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Rapportens Tittel:

REPORT FROM CRUISE WITH KV "SENJA" AND KV "ANDENES" TO THE BARENTS SEA, 1-24 APRIL 1986 (PRO MARE CRUISE NO.7)

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Prosjekt Nr:

Oppdragsgiver ref:

PRO MARE (NFFR, NAVF, MD)

Ansvarlig:

Sammendrag: The purpose of the cruise was to investigate the plankton development in early spring. This report, which is mainly administrative, summarizes information on cruise participants, cruise tracks and stations, sampling and laboratory facilities. An overview of hydrographical conditions and phytoplankton development is also given. Melting of ice in Atlantic water had produced stratified conditions which favoured early bloom development. In terms of phytoplankton, the stations occupied ranged from late winter prebloom situation to an active spring bloom situation half way towards nutrients depletion.

Stikkord:

Ice edge

Spring bloom

Zooplankton reproduction

Sendt til:

NAVF

NFFR

MD

PRO

KYSTV

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PREWORD

The Norwegian Research Program for Marine Arctic Ecology (PRO MARE) is a 6 years program (1984-1989). The study area is the central and northern part of the Barents Sea. PRO MARE consists of applied basic research with the aim to provide background information for better management of the living resources and for evaluation of possible consequences of future oil development.

Six cruises have so far been organized within the framework of PRO MARE. This is the 7th PRO MARE cruise and the first onboard a vessel from the Norwegian Coast Guard. PRO MARE gratefully acknowledges this support from the Coast Guard. We would especially like to thank Commander Gulliksrud and his crew onboard K/V "Senja" and Commander Kjeldsen and his crew onboard K/V "Andenes" for all the help we received and for their positive attitude towards our mission.

INTRODUCTION

Previous plankton investigations in the Barents Sea, both prior to and in PRO MARE, have mainly been carried out during late spring and summer. It has been clear, however, that the onset of the phytoplankton development and zooplankton reproduction occur fairly early in the spring. The onset of the spring phytoplankton increase depends on the mechanisms for water column stabilization and can take place in April or even late March in the ice edge area (REY and LOENG 1985, SLAGSTAD 1985). The main spawning of the important copepod Calanus finmarchicus seems also to take place in April (SKJOLDAL et al. 1986).

The present cruise was scheduled for April in order to study this early spring development and reproduction of the plankton. The ice-going coast guard vessels KV "Senja" and KV "Andenes" made it possible to extend the investigations from open water and into ice covered water. The winter of 1985/86 was cold with more southerly distribution of ice than during the last few years. This prevented us from going beyond 76^0N and into the true Arctic waters north of the polar front. The phytoplankton spring bloom constitutes about 50% of the annual primary production in the Barents Sea (REY et al. 1986). Due to its great quantitative importance, it is particularly important that the spring bloom dynamics are thoroughly understood and properly modelled. Similarly, we need detailed knowledge of the spawning and early development of the dominant zooplankters, especially how and to what extent these processes depend on the growth of phytoplankton.

The relationships between the physical environment and phytoplankton growth on one hand, and between phytoplankton growth and zooplankton reproduction on the other, were central themes for the present investigation. This was carried out by representatives of several different PRO MARE projects as well as some outside PRO MARE, studying organisms ranging from bacteria and heterotrophic flagellates through phytoplankton and microzooplankton to larger zooplankters. As a supplement to this field study, efforts in mathematical modelling of plankton was concentrated on the spring plankton development (SLAGSTAD

1986).

The present report is mainly administrative, summarizing information on cruise tracks, stations, sampling, etc. It also provides a broad overview of the physical environmental conditions and the biological development. More detailed results will be presented later in a data report with separate contributions from the participating projects.

CRUISE PARTICIPANTS

The different projects that were represented on the cruise are summarized in Table 1. Table 2 gives a list of the cruise participants as well as their institutional and project affiliation.

Table 1. Projects represented on the cruise.

Project name	Code
<u>PRO MARE projects</u>	
Feeding conditions of capelin and herring in the Barents Sea	a
Nitrogen cycling in the Arctic	b
Marine ecological research in Arctic: phytoplankton	c
Algae in ice and polynyas	d
Microbial heterotrophic activity	e
The role of ciliates in the Arctic pelagic ecosystem	f
<u>Calanus</u> <u>finmarchicus</u> and <u>C</u>. <u>glacialis</u> in the Barents Sea - growth strategy and ecological importance	g
Sedimentation in the marginal ice zone	h
Under-ice fauna in the Arctic	i
<u>Other projects</u>	
Bio-optical properties of the Barents Sea	j
Nanoplankton biomass in the Barents Sea	k
Vertical mixing in the water column (radium, radon)	l

Nine different projects from PRO MARE participated on the cruise. Seven of these were plankton projects whereas the remaining two dealt with under-ice fauna and ice flora. In addition, 3 projects from outside PRO MARE were represented.

The number of scientific personnel was 25 both on KV "Senja" and KV "Andenes". The total number of cruise participants was 31; 19 of these joined the cruises with both ships whereas 12 participated on one ship only (Table 2). Eleven of the scientific cruise members came from the Institute of Marine Research in Bergen, 6 from the University of Tromsø, 4 from the University of Bergen, 3 from the University of Oslo, 2 from the University of Trondheim, and 5 were visiting scientists from several universities in USA.

Table 2. List of participants on the cruises with KV "Senja" and KV "Andenes".

Name	Institution[1]	Project code	KV "Senja"	KV "Andenes"
Einarsen, Signe	FHI	a		x
Hagebø, Magnar	FHI	a	x	x
Hassel, Arne	FHI	a	x	x
Klungsøyr, Jarle	FHI	a		x
Leinebø, Reidar	FHI	a		x
Melle, Webjørn	FHI	a	x	x
Mora, Fernando	FHI	a	x	x
Omli, Lena	FHI	a	x	x
Rey, Francisco	FHI	a	x	x
Skjoldal, Hein Rune	FHI	a	x	x
Træland, Jorunn	FHI	a	x	
Farbrot, Tove	UiO	b	x	x
Kristiansen, Svein	UiO	b	x	x
Kokkinakis, Steven	OSU, USA	b	x	x
Wassmann, Paul	UiO	h	x	

Eilertsen, Hans Chr.	UiTø	c		x
Hansen, Jon R.	UiTø	c	x	
Hansen, O.B.	UiTø	c		x
Jakobsen, Tove	UiTø	g	x	
Tande, Kurt	UiTø	g		x
Seim, Bjørnar	UiTø	i	x	x
Haugen, Tore	UiTr	d	x	
Hegseth, Else Nøst	UiTr	d	x	x
Martinusen, Ingrid	UiB	e	x	x
Thingstad, T. Frede	UiB	e	x	x
Dale, Torbjørn	UiB	f	x	x
Hewes, Christopher	UiB	k	x	x
Chamberlin, W. Sean	USC, USA	j	x	x
Holm-Hansen, Osmund	SIO, USA	j	x	
Bell, Linda	USF, USA	l	x	x
Fanning, Kent	USF, USA	l	x	x

[1] FHI : Institute of Marine Research, Directorate of Fisheries
UiB : University of Bergen
UiO : University of Oslo
UiTr: University of Trondheim
UiTø: University of Tromsø
OSU : Oregon State University
USC : University of Southern California, Los Angeles
SIO : Scripps Institution of Oceanography
USF : University of South Florida

The cruise leader was Hein Rune Skjoldal.

SHIPS AND FACILITIES

KV "Senja" and KV "Andenes" are coast guard vessels of the Nordkapp class. They are 105 m long and constructed for operating in Arctic waters. Assistance in oceanographic research is one of the general tasks of the Norwegian Coast Guard. Laboratory space has been set aside onboard the Nordkapp-class vessels, but these laboratories are only to a limited extent equipped for specific research purposes. For the present cruise the ships were equipped for our specific needs with regards to both laboratory conditions and facilities for biological and hydrographical sampling. The planning for this was based on visits onboard KV "Andenes" in December, KV "Nordkapp" in February and KV "Andenes" in March.

Eight different rooms, including the storage room, were available and used as laboratories. These were:

- Hydrogenroom at 01 deck, 9m^2; used for nutrients analysis and by Dr. Fanning.

- Meteorological laboratory at 01 deck, 11m^2; used for nitrogen work by Kristiansen and his group.

- Wet laboratory at the main deck, 11m^2; used for zooplankton work by Dale and Hassel with coworkers.

- Surveyance laboratory at the main deck, 10m^2; used for CTD and fluorometer deck units, and by Sean Chamberlin.

- Dark room at the main deck; used for fluorescence microscopy (Hewes).

- Dry laboratory (no. 138) at deck 2 (below main-deck), 10m^2; used for work with phytoplankton and grazing (Eilertsen, Hegseth, Tande and coworkers).

- Dry laboratory (no. 134) at deck 2, 14m^2; used for work with phytoplankton and microbiology (Rey, Thingstad and coworkers).

- Storage room at deck 2, $20m^2$; used for incubator systems and scintillation counter.

Altogether, about $95m^2$ of laboratory space was available and this proved sufficient for our purposes. Each laboratory was equipped with benches, shelves, etc. by the various scientists according to their specific needs. This was done rather provisionally using beams and plywood, and in a way which facilitated the transfer from one ship to the other.

In addition to the above laboratories, two offices were at our disposal for paper work and for setting up personal computers.

All sampling was carried out from the after deck. Three different winches were brought onboard for this purpose. The CTD winch was borrowed from the Instrument Service of NAVF (The Norwegian Research Council for Science and the Humanities). A second winch was rented and used for operating water bottles and plankton nets. Fundaments for these two winches were welded to the deck and the winches were mounted by screwing them onto the fundaments.

The CTD and hydrography winches were mounted along side each other on the starbord side. A specially made A-frame was mounted in the port opening in the rail on the starboard side. This frame carried the 2 meter wheels for the CTD cable and the hydrography wire respectively.

A third and smaller winch was used to operate an <u>in situ</u> Q fluorometer. This winch was placed in front of the other two winches and tied down with ropes.

The ship's towing winch and the crane on the after deck was used when operating the more heavy equipment for zooplankton sampling, i.e. a plankton pump ("Hufsa") and a Gulf III towing plankton sampler. A 10-mm wire was winded onto the winch on top of the towing wire.

The CTD and hydrography winches were electro-hydraulic. Their power supply was not a problem on KV "Andenes" since this ship had been modified in connection with the Norwegian Antarctic Expedition in 1984/85. On KV "Senja", on the other hand, power lines had to be installed for the electricity needed on the after deck.

A practical general problem was caused by the 60 Hz (115 V) currency that was used onboard the coast guard vessels. This necessitated the use of currency transformers or modifications of some of the equipment that was used. Each of the participating projects had to solve their specific problems in this respect. For the incubator system that was in common use by several projects, a currency transformer was built at the University of Oslo from two electromotors operating on 60 Hz and 50 Hz, respectively.

The vessels had a Lynx helicopter stationed onboard during the cruise. Use of the helicopter could be incorporated in our plans. Besides frequent use for ice reconnaissance, the helicopter was used to bring personnel to and from an ice floe sampling station.

In retrospect, and for the benefit for possible future cruises, we can identify the following weak points in our planning and preparation for the cruise.

- We did not properly communicate our specific requirements and needs to the coast guard, and they were accordingly not aware of our rather complicated and extensive logistical requirements. This made the last part of the preparation period more hectic and confusing than it should have been. Early contact and exchange of information with the coast guard, both centrally and directly with the ships to be used, is therefore important.

- The cruise was arranged so that we disposed two vessels in about 2 weeks each. The transfer of equipment and personnel was quite extensive and had to be done in port. The transfer and steaming from and to the investigation area took almost 4 days of our cruise time. It would have been equally effective and logistically much simpler if one ship could be disposed in 3 weeks rather than two ships for a total of 4 weeks.

- The low air temperatures (-15 to -18^{0}C) during much of the time in the ice caused some problems that delayed the station work on the after deck. The winches were often difficult to start in the cold. Withdrawal of samples from the water bottles which took place on deck, was complicated due to rapid freezing of the sample water. Freezing also caused malfunctioning of the water bottle rossette and thawing in -1.8^{0}C seawater is indeed a slow process. A heated shelter on the after deck for storing and withdrawal of samples from the water bottles would have reduced these problems considerably. Use of hydraulic winches coupled to the hydraulic system of the ship would also have been advantageous.

As a general conclusion, however, the coast guard vessels functioned remarkably well as research vessels for our purposes. There was reasonably good working space for 25 scientists doing rather demanding laboratory work. The officers and crew members were very cooperative and we are grateful for all the help we received on both KV "Senja" and KV "Andenes".

CRUISE TRACKS AND STATIONS

Fig. 1 shows the cruise tracks and stations worked during the cruise legs with KV "Senja" and KV "Andenes". The positions, times, and samples taken at the various stations are tabulated in Appendix A.

We were limited to working in the Norwegian sector of the Barents Sea where the major effort was spent in the Hopen Depth and the western slope of the Central Bank. During the first leg with KV "Senja" we also crossed the Svalbard Bank.

The cruise tracks for KV "Senja" as they appear on Fig. 1 are more erratic than intended due to rescue missions that the ship had to carry out. This caused some delay but had no serious effect on our scientific program.

Due to the cold weather and northerly winds, the ice was distributed far to the South (about 75^{0}N) in the central Barents Sea and it was

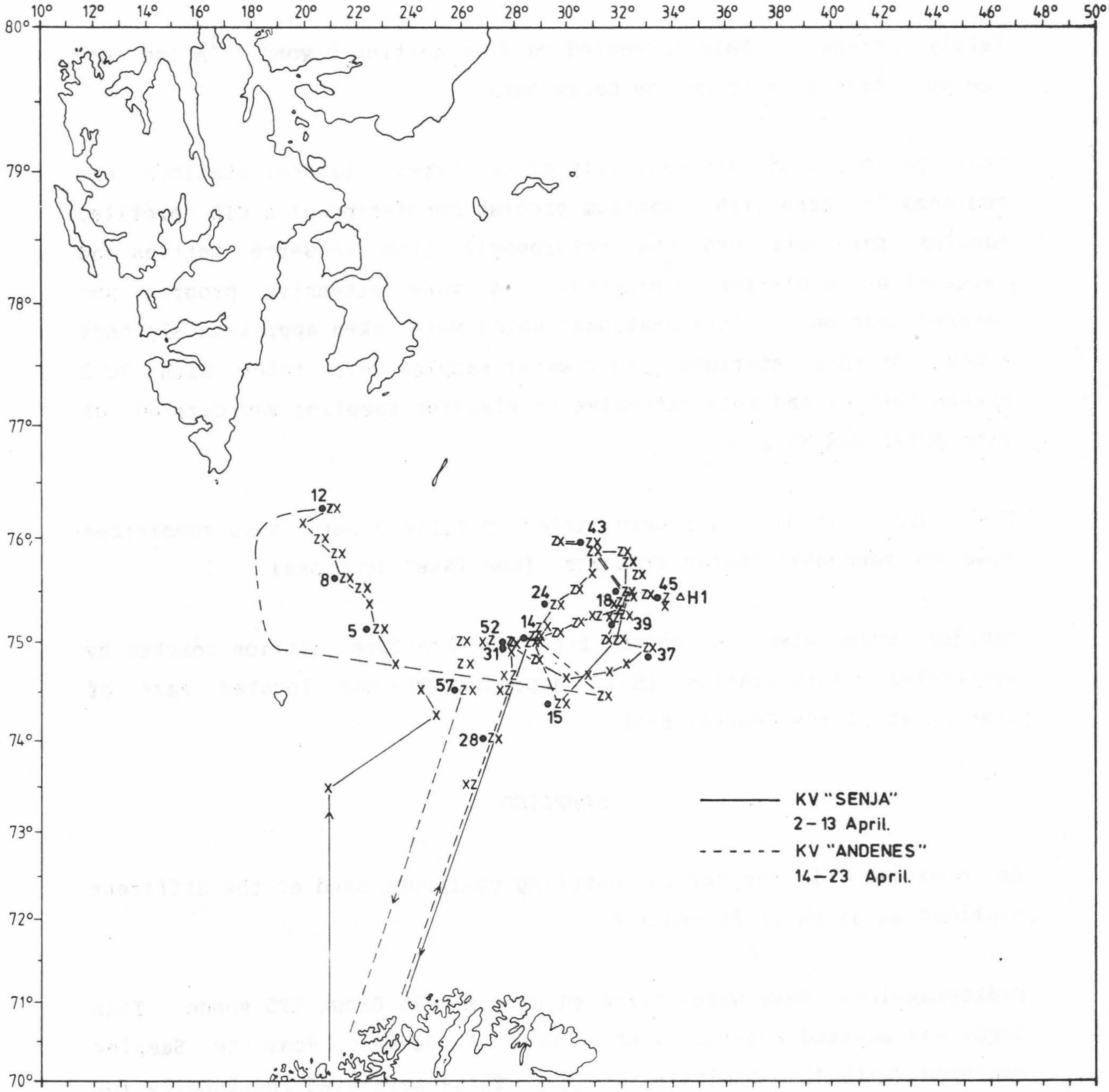


Fig. 1. Cruise tracks and sampling stations for KV "Senja" and KV "Andenes" in the periods 2 - 13 April and 14 - 23 April 1986, respectively. Z - CTD profile; X - water samples and Juday net samples of zooplankton; ● - big station where additional samples of plankton were taken, identified by station number; Δ - ice floe station reached by helicopter.

fairly strong. This prevented us from getting beyond 76^{0}N and into the pure Arctic water on the Great Bank.

Stations occupied were basically of two types. Lighter stations were routineally taken with a minimum program consisting of a CTD profile, samples for nutrients and chlorophyll from rossette bottles and vertical net hauls for zooplankton. A more extensive program was carried out on "big stations" which were taken approximately once a day. At these stations larger water samples were taken with 30-l Niskin bottles and more extensive zooplankton sampling was carried out with Hufsa and WP-2 net.

The "big stations" have been listed in Table 3 which also summarizes some environmental characteristics (see later sections).

Samples were also collected from an ice-floe station reached by helicopter. This station (H-1, Appendix A) was located east of station 45 on the Central Bank.

SAMPLING

An overview of the various sampling equipment used at the different stations is given in Appendix A.

Hydrographical data were collected with a Neil Brown CTD sonde. This sonde was mounted together with a General Oceanic Rossette Sampler equipped with 10 5-L Niskin bottles. These were used routineally for obtaining samples for nutrients and chlorophyll profiles. On a few occasions Nansen bottle casts were used instead of the CTD and rossette due to bad weather or equipment malfunction (Appendix A). 30-L Niskin bottles were used to obtain larger water samples from selected depths. For more detailed analysis of phytoplankton and microorganisms, which included microscopy, chemical composition, C, N and P turnover, etc., 60-L samples from 2 or 3 main depths were used. These samples were obtained by pooling water from 2 or 3 30-L Niskin bottles taken from the same depth into a 60-L container. This water was prefiltered through 250 µm screen when draining the Niskin bottle contents into the container.

The big Niskin bottles were also used for sampling of microzooplankton. 20-25 L samples from 6-8 depths in the upper 100 m were screened through 30 µm. The retained organisms were washed off the screen and preserved with buffered formalin. In some cases the concentrated samples were divided in two parts with a Folsom plankton splitter; one part was filtered onto preweighed Whatman GF/C filters for biomass determination and the second part was preserved.

Samples for analysis of radium and radon (Dr. Fanning) were collected with 30-L Niskin bottles. In situ chlorophyll fluorescence profiles were determined with a Q fluorometer.

Samples of mesozooplankton were routineally collected with a 36-cm diameter, 180 µm mesh Juday net equipped with closing device. Separate hauls were usually taken from 10 m above bottom to 100 m and from 100 m to the surface. These samples were divided in 2 with the Folsom splitter. One part was transferred to preweighed aluminum trays and frozen for later dry weight biomass determination. The other half was fixed with buffered formalin for analysis of species and stage composition.

Samples of the vertical distribution of mesozooplankton at the main stations were obtained with "Hufsa", a specially designed in situ plankton pump and net system. 180 µm mesh net was used and samples were taken from 6-8 depths in the upper 100 m (same depths as for microzooplankton). These samples were split once or twice with the Folsom splitter to obtain subsamples for biomass determination, gut chlorophyll content analysis, and microscopical examination.

Zooplankton samples used for live incubation experiments (respiration, excretion) were collected with WP-2 zooplankton net equipped with a large and non-filtering cod-end.

Gulf III high speed plankton sampler was used on a few occasions in an attempt to collect krill.

ICE

The ice was distributed fairly far to the South in April. The southern ice borders for 16 March, 1 April, 15 April and 28 April, based on weekly ice maps produced by the Meteorological Institute, are shown in Fig. 2. By the end of March, much of the Svalbard Bank was free for ice and the ice extended south to about $75^0$50'N between 30-35^0E. Due to strong northern winds and low temperatures, the ice moved southwards in early April to between 75^0 and $74^0$30'N in the central part of the investigation area by 15 April.

The southern shift in the ice distribution and the cold weather made it more difficult to get north into the ice during the second part of the cruise than during the first. With KV "Andenes" we reached our northernmost station at $75^0$57'N by following a newly frozen large lead that curved in a NW to W direction (Fig. 1).

HYDROGRAPHY

The environmental conditions and seasonal plankton development will be briefly described here and in the following section based on results from the big stations. An overview and characterization of these stations are given in Table 3 while vertical profiles of temperature, salinity and nutrients are shown in Fig. 3.

Stations 5 and 8 were located on the shallow Svalbard Bank and had homogeneous water with salinities of 34.95 (mixed Atlantic and Arctic) and 34.8 (Arctic), respectively. Station 12 was located in the polar front region in Storfjordrenna, with Arctic water overlying mixed Atlantic-Arctic water.

Stations 37 and 45 were located on the southwestern side of the Central Bank. These stations were located close to the polar front in this area and the water columns were stratified, especially at station 45.

The remaining big stations were located in the Hopen Depth. The

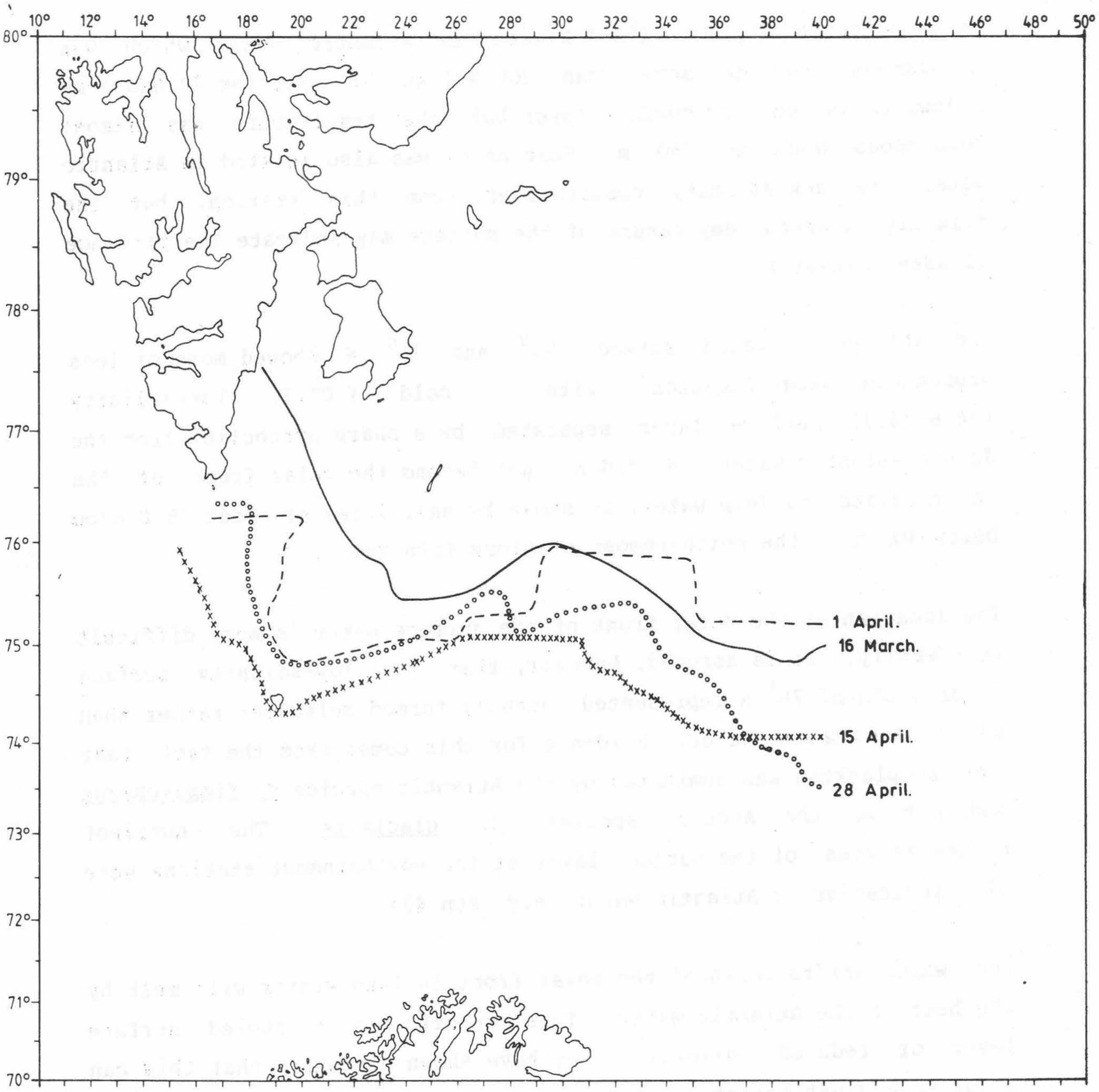


Fig. 2. Southern ice limits, taken from weekly ice maps from the Meteorological Institute for 16 March, 1, 15 and 28 April 1986.

stations south of about $74^0 30'$ N were in Atlantic water which was homogenous down to more than 200 m (stn 15). Station 28 had some meltwater in the very surface layer but the temperature was almost homogenous down to 250 m. Station 57 was also located in Atlantic water. We lack salinity observations from this station, but the slightly lowered temperature of the surface may indicate the presence of some meltwater.

The stations located between 75^0 and 76^0 N showed more or less pronounced stratification, with a cold ($<0^0$C), low-salinity (34.6-34.7) surface layer separated by a sharp pycnocline from the deeper Atlantic water. We did not get beyond the polar front of the intermediate and deep water, as shown by salinities of about 35.0 o/oo below 100 m at the northernmost stations (stn 43).

The location of the polar front of the surface water is more difficult to identify. It is assumed, however, that the low-salinity surface layer south of 76^0 N represented recently formed meltwater rather than being true Arctic water. Evidence for this comes from the fact that the zooplankton was dominated by the Atlantic species C. finmarchicus and not by the Arctic species C. glacialis. The nutrient concentrations of the surface layer at the northernmost stations were also indicative of Atlantic water (e.g. stn 43).

Ice which drifts south of the polar front in late winter will melt by the heat of the Atlantic water. This results in a cooled surface layer of reduced salinity. We have shown elsewhere that this can occur to a great extent in cold years with southerly distributed ice, e.g. 1979 and 1981 (SKJOLDAL et al. 1986, REY et al. 1986). Such ice melt in Atlantic water evidently took place also in 1986, as shown by the southerly distribution of ice (Fig. 2) and the hydrographical results (Fig. 3).

The meltwater layer was in general thicker with a deeper pycnocline in the central part of the Hopen Depth around 28-30^0 E (Fig. 3; stn. 14, 24, 31, 43) than in the area of our standard sampling section (section I) further east (stn. 18, 39).

Table 3. Overview and characterization of the major stations.

Station No.	Position N	Position E	Date (April)	Depth (m)	Stability $\Delta \sigma_t$ 5-100m	Nitrate, 0-100m (mmol m^{-2}) Content	Nitrate, 0-100m (mmol m^{-2}) Consumption[1]	Ice
5	75°09'	22°42'	4	84	0	604[2]	~ 30	Close pack
8	75°38'	21°25'	5	36	0	260[3]	~ 25	Close pack
12	76°17'	20°59'	6	213	0.00	1081	~ 0	Open pack
14	75°03'	28°40'	8	356	0.133	1113	262	None
15	74°21'	29°36'	9	391	0.001	1291	9	None
18	75°29'	32°06'	10	309	0.172	1304	18	Open pack
24	75°20'	29°26'	11	348	0.144	1098	180	Open pack
28	74°00'	27°11'	15	416	0.077	1223	15	None
31	74°58'	27°46'	16	330	0.088	975	288	Open pack
37	74°54'	32°59'	17	141	0.018	1074	75	Close pack
39	75°13'	31°58'	18	323	0.209	1172	53	Close pack
43	75°54'	30°45'	19	331	0.208	1109	107	Close pack
45	75°26'	33°42'	20	200	0.149	1087	60	Close pack
52	74°58'	27°50'	21	337	High[4]	871	330	None
57	74°30'	26°04'	22	351	Low[4]	1125	55	None

1 Estimated by assuming the prebloom nitrate concentration equal to the mean nitrate concentration below 100 m

2 0 - 50 m

3 0 - 25 m

4 No salinity observations

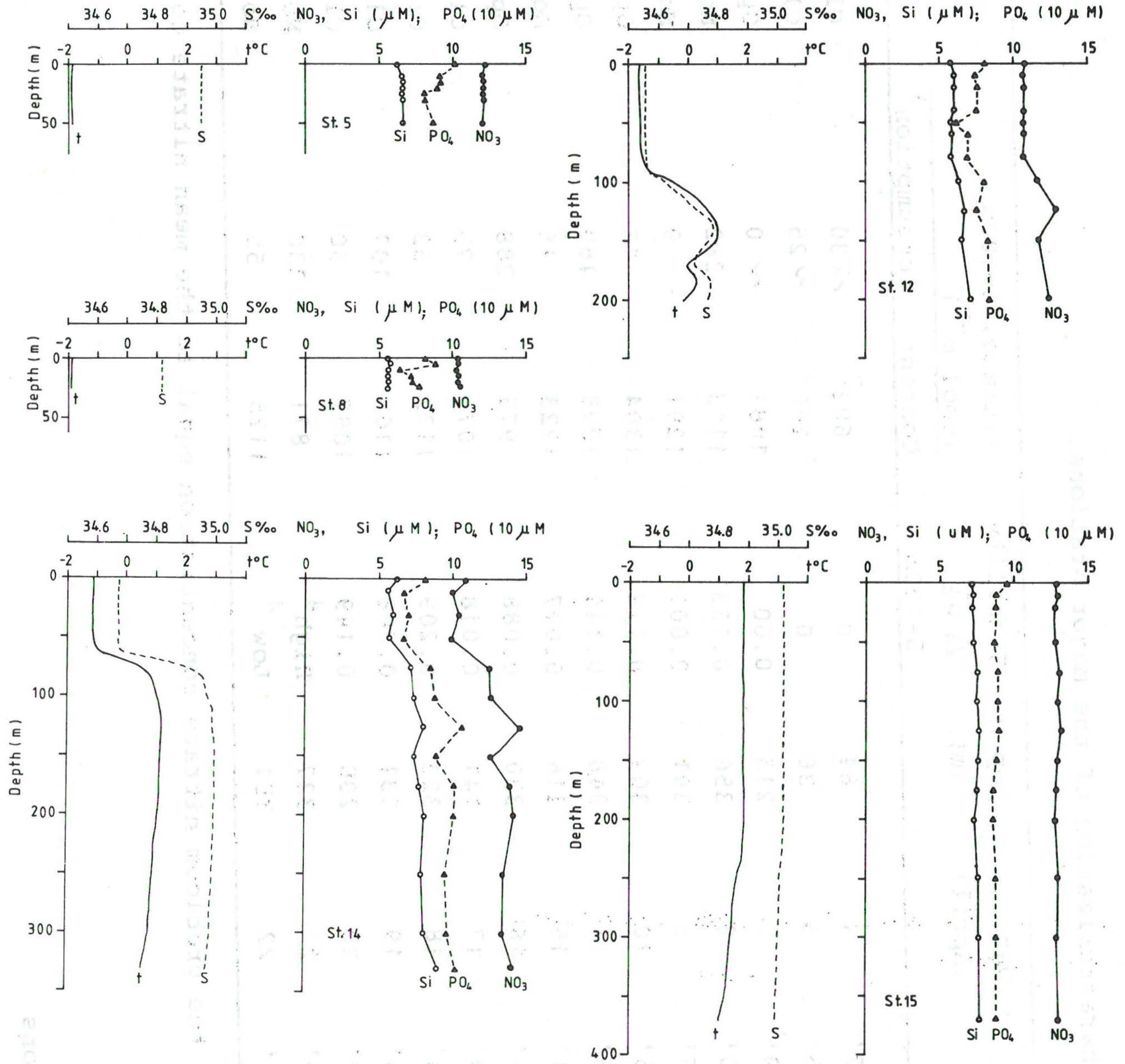
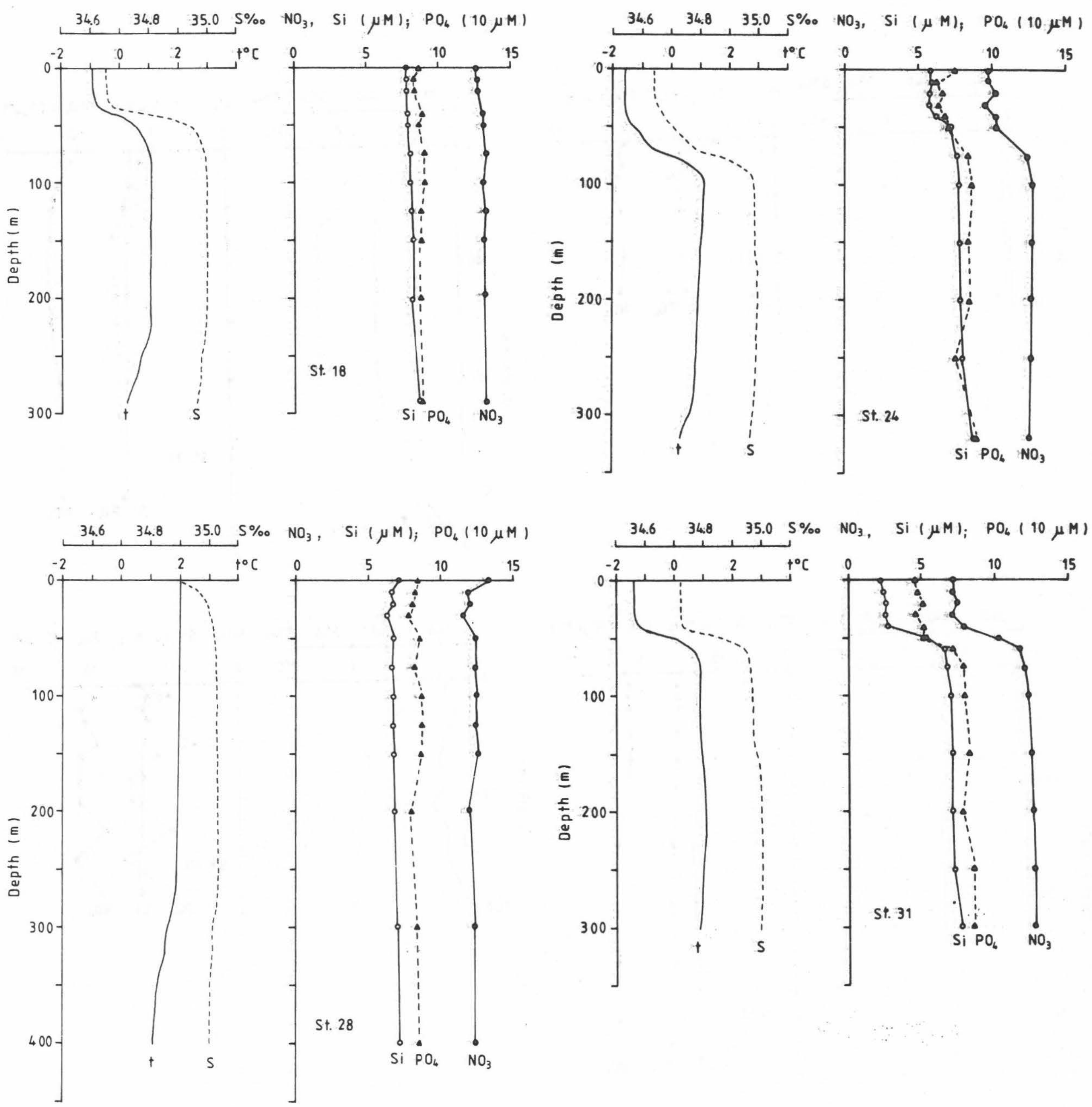


Fig. 3. Vertical profiles of temperature, salinity and nutrients (NO_3 - nitrate; PO_4 - phosphate; Si - silicate) at the big stations.



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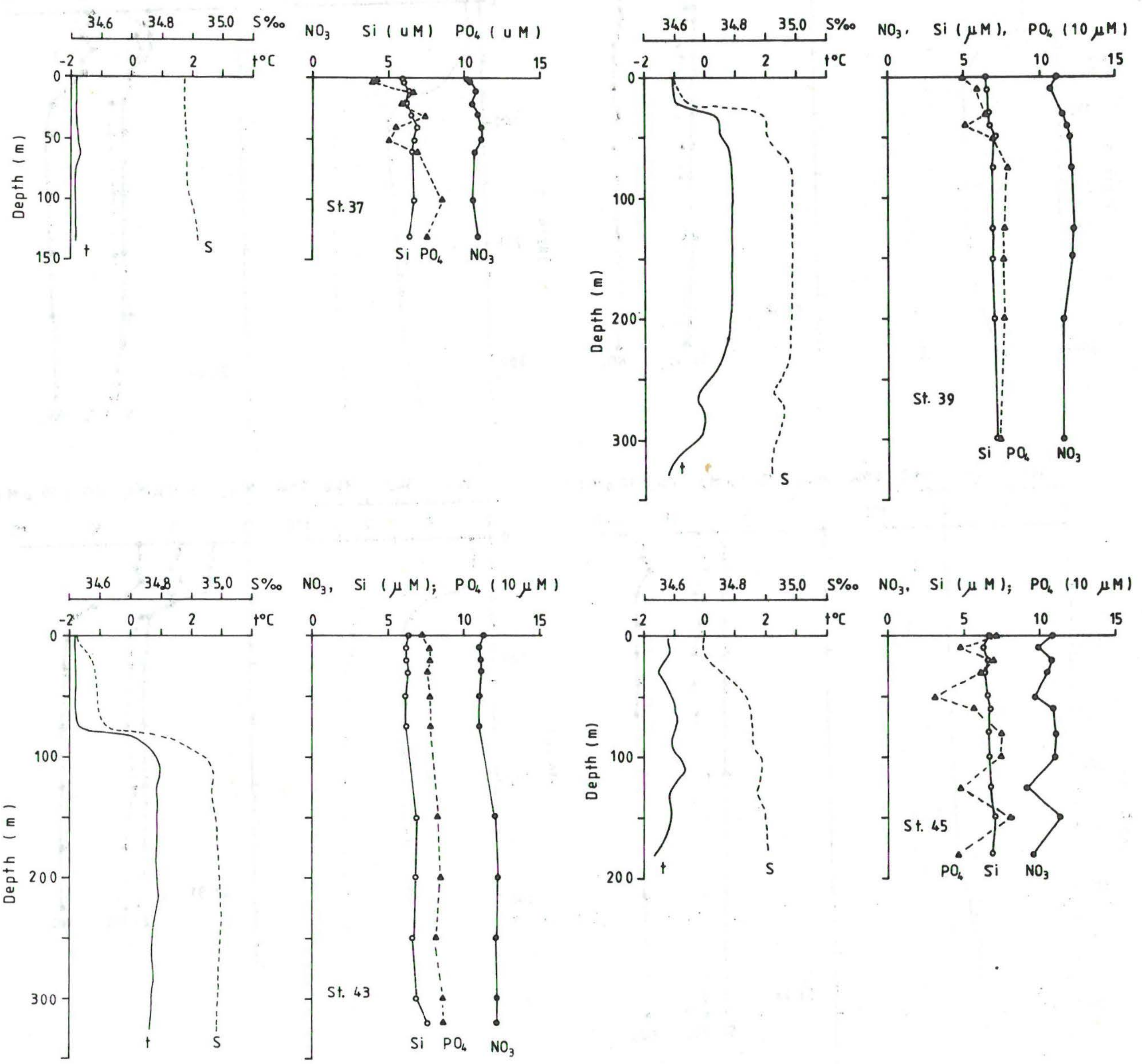

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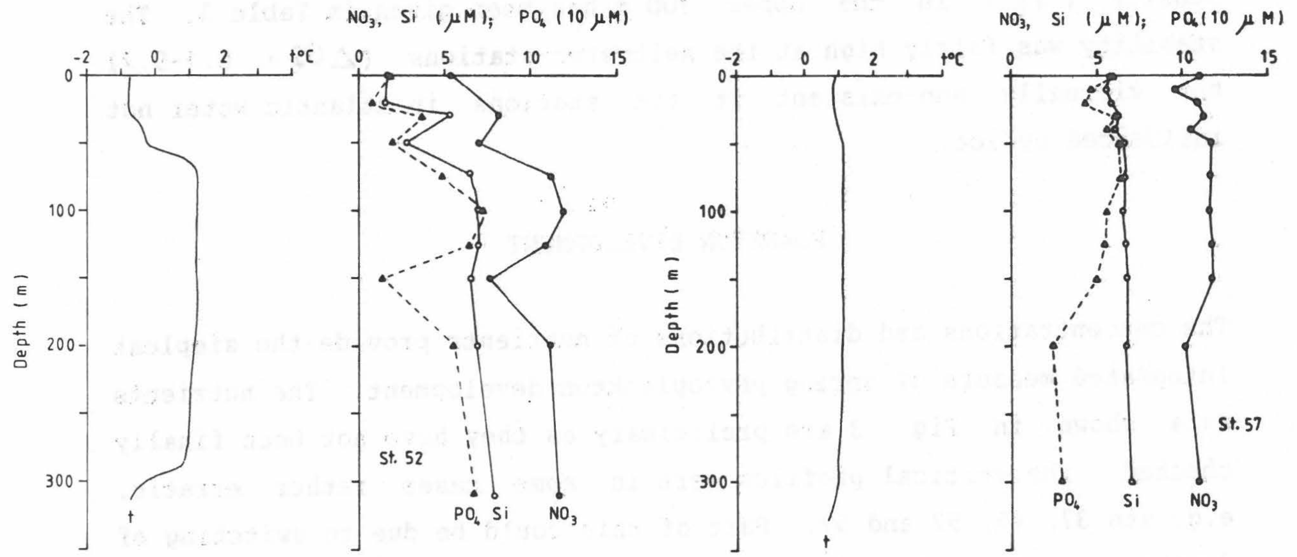

Fig. 3. Continued.

As a coarse measure of water column stability, the difference in density (σ_t) in the upper 100 m has been given in Table 3. The stability was fairly high at the meltwater stations ($\Delta\sigma_t$ = 0.1-0.2) but virtually non-existent at the stations in Atlantic water not influenced by ice.

PLANKTON DEVELOPMENT

The concentrations and distributions of nutrients provide the simplest integrated measure of spring phytoplankton development. The nutrients data shown in Fig. 3 are preliminary as they have not been finally checked. The vertical profiles were in some cases rather erratic, e.g. stn 37, 45, 52 and 57. Part of this could be due to switching of depths during sampling from the rossette.

The nitrate consumption at each station has been estimated by subtracting the integrated content of nitrate in the upper 100 m from an estimated prebloom winter content. The latter was calculated by assuming homogenous nitrate distribution with a concentration equal to the average concentration deeper than 100 m. This procedure gives fairly realistic estimates for the stations in deeper Atlantic water. For the shallow water stations with Arctic or mixed water, the calculations become more uncertain. For these stations (stn 5, 8, 12, 37 and 45) winter nitrate levels were estimated from previously determined relationships between salinity and nitrate (HASSEL et al. 1986, and unpublished results from cruise with M/S "Lance" in May-June 1983 (GJØSÆTER et al. 1983)).

The estimates of nitrate consumption (Table 3) allow an approximate ranking of the stations in terms of phytoplankton development. There had been virtually no consumption of nitrate at the stations in homogenous Atlantic water (Fig. 3; stn. 15, 28). The nitrate consumption was highest at the southern meltwater stations (stn 14, 24, 31, 52) while being somewhat lower at the northern (stn 43) and much lower at the eastern meltwater stations (stn 18, 39). The nitrate consumption at the Central Bank stations (stn 37 and 45) seemed to be moderately high, whereas the nitrate consumption at the Svalbard Bank stations (stn 5, 8, 12) appeared to be low.

The estimates of nitrate consumption show that the big stations spanned a range of phytoplankton development from late winter prebloom conditions to an active spring bloom situation approximately half-way to its maximum in terms of nitrate consumption. This provides a useful gradient against which other plankton properties can be compared in subsequent data analysis. This is especially the case for the series of Atlantic water stations ranked in order of increasing bloom development: 15, 28, 18, 39, 57, 43, 24, 14, 31 and 52.

OTHER ACTIVITIES

Observation and sampling of under-ice fauna and flora were done by diving in leads in the vicinity of the ship at station. The sampling was performed by the diver Bjørnar Seim (from the PRO MARE-project Under-ice fauna in the Arctic), assisted by divers from the Coast guard.

The intention was to deploy moored sediment traps in open water. Due to bad weather conditions this was not attempted during the first cruise leg, and illness prevented the scientist in charge of this study (P. Wassmann) to participate on the second leg.

In addition to the scientific work, the harsh but beautiful Arctic environment inspired many to poetic efforts. This resulted in a considerable number of limericks that was read over the ships loadspeakers at morning shake. Space prohibits us from reproducing all of them but a sample of limericks produced on KV "Senja" is given in Appendix B.

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APPENDIX A

List of stations and overview of samples taken from KV "Senja" (A) and KV "Andenes" (B).

Abbreviations:

CTD	-	sonde for measuring salinity, temperature and depth
N	-	Nansen water sampler
PP	-	phytoplankton
MZP	-	microzooplankton
FLU	-	*in situ* fluorometer (chlorophyll)
JUDAY 36	-	36 cm diameter Juday zooplankton net
WP-2	-	zooplankton net
HUFSA	-	*in situ* zooplankton pump and net
GULF	-	high speed zooplankton sampler
RA-RD	-	samples of radium - radon

A. KV SENJA

ST.NO.	POSITION N	E	DATE	TIME	CTD	WATERBOTTLES ROSETTE	30L PP	MZP	FLU	JUDAY 36	WP-2	HUFSA	GULF	30-L RA-RD
1	73° 28'	20° 57'	3 APR	1440			X			X				
2	74° 15'	25° 03'	4 APR	0130		N				X				
3	74° 30'	24° 23'	4 APR	0450		N				X				
4	74° 45'	23° 25'	4 APR	0730		N				X				
5	75° 09'	22° 42'	4 APR		X	X	X	X	X	X	X	X		
6	75° 20'	22° 29'	5 APR	0030						X				
7	75° 31'	22° 01'	5 APR	0730	X	X				X				
8	75° 38'	21° 25'	5 APR	1140	X	X	X	X	X	X	X	X		
9	75° 49'	21° 04'	5 APR	2000	X	X				X				
10	75° 58'	20° 26'	5 APR	2350	X	X				X				
11	76° 09'	19° 59'	6 APR	0235		N				X				
12	76° 17'	20° 59'	6 APR	0820	X	X	X	X						
13	74° 25'	31° 12'	8 APR	1120	X	X				X	X			
14	75° 03'	28°40'	8 APR	2230	X	X	X	X			X	X		
15	74° 21'	29° 36'	9 APR	1410	X	X	X	X		X	X	X		
16	75° 00'	31° 50'	10 APR	0010	X	X				X				
17	75° 15'	32° 01'	10 APR	0320	X	X				X				
18	75° 29'	32° 06'	10 APR	0830	X	X	X	X	X	X	X	X		
19	75° 45'	32° 07'	10 APR	1830	X	X				X	x			
20	75° 49'	32° 00'	10 APR	2310	X	X				X				
21	75° 49'	30° 50'	11 APR	0710	X	X				X				
22	75° 39'	30°55'	11 APR	1230						X	X			
23	75° 30'	30° 09'	11 APR	1810	X	X				X				
24	75° 20'	29° 26'	11 APR	2200	X	X	X	X	X	X	X	X		
25	75° 09'	28° 54'	12 APR	0500	X	X				X				
26	75° 00'	28° 28'	12 APR	0740	X	X				X				

ST.NO.	POSITION N	E	DATE	TIME	CTD	WATERBOTTLES ROSETTE	30L PP	MZP	FLU	JUDAY 36	WP-2	HUFSA	GULF	30-L RA-RD
27	73° 30'	26° 30'	15 APR	0830	X	X				X	X			
28	74° 00'	27° 11'	15 APR	1620	X	X	X	X	X	X	X	X		X
29	74° 30'	27° 45'	16 APR	0110	X	X				X				
30	74°'40'	27° 55'	16 APR	0350	X	X				X				
31	74° 58'	27° 46'	16 APR	0850	X	X	X	X	X	X	X	X		
32	74° 47'	28° 42'	16 APR	1730	X	X				X	X			
33	74° 39'	30° 01'	16 APR	2320		N				X				
34	74° 41'	30° 43'	17 APR	0250		N				X				
35	74° 43'	31° 35'	17 APR	0620		N				X				
36	74° 46'	32° 12'	17 APR	0940		N				X	X			
37	74° 54'	32° 59'	17 APR	1430	X	X	X	X	X	X	X	X		X
38	75° 00'	31° 18'	18 APR	1030	X	N				X	X			
39	75° 13'	31° 58'	18 APR	1600	X	X	X	X	X	X	X	X		
40	75° 29'	32° 13'	19 APR	0230	X	X			X	X				
41	75° 40'	31° 31'	19 APR	0640	X	X				X				
42	75° 54'	30° 44'	19 APR	1000	X	X			X	X				
43	75° 54'	30° 45'	19 APR	1340	X	X	X	X	X	X	X	X		X
44	75° 57'	29° 29'	19 APR	2200	X	X				X				
H-1	75° 26'	34° 15'	20 APR	1200		2.5-L								X
45	75° 26'	33° 42'	20 APR	1530	X	X	X	X	X	X	X	X		
46	75° 27'	32° 50'	20 APR	2200	X	X			X	X				
47	75° 21'	32° 01'	21 APR	0440	X	X			X	X				
48	75° 14'	32° 01'	21 APR	0640	X	X			X	X				
49	75° 15'	31° 10'	21 APR	1100	X	X			X	X				
50	75° 11'	30° 19'	21 APR	1430	X	X			X	X	X			
51	75° 06'	29° 29'	21 APR	1730	X	X			X	X	X			
52	74° 58'	27° 50'	21 APR	2200	X	X	X	X	X	X		X		X
53	75° 02'	28° 40'	22 APR	0340	X	X			X	X				
54	75° 00'	27° 04'	22 APR	0650	X	X			X	X				
55	75° 00'	25° 59'	22 APR	0930	X	X			X	X			X	
56	74° 45'	26° 00'	22 APR	1240	X	X			X	X	X			
57	74° 30'	26° 04'	22 APR	1540	X	X	X	X	X	X	X	X	X	

APPENDIX B

LIMERICKS

- Et rødt-blått fantom med driv i
  fløy rundt med slire og kniv i
  han surret og bandt
  alt han fant
  men havets krefter de over ham vant

- En høyvokst og vakker kvinne
  med dyrbare plankton i sinnet
  har nettopp passert de tretti
  det gjorde hun jammen rett i

- The bright shining comet is coming back
  with tail pointing out from his head or neck
  but don't be afraid
  we shall not be hurt
  cause Mickie Mouse is under his shirt

(Følgende 4 limericks henspeiler på vanskelige arbeidsforhold og ble unnfanget i feberrus)

- En forsker på små ciliater
  med lupen sin langt ut av vater
  han ropte og skrek
  ble mer og mer blek
  der svømte jo unna ti tusen små krek

- En hutrende dame fra akterdekk
  i dertil egnet arbeidsantrekk
  fikk her i dag sin store skrekk
  da vannet kom ut og frøs på en flekk

- En kraftig gransker med skjegg og bart
  skulle få sonden sin ut i en fart

og måle både temp og salt
men det ble umulig når alt kom til alt

- En ekte HUFSA-kall i fra Bergenskanten
han følte seg temmelig svak og skranten
nå ligger han flat og venter på straffen
for at han overfor HUFSA ga blaffen

- A Norwegian scientist named Arne
makes his life as a zooplankton farmer
he says with an "uff da"
as he lowers his HUFSA
if zooplankton were women, I'd be warmer

- There is a young trapper named Paul
who has a peculiar haul
he's trapping the feces
of zooplankton species
which he's quite fond of showing us all

- There is a chief scientist named Skjoldal
whose big station sampling is quite cold
he says with a grin
as ice forms on his chin
"it's science for men who are bold"

- The young lads who work in the galley
have many broken dishes to tally
when the ship takes a roll
the cooks pay the toll
as the dinner flies like Comet Halley

- The second in command of "Senja"
has a voice that would startle a penguin
when breakfast is ready
his announcements come steady
and the dreams that we had are soon ended

- There is a young crewman named George
  his work affects all that are on board
  he washes our clothes
  and scents them with rose
  and now we all smell like a whore

- En kapteinløytnant fra "Senja" ble beryktet
  da han seilte så skaffetøyet "flyktet"
  gjennom luften de suste
  og i skottet de knuste
  nå er han av kokkene fryktet

- En isbjørn fra Novaja Zemlja
  kunne kjenne det kile i tenna
  da det seilte forbi
  en middag for ti
  merket "Forsker på boks" à là "Senja"

(En historie med moral, spesielt myntet på de som håndterte de store vannhenterne på akterdekk:)

- En nærsynt sel født på Møre
  vår vannhenter ville forføre
  men den smekket igjen
  han kom rent i beklem
  og skrek: damer jeg aldri skal røre

- Han Torbjørn han ville ha kaffe
  mon tro hvordan kopp seg skaffe?
  en mugge er bra
  den kan jeg vel ta?
  for det kan vel ingen meg straffe?

  Reaksjonen den kom like etter
  da sjefen for Torbjørn beretter:
  En mugge er bra
  til fløte å ha
  men du bruker kopp heretter!

Finale - limerick

- Stor takk ifra alle Pro Marer
til mannskapets kvinner og karer
som i kampen mot maktene
på de slitsomme vaktene
har reddet oss fra alle farer

For vår skyld har de frosset på tærne
mens de undret om vi er litt gærne
der vi haler opp vann
i bøtter og spann
for å hive det vekk i det fjerne

Vi har overlevd sjøgang og ising
vi har overlevd urolig spising
vi har jobbet og slitt -
i alle fall litt!
skal vi fortelle med overbevising

Vi har tømt både kaffe og brus
i salongen hvor vi har holdt hus
vi har slått dem i spill -
vi kan når vi vil
ikke bare om amøber og "smålus"

Så i kveld er det klart for finale
helst med fest med bevertning og tale
vi har hatt det helt flott
dere passet oss godt
kanskje Forsvaret "e'kje så gale"