

**DISTRIBUTION, ABUNDANCE AND ADJUSTED INDICES FOR  
COD, HADDOCK, REDFISH AND GREENLAND HALIBUT  
IN THE BARENTS SEA WINTER 1997**

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## 1. NARRATIVE

The annual Norwegian combined acoustic and bottom trawl survey for demersal fish was carried out in the period 3 February to 1 March 1997 by R/V "G.O. Sars", R/V "Johan Hjørt" and hired R/V "Jan Mayen". Fig.1.1 shows course tracks and trawl stations and Fig. 1.2 presents the survey area with main areas A, B, C, D and additional areas D', E and S (part of the Svalbard-area). Table 1.1 gives the size of each main area and additional areas covered each year in the time series 1981-1997.

Due to several uncontrollable circumstances it was only possible to cover the Norwegian zone of the Barents Sea winter 1997. The indices for 1997 are adjusted by dividing the indices for the Norwegian zone by the corresponding indices for 1996 and multiplying by the total for 1996. The reason for using 1996-indices for adjustment is that of the years with a complete coverage (1993-1996) the oceanographic conditions were most similar in 1996 and 1997.

230 CTD stations and 279 trawl stations, 192 predetermined bottom trawl stations, were performed during the survey. 178 of the predetermined bottom trawl stations are included in the calculations of the swept-area indices (Fig. 1.2). 13 of the trawl stations were pelagic trawl hauls for identification of acoustic registrations (species and size group). Table 1.2 gives an overview of the material collected.

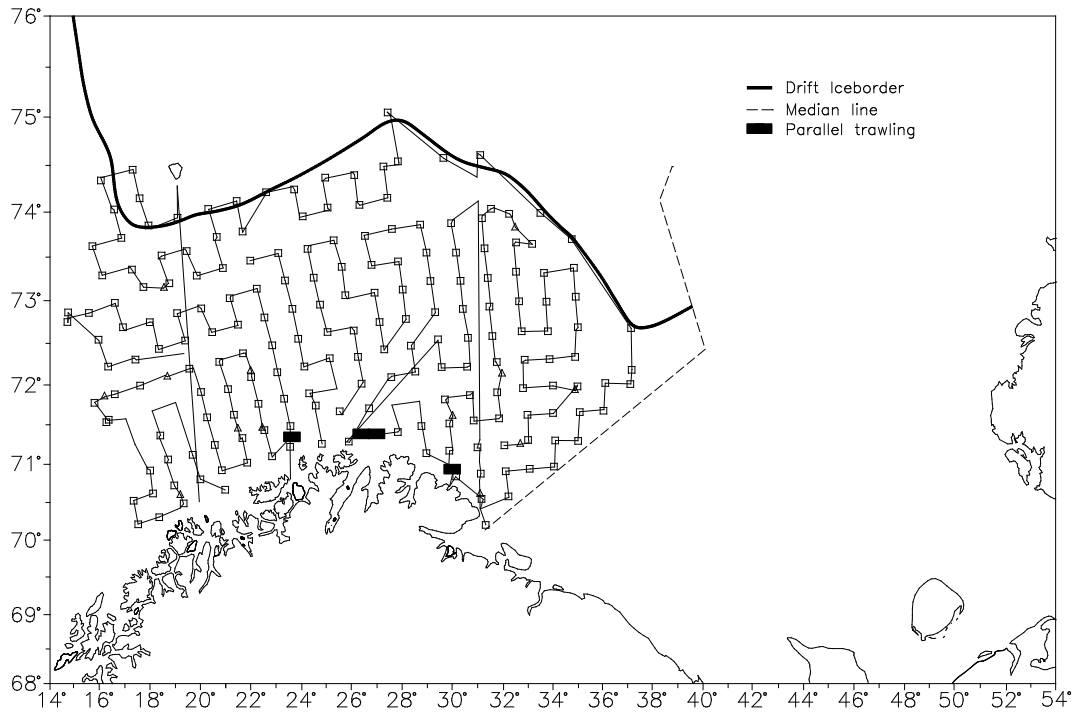


Figure 1.1. Survey tracks and trawl stations; R/V "G.O. Sars" 8.2-1.3, R/V "Johan Hjort" 8.2-18.2 and R/V "Jan Mayen" 3.2-27.2 1997. Iceborder is indicated.

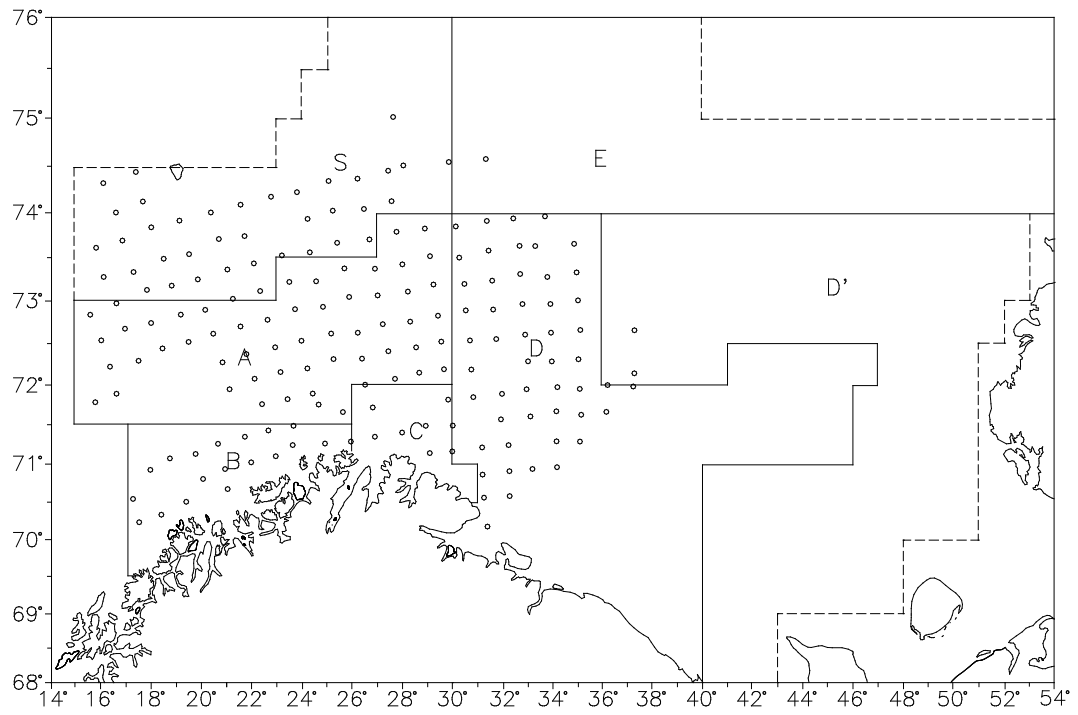


Figure 1.2. The survey area with main areas A, B, C and D, additional areas D', E and S and stations taken in the bottom trawl survey 8.2 - 1.3 1997.

Table 1.1. Area (n.miles<sup>2</sup>) covered in the bottom trawl surveys in the Barents Sea winter 1981-1997.

Area	Year					
	1981-1992	1993	1994	1995	1996	1997 <sup>1</sup>
A	23299	23929	27131	27131	25935	27581
B	8372	8372	8372	8372	9701	9701
C	5348	5348	5348	5348	5048	5048
D	51116	51186	51186	51186	53932	23592
D'	-	23152	24975	56822	53247	2684
E	-	8965	12576	14859	5818	1954
Svalbard		16690	14252	22836	11600	16989
ABCD	88835	88835	92037	92037	94016	65922
Total	88835	137642	143840	186554	165281	87549

<sup>1)</sup> Norwegian zone only

Table 1.2. Number of trawl stations, fish measured for length (L) and age (A) for main areas and trawl types in the Barents Sea (Norwegian zone) winter 1997. B1=fixed bottom trawl, B2=other bottom trawl, P=pelagic trawl.

Area	Trawl type	No. hauls	Cod		Haddock		S.marinus	S. mentella	Greenland halibut	
			L	A	L	A	L	L	L	A
A	B1		7035	777	5363	325	316	5732	104	
	B2		1	-	14	-	-	86	36	
	P		3	-	105	8	-	2	-	
B	B1		847	159	1727	143	353	345	8	
	B2		875	227	1576	172	212	153	1	
	P		2	-	68	10	2	-	-	
C	B1		877	89	1476	94	265	613	8	
	B2		8450	-	14619	-	3761	540	6	
	P		73	-	248	-	15	-	-	
D	B1		12282	710	4632	244	339	1216	115	
	B2		-	-	-	-	-	-	-	
	P		288	4	151	3	-	1	-	
D'	B1		279	10	-	-	-	-	-	
	B2		-	-	-	-	-	-	-	
	P		-	-	-	-	-	-	-	
E	B1		53	4	-	-	-	5	-	
	B2		-	-	-	-	-	-	-	
	P		-	-	-	-	-	-	-	
S	B1		4316	401	75	4	166	2304	396	
	B2		-	-	-	-	-	-	-	
	P		-	-	-	-	-	-	-	
Total	B1	178	25689	2150	13273	810	1439	10215	631	
	B2	88	9326	227	16209	172	3973	779	43	
	P	13	366	4	572	21	17	3	1	
Sum		279	35381	2381	30054	1003	5429	10997	675	635

## 2. OCEANOGRAPHIC CONDITIONS

Fig. 2.2 shows the iceborder and horizontal distribution of temperature at the surface, 100 m depth and at the bottom. Compared to February 1996 the iceborder was more southwards. In the western part of the Barents Sea the temperatures were similar to those observed last year, and it was actually a small increase in mean temperatures in 50-200 m depth in the sections "Fugløya-Bjørnøya" and "Vardø-Nord" (Fig. 2.1). In the eastern part of the Norwegian zone, however, the isotherms for 0E and -1E C was observed further to the west than in 1996. This indicates a somewhat cooler situation in the eastern part of the Barents Sea, and the same was observed during the 0-group investigations in August 1996.

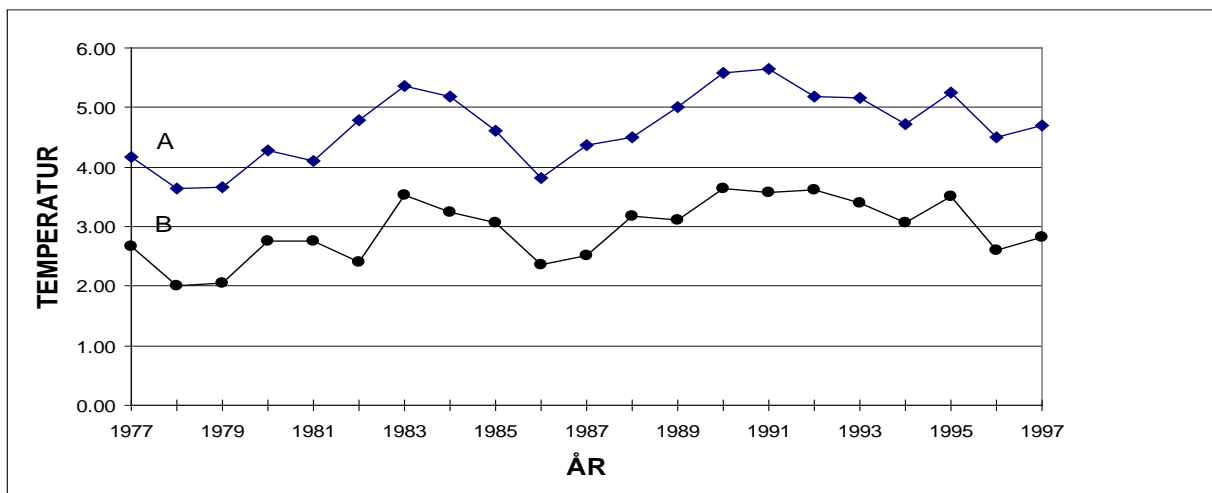


Fig. 2.1. Mean temperatures in 50-200 m depth in the sections "Fugløya-Bjørnøya" (A) and "Vardø-Nord" (B) March 1977 - 1997.

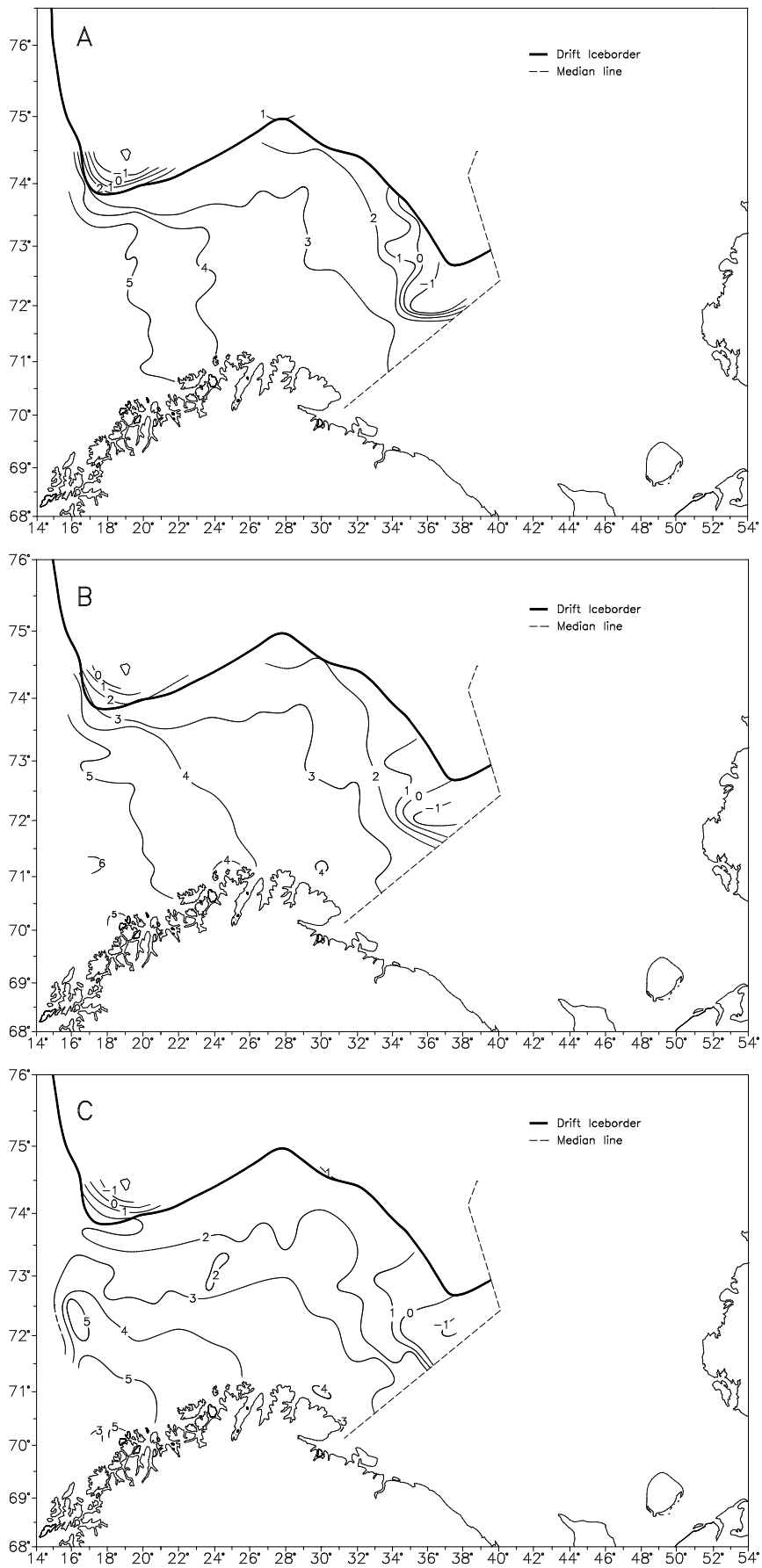


Figure 2.2. Temperature distribution February-March 1996. A) surface, B) 100 m depth, C) bottom.

### 3. DISTRIBUTION AND ABUNDANCE OF COD

#### 3.1 Bottom trawl investigations

Fig.3.1-3.4 show the distribution of cod < 20 cm, 20-34 cm, 35-49 cm and  $\geq 50$  cm, respectively (number per hour trawling). The highest catches of the smallest fish were made in the north-eastern part of the Norwegian zone. The more southern ice border caused a poorer coverage and delimitation towards north than in the previous years. The highest catches of medium sized cod (20-34 and 35-49 cm) were also made in the eastern part of the Norwegian zone, and neither these size groups were properly delimited northwards against the ice edge. Further south and west fewer dense registrations were found than in 1996. The largest cod was more westerly distributed, and the areas with dense registrations were smaller than last year, especially along the coast and in west at the edge of the continental shelf.

Table 3.1 presents abundance indices by 5-cm length group and area with standard error of mean and coefficient of variance (CV) for the total. In the area covered it was found less fish than in 1996, especially of cod larger than 40 cm. Table 3.2 gives indices at length and age, and Table 3.3 by age group and area.

The time series is presented in Table 3.4. The indices for 1997 are adjusted by dividing the indices for the Norwegian zone (Table 3.3 total) by the corresponding indices for 1996 and multiplying by the total for 1996. Compared to last year it was a little fewer 1 year old cod, somewhat more of the 2 and 3 group, about the half of 4-6 years old fish and about the same of older fish. Most of the 6-7 years and older fish are outside the survey area this time of the year on spawning migration along the coast and are only to a small extent covered by the investigation. Table 3.5 shows the proportion (%) of the different age groups found in the Norwegian zone in 1993-1996. The proportion is usually lowest for the youngest age groups and increases with age. The numbers for the plus group are very uncertain because of the few observations in this group.

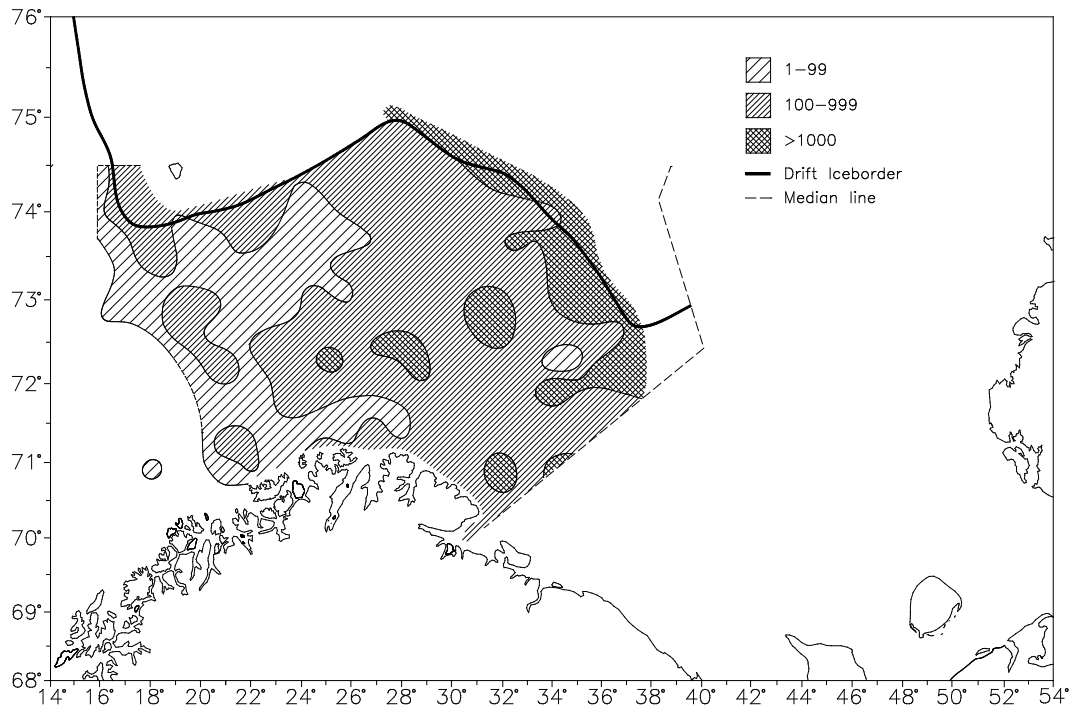


Figure 3.1. COD < 20 cm. Distribution in the trawl catches winter 1997 (number per hour trawling).

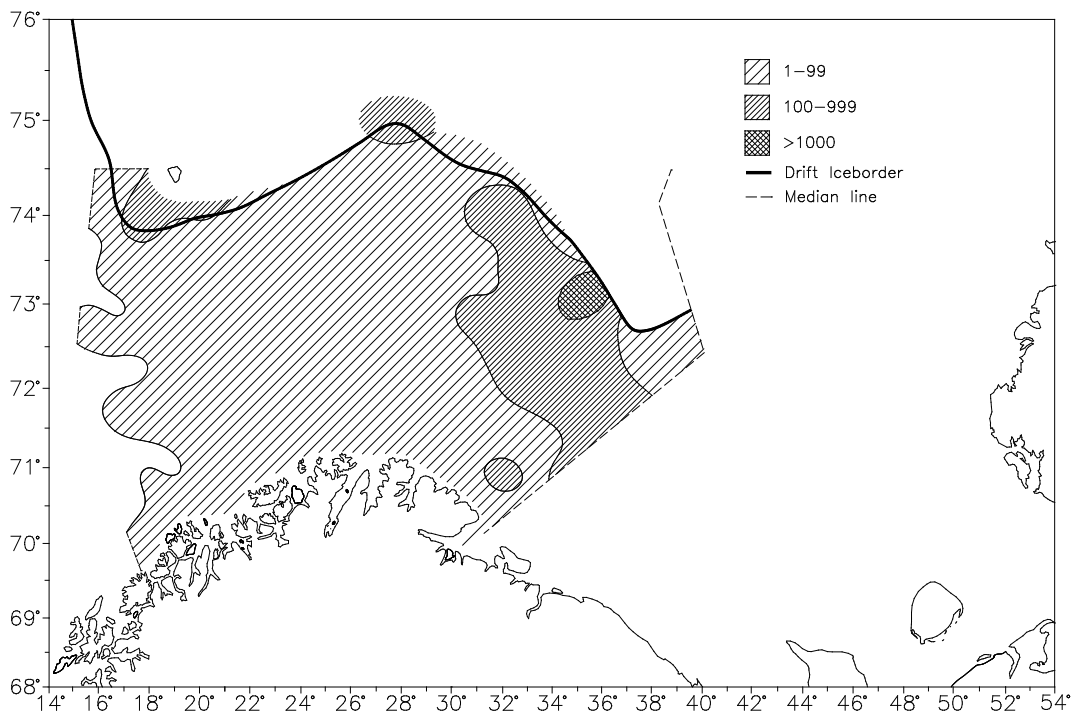


Figure 3.2. COD 20-34 cm. Distribution in the trawl catches winter 1997 (number per hour trawling).



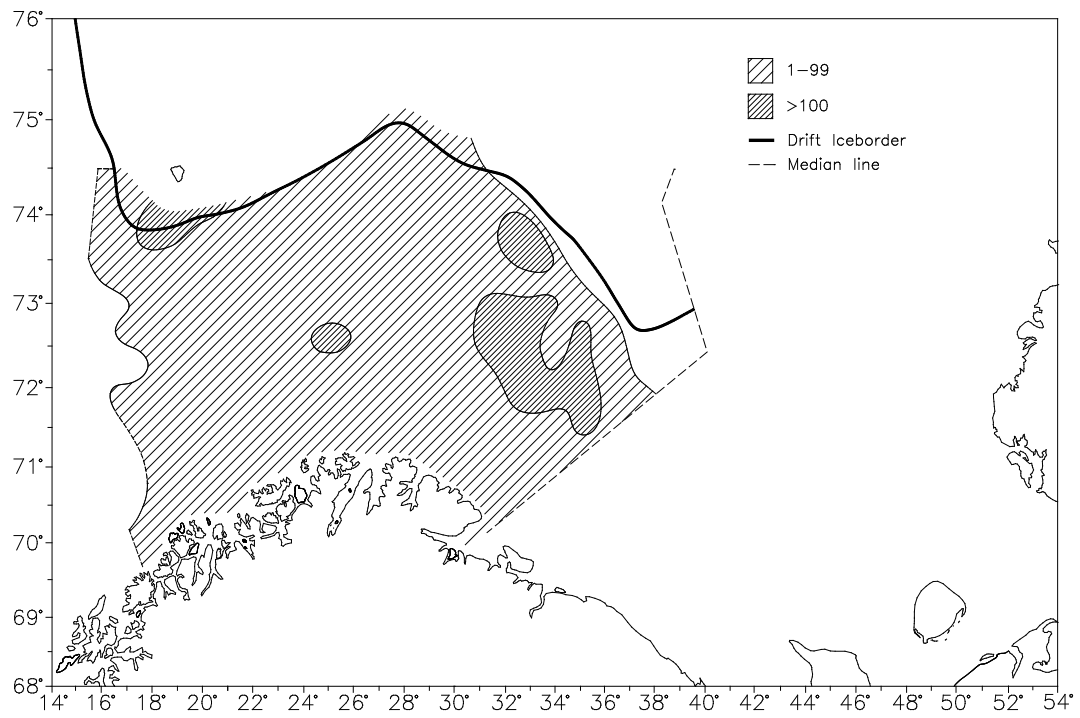


Figure 3.3. COD 35-49 cm. Distribution in the trawl catches winter 1997 (number per hour trawling).

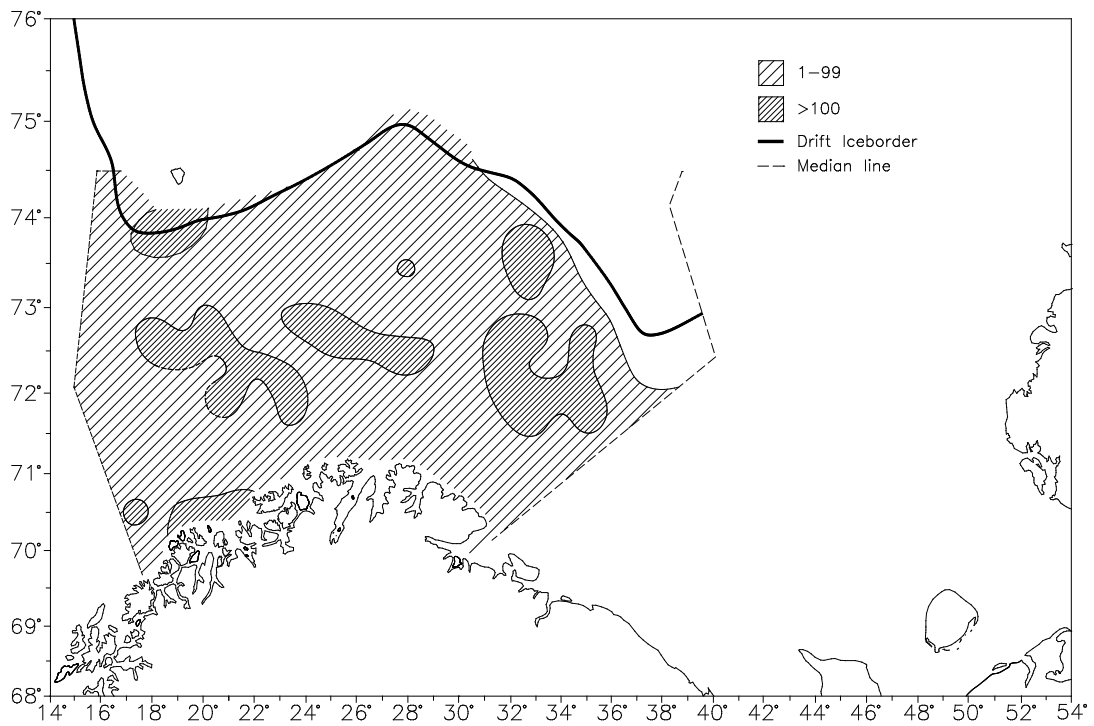


Figure 3.4. COD  $\dot{S}$  50 cm. Distribution in the trawl catches winter 1997 (number per hour trawling).

Table 3.1. COD. Abundance indices (I) at length with standard error of mean (S) from bottom trawl hauls for main areas of the Barents Sea (Norwegian zone) winter 1997 (numbers in millions).

Length (cm)	Area																
	A		B		C		D		D'		E <sup>1</sup>		S		Total		
	I	S	I	S	I	S	I	S	I	S	I	S	I	S	I	S	CV (%)
5-9	28.5	7.7	2.5	1.4	5.9	1.8	164.6	61.4	44.4	17.5			4.1	2.0	249.9	64.4	25.3
10-14	168.8	23.6	8.1	2.4	37.7	10.2	868.2	363.1	131.9	73.2			81.7	13.3	1296.4	371.6	24.2
15-19	27.8	4.3	2.3	0.9	1.9	0.8	95.6	31.8	12.2	10.3			31.8	19.2	171.7	38.8	21.3
20-24	8.7	1.1	0.8	0.3	0.7	0.3	70.4	24.9	2.6	2.2			22.5	12.0	105.6	27.8	25.2
25-29	4.7	0.6	0.2	0.1	0.9	0.4	44.1	9.7	0.8	0.7			6.5	2.0	57.3	9.9	17.3
30-34	4.3	0.5	0.8	0.3	0.9	0.4	42.1	8.5	0.2	0.2			5.8	1.7	54.0	8.7	16.1
35-39	3.5	0.7	0.4	0.1	0.5	0.4	22.8	4.5					2.9	1.0	30.1	4.7	15.5
40-44	3.4	0.7	0.4	0.2	0.4	0.3	15.9	3.0					4.1	1.2	24.1	3.3	13.5
45-49	5.2	0.8	0.6	0.1	0.5	0.4	16.0	3.1					5.1	1.4	27.1	3.5	12.7
50-54	8.4	1.2	0.8	0.2	0.8	0.3	16.2	3.3					4.2	1.1	30.3	3.7	12.3
55-59	10.2	1.4	1.4	0.3	0.7	0.3	12.2	2.6					4.4	1.2	28.9	3.2	11.1
60-64	9.0	1.2	1.9	0.4	0.9	0.4	6.1	1.1					2.3	0.6	20.2	1.8	9.0
65-69	6.1	0.9	2.3	0.6	0.8	0.5	2.7	0.4					1.3	0.4	13.2	1.3	10.0
70-74	3.6	0.5	2.4	0.7	0.6	0.4	1.4	0.2					0.8	0.2	8.7	1.0	11.9
75-79	1.9	0.3	1.4	0.5	0.5	0.3	0.9	0.2					0.6	0.2	5.2	0.7	14.0
80-84	0.7	0.2	0.5	0.2	0.2	0.2	0.4	0.1					0.1	0.1	2.0	0.4	17.9
85-89	0.2	0.1	0.2	0.1	0.1	+	0.1	0.1					0.1	+	0.6	0.1	20.2
>90	0.3	0.1	0.3	0.1	+	+	0.5	0.1					+	+	1.1	0.2	16.2
Sum	295.0	25.4	27.0	3.3	53.9	10.5	1380.3	370.8	192.1	76.0			178.3	26.6	2126.7	380.4	15.9

<sup>1)</sup> Only 1 station, not included in estimate

Table 3.2. COD. Abundance indices at length and age from the bottom trawl survey in the Barents Sea (Norwegian zone) winter 1997 (numbers in millions).

Length (cm)	Age (yearclass)										Sum
	1 (96)	2 (95)	3 (94)	4 (93)	5 (92)	6 (91)	7 (90)	8 (89)	9 (88)	10+ (87+)	
5-9	249.9										249.9
10-14	1278.8	17.6									1296.4
15-19	2.8	168.9									171.7
20-24	2.2	93.8	9.6								105.6
25-29		14.9	42.4								57.3
30-34		0.3	49.5	4.2							54.0
35-39			13.4	16.4	0.4						30.1
40-44			0.8	17.3	5.9	0.1					24.1
45-49			0.2	10.4	16.5	0.2					27.1
50-54				2.5	21.3	6.3	0.1				30.3
55-59				0.1	10.6	17.2	0.9	+			28.9
60-64					1.3	15.5	3.4	+			20.2
65-69						4.3	8.8	0.2			13.2
70-74						0.9	7.1	0.7			8.7
75-79							3.7	1.5	+		5.2
80-84							0.5	1.2	0.2		2.0
85-89							0.1	0.3	0.2	+	0.6
>90							+	0.6	0.3	0.2	1.1
Sum	1533.8	295.4	116.0	50.9	56.0	44.4	24.6	4.6	0.8	0.2	2126.7

Table 3.3. COD. Abundance indices from bottom trawl hauls for main areas of the Barents Sea (Norwegian zone) winter 1997 (numbers in millions).

Area	Age (Yearclass)										Total
	1 (95)	2 (94)	3 (93)	4 (92)	5 (91)	6 (90)	7 (89)	8 (88)	9 (87)	10+ (86+)	
A	190.6	45.1	9.5	6.8	12.5	18.0	11.0	1.4	0.2	+	295.0
B	8.8	4.9	1.2	1.0	1.1	3.3	4.7	1.6	0.3	0.1	27.0
C	43.6	2.3	2.5	1.0	0.7	1.3	1.9	0.6	-	-	53.9
D	1028.8	173.9	88.7	34.8	33.3	15.1	4.8	0.7	0.2	+	1380.3
D'	176.3	15.6	0.2	-	-	-	-	-	-	-	192.1
E			-	-	-	-	-	-	-	-	-
S	85.7	53.6	14.0	7.3	8.5	6.7	2.2	0.2	0.1	-	178.3
ABCD	1271.8	226.2	101.9	43.6	47.6	37.7	22.4	4.3	0.7	0.2	1756.2
Total	1533.8	295.4	116.0	50.9	56.0	44.4	24.6	4.6	0.8	0.2	2126.7

Table 3.4. COD. Abundance indices from bottom trawl surveys in the Barents Sea winter 1981-1997 (numbers in millions). 1981-1992 includes only main areas A, B, C and D

Year	Age (years)										Total
	1	2	3	4	5	6	7	8	9	10+	
1981	4.6	34.3	16.4	23.3	40.0	38.4	4.8	1.0	0.3	0.0	163.1
1982	0.8	2.9	28.3	27.7	23.6	15.5	16.0	1.4	0.2	0.0	116.5
1983	341.9	19.0	22.3	37.1	33.3	13.5	4.6	3.0	0.6	0.2	474.4
1984	2864.4	393.2	115.9	26.2	18.9	10.6	3.2	0.5	0.2	0.1	3433.1
1985	51.5	727.6	144.4	99.5	15.7	6.4	2.5	0.2	0.1	0.1	1047.8
1986	741.8	461.5	657.1	137.1	75.0	23.3	5.5	0.6	0.2	0.1	2102.2
1987	33.4	457.4	233.4	365.5	46.1	11.3	1.4	0.4	+	0.0	1148.9
1988	5.0	72.9	185.2	95.3	189.5	19.1	3.6	0.6	0.1	0.0	571.3
1989	9.4	13.6	36.5	64.9	35.2	77.9	8.7	0.8	0.2	0.2	247.4
1990	161.0	50.8	23.3	30.1	33.6	19.7	23.9	1.3	0.4	0.1	344.1
1991	470.8	224.7	32.3	19.1	17.5	16.1	9.3	9.7	0.5	0.1	800.1
1992	131.6	528.9	149.6	49.5	18.4	11.8	7.5	4.0	2.7	0.2	904.3
1993	534.1	331.0	311.8	152.6	69.0	14.2	6.9	4.2	2.2	2.1	1430.2
1994	861.8	496.8	276.3	297.6	145.9	46.9	8.8	2.3	1.2	1.2	2138.8
1995	4892.4	503.8	288.2	231.2	249.2	70.4	18.0	2.2	0.7	1.0	6256.8
1996	5778.8	715.5	177.6	116.0	136.9	107.5	24.5	2.9	0.4	0.5	7060.5
1997 <sup>1)</sup>	5036.7	1037.6	243.5	68.1	78.5	56.1	29.7	6.4	1.1	1.0	6558.5

<sup>1)</sup> Adjusted indices

Table 3.5. Proportion (%) of the abundance indices from bottom trawl surveys in the Barents Sea winter 1993-1996 found in the Norwegian zone.

Year	Age (years)										Total
	1	2	3	4	5	6	7	8	9	10+	
1993	90	32	54	85	92	91	86	92	91	83	66
1994	38	36	40	54	68	77	67	71	92	92	43
1995	50	36	58	89	89	95	92	83	100	100	53
1996	30	28	48	75	71	79	83	72	75	20	33

## 3.2 Acoustic investigations

Fig. 3.5 - 3.10 presents the distribution of cod age groups 1 - 6+. As found in the bottom trawl investigation the youngest age groups were distributed further to the east than the older ones. For age group 4 and older the area of dense registrations was smaller than in 1996, but as earlier mentioned most of the 6-7 years and older fish are outside the survey area this time of the year on spawning migration along the coast and are only to a small extent covered by the investigation.

Table 3.6 presents indices by age group, area and acoustic layer, pelagic (P) and bottom (B). In area C it was registered more fish than in 1996, while in the total area covered in 1997 it was found about 40 % less than in the corresponding area last year. The reduction was largest in area B and area S (part of the Svalbard area), where especially the proportion in the pelagic layer was much reduced. 1 and 4-6 years old cod had the largest reductions, while the indices of the other age groups were at the same level as in 1996.

The time series is presented in Table 3.7, and the 1997 indices are adjusted the same way as the swept-area indices. The trend is the same as found in the bottom trawl investigation, but with a larger reduction of the 1-group index, a smaller increase for the 2-group and a larger increase for the 3-group, a smaller reduction of the 4-group and similar high reductions in the indices for 5 and 6 years old fish, while the indices for the older cod were at the 1996-level. In the acoustic investigation in 1996 a higher proportion of the indices was from the Norwegian zone than in the bottom trawl survey, especially for the two youngest age groups. The reason for this may be that in the eastern part of the Barents Sea the young cod tend to stay nearer the bottom, while further west it is often found more pelagic.

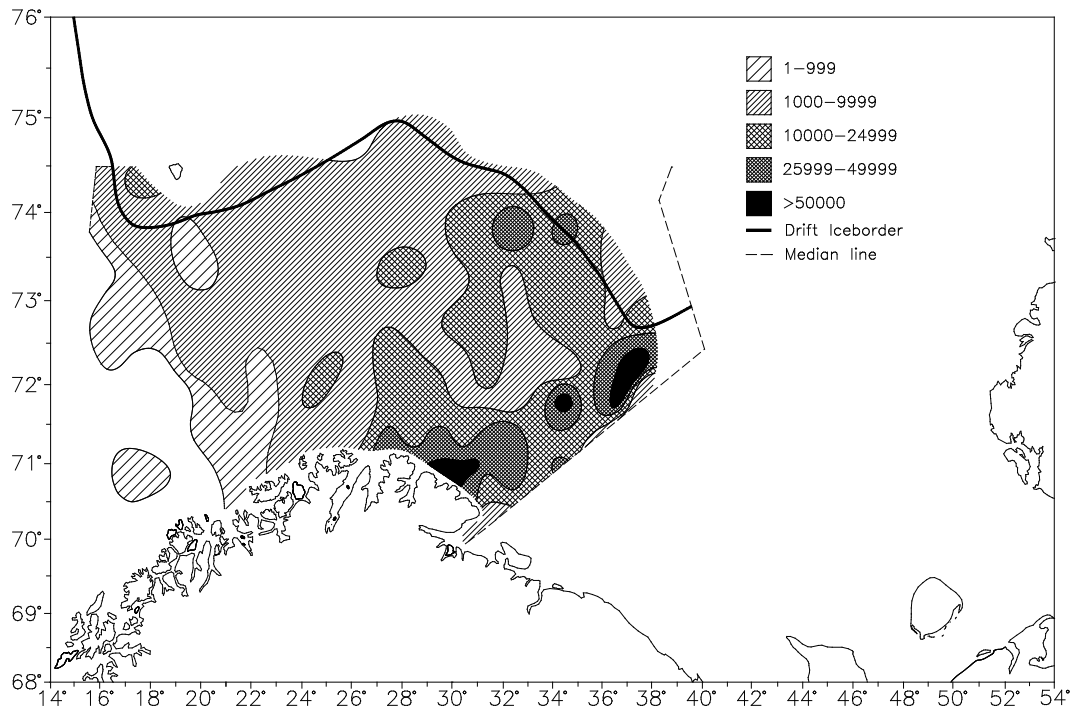


Figure 3.5. 1-GROUP COD. Distribution winter 1997 (echo recordings, no. of fish per square nautical mile).

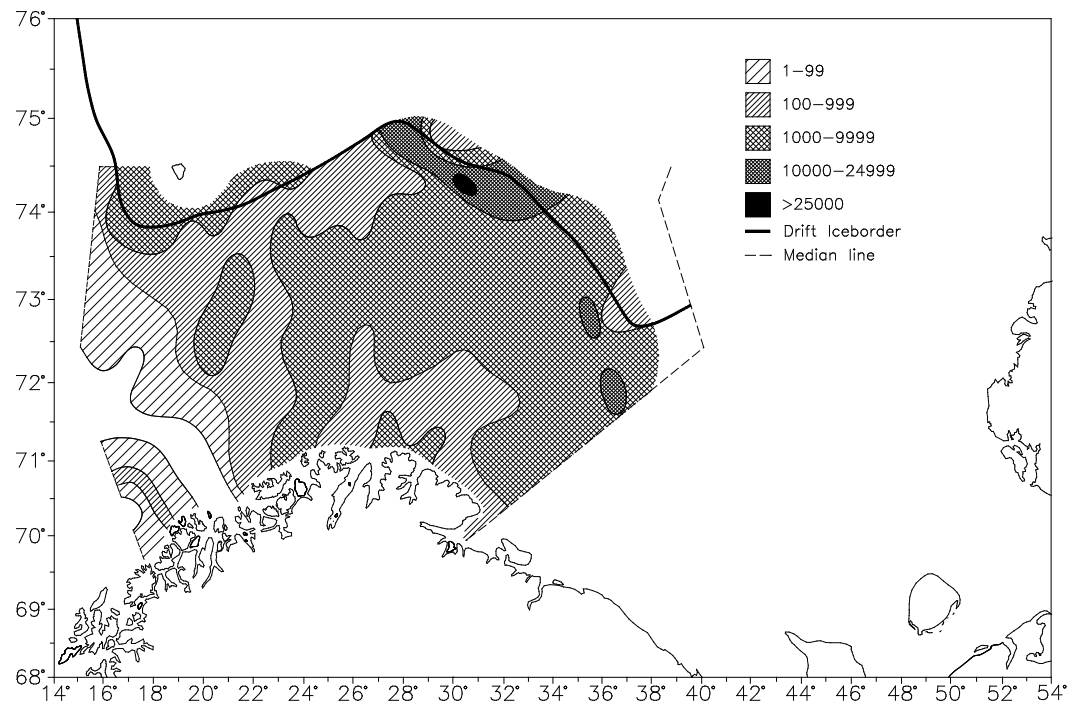


Figure 3.6. 2-GROUP COD. Distribution winter 1997 (echo recordings, no. of fish per square nautical mile).

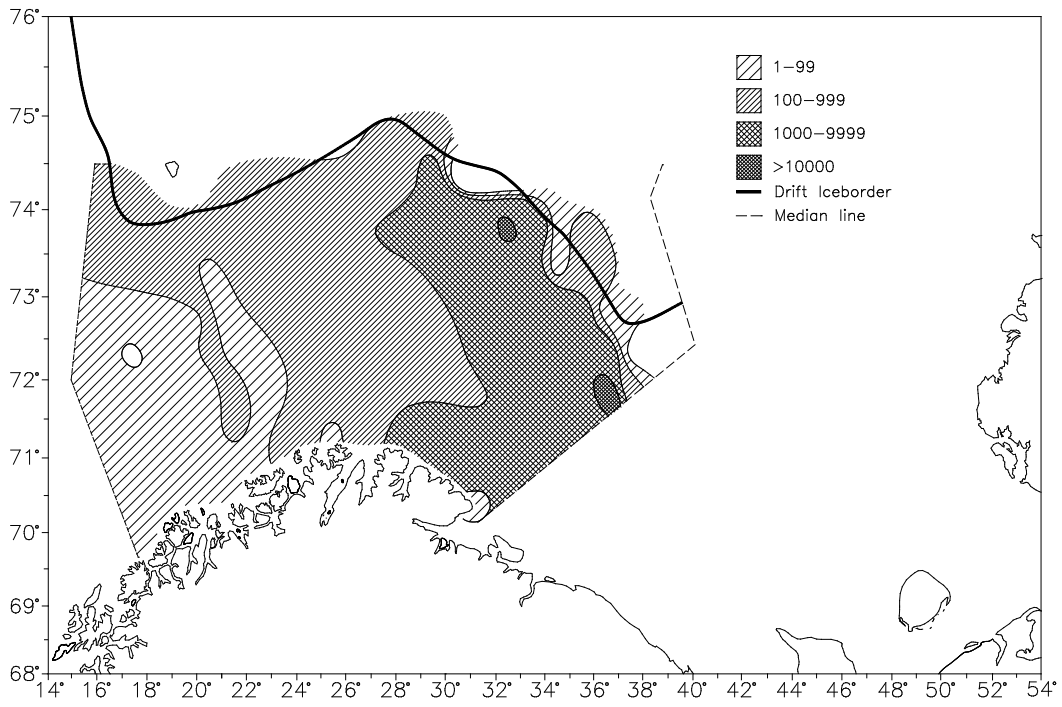


Figure 3.7. 3-GROUP COD. Distribution winter 1997 (echo recordings, no. of fish per square nautical mile).

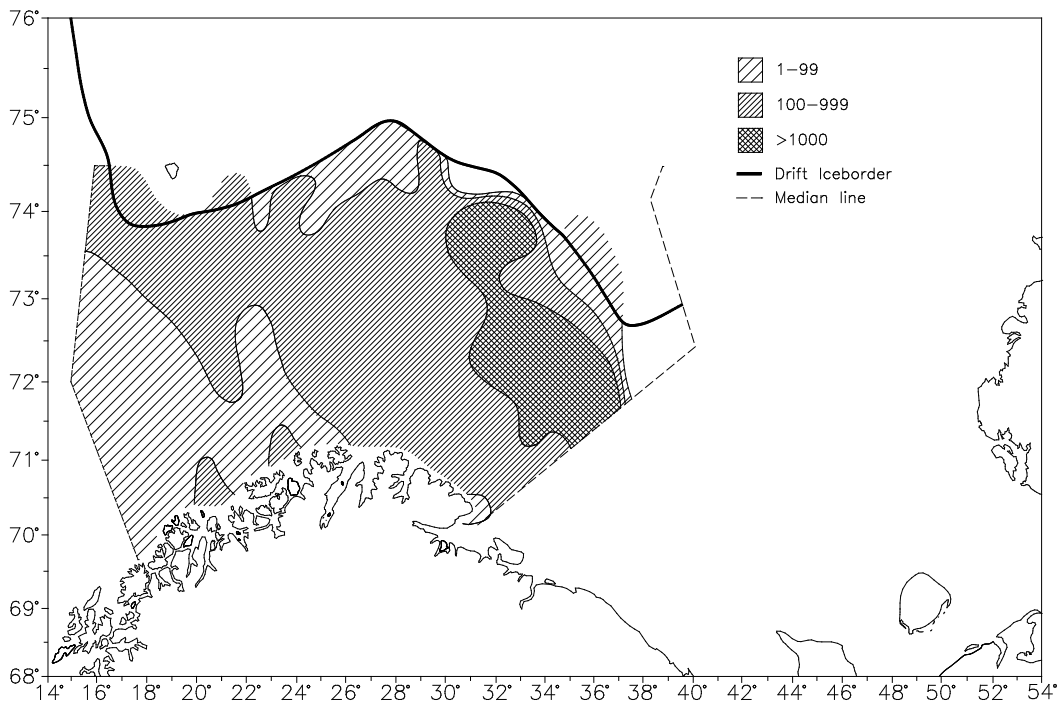


Figure 3.8. 4-GROUP COD. Distribution winter 1997 (echo recordings, no. of fish per square nautical mile).

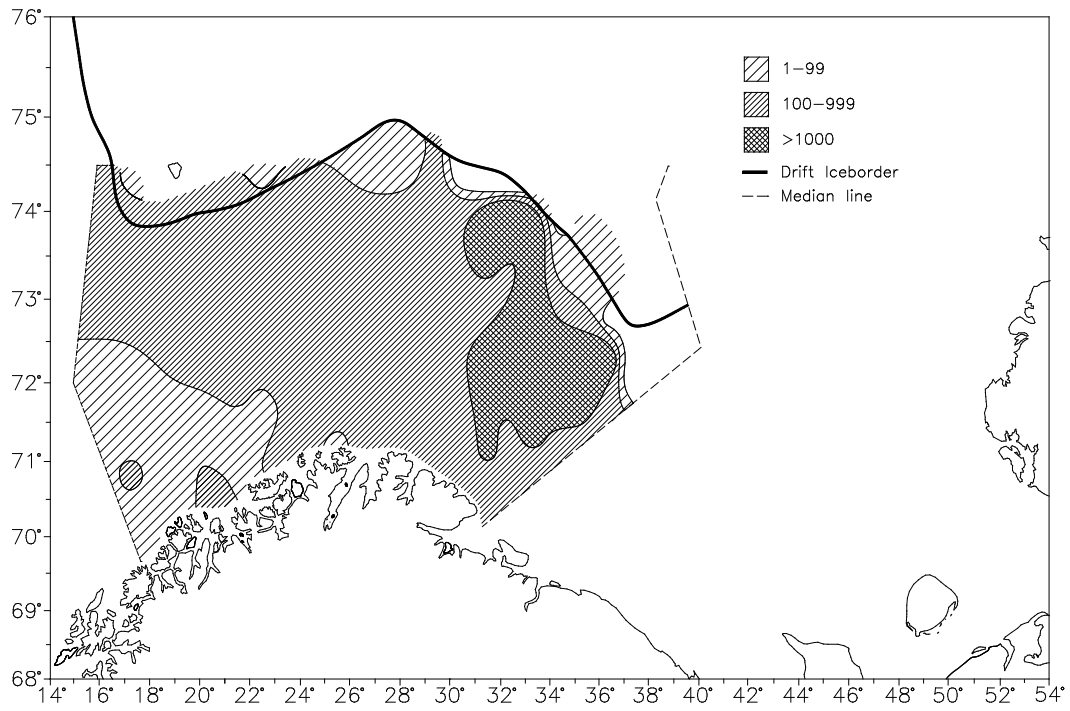


Figure 3.9. 5-GROUP COD. Distribution winter 1997 (echo recordings, no. of fish per square nautical mile).

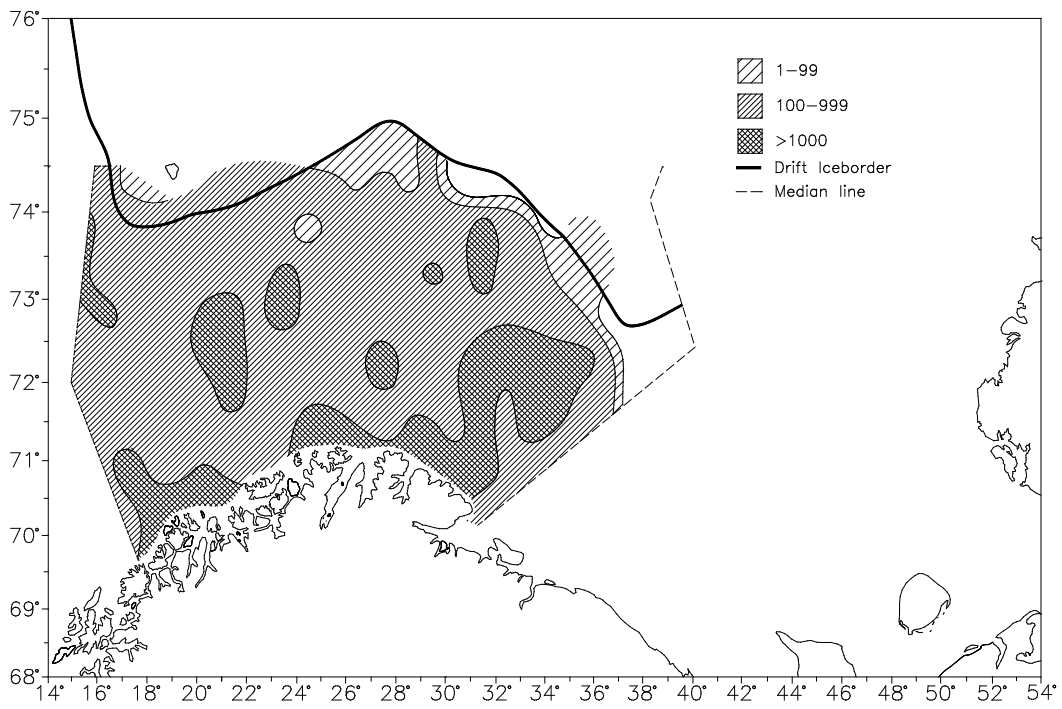


Figure 3.10.6-GROUP AND OLDER COD. Distribution winter 1997 (echo recordings, no. of fish per square nautical mile).



Table 3.6. COD. Acoustic abundance indices in the pelagic layer (P) and in the 10 m layer above the bottom (B) for the main areas of the Barents Sea (Norwegian zone) winter 1997 (numbers in millions).

Area	Layer	Age (Yearclass)										Total
		1 (96)	2 (95)	3 (94)	4 (93)	5 (92)	6 (91)	7 (90)	8 (89)	9 (88)	10+ (87+)	
A	P	82.6	20.8	4.9	2.9	5.1	7.3	4.6	0.6	0.1	+	128.9
	B	39.6	10.6	2.7	1.6	2.7	3.8	2.4	0.3	+	+	64.1
B	P	1.8	0.9	0.2	0.1	0.2	0.6	0.8	0.3	0.1	+	4.9
	B	2.0	1.2	0.3	0.3	0.4	1.4	1.9	0.7	0.1	0.1	8.5
C	P	128.8	3.7	5.5	1.4	0.8	1.7	2.3	0.7	-	-	144.8
	B	28.8	1.0	1.1	0.3	0.2	0.5	0.8	0.2	-	-	32.9
D	P	251.5	49.4	38.0	17.3	16.0	8.1	3.3	0.6	0.2	+	384.3
	B	178.8	32.6	25.1	11.7	11.2	5.4	2.0	0.3	0.1	+	267.2
D'	P	36.3	4.2	0.1	-	-	-	-	-	-	-	40.5
	B	17.6	1.9	0.1	-	-	-	-	-	-	-	19.6
E	P	0.4	12.0	-	-	-	-	-	-	-	-	12.4
	B	0.4	14.9	-	-	-	-	-	-	-	-	15.3
S	P	23.7	9.1	3.4	2.0	3.0	3.3	1.0	0.1	+	-	45.6
	B	27.4	17.3	4.3	1.9	2.0	1.7	0.6	0.1	+	-	55.2
ABCD	P	464.7	74.8	48.6	21.7	22.1	17.7	10.9	2.2	0.4	0.1	662.9
	B	249.2	45.4	29.2	13.9	14.5	11.1	7.1	1.4	0.3	0.1	372.7
Total	P	525.1	100.0	52.0	23.7	25.0	20.9	11.9	2.3	0.4	0.1	761.5
	B	294.8	79.6	33.5	15.9	16.6	12.8	7.7	1.5	0.3	0.1	462.7
	Sum	819.9	179.6	85.5	39.6	41.6	33.7	19.6	3.8	0.7	0.2	1224.2

Table 3.7. COD. Abundance indices from acoustic surveys in the Barents Sea winter 1981-1997 (numbers in millions).

Year	Age (years)										Total
	1	2	3	4	5	6	7	8	9	10+	
1981	8	82	40	63	106	103	16	3	1	1	423
1982	4	5	49	43	40	26	28	2	+	0	197
1983	0	19	13	23	27	14	7	4	1	+	108
1984	1807	150	31	11	7	5	2	+	+	0	2013
1985	108	768	179	127	21	9	6	+	+	+	1218
1986	1302	590	595	124	56	7	2	+	+	0	2676
1987	3	72	96	256	46	12	1	1	+	0	487
1988	2	29	64	42	75	9	2	+	+	0	224
1989	9	9	20	43	27	57	8	1	+	0	174
1990	350	45	16	24	27	22	40	3	1	0	526
1991	187	234	55	31	27	25	14	16	1	0	591
1992	348	579	182	48	18	11	8	4	2	0	1201
1993	1686	432	300	163	80	14	7	3	1	3	2688
1994	1083	686	358	343	159	43	9	2	1	1	2685
1995	2644	280	181	161	214	69	18	2	1	1	3570
1996	2404	335	96	70	86	75	21	3	+	+	3090
1997 <sup>1)</sup>	1453	408	170	53	51	37	22	4	1	+	2198

<sup>1)</sup> Adjusted indices

### 3.3 Growth

Table 3.8 and 3.10 presents length and weight at age by main area from the investigation winter 1997. In the youngest age groups the lowest values were found furthest to the east (area D' and E). For 3-7 years old cod the highest values were recorded in west in area B. Otherwise there were only minor differences between the areas, partly due to incomplete coverage of the eastern part of the Barents Sea, where usually the lowest values are found. In the oldest age group there are few observations and the data are more uncertain.

Table 3.9 and 3.11 present the time series of length and weight at age for the whole area of investigation. Since the lowest values usually are found in the eastern part of the area, the figures for 1997 have been adjusted the same way as the abundance indices, using the ratio "1996-total value/1996-Norwegian zone value" as adjusting factor in each age group. Except for the 5-group, all lengths and weights were lower than in 1996 and among the lowest in the time series. The condition factors ( $W/L^3 A100$ ), however, were more normal and at about the same level as last year.

Table 3.8. COD. Length (cm) at age in main areas of the Barents Sea (Norwegian zone) from the investigation winter 1997.

Area	Age (yearclass)							
	1 (96)	2 (95)	3 (94)	4 (93)	5 (92)	6 (91)	7 (90)	8 (89)
A	11.9	17.7	31.8	43.3	51.7	60.1	69.1	80.5
B	10.8	16.3	32.4	44.1	53.6	61.2	70.1	77.7
C	11.8	18.4	29.8	44.8	52.2	58.6	68.3	77.4
D	11.9	19.4	30.1	40.5	50.5	58.8	69.5	87.8
D'	10.4	18.9	31.0	-	-	-	-	-
E	9.0	14.3	-	-	-	-	-	-
S	12.4	19.7	29.6	42.2	50.2	58.9	69.4	79.3
Total	11.7	19.2	30.2	41.2	50.8	59.5	69.3	80.2

Table 3.9. COD. Length (cm) at age in the Barents Sea from the investigations winter 1978 - 1997.

Area	Age (yearclass)							
	1 (95)	2 (94)	3 (93)	4 (92)	5 (91)	6 (90)	7 (89)	8 (88)
1978	14.2	23.1	32.1	45.9	54.2	64.6	67.6	76.9
1979	12.8	22.9	33.1	40.0	52.3	64.4	74.7	83.0
1980	17.6	24.8	34.2	40.5	52.5	63.5	73.6	83.6
1981	17.0	26.1	35.5	44.7	52.0	61.3	69.6	77.9
1982	14.8	25.8	37.6	46.3	54.7	63.1	70.8	82.9
1983	-	26.1	34.8	46.8	56.0	64.5	73.3	80.4
1984	13.8	26.2	35.8	49.2	57.9	67.4	79.6	82.2
1985	14.5	23.5	40.3	50.8	62.2	71.1	81.8	88.7
1986	13.3	22.6	34.4	50.4	60.0	70.2	82.3	95.2
1987	14.5	21.0	31.8	41.1	55.7	67.2	81.8	94.5
1988	14.7	22.5	29.7	37.0	46.4	58.0	70.1	81.1
1989	12.7	25.7	34.7	40.6	47.5	57.1	68.5	84.0
1990	14.3	29.0	39.4	47.4	53.9	60.9	70.9	87.5
1991	13.8	27.6	41.6	52.6	60.2	68.2	73.8	79.0
1992	13.4	24.7	41.3	50.7	59.9	69.2	77.0	82.7
1993	11.4	20.7	35.9	50.9	59.2	68.8	76.2	84.5
1994	12.0	18.5	30.5	44.8	55.0	64.6	73.5	84.0
1995	12.7	18.8	29.9	42.5	54.2	63.9	76.0	82.0
1996	12.6	19.6	28.1	40.9	49.3	61.4	72.3	85.3
1997 <sup>1)</sup>	11.4	18.9	28.0	40.1	49.6	59.2	69.1	80.5

<sup>1)</sup> Adjusted lengths

Table 3.10. COD. Weight (g) at age in main areas of the Barents Sea (Norwegian zone) from the investigation winter 1997.

Area	Age (yearclass)							
	1 (95)	2 (94)	3 (93)	4 (92)	5 (91)	6 (90)	7 (89)	8 (88)
A	13	49	281	712	1165	1804	2765	4724
B	10	40	320	798	1333	1988	3037	4123
C	11	46	221	794	1197	1821	2801	3897
D	14	61	249	612	1169	1768	2934	6467
D'	9	54	288	-	-	-	-	-
E	6	28	-	-	-	-	-	-
S	15	62	225	656	1097	1758	2858	4393
Total	13	58	249	639	1161	1799	2861	4569

Table 3.11. COD. Weight (g) at age in the Barents Sea from the investigations winter 1985 - 1997.

Area	Age (yearclass)							
	1 (95)	2 (94)	3 (93)	4 (92)	5 (91)	6 (90)	7 (89)	8 (88)
1985	-	-	670	1070	2230	3650	4920	5060
1986	-	-	390	1090	1850	3110	4320	5509
1987	21	65	230	490	1380	2300	3970	-
1988	20	80	203	410	793	1473	2706	4613
1989	10	150	380	590	930	1570	2640	4940
1990	28	229	570	1030	1460	1930	2890	4370
1991	20	190	720	1370	2040	2850	3660	4630
1992	20	130	640	1120	1850	2830	3980	4990
1993	11	76	430	1196	1766	2779	3894	5519
1994	12	59	261	797	1452	2273	3369	5062
1995	16	56	250	675	1347	2192	3606	4974
1996	15	61	206	633	1059	1995	3352	5512
1997 <sup>1)</sup>	13	54	197	593	1090	1788	2856	4650

<sup>1)</sup> Adjusted weights

## 4. DISTRIBUTION AND ABUNDANCE OF HADDOCK

### 4.1 Bottom trawl investigations

Fig. 4.1 - 4.4 shows the geographic distribution of haddock < 20 cm, 20-34 cm, 35-49 cm and  $\geq$  50 cm, respectively (number of fish per hour trawling). The smallest haddock had a somewhat wider distribution and larger area with dense registrations than in 1996. All larger size groups were well delimited towards the ice border in north and east, but not towards the median line. The distribution patterns were similar to those found last year, but with fewer dense observations, especially along the coast and in west along the continental edge.

Table 4.1 presents abundance indices by 5-cm length group and area with standard error of mean and coefficient of variance (CV) for the total. Fish of 15-19 cm dominated in all areas and made up 60 % of the total (by numbers). In 1996 fish > 40 cm made up more than 40 % of the total, while the corresponding figure in 1997 was less than 10 %. Table 4.2 gives indices at length and age, while Table 4.3 presents indices by age group and main area. It was found much more 1 and 7 years old haddock than in 1996 in all areas and a little more of the 3-group, while there was a large reduction in the indices for all other age groups.

In the time series (Table 4.4) the indices for 1997 have been adjusted the same way as for cod. The total index increased by 50 % from 1996 to 1997 due to a large increase of the 1-group index. The 1995-year class (2-group), which also was weak as 1-group, is further reduced. The same is the case for the 1993 and 1992 year classes (4 and 5 group). The 1991 and 1990 yearclasses are also much reduced from 1996 to 1997, but still the index for the 7 years old haddock is the highest in the time series. As for cod, most of the mature haddock is outside the survey area this time of the year on spawning migration further south and west.

Table 4.5 shows the proportion (%) of the indices for 1993-1996 that originated from the Norwegian zone. Compared to cod a higher proportion of the youngest haddock was found in the Norwegian zone, somewhat less of the medium aged fish and a similar proportion of the oldest fish. All over a higher proportion of the haddock indices came from the Norwegian zone, because of its more westerly distribution.

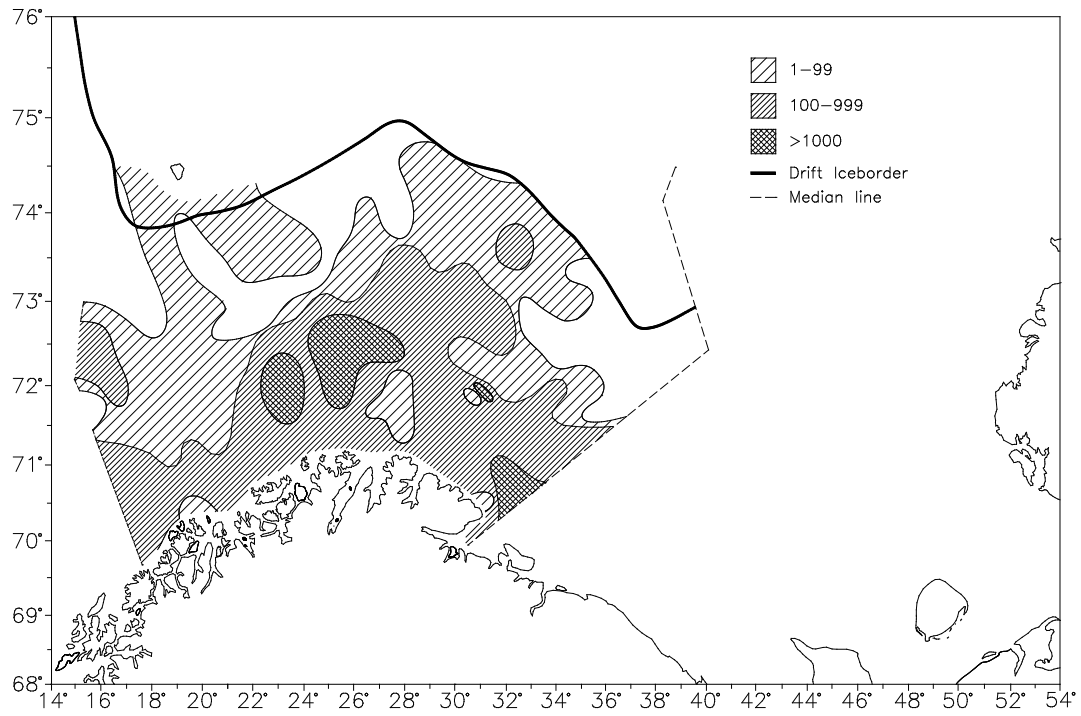


Figure 4.1. HADDOCK < 20 cm. Distribution in the trawl catches winter 1997 (number per hour trawling).

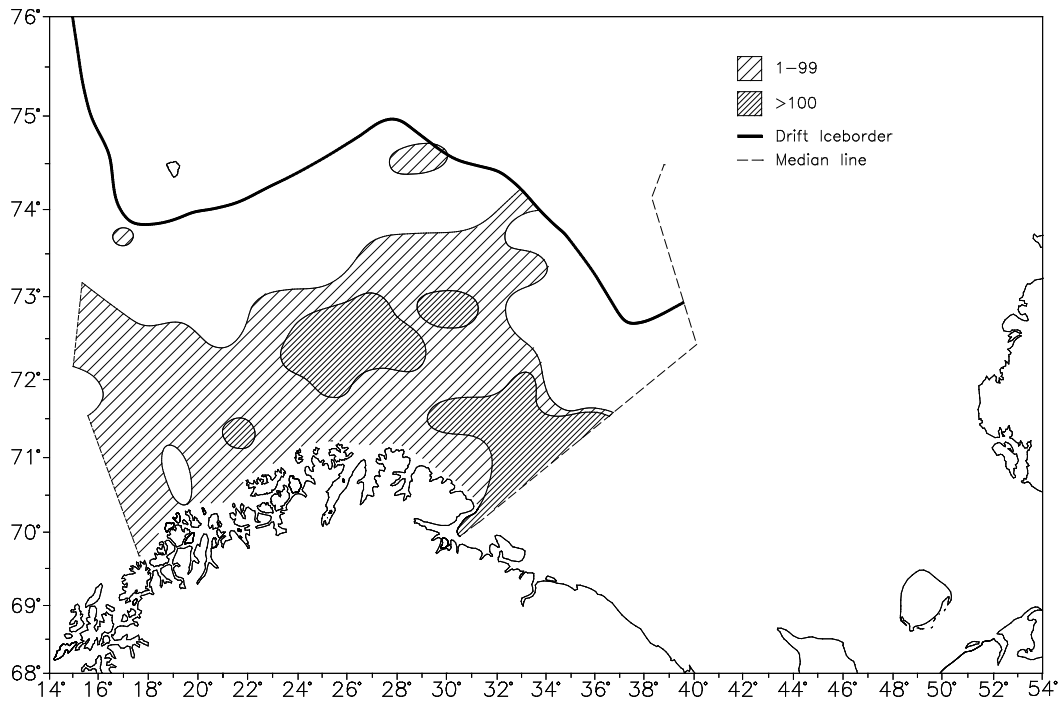


Figure 4.2. HADDOCK 20-34 cm. Distribution in the trawl catches winter 1997 (number per hour trawling).

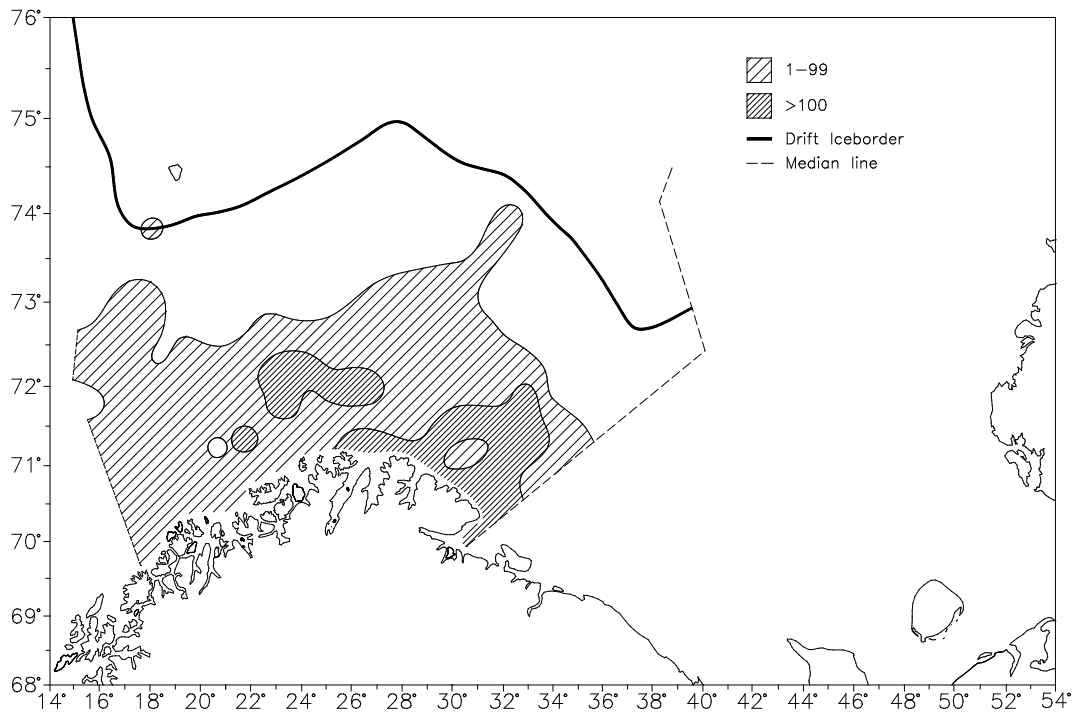


Figure 4.3. HADDOCK 35-49 cm. Distribution in the trawl catches winter 1997 (number per hour trawling).

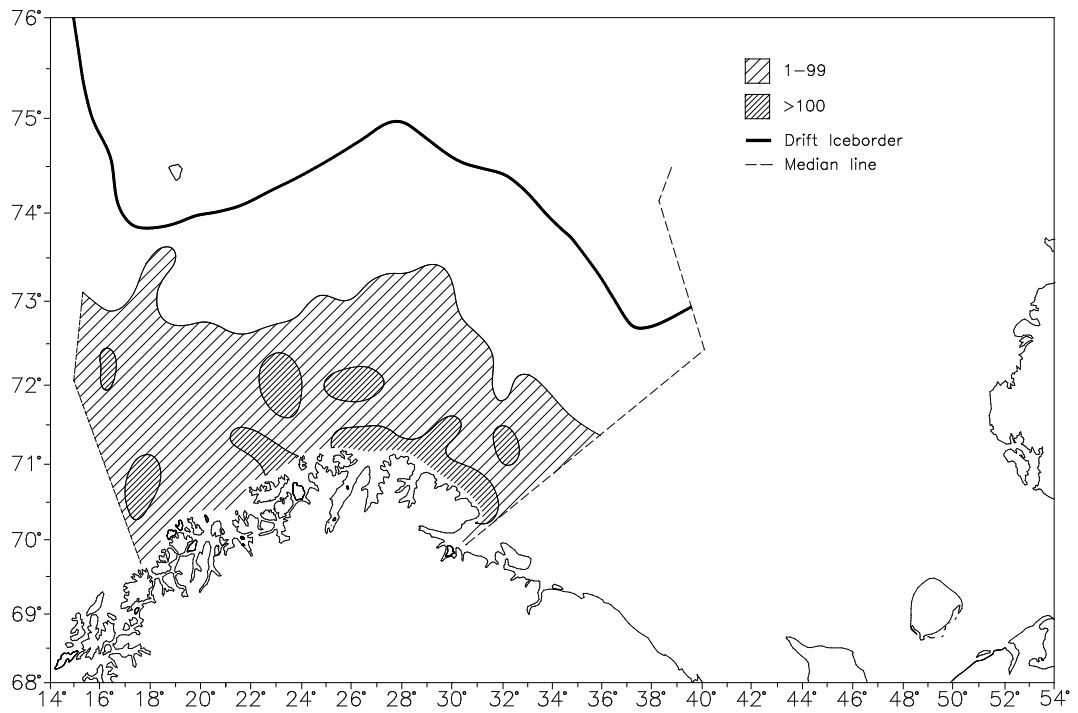


Figure 4.4. HADDOCK > 50 cm. Distribution in the trawl catches winter 1997 (number per hour trawling).

Table 4.1. HADDOCK. Abundance indices (I) at length with standard error of mean (S) from bottom trawl hauls for main areas of the Barents Sea (Norwegian zone) winter 1997 (numbers in millions).

Length (cm)	Area																
	A		B		C		D		D'		E		S		Total		
	I	S	I	S	I	S	I	S	I	S	I	S	I	S	I	S	CV (%)
10-14	62.5	15.5	27.3	9.9	16.0	7.8	94.3	40.8					+	+	200.1	45.5	22.7
15-19	317.8	57.5	107.8	25.7	51.0	15.2	245.3	80.1					2.1	0.9	724.0	103.0	14.2
20-24	10.8	2.2	4.8	1.9	1.2	0.4	19.5	5.4					0.1	+	36.3	6.1	16.9
25-29	20.1	4.1	2.5	1.5	1.8	0.7	17.5	2.3					+	+	41.8	5.0	11.9
30-34	9.6	1.7	1.3	0.8	1.3	0.4	14.4	2.2					-	-	26.7	3.0	11.1
35-39	4.6	0.9	1.3	0.5	1.3	0.3	5.2	1.1					+	+	12.4	1.5	12.2
40-44	4.6	1.1	2.1	0.8	3.1	0.6	6.7	1.4					+	+	16.5	2.0	12.1
45-49	8.2	2.2	5.2	1.6	7.3	2.1	10.8	3.0					+	+	31.6	4.5	14.3
50-54	8.6	2.6	6.7	1.9	6.4	1.7	5.9	1.8					+	+	27.6	4.1	14.9
55-59	3.4	1.0	3.5	1.1	2.5	0.8	2.1	0.6					+	+	11.5	1.8	15.6
60-64	0.5	0.2	0.7	0.2	0.5	0.2	0.2	0.1					+	+	2.0	0.3	16.6
65-69	+	+	0.1	0.1	0.1	0.1	0.1	+							0.4	0.1	31.9
70-74	+	+					+	+							+	+	71.3
75-79	+	+					+	+							+	+	71.2
Sum	450.8	59.9	163.2	27.8	92.4	17.4	421.9	90.2					2.4	0.9	1130.8	113.1	10.0



Table 4.2. HADDOCK. Abundance indices at length and age from the bottom trawl survey in the Barents Sea (Norwegian zone) winter 1997 (numbers in millions).

Length (cm)	Age (yearclass)										Sum
	1 (96)	2 (95)	3 (94)	4 (93)	5 (92)	6 (91)	7 (90)	8 (89)	9 (88)	10+ (87+)	
10-14	200.1										200.1
15-19	703.7	20.3									724.0
20-24	8.5	18.5	9.3								36.3
25-29	0.3	4.1	36.8	0.7							41.8
30-34		0.3	15.3	8.9	2.2	0.1					26.7
35-39			0.9	5.9	3.1	2.2	0.5				12.4
40-44			0.1	2.0	3.6	7.2	3.7				16.5
45-49				0.5	2.0	15.6	13.1	0.4			31.6
50-54				0.2	0.4	10.1	15.5	1.3			27.6
55-59					0.1	2.5	8.0	0.9			11.5
60-64						+	1.1	0.6	+		2.0
65-69							0.2	0.1	0.1	+	0.4
70-74								+		+	+
75-79										+	+
Sum	912.5	43.2	62.3	18.2	11.2	37.9	42.0	3.3	0.1	0.1	1130.8

Table 4.3. HADDOCK. Abundance indices from bottom trawl hauls for main areas of the Barents Sea (Norwegian zone) winter 1997 (numbers in millions).

Area	Age (Yearclass)										Total
	1 (96)	2 (95)	3 (94)	4 (93)	5 (92)	6 (91)	7 (90)	8 (89)	9 (88)	10+ (87+)	
A	361.1	29.1	27.1	7.4	3.4	9.8	11.5	1.5	+	-	450.8
B	135.6	4.5	3.9	1.6	1.5	5.0	10.1	1.1	+	+	163.2
C	67.1	0.7	3.3	0.9	1.6	9.0	9.2	0.6	-	-	92.4
D	346.7	8.8	28.1	8.3	4.7	14.1	11.3	0.1	+	+	421.9
D'	-	-	-	-	-	-	-	-	-	-	-
E	-	-	-	-	-	-	-	-	-	-	-
S	2.2	0.1	+	0.1	+	+	+	-	-	-	2.4
ABCD	910.3	43.1	62.3	18.1	11.2	37.9	42.0	3.3	0.1	0.1	1128.4
Total	912.5	43.2	62.3	18.2	11.2	37.9	42.0	3.3	0.1	0.1	1130.8

Table 4.4 HADDOCK. Abundance indices from bottom trawl surveys in the Barents Sea winter 1981-1997 (numbers in millions). 1981-1992 includes only main areas A, B, C and D

Year	Age (years)								Total
	1	2	3	4	5	6	7	8+	
1981	3.1	7.3	2.3	7.8	1.8	5.3	0.5	0.2	28.3
1982	3.9	1.5	1.7	1.8	1.9	4.8	2.4	0.2	18.2
1983	2776.8	6.6	2.7	2.7	1.3	1.3	2.8	1.3	2795.3
1984	5382.0	683.4	14.9	1.6	0.7	0.2	0.3	0.3	6083.3
1985	1421.2	1362.2	384.8	6.3	0.4	0.2	0.3	0.3	3175.5
1986	649.0	360.2	339.8	126.8	4.5	0.5	0.1	0.1	1480.9
1987	134.3	95.2	174.1	272.3	50.6	0.1	2.0	0.0	728.5
1988	44.6	16.1	28.8	67.4	110.7	15.7	0.2	0.0	283.6
1989	80.8	7.0	9.0	15.4	26.9	27.4	2.9	0.0	169.5
1990	555.4	51.4	4.1	3.4	5.2	9.4	12.1	1.7	642.8
1991	1526.0	420.9	72.4	12.6	3.1	2.4	3.0	5.6	2046.0
1992	1282.2	1191.2	283.5	59.9	4.1	0.9	1.3	5.1	2828.3
1993	717.5	585.1	467.8	105.6	10.3	0.5	0.5	2.2	1889.5
1994	587.5	200.3	296.0	448.2	50.8	3.2	0.2	1.1	1587.3
1995	1271.8	182.0	42.6	153.4	341.6	31.3	2.0	0.5	2025.3
1996	312.7	265.9	53.2	48.9	149.4	255.9	11.6	1.0	1098.5
1997 <sup>1)</sup>	1252.6	69.1	78.9	25.4	19.1	49.8	70.6	3.5	1569.0

<sup>1)</sup> Adjusted indices

Table 4.5. HADDOCK. Proportion (%) of the abundance indices from bottom trawl surveys in the Barents Sea winter 1993-1996 found in the Norwegian zone.

Year	Age (years)								Total
	1	2	3	4	5	6	7	8	
1993	0.65	0.34	0.26	0.38	0.70	1.00	0.80	0.68	0.44
1994	1.00	0.76	0.32	0.26	0.53	0.78	1.00	0.63	0.62
1995	0.87	0.75	0.72	0.39	0.56	0.67	1.00	0.90	0.76
1996	0.73	0.63	0.79	0.72	0.59	0.76	0.59	1.00	0.69

## 4.2 Acoustic investigations

Fig. 4.5 - 4.10 presents the distribution by age group of haddock. Apart from towards east all age groups were satisfactory covered. The distribution pattern was similar to that observed in 1996, but with less registrations of the oldest fish in west towards the continental edge.

Table 4.6 gives indices by age group, area and acoustic layer, pelagic (P) and bottom (B). As earlier mentioned haddock has a more westerly distribution than cod and usually more than 90 % is found within the old standard survey area ABCD. Therefore haddock was better covered than cod in 1997 since within ABCD only the eastern part of area D is outside the Norwegian zone. The total index increased a lot from 1996 to 1997 in area C and a little in area A, while it was reduced to about the half in area B. In area C and D the proportion of haddock in the pelagic layer was higher than last year.

The time series (Table 4.7), with adjusted indices for 1997, shows the same trend as the time series of swept-area indices. The total index increased by over 20 % due to a much higher 1-group index than in 1996. The indices for most other age groups were considerable lower than last year, though the index for 7 years old fish is the highest in the time series and that for the 6-group is the next highest in the time series.

Like for cod the proportion of the acoustic indices that came from the Norwegian zone in 1996 were higher than the corresponding proportions from the bottom trawl indices. The explanation is also the same; the fish tend to be more pelagic and available for acoustic detection in the Norwegian zone, while it perhaps is more available for bottom trawl further east.

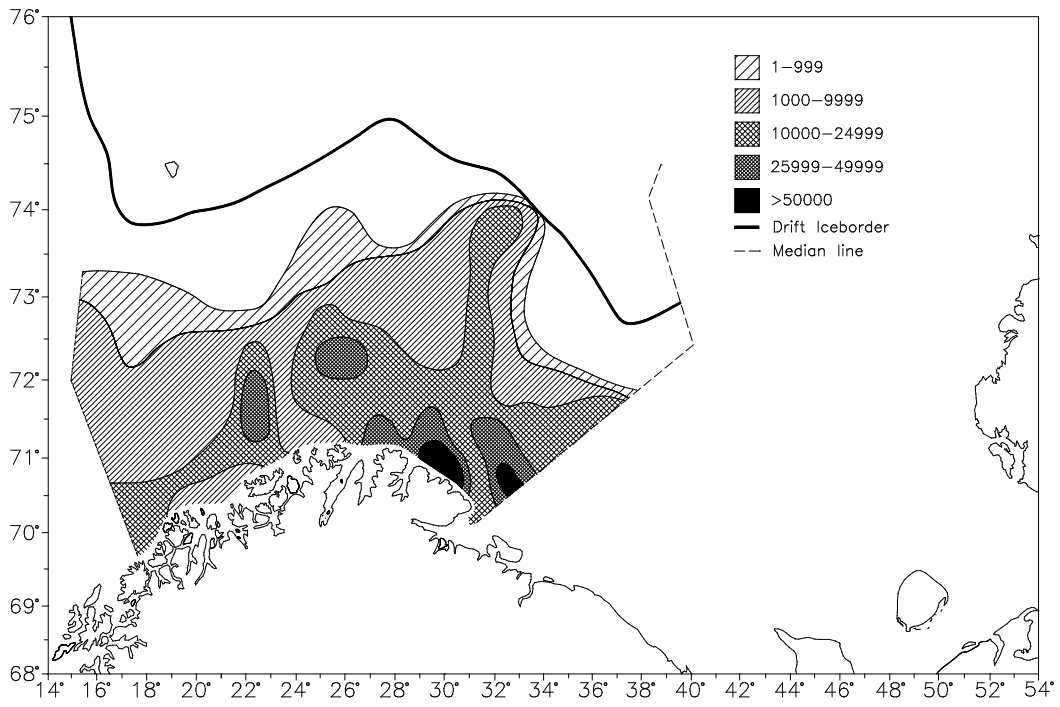


Figure 4.5. 1-GROUP HADDOCK. Distribution winter 1997 (echo recordings, number of fish per square nautical mile).

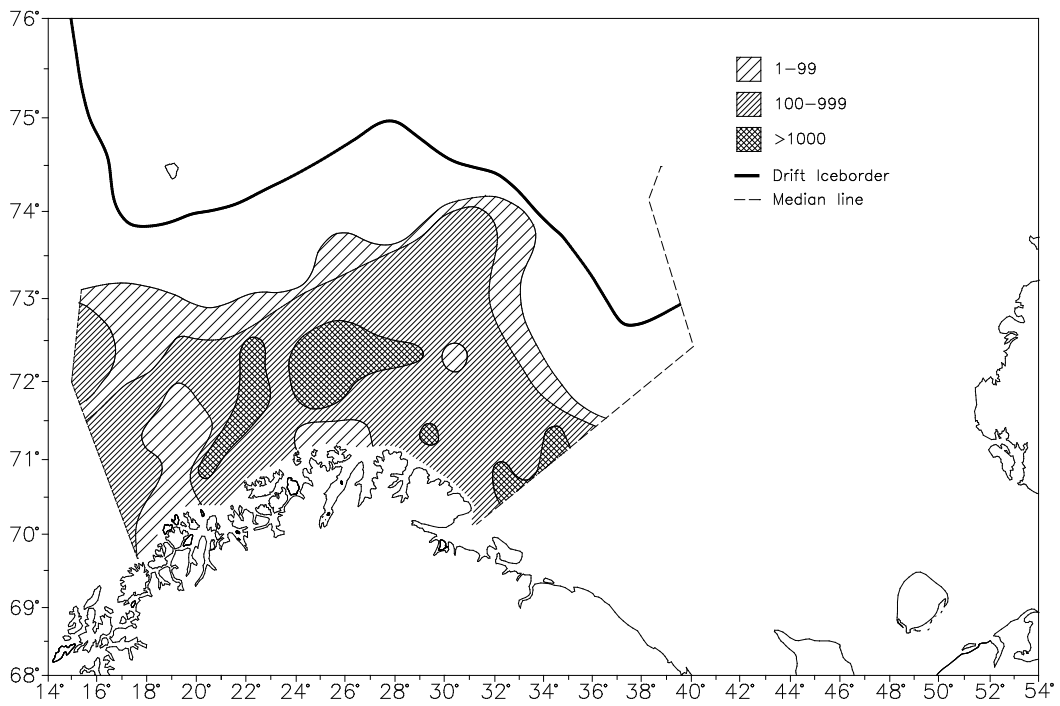


Figure 4.6. 2-GROUP HADDOCK. Distribution winter 1997 (echo recordings, number of fish per square nautical mile).

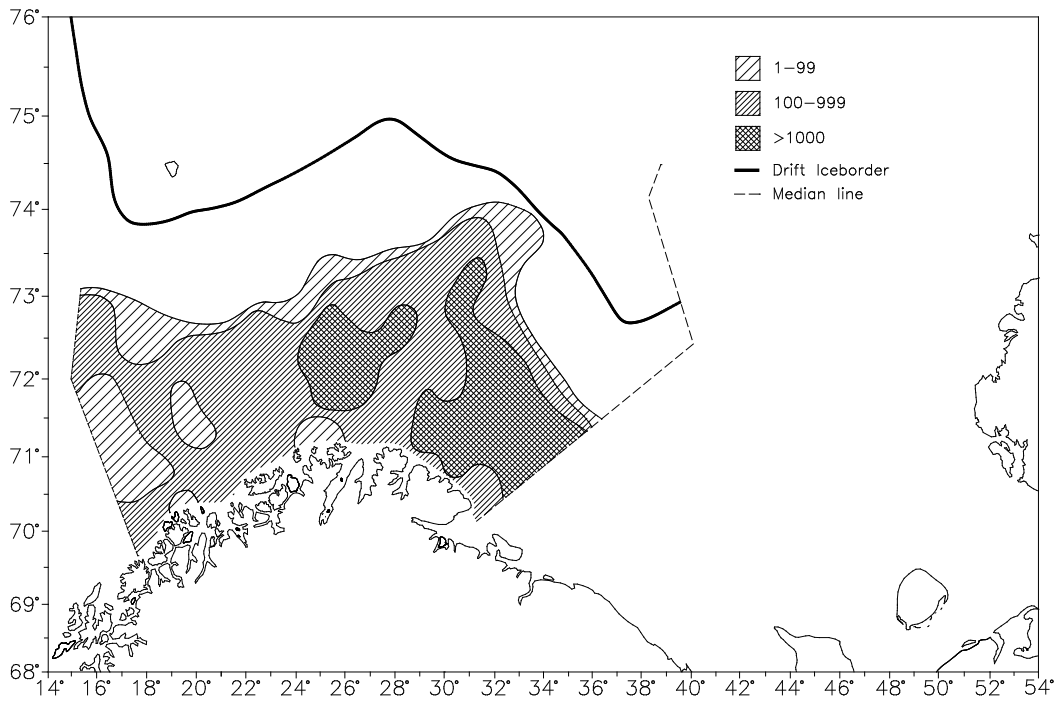


Figure 4.7. 3-GROUP HADDOCK. Distribution winter 1997 (echo recordings, number of fish per square nautical mile).

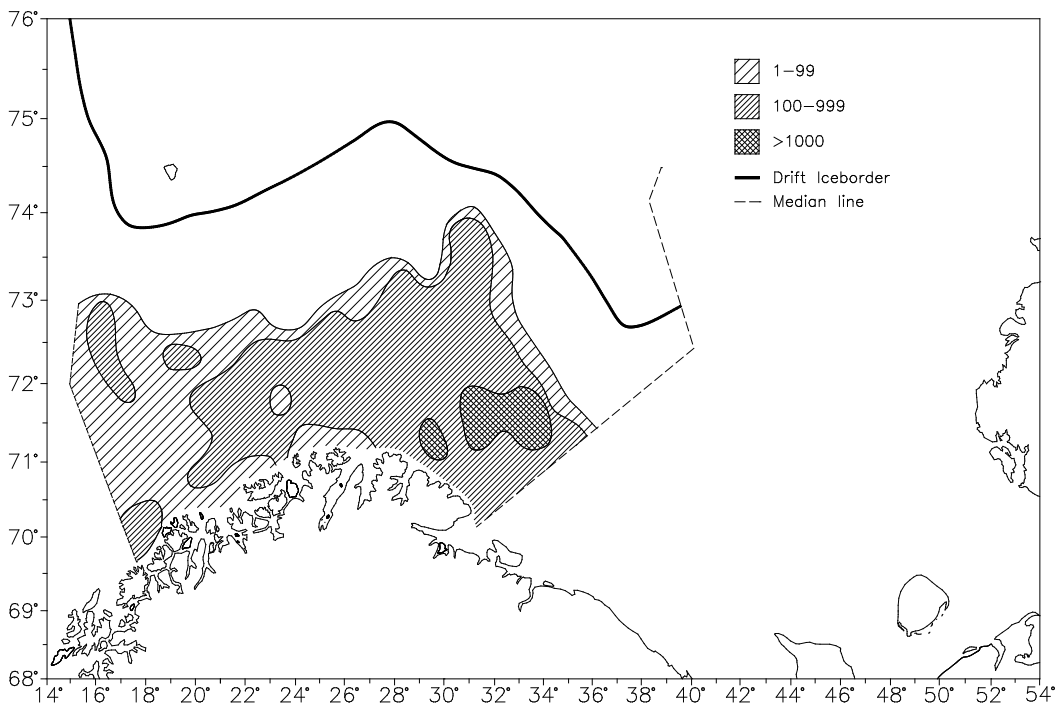


Figure 4.8. 4-GROUP HADDOCK. Distribution winter 1997 (echo recordings, number of fish per square nautical mile).

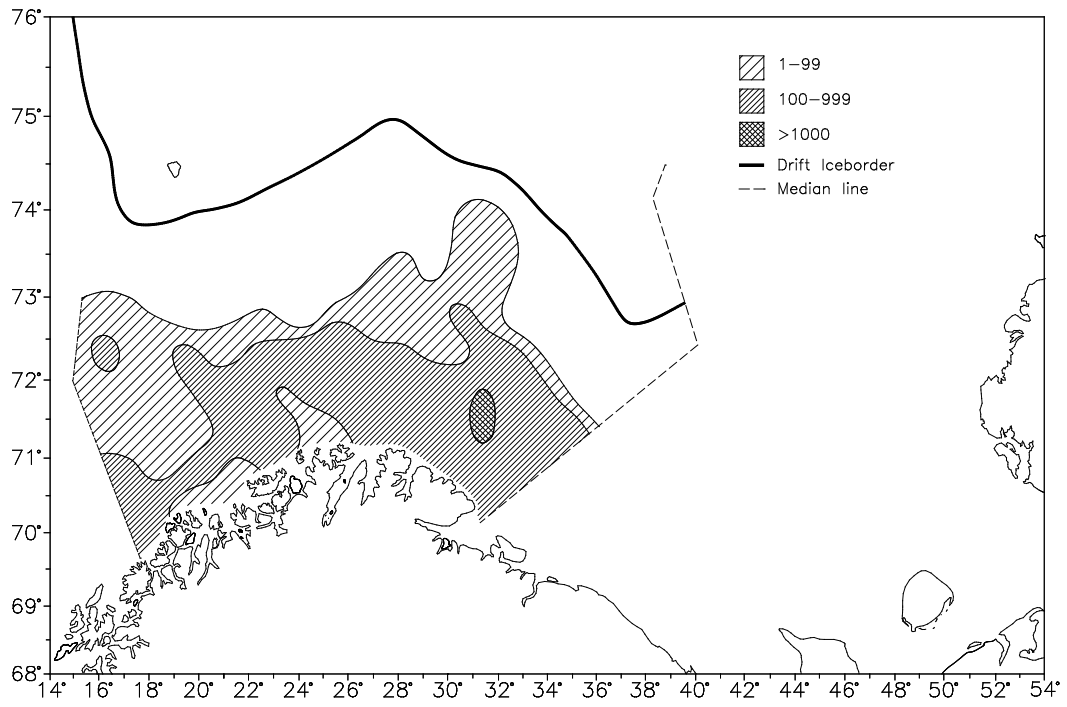


Figure 4.9. 5-GROUP HADDOCK. Distribution winter 1997 (echo recordings, number of fish per square nautical mile).

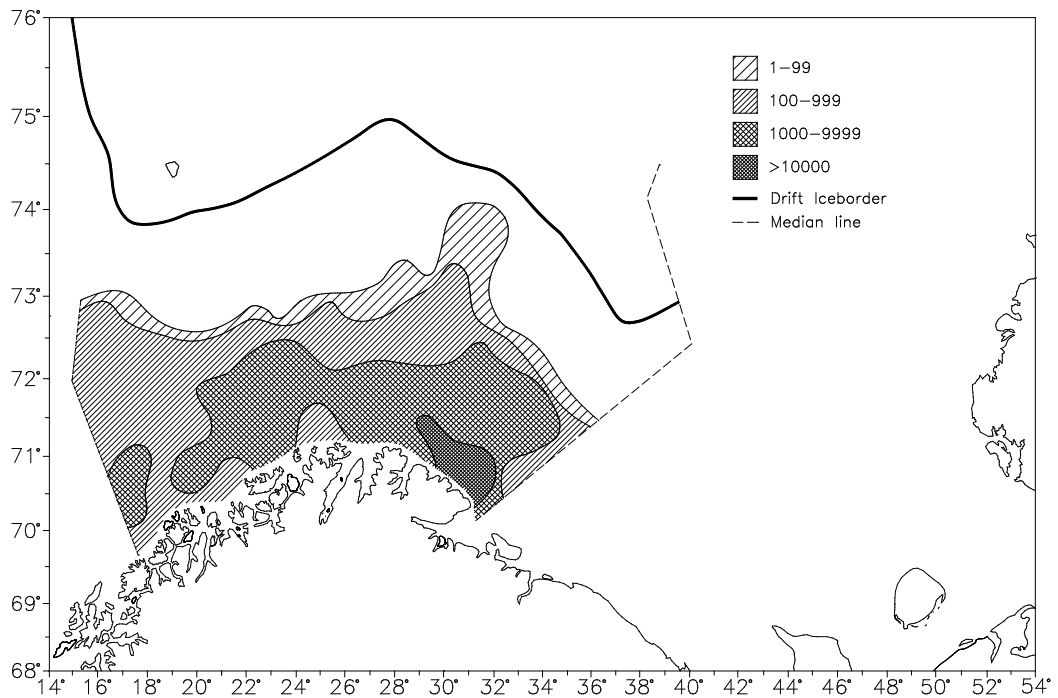


Figure 4.10. 6-GROUP AND OLDER HADDOCK. Distribution winter 1997 (echo recordings, number of fish per square nautical mile).

Table 4.6. HADDOCK. Acoustic abundance indices in the pelagic layer (P) and in the 10 m layer above the bottom (B) for the main areas of the Barents Sea (Norwegian zone) winter 1997, numbers in millions.

Area	Layer	Age (Yearclass)										Total
		1 (96)	2 (95)	3 (94)	4 (93)	5 (92)	6 (91)	7 (90)	8 (89)	9 (88)	10+ (87+)	
A	P	135.4	11.2	10.7	2.9	1.4	4.1	4.9	0.7	+	+	171.3
	B	39.1	3.3	3.8	1.0	0.5	1.2	1.4	0.2	+	+	50.5
B	P	51.3	1.5	1.4	0.6	0.6	2.2	4.3	0.5	+	+	62.4
	B	44.6	1.2	0.9	0.5	0.5	1.6	3.1	0.3	+	+	52.6
C	P	151.6	1.5	5.4	1.9	2.9	15.6	14.3	0.7	-	0.1	194.0
	B	54.7	0.3	1.3	0.4	0.5	2.9	2.7	0.1	-	-	63.0
D	P	154.1	4.3	20.9	7.2	4.1	11.4	8.8	0.1	+	0.1	211.1
	B	61.4	1.7	7.4	2.4	1.4	4.4	3.5	+	+	+	82.3
D'	P	-	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-
E	P	-	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-
S	P	0.2	-	-	-	-	-	-	-	-	-	0.2
	B	-	-	-	-	-	-	-	-	-	-	-
ABCD	P	492.4	18.5	38.4	12.5	9.0	33.4	32.3	1.9	0.1	0.1	638.9
	B	199.8	6.5	13.5	4.3	2.9	10.0	10.7	0.7	+	+	248.4
Total	P	492.6	18.5	38.4	12.5	9.0	33.4	32.3	1.9	0.1	0.1	638.9
	B	199.8	6.5	13.5	4.3	2.9	10.0	10.7	0.7	+	+	248.4
	Sum	692.4	25.0	51.9	16.8	11.9	43.4	43.0	2.6	0.1	0.2	887.3

Table 4.7. HADDOCK. Abundance indices from acoustic surveys in the Barents Sea winter 1981-1997 (numbers in millions).

Year	Age (years)										Total
	1	2	3	4	5	6	7	8	9	10+	
1981	7	14	5	21	60	18	1	+	+	+	125
1982	9	2	3	4	4	10	6	+	+	+	38
1983	0	5	2	3	1	1	4	2	+	+	18
1984	1685	173	6	2	1	+	+	+	+	+	1866
1985	1809	839	274	6	+	+	+	1	+	+	2928
1986	680	312	488	162	+	+	+	+	+	+	1644
1987	111	26	71	190	47	+	+	+	0	+	446
1988	20	5	8	20	38	6	+	+	0	+	97
1989	58	6	8	10	17	19	2	+	0	+	119
1990	493	44	4	3	4	7	11	1	+	+	568
1991	1938	265	49	7	2	2	2	4	+	0	2269
1992	859	685	110	19	2	+	+	1	2	+	1714
1993	1424	690	565	99	10	+	+	1	+	2	2790
1994	848	228	240	506	77	8	+	+	+	+	1908
1995	1380	285	36	113	391	40	2	+	+	1	2247
1996	249	229	44	31	76	150	8	1	0	+	788
1997 <sup>1</sup>	779	32	60	20	14	49	46	3	0	+	1002

<sup>1</sup>) Adjusted indices

### 4.3 Growth

Length and weight at age by main area are presented in Tables 4.8 and 4.10. In area S and in the oldest age group there are few samples and the data are uncertain. Like in 1996 the highest values were found in the westerly B.

The time series (Tables 4.9 and 4.11), with adjusted lengths and weights for 1997, shows that except for the 1 and 6 group all lengths and weights were slightly lower than those found in 1996. For 3-5 and 7 years old haddock it is the lowest values in the time series. The condition factors were more normal, but slightly lower than those measured last year.

Table 4.8. HADDOCK. Length (cm) at age in main areas of the Barents Sea (Norwegian zone) from the investigation winter 1997.

Area	Age (yearclass)							
	1 (96)	2 (95)	3 (94)	4 (93)	5 (92)	6 (91)	7 (90)	8 (89)
A	16.2	20.0	27.4	35.5	40.2	48.7	50.9	53.2
B	15.9	22.8	29.7	41.0	45.6	50.2	51.6	55.9
C	16.2	21.2	29.2	34.6	42.6	46.5	51.4	59.3
D	16.2	22.3	27.6	34.0	37.4	46.5	48.6	63.8
D'	-	-	-	-	-	-	-	-
E	-	-	-	-	-	-	-	-
S	18.0	-	-	41.1	-	-	60.0	-
Total	16.2	20.8	27.7	35.3	40.1	47.6	50.6	

Table 4.9. HADDOCK. Length (cm) at age in the Barents Sea from the investigations winter 1987 - 1997.

Area	Age (yearclass)						
	1 (96)	2 (95)	3 (94)	4 (93)	5 (92)	6 (91)	7 (90)
1987	13.9	21.6	30.2	39.2	47.0	62.5	-
1988	13.5	24.3	29.3	36.2	42.7	50.1	56.6
1989	16.3	22.5	32.0	36.8	43.0	47.3	53.6
1990	16.3	24.9	33.8	44.2	46.9	50.7	53.0
1991	16.9	25.0	37.0	42.7	54.3	55.2	53.8
1992	15.6	25.4	36.5	45.9	53.9	61.6	62.9
1993	14.4	21.8	32.2	42.6	50.6	58.4	57.9
1994	14.8	21.5	29.7	38.7	47.4	54.2	57.4
1995	15.4	19.9	27.9	34.0	42.6	51.3	55.9
1996	15.4	21.6	28.6	38.0	42.1	46.8	55.3
1997 <sup>1)</sup>	16.1	21.4	27.6	36.6	40.4	47.7	50.4

<sup>1)</sup> Adjusted lengths



Table 4.10. HADDOCK. Weight (g) at age in main areas of the Barents Sea (Norwegian zone) from the investigation winter 1997.

Area	Age (yearclass)							
	1 (96)	2 (95)	3 (94)	4 (93)	5 (92)	6 (91)	7 (90)	8 (89)
A	36	76	190	413	643	1142	1300	1461
B	31	101	249	676	1017	1280	1374	1699
C	34	78	232	377	693	974	1340	2114
D	35	100	198	383	525	974	1168	2510
D'	-	-	-	-	-	-	-	-
E	-	-	-	-	-	-	-	-
S	46	-	-	673	-	-	2076	-
Total	35	84	199	421	650	1062	1291	

Table 4.11. HADDOCK. Weight (g) at age in the Barents Sea from the investigations winter 1987 - 1997.

Area	Age (yearclass)						
	1 (96)	2 (95)	3 (94)	4 (93)	5 (92)	6 (91)	7 (90)
1987	24	91	273	542	934	2197	-
1988	25	120	350	450	730	1140	1560
1989	40	100	320	490	780	1040	1440
1990	42	148	370	827	988	1247	1425
1991	40	140	490	840	1630	1710	1600
1992	30	150	450	940	1510	2280	2510
1993	27	98	329	788	1331	2030	2324
1994	25	91	251	555	1026	1578	1813
1995	30	71	207	374	750	1278	1650
1996	30	92	224	557	745	1017	1783
1997 <sup>1)</sup>	35	91	200	469	650	1076	1327

<sup>1)</sup> Adjusted weights

## 5. DISTRIBUTION AND ABUNDANCE OF REDFISH

### 5.1 Bottom trawl investigations

The time series of bottom trawl indices for redfish (Table 5.2 and 5.4) are based on catch data from bobbins gear until 1988 and from rockhopper-gear from 1989 and onwards.

Fig. 5.1 shows the distribution of *Sebastes marinus*. The distribution pattern was quite similar to that observed in 1996, but with less fish towards the continental edge. Table 5.1 presents abundance indices by 5-cm length group and area with standard error of mean and coefficient of variance (CV) for the total. The indices for area A and C were halved from 1996 to 1997, while the index for area B was doubled and the total index for the investigated area increased by 10 %. The increase was caused by one large catch in area B, where size groups 30-34 and 35-39 cm dominated. Therefore standard error of mean and CV for these size groups and for the total were larger than last year. However, the time series (Table 5.2), with adjusted indices for 1997, shows that the total index is among the lowest in the time series. In 1996 more than 90 % of the *Sebastes marinus* was found in the Norwegian zone.

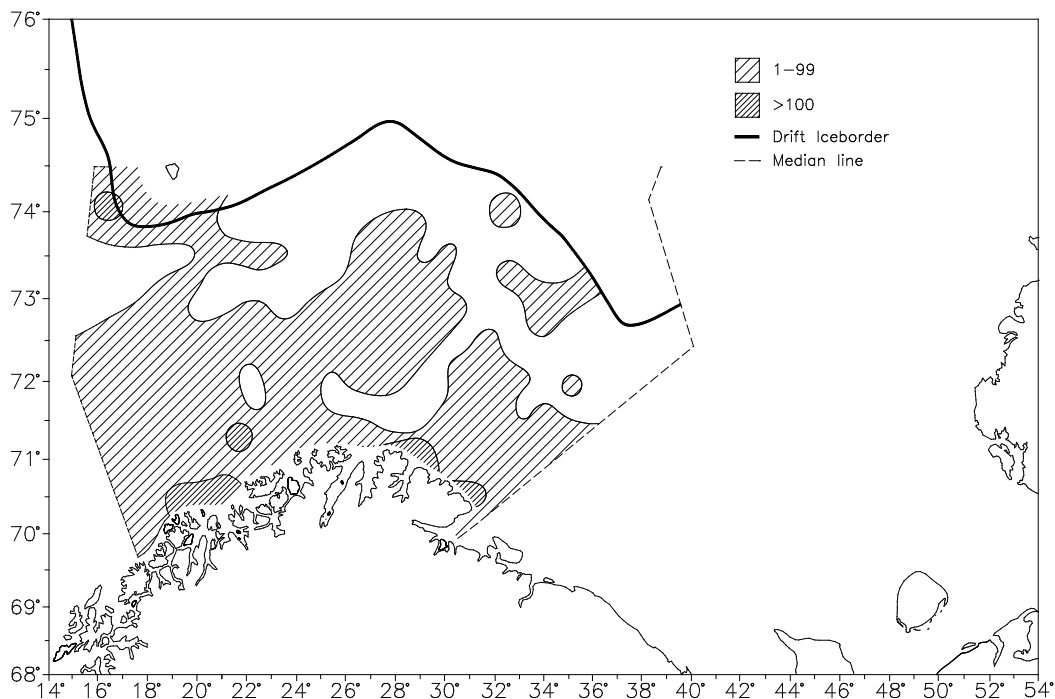


Figure 5.1. *Sebastes marinus*. Distribution in the trawl catches winter 1997 (no. per hour trawling).

Table 5.1. *Sebastes marinus*. Abundance indices (I) at length with standard error of mean (S) from bottom trawl hauls for main areas of the Barents Sea (Norwegian zone) winter 1997 (numbers in millions.).

Length (cm)	Area												Total				
	A		B		C		D		D'		E					S	
	I	S	I	S	I	S	I	S	I	S	I	S	I	S	CV (%)		
5-9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
10-14	-	-	0.1	0.1	-	-	0.2	0.1	-	-	-	-	0.3	0.1	42.1		
15-19	0.5	+	0.1	+	-	-	0.3	0.2	-	-	-	-	0.5	0.2	1.0	0.3	28.9
20-24	0.3	0.1	0.5	0.2	-	-	0.6	0.2	-	-	-	-	0.9	0.5	2.2	0.6	26.6
25-29	0.6	0.2	1.7	0.8	0.7	0.5	1.5	0.5	-	-	-	-	0.7	0.3	5.2	1.1	21.2
30-34	1.1	0.4	14.0	12.8	2.1	1.7	2.1	1.1	-	-	-	-	1.0	0.6	20.3	13.0	64.1
35-39	1.4	0.4	21.9	19.7	2.5	2.0	1.8	1.2	-	-	-	-	0.3	0.2	27.9	19.8	71.1
40-44	1.3	0.3	4.6	2.9	1.4	0.7	1.0	0.5	-	-	-	-	0.1	0.1	8.4	3.0	36.0
š 45	2.0	0.3	0.7	0.2	0.2	0.1	0.3	0.1	-	-	-	-	0.1	+	3.3	0.4	12.8
Sum	6.7	0.7	43.5	23.7	6.9	2.8	7.7	1.8	-	-	-	-	3.6	0.9	68.5	23.9	34.9

Table 5.3. *Sebastes mentella*.<sup>1</sup> Abundance indices (I) at length with standard error of mean (S) from bottom trawl hauls for main areas of the Barents Sea (Norwegian zone) winter 1997 (numbers in millions.).

Length (cm)	Area												Total				
	A		B		C		D		D'		E					S	
	I	S	I	S	I	S	I	S	I	S	I	S	I	S	CV (%)		
5-9	40.0	11.1	8.7	5.7	0.5	0.4	8.1	3.8	-	-	-	-	4.2	1.0	61.5	13.1	21.3
10-14	77.2	18.4	6.3	4.0	3.8	2.1	15.6	2.9	-	-	0.2	-	13.6	3.7	116.6	19.5	16.7
15-19	11.5	4.0	+	+	0.4	0.2	3.1	1.0	-	-	0.1	-	9.4	2.1	24.6	4.6	18.8
20-24	174.2	47.4	0.6	0.4	7.1	4.1	18.6	6.2	-	-	0.2	-	77.2	17.2	277.9	51.0	18.3
25-29	158.8	33.1	3.8	2.6	14.4	7.7	5.1	1.9	-	-	-	-	89.6	26.8	271.7	43.4	16.0
30-34	33.7	7.3	1.9	1.0	3.0	1.9	0.8	0.3	-	-	-	-	31.3	11.8	70.6	14.0	19.9
35-39	18.1	4.5	0.2	0.2	5.0	4.8	0.2	0.1	-	-	-	-	16.1	7.5	39.6	10.0	25.1
40-44	1.6	0.7	0.2	0.1	1.0	1.0	+	+	-	-	-	-	2.3	1.9	5.1	2.3	44.5
š 45	0.1	+	+	+	-	-	+	+	-	-	-	-	-	-	0.1	0.1	46.7
Sum	515.1	62.4	21.7	7.5	35.1	10.4	51.5	8.1	-	-	0.5	-	243.8	35.1	867.6	73.2	8.4

<sup>1)</sup> Includes unidentified *Sebastes* specimens, mostly less than 15 cm.

Table 5.2. *Sebastes marinus*. Abundance indices from bottom trawl surveys in the Barents Sea winter 1986-1997 (numbers in millions). 1986-1992 includes only main areas A, B, C and D.

Year	Length group (cm)									Total
	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	š 45	
1986	3.0	11.7	26.4	34.3	17.7	21.0	12.8	4.4	2.6	134
1987	7.7	12.7	32.8	7.7	6.4	3.4	3.8	3.8	4.2	83
1988	1.0	5.6	5.5	14.2	12.6	7.3	5.2	4.1	3.7	59
1989	48.7	4.9	4.3	11.8	15.9	12.2	6.6	4.8	3.0	114
1990	9.2	5.3	6.5	9.4	15.5	14.0	8.0	4.0	3.4	75
1991	4.2	13.6	8.4	19.4	18.0	16.1	14.8	6.0	4.0	105
1992	1.8	3.9	7.7	20.6	19.7	13.7	10.5	6.6	5.8	92
1993	0.1	1.2	3.5	6.9	10.3	14.5	12.5	8.6	6.3	64
1994	0.7	6.5	9.3	11.7	11.5	19.4	9.1	4.4	2.8	75
1995	0.6	5.0	13.1	11.5	9.1	15.9	17.2	10.9	4.7	88
1996	+	0.7	3.5	6.4	9.4	11.7	16.6	7.9	3.9	60
1997 <sup>1</sup>	-	0.4	1.3	2.7	6.9	21.4	28.1	8.4	3.3	73

<sup>1)</sup> Adjusted indices

The distribution of *S. mentella* is shown in Fig. 5.2. There were fewer dense registrations in north-west than last year. Table 5.3 presents abundance indices by 5-cm length group and area with standard error of mean and coefficient of variance (CV) for the total. The indices were much reduced in area B (65 %) and a little in area A and S. Standard error of mean and CV were at the same level as in 1996 or a little lower, and as usual lower than for *S. marinus*, which has a more patchy distribution.

The time series (Table 5.4), with adjusted indices for 1997, shows a decrease in the total index on 15 %, and the index is now a little below average level. This is mainly due to low indices for fish < 20 cm. For fish > 25 cm, however, the indices are among the highest in the time series. Close to 100 % of the *S. mentella* indices originated from the Norwegian zone (and part of the Svalbard area).

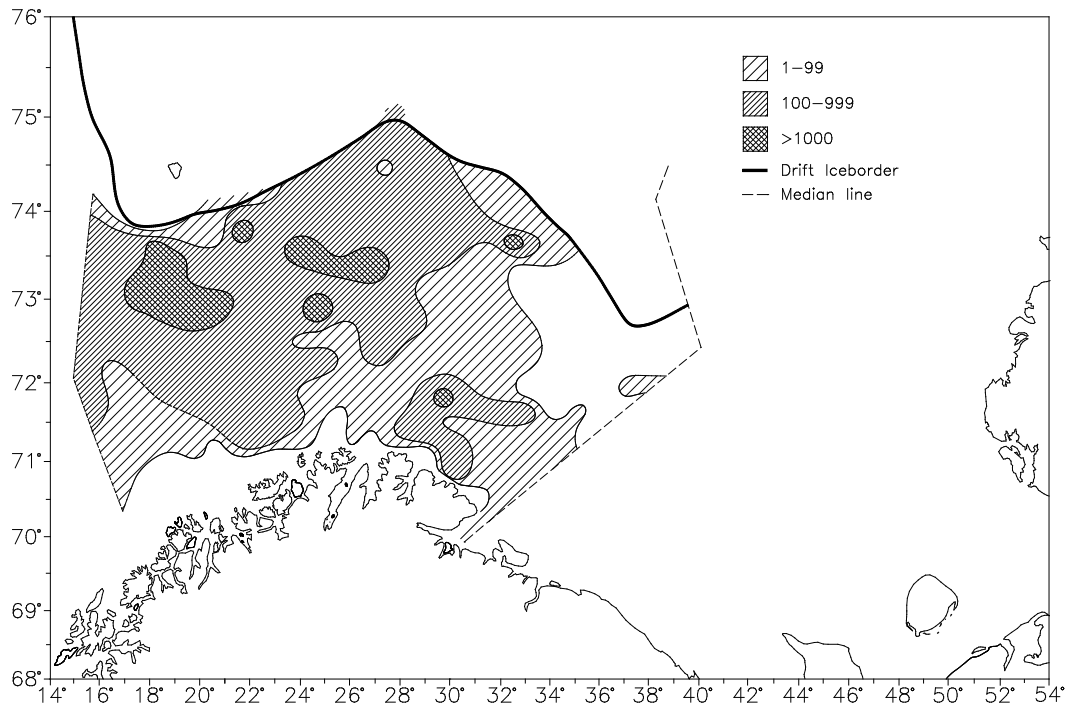


Figure 5.2. *Sebastes mentella*. Distribution in the trawl catches winter 1997 (no. per hour trawling).

Table 5.4. *Sebastes mentella*.<sup>1</sup> Abundance indices from bottom trawl surveys in the Barents Sea winter 1986-1997 (numbers in millions). 1986-1992 includes only main areas A, B, C and D.

Year	Length group (cm)									Total
	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	š 45	
1986	81.3	151.9	205.4	87.7	169.2	129.8	87.5	23.6	13.8	951
1987	71.8	25.1	227.4	56.1	34.6	11.4	5.3	1.1	0.1	433
1988	587.0	25.2	132.6	182.1	39.6	50.1	47.9	3.6	0.1	1070
1989	622.9	55.0	28.4	177.1	58.0	9.4	8.0	1.9	0.3	962
1990	323.6	304.5	36.4	55.9	80.2	12.9	12.5	1.5	0.2	830
1991	395.2	448.8	86.2	38.9	95.6	34.8	24.3	2.5	0.2	1123
1992	139.0	366.5	227.1	34.6	55.2	34.4	7.5	1.8	0.5	867
1993	30.8	592.7	320.2	116.3	24.2	25.0	6.3	1.0	+	1117
1994	6.9	258.6	289.4	284.3	51.4	69.8	19.9	1.4	0.1	979
1995	263.7	71.4	637.8	505.8	90.8	68.8	31.3	3.9	0.5	1674
1996	213.1	100.2	191.2	337.6	134.3	41.9	16.6	1.4	0.3	1037
1997 <sup>2</sup>	64.1	122.2	24.8	277.9	271.9	70.9	39.8	5.1	0.2	877

<sup>1)</sup> Includes unidentified *Sebastes* specimens, mostly less than 15 cm.

<sup>2)</sup> Adjusted indices

## 5.2 Acoustic investigations

Fig. 5.3 shows the geographic distribution of echo density of the three redfish *Sebastes marinus*, *S. mentella* and *S. viviparus*. The latter is only found in the Norwegian zone, mainly in area B, and is of no commercial interest. The distribution pattern was about the same as found in 1996, but with lower densities in north-west.

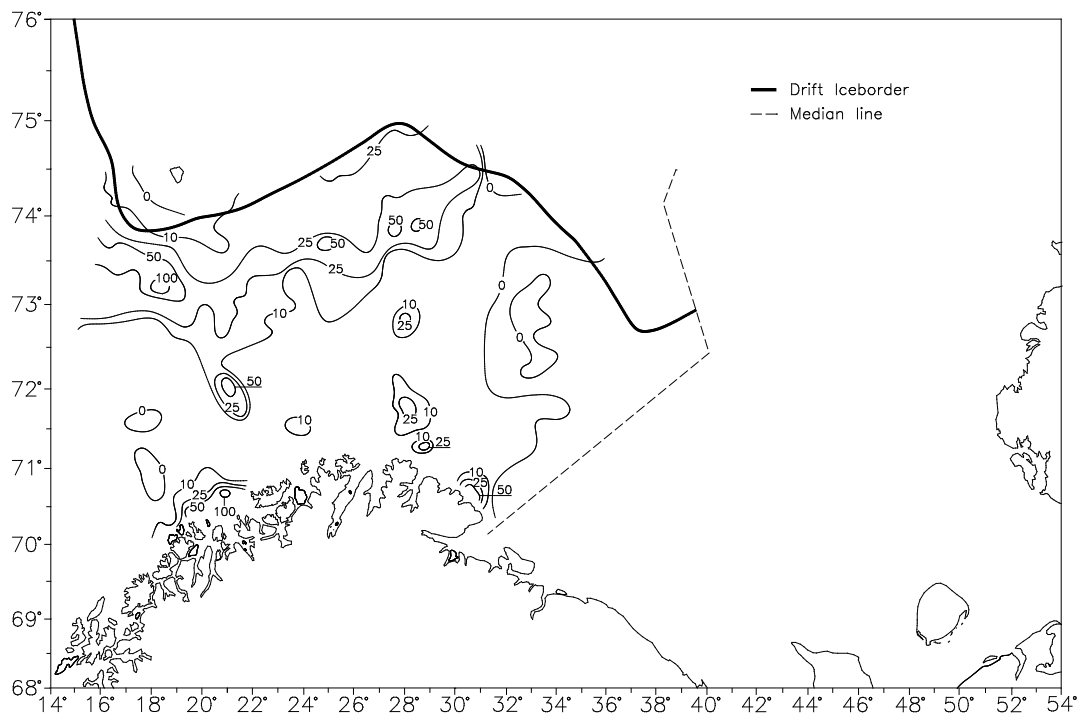


Figure 5.3. REDFISH (*Sebastes* spp.). Distribution of total echo abundance winter 1997. Unit is integrated backscattering surface per square nautical mile ( $m^2/nm^2$ ).

Table 5.5 gives acoustic indices of *S. marinus* by length group and main area. As usual most of the fish (66 %) were observed in area ABCD, but this year (1997) a somewhat larger proportion was found in the investigated part of the Svalbard area than in the two previous years. The time series (Table 5.6) shows a reduction in the total index of about 30 % from 1996 to 1997, to a level a little below average. The reduction was largest for length groups 35-39 and 40-44 cm. Like in the bottom trawl survey, about 90 % of the indices for 1996 came from the Norwegian zone.

Table 5.5. *Sebastes marinus*. Acoustic abundance indices for main areas of the Barents Sea (Norwegian zone) winter 1997 (numbers in millions).

Area	Length group (cm)								Total
	10-14	15-19	20-24	25-29	30-34	35-39	40-44	š 45	
A	-	0.1	0.4	1.4	1.0	1.3	1.0	1.6	6.7
B	+	+	0.1	0.6	2.9	5.2	2.1	0.4	11.4
C	-	+	-	0.9	1.6	2.5	1.9	0.9	7.8
D	0.1	0.1	0.5	1.4	2.1	2.0	0.8	0.3	7.3
D'	-	-	-	-	-	-	-	-	-
E	-	-	-	-	-	-	-	-	-
S	-	1.6	6.7	3.9	3.6	0.8	0.2	0.2	17.1
ABCD	0.1	0.3	1.0	4.3	7.6	10.9	5.8	3.2	33.4
Total	0.1	1.9	7.7	8.3	11.3	11.7	6.0	3.4	50.5

Table 5.6. *Sebastes marinus*. Abundance indices from acoustic surveys in the Barents Sea winter 1986-1997 (numbers in millions.) 1986-1992 includes only the area covered in 1986.

Year	Length group (cm)								Total
	10-14	15-19	20-24	25-29	30-34	35-39	40-44	š 45	
1986	4	7	7	8	5	1	+	6	38
1987	6	17	13	8	3	3	2	3	55
1988	1	1	5	4	2	1	1	+	15
1989	4	3	7	9	6	4	2	1	36
1990	2	2	6	9	9	6	5	4	43
1991	21	10	15	20	21	14	7	7	115
1992	2	4	9	11	13	11	5	3	58
1993	3	6	9	11	24	18	8	7	86
1994	5	11	5	5	7	5	2	1	41
1995	5	11	15	13	14	16	10	6	90
1996	1	4	9	13	15	22	10	4	77
1997 <sup>1)</sup>	0	2	9	10	12	12	6	3	55

<sup>1)</sup> Adjusted indices

Like in 1996 less than half of the *S. mentella* was found in area ABCD (Table 5.7). The rest was mainly registered in the Svalbard area, where a larger proportion of the total was found this year than in 1996. The time series (Table 5.8) shows that the total index for 1997 was at about the same level as in 1996, with less fish in length group 15-19 cm and some more in most other size groups. In 1996 close to 100 % of the acoustic index originated from the Norwegian zone.

Table 5.7. *Sebastes mentella*.<sup>1</sup> Acoustic abundance indices for main areas of the Barents Sea (Norwegian zone) winter 1997 (numbers in millions).

Area	Length group (cm)								Total
	10-14	15-19	20-24	25-29	30-34	35-39	40-44	š 45	
A	45.1	5.6	86.4	64.5	14.6	9.1	0.5	+	225.8
B	1.2	0.1	0.2	1.2	0.6	0.2	+	+	3.5
C	2.6	0.3	4.5	11.0	1.4	0.4	+	-	20.2
D	12.2	2.8	14.7	2.2	0.3	0.3	+	+	32.5
D'	-	-	-	-	-	-	-	-	-
E	12.5	5.2	8.9	0.8	-	-	-	-	27.4
S	90.0	26.8	113.9	84.8	27.0	14.7	1.4	-	358.6
ABCD	61.1	8.8	105.8	78.9	16.9	10.0	0.6	+	282.0
Total	163.6	40.8	228.6	164.5	43.9	24.6	2.0	-	668.0

<sup>1)</sup> Includes unidentified *Sebastes* specimens, mostly less than 15 cm.

Table 5.8. *Sebastes mentella*.<sup>1</sup> Abundance indices from acoustic surveys in the Barents Sea winter 1986- 1997 (numbers in millions.) 1986-1992 includes only the area covered in 1986.

(Year)	Length group (cm)								Total
	10-14	15-19	20-24	25-29	30-34	35-39	40-44	š 45	
1986	83	54	11	22	19	9	2	1	201
1987	17	178	86	34	10	3	1	+	329
1988	13	46	75	15	13	8	1	+	171
1989	35	12	89	36	6	10	2	+	190
1990	77	12	33	73	23	40	3	1	262
1991	549	88	31	75	38	33	3	+	817
1992	386	207	24	23	23	8	1	+	672
1993	1560	599	188	48	47	18	4	+	2464
1994	687	299	111	18	13	4	1	+	1133
1995	80	565	414	108	78	34	3	1	1283
1996	147	183	283	128	44	15	4	+	723
1997 <sup>2</sup>	165	41	229	165	44	25	2	0	670

<sup>1)</sup> Includes unidentified *Sebastes* specimens, mostly less than 15 cm.

<sup>2)</sup> Adjusted indices



## 6. DISTRIBUTION AND ABUNDANCE OF GREENLAND HALIBUT

Fig. 6.1 shows the distribution of Greenland halibut in the bottom trawl investigation. Major parts of the area of distribution of Greenland halibut are not covered during this survey. The distribution in the survey area was more westerly than in 1996, with fewer registrations towards the ice border in north-east.

Table 6.1 presents abundance indices by 5-cm length group and area with standard error of mean and coefficient of variance (CV) for the total. The index for area ABCD was almost halved from 1996 to 1997, mainly due to a large reduction in area D, which was not properly covered towards east this year. The index for area S, however, was almost doubled. The time series (Table 6.2), with adjusted indices for 1997, shows that the total index increased slightly (5 %) from 1996 to 1997. In 1996 about 75 % of the Greenland halibut indices originated from the Norwegian zone and Svalbard area. This year there were no signs of new recruitment, and like in previous years little fish < 40 cm was found.

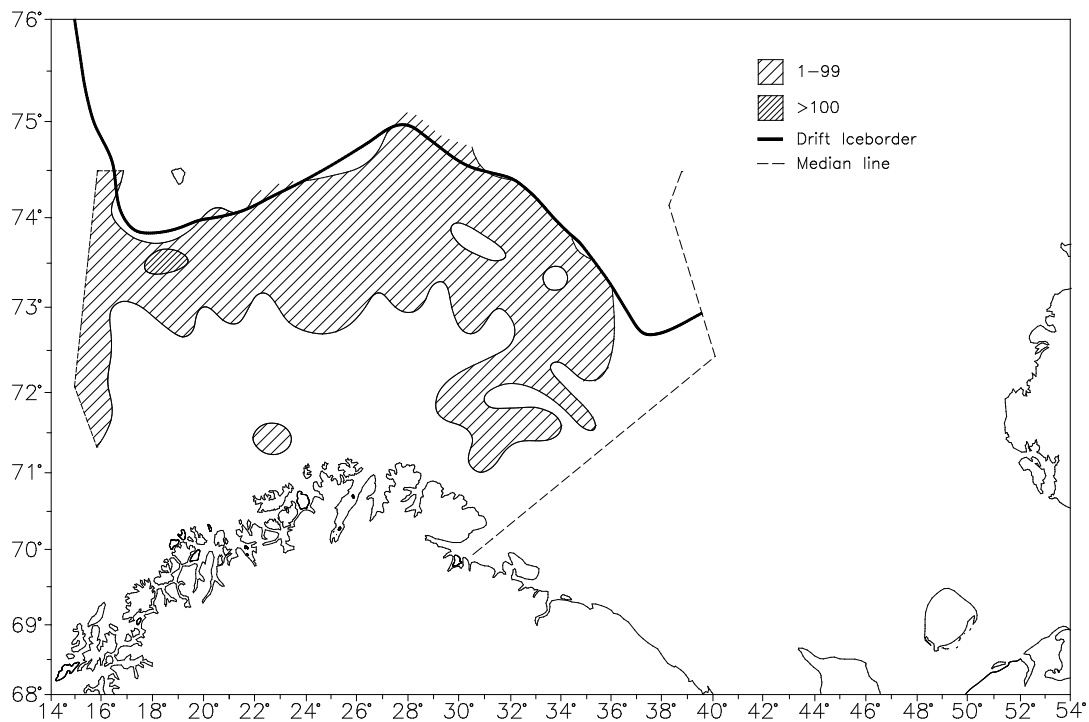


Figure 6.1. GREENLAND HALIBUT. Distribution in the trawl catches winter 1997 (no. per hour trawling).

Table 6.1. GREENLAND HALIBUT. Abundance indices (I) at length with standard error of mean (S) from bottom trawl hauls for main areas of the Barents Sea (Norwegian zone) winter 1997 (numbers in thousands).

Length (cm)	Area												
	A		B		C		D		D'		E		S
	I	S	I	S	I	S	I	S	I	S	I	S	
5-9	-	-	-	-	-	-	-	-	-	-	-	-	-
10-14	-	-	-	-	-	-	-	-	-	-	-	-	-
15-19	-	-	-	-	-	-	21	21	-	-	-	-	44
20-24	-	-	-	-	-	-	-	-	-	-	-	-	-
25-29	-	-	-	-	-	-	-	-	-	-	-	-	-
30-34	-	-	-	-	-	-	21	21	-	-	-	-	101
35-39	17	17	-	-	-	-	21	21	-	-	-	-	155
40-44	146	53	34	34	54	36	88	41	-	-	-	-	509
45-49	711	246	19	19	-	-	488	154	-	-	-	-	2826
50-54	803	306	39	39	-	-	818	335	-	-	-	-	3142
55-59	215	66	19	19	26	26	798	311	-	-	-	-	1344
60-64	204	82	19	19	56	37	231	102	-	-	-	-	590
65-69	-	-	53	39	85	62	85	50	-	-	-	-	366
70-74	69	50	-	-	-	-	63	35	-	-	-	-	149
75-79	-	-	-	-	-	-	-	-	-	-	-	-	66
š 80	-	-	-	-	-	-	-	-	-	-	-	-	22
Sum	2166	413	184	73	221	84	2634	500	-	-	-	-	9311

Table 6.2. GREENLAND HALIBUT. Abundance indices from the bottom trawl surveys in the Barents Sea winter 1990-1997 (numbers in thousands). 1990-1992 includes only main areas A, B, C and D.

Year	Length group (cm)											
	~ 14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69
1990	21	199	777	785	1205	1657	1829	2043	1349	479	159	1
1991	0	42	262	618	655	868	954	1320	1875	1577	847	1
1992	14	35	64	149	509	843	1096	1072	1029	827	633	1
1993	0	0	17	67	265	959	2310	4004	3374	1911	1247	4
1994	0	0	16	99	142	1191	2625	3866	2885	1796	753	4
1995	42	0	0	0	83	149	3228	9240	7438	2811	2336	9
1996	3149	0	0	0	61	124	1163	3969	4425	1824	1041	5
1997 <sup>1</sup>	0	65	0	0	219	249	872	4511	5931	2921	1938	6

<sup>1</sup>) Adjusted indices