview of ice stations

Activity	**Ice Station 1**	**Ice station 2**	**Ice Station 3**	**Ice station 4**	**Ice station 5**
	Pelagic Station 1	Pelagic station 3	Pelagic station 4	Pelagic station 9	Pelagic station 11
Ice Coring/core type					
Salinity	x	x	X	x	x
Temperature	x	x	x	x	x
Chemistry (incl. nutrients)	x	x	x	x	x
Density	x	x		x	x
Archive/Stratigraphy	x	x		x	x
Backup		x		x	
GEM-2/MP floe survey	x	x	x	x	*
Snow on ice research					
Snow pit	x	x	x	x	x
SWE, sites sampled	5	4	4	6	3
ASSIST Ice watch	Regularly (approx. every 3 hrs except for night-time and time on ice stations) during entire cruise, while KPH was in ice-covered waters				

* On Ice station 5 (Pelagic Station 11) Conducting GEM-2/MP ice floe survey was found unnecessary due to a dominance of level ice of similar thickness, and thin and smooth intensively melting snow cover.

4.1.3 Sea ice and snow thickness from transects

Sea ice thickness and snow depth from repeated transects by GEM-2 electromagnetic sensor and Magnaprobe snow depth sonde have become the backbone of distributed in-situ mass balance measurements. spatially distributed snow and ice mass balance measurements

4.1.3.1 Magnaprobe snow depth probe

The snow depth measurements along the transects were collected by an automated snow depth probe Magnaprobe by SnowHydro LLC (MP). The MP is equipped with a data logger that stores snow depths, GPS coordinates, the measurement timestamp, and several other auxiliary data. This enables a collection of about 1000–1500-point snow depth measurements per hour. The horizontal spacing of measurements is typically 1-3 m, depending on the surface and transect line type. The maximum snow depth measurable by MP used is 1.2 m.

4.1.3.2 GEM-2 electromagnetic induction device

The distance from the snow surface to the ice-ocean interface was measured by the electromagnetic induction (EM) method. This distance includes the combined thicknesses of the sea ice and snow layers and is commonly referred to as 'total thickness.' We used a broad and EM instrument sensor (GEM-2 by Geophex Ltd) towed on a small sled. The instrument includes a real-time data processing unit including a GPS receiver which communicates with a pocket PC that operates the sensor and records the EM and GPS data streams.

The GEM-2 is a broadband sensor that can transmit multiple configurable frequencies in the kHz range simultaneously. The sensor setup during the campaign used 5 frequencies with an approximately logarithmic spacing throughout the frequency range of the sensor (1.525 kHz, 5.325 kHz, 18.325 kHz, 63.025 kHz, and 93.075 kHz). The GEM-2 transmits the so-called primary field, which includes all chosen frequency components with one coil and records the primary field as well as a secondary field simultaneously with a receiver coil. The secondary field is the electromagnetic field induced by the primary field in any material with significant electrical conductivity. For the application on sea ice the strongest source for the secondary field is sea water. But since the method is sensitive to any materials with a significant electrical conductivity, the sled with the GEM-2 was towed more than 2 meters behind the GEM-2 operator, the person with the Magnaprobe or a bear guard accompanying the transect activities. The signal emitted by the GEM-2 is omni-directional, thus the EM-footprint depends on the size of the induction currents generated in the sea water. These in turn depend on the distance between sensor and ice/water interface and thus roughly total thickness itself. After each survey the transect measurements were also complemented by a sensor calibration, where the GEM-2 was placed at known heights above the sea ice surface using a wooden ladder on top of level ice with a known thickness determined by 5 drill holes.

4.1.3.3 Sea ice and snow thickness surveys conducted during the Polhavet2023 cruise were conducted during all ice stations.

The transects on ice stations 1,2 and 4 were all about 1.2 km long, of nearly triangular shape. The transect on ice station 4 had to be shortened down to ca 500 m long due to heavy for walk ridged icescape and bear in the vicinity of the ship.

Raw and processed data for both instruments is found in the respective station folders named “GEM2data” and “Magnaprobe” together with “Preliminary results GEM2”. Further processing and drift correction to the measurements positions is to be implemented later.

Preliminary results:

The inferred total thicknesses of ice and snow along the transect lines for all stations are shown on figures 3a-d, below.

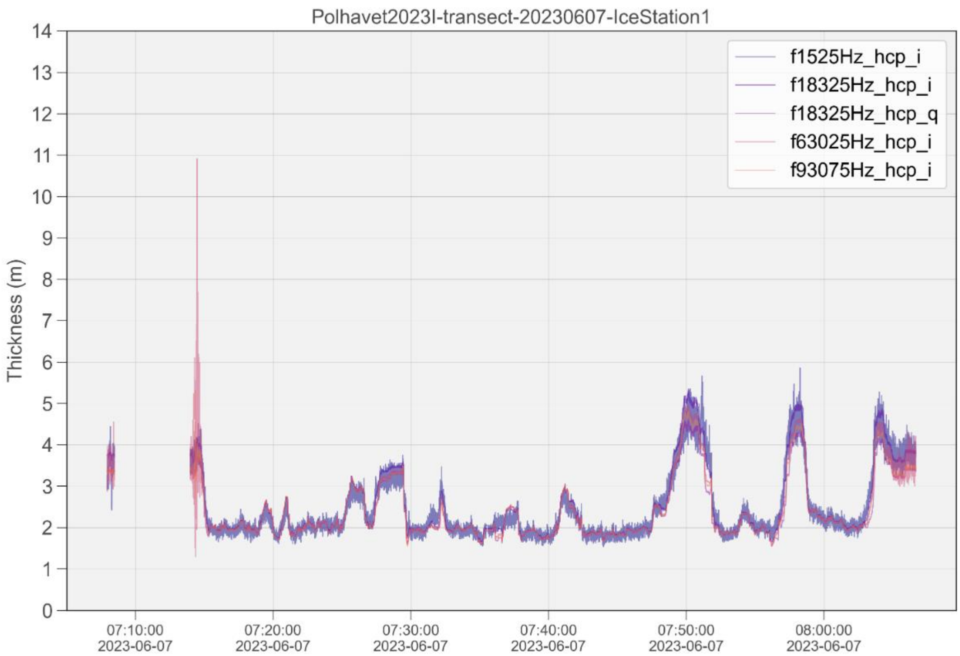


Figure 3a. Total thicknesses of ice and snow at ice station 1

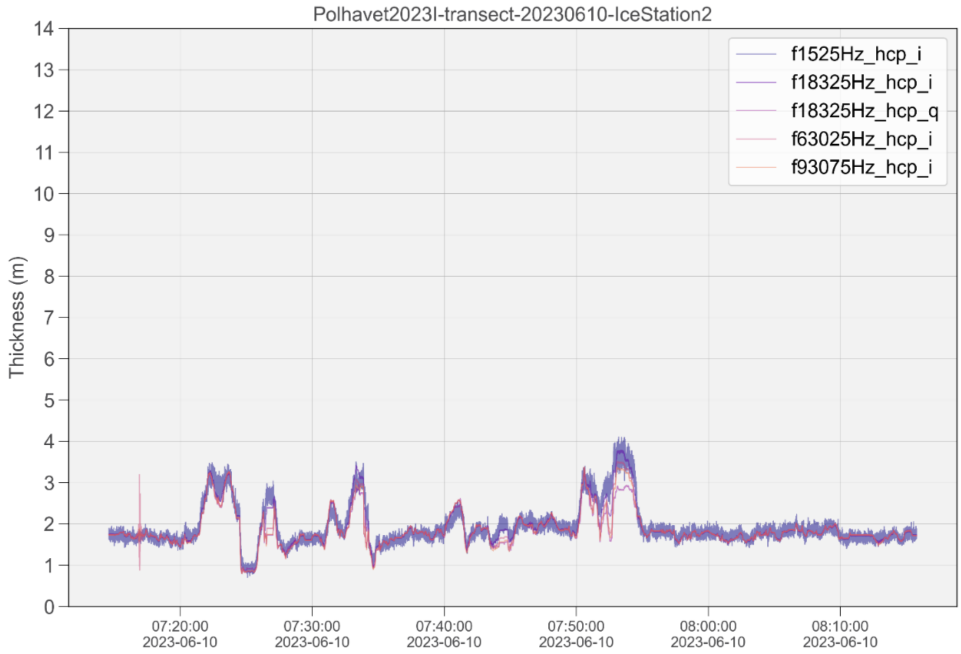


Figure 3b. Total thicknesses of ice and snow at ice station 2

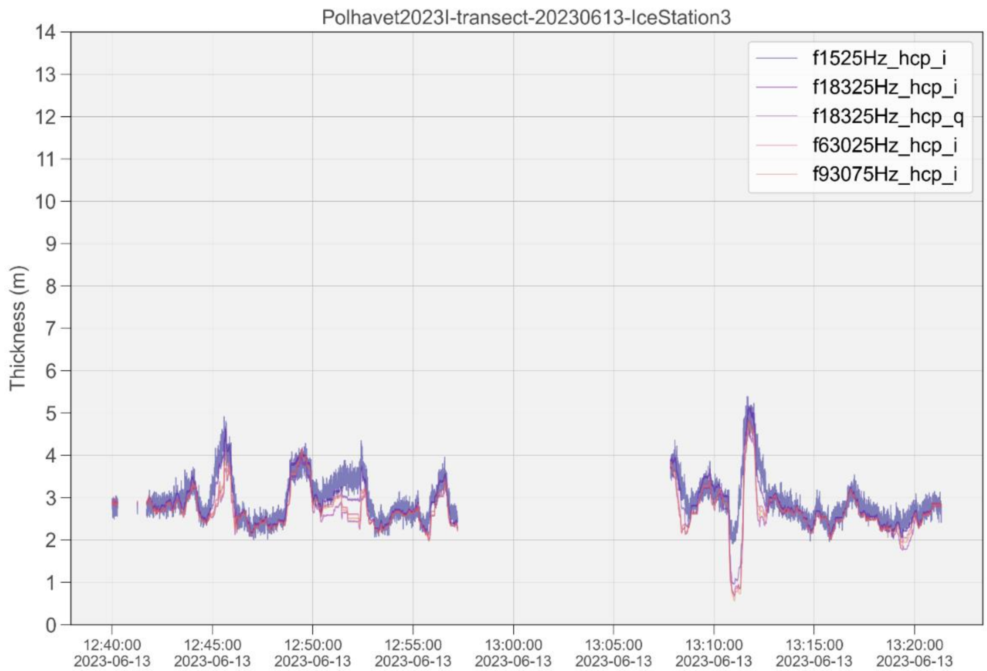


Figure 3c. Total thicknesses of ice and snow at ice station 3

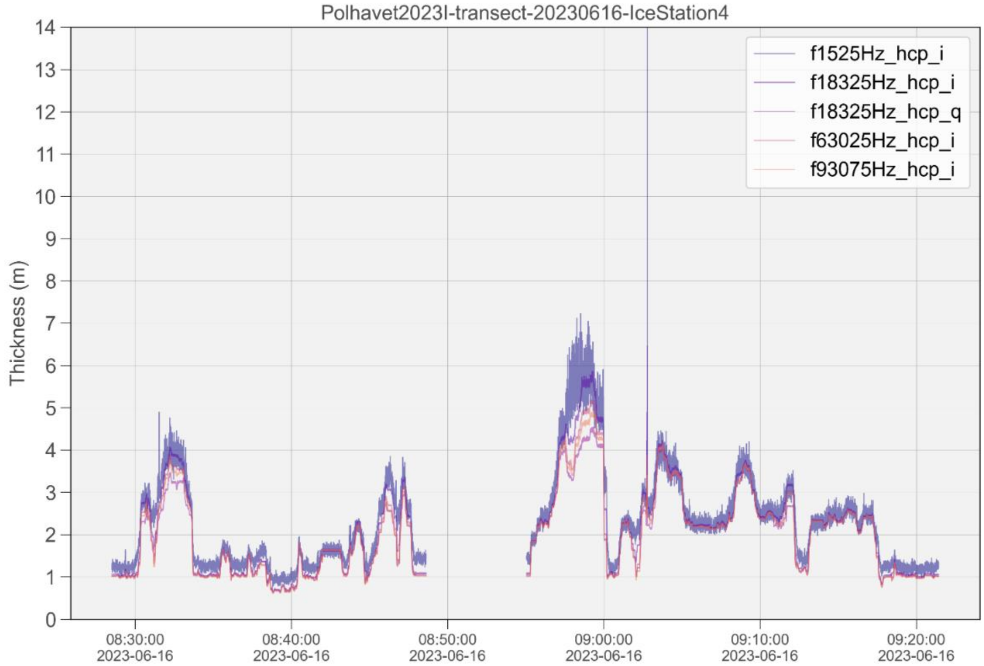


Figure 3d. Total thicknesses of ice and snow at ice station 4

Results demonstrate higher fractions of surveyed level ice on stations 1, 2 and 4 where thickness varied within 1-3 m with on average thinnest ice found on Ice station 4. Ice floe of Station 3 shows thickest ice, on average within 2-3 m which was also confirmed by direct measurements (thickness drillings).

For all four surveys results agree with direct measurements made on the coring sites suggesting these sites were representative on the local ice floe scales.

4.1.4 Sea ice salinity and temperature measured from sea ice cores

At each coring event during ice station work, a dedicated ice core was collected to obtain the ice salinity profile using a 9 cm diameter Kovacs ice corer. The recovered cores were sectioned on site at 5-cm to 10-cm vertical resolution.

Onboard, bulk salinity of melted sections were measured using a conductivity meter Cond 3110 SET3 S/N 19501082. Salinity is reported on the practical salinity scale (dimensionless). Oxygen isotope ratio samples were collected from the same cores.

At each coring event during ice station work, sea ice temperature profiles were also measured on one recovered ice cover within a few minutes from core extraction. The measurements were made using a thermistor probe Testo-720 in holes drilled at 10 cm spacing.

Preliminary results:

Measured salinity and temperature profiles of sea ice cores recovered on Ice stations 1, 2, 3 and 4 (Pelagic station 1, 3, 4 and 9) are shown below.

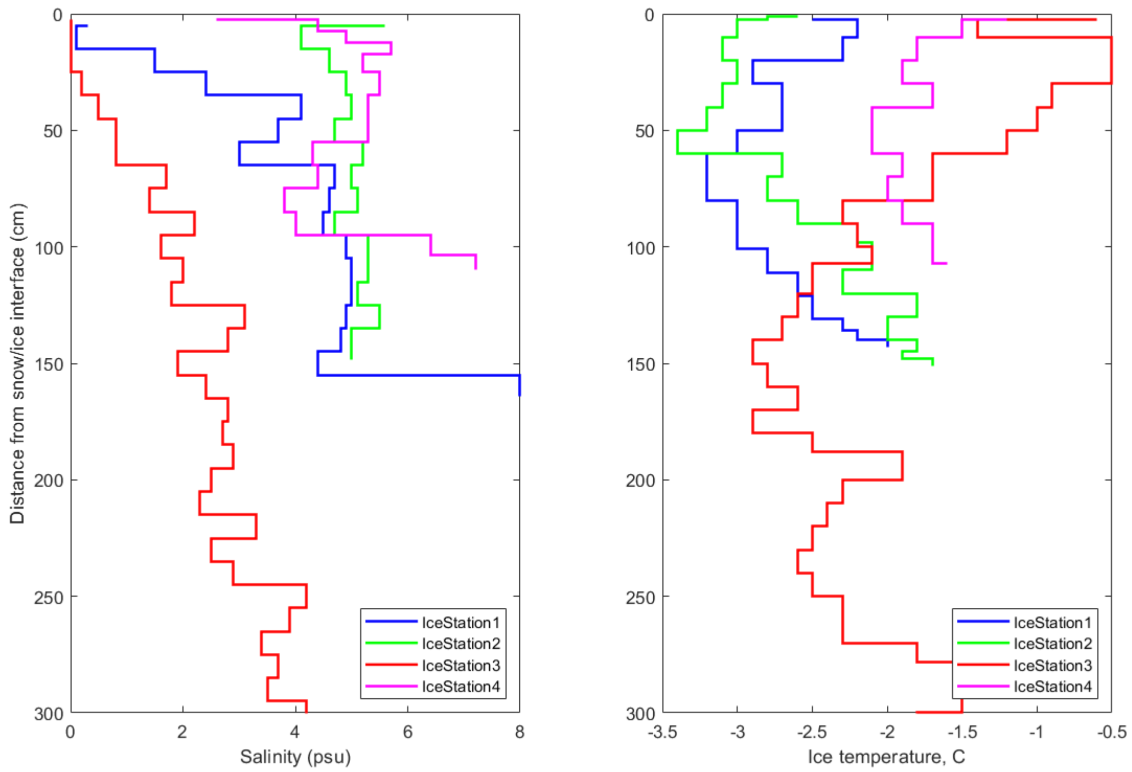


Figure 4. Salinity profiles from ice cores from Ice Stations 1 and 2 is indicative of older types of ice. With analysis of ice thickness and surface morphology, Ice Station 1 floe was likely Second year ice (SYI) while Station 3 floe was a multiyear ice (MYI). Profiles of sea ice from Ice Stations 2 and 4 is typical for First year ice (FYI). Note also cold core bottoms hence no melt conditions on all four ice stations.

4.1.5 Snow measurements and sampling

The overarching goal of the snow measurements was to characterize the structure of snow cover on sea ice studied during the cruise. Snow pits were made in locations next to the coring sites or sites with snow cover representative for the station floe. Each snow pit included the snow temperature and density profiles; snow samples were also taken for analysis of salinity profiles as well as bulk salinities were measured. Snow grain size and geometry were analyzed and registered following the existing classification scheme. Sampling for snow water equivalent (SWE) was conducted on at least 3 locations with variable snow thickness at each ice station.

Preliminary results:

Measured salinity and temperature profiles of snow cover recovered on all the Ice Stations are shown below. Depth 0 cm corresponds to the snow/ice interface. The salinity for Ice Stations 1, 3 and 5 is equal to 0 for all measured depth.

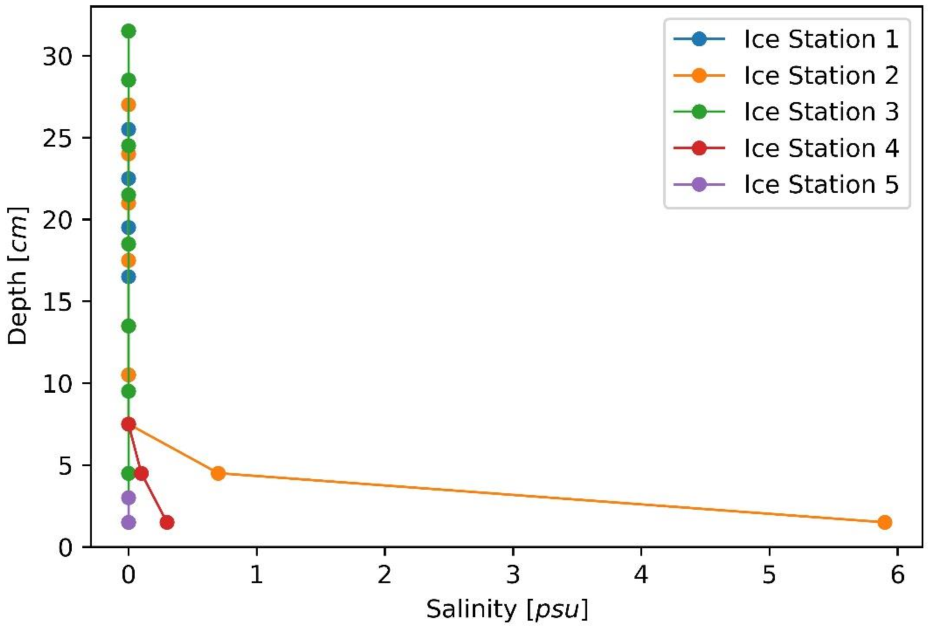


Figure 5a. Salinity profiles of snow cover

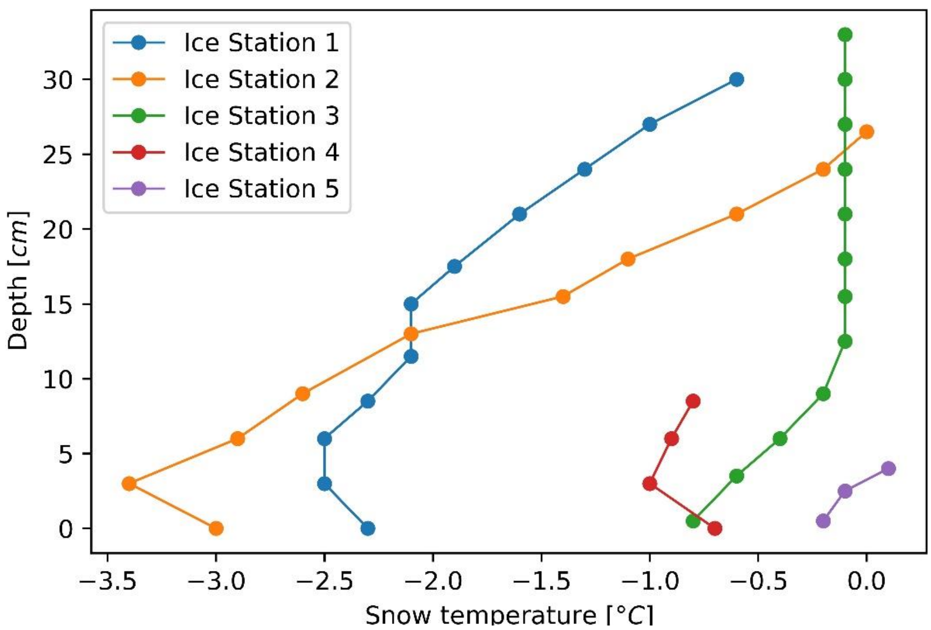


Figure 5b. Temperature profiles of snow cover

4.2. Underway measurement

Angelika Renner, IMR (Institute of Marine Research)

4.2.1 Meteorological observations

A Vaisala AWS430 weather station is mounted on the uppermost deck and measures wind speed and direction, air temperature, dew point, relative humidity, air pressure, radiation (by an additional radiometer). Data are recorded and logged every three seconds and transmitted to the Norwegian Meteorological Institute every 30 minutes to be used for weather forecasts.

4.2.2 Radiosondes

Weather balloons with radiosondes are released daily at 10:30-11:00 UTC for profiling of atmospheric properties (e.g., temperature, moisture, pressure). Data are logged onboard and sent to the German Weather Service (DWD).

4.2.3 Sea ice camera and radar

Images of ice conditions are taken by camera and from radar while moving in ice. Images are recorded every minute.

4.2.4 Cruise logger

A GPS-based position log is recorded continuously throughout the cruises. Data are logged every minute and the daily log files contain time and position, ship speed and heading, bottom depth, weather station data, and seawater temperature. Event logs are created for any activities.

4.2.5 Underway thermosalinograph and pCO_2 measurements

The seawater intake at 4m depth was opened after leaving Longyearbyen. Close to the intake, temperature is measured by a SBE38 thermometer. In the Clean Seawater lab, a SBE21 SeaCAT thermosalinograph monitors temperature, salinity and fluorescence (WET labs WET star fluorometer). Partial pressure of CO_2 in surface water from the seawater intake is measured autonomously by a pCO_2 sensor (General Oceanics) together with dissolved oxygen (Aanderaa), salinity, temperature, CDOM and chlorophyll a fluorescence, and additional atmospheric CO_2.

The seawater intake is closed when moving through ice and opened whenever sailing through open water. Measurements during this cruise were therefore patchy.

4.2.6 Vessel-mounted ADCPs

Two vessel-mounted ADCPs (flush in the hull; 38 kHz and 150 kHz RDI Ocean Surveyor) measured continuously throughout the cruise to capture ocean currents beneath the ship. Data were recorded using the RDI VMDAS data acquisition software. Standard configuration was used throughout the cruise, synchronised with the EK80:

38 kHz ADCP: CR1 CB611 WP00000 NP00001 NN128 NS800 NF1600 CX 1,0 BP000 BX17000 ND111100000 TP000300 TE00000300 EZ1020001 EX00000 EA004556 EJ108 EI038 ED00080 ES35 CK (narrowband profiling, 128 bins with 8 m bin depth, 16 m blanking distance, no bottom track, synchronised pinging with K-Sync, transducer misalignment of 45.56 degrees, transducer depth 8.0 m)

150 kHz ADCP: CR1 CB611 WP00000 NP00001 NN065 NS800 NF0600 CX 1,0 BP000 BX08000 ND111100000 TP000100 TE00000200 EZ1020001 EX00000 EA004642 EJ008 EI-017 ED00084 ES35 CK (narrowband profiling, 65 bins with 8 m bin depth, 6 m blanking distance, no bottom track, synchronised pinging with K-Sync, transducer misalignment of 46.42 degrees, transducer depth 8.4 m)

Data will be processed after the cruise.

4.2.7 EK80

Acoustic surveying was conducted continuously with a Simrad EK80 fisheries echosounder. Split beam transducer for frequencies 18, 38, 70, 120, 200 and 333 kHz are flush-mounted in the hull. All frequencies were operated in CW mode with range set to ocean depth. Depth from the EK80 was also fed to the cruise logger for bottom depth. To reduce interference and maximise data return, the EK80 (primary) was synchronized with the ADCPs (secondary).

4.3 Oceanographic measurements from the ship

4.3.1 Shipboard CTD profiles

Anna Nikolopoulos, NPI and Angelika Renner, IMR (PI Paul Dodd, not onboard)

A total of 52 CTD casts were completed (nr 109-160), distributed over 16 stations, see the station locations in Figure 1 and cast details in Table 2.

Twenty-six of the cast were dedicated to the Microplastics sampling program and made in sets of three or five to 50 m, 100 m, (250 m, 500 m) and bottom depth. These casts are named *Microplastics CTD* in Table 2, for further details see section 4.12.

Twelve full depth casts ('type A') were made in connection to sampling of carbonate chemistry, oxygen isotope ratios, nutrients and salinity (see section 4.4), eDNA (sections 4.6 and 4.7), primary production (section 4.8), and pelagic taxonomy and biogeochemistry (chl-a, FCM, POC/PON, phytoplankton; section 4.9). Water was then drawn at standard depths (bottom, 2000 m, (1500 m selected casts only), 1000 m, 750 m, 400 m, 250 m, 200 m, 150 m, 100 m, 75 m, 50 m, 25 m, 15 m, 10 m). To accommodate sampling of the parameters requiring large water volumes (nitrate uptake, eDNA) a second/shallower cast was made right after the main/full depth cast as soon as this had been emptied. If the chlorophyll maximum occurred at a different depth from the listed standard depths, it was sampled at the second/shallow casts.

For this sampling program, a paper log sheet was completed for each CTD cast, listing the depths at which bottles were fired and the serial numbers of water samples taken from each bottle for all respective parameters. Scanned images of these paper log sheets are included in Appendix 5.4.

The remaining casts were made to accommodate the need for filtration/incubation water, or with sensors only (no sampling except for salinity bottles).

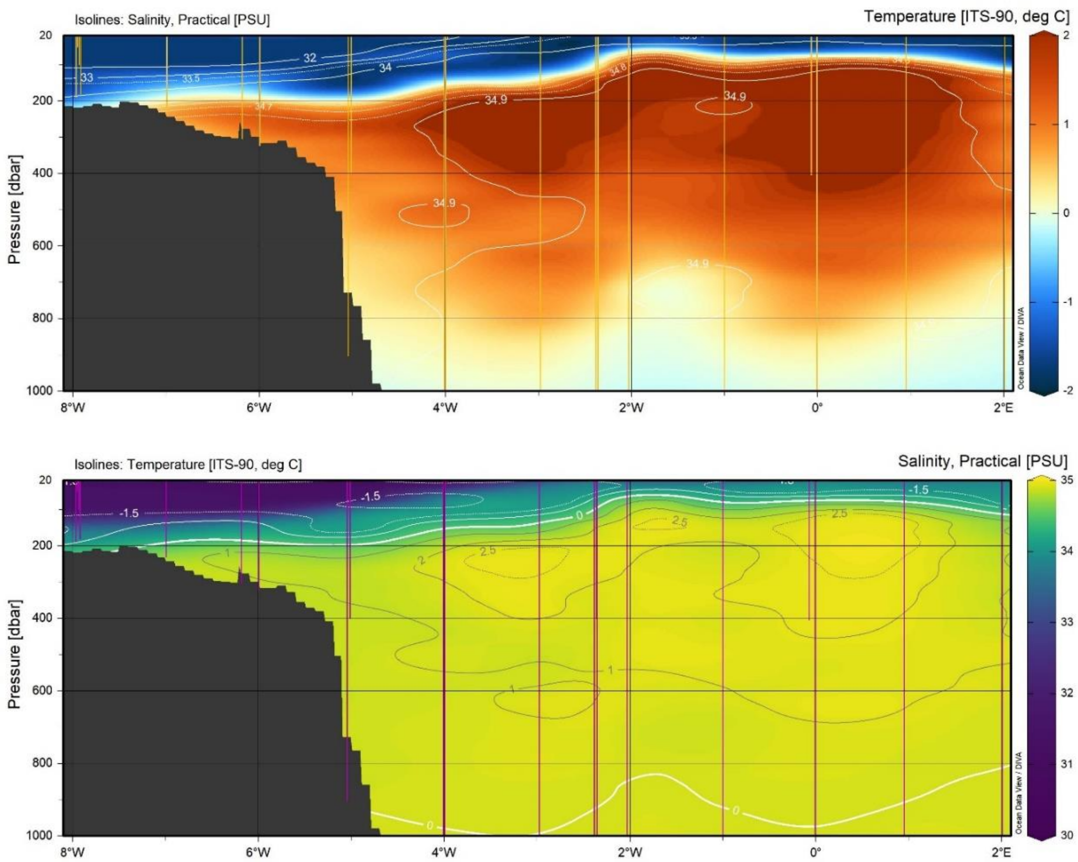
For all casts except nr 119 (st.3), the main 24-bottle CTD rosette was used lowered through the moon pool (Figure 6). Just prior to cast nr 119 an oil leakage was detected in the moonpool, and an auxiliary 12-bottle CTD rosette was used instead, lowered over the side of the vessel. For this cast, all the sensors were moved from the main CTD rosette to the small 12-bottle CTD rosette. The leakage was sealed and the moonpool flushed while steaming in open waters toward station 4. All sensors were moved back to the main rosette again for cast 120 and onward.

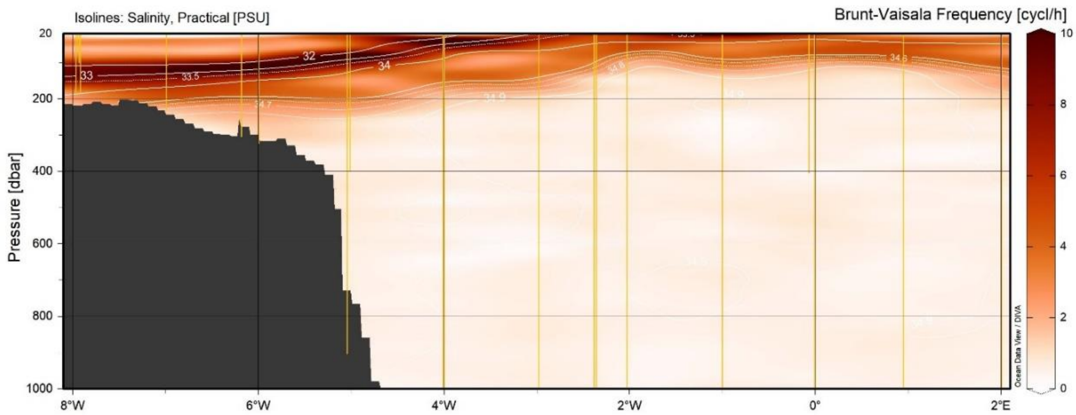
The CTD was monitored by IMR instrument engineers using the SBE Seasave software. Data acquisition was initiated just before deployment with the CTD on deck and allowed to run until the CTD was back on deck at the end of the cast. Cast starting GPS data (time and position) from the ship's navigation system (NMEA) fed to the acquisition computer and were automatically added to the header of all data files. For sampling of seawater, Niskin bottles were fired using the Sea-Bird acquisition software so that a bottle file (. bl) was created for each deployment.

The CTD was a SBE911+ unit accompanied by several auxiliary sensors (Table 3). The rosette was also equipped with two ADCPs, further details are given in 4.3.2. To avoid problems with icing the T, S and O_2 ducts were not flushed between stations – an extended surface soak was specified to account for this. At the beginning of stations, the CTD was lowered to 15 dbar and allowed to soak for 2 minutes after the pump started. After the soak was complete and sensors stabilised the CTD was brought to 10 m (moonpool aperture) before being lowered to the desired cast depth. Note that the upper 10 m of the profiles taken with this CTD-rosette describes water trapped in the moon pool and not necessarily the natural environment. For full-depth casts, the altimeter reading was used to stop at 8-10 m above the bottom.

All four temperature and conductivity/salinity sensors functioned well throughout the cruise and the offset between the primary and secondary sensors were within acceptable range (< 5%). The conductivity sensors will be post-cruise calibrated based on samples taken within the water sampling program but analysed after the cruise (see section 4.4.4). The two oxygen sensors worked well at first, with only a minor offset between the primary and secondary sensors, but diverted from each other after cast 120. For cast 121 and onward, the secondary sensor showed lower values than the primary sensor albeit the offset between the two sensors remained constant. No samples of dissolved oxygen were taken onboard for calibration, but the sensor values will be further scrutinized on land to judge the appropriateness of these profiles. The remaining sensors appeared to work well but were not monitored in detail. The Chl *a*/fluorescence sensors will be post-cruise calibrated based on samples taken and analysed throughout the cruise (see section 4.9.1.1).

Some preliminary results for selected variables over the main transect are provided in Figure 6. However, note that the sensor data shared in the cruise work folder has undergone a first round of automated Seabird processing routines, but has not yet been fully quality-controlled and processed. Further details and results for the CTD sensor data will be provided after the complete post-cruise processing, in conjunction with the publication of quality-assesse-ssed data set at the Norwegian Polar Data Centre (https://data.npolar.no/).




Isolines: Salinity, Practical [PSU]
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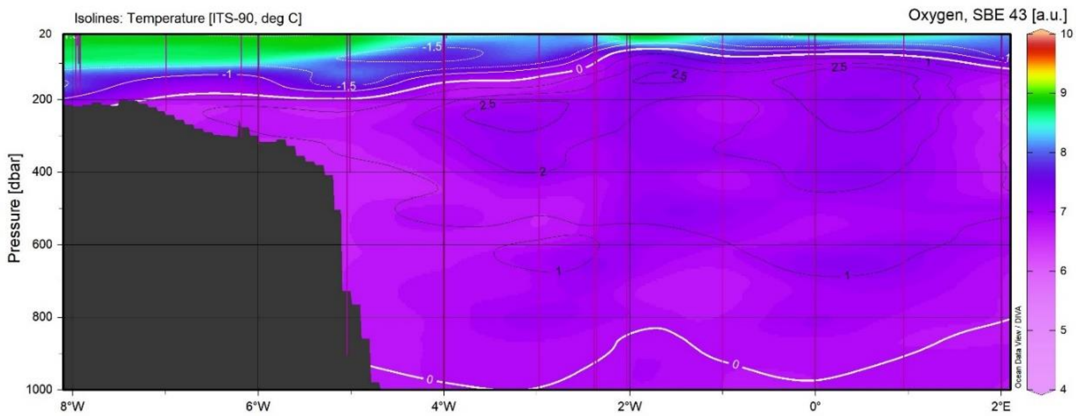
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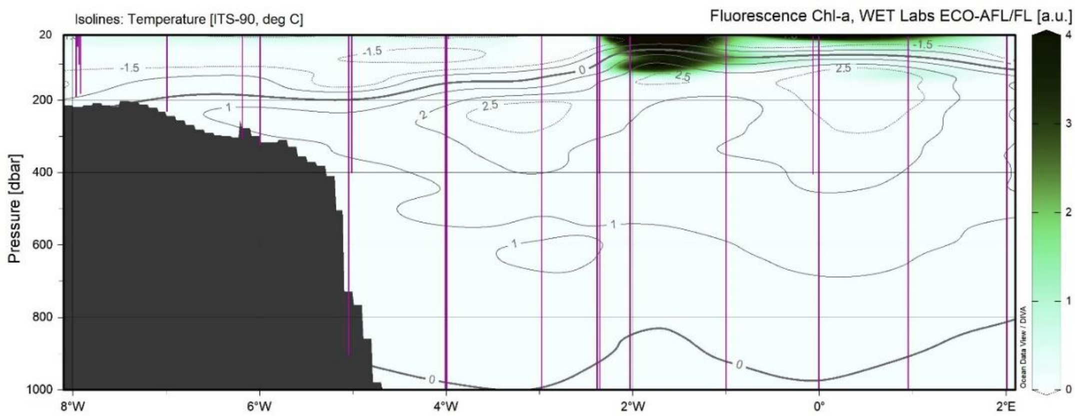
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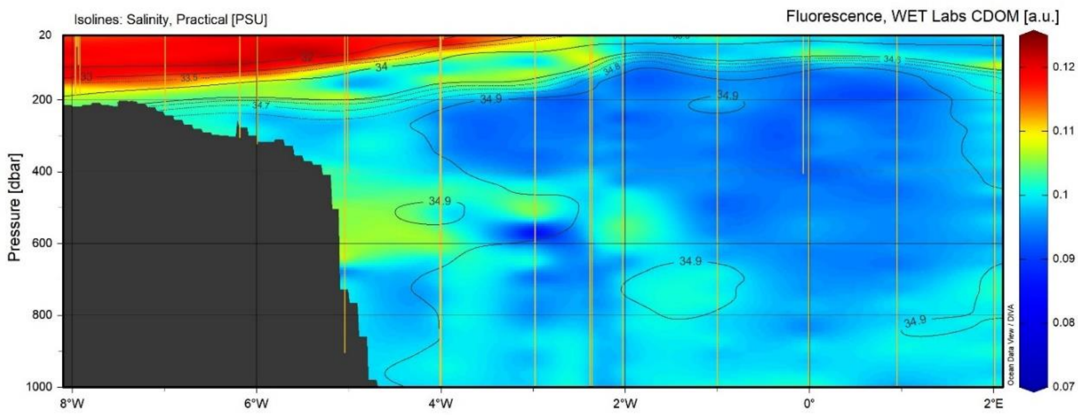
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Fluorescence, WET Labs CDOM [a.u.]
Pressure [dbar]
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Ocean Data View / DIVA

Figure 6. Gridded distributions of temperature, salinity, stratification, oxygen, Chl-a fluorescence, and CDOM fluorescence over the main Fram Strait section, between 20-1000 m depth. Note that these overviews are based on the preliminary CTD sensor data (hence coarsely truncated at 20 m), provided in the onboard cruise work folder and will be updated after the quality assessment of data. Yellow/pink lines mark the locations of the CTD casts included in the interpolation. [a.u.] denotes arbitrary (qualitative) units for non-calibrated sensors.

Table 2. Summary of all 52 CTD casts (named nr 109 – 160) distributed over 16 stations (no cast taken at st.2). All casts but nr. 119 were made with the large 24-bottle CTD rosette through the moonpool. The letters (A) and (B) denote the slightly different parameter setups according to the cruise sampling plan. Sea ice stations were established at st.1 (#1), st.3 (#2), st.4 (#3), st.9 (#4), and st.11 (#5).

CTD cast nr.	Station Name	Date (UTC)	Time (UTC)	Latitude (decdeg N)	Longitude (decdeg E)	Bottom depth (m)	Cast depth (m)	Event Remarks
109	st.1	2023-06-05	18:31	79.2860	-1.6745	2553	201	Test cast
110	st.1	2023-06-05	22:47	79.2592	-1.6807	2564	2608	Microplastics CTD
111	st.1	2023-06-06	01:01	79.2536	-1.6854	2573	500	Microplastics CTD
112	st.1	2023-06-06	02:06	79.2525	-1.6762	2573	250	Microplastics CTD
113	st.1	2023-06-06	02:48	79.2517	-1.6682	2577	100	Microplastics CTD
114	st.1	2023-06-06	03:20	79.2511	-1.6609	2578	50	Microplastics CTD
115	st.1	2023-06-06	15:59	79.1811	-1.5552	2590	2624	Main CTD cast to bottom (A)
116	st.1	2023-06-06	19:12	79.1569	-1.5478	2582	51	Filtering water for IceStation#1
117	st.1	2023-06-07	06:00	79.1149	-1.7998	2569	401	Shallow CTD cast (A)
118	st.3	2023-06-09	02:30	80.0144	2.8088	2533	2565	Main CTD cast to bottom (A)
119*	st.3	2023-06-10	10:44	79.9875	2.4392	2670	500	Shallow CTD cast (A), with small CTD ('Skuteside')
120	st.4	2023-06-12	11:17	78.7537	-6.1820	314	304	Main CTD cast to bottom (A)
121	st.4	2023-06-12	12:48	78.7335	-6.1816	302	299	Shallow CTD cast (A)
122	st.4	2023-06-13	07:03	78.6048	-6.4975	301	291	Microplastics CTD
123	st.4	2023-06-13	07:45	78.6037	-6.5115	291	100	Microplastics CTD
124	st.4	2023-06-13	08:18	78.6035	-6.5205	286	50	Microplastics CTD
125	st.5	2023-06-14	04:10	78.7987	-7.9166	189	181	Microplastics CTD
126	st.5	2023-06-14	04:48	78.7942	-7.9332	191	100	Microplastics CTD
127	st.5	2023-06-14	05:18	78.7913	-7.9481	197	50	Microplastics CTD
128	st.5	2023-06-14	06:00	78.7879	-7.9653	194	189	Main CTD cast to bottom (A)
129	st.6	2023-06-14	10:04	78.8309	-6.9916	239	230	Main CTD cast to bottom (A)
130	st.7	2023-06-14	14:47	78.8013	-5.9937	319	322	Main CTD cast to bottom (A)
131	st.8	2023-06-14	18:26	78.7973	-5.0438	894	903	Main CTD cast to bottom (A)
132	st.8	2023-06-14	20:23	78.7763	-5.0109	895	400	Shallow CTD cast (A)
133	st.9	2023-06-15	06:08	78.8134	-3.9746	1847	30	Filtering water for IceStation#4
134	st.9	2023-06-15	07:42	78.7964	-3.9957	1820	1861	Microplastics CTD
135	st.9	2023-06-15	15:16	78.7182	-4.0097	1762	1773	Main CTD cast to bottom (A)
136	st.9	2023-06-15	17:37	78.6936	-4.0096	1759	400	Shallow CTD cast (A)
137	st.9	2023-06-15	21:03	78.6556	-4.0041	1742	500	Microplastics CTD
138	st.9	2023-06-15	21:53	78.6464	-4.0015	1741	251	Microplastics CTD
139	st.9	2023-06-15	22:38	78.6384	-3.9995	1742	100	Microplastics CTD
140	st.9	2023-06-15	23:16	78.6317	-3.9990	1744	51	Microplastics CTD
141	st10	2023-06-17	03:04	78.7989	-2.9746	2508	2546	CTD cast to bottom (B)
142	st11	2023-06-17	10:43	78.9689	-2.0226	2597	40	Filtering water for IceStation#5

143	st11	2023-06-18	02:58	78.7850	-2.3560	2626	2662	Main CTD cast to bottom (A)
144	st11	2023-06-18	06:04	78.7509	-2.3590	2629	400	Shallow CTD cast (A)
145	st11	2023-06-18	08:01	78.7221	-2.3806	2630	2661	Microplastics CTD
146	st11	2023-06-18	10:23	78.6866	-2.4251	2623	500	Microplastics CTD
147	st11	2023-06-18	11:22	78.6729	-2.4457	2623	251	Microplastics CTD
148	st11	2023-06-18	12:07	78.6626	-2.4617	2623	100	Microplastics CTD
149	st11	2023-06-18	12:46	78.6539	-2.4782	2623	50	Microplastics CTD
150	st12	2023-06-19	02:53	78.8027	-2.0273	2671	2704	No sampling of water
151	st13	2023-06-19	07:16	78.8270	-1.0025	2429	2459	CTD cast to bottom (B)
152	st13	2023-06-19	11:30	78.8336	-0.0070	2588	2621	Main CTD cast to bottom (A)
153	st14	2023-06-19	14:20	78.8298	-0.0679	2578	400	Shallow CTD cast (A)
154	st15	2023-06-19	17:46	78.8166	0.9528	2365	2394	No sampling of water
155	st16	2023-06-19	21:39	78.8454	2.0091	2502	2529	No sampling of water
156	st17	2023-06-20	07:59	78.4189	7.0959	3283	3346	Microplastics CTD
157	st17	2023-06-20	10:30	78.4189	7.0959	3284	501	Microplastics CTD
158	st17	2023-06-20	11:23	78.4189	7.0959	3284	251	Microplastics CTD
159	st17	2023-06-20	12:12	78.4189	7.0959	3284	101	Microplastics CTD
160	st17	2023-06-20	12:54	78.4189	7.0959	3284	51	Microplastics CTD

Table 3. CTD sensor package configuration. Note that also surface PAR voltage from the ship's instrumentation was added to the CTD files, but please refer to the IMR instrument personnel before using these measurements.

Channel	Sensor	Serial Number	Last Calibration
Frequency 0	SBE03 Temperature 1	5884	14-Oct-22
Frequency 1	SBE04 Conductivity 1	2860	18-Oct-22
Frequency 2	SBE09 Pressure	141612	19-Dec-17
Frequency 3	SBE03 Temperature 2	6504	12-Oct-22
Frequency 4	SBE04 Conductivity 2	3123	18-Oct-22
A/D Voltage 0	SBE43 Oxygen 1	1259	09-Aug-22
A/D Voltage 1	Altimeter	73084	24-Dec-2017
A/D Voltage 2	WET Labs Chl. A	FLRTD-6506	18-Sep-2020
A/D Voltage 3	None	-	-
A/D Voltage 4	Transmissometer	CST-2003DR	01-Oct-2019
A/D Voltage 5	WET Labs CDOM	FLCDRTD-4531 NPI	12-May-2023
A/D Voltage 6	Biospherical Li-COR PAR	70736	29-Oct-2018
A/D Voltage 7	SBE43 Oxygen 2	3483	24-May-22
Ch.15/SPAR Voltage	Biospherical Li-COR Surface PAR (ship instr.)	20568	27-Nov-2017

4.3.2 Lowered ADCP

Two RD Instruments 300 kHz Workhorse Acoustic Doppler Current Profilers (ADCPs) and an external battery package were mounted on the main CTD rosette frame with the downward looking as primary (s/n 24474) and the upward looking like secondary sensor (s/n 24472), see Figure 7. The ADCPs were started and stopped before and after each CTD cast by the instrument engineers using BBTalk on a laptop in the Fine Electronics workshop. They were configured as follows:

Primary: CR1 WM15 RN M0116 CF11101 EX00100 EZ0011101 TC2 WP1 TB 00:00:01.20 TE 00:00:00.80 TP 00:00.00 WN015 WS0800 WF0000 WV250 LZ30,220 LW1 SM1 SA011 SW05500 SI0 CK T? W? CS

15 bins with 8 m bin depth, 2.5 m/s ambiguity velocity, automatic ping cycling, narrowband mode, bottom detection

Secondary: CR1 WM15 RN S0116 CF11101 EX00100 EZ0011101 TC2 WP1 TB 00:00:01.20 TE 00:00:00.80 TP 00:00.00 WN015 WS0800 WF0000 WV250 LZ30,220 LW1 SM2 SA011 SS0 ST0300 CK T? W? CS

15 bins with 8 m bin depth, 2.5 m/s ambiguity velocity, automatic ping cycling, narrowband mode

In total, 51 dual profiles were collected. On cast 119, the small CTD rosette was deployed over the side and no LADCP data were collected on that cast as the LADCPs do not fit on the frame.

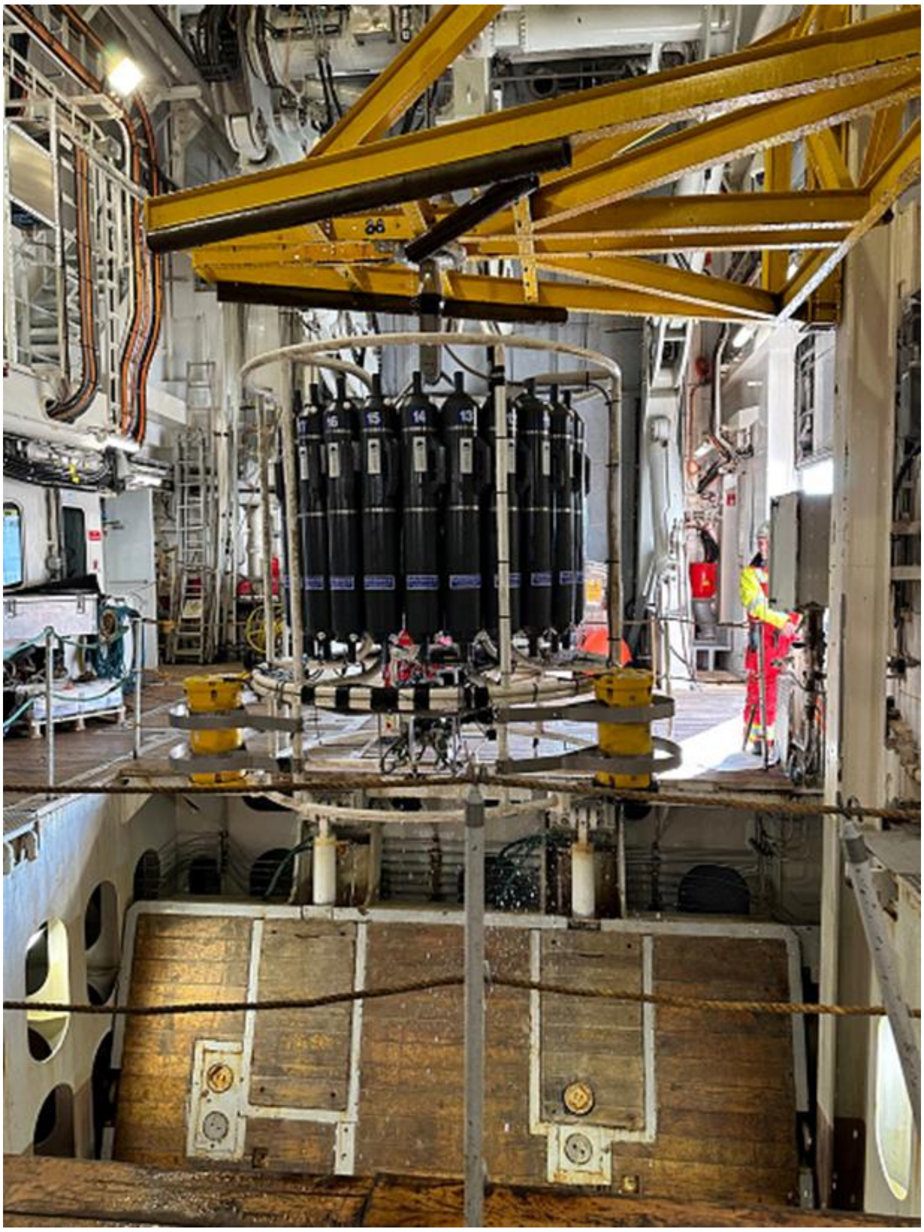

Figure 7. The main 24-Niskin bottle rosette coming up through the moonpool after a completed cast. The CTD sensor package is visible in the center of the rosette, and the two yellow ADCPs on the sides. Photo by Ann Kristin Balto.

4.4 Water samples for physical and chemical parameters

Angelika Renner, IMR

Chemical parameters measured from Niskin bottle samples include carbonate chemistry for ocean acidification, oxygen isotope ratio $\delta^{18}O$, inorganic nutrients, and salinity for calibration of the CT; these were the first samples taken (in that order) from each Niskin sampled. At all sampling stations of type, A and B (see Table 2), water was drawn at standard depths (bottom, 2000 m, (1500 m selected casts only), 1000 m, 750 m, 400 m, 250 m, 200 m, 150 m, 100 m, 75 m, 50 m, 25 m, 15 m, 10 m). If the chlorophyll maximum occurred at a different depth, extra nutrient and DIC samples were taken. Surface could not be sampled as the CTD was deployed through the moonpool. Sampling was conducted following Nansen Legacy and Institute of Marine Research sampling protocols.

4.4.1 Carbonate chemistry

PIs: Melissa Chierici, IMR; Agneta Fransson, NPI

Samples for determination of total alkalinity and total dissolved inorganic carbon were collected for studies of ocean acidification state and oceanic CO_2 uptake. Samples were taken from all depths (standard depths and chl max) at 13 stations (in total 152 samples). Water from the Niskin bottles was filled into 250 ml borosilicate bottles which were rinsed by overflow with at least one bottle volume and closed with tight plastic screw caps. 50 µl HgCl2 was added after the sampling. Samples were stored cool and dark and will be analysed at IMR Tromsø.

4.4.2 Oxygen isotope ratios

PI: Paul Dodd, NPI

Seawater $\delta^{18}O$, a tracer for meteoric and other water sources, was sampled at all standard depths at 12 casts (in total 147 samples). Water from the Niskin bottles was filled into 40 ml glass vials (rinsed three times; filled to the rim). The vials were sealed with parafilm and stored cool for analysis on land.

4.4.3 Nutrients

PI: Melissa Chierici, IMR

Samples for inorganic nutrients (nitrate, nitrite, phosphate and silicate in seawater) were taken from all depths (standard depths and chl max) at 13 stations, resulting in 152 samples. The samples were filled into 20 ml plastic vials (rinsed three times), fixated with 200 µl chloroform and stored cool and dark. Samples will be analysed at IMR Bergen.

Additional 23 nutrient samples were taken for primary productivity rates studies in incubations, see section 4.8.

4.4.4 Salinity

PI: Angelika Renner, IMR

Salinity samples were taken for calibration of the conductivity sensors on the CTD package. Glass bottles (250 ml; rinsed three times; dried off and capped with inner and outer caps) were filled from Niskin bottles for analysis onboard. Samples were taken on all standard depths at 12 CTD casts, resulting in 147 samples. A Guildline Portasal salinometer (SN 70177) was set up in the dry lab (air temperature ~20 °C, bath temperature set to 22 °C). However, malfunctioning of the salinometer hindered sample analysis, so that only 11 samples could be measured onboard. The remaining samples were stored for measurement during a later cruise or on land and the results will be made available in connection to the publication of the quality assessed data set.

Following IMR protocols, additional water samples were taken by the instrument engineers from the deepest Niskin at all CTD casts. These samples will be analysed by IMR during a later cruise or at IMR Bergen.

4.5 Oceanographic measurements from the sea ice

Anna Nikolopoulos, NPI, Angelika Renner, IMR, and Julie Sortland, UiT

The oceanographic team performed measurements with sensors for ocean turbulence, temperature, salinity, chlorophyll-a, and nitrate at all five sea ice stations. The objective was to determine dissipation rates of turbulent kinetic energy and fluxes of heat and nutrients.

4.5.1 Microstructure and turbulence measurements (MSS)

Depth profiles of ocean microstructure were measured during the ice stations with an MSS90L microstructure sensor profiler (SN046; Sea & Sun Technology, Germany). In total 47 MSS casts were made at the five ice stations, see Table 4 for an overview.

The MSS is a loosely tethered free-fall instrument equipped with two shear sensors, as well as with fast response acceleration, turbidity, temperature, conductivity, and chlorophyll-a fluorescence sensors. The instrument profiles vertically, with all sensors pointing downward and sampling at 1024 Hz. Data are transmitted via an online cable in real time to a PC data acquisition system (Standard Data Acquisition software package) and data are recorded on the downcast until the maximum depth or end of cable has been reached. No data is recorded on the upcast.

The instrument should be operated in waters as undisturbed as possible by the ship's operations or any local ridged-ice topography. The MSS is optimally operated through a hole in the ice but at large sea ice thicknesses (> 1.8 m), the alternative may be to measure from the ice edge by an open lead, for using the time more effectively to sampling rather than to hole-making.

At every ice station, a measuring site was selected at a safe distance to the ship (in terms of disturbance), in as flat ice conditions as possible, but still within good sight for the bridge bear watch. During all stations, the ship was moored to the ice to minimize the need for using thrusters and propellers. At st.1 and st.4 the profiles were measured by the ice edge (estimated to 1.8 - 2 m thickness) and at st.3, st.9, and st.11 from a hole through 70-95 cm thick ice. The holes were made to about 70x70 cm in dimension, with help of 5-6 slightly overlapping auger holes of 25 cm diameter each, and any sharp edges smoothed out with an ice saw (Figure 8). At all measuring sites, a manual winch with just over 200 m cable was set up by the ice edge/hole and sets of 3 or more casts were performed 1-5 times during each ice station.

The instrument is decoupled from operation-induced tension by paying out cable at sufficient speed to keep it slack. It is ballasted for reaching a typical fall speed of 0.5-0.7 m s^{-1}. This ballast is most easily adjusted by adding or removing thin metal rings just above the sensor end (leading end) of the profiler. The instrument had been last used in the Southern Ocean and the ballast hence needed to be adjusted to match the recommended fall speed. The first three casts (st. 1) were performed at an average 0.74 m s^{-1} falling speed, which is a slightly above the recommended speed. For casts 9-17 (st.3), the weights were adjusted to 1 thin ring resulting in a falling speed of 0.57 m s^{-1}, while the remaining casts 18-47 ran at an average of 0.68 m s^{-1} after a final adjustment to 2 thin rings.

Figure 8. Example of the measurement set up from St.9 (ice station #4). Acknowledgements to Oda Siebke Løge who helped with the MSS profiling during this station.

4.5.2 Under-ice CTD and nitrate profiling (SUNA & RBR)

Depth profiles of temperature, salinity and nitrate under the ice were taken using a RBR Concerto CTD (s/n 201412) and a SUNA (s/n 2096) mounted on an aluminum frame. The frame was lowered by hand using a 50 m Kevlar rope. The RBR was programmed to measure at 2 Hz. The SUNA was operating in continuous mode with 20 lights to 1 dark frame and no averaging.

In total, 18 profiles were taken at the five ice stations. During the first and potentially parts of the second ice station (st. 1 and st. 3), SUNA measurements might have been compromised by tape. During the fourth ice station (st. 9), the pressure sensor on the RBR started showing large deviations. Visual inspection of the instrument did not show any faults, but the problem persisted into the last ice station (st. 11). Clocks of both instruments were synchronised before the first deployment, but at the end of the cruise, a clock offset of almost four minutes was noted, with the clock of the RBR Concerto leading by 3 minutes, 54 seconds to the SUNA.

At st. 4, st. 9 and st.11, an additional handheld Ruskin RBR Concerto[3] CTD (s/n 204991) with auxiliary sensors for chlorophyll (Seapoint) and photosynthetically active radiation (PAR; LiCOR) was used in connection to the sampling for environmental characteristics within the primary production sampling program (section 4.8.3). These casts went down to 30 m depth (in continuous mode, at 2 Hz rate) and are denoted 'RBR-PAR' in Table 4.

Figure 9. RBR Concerto and SUNA mounted on a frame for deployment.

Table 4. Cast details for the oceanographic profiling with MSS, SUNA and CTDs (RBR) during the ice stations. All RBR-PAR casts marked with * were taken from another measuring site than the MSS-site. The MSS and SUNA sampling activity at the last ice station was cut short due to fog.

Gear Type	**Date (UTC)**	**Time (UTC)**	**Depth (m)**	**File name**
Ice Station #1 (st.1)				
MSS	2023-06-06	11:41	218	AO23_cast0001.MRD
MSS	2023-06-06	12:09	209	AO23_cast0002.MRD
MSS	2023-06-06	12:39	221	AO23_cast0003.MRD
MSS	2023-06-06	14:07	222	AO23_cast0004.MRD
MSS	2023-06-06	14:26	200	AO23_cast0005.MRD
SUNA	2023-06-06	13:38	47	A0000007.CSV
RBR	2023-06-06	13:38	47	201412_20230607_0819.rsk
SUNA	2023-06-06	19:00	48	A0000008.CSV
RBR	2023-06-06	19:00	48	201412_20230607_0819.rsk
SUNA	2023-06-06	19:04	49	A0000008.CSV or A0000008_1.CSV
RBR	2023-06-06	19:04	49	201412_20230607_0819.rsk
MSS	2023-06-07	08:03	197	AO23_cast0006.MRD
MSS	2023-06-07	08:18	198	AO23_cast0007.MRD
MSS	2023-06-07	08:32	205	AO23_cast0008.MRD
SUNA	2023-06-07	08:55	48	A0000008.CSV
RBR	2023-06-07	08:55	48	201412_20230607_1555.rsk
Ice Station #2 (st.3)				
MSS	2023-06-09	12:59	200	AO23_cast0009.MRD
MSS	2023-06-09	13:16	200	AO23_cast0010.MRD
MSS	2023-06-09	13:35	200	AO23_cast0011.MRD
MSS	2023-06-09	17:34	200	AO23_cast0012.MRD
MSS	2023-06-09	17:49	200	AO23_cast0013.MRD
MSS	2023-06-09	18:03	202	AO23_cast0014.MRD
SUNA	2023-06-09	17:26	47	A0000009.CSV
RBR	2023-06-09	17:26	47	201412_20230610_1349.rsk
SUNA	2023-06-09	18:21	48	A0000009.CSV
RBR	2023-06-09	18:21	48	201412_20230610_1349.rsk
MSS	2023-06-10	07:49	220	AO23_cast0015.MRD
MSS	2023-06-10	08:04	218	AO23_cast0016.MRD
MSS	2023-06-10	08:19	217	AO23_cast0017.MRD
SUNA	2023-06-10	08:45	48	A0000010.CSV
RBR	2023-06-10	08:45	48	201412_20230610_1349.rsk
Ice Station #3 (st.4)				
MSS	2023-06-13	04:37	218	AO23_cast0018.MRD
MSS	2023-06-13	04:50	219	AO23_cast0019.MRD
MSS	2023-06-13	05:03	218	AO23_cast0020.MRD
SUNA	2023-06-13	07:22	48	A0000010.CSV
RBR	2023-06-13	07:22	48	201412_20230614_1921.rsk
MSS	2023-06-13	07:47	220	AO23_cast0021.MRD
MSS	2023-06-13	08:00	221	AO23_cast0022.MRD
MSS	2023-06-13	08:13	218	AO23_cast0023.MRD
SUNA	2023-06-13	08:32	48	A0000010.CSV

RBR	2023-06-13	08:32	48	201412_20230614_1921.rsk
RBR-PAR	2023-06-13	08:39	30	204991_20230619.rsk
MSS	2023-06-13	11:03	219	AO23_cast0024.MRD
MSS	2023-06-13	11:16	220	AO23_cast0025.MRD
MSS	2023-06-13	11:30	219	AO23_cast0026.MRD
SUNA	2023-06-13	11:51	49	A0000011.CSV
RBR	2023-06-13	11:51	49	201412_20230614_1921.rsk
RBR-PAR	2023-06-13	11:56	30	204991_20230619.rsk
RBR-PAR	2023-06-13	12:00	30	204991_20230619.rsk
MSS	2023-06-13	12:11	219	AO23_cast0027.MRD
MSS	2023-06-13	12:24	221	AO23_cast0028.MRD
SUNA	2023-06-13	12:43	48	A0000011.CSV
RBR	2023-06-13	12:43	48	201412_20230614_1921.rsk
MSS	2023-06-13	12:50	220	AO23_cast0029.MRD
Ice Station #4 (st.9)				
MSS	2023-06-15	11:18	200	AO23_cast0030.MRD
RBR-PAR*	2023-06-15	11:33	30	204991_20230619.rsk
MSS	2023-06-15	11:35	202	AO23_cast0031.MRD
MSS	2023-06-15	11:47	202	AO23_cast0032.MRD
SUNA	2023-06-15	12:15	1)	A0000012.CSV
RBR	2023-06-15	12:15	1)	201412_20230616_1625.rsk
SUNA	2023-06-15	12:22	1)	A0000012.CSV
RBR	2023-06-15	12:22	1)	201412_20230616_1625.rsk
MSS	2023-06-15	12:35	204	AO23_cast0033.MRD
RBR-PAR*	2023-06-15	12:39	30	204991_20230619.rsk
MSS	2023-06-15	12:48	205	AO23_cast0034.MRD
MSS	2023-06-15	13:01	205	AO23_cast0035.MRD
SUNA	2023-06-15	13:18	1)	A0000012.CSV
RBR	2023-06-15	13:18	1)	201412_20230616_1625.rsk
MSS	2023-06-15	13:38	205	AO23_cast0036.MRD
MSS	2023-06-15	13:50	205	AO23_cast0037.MRD
MSS	2023-06-15	14:04	204	AO23_cast0038.MRD
MSS	2023-06-15	18:43	213	AO23_cast0039.MRD
MSS	2023-06-15	18:58	213	AO23_cast0040.MRD
MSS	2023-06-15	19:13	212	AO23_cast0041.MRD
SUNA	2023-06-15	19:41	1)	A0000013.CSV
RBR	2023-06-15	19:41	1)	201412_20230616_1625.rsk
MSS	2023-06-16	08:48	210	AO23_cast0042.MRD
MSS	2023-06-16	09:01	210	AO23_cast0043.MRD
MSS	2023-06-16	09:15	209	AO23_cast0044.MRD
SUNA	2023-06-16	09:31	47	A0000014.CSV
RBR	2023-06-16	09:31	47	201412_20230616_1625.rsk
RBR-PAR*	2023-06-16	13:21	30	204991_20230619.rsk
Ice Station #5 (st.11)				
RBR-PAR*	2023-06-17	16:54	30	204991_20230619.rsk
RBR-PAR*	2023-06-17	17:02	30	204991_20230619.rsk
SUNA	2023-06-18	08:32	1)	A0000015.CSV
RBR	2023-06-18	08:32	1)	201412_20230619_1344.rsk

MSS	2023-06-18	08:44	217	AO23_cast0045.MRD
MSS	2023-06-18	08:58	217	AO23_cast0046.MRD
MSS	2023-06-18	09:10	217	AO23_cast0047.MRD
SUNA	2023-06-18	09:21	48	A0000015.CSV
RBR	2023-06-18	09:21	48	201412_20230619_1344.rsk

1) Pressure sensor issues – maximum depth to be determined in post-processing.

4.6 eDNA for microbial and fish diversity & Nitrification incubations

Ana Gomes and Leonor Pizarro, CIIMAR

4.6.1 Filtration of seawater and ice cores

Bacterial communities have a pivotal role in regulating biogeochemical processes such as the nitrogen cycle in the ocean. The aim of the work developed during this cruise is to decipher the bacterial communities' composition in the sampled sites, with a special emphasis in nitrifying bacterial organisms.

During the transect of the cruise across all type-A stations, seawater samples (approximately 25 L per depth) were taken with the CTD cast in the moonpool at 10 m, deep chlorophyll maximum (DCM), Atlantic water and bottom (the latter three determined at each station). Due to an oil leakage at station 3, the auxiliary CTD was deployed from the side of the ship to collect samples from the DCM and Atlantic water. In this station, seawater samples from under the ice were also collected manually at 10 m with a Niskin bottle through an ice hole. Seawater samples were collected in carboys.

In each ice station, ice cores were collected (sections: 0-5 cm, 5-10 cm, 10-30 cm and top 10 cm). Ice core samples were collected in ice-melting containers and cores were left to melt overnight with 0.22 µm filtered seawater from 10 m depth before further processing.

Seawater and ice core samples were filtered onto Sterivex filters with 0.22 µm pore size using peristaltic pumps to retain cells for which DNA will be extracted once ashore. For each Sterivex filter, approximately 7 L of seawater was filtered, except for station 3 where filters got clogged due to a phytoplankton bloom. Sterivex filters were subsequently stored at -80ºC. Before filtrations, all equipment was washed with tap water, bleach (10%), MilliQ water, and water from the location, in this order, to avoid contamination between sampling stations.

After the cruise, both the seawater and ice core samples will be further analysed for microbial and fish diversity with 16S and 18S rRNA metabarcoding (short reads - Ilumina and full length - PacBio) and metagenomics (shot gun sequencing - Ilumina).

4.6.2 Nitrification incubations

In parallel, and for the ice stations, nitrification incubations were set up in the dark at 1ºC (in a cold room) using 1.5 L seawater from the DCM and bottom depths. The following experimental setup was used:

- Control incubations without the addition of $^{15}NH_4$
- Incubations with the addition of 56 µL $^{15}NH_4$ (2 replicates)

After 0, 12 and 24 hours of incubation, 40 mL of seawater was filtered with a syringe through a membrane filter (0.22 µm pore size) into 50 mL vials. Samples were stored at -80ºC for subsequent nitrification measurements after the cruise.

Table 5: Filtered water samples per station and depth.

Depth	Station 1	Station 3	Station 4	Station 5	Station 8	Station 9	Station 11	Station 14	Total samples
10 m	AO23_9 AO23_10 AO23_11	AO23_21A-C AO23_22A-C AO23_23A-C	AO23_35 AO23_36 AO23_37	AO23_47AO23_48AO23_49	AO23_56 AO23_57 AO23_58	AO23_68 AO23_69 AO23_70	AO23_86 AO23_87 AO23_88	AO23_104A-B AO23_105A-B AO23_106A-B	33
DCM	AO23_12 AO23_13 AO23_14	AO23_33A-B AO23_34A-B AO23_35A-B	AO23_44 AO23_45 AO23_46	AO23_53AO23_54AO23_55	AO23_62 AO23_63 AO23_64	AO23_74 AO23_75 AO23_76	AO23_92 AO23_93 AO23_94		24
Atlantic water	AO23_15 AO23_16 AO23_17	AO23_24A-C AO23_25A-C AO23_26A-C	AO23_38 AO23_39 AO23_40		AO23_65 AO23_66 AO23_67	AO23_77 AO23_78 AO23_79	AO23_95 AO23_96 AO23_97	AO23_113 AO23_114 AO23_115	27
Bottom	AO23_1 AO23_2 AO23_3	AO23_18 AO23_19 AO23_20	AO23_41 AO23_42 AO23_43	AO23_50AO23_51AO23_52	AO23_59 AO23_60 AO23_61	AO23_71 AO23_72 AO23_73	AO23_89 AO23_90 AO23_91	AO23_107 AO23_108 AO23_109	24
Total samples	12	27	12	9	12	12	12	12	

Table 6. Filtered ice core samples per station and ice core section.

Ice core section (cm)	Station 1	Station 3	Station 9	Station 11	Total samples
0-5	AO23_4A-B	AO23_27	AO23_80	AO23_98	5
5-10	AO23_5	AO23_28	AO23_81	AO23_99	4
10-30	AO23_6 AO23_7	AO23_29 AO23_30	AO23_82 AO23_83	AO23_100 AO23_101	8
Top 10	AO23_8	AO23_31 AO23_32	AO23_84 AO23_85	AO23_102 AO23_103	7
Total samples	6	6	6	6	

Table 7. Nitrification samples per station and sampling time.

Sampling time (hours)	Station 1	Station 3	Station 4	Station 9	Total samples
0	1_Bottom_R1_T0 1_Bottom_R2_T0 1_Bottom_C_T0 1_DCM_R1_T0 1_DCM_R2_T0 1_DCM_C_T0	3_Bottom_R1_T0 3_Bottom_R2_T0 3_Bottom_C_T0 3_DCM_R1_T0 3_DCM_R2_T0 3_DCM_C_T0	4_Bottom_R1_T0 4_Bottom_R2_T0 4_Bottom_C_T0 4_DCM_R1_T0 4_DCM_R2_T0 4_DCM_C_T0	9_Bottom_R1_T0 9_Bottom_R2_T0 9_Bottom_C_T0 9_DCM_R1_T0 9_DCM_R2_T0 9_DCM_C_T0	6

12	1_Bottom_R1_T1 1_Bottom_R2_T1 1_Bottom_C_T1 1_DCM_R1_T1 1_DCM_R2_T1 1_DCM_C_T1	3_Bottom_R1_T1 3_Bottom_R2_T1 3_Bottom_C_T1 3_DCM_R1_T1 3_DCM_R2_T1 3_DCM_C_T1	4_Bottom_R1_T1 4_Bottom_R2_T1 4_Bottom_C_T1 4_DCM_R1_T1 4_DCM_R2_T1 4_DCM_C_T1	9_Bottom_R1_T1 9_Bottom_R2_T1 9_Bottom_C_T1 9_DCM_R1_T1 9_DCM_R2_T1 9_DCM_C_T1	6
24	1_Bottom_R1_T2 1_Bottom_R2_T2 1_Bottom_C_T2 1_DCM_R1_T2 1_DCM_R2_T2 1_DCM_C_T2	3_Bottom_R1_T2 3_Bottom_R2_T2 3_Bottom_C_T2 3_DCM_R1_T2 3_DCM_R2_T2 3_DCM_C_T2	4_Bottom_R1_T2 4_Bottom_R2_T2 4_Bottom_C_T2 4_DCM_R1_T2 4_DCM_R2_T2 4_DCM_C_T2	9_Bottom_R1_T2 9_Bottom_R2_T2 9_Bottom_C_T2 9_DCM_R1_T2 9_DCM_R2_T2 9_DCM_C_T2	6
Total samples	18	18	18	18	

4.7 Community compositions of particle associated and free-living prokaryotic communities using Meta-OMICS techniques

Vipindas Puthiya Veettil and Aswathi Das M T, NCPOR

The Arctic Ocean has been a focal point of climate change due its rapid warming in comparison to other ocean realms. The rapid decline in sea-ice concentrations, freshening of the water column and increased run-off of nutrients from the terrestrial environment have been a topic of interest by the broader scientific community. The decline in sea-ice concentration in the Arctic Ocean creates increased salinity gradient across the water column it strengthens water column stratification, all these physio-chemical changes influence the microbial ecosystem of the Arctic. In the present expedition, we aim to decipher the community compositions of particle associated and free-living prokaryotic communities and study its role in the functioning of ecosystems using metagenomics approaches. The water samples were collected at four to five different depths covering, bottom water, Atlantic water, Deep Chlorophyll Maximum (DCM), and Surface water (10 m) across all type-A CTD and three type B stations. The collected water samples (17 litres) were filtered in triplicates (about 5 litres /per filter) by size fractionization method using 3 µm and 0.22 µm membrane filters (Merck-Millipore). The membrane filters containing microbial cell mass were frozen at -80^{0} C immediately after filtration and will be further analysed at the Polar Biology laboratory, National Centre for Polar and Ocean Research, India. We have also filtered 2 litres of water sample from each station through 0.7GF/F filters for collecting the particles in the water and this will be utilized for characterization of organic compounds in the particle.

4.8 Primary production measurments

4.8.1 Nitrogen- and carbon-uptake measurements in sea ice algae and phytoplankton

Eva Leu, Akvplan-niva and Fowzia Ahmed, University of Manitoba

To measure carbon- and nitrogen-uptake rates natural communities of sea ice algae and phytoplankton were incubated with enriched stable isotope compounds, $NaH^{13}CO_3$, $Na^{15}NO_{3}$, and $^{15}NH_4Cl$, respectively. Phytoplankton samples were collected with Niskin bottles on the CTD rosette, and in one case (St. 4) with a Ruttner water sample from the ice edge (due to an oil spill in the moonpool). Sea ice algae samples were collected by scraping off the skeletal layer at the sea ice-water interface with a knife and diluted in filtered surface seawater from the same station. Phytoplankton and sea ice algae incubations were always run for 24 hours; in four out of five cases, sea ice algae incubations were run as well for 4 hours. Both setups used 7 different light intensities, including one dark control. All samples were spiked with $NaH^{13}CO_3$, and in addition one nitrogen source, most often $Na^{15}NO_3$ (for details, see Table 8). At the end of the incubation period, samples were filtered onto pre-combusted GF/F filters and stored frozen for analyses of POC/PON and stable isotopes. All samples measured in these incubations were initially characterized physiologically by FRRf (see own paragraph). When time permitted, a quick check of the most dominating species was done microscopically from either the phytoplankton net sample or the 64 µm Bongo-net sample.

In combination with the sea ice algae incubations, we also collected samples for intracellular nutrients (from a separate scrape sample from another ice core), as well as macromolecular composition that will be analysed by Fourier-transform infrared spectroscopy (FTIR).

Table 8. Overview of all carbon- and nitrogen-uptake incubations run during the cruise. Phytoplankton incubations were collected from the depth of maximum Chl *a* concentration the *in-situ* fluorescence.

St no	CTD event #	Time start	Time end	Type of Sample	Sample depth	Type of spike	Duration
1		6th June, 16:00	7th June, 16:00	Scrape (bottom ice algae)	n.a.	CO3+ NO3 and CO3+ NH4	24 hours
3		10th June, 12:30	11th June, 12:30	Scrape (bottom ice algae)	n.a.	CO3+ NO3	4 and 24 hours
9		15th June, 16:00	16th June, 16:00	Scrape (bottom ice algae)	n.a.	CO3+ NO3	4 and 24 hours
11		17th June, 20:00	18th June, 20:00	Scrape (bottom ice algae)	n.a.	CO3+ NO3	4 and 24 hours
11		18th June, 21:00	19th June, 21:00	Sub-ice community (Melosira)	n.a.	CO3+ NO3	4 and 24 hours
1	116	6th June, 22:30	7th June, 22:30	phytoplankton	15m	CO3+ NO3	24 hours
3	118	9th June, 13:15	10th June, 13:15	phytoplankton	10m	CO3+ NO3, plus 1 bottle NH4	24 hours
4	121	12th June, 16:30	13th June, 16:30	phytoplankton	10m	CO3+ NO3	24 hours
5	128	14th June, 9:30	15th June, 9:30	phytoplankton	35m	NO3 only; 1 bottle NH4	24 hours
9	136	15th June, 21:00	16th June, 21:00	phytoplankton	25m	CO3+ NO3	24 hours
11	144	18th June, 10:00	19th June, 10:00	phytoplankton	25m	CO3+ NO3	24 hours

4.8.2 Phytoplankton and sea ice algal photophysiology measured by Fast Repetition Rate fluorometry (FRRf)

Eva Leu, Akvaplan-niva

To gain more detailed information about the physiological state of the different phytoplankton and ice algal communities we encountered on the cruise, water samples from the Niskin bottles or scrape samples from bottom sea ice were taken for analysis by Fast Repetition Rate Fluorometry. This technique allows to measure in a controlled benchtop-approach maximum photosynthetic yield of dark-acclimated microalgae, which gives indications about potential stress and photosynthetic efficiency. In addition, Fast Light Curves (FLC) were measured, which provide information about the photo acclimation state of algae.

These analyses were carried out at 10 sampling stations (St 1, 3-9, 11, 13), usually from two different depths: 10m and Chl *a* maximum. Occasionally, several depths were included (see table below). All sea ice algal communities that were incubated for C- and N-uptake measurements were measured as well. On the last ice station, FRRf-measurements were done on both bottom sea ice algal communities and the loosely attached Melosira assemblages (collected by a pump deployed through an ice corer hole).

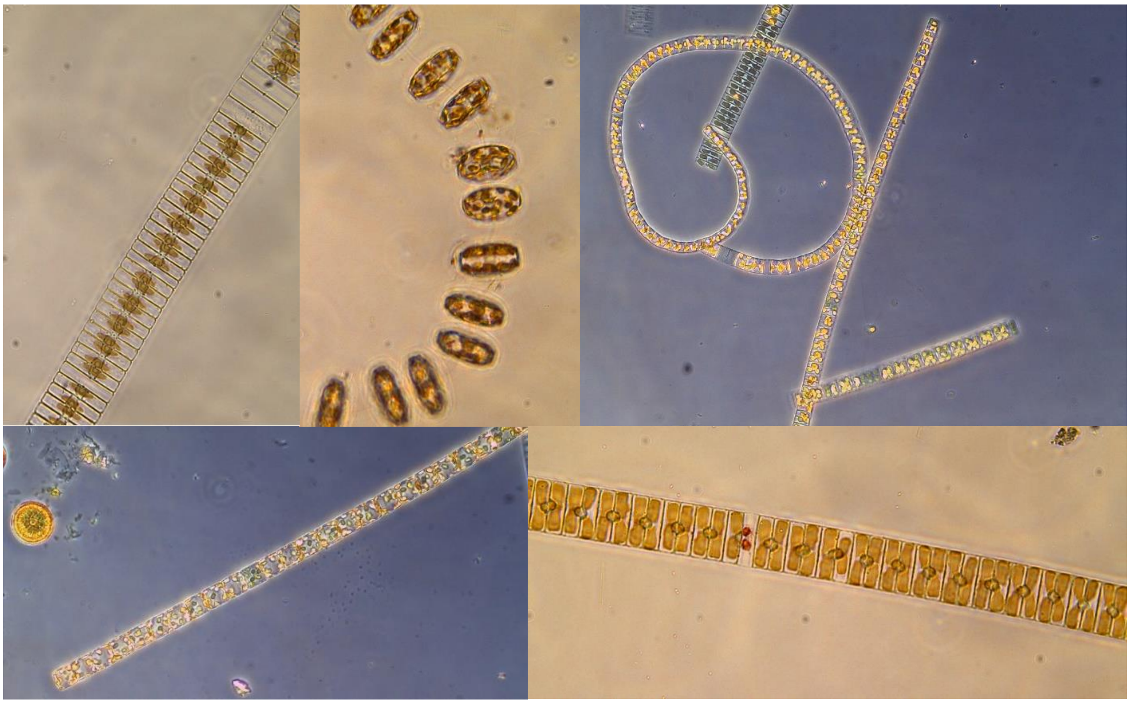

Figure 10. Examples of pelagic diatom colonies found in samples during the cruise (*Fragilariopsis oceanica, Thalassiosira* sp., *Pauliella taeniata, Bacterosira bathyomphala, Navicula sp.(?))*. All pictures by Eva Leu.

Table 9. Overview of all FRRf measurements carried out during the cruise.

Fast Repetition Rate Fluorometry measurements during AO 2023_1 SUDARCO

CTD #	Station #	Date	Time (UTC)	Long	Lat	Depth [m]	sample type	Fv/Fm	FLC	blank
	1	07/06/2023		79.0505	-1.9824	10-0	handnet	x	x	x
	1	07/06/2023		79.0505	-1.9824	50-0	handnet	x	x	x
	1	07/06/2023				surface	: algae aggrega	x	x	x
118	3	09/06/2023	02:30	80.0144	2.8088	10	water	x	x	x
118	3	09/06/2023	02:30	80.0144	2.8088	50	water	x	x	x
118	3	09/06/2023	02:30	80.0144	2.8088	nkton incubat	water	x	x	x
	3	09/06/2023				ice algae incubatior	scrape	x	x	x
120	4	12/06/2023	11:17	78.7537	-6.1820	10	water	x	x	x
120	4	12/06/2023	11:17	78.7537	-6.1820	Chl max 33	water	x	x	x
120	4	12/06/2023	11:17	78.7537	-6.1820	50	water	x	x	x
128	5	14/06/2023	06:00	78.7879	-7.9653	10	water	x	x	x
128	5	14/06/2023	06:00	78.7879	-7.9653	Chl max 35	water	x	x	x
129	6	14/06/2023	10:04	78.8309	-6.9916	10	water	x	x	x
129	6	14/06/2023	10:04	78.8309	-6.9916	Chl max 35	water	x	x	x
130	7	14/06/2023	14:47	78.8013	-5.9937	10	water	x	x	x
130	7	14/06/2023	14:47	78.8013	-5.9937	Chl max 25	water	x	x	x
130	7	14/06/2023	14:47	78.8013	-5.9937	50	water			
131	8	14/06/2023	18:26	78.7973	-5.0438	10	water			
131	8	14/06/2023	18:26	78.7973	-5.0438	Chl max 25	water	x	x	x
135	9	15/06/2023	15:16	78.7182	-4.0097	10	water	x	x	x
135	9	15/06/2023	15:16	78.7182	-4.0097	Chl max 25	water	x	x	x
	9	15/06/2023				ice algae incubatior	scrape	x	x	x
	9	16/06/2023				ice algae A	scrape	x	x	x
	9	16/06/2023				ice algae B	scrape	x	x	x
	9	16/06/2023				ice algae C	scrape	x	x	x
143	11	18/06/2023	02:58	78.7850	-2.3560	10	water	x	x	x
143	11	18/06/2023	02:58	78.7850	-2.3560	Chl max 25	water	x	x	x
	11	17/06/2023				ice algae B	scrape	x	x	x
	11	17/06/2023				ice algae incubatior	scrape	x	x	x
	11	18/06/2023				Melosira D	pump sample	x	x	x
	11	18/06/2023				Melosira E	pump sample	x	x	x
	11	18/06/2023				Melosira big bot	pump sample	x	x	x
	11	18/06/2023				ice algae scrap	scrape	x	x	x
151	13	19/06/2023				10	water	x	x	x
151	13	19/06/2023				Chl max 32	water	x	x	x
151	13	19/06/2023				deep Chl max 8	water	x	x	x
151	13	19/06/2023				25 m	water	x	x	x

4.8.3 Additional sampling for environmental characteristics on sea ice stations

Eva Leu, Akvaplan-niva

To interpret the above-described measurements correctly, we are reliant on a detailed description of the environmental conditions the organisms have been living in. At each sea ice station, we therefore performed light measurements, comparing the incoming PAR (photosynthetically active radiation) above undisturbed snow-covered sea ice with the under-ice light intensities, before and after snow removal. The upwelling irradiance of intact snow and snow-free ice surfaces was measured, too. Nutrient samples were taken at 0 and 5m below the sea ice, and CTD-profiles were taken by a handheld CTD including an *in-situ* fluorescence and a cosine-corrected LiCOR sensor through a hole in the ice (or the ice edge at St. 4), down to 30m at stations 4, 9, and 11.

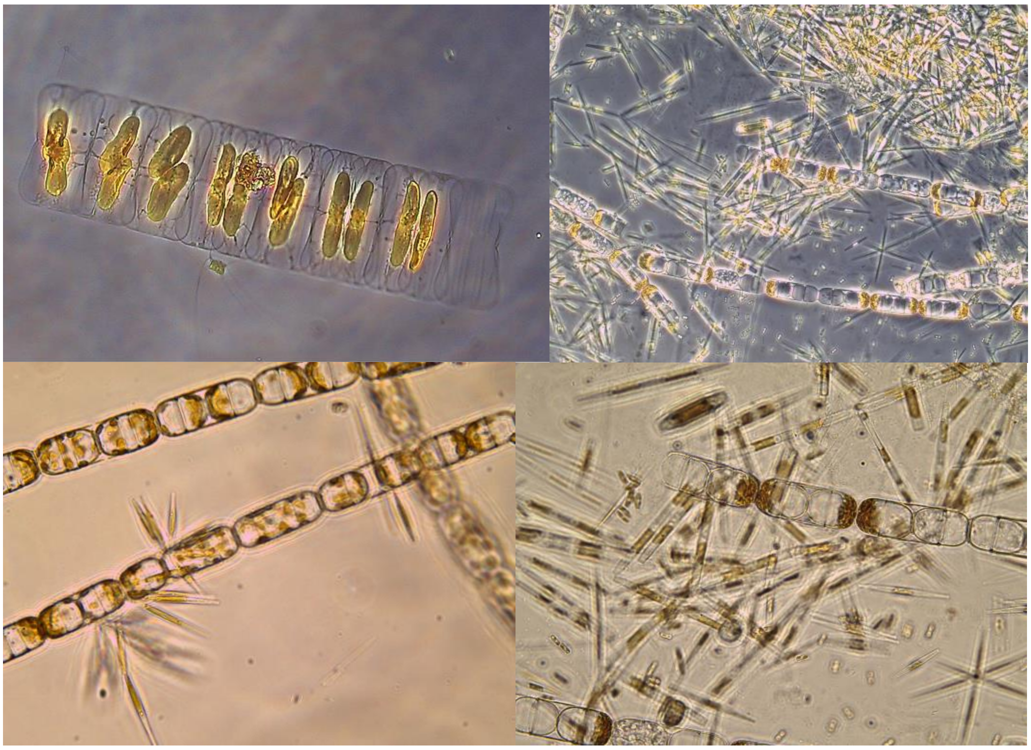

Figure 11. Examples of sea ice diatoms found during the cruise (*Entemoneis* sp., *Melosira arctica, Nitzschia frigida, Synedropsis hyperborea, Navicula sp.)*. All pictures by Eva Leu

4.9 Pelagic and sea ice protist taxonomy and biogeochemistry

Megan Lenss

4.9.1 Pelagic

4.9.1.1 Chlorophyll a

Chlorophyll-*a* (Chl *a*) is a proxy for biomass of primary producing organisms. Seawater from 6 standard depths in addition to the depth of the Chl *a* maximum, if it differed from standard depths by > 5m, was collected using a Niskin bottle rosette at type A and type B CTD casts. Seawater was also collected through man-made holes in the sea ice using a handheld Rutner sampler from 5 standard depths in the upper 20m of the water column at each ice station for increased resolution in the upper water column. A measured volume of water was filtered onto 25 mm Whatmann glass fibre filters and placed in 5 mL of methanol for extraction. Immediately following an 18–24-hour extraction period, samples were analysed onboard using a Turner Trilogy Fluorometer. Chl *a* samples were collected at type A and type B CTD casts.

4.9.1.2 Flow cytometry

Flow cytometry provides information on the abundance and size distribution of microorganisms. Seawater from 6 standard depths in addition to the depth of the Chl *a* maximum, if it differed from standard depths by > 5m, was collected using a Niskin bottle rosette at type A CTD casts. Seawater was also collected through man-made holes in the sea ice using a handheld Rutner sampler from 5 standard depths in the upper 20m of the water column at each ice station for increased resolution in the upper water column. 1.8 mL of water was fixed with 25% glutaraldehyde before flash freezing at -80˚C. Samples will be further analysed ashore.

4.9.1.3 Particulate organic carbon/nitrogen (POC/PON)

POC/PON is a proxy for organic biomass in the water column. Seawater from 6 standard depths in addition to the depth of the Chl *a* maximum, if it differed from standard depths by > 5m, was collected using a Niskin bottle rosette at type A and type B CTD casts. Seawater was also collected through man-made holes in the sea ice using a handheld Rutner sampler from 5 standard depths in the upper 20m of the water column at each ice station for increased resolution in the upper water column. A measured volume of water was filtered onto pre-combusted Whatmann glass fibre filters. Filters were dried at 60˚C for approx. 24 hours and packed for further analysis ashore.

4.9.4.4 Phytoplankton Taxonomy

Samples for phytoplankton taxonomy are taken to understand the community composition of phytoplankton. Samples from 6 standard depths in addition to the depth of the Chl *a*, if it differed from standard depths by > 5m, maximum was collected using a Niskin bottle rosette at type A CTD casts. Seawater was also collected through man-made holes in the sea ice using a handheld Rutner sampler from 5 standard depths in the upper 20m of the water column at each ice station for increased resolution in the upper water column. 190 mL of sample was spiked with 0.8 mL of 25% glutaraldehyde and 20% hexamine-buffered formaldehyde for fixation. Once ashore, fixed samples will be shipped to IOPAN (Sopot, Poland) for further identification and analysis.

4.9.4.5 Ship-board Phytoplankton Net

Samples for taxonomic analysis of rare phytoplankton species were collected at stations 1, 3, 4, 9, and 11 using a shipboard phytoplankton net with 10 µm mesh size. The net was lowered to 50 m depth and slowly towed upwards through the water column at a speed of 0.1 m s^{-1}. 90 mL of sample was fixed with 3 mL of strontium chloride and 20% hexamine-buffered formaldehyde for a final solution concentration of 10%. Fixed samples will be shipped to IOPAN (Sopot, Poland) for identification and analysis once ashore.

4.9.4.6 On-ice Phytoplankton Net

Samples for taxonomic analysis of rare phytoplankton species were collected at stations 1, 4, and 9 using a hand-towed phytoplankton net with 20 µm mesh size. The net was lowered to 25 m depth and slowly towed upwards through the water column. 90 mL of sample was fixed with 3 mL of strontium chloride and 20% hexamine-buffered formaldehyde for a final solution concentration of 10%. Fixed samples will be shipped to IOPAN (Sopot, Poland) for identification and analysis once ashore.

4.9.2 Sea Ice

4.9.2.1 Chlorophyll-a

Chlorophyll *a* (Chl *a*) is a proxy for algal biomass in sea ice. Ice cores for Chl *a* were collected using a 9 cm core barrel at all ice stations. Three profile cores with sectioning 0-3 cm, 3-10 cm, 10-20 cm, and 20 cm sections thereafter were collected at each location. Cores were brought onboard and melted with a filtered seawater buffer (100 mL seawater to 1 cm ice) at room temperature in the dark. Melted cores were pooled together and a measured volume of sample was then filtered onto 25 mm Whatmann glass fibre filters. Filters were placed in 5 mL of methanol for extraction. Immediately following an 18–24-hour extraction period, samples were analysed onboard using a Turner Trilogy Fluorometer.

4.9.2.2 Particulate organic carbon/nitrogen (POC/PON)

POC/PON is a proxy for organic biomass in sea ice. Ice cores for POC/PON were collected using a 9 cm core barrel at all ice stations. Three profile cores with sectioning 0-3 cm, 3-10 cm, 10-20 cm, and 20 cm sections thereafter were collected at each location. Cores were brought onboard and melted with a filtered seawater buffer (100 mL seawater to 1 cm ice) at room temperature in the dark. Melted cores were pooled together and a measured volume of water was filtered onto pre-combusted Whatmann glass fibre filters. Filters were dried at 60˚C for approx. 24 hours and packed for further analysis ashore.

4.9.2.3 Sea ice flow cytometry

Flow cytometry provides information on the abundance and size distribution of microorganisms. Ice cores for flow cytometry were collected using a 9 cm core barrel at all ice stations. Samples for flow cytometry were taken from a pooled sample of 3 cores sectioned 0-3 cm, 3-10 cm, and 10-20 cm. Cores were brought onboard and melted with a filtered seawater buffer (100 mL seawater to 1 cm ice) at room temperature in the dark. Once melted, 1.8mL of sample was fixed with 25% glutaraldehyde for 2 hours at +4˚C before flash freezing at -80˚C. Samples will be further analysed ashore.

4.9.2.4 Sea ice algae taxonomy

Samples for sea ice algae taxonomy are taken to understand the community composition of ice alga. Samples for ice algal taxonomy were taken from a pooled sample of 3 cores sectioned 0-3 cm, 3-10 cm, and 10-20 cm. Cores were brought onboard and melted with a filtered seawater buffer (100 mL seawater to 1 cm ice) at room temperature in the dark. 190 mL of sample was spiked with 0.8 mL of 25% glutaraldehyde and 20% hexamine-buffered formaldehyde for fixation and stored at +4˚C. Once ashore, fixed samples will be shipped to IOPAN (Sopot, Poland) for further identification and analysis.

4.10 Zooplankton taxonomy, abundance, biomass and genomics

Malin Daase, UiT, Slawomir Kwasniewski, IO PAN, Magdalena Dolinkiewicz, UG and Anette Wold, NPI

The main objective of the work was to collect samples to study the mesozooplankton community in terms of taxonomic composition, abundance and biomass (zooplankton community study). In addition, our goal was to collect individuals of less common species, to add their barcode to the gene library of Arctic zooplankton. The original aim of the work was to collect deep-water species from the Nansen Basin of the Arctic Ocean. This region is rarely visited for research and zooplankton species from these waters are rarely sampled hence their gene sequences are missing in the gene libraries. Since we did not reach the Nansen Basin, we focused on collecting species for genetic identification from the deep waters of the Fram Strait as well as the outflow area on the East Greenland shelf and slope in the western Fram Strait.

4.10.1 Sampling methods

Mesozooplankton was sampled with Multiple Plankton Sampler MultiNet type Mammoth (Hydro-Bios Kiel, 9 nets, opening: 1.0 m^2, net length: 550 cm, mesh size: 180 µm, Figure 12) and Bongo net (Hydro-Bios Kiel, opening: 2 x 0.2827m^2, nets length: 250 cm, mesh sizes: 64 µm & 180 µm). Macrozooplankton was sampled with MIK net (Midwater Ring Net, opening: 3.14 m^2, net length: 13 m, mesh size: 1.6 mm µm and 500 µm (last meter)).

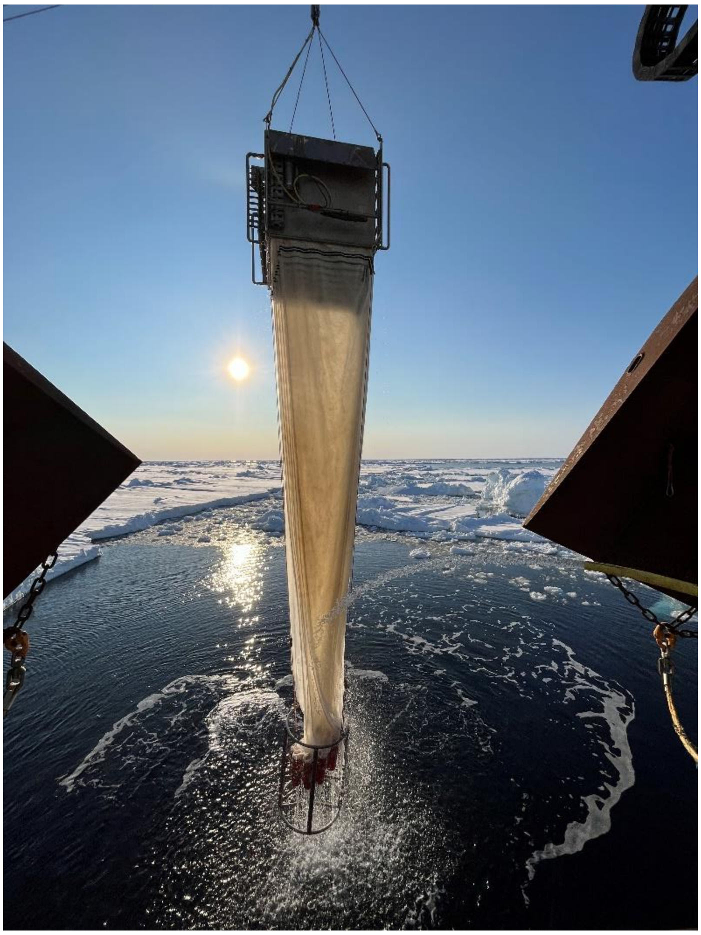

Figure 12. MultiNet Mammoth, sampling capacity: 9 depth strata, opening area: 1 m^2.

4.10.1.1 MultiNet

Depth stratified samples were taken with the MultiNet Mammoth from the following standard depths at the deep stations: bottom-2500 m, 2500-2000 m, 2000-1500 m, 1500-1000 m, 1000-600 m, 600-200 m, 200-50 m, 50-20 m, 20-0 m. On the shelf the following depths were sampled; Bottom-250 m, 250-200 m, 200-150 m, 150-100 m, 100-50 m, 50-20 m, 20-0 m.

Samples from one deployment of MultiNet Mammoth were preserved in buffered 4% formaldehyde for mesozooplankton abundance/taxonomy (community samples). Examination of these samples will be conducted at Plankton Ecology Laboratory at the Institute of Oceanology (IO PAN) in Sopot, Poland, as a part of long-term collaboration in Arctic zooplankton ecology studies. Samples from the second Mammoth deployment were scanned for rare species, which when found were picked out. These samples will be subjected to genome analysis to add their gene sequences to gene libraries (genetic samples). The picked species were photographed either with a digital microscope camera or with other types of digital cameras, and the individuals were placed in cryovial or larger sampling bottles, preserved in 96% EtOH and stored at -20 °C. An overview of species picked for gene sequencing (barcoding) can be found in Table 12. The remaining sample was preserved in 96% EtOH and stored at -20 °C. The genetic samples will be used for metabarcode analysis, the results of which will then be compared with the results of the community sample analysis based on morphology to compare the faunal findings of between these two methods.

At St. 1 two of the MultiNet deployments failed and therefore not all depth layers were sampled. During the first deployment, the ropes became entangled in the upper part of the MultiNet box and during the second deployment, the wire got caught in drift ice and the net was left hanging at 1200 m depth for over an hour, hence the batteries ran out and the subsequent nets could not be opened and the uppermost sample is from 1500-0m.

4.10.1.2 Bongo net

The Bongo net was equipped with one 180 µm net and one 64 µm net bags. The net was used to take samples from the upper 1000 m. The sample from each net was split in two; one part for taxonomy which was processed in the same way as the MultiNet taxonomy sample, and one part that was frozen at -20 °C for later analysis for total biomass, metabarcoding, carbon and nitrogen content (C/N) and fatty acid (FA) composition.

4.10.1.3 MIK net

The MIK net was deployed down to 1000 m only. All gelatinous species from the net catch were removed, sorted to taxa/taxonomic groups and stored at 3 °C for later identification (see below). The remaining sample was split in two parts. One part was preserved in buffered 4% formaldehyde for abundance/taxonomy, and the other part was preserved in EtOH for metabarcoding.

4.10.1.4 Gelatinous zooplankton

Each gelatinous organism selected from the MultiNet deployment dedicated to metabarcoding and the MIK deployment was measured and photographed on a light table. Individuals were picked up using a metal spoon with holes and excess water was removed by blotting using a paper towel under the spoon. The individuals were then weighted and afterwards stored in 96% EtOH at -20°C for genetic analysis by Sanna Majaneva at Akvaplan-niva/NTNU. The species found are listed in Table 13 and some collected species are shown in Figure 13.

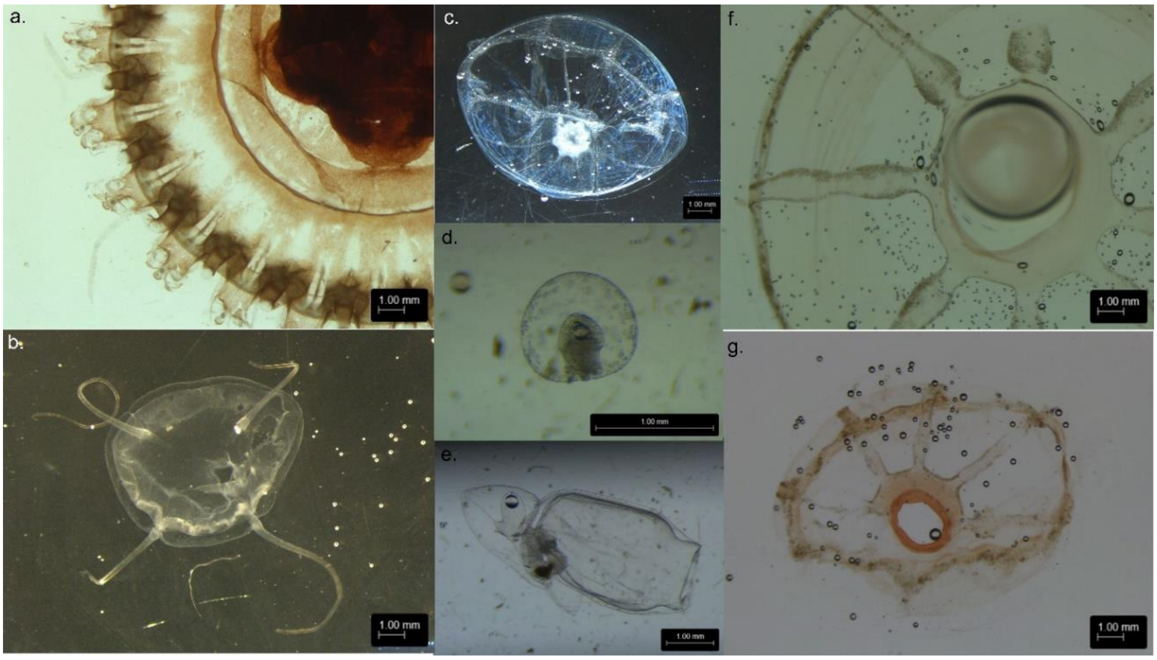

Figure 13. Selection of gelatinous species observed in the MIK net and the MultiNet samples. A. detail of *Atolla* sp. b. *Aeginopsis laurentii*, c. *Sminthea arctica*, d. *Plotocnide borealis*, e. *Dimophyes arctica*, f. *Botrynema brucei*, g. *Botrynema ellinorae*. Photos: Slawomir Kwasniewski

Table 10. Overview of sampling depths, and hauling speed for different zooplankton nets

Gear	Sampling depth	Hauling speed (m/s)	
		lowering	heaving
MultiNet 180 µm (deep)	Bottom-2500-2000-1500-1000-600-200-50-20-0m	0.5*	0.5
MultiNet 180 µm (shelf)	Bottom-250-200-150-100-50-20-0m	0.5*	0.5
Bongo net 64 & 180 µm	1000-0m	0.5	0.3
MIK 1500 µm	1000-0m	0.4	1.0

*According to the manual the lowering speed could be 0.8 m/s but since the ropes got entangled in the frame during the first deployment, we decided to reduce the lowering speed to 0.5 m/s to avoid the problem.

Table 11. Overview of mesozooplankton community samples

Gear	Sample type	Stations	Number of samples
MultiNet 180 µm	Mesozooplankton Taxonomy (formaldehyde)	St. 1,3,4,9,11	41
	Mesozooplankton Metabarcoding (EtOH)		41
Bongo net 64 & 180 µm	Mesozooplankton Taxonomy (formaldehyde)	St. 1,3,4,9,11	6
	Mesozooplankton biomass, metabarcoding, C/N, FA (frozen)		6
MIK net 1.6 mm	Macrozooplankton Taxonomy (formaldehyde)	St. 1,3,4,9,11	5
	Macrozooplankton Metabarcoding (EtOH)		5

4.10.2 Observations of the mesozooplankton community from MultiNet sampling

4.10.2.1 Deep stations (St. 1, St. 3, St. 9 and St. 11)

At stations 1 and 3 (located further north in the Fram Strait) a phytoplankton bloom was observed. At station 3 the bloom was dominated by *Phaeocystis* (*P. pouchetii* cf.) clogging the two upper Mammoth nets (from 50-20 and 20-0 m) as well as the Bongo nets. This likely affected nets filtering efficiency for these depth layers.

At all deep stations, the zooplankton community within the upper 50 m water layer was dominated by calanoid copepod *C. hyperboreus,* in addition to cyclopoid copepod *Oithona similis* and calanoid *Metridia* (most probably *M. longa*). At St. 3, we observed high numbers of appendicularians (from genus *Oikopleura*) in surface waters and right under the ice. The houses of this appendicularian were visibly covered by brownish spots, algal cells of *Phaeocystis*. The intermediate depths were characterized by higher abundance of *Metridia* (*M. longa*), *Microcalanus* spp. and *Triconia borealis*, in addition to a mixed community of *Calanus* (including *C. hyperboreus*, but also *C. glacialis* and *C. finmarchicus*, judging from the prosome length).

Figure 14. Dominance of *C. hyperboreus* in the surface samples (Photo: Malin Daase)

The deeper layers (2500-600 m) did show the highest diversity and a high abundance of gelatinous zooplankton, with *Botrynema brucei* and *B. brucei ellinorae* and *Atolla* (most probably *Atolla* cf. *tenella*) being the most conspicuous species. Several large-sized Arctic copepods were found at depths, the most dominant were *Paraeuchaeta* spp. (including *P. barbata* and *P. glacialis*), *Aetideopsis rostrata, Gaetanus brevispinus* and *G. tenuispinus, Scaphocalanus magnus*, S*pinocalanus antarcticu*s. Among other noticeable large zooplankton were the amphipod *Cyclocaris guilelmi*, the decapod *Hymenodora glacialis* and the chaetognath *Eukrohnia hamata*. The deepest samples, particularly at stations 1 and 3, had a high abundance of large protistan organisms which were tentatively assigned to "radiolarians". In samples from the western most stations (stations 4 (shelf) and 9) less common copepods such as *Chiridiella* sp., *Augaptilus glacialis*, *Haloptilus acutifrons*, *Temorites brevis* or a siphonostomatoid copepod *Hyalopontius typicus* were also found during sorting of the genetic MultiNet samples. Also, at every deep station the magnificent deep water chaetognath *Pseudosagitta maxima* was also observed.
Samples from station 11 were not sorted but directly preserved in ethanol.

Figure 15. 1500-1000 m Multinet sample St.1 (Photo: Malin Daase)

4.10.2.2 Shelf station (St. 4)

A diatom occurrence (at an early bloom stage?) was observed in the surface waters of station 4 but it did not caused clogging of the nets to the same degree as at the previous stations St. 1 and St. 3. On the shelf, the zooplankton community was dominated by *C. hyperboreus* but *C. glacialis* was also abundant (represented by females) and a few *C. finmarchicus* were also noticed. A surprisingly high number of calanoid copepod *Scaphocalanus magnus* was observed in all layers. This is a deeper-water species, and its presence could indicate an intrusion of Atlantic waters from under the surface water layers onto the shelf. The shelf samples were also characterized by the presence of meroplankton taxa (Echinodermata larvae, Cirripedia nauplii), a high abundance of *Calanus* nauplii and a noticeable presence of pteropod snail *Limacina helicina*.

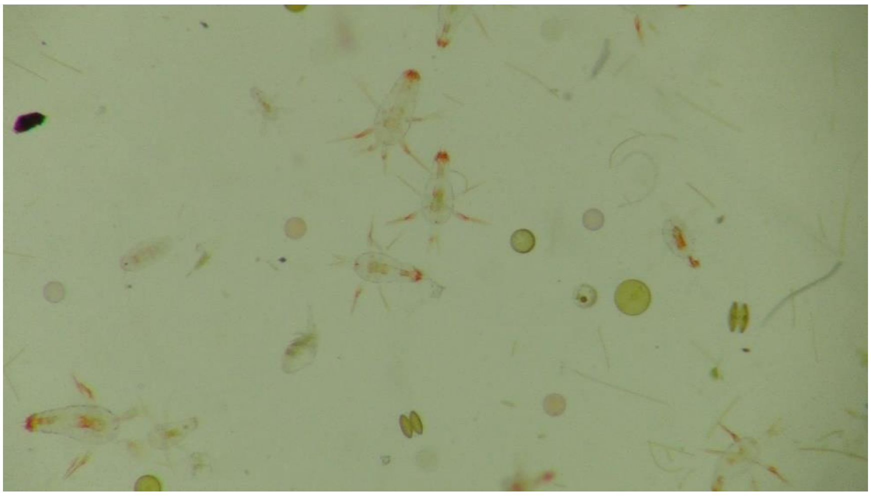

Figure 16. High abundance of *Calanus* nauplii and large centric diatoms on the shelf (St4).
Photo: Malin Daase

The most conspicuous faunistic findings from the sorting of the samples for genetic analyses and for large gelatinous species collecting were the finding of the amphipod *Andaniexis abyssi* st.9 and an extremely large (11.2 cm length, 74 g wet mass) and colorful ctenophore from family Beroidae. It was tentatively identified from a picture by Dr. Maciej Manko as Beroe abyssicola.

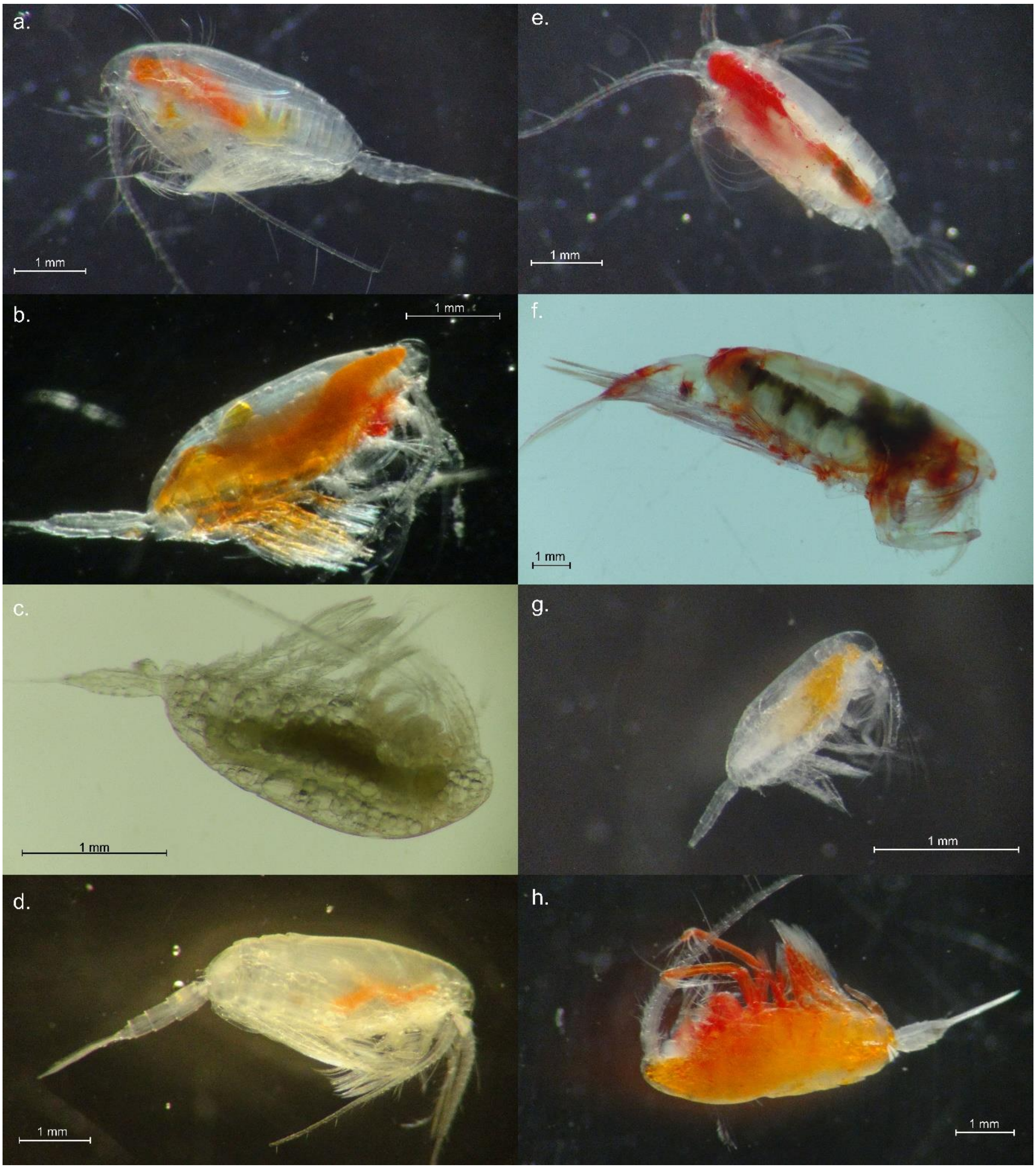

Figure 17. Common copepods in deeper Atlantic waters: a. *Aetideopsis rostrata*, b. *Scaphocalanus magnus*, c. *Spinocalanus antarcticus*, d. *Chiridius obtusifrons*, e. *Gaetanus brevispinus*, f. *Paraeuchaeta barbata,* g. *Scaphocalanus brevicornis,* h. *Pseudochirella sp.* Photos: Malin Daase

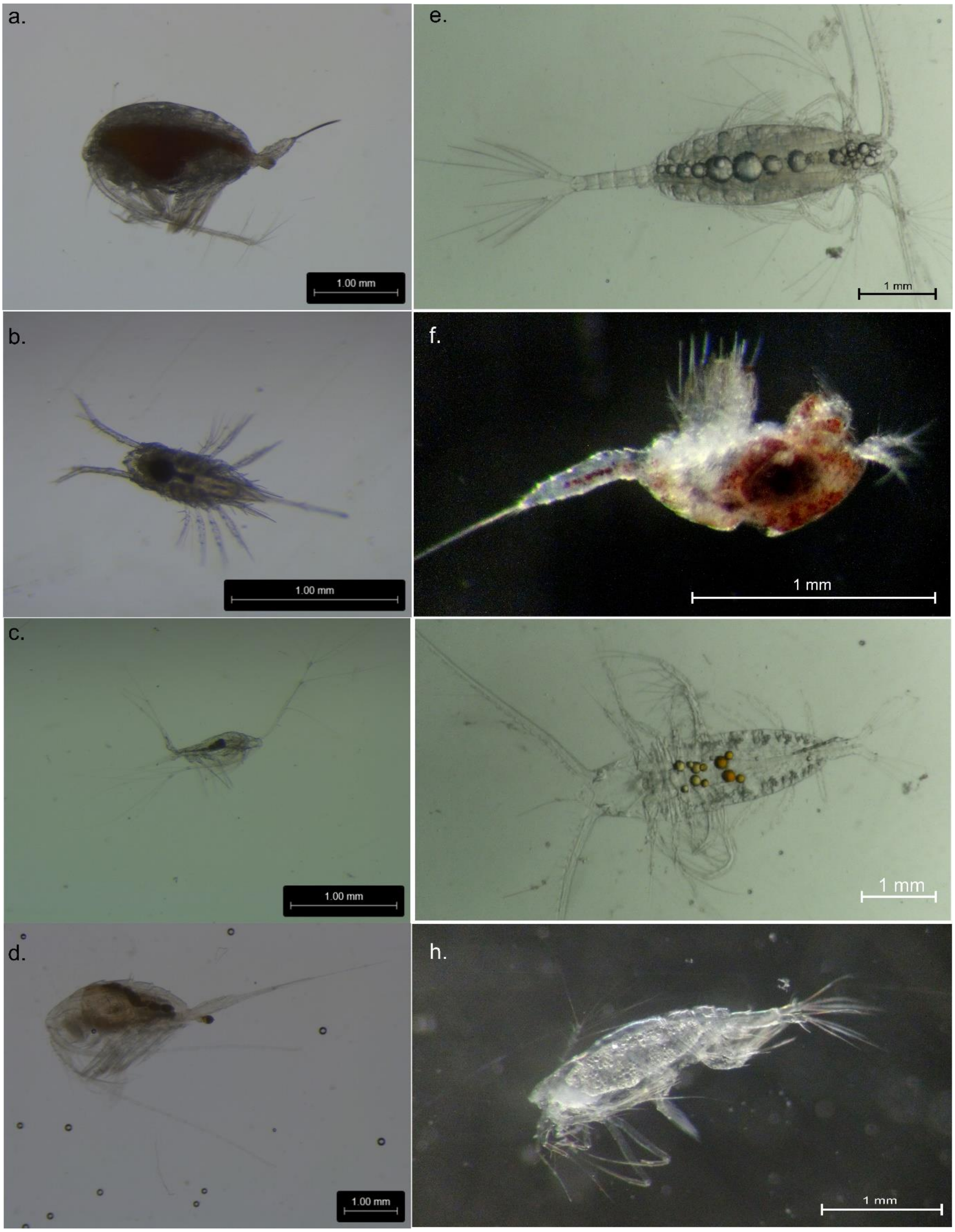

Figure 18. Less common copepod species observed during the cruise: a. *Chiridiella* sp. b. unidentified Harpacticoid, c. *Neomormonilla polaris*, d. *Lucicutia* sp., e. *Augaptilus glacialis*, f. unidentified Cyclopoid, g. *Haloptilus acutifrons*, h. *Hyalopontius typicus*. Photos: a-d Slawomir Kwasniewski; e-h: Malin Daase

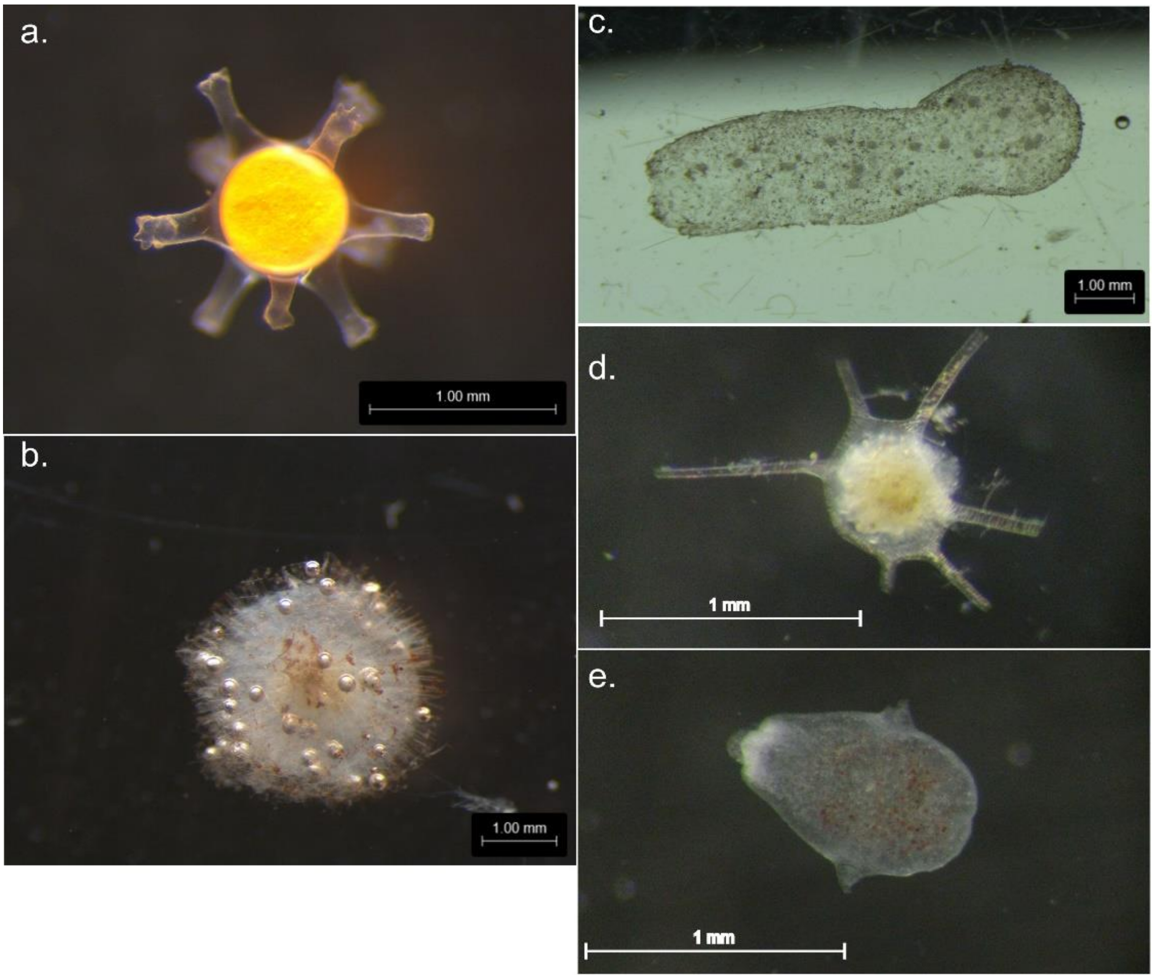

Figure 19. Unidentified objects observed in the Multinet samples: a. unidentified egg or larvae; b. Radioloaria; c. egg sac; d. maybe a protozoa? e. unidentified larvae (possibly *Clione limacina*).
Photos: a-c: Slawomir Kwasniewski, d-e: Malin Daase

Table 12. Overview of rare species (single individuals) sampled from the MIK net and Multinet at each station.

	Species	st.1	st.3	st.4	st.9	st.11	TOTAL
Amphipoda	*Cyclocaris guilelmi*	5	4	0	0	0	**9**
	Eusirus holmii	1	2	0	0	0	**3**
	Lanceola clausi	2	1	0	0	0	**3**
	Scina borealis	0	1	0	0	0	**1**
	Themisto libellula	1	0	0	0	0	**1**
Copepoda	*Aetideidae* indet.	0	0	1	0	0	**1**
	Aetideopsis minor	0	0	6	0	0	**6**
	Aetideopsis rostrata	2	6	0	0	0	**8**
	Andaniexis abyssi	0	0	0	1	0	**1**
	Augaptilus glacialis	0	0	0	4	0	**4**
	C glacialis with parasite	0	0	1	0	0	**1**
	Chiridiella sp.	0	0	0	3	0	**3**
	Chiridius obtusifrons	0	2	4	0	0	**6**
	Copepoda indet.	1	0	0	0	0	**1**
	Cyclopoida Lubbockia	1	0	0	1	0	**2**
	Gaetanus brevispinus	3	4	0	0	0	**7**
	Gaetanus tenuispinus	1	1	3	0	0	**5**
	Haloptilus acutifrons	0	0	0	2	0	**2**
	Harpacticoida indet.	0	0	0	1	0	**1**
	Harpacticoida Clytemnestra cf.	0	0	0	1	0	**1**
	Heterorhabdus compactus	0	0	1	0	0	**1**
	Heterorhabdus norvegicus	1	1	6	3	0	**11**
	Hyalopontius typicus	0	0	0	2	0	**2**
	Lucicutia sp.	0	0	0	2	0	**2**
	Microcalanus spp.	0	0	0	3	0	**3**
	Neomormonilla polaris	0	0	1	1	0	**2**
	Paraeuchaeta spp.	0	1	0	0	0	**1**
	Paraeuchaeta barbarta	1	1	0	2	0	**4**
	Paraeuchaeta glacialis	2	1	0	0	0	**3**
	Pseudochirella sp. (cf. P. spectabilis)	1	1	0	1	0	**3**
	Pseudochirella spectabilis	1	0	0	0	0	**1**
	Scaphocalanus brevicornis	0	0	0	5	0	**5**
	Scaphocalanus magnus	2	0	4	0	0	**6**
	Scolecithricella minor	0	0	6	0	0	**6**
	Spinocalanus spp.	2	0	0	5	0	**7**
	Spinocalanus antarcticus	2	3	0	0	0	**5**
	Spinocalanus horridus	0	0	0	5	0	**5**
	Temorites brevis	0	0	0	2	0	**2**
	Tharybis sp.	0	0	0	1	0	**1**
	Tharybis cf. angularis	0	1	0	0	0	**1**
	Triconia borealis	0	0	3	0	0	**3**
other crustacea							**0**
Decapoda	*Hymenodora glacialis*	2	3	0	0	0	**5**
Decapoda	*Pasiphae* asp.	0	0	0	0	1	**1**
Isopoda	*Isopoda* indet.	0	1	3	1	0	**5**
Mysida	*Mysida* indet.	1	1	0	0	0	**2**
Ostracoda	*Ostracoda* indet.	8	6	0	0	0	**14**
Appendicularia	*Oikopleura* spp.	0	5	1	0	0	**6**
Chaetognatha	*Eukrohnia hamata*	0	2	0	0	0	**2**

	Pseudosagitta maxima	2	1	1	0	0	**4**
Polychaeta	*Pelagobia longicirrata*	0	5	2	2	0	**9**
	Tomopteris sp. (cf. T. septentrionalis)	0	0	0	2	0	**2**
	Typhloscolex sp.	0	0	0	7	0	**7**
Pteropoda	*Clione limacina*	0	2	0	0	0	**2**
	Clione limacina larvae cf.	0	0	0	1	0	**1**
	Limacina helicina	0	0	6	0	0	**6**
Ctenophora	*Ctenophora juvenile*	0	0	1	0	0	**1**
Hydrozoa	*Hydrozoa actinula cf.*	0	0	0	2	0	**2**
Other	Egg sac indet.	0	2	3	0	0	**5**
	Protozoa indet.	0	0	0	1	0	**1**
	Radiolaria indet.	1	1	0	2	0	**4**
	TOTAL						**219**

Table 13. Overview of number of individuals of gelatinous zooplankton (single individuals) sampled at each station from the MIK net and Multinet nets. All species belong to the Phylum Cnidaria (except for one Ctenophora)

Species	**st.1**	**st.11**	**st.3**	**st.4**	**st.9**	**TOTAL**
Aeginopsis laurentii	1	0	0	2	1	**4**
Aglantha digitale	11	0	6	0	1	**18**
Atolla tenella	8	0	5	0	13	**26**
Bathykorus bouilloni	0	0	4	0	0	**4**
Beroe cucumis	2	1	5	1	1	**10**
Botrynema brucei	3	0	1	0	7	**11**
Botrynema brucei ellinorae	13	0	8	0	15	**36**
Crossota norvegica	1	2	0	0	0	**3**
Crystalophaes amygdalina	0	0	0	0	3	**3**
Ctenophora	0	1	0	0	0	**1**
Cyanea ephyra	0	0	0	1	0	**1**
Dimophyes arctica	15	0	1	0	0	**16**
Gilia reticulata	0	0	0	0	2	**2**
Homoeonema platygonon	1	0	0	0	2	**3**
Mertensia juvenile	0	0	0	0	1	**1**
Plotocnide borealis	0	0	0	3	0	**3**
Rudjakovia plicata	0	0	1	1	3	**5**
Siphonophorae-nectophore	0	0	0	0	1	**1**
Sminthea arctica	0	0	13	0	11	**24**
Solmundella bitentaculata	0	0	0	0	2	**2**
TOTAL						**174**

4.10.3 *Calanus glacialis* haplotype study

At stations 4, 5 and 9 we picked individual *Calanus* for a study on *Calanus* haplotypes. 20 individuals were placed individually in cryovials and preserved in ethanol. Their prosome length was measured prior to fixation, or a picture was taken, and prosome length was measured based on the image. In addition, 5 individuals were frozen at -80 for fatty acid (FA) analysis, and 3x5 individuals were pooled and frozen for stable isotope analysis. The samples will be analysed by Kohei Matsuno at Hokkaido University, who requested these samples.
We initially aimed to sample *Calanus glaci*alis CVs. The abundance of CVs was low at all stations and the *C. glacialis* population consisted of females. We, therefore, picked females at st5 and st.9 and *C. hyperboreus* CVs at st4.

Table 14. Overview of *Calanus* samples for haplotype study

Station	**Gear**	**Sample depth (m)**	**Species**	**Stage**	**# ind genetics**	**# ind FA**	**# ind SI**
St4	Bongo	300-0	*C. hyperboreus*	CV	20	5	3x5
St5	Bongo	250-0	*C. glacialis*	CV	8	0	0
St5	Bongo	250-0	*C. glacialis*	AF	17	5	1x5
St9	Multinet	50-0	*C. glacialis*	AF	20	5	3x5

4.11 Sea Ice Meiofauna

Malin Daase, UiT (& Janne Søreide, UNIS)

Arctic sea ice provides a wide range of microhabitats for biota that inhabits the brine channels and the ice–water interface. Sympagic meiofauna comprises multicellular organisms such as nematodes, harpacticoid copepods, flatworms, and rotifers typically ranging from ~20 to 500 µm in size. Single-celled ciliates are also regarded as sea ice meiofauna, and in addition, both pelagic and benthic meiofaunal species occur in sea ice, often as larvae or juvenile stages.
Among sea ice associated multicellular organisms, sea ice meiofauna remain the most poorly studied in terms of diversity and abundance and the temporal and spatial variability in these parameters. Community composition of sea ice meiofauna can vary substantial between locations (fast ice vs pack ice, fjords vs open water), across the Arctic and with ice thickness, age and snow cover.
With sea ice declining, consequences for sea ice biota seem inevitable, but are undocumented, particularly for the smaller size classes. It is therefore critical to document ice biota composition, abundance, and natural variability to be able to evaluate ecosystems responses Arctic Sea ice decline. The purpose of the meiofauna sampling during this cruise was to document the species composition and abundance in the pack ice. In addition to the meiofauna samples described here, samples were also taken in a comparable manner for metabarcoding (see Ana and Leonora report).

4.11.1 Sampling

At each ice station, three ice cores were taken with the Kovacs ice corer. The core was cut into three sections: 0-5, 5-10 and 10-30 cm. Snow depth, ice thickness and freeboard were noted at each coring site (see Sea ice log). The core section was melted in filtered sea water, with 100 ml seawater added to each centimetre of ice core. The three replicates of each section were pooled, and the cores were left to melt at room temperature. When the cores were melted, the total water volume was measured, and the samples was sieved through a 20µm sieve. The sample was preserved in ethanol and stored at -20. The samples will be processed by Janne Søreide at UNIS.

4.11.2 Observations

The 0-5 cm section was inspected under the stereomicroscope after the core was melted and before the sample was preserved. At St. 1 and 3 the meiofauna abundance was very low, only a few individual rotifera and harpacticoid copepods were found. At St. 9, a high concentration of diatoms was observed and the abundance of meiofauna was high, particular ciliates and rotifers who were happily cruising around in the sample and appeared to be in good conditions. A few harpacticoids copepods were also observed. St. 11 was characterized by high abundance of Melosira cells, and rotifers and ciliates were abundant, but not as abundant as at St 9.

Table 15. Overview of Meiofauna samples

station	date	sample section from (cm)	sample section to (cm)	# replicates	add water	total volume	sieve mesh	fixative
St1	06.06.2023	0	5	3	1500	NA	20	ethanol
St1	06.06.2023	5	10	3	1500	NA	20	ethanol
St1	06.06.2023	10	30	3	5000	NA	20	ethanol
St3	09.06.2023	0	5	3	1500	2450	20	ethanol
St3	09.06.2023	5	10	3	1500	2340	20	ethanol
St3	09.06.2023	10	30	3	6000	9450	20	ethanol
St9	15.06.2023	0	5	3	1500	2390	20	ethanol
St9	15.06.2023	5	10	3	1500	2400	20	ethanol
St9	15.06.2023	10	30	3	6000	9600	20	ethanol
St11	17.06.2023	0	5	3	1500	2400	20	ethanol
St11	17.06.2023	5	10	3	1500	2500	20	ethanol
St11	17.06.2023	10	30	3	6000	9400	20	ethanol

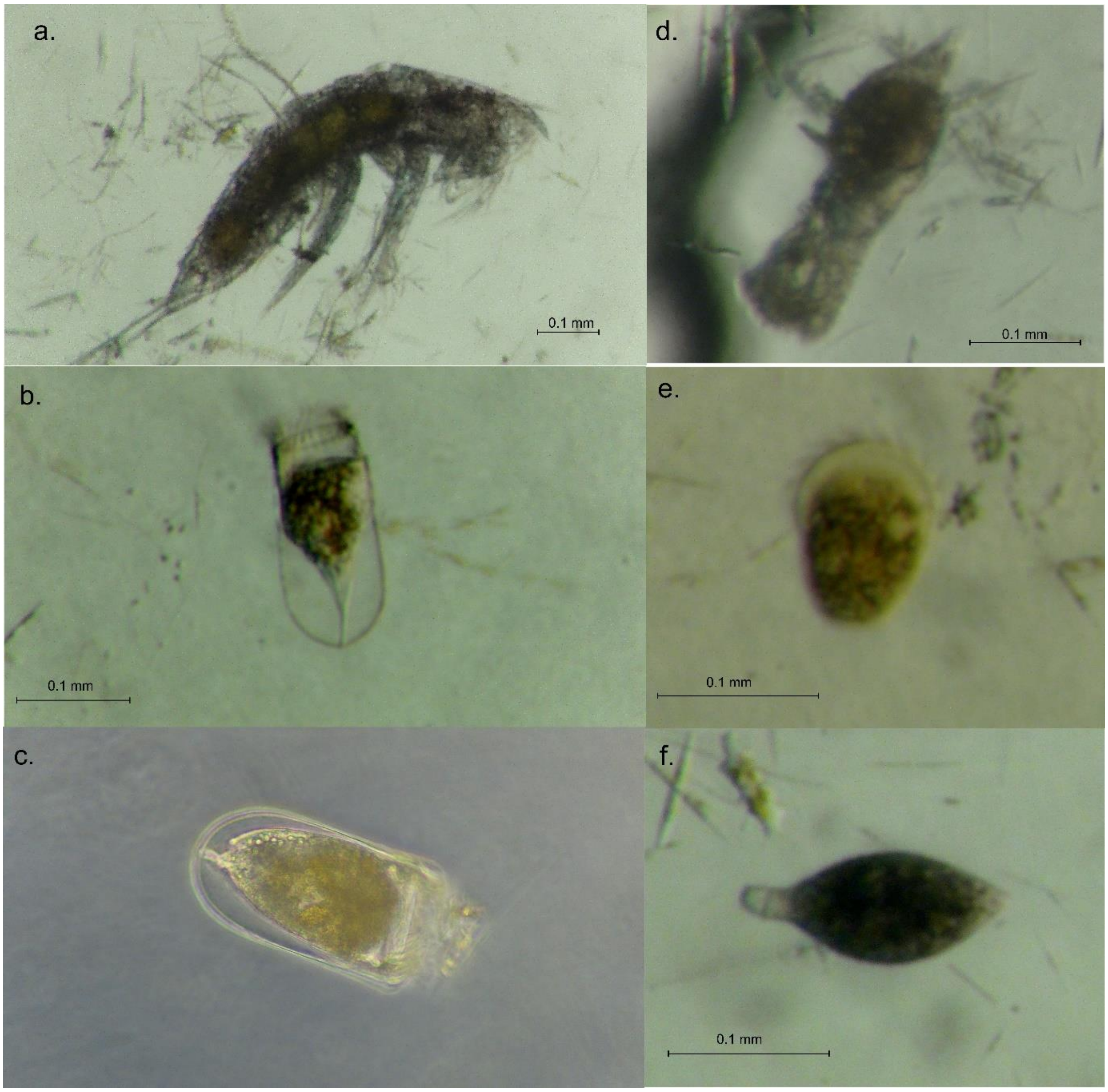

Figure 20. A selection of species observed in the 0-5 m section of the ice at St. 9. A. Harpacticoid copepod, b. and c. a rotifer, d. a different rotifer; e. a ciliate (?), f. a ciliate? Photos: Malin Daase

4.12 Contaminants and Microplastic

Ingeborg Hallanger NPI, and Oda S. Løge NILU, Carolin Philipp NPI and Giulia Gentili NPI

Water samples for microplastic were taken using Niskin bottles mounted to the CTD through the moonpool. Samples were taken from the bottom, 500 m, 250 m, 100 m and 50 m. Each depth was one cast and all Niskin-bottles were used for replication of one depth – total of 80 L per sample, with 3 samples per depth. Niskin-bottles were emptied into a 50 µm metal sieve, which was rinsed into a PPCO Nalgene bottle for transport and storage. Before sampling the CTD was washed down with a hose to remove any pollution that might collect on the outside of the bottles and CTD frame. During sampling a second sieve was held in tandem to the sampling sieve to act as a field-blank sample. A total of 5 stations were sampled for microplastic.

Neuston Catamaran (manta net) was used once to sample surface-water for microplastic. Due to high amounts of phytoplankton in the sea towing time was reduced to 5 minutes, and surface-water was only sampled at station 2.

Ice cores (n=3) from all ice stations was collected and divided in three equal segments: upper, middle and lower. These segments were tawed onboard and 1 liter of water collected from the segment. These were stored in 1 liter PPCO Nalgene bottles, and not frozen. These samples will be used to analyse PFAS.

Seawater (n=4, 1 L) under or at the side of the ice flow where the ice stations were located was collected and stored in 1 liter PPCO Nalgene bottles, and not frozen. These samples will be used to analyse PFAS.

Underway seawater was sampled as a trial using passive samplers. Seawater from 4 m depth at the seawater intake was used. This intake is closed when the ship is in ice and therefore only the open water passage was possible to sample. These samples will be analysed for PFAS and POPs.

Air was sampled for both PFAS and microplastics. Both samplers were used both in transit and at the sea ice stations and were sampling for 10-48 hours. During transit, the samplers were placed on the observation deck (9th deck), in front, so that it would have minimal contamination from the exhaust outlet of the boat. At ice stations, the samplers were connected to several power cords, and placed approximately 60-70 m from the boat, and as far as possible from other activities on the ice. The air sampled for PFAS consists of a low volume sampler with a pump, a flowmeter, and an ABN-adsorbent cartridge with filter and adsorbent. The sampler draws air with an average flowrate of around 1,2 m^3/hour. Sampling was always done with two parallels. Sampling of microplastics in air was done with an active air sampler equipped with a pump, a flowmeter, and an aluminum filtration cascade filtering out particles of size >5 µm, at a flow rate of around 5 m^3/hour.

Species specific zooplankton samples were collected for PFAS, POPs and 6-DPP at station 1, 3, 4 and 9. At each station 4-6 MIK nets from 200 m depth to surface was used to get enough biomass for sampling. Samples of Calanus sp. (dominated by *Calanus hyperboreus*) and arrow worms (dominated by *Eukrohinia hamata*) was collected for further analytical work.

Table 16. Overview microplastic and contaminant samples

	Media	**Equipment**	**Depth**	**Station**
Microplastic	Seawater	CTD	50, 100, 250, 500, bottom	st1, st4, st5, st9
	Air	Filter with pump	-	Under transit, st1, st3, st4, st9
	Sea water	Neuston Catamaran	Surface	st2
POP	Zooplankton	MIK	0-200	st1, st3, st4, st9
	Seawater	Passive sampler	4	Under transit
6-DPP	Zooplankton	MIK	0-200	st1, st3, st9
PFAS	Zooplankton	MIK	0-200	st1, st3, st4, st9
	Ice-cores			st1, st3, st9
	Air	Filter with pump	-	Under transit, st1, st3, st4, st9
	Seawater at the ice-flow	Bottle	Surface	St1, st3, st4, st9

4.13 Aerial oorthophotos from the sea ice stations

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On each of the five ice stations a DJI Mavic 2 Pro was used to take a matrix of images to create orthophotos of the ice stations.

Table 17. Overview of aerial orthophoto flights

Date	Station name	Flight altitude	Comment
2023-06-10	st1	80 m	
2023-06-11	st3	80 m	
2023-06-13	st4	80 m	Too much wind to finish the flight
2023-06-15	st9	80 m	
2023-06-18	st11	120 m	Short flight due to starting drizzle

4.13.1 Flying

Before a flight at a new ice station the compass was calibrated on the ice in save distance (≥50 meters) from the ship. The camera focus was set to automatic, and the exposure was set manually. The drone flight was mostly executed in 80 meters altitude above the sea ice.

An orthogonal zigzag pattern was followed manually. An overlap of 70% both horizontally and vertically was used to get full coverage of the extent. Near the ship even more overlapping is recommended.

Some ice stations had a drift of 0.6 – 0.9 knots which equates to around 18 – 27 m drift per minute. Since the drone uses GPS for positioning itself the ice floe will drift away underneath the drone. This drift had to be compensated while flying.

4.13.2 Image processing

For stitching together, the images a dockerised version of WebODM from the OpenDroneMap project has been used (https://github.com/OpenDroneMap/WebODM). Stitching was done with the option “High Resolution”. The images have been resized to 2048 px to avoid “out of memory” errors.

4.13.3 Data

The resulting orthophoto is a GeoTIFF that contains both the image data as well as positional data. It can be used in GIS software, e.g., QGIS.

Thanks to Vegard Stürzinger and Adam Steer for support and advice.

5 Appendix

5.1 Cruise timeline

Date	Major Activities
01.06.2023 *Day 1* *20 days remaining*	**Participants joining in Tromsø boarded 13:00** **SAR image RS2_20230601_065627_0076_SCWA_HHHV_SGF_1056976_0544_65914404 acquired** **Polarview.aq Ice concentration acquired** Loaded 1 container & 14 pallets with scientific equipment Flush mounted 150 kHz ADCPs and EK80 echo sounder started **Departed Longyearbyen 16:00** Based on the ice satellite images and ice concentration charts we decided to try to reach the Nansen basin by the Fram strait along the 0 meridian. The ice was to dens north of Svalbard and experience from preceding cruise indicated that the ice was very dense and heavy north of Svalbard Steamed west towards the ice edge Meeting with the science crew 1800, safety brief from the KPH crew and presentation of the crew, science problems and cruise plans
02.06.2023 *Day 2* *19 days remaining*	**Satellite image - S1A_EW_GRDM_1SDH_20230602T074534_C804_N_1 acquired** **Satellite image - processors_2023-06-02T10_08_07Z.tif (from bridge)** **Polarview.aq Ice concentration acquired** Met the ice edge at 1025 78°43' N 001° 28.5'Ø and worked our way northwest in loose ice Ice became gradually denser further north'
03.06.2023 *Day 3* *18 days remaining*	**Satellite image- S1A_EW_GRDM_1SDH_20230603T064808_7527_N_1 acquired** **SAR image RS2_20230603_141808_0075_SCWA_HHHV_SGF_1057492_0592_65914407 acquired** **Polarview.aq Ice concentration acquired** Continued north along 002°W the ice is heavy, dens and thick, no considerable progress north
04.06.2023	**Satellite image- S1A_EW_GRDM_1SDH_20230604T055033_3B2C_N_1.tif acquired**

     Day 4 *17 days remaining*	**SAR image SAR image RS2_20230604_070846_0076_SCWA_HHHV_SGF_1057645_0608_65914410 acquired** **Satellite image - S1A_EW_GRDM_1SDH_20230604T072917_16DA_N_1 acquired** **Polarview.aq Ice concentration acquired** Continued north along 003°W the ice is heavy, dens and thick, no progress north and late night we gave up and decided to go SE into Norwegian waters Applied to work in Danish territorial waters
05.06.2023 *Day 5* *16 days remaining*	**Satellite image- S1A_EW_GRDM_1SDH_20230604T055033_3B2C_N_1 acquired** **Modis image sic_modis-aqua_amsr2-gcom-w1_merged_nh_1000m_20230531 acquired** **Polarview.aq Ice concentration acquired** Established ice-station 79° 16,25'N 001° 39,89'W in the afternoon, CTD and nets
06.06.2023 *Day 6* *15 days remaining*	**Satellite image- S1A_EW_GRDM_1SDH_20230609T073732_4AED_N_1 acquired** **Polarview.aq Ice concentration acquired** Ice station continued
07.06.2023 *Day 7* *14 days remaining*	**SAR image RS2_20230607_140142_0076_SCWA_HHHV_SGF_1058340_0689_65914416 acquired** **Polarview.aq Ice concentration acquired** Satellite image RS2_20230607_140142_0076_SCWA_HHHV_SGF_1058340_0689_65914416 Ice station continued until 15:00 steamed SE to get on the E side of the ice that extends from the north
08.06.2023 *Day 8* *13 days remaining*	**Polarview.aq Ice concentration acquired** Steamed SE and N 79° 37.15N 004° 55.17 E From this position we can utilize and opening N of Svalbard to reach the Nansen basin
09.06.2023	**SAR image RS2_20230609_062253_0075_SCWA_HHHV_SGF_1058697_0728_65914419 acquired**

Day 9 *12 days remaining*	**Polarview.aq Ice concentration acquired** **Satellite image S1A_EW_GRDM_1SDH_20230609T073732_4AED_N_1** Established ice station 80° 01.00N 002° 48.31 E, worked all day at the ice station CTD and nets Got permit to work in Danish territorial waters
10.06.2023 *Day 10* *11 days remaining*	**Satellite image S1A_EW_GRDM_1SDH_20230609T073732_4AED_N_1** **Polarview.aq Ice concentration acquired** Decision to give up reaching Nansen basin because of dense ice and no sign of improvement of the ice conditions and needed steaming time Continued ice station to 1500. Decided to work along the Fram strait transect Steamed towards 78° 50N 006° 30W to establish an ice station and do CTD's (Fram strait transect)
11.06.2023 *Day 11* *10 days remaining*	**satellite image - processors_2023-06-11T08_53_19Z.tif acquired (from bridge)** **Polarview.aq Ice concentration acquired** Free of the ice 0400, steamed towards 78° 50N 006° 30W
12.06.2023 *Day 12* *9 days remaining*	**satellite image - processors_2023-06-12T09_59_05Z.tif (from bridge)** **Polarview.aq Ice concentration acquired** Established ice station 78° 46' 11'' N 6° 11' 21'' W Ice station rest of the day, CTD and nets
13.06.2023 *Day 13* *8 days remaining*	**satellite image - processors_2023-06-14T09_20_32Z.tif (from bridge)** **Polarview.aq Ice concentration acquired** Work on ice station and CTD's and nets all day Steamed towards 008W kl 1700
14.06.2023 *Day 14*	**Satellite image processors_2023-06-14T09_20_32Z** **Polarview.aq Ice concentration acquired** Arrived 008W 05:00 CTD, water samples and net hauls Steamed to - 007W -CTD, water samples Steamed to - 006W - CTD, water samples

7 days remaining	Steamed to -CTD, water samples
15.06.2023 *Day 15* *6 days remaining*	**Satellite image processors_2023-06-15T09_16_55Z** **Polarview.aq Ice concentration acquired** Established an ice station with CTD and nets, continued all day
16.06.2023 *Day 16* *5 days remaining*	**Satellite image processors_2023-06-16T09_25_34Z** **Polarview.aq Ice concentration acquired** Continued ice station @ 4W to late afternoon
17.06.2023 *Day 17* *4 days remaining*	**Satellite image processors_2023-06-17T14_27_11Z** **Polarview.aq Ice concentration acquired** CTD and water samples at 3W Established an ice station with CTD and nets at 78° 58'' N 2° 8'' W -fog
18.06.2023 *3 days remaining*	**Polarview.aq Ice concentration acquired** Around midnight we steamed towards 78° 47'' N 002° 0'' W
19.06.2023 *Day 19* *2 days remaining*	**Polarview.aq Ice concentration acquired** Arrived at 78° 47' N 002° 0' W early morning. CTD, fog CTD's at 78° 50'' N 002° 0'' W, 78° 50'' N 000° W, 78° 50'' N 001°E, 78° 50'' N 002° E
20.06.2023 *Day 20* *1day remaining*	Steaming towards Longyearbyen N78° 25' 8'' E007° 5' 46'' Deep CTD for water collection to microplatic analysis
21.06.2023 *Day 21* *0 days remaining*	Arrived in Longyearbyen 06:00 Disembarking and unloading

5.2 Cruise participant list

Organisation			
0	Paul Dodd	NPI	SUDARCO project lead (not participating)
1	Harald Steen	NPI	Cruise Leader
2	Anette Wold	NPI	Deputy Cruise Leader
3	Rupert Krapp	NPI	On-Ice Safety
4	Ann Kristin Balto	NPI	Communication and Outreach
Pelagic ecosystem			
5	Megan Lenss	NPI	Pelagic ecosystem, protist, chl, poc/n
6	Malin Daase	UiT	Pelagic ecosystem, zooplankton
7	Magdalena Dolinkiewicz	IOPAN	Pelagic ecosystem, zooplankton
8	Slawomir Kwasniewski	IOPAN	Pelagic ecosystem, zooplankton
Primary production			
9	Eva Susanne Leu	Akvaplan-niva	Primary production
10	Fowzia Ahmed	U. Manitoba	Primary production
eDNA			
11	Ana Gomes	CIIMAR	Procaryotes eDNA
12	Leonor Mendes	CIIMAR	Procaryotes eDNA
13	Aswathi Das Thazhath	NCPOR	Bacterial eDNA
14	Vipin Das Veettil	NCPOR	Bacterial eDNA
Oceanography			
15	Angelika Renner	IMR	Oceanography incl. Water sampling
16	Anna Nikolopoulos	NPI	Oceanography incl. Water sampling
17	Julie Sortland	IMR	Oceanography incl. Water sampling
18	Olaf Schneider	NPI	Data management, processing, oceanography
Microplastic & contaminants			
19	Ingeborg G. Hallanger	NPI	Microplastic in water, net samples, sea ice
20	Carolin Philipp	NPI	Microplastic in water, net samples, sea ice
21	Giulia Gentili	NPI	Microplastic in water, net samples, sea ice
22	Oda Siebke Løge	NILU	Microplastic & contaminants in air
Sea ice			
23	Dmitry Divin	NPI	Physical properties of sea ice and snow
24	Cora Marie Anna Hoppe	UiT	Physical properties of snow

5.3 Activity log

Station	Latitude	Longitude	Bottom Depth (m)	Gear Type	Date	Time (UTC)	Local Station ID	Maximum depth(m)	Minimum depth (m)	Event Remarks
st.1	78.7244	2.1645		Manta net	02/06/2023	07:09:07	36	0	0	
st.1	79.2860	-1.6745	2553	CTD w/bottles	05/06/2023	18:31:07	109	201	10	
st.1	79.2592	-1.6807	2564	CTD w/bottles	05/06/2023	22:47:50	110	2608	10	Microplastics CTD
st.1	79.2536	-1.6854	2573	CTD w/bottles	06/06/2023	01:01:50	111	500	10	Microplastics CTD
st.1	79.2525	-1.6762	2573	CTD w/bottles	06/06/2023	02:06:14	112	250	10	Microplastics CTD
st.1	79.2517	-1.6682	2577	CTD w/bottles	06/06/2023	02:48:29	113	100	10	Microplastics CTD
st.1	79.2511	-1.6609	2578	CTD w/bottles	06/06/2023	03:20:43	114	50	10	Microplastics CTD
st.1	79.2430	-1.5980	2586	Multinet 180 um	06/06/2023	06:41:52	1			Multinet #1; Net failed; Rope entangled
st.1	79.2135	-1.5778	2596	Multinet 180 um	06/06/2023	10:58:24	2	2554	0	Multinet #2; Metabarcoding; Wire stuck in ice flow; Battery empty; Net 5-9 did not open
st.1	79.1811	-1.5552	2590	CTD w/bottles	06/06/2023	15:59:33	115	2624	10	Shallow CTD cast (A); IceStation#1
st.1	79.1569	-1.5478	2582	CTD w/bottles	06/06/2023	19:12:47	116	51	10	Eva's CTD; IceStation#1
st.1	79.1554	-1.5504	2580	Multinet 180 um	06/06/2023	19:27:23	3	2532	0	Multinet #3; Taxonomy
st.1	79.1365	-1.6223	2573	MIK-net 1500 um	06/06/2023	22:31:54	4	1000	0	MIK net taxonomy & metabarcoding
st.1	79.1304	-1.6504	2572	MIK-net 1500 um	06/06/2023	23:38:59	5	200	0	MIK net Microplastic/Ecotox
st.1	79.1288	-1.6582	2572	MIK-net 1500 um	06/06/2023	23:57:49	6	200	0	MIK net Microplastic/Ecotox
st.1	79.1276	-1.6657	2572	MIK-net 1500 um	07/06/2023	00:16:07	7	200	0	MIK net Microplastic/Ecotox
st.1	79.1265	-1.6735	2572	MIK-net 1500 um	07/06/2023	00:36:44	8	200	0	MIK net Microplastic/Ecotox

st.1	79.1257	-1.6800	2572	MIK-net 1500 um	07/06/2023	00:54:54	9	200	0	MIK net Microplastic/Ecotox
st.1	79.2693	-1.6665		Sea Ice Station	05/06/2023	21:00:00	38			Standard ice station
st.1	79.1149	-1.7998	2569	CTD w/bottles	07/06/2023	06:00:15	117	401	11	Shallow CTD cast (A); IceStation#1
st.1	79.0707	-1.9042	2573	Bongo net 180 um	07/06/2023	10:44:28	10	1000	0	Taxonomy & Metabarcoding
st.1	79.0505	-1.9824	2573	Phytoplankton net 20 um	07/06/2023	12:40:11	11	50	0	Taxonomy & Metabarcoding
st.2	78.7292	4.6622		Manta net	08/06/2023	07:29:13	40	0	0	
st.2	78.7341	4.7049		Manta net	08/06/2023	07:48:58	41	0	0	
st.2	78.7352	4.6846		Manta net	08/06/2023	08:07:10	42	0	0	
st.3	80.0144	2.8088	2533	CTD w/bottles	09/06/2023	02:30:08	118	2565	11	Main CTD cast to bottom (A); IceStation#2
st.3	80.0196	2.7628	2533	Multinet 180 um	09/06/2023	08:37:14	12	2500	0	Multinet #4; Metabarcoding
st.3	80.0087	2.7031	2533	Multinet 180 um	09/06/2023	08:37:14	13	2500	0	Multinet #5; Taxonomy
st.3	79.9949	2.6482	2533	MIK-net 1500 um	09/06/2023	15:22:19	14	1000	0	MIK net taxonomy & metabarcoding
st.3	79.9892	2.6275	2533	MIK-net 1500 um	09/06/2023	17:02:19	15	200	0	MIK net Microplastic/Ecotox
st.3	79.9884	2.6265	2625	MIK-net 1500 um	09/06/2023	17:24:30	16	200	0	MIK net Microplastic/Ecotox
st.3	79.9872	2.6263	2626	MIK-net 1500 um	09/06/2023	17:56:27	17	200	0	MIK net Microplastic/Ecotox
st.3	80.0197	2.7830		Sea Ice Station	09/06/2023	07:25:43	43			Standard ice station
st.3	79.9875	2.4392	2670	CTD w/bottles	10/06/2023	10:44:14	119	500	4	Shallow CTD cast (A); IceStation#2; Sensors moved to small CTD ('Skuteside')
st.3	79.9879	2.4200	2673	Bongo net 180 um	10/06/2023	11:15:09	18	1020	0	Taxonomy & Metabarcoding
st.3	79.9882	2.3776	2679	Phytoplankton net 20 um	10/06/2023	13:03:51	19	50	0	

st.4	78.7747	-6.1909	310	Bongo net 180 um	12/06/2023	09:08:09	20	300	0	Taxonomy & Metabarcoding
st.4	78.7689	-6.1886	309	Bongo net 180 um	12/06/2023	09:49:23	21	300	0	Taxonomy & Metabarcoding
st.4	78.7646	-6.1868	315	Bongo net 180 um	12/06/2023	10:16:58	22	300	0	Taxonomy & Metabarcoding
st.4	78.7576	-6.1835	313	Phytoplankton net 20 um	12/06/2023	10:56:43	23	50	0	
st.4	78.7537	-6.1820	314	CTD w/bottles	12/06/2023	11:17:02	120	304	10	Main CTD cast to bottom (A); IceStation#3
st.4	78.7467	-6.1803	314	MIK-net 1500 um	12/06/2023	11:50:31	24	300	0	MIK net taxonomy & metabarcoding
st.4	78.7335	-6.1816	302	CTD w/bottles	12/06/2023	12:48:42	121	299	10	Shallow CTD cast (A); IceStation#3
st.4	78.7263	-6.1847	301	MIK-net 1500 um	12/06/2023	13:18:23	25	200	0	MIK net Microplastic/Ecotox
st.4	78.7223	-6.1871	303	MIK-net 1500 um	12/06/2023	13:34:13	26	200	0	MIK net Microplastic/Ecotox
st.4	78.7170	-6.1912	298	MIK-net 1500 um	12/06/2023	13:55:29	27	200	0	MIK net Microplastic/Ecotox
st.4	78.7113	-6.1967	297	MIK-net 1500 um	12/06/2023	14:17:48	28	200	0	MIK net Microplastic/Ecotox
st.4	78.7027	-6.2076	295	Multinet 180 um	12/06/2023	14:51:43	29	273	0	Multinet #6; Metabarcoding
st.4	78.6774	-6.2545	291	Multinet 180 um	12/06/2023	16:36:59	30	268	0	Multinet #7; Taxonomy
st.4	78.6633	-6.4238	271	Sea Ice Station	12/06/2023	21:20:07	46			Standard ice station
st.4	78.6048	-6.4975	301	CTD w/bottles	13/06/2023	07:03:18	122	291	10	Microplastics CTD
st.4	78.6037	-6.5115	291	CTD w/bottles	13/06/2023	07:45:15	123	100	10	Microplastics CTD
st.4	78.6035	-6.5205	286	CTD w/bottles	13/06/2023	08:18:11	124	50	10	Microplastics CTD
st.5	78.7987	-7.9166	189	CTD w/bottles	14/06/2023	04:10:42	125	181	10	Microplastics CTD
st.5	78.7942	-7.9332	191	CTD w/bottles	14/06/2023	04:48:47	126	100	10	Microplastics CTD
st.5	78.7913	-7.9481	197	CTD w/bottles	14/06/2023	05:18:32	127	50	10	Microplastics CTD
st.5	78.7879	-7.9653	194	CTD w/bottles	14/06/2023	06:00:08	128	189	10	Main CTD cast to bottom (A)

st.5	78.7860	-7.9739	191	Bongo net 180 um	14/06/2023	06:25:41	31	177	0	Taxonomy & Metabarcoding
st.5	78.7841	-7.9814	188	Bongo net 180 um	14/06/2023	06:52:43	32	177	0	C. glacialis
st.6	78.8309	-6.9916	240	CTD w/bottles	14/06/2023	10:04:42	129	230	10	Main CTD cast to bottom (A)
st.7	78.8013	-5.9937	319	CTD w/bottles	14/06/2023	14:47:53	130	322	10	Main CTD cast to bottom (A)
st.8	78.7973	-5.0438	894	CTD w/bottles	14/06/2023	18:26:25	131	903	10	Main CTD cast to bottom (A)
st.8	78.7763	-5.0109	895	CTD w/bottles	14/06/2023	20:23:16	132	400	10	Shallow CTD cast (A)
st.9	78.8134	-3.9746	1847	CTD w/bottles	15/06/2023	06:08:10	133	30	10	Filtering water for IceStation#4
st.9	78.7964	-3.9957	1820	CTD w/bottles	15/06/2023	07:42:17	134	1861	10	Microplastics CTD
st.9	78.7811	-4.0093	1824	Multinet 180 um	15/06/2023	09:10:59	33	1756	0	Metabarcoding; Multinet #8
st.9	78.7543	-4.0191	1824	Multinet 180 um	15/06/2023	11:47:05	34	1734	0	Taxonomy; Multinet #9
st.9	78.7182	-4.0097	1762	CTD w/bottles	15/06/2023	15:16:21	135	1773	10	Main CTD cast to bottom (A); IceStation#4
st9	78.8222	-3.9613	1864	Sea Ice Station	15/06/2023	05:20:22	47			Standard ice station
st.9	78.6936	-4.0096	1759	CTD w/bottles	15/06/2023	17:37:13	136	400	10	Shallow CTD cast (A); IceStation#4
st.9	78.6878	-4.0090	1757	MIK-net 1500 um	15/06/2023	18:09:37	35	1000	0	MIK net taxonomy & metabarcoding
st.9	78.6764	-4.0077	1756	MIK-net 1500 um	15/06/2023	19:11:01	36	200	0	MIK net Microplastic/Ecotox
st.9	78.6721	-4.0070	1755	MIK-net 1500 um	15/06/2023	19:34:18	37	200	0	MIK net Microplastic/Ecotox
st.9	78.6688	-4.0065	1750	MIK-net 1500 um	15/06/2023	19:52:32	38	200	0	MIK net Microplastic/Ecotox
st9	78.6652	-4.0060	1750	MIK-net 1500 um	15/06/2023	20:11:33	39	200	0	MIK net Microplastic/Ecotox
st.9	78.6619	-4.0054	1744	MIK-net 1500 um	15/06/2023	20:29:29	40	200	0	MIK net Microplastic/Ecotox
st.9	78.6556	-4.0041	1742	CTD w/bottles	15/06/2023	21:03:35	137	500	10	Microplastics CTD

st.9	78.6464	-4.0015	1741	CTD w/bottles	15/06/2023	21:53:53	138	251	10	Microplastics CTD
st.9	78.6384	-3.9995	1742	CTD w/bottles	15/06/2023	22:38:13	139	100	10	Microplastics CTD
st.9	78.6317	-3.9990	1744	CTD w/bottles	15/06/2023	23:16:45	140	51	10	Microplastics CTD
st9	78.4295	-4.2133	1488	Bongo net 180 um	16/06/2023	18:04:18	41	1000	0	Taxonomy & Metabarcoding
st9	78.4128	-4.2406	1466	Phytoplankton net 20 um	16/06/2023	19:35:51	42	50	0	
st10	78.7989	-2.9746	2508	CTD w/bottles	17/06/2023	03:04:57	141	2546	10	CTD cast to bottom (B)
st11	78.9689	-2.0226	2597	CTD w/bottles	17/06/2023	10:43:42	142	40	10	Filtering water for IceStation#5
st11	78.9615	-2.0493	2597	Multinet 180 um	17/06/2023	11:29:47	43	2547.5	0	Metabarcoding; Multinet #10
st11	78.9397	-2.1387		Sea Ice Station	17/06/2023	14:24:48	48			Standard ice station
st11	78.8749	-2.1682	2595	Multinet 180 um	17/06/2023	19:30:50	44	2555.6	0	Taxonomy; Multinet #11
st11	78.7850	-2.3560	2626	CTD w/bottles	18/06/2023	02:58:35	143	2662	10	Main CTD cast to bottom (A); IceStation#5
st11	78.7509	-2.3590	2629	CTD w/bottles	18/06/2023	06:04:08	144	400	10	Shallow CTD cast (A); IceStation#5
st11	78.7221	-2.3806	2630	CTD w/bottles	18/06/2023	08:01:26	145	2661	10	Microplastics CTD
st11	78.6866	-2.4251	2623	CTD w/bottles	18/06/2023	10:23:50	146	500	10	Microplastics CTD
st11	78.6729	-2.4457	2623	CTD w/bottles	18/06/2023	11:22:40	147	251	10	Microplastics CTD
st11	78.6626	-2.4617	2623	CTD w/bottles	18/06/2023	12:07:52	148	100	10	Microplastics CTD
st11	78.6539	-2.4782	2623	CTD w/bottles	18/06/2023	12:46:43	149	50	10	Microplastics CTD
st11	78.6509	-2.4846	2623	MIK-net 1500 um	18/06/2023	13:00:52	45	1000	0	MIK net taxonomy & metabarcoding
st11	78.5795	-2.5495		Bongo net 180 um	18/06/2023	20:08:33	46	1000	0	Taxonomy & Metabarcoding
st11	78.5583	-2.5498		Phytoplankton net 20 um	18/06/2023	21:51:43	47	50	0	
st12	78.8027	-2.0273	2671	CTD w/bottles	19/06/2023	02:53:45	150	2704	10	Sensor cast only
st13	78.8270	-1.0025	2429	CTD w/bottles	19/06/2023	07:16:23	151	2459	10	CTD cast to bottom (B)
st13	78.8336	-0.0070	2588	CTD w/bottles	19/06/2023	11:30:55	152	2621	10	Main CTD cast to bottom (A)

st14	78.8298	-0.0679	2578	CTD w/bottles	19/06/2023	14:20:43	153	400	10	Shallow CTD cast (A)
st15	78.8166	0.9528	2365	CTD w/bottles	19/06/2023	17:46:31	154	2394	10	Sensor cast only
st16	78.8454	2.0091	2502	CTD w/bottles	19/06/2023	21:39:48	155	2529	10	Sensor cast only
st17	78.4189	7.0959	3283	CTD w/bottles	20/06/2023	07:59:08	156	3346	10	Microplastics CTD
st17	78.4189	7.0959	3284	CTD w/bottles	20/06/2023	10:30:06	157	501	10	Microplastics CTD
st17	78.4189	7.0959	3284	CTD w/bottles	20/06/2023	11:23:38	158	251	10	Microplastics CTD
st17	78.4189	7.0959	3284	CTD w/bottles	20/06/2023	12:12:26	159	101	10	Microplastics CTD
st17	78.4189	7.0959	3284	CTD w/bottles	20/06/2023	12:54:04	160	51	10	Microplastics CTD

5.4 Water sampling log-sheets

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

Station:	115	Lat:	79° 10.86	MP ☐	Date: 6 june	Pmax: 2623
Echo:	2590	Lon:	01° 53 W	24 ☐	UTC Time: 16:00	Alt: 9.6

Niskin		Pressure	AT-CT	δ18O	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes	Niskin
1	☑	btm	1	1	1		1										1
2	☑	btm											A023-1				2
3	☑	btm											A023-2 A023-3				3
4	☑	btm										V					4
5	☑	btm										V					5
6	☑	btm									[illegible]						6
7	☐	2000	2	2	2		2										7
8	☐	2000										V					8
9	☐	2000										V					9
10	☑	1500	3	3	3		3										10
11	☑	1000	4	4	4		4										11
12	☑	750	5	5	5		5										12
13	☑	400	6	6	6		6										13
14	☑	400										V					14
15	☑	400										V					15
16	☑	250	7	7	7		7										16
17	☑	200	8	8	8		8										17
18	☑	150	9	9	9		9										18
19	☑	100	10	10	10	31, 32, 33	10	11	11	11							19
20	☑	75	11	11	11	28, 29, 30	11	10	10	10							20
21	☑	50	12	12	12	25, 26, 27	12	9	9	9							21
22	☑	25	13	13	13	22, 23, 24	13	8	8	8							22
23	☐	15	14	14	14		14										23
24	☐	10	15	15	15	16, 17, 18	15	6	6	6							24

St.1: Eva's CTD (ICESTN #1)

Station:	116	Lat:	79.5°569
Echo:	2582	Lon:	-1.5°478

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

MP □	Da
24 □	

Niskin		Pressure	AT-CT	$\delta^{18}O$	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	N
1	□	50					X									
2	□	15			249											Chla m
3	□	15			250											
4	□	15														
5	□	15	189													
6	□	15														
7	□	15														
8	□	15														
9	□	15														
10	□	15														
11	□															
12	□															
13	□															
14	□															
15	□															
16	□															
17	□															
18	□															
19	□															
20	□															
21	□															
22	□															
23	□															
24	□															

St.1: Eva's CTD (ICESTN#1)

Station:	116	Lat:	79.5569°
Echo:	2582	Lon:	-1.5478°

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

MP ☐	Date:	06/06/23
24 ☐	UTC Time:	19:12

Niskin		Pressure	AT-CT	$\delta^{18}O$	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	☐	50					X									
2	☐	15			249											Chl a max
3	☐	15			250											
4	☐	15														
5	☐	15	189													
6	☐	15														
7	☐	15														
8	☐	15														
9	☐	15														
10	☐	15														
11	☐															
12	☐															
13	☐															
14	☐															
15	☐															
16	☐															
17	☐															
18	☐															
19	☐															
20	☐															
21	☐															
22	☐															
23	☐															
24	☐															

St. 3 DEEP CAST (ICESTN#2)

Station:	118	Lat:	80 ° 00.86		Arctic Ocean 2023	MP ☐	Date:	9. juni
Echo:	2533	Lon:	2 ° 48.56	E	CTD & Water Sampling Log Sheet	24 ☐	UTC Time:	02:3

Niskin		Pressure	AT-CT	δ18O	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	✓	btm	16	16	16		16									
2	✓	btm									3-Bottom.R1 3-Bottom.R2 3-Bottom.[illegible]					
3	✓	btm										AO-23 St3-B				
4	✓	btm										AO-23 St3-B				
5	✓	btm										~~AO-23 St3-B~~				
6	✓	btm											AO23.18			
7	✓	btm											AO23.19			
8	✓	2000	17	17	17		[illegible]									
9	✓	2000										AO-23 St3-2000				
10	✓	2000					17					AO-23 St3 2000				
11	✓	1500	18	18	18		18									
12	✓	1000	19	19	19		19									
13	✓	750	20	20	20		20									
14	✓	400	21	21	21		21									
15	✓	250	22	22	22		22									
16	✓	200	23	23	23		23									
17	✓	150	24	24	24		24									
18	✓	100	25	25	25	58, 59, 60	25	17	28	29						
19	✓	75	26	26	26	55, 56, 57	26	16	27	28						
20	✓	50	27	27	27	52, 53, 54	27	15	26	27						
21	✓	25	28	28	28	49, 50, 51	28	14	25	26						
22	✓	15	29	29	29		29									
23	✓	10	30	30	30		30									
24	✓	10				43, 44, 45		12	23	25						

St 3. SHALLOW CAST. NB: SIDE-CTD (ICESTN #2)

Station:	119	Lat:	°	Echo:	2670	Lon:	°

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

MP ☐ | Date: 10 juni
24 ☐ | UTC Time:

Niskin		Pressure	AT-CT	$\delta^{18}O$	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	☑	500														
2	☑	500														Eva's bottles filterw
3	☑	500														Eva's bottles filterw.
4	☑	100										• ~~A023 St3 AW~~				Bac
5	☑	100										• A023 St3 AW				Bac
6	☑	100										A023 St3 AW				
7	☑	100											• A023-24			edna
8	☑	100											• A023-25			edna
9	☑	100											• A023-26			edna.
10	☑	25										•				Bac
11	☑	25										• A023 Scm St3				Bac
12	☑	25										A023 Scm St3				
13	☐															
14	☐															
15	☐															
16	☐															
17	☐															
18	☐															
19	☐															
20	☐															
21	☐															
22	☐															
23	☐															
24	☐															

St 4 full / Deep cast (ICESTN #3)

Station:	120	Lat:	78° 45.2		Arctic Ocean 2023	MP □	Date:
Echo:	314	Lon:	06° 10.9W		CTD & Water Sampling Log Sheet	24 □	UTC Time:

Niskin		Pressure	AT-CT	$\delta^{18}O$	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	✓	btm	31	31	31		31									
2	✓	btm										A023 st4 B				BAC
3	✓	btm										A023 st4 B				↓
4	✓	btm											A023-41			eDNA
5	✓	btm											A023-42			↓
6	✓	btm											A023-43			↓
7	✓	250	32	32	32		32									AW-signature?
8	✓	200	33	33	33		33									↓
9	✓	150	34	34	34		34									
10	✓	100	35	35	35	85 86 87	35	23	44	53						
11	✓	75	36	36	36	88 89 90	36	24	45	52						
12	✓	50	37	37	37	91 92 93	37	25	49	51						
13	✓	Chlmx	188	—	242	94 95 96	—	26	46	50						Chlmax (2nd) = 35
14	✓	Chlmx														NCU
15	✓	Chlmx														↓
16	✓	25	38	38	38	97 98 99	38	27	47	49						
17	✓	15	39	39	39		39									
18	✓	10	40	40	40		40									
19	✓	10				100 101 102		28	48	48						
20	✓	10										A023 St 4S				BAC
21	✓	10										A023 St4S				↓
22	✓	10											A023-35			eDNA
23	✓	10											A023-36			↓
24	✓	10											A023-37			↓

S... shallow ... cast (ICESIN #3)

Station:	121	Lat:	78 ° 43.94
Echo:	302	Lon:	6 ° 10.97

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

MP ☐	Date:	12/06
24 ☐	UTC Time:	12:50

Niskin		Pressure	AT-CT	δ18O	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	✓	bhm					•									
2	✓	250										• AO-23 st4 AW				AW-signature
3	✓	250										• AO 23 st4 AW				↓
4	✓	250											• AO23-44			
5	✓	250											• AO23-45			
6	✓	250											• AO23-46			
7	✓	250														↓
8	✓	100										• AO 23 st-4				
9	✓	100										• AO23 st-4				
10	✓	100														
11	✓	100														
12	✓	100														
13	✓	50										•				Bottom of elevated
14	✓	50										•				↓
15	✓	50											•			
16	✓	50											•			
17	✓	50											•			↓
18	✓	35										• AO-23 st-4				Chlmax(2nd) dep
19	✓	35										• AO23 st-4				cast 120
20	✓	35											• AO23-38			↓
21	✓	35											• AO23-39			
22	✓	35											• AO23-40			✓
23	✓	10												•		NCU
24	✓	10												•		↓

St. 5 MAIN CTD CAST 1 ("DEEP")

Station:	128	Lat:	78 ° 47.263	Arctic Ocean 2023 CTD & Water Sampling Log Sheet	MP ☐	Date: 2023-06-1[illegible]
Echo:	194	Lon:	7 ° 57.977 W		24 ☐	UTC Time: 06:02

Niskin		Pressure	AT-CT	$\delta^{18}O$	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	✓	btm	41	41	41		41 ✓									
2	✓	btm										AO23 B St5				
3	✓	btm										AO23 B St5				
4	✓	btm											50			
5	✓	btm											51			
6	✓	btm											52			
7	✓	150	42	42	42		42 ✓									
8	✓	100	43	43	43	133 134 135	43 ✓	39	60	66						
9	✓	75	44	44	44	130 131 132	44 ✓	38	59	65						
10	✓	50	45	45	45	127 128 129	45 ✓	37	58	64						
11	✓	35	187	—	237	124 125 126	—	36	57	63						"Chlmx"
12	✓	35												✓		↓
13	✓	35												✓		
14	✓	35										AO23 scn St5				
15	✓	35										AO23 scn St5				
16	✓	35											53, 54			
17	✓	35											55			
18	✓	25	46	46	46	121 122 123	46 ✓	35	56	62						
19	✓	15	47	47	47		47 ✓									
20	✓	10	48	48	48	118 119 120	48 ✓	34	55	61						
21	✓	10										AO23 S St5				
22	✓	10										AO23 S St5				
23	✓	10											48, 49			
24	✓	10											50			

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

Station:	129	Lat:	78 ° 4983
Echo:	240	Lon:	6 ° 59.42 W

MP ✓	Date: 14/6.2
24 ☐	UTC Time: 10:10

Niskin		Pressure	AT-CT	$\delta^{18}O$	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	✓	btm	49	49	49		49 ✓									
2	✓	btm														
3	✓	200	50	50	50		50 ✓									
4	✓	150	51	51	51		51 ✓									
5	✓	100	52	52	52		52 ✓									
6	✓	100							66	73						
7	✓	75	53	53	53		53 ✓									
8	✓	75							65	72						
9	✓	50	54	54	54		54 ✓									
10	✓	50							64	71						
11	✓	35	186	—	236		—									
12	✓	35						40	63	70						Chl max
13	✓	35										A023 scm st6				↓
14	✓	35										A023 scm st6				↓
15	✓	25	55	55	55		55 ✓									
16	✓	25							62	69						
17	✓	25														
18	✓	25														
19	✓	15	56	56	56		56 ✓									
20	✓	10	57	57	57		57 ✓									
21	✓	10							61	68						
22	✓	10										A023 S st6				
23	✓	10										A023 S st6				
24	✓	10														

St. + @ 6°W Full depth

Station:	130	Lat:	78 ° 48.06	Echo:	319	Lon:	05 ° 59.5 W

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

MP ☐	Date:	14/6-2
24 ☐	UTC Time:	14:49

Niskin		Pressure	AT-CT	δ[18]O	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	✓	btm					Roy									
2	✓	btm	58	58	58		58 ✓									
3	✓	250	59	59	59		59 ✓									
4	✓	200	60	60	60		60 ✓									
5	✓	150	61	61	61		61 ✓									
6	✓	100	62	62	62		62 ✓									
7	✓	100							71	78						
8	✓	75	63	63	63		63 ✓									
9	✓	75							70	77						
10	✓	50	64	64	64		64 ✓									
11	✓	50							69	76						
12	✓	25	65	65	65		65 ✓									Chl max!
13	✓	25						41	68	75						↓
14	✓	25														↓
15	✓	25										A023 Scm st7				↓
16	✓	25										A023 Scm st7				↓
17	✓	15	66	66	66		66 ✓									↓
18	✓	15														
19	✓	10	67	67	67		67									
20	✓	10							67	74						
21	✓	10														
22	✓	10														
23	✓	10										A0-23 S st7				
24	✓	10										A023 S st7				

St. 8 5°W Deep Cast

Station:	131	Lat:	78° 47.78
Echo:	894	Lon:	5° 02.5 W

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

MP	☑	Date:	14/6-2
24	☑	UTC Time:	18.28

Niskin		Pressure	AT-CT	$\delta^{18}O$	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	☑	btm	68	68	68		68 ✓									
2	☑	btm														
3	☑	btm										AO23 B st8				
4	☑	btm										AO23 B st8				
5	☑	btm											AO23_59			
6	☑	btm											AO23-60			
7	☑	btm											AO23-61			
8	☑	750	69	69	69		69 ✓									
9	☑	400	70	70	70		70 ✓									
10	☑	250	71	71	71		71 ✓									
11	☑	200	72	72	72		72 ✓									
12	☑	150	73	73	73		73 ✓									
13	☑	100	74	74	74	151 152 153	74 ✓	47	77	84						
14	☑	75	75	75	75	148,149 150	75 ✓	46	76	83						
15	☑	50	76	76	76	145 146 147	76 ✓	45	75	82						
16	☑	25	77	77	77	142 143 144	77 ✓	44	74	81						Chlmax = 25m
17	☑	25														Chlmax = 25m
18	☑	15	78	78	78	139 140 141	78 ✓	43	73	80						
19	☑	10	79	79	79	136 137 138	79 ✓	42	72	79						
20	☑	10										AO23 10 st8				
21	☑	10										AO23 10 st8				
22	☑	10											AO23-56			
23	☑	10											AO23-57			
24	☑	10											AO23_58			

St 8 5°W Shallow Cast

Station:	132	Lat:	78 ° 46,49
Echo:	896	Lon:	5 ° 00.48 W

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

MP ☒	Date: 14/6 23
24 ☐	UTC Time: 20:20

Niskin		Pressure	AT-CT	$\delta^{18}O$	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	✓	400														
2	✓	250										A023 Aw St8				Std depth for
3	✓	250										A023 Aw St8				↓
4	✓	250														
5	✓	250											65			
6	✓	250											66			
7	✓	250											67			
8	✓	25														Chl max
9	✓	25										A023 Scm St8				↓
10	✓	25										A023 Scm St8				
11	✓	25											62			
12	✓	25											63			
13	✓	25											64			
14	☐															
15	☐															
16	☐															
17	☐															
18	☐															
19	☐															
20	☐															
21	☐															
22	☐															
23	☐															
24	☐															

St. 9 DEEP CTD (Ice station #4)

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

Station:	135	Lat:	78°43'	MP ☐	Date:	15 juin
Echo:	1761	Lon:	4°00 W	24 ☐	UTC Time:	15:19

Niskin		Pressure	AT-CT	δ18O	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	√	btm	80	80 √			80									
2	√	btm										A023 B st8				
3	√	btm										A023 B st9				
4	√	btm											A023-71			
5	√	btm											A023-72			
6	√	btm											A023-73			
7	√	1000	81	81 √			81									
8	√	750	82	82 √			82									
9	√	400	83	83 √			83									
10	√	250	84	84 √			84									
11	√	200	85	85 √			85									
12	√	150	86	86 √			86									
13	√	100	87	87 √		181 182 183	87	52	87	95						
14	√	75	88	88 √		178 179 181	88	51	86	94						
15	√	50	89	89 √		175 176 177	89	50	85	93						bottle leaking
16	√	~~25~~	~~90~~				~~90~~									chlorofyl max le
17	√	25	90	90 √		172 173 174	90	49	84	92						≈ 23-30 m
18	√	15														
19	√	10	91	91 √		169 170 171	91	48	83	91						
20	√	10										A023 S st9				
21	√	10										A023 S st9				
22	√	10											A023-68			
23	√	10											A023-69			
24	√	10											A023-70			

St. 9 SHALLOW CAST (Icestation #4)

Station:	136	Lat:	78° 41'	
Echo:	1759	Lon:	04° 00	W

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

MP ☐	Date:	15 juni…
24 ☐	UTC Time:	17:38

Niskin		Pressure	AT-CT	$\delta^{18}O$	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	☑	400														
2	☑	250										AO23 AW st8				↑
3	☑	250										AO23 AW st7				Std depth for AW…
4	☑	250											• 77			↓
5	☑	250											• 78			↓
6	☑	250											• 79			↓
7	☑	25												• V		↑
8	☑	25												• V		Chl-mx = 25 m…
9	☑	25										• AO23 scm st1				↓
10	☑	25										• AO23 scm st9				↓
11	☑	25											• 74			↓
12	☑	25											• 75			↓
13	☑	25											• 76			↓
14	☑	10														
15	☑	10														
16	☑	10														
17	☐															
18	☐															
19	☐															
20	☐															
21	☐															
22	☐															
23	☐															
24	☐															

St. 10 @ 3°W (type B)

Station:	141	Lat:	78° 47,9
Echo:	2508	Lon:	2° 58' W

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

MP ☐	Date:	17 juni
24 ☐	UTC Time:	03:04

Niskin		Pressure	AT-CT	δ¹⁸O	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	√	btm														
2	√	btm	92	92	92		92									
3	√	btm										A023 B st10				
4	√	btm										A023 B st10				
5	√	2000	93	93	93		93									
6	√	1000	94	94	94		94									
7	√	750	95	95	95		95									Niskin leaking (low[illegible]
8	√	400	96	96	96		96									Niskin leaking ([illegible]
9	√	250	97	97	97		97									
10	√	250										A023 Aw st10				AWmax @ 250m ↓
11	√	250										A023 Aw st10				
12	√	200	98	98	98		98									
13	√	150	99	99	99		99									
14	√	100	100	100	100		100		100	105						
15	√	75	101	101	101		101		99	104						Niskin leaking ([illegible]
16	√	50	102	102	102		102		98	103						
17	√	25	103	103	103		103	58	97	102						25m = CHLmx
18	√	25										A023 sum st10				↓
19	√	25										A023 scm st10				clorofyll max
20	√	25														
21	√	15	104	104	104		104									
22	√	10	105	105	105		105		96	101						
23	√	10										A023 S st10				
24	√	10										A023 S st10				

St. 11 - DEEP CAST   (ICE STATION…   KI 03:00

Station:	143	Lat:	78 ° 46
Echo:	2626	Lon:	2 ° 21 W

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

MP ☐	Date:	18…
24 ☐	UTC Time:	03:00

Niskin		Pressure	AT-CT	δ18O	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	✓	btm	106	106	106		106 ✓									
2	✓	btm										A023 B St11				
3	✓	btm										A023 D St11				
4	✓	btm											A023.39			
5	✓	btm											A023.90			
6	✓	btm											A023.91			
7	✓	2000	107	107	107		107 ✓									
8	✓	1000	108	108	108		108 ✓									
9	✓	750	109	109	109		109 ✓									
10	✓	400	110	110	110		110 ✓									
11	✓	250	111	111	111		111 ✓									leaky niskin (btm
12	✓	200	112	112	112		112 ✓									
13	✓	150	113	113	113		113 ✓									
14	✓	100	114	114	114	220 221 222	114 ✓	68	110	120						leaky niskin
15	✓	75	115	115	115	217 218 219	115 ✓	67	109	119						Niskin leaking
16	✓	50	116	116	116	214 215 216	116 ✓	66	108	118						
17	✓	25	118 !	118	118	211 212 213	117 ✓	65	107	117						25m = CHLmx
18	✓	25														
19	✓	15	119 !	119	119		118 ✓									
20	✓	10	117 !	117	117	208 209 210	119 ✓	64	106	116						
21	✓	10										A023 ? St11				
22	✓	10										A023 S St11	(1)			eDNA: use also #22
23	✓	10											A023.37			
24	✓	10											A023.88			

St. 11 SHALLOW CAST (ICE STATION = 5)

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

Station:	144	Lat:	78° 44.9
Echo:	2629	Lon:	2° 21.5 W

MP ☐	Date:	18 jun
24 ☐	UTC Time:	06:05

Niskin		Pressure	AT-CT	$\delta^{18}O$	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	✓	400														
2	✓	250										A023 St11 AW				AW
3	✓	250										A023 AW St11				↓
4	✓	250											A023 95			
5	✓	250											A023-96			
6	✓	250											A023-97			↓
7	✓	150														Std dpth closest t
8	✓	150														
9	✓	150														
10	✓	150														
11	✓	150														↓
12	✓	25										A023 scm St11				Chlmx
13	✓	25										A023 scm St11				↓
14	✓	25											A023-97			
15	✓	25											A023-93			
16	✓	25											A023.94			
17	✓	25												✓		
18	✓	25												✓		↓
19	↓	10												–		
20	↓	10												–		
21	↓	10														
22	☐															
23	☐															
24	☐															

St 13 @ 1°W (Type B)

Station:	151	Lat:	78° 49.6
Echo:	2429	Lon:	01° 00.3 W

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

MP ☐	Date: 19/6-
24 ☐	UTC Time: 07:20

Niskin		Pressure	AT-CT	δ18O	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	✓	btm	120	120	120		120									
2	✓	btm														
3	✓	btm														
4	✓	btm														
5	✓	2000	121	121	121		121									
6	✓	1000	122	122	122		122									
7	✓	750	123	123	123		123									
8	✓	400	124	124	124		124									
9	✓	250	125	125	125		125									
10	✓	200	126	126	126		126									
11	✓	150	127	127	127		127									Std dpth within A
12	✓	100	128	128	128		128		118	129						
13	✓	87	?													Deep Chl mx ↓
14	✓	87														
15	✓	75	129	129	129		129		117	128						NB leaking
16	✓	50	130	130	130		130		116	127						NB leaking
17	✓	32	185	–	235		–	69	115	126						Chl mx NB leaking
18	✓	32														↓
19	✓	32														
20	✓	25	131	131	131		131		114	125						Niskin leaking (b
21	✓	15	132	132	132		132									
22	✓	10	133	133	133		133		113	124						
23	✓	10														NB leaking
24	✓	10														

N Bottle 15, 16, 17 & 23 are dripping/"leaking"

St14 @ OW DEEP CAST TYPE A

Station:	152	Lat:	78 ° 50.00
Echo:	2588	Lon:	00 ° 00.31 W

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

MP ☒	Date: 19/06-23
24 ☒	UTC Time: 11:53

Niskin		Pressure	AT-CT	δ18O	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	☑	btm										A023 st14 B st14				
2	☑	btm										A023 B st14				
3	☑	btm											A023_107			
4	☑	btm											A023_108			
5	☑	btm											A023_109			
6	☑	btm	134	134	134		134									
7	☑	2000	135	135	135		135									
8	☑	1000	136	136	136		136									
9	☑	750	137	137	137		137									
10	☑	400	138	138	138		138									
11	☑	250	139	139	139		139									
12	☑	200	140	140	140		140									
13	☑	150	141	141	141		141									
14	☑	100	142	142	142	244 245 246	142		124	137						
15	☑	75	143	143	143	241 242 243	143		123	136						
16	☑	50	144	144	144	238 239 240	144		122	135						
17	☑	25	145	145	145	235 236 237	1		121	134						
18	☑	15	146	146	146	232 233 234	2	70	120	133						Chl mx = 15 m
19	☑	15														↓
20	☑	10										A023 S st14				
21	☑	10										A023 S st14	A023_104			
22	☑	10											A023_105			
23	☑	10											A023_106			
24	☑	10	147	147	147	229 230 231	3		119	132						

St. 14 @ °W SHALLOW CAST (TYPE A)

Station:	153	Lat:	78 ° 49.7		MP ☐	Date:	19/6
Echo:	2518	Lon:	00 ° 04.1	W	24 ☐	UTC Time:	14:22

Arctic Ocean 2023
CTD & Water Sampling Log Sheet

Niskin		Pressure	AT-CT	$\delta^{18}O$	Nutrients	FCM	Salinity	Phyto-plankton	Chloro-phyll	POC & PON	Nitrifi-cation	eDNA (bacteria)	eDNA (pro/eu/fish)	N & C uptake	Micro-plastic	Notes
1	☑	400														
2	☑	150										AO23 AW St14				Std depth w AW
3	☑	150										AO23 AW St14				
4	☑	150														
5	☑	150														
6	☑	150														
7	☑	85														Deep Chl
8	☑	85														
9	☑	85														
10	☑	85														
11	☑	85														
12	☑	85														
13	☑	15										AO23 scm St14				Chl mx=15
14	☑	15										AO23 scm St14				
15	☑	15														
16	☑	15														
17	☑	15														
18	☑	15														
19	☑	15														
20	☑	10														
21	☑	10														
22	☐															
23	☐															
24	☐															