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ESTIMATES OF STOCK SIZE OF COD, HADDOCK, REDFISH AND GREENLAND HALIBUT IN THE BARENTS SEA AND THE SVALBARD AREA AUTUMN 1987

by

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ABSTRACT

Combined acoustic and bottom trawl survey for cod and haddock were carried out in the Svalbard area together with an acoustic survey in the Barents Sea in autumn 1987. The abundance index in numbers of cod continued to increase in the Svalbard area , mainly because a larger part of the stock has become aqoustically detectable. In the Barents Sea the index has decreased a little since previous autumn and some more since last winter, partly because of an inadequate area coverage in southeast and more scattered registrations than during the winter survey. The results for haddock show that the stock is almost not present in the Svalbard area and that it is decreasing in the Barents Sea. The abundance of the redfish species Sebastes marinus and S. mentella have decreased both in the Svalbard area and in the Barents Sea, while the abundance index of S. viviparus show a huge increase, mainly because of better area coverage in southwest. The abundance of Greenland halibut is decreasing, probably because of recruitment failure.

1. INTRODUCTION

The Svalbard area has been covered by a stratified bottom trawl survey in the autumn since 1981 (Randa and Smedstad, 1982, 1983; Godø *et al.*, 1984; Godø, 1985). In 1985, with a rapidly increasing cod stock, the investigations were carried out as a combined acoustic and bottom trawl survey (Godø and Nedreaas, 1986). The same was done in 1986 (Godø *et al.*, 1987).

Cod and haddock in the Barents Sea has until recently mainly been investigated during winter time (acoustic survey since 1975 and in addition bottom trawl survey since 1981). In autumn 1986 a multispecies investigation was conducted for the first time in the Barents Sea and the Svalbard area, and the whole area was covered by an acoustic survey. The investigation was repeted in 1987.

Since 1977 the results of these surveys have been used more or less directly in the stock assessments of North-East Arctic cod and haddock. The current paper presents the results from autumn 1987.

2. MATERIAL AND METHODS

The survey in the Svalbard area was carried out from 6 September to 12 October 1987, using the research vessels R/V "Eldjarn" and R/V "Michael Sars". The survey was conducted as both a bottom trawl survey (mainly by R/V "Michal Sars") and as an acoustic survey (R/V "Eldjarn"). The total number of trawl stations in the survey was 229, of which 39 were taken with midwater trawl. 133 of the bottom trawl stations were included in the stratified bottom trawl survey. A total of 207 hydrographical stations were taken. Figs 2.1 and 2.2 show the survey tracks, hydrographical stations and trawl stations worked by "Eldjarn" and "Michael Sars". Fig. 2.3 shows the trawl stations taken in the bottom trawl survey.

The acoustic survey in the Barents sea area was carried out in the period 4 September to 12 October 1987 using the research vessel R/V "G.O.Sars". The total number of trawl stations in the survey was 124, of which 59 were taken with midwater trawl. A total of 223 hydrographical stations were taken. Fig. 2.4 show the survey tracks, hydrographical stations and trawl stations worked by "G.O.Sars".

2.1 Acoustic Surveys

The acoustic surveys were carried out as in 1986. The method is described by Dalen *et al.* (1982) and Dalen and Smestad (1979, 1982, 1983). The acoustic equipment used was:

"Eldjarn" : Simrad EK-400, 38kHz hull mounted echosounder.

"G.O.Sars" : Simrad EK-400 and ES-400, 38kHz hull mounted modified "split-beam" echosounder and 38kHz towed echosounder.

"Michael Sars": Simrad EK-S, 38kHz hull mounted echosounder.

All ships used a digital echo integrator system developed at the Institute of Marine Research, run on NORD 10 computers (Blindheim et al., 1982). The acoustic systems are calibrated using the method described by Foote et al. (1983).

All the echo integrator systems produce output in units of sound reflecting surface per square nautical mile (m^2/nm^2). The factor used to convert this to number of cod and haddock per square nautical mile is set to $C = 2.49 \times 10^6 \times L^{-2.18}$. This factor equals a target strength $TS = 10 \log (\sigma/4\pi) = 21.8 \log L - 74.9$ where L is the length of the fish and σ is the back scattering surface of a single fish of that length. The corresponding conversion factor used for redfish is $C = 5.20 \times 10^5 \times L^{-2.0}$.

The area units used in the acoustic surveys are $1/2^0$ latitude x 1^0 longitude. The average reflection is calculated for each area unit and multiplied by the area to give the "echo abundance". These echo abundances are first added up for a number of sub-areas and finally, pooled to the total echo abundance for the whole survey area.

2.2 Bottom Trawl Survey

Fig. 2.5 show the Svalbard survey area with the strata used in the bottom trawl survey, and also the division into the sub-areas. The distribution of the bottom trawl stations included in the calculations are shown in Fig. 2.3. Following the survey design described by Dalen et al. (1982) and Randa and Smedstad (1982) the number of stations was redused to the minimum required for keeping the accuracy at an acceptable level. The area stratification is based on geographical areas which are divided into strata according to the bottom depth. The depth intervals are 0-100m, 100-200m, 200-300m, 300-400m and >400m.

The trawl used in the bottom trawl survey is a shrimp trawl (Campelen, 1800 meshes, with rubber bobbins and 35 mm meshes in the codend). The sweep wires are 80m and the otter boards used are pelagic doors modified for bottom trawling. The method used to calculate the abundance indices is based on the stratified swept-area considerations described by Dalen et al. (1983) using 25.0 m as the sweeping-width of the trawl. The towing distance of a standard trawl haul is 3.0 nautical miles at a speed of 3 knots.

3. HYDROGRAPHY

Figs 3.1 and 3.2 show the temperature distribution at the surface and at the bottom respectively. The temperature distribution is supplemented with data from the Sovjet vessels taking part in the multispecies survey. The temperatures were similar to 1986 except for the eastern part of the Barents Sea where the temperature had decreased by up to 0.5^0 C compared to the autumn 1987.

4. COD

4.1 Bottom Trawl Survey Svalbard

Fig. 4.1 shows the geographical distribution of cod in 1987. The highest consentrations were observed around Bear Island and south-east of South Cape (Spitsbergen). In previous years there have also been higher consentrations off the Spitsbergen west coast and between Bear Island and South Cape (Godø and Nedreaas, 1986; Godø et al., 1987).

The catches were dominated by the 1983 and 1984 year-classes (Table 4.1), as in the previous years. The indices of the 1982 and 1983 year-classes decreased by 60% and 42% respectively, while the index of the 1984 year class increased with 34%. The index of the 1985 year class was 7.5 times higher than the previous year. There was a tremendous increase in the abundance of cod from 1983 to 1985. This development levelled out in 1986, and the total abundance indices decreased by 25% from 1986 to 1987. One explanation for this might be that the cod became more pelagic, because the abundance of cod increased drastically in the acoustic survey from 1986 to 1987 (Table 4.2).

4.2 Acoustic Survey

The distributions of the total echo abundance of cod and haddock combined in 1986 and 1987 are presented in Fig. 4.2.1 and 4.2.2 respectively. In 1986 the highest consentrations in the Svalbard area were observed in a couple of patches along the Spitsbergen west coast and at the shelf/slope areas around Bear Island and towards Hopen Island. In the Barents Sea the consentrations were mainly east of 30° east (east of Finnmark), but it should be noted that the coverage in the south-east was inadequate. Next autumn (1987) the highest abundances in the Svalbard area were found around Bear Island and in Storfjordrenna (south and east of South Cape), while the fish to a large extent had left the Spitspergen west coast and migrated southwards to Storfjordrenna. In the Barents Sea there were one consentration east of 42° east, two smaller patches off the coast of East-Finnmark and only scattered observations on the banks along the Murman coast and East-Finnmark. The abundance in the offshore areas are somewhat smaller than the previous autumn, and much further to the east than last winter (1987).

By far the greater part of the cod registrations were observed in the Svalbard area in 1987 (Fig. 4.2.3 and Table 4.2). North of 76° N there were only minor registrations, dominated by the 1985 and 1986 year-classes. The greatest consentrations were found in Storfjordrenna and around Bear Island. These registrations were dominated by the 1983 and 1984 year classes, with elements of the 1982, 1985 and 1981 year-classes.

The registrations of cod in the Barents Sea were only about 50 % of the registrations in the Svalbard area. Most of it was observed in the eastern part of the Barents Sea, the 1983 year-class being the most important, but with elements of the 1982, 1984, 1985 and 1981 year-classes. Compared to previous autumn, the total index on numbers of cod in the Barents Sea

decreased by 8 %. The reduction from last winter (1987) was 39 %, and all year-classes showed the same reduction. In 1986 the index decreased with 77% from winter to autumn.

Several causes may explain that the cod is less abundant in the Barents Sea during autumn than in winter. The coverage during autumn may have been inadequate in the east and south-east (as in 1986), which was confirmed by a later polar cod survey in the area west of Nova Zemlya. In the autumn 1987 cod were consentrated close to the bottom and difficult to detect acoustically. The abundance is therefore underestimated.

The abundance of cod in the Svalbard area was four times higher in autumn 1987 than 1986 (Table 4.2), and an increase was obsereved for all age groups, except for the 1980 year-class. One explanation would be a mass migration from the Barents Sea to the shelf around Bear Island. However, the frequency of the Barents Sea otolith type has not increased in the area.

At the same time as the abundance of cod in the Bear Island area increased in the layer above bottom, the abundance decreased in the near bottom layer (Table 4.1). This indicates that the fish had lifted even more from the bottom and a larger part could be detected aqoustically, mainly in the area Bear Island and Spitsbergen.

In previous years the cod has to a certain degree migrated to the Spitsbergen Bank during summer and early autumn, but cold water prevented this migration in 1987. The distribution became more pelagic over deeper water, more consentrated and easier to detect by aqoustic methods (Godø and Nedreaas, 1986; Godø et al., 1987). In addition the methods for registration of fish close to the bottom has improved, caused by improved instruments and computer handling of the reflected signals. However, the aqoustic measurements of fish close to the bottom is still not sufficient.

5. HADDOCK

5.1 Bottom Trawl Survey Svalbard

The abundance of haddock is low compared to cod. The geographical distribution is simular to last year (Fig. 5.1.), but the index on numbers is reduced by 98 % (Table 5.1). From 1985 to 1986 the reduction was more than 50 %. The age distributions (Table 5.1) indicates low recruitment. In 1986 the catches were dominated by the 1983 year class, while in 1987 all year classes came out very weak.

5.2 Acoustic Survey

Fig. 5.2 shows the geographical distribution of haddock in the aqoustic survey. The highest consentrations were found east of North Cape along the Norwegian and Sovjet coast. In the other areas investigated there were only minor registrations of haddock.

From autumn 1986 to autumn 1987 the total index on numbers of haddock in

the Barents Sea decreased with 26 % (Table 5.2). The reduction was observed for all year classes except for the 1983 year-class. As for cod, the estimate was far bellow (44 %) the estimate made during the winter survey earlier the same year. The reason for the great difference is probably the same factors as mentioned for cod. The dominating year-classes both in winter and autumn were the 1983, 1984 and 1982 year-classes.

Both in 1986 and 1987 only small amounts of haddock were observed in the Svalbard area, especially in 1987, when all year-classes were poor. The same was found in the bottom trawl survey (Table 5.1).

6. REDFISH

6.1 Bottom Trawl Survey Svalbard

Sebastes marinus. The abundance of this redfish species has never b great outside Spitsbergen. The greatest concentrations are found at depths between 200-300 meter west of Prins Karls Forland, west of Hornsund and in a wider area west of Bear Island. In 1985 and 1986 catches of more than 100 specimens were taken per hour trawling on two of these locations while in 1987 no catch exeeded 100 specimens. The area west of Hornsund has in 1987 become larger and the catches in this area show a slight increase. However, the total abundance indices for the total investigated area have decreased both in numbers (Table 6.1.1) and weight.

Sebastes mentella. The distribution of mentella is much more continuous over the survey area than that of marinus. Catches of 1000 specimens or more per hour trawling were common in 1985 and 1986 but did not occur in 1987. However, this survey is based on a fixed station grid and not on trawling upon registrations in situ. The abundance indices show an alarming decline of this stock in this area (Table 6.1.2). From 1986 to 1987 there has been a reduction of about 40% in both numbers and biomass.

6.2 Acoustic Survey

Figure 6.2.1 and 6.2.2 show the distribution of S. marinus, S. mentella and S. viviparus altogether in 1986 and 1987, respectively. In the Barents Sea there are no acoustic registrations of redfish east of 32^0 - 33^0 E. The limits of distribution are the same in 1987 as in 1986, but the areas of denser concentrations differ somewhat. The distribution of each species is shown in Figures 6.2.3 - 6.2.5. At present we are doing research on getting more precise measurements on redfish target strengths (TS!. We have reasons to believe that the used TS-values in this and previous surveys are not giving the correct absolute numbers, and the estimates must therefore be used as indices.

Svalbard areas

The total acoustic estimates of S.marinus show a considerable reduction spread over almost all length-groups (Table 6.2.1). The stock of S.mentella in the Svalbard area is about ten times the stock of S.marinus. The acoustic estimates of S.mentella show a 50% reduction from 1986 to

1987 (Table 6.2.2). We know that S.viviparus occur up to Bear Island, but the acoustic registrations of this species outside Spitsbergen are too doubtful to be taken into account and discussed. We will in the coming surveys try to prove or disprove this occurence.

Barents Sea.

Regarding S.marinus 70% of the stock north of 69^0 N is within the Barents Sea. The percentage reduction of the marinus - stock in the Barents Sea is of the same magnitude as in the Svalbard area. The estimate for the total area (Svalbard + Barents Sea) show an alarming reduction of 72% from 1986 to 1987, spread over almost all length groups.

Regarding S.mentella, 70 - 75% of the stock north of 69^0 N is within the Barents Sea. Looking at the Svalbard area it is fish less than 20 cm that contribute mostly to the total acoustic estimate (Svalbard + Barents Sea). From 1986 to 1987 there has been a considerable reduction spread over almost all length-groups except 20 - 24 cm. The reason for the increase in this length-group is the strong 82-yearclass growing from length-group 15-19 cm in 1986 to the 20-24 cm length-group in 1987. Also for S.mentella the estimate for the total area show an alarming reduction of nearly 60% from 1986 to 1987.

Regarding S. viviparus the main occurrence is within the southwestern part of the survey area. The acoustic abundance estimate show an huge increase for all length-groups from 1986 to 1987 (Table 6.2.3). The main reason for this increase is probably a better covering of this area in 1987.

7. GREENLAND HALIBUT

7.1 Bottom Trawl Survey Svalbard

Total indices in numbers of Greenland halibut increased until 1985 and have since then decreased by more than 50 % (Table 7.1). This is probably caused by poor recruitment the last years since there is caught relatively few fish less than 30 cm. Godø and Haug (1987) mention competition and predation by cod and by-catch in the shrimp fishery as possible reasons for recruitment failure. The distribution of Greenland halibut in the trawl catches is shown in Fig. 7.1. Except for the registration south-east of the Bear Island, the distribution is mainly the same as in 1986 and 1985 and the highest consentrations are found north of 77^0 - 78^0 N.

REFERENCES

Blindheim, J., Eide P.K, Knudsen H.P. and Vestnes G. 1982. A shipborne data logging and processing system for acoustic fish surveys. Fish Res., 1: 141-153.

Dalen, J., Hylen, A., Nakken, O., Randa, K. and Smedstad, O. M. 1982. Norwegian investigations on young cod and haddock in the Barents Sea during the winter 1982. Coun. Meet. int. Coun. Explor. Sea, 1982 (G:4): 1-32. [Mimeo.]

Dalen, J., Hylen, A., Nakken, O., Randa, K. and Smedstad, O. M. 1983. Preliminary report of the Norwegian investigations on young cod and haddock in the Barents Sea during the winter 1983. Coun. Meet. int. Coun. Explor. Sea, 1983 (G:15) : 1-23. [Mimeo.]

Dalen, J. and Smedstad, O.M. 1979. Acoustic method for estimating absolute abundance of young cod and haddock in the Barents Sea. Coun. Meet. int. Coun. Explor. Sea, 1979. (G:51): 1-24. [Mimeo.]

Dalen, J. and Smedstad, O. M. 1982. Abundance estimation of demersal fish in the Barents Sea by an extended acoustic method. Contr Symp. in Fisheries Acoustics, 21 - 24 June 1982, Bergen, [Mimeo.]

Dalen, J. and Smedstad, O.M. 1983. Abundance estimation of demersal fish in the Barents Sea by an extended acoustic method. In: Nakken, O. and Venema S.C.(Eds), Symposium on fisheries acoustics. Bergen, Norway, 21-24 June 1982. FAO Fish. Rep., (300):232-239.

Foote, K. G., Knudsen, H. P. and Vestnes, G. 1983. Standard calibration of echo sounders and echo integrators with optimal copper spheres. Fisk. Dir. Skr. Ser. HavUnders., 17: 335-346.

Godø, O.R., 1985. Preliminary report of the Norwegian groundfish survey Bear Island and West-Spitsbergen in the autumn 1984. Coun. Meet. int. Coun. Explor. Sea, 1985. (G:65): 1-17. [Mimeo.]

Godø, O.R. and Haug, T. 1987. Preliminary report on recruitment variation in Greenland halibut, Reinhardtius hippoglossoides (Walbaum), in the Svalbard area. NAFO SCR Doc. 87/83.: 1-14.

Godø, O.R., Hylen, A., Jacobsen, J.A., Jakobsen, T., Mehl, S., Nedreaas,K., and Sunnanå, K. 1987. Estimates of stock size of Northeast Arctic cod and haddock from survey data 1986/1987. Count. Meet int. Coun. Explor. Sea, 1987. (G:37): 1-47. [Mimeo.]

Godø, O.R. and Nedreaas, K. 1986. Preliminary report of the Norwegian groundfish survey at Bear Island and West-Spitsbergen in the autumn 1985. Coun. Meet. int. Coun. Explor. Sea, 1985 (G:81): 1-14. [Mimeo.]

Godø, O.R., Randa, K. and Smedstad, O.M. 1984. Preliminary report of the Norwegian groundfish survey at Bear Island and West-Spitsbergen in the autumn 1983. Coun. Meet. inte. Coun. Explor. Sea, 1984 (G:46): 1-17. [Mimeo.]

Randa, K. and Smedstad, O.M. 1982. The Norwegian groundfish survey at Bear Island and West-Spitsbergen in the autumn 1981. Coun. Meet. int. Coun. Explor. Sea, 1982 (G:42): 1-17. [Mimeo.]

Randa, K. and Smedstad, O.M. 1983. Preliminary report of the Norwegian groundfish survey at Bear Island and West-Spitsbergen in the autumn 1982. Coun. Meet. int. Coun. Explor. Sea, 1983 (G:34): 1-17. [Mimeo.]

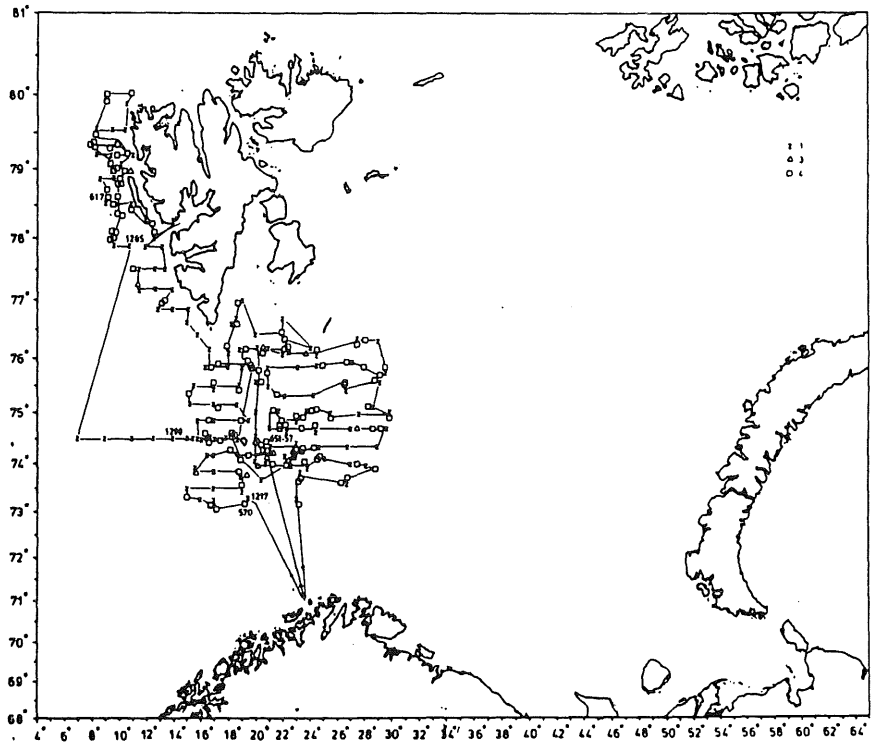

Fig. 2.1. Survey tracks and stations taken by R/V "Eldja 5.9. - 12.10. 1987.
1 = CTD-station, 3 = pelagic trawl, 4 = bottom trawl.

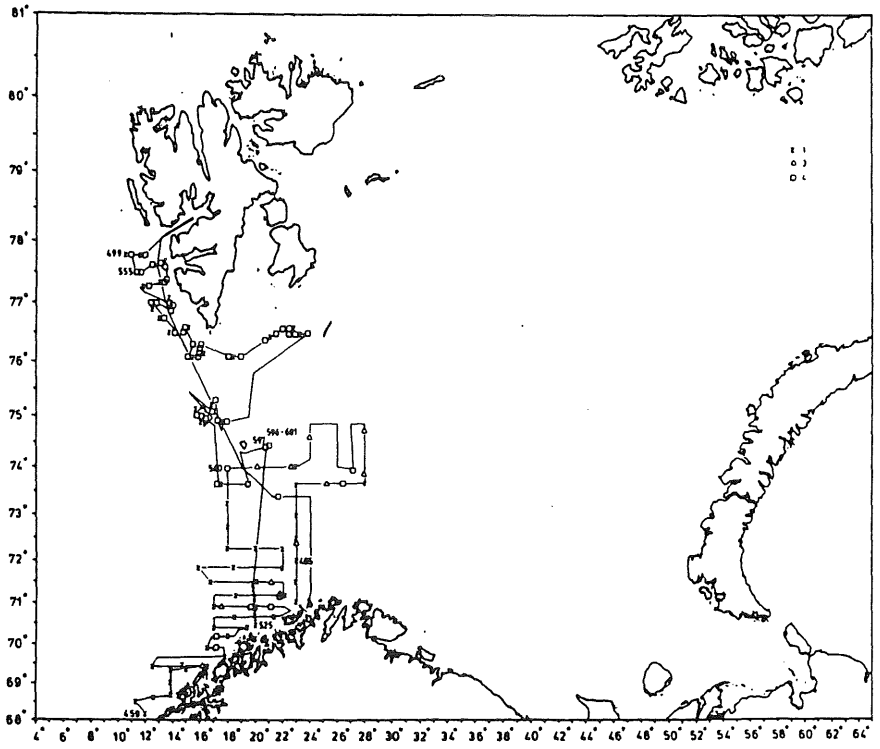

Fig. 2.2. Survey tracks and stations taken by R/V "Michael Sars" 7.9. - 13.10. 1987. Legend, see fig. 2.1.

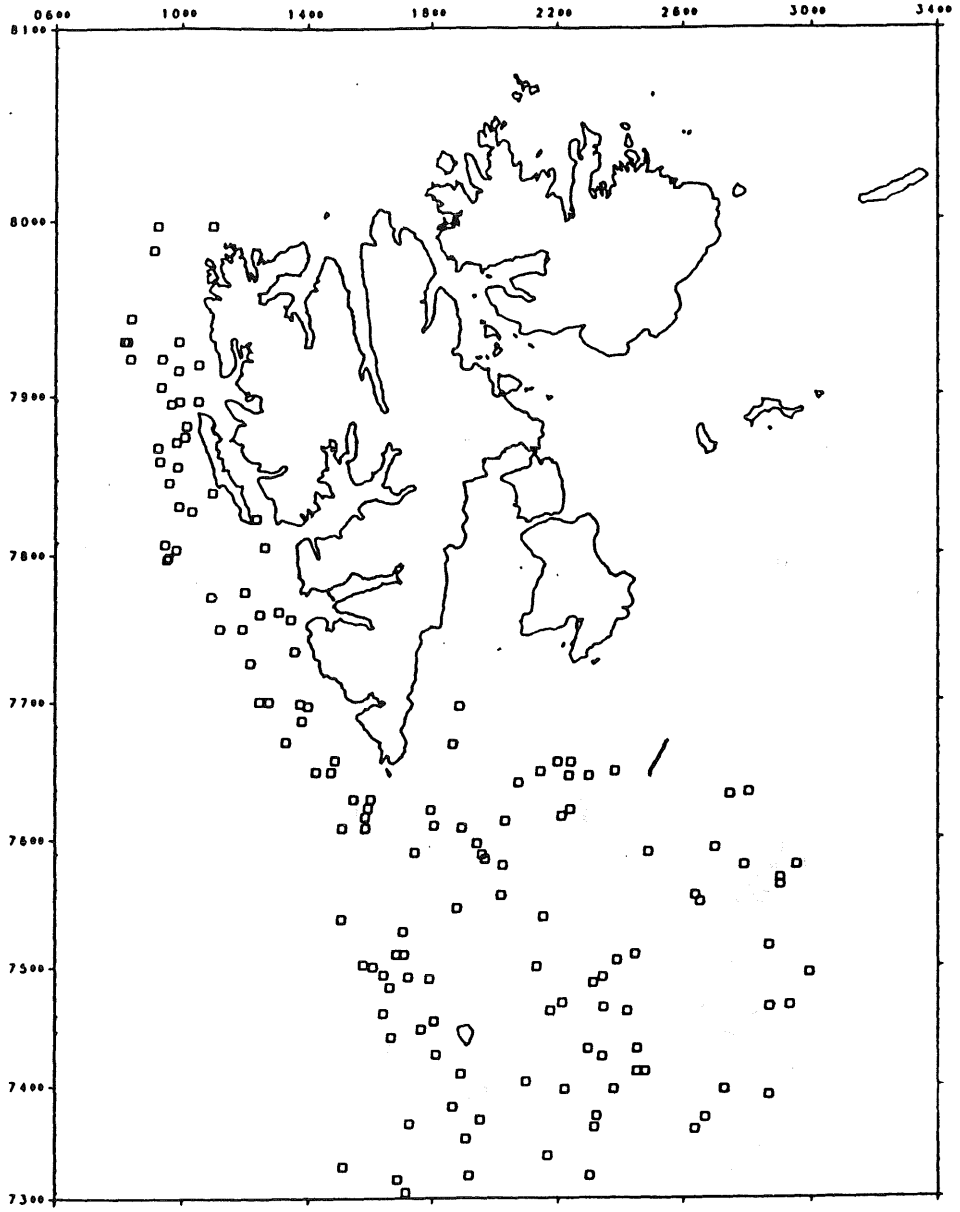

Fig. 2.3. Bottom trawl-stations taken by R/V "Eldjarn" and R/V "Michael Sars" 06.09. - 08.10. 1987.

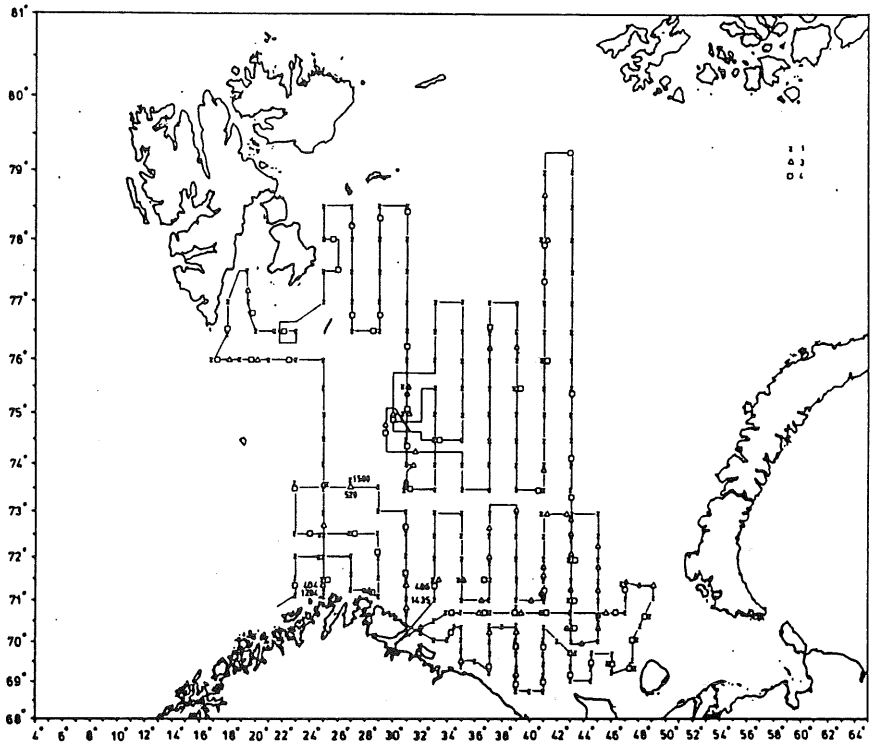

Fig.2.4. Survey tracks and stations made by R/V "G.O.Sars 4.9. - 16.10. 1987. Legend, see fig. 2.1.

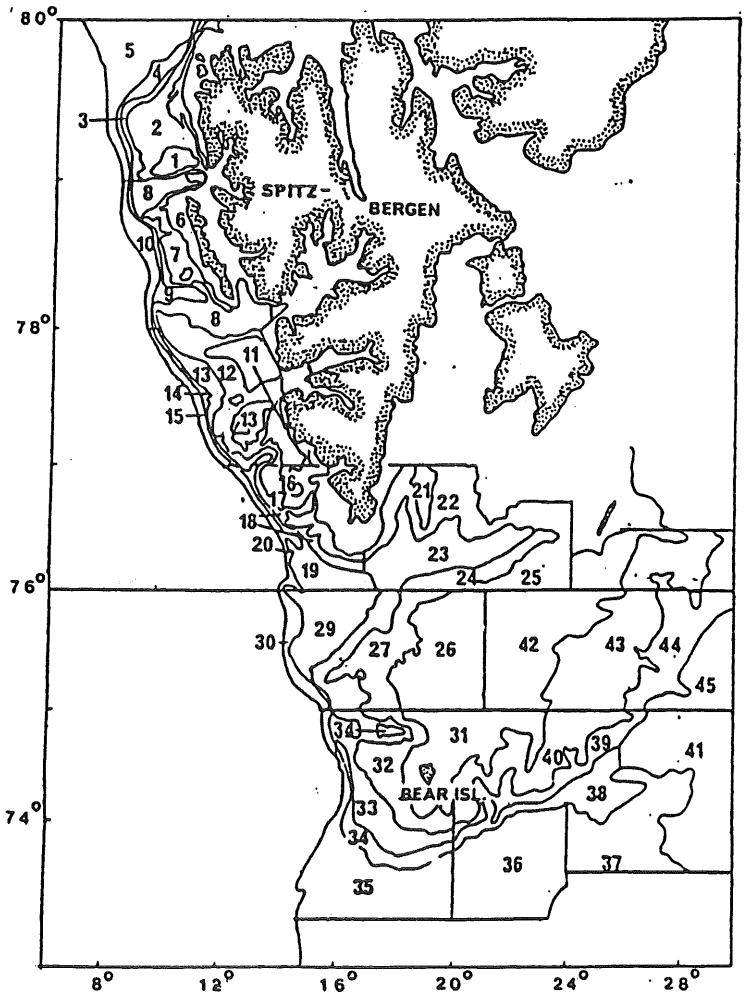

Fig. 2.5. The strata system used in the bottom trawl survey in the Svalbard region.

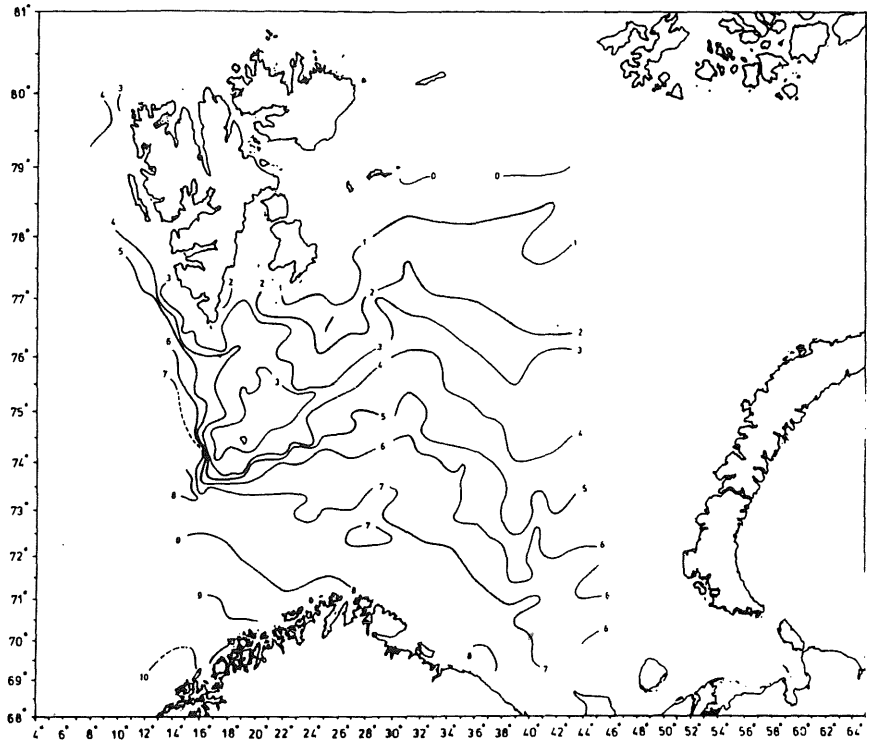

Fig. 3.1. Temperature distribution (°C) at the surface.

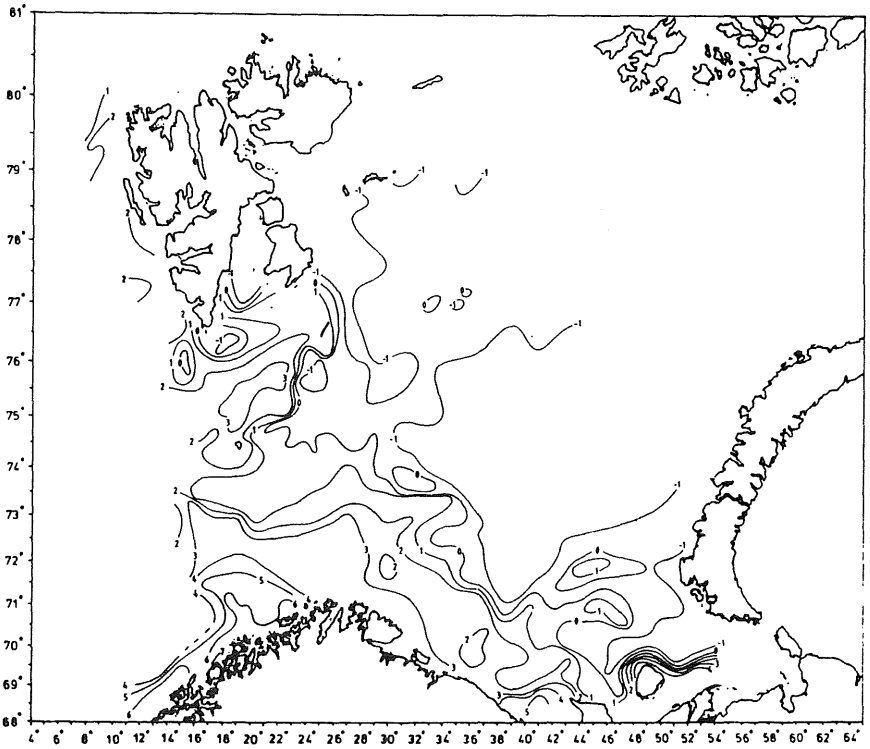

Fig. 3.2. Temperature distribution (°C) at the bottom.

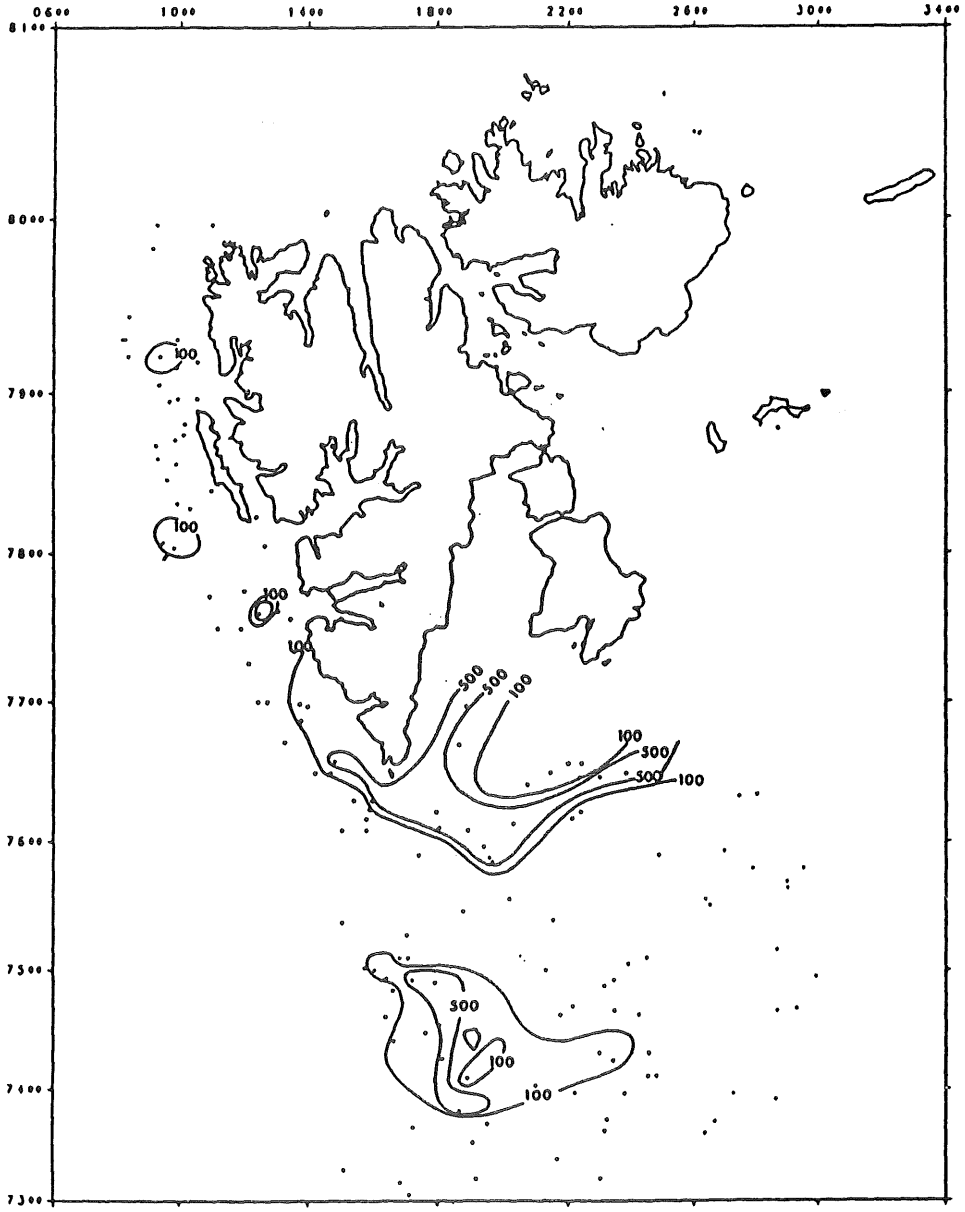

Fig. 4.1. Distributon of cod in the bottom trawl survey 1987 (number per hour trawling).

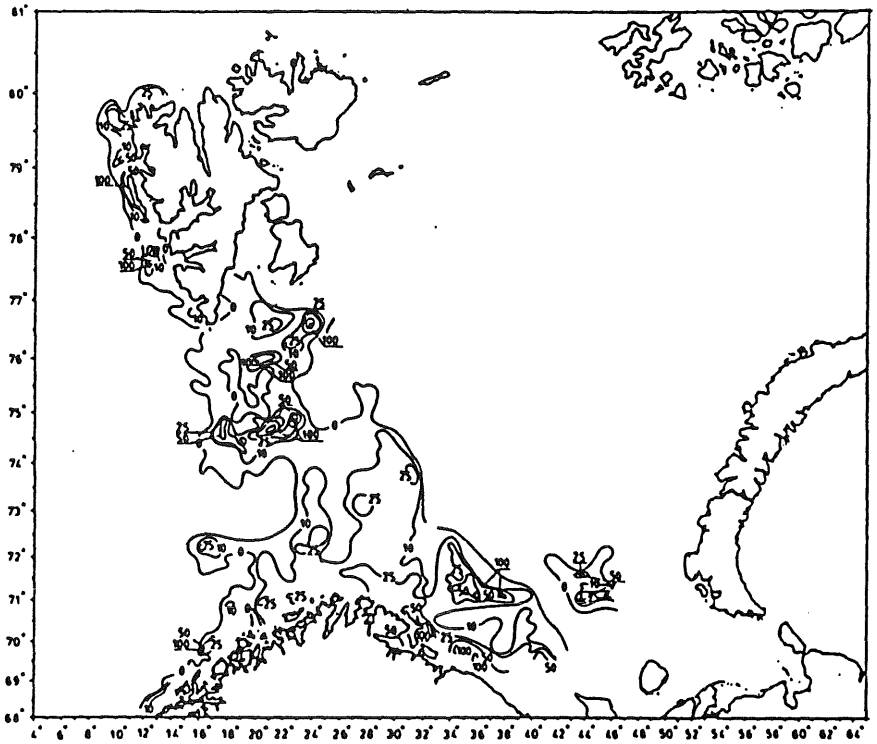

Fig. 4.2.1. Distribution of total echo abundance of cod and haddock combined in autumn 1986. Units are integrated back scattering surface per square nautical mile $(m/naut.mile)^2$.

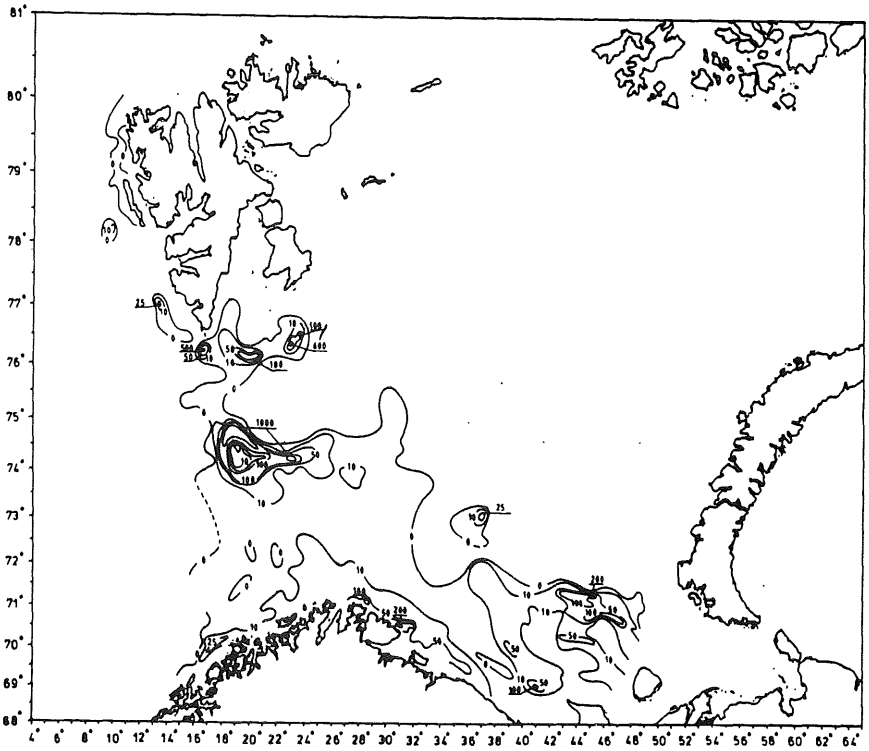

Fig. 4.2.2. Distribution of total echo abundance of cod and haddock combined in autumn 1987.

Units: see Fig. 4.2.1.

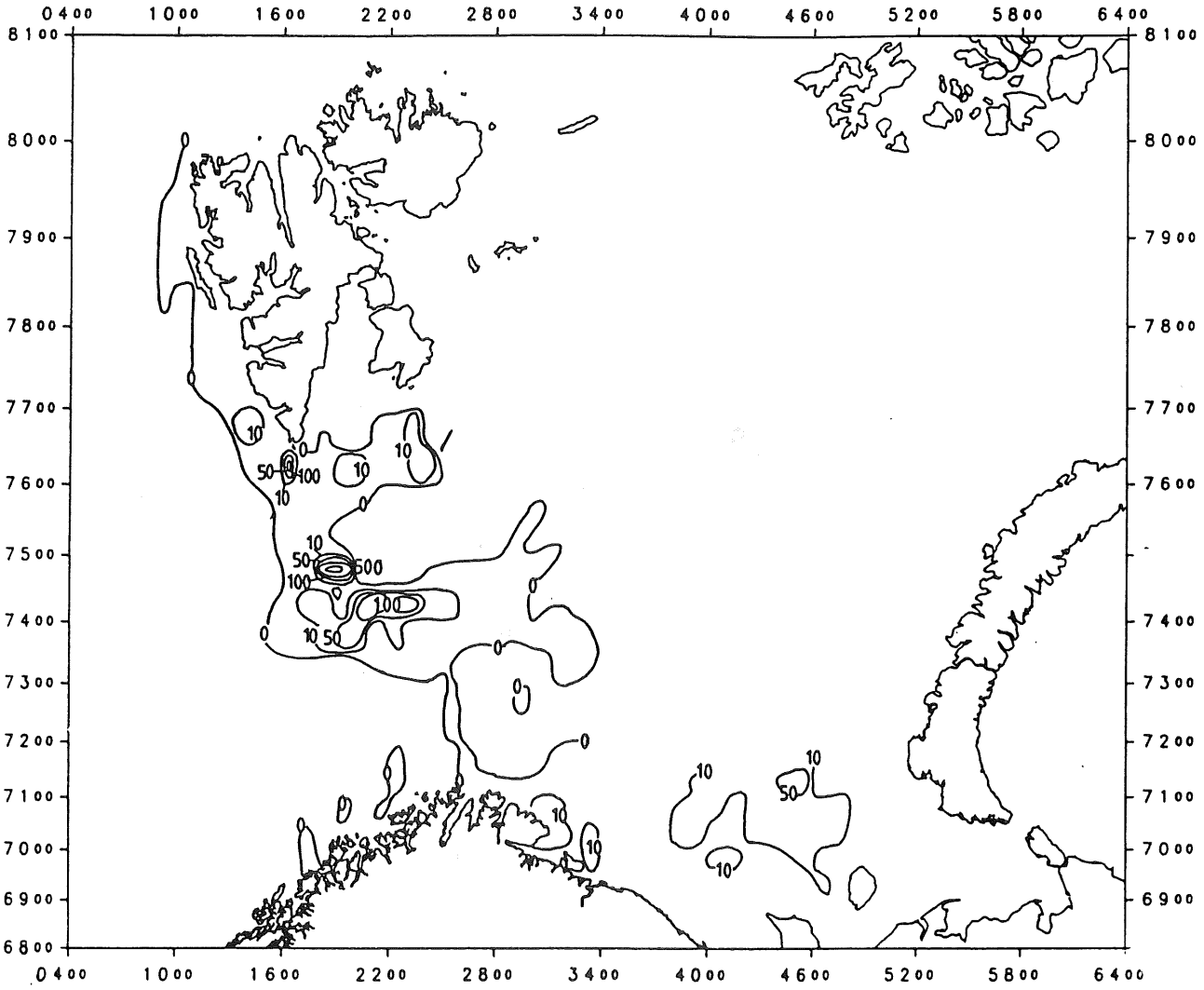

Fig. 4.2.3. Distribution of cod autumn 1987 (number of fish in 1000 per square nautical mile).

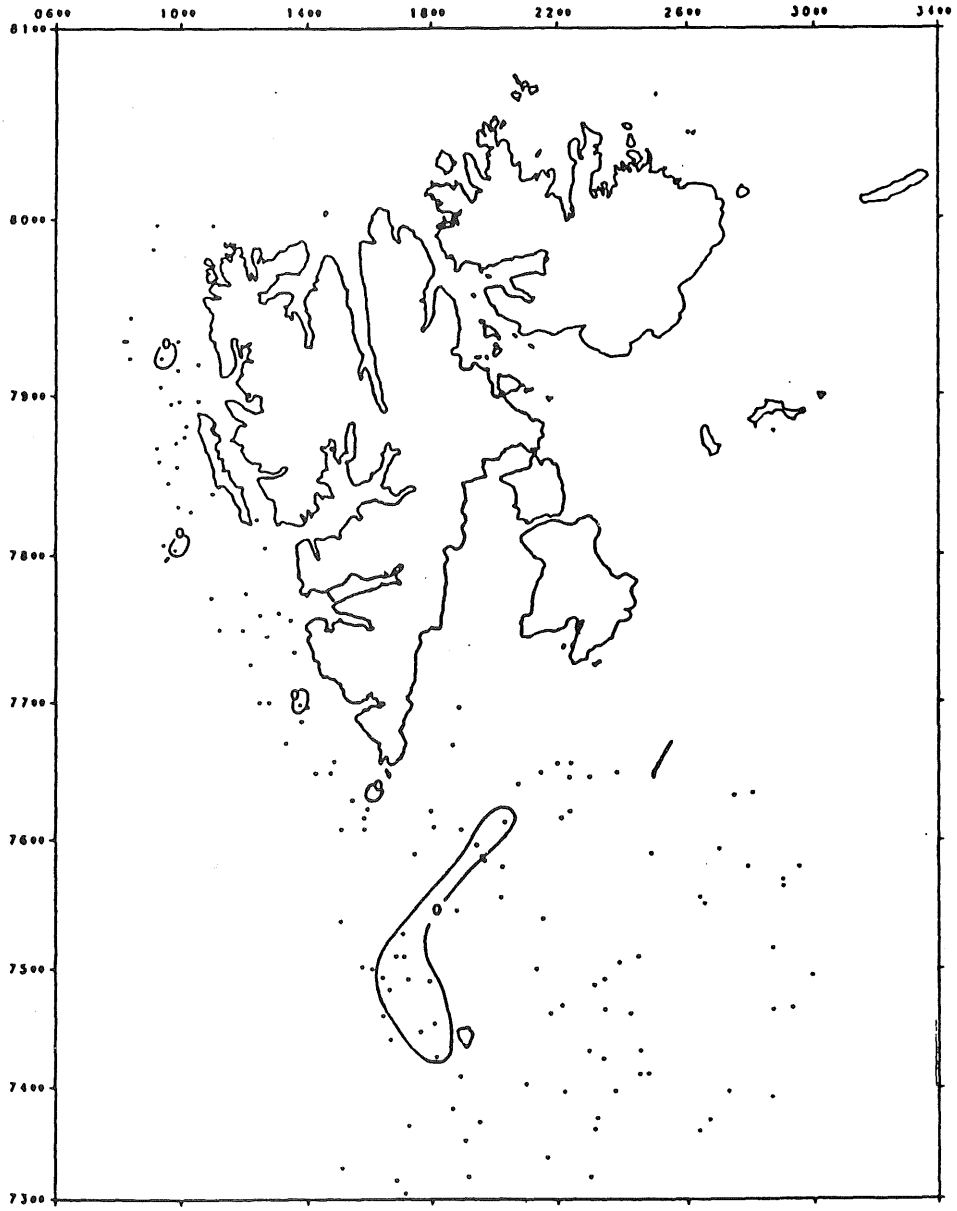

Fig. 5.1. Distribution of haddock in the bottom trawl survey 1987 (number per hour trawling).

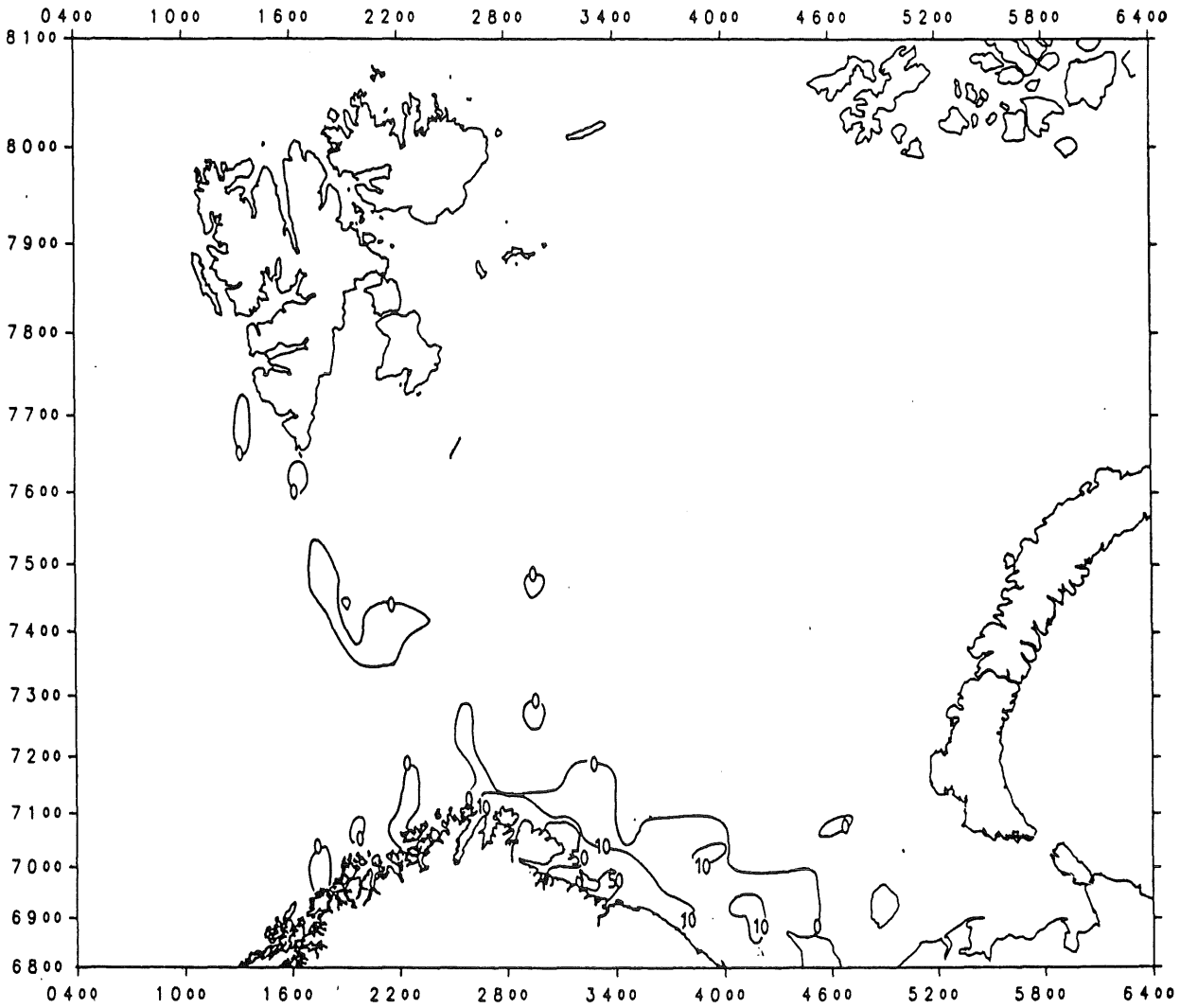

Fig. 5.2. Distribution of haddock autumn 1987 (number of fish in 1000 per square nautical mile).

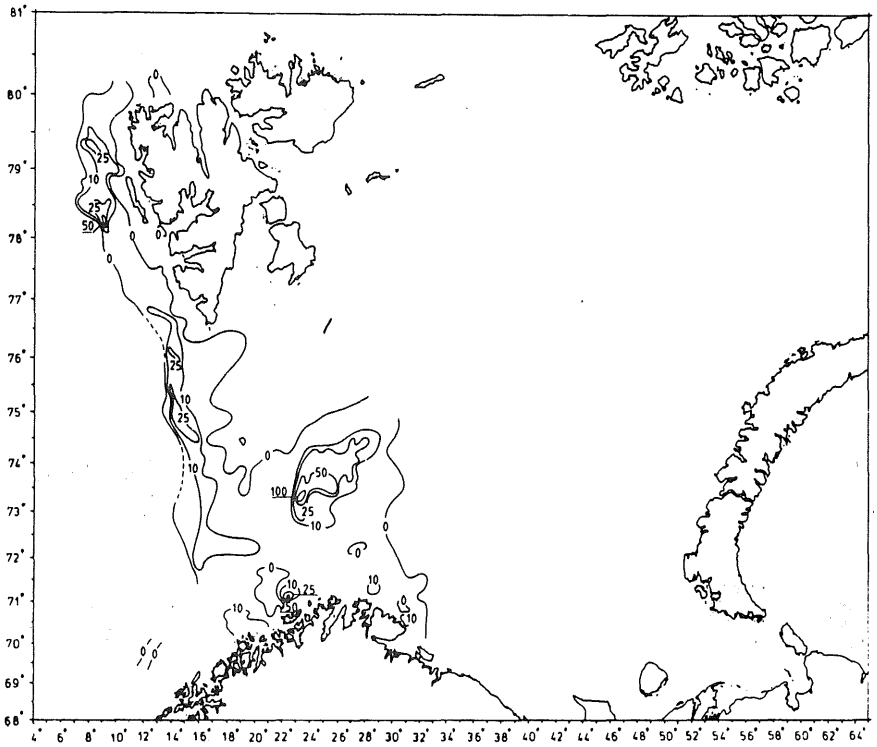

Fig. 6.2.1. Distribution of total echo abundance of all 3 redfish species combined in autumn 1986, Units, see fig. 4.2.1.

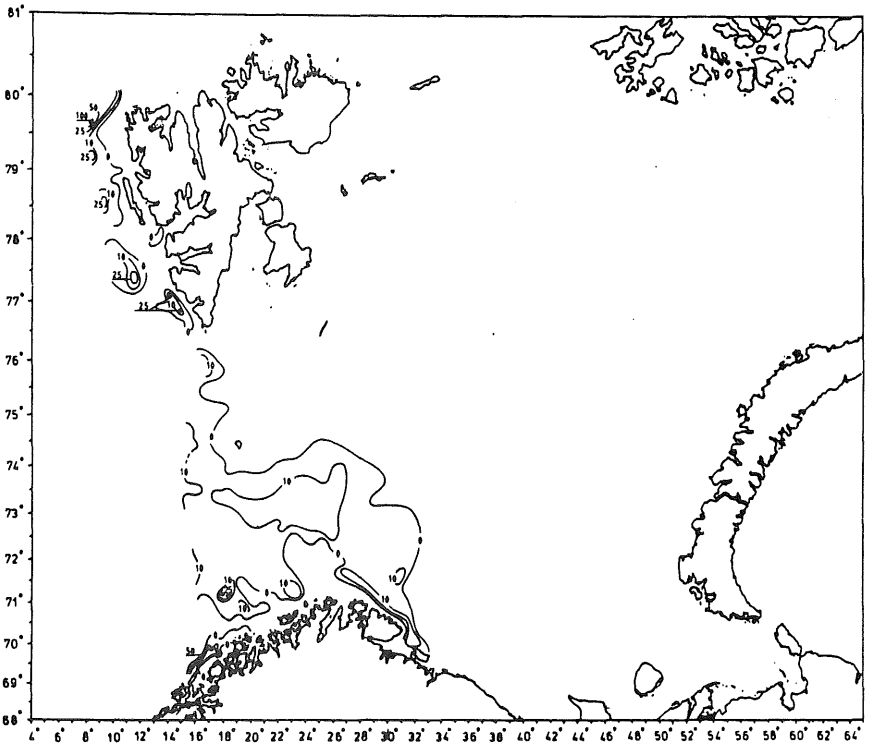

Fig. 6.2.2. Distribution of total echo abundance of all 3 redfish species combined in autumn 1987. Units: see Fig.4.2.1.

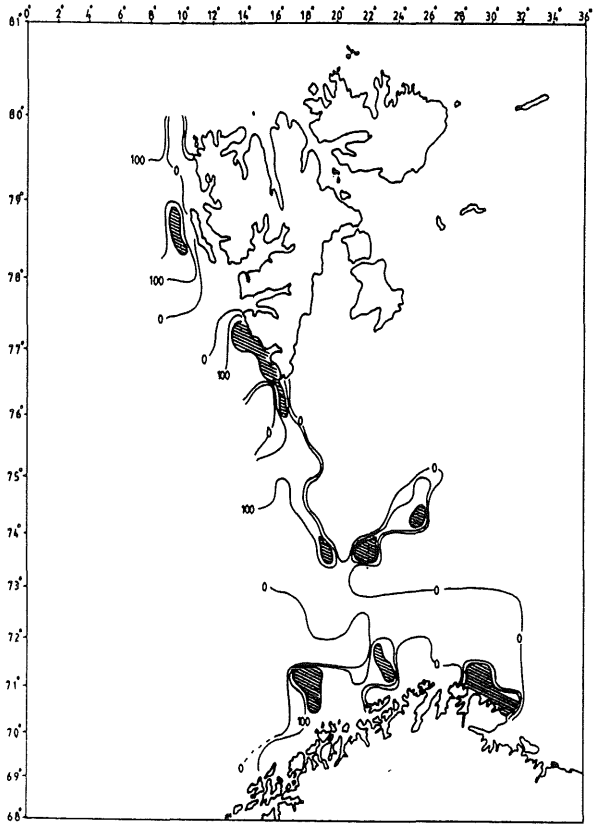

Fig. 6.2.3. Distribution of Sebastes marinus autumn 1987 (number of fish per square nautical mile, hatched = > 1000).

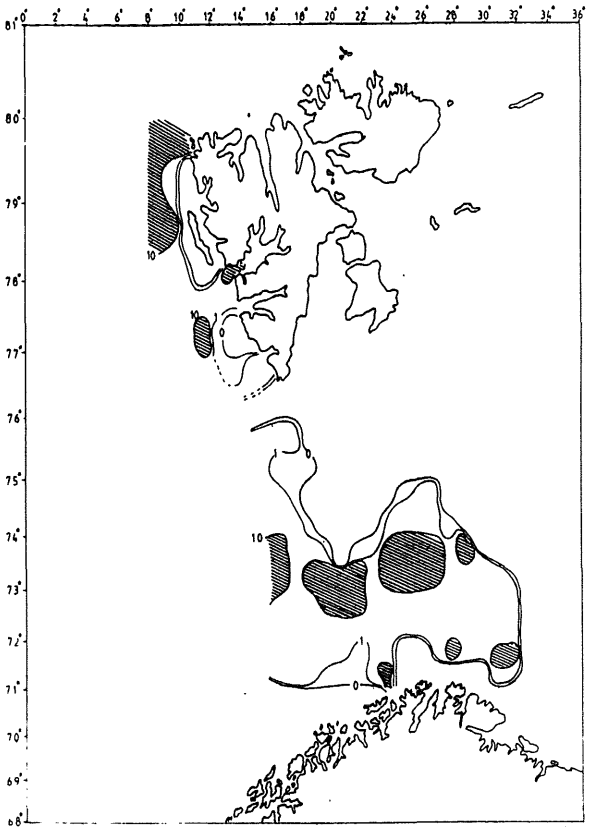

Fig. 6.2.4. Distribution of Sebastes mentella autum 1987 (number of fish in 1000 per square nautical mile, hatched = > 10.000).

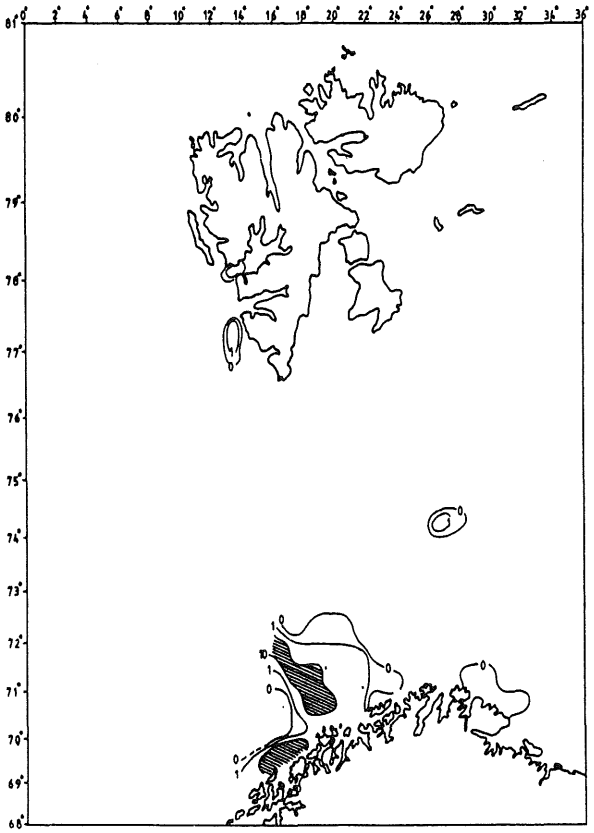

Fig. 6.2.5. Distribution of Sebastes viviparus autumn 1987 (number of fish in 1000 per square nautical mile, hatched = > 10.000).

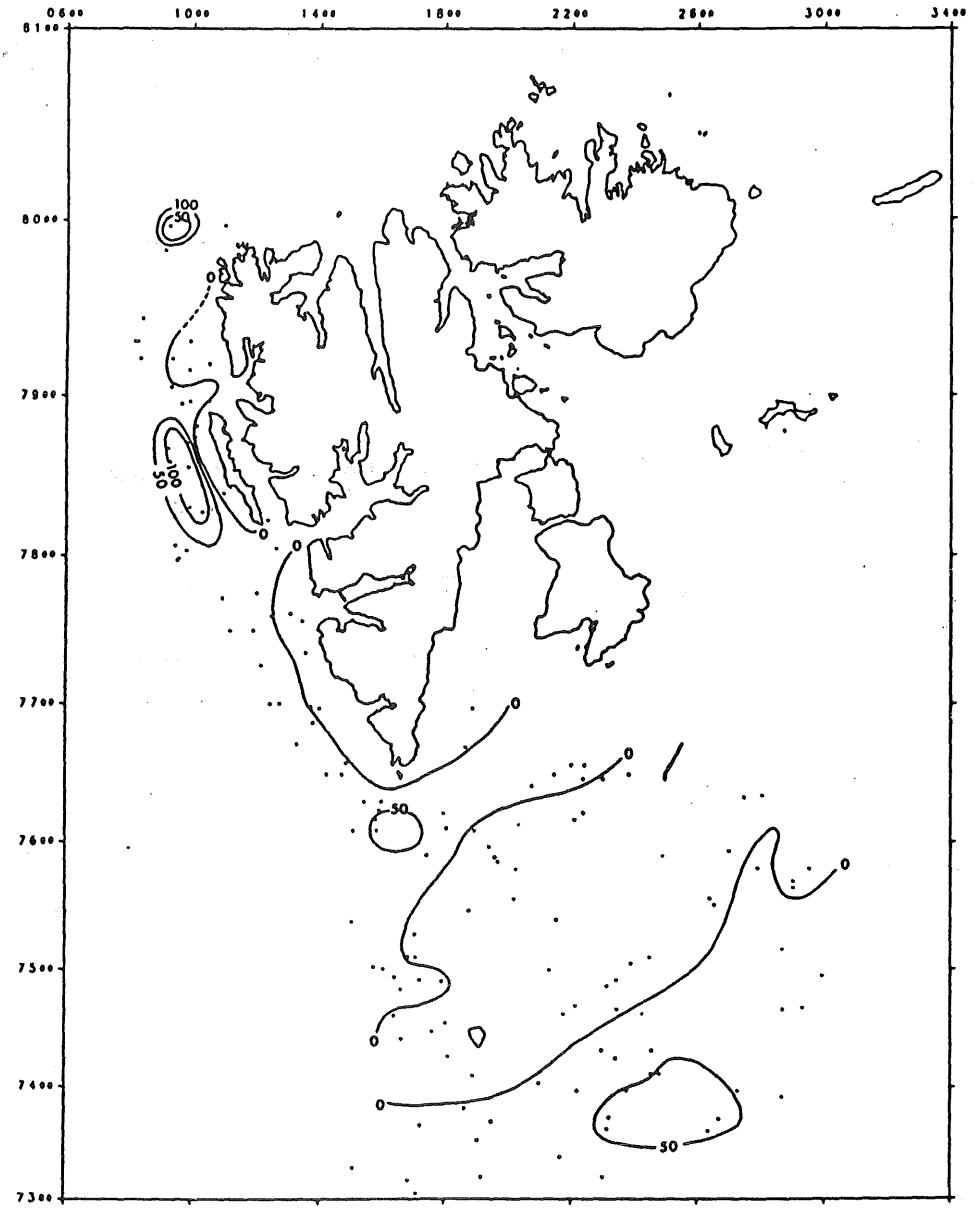

Fig. 7.1. Distribution of Greenland halibut in the bottom trawl survey 1987 (number per hour trawling).

Table 4.1. Cod. Abundance indices for each age group from the bottom trawl survey in the Spitsbergen / Bear Island areas 1981 - 1987. (numbers in millions).

Year of invest.	Year-class 1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	1971	Total
1981							0.1	22.2	9.0	5.5	1.3	6.1	3.8	0.7	0.4	0.4	49.8
1982						1.5	4.0	22.2	9.3	2.8	1.9	2.9	0.4	0.1	0.1		45.6
1983					14.6	5.1	6.2	9.5	3.0	2.5	1.3	1.6	0.4	0.2			44.4
1984				52.2	42.7	5.6	4.2	5.3	2.2	0.5	0.5	0.4	0.2				113.8
1985			27.0	133.1	74.3	27.9	6.5	7.7	1.4	1.4	0.1	0.3					279.7
1986		3.5	50.1	164.0	44.0	18.1	3.2	1.3	0.3	0.1							285.0
1987	3.3	26.2	67.0	94.7	18.1	6.5	0.6	0.1	0.1								215.0

Table 4.2. Acoustic abundance estimates for each year-class of c o d from surveys in 1986 - 87. Numbers in millions.

Area/ Year	Year - class 1986	1985	1984	1983	1982	1981	1980	1979	Total
Barents Sea									
Winter 86.		625	578	1246	424	225	27	9	3136
Autumn 86.		42	96	290	99	45	12	1	587
Winter 87.	1	47	126	506	128	37	4	3	852
Autumn 87.	2	49	42	302	90	26	3	+	516
Svalbard									
Autumn 86.		10	68	125	42	19	5	12	281
Autumn 87.	13	98	329	413	87	33	2	+	971
Total									
Autumn 86.	5	52	164	415	141	64	17	13	868
Autumn 87.	15	147	371	715	177	59	5	+	1487

Table 5.1. Haddock. Abundance indices for each age group from the bottom trawl survey in the Spitsbergen /Bear Island areas 1985 - 1987. (numbers in millions).

Year of invest.	Year - class 1986	1985	1984	1983	1982	1981	1980	1979	Total
1985			21.8	33.0	1.1	+			55.9
1986		0.4	2.3	19.6	2.3	+			24.6
1987	0.1	+	0.1	0.1	+	+			0.3

Table 5.2. Acoustic abundance estimates for each year-class of haddock from surveys in 1986 - 87. Numbers in millions.

Area/ Year	Year - class 1986	1985	1984	1983	1982	1981	1980	1979+	Total
Barents Sea									
Winter 86.		346	502	1720	751	2	1	1	3323
Autumn 86.		89	195	246	93	0	0	1	625
Winter 87.	37	29	175	640	166	+	+	+	1049
Autumn 87.	5	25	88	276	69	+	+	+	461
Svalbard									
Autumn 86.		+	2	21	2	0	0	0	25
Autumn 87.	+	+	1	+	0	0	0	0	2
Total									
Autumn 86.		89	197	267	95	0	0	1	650
Autumn 87.		25	89	276	69	+	+	+	463

Table 6.1.1. Sebastes marinus. Abundance indices for each length group from the bottom trawl surv in the Spitsbergen/Bear Island areas 1985-1987. (Numbers in thousands).

Year of investig.	Length-groups in cm 5- 9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45+	TOTAL
1985	158	1307	795	1728	2273	1417	311	142	194	8410
1986	200	2961	1768	547	643	1520	639	467	196	9710
1987	124	1343	1964	1185	1367	652	352	29	44	7070

Table 6.1.2. Sebastes mentella. Abundance indices for each length group from the bottom traw survey in the Spitsbergen/Bear Island areas 1985-1987. (Numbers in millions).

Year of investig.	Length-groups in cm 5- 9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45+	TOTAL
1985	5	270	191	40	16	6	3	4	1	537
1986	6	101	192	17	10	5	2	4	+	338
1987	20	14	140	19	6	2	1	2	+	208

Table 6.2.1 . Acoustic abundance estimates for each length group of Sebastes marinus (numbers in millions) during the multispecies surveys in autumn 1986 and 1987.

AREA	YEAR	LENGTH GROUPS IN CM 5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45+	TOTAL
Spitsberg/ Bear Island	86	+	4	4	1	1	2	1	2	7	28
	87	+	2	2	1	+	+	+	+	+	7
Barents Sea	86	4	17	12	8	9	3	2	3	5	65
	87	+	+	+	4	4	5	1	+	+	18
Total area	86	4	21	16	9	10	5	3	5	12	93
	87	+	2	3	5	5	5	1	+	+	26

Table 6.2.2. Acoustic abundance estimates for each length group of Sebastes mentella including unidentified Sebastes spp.(numbers in millions) during the multispecies surveys in autumn 1986 and 1987.

		LENGTH GROUPS IN CM									
AREA	YEAR	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45+	TOTAL
Spitsberg/											
Bear Island	86	3	105	124	6	4	1	+	3	+	249
	87	24	26	54	6	1	+	+	1	+	117
Barents Sea	86	70	215	387	37	41	5	1	+	+	762
	87	16	11	176	80	4	1	+	2	+	294
Total area	86	73	320	511	43	45	6	1	3	+	1011
	87	41	38	230	87	6	1	+	3	+	412

Table 6.2.3. Acoustic abundance estimates for each length group of Sebastes viviparus (numbers in millions) during the multispecies surveys in autumn 1986 and 1987.

		LENGTH GROUPS IN CM									
AREA	YEAR	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45+	TOTAL
Spitsberg/											
Bear Island	86										0
	87	1	+	2							5
Barents Sea	86	2	13	6	5	2	+				31
	87	51	55	35	38	5					185
Total area	86	2	13	6	5	2	+				31
	87	52	55	37	38	5	+				190

Table 7.1. Stratified trawl indices on numbers (thousands) for different length-groups of Greenland halibut in 1984 - 1987.

Year of	Length-group in cm												
invest.	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	> 60	Total
1984	157	1179	1864	1175	1925	3654	5912	6733	5309	3952	2140	2630	36630
1985	17	867	708	1679	1787	3598	6114	9234	7201	4431	1880	1934	39450
1986	19	59	59	506	1071	2453	2940	4790	3524	1830	915	1304	19470
1987	167	463	333	370	1110	2904	4311	4162	2738	1184	499	259	18500