Survey report for RV "DANA"
25th June2002 – 8th July 2002

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1. INTRODUCTION

Since 1991 the Danish institute for Fisheries research has participated in the ICES coordinated international hydro acoustic survey on herring in the North Sea, Skagerrak and Kattegat with the responsibility for the survey area in Skagerrak and Kattegat.

In 2002 the survey with R/V DANA has been covering the Skagerrak and Kattegat. The survey was conducted in the period June 25 to July 8 2002.

2. SURVEY

2.1 Personnel

During calibration 25-27/6-2002
Karl-Johan Stæhr (cruise leader), DIFRES
Bo Lundgren (ass. cruise leader), DIFRES
Torben Filt Jensen, DIFRES
Mogens R. Sørensen, DIFRES
Thyge Dyrnesli, DIFRES
Claus Halle, DIFRES

During acoustic monitoring 27/6-8/7-2002
Karl-Johan Stæhr (cruise leader), DIFRES
Torben Filt Jensen (ass. cruise leader), DIFRES
Niels Jørgen Phil (acoustic), DIFRES
Lise Sindahl (fish lab.), DIFRES
Uffe Nielsen (acoustic), DIFRES
Helle Rasmussen (fish lab.), DIFRES
Lotte A. Worsøe (fish lab.), DIFRES
Inge Holmberg (fish lab.), DIFRES
Ulrik Cold (fish lab.), DIFRES
Bo Tegen Nielsen (electronics), DIFRES

2.2 Narrative

Departure: Hirtshals 25 June 2002 at 1200 hour for calibration.
Visit to harbour 27 June 2002 for exchange of scientific personnel before start of acoustic monitoring.
Arrival: Hirtshals 8 July 2002 at 0600 hour.

2.3 Survey design

The survey was carried out in the Skagerrak, east of 6° E, and Kattegat (Fig. 1). The area was split into 7 subareas (Fig. 2). The survey was started in the northwest corner of the survey area. In principal the survey design were planned with north-south survey tracks with a spacing of 10-15 NM in the area west of 10°E. Due to the fixed time periods for fishing could this structure not be kept. This gave a not standard like survey track in the western part of Skagerrak. Along the Swedish coast the transects were made east west with a spacing of 10 NM. In Kattegat the survey track were made in a zigzag way due to depth curves and ship traffic.

2.4 Calibration

The Simrad EY 50038 kHz echosounder were calibrate with a standard coper sphere calibration at Bornö, Sweden 25-27 June 2002. See Table 1.

2.5 Acoustic data collection

Acoustic data was sampled using SimradEY500 28kHz echo sounder with the transducer at a towed body (Type ES 38-29). The towed body was running at aprox. 3 m depth. The speed of the vessel during acoustic sampling was 8 – 12 knots. Acoustic data were collected all 24 hours. The sampling unit was 1 NM. The data are store in 1m intervals for each 1 NM on tape. Integration is conducted from 3 – 300 m below the transducer.

2.6 Biological data - fishing trawls

Trawl hauls were carried out during the survey for species identification. Pelagic hauls (Fig. 3) were carried out using a FOTÖ trawl (16 mm in the codend) while demersal hauls (Fig. 3) were carried out using an EXPO trawl (16 mm in the codend). Trawling was carried out in the time intervals 1000 to 1600h and 2000 to 0400h UTC (Table 1). The trawling strategy was made in a way that all dept areas was covered with in each geographical strata (see Fig. 2)
In the deeper areas mid water hauls were made to identify until which depth herring will be found. 1hour hauls were used as a standard during the survey.

The fish caught were sorted in to species, length distribution and weight for each species were analyzed. The fish were measured to nearest 0.5 cm total length below and the weight to nearest 0.1g wet weight. In each trawl haul 10 herring per 0.5 cm length class were sampled for determination of age, race (North Sea autumn spawners or Baltic Sea spring spawmers) and maturity. Micro-structure formed during the larval period were used for the discrimination of herring race.

2.7 Hydrographic data

In connection to trawling CTD profiles were made with a Sea Bird . During the survey salinity and temperature were measured in 5 m depth. Distribution of CTD stations is shown in Fig. 4.

2.8 Data analysis

Scrutiny of the acoustic data was done for each mile.

For each sub area the mean back scattering cross section was estimated for herring, sprat, gadoids and mackerel by TS relationship given in the Manual for Herring Acoustic Surveys in ICES Division III, IV, and IVa (ICES 2000).

$$\text{Herring TS} = 20 \log L - 71.2 \text{ dB}$$
$$\text{Sprat TS} = 20 \log L - 71.2 \text{ dB}$$
$$\text{Gadoids TS} = 20 \log L - 67.5 \text{ dB}$$
$$\text{Mackerel TS} = 20 \log L - 84.9 \text{ dB}$$

Where L is the total length in cm. The number of fish per species was assumed to be in proportion to the contribution of the given species in the trawl hauls. Therefore, the density of a given species was estimated by sub area using the species composition in the trawl hauls. The nearest trawl hauls were allocated to sub areas with uniform depth strata. The length-race and length-age distributions for herring were assumed to be in accordance with the length-race and length-age distributions in the allocated trawl hauls.
Length-weight relationships by race for the herring were made based on the single fish sampled in each haul for micro-structure analysis of the otolith.

3. RESULTS & DISCUSSION

3.1 Acoustic data

The total number of acoustic sample units at 1 NM used in the stock size calculation was 1098.
Herring and sprat was not observed mid water trawl hauls at depths below 150 meters. Therefore, layers below 150 meter were excluded during the estimation.

3.2 Biological data

31 hauls were conducted (16 surface hauls, 3 mid water hauls and 12 bottom hauls (Fig. 3 and table 2 and 3). The total catch was 15,604 kg with a mean catch at 503 kg. Herring was present in 29 of the hauls and was the dominant catch in the fishery with a total catch at 78,300 kg No herring was present in hauls below 150 m depths. Whiting haddock and mackerel dominated the remaining species with a total catch at 1,255 kg, 1,094 kg and 1,042 kg respectively. Whiting and haddock were mainly taken in the bottom hauls, were as mackerel was taken in surface hauls. Jellyfish was also present in high quantities in the catches by totally 1,596 kg.

Keys for length-race, length-age per race and length-weight per race were made for each strata based on the single fish sampled in each haul for micro-structure analysis of the otolith.

Based on the single fish sampled in each haul for micro-structure analysis of the otolith the maturity by age key was made for both North Sea herring and Western Baltic herring as given in the text table below. For the North Sea autumn spawners all herring at maturity state 3 and up worth were taken as mature.

North Sea autumn spawners:

WR	0im	1im	2im	2ma	3im	3ma	4im	4ma	5im	5ma
%	100	100	88	12	90	10	83	17	50	50

For the Western Baltic spring spawners all herring of maturity state 2 and up worth were taken as mature.

Western Baltic spring spawners:

WR	0im	1im	1ma	2im	2ma	3im	3ma	4im	4ma	5ma	6	7	8	9	10	11
%	100	93	7	38	62	15	85	5	95	100	100	100	100	100	100	100

The total catch during the survey was 15,604 kg with a mean catch of 503 kg. This is at the same mean catch level as in 2001. For herring the mean catch in all hauls was 268 kg witch is at the same level as in 2001

For the surface hauls the mean catch was 559 kg witch is 88% of what was seen in 2001. These catches in 2001 were dominated by herring (table 2).

For the bottom hauls the mean catch was 514 kg witch is 68 % of what was seen in 2001. These catches in 2002 were dominated by whiting where as the mean catch of haddock was 32% of what was seen in 2001.

3.3 Biomass estimates

The total biomass estimates for the survey:

North Sea atumn spawning herring	263,908 tonnes	41%
Western Baltic spring spawning herring	315,514 tonnes	59%
Total herring	**579,422 tonnes**	

The age composition and mean weight per age and mean length per age for the two herring stock components in the survey area are given in Table 5

The biomass of North Sea autumn spawning herring in the survey area was estimated to 263,908 tones. This is 3.25 times the biomass estimated in 2001 and 55% of the biomass estimated in 2000. Compared to 2001 and 2000 especially the 0 and 1 WR the biomass are much higher than in 2001. See text table below.

Biomass estimate per age for North Sea autumn spawning herring 1998 to 2002 in tonnes

	WR									
Year	0	1	2	3	4	5	6	7	8	Total
2002	11744,0	220366,0	18286,3	10268,8	2086,0	1157,1				263908,3
2001	1427,6	53022,2	20373,9	5118,0	844,3	275,0	101,1			81162,2
2000	5240,6	446190,5	19457,2	1082,7	982,9					472953,8
1998	4450,5	129264,4	19804,0	4484,0	265,8	85,1	73,4		498,1	161163,0

The biomass of the Western Baltic spring spawning herring in the survey area was estimated to 315,514 tones. This is 3.7 times the biomass estimated in 2001 and 92 % of the biomass estimated in 2000. Compared to 2001 all the year classes are higher in 2002, but especially the 1, 2, 3, 4 and 5 WR. Compared to 2000 the large year class can be seen again in 2002 shifted 2 winter rings up. See text table below.

Biomass estimate per age for Western Baltic spring spawning herring 1998 to 2002 in tonnes

	WR												
Year	0	1	2	3	4	5	6	7	8	9	10	11	Total
2002	158	71402,5	85123,5	91729,5	48377,1	10157,6	4500,1	1510,4	885,1			1669,9	315513,7
2001		3606,6	34159,2	31981,0	7796,0	5297,8	1838,7	278,7	159,9		45,5	34,3	85197,7
2000		64747,5	133347,6	69313,5	42998,9	25043,5	5839,7	1472,0					342762,7
1998		5587,6	115485,5	59395,7	20021,2	8579,8	3801,6	3119,6	3957,8	863,8	401,2		234800,9

The geographic distribution by number for both stocks are shown in Fig. 6.

The geographical distribution of the biomass given as % of the total estimated biomass per sub area is given for each stock component in the text tables below.

% of total biomass estimate per sub area for North Sea autumn spawning herring 1998 to 2002

	sub area						
Year	3	4	5	6	7	8	9
2002	0,8	33,1	6,7	19,9	5,5	7,0	27,0
2001		14,2	7,6	16,6	3,7	44,4	13,4
2000		28,7	1,1	32,1	1,1	9,2	27,7
1998		9,5	6,5	15,5	13,2	31,5	23,7

% af total biomass estimate per sub area for Western Baltic spring spawning herring 1998 to 2002

	sub area						
Year	3	4	5	6	7	8	9
2002	0,6	21,8	16,1	16,9	7,7	9,5	27,3
2001		16,8	12,8	12,6	6,0	24,4	27,5
2000		22,9	3,1	36,4	1,5	16,1	20,0
1998		6,5	17,3	6,8	24,3	24,2	20,9

It can be seen that the geographical distribution for both stock components are very variable in this survey area, Skagerrak and Kattegat.

Figure 1. Survey track

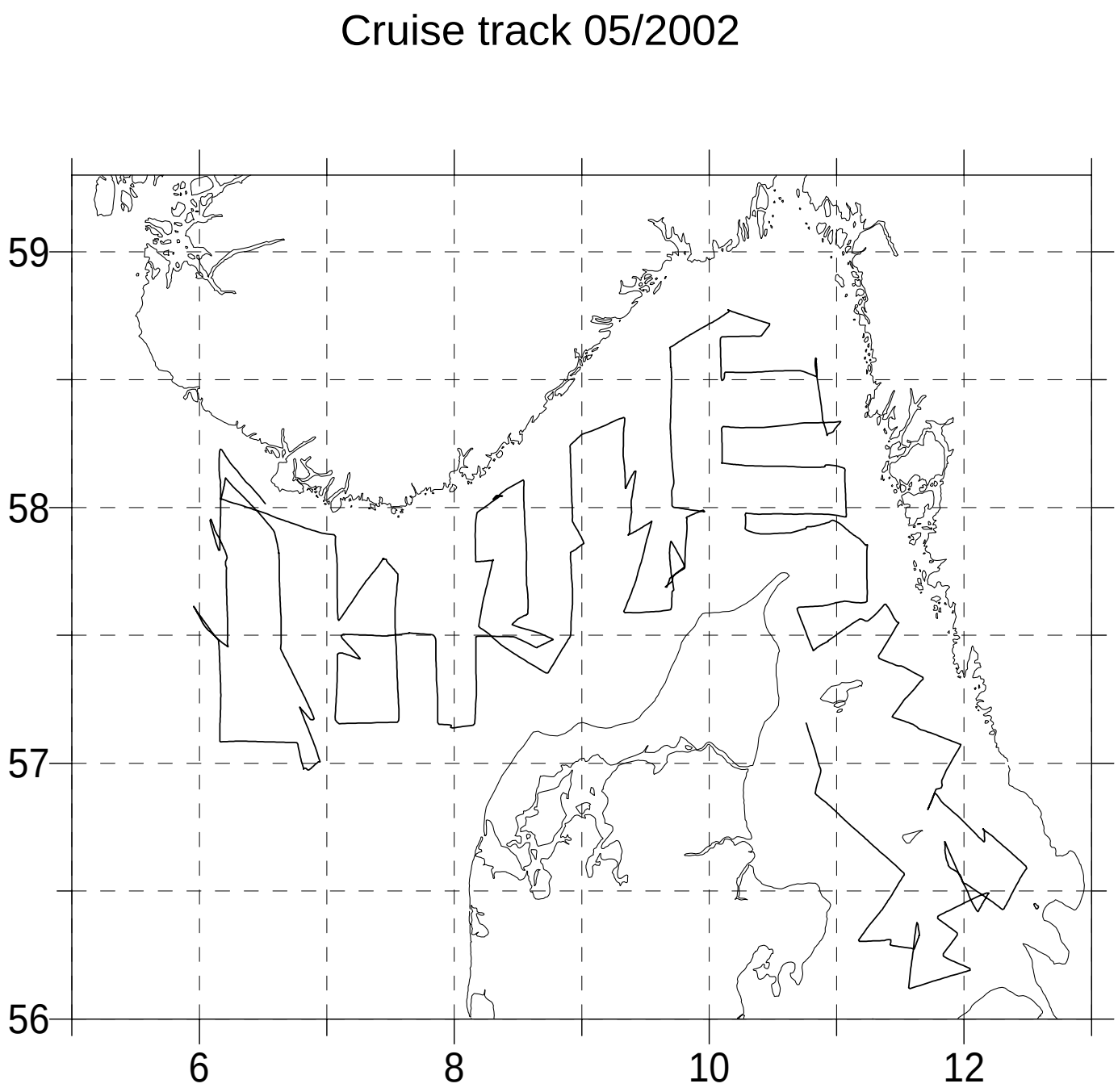

Figure 2. Sub areas used in the estimation for R/V Dana 2002

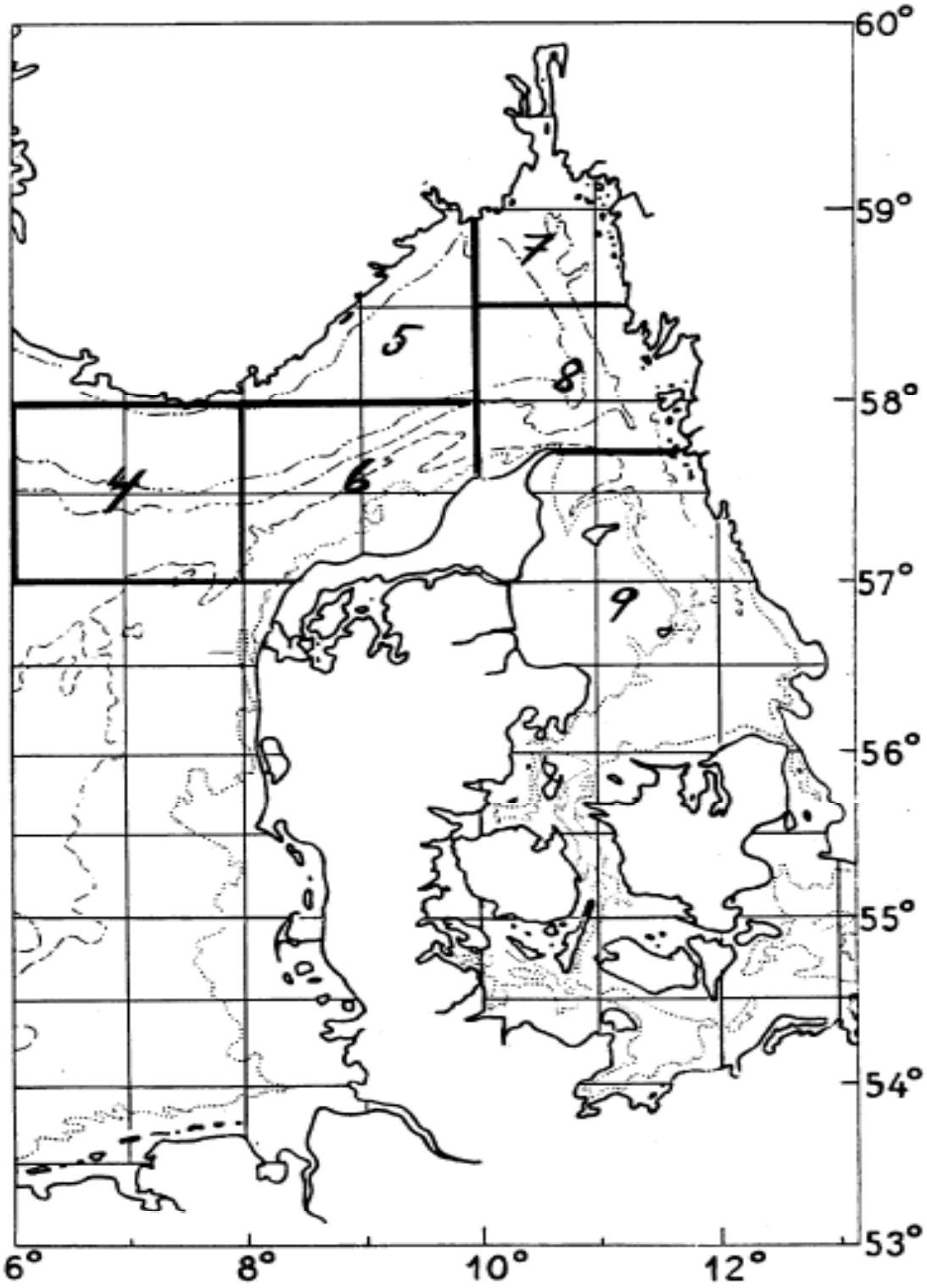

Figure 3. Trawl hauls with R/V Dana 2002, Fotö hauls are pelagic and Expo hauls are demersal.

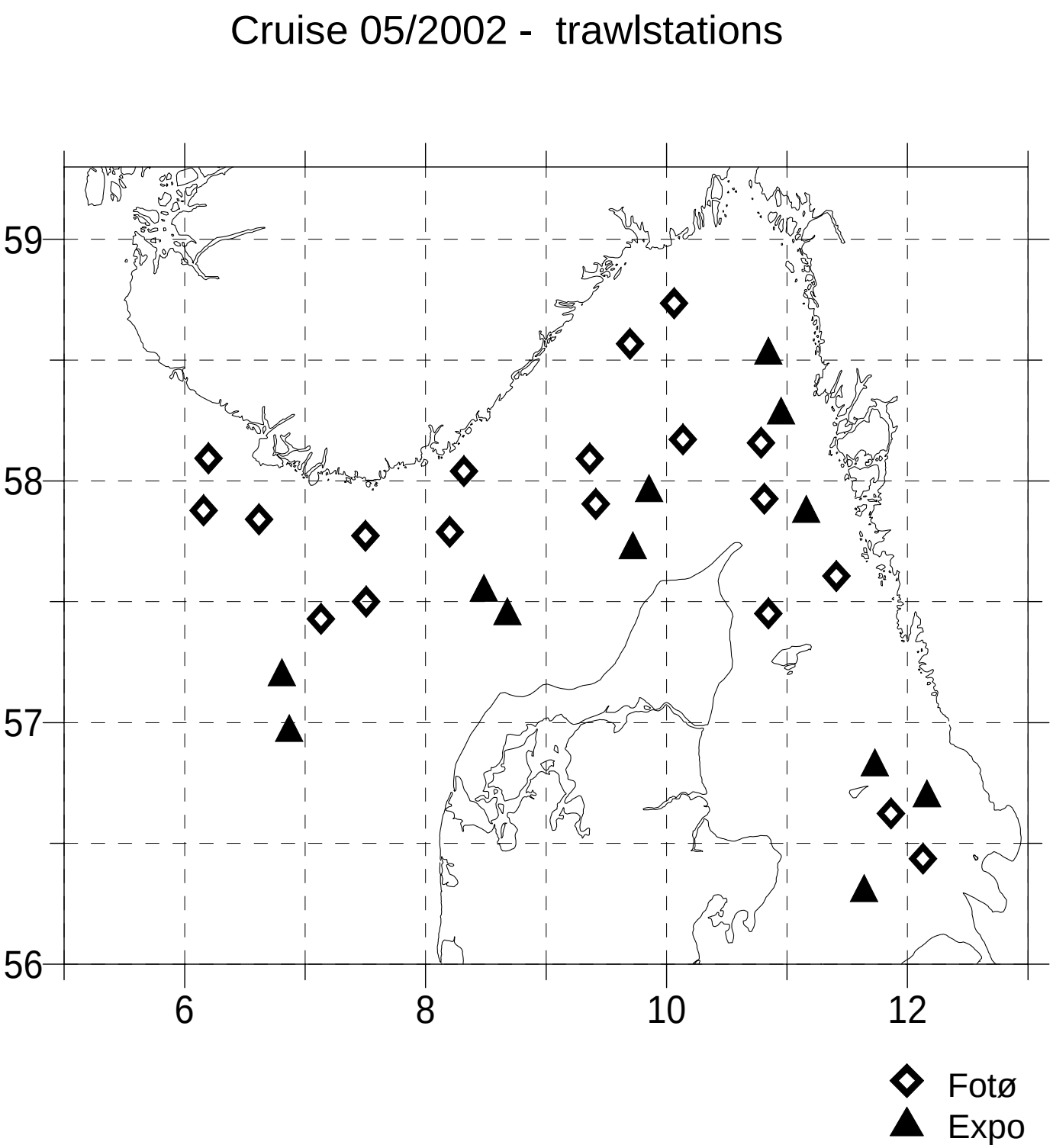

Figure 4. CTD stations with R/V Dana 2002

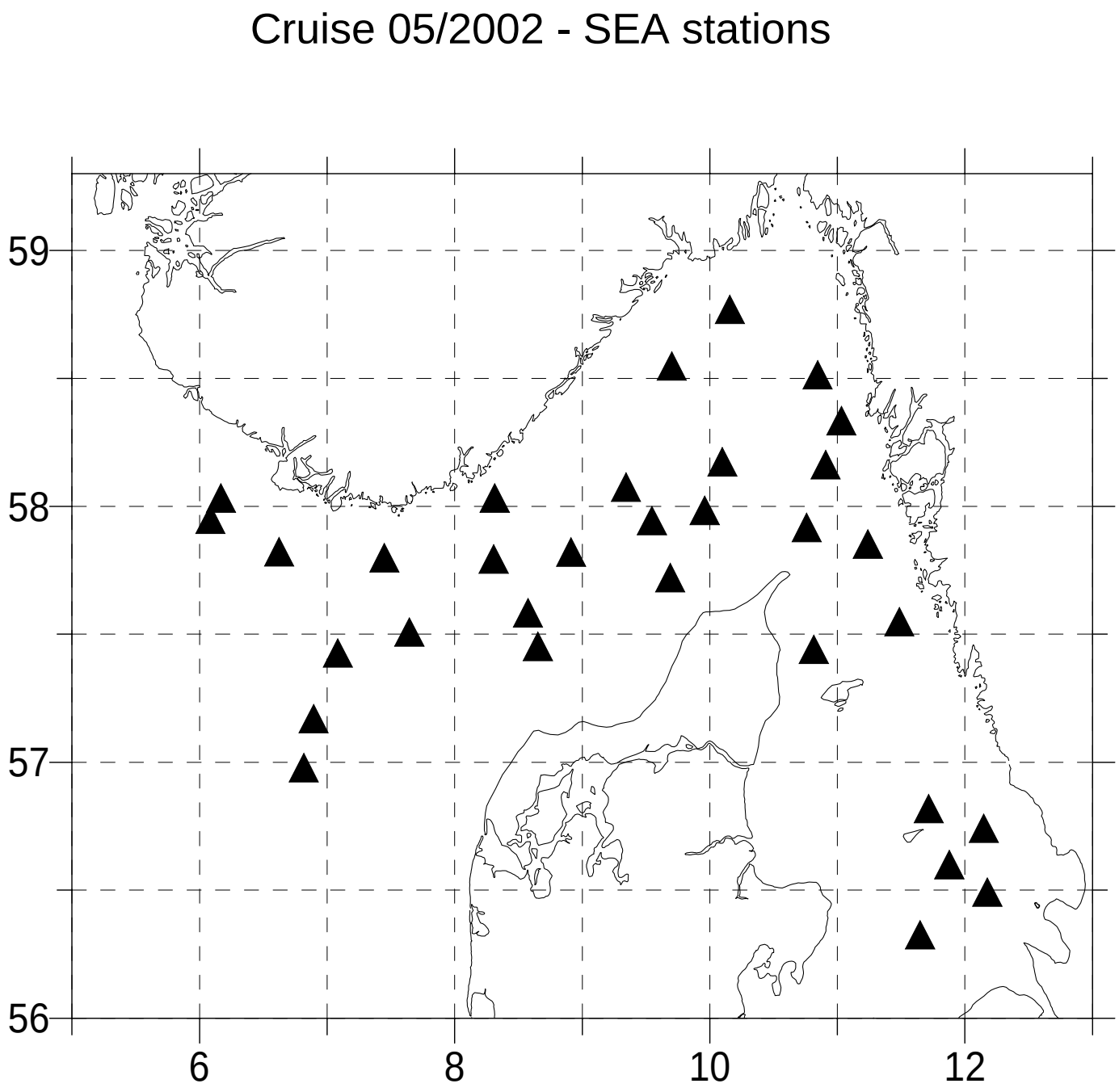

Figure 5.

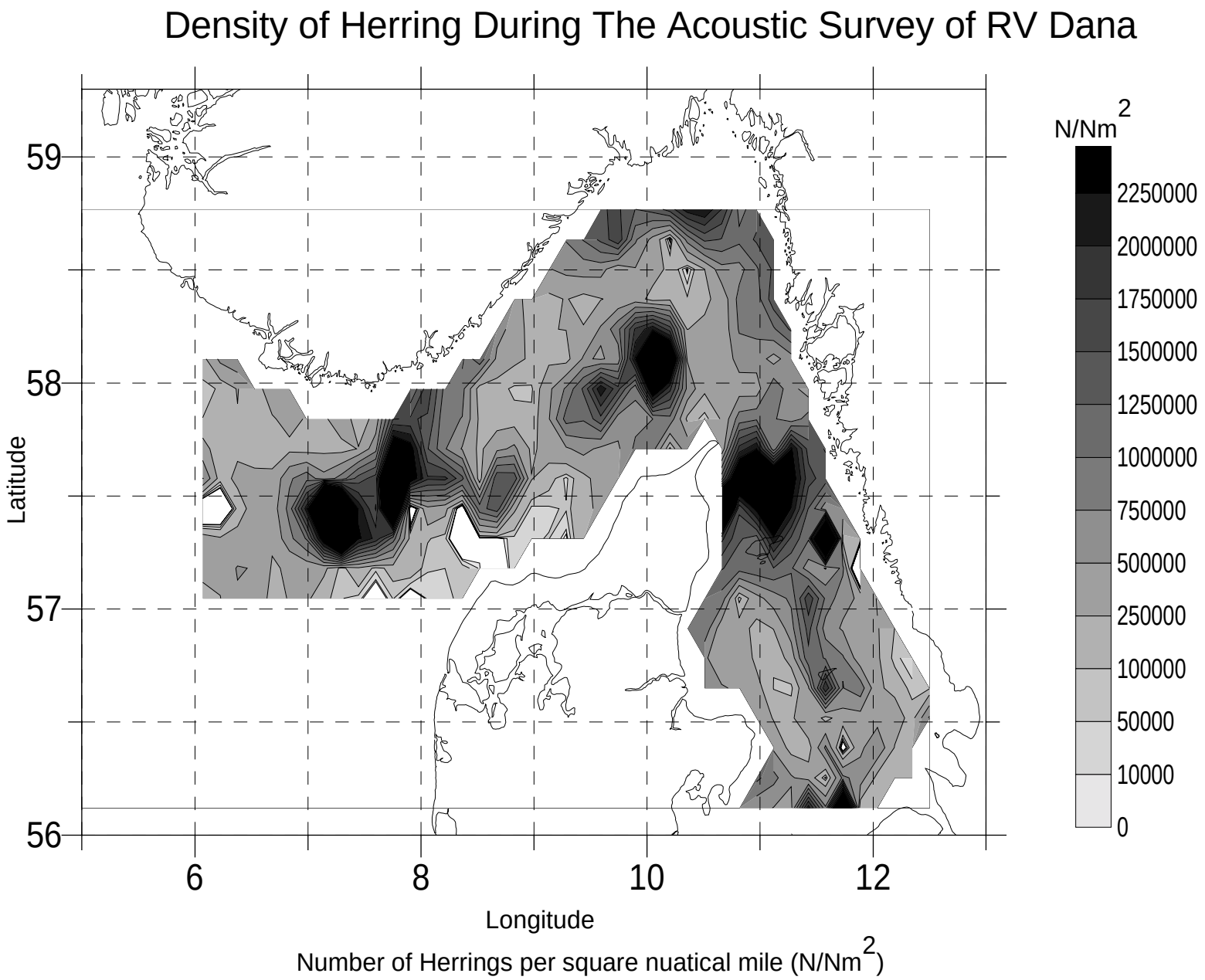
Density of Herring During The Acoustic Survey of RV Dana
N/Nm2
2250000
2000000
1750000
1500000
1250000
1000000
750000
500000
250000
100000
50000
10000
0
59
58
57
56
Latitude
6
8
10
12
Longitude
Number of Herrings per square nuatical mile (N/Nm2)

Table 1. Simrad EY500 and analysis settings used on the July 1998 herring acoustic survey.

Transceiver Menu	
Frequency	38 kHz
Sound speed	1498 $m.s^{-1}$
Max. Power	2000 W
Equivalent two-way beam angle	-20.5 dB
Default Transducer Sv gain	25.13 dB
3 dB Beamwidth	6.6°
Calibration details	
TS of sphere	-33.6 dB
Range to sphere in calibration	8.20
Measured NASC value for calibration	26500
Calibration factor for NASCs	0.844
Log Menu	
Simulated	1,0 n.mi. at 10 knots
Operation Menu	
Ping interval	1 s external trig
Analysis settings	
Bottom margin (backstep)	1.0 m
Integration start (absolute) depth	9 m
Range of thresholds used	-70 dB

Table 2. Trawl haul information from R/V Dana 25 June to 8 July 2002

Haul no.	Date	Position		Mean depth	Trawl depth	Trawl	Used in	Total catch
	0	N	E	m	m		calculation	kg
148	020628	57 52.68	006 09.47	546	290	Fotö		37
252	020629	56 58.64	006 52.17	38	Bottom	Expo	+	159
270	020629	57 12.47	006 48.42	65	Bottom	Expo	+	510
316	020629	57 50.40	006 37.00	346	Surface	Fotö	+	498
338	020630	58 06.56	006 11.91	343	Surface	Fotö	+	405
414	020630	57 46.37	007 30.06	440	150-165	Fotö	+	114
485	020630	57 25.70	007 07.90	121	Surface	Fotö	+	159
510	020701	57 30.01	007 30.66	208	Surface	Fotö	+	518
588	020701	57 27.66	008 40.75	39	Bottom	Expo	+	441
604	020701	57 33.44	008 29.00	102	Bottom	Expo	+	1128
647	020701	58 02.40	008 19.10	340	Surface	Fotö	+	422
670	020702	57 47.34	008 12.04	490	Surface	Fotö	+	440
798	020702	58 05.50	009 21.70	580	Surface	Fotö	+	388
819	020703	57 54.27	009 24.73	156	Surface	Fotö	+	290
891	020703	57 44.02	009 43.18	36	Bottom	Expo	+	1734
908	020703	57 58.18	009 51.32	98	Bottom	Expo	+	412
953	020703	58 34.00	009 41.80	560	Surface	Fotö	+	235
970	020704	58 44.12	010 03.78	295	Surface	Fotö	+	1188
1034	020704	58 32.35	010 50.65	85	Bottom	Expo	+	575
1057	020704	58 17.47	010 57.04	105	Bottom	Expo	+	350
1100	020704	58 10.30	010 07.30	250	Surface	Fotö	+	630
1120	020705	58 09.47	010 47.07	150	Surface	Fotö	+	440
1186	020705	57 55.57	010 48.65	160	57-101	Fotö	+	340
1198	020705	57 53.06	011 09.50	58	Bottom	Expo	+	256
2029	020705	57 27.00	010 50.70	39	Surface	Fotö	+	630
1265	020706	57 36.38	011 24.55	56	Surface	Fotö	+	888
1342	020706	56 50.09	011 43.67	43	Bottom	Expo	+	310
1363	020706	56 42.41	012 07.64	42	Bottom	Expo	+	136
1411	020706	56 37.30	011 51.70	31	Surface	Fotö	+	667
1435	020707	56 26.18	012 07.64	33	Surface	Fotö	+	1373
1511	020707	56 18.67	011 38.40	29	Bottom	Expo	+	230

Table 3. Trawl haul species composition for R/V Dana 25 June to 8 July 2002

		148	252	270	316	338	414	485	510	588	604	647	670	798
Trawl catch, kg		37	159	510	498	405	114	130	478	438	1128	422	440	388
	Lycodes vahli													
Anchovy	*Engraulis encrasicolus*	0,1												
Squid	*Loligo spp.*		0,6											
Blue whiting	*Micromesistius poutassou*	1,6			0,2	16,9	100,8		17,4				38,1	
Sprat	*Sprattus sprattus*													
Greater weever	*Trachinus draco*									2,9				
Dragonet	*Calllionymus spp.*		0,1							0,8				
Poor cod	*Trisopterus minutus*										0,5			
Catfish	*Anarhicas lupus*			5,4							7,3			
	Rhinonemus cimbrius													
Horse mackerel	*Trachurus trachurus*		0,1							0,6		0,4		
Long rough dab	*Hippoglosides plattessoides*			6,3							84,9			
Garfish	*Belone belone*				2,1	0,5			0,5			0,4		0,4
Whiting	*Merlangius merlangus*		2,0	77,7						255,0	29,1			
Invertebrates		19,6	31,7	85,6		14,2	9,3	6,2	18,9	36,7	11,4	18,3	243,4	72,1
Dab	*Limanda limanda*		5,1	7,4						11,7	0,4			
Norway lobster	*Nephrops norvegicus*													
Gurnard	*Trigala spp.*		21,5					0,2		14,8				
Haddock	*Melanogrammus aeglefinus*		76,6	102,8							815,7			
Hake	*Merluccius merluccius*			3,9						0,5	5,3			
Salmon	*Salmo solar*											1,5		
Sheppy argentine	*Maurolicus muelleri*													
Ling	*Molva molva*													
	Lumpenus lampretaeformis										0,6			
krill														
Mackerel	*Scomber scombrus*	0,6		8,6	237,5			10,2	10,7	0,2		102,4	13,7	0,5
Picked dogfish	*Squalus acanthias*				0,7	0,8							0,8	
Plaice	*Pleuronectes platessa*			3,0						11,9				
Lemon sole	*Microstomus kitt*		4,0	0,4						24,0	5,7			
Pilchard	*Sardina pilchardus*							0,4		8,6				
Saithe	*Pollachius virens*	6,9	3,3							0,6	19,0			5,3
Herring	*Clupea harengus*	2,3	0,1	98,1	253,7	367,1	3,8	111,2	430,2	58,8		298,9	134,4	289,7
Witch	*Glyptocephalus cynoglossus*													
	Myxine glutinosa										0,5			
Flounder	*Platichthys flesus*													
Norway pout	*Trisopterus esmarki*						0,1				90,1			
Lumpsucker	*Cyclopterus lumpus*	5,5			4,3	5,5		1,8					9,5	20,0
Lesser silver smelt	*Argentina sphyraena* *													
Crab	*Cancer pagurus*									0,4				
Starry ray	*Raja radiata*			21,7						0,8	1,3			
Sandeels	*Ammodytes spp.*		1,4											
Greater sandell	*Hyperoplus lanceolatus*		0,6							7,2				
Cod	*Gadus Morhua*		11,7	88,5						2,4	56,6			
Spinous spider crab	*Maia squinado*													
Sculpin	*Myoxocephalus scorpius*													

Table 3. Continued

Haul		819	891	908	953	970	1034	1057	1100	1120	1186	1198	2029	1265
Trawl catch, kg		290	1734	412	235	1188	568	274	630	440	340	256	630	888
	Lycodes vahli													
Anchovy	*Engraulis encrasicolus*													
Squid	*Loligo spp.*		3,0		0,1		0,6					0,6		
Blue whiting	*Micromesistius poutassou*	1,7								113,4	4,8			
Sprat	*Sprattus sprattus*												11,9	
Greater weever	*Trachinus draco*		2,3					0,1		0,3			4,8	0,5
Dragonet	*Calllionymus spp.*		1,5									0,3		
Poor cod	*Trisopterus minutus*													
Catfish	*Anarhicas lupus*													
	Rhinonemus cimbrius			2,7			1,0					1,7		
Horse mackerel	*Trachurus trachurus*												4,5	
Long rough dab	*Hippoglosides plattessoides*		0,5	1,8			1,9	0,4				30,2		
Garfish	*Belone belone*	0,3			1,7	6,1			11,1	3,7			0,3	2,0
Whiting	*Merlangius merlangus*		130,8	39,6			442,6	64,2				127,1		
Invertebrates				7,7	163,7	26,8	51,2		100,8	28,3		18,6	29,6	333,1
Dab	*Limanda limanda*		144,0											0,9
Norway lobster	*Nephrops norvegicus*			0,1			1,5					1,3		
Gurnard	*Trigala spp.*		2,5									1,2		
Haddock	*Melanogrammus aeglefinus*			97,8			0,6					0,4		
Hake	*Merluccius merluccius*		0,4	2,5			2,9	0,4				13,3		
Salmon	*Salmo solar*													
Sheppy argentine	*Maurolicus muelleri*							0,4						
Ling	*Molva molva*			1,3										
	Lumpenus lampretaeformis						5,8							
krill		194,8						65,1			225,6			
Mackerel	*Scomber scombrus*	15,3			8,9	405,8			57,7	36,2	2,7	1,1	4,4	62,3
Picked dogfish	*Squalus acanthias*		2,4				1,0	0,1						
Plaice	*Pleuronectes platessa*		7,1				1,9	1,2				2,3		
Lemon sole	*Microstomus kitt*		4,3	0,4			0,3	0,4				2,6		
Pilchard	*Sardina pilchardus*													
Saithe	*Pollachius virens*			21,2			4,2	50,2			15,3	4,5		
Herring	*Clupea harengus*	75,8	1424,7	66,9	69,5	748,3	7,5	5,0	460,4	258,0	91,6	47,1	574,0	489,0
Witch	*Glyptocephalus cynoglossus*			0,3			0,5							
	Myxine glutinosa											0,1		
Flounder	*Platichthys flesus*													
Norway pout	*Trisopterus esmarki*	0,5		155,1			42,8	68,6				2,3		
Lumpsucker	*Cyclopterus lumpus*	1,5				0,9								
Lesser silver smelt	*Argentina sphyraena* *						0,1							
Crab	*Cancer pagurus*													
Starry ray	*Raja radiata*		1,3					2,3				0,6		
Sandeels	*Ammodytes spp.*													
Greater sandell	*Hyperoplus lanceolatus*												0,1	0,2
Cod	*Gadus Morhua*		8,6	14,6			1,4	14,0						
Spinous spider crab	*Maia squinado*							1,4				0,5		
Sculpin	*Myoxocephalus scorpius*													

Table 3. Continued

Haul		1342	1363	1411	1435	1511	Total survey	Mean survey	Max survey	Min survey
Trawl catch, kg		323	136	667	1216	230	15604	503,4	1734	37
	Lycodes vahli						0	0,0	0	0
Anchovy	Engraulis encrasicolus						0,1	0,0	0,1	0,1
Squid	Loligo spp.						4,9	0,2	3	0,1
Blue whiting	Micromesistius poutassou						294,9	9,5	113,4	0,2
Sprat	Sprattus sprattus			31,7		45	88,6	2,9	45	11,9
Greater weever	Trachinus draco	0,2		0,7	0,9	1,8	14,5	0,5	4,8	0,1
Dragonet	Calllionymus spp.						2,7	0,1	1,5	0,1
Poor cod	Trisopterus minutus						0,5	0,0	0,5	0,5
Catfish	Anarhicas lupus	1,9					14,6	0,5	7,3	1,9
	Rhinonemus cimbrius						5,4	0,2	2,7	1
Horse mackerel	Trachurus trachurus		0,1		0,6	0,6	6,9	0,2	4,5	0,1
Long rough dab	Hippoglosides plattessoides	1,7	1,5				129,2	4,2	84,9	0,4
Garfish	Belone belone				0,7		29,8	1,0	11,1	0,3
Whiting	Merlangius merlangus	6,3	29			52	1255,4	40,5	442,6	2
Invertebrates		8,5	19	142,2	79,6	19,3	1595,8	51,5	333,1	6,2
Dab	Limanda limanda	14,1	0,5			62,4	246,5	8,0	144	0,4
Norway lobster	Nephrops norvegicus						2,9	0,1	1,5	0,1
Gurnard	Trigala spp.	0,1	0,1			1,7	42,1	1,4	21,5	0,1
Haddock	Melanogrammus aeglefinus						1093,9	35,3	815,7	0,4
Hake	Merluccius merluccius						29,2	0,9	13,3	0,4
Salmon	Salmo solar						1,5	0,0	1,5	1,5
Sheppy argentine	Maurolicus muelleri						0,4	0,0	0,4	0,4
Ling	Molva molva						1,3	0,0	1,3	1,3
	Lumpenus lampretaeformis						6,4	0,2	5,8	0,6
krill							485,5	15,7	225,6	65,1
Mackerel	Scomber scombrus			16,1	48		1042,9	33,6	405,8	0,2
Picked dogfish	Squalus acanthias	0,2					6	0,2	2,4	0,1
Plaice	Pleuronectes platessa	2	4,7			8,3	42,4	1,4	11,9	1,2
Lemon sole	Microstomus kitt	3,2	0,2				45,5	1,5	24	0,2
Pilchard	Sardina pilchardus						9	0,3	8,6	0,4
Saithe	Pollachius virens	0,3					130,8	4,2	50,2	0,3
Herring	Clupea harengus	278,5	68,5	476,2	1085,9	24,8	8300	267,7	1424,7	0,1
Witch	Glyptocephalus cynoglossus						0,8	0,0	0,5	0,3
	Myxine glutinosa						0,6	0,0	0,5	0,1
Flounder	Platichthys flesus		0,5				0,5	0,0	0,5	0,5
Norway pout	Trisopterus esmarki	0,6					360,1	11,6	155,1	0,1
Lumpsucker	Cyclopterus lumpus	1,8				4,5	55,3	1,8	20	0,9
Lesser silver smelt	Argentina sphyraena *						0,1	0,0	0,1	0,1
Crab	Cancer pagurus						0,4	0,0	0,4	0,4
Starry ray	Raja radiata						28	0,9	21,7	0,6
Sandeels	Ammodytes spp.					2,6	4	0,1	2,6	1,4
Greater sandell	Hyperoplus lanceolatus	0,1				5,8	14	0,5	7,2	0,1
Cod	Gadus Morhua	2,7	10,5			1,4	212,4	6,9	88,5	1,4
Spinous spider crab	Maia squinado						1,9	0,1	1,4	0,5
Sculpin	Myoxocephalus scorpius	0,5					0,5	0,0	0,5	0,5

Table 4. Trawl length frequency composition (by trawl number and strata) for R/V Dana 2002

Sub area	4	4	4	4	3	4	4	4	6	5	6	5	6	6	6	5	7	7	8	8	8	8	8	9	9	9	9	9	9	9
cm \haul	148	252	270	316	338	414	485	510	588	647	670	798	819	891	908	953	970	1034	1057	1100	1120	1186	1198	2029	1265	1342	1363	1411	1435	1511
7,5																								1						
8,0																								3	1					
8,5																								5	1	6	1			
9,0																			1				2	12	11	7		2		1
9,5										5	1								1				1	38	39	11	1	4		2
10,0										3	1								10				6	61	60	15	2	4		2
10,5																			28			1	5	82	21	23	5	4		3
11,0										1									21			5	2	113	14	9	2	6		1
11,5																			2			3	2	82	3	1		2		
12,0																						1	2	21	1					
12,5										1																				
13,0						2																	2	1						
13,5		1				2			5													5	8	4	1					
14,0						1			27					7							1	7	25	7	6	1		1		2
14,5									44	4				28					1		1	16	42	6	12		1	2		
15,0			11	3	1				62	4				59	2				1		7	6	59	9	15	1	1	2		
15,5			29	2					79	4				68	3				6		4	23	68	12	14	8	1	20	1	6
16,0	1		42	3	2			1	88	15				82	2				7		5	61	81	15	23	44	8	34	10	5
16,5			52	6	7				66	36				78	1	1	5	1	6		32	96	102	17	18	70	15	71	13	8
17,0	4		25	8	36	1			49	113				58	2	1	18		3		55	134	53	8	17	78	40	103	36	26
17,5	6		13	24	135			5	58	361	5		1	28	1	4	40	3	2		75	83	32	8	14	33	49	99	77	27
18,0	8		7	28	134	2		13	25	572	5		8	10	3	10	62	4			58	42	13	2	14	19	38	35	61	23
18,5	11	1	2	37	63	5	5	8	15	291	3		4	13	10	3	74	4			43	8	7	2	8	8	17	13	19	15
19,0	11		5	19	13	1	11	24	4	124	2		17	2	23	1	36	6			19	5	2	1	4	5	8	6	11	4
19,5	4		1	12	8		30	29		51	5		30	2	26	1	27	3			9	1	1		1	1	5	3	1	2
20,0	2		1	5	4	2	64	29		11	10	2	40	1	31	1	6	4			11	1	1		1	6	6	5		
20,5				7	2	1	61	26		11	12	1	32	1	26	7	10	6	2	3	11		1	1	3	5	4	11	7	2
21,0	2			12	7	1	49	30		15	19	3	31		27	13	20	14		1	16	2	1		2	7	12	17	7	3
21,5				41	6	4	24	48		18	54	8	28		17	22	18	21		3	28				2	2	10	8	7	1
22,0				42	7	6	18	23		11	57	14	25		19	32	24	11		6	20		3			3	4	1	1	1
22,5				27	3		18	22		22	79	15	22		8	42	27	8	1	11	17		2			4	2		1	
23,0				11	3		7	11		4	42	21	7		2	19	9	11		14	8		7							
23,5				19		1	15	12			37	18	13		2	18	9	5		8	8				2		1			
24,0	1			11		1	6	3			30	25	6		3	8	6	3	2	8	5				1					
24,5				11			11	14			32	19	2			9	8	6		22	4									
25,0				8			2	11			17	19	4			7	8			16	1				1	1				
25,5				2			1	15			15	20	3			5	3			26	2									
26,0								5			3	19	2			6	5	1		23	2				3	1				
26,5				1				13			2	14	1			2	2			27	2									
27,0				1				6			5	12	1			2	1			16	1									
27,5								4			0	6	1			2	1			14	1				1					
28,0								4			3	1	1					1		15										
28,5				1							2	3					1			9										
29,0												3								12										
29,5												2								6										
30,0																1				1										
30,5																				1										
31,0																				2										
31,5																														
32,0																														

Table 5.

Table 5a. Biomass of herring by age, stock and sub area for R/V Dana 25 June to 8 July 2002

Subarea	WR										Total biomass tonnes
	0im	1im	2im	2ma	3im	3ma	4im	4ma	5im	5ma	
	North Sea Autumn spawners										
3		1911,3	30,2	4,1	43,2	4,8					1993,6
4	2809,1	73871,1	5239,5	714,5	4105,3	456,1	187,6	38,4			87421,6
5	6,3	9000,7	2092,4	285,3	3450,9	383,4	1400,4	286,8	389,8	389,8	17685,7
6	160,2	47493,0	3838,5	523,4	468,5	52,1					52535,7
7	840,9	9993,0	2688,3	366,6	527,8	58,6					14475,3
8	496,1	15315,2	1202,6	164,0	646,2	71,8	143,4	29,4	188,8	188,8	18446,4
9	7431,4	62781,8	1000,3	136,4							71349,9
Total	11744,0	220366,0	16091,9	2194,4	9242,0	1026,9	1731,4	354,6	578,6	578,6	263908,3
%	4,5	83,5	6,1	0,8	3,5	0,4	0,7	0,1	0,2	0,2	100,0

Subarea	WR																Total biomass tonnes
	0im	1im	1ma	2im	2ma	3im	3ma	4 im	4ma	5ma	6	7	8	9	10	11	
	Western Baltic spring spawners																
3		249,7	18,8	275,2	449,0	119,5	677,0	9,7	184,3	44,5							2027,5
4		6467,8	486,8	8521,7	13903,9	4309,9	24422,7	406,7	7726,6	2376,3		247,4					68869,7
5		2947,3	221,8	4219,0	6883,7	2675,3	15160,3	522,9	9934,4	3806,5	2077,3	572,3				1669,9	50690,8
6		3765,1	283,4	3701,9	6039,9	3182,0	18031,4	802,5	15247,6	974,3	886,7	376,0	156,0				53446,8
7		1365,1	102,7	3897,9	6359,8	1170,4	6632,2	150,4	2856,8	1675,9							24211,3
8	158,0	1328,5	100,0	3388,4	5528,5	1650,9	9355,1	237,8	4519,1	1280,2	1536,2	314,8	729,1				30126,6
9		50280,7	3784,6	8342,8	13611,9	651,4	3691,3	288,9	5489,5								86141,1
Total	158,0	66404,3	4998,2	32346,9	52776,6	13759,4	77970,1	2418,9	45958,2	10157,6	4500,1	1510,4	885,1			1669,9	315513,7
%	0,1	21,0	1,6	10,3	16,7	4,4	24,7	0,8	14,6	3,2	1,4	0,5	0,3			0,5	100,0

Table 5b. Number of herring by age, stock and sub area for R/V Dana 25 June to 8 July 2002

Subarea	WR										Total number *1000000
	0im	1im	2im	2ma	3im	3ma	4im	4ma	5im	5ma	
	North Sea autumn spawners										
3		47,40	0,43	0,06	0,62	0,07					48,58
4	194,88	1744,91	67,18	9,16	49,98	5,55	2,11	0,43			2074,20
5	1,03	221,62	19,04	2,60	29,87	3,32	11,11	2,28	2,52	2,52	295,90
6	14,77	1027,70	29,91	4,08	5,76	0,64					1082,86
7	116,59	212,77	30,80	4,20	7,47	0,83					372,66
8	70,35	419,46	11,09	1,51	5,83	0,65	1,19	0,24	1,22	1,22	512,78
9	1113,35	2044,65	25,01	3,41	0,00	0,00					3186,41
total	1510,96	5718,51	183,46	25,02	99,53	11,06	14,41	2,95	3,74	3,74	7573,39
%	19,95	75,51	2,42	0,33	1,31	0,15	0,19	0,04	0,05	0,05	100,00

Subarea	WR																Total number *1000000
	0im	1im	1ma	2im	2ma	3im	3ma	4 im	4ma	5ma	6	7	8	9	10	11	
	Wester Baltic spring spawners																
3		6,48	0,49	3,99	6,51	1,55	8,81	0,11	2,01	0,42							30,37
4		184,74	13,91	123,69	201,81	51,60	292,37	4,07	77,34	19,86		1,74					971,13
5		69,55	5,23	57,20	93,32	28,92	163,89	4,25	80,80	26,10	13,69	3,53				10,43	556,92
6		112,41	8,46	53,92	87,98	38,26	216,82	8,05	153,03	6,10	5,89	2,12	0,80				693,86
7		34,89	2,63	50,97	83,16	15,35	86,96	1,72	32,66	14,85							323,18
8	22,41	43,24	3,25	48,33	78,85	18,62	105,50	1,88	35,75	7,40	8,22	1,57	3,76				378,77
9		1380,56	103,91	164,91	269,07	11,31	64,11	3,71	70,58	0,00							2068,17
total	22,41	1831,87	137,88	503,01	820,69	165,61	938,46	23,80	452,18	74,73	27,79	8,96	4,56			10,43	5022,39
%	0,45	36,47	2,75	10,02	16,34	3,30	18,69	0,47	9,00	1,49	0,55	0,18	0,09			0,21	100,00

Table 5c. Mean weight (g) by age, stock and sub area of herring for R/V Dana 25 June to 8 July 2002

Subarea	WR									
	0im	1im	2im	2ma	3im	3ma	4im	4ma	5im	5ma
	North Sea autumn spawners									
3		40,2	78,3	78,3	79,1	79,1				
4	14,4	42,3	78,0	78,0	82,1	82,1	89,0	89,0		
5	6,1	40,6	109,9	109,9	115,5	115,5	126,1	126,1	154,5	154,5
6	10,8	46,2	128,3	128,3	81,3	81,3				
7	7,2	47,0	87,3	87,3	70,7	70,7				
8	7,1	36,5	108,4	108,4	110,8	110,8	120,0	120,0	154,5	154,5
9	6,7	30,7	40,0	40,0						

Subarea	WR															
	0im	1im	1ma	2im	2ma	3im	3ma	4 im	4ma	5ma	6	7	8	9	10	11
	Western Baltic spring spawners															
3		38,5	38,5	69,0	69,0	76,9	76,9	91,8	91,8	104,8						
4		35,0	35,0	68,9	68,9	83,5	83,5	99,9	99,9	119,7		142,0				
5		42,4	42,4	73,8	73,8	92,5	92,5	122,9	122,9	145,9	151,8	162,0				160,1
6		33,5	33,5	68,7	68,7	83,2	83,2	99,6	99,6	159,7	150,6	177,6	194,0			
7		39,1	39,1	76,5	76,5	76,3	76,3	87,5	87,5	112,8						
8	7,0	30,7	30,7	70,1	70,1	88,7	88,7	126,4	126,4	172,9	186,9	201,0	194,0			
9		36,4	36,4	50,6	50,6	57,6	57,6	77,8	77,8							

Table 5d. Mean length (cm) by age, stock and sub area of herring for R/V Dana 25 June to 8 July 2001

Subarea	WR									
	0im	1im	2im	2ma	3im	3ma	4im	4ma	5im	5ma
	North Sea autumn spawners									
3		18,03	21,94	21,94	22,21	22,21				
4	13,28	18,09	22,23	22,23	22,95	22,95	24,50	24,50		
5	10,10	18,07	23,74	23,74	24,94	24,94	25,29	25,29	26,50	26,50
6	12,03	18,39	25,00	25,00	23,00	23,00				
7	10,58	18,55	22,93	22,93	21,89	21,89				
8	10,50	17,25	24,00	24,00	24,33	24,33	25,00	25,00	26,50	26,50
9	10,34	16,42	18,00	18,00						

Subarea	WR															
	0im	1im	1ma	2im	2ma	3im	3ma	4 im	4ma	5ma	6	7	8	9	10	11
	Western Baltic spring spawners															
3		17,88	17,88	21,67	21,67	22,68	22,68	24,10	24,10	25,95						
4		17,21	17,21	21,64	21,64	23,17	23,17	24,40	24,40	25,74		26,00				
5		18,48	18,48	22,10	22,10	23,73	23,73	25,63	25,63	27,45	27,28	27,00				28,71
6		16,91	16,91	21,75	21,75	23,23	23,23	24,18	24,18	27,66	27,29	27,60	29,00			
7		17,89	17,89	22,24	22,24	22,59	22,59	23,38	23,38	24,79						
8	10,87	16,46	16,46	21,70	21,70	23,29	23,29	25,85	25,85	28,19	28,82	28,50	29,00			
9		17,47	17,47	19,65	19,65	20,69	20,69	22,75	22,75							