Cruise report

The Polar Night Cruise

BIO-8510 ARCTOS

8 - 21 January 2012

Edited by Malin Daase

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BIO-8510 ARCTOS - Marine ecological research cruise to Svalbard

During the polar night, early January 2012, a very special cruise took place to the areas north of Svalbard including Sofiadjupet and the "Whalers Bay" in the southern Arctic Ocean and to the research site Rijpfjorden. This was a unique cruise to the Arctic Ocean during a time of the year when very few scientists have visited these remote areas. The idea was to take the pulse on the Arctic ecosystem mid-winter. It was a combined student and research cruise. Students were signed up for the BIO-8510 course at the University of Tromsø. The BIO-8510 ARCTOS - Marine ecological research cruise to Svalbard course runs each second year and is based upon cruises with RV Helmer Hanssen to the waters around Spitsbergen and the Barents Sea. Research questions relevant to activities within the ARCTOS network were addressed and the course opened up for individual students to obtain necessary samples for their PhD work. All scientists and students involved gave talks about their research during the cruise. Research conducted during the cruise was part of the following projects:

- Russian-Norwegian field work cooperation on marine properties in Svalbard waters, (NFR-project 196211/S30), RIS ID 4780
- Climate effects on planktonic food quality and trophic transfer in Arctic (NFR project CLEOPATRA I and II) RIS ID 2463
- Avian Vectors of Invertebrate Faunas (NFR project 196172/S30) RIS ID 4705,
- Arctic marine Ice-associated ecosystem in a Changing Environment (Arctic-ICE), University of Manitoba
- Center for Ice, Climate & Ecosystems, Norwegian Polar Institute
- and other NP, UNIS, UiT related projects

I. Background

The ecosystems of the immense continental shelves of the Arctic Ocean are presently impacted by the most visible climate shifts seen in modern history. Spectacular ecosystem changes are already observed at the periphery of the Arctic Ocean in response to the changing ice regime. This transformation will alter biological productivity with large consequences for the unique Arctic marine fauna. Forecasting the response of Arctic Ocean ecosystems to amplifying climate and industrial stresses requires pan-Arctic syntheses of existing knowledge and the circum-Arctic coordination of new research efforts. Most studies in the Arctic Ocean are conducted during summer and autumn, with a few exceptions such as for example the Canadian Flaw Lead project (CFL), the Fram voyage and the Russian ice drift stations. To our knowledge no marine investigation has taken place during the polar night in the Arctic Ocean north of the Svalbard during the last decades.

II. Participants

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III. Cruise Schedule

The cruise started in Tromsø on Sunday, 8 January 2012. R/V Helmer Hanssen steamed northwards and a brief station was taken north of Bjørnøya on the 10 January to dredge from clams. The boat arrived in Rijpfjorden in the morning of the 12 January when a intense two day sampling program started that lasted until the evening of 13 January. From Rijpfjorden the boat steamed north-west wards towards the ice edge. 10 CTD stations were taken along the way. Sampling within the ice started on Saturday afternoon, 14 January. The ship drifted northwards while sampling and reached its northermost position at 81°45' N on Sunday, 15 January. The ice edge was left on Sunday evening and the boat steamed south towards Moffen island. On the way 9 CTDs were taken and two fish trawls were conducted at the shelf break. At Moffen the area was scanned with the infrared camera to see if any walross were in the area. The boat arrived in Longyearbyen on 17 January and 5 cruise participants left the boat to fly back to the mainland. 3 people from UNIS joined the cruise to assist sampling in Adventfjorden and Isfjorden. Sampling in this area was finsihed at Wednesday evening, 18 January, and 8 people left the boat to remain in Longyearbyen. The cruise ended in Tromsø on saturday the 21 January.

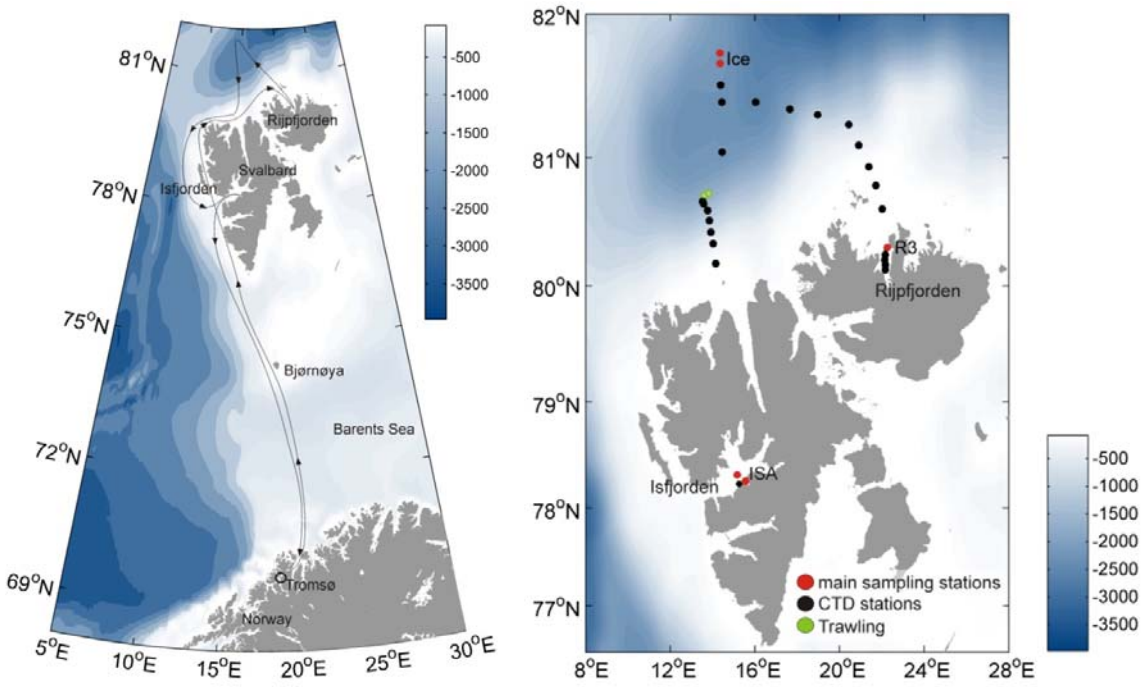

Figure 1: Map over study area and sampling locations during Polar Night Cruise 2012

Table 1: Overview of main stations during the Polar Night Cruise January 2012 (For detailed sampling program see Appendix I)

	Latitude		Longitude		Date	
	°N	minutes	°E	minutes	arrival	departure
Bjørnøya	77	44.56	19	15.20	10.01.2012	
Rijpfjorden						
R3	80	19.27	22	14.42	12.01.2024	14.01.2012
inner Rijpfjorden	80	7.82	22	9.45	13.01.2012	
Ice edge						
Ice station	81	41.67	14	16.96	14.01.2012	15.01.2012
Ice station	81	45.19	14	18.19	15.01.2012	
ISA	78	15.72	15	33.69	17.01.2012	18.01.2012
Isfjorden	78	18.72	15	12.53	17.01.2012	

IV. Study area

The archipelago of Svalbard is located in a border-area between Atlantic and Arctic climatic and biogeographic zones (Stroemberg 1989). The main pathway of Atlantic water into the Arctic Ocean (the West Spitsbergen Current, WSC) runs along the western coast of Svalbard. There is a high inter-annual variability in the strength of the WSC and the inflow of Atlantic water to the Arctic (Saloranta & Haugan 2001). In addition, Svalbard waters are often modified by local oceanographic processes (e.g. freshwater runoff, wind driven circulation, and cooling).
At the northwestern corner of Svalbard the WSC splits into to branches. The Svalbard branch turns eastwards and enters the Arctic Ocean following the continetal slope (Rudels et al. 1999). This branch defines the largest input of Atlantic water in the Arctic Ocean (Manley 1995) and the inflow of warm Atlnatic water keeps this area largly ice free also during winter, forming an ice free bay north of Svalbard often refereed to as the ”Whalers Bay”.

Rijpfjorden
Rijpfjorden is located on the northern coast of Nordaustlandet. It is a north-facing fjord (max 240 m deep) with a wide opening towards the broad shallow shelf (100–200 m deep), which extends to the shelf-break of the Polar Basin at approx. 81 N. Rijpfjorden is dominated by cold Arctic water masses and the inflow of Atlantic water is much less pronounced here compared to fjords along the western coast of Spitsbergen, thus Rijpfjorden represents a ‘true’ Arctic fjord. Ice forms in October and lasts until July (Ambrose et al. 2006, Søreide et al. 2010, Wallace et al. 2010). Interannual variations in timing of freeze-up and ice break up as well as ice thickness are observed (Leu et al. 2011).

Isfjorden and Adventfjorden
Isfjorden is the largest fjord on the western coast of Svalbard. While the inner fjords of the Isfjoren system are influences by glacial and fluvial inputs, the central part of Isfjorden is strongly affected by inflowing Atlantic water and annual variations in the inflow/distribution of water masses have been observed (Nilsen et al. 2008). Isfjorden is an important foraging area for numerous bird species breeding along the shore of Isfjorden and its branching fjords.

Isfjorden is also the area mostly influenced by human activity (i.e. mining industry, recreational activities, boat traffic) since the largest settlements (Longyearbyen and Barentsburg) are located here.
Adventfjorden is 8.3 km long and 3.4 km wide arm of Isfjorden. Water depths vary from 50 to 80 m, and only in the fjord mouth they reach 100 m. The wide and deep fjord inlet provides easy water exchange with the central Isfjorden (Zajaczkowski et al. 2010). Two braided rivers, the Advent River and the Longyear River, form a 0.9 km wide tidal flat situated in the innermost part of Adventfjorden. The rivers transport meltwater from the glaciers, retreated several kilometers from the seashore. The melting period is restricted to approximately 120 days (Weslawski et al. 1999). In winter, the supply of terrigenous material to the fjord stops, as the rivers are frozen and the surface of the fjord is usually covered by fast ice about 1 m thick. However, in recent years (since 2005) ice was not observed in the fjord or only in the inner most parts.

Marine observatories
At the moment marine bio-physical marine observatories are operated by ARCTOS in Rijpfjorden (since 2006) as well as Adventfjorden (2011). The Scottish Association for Marine Science (SAMS) is coordinating this work. Similar moorings are also located in Kongsfjorden (established in 2002) and Billfjorden (since 2008?). The observatories consist of multi instrumental biological-physical moorings that continuously record phytoplankton biomass (fluorescence), vertical migration of zooplankton (ADCP), species composition of plankton (sediment traps), direction and speed of currents (ADCP), temperature and salinity (CTD and termistors) and sedimentation rates (sediment traps).

V. Projects

The following research projects were adressed during the cruise:

	Project title	Responsible
	1. Physical environment	
1.1.	Hydrography	
1.2.	Winter convection in the atmosphere surface layer	*Vasily Bednenko*
	2. Small stuff: DOM, pico- and microplankton, ice algae, phytoplankton & sedimentation	
2.1.	Stable isotope signatures (C&N) of dissolved and particulate organic and inorganic carbon pools during the polar night	*Maria Calleja*
2.2.	Sea ice diatom specific biomarker IP25	*Thomas Brown*
2.3.	ECOTAB: Effect of Climate change On The Arctic Benthos	*Nathalie Morata*
2.4.	Microbial metagenome	*Tove Gabrielsen*
2.5.	Changes in copepods' diet in the warming Arctic	*Jozef Wiktor*
2.6.	Winter survival of phytoplankton and ice algae	*Else Nøst Hegseth*
	3. Mesozooplankton and *Calanus*	
3.1.	Impact of climate on food quality and availability for higher trophic levels in the Arctic form pico- to macroplankton	*Kasiula Blachowiak-Samolyk,*
3.2.	Overwintering strategy – diapause and biophysical properties of wax esters	*David Pond*
3.3.	Vertical distribution of lipid concentration	*Malin Daase*
3.4.	Winter reproduction of Arctic *Calanus*	*Elisabeth Halvorsen*
	4. Macrozooplankton	
4.1.	Predation in winter	*Øystein Varpe*
4.2.	Diel vertical migration during polar night	*Jørgen Berge*
4.3.	Overwintering and reproductive strategies of Mysidae, Ctenophora and Cnidaria	*Clare Webster*
4.4.	The biological performance of hyperiid amphipods during the Polar night	*Angelina Kraft*
4.5.	Chaetognaths	*Jordan Grigor*
4.6.	Life strategy and shell morphology of Limacina helicina	*Stig Falk-Petersen*
4.7.	Apherusa glacialis	*Jørgen Berge*
	5. Higher trophic levels	
5.1.	Winter birds	*Jørgen Berge*
5.2.	Metabolism and ecophysiology of polar cod	*Jasmine Nahrgang*

1. The Physical Environment

1.1 CTD and hydrography

CTD-personnel: Ronald Berntsen, Mark Moline; Data sum-up: Malin Daase

CTD (Conductivity, Temperature and Depth) profiles were taken at each station. In addition CTD measurements were taken along two transect: one crossing the shelf break going north-west from Rijpfjorden to the Ice station and one crossing the shelf break going south-west from the Ice station to Moffen.

Sampling in Rijpfjorden was conducted close to where the mooring is located at site R3 (80°18'N, 22°15'E, Figure 1) in a basin of approximately 270 m depth. Water temperatures in the upper 50 m were around -1°C (Figure 2) indicating that surface cooling was going on. Relative warm waters (2°C) were observed below 75 m (Figure 2). The fjord was ice free although ice started to form by the time the boat left Rijpfjorden on the 13 January. Land fast ice was found in the inner part of Rijpfjorden. Here water temperatures were low (-1 °C) at the surface (upper 20 m) and close to the bottom and around 0-1°C from 20-150 m (Figure 2).

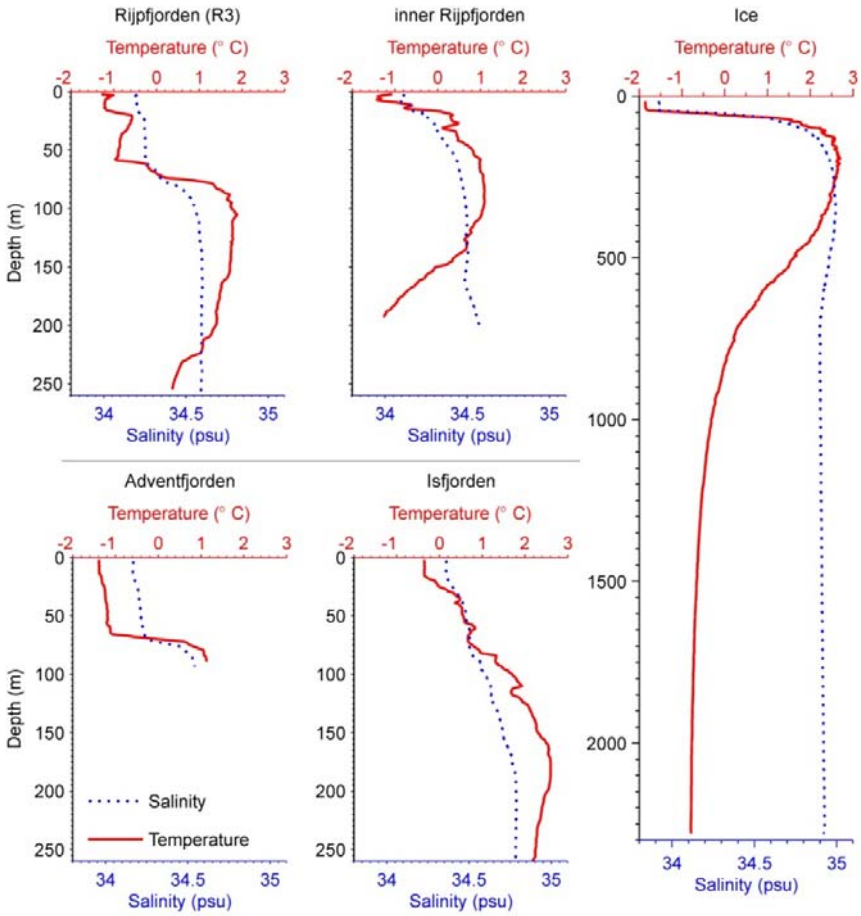

Figure 2: Temperature and salinity profiles at the main sampling stations. Note differences in scale on y-axis for the Ice station.

Cold and less saline water was found on the shelf outside Rijpfjorden (Figure 4). At the shelf break water temperatures and salinities increase sharply indicating the presence of Atlantic

water which flows east along the shelf break. The core of the Atlantic current could be observed below 100 m but water temperatures up to +3 ^{o}C close were also observed at the surface over the shelf break (81^{o}18'N, 18^{o}58'E; Figure 4).

The ice edge was not clearly defined but started with a zone of freshly formed pancake ice (Figure 3a) which afterwards gave way to larger ice floes (up to 2 m thick, Figure 3b). The northermost position the ship reached was 81^{o}45'N. The Ice station was characterized by a layer of cold and fresh water in the upper 50 m (Figure 2). Below that temperature and salinity increased sharply and Atlantic water (T> 2^{o}C, S> 35 psu) could be observed below 100 m. Temperature decreased below 500 m to -1^{o}C below 1000 m while salinity remained at 34.9 psu through the water column (Figure 2). Due to heavy winds from southwest and decreasing temperatures heavy ice slush was formed in the formerly open leads between the ice floes making it impossible to deploy and retrieve instruments from the water (Figure 3c,d).

Surface temperatures remained >-1^{o} along the transect from the Ice station towards Moffen but between 50-500 m Atlantic water prevailed. Surface temperature reached 4^{o} C at the shelf break north of Moffen and temperature remained high (> 2^{o} C over) the shelf (Figure 5).

Water temperatures and salinity were low in the upper 60 m in Adventfjorden (<-1^{o}C, <34.2) but both increased close to the bottom to +1^{o}C and 34.5 psu (Figure 2). Water temperatures and salinities in Isfjorden (just outside Adventfjorden) increased throughout the water column from -0.5^{o}C and 34.1 at the surface to > 2^{o}C and 34.5 below 150 m (Figure 2).

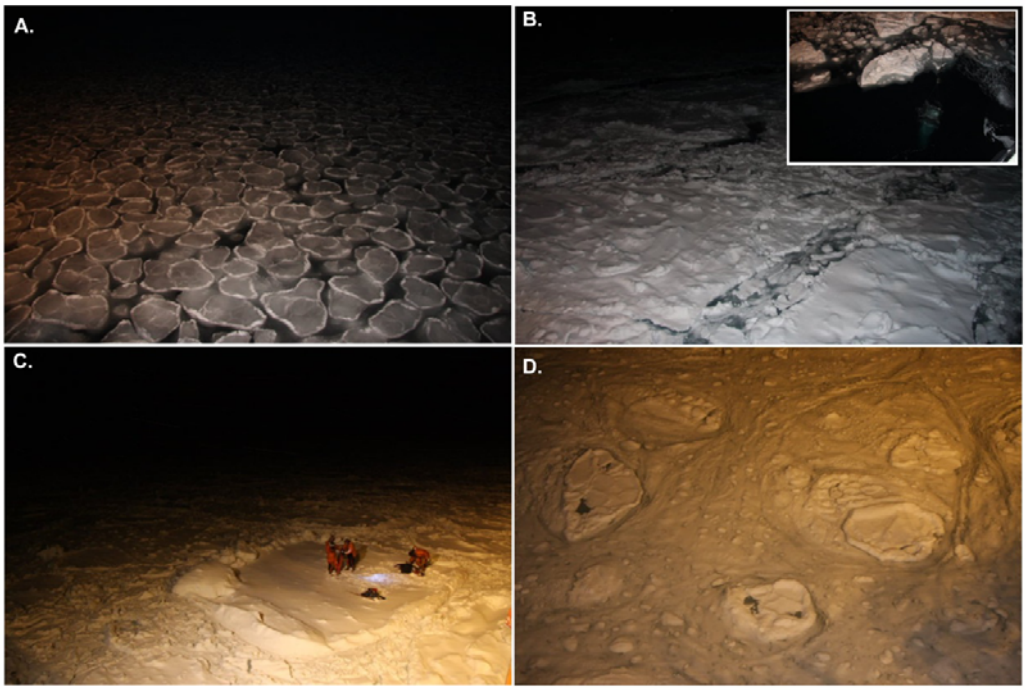

Figure 3: Ice formation encountered at the Ice station (81^{o}45'N). A. Freshly formed pancake ice. B. Ice condition at start of Ice station: instruments could easily be deployed. C. Ice conditions a few hours later: heavy slush had formed around ice floes (D.). Ice cores were taken from larger ice floes, approx. 2 m thick

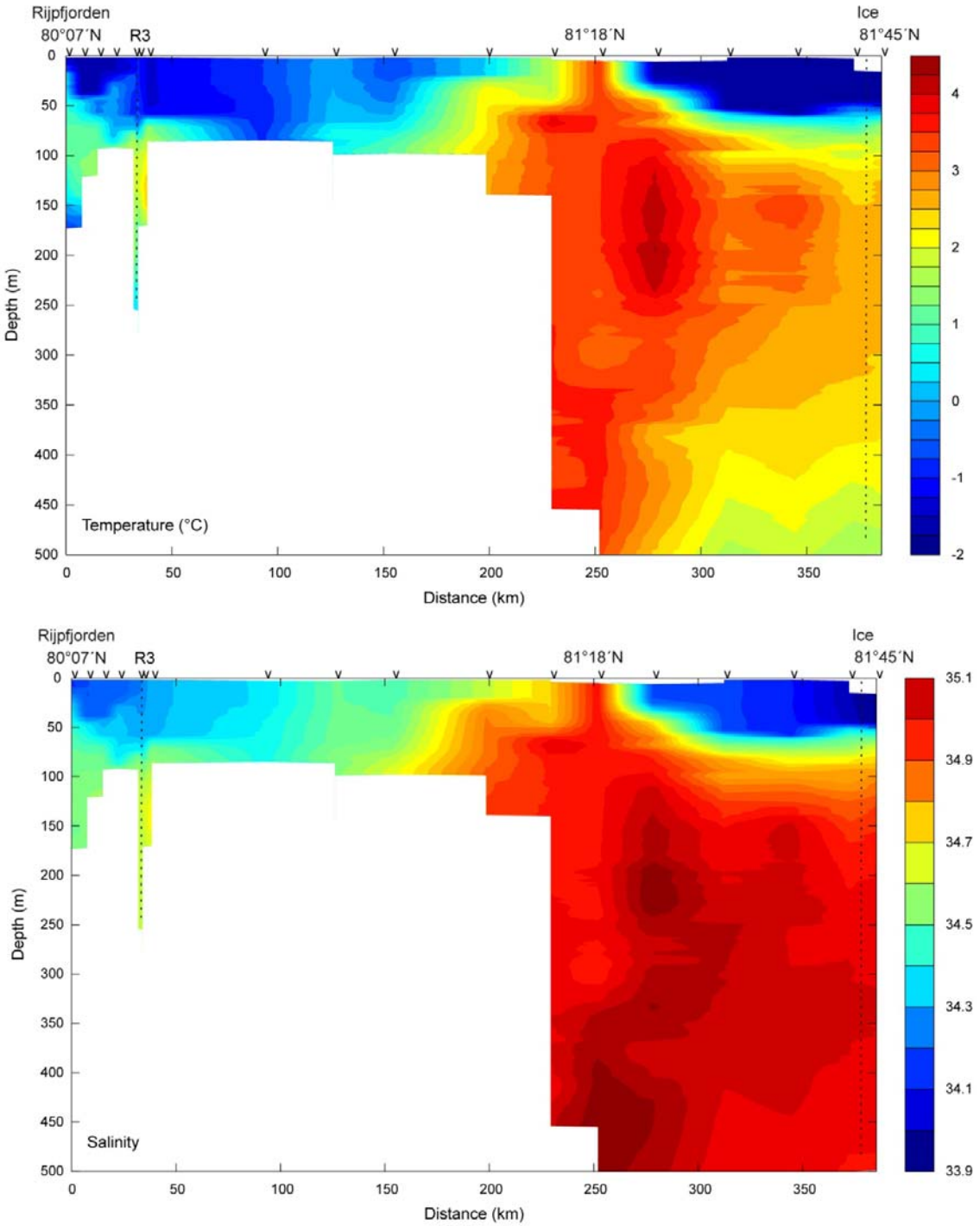

Figure 4: Temperature and salinity distribution along a transect from the inner part of Rijpfjorden to the Ice station. 'v' indicate position were CTD profile was taken

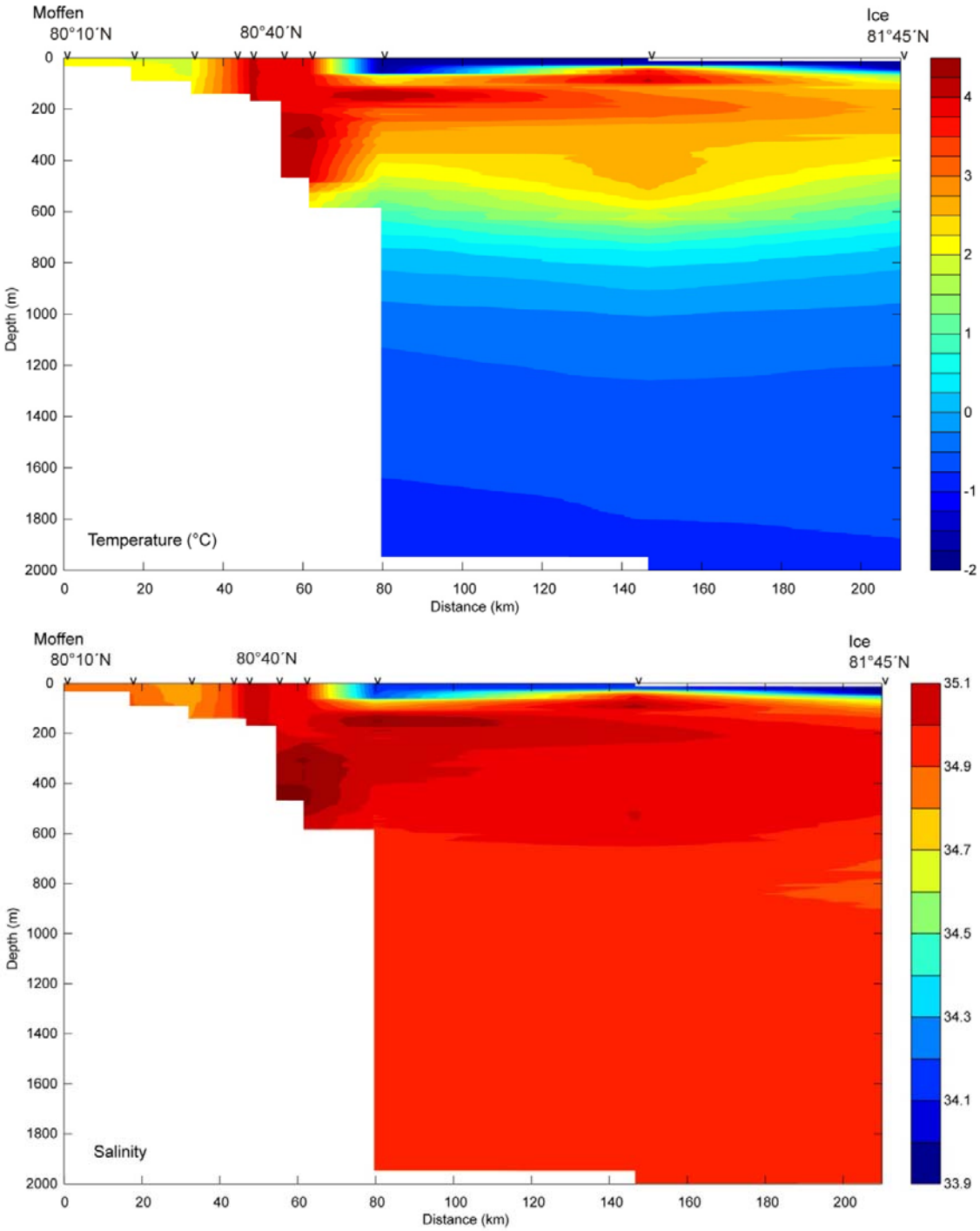

Figure 5: Temperature and salinity distribution along a transect from the Ice station to Moffen island. 'v' indicate position were CTD profile was taken

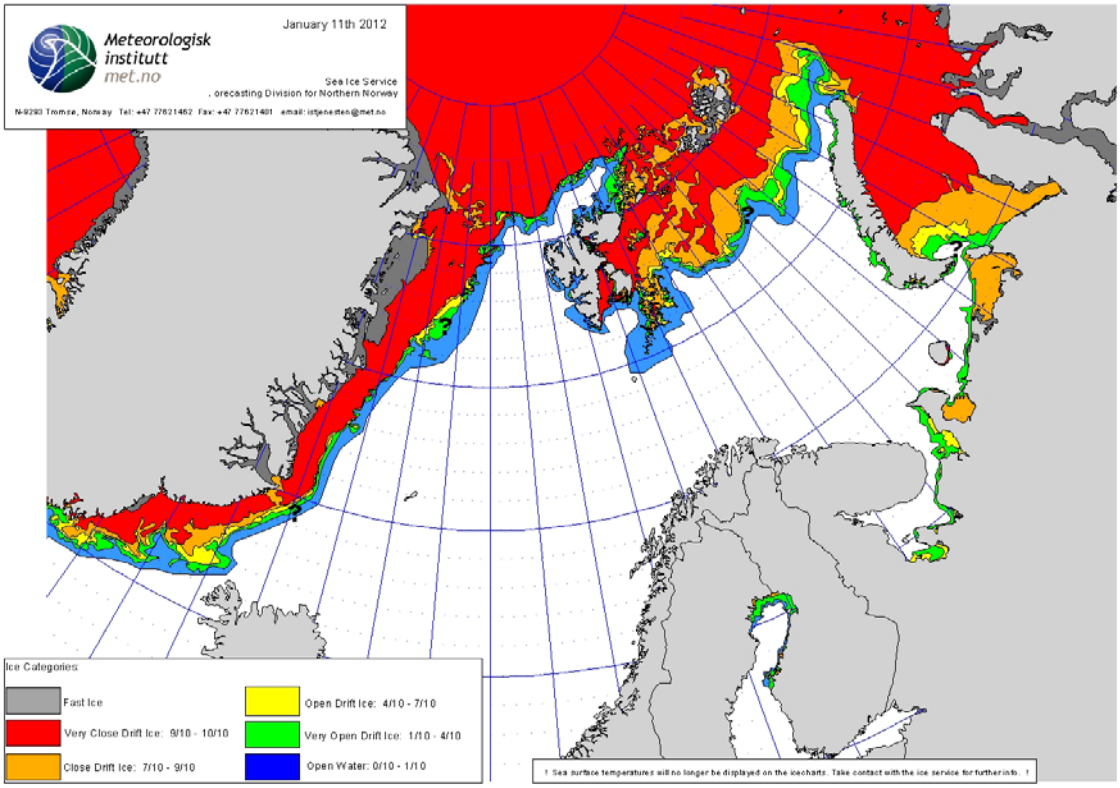

Figure 6: Ice chart from 11. January 2012

1.2 Winter convection in the atmosphere surface layer

Vasily Bednenko, Arctic and Antarctic Research Institute

The main aim of this investigation was to estimate energy exchange fluxes in the Marginal Ice Zone in the winter period. All measurements and observations of meteorological parameters and ice conditions were taken onboard Helmer Hanssen from 9 to 17 January 2012. Components of longwave surface balance were measured. Heat fluxes from the surface to atmosphere will be calculated. These estimates can be used as lower boundary conditions for atmospheric boundary layer modeling and regional climate models.
Effective irradiance of the atmosphere was measured continuously from 9 to 17 January 2012. Air temperature, air pressure, relative humidity (14 m.a.s.l) and wind velocity and wind direction (20 m.a.s.l.) were logged every 3 hours by the ship`s meteorological station. In additional sea-water-ice temperature was measured. Atmospheric and sea-ice conditions were observed from the foredeck of the vessel. The ice description estimations included estimating the concentrations of different ice types, floe size, snow-cover thickness, percentage of ridging and rafting. The nomenclature for ice types follows terms according to Steffen (1986). Incoming longwave radiation was measured with Eppley PIR precision radiometer in wavelength range: 3.5 to 50 μm. The sensitivity of this sensor is 4 μV/Wm-2 and its response time 2 s. The surface radiation temperature was measured by noncontact temperature measurement Raytek MX4 established on the foredeck of the vessel. The type of measurements and total quantity is showed in table 1.

Table 2: Meteorological and radiation measurements conducted during Polar Night cruise January 2012

№	Type of measurements	Time resolution	Period of measurements	Total amount	Data format
1	Meteorological measurements:				
	1.1. Temperature	1 min	9.01.2012-17.01.2012	18800	*.xls
	1.2. Relative humidity	1 min		18800	*.xls
	1.3. Wind speed	1 min		18800	*.xls
	1.4. Wind direction	1 min		18800	*.xls
2	Measurements of surface temperature	1 min		18800	*.doc
3	Measurements of atmospheric irradiance	5 min	11.01.2012-17.01.2012	1850	*.doc
4	Ice condition observations	3 hours	9.01.2012-17.01.2012	64	*.doc

2. Dissolved matter, pico and microplankton, ice algae, phytoplankton, sedimentation

The "small stuff" group investigated the lower trophic level components of the Arctic carbon cycle, by focusing on the characterization of organic matter sources and on lower trophic levels interactions in the three major components of the Arctic ecosystem (ice, water column and sediment). Chemical parameters (dissolved gases, nutrients, pigments, DNA/RNA, carbon/nitrogen and stable isotopes will be measured in ice (Tove), water column (Maria) and sediment (Nathalie). Bacteria will be studied in ice (Tove) and water column (Maria). Nano/microplankton will be studied both in ice and water column (Anna). Phytoplankton/ice algae will be collected for taxonomy and culture (Else) and specific markers (Thomas). Carbon remineralisation by zooplankton and benthos will be measured (Nathalie).

2.1 Carbon and Nitrogen stable isotope signatures of dissolved and particulate organic and inorganic carbon pools during the polar night.

Maria Calleja, CSIC- IMEDEA, IACT - Spain

Short description and main objective:
Stable isotope tracers are powerful tools for following the flow of carbon (C) and nitrogen (N) through biogeochemical processes in marine ecosystems. They have been applied as tracers for marine productivity and to reveal sources of organic matter and trophic relationships in food web studies. The marked seasonality in primary production in polar marine systems is reflected in larger variations in isotope signatures compared to tropical and subtropical systems. However few studies investigating these processes have concentrated on high-latitude systems and non-isotopic data of organic and inorganic pools have been published, to our knowledge, during the Polar winter of the Arctic Ocean. The study of C and N stable isotopes of organic and inorganic pools of carbon can be of great use if we aim to understand the processes that control either the degradation of dissolved organic matter (internal to the Arctic Ocean) or its preservation (ultimately with export to the North Atlantic Ocean) during the polar winter, a critical issue particularly in light of the recent changes in the hydrological cycle of the Arctic region.
My contribution to the ARCTOS cruise, in January 2012 on board the RV. Helmer Hansen, is a unique opportunity to collect samples for isotopic analysis during the Arctic winter season.

Sampling strategy and methodology:

1. CTD sampling

Sampling sites. 3 main sites where sampled for characterization of organic and inorganic carbon pools in the water column from surface waters to bottom waters.
1) Ripfjorden, an arctic fjord in the North East of Svalbard (Lat. 80 18.527N, long. 22 15.831E) with polar water influence; 2) Sofiadypet, a deep site on the ice-edge, (Lat. 81 41.308N, long14 17.141E) 3) and Isfjorden/Adventfjorden, an arctic fjord in the East of Svalbard, influenced by the warm currents of Atlantic water, (Lat. 78 15.614N, long.15 33.843E)
The following parameters have been sampled for the whole water column in each study site:

- Determination of concentration and stable carbon ($\delta^{13}C$) isotopic composition of Dissolved Inorganic Carbon (**DIC**). Posterior analysis at the IACT on a the GC-IRMS (GasBench-IRMS, Thermo-Finnigan).
- Determination of concentration and stable isotopes in Volatile Organic Carbon (**VOC**). Posterior analysis at the IACT by purge and traps and gas chromatography coupled to an Isotope Ratio mass spectrometer (GC-IRMS) (Atomx-Trace GC Ultra +DSQ+Conflow+DeltaXP , Teledyne and Thermo-Finnigan).
-Determination of concentration and stable carbon ($\delta^{13}C$) isotopic composition of Dissolved Organic Matter (**DOM**) to perform analysis of both Dissolved Organic Carbon (**DOC**) and Dissolved Organic Nitrogen (**DON**). Posterior analysis at the IACT (TOC-GC-IRMS) (IO and Thermo-Finnigan) and Total Organic Carbon and Nitrogen Analyzer (Shimadzu).
-Determination of concentration and stable nitrogen ($\delta^{15}N$ and $\delta^{18}O$) isotopic composition of nitrates (**NO_3^-**). Posterior reduction to $N_2O_{(g)}$ and analysis at the IACT on by GC-IRMS (Thermo-Finnigan).
-Determination of Chromophoric Dissolved Organic Matter (**CDOM**) absorbance to study the optic properties of DOM pool during Polar winter. Analyze on a spectrophotometer once back to the lab at the University of Granada.
-Determination of Fluorescent Dissolved Organic Matter (**FDOM**) by Excitation-emission matrix spectroscopy (EEMS) will be performed to further characterize different origins and properties of DOM. Analyze once back to the lab at the University of Granada.
-Determination of **Bacterial Abundance** through the water column. Samples are frozen on liquid Nitrogen and kept frozen until analysis in the University of Granada by Flow Cytometry.

2. Seawater continuous flow sampling.

-Determination of stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotopic composition of Particulate Organic Matter (**POM**). Filtration through pre-combusted GFF filters of 8-15 L of water sample per station and within transects. Sample were taken from the continuous seawater flow. Pre-filtration through a 60µm mesh was performed. GFF filters were collected and store frozen. Posterior analysis at the IACT on a Carlo Erba Elemental Analyzer (EA-IRMS).

3. Ice core sampling

3 Ice cores were sampled in Ripfjordern on January 12, 2012 at 8am local time. Only the lower 10cm were kept into an acid clean pocket and storage at -20 before melting and sampling.

4. Experiments from Ripfjorden surface and bottom water

Testing bacterial growth efficiency, DOM consumption and bacterial respiration rates during the polar night, at surface and bottom waters from an arctic fjord

2 x 20 L of 0.2µm surface and bottom, seawater from Ripfjorden station was sampled from the CTD. 2L of 0.8µm from the same depths were also collected and used as inoculum.

The 0.2µm filtered seawater from both surface and bottom were transferred into 3 x 2L gas tight: control bags.
The remaining 0.2µm filtered seawater was inoculated with 0.8µm filtered seawater of the corresponding depth (see figure): experiment bags.
All bags are kept in the cold room at 4C and darkness, and sampling is performed every day.

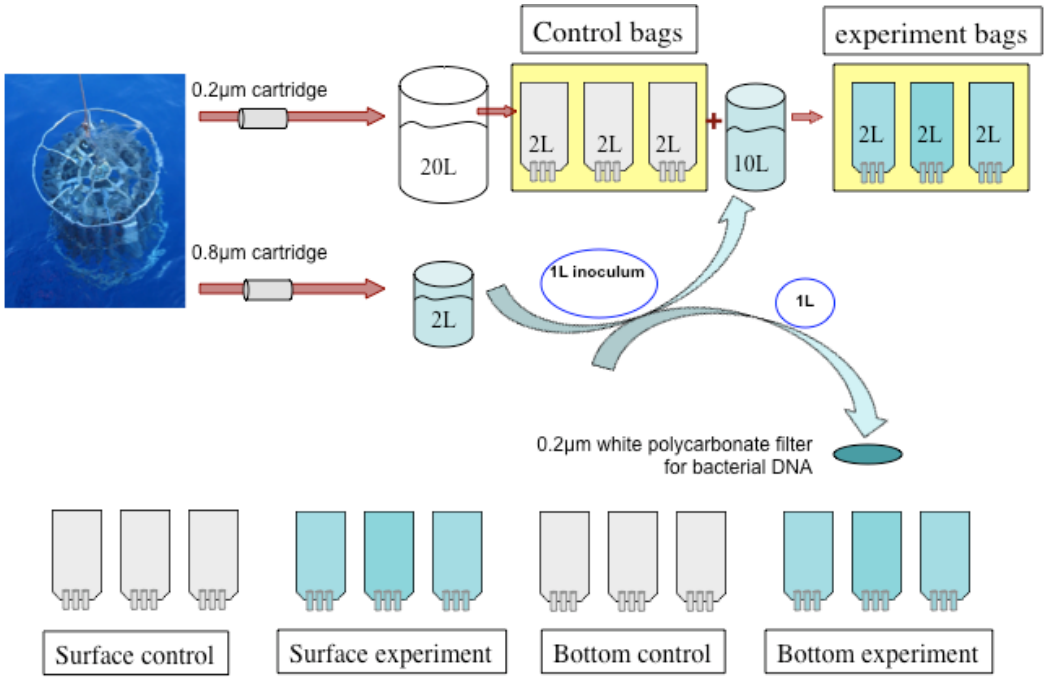

Figure 7: Experimental set up

Also, at the beginning and end of the experiment samples for bacterial are collected in order to identify the bacteria community that was present in the initial seawater, and the one that grew under our experimental condition.

Total list of samples taken

Table 3: CTD samples

station	CTD	Depth (m)	Var1	Var2	Var3	Var4	Var5	Var6
Ripfjorden	0523	0	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0523	5	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0523	15	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0523	35	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0523	75	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0523	150	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0524	bottom	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
Sofie Djupet	0545	0	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0545	5	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0545	15	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0545	35	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0545	75	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0545	150	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0542	500	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0546	1000	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0546	1500	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0546	2000	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0546	bottom	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
Isfjorden	0567	0	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0567	5	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0567	15	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0567	35	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0567	60	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA
	0567	bottom	DIC	VOC	NO_3^-	DOC/DON	CDOM/FDOM	BA

Table 4: Ice core samples**.** Samples are taken from the bottom 10 cms

station	Lat	Long	Ice core	Var1	Var2	Var 3	Var4	Var5
Ripfjorden			1	DOC/ DON	CDOM/FDOM	BA		
			2	DOC/ DON	CDOM/FDOM	BA		
			3	DOC/ DON	CDOM/FDOM	BA		
			1+2+3				POM (GFF)	Bact DNA

Table 5: Experiment samples from bottom (B) and surface (S) seawater incubations. All samples are taken everyday during 10 days, from all 12 bags.

station	Sampling time	Var1	Var2	Var3	Var4	Var5
Ripfjorden	1/13/12	DIC	DOC/DON	CDOM/FDOM	BA	Viruses
	1/14/12	DIC	DOC/DON	CDOM/FDOM	BA	Viruses
	1/15/12	DIC	DOC/DON	CDOM/FDOM	BA	Viruses
	1/16/12	DIC	DOC/DON	CDOM/FDOM	BA	Viruses
	1/17/12	DIC	DOC/DON	CDOM/FDOM	BA	Viruses
	1/18/12	DIC	DOC/DON	CDOM/FDOM	BA	Viruses
	1/19/12	DIC	DOC/DON	CDOM/FDOM	BA	Viruses
	1/20/12	DIC	DOC/DON	CDOM/FDOM	BA	Viruses
	1/21/12	DIC	DOC/DON	CDOM/FDOM	BA	Viruses
	1/22/12	DIC	DOC/DON	CDOM/FDOM	BA	Viruses

Experiment samples from sediment cores.

Samples for DOC, DIC and BA were also collected in collaboration with Nathalie Morata and Emma Michaud (see their report for more information about those)

List of potential publications:

Carbon and Nitrogen dynamics and isotopic signatures in the water column during the polar arctic night. M. Ll. Calleja and co-authors. To be submitted to *Biogeosciences*

Bacterial respiration in surface and deep waters from an Arctic fjord during the polar night. M. Ll. Calleja and co-authors. To be submitted to *Limnology and Oceanography.*

2.2 Sea ice diatom specific biomarker IP25

Sea ice/phytoplanktonic specific biomarker analysis of the food web during the Polar Night.

Dr Thomas Brown and Ashleigh Ringrose, University of Plymouth, Plymouth, UK

The main objective whilst on this cruise was to sample as many different trophic levels in a Polar Night food web as possible to investigate potential cycling of algal origin carbon biomass during a period believed to be void of carbon production. Sampling was concentrated at Rijpfjorden, with additional samples collected from Bjornøya, the ice edge at 81°45N above Svalbard and Isfjorden.

A combination of ice coring, MIK nets, pelagic and benthic trawls, RP sled, triangle dredge and box coring was employed to obtain samples. From Rijpfjorden samples were chosen to represent as many trophic levels of the food web as possible, from the sea ice, zooplankton, pelagic, benthic, epifaunal and infaunal organisms.

Additional sea ice samples were collected from the ice edge at 81°45N above Svalbard. A triangle dredge was obtained from Bjornøya with a benthic trawl taken on the shelf break north of Svalbard for comparison of specific food web compartments to Rijpfjorden.

Analysis of all samples for total lipid, sea ice and phytoplanktonic specific biomarkers (highly branched isoprenoids; including IP_{25}) and stable isotopes will be carried out upon return the UK.

Highly branched isoprenoids (HBIs) are produced specifically by sea ice and planktonic diatoms and have recently been identified in Arctic animals. The samples obtained from this cruise will facilitate further investigation into the use of these chemicals in food webs as dietary source indicators.

Table 6: Overview of samples taken for IP25 analysis

Station and sampling instrument	Sample	Number of species sampled	Number of organisms
Bjornoya - Triangle dredge	Epifauna	14	88
Rijpfjorden – Bottom and Pelagic Net Trawls, MIK	Infauna, Epifauna, Demersal fauna, Pelagic fauna, sediment and sea ice cores	23	154
Ice Edge – Kovacs Ice Corer	Sea ice cores x3		
Shelf Break – Bottom Net Trawl	Demersal fauna	17	43
Isfjorden	Demersal fauna, Pelagic fauna and sediment	17	74

2.3 ECOTAB: Effect of Climate change On The Arctic Benthos

Dr Nathalie Morata, Dr Emma Michaud, LEMAR, France
Dr Thomas Brown and Ashleigh Ringrose, University of Plymouth, Plymouth, UK

Introduction
Because of the ice-dependent character of Arctic marine ecosystems, climate-induced changes in sea-ice cover are expected to lead to shifts in primary production regime, having repercussions on food web structures, ecosystem functioning and carbon cycle. It is in particular hypothesized that the previous benthic-oriented system might switch to a more pelagic one, at the expense of the benthos. The goal of this study is to understand the ***benthic activities during the polar night***, when production is thought to be at its minimum.

For doing so, ***inputs of organic matter*** to the seafloor, and ***response from the benthos*** were studied in ***Rijpfjorden*** and ***Isfjorden***. Sediment was collected by a box core (photo on the right). Subcores were sampled for ***flux*** and ***sediment biomarkers*** study. For the fluxes study, large sediment cores were incubated for 24 hours. During that time, oxygen was monitored every 4-6h. Samples for nutrients and DOC/DIC were collected at the beginning and at the end of the incubation. For biomarker studies, sediment cores were sliced (0-0.5, 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, 4-5, 5-6, 6-8, 8-10). Slices were frozen for future analyses back at the lab.

In addition, in Rijforden, extra cores were collected for performing a ***feeding experiment***, in order to understand if inputs of food trigger and increase benthic activities (theory developed in Renaud et al. 2007 and Morata et al. 2011). Intact cores were incubated with additional freeze-dried phytoplankton. Oxygen, nutrients, DOC/DIC were monitored, as well as sediment biomarker profiles and bioturbation (by addition of fluorescent beads).

Finally, for each station, samples were collected for determination of the ***macrofauna*** and ***meiofauna*** community composition and biomass.

Table 7: Samples for Fluxes

From	What	Where
Boxcore	Community activities:	
in both Rijpfjorden	Nutrient and O2 fluxes	LEMAR, France
and Isfjorden	Bioturbation (only Rijpfjorden)	LEMAR, France
	DOC/DIC fluxes	IACT, Spain Maria

Table 8: Samples for Sedimentary biomarkers profiles

From	What	Where
Boxcore	Biomarker profiles:	
in both Rijpfjorden and Isfjorden	CN	LEMAR, France
(0-0.5, 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4,	Organic matter	LEMAR, France
4-5, 5-6, 6-8, 8-10)	Pigments	LEMAR, France
	Porosity	LEMAR, France
	Bioturbation (luminophores, only Rijpforden)	LEMAR, France
	Grain size	
	Lipids (IP_{25}, Fatty acids)	IOPAS, Poland
	Inorganic elements (Mn, Fe)	Plymouth, UK (Tom)
	Grain size per slice	Plymouth, UK (Tom)
	Bacteria	Plymouth, UK (Tom)
		IACT, Spain (Maria)

Table 9: Samples for Benthic communities

From	What	Where
Boxcore	Meiofauna	IOPAS, Poland
Van Veen Grab	Macrofauna	IOPAS, Poland
in both Rijpfjorden and Isfjorden		

Figure 8: Box core sample

2.4 Microbial metagenome

Tove Gabrielsen, UNIS

Marine microbes represent a plethora of divergent evolutionary lineages from all three domains of life (Archaea, Bacteria and Eukaryota). Although their diversity in various marine habitats has been investigated throughout the last decade using molecular tools (metagenomics), their function and importance in the marine ecosystem is to a large degree unknown. In particular, both their diversity and function in arctic waters throughout the polar night period is virtually unknown. The January 2012 cruise with Helmer Hanssen gives us a unique possibility to sample the microbial metagenome at various localities during the polar night and will enable us to investigate its importance in the arctic winter. In particular, we are interested in sampling also in Adventfjorden in relation to our established field station (mooring, weekly sampling starting January 2012) in the mouth of Adventfjorden. We would like to take the following samples: water samples for nutrients, Chl a, phytoplankton community, POC, DNA/RNA analyses would be taken from at least 5m, 15m, 35m, 75m, 150m, and preferably more depths. Phytoplankton net hauls will be taken using a 20 um net. In Adventfjorden, also WP11 and WP2 nets would be used to collect various size fractions of zooplankton. In addition, we would like to use a 24h sediment trap (depths 20m, 40m, 60m, 90m) in Adventfjorden and possibly at the other sites if the time allows it.

2.5 Microalgae in the Polar Night

Else Nøst Hegseth, Department of Arctic and Marine Biology, University of Tromsø

Background

Phytoplankton and ice algae are the primary producers in high north areas – north of the Arctic Circle - and contribute to the primary production to varying degrees based on ice and light seasonality. The initiation of the growth period, the transition from winter to spring, is particularly important in high latitudes. While primary production ceases during the dark winter, some heterotrophic growth may occur. The spring bloom in high latitudes consists of diatoms and the flagellate *Phaeocystis pouchetii*. The bloom in shelf areas in Northern Norway relies on resting spores or cells in the sediment, which both need to be brought up to the surface and get sufficient light and day lengths to germinate and start growing. Bringing up the diatom spores is a physical process (winter convection). Cooling homogenizes the water masses and is usually completed in mid-late winter so that mixing of the water column will easily occur down to the sea floor. Spores generally start to germinate after the spring equinox, and the spring bloom peaks in mid-late April.

Changes in physical processes (warmer water, shallower mixing) may have a significant effect on the bloom timing, magnitude and species composition, which in turn impacts on the size structure, vertical distribution patterns and life history traits of zooplankton. Climate-induced alterations of these relationships will have serious implications for higher trophic levels of these ecosystems, including planktonic invertebrate predators, fish and seabirds.

Primary production in ice is performed by ice algae. The winter survival of these algae is long debated, and suggestions have been that spores/resting cells use the ice as a winter habitat. In areas with annual ice this would present a problem, and a more likely explanation is that these species too use the bottom sediments for survival for their resting stages. Winter

convection in pack ice areas probably goes on in leads, which are frequent here. Observations of sediment on the ice underside support this theory.

Aim of the cruise

During the cruise we will look for the resting stages of diatoms in water, sediment and ice, to confer that these winter stages are the same and are found in the same habitats as further south. We also plan to map the still unknown life cycle of *Phaeocystis*, e.g. its survival strategy in winter, in cooperation with The Metagenomics project.

Comparing ice-free fjords like Balsfjorden and ice-covered fjords like Rijpfjorden will help to understand the requirements both for the initiation of the pelagic and ice algal spring bloom.

Ice cores will be sampled and melted to look for ice algal resting stages, along with sediment samples, and we hope to be able to answer the not yet resolved question of winter survival of ice algae in the Barents Sea.

Sampling

Table 10: The following stations and parameters were sampled during the cruise:

Date	Location	Parameter	Depth	Ice
12.01.12	Rijpfjorden R3	Chlorophyll (total and < 10 µm fraction)	0, 5, 15, 35, 75, 150, 265 m (bottom)	7 ice cores
		Nutrients, POC	Same depths	Slices of 10 cm
		Phytoplankton	Same depth + conc. samples 0, 15, 150 m	Ice algae, POC, EPS, nutrients
14.01.12	Sofiadypet	Chlorophyll (total and < 10 µm fraction)	0, 5, 15, 35, 75, 150 m	5 ice cores
		Nutrients, POC	Same depths	Slices of 10 cm
		Phytoplankton	Same depths and conc. samples from 15 and 150 m	Ice algae, POC, EPS, nutrients

Preliminary results

Both of the sampling areas had very pronounced pycnoclines, but the phytoplankton communities were not distributed according to the hydrography. The reason for this is likely the very low biomass, which was as expected. In Rijpfjorden values were between 0.01 and 0.02 µg l^{-1}, and slightly higher in Sofiadypet (up to 0.04). The majority of the biomass was found in the < 10µm fraction, which likely will be dominated by small flagellates, and may also contain a *Phaeocystis* winter stage. Mixing had not yet reached the bottom in Rijpfjorden, so that any spores or resting cells of diatoms are not likely to be found in the upper layers at this time. Filtering of melted ice cores revealed a lot of organic material in the ice, and it remains to be seen whether there are cells/resting stages here.

3. Mesozooplankton / *Calanus*

The Mesozooplankton/ *Calanus* group focused on sampling the mesozooplankton (size class 200 µm-2 mm) community using the Hydrobios Multinet (0.25 m^2, mesh size 200 µm), the WP3 net (mouth opening 1 m^2, mesh size 1 mm) and a WP2 net with 63 µm mesh size (mouth opening 0.25 m^2). At each station a Multinet was taken from predefined standard depth (5 depth strata, according to standard sampling protocol established by the Norwegian Polar Institute, Table 11) and the samples were fixed in 4% formalin-seawater solution. These samples will be analysed by Kasiula Blachowiak-Samolyk at IOPAS and will provide background information on the mesozooplankton species composition and the vertical distribution.

3.1 Impact of climate on food quality and availability for higher trophic levels in the Arctic form pico- to macroplankton

Kasiula Blachowiak-Samolyk (IOPAS)

Previous studies have been focused on 'classical' phyto –, and mesozooplankton research. To obtain complete picture of pelagic structure the studies of omitted fractions of pico- (mainly heterotrophic organisms) and macroplankton (usually unrepresentatively taken during standard collections with Multinet and WP2 net) are necessary. On the basis of phyto- and zooplankton coherent studies, containing full spectrum of size fractions, we want to verify the accuracy of research hypothesis about shift of phenological phases of phyto- and zooplankton, which cause the incompatibility of biomass peaks of primary producers and consumers in trophic web.
During the Polar night Multinet samples were taken in Rijpfjorden and in the ice from standard depth (Table 11) and these will be analyzed for mesozooplankton species composition and the vertical distribution. In addition samples taken by the macrozooplankton group with the MIK net will provided information on species and size distribution of the Macrozooplankton community. The samples are fixed in formalin and will be send to IOPAS where they will be analyzed.

The Multinet data will also be analysed for the size distribution of the mesozooplankton community (Mesozooplankton community structure – size distribution Claudia Halsband (Akvaplan Niva)

Table 11: Overview of Multinet samples taken from standard depth and fixed in formalin

ID number	Station	date	time	depth (m) from	depth (m) to	Preservation method	samples taken for
PNC-9	Rijpfjorden	12.01.2012	13:10	260	200	formalin	Kasiula
PNC-10	Rijpfjorden	12.01.2012	13:10	200	100	formalin	Kasiula
PNC-11	Rijpfjorden	12.01.2012	13:10	100	50	formalin	Kasiula
PNC-12	Rijpfjorden	12.01.2012	13:10	50	20	formalin	Kasiula
PNC-13	Rijpfjorden	12.01.2012	13:10	20	0	formalin	Kasiula
PNC-24	Rijpfjorden	13.01.2012	01:05	260	200	formalin	Kasiula
PNC-25	Rijpfjorden	13.01.2012	01:05	200	100	formalin	Kasiula
PNC-26	Rijpfjorden	13.01.2012	01:05	100	50	formalin	Kasiula
PNC-27	Rijpfjorden	13.01.2012	01:05	50	20	formalin	Kasiula
PNC-28	Rijpfjorden	13.01.2012	01:05	20	0	formalin	Kasiula
PNC-79	Ice station	15.01.2012	11:30	2000	1200	formalin	Kasiula
PNC-80	Ice station	15.01.2012	11:30	1200	600	formalin	Kasiula
PNC-81	Ice station	15.01.2012	11:30	600	100	formalin	Kasiula
PNC-82	Ice station	15.01.2012	11:30	100	10	formalin	Kasiula

Winter Ecology of *Calanus* spp. in the Arctic

The three co-occurring Calanoid copepods *C. hyperboreus*, *C. glacialis* and *C. finmarchicus* are the key secondary producers in Arctic seas, accounting for 70-90% of the zooplankton biomass there (Conover & Huntley 1991, Hirche & Kwasniewski 1997). In the Barents Sea-Svalbard region it is particularly the Arctic shelf species *C. glacialis* and the smaller north Atlantic *C. finmarchicus* that account for this biomass (Daase & Eiane 2007, Søreide et al. 2008). These two species are indicator species of Arctic and Atlantic waters, respectively (Daase et al. 2007, Blachowiak-Samolyk et al. 2008). One major future concern is whether the North Atlantic *C. finmarchicus* will replace the larger and more energy-rich *C. glacialis* in a warmer Arctic which will have negative consequences for the entire lipid-driven Arctic marine food web (Falk-Petersen et al. 2007, Steen et al. 2007). *Calanus* is able to convert low-energy carbohydrates and proteins in algae into high energy wax ester lipids (Lee et al. 2006), which makes them extremely lipid-rich (50-70% lipids of dry weight) food items for higher trophic levels (Falk-Petersen et al. 2009). As a key adaptation to life at high latitudes *Calanus* conducts seasonal ontogenetic vertical migration (Hirche 1996, Hirche 1997, Kosobokova 1999). After synthesizing large lipid reserves during the productive season (Conover & Huntley 1991, Scott et al. 2000), the animals descend to deeper water where the winter is spent in a non-feeding state with reduced metabolism (Conover & Huntley 1991, Hirche 1996). This diapause is one of the major features of polar life cycles and defines to a large extent the success and the rate of productivity of high-latitude populations (Varpe et al. 2009, Søreide et al. 2010). Surviving the long polar night requires that sufficient energy has been stored during the productive summer. Because of the delicate timing between the onset and end of diapause, this period may be particularly sensitive to global warming (Søreide et al. 2010, Leu et al. 2011). Knowledge on the physiology and behavior during overwintering is, however, scarce. Some studies exist on *C. finmarchicus* and *C. helgolandicus*, but they are conflicting. Some argue that *Calanus* need to feed in winter to meet their energy requirements (Marshall & Orr 1955), whereas others suggest they do not (Hirche 1983). *C. glacialis* CV molt to adults during November-January in the Svalbard archipelago (J.E. Søreide et al. unpubl. results) which challenge the theory that *C. glacialis* stays in diapause during the entire winter.

During the Polar Night Cruise different aspects of *Calanus* life history relating to overwintering strategies, lipid storage and reproduction were addressed.

3.2 Overwintering strategy - diapause and biophysical properties of wax esters

David Pond, BAS

Diapause, a state of reduced metabolism, is in many zooplankton species one of the major features of polar life cycles. Individual fitness and population productivity are closely linked to this winter ecology. Furthermore, the impact of environmental change on the biota of the Arctic is likely to operate also via changes in the costs of overwintering. This project will improve our understanding of winter metabolism, feeding, and seasonal migrations. We use *Calanus hyperboerus and/or C. glacialis*, an abundant herbivorous copepod, as our case and combine field and laboratory investigations with modeling to reach our aim of an improved understanding of the physiological and life history adaptations concerning overwintering. A central element of our approach is to move towards an individual-based zooplankton ecology where states, such as lipid reserves, are measured at the level of individuals.
Recently studies found that the lipids of the dominant calanoid copepod in the Southern Ocean, *Calanoides acutus* have critical roles in initiating their descent to the ocean depths and in (Pond & Tarling 2011); Pond et al. in press). Analysis of the levels of unsaturation (number of double bonds) of the wax esters in CV *C. acutus* has indicated that those copepods migrating into the deep ocean contained similarly high levels of polyunsaturated wax esters, whilst those from the surface were highly variable. Pond and Tarling analyzed *C. acutus* wax esters using high pressure differential scanning calorimetry (HP-DSC), a technique that can be used to determine the influence of temperature and pressure simultaneously on the solid-liquid phase changes of lipids and other materials. It was discovered that wax esters with high levels of unsaturation (> 50%), i.e. similar to that found in dormant copepods, possess unusual biophysical properties. At pressures equivalent to water depths > 500 m and at ambient temperatures for the deep sea, a proportion of the wax ester pool changed physical state from liquid to solid phase. As the animals swim deeper, water pressure triggers a process that converts their oil to a more solid form rather like the consistency of butter. This change in density acts like a 'diver's weight belt', enabling them to be neutrally buoyant and spend winter in deep waters without wasting energy on constant swimming.

Depth stratified samples of the three dominate calanoids, (*Calanus finmarchicus, C. glacialis* and *C. hyperboreus*) were collected from Rijpfjorden and the Sofia Deep (Table 12). Additional samples of other taxa were also collected to study the amount, composition and physical properties (phase transitions) of their lipids.

Table 12: Overview of samples taken for lipid analysis (David Pond)

	PNC	NET	Number individuals	Depth	Stage
RIJYFYORDEN					
12/01/2012	7	MIK	2	75	LIPID FISH
12/01/2012	7	MIK	2	75	CLIONE
12/01/2012	7	MIK	Bulk	75	*CALANUS* SP
12/01/2012	7	MIK	40	75	CV
MIDDAY STATION					
12/01/2012	14	MULTI	8	220-250	CV
12/01/2012	14	MULTI	1	220-250	C. HYP CIV
12/01/2012	18	MULTI	10	0-125	CV
12/01/2012	17	MULTI	10	125-160	CV
12/01/2012	16	MULTI	10	160-190	CV
12/01/2012	15	MULTI	10	190-220	CV
MIDNIGHT STATION					
13/01/2012	33	MULTI	20	0-20	CV
13/01/2012	33	MULTI	2	0-20	C. HYP MALE
13/01/2012	30	MULTI	10	192-224	CV
13/01/2012	30	MULTI	3	192-224	C. HYP MALE
13/01/2012	32	MULTI	6	20-128	C. HYP MALE
SOFIA DEEP					
14/01/2012	67	MULTI		900-1200	PARAEUCHAETA
14/01/2012	72	MULTI	4	600-2000	C. HYP FEMALE
14/01/2012	72	MULTI	9	600-2000	C. HYP V
14/01/2012	72	MULTI	6	600-2000	C. HYP CIV
14/01/2012	72	MULTI	10	600-2000	C. HYP CIII
14/01/2012	72	MULTI	6	600-2000	C. HYP female
14/01/2012	72	MULTI	3	600-2000	E. NORVEGICA
14/01/2012	72	MULTI	BULK	600-2000	PARAEUCHAETA MALE
14/01/2012	72	MULTI	BULK	600-2000	CV'S C. HYP
14/01/2012	72	MULTI	BULK	600-2000	CIII'S C. HYP
14/01/2012	72	MULTI	BULK	600-2000	CIV'S C. HYP
14/01/2012	72	MULTI	BULK	600-2000	C. HYP FEMALE
14/01/2012	71	MULTI	2	0-50	C. HYP FEMALE
14/01/2012	74	MULTI	2	1800-2000	C. HYP CV
14/01/2012	74	MULTI	1	1800-2000	C. HYP CIII
14/01/2012	77	MULTI	6	1200-1400	C. HYP CV

14/01/2012	77	MULTI	2	1200-1400	C. HYP CIV
14/01/2012	77	MULTI	2	1200-1400	C. HYP MALE
14/01/2012	77	MULTI	10	1200-1400	C. HYP CIII
14/01/2012	77	MULTI	3	1200-1400	C. HYP FEMALE
14/01/2012	76	MULTI	4	1400-1600	C. HYP FEMALE
14/01/2012	76	MULTI	2	1400-1600	C. HYP CV
14/01/2012	76	MULTI	5	1400-1600	C. HYP CIV
14/01/2012	76	MULTI	6	1400-1600	C. HYP CIII
14/01/2012	73	MULTI	10	200-600	C. HYP FEMALE
14/01/2012	73	MULTI	2	200-600	C. HYP CV
14/01/2012	73	MULTI	1	200-600	C. HYP CIV
14/01/2012	70	MULTI	8		C. HYP FEMALE
15/01/2012	84	MULTI	BULK	900-1200	C. HYP MIXED
15/01/2012	85	MULTI	BULK	600-900	C. HYP MIXED
15/01/2012	86	MULTI	BULK	400-600	C. HYP MIXED
15/01/2012	87	MULTI	BULK	200-400	C. HYP MIXED
15/01/2012	86	MULTI	BULK	400-600	SAGITTA WITH OIL
15/01/2012	86	MULTI	2	400-600	CTENOPHORE
ADVENTFJORDEN					
17/01/2012	106	MIK	4	35	LIPID FISH
17/01/2012	106	MIK	1 BULK	35	SAGITTA + OIL
17/01/2012	106	MIK	1 BULK	35	SAGITTA - OIL
17/01/2012	ELIZABETH	EXPERIMENT	4	0	C. HYP EGGS
18/01/2012	115	MIK	BULK	35	SAGITTA - OIL

3.3 Vertical distribution of lipid sack area in overwintering *Calanus*

Malin Daase, Norwegian Polar Institute/ University of Tromsø

In Rijpfjorden and the ICE station multinet samples were taken to investigate the state of the lipid content of the *Calanus* population at different depth (Table 13). Multinet depth were chose to obtain a finer depth resolution of the deeper layers under the assumption that the major part of the population would be concentrated at greater depth for overwintering.
Subsamples containing approximately 100 *Calanus* were taken from each depth and digitale images were taken of all *Calanus* indviduals in the subsamples. Image analysis of the lipid sack area will provide a measure of lipid content and wax ester concentration (Vogedes et al. 2010). This work was coordinated with the sampling of David Pond, so digital images are available of all individuals that D. Pond took.
Additional samples:

Genetics:
Multinet samples taken in Rijpfjorden from 0-20, 20-224 and 224-256 m were fixed in ethanol for genetical analysis. The 0-20 and 224-256 m samples will be analysed by Janne Søreide, UNIS. The 200-224 m will be analysed by Sünnje Basedow, Univ. Nordland. A bulk sample of mesozoplankton taken from 0-2000 m (not quantitative) at the Ice station was also fixed in ethanol and will be analysed by Sünnje Basedow, Univ. Nordland.

Digitale images of 30 individuals of stage CIV and CV of C. finmarchicus/glacialis from the surface layer and the deepest layer in Rijpfjorden were taken and each individual was fixed in ethanol for genetical analysis (Tove Gabrielsen, UNIS).

Lipid, enzyms, dry weight:
C. finmarchicus (CV) and *C. glacialis* CIV and CV were frozen for lipid and enzym analysis. In addition mature and unmature individuals of *C. glacialis* picked out of WP3 net hauls females were frozen for lipid analysis. Individuals of *C. glacialis* CV and CIV were frozen in preweight tin-cups for C:N analysis and dry weight measurements. All these samples were taken for Janne Søreide, UNIS.

Preliminary results:
Contrary to our expectations that the bulk of the *Calanus* population would be found in the deep layers we observed *Calanus* distributed all over the water column in Rijpfjorden and in the ice. There was no apparent indication that *Calanus* further up in the water column had smaller lipid sacks but lipid rich *Calanus* individuals could be observed in all layers.
A high abundance dead *Calanus* were observed in one of the deepest layer in one of the first Multinet hauls taken in Rijpfjorden. This was not observed in the net haul taken the next day at the same depth.
Abundance of *Calanus* was very low at the ice station, in particular in the deep layers were C. hyperboreus prevailed. High abundance of *C. finmarchicus* with large lipid sacks was observed in the upper 300 m.

Table 13: Overview of Multinet samples taken for lipid analysis and genetics

Sample ID	Station	date	time	depth (m) from	depth (m) to	Preservation method	samples taken for
PNC-14	R3	12.01.2027	13:50	256	224	pictures, frozen,	Malin, David, dry weight
PNC-15	R3	12.01.2027	13:50	224	192	pictures, frozen,	Malin, David, dry weight
PNC-16	R3	12.01.2027	13:50	192	160	pictures, frozen,	Malin, David, dry weight
PNC-17	R3	12.01.2027	13:50	160	128	pictures, frozen,	Malin, David
PNC-18	R3	12.01.2027	13:50	128	0	pictures, frozen,	Malin, David, dry weight
PNC-29	R3	13.01.2012	01:57	256	224	pictures, frozen,	Malin, David
PNC-30	R3	13.01.2012	01:57	224	192	pictures, frozen, ethanol (30 CV, 30 CIV)	Malin, David, Tove
PNC-31	R3	13.01.2012	01:57	192	128	pictures, frozen,	Malin, David
PNC-32	R3	13.01.2012	01:57	128	20	pictures, frozen,	Malin, David
PNC-33	R3	13.01.2012	01:57	20	0	pictures, frozen, ethanol (30 CV, 30 CIV)	Malin, David, Tove
PNC-42	R3	13.01.2012	13:09	256	224	ethanol	Janne Søreide
PNC-43	R3	13.01.2012	13:09	224	20	ethanol	Sünnje Basedow
PNC-44	R3	13.01.2012	13:09	20	0	ethanol	Janne Søreide
PNC-67	Ice station	14.01.2012	16:20	1200	900	pictures, frozen, etc.	Malin, David
PNC-68	Ice station	14.01.2012	16:20	900	600	pictures, frozen, etc.	Malin, David
PNC-69	Ice station	14.01.2012	16:20	600	300	pictures, frozen, etc.	Malin, David
PNC-70	Ice station	14.01.2012	16:20	300	50	pictures, frozen, etc.	Malin, David
PNC-71	Ice station	14.01.2012	16:20	50	0	pictures, frozen, etc.	Malin, David
PNC-72	Ice station	14.01.2012	17:30	2000	600	pictures, frozen, etc.	Malin, David
PNC-73	Ice station	14.01.2012	17:30	600	200	pictures, frozen, etc.	Malin, David
PNC-74	Ice station	14.01.2012	20:42	2000	1800	pictures, frozen, etc.	Malin, David
PNC-75	Ice station	14.01.2012	20:42	1800	1600	pictures, frozen, etc.	Malin, David
PNC-76	Ice station	14.01.2012	20:42	1600	1400	pictures, frozen, etc.	Malin, David
PNC-77	Ice station	14.01.2012	20:42	1400	1200	pictures, frozen, etc.	Malin, David
PNC-84	Ice station	15.01.2012	15:10	1200	900	Apherusa photos and frozen	Jørgen
PNC-85	Ice station	15.01.2012	15:10	900	600	Apherusa photos and frozen	Jørgen
PNC-86	Ice station	15.01.2012	15:10	600	400	Apherusa photos and frozen	Jørgen
PNC-87	Ice station	15.01.2012	15:10	400	200	Apherusa photos and frozen	Jørgen

Table 14: Samples taken from Multinet samples for lipid an enzyme analysis (frozen)

sample ID	Depth (from)	Depth (to)	Species	Stage	Individuals/ replicate	No. replicates
PNC-14	256	224	C. finmarchicus	CV	10	1
PNC-14	256	224	C. glacialis	CV	10	4
PNC-14	256	224	C. glacialis	CIV	10	6*
PNC-18	128	0	C. finmarchicus	CV	10	4
PNC-18	128	0	C. glacialis	CV	10	4
PNC-18	128	0	C. glacialis	CIV	10	4^

*1 replicate only 7 individuals; CIV were most likely small C. glacialis, the length often 32-32 measuring units
^CIV were most likely small C. glacialis, the length often 32-32 measuring units

3.4 Winter reproduction of Arctic *Calanus*

Elisabeth Halvorsen, BFE, University of Tromsø, Hildur Pettrusdottir, HAFRO

Introduction

The two copepod species, *Calanus hyperboreus* and *C. glacialis,* are important players in the arctic marine ecosystem, as they constitute a high biomass of energy rich food for fish and sea birds. A key characteristic of the genus *Calanus* in the Arctic is their capacity to build up energy reserves during the short productive period in spring and summer, and then overwinter at depth before resurfacing to reproduce in winter/spring (Falk-Petersen et al. 2009). Reproduction is fuelled to a large extent by stored energy reserves (lipids). How the female allocate these reserves to the eggs, and how the lipid composition influence the buoyancy properties of the eggs that are laid at depth, are of importance in order to understand the mechanisms at play which allows this species to prepare in advance for the extremely short and fairly unpredictable phytoplankton spring bloom.

Material & Methods

Animals for experiments were sampled in Rijpfjorden with a WP-3 net with a large, non-filtering cod-end to ensure as gentle treatment as possible. Animals were sampled from the whole water column: 270 m to the surface. In the Sofia depth, females for experiments were taken from a Multinet sample from 1200-600m, and from a WP-3 haul from 2000m to surface. Live females of *Calanus hyperboreus* and *C. glacialis* were sorted, and only females with clearly visible gonads, and in good shape, were selected. They were then incubated individually in filtered sea water (FSW), at a temperature of 1.5 °C. This corresponds to an average temperature for the depth intervals where most of the females were found at the two sites. Egg production experiments were run for at least 3 days, since *Calanus* is known to lay eggs in spawning events with intervals of about 2-3 days.

After incubating for 24 h, the eggs produced from each female were counted, placed in 6-well plates and incubated in FSW at 1.5°C until hatching. Hatching success will be estimated based on the time when 50% of the eggs were hatched.
Eggs have also been frozen in order to measure lipid levels in the eggs. This is to compare with hatching success, and also study the buoyancy properties of the eggs.

In order to assess the proportion of mature females in the Rijpfjord population, two depth strata were sampled quantitatively with a WP-3 net, and the gonad maturation state of all females will be determined from fixed samples according to the method of Niehoff 1998. For the Sofia depth, this will be assessed based on the Multinet samples from 5 depths.

Preliminary results

Both immature and mature (clearly visible gonads) females of *Calanus hyperboreus* were present in Rijpfjord as well as in the Sophia depth. Males were also present, and some of the immature females carried sperm sacks attached to the oviducts, indicating that this is the period of mating in this species. *Calanus glacialis* was only found in Rijpfjord, and the females seemed all to be immature. However, also for this species there were many males present, and some females carried sperm sacks attached to their oviducts.

Egg production in *Calanus hyperboreus* was variable between individual females, and ranged from 1 to 243 eggs pr. 24 hours. The females spawn in several spawning events, which take place at intervals of 3-8 days.
Hatching success of the eggs seems very high for the first experiments, with nearly 100% of the eggs hathing within 72 hours for some females.

Calanus glacialis did not produce any eggs at this stage.

Figure 9: *Calanus hyperboreus* female with clearly visible orange gonads (left), and eggs (right). Photos: David Pond.

Table 15: Sampling scheme for *Calanus* reproduction

Station	Date	Time	Position	Instrument	Depth (m)	Use/ Sample stored
Rijpfjorden	12.01.12	08:20	801856N 0221461E	CTD	270	3 bottles for incubation
Rijpfjorden	12.01.12	08:45	801856N 0221461E	Go-Flo	0,10,20,30,40,100	**UiT**
Rijpfjorden	12.01.12	15:20	8018400N 0221608E	Go-Flo	50	**UiT**
Rijpfjorden	13.01.12	03:20	8018522N 02215923E	WP-3 large cod-end	270-0	Live *Calanus* females for experiments onboard
Rijpfjorden	13.01.12		8018522N 02215923E	WP-3 large cod-end	270-0	Live *Calanus* females for experiments onboard
Rijpfjorden	13.01.12	04:30	8018522N 02215923E	WP-3 filtering cod-end	270-100m	Quantitative sample for stage composition. **UiT**
Rijpfjorden	13.01.12		8018522N 02215923E	WP-3 filtering cod-end	100-0	Quantitative sample for stage composition. **UiT**
Rijpfjorden	13.01.12		8018522N 02215923E	WP-3 large cod-end	270-0	Live *Calanus* females for experiments onboard
Sofia depth	15.01.12	08:30	814333N 0142039E	WP-3 filtering cod-end	2000-600*	
Sofia depth	15.01.12	10:15	814333N 0142039E	WP-3 filtering cod-end	2000-600#	Live *Calanus* females for experiments onboard

*net failure – no sample
#net failure – probably reduced sample

Table 16: Egg production experiments

Exp. no	Date of sampling	Date start exp.	Date end exp.	Origin of females	# Females	Species
1	13.01.12	13.01.12	15.01.12	Rijpfjord	20	*C. hyperboreus*
2	13.01.12	13.01.12	-	Rijpfjord	10	*C. hyperboreus*
3	14-15.01.12	15.01.12	-	Sofia depth	10	*C. hyperboreus*
4	13.01.12	17.01.12		Rijpfjord	20	*C. glacialis*
Total # females					60	

4. Pelagic macrozooplankton, nekton and acoustics

Five projects are being carried out with these data:

4.1 Predation during the polar night

Øystein Varpe, Norwegian Polar Institute

The project will try to assess the vertical distribution of *Calanus* (Multinet) and of potential predators of *Calanus* by using the Tucker trawl (MIK) above, in and below the main sound scattering layer for 10 min. These samples will complement a similar set of samples obtained in July 2010 in Rijpfjorden, so both winter and summer data on vertical distribution of *Calanus* and potential predators will be available. Samples will be split in half with one half to be fixed in formalin and the other to be frozen for lipid and stable isotope analyses. Stomach content and abundance of predators will be investigated (pelagic trawl). This sampling can easily be combined with the DVM project-sampling.

4.2 DVM during the polar night

Jørgen Berge, UNIS

Objectives: Recently research carried out in the Svalbard archipelago challenged the assumption that most biological processes stop during the polar night at high latitudes due to low food availability and the lack of light by presenting evidence of both active and synchronized diel vertical migration (DVM) of zooplankton during the polar night. Although the polar night at these latitudes is perceived by the human eye as having continuous and total darkness, the new data indicate that Arctic zooplankton nevertheless respond to variations in the very low light levels. These studies reporting zooplankton vertical migration were based on acoustic data but it is yet unclear which organisms are carrying out the DVM during low light conditions. Thus the objective of this study is to determine the primary physical and biological factors that are responsible for the diel vertical migration patterns of zooplankton in the high Arctic during the polar night and twilight period, and to elucidate the resultant ecosystem effects.

4.3 Abundance, distribution and community composition during the polar night with reference to overwintering and reproductive strategies

Clare Webster, Univ. St. Andrews

To assess the abundance, distribution and community composition of the macrozooplankton and nekton communities during the polar night both traditional net sampling and acoustical methods will be utilised. This facilitates a ground truth of the echosounders and increases the temporal and spatial resolution of the data collected during the polar night. Combined with environmental data such as temperature, salinity, depth and ice cover we can then investigate potential drivers. Gut content analysis will be utilised to investigate overwintering strategies of macrozooplankton and nekton and can complement the 4.1 predation project. Any signs of reproduction, particularly of small crustaceans and gelatinous zooplankton will be examined.

Methods Macrozooplankton

Station 1 Rijpfjorden

Macrozooplankton were targeted using the MIK net which has a 1.5 mm mesh size and a 3.14 m^2 opening. It was deployed seven times (Table 17) at both midday and midnight.

Table 17. MIK net deployments at station 1 (Rijpfjorden) during the polar night cruise 2012.

PNC	Date	Time (GMT)	Depth (m)	Lat/long 80 ° N	22° E
7	12/01/12	11:46	75	19.09	11.39
				19.17	11.45
8	12/01/12	12:22	225	18.86	14.75
				18.59	16.14
22	13/01/12	23:53	20	18.51	15.96
				18.73	18.13
23	13/01/12	00:29	75	18.76	15.99
				19.27	15.08
39	13/01/12	11:04	20	18.79	14.4
				19.1	14.46
40	13/01/12	11:36	75	19.1	14.48
				19.1	17.01
41	13/01/12	12:18	225	18.61	15.36
				18.24	14.69

Station 2 Sofiadjupet

No MIK nets were deployed.

Station 3 Isfjorden

Five MIK nets were deployed (Table 18).

Table 18. Five MIK nets were deployed at the third and final station (Isfjorden) during the polar night cruise 2012.

PNC	Date	Time (GMT)	Depth (m)	Lat/long 78 ° N	15° E
104	17/01/12	19:57	225	19.77	05.49
				15.74	34.58
106	17/01/12	22:08	35	16.21	31.60
				15.68	33.40
107	17/01/12	22:44	60	15.69	33.38
				16.13	31.77
115	18/01/12	11:42	30	16.03	33.49
				15.75	34.42
116	18/01/12	12:07	60	15.74	33.14
				16.23	31.92

The cod end was transferred immediately to a bucket marked at 5L and at 10L on deck and diluted up to the 10L mark in the wet lab. Subsamples of 0.6 L were then taken as follows:

1. A sample for community analysis was fixed in 4% formaldehyde and will be analysed in February 2012 by Clare Webster at IOPAS assisted by Katarzyna Blachowiak-Samolyk. The results of this will be utilised by Clare Webster for community composition correlation with acoustic data (4.3) and Jørgen Berge for DVM project (4.2).
2. The second subsample was sieved through a 500 um mesh and wet weight taken. It was then wrapped in tinfoil and stored in the -80°C freezer for lipid and stable isotope analysis. These samples will be analysed at the University of Tromsø by Øystein Varpe for studies on predation during winter (4.1).
3. The third subsample was used for collection of live amphipods by Angelina Kraft which were frozen for lipid and stable isotope analysis (see 4.4.). From this same sample chaetognaths were collected by Jordan Grigor and stored in 4% formaldehyde, ethanol, and frozen for later analysis of their taxonomy, genetics, lipids and stable isotopes (4.5.).

Methods Nekton

Station 1 Rijpfjorden

For nekton and macrozooplankton five pelagic trawls were deployed (Table 19). The pelagic trawl has a mesh size of 1 cm and a diameter of 9 m.

Table 19. Five pelagic trawls were deployed at the first station (Rijpfjorden) during the polar night cruise 2012.

PNC	Date	Time (GMT)	Depth (m)	Lat/long 80 ° N	22° E
5	12/01/12	10:25	175	18.63	13.22
				19.27	14.43
20	12/01/12	21:47	225	18.05	15.18
				18.91	15.64
21	12/01/12	22:36	200	18.49	14.78
				17.76	14.28
48	13/01/12	16:04	225	18.5	14.91
				17.93	14.92
49	13/01/12	16:44	70	18.21	14.97
				18.93	15.44

Station 2 Sofiadjupet

No pelagic trawls were deployed

Extra station - Shelf break

One pelagic trawl was taken at the shelf break (Table 20)

Table 20. One pelagic trawl was deployed at the shelf break between Sofiadjupet and Isfjorden during the polar night cruise 2012.

PNC	Date	Time (GMT)	Depth (m)	Lat/long 80 ° N	13° E
92	16/01/12	4:34	200	42.57	36.25
				42.88	32.46

Station 3 Isfjorden

Four pelagic trawls were deployed (Table 21).

Table 21. Four pelagic trawls were deployed at the third and final station (Isfjorden) during the polar night cruise 2012.

PNC	Date	Time (GMT)	Depth (m)	Lat/long 78 ° N	15° E
103	17/01/12	18:57	200	19.13	9.01
				19.75	6.13
105	17/01/12	21:33	50	15.75	34.55
				16.23	31.74
113	18/01/12	10:25	30	15.97	32.42
				15.43	34.78
114	18/01/12	11:03	55	15.64	35.05
				16.17	32.56

All trawls were emptied into a large bucket on deck and carried to the fish sorting area. Here animals were sorted by taxon and subsamples selected for measurements as follows:

1. All animals were separated by taxon, counted and weighed for correlation with acoustic data (Clare Webster).
2. All fish were identified as far as possible and length (from nose to tail fork) breadth (at widest point) and wet weight were taken of every individual or of a subsample of 100 if a species was present in larger numbers. These data will be used for 4.1 (Øystein Varpe) and for acoustic correlation 4.3 (Clare Webster).
3. Gut content data were taken from the third pelagic trawl (PNC 21) for 4.1 (Øystein Varpe) from 6 haddock, 26 Atlantic cod and 40 polar cod (of which 18 were large selected individuals).
4. 22 of the aforementioned polar cod that were not size selected were also sexed and had their gonad and somatic weight measured as part of project 5.1 (Jasmine Nahrgang).

Acoustics

The SIMRAD ER60 echosounding equipment was set at a maximum ping rate for the entirety of the cruise. The three frequencies (18 kHz, 38 kHz and 120 kHz) were calibrated prior to the cruise on the 17/10/11 (table 6). All three echosounders are permanently installed on the drop keel of the RV *Helmer Hanssen.* Recording of data began at 19:28 GMT on 08/01/12. Note that the EK60 time is 11 mins and 30 secs ahead of GMT. Power settings are at 1000W for the 18 kHz and the 38 kHz and 500W for the 120kHz transducer. On leaving port the EK60 range saved was set at 500m. A bottom artefact was noted for the 38 kHz transducer. The drop keel was lowered at midday on the 10/01/12. The drop keel lowers the transducers a further 3.2 metres under the ship meaning the transducers sit a total of 8.7 metres below the surface. On the 10/01/12 at 16:00 (EK60 time) the range saved was increased to 600m and

the bottom artefact was no longer seen. At 17:31 the range was changed to 250m and the bottom artefact reappeared. At 17:37 range was set back to 600m. This was repeated on the 11/01/12 - at 14:36 the range was changed to 150m and the same bottom artefact was noted. It was subsequently changed back to 600m - again the bottom artefact was no longer recorded.
On the 12/01/12 at 07:10 GMT the drop keel was raised because we were in Rijpfjorden and ice was present. It remained raised for the remainder of the cruise. Between 08:15 and 08:19 (EK60 time) the range was changed to 300m, 1000m and then back to 600m. Pelagic sampling began at 10:25 GMT.
On leaving Rijpfjorden the saved range was changed to 3000m and on the 15/01/12 at 05:51 the saved range was changed to 1000m – and it remained at this for the rest of the cruise. The EK60 stopped recording on 21/01/12 at 09:00 on arrival back at the port of Tromsø. The CTD data will be used to calculate the speed of sound of water at the different stations including the shelf break and will be used for post processing of the acoustic data. Post-processing will be carried out using the software Echoview v4.9 and Matlab v7.13 by Clare Webster (4.3).

Table 22. Calibration parameters from 17/10/11 of the three permanently installed echosounders onboard the RV *Helmer Hanssen*.

Frequency (kHz)	**18**	**38**	**120**
Gain (dB)	23.4	26.37	23.07
s_A correction (dB)	-0.7	-0.71	-0.5
2-way beam angle (dB re 1 steradian)	-17	-20.6	-21.1
Angle sensitivity Along (deg)	13.9	21.9	21
Athwart (deg)	13.9	21.9	21
Angle offset Along (deg)	0.15	0.01	0.12
Athwart (deg)	-0.06	-0.01	-0.07
3 dB beam width Along (deg)	10.7	6.82	7.36
Athwart (deg)	10.74	6.98	7.46
Power (W)	2000	2000	500
Pulse duration (μs)	1024	1024	1024
Alpha (dB/km)	2.8	9.9	3.5
Bandwidth (kHz)	1.57	2.43	3.03
Serial numbers Transducer	2048	24392	29488
GPT	907-20346b	102-203464b	102-2034688

Conclusion

This cruise acquired invaluable quantitative data on poorly described polar night pelagic macrozooplankton and nekton communities and will provide important information not just for the Arctic scientific community but for our understanding of seasonal dynamics of macrozooplankton and nekton as a whole, many of which are commercially important species or provide a valuable food source for commercial fish species throughout the polar night. This data is particularly important in light of the effects of projected climate change and its impact on the Arctic sea.

4.4 Bioluminescence

Mark Moline, UNIS/ Cal PolyTech

With the majority of the CTD profiles taken during the cruise, bioluminescence was taken as a supplemental measurement to help address the distribution and interaction of the dinoflagellate and zooplankton communities (Table 23). Bioluminescence was measured with a WetLabs Inc. UBAT bathyphotometer logging on a WetLab Inc. DH4 data logger. Samples were taken for 47 stations at 60Hz to capture the kinetics of each bioluminescence flash which identifies the specific group of zooplankton responsible (Figure 10). Profiles of bioluminescence will be compared to the WP2, WP3, and MIK nets to correlate bioluminescence species abundance data with the flash identifications. This will provide a detailed picture of the vertical distribution of organisms in the water column to examine interactions and was planned to relate to bird diving depths. For some of the stations, the rosette remained at particular depths for extended durations (5-10 min) to account for the variability in sampling and the low abundance of individual organisms during the polar night. Profiles of bioluminescence were focused in the three station locations (Rijpfjorden, Sophia dijpet, and Adventfjorden) in addition to the two transects highlighted in 1.1 for CTD.

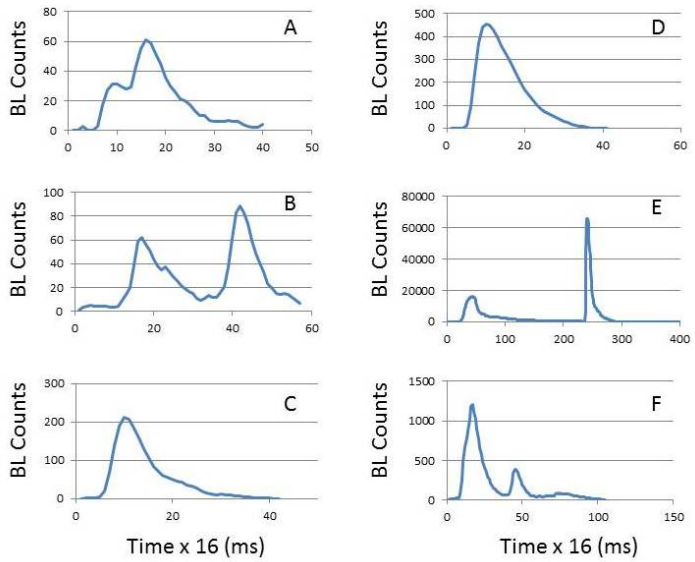

Figure 10. Examples of bioluminescent flashes measured in Rijpfjorden. Depending on the organism, the shape of the flash, the duration, and the intensities will vary. For example, A and B are examples of dioflagellate flashes, C and D are copepods, and E and F are examples of ctenophores.

Table 23. Log of bioluminescence profiles taken during the polar night cruise.

Date	Time (UTC)	St. nr.	Location	Latitude	Longitude	Depth	Log
12/01/2012	07:10	0514	Rijpfjorden	80 18.549N	22 15.469E	284	9703
12/01/2012	11:04	0515	Rijpfjorden	80 19.267N	22 14.421E	239	9713
12/01/2012	14:33	0516	Rijpfjorden	80 18.443N	22 15.494E	284	9718
12/01/2012	15:01	0517	Rijpfjorden	80 18.555N	22 14.012E	275	9719
12/01/2012	15:28	0518	Rijpfjorden	80 18.35N	22 16.993E	262	9720
12/01/2012	15:46	0519	Rijpfjorden	80 18.402N	22 16.251E	281	9720

12/01/2012	16:04	0520	Rijpfjorden	80 18.415N	22 15.362E	283	9720
12/01/2012	16:16	0521	Rijpfjorden	80 18.42N	22 14.733E	274	9720
12/01/2012	16:44	0522	Rijpfjorden	80 18.39N	22 16.962E	263	9721
12/01/2012	17:16	0523	Rijpfjorden	80 18.527N	22 15.831E	283	9721
12/01/2012	18:29	0524	Rijpfjorden	80 18.399N	22 16.717E	273	9722
12/01/2012	23:18	0525	Rijpfjorden	80 18.489N	22 15.7248E	284	9734
13/01/2012	05:13	0526	Rijpfjorden	80 15.097N	22 09.439E	95	9748
13/01/2012	05:52	0527	Rijpfjorden	80 12.583N	22 08.288E	126	9751
13/01/2012	06:24	0528	Rijpfjorden	80 09.942N	22 10.122E	175	9754
13/01/2012	09:09	0529	Rijpfjorden	80 07.815N	22 09.454E	199	9757
13/01/2012	10:28	0530	Rijpfjorden	80 18.52N	22 15.36E	284	9768
13/01/2012	18:05	0531	Rijpfjorden	80 17.970N	22 13.976E	262	9785
13/01/2012	19:14	0532	PN1	80 26.19N	22 07.59E	178	9794
13/01/2012	20:29	0533	PN2	80 36.867N	22 01.366E	95	9804
13/01/2012	21:39	0534	PN3	80 47.65N	21 43.366E	153	9816
13/01/2012	22:37	0535	PN4	80 55.59N	21 23.497E	109	9824
13/01/2012	23:48	0536	PN5	81 05.58N	20 54.388E	146	9836
14/01/2012	00:57	0537	PN6	81 14.380N	20 26.194E	459	9846
14/01/2012	02:46	0538	PN7	81 18.889N	18 58.091E	548	9860
14/01/2012	04:51	0539	PN8	81 21.178N	17 38.801E	785	9873
14/01/2012	06:59	0540	PN9	81 24.071N	16 02.671E	2380	9889
14/01/2012	09:10	0541	PN10	81 31.907N	14 22.95E	2469	9906
15/01/2012	16:30	0548	Sofie Djupet	81 44.697N	14 20.886E	2269	9938
16/01/2012	06:20	0552	PN14	80 39.255N	13 35.094E	487	15
16/01/2012	07:09	0553	PN15	80 36.17N	13 46.182E	182	19
16/01/2012	07:52	0554	PN16	80 31.299N	13 50.70E	150	27
16/01/2012	08:35	0555	PN17	80 25.89N	13 54.923E	170	30
16/01/2012	09:18	0556	PN18	80 20.32N	14 01:50E	99	36
16/01/2012	10:20	0557	PN19	80 10.931N	14 08.710E	40	46
17/01/2012	06:41	0558	Isfjorden	78 19.44N	14 55.28N	210	250
17/01/2012	10:27	0559	Adventfjorden	78 15.71N	15 33.69E	87	264
17/01/2012	11:00	0560	Adventfjorden	78 15.448N	15 32.686E	80	265
17/01/2012	11:16	0561	Adventfjorden	78 15.768N	15 33.138E	88	265
17/01/2012	14:11	0562	Adventfjorden	78 15.848N	15 32.873E	89	272
17/01/2012	14:39	0563	Adventfjorden	78 15.869N	15 33.248E	88	272
17/01/2012	15:04	0564	Adventfjorden	"	"	86	272
17/01/2012	15:22	0565	Adventfjorden	"	"	86	272
17/01/2012	15:49	0566	Adventfjorden	78 15.452N	15 34.760E	81	272
17/01/2012	16:33	0567	Adventfjorden	78 15.614N	15 33.843E	87	273
18/01/2012	00:43	0568	Isfjorden	78 20.108N	15 08.754E	267	307
18/01/2012	12:40	0569	Adventfjorden	78 16.075N	15 31.710E	95	344

4.5 The biological performance of hyperiid amphipods during the Polar night

Angelina Kraft, AWI

Rijpfjorden - Within the fjord of Rijpfjorden, a diel vertical migration study of hyperiid amphipods was performed during the Polar night. A total of seven Midwater Isaak Kit Trawls (MIK-nets, 1500 µm mesh, 3.14 m² opening) were sampled during midday and midnight (UTC). At each station, stratified macrozooplankton samples were collected. From a subsample, present amphipods were identified to species level, staged, measured and frozen at -55° C for the later analyses of their gut content and lipid composition at the AWI home laboratory. Furthermore, sample for stable isotope analysis were sampled. Large hyperiids of the species *Themisto libellula* were sampled from 5 pelagic trawls, which included specimens of up to 45 mm total body length. Beside *T. libellula*, three more amphipod species were found, including the sub-arctic boreal species *T. abyssorum*, the pan-oceanic *Hyperia galba* and the ice-associated amphipod *Gammarus wilkitzkii*.
Sofia Deep - At Sofia Deep, the content of a WP3 net, hauled vertically from 0-2000 m, was investigated for the presence of amphipods. Three different species were found: *T. abyssorum*, *Cyphocaris bouveri* and *Cyclocaris guilelmi*, with the latter two being typical deep-water lyssianoid amphipods.
Isfjorden & Adventfjorden - Within both fjords, more specimens of *T. abyssorum* and *T. libellula* were sampled within several MIK trawls. Additionally, a typical North Atlantic amphipod species, *T. compressa*, was found in the nets.

With the on-board dataset, a total of 7 different amphipod species from 5 families (Table 23) were sampled during the winter cruise The collected amphipods included the epipelagic target species *Themisto abyssorum*, *T. libellula* and *T. compressa*, typical deep-water species (e.g. *Cyclocaris guilelmi*) and ice-associated amphipods (*G. wilkitzkii*). In total 382 were identified and measured, of which 97 were frozen for lipid analysis, 45 for gut content analysis and 114 for stable isotope analysis.

Table 24: The collected amphipod composition in 12 MIK trawls, 8 pelagic trawls and 1 WP3 during the ARCTOS winter cruise.

Sampling area	Taxon	MIK	Pelagic trawl	WP3
Rijpfjorden	Family Hyperiidae			
	Themisto abyssorum	x	x	
	Themisto libellula	x	x	
	Hyperia galba		x	
	Family Gammaridae			
	Gammarus wilkitzkii		x	
	Family Lysianassidae			
	Anonyx nugax		x	
Sofia Deep / Ice station	Family Hyperiidae			
	Themisto abyssorum			x
	Family Cyclocaridae			
	Cyclocaris guilelmi			x
	Family Cyphocarididae			
	Cyphocaris bouveri			x
Isfjorden/Adventfjorden	Family Hyperiidae	x		
	Themisto abyssorum	x		
	Themisto libellula	x	x	
	Themisto compressa	x		
	Hyperia galba	x		
	Family Lysianassidae			
	Anonyx nugax	x	x	

4.6 Chaetognaths

Jordan Grigor, Université Laval

Background

Chaetognaths are a widespread phylum of gelatinous zooplankton. They are recognised as being key invertebrate predators on copepods and comprise 5-15% of the global zooplankton biomass (Longhurst 1995). However, in many areas of the Arctic, chaetognaths have been given insufficient research attention. Two chaetognath species are expected to reside in Svalbard waters; the dominant *Parasagitta elegans* and a second species *Eukronia hamata*. To date, only one study has examined the ecologies of chaetognaths in Svalbard waters with a high seasonal resolution (Grigor *et al*. in prep).

In January 2012 (during the polar night), a unique opportunity arose to sample the chaetognath communities at several locations around Svalbard, onboard the RV Helmer Hanssen. This cruise coincided very neatly with my upcoming PhD on chaetognath ecology at Université Laval in Quebec, Canada. During my PhD, which will commence in February, I will analyse a ten-year time series of chaetognath samples from the Canadian Arctic. These samples, held at Université Laval, have been treated in different ways, enabling me to study many different aspects of chaetognath ecology. Some aspects that might be explored include diet, genetics and population dynamics.

The prospect of a pan-Arctic synthesis of data on chaetognath ecology is an exciting one, which will contribute considerably to reducing the knowledge gap previously described. During this ten day polar night cruise, chaetognath samples were collected and stored in an appropriate manner. The aim is to explore the same ecological parameters in specimens from the European and Canadian Arctic, and look for similarities and differences between regions.

Methods

Three locations around Svalbard were sampled for chaetognaths; Rijpforden: a fjord off the north coast (80,90^{o}N), Ice Station 2412 at the ice edge (81,44^{o}N), and Adventfjorden (78,16^{o}N): a fjord on the west coast (Table 1). These locations differ considerably in meteorological and oceanographical conditions during January (for more information, see sections on physical conditions). Specimens were collected from a range of depths using three different nets; MIK (3.14m^2 opening, 1.5mm mesh size), MPS (0.25m^2 opening, 0.2mm mesh size) and WP3 (1m^2 opening, 1mm mesh size). The majority of the chaetognath samples in Table 1 were collected with the MIK. Due to its much larger opening area, the MIK succeeded in capturing considerably higher abundances than the MPS and WP3 gears. MPS and WP3 data were mainly used when MIK data were lacking.

From each MIK zooplankton sample, 0.6l of 10l was taken out for quantitative analysis. Clare Webster (PhD student, St. Andrew's) will measure abundances of *P. elegans* and *E. hamata* in these subsamples, and lengths of individuals. She aims to send me these data in March 2012. A second subsample (of uncertain volume) was extracted and visually examined for the presence of chaetognaths. Individuals were picked out and added to sealed plastic/glass containers. Some containers were treated 96% ethanol and others with 4% buffered seawater-formalin solution (Table 1). From the majority of the MIK samples, 30 individuals (3 replicates of 10 individuals) were picked out for lipid analyses and 75 individuals (3 replicates of 25 individuals) for isotope analyses, and frozen in plastic zip bags at -50^{o}C. The "*Calanus*" team also picked out chaetognaths from the MPS samples (it is unclear whether they picked out all chaetognaths present). Individuals collected by MPS were were stored in plastic containers, in 96% ethanol or 4% buffered formalin-seawater solution. Samples are stored at NPI in Tromsø. Detailed overview of samples is given in Appendix II.

A note of thanks
I am very grateful for my place on this cruise and would like to thank Stig Falk-Petersen and Øystein Varpe for the invitation. I would also like to thank Stig, Anette Wold and Malin Daase for organising it so well. And all the other cruise participants for help and advice, for helping me with my French, and for making this cruise one to remember.

4.7 Shell morphology of *Limacina helicina*

Stig Falk-Petersen, Anette Wold, Malin Daase (NPI)

Very little is known about the life strategy of *Limacina helicina* and *Clione limacina.* These species are important component in the Arctic food web and can occur in enormous amounts and is now a target species for ocean acidification studies. *L. helicina* has a rather patxchy distribution but can dominate the zooplankton community and represents the maximum contribution to the biogenic flux. NPI in co-operation with other ARCTOS institutions plan a long term investigation to increase our understanding of the life strategy, the ecological role and how ocean acidification can influence its biology. The team will investigate the variability in abundance with depth in different localities in Svalbard waters. Changing in proteins, total lipid, lipid classes, fatty acids, stable isotopes and possible carbohydrates, carbon/carbonate (Clara Mano), shell thickness, shell morphology and shell mineralogy (Clara Mano) contents will be also investigated to understand the potential reserve of energy available to counteract the ocean acidification under extreme seasonal environmental conditions. However, *Limacina helicina* was not found in any MIK or Multinet hauls taken during so no samples were taken apart from 30 individuals of juvenile *Limacina helicina* which were taken from a WP3 63 µm net haul in Rijpfjorden and stored in ethanol. The aim is to analyse juvenile *Limacina helicina* with a specialised CT scanner for a comparison of thickness between these modern samples and (hopefully) old samples collected from just north of Kongsfjorden. This work will be done by Ella How, LOV.

4.8 Apherusa-Ice fauna and the Captain Nemo theory

Jørgen Berge, UNIS

From the ice station at 81°45'N 14th and 15th of January 2012, we collected 19 specimens of Apherusa glacialis from depths between 200 and 2000 m. Samples were collected with MPS and WP3 netts. 16 specimens were frozen individually, two specimens were preserved on EtOH. One specimens was lost in the process. Frozen samples will be transported to Tromsø where A. Wold will process them. A picture of all specimens except the two preserved on EtOH was taken by M. Daase onboard (see table below with picture IDs). The samples will be prepared for a publication during winter 2012 (lead author J. Berge).

Table 25: Overview of Apherusa glacialis samples taken on the cruise:

	"A.g." number	Frozen	EtOH	Picture	Pic ID	
14th January 2012						
MPS 2000-600m	1	x		x	PNC72_*Calanus*0140	Female with eggs, longest
MPS 2000-600m	2	x		x	PNC72_*Calanus*0136	Female with eggs, shortest
MPS 2000-600m	3	x		x	PNC72_*Calanus*0133	no sexual char
MPS 2000-600m	4	x		x	PNC72_*Calanus*0129	male
MPS 2000-600m	5	x		x	PNC72_*Calanus*0130	male
MPS 2000-600m	19			x	PNC72_*Calanus*0143	female, not preserved
MPS 600-200	6	x		x	PNC73_*Calanus*0015	no sexual char
MPS 600-200	7	x		x	PNC73_*Calanus*0013	Female with eggs. NB: check ID A.g.8 is the largest!
MPS 600-200	8	x		x	PNC73_*Calanus*0014	Female with eggs (large)
15th January 2012						
MPS 1200-900	9	x		x	PNC70b_*Calanus*0082	Female with egg
MPS 1200-600	10	x		x	PNC70b_*Calanus*0125	Female with eggs
MPS 1200-600	11	x		x	PNC70b_*Calanus*0121	no sexual char
WP3 2000-0	18		x		-	Female with egg
WP3 2000-0	19		x		-	No sex char
MPS 400-200	16	x		x	Apherusa0007	Female with eggs
MPS 600-400	12	x		x	Apherusa0001	Female with eggs
MPS 900-600	13	x		x	Apherusa0003	no sex
MPS 900-600	14	x		x	Apherusa0004	no sex
MPS 900-600	15	x		x	Apherusa0006	no sex

5. Higher trophic levels

5.1 Winter birds

Jørgen Berge, Mark Moline, UNIS

Before the cruise a IR camera rented from Aptomar was installed onboard the ship (on roof at port side). This camera was intended for monitoring seabirds during the cruise, and possibly aiding collecting samples. However, the camera did not work according to plan, and it was not used as planned. During the first part of the cruise, no birds were collected, but observations were made:

Rijpfjorden: One little auk
Ice station: Two little auks, one black guillemot, one glaucus gull

Transect from Tromsø to Svalbard: numerous fulmars, kittiwakes and glaucus gulls, especially round Bear Island.

Bird collections will be attempted during the last part of the cruise in Isfjorden.

5.2 Pilot study on metabolism and ecophysiology of polar cod

Reproduction biology of polar cod during the polar night

Jasmine Nahrgang, University in Tromsø

Polar cod (*Boreogadus saida*) were caught with a Campelen Super 1800 bottom trawl added with a fish lift (IMR) in Rijpfjorden on the 12/01/2012 during midday. From this trawl, all the polar cods were transferred to a tank on deck with running seawater. Immediately after trawling, 20 individuals were dissected and tissues stored onboard RV Helmer Hanssen before transfer to the University of Tromsø for further biochemical and histological analyses (Table 26).

Table 26: Polar cod tissue sampled and analyses that will be performed.

Tissue	Snap frozen in liquid nitrogen	Preserved in 4% formalin	Frozen at -20C	Ethanol
Plasma	Sex steroids			
Liver	Energy reserves (lipids, proteins, carbohydrates), cellular respiration (ETS activity)			
Bile	PAH metabolites and bile acids			
Gonads	Energy reserves (lipids, proteins, carbohydrates), cellular respiration (ETS activity)	Histology		
Muscle			Energy content	
Otoliths				Age determination

Four additional fish were dissected for liver, gills, heart, brain, spleen and gonads, snap frozen in liquid nitrogen. These samples will be sent to NIVA for testing polar cod mRNA on cod microarray.

Two more bottom trawls were taken in Rijpfjorden, where subsamples of 100 random polar cods were recorded for size, total weight and gender as well as gut content analysed for a fish community study and study of the sex ration of polar cod related to age. In addition, for 50 specimens of these, gonad and somatic weights were recorded for calculation of the gonadosomatic index (GSI).

The remaining fishes in the tank were transferred to the UNIS facilities upon arrival in Longyearbyen for experiments taking place from March to May 2012 and related to the Polarisation project (NFR to UiT/Jasmine Nahrgang).

Metabolism of polar cod

Oxygen consumption rates of polar cod were studied onboard the ship using an intermittent flow through respirometer in the cold room (2-4^{o}C). Out of 12 specimens analyzed over a period of 24h each, 8 fish gave successful results with respiration rates close to what was recorded previously (Figure 11). The high levels observed at the beginning of the measurement are linked to handling stress. These fishes were dissected for liver and gonad samples to optimize the ETS assay (cellular respiration) and compare the ETS activity within the tissues to the whole body respiration rates.

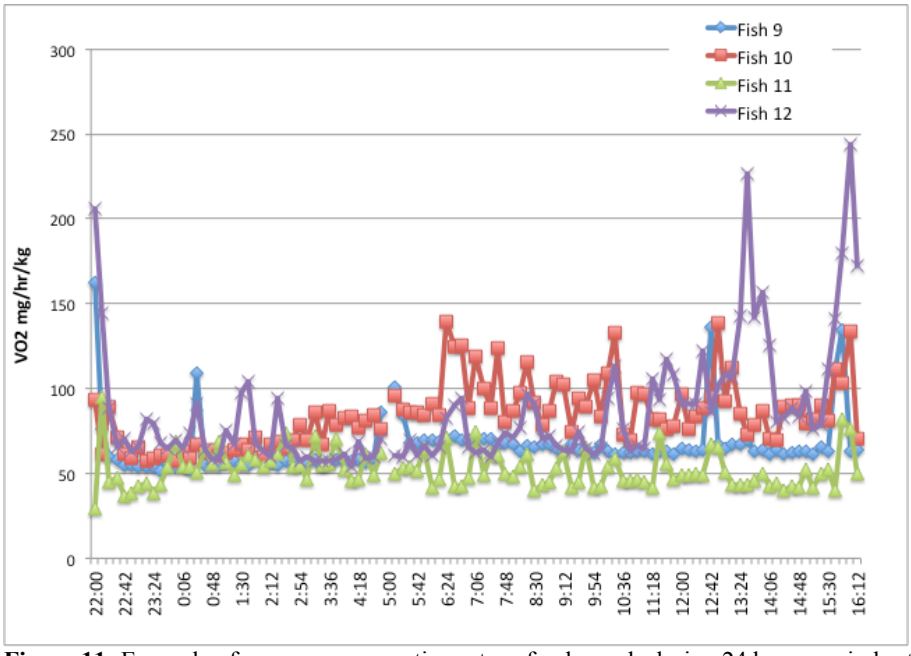

Figure 11: Example of oxygen consumption rates of polar cods during 24 hours periods at 4C.

6. Additional Sampling

6.1 Leptoclinus maculatus

Svetlana A. Murzina (Stig Falk-Petersen)
Leptoclinus from pelagic and benthic trawls in Rijpfjorden and Isfjorden were frozen at -20^{o}C.

6.2 Meroplankton

Eike Stübner, UNIS

As part of the PhD project of Eike Stübner the water column in Rijpfjorden and Adventfjorden was sampled with a WP2 net with 63 µm mesh size to investigate the occurrence and species composition of meroplanktic species. Samples were fixed in formalin and ethanol and transferred to UNIS.

VI. Talks and presentations during the Polar night cruise 2012

1. Jørgen Berge: DVM at high latitudes
2. Jørgen Berge: Evolution of the Arctic *Calanus* complex
3. Thomas Brown. IP25, a multipurpose sea ice diatom biomarker.
4. Ashleigh Ringrose. Investigating the use of the sea ice biomarker IP25 in Arctic food webs
5. Clare Webster. The effects of temperature and food on the reproduction of *Aurelia aurita*, the moon jelly.'
6. Øystein Varpe: Fitness and phenology: annual routines and zooplankton adaptations to seasonal cycles
7. Angelina Kraft: The performance of pelagic amphipods in the northern Fram Strait
8. David Pond: How lipids facilitate the life-histories of polar zooplankton
9. Katarzyna Błachowiak-Samołyk: The diversity of pelagic ostracods in the Central Eastern Atlantic Ocean
10. Hildur Petrursdottir: Trophic structure of the Iceland Sea
11. Vasily Bednenko: Experimental investigation of heat fluxes in the marginal ice zone including some words on "Influence of anthropogenic pollution on radiative properties of snow cover and atmosphere"
12. Else Nøst Hegseth: Ice algae in the high north
13. Else Nøst Hegseth: Phytoplankton and winter-spring transition
14. Stig Falk-Petersen. The oceanography of Svalbard waters told by a marine biologist
15. Stig Falk-Petersen: The Russian drift ice stations
16. Tove M Gabrielsen: Use of metagenomics and metatranscriptomics to study the diversity and function of microbial eukaryotes
17. Jasmine Nahrgang: Biology of polar cod and potential disruption by petroleum-related compounds
18. Jordan Grigor: The annual routine of the chaetognath *Parasagitta elegans* in the Arctic
19. Eike Stübner.: Seasonality and trophic interactions in Arctic meroplankton. PhD project UNIS / UoT
20. Anette Wold: Calanus glacialis- the role of lipids in the life cycle and for the Arctic food web
21. Malin Daase: Arctic zooplankton and life history variability in *C. glacialis*
22. Mark Moline: Bioluminescence in the Sea
23. Elisabeth Halvorsen: Egg production in *Calanus* during the polar night?
24. Nathalie Morata, Emma Michaud: ECOTAB: Effect of climate change on the Arctic benthos
25. Maria de Lluch Calleja Cortès: Understanding fluxes of organic C and N on the ocean: biogeochemical cycles

VII. Outreach

- December 2011. Interview of Stig Falk-Petersen with NRK1 by Lars Egil Mogårde – Polarnatt tokt.
- January 2012. Interview with Egil Pettersen. TV 2 at nine oclock news. http://www.tv2.no/nyheter/innenriks/aate-kan-forklare-polargaate-3677139.html
- Stig Falk-Petersen et al. December 2012. Polar night cruise blog at University of Tromsø web site: http://blogg.uit.no/aba001/
- Mark Moline blog: http://svalbard-fulbright.blogspot.com/
- Article on NRK website (23.01.2012): Oppdaget ukjent massedød i isødet (http://www.nrk.no/nyheter/distrikt/troms_og_finnmark/1.7960421)
- News article on Norwegian Polar Institute website: Unik funn fra havets bunn (19.01.2012) http://www.npolar.no/no/nyheter/2012/2012-01-19-tokt-i-polarnatta.html
-

Thomas Brown and Ashleigh Ringrose:

- Education through Expeditions webpage and Polar Night Cruise blog
  http://norwegianpolarnightcruise2012.blogspot.com/2012/01/this-place-is-unbelievable.html
  http://www.etelive.org/content/contentete.numo?id=165
- Plymouth Herrold Newspaper –
- Royal Society of Chemistry taught laboratory schools to outreach

Clare Webster:

School-age children in Glasgow

As a follow up to some emails sent to a class of 8-9 year olds during the Polar night cruise and the obvious interest they had in the cruise, in early February short (30 minute) Powerpoint presentations using pictures and simple teaching slides will be shown to classes of children aged between 5 and 11 in Glasgow, Scotland to teach and (hopefully) spark interest in science at sea. Clare Webster (PhD student, St Andrews University).
For more information please contact Clare Webster (cnw3@st-andrews.ac.uk) or Mrs Noelle Ryan at Golfhill Primary School, Glasgow (nryan@golfhill-pri.glasgow.sch.uk).

VIII. Blog entries

Follow the first ever cruise into the polar night with University of Tromsø research vessel Helmer Hanssen.
Here are all blog published during the cruise on http://blogg.uit.no/aba001/

Jan.03, 2012

Into the Polar Night

Follow the international team of researchers as they venture into the Polar Night on the R/V Helmer Hanssen.
The ecosystems of the immense continental shelves of the Arctic Ocean are presently impacted by what is forecasted to be one of the most abrupt climate shifts seen in modern history. Already spectacular ecosystem changes are observed at the periphery of the Arctic Ocean in response to the changing ice regime. This transformation will alter biological productivity with large consequences for the unique Arctic marine fauna. Forecasting the response of Arctic Ocean ecosystems to amplifying climate and industrial stresses requires pan-Arctic syntheses of existing knowledge and the circum-Arctic coordination of new research efforts. Most studies in the Arctic Ocean are conducted during summer and autumn, with a few exceptions such as for example the CFL project, the Fram voyage, the Russian ice drift stations. To our knowledge no marine investigation has taken place during the polar night in the Arctic Ocean north of the Svalbard the last decades.

Jan.07, 2012

Arriving Into the Polar Night

So, finally, after three months of planning and preparation the SAS flight from Oslo took me over the Arctic circle which, at 66°N, marks the furthest northern reaches of our world – here the sun does not shine at all for at least one day a year. I was headed for the city of Tromsø, which Arctic explorers set out from and which for some, would be their last time on continental Europe.
Most of these explorers were drawn here in search of trade passages towards the east and would begin, at least, during the more favourable summer months. But here I am, in the depths of winter, and in the darkness of the polar night about to head still further north, around the islands of Svalbard, where at 82° N we would find ourselves closer to Alaska than London.
My excitement was fuelled as I peered out into the blackness which was my airplane window and caught my first blurry glimpse of the northern lights – a green ribbon-like cloud hanging eerily in the sky – and then to my surprise I could see the ground – a white landscape of massive mountains lit by a bright moon. I suppose I thought it would be pitch black but even in the middle of winter in Tromsø there is still enough light to appreciate the impressive surroundings between 10am and 2pm every day!
We've got just two more days in this beautiful city before we can pull off from the dockside of Tromsø harbour. It will take us approximately 72 hours to reach the drk icy waters of northern Svalbard and then the work really begins! We are all nervous and excited about being the first research expedition to work there in the middle of winter, and we are all aware how important the data we collect will be to our understanding of polar regions and to the pressing issues surrounding climate change – let's hope we're not all too seasick!
Clare Webster, Postgraduate Researcher, University of St Andrews

Jan.08, 2012

Out of the Box

My name is Jordan Grigor. I am 23 years old and come from Edinburgh in Scotland. On this cruise I will be collecting and studying a wide range of marine animals, from fish to amphipods.

A little bit about me: I have been interested in marine biology since high school, and when I was younger I dreamt about coming to the Arctic and seeing polar bears. From 2006-2010 I studied my undergraduate degree in marine science at the Scottish Association for Marine Science (SAMS), a part of the University of the Highlands and Islands (UHI). During the third year of my degree, I was offered a very unique opportunity to live on Svalbard for a year and take classes in Arctic biology at the University Centre in Svalbard (UNIS). This amazing opportunity arose from the signing of a new ERASMUS agreement between UHI and UNIS. And it couldn't have come at a more perfect time; having lived and worked in Scotland for 19 years, I was looking for a new adventure. Going to the Arctic seemed like a really cool thing that you only see people do on TV. I jumped at the opportunity to do something "out of the box".

I travelled to Svalbard alongside my friend and fellow third year in August 2008. We both stayed until the following June. To read all about my experiences during the year check out the blog I wrote at the time https://www.sams.ac.uk/expedition-blogs/students-in-the-Arctic/jordans-blog

During my time on Svalbard I worked on the Ice Edge Programme (http://www.iceedge.no/) , a cool study that we carried out in one of Svalbard's fjords. We sampled this fjord, called Billefjorden, every two-four weeks throughout the year. But we were not working on the larger Arctic creatures that are symbols of the Arctic. We were interested the much smaller plankton living in the water, which less people are familiar of. My special animal to study was a worm called Parasagitta elegans. These smaller animals are very because they are near the bottom of the food chain, and without them, larger animals such as fish and birds would go hungry. I loved working on Parasagitta elegans so much that I am going to study it in the Canadian Arctic during my PhD from February.

Last summer I was invited back to Svalbard to take part in a midnight-sun cruise. It was another great experience, especially for improving my skills on how to work with plankton. I was over the moon when they invited me back a third time to take part in this special polar night cruise. This time around, I will be collecting my own samples which I will work on in my PhD. My experiences so far have in some ways prepared me for the cruise, but not entirely. For example I have not travelled so far north on Svalbard, and to do this at a time of year when it's not usually possible makes it all the more thrilling! There will be extra challenges to deal with such as the darkness, the cold and the sea ice, but I am ready to tackle them and can't wait to get started! I hope to write several blogs when I'm on the cruise to let you know how I'm getting on.

Grigor Jordan, Scotland and Canada

Jan.08, 2012

Christmas…

Christmas… I am explaining to my family that I will spend three weeks on board of a Norwegian boat to go to an Arctic expedition, to the very north… It might not be the northern reachable latitude, but it does sound to everybody like if I was going to the end of the world… a big adventure… I am going somewhere where non of those who are listening will probably ever go, so I can see their excitement in their eyes and I can't avoid feeling the same way. I have been in many other cruises but just hearing myself talking about this one I see how it makes me feel like a kid again, thirsty of exploring unknown places…

So I prepare everything, buy and borrow clothes I never wore before (aware that I will still probably miss something important), get all the material I will need to do my experiments and leave Spain… everything is coming with me on the plane, so I cross my fingers and hope that nothing will get lost… First contact with the snow occurs in Oslo airport, coming out from the plane I step on the ice. I didn't have this unstable feeling since seven years ago, when I went to the southern pole, now I remember how clumsy I felt… but, even I almost slip in the silliest way and fall down, I feel how lucky I am again, visiting the two poles in just one life is not that common…

I finally get to Tromsø airport twenty-two hours after I woke up to leave Spain. I am tired, and not excited any more, just want to go to bed. After waiting for another hour outside, freezing cold, I finally get a taxi to go to my hotel. When I ask the taxi driver about when is the sun coming up (and I meant when is it going to be day time in Tromsø) he answers that it is not going to happen until the 28th of January (is January 2nd and I will fly back to Spain on January 24th) I want both to laugh and cry at that moment… Is he being sarcastic? I mean, I knew I was not going to see the sun during my stay here, but, is it necessary to say it like that? Doesn't people have a bit of light during daytime here? Anyways, I don't have energy for any extra bad news, so I don't ask any more questions…

I sleep a few hours and wake up for breakfast, I am starving. Unconsciously holding my breathe I ask the receptionist the same question I asked the taxi driver the night before, in slightly different words, and I get a nicer answer…there is some decent light between 10:30am and 1:30pm…good, I can exhale again. Still exhausted from the trip I come back to my room, lay down on bed and close my eyes again, but, I can't fall sleep again, some light is coming in through the curtains… didn't she talk about just three hours of light?… what the hell am I doing inside the hotel!

Exploring Tromsø… my excitement is back… again the clumsy feeling of instability while walking on the ice. I accept that this feeling won't probably leave me during the whole trip, but this is ok, I am beginning to like it… makes me smile when I think I am not done for that weather. I enter into a cute wood shop in front of the ocean side and it happens to be the tourist information center with all these pictures of amazing nightlights. Now I remember, the taxi driver did say something nice… the weather was great these days to go hunt for the auroras… I know we will probably have chances of seeing them on board during the cruise but I can't resist the temptation and book an excursion to go chase them that same day.

The northern nightlights… I have never seen anything like that before… I didn't see anything close by far to the postcards pictures, but wow, they were beautiful… There were a few clouds, and sometimes the aurora, if any, could get muddled by them. But something in the way they move, like a smooth dance, or their change in light intensity makes you recognize one from the other and, once you localize the nightlight, you can't do anything but just keep looking at it…so mysterious, so magical… those are the times where I want to forget about my scientific and analytical mind. I don't want to know where these lights are coming from or what is the chemical or physical explanation about the actual phenomenon. I rather listen to the mythological story of the roman goddess of down or to the native legends about the dancing souls of death…

Maria de Lluch Calleja Cortès, Spain

Jan.08, 2012,
Getting Ready…

Monday, January 2, 2012 – 4:30 am: It is dark, cold and raining outside in Brest (France)…time to head to the north, darker, colder and snowier!!!

The airport crew knows us very well already as we have been arranging for one week the transportation of 5 bigggg boxes for science! 6h40 the plane takes off. After 3 planes (Brest-

Paris-Oslo-Tromso), after visits of airports, some flight delay, we finally arrive at Tromso airport.
It is now **Tuesday, January 3, 1:15 am**. Who would have thought that the trip to Tromso was as long as to going to North America?
Unfortunately we therefore drove the car in the side road...
Thursday, January 4, 8:00 am. To bring heavy boxes, we rented a car nice and fancy. Surprisingly, the streets in Tromso are covered by ice. Every car has spikes on the tires, and we are not used to such equipment. Unfortunately we therefore drove the car in the side road…the car needed to be towed.
Sunday, January 8, 23:00 am. Now that the hole in the hull has been fixed, we are ready for good meals. We finally leave after one week of getting ready, it is time to go.
This first week allowed us to prepare mentally for the polar night since in Tromso there is only a couple of hours of light during the day and further up north it will be total darkness 24/7.
Now the sky is dark and it is snowing…this is beautiful. It is time to try survival suits.
Natalia Morata and Emma Michaud, LEMAR France

Jan.10, 2012

A Bumpy Way North

It's an interesting sight. Tons and tons of scientific equipment and bags in all shapes and sizes, standing in the snow. Beside it, there is the ship, 'our' ship, as it's going to be the home and working place for 24 scientists and 11 crew members for the next two weeks – or to be more specific during our expedition into the polar night – the *R/V Helmer Hanssen.* With many helping hands and about 6 hours later, all the equipment has been loaded and stored onboard. And after a short stop at the quayside for Diesel, which was accompanied by dense snowfall reflected in the orange ship lights, the *Hanssen* is ready to start her winter expedition to the Arctic on a Sunday evening, 8th of January. On our way we enjoyed the last specks of light from dawn & dusk while sailing swiftly north across the Barents Sea opening. The first two days were mostly busy with unpacking of our instruments, lab equipment and getting to know colleagues whom we will share not only the equipment but our living space with during this expedition. Our spirits were high to make a smooth way up north, but then the weather was not completely on our side; causing some cases of seasickness and sleepless nights as the ship rocked back, forth, and sideways in alternating and unpredictable patterns. Ok then, a bumpy but nevertheless exciting start.
Passing by Bear Island (in Norwegian called 'Bjørnøya', located at 74°N) on Tuesday in the early morning, we are eager for the first sampling at our main research area in the northern fjords and open waters of Svalbard. An expedition into complete darkness (at least to the human eye); and into one of the most challenging environments on earth. Feeling the cold wind coming from the north, we are looking forward to see the first ice floes (and some of us bet secretly on who will spot the first polar bear in the ship's headlights).
Angelina Kraf, PhD Student, Germany

Jan.10, 2012

We Must Be Mad

I had never been on a research cruise or even holiday cruise before this so I have been very excited for the last few months. I completed my undergraduate degree in Chemistry and came into this PhD with a lot to learn about marine environments, let alone the Arctic. However my interest in this part of the world has always been great so I am so keen to learn more.
Trying to explain to my family and friends who are not scientists, why I am going on the ship to the very cold and very dark Norwegian Arctic was quite hard. Another reason why this

cruise is so exciting is that it is uuu first research cruise to go north of Svalbard in the winter in the last decade. We must be mad!
After a few days delay waiting in Tromso we finally set sail on Sunday evening around 10pm, and I went to sleep a very excited scientist. Through the night however the sea across from Norway to Svalbard was very choppy and a lot of us were feeling very unwell all day yesterday. The crew have been very helpful and have given out patches to help with the sea-sickness…I definitely recommend them.
The ship is called the Helmer Hanssen, having just been changed from the Jan Mayen as the University of Tromsø now owns the ship. It is nearly 64 metres long and can carry 29 people not including crew and was originally a fishing boat. It is not as large as others however still amazing to a person who has never been on a research vessel before.
I can't wait to get to Rjipforden and start sampling, partly because the ship will not be swaying anymore as it will have to stop and also that I can actually start my work and sampling. The captain predicts we will arrive in Rjipforden Thursday morning as we are still just underneath Svalbard, we haven't even started making our way round the west coast of the island yet as it takes so long.
The samples I hope to get from each of the stations; Rjipforden, Sofiajupet and Isfroden, include many different benthic and pelagic animals and these will be taken using trawls and nets. The aim is to try and sample the same or very similar species at each station, investigating differences of dietary sources (sea ice or phytoplankton based) and if these change in each location. Ice and sediment samples will also be taken along with sea birds also. This means a large food web dataset can be made of the winter period, from the producers in the ice and/or sediment, to the predators above the ice.
Fingers crossed the cruise goes to plan, and we get to the first sampling station by Thursday…wish us luck!
Ashleigh Ringrose, Plymouth University, England.

Jan.10, 2012

North of Bear Island

I wake up after a good night's sleep, the first night onboard the *Helmer Hanssen*, but not the first time. It took some time before I fell asleep, I like the feeling of the ship moving on the big waves but it takes time to forget to "think" about it and just fall asleep…
I stand up and try to find my balance, moving from one foot to the other. Suddenly, within half a minute, I feel this nasty sickness growing inside my stomach. Amazing how fast it came. Breakfast will be short for me this morning and I cannot even think of eating ham and cheese, as I usually do. This morning's breakfast is one slice of bread with strawberry jam. I have to go back to bed or I will not survive the crossing of the Barents Sea. The sickness is getting worse every minute. I take these sickness pills and lay down hoping that the feeling will leave as fast as it came…but noooo. I remember someone told me once about sea sickness: first, you think you will die…then, you are afraid you will not! I fall asleep.
I am much better, probably the pills are doing their work and I also get used to the movement. It has always been like this, after a while I don´t mind anymore about the movement, except for the tiredness you feel from always adjusting your balance, going from feeling like a feather to having a 100kg extra weight to carry over only 20 seconds. I have a good lunch. The food is great, I have appetite, a good sign.
I have a walk outside, it´s mid-day and surprisingly there is still light to see. We are not yet so far north. The Bear Island will be reached in about 24h. We are leaving behind us a beautiful mixture of orange, pink and purple colours in the sky and heading into a dark blue mass of clouds in the north.
I have to get some work done. I took with me a big box filled with respiration equipment to study the metabolism of arctic species during the polar night. To make a long story short, this

equipment has arrived very much delayed and I haven´t gotten the chance to try it. So I unpack each single pieces and start reading the installation manuals, those for setting up the system, the respiration chambers, the tubings, the pumps…I feel like it´s christmas and I got a giant Legogame to construct. Maybe, you relate this more to mounting IKEA bookshelves….but I am still like a kid, I like Lego. Then, there are the manuals for the different software…yes, because of course, it would be too simple to have only one software: why making things simple when you can make them complicated?! Here the problems start… nothing seems to work, everything is complicated and the best of it, I can´t say what it is I don´t understand, except maybe how the whole system works. Just a mess. I spend 48h trying, pushing buttons…but error messages never stop to pop up. And I need this system for tonight when I get my first samples from Bear Island!

We now know that we will reach the sampling station at 3 am during the night. It´s 11pm and I decide, that this is the last chance for me to get this respiration system to work …but it doesn´t. The last resource I have is to contact the specialists, those that sold us the system and told us no training was necessary- it´s so simple. I write an email and hopefully they will confirm that everything is simple, that I "just have to…" and that it is just me that is too stupid. It´s ok if I don´t start the respiration experiment as soon as I get the animals, I can wait some more time. My organisms can stay in a tank onboard with running seawater.

At 3 am, we are ready for the triangular dredge. When I come out of my cabin, the crew already had lowered the dredge. We are waiting ready to collect a lot of cute creatures of the sea and especially the Icelandic scallop, which is the one Nathalie and me would like to study together. The dredge comes up, it´s a mass of sand and fine stone. Thomas, also waiting to collect whatever comes up alive looks curious. Asking from the distance whether this looks good or not. No, not at all.there is really not much alive there. But it´s ok, it´s the first trawl of the night, the first of the whole cruise…we will be more lucky the next time. The ship is moved and the triangular dredge lowered again. Maybe 30 minutes later, it comes up again, with 3 cold and sleepy scientists hoping so much that this time there will be more to see! It´s is better indeed, but the scallops are not there this time either. Thomas is happy, there is at least a lot of other things he can use, sea stars, small shrimps, sea cucumber, corals, sponges and sea urchins. He picks some specimens of each. I am myself fascinated by all that can be found on the bottom. I think these creatures are so cute and diverse. Third and last trawl. We are already so delayed that we have to decide how long we keep trying to find the scallops. I believe that this is not the priority of this cruise. The stations further North, in Rijpfjorden and at the Ice edge are much more important for everyone. So we cross our fingers, this is our last try…. And so, there it comes up again with a lot of interesting and "cute" stuff…but not a single scallop, only empty shells. Ok, what do we do? I still need to test my respiration equipment, I need to put something living in my chambers to see if they breath…well of course they breath…but do my system measure that? I collect all I can find. It´s not a big deal this time if I don´t get the scallops- that would have been the little extra data. As long as I get my respiration system to work when we reach Rijpfjorden and I can use it on my favorite fish -the polar cod- then I am happy!

Jasmin Narangh, University of Tromsø

Jan.10, 2012

"re•lent•less"

"re•lent•less": Adjective meaning; Oppressively constant; incessant; harsh or inflexible.

Let's consider a new definition of the word from the perspective of Polar Research Scientists determined to advance the global knowledge of biological activity in the frigid black waters of the Arctic during winter…

01:00

Ship rocks Left, right. . . Left, right . . . Forward and back . . . Forward in back . . . Up and down . . . Up and down.

"Its pitch black and cold outside"

05:00

Ship continues to rock Left, right. . . Left, right . . . Forward and back . . . Forward in back . . . Up and down . . . Up and down.

"Its pitch black and cold outside"

13:15

Yup, ship is still rocking Left, right. . . Left, right . . . Forward and back . . . Forward in back . . . Up and down . . . Up and down.

"Its pitch black and cold outside"

. . . . Being one of only two scientists with a background in chemistry on board I could have made a financial killing. Seasick medication! However, I chose a different line of work; Marine Ecosystem Research.

Despite being winter, despite being in the Arctic, despite it being very cold outside, the ocean is open; there is no significant amount of sea ice where we are heading. The result is a relentless onslaught of waves. Some people are fine, they don't even notice. There they are sitting at desks, heads buried in their glowing computer screens working on publications, firing off e-mails before we go so far north we loose satellite signal.

Others, who are not so lucky, stand outside in the cold staring intently, not at their work, but at the wandering horizon somewhere in the dark . . . . where am I? Well, I'm staring at a computer screen, thinking of a horizon!

The unshakable, deep-seated feeling of seasickness is "re•lent•less", please update your dictionaries accordingly. But with the unfathomable time, money and effort that has gone into planning this trip, nobody can afford to let the sea get the better of them. There are many PhD students onboard whose successful completion of their 3 (or more) years of study depend upon the samples they will acquire from this cruise.

When friends and family from the UK hear that we are coming to Svalbard, the first response is always. . . . "where?". Once explained, this is almost always followed by "you lucky (insert desired expletive!)". Anyone of my friends and family want to swap? . . . didn't think so!

To make things worse, when I collect my samples, I have the ultimate test of commitment to my work. In the belly of the ship, where it is noisy, hot and smelly, I will spend hours identifying, dissecting and storing freshly caught fish guts for chemical analysis upon my return to Plymouth. Isn't science so glamorous?

On top of feelings of our personal wellbeing (or otherwise!), many of us of course leave behind families and friends. The Polar Night Cruise will be relatively short (requiring just three weeks away from home for me), compared, at least, to trips to Antarctica which can last for months. However, my pregnant wife dealing with toilet training our little puppy would probably beg to differ! (Sorry my dear, I'll be home soon!).

Dr Thomas Brown, Plymouth University, UK.

Jan.10, 2012

Into Stormy Waters

We managed to wake up for our shift's breakfast and now we are waiting for the stormy weather which is expected this afternoon… frightening. We went for 'ritual' walk around the ship starting from the bridge. First day when we were leaving Tromso we thought that the reason of 'romantic darkness' on the way to the bridge and therein was dedicated for the newcomers onboard to observe the coastal Norway beauty. After three days we realised that it is ordinary state of art and walking across the ship without a lighter is dangerous and may result at least a broken leg. Despite that doctor's titles are very common among the cruise participants (at least a half of scientists), the fact that a medical doctor does not join the cruise has not got calming effect. Even though we are one of the very first explorers discovering Arctic during winter a unique chance to notice the Northern Lights (we are looking forward very much!!!) decreasing every day. Until now except a few seagulls and sailors we have not noticed anyone outside. Absolute darkness and surrounding nothingness keep everybody inside the ship. Nothing strange, we are sitting in our (hopefully) safe cabin and symptoms of incoming storm (falling down bottles, unsteady floor, waving coats and so on) are increasing with every single minute. Luckily we will reach our sampling stations the earliest on Thursday, so without the pricks of conscience we can take our pills and jump to beds. Keep your fingers crossed for our successful exploration of the Arctic during polar night and safety return home.

Katarzyna Blachowiak-Samolyk and Anna Kubiszyn, IOPAS, Poland

Jan.12, 2012

Here's Charlie!

One of the major players in the zooplankton is a copepod called *Calanus*. We have a nickname for this species in my group.
It´s called "Kalli", which transfers to "Charlie" in English. Actually, here in the North there are three *Calanus*species, who look very alike but are in different sizes, one Atlantic one and two Arctic ones which are larger and more lipid rich that the Atlantic one.
I have been interested in and working with zooplankton for quite a long time. We are a small group of three in the Marine Research Institute in Iceland working with zooplankton, so it has been a big experience for me to meet all my fellow cruise members (24 students and scientists) who all know a bunch about zooplankton and have a lot of work experience in this field.
Zooplankton are the tiny animals that float around on the surface of the ocean and feed on the microscopic plants of the sea that make up the phytoplankton, or on each other and are then again essential as food for animals at higher trophic levels such as fish, birds and whales.
We actually think of "Charlie" with respect, we know the importance of this species for the ecosystem and we are frequently checking on him, how he is doing? Is he eating? Is he fat enough? Have the females laid any eggs? Are they still in the surface or have they gone deeper in the ocean to "sleep" like the bears do on land? In this cruise we will be checking on "Charlie" again and we are all very excited to arrive at the first sampling station in Riipfjorded to see how he is doing in the dark polar winter.

Hildur Pétursdóttir, PhD student from Iceland

Jan.17, 2012

Living on the Edge

It has been a very busy last few days. We passed 80° N on Wednesday evening and we've had no internet since. At this latitude the signal from the satellite finds it difficult to reach us. Finally after nine days of travelling and waiting we arrived in Rijpfjorden which cuts into the Nordaustland's northern coast; an island in the northeast of Svalbard. Suddenly, we had a lot more work to do. From tiny plankton that cannot be seen by eye to the polar cod that have anti-freeze in their blood; the entire community needed to be analysed. Even the organisms inside the ice needed to be extracted in order to get an idea of how the food web works during the polar night. Sampling animals in the open sea in the middle of the fjord was done using nets of various shapes and sizes depending on the animal of interest. Measurements of the temperature and salinity were taken and will tell us more about the influences on the community structure as a whole. Sampling biology inside the ice would be a little more complicated!

After 22 hours of sorting through net samples I woke after just 2 hours of sleep – driving the ship into the thick ice around the edges of the fjord was an experience I could not miss! My first sight of the ice was stunning. The ship did not stop and the sound of the ice breaking against the hull of the ship filled the darkness around me. Just as soon as I stumbled onto the deck and was waking to these sounds I glimpsed footprints on the ice! Could people have already been out sampling the ice? With a closer look I realised they were unmistakeably polar bear tracks! Luckily, we had the opportunity to leave the ship when it was stuck into the ice and walk out to take ice cores for biological samples. This was an awe inspiring experience – wind sculpted ice formations twinkled in the ships lights, the stars shone above and the northern lights lay in a streak across the dark sky. We walked past the polar bear tracks that were as wide as dinner plates and as our own feet quickly felt the cold from the ice below we contemplated the motivations of those explorers that headed off from an ice edge like this trying to reach the North Pole. I for one, was glad to be returning to the warmth of the ship.

We have left Rijpfjorden now and are enjoying a short chance to rest before we begin sampling at our furthest north location, right at the edge of the Arctic ice cap.

Clare Webster, Postgraduate researcher, St Andrews University, Scotland.

Jan.17, 2012

Towards the Sofia Deep

An update from 81,4 degress North: Probably the northernmost reach of any research vessel in dark January.We have been onboard the R/V Helmer Hanssen on the Polar night cruise for 6 days, and in that time so much has happened, so it's time for an update. After a few days delay, the vessel left Tromso on Sunday 8th January. The ship itself is pretty big – there's enough space for everyone to work and enough storage rooms and cold rooms, fridges and freezers for everyone to store all the samples they want to take. There's also a mesh and galley where we take it in shifts to have our meals. Onboard the ship, the first job for the scientists and students was to unload all the equipment that we would be using in the next two weeks. Most of this was transported into the hull on pallets. Once everything was unloaded and set up and expensive equipment was fixed to the desk to avoid damage, the adventure was on.

We sailed north towardsSvalbard, making a brief stop at Bjornoya to collect samples for one PhD student. We reached our first main sampling station in Rijpfjorden 4 days after setting sail. Rijpfjorden is located on the north coast, and it is really special we managed to get into it, because it is often heavily ice covered at this time of year. When we got to Rijpfjorden the work really got started!

Shortly before we left Tromso, the group had been split into three task forces, organisational teams working together on different levels of the Arctic food chain. The groups were; the "small stuff group" (well most of us were working on plankton anyway, which are definitely much smaller than say whales, so in some ways we were all in this group, but this was a team which specifically looked at the plants and bacteria that are too small to see with the eye). Then there was the "*Calanus* group", which unsurprisingly were counting and studying *Calanus* copepods. On a typical marine biology cruise to the Arctic, many people onboard work on *Calanus* copepods because they are considered to be "key species" in the Arctic. This means that they are particularly important to Arctic food webs. The reason is because they are eaten by many larger animals such as seabirds and whales, and provide these predators with vast amounts of energy via stored fat reserves. The third group, the one I'm in, is the "*Themisto* group", so named after a species of amphipod; *Themisto libellula*, that we thought we might find lots of, because we have found lots of at other times of year, anyway we didn't. The *Themisto* group mainly look at animals that are often higher up the food chain and bigger than *Calanus*. This also included fish, chaetognaths (my favourite animal) and jellies. The first step was to bring these animals onto the ship using a range of different gears and trawl nets, operated by the crew. Many of the fish in the trawls were from two cod species; Atlantic cod and Polar cod, which although look a little similar, can be quite easily separated into species because they have different colourations and body patterns. Fish were weighed and measured and their stomachs were removed so that we could see what they have been eating. The most interesting thing I've seen in the samples this far is loads of females of the common shrimp *Pandalus borealis* bearing cool-looking neon blue eggs. That shows that they are reproducing in these "extreme" winter conditions.

When I wasn't helping others with their sampling and sorting, I was picking out chaetognaths (arrow worms) to work on in my PhD inCanada. It's a matter of carefully noting the depth, time, station number etc. at which they were collected. Then I stored them in various chemicals such as formalin which prevents them from decaying, so that their bodies will still be in great condition years from now!

Last night, we left Rijpfjorden for our second station Sofia Deep. When we get there (late tonight probably), the work will be much of the same as in Rijpfjorden, but the oceanographic conditions will be different and it will be interesting to see if there are major differences between the animals at these locations. Do we see the same species of fish? How will the size of chaetognaths differ between locations?

Make no mistake; it hasn't always been plain sailing. For at least two days on the way up north, I (and many others) was pretty seasick. The waves were pretty large at some points. When the seasickness kicks in, your energy can deteriorate pretty fast, so it's better to take pills to prevent it before it starts. I had brought pastilles with me but maybe I didn't start taking them early enough, so will be more careful on the way back south.

But overall, it has been a very enjoyable cruise. When we go out on deck (fully clothed with hard hats on), look out into the night and all we can see is the brightness of the moon, and a small distance ahead covered in sea ice that looks like pancakes, we realise pretty fast how lucky we are to be here.

Jordan Grigor, PhD student, Scotland and Canada

Jan.18, 2012

Steaming back, summing up

As the Helmer Hanssen is steaming back to Tromsø, it is time to sum up.

My name is Vasily Bednenko. I am the only meteorologist on this cruise. I have an important mission – to perform an experiment to estimate the energy exchange fluxes in the Marginal Ice Zone onboard the research vessel Helmer Hansen during the winter period. I started my PhD project this year and this investigation will be great both for starting my own project and

my work at the department of Air and Ocean Interaction at the Arctic and Antarctic Research Institute. For this investigation the following instruments will be used: Eppley PIR precision infrared radiometer, noncontact temperature measurement Raytek MX4, and a weather station with ultrasonic wind speed and directions sensor which were established on the vessel. I have been writing entries which I would like to share with you:

04.01.2012: I met some of the participants at NPI in Tromso. We had a short meeting to get to know each other.

08.01.2012: All equipment is loaded. We start steaming to Ripforden on Svalbard. Tonight I installed all my sensors on the fore-deck of the vessel. The surface temperature measurer was fixed on the tripod on the deck at a height 11m above the water. I am having a problem with Infrared Radiometer which I have just received from Ny-Alesund for this cruise. I am working on it with an instrument person.

09.01.2012: Still working on sensor. In the evening the problem was solved. The instrument was established on the fore-deck, connected with a standard data-logger. It takes measurement with a time average 5 min.

12.01.2012: I helped the guys in the Themisto group sort fishes. Now I can select the Atlantic Cod from an ensemble of the Polar Cods and Haddocks species =)

13.01.2012: The ship reached the ice edge for ice sampling. A 14 degrees vertical temperature gradient from the water surface to 14 m height (a.w.l.) was measured. Not so bad for a "relatively warm" atmosphere. I have to know where the ice is. If you have a good hearing you can know when the boat meets ice floes with a good time resolution. =)

14.01.2012: I received congratulations for my 25th birthday after the evening meeting. It was very unexpected and I would like to agree with the words of Thomas Brown from my greeting card – "There is no better place for that one".

15.01.2012: Our vessel reached 81.45 North.

16.01.2012: In Russia we have a tradition. "If you want to visit the place you love – throw a coin out to the water" So, I threw all I had…

17.01.2012: Date of our arrival in Longyearbyen. Time to go back home. Calculations, analysis and writing a scientific article will start. Then all technical goals have been completely executed. The preliminary result will be presented in cruise report.

My greatest thanks to

- **Stig Falk-Petersen** for the opportunity to take a place in this cruise,
- **Anette Wold** for a logistic,
- **Ronald Berntsen** for useful advises in instrument questions,
- **Jordan Grigor** which shared a small cabin with me and made it more ample,
- And for **all and all of you** for your presentations, friendship and work atmosphere.

With best wishes,

Vasily Bednenko, PhD student, researcher, Arctic and Antarctic Research Institute, Saint-Petersburg, Russia.

Jan.18, 2012

The final samples

The polar night cruise is commencing with sampling in the Isfjorden system, close to Longyearbyen and home to us scientists at UNIS. After one week of field work collecting sea water, sea ice and phytoplankton samples in High Arctic sites such as Rijpfjorden and Sofiadjupet , the "microbial/phytoplankton group" has collected a unique set of samples that we are looking forward to analyzing back home in our labs at UNIS, UiT and IOPAS. Although filtering seawater for 10-12 hours after each sampling station does not feel particularly exotic, it is definitely worth the effort (I hope!). The finding from this cruise of high-Arctic fish and zooplankton in "spring mode", is intriguing in terms of what kind of

small organisms that are present in the pelagic and sea ice, and thus available as food for the zooplankton.
The sampling in the Isfjorden system is part of UNIS´ ongoing field campaign to investigate the microbial sea at the polar night and early spring transition. I was lucky to have reinforcements in the microbial sampling by UNIS scientists and students that came aboard for the Isfjorden sampling.
Today we are taking our final samples when we collect our 24h sediment trap and leave the ship in Longyearbyen tonight for home sweet home. Thanks for a fantastic cruise!
Tove M. Gabrielsen, Associate professor at UNIS

Jan.19, 2012

A breath of fresh air

What do you like about the Arctic? The answer to this question is manifold, and certainly not an easy one. Having being asked it much more than once, I usually answer the most obvious… being able to do research in one of the most fascinating environments on earth, seeing all those sights including foraging polar bears, blowing whales, the art of nature with an ever changing shape ice sheets, the midnight sun during summer, and of course the sky with Polar nights during winter. But there is one thing I often forget about, and it is something maybe even more important than the wonderful things I just mentioned, only described in one word:
Air.
Ok, I should be little more specific: Fresh, clean air, as clean as you possibly only get it in certain parts of the world. So important for live is this mix of mainly nitrogen and oxygen. Being nowadays more of a city person, as most of our world's population, I tend to forget about it. The closest I get into it in an everyday manner is this feeling of relieve when I come out of a crowded meeting- or classroom or another stuffed place, full of people, into the open and taking in (consciously or subconsciously) a breath of fresh air. But out here, in the northernmost part of the world, on a research vessel up to 81°N, with none but your ship-mates out there for a hundred miles – you experience it every day when you work outside, stand with your nose in the wind and wait for your precious nets full of fish and small planktonic organisms to be hauled on board. And, subconsciously, your body gets used to it. Even after just two weeks, I guess you are so used to it, that as soon as you get back to a city you think 'it stinks here' – for the lack of a better phrase. And I do not mean just standing in front of an outlet of a car, or a factory. No, I imagine it is something more; everything around you seems to smell differently.

Of course you also can get this contrast when comparing the countryside with a city, the salty smell of sea-air compared to the one away from the coast, or just my walking through a forest or park, or climbing on a mountain. But in the end, in my opinion, the contrast is even more intense after being in such a remote place of the world. Usually I lose this feeling after a day or even a few hours, being back in familiar surroundings and with solid ground under your feet. But every time I go to the Arctic, I remember – if only subconsciously. And it seems that this breath of fresh air is what I like about being up in the high north, and maybe I like it even the most?
Now, towards the end of our cruise (already packing and sorting through lots of data) I think it is time to say thanks: Thanks to all of my fabulous colleagues here on the ship for making this an unforgettable cruise. Thanks to our cruise leaders and organizers, for giving me the opportunity to join. Thanks to the crew, for safe sailing and all the help on deck. Thanks to the kitchen chef and stewardess for three delicious meals a day (and lots of other food in between). Thanks to Malin, for giving me the necessary inspiration for this blog contribution.

And of course also thanks to you out there, reading all of this. Don't forget to stick your nose into the wind when you have the opportunity!
Angelina Kraft, Germany

Jan.19, 2012

Babies, finally!

Today, 5 days after the first eggs were laid, we finally get to see the results of all the effort with sampling, struggling with the ice, incubation and tedious checking if the eggs manage to hatch.Hundreds of small, fat orange copepod larvae swimming actively around in our small beakers. The females were collected in Rijpfjord (a north facing fjord at Nordvestlandet in the Svalbard archipelago) on the 13th January, and have been producing eggs at various intervals since then, together with their open ocean sisters from the Sofia depth collected 2 days later.
Calanus hyperboreus is a large planktonic copepod, and a key player in the arctic marine food chain as high-energy food for fish and seabirds. Its life cycle is adapted to the very short and unpredictable productive season in the Arctic. During the spring phytoplankton bloom it feeds intensively and get very fat and lipid rich. In early autumn it descends to depths of 600-2000 m, where it starts to mature, mate, and lay the eggs during winter. In total darkness, and at temperatures between 1.5 and -1.8 °C. The eggs are neutrally buoyant, and slowly, slowly rise to the surface as they hatch, and the larvae develop, depending solely on the energy reserves provided from the egg, until they reach the first feeding stage. And then – if everything matches – they will be up at the surface right in time for the big feast of the spring phytoplankton bloom, which allows them to feed and grow further. Then they return to the deep, overwinter, rise up to the surface to feed again the next spring in order to reach the last stages before adulthood, re-descend, mature, and the cycle continues…
And during this exceptional cruise into the polar night, we were able to capture the action right on.
Elisabeth Halvorsen, Department of Arctic and Marine Biology, University of Tromsø

Jan.20, 2012

Back in Tromsø

The change from the polar night in the high north to Tromsø, which will see the sun for the first time today, was pronounced. So much light here, and so little light there! But the day in Rijpfjorden was magic, when we were standing on the ice in full moonlight, millions of stars and a flaming aurora above – in the middle of the day!
In spite of the moon – you may fully understand why the polar winter is a difficult time to survive for a microscopic algae in need of light to grow. This purpose of this cruise for me, working with phytoplankton and ice algae, was to locate these organisms at this time of the year and find out how they survive the long dark months.
There are three environments to look for algal cells: the water, the ice and the sediments. The number of cells in the water was extremely low, so we filtered hundreds of liters of sea water to get concentrated samples to look at in the microscope back in the lab. And we melted ice cores to look for cells in the ice. Finally, we also sampled sediments, which we will try to grow as cultures in the lab. The theory is that the algal cells survive much in the same way as land plants by forming resting stages (spores) which resembles plant seeds. These spores will most likely stay on the bottom of the ocean (if it is not too deep), being mixed up in spring so they can germinate and start to grow. It means they are not very visible at this stage because they are difficult to see in sediment. They may also be found in water or in ice, but 'the hunt for the spores' will have to wait till we get the samples back and into the lab.
The difference in plant and animal life during the polar winter in the ocean was striking! The water was filled with small animals (copepods and others), but no algae. It is obvious that

these animals live on fat resources they produced last autumn, and not until their babies are borne and about to grow up will there be new and juicy food for everyone – in the shape of the phytoplankton spring bloom!
The dark winter is not well studied (for obvious reasons!), and we hope that the results we will eventually get from this cruise will close some of the gap of knowledge of life in the ocean during the polar night
Else Nøst Hegseth, Department of Arctic and marine Biology, University of Tromsø

Jan.21, 2012

A dirty job

After travelling thousands of kilometers by car, plane, boat, in the dark, in the rain, in the snow, we finally found what we came here to look for: MUD !!!
We arrived at the Rijpford station in the middle of the night. Usually, on multidisciplinary cruises, benthos is always at the worst time, in the middle of the night, and at the end of the station in order to make sure we don't "pollute" the water column of the pelagic people. In this cruise, well it is polar night, so there is not really a darker or worst time, and we started the station by our mud sampling! How exciting to be the first! Although we got many technical problems (the winch broke…) we managed to get beautiful undisturbed pristine mud. We will use this mud for various purposes. First we will check the benthic community composition and biomass (macrofauna and meiofauna, Photo 1)). We will also incubate sediment cores in order to measure the benthic activities (bioturbation, oxygen demand, carbon and nutrient recycling). We will finally look at the sediment composition in organic matter (carbon, nitrogen, lipids, pigments, photo 2).
Working with sediment is a hard job respect to water column. Indeed the "rosette" which permits to sample water, and zooplankton nets, are deployed from a special warm room. The box core (which permits to sample sediment, photo 3) is way too big to fit in that room and has to be deployed from a special deck outside. This means we have to carry our cores through various stairs, without disturbing our sediment. In addition, once we got the mud, the hard job only starts. Since it is the polar night, and the water is at 0-2°C, we need to perform our experiment in the cold room (2°C), and in the dark (we have little head lights though). And as we really like to work in these conditions, we will come back to the cold room every 4-6 hours to make measurements of oxygen. Hopefully, we will have good results at the end! But to know this, we will need to be patient as we will do analyses back at the lab, and it will take a few months!
After such efforts, we deserved a little break. So when we had a little stopover in Longyearbyen, we took advantage to go to visit the famous Kroa restaurant, where we had the traditional homemade burger, and a Caipirissima (some kind of Arctic Caipirina).
Nathalie Morata and Emma Michaud, LEMAR, France

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Appendix I: Sampling log

Data base ID	Station	Latitude N	Latitude min	Longitude E	Longitude min	Bottom depth (m)	Date (UTC)	Time (UTC)	Gear	Sampling depth (m) from	Sampling depth (m) to	CTD nr	Sample type	project	Stored in
None	Bjørnøya	77	44.56	19	15.20	94	10.01.2012	02:42	Triangular scrape	94			IP25	Tom	frozen
None	Bjørnøya	77	44.28	19	23.43	77	10.01.2012	03:12	Triangular scrape	77			IP25	Tom	frozen
None	Bjørnøya	77	44.34	19	38.50	60	10.01.2012	04:07	Triangular scrape	60			IP25	Tom	frozen
PNC-1	R3	80	19.02	22	15.03	272	12.01.2012	02:28	Boxcorer	272			experiment	Nathalie	
PNC-1	R3	80	18.98	22	15.06	274	12.01.2012	03:52	Boxcorer	274			experiment	Nathalie	
PNC-2	R3	80	18.94	22	34.11	268	12.01.2012	05:27	Grab	268			experiment	Nathalie	
PNC-2	R3	80	18.97	22	15.54	265	12.01.2012	05:37	Grab	265			experiment	Nathalie	
PNC-2	R3	80	19.02	22	15.58	257	12.01.2012	05:49	Grab	257			experiment	Nathalie	
PNC-3	R3	80	18.54	22	15.47	274	12.01.2012	08:20	CTD	0	270	514	CTD	Elisabeth	
None	R3	80	18.56	22	13.77	274	12.01.2012	07:39	GoFlow	0	0		water samples	Elisabeth	
None	R3	80	18.56	22	13.35	274	12.01.2012	07:51	GoFlow	10	10		water samples	Elisabeth	
None	R3	80	18.56	22	12.68	274	12.01.2012	08:05	GoFlow	20	20		water samples	Elisabeth	
None	R3	80	18.56	22	12.09	274	12.01.2012	08:17	GoFlow	30	30		water samples	Elisabeth	
None	R3	80	18.56	22	11.38	274	12.01.2012	08:28	GoFlow	40	40		water samples	Elisabeth	
None	R3	80	18.56	22	11.68	274	12.01.2012	08:41	GoFlow	50	50		water samples	Elisabeth	
PNC-4	R3	80	18.81	22	13.92	268	12.01.2012	09:17	Bottom trawl	260	0		fish	Macro-Group	frozen
PNC-5	R3	80	18.62	22	13.22	255	12.01.2012	10:25	pelagic trawl	175	0		fish	Macro-Group	frozen
PNC-6	R3	80	19.27	22	14.42	239	12.01.2012	11:04	CTD	230	0	515	Fluorescence	Mark	
PNC-7	R3	80	19.09	22	11.39	211	12.01.2012	11:46	MIK	75	0		Macroplankton	Macro-Group	formalin, frozen
PNC-8	R3	80	18.86	22	14.75	280	12.01.2012	12:20	MIK	225	0		Macroplankton	Macro-Group	formalin, frozen
PNC-9	R3	80	18.51	22	15.70	284	12.01.2012	13:10	MPS	260	200		abundance	Mesozoopl.	formalin
PNC-10	R3	80	18.51	22	15.70	284	12.01.2012	13:10	MPS	200	100		abundance	Mesozoopl.	formalin
PNC-11	R3	80	18.51	22	15.70	284	12.01.2012	13:10	MPS	100	50		abundance	Mesozoopl.	formalin

Data base ID	Station	Latitude		Longitude		Bottom depth (m)	Date (UTC)	Time (UTC)	Gear	Sampling depth (m)		CTD nr	Sample type	project	Stored in
		N	min	E	min					from	to				
PNC-12	R3	80	18.51	22	15.70	284	12.01.2012	13:10	MPS	50	20		abundance	Mesozoopl.	formalin
PNC-13	R3	80	18.51	22	15.70	284	12.01.2012	13:10	MPS	20	0		abundance	Mesozoopl.	formalin
PNC-14	R3	80	18.51	22	15.70	284	12.01.2012	13:50	MPS	256	224		lipids	Calanus	pictures, frozen
PNC-15	R3	80	18.51	22	15.70	284	12.01.2012	13:50	MPS	224	192		lipids	Calanus	pictures, frozen
PNC-16	R3	80	18.51	22	15.70	284	12.01.2012	13:50	MPS	192	160		lipids	Calanus	pictures, frozen
PNC-17	R3	80	18.51	22	15.70	284	12.01.2012	13:50	MPS	160	128		lipids	Calanus	pictures, frozen
PNC-18	R3	80	18.51	22	15.70	284	12.01.2012	13:50	MPS	128	0		lipids	Calanus	pictures, frozen
None	R3	80	18.51	22	15.70	284	12.01.2012	14:20	GoFlow	20	0		water samples	Tove	
None	R3	80	18.51	22	15.70	284	12.01.2012	14:33	CTD+water	100	0	516	water samples	Tove	
None	R3	80	18.51	22	15.70	274	12.01.2012	15:00	CTD+water	100	0	517	water samples	Tove	
None	R3	80	18.51	22	15.70	262	12.01.2012	15:28	CTD+water	100	0	518	water samples	Tove	
None	R3	80	18.51	22	15.70	283	12.01.2012	15:46	CTD+water	100	0	519	water samples	Tove	
None	R3	80	18.51	22	15.70	279	12.01.2012	16:04	CTD+water	100	0	520	water samples	Tove	
None	R3	80	18.51	22	15.70	272	12.01.2012	16:16	CTD+water	100	0	521	water samples	Tove	
None	R3	80	18.51	22	15.70	272	12.01.2012	16:44	CTD+water	100	0	522	water samples	Tove	
None	R3	80	18.51	22	15.70	284	12.01.2012	17:16	CTD+water	100	0	523	water samples	Tove	
None	R3	80	18.51	22	15.70	283	12.01.2012	18:29	CTD+water	100	0	524	water samples	Tove	
None	R3	80	18.51	22	15.70	221	12.01.2012	20:15	20µm Net	20	0		Phytoplankton	Anna	
PNC-19	R3	80	19.06	22	12.40	230	12.01.2012	20:46	Bottom trawl	230			fish	Macro-Group	frozen
PNC-20	R3	80	18.05	22	15.18	263	12.01.2012	21:47	pelagic trawl	225			fish	Macro-Group	frozen
PNC-21	R3	80	18.91	22	14.79	276	12.01.2012	22:36	pelagic trawl	200			fish	Macro-Group	frozen
None	R3	80	18.48	22	15.72	284	12.01.2012	23:18	CTD+water	100	0	525	water samples	Tove	
PNC-22	R3	80	18.51	22	15.95	282	12.01.2012	23:53	MIK	20	0		Macrozooplankton	Macro-Group	formalin, frozen
PNC-23	R3	80	18.75	22	15.98	275	13.01.2012	00:29	MIK	75	0		Macrozooplankton	Macro-Group	formalin, frozen
PNC-24	R3	80	18.75	22	15.98	281	13.01.2012	01:05	MPS	260	200		abundance	Mesozoopl.	formalin
PNC-25	R3	80	18.75	22	15.98	281	13.01.2012	01:05	MPS	200	100		abundance	Mesozoopl.	formalin
PNC-26	R3	80	18.75	22	15.98	281	13.01.2012	01:05	MPS	100	50		abundance	Mesozoopl.	formalin

Data base ID	Station	Latitude N	min	Longitude E	min	Bottom depth (m)	Date (UTC)	Time (UTC)	Gear	Sampling depth (m) from	to	CTD nr	Sample type	project	Stored in
PNC-27	R3	80	18.75	22	15.98	281	13.01.2012	01:05	MPS	50	20		abundance	Mesozoopl.	formalin
PNC-28	R3	80	18.75	22	15.98	281	13.01.2012	01:05	MPS	20	0		abundance	Mesozoopl.	formalin
PNC-29	R3	80	18.75	22	15.98	281	13.01.2012	01:57	MPS	256	224		lipids	Calanus	pictures, frozen
PNC-30	R3	80	18.75	22	15.98	281	13.01.2012	01:57	MPS	224	192		lipids	Calanus	pictures, frozen
PNC-31	R3	80	18.75	22	15.98	281	13.01.2012	01:57	MPS	192	128		lipids	Calanus	pictures, frozen
PNC-32	R3	80	18.75	22	15.98	281	13.01.2012	01:57	MPS	128	20		lipids	Calanus	pictures, frozen
PNC-33	R3	80	18.75	22	15.98	281	13.01.2012	01:57	MPS	20	0		lipids	Calanus	pictures, frozen
None	R3	80	18.52	22	15.93	283	13.01.2012	02:22	WP3	270	0		experiment	Elisabeth	
None	R3	80	18.64	22	15.44	285	13.01.2012	02:48	WP3	270	100		community	Elisabeth	
None	R3	80	18.37	22	16.24	279	13.01.2012	03:23	WP3	100	0		community	Elisabeth	
None	R3	80	18.52	22	15.84	283	13.01.2012	04:06	WP3	?			experiment	Elisabeth	
PNC-34	Rijpfjorden	80	15.09	22	9.44	95	13.01.2012	05:13	CTD	95	0	526	CTD transect		
PNC-35	Rijpfjorden	80	12.58	22	8.29	126	13.01.2012	05:52	CTD	126	0	527	CTD transect		
PNC-36	Rijpfjorden	80	9.94	22	10.12	175	13.01.2012	06:24	CTD	175	0	528	CTD transect		
PNC-37	Rijpfjorden	80	7.82	22	9.45	199	13.01.2012	09:09	CTD	199	0	529	CTD transect		
PNC-38	Rijpfjorden	80	18.53	22	15.36	283	13.01.2012	10:29	CTD	283	0	530	CTD transect		
PNC-39	R3	80	19.11	22	14.46	278	13.01.2012	11:04	MIK	20	0		Macrozooplankton	Macro-Group	formalin, frozen
PNC-40	R3	80	19.11	22	14.46	278	13.01.2012	11:36	MIK	75	0		Macrozooplankton	Macro-Group	formalin, frozen
PNC-41	R3	80	19.11	22	14.46	278	13.01.2012	12:18	MIK	225	0		Macrozooplankton	Macro-Group	formalin, frozen
PNC-42	R3	80	18.51	22	15.99	282	13.01.2012	13:09	MPS	256	224		genetics	Calanus	ethanol
PNC-43	R3	80	18.51	22	15.99	282	13.01.2012	13:09	MPS	224	20		genetics	Calanus	ethanol
PNC-44	R3	80	18.51	22	15.99	282	13.01.2012	13:09	MPS	20	0		genetics	Calanus	ethanol
PNC-45	R3	80	18.51	22	15.99	282	13.01.2012	13:30	WP2 63 µ	50	0		Meroplankton	Eike	formalin
PNC-46	R3	80	18.51	22	15.99	282	13.01.2012	13:45	WP2 63 µ	250	0		Meroplankton	Eike	formalin
PNC-47	R3	80	18.45	22	14.31	270	13.01.2012	14:39	RP sledge	270			benthos	Macro-Group	formalin, frozen
PNC-48	R3	80	18.50	22	14.90	271	13.01.2012	16:04	pelagic trawl	225			fish	Macro-Group	frozen
PNC-49	R3	80	18.21	22	14.96	275	13.01.2012	16:44	pelagic trawl	70			fish	Macro-Group	frozen

Data base ID	Station	Latitude N	min	Longitude E	min	Bottom depth (m)	Date (UTC)	Time (UTC)	Gear	Sampling depth (m) from	to	CTD nr	Sample type	project	Stored in
PNC-50	R3	80	18.62	22	14.37	270	13.01.2012	17:40	Bottom trawl	270			fish	Macro-Group	frozen
PNC-51		80	17.97	22	13.97	262	13.01.2012	18:05	CTD	262	0	531	CTD transect		
PNC-52		80	19.16	22	7.59	178	13.01.2012	19:14	CTD	178	0	532	CTD transect		
PNC-53		80	36.86	22	1.36	95	13.01.2012	20:29	CTD	95	0	533	CTD transect		
PNC-54		80	47.65	21	43.36	152	13.01.2012	21:39	CTD	152	0	534	CTD transect		
PNC-55		80	55.58	21	23.29	109	13.01.2012	22:37	CTD	109	0	535	CTD transect		
PNC-56		81	5.58	20	54.38	146	14.01.2012	23:48	CTD	146	0	536	CTD transect		
PNC-57		81	14.38	20	26.19	459	14.01.2012	00:57	CTD	459	0	537	CTD transect		
PNC-58		81	18.89	18	58.09	548	14.01.2012	02:46	CTD	500	0	538	CTD transect		
PNC-59		81	21.17	17	38.80	784	14.01.2012	04:51	CTD	500	0	539	CTD transect		
PNC-60		81	24.07	16	2.67	2380	14.01.2012	06:59	CTD	500	0	540	CTD transect		
PNC-61		81	31.11	14	22.95	2469	14.01.2012	09:10	CTD	500	0	541	CTD transect		
PNC-62	Ice station	81	40.45	14	21.66	2417	14.01.2012	11:17	CTD	500	0	542	CTD transect		
PNC-63	Ice station	81	40.76	14	19.74	2410	14.01.2012	12:02	CTD	100	0	543	water samples		
PNC-64	Ice station	81	40.95	14	18.68	2407	14.01.2012	12:23	CTD	100	0	544	water samples		
PNC-65	Ice station	81	41.08	14	18.80	2395	14.01.2012	12:40	CTD	100	0	545	water samples		
PNC-66	Ice station	81	41.67	14	16.96	2370	14.01.2012	14:10	CTD	100	0	546	water samples		
PNC-67	Ice station	81	42.72	14	16.35	2289	14.01.2012	16:20	MPS	1200	900		lipids	Calanus	pictures, frozen
PNC-68	Ice station	81	42.72	14	16.35	2289	14.01.2012	16:20	MPS	900	600		lipids	Calanus	pictures, frozen
PNC-69	Ice station	81	42.72	14	16.35	2289	14.01.2012	16:20	MPS	600	300		lipids	Calanus	pictures, frozen
PNC-70	Ice station	81	42.72	14	16.35	2289	14.01.2012	16:20	MPS	300	50		lipids	Calanus	pictures, frozen
PNC-71	Ice station	81	42.72	14	16.35	2289	14.01.2012	16:20	MPS	50	0		lipids	Calanus	pictures, frozen
PNC-72	Ice station	81	43.21	14	16.82	2275	14.01.2012	17:30	MPS	2000	600		lipids	Calanus	pictures, frozen
PNC-73	Ice station	81	43.21	14	16.82	2275	14.01.2012	17:30	MPS	600	200		lipids	Calanus	pictures, frozen
PNC-74	Ice station	81	43.70	14	13.55	2267	14.01.2012	20:42	MPS	2000	1800		lipids	Calanus	pictures, frozen
PNC-75	Ice station	81	43.70	14	13.55	2267	14.01.2012	20:42	MPS	1800	1600		lipids	Calanus	pictures, frozen
PNC-76	Ice station	81	43.70	14	13.55	2267	14.01.2012	20:42	MPS	1600	1400		lipids	Calanus	pictures, frozen

Data base ID	Station	Latitude N	min	Longitude E	min	Bottom depth (m)	Date (UTC)	Time (UTC)	Gear	Sampling depth (m) from	to	CTD nr	Sample type	project	Stored in
PNC-77	Ice station	81	43.70	14	13.55	2267	14.01.2012	20:42	MPS	1400	1200		lipids	Calanus	pictures, frozen
PNC-78	Ice station	81	43.78	14	17.37	2257	15.01.2012	07:13	WP3	1200	0		abundance	Elisabeth	formalin
PNC-79	Ice station	81	44.56	14	15.29	2276	15.01.2012	11:30	Multinet	2000	1200		abundance	Mesozoopl.	formalin
PNC-80	Ice station	81	44.56	14	15.29	2276	15.01.2012	11:30	Multinet	1200	600		abundance	Mesozoopl.	formalin
PNC-81	Ice station	81	44.56	14	15.29	2276	15.01.2012	11:30	Multinet	600	100		abundance	Mesozoopl.	formalin
PNC-82	Ice station	81	44.56	14	15.29	2276	15.01.2012	11:30	Multinet	100	10		abundance	Mesozoopl.	formalin
PNC-83	Ice station	81	45.07	14	16.77	2270	15.01.2012	14:05	CTD	500	0	547	water samples	Tove	
PNC-84	Ice station	81	45.19	14	18.19	2266	15.01.2012	15:10	Multinet	1200	900		Apherusa	Jørgen	frozen
PNC-85	Ice station	81	45.19	14	18.19	2266	15.01.2012	15:10	Multinet	900	600		Apherusa	Jørgen	frozen
PNC-86	Ice station	81	45.19	14	18.19	2266	15.01.2012	15:10	Multinet	600	400		Apherusa	Jørgen	frozen
PNC-87	Ice station	81	45.19	14	18.19	2266	15.01.2012	15:10	Multinet	400	200		Apherusa	Jørgen	frozen
PNC-88	Ice station	81	44.70	14	20.89	2270	15.01.2012	16:30	CTD	0	2270	548	CTD transect		
PNC-89	Ice station	81	23.81	14	26.58	2195	15.01.2012	19:55	CTD	0	2100	549	CTD transect		
PNC-90		81	2.45	14	26.93	1951	15.01.2012	23:27	CTD	0	500	550	CTD transect		
PNC-91		80	43.63	13	48.87	685	16.01.2013	03:12	Bottom trawl	680			fish	Macro-Group	frozen
PNC-92		80	42.57	13	36.25	744	16.01.2013	04:34	pelagic trawl	200			fish	Macro-Group	frozen
PNC-93		80	40.17	13	31.86	598	16.01.2013	05:32	CTD	500	0	551	CTD transect		
PNC-94		80	39.25	13	35.09	487	16.01.2013	06:20	CTD	480	0	552	CTD transect		
PNC-95		80	36.17	13	46.18	182	16.01.2013	07:09	CTD	180	0	553	CTD transect		
PNC-96		80	31.20	13	50.70	150	16.01.2013	07:52	CTD	150	0	554	CTD transect		
PNC-97		80	25.89	13	54.92	170	16.01.2013	08:35	CTD	170	0	555	CTD transect		
PNC-98		80	20.33	14	1.50	99	16.01.2013	09:18	CTD	99	0	556	CTD transect		
PNC-99		80	10.93	14	8.71	40	16.01.2013	10:20	CTD	40	0	557	CTD transect		
PNC-100	Isfjorden	78	19.44	14	55.05	210	17.01.2012	06:41	CTD	250	0	558	CTD	Tove	
PNC-101	ISA	78	15.72	15	33.69	87	17.01.2012	10:27	CTD	80	0	559	water samples	Tove	
None	ISA	78	15.72	15	33.69	87	17.01.2012	11:04	CTD	80	0	560	water samples	Tove	
None	ISA	78	15.72	15	33.69	87	17.01.2012	11:16	CTD	80	0	561	water samples	Tove	

Data base ID	Station	Latitude		Longitude		Bottom depth (m)	Date (UTC)	Time (UTC)	Gear	Sampling depth (m)		CTD nr	Sample type	project	Stored in
		N	min	E	min					from	to				
None	ISA	78	15.92	15	31.35	87	17.01.2012	12:42	Sediment traps		0		Sedimentation	Tove	
None	ISA	78	15.72	15	33.69	87	17.01.2012	14:11	CTD	80	0	562	water samples	Tove	
None	ISA	78	15.72	15	33.69	87	17.01.2012	14:39	CTD	80	0	563	water samples	Tove	
None	ISA	78	15.72	15	33.69	87	17.01.2012	15:05	CTD	80	0	564	water samples	Tove	
None	ISA	78	15.72	15	33.69	87	17.01.2012	15:22	CTD	80	0	565	water samples	Tove	
None	ISA	78	15.72	15	33.69	87	17.01.2012	15:49	CTD	80	0	566	water samples	Tove	
None	ISA	78	15.72	15	33.69	87	17.01.2012	16:33	CTD	80	0	567	water samples	Tove	
PNC-102	Isfjorden	78	18.72	15	12.53	274	17.01.2012	17:45	Bottom trawl	270			fish	Macro-Group	frozen
PNC-103	Isfjorden	78	19.13	15	9.01	268	17.01.2012	18:57	pelagic trawl	200			fish	Macro-Group	frozen
PNC-104	Isfjorden	78	19.77	15	5.49	268	17.01.2012	19:57	MIK	250	0		Macrozooplankton	Macro-Group	formalin, frozen
PNC-105	ISA	78	15.74	15	34.58	83	17.01.2012	21:33	pelagic trawl	50			fish	Macro-Group	frozen
PNC-106	ISA	78	16.21	15	31.59	98	17.01.2012	22:08	MIK	35	0		Macrozooplankton	Macro-Group	formalin, frozen
PNC-107	ISA	78	15.68	15	33.38	98	17.01.2012	22:38	MIK	60	0		Macrozooplankton	Macro-Group	formalin, frozen
PNC-108	Isfjorden	78	19.23	15	10.05	278	17.01.2012	23:56	WP2 63 µ	200	50		Meroplankton	Eike	formalin
PNC-109	Isfjorden	78	19.23	15	10.05	278	18.01.2012	00:22	WP2 63 µ	50	0		Meroplankton	Eike	formalin
PNC-110	Isfjorden	78	20.10	15	8.75	267	18.01.2012	00:43	CTD	260	0	568	CTD		
PNC-111	Isfjorden	78	20.00	15	8.89	268	18.01.2012	01:19	Boxcorer	268			experiment	Nathalie	
PNC-111	Isfjorden	78	20.00	15	8.89	268	18.01.2012	02:12	Boxcorer	268			experiment	Nathalie	
PNC-112	Isfjorden	78	19.83	15	9.18	268	18.01.2012	03:06	Van Veen Grab	268			experiment	Nathalie	
PNC-112	Isfjorden	78	19.83	15	9.18	268	18.01.2012	03:20	Van Veen Grab	268			experiment	Nathalie	
PNC-112	Isfjorden	78	19.83	15	9.18	268	18.01.2012	03:32	Van Veen Grab	268			experiment	Nathalie	
PNC-113	ISA	78	15.96	15	32.41	90	18.01.2012	10:25	pelagic trawl	30			fish	Macro-Group	
PNC-114	ISA	78	15.63	15	35.05	80	18.01.2012	11:03	pelagic trawl	55			fish	Macro-Group	
PNC-115	ISA	78	16.02	15	33.48	80	18.01.2012	11:42	MIK	30	0		Macrozooplankton	Macro-Group	
PNC-116	ISA	78	15.73	15	33.14	80	18.01.2012	12:07	MIK	60	0		Macrozooplankton	Macro-Group	
PNC-117	ISA	78	16.07	15	33.71	80	18.01.2012	12:40	CTD	80	0	569	CTD		
PNC-118	ISA	78	15.89	15	32.60	80	18.01.2012	15:54	WP2 63 µ	25	0		Meroplankton	Eike	formalin

Data base ID	Station	Latitude		Longitude		Bottom depth (m)	Date (UTC)	Time (UTC)	Gear	Sampling depth (m)		CTD nr	Sample type	project	Stored in
		N	min	E	min					from	to				
PNC-119	ISA	78	15.89	15	32.60	80	18.01.2012	16:04	WP2 63 µ	25	0		Meroplankton	Eike	ethanol
PNC-120	ISA	78	15.89	15	32.60	80	18.01.2012	16:14	WP2 63 µ	25	0		Meroplankton	Eike	alive
PNC-121	ISA	78	15.89	15	32.60	80	18.01.2012	16:24	WP2 63 µ	65	25		Meroplankton	Eike	formalin
PNC-122	ISA	78	15.89	15	32.60	80	18.01.2012	16:34	WP2 63 µ	65	25		Meroplankton	Eike	ethanol
PNC-123	ISA	78	15.89	15	32.60	80	18.01.2012	16:44	WP2 63 µ	65	25		Meroplankton	Eike	alive
PNC-124	Isfjorden	78	14.11	15	15.25	180	18.01.2012	21:43	CTD	180	0	570	CTD	Tove	

Appendix II: Information on the chaetognath samples collected on this polar night cruise (January 2012): unique sample identifier (PNC), sample station, date, gear used to sample (MIK, MPS, WP3) and number in series, whether the sample was collected during day or night, sample depth(s), how sample was treated (ethanol, formalin, frozen), type of container used to store sample, number of individuals in each container (where available), number of large plastic bag in which containers are located (logistics) and notes about each sample.

Code	Station	Date	Gear	Gear no.	Day/ Night	Depth(s) (m)	Treatment added	Type of container	No. individuals in containers	Bag no.	Notes	Sample stored at:
PNC7	R3 Rijpfjorden	12/1/12	MIK	1	Day	75	96% ethanol	Plastic container		1	Depth written as 70m on bottle	NPI Tromso
PNC7	R3 Rijpfjorden	12/1/12	MIK	1	Day	75	4% buffered formalin-seawater solution	Plastic container		1	Depth written as 70m on bottle	NPI Tromso
PNC7	R3 Rijpfjorden	12/1/12	MIK	1	Day	75	4% buffered formalin-seawater solution	Plastic container		1	Depth written as 70m on bottle	NPI Tromso
PNC7	R3 Rijpfjorden	12/1/12	MIK	1	Day	75	4% buffered formalin-seawater solution	Plastic container		1	Depth written as 70m on bottle	NPI Tromso
PNC7	R3 Rijpfjorden	12/1/12	MIK	1	Day	75	4% buffered formalin-seawater solution	Plastic container		1	Depth written as 70m on bottle	NPI Tromso
PNC7	R3 Rijpfjorden	12/1/12	MIK	1	Day	75	Frozen for lipids (-50°C)	Zip bag	10		Depth written as 70m on bag	NPI Tromso
PNC7	R3 Rijpfjorden	12/1/12	MIK	1	Day	75	Frozen for lipids (-50°C)	Zip bag	10		Depth written as 70m on bag	NPI Tromso
PNC7	R3 Rijpfjorden	12/1/12	MIK	1	Day	75	Frozen for lipids (-50°C)	Zip bag	10		Depth written as 70m on bag	NPI Tromso
PNC7	R3 Rijpfjorden	12/1/12	MIK	1	Day	75	Frozen for isotopes (-50°C)	Zip bag	25		Depth written as 70m on bag	NPI Tromso
PNC7	R3 Rijpfjorden	12/1/12	MIK	1	Day	75	Frozen for isotopes (-50°C)	Zip bag	25		Depth written as 70m on bag	NPI Tromso
PNC7	R3 Rijpfjorden	12/1/12	MIK	1	Day	75	Frozen for isotopes (-50°C)	Zip bag	25		Depth written as 70m on bag	NPI Tromso
PNC8	R3 Rijpfjorden	12/1/12	MIK	2	Day	225	96% ethanol	Plastic container		2	Depth written as 220m on bottle	NPI Tromso
PNC8	R3 Rijpfjorden	12/1/12	MIK	2	Day	225	4% buffered formalin-seawater solution	Plastic container		2	Depth written as 220m on bottle	NPI Tromso
PNC8	R3 Rijpfjorden	12/1/12	MIK	2	Day	225	4% buffered formalin-seawater solution	Plastic container		2	Depth written as 220m on bottle	NPI Tromso
PNC8	R3 Rijpfjorden	12/1/12	MIK	2	Day	225	4% buffered formalin-seawater solution	Plastic container		2	Depth written as 220m on bottle	NPI Tromso
PNC8	R3 Rijpfjorden	12/1/12	MIK	2	Day	225	Frozen for lipids (-50°C)	Zip bag	10		Depth written as 220m on bag	NPI Tromso
PNC8	R3 Rijpfjorden	12/1/12	MIK	2	Day	225	Frozen for lipids (-50°C)	Zip bag	10		Depth written as 220m on bag	NPI Tromso
PNC8	R3 Rijpfjorden	12/1/12	MIK	2	Day	225	Frozen for lipids (-50°C)	Zip bag	10		Depth written as 220m on bag	NPI Tromso
PNC8	R3 Rijpfjorden	12/1/12	MIK	2	Day	225	Frozen for isotopes (-50°C)	Zip bag	25		Depth written as 220m on bag	NPI Tromso
PNC8	R3 Rijpfjorden	12/1/12	MIK	2	Day	225	Frozen for isotopes (-50°C)	Zip bag	25		Depth written as 220m on bag	NPI Tromso
PNC8	R3 Rijpfjorden	12/1/12	MIK	2	Day	225	Frozen for isotopes (-50°C)	Zip bag	25		Depth written as 220m on bag	NPI Tromso
PNC14	R3 Rijpfjorden	12/1/12	MPS		Day	256-224	4% buffered formalin-seawater solution	Glass vial	15	5		NPI Tromso
PNC16	R3 Rijpfjorden	12/1/12	MPS		Day	192-160	4% buffered formalin-seawater solution	Plastic container	6	5		NPI Tromso
PNC17	R3 Rijpfjorden	12/1/12	MPS		Day	160-128	4% buffered formalin-seawater solution	Plastic container		5		NPI Tromso
PNC18	R3 Rijpfjorden	12/1/12	MPS		Day	128-0	4% buffered formalin-	Plastic container		5	Label inside says PNC16. All other	NPI Tromso

							seawater solution				info is correct.	
PNC22	R3 Rijpfjorden	13/1/12	MIK	3	Night	20	96% ethanol	Plastic container		3		NPI Tromso
PNC22	R3 Rijpfjorden	13/1/12	MIK	3	Night	20	4% buffered formalin-seawater solution	Plastic container		3		NPI Tromso
PNC22	R3 Rijpfjorden	13/1/12	MIK	3	Night	20	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC22	R3 Rijpfjorden	13/1/12	MIK	3	Night	20	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC22	R3 Rijpfjorden	13/1/12	MIK	3	Night	20	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC22	R3 Rijpfjorden	13/1/12	MIK	3	Night	20	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC22	R3 Rijpfjorden	13/1/12	MIK	3	Night	20	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC22	R3 Rijpfjorden	13/1/12	MIK	3	Night	20	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC23	R3 Rijpfjorden	13/1/12	MIK	4	Night	75	96% ethanol	Plastic container		3		NPI Tromso
PNC23	R3 Rijpfjorden	13/1/12	MIK	4	Night	75	4% buffered formalin-seawater solution	Plastic container		3		NPI Tromso
PNC23	R3 Rijpfjorden	13/1/12	MIK	4	Night	75	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC23	R3 Rijpfjorden	13/1/12	MIK	4	Night	75	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC23	R3 Rijpfjorden	13/1/12	MIK	4	Night	75	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC23	R3 Rijpfjorden	13/1/12	MIK	4	Night	75	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC23	R3 Rijpfjorden	13/1/12	MIK	4	Night	75	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC23	R3 Rijpfjorden	13/1/12	MIK	4	Night	75	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC29	R3 Rijpfjorden	13/1/12	MPS		Night	256-224	4% buffered formalin-seawater solution	Plastic container	8	5		NPI Tromso
PNC30	R3 Rijpfjorden	13/1/12	MPS		Night	224-192	4% buffered formalin-seawater solution	Plastic container		5		NPI Tromso
PNC31	R3 Rijpfjorden	13/1/12	MPS		Night	192-128	4% buffered formalin-seawater solution	Plastic container	12	5		NPI Tromso
PNC32	R3 Rijpfjorden	13/1/12	MPS		Night	128-20	4% buffered formalin-seawater solution	Plastic container		5		NPI Tromso
PNC33	R3 Rijpfjorden	13/1/12	MPS		Night	20-0	4% buffered formalin-seawater solution	Plastic container		5		NPI Tromso
PNC33	R3 Rijpfjorden	13/1/12	MPS		Night	20-0	4% buffered formalin-seawater solution	Plastic container	3	5		NPI Tromso
PNC41	R3 Rijpfjorden	13/1/12	MIK	7	Day	225	96% ethanol	Plastic container		3		NPI Tromso
PNC41	R3 Rijpfjorden	13/1/12	MIK	7	Day	225	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC41	R3 Rijpfjorden	13/1/12	MIK	7	Day	225	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC41	R3 Rijpfjorden	13/1/12	MIK	7	Day	225	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC41	R3 Rijpfjorden	13/1/12	MIK	7	Day	225	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC41	R3 Rijpfjorden	13/1/12	MIK	7	Day	225	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC41	R3 Rijpfjorden	13/1/12	MIK	7	Day	225	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC68	Ice Station 2412	14/1/12	MPS		Day	900-600	96% ethanol	Plastic container		4		NPI Tromso

PNC69	Ice Station 2412	14/1/12	MPS		Day	600-300	96% ethanol	Plastic container		4		NPI Tromso
PNC78	Ice Station 2412	15/1/12	WP3		Day	2000-0	96% ethanol	Plastic container	27	4		NPI Tromso
PNC84	Ice Station 2412	15/1/12	MPS		Day	1200-900	96% ethanol	Plastic container	5	4		NPI Tromso
PNC85	Ice Station 2412	15/1/12	MPS		Day	900-600	96% ethanol	Plastic container	41	4	Label inside says PNC88. All other info is correct.	NPI Tromso
PNC86	Ice Station 2412	15/1/12	MPS		Day	600-400	96% ethanol	Plastic container	56	4		NPI Tromso
PNC87	Ice Station 2412	15/1/12	MPS		Day	1200-900	96% ethanol	Plastic container	20	4		NPI Tromso
PNC104	Adventfjorden	17/1/12	MIK	8	Night	250	96% ethanol	Plastic container	100	3		NPI Tromso
PNC104	Adventfjorden	17/1/12	MIK	8	Night	250	4% buffered formalin-seawater solution	Plastic container	100	3		NPI Tromso
PNC104	Adventfjorden	17/1/12	MIK	8	Night	250	4% buffered formalin-seawater solution	Plastic container	Many	3		NPI Tromso
PNC104	Adventfjorden	17/1/12	MIK	8	Night	250	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC104	Adventfjorden	17/1/12	MIK	8	Night	250	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC104	Adventfjorden	17/1/12	MIK	8	Night	250	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC104	Adventfjorden	17/1/12	MIK	8	Night	250	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC104	Adventfjorden	17/1/12	MIK	8	Night	250	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC104	Adventfjorden	17/1/12	MIK	8	Night	250	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC106	Adventfjorden	17/1/12	MIK	9	Night	35	4% buffered formalin-seawater solution	Plastic container	77	6		NPI Tromso
PNC106	Adventfjorden	17/1/12	MIK	9	Night	35	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC106	Adventfjorden	17/1/12	MIK	9	Night	35	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC106	Adventfjorden	17/1/12	MIK	9	Night	35	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC106	Adventfjorden	17/1/12	MIK	9	Night	35	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC106	Adventfjorden	17/1/12	MIK	9	Night	35	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC106	Adventfjorden	17/1/12	MIK	9	Night	35	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC107	Adventfjorden	17/1/12	MIK	10	Night	60	96% ethanol	Plastic container	51	6		NPI Tromso
PNC107	Adventfjorden	17/1/12	MIK	10	Night	60	4% buffered formalin-seawater solution	Plastic container	100	6		NPI Tromso
PNC107	Adventfjorden	17/1/12	MIK	10	Night	60	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC107	Adventfjorden	17/1/12	MIK	10	Night	60	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC107	Adventfjorden	17/1/12	MIK	10	Night	60	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC107	Adventfjorden	17/1/12	MIK	10	Night	60	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC107	Adventfjorden	17/1/12	MIK	10	Night	60	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC107	Adventfjorden	17/1/12	MIK	10	Night	60	Frozen for isotopes	Zip bag	25			NPI Tromso

							(-50°C)					
PNC115	Adventfjorden	18/1/12	MIK	11	Day	30	96% ethanol	Plastic container	100	6		NPI Tromso
PNC115	Adventfjorden	18/1/12	MIK	11	Day	30	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC115	Adventfjorden	18/1/12	MIK	11	Day	30	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC115	Adventfjorden	18/1/12	MIK	11	Day	30	Frozen for lipids (-50°C)	Zip bag	10			NPI Tromso
PNC115	Adventfjorden	18/1/12	MIK	11	Day	30	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC115	Adventfjorden	18/1/12	MIK	11	Day	30	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC115	Adventfjorden	18/1/12	MIK	11	Day	30	Frozen for isotopes (-50°C)	Zip bag	25			NPI Tromso
PNC116	Adventfjorden	18/1/12	MIK	12	Day	60	4% buffered formalin-seawater solution	Plastic container	100	6		NPI Tromso