

R1/12

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FRV *Scotia*

Cruise 1900S

REPORT

7-21 December 2000

Personnel

M Heath	(In charge)
S Hay	
S Hughes	
J Dunn	
J Hunter	
C Shaw	
N Collie	
R Swift	Visitor (University of Aberdeen, cetacean studies)
J Gordon	Visitor (University of Aberdeen, cetacean studies)
T Smith	Visitor (Plymouth Marine Laboratory)

Project

AE11n - 15 days

Sampling Gear

Hydrographic CTD; Plankton nets (ARIES); towed hydrophone and sonobuoys.

Area

Northwestern North Sea, Faroe Shetland Channel, and Rockall/North Atlantic.

Objectives

1. To conduct routine hydrographic sampling at stations along the standard JONISIS, Fair Isle-Munken and Nolso-Flugga survey lines.
2. To conduct plankton and hydrographic sampling with ARIES in the Faroe Shetland Channel.
3. To conduct plankton and hydrographic sampling with ARIES at stations towards Rockall and the Iceland Basin.
4. To collect data on the abundance of cetaceans along the cruise track using towed hydrophone arrays.

Narrative

Scotia sailed from Aberdeen at 1200 hours on 7 December 2000. After conducting instrument trials *en route*, hydrographic sampling commenced at the eastern end of the JONSSIS line at 0530 hours on 8 December. All the JONSSIS stations were completed by 1930 hours the same day, and a course was set for the start of the Fair Isle-Munken line.

After a delay due to bad weather on the night of 8-9 December, relatively good weather conditions (wind speed less than 30 kn) were encountered during 9-12 December, allowing all of the Fair Isle-Munken and Nolso-Flugga hydrographic and plankton stations to be completed, including replicate ARIES sampling at one of the stations in the middle of the Channel on each line.

In the early hours of 13 December, the vessel began a passage to the start of the Atlantic station grid off Barra Head. However, strong west and southwesterly winds forced the vessel to route east of Shetland and through the Minches. The passage took almost two days, including a short stop off Uig on Skye to collect a parcel of spares for scientific equipment from the harbor office.

Sampling off Barra Head commenced at 1930 hours on 14 December, and continued in a westerly direction across the Rockall Trough, Rockall Bank and beyond to 18°W by late on 16 December. At this point, bad weather, and a forecast of extreme weather conditions further to the west forced the cessation of operations and vessel back-tracked to Rockall. During 17 December, a passage was made to stations between Rosemary Bank and the Wyville-Thomson Ridge where around 27 hours of work was carried out before setting a passage back to Aberdeen. Gale force southeasterly winds made for a long and very uncomfortable journey home, and the vessel docked at 0700 hours on 21 December.

Results

General

The vessel was successfully able to exploit the breaks in the weather to achieve all of the hydrographic and plankton sampling objectives in the North Sea and Faroe-Shetland Channel. Sampling in the Atlantic was severely hampered by lack of time, and we were unable to extend the sampling as far west as we would have wished.

The cruise track and sampling locations are shown in Figure 1.

Equipment performance

The ship's CTD system performed extremely well. The ARIES system produced 100% data and sample return throughout the cruise, collecting 924 plankton net samples and 907 water samples with 50-75 m depth resolution, as well as CTD and Optical Plankton Counter data. The long range acoustic telemetry system for monitoring the depth of the ARIES also performed extremely well to depths of 2,500 m in even the worst weather conditions.

The baseline instability problems encountered on earlier cruises with the Bran-Luebbe nutrient autoanalyser system were still present at the start of this cruise, and despite extensive investigations of the power supplies by ship's staff, the precise origins of the problem still could not be traced. All nutrient analysis during the survey was successfully completed using the Skalar autoanalyser.

Data from the thermosalinograph coupled to the non-toxic seawater supply in the water sampling laboratory, and from a chlorophyll fluorometer, were logged by the computing system on the

ship. Data accumulated by the central database system were accessed routinely during the cruise to monitor progress and changes in weather and hydrographic conditions (Fig. 2).

Hydrographic monitoring

Temperature and salinity data from the Fair Isle-Munken and Nolso-Flugga sections are shown in Figures 3 and 4. Salinity in the shelf edge current west of Shetland was lower than in 1999, but higher towards the Faroese side of the Faroe-Shetland Channel. Surface water temperatures were higher than in 1999.

All water samples collected for salinity analysis were processed during the cruise, and calibrations for the CTD system both on the profiling conducting cable and on ARIES were derived.

Faroe-Shetland Channel plankton monitoring

Calanus finmarchicus were, as usual, abundant in the cold bottom waters of the Faroe-Shetland Channel. Calibrations were applied to the Optical Plankton Counter data to derive quantitative estimates of the concentration of *Calanus* in approximately 10 m depth intervals. A qualitative assessment of the vertical distribution of abundance from the ARIES net samples confirmed the quantitative results from the Optical Plankton Counter. The mean abundance below the isopycnal surface separating the bottom waters from the upper layers was the lowest recorded since monitoring began in January 1993 (Figs 5 and 6). Specimens of *Calanus* were sorted from freshly collected ARIES samples at each station and frozen in liquid nitrogen for lipid analysis.

Atlantic survey

The objective of the Atlantic Sea survey was to continue the process of mapping the overwintering distribution of *Calanus*. This task was started in 1996, and during this cruise the aim was to cover an area between the Hebrides and the mid-Atlantic Ridge which has not previously been sampled in the winter. Some new ground was covered in the area around Rockall and west to 18°W, but the most important area (16°W-32°W) could not be reached due to lack of time under the weather conditions. The sampling that was completed, confirmed the indications of earlier work that both *Calanus finmarchicus* and *Calanus helgolandicus* are almost completely absent from the Rockall Trough in winter, whilst the abundance of *Calanus finmarchicus* increases with distance westwards from Rockall (Fig. 7).

Replicate sampling

Three replicate ARIES tows were carried out at each of three stations during the cruise - one on the Fair Isle Munken Line, one on the Nolso-Flugga Line, and one in the Atlantic. The purpose was to quantify the sampling variability around estimates of plankton abundance for a given station. As a by-product, we also obtained the samples and data required to estimate these parameters for nutrient and chlorophyll concentrations. Vertical profiles of *Calanus* abundance, estimated from calibrated Optical Plankton Counter data, at each of the replicate stations are shown in Figure 8.

Cetacean distributions

Cetacean sounds were recorded during around 1,000 miles of towed hydrophone track, and from 18 passive sonar listening buoy deployments by staff from the University of Aberdeen. Sperm whale, pilot whale, and dolphins were the most commonly heard cetaceans. Sperm and

pilot whales were most frequently encountered in the western side of the Faroe-Shetland Channel and south of the Wyville Thomson Ridge. Dolphins were very numerous around the eastern side of Rockall Bank, where there were also a number of visual sightings.

Hydro-acoustic data

Eighteen, 38, 120 and 200 kHz hydro-acoustic data were recorded to disc throughout the cruise for later analysis. Extensive mid-water scattering layers were seen over most of the survey region, and some sampling of these was carried out with a 1.5 mm mesh, 2.5 m² mouth opening Methot-Isaacs-Kidd trawl. Catches with this net included various species of myctophid fish, large crustaceans, and some gelatinous species.

M R Heath
9 January 2001

Seen in draft: R Walton, OIC

Table 1

JONSIS line stations

Name	Latitude	Longitude	Depth	Hydrographic cast no	Plankton haul nos
JO 1	59°17.00'N	02°14.00'W	75 m	615	
JO 1A	59°17.00'N	02°5.00'W	90 m	614	
JO 2	59°7.00'N	01°56.00'W	100 m	613	
JO 3	59°17.00'N	01°48.00'W	80 m	612	
JO 4	59°17.00'N	01°40.00'W	90 m	611	
JO 5	59°17.00'N	01°30.00'W	95 m	610	
JO 6	59°17.00'N	01°20.00'W	110 m	609	
JO 6A	59°17.00'N	01°10.00'W	120 m	608	
JO 7	59°17.00'N	01°0.00'W	125 m	607	
JO 8	59°17.00'N	00°40.00'W	120 m	606	
JO 9	59°17.00'N	00°20.00'W	140 m	605	
JO10	59°17.00'N	00°0.00'W	135 m	604	

Table 2

Fair Isle - Munken line stations

Name	Latitude	Longitude	Depth	Hydrographic cast no	Plankton haul nos
FIM-01	60°10.00'N	03°44.00'W	150 m	616	
SEFOS-1	60°13.00'N	03°51.50'W	170 m	617	
FIM-02	60°16.00'N	03°59.00'W	200 m	618	
SEFOS-2	60°18.00'N	04°04.50'W	330 m	619	
FIM-03	60°20.25'N	04°09.00'W	390 m	620	
FIM-04	60°25.00'N	04°19.00'W	655 m	621	107
FIM-05	60°29.00'N	04°26.00'W	995 m	622	108-110
FIM-06	60°35.00'N	04°45.00'W	1,090 m	623	111-119
FIM-6a	60°38.00'N	04°54.00'W	1,030 m	624	
FIM-07	60°43.00'N	05°06.00'W	915 m	625	120-122
FIM-08	60°47.00'N	05°16.00'W	830 m	626	
FIM-09	60°51.00'N	05°29.00'W	600 m	627	
FIM-10	61°02.00'N	05°57.00'W	280 m	628	
FIM-11	61°12.00'N	06°22.00'W	240 m	629	

Table 3

Nolso - Flugga line stations

Name	Latitude	Longitude	Depth	Hydrographic cast no	Plankton haul no
NOL-01	60°56.00'N	01°00.00'W	110 m	645	
SEFOS-3	60°58.70'N	01°17.70'W	125 m	644	
SEFOS-4	61°01.40'N	01°35.40'W	155 m	643	
NOL-02	61°04.00'N	01°53.00'W	270 m	642	
SEFOS-5	61°06.00'N	02°01.50'W	440 m	641	
NOL-03	61°08.00'N	02°10.00'W	550 m	640	
SEFOS-6	61°09.30'N	02°17.50'W	630 m	639	
NOL-3a	61°11.00'N	02°25.00'W	730 m	638	
NOL-04	61°14.00'N	02°40.00'W	1,080 m	637	134-142
NOL-05	61°21.00'N	03°10.00'W	1,370 m	636	131-133
NOL-06	61°28.00'N	03°42.00'W	1,235 m	635	127-130
NOL-07	61°35.00'N	04°15.00'W	990 m	634	124-126
NOL-08	61°42.00'N	04°51.00'W	235 m	633	123
NOL-09	61°49.00'N	05°21.00'W	180 m	632	
NOL-10	61°54.00'N	05°45.00'W	290 m	631	
NOL-11	62°00.00'N	06°12.00'W	125 m	630	

Table 4

Atlantic stations

Number	Latitude	Longitude	Depth	Hydrographic cast no	Plankton haul nos
A-1	56°30.00'N	8°00.00'W	122 m		143-145
A-2	56°30.00'N	9°00.00'W	135 m		146-148
A-3	56°30.00'N	10°00.00'W	1,735 m		149-151
A-4	56°30.00'N	11°20.00'W	2,338 m		152-154
A-6	56°30.00'N	14°00.00'W	873 m		155-157
A-7	56°30.00'N	15°00.00'W	168 m		158-160
A-8a	56°30.00'N	16°30.00'W	537 m		161-163
A-10	56°30.00'N	18°00.00'W	1,340 m		164-166
A30	59°30.00'N	10°00.00'W	1,128 m		167-175
A31	59°30.00'N	8°00.00'W	606 m		176-179
A32	59°30.00'N	6°30.00'W	303 m		180-182

Figure 1

Scotia cruise 19/00 - survey track 12:00 7 December to 06:30 21 December 2000

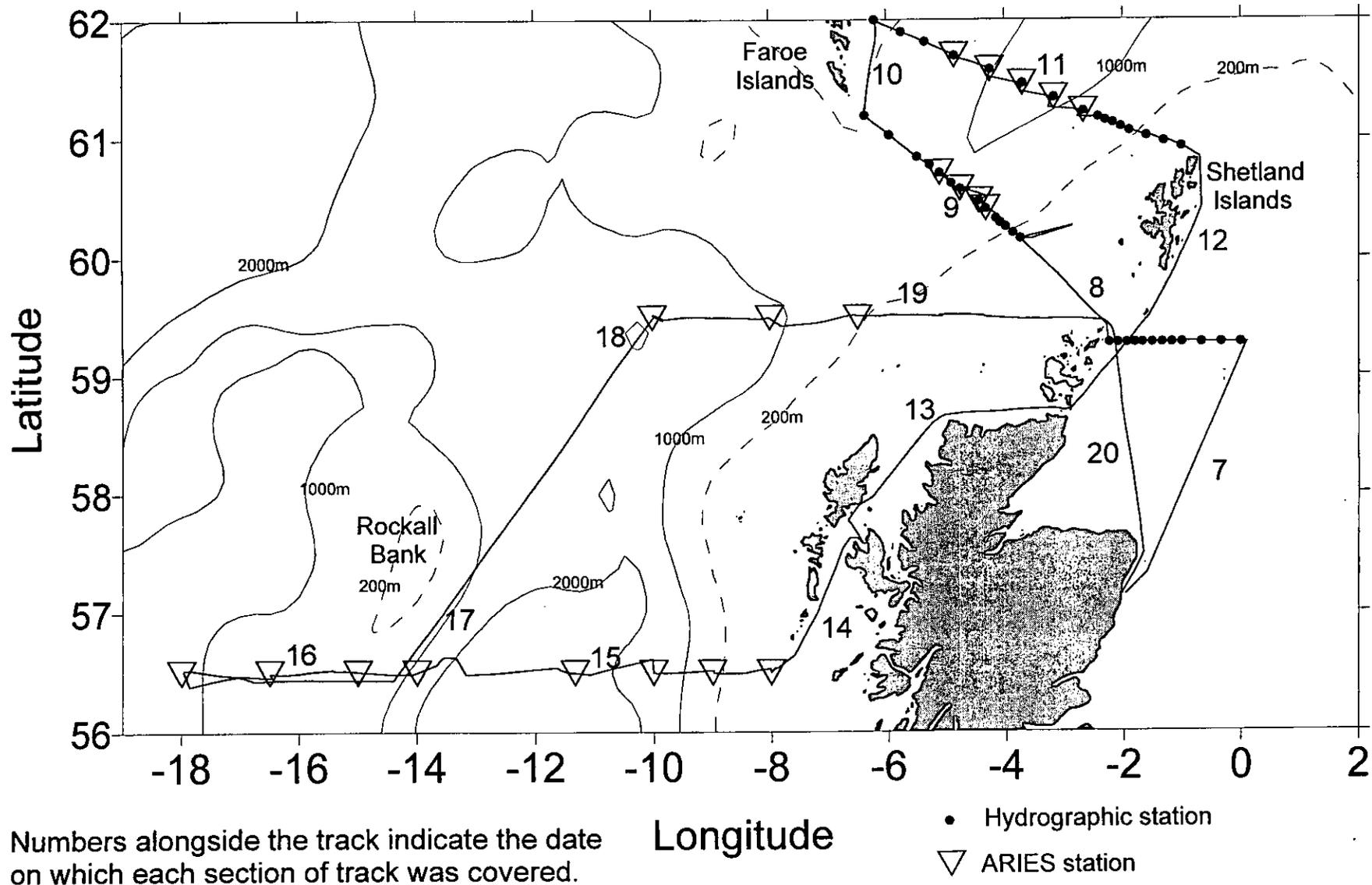


Figure 2. Data on meteorological and surface hydrographic conditions during the cruise extracted from the ships central database.

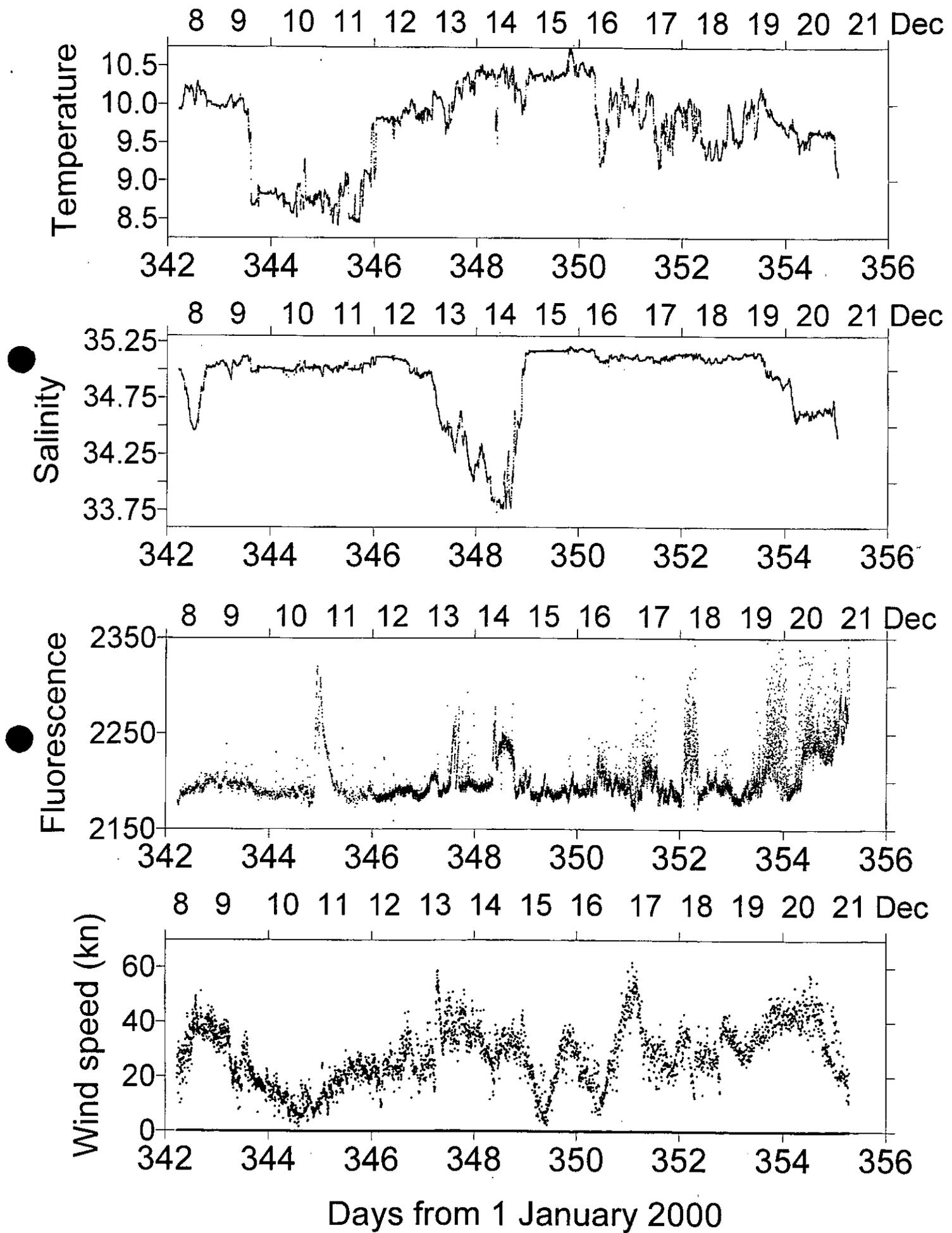


Figure 3

Temperature, salinity and density data along the Fair-Isle Munken monitoring section in the Faroe-Shetland Channel.

Section Plot, 1900S, Fairisle-Munken Line, Stations 616 : 629

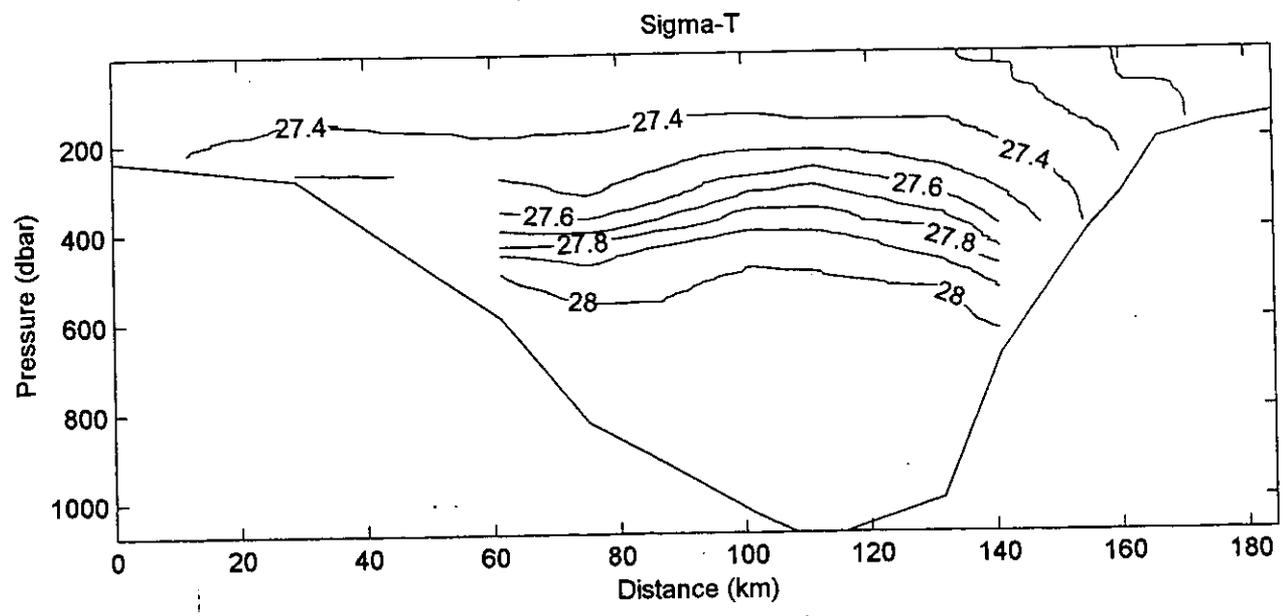
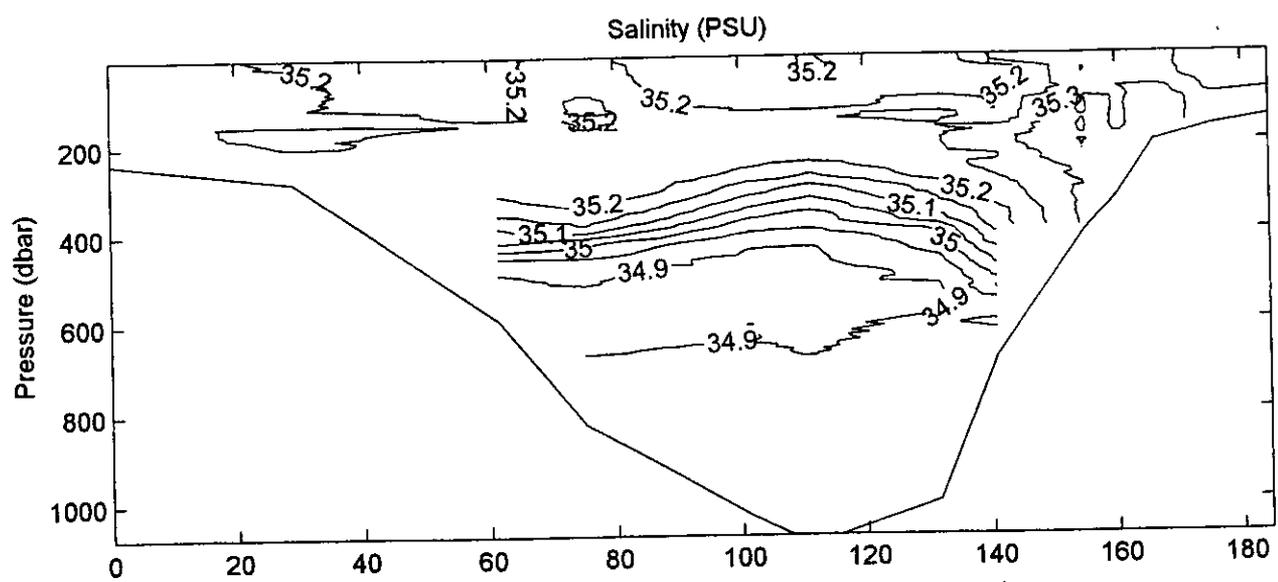
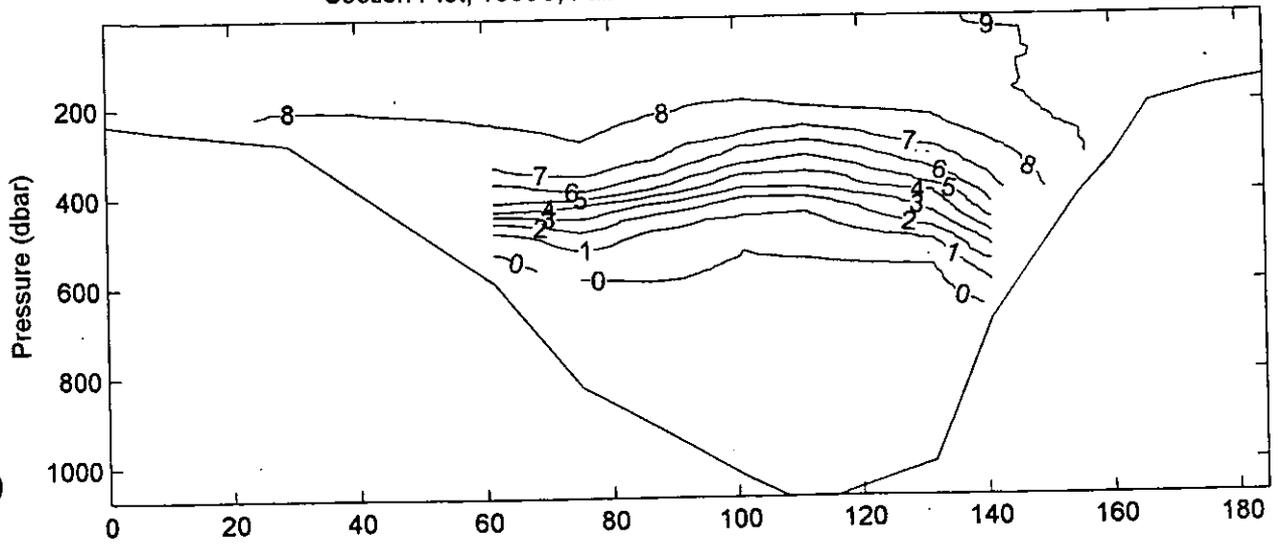


Figure 4

Temperature, salinity and density data along the Nolso-Flugga monitoring section in the Faroe-Shetland Channel.

Section Plot, 1900S, Nolso-Flugga Line, Stations 630 : 645

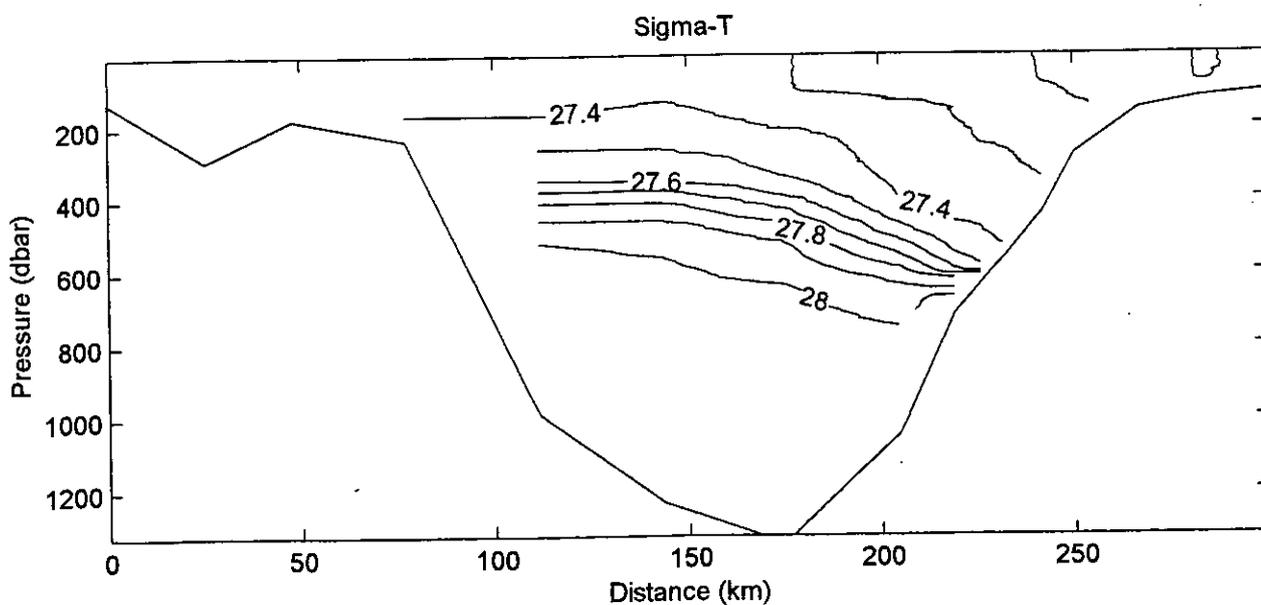
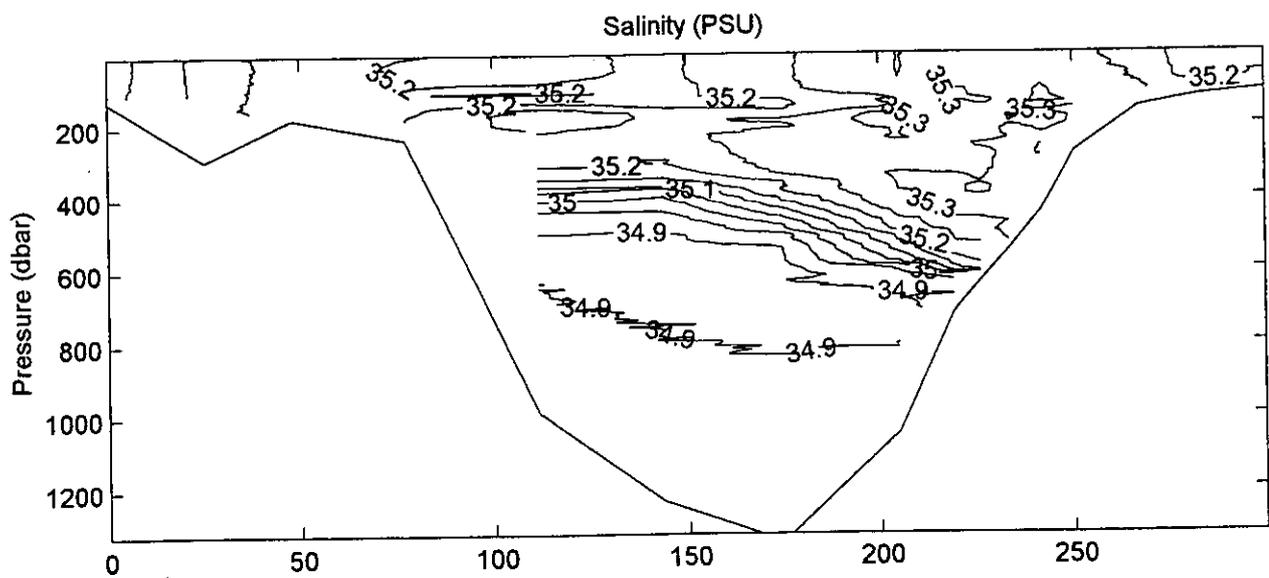
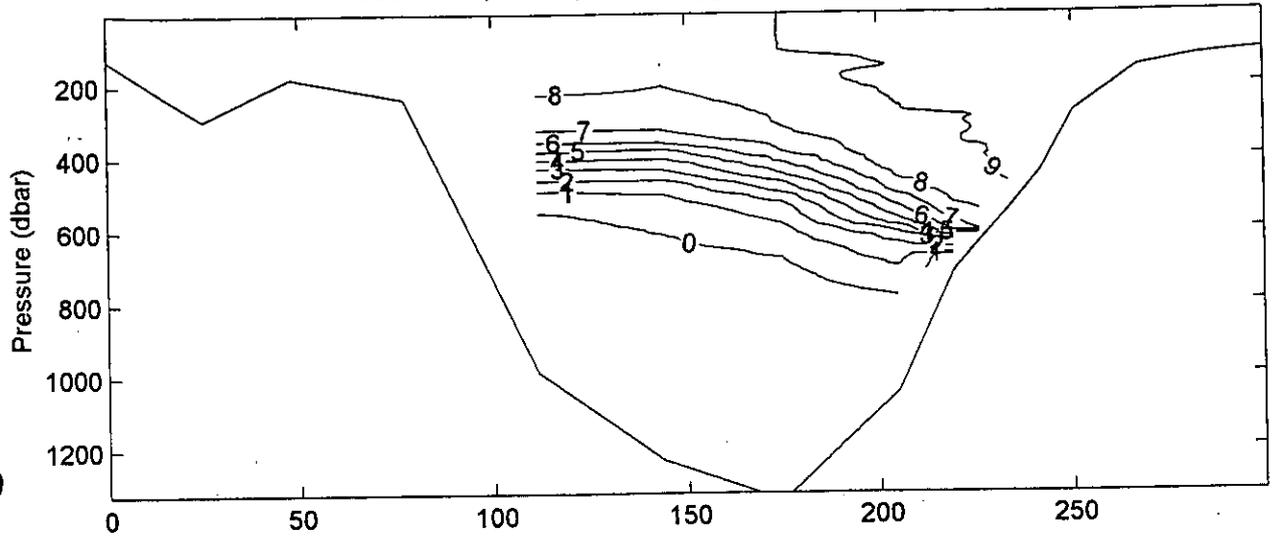


Figure 5

Mean concentration (number/m³) of *Calanus finmarchicus* in the surface (open bars) and bottom waters (solid bars) along the Fair Isle - Munken section in 2000 (winter 00/01), compared to previous years. Numbers next to each bar indicated the number of 1 min Optical Plankton Counter samples in each case.

Fair Isle-Munken survey line

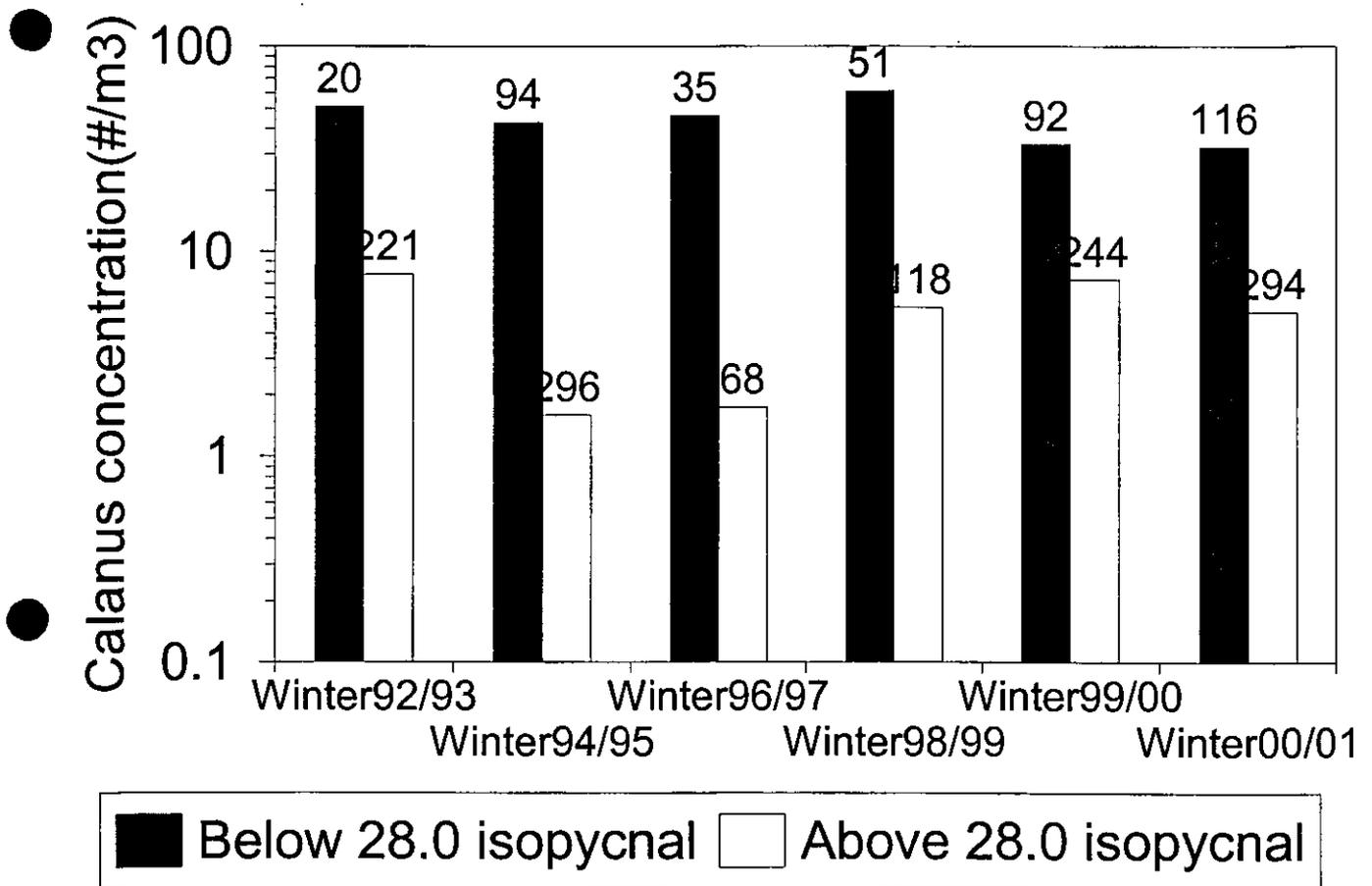


Figure 6

Mean concentration (number/m³) of *Calanus finmarchicus* in the surface (open bars) and bottom waters (solid bars) along the Nolso - Flugga section in 2000 (Winter 00/01), compared to previous years. Numbers next to each bar indicated the number of 1 min Optical Plankton Counter samples in each case.

Nolso-Flugga survey line

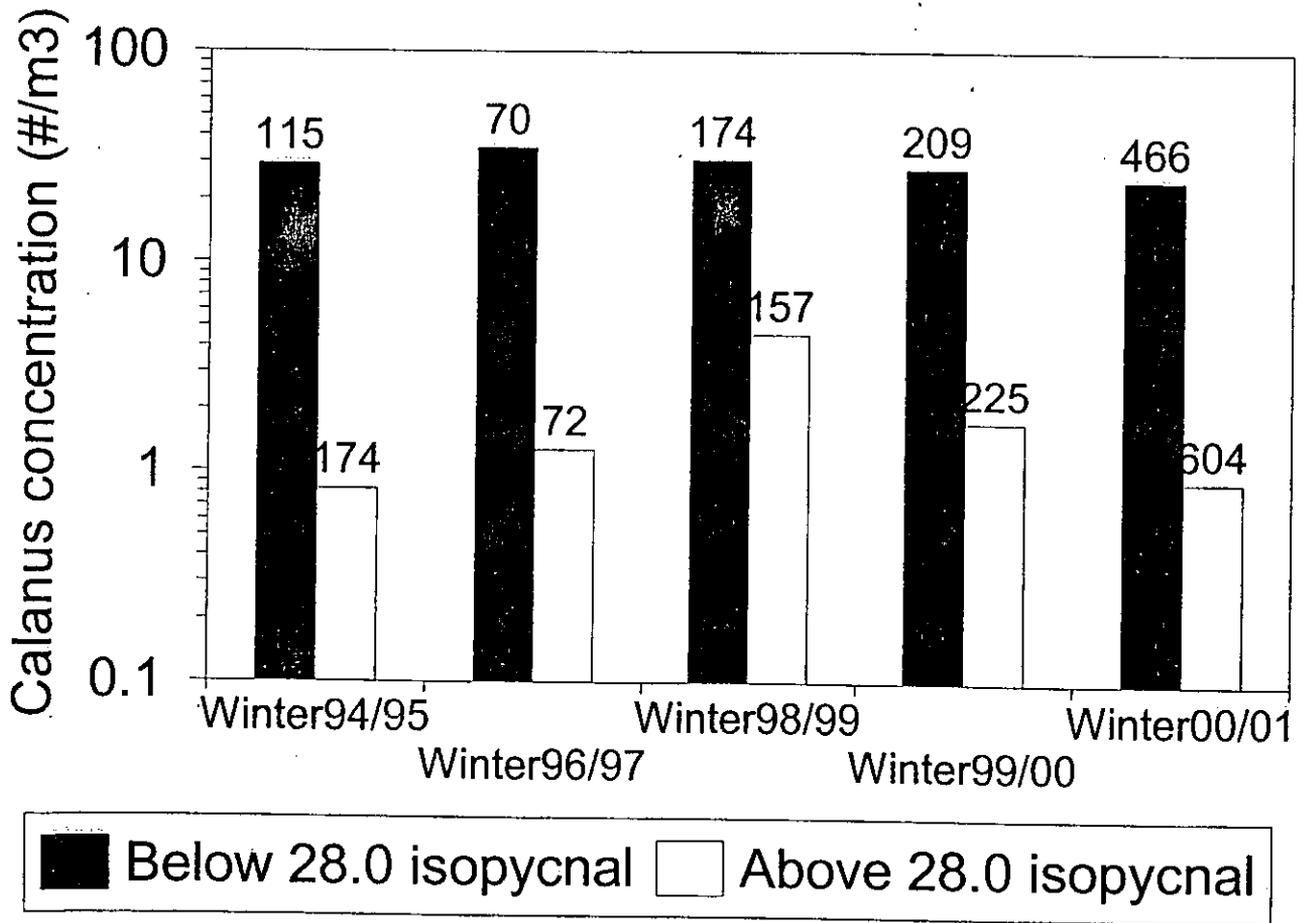


Figure 7. Abundance in the whole water column (number below one square metre of sea surface) of *Calanus* at Faroe-Shetland Channel and Atlantic sampling stations in December 2000.

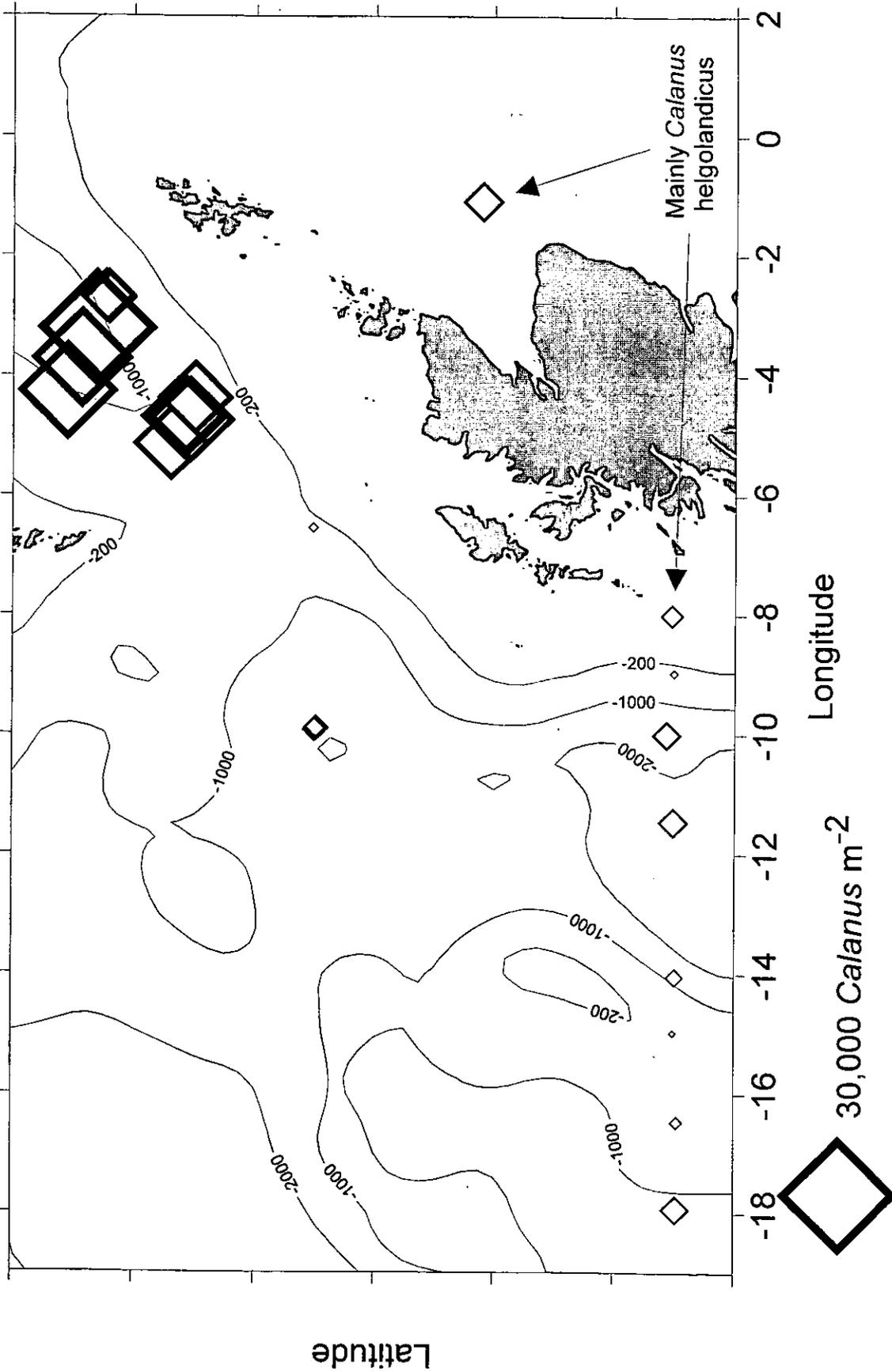


Figure 8. Replicate vertical profiles of *Calanus* abundance at three stations during the cruise. Data points are from 30 sec integrals of particle counts from an Optical Plankton Counter, calibrated in terms of stage C-V *Calanus*.

