the Nansen LEGACY

Polar cod connectivity cruise 2022

Cruise Report

The Nansen Legacy Report Series 37/2023

Polar cod connectivity cruise 2022

Cruise 2022114

R/V G.O Sars

Longyeabyen-Tromsø

12 November – 21 November 2022

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CONTENT

SUMMARY

The Nansen Legacy Polar Cod Connectivity cruise aimed at unravelling polar cod and capelin population connectivity and relation to the physical and chemical environment in Svalbard's fjords. The main focus areas were Isfjorden, Kongsfjorden, Storfjorden and the South-East of Svalbard. A total of 36 stations were visited to collect of information on polar cod and capelin vertical and horizontal distribution (using echosounder, pelagic and bottom trawls), their population, life cycle and size structure (observation of maturity, otoliths reading and genetic sampling), as well as their diet (stomachs content, sampling of benthic/planktonic prey). Other studies were conducted in link with the objectives of the research foci RF2 The Human Impacts and RF3 The Living Barents Sea. The cruise was also an opportunity to visit well-known monitoring stations to complete already long time series and investigate seasonal variability.

The cruise started November 12th in Longyearbyen and ended in Tromsø on November 22nd, 2022. The first two days and a half were spent on multidisciplinary sampling in thirteen stations distributed in contrasted areas inside Isfjorden. A rockhopper gear strapping was installed after the first bottom trawl to avoid mud and rocks and kept for the whole cruise. There were some difficulties also with the grab which did not always close. It was possible to spend one day sampling Kongsfjorden, thanks to relatively good weather and low sea-ice conditions. However, the presence of cables on the seafloor and irregular and unsuitable bottom types in that fjord did not allow for bottom trawling to sample demersal and benthic communities. After approximately one day of steaming south in good weather conditions, the sampling continued in Storfjorden. However, the shallowest stations north of Storfjorden and on the way out of the fjord towards the South-East of the archipelago could not be sampled due to time constraints and difficult navigational access. Finally, five multidisciplinary stations could be sampled in the South-East of Svalbard before the two-days transit to Tromsø. Overall, most stations were visited. Polar cod largest fish were maturing, but not mature. Further analyses of the samples should unveil potential genetic differences across the fjords, and image analyses of plankton net samples will be able to detect if there were already eggs in the water column at the beginning of the dark season. There was very little signal on the echosounder during most of the cruise, but the extractive sampling revealed a diversity of communities in the different fjords.

INTRODUCTION

SCIENTIFIC GOALS AND ACHIEVEMENTS

The Nansen Legacy Polar Cod Connectivity cruise on the research vessel R/V G.O. Sars investigated the connectivity of polar cod and capelin population and their environment. It addressed objectives of the Nansen Legacy Research Foci RF1: the Physical drivers and RF3: the living Barents Sea by characterising the environmental and ecological conditions in early winter in the western and southern Svalbard fjords, and the Research Focus RF2: the Human impacts, through the investigation of ocean acidification and water chemistry in the fjords and through the study of the link between environmental conditions and population connectivity. Whole-ecosystem data were collected at multidisciplinary stations and provided rich background characterisation for the main focus on fish population connectivity, and also supported other important Nansen Legacy monitoring, studies and experiments. Despite some technical issues with the gears and a reduced scientific crew due to Covid, the cruise successfully sampled most of the planned stations, including long-term monitoring sites.

BRIEF DESCRIPTION OF THE ACTIVITIES

The cruise lasted for nine days between the 12th and 21st of November 2022. Two days of steaming had to be set aside to join Tromsø, so the sampling plan covered seven days. Two days were dedicated to sampling in Isfjorden, one in Kongsfjorden and three in Storfjorden and South-East of Svalbard (Figure 1, Table 1). The rest of the available time was mainly taken up by the steaming time from one fjord to another. The scientific crew of 25 was reduced by three before the start of the cruise because of COVID. The sampling plan had to be adapted accordingly. Three more people left the boat after 48h, as planned, once the main stations in Isfjorden were done. For the rest of the cruise, the scientist team was thus composed of 22 people, mainly master students, PhDs and Postdocs.

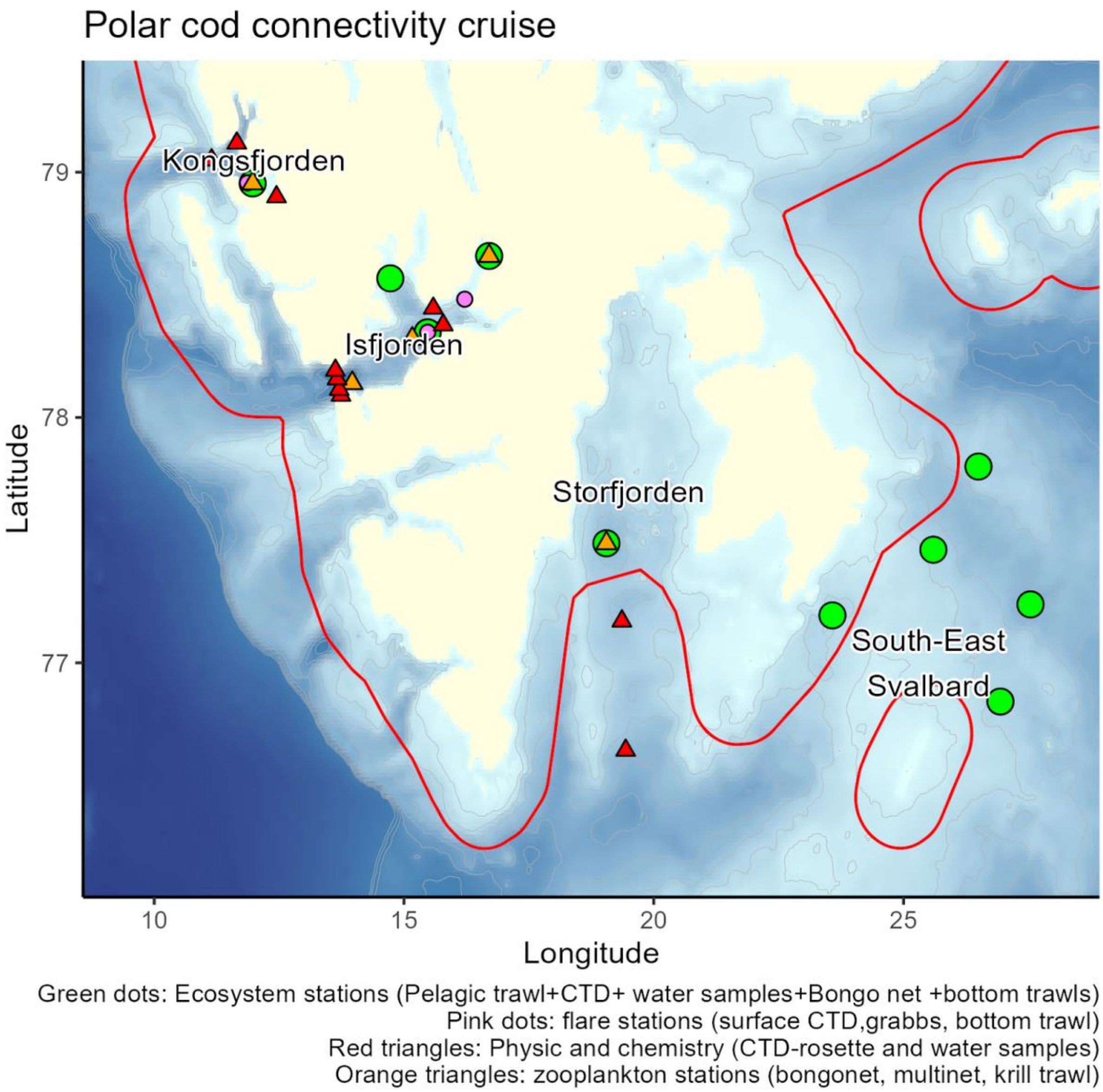

Figure 1: *Stations sampled during the Polar cod connectivity cruise in November 2022 from Longyearbyen to Tromsø. Red line indicates the 12 nm border.*

Table 1: *Stations sampled during the Polar cod connectivity cruise in November 2022 from Longyearbyen to Tromsø. Gear used and their serial number is indicated as columns for each station. Depth is the rounded average depth at the station in meters.*

Date start	Time	Location	Station name	Latitude	Longitude	Pelagic trawl	CTD + water	Bongonet	Multinet	Grabs	Krill trawl	Bottom trawl	Depth
12/11/2022	12:44:07	Isfjorden	EcoSt1[Flare1]	78° 20.8423' N	15° 28.4288' E	464	402	3269		20-21-22-23-24	465	466	227
	21:43:52	Isfjorden	IsK	78°19.236'N	15°9.933'E			3270	380-381				279
13/11/2022	00:03:17	Isfjorden	Transect1o	78° 26.7' N	15° 35.16' E		403						144
	00:59:06	Isfjorden	Transect2o	78° 22.62' N	15° 47.1' E		404						174
	02:52:53	Billefjord	EcoSt2[BAB]	78°39.485	16°42.235	467	405-406	3271-3272-3273	382-383-384	25-26-27-28-29	468	469	195
	13:02:07	Billefjord	Flare2	78° 28.92' N	16° 12.96' E		407			30-31-32		470	181
	20:56:43	Nordfjord	EcoSt3	78° 34.02' N	14° 43.56' E	471	408-409	3274-3275				472	110
14/11/2022	11:11:03	outer Isfjorden	Flare3	78° 11.2902' N	14° 11.5082' E		410			33-34		473	154
	14:32:46	outer Isfjorden	IsG-failed	78°8.359'N	13°57.840'E		411						305
	15:19:22	outer Isfjorden	Transect3o	78° 5.4' N	13° 44.28' E		412						93.6
	15:55:18	outer Isfjorden	Transect4o	78° 6.84' N	13° 42.18' E		413						301
	16:50:30	outer Isfjorden	Transect5o	78° 9.42' N	13° 39.66' E		414						401.2
	17:48:48	outer Isfjorden	Transect6o	78° 11.52' N	13° 37.56' E		415						95.8
	18:43:40	outer Isfjorden	IsG	78°8.359'N	13°57.840'E		416	3276-3277	385				305
15/11/22	07:20:06	Kongsfjorden	Transect7o	79° 2.99' N	11° 8.91' E		417						320
	08:20:57	Kongsfjorden	Transect8o	79° 7.08' N	11° 39.18' E		418						307
	10:38:11	Kongsfjorden	Transect9o	78° 53.94' N	12° 26.85' E		419						79
	14:23:24	Kongsfjorden	EcoSt5[kb3]	78° 57.24' N	11° 58.26' E	474	420	3278-3279-3280	386-387		475		331
	20:31:00	Kongsfjorden	Flares4	78° 57.39' N	11° 52.098' E		421			35-36-37			350
17/11/22	00:06:43	Storfjorden	Transect8o[7And]	76° 38.58' N	19° 26.28' E		422						195
	03:43:40	Storfjorden	Transect9o[5And]	77° 10.2' N	19° 21.72' E		423						162
	05:33:52	Storfjorden	EcoSt6[3And]	77° 29.22' N	19° 3.12' E	476	424-425	3281-3282-3283	388-389	38-39	477	478	175
	21:46:59	SE Svalbard	EcoSt7	77° 11.604' N	23° 34.56' E	479	426	3284				480	119
18/11/22	03:25:13	SE Svalbard	EcoSt8	77° 27.66' N	25° 35.82' E	481	427	3285				482	80
	08:48:46	SE Svalbard	EcoSt9	77° 48' N	26° 30' E	483	428	3286				484	116
	14:55:52	SE Svalbard	EcoSt10	77° 14.28' N	27° 32.52' E	485	429	3287		40-41-42-43-44		486	226
	21:55:59	SE Svalbard	EcoSt11			487	430	3288				488	114

The research vessel R/V G.O. Sars left Longyearbyen on November 12th, 2022, at noon, after the safety brief. One first multidisciplinary station, EcoSt1, was taken outside of Longyearbyen, in an area with flares that host chemosynthetic ecosystems (Figure 2). The bottom trawl was full of mud and the samples obtained were not representative of the catch. After this, the bottom trawl was equipped with a rockhopper gear strapping, to avoid charging it with rocks or mud. Zooplankton samples (bongonet, multinet) were then taken at a close location, on the monitoring station IsG, at the deepest point of Isfjorden. Two CTD profiles and water samples were taken at the entrance of Billefjorden (Transect1o, Transect2o), before sampling the second ecosystem station, EcoSt2, at the monitoring location "BaB". Supplementary sampling of CTD_Rosette, grabbs and bottom trawl were taken at a location nearby where flare ecosystems had previously been sampled (Flare2). The third and last ecosystem station in Isfjorden, EcoSt3, was taken in Nordfjorden during the night of the 13th to the 14th. After a stop in Longyearbyen where three people disembarked, dedicated samples for benthos, zooplankton and water chemistry and physical oceanography were taken at a flare station (Flare3), a long-term monitoring station (IsG) and in a transect at the opening of Isfjorden (Transect3o-7o, Figure 2), respectively. The echosounder was scrutinised all the time while in Isfjorden but no registration was detected. For future reference, it should be noted that the bottom trawl regularly caught large quantities of rocks and mud, even equipped with a rockhopper gear strapping.

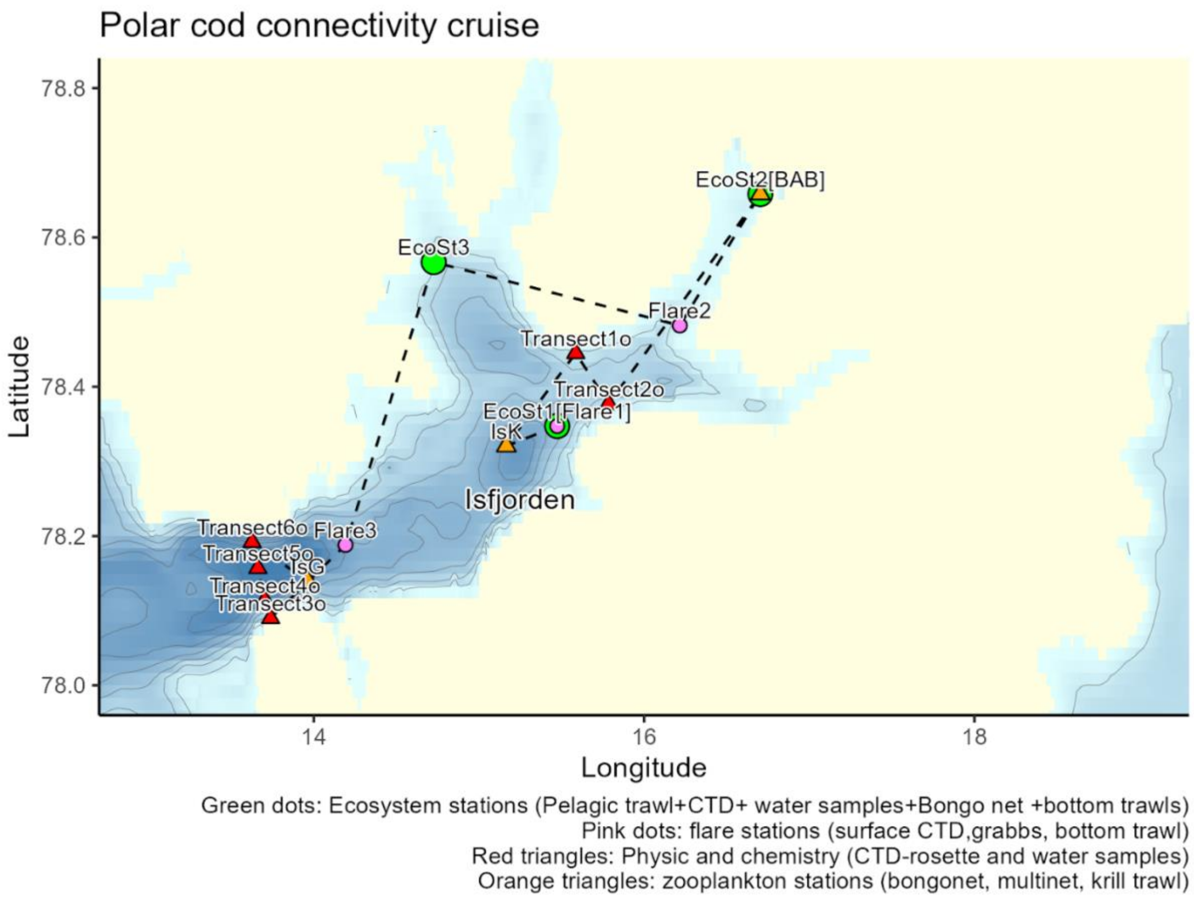

Figure 2: *Stations sampled inside Isfjorden during first two days of the Polar cod connectivity cruise in November 2022 from Longyearbyen to Tromsø. Dotted black line indicate the sailing route.*

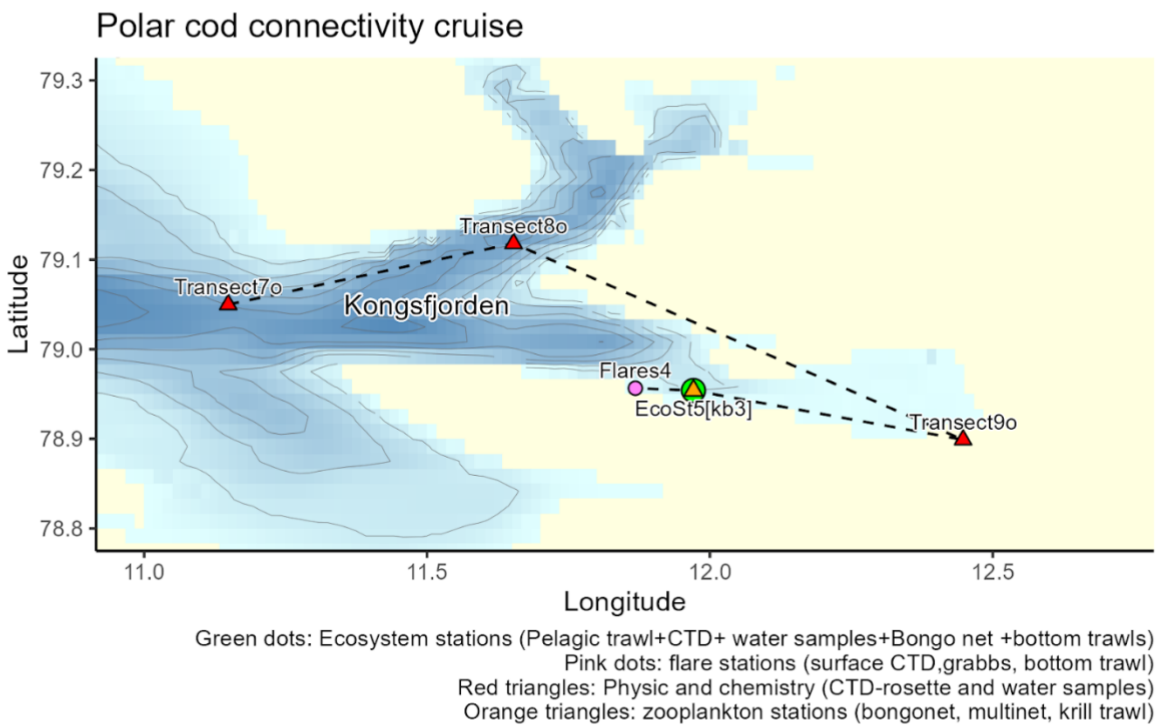

Figure 3: *Stations sampled inside Kongsfjorden during the Polar cod connectivity cruise in November 2022 from Longyearbyen to Tromsø. Dotted line indicates the sailing route.*

The steaming time to Kongsfjorden was approximately 12h and we began with CTD and water samples at three stations from the opening to the inner southern part of Kongsfjorden (Figure 3). The last CTD station (Transect9o) is situated in a remote part of the fjord where there is often ice and not easily accessed. Thankfully the ice was limited, and the sampling was thus possible. The monitoring station Kb3 (EcoSt5) was successfully sampled for water chemistry, oceanography, zooplankton, pelagic data. Two grabs were done one nautical mile away from EcoSt5, at a flare location (Flare4). Unfortunately, because of cables, irregular topography and muddy bottom types, it was impossible to do a bottom trawl in Kongsfjorden, despite looking for a suitable location for some hours. We left Kongsfjorden around midnight between the 15th and 16th of November, with only a five-hour delay.

The steaming to Storfjorden took nearly 24h. We arrived at the first and deepest station around midnight. The two first stations (Transect10o and 11o, a.k.a. the monitoring stations "7And" and "5And") were dedicated to chemical oceanography with water samples collected at higher resolution in the deeper water and at the bottom. The third station was sampled for all ecosystem components (EcoSt6[3And]). Two other ecosystem stations were originally planned North and East of EcoSt6, respectively. They were both abandoned because they were shallower than 100m (so no bottom trawl was allowed there) and to save steaming time. The second one, at the East of EcoSt6 was also difficult to access for the ship. Instead of those two stations, echosounder was scrutinised for capelin or polar cod on the way to the first station in the south-eastern part of Svalbard, EcoSt7. A school of fish was detected only when arriving close to that station, and the pelagic trawl was done on that registration.

Five ecosystem stations (EcoSt7-11) were sampled successfully in approximately 24 hours between the 17th and 18th of November in the south-eastern part of Svalbard. These stations were limited to one pelagic trawl, one CTD and water samples, one bongo net and one bottom trawl as the focus in this area was mainly on fish, and as other disciplines had less interest in sampling there.

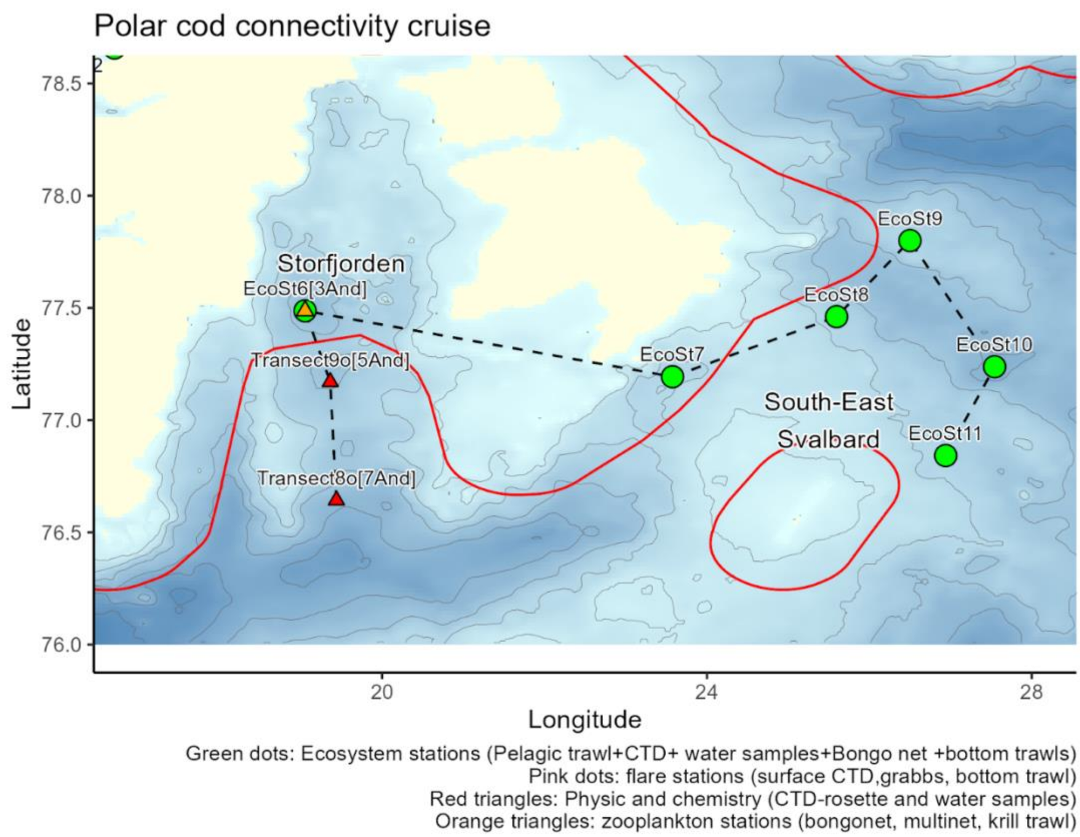

Figure 4: *Stations sampled in Storfjorden and on the shelf area South-East of Svalbard during the Polar cod connectivity cruise in November 2022 from Longyearbyen to Tromsø. Red line indicates the 12 nm border. Dotted line indicates the sailing route.*

ALONG TRACK MEASUREMENTS CARRIED OUT DURING THE CRUISE

ACOUSTIC MEASUREMENTS OF ZOOPLANKTON AND FISH WITH THE VESSEL'S EK80

G.O. Sars is equipped with six scientific Simrad EK80 echo sounders (18, 38, 70, 120, 200, 333 kHz). Backscatter profiles were scrutinized by the instrument and ship crew within each fjord and in transit from Storfjorden and South-East Svalbard, but very few schools were detected. One catch on registration was done when arriving to EcoSt7 and was a clean catch of herring juveniles.

STATION-BASED WORK

The Polar Cod connectivity cruise explored the four contrasted areas.

RESEARCH FOCI 2: HUMAN DRIVERS

TASK: 2 - 1.1. CURRENT VARIABILITY AND DRIVERS OF OCEAN ACIDIFICATION

Wanying Ji (on board), Melissa Chierici (IMR), Agneta Fransson (NPI), Elizabeth Jones (IMR)

The aim for the ocean chemistry data is to 1) trace the influence of water from the Atlantic water and the Coastal Current on the chemistry in West Spitsbergen fjords. This information is related to the water mass description, which is useful information for the polar cod distribution; 2) Storfjorden study: Investigate enhanced vertical CO2 transport to bottom water. This requires higher sampling resolution from bottom than standard depths (See Table 2); 3) obtain fall/winter data in established time series stations in Kongsfjorden and Isfjorden. Additional information from the collected data set is used to study ocean acidification state and variability and drivers (upwelling, biological processes, and water mass distribution).

Water sampling was performed from the CTD-Rosette system with 12 Niskin bottles at 22 stations (Table 2) at standard depths (Table 3a and 3b) covering the full water column. Water samples were collected for post-cruise determination of total dissolved inorganic carbon (DIC), total alkalinity (AT), nutrients (nitrate, nitrite, phosphate and silicic acid) at IMR laboratories in Tromsø and Bergen. In addition, oxygen stable isotopic ratio ($\delta^{18}O$) samples were collected on the same locations in 20 ml HDPE vials, parafilmed and stored cold and dark, and will be analysed post-cruise in the Netherlands. In total 630 samples were collected.

***Table 2.** Sampling locations and dates for water samples collected for AT, DIC, nutrients and $\delta^{18}O$*

Date	Time (UTC)	Latitude	Longitude	Bottom Depth (m)	Station Name	Local Station ID
2022-11-12	14:09:36.1470(	78.347	15.474	227	EcoSt1	402
2022-11-13	00:03:17.4880(	78.445	15.585	144	Transect1	403
2022-11-13	00:59:05.8390(	78.377	15.785	174	Transect2	404
2022-11-13	04:02:00.3500(	78.658	16.705	195	EcoSt2	405
2022-11-13	22:17:10.8200(	78.567	14.726	106	EcoSt3	408
2022-11-14	15:19:22.2790(	78.090	13.739	94	Transect3	412
2022-11-14	15:55:17.6210(	78.114	13.703	301	Transect4	413
2022-11-14	16:50:29.6360(	78.157	13.660	405	Transect5	414
2022-11-14	17:48:47.7220(	78.188	13.631	96	Transect6	415
2022-11-14	18:43:40.0890(	78.139	13.964	305	EcoSt4 (ISG)	416
2022-11-15	07:20:05.8410(	79.050	11.150	320	Transect 7	417
2022-11-15	08:20:57.4630(	79.119	11.656	307	Transect 8	418
2022-11-15	10:38:11.0960(	78.899	12.445	80	Transect 9	419
2022-11-15	15:47:39.8460(	78.954	11.970	332	EcoSt5(KB3)	420
2022-11-17	00:06:43.4230(	76.640	19.438	195	Transect8 (7Ar	422
2022-11-17	03:43:40.0640(	77.170	19.361	163	Transect9 (5Ar	423
2022-11-17	06:45:41.1430(	77.487	19.051	176	EcoSt6 (3And)	424
2022-11-17	23:09:15.8100(	77.193	23.577	120	EcoSt7	426
2022-11-18	04:23:45.2770(	77.392	24.985	78	EcoSt8	427
2022-11-18	10:03:15.2780(	77.800	26.504	116	EcoSt9	428
2022-11-18	16:06:47.8930(	77.238	27.540	226	EcoSt10	429
2022-11-18	23:10:51.0180(	76.775	26.799	114	EcoSt11	430

Table 3: *The standard depths for water sampling in general (a, left) and in Storfjorden (b, right)*

STANDARDYP

Vh.nr.								
12								5
11							5	10
10						5	10	20
9					5	10	20	30
8				5	10	20	30	50
7			5	10	20	30	50	75
6		5	10	20	30	50	75	100
5	5	10	20	30	50	75	100	125
4	10	20	30	50	75	100	125	150
3	20	30	50	75	100	125	150	200
2	30	50	75	100	125	150	200	250
1	50	75	100	125	150	200	250	300

Vh.nr.						
12		5	5	5	5	5
11		10	10	10	10	10
10	5	20	20	20	20	20
9	10	30	30	50	50	50
8	20	50	50	75	75	100
7	30	75	75	125	100	150
6	50	125	125	100	150	200
5	75	100	100	150	200	250
4	bot-20 m	bot-20 m	bot-20 m	bot-20 m	bot-20 m	bot-20 m
3	bot-15m	bot-15m	bot-15m	bot-15m	bot-15m	bot-15m
2	bot-10m	bot-10m	bot-10m	bot-10m	bot-10m	bot-10m
1	100 Bot-3m	125 Bot-3m	150 bot-3m	200 bot-3m	250 bot-3m	300: bot-3 m

TASK: 2- 3.3 QUANTIFICATION OF THE SENSITIVITY TO OCEAN ACIDIFICATION FOR DIFFERENT SPECIES AND LIFE-STAGES OF CALANUS SPP.

Tipping points in overwintering Calanus glacialis in the face of ocean acidification and warming.

Mathieu Lutier (UiO), James A. Orr (University of Oxford), Samuel Macaulay (University of Oxford), Janne E. Søreide (UNIS), Sam Dupont (GU), Michelle C. Jackson (University of Oxford), Ketil Hylland (UiO), Katrine Borgå (UiO), Khuong Van Dinh (UiO)

Human activities are inducing extremely rapid ocean acidification and warming that could exceed tipping points of marine species, beyond which small environmental changes impact individual fitness. This is particularly the case in the Arctic where environmental changes are the fastest on earth. Copepods of the *Calanus* genus represent the largest zooplankton biomass in Arctic and therefore play a major role in the functioning of Arctic food webs. Their success is closely linked to their ability to survive extreme winter conditions by reducing their metabolism to a minimum termed diapause. The induction of this mechanism remains little known and could be impacted by ocean acidification and warming, but this has not yet been investigated. Here, we will expose Arctic *Calanus* copepods to 16 pH conditions and two temperatures to determine if there is a pH tipping point in the induction of diapause and if it is influenced by temperature. This experiment was conducted during short-term exposure on the research vessel G.O. Sars in November 2022 to be close to the overwintering field conditions. This will then be supplemented by a longer-term exposure after bringing the copepods back to the laboratory at the University of Oslo. Key overwintering parameters such as survival, respiration and polar and neutral lipid classes will be investigated. This approach will provide important insights into how physiological tipping points evolve in multi-stressor environments and which environmental cues induce diapause.

Samples: Live copepods collected in Billefjord (BAB station), November 13, 2022 at 5:20 a.m. with Bongo net (180μm).

- 400 copepods were exposed on board for 5 days to 16 pH conditions (pH 8.0 to 6.5) and two temperatures (0˚C and 4˚C).
- 2000 copepods were brought back to Oslo for long-term exposure to ocean acidification and warming under more controlled conditions.

TASK: 2-3.1 CLIMATE CHANGE AND FISHERIES: SPATIAL ENVIRONMENTAL VARIABLES AND GENOMICS

Marius F. Maurstad (UiO), Leif Christian Stige(UiO, Norwegian veterinarian institute), Siv Nam Khang Hoff (UiO), Sissel Jentoft (UiO)

The aim of this task is to investigate the roles of spatiotemporal population structure and possible local adaptations in three key fish species in the northern Barents Sea ecosystem: The Northeast Arctic population of the Atlantic cod *(Gadus morhua*), capelin *(Mallotus villosus*) and polar cod (*Boreogadus saida*). If local adaptations are important for population dynamics and responses to climate change, it may be necessary to revisit the management of fisheries in order to maintain intact spatial and genetic structure. For this purpose, individual samples of these species will be collected at transect cruises in summer and winter for whole-genome sequencing. We will also include samples of the same species collected in associated projects at other locations, such as at their spawning grounds. From these data, we aim to characterise the population substructure(s) for each of the species, as well as identify signatures of directional selection, for instance, as a result of temperature adaptations. In addition to spatial structure, we will assess possible temporal structure linked to seasonal partitioning of habitat use. During this research cruise onboard RV G.O. Sars, we collected tissue samples of the polar cod, capelin, and Northeast Arctic cod in the fjords of Svalbard to investigate intraspecific connectivity. Samples were specifically collected from eco-stations in Isfjorden, Kongsfjorden, Storfjorden and East of Svalbard (See Table 4 for samples taken at each eco-station).

Table 4*: Counts of the three different fish species sampled per station.*

	Species		
Station	*Boreogadus saida*	*Mallotus villosus*	*Gadus morhua*
EcoSt1	25	10	0
EcoSt2	25	10	0
Flare2	0	10	10
EcoSt3	10	0	0
Flare3	10	0	0
EcoSt5[Kb3]	19	23	8
EcoSt6[3And]	48	0	0
EcoSt7	18	12	9
EcoSt9	0	21	6
Ecost10	13	6	0
Total	168	92	33

For sampled fish, a tissue sample was taken for whole-genome DNA sequencing (approx. 20x coverage). Tissue samples consisted of either gill and/or fin clip for polar cod, gill and/or fin clip for (capelin), and spleen or fin clip for Northeast Arctic cod. Samples were taken for RNA sequencing from the spleen of most polar cod (including gonads for a few samples) and Northeast Arctic cod, as well as the liver of some capelin. Gut samples from some polar cod were taken for metagenomic sequencing. Additionally, otoliths were collected for all fish except capelin to determine the age. Metadata was recorded for all sampled fish and included the following parameters: fork length, total length, total weight, sex, maturation stage and presence of ecto/endoparasites.

RESEARCH FOCI 3: THE LIVING BARENTS SEA

TASK: 3-1.1: CHARACTERIZE BIOLOGICAL COMMUNITIES IN SYMPAGIC, PELAGIC AND BENTHIC REALMS IN THE NORTHERN BARENTS SEA AND ADJACENT SLOPE IN TERMS OF BIODIVERSITY, ABUNDANCE, BIOMASS AND DISTRIBUTION PATTERNS AND 2.1: DESCRIBE SEASONALITY IN COMMUNITY COMPOSITION AND LIFE CYCLE STAGES AT DIFFERENT TROPHIC LEVELS 4.2 TROPHIC ECOLOGY OF KEY ZOOPLANKTON

MESOZOOPLANKTON

Michael Lemke (UNIS), Janne Søreide (UNIS)

The goal of my project is to investigate the variability in *Calanus* populations in fjords of Svalbard. Because of their importance to the food web, it is important to understand the life cycles and distribution of *Calanus* spp. In particular, the project is looking at *Calanus finmarchicus* and *Calanus glacialis*. *Calanus* were collected using a 180 μm mesh MultiNet from four main stations during the cruise: ISK (Isfjorden), BAB (Billefjorden), KB3 (Kongsfjorden), and SF (Storfjorden). ISK, BAB, and KB3 stations are part of a time series that increase their value as chosen targets, and Storfjorden was included as part of a previous cruise in September. At each station, plankton samples were collected and examined at surface and bottom depths to see where the *Calanus* are in their life cycle. From the samples, individual *Calanus* would be imaged with a stereomicroscope to later analyse lipid content and prosome size. These imaged *Calanus* were then frozen to later be confirmed as either *C. finmarchicus* or *C. glacialis* by molecular techniques.

In addition, samples were collected from Bongo Nets with a 180 and 64 μm mesh. These will be analysed with metabarcoding techniques and for community composition as part of separate projects. The following samples were collected:

Table 5: *Counts of individuals sampled per station and per analysis.*

Station	Calanus individuals for imaging and molecular workup	Samples for Community Analysis	Samples for Metabarcoding	Biomass
ISK Flare	-	1	1	-
ISK	115	7	2	2
BAB	154	6	2	2
Nordfjorden	-	1	1	1
ISA	-	1	1	1
ISG	123	7	2	2
KB3	135	7	2	2

SF	135	6	2	2
EcoSt7	-	1	1	1
EcoSt8	-	1	1	1
EcoSt9	-	1	1	1
EcoSt10	-	1	1	1
EcoSt11	-	1	1	1

The copepods were much more abundant in the deeper layers as they descend to overwinter. As a result, few individuals were obtained from the surface layers. There appears to be some variation in antennae colour and life stage frequency distribution, with Billefjorden having the palest antennae and Storfjorden the highest number of adult males and adult females. Time will tell the species, lipid, and size frequency distribution between the fjords.

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MACROZOOPLANKTON

Andreas Lunde (UNIS), Janne Søreide (UNIS)

The aim of this cruise was to use the krill trawl to get a better understanding of the microzooplankton, and in particular the krill community during the early polar night across different Svalbard fjords. The four stations IsK, BAB, KB3 and SF were chosen due to my own previous samples and the time series in several of these fjords.

At each station the krill trawl was trawled down to 10m above sea bottom before returned. Each sample was reviewed for subsampling and then fish and large jellyfish were removed. The rest was divided between a sample for species determination on board, a sample preserved in formalin and a sample preserved frozen. The sample on board was subsampled until the species composition of the sample was considered to be estimated to a reasonable level and around 30 individuals of the dominant species was length measured. Afterwards the rest of the sample was looked through for rare species. The measured individuals were dried at 60 degrees and will be weighed after returning to UNIS. Individuals that were not determined to species level was preserved in ethanol and will be reviewed at UNIS. Individuals too damaged to identify to species level was determined to highest taxa. Frozen and formalin preserved samples will be used for calorimetry, and further species counts and length measurements.

This is a list of the samples I will bring to UNIS:

Table 6: *List of macrozooplankton samples and their preservation method.*

Count	Trawl	Content	Preservation
1	Krill trawl Isk	Unknown Amphipod	Ethanol
2	Krill trawl BAB	7 undetermined *H.galba/H.medusarum*	Ethanol
3	Krill trawl BAB	Unknown mysiid	Ethanol
4	Krill trawl BAB	Community sample	Formalin
4	Krill trawl BAB	Community sample	Frozen
5	Krill trawl BAB	*T.libellula*	Dried
6	Krill trawl BAB	*M.norvegica*	Dried
7	Krill trawl BAB	Mysiids	Dried
8	Krill trawl BAB	*T.abyssorum*	Dried
9	Krill trawl BAB	*T.inermis*	Dried
10	Krill trawl BAB	*T.raschii*	Dried
11	Krill trawl KB3	Community sample	Formalin
12	Krill trawl KB3	Community sample	Frozen
13	Krill trawl KB3	Unknown amphipod	Ethanol
14	Krill trawl KB3	Undetermined H.galba/H.medusarum	Ethanol
15	Krill trawl KB3	*T.inermis*	Dried
16	Krill trawl KB3	T.raschii	Dried
17	Krill trawl KB3	*M.norvegica*	Dried
18	Krill trawl KB3	*T.abyssorum*	Dried
19	Krill trawl KB3	*T.libellula*	Dried
20	Krill trawl KB3	Chaetognaths	Dried
21	Krill trawl SF	Community sample	Frozen
22	Krill trawl SF	Community sample	Formalin
23	Krill trawl SF	Unknown Amphipod #1	Ethanol
24	Krill trawl SF	Unknown Amphipod #2	Ethanol
25	Krill trawl SF	Unknown Amphipod #3	Ethanol
26	Krill trawl SF	Undetermined H.galba/H.medusarum	Ethanol
27	Krill trawl SF	*T.inermis*	Dried
28	Krill trawl SF	*T.raschii*	Dried
29	Krill trawl SF	*M.norvegica*	Dried
30	Krill trawl SF	*C.limacina*	Dried
31	Krill trawl SF	*T.abyssorum*	Dried

Observations: Based on the samples so far it appears *Meganyctiphanes norvegica* was the most common species in the IsK sample, while in the other fjords *Thysanoessa inermis* and *Thysanoessa raschii* appeared to be the most found in the samples.

GELATINOUS ZOOPLANKTON

Gitte Krohn-Pettersen (NTNU), Sana Majaneva (NTNU)

This part of the work was connected to Nansen Legacy RF3 – The living Barents Sea, where Sanna Majaneva is working on the gelatinous zooplankton of the Barents Sea. Many of these gelatinous species are bioluminescent, producing and emitting of light by living organisms, and their bioluminescent properties were measured during this cruise by Gitte Krohn-Pettersen as a part of her master thesis. The aim was to collect ctenophores, hydrozoans and other potentially bioluminescent zooplankton, to investigate if they actually are bioluminescence and what kind of bioluminescence do different zooplankton species produce. This data would then be added to a dataset used for estimating whether bioluminescent fingerprints can be used as a tool for species identification. In the procedure, the specimens were collected by bongo- or multinet, and then sorted out. Individuals of different species were then run one by one through the UBAT (Underwater Bioluminescence Assessment Tool) to measure the flash kinetics of their bioluminescence. Unfortunately, the collected samples did not contain much bioluminescent species. Bioluminescent specimens were mainly copepods of species *Metridia Longa*. Some ctenophores were also present in the samples but due to flaws in the handling procedure they were not preserved in a condition adequate to flash kinetics measurements.

Below is an overview of the samples collected.

Table 7: *Counts of bioluminescent specimens sampled per station.*

Station	Specimens collected	Species
ISK	42 species	*Metridia Longa*
EcoSt2(BAB)	15 species	*Metridia Longa*
EcoSt6(3And)	33 species	*Metridia Longa*

The collected samples contained also other copepods, for example of genus *Calanus*, but these were not bioluminescent.

TASK: 1.1: CHARACTERIZE BIOLOGICAL COMMUNITIES IN SYMPAGIC, PELAGIC AND BENTHIC REALMS IN THE NORTHERN BARENTS SEA AND ADJACENT SLOPE IN TERMS OF BIODIVERSITY, ABUNDANCE, BIOMASS AND DISTRIBUTION PATTERNS; 2.1: DESCRIBE SEASONALITY IN COMMUNITY COMPOSITION AND LIFE CYCLE STAGES AT DIFFERENT TROPHIC LEVELS 3-4.3: TROPHIC LINKS TO FISH AND MAMMALS

E. Eriksen, S. Karlson, B. Husson and E. Boge (IMR)

Fish communities were investigated by trawling in the pelagic layer (0-60m) and near the bottom (5 metre above the seabed). Totally, 22 fish species were identified to species level and some fishes were identified to family's level (Table 8)

Table 8: *Counts of the three different fish species sampled per station.*

Trawl serie nr	3601	3602	3603	3604	3605	3606	3607	3608	3609	3610	3611	3612	3613	3614	3615	3616	3617	3618	3619	3620	3621	3622	3623	3624	3625
Amblyraja radiata							x																		
Anisarchus medius																			x						
Benthosema	x																								
Boreogadus saida	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x
Careproctus										x															
Clupea harengus	x	x	x	x	x		x	x		x	x	x	x			x	x	x	x	x				x	x
Cyclopterus lumpus																								x	
Eutrigla gurnardus																				x	x				
Gadus morhua	x	x	x	x	x		x	x	x		x	x	x	x		x	x	x	x		x		x	x	x
Hippoglossoides platessoides			x				x		x	x							x		x		x		x		x
Leptagonus decagonus							x			x					x		x		x		x				x
Leptoclinus maculatus		x	x	x	x		x			x									x						
Liparis bathyarcticus						x																			
Lumpenus lampretaeformis							x																		
Lycodes																					x				x
Lycodes pallidus															x				x						
Lycodes seminudus							x																		
Mallotus villosus	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
Melanogrammus aeglefinus	x	x		x			x	x			x		x	x		x	x	x	x	x				x	
Myoxocephalus scorpius											x										x				
Paraliparis bathybius						x															x				
Pollachius virens								x			x		x												
Rajidae										x															
Reinhardtius hippoglossoides		x					x	x				x											x	x	
Sclerocrangon							x																		
Sebastes			x														x	x	x	x	x			x	
Sebastes mentella																							x		
Stichaeidae						x			x		x	x	x	x			x				x				x

In total, 2 385 fish were length measured, 718 weight measured, sex was identified of 187 specimens. In addition to fish trawl catches includes also jellyfish, euphausiids (*Meganyctiphanes norvegica* and *Thysanoessa inermis*), and shrimps (*Pandalus borealis*, *Sclerocrangon*, and Dendrobranchiata). Other benthos organisms will be reported below in Benthos section.

TASK: 3-1.1 CHARACTERIZE BIOLOGICAL COMMUNITIES IN SYMPAGIC, PELAGIC AND BENTHIC REALMS IN THE NORTHERN BARENTS SEA AND ADJACENT SLOPE IN TERMS OF BIODIVERSITY, ABUNDANCE, BIOMASS AND DISTRIBUTION PATTERNS, T3-1.2, AND T3-4.4 SYMPAGIC-PELAGIC-BENTHIC COUPLING

Arunima Sen (UNIS), Annemijn Sandig (UNIS), Nil Rodes (UNIS), Victor Gonzalez-Triginer (UNIS)

The benthos team had two main goals for the cruise. First was to collect sediment infauna with Van Veen grabs for sediment community analyses, and specifically to compare benthic communities at flare locations and non-flare locations. The second goal was to use the benthic trawl to collect animals from both flare and non-flare locations for stable isotope analyses to understand the food web and to identify the contribution, if any, of chemosynthetically fixed carbon. Sediment surface samples were also collected to quantify sediment parameters such as grain size, and total organic carbon and to quantify photosynthetic material through measurements of chlorophyll and phaeopigments. Niskin water samples were collected as well to get baseline carbon and nitrogen isotope ratios for photosynthetic material (POC).

Below is an overview of the samples collected from the different stations:

Table 9: *Samples collected with grabs and bottom trawl at each station.*

Station	POC samples	Grabs and sediment samples	Animals from trawl
EcoSt 1	3 replicates (3L)	1 replicate	14 taxa
EcoSt 2	3 replicates (3L)	2 replicates	27 taxa
Flare 2	3 replicates (3L)	2 replicates	36 taxa
Flare 3	3 replicates (3L)	2 replicates	21 taxa*
Flare 4	3 replicates (3L)	2 replicates	Could not trawl
EcoSt 6	3 replicates (3L)	2 replicates	50 taxa+
EcoSt 7	3 replicates (3L)	2 replicates	50 taxa
EcoSt 8	0	0	2 taxa¤
EcoSt 9	0	0	16 taxa¤
EcoSt10	3 replicates (3L)	2 replicates	50 taxa

** VERY muddy sediment, crew had to suspend and wash the trawl in water for a few hours before the catch was brought on deck. Too muddy and large to work with, only two buckets were rinsed and sorted for animals and fish.*

+ Highly dominated by bivalves.

¤ Did not process trawl, fish group saved some iconic taxa for us (too many trawls in a short amount of time, beyond our capacity to fully process all trawls).

Based on the sampling, it appears that the benthos in Storfjorden contains larger sized animals on average, than Isfjorden and Kongsfjorden, though this needs to be confirmed with systematic analyses and characterization. Storfjorden also contained many interesting taxa such as *Gorgonocephalus* (Medusa head ophiuroids) and large isopods.

TASK: 3-1.1 1.1 CHARACTERIZE BIOLOGICAL COMMUNITIES IN SYMPAGIC, PELAGIC AND BENTHIC REALMS IN THE NORTHERN BARENTS SEA AND ADJACENT SLOPE IN TERMS OF BIODIVERSITY, ABUNDANCE, BIOMASS AND DISTRIBUTION PATTERNS

Kim Præbel, Jacob Christensen (UiT Research Group for Genetics (RGG))

The RGG group's main priority was the collection of *Ctenodiscus crispatus* and *Pandalus borealis* for investigation into their potential use as eDNA reservoirs. Secondary and tertiary priorities were the sampling of genetic material from a Greenland shark (should one be caught in a trawl), and the collection of whole benthic fishes for use in Jacob's PhD. No Greenland shark was caught, so only primary and tertiary priorities were executed on the cruise.

Both bottom and pelagic trawls were used to collect samples.

Some trawls were deemed too contaminated to use in the eDNA protocol due to time spent on the bench, muddy sediment, etc.

The benthic team was given priority when taking any samples from bottom trawls. Below is an overview of the samples collected:

***Table 10**: Samples collected at each station.*

Station	Trawl Type	Bottom Depth (m)	Lat	Long	UUID	Date	Time	Taxon	Count
EcoSt1	pelagic	259.05	78.3403	15.2958	b27da880-6287-11ed-a0d0-bdaa9931fd94	12.11.2022	12:44	Pandalus borealus	10
EcoSt3	bottom	114.85	78.5558	14.7710	865e4ab0-63aa-11ed-a0d0-bdaa9931fd94	13.11.2022	23:25	Pandalus borealis	30
EcoSt3	pelagic	136.255	78.5305	14.8974	ad6137e0-6395-11ed-a0d0-bdaa9931fd94	13.11.2022	20:56	Sclerocrangon	10
EcoSt3	Bottom	114.85	78.5558	14.7710	865e4ab0-63aa-11ed-a0d0-bdaa9931fd94	13.11.2022	18:04	Ctenodiscus crispatus	2
Flare 3	bottom	222.555	78.1713	14.3109	ebf8feb0-6418-11ed-a0d0-bdaa9931fd94	14.11.2022	12:36	Pandalus borealis	30
Flare 3	bottom	222.555	78.1713	14.3109	ebf8feb0-6418-11ed-a0d0-bdaa9931fd94	14.11.2022	12:36	Ctenodiscus crispatus	15
EcoSt5	pelagic	350.96	78.9584	11.8787	1018cc70-64f1-11ed-a0d0-bdaa9931fd94	15.11.2022	14:23	Pandalus borealus	25
EcoSt5	pelagic	350.96	78.9584	11.8787	1018cc70-64f1-11ed-a0d0-bdaa9931fd94	15.11.2022	14:23	Sculpin	1
EcoSt7	bottom	116.93	77.1772	23.5710	53070e10-66d2-11ed-a0d0-bdaa9931fd94	17.11.2022	23:48	Ctenodiscus crispatus	20
EcoSt6	bottom	117.22	77.4621	19.0710	0dde27f0-6660-11ed-a0d0-bdaa9931fd94	17.11.2022	10:10	Ctenodiscus crispatus	10
EcoSt6	bottom	117.22	77.4621	19.0710	0dde27f0-6660-11ed-a0d0-bdaa9931fd94	17.11.2022	10:10	Sclerocrangon	10
EcoSt6	bottom	117.22	77.4621	19.0710	0dde27f0-6660-11ed-a0d0-bdaa9931fd94	17.11.2022	10:10	Mussels	20
EcoSt7	bottom	116.93	77.1772	23.5710	53070e10-66d2-11ed-a0d0-bdaa9931fd94	17.11.2022	23:48	Sclerocrangon	10
EcoSt7	bottom	116.93	77.1772	23.5710	53070e10-66d2-11ed-a0d0-bdaa9931fd94	17.11.2022	23:48	Pandalus borealus	25
EcoSt6	bottom	117.22	77.4621	19.0710	0dde27f0-6660-11ed-a0d0-bdaa9931fd94	17.11.2022	10:10	Leptoclinus	1

EcoSt6	bottom	117.22	77.4621	19.0710	0dde27f0-6660-11ed-a0d0-bdaa9931fd94	17.11.2022	10:10	Leptoclinus	1
EcoSt6	bottom	117.22	77.4621	19.0710	0dde27f0-6660-11ed-a0d0-bdaa9931fd94	17.11.2022	10:10	Leptoclinus	1
EcoSt6	bottom	117.22	77.4621	19.0710	0dde27f0-6660-11ed-a0d0-bdaa9931fd94	17.11.2022	10:10	Leptoclinus	1
EcoSt6	bottom	117.22	77.4621	19.0710	0dde27f0-6660-11ed-a0d0-bdaa9931fd94	17.11.2022	10:10	Leptoclinus	1
EcoSt10	bottom	211.405	77.1938	27.6362	2db11280-6774-11ed-a0d0-bdaa9931fd94	18.11.2022	19:07	Ctenodiscus crispatus	20
EcoSt11	bottom	114.34	76.7718	26.8391	28a49560-679b-11ed-a0d0-bdaa9931fd94	18.11.2022	23:46	Ctenodiscus crispatus	20
EcoSt10	Bottom	211.405	77.1938	27.6362	2db11280-6774-11ed-a0d0-bdaa9931fd94	18.11.2022	19:07	Eelpout	1
EcoSt10	bottom	211.405	77.1938	27.6362	2db11280-6774-11ed-a0d0-bdaa9931fd94	18.11.2022	19:07	Snailfish	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Eelpout	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Eelpout	1
EcoSt11	bottom	114.34	76.7718	26.8391	28a49560-679b-11ed-a0d0-bdaa9931fd94	18.11.2022	23:46	Eelpout	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Eelpout	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Sculpin	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Eelpout	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Sculpin	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Eelpout	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Eelpout	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Eelpout	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Snailfish	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Eelpout	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Eelpout	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Eelpout	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Sculpin	1
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Sculpin	2
EcoSt9	bottom	119.97	77.7785	26.5449	ecb370a0-672f-11ed-a0d0-bdaa9931fd94	18.11.2022	10:58	Eelpout	1
EcoSt8	bottom	115.995	77.4359	25.6786	107efb30-6708-11ed-a0d0-bdaa9931fd94	18.11.2022	06:13	Eelpout	1
EcoSt10	bottom	211.405	77.1938	27.6362	2db11280-6774-11ed-a0d0-bdaa9931fd94	18.11.2022	19:07	Eelpout	1
EcoSt10	bottom	211.405	77.1938	27.6362	2db11280-6774-11ed-a0d0-bdaa9931fd94	18.11.2022	19:07	Eelpout	1
EcoSt10	bottom	211.405	77.1938	27.6362	2db11280-6774-11ed-a0d0-bdaa9931fd94	18.11.2022	19:07	Eelpout	1
EcoSt10	bottom	211.405	77.1938	27.6362	2db11280-6774-11ed-a0d0-bdaa9931fd94	18.11.2022	19:07	Eelpout	1

SAMPLE AND DATA MANAGEMENT

Luke Marsden (UNIS)

Routines for labelling and logging of samples and metadata for Nansen Legacy were developed prior to and established during the AeN Joint Cruise 1-2 of 2018 and built upon thereafter. The essential part of this system is that all samples and datasets are labelled with a UUID, and all information about each sample is logged in an excel sheet containing all relevant metadata and standardised parameters. The UUIDs are printed on stickers that can be attached to the samples. The stickers are available in different sizes. Two label printers were set up on G.O. Sars for the first time with a virtual server on the network onboard, so that they could be accessed from both stationary and personal computers. The excel sheet used for logging of sample information is generated using an excel template generator which was made available on the same virtual server along with an excel file checker, UUID generator and relevant documentation (the labelling manual, sampling protocol v10, and lists over the gear and sample types used in the project).

Universally unique IDs (UUIDs) for the individual gear used were assigned. Metadata about the sampling activities were harvested semi-automatically from the cruise logger (Toktlogger v.1.1.2). Nansen Legacy and IMR used the same UUIDs for each activity. Additional relevant metadata were added (e.g., sample depths, station names, sampling protocols). Metadata about Niskin bottles were harvested semi-automatically from the Toktlogger and the .btl files. This information was combined in an Excel file and shared in the cruise folder so that the scientists could grab the Parent IDs for their samples and also did not individually have to acquire metadata about the gear casts. Around 109 activities were registered (Appendix 1), and almost 3897 entries were uploaded to the metadata catalogue, hosted by SIOS, after the cruise. Sample and metadata information are accessible and searchable through the SIOS webpage (https://sios-svalbard.org/aen/tools). In addition to logging information about collected samples, information about planned datasets based on data collected from the cruise was collected (Appendix 3)

COMMUNICATION AND OUTREACH

Maria Philippa Rossi (UNIS)

Maria Philippa Rossi, information advisor at UNIS and part of the communication working group of AeN, attended the meetings during the cruise preparation and was on board the first three days at sea. She interviewed the crew and took pictures of the activities. The cruise story will be part of a chapter on Nansen Legacy in popular science book.

The scientific crew also sent pictures of the trip on Instagram during the cruise. Planned outreach stories can be found under Appendix 4.

APPENDICES

APPENDIX 1: FULL STATION LIST WITH LOCATIONS AND SAMPLING GEAR (MODIFIED FROM CRUISE LOG)

Station Name	Date	Time	Latitude	Longitude	IMR station ID	PI	Gear
EcoSt1	12/11/22	12:44:07	78.3403	15.2958	464	Berengere Husson	Harstad trawl
EcoSt1	12/11/22	14:09:36	78.3467	15.4736	402	Berengere Husson	CTD w/bottles
EcoSt1	12/11/22	14:27:44	78.3467	15.4735	3269	Berengere Husson	Bongonet 180 um
EcoSt1	12/11/22	15:00:16	78.3467	15.4735	20	Berengere Husson	Box core
EcoSt1	12/11/22	15:18:34	78.3467	15.4735	21	Berengere Husson	Box core
EcoSt1	12/11/22	15:43:52	78.3467	15.4735	22	Berengere Husson	Box core
EcoSt1	12/11/22	15:58:12	78.3467	15.4736	23	Berengere Husson	Box core
EcoSt1	12/11/22	16:15:18	78.3467	15.4736	24	Berengere Husson	Box core
EcoSt1	12/11/22	17:03:04	78.3601	15.4177	465	Berengere Husson	Macroplankton trawl
EcoSt1	12/11/22	18:50:45	78.3284	15.1964	466	Berengere Husson	Campelen trawl
ISK	12/11/22	21:43:51	78.3206	15.1664	3270	Berengere Husson	Bongonet 180 um
ISK	12/11/22	22:13:38	78.3206	15.1664	380	Berengere Husson	Multinet 180 um
ISK	12/11/22	22:46:52	78.3205	15.1664	381	Berengere Husson	Multinet 180 um
Transect1o	13/11/22	0:03:17	78.4452	15.5850	403	Berengere Husson	CTD w/bottles
Transect2o	13/11/22	0:59:05	78.3771	15.7846	404	Berengere Husson	CTD w/bottles
EcoSt2	13/11/22	2:52:53	78.5932	16.4865	467	Berengere Husson	Harstad trawl
EcoSt2	13/11/22	4:02:00	78.6581	16.7052	405	Berengere Husson	CTD w/bottles
EcoSt2	13/11/22	4:15:25	78.6581	16.7052	3271	Berengere Husson	Bongonet 180 um
EcoSt2	13/11/22	4:34:21	78.6581	16.7052	3272	Berengere Husson	Bongonet 180 um
EcoSt2	13/11/22	5:02:08	78.6581	16.7053	3273	Berengere Husson	Bongonet 180 um
EcoSt2	13/11/22	5:23:03	78.6581	16.7052	406	Berengere Husson	CTD w/bottles
EcoSt2	13/11/22	5:44:07	78.6581	16.7053	382	Berengere Husson	Multinet 180 um
EcoSt2	13/11/22	6:18:13	78.6581	16.7053	383	Berengere Husson	Multinet 180 um
EcoSt2	13/11/22	6:58:25	78.6581	16.7052	384	Berengere Husson	Multinet 180 um
EcoSt2	13/11/22	7:33:00	78.6581	16.7053	25	Berengere Husson	Box core
EcoSt2	13/11/22	7:48:28	78.6581	16.7053	26	Berengere Husson	Box core
EcoSt2	13/11/22	8:06:45	78.6581	16.7053	27	Berengere Husson	Box core
EcoSt2	13/11/22	8:27:55	78.6581	16.7053	28	Berengere Husson	Box core

EcoSt2	13/11/22	8:48:38	78.6581	16.7053	29	Berengere Husson	Box core
EcoSt2	13/11/22	9:29:31	78.6472	16.6287	468	Berengere Husson	Macroplankton trawl
EcoSt2	13/11/22	10:49:19	78.6082	16.5214	469	Berengere Husson	Campelen trawl with fish lift
Flare2	13/11/22	13:02:06	78.4165	15.8136	407	Berengere Husson	CTD w/bottles
Flare2	13/11/22	15:47:32	78.4165	15.8135	30	Berengere Husson	Box core
Flare2	13/11/22	16:23:59	78.4165	15.8136	31	Berengere Husson	Box core
Flare2	13/11/22	17:07:05	78.4165	15.8136	32	Berengere Husson	Box core
Flare2	13/11/22	18:04:24	78.4105	15.7757	470	Berengere Husson	Campelen trawl with fish lift
EcoSt3	13/11/22	20:56:42	78.5305	14.8974	471	Berengere Husson	Harstad trawl
EcoSt3	13/11/22	22:17:10	78.5670	14.7259	408	Berengere Husson	CTD w/bottles
EcoSt3	13/11/22	23:25:56	78.5558	14.7710	472	Berengere Husson	Campelen trawl with fish lift
EcoSt3	14/11/22	4:02:51	78.5670	14.7261	3274	Berengere Husson	Bongonet 180 um
EcoSt3	14/11/22	6:52:33	78.2707	15.4733	409	Berengere Husson	CTD w/bottles
EcoSt3	14/11/22	7:06:56	78.2707	15.4733	3275	Berengere Husson	Bongonet 180 um
Flare3	14/11/22	11:11:02	78.1882	14.1918	410	Berengere Husson	CTD w/bottles
Flare3	14/11/22	11:26:07	78.1882	14.1918	33	Berengere Husson	Box core
Flare3	14/11/22	11:39:44	78.1882	14.1918	34	Berengere Husson	Box core
Flare3	14/11/22	12:36:11	78.1713	14.3109	473	Berengere Husson	Campelen trawl with fish lift
ISG-failed	14/11/22	14:32:45	78.1393	13.9635	411	Berengere Husson	CTD w/bottles
Transect3o	14/11/22	15:19:22	78.0896	13.7394	412	Berengere Husson	CTD w/bottles
Transect4o	14/11/22	15:55:17	78.1142	13.7028	413	Berengere Husson	CTD w/bottles
Transect5o	14/11/22	16:50:29	78.1570	13.6601	414	Berengere Husson	CTD w/bottles
Transect6o	14/11/22	17:48:47	78.1884	13.6308	415	Berengere Husson	CTD w/bottles
ISG	14/11/22	18:43:40	78.1395	13.9643	416	Berengere Husson	CTD w/bottles
ISG	14/11/22	18:59:46	78.1394	13.9643	3276	Berengere Husson	Bongonet 180 um
ISG	14/11/22	19:30:02	78.1395	13.9644	3277	Berengere Husson	Bongonet 180 um
ISG	14/11/22	19:59:52	78.1395	13.9643	385	Berengere Husson	Multinet 180 um
Transect7o	15/11/22	7:20:05	79.0496	11.1502	417	Berengere Husson	CTD w/bottles
Transect8o	15/11/22	8:20:57	79.1186	11.6564	418	Berengere Husson	CTD w/bottles
Transect9o	15/11/22	10:38:11	78.8989	12.4448	419	Berengere Husson	CTD w/bottles
EcoSt5[Kb3]	15/11/22	14:23:23	78.9584	11.8787	474	Berengere Husson	Harstad trawl
EcoSt5[Kb3]	15/11/22	15:47:39	78.9540	11.9703	420	Berengere Husson	CTD w/bottles

EcoSt5[Kb3]	15/11/22	16:01:57	78.9541	11.9705	3278	Berengere Husson	Bongonet 180 um
EcoSt5[Kb3]	15/11/22	16:45:12	78.9541	11.9706	3279	Berengere Husson	Bongonet 180 um
EcoSt5[Kb3]	15/11/22	17:17:10	78.9541	11.9706	3280	Berengere Husson	Bongonet 180 um
EcoSt5[Kb3]	15/11/22	17:47:01	78.9541	11.9706	386	Berengere Husson	Multinet 180 um
EcoSt5[Kb3]	15/11/22	18:15:30	78.9541	11.9705	387	Berengere Husson	Multinet 180 um
EcoSt5[Kb3]	15/11/22	19:01:28	78.9594	11.9095	475	Berengere Husson	Macroplankton trawl
Flare4	15/11/22	20:30:59	78.9567	11.8713	421	Berengere Husson	CTD w/bottles
Flare4	15/11/22	20:48:23	78.9567	11.8712	35	Berengere Husson	Box core
Flare4	15/11/22	21:13:49	78.9567	11.8712	36	Berengere Husson	Box core
Flare4	15/11/22	21:33:24	78.9567	11.8712	37	Berengere Husson	Box core
Transect10o[7And]	17/11/22	0:06:43	76.6395	19.4376	422	Berengere Husson	CTD w/bottles
Transect11o[5And]	17/11/22	3:43:40	77.1701	19.3606	423	Berengere Husson	CTD w/bottles
EcoSt6[3And]	17/11/22	5:33:52	77.4244	19.1057	476	Berengere Husson	Harstad trawl
EcoSt6[3And]	17/11/22	6:45:41	77.4871	19.0514	424	Berengere Husson	CTD w/bottles
EcoSt6[3And]	17/11/22	7:00:06	77.4870	19.0521	3281	Berengere Husson	Bongonet 180 um
EcoSt6[3And]	17/11/22	7:17:39	77.4870	19.0520	3282	Berengere Husson	Bongonet 180 um
EcoSt6[3And]	17/11/22	7:33:48	77.4870	19.0521	3283	Berengere Husson	Bongonet 180 um
EcoSt6[3And]	17/11/22	7:57:23	77.4870	19.0521	388	Berengere Husson	Multinet 180 um
EcoSt6[3And]	17/11/22	8:20:05	77.4870	19.0521	389	Berengere Husson	Multinet 180 um
EcoSt6[3And]	17/11/22	8:53:53	77.4751	19.0644	477	Berengere Husson	Macroplankton trawl
EcoSt6[3And]	17/11/22	10:10:25	77.4621	19.0710	478	Berengere Husson	Campelen trawl with fish lift
EcoSt6[3And]	17/11/22	11:39:39	77.4626	19.0710	425	Berengere Husson	CTD w/bottles
EcoSt6[3And]	17/11/22	11:45:55	77.4626	19.0708	38	Berengere Husson	Box core
EcoSt6[3And]	17/11/22	12:02:50	77.4626	19.0708	39	Berengere Husson	Box core
EcoSt7	17/11/22	21:46:59	77.1274	23.4308	479	Berengere Husson	Harstad trawl
EcoSt7	17/11/22	23:09:15	77.1932	23.5765	426	Berengere Husson	CTD w/bottles
EcoSt7	17/11/22	23:17:39	77.1932	23.5766	3284	Berengere Husson	Bongonet 180 um
EcoSt7	17/11/22	23:48:24	77.1772	23.5710	480	Berengere Husson	Campelen trawl with fish lift
EcoSt8	18/11/22	3:25:12	77.4014	25.1280	481	Berengere Husson	Harstad trawl
EcoSt8	18/11/22	4:23:45	77.3924	24.9852	427	Berengere Husson	CTD w/bottles
EcoSt8	18/11/22	4:31:42	77.3923	24.9899	3285	Berengere Husson	Bongonet 180 um
EcoSt8	18/11/22	6:13:05	77.4359	25.6786	482	Berengere Husson	Campelen trawl with fish lift

EcoSt9	18/11/22	8:48:46	77.7426	26.3566	483	Berengere Husson	Harstad trawl
EcoSt9	18/11/22	10:03:15	77.8003	26.5037	428	Berengere Husson	CTD w/bottles
EcoSt9	18/11/22	10:11:24	77.8003	26.5034	3286	Berengere Husson	Bongonet 180 um
EcoSt9	18/11/22	10:58:25	77.7785	26.5449	484	Berengere Husson	Campelen trawl with fish lift
EcoSt10	18/11/22	14:55:52	77.3098	27.4127	485	Berengere Husson	Harstad trawl
EcoSt10	18/11/22	16:06:47	77.2377	27.5398	429	Berengere Husson	CTD w/bottles
EcoSt10	18/11/22	16:19:09	77.2377	27.5397	3287	Berengere Husson	Bongonet 180 um
EcoSt10	18/11/22	16:56:11	77.2377	27.5399	40	Berengere Husson	Box core
EcoSt10	18/11/22	17:19:46	77.2377	27.5398	41	Berengere Husson	Box core
EcoSt10	18/11/22	17:38:24	77.2377	27.5398	42	Berengere Husson	Box core
EcoSt10	18/11/22	17:53:18	77.2377	27.5398	43	Berengere Husson	Box core
EcoSt10	18/11/22	18:07:54	77.2377	27.5398	44	Berengere Husson	Box core
EcoSt10	18/11/22	19:06:59	77.1938	27.6362	486	Berengere Husson	Campelen trawl with fish lift
EcoSt11	18/11/22	21:55:59	76.8421	26.9399	487	Berengere Husson	Harstad trawl
EcoSt11	18/11/22	23:10:51	76.7748	26.7986	430	Berengere Husson	CTD w/bottles
EcoSt11	18/11/22	23:20:18	76.7742	26.7987	3288	Berengere Husson	Bongonet 180 um
EcoSt11	18/11/22	23:46:01	76.7718	26.8391	488	Berengere Husson	Campelen trawl with fish lift

APPENDIX 2: LIST AND PICTURE OF PARTICIPANTS

NB: People that participated in the cruise preparation but did not go on board are indicated in blue. People that left after the first three days are indicated in green.

Name	Institute	Tasks
Erling Boge Erling.Boge@hi.no	IMR	Technician fish sampling
Melissa Chierici melissa.chierici@hi.no	IMR	Water chemistry/oceanography
Jacob Christensen jch018@post.uit.no	UiT	Benthos/ shark sampling
Elena Eriksen elena.eriksen@hi.no	IMR	Fish sampling
Agneta Fransson Agneta.Fransson@npolar.no	NPI	Water chemistry/oceanography
Egil Frøyen egil.froeyen@hi.no	IMR	Chief instrument
Victor Gonzalez Triginer victortr@unis.no	UNIS	Benthos sampling/ acoustic
Siv Hoff s.n.k.hoff@ibv.uio.no	UiO	Fish genetics
Bérengère Husson berengere.husson@hi.no	IMR	Cruise leader/Fish sampling
Randi Ingvaldsen randi.ingvaldsen@hi.no	IMR	Cruise owner
Sissel Jentoft sissel.jentoft@ibv.uio.no	UiO	Fish sampling/genetics
Wanying Ji Wanying.Ji@hi.no	IMR	Water chemistry/oceanography
Elisabeth Jones elizabeth.jones@hi.no	IMR	Water chemistry/oceanography

Stine Karlson Stine.Karlson@hi.no	IMR	Technician fish sampling
Gitte Krohn-Pettersen gittek@stud.ntnu.no	NTNU	Gelatinous zooplankton sampling
Michael Lemke m.f.a.lemke@students.uu.nl	UNIS	Mesozooplankton sampling
Andreas Lunde 106831@student.unis.no	UNIS	Macrozooplankton sampling
Mathieu Lutier mathieu.lutier@ibv.uio.no	UiO	Copepod experiment/ sampling
Samuel Macaulay samuel.macaulay@biology.ox.ac.uk	University of Oxford	Copepod experiment/ sampling
Luke Marsden lukem@unis.no	UNIS	Data management
Marius F. Maurstad m.f.maurstad@ ibv.uio.no	UiO	Fish sampling/genetics
James Orr james.orr@biology.ox.ac.uk	University of Oxford	Copepod experiment/ sampling
Maria Philippa Rossi mariaro@unis.no	UNIS	Communication
Kim Præbel kim.praebel@uit.no	UiT	Benthos metabarcoding
Nil Rodes nilr@unis.no	UNIS	Benthos sampling
Annemijn Sandig annemijn.sandig@wur.nl	UNIS	Benthos sampling
Arunima Sen arunimas@unis.no	UNIS	Benthos sampling/isotopes
Leif Christian Stige l.c.stige@ibv.uio.no	UiO	Fish sampling/genetics
Janne Søreide JanneS@unis.no	UNIS	Zooplankton sampling
Sverre Waardal Heum sverre.waardal.heum@hi.no	IMR	Instrument team
Jan Frode Wilhemsen jan.frode.wilhelmsen@hi.no	IMR	Instrument team

APPENDIX 3: PLANNED DATASETS

PI	Dataset	When are analyses planned for	RF	Sharing within project	Publishing data	Ask for embargo of data?	If yes, why?
Sissel Jentoft	Tissue samples + metadata + genome sequences	2023-2024	RF 2	2023-2024	2024	Yes	Phd-project/ master project
Elena Eriksen	Fish samples (length, weight, sex, maturation, special stage, stomach fullness, diet composition) + metadata	2023	RF 3	2023	2024	Yes	peer review paper
Sanna Majaneva	Bioluminescence of mesozooplankton	2023	RF 2	No	2023	Yes	Masters student
Kim Præbel Jacob Christensen	Tissue samples + metadata + genome sequences	2023-2026	RF 2	No	unknown	yes	PhD project
Janne Søreide	Lipid area, life stage frequency distribution, prosome area, prosome length, species distribution	2022-2023		Maybe	Maybe	No	
Janne Søreide	Zooplankton fixed in ethanol and formalin	Ask PI		Ask PI	Ask PI	Ask PI	Ask PI
Melissa Chierici	Water column on DIC/AT	2023/24	RF2	Ask PI	Ask PI	Ask PI	Ask PI
Melissa Chierici	Water column on nutrients	2023	RF 2	2023	2023	No	
Agneta Fransson	Water column data on $\delta^{18}O$	2023/24	RF 2/1	Ask PI	Ask PI	Ask PI	Ask PI

Janne Søreide	Weights, length measures, energy content and species count	November-December 2022		Ask PI	Maybe	Ask PI	Ask PI
Arunima Sen	species list, carbon and nitrogen isotope ratios	2023-2024	RF 3	sure	yes	no	

APPENDIX 4: OUTREACH

- Planned: A news story about Arunima Sen (for Forskning.no), by Maria Philippa Rossi.
- Planned: A podcast "The ColdCast" episode on Arunima Sen, by Maria Philippa Rossi.
- In progress: the cruise will be part of Maria Philippa Rossi popular scientific book about science in Svalbard (tentative title "Isens forvarere" (The defenders of the ice)). Publication in autumn 2023.

The Nansen Legacy in numbers

6 years

The Nansen Legacy is a six-year project, running from 2018 to 2023.

280 people

There are about 230 researchers working with the Nansen Legacy, of which 73 are early career scientists. In addition, 50 persons are involved as technicians, project coordinators, communication advisers and board members.

1 400 000 km² of sea

The Nansen Legacy investigates the physical and biological environment of the northern Barents Sea and adjacent Arctic Ocean.

10 institutions

The Nansen Legacy unites the complimentary scientific expertise of ten Norwegian institutions dedicated to Arctic research.

>10 fields

The Nansen Legacy includes scientists from the fields of biology, chemistry, climate research, ecosystem modelling, ecotoxicology, geology, ice physics, meteorology, observational technology, and physical oceanography.

50/50 financing

The Nansen Legacy has a total budget of 740 million NOK. Half the budget comes from the consortiums' own funding, while the other half is provided by the Research Council of Norway and the Ministry of Education and Research.

>350 days at sea

The Nansen Legacy will conduct 15 scientific cruises and spend more than 350 days in the northern Barents Sea and adjacent Arctic Ocean between 2018 and 2022. Most of these cruises are conducted on the new Norwegian research icebreaker RV *Kronprins Haakon*.

nansenlegacy.org

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Photo cover: Maria Philippa Rossi