CRUISE REPORT HHUMLT24
Longyearbyen–Tromsø, July 3–10, 2024

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HHUMLT24

R/V Helmer Hanssen

The Arctic University Museum of Norway

Longyearbyen–Tromsø, July 3–10, 2024

https://doi.org/10.7557/7.7825

Septentrio Reports 1, 2024

Contents

Introduction

R/V Helmer Hanssen is an ice class research vessel owned by UiT The Arctic University of Norway. The HHUMLT24 cruise onboard R/V Helmer Hanssen was an initiative by The Arctic University Museum of Norway (UMAK, UiT). Sampling was conducted for the following four projects: 1. The Scalidophora of Norway, 2. The role of microRNAs in animal evolution, 3. The diversity of benthic fauna around Svalbard and the Barents Sea, 4. Reconstruction of past ecosystems using sedimentary ancient DNA. For the first project, which aimed to sample scalidophoran fauna, primarily kinorhynchs, for the Scalidophora of Norway project funded by Artsdatabanken, box cores were taken. The second project employed plankton nets, box cores, and a triangular dredge. The third project used samples from box cores, plankton nets, and a triangular dredge to collect marine macrofauna for the museum collections. All macrofauna present in plankton nets, box cores, and triangular dredge samples were photographed, and records were uploaded to GBIF https://www.gbif.org/dataset/b658be04-ff4a-4e50-8468-dcbed5451fe0. The fourth project took gravity cores. The cruise leader was Andreas Altenburger (UiT).

Itinerary

The HHUMLT24 cruise embarked from Longyearbyen, Svalbard at 7:00 CET on Wednesday the 3rd of July 2024 and ended in Tromsø, Norway on Wednesday the 10th of July 2024 at 9:00 CET. The total distance travelled was about 1105 nautical miles and the total time spent at sea amounted to approximately 165 hours (6 days 21 h). Travel and sample processing time during the cruise amounted to 114.5 hours (4 days 18.5 h) while the time used for taking the samples was 50.5 hours (2 days 2.5 h). In total, 14 stations were sampled (Fig. 1).

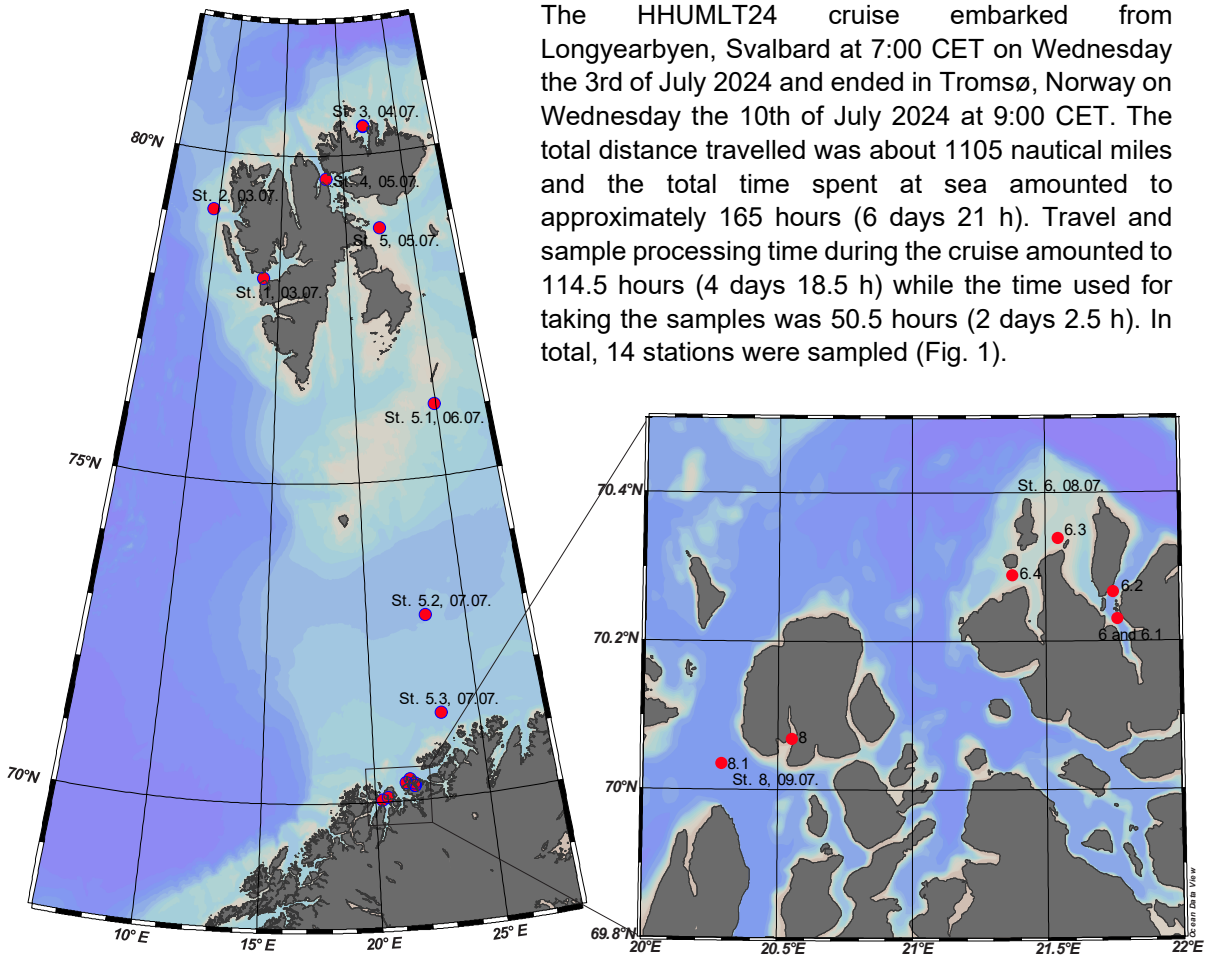

Figure 1. Map of Svalbard, the Barents Sea, and Northern Norway. Red dots represent sampling stations. Note that the map represents coordinates in decimal degrees. Coordinates in the report are in degrees, and decimal minutes as recorded on the ship.

Project summaries

During the HHUMLT24 cruise, marine fauna was sampled for the following research projects:

1. Distribution and DNA barcoding of Scalidophora along the coast of Svalbard, the Barents Sea, and Northern Norway. To investigate the biodiversity of Scalidophora around Svalbard and the Barents Sea, sea floor samples were taken with a box corer. Live kinorhynchs were collected to try culturing, a challenge that has not been solved by any research group.
    a. PI: Andreas Altenburger, Joel Vikberg Wernström
    b. Sampling gear: Box corer

2. The project MIRevolution asks if there is one driving force of animal evolution that explains the immense diversity of life. And if this force can help us to understand the exceptional success of parasites? The underlying very strong feature of both processes seems in fact to be very small: microRNAs. MicroRNAs regulate important biological processes, they fine-tune cellular programs and are among the most studied molecules ever. In this TFS project led by Dr. Bastian Fromm, novel sequencing approaches, and single cell experiments will be performed, taking advantage of the unique biodiversity in Northern Norway and around Svalbard, to deepen the understanding of animal evolution and answer open questions in systematics and gene-regulation. For this project multiple samples of Chaetognath, Nemertea, Gastropod and Appendicularia were collected and snap-frozen or stored in RNAlater for further processing.
    a. PI: Anju Angelina Hembrom
    b. Sampling gear: WP2 plankton nets, triangular dredge

3. Macrofaunal and megafaunal diversity of Svalbard and the Barents Sea. Macrofauna compromises marine animals in the size range of 0.5 to 1 cm and megafauna is any animal larger than 1 cm. All fauna of these two size classes were picked from the substrate and photographed individually. Fauna was either identified immediately or based on the photographs taken. Identification was to the lowest possible taxonomic level and the findings were recorded to be published as a dataset to the Global Biodiversity Information Facility (GBIF). Some specimens were fixed and included in the marine invertebrate collection of the Arctic University Museum of Norway (UiT).
    a. PI: Andreas Altenburger
    b. Sampling gear: Box corer and triangular dredge

4. Mapping of historical eukaryotic diversity by studying ancient DNA from sea sediments on Svalbard's' northern coast and on the coast of northern Norway. To better understand threats to pristine polar ecosystems by anthropogenic climate change, sed*a*DNA (sedimentary ancient DNA) will later be sampled from the marine sediment cores collected at this cruise to reconstruct eukaryote communities and map community change from the last postglacial warming period (~ c. 12 cal. kyr BP) to present. Such data can allow for the modelling of future ecosystem changes. For this project a 6 m long gravity corer was used to collect 4 cores between ~1 m – 5 m in length. The coring equipment was handled by the vessels' crew. After sediment capture the core tubes were cut into 1 m sections and capped on deck while taking precautions to avoid contaminating the core sediments with foreign DNA. A total of 15 core sections were stored at 4°C for later analyses in ancient DNA laboratories at UiT. This project was part of the doctoral thesis of Sanne Bergman.
    a. PI: Andreas Altenburger, Sanne Bergman
    b. Sampling gear: Gravity corer

5. Miscellaneous: 1. Annelid tubes and polychaetes from a variety of families were collected for Associate Professor Anette Högström and her paleontological research at the Arctic University Museum of Norway (UiT). The tubes and polychaetes were picked out from samples, photographed, and preserved in 70 % EtOH. 2. Specimens of *Arctica islandica* were sampled for Katharina Kniesz, Leibnitz-Institut für Ostseeforschung Warnemünde.
    a. PI: Vanessa Pitusi
    b. Sampling gear: Boxcorer, triangular dredge

Station details

02.07.2024

Station 0

Before departure, sand was sampled in the Longyearbyen marina and examined for presence of meiofaunal flatworms in the family Otoplanidae (Fig. 2). 18 specimens were retrieved, photographed, and preserved in 100% ethanol for molecular study within Joel Vikberg Wernström's doctoral thesis research.

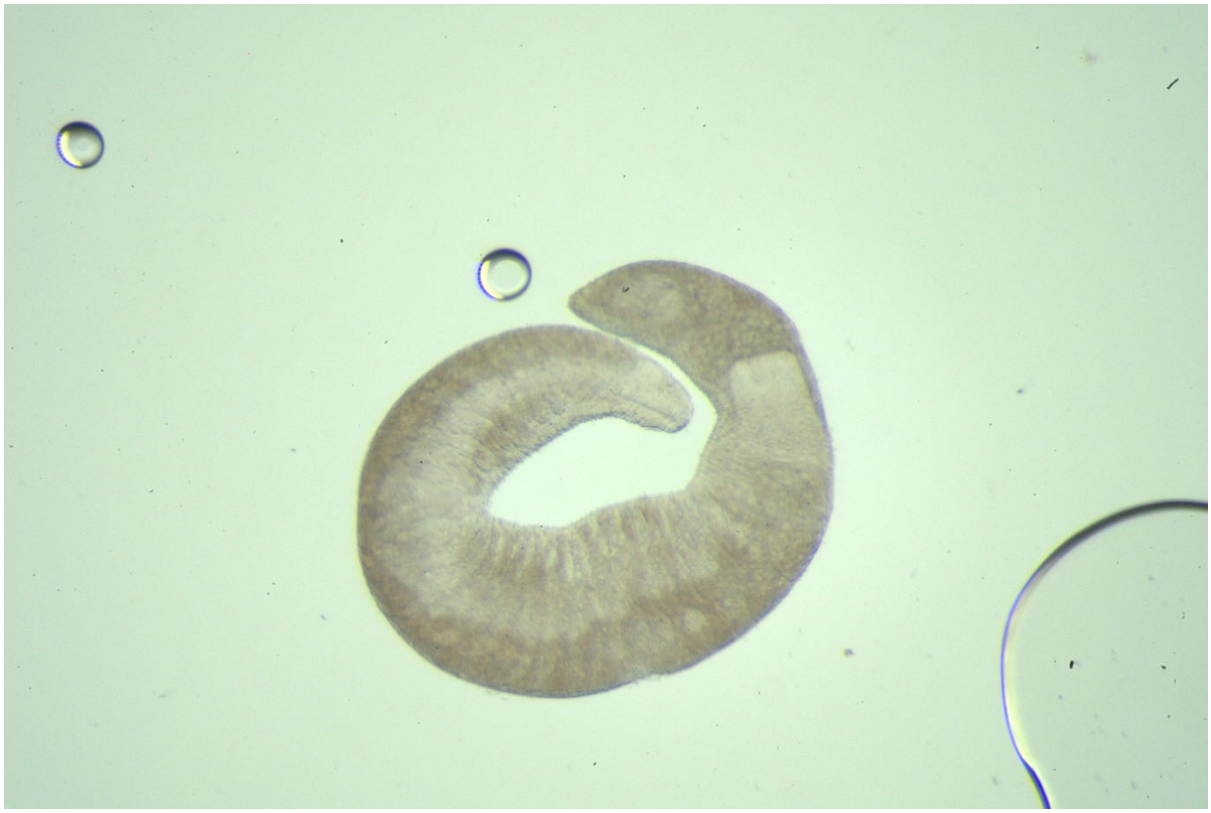

Figure 2. An Otoplanidae retrieved from sand in the Longyearbyen marina.

03.07.2024

07.10 CET (05.10 UTC), boarding of Helmer Hanssen (HH) in Longyearbyen.

05.25 UTC, departure from the port of Longyearbyen. Unpacking of equipment and consumables, setup of laboratories and the macrofauna photography station.

06.00 UTC, safety briefing with demonstration of the muster process and survival suits.

Station 1

The first sampling event took place on the 3rd of July at the mouth of Isfjorden. Benthic mud from this area could provide new records of kinorhynchs, which are often abundant within fjord systems. Zooplankton sampling was carried out as planned, but the triangular dredge was not used, allowing for more processing time of the plentiful specimens retrieved from the box corer.

08.03 UTC, HH station 986. The WP2 plankton net with mesh size 180 µm lowered at 78°08.367019 N, 013°51.065071 E, depth 377.96 m. The plankton net retrieved multiple chaetognaths of the species *Eukrohnia hamata*. In addition, plentiful calanoid copepods, ctenophores, the siphonophore *Dimophyes arctica* and the appendicularian *Oikopleura vanhoeffeni* were found. In addition, cirriped larvae were abundant in the sample. The Chaetognatha samples were fixed in 100% ethanol, RNA later and snap frozen in liquid Nitrogen to be used for whole genome and smallRNA sequencing for the doctoral thesis research of Anju Hembrom.

08.36 UTC, HH station 987. The same plankton net was lowered again at 78°08.637946 N, 013°51.767966 E, and a depth of 408.01 m. Plankton sampling was completed at 09.13 UTC and yielded a sample similar to the one from the first haul. Multiple individuals of the chaetognath *Eukrohnia hamata* were retrieved from the plankton net and stored in RNA Later, some individuals were also flash frozen for use in Anju Hembrom's doctoral research project, and one individual was preserved in 70% ethanol for the museum collection.

10.07 UTC, HH station 988. The box core (50 x 50 x 60 cm) was lowered at 78°08.488082 N, 013°51.240941 E and a depth of 397.57 m. When retrieved, the box core contained plentiful mud with a redox layer which occurred approximately 2-3 cm under the sediment surface. Macroscopic organisms included brittle stars, tube-dwelling annelids, empty shells of bivalves such as e.g. *Hiatella arctica* and *Ciliatocardium ciliatum* and the nemertean *Lineus ruber* (Fig. 3). The *Lineus ruber* was stored in RNA later. Sediment was sampled for eDNA (for community analysis of eukaryotes) and macrofauna. Annelid tubes were collected, photographed and preserved in 96 % ethanol for Associate Professor Anette Högström (UiT). Lastly, the top layer of sediment was scraped off from about half the box core's surface using a spoon and subjected to the bubble and blot method of extracting ecdysozoan meiofauna. Many meiofauna specimens were retrieved, including nematodes, copepods and plentiful kinorhynchs. Kinorhynchs were manually picked out from the bubble and blot extract and divided into thirds which were (1) preserved in 100% ethanol and frozen in -80 C for molecular study (2) preserved in a solution of 4% formaldehyde (10% formalin) for morphological study and (3) kept alive in seawater and sediment for culturing attempts, all under the Artsdatabanken project Scalidophora of Norway.

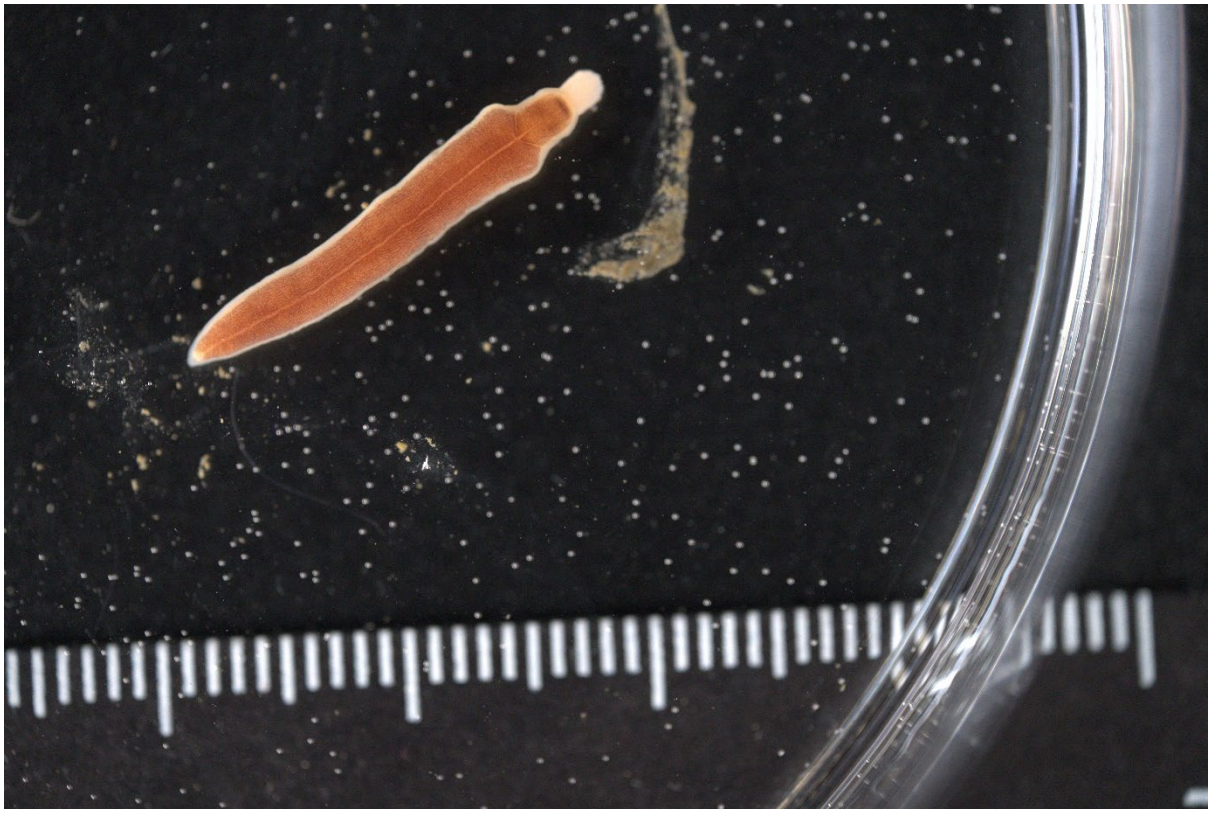

Figure 3. The nemertean *Lineus ruber* retrieved from the box core sample at station 1.

Station 2

The second sampling event took place on the 3rd of July at 20.40 UTC. Two localities of different depth and distance from the shore were considered, with the shallower, near-shore one favored.

20.45 UTC, HH station 989. WP2 plankton net with mesh size of 180 µm lowered at 79°07.290885 N, 09°38.265847 E, depth 79.46 m. The plankton net yielded mainly calanoid copepods. The pteropods *Limacina helicina* and *Limacina retroversa* as well as the ctenophores *Beroe cucumis* and *Mertensia ovum* were also found. In addition, specimens of the chaetognath *Eukrohnia hamata* and *Parasagitta elegans* as well as the pelagic amphipod *Themisto abyssorum* were abundant in the sample. The *Limacina helicina* was flash frozen, and *Parasagitta elegans* was stored in RNA later.

21.15 UTC, HH station 990. Box core lowered at 79°07.166591 N, 09°36.184385 E at a depth of 86.43 m. The box core returned silty, dense sand, which contained a macrofauna community primarily composed of ophiuroid echinoderms. Among the species identified was *Ophiura sarsii.* Some sediment samples were preserved for eDNA analysis. Remaining sand was collected and subjected to freshwater shock treatment to search for loriciferans. The extract yielded plentiful benthic copepods and nematodes, some tanaidaceans and a few sipunculids, but no loriciferans.

21.31 UTC, HH station 991. The triangular dredging session started at 79°07.53815 N, 09°35.670960 E at a depth of 84.99 m. Mainly stony substrate with small stones with encrusting bryozoans, the barnacle *Balanus balanus* and calcareous algae were retrieved (Fig. 4). The dredging also returned more ophiuroids (*Ophiura sarsii, Ophiopholis aculeata, Gorgonocephalus eucnemis*) in addition to asteroid (*Crossaster* sp. and *Henricia* sp.), and echinoid (*Strongylocentrotus* sp.) echinoderms. A few *Astarte* sp. bivalves were also recorded. Polychaetes present were represented by the family Serpulidae and the genus *Nothria* sp.

Figure 4. Sorting content from the triangular dredge at station 2.

04.07.2024

Station 3

Figure 5. Gravity corer deployed at station 3.

The third sampling event took place on 4th July south of Sjuøyane at 80°25.261381 N, 21°58.145413 E. This area was chosen based on samples needed for the doctoral thesis of Sanne Bergman. For this a deeper station on the Barents Sea shelf (approximately 285 m) was chosen based on previous publications and associated bathymetry data (Lejzerowicz et al. 2013; Nguyen et al. 2023). As with previous stations, a WP2 net was taken first, followed by the box corer. The last sampling at the station was with a gravity corer (Fig. 5). The triangular dredge was omitted due to the muddy nature of the sediment.

15.43 UTC, HH Station 992. The WP2 net of mesh size 180 µm was lowered at 80°25.430996 N, 021°58280514 E to a depth of 278.21 m. The plankton net sample was totally dominated by calanoid copepods and appendicularians (*Oikopleura vanhoeffeni*). In addition, a few specimens of *Eukrohnia hamata, Mertensia ovum* and *Aglantha digitale* were recorded.

16.19 UTC, HH Station 993. The box corer was lowered at 80°25.255588 N, 021°58.206282 E to a depth of 288.75 m. The box core returned with sediment similar of nature to the one at Station 1. The sediment was a loose, brown top layer of mud with a black, dense clay layer underneath. Polychaete tubes, brittle stars, one amphipod and one cumacean were visible. Three eDNA samples were taken prior to the collection of the top 2 cm with cut-off 60 mL syringes. Three samples were collected and preserved in 10 % formalin. Qualitative samples were taken with a spoon; three of which were preserved in 10 % formalin and three in absolute ethanol. Annelid tubes were collected for Associate Professor Anette Högström (UiT). These were photographed and preserved in 96 % ethanol. The remaining mud

was collected both for bubble and plot, and sieving (1 mm mesh size). All macrofauna was picked from the sediment surface and from the sieve and kept until being photographed.

18.53 UTC, HH Station 994. Gravity core number 1 was taken at 80°25.274055 N, 021°57.800903 E at a depth of 284.74 m. The first coring attempt was unsuccessful due to a vacuum failure, causing the captured sediments to leak out as the contraption was winched up on deck. Only approximately 1 m of sediment was present in the tube even though the whole corer was covered in sediment. The crew suspects that the corer fell on its side on the seafloor. The lower end of the liner tube was caped as soon as it was out of the corer. The gravity corer was cleaned and reloaded for a second attempt at a nearby location.

Station 3.1

19.31, HH Station 995. A second gravity core was taken at 80°25.261381 N, 021°58.145413 E at a depth of 288.19 m and the core liner was filled with 4.67 m of sediment. Upon return to the surface, the core liner was capped on both ends and processed accordingly (Fig. 6). After capping, the core liner was washed of all external dirt and dried with cloth. The core liner was then cut into 1 m sections with a saw and all individual sections were capped. Throughout the core handling process, all visible sediments were muddy and compact without gravel or stones. All tools were disinfected between cutting sections to prevent DNA cross-contamination. Disinfection was done with a gas burner. The caps were anchored using Gaffa and electrical tape. The core was then labelled with an ID consisting of the cruise name, station, core section and the initials of Sanne Bergman, HHUMLT24_3_5-6m_SB. The label was covered in transparent tape to prevent it rubbing off, and the cores were stored cool at 4 °C.

Figure 6. Processing of the sediment-filled core liner.

05.07.2024

Station 4

The fourth sampling event took place on 5th July in Hinlopen Strait. As with previous stations, the sampling started with a WP2 net followed by a box corer and this time a sample was also taken with the triangular dredge.

06.56 UTC, HH Station 996. The first WP2 net was lowered at 79°39.466071 N, 18°34.26630 E to a depth of 314.95 m. The sample contained two individuals of *Themisto libellula* and numerous specimens of *Themisto abyssorum*. The sample also contained calanoid copepods, appendicularians, and larval stages of decapods. The ctenophores *Beroe* sp. and *Mertensia ovum* were also recorded as well as the pteropod *Limacina helicina*. In addition, one juvenile *Cyanea capillata* was found. Multiple individuals of the chaetognath *Parasagitta elegans* were also found, which were stored in RNA later.

07.43 UTC, HH Station 998. The box corer was lowered at 79°39.462428 N, 018°31.873654 E to a depth of 313.87 m. Once back onboard, all water was drained from the surface. Only a third of the box corer was filled with sediment. The top was brown and somewhat gelatinous. Underneath the top layer was clay with black traces. Macrofauna was present in the sample and represented by brittle stars, one small bivalve, one pycnogonid, and annelid tubes. As before, the first samples taken were for eDNA followed by the collection of the top 2 cm with cut-off 60 mL syringes. Three samples of the top layer were taken and preserved in 10 % formalin. Then six qualitative samples were taken with a spoon of which three were preserved in absolute ethanol and three in 10 % formalin. Lastly, more of the top mud layer was taken with a spoon and transferred to a bucket for bubble and plot. The rest of the box core was discarded.

08.27-09.03 UTC, HH Station 999. The triangular dredge was dragged across the seafloor at a depth of 315.57 to 298.95 m. It was lowered at 79°38.681988 N, 018°32.248650 E and retrieved at 79°39.539958 N, 018°28.818865 E. It was filled with mud and clay (Fig. 7). The mud was brown, whereas the clay had traces of black and assumed anoxia. Plenty of organisms were retrieved from the sample and photographed. Annelid tubes, as well as selected annelids were preserved in 70 % ethanol for Associate Professor Anette Högström (UiT).
Organisms present included numerous mudstars (*Ctenodiscus crispatus*) and brittle stars *(Ophiura sarsii, Ophiacantha bidentata* and *Ophiocten sericeum*). Annelids, molluscs, crustaceans and annelid tubes were also found. Among the molluscs the bivalves *Astarte* sp., *Bathyarca glacialis* and *Ciliatocardium ciliatum* were recorded. Empty shells of *Yoldia hyperborea, Nucula pernula, Euspira pallida* and *Cryptonatica affinis* were noted. In addition, the gastropod *Colus* sp. with the anemone *Allantactis parasitica* was present. Among the crustaceans one specimen of *Pandalus borealis*, one specimen of *Epimeria loricata* as well as the hermit crab *Pagurus pubescens* were found. *Nymphon* sp. and *Boreonymphon* sp. sea spiders were also recorded. Polychaetes and their tubes dominated the sample and included the following families - Ampharetiidae, Pectinariidae, Terebellidae, Lumberinidae, and the genus *Spiochaetopterus* sp.

Figure 7. Processing the triangular dredge from Station 4.

Station 5

The fifth sampling event took place in the evening of July the 5th. At this station, only one plankton net and the box corer were taken. The triangular dredge was omitted due to the muddy nature of the sediment.

18.46 UTC, HH Station 1000. The first WP2 net was lowered at 78°52.361908 N, 022°34.466959 E to a depth of 127.32 m. The sample contained multiple individuals of chaetognaths *Parasagitta elegans* and *Eukrohnia hamata* which were stored in RNA later. The sample also contained one individual of the Gastropod *Clione limacina,* and multiple individuals of *Limacina helicina* which was also stored in RNA later.

19.00 UTC, HH Station 1001. The box corer was lowered at 78°52.377867 N, 022°34.078333 E to a depth of 127.09 m. The box core consisted of aerated brown mud underneath which was a layer of dense clay with traces of anoxic layers (Fig. 8). The mud layer was thicker than 2 cm and macrofauna was present. This macrofauna included brittle stars (*Ophiacantha bidentata* and *Ophiocten sericeum*), benthic amphipods, pycnogonids (*Nymphon hirtum*), and annelid tubes. The water was drained of the sample, a photo was taken of the surface, and three eDNA samples were extracted by sticking 50 mL Falcon tubes in the top mud layer. Afterwards, the top 2 cm of the mud were collected with a cut-off 60 mL syringes. These samples were preserved in 10 % formalin. Then one qualitative sample was collected with a spoon and preserved with 10 % formalin. In addition, three qualitative samples were collected and preserved in absolute ethanol. Some portion of the sediment was collected with a spoon and sieved through a 1000 µm sieve. The remaining aerated sediment was collected in two buckets for bubble and plot.

Figure 8. Box core surface, eDNA sampling, and sample processing after siphoning off the water at station 5.

06.07.2024

Station 5.1

Starting the journey south from Svalbard towards the Norwegian coast. This station was named “Station 5.1” and sampling consisted of one WP2 net.

12.09 UTC, HH Station 1002. The 180 um mesh size WP2 net was lowered at 76°06.771266 N, 024°54.563544 E to a depth of 80.43 m. The bottom depth was around 79 m near Hopenryggen. The sample consisted of juvenile polychaetes, cirriped nauplii, cypris larvae, the cyclopoid copepod *Oithona atlantica*, the calanoid copepods *Calanus finmarchicus* and *Calanus glacialis* (Figs. 9-10), copepod nauplii stages, and the chaetognaths *Parasagitta elegans* and *Eukrohina hamata* (stored in RNA later).

Figure 9. Impression of the content of the plankton net on station 5.1.

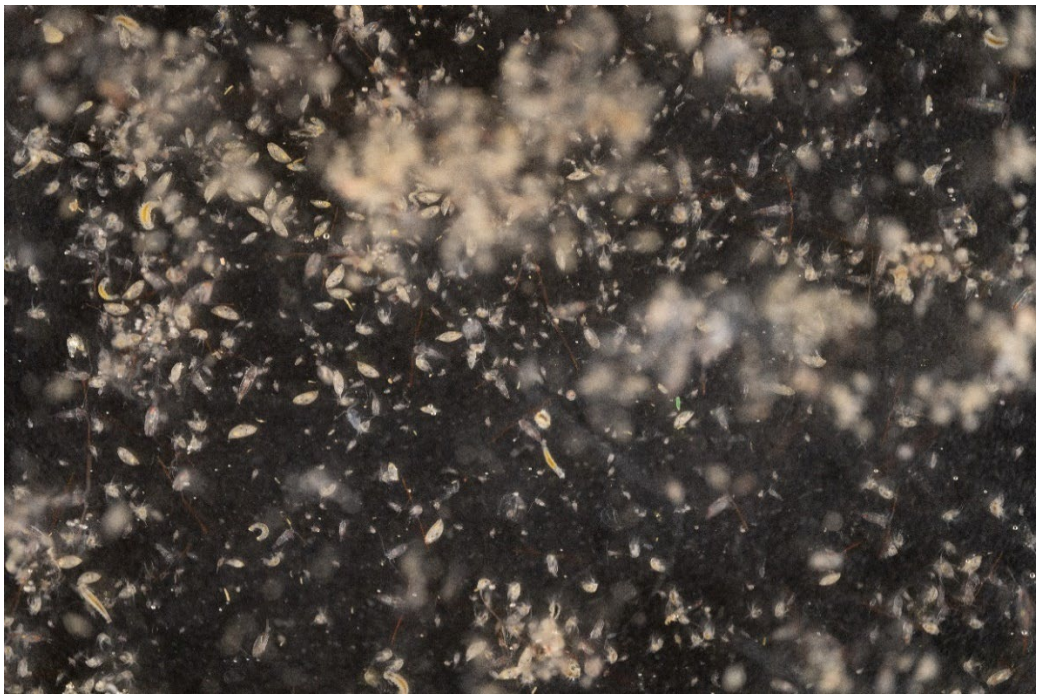

Figure 10. Close-up of the content of the petri dish in Figure 9, with many *Calanus* specimens and meroplankton

07.07.2024

Station 5.2

Additional sampling in the Barents Sea. This station was named “Station 5.2” and sampling consisted of a plankton net and a box corer.

06.24 UTC, HH Station 1003. The WP2 net was lowered at 72°53.377538 N, 022°58.263872 E to a depth of 403.36 m. The sample was very diverse and contained several different copepod species where *Calanus* sp*., Oithona similis, Microcalanus* sp. and *Microsetella norvegica* were the most abundant. The chaetognath *Eukrohnia hamata,* pelagic gastropod *Limacina retroversa* and the pelagic amphipod *Themisto abyssorum* were also abundant. Meroplankton were few but contained a few hydromedusae where *Aglantha digitale* was the most common. While no quantitative comparisons were performed, the sample contained visually more diatoms than the plankton net samples from the Svalbard region.

07.29 UTC, HH Station 1005. The box corer was lowered at 72°54.120504 N, 022°57.171476 E to a depth of 407.44 m. The box corer was filled with clay covered in a layer of brown mud. The mud was loose and the clay dense. Annelid tubes were visible on the surface. Other macrofauna retrieved included two brittle stars (*Ophiacantha bidentata*, Fig. 11), bryozoans, a sponge, and two bivalves (*Astarte* sp.). After the water was siphoned off the top of the sediment, three eDNA samples were taken (and frozen at –20°C) followed by three quantitative samples of the upper 2 cm mud layer. These were preserved in 10 % formalin. Then one qualitative sample was taken and preserved in 10 % formalin and three qualitative samples that were preserved with absolute ethanol. A portion of the mud was sieved through a 1000 µm sieve, and the rest was transferred to two buckets for bubble & plot.

Figure 11. *Ophiacantha bidentata* found in the box corer sample at Station 5.2.

Station 5.3

Third sampling event in the Barents Sea. This station was named “Station 5.3” and sampling consisted of a plankton net and a box corer.

18.27 UTC, HH Station 1006. The WP2 net was lowered at 71°20.626021 N, 23°14.773550 E to a depth of 100 m; the actual bottom depth was 393.48 m. The cod end drained fast and not much zooplankton was present in the sample.

18.42 UTC, HH Station 1007. The box corer was lowered at 71°20.687256 N, 023°14.902492 E to a depth of 392.28 m. The box core was filled with clay and a relatively dry layer of mud on top. There were some annelid tubes, brittle stars, and two benthic amphipods (Fig. 12). After the water was siphoned off the top of the sediment, three eDNA samples were taken (and frozen at -20°C) followed by three quantitative samples of the upper 2 cm mud layer. These were preserved in 10 % formalin. Then one qualitative sample was taken and preserved in 10 % formalin and three qualitative samples that were preserved with absolute ethanol. A portion of the mud was sieved through a 1000 µm sieve, and another portion was taken and placed in a 44 µm sieve. This sieve was placed in a petri dish and ice was added on top of the mud to make any soft bodied fauna move downward and out of the mud. The rest of the box corer sample was transferred to two buckets for bubble & plot.

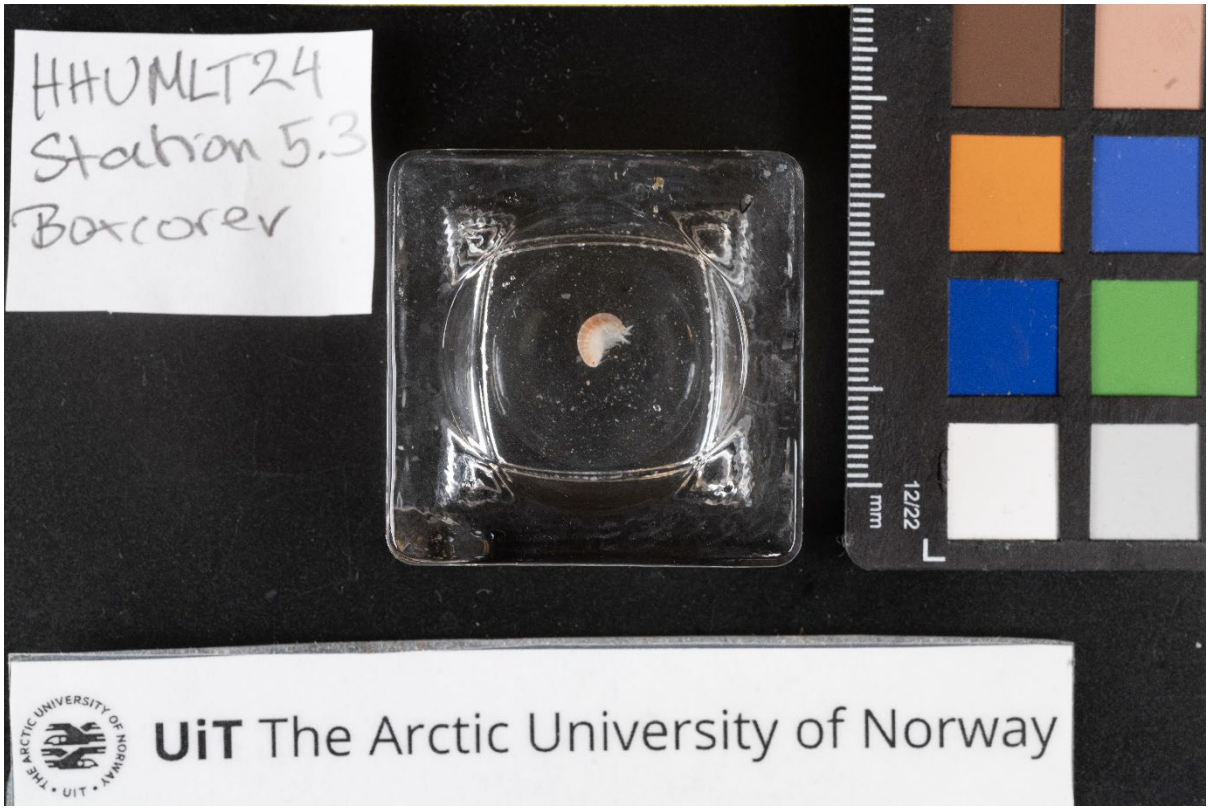

Figure 12. An unidentified amphipod from the box core at station 5.3.

08.07.2024

Station 6

This sampling event took place in Tverrfjord-Langfjord and consisted of two plankton nets, a box corer and a gravity corer.

06.09 UTC, HH Station 1008. The first plankton net was taken at 70°13.804459 N, 021°46.164065 E from the bottom (depth 184.22 m) to the surface. The net was very clogged with macroalgal debris and ctenophores and, therefore, another net was deployed. The first net consisted mainly of *Calanus* copepods and the ctenophores *Bolinopsis infundibulum* and *Beroe cucumis*.

06.28 UTC, HH Station 1009. The second plankton net was taken in 70°13.814743 N, 021°46.322751 E the upper 100 m. This sample was a lot cleaner and contained fewer ctenophores, though a few large *Bolinopsis infundibulum* were recorded. *Calanus finmarchicus* copepods dominated the sample. A few pteropods, krill and appendicularians were also recorded. In the meroplankton fraction of the sample, hydromedusae and bivalve larvae dominated. A few individuals of the chaetognath *Parasagitta* elegans were also found.

06.44 UTC, HH Station 1010. The box corer was lowered at 70°13.855684 N, 021°46.269071 E to a depth of 183.49 m (Fig. 13). The box corer was filled with more sandy sediment rather than mud. Part of the sediment appeared to have a green “layer”, which could be attributed to recent sedimentation of phytoplankton. Annelid tubes and tiny bivalves (*Astarte* and *Thracia*) were present. After the water was siphoned off the top of the sediment, three eDNA samples were taken (and frozen at –20°C) followed by three quantitative samples of the upper 2 cm mud layer. These were preserved in 10 % formalin. Then one qualitative sample was taken and preserved in 10 % formalin (made with seawater) and three qualitative samples that were preserved in absolute ethanol. A portion of the mud was sieved through a 1000 µm sieve. The rest of the box corer sample was transferred to two buckets for bubble & blotting, which yielded some kinorhynchs.

07.41 UTC, HH Station 1011. The first gravity core was taken from 70°13.867008 N, 21°46.054594 E at 180 m depth. The first attempt failed and did not contain any sediments. The corer was cleaned and reloaded for a second attempt.

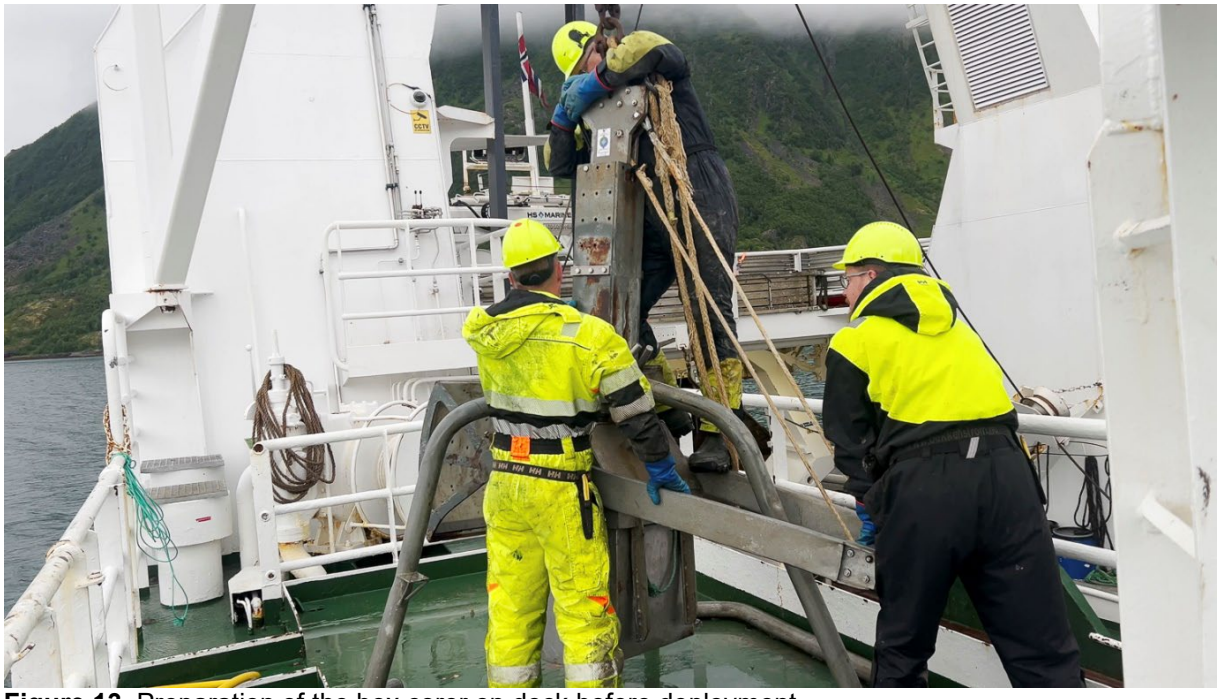

Figure 13. Preparation of the box corer on deck before deployment

Station 6.1

08.12 UTC, HH Station 1012. The second gravity core was collected from 70°13.791585 N, 21°46.167229 E at 183,8 m depth. This attempt was successful at retrieving 1 m of sediments. The core ends were capped and taped, after which the liner was cleaned with water and dried with synthetic cloths and tissue paper. Following the same disinfection routines of previous cores, the core was cut into 1 m and capped, taped and marked. The core was stored at 4°C. A longer consecutive sediment sequence was desired, and the gravity corer was cleaned and reloaded for a third attempt.

Station 6.2

09.01 UTC, HH Station 1013. The third core was acquired from 70°16.029349 N, 21°45.138660 E at 209 m depth and was approximately 4 m long (Fig. 14). The liner tube was capped, taped and then rinsed, dried and cut into 4 pieces à 1 m using the previously described disinfection routine. Sediments were of heterogenous and dense organic-rich clay character with a strong sulphury smell. The core was stored at 4°C.

Figure 14. Processing of the gravity core on deck

Station 6.3

This station was chosen for a triangular dredge based on depth and bottom topography.

10.27-10.36 UTC, HH Station 1014. A triangular dredge was lowered at 70°20.327262 N, 021°32.922920 E and retrieved at 70°20.187810 N, 021°32.260409 E. It was lowered and dragged at a depth of 47.57 m to 47.06 m. The dredge was filled with hard bottom substrate which consisted of rocks and shell fragments. The living macrofauna included encrusting red algae, tube worms, chitons, a variety of echinoderms, brachiopods, bivalves, gastropods, tunicates and crustaceans. The fauna was characterized by large amounts of brachiopods of the species *Hemithiris psittacea* and *Macandrevia cranium*. In addition, several sea urchin species (*Spatangus purpureus, Echinocardium*

flavescens, Strongylocentrotus sp.*, Echinocyamus pusillus*) and other echinoderms such as *Henricia* sp. sea stars and *Ophiopholis aculeata* and *Ophiothrix fragilis* brittle stars were abundant. Molluscs were also abundant and especially bivalves such as *Astarte* spp., *Parvicardium* spp. and *Palliolum* spp. and *Modiolula phaseolina* were noticeable. Tunicates were dominated by *Styela rustica, Dendrodoa* sp. and *Ascidia virginea*. After letting the samples stand for a while, nemerteans and the siphunculid *Phascolion strombi* crawled out of abandoned polychaeta tubes. The latter was preserved for the collections at the Arctic University Museum of Norway. Some sand that was brought up with the dredge was freshwater shocked to look for Loriciferans, but none were found. Another portion of sand was subjected to extraction with magnesium chloride to search for flatworms. While none were found, a rich fauna of interstitial annelids revealed itself, and a sub-millimeter long specimen of the meiofaunal nudibranch *Embletonia pulchra* was photographed and preserved in 100% ethanol for DNA barcoding within Fredrik Broms research project NUDIST (Nudibranch Distribution in Northern Norway).

Station 6.4

This station was chosen for a triangular dredge based on depth and bottom topography.

12.07 UTC, HH Station 1015. The dredge was lowered at 70°17.366476 N, 021°22.474652 E and retrieved at 70°17.148200 N, 021°21.550677 E. It was lowered to an initial depth of 50.44 m and retrieved at 46.96 m. The content of the dredge consisted of rocks, and shell fragments. The fauna included brittle stars (*Ophiopholis aculeata* and *Ophiothrix fragilis*), bryozoans (including *Reteporella beaniana*), sea squirts (e.g. *Ascidia virginea*), bivalves *(*including *Astarte* sp. and *Chlamys islandica*)*,* nemerteans (e.g. *Nipponnemertes pulchra* and *Tubulanus superbus*), brachiopods (*Hemithiris psittacea* and *Macandrevia cranium*), crustaceans (e.g. *Balanus balanus*), echinoderms (e.g. *Echinocardium flavescens* and *Echinocyamus pusillus*) annelids (including *Phascolion (Phascolion) strombus* and *Chaetopterus variopedatus*). All organisms found were photographed to be documented and identified (Fig. 15).

Figure 15. Photographing the fauna found in the triangular dredge.

Station 7

This station was skipped due to bad weather and heavy winds (16m/s).

09.07.2024

Station 8

This sampling event consisted of a plankton net, two box corers and a gravity core.

06.07 UTC, HH Station 1016. The WP2 net was lowered at 70°04.102028 N, 20°32.961574 E to a depth of 52.54 m. The cod end drained well and there was relatively little zooplankton in the sample. The sample was dominated by *Calanus finmarchicus* and large amounts of meroplankton. The meroplankton consisted mainly of cirriped larvae, bryozoan larvae and ophiuroid larvae. A few polychaetes, nemertean and holothurian larvae were also present in the sample. Crustacean larvae were few but contained both squat lobster, hermit crab and crab larvae. One king crab (*Paralithodes camtschaticus*) larvae was recorded. Among the holoplankton, the appendicularian *Oikopleura dioica* was the second most abundant group.

06.23 UTC, HH Station 1017. The first box corer was lowered at 70°04.147588 N, 020°33.115027 E to a depth of 52.10 m. This box corer came up partly disturbed due to a stone that blocked the tight closing of the shovel. The portion of sediment that was undisturbed was used to take three eDNA samples and one bubble & plot sample.

06.48 UTC, HH Station 1018. The second box corer was lowered at 70°04.235415 N, 020°33.218564 E to a depth of 53.36 m. This box corer was like the first box corer and contained disturbed sediment. The portion of undisturbed sediment was used to sample quantitatively three times with cut-off 60 mL syringes. These samples were preserved in 10 % formalin prepared with seawater. Then one qualitative sample was taken and preserved in 10 % formalin (made with seawater) and three qualitative samples that were preserved in absolute ethanol. The remainder of the undisturbed sediment was collected for bubble & blot with a spoon, which yielded plentiful kinorhynchs. A general observation was that kinorhynch numbers appeared to be much higher near land and within fjords than out in the Barents Sea. The rest of the sediment was discarded. Both box cores contained sandy sediment with a thin (approximately 2 cm) layer of brown-grey sandy sediment under which the anoxic layer started. The sediment contained shell fragments of varying sizes. Most of the water drained out of the box corer when it came up and, thus, little was left in it and there was no need to siphon it off.

07.25 UTC, HH Station 1019. The gravity corer was lowered at 70°04.180599 N, 20°33.193869 E to a depth of 52.05 m (Fig. 16). Unfortunately, the first core came back empty, and no second attempt was made due to the shallow depth of the fjord. A second, deeper location was selected.

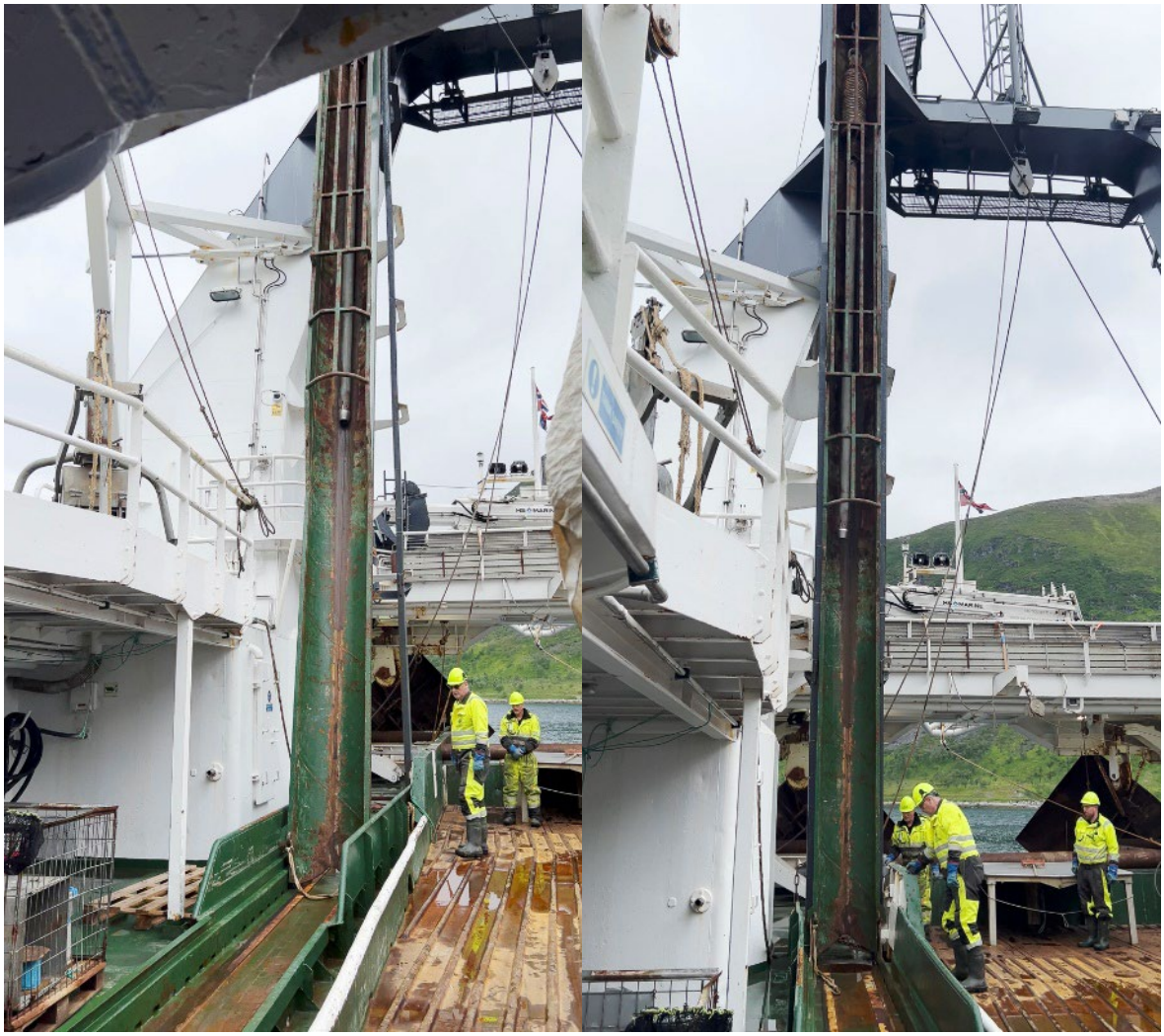

Figure 16. Deployment of the gravity core

Station 8.1

This station consisted of a plankton net, gravity corer and box corer. It was chosen based on the bottom depth of around 400 m.

08.25 UTC, HH Station 1020. The WP2 plankton net was lowered at 70°02.048939 N, 020°17.315872 E at a depth of 427.17 m. The water sample was almost clear with mostly *Calanus* sp. and a few appendicularians (*Oikopleura dioica*).

09.06 UTC, HH Station 1021. The gravity corer was lowered at 70°01.945118 N, 20°18.529368 E to a depth of 421 m. This core retrieval was successful and resulted in a 4,92 m long sediment core with a top layer of brown mud and grey clay underneath. The liner was capped and taped followed by cleaning, drying, and cutting. After cutting, the new pieces were also capped, taped and marked (tools were disinfected between each cut). Cores were stored at 4°C.

10.45 UTC, HH Station 1022. The box corer was lowered at 70°02.202638 N, 020°16.521777 E to a depth of 434.88 m. The box corer was filled with undisturbed sediment and contained traces of hydroids and annelid tubes. The sediment consisted of a layer of mud with clay underneath. Then one qualitative sample was taken and preserved in 10 % formalin (made with seawater) and three qualitative samples that were preserved in absolute ethanol. A portion of the mud was sieved through a 1000 µm sieve to look for macrofauna. The remainder of the undisturbed sediment was collected for bubble & blot (Fig. 17) with a spoon, which revealed the presence of acoels and *Solenogastres*.

Figure 17. Bubble and plot method in the background, with fixation of sediment in 10% formalin in the foreground. For the bubble and plot method, a mixture of seawater and sediment is poured from one bucket into another to create air bubbles. This process is repeated 10 to 30 times. The chitinous cuticle of some meiofauna is hydrophobic, causing them to adhere to air bubbles. Consequently, they can be easily retrieved from the water surface after allowing the water-sediment mixture to settle for approximately 10 minutes.

Permits

Relevant permits for the fieldwork were applied for prior to the cruise. These included an application to the governor of Svalbard regarding fieldwork in Svalbard (RiS-12509/A1) and an application to the Sokkeldirektoratet (ref. OD 24/566/E1MS) for permission to take gravity cores. Both activities were granted permission within the boundaries of the law.

Acknowledgements

All authors of this report would like to extend our heartfelt thanks to the crew of the R/V Helmer Hanssen, who were exceptionally helpful throughout the cruise. We are additionally grateful to Elisabeth Halvorsen of the Faculty of Biosciences, Fisheries and Economics (UiT) for lending us equipment for the plankton nets. Finally, we thank Artsdatabanken whose funding made this cruise possible.

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Cabin list

Name	Cabin
Vanessa	211
Sanne	212
Anju	213
Jan	323
Knut-Geir	214
Andreas	505
Joel	215
Hanna	216
Fredrik	322

Daily schedule

Breakfast	7:30 – 08:00
Cake	10:00
Lunch	13:30 – 14:00
Cake	17:00
Group meeting	17:00
Dinner	19:30 – 20:00
Meeting with captain	08:00

Appendix

Station log

Cruise Nr	Date UTC	Time UTC	Logg (nm)	Station type	StNr	Speed	Lat	Long	Depth (m)	Air Temp (°C)	Water Temp (°C)	Wind Speed (m/s)	Humidity (%)	Winddir (deg)	Light SPAR
HHUMLT24	03.07.2024	08:03:28	5642,503	Net WP2 START	986	0,4	78°08.367019 N	013°51.065071 E	377,96	6,7	5,2	4,3	81,1	258,4	142
HHUMLT24	03.07.2024	08:36:08	5642,811	Net WP2 STOP	986	0,6	78°08.637625 N	013°51.767516 E	408,11	6,8	5,3	4,5	81,2	247,4	322
HHUMLT24	03.07.2024	08:36:10	5642,811	Net WP2 START	987	0,6	78°08.637946 N	013°51.767966 E	408,01	6,8	5,3	4,7	81,2	255,5	322
HHUMLT24	03.07.2024	09:12:50	5643,304	Net WP2 STOP	987	3,5	78°08.983894 N	013°53.062466 E	401,22	6,2	5,4	4,4	82,7	255,7	336
HHUMLT24	03.07.2024	10:06:38	5644,265	Box core (BC)	988	0,3	78°08.488082 N	013°51.240941 E	397,57	5,9	5,5	4,8	85,7	246,1	408
HHUMLT24	03.07.2024	20:45:23	5737,35	Net WP2 START	989	0,6	79°07.290885 N	009°38.265847 E	79,46	4,8	5,5	11,5	87,3	8,5	147
HHUMLT24	03.07.2024	20:55:06	5737,531	Net WP2 STOP	989	1,3	79°07.163743 N	009°37.650739 E	85,22	4,7	5,6	12,4	88,4	1,7	161
HHUMLT24	03.07.2024	21:15:06	5737,859	Box core (BC)	990	1,7	79°07.166591 N	009°36.184385 E	86,43	4,8	5,5	12,1	88,5	1,5	151
HHUMLT24	03.07.2024	21:30:42	5738,242	Triangular dredge START	991	1,8	79°07.532815 N	009°35.670960 E	84,99	4,7	5,6	11,3	88,8	8,4	131
HHUMLT24	03.07.2024	21:42:25	5738,599	Triangular dredge STOP	991	1,8	79°07.890086 N	009°35.580005 E	86,77	4,7	5,5	13,3	88,7	6,5	141
HHUMLT24	04.07.2024	15:43:49	5917,489	Net WP2 START	992	0,2	80°25.430996 N	021°58.280514 E	278,21	-0,3	2,7	4,5	87,9	21,4	142
HHUMLT24	04.07.2024	16:08:55	5917,65	Net WP2 STOP	992	0,3	80°25.304751 N	021°58.815078 E	286,25	-0,2	2,5	4,8	89,4	17,7	217
HHUMLT24	04.07.2024	16:19:50	5917,764	Box core (BC)	993	0,7	80°25.255588 N	021°58.206282 E	288,75	-0,1	2,4	5,2	90,4	14,7	175
HHUMLT24	04.07.2024	18:32:58	5919,374	Gravity core (GC)	994	0,4	80°25.274055 N	021°57.800903 E	284,74	0,1	2,4	5,7	87,6	26,4	109

HHUMLT24	04.07.2024	19:31:46	5920,383	Gravity core (GC)	995	0,5	80°25.261381 N	021°58.145413 E	288,19	0,3	2,5	6,1	93,1	10,6	97
HHUMLT24	05.07.2024	06:56:14	6024,021	Net WP2 START	996	0,7	79°39.466071 N	018°34.246630 E	314,95	1,3	3,2	12,3	91,1	342,3	57
HHUMLT24	05.07.2024	07:19:51	6024,391	Net WP2 STOP	996	0,5	79°39.412420 N	018°32.423242 E	313,95	1,2	3,3	13,6	92,1	329,2	58
HHUMLT24	05.07.2024	07:25:24	6024,422	Net WP2 START	997	0,7	79°39.400766 N	018°32.287817 E	315	1,2	3,6	14,7	92,5	331,3	70
HHUMLT24	05.07.2024	07:30:57	6024,51	Net WP2 STOP	997	1	79°39.364372 N	018°32.030455 E	314,27	1,1	3,4	13,8	92,5	325,8	80
HHUMLT24	05.07.2024	07:43:02	6024,652	Box core (BC)	998	0,4	79°39.462428 N	018°31.873654 E	313,87	0,9	3,5	15,6	93	321,5	135
HHUMLT24	05.07.2024	08:27:35	6025,556	Triangular dredge START	999	1,1	79°38.681988 N	018°32.248650 E	315,57	1,3	3,5	14,4	91,4	313,4	232
HHUMLT24	05.07.2024	09:03:18	6026,615	Triangular dredge STOP	999	1,9	79°39.539958 N	018°28.818865 E	298,95	1,7	3,7	11,1	85,3	312,6	230
HHUMLT24	05.07.2024	18:46:11	6099,577	Net WP2 START	1000	0,4	78°52.361908 N	022°34.466959 E	127,32	1,2	2,5	3,5	89,1	223,2	63
HHUMLT24	05.07.2024	18:59:01	6099,705	Net WP2 STOP	1000	0,6	78°52.386573 N	022°34.084462 E	127,24	1	2,2	3,1	90,3	240,8	59
HHUMLT24	05.07.2024	19:00:53	6099,714	Box core (BC)	1001	0,4	78°52.377867 N	022°34.078333 E	127,09	1,1	2,4	2,9	90,5	243,6	59
HHUMLT24	06.07.2024	12:09:39	6278,318	Net WP2 START	1002	0,2	76°06.771266 N	024°54.563544 E	80,43	2,3	2	12,4	90	26,3	216
HHUMLT24	06.07.2024	12:16:34	6278,382	Net WP2 STOP	1002	0,6	76°06.745776 N	024°54.323001 E	80,13	2,2	2,1	11,8	92	21,9	164
HHUMLT24	07.07.2024	06:24:43	6474,598	Net WP2 START	1003	1,2	72°53.377538 N	022°58.263872 E	403,36	8,8	8,3	10,2	94,1	195,2	285
HHUMLT24	07.07.2024	06:56:06	6474,988	Net WP2 STOP	1003	1,1	72°53.746238 N	022°57.920980 E	405,72	8,7	8,3	8,9	89,7	181,7	406

HHUMLT24	07.07.2024	06:58:08	6475,014	Net WP2 START	1004	0,5	72°53.765768 N	022°57.862140 E	405,59	8,8	8,2	9,4	89,5	185	368
HHUMLT24	07.07.2024	07:05:13	6475,117	Net WP2 STOP	1004	1,4	72°53.853096 N	022°57.678180 E	407,16	8,9	8,2	10,4	89,5	185,9	445
HHUMLT24	07.07.2024	07:29:10	6475,507	Box core (BC)	1005	0,9	72°54.120504 N	022°57.171476 E	407,44	8,9	8,3	9,6	90,1	181,1	525
HHUMLT24	07.07.2024	18:27:00	6570,512	Net WP2 START	1006	1,3	71°20.626021 N	023°14.773550 E	393,48	10,1	10	3,6	82,5	295,8	280
HHUMLT24	07.07.2024	18:38:22	6570,562	Net WP2 STOP	1006	0,7	71°20.662735 N	023°14.853692 E	392,52	9,8	10,1	2,6	80,7	286,5	225
HHUMLT24	07.07.2024	18:41:59	6570,591	Box core (BC)	1007	0,5	71°20.687256 N	023°14.902492 E	392,28	9,8	9,9	2,3	80,1	293,8	225
HHUMLT24	08.07.2024	06:09:41	6661,277	Net WP2 START	1008	0,3	70°13.804459 N	021°46.164065 E	184,22	9,6	12,5	8,1	86,2	325,8	53
HHUMLT24	08.07.2024	06:28:16	6661,355	Net WP2 STOP	1008	0,3	70°13.812517 N	021°46.319448 E	184,22	9,6	12,3	7	85,5	316,3	54
HHUMLT24	08.07.2024	06:28:44	6661,357	Net WP2 START	1009	0,3	70°13.814743 N	021°46.322751 E	184,19	9,6	12,3	6,6	85,6	315,8	53
HHUMLT24	08.07.2024	06:36:57	6661,398	Net WP2 STOP	1009	0,3	70°13.852700 N	021°46.369407 E	183,08	9,6	12,2	5,9	85,1	318,9	72
HHUMLT24	08.07.2024	06:43:56	6661,465	Box core (BC)	1010	0,8	70°13.855684 N	021°46.269071 E	183,49	9,7	12,1	5,5	85,1	332,5	92
HHUMLT24	08.07.2024	07:41:59	6661,988	Gravity core (GC)	1011	0,4	70°13.867008 N	021°46.054594 E	179,99	10,1	11,8	2	83,7	18	108
HHUMLT24	08.07.2024	08:12:00	6662,476	Gravity core (GC)	1012	0,5	70°13.791585 N	021°46.167229 E	183,81	10,3	12,3	2,3	79,9	303,5	250
HHUMLT24	08.07.2024	09:01:12	6665,005	Gravity core (GC)	1013	0,1	70°16.029349 N	021°45.138660 E	209,32	11,1	12,2	3,9	76,3	252,2	110
HHUMLT24	08.07.2024	10:27:12	6673,562	Triangular dredge START	1014	1,7	70°20.327262 N	021°32.922920 E	47,57	10,6	11,9	3,5	70,5	220	207

HHUMLT24	08.07.2024	10:36:05	6673,825	Triangular dredge STOP	1014	1,8	70°20.187810 N	021°32.260409 E	47,06	10,7	12	7,6	70	271,8	258
HHUMLT24	08.07.2024	12:07:44	6678,308	Triangular dredge START	1015	0,8	70°17.366476 N	021°22.474652 E	50,44	11,1	11,7	12,8	69,5	270,5	426
HHUMLT24	08.07.2024	12:28:30	6678,695	Triangular dredge STOP	1015	1,3	70°17.148200 N	021°21.550677 E	46,96	11,3	11,6	8,8	65,5	271,7	1152
HHUMLT24	09.07.2024	06:07:02	6746,248	Net WP2 START	1016	0,2	70°04.102028 N	020°32.961574 E	52,54	10,5	11,6	4,5	77,4	198,2	269
HHUMLT24	09.07.2024	06:15:34	6746,306	Net WP2 STOP	1016	0,6	70°04.132047 N	020°33.081461 E	52,1	10,6	11,1	5,4	78	209,6	303
HHUMLT24	09.07.2024	06:23:13	6746,361	Box core (BC)	1017	0,6	70°04.147588 N	020°33.115027 E	53,18	10,6	10,9	5,4	78	196,7	365
HHUMLT24	09.07.2024	06:48:15	6746,585	Box core (BC)	1018	0,6	70°04.235415 N	020°33.218564 E	53,36	10,8	11,3	4	74,6	191	480
HHUMLT24	09.07.2024	07:25:04	6747,018	Gravity core (GC)	1019	0,2	70°04.180599 N	020°33.193869 E	52,05	10,9	11	5,3	72,3	227,9	209
HHUMLT24	09.07.2024	08:25:01	6753,767	Net WP2 START	1020	0,5	70°02.048939 N	020°17.315872 E	427,17	10,2	10,7	8,9	73,2	271,4	165
HHUMLT24	09.07.2024	08:57:51	6754,178	Net WP2 STOP	1020	0,8	70°01.976028 N	020°18.434283 E	420,57	9,8	10,5	4,2	79	275,5	144
HHUMLT24	09.07.2024	09:06:30	6754,268	Gravity core (GC)	1021	0,5	70°01.945118 N	020°18.529368 E	420,99	10	10,5	3,3	76,8	261,7	175
HHUMLT24	09.07.2024	10:45:31	6755,856	Box core (BC)	1022	1,1	70°02.202638 N	020°16.521777 E	434,88	10,2	10,8	10,7	74,5	280,8	342