

## APPENDIX IIB: Denmark

### Acoustic Herring Survey report for RV “DANA”

29<sup>th</sup> June 2005 – 11<sup>th</sup> July 2005

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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 2005-survey with R/V DANA, covering the Skagerrak and Kattegat, was conducted in the period June 30 to July 11 2005, while calibration was done during June 29 to June 30 .

#### 2. SURVEY

##### 2.1 Personnel

###### **During calibration 28/6 – 30/6-2005**

Bo Lundgren (cruise leader)	HFI
Torben Filt Jensen (assisting cruise leader)	ITT
Mogens R Sørensen	ITT
Thyge Dyrnesli	ITT
Bo Tegen Nielsen	ITT
Claus Halle	ADM

###### **During acoustic monitoring 30/6-11/7-2005**

Bo Lundgren (cruise leader)	HFI
Torben Filt Jensen (assisting cruise leader)	ITT
Lotte Worsøe Clausen	HFI
Lise Sindahl	HFI
Helle Rasmussen	HFI
Tommy Kristensen	HFI
Michael van Deurs	HFI
Mogens R Sørensen	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 28th 2005 at 12.00 for the calibration site in the Gullmar Fjord in Sweden. Some tests of the echosounder equipment and some preparations for the calibration next day were carried out underway.

R/V Dana stopped outside Hirtshals harbour on July 30 2005 at 11.00 for exchange of scientific personnel and left again at 12.00 (Danish local time, 16.00 UTC) with a north-easterly course, starting the survey in the eastern Skagerrak. The survey work (acoustic integration) had already started on the way from the calibration site to Hirtshals at 06.38 UTC on the position 58° 11.80' N 11° 07.12' E in the south-eastern part of the Skagerrak. The eastern Skagerrak area was covered June 30 – July 3, western Skagerrak during July 4 – 7 and Kattegat during July 8 – 11. A short stop just outside Hirtshals on July 4 was done to change a crew member. Totally the survey covered about 1900 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 these data are strongly dependent on the weather conditions, but this year the weather was unusually 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 near the Danish coast in Skagerrak at July 11 09.40 UTC on the position 57° 43.18' N 10° 14.00' E. Dana went to harbour in Hirtshals on July 11 2005 at 10.30 hour.

### 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 10<sup>th</sup> 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 the Bornö Island site in the Gullmar Fjord, Sweden during 29 June 2005. The calibration was performed according to the procedures established the previous year when the echosounder equipment had been upgraded to 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. Calibration of the paravane split-beam transducer at 38 kHz was done against a 60 mm copper sphere. 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. 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.

As a backup in case of failures in the EK60 system tests of the functionality were also carried on the previously used EY500 echo sounder.

## **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 1800h and 2200 to 0300h 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 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.2.

## **2.8 Data analysis**

The raw data is preintegrated into 1m samples for each ping 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):

$$\text{Herring TS} = 20 \log L - 71.2 \text{ dB}$$

$$\text{Sprat TS} = 20 \log L - 71.2 \text{ dB}$$

$$\text{Gadoids TS} = 20 \log L - 67.5 \text{ dB}$$

$$\text{Mackerel TS} = 20 \log L - 84.9 \text{ dB}$$

where L is the total length in cm. The number of fish per species 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**

40 hauls were conducted (20 surface hauls, 2 mid water hauls and 16 bottom hauls, one of which was unsuccessful (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	100	0	80	20	50	50	100	100	100	100

Spring spawners:

WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6i	7	8	9+
%	100	89	11	40	60	11	89	4	96	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

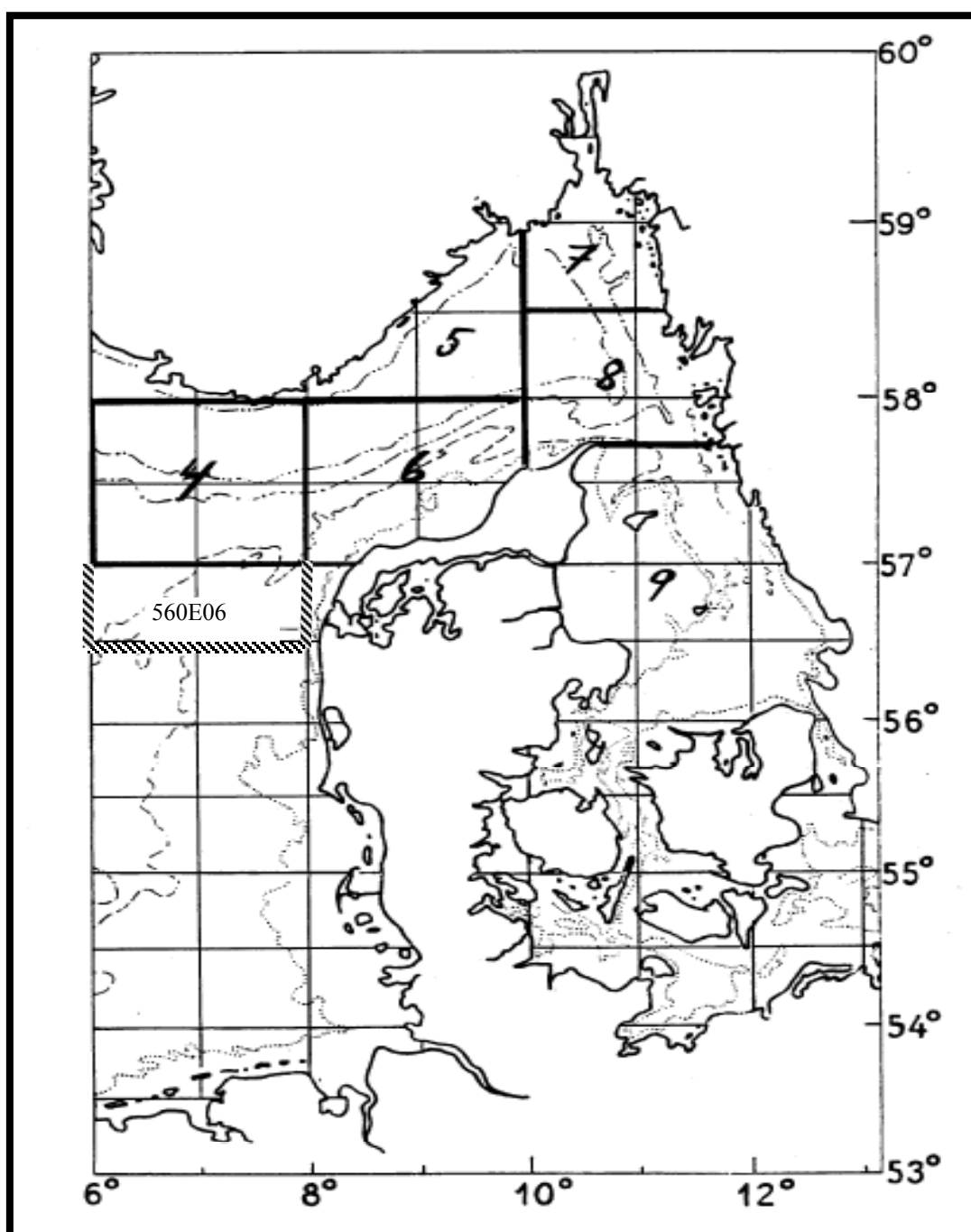
The total herring biomass estimate for the survey is 242,000 tonnes of which 4.4 % or 11,00 tonnes is North Sea autumn spawning herring and 95.6 % or 231,000 tonnes is spring spawning herring.

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.

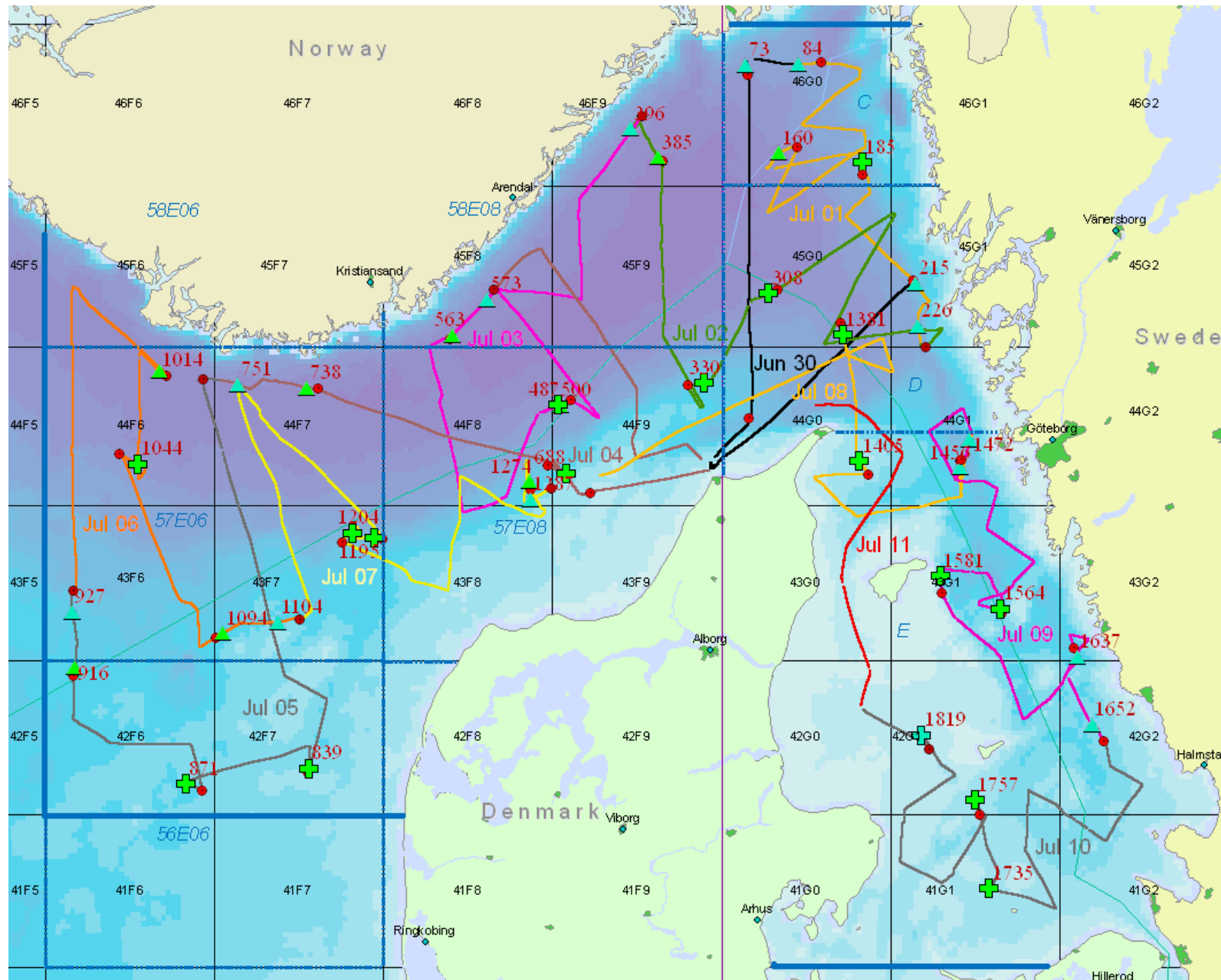
### Stratum overview Acoustic Herring Survey R/V Dana Cruise 042005 July 2005

Stratum Nr	Stratum ID	Area Nm <sup>2</sup>	Number of logs	Hauls in stratum	Hauls from neighbour strata	Total hauls used	Mean Sa	Mean TS
3	580E06	209	27	0	4	4	31.29948	-47.3408
4	570E06	3600	288	7	3	10	192.0751	-47.40157
5	580E08	1822	147	4	1	5	62.3704	-43.64462
6	570E08	3406	296	3	5	8	115.337	-44.97896
7	C	988	109	4	2	6	132.4637	-41.16075
8	D	1837	291	4	6	10	186.8298	-41.36337
9	E	5228	439	8	0	8	229.1694	-48.22463
10	560E06	1990	92	3	3	6	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 July Danish acoustic survey of R/V Dana 2005.

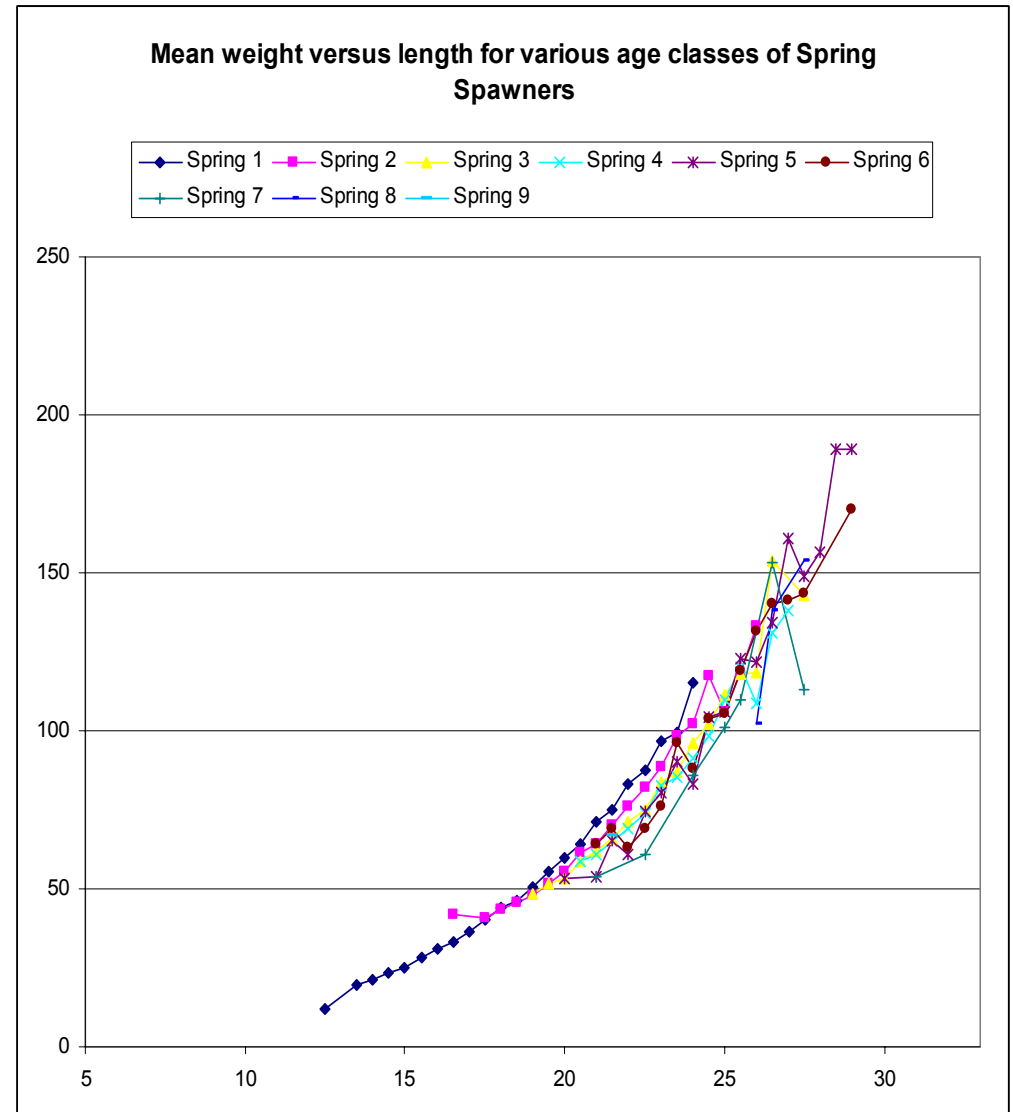
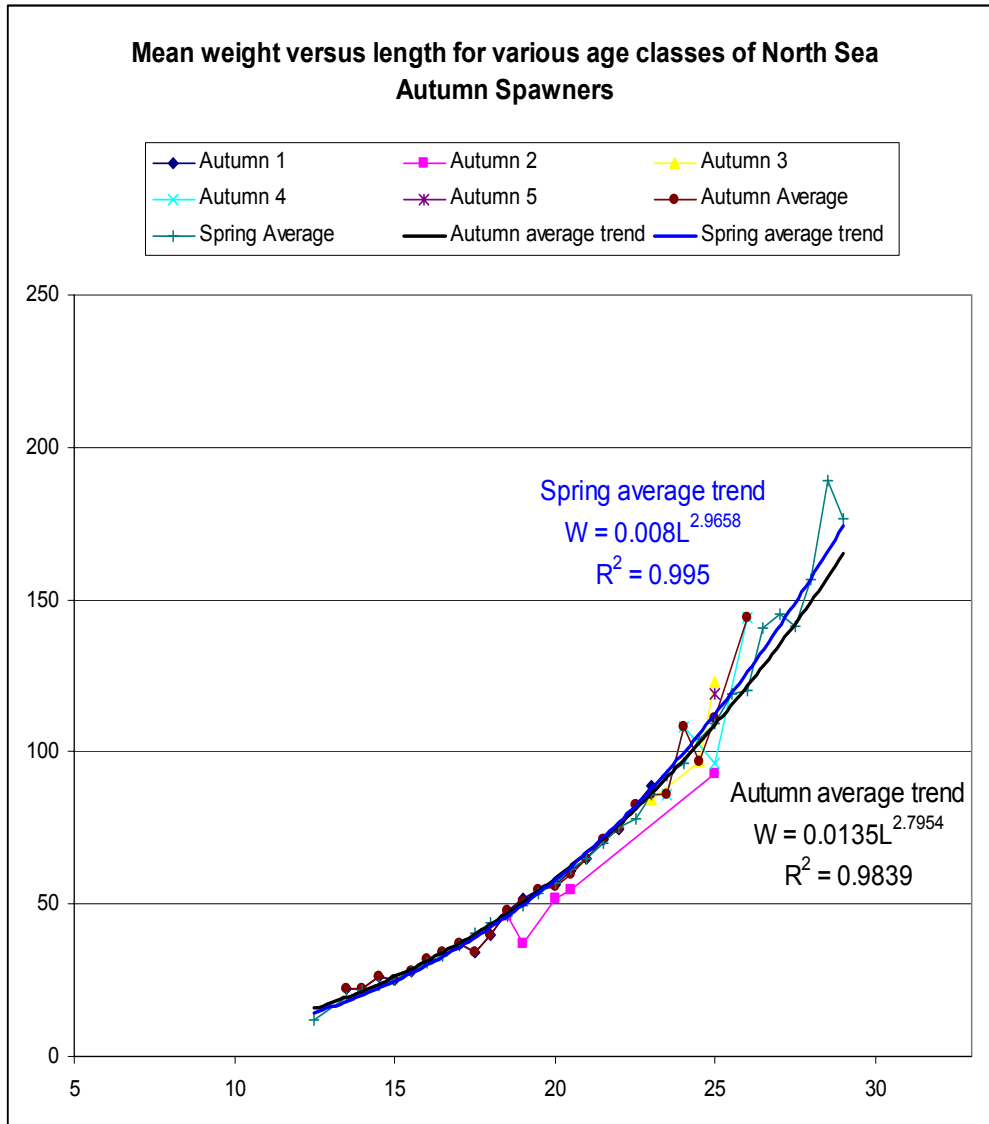
## Cruise track and stations during the Acoustic Herring Survey R/V Dana Cruise 042005 July 2005



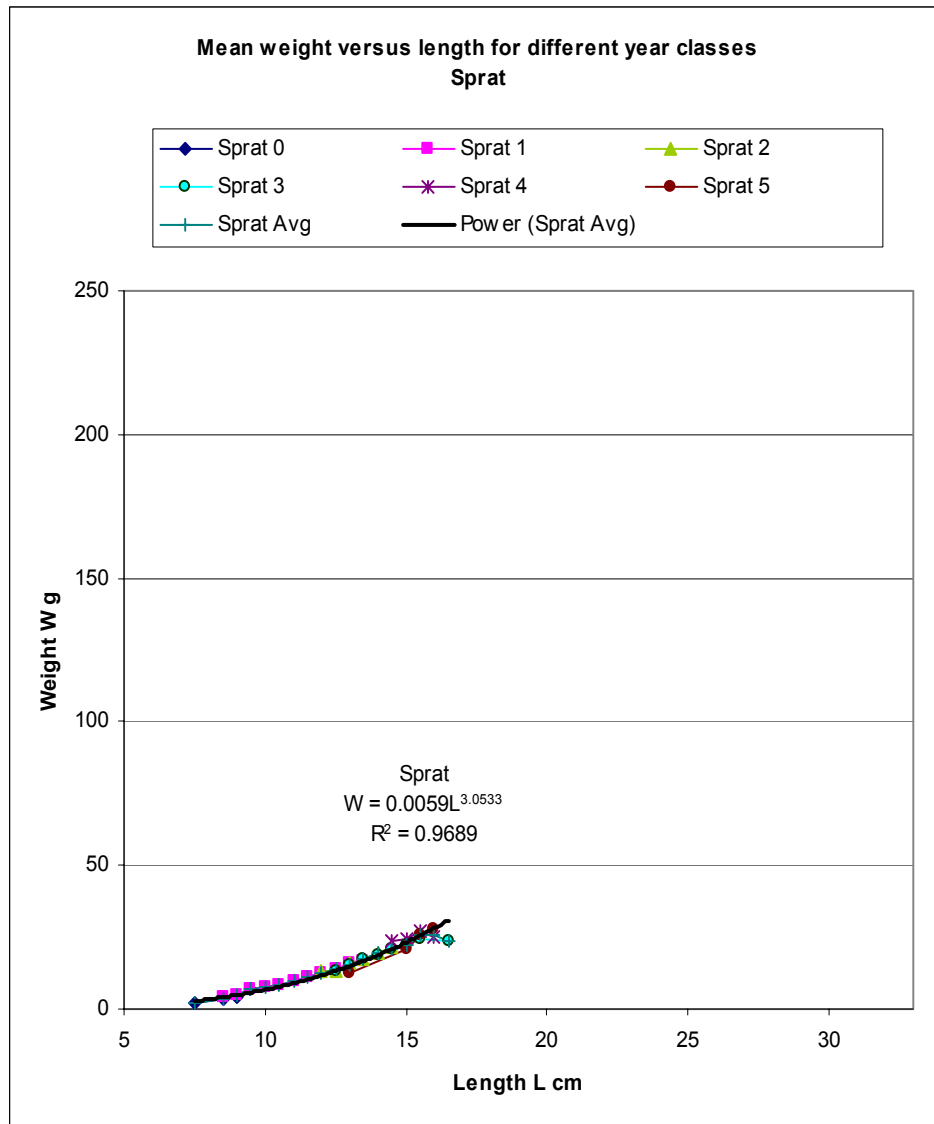
**Figure IIB.2.** Map of the eastern North Sea, Skagerrak and Kattegat showing cruise track, the location of stations (trawl hauls and CTD stations) during the July Danish acoustic survey (Fotö hauls ▲ are pelagic and Expo hauls ⊕ are generally demersal, Red numbers are haul IDs cumulative sailed distance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

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

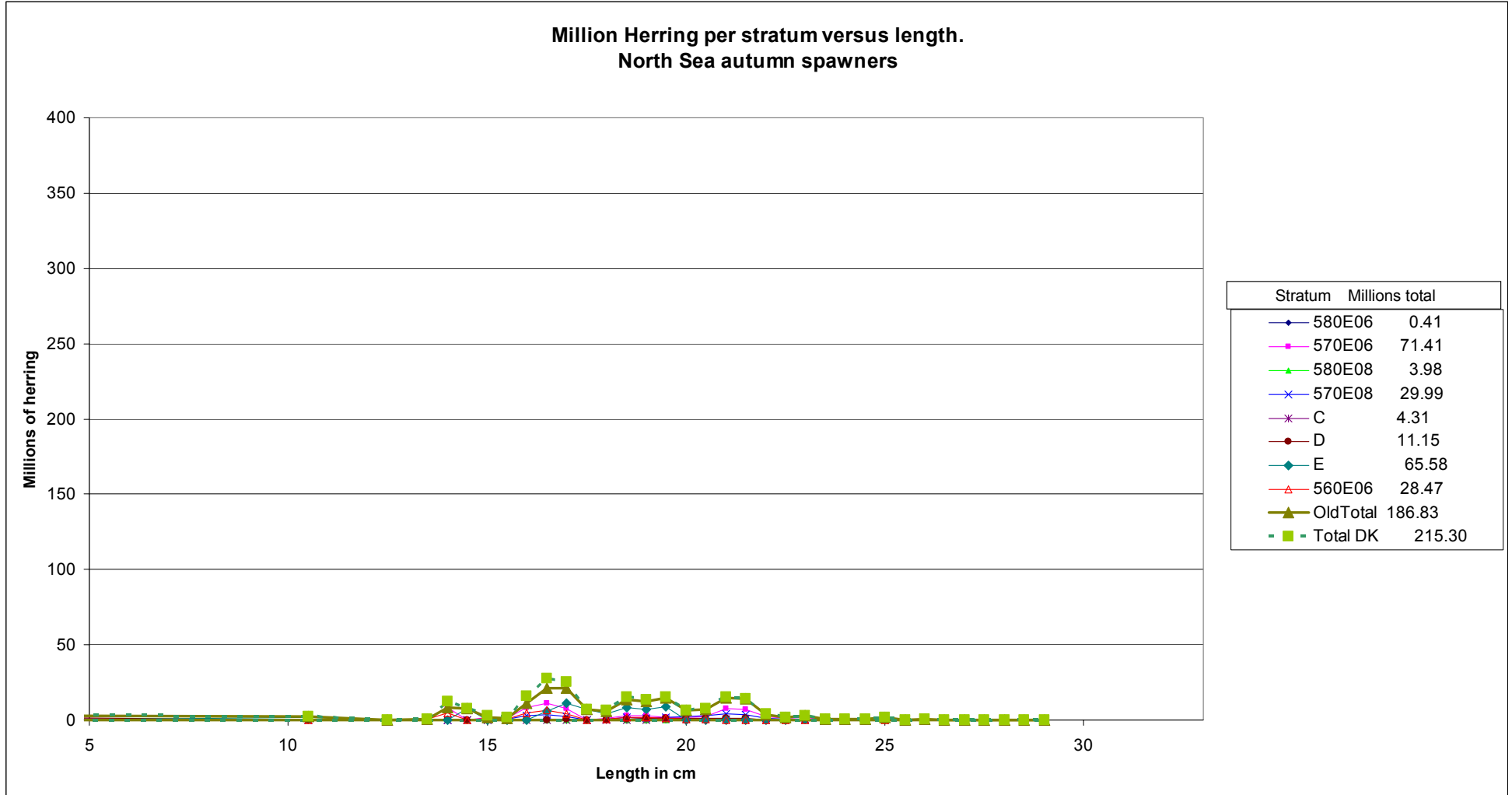




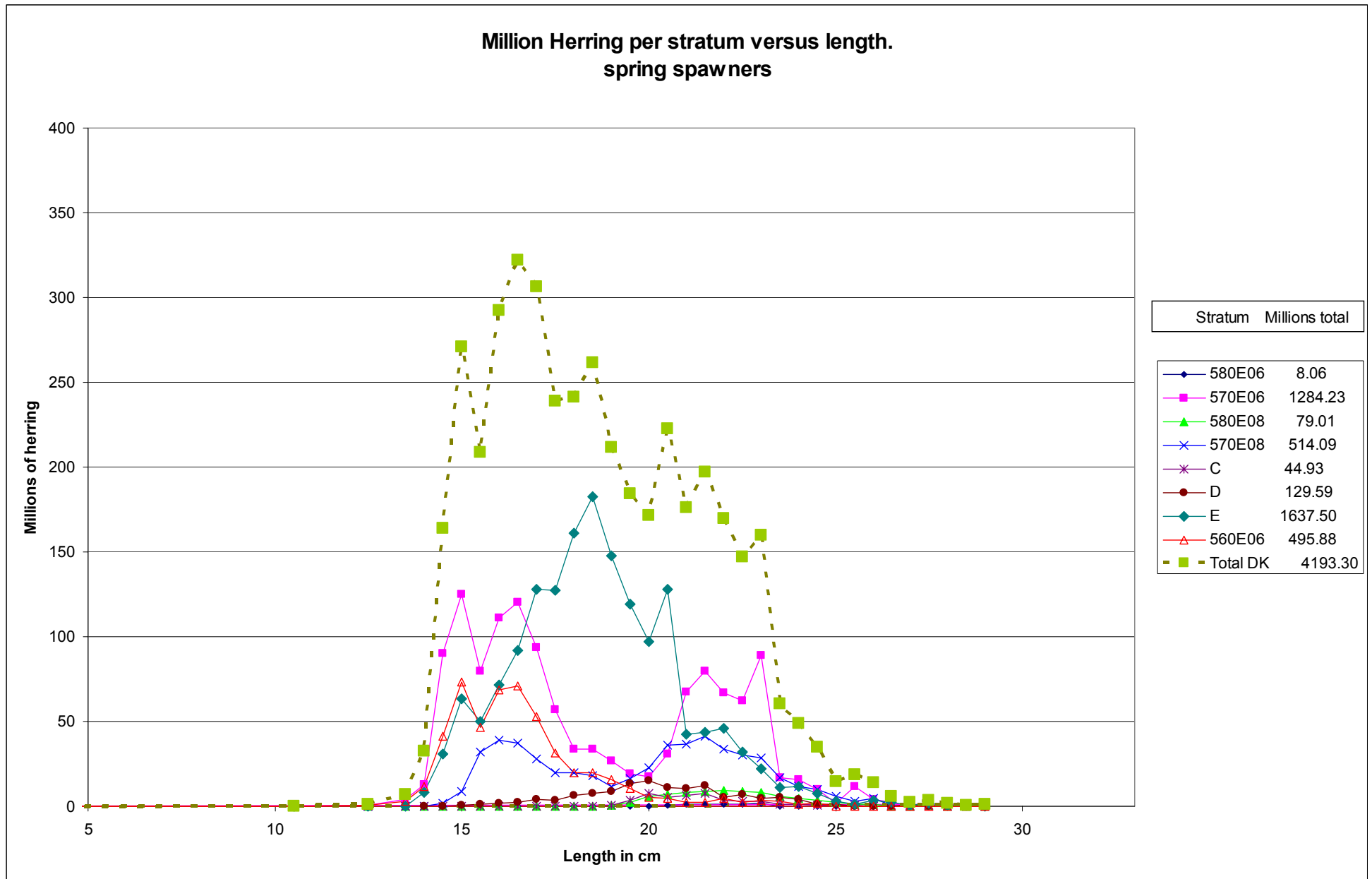
**Figure IIB.4.a** Length weight relationship by winter ring numbers for herring from the July 2005 Danish acoustic survey.



**Figure IIB.4.b** Length weight relationship by winter ring numbers for sprat from the July 2005 Danish acoustic survey.



**Figure IIB.5.a** Estimated number of herring per length group in various strata from the July 2005 Danish acoustic survey.



**Figure IIB.5.b** Estimated number of herring per length group in various strata from the July 2005 Danish acoustic survey.

**Table IIB.1.** Simrad EK60 and analysis settings used during the the Acoustic Herring Survey R/V Dana Cruise July 2005

<b>Transceiver Menu</b>	
Frequency	38 kHz
Sound speed	1491 m.s <sup>-1</sup>
Max. Power	2000 W
Equivalent two-way beam angle	-20.5 dB
Default Transducer Sv gain	24.59 dB
3 dB Beamwidth	6.9°
<b>Calibration details</b>	
TS of sphere	-33.6 dB
Range to sphere in calibration	9.08 m
Measured NASC value for calibration	23100 m <sup>2</sup> /nmi <sup>2</sup>
Calibration factor for NASCs	1.00
<b>Log Menu</b>	
Distance	1,0 n.mi. using GPS-speed
<b>Operation Menu</b>	
Ping interval	1 s external trig
<b>Analysis settings</b>	
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 July 2005

Haul Nr	Haul ID	Date Time UTC	Sun Time	ICES Square	Lat N	Long E	Trawl Type	Bottom depth m	Wire Length m	Door distance m	Haul duration 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	73	30-06 21:45	22:25	46G0	58.52.344	010.08.864	Fotø	173.1	340	53	60	182	29.7	1.00	29.7	Jellyfish, Mackerel, Herring, Garfish	3.2	73	2	83	1
2	84	30-06 23:58	00:40	46G0	58.52.599	010.27.641	Fotø	162.6	370	53	61	350	35.0	2.77	97.1	Mackerel, Krill, Herring	3.9	89	5	118	2
3	160	01-07 10:56	11:38	46G0	58.36.192	010.20.741	Fotø	270.8	800	103	60	200				Krill, Saithe	3.3	323	4	46	2
4	185	01-07 15:22	16:05	46G0	58.34.453	010.50.227	Expo	85.4	400	65	60	3500	0.6	132.74	75.4	Mainly Krill, Dogfish, Saithe, Cod	2.7	176	3	322	1
5	215	01-07 21:19	22:04	45G1	58.11.855	011.08.990	Fotø	69.6	320	68	61	438	27.2	8.23	223.9	Herring, Mackerel, Jellyfish, Garfish	3.5	144	2	113	1
6	226	01-07 23:31	00:15	45G1	58.03.924	011.09.950	Fotø	89.5	330	58	60	774	32.7	15.25	498.2	Herring, Krill, Mackerel, Garfish	3.8	172	1	272	0
7	308	02-07 10:35	11:16	45G0	58.10.094	010.17.027	Expo	202.7	1000	95	60	80				Blue whiting, Lump sucker, Saithe	2.9	294	3	191	1
8	330	02-07 14:08	14:48	44F9	57.53.218	009.54.010	Expo	60.1	360	66	60	56	13.4	1.00	13.4	Jellyfish, Herring, Haddock, Whiting, Hake	2.8	281	3	251	1
9	385	02-07 21:19	21:57	46F9	58.35.340	009.37.850	Fotø	486.1	340		60	310	22.1	2.20	48.5	Mackerel, Herring, Jellyfish, Garfish	4.0	210	5	202	2
10	396	02-07 23:35	00:13	46F9	58.40.624	009.28.108	Fotø	292.8	330		60	157	21.6	1.00	21.6	Jellyfish, Krill, Herring, Mackerel, Garfish	3.5	43	5	190	2
11	487	03-07 10:38	11:14	44F9	57.48.992	009.03.163	Fotø	172.5	1100		60	70				Saithe, Mackerel, Lump sucker	3.4	292	5	91	2
12	500	03-07 13:05	13:42	44F8	57.49.046	009.02.173	Expo	176.2	630	83	60	35				Jellyfish, Lump sucker	3.0	297	7	95	3
13	563	03-07 21:21	21:54	45F8	58.02.148	008.24.995	Fotø	461	320	68	60	261	24.7	2.71	67.0	Jellyfish, Krill, Herring, Mackerel, Garfish	3.5	43	5	105	3
14	573	03-07 23:30	00:04	45F8	58.08.827	008.37.063	Fotø	340.4	320		60	456	25.1	1.00	25.1	Jellyfish, Krill, Mackerel, Herring, Garfish	2.7	41	8	147	3
15	688	04-07 14:16	14:52	44F9	57.36.050	009.04.993	Expo	42.9	410	75	60	30	0.1	1.00	0.1	Jellyfish, Herring, Gurnard	3.3	247	11	96	5
16	738	04-07 21:19	21:49	44F7	57.52.191	007.33.267	Fotø	481	330	68	60	191	9.8	1.00	9.8	Mackerel, Jellyfish, Krill, Herring, Garfish, Blue whiting	5.2	258	16	108	6
17	751	04-07 23:40	00:09	44F7	57.52.889	007.08.613	Fotø	374	320		60	439	18.0	4.14	74.5	Jellyfish, Krill, Mackerel, Herring, Garfish, Blue whiting	5.2	259	17	105	6
18	839	05-07 10:24	10:54	42F7	56.39.159	007.33.719	Expo	33.9	220	73	60	120	9.9	5.95	59.0	Herring, Jellyfish, Sprat, Gurnard, Flatfish	3.7	2	8	235	4
19	871	05-07 14:55	15:23	42F6	56.36.136	006.50.132	Expo	42.6	275	80	60	59	5.2	1.91	10.0	Sprat, Herring, Jellyfish, Krill, Gurnard, Whiting, Cod, Flatfish	3.3	116	3	211	2
20	916	05-07 21:25	21:49	43F6	56.58.665	006.10.814	Fotø	58.8	325	72	60	127	11.3	1.93	21.9	Mackerel, Herring, Jellyfish, Garfish	3.8	3	4	193	2
21	927	05-07 23:34	23:59	43F6	57.09.403	006.09.863	Fotø	66	325		60	160	20.0	4.40	87.9	Herring, Mackerel, Jellyfish, Garfish	4.0	181	3	147	2
22	1014	06-07 10:30	10:56	44F6	57.55.406	006.40.724	Fotø	375.2	325	68	60	76	1.3	1.00	1.3	Jellyfish, Herring, Garfish	4.5	225	5	126	2
23	1044	06-07 14:55	15:21	44F6	57.37.884	006.33.266	Expo	183.7	720		60	50				Pearlside, Lump sucker, Krill, Haddock	3.3	245	2	170	1
24	1094	06-07 21:22	21:50	43F7	57.05.391	007.03.426	Fotø	55.5	330	68	60	511	15.0	10.78	161.9	Mackerel, Herring, Jellyfish	3.8	60	5	31	2
25	1104	06-07 23:41	00:10	43F7	57.07.410	007.22.811	Fotø	44	325		61	212	16.8	9.08	152.5	Herring, Mackerel, Jellyfish, Gurnard, Whiting	3.7	76	3	79	2
26	1195	07-07 10:28	11:00	43F7	57.23.860	007.57.107	Expo	82.3	436		60	49	6.1	1.00	6.1	Cod, Haddock, Herring, Ling, Jellyfish Saithe	3.0	275	6	46	3
27	1204	07-07 12:38	13:09	43F7	57.24.710	007.49.170	Expo	119.4	400	74	60	20				Jellyfish	2.4	312	7	68	3
28	1274	07-07 21:21	21:56	44F8	57.34.437	008.52.114	Fotø	67.3	325	68	60	115	16.4	2.19	35.9	Jellyfish, Herring, Mackerel	3.8	189	5	31	3
29	1287	07-07 23:45	00:21	44F8	57.31.111	008.52.371	Fotø	40.5	325	67	60	510	10.3	27.55	285.0	Herring, Mackerel, Horse mackerel, Haddock, Hake	3.9	63	4	65	2
30	1381	08-07 10:43	11:26	45G0	58.02.328	010.43.400	Expo	200.1	850	100	60	469	1.6	2.14	3.5	Shrimp, Blue whiting, Saithe, Lump sucker, Jellyfish	3.0	169	2	11	1
31	1405	08-07 14:37	15:20	44G0	57.38.368	010.49.194	Expo	25.5	205	65	60	1492	5.2	9.65	49.7	Sprat, Whiting, Herring, Jellyfish, Dogfish, Flatfish, Hake	3.2	146	4	340	2
32	1456	08-07 21:19	22:05	44G1	57.37.047	011.24.769	Fotø	57.7	330	63	60	241	19.3	4.51	87.1	Jellyfish, Herring, Sprat, Mackerel, Dogfish	3.8	175	7	7	3
33	1472	08-07 23:58	00:44	44G1	57.42.430	011.28.371	Fotø	64.4	320		60	420	21.1	16.37	344.7	Herring, Jellyfish, Mackerel, Sprat	3.8	343	2	74	1
34	1564	09-07 10:39	11:25	43G1	57.10.112	011.39.316	Expo	63.9	400	60	47	895	17.7	3.38	59.9	Jellyfish, Whiting, Herring, Cod, Saithe, Flatfish, Haddock	2.9	6	3	289	1
35	1581	09-07 13:37	14:23	43G1	57.16.449	011.17.931	Expo	33.4	260	77	60	1317	1.4	7.07	10.1	Sprat, Dogfish, Whiting, Haddock, Flatfish, Jellyfish, Herring, Hake, Common Weaver	3.2	175	6	344	3
36	1637	09-07 21:23	22:11	42G2	57.00.878	012.06.485	Fotø	45.6	325	62	60	225	12.3	3.77	46.3	Jellyfish, Sprat, Herring, Mackerel	3.7	326	4	276	2
37	1652	10-07 00:04	00:53	42G2	56.47.729	012.11.747	Fotø	38.3	325	69	60	456	3.2	1.00	3.2	Jellyfish, Herring, Mackerel, Common weaver, Sprat	3.7	149	4	41	2
38	1735	10-07 10:23	11:10	41G1	56.15.536	011.35.239	Expo	26.6	200		60	575	0.4	3.49	1.3	Sprat, Jellyfish, Herring, Flatfish	3.3	30	3	288	1
39	1757	10-07 14:10	14:56	42G1	56.32.946	011.30.115	Expo	26	230		51	1270	0.4	8.51	3.3	Sprat, Jellyfish, Whiting, Flatfish, Bullrout, Herring,	3.0	164	6	307	2
40	1819	10-07 21:39	22:23	42G1	56.45.687	011.11.158	Expo	16.5	180		60	1200	16.3	9.74	158.4	Jellyfish, Herring, Sprat, Mackerel	3.2	157	6	285	3

**Table IIB.3.** Trawl haul species composition in kg during the Acoustic Herring Survey R/V Dana Cruise July 2005

SpeciesName	GearName	560E06			570E06									570E08						580E08				
		839	871	916	738	751	927	1014	1044	1094	1104	1195	1204	1274	330	487	500	688	1287	1381	385	396	563	573
		30.5 m	44 m	Surf	Surf	Surf	Surf	Surf	166 m	Surf	Surf	54 m	90 m	Surf	50 m	120 m	175 m	35 - 60 m	Surf	200 m	Surf	Surf	Surf	Surf
ICES square	42F7	42F6	42F6	44F7	44F7	43F6	44F6	44F6	43F7	43F7	43F7	43F7	44F8	44F9	44F9	44F9	44F9	44F8	45G0	46F9	46F9	45F8	45F8	
		Expo	Expo	Fotø	Fotø	Fotø	Fotø	Expo	Fotø	Fotø	Expo	Expo	Fotø	Expo	Fotø	Expo	Expo	Fotø	Expo	Fotø	Fotø	Fotø	Fotø	
Sprattus sprattus		11.6	23.5			0.0												0.3				0.0		
Clupea harengus		59.0	10.0	21.9	9.8	74.5	87.9	1.3		161.9	152.5	6.1		35.9	13.4		0.1	285.0	3.8	48.5	21.6	67.0	25.1	
Medusa, spp		22.4		13.0			10.8	71.9	0.6	12.9	17.3	3.3	20.0	65.7	24.8			7.6		21.0				
Invertebrata			9.4		70.4	207.0										8.6					108.0	129.0	350.2	
Scomber scombrus		1.4		89.5	97.7	130.8	60.0			335.0	31.4			12.1		0.6		129.8		224.8	19.7	30.7	70.9	
Pollachius virens									6.0			2.1				56.7			56.0					
Squalus acanthias					0.8																			
Gadus Morhua			2.5							0.3	0.0	16.8		0.3	0.5				0.4	36.6				
Merlangius merlangus			3.1	0.0	0.0	0.5	0.0	0.0		0.1	2.1	0.0		0.2	3.7		0.0	1.0				0.1		
Euphausiidae spp.									10.9															
Pollachius pollachius												1.2												
Micromesistius poutassou					2.0	9.7													144.1			0.5	1.0	
Pandalus spp., Crangon spp.																			166.6					
Merluccius merluccius															2.8			3.0		0.2				
Trisopterus esmarki													0.0		0.1					2.9				
Belone belone				2.5	9.1	14.4	1.0	1.3		0.7										15.6	7.5	33.3	8.6	
Cyclopterus lumpus					1.0			0.1	14.8						0.7	4.1	3.9		44.3			0.3	0.2	
Trachurus trachurus		4.7				0.4												86.4						
Maurolicus muelleri					0.0	0.0			16.7										1.2					
Melanogrammus aeglefinus		0.3	0.0		0.0		0.0	0.0	1.0		0.0	14.4		0.0	9.7		0.0		0.1					
Limanda limanda		7.9	2.7																					
Trigala spp.		9.4	4.2	0.1			0.3				8.6						0.1	3.2						
Pleuronectes platessa		0.4	2.3												0.4				0.3					
Trachinus draco																								
Myoxocephalus scorpius																								
Molva molva											4.7													
Hippoglossides plattessoides															0.1									
Salmo salar						1.7		1.4																
Microstomus kitt		2.5																						
Scophthalmus rhombus																								
Loligo spp.					0.1					0.1		0.2		0.6					0.9					
Enchelyopus cimbrius																						1.8		
Hyperoplus lanceolatus		0.6	0.4																					
Nephrops norvegicus																						1.0		
Lycodes vahli																						1.0		
Oncorhynchus mykiss, Salmo gairdneri																								
Ammodytes xx			0.5																					
Argentina sphyraena *																						0.3		
Glyptocephalus cynoglossus																						0.3		
Lumpenus lampretaeformis																								
Myxine glutinosa																						0.2		
Platichthys flesus																								
Hovedtotal		120.0	58.5	127.0	191.0	439.0	160.0	76.0	50.0	511.0	212.0	48.8	20.0	115.0	56.0	70.0	34.6	30.2	510.0	468.5	310.0	156.8	261.0	456.0

**Table IIB.3.** Trawl haul species composition in kg during the Acoustic Herring Survey R/V Dana Cruise July 2005 (continued)

SpeciesName	Stratum				C					D					E					Total In survey	Max In survey
	Station Nr	73	84	160	185	215	226	308	1405	1456	1472	1564	1581	1637	1652	1735	1757	1819			
	Fishing depth	Surf	Surf	120-160 m	86 m	Surf	Surf	180 m	17 m	Surf	Surf	48 m	23 m	Surf	Surf	20 m	18 m	10 m			
	ICES square	46G0	46G0	46G0	46G0	45G1	45G1	45G0	44G0	44G1	44G1	43G1	43G1	42G2	42G2	41G1	42G1	42G1			
	Fotø	Fotø	Fotø	Expo	Fotø	Fotø	Expo	Expo	Fotø	Fotø	Expo	Expo	Fotø	Fotø	Expo	Expo	Expo				
Sprattus sprattus					0.2	0.1		1231.6	34.9	1.5	0.1	1033.6	86.7	1.2	553.2	1123.7	21.2	4123.4	1231.6		
Clupea harengus	29.7	97.1		75.4	223.9	498.2		49.7	87.1	344.7	59.9	10.1	46.3	3.2	1.3	6.7	158.4	2776.9	498.2		
Medusa, spp	101.6				28.6				129.0	64.4			88.2	447.9	17.6		1007.1	2236.3	1007.1		
Invertebrata						184.0		34.5			728.4	11.2				106.5		1947.1	728.4		
Scomber scombrus	43.2	136.8			179.0	78.6			4.2	8.4			2.2	2.4		0.9	2.1	1692.2	335.0		
Pollachius virens			23.9	1261.0			1.5				4.4							1411.6	1261.0		
Squalus acanthias	1.2			995.6				19.2	1.3		1.5	177.2						1196.8	995.6		
Gadus Morhua				491.1				2.3			20.0							570.9	491.1		
Merlangius merlangus	0.0	0.0		121.3	0.0			125.0	0.1	0.1	74.3	16.3	0.7		0.2	17.4	0.1	366.5	125.0		
Euphausiidae spp.		116.0	157.8															284.7	157.8		
Pollachius pollachius				257.0														258.1	257.0		
Micromesistius poutassou							24.7											181.9	144.1		
Pandalus spp., Crangon spp.																		166.6	166.6		
Merluccius merluccius				151.2				4.3					2.1					163.7	151.2		
Trisopterus esmarki				141.2									0.1					144.4	141.2		
Belone belone	5.8	0.2			3.5	12.1				0.3	0.2						8.1	124.1	33.3		
Cyclopterus lumpus			13.6		1.7	0.3	23.1				0.4		0.1				0.2	108.7	44.3		
Trachurus trachurus					0.7				1.4	0.4			0.2				0.4	94.6	86.4		
Maurolicus muelleri		0.0	4.6				30.7											53.4	30.7		
Melanogrammus aeglefinus	0.0	0.0	0.1	6.1	0.0						2.2	16.0					0.1	50.1	16.0		
Limanda limanda					0.5			8.8				12.3			2.6	10.6	0.2	45.5	12.3		
Trigala spp.								1.2									0.1	27.2	9.4		
Pleuronectes platessa								4.4			0.2	1.4					1.8	11.1	4.4		
Trachinus draco	0.1								0.1	0.1		5.9	0.7	1.3	0.1		2.2	10.5	5.9		
Myoxocephalus scorpius								1.6									5.2	6.8	5.2		
Molva molva																		4.7	4.7		
Hippoglossides plattessoides											3.3	0.7						4.1	3.3		
Salmo salar										0.3		0.2						3.5	1.7		
Microstomus kitt												0.2						2.7	2.5		
Scophthalmus rhombus								1.7				0.7						2.4	1.7		
Loligo spp.																		2.0	0.9		
Enchelyopus cimbrius																		1.8	1.8		
Hyperoplus lanceolatus																0.6		1.6	0.6		
Nephrops norvegicus																		1.0	1.0		
Lycodes vahli																		1.0	1.0		
Oncorhynchus mykiss, Salmo gairdneri						0.9												0.9	0.9		
Ammodytes xx																		0.5	0.5		
Argentina sphyraena *																		0.3	0.3		
Glyptocephalus cynoglossus																		0.3	0.3		
Lumpenus lampraeformis											0.3							0.3	0.3		
Myxine glutinosa																		0.2	0.2		
Platichthys flesus												0.2						0.2	0.2		
Hovedtotal	181.6	350.0	200.0	3500.0	438.1	774.0	80.0	1484.4	258.5	420.0	895.1	1288.0	225.0	456.0	575.0	1273.4	1200.1	18080.6	3500.0		



**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)														
Stratum	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9+
580E06	0.0000	0.3851	0.0000	0.0091	0.0000	0.0112	0.0056	0.0003	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000
570E06	0.0000	69.6662	0.0000	0.6873	0.0000	0.6750	0.3375	0.0215	0.0215	0.0000	0.0000	0.0000	0.0000	0.0000
580E08	0.0000	3.5147	0.0000	0.2155	0.0000	0.1284	0.0642	0.0298	0.0298	0.0000	0.0000	0.0000	0.0000	0.0000
570E08	0.0000	28.3151	0.0000	0.9269	0.0000	0.3903	0.1952	0.0800	0.0800	0.0000	0.0000	0.0000	0.0000	0.0000
C	1.0944	3.0023	0.0000	0.1542	0.0000	0.0336	0.0168	0.0059	0.0059	0.0000	0.0000	0.0000	0.0000	0.0000
D	1.9871	8.6846	0.0000	0.3401	0.0000	0.0699	0.0350	0.0180	0.0180	0.0000	0.0000	0.0000	0.0000	0.0000
E	0.3906	57.5723	0.0000	4.1469	0.0000	0.5860	0.2930	1.0518	1.0518	0.4858	0.0000	0.0000	0.0000	0.0000
560E06	0.0000	28.2782	0.0000	0.1150	0.0000	0.0452	0.0226	0.0025	0.0025	0.0000	0.0000	0.0000	0.0000	0.0000

Spring Spawners														
Abundance (Millions)														
Stratum	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9+
580E06	0.0000	0.8485	0.1098	1.8295	2.6843	0.2251	1.7381	0.0390	0.3081	0.1819	0.0724	0.0183	0.0048	0.0000
570E06	0.0000	749.3839	96.9700	115.4572	169.4059	13.2829	102.5731	2.3849	18.8146	10.4452	4.2243	1.0281	0.2567	0.0000
580E08	0.0000	10.0615	1.3020	16.6373	24.4112	2.0967	16.1914	0.5701	4.4974	1.7494	1.1433	0.2266	0.1265	0.0000
570E08	0.0000	231.7951	29.9942	68.3147	100.2356	6.8937	53.2349	1.6595	13.0914	4.9372	3.1045	0.5629	0.2670	0.0000
C	0.0000	9.5996	1.2422	10.2887	15.0963	0.7523	5.8095	0.1410	1.1125	0.5225	0.2881	0.0527	0.0291	0.0000
D	0.0000	50.4916	6.5336	21.6217	31.7247	1.5589	12.0381	0.3804	3.0009	1.0449	1.0527	0.1218	0.0258	0.0000
E	0.0000	770.9889	99.7656	233.8818	343.1658	13.6462	105.3790	3.2205	25.4063	19.4624	16.3734	4.1163	0.8115	1.2864
560E06	0.0000	430.9351	55.7628	1.3058	1.9159	0.5854	4.5205	0.0626	0.4936	0.2021	0.0709	0.0234	0.0000	0.0000

**Table IIB.5b** Mean weight of herring by age, maturity, stock and subarea for the Acoustic Herring Survey R/V Dana Cruise July 2005

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	75.50	75.50	70.34	70.34	100.19	100.19	124.44	124.44	0.00	0.00	0.00	0.00	0.00
570E06	0.00	47.63	47.63	69.62	69.62	100.98	100.98	124.44	124.44	0.00	0.00	0.00	0.00	0.00
580E08	0.00	72.26	72.26	81.89	81.89	111.66	111.66	124.44	124.44	0.00	0.00	0.00	0.00	0.00
570E08	0.00	56.61	56.61	75.96	75.96	109.98	109.98	124.44	124.44	0.00	0.00	0.00	0.00	0.00
C	0.27	69.39	69.39	69.50	69.50	108.06	108.06	124.44	124.44	0.00	0.00	0.00	0.00	0.00
D	0.40	60.49	60.49	71.30	71.30	110.97	110.97	124.44	124.44	0.00	0.00	0.00	0.00	0.00
E	8.34	41.52	41.52	48.71	48.71	111.70	111.70	119.82	119.82	124.44	0.00	0.00	0.00	0.00
560E06	0.00	35.97	35.97	67.87	67.87	106.96	106.96	124.44	124.44	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	73.11	73.11	83.16	83.16	93.54	93.54	106.80	106.80	120.47	129.36	131.42	149.20	0.00
570E06	0.00	35.56	35.56	81.34	81.34	93.75	93.75	106.88	106.88	119.37	127.76	130.79	149.20	0.00
580E08	0.00	69.37	69.37	82.51	82.51	98.07	98.07	112.82	112.82	119.84	125.76	125.79	162.25	0.00
570E08	0.00	42.46	42.46	79.24	79.24	95.33	95.33	111.73	111.73	113.93	122.08	125.70	160.79	0.00
C	0.00	65.23	65.23	75.51	75.51	92.05	92.05	109.26	109.26	116.15	126.25	125.69	162.67	0.00
D	0.00	52.08	52.08	74.09	74.09	93.58	93.58	115.76	115.76	113.95	134.23	120.57	157.54	0.00
E	0.00	39.23	39.23	60.54	60.54	78.64	78.64	82.88	82.88	105.31	101.97	111.80	140.61	77.79
560E06	0.00	35.19	35.19	87.89	87.89	106.20	106.20	112.29	112.29	112.30	115.56	117.84	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 2005

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	21.3	21.3	20.7	20.7	23.3	23.3	25.0	25.0	0.0	0.0	0.0	0.0	0.0
570E06	0.0	18.0	18.0	20.7	20.7	23.4	23.4	25.0	25.0	0.0	0.0	0.0	0.0	0.0
580E08	0.0	21.0	21.0	21.6	21.6	24.1	24.1	25.0	25.0	0.0	0.0	0.0	0.0	0.0
570E08	0.0	19.2	19.2	21.2	21.2	24.0	24.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0
C	3.5	20.7	20.7	20.6	20.6	23.9	23.9	25.0	25.0	0.0	0.0	0.0	0.0	0.0
D	3.6	19.7	19.7	20.8	20.8	24.1	24.1	25.0	25.0	0.0	0.0	0.0	0.0	0.0
E	10.5	17.4	17.4	18.5	18.5	24.1	24.1	24.6	24.6	25.0	0.0	0.0	0.0	0.0
560E06	0.0	16.6	16.6	20.5	20.5	23.8	23.8	25.0	25.0	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	21.0	21.0	21.9	21.9	22.8	22.8	23.7	23.7	24.6	25.0	25.4	26.5	0.0
570E06	0.0	16.5	16.5	21.7	21.7	22.8	22.8	23.7	23.7	24.5	25.0	25.4	26.5	0.0
580E08	0.0	20.7	20.7	21.8	21.8	23.1	23.1	24.2	24.2	24.6	25.0	25.1	27.2	0.0
570E08	0.0	17.5	17.5	21.5	21.5	22.9	22.9	24.1	24.1	24.2	24.7	25.0	27.1	0.0
C	0.0	20.3	20.3	21.2	21.2	22.6	22.6	23.9	23.9	24.3	25.0	25.0	27.2	0.0
D	0.0	18.8	18.8	21.1	21.1	22.7	22.7	24.3	24.3	24.1	25.5	24.7	27.0	0.0
E	0.0	17.1	17.1	19.7	19.7	21.5	21.5	21.9	21.9	23.5	23.3	23.8	26.0	21.5
560E06	0.0	16.5	16.5	22.2	22.2	23.7	23.7	24.2	24.2	24.1	24.4	24.5	0.0	0.0

