

SURVEY REPORT

RV "G.O. SARS" 27 June - 18 July 1998

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Objectives: Abundance estimation of herring and sprat in the area between latitudes, 57°00'N and 62°00'N and between longitudes 01°00'E and 08°00'E. Map the general hydrographical regime and monitor the standard profiles, Oksøy-Hanstholm, Hanstholm-Aberdeen, Utsira - Start Point, Feie - Shetland.

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NARRATIVE

In this report the results from the Norwegian coverage of the International Herring Acoustic Survey for 1998 is presented. The time series of this survey extends back to 1984. Five countries cooperate to survey the North Sea and the Skagerrak for an acoustic abundance estimation of herring and sprat. The surveys are planned in the Planning Group for Herring Surveys (Anon. 1998) which is a sub group under the ICES Herring Assessment Working Group for the Area South of 62°N. In the recent years, the total survey area has been divided between the participating countries, represented by the vessels, as shown in Figure 1.

The Norwegian coverage, by RV "G.O. Sars", started in Bergen, 27 June 1998. A call was made in Aberdeen on 1 July, in Egersund on 6 July, Haugesund on 10 July and in Lerwick, Shetland on 15 July. The survey was finished in Bergen on 18 July.

The survey started in south by doing systematic parallel transects in the east-west direction. The distance between the transects was 15-20 NM apart. In the northernmost part of the survey area the investigations were carried out by systematic parallel transects in the north-south direction with 15-20 NM distance between the transects.

Sounder: ES 38 B.

Due to rough weather conditions during the survey, the lowering keel was used in almost the entire survey.

The S_A -values were divided between the following categories on the basis of trawl catches and characteristics on the echo recording paper:

herring, sprat, other pelagic fish, demersal fish, plankton

The following target strength (TS) function was applied to convert S_A -values of herring and sprat to number of fish:

$$TS = 20 \log L - 71,2 \text{ dB} \quad (1)$$

or on the form: $C_F = 1.05 \cdot 10^6 \cdot L^{-2} \quad (2)$

where L is total length.

The acoustic method as used in Norway for the abundance estimation of pelagic fish is described by Toresen *et al* (1998).

In the Skagerrak and off the south west coast of Norway, North Sea autumn spawners and Western Baltic spring spawners mix during summer. No method for routine stock discrimination on individual herring is available. To calculate the maturing part of the two stocks in each age group, the observed maturity stages were applied for both stocks. The proportion of Baltic spring spawners and North Sea autumn spawners within each square were calculated by applying the formula, $WBaltic = ((\text{mean vertebrae} - 55.8) / (56.5 - 55.8))$ (ICES 1997), for stock discrimination by vertebrae counts on total number in each age group.

RESULTS

Hydrography

The horizontal distributions of temperature at 5m, 50m and at bottom in the surveyed area are shown in Fig. 3a-c. The surface water had temperatures ranging from 11-14°C, with small differences between the various areas. The temperatures measured at 5 m were 3-4° lower in the eastern part of the surveyed area than last year, which had the highest temperatures in the 1994-1997 serie of data.

DISTRIBUTION AND ABUNDANCE OF HERRING AND SPRAT

Herring

The horizontal distribution of herring is shown in Fig. 4. Herring was mostly found in the south eastern part of the surveyed area. Here immature autumn spawners were mixed with maturing and adult Western Baltic spring spawners. Mature herring were also found by surface trawling north of 61° 30', but here no registrations were shown on the echo sounder.

The registrations were very scattered in the whole surveyed area and the recorded herring were mainly found in small schools close to the surface. No 'real' herring schools were detected and most of the trawling positions were regularly chosen, by trawling every 20-30 NM, and not based on echo registration. Due to this behaviour and to the large extent of the use of the lowering keel, herring may have been underestimated during the survey.

The abundance by ICES statistical squares, divided in Western Baltic spring spawners and North Sea autumn spawners is shown in Table 1. The numbers are given age disaggregated and the numbers in age groups 2 and 3 are split in mature/immature parts. The surveyed squares where no herring were recorded are not presented in the table. The mean weights at age applied for biomass estimation are shown in Table 2. The total estimated number of herring by age and length is shown in Table 3. The total estimated biomass per age group and stock is also shown in this table. The total estimated biomass of North Sea herring in the area covered by the Norwegian vessel is the same as last year, about 150 000 t, (Anon. 1998b). The estimated spawning stock biomass was somewhat higher than last year estimate, 73 000 t. The biomass of Western Baltic spring spawners in the area was reduced to 50 % of the 1997-estimate. The Norwegian vessel covered the same area in 1998 as in 1997.

Sprat

No sprat was caught and thus no Sa-values were allocated to sprat.

REFERENCES

- Anon. 1997. Report of the Herring Assessment Working Group for the Area South of 62°N. ICES CM 1997/Assess: 8.
- Anon. 1998a. Report of the Planning Group for Herring Surveys, Bergen, Norway, 12-16 January 1998. ICES CM 1998/G: 4, Ref.D.
- Anon. 1998b. 1997 ICES Co-ordinated acoustic survey of ICES Divisions IIIa, IVA, IVB and VIA (north). ICES CM 1998/OPEN: 22
- Toresen, R., Gjøsæter, H. and de Barros, P. 1998. The acoustic method as used in the abundance estimation of capelin (*Mallotus villosus* Müller) and herring (*Clupea harengus* Linné) in the Barents Sea. Fisheries Research, 34: 27-37.

Table 1. Estimated number of herring in ICES stat squares divided in stocks and agegroups.

R/V 'G.O. Sars', 27 June - 18 July 1998.												
42F0	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
11,54	34,62	10,34	2,43	0,00	0,00	1,22	0,00	0,00	0,00	0,00	0,00	60,15
42F1	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
1,28	3,85	1,15	0,27	0,00	0,00	0,14	0,00	0,00	0,00	0,00	0,00	6,68
43F6	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
57,48	3,37	11,28	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	72,13
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
11,77	15,53	3,88	0,57	1,70	0,00	0,00	0,00	0,00	0,00	0,00	0,00	33,46
43F7	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
113,04	56,32	4,24	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	173,60
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
23,15	118,61	29,65	17,59	52,77	0,00	29,51	4,54	0,00	0,00	0,00	0,00	275,83
44F4	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
11,51	27,65	16,95	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	56,11
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	11,27	2,82	2,45	7,34	0,00	6,90	2,88	0,58	0,00	0,00	0,00	34,22
44F5	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
31,99	76,87	47,12	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	155,98
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	31,32	7,83	6,80	20,39	0,00	19,19	8,00	1,60	0,00	0,00	0,00	95,14
44F6	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
13,01	31,41	7,37	0,63	0,80	0,00	0,18	0,00	0,00	0,00	0,00	0,00	53,38
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
7,64	9,80	2,45	2,38	7,13	0,00	18,04	7,29	3,64	1,21	1,21	0,00	60,79
44F7	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
31,42	15,65	1,18	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	48,25
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
6,43	32,97	8,24	4,89	14,67	0,00	8,20	1,26	0,00	0,00	0,00	0,00	76,66

45F3	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
1,04	2,48	0,28	0,00	0,00	0,00	0,13	0,00	0,00	0,00	0,00	0,00	3,93
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	0,70	0,17	0,12	0,35	0,00	0,23	0,16	0,03	0,00	0,00	0,00	1,76
45F4	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
19,14	45,48	5,05	0,00	0,00	0,00	2,36	0,00	0,00	0,00	0,00	0,00	72,03
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	12,77	3,19	2,14	6,42	0,00	4,19	3,02	0,50	0,00	0,00	0,00	32,24
45F5	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
19,49	46,30	5,14	0,00	0,00	0,00	2,40	0,00	0,00	0,00	0,00	0,00	73,34
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	13,00	3,25	-2,18	6,54	0,00	4,27	3,08	0,51	0,00	0,00	0,00	32,82
45F6	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
11,95	28,39	3,15	0,00	0,00	0,00	1,47	0,00	0,00	0,00	0,00	0,00	44,96
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	7,97	1,99	1,34	4,01	0,00	2,62	1,89	0,31	0,00	0,00	0,00	20,12
46F1	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,01	0,77	0,95	0,15	0,25	0,00	0,02	0,00	0,00	0,00	0,00	0,00	2,16
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	0,22	0,06	0,01	0,04	0,00	0,35	0,16	0,01	0,06	0,01	0,01	0,95
46F3	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,92	49,60	60,62	9,43	16,06	0,00	1,43	0,00	0,00	0,00	0,00	0,00	138,05
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	14,35	3,59	0,95	2,86	0,00	22,37	10,07	0,92	3,66	0,92	0,92	60,60
46F4	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,32	17,44	21,31	3,32	5,64	0,00	0,50	0,00	0,00	0,00	0,00	0,00	48,53
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	5,05	1,26	0,33	1,00	0,00	7,87	3,54	0,32	1,29	0,32	0,32	21,31
46F5	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,41	22,47	27,47	4,27	7,28	0,00	0,65	0,00	0,00	0,00	0,00	0,00	62,55
	Baltic Spring Spawner											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	6,50	1,63	0,43	1,29	0,00	10,14	4,56	0,41	1,66	0,41	0,41	27,46

47F1	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
1,40	1,76	1,33	0,16	0,76	0,00	0,27	0,40	0,00	0,00	0,00	0,00	6,08
Baltic Spring Spawner												
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	1,22	0,30	0,00	0,00	0,00	0,45	0,00	0,08	0,12	0,00	0,04	2,21
47F3	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
25,24	31,67	23,89	2,82	13,76	0,00	4,80	7,21	0,00	0,00	0,00	0,00	109,39
Baltic Spring Spawner												
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	21,89	5,47	0,00	0,00	0,00	8,18	0,00	1,44	2,16	0,00	0,72	39,87
47F4	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
2,52	3,17	2,39	0,28	1,38	0,00	0,48	0,72	0,00	0,00	0,00	0,00	10,94
Baltic Spring Spawner												
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	2,19	0,55	0,00	0,00	0,00	0,82	0,00	0,14	0,22	0,00	0,07	3,99
48F3	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	3,43	12,16	1,72	4,41	0,00	8,39	2,01	0,00	0,00	0,41	0,41	32,95
Baltic Spring Spawner												
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	3,94	0,98	0,31	0,94	0,00	0,63	0,86	0,00	0,00	0,00	0,00	7,67
48F4	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,11	4,41	1,89	0,32	0,30	0,00	0,00	0,02	0,00	0,00	0,00	0,00	7,05
Baltic Spring Spawner												
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	0,00	0,00	0,66	1,98	0,00	1,12	0,31	0,00	0,00	0,00	0,00	4,08
49F3	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	0,35	1,24	0,17	0,45	0,00	0,85	0,20	0,00	0,00	0,04	0,04	3,36
Baltic Spring Spawner												
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	0,40	0,10	0,03	0,10	0,00	0,06	0,09	0,00	0,00	0,00	0,00	0,78
49F4	North Sea Autumn spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,24	9,30	3,98	0,68	0,63	0,00	0,00	0,05	0,00	0,00	0,00	0,00	14,88
Baltic Spring Spawner												
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	0,00	0,00	1,39	4,18	0,00	2,37	0,66	0,00	0,00	0,00	0,00	8,60
50F0	North Sea Autumn Spawners											
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	0,15	1,07	0,00	0,75	0,00	0,61	0,64	0,21	0,07	0,04	0,00	3,54

50F2 North Sea Autumn Spawners												
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	0,11	1,74	0,15	1,23	0,00	1,65	0,55	0,24	0,08	0,04	0,08	5,86
50F3 North Sea Autumn Spawners												
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	0,13	2,09	0,18	1,47	0,00	1,98	0,66	0,28	0,09	0,05	0,09	7,03
51F1 North Sea Autumn Spawners												
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	4,45	32,67	0,00	22,93	0,00	18,56	19,65	6,55	2,18	1,09	0,00	108,09
51F2 North Sea Autumn Spawners												
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	0,04	0,68	0,06	0,48	0,00	0,65	0,22	0,09	0,03	0,02	0,03	2,31
52F2 North Sea Autumn Spawners												
1	2I	2M	3I	3M	4I	4M	5	6	7	8	9+	Total
0,00	5,38	4,00	4,80	1,60	0,69	0,23	0,11	0,23	17,05	3,41	0,00	37,51

Table 2. Herring. Weight at age (g) for age groups and mature/immature fish in sub areas.												
R/V 'G.O. Sars', 27 June - 18 July 1998.												
42F0												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
64,20	72,40	94,20	83,00		105,50						419,30	
42F1												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
64,20	72,40	94,20	83,00		105,50						419,30	
43F6												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
58,70	62,90	92,40		116,50							60,40	
43F7												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
59,00	82,00	87,80	102,20	116,00	122,70	142,00					78,90	
44F4												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
76,10	92,60	117,20	119,00	133,00	164,40	190,60	246,00				108,40	
44F5												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
76,10	92,60	117,20	119,00	133,00	164,40	190,60	246,00				108,40	
44F6												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
68,80	81,00	113,40	117,00	120,20	157,50	175,00	170,70	241,00	227,00		109,60	
44F7												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
59,00	82,00	87,80	102,20	116,00	122,70	142,00					78,90	
45F3												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
71,80	83,70	116,30	93,00	124,40	158,80	180,30	246,00				92,80	
45F4												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
71,80	83,70	116,30	93,00	124,40	158,80	180,30	246,00				92,80	
45F5												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
71,80	83,70	116,30	93,00	124,40	158,80	180,30	246,00				92,80	
45F6												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
71,80	83,70	116,30	93,00	124,40	158,80	180,30	246,00				92,80	
46F1												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
88,00	102,80	128,30	103,30	151,30	177,70	153,60	237,00	190,50	235,00	150,00	131,00	
46F3												
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
88,00	102,80	128,30	103,30	151,30	177,70	153,60	237,00	190,50	235,00	150,00	131,00	

46F4											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
88,00	102,80	128,30	103,30	151,30	177,70	153,60	237,00	190,50	235,00	150,00	131,00
46F5											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
88,00	102,80	128,30	103,30	151,30	177,70	153,60	237,00	190,50	235,00	150,00	131,00
47F1											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
76,10	91,70	119,40	97,30	152,20	176,00	167,80	243,00	204,00		150,00	115,80
47F3											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
76,10	91,70	119,40	97,30	152,20	176,00	167,80	243,00	204,00		150,00	115,80
47F4											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
76,10	91,70	119,40	97,30	152,20	176,00	167,80	243,00	204,00		150,00	115,80
48F3											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	116,50	151,50	122,40	163,80	176,00	174,00			229,00		157,20
48F4											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
83,00	105,30	125,40	108,40	128,50	134,30	123,70					115,50
49F3											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	116,50	151,50	122,40	163,80	176,00	174,00			229,00		157,20
49F4											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
83,00	105,30	125,40	108,40	128,50	134,30	123,70					115,50
50F0											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	131,30	163,50		174,10	185,50	209,20	227,50	283,50	185,00		183,70
50F2											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	135,00	166,90	135,70	195,00	218,9	246,6	232,3	300,5	338	256	183,70
50F3											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	135,00	166,90	135,70	195,00	218,9	246,6	232,3	300,5	338	256	183,70
51F1											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	131,30	163,50		174,10	185,50	209,20	227,50	283,50	185,00		183,70
51F2											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	135,00	166,90	135,70	195,00	218,9	246,6	232,3	300,5	338	256	183,70
52F2											
1	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	135,00	166,90	135,70	195,00	218,9	246,6	232,3	300,5	338	256	183,70

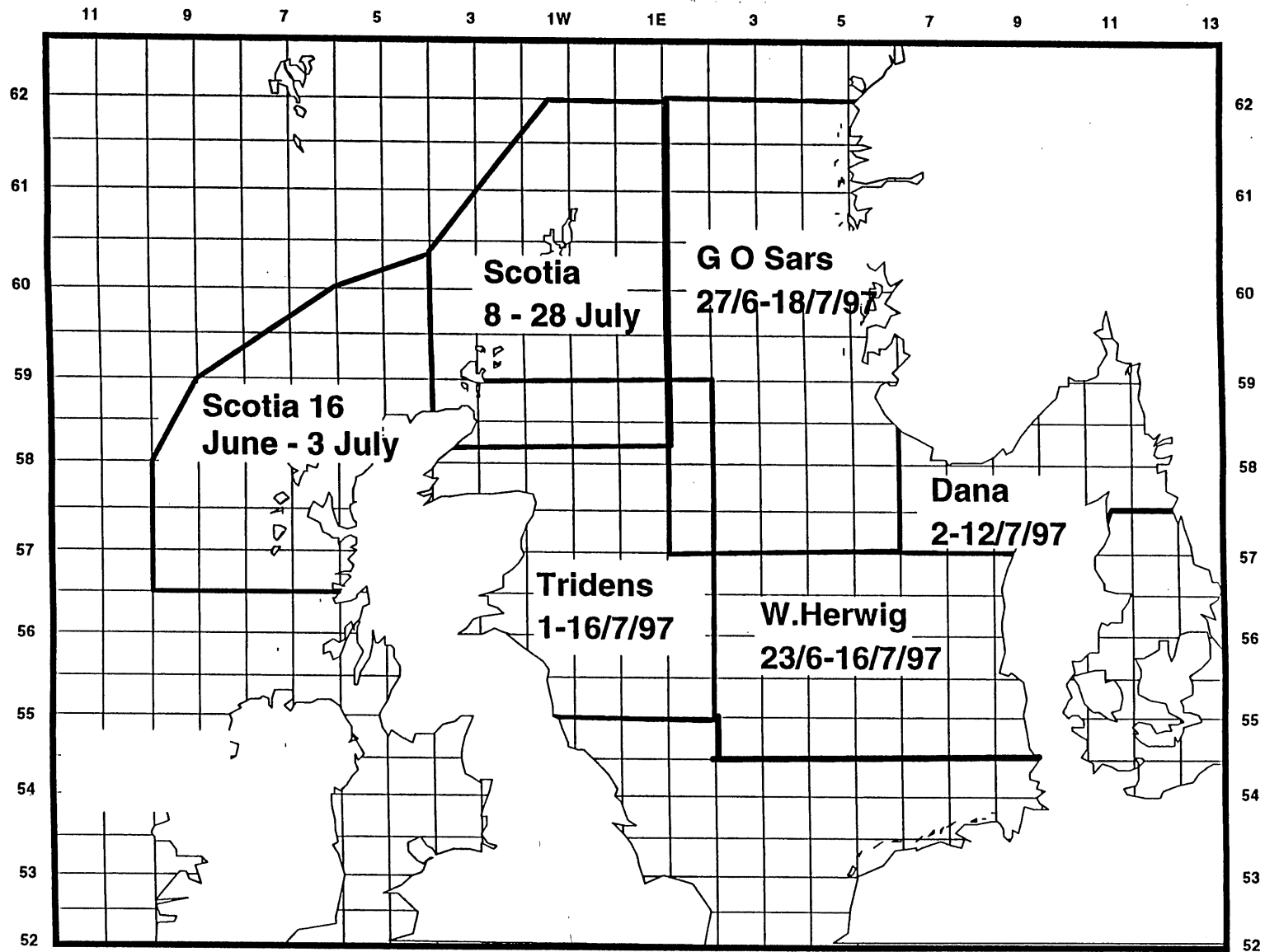


Fig. 1. International Herring Acoustic Survey. Total survey area as divided between the participating countries (from Anon. 1997)

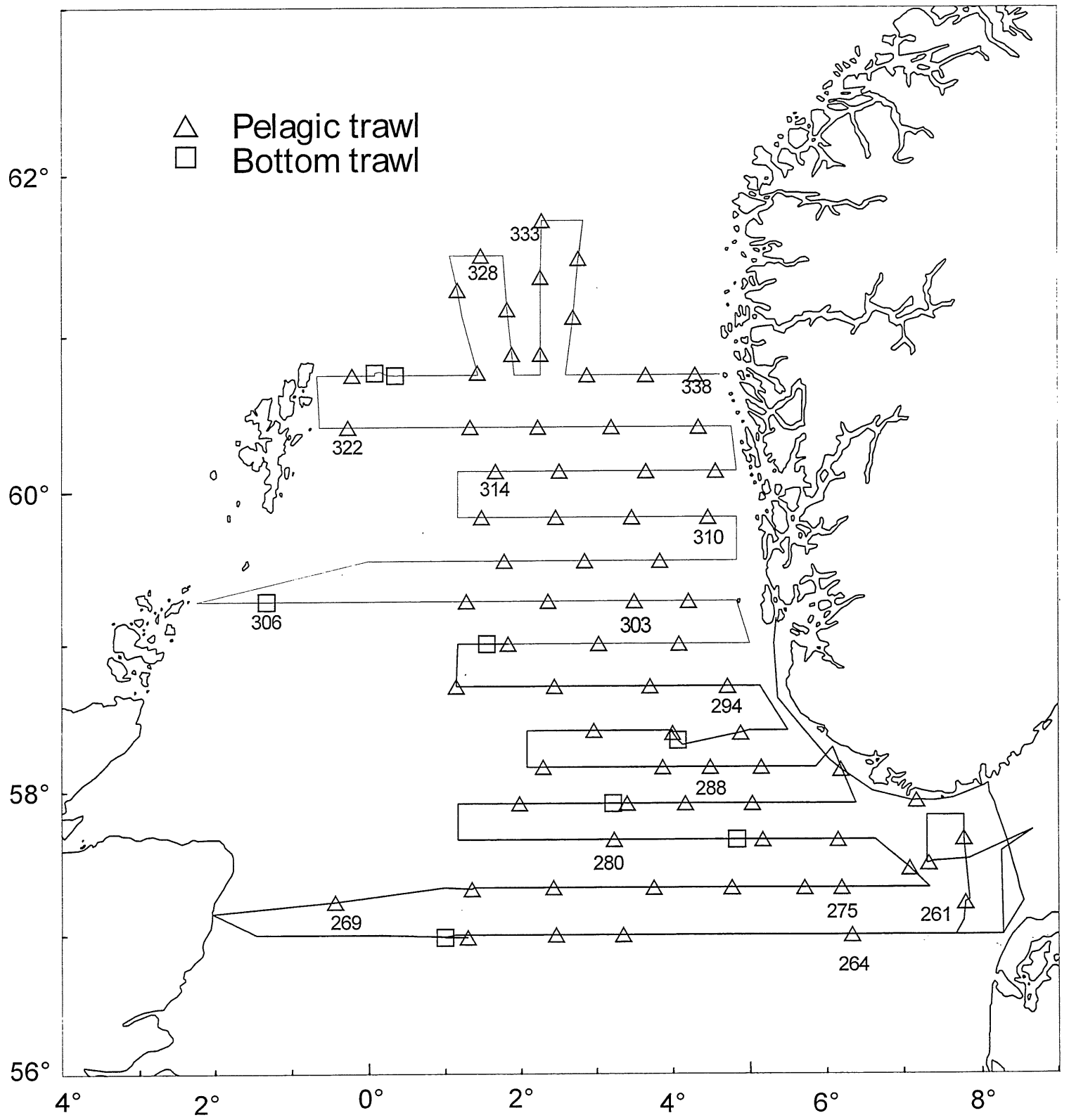


Figure 2a .Course lines with trawl statons, R/V G. O. Sars, 27 June - 18 July 1998

Z CTD

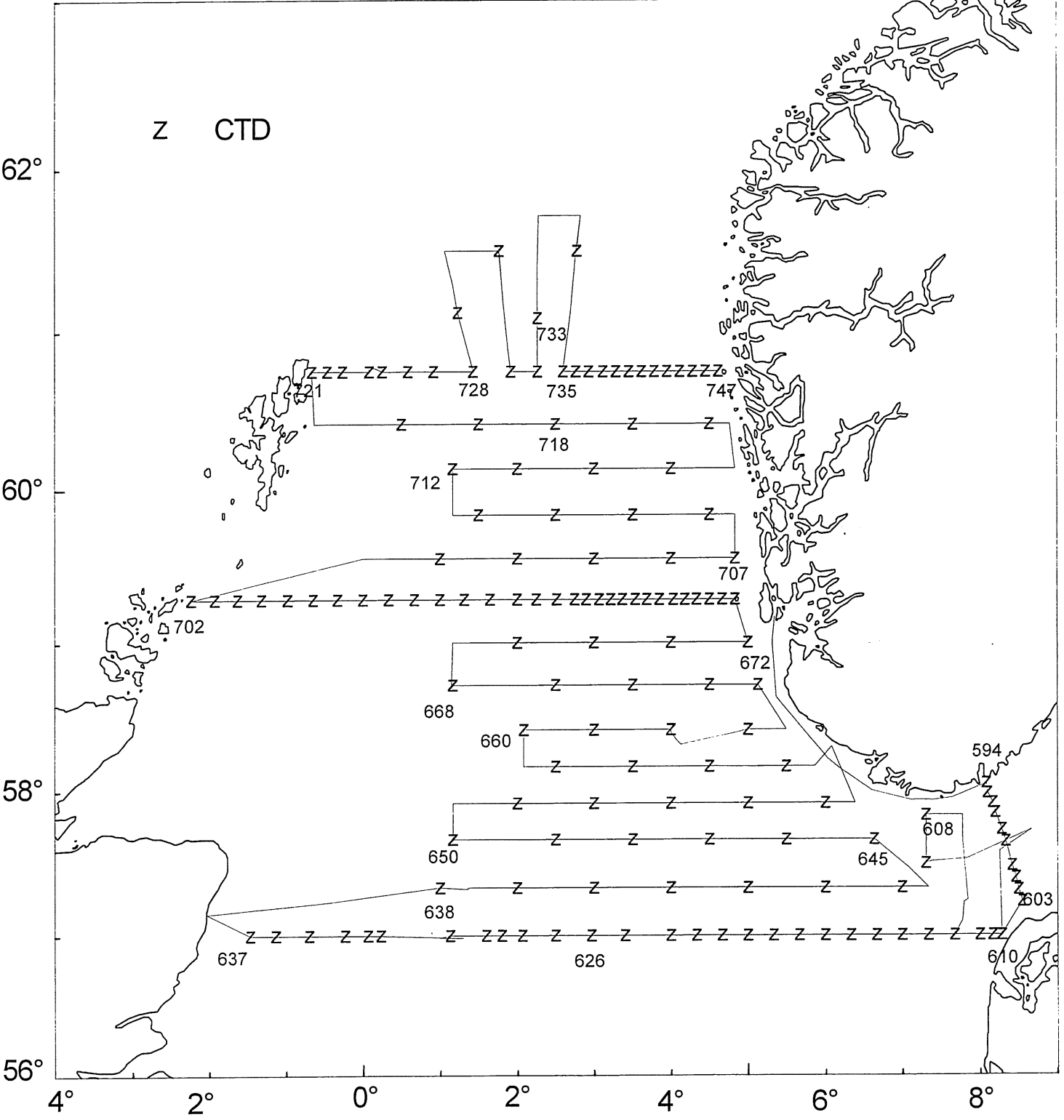


Figure 2b .Course lines with CTD (Z) stations, R/V G. O. Sars, 27 June - 18 July 1998

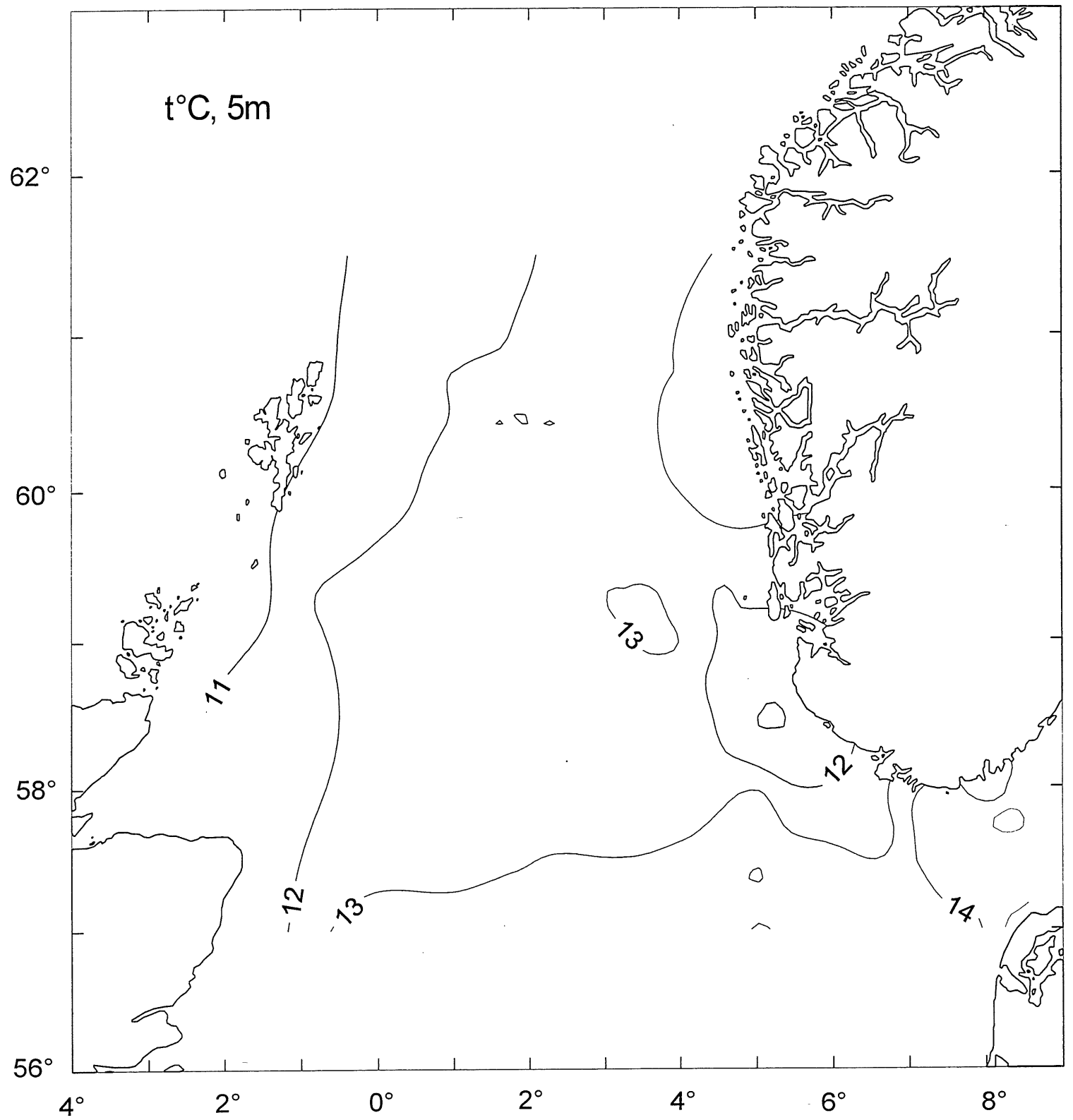


Figure 3a .Distribution of temperature in 5m, R/V G. O. Sars, 27 June - 18 July 1998

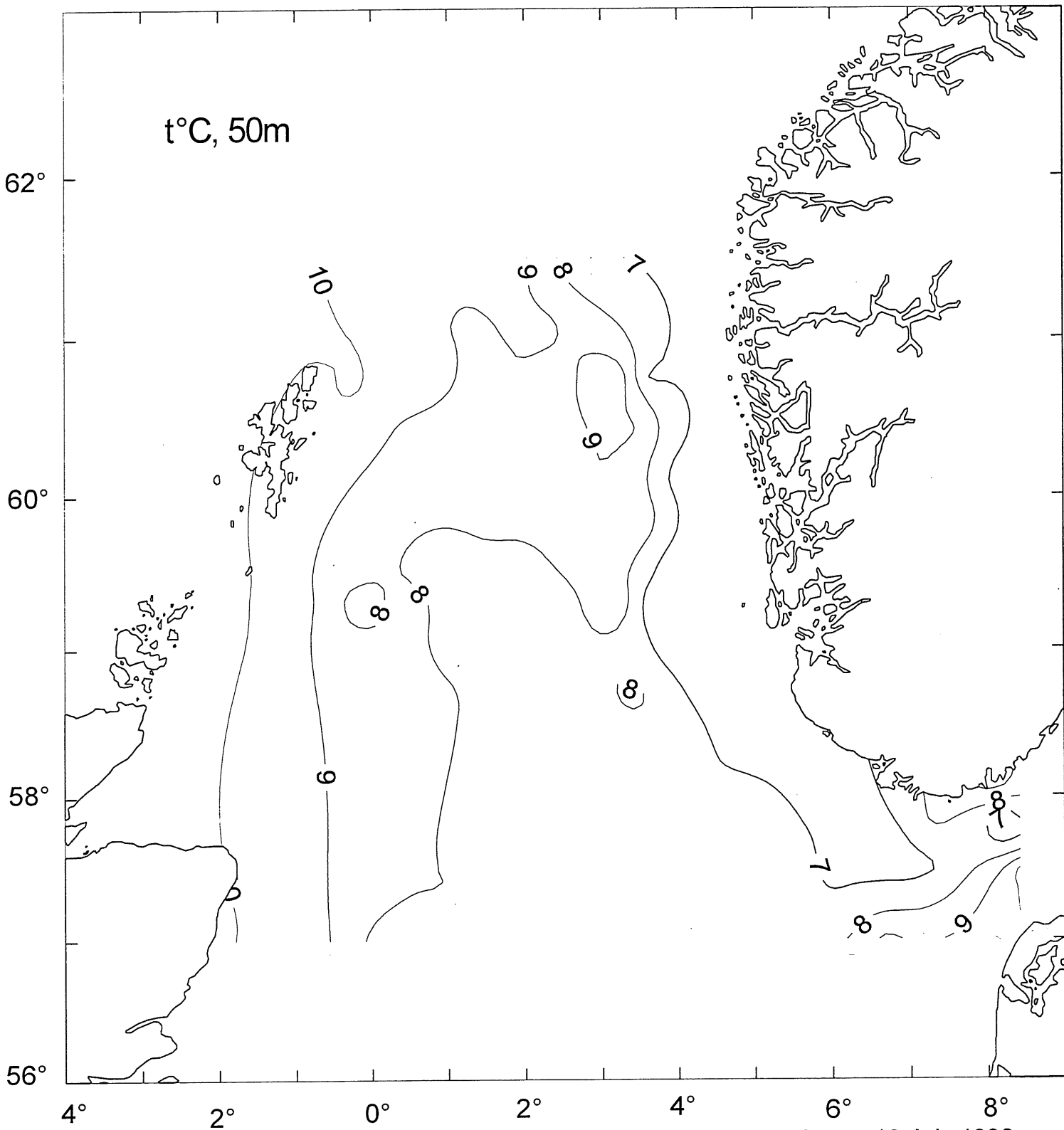


Figure 3b .Distribution of temperature in 50m, R/V G. O. Sars, 27 June - 18 July 1998

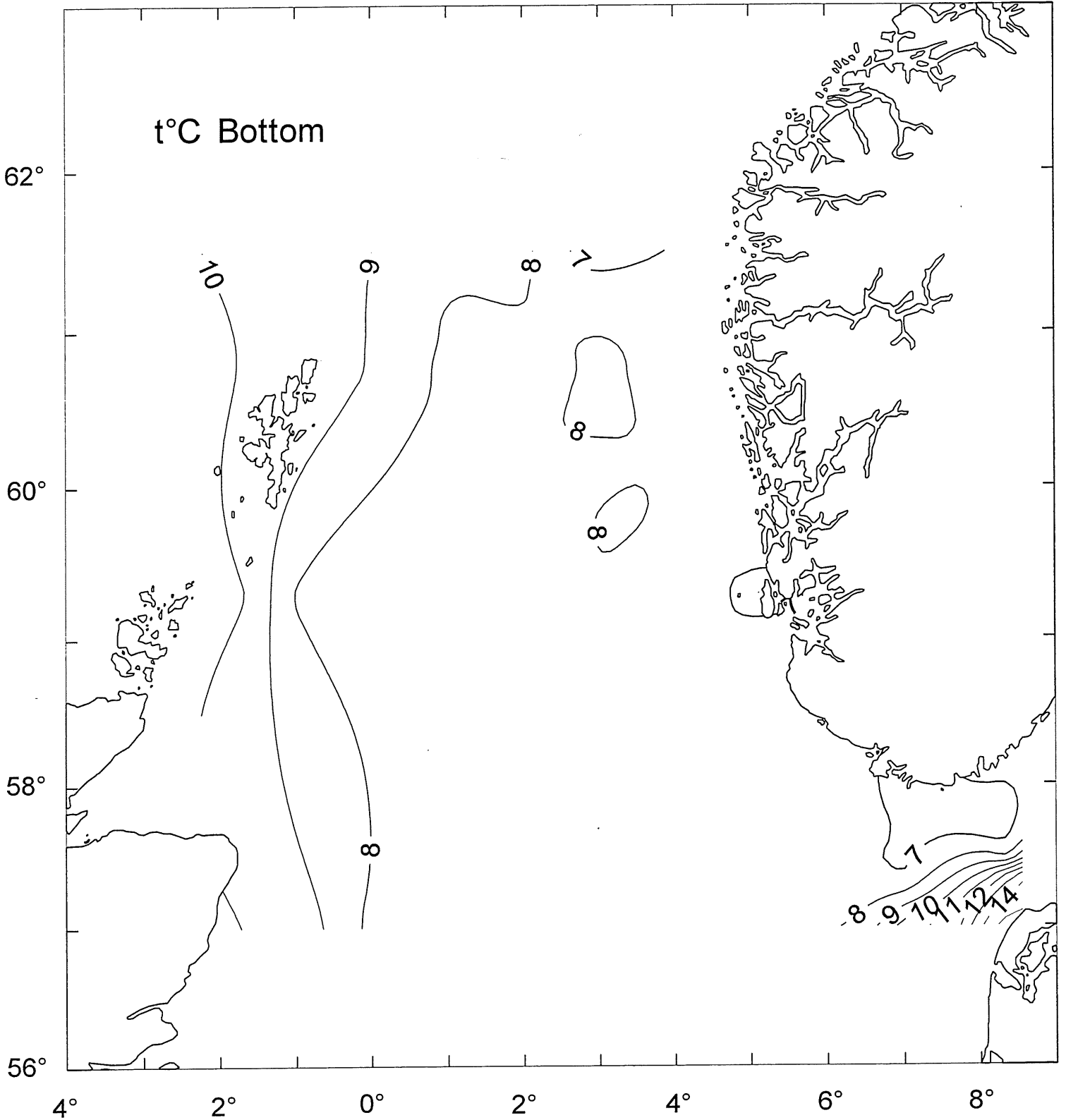


Figure 3c .Distribution of temperature at bottom, R/V G. O. Sars, 27 June - 18 July 1998

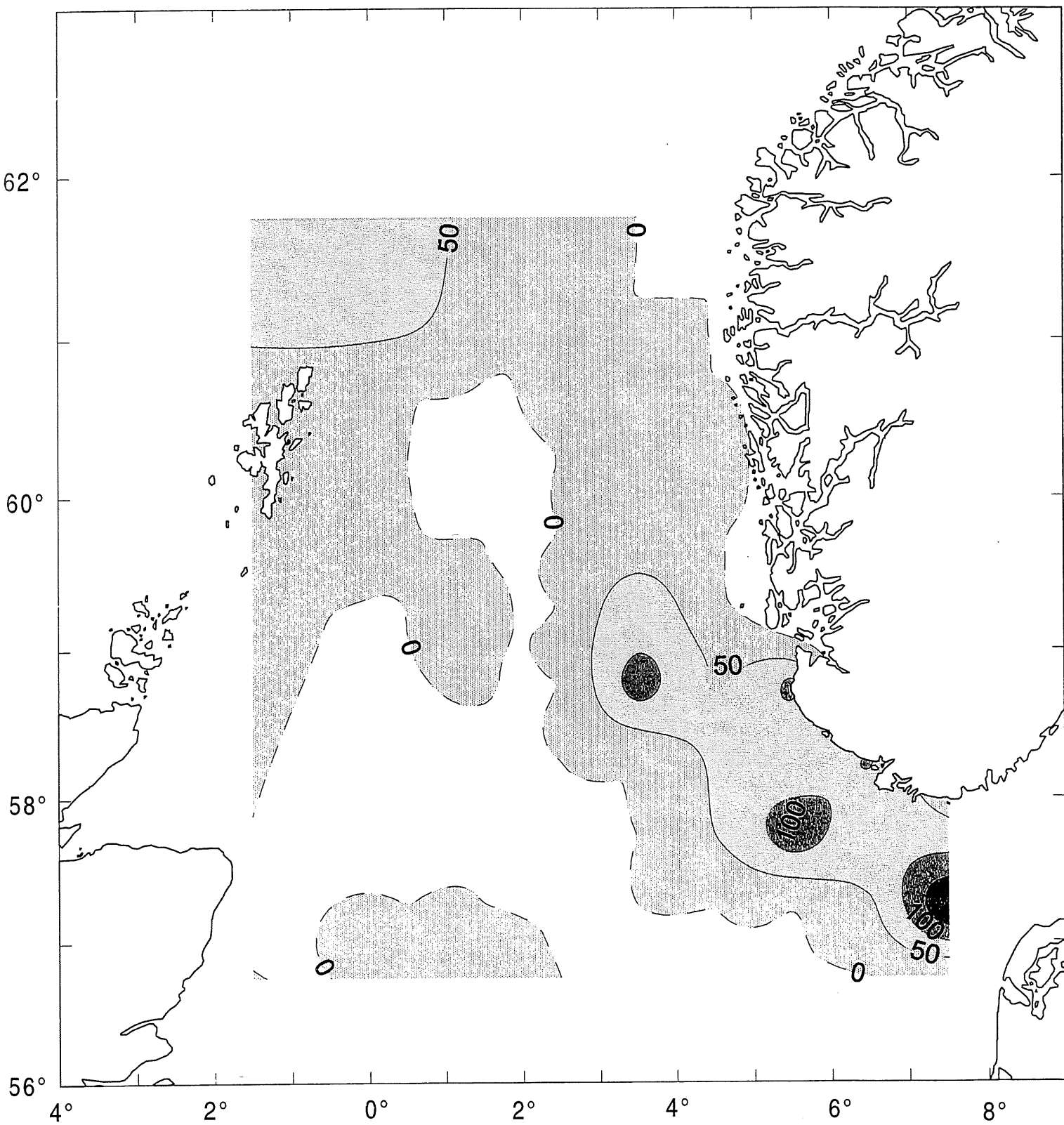


Figure 4 .The horizontal distribution of herring, R/V G. O. Sars, 27 June - 18 July 1998