

APPENDIX IIB: Denmark

Acoustic Herring Survey report for RV “DANA”

27th June 2003 – 10th July 2003

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1. INTRODUCTION

Since 1991 the Danish institute for Fisheries Research (DIFRES) has participated in the ICES coordinated herring acoustic survey of the North Sea and adjacent waters with the responsibility for the surveying the Skagerrak and Kattegat area.

The actual 2003-survey with R/V DANA, covering the Skagerrak and Kattegat, was conducted in the period June 30 to July 10 2003, while some tests carried out June 27 and calibration was done during June 28 - 29.

2. SURVEY

2.1 Personnel

During calibration 28-29/6-2003

Bo Lundgren (cruise leader)	HFI
Torben Filt Jensen (assisting cruise leader)	ITT
Lotte A. Worsøe Clausen	HFI
Mogens R. Sørensen	ITT
Thyge Dyrnesli	ITT
Bo Tegen Nielsen	ITT

During acoustic monitoring 30/6-10/7-2002

Bo Lundgren (cruise leader)	HFI
Lotte A. Worsøe Clausen (assisting cruise leader)	HFI
Torben Filt Jensen (assisting cruise leader)	ITT
Uffe Nielsen	HFI
Lise Sindahl	HFI
Tommy Henriksen	HFI
Mette Sørup	HFI
Rasmus F. Jensen	HFI
Bo Tegen Nielsen	ITT

HFI = Dept for Marine Fisheries, DIFRES, Denmark

ITT = Dept. of IT and Technical Support, DIFRES, Denmark

2.2 Narrative

R/V Dana left Hirtshals on 27 June 2003 at 12.30 for the calibration site in the Gullmar Fjord in Sweden. Some tests of new equipment were to be carried out underway. After about 1 hour's sailing a seawater cooler supply pipe broke, which made it necessary to back to harbour for repair. A new departure was made at 18.30 after which detailed functional tests were carried out underway across Kattegat until about 06.00 the next morning. Some tests of the echosounder equipment and some preparations for the calibration next day were carried out as well. A problem with a leaky connector in a 38 kHz transducer paravane was found and corrected. The problem showed up only when paravane was in the water.

R/V Dana was back in harbour on 30 June 2003 at 06.00 for exchange of scientific personnel and left again at 12.00 on June 30 with a westerly course to start the survey. The survey work (acoustic integration) started at 20.00 on the position 57° 53' N 06° 56' E in the western part of the Skagerrak. Totally the survey covered about 1600 nautical miles mainly using the 38 kHz paravane transducer running at depths of 4 – 6 m depending on the sea state and sailing direction relative to the waves.

The survey ended in Hirtshals on 10 July 2003 at 11.00 hour.

2.3 Survey design

The survey was carried out in the Skagerrak, east of 6° E, and Kattegat (Fig. IIB.1). The area is split into 7 sub-areas (Fig. IIB.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 this structure could not be kept. This gave a non-standard 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

Both the Simrad EY 500 38 kHz and EY500 120 kHz echosounders were calibrated with standard copper spheres (60 and 30.5 mm, respectively) at Bornö, Sweden 28-29 June 2003. See Table IIB.1.

2.5 Acoustic data collection

Acoustic data was sampled using mainly the SimradEY500 38kHz echosounder with the transducer in a towed body (Type ES 38). The towed body runs running at approx. 3 m depth in good weather and down to about 6 -7 m as needed when breaking waves occur. The speed of the vessel during acoustic sampling was 8 – 10 knots. Acoustic data was collected all 24 hours. The sampling unit was 1 NM. Raw data is collected and stored. For the survey purpose raw data is pre-integrated into 1m meter samples for each ping and stored as files on harddisk for each 1 nm interval. Integration is conducted from 3 m to usually max 300 m below the transducer. During trawl hauls the towed body is taken aboard and the echosounder run on the hull transducer. The data collected during the hauls has not been included in the integration data. Some 120 kHz data were also collected during trawl hauls.

2.6 Biological data - fishing trawls

Trawl hauls were carried out during the survey for species identification. Pelagic hauls (Fig. IIB.3) were carried out using a FOTÖ trawl (16 mm in the codend) while demersal hauls (Fig. IIB.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 IIB.2). The trawling strategy was made in a way that all depth areas were covered within each geographical strata (see Fig. IIB.2). In the deeper areas mid water hauls were made to identify until which depth herring will be found. 1 hour hauls were used as a standard during the survey.

The fish caught were sorted into species, length distribution and weight for each species were recorded. 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 spawners) and maturity. Micro-structure formed during the larval period were used for the discrimination of herring race. Maturity was determined according to an 8-stage scale as also used by Scotland (see Survey Manual App IV).

2.7 Hydrographic data

CTD profiles with a Seabird 911 were made immediately before or after each trawl haul. Salinity and temperature were measured continuously during the cruise at an intake at about 5 m depth. Data is stored together with position and weather data in the vessel's general information system. The distribution of CTD stations is shown in Fig. IIB.4.

2.8 Data analysis

Scrutiny of the acoustic data is done for each mile, using special judging software, mostly deleting layers and/or intervals with interference from wave- or ship wake-bubbles or rarely bottom-integration. In areas with heavy abundance of jellyfish or zooplankton, usually krill, manually adjustable thresholds were applied separately to each layer to suppress background echoes.

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

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

where L is the total length in cm. The number of fish per species is assumed to be in proportion to the contribution of the given species in the trawl hauls. Therefore, the relative density of a given species is estimated by subarea using the species composition in the trawl hauls. The nearest trawl hauls are allocated to subareas with uniform depth strata. The length-race and length-age distributions for herring are 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 and frozen for later for micro-structure analysis of the otolith after the cruise.

3. RESULTS & DISCUSSION

3.1 Acoustic data

The total number of acoustic sample units at 1 NM used in the stock size calculation is about 1300. Herring and sprat was not observed in mid-water trawl hauls at depths below 150 meters. Therefore, layers below 150 meter were excluded from the estimation.

3.2 Biological data

33 hauls were conducted (15 surface hauls, 3 mid water hauls and 14 bottom hauls (Figure IIB.2 and Tables IIB2 and IIB.3.)). The total catch was 14,297 kg with a mean catch at 447 kg. Herring was present in 26 of the hauls and was the dominant catch in the fishery with a total catch at 3,534 kg. No herring was present in hauls below 150 m depths. Blue whiting, whiting, saithe, Norway pout, haddock and mackerel were the most common among the remaining species with a total catch at 1,177 kg, 743 kg, 599 kg, 525 kg, 341 kg and 175 kg respectively. They were mainly taken in the bottom and pelagic hauls, while mackerel and garfish were taken in surface hauls. Jellyfish and krill were sometimes present in high quantities in the catches totally almost 5 tonnes and 1,5 tonnes respectively. In the southern Kattegat totally 240 kg of sprat was taken.

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. In accordance with the survey manual both North Sea autumn spawners and Baltic spring-spawners at maturity state 3 and up have been considered as mature. The following constants have been used to split the catch.

North Sea autumn spawners:

WR	0im	1im	2im	2ma	3im	3ma	4	5
%	100	100	94	6	91	9	100	100

Western Baltic spring spawners:

WR	0im	1im	1ma	2im	2ma	3im	3ma	4	5	6	7	8	9+
%	100	100	0	99	1	96	4	100	100	100	100	100	100

The total catch during the survey was about 14.3 tons of which about one third was jellyfish with a mean catch of 450 kg. For herring the total catch was 3.5 tons which is clearly lower than previous years.

3.3 Biomass estimates

The total herring biomass estimate for the survey is 264,000 tonnes of which 51 % or 141,000 tonnes is North Sea autumn spawning herring and 49 % or 122,000 tonnes is Western Baltic spring spawning herring.

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 IIB.5

Stratum overview Acoustic Herring Survey R/V Dana Cruise 04/03 July 2003

Stratum Nr	Stratum ID	Stratum Nm ²	Number of logs	Nr hauls in stratum	Nr hauls allocated from neighbour strata	Total hauls used
3	580E06	209	35	1	0	1
4	570E06	3600	320	6	5	11
5	580E08	1822	108	7	2	9
6	570E08	3406	186	5	9	14
7	C	988	65	2	2	4
8	D	1837	255	7	2	9
9	E	5228	296	4	2	6

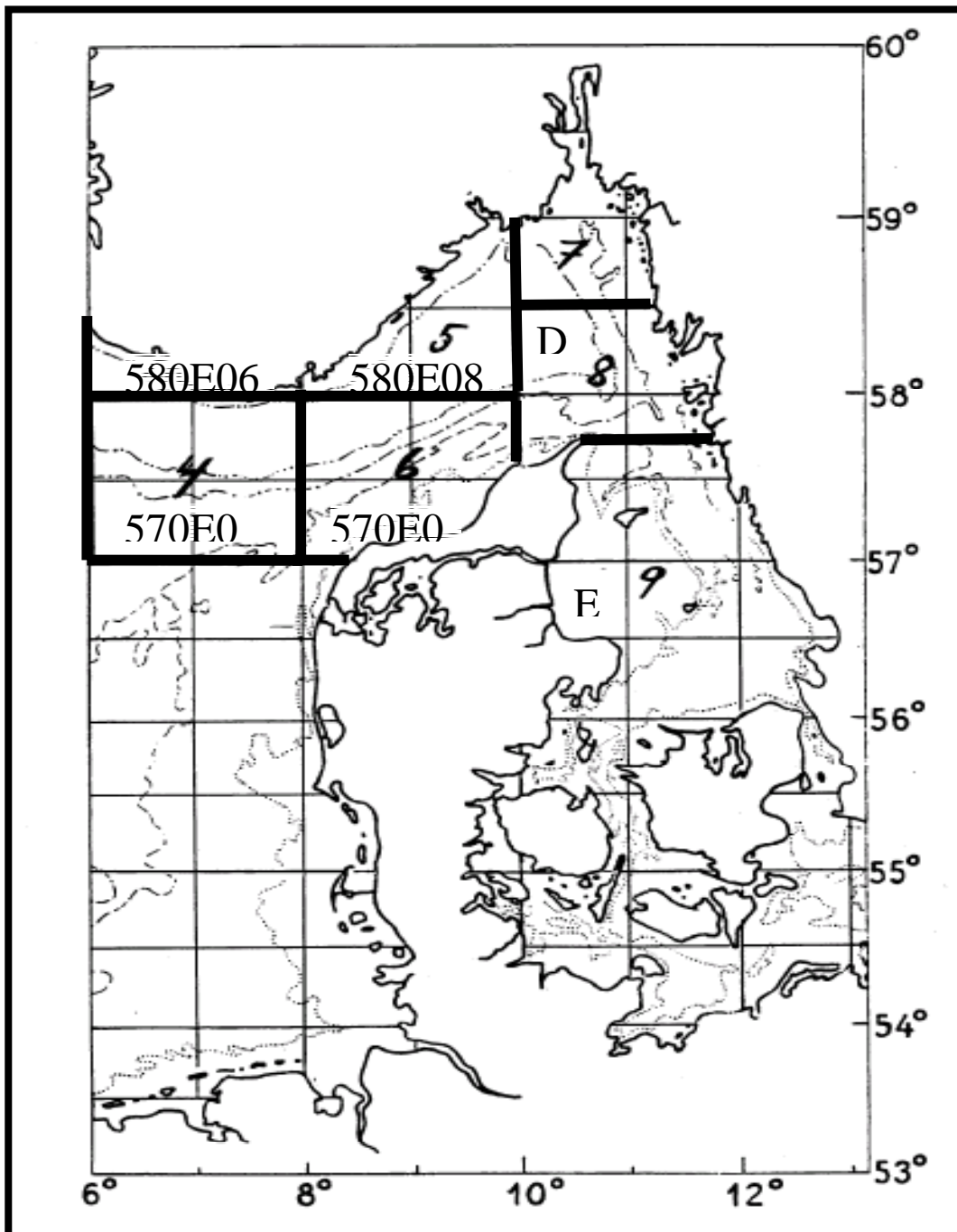


Figure IIB.1. Map of the eastern North Sea, Skagerrak and Kattegat showing the sub areas used in the estimation during the July Danish acoustic survey of R/V Dana 2003.

Cruise track and stations during the Acoustic Herring Survey R/V Dana Cruise 04/03 July 2003

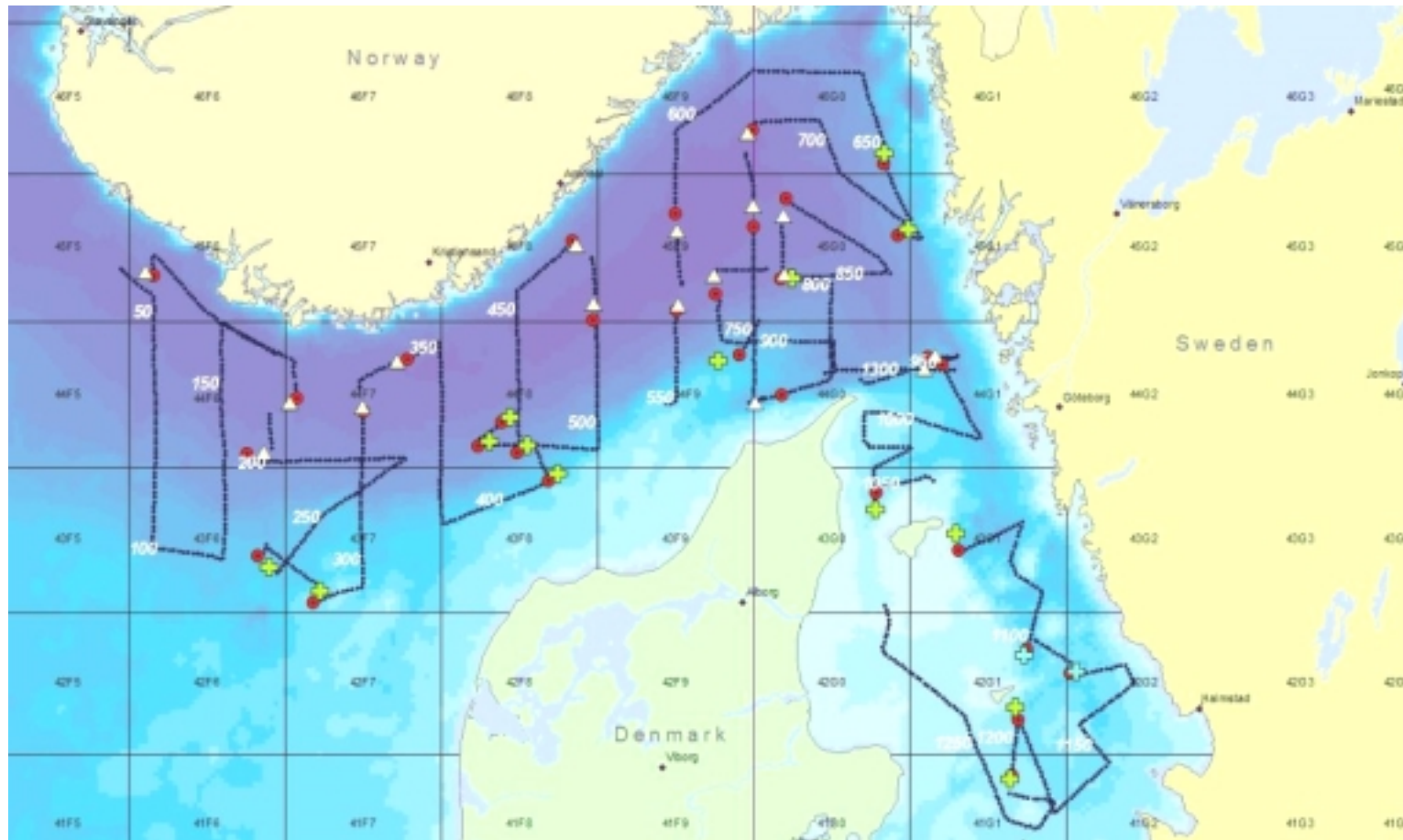


Figure IIB.2. Map of the eastern North Sea, Skagerrak and Kattegat showing cruise track, the location of CTD stations ● and the location of trawl hauls during the July 2003 Danish acoustic survey (Fotö hauls ▲ are pelagic and Expo hauls ⊠ are demersal, White numbers cumulative sailed distance along the track in nm).

Bathymetry from:
The MAST project
DYNOCS MAST II
contract No MAS2-

CT94-0088

Density in numbers of herring during the Acoustic Herring Survey R/V Dana Cruise July 2003

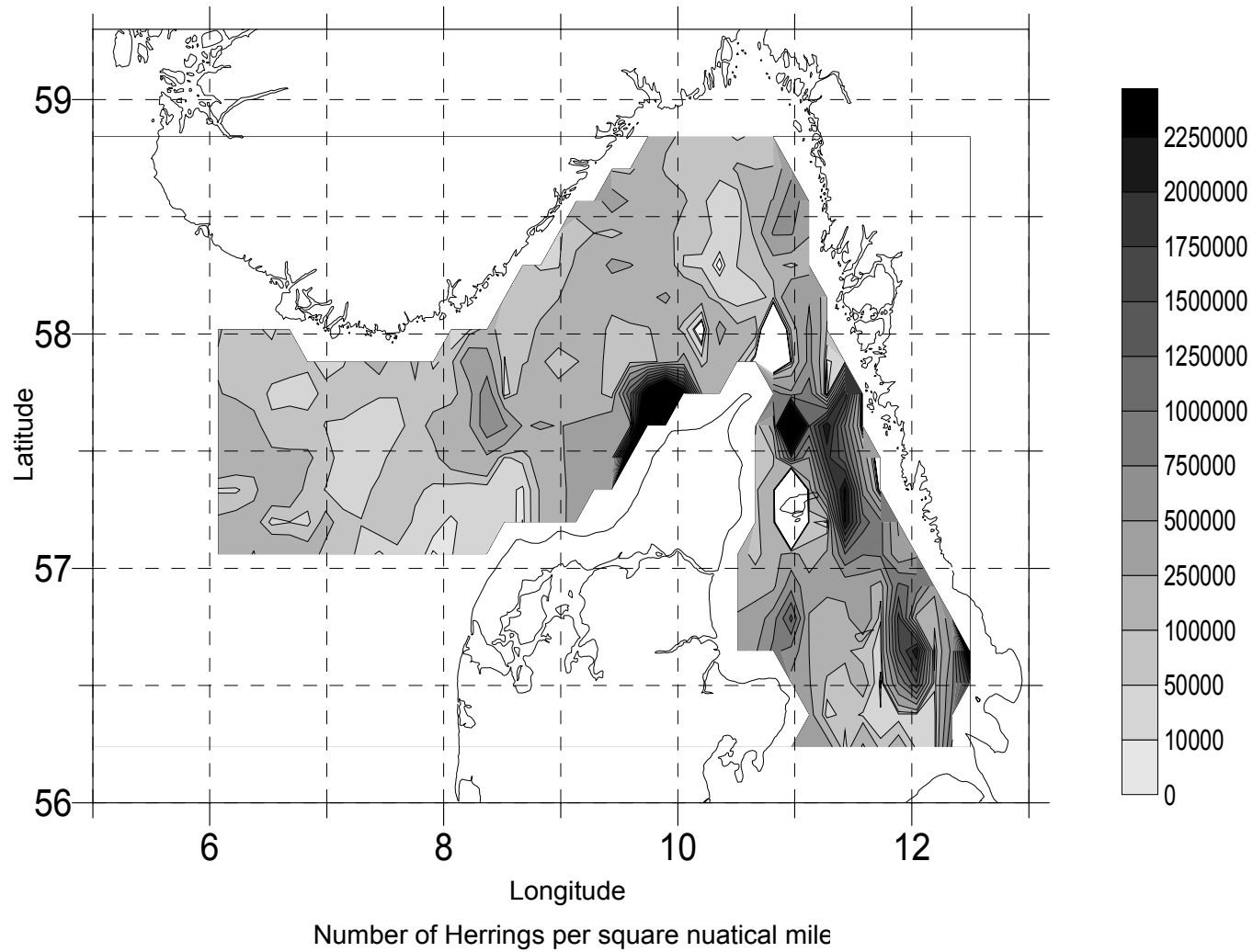


Figure IIB.3.a Contoured density (N/nm²) of herring from the July 2003 Danish acoustic survey in the eastern North Sea, Skagerrak and Kattegat.

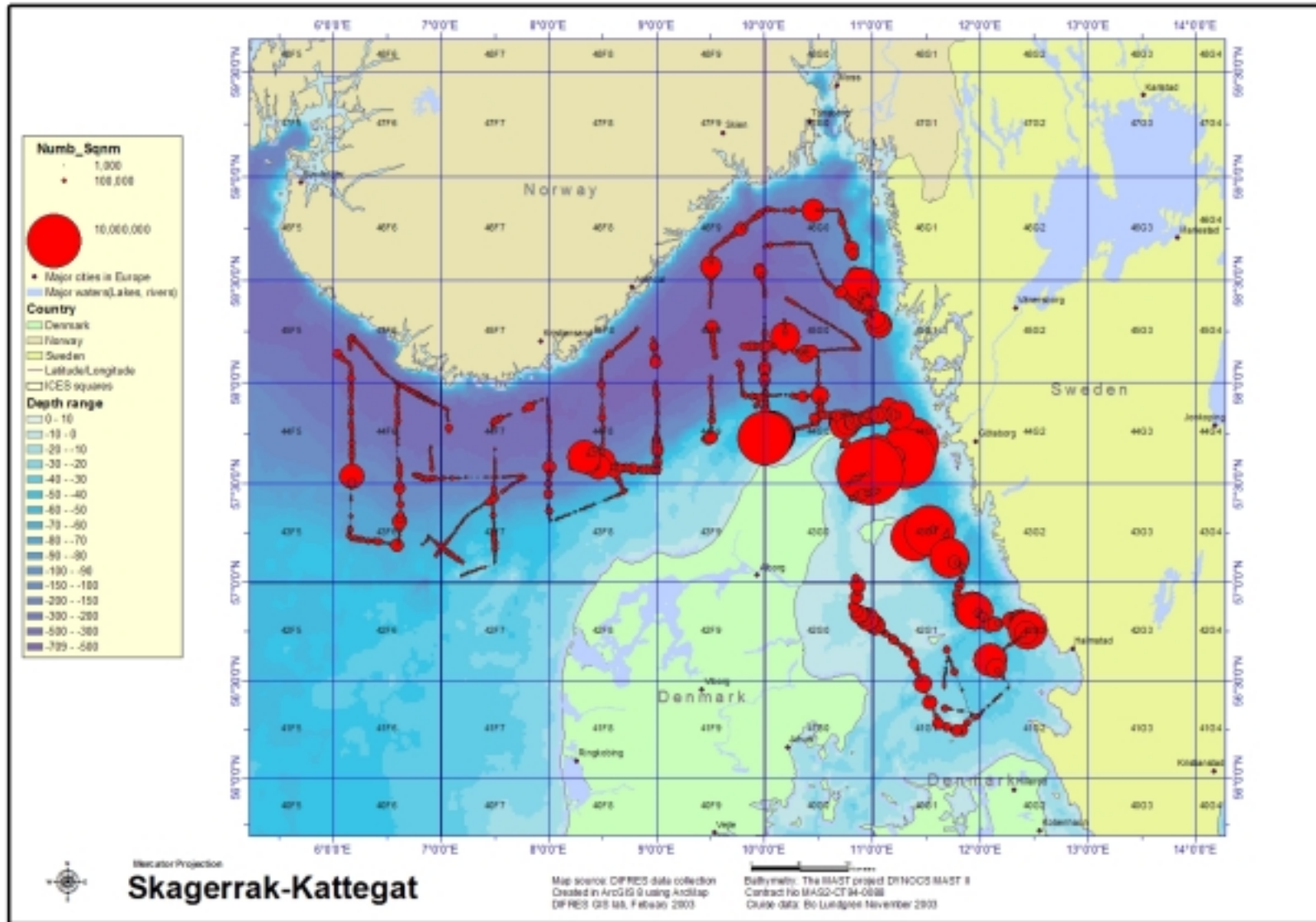


Figure IIB.3.b Herring density (in numbers per nm²) along the track of the July 2003 Danish acoustic survey in the eastern North Sea, Skagerrak and Kattegat

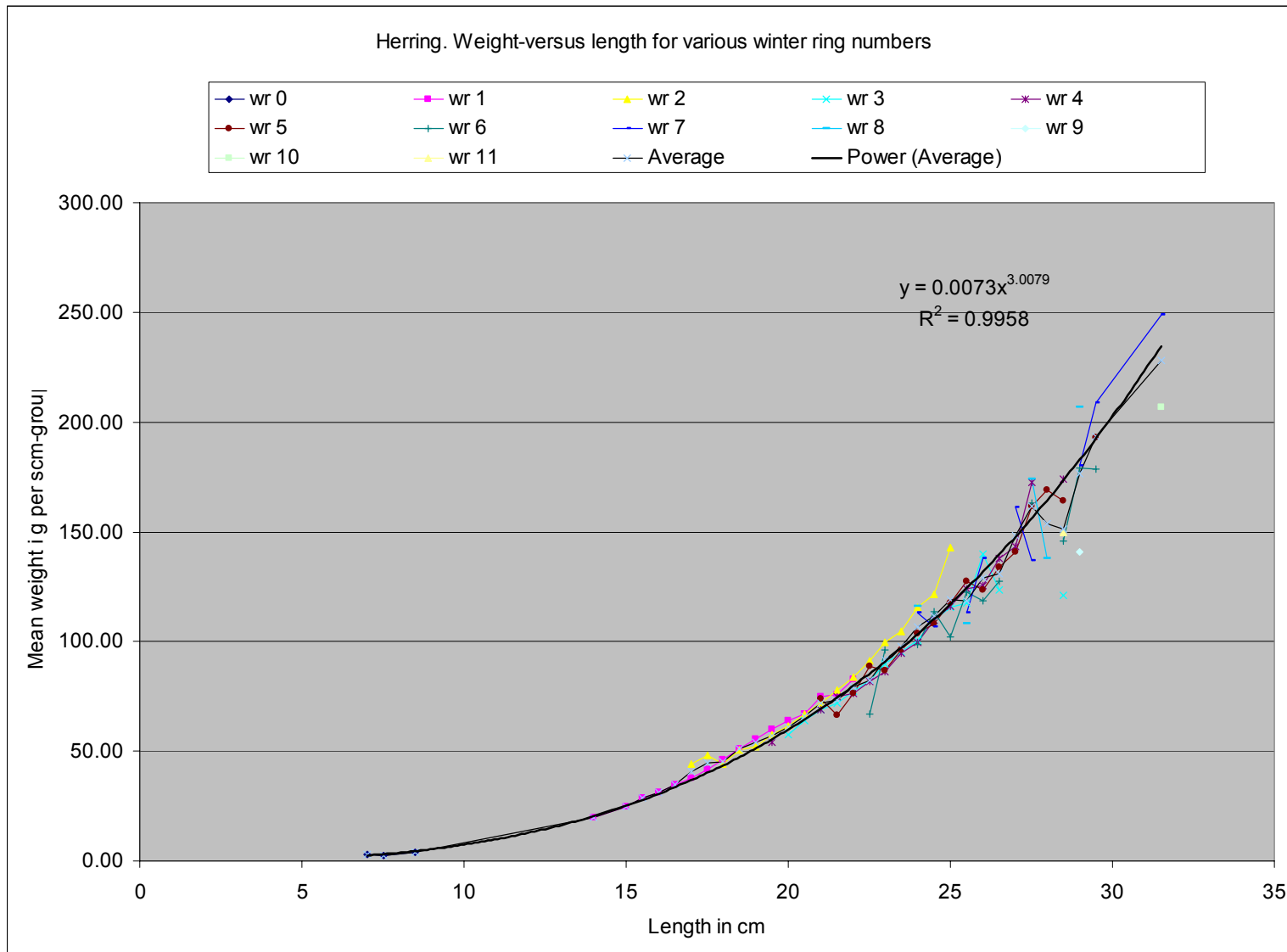


Figure IIB.4.a Length weight relationship by winter ring numbers for herring from the July 2003 Danish acoustic survey.

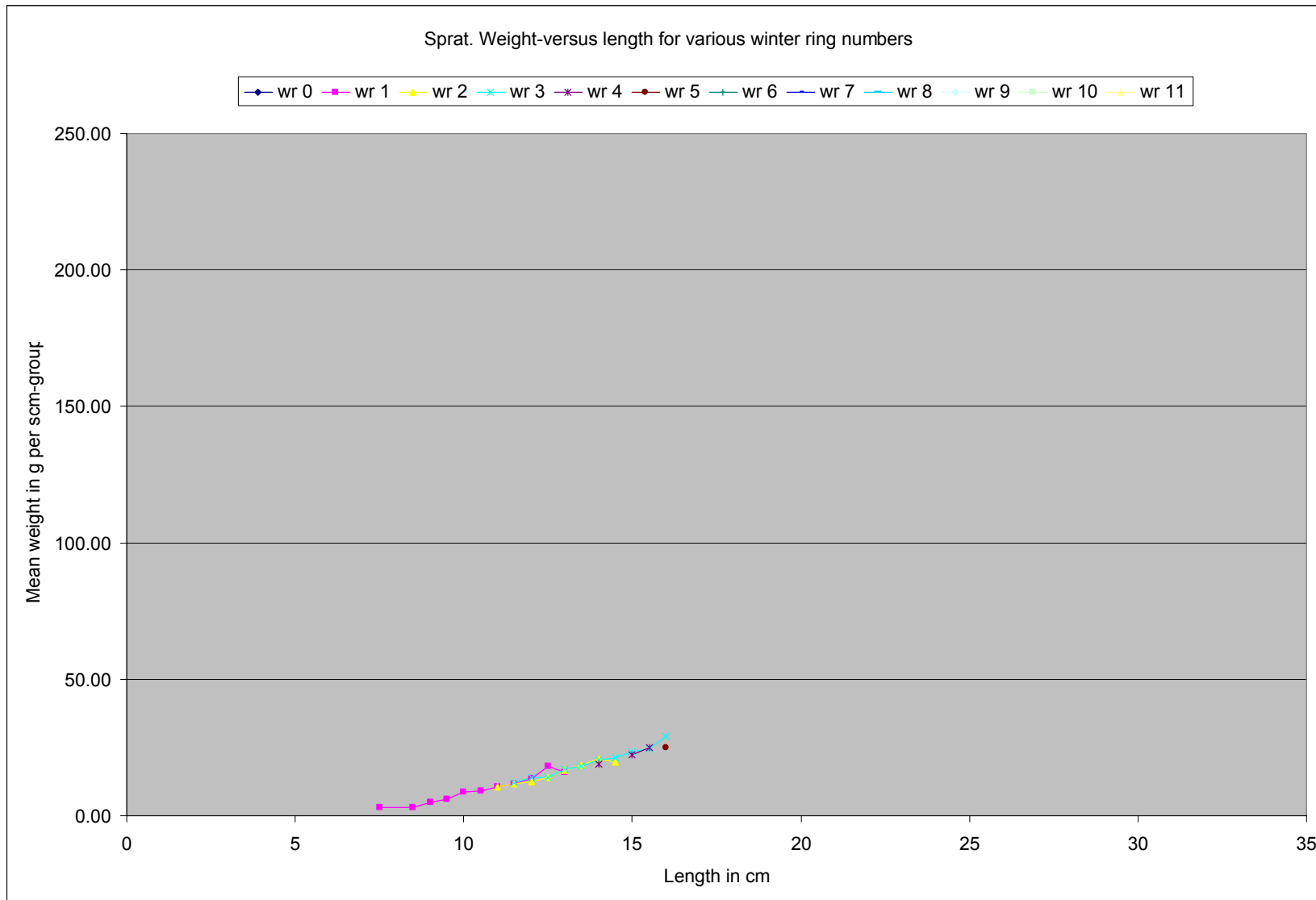


Figure IIB.4.b Length weight relationship by winter ring numbers for sprat from the July 2003 Danish acoustic survey.

Table IIB.1. Simrad EY500 and analysis settings used during the the Acoustic Herring Survey R/V Dana Cruise July 2003

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	
Distance	1,0 n.mi. using GPS-speed
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 IIB.2. Trawl hauls during the Acoustic Herring Survey R/V Dana Cruise July 2003

Haul no.	Date	UTC	Sun	ICES	Latitude	Longitude	Trawl	Catch depth	Mean	Total	Main Species	Trawling	Trawling	Wind	Sea state
									Bottddepth	catch		speed	duratin	speed	
	dd-mm-yyyy	Time	time	Square	N	E		m	M	Kg		Kn	min,	m/s	
36	30-06-2003	23:23:00	23:47	45F5	58 11.18	06 06.23	FOTÖ	Surface	317	232.866	Blue Whiting, Herring	4.6	60	11	4
190	01-07-2003	21:33:00	22:01	44F7	57 41.6	06 55.1	FOTÖ	Surface	332	325	Herring, Mackerel, Blue Whiting	3.8	60	10	4
204	02-07-2003	00:26:00	00:53	44F7	57 32.93	06 46.32	FOTÖ	145	203	104.332	Saithe, Blue Whiting	3.3	60	8	3
280	02-07-2003	10:33:00	11:00	43F6	57 11.5	06 49.8	EXPO	Bottom	65	93	Haddock, Cod, Whiting	3.5	60	8	3
303	02-07-2003	14:14:00	14:42	43F7	57 01.9	07 10.9	EXPO	Bottom	33	113	Gurnard, Dab	3	60	8	2
354	02-07-2003	21:24:00	21:54	44F7	57 45.9	07 29.7	FOTÖ	Surface	416	300	Krill, Blue Whiting, Herring, Jellyfish	3.6	60	3	1
368	03-07-2003	00:25:00	00:55	44F7	57 52.6	07 47.5	FOTÖ	Surface	510	252	Krill, Herring, Jellyfish	3.6	60	6	2
445	03-07-2003	10:21:00	10:56	43F8	57 27.3	08 41.0	EXPO	Bottom	37	390	Jellyfish, Whiting, juvenile whiting, haddock, norway pout	3.1	60	5	2
456	03-07-2003	13:17:00	13:51	44F8	57 33.3	08 28.8	EXPO	Bottom	101	695	Norway pout, Haddock, Saithe	3.3	60	9	2
510	03-07-2003	21:31:00	22:06	45F8	58 13.4	08 57.0	FOTÖ	Surface	412	362	Herring, Mackerel, Jellyfish	3.5	60	10	4
525	04-07-2003	00:18:00	00:53	45F8	58 00.3	08 58.5	FOTÖ	Surface	594	272	Herring, Krill, Jellyfish	3.7	60	11	3
585	04-07-2003	10:32:00	11:05	44F8	57 34.5	08 14.3	EXPO	Bottom	173	597	Blue Whiting, Saithe, Herring	2.6	60	6	2
600	04-07-2003	13:59:00	14:32	44F8	57 39.4	08 23.2	EXPO	Bottom	213	233	Blue Whiting, Shrimp, Haddock	2.9	60	4	2
658	04-07-2003	21:25:00	22:03	45F9	58 06.8	09 32.7	FOTÖ	Surface	483	123.247	Herring, Mackerel, Blue Whiting	3.7	60	3	1
675	05-07-2003	00:17:00	00:55	45F9	58 21.7	09 30.6	FOTÖ	Surface	619	174.533	Herring, Jellyfish, Krill, Garfish	3.8	60	3	0
752	05-07-2003	10:25:00	11:08	46G0	58 31.6	10 50.5	EXPO	Bottom	87	1542	Norway pout, Jellyfish, Saithe, Herring	2.9	60	4	0
770	05-07-2003	14:08:00	14:51	45G0	58 17.0	10 55.7	EXPO	Bottom	113	474	Krill, Norway pout, Saithe	3.1	60	2	1
826	05-07-2003	21:28:00	22:07	46F9	58 34.6	09 57.0	FOTÖ	Surface	471	232	Krill, Herring, Jellyfish	3.5	60	4	1
840	06-07-2003	00:18:00	00:58	45G0	58 19.6	09 59.9	FOTÖ	Surface	473	164.846	Krill, Herring, Jellyfish, Garfish	3.6	60	1	0
925	06-07-2003	10:26:00	11:07	45G0	58 08.6	10 10.6	EXPO	Bottom	195	488	Saithe, Blue Whiting, Shrimp	3.2	60	5	1
940	06-07-2003	13:54:00	14:34	45G0	58 24.5	10 12.2	FOTÖ	150	460	105	Lumpsucker, Saithe, Jellyfish, Krill	3.3	60	3	0
990	06-07-2003	21:22:00	22:02	45G0	58 10.2	10 06.1	FOTÖ	Surface	239	132	Krill, Herring, Jellyfish, Garfish	3.5	60	1	0
1005	07-07-2003	00:19:00	00:58	45F9	58 05.7	09 45.12	FOTÖ	Surface	417	252	Krill, Herring, Jellyfish, Garfish	3.8	60	0	0
1080	07-07-2003	10:23:00	11:03	44G0	57 44.7	10 09.6	FOTÖ	23	82.5	20	Jellyfish, old fish from trawl	3.2	60	14	6
1105	07-07-2003	13:58:00	14:37	44F9	57 53.1	09 53.2	EXPO	Bottom	59	210	Herring, juvenile whiting, haddock, norway pout	2.9	60	13	5
1167	07-07-2003	21:19:00	22:03	44G1	57 53.3	11 16.9	FOTÖ	Surface	75	410	Herring, Jellyfish	3.3	44	12.5	5
1183	08-07-2003	00:17:00	01:01	44G1	57 50.7	11 06.0	FOTÖ	Surface	50	752	Herring	3.6	60	12	5
1265	08-07-2003	10:18:00	11:01	43G0	57 24.8	10 46.9	EXPO	Bottom	38	281	Herring, Bullrout	3.5	60	3	1
1293	08-07-2003	14:22:00	15:07	43G1	57 13.0	11 18.5	EXPO	Bottom	29	1612	Herring, juvenile whiting, sprat	3.2	60	5	1
1342	08-07-2003	21:19:00	22:05	42G1	56 54.4	11 46.4	EXPO	Surface	51		JELLYFISH; trawl emptied	3.4	30	9	3
1360	09-07-2003	00:16:00	01:04	42G2	56 47.5	12 01.7	EXPO	Surface	40	2320	JELLYFISH, herring	3	60	3	2
1445	09-07-2003	10:17:00	11:03	42G1	56 37.1	11 41.5	EXPO	Bottom	31	410	Sprat, Herring, Whiting	3.3	60	10	4
1462	09-07-2003	13:30:00	14:16	41G1	56 22.1	11 37.1	EXPO	Bottom	26	646	Herring, Jellyfish, Whiting, Sprat	2.8	60	9	4

Table IIB.3. Trawl haul species composition in kg during the Acoustic Herring Survey R/V Dana Cruise July 2003

Haul type (surface, pelagic, bottom)		s	s	p	b	b	s	S	b	b	s	s	b	B	s	s	b	b	s
Fishing depth		Surface	Surface	145	Bottom	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Bottom	Surface
Strata		3	4	4	4	4	4	4	6	6	5	5	6	6	5	5	7	8	5
Haul		36	190	204	280	303	354	368	445	456	510	525	585	600	658	675	752	770	826
Trawl catch, kg		232.9	325	104.3	92.9	113	300	252	390	695	362	272	597	233	123.2	174.5	1542	474	232
Vahl's eelpout	<i>Lycodes vahl</i>												0.1						
Anchovy	<i>Engraulis encrasicolus</i>						0.1												
Squid	<i>Loligo spp.</i>				0.7				0.2										
Blue whiting	<i>Micromesistius poutassou</i>	71.3	3.8	32.4			99.5	4.4			1.9	3.3	555.5	157.5	5.4	0.8		1.3	
Sprat	<i>Sprattus sprattus</i>																		
Common weaver	<i>Trachinus draco</i>							0.1								0.1			
Dragonet	<i>Callionymus spp.</i>																		
Poor cod	<i>Trisopterus minutus</i>																		
Catfish	<i>Anarhichas lupus</i>				7.5														
Fourbeard rockling	<i>Enchelyopus cimbrius</i>													0.8					
Horse mackerel	<i>Trachurus trachurus</i>								0.8										
Long rough dab	<i>Hippoglossoides platessoides</i>				0.3	0.1				1.6				1.7			0.2		
Garfish	<i>Belone belone</i>	13.9	7.6				2.8	1.0			5.1	3.7			1.7	10.8			3.2
Whiting	<i>Merlangius merlangus</i>	0.2	0.2		8.2		0.3	0.8	34.2	29.3		0.3	0.1		0.7	0.3	36.7	1.0	0.5
Invertebrates		93.0	26.0			59.2	63.8	62.9	326.2	1.3	103.8	50.9		8.5	69.2	60.0	518.7		
Dab	<i>Limanda limanda</i>				2.4	15.0			5.6										
Norway lobster	<i>Nephrops norvegicus</i>													0.2			0.3	0.2	
Gurnard	<i>Trigala spp.</i>				0.4	38.2			0.4										
Haddock	<i>Melanogrammus aeglefinus</i>				51.3				7.1	188.0			0.5	22.1	0.1		4.7	11.9	0.2
Hake	<i>Merluccius merluccius</i>			0.8					0.4	1.0			5.4	2.0			2.7	0.3	
Salmon	<i>Salmo salar</i>																		
Pearlside	<i>Maurolicus muelleri</i>	0.2	0.3					0.1											
Ling	<i>Molva molva</i>																	0.5	
Snake blenny	<i>Lumpenus lampretaeformis</i>																		
Krill	<i>Euphausiidae spp.</i>	0.7	0.5				100.0	98.9			120.0	50.9				49.0	518.7	281.8	153.3
Pollack	<i>Pollachius pollachius</i>																0.5		
Mackerel	<i>Scomber scombrus</i>	23.0	15.8				2.8	7.5	0.6		37.7	10.2	0.3		11.8				12.4
Picked dogfish	<i>Squalus acanthias</i>							2.5						0.3					
Plaice	<i>Pleuronectes platessa</i>					0.1			0.5										
Lemon sole	<i>Microstomus kitt</i>								6.5	5.2							2.4	0.2	
Pilchard, sardine	<i>Sardina pilchardus</i>																		
Saithe	<i>Pollachius virens</i>			70.3						184.0			22.1				97.8	79.7	
Herring	<i>Clupea harengus</i>	30.5	270.9				19.7	71.1		8.3	90.7	150.1	9.6	0.1	34.4	52.8	166.4	16.5	60.0
Gray sole	<i>Glyptocephalus cynoglossus</i>																		
Hagfish	<i>Myxine glutinosa</i>												0.1						
Flounder	<i>Platichthys flesus</i>																		
Norway pout	<i>Trisopterus esmarki</i>				2.6				5.0	255.4			1.8	4.8			183.2	56.4	
Lumpsucker	<i>Cyclopterus lumpus</i>			0.9			11.1	2.5			2.8	2.1	0.9	3.6		0.8			2.6
Lesser silver smelt	<i>Argentina sphyraena</i> *												0.2						
Edible crab	<i>Cancer pagurus</i>																		
Starry ray	<i>Raja radiata</i>																		
Sandeels	<i>Ammodytes spp.</i>								0.1										
Greater sandell	<i>Hyperoplus lanceolatus</i>				0.2	0.3			1.8										
Cod	<i>Gadus Morhua</i>				19.5				0.3	20.9				4.1			8.7	24.4	
Spiny stone-crab	<i>Lithodes maia</i>																		
Shrimp	<i>Pandalus spp., Crangon spp.</i>												26.9						
Bullrout	<i>Myoxocephalus scorpius</i>																		
		232.9	325.1	104.3	92.9	113.0	300.0	252.0	389.7	695.0	362.0	271.5	596.4	233.0	123.2	174.5	1541.5	473.6	232.0

Table IIB.3. Trawl haul species composition in kg during the Acoustic Herring Survey R/V Dana Cruise July 2003 (continued)

Haul type (surface, pelagic, bottom)		s	b	P	s	s	p	B	s	s	b	b	s	b	b	
Fishing depth		Surface	Bottom	150	Surface	Surface	23	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Bottom
Strata		5	8	8	8	5	9	6	9	9	9	9	9	9	9	9
Haul		840	925	940	990	1005	1080	1105	1167	1183	1265	1293	1342	1360	1445	1462
Trawl catch, kg		164.8	488	105	132	252		210	410	752	281	1612		2320	410	646
Vahl's eelpout	<i>Lycodes vahl</i>		1.9													
Anchovy	<i>Engraulis encrasicolus</i>															
Squid	<i>Loligo spp.</i>															
Blue whiting	<i>Micromesistius poutassou</i>		234.8			5.6										
Sprat	<i>Sprattus sprattus</i>										0.0	106.1		0.2	123.4	10.5
Common weaver	<i>Trachinus draco</i>	0.1									0.2	3.0		0.5	0.2	
Dragonet	<i>Callionymus spp.</i>															
Poor cod	<i>Trisopterus minutus</i>															
Catfish	<i>Anarhichas lupus</i>															
Fourbeard rockling	<i>Enchelyopus cimbrius</i>															
Horse mackerel	<i>Trachurus trachurus</i>									0.5						
Long rough dab	<i>Hippoglossides plattessoides</i>							0.9								0.2
Garfish	<i>Belone belone</i>	15.0		1.0	3.4	6.1			3.1	7.0						0.2
Whiting	<i>Merlangius merlangus</i>	0.2				0.3		17.2	0.1		6.1	500.1			38.5	67.7
Invertebrates		47.0		40.0	29.4	51.0	10.0	10.5	225.4	29.9	158.0	44.8		2207.4	195.8	420.6
Dab	<i>Limanda limanda</i>							0.2			21.9	3.0			2.8	11.9
Norway lobster	<i>Nephrops norvegicus</i>		0.2					0.2								
Gurnard	<i>Trigala spp.</i>												0.1	0.1	0.2	
Haddock	<i>Melanogrammus aeglefinus</i>	0.0	54.1			0.0		1.3			0.1				0.1	
Hake	<i>Merluccius merluccius</i>		0.4					0.5	0.8					1.6		
Salmon	<i>Salmo salar</i>															
Pearlside	<i>Maurolicus muelleri</i>															
Ling	<i>Molva molva</i>															
Snake blenny	<i>Lumpenus lampretaeformis</i>															
krill	<i>Euphausiidae spp.</i>	47.0		39.5	29.4	56.0										
Pollack	<i>Pollachius pollachius</i>															
Mackerel	<i>Scomber scombrus</i>	2.0		0.5	18.4	16.3			5.4	9.2		0.3		1.0		0.5
Picked dogfish	<i>Squalus acanthias</i>															
Plaice	<i>Pleuronectes platessa</i>							0.5			0.3				0.8	2.1
Lemon sole	<i>Microstomus kitt</i>														0.6	
Pilchard, sardine	<i>Sardina pilchardus</i>															
Saithe	<i>Pollachius virens</i>	10.1	126.5	8.8												
Herring	<i>Clupea harengus</i>	39.6	0.7		37.5	116.7		173.0	173.2	696.4	84.5	946.9		109.2	45.2	130.0
Gray sole	<i>Glyptocephalus cynoglossus</i>		0.6													
Hagfish	<i>Myxine glutinosa</i>															
Flounder	<i>Platichthys flesus</i>										0.2					
Norway pout	<i>Trisopterus esmarki</i>		9.8					5.7			0.7					
Lumpsucker	<i>Cyclopterus lumpus</i>	3.2	1.7	15.2	13.8				1.6	9.6	1.4	7.8			1.6	1.1
Lesser silver smelt	<i>Argentina sphyraena</i> *															
Edible crab	<i>Cancer pagurus</i>															
Starry ray	<i>Raja radiata</i>															
Sandeels	<i>Ammodytes spp.</i>														0.1	
Greater sandell	<i>Hyperoplus lanceolatus</i>															
Cod	<i>Gadus Morhua</i>		0.1					0.1							0.8	0.9
Spiny stone-crab	<i>Lithodes maia</i>															
Shrimp	<i>Pandalus spp., Crangon spp.</i>		57.4													
Bullrout	<i>Myoxocephalus scorpius</i>										7.7					
		164.2	488.0	105.0	132.0	252.0	10.0	210.0	409.7	752.7	281.0	1612.0	0.0	2320.0	409.9	646.0

Table IIB.3. Trawl haul species composition in kg during the Acoustic Herring Survey R/V Dana Cruise July 2003 (continued)

Haul type (surface, pelagic, bottom) Fishing depth Strata		Total survey	Mean survey 32	Max survey	Min survey
Haul					
Trawl catch, kg		14297.7	446.80	2320.0	92.9
Vahl's eelpout	<i>Lycodes vahl</i>	2.0	0.06	1.9	0.1
Anchovy	<i>Engraulis encrasicolus</i>	0.1	0.00	0.1	0.1
Squid	<i>Loligo spp.</i>	0.8	0.03	0.7	0.2
Blue whiting	<i>Micromesistius poutassou</i>	1177.5	36.80	555.5	0.8
Sprat	<i>Sprattus sprattus</i>	240.3	7.51	123.4	0.0
Common weaver	<i>Trachinus draco</i>	4.1	0.13	3.0	0.1
Dragonet	<i>Callionymus spp.</i>	0.0	0.00	0.0	0.0
Poor cod	<i>Trisopterus minutus</i>	0.0	0.00	0.0	0.0
Catfish	<i>Anarhichas lupus</i>	7.5	0.23	7.5	7.5
Fourbeard rockling	<i>Enchelyopus cimbrius</i>	0.8	0.02	0.8	0.8
Horse mackerel	<i>Trachurus trachurus</i>	1.3	0.04	0.8	0.5
Long rough dab	<i>Hippoglossides plattessoides</i>	4.9	0.15	1.7	0.1
Garfish	<i>Belone belone</i>	85.6	2.67	15.0	0.2
Whiting	<i>Merlangius merlangus</i>	743.0	23.22	500.1	0.1
Invertebrates		4913.6	153.55	2207.4	1.3
Dab	<i>Limanda limanda</i>	62.8	1.96	21.9	0.2
Norway lobster	<i>Nephrops norvegicus</i>	1.0	0.03	0.3	0.2
Gurnard	<i>Trigala spp.</i>	39.3	1.23	38.2	0.1
Haddock	<i>Melanogrammus aeglefinus</i>	341.6	10.67	188.0	0.0
Hake	<i>Merluccius merluccius</i>	15.8	0.49	5.4	0.3
Salmon	<i>Salmo salar</i>	0.0	0.00	0.0	0.0
Pearlside	<i>Maurolicus muelleri</i>	0.6	0.02	0.3	0.1
Ling	<i>Molva molva</i>	0.5	0.01	0.5	0.5
Snake blenny	<i>Lumpenus lamprataeformis</i>	0.0	0.00	0.0	0.0
krill	<i>Euphausiidae spp.</i>	1545.9	48.31	518.7	0.5
Pollack	<i>Pollachius pollachius</i>	0.5	0.01	0.5	0.5
Mackerel	<i>Scomber scombrus</i>	175.8	5.49	37.7	0.3
Picked dogfish	<i>Squalus acanthias</i>	2.8	0.09	2.5	0.3
Plaice	<i>Pleuronectes platessa</i>	4.4	0.14	2.1	0.1
Lemon sole	<i>Microstomus kitt</i>	14.9	0.46	6.5	0.2
Pilchard, sardine	<i>Sardina pilchardus</i>	0.0	0.00	0.0	0.0
Saithe	<i>Pollachius virens</i>	599.3	18.73	184.0	8.8
Herring	<i>Clupea harengus</i>	3533.9	110.44	946.9	0.1
Gray sole	<i>Glyptocephalus cynoglossus</i>	0.6	0.02	0.6	0.6
Hagfish	<i>Myxine glutinosa</i>	0.1	0.00	0.1	0.1
Flounder	<i>Platichthys flesus</i>	0.2	0.01	0.2	0.2
Norway pout	<i>Trisopterus esmarki</i>	525.5	16.42	255.4	0.7
Lumpsucker	<i>Cyclopterus lumpus</i>	84.4	2.64	15.2	0.8
Lesser silver smelt	<i>Argentina sphyraena</i> *	0.2	0.01	0.2	0.2
Edible crab	<i>Cancer pagurus</i>	0.0	0.00	0.0	0.0
Starry ray	<i>Raja radiata</i>	0.0	0.00	0.0	0.0
Sandeels	<i>Ammodytes spp.</i>	0.2	0.01	0.1	0.1
Greater sandell	<i>Hyperoplus lanceolatus</i>	2.3	0.07	1.8	0.2
Cod	<i>Gadus Morhua</i>	79.8	2.49	24.4	0.1
Spiny stone-crab	<i>Lithodes maia</i>	0.0	0.00	0.0	0.0
Shrimp	<i>Pandalus spp., Crangon spp.</i>	84.3	2.63	57.4	26.9
Bullrout	<i>Myoxocephalus scorpius</i>	7.7	0.24	7.7	7.7

Table IIB.4.a Trawl length frequency composition by stratum and trawl station for the Acoustic Herring Survey R/V Dana Cruise July 2003

Length cm	Herring Strata/Station numbers																							Herring Total			
	570E06			570E08				580E06	580E08					C	D					E							
	190	354	368	456	585	600	1105	36	510	525	658	675	826	1005	752	770	840	925	990	1167	1183	1265	1293	1360	1445	1462	
7.5																						1					1
8																						2					2
9																						1					1
12.5																						1					1
14																									2		2
15																								7	14	6	27
15.5																											50
16																						5	27	1		17	86
16.5			1				5	2						2						1	45	25	39	63	33	62	86
17	3	2	1	1			12	3	2	3			1		3		1		3	60	69	84	126	89	106	95	
17.5	5	1		1	2		35	2	6	7	3	3	3	1	15	2	6		4	62	96	83	87	86	53	48	
18	11	1	5	4	6		45	2	10	11	7	2	6	1	27	3	9	1	8	35	60	27	29	27	17	7	
18.5	16	3		3	12		59	5	41	24	20	8	21	9	33	3	17		19	22	27	4	14	5	6	248	
19	35	16		1	12		44	5	65	24	24	8	23	10	35	4	19	2	37	5	5	3		4	1	328	
19.5	93	13		6	16		23	22	60	34	23	9	23	18	21	2	12		25	6	2	2	1	3	3	1	378
20	73	17	42	9	21		21	30	47	31	26	13	19	13	20	3	26		19	9	1	3		1	1	4	412
20.5	60	12	28	4	12		2	40	27	49	20	25	29	22	22	1	28		21	2			2	1	1	4	454
21	40	10	28	2	13	1	1	30	23	38	14	35	25	14	23	6	21		18	2	1					4	407
21.5	25	12	16	5	3			19	14	17	16	28	25	18	18	6	30		13								345
22	24	10	14	1	4			24	21	21	15	29	25	20	19	5	26		10								265
22.5	22	9	23	1	2			20	14	14	8	30	33	25	16	6	29		11								268
23	16	7	12	1	6			6	10	11	10	25	32	20	14	3	21		3								263
23.5	7	4	14		8			15	5	12	9	25	23	23	6	10	12		5	1							197
24	7	8	9	3	2			22	6	6	14	16	16	23	2	6	9		6								179
24.5	13	5	6		5			17	3	7	7	9	10	13	1	3	3		7	1							155
25	2	6	2	3	5			17	2	4	9	3	9	8	1		2		1								110
25.5	4	1	3	1	2			10	1	4	9	4	3	9			2		5								74
26	5	3	1		2			13	2	4	6	2	3	4			1										58
26.5	4	2	1					4		1	2	2	2	6			2										46
27	1		2					10		3	3	2	2	2			2										24
27.5					1			6		1	2	3		5			3	1	4								33
28									1	1	2			1	1	1			1								18
28.5	1		1					2			1	2		1					1								8
29			2		1			2						1		0											7
29.5	1							1		1																	6
31.5								2																			3
33.5			27																								2
34			35																								27
34.5			35																								35
Grand Total	468	143	307	46	135	1	247	329	360	328	250	281	333	268	277	64	279	4	221	255	286	257	354	253	270	264	6280

Table IIB.4.b Raised catch numbers and weights of herring by trawl station for the Acoustic Herring Survey R/V Dana Cruise July 2003

Station	36	190	354	368	456	510	525	585	600	658	675	752	770	826	840	925	990	1005	1105	1167	1183	1265	1293	1360	1445	1462	Total
Raised Catch Numbers	329	3683	250	836	123	1375	2018	135	2	413	637	2574	182	754	529	11	498	1263	3282	3894	17736	2271	27306	3231	1414	4028	78775
Raised Catch Weight in kg	30.53	270.89	19.67	71.13	8.31	90.66	150.07	9.59	0.10	34.40	52.80	166.43	16.50	59.96	39.60	0.68	37.50	116.71	173.01	173.21	696.43	84.46	946.91	109.20	45.18	130.02	3533.93

Table IIB.5a Numbers of herring by age, maturity, stock and sub area for the Acoustic Herring Survey R/V Dana Cruise July 2003

North Sea Autumn spawners.													
Abundance (Millions).....													
Stratum	0	1i	1m	2i	2m	3i	3m	4	5	6	7	8	9+
580E06	0.00	3.02	0.00	1.03	0.06	0.16	0.02	0.11	0.00	0.00	0.00	0.00	0.00
570E06	0.00	85.68	0.00	25.08	1.57	1.96	0.20	0.61	0.00	0.00	0.00	0.00	0.00
580E08	0.00	92.64	0.00	17.41	1.09	1.63	0.16	1.07	0.15	0.00	0.00	0.00	0.00
570E08	0.00	212.75	0.00	46.25	2.89	3.65	0.37	1.10	0.21	0.00	0.00	0.00	0.00
C	0.000	43.883	0.000	8.643	0.540	0.818	0.082	0.173	0.219	0.000	0.000	0.000	0.000
D	0.000	231.355	0.000	21.809	1.363	1.901	0.190	1.419	0.393	0.000	0.000	0.000	0.000
E	2.830	2774.691	0.000	7.131	0.446	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Baltic Sea Spring spawners													
Abundance (Millions).....													
Stratum	0	1i	1m	2i	2m	3i	3m	4	5	6	7	8	9+
580E06	0.00	0.12	0.00	4.81	0.01	2.38	0.09	3.22	1.28	0.27	0.26	0.13	0.02
570E06	0.00	3.25	0.00	89.84	0.27	30.92	1.15	27.02	10.03	1.92	1.08	0.83	0.08
580E08	0.00	3.83	0.00	68.75	0.21	36.14	1.35	34.08	11.92	1.62	1.19	0.56	0.06
570E08	0.00	8.43	0.00	163.14	0.49	60.69	2.26	51.52	19.44	3.32	1.40	1.41	0.09
C	0.000	1.751	0.000	36.055	0.109	22.800	0.849	14.991	4.796	0.610	0.258	0.115	0.000
D	0.000	13.439	0.000	79.791	0.240	44.211	1.646	41.405	14.429	1.526	1.497	0.595	0.000
E	0.000	1011.919	0.000	108.439	0.327	14.005	0.521	2.151	0.836	0.046	0.092	0.000	0.000

Table IIB.5b Mean weight of herring by age, maturity, stock and subarea for the Acoustic Herring Survey R/V Dana Cruise July 2003

North Sea Autumn spawners.													
Mean weights (g)													
Stratum	0	1i	1m	2i	2m	3i	3m	4	5	6	7	8	9+
580E06	0.000	55.583		68.714	68.714	107.335	107.335	128.883	0.000	0.000	0.000	0.000	0.000
570E06	0.000	53.791		66.404	66.404	89.704	89.704	124.239	0.000	0.000	0.000	0.000	0.000
580E08	0.000	51.728		65.835	65.835	97.373	97.373	135.491	164.524	0.000	0.000	0.000	0.000
570E08	0.000	51.827		65.530	65.530	91.206	91.206	123.141	164.524	0.000	0.000	0.000	0.000
C	0.000	50.290		67.853	67.853	89.187	89.187	116.997	164.524	0.000	0.000	0.000	0.000
D	0.000	45.079		64.508	64.508	93.533	93.533	137.427	164.524	0.000	0.000	0.000	0.000
E	5.203	35.190		51.249	51.249	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Baltic Sea Spring spawners													
Mean weights (g)													
Stratum	0	1i	1m	2i	2m	3i	3m	4	5	6	7	8	9+
580E06		52.515		71.763	71.763	90.922	90.922	115.886	122.997	139.150	181.966	155.350	173.520
570E06		51.911		69.634	69.634	86.277	86.277	107.472	113.275	134.237	159.534	154.647	173.520
580E08		50.679		72.279	72.279	88.368	88.368	111.861	120.911	118.564	137.568	136.193	173.520
570E08		50.064		69.809	69.809	87.136	87.136	106.567	114.671	128.225	133.744	148.168	173.520
C		49.425		74.234	74.234	88.536	88.536	97.867	110.349	101.536	111.361	106.131	0.000
D		41.943		72.521	72.521	88.524	88.524	112.351	122.798	111.579	133.879	135.596	0.000
E	0.000	35.158		55.920	55.920	66.936	66.936	100.661	100.252	110.102	110.102	0.000	0.000

Table IIB.5b Mean weight of herring by age, maturity, stock and subarea for the Acoustic Herring Survey R/V Dana Cruise July 2003

North Sea Autumn spawners.													
Mean lengths (cm)													
Stratum	0	1i	1m	2i	2m	3i	3m	4	5	6	7	8	9+
580E06	0.00	19.46		20.89	20.89	24.06	24.06	25.78	0.00	0.00	0.00	0.00	0.00
570E06	0.00	19.27		20.66	20.66	22.65	22.65	25.47	0.00	0.00	0.00	0.00	0.00
580E08	0.00	19.02		20.57	20.57	23.33	23.33	26.21	28.00	0.00	0.00	0.00	0.00
570E08	0.00	19.03		20.56	20.56	22.80	22.80	25.40	28.00	0.00	0.00	0.00	0.00
C	0.00	18.84		20.77	20.77	22.75	22.75	24.97	28.00	0.00	0.00	0.00	0.00
D	0.00	18.14		20.41	20.41	23.07	23.07	26.33	28.00	0.00	0.00	0.00	0.00
E	8.61	16.74		19.00	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Baltic Sea Spring spawners													
Mean lengths (cm)													
Stratum	0	1i	1m	2i	2m	3i	3m	4	5	6	7	8	9+
580E06		19.05		21.20	21.20	22.92	22.92	24.83	25.33	26.34	28.69	27.36	28.50
570E06		19.03		21.00	21.00	22.52	22.52	24.21	24.63	25.99	27.41	27.29	28.50
580E08		18.89		21.24	21.24	22.72	22.72	24.50	25.15	24.97	26.29	26.18	28.50
570E08		18.80		21.01	21.01	22.60	22.60	24.14	24.72	25.61	25.97	26.90	28.50
C		18.74		21.43	21.43	22.75	22.75	23.51	24.38	23.79	24.57	24.19	0.00
D		17.71		21.26	21.26	22.74	22.74	24.53	25.27	24.48	26.08	26.12	0.00
E	0.00	16.73		19.53	19.53	20.69	20.69	23.73	23.69	24.50	24.50	0.00	0.00

