

Acoustic Survey for North Sea Herring and Sprat

RV "SARSEN", 1 – 22 July 2003

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1. INTRODUCTION

The report presents the results from the Norwegian coverage of the International Herring Acoustic Survey for 2003 (Figure 1). 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 (ICES 2003), a sub group under the ICES Herring Assessment Working Group for the Area South of 62°N. The data from this survey will be combined with the other surveys to provide a combined age-structured abundance index for use in the assessment made by the ICES Herring Assessment Working Group (HAWG) in March 2004.

Objectives: To estimate the abundance of herring and sprat in the area between latitudes 56°30'N and 62°00'N and 02°00'-06°00'E. Map the general hydrographical regime and monitor the standard profiles Oksøy - Hanstholm, Hanstholm - Aberdeen, Utsira - Start Point and Feie - Shetland.

2. SURVEY DESCRIPTION AND METHODS

2.1 Personnel

Else Torstensen	(Cruise leader)
Bjarte Kvinge	(Acoustic expert)
Karen Gjertsen	(Fish.lab)
Eilert Hermansen (1 – 11 July)	(Fish.lab)
Anne-Liv Johnsen	(Fish.lab)
Bente Lundin (11-22 July)	(Fish lab)
Sigmund Myklevoll (1-11 July)	(Fish.lab)
Georg Skaret	(Acoustic technician)
Bjørn Vidar Svendsen	(Fish.lab)

No exchange of staff with "Scotia" was made this year.

2.2 Narrative

RV “Sarsen” (re-named, former RV”G.O.Sars”) sailed at 1400 UTC on 1 July 2003. The vessel made passage to Uggedalseide/Tysnes to calibrate the acoustic instruments. The conditions appeared to be unfavourable for calibration as there were too much fish/jellyfish in the sea. The vessel continued south and anchored in Rosfjord, N 58°03’96’’E 7°00’4’’ at 1440 UTC on 2 July to do the calibration of the sounders. At 2130 UTC RV “Sarsen” left the fjord following a successful calibration and commenced the survey at 0240 UTC 3 July at 58° 3’N and 8°5’ E, the first hydrographic-station (CTD623) on the Oksøy – Hanstholm transect.

The survey continued with transects from south to north. In general, the weather conditions were good. Early in the survey there were a couple of days with rough weather and lots of noises on the transducer, even with the drop keel in use.

A call was made in Egersund on 2 July, in Aberdeen on 7 July, in Stavanger on 11 July and in Lerwick, Shetland on 20 July. The survey finished in Bergen on 22 July 2003 at 1800 hrs UTC. During the survey, about 3.500 n.mi. were sailed, 75 trawl hauls and 145 CTD stations were taken. Figure 2 gives the cruise track and locations of trawl hauls and Figure 3 the locations of CTD-stations.

2.3 Survey design

The survey was carried out in systematic parallel transects in the east-west direction with a dense transect spacing between 2° and 4° E and a wider spacing between 4° and 6° E (Figure 1) progressing from south to north. In order to plan the parallel transects in between the hydrografic transect, wide spacing transects were carried out in the south easter area (44F4, 44F5, 45F4, 45F5, 46F4 and 46F5). Dense spacing (13-15 nm) was used in the overlapping area east of Shetland.

2.4 Calibration

The acoustic sounders, SIMRAD EK500 38 were controlled and calibrated on 2 July, before the start of of the survey. A standard sphere calibration was carried out (Foote et al. 1983). For calibration of the 38kHz sounder a 60 mm copper sphere (CU60), Ts -33,7 dB, was used. Agreement between means of the calibrations this year and value from last year on the same systems, was better than 0.1 dB. The main settings for the 38 kHz are given in Table 1.

2.5 Acoustic data collection

Acoustic data were collected 24 hours per day using a SIMRAD EK500 38 kHz echo sounder with an ES38B SK transducer mounted on the drop keel. Additional data was collected at 120 kHz ((ES120-7 transducer) but was not used in the present analysis. Echo integrator data was collected from 10 m below the surface (transducer at 5-7.5 m depth, depending on weather conditions and the keel in use) to 1 m above the seabed. The speed of the vessel during the acoustic sampling was 10-11 knots. The acoustic data were archived to tape. The acoustic recordings were scrutinized twice per day using the IMR BEI/SIMRAD BI500 Scientific Post Processing System (The Bergen Echo Integrator) (Foote et al. 1991). Paper records were kept for acoustic data at 38 kHz.

2.6 Biological data - fishing trawls

Trawling was carried out for supporting the species identifications of acoustic scatters and for biological sampling. “Åkra” trawl (16 x 20 m) was used for pelagic trawling and a Campelen 1800 equipped with a Rock hopper gear for bottom trawling. The pelagic trawl had a 11 mm cond end liner. The bottom trawl hauls were monitored using Simrad TS150 scanning netsonde and the pelagic trawl hauls monitored by Scanmar TE40, and depth sensor D1200.

Biological samples (length, weight) were taken of the most important species according to the IMR fish-sampling manual (Fotland et.al. 2002). Herring samples (up to 150 fish) were taken randomly from the catches. Target species were also examined for age, sex, maturity (8 point scale), fat, stomach contents and vertebral counts (east of 2°00'E). Herring was examined for macroscopic evidence of *Ichthyophonus* infection.

2.7 Hydrographic data

CTD stations for temperature, salinity and density measures, were taken regularly in addition to the four standard hydrographical profiles, Oksøy-Hanstholm, Hanstholm-Aberdeen, Utsira - Start Point and Feie – Shetland.

2.8 Data analysis

Echogram scrutiny was made per 5 n.mi. S_A values were allocated to the following categories: herring, sprat, pelagic fish, demersal fish, plankton and other. To calculate integrator conversion factors the target strength of clupeids in the mixture were estimated using the following TS/length relationship:

$$TS = 20\log_{10}L - 71.2 \text{ dB}$$

Herring were separated from other recordings by using catch information and characteristics of the recordings. The abundance estimation is made by ICES rectangles and summed up for the whole area. Toresen et al (1998) describes the acoustic method used for the abundance estimation in this survey.

North Sea autumn spawners and Western Baltic spring spawners (WBSS) are mixed during summer in the area covered by RV ”Sarsen”. No system for workable stock discrimination on individual herring during the survey is available. The proportion of Baltic spring spawners and North Sea autumn spawners by age was calculated by applying the formula, $WBSS = ((56.5 - VS(\text{sample})) / (56.5 - 55.8))$ (ICES 1999). All samples were worked up on board. The length-at age and weight-at age were assumed to be the same in the two stocks. The measured proportions of mature fish were applied equally to calculate the maturing part of each age group in both stocks

3. RESULTS & DISCUSSION

3.1 Hydrography

The horizontal distributions of temperature at 5m, 50m and at bottom in the surveyed area are shown in Figure 3a-c, based on data from 145 CTD stations. The surface water (5 m depth) in the North Sea temperatures ranged from 13-14° C in the west to 15-18° C along the Norwegian west coast. These were in general 1-2°C higher than measured at the same time in 2002 (Torstensen, 2002). Off the west coast the temperatures at 5 m depth were 2-3°C higher than last year. At 50 m depth the temperature along the south western Norwegian coast was 2-3°C lower than in 2002. At the bottom the temperature regime was about the same as last year, with higher temperatures in west (up to 10-12°C) and in south east (up to 10-14°C) than in the central area (7-8°C).

The hydrographical data are part of a general monitoring program in IMR and will be analysed and published separately.

3.2 Acoustic data

3.2.1 Herring

The geographical distribution of the S_A values assigned to herring is presented by 5-n.mi. along the cruise track in Figure 4. This year more herring schools were observed than in the last years but they were found as single schools scattered distributed over the area, often close to the surface. Trawling targeting some of the larger single schools failed as we were not able to detect them again. Highest mean densities were measured in the ICES rectangles 44F5, 46F2 and 42F2. Random trawling positions were regularly chosen for trawling at the surface; i.e. not based on echo registration. In the “Norwegian” area herring tends to keep close to the surface during daytime and may thus be under-estimated.

3.2.2 Sprat

No sprat was registered in the target area of the Norwegian survey.

3.3 Biological data

The total number of valid trawl hauls was 75, 63 pelagic and 12 bottom trawl hauls (see Fig. 2, Table 2). Of the pelagic hauls, 4 were mid water hauls and 59 were performed with large buoys for fishing at the surface. In general 30 min hauls were made. Catch composition per haul is given in Table 3. Herring was present in 45 hauls of which 28 had sample size >20 herring. The length distributions of herring are presented in Table 4. A total of 2.750 fish were measured and 1.575 fish were aged (otoliths). Few herring was observed with *Ichthyophonus* infection. In the Shetland area, however, infected fish was found in three out of 4 herring samples (BT503, BT506 and BT508) with 3-7 % of the fish infected.

3.4 Abundance and Biomass estimates

3.4.1 Herring

The abundance by ICES statistical rectangles, is given separated by stock, in Table 5. The numbers are given age disaggregated and the numbers in age groups 1,2 and 3 are given by immature/mature. Table 6 presents the mean weights at age applied for biomass estimations by ICES rectangles. Total estimated number of herring by age and length is given in Table 7, which also presents the total estimated biomass per stock.

Total number of herring was 4,812 million of which 63% was North Sea Autumn Spawners (NSAS) and 37% western Baltic Spring Spawners (WBSS). Total stock biomass of NSAS was estimated to 280,000 tonnes and the spawning stock biomass as 159,000 tonnes of which the 2-ringers (the 2000 year-class) made 44% and 42% respectively. The 1998-year class made 9% of the number and 17% of the biomass. The total biomass of WBSS was 158,000 tonnes.

The following table gives the historical development of the abundance of NSAS spawning biomass and the total biomass of the WBSS as estimated by the Norwegian survey in 1997-2003. For both stocks, the estimates this year were the second highest for the period.

Year	Herring Biomass (10 ³ tonnes)	
	North Sea herring SSB	Total Western Baltic Spring Spawners
1997	50	160
1998	73	88
1999	259	74
2000	13	51
2001	51	89
2002	90	138
2003	159	158

Table 8 gives the mean length, mean weight, numbers (millions) and biomass (thousands of tonnes) by age and maturity stage for the North Sea autumn spawners and the Western Baltic spring spawners in the Norwegian target area in July 2003.

4. REFERENCES

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Table 1. Simrad EK500 and analysis settings used on the SARSEN2003008 herring acoustic survey.

Transceiver 1 Menu (38 kHz)	
Absorption coefficient	10 dB.km ⁻¹
Pulse length	Medium
Bandwidth	Wide
Max. Power	2000 W
Equivalent two-way beam angle	-21.0 dB
Default Transducer S _v gain	26.95 dB
TS-svingerfølsomhet	27.10 dB
3 dB Beamwidth	6.9/6.8 deg
Alongship offset	-0.10 deg
Althw.Ship Offset	0.03 deg
Calibration details	
TS of sphere	-33.54 dB (cupper 60 mm diameter)
Range to sphere in calibration	39.0
Selected (sA) NASC value for calibration	1573
Log Menu	
Mode NM+	
Operation Menu	
Ping interval	0.0 (all ranges)
Display	
TVG	20 log R
Integration line	1000
TS colour min.	-70 dB
Sv colour min.	-60 dB
Printer	
TS colour min.	-60 dB
Sv colour min	-70 dB

Transceiver 1 Menu (120 kHz)	
Absorption coefficient	38 dB.km ⁻¹
Pulse length	Long
Bandwidth	Narrow
Max. Power	1000 W
Equivalent two-way beam angle	-20.8 dB
Default Transducer S _v gain	26.10 dB
TS transducer gain	25.90 dB
3 dB Beamwidth	7.8/7.3 deg
Alongship offset	-0.19 deg
Althw.Ship Offset	0.33 deg
Calibration details	
TS of sphere	-39.57 dB (tungsten 38.1 (mm?) diameter)
Range to sphere in calibration	40.38
Selected (sA) NASC value for calibration	351
Log Menu	
GPS	
Operation Menu	
Ping interval	0.0 (all ranges)

Table 2. Details of fishing trawl stations during the Norwegian acoustic survey, RV "Sarsen", 1-22 July 2003

PT= pelagic trawl BT= bottom trawl.

Trawl haul no	Date	Lat	Lon	Time UTC	Water depth (m)	Trawl depth (m)	Duration min
BT440	03.jul	57°33'	8°22' E	0845	120	120	8
PT441	03.jul	57°00'	7°47' E	1510	41	0	29
PT442	03.jul	57°00'	6°40' E	2029	58	0	29
PT443	04.jul	57°00'	5°59' E	0009	52	0	30
PT444	04.jul	57°00'	5°19' E	0327	56	0	32
PT445	04.jul	57°00'	4°07' E	0845	64	0	30
PT446	04.jul	57°00'	2°55' E	1423	70	0	30
PT447	04.jul	56°55'	2°00' E	1934	92	0	25
PT448	05.jul	56°52'	3°28' E	0238	65	0	30
PT449	05.jul	56°51'	4°29' E	0757	62	0	31
PT450	05.jul	56°49'	5°48' E	1353	56	0	30
PT451	05.jul	56°41'	5°00' E	1930	64	0	28
PT452	05.jul	56°41'	3°59' E	2356	53	0	31
PT453	06.jul	56°41'	2°44' E	0506	71	0	30
PT454	06.jul	56°48'	1°53' E	0907	92	0	30
BT455	06.jul	57°00'	1°05' E	1457	90	90	30
PT456	08.jul	57°13'	0°42' E	0346	87	0	30
PT457	08.jul	57°14'	1°47' E	0753	96	0	35
PT458	08.jul	57°15'	2°32' E	1130	81	0	31
BT459	08.jul	57°15'	3°25' E	1538	63	63	30
PT460	08.jul	57°15'	5°02' E	2117	62	0	29
PT461	09.jul	57°23'	5°56' E	0148	78	0	30
PT462	09.jul	57°36'	5°55' E	0436	145	10	34
PT463	09.jul	57°32'	3°17' E	1653	66	0	31
PT464	09.jul	57°32'	2°05' E	2127	83	0	30
PT465	10.jul	57°44'	2°21' E	0222	80	0	30
PT466	10.jul	57°44'	3°42' E	0737	67	0	30
PT467	10.jul	57°59'	3°16' E	1235	88	48	30
PT468	10.jul	58°00'	2°05' E	1741	84	0	29
PT469	10.jul	58°14'	2°51' E	2202	72	0	29
PT470	11.jul	58°14'	3°34' E	0052	105	0	29
PT471	11.jul	58°15'	4°39' E	0450	288	0	31
PT472	12.jul	58°15'	5°01' E	1630	308	0	37
PT473	12.jul	58°25'	5°41' E	2220	308	0	30
PT474	13.jul	58°43'	5°05' E	0224	220	0	30
PT475	13.jul	58°43'	4°43' E	0432	222	0	33
BT476	13.jul	58°28'	2°46' E	1348	101	101	33
BT477	13.jul	58°41'	2°05' E	1830	99	99	33
PT478	13.jul	58°42'	3°19' E	2327	107	0	28
PT479	14.jul	58°49'	4°00' E	0252	281	0	30
PT480	14.jul	58°54'	2°53' E	0819	124	45	30
BT481	14.jul	58°54'	2°24' E	1107	115	115	34
PT482	14.jul	58°06'	3°40' E	1945	260	0	31
PT483	14.jul	59°05'	4°45' E	2356	264	0	36
PT484	15.jul	59°17'	2°10' E	1355	124	0	30
BT485	15.jul	59°17'	1°33' E	1654	112	112	31
PT486	15.jul	59°17'	0°32' W	0051	139	0	31
PT487	16.jul	59°17'	0°32' E	0051	139	0	31
PT488	16.jul	59°32'	2°08' E	1958	122	0	31
PT489	16.jul	59°32'	3°04' E	2346	129	0	34
PT490	16.jul	59°32'	3°24' E	0153	203	20	30

Table 2. Cont.

Trawl haul no	Date	Lat	Lon	Time UTC	Water depth (m)	Trawl depth (m)	Duration min
PT491	16.jul	59°39'	4°40' E	757	264	0	32
PT492	17.jul	59°42'	3°12' E	1334	153	0	30
PT493	17.jul	59°53'	2°24' E	1914	100	0	28
PT494	17.jul	59°54'	3°03' E	2157	127	0	33
PT495	18.jul	59°54'	3°54' E	0100	283	0	30
PT496	18.jul	59°53'	4°28' E	0344	281	0	30
PT497	18.jul	60°06'	4°11' E	0829	293	0	29
PT498	18.jul	60°06'	2°32' E	1436	106	0	30
PT499	18.jul	60°18'	3°02' E	2051	119	0	28
PT500	18.jul	60°18'	3°50' E	2358	294	0	30
PT501	19.jul	60°25'	4°39' E	0355	372	0	30
PT502	19.jul	60°34'	3°26' E	0916	302	0	30
BT503	19.jul	60°33'	0°53' E	1845	140	140	28
PT504	19.jul	60°33'	0°11' E	2256	106	0	29
PT505	20.jul	60°33'	0°27' E	0027	118	16	29
BT506	20.jul	60°20'	0°48' E	0713	161	161	22
PT507	20.jul	60°12'	0°26' E	2122	121	0	28
BT508	21.jul	60°42'	0°34' E	0214	142	142	32
PT509	21.jul	60°58'	0°39' E	0437	139	0	30
BT510	21.jul	60°58'	0°05' E	0700	145	145	31
BT511	21.jul	60°53'	0°46' W	1210	98	98	30
PT512	21.jul	60°44'	2°13' E	2339	123	0	29
PT513	22.jul	60°44'	3°12' E	0412	291	0	30
PT514	22.jul	60°44'	4°07' E	0918	316	0	28

Table 3. RV "Sarsen" 1 - 22 July 2003. Catch compositions in the trawl hauls (kg).

Trawl station		440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	
Total catch (kg)		151.77	7.43	82.90	11.91	5.27	500.00	0.09	3.00	3.71	12.89	52.69	51.66	0.62	6.68	3.21	576.77	17.40	0.38	33.56	212.35	30.29	
Herring	Clupea harengus	0.17					486.34									0.08	468.10	17.36	0.34		12.35		
Sprat	Sprattus sprattus																						
Pilchard	Sardina pilchardus																						
Anchovy	Engraulis encrasicolus																						
Mackerel	Scombrus scombrus		1.64	12.44	6.71		12.55			1.25	0.17					0.65				32.54		24.22	
Horse mackerel	Tracurus tracurus																						
Norway pout	Trisopterus esmarkii	5.10																					
Haddock	Melanogrammus aeglefinus	2.42	5.38	0.01							0.13						58.60		0.00	0.00	60.19		
Whiting	Merlangius merlangus		0.16	0.07	0.06	0.01					0.02	0.03	0.02				20.60	0.01	0.03	0.01	11.84	0.00	
Blue-whiting	Micromesistius poutassou	101.10																					
Saithe	Pollachius virens	37.00																					
Hake	Merluccius merluccius	1.45																					
Pollack	Pollachius pollachius																						
Torsk	Brosme brosme																						
Cod	Gadus morhua																						
Poor cod	Trisopterus minutus																						
Ling	Molva molva																						
Argentine	Argentina sphyraena																						
Sandeels	Ammodytidae spp				0.01																		
Gurnard	Trigla spp		0.26	0.38	1.14	0.26	1.11	0.09		0.36	1.18	2.66	0.27	0.11		0.29	3.80				3.24	2.82	
Dab	Limanda limanda																12.60				97.02		
Plaice	Pleuronectes platessa																						
Witch	Glyptocephalus cynoglossus																						
Lomre	Microstomus kitt																1.53				1.74		
Long rough dab	Hippoglossoides platessoides	1.76															10.62				25.97		
Wolffish	Anarhichas lupus																						
Lumpsucker	Cyclopterus lumpus									2.10	1.39		1.38		1.68	2.19				1.01			
Monkfish	Lophius piscatorius																						
Norway haddock	Sebastes marinus																						
Pigghå	Squalus acantias	1.76																					
Jellyfish			70.00	4.00	5.00			3.00		10.00	50.00	50.00	0.50	5.00								3.00	
Other		1.02												0.01			0.92	0.03				0.25	

Table 3. Cont

Trawl station		461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481
Total catch (kg)		2010.94	10.72	4500.00	258.79	23.62	1.98	114.26	3.04	32.44	33.67	8.01	125.70	97.42	6.69	16.12	103.76	718.67	81.19	43.15	0.00	151.17
Herring	Clupea harengus	6.71	0.41	4500.00	5.47					0.79	11.04	1.03	74.44	30.64	1.46	0.23	32.40	569.20	19.68	33.16		62.36
Sprat	Sprattus sprattus																					
Pilchard	Sardina pilchardus																					
Anchovy	Engraulis encrasicolus																					
Mackerel	Scombrus scombrus	3.76	0.27		2.85	23.62	0.23	1.00		2.64	17.08	3.60	33.64	3.96	4.16	10.66			55.70	8.52		
Horse mackerel	Tracurus tracurus				0.42						0.28						0.38		3.46	1.42		
Norway pout	Trisopterus esmarkii																	8.30				47.30
Haddock	Melanogrammus aeglefinus	0.00				0.00	0.00	42.88	0.01	0.00				0.02		0.01	36.40	71.90				24.00
Whiting	Merlangius merlangus	0.02	0.03		0.05	0.01	0.01	46.05	0.01	0.71	0.05	0.00	0.11	0.00	0.01	0.04	14.56	26.00		0.04		4.60
Blue-whiting	Micromesistius poutassou													17.80								
Saithe	Pollachius virens										1.48	3.04					4.62	23.36				3.30
Hake	Merluccius merluccius																					
Pollack	Pollachius pollachius																					
Torsk	Brosme brosme																					
Cod	Gadus morhua																1.94					
Poor cod	Trisopterus minutus																					
Ling	Molva molva																		1.30			
Argentine	Argentina sphyraena																					
Sandeels	Ammodytidae spp																					
Gurnard	Trigla spp	0.45						4.33		0.62							2.27	1.19	0.05			
Dab	Limanda limanda																2.36	13.86				0.21
Plaice	Pleuronectes platessa																					
Witch	Glyptocephalus cynoglossus																					
Lemon dab	Microstomus kitt																					0.55
Long rough dab	Hippoglossoides platessoides																1.71	4.12				7.15
Wolfish	Anarhichas lupus																					
Lumpsucker	Cyclopterus lumpus						0.74			2.67	0.23	1.89	0.84									
Monkfish	Lophius piscatorius																					
Norway haddock	Sebastes marinus																					
Piggå																						
Jellyfish		2000.00	10.00		250.00		1.00	20.00	3.00	25.00	5.00		10.00	45.00		5.00	4.00					
Other					0.01		0.00		0.02	0.01			3.63		1.07	0.19	3.12	0.74	1.00			1.70

Table 3. Cont

Trawl station		482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502
Total catch (kg)		58.84	100.64	229.97	1.69	71.81	51.70	10.44	49.14	104.15	17.65	37.27	2.22	58.36	215.20	7.43	2.44	5.69	40.22	60.46	430.58	31.04
Herring	Clupea harengus	7.33	72.18	182.48		2.11	33.58		6.12	95.40	0.99		0.19	13.99	167.72	0.94	0.34		0.96	10.72	18.00	0.64
Sprat	Sprattus sprattus																					
Pilchard	Sardina pilchardus																					
Anchovy	Engraulis encrasicolus																					
Mackerel	Scombrus scombrus	27.46	1.85	22.48		0.58	17.62	0.23	35.40	8.70	4.02	32.20		41.86	39.62	4.19		0.12	37.78	2.92	379.50	28.56
Horse mackerel	Tracurus tracurus					0.12			2.62							0.28			0.37		0.07	0.90
Norway pout	Trisopterus esmarkii					0.16																
Haddock	Melanogrammus aeglefinus	0.01				50.80							0.01									
Whiting	Merlangius merlangus	0.04	0.26			0.71		0.07		0.01			0.02			0.03	0.02				0.01	
Blue-whiting	Micromesistius poutassou		8.57																		14.92	
Saithe	Pollachius virens		7.68			7.34								6.62				4.90			16.40	
Hake	Merluccius merluccius																					
Pollack	Pollachius pollachius																					
Torsk	Brosme brosme																					
Cod	Gadus morhua					2.36																
Poor cod	Trisopterus minutus																					
Ling	Molva molva																					
Argentine	Argentina sphyraena																					
Sandeels	Ammodytidae spp																					
Gurnard	Trigla spp					0.64		0.08												0.43		0.44
Dab	Limanda limanda					1.04																
Plaice	Pleuronectes platessa					1.26																
Witch	Glyptocephalus cynoglossus																					
Lemon dab	Microstomus kitt					0.39																
Long rough dab	Hippoglossoides platessoides					2.70																
Wolffish	Anarhichas lupus																					
Lumpsucker	Cyclopterus lumpus	4.00			1.10					2.58							1.08		0.65			
Monkfish	Lophius piscatorius																					
Norway haddock	Sebastes marinus																					
Pigghå																						
Jellyfish		20.00	5.00	25.00	0.50		0.50	10.00	5.00	10.00	5.00	2.00	2.50		2.00	1.00	0.50			5.00	33.00	0.50
Other		0.01	5.11	0.01	0.09	1.61		0.06		0.05	0.04	0.07	0.01	0.01	1.24		0.17	0.04		10.50		

Table 3. Cont

Trawl station		503	504	505	506	507	508	509	510	511	512	513	514
Total catch (kg)		199.92	0.34	6.17	218.25	3.01	267.78	3.69	74.71	87.08	97.41	1.11	6.23
Herring	Clupea harengus	10.41			41.76		43.32		0.83				
Sprat	Sprattus sprattus												
Pilchard	Sardina pilchardus												
Anchovy	Engraulis encrasicolus												
Mackerel	Scombrus scombrus			5.63		2.90		2.50	0.10		96.40	1.10	6.22
Horse mackerel	Tracurus tracurus	0.79	0.33		0.60				1.09	0.22	1.00		
Norway pout	Trisopterus esmarkii	108.50			79.43		112.80		20.20				
Haddock	Melanogrammus aeglefinus	9.75			3.29		42.20		10.66	6.24			
Whiting	Merlangius merlangus	15.14			28.98		38.20	0.01	0.73			0.00	
Blue-whiting	Micromesistius poutassou				5.94								
Saithe	Pollachius virens	17.36			11.38		2.26		2.04	5.36			
Hake	Merluccius merluccius	4.13			0.08		1.80						
Pollack	Pollachius pollachius												
Torsk	Brosme brosme												
Cod	Gadus morhua								19.74	21.20			
Poor cod	Trisopterus minutus												
Ling	Molva molva								5.28				
Argentine	Argentina sphyraena												
Sandeels	Ammodytidae spp		0.00										
Gurnard	Trigla spp	1.89				0.08	1.61	0.11	0.90	2.29			
Dab	Limanda limanda	0.69							0.16				
Plaice	Pleuronectes platessa												
Witch	Glyptocephalus cynoglossus				0.67								
Lemon dab	Microstomus kitt	0.81					1.80		0.05	3.63			
Long rough dab	Hippoglossoides platessoides	24.83			28.04		9.33		3.63	0.46			
Wolffish	Anarhichas lupus								2.00				
Lumpsucker	Cyclopterus lumpus							0.80					
Monkfish	Lophius piscatorius												
Norway haddock	Sebastes marinus												
Pigghå													
Jellyfish				0.50				0.18					
Other		5.61	0.01	0.04	18.09	0.04	14.46	0.09	7.32	47.68	0.01	0.02	0.01

Table 4. RV "Sarsen" 1-22 July 2003. Herring length (cm) distribution in trawl hauls where sample size > 20 herring

Trawl st	445	455	456	459	461	463	464	470	472	473	476	477	478	479
ICES rect	43F4	43F2	43F0	43F3	43F5	44F3	44F2	45F3	45F5	45F5	45F2	46F2	46F3	46F3
15.0														
15.5														
16.0										1				
16.5	5	1		6	3									
17.0	4	1	2	10	6			1						
17.5	12		1	21	8	5	2			1				
18.0	22		1	29	21	16	2			3	2			
18.5	24	4	8	19	31	20	10	1		1	1			
19.0	16	3	15	9	22	25	7	3	2	3	7			
19.5	9	13	15	3	10	10	7	5	3	5	5			2
20.0	6	9	29	3	7	2	10	6	7	4	7			4
20.5	1	13	17		6	10	10	2	13	18	7			6
21.0	1	21	7		2	6	9	5	9	16	7	1	2	10
21.5		17	1		4	5	8	3	14	18	5		2	9
22.0		16	3				6	9	8	11	14	2	5	8
22.5		11	1		1	1	5	3	4	5	7	1	5	8
23.0		12					4	7	6	3	9	7	10	4
23.5		15			1			6	5	4	8	5	7	2
24.0		4						6	7	2	7	6	7	8
24.5		2			1				4		3	7	9	6
25.0		3						10	4	2	3	17	14	8
25.5		2						5	3		2	13	11	6
26.0		1						7	4			12	6	6
26.5		2						5	2		5	13	9	4
27.0								6	1			8	5	2
27.5								4	2	1		4	2	2
28.0								1	2	2	1	3	3	2
28.5								2				1	1	
29.0								1					2	1
29.5														1
30.0														
30.5														
31.0														
31.5														
32.0														
32.5														1
33.0														
33.5														
34.0														
34.5														
35.0														
35.5														
36.0														
Total N	100	150	100	100	123	100	80	98	100	100	100	100	100	100
mean W(g)	0.051	0.091	0.063	0.050	0.055	0.059	0.068	0.113	0.101	0.085	0.092	0.145	0.136	0.119
mean L(cm)	18.7	22.1	20.1	18.2	19.1	19.4	20.6	23.8	22.8	21.6	22.4	25.6	25.0	23.8

Table 4. Contd

Trawl st	481	482	483	484	486	487	489	490	494	495	500	501	503	506	508
ICES rect	46F2	47F3	47F4	47F4	47F1	47E9	48F3	48F3	48F3	48F3	49F3	49F4	50F0	49F0	50F0
15.0															
15.5															
16.0															
16.5															
17.0															
17.5															
18.0															
18.5															
19.0			1												
19.5												1			
20.0					2							1			
20.5	1				2	1					1	1			
21.0			5		3							3		1	
21.5	1		5		12	1						10			
22.0	2		20		15	5	1			1		17			
22.5	3		9		12	1				2	2	6			
23.0	4		13		13	2	2	2		4	2	13			
23.5	2	1	3		8	6	3	1	1	4	1	6			
24.0	3	6	14		8	3	7	2	2	10	4	11		1	4
24.5	3	1	5		11	17	3	5	5	11	1	6		2	8
25.0	7	4	11		6	1	29	2	2	13	8	7		4	13
25.5	5	5	3		1	15	4	8	13	12	7	6		4	13
26.0	8	4	6		2	1	8	1	4	8	10	8		5	9
26.5	12	7	2		4		8	5	18	6	12	8		3	6
27.0	14	5					5	4	10	13	12	4		1	4
27.5	11	3	2				4	2	5	4	7	4		2	7
28.0	12	8	1		1		1	5	17	12	6	8		3	7
28.5	7	1						2	6	1				4	2
29.0	3	2					1	3	8	5	1			3	2
29.5	2	3						1	7	1		2		5	3
30.0								1	3	1		1		2	1
30.5									1			1			1
31.0							1			1		1			
31.5									1						
32.0															1
32.5												1			
33.0															1
33.5															
34.0															
34.5															
35.0															
35.5															
36.0											1				
Total	100	50	100	100	21	101	35	100	85	100	63	100	54	100	150
mean W(g)	0.167	0.147	0.111	0.110	0.100	0.138	0.175	0.196	0.165	0.155	0.17	0.112	0.1929	0.168	0.204
mean L(cm)	26.5	26.8	23.7	23.4	23.3	25.5	27.3	27.5	26.8	25.9	26.9	23.7	27.5	26.7	27.8

Table 5. Estimated number by age (ringers) and maturity by stocks by ICES rectangles. RV "Sarsen" 1-22 July 2003. (I=immature, M=mature)

42F2	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	228.90	169.56	0.00	4.07	4.07	0.00	0.00	0.00	0.00	0.00	406.59
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42F3	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	10.25	0.00	15.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.27
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	62.98	0.00	3.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.73
42F4	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	2.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.34
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	17.24	0.00	3.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.76
42F5	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	1.33	0.00	3.40	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.87
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	13.44	0.00	1.53	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.03
43F2	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	14.80	0.00	9.35	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.13
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	7.29	0.00	1.16	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.57
43F3	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	52.12	0.00	19.95	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.41
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	33.32	0.00	5.30	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.98
43F4	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	51.81	0.00	75.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	127.67
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	318.25	0.00	18.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	337.22

Table 5. Contd.

43F5	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	56.30	0.00	19.25	1.67	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	77.99
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	14.97	0.00	1.23	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.30
44F2	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	13.50	0.00	15.90	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.44
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	13.50	0.00	3.73	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.71
44F3	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	18.38	0.00	16.26	3.32	2.19	2.56	7.67	3.53	0.44	0.00	0.00	0.00	54.34
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	20.72	0.00	8.37	1.71	0.45	0.52	1.15	0.00	0.00	0.00	0.00	0.00	32.93
44F4	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	22.21	0.00	46.04	22.23	8.52	25.57	27.02	14.01	2.00	0.00	0.00	0.00	167.60
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	29.44	0.00	51.92	25.07	4.79	14.38	16.56	8.59	1.23	0.00	0.00	0.00	151.97
44F5	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	746.52	0.00	255.31	22.20	10.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1034.20
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	198.44	0.00	16.30	1.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	216.16
45F2	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	9.10	16.22	0.00	6.76	8.73	2.16	0.71	0.00	0.00	0.00	43.68
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	4.83	1.21	13.10	23.34	0.00	16.55	13.65	3.38	1.11	0.00	0.00	0.00	77.17
45F3	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	5.13	0.00	6.34	1.75	1.18	1.38	4.48	2.16	0.27	0.00	0.00	0.00	22.67
	Baltic Spring Spawner												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	1.49	0.41	0.44	0.51	0.92	0.00	0.00	0.00	0.00	0.00	3.76

Table 5. Contd.

45F4	North Sea Autumn spawners													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	4.17	0.00	8.64	4.17	1.60	4.80	5.07	2.63	0.38	0.00	0.00	0.00	31.45	
	Baltic Spring Spawner													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	5.52	0.00	9.74	4.70	0.90	2.70	3.11	1.61	0.23	0.00	0.00	0.00	28.51	
45F5	North Sea Autumn spawners													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	4.90	0.00	7.85	3.00	0.80	1.70	0.00	0.00	0.00	0.00	0.00	0.00	18.24	
	Baltic Spring Spawner													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	23.91	0.00	52.53	20.06	6.47	13.75	7.68	4.71	1.49	0.00	0.00	0.00	130.60	
46F2	North Sea Autumn spawners													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	0.00	0.00	16.11	66.74	0.00	34.49	102.75	29.12	3.69	12.13	0.00	0.00	265.05	
	Baltic Spring Spawner													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	0.00	0.00	5.96	24.69	0.00	29.38	15.35	4.35	0.55	1.81	0.00	0.00	82.10	
46F3	North Sea Autumn spawners													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	2.02	0.58	15.63	43.87	0.57	4.72	10.04	3.31	0.81	1.28	0.21	0.00	83.05	
	Baltic Spring Spawner													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	4.96	1.42	8.05	22.60	1.90	15.80	22.35	7.37	1.81	2.85	0.48	0.00	89.58	
46F4	North Sea Autumn spawners													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	1.12	0.37	28.03	17.91	1.86	3.72	5.25	1.21	0.64	0.19	0.00	0.00	60.31	
	Baltic Spring Spawner													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	9.08	3.03	40.34	25.77	7.92	15.84	21.01	4.85	2.55	0.77	0.00	0.00	131.16	
46F5	North Sea Autumn spawners													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	10.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.86	
	Baltic Spring Spawner													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	9.63	0.00	44.30	1.70	9.26	0.00	3.16	0.00	0.00	0.00	0.00	0.00	68.06	
47F2	North Sea Autumn spawners													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	0.00	0.00	0.19	3.30	0.95	5.06	5.84	2.43	0.89	0.71	0.45	0.00	19.82	
	Baltic Spring Spawner													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
0.00	0.00	0.00	0.17	2.93	0.12	0.63	6.58	2.74	1.01	0.80	0.51	0.00	15.47	

Table 5. Contd.

47F3	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	0.77	4.64	1.04	2.09	12.48	7.22	0.66	1.97	0.00	0.00	30.87
Baltic Spring Spawner													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	1.93	11.59	7.07	14.14	38.90	22.52	2.05	6.14	0.00	0.00	104.34
47F4	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	2.52	1.26	7.46	6.18	0.00	0.00	2.54	0.73	0.14	0.00	0.00	0.00	20.82
Baltic Spring Spawner													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	45.81	37.96	9.02	16.55	10.81	3.10	0.59	0.00	0.00	0.00	123.83
48F2	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	0.15	1.17	0.04	0.78	1.14	0.53	0.25	0.11	0.25	0.00	4.43
Baltic Spring Spawner													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48F3	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	5.18	30.22	1.59	24.65	34.01	13.76	5.32	2.17	4.75	0.00	121.64
Baltic Spring Spawner													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48F4	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	1.42	0.00	8.00	13.05	1.14	13.10	11.68	6.88	0.36	1.20	0.36	0.71	57.88
Baltic Spring Spawner													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
49E9	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	1.03	0.00	1.03	35.94	1.09	32.79	24.64	2.05	1.03	3.08	0.00	0.00	102.68
49F0	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	3.34	0.00	3.34	116.95	3.56	106.71	80.19	6.68	3.34	10.02	0.00	0.00	334.13
49F2	North Sea Autumn spawners												
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	2.19	4.98	0.72	6.16	6.47	3.34	0.60	0.71	0.38	0.21	25.76
Baltic Spring Spawner													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 6. Weight at age and maturity by ICES rectangles. RV “Sarsen” 1-22 July 2003.
(I=immature, M=mature)

50F4													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	76.00	0.00	103.00	104.80	143.00	142.80	155.20	170.20	194.00	258.30	248.00	220.40	115.56
50F3													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	76.00	0.00	103.00	104.80	143.00	142.80	155.20	170.20	194.00	258.30	248.00	220.40	115.56
50F2													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50F1													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50F0													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	80.00	0.00	106.50	147.90	185.00	181.70	206.80	205.70	222.70	221.60	245.30	0.00	186.09
50E9													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	80.00	0.00	104.00	144.50	185.00	174.10	192.40	196.50	181.00	177.50	0.00	0.00	167.22
49F4													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	76.00	0.00	103.00	104.80	143.00	142.80	155.20	170.20	194.00	258.30	248.00	264.00	115.56
49F3													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	76.00	0.00	103.00	104.80	143.00	142.80	155.20	170.20	194.00	258.30	248.00	264.00	115.56
49F2													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	117.50	142.80	133.30	164.60	169.10	185.40	193.50	240.20	215.70	264.00	156.15
49F0													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	80.00	0.00	104.00	144.50	185.00	174.10	192.40	196.50	181.00	177.50	0.00	0.00	167.22
49E9													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	80.00	0.00	104.00	144.50	185.00	174.10	192.40	196.50	181.00	177.50	0.00	0.00	167.22
48F4													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	76.00	0.00	103.00	104.80	143.00	142.80	155.20	170.20	194.00	258.30	248.00	264.00	146.50
48F3													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	121.30	151.70	123.50	179.50	177.60	188.90	208.10	220.70	220.40	0.00	173.70

Table 6. Contd.

48F2													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	131.70	157.10	130.00	192.50	182.40	198.80	212.00	220.70	220.40	0.00	183.00
47F4													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	86.00	92.00	99.00	111.60	107.80	129.20	127.90	158.00	165.00	0.00	0.00	0.00	111.60
47F3													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	0.00	0.00	86.00	129.00	113.00	155.30	146.70	151.10	192.00	205.70	0.00	0.00	146.60
47F2													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	0	0	86	154.60	113.00	187.30	168.10	170.30	213.80	213.30	234.30	0.00	178.70
46F5													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	72.10	0.00	86.00	102.00	95.70	0.00	120.50	0.00	0.00	0.00	0.00	0.00	84.40
46F4													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	77.50	86.50	96.20	116.70	108.40	137.40	132.20	182.00	165.00	163.00	0.00	0.00	112.80
46F3													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	77.10	86.50	95.00	127.70	113.00	146.30	152.10	152.20	174.00	191.20	225.00	0.00	132.50
46F2													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	0.00	0.00	95.10	127.50	0.00	145.30	177.70	193.00	171.00	197.30	0.00	0.00	153.70
45F5													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	73.70	0.00	85.60	98.80	92.90	118.10	136.10	141.00	195.00	0.00	0.00	0.00	95.30
45F4													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	67.70	0.00	89.60	103.00	107.00	123.70	151.60	152.40	181.00	0.00	0.00	0.00	106.60
45F3													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	62.80	0.00	93.90	113.90	114.50	137.10	155.40	160.90	167.00	0.00	0.00	0.00	112.60
45F2													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
	54.10	70.20	78.10	104.60	0.00	130.50	146.50	153.00	200.00	0.00	0.00	0.00	108.30
44F8													
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 6. Contd.

43F4														
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
	49.80	0.00	58.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.90	
43F3														
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
	52.90	0.00	67.60	82.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	57.90	
43F2														
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
	53.40	0.00	71.70	92.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61.90	
42F5														
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
	49.90	0.00	60.70	86.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.30	
42F4														
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
	48.60	0.00	58.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.30	
42F3														
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
	49.80	0.00	58.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.90	
42F2														
0	1	1M	2I	2M	3I	3M	4	5	6	7	8	9+	Total	
	0.00	0.00	83.00	104.80	0.00	141.00	0.00	0.00	0.00	0.00	0.00	0.00	91.25	

Table 7. Estimated number and biomass by age and length groups. Total also presented by stocks. RV "Sarsen", 1-22 July 2003.

Length (cm)	Age groups (wr)									N (mill)	Ton (10 ³)	
	1	2	3	4	5	6	7	8	9+			
15.0-15.9												
16.0-16.9	70.92										70.92	2.83
17.0-17.9	309.80	13.57									323.37	13.76
18.0-18.9	863.50	88.44									951.94	47.93
19.0-19.9	399.45	231.87									631.32	36.67
20.0-20.9	113.03	282.02									395.04	27.59
21.0-21.9	61.82	348.19	5.82								415.84	34.11
22.0-22.9	7.75	314.17	22.03	3.20							347.15	32.63
23.0-23.9		285.47	40.80	6.17	3.56						336.00	36.04
24.0-24.9		148.08	97.95	30.31	8.12						284.46	34.22
25.0-25.9		105.15	119.77	104.07	13.97						342.96	46.64
26.0-26.9		48.07	57.53	129.25	56.79	2.92	2.26				296.83	46.33
27.0-27.9		3.20	37.13	102.84	35.87	11.36	8.13				198.53	34.76
28.0-28.9		1.27	23.52	58.91	39.05	11.90	7.48	2.55			144.67	28.08
29.0-29.9			3.68	12.98	18.38	4.72	13.99	4.60			58.34	12.02
30.0-30.9			1.76		1.10		1.61	0.39	1.61		6.48	1.58
31.0-31.9				0.59	1.71			0.99			3.30	0.82
32.0-32.9							1.65		1.61		3.26	1.11
32.0-32.9												
32.0-32.9												
32.0-32.9												
32.0-32.9							1.61				1.61	0.61
N (mill)	1826	1869	410	448	179	31	37	9	3		4812	438
NS herring	1033	1325	221	287	115	18	24	8	3			
Baltic spr	793	544	189	161	63	13	12	1				
							NS herring (millions)					3035.08
							SSB, NS herring (tonnes 10 ³)					159.99
							Baltic spr (tonnes ³)					157.65

Table 8. Mean length, mean weight, numbers (millions) and biomass (thousands of tonnes) by age and maturity stage for herring in the Norwegian target area. RV "Sarsen", 1-22 July 2003.

Age	L _{mean}	W _{mean}	North Sea Autumn Spawners				Western Baltic Spring Spawners			
			No (mill)	%	Biom.(10 ³ t)	%	No (mill)	%	Biom(10 ³ t)	%
1I	19.2	52.6	1031	34.0	54	19.4	788	44.3	41	26.3
1M	21.4	89.6	2	0.1	0	0.1	6	0.3	1	0.3
2I	21.7	75.1	847	27.9	64	22.7	339	19.1	25	16.1
2M	23.7	113.5	478	15.8	54	19.4	205	11.5	23	14.8
3I	24.1	82.1	37	1.2	3	1.1	48	2.7	4	2.5
3M	25.8	146.5	184	6.1	27	9.6	141	7.9	21	13.1
4	26.7	162.6	287	9.5	47	16.7	161	9.1	26	16.6
5	27.2	173.7	115	3.8	20	7.2	63	3.6	11	7.0
6	28.2	190.0	18	0.6	3	1.2	13	0.7	2	1.5
7	29.3	214.0	24	0.8	5	1.9	12	0.7	3	1.7
8	29.4	226.6	8	0.2	2	0.6	1	0.1	0	0.1
9+	31.5	232.8	3	0.1	1	0.3	0	0.0	0	0.0
Total	23.4	90.9	3035	100.0	280	100	1777	100	158	100
Immature	20.9	63.5	1915	63.1	121	43.1	1175	66.1	71	44.9
Mature	25.5	140.0	1118	36.9	159	56.9	596	33.9	87	55.1

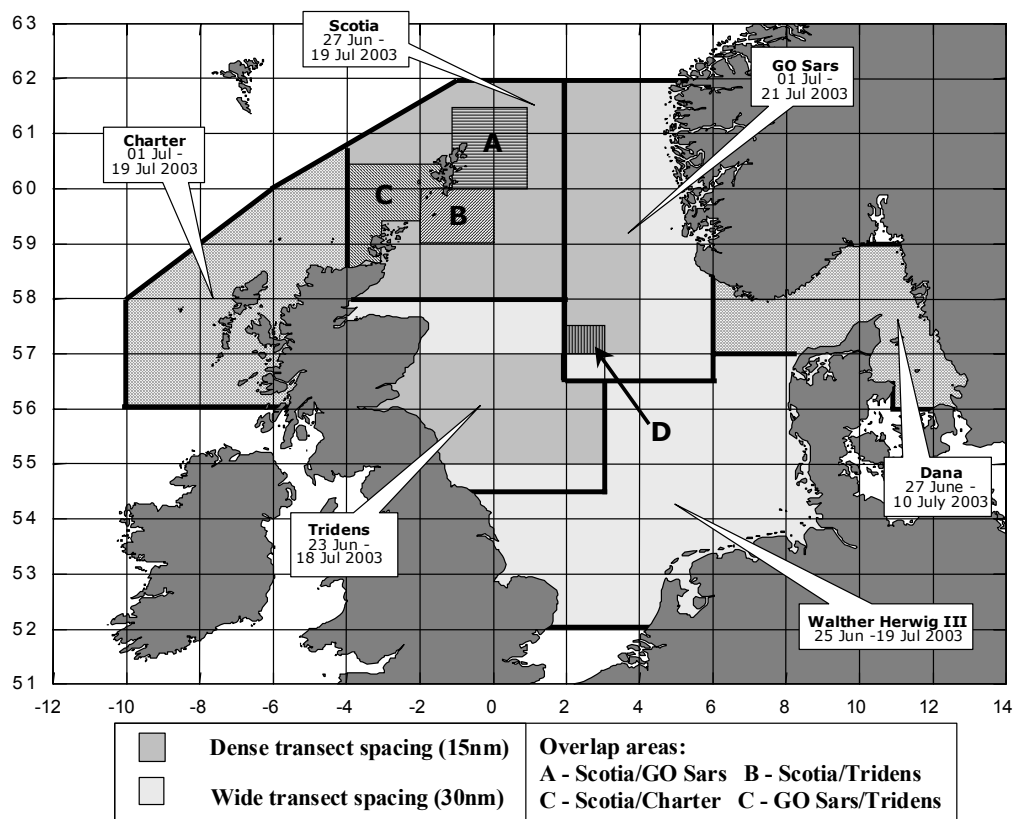


Figure 1. Survey area layouts and dates for all participating vessels in the 2003 acoustic survey of the North Sea and adjacent areas (ICES 2003).

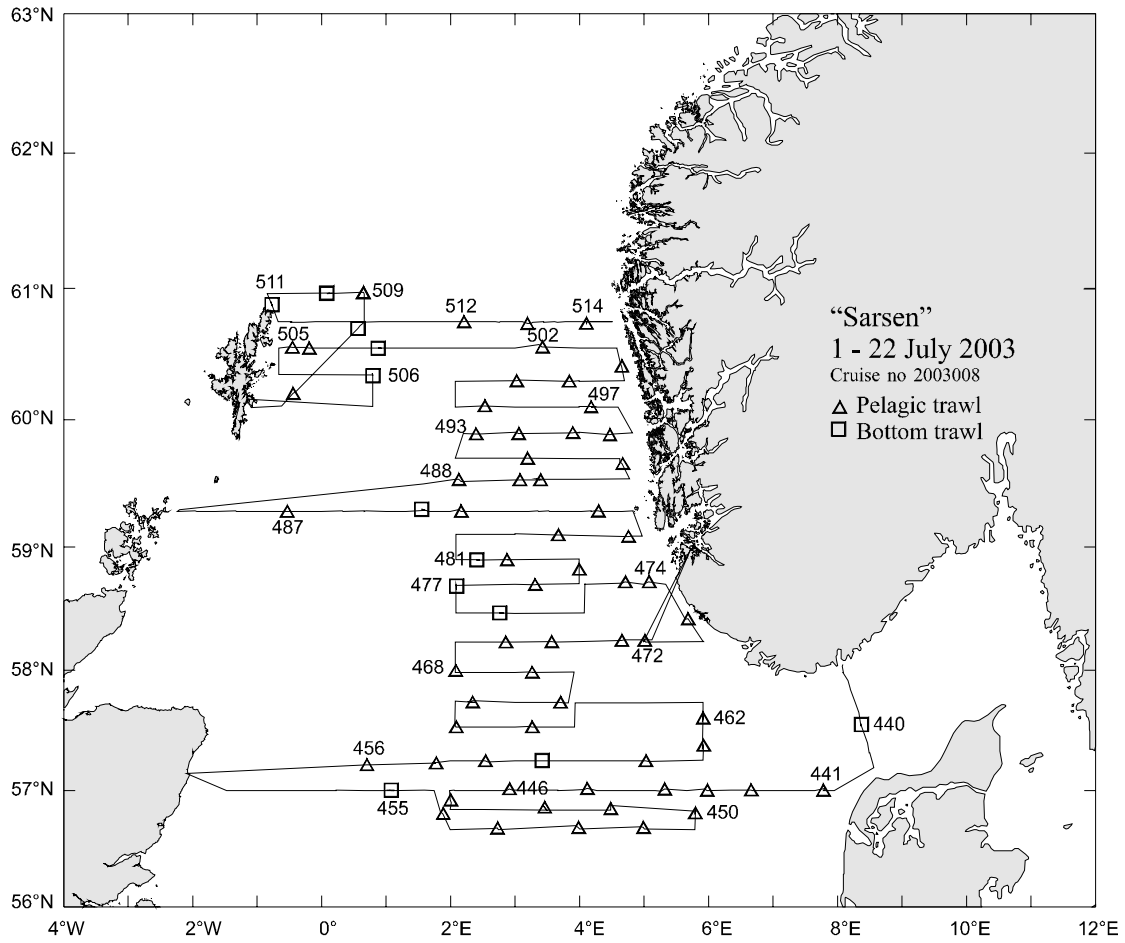


Figure 2. Cruise track and fishing trawls undertaken during the acoustic survey on RV "Sarsen", 1-22 July 2003.

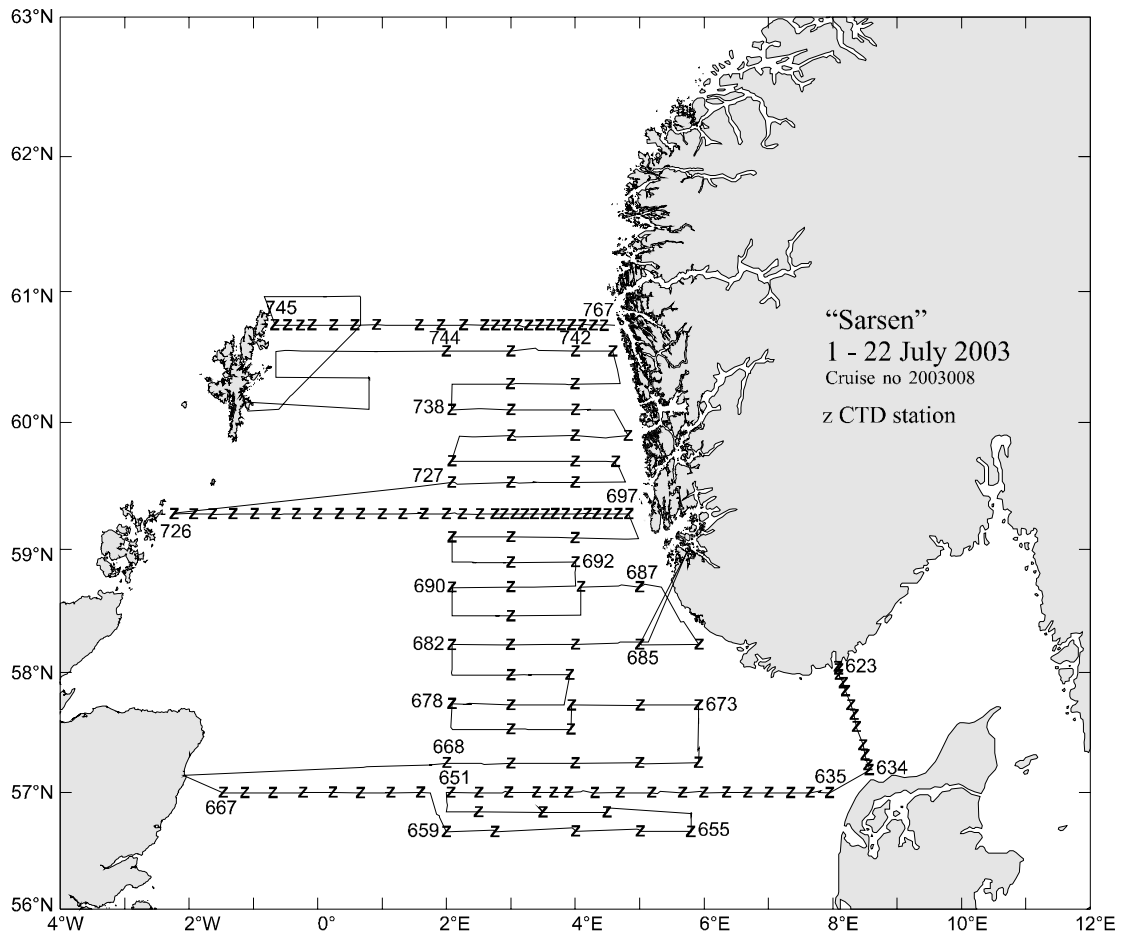


Figure 3. Cruise track and CTD-stations undertaken during the acoustic survey on RV “Sarsen”, 1-22 July 2003

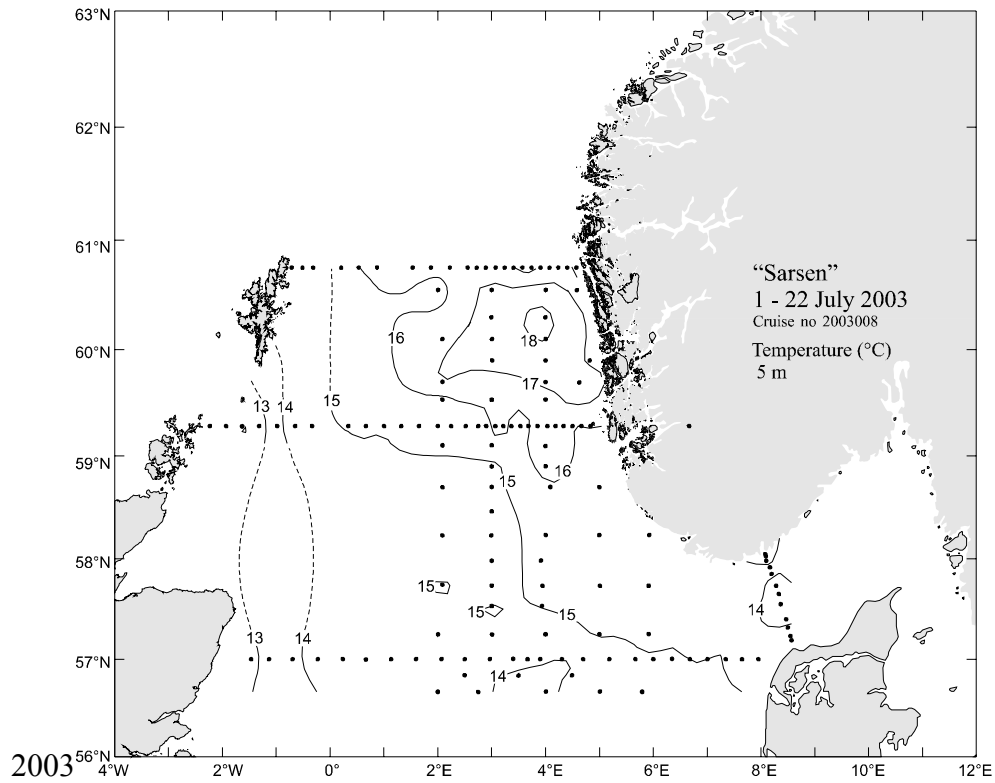


Figure 4a. The horizontal distribution of temperature at 5 m. RV “Sarsen”, 1-22 July 2003.

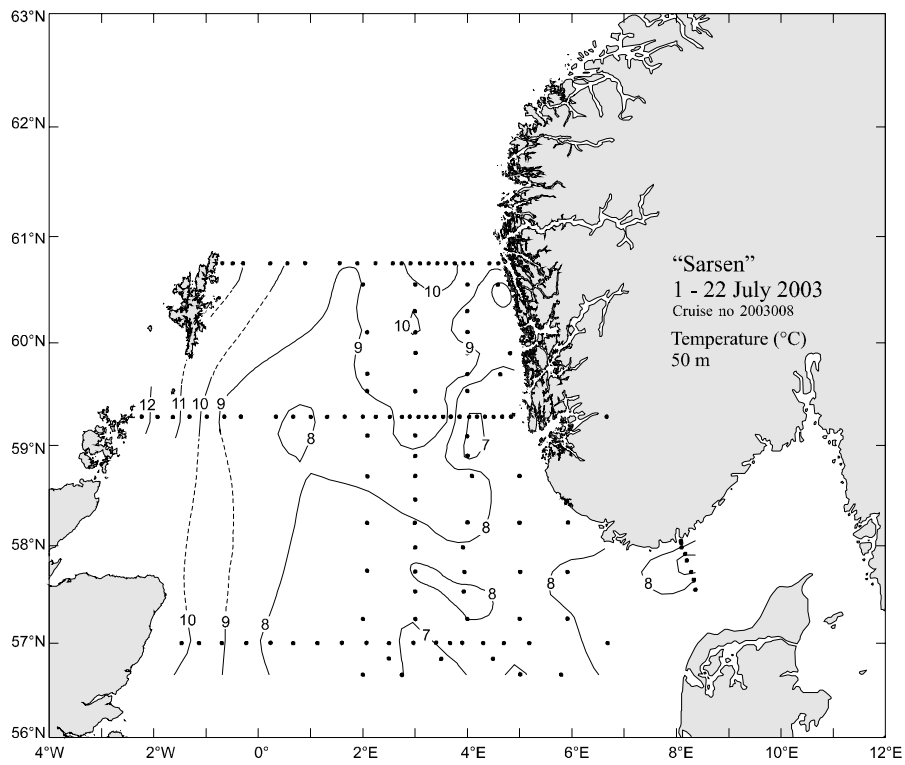


Figure 4b. The horizontal distribution of temperature at 50m. RV “Sarsen”, 1-22 July 2003

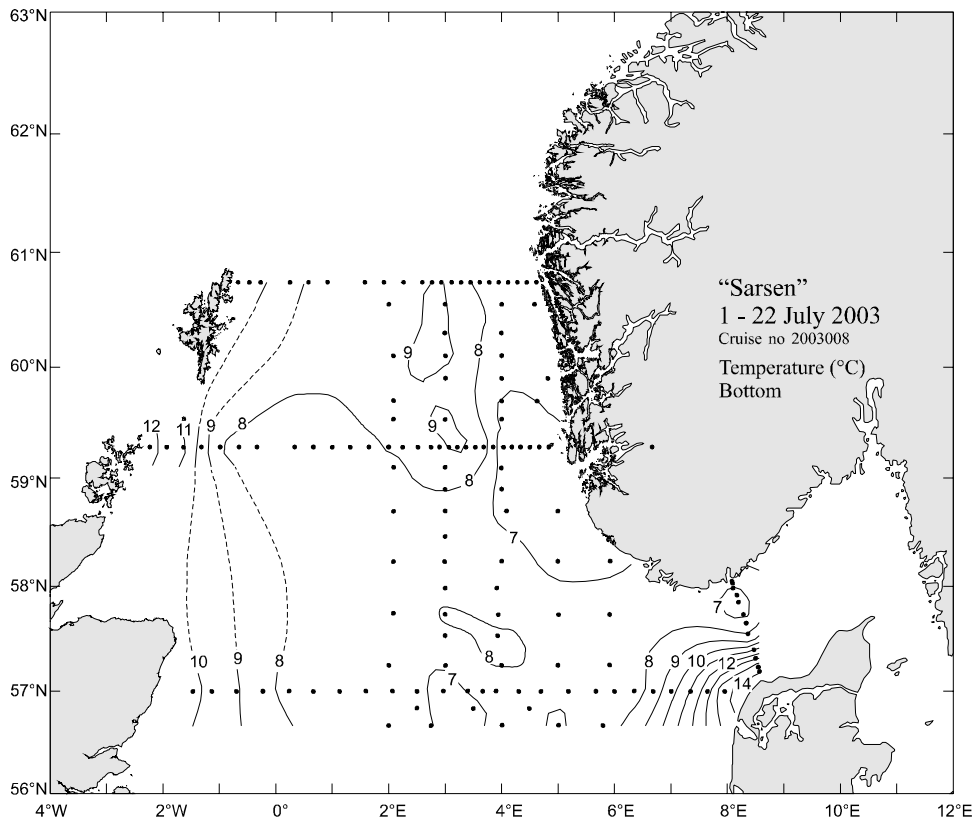


Figure 4c. The horizontal distribution of temperature at bottom. RV “Sarsen”, 1-22 July 2003

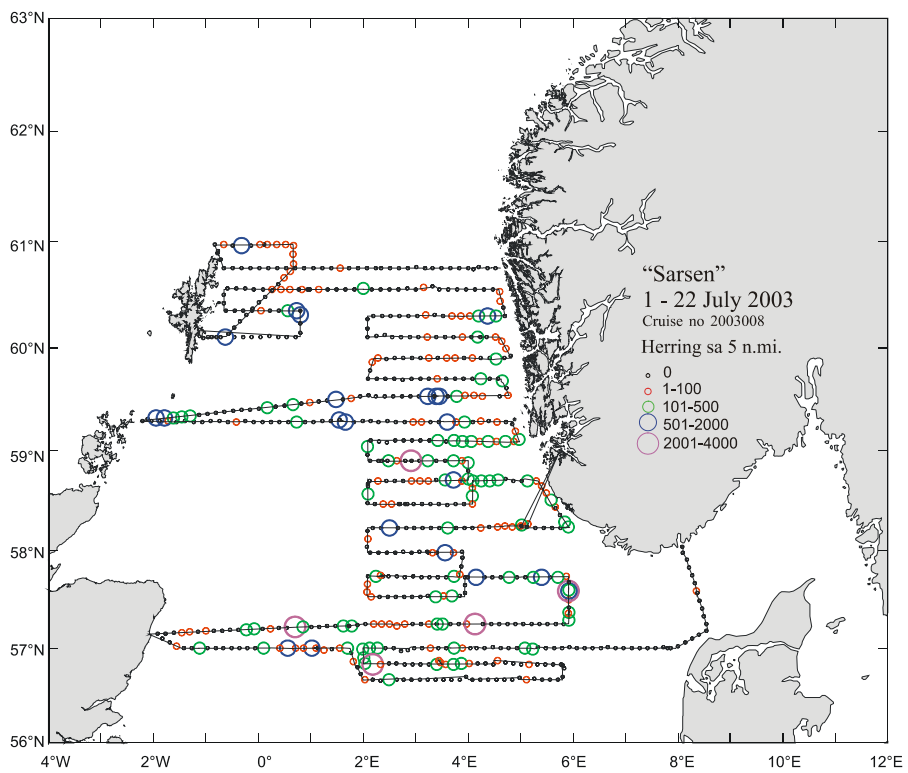


Figure 5. Mean S_A -values attributed to herring per 5 n.mi. during the acoustic survey on RV “Sarsen”, 1-22 July 2003.

