APPENDIX IIB: Denmark

Acoustic Herring Survey report for RV "DANA"

23rd June2006 – 6th July 2006

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1. INTRODUCTION

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

The actual 2006-survey with R/V DANA, covering the Skagerrak and Kattegat, was conducted in the period June 25 to July 6 2006, while calibration was done during June 23 to June 25 .

2. SURVEY

2.1 Personnel

During calibration 23/6 – 25/6-2006

Bo Lundgren (cruise leader)	HFI
Torben Filt Jensen(assisting cruise leader)	ITT
Tommy Nielsen	ITT
Bo Tegen Nielsen	ITT
Martin Nielsen, technician trainee	
Jan Skriver, journalist	

During acoustic monitoring 25/6 - 6/7-2006

Bo Lundgren (cruise leader)	HFI
Karl-Johan Stæhr (assisting cruise leader)	HFI
Lotte Worsøe Clausen	HFI
Lise Sindahl	HFI
Helle Rasmussen	HFI
Sanne B.Ryle	HFI
Nina Fuglsang	HFI
Thyge Dyrnesli	ITT

HFI = Dept for Marine Fisheries, DIFRES, Denmark
ITT = Dept. of IT and Technical Support, DIFRES, Denmark
ADM = Administration Dept, DIFRES, Denmark

2.2 Narrative

R/V Dana left Hirtshals on June 23rd 2006 at 12.00 to perform transducer calibration in the Danish part of Kattegat and not as normally at Bornø in the Gullmar Fjord in Sweden. This because a mail with the application to get a permission to enter Swedish waters due to unknown technical reasons did not reach the contact person responsible for sending the applications to the authorities.

R/V Dana stopped outside Frederikshavn harbour on July 25th 2006 at 14.00 for exchange of scientific personnel and left again at 16.00 Danish local time (14.00 UTC) steaming towards the north-westerly corner of the survey area in the Skagerrak. The survey work (acoustic integration) started at the position 58º 08.15´ N 06º 14.99´ E in the north-western part of the Skagerrak. The western Skagerrak area was covered June 26 – June 30, eastern Skagerrak during June 30 – July 3 and Kattegat during July 4 – 6. Short stops were made just outside Hirtshals on July 1 and just outside Skagen on July 3 to change a crew member. Totally the survey covered about 1800 nautical miles mainly using data from the 38 kHz paravane transducer running at depths of 4 – 6 m depending on the sea state and sailing direction relative to the waves. Simultaneously data from the 120 kHz and 18 kHz echosounders using the hull-mounted transducers were also recorded. The quality of the latter data is strongly dependent on the weather conditions, but this year the weather was calm so only about a days time of data were unusable. During trawling hull-mounted transducers were used for all three frequencies. The acoustic integration ended north of Skagen at July 06 06.30 UTC on the position 57º 35.66´ N 09º 57.59´ E. Dana went to harbour in Hirtshals on July 11 2005 at 09.30 hour local time.

2.3 Survey design

The survey was carried out in the Kattegat and in the Skagerrak, east of 6° E and north of 56° N (Fig. IIB.1). The area is split into 7 sub-areas surveyed by Dana and one overlap area to be surveyed also by the Norwegian and German survey partners. This year the survey was started in the eastern Kattegat and ended in the western Skagerrak in order to reach the overlap area on June 10th at the same time as the other partners. In principal the survey is designed with parallel survey tracks at right angles to the depth lines with a spacing of 10-15 nm in the area west of 10°E. Due to limited time periods and places for fishing (late morning, early afternoon and immediately before and after midnight; limited amount of fishable positions for bottom trawl hauls) this structure cannot not be kept strictly. Along the Swedish coast the transects are planned as east-west transects with a spacing of 10 nm approximately at right angles to the coastline. In Kattegat the survey track was made in a zigzag way adapted to the depth curves and the relatively heavy ship traffic.

2.4 Calibration

The echo sounders were calibrated at two different locations in Kattegat during 24 - 25 June 2006. The calibration was performed accordingto the procedures established for EK60 with three frequencies (18, 38 and 120 kHz). This was the second calibration of the year, the previous one during a cruise to the Norwegian Sea in May. The calibration of the paravane split-beam transducer at 38 kHz was done against a 60 mm copper sphere at a position in Aalbæk Bugt (57° 36.77'N 10° 34.18'E). Calibration of the three hull-mounted split-beam transducers at 18, 38 and 120 kHz were carried out against 63mm, 60 mm and 23 mm copper spheres, respectively at a position just north of Læsø (57° 28.48'N 11° 03.72'E). The results were similar to the previous calibration earlier in the year, and for 38 kHz close to results from previous years. The calibration and setup data of the EK60 38 kHz used during the survey are shown in Table IIB.1.

2.5 Acoustic data collection

Acoustic data were collected using mainly the Simrad EK60 38kHz echosounder with the transducer (Type ES 38 7x7 degrees main lobe) in a towed body. The towed body runs at approx. 3 m depth in good weather and down to about 6 -7 m as needed depending on the weather conditions, this year mostly at 4 – 5 m. The speed of the vessel during acoustic sampling was 9 – 11 knots. Also EK60 18 kHz and 120 kHz data were collected, but has not been directly used for the survey estimate but as an aid when distinguishing between fish and plankton. Acoustic data were recorded as raw data on harddisk all 24 hours also during fishing operations, but data taken during fishing periods (usually two daytime hauls and two nighttime hauls (the latter immediately before and after local midnight)) are not used for the biomass estimate. The sampling unit (ESDU) was one nautical mile (nm). For the purpose of the later judging process raw data is also pre-integrated into 1 m meter samples for each ping. These samples stored in separate files one for each ESDU. Integration is conducted from 3 m below the transducer to 1 m above the bottom or to max 300 m depth. During trawl hauls the towed body is taken aboard and the EK60 38 kHz echosounder run on the hull transducer.

2.6 Biological data - fishing trawls

Trawl hauls were carried out during the survey for species identification. Pelagic hauls were carried out using a FOTÖ trawl (16 mm in the codend) while demersal hauls (Fig. IIB.2) were carried out using an EXPO trawl (16 mm in the codend). Trawling was carried out in the time intervals 1000 to 1600 and 2200 to 0300 UTC (Table IIB.2), usually two day hauls (mostly demersal and two night hauls (mostly surface or midwater). The strategy was to cover most depth zones within each geographical stratum (see Fig. IIB.2). In the deeper areas midwater hauls were made to help identify the largest depth at which herring would be expected. 1 hour hauls were used as a standard during the survey, but sometimes shortened if the catch indicators indicated very large catches.

The fish caught were sorted into species groups and length groups within each species. Number of individuals and weight for each length group for each species was recorded with emphasis on pelagic species. The clupeid fish were measured to the nearest 0.5 cm total length below, other fish to 1 cm, and the weight to the nearest 0.1g wet weight. In each trawl haul 10 (if available) 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. 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.2.

2.8 Data analysis

The raw data is preintegrated into 1m samples for each ping and and divided into 1 mile datasets and stored on harddisk as files. Scrutiny of the acoustic data is done for a fixed set of layers (3-6 m, 6- 10, 10 – 20 and so on) for each mile, using special judging software. It allows deleting layers and/or intervals with interference from wave- or ship wake-bubbles or rarely with bottom-integration. In areas with heavy abundance of jellyfish or zooplankton, usually krill, manually adjustable thresholds is 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):

Herring TS = 20 log L – 71.2 dB
Sprat TS = 20 log L – 71.2 dB
Gadoids TS = 20 log L – 67.5 dB
Mackerel TS = 20 log L – 84.9 dB

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 of 1 nm (ESDU's) 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

35 hauls were conducted (24 surface hauls, 2 mid water hauls, one of which was unsuccessful, and 10 bottom hauls (Figure IIB.2 and Tables IIB2 and IIB.3.). The total catch was 18 tons of which about 2.2 tons were jellyfish. Herring was present in 30 of the hauls and a total catch of about 2800 kg was taken during the survey. In only one haul herring was present below 150 m depths. Noticable amounts of sprat were caught in two hauls in the southwestern Skagerrak and relatively large amounts in 8 hauls in Kattegat a total of 4100 kg for the whole survey. Mackerel was also present in many (24) of the hauls distributed over the survey area. Otherwise jellyfish and other invertebrates (krill, shrimp, Norway lobster) were the most common among the remaining species.

Based on maturity analysis of frozen single fish samples from each haul, where micro-structure analysis of the otoliths was used to differentiate between North Sea herring and Western Baltic herring, the maturity by age key was made for both races is given in the text table below. North

Sea autumn spawners at maturity stage 3 and up and spring-spawners at maturity state 2 and up have been considered as mature. The following constants have been used to split the catch.

North Sea autumn spawners:

WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8
%	100	100	0	93	7	100	0	-	-	100	100	100	100

Spring spawners:

WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6i	7	8	9+
%	100	99	1	97	3	86	14	80	20	100	100	100	100	100

Figure IIB.4.a shows the length-weight relations for various age groups an the average for the two races based on the single fish data. The trendline estimates are based on the points of the average relations. Figure IIB.4.b shows the length-weight relations for sprat.

Table IIB.4.a shows the size distribution and total number of herring in each trawl haul based on the total catch for small catches or on subsamples raised to total catch for large samples. Table IIB.4.b shows the corresponding total catches.

3.3 Biomass estimates

The total herring biomass estimate for the survey is 567,000 tonnes of which 27.0 % or 153,000 tonnes is North Sea autumn spawning herring and 73,0 % or 414,000 tonnes is spring spawning herring.

The estimated total number of herring, mean weight and mean length per age and maturity group in each of the surveyed strata for the two herring stock components in the are given in Table IIB.5.a, b, and c. Stratum 560E06 is the overlap area and the others together is the standard Danish survey area.

Figures IIB.5.a and b show plots of the estimated number of either autumn spawning or spring spawning herring per stratum and and the total.

Stratum overview Acoustic Herring Survey R/V Dana Cruise 042005 July 2005

Stratum Nr	Stratum ID	Area Nm^2	Number of logs	Hauls in stratum	Hauls from neighbour strata	Total hauls used	Mean Sa	Mean TS
3	580E06	209	5	0	4	4	31.29948	-47.3408
4	570E06	3600	303	7	3	10	192.0751	-47.40157
5	580E08	1822	95	4	1	5	62.3704	-43.64462
6	570E08	3406	320	3	5	8	115.337	-44.97896
7	C	988	82	4	2	6	132.4637	-41.16075
8	D	1837	184	4	6	10	186.8298	-41.36337
9	E	5228	349	8	0	8	229.1694	-48.22463
10	42F6	995	47	1	0	0	103.1449	-47.65321

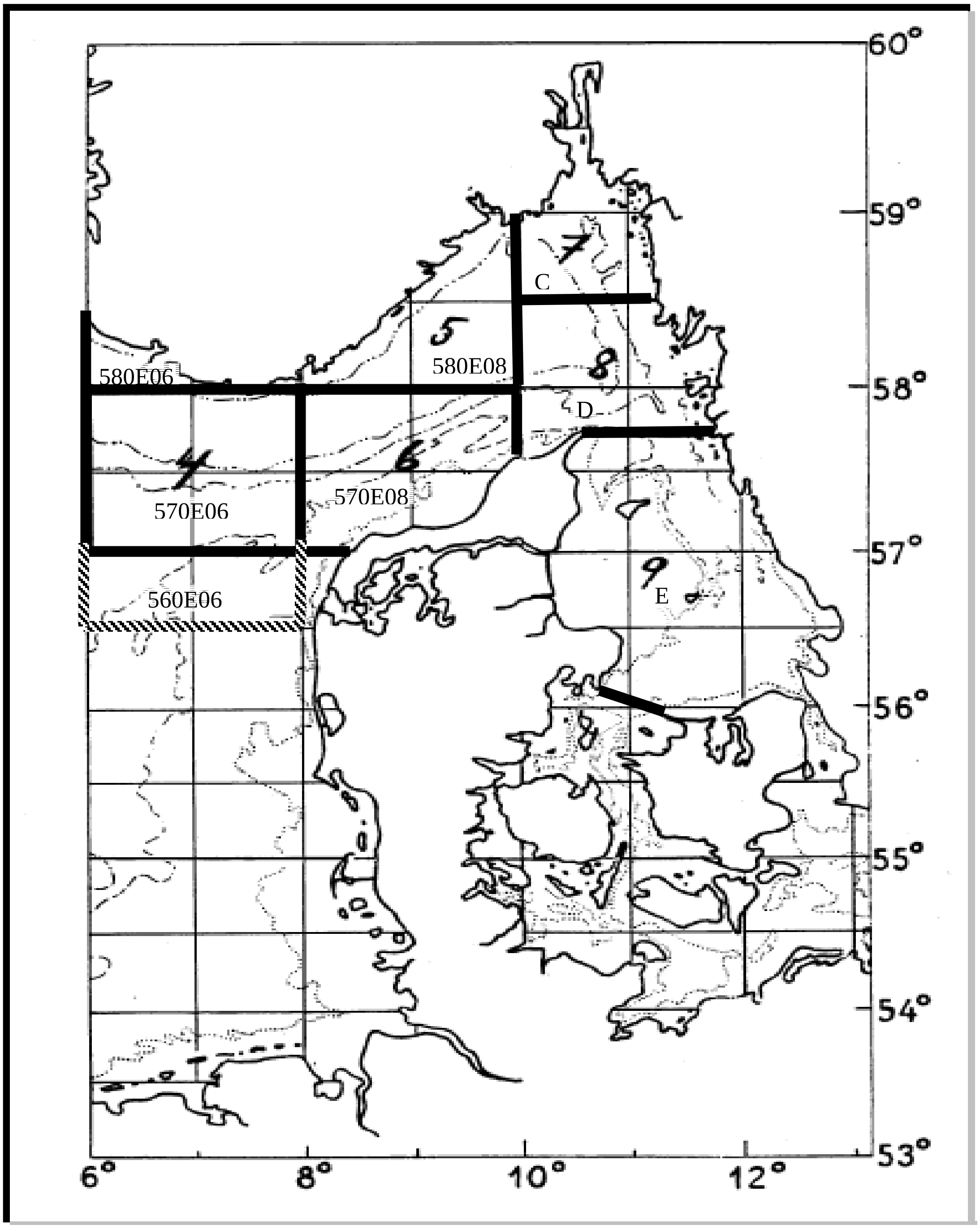


Figure IIB.1. Map of the eastern North Sea, Skagerrak and Kattegat showing the sub areas used in the estimation during the June-July 2006 Danish acoustic survey of R/V Dana.

Cruise track and stations during the Acoustic Herring Survey R/V Dana Cruise 052006 July 2006

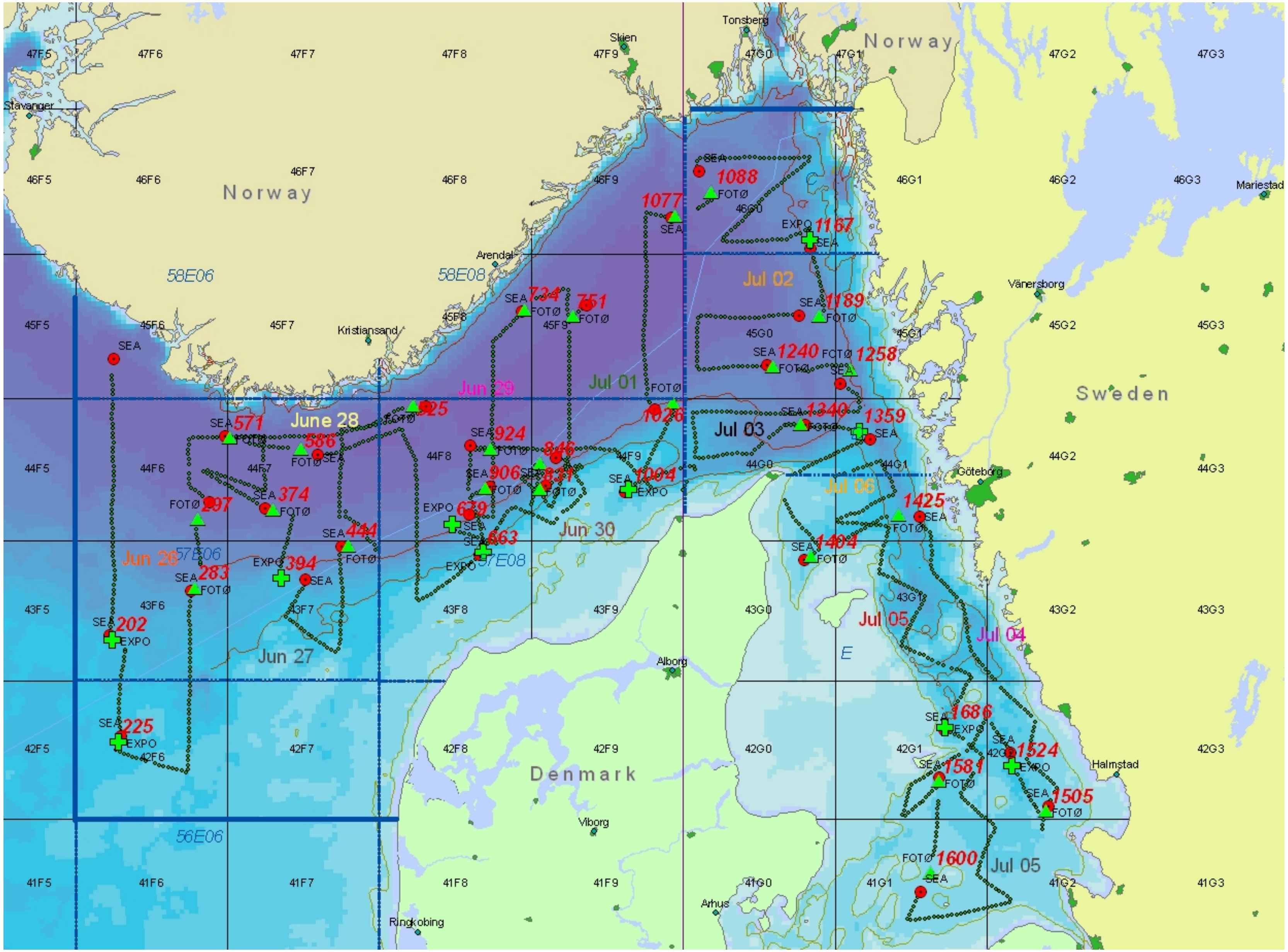


Figure IIB.2. Map of the eastern North Sea, Skagerrak and Kattegat showing cruise track, the location of stations (trawl hauls and CTD stations) during the June - July Danish acoustic survey (Fotö hauls ▲ are pelagic and Expo hauls ╬ are generally demersal, Red numbers are haul IDs indicating cumulative sailed distance along the track in nm).

Bathymetry from: The MAST project DYNOCS MAST II contract No MAS2-CT94-0088

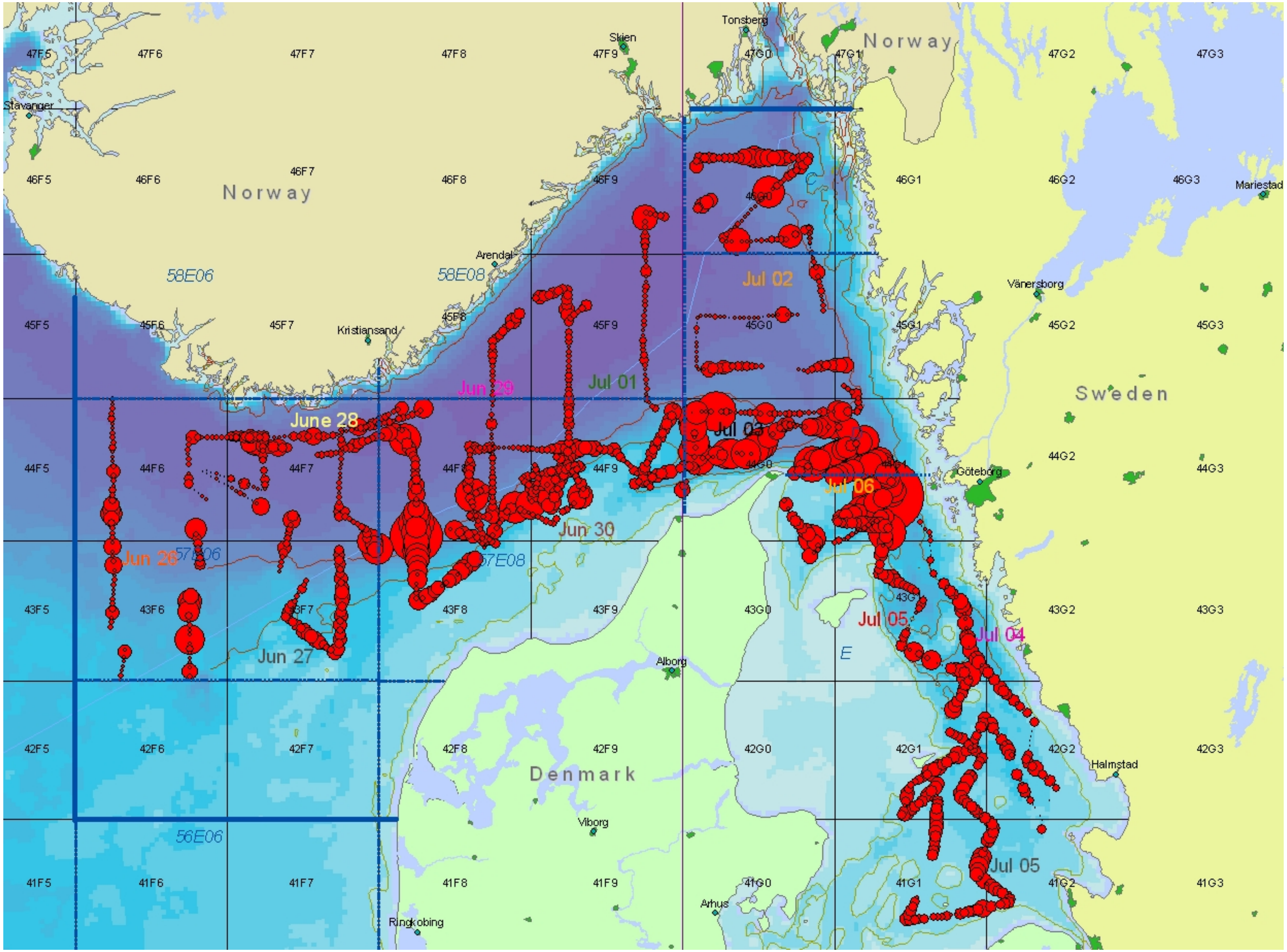
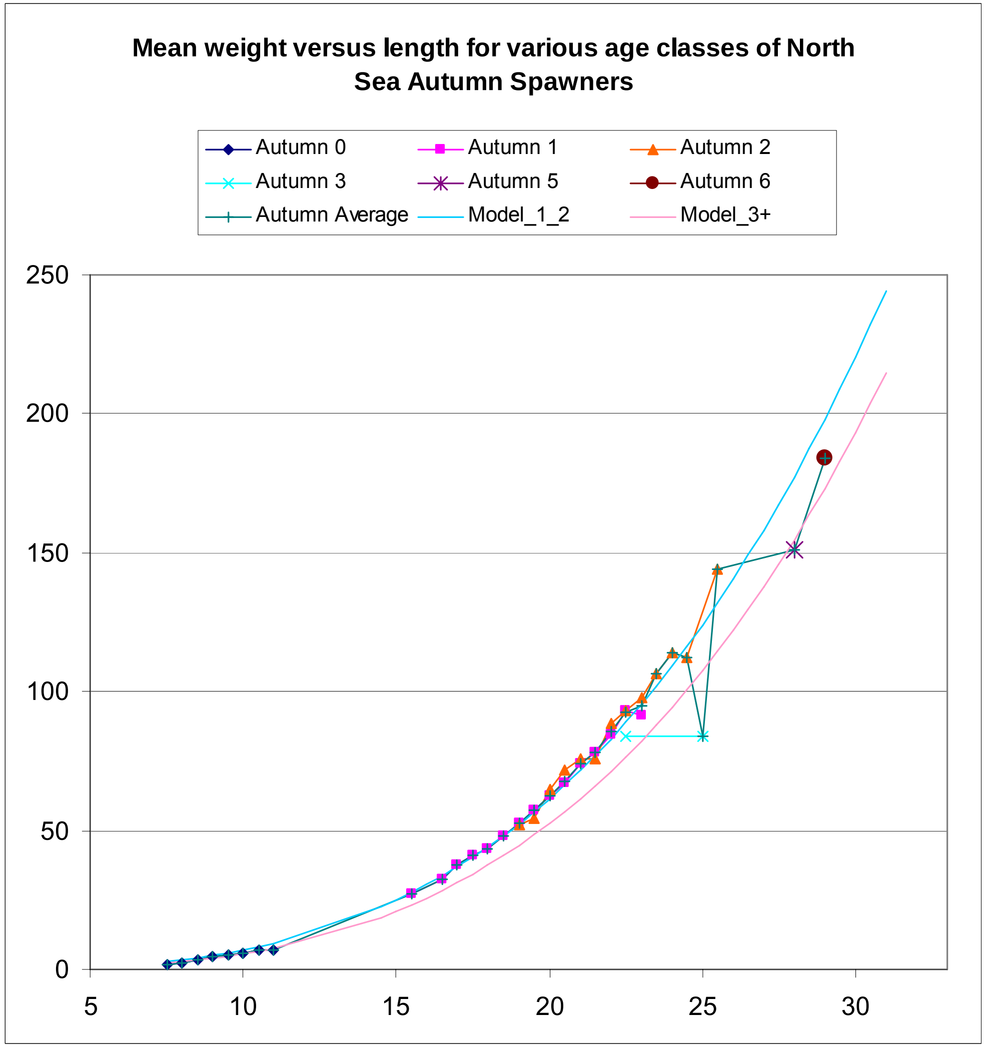


Figure IIB.3.b Relative herring density (in numbers per nm²) along the track of the June-July 2006 Danish acoustic survey in the eastern North Sea, Skagerrak and Kattegat. Red circles indicate relative density of herring per ESDU (1 nm).



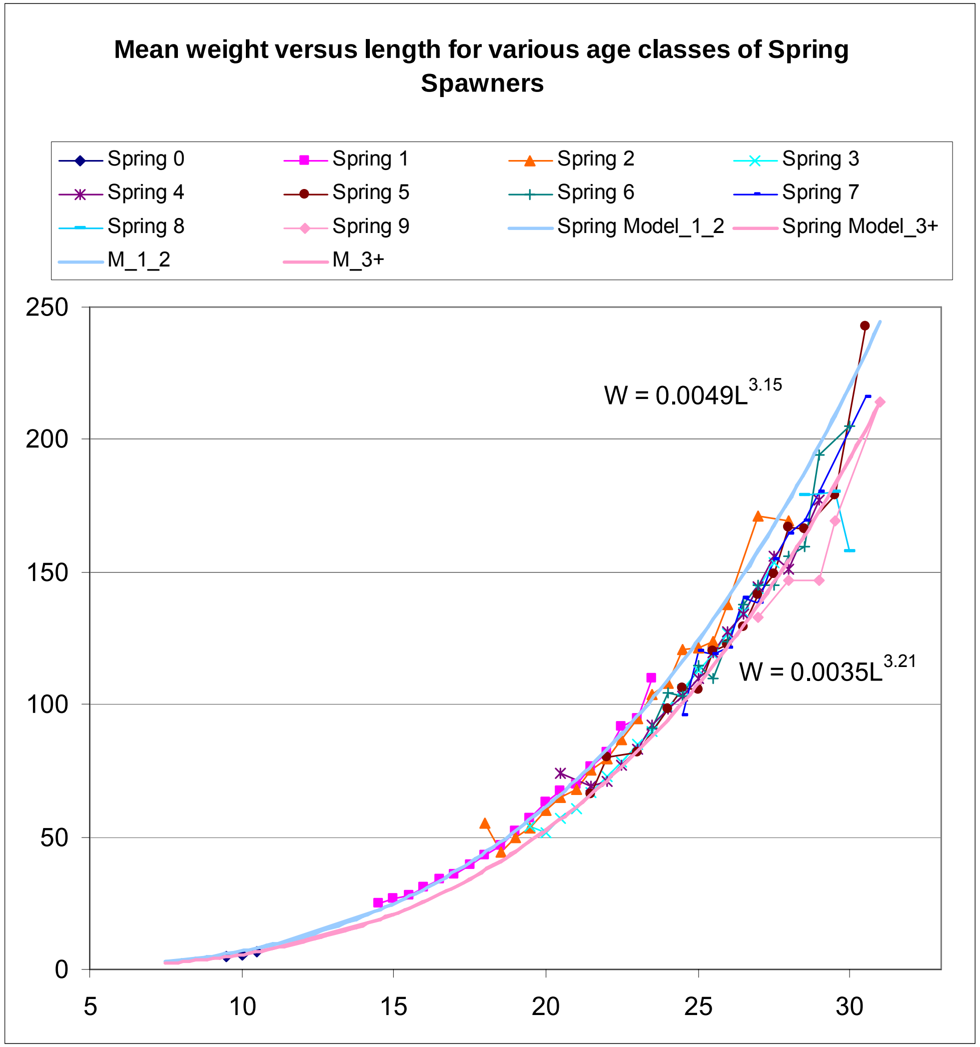


Figure IIB.4.a Length weight relationship by winter ring numbers for herring from the June - July 2006 Danish acoustic survey.

Figure IIB.4.b Length weight relationship by winter ring numbers for sprat from the June - July 2006 Danish acoustic survey.

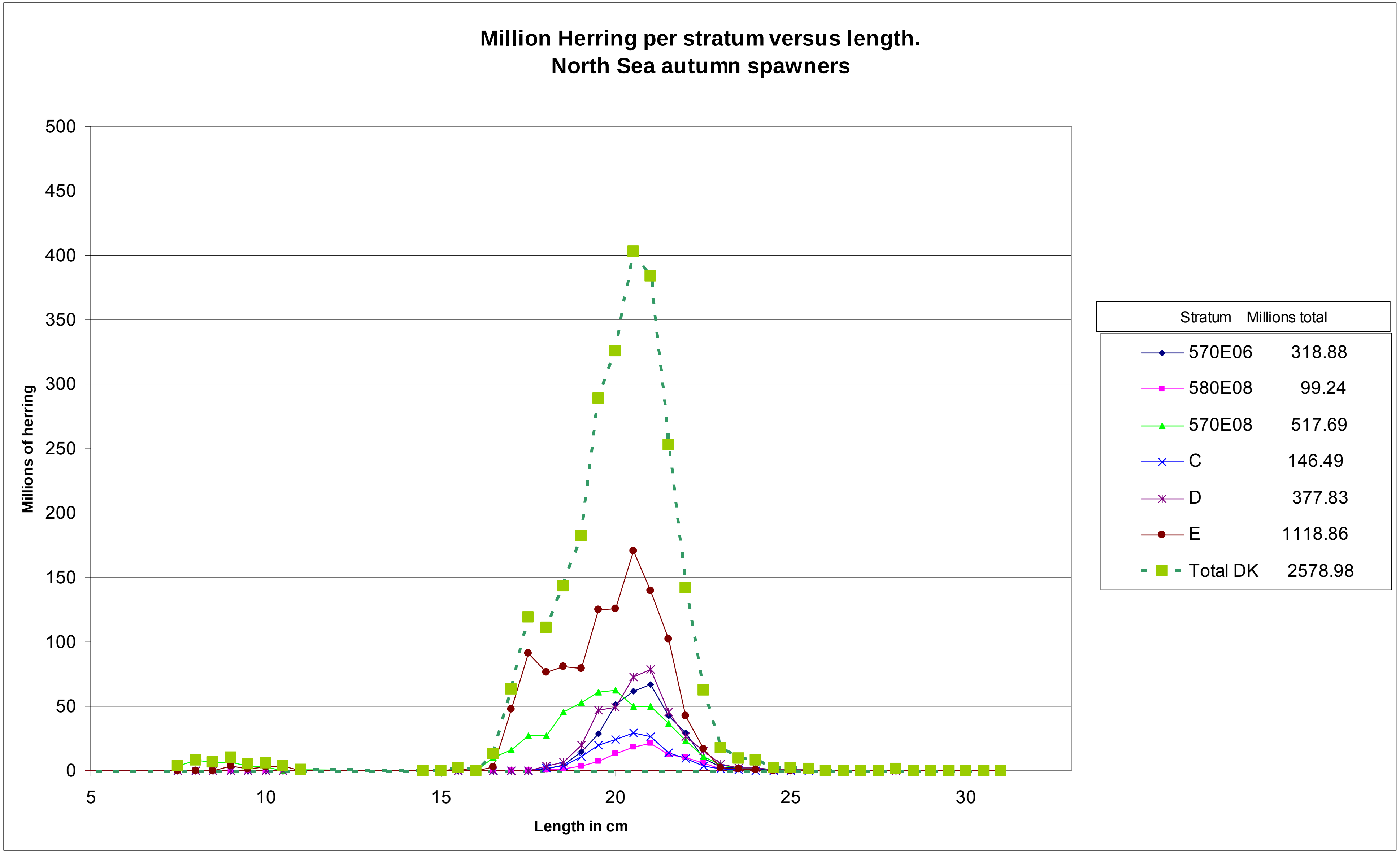


Figure IIB.5.a Estimed number of herring per length group in various strata from the July 2006 Danish acoustic survey.

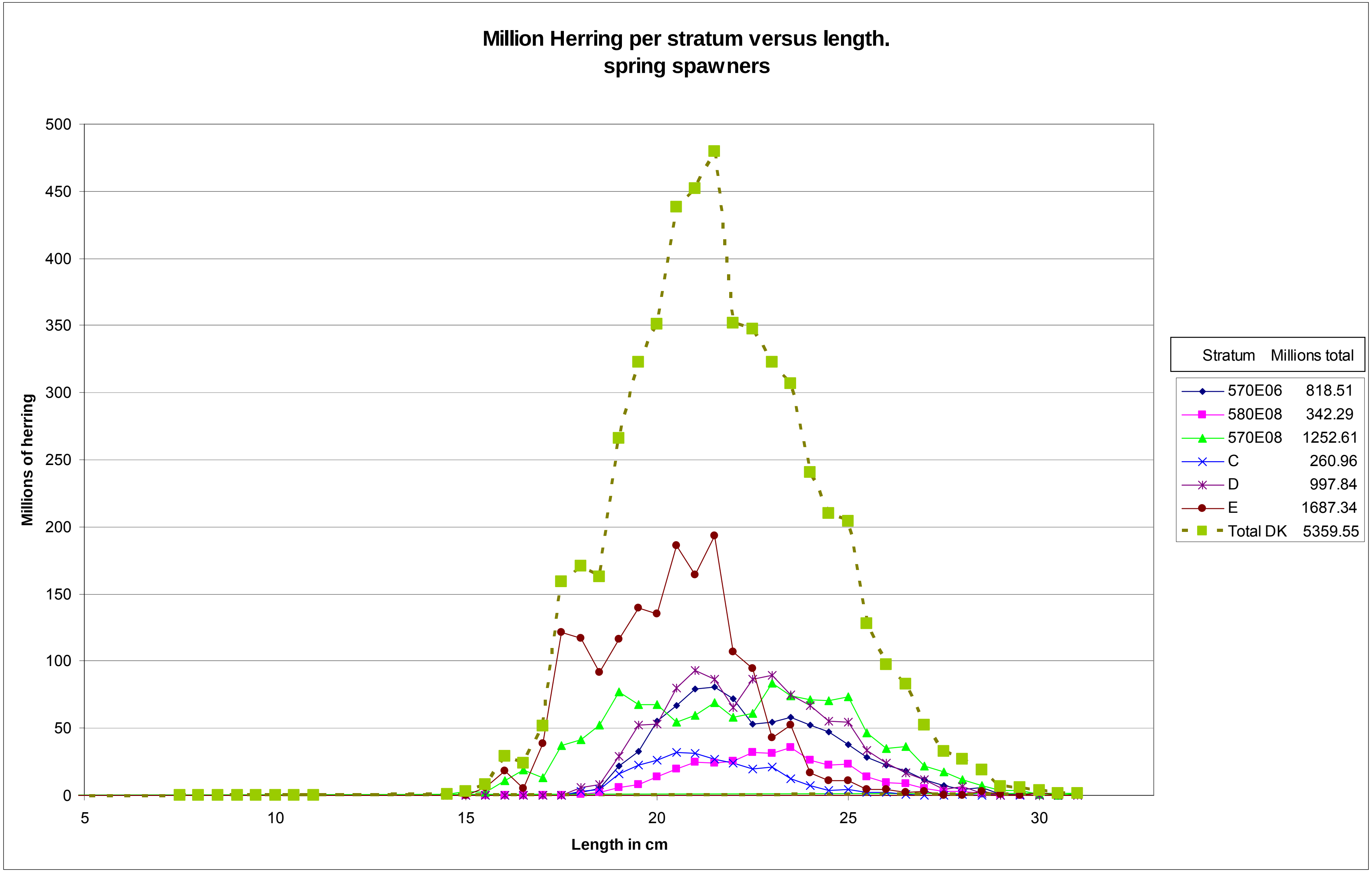


Figure IIB.5.b Estimed number of herring per length group in various strata from the June - July 2006 Danish acoustic survey.

Table IIB.1. Simrad EK60 and analysis settings used during the the Acoustic Herring Survey R/V Dana Cruise July 2006

Transceiver Menu	
Frequency	38 kHz
Sound speed	1495 $m.s^{-1}$
Max. Power	2000 W
Equivalent two-way beam angle	-20.5 dB
Default Transducer Sv gain	24.65 dB
3 dB Beamwidth	6.8°
Calibration details	
TS of sphere	-33.6 dB
Range to sphere in calibration	9.20 m
Measured NASC value for calibration	24941 m^2/nmi^2
Calibration factor for NASCs	1.00
Absorption coeff	9.872 dB/km
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	7 - 9 m
Range of thresholds used	-70 dB

Table IIB.2. Trawl hauls during the Acoustic Herring Survey R/V Dana Cruise June-July 2006

Haul Nr	Haul ID	Date Time UTC	Sun Time	ICES Square	Lat N	Long E	Trawl Type	Bottom depth m	Wire Length m	Door distan-ce m	Haul dura-tion m	Catch weight kg	Herring weight kg	Raising ratio	Raised herring kg	Main species	Trawl speed kn	Trawl Dir deg	Wind Speed m/s	Wind Dir deg	Sea State Bf
1	202	01-02-06 10:54	11:19	43F6	57.07.179	006.19.057	Expo	67			60	75				Dab, Whiting	3.2	127	6		3
2	225	26-06-06 14:43	15:08	42F6	56.46.838	006.17.111	Expo	49			30	34				Cod, Large Medusa	3	213	7		3
3	283	26-06-06 21:39	22:06	43F6	57.19.936	006.47.205	Fotö	98			60	835				Herring, Mackerel	4	14	5		2
4	297	27-06-06 00:22	00:50	44F6	57.34.472	006.48.526	Fotö	268			60	882				Mackerel, Herring, Blue whiting	4.1	26	6		3
5	374	27-06-06 10:49	11:18	44F7	57.36.576	007.18.498	Fotö	296			60	12				Large Medusa, Saithe	3.6	101	9		3
6	394	27-06-06 13:51	14:21	43F7	57.21.965	007.21.468	Expo	80			73	20				Haddock, Saithe	3.4	88	11		4
7	444	27-06-06 21:05	21:36	43F7	57.28.848	007.48.015	Fotö	157			60	1930				Mackerel, Herring	3.8	98	13		5
8	525	28-06-06 14:24	14:57	44F8	57.58.403	008.13.650	Fotö	522			59	150				Herring, Mackerel, Large Medusa	2.7	89	5		4
9	571	28-06-06 21:12	21:40	44F7	57.51.729	007.01.001	Fotö	429			60	1776				Mackerel, Herring	3	105	13		6
10	586	29-06-06 00:19	00:49	44F7	57.49.302	007.29.353	Fotö	471			60	380				Mackerel, Herring, Large Medusa	3.2	104	11		5
11	663	29-06-06 10:24	10:59	43F8	57.27.455	008.41.240	Expo	38			54	92				Large Medusa	3.4	57	7		3
12	679	29-06-06 13:24	13:58	44F8	57.33.571	008.28.947	Expo	101			61	1565				Norway Pout, Saithe	3.3	65	7		3
13	734	29-06-06 21:11	21:47	45F9	58.18.560	008.57.445	Fotö	425			60	400				Mackerel, Herring, Large Medusa	3.1	41	7		3
14	751	30-06-06 00:17	00:54	45F9	58.17.172	009.16.681	Fotö	570			60	1219				Mackerel, Herring, Whiting	3.5	52	5		3
15	831	30-06-06 10:32	11:09	44F9	57.40.829	009.03.716	Fotö	66			60	60				Herring, Large Medusa	3.6	213	4		1
16	846	30-06-06 13:12	13:48	44F9	57.46.290	009.03.781	Fotö	110			59	0				0	3.7	76	5		1
17	906	30-06-06 21:09	21:44	44F8	57.41.159	008.42.181	Fotö	158			59	1135				Mackerel, Herring	3.7	255	7		2
18	924	01-07-06 00:13	00:48	44F8	57.49.407	008.44.287	Fotö	438			60	502				Mackerel, Herring, Large Medusa	4	277	7		2
19	1004	01-07-06 10:44	11:23	44F9	57.40.822	009.38.876	Expo	41			60	285				Herring	2.9	48	4		1
20	1026	01-07-06 14:08	14:47	44F9	57.59.137	009.56.254	Fotö	97			60	172				Herring, Large Medusa	3.9	247	4		1
21	1077	01-07-06 21:09	21:49	46F9	58.37.988	009.56.990	Fotö	449			59	445				Mackerel, Herring, Large Medusa	3.7	77	3		0
22	1088	02-07-06 00:15	00:55	46G0	58.42.865	010.11.533	Fotö	253			60	505				Mackerel, Herring, Large Medusa	4.1	331	3		1
23	1167	02-07-06 10:41	11:24	46G0	58.32.963	010.50.314	Expo	84			40	148				Invertebrates, Herring	3	13	2		0
24	1189	02-07-06 14:08	14:52	45G0	58.17.270	010.54.201	Fotö	146			60	236				Herring, Large Medusa, Mackerel	3.7	269	2		0
25	1240	02-07-06 21:15	21:57	45G0	58.06.753	010.35.690	Fotö	216			59	355				Mackerel, Large Medusa, Herring	4	97	4		0
26	1258	03-07-06 00:17	01:01	45G1	58.06.103	011.06.406	Fotö	126			59	666				Herring, Mackerel, Large Medusa	3.6	216	5		0
27	1340	03-07-06 10:34	11:17	44G0	57.54.525	010.46.863	Fotö	152			60	108				Large Medusa, Herring	3.4	273	5		1
28	1359	03-07-06 13:41	14:25	44G1	57.53.136	011.09.863	Expo	59			59	128				Herring, Whiting, Invertebrates	2.6	134	3		1
29	1404	03-07-06 21:10	21:53	43G0	57.26.577	010.50.663	Fotö	40			60	550				Large Medusa, Herring	3.9	51	3		0
30	1425	04-07-06 00:37	01:22	44G1	57.35.399	011.25.267	Fotö	68			60	924				Mackerel, Large Medusa, Herring	4	102	4		1
31	1505	04-07-06 10:31	11:20	42G2	56.31.739	012.23.709	Fotö	30			59	385				Large Medusa, Herring	4	196	2		1
32	1524	04-07-06 13:49	14:37	42G2	56.41.714	012.10.061	Expo	42			59	66				Invertebrates, Cod	2.6	292	2		1
33	1581	04-07-06 20:58	21:45	42G1	56.38.201	011.41.234	Fotö	32			60	306				Large Medusa, Sprat, Herring, Mackerel	4	182	4		0
34	1600	05-07-06 00:20	01:07	41G1	56.18.172	011.38.159	Fotö	27			60	225				Large Medusa, Mackerel	4.5	208	7		2
35	1686	05-07-06 10:32	11:19	42G1	56.49.938	011.43.959	Expo	49			60	1698				Sprat	2.8	19	4		2

Table IIB.3. Trawl haul species composition in kg during the Acoustic Herring Survey R/V Dana Cruise June-July 2006

Station	202	225	283	297	374	394	444	525	571	586	663	679	734	751	831	846	906
ICES sq.	43F6		43F6	44F6	44F7	43F7	43F7	44F8	44F6	44F7	43f8	44F8	45F8	45F9	44F9	44F9	44F8
Gear	Expo	Expo	Fotö	Fotö	Fotö	EXPO	Fotö	Fotö	Fotö	Fotô	EXPO	EXPO	Fotö	Fotô	Fotö	Fotö	Fotö
Fishing depth	Bottom	Bottom	Surface	Surface	150-165	Bottom	Surface	Surface	Surface	Surface	Bottom	Bottom	Surface	Surface	Surface	60-70	Surface
Total depth	67	49	63	268	296	80	157	522	431	471	38	101	425	570	66	110	158
Day/Night	D	D	N	N	D	D	N	D	N	N	D	D	N	N	D	D	N
Total catch	75	34	835	882	12	20	1,930	150	1,776	380	92	1,565	400	1,219	60	0	1,135
Scomber scombrus			357.9	353	0.7		1240.6	41.6	1267.8	225.3			261.9	812.7	4.3		658.1
Clupea harengus			468.9	344.9		0.2	633.4	82.6	465.2	85.5	0.1	0.9	96.6	363.2	30.2		423.7
Medusa, spp	0.5	4.8		52.6	8.4		28.9	22.9	36.9	54.6	91.1		38.1	33.4	24.5		46.5
Sprattus sprattus															0.1		
Trisopterus esmarki	6.7	0.1										1414.4					
Inv	0.3	0.3				2.6						17.7					
Micromesistius poutassou				118.8						14.7							
Merlangius merlangus	11.8	0.2							0.1		0.2	16.5	0.1		0.1		
Pollachius virens	2.3				3	2.8						80.4					3.5
Limanda limanda	33	9.2										9.9					
Belone belone			1.5	1.1		3.8	15.5	2.5	5				1.3	0.6	0.2		2.4
Cyclopterus lumpus			1.3	11.5		1.3	9.7	0.1	0.9			0.8	1.7	8.1			
Gadus Morhua	5.1	13.1				0.7						10.2					
Melanogrammus aeglefinus	3.5	0.4				6.9					0.1	10.6		0.1			
Trachinus draco																	
Merluccius merluccius	3.4											0.2					
Hippoglosides plattessoides	1.6	0.5															
Entelurus aequoreus	0.7		2.9	0.1	0.1		1.9	0.3	0.2				0.2	0.1	0.5		0.8
Pleuronectes platessa	1.3	1.5				0.6						0.9					
Loligo spp.	2.6		0.9			0.4					0.3			0.7			
Trigala spp.	1.3	1.5	1.5			0.2					0.3				0.2		
Trachurus trachurus																	
Microstomus kitt	0.1	1.5				0.5						1					
Glyptocephalus cynoglossus												1.6					
Hyperoplus lanceolatus		0.7															
Pollachius pollachius																	
Engraulis encrasicolus															0.1		
Ammodytes xx		0.2															
Oncorhynchus mykiss, Salmo gairdneri																	

Table IIB.3. Trawl haul species composition in kg during the Acoustic Herring Survey R/V Dana Cruise June-July 2006 (continued)

Station	924	1004	1026	1077	1088	1167	1189	1240	1258	1340	1359	1404	1425	1505	1524	1581	1600	1686	Total
ICES sq.	44F8	44F9	44F9	46F9	46G0	46G0	45G0	45G0	45G1	44G0	44G1	43G0	44G1	41G2	42G2	42G1	41G1	42G1	
Gear	Fotö	EXPO	Fotö	Fotö	Fotö	EXPO	Fotö	Fotö	Fotö	Fotö	EXPO	Fotö	Fotö	Fotö	Expo	Fotö	Fotö	Expo	
Fishing depth	Surface	Bottom	Surface	Surface	Surface	Bottom	Surface	Surface	Surface	Surface	Bottom	Surface	Surface	Surface	Bottom	Surface	Surface	Bottom	
Total depth	438	41	97	449	253	84	146	216	126	152	59	40	68	30	42	32	27	49	
Day/Night	N	D	D	N	N	D	D	N	N	D	D	N	N	D	D	N	N	D	
Total catch	502	285	172	445	505	148	236	355	686	108	128	550	924	385	66	306	225	1,698	18284.6
Scomber scombrus	258.5		7.8	226.7	223		12.6	151.6	138.4	1.8		8.4	772.1			32	58	1	7115.8
Clupea harengus	127.9	176.5	90.3	143.5	150.9	31.4	171.1	64.5	415.3	11.4	52.1	98	64.6	1.1		46.6	5.6	28.1	4674.3
Medusa, spp	84.9		71.8	67.6	128.5		48	124.1	126.9	93.1		426.1	68.5	383.4		146.9	146.4	191.4	2550.8
Sprattus sprattus						0.1						0.3			0.3	64.2	1.8	1429.1	1495.9
Trisopterus esmarki						5.3					1.5								1428
Inv		21.6				90.8					15.3				40.5				189.1
Micromesistius poutassou	20																		153.5
Merlangius merlangus	0.1	30.8		0.6		5.7				0.2	40.3	0.1			2.8			29.7	139.3
Pollachius virens						0.2		3.5			0.5								96.2
Limanda limanda		14.4				0.5												12.9	79.9
Belone belone	6.6			0.5	0.1			4.1	5	0.2		9	17.1			0.2	0.3		77
Cyclopterus lumpus	2.9		1.8	5.8	2.6		4	7.2	0.3	1	1.5		0.2		3.7	0.9	2.1	1.6	71
Gadus Morhua		4.6				2					7.3				14.7			0.9	58.6
Melanogrammus aeglefinus		18.3		0.1		1.5					1.4				0.9				43.8
Trachinus draco												5		0.5		15.3	10.7	2.2	33.7
Merluccius merluccius		14.8									2.2				0.2				20.8
Hippoglosides plattessoides						5.1					4.3				0.7				12.2
Entelurus aequoreus	0.3		0.3	0.3			0.3	0.1		0.3									9.4
Pleuronectes platessa		0.5				0.2					0.9				2.2			0.9	9
Loligo spp.	0.9	1				0.5													7.3
Trigala spp.		1.6													0.1	0.1			6.8
Trachurus trachurus												3	1.4						4.4
Microstomus kitt		0.9				0.1					0.2								4.3
Glyptocephalus cynoglossus																			1.6
Hyperoplus lanceolatus												0.2							0.9
Pollachius pollachius											0.5								0.5
Engraulis encrasicolus														0.1					0.2
Ammodytes xx																			0.2
Oncorhynchus mykiss, Salmo gairdneri																	0.1		0.1

Table IIB.4.a Raised length frequency composition by stratum and trawl station for the Acoustic Herring Survey R/V Dana Cruise July 2006

Stratum	570E06						570E08								580E08		C			D					E						
Station	283	297	394	444	571	586	525	663	679	831	906	924	1004	1026	734	751	1077	1088	1167	1189	1240	1258	1340	1359	1404	1425	1505	1581	1600	1686	
ICES Sq	43F6	44F6	43F7	43F7	44F7	44F7	44F8	43F8	44F8	44F9	44F8	44F8	44F9	44F9	45F8	45F9	46G0	46G0	46G0	45G0	45G0	45G1	44G0	44G1	43G0	44G1	41G2	42G1	41G1	42G1	
length\Gear	Fotø	Fotø	Expo	Fotø	Fotø	Fotø	Fotø	Expo	Expo	Fotø	Fotø	Fotø	Expo	Fotø	Fotø	Fotø	Fotø	Fotø	Expo	Fotø	Fotø	Fotø	Fotø	Expo	Fotø	Fotø	Fotø	Fotø	Fotø	Expo	Total
75										10																					10
80										21																					21
85										17																					17
90										18															17						35
95										10															7						17
100										7															15						22
105																									20						20
110										1																					1
145													5																		5
150													26																		26
155										3			21															2		10	35
160										3			98															2		30	133
165										44			124												7			2		10	187
170										26			192												23			6	4	111	362
175				22						62	15		393					6		6					149	2		6	6	274	941
180				109			6			102	29		243				28		17			20			453			2	4	152	1164
185				240	58		12	1	19	120	87	11	362		6			64	22	6		20		25	513	12		7	5	51	1640
190	110			960	73	12	35			135	102	5	362		12		39	121	66	90		99		48	410	39		28	12	20	2779
195	219	16		1636	175	3	58			55	146	22	331		18		101	153	110	102	4	138	4	133	189	60	1	61	18	10	3763
200	904	33		1353	570	59	75			16	394	103	207	7	55	56	180	223	99	152	2	335		103	83	74	2	73	18		5174
205	1096	33		1134	906	108	69			13	277	103	124	3	42	160	315	338	66	254	7	730	9	180	46	97	2	171	16	10	6310
210	1287	99		938	1111	86	118			5	262	124	5	34	52	272	247	344	39	412	4	1381	13	145	33	111	2	134	11	10	7281
215	876	280		982	731	89	72			3	364	108		51	52	240	186	217	22	321	11	1026	13	76	10	100	5	86	8	10	5939
220	630	247		393	643	114	66				364	87		51	61	232	135	267		293	18	474	15	23	13	79	2	81	1		4289
225	219	198		262	322	56	83				248	65	5	51	100	384	96	127	11	197	51	474	22	19	3	100	1	33	3		3129
230	82	132		196	278	96	72			3	262	119		82	70	184	146	108	6	164	75	335	12	7	10	51		15	2		2506
235	82	346		65	161	62	89				175	81		85	115	272	107	51		85	79	118	12	5		30	1	15	1		2038
240	55	429		87	161	52	46			3	219	92		92	118	136	56	19		79	97	99	6	2		32		2			1881
245	55	313		65	146	46	58				335	70		71	73	160	62	25		23	99	79	5	2	3	14		6			1711
250	55	313		44	102	40	26			3	204	76		129	67	96	51	6		23	60	20	3	4	3	16		2			1341
255		214		44	58	34	32				175	59	5	51	33	112	22	6		17	46		5			9					924
260	27	148		22	88	28	20				146	54		34	27	48	34			6	33		3			7		2			727
265	27	148		87	15	19	12			3	146	49		41	30	48	11				11		3			5					654
270	27	82		22	15	9	14				102	27		20	12	32					11	20	2	4		2					402
275		49		44	15	9	6			3	117	22		10	21	8				6	7										315
280	27	33		22		3	3				44	11		20	9		11	6			2		1								193
285		66				3	6			3	44	5		3	3	16					2					7					158
290			1			3					15	16			6	8										2					51
295	27										29	5		3																	65
300												5						6								5					16
305		16													3																20
310											29																				29
Total	5807	3198	1	8726	5627	932	976	1	19	686	4329	1320	2505	841	986	2464	1827	2089	457	2234	620	5366	128	774	2009	854	16	733	109	699	56333

Table IIB.4.b Raised catch weights of herring by trawl station for the Acoustic Herring Survey R/V Dana Cruise July 2006

Stratum	570E06						570E08								580E08		C			D					E						
Station	283	297	394	444	571	586	525	663	679	831	906	924	1004	1026	734	751	1077	1088	1167	1189	1240	1258	1340	1359	1404	1425	1505	1581	1600	1686	
ICES Sq	43F6	44F6	43F7	43F7	44F7	44F7	44F8	43F8	44F8	44F9	44F8	44F8	44F9	44F9	45F8	45F9	46G0	46G0	46G0	45G0	45G0	45G1	44G0	44G1	43G0	44G1	41G2	42G1	41G1	42G1	
length\Gear	Fotø	Fotø	Expo	Fotø	Fotø	Fotø	Fotø	Expo	Expo	Fotø	Fotø	Fotø	Expo	Fotø	Fotø	Fotø	Fotø	Fotø	Expo	Fotø	Fotø	Fotø	Fotø	Expo	Fotø	Fotø	Fotø	Fotø	Fotø	Expo	Total
Total kg	468.9	344.9	0.2	633.5	465.2	85.5	82.6	0.0	0.9	30.2	423.7	127.9	176.5	90.3	96.6	363.2	143.5	150.9	31.4	171.1	64.5	415.3	11.4	52.1	98.0	64.6	1.0	46.6	5.6	28.1	181.9

Table IIB.5a Numbers of herring by age, maturity, stock and sub area for the Acoustic Herring Survey R/V Dana Cruise July 2005

North Sea Autumn spawners. Abundance (Millions) or proportions......	North Sea Autumn spawners. Abundance (Millions)													
0	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9+
580E06	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
570E06	0.000	313.225	0.000	72.161	5.660	1.311	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
580E08	0.000	72.471	0.000	5.200	0.408	0.000	0.000	0.000	0.000	0.281	0.000	0.000	0.000	0.000
570E08	30.989	425.099	0.000	37.470	2.939	2.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C	0.000	125.248	0.000	19.682	1.544	0.000	0.000	0.000	0.000	0.317	0.000	0.000	0.000	0.000
D	0.000	265.606	0.000	12.089	0.948	1.529	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
E	6.566	107.840	0.000	17.390	0.000	1.233	0.000	0.000	0.000	0.000	1.086	0.000	0.000	0.000
560E06	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Western Baltic Spring Spawners Abundance (Millions)													
Stratum	0.000	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9+
580E06	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
570E06	0.000	113.511	29.151	86.723	188.002	14.881	191.226	2.099	71.022	27.547	11.874	7.075	0.000	1.919
580E08	0.000	44.570	11.446	34.222	74.188	9.718	124.882	1.277	43.218	9.647	6.134	2.206	0.881	0.775
570E08	0.000	299.951	77.030	119.150	258.298	22.292	286.455	3.714	125.654	43.740	21.711	7.284	1.773	4.749
C	0.000	48.478	12.450	35.472	76.897	5.112	65.691	0.401	13.552	0.654	0.436	0.508	0.311	0.439
D	0.000	199.938	51.346	119.725	259.543	24.221	311.244	2.747	92.928	20.297	9.042	1.653	0.696	0.802
E	5.385	904.479	206.535	302.416	591.085	53.684	522.202	2.244	56.100	13.492	10.324	4.140	0.000	0.000
560E06	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	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 2006

	North Sea Autumn spawners. Mean weight (g)													
Stratum	**0**	**1i**	**1m**	**2i**	**2m**	**3i**	**3m**	**4i**	**4m**	**5**	**6**	**7**	**8**	**9+**
580E06	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
570E06	0.00	72.84	72.84	83.91	83.91	84.00	84.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
580E08	0.00	71.19	71.19	75.44	75.44	0.00	0.00	0.00	0.00	151.00	0.00	0.00	0.00	0.00
570E08	3.62	54.88	54.88	77.41	77.41	84.00	84.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C	0.00	66.14	66.14	72.15	72.15	0.00	0.00	0.00	0.00	151.00	0.00	0.00	0.00	0.00
D	0.00	68.42	68.42	73.66	73.66	84.00	84.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	5.12	58.42	58.42	69.36	69.36	84.00	84.00	0.00	0.00	0.00	184.00	0.00	0.00	0.00
560E06	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

	Spring Spawners Mean weight (g)													
Stratum	**0**	**1i**	**1m**	**2i**	**2m**	**3i**	**3m**	**4i**	**4m**	**5**	**6**	**7**	**8**	**9+**
580E06	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
570E06	0.00	67.08	67.08	80.57	80.57	99.33	99.33	112.48	112.48	121.59	145.94	156.28	0.00	152.69
580E08	0.00	66.29	66.29	81.51	81.51	94.76	94.76	108.79	108.79	132.27	129.70	143.25	173.99	142.25
570E08	0.00	55.53	55.53	81.30	81.30	101.35	101.35	114.55	114.55	132.64	151.53	164.45	173.57	176.44
C	0.00	57.73	57.73	69.64	69.64	81.70	81.70	97.29	97.29	104.44	116.00	112.00	158.00	147.00
D	0.00	61.62	61.62	78.05	78.05	91.15	91.15	111.45	111.45	127.29	132.98	134.30	180.00	147.00
E	5.85	47.89	47.89	60.34	60.34	66.19	66.19	87.84	87.84	90.96	145.56	126.34	0.00	0.00
560E06	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 IIB.5c Mean length of herring by age, maturity, stock and subarea for the Acoustic Herring Survey R/V Dana Cruise July 2006

	North Sea Autumn spawners.							-	-	-	-	-	-	-
	Mean length (cm)							-	-	-	-	-	-	-
Stratum	**0**	**1i**	**1m**	**2i**	**2m**	**3i**	**3m**	**4i**	**4m**	**5**	**6**	**7**	**8**	**9+**
580E06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
570E06	0.0	20.8	20.8	21.5	21.5	22.5	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
580E08	0.0	20.7	20.7	21.3	21.3	0.0	0.0	0.0	0.0	28.0	0.0	0.0	0.0	0.0
570E08	8.6	19.2	19.2	21.2	21.2	22.5	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	0.0	20.4	20.4	21.0	21.0	0.0	0.0	0.0	0.0	28.0	0.0	0.0	0.0	0.0
D	0.0	20.6	20.6	21.2	21.2	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	9.5	19.8	19.8	20.6	20.6	25.0	25.0	0.0	0.0	0.0	29.0	0.0	0.0	0.0
560E06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	Spring Spawners													
	Mean length (cm)													
Stratum	**0**	**1i**	**1m**	**2i**	**2m**	**3i**	**3m**	**4i**	**4m**	**5**	**6**	**7**	**8**	**9+**
580E06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
570E06	0.0	20.3	20.3	21.6	21.6	23.9	23.9	25.0	25.0	25.7	27.0	27.5	0.0	28.4
580E08	0.0	20.3	20.3	21.9	21.9	23.6	23.6	24.8	24.8	26.3	26.4	27.0	29.2	28.0
570E08	0.0	19.1	19.1	21.7	21.7	24.1	24.1	25.0	25.0	26.3	27.7	28.1	29.6	29.4
C	0.0	19.6	19.6	20.9	20.9	22.8	22.8	24.1	24.1	25.3	26.0	26.0	30.0	28.0
D	0.0	20.0	20.0	21.7	21.7	23.5	23.5	24.9	24.9	26.1	26.7	27.0	29.5	28.0
E	10.2	18.6	18.6	20.5	20.5	21.7	21.7	23.3	23.3	23.3	26.6	25.9	0.0	0.0
560E06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0