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Hydrography Committee
Ref. Pelagic Fish Committee

HYDRO-CHEMICAL OBSERVATIONS IN THE NORTH SEA DURING THE INTERNATIONAL YOUNG FISH SURVEY 1986

by

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1 Introduction

The objective of this paper is to present a review of the hydrographic data collected during this year's International Young Fish Survey in the North Sea, and to give a preliminary assessment of some of nutrient data that were requested in addition to the hydrographic data in a number of Council Resolutions. A routine for collecting these data was established commencing with the 1984 survey, and it was the original intention of this paper to present a thorough review of them. Unfortunately all of the available data have not yet been submitted to the Service Hydrographique.

2 Data Coverage

Figure 1 tabulates the number of stations worked during each of the surveys from 1984 to 1986. The total number of stations is more-or-less constant at about 400, in spite of the fact that no data has been received from Sweden ("Argos") in 1985 and 1986, and from France ("Thalassa") in 1986. In 1986, only the temperature data supplied by Denmark ("Dana") could be used as salinity data from that ship was in error by approximately 0.5.

The Figure shows that in 1984 nutrients samples were collected at almost 65% of the stations, with contributions from 4 ships. However data have only been supplied from 2 of the ships in 1985 and 1986, with only approximately 25% of the stations covered. It is known that much more data is potentially available, hence the reason for not conducting a more thorough analysis of the data at present.

3 Hydrographic situation during IYFS '86

The bottom temperature and salinity distribution during IYFS '86 is presented in Figures 2 and 3. Figure 4 lists the time series of temperature and salinity at 10 locations in the North Sea, since the start of these series of observations in 1972.

As usual the hydrographic situation closely reflects the meteorological situation. Air temperature was well below average throughout the North Sea area in January and February and, as a result, sea temperatures were at least 1^0 below their 1985 levels, except in the far north of the area. Indeed temperatures were lower than at any other time during these surveys, except for 1979.

These very cold conditions were a direct consequence of the very

low frequency of westerly winds. Indeed westerly winds did not occur at all from January 28 until early March. Winds during February were markedly weak, and mostly from the easterly sector, as they were in 1985. As a result the distribution of salinity was markedly similar to that encountered in 1985. A feature of note was the large area of very low salinity to the west of Denmark, and a complete absence of any significant incursion of saline water from the English Channel. A similar situation existed in 1975 and 1982. (see eg point 10 in Figure 4).

4 Some comments on the nutrient data

Figures 5, 6 and 7 are charts showing the depth mean distribution of temperature, salinity, phosphate, silicate and nitrate during the surveys of 1984, 1985 and 1986 respectively. Only those stations at which all these parameters were measured are included.

In spite of the rather similar distribution patterns of temperature and salinity in each of these years, the nutrient distributions show marked differences. Some of these differences probably can be attributed to the difficulty of contouring the data from the relatively low number of stations that have so far been made available for the 1985 and 1986 surveys. In Figure 5, which give the distributions for 1984, some values, especially phosphate, have been ignored because there were several suspiciously low values. In the shallow continental area of the southern North Sea, silicate levels varied without any apparent pattern between 2 and 13 µg-at/l. However the distribution of minimum and maximum levels of nutrients is as expected, ie high levels associated with the Atlantic water masses and the continental coastal waters and an area of minimum concentration between these areas, in the southern Central North Sea. The low levels in this area can be partly explained by the persistent production of phytoplankton in the Dogger Bank area (Brockmann, 1985).

In 1985, nitrate in the central northern parts of the North Sea (Figure 6) is some 20-50% higher than in 1984 and 1986. In 1986 (Figure 7) they are very low off the continental coast (except Denmark).

An issue that will have to be examined in detail following the submission of all of the data is whether the nutrient data collected by each of the ships is consistent, and of comparable accuracy. Recent experiences in other multi-ship surveys suggests that there may be cause for some concern in this. Indeed the data submitted thus far suggests some reason for doubt concerning its quality. A thorough examination of data quality cannot, however, be undertaken without first isolating effects due to changing oceanographic factors. One factor that has remained constant is the distribution of stations worked by each of the participating ships.

One method that will be used to attempt to distinguish between year-to-year and ship-to-ship differences is by means of number histograms, examples of which are given in Figure 8. By this means it is possible to distinguish between the results of 1984, 1985 and 1986, and between the 1986 results of "Cirolana" and

"Scotia", for example. The reader may wish to draw his own conclusion from this material, but I would like to draw attrention to the following points from these diagrams (letters are as for each part of Figure 8 - note also that there are 3 times more values available for 1984).

A) Low levels of phosphate are common in 1984 and 1986. (These were fairly randomly distributed throughout the North Sea, especially in 1984, but not for the Anton Dohrn data set).

B) The 1986 "Cirolana" phosphate distribution was quite different (many very low values) from "Scotia's" data.

C) Silicate values steadily increased from 1984 to 1986, particularly in 1986.

D) The high silicate values were obtained entirely from the "Cirolana" data set.

E) There were many high values of nitrate in 1985, and were relatively low in 1986, reflecting the distribution in Figure 6.

F) 1986 "Cirolana" nitrate values are very low relative to the "Scotia" values.

G) There is a tendency for decreasing salinity from 1984 to 1986. In particular there was a higher frequency of low salinity values in 1986.

H) "Cirolana" salinity values are slightly lower that those for "Scotia", reflecting the more southerly disposition of the "Cirolana" stations.

The above points raise issues which at present cannot be explained without a more detailed consideration of contributing analytical and oceanographic factors. This will be pursued following submission of all the available data.

5 Reference

Brockmann U.H. and G. Wegner, 1985. Hydrography, nutrient and chlorophyll distribution in the North Sea in February 1984. Arch. FischWiss, 36, 1/2,27-45.

Figure 1 - Details of Hydro-chemistry station data IYFS 1984-1986

	Total Number of stations			Number of stations with nutrients.		
Year	1984	1985	1986	1984	1985	1986
Anton Dohrn	100	124	120	100	0	0
Dana	36	38	41	0	0	0
Thalassa	44	60		22	0	
Eldjarn	42	41	42	0	0	0
Tridens	25	52	40	0	0	0
Isis			49			0
Cirolana	50	56	62	50	56	62
Explorer	59			59		
Scotia		59	53		59	53
Argos	35			0		
Σ	391	430	407	231	115	115

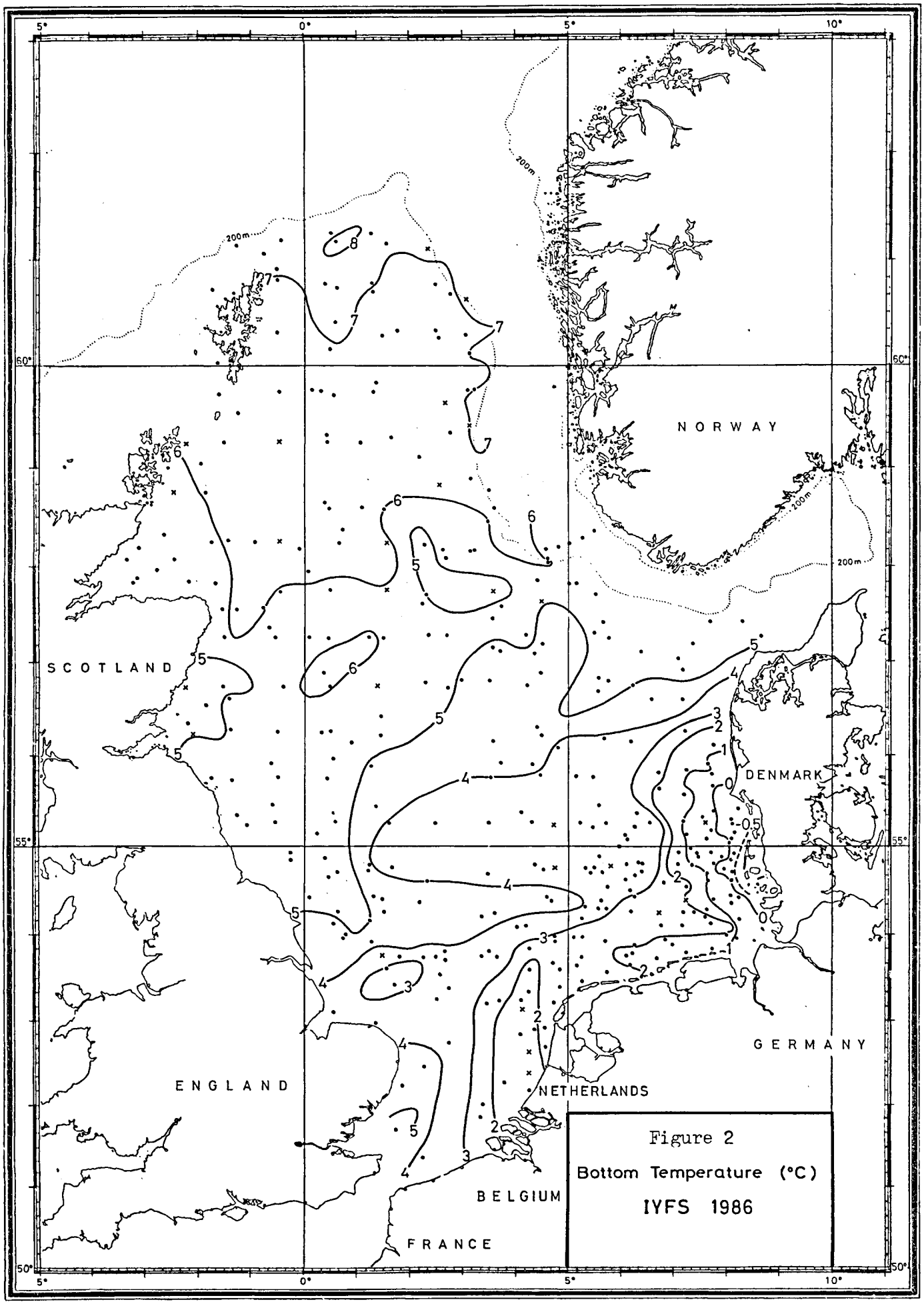


Figure 2

Bottom Temperature (°C)

IYFS 1986

ICES SERVICE HYDROGRAPHIQUE

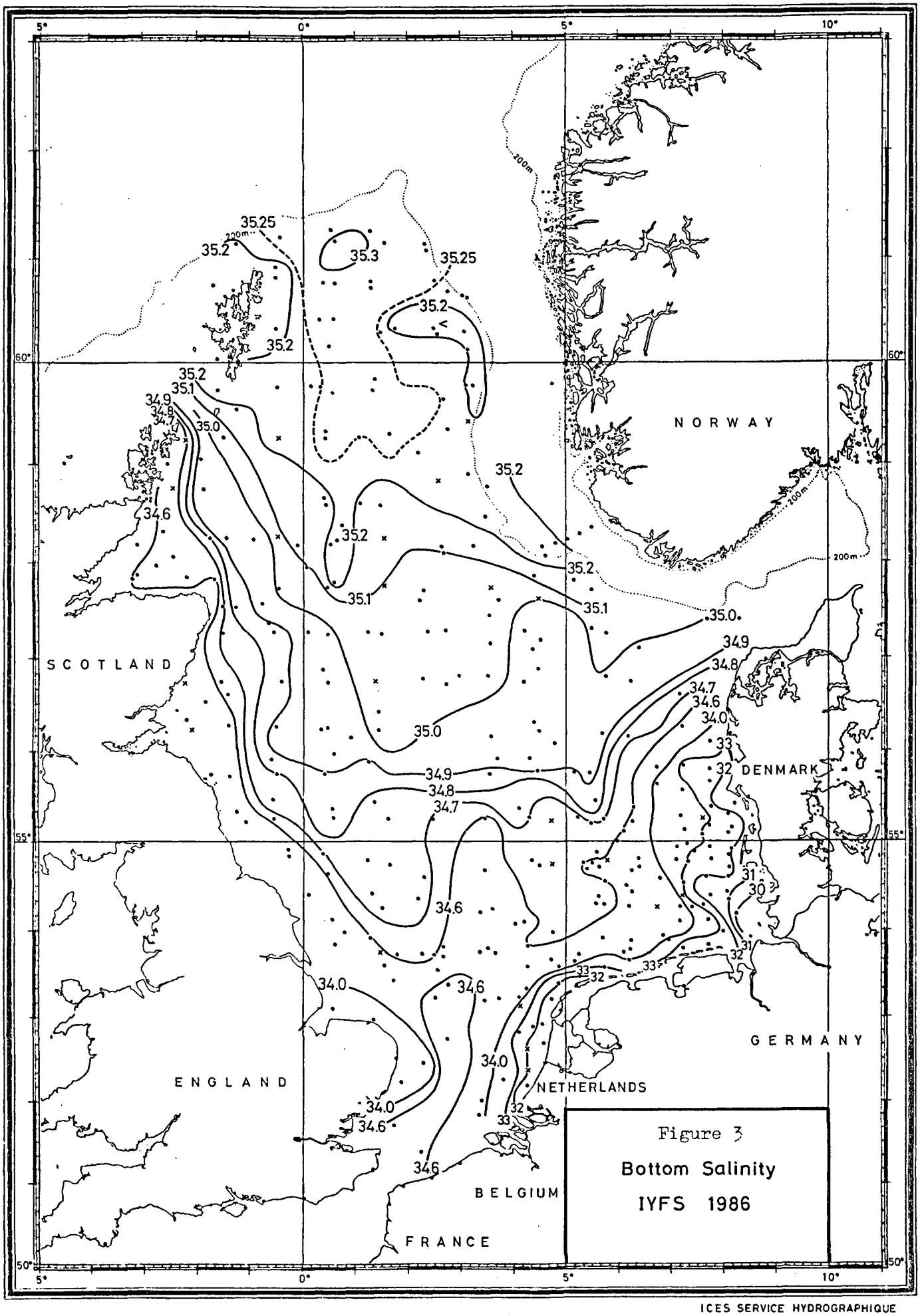
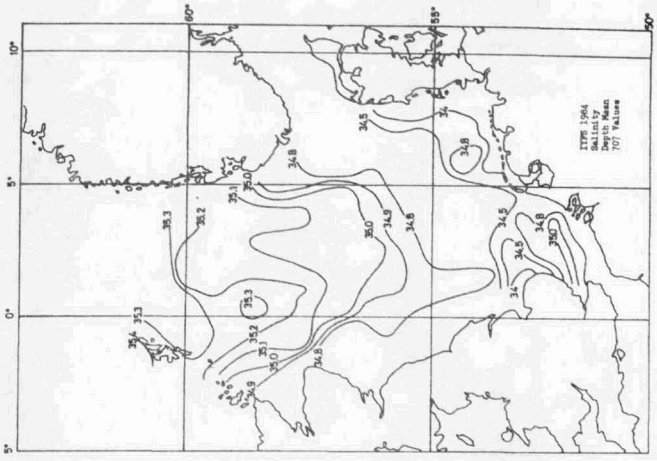
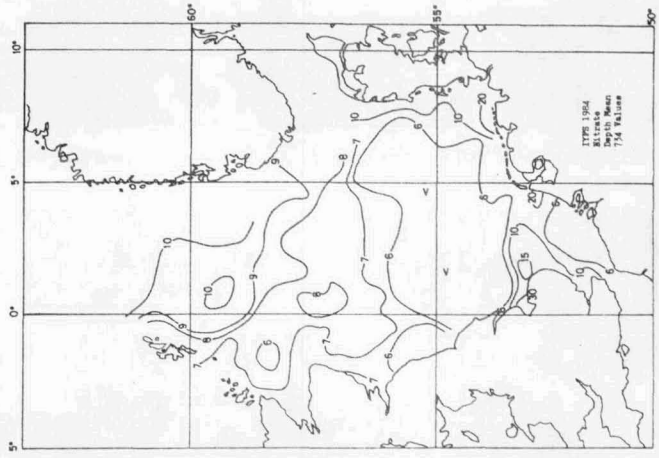

5°
0°
5°
10°
60°
55°
50°
200m
35.25
35.2
35.3
35.1
35.0
34.9
34.8
34.7
34.6
34.0
33
32
31
30
NORWAY
SCOTLAND
ENGLAND
DENMARK
GERMANY
NETHERLANDS
BELGIUM
FRANCE
Figure 3
Bottom Salinity
IYFS 1986
ICES SERVICE HYDROGRAPHIQUE

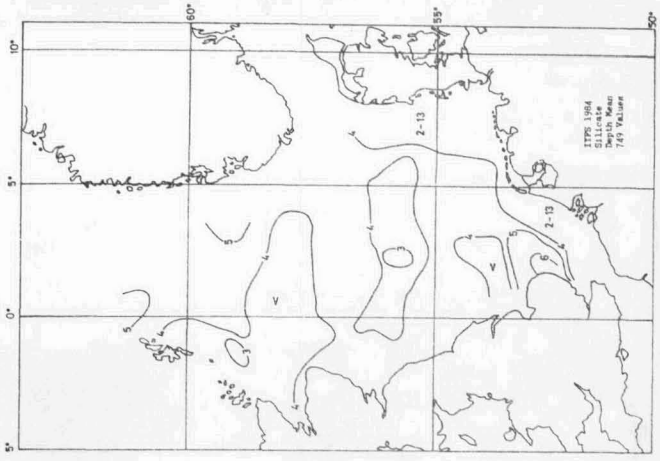
Figure 4 - Time series data of bottom temperature and salinity during IYFS survey 1972-86

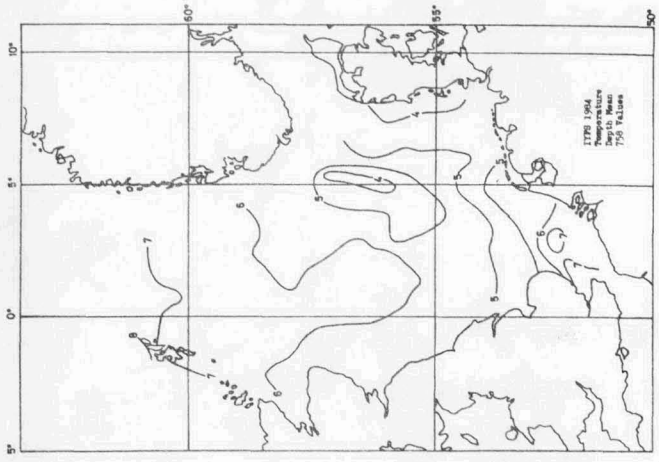
LOCATION	1		2		3		4		5		6		7		8		9		10	
Position	60° 0'N 2° E		57° 30'N 0°		57° 30'N 2° E		57° 30'N 4° E		55° 0'N 0°		55° 0'N 2° E		55° 0'N 4° E		55° 0'N 8° E		54° 0'N 3° E		52° 30'N 3° E	
Year	t,	S-30	t,	S-30	t,	S-30	t,	S-30	t,	S-30	t,	S-30	t,	S-30	t,	S-30	t,	S-30	t,	S-30
1972	5.8	5.22	6.9	5.08	5.9	5.20	4.5	4.78	6.5	4.91	4.8	4.86	5.2	4.80	2.5	3.80	5.2	4.70	6.9	5.10
1973	-	-	7.4	5.02	7.2	5.20	6.7	5.10	7.0	5.05	6.1	5.00	6.0	4.86	5.0	3.00	6.4	4.80	6.5	5.05
1974	6.9	5.28	6.5	5.11	6.5	5.08	6.3	5.04	6.5	4.90	6.0	4.90	5.6	4.90	4.7	3.00	6.1	4.78	8.0	5.20
1975	7.3	5.20	6.6	5.05	6.6	5.15	6.4	5.13	6.6	4.95	6.4	4.90	6.1	4.85	5.2	3.50	5.9	4.62	6.9	4.62
1976	6.7	5.20	6.5	5.00	6.5	5.15	5.6	5.12	6.1	4.81	4.9	4.95	4.9	4.85	2.2	1.00	5.1	4.78	5.1	4.80
1977	6.0	5.18	6.2	5.02	5.1	5.00	4.8	4.92	6.0	4.98	4.9	4.85	5.0	4.80	3.1	3.60	5.6	4.78	7.1	5.22
1978	6.4	4.88	6.6	5.02	6.0	4.90	4.7	4.88	5.6	4.78	4.9	4.88	4.2	4.80	2.2	2.50	4.6	4.68	5.5	4.90
1979	6.4	5.15	6.0	4.80	4.1	4.88	4.0	4.98	4.5	4.64	2.8	4.62	2.8	4.62	-1.5	2.00	3.0	4.62	4.2	4.95
1980	5.9	5.12	6.6	5.00	5.5	5.00	4.5	4.70	6.1	4.60	3.8	4.65	4.5	4.50	3.1	3.50	5.1	4.70	6.1	5.11
1981	6.9	5.22	6.6	4.90	6.2	5.05	5.8	5.15	6.5	4.80	5.8	4.82	5.1	4.82	3.4	2.50	-	-	-	-
1982	6.6	5.28	6.1	5.02	5.9	5.05	5.5	5.10	5.5	4.72	4.8	4.82	4.5	4.62	2.8	2.50	4.7	4.30	6.0	4.65
1983	6.9	5.22	6.5	5.00	6.4	5.10	6.2	5.15	5.6	4.62	6.1	4.95	5.2	4.90	3.0	3.00	5.2	4.80	6.4	4.70
1984	6.3	5.18	6.4	5.10	6.4	5.10	5.2	5.12	5.9	4.80	5.0	4.84	4.9	4.90	3.5	3.00	4.9	4.65	7.4	4.95
1985	6.9	5.17	6.8	5.10	6.5	5.18	5.9	5.05	6.5	4.70	4.7	4.91	5.0	4.90	1.0	2.50	4.0	4.70	6.0	4.80
1986	6.6	5.25	5.8	5.05	5.4	5.08	5.2	5.05	5.2	4.65	3.9	4.72	3.6	4.60	0.0	2.50	4.0	4.60	4.0	4.65

Figure 5 - IYFS 1984









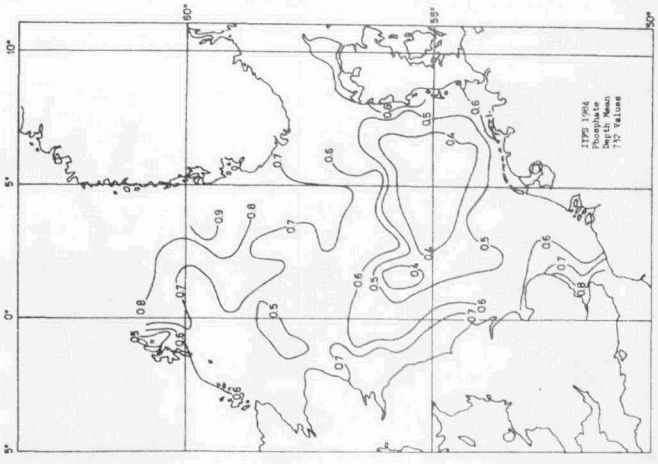
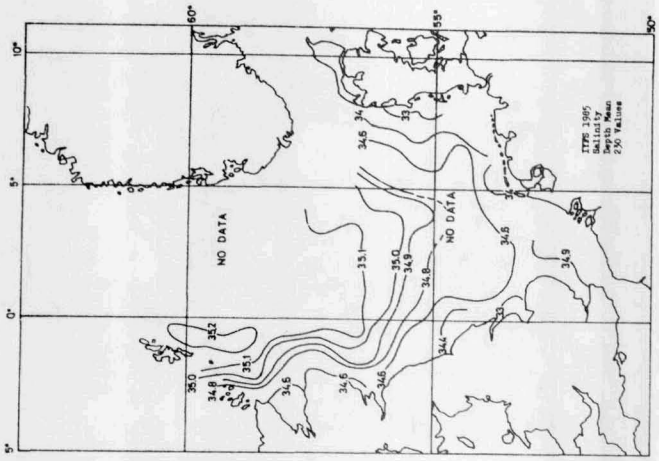
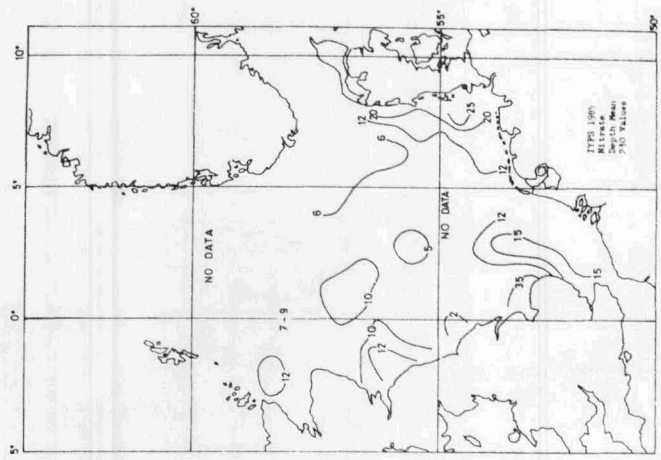
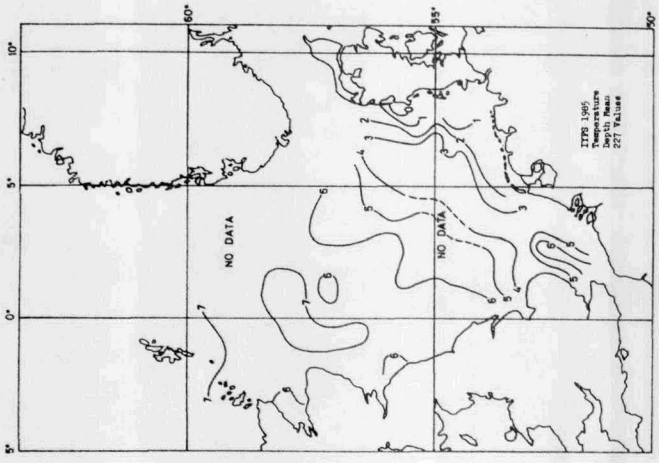
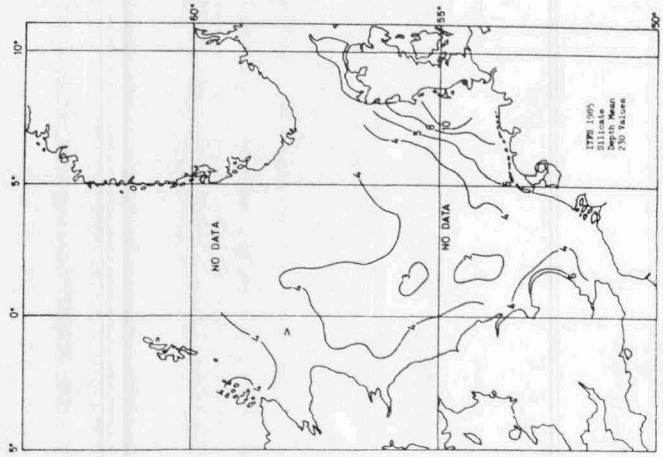


Figure 6 - IYFS 1985









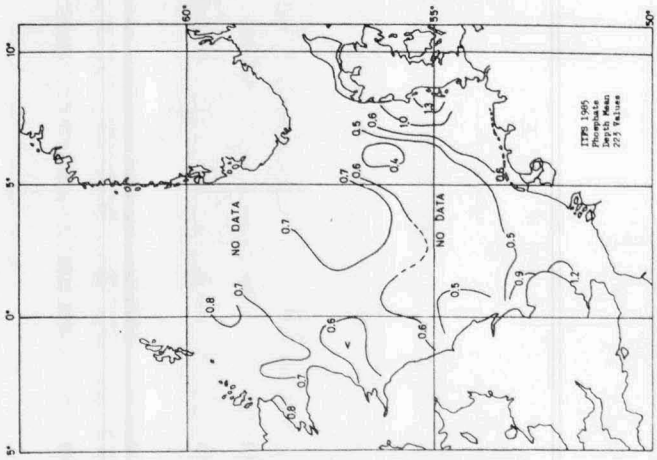
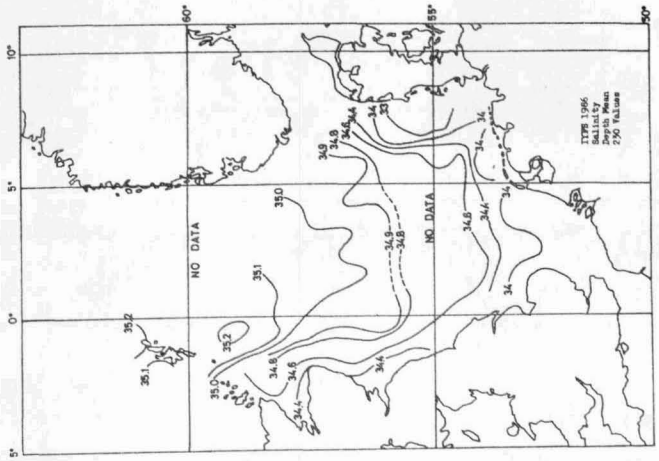
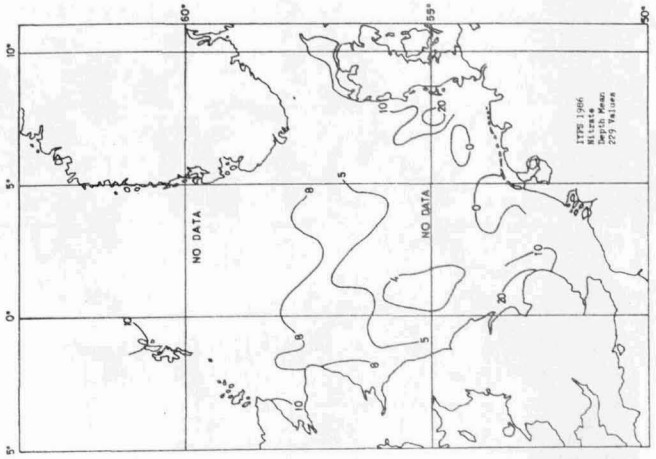
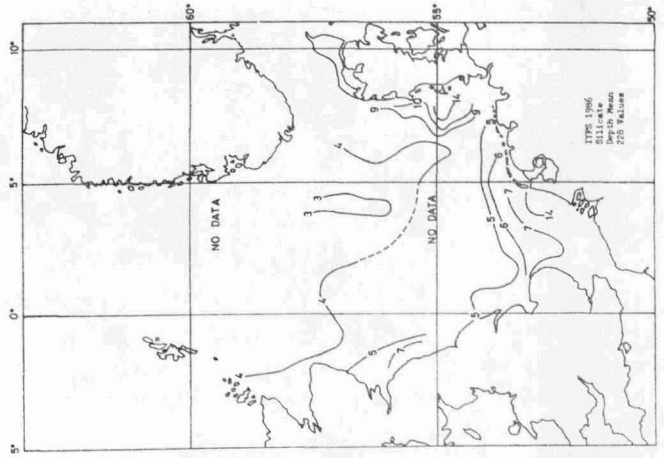
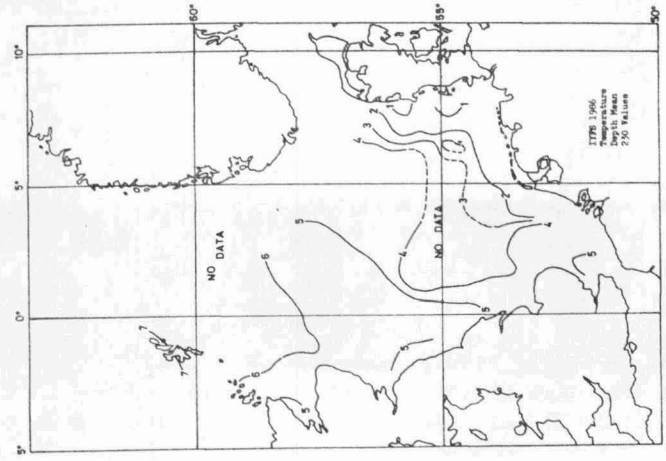


Figure 7 - IYFS 1986









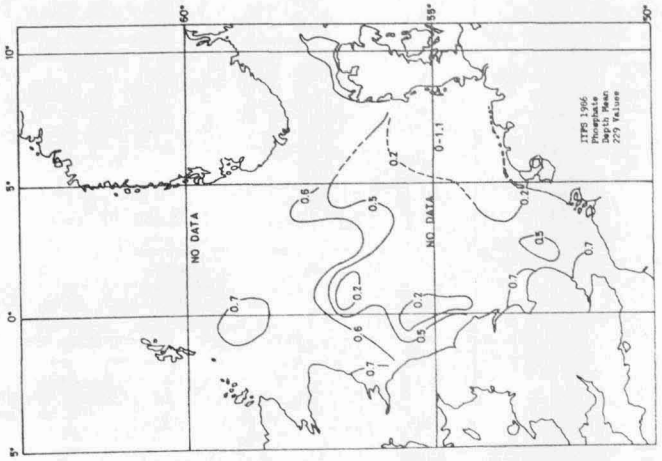


Figure 8 - Number Histograms IYFS nutrients and salinity

('0'=1; '1'=2; → → → '*'=>10 values)