PRELIMINARY CRUISE REPORT

R.V. "Johan Hjort", 7/7 - 2/8 1995.

Cruise no. 7, 1995

Norwegian Sea

INTRODUCTION

This survey was both a part of the Norwegian Sea programme, Mare Cognitum, of IMR, Bergen and a part of the international surveys in the Norwegian Sea during summer 1995, for the study of the Norwegian Spring Spawning Herring, its distribution, migration and stock composition, as well as for collection of plankton samples and environmental data. A planning group for these surveys, with participants from Norway, Faroe Isles, Iceland and Russia, met in Bergen in March -95 where agreement was reached of which area the various vessels should cover and of certain standard procedures to be worked (Anon. 1995).

The eastern part of the Norwegian Sea, i.e. from 62° to 69° N along the Norwegian coast and westwards to approximately 5° W, was planned to be surveyed. However, this was adjusted in accordance with recordings and time available through the survey. Figs. 1-2 show the transections made, with trawl stations and hydrographic and plankton stations respectively. The goal was to map recordings of herring, obtained both by use of echo sounder and of sonar, and the echo recordings of blue whiting, mesopelagic fish and plankton. In addition also other pelagic fish, like mackerel, horse mackerel, lumpsucker and salmon were sampled.

PARTICIPANTS

The following persons participated:

Gunnar Bakke	IMR, Bergen
Otte Bjelland	IMR, Bergen
Herman Bjørke	IMR, Bergen (7-20/7)
Ove Djupevåg	IMR, Bergen
Karsten Hansen	IMR, Bergen (20/7-2/8)
Lars Petter Hansen	NINA, Trondheim (20/7-2/8)
Marianne Holm	IMR, Bergen (7-20/7)
Jens Chr. Holst	IMR, Bergen
Terje Monstad	IMR, Bergen
Rolf Sundt	IMR, Bergen
Leif Nøttestad	IMR, Bergen
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Olav Waagan	UiT, Trondheim
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Egil Øvretveit	IMR, Bergen

METHODS

For echo recordings of fish and plankton the BEI-system was used in connection with a Simrad EK-500/ES38B-SK echo sounder. The following settings were used:

Mode	Active
Transducer depth	7m
Absorbtin coeff.	10dB
Pulse length	Medium
Bandwith	Wide
Max power	200W
Angle sensity	21.9dB
2-way beam angle	-21.0dB
Sv Transducer gain	28.0dB
Ts Transducer gain	27.7dB
3dB Beam width	7.2dB
Alongship offset	-0.06dg
Anthw.ship offset	-0.03dg

The integrated echo values, area of back scattering strength (S_A), were scrutinized and allocated to species or groups of species. In addition schools were recorded by sonar, Simrad SR 240, which was used throughout the survey, directed 90° to either side and tilted mostly 7° down. The schools were counted and measured at the screen and logged manually. In some occasions the schools' migration speed and directions were observed more closely by following them at a distance without herding effect and using the tracking programme connected to the sonar.

For identification of the recordings and collection of biological samples, a pelagic trawl (Åkra) with 20-25 m vertical opening was used. Trawl stations were taken at even intervals, mostly 60 nautical miles apart, and often as double hauls in the same location, i.e. one haul aiming at recordings in the water column, and one of 30 minutes duration in the sea surface layer, using large rubber floats on the trawl wings. In addition to the standard work-up of the pelagic fish samples, stomachs were also collected from most of these catches. They were either frozen or preserved by use of formaldehyd for later analysis.

CTD-sonde were used at a net of stations for observation of temperature and salinity, and MOCNESS for plankton sampling, mostly down to 200 m but at some stations down to 700m depth. In connection with these, the CTD sonde was operated to 500 and 1000m respectively, and for monitoring chlorophyll and nutrition salts, water samples were taken at the standard depths. At the two standard hydrographic sections, "Svinøy-NW" and "Gimsøy-NW", plankton samples were collected by use of WP2-net.

For catching salmon a long-line was used at two different locations, and while towing trolling were tried at a great number of trawl and MOCNESS stations.

Whale obervations were performed from the bridge throughout the survey.

RESULTS

Herring

The herring concentrations were observed as small schools in the sea surface layer over greater parts of the area surveyed. Recordings were made by both the echo sounder and by the sonar. Fig. 3 shows the S_A-values of herring averaged by rectangle. From 64° and 71°N rather notable recordings were made between the Norwegian coast and up to 100-200 nautical miles off. Mostly smaller herring, with length from 20-30 cm were found, and only traces of the larger Norwegian Spring Spawning herring were observed. The largest herring were thus found in the north, i.e. east of Jan Mayen in the international and the Norwegian economical zones along 71°N between 2° and 10°E. These observations, together with the recordings of large herring made by "G.O.Sars" in June in the Jan Mayen zone (Misund, 1995), could indicate a migration north-eastwards and a present location north of the area covered by Johan Hjort in July.

The highest concentrations of herring, recorded by echo sounder, were found in an area around the position 70°10'N 09°00'E and in the Halten bank area around the position 64°30'N 10°00'E. The geographical distribution pattern based on the S_A-values was in most areas quite similar to the one based on the sonar-recorded schools. The largest schools, however, were recorded in the Halten bank area, having a north-northeastern migration direction.

Separate length distributions of each trawl station are given in Appendix I. Length and age distributions of some stations representing the three areas of interest marked on Fig.3, A: Halten bank area, B: off Lofoten and C: in the area around pos. 71°N 06°E, are shown on Fig 4. The smallest herring were found in the Halten bank area, with mean length of 25.4 cm, the 3 year olds dominating. In the area off Lofoten the 4 year olds dominated and the mean length in the samples was 27,5 cm. In the international zone (area C), larger herring were also contributing to the recordings, with the 1983 yearclass making up more than 25% in numbers, almost the same as that of the 1990 yearclass.

The presence of *Ichthyophonus hoferi* in the herring was rather low, and infected specimens were only observed in a few of the samples analysed.

Blue whiting

Recordings of blue whiting were made throughout the survey, and the distribution was rather even over the whole area surveyed. Fig. 5 gives the S_A-values averaged by rectangle, with marking of the areas used in the calculation of the stock size. The best recordings were made in the area along and off the Norwegian shelf edge between 64° and 68°N. Blue whiting appeared mostly at depths from 200-350m, but were also found

within the whole water column from 25 to 500m, especially in the north-westernmost area.

Zero-line of the distribution was neither reached to the south, nor to the north or west, but only at a few places to the east, i.e. near the coast off Møre, Lofoten and Troms. The total stock in the Norwegian Sea was consequently not covered by this survey.

The biomass of the observed concentrations of blue whiting was estimated to 1.8 mill. tonnes, representing an abundance of 15.6×10^9 individuals. (Table 1). The length dependent density coefficient used was the same as used earlier for blue whiting estimates: $C_F = 1.488 \times 10^6 \times l^{-2.18}$, where l is the fish length. A map with the the biomass by rectangle is given in Appendix II.

In summer 1993 the biomass was estimated to be 1.7 mill t, but within the area from Skagerrak to 74°N in the Norwegian Sea. Within the same area coverd both these years, the difference should be approxmately 0.3 mill tonnes more in 1995 than estimated in 1993. The spawning stock to the west of the British Isles was, however, estimated to be 6.1 mill tonnes in March/April 1995, which demonstrates that only a part of the total stock was measured during its feeding season in the Norwegian Sea.

Separate length distributions for each trawl station are given in Appenndix III. The 1 year old blue whiting dominated in the stock, and totally contributed with 45% by numbers for the whole area surveyed. The length ranged from 20-39cm with the peak of the 1 year olds at 23cm (Fig. 6). Further, this yearclass (1994) was most frequent in the coastal area (area I) and in the south (area II), where it contributed with more than 60% and 50% respectively. The oldest blue whiting were found mostly in north, and thus the 5 year olds contributed with 30% in numbers in north (area V), being the most numerous one there (Fig. 7).

During the spring survey in 1995 the one year olds were also found to be the most numerous ones contributing with 27% to he observed stock (Monstad et al.,1995). The present result in the feeding area thus confirm the strength of the 1994 yearclass of blue whiting, as being among the best recorded at this age.

Mackerel

Catches of mackerel were obtained in surface trawl hauls from 61°N to 71°N. The number caught varied from a few to more than 2500 per hour towing (Fig. 8). The best area was in the southern and central part of the Norwegian Sea, from 63°N to 67°N between 06°E and 05°W. Faint recordings of mackerel were also recorded by the echo sounder, the traces entirely located in the sea surface layer (Fig. 9).

In Appendix IV the separate length distributions for each trawl station are given, and on Fig. 10 the length distribution from two areas, south and north of 66°30'N respectively, are shown. The size of the mackerel increased with increasing latitude.

Atlantic Salmon.
During the survey a pilot study for sampling Atlantic salmon on board IMR vessels was carried out. The main objective of the study was to test whether drifting long lines and otter board trolling could be used to sample salmon from the R/V "Johan Hjort".

A 200 hooks drifting long line baited with frozen sprat was set at two locations. The line was baited during the setting and hauled by hand. Only minor difficulties were experienced during this operation and the method appeared to work satisfactory from the R/V "Johan Hjort". Although no salmon was caught, it was concluded that, given some practising, this method could be used from the research vessel if desirable.

Two otter boards of differing size were constructed during the cruise, and trolling was carried out using the otter boards during most trawl hauls. Technically, the method functioned satisfactory and mackerel were caught at several stations. However, post-smolt salmon (salmon first summer in the sea) known to be in the area were not caught and trolling thus cannot be applied for catching this age group of salmon. That no larger salmon were caught is primarily ascribed to the fact that the survey was conducted outside the feedig area of the 1- and 2-winter salmon.

A total of 62 post-smolt salmon were caught in surface trawl hauls throughout the sampled area. Beside the post-smolts, 4 salmon of aquaculture origin were also caught (Fig. 11).

Others
Fig. 12 shows the number of lumpsucker caught in surface trawl hauls of 30 minutes duration. Samples are frozen for later analyses.

Mesopelagic fish were recorded by echo sounder over most part of the area surveyed, the best recording obtained in the cenral part, and low or no recordings in the western and north-western areas (Fig. 13). Samples from a number of trawl stations were collected and preserved to be worked up later at the IFM, Bergen.

Plankton was also recorded by eco sounder, using the same threshold level as for fish recordings while allocating the SA-values to species, i.e. -92 dB (Fig. 14). The samples from the MOCNESS-statons are at present under preparation, as are the dry-weight measurements.

Whale observations

During the cruise, whale observations were conducted 24 hours a day from the bridge. Most time of the survey time, the weather conditions were quite unfavorable, with long periods of extremely low visibility due to fog. The conditions also suddenly changed. Registrations are not performed in a systematical manner, the true observation areas are scattered and sporadic, and the material (Table 2) should consequently not be used in any quantitative considerations.

The main purpose of the whale registration on this cruise, however, was to investigate if whale can be detected by sonar. The sonar used was a 24 kHz long range fisheries sonar (Simrad SR 240), which gives a rough image of the observed schools, and is therefore far from ideal for revealing detailes. However, it offered an indicatition of possibilities and limitatons with sonar registration of whales.

All the whales observed in the vicinity of the vessl were approached slowly, in order to investigate how the image would appear on the sonar screen. The images were recorded on video. All the whales that were approached were observed clearly on the sonar screen, as long as they were not more than approximately 400m away. This was the case even though the echoes were relatively strong at this distance, and might indicate a fundamental limitation of sonar registration of targets in the surface due to downward bending of the acoustic beams. The only means of distinguishing species was to consider the size of images, which only offered a rough indication. It was hard to count the number of whales in groups on the sonar image, but the number of whales was fairly constant throughout each session, and independent of the number that could be observed visually at the sea surface.

The conclusion is that it is possible that sonars can be useful as means of detecting whales during cruises, but it seems unlikely to be possible to distinguish species with this technique. If detection range is limited to 400m, the sampling volume will be quite small, and accordingly close transect lines should be chosen in the surveys.

Hydrography

Figs. 15-18 show the horizontal temperature distributions at 5, 50, 200 and 400m depths respectively. In the surface layer the temperature had an evenly increase from 7-8° C in the west, being coldest in the south, to 10-11.5° C near the Norwegian coast, being coldest in the north. From 50m and down a frontal area could be distinguished along the continental slope, especially in the south where the temperature changed from 0.5° to 5-6° C within a rather small area (Fig.18).

The corresponding salinity distributions are given on Figs. 19-22, showing the appearance of relative low values, 32-33.5 $^{\circ}/_{oo}$ near the coast in the surface layer and a rather sharp

gradient approximately 100 nautical miles off. The gradient was nearer to the coast at 50 m, but at 200 and 400m depths the conditions were more homogenous.

The vertical distributions of temperature and salinty for the Svinøy-section and the Gimsøy-section are shown on Figs. 23-24.

References

Monstad, T., Belikov, S., Shamrai, E. and McFadsen, I. 1995. Investigations on blue whiting in the area west of he British Isles, spring 1995. ICES, Doc. C.M. 1995/H:7.

Misund, O.A. 1995. Cruise report, cruise no. 9, 1995, R/V"G.O.Sars", 26/-22/6 1995. Institutef Marine Research, Bergen.

Bergen 8/9 1995

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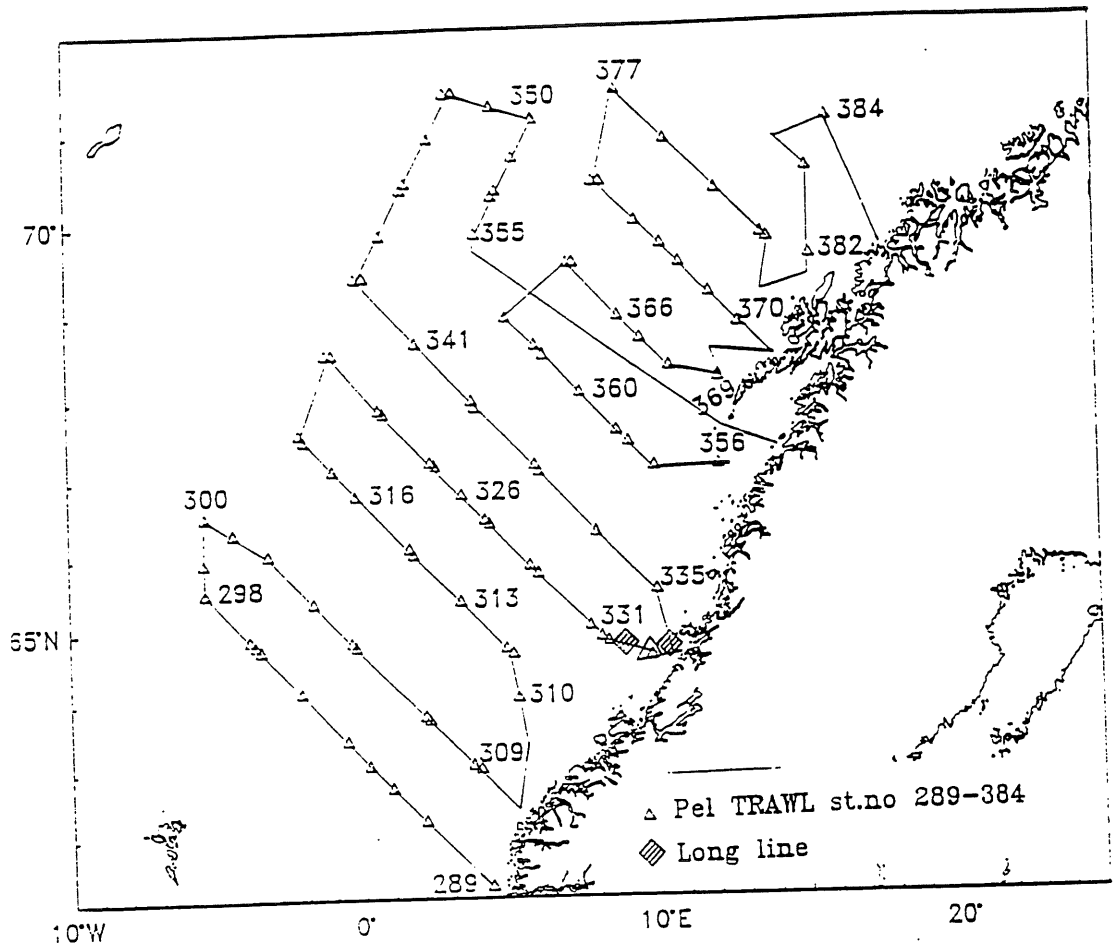
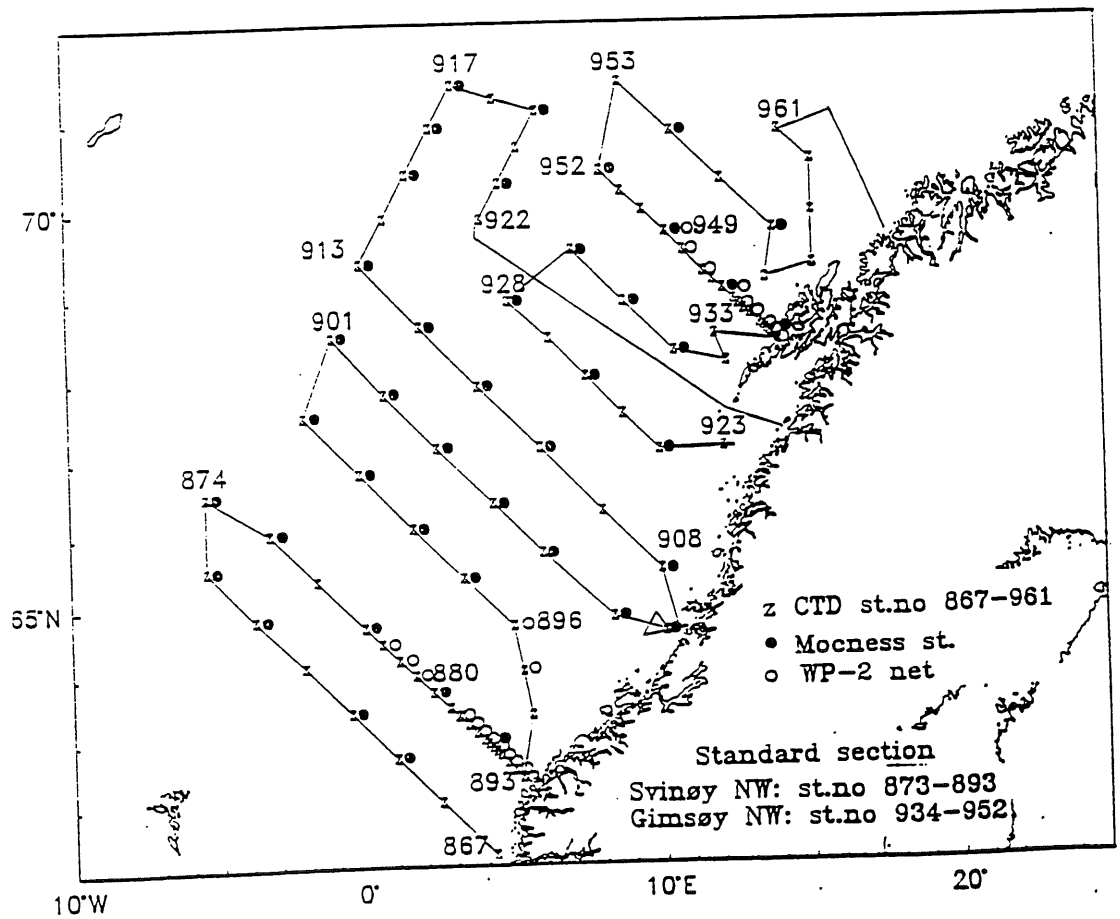


Fig. 1. Cruise track with fishing stations, R/V "Johan Hjort", 7/7-2/8 1995.



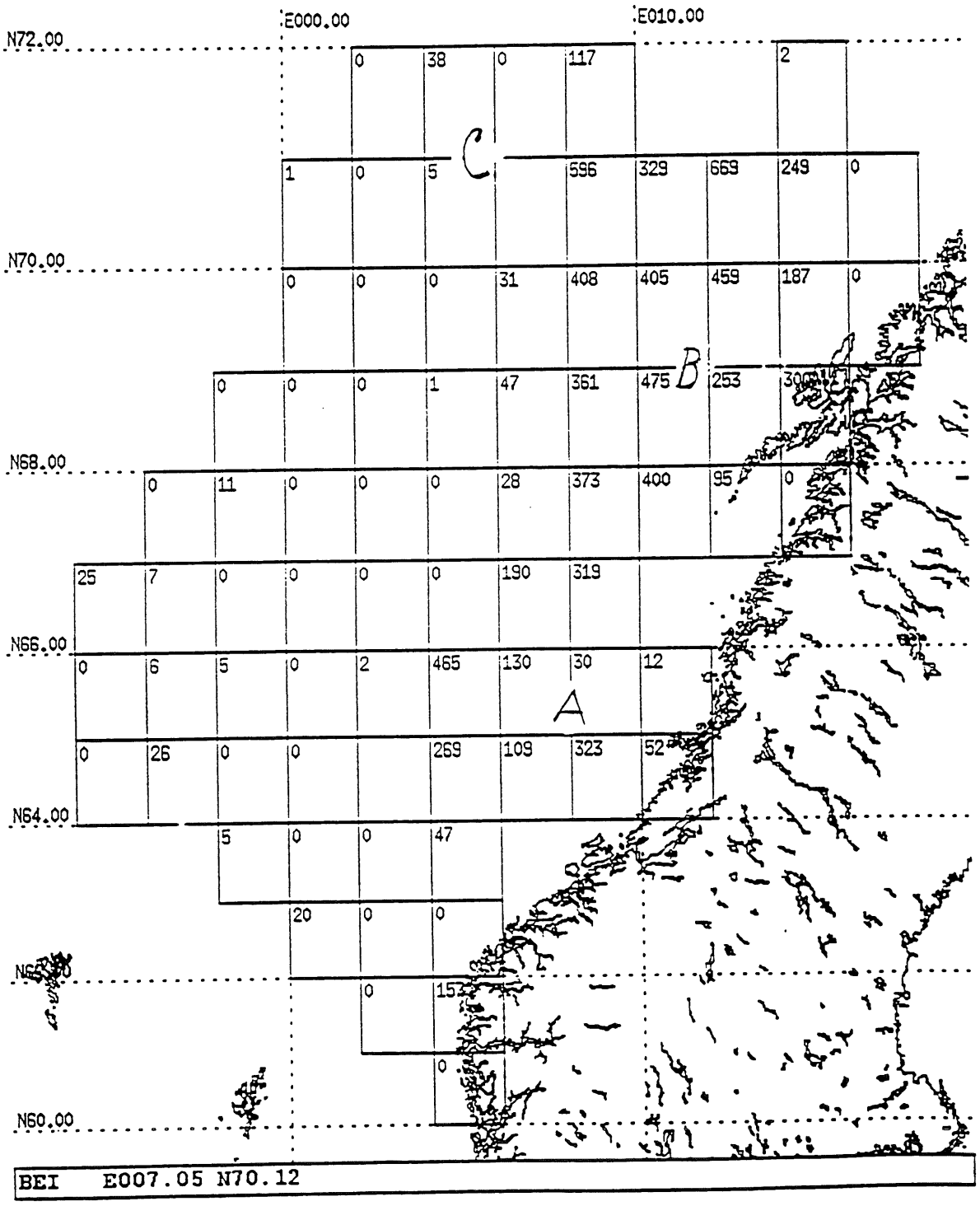


Fig. 3. Distribution of herring, BEI-map of S_A-values. A-C show areas represented by age and length compositions presented on Fig. 4.

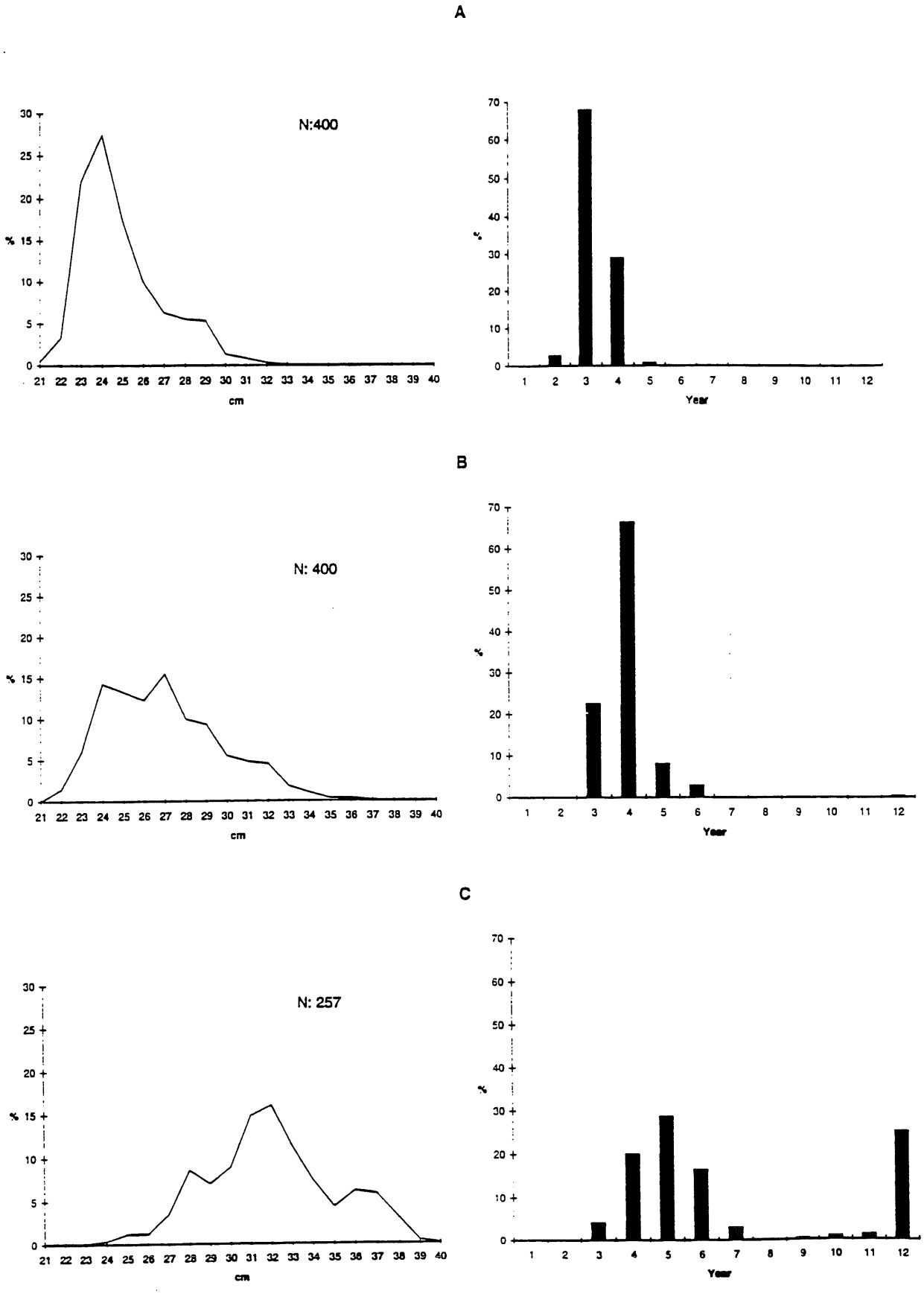


Fig. 4. Length and age composition in herring samples from the areas marked on Fig. 3. A: T.st.329, 331, 333, 336. B: T.st.336, 368, 369, 370, 372. C: T.st. 347, 348, 350, 351, 352, 377.

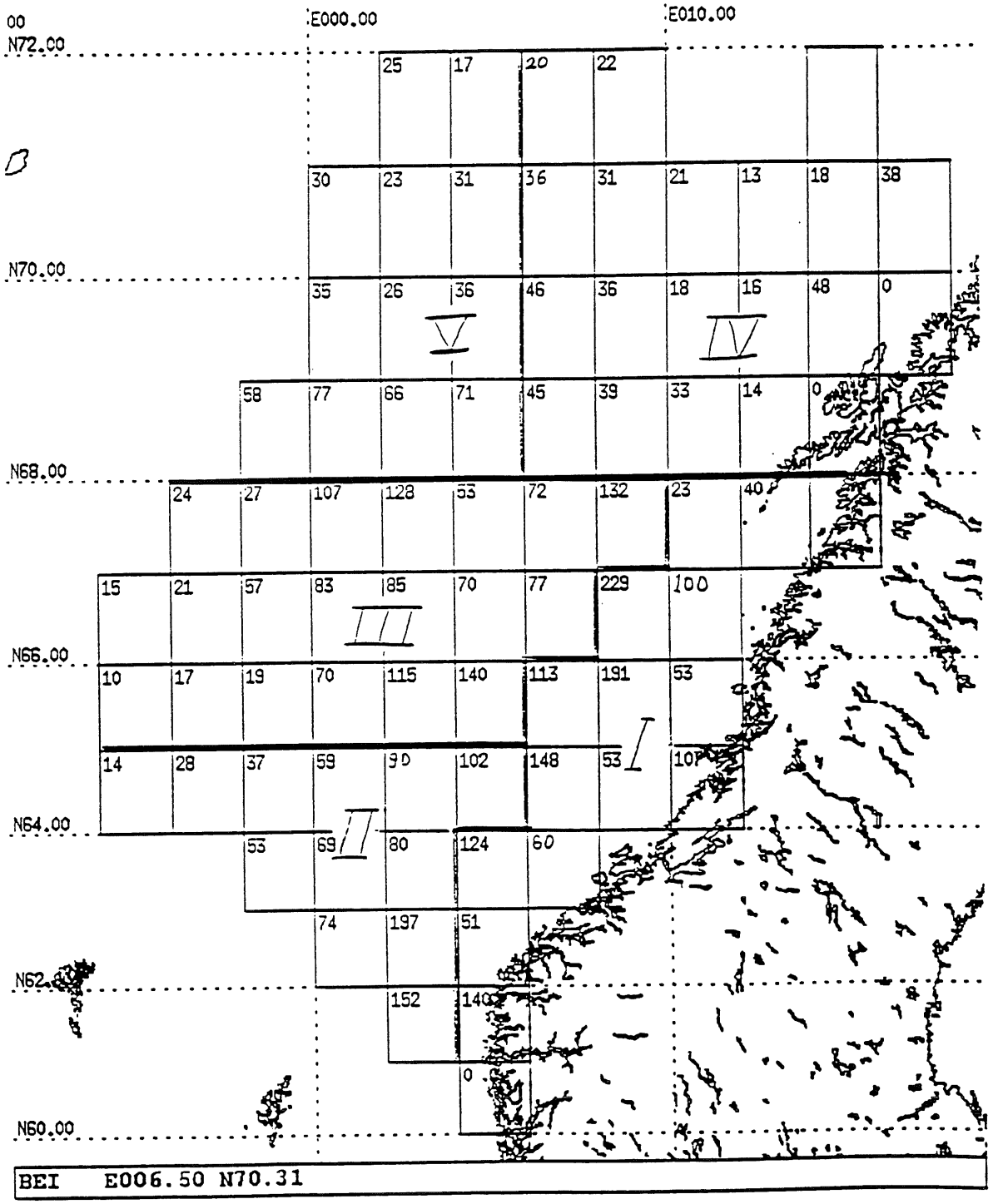


Fig. 5. Distribution of blue whiting, BEI-map of S_A-values. I-IV are areas represented by age and length compositions presented on Fig. 7.

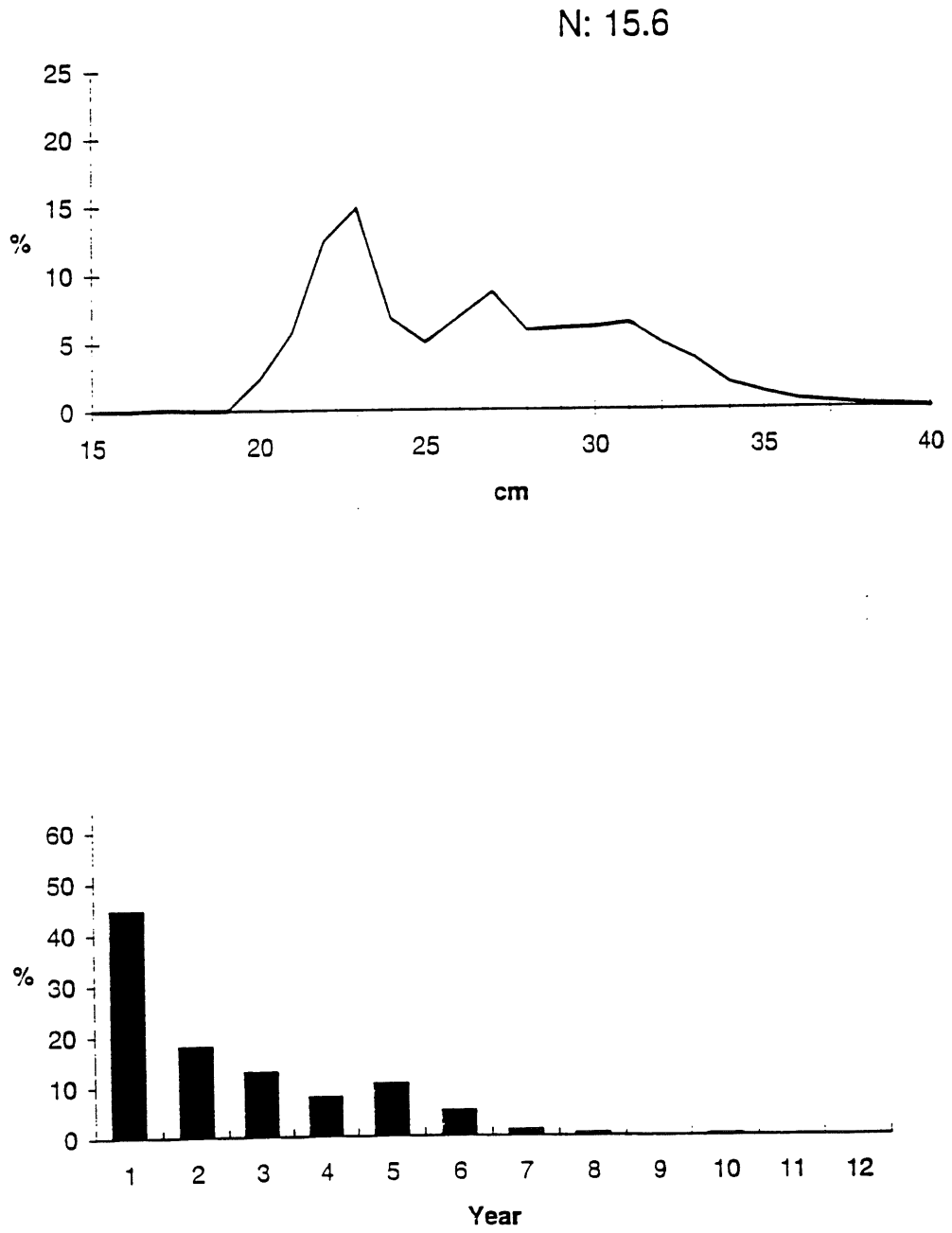


Fig. 6. Total length and age composition (N%) of blue whiting, weigthed by abundance. N= 10^9 individuals .

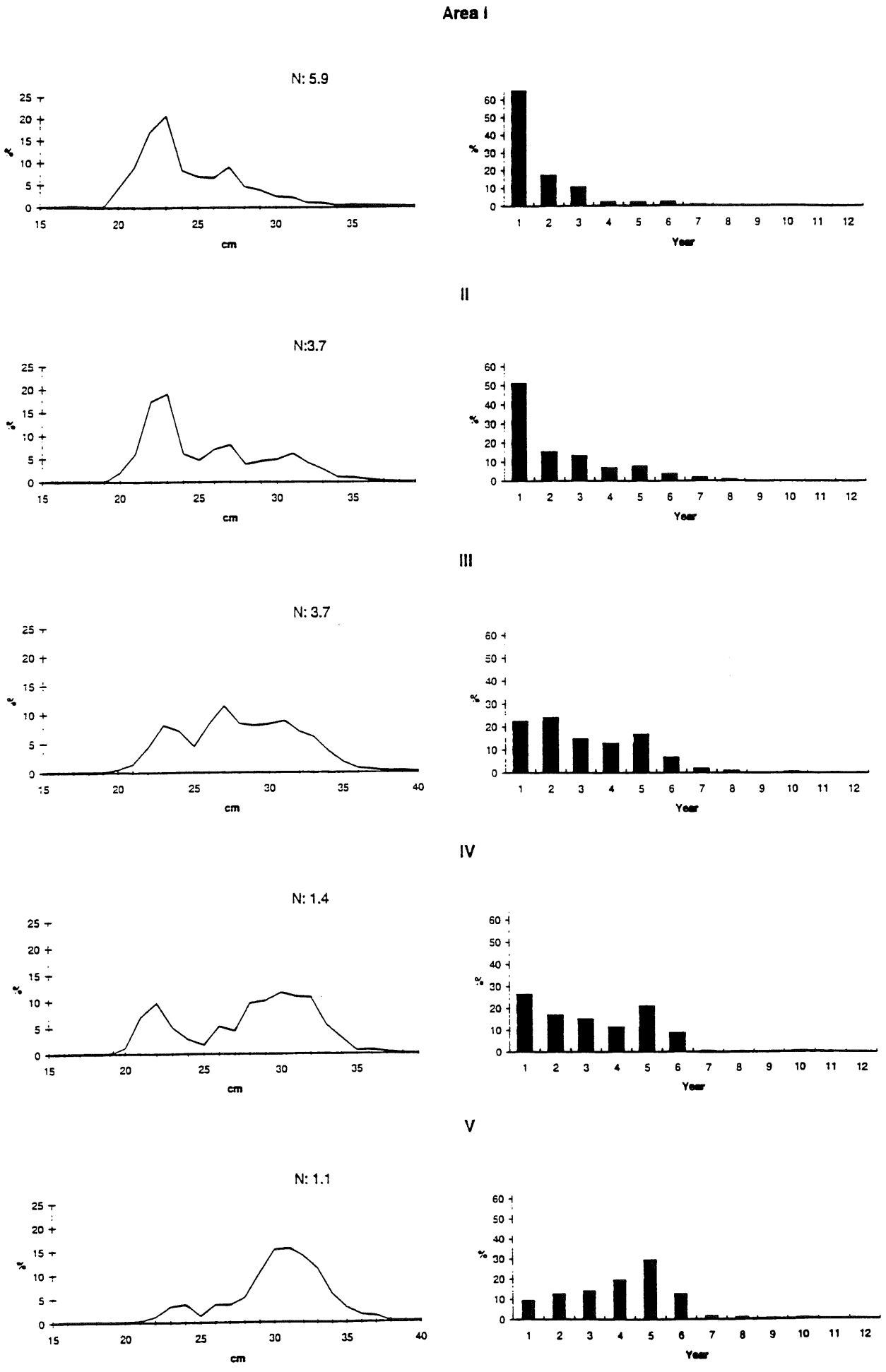
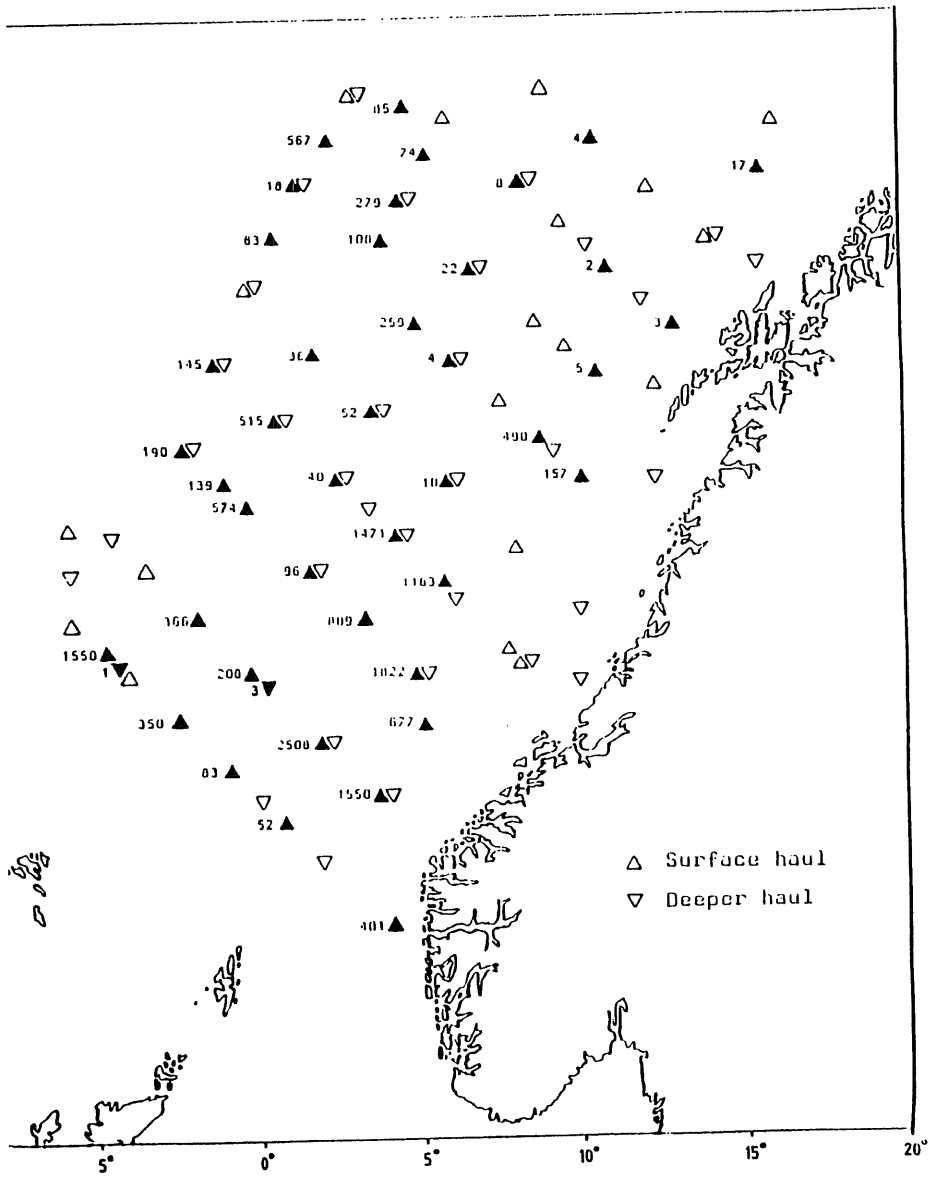


Fig. 7. Length and age composition (N%) of blue whiting in the [illegible] weighted by abundance. N= 10^9



g. 8. Catch of mackerel, numbers per hour towing, on filled symbols for the pelagic trawl stations.

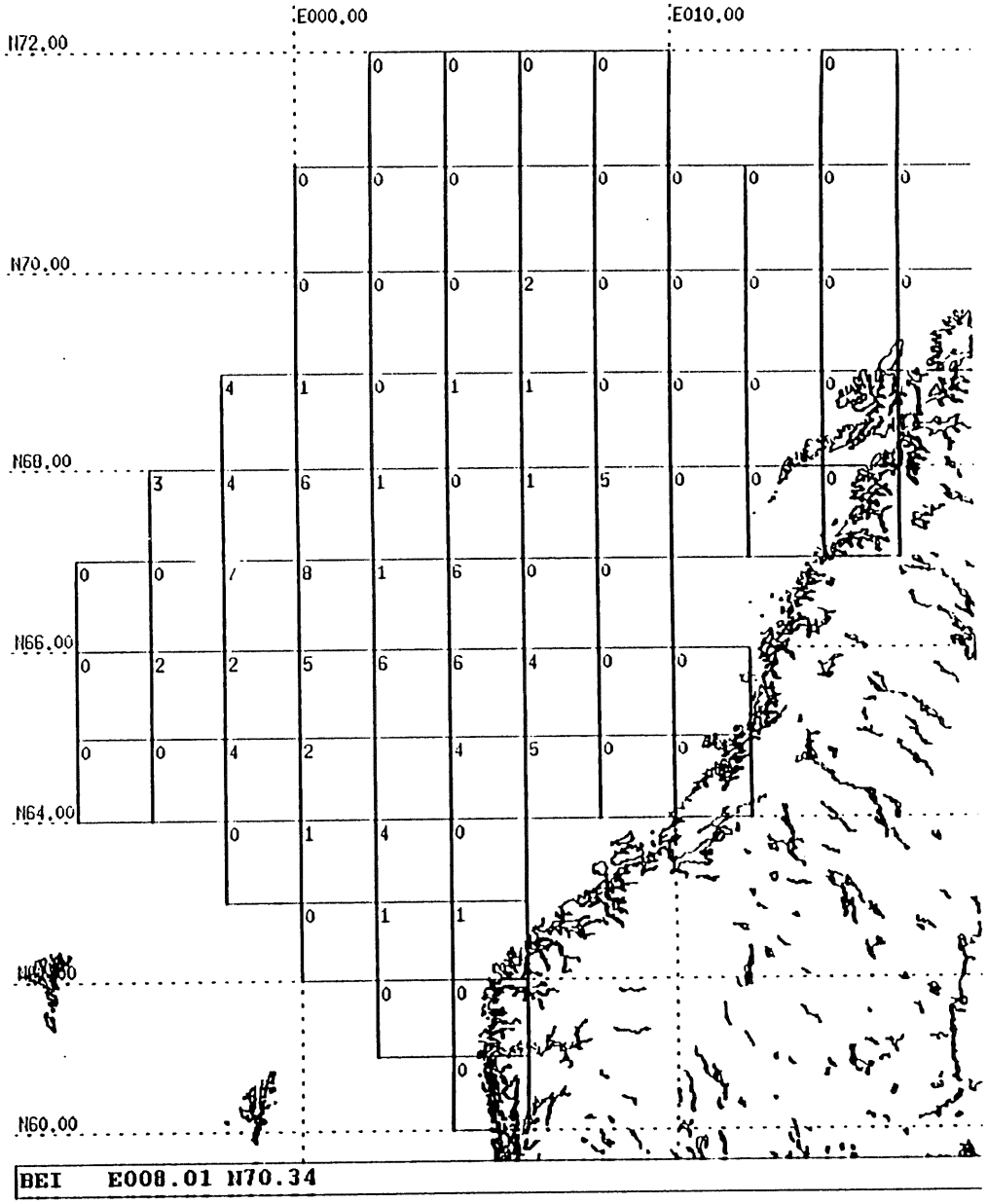
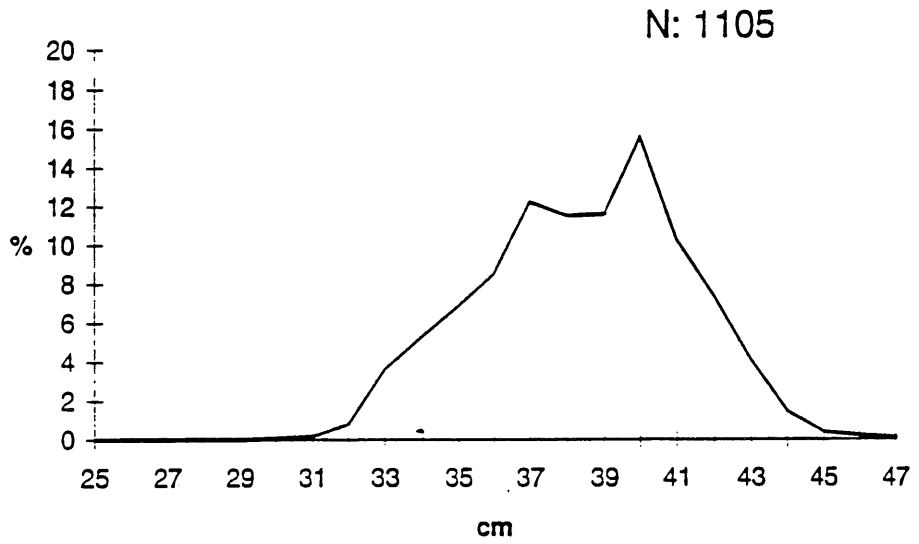


Fig. 9 Distribution of mackerel, BEI-map of S_A-values.



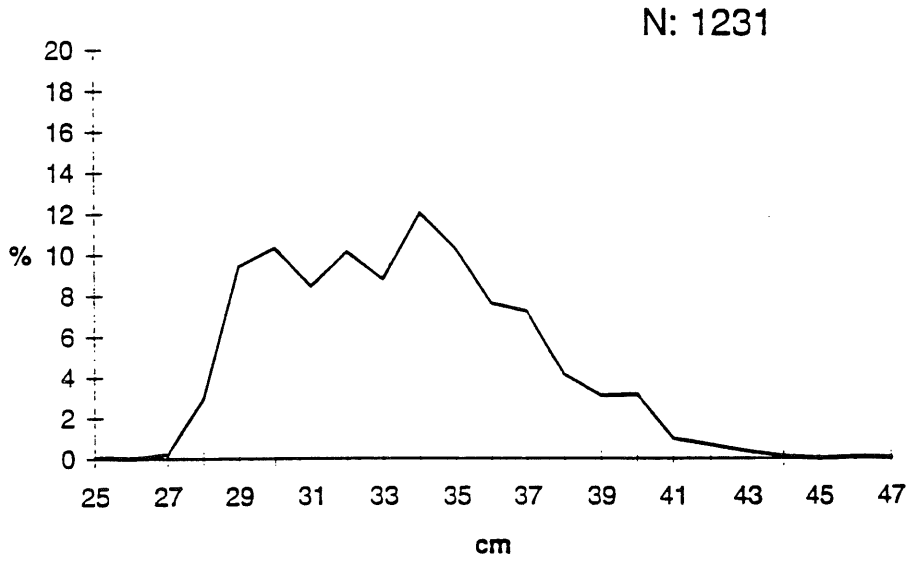


Fig. 10. Length distribution of mackerel in samples from the trawl stations north of 66°30'N (above) and south of 66°30'N (below).

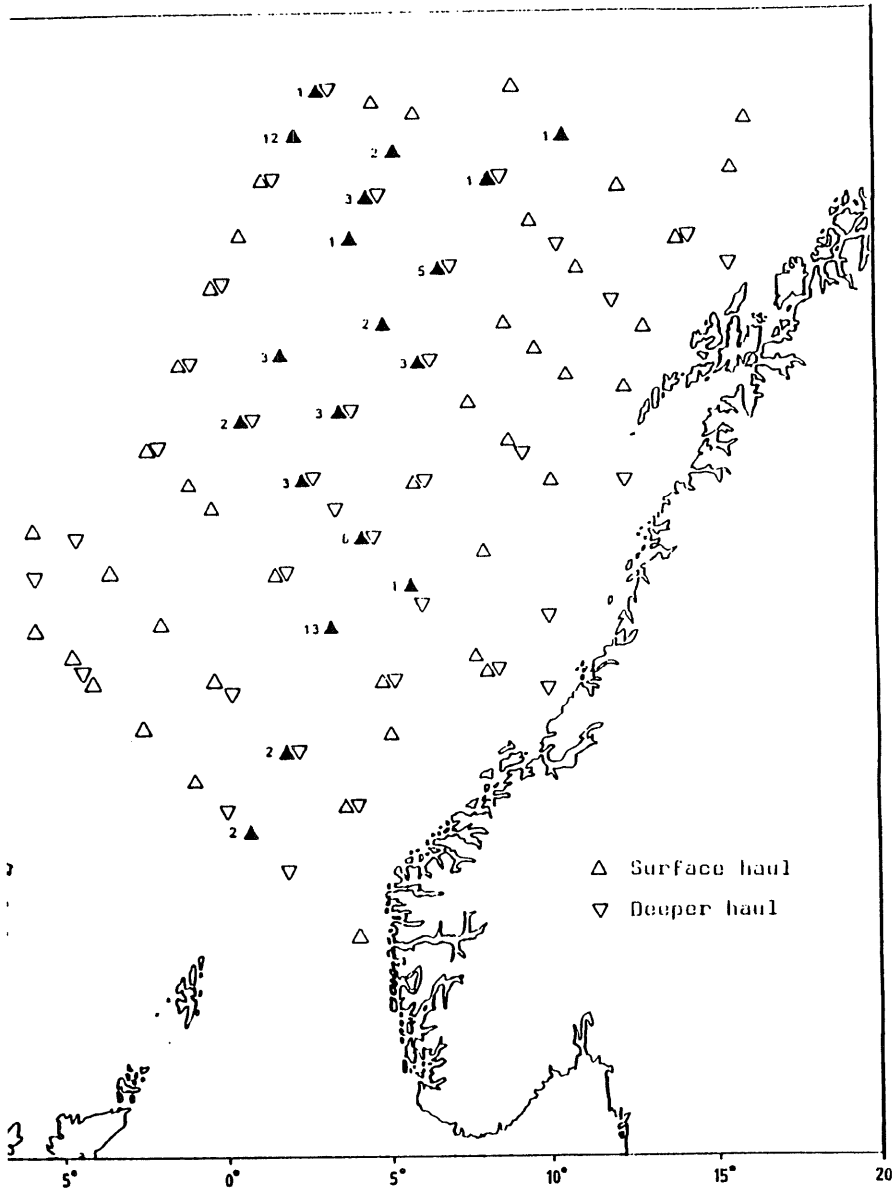


Fig. 11. Catch of salmon (post-smolt), in numbers pr trawl station, filled symbols.

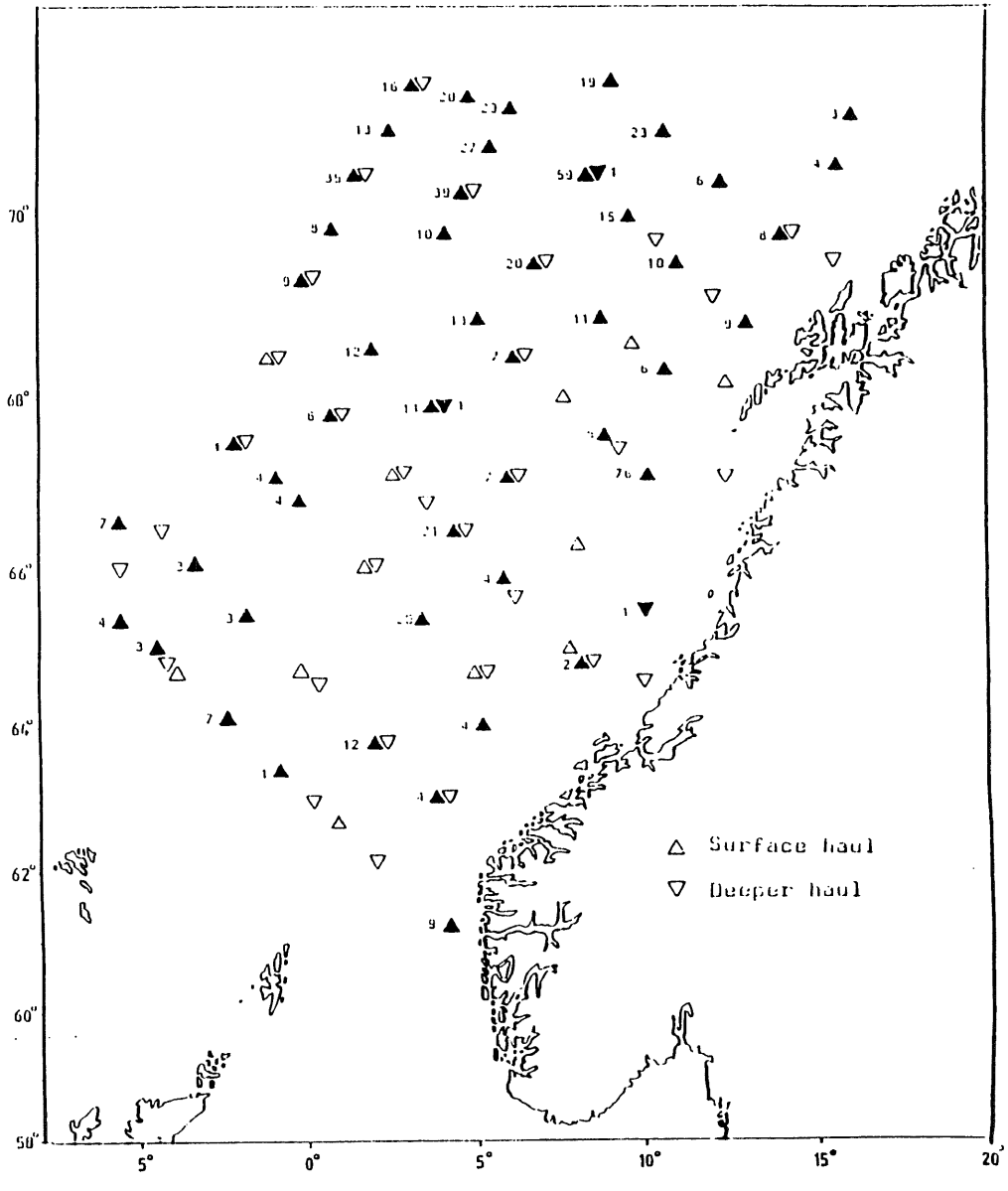


Fig. 12. Catch of lumpsucker, in numbers pr trawl station, filled symbols.

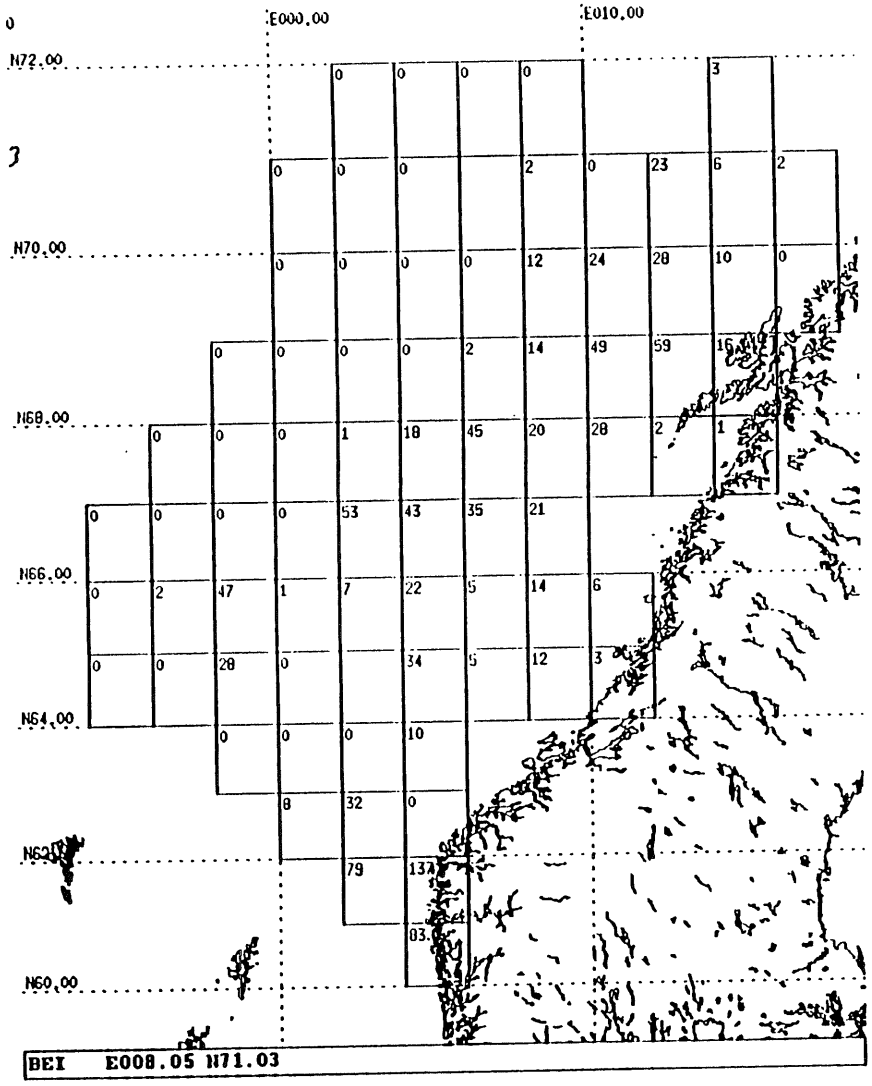


Fig. 13. Distribution of Mesopelagic fish, BEI-map of S_A-values.

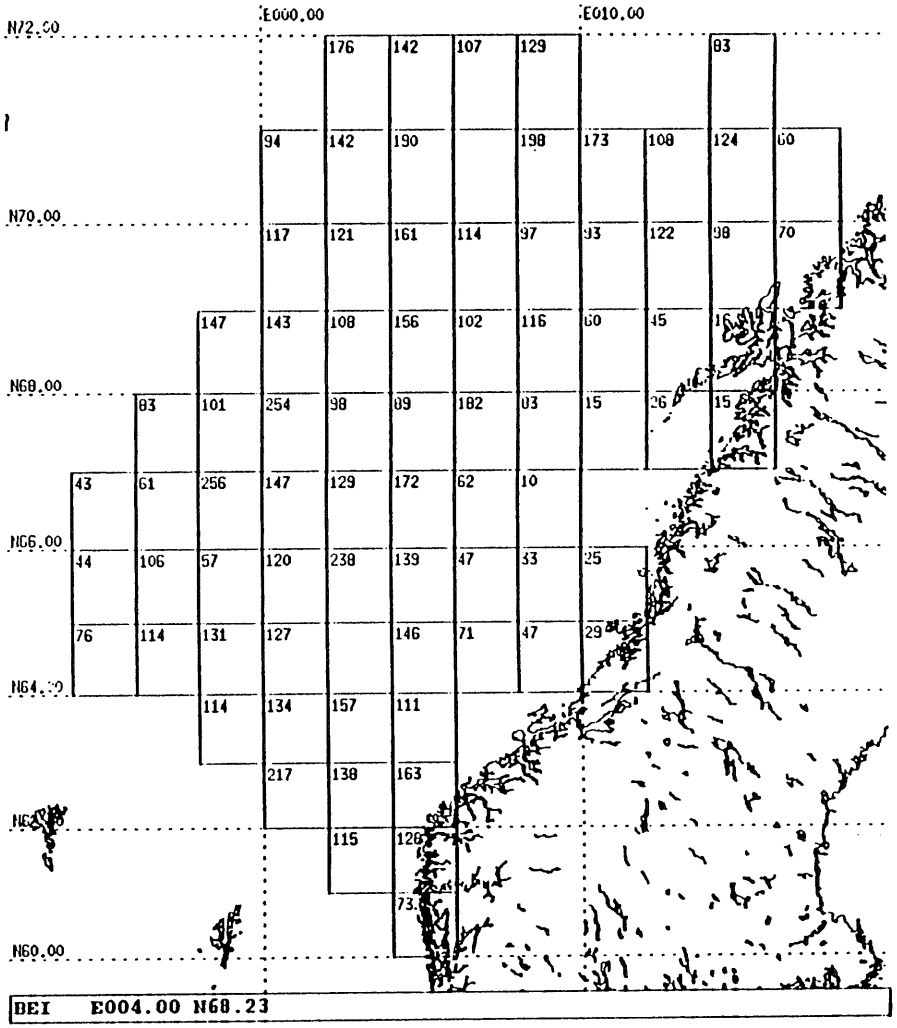


Fig. 14. Distribution of plankton, BEI-map of S_A-values.

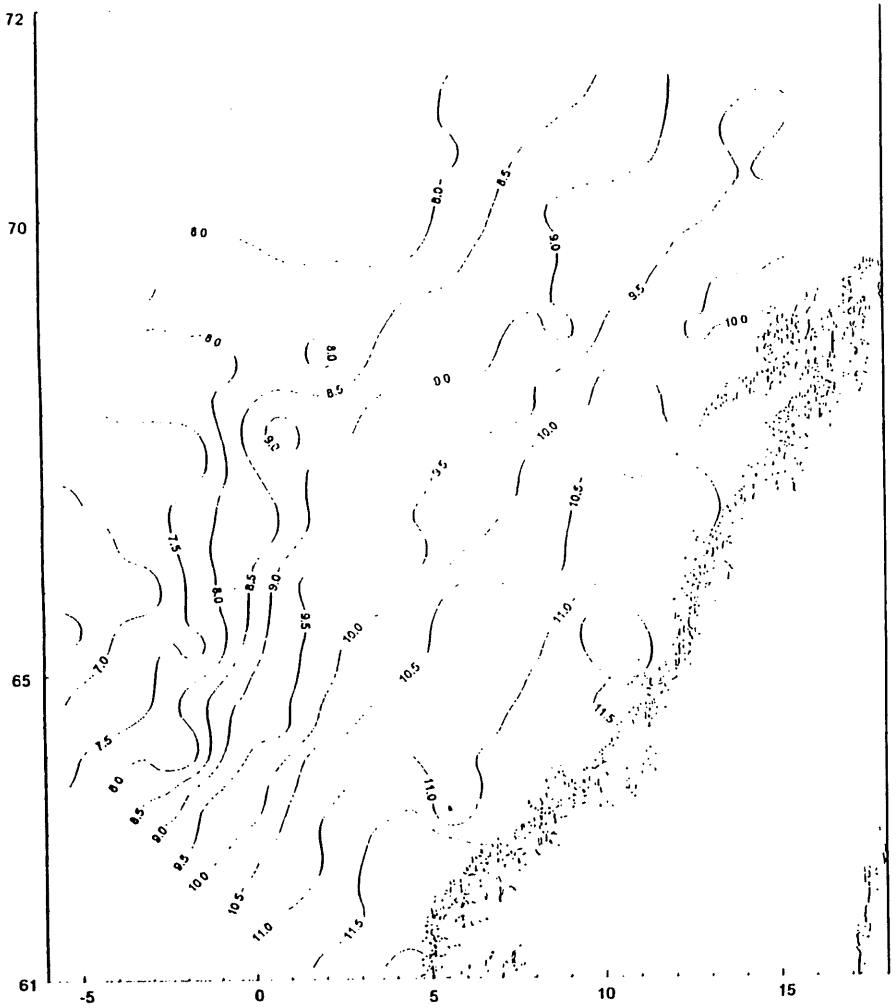


Fig. 15. Temperature, t° C, in the surface layer.

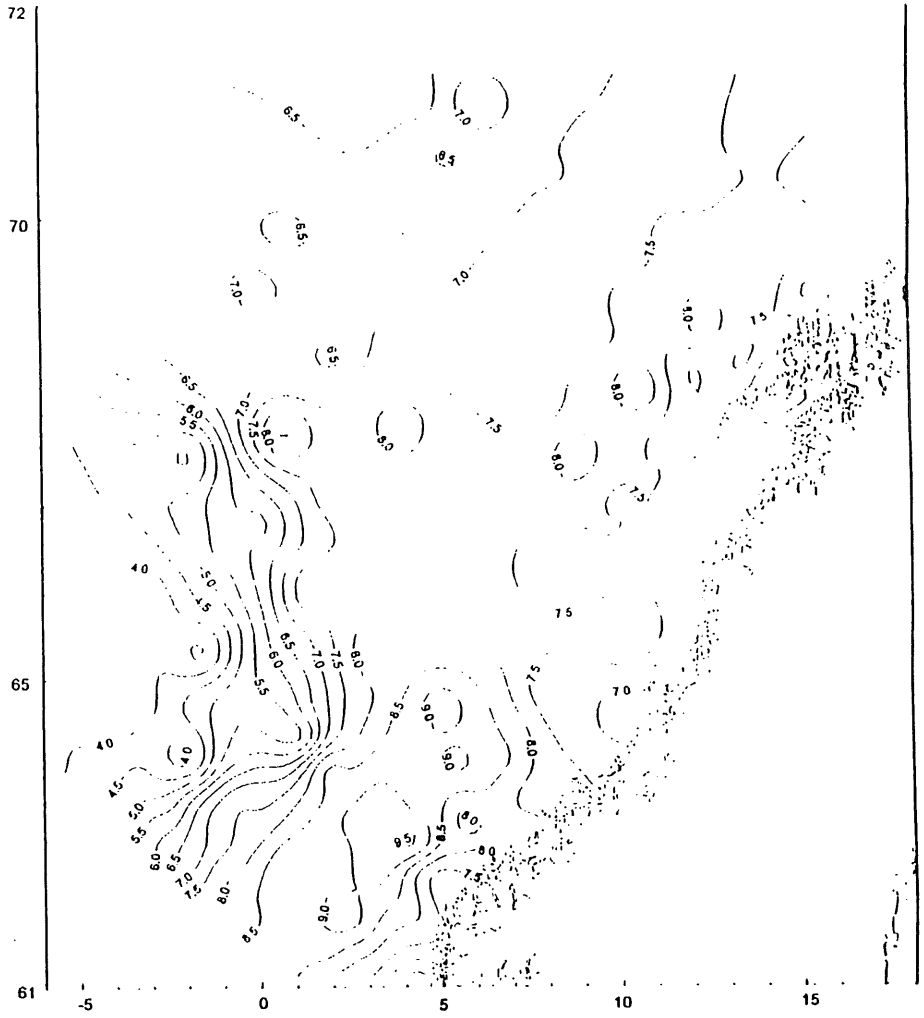


Fig. 16. Temperature, t° C, in 50m depth.

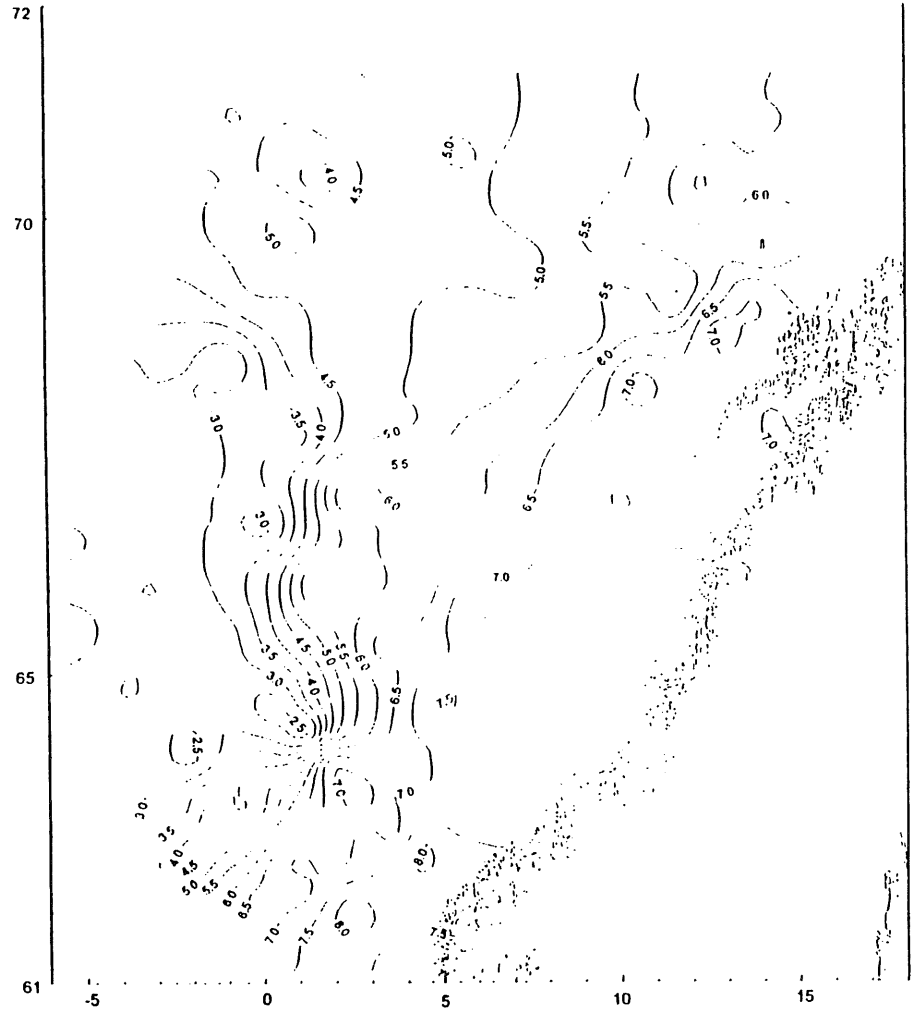


Fig. 17. Temperature, t° C, in 200m depth.

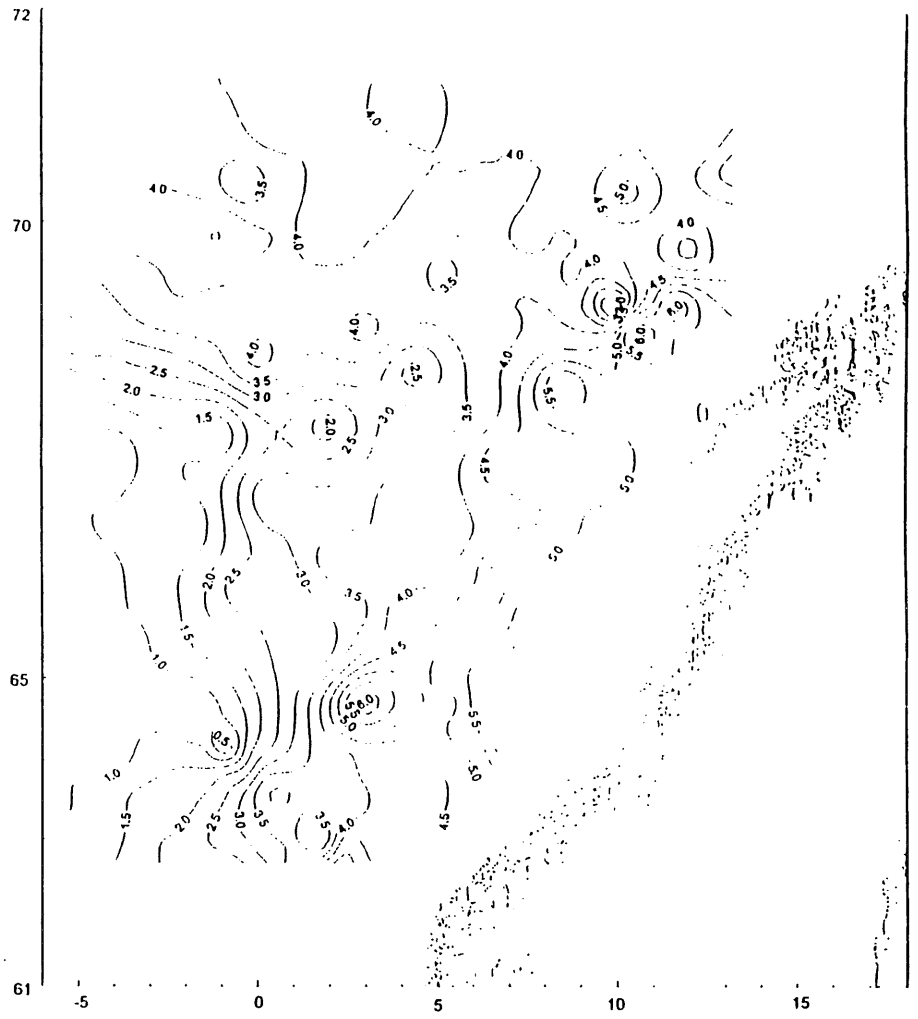


Fig. 18. Temperature, t° C, in 400m depth.

Fig. 19. Salinity, $^{0}/_{00}$, in the surface layer.

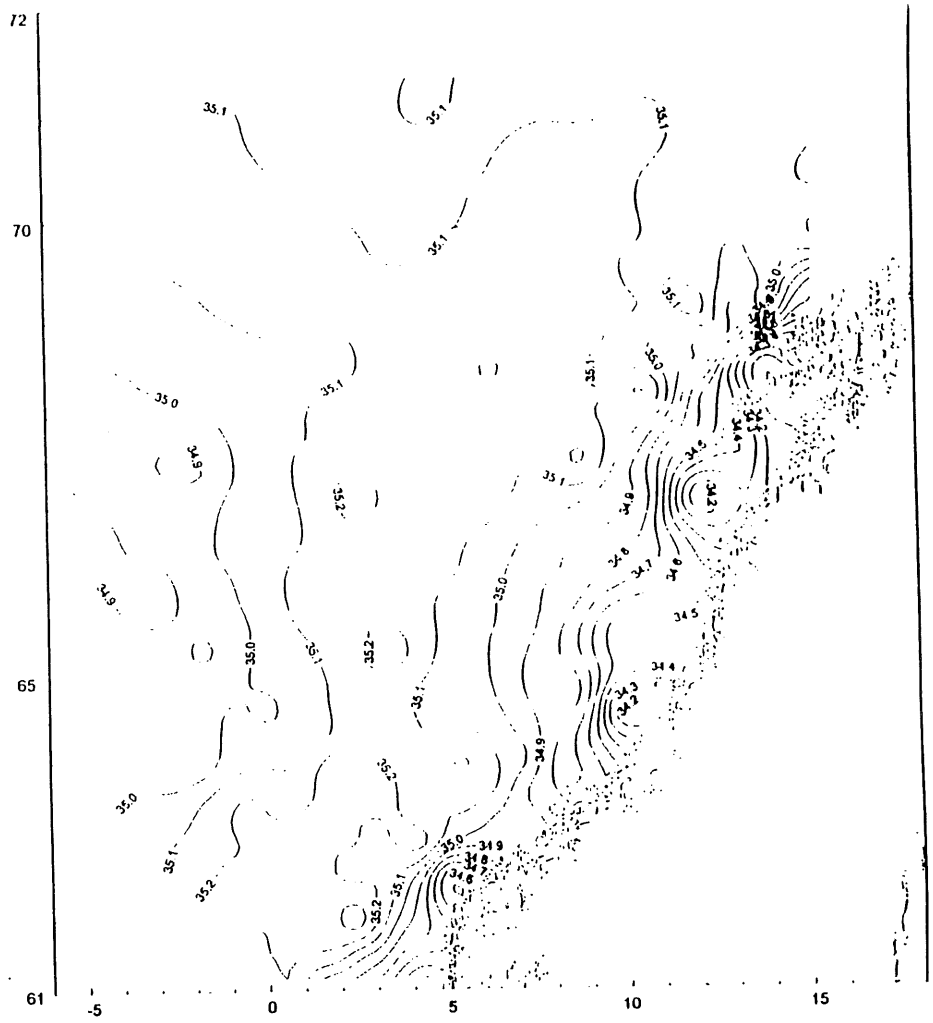


Fig. 20. Salinity, $^{0}/_{00}$, in 50m depth.

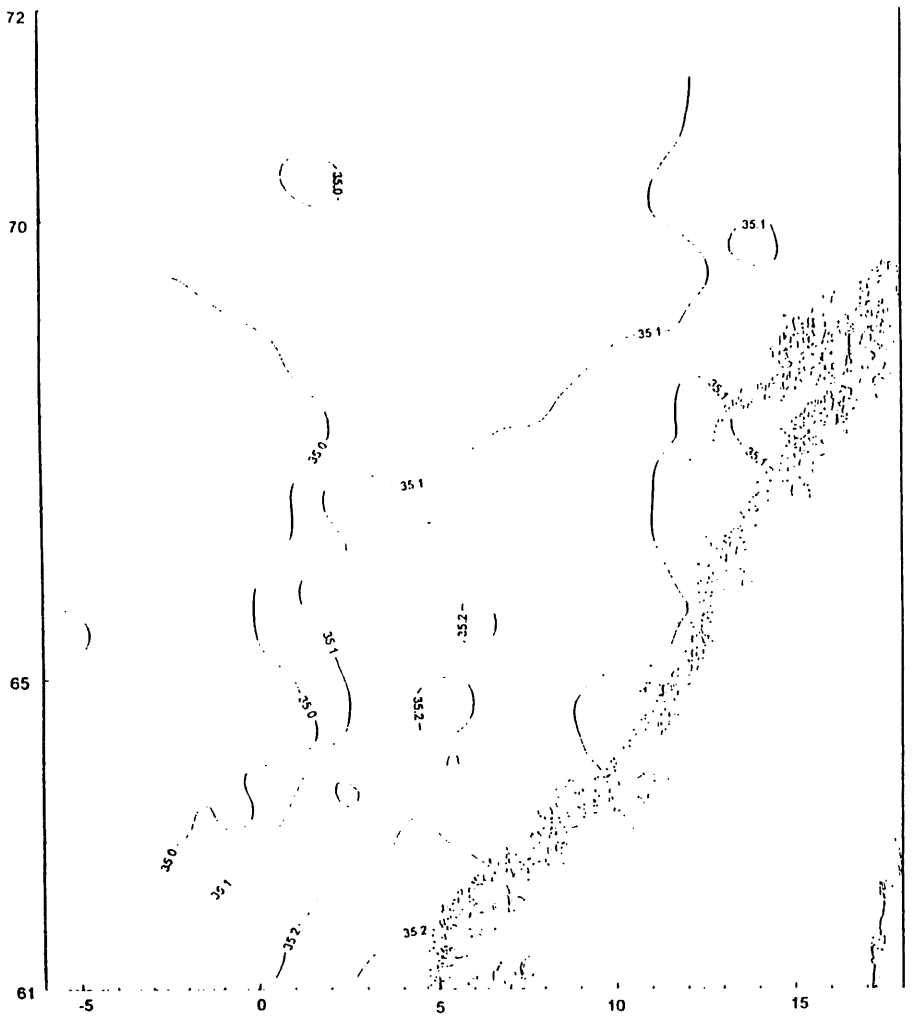


Fig. 21. Salinity, $^{0}/_{00}$, in 200m depth.

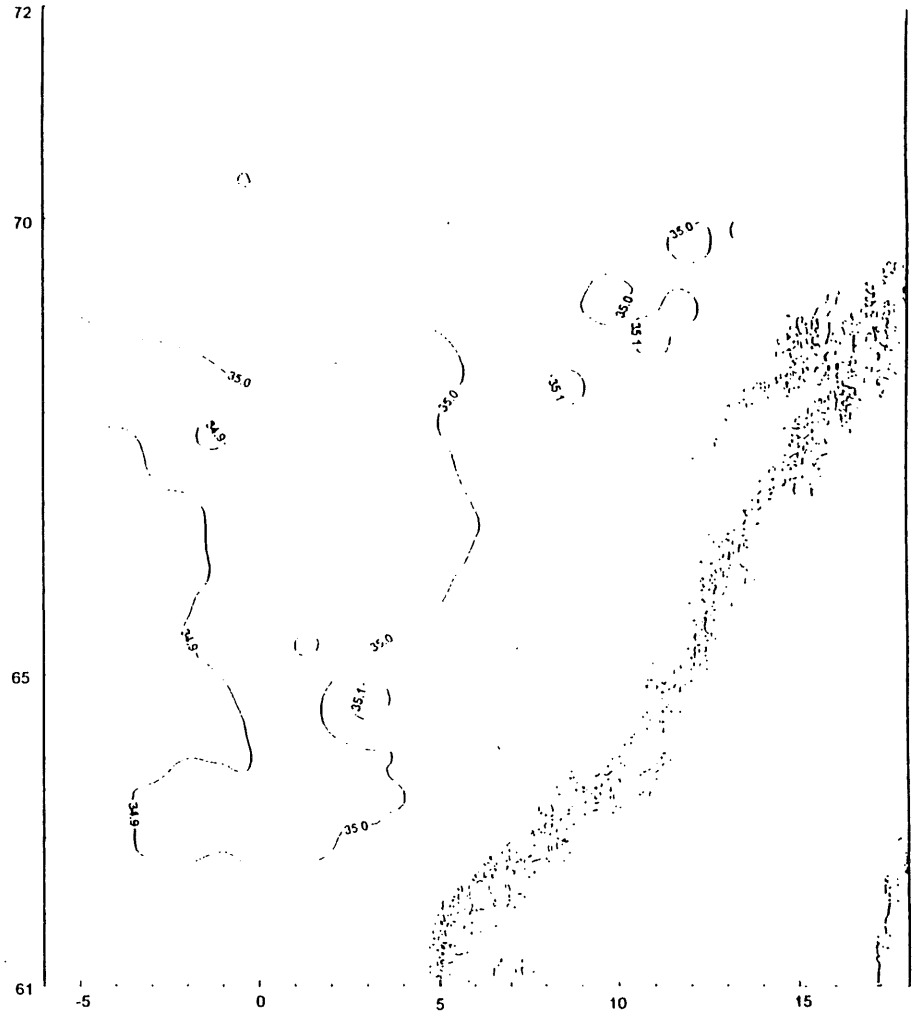
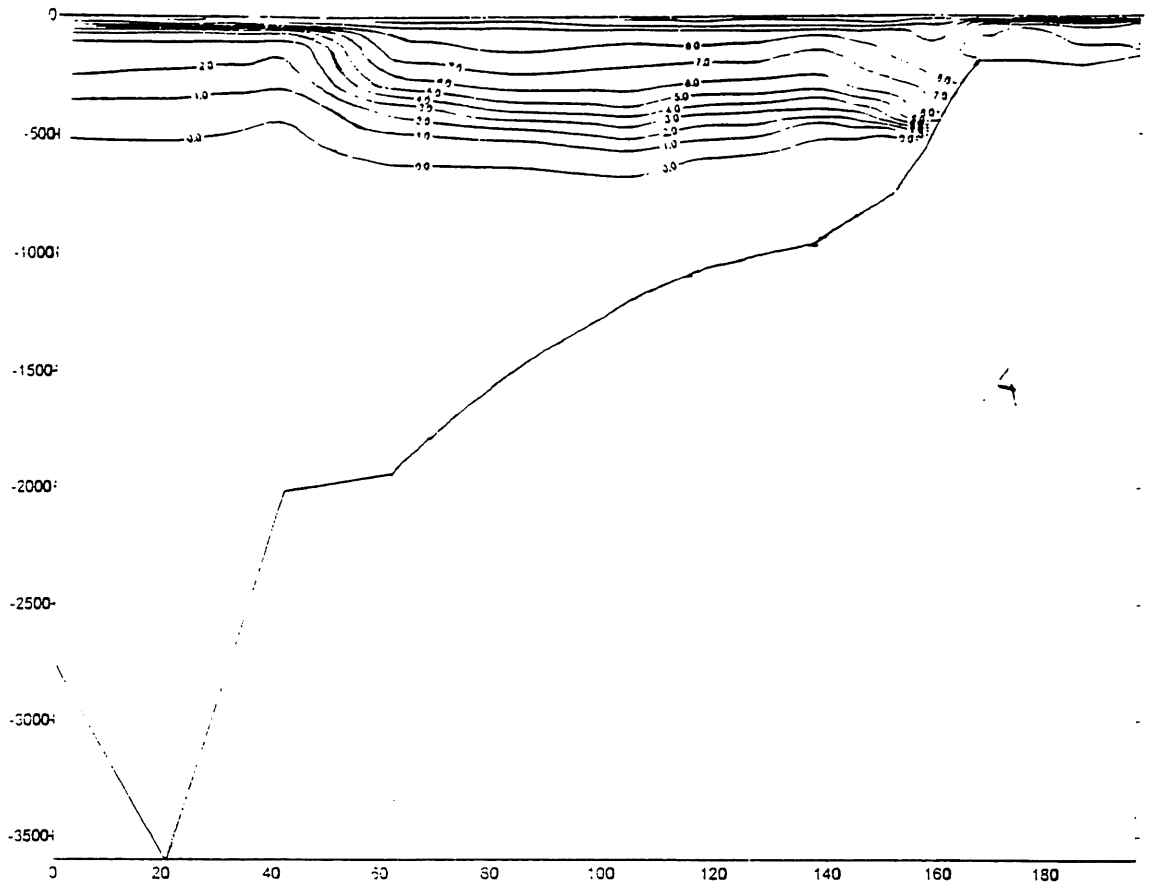


Fig. 22. Salinity, $^{0}/_{00}$, in 400m depth.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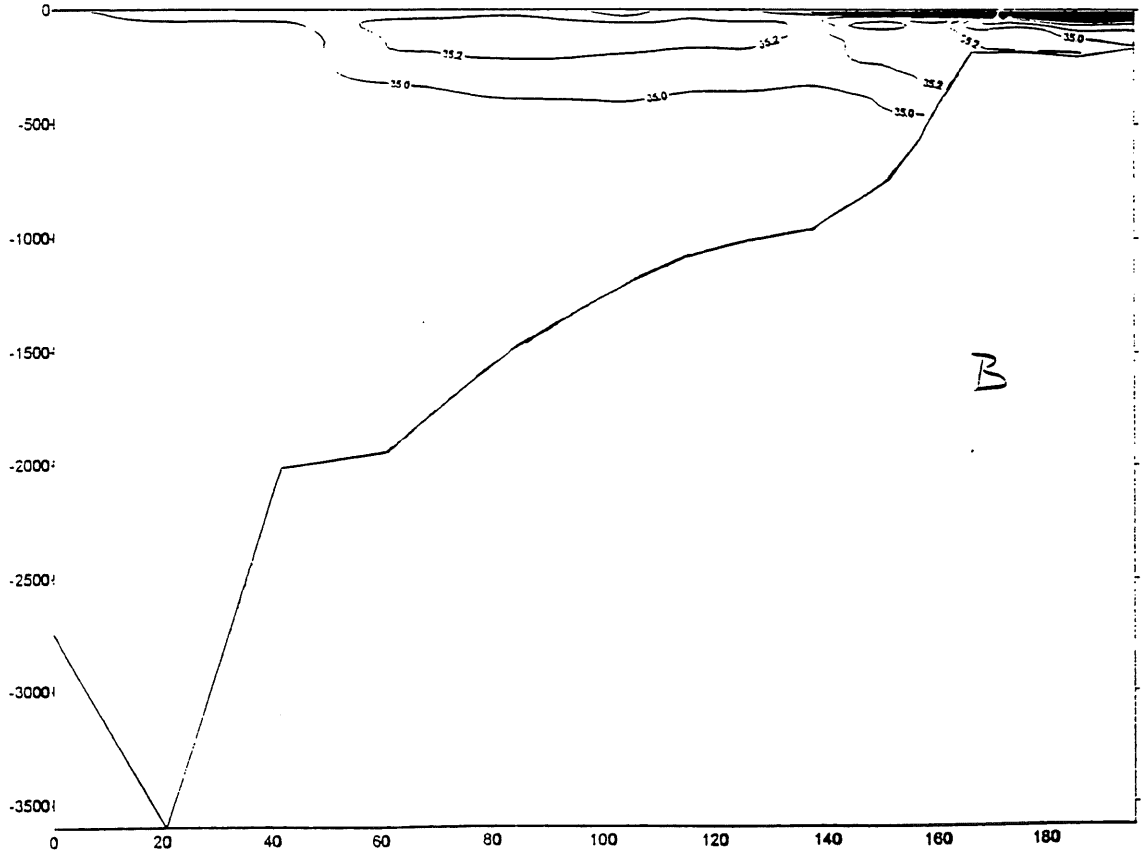
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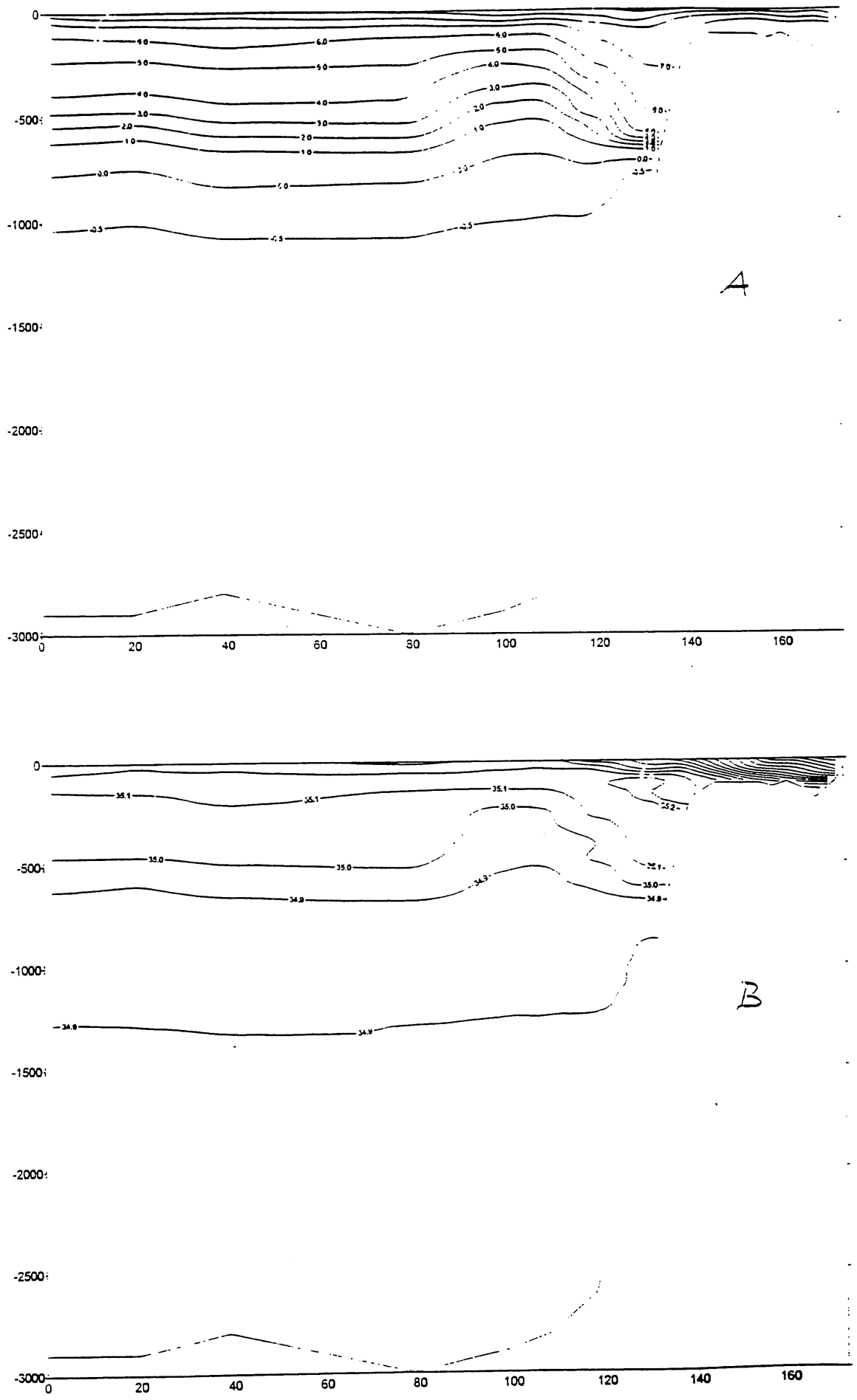


Fig. 24. Temperature, t° C, in the Gimsøy-section (A)

1Mengd2 Ver 0692 Mengdeberegninger Kolmule Kolmule sommer-95
0Antall i omr. : N x 10 Exp-6 Middel-lengde : Cm Vekt i omr. : Tonn x 10 E
Gj.vekt : Gram Kondisjon : 1000 x Vekt/ Lengde Exp 3 Dato : 24/ 8-1995
0 6 -2.18
C : 1.490 * 10 * L
Område : Alle

0 Lengde	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Tot	Vekt
17.0-17.9	15															15	.4
18.0-18.9																0	.0
19.0-19.9																0	.0
20.0-20.9	368															368	17.6
21.0-21.9	883	19														902	47.2
22.0-22.9	1888	58														1946	118.7
23.0-23.9	2156	150			18											2324	162.0
24.0-24.9	947	86		20												1053	84.1
25.0-25.9	471	163	136	10												780	69.1
26.0-26.9	112	767	192													1071	113.5
27.0-27.9	62	747	506	30	5											1350	159.2
28.0-28.9	31	507	338	21	13											910	119.9
29.0-29.9	41	263	252	191	145	46	1									939	135.5
30.0-30.9		23	297	271	283	81										955	153.4
31.0-31.9		16	148	225	443	126	33	8								999	169.5
32.0-32.9		12	85	155	326	144	33	9								764	146.2
33.0-33.9			26	173	207	115	56									577	120.8
34.0-34.9			19	73	77	90	16	22		1						298	67.9
35.0-35.9				33	70	52	15	11								181	43.4
36.0-36.9					24	54	14	3								95	24.5
37.0-37.9				7	7	41	5									60	19.8
38.0-38.9						19				9						28	7.0
39.0-39.9					4	7		8	1							20	6.5
40.0-40.9										5						5	1.8
0 Antall:	6974	2811	1999	1209	1622	775	173	61	1	15	0	0	0	0	0	15640	
Gj.lgd:	23.22	27.10	28.79	31.38	31.91	33.29	33.53	34.75	39.50	38.90	.00	.00	.00	.00	.00	26.83	
Vekt:	472.5	318.3	272.9	212.4	298.1	158.4	36.6	13.4	.3	4.9	.0	.0	.0	.0	.0	1787.9	
Gj.vkt:	67.8	113.2	136.5	175.7	183.8	204.4	211.5	220.2	345.0	327.9	.0	.0	.0	.0	.0	114.3	
Kond.:	5.3	5.6	5.6	5.6	5.7	5.5	5.6	5.2	5.6	5.6	.0	.0	.0	.0	.0	5.5	

Table 1. Abundance estimate of blue whiting.

Date	UTC	Logg	Latitude	Longitude	Ø-V	n	Species
08.jul	07:50	5679	6208.09	00208.09	Ø	> 13	Pilot whale
08.jul	19:25	5758	6305.00	00013.50	Ø	1	Sperm whale
08.jul	20:00	5762	6304.50	00014.99	Ø	1	Sperm whale
09.jul	05:30	5830	6314.12	00105.89	V	15	Killer whale
09.jul	09:30	5866	6404.25	00204.14	V	1	Sperm whale
10.jul	14:10	5067	6647.63	00526.43	V	1	Fin whale
10.jul	15:20	6063	6624.13	00525.67	V	1	Minke whale
10.jul	15:30	6063	6625.00	00527.71	V	1	Minke whale
10.jul	18:50	6081	6629.90	00523.08	V	1	Sperm whale
11.jul	13:50	5060	6614.95	00055.98	V	1	Minke whale
11.jul	13:20	6226	6501.71	00055.98	V	400-1000	Pilot whale
11.jul	15:10	6248	6448.13	00018.86	V	10-15	Killer whale
16.jul	14:15	7026	6740.68	00102.94	V	1	Killer whale
21.jul	14:25	7729	6658.40	00618.92	Ø	1	Sperm whale
22.jul	11:46	7878	6844.60	00138.96	Ø	1	Sperm whale
23.jul	15:08	8061	7108.90	00257.76	Ø	1	Sperm whale
24.jul	23:34	8273	6918.97	00520.44	Ø	1	Sperm whale
25.jul	05:19	8346	6838.91	00811.77	Ø	1	Sperm whale
28.jul	01:32	8895	6916.61	00745.23	Ø	1	Sperm whale
28.jul	01:40	8900	6914.86	00750.46	Ø	15-20	Killer whale
29.jul	10:37	9142	6859.96	01224.22	Ø	1	Spermwhale
29.jul	11:20	9145	6902.33	01218.04	Ø	2	Spermwhale
29.jul	11:26	9145	6902.36	01218.19	Ø	1	Spermwhale
29.jul	11:29	9145	6902.39	01218.27	Ø	1	Spermwhale
29.jul	12:39	9146	6903.87	01216.27	Ø	1	Spermwhale
01.aug	10:17	9602	7034.97	01502.41	Ø	1	Spermwhale
01.aug	13:50	9633	7053.38	01432.41	Ø	10	White beaked dolphin
01.aug	14:05	9633	7053.59	01432.68	Ø	10	White beaked dolphin
01.aug	14:26	9636	7054.39	01444.17	Ø	10	White beaked dolphin
01.aug	14:31	9637	7054.60	01444.80	Ø	10	White beaked dolphin
01.aug	15:01	9643	7056.14	01502.70	Ø	1	Humpback whale
01.aug	15:30	9648	7057,74	01518.16	Ø	15	White beaked dolphin

Table 2. Whale observations, n, with log, date and positions.

PPENDIX I. Lentgh distributions of herring.

SILD (NVG)
F/F "Johan Hjort"
7. juli - 2. august 1995

Trålstasjon nr.

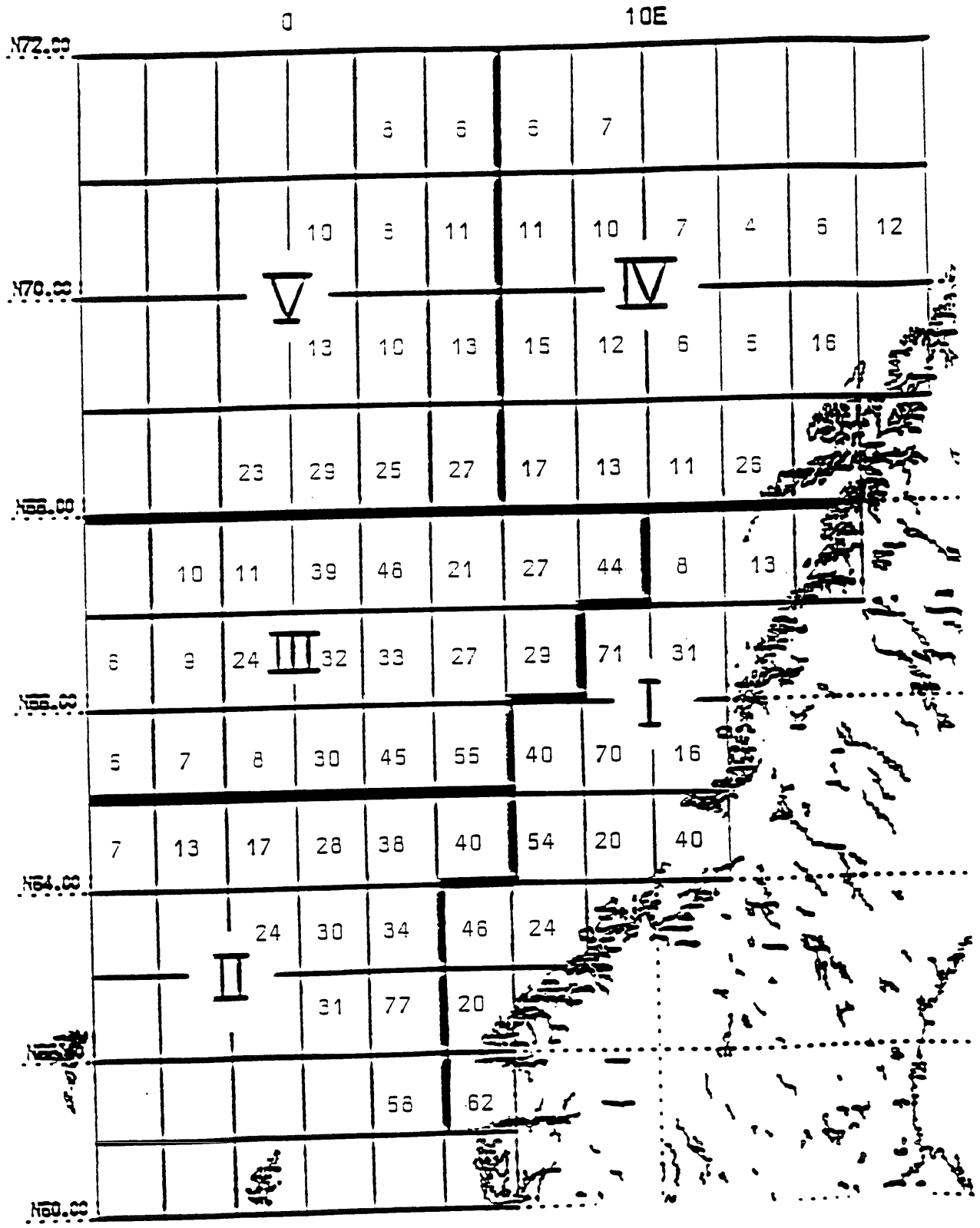
289	291	292	294	297	302	307	308	310	312	313	316	317	319	320	324	329	331	332	333	336	338	341	342	344	345	347
1																			2							
1																	5		8							
									14							6	34	1	42	6						
									42							23	42		30	15						
1								2	25							28	11	1	4	27	2					
								1	9							17	4		6	13	14					
				1					7							13	2			10	11					
							1		1							10			4	8	22					
2																										
2	2						1	1	2							1	2		4	14	28					
2	1		1					1								2				3	12			3		
	4							1		1				1						3	7			1		
		1					2					1		1						1	3			5		1
	2					1								3				1			1			4		2
	2													4										7		7
															1			1						3		6
					1									2								1		9	1	5
											1		2	1									1	19	1	4
													1	3									3	9	2	1
																										1
9	11	1	1	1	1	1	4	6	100	1	1	1	3	15	1	100	100	4	100	100	100	1	4	60	4	27
18	22	2	2	2	2	2	8	12	3924	2	2	2	6	31	2	38494	160000	8	150000	32583	566	2	8	124	8	56
185	302	305	180	185	275	360	241	208	151	270	385	365	483	407	345	167	128	230	131	167	214	370	429	413	425	393
26.5	32	32.5	30.5	27.5	27.8	35.3	30.9	28.3	25.1	31.8	37.3	32.8	37.8	35.3	35.3	26.1	24.4	29.3	24.4	26.7	29	36.3	38.2	35.9	37.9	35.7

APPENDIX I. Lentgh distributions of herring (continues)

7. juli - 2. august 1995

Trålstasjon nr.																											
348	350	351	352	353	355	357	359	361	363	364	366	368	369	370	372	374	375	376	377	378	379	381	383	384	SUM	%
																									0	0.00
																									0	0.00
																									1	0.04
						1																			2	0.08
																									0	0.00
																							1		1	0.04
																							2	1	5	0.20
						8						2	2	1	1		1						4	1	33	1.33
						32	1					5	7	8	4	2					3	16	6	1	188	7.61
	1					24					1	17	11	23	6	3				2	2	13	7		262	10.60
		3				9	15			1	3	20	8	20	5	5	1				3	18	6	1	219	8.86
		2				12	15				5	21	8	14	6	11			1	1	1	6	9		176	7.12
		9				4	19			2	17	23	15	10	14	15	2			2	1	13	17		207	8.37
	3	19				5	25			6	18	5	8	11	16	23	18			8	7	16	17		253	10.23
	1	14		1		3	13		6	8	20	3	11	3	20	20	36		3	12	9	10	16		266	10.76
	3	9	1	3	1	2	7		9	14	18		11	1	10	9	22		10	7	23	6	8	1	200	8.09
2	2	15	5		2		4		10	5	11	1	8	3	7	2	18	1	16	6	20	2	4		162	6.55
	2	14	3	1	4		1	3	11	14	3	1	8	3	6	3	2		22		16		3		135	5.46
2	5	6	4	1	5			4	8	9	3		3	3	1	4	1		14		11				98	3.96
1	6	3	2	3	2			3	2	3		2			2				8	3	2				62	2.51
3	4	1	4	3	2			1	5	3					1				2	3					43	1.74
3	3	4	7	2	3				2	3	1				1				2		1			1	52	2.10
10	5	1	8	5	4				3	2						1			1		1				70	2.83
2	1		4		2				1	1									3						33	1.33
1	1							1																	4	0.16
																									0	0.00
																									TOTAL	
24	37	100	38	19	25	100	100	12	57	71	100	100	100	100	100	98	101	1	82	44	100	100	100	6	2472	
48	77	2183	76	39	52	77261	7486	23	57	142	3306	18920	11046	7276	8266	4280	350	1	164	176	6544	36085	6630	12		
391	348	256	412	495	358	126	194	350	304	263	218	153	181	154	215	201	235	260	298	238	245	161	183	149		
36.3	33.7	30.6	35.3	34.6	34.7	24.9	27.9	34.1	32.6	31.9	29.2	26.4	28.1	26.5	28.7	28.6	29.8	31.3	33.2	30.1	30.8	26.7	27.5	26.7		

APPENDIX II. Biomass in 1000 tonnes of blue whiting.



APPENDIX III. Lentgh distributions of blue whiting.

7. juli - 2. august 1995

	Trålstasjon nr.																		
cm	290	292	295	296	299	301	304	305	306	309	311	315	318	321	322	325	328	330	334	335
15																				
16																				1
17																				
18																				
19																				
20	4										1	1						1		12
21	14									2	3							1	1	20
22	36	2								16	6	1			1	1	8	6	6	25
23	29	9								28	20	6			7	2	8	13	13	28
24	6	12		1						11	7	5			12		7	10	7	8
25	5	9		1					1	7	5	3			5	3	2	8	15	4
26	5	17		3				1	4	9	10	11			9		9	20	9	1
27	1	16	1	3				2	7	16	18	12	1		11	8	6	14	12	1
28		7	1	4		4		2	4	7	9	11	1	1	8	15	7	6	14	
29		10	1	8		3		4	9	5	7	10	1	2	10	15	9	2	19	
30		5	2	10	1	6	1	18	8	4	4	6	5	5	11	22	11	2	11	
31		7	4	18		20		23	10	1	8	5	5	3	13	17	10		11	
32		1	13	20	1	14	1	25	4		1	6	10	6	7	11	9	1	8	
33		4	11	18		21	1	12	2		1	4	11	5	4	6	8		7	
34			8	10	1	18		5	1				13	3	1		5		3	
35		1	9	3	1	9		5				2	5						7	
36			1	1		2		2		1			4				1		2	
37						2		1					2		1				2	
38						1												1	2	
39																			1	
40													1							
N	100	100	51	100	4	100	3	100	50	107	100	83	59	25	100	100	100	85	150	100
N/t	1589	663	24	456	4	1403	9	109	654	214	389	84	59	25	1284	153	125	85	150	526
W	69	119	232	200	249	230	183	193	146	96	109	135	218	188	136	146	143	98	141	58
L	23.1	27.3	33.2	31.8	33.3	33	32.2	32.1	29.8	25.5	26.5	28.4	33.5	32.1	28.5	30	28.8	25.9	28.9	22.7

APPENDIX III. Lentgh distributions of blue whiting (continues).

7. juli - 2. august 1995

	Trålstasjon nr.																			
cm	337	340	343	346	349	354	356	358	362	365	367	371	373	376	380	382			SUM	%
15																			0	0.00
16																			0	0.00
17																			1	0.03
18																			0	0.00
19																			0	0.00
20							3	1		1	6	1							31	1.08
21	3					2	10	5			12	16				1			90	3.15
22	1			1		7	9	14			14	21	3	4					182	6.36
23	1	4		2		9	9	12	1	2	7	8		3	1				222	7.76
24	2	3		1		9	6	15	2	4	7	1		5					141	4.93
25	1	2					6	11		2	2	1	1	2		1			97	3.39
26	2	8		3	1	4	2	6	1	6	7	2	2	5	2	2			161	5.63
27	4	3		4	2	5	3	21	2	3	8	3	1	4	1	1			194	6.78
28	5	8	2	5	7	5	2	8	3	16	9	6	2	6	2	4			191	6.68
29	6	17	5	12	14	11	2	4	6	15	9	5	4	11	1	4			241	8.42
30	4	16	20	10	15	11	1	3	16	27	6	5	2	16	2	2			288	10.07
31	9	20	16	11	20	16	1		11	14	4	6	2	13	5	1			304	10.63
32	2	9	21	9	16	8	1		19	7	5	7	3	20	1	3			269	9.40
33	6	7	16	7	11	7	1		21	3	2		2	5	4				207	7.24
34	8	2	9	2	8	2	1		11		2	3	1	2	1				120	4.19
35	4	1	5	5	3	3			3					2					68	2.38
36	1		4			1	1		2			1	1	1					26	0.91
37	1		2		3		2		1					1					18	0.63
38	1								1										6	0.21
39	2																		3	0.10
40																			1	0.03
N	63	100	100	72	100	100	60	100	100	100	100	86	24	100	20	19		TOTAL	2861	
N/t	47	497	105	72	197	313	90	2947	160	408	251	73	24	120	20	7				
W	154	151	190	183	189	146	85	88	189	150	97	97	138	148	150	129				
L	30.9	29.9	32.5	30.6	31.5	28.9	25.3	25.5	32	29.5	26.8	26	29.5	30	30.5	28.9				

APPENDIX IV. Lentgh distributions of mackerel.

7. juli - 2. august 1995

	Trålstasjon nr.																									
cm	289	291	293	294	296	297	303	304	305	307	308	310	312	313	314	316	317	319	320	323	324	327	329	338	339	341	344
25	1																										
26																											
27	3																										
28	14	1	1							9	3	8															
29	21	15	1							22	33	17	7														
30	9	4	8							34	34	23	11	1	1		1						2				
31	3	1	9		1	2		1		14	11	20	24	2	3					1		3	10	1			
32	3	1	9	6				1	1	7	10	14	18	20	6	2				1	1	6	23		1		
33			2	9		6	4	10		5	2	8	10	16	4	6	3			6	1	7	25		3		
34		1	3	16		11	9	12	2	4	3	6	16	24	7	7	4			17	3	14	20	2	1		
35			3	13		12	17	11		3	1	1	10	20	6	13	3	2	2	19	4	18	11		3		
36				12		14	18	8	1	2		1	5	10	5	12	9	5	5	22	3	17	1	1	2	1	
37		1	2	16		15	13	8		1		2	2	5	4	10	10	11	1	23	2	15	5		7	5	
38			2	11		10	20	2							2	13	10	6	9	4	3	3	1		3	1	3
39				6		12	7				1		1	1	1	10	8	14	8	3	1	9		1	2	5	6
40				6		12	6	3			1		1		5	9	14	19	11	1	2	4	1		1	2	11
41				3		4	3								1	10	4	10	15	1		1			1	1	8
42				1		2	2							1	2	1	3	14	9	1					1	2	5
43				1			1								1	6		9	4				1				4
44				1												1		1	5							1	1
45																		1									1
46											1								1								1
47																				1							
N	54	24	40	101	1	100	100	56	4	101	100	100	105	100	48	100	69	92	70	100	20	97	100	5	25	18	40
N/t	401	52	83	350	1	1550	366	208	3	2508	1550	677	1822	809	96	574	139	190	145	515	40	1471	1183	10	52	36	83
W	242	236	301	404	260	454	448	388	374	255	256	298	335	394	440	541	561	645	657	458	450	473	363	422	502	594	681
L	29.5	30.1	32.7	36.7	31.5	37.4	37.4	35.6	34.5	31	31	31.4	33	34.5	36	38	38.4	40.3	40.7	36.4	36.6	36.1	33.9	35.3	37.1	39.6	41.3

APPENDIX IV. Lentgh distributions of mackerel (continues).

7. juli - 2. august [illegible]

cm	Trålstasjon nr. 345	347	350	352	353	355	357	359	361	363	364	368	370	372	375	378	383	SUM	%
25																		1	0.04
26																		0	0.00
27																		3	0.13
28																		36	1.54
29																		116	4.97
30																		128	5.48
31																		106	4.54
32							1	3										134	5.74
33								20					1					148	6.34
34				5			1	17		2								207	8.86
35			1	5	1			14		7	2							202	8.65
36		1	2	6	2	2		13		7					1			188	8.05
37		6	5	10	12			10	2	17	2	1			1			224	9.59
38	1	6	7	6	15	5		14		19	1				1			178	7.62
39		15	8	2	14	5		4		20	1						1	166	7.11
40	1	30	5	2	26	14		4		16	2					1	1	211	9.03
41		12	10	1	14	14		1		7	2						2	125	5.35
42	4	18	1		8	7				4	1			*1*	1			89	3.81
43	3	8	1		5	4				1								49	2.10
44		4	1		2													17	0.73
45					1	1												4	0.17
46																		3	0.13
47																		1	0.04
N	9	100	41	37	100	52	2	100	2	100	11	1	1	1	4	1	4	TOTAL 2336	100
N/t	18	567	85	74	279	108	157	490	4	259	22	5	3	2	8	4	17		
W	733	686	590	547	679	666	328	445	642	591	563	535	330	750	528	655	573		
L	42.2	40.9	39.7	37.2	40.1	40.9	33.5	36	37.5	38.8	40.1	38	33	*42.5*	38.8	40.5	40.8		

ursiv: Ikke lengdemålt, antatt lengde.