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**PRELIMINARY REPORT OF THE NORWEGIAN GROUND FISH SURVEY AT  
BEAR ISLAND AND WEST-SPITZBERGEN IN THE AUTUMN 1985**

by

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ABSTRACT

This report describes the results from a stratified bottom trawl survey carried out in September/October 1985. The cod stock was dominated by the 1982 and the 1983 year classes. Also the 1984 year class recruited considerably to the area. The year classes 1982-1984 made up 84% of the total index in numbers and the index increased by 130% from 1984 to 1985.

The haddock was totally dominated by the 1983 and 1984 year classes and the total index in numbers decreased while the corresponding in weight increased from 1984 to 1985.

Acoustic abundance estimation of cod and haddock gave figures of roughly half the size of the trawl indices.

The most abundant species in the area were long rough dab and redfish.

## INTRODUCTION

The investigations described are partly a supplement to the investigations carried out on cod and haddock in the Barents Sea during the winter (Hysten, Jakobsen, Nakken and Sunnanå 1985), and partly a monitoring of the demersal fish stocks in the area. During the first years of the Spitzbergen investigations, acoustic surveys were carried out (Dalen, Rørvik and Smedstad 1977 and Dalen and Smedstad 1978). The drastic reduction of the cod stock in the area has, however, made it almost impossible to record the cod with acoustic equipment. Therefore the investigations in 1981, 1982, 1983 and 1984 (Randa and Smedstad 1982, 1983 and Godø, Randa and Smedstad 1984) were carried out as stratified bottom trawl surveys. The cod stock is now again increasing in the Svalbard - Bear Island area (Godø 1985), and in 1985 the survey was carried out as a combined acoustic and bottom trawl survey.

## MATERIALS AND METHODS

### Trawl survey

The survey was carried out by R/V "Eldjarn" and M/Tr "Raiti" in the period September 9 - October 5 1985. Both vessels were equipped with a Campelen 1800 meshes shrimp trawl with rubber bobbins and codend mesh size of 35 mm. The length of the sweepwires were 80 m. During a standard haul the trawl was towed for three nautical miles at a speed of three knots. The trawl stations are shown in Fig.3. Hydrographical observations were obtained on all stations with CTD-sonde (Fig.2).

The survey was designed as a stratified random trawl survey. The

investigated area was divided into 45 strata based on depth and geographic location (Fig.1). The following depth intervals were used: 0 -100 m, 100 - 200 m, 200 - 300 m, 300 - 400 m and >400 m. The total area was divided into two subareas. The area north of 76° N consists of the strata 1-22 and the southern area of the strata 23-45. The allocation of trawl hauls and the statistical calculations are described by Randa and Smedstad (1982) who presented the results as mean catch indices while swept area indices are calculated from the cruise results in 1985.

#### Acoustic survey

The acoustic survey was carried out as in the winter survey in the Barents Sea (Hyllen et al. 1985). The method is described by Dalen and Smedstad (1979, 1983).

EK-400 (Simrad), connected to a Nord 10 echo integrator with a Simrad QX preprocessor was used in the abundance estimation. The integrator system developed at the Institute of Marine Research, Bergen, is fully described by Blindheim, Eide, Knudsen, and Vestnes (1982). The acoustic system was calibrated according to the method described by Foote, Knudsen, and Vestnes (1982). Echo sounder settings and performance were as follows:

#### EK-400

$$SL + VR = 136.7 \text{ dB}$$

$$\text{Transducer } 8 \times 8^{\circ}$$

$$\text{TVG/Atten.} = 20\log R - 10\text{dB}$$

$$C_I = 0.29 \text{ m}^2/\text{n.mil}^2$$

The abundance calculations were performed with the target strength relation

$$TS = 21.8 \log L - 74.96 \text{ (dB)}$$

and was further used to calculate the fish constant ( $C_F$ )

$$C_F = 2.49 \cdot 10^6 \cdot L^{-2.18} \text{ numb. fish/m}^2$$

where  $L$  is fish length. Total number ( $N_{tot}$ ) is given by

$$N_{tot} = \sum_{i=1}^n C_{F_i} \cdot \bar{M}_i \cdot A_i$$

where  $C_{F_i}$  is the fish constant in a given subarea  $i$

$\bar{M}_i$  is mean integrator value in subarea  $i$

$A_i$  is the area of subarea  $i$

$n$  is the number of subareas

## RESULTS

### Hydrography

The temperature distributions in 50 m and at the bottom are shown in Fig. 4 and 5. Only minor differences compared to the 1984 results were observed.

### Cod

#### Bottom trawl survey

Cod were recorded in the trawl catches in all areas. As in 1984 considerable quantities of cod were found on the western side of Spitzbergen north of  $76^{\circ}$  N (Fig. 6). The highest mean catch rate in numbers was obtained in stratum 6 (Fig. 1), this year as in 1984. The maximum catch rate was 3093 specimens in 1985 against 1685 in 1984. In all strata north of  $76^{\circ}$  N with depth less than 100 m, the mean catch exceeded 150 specimens per hour. The mean stratum catches decreased with depth.

In 12 of the 23 strata south of  $76^{\circ}$  N, the mean catches exceeded 100

specimens per hour. These strata were in depths shallower than 300 meter. Maximum calculated density was observed in stratum 25 in the 0-100 meter zone (967 specimens per hour). North and northeast of Bear Island, in areas with depth less than 100 meter, the mean catches were 200 specimens per hour in the four strata. The distribution of cod is shown in Fig. 6.

Age compositions of cod on area and depth are shown in Fig. 14. In the northern area (north of  $76^{\circ}$  N) the recorded cod were mainly made up of the 1983 and the 1984 year classes which almost exclusively were distributed shallower than 200 meter. In the southern area the 1982 and the 1983 year classes dominated in the shallowest areas. In areas of 100 to 300 meters depth, the 1983 year class was most numerous. The highest densities of older fish was also observed in the same depths (100-300 meter). A major difference between the northern and the southern areas in 1985 was the recruitment of the 1984 year class. In the northern area this year class is recorded as the best since the investigations started in 1981. South of  $76^{\circ}$  N the 1984 year class is on the recruitment level of the 1982 year class or less.

Stratified indices of cod in numbers and weight are presented in Table 1 and 2. They show that the main cod concentrations were south of  $76^{\circ}$  N, however, the difference between the two main areas was not so prominent this year because of the good recruitment of the 1984 year class in the northern area. The indices in numbers show a decreasing trend with increasing depth, while the corresponding in weight varied less as the largest cod were found in the deeper areas.

The stratified indices in numbers for the different year classes (Table 3 and 4) confirmed that the 1982 and especially the 1983 year class are strong compared to the previous ones. It is further indicated that the strength of the 1984 year class is between the two previous ones. Because of the northern recruitment of the 1984 year class, there is now a relatively high density of cod in the entire investigated area, especially in areas shallower than 300m. During the

last year the indices in numbers increased with about 150 %. Table 5 and 6 demonstrate the difference between the two main areas in the historic development of the indices.

In the discussion of the indices, it must be kept in mind that the confidence limits are in many cases rather high (Table 3).

It is known from the bottom trawl surveys in the Barent Sea and in the Spitzbergen-Bear Island area that the indices in numbers usually increase for a year class up to an age of 3-4 years (Table 4, Hylén et al. 1985). In the 1985 survey it is seen from Table 4 that there is a remarkable increase of the indices in numbers for the 4-6 year old cod. Especially the increase of the 1981 year class is considerable (from 5.6 in 1984 to 27.9 in 1985). Concerning the 1981 year class, a similar problem is observed in the Barents Sea (Hylén et al. 1985). The increase of the 1981 year class index may be an ageing problem; i.e. specimens from the more abundant 1982 year class has been classified as 4 year olds in 1985. Neither the 1984 - 1985 indices (Table 4), nor the mean length increase of the two year classes from 1984 to 1985 in the following text table indicate such an error.

YEAR	YEAR CLASS	
	1981	1982
1984	45.4	34.0
1985	54.0	45.4

In general there may have been an overall increase in catchability of cod resulting in higher indices in 1985 compared to earlier. In that case the 1985 estimates are too high compared to earlier years. There is, however, no known reason for such an increase. The survey was carried out as in earlier years with the exception of the introduction of Scanmar instrumentation for observation of trawl geometry during trawling. According to Engås and Godø (1986), a better control of each trawl haul was obtained, which resulted in increased possibility of for example to rise a fallen door and control the exact time of

bottom contact. It is possible that the use of this instrumentation has caused some of the unexpected increase of the trawl indices but hardly all. The instruments were used on about 100 of the 202 trawl hauls.

#### Acoustic survey

Based on experiences from last year (Godø 1985), an acoustic survey was carried out together with the bottom trawl survey. Geographic distribution of acoustic abundance is presented in Fig. 7. Areas of high abundance are the same as indicated by the trawl survey (Fig.6). In Table 4 the estimated numbers on age groups are given together with the corresponding figures from the bottom trawl survey. The total estimated abundance was 146.3 million cod, which is roughly half the bottom trawl estimate. Important reasons for the large discrepancy between the two estimates are supposed to be:

- in the main areas of distribution, the cod was concentrated very close to the bottom, and it is believed that a considerable proportion of the fish may have avoided integration
- the cod was mainly distributed in relatively shallow areas. According to Engås and Godø (1985) and Ona (1986), ship avoidance effects may thus have caused an underestimation

The open isolines in Fig. 6 and 7 show that the survey do not cover the total area of distribution of cod especially north-northeast of the Hopen Island, which thus indicate that the presented estimates are too low.

The mean lengths of the 1982 and the 1983 year classes were about 45 cm and 30 cm respectively in September 1985. Most of the 1982 year

class will pass the minimum landing size of 42 cm in 1986. Undersized fish will probably make up a considerable proportion of the commercial catches if the 1982 year class to a considerable extent mix up with the abundant 1983 year class, as was indicated in this survey.

#### Haddock

A small reduction of the indices of haddock from 1984 to 1985 was observed in spite of a considerable recruitment of the 1984 year class (Table 5 and Fig.15). The indices in weight increased in the southern area (Table 6). The haddock was composed of almost exclusively the 1983 and 1984 year classes (97%). The main areas of distribution were shallower than 300 m. Compared to the 1984 results, the haddock was more evenly distributed; i.e. the highest catches were avoided. The patchy distribution observed last year, (Godø 1985), may thus have created a too high estimate in 1984.

The acoustic abundance estimate gave 27.3 million fish which is roughly half the bottom trawl estimate. The reason for the discrepancy between the two estimates are believed to be the same as for cod.

#### Redfishes

Together with long rough dab, the redfishes were the dominant species in the area. Also in 1985 Sebastes mentella was the dominating redfish species in the Bear Island and West-Spitzbergen area. Sebastes marinus constituted about 2% of the catches in numbers in the southern area (Table 1), while being insignificant in the northern area. The total indices in numbers indicate minor variation in abundance compared to last year for S. mentella, while S. marinus decreased considerably (75%). The total index in weight, however, indicates a considerably decrease of 56% in abundance also for S.mentella. These



reductions may be a result of emigration since the main area of distribution is at the southern border of the area of investigation.

S.mentella was most numerous in depths between 100 m and 300 m north of  $76^{\circ}$  N and deeper than 200 m south of  $76^{\circ}$  N (Table 1). The influence of larger fish increased with depth as observed during the previous cruises.

S.marinus was most numerous in depths between 300 m and 400 m north of  $76^{\circ}$  N and between 100 m and 300 m south of  $76^{\circ}$  N. Comparison with last year indicate that the preferable depth interval for S.marinus north of  $76^{\circ}$  N may vary, while it seems to be more constant south of  $76^{\circ}$  N. The influence of larger S.marinus also increased with depth.

In numbers and weight respectively 37% and 41% of S.mentella is distributed north of  $76^{\circ}$  N while the corresponding percentages for S.marinus are 8% and 18%. This indicates that relatively more large S.marinus are distributed north of  $76^{\circ}$  N which correspond to the length distribution in Fig. 19.

The overview below shows the percent changes in numbers and weight of S.mentella and S.marinus from last year (1984).

	North of $76^{\circ}$ N		South of $76^{\circ}$ N	
	<u>S.mentella</u>	<u>S.marinus</u>	<u>S.mentella</u>	<u>S.marinus</u>
In numbers	- 29%	+ 86%	+ 24%	- 77%
In weight	- 21%	+ 132%	- 67%	- 59%

South of  $76^{\circ}$  N there is a relative increase of S.mentella in numbers, while there is a decrease in weight. This indicate more young fish in this southern area compared with 1984. Except for this fact and for

the great percent increase of S. marinus in the northern area, which, however, is rather insignificant in absolute numbers, the quantities of redfishes have diminished. These surveys do not cover the entire area of redfish distribution, and migrations to and from the covered area may influence the results from year to year. In 1986 the survey will be enlarged to cover the entire area of distribution.

Geographic distribution and length distributions are presented in Figs. 9, 10, 18, and 19.

The main limitation in estimating redfish abundance by stratified bottom trawl survey, is the vertical distribution of the species.

#### Greenland halibut

Total indices in numbers of Greenland halibut increased slightly from 1984 to 1985 while the corresponding indices in weight exhibited a similar decrease. It has earlier been assumed that the recruitment mainly comes from the northern area (Godø and Haug 1985). In the two last years, however, there has been a considerable recruitment failure of fish less than 30 cm (Fig. 21). In contrary there is in 1985 observed a certain recruitment of small Greenland halibut in the southern area. Compared to the rich recruitment in the northern area in the beginning of this decade, the recruitment in 1984 and 1985 must be considered poor (Godø and Haug, manus.). Consequently the stock now probably face a recruitment problem, which will result in a decreasing commercial exploitable stock during the coming years. In spite of reduced recruitment during the last years, the indices in numbers have till now increased. This is probably a result of increasing catchability up to a certain size (compare with the indices on year classes of cod in Table 4).

Concerning the recruitment problem, it should be mentioned that the main nursery areas frequently coincide with important shrimp fishing

grounds. It is thus possible that bycatch of small Greenland halibut has reduced the recruitment; to what extent is , however, unknown.

#### Long rough dab

Together with the redfishes long rough dab was the most numerous species in the area. Its distribution covered all the area investigated, but it was most abundant in depths between 100 and 300 m around the Bear Island where the mean catchrates exceeded 1000 individuals per hour trawling (Fig. 12). The stratified indices in numbers were reduced with about 30% compared to the 1984 results (Table 5).

#### Blue whiting

Blue whiting was mainly caught in the southern area. The catches were largest in 200-300 m depth (Table 1 and 2). The catches were mainly made up of fish between 30 and 40 cm (Fig. 17). The stratified indices in numbers were reduced with about 60 % compared to the 1984 results, which were exceptionally high (Table 5). Migration is believed to be a main reason for the great fluctuation in the blue whiting indices.

#### Saithe

Saithe was found in high concentrations off the Spitzbergen coast between the Hornsund Bank and the Kings Bay in 1984. Catches of several tons were obtained. The catches were 0-group saithe of 13-15 cm in length. Also in 1985 saithe was caught in the same areas, but the catches were much smaller than the previous year. The mean length was 22.5 cm (Fig.16), and age samples confirmed that the 1984 year class made up the bulk of the catches.

### Shrimps

All catches in the strata deeper than 200 m contained shrimps. Catchrates higher than 100 kg per hour were obtained in limited areas off West-Spitzbergen as well as in the Storfjord channel and east-southeast of the Bear Island (Fig. 13). The stratified total indices were reduced with about 50% compared to the 1984 results (Table 6).

### Catfishes

In all area small quantities of catfishes were caught. The indices of the smaller catfish were roughly doubled compared to 1984, while the two other species only showed minor changes (Table 5 and 6).

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Table 1. Stratified indices on numbers for different depths and areas in 1985.

Species	North of 76° N						South of 76° N						Total
	0-100	100-200	200-300	300-400	>400	Total	0-100	100-200	200-300	300-400	>400	Total	
Cod	45830	30900	4727	985	364	82810	119500	34840	27860	9644	5949	197700	280600
Haddock	24230	5200	637	11	15	30090	10370	5281	9511	557	44	25760	55850
Saithe	14470	26660	513	0	0	41640	24	0	0	0	0	24	41660
<u>S. Marinus</u>	0	150	133	388	23	695	0	598	6906	168	39	7711	8405
<u>S. Mentella</u>	+	108610	62330	23930	3554	198430	0	92	92730	176300	68410	338400	536820
Greenland halibut	0	126	2373	687	10740	13930	0	50	8733	6460	10270	25520	39450
Long rough dab	643	33830	48130	2005	492	85100	8188	172300	157700	42160	23280	403500	488600
Blue whiting	2	0	17	251	51	322	0	192	10120	6506	9131	25950	26270
Jelly cat	0	27	33	45	12	116	4	827	540	536	416	2323	2439
Catfish	72	903	2169	165	67	3376	77	668	717	59	39	1561	4936
Smaller catfish	121	967	719	468	205	2481	174	4313	1492	579	127	6686	9167

Table 2. Stratified indices on weight for different depths and areas in 1985.

Species	North of 76° N						South of 76° N						Total
	0-100	100-200	200-300	300-400	>400	Total	0-100	100-200	200-300	300-400	>400	Total	
Cod	10830	15000	3624	2698	835	32980	71310	20000	17300	13320	11530	133500	166400
Haddock	3221	776	61	2	9	4068	4633	1327	1101	65	1	7122	11190
Saithe	1873	2911	58	0	0	4842	+	0	0	0	0	+	4842
<u>S. Marinus</u>	0	24	47	206	18	295	0	101	1107	116	22	1346	1641
<u>S. Mentella</u>	0	8255	3032	3355	489	15130	0	53	4376	8964	8639	22030	37160
Greenland halibut	0	73	1093	477	6239	7882	0	85	3186	3708	12290	19270	27160
Long rough dab	56	4217	2512	234	63	7082	1755	27290	16300	4420	3247	53010	60090
Blue whiting	+	0	3	61	15	79	0	74	3236	1943	2390	7643	7721
Jelly cat	0	131	64	155	24	373	31	7965	5434	4068	2788	20290	20660
Catfish	45	615	748	155	75	1638	160	1696	1025	56	387	3323	4961
Smaller catfish	451	1558	652	297	96	3055	844	21360	1863	565	483	25110	28170
Shrimps	0	18	2143	705	965	3830	0	84	2034	7003	3547	12670	16500

Table 3. Stratified trawl indices on numbers for different ages of cod in 1985.

Depth	Age										Total	
	1	2	3	4	5	6	7	8	9	10+		
North of 76° N												
0-100	11.4±17.4	27.7±27.5	5.5±6.0	1.0±0.4	0.2±0.2							
100-200	6.3±3.8	13.2± 7.2	6.5±3.3	3.1±2.7	0.7±1.1	0.7±0.1	0.2±0.2	0	0	0	45.8±43.7	
200-300	0.8±0.3	2.1±2.2	0.9±0.9	0.4±0.2	0.2±0.1	0.3±0.2	0.1±0.1	+	0	+	30.9±27.7	
300-400	+	+	+	0.2±0.1	0.2±0.1	0.4±0.1	0.1±0.1	+	0	+	4.7±3.1	
>400	+	+	+	0.1±0.1	0.1±0.1	0.1±0.1		+	0	+	1.0±0.4	
Total	18.5±17.5	43.0±27.8	12.9±1.6	4.8±1.6	1.4±0.6	1.5±0.7	0.3±0.1	+	0	+	82.8±51.8	
South of 76° N												
0-100	1.5±1.0	52.2±29.4	49.4±32.7	13.1±9.9	1.6±1.2	0.8±0.6	0.1±0.1					
100-200	4.1±1.6	18.1±5.2	6.3±2.9	3.4±1.1	0.8±0.2	0.8±0.2	0.1±0.1	0.1±0	+	+	119.5±66.9	
200-300	2.6±1.6	15.5±10.7	3.1±2.9	2.9±1.1	1.1±0.4	1.6±0.9	0.2±0.1	0.1±0.1	+	0.1±0	34.8±9.1	
300-400	0.3±0.2	2.3±0.9	1.6±1.0	2.4±0.7	1.0±0.2	1.5±0.7	0.3±0.1	0.1±0.1	+	0.1±0.1	127.9±17.0	
>400	0.1±0.1	1.0±0.8	1.0±0.5	1.4±0.9	0.7±0.4	1.4±0.7	0.3±0.2	0.1±0.1	+	+	9.6±2.8	
Total	8.5±2.4	90.0±31.7	61.4±33.1	23.1±10.1	5.1±1.3	6.2±1.5	1.1±0.2	1.1±0.2	0.1±0	0.2±0	197.7±65.0	
Total all areas	27.0±17.7	133.1±17.7	74.3±33.8	27.9±10.2	6.5±1.4	7.7±1.6	1.4±0.3	1.4±0.3	0.1±0	0.3±0	280.6±83.2	

Table 4. Stratified trawl indices on numbers for different year-classes of cod in 1981 - 1985.  
For 1985 the acoustic indices have also been presented.

Year of investigation	Year-class														Total
	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	1971	
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 trawl	27.0	133.1	74.3	27.9	6.5	7.7	1.4	1.4	0.1	0.3					279.7
1985 acoustic	13.7	73.3	41.6	13.1	2.9	1.3	0.4	0.1	+	+					146.4



Table 5. Stratified trawl indices on numbers for different species in 1981 - 1985.

	Year	Number of hauls	Cod	Haddock	<u>S.marinus</u>	<u>S.mentella</u>	Greenland halibut	Long rough dab	Blue whiting	Jelly cat	Catfish	Smaller Catfish
North of 76°N	1981	66	1 467	327	3 415	45 680	13 600	48 720	1 821	35	621	1 209
	1982	70	4 140	56	204	59 190	12 940	34 190	537	30	1 527	279
	1983	70	3 251	362	36 330	58 360	14 360	32 560	128	56	690	975
	1984	72	20 700	38 490	373	278 600	12 680	73 410	422	34	2 167	1 518
	1985	77	82 810	30 090	695	198 430	13 970	85 100	322	116	3 376	2 481
South of 76°N	1981	119	48 310	481	58 250	133 800	6 492	287 500	26 650	1 235	790	1 242
	1982	121	41 460	928	11 790	218 500	13 070	336 100	27 230	1 360	1 082	1 452
	1983	117	42 670	3 358	6 070	248 100	12 330	339 800	30 480	1 456	960	2 155
	1984	122	90 810	30 160	33 100	273 500	23 960	592 400	67 110	2 083	1 358	4 190
	1985	125	197 700	25 760	7 711	338 400	25 520	403 500	25 950	2 323	1 561	6 686
Total	1981	185	49 770	808	61 670	179 500	20 100	336 300	28 470	1 270	1 411	2 450
	1982	192	45 600	984	11 990	277 600	26 000	370 300	27 760	1 391	2 609	1 730
	1983	187	45 920	3 720	42 400	306 500	26 690	372 400	30 610	1 511	1 650	3 130
	1984	194	111 500	68 640	33 470	552 100	36 630	665 800	67 530	2 117	3 525	5 709
	1985	202	280 600	55 850	8 405	536 820	39 450	488 600	26 270	2 439	4 936	9 167

Table 6. Stratified trawl indices on weight for different species in 1981 - 1985.

	Year	Cod	Haddock	<u>S.marinus</u>	<u>S.mentella</u>	Greenland halibut	Long rough dab	Blue whiting	Jelly cat	Catfish	Smaller Catfish	Shrimps
North of 76°N	1981	3 156	942	453	11 030	3 645	4 125	400	30	1 032	343	17 060
	1982	3 348	5	63	9 804	6 550	2 858	158	130	1 359	363	24 810
	1983	3 226	35	3 984	6 869	4 967	2 322	38	217	462	1 104	13 240
	1984	5 704	5 136	127	19 250	6 840	5 132	83	197	1 238	1 376	6 901
	1985	32 980	4 068	295	15 130	7 880	7 082	79	373	1 638	3 055	3 830
South of 76°N	1981	73 270	988	10 230	31 510	5 794	40 770	4 968	9 427	1 054	3 764	50 650
	1982	61 180	469	4 325	49 830	15 660	45 510	7 741	12 590	1 849	6 425	68 780
	1983	54 350	474	1 252	35 350	18 170	46 610	9 349	14 130	2 335	6 309	60 090
	1984	66 510	3 201	3 262	65 670	24 220	82 160	20 530	19 260	4 538	13 480	31 740
	1985	133 500	7 122	1 346	22 030	19 270	53 010	7 643	20 290	3 323	25 110	12 670
Total	1981	76 430	1 930	10 680	42 530	9 439	44 890	5 368	9 457	2 086	4 407	67 710
	1982	64 530	502	4 388	59 640	22 221	48 370	7 899	12 720	3 209	6 788	93 590
	1983	57 580	509	5 236	42 350	23 130	48 930	9 387	14 350	2 797	7 412	74 330
	1984	72 210	8 337	3 389	84 920	31 060	87 290	20 610	19 450	5 776	14 850	38 640
	1985	166 400	11 119	1 641	37 160	27 160	60 090	7 721	20 660	4 961	28 170	16 500

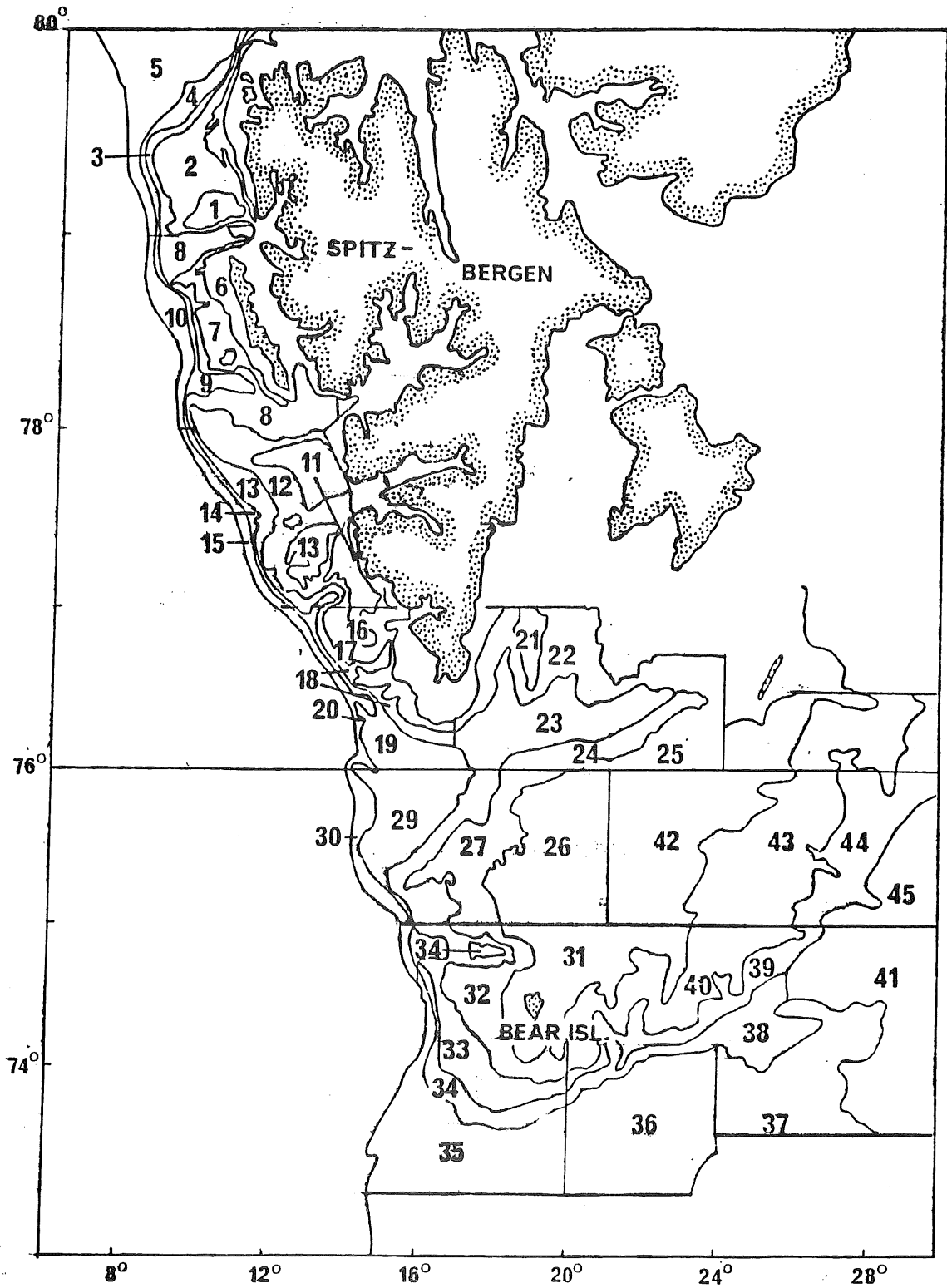


Fig.1. The area of investigation with the different strata.

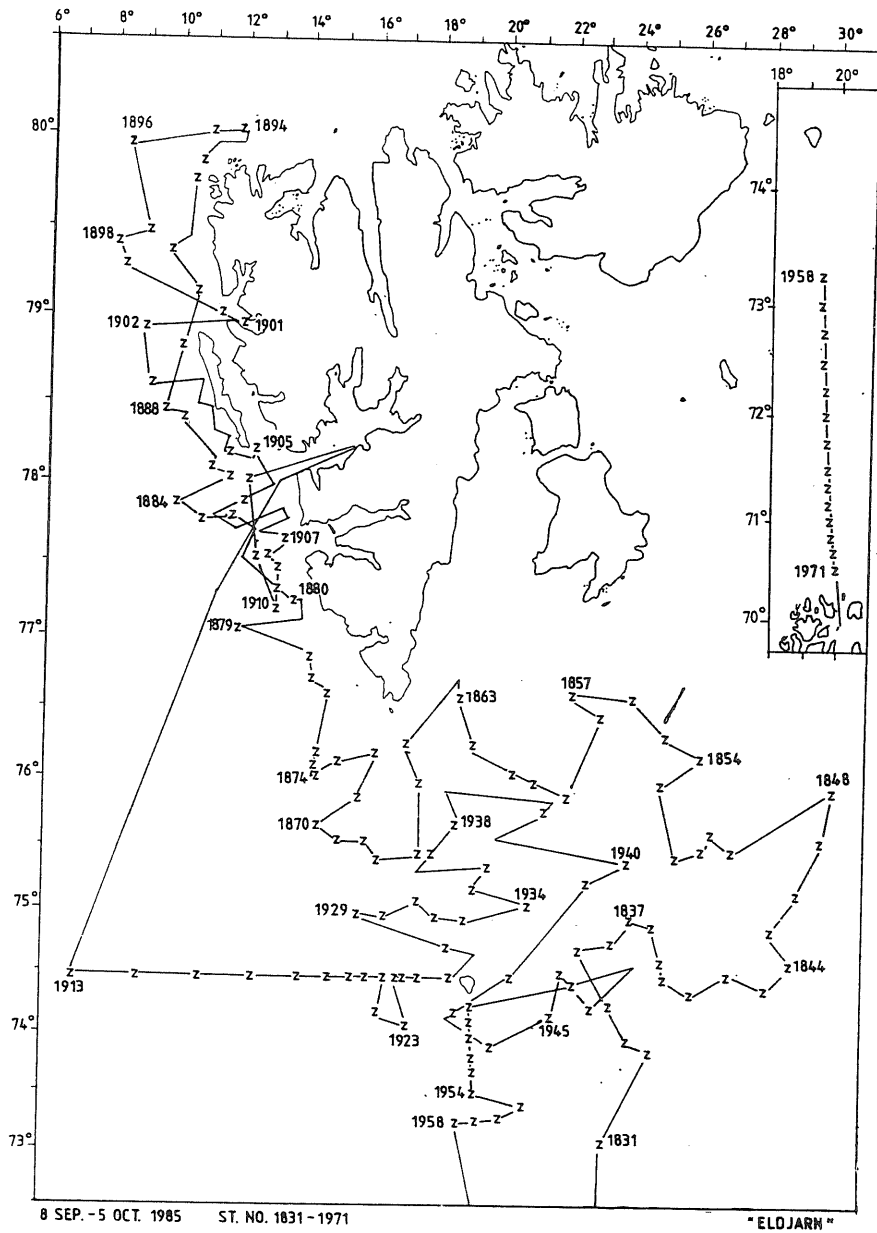


Fig.2. Survey tracks and hydrographic stations taken by R/V "Eldjarn" in the period 10 September - 5 October 1985.

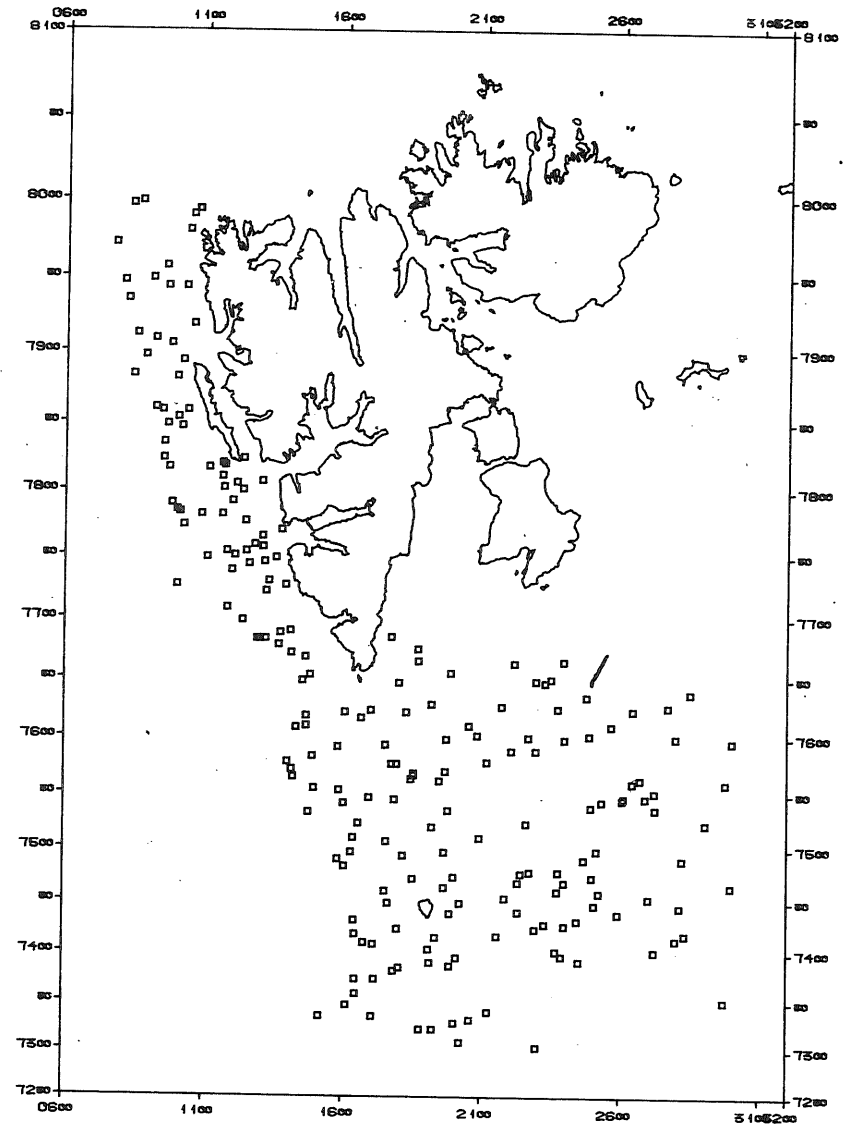


Fig.3. Bottom trawl stations taken by R/V "Eldjarn" and M/Tr "Raiti" 10 September - 5 October 1985.

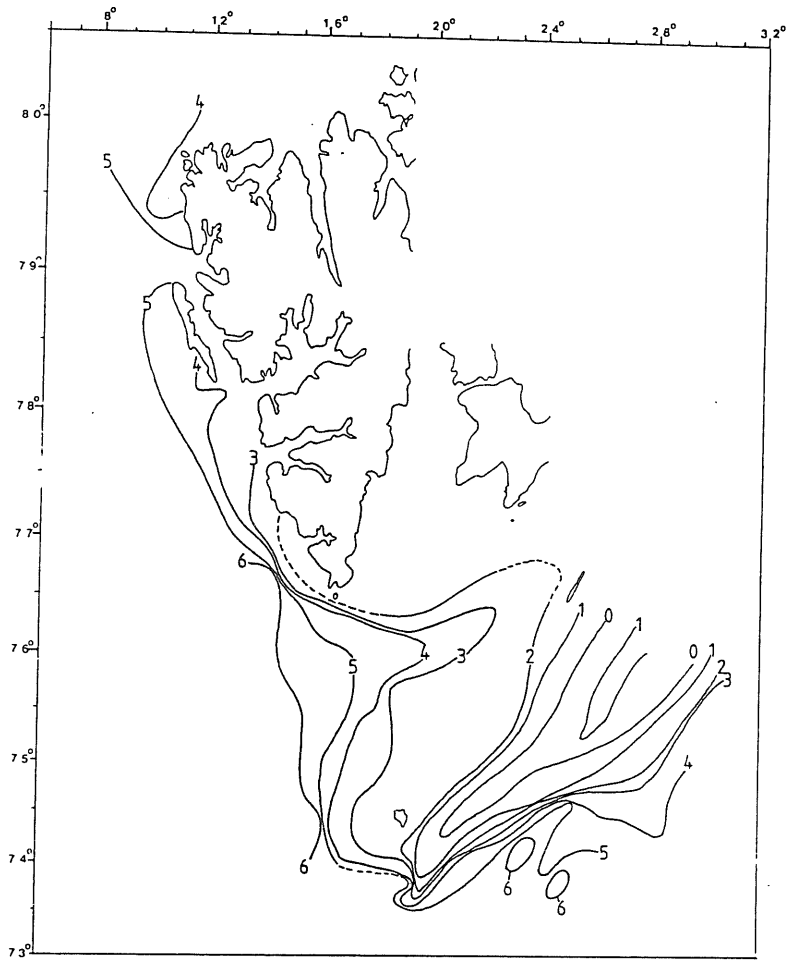


Fig.4. Temperature ( $^{\circ}$ C) in 50 meters depth.

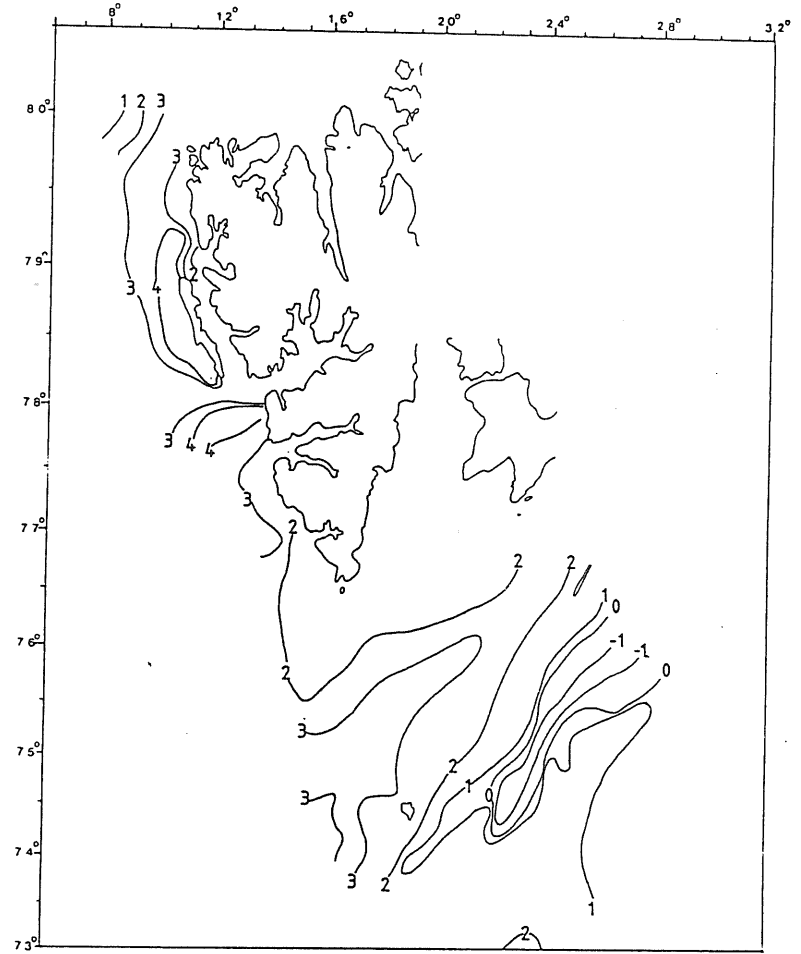


Fig.5. Temperature ( $^{\circ}$ C) at the bottom.

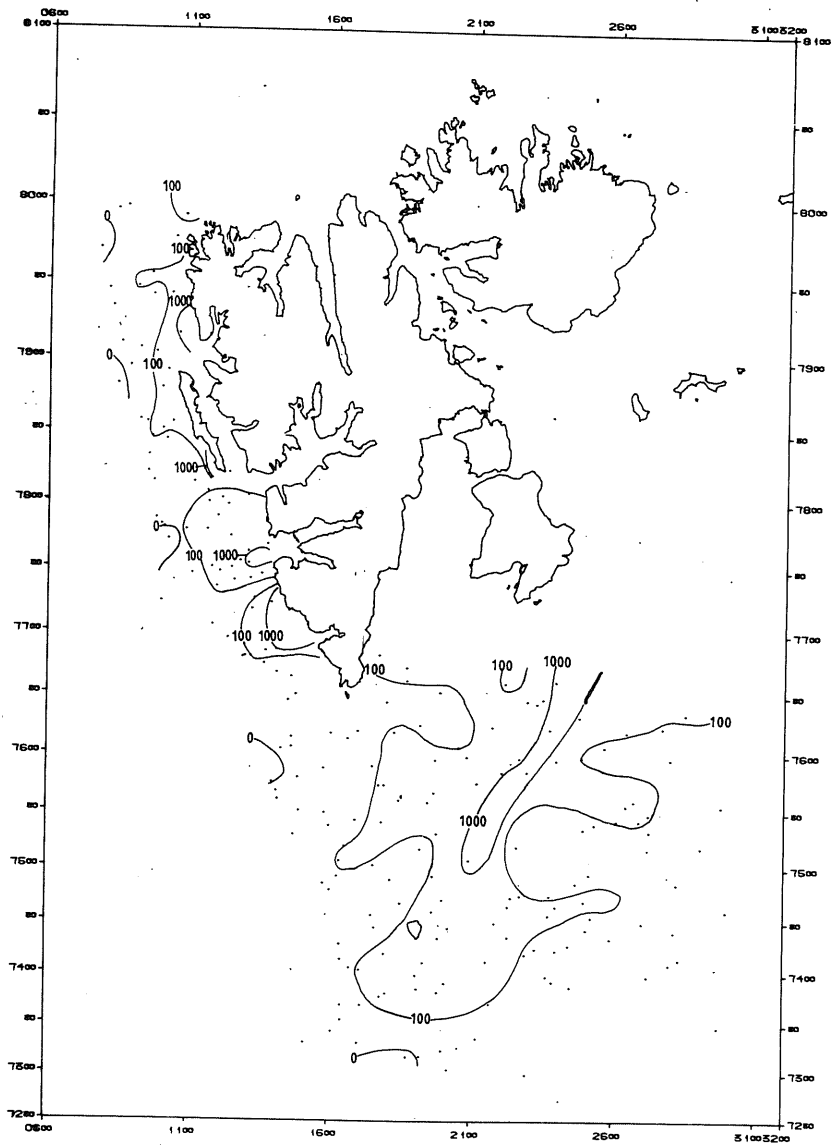


Fig.6. Distribution of cod in the trawl catches (numbers per hour trawling).

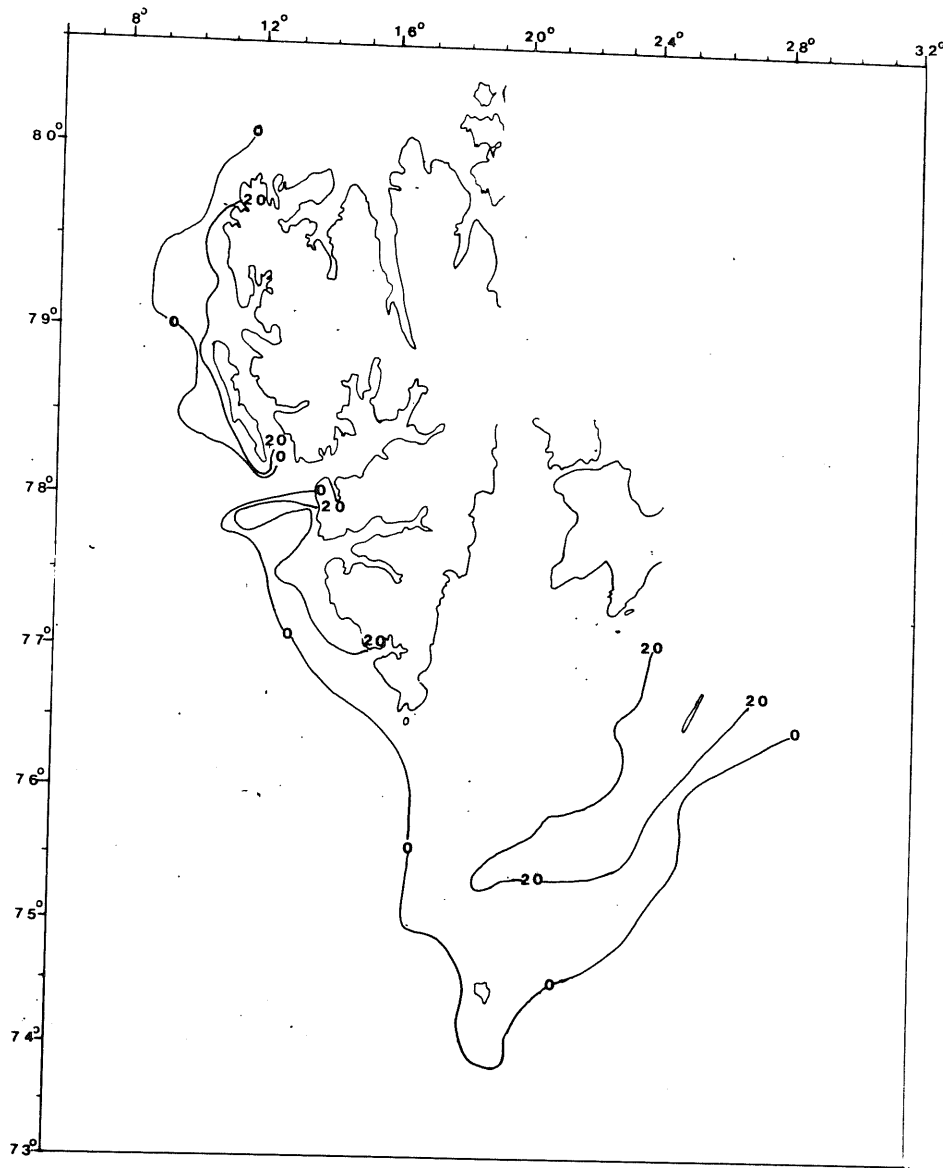


Fig.7. Distribution of acoustic abundance of cod and haddock together.

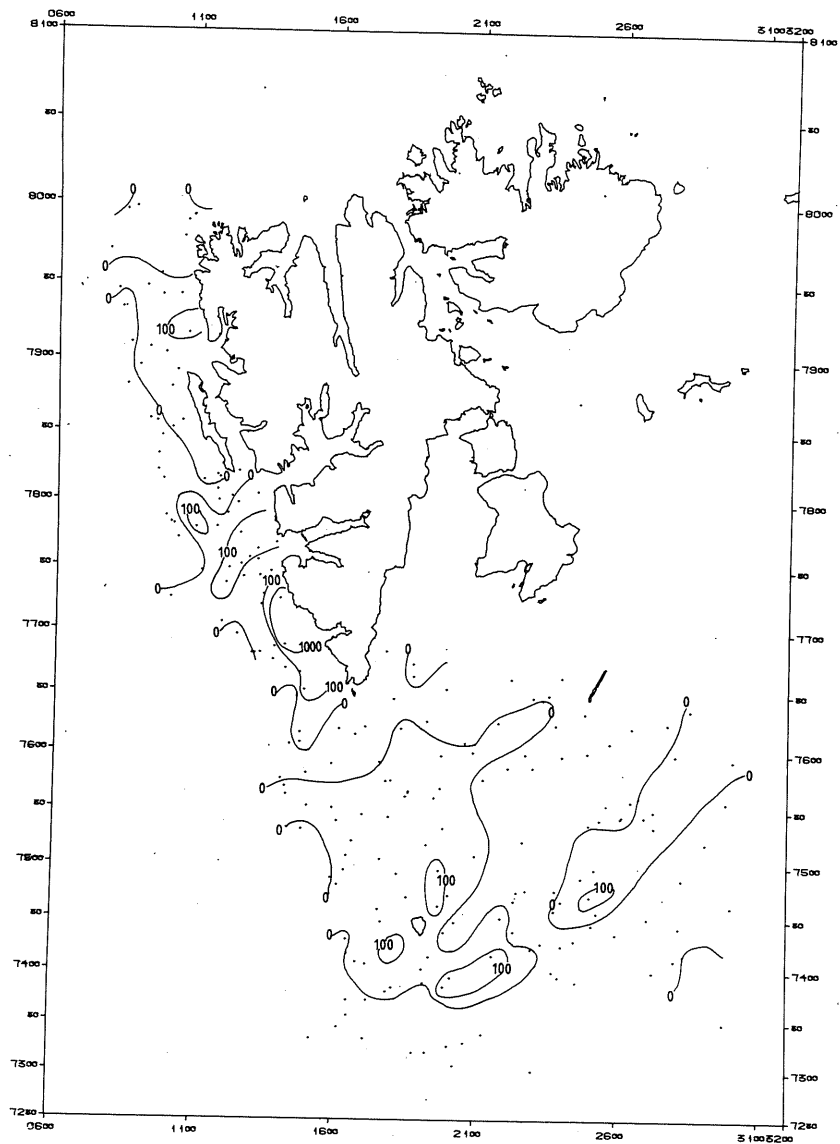


Fig.8. Distribution of haddock in the trawl catches (numbers per hour trawling).

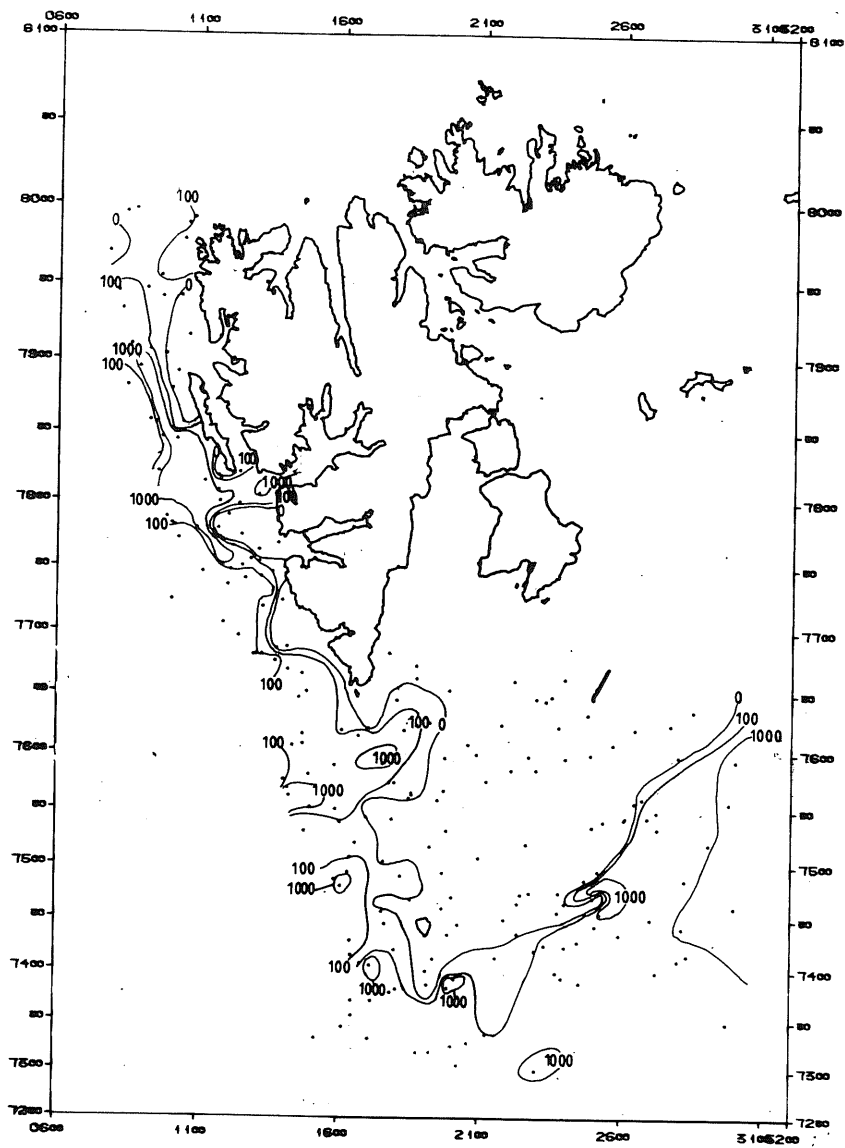


Fig.9. Distribution of *Sebastes mentella* in the trawl catches (numbers per hour trawling).

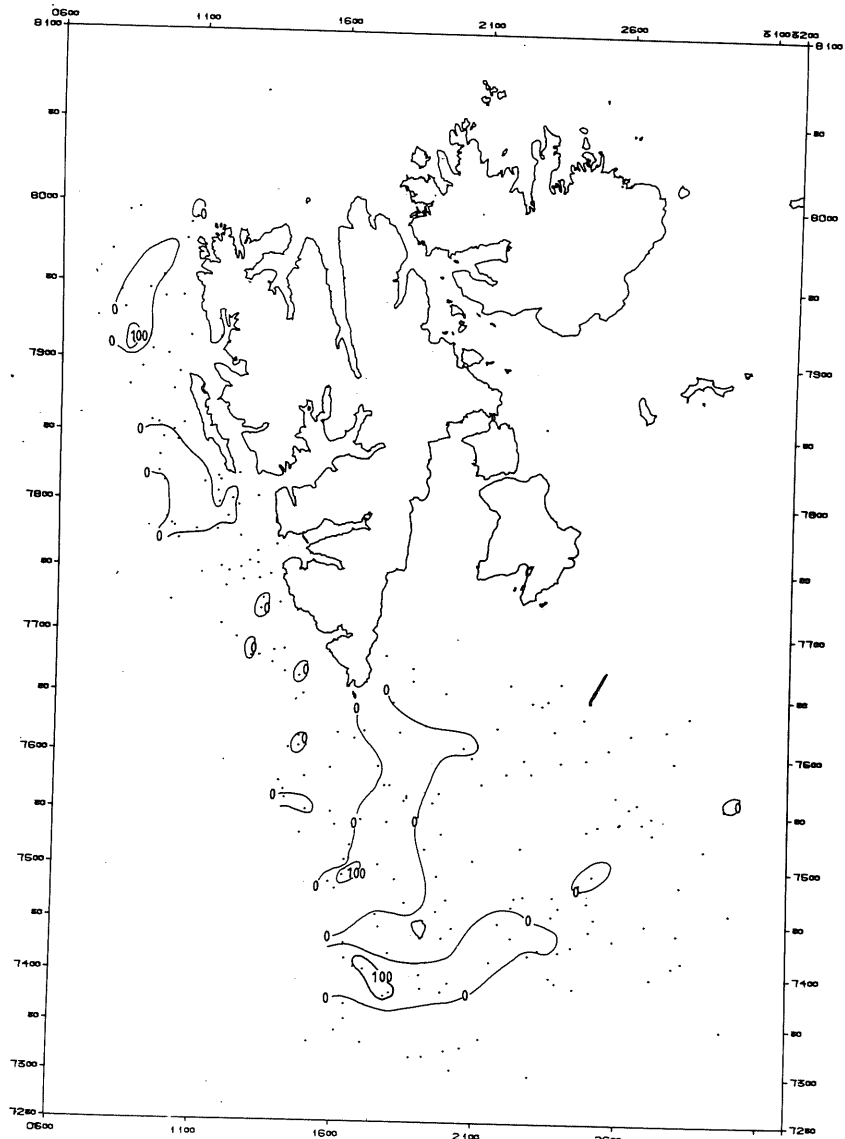


Fig.10. Distribution of Sebastes marinus in the trawl catches (numbers per hour trawling).

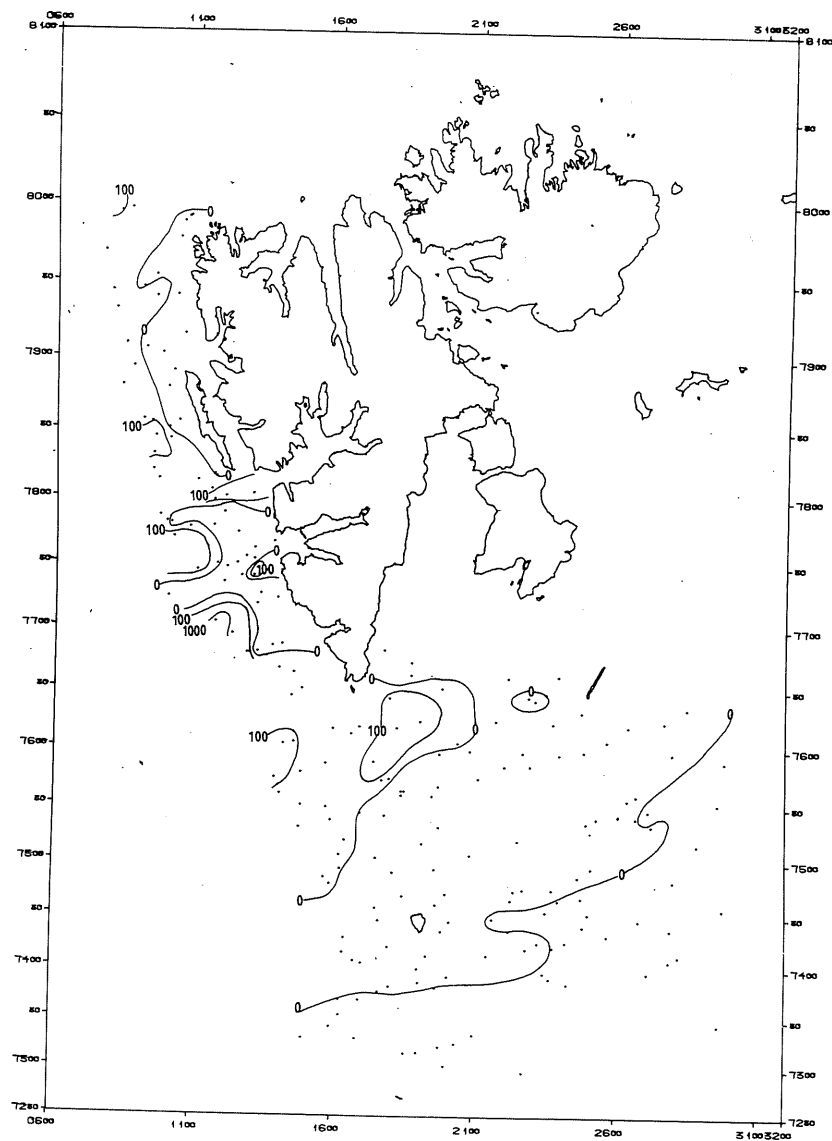


Fig.11. Distribution of Greenland halibut in the trawl catches (numbers per hour trawling).

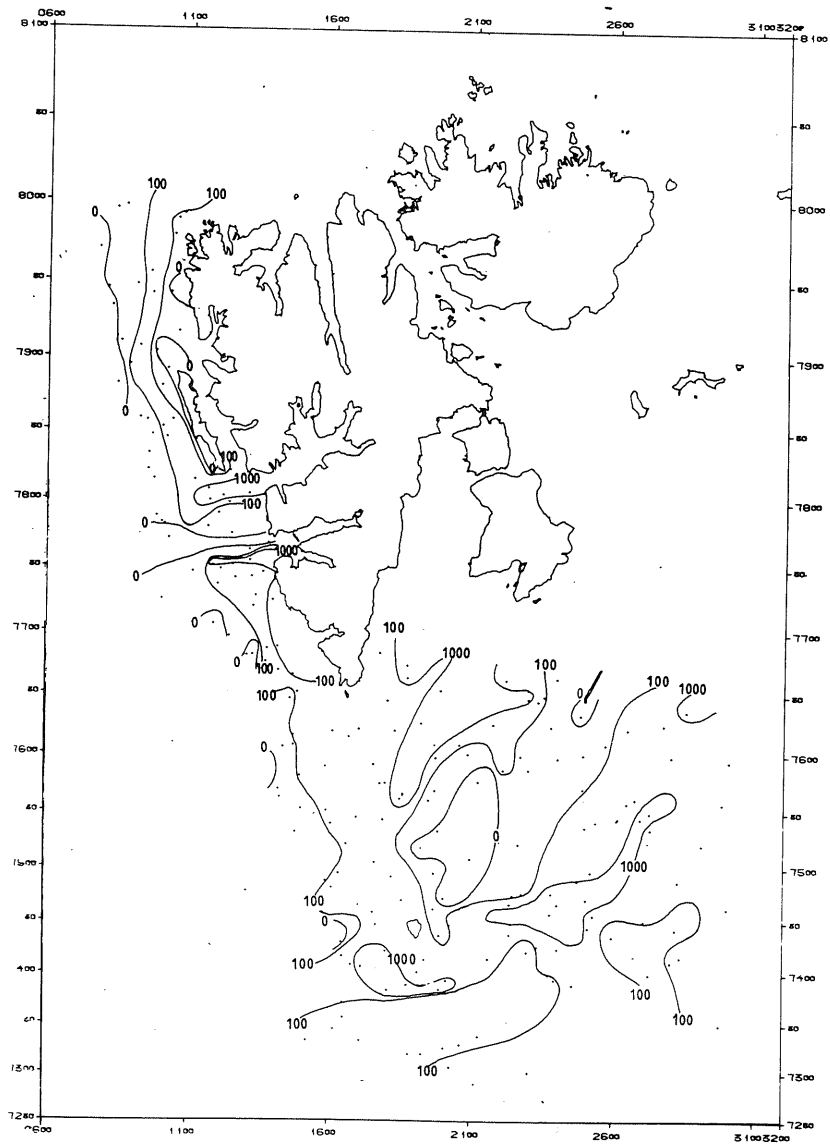


Fig.12. Distribution of long rough dab in the trawl catches (numbers per hour trawling).

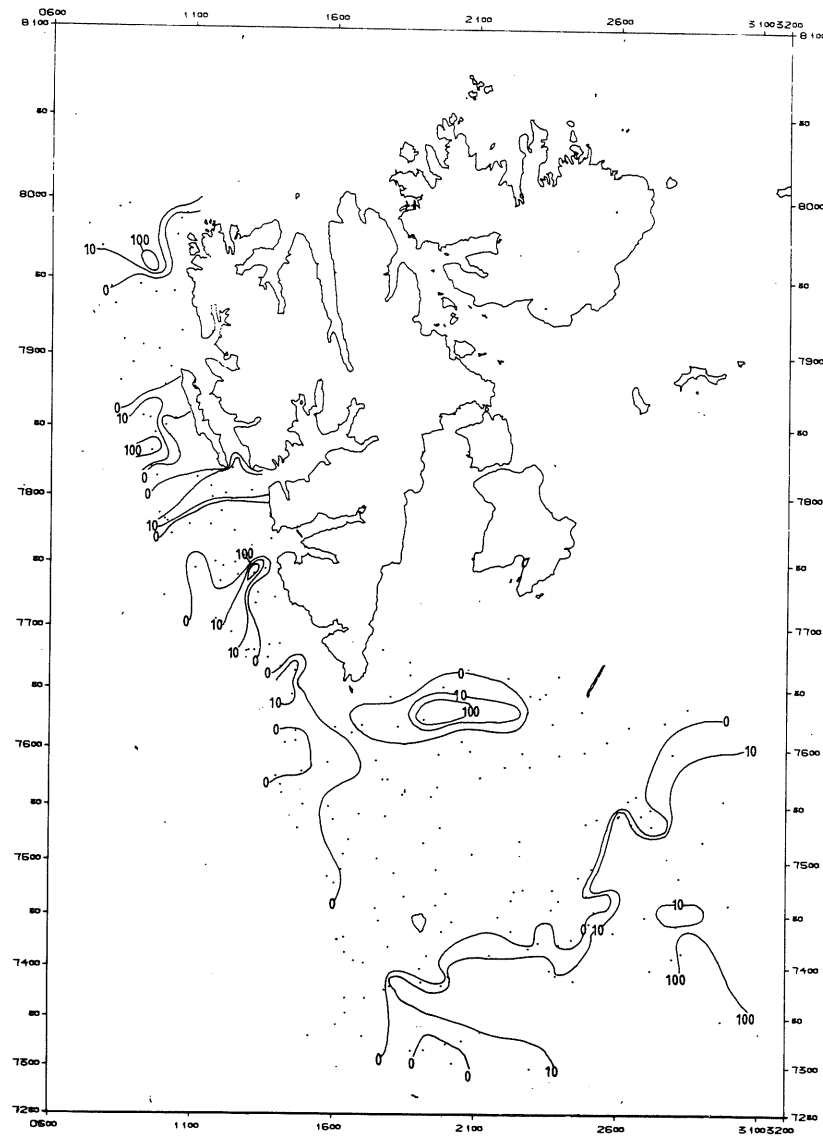


Fig.13. Distribution of shrimps in the trawl catches (kilograms per hour trawling).



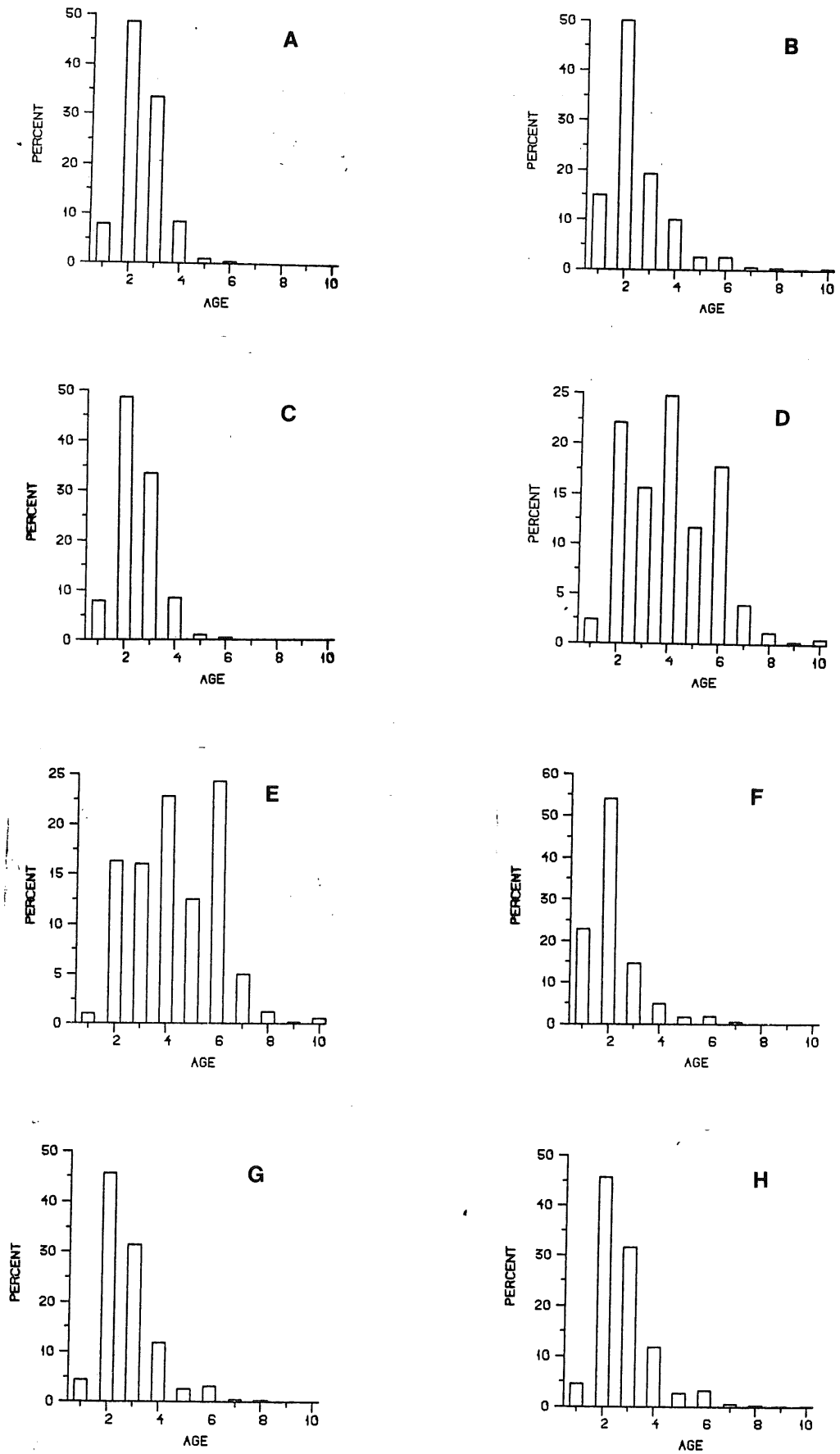


Fig.14. Age distribution of cod. A:0-100m, B:100-200m, C:200-300m, D:300-400m, E:deeper than 400m, F:Northern area, G:Southern area, H:Total area.

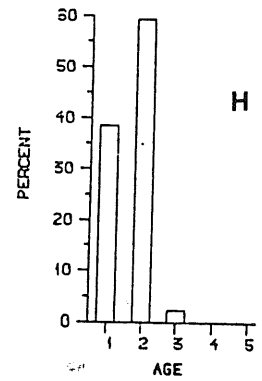
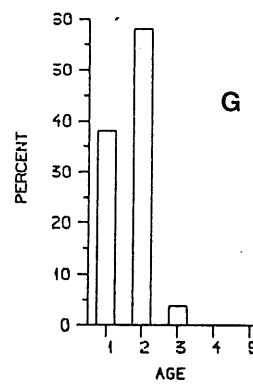
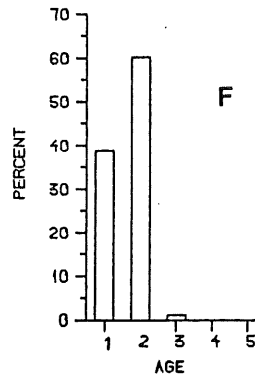
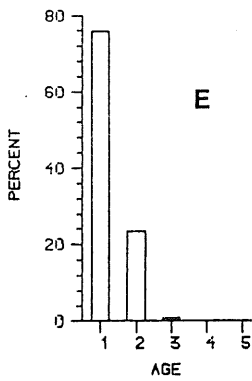
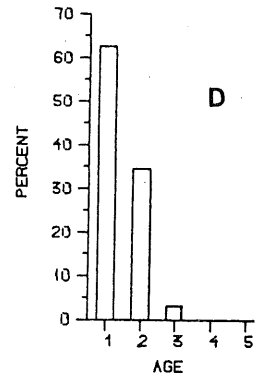
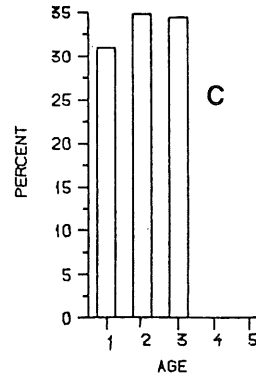
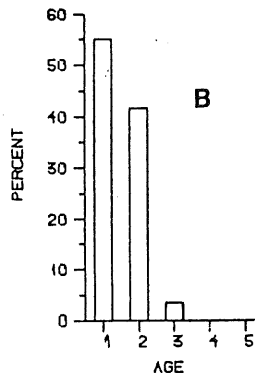
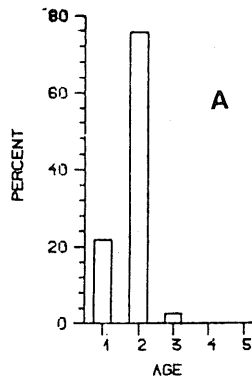


Fig.15. Age distribution of haddock. A:0-100m, B:100-200m, C:200-300m, D:300-400m, E:deeper than 400m, F: Northern area, G:Southern area, H:Total area.

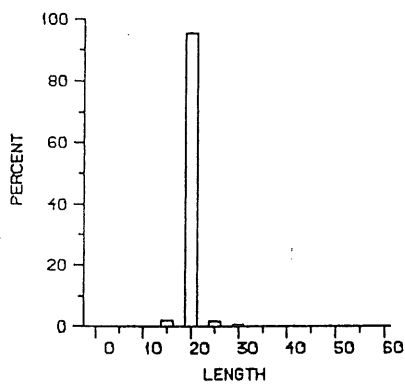


Fig.16. Length distribution of saithe.

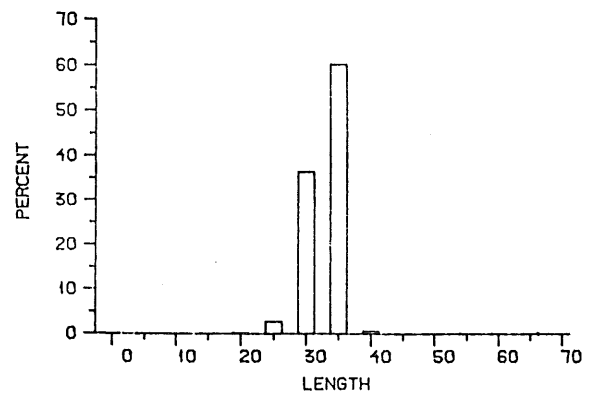


Fig.17. Length distribution of blue whiting.

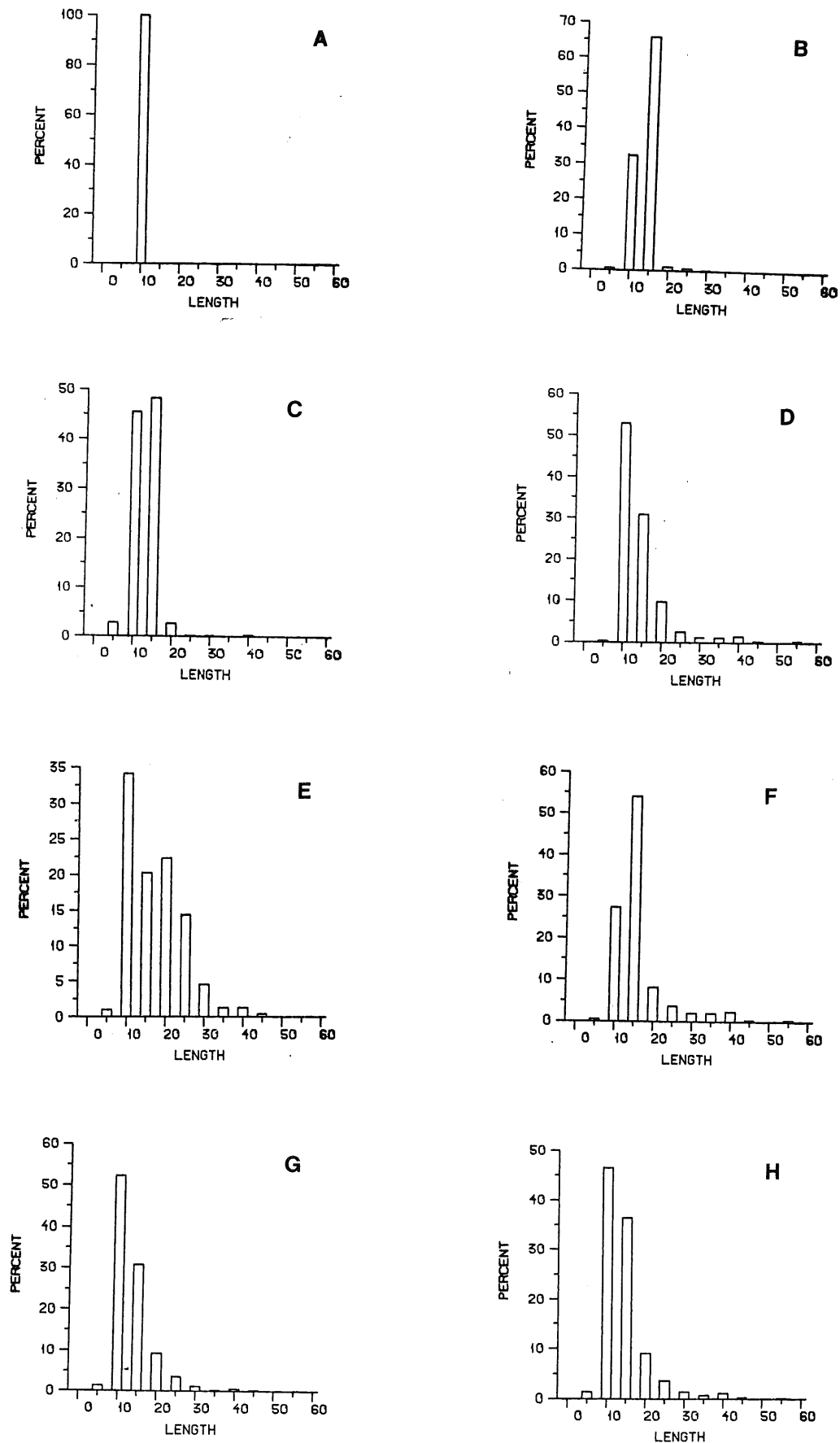


Fig.18. Length distribution of *S.mentella*. A:0-100m, B:100- 200m, C:200-300m, D:300-400m, E:deeper than 400m, F:Northern area, G:Southern area, H:Total area.

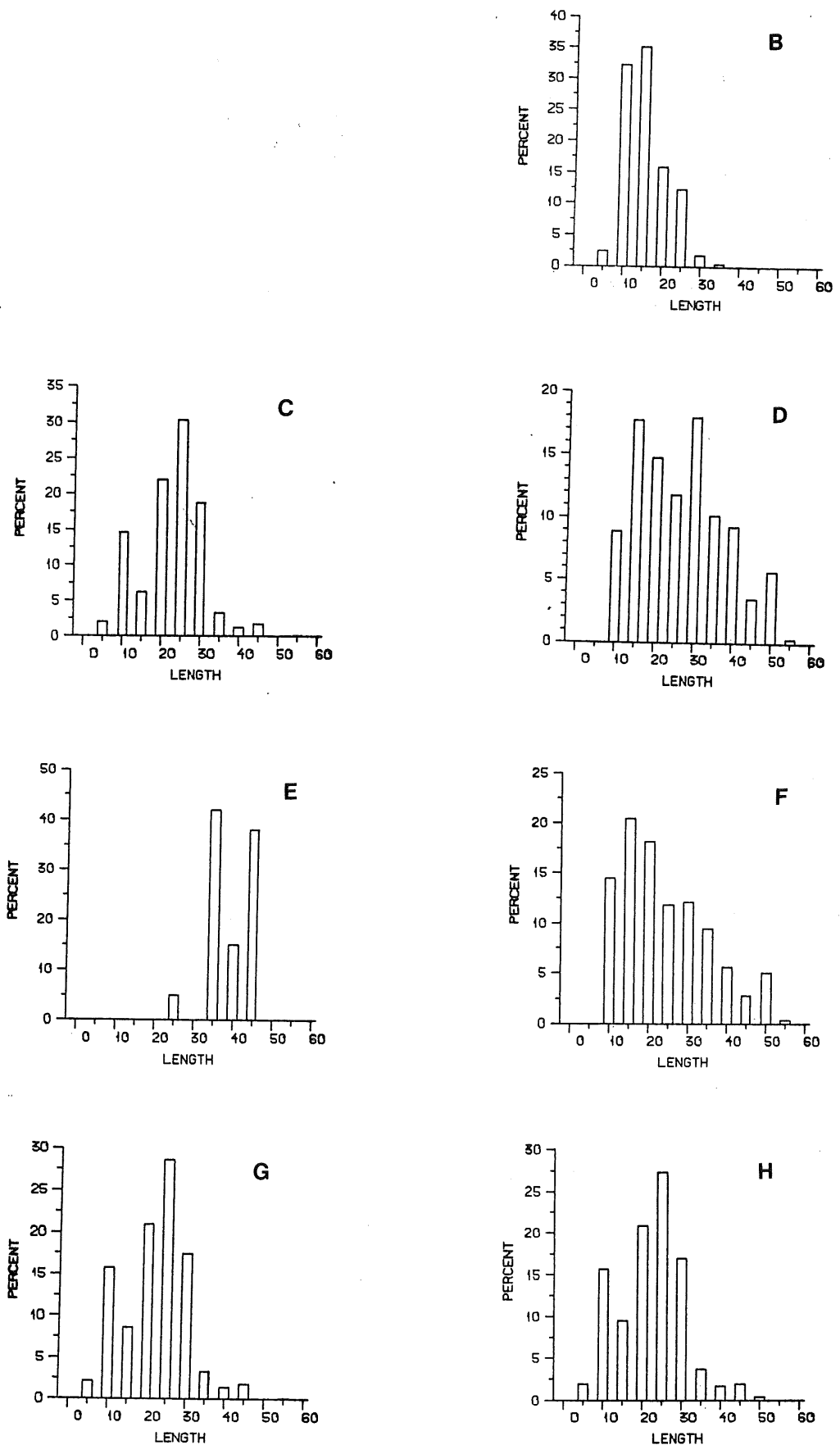


Fig.19. Length distribution of *S.marinus*. A:0-100m, B:100-200m, C:200-300m, D:300-400m, E:deeper than 400m, F:Northern area, G:Southern area, H:Total area.

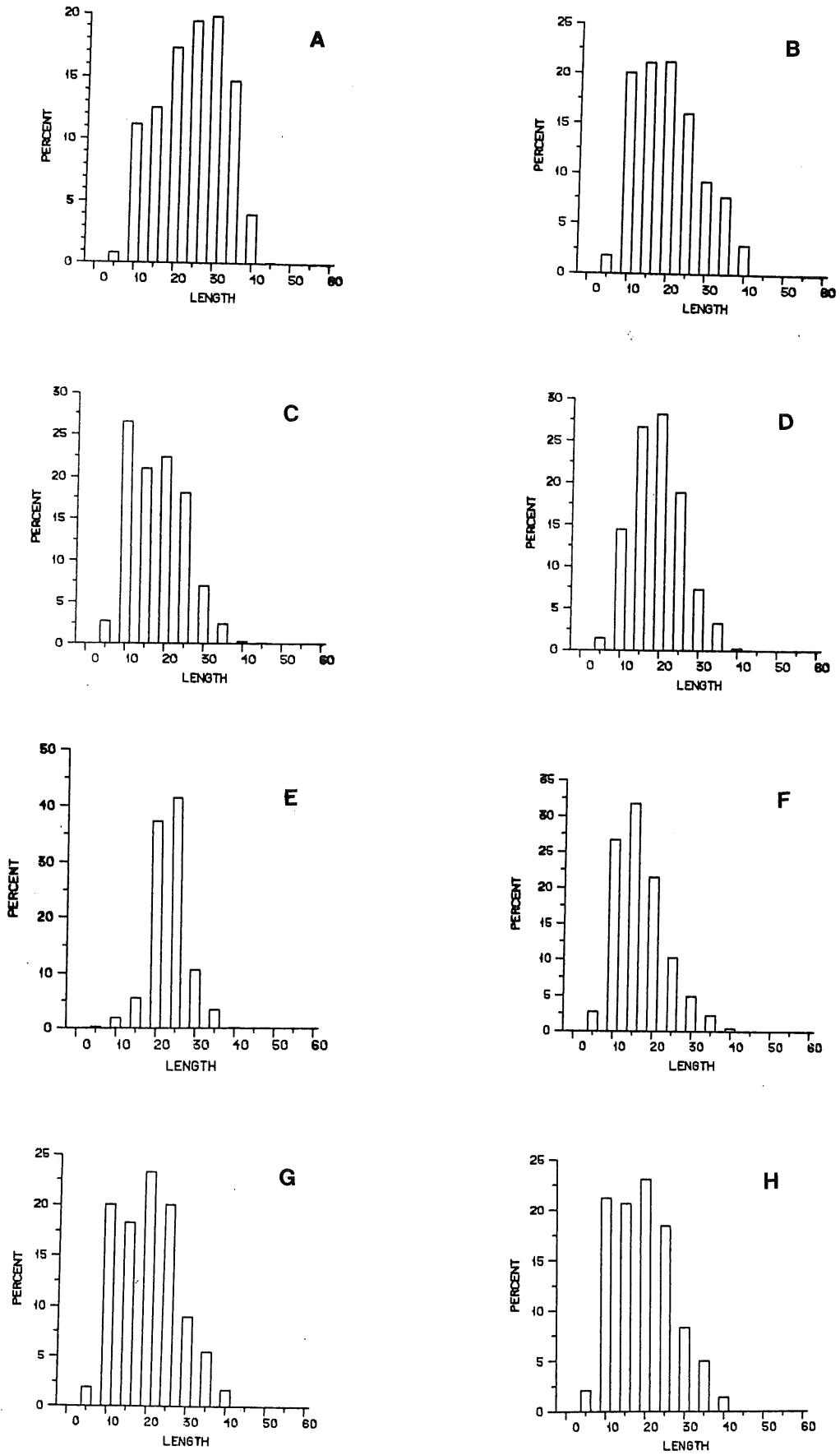


Fig.20. Length distribution of long rough dab. A:0-100m, B:100-200m, C:200-300m, D:300-400m, E:deeper than 400m, F:Northern area, G:Southern area, H:Total area.

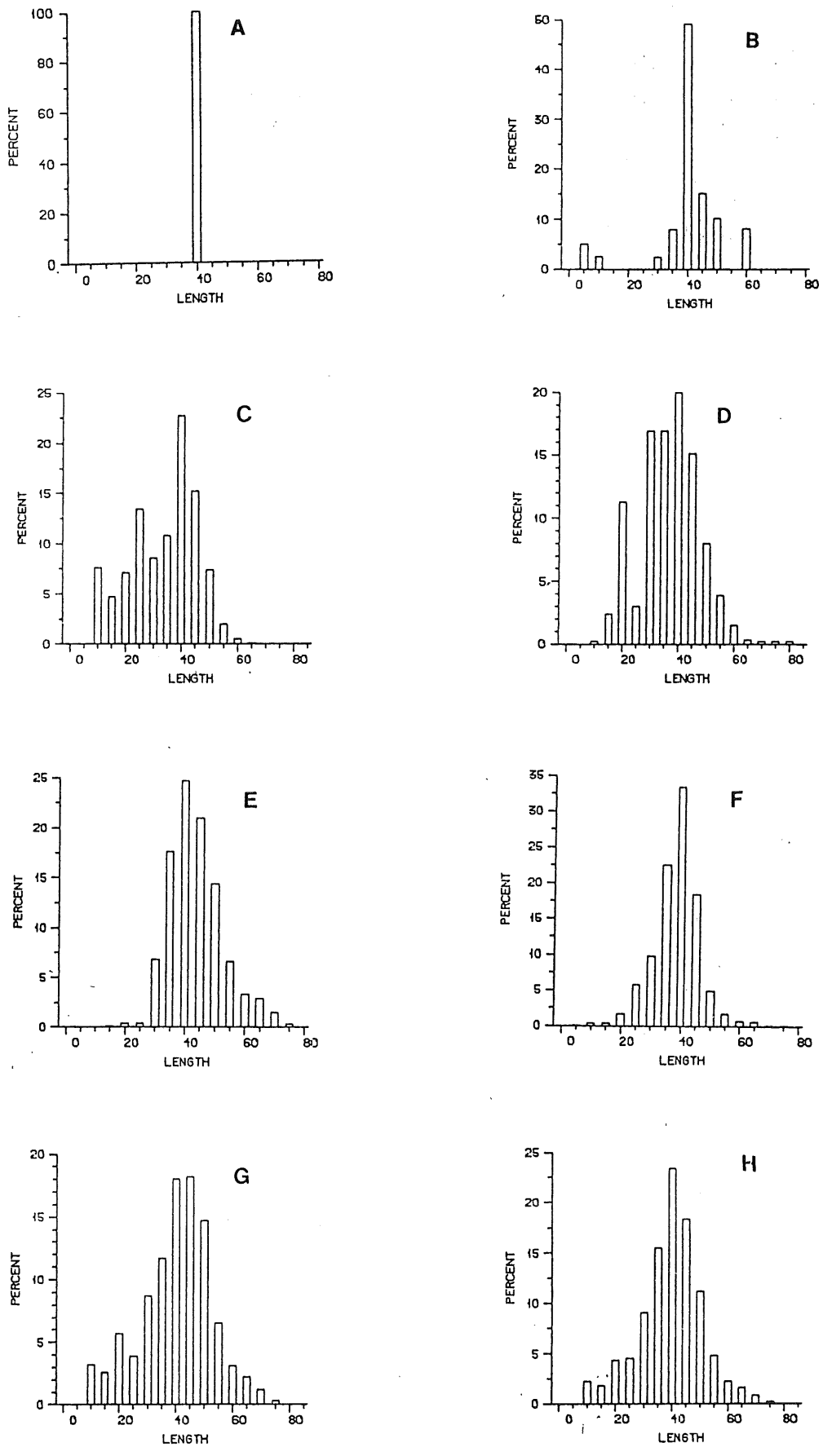


Fig.21. Length distribution of Greenland halibut. A:0-100m. B:100-200m. C:200-300m. D:300-400m. E:deeper than 400m. F:Northern area. G:Southern area. H:Total area.