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International Council for the
Exploration of the Sea

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REPORT OF THE WORKING GROUP ON OCEANIC HYDROGRAPHY

Bergen, 18 - 20 April 1994

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Report on the meeting of the ICES Working Group on Oceanic Hydrography Bergen 18 - 20 April 1994.

1. Opening

Dr. Johan Blindheim, Institute of Marine Research, Bergen welcomed the working group to Bergen.

2. Review of membership

The latest list of members from the ICES Secretariate showed that the following had been appointed members of the working group:

Mr. Dillingh (Netherlands), Mr. Golmen (Norway), Ms. Lavin (Spain), Mr. Ostrowski (Poland), Mr. Lafaivre and Dr. Naraynan (Canada).

The following have left the working group:

Mr. Colbourne and Dr. Gratton (Canada), Dr. Gordon (USA) and Prof Foldvik (Norway).

3. Remarks from the ICES Oceanography secretary

The chairman invited discussion on the comments of the Oceanography Secretary, as handed out the previous day. With regard to the secretaries question what products are wanted when the complete data set of the Service Hydrographique is available by computer and when the data set is extended by incorporation of missing historical data sets, it was remarked that it is not especially distribution maps of physical parameters as suggested by the secetary. A reliable, accessible and powerful data base is more important. With the existing electronic atlases and their expected development in the next 5 years, it is assumed that in the near future each scientist can produce all types of products from the ICES data holdings. The wish was expressed to make timeseries at standard stations or sections directly accessible.

With regard to the 100-th anniversary of ICES Data Bank it was remarked that the time nearly coincides with the next decadal symposium on oceanic variability, to be organized around 2001. It may be a good idea to make a connection between both events.

The Oceanography Secretary remarked in his comments that whereas salinity data submitted to ICES are nowadays reliable due to improved procedures, the quality of submitted nutrient data is regularly too low. B. Dickson (MAFF, Lowestoft) stated that the ICES MCWG regularly organizes nutrient intercomparisons, the fifth has just been completed. The results from the intercomparisons show a time-dependent quality of laboratories and of individual technicians. On a question from G. Becker (BSH, Hamburg) it was noted that now the nutrient chapter of the WOCE manual on methods has been published which may be used as a guideline. Dickson answered that the WOCE manual establishes methodology, while only the intercomparisons can establish what quality can be achieved.

J. Blindheim (IMR, Bergen) noted that the quality flags, as used within WOCE, are useful and can be used in a flexible way. He asked whether the use of such flags also could be implemented within ICES. T. Rossby (URI, Rhode Island) stressed that for the implementation of historic data into data centres, as in GODAR, the quality flagging should not be so strict, according to modern methods, so that no historic data should come through the quality evaluation. Quality requirements should represent the state of the art for the period those data were recorded.

B. Dickson (MAFF, Lowestoft) reminded the participants of his activities with regard to making an inventory of flow statistics from long term current meter moorings. Modellers need such inventories in order to validate their eddy resolving models. All participants were invited to submit available current statistics to Bob Dickson.

4. Radioactive contamination in the Nordic Seas - the question about contamination and spreading.

Four lectures were given:

Lars Føyn, IMR, Bergen, spoke about impact of radiation from the Kara Sea and the submarine Komsomolets off Bear Island. Dr. Føyn noticed that only a little part of the Nordic and Arctic Seas were productive areas for fish. Radioactive uptake in fish in the Barents Sea was highest in the sixties during the bomb tests (80 Bq). Since then it has declined. Fresh water fish have much higher levels (20.000-30.000 Bq) as a result of the Chernobyl accident. Also research in the Baltic and along the Norwegian coast after the Chernobyl accident showed positive indications in the Baltic, but less so off Norway. The observed radioactivity in the Nordic Seas is traced to the liquid form from Sellafield, whereas the solid forms in the Kara Sea are much less observed, except in a fjord on Novaja Selmaja. (Sivalky Bay). The submarine Komsomolets is at 1680 m depth, 73 43,49'N; 13 16,03'E. Thus it can hardly effect fisheries in the Barents Sea. Its content of Cesium 137 is around 600 gr and of Strontium 300 gr compared with 500 kg Cesium 137 per km^3 water and 8000 tonnes Strontium per km^3 water in the Sea. Sellafield gave 300-400 kg Plutonium in 30 years, while the submarine only contains about 10 kg in reactor and warheads.

Johan Blindheim, IMR, Bergen, spoke about possible spreading from the submarine into fishing fields. Both hydrography and direct current measurements show that connection from the deep to upper layers is virtually negligable. A possible pathway is in the anticyclonic gyre of the Greenland Sea or even through the overflow across the Greenland-Scotland Ridge system. This is in both cases a long way to go with a high dilution effect. Blindheim concluded: leave the submarine where it is, pack it possibly, but don´t lift it.

Poul Budgell, Nansen Center, showed modelling of circulations in the area of concern, together with hydrographic sections in the Norwegian and the Kara Seas. He also showed a model from outlets of rivers as Ob and Yenisei. Transports due to resuspension of sediment and drift-ice was also mentioned. He also spoke about cooperation in research on the matter in question with the Russians.

It should also be mentioned that the interest behind the different aspects of research in the field are manyfold (research money, constructions, and not least fish and fish industries).

Bjørn Ådlandsvik, IMR, Bergen showed results of modelling of the near-bottom currents in the areas in question. His model revealed the possible spreading pattern from the submarine location, including directions both northward as well as westward to Greenland.

Finally Sv.A.Malmberg showed some data on radioactive concentration in Icelandic waters, revealing very low concentrations both in the sea as in fucus and fish (<1 Bq), the higher ones found north of the country.

In the discussion after the lectures the questions about monitoring of the radioactive contamination and its organization was brought up. It was stated that the fallout and contamination from Sellafield were easy to detect, but other sources not. It was mentioned that river sedimentation is quite an effective filter. The Russian dumping of solid wastes may some time in the future be detectable.

At the end of the session Bob Dickson, U.K. suggested that ICES WGOH could have a role to play in coordination of research on radioactive contamination in the Nordic and Arctic Seas to avoid duplicates and interference with different bodies, governmental and non-governmental.

The overall result of the discussions revealed no risks for fisheries due to Russian disposal and the submarine, at least not for the time being. Continuous monitoring though is needed, including modelling.

5 Climatic variability & longterm changes in Pan-Atlantic cod populations.

A report from the Cod and Climate meeting in Reykjavik in August 1993 was given by Bob Dickson, where particular emphasis was placed on work by Keith Brander, who in a broad overview of the North Atlantic cod stocks had linked with a strong liniar correlation to the fish weight at age 4 with the ambient temperatures found until that age. This, as was underlined, is a renewed treatment of an old subject. During the Reykjavik meeting the initial talks dealt with the problem of overfishing, but as Bob Dickson summarized, Brander´s results may indicate that climate may determine whether a stock in fact is being overfished. The discussion was initiated by Erik Buch, who could show that Brander´s one deviant point from West Greenland in fact was based on irrelevant data and that the West Greenland cod stock in fact conformed to the overall regression. A discussion ensued in which Bob Dickson underlined that temperature must be interpreted as a proxy of broad environmental changes, not in terms of its physiological effects as e.g. how it affects the metabolic rates of the fish.

Svein Sundby wanted to interpret temperature as a proxy variable in this connection and underlined the importance of mixed-layer dynamics to explore the links between atmospheric variables and termal conditions of the sea. He furthermore wanted the Working Group to explore the links between environmental and thermal conditions.

Jens Meincke, inquired how the overall work was progressing and could report that the symposium proceedings from Reykjavik will appear this autumn.

Johan Blindheim noted that this general topic will most likely be treated in other contexts such as the Mare Cognitum program, in which several of the Nordic countries are engaged.

Svein Sundby (as an answer to Jens Meincke) informed that quite a lot of work is in progress, and especially mentioned a forthcoming ICES-workshop in Copenhagen this August on dynamical effects of the environment on zooplankton production. He furthermore raised the question of forthcoming interactions with numerical modellers, especially in view of his standpoint that temperature is a proxy variable for other physical processes (mainly as induced by changes of the wind field). Erik Buch raised the question of which temperature is relevant, surface or deep-water?

Eberhard Fahrbach indicated the importance of the W.G. not raising completely self-evident questions for physical oceanographers in its recommendations for future work. Hendrik van Aken concurred.

Savi Narayanan reported that one of the mayor thrusts of the Northern Cod Science programme in Canada is to examine the oceanographic influence on cod. Analysis to date suggest that, though there are changes in the distribution, abundance, length at age, and other characteristics of cod coincident with the recent cooling of the environment, cod abundance or recruitment was not correlated with water temperature. What this may mean is that the relationships between environment and cod is rather complex, and that the temperature and salinity at the few long-term monitoring stations may not be the appropiate index for representing the climate change in the cod habitat. The question of what other type of oceanographic measurements and where and how often was discussed at a recent workshop at BIO. The conclusion was to continue more or less the status-quo for temperature and salinities but enhance the biomonitoring to understand the mechanisms better.

Lena Lastein, Svein Sundby and Hendrik van Aken discussed which biological parameters to measure. Erik Buch summarized the discussion by noting that standard work is to be continued, it being of great importance. Jens Meincke raised the possibility of a minisymposium or theme session on this general subject at a forthcoming ICES-meeting, as a followup to the Cod and Climate Symposium. Bob Dickson underlined that the biologists of the Backward Forcing Study Group of the Cod and Climate W.G. most likely will ask questions about the oceanographical background for extreme events, and this should be kept in mind when planning future meetings.

The overall recommendation from the WG on Oceanic Hydrography was to work for the arrangement of a special session in connection with the 1995 ICES Statutory Meeting and to continue the ongoing dialogue between cod biologists and physical oceanographers.

6. Results from standard stations and sections.

The current status of environmental change, together with effects on fish stocks (where known) were reviewed by region:

(a) Canadian shelf. (S. Narayanan, St. Johns, Newfoundland). Following the 1992 Moritorium on cod fishing, the stocks of a range of groundfish continued to decline through 1993, but a major workshop set up in 1993 to assess whether and to what extent these changes might be environmentally driven could come to no firm conclusion. Though certain aspects of the spawning migration and the survival of eggs and larvae are influenced by environmental changes, the latter cannot explain such a sudden decline in the groundfish. A range of environmental indices were described. Air temperatures have been extremely cold especially in the nothern part of this section (W. Greenland and the Canadian Arctic). The ice cover in the latitude band 45-55°N shows peaks in 1972, 1984-85, and in recent years since 1990, while the NW Wind Component at Cartwright and St. Johns which brings the ice and which had peaked in the early 70´s, was again reasonably strong in the most recent years. The standard hydrographic sections at 47°N (Flemish Cap), C. Bonavista, White Bay, Seal Island have shown a time-dependent change in the volume of the intermediate cold water layer with peaks in 1972/73, 1984/85 and very recently (1990/1)). T and S anomalies at the time series station 27 (off Newfoundland) and on a long-term mooring at 200 m depth on Hamilton Bank both show a recent cooling, with freshening also at stn 27, which may be echoed at the Prince 5 Station at the mouth of the Bay of Fundy. The deep Emerald Basin data, however, show an opposite, warming, trend, but there the shelf-edge front has moved closer to the coast, effecting an increase in the flow of warm slope water into this basin.

(b) West Greenland (E. Buch, Farvandsvaesenet). The air temperature at Nuuk show somewhat cold conditions in 1993-94 but not as intense as the record chilling of the 1983-84 period. Equally, though the mean temperature on top of Fylla Bank has shown regular fluctuations in the 1980´s and 1990´s, it has not seen as severe cooling as occurred with the passage of the Great Salinity Anomaly in 1970. However, the regular July survey in West Greenland waters in 1993 were remarkable in their heavy ice conditions, with both a heavy influx of polar ice rounding C. Farewell from the east, and an anomalous extent of the locally generated "West ice" in the Davis Strait. Both disrupted the standard hydrographic surveys.

(c) Iceland (S-A. Malmberg, MRI Reykjavik). A contrasting picture to Canadian and W. Greenland waters, with a strong Irminger Current influence pervading the nursery grounds off North Icelandic waters. Though T and S have shown marked interannual fluctuations since the minima in both during the 1960´s, the Siglunes Section, 1952-93, shows warm (>4°C), saline "Atlantic" conditions in each of the last three spring surveys. Despite this there has been little sign of a benevolent environmental influence on the cod fishery. Instead a steady increase in fishing mortality and decrease in catch have resulted in a 33% reduction in catch, a 66% reduction in recruitment and 66% reduction in spawning stock biomass since the 1950´s.

(d) Faroe Islands (Lena Lastein). The environmental fluctuations on the standard sections to North, SE and SW of Faroes were described. In particular the average salinity in the 100-300 m depth layer of the Faroe Bank Channel, after rising steadily from the mid-70´s minimum associated with the GSA, had recently shown signs of freshening once again in recent years.

(e) Norway (J. Blindheim, IMR Bergen). Recent T and S trends were described for the range of standard sections that are worked at variable frequency from the White Sea to the Skagerrak. The 50-200 m mean T at Svinø, Lofoten and Bear Island - Fugløy have been generally in phase, with minima in the late 70´s (GSA) and two maxima since then, in the mid-80´s and in recent years. However, the amplitude of these changes is larger in the north suggesting the role of heat exchange with the atmosphere. Salinities which showed a sharp increase after the GSA have declined since. Effects on the Barents Sea ecosystem are partly a chain effect of the rise of the herring which grazed down the capelin fry, reducing the food supply for cod, and causing a southward invasion by the seal population which normally depend on young cod and capelin for food. However, from 1989 onwards there have been 4 medium-to-strong cod year classes in the Barents Sea. In the Norwegian sector of the North Sea the bottom temperature rose from minimum values in the mid 70´s to record two peaks since, more or less in phase with those of the Barents Sea. After 1990 the Hirtshals-Arendal section across the Skagerrak showed its highest recorded temperatures, partly due to the weakness of winter cooling there and partly through the advective effect of a strong Atlantic inflow.

(f) Greenland Sea (G. Becker, BSH Hamburg, J.Meincke, Univ., Hamburg.). The Greenland Sea, in particular a central section along 75°N, is at least annually surveyed since 1986 through national work (Norway, Germany, Poland, Russia) and international work (Greenland Sea Project, Winter Greenland Sea Project et al.). The trends for the deep layers are clear. There is a continous warming and stratification due to enhanced influx of Arctic Ocean deep waters as a consequence of missing local convection renewal. For the intermediate and upper layers (1200m to surface) there is a strong variability in convection renewal. In 1993 wintertime convection was observed to be only thermally induced. Due to relative warm conditions in the 0 to 600m level (0.8 to 0.3°C away from the freezing point) no new ice formation and accordingly no brine release were observed.

(g) West of Scotland (D. Ellett, DML Oban). The standard section from the Scottish shelf to Rockall has continued with some recovery from recent relatively fresh conditions in the near-surface layers, and in March 1994, some indications of cascading from the crest of Anton Dohrn Seamount down the upper slope of the eastern Rockall Trough, with oxygenated water to 600 m and a second layer to 900 m below that. At the depth of the Labrador Sea Water layer (1400-1600 m), salinities had been up to 7 SD´s below the long term mean in 1991 as the result of resumed convection in the Labrador Sea in the late 80´s and its subsequent spread eastward. These conditions are now recovering to more normal levels at this depth but are still >1 SD below the mean. A Seacat logger is now in place to act as a continuous monitor of salinity in the Rockall Trough.

(h) Central Atlantic (H. Van Aken, NIOZ Texel). The Dutch navy now works a detailed XBT section from the western Channel to the Caribbean, four times per year, with accompanying surface salinities. The Celtic Sea is now surveyed by the National Fisheries Research Institute every November and the Bay of Biscay less regularly in summer. The June and November ´92 surveys found residual evidence in the Western Celtic Sea of the anomalously high salinities that had spread into the European Shelf in 1991. However, by November 1993 this had gone; temperatures were a little higher there, while sea surface salinities in the W. Channel had decreased to 35.0 instead of the 35.5 observed the year before. There are Dutch plans to piece together a 10 yr salinity data set for the Celtic Sea.

(i) 48°N Section (G. Becker BSH, Hamburg). Compared with the equivalent HUDSON section of 1982, a section by Sy and Koltermann in 1993 was 0.3°C colder in the West Atlantic and 0.1-0.2°C colder in the eastern Atlantic at the depth of the LSW temperature minimum. Salinities in this layer were 0.04 psu fresher in the eastern Atlantic in 1993 and the LSW layer was of considerably greater thickness, so that its volume in 1993 was approximately double that of the 1982 section. The section is to be repeated in October-November 1994 and September 1995 and then annually or every 2nd year. This will provide the evidence of interannual variability neccessary to place the comparison of the few existing sections (IGY, 1982, 1993) on a stronger footing.

(j) Spain (E. Buch). The Chairman reported brief details of the 4 standard sections (W coast, La Coruna and Santander) that are worked up to 12 times per year by Spain. (Salinity temperature, nitrate, phosphate).

In closing this agenda item, the Chairman repeated the request of the ICES Oceanographic Secretary that standard section data be submitted more promptly and completely to the Ser. Hydrographique. The meeting concluded that a selected subset of section data should be appended to the Working Group report. It was pointed out that the Atlantic Climate Change Programme had recently produced its first newsletter in March 1994, that 3 per year were planned, and that the ICES WGOH membership might benefit from and contribute to this series.

7. International programmes.

WOCE

Hendrik van Aken reviewed the ongoing and planned WOCE activities in the North Atlantic. The WG was informed that the one time hydrographic sections in west - east direction were completed; the north-south sections were still missing. The repeat hydrography in the eastern basin has started; the western basin repeat hydrography is scheduled for 1996 and later.

The WG noted the delay in the review of cruise reports and data reports by the WOCE office. The data holdings are therefore restricted until now and the North Atlantic Workshop has been postponed twice due to the lack of data.

Jens Meincke presented results from the AR7 section from Iceland to Greenland. He informed the WG that AR7 will be repeated four times in different seasons until 1995.

Svein Østerhus gave an overview on the status on the Nordic WOCE, especially on the planned ADCP moorings (in total 10 moorings) which will be deployed in summer 1994.

Jens Meincke and Bob Dickson informed the WG on the relation of GOOS to CLIVAR.

Svein Østerhus presented results from Weathership M as a contribution to WOCE. The WG discussed the data quality and recommends additional measurements at this position. The WG ask the Hydrography Committee to recommend a continuation of oceanographic observation on Ocean Weathership M and that steps are taken to introduce observations of additional parameters e.g. CO_2, currents by ADCP, oxygen, nutrients etc. Data quality shall live up to the standards of international programs such as WOCE and Mare Cognitum, who will be potential users of Station M. data.

MARE COGNITUM

J. Blindheim introduced Mare Cognitum, a Norwegian proposal for an interdisciplinary study on the effects of climate variation on the Nordic Seas ecosystem. Based on observational evidence that decadal fluctuation of the physical environment are closely correlated with changes in the year class strength of commercially important fish population a programme was designed with the goal of improved understanding of

- ocean climate
- resource ecology
- carbon cycle

A workshop on the ocean climate issue has found the following topics to be of primary importance

- Establish relationships between regional oceanography and atmospheric variables

- Identify and model the mechanisms leading to observed regional variability with a view of predicting changes in the physical environment

- Study upper ocean dynamics relevant to biological productivity

Plans for field observations were presented. They primarily consists of an enhancement of ongoing Norwegian, Faroese and Icelandic section work in the Nordic Seas. The proposal will be submitted to the Norwegian Science Council for funding from 1995 onwards.

The close topical relationship of the Norwegian proposal with other ongoing/planned activities in the Nordic Seas/Northern North Atlantic (e.g. WOCE, ACCP, MAST-Proj.) led the WG to ask the Norwegian colleagues to report regularily on the progress of the project.

Greenland Sea Project reported by E. Fahrbach.

The Greenland Sea Project officially ended in summer 1993 after having accomplished a winter hydrographic survey in early 1993 and a further repeat of the 75°N transect from 12°W to 9°E. However, measurements are still going on in the area in spite of the official end of the project.

In comparison to earlier realisations of 75°N transect a further warming of the Greenland Sea Deep Water was measured in 1993. The near bottom potential temperatures ranged at -1.22°C in 1990 and increased to -1.20°C in 1993. In that year they displayed the highest values ever observed. This confirmed the persistence of the trend observed during the past years showing a continous increase in potential temperature and salinity of the deep and bottom water which indicated that deep water formation was drastically reduced since thelate seventies

As a contribution to the Greenland Sea Project current meter moorings were deployed. The ones in the western boundary current of the gyre including the East Greenland were maintained since 1987. However, the locations varied significantly due to the heavy ice cover and make it difficult to compile continous time series to resolve the horizontal structure of the current. It is hoped that during the coming summer a set of five moorings will allow to determine the seasonal cycle and the lateral structure of the East Greenland Current. During the past deployement extremely high speeds of 20 to 40 cm/s were observed in all depths over the continental slope.

A significant part of the data from moorings in the Greenland Sea Gyre deployed by various participants of the Greenland Sea Project from 1988 to 1989 were collected in the Alfred-Wegener-Institute. The current pattern confirm the cyclonic circulation of the gyre by direct measurements. E. Fahrbach offered to all GSP-participants to to include further current meter data into the data bank to establish a more complete picture of the current system in the Greenland Sea.

Most of the hydrographic data collected during the GSP is available to ICES.

A symposium on the Greenland Sea is scheduled for March 6-9 1995 in Hamburg.

GLOBEC.

The results from the six working groups (WG on Population Dynamics and Physical Variability, WG on Sampling and Observations Systems, WG on Cod and Climate, WG on the Southern Ocean, WG on Numerical Moddelling and WG on Providence), etablished on the Globec Planning Meeting in Ravello Italy 31/3-2/4 1992, were the topic on the Globec Preliminary Planning Conference in Georgia 10-15/1 1994. Based on the results from the working groups, a report concerning the project will be finished on the Globec-International Strategic Planning Conference at the IOC Headquaters in Paris 18-22/7 1994.

Svein Sundby reported that three global projects under Globec are planned:

US Georges Bank - Globec.
Mare Cognitum.
Canada Globec.

Further, four programmes connected to the Globec programme were mentioned :

Cod and climate change programme.
The North Pacific Programme.
South Ocean Programme.
Small Pelagic Fish and Climate Changes (concerning the populations in California and South America).

EEC MAST 3 programme.

The EEC MAST 3 is a programme of the European Union. Application dead lines will be within a year. Possibly funded in part by MAST 3 [partly also by the NOAA SIO/LDEO Consortium] a group led by Mallki (IMR, Helsinki), Meincke (IFMH, Hamburg) and Dickson [MAFF Lowestoft] plan to build on past mooring recoveries from the overflow stream off East Greenland by working a coherent set of 3 arrays (2 moorings & 3 instruments per array) and an upward looking ADCP to assess long term variations in the thickness and speed of the overflow plume for a period of up to 10 years. Eberhard Fahrbach suggested that the project should also include large scale mooring sections in Fram Strait, to determine the water transport between the Arctic Ocean and the Nordic Seas. Additional measurements should be made on the western Barents Sea shelf to determine the component going through this area. Svend-Aage Malmberg suggested that measurements of the Icelandic Currents were included in the observation programme for Denmark Strait, which was accepted.

The full programme will be described at the WOCE-ACCP meeting in Princeton, May 11-13. Eberhard Fahrbach reminded the participants of the ECOPS Conference 12-16/9 1994 in Warnemunde, Germany.

Others.

Tom Rossby informed about the sound source moorings deployed in the Newfoundland Basin to provide acoustic navigation for three deployments (July-Aug 1993, Nov-Dec 1993 and Oct 1994) of isopycnal floats on two density surfaces (sigma-t = 27.2 and 27.5) to study the circulation and exchange of waters across the North Atlantic Current and Polar Front. He also gave a brief report on the planning of a deep convection experiment in the Labrador Sea 1996-1997, with the aim of determining two- and three dimensional flow in the area using a variety of drifter techniques. Lastly, he gave a brief update on the progress of a program to measure, on a weekly basis, the upper ocean velocity field between New York and Bermuda using a container-vessel mounted Acoustic Doppler Current Profiler. He suggested that this technique might be particularly relevant for the vessel used for Ocean Weather Station 'Mike' since it crosses the North Atlantic (NAC) and Norwegian Coastal Currents during its monthly trips to its home port. Since weather stations are allowed a modest amount a freedom of manuvering, he suggested that the ADCP could also be used to examine the temporal variability of the NAC while the ship is on station.

Harald Loeng reported from the Artic Monitoring and Assessment programme (AMAP). The primary objectives of the programme is the measurements of the levels of antropongenic pollutants and assessment of their effects in relevant compartment parts of the artic environment. A quality status report will be finished at May 1996.

8. The NANSEN Report

Last year WGOH asked John Gould to write the final NANSEN report. He has written one third of the report, but due to his new job as WOCE director he will not be able to complete the work. WGOH want to have the report ready to the next meeting, WGOH therefore asked Bogi Hansen and Svein Østerhus will finalize the report.

9. IOC/ICES GODAR project.

Gerd Becker reported that more data from Germany will be submitted to ICES, but some data are still missing. Harry Dooley is looking for data in Kiel.

10. Oceanographic Instrumentation.

Dr. Dickson suggested that there were a scope for notes about instumentation to be published by ICES, and gave three instances from a recent cruise of problems wich could be usefully be brought to the notice of working group members:

* An Aanderaa 3239D pressure sensor deployed during one year at 300db showed real events, but also a marked overall drift to shallower values. However, when subsequently tested on the CTD wire, its calibration had returned to the pre-deployment values.

* In two current meters the enmeshing between the encoder and star wheel had failed, which allowed continuous rotation to consume the battery power within a few hours.

* Current direction is recorded in the Aanderaa current meter by a clampingcurrent which attracts the S-pole of the compass, allowing a contact to be made at the opposite end of the needle. In the vicinity of the Magnetic South Pole a large dip angle reinforces this attraction and had caused the needle to stick in its housing in a certain sector. The mean angle of the resulting blank sector of the direction scatter plot closely approximated to the bearing of the magnetic pole. Dr. Dickson suggested that in similar conditions it would in the future be appropiate to reverse the compass to avoid this problem. It was noted that the manufacturer of the S4 current meter had warned of problems in areas where dip angles are large.

Dr. Dickson also noted that Freon-10 had proven a valuable new tracer in the Croget Basin.

Professor Meincke reported upon a 2½ month trial of a new SeaBird rosette sampler in the Greenland Sea. A more robust frame will be designed by the manufacturer, and problems with the glue used on the water bottles need to be solved, but in other respects the operation of the sampler was very reliable.

Dr. Dickson noted that the problems which affected the General Oceanic rosette sampler had been found to originate from a flatteried section on the spindle of the stepping motor system, which allowed water to penetrate the seal. Replacement spindles had been made and cured the problem on his recent cruise.

Professor Rossby noted that there is a newsletter that is circulated by and for marine technicians working on UNOLS vessels (UNOLS = University National Oceanographic Laboratory System), and that this might be a means for distributing information of a technical nature. Working group members expressed keen interest in making contact with this newsletter and Prof. Rossby offered to pass the names.

Dr. Fahrbach advised care in formal publication of criticism of products, and stressed the need for strictly factual data. He also reported upon problems with Oceano and General Oceanic acoustic releases after 2 years deployment in deep cold water. These conditions had caused the jelly filling in the heads to stiffen, affecting the sound transmission. When brought back to the surface, however, the releases had quickly reverted to normal operation. Shorter deployments were recommended in cold water.

Professor Meincke had experienced problems with releases which had erroneously confirmed release. This had arisen because the signal had been send before the spindle of the rotor had made 3/4 of a revolution and had subsequently stopped.

After discussion of the means of keeping instrumental matters to the fore, the working group agreed that the topic should be put on the agenda annually and noted in the groups report to the Statutory Meeting. Professor Rossby stressed the opportunities given by Voluntory Observing Ships (VOS), and Dr. Dickson spoke of new, cheaper sensors being evolved for a new Continous Plankton undulator. Dr. Narayanan noted a fast-spooling winch being developed by BIO for underway CTD profiling from VOS. Other members mentioned the need for calibration checks upon data collected by non-specialist observers. The use of telegraph cables for trans-oceanic observations was briefly discussed.

11. Standard names for North Atlantic water masses.

Professor Meincke started off the discussion by pointing out the difficulty in standardizing the water mass names when the differences in the T/S characteristics defining these are quite often smaller than the natural variability within each water mass. On the other hand it is confusing when the same water mass may be referred to by different names in the literature. The conclusion from the discussion that followed was that standardizing names for each water mass is not practical, and may not be necessary as long as the T/S definitions are included.

12. Election of chairman.

The present chairman dr. Erik Buch was elected for another three year period.

13. Any other business.

B. Dickson advertised for the XXIst IUGG General Assembly in Boulder, Colorado from 2 to 15 July 1995. He will convene a symposium on large-scale ocean circulation with three co-convenors: H.L. Bryden, R. Davis and E. Fahrbach covering direct measurements of the global conveyor, the great trans-ocean sections, new lagrangian data-sets, and circulation of polar and sub-polar seas.

T. Rossby indicated that at present little use is made by the oceanographic community to publish results on ocean-atmosphere interactions in the Bulletin of the American Meteorological Society. He recommended that journal as a valuable forum.

Standard sections and stations to include in the report:

It was agreed that the sections off Newfoundland, Westgreenland, the Siglunes Section, the 48°N section, the sections around Norway and West of Scotland should be included in the report. S. A. Malmberg will provide the contribution from Iceland and G. Becker the one along 48°N.

T. Rossby raised the question of educational aspects of the activities in the working group. It was stated that there is no general direction because the educational systems are rather different in the different countries. However, there are means and organisational structures available to exchange graduate students between the different countries and various examples of present or past exchanges were given. Mostly they occur on the basis of bilateral agreements.

14. Place, date and topics of next meeting

D. Ellet reported an invitation from the Director of the Dunstaffnage Marine Laboratory for the working Group to meet next year in Oban. The invitation from the Dunstaffnage Marine Laboratory was accepted by the Working Group. Date: 26 to 28 April 1995.

As topics for the next meeting the following subjects were proposed:

- Radio-activity contamination in the Nordic Seas
- Standard Sections and Stations
- Questions relating to Cod and Climate.
- Review of national and international projects in the North Atlantic (WOCE, Mare Cognitum etc.)
- Results from WOCE North Atlantic Workshop..
- The Nansen summary paper.

Appendix 1.

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APPENDIX 2

AGENDA

1. Opening.
2. Review of membership.
3. Remarks from the ICES Oceanography Secretary.
4. Radioactive contamination of the Nordic Seas.
5. Climatic variability and long term changes on pan-atlantic Cod Populations.
6. Results from standard stations and sections.
7. International programmes.
   * WOCE Hydrographic Programme.
   * Mare Cognitum.
   * Greenland Sea Project.
   * Globec
   * EEC MAST 3 programme.
   * Others
8. NANSEN Report.
9. IOC/ICES GODAR project.
10. Oceanographic instrumentation.
11. Standard names for North Atlantic Water masses.
12. Election of chairman.
13. Any other business
14. Place, date and topics of next meeting

APPENDIX 3

Recommendations.

1) The Working Group on Oceanic Hydrography recommends the 100-th anniversary of the ICES Data Bank to celebrated in connection with next decadal symposium in year 2002.

2) The Working Group on Oceanic Hydrography recommends to follow the results from research and monitoring of the radioactive contamination of the Nordic Seas and help to optimize the coordination of research and monitoring activities.

3) The Working Group on Oceanic Hydrography recommends to continue the ongoing dialog between cod biologists and physical oceanographers and that a Special Topic Session should be arranged on the 1995 Statutory Meeting with the titel : "Relations between cod growth and physical oceanography focussing on special events".

4) The Working Group on Oceanic Hydrography asks the Hydrography Committee to recommend a continuation of oceanographic observations from Ocean Weathership M and that steps are taken to introduce observations of additional parameters e.g. carbondioxid, currents bt ADCP, oxygen, nutrients etc. and that the data quality live up to standards of international programmes such as WOCE and Mare Cognitum.

5) The Working Group on Oceanic Hydrography recommends to follow the developments in the MAre Cognitum Programme.

6) The Working Group on Oceanic Hydrography recommeds Dr. Erik Buch to be nominated as chairman for another 3-year period.

7) The Working Group on Oceanic Hydrography (chairman: Dr. Erik Buch, Denmark) will meet in Oban, Scotland from 24-26 April 1995 to:

   a) review result from research and monitoring programmes related to radioactive contamination of the Nordic Seas.

   b) update and review results from Standard Sections and Stations.

   c) assess progress in the understanding of the role climatic variability and the long-term changes of the pan-atlantic cod populations.

   d) review progress in national and international projects in the North Atlantic (WOCE, Mare Cognitum etc).

   e) asses results from the WOCE North Atlantic Workshop.

   f) Finalize the report on the ICES NANSEN Project.

   g) asses and evaluate oceanographic instrumentation.

APPENDIX 4

Results from Standard sections and stations

CANADA

by

SAVI NARAYANAN

The decline of several commercial and non-commercial fish stocks during the late 1980s and 1990s has generated a renewed interest in the long time series from the Standard Sections and Standard Stations and a willingness to provide support for the occupation of these. The Northwest Atlantic Fisheries Centre in St. John's, Canada, is responsible for the occupation of the Seal Island, White Bay, Bonavista and Flemish Cap Sections across the Labrador and Newfoundland Shelves, and of the Standard Station (Station 27) off St. John's Newfoundland. In addition, as part of the Labrador Current Variability Study, a long time series of current meter observations have been collected from inshore Hamilton Bank on the southern Labrador Shelf. St. Andrews Biological Station is responsible for the Standard Station Prince 5, a station off St. Andrews, New Brunswick, near the entrance to Bay of Fundy.

Basic conclusion from these time series is that the cold period that was established in 1984 in the northwest Atlantic, is continuing into 1994, except for a brief recovery during the late 1980s. The area of the cold intermediate layer (CIL: sub-surface layer of sub-zero temperatures across the shelf) along each of the four standard sections during the summer months remained well above normal in 1994 and was larger than the 1992 value (Fig. 1; shorter time series from the White Bay Section not shown). Ocean temperatures and water salinities at Station 27 (Fig. 2) were also generally below normal throughout the water column, and were consistent with the near-bottom temperatures at the mooring site on Hamilton bank (Fig. 3).

Temperatures and salinities at Prince 5 were also below normal (Fig. 4). However, temperatures at shallow depths on the Scotian Shelf were dominated by high-frequency oscillations and did not exhibit any trends, whereas in the basin of the shelf, the deep water temperatures were warmer than normal indicating an increase in the slope-water intrusions.

Coastal regions bordering the Labrador Sea experienced near record cold annual air temperatures effecting a more extensive than normal ice cover over the Labrador and Newfoundland shelves in 1993.

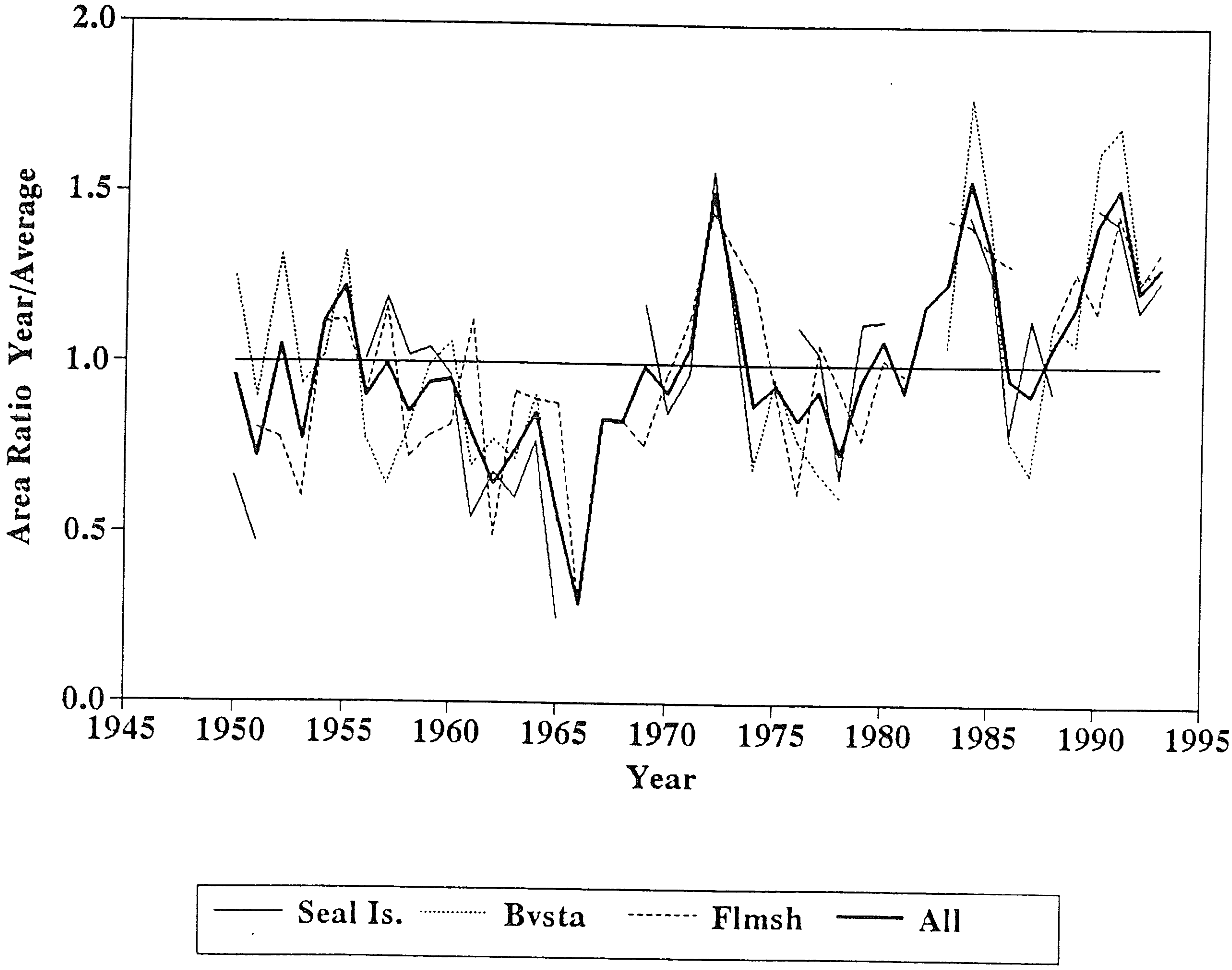
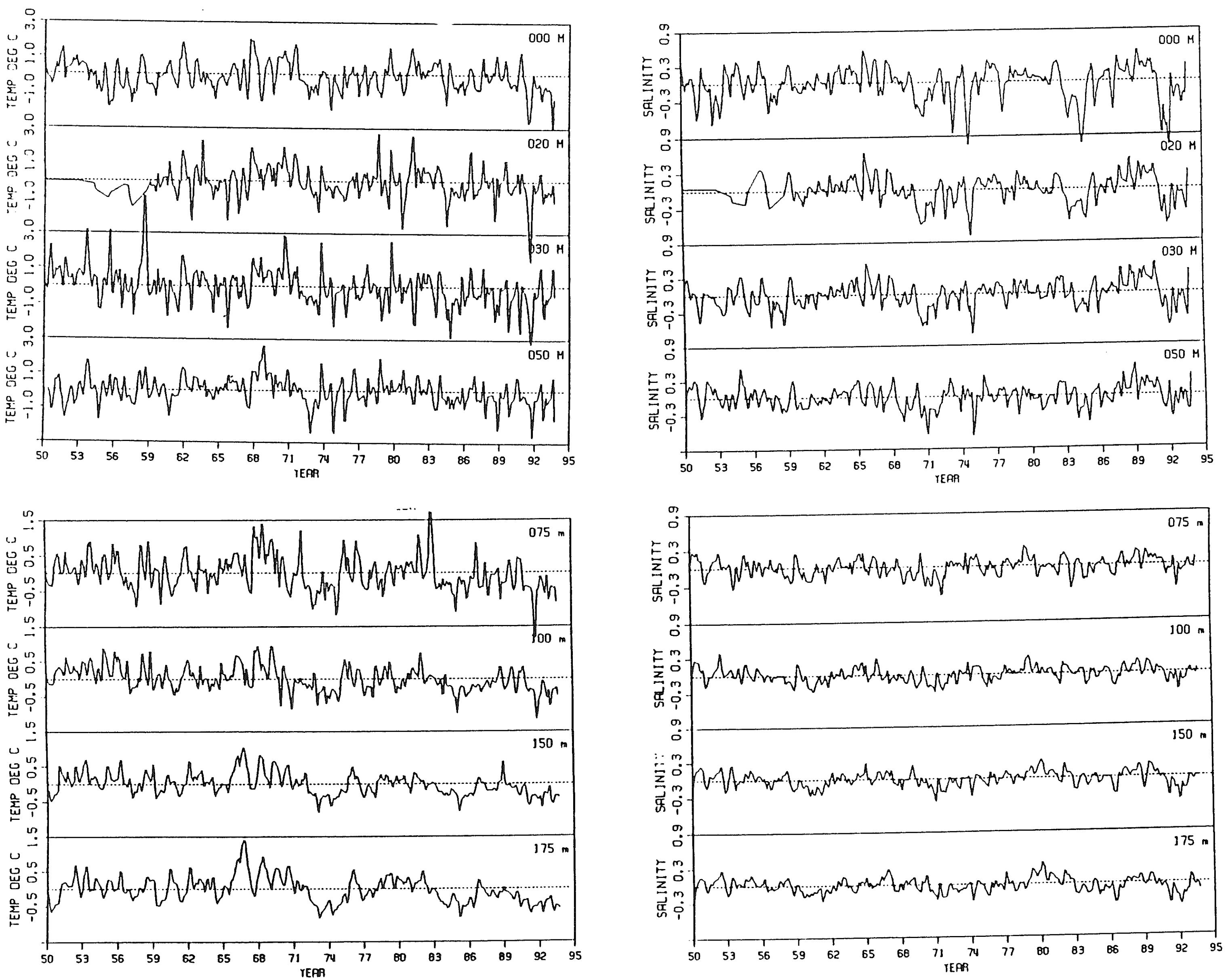


Fig. 1 Time series of the CIL area for Seal Island, Bonavista and Flemish Cap sections, normalized with respect to the long-term mean for each, and the average of the three; values greater than 1 represent above average CIL area.

Fig. 2 Temperature and salinity anomalies at STATION 27 at selected depths



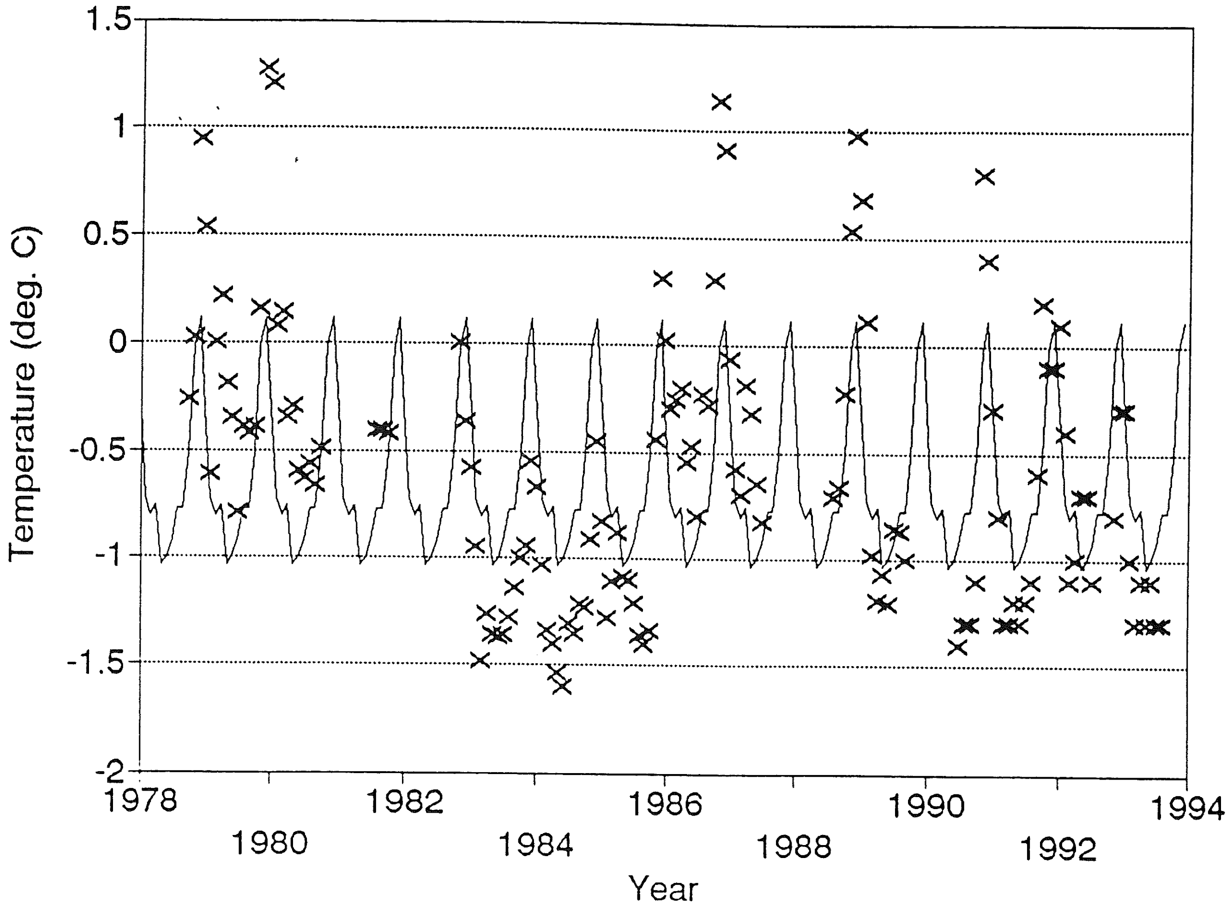


Fig. 3 A comparison of the near-bottom (200 m) monthly mean temperature (X) at the inshore Hamilton Bank mooring (53° 44.2′ N, 55° 28.6′ W) with the 1978 - 1993 average.

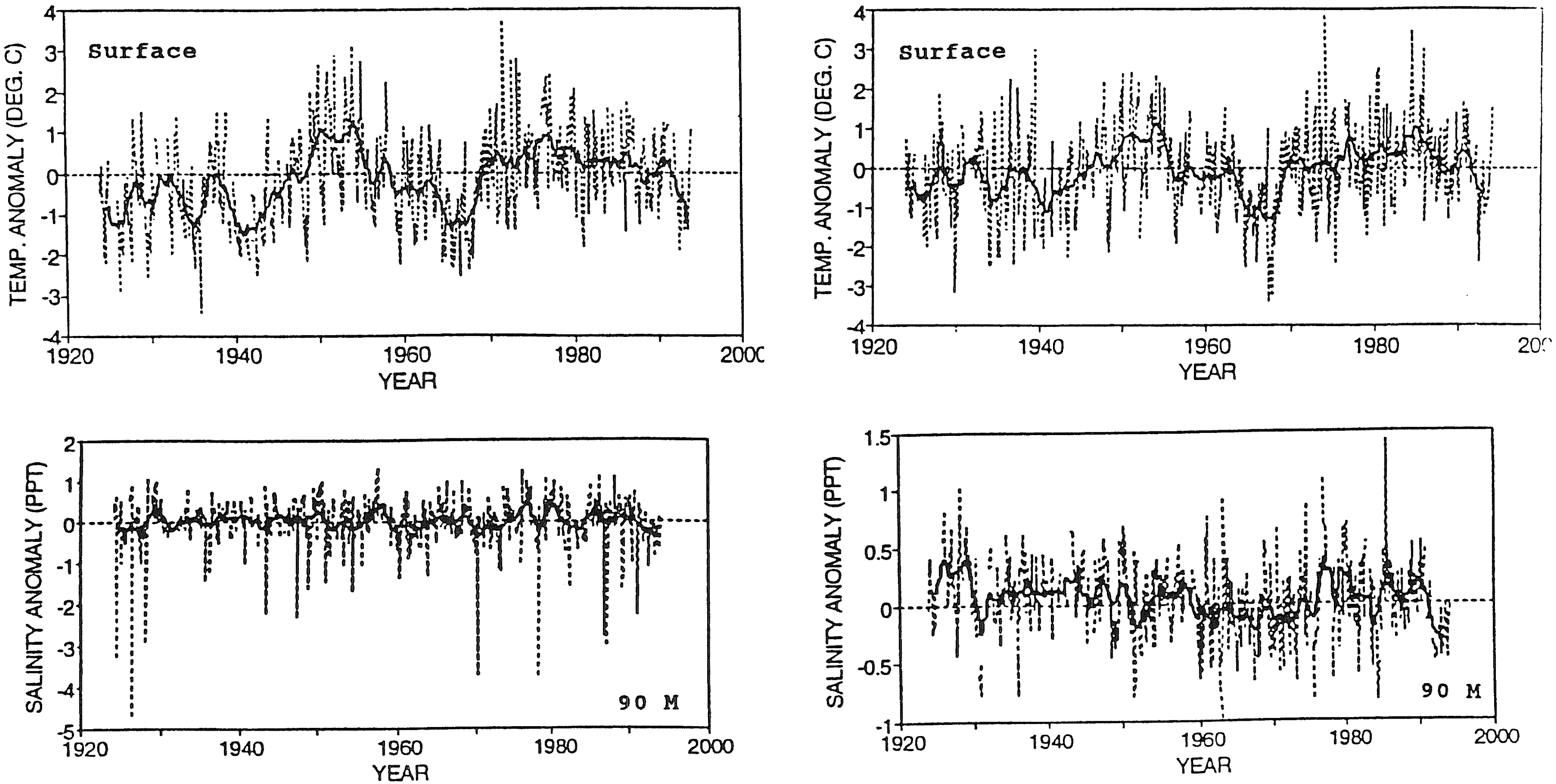


Fig. 4 The monthly means and the 25-month running means of the temperature and salinity anomalies for Prince 5.

West Greenland

by

Erik Buch

The standard sections along the southwest coast of Greenland are worked once a year in June - July by the Royal Danish Administration of Navigation and Hydrography.

Atmospheric conditions.

The climatic conditions over West Greenland has been rather cold during recent years, Fig.1.

After the extremely cold period at the beginning of the decade (1982-84) the climatic conditions normalized; after 1989 the air temperatures have again shown negative anomalies, especially during winter.

Studies of the meteorological circulations over the Greenland area show that the present cold climate is caused by a cold arctic airmass over the Davis Strait, i.e. the same phenomenon as in the early 1980'es.

The cold atmosphere has resulted in a cooling of the oceanic surface-layer along the entire West Greenland coastline which again has resulted in a greater than normal coverage of sea-ice in the Davis Strait during recent winters.

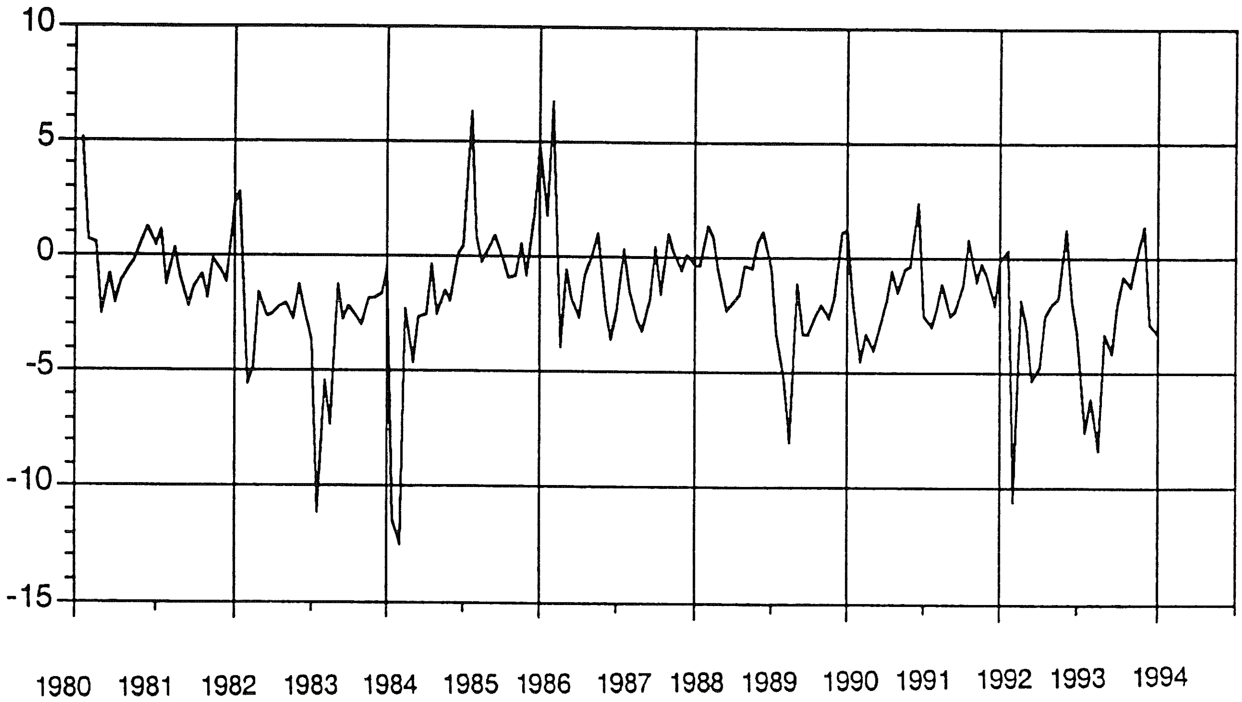


Fig.1. Monthly mean air temperature anomalies from Nuuk for the period 1980 to 1993.

The Fylla Bank mid-June time series

The mean temperature on top of Fylla Bank (Fylla Bank Section St.2, 44 m) medio June has been measured since 1950. It has been taken as an indicator on the climatic conditions in the West Greenland area and used in that respect in fisheries assesment work. In Fig. 2 the time series of actual observations as well as a three year running mean of the temperature on top of Fylla Bank are shown. It is noticed that since 1989 the temperature conditions have been comparable to the conditions observed during the two previous cold periods, i.e. the cold years around 1970 and 1983.

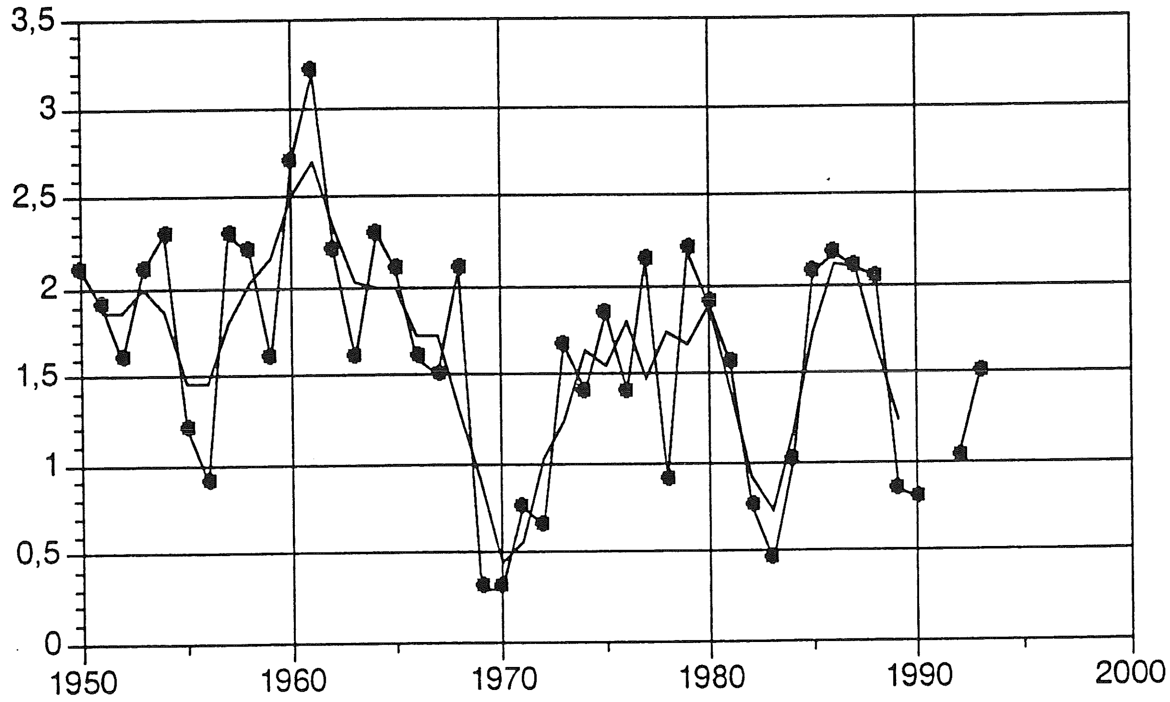


Fig.2. Mean temperatures on top of Fylla Bank Medio June, 1950-93.

-------- Observed Values
——— 3 years running mean

Results from the 1993 cruise.

The 1993 cruise (1 - 8 July 1993) was impeded by the presence of large amounts of polar drift ice carried to the area by the East Greenland Current, Fig. 3. For this reason it was impossible to operated the Cape Farewell section.

The observed surface temperatures and salinities are shown in Fig. 4-5. Water of Atlantic origin (T > 3°C and S > 34.5) could not be observed at the surface in early July 1993 due to the above mentioned great inflow of Polar Water and sea ice carried by the East Greenland Current.

Examples of the vertical distribution of temperature and salinity on the six sections is given in Fig. 6 - 7.

The surface layer is at all sections dominated by the inflowing cold, relatively fresh polar water.

At greater depths, where water of Atlantic origin is found, the oceanographic conditions are dominated by temperatures in the interval 2.5 - 4.0°C and salinities between 34.50 and 34.85, values characterizing Sub-Atlantic Water. It is however remarkable that undiluted Irminger Water (S > 34.92) not was observed in 1993 not even at the southernmost sections. Only diluted Irminger Water with salinities slightly above 34.85 were present as far north as the Sukkertop section.

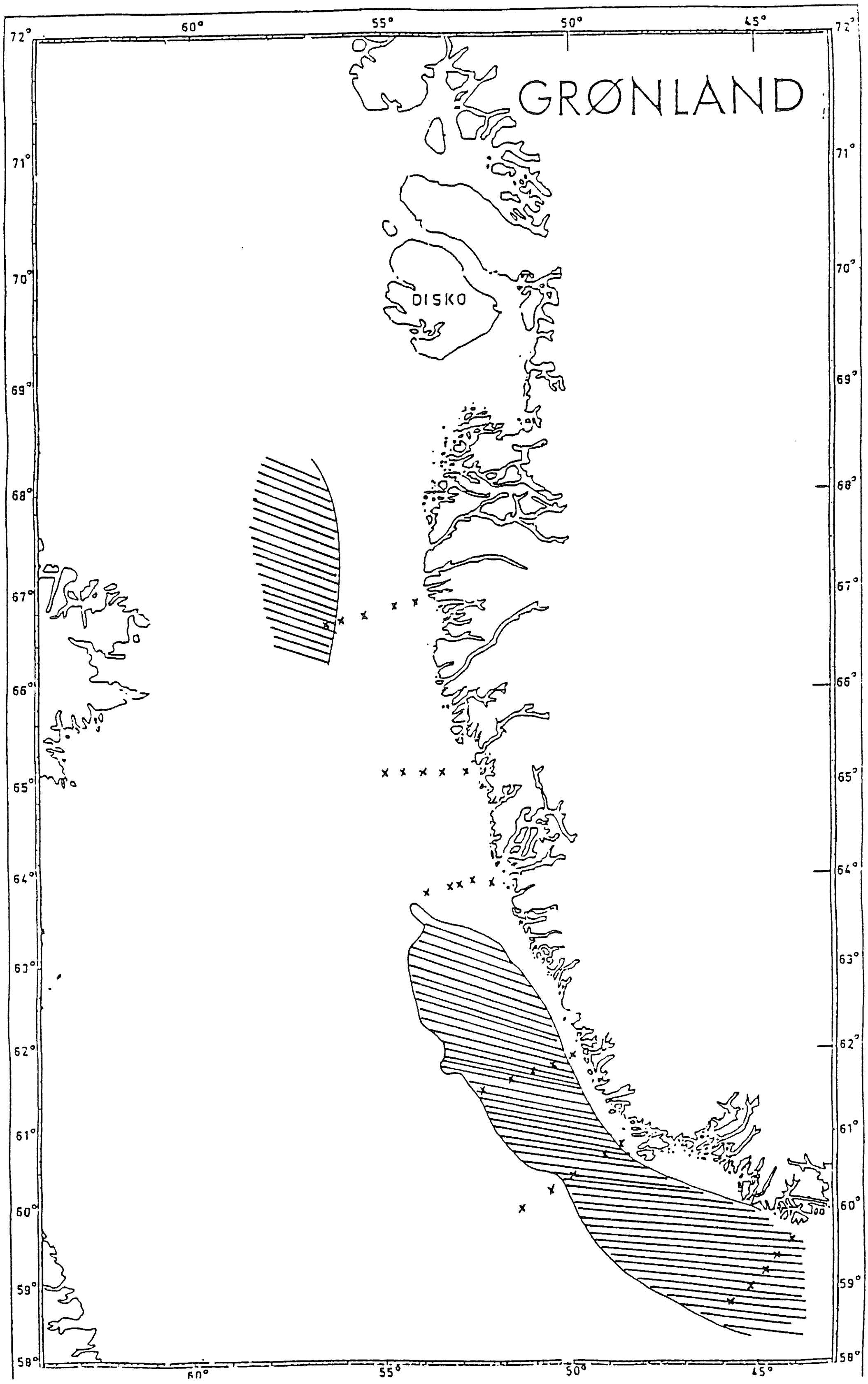


Fig. 3. Distribution of sea-ice off West Greenland primo July 1993.

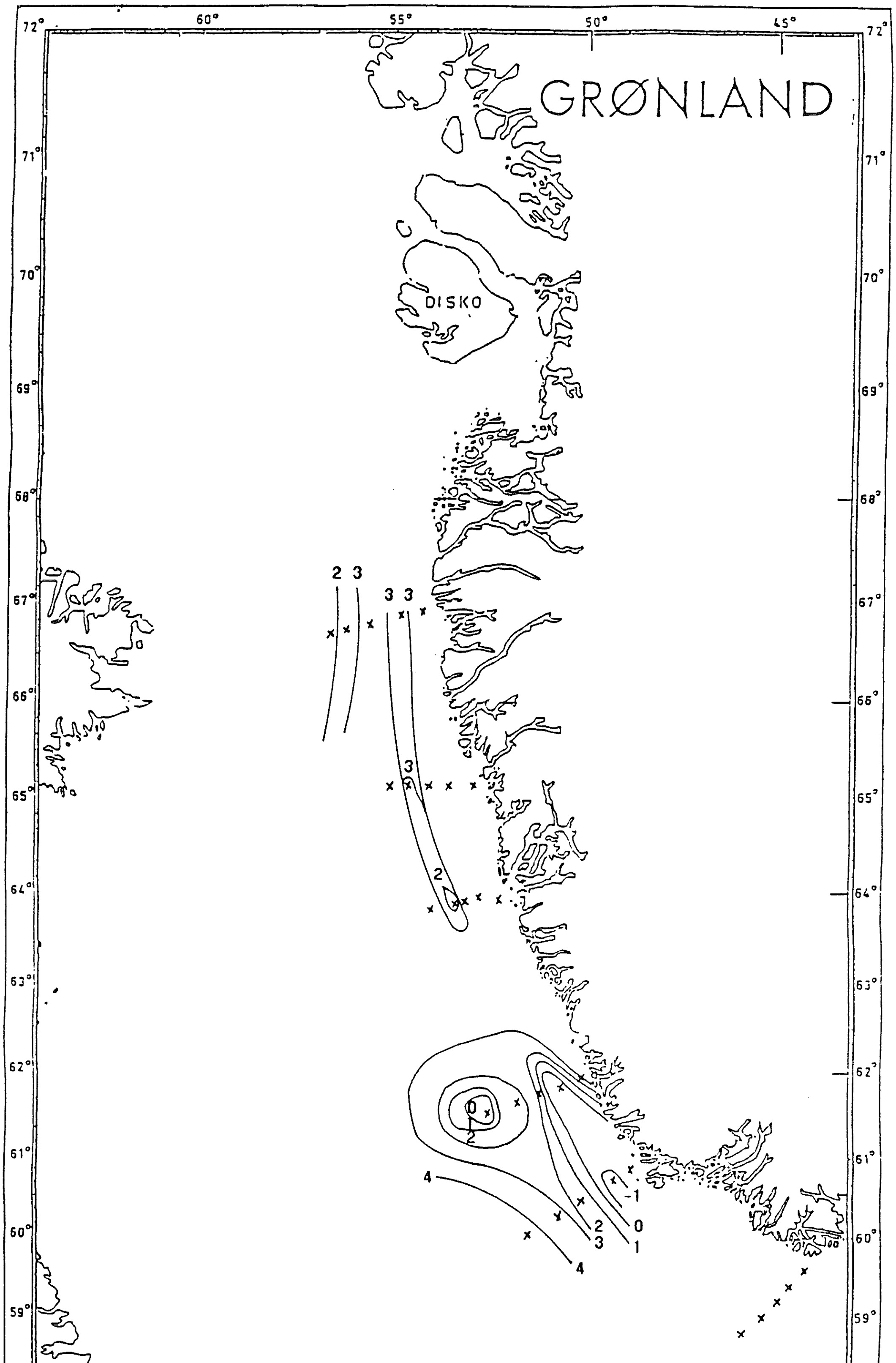


Fig.4. Surface temperatures off West Greenland primo July 1993.

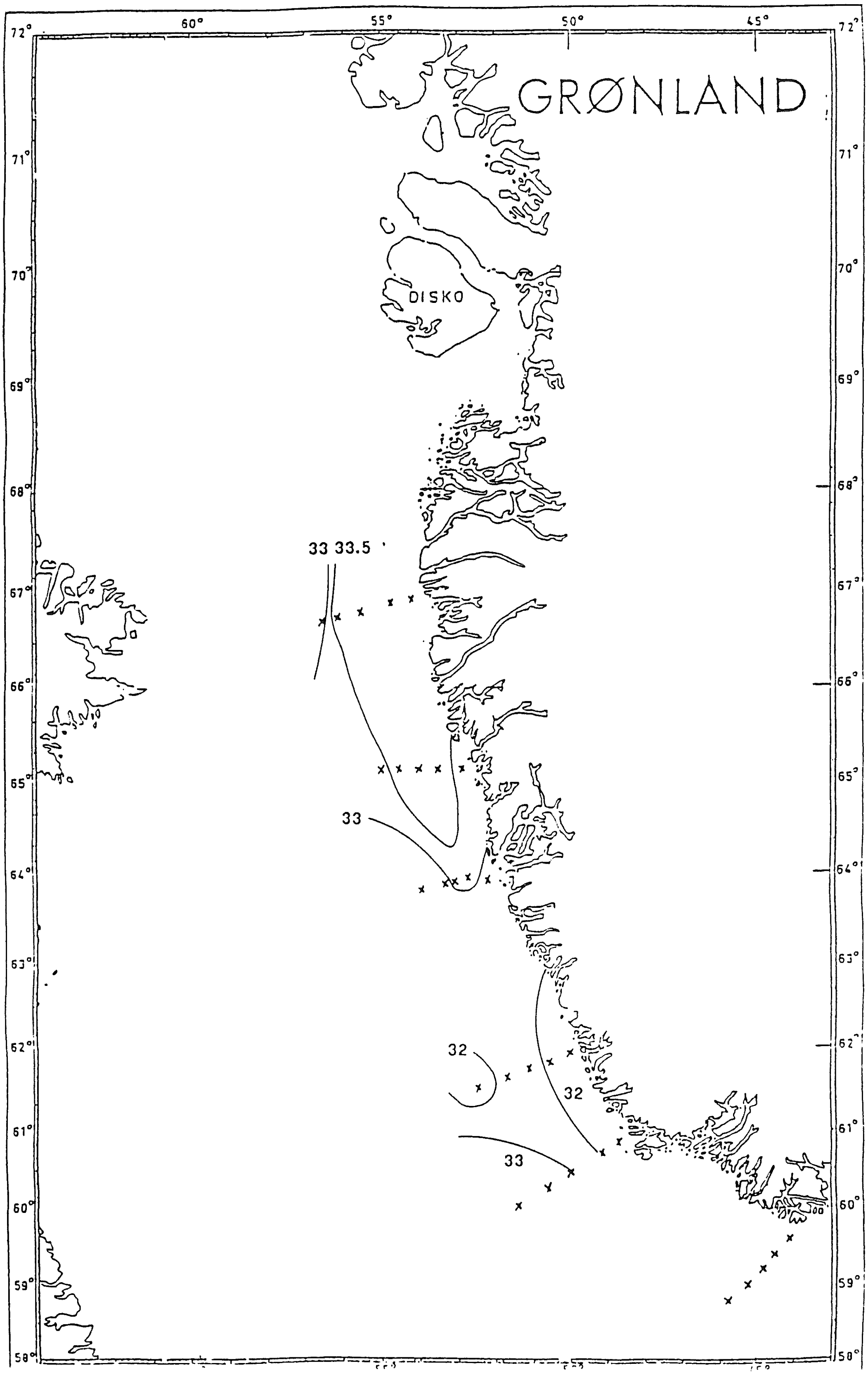


Fig.5. Surface salinities off West Greenland primo July 1993.

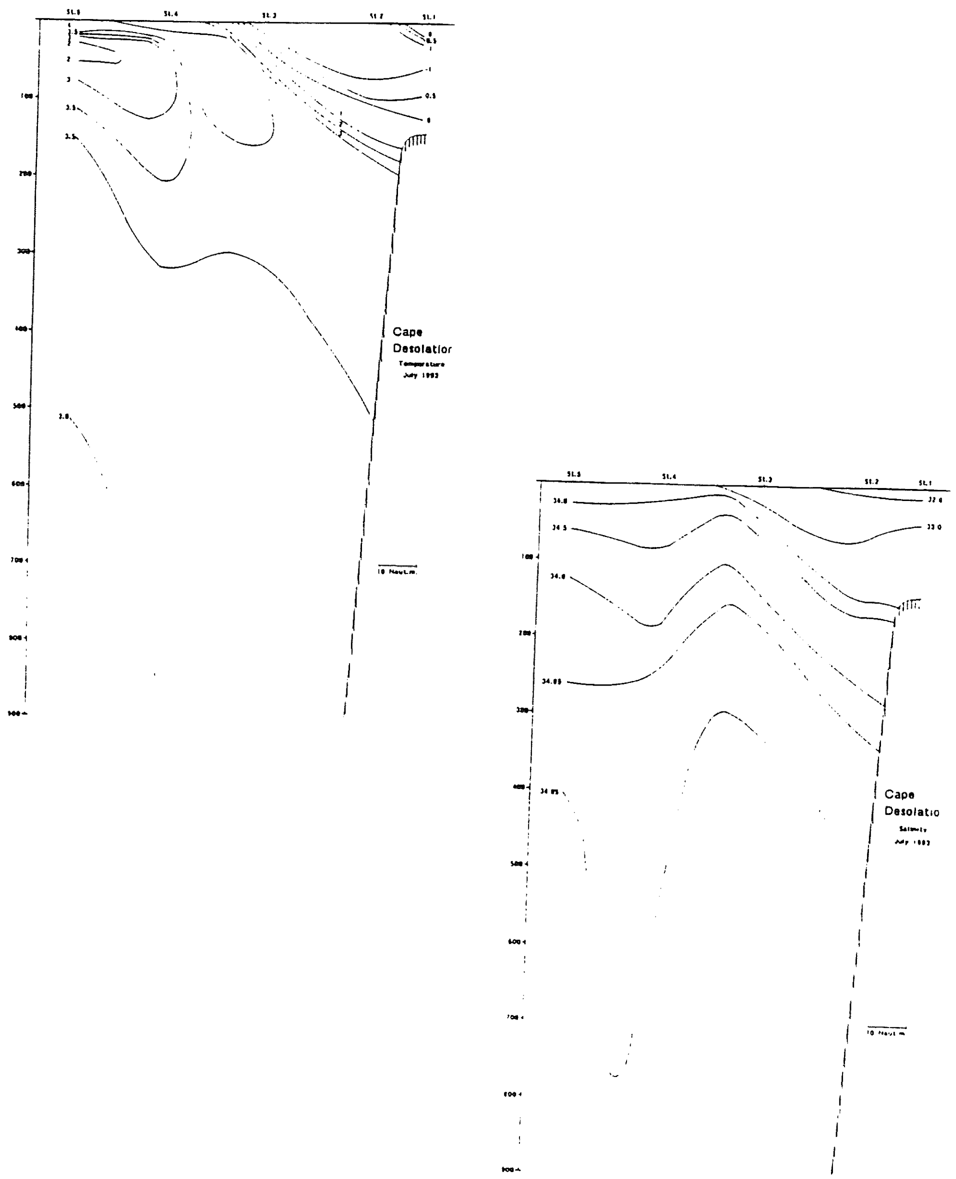


Fig.6 Vertical distribution of temperature and salinity at the Cape Desolation section primo July 1993.

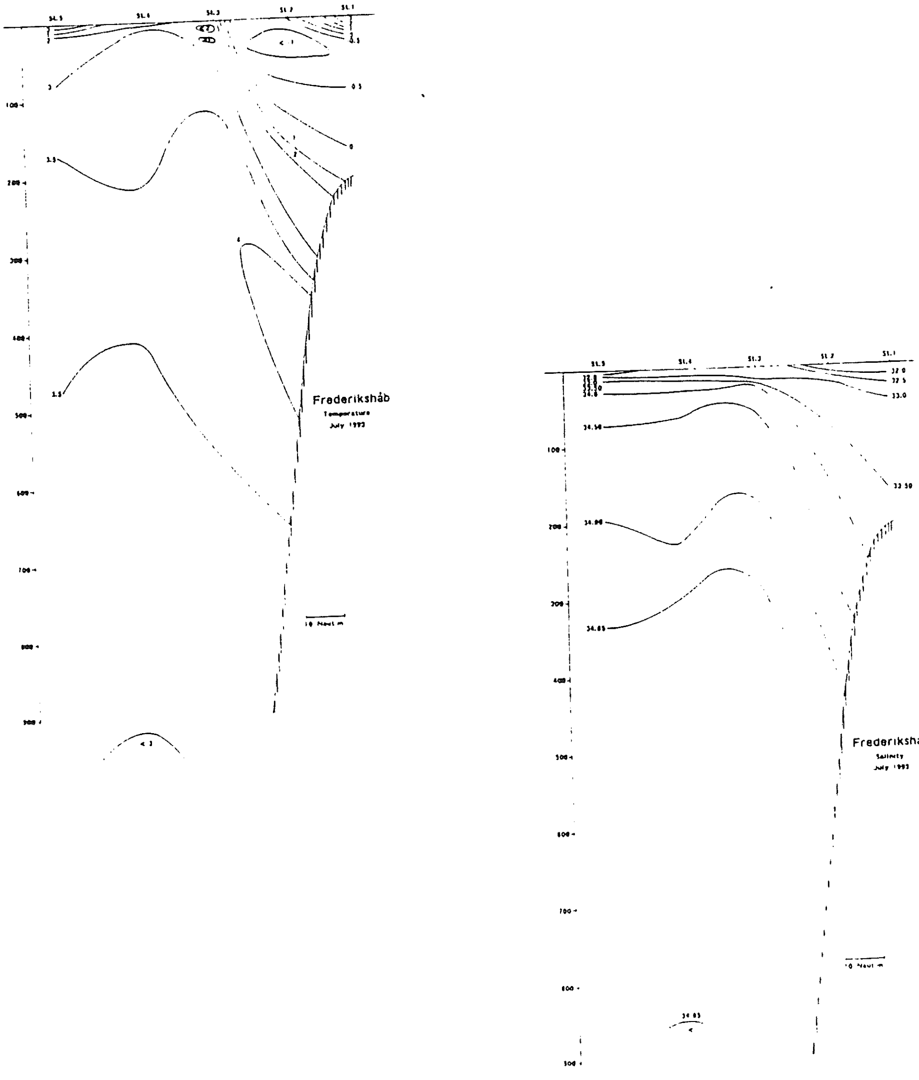


Fig.7 Vertical distribution of temperature and salinity at the Frederikshaab section primo July 1993.

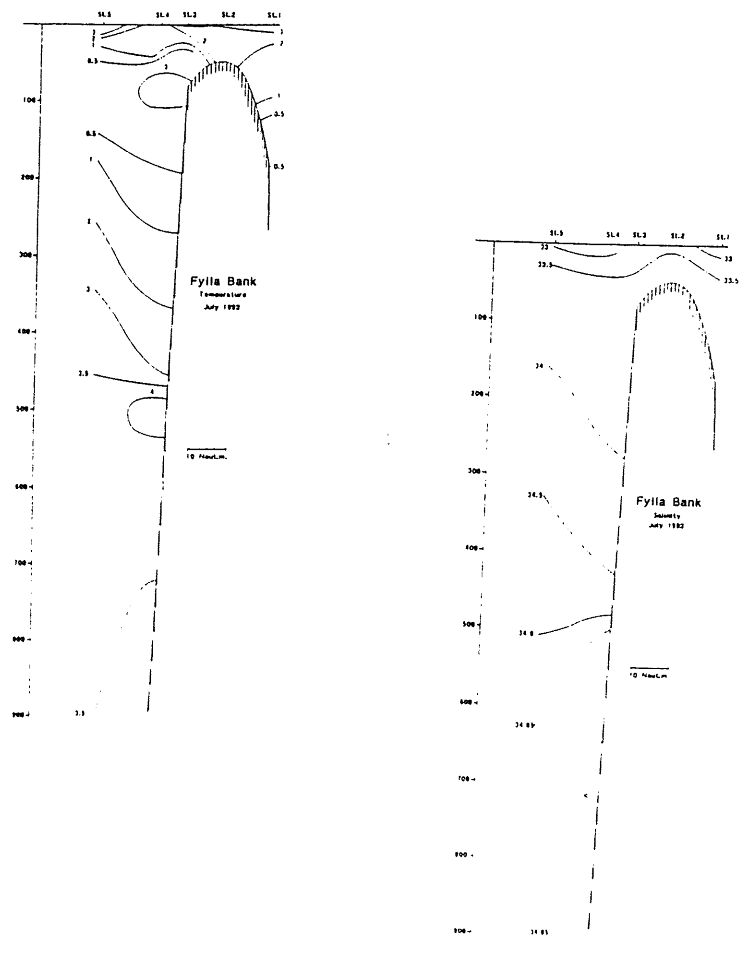


Fig.8 Vertical distribution of temperature and salinity at the Fylla Bank section primo July 1993.

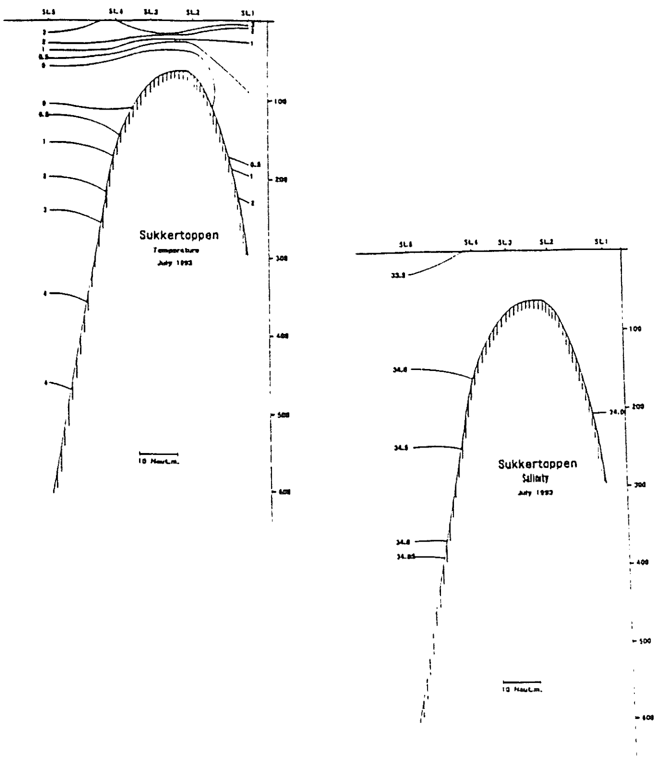


Fig.9 Vertical distribution of temperature and salinity at the Sukkertoppen section primo July 1993.

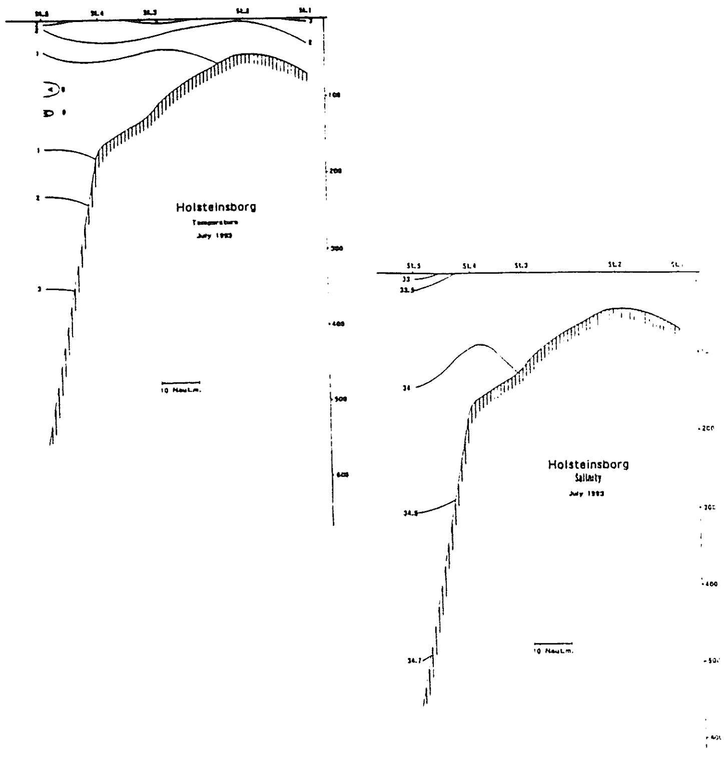


Fig.10. Vertical distribution of temperature and salinity at the Holsteinsborg section primo July 1993.

ICELAND

by

Svend Aage Malmberg

The evaluation of environmental conditions in Icelandic waters is mainly based on data obtained during a biological/oceanographic surveys carried out in spring. As in two previous years the main results from the spring of 1993 indicate favourable hydrobiological conditions in Icelandic waters with a continuation of influx of Atlantic water into the North-Icelandic shelf area. In contrary cold low salinty water was present in the shelf area north of Iceland during 1988-1990 while during 1984-1987 warm Atlantic water was again present. During the spring of 1993 the zooplankton densities north of Iceland were amongst the highest recorded in recent years. Further, nutrient densities were still high and therefore a continuation of phytoplankton growth may be expected.

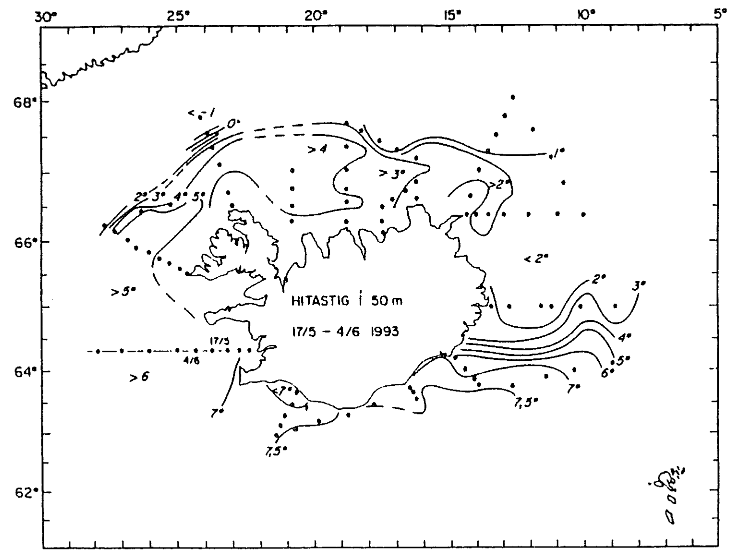


Fig. 1.1. Temperature at 50 m in Icelandic waters in spring 1993.

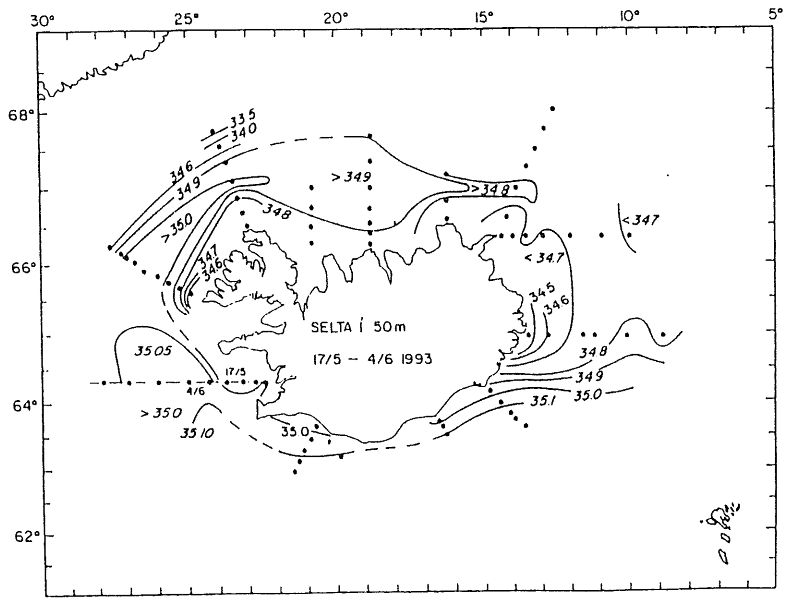


Fig. 1.2. Salinity at 50 m in Icelandic waters in spring 1993

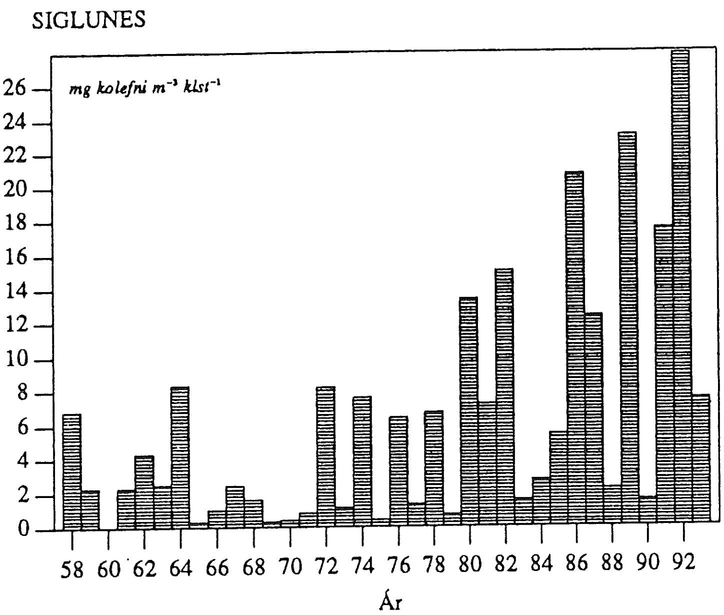


Fig. 1.6. Mean primary production ($mg\ C\ m^{-3}\ h^{-1}$) at 10 m at Siglunes section in spring 1958-1993.

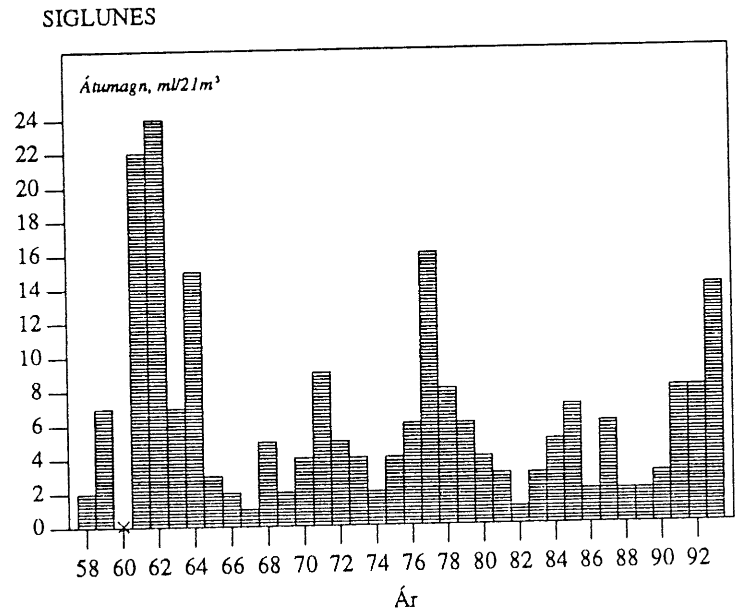


Fig. 1.7. Variations in zooplankton density ($ml/21m^3$, 50-0 m) at Siglunes section in spring 1958-1993.

HITASTIGSFRÁVIK Á SIGLUNESSNIÐI

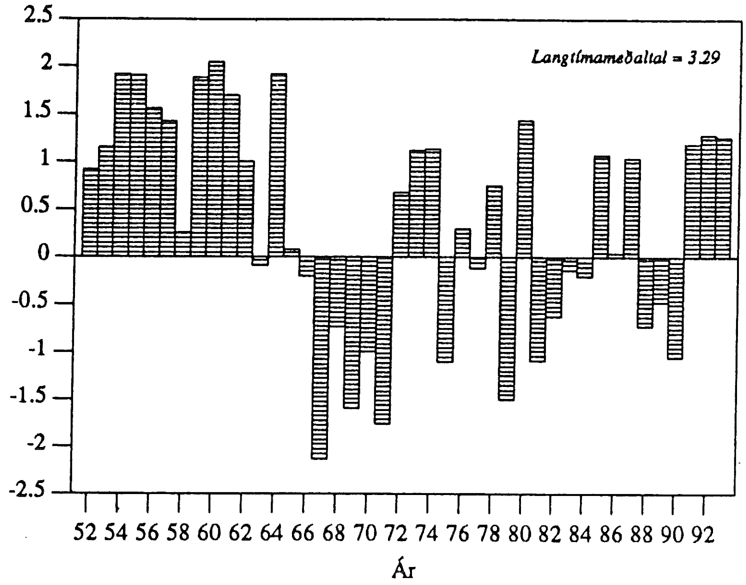


Fig. 1.8. Deviations 1952-1993 from 1961-1980 mean in temperature at Siglunes section.

SELTUFRÁVIK Á SIGLUNESSNIÐI

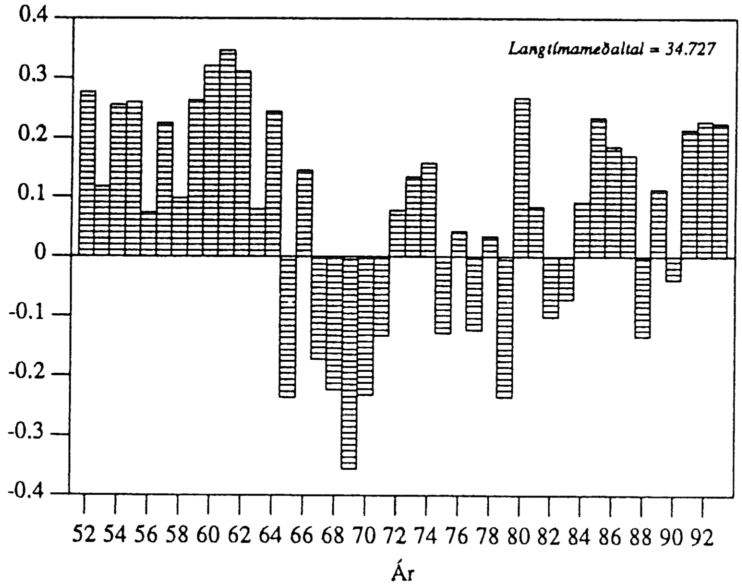


Fig. 1.9. Deviations 1952-1993 from 1961-1980 mean in salinity at Siglunes section.

Faroe Islands

by

Bogi Hansen

The three Faroese standard sections were occupied four times in 1993, 5/2-9/2, 15/5-27/5, 13/8-17/8 and 26/9-28/9. In the Faroe bank Channel, both temperature and salinity of the upper water have been decreasing in the nineties and the salinity of the 100-300m layer was in 1993 about 0.05 to 0.10 below typical values in the late eighties (Fig.1). North of the Faroes the salinity of the Atlantic water wedge has also decreased and the core of this current is now typically below 35.20 in salinity as exemplified in Figure 2. The extension of the Atlantic water on standard section N has also decreased, indicating that dynamical changes are occurring between Iceland and the Faroes (Hansen & Kristiansen, submitted to the 1994 ICES Statutory meeting).

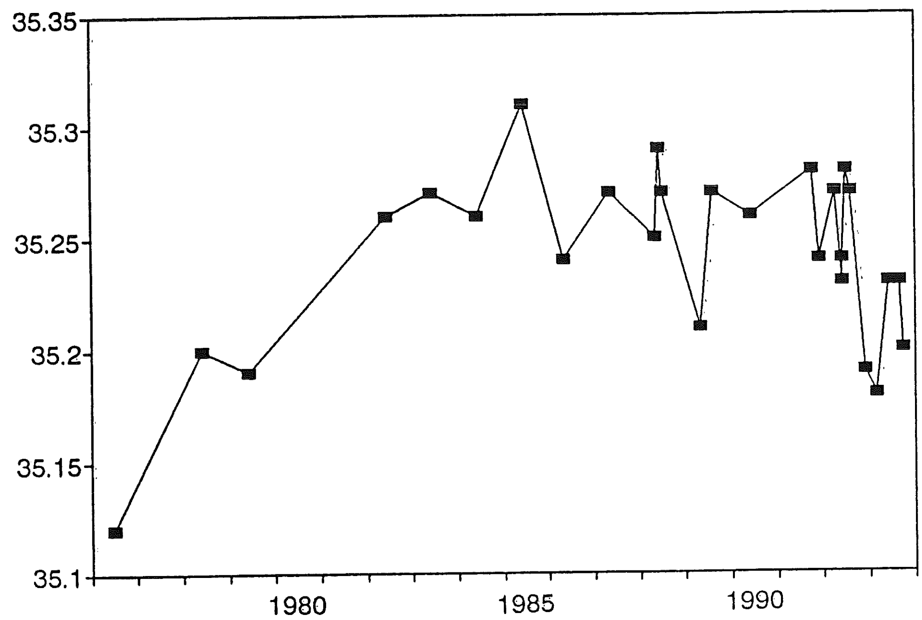


Figure 1. Average salinity of the 100-300m layer in the Faroe Bank Channel from CTD station between 61°00 and 61°30 North and between 7° and 9° West with bottom depth at least 700m. (From Hansen & Kristiansen, 1994).

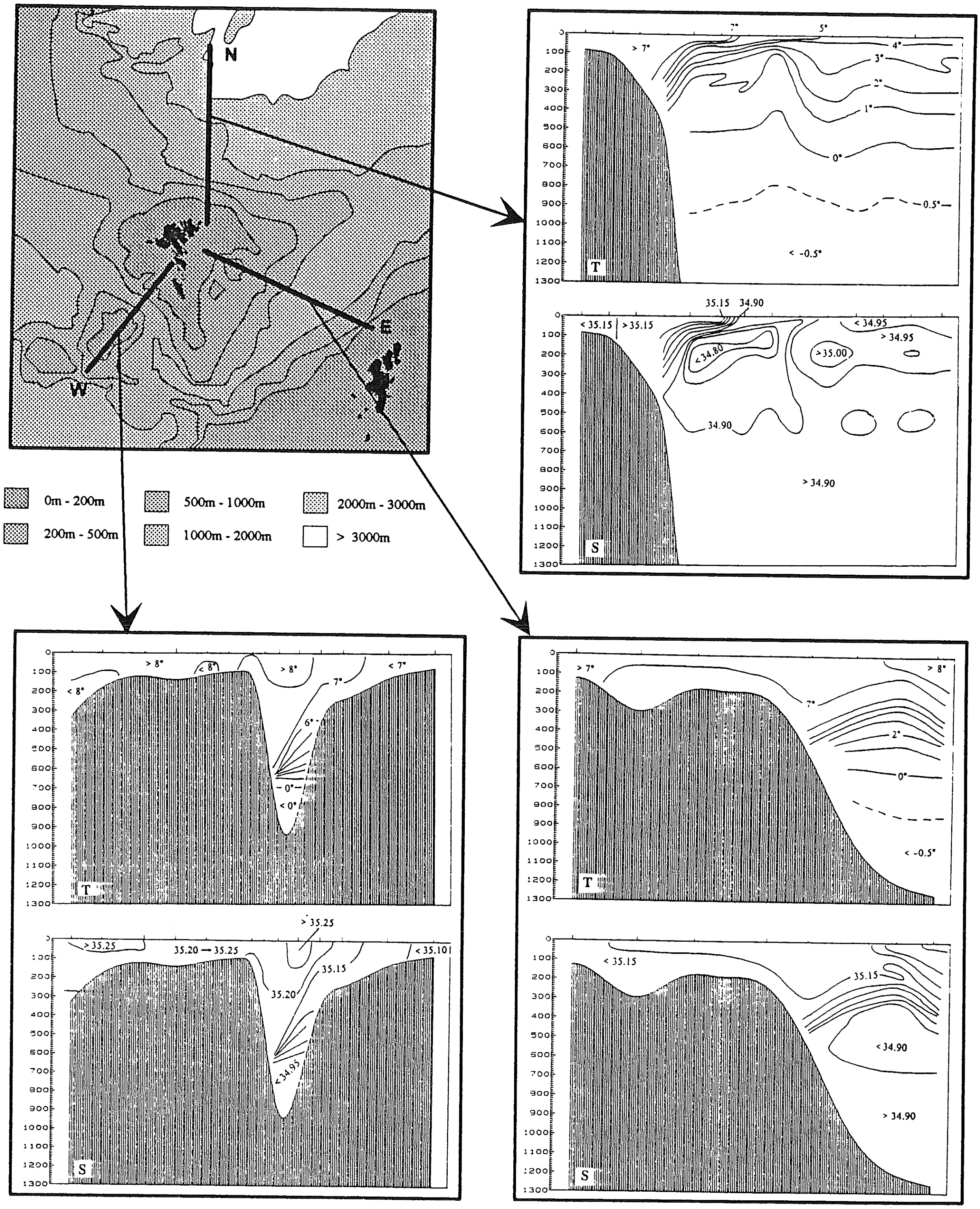


Figure 2. Temperature and salinity sections from the May 1993 cruise of R/V Magnus Heinason.

Norway

by

Johan Blindheim

Locations of Norwegian standard sections and fixed oceanographic stations are indicated in Fig. 1 Time series of temparature and salinity from the sections Svinøy-NW, Gimsøy-NW and Sørkapp (West Spitsbergen) - W are shown in Fig. 2, and from Fugløya - Bjørnøya, Vardø - N and Sem Islands - N in the Barents Sea are shown in Fig. 3.

The warm period since 1988/90 with conditions in favour of increased biological production in the Atlanic domain of the Nordic Seas and the Barents Sea, contributed to good recruitment and growth of the most important fish stocks ind the region.. This period, in which maximum temperatures were reached in 1990/91, now seems to be coming to an end. Since 1991 there has been a cooling trend, although the section Svinøy - NW in the southern Norwegian Sea indicates a slight temperature and salinity increase from 1991 to 1992 (Fig. 2.A). This increase may also indicate that the present cold period will be rather moderate, or it may be just "noice" on the general trend.

Fig 4. shows the temperature/salinity trend in summer at stations A and B on the section across the North Sea between Utsira and Startpoint (Fig. 1). The warm period around 1990 is apparent also in these positions, although it was less pronounced in the North Sea than in the Barents Sea.

Fig. 5 shows temperature and salinity trends at 600 m depth in Skagerrak since 1947. In this time serie the warm period 1990-1992 is the warmest on record. This is possibly more due to moderate winter cooling in the North Sea than to an extremely warm inflow.

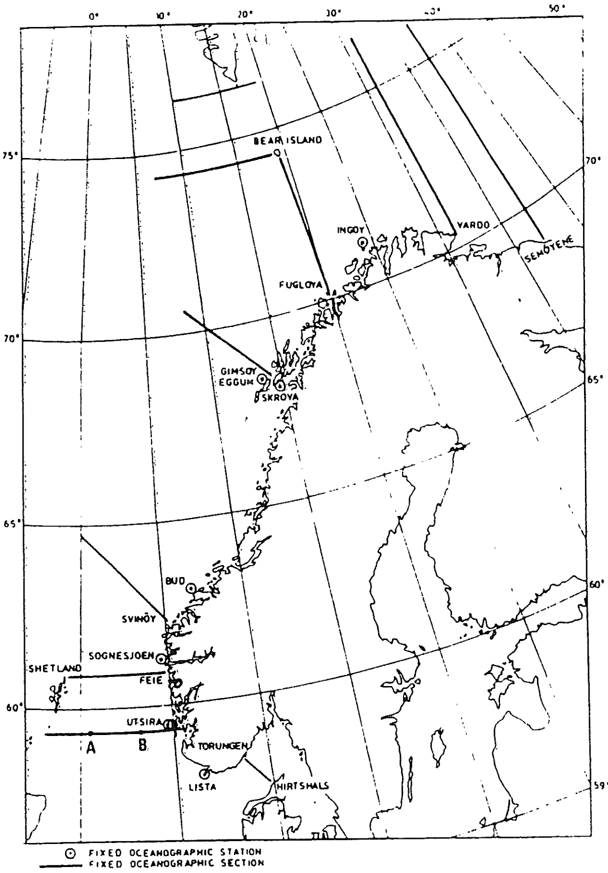


Fig.1 Norwegian standard sections and fixed oceanographic stations.

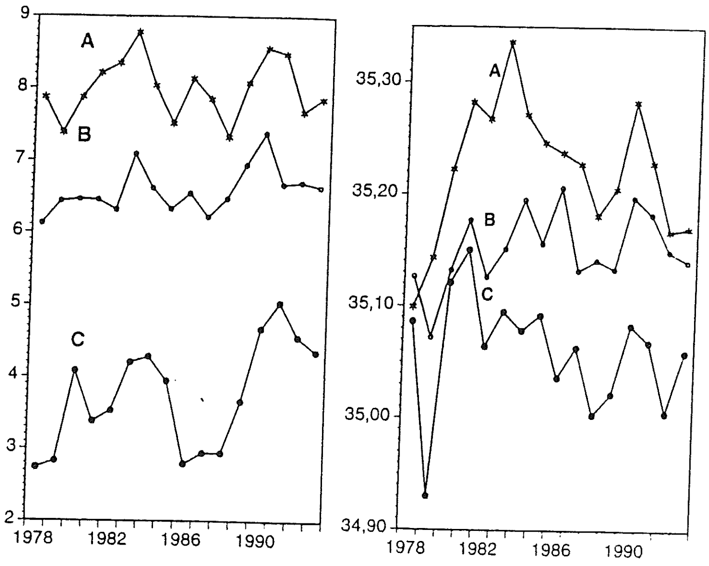


Fig.2. Temperature and salinity in the core of Atlantic water (August-September) in the sections Svinøy - NEW (A), Gimsøy - NW (B) and Sørkapp - W (C), averaged between 50 and 200 m depth.

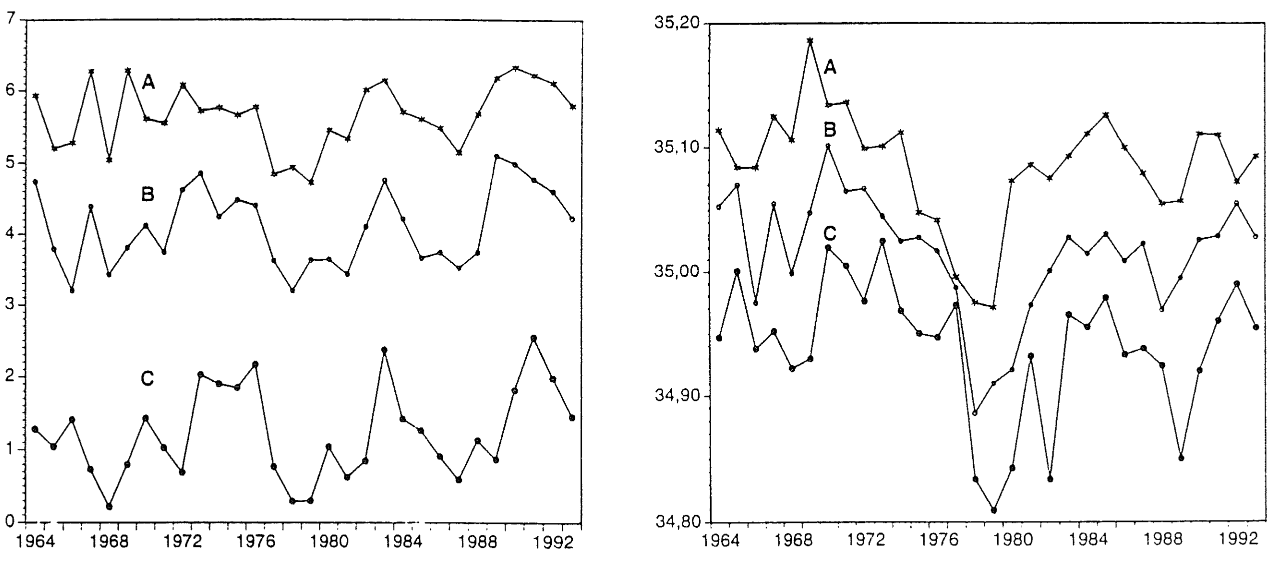


Fig.3. Temperature and salinity (August/September) in the sections Fugløya - Bjørnøya (A), Vardø - N (B) and Sem Islands - N (C), averaged between 50 and 200 m depth.

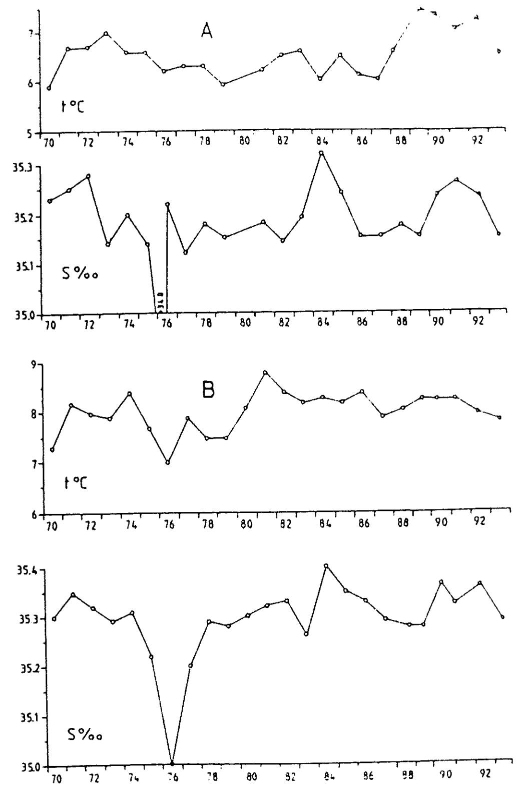


Fig.4. Temperature and salinity near bottom in the northwestern part of the North Sea (A) and in the core of Atlantic water (B) at the western shelf edge of the Norwegian Trench during summers 1970 - 1993. Location of A and B in Fig. 1.

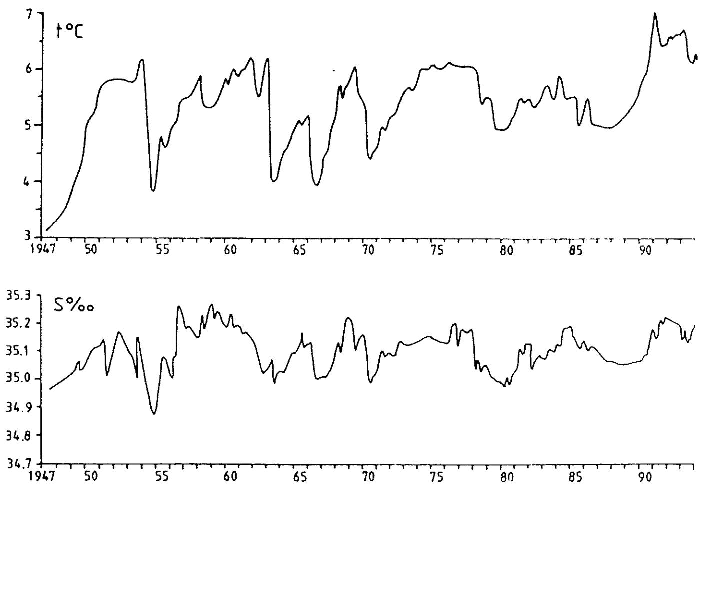


Fig.5. Variations in the temperature and salinity of the bottom water (600 m depth) in Skagerrak for the years 1947 - 1993.

Scotland

RESULTS FROM STANDARD SECTIONS, MARCH 1993-MARCH 1994 DUNSTAFFNAGE MARINE LABORATORY, SCOTLAND.

by

David Ellett

The standard CTD section across the deep water of the Rockall Channel west of the Hebrides was completed during 14-17 May and 5-9 September 1994, and the eastern half was worked from the shelf-edge to Anton Dohrn Seamount during 17 - 19 March 1994. Near-surface salinity rose from the unusually low values observed in September 1992, although it remained somewhat below the 30-year mean in May 1993. In September 1993 near-average salinity was found. In depths of 1500-2000m salinity continued a gradual rise from the minimum values encountered in 1990, and which appear to have originated in the Labrador Sea 18 years previously.

Additional sections across the shelf-edge in May 1993 showed cold dense bottom water upon the Scottish shelf which appeared to have descended the slope to 300m depth two days later (Figure 1). In March 1994 winter mixing had penetrated to 600m at the stations adjacent to the slope and to the crest of Anton Dohrn Seamount. At stations approaching the seamount a second well-oxygenated mixed layer at about 600 - 900m depth suggested that water cooled above the seamount had sunk into the interior of the channel (Figure 2).

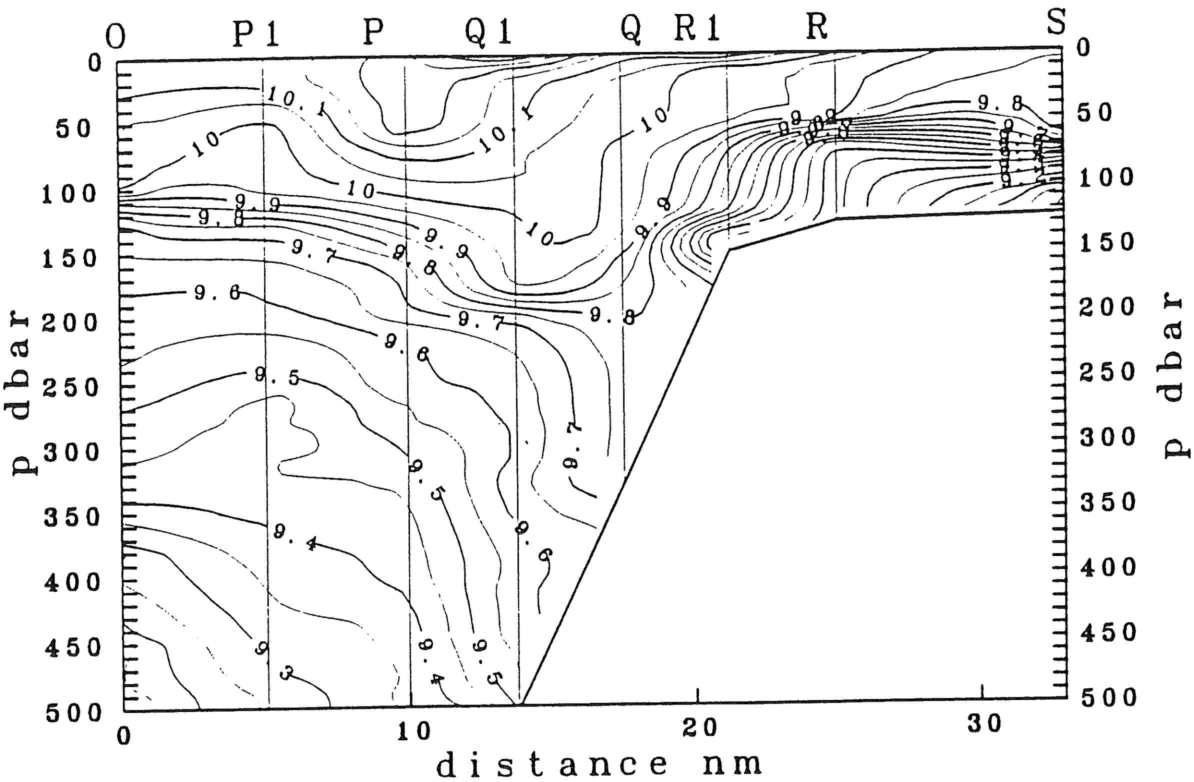


Figure 1a. Temperature across the Scottish shelf-edge in 57°N, 17-18 May 1993

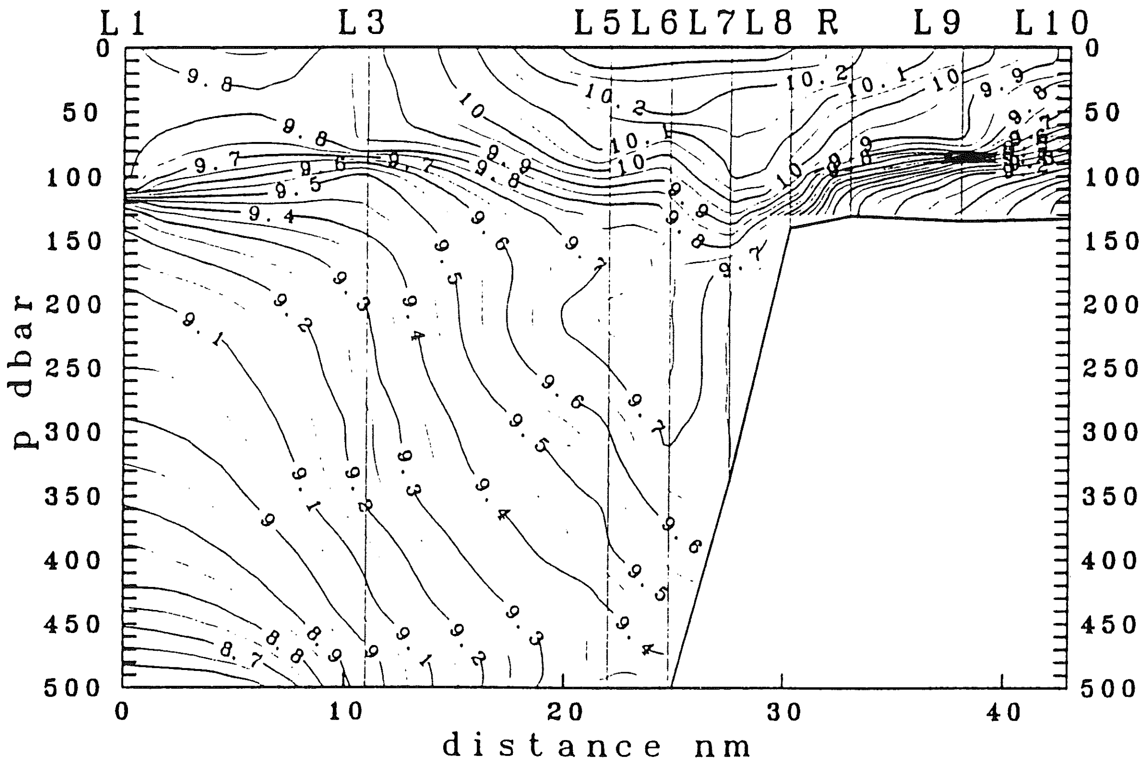


Figure 1b. Temperature across the Scottish shelf-edge in 57°N, 19-20 May 1993

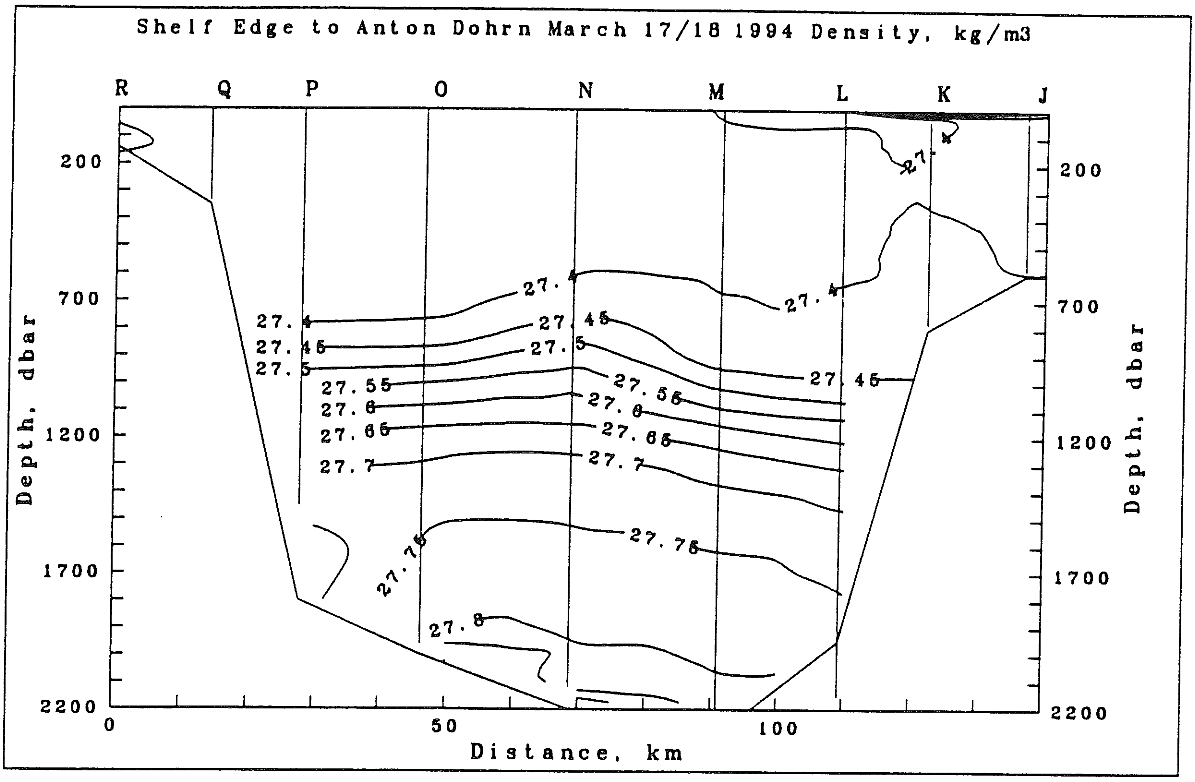


Figure 2a. Density section from Anton Dohrn Seamount (station J) to the Scottish shelf-edge in 57°N (station R), 17-18 March 1994.

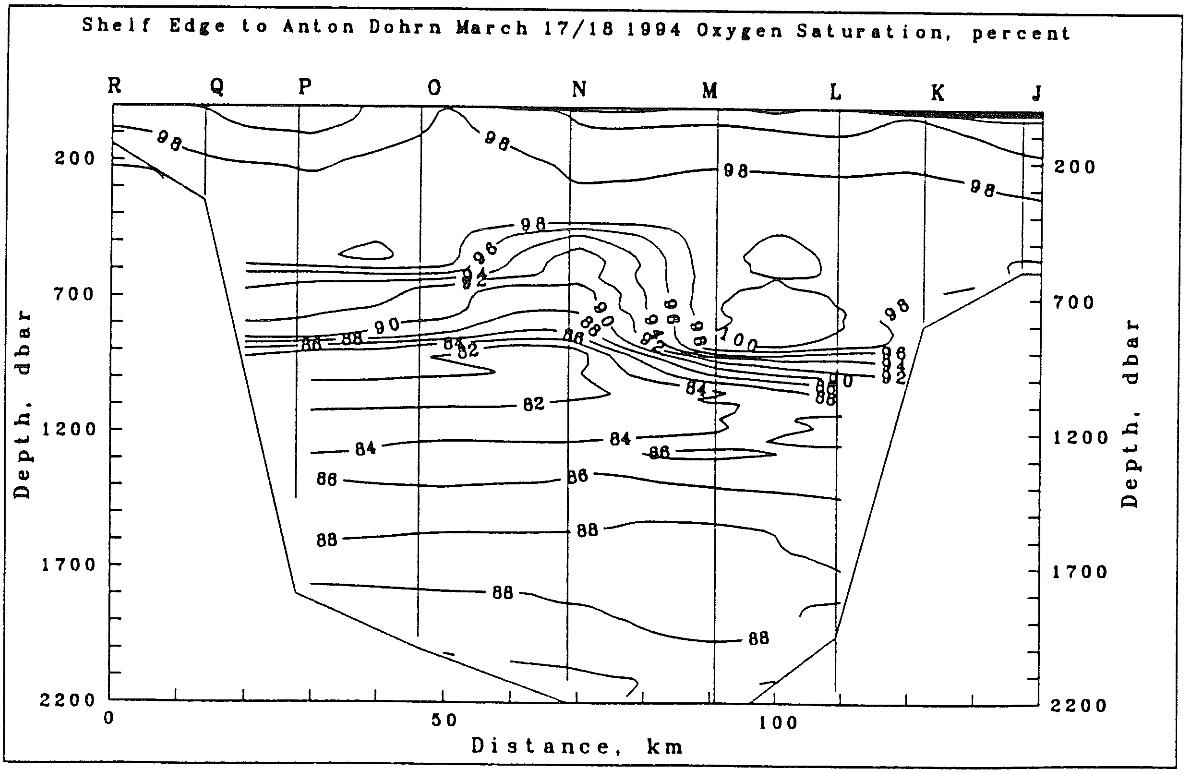


Figure 2b. Oxygen (% saturation) section from Anton Dohrn Seamount (station J) to the Scottish shelf-edge in 57°N (station R), 17-18 March 1994.

RESULTS FROM FAROE-SHETLAND CHANNEL STANDARD SECTIONS
Marine Laboratory Aberdeen, Scotland

by

W R Turrell

The two standard Faroe-Shetland Channel sections (Nolso (Faroe) - Flugga (Scotland) and Fair Isle (Scotland) - Munken (Faroe)) have been occupied by the Marine Laboratory Aberdeen on four occasions since December 1992. The preliminary results are presented here as contoured sections in Figures 1 to 4. They may be compared with the mean sections derived from calibrated data collected along both sections between 1903 and 1992 (Figure 5). The time-series of North Atlantic salinity as defined by the maximum salinity recorded inshore from the 200m contour on the Scottish continental shelf has been extended to 1994 in figure 6. Temperature-salinity diagrams derived from the preliminary data are presented as Figures 7 and 8, and the derived T and S characteristics of the different water masses are presented in Table 1.

In summary 1993 appears to be characterised by low salinities in the Faroe-Shetland Channel. Norwegian Sea Deep Water (NSDW) appears to have been of low salinity (34.90) compared to previous years, but abnormally so. Large areas of low salinity intermediate water were evident, possibly of Arctic Intermediate (AI) and Norwegian Sea Intermediate (NSI) origin. In April 1994 North Atlantic (NA) salinities were very low, and Modified North Atlantic water (MNA) salinities were reduced.

Figure 1 - December 1992

NA-water with salinities > 35.3 persisted of the Scottish side of the Cannel. Bottom water conditions appear "normal", with the absence of much low salinity water. This is confirmed by the TS diagram. An inflection on the diagram at 1.8°C, 34.93 has been identified with Arctic Intermediate water (AI). However this water fills little of the cross-section, and the remainder is occupied by NSD water.

Figure 2 - May 1993

Reduced amounts of NA-water at the Scottish slope. A core of cold (-0,5 to 2°C), low salinity (<34.9) intermediate water is observed in the central waters of the Cannel. The uppper (400-600m), northerly waters show ts characteristics of AI water (2,4°C, 34,85) but the remainder of the low salinity water has the characteristics of Norwegaian Sea Intermediate water as described by Martin (1993). It is not unambiguously clear from the TS-diagram whether this water mass is present or not, owing to the low salinity of the AI water which possibly masks the inflection indicating the presence of NSI water which is seen in the TS-diagrams of the following two surveys.

Figure 3 - September 1993

Again reduced areas of salinity > 35,3 on the Scottish shelf compared to the mean. The extensive areas of low salinity intermediate water still evident in both sections. The TS diagram reveals the presence of NSI water owing to the increased salinity of the AI water. AI water is reatricted to the northern slope of the channel, whereas NSI and NSD water fills the remainder of the bottom of the channel.

Figure 4 - April 1994

Very low salinity water at the shelf edge north of Scotland (35.26). The salinity minimum in the central Channel is still evident, and the TS-diagram reveals it to be partly NSI water, and partly NSD water.

Time Series - NA water

Figure 6 shows the temporal chane in North Atlantic water salinity since 1900. It would appear from the single survey in 1994 that lower than average salinities are presently being experienced. The standard sections are due to be repeated in September.

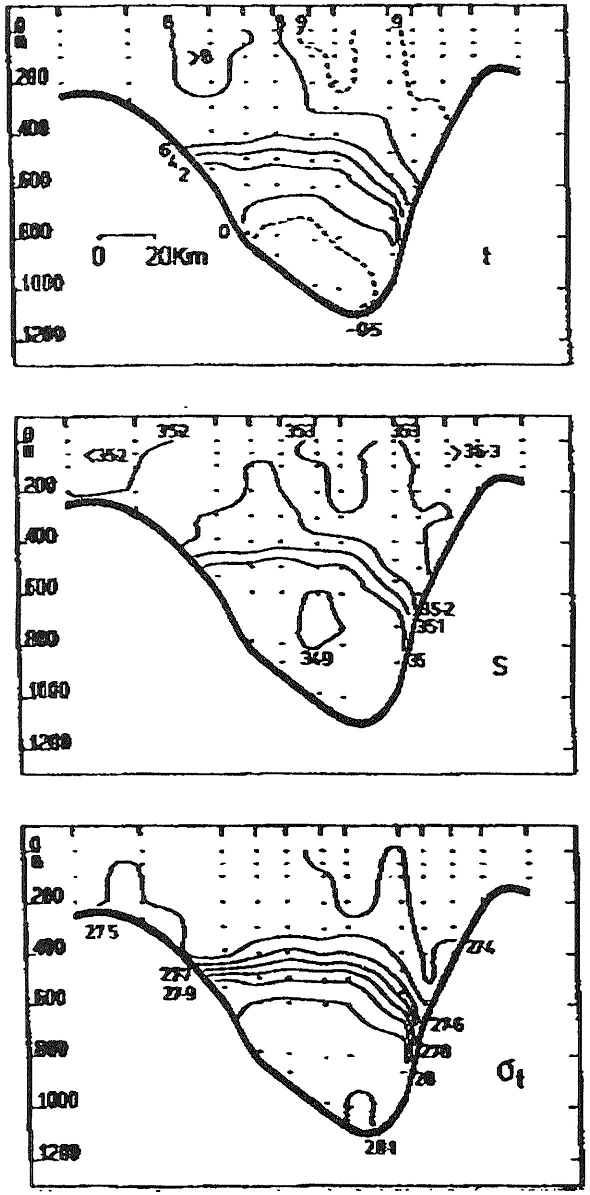
Time Series - NSD water

Figure 7 shows the time series of the salinity of the NSD water. While the values observed in 1993 in the bottom water of 34.90 are low, they have been observed before.

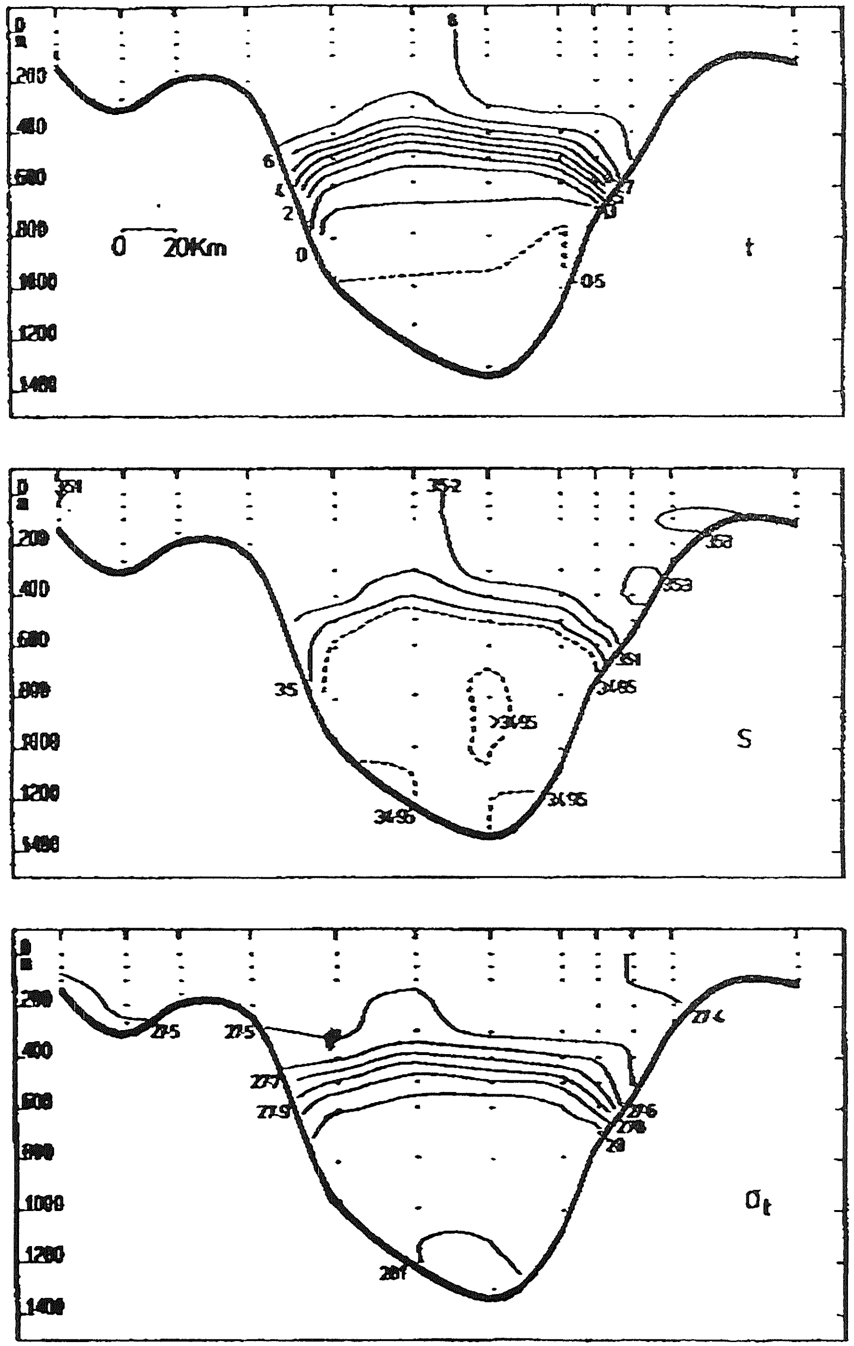
Table 1. Characteristic T and S of different water masses during the four surveys.

No.	MNA		NA		AI		NSI		NSD	
	T	S	T	S	T	S	T	S	T	S
1	7.3	35.16	8.5	35.29	1.8	34.93			-0.5	34.94
2	7.4	35.17	9.0	35.31	2.4	34.85			-0.6	34.90
3	9.0	35.13	10.0	35.30	4.0	34.94	0.5	34.88	-0.6	34.90
4	6.5	35.13	8.0	35.26	3.6	34.94	0.4	34.88	-0.6	34.91

DECEMBER 1992



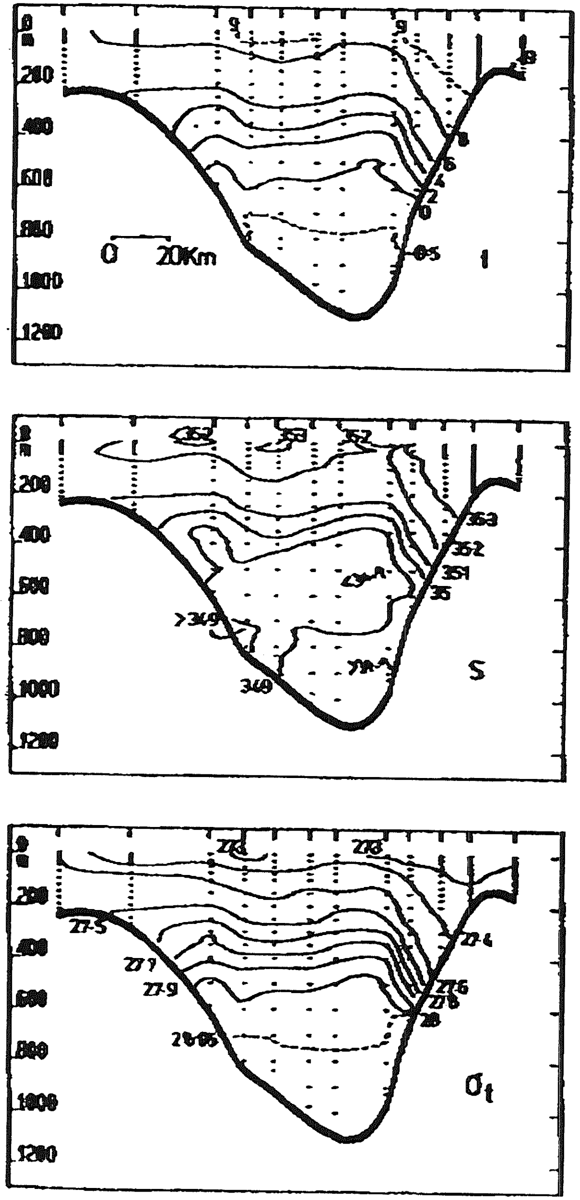
MUNKEN – FAIR ISLE



NOLSO – FLUGGA.

Fig. 1

MAY 1993



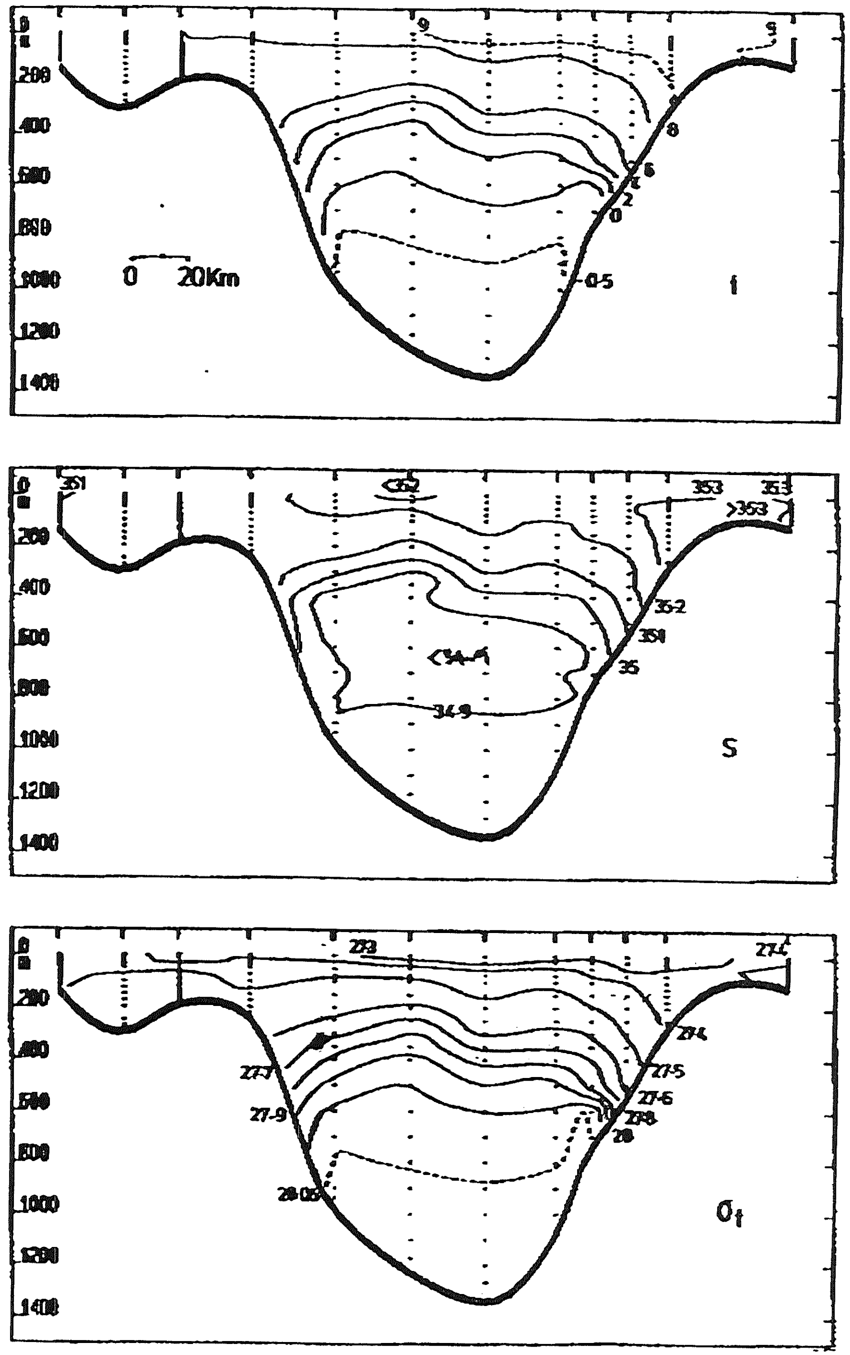


Fig. 2.

SEPTEMBER 1993

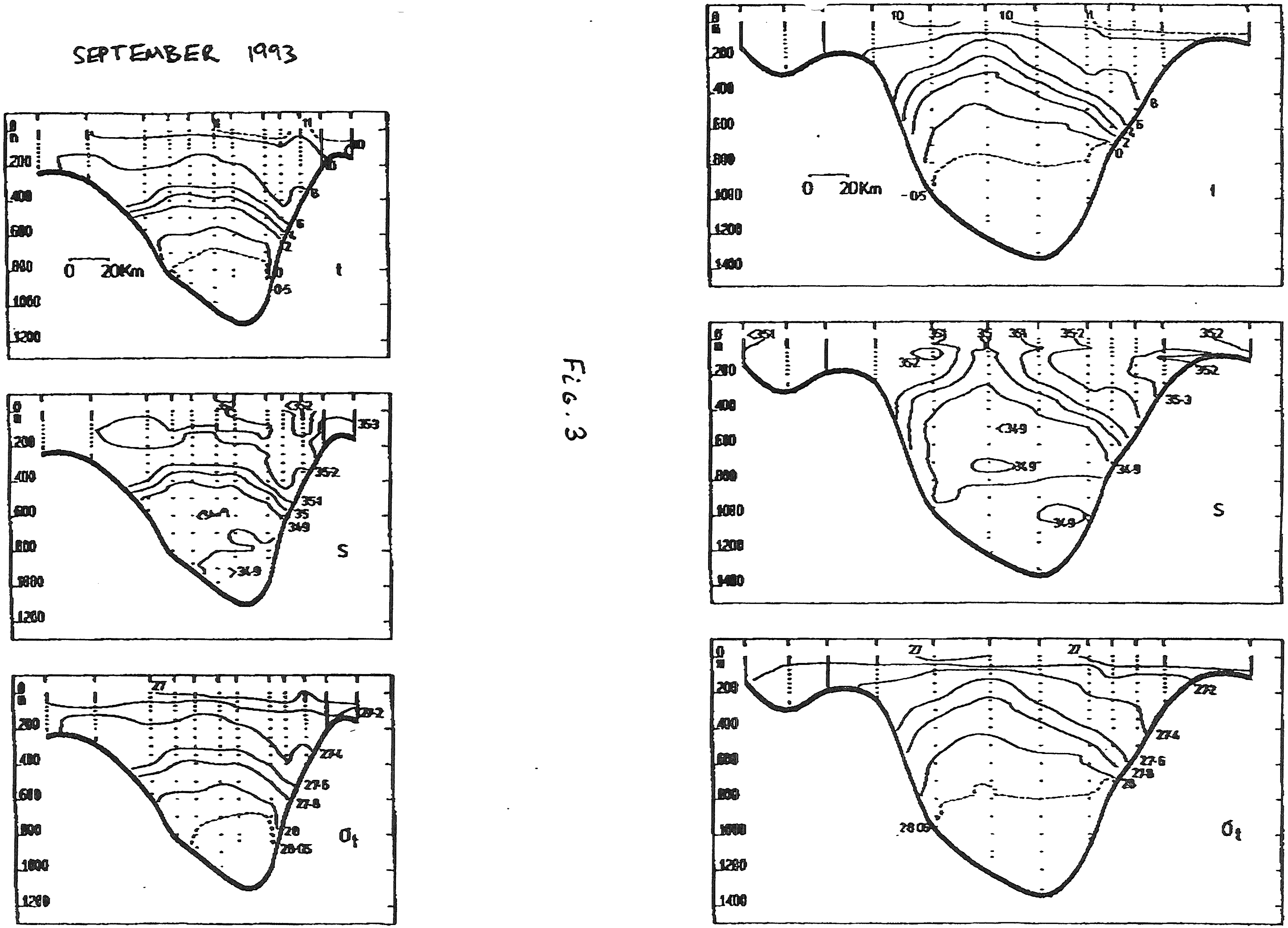


Fig. 3

APRIL 1994

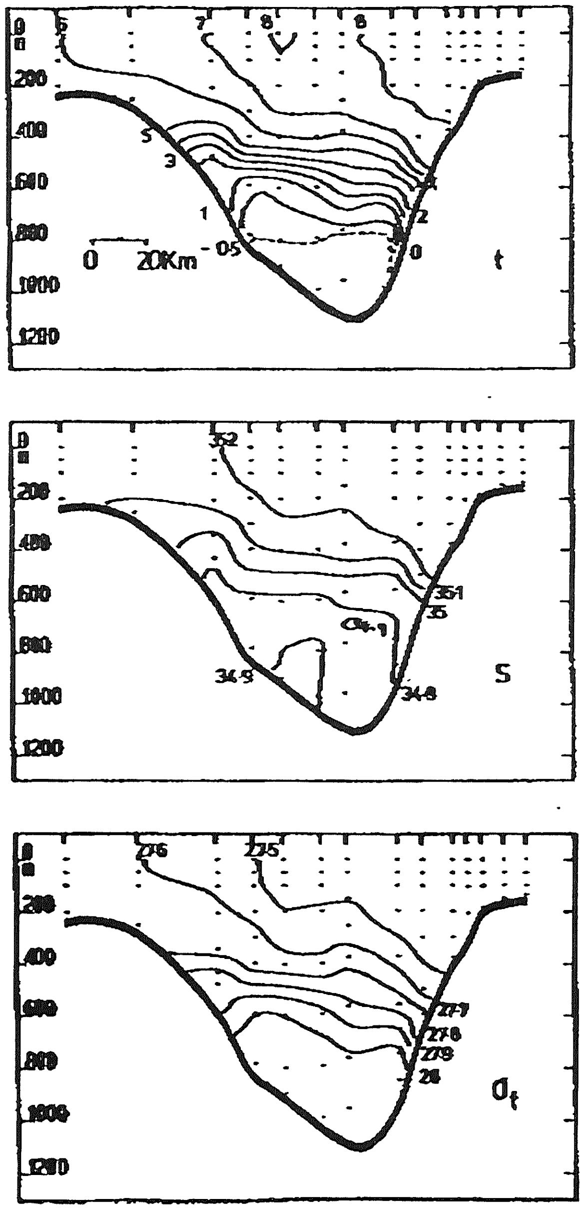
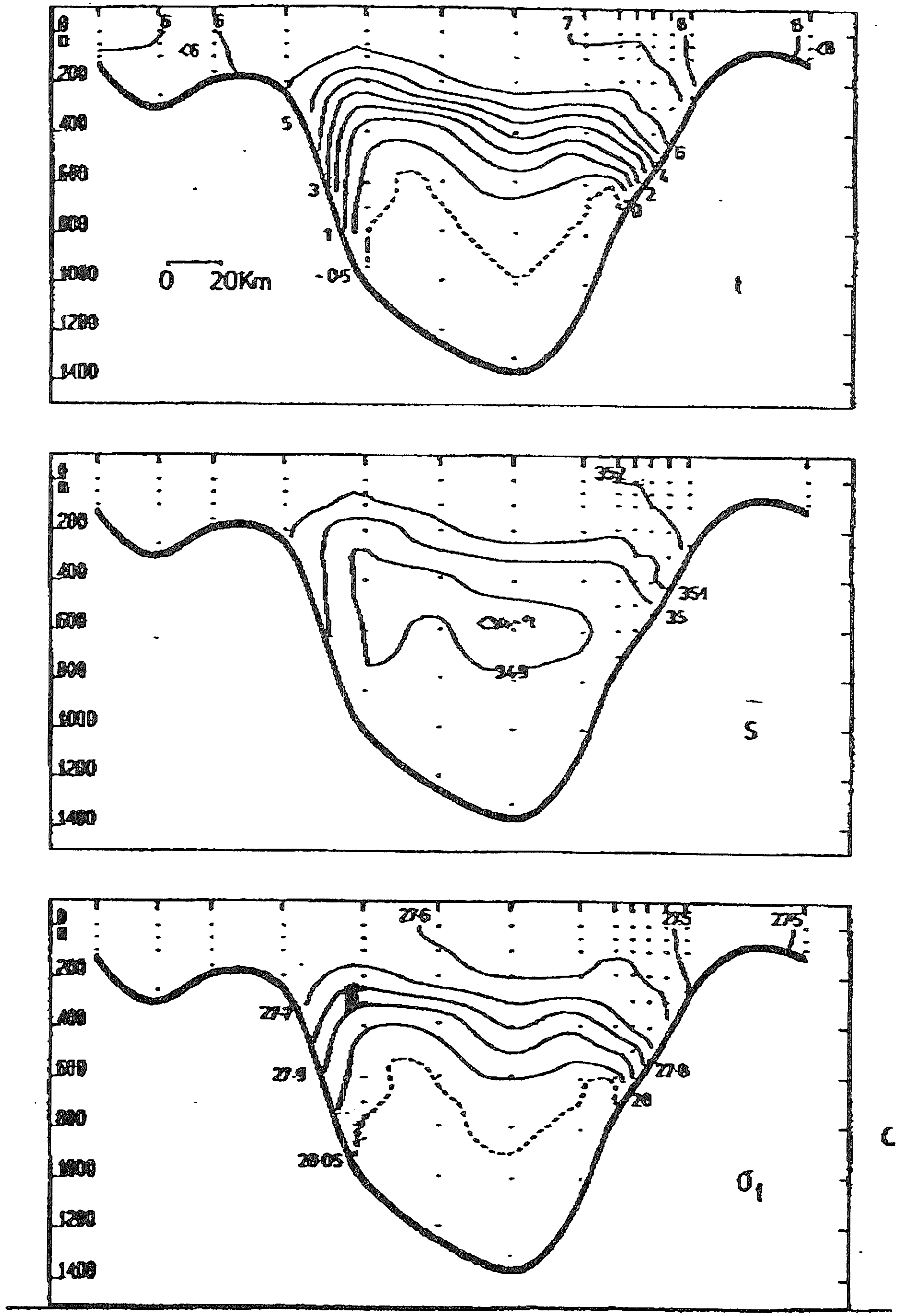


Fig. 4



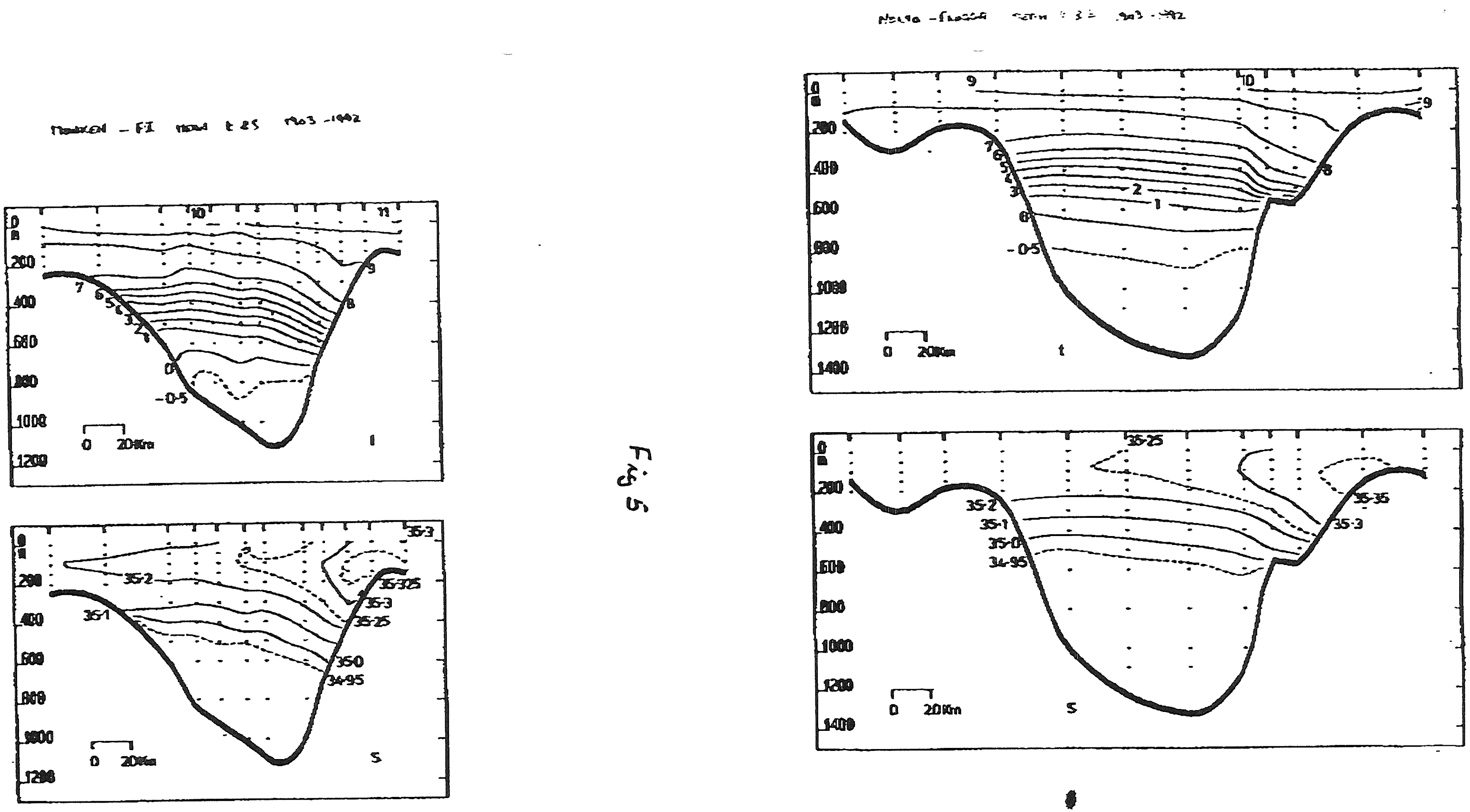

0
m
200
400
600
800
1000
1200
1400
0 20Km
t
S
-0·5
35·2
35·1
35·0
34·95
35·25
35·3
35·35

Fig 5

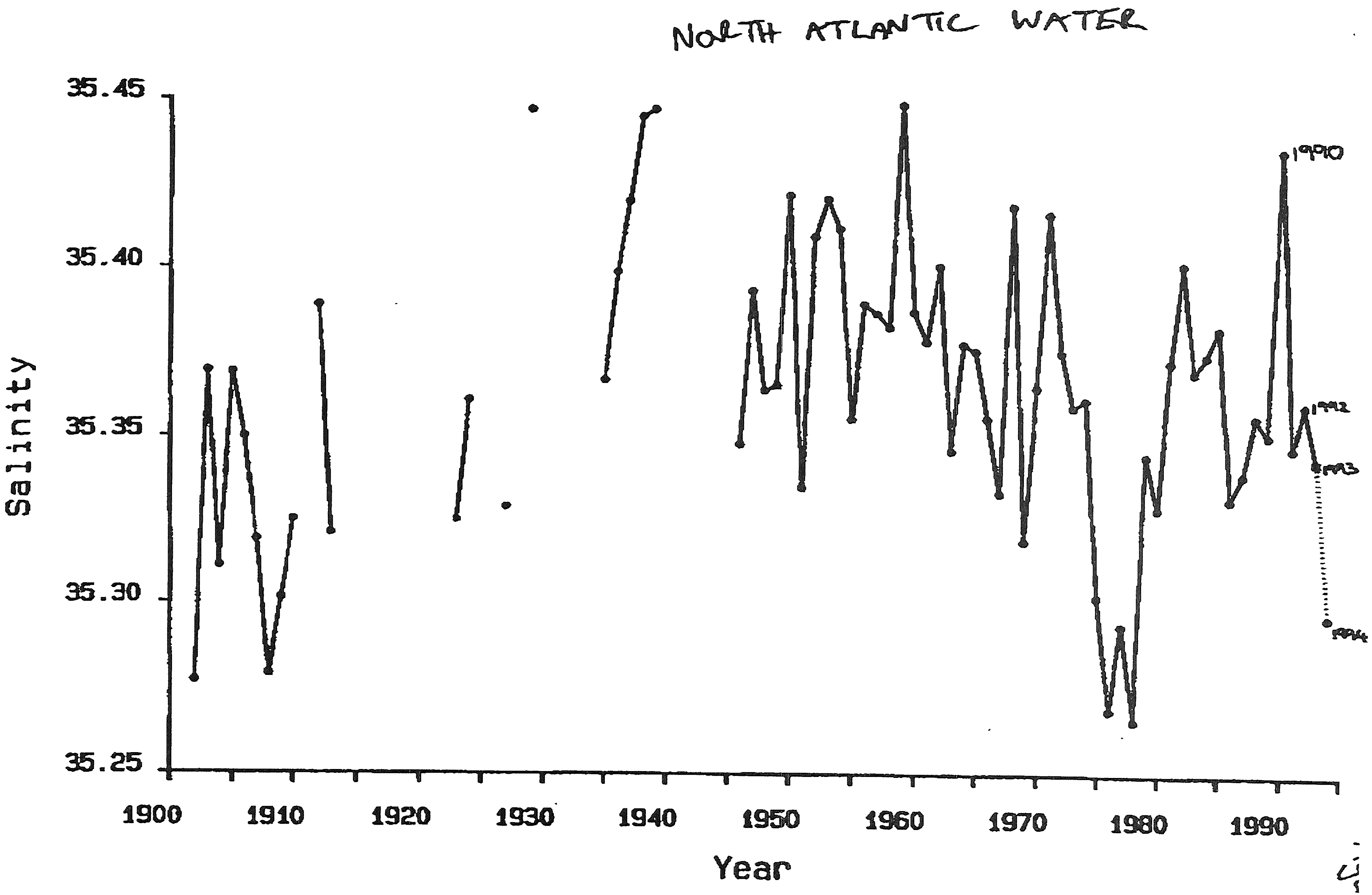

NORTH ATLANTIC WATER
Salinity
35.45
35.40
35.35
35.30
35.25
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
Year
1990
1992
1993
1994

Fig.6.

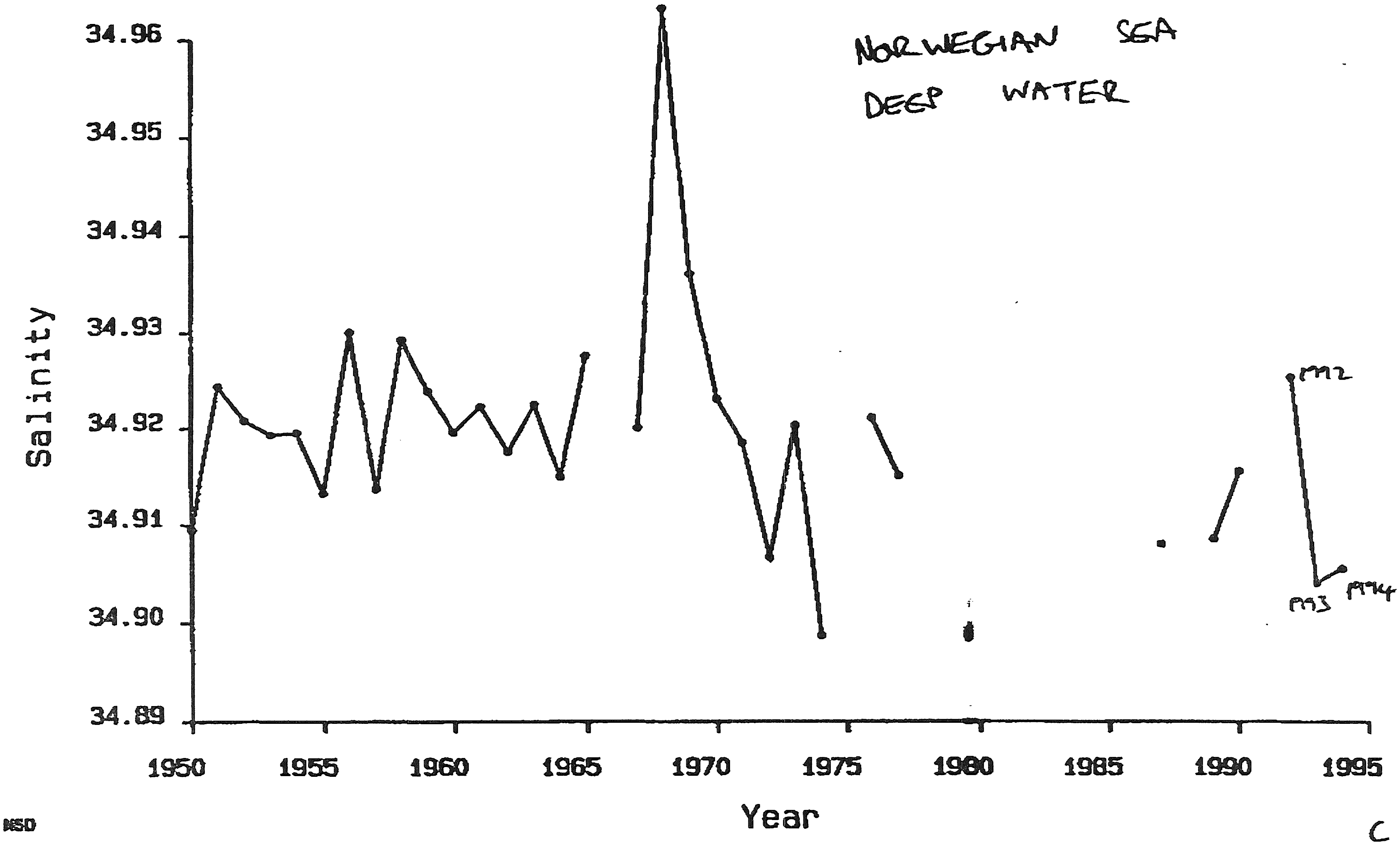

NORWEGIAN SEA
DEEP WATER
Salinity
34.96
34.95
34.94
34.93
34.92
34.91
34.90
34.89
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
Year
1992
1993
1994

Fig. 7.

NSD

c

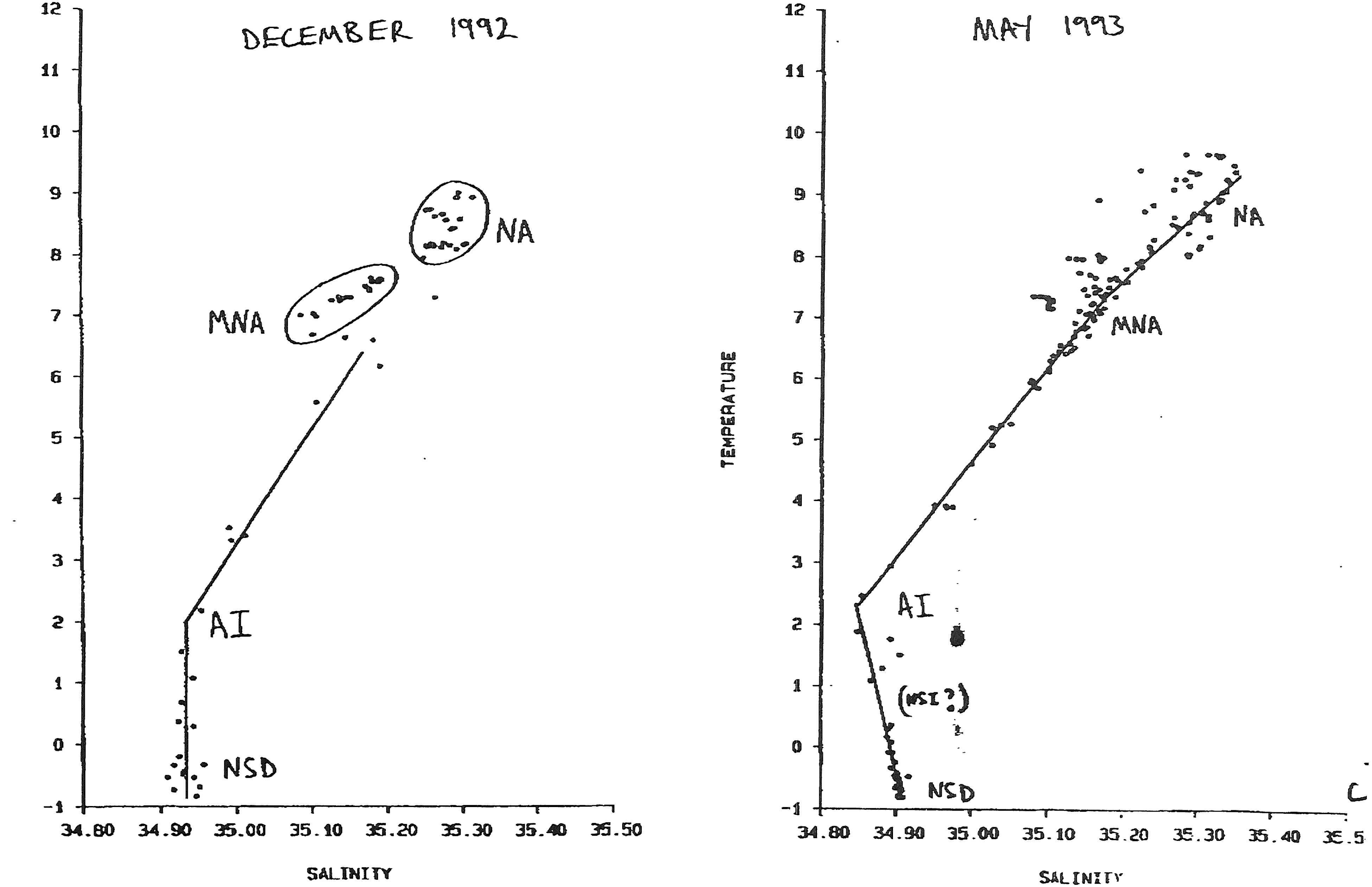

DECEMBER 1992
TEMPERATURE
SALINITY
NA
MNA
AI
NSD
MAY 1993
NA
MNA
AI
(NSI ?)
NSD
C

Fig. 8

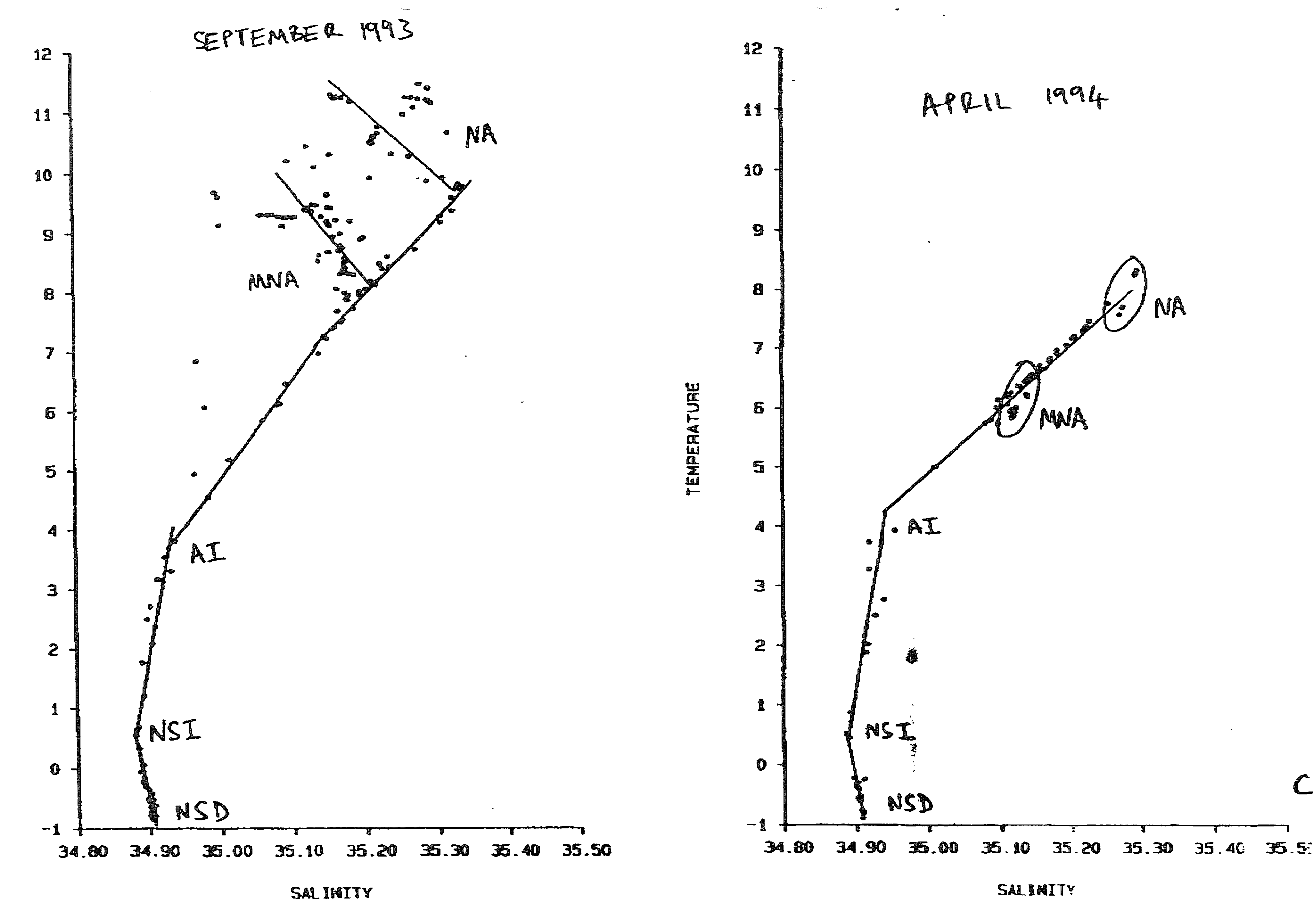

SEPTEMBER 1993
TEMPERATURE
SALINITY
NA
MNA
AI
NSI
NSD
APRIL 1994
TEMPERATURE
SALINITY
NA
MNA
AI
NSI
NSD
C

Fig. 9.

Netherlands

by

Hendrik van Aken

The Netherlands Institute for Sea Research

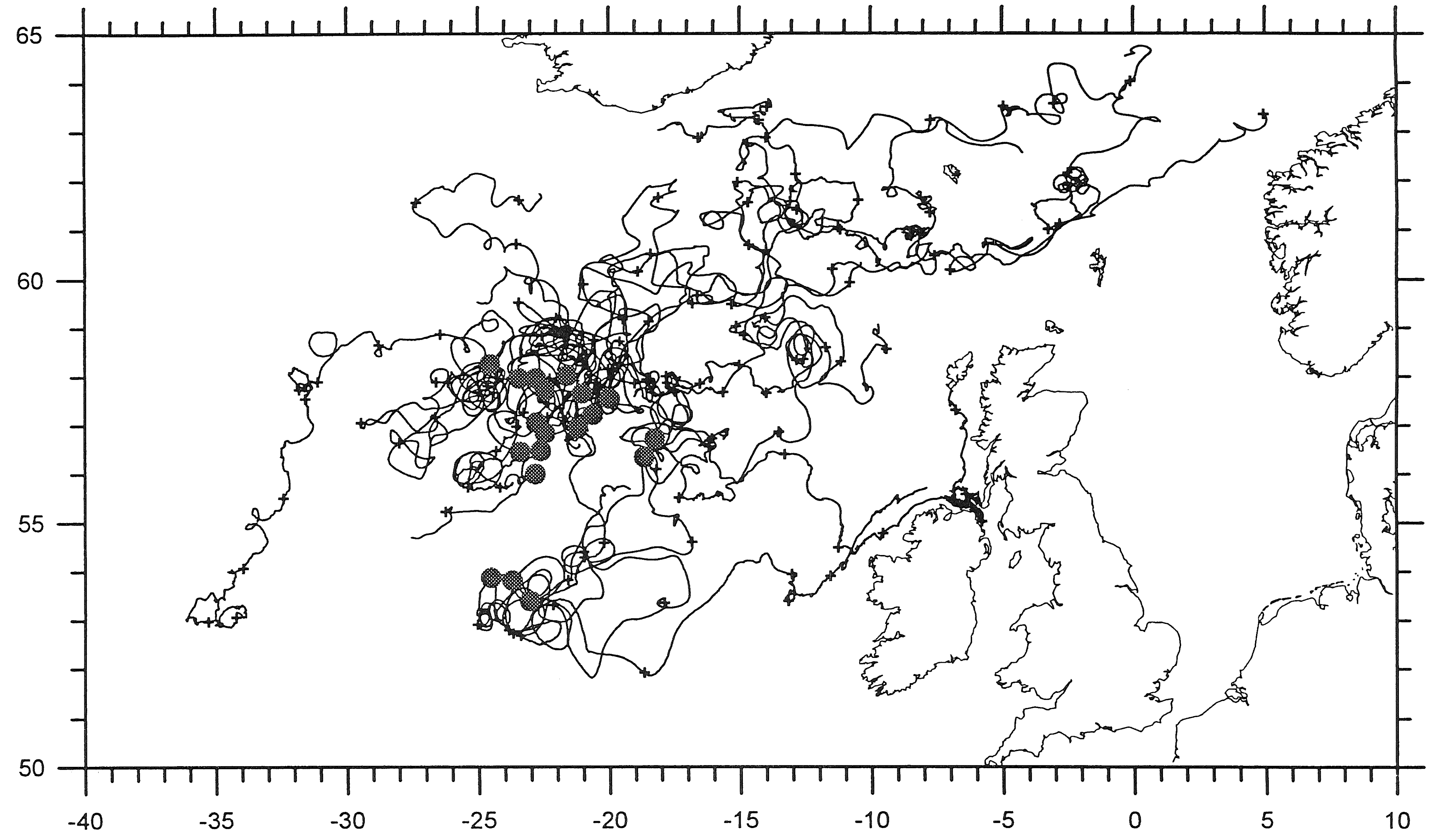
The Netherlands Institute for Sea Research (Texel) has initiated a surface drifter programme in the northern Northeast Atlantic, in 1991. Till the end of 1993 19 drifters have been launched and a total of about 10 drifter years have become available. A spagetti diagramme of the drifter tracks show that from the launch positions west of the Rockall - Hatton- plateau (large dots) the drifters are advected in a wide range of directions. Some drifters cross the Rockall - Hatton Plateau and reach the Scottish continental slope. A number of drifters reach the southern Norwegien Sea following paths north as well as south of the Faroes. A small number of drifters followed a cyclanic course through the Iceland Basin, altinately flowing SW along the Reykjanes Ridge. The drifter tracks showed an intense eddy activity in the Iceland Basin.

This drifter programme is planned to be continued in the near future.

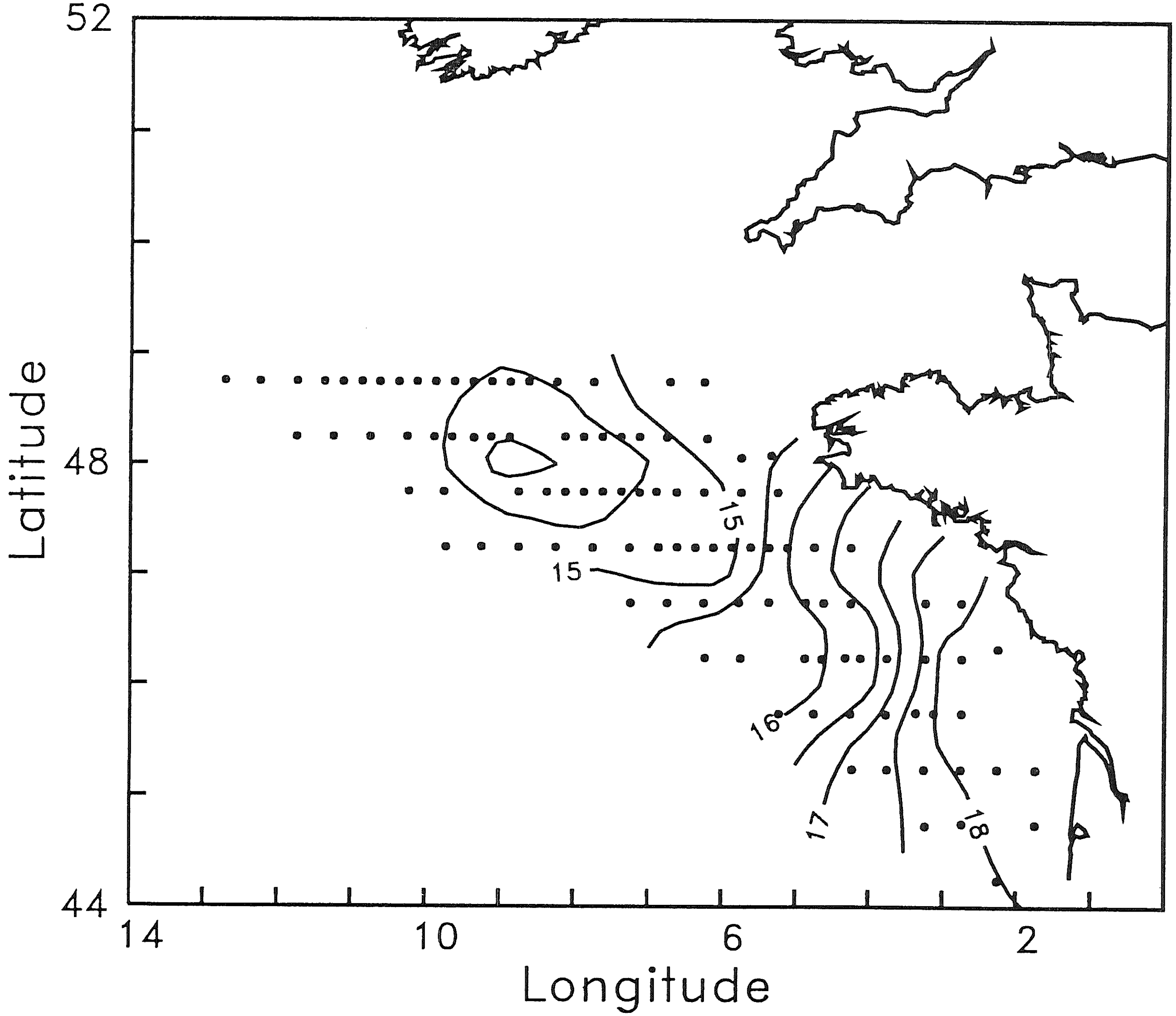
The Netherlands Institute for Fisheries Research

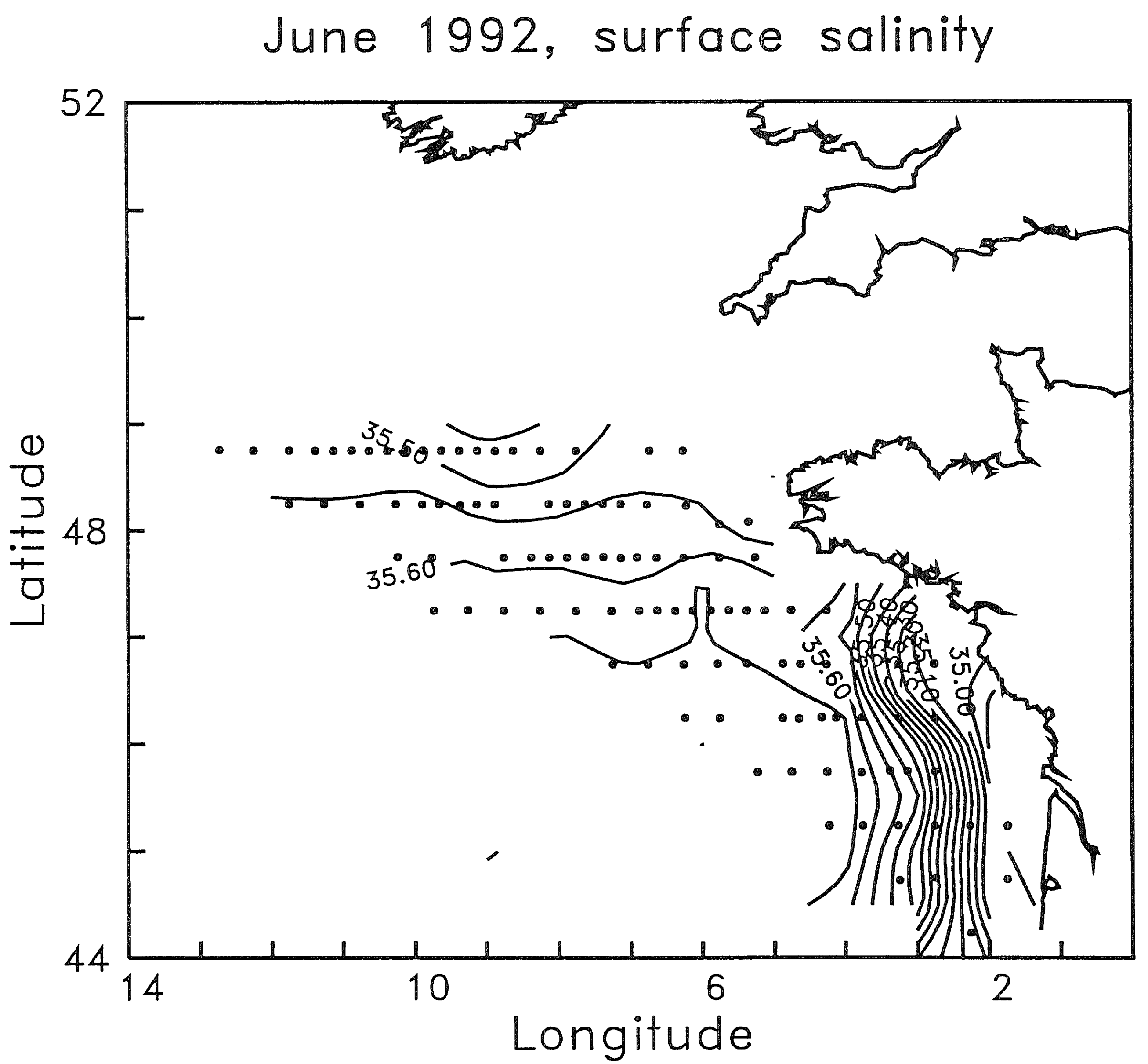
The Netherlands Institute for Fisheries Research (RIVO) annually carries out a mackerel survey in November in the Celtic Sea. Once every 4 or 5 year an additional fisheries survey in the northern Bay of Biscay. During these surveys of RV Tridens CTD-casts to a depth of 200 m are recorded. Temperature and salinity data from June 1992, November 1992 and November 1993 have been presented. In June 1992 the seasonal thermal stratification was observed everywhere, being reinforced in the French coastal zone by additional salinity stratificatien due to river outflow. Both in June and November 1992 the surface salinity at 40°N was about 35.5 to 35.6, in agreement with the positive salinity anomaly, reported last year. In the western Channel the surface salinity ranged between 35.45 and 35.50. During the November 1993 survey the surface waters were significantly fresher with salinities of about 35.3 at 48°N and around 35.0 in the western Channel.

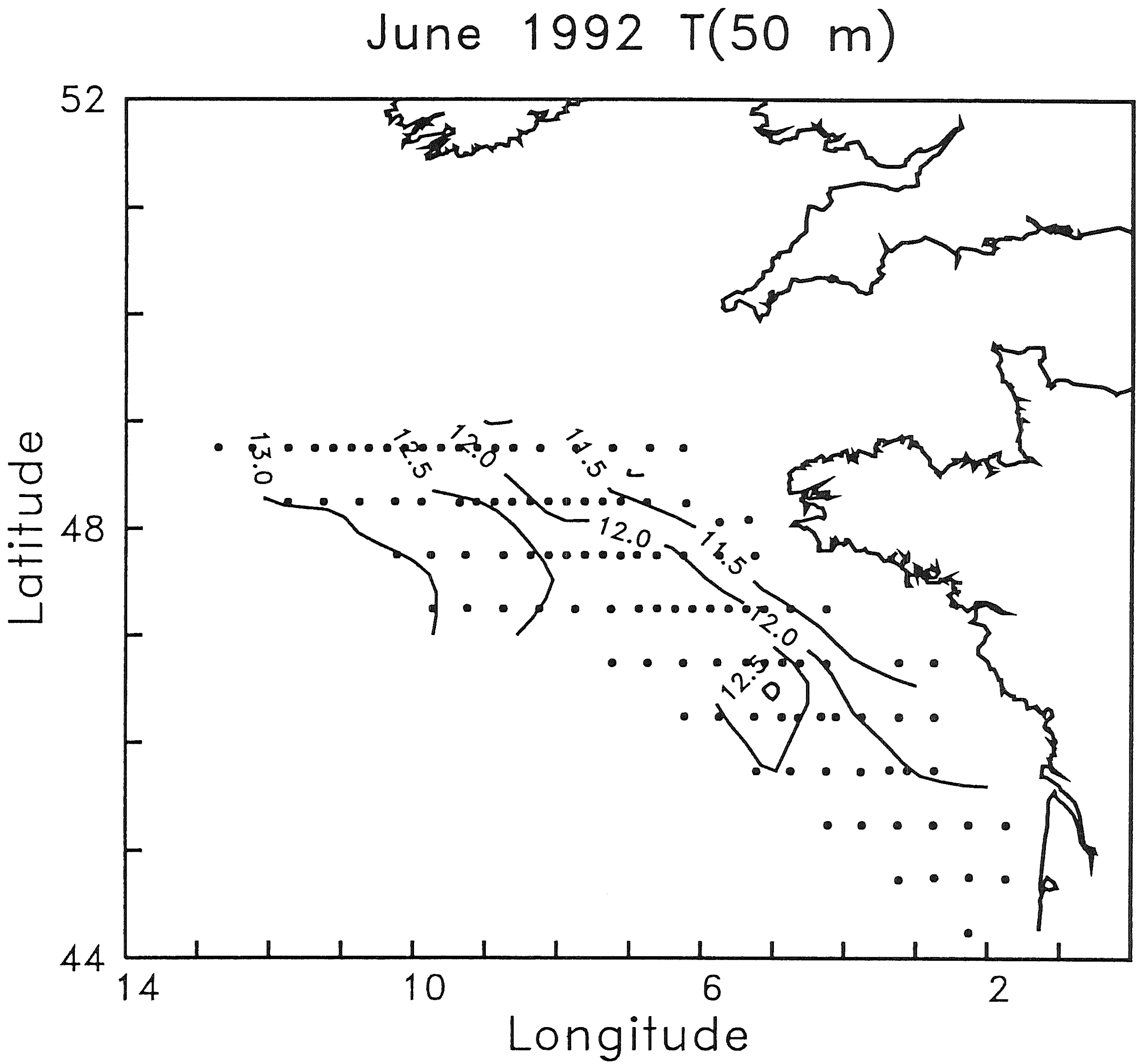
Efforts will be made to compile a data set with all available hydrographic data from the mackerel surveys before 1992 and to continue the data compilation for future surveys.

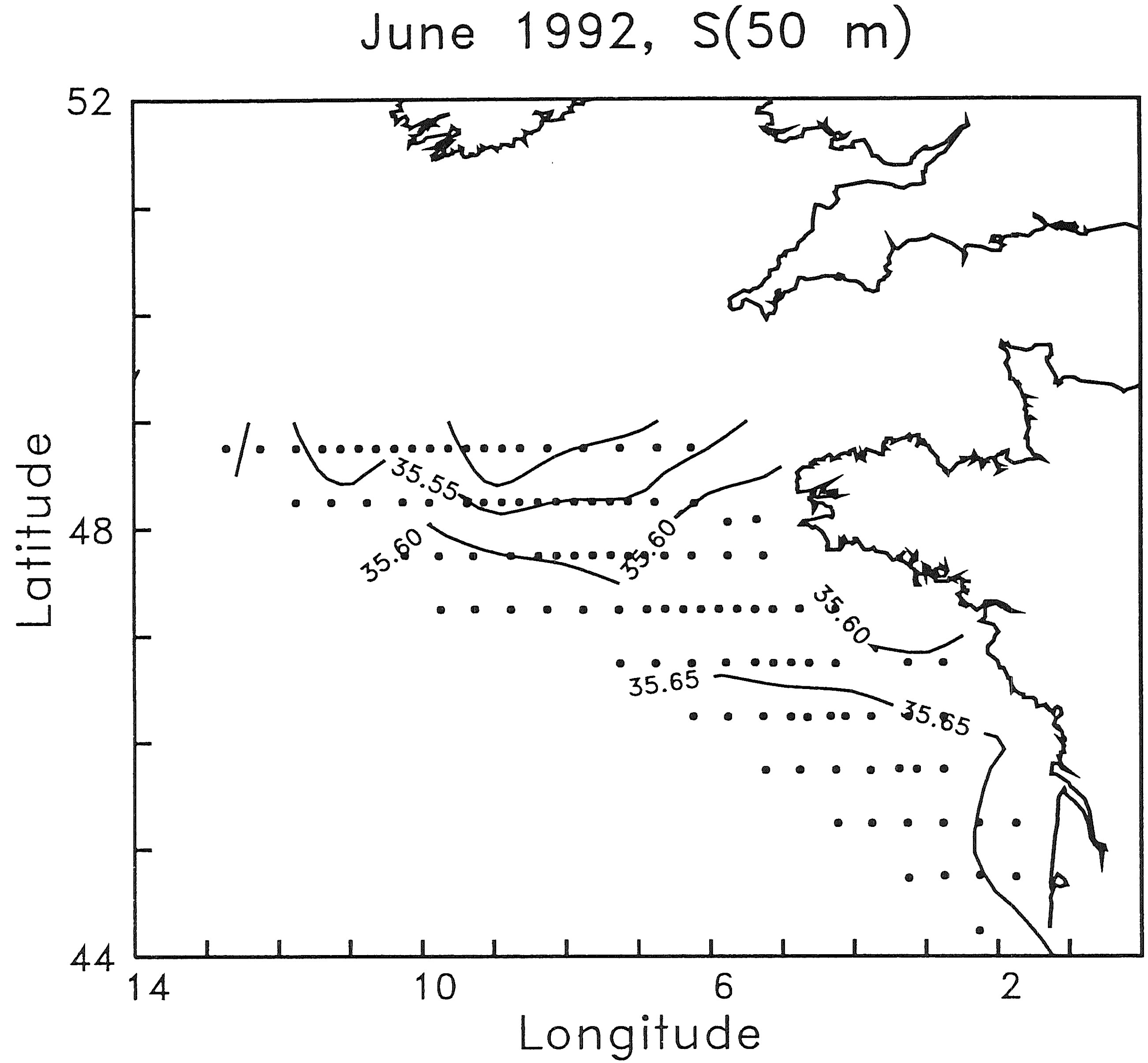

65
60
55
50
-40
-35
-30
-25
-20
-15
-10
-5
0
5
10

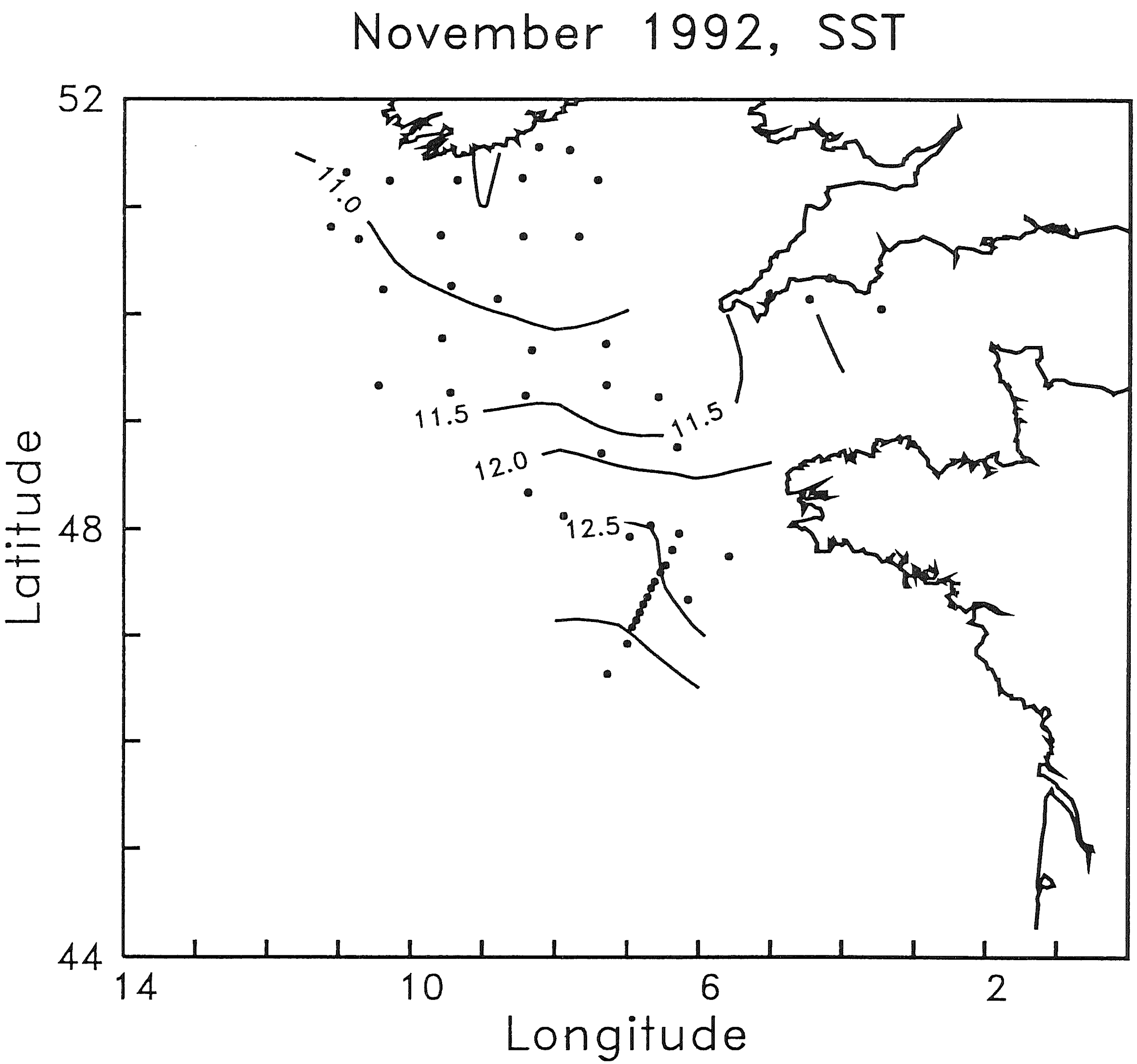
June 1992, SST



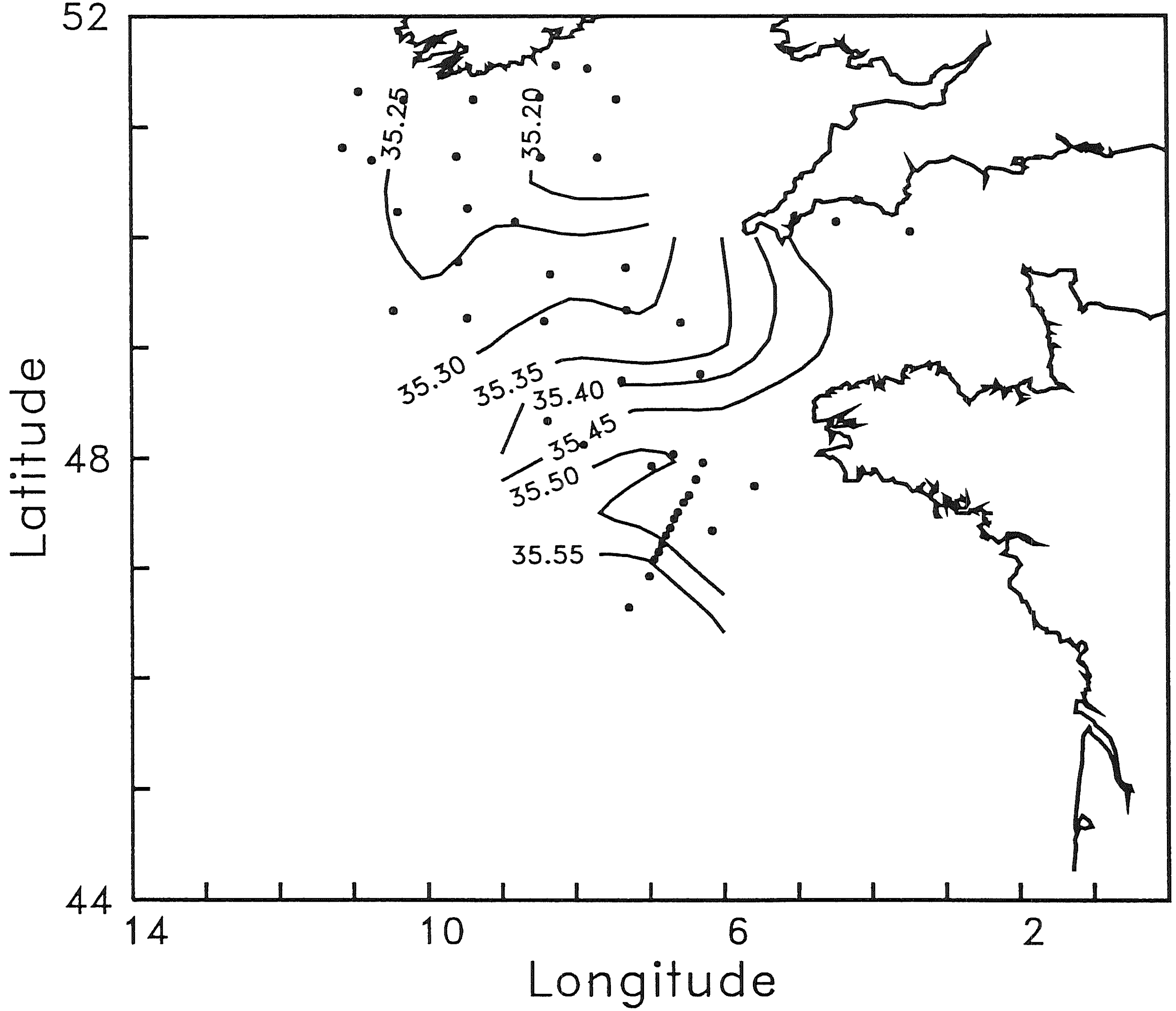

June 1992, surface salinity
Latitude
52
48
44
Longitude
14
10
6
2
35.50
35.60
35.60
35.00

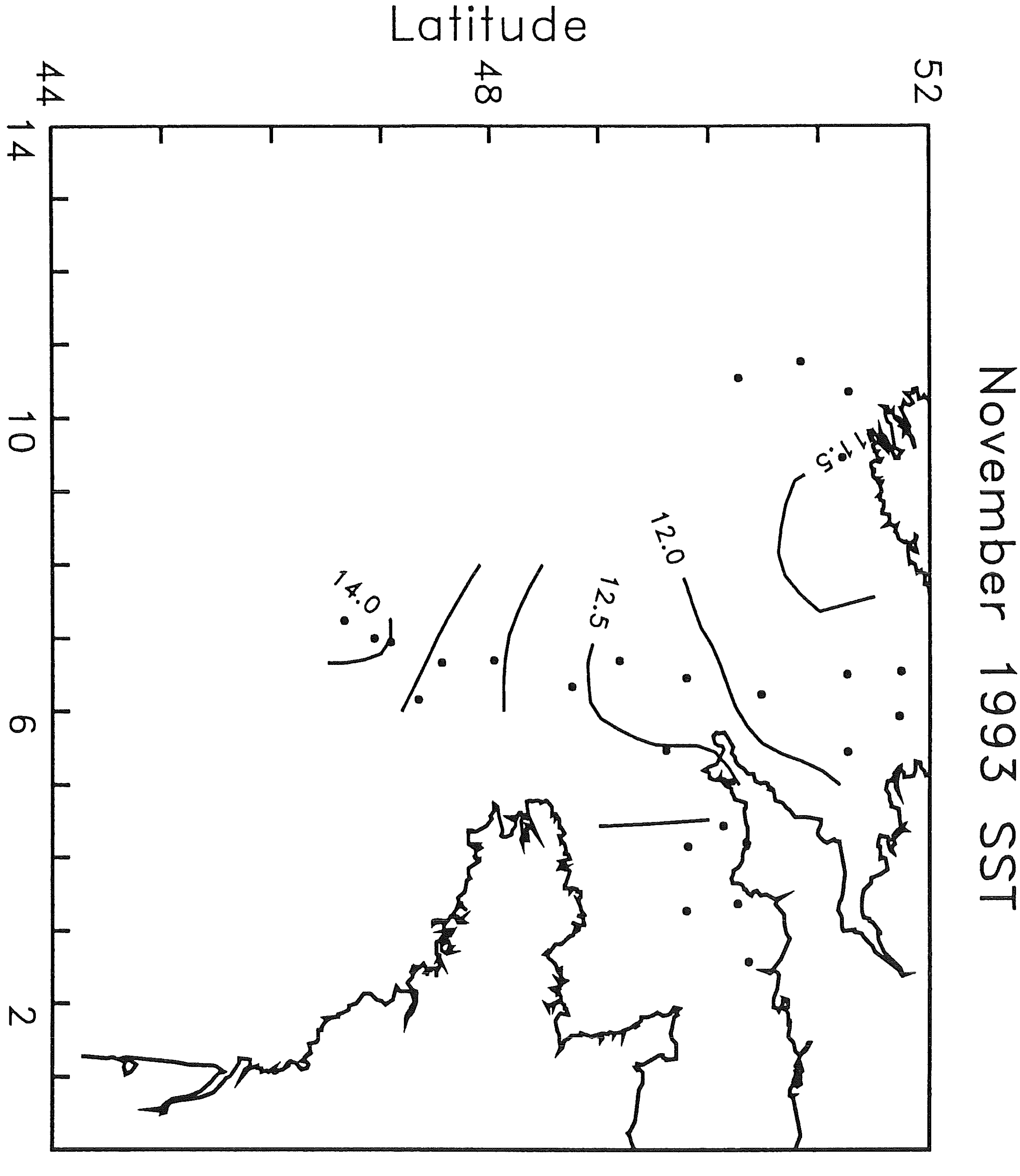

June 1992 T(50 m)
Latitude
52
48
44
Longitude
14
10
6
2
13.0
12.5
12.0
11.5
12.0
11.5
12.0
12.5


June 1992, S(50 m)
52
48
44
Latitude
14
10
6
2
Longitude
35.55
35.60
35.60
35.60
35.65
35.65

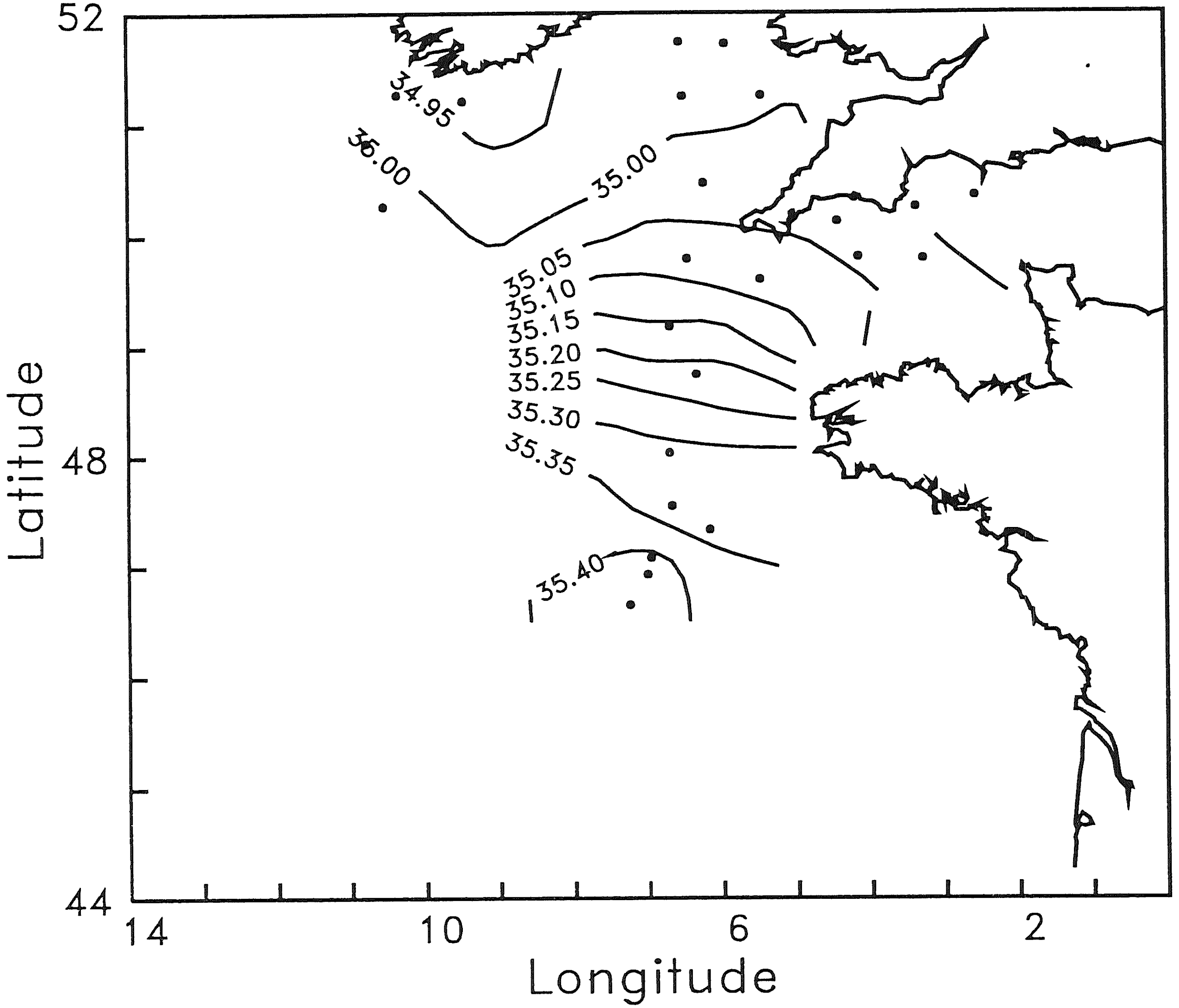

November 1992, SST
52
48
44
Latitude
14
10
6
2
Longitude
11.0
11.5
11.5
12.0
12.5

November 1992 surface salinity




November 1993 SST
Latitude
Longitude
44
48
52
14
10
6
2
11.5
12.0
12.5
14.0

November 1993 surface salinity



Germany

by

Gerd Becker

In July 1993 the German RV GAUSS (A. Sy and K.P. Koltermann) worked the proposed WOCE hydrographic section A2 along the 48°N in a repeat mode from Halifax to Hamburg (fig. 1). In the western Atlantic the section leaves the Newfoundland shelf perpendicular to it and runs parallel to the Canadian mooring array ACM 6. At station 23 it joins the old 1957 RRS DISCOVERY Section towards the European shelf closely following the 1982 HUDSON Section. On the outward leg GAUSS completed a high-density deep XBT/XCTD-section AX3 and deployed five current meter rigs off the North European shelf and on the western side of the MAR at 48°N.

Figure 2 a-d shows the bottle data set section for theta, salinity, sigma-theta and oxygen analysed with an objective analysis method (note: different contour intervals in the plots). The hydrographic section reveals considerable changes in the water mass characteristics at intermediate depths since the early 1980s. The Labrador Sea Water (LSW) with its clear oxygen and salinity signal now was found at depths of more than 2000 m in the Western basin, the core temperature down to ca. 3.2°C. Compared to the last section of comparable quality, worked by the Canadian CCS HUDSON on cruise 82-002 in April 1982, the LSW properties in the Western basin are markedly different (fig. 3). most conspicuous is the depth of the LSW east of Newfoundland, that increased by about 700 m from ca. 1400 m in 1982 to more than 2100 m in July 1993. The temperatures are cooler by 0.4 to 0.5°C, and salinities are only slightly fresher by less than 0.01. On first estimates, the amount of LSW has more than doubled from 1982 to 1993 at 48°N.

Remarkable is the decrease in changes when passing over the MAR into the Eastern basin. Immediately east of the ridge, the LSW is found almost at the same depths of ca. 1800 m as in 1982, the temperatures are some 0.1°C colder and salinities have decreased by about 0.01 to 0.02.

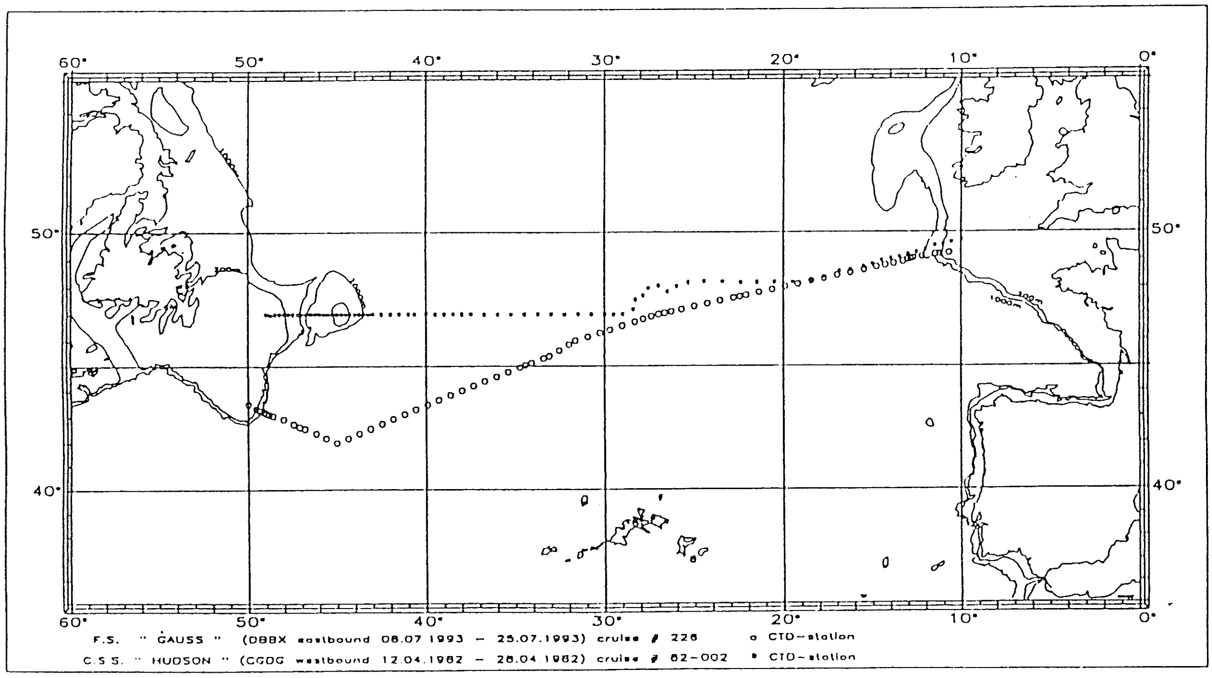
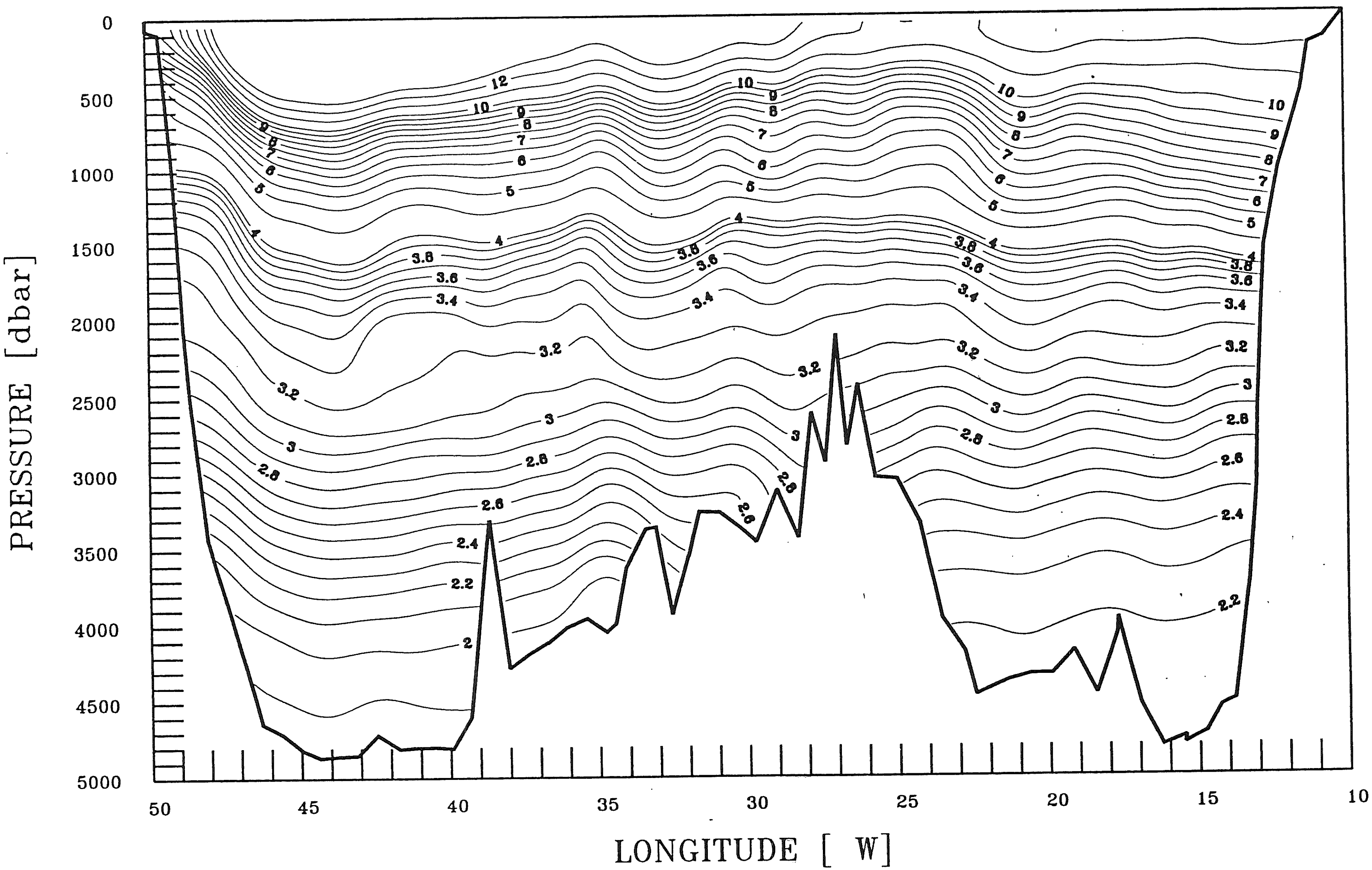


Figure 1. Station map of the Gauss cruise along A2, July 1993, and the 1982 Hudson stations.

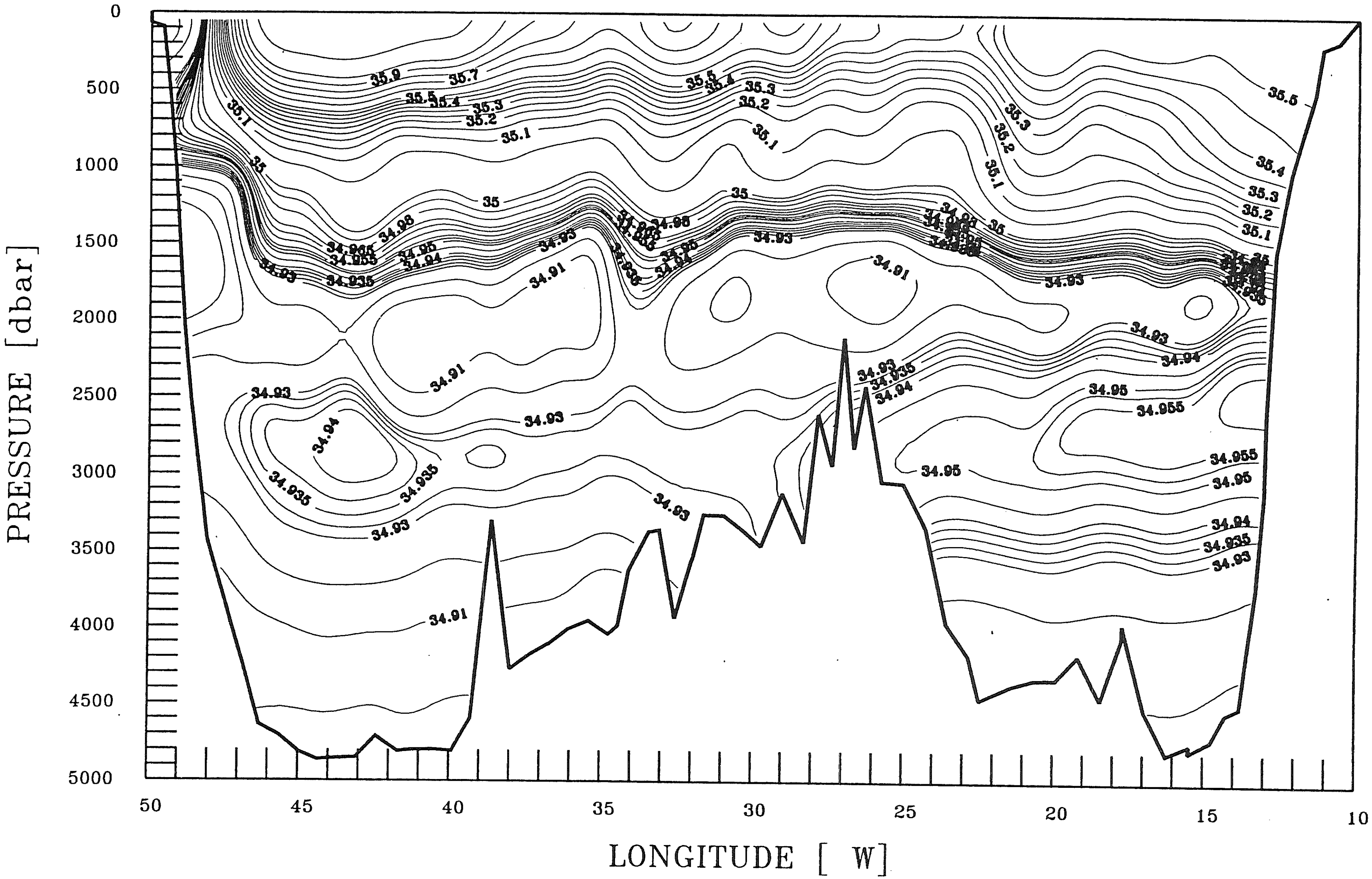
GAUSS93, 48 N, Bottle, THETA [C]



No of GRD-Points in X = 200
No of GRD-Points in Y = 100
(FAST_GRID3,PV-WAVE,ITER=20,NGHBR=3)

Minimum Contour: −0.5
Maximum Contour: 14.0
Contour Interval: the.lvl
−0.5 to 1.5: 0.5
1.5 to 4.0: 0.1
4.0 to 10.0: 0.5
10.0 to 14.0: 1.0

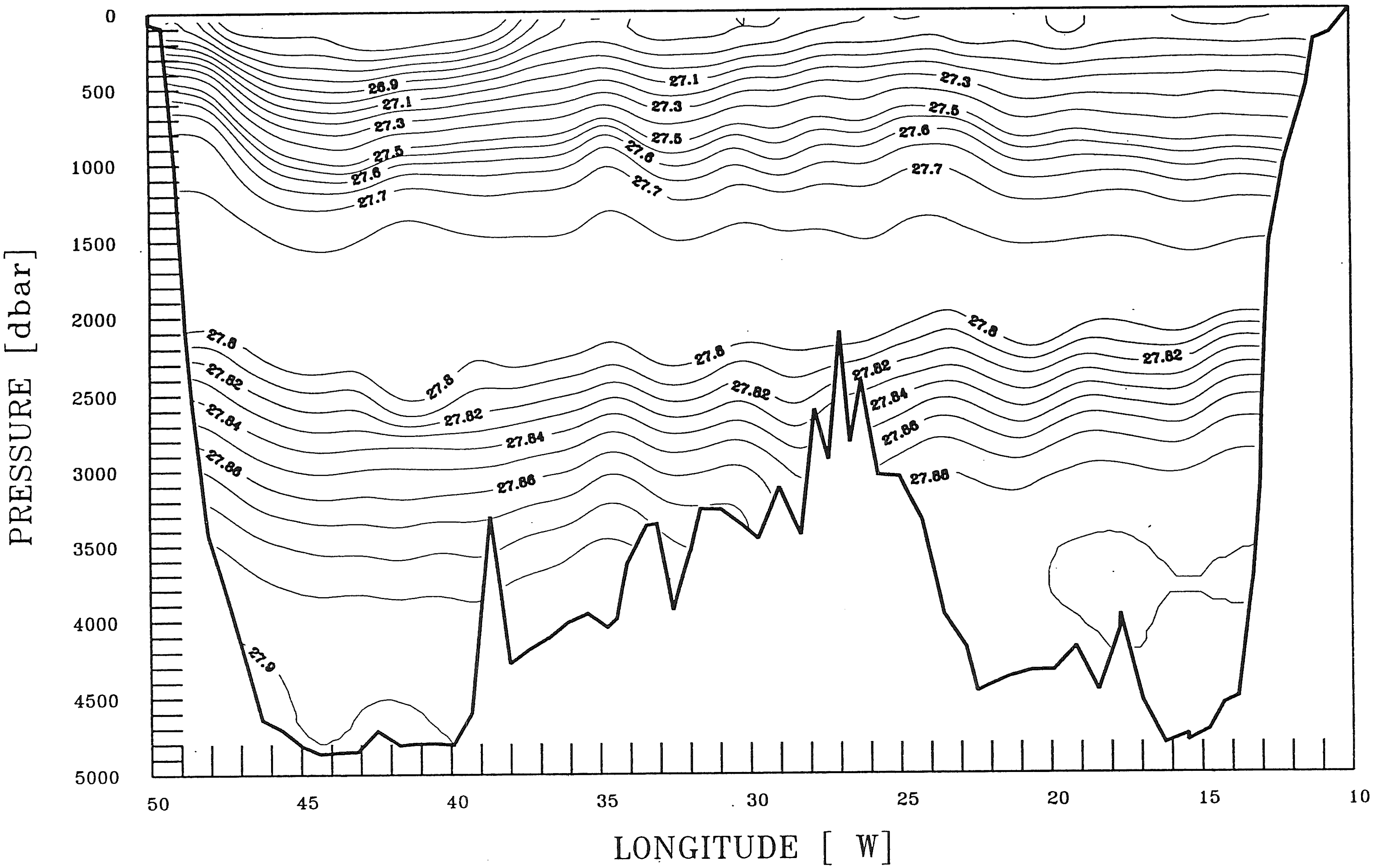
GAUSS93, 48 N, Bottle, Salinity



No of GRD-Points in X = 200
No of GRD-Points in Y = 100
(FAST_GRID3,PV-WAVE,ITER=20,NGHBR=3)

Minimum Contour: 33.
Maximum Contour: 36.
Contour Interval: salpv2d.lvl
33.000 to 34.500: 0.5000
34.500 to 34.900: 0.2000
34.900 to 34.930: 0.0100
34.930 to 34.940: 0.0025; 34.945,34.95,34.9525
34.955 to 34.970: 0.005
34.970 to 34.980: 0.010
35.000 to 36.000: 0.200

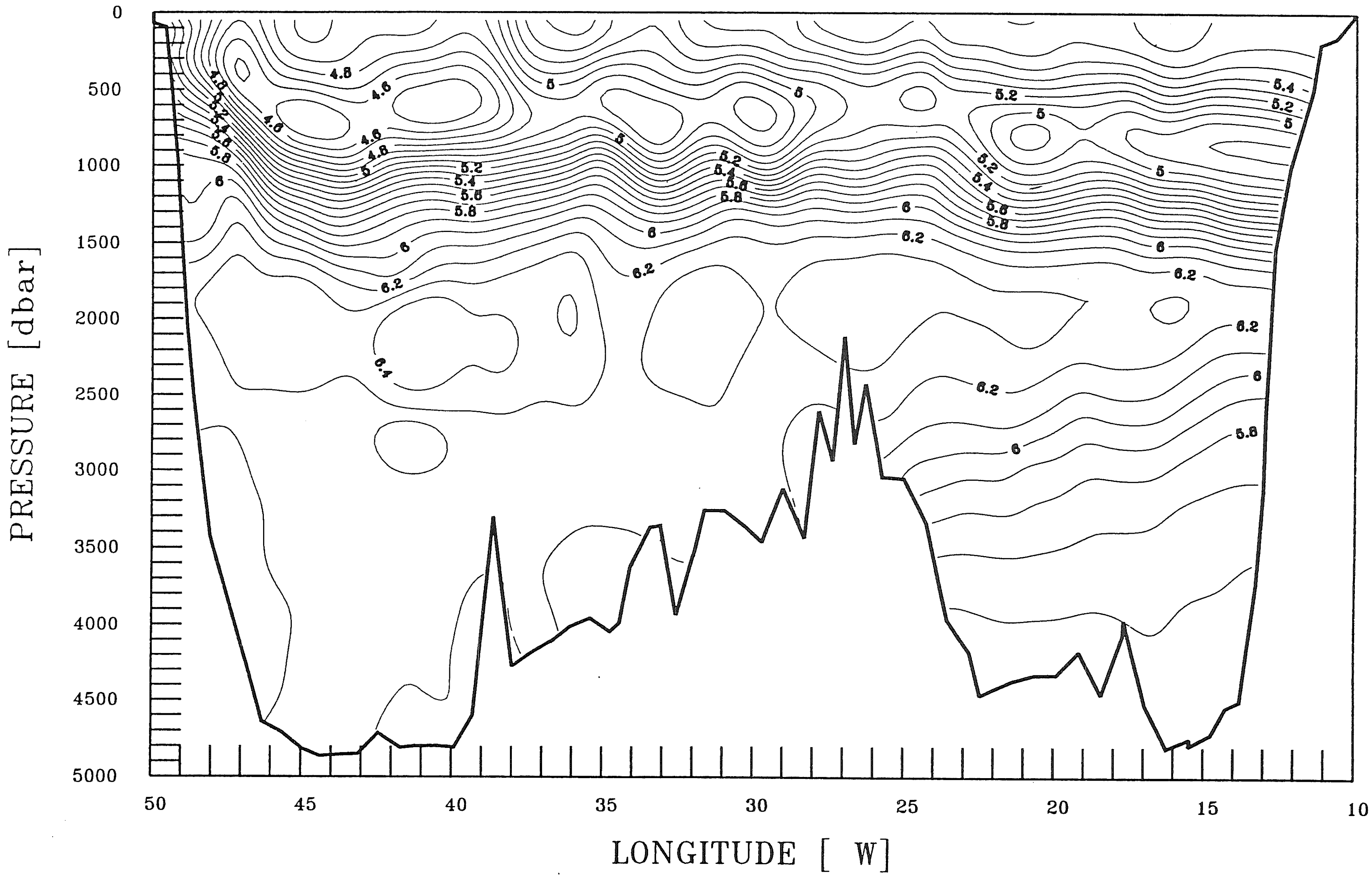
GAUSS93, 48 N, Bottle, SIGMA-THETA [kg/(m**3)]



No of GRD-Points in X = 200
No of GRD-Points in Y = 200
(FAST_GRID3,PV-WAVE,ITER=20,NGHBR=3)

Minimum Contour: 26.5
Maximum Contour: 28.0
Contour Interval: si0.lvl
26.5 to 27.5: 0.10
27.5 to 27.8: 0.05
27.8 to 28.0: 0.01

GAUSS93, 48 N, Bottle, OXYGEN [ml/l]



No of GRD-Points in X = 200
No of GRD-Points in Y = 100
(FAST_GRID3,PV-WAVE,ITER=20,NGHBR=3)

Minimum Contour: 2.0
Maximum Contour: 8.0
Contour Interval: 0.1

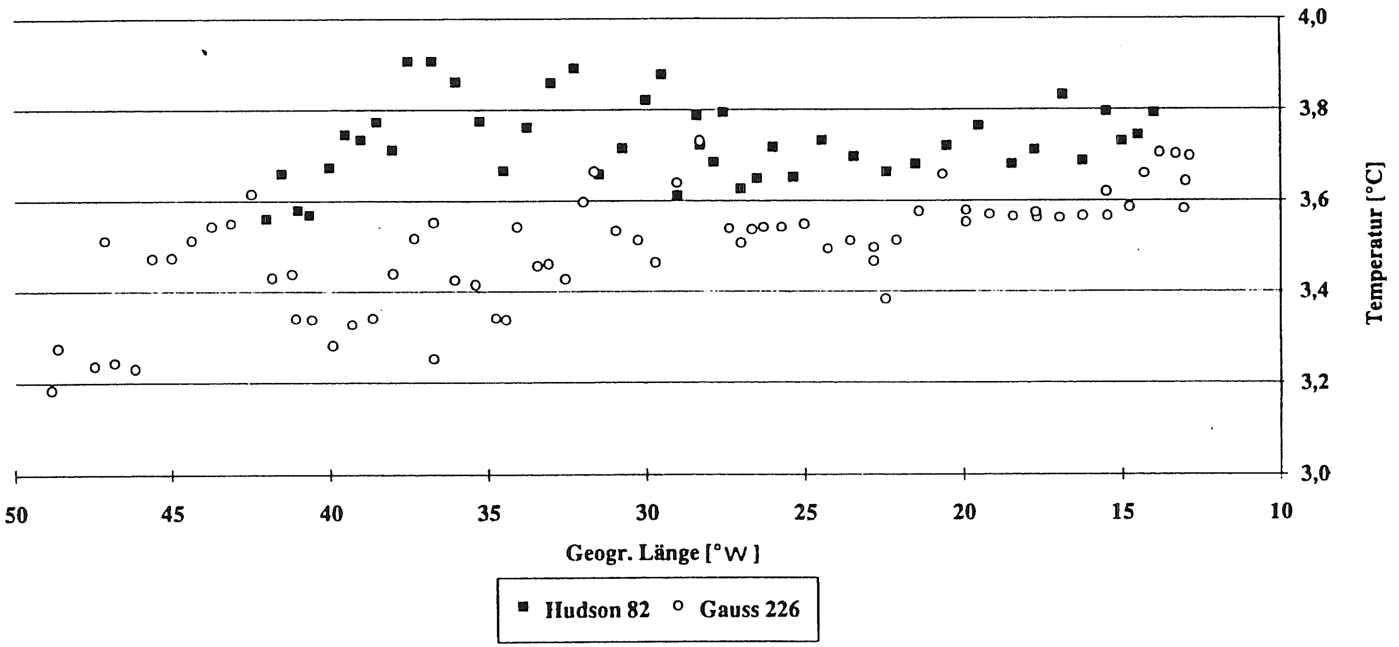


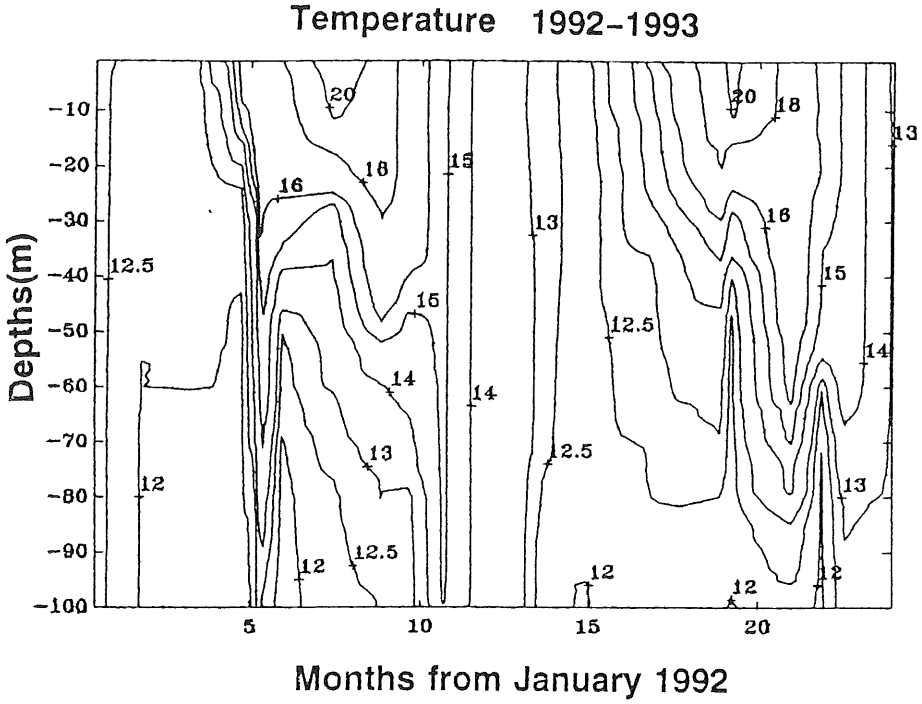
Figure 3. The Labrador Sea Water Temperature Minimum along the 48°N section. Hudson (■) in 1982, Gauss on A2 in July 1993 (o).

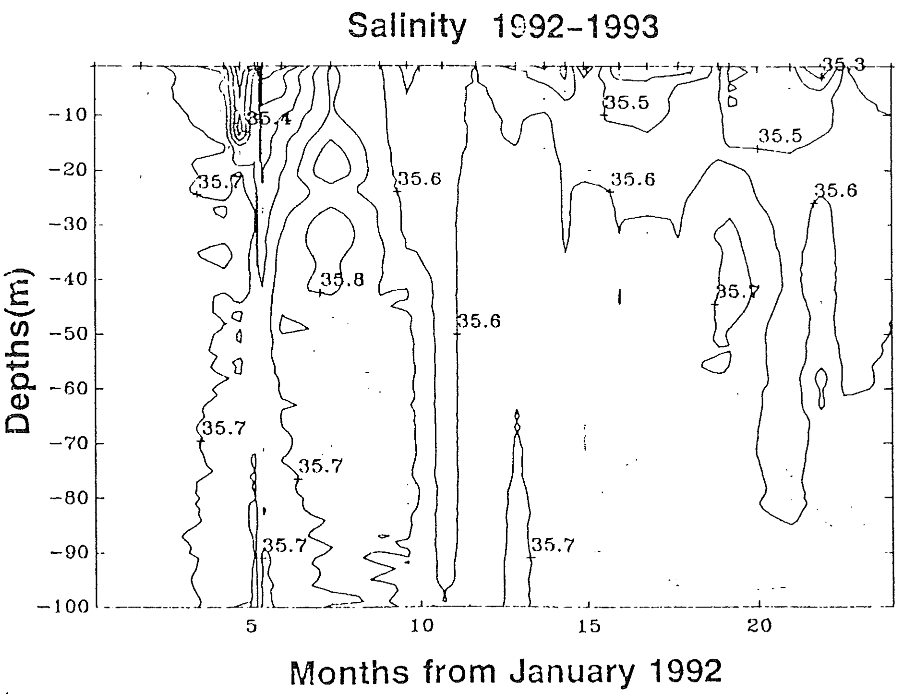
SPAIN

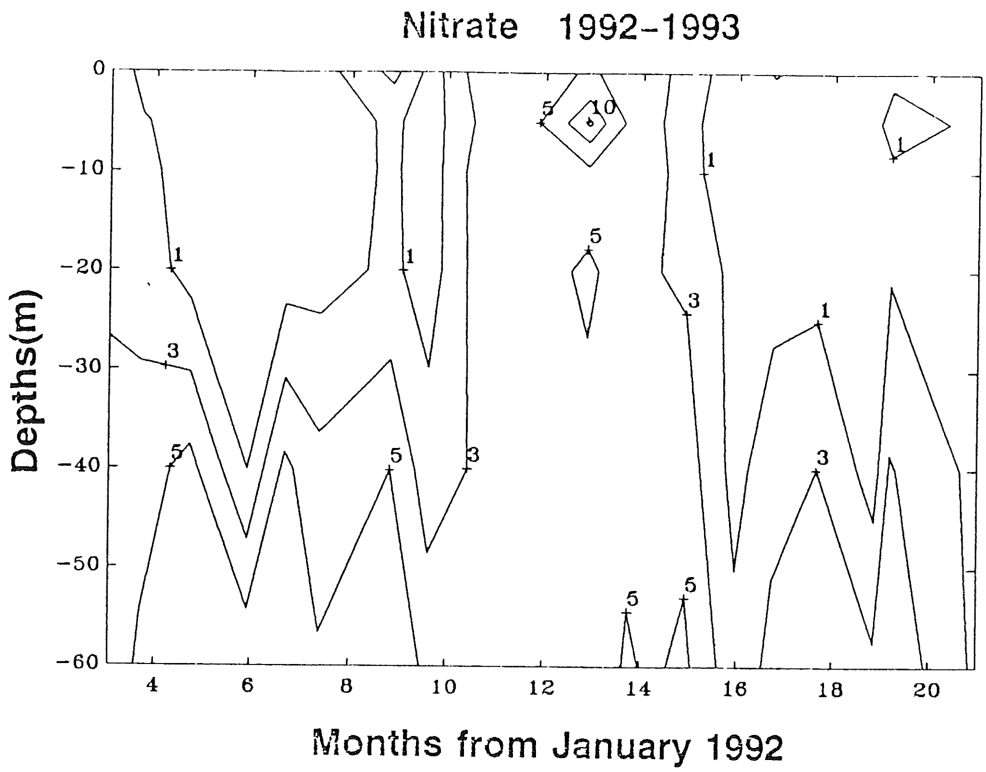
by

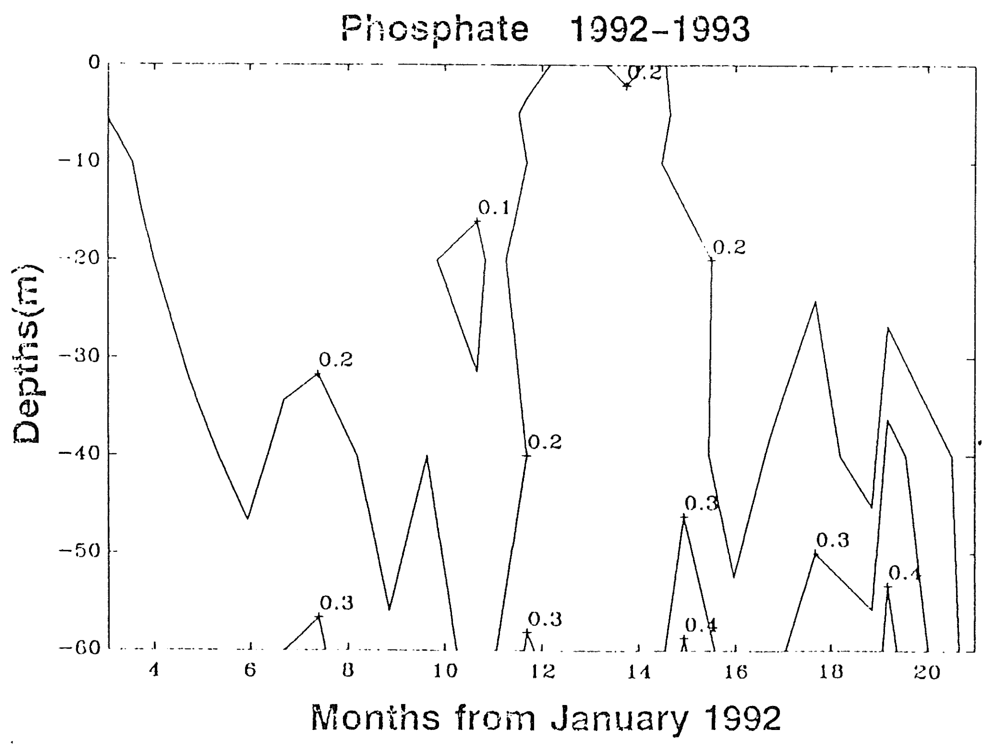
Alicia Lavin

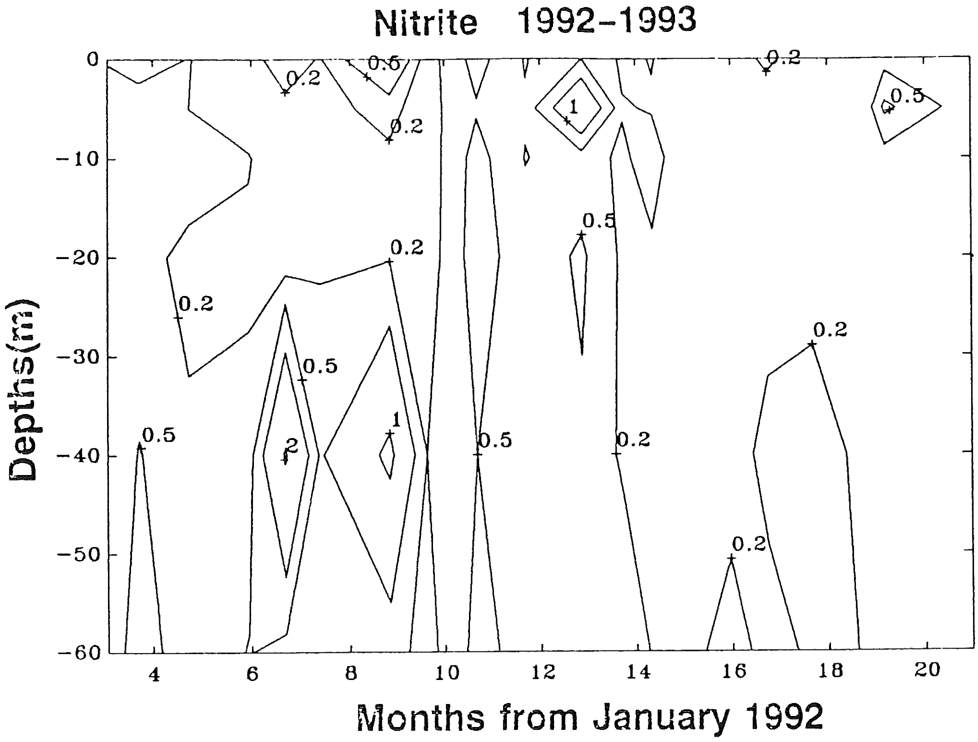
Plots of temperature, salinity, nitrate, nitrite and phosphate from a 100 m deep station at the Santander Section (43°34N, 03°47W).






Nitrate 1992-1993
Depths(m)
Months from January 1992
0
-10
-20
-30
-40
-50
-60
4
6
8
10
12
14
16
18
20
1
3
5
10


Phosphate 1992-1993
Depths(m)
Months from January 1992
0
-10
-20
-30
-40
-50
-60
4
6
8
10
12
14
16
18
20
0.1
0.2
0.3
0.4



Nitrite 1992-1993
Depths(m)
Months from January 1992
0
-10
-20
-30
-40
-50
-60
4
6
8
10
12
14
16
18
20
0.2
0.5
1
2