Haakon Hop and Stig Falk-Petersen (eds.)

Spatial and temporal variability of the ice–ocean system in the Marginal Ice Zone of the Barents Sea

MARINØK cruises,
May 1999 and March-April 2000

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The physical and ecological processes in the Marginal Ice Zone (MIZ) of the northern Barents Sea were investigated during 1995-1996 in a multidisciplinary, international, research programme named ICE-BAR (Falk-Petersen *et al.* 2000). Its overall goal was to investigate the importance of the MIZ for the productivity and biodiversity of the northern Barents Sea. To achieve this goal it was necessary to understand the underlying physical and biological processes in this area. This programme built directly on the knowledge obtained in the PRO-MARE programme, conducted in the northern Barents Sea from 1984 to1989 (Sakshaug *et al.* 1994a, b). The current MARINØK research programme, including research cruises in May 1999 and March 2000, represented the continuation of the research efforts in the northern Barents Sea.

Marginal Ice Zones are some of the most dynamic areas in the world's oceans. The latitudinal location of the ice edge during summer in the Barents Sea can vary by hundreds of kilometres from year to year (Gloersen *et al.* 1992), and there is a strong relationship between the North Atlantic Oscillation (NAO) and the maximum sea ice extent during spring (Vinje 2001). The interaction between the atmosphere, ocean and sea ice is strong within the MIZ and adjacent sea, with large variations in ocean-ice-atmosphere heat flux and momentum transfer over short distances (order of a few kilometres). Near the ice edge, mesoscale interactions result in strong hydrodynamic instabilities, producing eddies, jets and filaments that redistribute ice, heat, salt and momentum over scales of 5-10 km. The ice edge zone may also undergo rapid changes in ice cover extent and concentration because of changing wind directions. Conventional ice-ocean-biological production models cannot accurately represent the highly variable conditions of the Marginal Ice Zone.

The water masses of the northern Barents Sea are characterised by the influx of cold Arctic water from the north. Arctic water is also formed locally in the northern Barents Sea by the summer melting of sea ice (Rudels *et al.* 1999). Atlantic water from the North Atlantic current flows northwards east of Sentralbanken (Central Bank) as well as east of Storbanken (Great Bank) below the Arctic water masses (Rudels *et al.* 1999). At the Polar Front, the cold Arctic water meets warmer Atlantic water which subsides below the less saline Arctic water masses. The Polar Front generally follows the bottom topography at 250 m depth south of Bjørnøya and Hopen (Gawarkiewicz & Plueddemann 1995), although the approximate location of the front can also be observed as the boundary between warm Atlantic and cold Arctic waters. The maximum ice extent during winter often coincides with the Polar Front (Loeng 1991), and during the spring the ice edge starts to retreat northwards because of melting.

The main part of the sea ice mass in the Barents Sea is locally formed first-year ice. Inflow of multi-year ice from the Arctic Ocean to the Barents Sea takes place through the passages east of Svalbard (Vinje & Kvambekk 1991). The ice-covered area in the Barents Sea shows great seasonal and annual variations (Loeng 1991; Falk-Petersen *et al.* 2000). The freezing generally starts in September and proceeds rapidly to maximum ice cover in December-January, which lasts until March-April. The melting starts slowly in April-May, proceeds rapidly in June to August, and the minimum ice extent is reached during August-October (Falk-Petersen *et al.* 2000).

The Marginal Ice Zone of the northern Barents Sea is an ecologically important area because it represents the most productive area in Arctic water masses (Falk-Petersen *et al.* 2000). Arctic water masses are generally less productive than Atlantic water masses, and the production becomes concentrated in the vicinity of the ice edge. The well-known ice edge effect (Sakshaug & Skjoldal 1989; Strass & Nöthig 1996; Sakshaug 1997) has a major influence on the spring bloom pattern of chlorophyll-*a*, although the spatial variability of the chlorophyll-*a* concentrations in this region is high, as shown by satellite images of ocean colour (Engelsen *et al.* 2002).

In spring, melt water creates salinity gradients in the water column, with resulting stabilisation of the upper water masses. This stability combined with a generally ample supply of nutrients after the winter and increased radiation during the spring sets the condition for vigorous phytoplankton production near the surface (Syvertsen 1991; Melnikov 1997; Falk-Petersen *et al.* 1998; Hegseth 1998) within the Stable Upper Layer (SUL) (Engelsen *et al.* 2002). Thus, the onset of plankton blooms is directly related to the seasonal availability of incident light and melting of the ice (Sakshaug & Slagstad 1991). In contrast, the phytoplankton variability in ice-free waters is a function of both light through the water column (Sverdrup 1953) and nutrient supply from e.g. vertical mixing (Dutkiewicz *et al.* 2001).

The peak of the bloom in the Barents Sea may reach biomass (chlorophyll-*a*) values of 20 mg m^{-3} at the surface, and integrated up to 900 mg m^{-2} for the upper 50 m of the water column (Hegseth 1992). The magnitude of the annual primary production in the northern Barents Sea is related to spatial variation in ice cover, which is partly determined by the inflow of warm Atlantic water, and stratification of the water column caused by the melting processes. During the seasonal ice melt, algal blooms sweep across the entire northern Barents Sea, and the total annual production is about 40-50 g C m^{-2} (Rey & Loeng 1985; Wassmann & Slagstad 1993; Hegseth 1998). If satellite information on phytoplankton biomass and/or primary production is to be used on a large scale, phytoplankton must be reliably quantified in terms of sea-surface chlorophyll-*a*, which can be extended to determine an integrated plankton biomass for the water column. Relationships between surface chlorophyll-*a* and mean water column concentrations within the euphotic zone (0-50

m) have recently been established for the Barents Sea MIZ (Engelsen *et al.* 2002, Engelsen *et al.* in press).

During the short primary production period there is also a high production of secondary producers, mainly copepods and microzooplankton in the pelagic zone (Hallberg & Hirche 1980; Hirche 1989; Slagstad & Tande 1990; Tande & Slagstad 1992; Hirche & Mumm 1992; Hansen *et al.* 1996a; Falk-Petersen *et al.* 1999), but also amphipods and juvenile polar cod (*Boreogadus saida*) associated with ice floes (Lønne & Gulliksen 1989; Hop *et al.* 2000). The zooplankton species in the Barents Sea comprise either local populations or advected ones, which have a preference for either the cold, less saline Arctic water or the relatively warm, saline Atlantic water. The distribution of Arctic and Atlantic water masses and their mixing, thus has a major influence on the zooplankton distribution in the Barents Sea (Tande *et al.* 1985; Hassel 1986; Falk-Petersen *et al.* 1999, Søreide *et al.* in press).

Most zooplankton studies in the Barents Sea have been limited to the numerically important copepods, particularly of the genus *Calanus* (e.g. Eilertsen *et al.* 1989; Pedersen *et al.* 1995; Falk-Petersen *et al.* 1999). The main copepods associated with the Arctic waters are *Calanus glacialis*, *C. hyperboreus* and *Pseudocalanus* sp., whereas *C. finmarchicus* and *Metridia longa* usually dominate in water of Atlantic origin (Pedersen *et al.* 1995; Falk-Petersen *et al.* 1999). These copepods have adapted their life cycles to the extreme fluctuations in both food availability and physical conditions. During their ontogenetic migration they feed and grow as young stages in the euphotic zone, store lipids and wax esters in overwintering stages (Sargent & Henderson 1986; Falk-Petersen *et al.* 1987; Scott *et al.* 2000) and finally descend to deep water. Different strategies of timing of reproduction with the onset of phytoplankton development have been observed. Readily available food sources are a prerequisite for spawning of *C. finmarchicus*, but laboratory studies have shown that immediate food supply is not required for breeding of *C. hyperboreus* (Conover 1962, 1967). The Arctic species *C. glacialis* may have evolved a mixed strategy with egg production based on stored lipids in early spring and food intake-dependent spawning later in the season (Smith 1990). This species has also been observed to spawn earlier in the season before the spring bloom (Falk-Petersen *et al.* 1999).

Distribution and quantitative information on the larger zooplankton organisms (> 3 mm), i.e. hydromedusas, siphonophores, ctenophores, chaetognaths, amphipods and euphausiids, are still very limited. In a recent study (based on the MARINØK-cruises) Søreide *et al.* (in press) found that the numerically important macro-zooplankton in the northern Barents Sea were *Calanus glacialis*, *C. hyperboreus*, *Thysanoessa inermis* and *Aglantha digitale*. These were also important in terms of biomass together with *Beröe cucumis*, *Clione limacina* and *Sagitta elegans*. Good indicator species for Arctic water were *C. glacialis*, *C. limacina*, *Mertensia ovum* and *Themisto libellulla*, and for Atlantic water *Thysanoessa* spp. (*T. inermis*, *T. longicaudata* and *T. raschii*). Characteristic for mixed water masses, i.e. the Polar Front region, was low macro-zooplankton abundance, biomass and species richness compared to that found in Atlantic and Arctic water masses. Even though large zooplankton are less important numerically than copepods, their role in trophodynamic processes may be very important due to their large predation impact (Falkenhaug 1991; Swanberg & Båmstedt 1991; Dalpadado & Skjoldal 1996; Dalpadado *et al.* 2001).

Arctic marine organisms use lipids to a large extent in metabolism, for insulation and as seasonally accumulated energy stores for overwintering and reproduction. The lipid or energy flow is a function of the seasonal energy flux through the system, which originates from the seasonal plankton and ice-algal blooms concentrated in the Marginal Ice Zone and at the Polar Front in the Barents Sea (Falk-Petersen *et al.* 1990, 1998). Pelagic zooplankton and ice-fauna exposed to marked variation in available food have responded, *inter alia*, by storing large amounts of lipids as energy reserves. The increase in lipid level from 10-20% of the dry weight in the phytoplankton to 50-70% in the herbivorous zooplankton and ice-fauna is probably one of the most fundamental and key specialisations in Arctic bioproduction (Falk-Petersen *et al.* 1998; Scott *et al.* 2000). This transfer is efficient since the energy in lipids may be transferred across 3-4 trophic levels within six months (Falk-Petersen *et al.* 1990).
The strong seasonal pulse of energy through the ice-associated and pelagic marine food webs directly influences the abundance of animals in the upper trophic levels, represented by large marine mammal and sea bird populations in and around the northern Barents Sea (e.g. Mehlum & Gabrielsen 1993; Haug *et al.* 1994; Wiig 1995; Anker-Nilssen *et al.* 2000). Biodiversity has been identified as an important measurement of environmental quality (Hansen *et al.* 1996b). Arctic biodiversity is visualised through an abundance of top predators in the marine system, especially along the ice-edge, however it is also recognised that biodiversity at lower and middle trophic levels are integral parts of a functional ecosystem.(Hop *el al.* 1998)

The European Arctic has become a sink for many pollutants, such as persistent organic pollutants (POPs) which originate from chemical use in industrial and agricultural areas at lower latitudes (e.g. Wania & Mackay 1993; Oehme *et al.* 1996). Contaminants such as polychlorinated biphenyls (PCBs), chlorinated pesticides and polycyclic aromatic hydrocarbons (PAHs) are of special concern in the Arctic due to their persistence and physical-chemical properties (Barrie *et al.* 1992). The transport vectors are several, but the most important ones for our study area are air masses, ocean currents and ice drift (Barrie *et al.* 1992; Pfirman *et al.* 1995). Sea ice drift routes influence the concentrations of organochlorine pollutants in ice-assocated organisms (Borgå *et al.* 2002b). The POPs are incorporated with sediments as the ice forms (Nürnberg *et al.* 1994), and, in addition, POPs transported with the atmosphere are deposited and accumulated on the sea ice (Klungsøyr *et al.* 1995). As the sea ice melts in the marginal ice zone, organisms associated with the sea ice are potentially exposed to the POPs. The temporal coherence of plankton blooms and release of material from the melting sea ice enhances the risk of uptake of contaminants by the lowest trophic levels in the food chain. However, in a recent study by Borgå *et al.* (2002a) it was showed that habitat (ice versus water masses) accounted for a smaller part of the variance than diet; only a few compounds were found to differ between sympagic and pelagic species.

Many organochlorines (OCs) are lipophilic and will be transferred with the energy (lipid) flow (Falk-Petersen *et al.* 1990), although their food web magnification potential depends highly on the metabolic capacity of each organism at the different trophic levels (e.g. Livingstone 1992; Walker 1992). Because many persisteut and lipophilic organochlorines, such as PCBs, biomagnify in food webs (e.g. Thomann 1989; Borgå *et al.* 2001), they are found at high levels in top predators of the Barents Sea ecosystem, such as polar bears (*Ursus maritimus*) and glaucous gulls (*Larus hyperboreus*) (e.g. Norheim *et al.* 1992; Gabrielsen *et al.* 1995; Bernhoft *et al.* 1997). Potential effects are impaired reproductive success, impaired nervous system function, reduction in body weight, endocrine disruption and immunosuppression (e.g. Rogan & Gladen 1992; Safe 1994). The biomagnification of selected organochlorines across trophic levels in the marine food web of the Barents Sea has been investigated (Borgå *et al.* 2001; Hop *et al.* 2002). Stable isotopes of carbon and nitrogen are often used as quantitative measures of trophic levels in the marine food web (Hobson & Welch 1992; Hobson *et al.* 1995), and can, thus, be used in calculations of food web magnification factors (Fisk *et al.* 2001; Hop *et al.* 2002).

To manage the biodiversity of the MIZ it is critical to understand the underlying ecological processes as well as the bioaccumulation of contaminants in the Arctic marine food web. This project has already resulted in fundamental knowledge about lower and intermediate trophic levels of the MIZ food web. Research undertaken by the Norwegian Polar Institute in the MIZ has sprung directly from governmental suggestions for Norwegian research in the Arctic (Stortingsmelding nr. 42, 1992-93), and the project conforms with the mandates of the Norwegian Polar Institute: to improve the knowledge base on the productivity and biodiversity of ice-covered marine Arctic areas. The research results are of direct relevance to a risk analysis which is being performed in connection with proposed petroleum activity in the Barents Sea. An analysis and presentation module for predicting the distribution of biological resources in time and space within the MIZ has been developed (Pedersen *et al.* 2001). It is essential to obtain a good description of the ice-ocean dynamics in order to understand how key abiotic factors influencing the marine ecology of the region. Physical information is needed in forecasting of ice edge location and oil spill trajectories, whereas ecological information is necessary for predicting effects of oil spills on the marine organisms in the Marginal Ice Zone.

This report summarises the activities of two cruises conducted under the MARINØK/Norsk Hydro programme. The cruises were conducted with the Norwegian Polar Institute research vessel *Lance* to the Marginal Ice Zone of the northern Barents Sea during 1-26 May, 1999 and 24 March - 5 April, 2000. Both cruises included transects along and across the ice edge. Sampling was conducted at ice stations and open water stations, although work from the ice was only performed in 1999. The report is assembled as a series of scientific reports from the different working groups.

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3. MARINØK cruises

3.1 May 1999 cruise

The May 1999 cruise consisted of one transect (T) along the ice edge from 26-34 °E (5-7 May), and two transects into the Marginal Ice Zone at about 33 °E (8-15 May) in the central Barents Sea (Transect A) and at about 27 °E (16-24 May) near Hopen Island (Transect B) (Fig. 1). Transect T included 15 sampling stations, whereas transects A and B included three ice stations and one open water station each. Transect T went in 1/10 ice cover (Fig. 2), whereas Transects A and B extended from the conslidated pack ice (7-9/10), through open pack ice (3-6/10) and ended in open water (Figs. 3). In addition, there were six oceanographic transects across the ice edge. The outer ice edge had moved north during the time it took to perform the across-ice transects (Fig. 2 versus Fig. 3). A total of 141 oceangraphic stations were sampled (Fig 4).

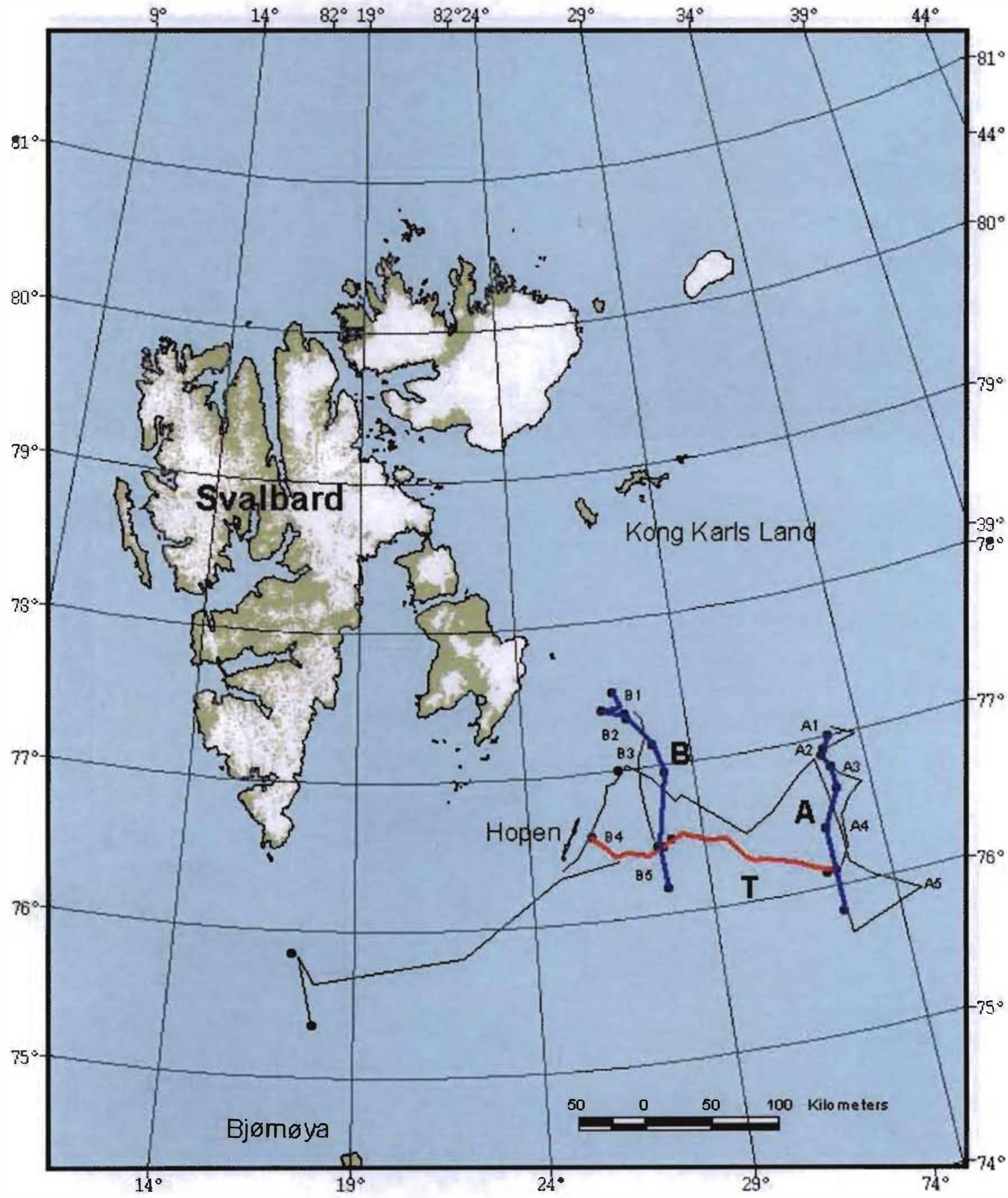


Figure 1. Marinøk cruise track, May 1999. Transects A, B, and T are indicated, plus all ice stations.

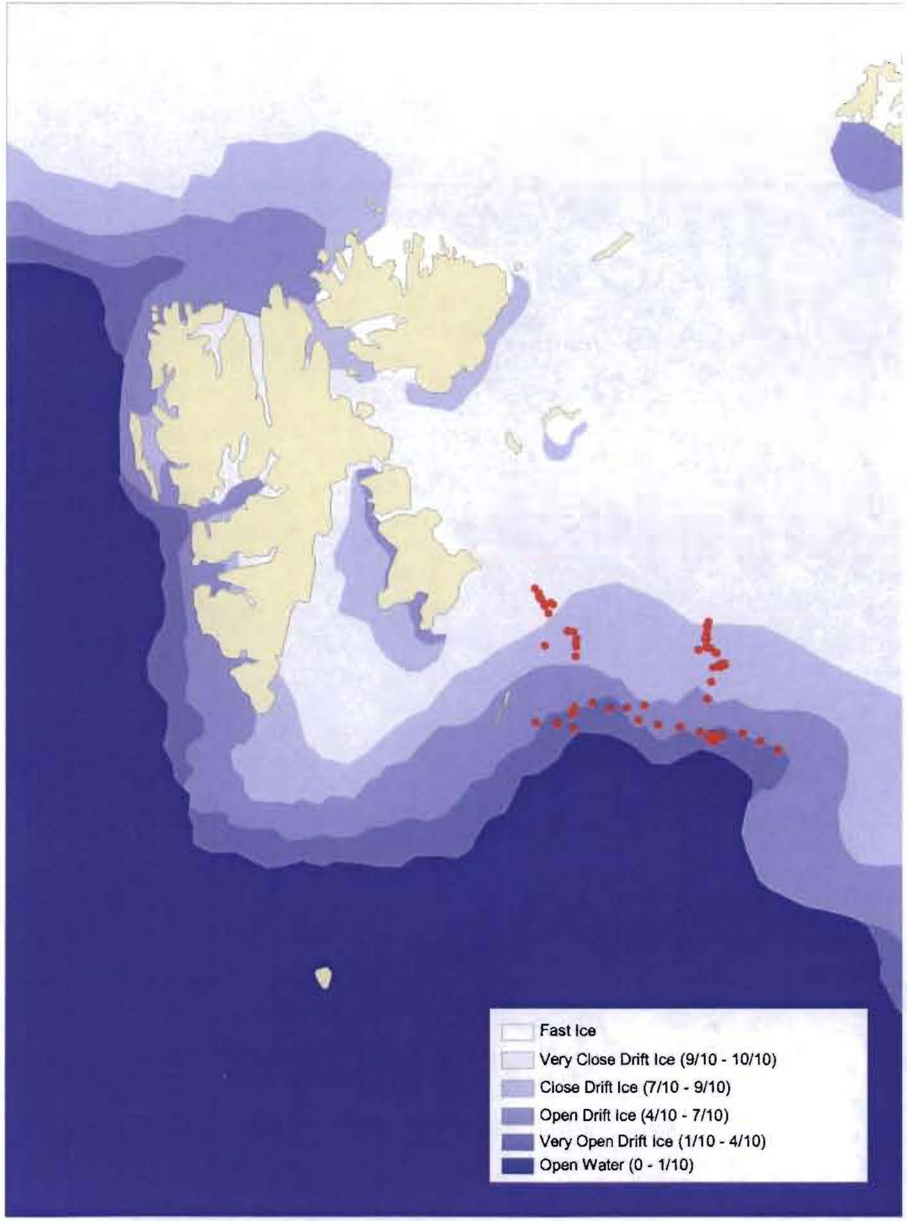


Figure 2. Sampling stations and ice cover, 7 May 1999.

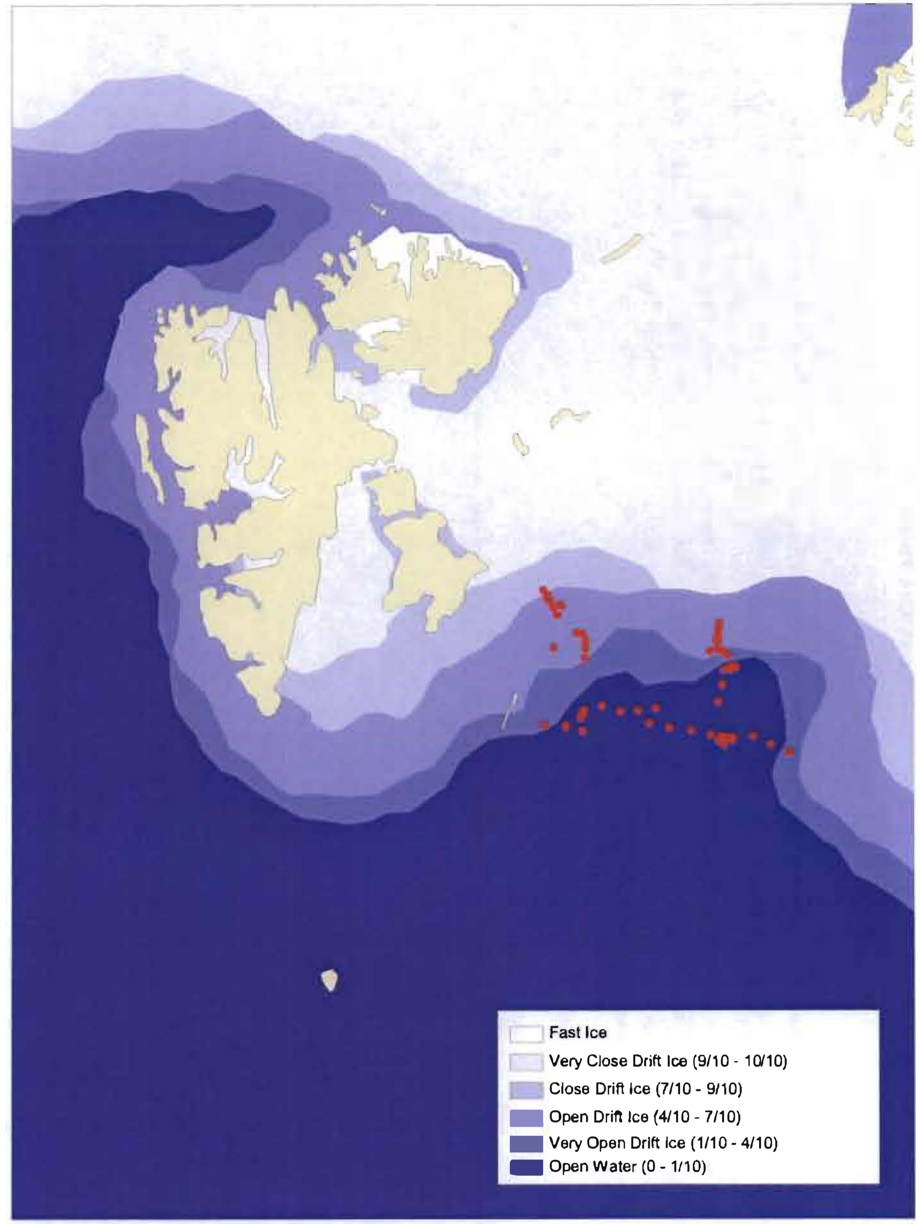


Figure 3. Sampling stations and ice cover, 20 May 1999.

3.2 March-April 2000 cruise

The March-April 2000 cruise consisted of one transect along the ice edge, and one transect into the ice (Fig. 5). The transect along the ice edge went in 10 % ice cover, whereas the across-ice transect went from consolidated first-year ice (< 0.7 m thick) into ice-free waters. A total of 102 oceangraphic stations were sampled (Fig 5).

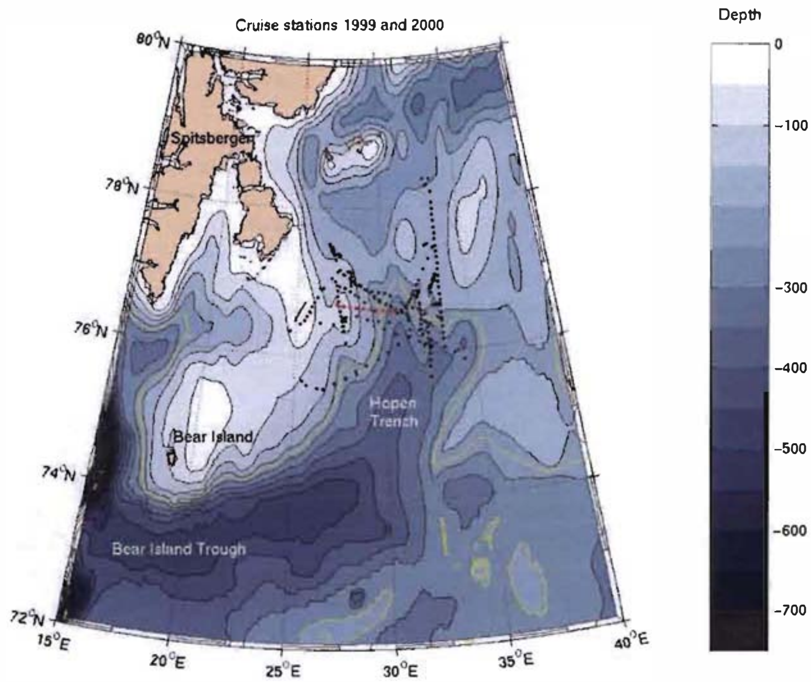


Figure 4. Positions of all CTD stations in 1999 and 2000. The red dots indicate section 6 during the 2000 cruise.

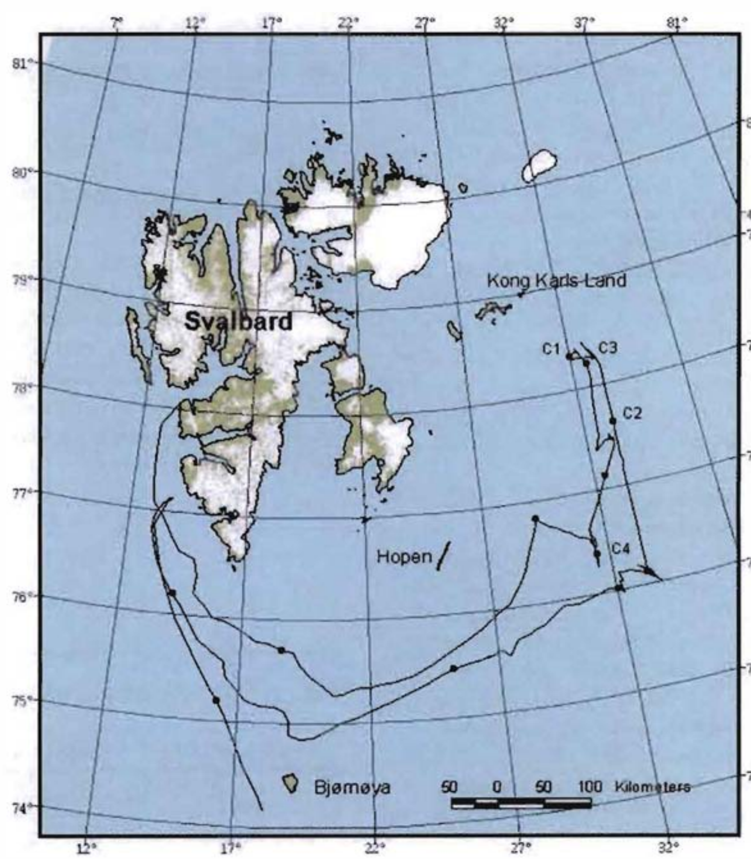


Figure 5. Marinøk cruise track, March – April 2000. C1 to C4 are ice stations.

4.1 Temporal and spatial variability of oceanographic processes at the ice edge

Edmond Hansen, Ole Anders Nøst, Janne Økland, Alexei Stuliy, Kristen Fossan, Tor Ivan Karlsen, and Harvey Goodwin

Background

The Marginal Ice Zone (MIZ) is an area featuring extreme variability in many of the physical constituents of the air-sea-ice system. Central oceanographic and ice related physical factors at the ice edge that demonstrate temporal and spatial variability include: ice edge position; shape and advance/ retreat rates; MIZ coverage; the ice velocity field; vertical stratification, stability and depth of the mixed layer; ocean circulation (mesoscale eddies, upwelling/downwelling); and oceanic fronts, their location and gradients.

The spatial and temporal variability of these physical factors are regulated by several different processes. These processes take place on a vast range of spatial and temporal scales, through complex and coupled ice, ocean and atmosphere dynamic and thermodynamic mechanisms, and are under the influence of the local topography. The extremes of these scales are the linkage to the North Atlantic Oscillation (NAO) on a large (hemispherical) scale, orchestrating the inflow of warm North Atlantic water to the Barents Sea. On the other end of the scale, local wave activity at the outer MIZ breaks the ice cover into an array of discrete ice floes and significantly contributes to the shaping of the ice edge.

The Barents Sea ecosystem is strongly influenced by the physics and features of the MIZ and the ice edge. However, these processes and their couplings are not well understood, and should therefore be studied as a part of the efforts to establish a link between the physical factors, the ice as a habitat, and the eventual characteristics of the ecosystems of the area. The project also investigates the regional components and indicators of northern hemispheric climate variability.

Goal and objectives

The goal is to procure basic knowledge, qualitative and quantitative, on the physical factors characterising the Barents Sea MIZ as a dynamic habitat, and on the mechanisms and processes linking these factors and their temporal and spatial variability. The goal of the project is pursued through the following objectives:

- Quantification of the cryospheric factors listed and their variability, by analysing relevant historical data sets and field data.
- Quantification of the hydrographic factors listed, through field cruises at different seasons, supplemented with historical data.
- Evaluation of the performance of a numerical coupled ice-ocean model for this actual application, by comparing it with historical and field data.
- Acquisition of a basic understanding of the various processes involved and the relative importance of the different factors and their variability, by running process studies with a numerical, coupled ice-ocean model.

Here we report the activities, methods and some raw data with regard to the first two objectives of the study.

Methods and activities

CTD (Conductivity Temperature Depth) casts were done on a total of 141 stations (Fig. 6). The stations constituting synoptic transects are listed in Table 1. Water samples were taken on most CTD stations in order to calibrate the conductivity measurements.

The Acoustic Doppler Current Profiler (ADCP) on *Lance* was continuously running during the cruise, and provided the 3D hydrographic velocity profile for the transects and the different stations.

A DCM12 rig was deployed at 45 meters depth on 4 May 1999, 20:50 UTC. The position was 76° 34.73' N, 25° 48.95' E, just east of Hopen. It was retrieved on 22 May 1999, 09:50 UTC, and thus provided an 18-day long time-series of the 3D hydrographic velocity profile at that location, in addition to ice drift velocities.

An ADCP rig was deployed at 270 meters depth on 8 May 1999, 20:50 UTC. The position was 76° 25.82' N, 32° 19.26' E, i.e. Hopendjupet. It was retrieved on 22 May 1999, 18:20 UTC, and thus provided a 14-day long time series of the 3D hydrographic velocity profile at that location.

Four CMR ICEX ARGOS drift buoys equipped with Global Positioning System (GPS) receivers were deployed with 15-20 km spacing across the MIZ. The buoys were put on large ice floes. The buoy number and date and position of deployment are shown in Table 2.

Table 1. CTD and ADCP transects, May 1999.

Transect	Start station	End station	Ice edge
1	2	15	Along (T)
2	16	30	Across
3	36	48	Across
4	53	61	Across
5	61	68	Across
6	68	76	Across
7	76	86	Across

The buoys continuously transmitted their position via satellite, revealing the ice drift pattern at this section. Buoys 3611 and 3612 were retrieved on 10 June 1999 by helicopter from Longyearbyen (Superpuma with Search and Rescue crew). Due to a failure of the bearing instruments, buoy numbers 15524 and 15526 were not found.

Preliminary results

The positions of all stations along with the bathymetry of the area are shown in Fig. 6. One transect along and six transects across the ice edge were performed, in addition to CTD casts every third hour on the stations in the ice and in open water. The salinity structure for profiles along and across the ice edge are shown in Figs. 7 and 8, respectively. An example of the temperature and salinity structure of an ice station (Fig. 9) can serve as input to the interpretation of the biotic data sampled at such stations.

Table 2. ARGOS drift buoys deployed on 8 May 1999.

Buoy number	Deployment date	Time (UTC)	Deployment position
15524	8 May	07:20	76° 14.0' N, 32° 30.0' E
3611	8 May	10:40	76° 23.7' N, 32° 23.6' E
3612	8 May	13:50	76° 33.7' N, 32° 07.2' E
15526	8 May	19:45	76° 48.8' N, 32° 02.6' E

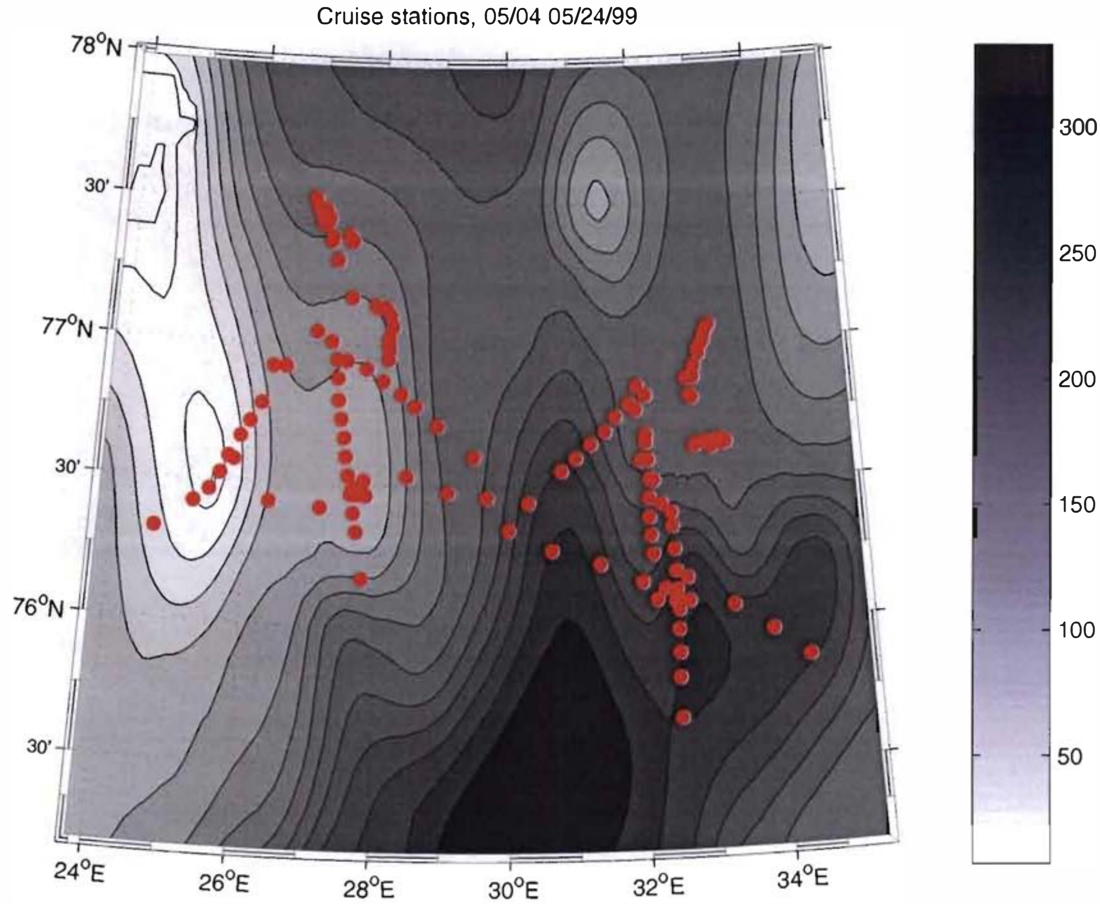


Figure 6. The CTD stations during the cruise and the bathymetry of the area, May 1999.

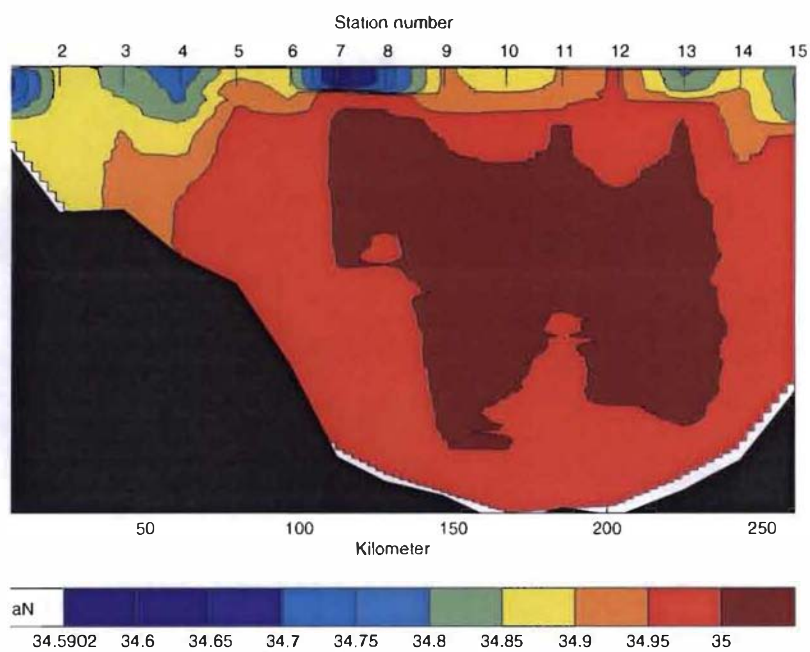


Figure 7. The salinity structure at section 1 (Transect T, Fig. 1) along the ice edge, May 1999.

Figure 8. The salinity structure at section 2 (Transect A, Fig. 1) across the ice edge, May 1999.

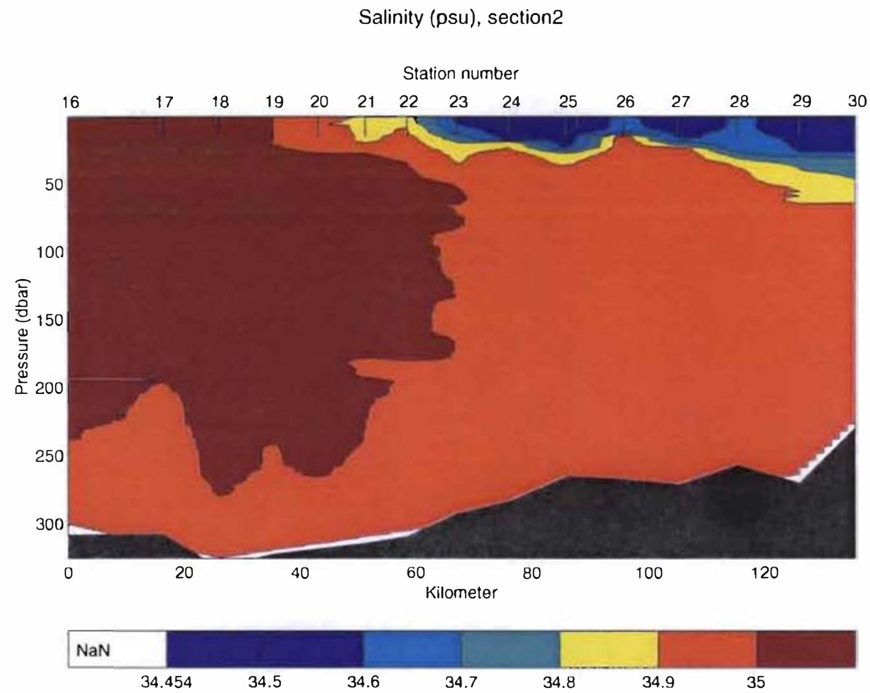
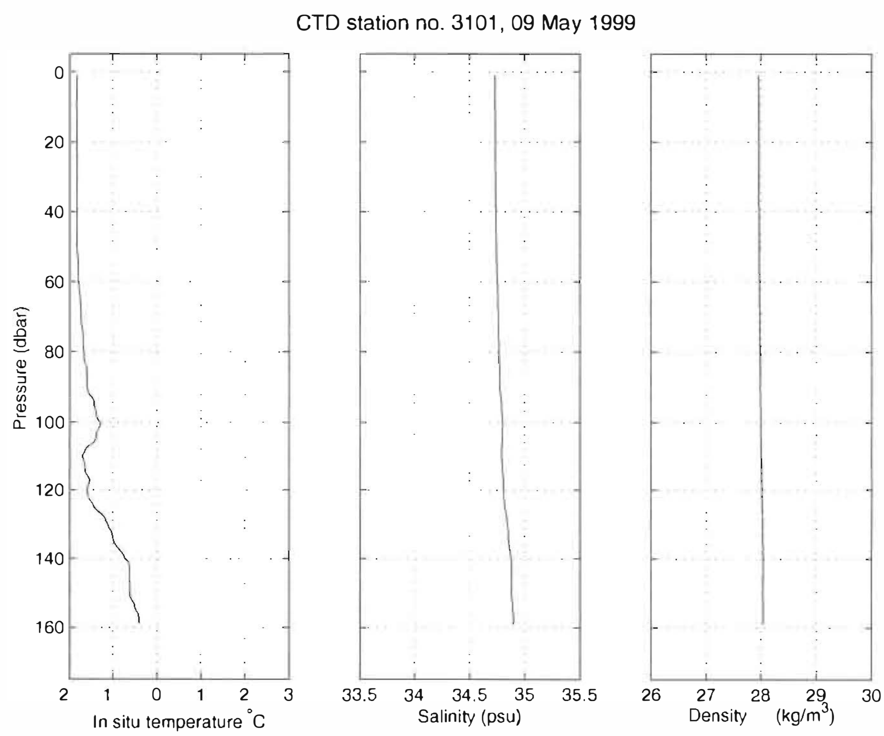


Figure 9. The hydrographic structure at ice station A1, May 1999.



4.2 Ice observations

Harvey Goodwin, Sebastian Gerland, and Boris Ivanov

Introduction

Several projects needed background information on sea ice conditions during the cruise to include in the interpretation of other data. These observations are intended to be used for interpretation of satellite remote sensing imageries, particularly SAR imagery, to develop classifications for different ice types and ice characteristics. Detailed descriptions of the ice are necessary in order to define as many distinct classification classes as possible.

Methods and activities

Standard observations were taken every three hours from the ship's bridge for the duration of the cruise. Ice classification and estimation of ice concentration were based on a system adapted from NOAA (2001). This involves estimating the proportion of different ice types, floe sizes, snow-cover thickness, percentage of ridging and rafting, and percentage of brown ice. Extra observations were made during transects perpendicular to the ice edge or under rapidly changing ice conditions. Generally, only one or two observations were taken at ice stations unless conditions were changing rapidly. Observations were taken less regularly during open water transects when the condition was considered to be 100% open water.

Ice type was divided into nine categories: grease and slush, pancake, dark nilas, light nilas, grey/grey white, white first-year, white second-year, white multi-year, and brash ice; and open water. In addition to observing the ice conditions, several other parameters were noted such as air and sea temperature; air pressure; wind speed and direction, ship speed and heading.

To complement each observation, a photograph was taken using a digital camera with a 35 mm lens and it was noted whether the photo was taken from the port or starboard side. All photos include the horizon so that comparisons of floe size can be made. To aid the determination of floe size, a series of four control photos were taken of a Zodiac boat (i.e. length-scale) at four distances from *Lance*.

In addition to the standard observations made from the bridge, a number of supplementary observations were made from the crow's nest at the six main ice stations and on transects perpendicular to the ice edge. Particularly detailed observations were taken when the transect coincided with radar satellite passes from ERS-2 and once for Radarsat. A time-lapse video was also in operation from the crow's nest for the entire duration of the cruise, taking an image of the ice approximately every 5 seconds.

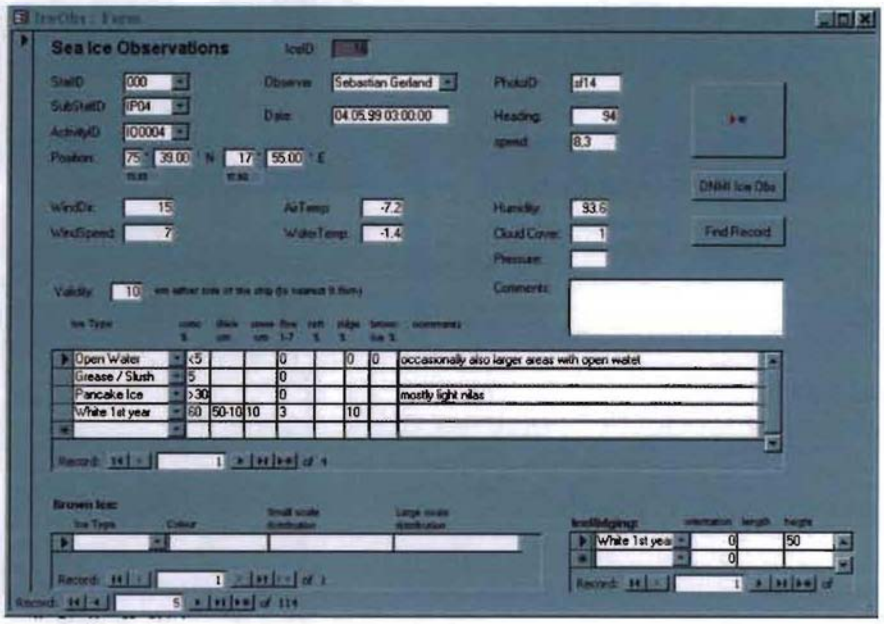


Figure 10. Example of a standard ice observation.

Figure 11. Sea ice in the Marginal Ice Zone, May, 1999.

Results

Results have been entered in an MS Access database and can be readily made available in Word or Excel. Observations were made available to the Norwegian Meteorological Institute (met.no) on a daily basis throughout the duration of the cruise so that they could use the data when compiling their ice maps. A standard ice observation and the accompanying photograph are presented in Figs. 10 and 11.

Reference

National Oceanic and Atmospheric Administration. 2001. Observers' guide to sea ice (http://response.restoration.noaa.gov/oilaids/seaice/seaice.html).

4.3 Satellite data and ice maps

Harvey Goodwin

Introduction

Ice maps produced by the Norwegian Meteorological Institute (met.no) were used in the planning of ice stations and ice transects. These maps are based on data from the passive microwave sensor SSM/I providing ice concentrations at a resolution of 25 km, and supplemented with AVHRR data (1 km resolution) when the area is cloud free. AVHRR imageries were acquired at the Norwegian Polar Institute (Tromsø) for cloud free days and sent via satellite to *Lance*. Since the Arctic often is affected by cloud cover, and by the polar night during winter, it is often difficult to obtain good satellite imagery from optical sensors. Because SAR imagery is independent of both atmospheric and light conditions, an attempt was made to use SAR imagery from ERS-2 and from Radarsat. The main aim of using SAR data is to improve ice classification, determine areas of ridging and rafting, and persistent polynyas. The final goal of these improved classifications is to be able to predict preferred ice habitats for marine mammals, such as the polar bear, from known ice characteristics.

Data obtained on board *Lance*

Ice maps were received daily from Met.no in ArcView format with the exception of Saturdays, Sundays, and Bank Holidays.

- AVHRR imagery with a resolution of 1 km for the following dates: 4, 5, 6, 7, 11, 12, 14, 18, 19 and 20 May 1999.

- A Radarsat image from Wednesday 12 May 1999 05:28 (UTC). This image covers an area of 500 km x 500 km with a resolution of 100 m. The corner coordinates for the image are:
  81.82° N, 23.11° E   79.87° N, 46.42° E
  73.45° N, 29.35° E   74.60° N, 14.84° E

- 2 ERS images from Sunday 16 May 1999 10:25 (UTC). The corner coordinates for the two adjacent images are:
  77° 56'N, 27° 14'E   77° 30'N, 30° 52'E
  76° 19'N, 23° 41'E   75° 55'N, 27° 00'E

- 1 ERS image from Wednesday 19 May 1999 10:05 (UTC). The corner coordinates for the image are:
  77° 56'N, 25° 48'E   77° 30'N, 29° 26'E
  77° 08'N, 23° 55'E   76° 43'N, 27° 23'E

Unfortunately we had very few satellite passes from ERS-2 that coincided with our position. However, it is possible to obtain other ERS-2 imageries from any day during the cruise for our study area since Tromsø Satellite Station downloaded all scenes. All ERS-2 images cover an area of 100 km x 100 km and have a resolution of approximately 30 m. More ERS images may be acquired, after we have further assessed the data set, to provide a time series of ice cover change.

Figure 12. An example of a radarsat image, May 1999 (Edgeøya and Hopen can be seen).

Preliminary results

It was feasible to obtain some of the SAR imagery in near real time a few hours after acquisition (Figs 12, 13). It was then possible to study the imagery in parallel with taking ice observations from the crow's nest, and differences between satellite and ship based observations were noted. It is not expected that individual ridging will be discernible from the imagery, but that areas containing high concentrations of ridges and rafting should be visible. The ERS-2 imageries available on the cruise were not at full resolution, but higher resolution imageries could be obtained after the return to Tromsø (Fig. 13).

4.4 Atmospheric circulation within the Marginal Ice Zone

Alexei Stuliy and Edmond Hansen

Background

The change of the surface conditions from open water through the Marginal Ice Zone (MIZ) to sea ice and vice versa, leads to a modification of the Atmospheric Boundary Layer (ABL) in the MIZ vicinity. These changes can be due to either the change of the ABL height or through the baroclinic effects caused by the horizontal temperature gradient. These processes are particularly intense in the MIZ, which is a transitional zone between pack ice and open water. The ice concentration, roughness, floe diameter, thickness, temperature and other characteristics are highly variable in space and time. The atmospheric mesoscale weather and cloud conditions, as well as the water temperature, also vary greatly. This variability results in complicated air-ice-sea interactions in the MIZ.

The transfer of momentum from the atmosphere to the sea ice/water surfaces (wind stress) is one of the most important air-ice-sea interactions that occur in the high altitude MIZ. In fact, with exception of

Figure 13. More detailed ERS-2 image (upper half of Fig. 12), May 1999.

the tides, almost all motion in the sea ice is driven directly or indirectly by atmospheric influence. In turn, latent and sensible heat fluxes from the ocean surfaces fuel a large part of the atmospheric circulation. Winds act on the upper part of the ocean, creating currents, turbulence, sea surface tilt, and ice movement. The physical characteristics of the sea ice also change due to ice movement. All of the interactions above, and other complicated interactions, such as water mass transformation and dense water formation are important for the ice dynamics.

During the Marinøk cruise in May 1999, measurements were taken to study air modification in the Atmosphere Boundary Layer flow across rhe Marginal Ice Zone of the Barents Sea. These were carried out in order to obtain a better understanding of the nature and the role of the MIZ in the Arctic.

Methods and activities

A tethered weather balloon was used to provide a "synoptic" atmospheric profile on the transects across the ice edge, as well as on the ice stations. The balloon was taken up on stations 17, 20, 22, 24, 26, 28, 30, 31, 33, 34a, and 34b (Transect A, Fig. 1) and on stations 49, 50, 51, 52 (Transect B, Fig. 1). On stations 31 and 49, the balloon was taken up from the sea ice (approx. 2 m above sea level), wheras the remaining profiles were taken from rhe helicopter deck (12 m above sea level). These measurements provided atmospheric humidity, velocity and pressure profiles across the MIZ.

A weather station measured temperature and wind velocity variations in the lowest part of the atmosphere. This station was deployed on the ice at ice stations (Stations 31, 32, 33, 34, 39, 50), and was run for at least 3 hours at each station. Temperature and wind sensors were located at 0.5, 1.5 and 3.0 m above the sea level. The data obtained provided information on the wind stress variation and drag coefficients across the MIZ.

Preliminary results

The Atmospheric Boundary Layer (ABL) is usually srable and stratified, with a vertical temperature gradient exceeding the moist adiabatic lapse rate (approx. 0.8 °C per 100 m, for neutral conditions). Therefore, mixing occurs mostly due to mechanical forcing, as a shear stress, except over open leads where buoyancy also contributes. Since turbulence occurs because of mechanical forcing when wind blows over 100% ice, the mixed layer cannot grow above a certain limit (50-150 m in our case), and most atmospheric pollutants are trapped within it. When the buoyancy force also causes mixing, a rise of the upper limit of the ABL is produced, and here the pollutant concentrations may be reduced. The potential temperature profiles (Figs. 14a, b) from our observarions become useful when interpreting how the boundary layer evolves. The potential temperature profile is usually sufficient to identify the parts of the boundary layer, with the structure of the ABL being clearly evident.

Stable conditions

Profiles taken at stations 22, 26, 28, 30, 31 and 34a on Transect A (Fig. 1) and 49, 50 on Transect B (Fig. 1) can be described as stable, as the botrom sections of the profile are transformed by contact with sea ice. The air was cooled by contact with ice due to negative sensible heat flux plus divergence of long-wave radiation. The greatest static stability is near the ground, and the stability decreases gradually with height. The mixed,

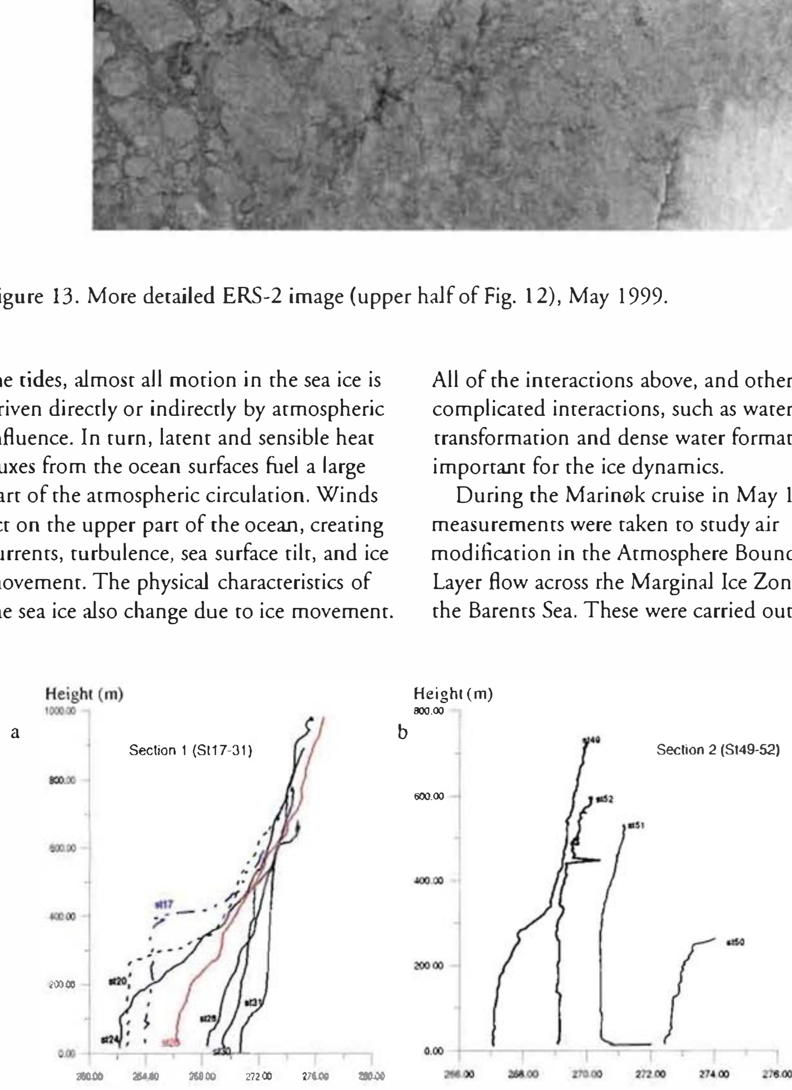


Figure 14. Growth of the atmospheric boundary layer with wind blowing off the ice sheet. Potential temperature was calculated as: $Q = T(P_0/P)^{0.286}$, where T is absolute temperature (Kelvin) and P_0 is sea level pressure. Station number is indicated on each curve for: a) Transect A. b) Transect B.

weakly turbulent layers are close to the ice and are highly stable, with thicknesses not exceeding 50-150 m. Although the wind at sea level becomes lighter or even calm, the wind aloft accelerates to supergeostrophic speeds. This phenomenon is called the low-level or polar jet and has a magnitude of 7-8 m s^{-1} and peaks 150-200 m above the ice surface. The nature of this jet is still unclear. There might be several reasons for its development, such as synoptic-scale baroclinicity, fronts, warm advection from open water, and "ice breezes" phenomena. A few hundreds meters above the jet, the wind speed is slower and closer to its geosrrophic value. It seems that strong shear below the jet is accompanied by a rapid change in wind direction, and that the polar jet has extremely narrow thickness (only 20-30 metres) with a magnitude of 7.5 m s^{-1} and a well developed turbulent mixed layer underneath.

The statically stable air tends to suppress turbulence, while the developing low-level jet enhances wind shears that tend to generate turbulence. As a result there are mixed layers (ML) on the bottom of each profile with a thickness that does not exceed 100-150 m. Buoyantly generated MLs (found at stations 24, 20-17) tend to be more uniformly mixed than those driven mechanically because of their convection motion, whereas shear stress generates mostly horizontal motions.

As opposed to stations with unstable conditions that have a clearly identified top, a Stable Boundary Layer (SBL) profile (Fig. 15) has a poorly defined top that smoothly blends into the rest of the atmosphere. Also the SBL profiles usually have characteristics that are not in equilibrium with the surface due to little vertical mixing. Thus, many definitions of SBL height are based on relative comparisons of SBL state aloft to near surface state, and it may vary from 50 to 400 meters depending on which definition is applied. In some cases we probably had warm air advection from the open ocean, as the underlying water surface was colder than the air.

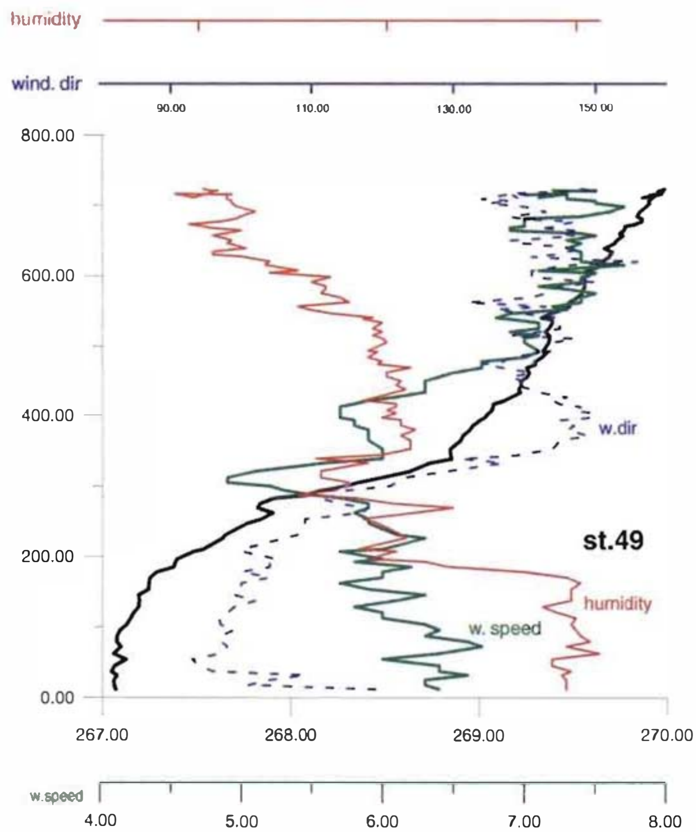


Figure 15. Stable conditions. Example of a vertical profile of wind speed, wind direction, temperature, and relative humidity, Station 49, Barents Sea, May 1999.

Unstable conditions

Profiles at stations 17, 20, 24, 33a, 51, and 52 were taken over open water or over pancake ice, if present. These convectively driven profiles can be described as unstable. Convective sources include heat transfer from the relatively warm water surface, and radiative cooling from the top of the cloud layer. The first source creates thermals of warm air rising from the ocean surface, whereas the second creates thermals of cool air sinking down from cloud tops. Both can occur at the same time, particularly when a cool stratocumulus tops the mixed layer. In addition to convection, which is the dominant mechanism, there is wind shear both close to the surface and across the top of the mixed layer that contributes to turbulence generation. The resulting turbulent mixed layer (layer A, Fig. 16) tends to mix heat, moisture, and momentum uniformly in the vertical aspect. The potential temperature is almost adiabatic throughout the mixed layer. Within the surface layer there is usually a superadiabatic layer (temperature decreasing rapidly with height), but it cannot be shown with our measurements because the tethered balloon was used from the helicopter deck (i.e. 12 m above sea level). Wind speeds are subgeostrophic (less then geostrophic) throughout the mixed layer, with less pronounced turning angles than in the stable case. The middle portion of the ML has nearly constant wind speed and direction. Humidity tends to decrease with height and across the top of the ML this is very pronounced (layer B, Fig. 16). This can be used together with potential temperature profiles to identify the ML upper limit in our measurements.

Layer B (Fig. 16), called the entrainment zone, acts as an interface between the ML and the free atmosphere above (layer C). Another measure of ML depth is the height at which an air parcel rising from the surface becomes neutrally buoyant. However, the air parcel does not simply stop at that level but continues to rise up to a certain limit where it becomes negatively buoyant. Then, the negatively buoyant parcel sinks back down into the ML pushing an additional volume of warm air from the free atmosphere down into the ML. These relatively warmer parcels become rapidly mixed down into the ML due to the strong turbulence there, and do not rise again despite their positive buoyancy. The resulting growth in ML thickness is referred to as entrainment or penetrative convection. In mid-latitudes the ML usually grows during daytime and declines during the night because the heat from the ground cannot drive this convection without solar radiation input. In polar regions, the situation is quite different and the whole convective boundary layer does not change in thickness over 24 hours because of permanent sensible and latent heat fluxes arising from the ocean surface.

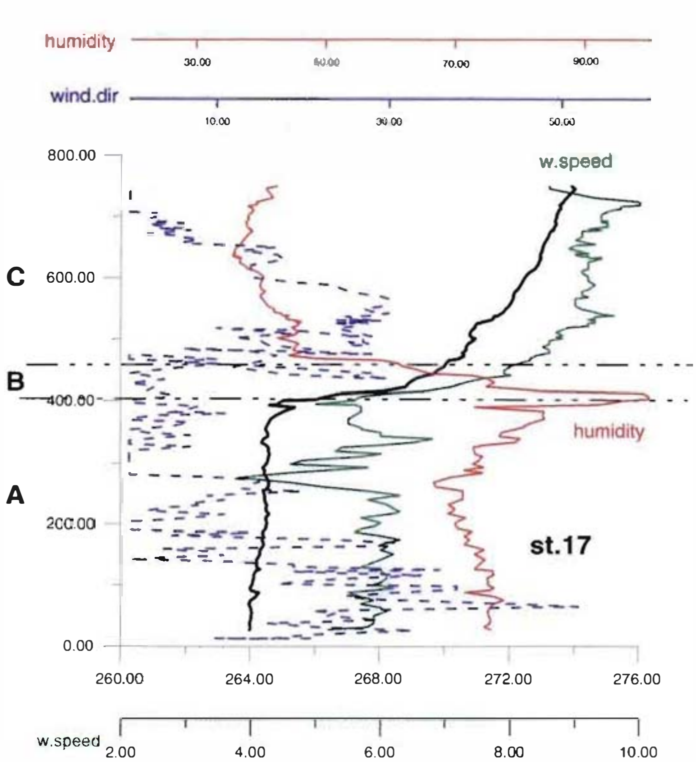


Figure 16. Unstable conditions. Example of a vertical profile of wind speed, wind direction, temperature, and relative humidity, at station 17, Barents Sea MIZ, May 1999.

4.5 Solar radiation and physical properties of sea ice in the Barents Sea

Sebastian Gerland, Boris Ivanov, Harvey Goodwin, Józef Wiktor, and Jan-Gunnar Winther

Background

The Marginal Ice Zone is very sensitive to climate changes, especially with regard to its regional distribution and dynamics, but also its ecology. For example, a small warming or influence by air-transported dust or sediments may change the spectral surface albedo of snow or sea ice and thus alter the net radiation and the energy balance of the system. Consequently, the boundary conditions of the ecological system change. Furthermore, the melting of the ice would be accelerated and its mechanical stability would be reduced; break-up would occur earlier in the season. The physical properties of the ice as well as the sea ice and snow thickness play a key role in such scenarios. Physical property data are crucial as index ground-truth parameters in remote sensing studies of the conditions and dynamics of the Arctic sea ice cover. Furthermore, knowledge of the physical (including optical) properties is needed for energy balance calculations and modelling of dynamics (volume, velocity, and drift patterns) and thermodynamics of sea ice in the Arctic. The results of our study could be used as input parameters for regional climate models.

Objectives

Through detailed measurements of spectral reflectance of solar radiation and the physical properties of sea ice, snow, and water in the MIZ of the Barents Sea, we will analyse the relationship between the physical properties of the sea ice and its absorption of solar radiation. Surface albedo and radiation were measured for energy balance calculations, climate modelling and remote sensing ground-truth purposes by using a spectroradiometer and short- and long-wave radiation sensors. We anticipate to determine the amount of solar radiation (spectrally) that penetrates into the sea ice and water masses below and therefore is available for biological production. The physical properties of the sea ice include surface characteristics of snow and ponds, radiation and optical properties such as spectral surface albedo and transmittance of different sea ice types as well as temperature, salinity and texture/stratigraphy of the sea ice with depth of sea ice cores.

The development of ice algae is directly connected to the radiation conditions and also changes in the physical properties (e.g. temperature, porosity, salinity) of the sea ice. The ice algae in turn influences the amount of light that penetrates the sea ice. The results from this study would be of value for the ongoing work within SpecRef (see Gerland *et al.* 1999; Winther *et al.* 1999), one of the projects of the ALV programme (Arctic Light and Heat, Norwegian Research Council). As we are also studying the physical and optical properties of sea ice of different types in the cold lab (first-year fast ice from Kongsfjorden and artificial ice from the Interice II-EU/LSF project) the sea ice from the MIZ would provide complimentary information. Consequently, we would be able to generate a comprehensive picture of the relevant Arctic sea ice types, which is crucial for studies of polar climate changes.

Methods and activities

1. Work from the ship

Observations of sea ice and weather conditions were made from the bridge every three hours throughout the cruise, as long as the ship was in ice and conditions were changing. (For detailed information, see Appendix 1). In order to determine quantitatively the transparency of the upper part of the water column, a Secchi disk was used at a number of stations from the ship and at some places, additionally, from the rubber boat or the sea ice edge. In total, 17 observations were obtained, beginning on 7 May 1999 (station 15) and ending on 21 May 1999 (station 52). The minimum observed Secchi disk depth was 4 m and the maximum 20 m.

Atmospheric radiation was monitored from the crow's nest roof (27 m above sea level) between 4-24 May 1999. Short and long-wave radiation were measured as follows:

Incoming short-wave solar radiation. Incoming short-wave solar radiation (W m^{-2}) was measured with the AARI thermoelectric pyranometer (TEP-29) in the 300 to 3000 nm wavelength region. The sensitivity of this sensor is 0.067 mv/(W m^{-2}) and the response time is 10 seconds.

Long-wave radiation balance. Long-wave radiation balance of the atmosphere was measured with an AARI upward and downward looking pyranometer and pyrgeometer in the 3500 to 17000 nm waveband. The opening angles were 90° (up) and 45° (down). The sensitivity is 0.055 mv/(W m^{-2}) and 0.025 mv/(W m^{-2}), respectively. The response time for these sensors is 15 sec. These sensors consist of a thermopile shielded by a germanium hemisphere. We used a LI-1000 DataLogger (LI-COR, Inc.) to register the signals from the radiation sensors. The interval between logged time averages was 10 min., with registration of maximum and minimum information of radiation components within these intervals.

II. Work from ice stations

Work on the ice was performed on a total of eight different stations (1, 15, A1/31, A2/33, A3/34, B1/49, B2/50 and B3/51). Of these eight, six "big" stations included radiation measurements, the other two "small" stations (1 and 15) included only sampling and physical property measurements of snow and ice.

Sampling

Ice cores were collected at all eight stations. Usually we collected three cores per station and investigated the ice surface or floe. One of the cores was cut in the field for salinity measurements on melted samples. The other two cores were stored and transported to Tromsø for later analyses in the cold laboratory. We used a 4" corer (Type Kovacs Mark II), driven by a two-stroke combustion engine. The core quality was usually very good. Snow was sampled in order to determine the salinity of melted samples. From samples that were to be melted on board the ship, some sub-samples were taken in order to provide algae samples. These core samples had to be melted slowly under controlled conditions so that the osmotic pressure did not damage the original algal structure.

Radiation/optical measurements

Using the FieldSpec FR spectroradiometer (Analytic Spectral Devices, Boulder, USA), we measured surface albedo on various surfaces on the six "big" sea ice stations. The FieldSpec FR is capable of measuring irradiance from 350 to 2500 nm wavelengths. Additionally, the irradiance was measured using a cosine receptor both in air and under water through boreholes in order to determine the bulk attenuation of sea ice and snow. Some additional tests with different measurement setups were performed (e.g. attenuation in the water at different depths in the uppermost layer (1 m) of water; surface albedo under varying observation angles). For the underwater measurements, an optical fibre cable was used in combination with an adjustable aluminium arm which held the sensor below the sea ice away from borehole disturbances. Spectral data were logged using the FR (surface albedo) and VNIR (under ice measurements) software, which was running on the connected ZEOS personal computer. Data are stored as binary files, with filename showing date, type of measurement, number of data sets on this site, and number of recordings (as extension). Data processing will be done by FR software tools RCALC and STABLE.

PAR (Photosynthetically Active Radiation) measurements were performed using Licor quantum sensors (Licor Inc., Lincoln, USA). A LI-190SA quantum sensor was used for in-the-snow and air measurements of solar radiation penetration. In certain cases we used an additional LI-190SA quantum sensor as a reference (installed at 1.5 m above the sea ice surface) in order to correct for changing conditions at the snow surface (variations with time of incoming solar radiation). The sensitivity of the LI-190SA sensor is 8 μA per 1000 μmol/(sec m^2). The response time is 10 μsec. Those observations were only made on the ice stations with a snow cover of at least 0.1 m, because in thinner snow it is not possible to install the sensor without distorting the snow. We were able to measure PAR in the snow at between three and six levels. For recording the data, we used a LI-189 quantum meter. If two measurements by two sensors were taken simultaneously, a LI-1000 DataLogger was used.

Underwater PAR was measured at several depths up to 25 m with LI-192SA quantum sensor in the 400 to 700 nm wavelength region, which is the same band as the LI-190SA measures. The unit of measurement is μmol/(sec m^2). The sensitivity of this sensor is 3 μA per 1000 μmol/(sec m^2), and the response time 10 μsec. The soundings were made from a drillhole or a rubber boat using a special 2009S lowering frame and 3 m long wooden arm. Incoming PAR at the surface was observed in parallel with a LI-190SA quantum sensor. This sensor was used as a reference in order to correct for changing conditions at the surface during observation of the underwater penetrating radiation. A LI-1000 DataLogger was used for simultaneous registration of the signals from both sensors. At station B1/49, a profile was measured over a regular first-year ice floe, going from 30 m from the ice edge on the ice towards the edge and on the water 40 m off the ice edge. The spacing between measurement points was variable with the highest spatial resolution near the ice edge.

Back-diffuse radiation caused by reflection of solar radiation at the snow/ice interface was measured using two different types of sensors. The first one was an AARI snow pyranometer (SP) recording wavelengths from 300-3000 nm. The opening angle for this sensor is 100°. The sensitivity of this sensor is 0.04 mv/(W m^{-2}) and the response time is 10 sec. The second sensor was a LI-190SA quantum sensor with characteristics as described above. We used these sensors for measurements of back-diffuse radiation on all "big" ice stations. The majority of our measurements were carried out on the surface of first-year ice, while further measurements were performed on the surface of young ice (grey, grey-white). For logging of the back-diffuse data, we used portable 26 III TRUE RMS FLUKE multimeter (SP signals) and a LI-1000 DataLogger (LI-190SA data). To measure back diffuse PAR, we used two LI-190SA sensors simultaneously, i.e. same as for under-water measurements.

Physical property measurements

On the snow, the following parameters were logged as standard on all eight stations: snow density, snow temperature, liquid water content of snow, melted-snow salinity and snow stratigraphy. The total snow thickness determined the number of measurements that could be made. The snow temperature was measured using a Digitron electronic thermometer with Pt100 needle probe. The density was determined volumetrically using a 0.5 l metal tube and a spring balance. Liquid water content was calculated from dielectric measurements using a LEAS Tel 05.1 instrument and density data. The salinity of melted samples was measured on board ship with a conductivity meter, at a temperature of +20 °C.

Stratigraphy of snow and ice

Snow types of all detectable snow layers that were covering the sea ice were characterized at all eight ice stations, using the classification of LaChapelle (1992). Additionally, the average grain size and hardness of snow were recorded. A simple stratigraphic description was undertaken on ice cores, describing the amount of air bubbles, prominent layers and visible algal concentration.

Snow and ice thickness measurements

As a standard we took thickness measurements parallel to all core drillings (thickness of snow and ice, freeboard). Additionally, if the ice floes we were working on were large enough, we performed thickness profiles. Four in total were made, two 50 m (stations A1 and B1), one 30 m (station B1) and one 25 m (station B3) long profiles. The horizontal distance between each hole was 5 m. The snow thickness was measured every 2.5 m.

Planned work after the cruise

Data processing

Most of the radiation data need to be processed in order to calibrate the data and make the binary files readable. Sun elevations for certain observation times have to be calculated. Physical property data will be processed and partly corrected by means of instrument calibrations. Meteorological data and radiation monitoring (shipboard and possibly from Hopen) for the relevant time periods as well as remote sensing information need to be compiled. After these steps have been performed, the scientific analyses and data interpretation can be made.

Laboratory work

We plan to perform optical measurements on ice samples in the cold laboratory in Tromsø. We want to use the spectroradiometer in order to determine the spectral attenuation of optical radiation in defined sea ice types. Additionally, ice algae and chlorophyll-*a* concentrations will be measured in selected cores.

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4.6 Phytoplankton and ice flora investigations

Józef Wiktor

Methods and activities

During the cruise, 52 samples of phytoplankton and 80 of chlorophyll-a were collected from the upper layer (0 to 60-70 m) of the water column by using a Niskin bottle mounted on the CTD sonde (Table 3). Levels of sampling were chosen according to the *in vivo* fluorescence profiling. Samples of phytoplankton will be analysed in the laboratory for abundance and species composition in relation to water masses and ice coverage as well as for their chlorophyll-*a* content samples. Net samples of phytoplankton from the water column were taken for detailed taxonomic determination and biomass (converted to carbon) on chosen stations. The development of phytoplankton blooms in two different parts of the Barents Sea will be determined.

Ice algae were collected by SCUBA divers using electrical suction pumps with a 30 µm filtration mesh. A total of 30 samples were collected from six stations (Table 3).

4.7 Zooplankton diversity and food web studies in the Marginal Ice Zone

Michael Poltermann, Slawek Kwasniewski, Janne E. Søreide, Tone Vollen, Haakon Hop, and Bjørnar Seim

Background

The Marginal Ice Zone of the northern Barents Sea represents a biologically highly productive area that supports a diverse and rich living community, consisting of small phytoplankton organisms, zooplankton and a specific ice-associated faunal complex up to higher trophic level organisms such as fish, sea birds, seals, and polar bears. The ecosystem of the MIZ is strongly influenced by different physical and oceanographic factors such as ice coverage, ice movement, temperature, and water currents. However, the effects of these factors on the development and distribution of plankton communities, the basic components of Arctic marine food chains, are not well understood.

Goals and objectives

The present study attempts to establish links between biological and physical phenomena in order to understand the reasons and mechanisms responsible for the dynamics and biodiversity of this area.

The zooplankton study during this spring cruise was focused on two components:

1) Zooplankton distribution

Different size classes of zooplankton were sampled along and across the ice edge and the community will be quantified based on data on species composition, abundance, and biomass. The spatial distribution of zooplankton was determined in relation to the sea ice coverage and other physical and oceanographic properties in the MIZ, such as ice movement, ice thickness, water temperature, salinity, light, and hydrographic regimes.

2) Food web investigations

The lipid composition and the stable isotope ratios of the most abundant species were determined in order to understand food web structure and the energy transfer from lower to higher trophic levels within the pelago-sympagic food web. The population dynamics of the key species will be analysed to identify their importance in the ecosystem of the MIZ.

Table 3. Samples of phytoplankton and chlorophyll-*a* collected in May 1999 from the MIZ, northern Barents Sea.

Station	3	8	9	15	25	27	A1	A2	A3	A4	B1	B2	B3	B4	68	Total
Chlorophyll-*a*	8	8		8			8	8		8	8	8	8	8		80
Phytoplankton (bottle)	6	4		4			8	4		4	6	4	7	5		52
Phytoplankton (net)	1	1	1	1	1	1	1		1	1					1	10
Ice algae							5	5	5		5	5	5			30
Ice core (Phyto.+Chl-*a*)							1	1			1		1			4
light measurements							1	1	1		1	1	1	1		7

Methods and activities

Zooplankton was sampled with a Tucker trawl (1 mm mesh), Multi Plankton Sampler (MPS or MULTINET: 0.25 m^2 opening, five closing nets with 180 µm mesh size), WP-2 (180 or 200 µm mesh) and WP-3 (1000 µm mesh) nets, and macro-zooplankton net (1.55 and 4.00 mm mesh sizes). Polar cod and ice algae samples for lipid and stable isotope analyses were collected by SCUBA divers using suction pumps and hand held nets. Ice-associated amphipods were not present in the investigated areas, except for a few individuals (< 5).

Samples were taken along one west-east transect along the ice edge from station 2 to 15, and along two transects across the ice edge from station 31 to 35 and 49 to 52, respectively. In addition, samples were taken at three short stations on the oceanographic ice edge crossing transect. Zooplankton samples were taken at 12 short stations along the west-east transect (Fig. 1) for community and population dynamics studies from different water layers (bottom-100-50-30-10-0 m) by the MPS and from bottom to the surface by WP-3 net. Additional samples were taken at two long stations (2 and 15) to get animals for lipid and stable isotope analyses using the Tucker Trawl, WP-2 net and the macro-zooplankton net. The across ice edge transects consisted of three ice stations and one open water station (Fig. 1). At each of these stations, the Tucker Trawl (if the ice conditions permitted), the WP-3 net, and the macro-zooplankton net were used to get animals for lipid and stable isotope analyses. Community samples were taken every 6 hours by the MPS and WP-3 net over a 24-hour cycle for studies of diurnal variability. The largest fraction of the zooplankton was collected by the macro-zooplankton net and WP-3 net, sampling the whole water column or separate layers according to hydrographic conditions.

All samples for community studies were preserved in 4% buffered formaldehyde immediately after collecting. Samples for lipid class analyses were preserved in a chloroform-methanol solution, and samples for total lipid content and stable isotope analyses were frozen (Tables 4, 5 and 6). The zooplankton abundance/biomass data from this cruise is available on the Norwegian Polar Institute's database.

Table 4. Total number of animals/ samples collected for analyses of total lipid, May 1999.

Stations MØ 2-15-31-32-33-34-35-49-50-51-52

Species	Stage or size class						
Copepoda	C I	C II	C III	C IV	C V	FF	MM
Calanus finmarchicus				17/3	72/6	98/7	10/3
Calanus glacialis				90/6	17/1	58/7	7/1
Calanus hyperboreus				26/3	58/6	64/8	
Amphipoda	small	medium	large				
Themisto libellula	101/3		5/3				
Themisto abyssorum							
Euphausiacea	small	medium	large				
Thysanoessa inermis	68/9	4/2	29/7				
Thysanoessa longicaudata	14/4		11/2				
Thysanoessa raschii			1/1				
Pteropoda	small	large					
Clione limacina	18/3	6/3					
Others							
Metridia longa	30/2						
Pandalus borealis	1/1						
Boreogadus saida	3/1						

Table 5. Total number of animals/ samples collected for analyses of lipid classes, May 1999.

Stations: MØ 2-15-31-32-33-34-35-49-50-51-52

Species	Stage or size class						
Copepoda	C I	C II	C III	C IV	C V	FF	MM
Calanus finmarchicus			14/2	66/6	70/9	79/9	43/6
Calanus glacialis			20/2	105/10	40/6	85/9	10/2
Calanus hyperboreus				47/6	59/8	63/8	
Amphipoda	small	medium	large				
Themisto libellula	93/6	1/1	7/5				
Themisto abyssorum			1/1				
Hyperia galba	4/1						
Euphausiacea	small	medium	large				
Thysanoessa inermis	55/7	13/2	38/7				
Thysanoessa longicaudata	34/7		9/2				
Thysanoessa raschii	2/1		3/1				
Pteropoda	small	large					
Clione limacina	22/6	8/5					
Others							
Metridia longa	35/3						
Hyperocha medusarum	1/1						
Pandalus borealis	1/1						
Sarsia flammea	1/1						
Algae	8/4						

Table 6. Total number of animals/samples collected for analyses of stable isotopes, May 1999.

Stations MØ 2-15-31-33-34-35-49-50-51-52

Species	Stage or size class						
Copepoda	C I	C II	C III	C IV	C V	FF	MM
Calanus finmarchicus					75/4	156/8	
Calanus glacialis				65/3	10/1	141/6	
Calanus hyperboreus				53/3	38/3	149/7	
Amphipoda	small	medium	large				
Themisto libellula	64/2	3/1	7/3				
Themisto abyssorum							
Hyperia galba		15/4					
Euphausiacea	small	medium	large				
Thysanoessa inermis	67/9	8/2	39/7				
Thysanoessa longicaudata	15/4						
Thysanoessa raschii	1/1						
Pteropoda	small	large					
Clione limacina	22/3	28/6					
Others	small	medium	large				
Pandalus borealis	5/1		2/1				
Beröe cucumis		24/3					
Mertensia ovum		22/2					
Chaetognatha spp.			139/6				
Pareuchaeta norvegica			5/1				
Aglantha digitale		80/2					
Boreogadus saida	7/2						

4.8 Collections of shrimp larvae

Tone Vollen

Samples of shrimp (*Pandalus borealis*) larvae were collected for the Norwegian College of Fishery Science, University of Tromsø. The water column from 10 m above the bottom to the surface was sampled with a WP-3 net, Macro-zooplankton net, and Tucker Trawl (TT). Samples were obtained from six stations in the MIZ (Table 7).

Table 7. Station location, sampling depths and number of samples taken for shrimp larvae, May 1999.

Station	Latitude °N	Longitude °E	Date	Bottom depth (m)	No. of samples
MØ 3	76° 24.6'	27° 07.1'	05.05	TT 0-50	1
MØ 15	75° 52.2'	34° 24.5'	07.05	225	2
MØ 31	76° 55.0'	32° 55.0'	10.05	140-160	1
MØ 33	76° 48.9'	32° 49.2'	11.05	140-190	1
MØ 34	76° 38.0'	32° 52.2'	12.05	165-200	2

4.9 Transfer of organic pollutants from the abiotic environment to the lowest trophic levels of the ice-associated food chain

Kristina Olsson and Frode Engen

Background

Organic contaminants are transported to the Arctic environment through different pathways such as river run-off, water mass circulation and long-range atmospheric transport (e.g. Klungsøyr *et al.* 1995). Sediments deposited on the shallow Arctic shelf seas become incorporated into newly forming ice (e.g. Nürnberg *et al.* 1994), and sea ice formed in the Kara Sea has been shown by model simulations to enter the Barents Sea. Melting occurs when sea ice encounters the warm Atlantic waters north and north-west of Svalbard. The same mechanism takes place in the Marginal Ice Zone (MIZ) in the Barents Sea (Pfirman *et al.* 1995). During the melting period, the marginal ice zone experiences an intense spring algal bloom, and the temporal coherence of a bloom and release of material from the melting sea ice enhance the risk of uptake of contaminants by the lowest trophic levels in the food web. Once incorporated into these organisms, the contaminants can be transferred and biomagnified in the food chains. Field measurements show an increase in concentration of organic contaminants in higher trophic levels (Jarman *et al.* 1997).

The objective of this study is twofold: firstly, to detect levels of organic contaminants in sea ice, sea water, snow, and algae and, secondly, to calculate bioconcentration factors from these sources to the lowest trophic levels of the marine food web. Measurements of both the particulate and dissolved phase will be made, which includes pioneering work regarding analysis of organic contaminants in the dissolved phase. The conraminants included in this part of the project are non-planar PCBs, PAHs, and pesticides such as DDTs, HCHs, HCB, toxaphene and chlordanes.

Methods and activities

The field sampling performed during the cruise was successful, obraining both abiotic (snow, sea ice, sea water) and biotic components (ice algae, phytoplankton) of the Marginal Ice Zone (Table 8).

Sea water

At seven locations, sea water samples were collected using a stainless steel filtration system. The water was pumped, on board, through pre-combusted glass-fibre filters (Whatman GF/F) with pore size 0.7 µm ro retain particles and thereto-associated OCRs. The dissolved OCs were trapped from the filtrate on a polyurethane foam (PUF) column. The filters and PUFs were wrapped in aluminium foil, and packed in plastic bags and stored at -20 °C.

Sea ice and snow samples

A total of 47 sea ice cores were collected at the six ice stations using a Kovacs Mark II ice corer. The length of these cores varied between 46-98 cm, with a mean length of 66 cm. The cores were sliced into 20-30 cm intervalsections, packed into aluminium foil and stored at -20 °C. Dirty ice, found at one of the ice stations, was collected as three sub-samples and stored at -20 °C.

Three snow samples were collected. Two replicatesreplicate were taken at the first ice station on the eastern ice transect A (Fig.1). The third sample was taken at the first ice station on the western ice transect B. The snow samples were collected in stainless steel conrainers (pre-rinsed with methanol and n-hexane) immediarely after arriving atto the stations to reduce the risk of contaminarion from the ship.

Phytoplankton and ice algae

Two phytoplankton samples were collected aton rhe two pelagic stations on the open water rransecr and a third sample was taken at rhe fourth (last) sration on the second ice rransect (Fig. 1). The samples wete taken using a phyroplankton net with a mesh size of 25 µm. The samples were filtered through GF/C filters and the filters were stored at -20 °C.

Divers collected ice algae samples at the six ice stations. The samples were filtered and stored using the same method as described for phytoplankton. In addition, threads of *Melosira arctica* were collected with a suction pump and treated in the same manner.

All samples will be analysed for non-planar PCBs, PAHs and a range of pesticides including DDT, HCHs, HCB, chlordanes and toxaphene in rhe laboratory at Stockholm University. The analytical infrastructure includes a Carlo Erba EA 1108 HCN-O elemental analyser connected to a Micromass Ultima Autospec and Fisons GC8000/ MD800 for HOC analysis. Samples are stored at -20 °C at Akvaplan-niva prior to analysis.

Table 8. Type and number of samples collected for organic pollutanr analyses from the Marginal Ice Zone, May 1999.

Station ID	Snow	Sea ice	Sea water	Phytoplankton	Ice algae
3	-	-	1	1	-
15	-	-	1	1	-
31	2	1	1	-	1
33	-	1	1	-	1
34	-	1	1	-	1
35	-	-	1	-	-
49	1	1	-	-	1
50	-	1	-	-	1
51	-	1	-	-	2
52	-	-	1	1	-

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4.10 Persistent organic pollutants (POPs) in sympagic and pelagic food chains in the Marginal Ice Zone; bioconcentration and biomagnification

Katrine Borgå, Geir Wing Gabrielsen, Ole Gunnar Støen, Bjørnar Seim, and Katarzyna Dmoch

Background

Due to their physicochemical properties, persistent organic pollutants (POPs) are transported on a long range, bioaccumulate in the lipids of organisms, and are transferred from prey to predator along with the flux of energy. There are few data available on the accumulation of POPs in the most important prey organisms in the Barents sea food chain and previous studies, from open water areas, are based on bulk samples of zooplankton, making a detailed interpretation of data difficult (Joiris *et al.* 1997; Borgå *et al.* 2001). Brünnich's guillemot *(Uria lomvia)*, black guillemot *(Cepphus grylle)* and black-legged kittiwake *(Rissa tridactyla)* were selected for sampling, as they feed mainly on fish and crustaceans. In spite of their similar feeding preferences, their POP patterns differ (Borgå *et al.* 2001). Based on diet analyses (Mehlum & Gabrielsen 1993; Erikstad 1990), we selected organisms which are the main prey organisms for Brünnich's guillemot, black guillemot, black-legged kittiwake, ringed seal *(Phoca hispida)* and harp seal *(Phoca groenlandica)*. The most common prey organisms for these predators are euphausiids, *Thysanoessa inermis* and amphipods, *Themisto libellula*, in addition to polar cod *(Boreogadus saida)*. For the little auk *(Alle alle)* and polar cod, the most common prey are Arctic calanoid copepods, of which we aimed to collect *Calanus glacialis* since this is the most numerous species in the ice covered areas in the Barents Sea. In addition to known feeding relationships based on diet analyses, the relative trophic position of the organisms in the food chain can be established using analyses of the stable isotopes of carbon and nitrogen (Hobson & Welch 1992).

Transport of POPs with the drifting sea ice has been hypothesised to be a potential source of contamination the Barents Sea (Alexander 1995; Pfirman *et al.* 1995). The POPs are incorporated with sediments as the ice forms. In addition, POPs transported with the atmosphere are deposited and accumulated on the sea ice. As the sea ice melts in the marginal ice zone, organisms living associated with the sea ice are potentially exposed to the POPs. To study the potential exposure of POPs with the sea ice, we aimed to compare pelagic crustaceans (calanoid copepods, euphausiids and amphipods) with ice-associated amphipods (*Gammarus wilkitzkii, Apherusa glacialis, Onisimus nanseni* and *O. glacialis*).

High seasonal variation in productivity and food availability in the Arctic has resulted in adaptations in the organisms such as building up of energy stores of lipids, which can be mobilised at times of food shortage. The transfer of lipids and energy in Arctic ecosystems is relatively fast (Falk-Petersen *et al.* 1990), and since POPs are highly lipophilic, there is a risk of a rapid enrichment of contaminants in the marine food chain (Hop *et al.* 2002). POPs have been shown to be associated with the organism's storage lipids (i.e. neutral lipids). The neutral lipids consist of lipid classes with different properties e.g. water solubility. Previous studies have shown a positive correlation between the contents of triacylglycerols, the most abundant neutral lipid class in vertebrates (e.g. Kawai *et al.* 1988, Jørgensen *et al.* 1997). Since wax esters are the most abundant neutral lipid class in some crustaceans (calanoid copepods and *Themisto libellula*), we want to study how the different lipid classes affect the accumulation of POPs.

Given the different patterns of POPs and similar diets (and thus exposure) of Brünnich's guillemot, black guillemot, and black legged kittiwake, we hypothesise that their abilities to metabolise and excrete POPs are different. It has been shown that differences in metabolic capacity between species result in differences in PCB congener patterns (Boon *et al.* 1994). To determine the metabolic capacity of the seabirds included in this study, we will measure the activity of the cytochrome P450 enzyme system.

Objectives

We aim to determine whether the:

- uptake of POPs in organisms of lower trophic levels is dominated by bioconcentration directly from the water or ice and bioaccumulation from the diet.
- bioaccumulation of POPs in sympagic organisms differs from the pelagic organisms due to different exposure because of their feeding habits or transport of POPs with the sea ice.
- patterns of POPs in alcids and kittiwake are related to the enzymatic activity of CYP P450.
- concentrations and pattern of POPs in zooplankton are determined by the lipid content and quality.

Methods and activities

Seabirds (Brünnich's guillemot, black guillemot, little auk, black-legged kittiwake) were shot with steel pellet shots from a Zodiac boat. The birds' livers (for POPs and enzymes analyses), stomachs (diet analyses), pectoral muscles (stable isotopes analyses) and hearts were dissected and frozen separately. Within 15 minutes after the seabirds were shot, the liver samples for analyses of CYP P450 enzyme activities were put in liquid nitrogen. We weighed each bird and measured the lengths of the wing, beak, and beak-head.

Polar cod were collected by divers using hand held nets and suction pumps. The total length of each fish was measured, the stomach preserved in 70 % ethanol and the otoliths dissected and stored in envelopes. The rest of the fish was frozen whole at -20 °C for analysis of POPs, stable isotopes, dry weight, wet weight and total lipids. Some polar cod were stored in chloroform:methanol (2:1) for lipid class and fatty acid analysis.

At station 8, during an inspection of the trawler "NES", the captain kindly allowed us to take samples from the bottom trawl. We collected shrimp *(Pandalus borealis)* and polar cod for analysis of POPs and stable isotopes. In addition, we collected samples of fishes Atlantic poacher *(Leptagonus decagonus)*, daubed shanny *(Leptoclinus maculatus)*, eelpouts *(Lycodes* sp.*)*, snake blenny *(Lumpenus lampraetaeformis)*, European sculpin *(Artediellus europeus)*, bigeye sculpin *(Triglops nybelini)*, sea-snail *(Liparis liparis)*, sea tadpole *(Careproctus reinhardti)*, long rough dab *(Hippoglossoides platessoides)*, Atlantic cod *(Gadus morhua)* and shrimp *(Sabinea* sp.*)*, which were pooled and stored frozen at -20 °C in aluminium foil.

We collected zooplankton samples mainly at the ice stations in the central Barents Sea (Transect A), and north of Hopen in the western Barents Sea (Transect B) (Fig. 1, Table 9). Due to a lack of animals, we collected zooplankton only at two of the pelagic stations (3 and 15) on transect T. A few specimens of ice amphipods (*Onisimus glacialis, Apherusa glacialis*, and *Gammarus wilkitzkii*) were collected by divers using an electric suction sampler or hand held nets, but they were not analysed.

Calanoid copepods *Calanus glacialis* and *Calanus hyperboreus* were collected with a WP-3 net (1000 µm mesh), the macro-zooplankton net (1.55 mm mesh), or the Tucker trawl (1 mm mesh). The samples were stored in polypropylene buckets until processed. *C. glacialis* stage VI females and *C. hyperboreus* stages IV, V, and VI females were identified and sorted under a stereoscopic microscope.

Macro-zooplankton, such as euphausiids (*Thysanoessa inermis, T. longicaudata*, and *T. raschii*), amphipods (*Themisto libellula, Hyperia galba*), gastropods (*Clione limacina*) and chaetognaths (*Sagitta elegans, Eukrohnia hamata*), were collected with the same nets as above. The samples were stored in polypropylene buckets until processed. The different species of euphausiids, amphipods and chaetognaths were identified and sorted under stereoscopic microscopes and divided into size groups.

All samples for POP analyses were stored frozen at -20 °C in polypropylene containers. The analysis of POPs (organochlorines; HCHs, HCB, chlordanes, DDTs, non-planar PCBs, Mirex) will be carried out at the Environmental Toxicology Laboratory, The Norwegian College of Veterinary Medicine, Oslo, Norway, according to methods in Bernhoft *et al.* (1997). The seabirds' livers will be analysed for the activity of testosterone hydroxylation and ethoxyresorufin-O-deethylation (EROD), according to Wolkers *et al.* (1998).

Samples of calanoid copepods, euphausiids, amphipods, chaetognaths and gastropods were collected, for analyses of stable isotopes and lipids (parallel samples to those analysed for organochlorines). The samples for stable isotopes were stored frozen in plastic bags. The analysis of stable isotopes will be carried out at The Institute for Energy Technology, Kjeller, Norway, according to methods in Hobson & Welch (1992). The analysis of polar and neutral lipids classes will be carried out at NERC Unit of Aquatic Biochemistry, School of Natural Sciences, University of Stirling, Scotland, according to methods described by Sargent & Falk-Petersen (1981).

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Table 9. Organisms sampled in the Marginal Ice Zone, May 1999.

Station	Copepods	Macro-zooplankton	Ice amphipods	Polar cod	Seabirds
3	+				
8				+	
15		+			
31/ A-1	+	+		+	+
33/ A-2	+	+			+
34/ A-3	+	+			+
35/ A-4		+			
49/ B-1	+	+	+	+	+
50/ B-2	+	+	+		+
51/ B-3	+	+		+	+
52/ B-4		+			

5.1 Temporal and spatial variability of oceanographic processes at the ice edge

Edmond Hansen and Ole Anders Nøst

Introduction

This section reports the activities and meta-data with regard to physical oceanography. The intention is to provide an overview of activities, instruments, and methods that were used and the data obtained during the cruise.

Background

The Arctic Marginal Ice Zone (MIZ) is an area featuring extreme variability in many of the physical constituents of the air-sea-ice system. Central oceanographic and ice related physical factors at the ice edge that demonstrate temporal and spatial variability include: ice edge position, shape and advance/retreat rates; MIZ coverage; the ice velocity field; vertical stratification, stability, and depth of the mixed layer; ocean circulation (mesoscale eddies, upwelling/downwelling); and the location and gradients of oceanic fronts.

The Barents Sea ecosystem is strongly influenced by the physics and features of the MIZ and the ice edge. However, these processes and their couplings are not well understood, and should therefore be studied as a part of the efforts to establish a link between the physical factors, the ice as a habitat, and the eventual characteristics of the ecosystem. The project is closely linked to the Polar Climate Programme at the Norwegian Polar Institute, as the issues addressed in this project are regional components and indicators of climate variability in the Northern Hemisphere.

The goal of the project is to acquire basic knowledge, qualitative and quantitative, on the physical factors characterising the Barents Sea MIZ as a dynamic habitat, and on the mechanisms and processes linking these factors and their temporal and spatial variability.

Methods and activities

The oceanographic activities took place during two cruises with legs conducted between 8 - 23 March 2000, and 26 March-5 April 2000. The following activities were carried out:

1. CTD on transects and at "stationary" stations
2. Water samples at each CTD station, for calibration of CTD conductivity gauge
3. ADCP on *Lance*, on transects and at "stationary" stations
4. RCM rig on bottom
5. ADCP rig on bottom

CTD on *Lance*

A Seabird SBE 911+ CTD was used, with the standard Seasoft software package. Casts were made at a total of 102 stations. The stations constituting synoptic transects are listed in Table 10. The positions of all stations are shown in Fig. 17, along with the bathymetry of the area, and Table 11 lists details of the station locations and depths.

Water samples for conductivity calibration

The conductivity and temperature sensors were calibrated by the manufacturer (Sea Bird Electronics Inc., Bellevue, Washington) before the cruise. Water samples were nevertheless taken on most CTD stations in order to control any drift in the conductivity cells. However, experience with the sensors on this CTD shows that the drift is very small during a cruise and seldom has to be accounted for. The CTD sensors were also sent to the manufacturer for post-cruise calibration.

Table 10. CTD and ADCP synoptic transects, March-April 2000.

Transect	Start station	End station
1	1	4
2	5	31
3	36	49
4	50	56
5	57	67
6	67	76
7	77	88
8	88	102

Vessel-mounted ADCP

Lance carries a RDI 150 kHz BB Vessel Mounted Acoustic Doppler Current Profiler (VMADCP). The ADCP was running during the cruise, and provided 3D velocity profiles of the transects and the different stations. However, the initial processing of the data revealed information of very poor quality. The signal featured much noise and extensive data gaps, especially the underway data. The reason for this has to be determined.

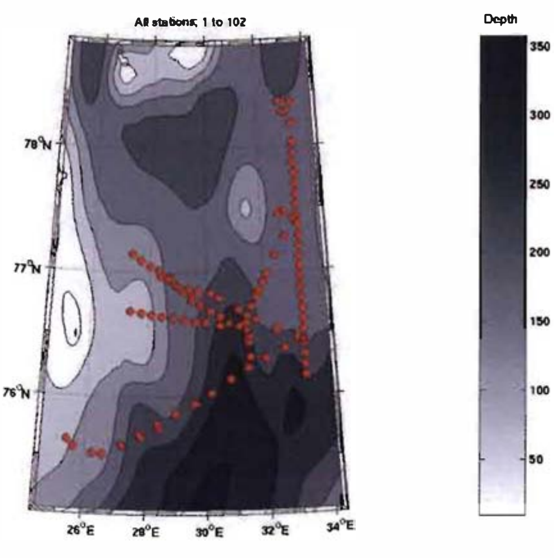

Figure 17. CTD station locations on the cruise in March-April 2000.

RCM mooring on the seafloor

An RCM rig was deployed on 13 March 2000 at 02:50 UTC, in position 75° 32.6' N, 26° 34.1' E, with depth 170 m. The rig consisted of three Aanderaa RCM7 units, located 10, 50, and 100 m from the bottom, respectively. Each unit measures current magnitude and direction, plus salinity and temperature. The mooring was recovered at the end of the cruise.

ADCP mooring on the seafloor

An RDI Workhorse 300kHz ADCP rig was deployed on 14 March 2000 at 08:45 UTC, in position 76° 27.3' N 33° 19.3' E, with depth 230 m. The ADCP was at a depth 115 m, i.e. 115 m from the bottom. The mooring was recovered at the end of the cruise.

Table 11. List of CTD stations, with position given in decimal degrees, March-April 2000.

Station number	Date	Time (UTC)	Latitude °N	Longitude °E	Depth (m)
Cruise – leg 1					
1	13.03	03:13:27	75.5433	26.6	173
2	13.03	05:22:42	75.6083	27.2083	232
3	13.03	07:29:40	75.68	27.8167	245
4	13.03	09:29:12	75.745	28.4117	255
5	15.03	03:12:46	76.1667	33.3167	298
6	15.03	04:11:21	76.25	33.3333	303
7	15.03	05:13:41	76.335	33.34	279
8	15.03	06:13:33	76.4183	33.3367	245
9	15.03	08:49:37	76.4567	33.3233	232
10	15.03	09:50:36	76.5333	33.33	200
11	15.03	10:48:33	76.6167	33.3333	164
12	15.03	11:47:07	76.7	33.3333	131
13	15.03	12:43:41	76.7833	33.3333	113
14	15.03	13:39:04	76.8667	33.3333	124
15	15.03	14:32:58	76.95	33.3333	148
16	15.03	15:29:12	77.0333	33.3333	139
17	15.03	16:26:52	77.1167	33.3333	133
18	15.03	17:25:39	77.2	33.3617	149
19	15.03	18:32:20	77.2833	33.3583	139
20	15.03	19:39:21	77.3667	33.335	139
21	15.03	20:41:37	77.45	33.3333	149
22	15.03	21:39:40	77.5333	33.3333	170
23	15.03	22:38:19	77.6167	33.3433	181
24	15.03	23:37:59	77.7	33.3333	158
25	16.03	00:37:25	77.7833	33.3333	160
26	16.03	01:39:05	77.8667	33.3	163
27	16.03	02:33:27	77.95	33.3333	156
28	16.03	03:27:10	78.0333	33.3333	169
29	16.03	04:59:19	78.1833	33.3333	164
30	16.03	06:09:33	78.2783	33.1333	170
31	16.03	07:30:07	78.3583	32.875	217
32	16.03	17:49:54	78.27	33.0083	156
33	17.03	09:58:52	78.35	33.3383	179
34	18.03	06:13:24	77.4633	32.68	148
35	18.03	08:33:02	77.485	32.85	142
36	18.03	18:47:19	77.4267	33.175	144
37	18.03	20:55:13	77.2767	32.8333	160
38	18.03	22:49:35	77.1333	32.4667	182
39	19.03	00:38:17	76.9833	32.15	210
40	19.03	01:41:53	76.9167	31.9833	219
41	19.03	02:42:57	76.8417	31.8333	240
42	19.03	03:33:07	76.8	31.7167	277
43	19.03	04:38:34	76.725	31.5667	277
44	19.03	22:09:12	76.3167	31.4683	325
45	19.03	23:55:01	76.4833	31.4333	314
46	20.03	00:38:11	76.5333	31.4	315
47	20.03	01:26:46	76.6	31.3667	287
48	20.03	02:11:35	76.65	31.3833	274
49	20.03	05:27:06	76.4417	31.425	315
50	20.03	15:12:10	76.5333	31.3667	313
51	20.03	16:04:21	76.5667	31.1167	292
52	20.03	17:21:34	76.6	30.7867	280
53	20.03	18:22:06	76.645	30.4667	272
54	20.03	19:28:12	76.6883	30.1467	263
55	20.03	20:38:55	76.725	29.795	261
56	20.03	21:46:01	76.7733	29.4833	254

Station number	Date	Time (UTC)	Latitude °N	Longitude °E	Depth (m)
Cruise – leg 2					
57	26.03	16:28:14	77.1433	27.3833	185
58	26.03	18:19:07	77.0917	27.7117	160
59	26.03	19:22:15	77.0467	28.035	173
60	26.03	20:28:06	77.0083	28.35	185
61	26.03	21:33:54	76.955	28.6333	210
62	26.03	22:41:10	76.9	28.9167	222
63	26.03	23:43:54	76.85	29.2	255
64	27.03	00:53:16	76.8	29.4833	261
65	27.03	02:04:47	76.75	29.8	260
67	27.03	08:00:42	76.5917	30.74	285
68	27.03	10:20:37	76.575	30.4633	279
69	27.03	11:32:23	76.6	30	277
70	27.03	12:41:38	76.6	29.6333	259
71	27.03	13:55:31	76.6167	29.2667	237
72	27.03	14:59:43	76.6333	28.8833	197
73	27.03	16:11:38	76.6417	28.4667	155
74	27.03	17:16:59	76.655	28.1	138
75	27.03	18:14:09	76.6717	27.75	135
76	27.03	19:30:24	76.6833	27.3667	105
77	29.03	2:42:05	76.9667	28.3933	178
78	29.03	13:45:38	76.95	28.7333	213
79	29.03	14:58:56	76.8833	29.0167	225
80	29.03	15:59:25	76.8667	29.3667	248
81	29.03	17:57:22	76.85	29.7333	256
82	29.03	19:19:33	76.8333	30.1333	232
83	29.03	20:29:29	76.7917	30.4333	260
84	29.03	22:11:56	76.7	31.1	266
85	30.03	00:04:29	76.6167	31.7167	290
86	30.03	02:12:18	76.5333	32.4167	259
87	30.03	03:56:32	76.4667	33.1167	277
88	30.03	05:55:39	76.45	33.3167	229
89	30.03	07:29:36	76.3833	32.6667	293
90	30.03	09:03:09	76.3083	32.0167	267
91	30.03	10:43:33	76.2333	31.3833	317
92	30.03	12:26:04	76.1417	30.7833	307
93	30.03	14:17:26	76.0333	30.1667	317
94	30.03	15:58:03	75.95	29.6	305
95	30.03	17:35.55	75.8667	28.9667	273
96	30.03	19:17:25	75.7833	28.3667	239
97	30.03	20:53:10	75.7	27.7833	252
98	30.03	22:32:16	75.6167	27.1833	224
99	31.03	00:16:58	75.5417	26.5833	170
100	31.03	03:19:23	75.55	26.2667	133
101	31.03	04:41:50	75.595	25.65	145
102	31.03	05:31:01	75.65	25.4167	112

5.2 Weather and sea ice conditions

Adrian Hauser

Weather conditions

The weather conditions to a large extent prohibited steaming into the sea ice to carry out the sampling programme. Apart from the passage of the ice field reaching from Sørkapp to Bjørnøya, at the beginning and end of the cruise, and a short transect into the sea ice during the night of 15-16 March, we observed sea ice only irregularly.

The synoptic conditions during the Matinøk 2000 cruise were characterised by the passage of two low pressure systems over the Barents Sea (Fig. 18). Two periods of strong winds (13-14 March) were experienced as a result of these low pressure systems.

Sea ice conditions

The sea ice conditions during the transect (night of 15-16 March) from open water into compact drift ice revealed rather big waves which broke the sea ice into small ice floes of less than 10 m diameter. However, the thickness of these first-year ice floes was up to 1 m with about 20% of grease and slush ice in amongst them. The sea ice put considerable pressure on the ship, which resulted in an immediate closing of the sea ice behind the vessel. This prohibited the use of the biological and oceanographic instruments as well as diving. Most of the samples were taken on the way back from the heavy ice in more open drift ice. The sea ice concentration was generally around 50% on 16 and 17 March, with about an equal amount of thick first-year ice and thin, new ice. No sea ice was observed at all on 19 and 20 March, and on the way back to Longyearbyen, ice conditions were highly variable.

Ice observations

The ice observations are intended to be used for interpretation of satellite remote sensing imagery, particularly SAR imagery to develop classifications for different ice types and ice characteristics. Detailed description of the ice is necessary in order to define distinct classification categories.

Methods and activities

Standard observations were taken every three hours from the ship's bridge for the duration of the cruise. Ice classification and estimation of ice concentration was based on a system adapted from NOAA (2001). This involves estimating the proportion of different ice types, floe size, snow-cover thickness, percentage of ridging and rafting, and percentage of brown ice.

Ice type was divided into nine categories; grease and slush, pancake, dark nilas, light nilas, grey/grey white, white first-year, white

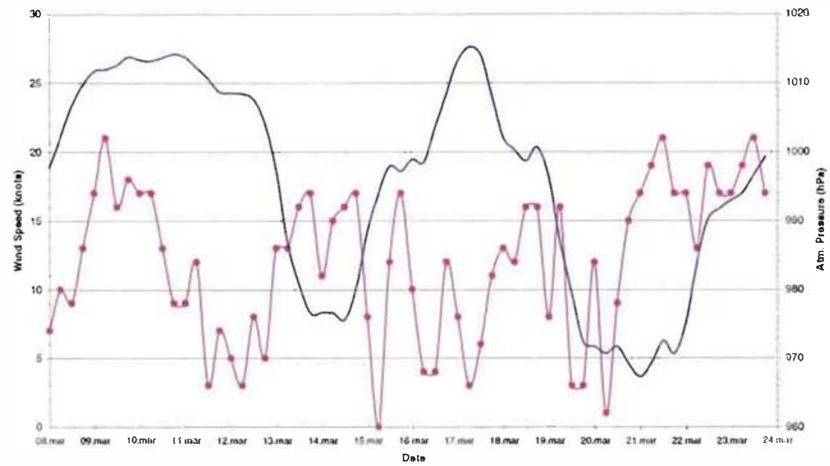

Figure 18. Wind speed (red) and atmospheric pressure (blue) at Hopen (76.5° N, 25° E), 08-24 March 2000.

second-year, white multi-year, and brash ice. Open water represented a 10th category. In addition to observing the ice conditions several other parameters were noted such as air and sea temperature, air pressure, wind speed and direction, ship speed, and heading. To complement each observation, a photograph was taken using a digital camera with a 35 mm lens and it was noted whether the photo was taken from the port or starboard side. All photos include the horizon so that comparisons of floe size can be made. A time-lapse video was operating from the crow's nest for the entire duration of the cruise, taking an image of the ice approximately every 5 seconds.

Results

Results have been entered in an MS Access database and can be made available in Word or Excel. Observations were made available to the Norwegian Meteorological Institute on a daily basis throughout the duration of the cruise so that they could use the data when compiling their ice maps. The same ice observation form as was used on the 1999 cruise was used in 2000 (Fig. 10).

Reference

National Oceanic and Atmospheric Administration. 2001. Observers' guide to sea ice (http://response.restoration.noaa.gov/oilaids/seaice/seaice.html).

5.3 Plankton diversity and food web studies in the Marginal Ice Zone

Michael Poltermann, Slawek Kwasniewski, Józef Wiktor, Janne E. Søreide, Tone Vollen, Haakon Hop, Bjørnar Seim, Trine Dahl, and Kjersti Dale

Background

The ecosystem of the Marginal Ice Zone is strongly influenced by different physical and oceanographic factors such as ice coverage, ice movement, temperature, and water currents. The effect of these factors on the development and distribution of plankton communities is not well understood, and, thus, the present study focused on establishing links between biological and physical phenomena. The goal is to understand the reasons and mechanisms responsible for the dynamics and biodiversity of this specific area. The analysis of the energy transfer from lower to higher trophic levels within the pelago-sympagic food web will enable us to identify key components and determine their importance for the entire food web of the MIZ.

Based on species composition, density, and biomass data, the spatial distribution of phyto- and zooplankton in relation to the sea ice coverage and other physical and oceanographic properties in the MIZ will be determined. The population dynamics of the key species will be analysed to identify their importance in the MIZ ecosystem. The lipid composition and the stable isotope ratio of the most abundant species will be determined in order to understand the energy transfer from lower to higher trophic levels within the pelago-sympagic food chain.

Objectives

Phytoplankton

- sampling for species composition and density distribution along and across the ice edge
- water sampling for chlorophyll-*a* distribution studies along and across the ice edge and for *in situ* fluorometer calibration

Zooplankton

- sampling for community and population dynamics studies along and across the ice edge
- sampling for food web analyses by lipid composition and stable isotope ratios

Methods and activities

Phytoplankton samples

During the cruise, sub-samples from water casts collected by means of Niskin-bottles attached to a Rosette sampler were taken from chosen layers of the water column (Table 12). The water samples were divided for chlorophyll-*a* concentration and phytoplankton abundance analyses. Sub-samples of 300-500 ml sea water were filtered through Whatmann GF/F filters. These were stored in the bio-freezer (-67 °C) and will be analysed fluorometrically for chlorophyll-*a*. For phytoplankton species composition, 250 ml water samples were fixed with Lugol's solution. Additionally, samples for species composition of phytoplankton were taken by means of a submersible suction pump with 20 µm net. In total, 34 samples for chlorophyll-*a* and 36 for species composition were taken during the cruise. No ice flora sampling was possible because of the weather conditions.

Zooplankton samples

Nets used for sampling of zooplankton included: Tucker Trawl (1 mm mesh), Multi Plankton Sampler (MPS, 180 µm mesh), WP-2 net (180 or 200 µm mesh), WP-3 net (1000 µm mesh), and Macro-zooplankton net (1.55 mm mesh). Due to bad weather conditions no ice fauna samples could be taken; there was likely no ice fauna associated with the observed type of ice.

Zooplankton samples for community and distribution studies were taken at five stations in ice covered and ice free areas in the MIZ using the Multi Plankton Sampler and the WP-3 net (Table 13). MPS samples were taken from five different layers: bottom to 100 m, 100-50 m, 50-30 m, 30-10 m, and 10-0 m. WP-3 samples were taken from the whole water column. All samples for community studies were preserved in 4% buffered formaldehyde immediately after collecting and was further analysed in the laboratory.

Table 12. Sampling locations for phytoplankton and chlorophyll-*a*, March 2000.

Station	Sample depth (m)	Date	Time	Bottom depth (m)	Phyt.	Chl-*a* I	Chl-*a* II	Remarks	Latitude °N	Longitude °E
MØ 12	5	15.03	11:42	131	+	-	-	oceanogr. stn.	76° 42'	33° 20'
MØ 12	30	15.03	11:42	131	+	-	-	oceanogr. stn.	76° 42'	33° 20'
MØ 12	50	15.03	11:42	131	+	-	-	oceanogr. stn.	76° 42'	33° 20'
MØ 32	0	17.03	18:30	156	+	300	490	open w. in 100% ice	78° 16.2'	33° 00.5'
MØ 32	5	17.03	18:30	156	+	300	470	open w. in 100% ice	78° 16.2'	33° 00.5'
MØ 32	10	17.03	18:30	156	+	300	500	open w. in 100% ice	78° 16.2'	33° 00.5'
MØ 32	20	17.03	18:30	156	+	300	430	open w. in 100% ice	78° 16.2'	33° 00.5'
MØ 32	50	17.03	18:30	156	+	300	470	open w. in 100% ice	78° 16.2'	33° 00.5'
MØ 32	70	17.03	18:30	156	+	300	430	open w. in 100% ice	78° 16.2'	33° 00.5'
MØ 34	0	18.03	06:30	148	+	500	500	10% ice	77° 27.8'	32° 40.8'
MØ 34	5	18.03	06:30	148	+	500	250	10% ice	77° 27.8'	32° 40.8'
MØ 34	10	18.03	06:30	148	+	500	500	10% ice	77° 27.8'	32° 40.8'
MØ 34	50	18.03	06:30	148	+	500	500	10% ice	77° 27.8'	32° 40.8'
MØ 34	80	18.03	06:30	148	+	500	500	10% ice	77° 27.8'	32° 40.8'
MØ 34	100	18.03	06:30	148	+	500	500	10% ice	77° 27.8'	32° 40.8'
MØ 34	surf	18.03		148	D.P	-	-	10% ice	77° 27.8'	32° 40.8'
MØ 34A	0	18.03	11:33	148	-	500	-	across front	77° 30.8'	32° 59. 4'
MØ 34A	0	18.03	11:33	148	-	500	-	across front	77° 30.8'	32° 59. 4'
MØ 34A	0	18.03	11:33	148	-	500	-	across front	77° 30.8'	32° 59. 4'
MØ 34A	0	18.03	11:33	148	-	500	-	across front	77° 30.8'	32° 59 43'
MØ 38	0	18.03	22:45	182	+	500	-	across front	77° 08'	32° 28'
MØ 38	5	18.03	22:45	182	+	500	-	across front	77° 08'	32° 28'
MØ 38	10	18.03	22:45	182	+	500	-	across front	77° 08'	32° 28'
MØ 39	0	19.03	00:39	210	+	500	-	across front	76° 59'	32° 09'
MØ 39	5	19.03	00:39	210	+	500	-	across front	76° 59'	32° 09'
MØ 39	10	19.03	00:39	210	+	500	-	across front	76° 59'	32° 09'
MØ 41	0	19.03	00:26	240	+	500	-	across front	76° 50.5'	31° 50'
MØ 41	5	19.03	00:26	240	+	500	-	across front	76° 50.5'	31° 50'
MØ 41	10	19.03	00:26	240	+	500	-	across front	76° 50.5'	31° 50'
MØ 43	0	19.03	04:31	277	+	500	-	across front	76° 43.5'	31° 34'
MØ 43	5	19.03	04:31	277	+	500	-	across front	76° 43.5'	31° 34'
MØ 43	30	19.03	04:31	277	+	500	-	across front	76° 43.5'	31° 34'
MØ 49	0	20.03	05:26	315	+	500	500	open water	76° 26.5'	31° 25.5'
MØ 49	5	20.03	05:26	315	+	500	500	open water	76° 26.5'	31° 25.5'
MØ 49	10	20.03	05:26	315	+	500	500	open water	76° 26.5'	31° 25.5'
MØ 49	20	20.03	05:26	315	+	500	500	open water	76° 26.5'	31° 25.5'
MØ 49	30	20.03	05:26	315	+	500	500	open water	76° 26.5'	31° 25.5'
MØ 49	50	20.03	05:26	315	+	500	500	open water	76° 26.5'	31° 25.5'
MØ 49	surf	20.03	08:00	315	D.P	-	-	open water	76° 26.5'	31° 25.5'

Samples for lipids were taken from WP-2, WP-3 and Tucker trawl hauls. Samples for lipid classes were put in scintillation vials with chloroform-methanol (2:1), whereas samples for total lipids were put in plastic bags. The animals were kept cold at all times by using trays of ice and the marked sample bags were subsequently placed in the bio-freezer.

Macro-zooplankton were sampled in a specially designed macro-zooplankton net, with opening area of 2.01 m^2 (diameter 1.60 m) and mesh size 1.55 mm. The net is 7 m long and a bucket and 45 kg of lead are connected to the end. The net is constructed for vertical hauls only and a Nansen closing mechanism makes it possible to sample discrete depths. A flow meter, which measures water flow (m^3) through the net, is attached to the net opening.

Two ice stations, (MØ 32 and MØ 34), and one open water station, (MØ 49) were sampled. The two ice stations were influenced by Arctic water, whereas the open water station showed no stratification and was Atlantic water from bottom to surface.

Because of high winds and heavy seas the boat drifted, which caused problems while sampling. The rotations of the flow meter showed up to 77% more water filtrated through the net than the theoretical calculated values (opening diameter in m^2 × water column depth in m).

To reduce errors due to possible vertical migration of zooplankton, the sampling was done during daylight between 11:30 and 17:30. In addition, one sampling series (six samples) was conducted during late evening/midnight at ice station MØ 32. Discrete sampling layers were chosen using the background of the CTD profile. A total of 19 community samples were collected during the cruise (Table 16). All samples for community studies were preserved in 4% buffered formaldehyde immediately after collecting.

Stable isotope samples

The trophic structures of the marine food web in the MIZ will be described by means of the stable isotopic ratio of $\delta^{13}C$ and $\delta^{15}N$. The most abundant species were collected (Table 17), and the samples were immediately frozen to -65 °C after species identification and length measurements. In the analysis, the ice stations were combined, whereas the open water station was treated separately.

Table 13. Locations of zooplankton sampling stations, March 2000.

Station	Transect	Date	Latitude °N	Longitude °E	Time	Depth (m)	Gear
MØ 31	Ice A1	16.03	78° 25.5'	32° 04.9'	12:25	247	MPS
MØ 32	Ice A1	16.03	78° 16.2'	33° 00.5'	19:10	148	MPS
MØ 32	Ice A1	16.03	78° 16.2'	33° 00.5'	20:05	158	WP-3
MØ 33	Ice A1	17.03	78° 20'	33° 13'	13:30	181	MPS
MØ 33	Ice A1	17.03	78° 20'	33° 13'	13:10	181	WP-3
MØ 34	Ice A2	18.03	77° 29.1'	32° 51.0'	09:00	177	MPS
MØ 34	Ice A2	18.03	77° 29.1'	32° 51.0'	09:50	140	WP-3
MØ 49	OW 1	20.03	76° 26.5'	31° 25.5'	12:15-13:10	312	MPS
MØ 49	OW 1	20.03	76° 26.5'	31° 25.5'	12:15-13:10	313	WP-3

Table 14. Number of animals/samples collected for lipid class analyses from stations MØ 32-34-49, March 2000.

Species	Stage or size class						
Copepoda	C I	C II	C III	C IV	C V	FF	MM
Calanus finmarchicus			10/1		15/2	15/2	10/1
Calanus glacialis			10/1	10/1	5/1	15/2	5/1
Calanus hyperboreus				15/2		11/2	5/1
Amphipoda	small	medium	large				
Themisto libellula		1/1					
Themisto abyssorum		1/1					
Euphausiacea	small	medium	large				
Thysanoessa inermis		2/1					
Thysanoessa longicaudata	10/2						
Pteropoda	small	large					
Clione limacina	1/1	1/1					
Others							
Metridia longa	20/2						

Table 15. Number of animals/samples collected for total lipid analyses from stations MØ 32-34-49, March 2000.

Species	Stage or size class						
Copepoda	C I	C II	C III	C IV	C V	FF	MM
Calanus finmarchicus			10/1		15/2	15/2	10/1
Calanus glacialis			23/2	15/1	6/2	20/3	
Calanus hyperboreus				15/3		15/3	
Amphipoda	small	medium	large				
Themisto libellula		1/1					
Themisto abyssorum		3/1					
Euphausiacea	small	medium	large				
Thysanoessa inermis		2/1					
Thysanoessa longicaudata	10/2						
Pteropoda	small	large					
Clione limacina	1/1	1/1					
Others							
Metridia longa	20/2						

Table 16. Details of sampling locations for macro-zooplankton, March 2000.

Station	Transect	Date	Latitude °N	Longitude °E	Time	No. hauls	Depth (m)
MØ 32-1	Ice A1	16.03	78° 16.2'	33° 00.5'	21:00-21:30	3	70-0
MØ 32-1	Ice A1	16.03	78° 16.2'	33° 00.5'	21:30-24:00	3	150-70
MØ 32-2	Ice A1	17.03	78° 21.0'	33° 20.3'	11:30-12:50	3	100-0
MØ 32-2	Ice A1	17.03	78° 21.0'	33° 20.3'	14:40-15:30	3	160-0
MØ 34-2	Ice A2	18.03	77° 29.1'	32° 51.0'	16:45-17:15	3	120-0
MØ 49-1	OW 1	20.03	76° 29.9'	31° 25.7'	12:15-13:10	4	300-0

Table 17. Number of animals/samples collected for stable isotope analyses from stations MØ 32-34-49 in March 2000.

Species	Stage or size class						
Copepoda	C I	C II	C III	C IV	C V	FF	MM
Calanus finmarchicus					70/3	57/2	22/1
Calanus glacialis						188/7	
Calanus hyperboreus				77/4		47/4	
Pareuchaeta norvegica						68/6	
Pareuchaeta glacialis						5/1	
Amphipoda	small	medium	large				
Themisto libellula	3/3	3/3					
Themisto abyssorum		13/7	4/3				
Hyperia galba	24/3	51/10					
Onisimus spp.	3/2	1/1					
Euphausiacea	small	medium	large				
Thysanoessa inermis	26/5						
Thysanoessa longicaudata	31/5	32/6					
Thysanoessa raschii	2/1	2/2	1/1				
Pteropoda	small	medium	large				
Clione limacina	6/3	11/4	2/2				
Others	small	medium	large				
Pandalus borealis	4/3	5/5	1/1				
Aglantha digitale	22/6						
Beröe cucumis		13/6	4/4				
Mertensia ovum	3/2	5/4					
Sagitta elegans		40/9					
Eukrona hamata	5/2		4/3				

5.4 Samples for population and energy dynamics of *Themisto libellula*

Kjersti Dale

Introduction

The purpose of the project was to study the population and energy dynamics of the pelagic amphipod *Themisto libellula* in the northern part of the Barents Sea and around Svalbard. The study focused on length-weight relationships and sex parameters of this species.

Methods and activities

During the cruise, *Themisto libellula* was sampled by means of a Tucker trawl (1 mm mesh, 1 m^2 opening area). Two different sampling strategies were used during trawling. The first was to take samples from the whole water column, trawling for 5 minutes at 10 m depth intervals from the bottom up to the surface. The other strategy was to take samples at only one depth. The planned trawling depths were calculated from rope length and angle using a clinometer. All *Themisto libellula* caught were immediately taken out of the trawl bucket and deep frozen in plastic bags. The wet-, dry-, ash- and lipid weights and the length of each animal will be determined later in the laboratory. A total of 12 hauls were taken at three ice stations and one open water station (Table 18).

Table 18. Sampling stations for amphipods, March 2000.

Station	Hauls	Date	Station type
MØ 32	2	16.03	Ice station
MØ 33	3	17.03	Ice station
MØ 34	3	18.03	Ice station
MØ 49	4	20.03	Open water

Results

First results indicate that most of the animals were concentrated in layers close to the bottom, with only a few animals present in the upper layers. Compared to samples taken during previous studies in summer, very few amphipods were present during this winter sampling. The size of the amphipods caught ranged from 10 to 25 mm. At the open water station only three amphipods were caught during 4 hours of trawling.

5.5 Persistent organic pollutants (POPs) in organisms in the Marginal Ice Zone

Katrine Borgå

Background

Transport of persistent organic pollutants (POPs) with the drifting sea ice has been proposed as a potential source of contamination the melting areas in the Barents Sea and the Fram Strait (Pfirman *et al.* 1995). The POPs are incorporated with sediments as the ice forms. In addition, POPs transported with the atmosphere are deposited and accumulated on the sea ice. As the sea ice melts in the Marginal Ice Zone, organisms living associated with the sea ice are potentially exposed to the POPs. Due to their physicochemical properties, persistent organic pollutants (POPs) bioaccumulate in the lipids of organisms and are transferred from prey to predator along with the flux of energy. To study the potential exposure of POPs with the sea ice, we aimed to study organisms living in association with sea ice all or parts of their life.

Samples of seabirds, pelagic crustaceans, and polar cod were collected in the Marginal Ice Zone of the Barents Sea in 1999. Unforrunately, the samples of polar cod (*Boreogadus saida*)were lost due to a fire in the laboratory. Since polar cod are important in our study of prey-predator relations and transfer of organic pollutants, we attempted to collect them during the 2000 cruise.

Methods and activities

Divers should have collected polar cod, but the ice condition prevented an ice station in old first-year ice. A few polar cod found in the Tucker trawls at some stations were collected. To validate the use of polar cod from another year in the food transfer study, we collected euphausiids (*Thysanoessa inermis*) and winged-snails (*Clione limacina*) with the Tucker trawl to compare with last year's samples. In spite of the scarcity of organisms in the trawls, a few samples were sorted and stored (Table 19).

The samples were stored frozen at -20 °C in polypropylene containers. The analysis of POPs (organochlorines; HCHs, HCB, chlordanes, DDTs, non-planar PCBs, Mirex) will be carried out at the Environmental Toxicology Laboratory, The Norwegian College of Veterinary Medicine, Oslo, Norway, according to methods in Bernhoft *et al.* (1997).

Table 19. Samples collected for POP analyses, March 2000.

Species	Station	Date	No. samples	Equipment
Boreogadus saida	32	16.03	1	TT
Boreogadus saida	33	17.03	1	TT
Boreogadus saida	34	18.03	4	TT/Macro-net
Thysanoessa inermis	32	16.03	1	TT
Thysanoessa inermis	49	20.03	1	TT
Clione limacina	33	17.03	3 (S, M, L)**	TT

*Length from 44 to 61 mm
**Small<20 mm, Medium 20-40 mm, Large>40 mm

References

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Appendix 1

Datalog 1999 Marinøk cruise

Datalog keys – for both 1999 and 2000 datalogs

GroupID	GroupName
PO	Physical Oceanography
IP	Ice Physics
ZP	Zooplankton/Phytoplankton
EC	Ecotox
SD	Scientific Diving

Gear ID	Gear Name
ADR	ADCP Rig
ADS	ADCP Ship
ATB	Atmospheric balloon
CDM	Conductivity Meter
CTD	CTD (SBE 911+)
DCM	Dielectric Constant Meter
DCR	DCM12 Rig
DET	Density Tube
DIC	Digital Camera
DTH	Digital Thermometer
FLU	Fluorometer
FRA	Frame
HAN	Hand net
ICA	Sea Ice Corer (ALU)
ICG	Sea Ice Corer (GFK)
IDB	ICEX Drift Buoys
LME	Light meter, PAR
MPS	Multiplankton sampler
MZN	Mega zooplankton net
NIB	Niskin bottle
NON	None
PPN	Phytoplankton net
PTR	Pelagic trawl
RAD	Radiation sensors
RFS	Reflectance spectrometer
RIF	Rifle
SDC	Secchi disc
SHG	Shotgun
SIA	Sea Ice Axe
SID	Sea Ice Thickness Drill
SIS	Sea Ice Saw
SSP	Snow Spade
SUP	Suction pump
TLV	Time laps video
TTR	Tucker trawl
TWP	Turbo water pump
UDV	Underwater digital video cam
UWC	Underwater camera
UWS	UW-spectrometer
WP2	WP2
WP3	WP3

WST	Weather Station

PersonID	PersonName
AH	Adrian Hauser
AS	Alexei Stuliy
BI	Boris Ivanov
BS	Bjørnar Seim
EH	Edmond Hansen
FE	Frode Engen
GG	Geir Wing Gabrielsen
H2	Haakon Hop
HG	Harvey Goodwin
JO	Janne Økland
JS	Janne Elin Søreide
JW	Jozef Wiktor
KB	Katrine Borgå
KD	Katarzyna Dmoch
KDale	Kjersti Dale
KF	Kristen Fossan
MP	Michael Poltermann
ON	Ole Anders Nøst
OS	Ole Gunnar Støen
SG	Sebastian Gerland
SK	Slawek Kwasniewski
TK	Tor Ivan Karlsen
TV	Tone Vollen

Activity ID	Activity Name
IP	Ice Physics
HS	Physical Oceanography
SM	Radiation Measurements
ZO	Zooplankton
PP	Phytoplankton
DI	Diving
SW	Sea Water Chemistry
SC	Snow Chemistry
IC	Ice Chemistry
TW	Trawling
HU	Hunting
OM	Optical Measurements
IS	Ice and Snow Sampling
PI	Physical Ice Properties
IO	Ice Observations
AM	Atmospheric Measurements

Sign ID	Stat ID	SubStat ID	Activity ID	Date	Depth	Ice	Latitude	Longitude	Gear ID	Sample	Comment
EH	001	PO01	HS0000	199905042345	41		76.57833	25.8	CTD		First station after VEINS transect
EH	001	PO02	HS0000	199905042345	41		76.57833	25.8	DCR		The start of the first along ice edge transect
EH	002	PO01	HS0000	199905050600	101		76.43333	26.36666	CTD		
EH	003	PO01	HS0000	199905051215	99		76.41666	27.15	CTD		
EH	004	PO01	HS0000	199905052215	131		76.5	27.76666	CTD		
EH	005	PO01	HS0000	199905052036	151		76.54333	28.45	CTD		
EH	006	PO01	HS0000	199905060150	208		76.47833	29.08333	CTD		
EH	007	PO01	HS0000	199905060150	273		76.46	29.67166	CTD		
EH	008	PO01	HS0000	199905061050	290		76.345	30	CTD		
EH	009	PO01	HS0000	199905061550	300		76.27166	30.645	CTD		
EH	010	PO01	HS0000	199905061830	320		76.22166	31.375	CTD		
EH	011	PO01	HS0000	199905062130	308		76.155	31.99666	CTD		
EH	012	PO01	HS0000	199905070018	314		76.165	32.66666	CTD		
EH	013	PO01	HS0000	199905070335	296		76.06166	33.36	CTD		
EH	014	PO01	HS0000	199905070637	275		75.97	33.905	CTD		
EH	015	PO01	HS0000	199905071120	227		75.87	34.40833	CTD		The last station on the along ice edge transect
EH	016	PO01	HS0000	199905072100	308		75.66833	32.5	CTD		The first station on the first across-ice edge transect Starting in open water, roughly 15-20 m away from the ice edge
EH	017	PO01	HS0000	199905072300	307		75.81333	32.5	CTD		
EH	017	PO02	HS0000	199905072300	307		75.81333	32.5	ATB		
EH	018	PO01	HS0000	199905080100	332		75.9	32.51	CTD		
EH	019	PO01	HS0000	199905080210	322		75.98333	32.50833	CTD		
EH	020	PO01	HS0000	199905080300	318		76.05333	32.51666	CTD		
EH	020	PO02	HS0000	199905080300	318		76.05333	32.51666	ATB		
EH	021	PO01	HS0000	199905080400	314		76.12666	32.505	CTD		
EH	022	PO01	HS0000	199905080530	309		76.19166	32.5	CTD		
EH	022	PO02	HS0000	199905080530	309		76.19166	32.5	ATB		
EH	023	PO01	HS0000	199905080745	292		76.26833	32.49	CTD		
EH	023	PO02	HS0000	199905080745	292		76.26833	32.49	IDB		
EH	024	PO01	HS0000	199905080905	283		76.35	32.47166	CTD		
EH	024	PO02	HS0000	199905080905	283		76.35	32.47166	ATB		
EH	025	PO01	HS0000	199905081105	265		76.43	32.32	CTD		
EH	025	PO02	HS0000	199905081105	265		76.43	32.32	IDB		
EH	025	PO03	HS0000	199905081105	265		76.43	32.32	ADR		
EH	026	PO01	HS0000	199905081345	267		76.51333	32.21666	CTD		
EH	026	PO02	HS0000	199905081345	267		76.51333	32.21666	ATB		
EH	026	PO03	HS0000	199905081345	267		76.51333	32.21666	IDB		
EH	027	PO01	HS0000	199905081615	271		76.58833	32.04166	CTD		
EH	028	PO01	HS0000	199905081835	257		76.6775	32.125	CTD		
EH	028	PO02	HS0000	199905081835	257		76.6775	32.125	ATB		

EH	029	PO01	HS0000	199905082035	270		76.76666	31.97666	CTD	
EH	029	PO02	HS0000	199905082035	270		76.76666	31.97666	IDB	
EH	030	PO01	HS0000	199905082245	234		76.85166	32.005	CTD	The last station of the across ice edge transect
EH	030	PO02	HS0000	199905082245	234		76.85166	32.005	ATB	
EH	031	PO01	HS0000	199905090900	160		76.91666	32.91666	CTD	The first sub-station on ice station A1. Only CTD reported here, but atmospheric sampling was also performed (balloon and weather station)
EH	031	PO02	HS0000	199905090900	166		76.91666	32.91666	CTD	
EH	031	PO03	HS0000	199905091500	169		76.96333	32.99666	CTD	
EH	031	PO04	HS0000	199905091830	159		76.975	32.99	CTD	
EH	031	PO05	HS0000	199905092100	160		76.9855	33.01333	CTD	The balloon was lost, it was last seen on its way to outer space at around 2300
EH	031	PO06	HS0000	199905100000	152		76.995	33.05833	CTD	
EH	031	PO07	HS0000	199905100315	150		77.00666	33.075	CTD	
EH	031	PO08	HS0000	199905100600	148		77.02333	33.09666	CTD	
EH	031	PO09	HS0000	199905100900	144		77.04166	33.125	CTD	
EH	031	PO10	HS0000	199905101200	142		77.05833	33.175	CTD	Last station on A1
EH	032	PO01	HS0000	199905110500	188		76.87333	32.775	CTD	First station on A2
EH	032	PO02	HS0000	199905110600	172		76.87833	32.835	CTD	
EH	032	PO03	HS0000	199905110600	173		76.87833	32.89166	CTD	
EH	033	PO01	HS0000	199905111400	191		76.815	32.82	CTD	Still on station A2, but moved here from station 32 due to an oil spill
EH	033	PO02	HS0000	199905111930	186		76.80333	32.86166	CTD	
EH	033	PO03	HS0000	199905121320	147		76.74666	33.12666	CTD	
EH	034	PO01	HS0000	199905122120	190		76.63333	32.87	CTD	First CTD on station A3
EH	034	PO02	HS0000	199905130025	196		76.64333	32.96666	CTD	
EH	034	PO03	HS0000	199905130300	186		76.64166	33.05333	CTD	
EH	034	PO04	HS0000	199905130300	195		76.64166	33.05333	CTD	
EH	034	PO05	HS0000	199905130900	197	0	76.62833	33.12166	CTD	
EH	034	PO06	HS0000	199905131215	173	0	76.65	33.17	CTD	
EH	034	PO07	HS0000	199905131515	159	0	76.65	33.28333	CTD	
EH	034	PO08	HS0000	199905131815	154	0	76.64166	33.34666	CTD	
EH	034	PO09	HS0000	199905132120	157	0	76.64166	33.30833	CTD	
EH	035	PO01	HS0000	199905140500	310	0	76.085	32.59833	CTD	First CTD on A4
EH	035	PO02	HS0000	199905140915	320	0	76.085	32.48166	CTD	
EH	035	PO03	HS0000	199905141230	313	0	76.11666	32.33333	CTD	
EH	035	PO04	HS0000	199905141600	317		76.08333	32.66666	CTD	
EH	035	PO05	HS0000	199905141810	301		76.08333	32.61666	CTD	
EH	035	PO06	HS0000	199905142130	317		76.39833	32.46333	CTD	
EH	035	PO07	HS0000	199905150310	312		76.08333	32.68333	CTD	
EH	036	PO01	HS0000	199905160300	132		76.16666	27.8	CTD	First CTD on across ice edge transect no. 2
EH	037	PO01	HS0000	199905160400	119		76.33333	27.7	CTD	

EH	038	PO01	HS0000	199905160445	117	76.4	27.65	CTD	
EH	039	PO01	HS0000	199905160520	131	76.46666	27.6	CTD	
EH	040	PO01	HS0000	199905160605	116	76.53333	27.555	CTD	
EH	041	PO01	HS0000	199905160705	112	76.6	27.51333	CTD	
EH	042	PO01	HS0000	199905160830	103	76.66666	27.47833	CTD	
EH	043	IP01	HS0000	199905160930	116	76.73333	27.425	CTD	
EH	043	PO01	HS0000	199905160930	116	76.73333	27.425	CTD	
EH	044	IP01	HS0000	199905161020	136	76.80166	27.37166	CTD	
EH	045	IP01	HS0000	199905161125	125	76.87833	27.355	CTD	
EH	045	PO01	HS0000	199905161125	125	76.87833	27.355	CTD	
EH	046	PO01	HS0000	199905161235	122	76.945	27.33333	CTD	
EH	047	PO01	HS0000	199905161330	114	77.00833	27.23333	CTD	
EH	048	PO01	HS0000	199905161550	208	77.16666	27.53333	CTD	Last CTD on second across ice edge transect
EH	049	PO01	HS0000	199905170220	188	77.425	27.03333	CTD	First CTD on ice station B1
EH	049	PO02	HS0000	199905170600	189	77.44666	27.03333	CTD	
EH	049	PO03	HS0000	199905170900	187	77.43166	27.09166	CTD	
EH	049	PO04	HS0000	199905171210	190	77.42666	27.01666	CTD	
EH	049	PO05	HS0000	199905171510	196	77.45	27	CTD	
EH	049	PO06	HS0000	199905171810	184	77.475	27.05333	CTD	
EH	049	PO07	HS0000	199905172120	188	77.475	27.01333	CTD	
EH	049	PO08	HS0000	199905172359	185	77.48333	26.92666	CTD	
EH	049	PO09	HS0000	199905180300	172	77.515	26.875	CTD	
EH	050	PO01	HS0000	199905181315	192	77.3	27.28	CTD	First CTD on ice station B2
EH	050	PO02	HS0000	199905182015	173	77.37	27.16333	CTD	
EH	050	PO03	HS0000	199905190015	172	77.36666	27.16666	CTD	
EH	050	PO04	HS0000	199905190300	173	77.38166	27.18333	CTD	
EH	050	PO05	HS0000	199905190945	201	77.38333	27.43333	CTD	
EH	050	PO06	HS0000	199905191230	199	77.36833	27.48833	CTD	
EH	050	PO07	HS0000	199905191510	198	77.36666	27.515	CTD	
EH	051	PO01	HS0000	199905200025	185	77.14	27.9	CTD	
EH	051	PO02	HS0000	199905200300	175	77.13333	27.95	CTD	
EH	051	PO03	HS0000	199905200600	179	77.13333	28.08333	CTD	
EH	051	PO04	HS0000	199905200900	181	77.10666	28.155	CTD	
EH	051	PO05	HS0000	199905201240	180	77.06666	28.19	CTD	
EH	051	PO06	HS0000	199905201600	164	77.025	28.14166	CTD	
EH	051	PO07	HS0000	199905201810	149	77	28.13666	CTD	
EH	051	PO08	HS0000	199905202125	143	76.985	28.14833	CTD	
EH	051	PO09	HS0000	199905210015	116	76.95	28.13333	CTD	
EH	052	PO01	HS0000	199905210720	138	76.51666	27.8	CTD	
EH	052	PO02	HS0000	199905211240	133	76.49333	27.71166	CTD	
EH	052	PO03	HS0000	199905211525	128	76.46	27.66666	CTD	
EH	052	PO04	HS0000	199905211810	129	76.465	27.68666	CTD	

EH	052	PO05	HS0000	199905212130	128	76.46666	27.71666	CTD
EH	052	PO06	HS0000	199905220000	135	76.46333	27.83333	CTD
EH	052	PO07	HS0000	199905220300	132	76.48333	27.73333	CTD
EH	052	PO08	HS0000	199905220610	135	76.48333	27.625	CTD
EH	053	PO01	HS0000	199905222355	317	76.09166	32.21333	CTD
EH	054	PO01	HS0000	199905230110	289	76.25333	32.175	CTD
EH	055	PO01	HS0000	199905230150	279	76.32	32.14666	CTD
EH	056	PO01	HS0000	199905230225	285	76.385	32.13333	CTD
EH	057	PO01	HS0000	199905230305	270	76.45333	32.13333	CTD
EH	058	PO01	HS0000	199905230400	267	76.52	32.15833	CTD
EH	059	PO01	HS0000	199905230455	266	76.58833	32.14	CTD
EH	060	PO01	HS0000	199905230600	257	76.65	32.11666	CTD
EH	061	PO01	HS0000	199905230800	259	76.81666	32.11666	CTD
EH	062	PO01	HS0000	199905230900	275	76.79	31.87	CTD
EH	063	PO01	HS0000	199905230935	274	76.74333	31.66	CTD
EH	064	PO01	HS0000	199905231030	297	76.69333	31.49333	CTD
EH	065	PO01	HS0000	199905231115	289	76.64833	31.26666	CTD
EH	066	PO01	HS0000	199905231200	286	76.6	31.03333	CTD
EH	067	PO01	HS0000	199905231245	281	76.55333	30.80833	CTD
EH	068	PO01	HS0000	199905231355	301	76.44166	30.30166	CTD
EH	069	PO01	HS0000	199905231615	250	76.605	29.475	CTD
EH	070	PO01	HS0000	199905231725	220	76.715	28.91666	CTD
EH	071	PO01	HS0000	199905231815	154	76.78333	28.56833	CTD
EH	072	PO01	HS0000	199905231845	116	76.74333	28.345	CTD
EH	073	PO01	HS0000	199905231925	104	76.87166	28.06333	CTD
EH	074	PO01	HS0000	199905232000	97	76.915	27.79666	CTD
EH	075	PO01	HS0000	199905232050	112	76.94166	27.48833	CTD
EH	076	PO01	HS0000	199905232245	126	77.04333	27.00333	CTD
EH	077	PO01	HS0000	199905240100	106	76.91666	26.53333	CTD
EH	078	PO01	HS0000	199905240145	77	76.91666	26.34	CTD
EH	079	PO01	HS0000	199905240220	63	76.78333	26.18333	CTD
EH	080	PO01	HS0000	199905240255	50	76.71666	26.01666	CTD
EH	081	PO01	HS0000	199905240325	42	76.66166	25.88333	CTD
EH	082	PO01	HS0000	199905240400	34	76.58833	25.71666	CTD
EH	083	PO01	HS0000	199905240425	40	76.52666	25.6	CTD
EH	084	PO01	HS0000	199905240455	45	76.46666	25.45	CTD
EH	085	PO01	HS0000	199905240520	51	76.42166	25.21666	CTD
EH	086	PO01	HS0000	199905240620	54	76.325	24.66333	CTD
FE	003	EC00	PP0000	199905051500		76.41666	27.93333	PPN
FE	003	EC00	SW0000	199905051400		76.41666	27.93333	TWP
FE	015	EC00	PP0000	199905071800		75.85833	34.93333	PPN
FE	015	EC00	SW0000	199905071200		75.85833	34.41666	TWP

FE	031	EC00	DI0000	199905091900	76.97666	32.99333	SIS		
FE	031	EC00	IC0000	199905091500	76.97666	32.99333	ICG		
FE	031	EC00	SC0000	199905090500	76.93166	32.91833	SSP		
FE	031	EC00	SW0000	199905091300	76.97666	32.93333	TWP		
FE	033	EC00	IC0000	199905111200	76.74666	32.08833	ICA		
FE	033	EC00	PP0000	199905111400	76.74666	32.08833	SIS		
FE	033	EC00	SW0000	199905111500	76.81166	32.93333	TWP		
FE	034	EC00	IC0000	199905121300	76.65	33.17	ICA		
FE	034	EC00	PP0000	199905121300	76.65	33.93333	SIS		
FE	034	EC00	SW0000	199905121100	76.65	33.17	TWP		
FE	035	EC00	SW0000	199905131300	76.11666	32.93333	TWP		
FE	049	EC00	IC0000	199905171300	77.42666	27.93333	ICA		
FE	049	EC00	PP0000	199905171100	77.42666	27.93333	SIS		
FE	049	EC00	SC0000	199905170200	77.42666	27.93333	SSP		
FE	050	EC00	IC0000	199905191300	77.32166	27.25666	ICA		
FE	050	EC00	PP0000	199905181400	77.32166	27.93333	SIS		
FE	051	EC00	IC0000	199905201600	77.00166	28.93333	ICA		
FE	051	EC00	PP0000	199905201800	77.00166	28.93333	SIS		
FE	052	EC00	PP0000	199905212300	76.465	27.93333	PPN		
FE	052	EC00	SW0000	199905211700	76.465	27.93333	TWP		
H2	031	SDA1	DI374	199905091205	76.95666	33.99333	HAN	pcod	Visibility 20m
H2	031	SDA1	DI375	199905091205	76.95666	33.99333	UDV	pcod	
H2	031	SDA1	DI376	199905091401	76.95666	33.99333	HAN	pcod	
H2	031	SDA1	DI377	199905091621	76.96666	32.99333	UDV	pcod	
H2	031	SDA1	DI378	199905091744	76.96666	32.99333	HAN	pcod	
H2	031	SDA1	DI379	199905091745	76.96666	32.99333	HAN	pcod	
H2	031	SDA1	DI380	199905101030	77.05666	33.17333	HAN	pcod	
H2	031	SDA1	DI381	199905101014	77.05666	33.17333	HAN	pcod	
H2	031	SDA1	DI382	199905101135	77.05666	33.17333	HAN	pcod	
H2	031	SDA1	DI383	199905101145	77.05666	33.17333	HAN	pcod	
H2	031	SDAX	DI384	199905101641	77.04166	33.13166	SUP	surv	Checking ice floe
H2	031	SDAX	DI385	199905101640	77.04166	33.13166	SUP	surv	Checking ice floe
H2	033	SDA2	DI386	199905111418	77.04166	33.13166	SUP	alga	Light, visibility 4m
H2	033	SDA2	DI387	199905111418	76.81666	32.81833	SUP	alga	Mass
H2	034	SDA2	DI388	199905111610	76.64333	33.14666	SUP	alga	Light
H2	034	SDA3	DI389	199905131030	76.64333	33.14666	UDV	alga	Mass, visibility 5m
H2	034	SDA3	DI390	199905131121	76.64333	33.14666	UDV	alga	Mass
H2	049	SDB1	DI391	199905171008	77.425	27.025	HAN	pcod	Visibility 17m
H2	049	SDB1	DI392	199905171004	77.425	27.025	UDV	pcod	
H2	049	SDB1	DI393	199905171121	77.425	27.025	SUP	alga	Light
H2	049	SDB1	DI394	199905171106	77.425	27.025	HAN	pcod	
H2	049	SDB1	DI395	199905171515	77.45666	27.02166	HAN	pcod	

H2	049	SDB1	DI396	199905171637	77.45666	27.02166	HAN	pcod	*Gammarus wilkitzkii* (1)
H2	049	SDB1	DI397	199905171940	77.475	27.04166	HAN	pcod	
H2	049	SDB1	DI398	199905171955	77.475	27.04166	UDV	pcod	*Melosira arctica* strands
H2	049	SDB1	DI399	199905172120	77.475	27.04166	SUP	alga	*Melosira arctica* sampl.
H2	050	SDB2	DI400	199905181607	77.335	27.195	SUP	alga	Light, visibility 20m
H2	050	SDB2	DI401	199905181620	77.335	27.195	UDV	pcod	*Apherusa glacialis* (3)
H2	050	SDB2	DI402	199905181713	77.335	27.195	HAN	pcod	
H2	050	SDB2	DI403	199905191335	77.37166	27.525	SUP	alga	Light
H2	050	SDB2	DI404	199905191345	77.37166	27.525	UDV	phot	Visibility 25 m
H2	050	SDB2	DI405	199905191430	77.36666	27.525	SUP	alga	*Onisimus glacialis* (1)
H2	050	SDB2	DI406	199905191510	77.36666	27.525	HAN	obse	Observing
H2	051	SDB3	DI407	199905201017	77.075	27.4685	SUP	alga	Light
H2	051	SDB3	DI408	199905201043	77.075	27.4685	HAN	pcod	
H2	051	SDB3	DI409	199905201445	77.02333	28.14166	UDV	alga	Mass, visibility 8 m
H2	051	SDB3	DI410	199905201442	77.02333	28.14166	HAN	pcod	
HG	000	IP00	IO0000	199905031900	75.35	17.93333	DIC		
HG	000	IP01	IO0001	199905032100	75.65	17.58333	DIC		
HG	000	IP02	IO0002	199905032130	75.7	17.55	MPS		
HG	000	IP03	IO0003	199905040000	75.83333	17.31666	DIC		
HG	000	IP04	IO0004	199905040300	75.65	17.91666	DIC		
HG	000	IP05	IO0005	199905040900	75.81166	21.81666	DIC		
HG	000	IP06	IO0006	199905041200	76.06666	23.43333	DIC		
HG	000	IP07	IO0007	199905041500	76.29666	24.835	DIC		
HG	000	IP08	IO0008	199905041800	76.38333	26.515	DIC		
HG	000	IP09	IO0009	199905042100	76.475	26.28666	DIC		
HG	001	IP00	IO0010	199905050000	76.57833	25.80333	DIC		
HG	002	IP00	IO0011	199905050300	76.5	26.21666	DIC		
HG	002	IP01	IO0012	199905050600	76.45	26.81666	DIC		
HG	003	IP00	IO0013	199905050900	76.41666	27.24	DIC		
HG	003	IP01	IO0014	199905051200	76.42	27.15666	DIC		
HG	003	IP02	IO0015	199905051500	76.39333	27.035	DIC		
HG	003	IP03	IO0016	199905051800	76.39666	26.96666	DIC		
HG	003	IP04	IO0017	199905052100	76.38833	27.14166	DIC		
HG	005	IP00	IO0018	199905060000	76.50333	28.10833	DIC		
HG	006	IP00	IO0019	199905060300	76.48833	28.96166	DIC		
HG	007	IP00	IO0020	199905060600	76.46333	29.67833	DIC		
HG	008	IP00	IO0021	199905060900	76.30333	30.11666	DIC		
HG	008	IP01	IO0022	199905061200	76.30333	30.14333	DIC		
HG	009	IP00	IO0023	199905061500	76.275	30.34833	DIC		
HG	010	IP00	IO0024	199905061840	76.22166	31.37	DIC		
HG	010	IP01	IO0025	199905062100	76.19666	31.56333	DIC		
HG	011	IP00	IO0026	199905070000	76.10166	32.50666	DIC		

HG	012	IP00	IO0027	199905070300	76.055	33.05833	DIC
HG	014	IP00	IO0028	199905070600	75.975	33.82	DIC
HG	015	IP00	IO0029	199905070950	75.85833	34.5	DIC
HG	015	IP01	IO0030	199905071200	75.86333	34.42333	DIC
HG	015	IP02	IO0031	199905071500	75.84	34.36	DIC
HG	015	IP03	IO0032	199905071800	75.83333	34.27833	DIC
HG	016	IP00	IO0033	199905072100	75.67666	32.525	DIC
HG	017	IP00	IO0034	199905080000	75.815	32.475	DIC
HG	020	IP00	IO0035	199905080300	76.055	32.50666	DIC
HG	022	IP00	IO0036	199905080600	76.19333	32.49333	DIC
HG	024	IP00	IO0037	199905080900	76.35166	32.47333	DIC
HG	025	IP00	IO0038	199905081200	76.43166	32.31833	DIC
HG	026	IP00	IO0039	199905081500	76.51166	32.20833	DIC
HG	026	IP01	IO0040	199905081610	76.58166	32.06833	DIC
HG	027	IP00	IO0041	199905081800	76.67666	32.12	DIC
HG	029	IP00	IO0042	199905082100	76.77	31.98166	DIC
HG	030	IP00	IO0043	199905090300	76.90666	32.83166	DIC
HG	031	IP00	IO0044	199905090300	76.93166	32.91833	DIC
HG	031	IP01	IO0045	199905101500	77.03666	33.13533	DIC
HG	031	IP02	IO0046	199905101800	76.92333	32.965	DIC
HG	031	IP03	IO0047	199905101940	76.85166	32.42666	DIC
HG	031	IP04	IO0048	199905102105	76.725	32.27666	DIC
HG	031	IP05	IO0049	199905102200	76.64166	32.49666	DIC
HG	032	IP00	IO0050	199905110610	76.87833	32.83	DIC
HG	032	IP01	IO0051	199905111205	76.82166	32.80333	DIC
HG	033	IP00	IO0052	199905120840	76.75333	33.06166	DIC
HG	033	IP01	IO0053	199905121500	76.70333	32.93666	DIC
HG	034	IP00	IO0054	199905122100	76.635	32.875	DIC
HG	034	IP01	IO0055	199905130000	76.64333	32.98833	DIC
HG	034	IP02	IO0056	199905130830	76.62833	33.12166	DIC
HG	034	IP03	IO0057	199905131630	76.65	33.31833	DIC
HG	034	IP04	IO0058	199905131830	76.64	33.34833	DIC
HG	034	IP05	IO0059	199905132140	76.63666	33.30333	DIC
HG	034	IP06	IO0060	199905132320	76.60166	33.08333	DIC
HG	034	IP07	IO0061	199905132345	76.55833	32.97	DIC
HG	035	IP00	IO0062	199905150840	76.48666	32.98166	DIC
HG	035	IP01	IO0063	199905151200	76.525	32.475	DIC
HG	035	IP02	IO0064	199905151500	76.53333	31.41666	DIC
HG	040	IP00	IO0065	199905160600	76.535	27.55333	DIC
HG	040	IP01	IO0066	199905160645	76.58	27.525	DIC
HG	042	IP00	IO0067	199905160900	76.70333	27.435	DIC
HG	043	IP00	IO0068	199905161000	76.76166	27.38333	DIC

HG	043	IP01	IO0069	199905161005	76.76166	27.38333	DIC	
HG	044	IP00	IO0070	199905161100	76.84	27.31833	DIC	
HG	045	IP00	IO0071	199905161210	76.91333	27.335	DIC	
HG	046	IP00	IO0072	199905161300	76.95333	27.32333	DIC	
HG	047	IP00	IO0073	199905161400	77	27.3	DIC	
HG	047	IP01	IO0074	199905161510	77.105	27.41166	DIC	
HG	048	IP00	IO0075	199905161820	77.20666	27.61833	DIC	
HG	048	IP01	IO0076	199905162100	77.29666	27.52166	DIC	
HG	048	IP02	IO0077	199905170000	77.405	26.50166	DIC	
HG	049	IP00	IO0078	199905170630	77.445	27.12	DIC	
HG	049	IP01	IO0079	199905180600	77.535	26.875	DIC	
HG	049	IP02	IO0080	199905180900	77.40166	26.88333	DIC	
HG	049	IP03	IO0081	199905181200	77.285	27.33833	DIC	
HG	050	IP00	IO0082	199905181630	77.34333	27.18833	DIC	
HG	050	IP01	IO0083	199905181810	77.36	27.17666	DIC	
HG	050	IP02	IO0084	199905182200	77.36833	27.16	DIC	
HG	050	IP03	IO0085	199905190020	77.36833	27.16166	DIC	
HG	050	IP04	IO0086	199905191805	77.34166	27.61166	DIC	
HG	050	IP05	IO0087	199905191825	77.315	27.70666	DIC	
HG	050	IP06	IO0088	199905192100	77.10333	27.77	DIC	
HG	050	IP06	IO0089	199905192345	77.06666	27.88333	DIC	
HG	051	IP00	IO0090	199905200030	77.14	27.575	DIC	
HG	051	IP01	IO0091	199905210100	76.925	28.085	DIC	
HG	051	IP02	IO0092	199905210230	76.85833	28.01	DIC	
HG	051	IP03	IO0093	199905210250	76.81833	27.965	DIC	
HG	051	IP04	IO0094	199905210305	76.78	27.92	DIC	
HG	051	IP05	IO0095	199905211500	76.78	27.92	DIC	Control photos for calibration of ice photos for estimating size of ice floes
HG	052	IP00	IO0096	199905220950	76.52166	26.84	DIC	
HG	052	IP01	IO0097	199905221015	76.53166	26.61833	DIC	
HG	052	IP03	IO0098	199905221220	76.56166	26.12333	DIC	
HG	052	IP04	IO0099	199905221530	76.47166	28.45	DIC	
HG	052	IP05	IO0100	199905221940	76.44	31.91166	DIC	
HG	052	IP06	IO0101	199905222100	76.415	32.29833	DIC	
HG	053	IP00	IO0102	199905230005	76.09166	32.21	DIC	
HG	057	IP00	IO0103	199905230300	76.43833	32.13666	DIC	
HG	060	IP00	IO0104	199905230600	76.67333	32.11333	DIC	
HG	062	IP00	IO0105	199905230900	76.79166	31.87	DIC	
HG	066	IP00	IO0106	199905231200	76.6	31.04	DIC	
HG	068	IP00	IO0107	199905231535	76.51833	29.94666	DIC	
HG	071	IP00	IO0108	199905231820	76.785	28.55333	DIC	
HG	073	IP00	IO0109	199905231945	76.89	27.95166	DIC	

HG	075	IP00	IO0110	199905232100		76.94333	27.48666	DIC		
HG	075	IP01	IO0111	199905232220		77.03333	27.055	DIC		
HG	076	IP00	IO0112	199905240015		76.99	26.77	DIC		
HG	080	IP00	IO0113	199905240300		76.72666	26.015	DIC		
JS	003	ZP00	ZO0004	199905051421	102	76.41	27.11833	WP2	Lipi	Lipid samples, 90-0 m
JS	003	ZP00	ZO0005	199905051441	102	76.41	27.11833	WP2	Lipi	Lipid samples, 90-0 m
JS	003	ZP00	ZO0006	199905051534	102	76.41	27.11833	MZN	CoDi	Community (1.55 mm, haul 1), 40-0 m Flowmeter out of function
JS	003	ZP00	ZO0007	199905051607	97	76.41	27.11833	MZN	CoDi	Community/Distribution, (1.55 mm, haul 2), 40-0 m New flowmeter
JS	003	ZP00	ZO0008	199905051622	95	76.41	27.11833	MZN	CoDi	Community (1.55 mm, haul 3),80-40 m
JS	003	ZP00	ZO0009	199905051654	95	76.41	27.11833	MZN	CoDi	Community (1.55 mm, haul 4), 40-0 m
JS	003	ZP00	ZO0010	199905051707	99	76.41	27.11833	MZN	CoDi	Community (1.55 mm, haul 5), 80-0 m
JS	003	ZP00	ZO0011	199905051719	99	76.41	27.11833	MZN	CoDi	Community (1.55 mm, haul 6), 80-0 m
JS	003	ZP00	ZO0012	199905051731	99	76.41	27.11833	MZN	CoDi	Community (1.55 mm, haul 7), 80-0 m
JS	003	ZP00	ZO0013	199905051901	99	76.41	27.11833	MZN	CoDi	Community (4 mm, haul 8), 80-0 m
JS	003	ZP00	ZO0014	199905051917	99	76.41	27.11833	MZN	CoDi	Community (4 mm, haul 9), 80-0 m
JS	003	ZP00	ZO0015	199905051930	99	76.41	27.11833	MZN	CoDi	Community (4 mm, haul 10), 80-0 m
JS	015	ZP00	ZO0001	199905071420	224	75.87	34.40833	MZN	Stab	Stable isotopes, (4 mm, haul 1), 195-0 m
JS	015	ZP00	ZO0002	199905071438	224	75.87	34.40833	MZN	CoDi	Community (4 mm, haul 2), 202-0 m
JS	015	ZP00	ZO0003	199905071438	224	75.87	34.40833	MZN	CoDi	Community (4 mm, haul 3), 205-0 m
JS	015	ZP00	ZO0004	199905071508	224	75.87	34.40833	MZN	Lipi	Lipids, (4mm, haul 4), 207-0 m
JS	015	ZP00	ZO0005	199905071521	224	75.87	34.40833	MZN	CoDi	Community (4 mm, haul 5), 208-0 m
JS	015	ZP00	ZO0006	199905071548	224	75.87	34.40833	MZN	CoDi	Community (1.55mm, haul 6), 207-0 m
JS	015	ZP00	ZO0007	199905071602	224	75.87	34.40833	MZN	CoDi	Community (1.55 mm, haul 7), 206-0 m
JS	015	ZP00	ZO0008	199905071623	224	75.87	34.40833	MZN	CoDi	Community (1.55 mm, haul 8), 208-0 m
JS	015	ZP00	ZO0009	199905071638	224	75.87	34.40833	MZN	Lipi	Lipids, (1.55 mm, haul 9), 212-0 m
JS	015	ZP00	ZO0010	199905071654	224	75.87	34.40833	MZN	Stab	Stable isotopes, (1.55 mm, haul 10), 210-0 m
JS	015	ZP00	ZO0011	199905071706	224	75.87	34.40833	MZN	Ecot	Ecotox, (1.55 mm, haul 11), 192-0 m
JS	015	ZP00	ZO0012	199905071720	224	75.87	34.40833	MZN	Ecot	Ecotox, (1.55mm, haul 12), 205-0 m
JS	031	ZP02	ZO0001	199905091315	160	76.95833	32.995	MZN	CoDi	Community (1.55 mm, haul 1), 145-0 m
JS	031	ZP02	ZO0002	199905091335	160	76.95833	32.995	MZN	Ecot	Ecotox, (1.55 mm), 145-0 m
JS	031	ZP02	ZO0003	199905091350	160	76.95833	32.995	MZN	Ecot	Ecotox, (1.55mm), 145-0 m
JS	031	ZP02	ZO0004	199905091405	160	76.96333	32.995	MZN	Ecot	Ecotox, (1.55mm), 150-0 m
JS	031	ZP02	ZO0005	199905091420	160	76 96333	32.995	MZN	CoDi	Community (1.55 mm), 150-0 m
JS	031	ZP02	ZO0006	199905091430	160	76.96333	32.995	MZN	CoDi	Community (1.55mm), 150-0 m
JS	031	ZP03	ZO0007	199905091510	169	76.975	32.99666	MZN	CoDi	Community (4 mm), 150-0 m
JS	031	ZP03	ZO0008	199905091530	169	76.975	32.99666	MZN	CoDi	Community (4 mm), 150-0 m
JS	031	ZP03	ZO0009	199905091545	169	76.975	32.99666	MZN	CoDi	Community (4 mm), 150-0 m
JS	031	ZP03	ZO0010	199905091655	169	76.975	32.99666	WP2	CoDi	Community, 150-0 m
JS	031	ZP03	ZO0011	199905091705	169	76.975	32.99666	WP2	CoDi	Community, 150-0 m
JS	031	ZP03	ZO0012	199905091715	169	76.975	32.99666	WP2	Lipi	Lipids, 150-0 m

JS	032	ZP01	ZO0001	199905110740	173	76.87833	32.83666	WP3	Lipi	Lipids, 155-0 m
JS	032	ZP01	ZO0002	199905110740	173	76.87833	32.83666	WP3	Ecot	Ecotox, 155-0 m
JS	033	ZP01	ZO0001	199905111620	191	76.815	32.82	MZN	CoDi	Community (1.55 mm, haul 1), 175-0 m
JS	033	ZP01	ZO0002	199905111635	191	76.815	32.82	MZN	CoDi	Community (1.55 mm, haul 2), 175-0 m
JS	033	ZP01	ZO0003	199905111650	191	76.815	32.82	MZN	CoDi	Community (1.55 mm, haul 3), 175-0 m
JS	033	ZP01	ZO0004	199905111710	191	76.815	32.82	MZN	Ecot	Ecotox, (1.55 mm), 175 -0 m
JS	033	ZP01	ZO0005	199905111730	191	76.815	32.82	MZN	Stab	Stable isotopes, (1.55 mm), 175-0 m
JS	033	ZP01	ZO0006	199905111745	191	76.815	32.82	MZN	Ecot	Ecotox, (1.55 mm), 175 -0 m
JS	033	ZP02	ZO0007	199905111845	186	76.80333	32.86166	MZN	Ecot	Ecotox, (1.55 mm), 175 -0 m
JS	033	ZP02	ZO0008	199905111845	186	76.80333	32.86166	MZN	Ecot	Ecotox, (1.55 mm), 175 -0 m
JS	033	ZP02	ZO0009	199905111920	186	76.80333	32.86166	MZN	Lipi	Lipids, (1.55 mm), 175-0 m
JS	033	ZP02	ZO0010	199905112045	186	76.80333	32.82	MZN	CoDi	Community (4 mm, haul 10), 175-0 m
JS	033	ZP02	ZO0011	199905112100	186	76.80333	32.82	MZN	CoDi	Community (4 mm, haul 11), 175-0 m
JS	033	ZP02	ZO0012	199905112115	186	76.80333	32.82	MZN	CoDi	Community (4 mm, haul 12), 175-0 m
JS	033	ZP05	ZO0013	199905121250	147	76.74666	33.12666	WP3	CoDi	Community (haul 1), 130-0 m
JS	033	ZP05	ZO0014	199905121345	147	76.74666	33.12666	WP3	CoDi	Community (haul 2), 130-0 m
JS	033	ZP05	ZO0015	199905121445	189	76.74666	33.12666	MZN	Lipi	Lipids, (1.55 mm), 175-0 m
JS	033	ZP05	ZO0016	199905121455	147	76.74666	33.12666	WP3	CoDi	Community (haul 3), 130-0 m
JS	033	ZP05	ZO0017	199905121600	189	76.74666	33.12666	MZN	Lipi	Lipids, (1.55 mm), 175-0 m
JS	033	ZP05	ZO0020	199905121600	189	76.74666	33.12666	MZN		
JS	034	ZP05	ZO0001	199905130845	197	76.62833	33.12166	MZN	Lipi	Lipids, (1.55 mm), 175-0 m
JS	034	ZP05	ZO0002	199905130855	197	76.62833	33.12166	MZN	Stab	Stable isotopes, (1.55 mm), 180-0 m
JS	034	ZP06	ZO0003	199905131050	197	76.62833	33.12166	WP3	Lipi	Lipids, 175-0 m
JS	034	ZP06	ZO0004	199905131125	197	76.62833	33.12166	WP3	Stab	Stable isotopes, 175-0 m
JS	034	ZP06	ZO0005	199905131305	173	76.65	33.17	MZN	Lipi	Lipids, (1.55 mm), 130-0 m
JS	034	ZP06	ZO0006	199905131320	173	76.65	33.17	MZN	CoDi	Community (1.55 mm), 150-0 m
JS	034	ZP06	ZO0007	199905131320	173	76.65	33.17	MZN	CoDi	Community (1.55 mm), 150-0 m
JS	034	ZP06	ZO0008	199905131350	173	76.65	33.17	MZN	CoDi	Community (1.55 mm), 150-0 m
JS	034	ZP06	ZO0009	199905131405	173	76.65	33.17	MZN	Ecot	Ecotox, (1.55 mm), 150-0 m
JS	034	ZP06	ZO0010	199905131420	173	76.65	33.17	MZN	Ecot	Ecotox, (1,55mm), 150-0 m
JS	034	ZP06	ZO0011	199905131450	173	76.65	33.17	MZN	Ecot	Ecotox, (1,55mm), 150-0 m
JS	034	ZP07	ZO0012	199905131535	159	76.65333	33.28333	MZN	CoDi	Community (4 mm), 135-0 m
JS	034	ZP07	ZO0013	199905131545	159	76.65333	33.28333	MZN	CoDi	Community (4 mm), 135-0 m
JS	034	ZP07	ZO0014	199905131655	159	76.65333	33.28333	MZN	CoDi	Community (4 mm), 140-0 m
JS	034	ZP07	ZO0015	199905131705	159	76.65333	33.28333	WP3	CoDi	Community, 140-0 m
JS	034	ZP07	ZO0016	199905131715	157	76.65333	33.28333	WP3	CoDi	Community, 140-0 m
JS	034	ZP07	ZO0017	199905131725	157	76.65333	33.28333	WP3	CoDi	Community, 140-0 m
JS	035	ZP02	ZO0001	199905141000	320	76.095	32.48166	MZN	Stab	Stable isotopes, (1.55 mm), 300-0 m
JS	035	ZP02	ZO0002	199905141030	320	76.095	32.48166	MZN	Stab	Stable isotopes, (1.55 mm), 300-0 m
JS	035	ZP03	ZO0003	199905141300	313	76.11666	32.33333	MZN	Lipi	Lipids, (1.55 mm), 300-0 m
JS	035	ZP03	ZO0004	199905141430	313	76.11666	32.33333	MZN	Ecot	Ecotox, (1.55 mm), 250-0 m
JS	035	ZP05	ZO0005	199905141850	301	76.08166	32.61666	MZN	CoDi	Community (1.55 mm), 300-0 m

JS	035	ZP05	ZO0006	199905141925	301	76.08166	32.61666	MZN	CoDi	Community (1.55 mm), 290-0 m
JS	035	ZP05	ZO0007	199905142005	301	76.08166	32.61666	MZN	CoDi	Community (1.55 mm), 290-0 m
JS	035	ZP06	ZO0008	199905142210	317	76.39833	32.46333	MZN	CoDi	Community (4 mm), 300-0 m
JS	035	ZP06	ZO0009	199905142235	317	76.39833	32.46333	MZN	CoDi	Community (4 mm), 300-0 m
JS	035	ZP06	ZO0010	199905142300	317	76.39833	32.46333	MZN	CoDi	Community (4 mm), 300-0 m
JS	035	ZP06	ZO0011	199905150025	317	76.39833	32.46333	WP3	CoDi	Community, 300-0 m
JS	035	ZP06	ZO0012	199905150045	317	76.39833	32.46333	WP3	CoDi	Community, 300-0 m
JS	035	ZP06	ZO0013	199905150110	317	76.39833	32.46333	WP3	CoDi	Community, 300-0 m
JS	049	ZP01	ZO0001	199905170445	186	77.445	27.03333	WP3	CoDi	Community, 170-0 m
JS	049	ZP01	ZO0002	199905170445	186	77.445	27.03333	WP3	CoDi	Community, 170-0 m
JS	049	ZP01	ZO0003	199905170510	186	77.445	27.03333	WP3	CoDi	Community, 170-0 m
JS	049	ZP01	ZO0004	199905170530	186	77.445	27.03333	MZN	CoDi	Community (4 mm, haul 1), 162-0 m
JS	049	ZP01	ZO0005	199905170540	186	77.445	27.03333	MZN	CoDi	Community (4 mm, haul 2), 162-0 m
JS	049	ZP01	ZO0006	199905170555	186	77.445	27.03333	MZN	CoDi	Community (4 mm, haul 3), 162-0 m
JS	049	ZP05	ZO0007	199905171445	196	77.45	27	MZN	CoDi	Community (1.55, mm haul 1). 165-0 m
JS	049	ZP05	ZO008	199905171445	196	77.45	27	MZN	CoDi	Community (1.55, mm haul 2), 165-0 m
JS	049	ZP05	ZO009	199905171715	196	77.45	27	MZN	CoDi	Community (1.55, mm haul 3), 165-0 m
JS	050	ZP02	ZO001	199905182135	173	77.37	27.16333	WP3	Stab	Stable isotopes, 50-0 m
JS	050	ZP02	ZO002	199905182145	173	77.37	27.16333	WP3	Lipi	Lipids, 50-0 m
JS	050	ZP02	ZO003	199905182155	173	77.37	27.16333	WP3	CoDi	Community, 155-0 m
JS	050	ZP02	ZO004	199905182205	173	77.37	27.16333	WP3	CoDi	Community, 155-0 m
JS	050	ZP02	ZO005	199905182215	173	77.37	27.16333	WP3	CoDi	Community, 155-0 m
JS	050	ZP02	ZO006	199905182245	173	77.37	27.16333	MZN	CoDi	Community (1.55 mm, haul 1), 150-0 m
JS	050	ZP02	ZO007	199905182255	173	77.37	27.16333	MZN	CoDi	Community (1.55 mm, haul 2), 150-0 m
JS	050	ZP02	ZO008	199905182310	173	77.37	27.16333	MZN	CoDi	Community (1.55 mm, haul 3), 150-0 m
JS	050	ZP03	ZO009	199905182315	173	77.38166	27.18333	MZN	CoDi	Community (4 mm, haul 1), 150-0 m
JS	050	ZP03	ZO010	199905182330	172	77.38166	27.18333	MZN	CoDi	Community (4 mm, haul 2), 150-0 m
JS	050	ZP03	ZO011	199905182330	172	77.38166	27.18333	MZN	CoDi	Community (4 mm, haul 3), 150-0 m
JS	051	ZP02	ZO001	199905200215	175	77.13333	27.95	WP3	CoDi	Community, 165-0 m
JS	051	ZP02	ZO002	199905200230	175	77.13333	27.95	WP3	CoDi	Community, 165-0 m
JS	051	ZP02	ZO003	199905200245	175	77.13333	27.95	WP3	CoDi	Community, 165-0 m
JS	051	ZP02	ZO004	199905200320	175	77.13333	27.95	MZN	CoDi	Community (4 mm, haul 1), 162-0 m
JS	051	ZP02	ZO005	199905200330	175	77.13333	27.95	MZN	CoDi	Community (4 mm, haul 2), 162-0 m
JS	051	ZP02	ZO006	199905200340	175	77.13333	27.95	MZN	CoDi	Community (4 mm, haul 3), 162-0 m
JS	051	ZP02	ZO007	199905200415	175	77.13333	27.95	MZN	CoDi	Community (1.55 mm, haul 1), 162-0 m
JS	051	ZP02	ZO008	199905200430	175	77.13333	27.95	MZN	CoDi	Community (1.55 mm, haul 2), 162-0 m
JS	051	ZP02	ZO009	199905200440	175	77.13333	27.95	MZN	CoDi	Community (1.55 mm, haul 3), 162-0 m
JS	051	ZP02	ZO010	199905200450	175	77.13333	27.95	MZN	Stab	Stable isotopes, (1.55 mm), 165-0 m
JS	051	ZP06	ZO0011	199905201445	164	77.025	28.14166	MZN	Stab	Stable isotopes, (1.55 mm), 125-0 m
JS	051	ZP06	ZO0012	199905201500	164	77.025	28.14166	WP3	Lipi	Lipids, 155-0 m (haul 6 *T. libellula*)
JS	051	ZP06	ZO0013	199905201610	164	77.025	28.14166	WP3	Ecot	Ecotox, 155-0 m
JS	051	ZP06	ZO0014	199905201620	164	77.025	28.14166	WP3	Ecot	Ecotox, 155-0 m

JS	051	ZP06	ZO0015	199905201620	157	77.025	28.14166	MZN	Ecot	Ecotox + Stable isotopes & Lipids, (1.55 mm), 146-0 m
JS	051	ZP06	ZO0016	199905201715	157	77.025	28.14166	MZN	Ecot	Ecotox + Stable isotopes & Lipids, (1.55 mm), 146-0 m
JS	052	ZP01	ZO0001	199905211005	138	76.51666	27.8	WP3	Stab	Stable isotopes + Lipids, 120-0 m
JS	052	ZP01	ZO0002	199905211020	138	76.51666	27.8	MZN	Stab	Stable isotopes + Lipids, (1.55 mm), 120-0 m
JS	052	ZP02	ZO0003	199905211345	133	76.49333	27.71166	MZN	Lipi	Lipids + stable isotopes, (1.55 mm), 120-0 m
JS	052	ZP02	ZO0004	199905211400	133	76.49333	27.71166	WP3	Lipi	Lipids + Stable isotopes, 120-0 m
JS	052	ZP02	ZO0005	199905211440	129	76.49333	27.71166	WP3	CoDi	Community, 120-0 m
JS	052	ZP02	ZO0006	199905211455	129	76.49333	27.71166	WP3	CoDi	Community, 120-0 m
JS	052	ZP02	ZO0007	199905211510	129	76.49333	27.71166	WP3	CoDi	Community, 120-0 m
JS	052	ZP03	ZO0008	199905211705	128	76.46	27.66666	MZN	CoDi	Community (4 mm, haul 2), 120-0 m
JS	052	ZP03	ZO0009	199905211710	128	76.46	27.66666	MZN	CoDi	Community (4 mm, haul 3), 120-0 m
JS	052	ZP03	ZO0010	199905211600	128	76.46	27.66666	MZN	CoDi	Community (1.55 mm, haul 1), 120-0 m
JS	052	ZP03	ZO0011	199905211615	128	76.46	27.66666	MZN	CoDi	Community (1.55 mm, haul 2), 120-0 m
JS	052	ZP03	ZO0012	199905211630	128	76.46	27.66666	MZN	CoDi	Community (1.55 mm, haul 3), 120-0 m
JS	052	ZP03	ZO0013	199905211655	128	76.46	27.66666	MZN	CoDi	Community (4 mm, haul 1), 120-0 m
KB	003	EC00	ZO0001	199905051005	100	76.4	27.2	TTR	Ecot	Ecotox (1 mm, trawl 1), 50 m, down-up
KB	003	EC00	ZO0002	199905051045	103	76.38333	27.18333	TTR	Ecot	Ecotox (1 mm, trawl 2), 20 m, 15 min horizontal trawl
KB	003	EC00	ZO0003	199905052010	99	76.38333	26.91666	TTR	Ecot	Ecotox (1 mm, trawl 3), 50 m, 15 min horizontal trawl
KB	003	EC00	ZO0004	199905051115	103	76.38333	27.1	TTR	Ecot	Ecotox (1 mm, trawl 3), 50 m, 15 min horizontal trawl
KB	008	EC00	TW002	199905061155	310	76.31666	30.08333	TTR	Ecot	Ecotox samples (polar cod, shrimps, other fish) were collected from Russian shrimp trawler "NES". Bottom trawl, 0740-1120.
KB	008	EC00	ZO001	199905060935	294	76.3	30.16666	TTR	Ecot	Ecotox, (1 mm, trawl 1), down-up 100 m wire two times, 50 m depth
KB	008	EC00	ZO002	199905061005	296	76.31666	30.08333	TTR	Ecot	Ecotox, (1 mm, trawl 2), down whole wire - up to 100 m wire - out whole wire - up.
KB	015	EC00	ZO001	199905070905	294	75,88333	34.38333	TTR	Ecot	Ecotox, (1 mm, trawl 1), down 100 m wire three times, ca. 50 m depth.
KB	015	EC00	ZO002	199905070931	235	75.86666	34.48333	TTR	Ecot	Ecotox, (1 mm, trawl 2), down whole wire (325 m) - up to 100 m wire - down whole wire - up
KB	015	EC00	ZO003	199905071008	246	75.85	34.5	TTR	Ecot	Ecotox, (1 mm, trawl 3). Out 314 m wire - 15 min. horizontal trawl – up
KB	015	EC00	ZO004	199905071046	229	75.86666	34.5	TTR	Ecot	Ecotox (1 mm, trawl 4), Out 315 m wire - 10 min. horizontal trawl - up.
KB	031	EC00	DI0001	1999050913.25		76.98333	33.99333	HAN	Ecot	MP, polar cod for ecotox, log no. 374
KB	031	EC00	DI0002	199905091401		76.98333	33.99333	HAN	Ecot	BS, polar cod for ecotox, log no. 376
KB	031	EC00	DI0003	199905091726		76.98333	33.99333	HAN	Ecot	HH, polar cod for ecotox, log no 377
KB	031	EC00	DI0004	199905091744		76.98333	33.99333	HAN	Ecot	MP, polar cod for stable isotopes, lipids and ecotox, log no 378
KB	031	EC00	DI0005	199905091745		76.98333	33.99333	HAN	Ecot	BS, polar cod for ecotox, log no 379

KB	031	EC00	DI0006	199905101030		76.98333	33.99333	HAN	Ecot	JES, polar cod for ecotox, log no 380
KB	031	EC00	DI0007	199905101014		76.98333	33.99333	HAN	Ecot	MP, polar cod for ecotox, log no 381
KB	031	EC00	DI0008	199905101135		76.98333	33.99333	HAN	Ecot	HH, polar cod for ecotox, stable isotopes an lipids, log no 382
KB	031	EC00	DI0009	199905101145		76.98333	33.99333	HAN	Ecot	BS, polar cod for ecotox, stable isotopes an lipids, log no 383
KB	031	EC00	HU0001	199905091730		76.9633	32.9967	SHG	Ecot	1 Brünnich's guillemot. GWG/OGS
KB	031	EC00	HU0002	199905100900		77.01	33.07	SHG	Ecot	11 Brünnich's guillemot. GWG/OGS
KB	033	EC00	HU0003	199905121400		76.7466	33.12833	SHG	Ecot	4 Black guillemot. OGS/BS.
KB	033	EC00	HU0004	199905121600		76.7466	33.12833	SHG	Ecot	2 Black guillemots, 4 Little auks. OGS/BS/FE.
KB	034	EC00	HU0005	199905131500		76.65	33.3116	SHG	Ecot	5 Black guillemots, 4 Black legged kittiwakes, 3 Little auks. OGS/BS
KB	034	EC00	HU0006	199905130900		76.628	33.12166	SHG	Ecot	6 Black legged kittiwakes. GWG/OGS
KB	035	EC00	ZO0001	199905140230	325	77.335	27.195	TTR	Ecot	Ecotox, (1 mm, trawl 1), out 325 m wire, 20 min trawling
KB	049	EC00	DI0010	199905171008		77.425	27.025	HAN	Ecot	JES, polar cod for ecotox, log no 391
KB	049	EC00	DI0011	199905171004		77.425	27.025	HAN	Ecot	HH, polar cod for ecotox, log no 392
KB	049	EC00	DI0012	199905171106		77.425	27.025	HAN	Ecot	MP, polar cod for ecotox, log no 394
KB	049	EC00	DI0013	199905171515		77.425	27.025	HAN	Ecot	MP, polar cod for ecotox, log no 395
KB	049	EC00	DI0014	199905171637		77.425	27.025	HAN	Ecot	HH, polar cod for stable isotopes, log no 396
KB	049	EC00	DI0015	199905171940		77.425	27.025	HAN	Ecot	BS, polar cod for ecotox, log no 397
KB	049	EC00	DI0016	199905172040		77.425	27.025	HAN	Ecot	HH, polar cod for ecotox, log no 398
KB	049	EC00	HU0007	1999051716		77.45	27	SHG	Ecot	6 Brünnich's guillemot, 5 Little auks, 5 Black guillemots. GWG/OGS
KB	049	EC00	ZO0001	199905170635	190	77.42166	27.03333	MZN	Ecot	Ecotox, 1550 μm, 150-0 m
KB	049	EC00	ZO0002	199905170653	190	77.42166	27.03333	MZN	Ecot	Ecotox, 1550 μm, 75-0 m
KB	049	EC00	ZO0003	199905170705	190	77.42166	27.03333	MZN	Ecot	Ecotox, 1550 μm, 75-0 m
KB	049	EC00	ZO0004	199905170725	190	77.42166	27.03333	WP3	Ecot	Ecotox, 50-0 m
KB	049	EC00	ZO0005	199905170738	190	77.42166	27.03333	WP3	Ecot	Ecotox, 50-0 m
KB	049	EC00	ZO0006	199905170748	190	77.42166	27.03333	WP3	Ecot	Ecotox, 50-0 m
KB	049	EC00	ZO0007	199905170755	190	77.42166	27.03333	WP3	Ecot	Ecotox, 50-0 m
KB	049	EC00	ZO0008	199905170805	190	77.42166	27.03333	WP3	Ecot	Ecotox, 50-0 m
KB	049	EC00	ZO0009	199905170815	190	77.42166	27.03333	WP3	Ecot	Ecotox, 50-0 m
KB	049	EC00	ZO0010	199905170821	190	77.42166	27.03333	WP3	Ecot	Ecotox, 50-0 m
KB	049	EC00	ZO0011	199905170830	190	77.42166	27.03333	WP3	Ecot	Ecotox, 50-0 m
KB	049	EC00	ZO0012	199905170845	190	77.42166	27.03333	WP3	Ecot	Ecotox, 50-0 m
KB	049	EC00	ZO013	199905180510	190	77.42166	27.03333	TTR	Ecot	Ecotox, Approx. trawl depth 170 m, 20 min. Touched bottom, benthic brittle stars and polychaetes and mud in the trawl.
KB	049	EC00	ZO014	199905180555		77.42166	27.03333	TTR	Ecot	Ecotox, Approx. trawl depth, 160 m, 20 min.
KB	049	EC00	ZO015	199905180640		77.42166	27.03333	TTR	Ecot	Ecotox, down 225 m to Approx. depth of 160 m, up to wire length 100 m, down to 225 again, up to

										surface
KB	050	EC00	DI0017	199905181700		77.31	27.28	HAN	Ecot	BS, polar cod for ecotox, log no 400
KB	050	EC00	DI0018	199905181620		77.31	27.28	HAN	Ecot	HH, polar cod for ecotox, stable isotopes an lipids, log no 401
KB	050	EC00	DI0019	199905181713		77.31	27.28	HAN	Ecot	MP, polar cod for ecotox, log no 402
KB	050	EC00	HU0008	199905181430		77.31	27.28	SHG	Ecot	3 Black legged kittiwakes. GWG/OGS.
KB	050	EC00	HU0009	199905190900		77.3833	27.41667	SHG	Ecot	1 Black guillemot, 5 black-legged kittiwakes. GWG/OGS.
KB	050	EC00	ZO0001	199905190600	188	77.29666	27.28833	WP3	Ecot	Ecotox, 50-0 m
KB	050	EC00	ZO0002	199905190610	188	77.29666	27.28833	WP3	Ecot	Ecotox, 50-0 m
KB	050	EC00	ZO0003	199905190625	188	77.29666	27.28833	WP3	Ecot	Ecotox, 50-0 m
KB	050	EC00	ZO0004	199905190640	188	77.29666	27.28833	WP3	Ecot	Ecotox, 50-0 m
KB	050	EC00	ZO0005	199905190655	188	77.29666	27.28833	WP3	Ecot	Ecotox, 50-0 m
KB	050	EC00	ZO0006	199905190710	188	77.29666	27.28833	WP3	Ecot	Ecotox, 50-0 m
KB	050	EC00	ZO0007	199905190720	188	77.29666	27.28833	WP3	Ecot	Ecotox, 50-0 m
KB	051	EC00	DI0020	199905201043		77.06667	28.19	HAN	Ecot	MP, polar cod for ecotox, log no 408
KB	051	EC00	DI0021	199905201442		77.06667	28.19	HAN	Ecot	MP, polar cod for ecotox, stable isotopes an lipids, log no 410
KB	051	EC00	HU0010	199905192200		77.1	27.7666	SHG	Ecot	1 Black guillemot, 4 Brünnich's guillemot, 1 Little auk. OGS/BS/KB. Along the ice edge
KB	051	EC00	HU0011	199905201330		77.06667	28.19	SHG	Ecot	3 Black guillemots. GWG/OGS
KB	051	EC00	HU0012	199905201830		77	28.13166	SHG	Ecot	4 Black legged kittiwakes, 4 Little auksGWG/OGS/FE/HG
KB	051	EC00	ZO0001	199905192109	170	77.1	27.76666	TTR	Ecot	Approx. trawl depth 170 m, 20 min. Along the ice edge
KB	051	EC00	ZO0002	199905192210	157	77.1	27.68333	TTR	Ecot	Approx. trawl depth 160 m, 20 min. Along the ice edge
KB	051	EC00	ZO0003	199905192255	167	77.08333	27.83333	TTR	Ecot	Approx. trawl depth 170 m, 20 min. Along the ice edge
KB	052	EC00	ZO0001	199905210500	139	76.53333	27.8	TTR	Ecot	Approx. trawl depth 120 m, 20 min.
KB	052	EC00	ZO0002	199905210545	139	76.53333	27.8	TTR	Ecot	Approx. trawl depth 120 m, 19 min.
KB	052	EC00	ZO0003	199905210625	139	76.53333	27.8	TTR	Ecot	Approx. trawl depth 120 m, 20 min.
MP	002	ZP00	ZO0000	199905050350	101	76.43333	26.36666	MPS	Comm	Community, 92-50-30-10-0 m
MP	002	ZP00	ZO0001	199905050515	102	76.43333	26.36666	WP3	Comm	Community, 90-0 m
MP	003	ZP00	ZO0002	199905051354	102	76.4	27.11666	MPS	Comm	Community, 90-50-30-10-0 m
MP	003	ZP00	ZO0003	199905051905	102	76.4	27.11666	WP3	Comm	Community, 90-0 m
MP	004	ZP00	ZO0016	199905052330	134	76.5	27.76666	WP3	Comm	Community, 125-0 m
MP	004	ZP00	ZO0017	199905052230	134	76.5	27.76666	MPS	Comm	Community, 120-50-30-10-0 m
MP	005	ZP00	ZO0018	199905060145	147	76.53333	28.45	WP3	Comm	Community, 140-0 m
MP	005	ZP00	ZO0019	199905060100	151	76.53333	28.45	MPS	Comm	Community, 140-100-50-30-10-0 m
MP	006	ZP00	ZO0020	199905060402	207	76.46666	29.06666	MPS	Comm	Community, 190-100-50-30-10-0 m
MP	006	ZP00	ZO0021	199905060448	207	76.46666	29.06666	WP3	Comm	Community, 180-0 m

MP	007	ZP00	ZO0022	199905060752	275	76.45	29.66666	WP3	Comm	Community, 200-0 m
MP	007	ZP00	ZO0023	199905060650	275	76.45	29.66666	MPS	Comm	Community, 200-100-50-30-10-0 m
MP	008	ZP00	ZO0024	199905061345	290	76.33333	29.98333	MPS	Comm	Community, 250-100-50-30-10-0 m
MP	008	ZP00	ZO0025	199905061345	275	76.33333	29.98333	WP3	Comm	Community, 250-0 m
MP	009	ZP00	ZO0026	199905061615	300	76.26666	30.63333	MPS	Comm	Community, 240-100-50-30-10-0 m
MP	009	ZP00	ZO0027	199905061645	298	76.26666	30.63333	WP3	Comm	Community, 275-0 m
MP	010	ZP00	ZO0028	199905062000	318	76.21666	31.35	WP3	Comm	Community, 300-0 m
MP	010	ZP00	ZO0029	199905061915	318	76.21666	31.35	MPS	Comm	Community, 300-100-50-30-10-0 m
MP	011	ZP00	ZO0030	199905062204	314	76.15	31.98333	MPS	Comm	Community, 300-100-50-30-10-0 m
MP	011	ZP00	ZO0031	199905062240	310	76.15	31.98333	WP3	Comm	Community, 310-0 m, net was on the bottom
MP	012	ZP00	ZO0032	199905070200	320	76.06666	32.66666	WP3	Comm	Community, 300-0 m
MP	012	ZP00	ZO0033	199905070050	311	76.06666	32.66666	MPS	Comm	Community, 295-100-50-30-10-0 m
MP	013	ZP00	ZO0034	199905070410	296	76.06666	33.36666	MPS	Comm	Community, 182-92-46-15-0 m
MP	013	ZP00	ZO0035	199905070455	296	76.06666	33.36666	WP3	Comm	Community, 258-0 m
MP	014	ZP00	ZO0036	199905070720	276	75.96666	33.9	WP3	Comm	Community, 258-0 m
MP	014	ZP00	ZO0037	199905070650	275	75.96666	33.9	MPS	Comm	Community, 267-100-50-30-10-0 m
MP	015	ZP00	ZO0038	199905071730	227	75.86666	34.4	MPS	Comm	Community, 200-100-50-30-10-0 m
MP	015	ZP00	ZO0039	199905071400	225	75.86666	34.4	WP3	Comm	No sample, net damage
MP	015	ZP00	ZO0040	199905071245	239	75.86666	34.41666	WP2	Lipi	Lipid samples, 220-0 m, strong algae bloom
MP	015	ZP00	ZO0041	199905071300	239	75.86666	34.41666	WP2	Lipi	Lipid samples, 220-0 m, strong algae bloom
MP	031	ZP00	ZO0000	199905091100	162	76.91666	32.91666	WP3	Comm	Community, 150-0 m, MØ 031-01, ice transect A
MP	031	ZP00	ZO0053	199905091030	162	76.91666	32.91666	MPS	Comm	Community, 150-100-50-30-10-0 m, MØ 031-01, ice transect A
MP	031	ZP00	ZO0055	199905091100	162	76.91666	32.91666	WP3	Lipi	Lipids, 150-0 m, MØ 031-01, ice transect A
MP	031	ZP00	ZO0056	199905091100	162	76.91666	32.91666	WP3	Lipi	Lipids, 150-0 m, MØ 031-01, ice transect A
MP	031	ZP00	ZO0057	199905091100	162	76.91666	32.91666	WP3	Ecot	Ecotox, MØ 031-01, ice transect A
MP	031	ZP00	ZO0058	199905091100	162	76.91666	32.91666	WP3	Ecot	Ecotox, MØ 031-01, ice transect A
MP	031	ZP00	ZO0059	199905091100	162	76.91666	32.91666	WP3	Ecot	Ecotox, MØ 031-01, ice transect A
MP	031	ZP00	ZO0060	199905091100	162	76.91666	32.91666	WP2	Comm	Community, 150-0 m, MØ 031-01, ice transect A
MP	031	ZP00	ZO0061	199905091100	162	76.91666	32.91666	WP2	CoDi	Community, 150-0 m, MØ 031-01, ice transect A
MP	031	ZP00	ZO0062	199905091100	162	76.91666	32.91666	MZN	Ecot	Ecotox (1.55 mm), 150-0 m, MØ 031-01, ice transect A
MP	031	ZP00	ZO0063	199905091100	162	76.91666	32.91666	MZN	Ecot	Ecotox (1.55 mm), 150-0 m, MØ 031-01, ice transect A
MP	031	ZP00	ZO0064	199905091100	162	76.91666	32.91666	MZN	Ecot	Ecotox (1.55 mm), 150-0 m, MØ 031-01, ice transect A
MP	031	ZP00	ZO0065	199905091100	162	76.91666	32.91666	MZN	Comm	Community (1.55 mm), 150-0 m, MØ 031-01, ice transect A
MP	031	ZP00	ZO0066	199905091100	162	76.91666	32.91666	MZN	Comm	Community (1.55 mm), 150-0 m, MØ 031-01, ice transect A
MP	031	ZP00	ZO0067	199905091100	162	76.91666	32.91666	MZN	Comm	Community (1.55 mm), 150-0 m, MØ 031-01, ice transect A

MP	031	ZP00	ZO0068	199905091600	169	76.96333	32.99666	MPS	Comm	Community, 150-100-50-30-10-0 m, MØ 031-03, ice transect A
MP	031	ZP00	ZO0069	199905091600	169	76.96333	32.99666	WP3	Comm	Community, 150-0 m, MØ 031-03, ice transect A
MP	031	ZP00	ZO0070	199905091600	169	76.96333	32.99666	WP2	Comm	Community, 150-0 m, MØ 031-03, ice transect A
MP	031	ZP00	ZO0071	199905091600	169	76.96333	32.99666	WP2	Comm	Community, 150-0 m, MØ 031-03, ice transect A
MP	031	ZP00	ZO0072	199905091600	169	76.96333	32.99666	WP2	Comm	Community - Janne S., 150-0 m, MØ 031-03, ice transect A
MP	031	ZP00	ZO0073	199905092200	158	76.99	33.03	MPS	Comm	Community, 150-100-50-30-10-0 m, MØ 031-05, ice transect A, net was at the bottom
MP	031	ZP00	ZO0074	199905092245	158	76.99	33.03	WP3	Comm	Community, 150-0 m, MØ 031-05, ice transect A, some lost - mostly jellies
MP	031	ZP00	ZO0075	199905100420	150	77.006	33.0825	MPS	Comm	Community, 138-100-50-30-10-0 m, MØ 031-07, ice transect A
MP	031	ZP00	ZO0076	199905100500	150	77.006	33,0825	WP3	Comm	Community, 135-0 m, MØ 031-07, ice transect A
MP	031	ZP00	ZO0077	199905100500	150	77.006	33,0825	WP3	Ecot	Ecotox, 135-0 m, MØ 031-07, ice transect A
MP	031	ZP00	ZO0078	199905100500	150	77.006	33.0825	WP3	Ecot	Ecotox, 135-0 m, MØ 031-07, ice transect A
MP	031	ZP00	ZO0079	199905100500	150	77.006	33.0825	WP3	Stab	Stable isotopes, 135-0 m, MØ 031-07, ice transect A
MP	031	ZP00	ZO0080	199905100500	150	77.006	33.0825	MZN	Stab	Stable isotopes (1.55 mm), 135-0 m, MØ 031-07, ice transect A
MP	031	ZP00	ZO0081	199905100500	150	77.006	33.0825	MZN	Stab	1.55 mm, stable isotopes, 135-0 m, MØ 031-07, ice transect A
MP	031	ZP00	ZO0082	199905100500	150	77.006	33.0825	MZN	Ecot	1.55 mm, ecotox, 135-0 m, MØ 031-07, ice transect A
MP	031	ZP00	ZO0083	199905100500	150	77.006	33.0825	MZN	Ecot	1.55 mm, ecotox, 135-0 m, MØ 031-07, ice transect A
MP	031	ZP00	ZO0084	199905101000	141	77.01	33.07	MPS	Comm	Community, 130-100-50-30-10-0 m, MØ 031-09, ice transect A
MP	031	ZP00	ZO0085	199905101000	141	77.01	33.07	WP3	Comm	Community, 130-0 m, MØ 031-09, ice transect A
MP	032	ZP00	ZO0086	199905110830	173	76.87666	32.89166	MPS	Comm	Community, 160-100-50-30-10-0 m
MP	032	ZP00	ZO0087	199905110800	173	76.87666	32.89166	WP3	Comm	Community, 155-0 m
MP	033	SDA2	DIL388	199905111610		76.81166	32.84333	SUP	alga	Mass
MP	033	ZP00	ZO0088	199905111545	190	76.81666	32.81666	WP3	Comm	Community, 175-0 m, MØ 033-01, ice transect A
MP	033	ZP00	ZO0089	199905111320	191	76.81666	32.81666	MPS	Comm	Community, 180-100-50-30-10-0 m, MØ 033-01, ice transect A
MP	033	ZP00	ZO0090	199905111940	186	76.80333	32.52833	MPS	Comm	Community, 170-100-50-30-10-0 m, MØ 033-02, ice transect A
MP	033	ZP00	ZO0091	199905112010	186	76.80333	32.52833	WP3	Comm	Community, 175-0 m, MØ 033-02, ice transect A
MP	033	ZP00	ZO0092	199905120150	170	76.79	32.97166	WP3	Comm	Community, 150-0 m, MØ 033-03, ice transect A
MP	033	ZP00	ZO0093	199905120210	170	76.79	32.97166	MPS	Comm	Community, 150-100-50-30-10-0 m, MØ 033-03, ice transect A
MP	033	ZP00	ZO0094	199905120800	151	76.75	33.07333	MPS	Comm	Community, 145-100-50-30-10-0 m, MØ 033-04, ice transect A

MP	033	ZP00	ZO0095	199905120830	151	76.75	33.07333	WP3	Comm	Community, 140-0 m, MØ 033-04, ice transect A
MP	033	ZP00	ZO0096	199905121330	147	76.74666	33.12833	WP3	Comm	Community, 135-0 m, MØ 033-05, ice transect A
MP	033	ZP00	ZO0097	199905121315	147	76.74666	33.12833	MPS	Comm	Community, 135-100-50-30-10-0 m, MØ 033-05, ice transect A
MP	034	ZP00	ZO0098	199905122200	182	76.63666	32.88666	MPS	Comm	Community, 165-100-50-30-10-0 m, MØ 034-01, ice transect A
MP	034	ZP00	ZO0099	199905122230	200	76.63666	32.88666	WP3	Comm	Community, 175-0 m, MØ 034-01, ice transect A
MP	034	ZP00	ZO0100	199905122255	200	76.63666	32.88666	WP3	Lipi	Lipids, 175-0 m, MØ 034-01, ice transect A
MP	034	ZP00	ZO0101	199905122315	200	76.63666	32.88666	MZN	Lipi	Lipids, 175-0 m, MØ 034-01, ice transect A
MP	034	ZP00	ZO0102	199905130415	186	76.64	33.08833	MPS	Comm	Community, 170-100-50-12-0 m, MØ 034-03, ice transect A
MP	034	ZP00	ZO0103	199905130515	188	76.64	33.08833	WP3	Comm	Community, 175-0 m, MØ 034-03, ice transect A
MP	034	ZP00	ZO0104	199905131020	187	76.62833	33.12166	MPS	Comm	Community, 182-100-50-30-10-0 m, MØ 034-05, ice transect A
MP	034	ZP00	ZO0105	199905131110	187	76.62833	33.12166	WP3	Comm	Community, 175-0 m, MØ 034-05, ice transect A
MP	034	ZP00	ZO0106	199905131615	162	76.65	33.31166	MPS	Comm	Community, 145-100-50-30-10-0 m, MØ 034-07, ice transect A
MP	034	ZP00	ZO0107	199905131635	166	76.65	33.31166	WP3	Comm	Community, 150-0 m, MØ 034-07, ice transect A
MP	034	ZP00	ZO0108	199905132145	166	76.63666	33.30333	MPS	Comm	Community, 150-100-50-30-10-0 m, MØ 034-09, ice transect A
MP	034	ZP00	ZO0109	199905132215	166	76.63666	33.30333	WP3	Comm	Community, 150-0 m, MØ 034-09, ice transect A
MP	035	ZP00	ZO0110	199905150545	316	76.09	32.69333	WP3	Comm	Community, 300-0 m, MØ 035-01, ice transect A
MP	035	ZP00	ZO0111	199905140515	317	76.08666	32.65333	MPS	Comm	Community, 300-100-50-30-10-0 m, MØ 035-01, ice transect A
MP	035	ZP00	ZO0112	199905140545	310	76.08666	32.65333	WP3	Comm	Community, 300-0 m, MØ 035-01, ice transect A
MP	035	ZP00	ZO0113	199905141115	319	76.10833	32.39333	MPS	Comm	Community, 300-100-50-30-10-0 m, MØ 035-03, ice transect A
MP	035	ZP00	ZO0114	199905141230	319	76.10833	32.39333	WP3	Comm	Community, 300-0 m, MØ 035-03, ice transect A
MP	035	ZP00	ZO0115	199905141710	312	76.08333	32.66666	MPS	Comm	Community, 290-100-50-30-10-0 m, MØ 035-05, ice transect A
MP	035	ZP00	ZO0116	199905141750	312	76.08333	32.66666	WP3	Comm	Community, 285-0 m, MØ 035-05, ice transect A
MP	035	ZP00	ZO0117	199905142315	312	76.045	32.365	MPS	Comm	Community, 290-100-50-30-10-0 m, MØ 035-06, ice transect A
MP	035	ZP00	ZO0118	199905142400	312	76.045	32.365	WP3	Comm	Community, 290-0 m, MØ 035-06, ice transect A, big *P. borealis* in net 5
MP	035	ZP00	ZO0119	199905150500	316	76.09	32.69333	MPS	Comm	Community, 290-100-50-30-10-0 m, MØ 035-07, ice transect A
MP	035	ZP00	ZO0120	199905150545	316	76.09	32.69333	WP3	Comm	Community, 300-0 m, MØ 035-07, ice transect A
MP	035	ZP01	TW0002	199905151040	244	76.52666	32.71166	PTR	kril	Mass
MP	049	ZP00	ZO0121	199905170340	188	77.425	27.03333	MPS	Comm	Community 170-100-50-30-10-0 m, MØ 049-01, ice transect B
MP	049	ZP00	ZO0122	199905170415	191	77.425	27.03333	WP3	Comm	Community, 175-0 m, MØ 049-01, ice transect B

MP	049	ZP00	ZO0123	199905171000	187	77.42833	27.07333	MPS	Comm	Community, 170-100-50-30-10-0 m, MØ 049-03, ice transect B
MP	049	ZP00	ZO0124	199905171100	187	77.42833	27.07333	WP3	Comm	Community, 160-0 m, MØ 049-03, ice transect B
MP	049	ZP00	ZO0125	199905171620	196	77.45	27	MPS	Comm	Community, 170-100-50-30-10-0 m, MØ 049-05, ice transect B
MP	049	ZP00	ZO0126	199905171700	196	77.45	27	WP3	Comm	Community, 160-0 m, MØ 049-05, ice transect B
MP	049	ZP00	ZO0127	199905172200	188	77.475	27	MPS	Comm	Community, 180-100-50-30-10-0 m, MØ 049-07, ice transect B
MP	049	ZP00	ZO0128	199905172230	188	77.475	27	WP3	Comm	Community, 160-0 m, MØ 049-07, ice transect B
MP	049	ZP00	ZO0129	199905180430	172	77.515	26.875	MPS	Comm	Community, 176-105-52-31-10-0 m, MØ 049-09, ice transect B
MP	049	ZP00	ZO0130	199905180530	172	77.515	26.875	WP3	Comm	Community, 150-0 m, MØ 049-09, ice transect B
MP	050	ZP00	ZO0131	199905181330	180	77.3	27.28	MPS	Comm	Community, 178-105-52-31-10-0 m, MØ 050-01, ice transect B
MP	050	ZP00	ZO0132	199905181700	180	77.3	27.28	WP3	Comm	Community, 170-0 m, MØ 050-01, ice transect B
MP	050	ZP00	ZO0133	199905181945	171	77.36666	27.16833	MPS	Comm	Community, 167-100-50-30-10-0 m, MØ 050-02, ice transect B
MP	050	ZP00	ZO0134	199905182030	171	77.36666	27.16833	WP3	Comm	Community, 155-0 m, MØ 050-02, ice transect B
MP	050	ZP00	ZO0135	199905190130	173	77.37166	27.16	MPS	Comm	Community, 160-100-50-30-10-0 m, MØ 050-04, ice transect B
MP	050	ZP00	ZO0136	199905190200	173	77.37166	27.16	WP3	Comm	Community, 160-0 m, MØ 050-04, ice transect B
MP	050	ZP00	ZO0137	199905190730	188	77.38333	27.41666	MPS	Comm	Community, 180-100-50-30-10-0 m, MØ 050-05, ice transect B
MP	050	ZP00	ZO0138	199905190900	188	77.38333	27.41666	WP3	Comm	Community, 160-0 m, MØ 050-05, ice transect B
MP	050	ZP00	ZO0139	199905191330	199	77.36833	27.48833	MPS	Comm	Community, 189-100-50-30-10-0 m, MØ 050-06, ice transect B
MP	050	ZP00	ZO0140	199905191400	200	77.36833	27.48833	WP3	Comm	Community, 190-0 m, MØ 050-06, ice transect B
MP	051	ZP00	ZO0141	199905200120	180	77.14	27.9	MPS	Comm	Community, 165-100-50-30-10-0 m, MØ 051-01, ice transect B
MP	051	ZP00	ZO0142	199905200140	180	77.14	27.9	WP3	Comm	Community, 170-0 m, MØ 051-01, ice transect B
MP	051	ZP00	ZO0143	199905200710	177	77.12666	28.13333	MPS	Comm	Community, 164-100-50-30-10-0 m, MØ 051-03, ice transect B
MP	051	ZP00	ZO0144	199905201020	176	77.12666	28.13333	WP3	Comm	Community, 160-0 m, MØ 051-03, ice transect B
MP	051	ZP00	ZO0145	199905201330	181	77.06666	28.19	MPS	Comm	Community, 168-100-50-30-10-0 m, MØ 051-05, ice transect B
MP	051	ZP00	ZO0146	199905201425	168	77.06666	28.19	WP3	Comm	Community, 155-0 m, MØ 051-05, ice transect B
MP	051	ZP00	ZO0147	199905201930	148	77	28.13166	MPS	Comm	Community, 135-100-50-30-10-0 m, MØ 051-07, ice transect B
MP	051	ZP00	ZO0148	199905202000	148	77	28.13166	WP3	Comm	Community, 140-0 m, MØ 051-07, ice transect B
MP	051	ZP00	ZO0149	199905210115	111	76.925	28.085	MPS	Comm	Community, 100-50-30-10-0 m, MØ 051-09, ice transect B, 4 nets only
MP	051	ZP00	ZO0150	199905210140	104	76.925	28.085	WP3	Comm	Community, 95-0 m, MØ 051-09, ice transect B

MP	052	ZP00	ZO0151	199905210800	128	76.51666	27.8	MPS	Comm	Community, 128-100-50-30-10-0 m, MØ 052-01, ice transect B
MP	052	ZP00	ZO0152	199905210915	138	76.51666	27.8	WP3	Comm	Community, 125-0 m, MØ 052-01, ice transect B
MP	052	ZP00	ZO0153	199905211410	133	76.49333	27.71166	MPS	Comm	Community, 120-100-50-30-10-0 m, MØ 052-02, ice transect B
MP	052	ZP00	ZO0154	199905211350	133	76.49333	27.71166	WP3	Comm	Community, 130-0 m, MØ 052-02, ice transect B
MP	052	ZP00	ZO0155	199905212000	129	76.46833	27.68166	MPS	Comm	Community, 122-100-50-30-10-0 m, MØ 052-04, ice transect B
MP	052	ZP00	ZO0156	199905212030	129	76.46833	27.68166	WP3	Comm	Community, 110-0 m, MØ 052-04, ice transect B
MP	052	ZP00	ZO0157	199905220200	129	76.48833	27.755	MPS	Comm	Community, 120-100-50-30-10-0 m, MØ 052-07, ice transect B
MP	052	ZP00	ZO0158	199905220225	129	76.48833	27.755	WP3	Comm	Community, 120-0 m, MØ 052-07, ice transect B
MP	052	ZP00	ZO0159	199905220800	135	76.35	27.67166	MPS	Comm	Community, 124-100-50-30-10-0 m, MØ 052-08, ice transect B
MP	052	ZP00	ZO0160	199905220845	135	76.35	27.67166	WP3	Comm	Community, 120-0 m, MØ 052-08, ice transect B
MP	053	ZP00	ZO0161	199905222300	317	76.09	32.20833	MPS	Comm	Community, 305-100-50-30-10-0 m, MØ 053, ice transect Z
MP	053	ZP00	ZO0162	199905222340	317	76.09	32.20833	WP3	Comm	Community, 300-0 m, MØ 053, ice transect Z
MP	068	ZP00	ZO0163	199905231415	301	76.44166	30.30166	MPS	Comm	Community, 190-100-50-30-10-0 m, MØ 068, ice transect Z
MP	068	ZP00	ZO0164	199905231445	301	76.44166	30.30166	WP3	Comm	Community, 290-0 m, MØ 068, ice transect Z
MP	076	ZP00	ZO0165	199905232240	128	77.04333	27.00333	MPS	Comm	Community, 115-100-50-30-10-0 m, MØ 076, ice transect Z
MP	076	ZP00	ZO0166	199905232310	124	77.04333	27.00333	WP3	Comm	Community, 115-0 m, MØ 076, ice transect Z
SG	001	IP00	IS0000	199905042315		76.57833	25.80333	ICG		2 ice cores for storage, and 1 for melting, 2 snow samples for melting
SG	001	IP00	PI0000	199905042355		76.57833	25.80333	DET		Snow density measurement
SG	001	IP00	PI0001	199905042355		76.57833	25.80333	CDM		Conductivity/salinity measurement on snow and ice
SG	001	IP00	PI0002	199905042355		76.57833	25.80333	DTH		Snow and sea ice temperature measurement
SG	001	IP00	PI0003	199905042355		76.57833	25.80333	NON		Snow and ice thickness measurement
SG	001	IP00	PI0004	199905042355		76.57833	25.80333	DCM		Snow dielectric constant measurement
SG	001	IP00	PI0005	199905042355		76.57833	25.80333	NON		Snow and ice characterization
SG	015	IP01	IS0000	199905071500		75.84	34.36	ICG		Cores A, B (temp.), D, E for storage Core C for melting (salinity) Nilas ice for melting Surface algae samples
SG	015	IP01	PI0000	199905071500		75.84	34.36	DTH		Snow and ice temperature measurement
SG	015	IP01	PI0001	199905071500		75.84	34.36	DCM		Snow dielectric constant measurement
SG	015	IP01	PI0002	199905071500		75.84	34.36	DET		Snow density measurement
SG	015	IP01	PI0003	199905071500		75.84	34.36	CDM		Conductivity/salinity measurement on snow and ice
SG	015	IP01	PI0004	199905071320		75.84	34.36	NON		Snow and ice thickness measurement
SG	015	IP01	PI0005	199905071500		75.84	34.36	NON		Snow and ice characterization

SG	015	IP01	SM0000	199905071300	75.84	34.36	SDC	Measurement from Lance
SG	031	IP02	IS0000	199905091400	76.93166	32.91833	ICG	Cores A-J from 3 different ice types
SG	031	IP02	PI0000	199905101030	76.93166	32.91833	DTH	Snow and ice temperature measurement
SG	031	IP02	PI0001	199905101030	76.93166	32.91833	DET	Density measurement on snow
SG	031	IP02	PI0002	199905101030	76.93166	32.91833	DCM	Liquid water content measurement on snow
SG	031	IP02	PI0003	199905101030	76.93166	32.91833	CDM	Conductivity/salinity measurement of snow and ice
SG	031	IP02	PI0004	199905101030	76.93166	32.91833	NON	Snow and ice characterization
SG	031	IP02	PI0005	199905091500	76.93166	32.91833	SID	50 m thickness profile
SG	031	IP02	SM0000	199905101155	76.93166	32.91833	RFS	Measurements of spectral albedo of surface and transmittance of snow and ice
SG	031	IP02	SM0001	199905101130	76.93166	32.91833	LME	PAR measurements above and in snow
SG	033	IP03	IS0000	199905111800	76.81666	32.81833	ICG	Ice cores A-C
SG	033	IP03	PI0000	199905112100	76.81666	32.81833	DTH	Snow and ice temperature measurement
SG	033	IP03	PI0001	199905112100	76.81666	32.81833	DET	Snow density measurement
SG	033	IP03	PI0002	199905112100	76.81666	32.81833	DCM	Liquid water content of snow measurement
SG	033	IP03	PI0003	199905112100	76.81666	32.81833	CDM	Conductivity/salinity measurement on snow and ice
SG	033	IP03	PI0004	199905111800	76.81666	32.81833	NON	Snow and ice thickness measurement
SG	033	IP03	SM0000	199905111500	76.81666	32.81833	RFS	Measurements of spectral albedo of surface and Transmittance of snow and ice
SG	033	IP03	SM0001	199905111500	76.81666	32.81833	LME	PAR measurements above and in snow PAR measurements above and in snow
SG	033	IP03	SM0002	199905121200	76.81666	32.81833	RFS	UW measurement in open water
SG	034	IP04	IS0000	199905131150	76.65	33.31666	ICG	Ice cores A-C
SG	034	IP04	PI0000	199905131150	76.65	33.31666	DTH	Snow and ice temperature measurement
SG	034	IP04	PI0001	199905131150	76.65	33.31666	DCM	Liquid water content of snow measurement
SG	034	IP04	PI0002	199905131150	76.65	33.31666	DET	Snow density measurement
SG	034	IP04	PI0003	199905131150	76.65	33.31666	CDM	Conductivity/salinity measurement on snow and ice
SG	034	IP04	PI0004	199905131150	76.65	33.31666	NON	Snow and ice thickness measurement
SG	034	IP04	SM0000	199905131025	76.65	33.31666	RFS	Measurements of spectral albedo of surface and transmittance of snow and ice
SG	034	IP04	SM0001	199905131025	76.65	33.31666	LME	PAR measurements above and in snow
SG	049	IP05	IS0000	199905171100	77.445	27.12	ICG	Ice cores A-D
SG	049	IP05	PI0000	199905171300	77.445	27.12	CDM	Conductivity/salinity measurement on snow and ice
SG	049	IP05	PI0001	199905171300	77.445	27.12	DET	Snow density measurement
SG	049	IP05	PI0002	199905171300	77.445	27.12	DTH	Snow and ice temperature measurement
SG	049	IP05	PI0003	199905171300	77.445	27.12	DCM	Liquid water content of snow measurement
SG	049	IP05	PI0004	199905171300	77.445	27.12	NON	Snow and ice thickness measurement
SG	049	IP05	SM0000	199905171510	77.445	27.12	RFS	Measurements of spectral albedo of surface and transmittance of snow and ice
SG	049	IP05	SM0001	199905171510	77.445	27.12	LME	PAR measurements above and in snow
SG	050	IP06	IS0000	199905191030	77.36833	27.16166	ICG	Ice cores A-D
SG	050	IP06	PI0000	199905191115	77.36833	27.16166	CDM	Conductivity/salinity measurement on snow and ice

SG	050	IP06	PI0001	199905191115	77.36833	27.16166	DET	Snow density measurement
SG	050	IP06	PI0002	199905191115	77.36833	27.16166	DTH	Snow and ice temperature measurement
SG	050	IP06	PI0003	199905191115	77.36833	27.16166	NON	Snow and ice thickness measurement
SG	050	IP06	SM0000	199905191315	77.36833	27.16166	RFS	Measurements of spectral albedo of surface, angular distribution
SG	050	IP06	SM0001	199905191315	77.36833	27.16166	LME	PAR measurements above and in snow
SG	051	IP07	IS0000	199905201330	77.14	27.90833	ICG	Ice cores A-D
SG	051	IP07	PI0000	199905201545	77.14	27.90833	CDM	Conductivity/salinity measurement on snow and ice
SG	051	IP07	PI0001	199905201545	77.14	27.90833	DET	Snow density measurement
SG	051	IP07	PI0002	199905201545	77.14	27.90833	DCM	Liquid water content of snow measurement
SG	051	IP07	PI0003	199905201545	77.14	27.90833	DTH	Snow and ice temperature measurement
SG	051	IP07	PI0004	199905201545	77.14	27.90833	NON	Snow and ice thickness measurement
SG	051	IP07	SM0000	199905201120	77.14	27.90833	RFS	Measurements of spectral albedo of surface
SG	051	IP07	SM0001	199905201120	77.14	27.90833	LME	PAR measurements above and in snow

Appendix 2

Datalog Marinøk 2000 cruise

Table 1. Datalog for the Marinøk 2000 cruise

Stat ID	SubStat ID	Activity ID	Date	Depth	Ice	Lat Deg	Lat Min	Lon Deg	Lon Min	Gear Name	Sample	Person ID	Comment
000	IP01	IO0001	200003101845	0	4	74	23.6	17	39.1	DIC		AH	
000	IP02	IO0002	200003110900	0	3	76	42.2	13	14	DIC		AH	
000	IP03	IO0003	200003111200	0	3	77	5.1	13	31.8	DIC		AH	
000	IP04	IO0004	200003111500	0	9	77	8.8	13	40.6	DIC		AH	
000	IP05	IO0005	200003111800	0	5	77	3.9	13	21.6	DIC		AH	
000	IP06	IO0006	200003120900	0	9	75	9.7	17	48.6	DIC		AH	
000	IP07	IO0007	200003121200	0	9	75	2.4	18	55.1	DIC		AH	
000	IP08	IO0008	200003121500	0	5	74	51.2	19	49.3	DIC		AH	
000	IP09	IO0009	200003121800	0	5	75	3.7	21	32.5	DIC		AH	
000	IP10	IO0010	200003130900	0	0	75	41.3	27	54	DIC		AH	
000	IP11	IO0011	200003131200	0	0	75	45.7	28	38.7	DIC		AH	
000	IP12	IO0012	200003131500	0	0	75	55.8	29	39.7	DIC		AH	
000	IP13	IO0013	200003131800	0	0	75	56.5	30	9.6	DIC		AH	
000	IP14	IO0014	200003140900	0	0	76	10.6	32	28.8	DIC		AH	
000	IP15	IO0015	200003141200	0	0	76	9.2	32	57.6	DIC		AH	
000	IP16	IO0016	200003141500	0	0	76	6.3	33	22.4	DIC		AH	
000	IP17	IO0017	200003141800	0	0	76	2.2	33	41.8	DIC		AH	
000	IP18	IO0018	200003150900	0	0	76	26.6	33	20.4	DIC		AH	
000	IP19	IO0019	200003151200	0	0	76	36.9	33	20.5	DIC		AH	
000	IP20	IO0020	200003151500	0	0	76	53.2	33	20.2	DIC		AH	
000	IP21	IO0021	200003151800	0	9	77	9.7	33	20.3	DIC		AH	
000	IP22	IO0022	200003160900	0	9	78	22.7	32	47.5	DIC		AH	
000	IP23	IO0023	200003161200	0	9	78	25.5	32	40.8	DIC		AH	
000	IP24	IO0024	200003161500	0	3	78	16.8	33	3.5	DIC		AH	
000	IP25	IO0025	200003161800	0	6	78	15.8	33	1.6	DIC		AH	
000	IP26	IO0026	200003170900	0	6	78	20.5	33	8.9	DIC		AH	
000	IP27	IO0027	200003171200	0	6	78	21.7	33	19.5	DIC		AH	
000	IP28	IO0028	200003171500	0	6	78	21.9	33	19.7	DIC		AH	
000	IP29	IO0029	200003171800	0	4	78	21.6	33	18.9	DIC		AH	
000	IP30	IO0030	200003180900	0	6	78	28.8	32	49.4	DIC		AH	
000	IP31	IO0031	200003181200	0	6	77	30.7	32	58.2	DIC		AH	
000	IP32	IO0032	200003181500	0	2	77	28.2	33	5.6	DIC		AH	
000	IP33	IO0033	200003181800	0	0	77	28	33	10.7	DIC		AH	
000	IP34	IO0034	200003190900	0	0	76	34.4	31	26.6	DIC		AH	

000	IP35	IO0035	200003191200	0	0	76	28.2	31	30.2	DIC	AH
000	IP36	IO0036	200003191500	0	0	76	27.4	31	25.3	DIC	AH
000	IP37	IO0037	200003191800	0	0	76	15.3	31	25.1	DIC	AH
000	IP38	IO0038	200003200900	0	0	76	27.4	31	27.8	DIC	AH
000	IP39	IO0039	200003201200	0	0	76	29.9	31	25.7	DIC	AH
000	IP40	IO0040	200003201500	0	0	76	31.1	31	20.5	DIC	AH
000	IP41	IO0041	200003201800	0	0	76	35.3	30	53.7	DIC	AH
000	IP42	IO0042	200003210900	0	0	75	44.5	25	50.5	DIC	AH
000	IP43	IO0043	200003211200	0	0	75	25.6	23	34.5	DIC	AH
000	IP44	IO0044	200003211500	0	3	75	20	22	3.1	DIC	AH
000	IP45	IO0045	200003211800	0	9	75	16.1	20	58.7	DIC	AH
000	IP46	IO0046	200003220900	0	3	76	33.3	14	50.7	DIC	AH
000	IP47	IO0047	200003221200	0	2	76	56.7	13	23.7	DIC	AH
000	IP48	IO0048	200003221500	0	3	77	26.1	12	47.4	DIC	AH
000	IP49	IO0049	200003221800	0	2	77	51.2	12	53	DIC	AH
001	PO01	HS0001	200003130404	173		75	32.6	26	36	CTD	EH
002	PO01	HS0001	200003130705	232		75	36.5	27	12.5	CTD	EH
003	PO01	HS0001	200003130910	245		75	40.8	27	49	CTD	EH
004	PO01	HS0001	200003131022	255		75	44.7	28	24.7	CTD	EH
005	PO01	HS0001	200003150407	238		76	10	33	19	CTD	EH
006	PO01	HS0001	200003150507	303		76	15	33	20	CTD	EH
007	PO01	HS0001	200003150610	279		76	20	33	20	CTD	EH
008	PO01	HS0001	200003150710	245		76	25	33	20	CTD	EH
009	PO01	HS0001	200003150940	232		76	27	33	19	CTD	EH
010	PO01	HS0001	200003151046	200		76	32	33	20	CTD	EH
011	PO01	HS0001	200003151140	164		76	37	33	20	CTD	EH
012	PO01	HS0001	200003151240	131		76	42	33	20	CTD	EH
013	PO01	HS0001	200003151343	113		76	47	33	20	CTD	EH
014	PO01	HS0001	200003151435	124		76	52	33	20	CTD	EH
015	PO01	HS0001	200003151535	148		76	57	33	20	CTD	EH
016	PO01	HS0001	200003151630	139		77	2	33	20	CTD	EH
017	PO01	HS0001	200003151724	133		77	7	33	20	CTD	EH
018	PO01	HS0001	200003151825	149		77	12	33	20	CTD	EH
019	PO01	HS0001	200003151930	139		77	17	33	20	CTD	EH
020	PO01	HS0001	200003152037	139		77	22	33	20	CTD	EH
021	PO01	HS0001	200003152040	149		77	27	33	20	CTD	EH
022	PO01	HS0001	200003152140	170		77	32	33	20	CTD	EH
023	PO01	HS0001	200003152235	181		77	37	33	20	CTD	EH
024	PO01	HS0001	200003160120	158		77	42	33	20	CTD	EH
025	PO01	HS0001	200003160140	160		77	47	33	20	CTD	EH
026	PO01	HS0001	200003160240	163		77	52	33	20	CTD	EH
027	PO01	HS0001	200003160330	156		77	57	33	20	CTD	EH

028	PO01	HS0001	200003160425	169		78	2	33	20	CTD		EH	
029	PO01	HS0001	200003160600	164		78	11	33	20	CTD		EH	
030	PO01	HS0001	200003160707	170		78	17	33	8	CTD		EH	
031	PO01	HS0001	200003160825	217		78	22	32	53	CTD		EH	
032	PO01	HS0001	200003161950	156	0	78	16.2	33	0.5	CTD		EH	
033	PO01	HS0001	200003171055	179	0	78	21	33	20.3	CTD		EH	
034	PO01	HS0001	200003180710	148	0	77	27.8	32	40.8	CTD		EH	
035	PO01	HS0001	200003180929	142	0	77	29.1	32	51	CTD		EH	
036	PO01	HS0001	200003181940	144	0	77	25.6	33	10.5	CTD		EH	
037	PO01	HS0001	200003182150	160	0	77	16.6	32	50	CTD		EH	
038	PO01	HS0001	200003182345	182	0	77	8	32	28	CTD		EH	
039	PO01	HS0001	200003190133	210	0	76	59	32	9	CTD		EH	
040	PO01	HS0001	200003190237	219	0	76	55	31	59	CTD		EH	
041	PO01	HS0001	200003190336	240	0	76	50.5	31	50	CTD		EH	
042	PO01	HS0001	200003190437	277	0	76	48	31	43	CTD		EH	
043	PO01	HS0001	200003190531	277	0	76	43.5	31	34	CTD		EH	
044	PO01	HS0001	200003192256	325	0	76	19	31	28.4	CTD		EH	
045	PO01	HS0001	200003200050	314	0	76	29	31	26	CTD		EH	
046	PO01	HS0001	200003200135	315	0	76	32	31	24	CTD		EH	
047	PO01	HS0001	200003200221	287	0	76	36	31	22	CTD		EH	
048	PO01	HS0001	200003200305	274	0	76	39	31	23	CTD		EH	
049	PO01	HS0001	200003200626	315	0	76	26.5	31	25.5	CTD		EH	
050	PO01	HS0001	200003201605	313	0	76	32	31	22	CTD		EH	
051	PO01	HS0001	200003201700	292	0	76	34	31	7	CTD		EH	
052	PO01	HS0001	200003201818	280	0	76	36	31	47.2	CTD		EH	
053	PO01	HS0001	200003201920	272	0	76	38.7	30	28	CTD		EH	
054	PO01	HS0001	200003202025	263	0	76	41.3	30	8.8	CTD		EH	
055	PO01	HS0001	200003202140	261	0	76	43.5	29	47.7	CTD		EH	
056	PO01	HS0001	200003202245	254	0	76	46.4	29	29	CTD		EH	
032	ZO01	ZO0002	200003162110	70		78	16.2	33	0.5	MZN	comm	JS	70-0 m
032	ZO01	ZO0003	200003162120	70		78	16.2	33	0.5	MZN	comm	JS	70-0 m
032	ZO01	ZO0004	200003162140	150		78	16.2	33	0.5	MZN	comm	JS	150-0 m
032	ZO01	ZO0005	200003162330	150		78	16.2	33	0.5	MZN	comm	JS	150-70 m
032	ZO01	ZO0006	200003162355	150		78	16.2	33	0.49998	MZN	comm	JS	150-70 m
032	ZP01	ZO0001	200003162100	70		78	16.2	33	0.49998	MZN	comm	JS	70-0 m
032	ZP02	ZO0001	200003171130	100		78	21	33	20.3	MZN	comm	JS	100-0 m
032	ZP02	ZO0002	200003171155	100		78	21	33	20.3	MZN	comm	JS	100-0 m
032	ZP02	ZO0003	200003171250	100		78	21	33	20.3	MZN	comm	JS	100-0 m
032	ZP02	ZO0004	200003171442	160		78	21	33	20.3	MZN	comm	JS	160-100 m
032	ZP02	ZO0005	200003171501	160		78	21	33	20.3	MZN	comm	JS	160-100 m
032	ZP02	ZO0006	200003171530	160		78	21	33	20.3	MZN	comm	JS	160-100 m
035	ZP01	ZO0001	200003181645	120		77	29.1	32	51	MZN	comm	JS	120-0 m

035	ZP01	ZO0002	200003181700	120		77	29.1	32	51	MZN	comm	JS	120-0 m
035	ZP01	ZO0003	200003181715	120		77	29.1	32	51	MZN	comm	JS	120-0 m
049	ZP01	ZO0001	200003201215	300		76	29.87	31	25.65	MZN	comm	JS	300-0 m
049	ZP01	ZO0002	200003201235	300		76	29.87	31	25.65	MZN	comm	JS	300-0 m
049	ZP01	ZO0003	200003201255	300		76	29.87	31	25.65	MZN	comm	JS	300-0 m
049	ZP01	ZO0004	200003201310	300		76	29.87	31	25.65	MZN	comm	JS	300-0 m
049	ZP01	ZO0004	200003201310	300		76	29.87	31	25.65	MZN		JS	
012	ZP01	PP0006	200003151520	131		76	42	33	20	NIB		JW	Chl *a* and species comp. from 5, 10, 50 m
032	ZP01	PP0006	200003162355	150		78	16.2	33	0.49998	NIB		JW	Chl *a* 0, 5, 10, 20, 70 and 70 m 2x
032	ZP01	PP0006	200003151520	131		76	42	33	20	NIB		JW	
034	ZP01	PP0006	200003181806	131		76	42	33	20	NIB		JW	
034	ZP01	PP0006	200003181806	131		76	42	33	20	SUP		JW	
038	ZO01	PP0006	200003181806	182		77	8	32	28	NIB		JW	Chl *a* and species comp. from 0, 5, 10 m
038	ZP	PP	200003181600	182	0	77	0	32	28	NIB		JW	Chl *a* 0, 5, 10m
038	ZP02	PP0002	200003180900	0	3	77	8	32	28	NIB		JW	
039	ZP01	PP0006	200003188033	210		76	59	32	9	NIB		JW	Chl *a* and species composition from 0, 5, 10 m
041	ZP01	PP0006	200003190033	210		76	50	31	50	NIB		JW	Chl *a* and species composition from 0, 5 and 10 m
043	ZO01	PP0006	200003190041	277		76	43.5	31	50	NIB		JW	Chl *a* conc. 0, 5, 10 m
043	ZP01	PP0006	200003190041	277		76	43.5	31	50	NIB		JW	Chl *a* and species comp. from 0, 5, 30 m
032	ZP00	ZO0001	200003161633	177		78	15	33	7	TTR	com	KDale	Net 1:130-90 (10 min), net 2: 90-50 (7 min), net 3: 50-0 (7 min); lipids, stable isotopes and ecotox.
032	ZP00	ZO0001	200003161730	167		78	15	33	7	TTR	com	KDale	Net 1: 150-90 (7 min), net 2: 90-0 (10 min); lipids, stable isotopes and ecotox
033	ZP	ZO	200003171830	170		78	20	33	13	TTR	com	KDale	Net 3: 150-140 (5 min), 140-130 (5 min), 130-120 (5 min), 120- 110 (5 min),110-100 (5 min); lipids, stable isotopes and ecotox
033	ZP	ZO	200003171005	178		78	20	33	13	TTR	com	KDale	Net 3: 160 (17 min); lipids and ecotox
033	ZP	ZO	200003171005	178		78	20	33	13	TTR	com	KDale	Net 3: 160 (17 min); lipids, stable isotopes and ecotox
033	ZP	ZO	200003171740	174		78	20	33	13	TTR	com	KDale	Net 3: 10-20 (10 min), 20-30 (5 min), 30-40 (5 min), 40-50 (5 min); lipids, stable isotopes and ecotox
033	ZP	ZO	200003171600	170		78	20	33	13	TTR	com	KDale	Net 3: 150 (10 min), 160 (5 min),140 (5 min), 130 (5 min), 70 (5 min), 40 (5 min); lipids, stable isotopes and ecotox
034	ZP	ZO	200003181830	148		77	29	32	54	TTR	com	KDale	Net 3: 110-0 (10x 5 min); lipids and

											ecotox
034	ZP	ZO	200003181600	160	77	29	32	54	TTR	com	KDale	Net 3: 130-0 (12x 5 min), lipids, stable isotopes and ecotox
034	ZP	ZO	200003181015	144	77	29	32	54	TTR	com	KDale	Net 3: 120-0 (10x5 min); lipids, stable isotopes and ecotox
049	ZP00	ZO0006	200003201100	313	76	27	31	27	TTR	Popd	KDale	Net 3: 290 (20 min), lipids, stable isotopes and ecotox
049	ZP00	ZO0006	200003201515	316	76	27	31	27	TTR	Popd	KDale	Net 3: 290 (20 min); lipids, stable isotopes and ecotox
049	ZP00	ZO0006	200003201030	313	76	27	31	27	TTR	Popd	KDale	Net 3: 250 (20 min); lipids, stable isotopes and ecotox
049	ZP00	ZO0006	200003201515	316	76	27	31	27	TTR		KDale	Samples for lipids, stable isotopes and ecotox
049	ZP00	ZO0006	200003201330	313	76	27	31	27	TTR	Popd	KDale	Net 3: 290-50 (20x 3 min); lipids, stable isotopes and ecotox
031	ZP00	ZO0001	200003161225	247	78	25.5	32	4.9	MPS	Comm	MP	229-100-50-30-10-0 m, no WP-3 because of ice
032	ZP00	ZO0001	200003162025	158	78	16.2	33	0.5	WP2	Lipi	MP	150-0 m; stable isotopes and lipids
032	ZP00	ZO0001	200003162005	158	78	16.2	33	0.5	WP3	Comm	MP	150-0 m
032	ZP00	ZO0001	200003161910	148	78	16.2	33	0.5	MPS	Comm	MP	135-100-50-30-10-0 m
033	ZP00	ZO0001	200003171310	181	78	20	33	13	WP3	Comm	MP	170-0 m
033	ZP00	ZO0001	200003170930	183	78	20	33	13	WP3	Lipi	MP	170-0 m; stable isotopes and lipids
033	ZP00	ZO0001	200003171330	181	78	20	33	13	MPS	Comm	MP	160-100-50-30-10-0 m
034	ZP00	ZO0001	200003180950	140	77	29.1	32	50.9	WP3	Comm	MP	120-0 m
034	ZP00	ZO0001	200003180900	177	77	29.1	32	50.9	MPS	Comm	MP	160-100-50-30-10-0 m, strong net drift, net 1 hit the bottom, ice in net 5
049	ZP00	ZO0000	200003200845	313	76	26.5	31	25.5	WP3	Lipi	MP	300-0 m
049	ZP00	ZO0000	200003200825	313	76	26.5	31	25.5	WP3	Comm	MP	298-0 m
049	ZP00	ZO0000	200003200700	312	76	26.5	31	25.5	MPS	Comm	MP	298-100-51-31-10-0 m

Table 2. Meteorological observations, Marinøk cruise 2000

Ice ID	Cruise ID	Stat ID	Sub Stat ID	Activity ID	Photo ID	Date	Headin g	Speed	Latitude	Longitude	Validity	Observer	Wind Dir	Wind Speed
4	MA00	000	IP01	IO0001		10032000	340	9	74.39333	17.65166	1	AH	30	17
5	MA00	000	IP02	IO0002	sf01	11032000	22	11.5	76.70333	13.23333	1	AH	90	21
6	MA00	000	IP03	IO0003	sf02	11032000	26	7	77.085	13.53	5	AH	90	12
7	MA00	000	IP04	IO0004	sf03	11032000	0	0	77.14666	13.67666	5	AH	100	15
8	MA00	000	IP05	IO0005	sf04	11032000	200	3	77.065	13.36	5	AH	300	10
9	MA00	000	IP06	IO0006	sf05	12032000	90	8	75.16166	17.81	5	AH	0	26
10	MA00	000	IP07	IO0007	sf06	12032000	180	7.5	75.04	18.91833	5	AH	270	17
11	MA00	000	IP08	IO0008	sf07	12032000			74.85333	19.82166	5	AH	30	19
12	MA00	000	IP09	IO0009	sf08	1203.000	68	9	75.06166	21.54166	5	AH	330	26
13	MA00	000	IP10	IO0010		13032000	66	7	75.68833	27.9	2	AH	60	43
14	MA00	000	IP11	IO0011		13032000	82	4	75.76166	28.645	2	AH	30	40
15	MA00	000	IP12	IO0012		13032000	69	7	75.93	29.66166	3	AH	45	37
16	MA00	000	IP13	IO0013		13032000	107	4	75.94166	30.16	5	AH	90	28
17	MA00	000	IP14	IO0014		14032000	112	3	76.17666	32.48	3	AH	30	36
18	MA00	000	IP15	IO0015		14032000	127	3.5	76.15333	32.96	5	AH	30	36
19	MA00	000	IP16	IO0016		14032000	128	3	76.105	33.37333	3	AH	30	31
20	MA00	000	IP17	IO0017		14032000	137	3.5	76.03666	33.69666	5	AH	30	31
21	MA00	000	IP18	IO0018		15032000	326	5	76.44333	33.34	5	AH	210	21
22	MA00	000	IP19	IO0019		15032000	0	6	76.615	33.34166	5	AH	150	22
23	MA00	000	IP20	IO0020		15032000	4	8	76.88666	33.33666	5	AH	120	15
24	MA00	000	IP21	IO0021	sf09	15032000	0	8	77.16166	33.33833	1	AH	90	12
25	MA00	000	IP22	IO0022	sf10	16032000	330	7	78.37833	32.79166	1	AH	150	15
26	MA00	000	IP23	IO0023	sf11	16032000	129	0	78.425	32.68	5	AH	45	12
28	MA00	000	IP24	IO0024	sf12	16032000	148	6.5	78.28	33.05833	5	AH	30	22
29	MA00	000	IP25	IO0025	sf13	16032000	355	3	78.26333	33.02666	3	AH	180	14
30	MA00	000	IP26	IO0026	sf14	17032000	76	0	78.34166	33.14833	5	AH	120	9
32	MA00	000	IP27	IO0027	sf15	17032000	66	0	78.36166	33.325	5	AH	120	7
33	MA00	000	IP28	IO0028	sf16	17032000	252	0	78.365	33.32833	5	AH	180	5
34	MA00	000	IP29	IO0029	sf17	17032000	102	2.5	78.36	33.315	5	AH	60	9
35	MA00	000	IP30	IO0030	sf18	18032000	239	1	77.48	32.82333	5	AH	330	28
36	MA00	000	IP31	IO0031	sf19	18032000	220	1.5	77.51166	32.97	5	AH	0	18
37	MA00	000	IP32	IO0032	sf20	18032000	187	1.3	77.47	33.09333	5	AH	0	23
38	MA00	000	IP33	IO0033		18032000	204	2	77.46666	33.17833	5	AH	30	24
39	MA00	000	IP34	IO0034		19032000	165	2	76.57333	31.44333	5	AH	30	34
40	MA00	000	IP35	IO0035		19032000	191	3	76.47	31.50333	5	AH	0	31
42	MA00	000	IP36	IO0036		19032000	186	2.4	76.39	31.42166	3	AH	330	35
43	MA00	000	IP37	IO0037		19032000	180	2	76.255	31.41833	3	AH	0	20
44	MA00	000	IP38	IO0038		20032000	340	0	76.45666	31.46333	5	AH	90	7

45	MA00	000	IP39	IO0039		20032000	6	1	76.49833	31.42833	3	AH	60	18
46	MA00	000	IP40	IO0040		20032000	40	1.7	76.51833	31.34166	2	AH	30	28
47	MA00	000	IP41	IO0041		20032000	300	7.5	76.58833	30.895	1	AH	120	16
48	MA00	000	IP42	IO0042		21032000	236	13	75.74166	25.84166	5	AH	150	16
49	MA00	000	IP43	IO0043		21032000	240	12	75.42666	23.575	2	AH	120	20
50	MA00	000	IP44	IO0044	sf21	21032000	86	1	75.33333	22.05166	2	AH	270	29
51	MA00	000	IP45	IO0045		21032000	268	4.6	75.26833	20.97833	2	AH	120	32
53	MA00	000	IP46	IO0046		22032000	302	12	76.555	14.845	5	AH	90	17
54	MA00	000	IP47	IO0047		22032000	325	11	76.945	13.395	5	AH	30	25
55	MA00	000	IP48	IO0048		22032000	358	10	77.435	12.79	5	AH	0	22
56	MA00	000	IP49	IO0049		22032000	12	10	77.85333	12.88333	5	AH	30	27

Table 3. Meteorological observations, Marinøk cruise 2000 continued

Stat ID	Sub Stat ID	Air Temp	Water Temp	Humidity	Pressure	Cloud Cover	Comments	X-Wind Component	Y-Wind Compone nt	Real Wind Speed (knots)	Real Wind Direction	Real Wind Speed (km h^{-1})
000	IP01	-11	-1.4	94	1011	2		-0.13	25.20	25.20	359.71	46.67
000	IP02	-10.3	0.5	97	1009	3		23.78	2.80	23.94	83.29	44.34
000	IP03	-13.3	-1	97	1008	2		13.85	1.03	13.89	85.74	25.73
000	IP04	-12.4	-1.9	97	1007	3		14.77	-2.60	15.00	100.00	27.78
000	IP05	-13.8	-1.4	97	1005	3		5.40	-10.48	11.79	152.73	21.83
000	IP06	-7.3	-1.8	97	1001	2		34.00	0.00	34.00	90.00	62.97
000	IP07	-10	-2.3	97	1001	2		17.00	-7.50	18.58	113.81	34.41
000	IP08	-9	-2.1	97	1000	2		9.50	16.45	19.00	30.00	35.19
000	IP09	-12.3	-2.1	97	1000	2		24.35	23.86	34.09	45.58	63.14
000	IP10	-0.7	1.9	97	974	3		41.18	-22.43	46.89	118.57	86.85
000	IP11	-0.9	2.2	97	974	3		41.05	-14.43	43.51	109.37	80.58
000	IP12	-0.9	2.3	97	971	3		40.34	-12.54	42.24	107.27	78.23
000	IP13	-0.3	1.7	97	970	3		-4.36	-27.95	28.28	188.87	52.38
000	IP14	0	-0.8	97	972	3		24.95	-29.49	38.63	139.77	71.54
000	IP15	0.5	1.4	97	975	3		16.86	-35.24	39.07	154.43	72.36
000	IP16	0.8	1.4	97	976	3		13.98	-30.59	33.63	155.44	62.29
000	IP17	0.9	1.1	97	979	3		9.36	-32.77	34.08	164.06	63.11
000	IP18	0.9	1.1	97	992	3		-1.33	-16.80	16.86	184.53	31.22
000	IP19	-0.1	-2.1	97	997	3		11.00	-13.05	17.07	139.88	31.61

000	IP20	-0.4	-2.1	95	999	3	12.99	-0.41	13.00	91.80	24.08
000	IP21	-1.7	-2.1	97	1001	3	12.00	8.00	14.42	56.31	26.71
000	IP22	-0.6	-2.1	97	1000	3	9.49	-1.44	9.60	98.61	17.78
000	IP23	-1.1	-2.2	97	1000	3	1.25	-11.93	12.00	174.00	22.22
000	IP24	-1.3	-2.1	97	1004	1	4.21	-27.50	27.82	171.29	51.52
000	IP25	-1.1	-2.1	97	1005	1	0.96	-10.96	11.00	175.00	20.37
000	IP26	-3.1	-2.1	97	1012	2	-2.48	-8.65	9.00	196.00	16.67
000	IP27	-2.3	-2.1	97	1013	1	-0.73	-6.96	7.00	186.00	12.96
000	IP28	-3.1	-2.1	97	1013	1	4.76	1.55	5.00	72.00	9.26
000	IP29	-2.6	-2.1	97	1011	1	5.23	-9.08	10.48	150.07	19.40
000	IP30	-1.3	-2.1	97	995	3	-14.43	-25.00	28.87	209.99	53.47
000	IP31	-1	-2.1	97	998	2	-12.53	-14.94	19.50	220.00	36.11
000	IP32	-0.2	-2.1	97	996	3	-2.96	-24.12	24.30	187.00	45.00
000	IP33	-1.5	-2.1	97	996	2	-20.23	-15.93	25.75	231.77	47.69
000	IP34	2	0.9	88	986	3	-8.28	-34.77	35.75	193.40	66.20
000	IP35	1.6	0.5	94	982	3	-6.49	-33.38	34.00	191.00	62.97
000	IP36	0.6	1.6	97	976	3	13.98	-34.36	37.10	157.85	68.71
000	IP37	1.9	1.6	95	973	2	0.00	-22.00	22.00	180.00	40.74
000	IP38	-0.7	1.3	97	965	1	6.58	2.39	7.00	70.00	12.96
000	IP39	-0.8	0.6	97	964	3	16.55	8.32	18.52	63.32	34.30
000	IP40	-0.6	0.6	97	960	3	27.40	10.88	29.48	68.35	54.61
000	IP41	-0.2	1.4	97	958	3	7.36	11.75	13.87	32.07	25.68
000	IP42	-0.5	-0.9	97	959	3	-3.76	7.11	8.05	332.11	14.90
000	IP43	-1.3	-1.8	97	962	3	-10.39	14.00	17.44	323.41	32.29
000	IP44	-2.4	-2.1	97	964	3	-1.03	29.00	29.02	357.97	53.74
000	IP45	-2.9	-2.2	97	967	3	10.43	28.09	29.97	20.36	55.50
000	IP46	-1.2	-1.5	97	984	3	-1.17	20.78	20.81	356.78	38.54
000	IP47	-1	-1.4	96	990	2	-8.49	33.92	34.96	345.95	64.75
000	IP48	-1.8	-1.6	90	993	2	-1.12	31.98	32.00	358.00	59.26
000	IP49	-2.1	-2.1	83	994	2	20.15	29.85	36.01	34.02	66.69


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