International Council for the
Exploration of the Sea

C.M. 1989/G:39
Demersal Fish Committe

ESTIMATES OF STOCK SIZE OF COD, HADDOCK, REDFISH AND GREENLAND HALIBUT IN THE BARENTS SEA AND THE SVALBARD AREA AUTUMN 1988

by

Arvid Hylen, Harald Loeng,
Sigbjørn Mehl and Kjell Nedreaas

Institute of Marine Research
P.O.Box 1870 - Nordnes
5024 Bergen Norway

ABSTRACT

Combined acoustic and bottom trawl survey for cod, haddock and redfish were carried out in autumn 1988 in the Svalbard area together with an acoustic survey in the Barents Sea. The abundance indices of cod decreased from 1987 to 1988 both in the Svalbard area and in the Barents Sea where the index has decreased since previous autumn and since last winter. The results for haddock show that the stock is almost not present in the Svalbard area and that it has decreased in the Barents Sea. The present stock situation of the redfish species Sebastes marinus in this northern part of the species' geographical distribution, show a decreasing trend since 1985-1986 although the acoustic survey give a higher index in 1988 compared to 1987. The abundance indices of S.mentella point to a more stable stock situation for this species after an alarming period of yearly decrease. Both the bottom trawl survey and the acoustic survey in 1988 confirm this. A huge variability in the indices of S.viviparus is probably caused by the fact that this survey only covers a minor part of the species' geographical distribution. The indices are therefore probably not able of showing real trends in this stock. The abundance of Greenland halibut has increased to the 1985-level.

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 and 1987 (Godø et al., 1987 and Hylen et al.,1988).

Cod and haddock in the Barents Sea has until recently mainly been surveyed 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 and 1988.

Since 1987 the results of these autumn surveys have been used in the stock assessments of North-East Arctic cod and haddock. The current paper presents the results from autumn 1988.

2. MATERIAL AND METHODS

The survey in the Svalbard area was carried out from 11 September to 16 October 1988, using the research vessel R/V"G.O.Sars" and a hired commercial trawler. The survey was conducted as a combined bottom trawl survey (mainly by the trawler) and as an acoustic survey (R/V "G.O.Sars"). The total number of trawl stations in the survey was 224, of which 24 were taken with midwater trawl. 171 of the bottom trawl stations were included in the stratified bottom trawl survey. A total of 123 hydrographical stations were taken. Fig. 2.1 shows the survey tracks, hydrographical stations and trawl stations worked by "G.O.Sars". Fig. 2.2 shows the trawl stations taken in the bottom trawl survey.

The acoustic survey in the Barents sea was carried out in the period 8 September to 21 October 1988 using the research vessels R/V "Michael Sars" and the R/V "Eldjarn". The total number of trawl stations in the survey was 141, of which 80 were taken with midwater trawl. A total of 405 hydrographical stations were taken. Fig. 2.1 shows the survey tracks, hydrographical stations and trawl stations worked by R/V "Michael Sars" and R/V "Eldjarn".

2.1 Bottom Trawl Survey

Fig. 2.1.1 shows the Svalbard survey area with the strata used in the bottom trawl survey. The distribution of the bottom trawl stations included in the calculations are shown in Fig. 2.2. Following the survey design described by Dalen et al. (1982) and Randa and Smedstad (1982) the number of stations were 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.

2.2 Acoustic Surveys

The acoustic surveys were carried out as in 1986 and 1987. 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 vessels 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 $C = 2.49 \times 10^6 \times L^{-2 \cdot 18}$. 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 $C = 5.20 \times 10^5 \times L^{-2 \cdot 0}$.

The area units used in the acoustic assessments 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.

3. HYDROGRAPHY

Figs.3.1 and 3.2 show the temperature distribution at 0 m and at bottom, respectively. The bottom temperature had increased since 1987, especially in the south-eastern Barents Sea. Calculations of mean bottom temperature from four different areas (see Fig.3.2) are presented in the text table below, and confirm the temperature increase close to the bottom. In area B the increse was more than 1^0 C. In the area D, just north of the Polar front, the temperature, however, was unchanged.

Mean temperature of 20 m thick bottom layer in four different areas shown in Fig.3.2.:

	A	B	C	D
1986	3.49	1.71	0.05	-0.72
1987	3.86	1.61	0.28	-0.65
1988	4.23	2.87	0.55	-0.77

Results from several cross-sections in the Barents Sea at early September showed the same tendency (ANON., 1988). Compared to the longterm mean, the temperature conditions in 1988 was close to the mean values in the whole area influenced by Atlantic water.

4. COD

4.1 Bottom Trawl Survey Svalbard

Fig. 4.1 shows the geographical distribution of cod in 1988. As in 1987 the highest consentrations were observed in 1988 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).

There was a tremendous increase in the abundance of cod from 1983 to 1985. This development levelled out in 1986. The total abundance index has decreased after 1986 and reached below the 1984 level in 1988. The catches were dominated by the 1983 and 1984 year-classes (Table 4.1.1), as in th previous years. The indices of the 1983 and 1984 year-classes decreased by 62% and 66% respectively, while the indexes of the 1982 and 1985 year classes decreased 38% and 40% respectively.

4.2 Acoustic Survey

The distribution of the total echo abundance of cod and haddock combined for 1988 is presented in Fig. 4.2.1. In 1988 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 between 16^0 and 34^0E (north of Finnmark). Only a few smaller patches where observed east of 35^0E.

About 55% of the cod registrations were observed in the Svalbard area in 1988 (Fig. 4.2.2 and Table 4.2.1). North of 76^0 N there were only minor registrations, dominated by the 1985 and 1986 year-classes. The highest 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 1986 year-classes.

The registrations of cod in the Barents Sea were only 83 % of the registrations in the Svalbard area. Most of them was observed north of East Finnmark, the 1983 year-class being the most important, with elements of the 1982, 1984 and 1985 year-classes.

Compared to previous autumn, the total index on numbers of cod in the Svalbard region and in the Barents Sea decreased by 86 and 78 % respectively. In the Barents Sea the reduction from last winter (1988) was 71%. All year-classes showed a similar reduction.

Reduced vulnerability in 1988 might be responsible for at least some part of the reduction caused by increased consentration of cod close to the bottom, which make it difficult to detect the fish acoustically.

5. HADDOCK

5.1 Bottom Trawl Survey Svalbard

The abundance of haddock is low compared to cod. The geographical distribution and the abundance is simular to last year (Fig.5.1.1 and Table 5.1.1). The age distributions (Table 5.1) indicate low recruitment.

5.2 Acoustic Survey

Fig.5.2.1 shows the geographical distribution of haddock in the aqoustic survey. The highest consentrations were found west of North Cape along the Norwegian coast. Some less abundant consentrations were recorded further east along the Norwegian and Soviet coast as far east as as 34^0 E. In other areas, Svalbard included, were only minor registrations of haddock.

From autumn 1987 to autumn 1988 the total abundance of haddock in the Barents Sea has decreased by 46% (Table 5.2.1) A high abundance is observed for the 1987 year class, the highest for one year olds. A reduction was observed for the 1982-1985 year classes. As for cod, the estimate were below the estimate made during the winter survey earlier the same year. The dominating year-class both in winter and autumn, excluding the 1987 year-class, was the 1983 year-class.

6. REDFISH

6.1 Bottom Trawl Survey Svalbard

The results from the bottom trawl survey show a decrease in stock abundance for Sebastes marinus after 1986 (Table 6.1.1). For Sebastes mentella the stock situation seem to have stabilized after a yearly decrease since 1985 (Table 6.1.2). For S.marinus and S.mentella the estimated numbers from the bottom trawl survey are 35% and 45%, respectively, of the acoustic estimated number in the same area. Figs.6.1.1 and 6.1.2 show the distribution of S.marinus and S.mentella in the bottom trawl survey.

6.2 Acoustic Survey

The distributions of the three redfish species Sebastes marinus, S.mentella and S.viviparus are based on mean integrator values within each statistical square. These mean integrator values are further converted to number of fish per (nautical mile)^2. The distribution of total echo abundance of all three redfish species combined is shown in Fig.6.2.1.

Sebastes marinus

The geographical distribution of S.marinus is shown in Figure 6.2.2 (A). In the total survey area, including Svalbard (north of 73^0N and west of 30^0E), the stock was acousticly estimated to 44×10^6 specimens (Table 6.2.1). This is an increase compared to autumn 1987, both in the Svalbard area and in the Barents Sea, but it is less than 50% of the estimated number in autumn 1986. Areas with fish concentrations above 1,000 specimens per nm^2 were recorded southwest of Prince Karls Forland (dominated by 15-24 cm fish), west of Southcape (15-19 cm), southwest of Bear Island (15-34 cm), outside Northcape (10-29 cm) and west of Tromsøflaket (10-19 cm).

Sebastes mentella

The geographical distribution of S.mentella is shown in Figure 6.2.2(B). In the total survey area this stock was acousticly estimated to 865×10^6 specimens (Table 6.2.2). This is twice the number in autumn 1987, but less than the estimated number in autumn 1986. In the Svalbard area (north of 73^0N and west of 30^0E) a higher abundance of S.mentella was observed this year than in 1986 and 1987. Areas with fish concentrations above 10,000 specimens per nm^2 were found northwest of Spitsbergen (10-19 cm), southwest of Prince Karls Forland (5-14 cm and 15-24 cm), along the continental edge and slope

from Southcape to south-southwest of Bear Island (5-24 cm), and outside the coast of Finnmark (5-9 cm and 20-29 cm).

Sebastes viviparus

The geographical distribution of S.viviparus is shown in Figure 6.2.2(C). As expected, S.viviparus was not observed in the Svalbard area. In the total survey area this stock was acousticly estimated to 39 x 10^6 specimens (Table 6.2.3). This is only one third of the estimated number in autumn 1987, but it is nearly the same number as in autumn 1986. Differences in the survey tracks from year to year in the southwestern part of the Barents Sea, where high concentrations of S.viviparus, sometimes occure, may cause rather considerably fluctuations from year to year in the estimated number of this species. One area with fish concentration above 10,000 specimens per nm^2 were found west of Tromsøflaket (dominated by 10-24 cm fish).

7. GREENLAND HALIBUT

7.1 Bottom Trawl Survey Svalbard

Total indices in numbers of Greenland halibut increased until 1985 and since then decreased by more than 50% to the low level in 1987 (Table 7.1.1). In 1988 the indices for nearly all age groups have increased, and the total index is at the 1985-level again. Competition and predation by cod and by-catch in the shrimp fishery were in the 1987-report (Hylen et al.1988) mentioned as possible reasons for a recruitment failure. The unexpected high indices in 1988 indicate that area coverage and variable fish availability during the survey may be equally good explanations for the variation in Greenland halibut indices in recent years. The distribution of Greenland halibut in the trawl catches is shown in Fig.7.1.1. The distribution is mainly the same as in previous years, but in 1988 subareas with catches above 100 specimens were more frequent.

REFERENCES

ANON.1988.Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1988. Coun. Meet.int.Coun.Explor.Sea,1988(G:45):1-37.

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. Contrib. to Symp. in Fisheries Acoustics, 21 - 24 June 1982, Bergen, Norway. [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 at 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. Coun.Meet.int.Coun. Explor.Sea,1987(G:37):1-47. [Mimeo.]

Godø,O.R. and Nedreaas,K.1986. Preliminary report of the Norwegian ground-fish 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.int.Coun.Explor.Sea,1984(G:46):1-17. [Mimeo.]

Hylen,A.,Jakobsen,J.A.,Mehl,S. and Nedreaas,K.1988. Estimates of stock size of cod, haddock, redfish and Greenland halibut in the Barents Sea and the Svalbard area Autumn 1988. Coun.Meet.int.Coun.Explor.Sea, 1988(G:44):1-25. [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.]

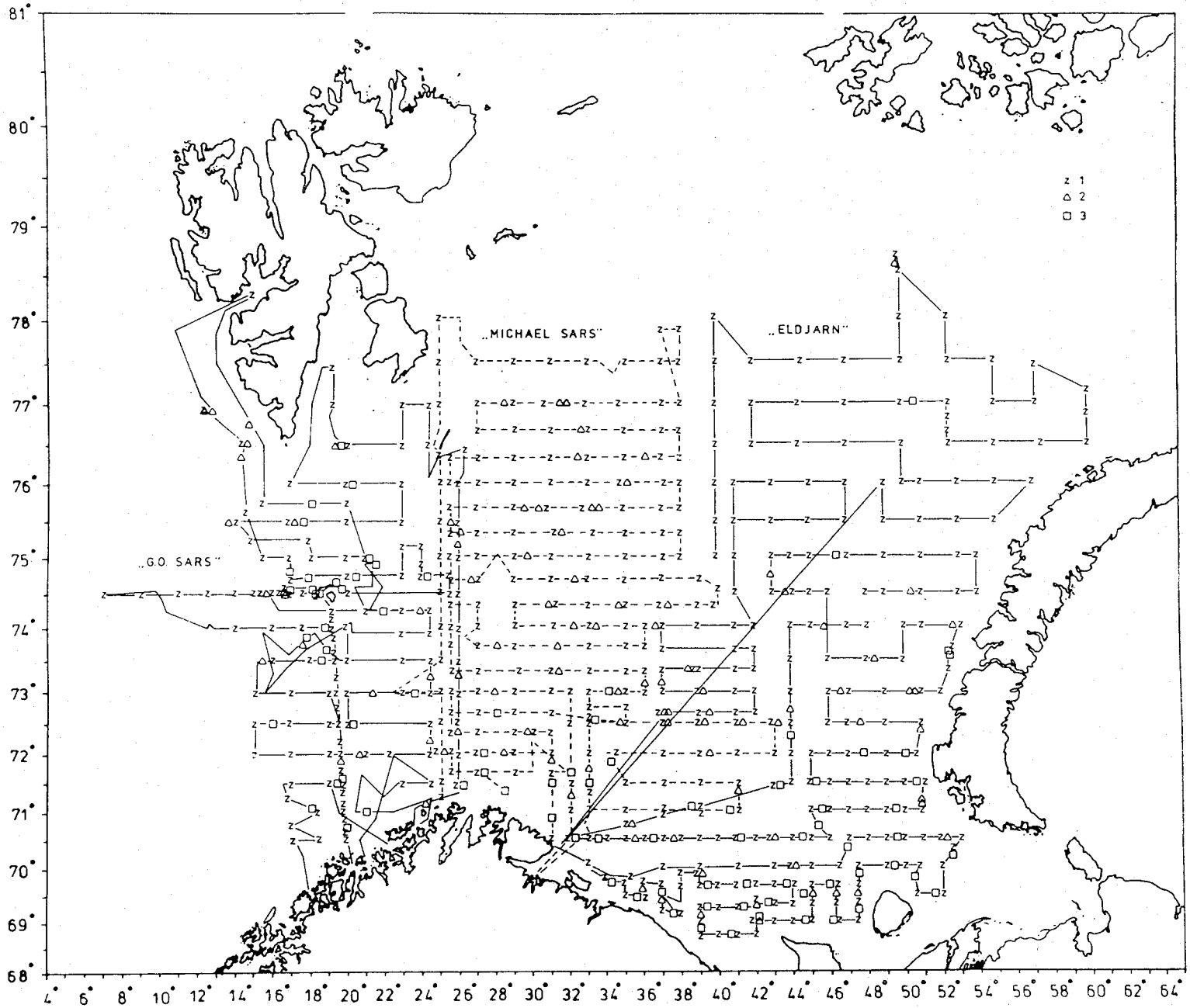


Fig:2.1. Survey tracks and stations taken by R/V "G.O.Sars" 11.9 - 16.10 and R/V "Michael Sars" and R/V "Eldjarn" 8.9 - 21.10 1988.
1 = CTD-station, 2 = pelagic trawl and 3 = bottom trawl.

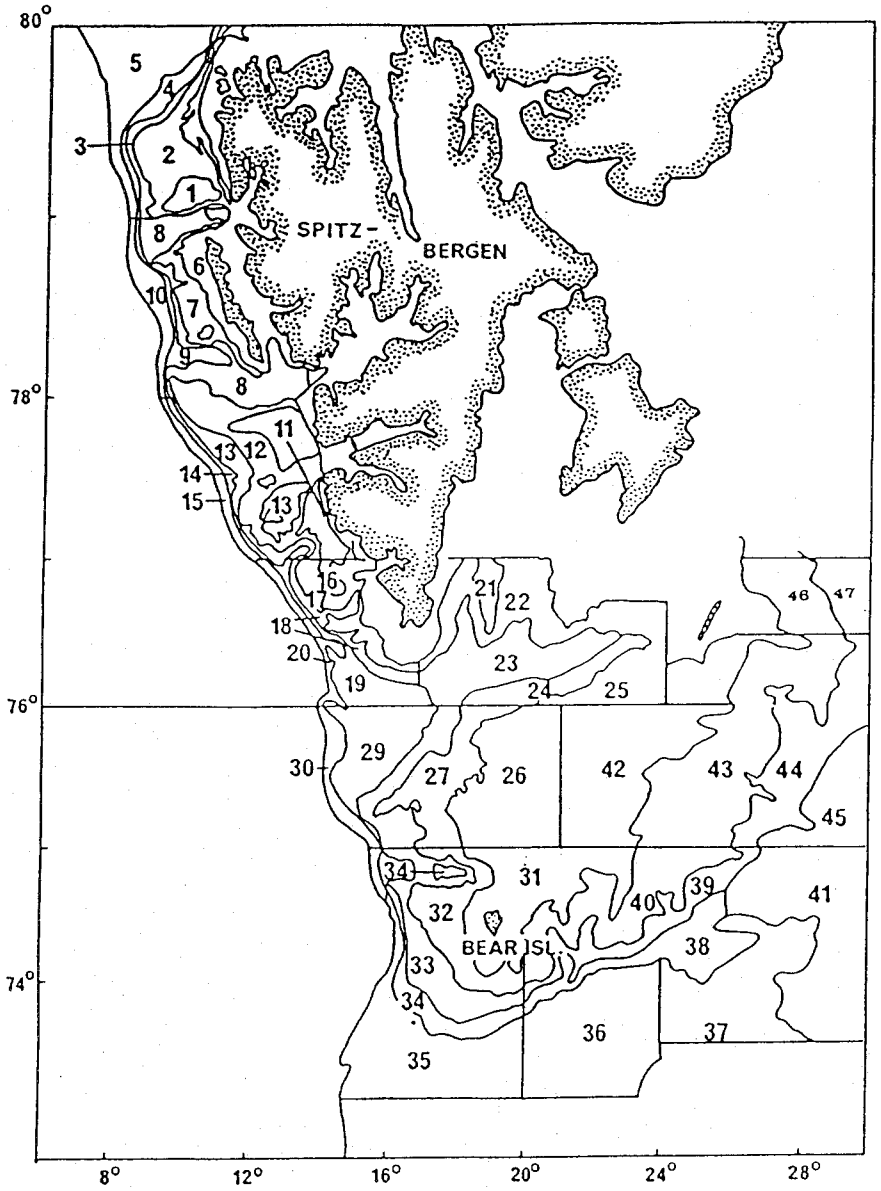


Fig:2.1.1. The area of investigation with the different strata.

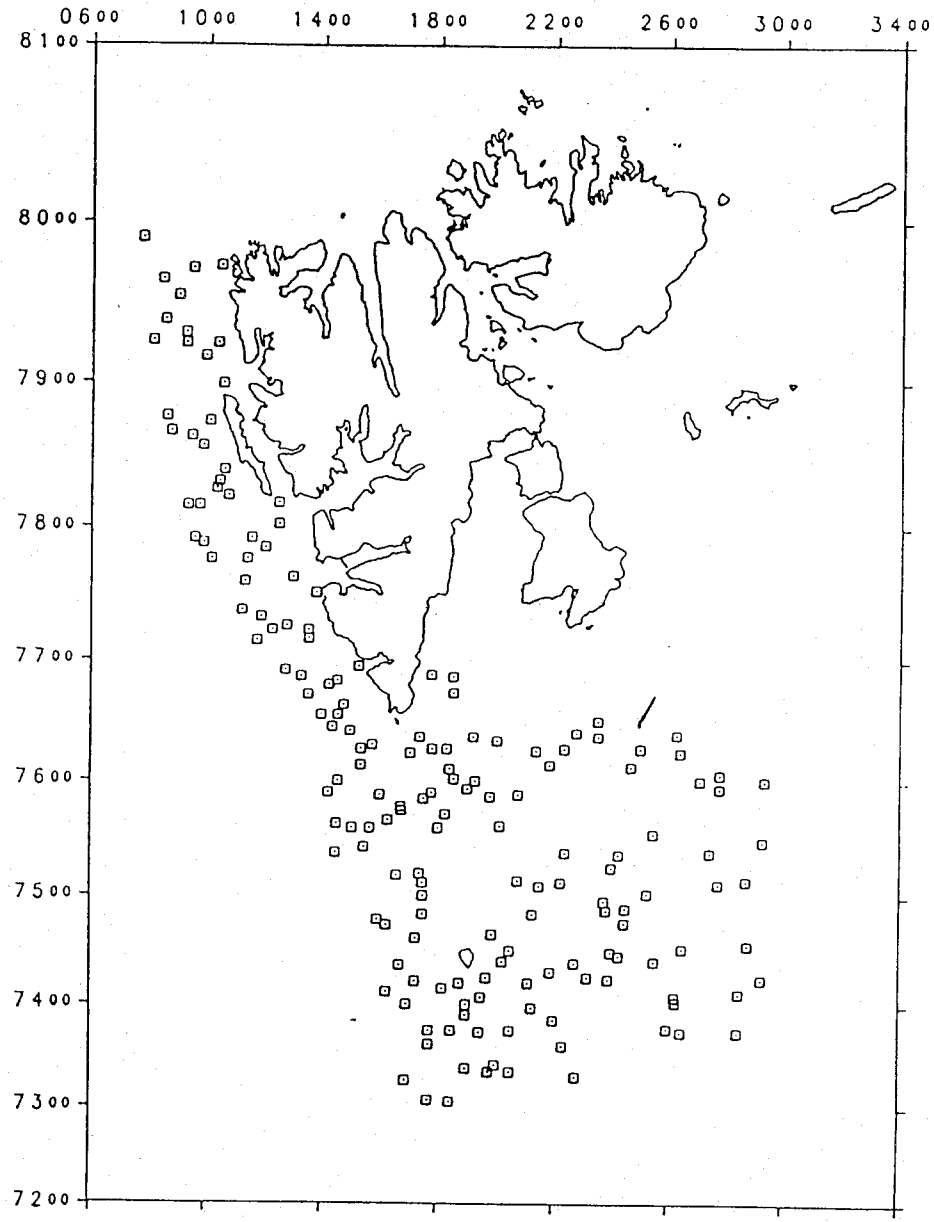


Fig:2.2. Bottom trawl-stations (171) taken by F/T "Anny Kræmer" 13.09.-07.10. 1988.

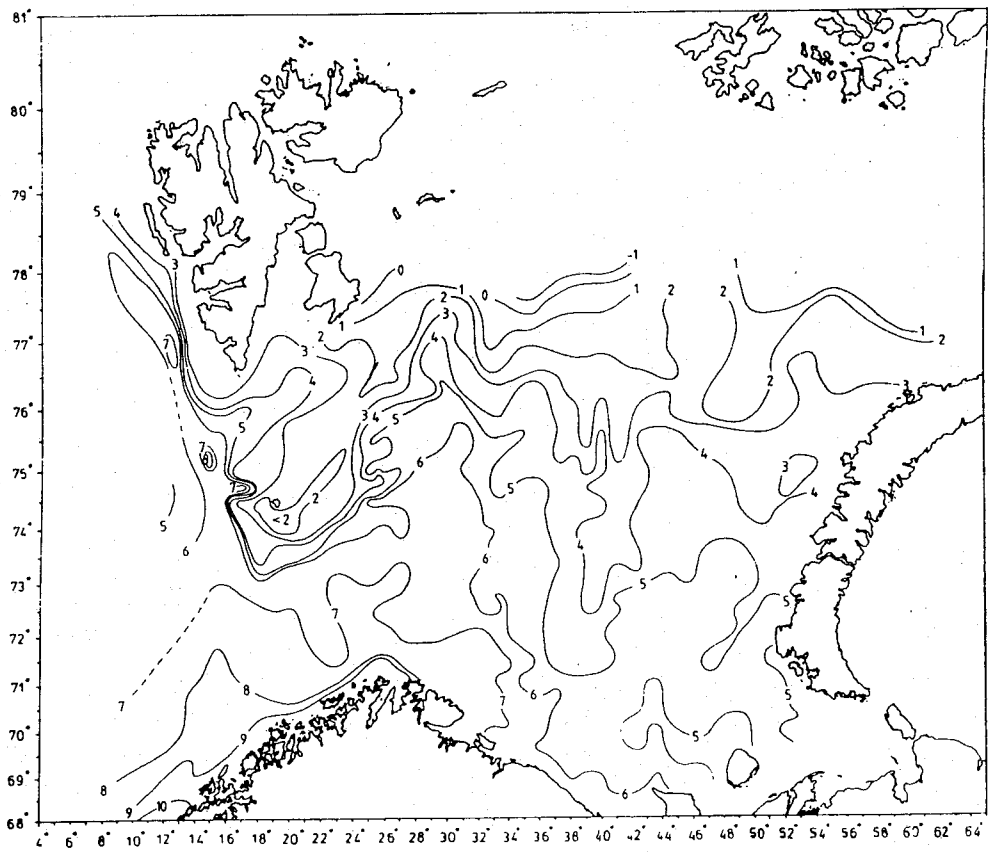


Fig:3.1. Temperature distribution (^{0}C) at the surface.

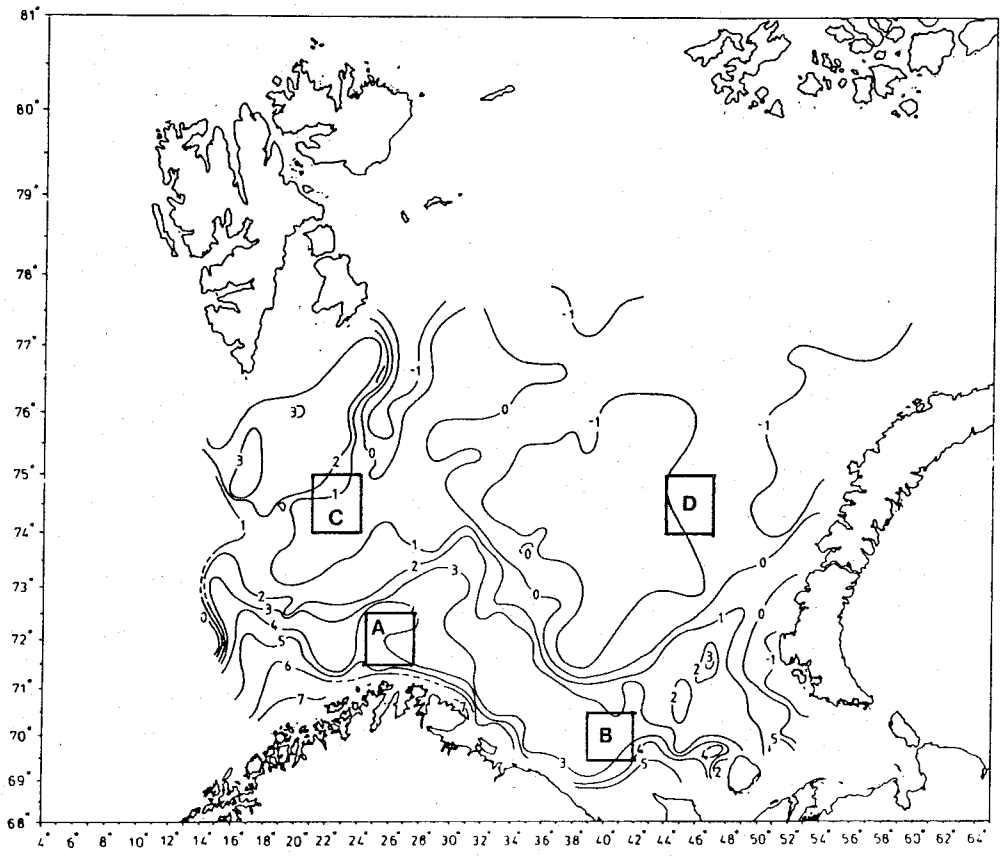


Fig:3.2. Temperature distribution at the bottom.
In areas A, B, C and D mean bottom temperatures have been calculated.

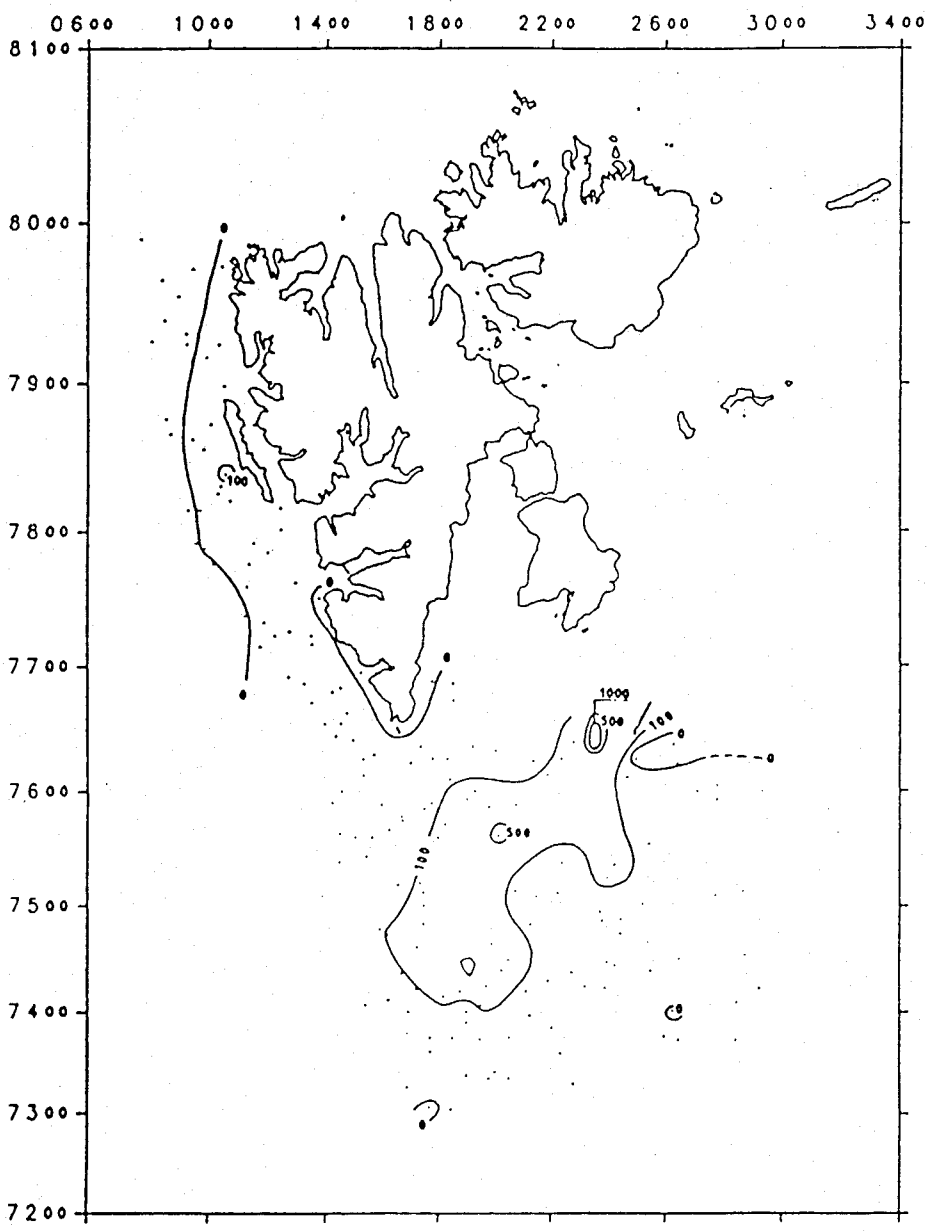


Fig:4.1.1. Distribution of Cod in the trawl catches (number per hour trawling).

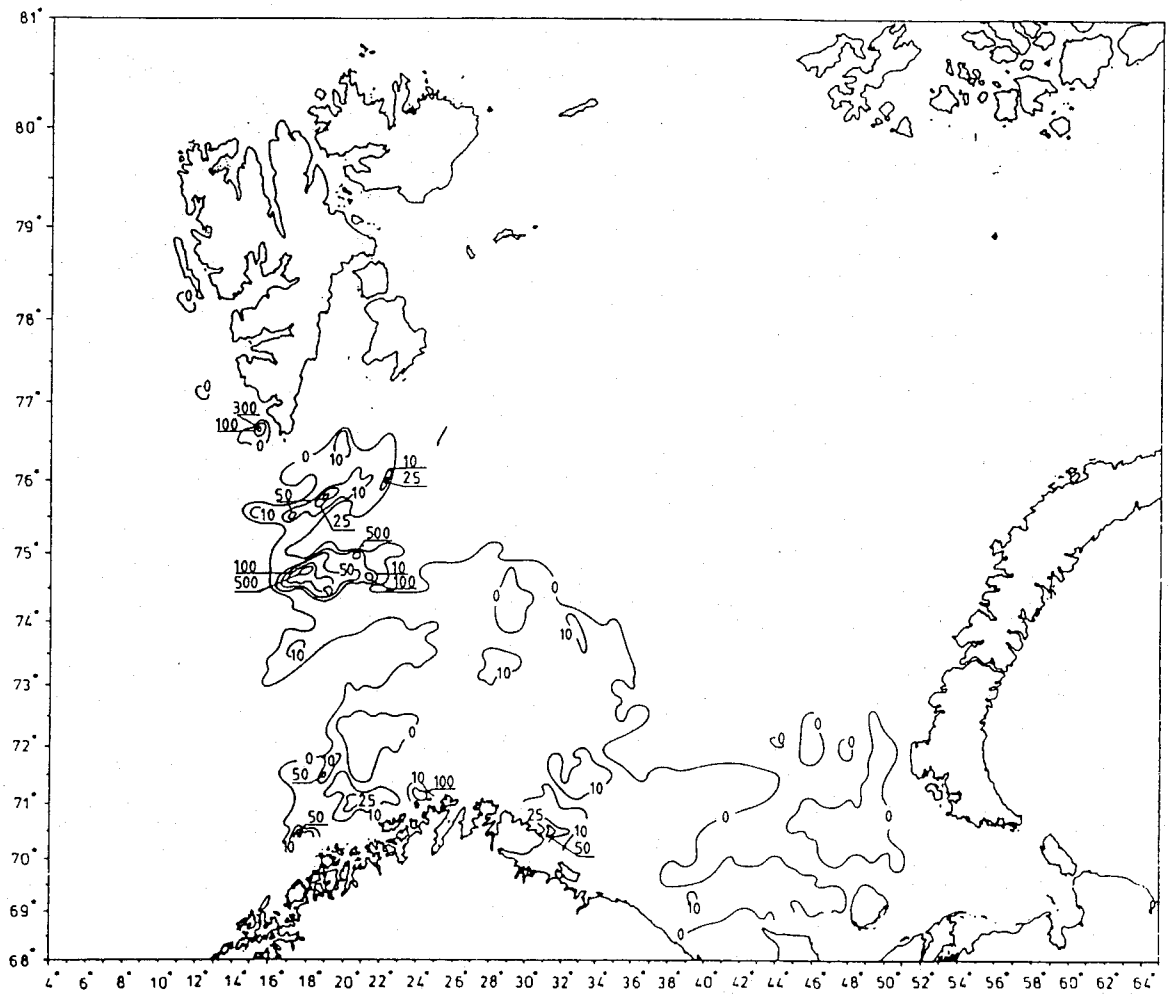


Fig:4.2.1. Distribution of total echo abundance of Cod and Haddock combined in autumn 1988. Units are integrated back scattering surface per square nautical mile $(m/naut.mile)^2$.

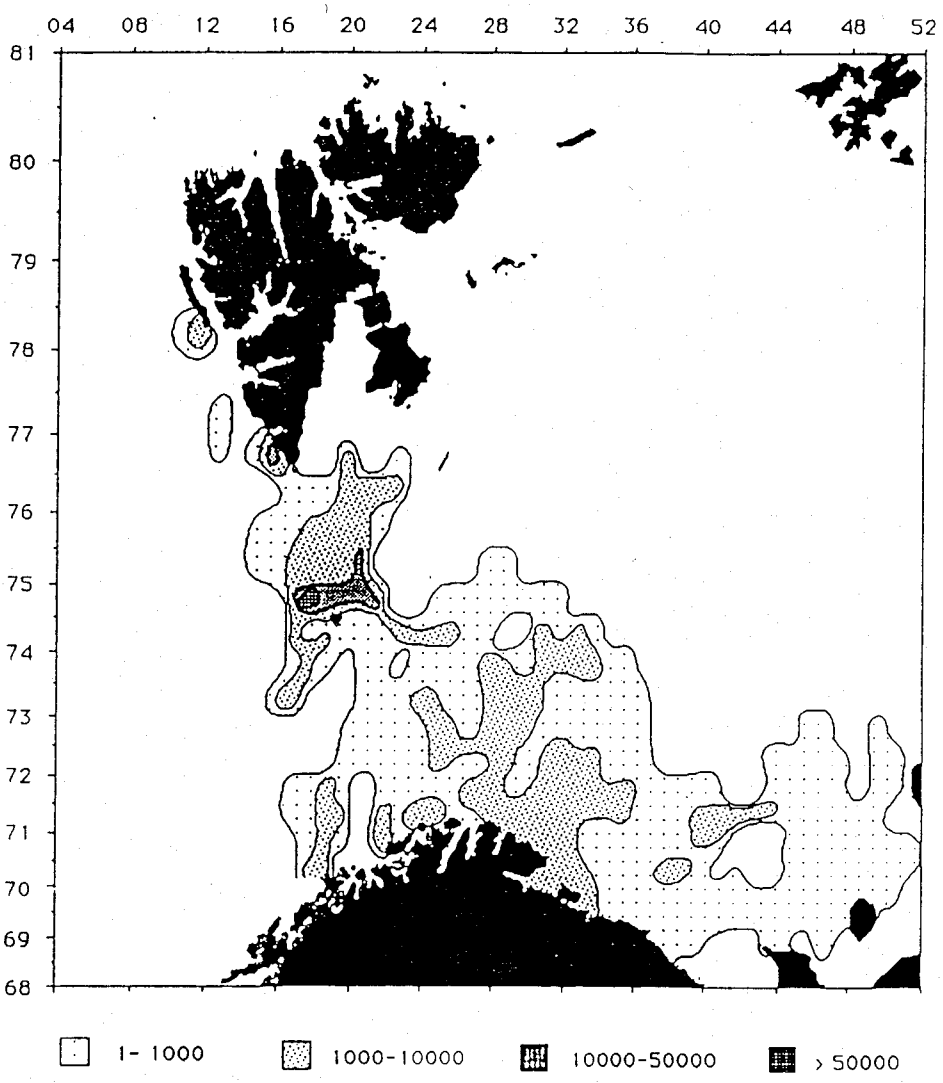


Fig:4.2.2. Distribution (acoustic) of Cod during the multispecies cruise autumn 1988. Number of fish per square nautical mile.

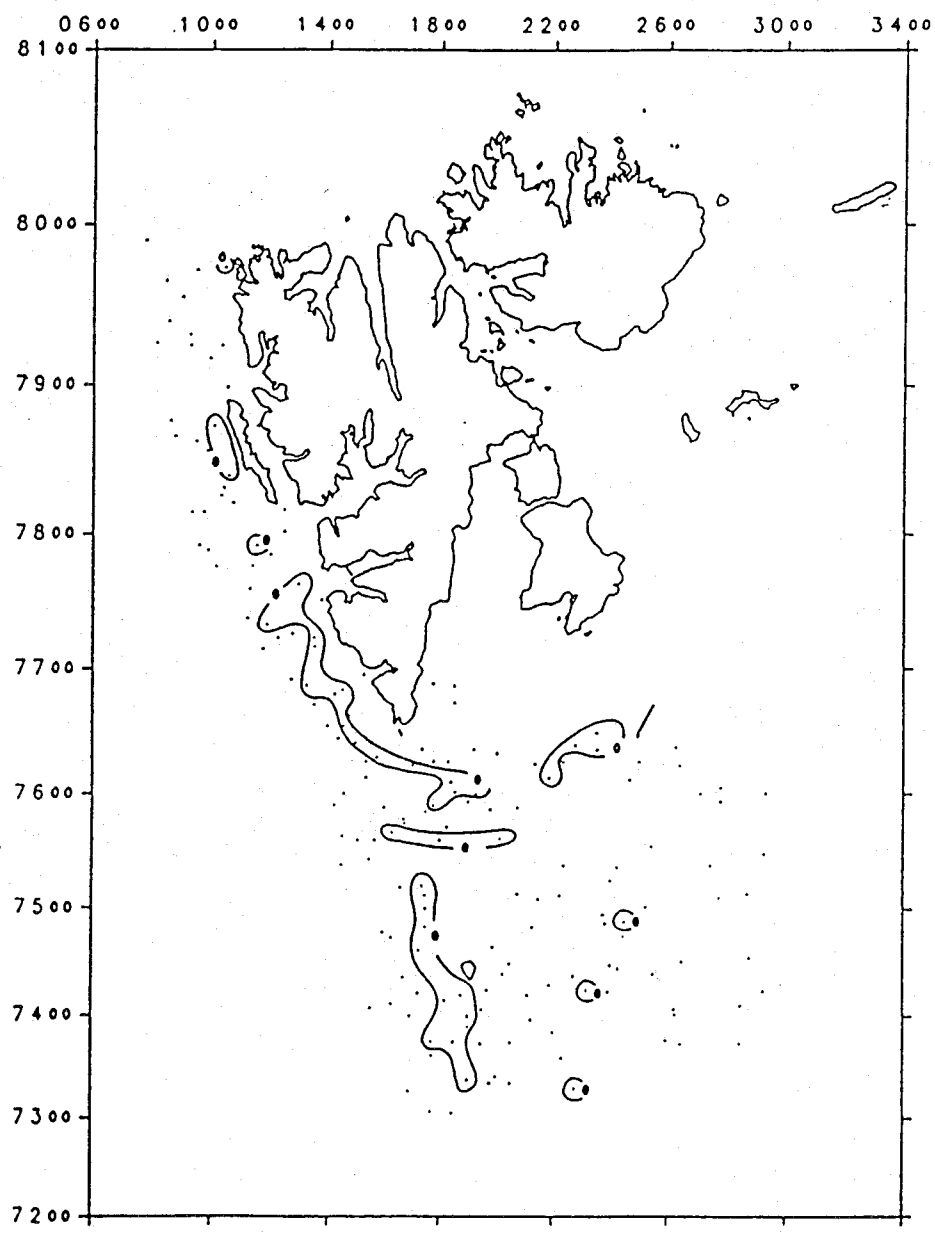


Fig:5.1.1. Distribution of Haddock in the trawl catches (number per hour trawling).

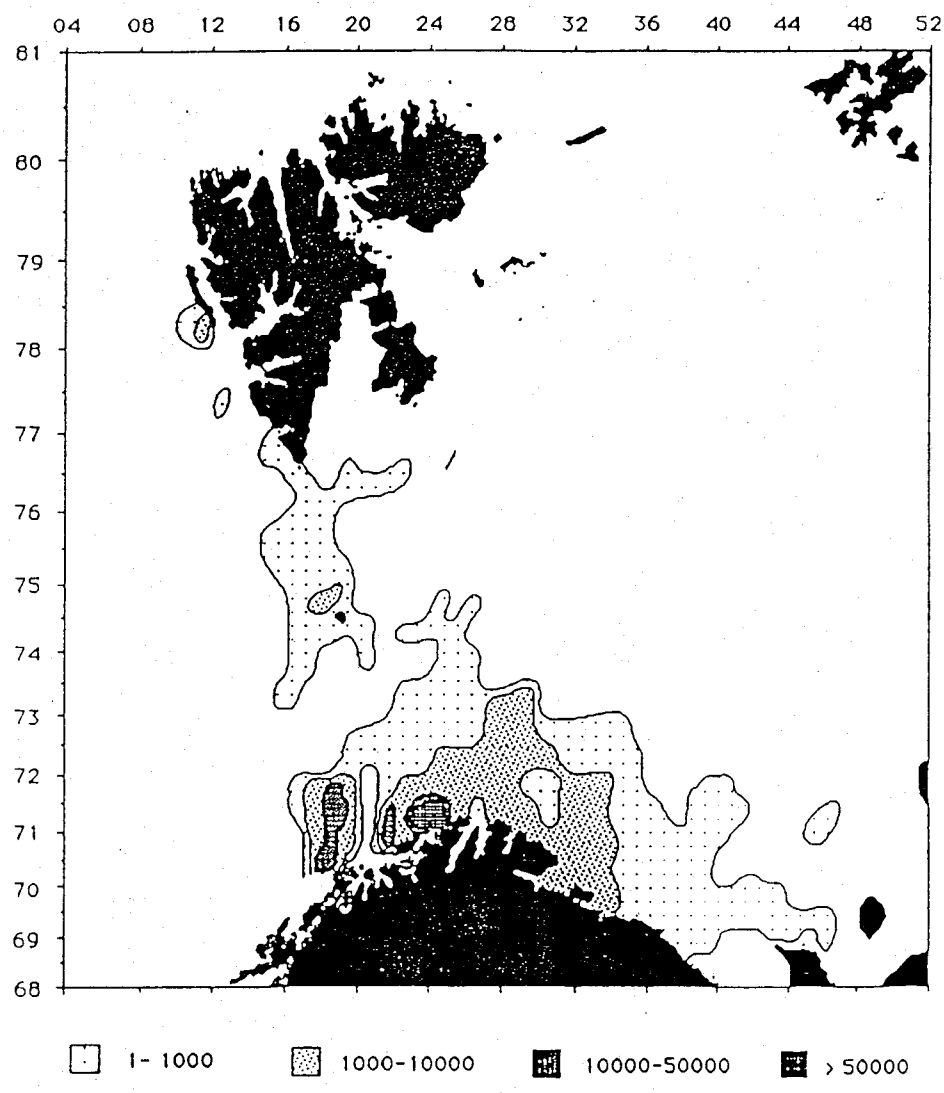


Fig:5.2.1. Distribution (acoustic) of Haddock during the multispecies cruise autumn 1988. Number of fish per square nautical mile.

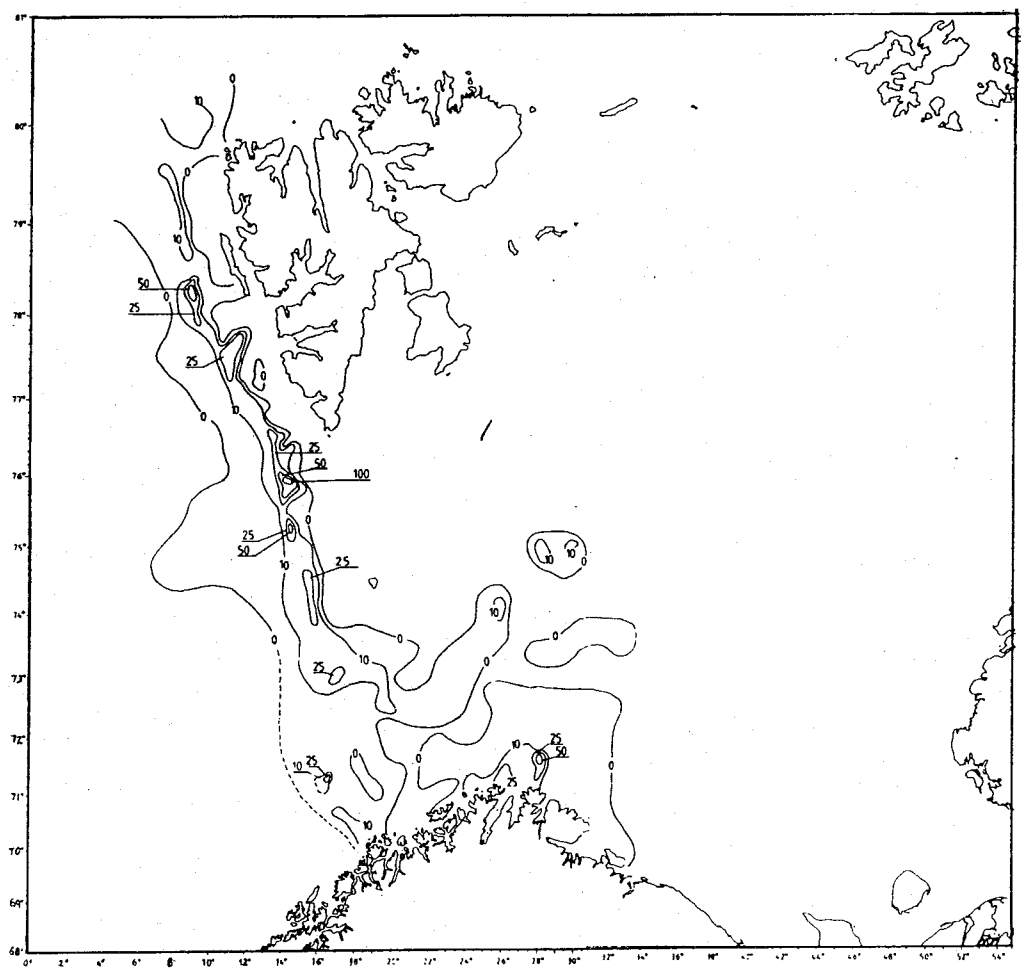


Fig:6.2.1. Distribution of total echo abundance of all 3 redfish species combined in autumn 1988. Units, see fig:4.2.1..

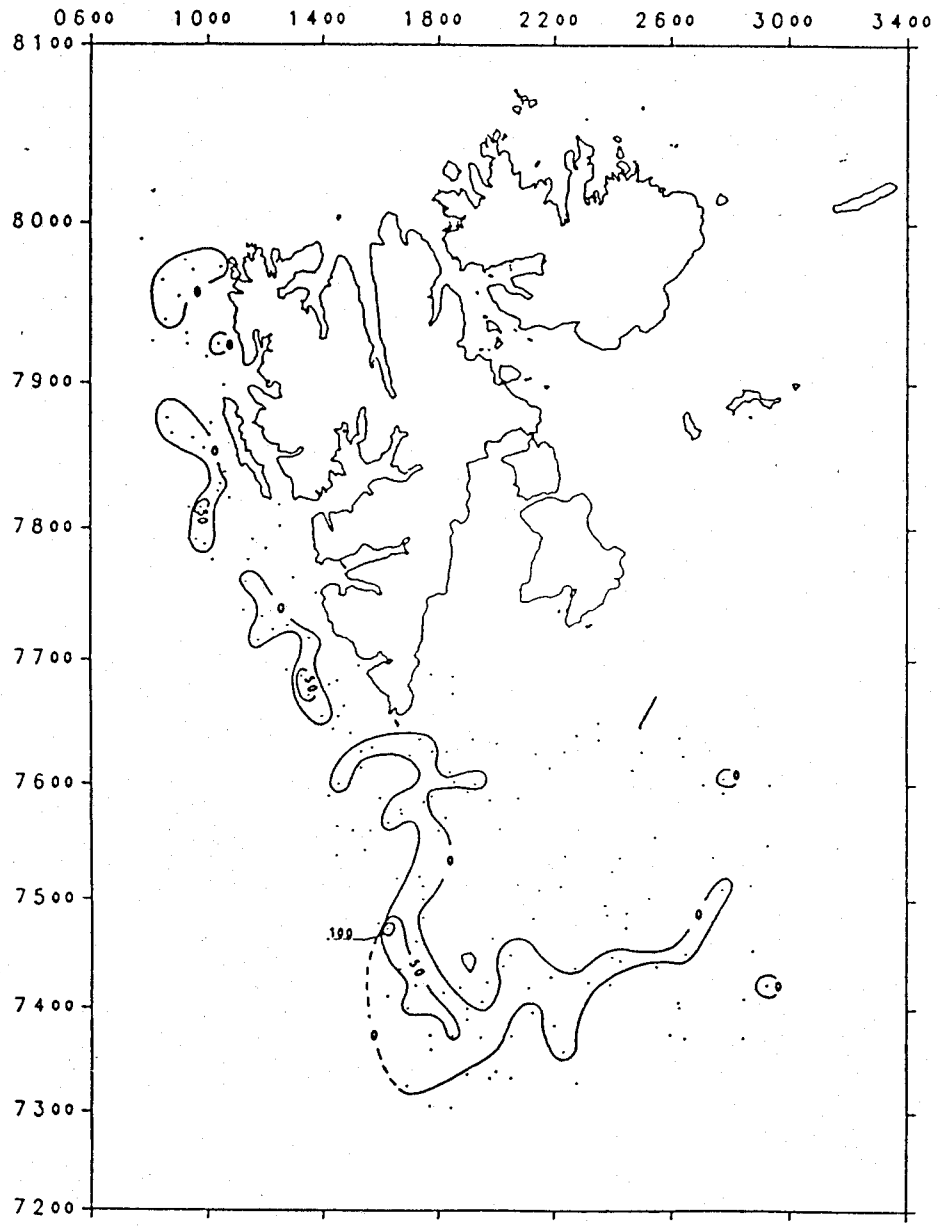


Fig:6.1.1. Distribution of Sebastes Marinus in the trawl catches (number per hour trawling).

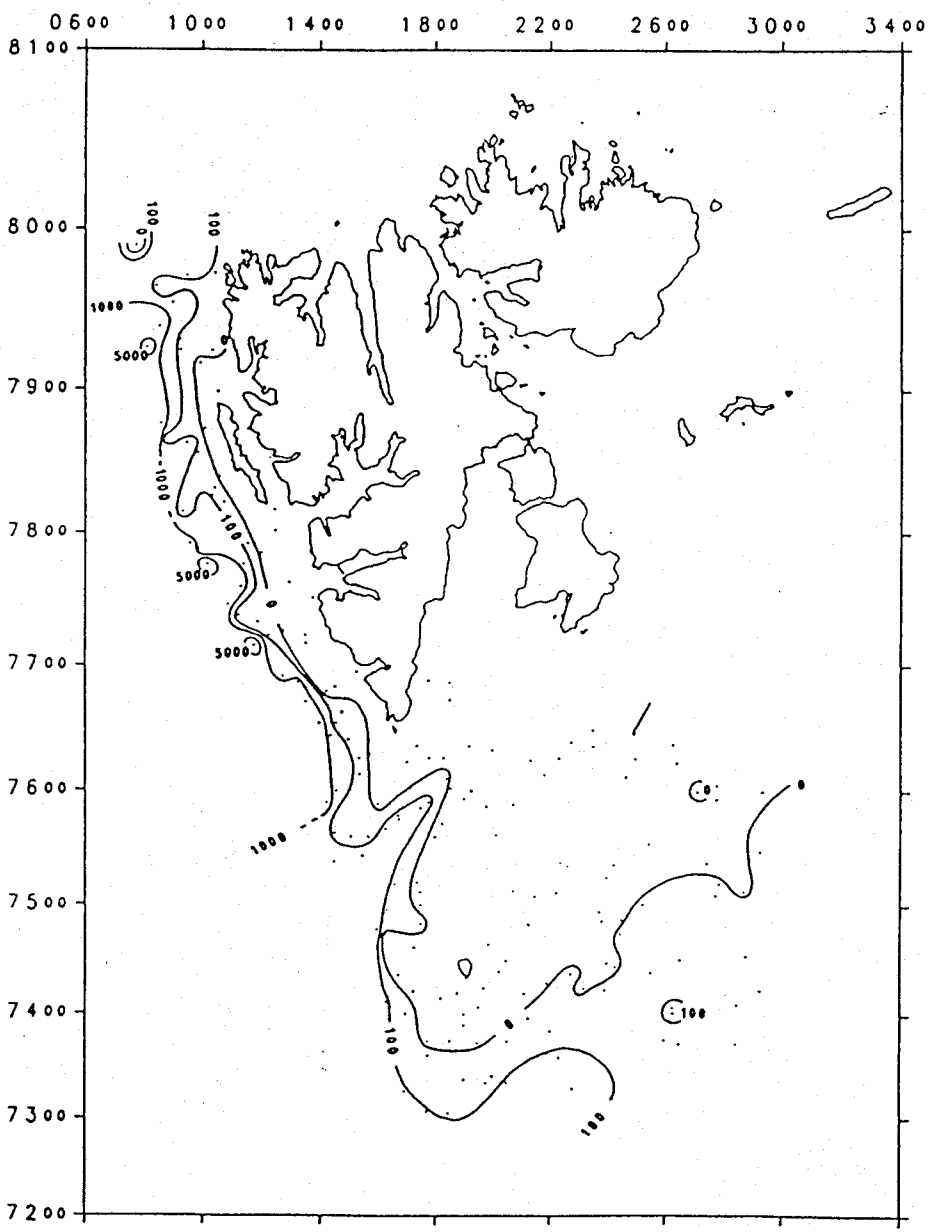
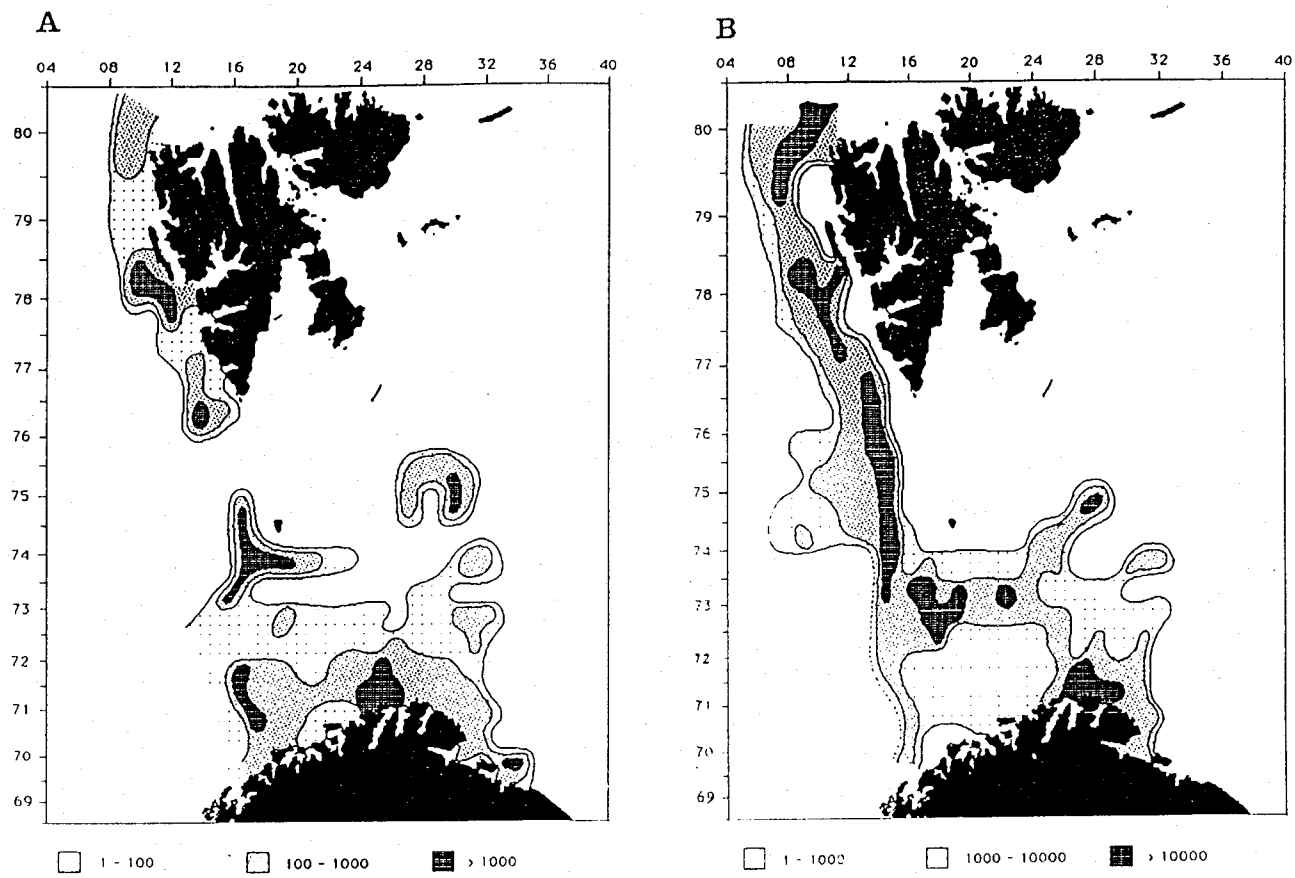


Fig:6.1.2. Distribution of Sebastes Mentella in the trawl catches (number per hour trawling).



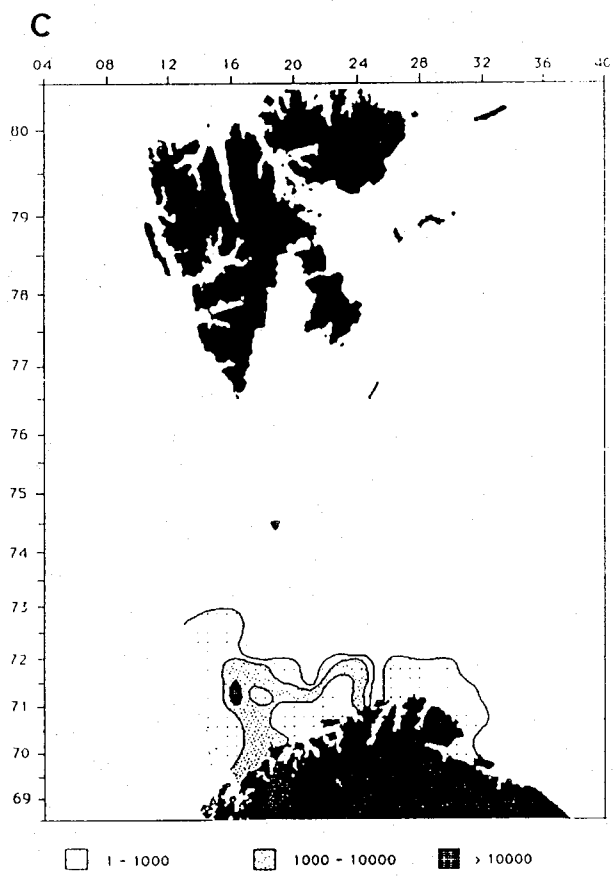


Fig: 6.2.2. Distribution (acoustic) of (A) Sebastes marinus, (B) Sebastes mentella and (C) Sebastes viviparus during the multispecies cruise autumn 1988. Number of fish per square nautical mile.

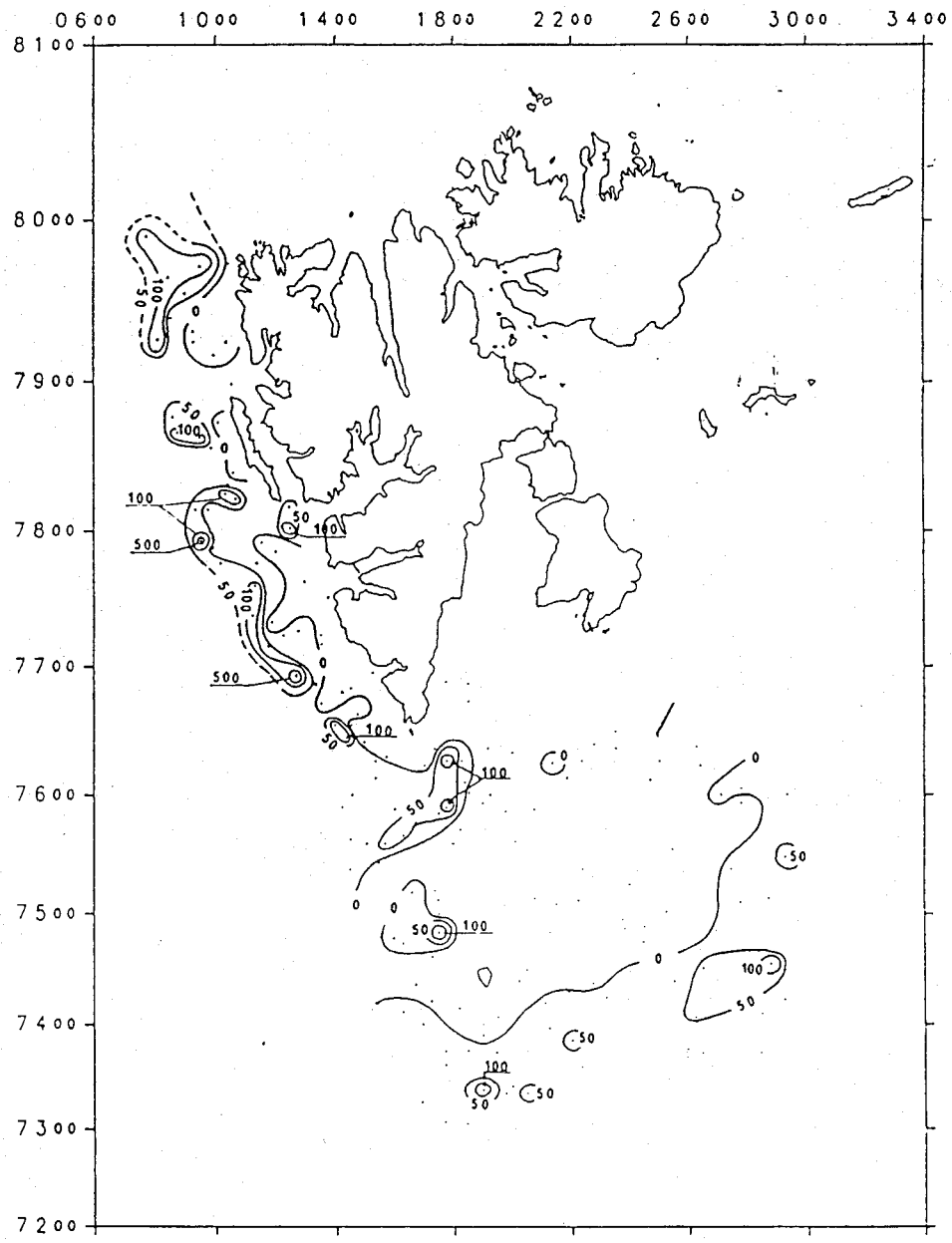


Fig:7.1.1. Distribution of Greenland Halibut in the trawl catches (number per hour trawling).

Table 4.1.1. Cod. Abundance indices for each age group from the bottom trawl survey in the Spitsbergen / Bear Island areas 1981 - 1988. (numbers in millions).

Year of invest.	Year-class 1987	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
1988	0.2	2.6	15.6	22.8	36.0	11.2	0.8	0.8	0.8	0.2								90.9

Table 4.2.1. Acoustic abundance estimates for each year-class of Cod from surveys in 1986 - 1989. (numbers in millions).

Year of invest.	Year-class 1987	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
Winter 88.	1	23	79	74	179	26	6	+	+	389
Autumn 88.	5	4	23	14	43	15	9	+	+	114
Svalbard										
Autumn 86.			10	68	125	42	19	5	12	281
Autumn 87.		13	98	329	413	87	33	2	+	971
Autumn 88.	+	16	22	24	50	18	6	+	+	138
Total										
Autumn 86.		5	52	164	415	141	64	17	13	868
Autumn 87.		15	147	371	715	177	59	5	+	1487
Autumn 88.	5	20	45	38	93	33	15	+	+	252

Table 5.1.1. Haddock. Abundance indices for each age group from the bottom trawl survey in the Spitsbergen / Bear Island areas 1985 - 1988. (numbers in millions).

Year of invest.	Year-class 1987	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
1988	0.5	+	+	0.1	0.2	0.1	+			0.9

Table 5.2.1. Acoustic abundance estimates for each year-class of Haddock from surveys in 1986 - 1989. (Numbers in millions).

Area/ Year	Year-class 1987	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
Winter 88.	8	7	20	70	150	23	+		+	279
Autumn 88.	170	19	5	17	32	4	+			247
Svalbard										
Autumn 86.			+	2	21	2	0	0	0	25
Autumn 87.		+	+	1	+	0	0	0	0	2
Autumn 88.	1	+	+	+	3	+	+			5
Total										
Autumn 86.			89	197	267	95	0	0	1	650
Autumn 87.			25	89	276	69	+	+	+	463
Autumn 88.	171	19	5	17	35	4				252

Table 6.1.1. Sebastes marinus. Abundance indices for each length group from the bottom trawl survey in the Spitsbergen / Bear Island areas 1985-1988. (Numbers in thousands).

Year of invest.	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
1988	520	1001	1953	1609	684	358	158	68	95	6450

Table 6.1.2. Sebastes mentella, including unidentified Sebastes spp. Abundance indices for each lenght group from the bottom trawl survey in the Spitsbergen / Bear Island areas 1985 - 1988. (Numbers in millions).

Year of inves.	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
1988	33	23	82	77	7	3	2	2	+	228

Table 6.2.1. Acoustic abundance estimates for each length group of Sebastes marinus (numbers in millions) during the multispecies surveys in autumn 1986-1988, north of 70°N.

AREA	YEAR	Length-groups in cm. 5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45+	TOTAL
Spits-	86	+	4	4	1	1	2	1	2	7	28
bergen/	87	+	2	2	1	+	+	+	+	+	7
Bear Isl.	88	+	+	4	5	2	2	1	+	1	18
Barents	86	4	17	12	8	9	3	2	3	5	65
Sea	87	+	+	+	4	4	5	1	+	+	18
	88	1	4	4	6	6	1	+	+	+	26
Total	86	4	21	16	9	10	5	3	5	12	93
area	87	+	2	3	5	5	5	1	+	+	26
	88	1	4	8	11	8	3	1	+	1	44

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 1986-1988, north of 70°N.

AREA	YEAR	Length-groups in cm. 5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45+	TOTAL
Spits-	86	3	105	124	6	4	1	+	3	+	249
bergen /	87	24	26	54	6	1	+	+	1	+	117
Bear Isl.	88	195	74	77	120	17	6	4	3	+	501
Barents	86	70	215	387	37	41	5	1	+	+	762
Sea	87	16	11	176	80	4	1	+	2	+	294
	88	163	42	20	96	32	2	+	+		264
Total	86	73	320	511	43	45	6	1	3	+	1011
area	87	41	38	230	87	6	1	+	3	+	412
	88	358	116	97	216	49	8	4	3	+	865

Table 6.2.3. Acoustic abundance estimates for each length group of Sebastes viviparus (numbers in millions) during the multispecies surveys in autumn 1986-1988, north of 70°N.

AREA	YEAR	Length-groups in cm. 5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45+	TOTAL
Spits-	86										0
bergen /	87	1	+	2							5
Bear Isl.	88										0
Barents	86	2	13	6	5	2	+				31
Sea	87	39	39	12	10	1					102
	88	0	10	14	11	3					39
Total	86	2	13	6	5	2	+				31
area	87	40	39	14	10	1					107
	88	0	10	14	11	3					39

Table 7.1.1. Stratified trawl indices on numbers (thousands) for different age groups of Greenland Halibut in 1984 - 1988.

Year of invest.	Age 1	2	3	4	5	6	7	8	9	10+	TOTAL
1984	550	3042	2924	8573	6847	5657	4345	2796	1709	187	36630
1985	884	3921	4294	6674	8793	8622	3920	1817	508	17	39450
1986	49	1005	1967	7314	4671	1754	2301	372	11	26	19470
1987	630	1014	3076	4409	4786	3141	964	364	108	8	18500
1988	818	4298	6191	6696	12289	2396	6015	338	257	20	39300