Acoustic Herring Survey report for RV "DANA"

26th June2008 – 10th July 2008

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1. INTRODUCTION

Since 1991 the DTU National Institute of Aquatic Resources (DTU AQUA) 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 2007-survey with R/V DANA, covering the Skagerrak and Kattegat, was conducted in the period June 29 to July 10 2008, while calibration was done during June 26 to June 29 2008.

2. SURVEY

2.1 Personnel

During calibration 26/6 – 29/6-2008
Karl-Johan Stæhr (cruise leader)
Torben Filt Jensen(assisting cruise leader)
Bo Lundgren
Thyge Dyrnesli
Bo Tegen Nielsen
Frederik Mathisen

During acoustic monitoring 29/6 - 10/7-2008
Karl-Johan Stæhr (cruise leader)
Bo Lundgren (assisting cruise leader)
Torben Filt Jensen
Lise Sindahl
Helle Rasmussen
Susanne Hansen
Nina Fuglsang
Thyge Dyrnesli

2.2 Narrative

The survey of R/V Dana was planned to start on the 26 June at 12.00 hours to go to Bornö in the Gullmar Fjord, Sweden for calibration of acoustic equipment. Due to a breakdown on the aft side-thruster the departure had to be postponed until 17.00 hours. The vessel was anchored at Bornö in the Gullmar Fjord, Sweden at midnight the 26 June and the calibration was initiated in the morning of the 27 June. The calibration was conducted until the morning of the 29 June.

The 29 June at noon the scientific crew was exchanged outside the harbour of Skagen. After the short break, R/V Dana steamed towards the north-westerly corner of the survey area in Skagerrak. The acoustic integration was initiated on the 29 June at 19.30 UTC at 57º53 N, 08º58E.

The western Skagerrak area was covered during June 29 – July 4, eastern Skagerrak during July 5 – 7 and Kattegat during July 7 – 10. The acoustic integration was ended at 57º25 N, 10º45 E at 06.00 UTC.

At the 3 July two crew members had to be changed at Hirtshals and the cruise line for the survey had to be modified from the optimal to make this exchange at Hirtshals possible.

In the morning of the10 July a new towed body was tested in Kattegat north of Læsø. R/V Dana arrived at Hirthals at 15.00 UTC on the 10 July.

Totally the survey covered about 1950 nautical miles mainly using data from the 38 kHz paravane transducer running at depths of 3 – 5 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 no data had to be excluded due to the weather.. During trawling hull-mounted transducers were used for all three frequencies.

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. 1). The area surveyed by Dana is split into 8 sub-areas.

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 parts of Kattegat the survey track was made in a zigzag pattern adapted to the depth curves and the relatively heavy ship traffic.

2.4 Calibration

The echosounders were calibrated at Bornö in Gullmar Fjord, Sweden during June 27-29 2008. The calibration was performed according to the procedures established for EK60 at three frequencies (18, 38 and 120 kHz). This was the second calibration of the year, the previous one before a cruise to the Norwegian Sea in May. The calibration of the paravane split-beam transducer at 38 kHz was

done with a 60 mm copper sphere. Calibration of the three hull-mounted split-beam transducers at 18, 38 and 120 kHz were carried out with 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 on the towed body close to results from previous years. The calibration and setup data of the EK60 38 kHz used during the survey are shown in Table 1.
The hull-mounted 38kHz transducer showed that two of the four segments had a lower sensitivity that the normal. The transducer is installed in 1985 and it is requested to be changed at the next docking of the vessel. Data from this transducer was not used for integration during this survey.

The 38 kHz on the new towed body was calibrated for the first time.

2.5 Acoustic data collection

Acoustic data were collected using mainly the Simrad EK60 38 kHz 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 hard disk all 24 hours a day, also during fishing operations, but data recorded during fishing periods (usually two daytime hauls and two night-time hauls (the latter immediately before and after local midnight)) have not been used for the biomass estimate. The sampling unit (ESDU) was one nautical mile (nm). 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 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 , 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. 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. Fourier Shape Analyses calibrated to Micro-structure formed in the otolith during the larval period was used for the discrimination of herring race (see Appendix VI, Application of otolith shape as a stock identification metod in mixed Atlantic Herring (*Clupea harengus* L) stocks in the North Sea and Western Baltic). Maturity was determined according to an 8-stage scale as also used by Scotland.

2.7 Hydrographic data

CTD profiles with a Seabird 911 were made immediately before or after each trawl haul. The distribution of CTD stations is similar to the distribution of the trawl hauls and shown in Fig. 2. 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.

2.8 Data analysis

For the judging process rawdata is 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.
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 subarea (56E06 – 58E08, C – E in Fig.1) 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 in the survey area 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 near-by 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-age and length weight relationships by race for the herring were made based on the single fish sampled in each haul and frozen for later for race analysis of the otolith after the cruise.

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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 1619. The distribution of ESDU on strata's is given in Table 2. Table 2 also shows the mean Sa and mean TS per strata used in the abundance estimation. The used strata's are shown in Figure 1 and the cruise track for the survey are shown in Figure 2.

Herring and sprat was not observed in midwater trawl hauls at depths below 150 meters. Therefore, layers below 150 meter were excluded from the estimation.

The relative herring density in numbers per nm^2 along the cruise track is shown in Figure 3. The distribution of herring was in 2008 distributed further west (west of 8˚ E) than in 2006 and 2007 and the large concentrations in Kattegat and along the Danish coast in Skagerrak are not as pronounced as in 2007 (see Fig. 4)

3.2 Biological data

During the survey in 2008 37 hauls were conducted, 27 surface hauls and 10 bottom hauls. The geographical distribution of hauls is shown in Fig. 2 and details on the hauls and catch are given in Table 3 and 4.

The total catch for the survey was 29.4 tons .Herring was present in 34 hauls with a total catch of 18.4 tons. The total catch of herring was dominated by one haul with 13.4 tons of herring In 2008 as in 2007 herring was fished best during daytime in surface hauls. Length distributions of herring per hauls are given in Table 5.
Sprat was present in the hauls in Kattegat (stratum F) and in stratum 560E6 where they contributed to the catch with 1% and 0.5%, respectively. For the total survey area herring, mackerel and sprat contributed to the total catch by 64%, 24 % and 0.1 %, respectively.

Based on the frozen single fish samples from each haul, where race 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. For North Sea autumn spawners specimens with maturity stage ≥3 or age ≥5 are regarded as mature, and for Baltic spring spawners specimens with maturity stage ≥2 or age ≥5 are regarded as mature.

North Sea autumn spawners:

Skagerrak

WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6
%	1	1	0	0,66	0,34	0,79	0,21	088	0,12	1	1

Kattegat

WR	0	1i	1m	2i	2m	3i	3m
%	1	1	0	1	0	0,57	0,43

Baltic Sea spring spawners:

Skagerrak

WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10
%	1	0.93	0.07	0.55	0.45	0.36	0.64	0.15	0.85	1	1	1	1	1	1

Kattegat

WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9
%	1	0.93	0.07	0.74	0.26	0.35	0.65	0.03	0.97	1	1	1	1	1

3.3 Biomass estimates

The total herring biomass estimate for the Danish acoustic survey with R/V Dana in June-July 2008 is 530,975 tonnes, of which 15.2 % or 80,470 tonnes is North Sea autumn spawning herring and 84,8 % or 450,505 tonnes is Baltic Sea spring spawning herring.
For the total number of herring the survey results is 11,840 mill., of which 37,8 % are North Sea autumn spawners and 62.2 % are Baltic Sea spring spawners.

The estimated total number of herring, mean weight, mean length and biomass per age and maturity stage in each of the surveyed strata are given in Tables 6 and 7 for North Sea autumn spawners and Baltic spring spawners, respectively.

A comparison for the results of the last three years surveys are given in the text table below.

	2006	2007	2008
Autumn spawners			
Abundance in mill.	1530	4443	4473
Biomass in tons	98786	315176	80469
Spring spawners			
Abundance in mill.	6407	8847	7367
Biomass in tons	471850	614048	450505

From 2006 to 2007 there was an increase in the abundance of Autumn spawners of 190 % and of the biomass of 219 %. The age structure in the abundance for 2006 and 2007 was similar with 86 % and 91 % of the total abundance as 1 WR for the two years respectively (seeTable 7). This corresponds to an overall increase of the abundance of Autumn spawners in the survey area.

From 2007 to 2008 the abundance of Autumn spawners increased by 0.7%, whereas the biomass decreased by 74%. As it can be seen from Table 7 this contradictory development between abundance and biomass is the result of a dramatic change in age composition from 2007 to 2008. In 2007 1 WR contributed with 91 % of the abundance of Autumn spawners whereas the 0 WR contributes with 88 % of the abundance in 2008. (Table 7).

The decline in biomass of Autumn spawners in for the Danish acoustic survey with R/V Dana in June-July 2008 from the survey in 2007 is therefore due to a change of age structure of the abundance in the survey area. This may also be the background for the change in the overall distribution pattern seen in 2008 (Fig 3 and 4)

For the Spring spawners no larger changes in the age structure over the years from 2006 to 2007 can be seen.

Figure 1. Map showing the survey area for the Danish acoustic survey with R/V Dana in June-July 2008. The map shows the sub areas used in the abundance estimation.

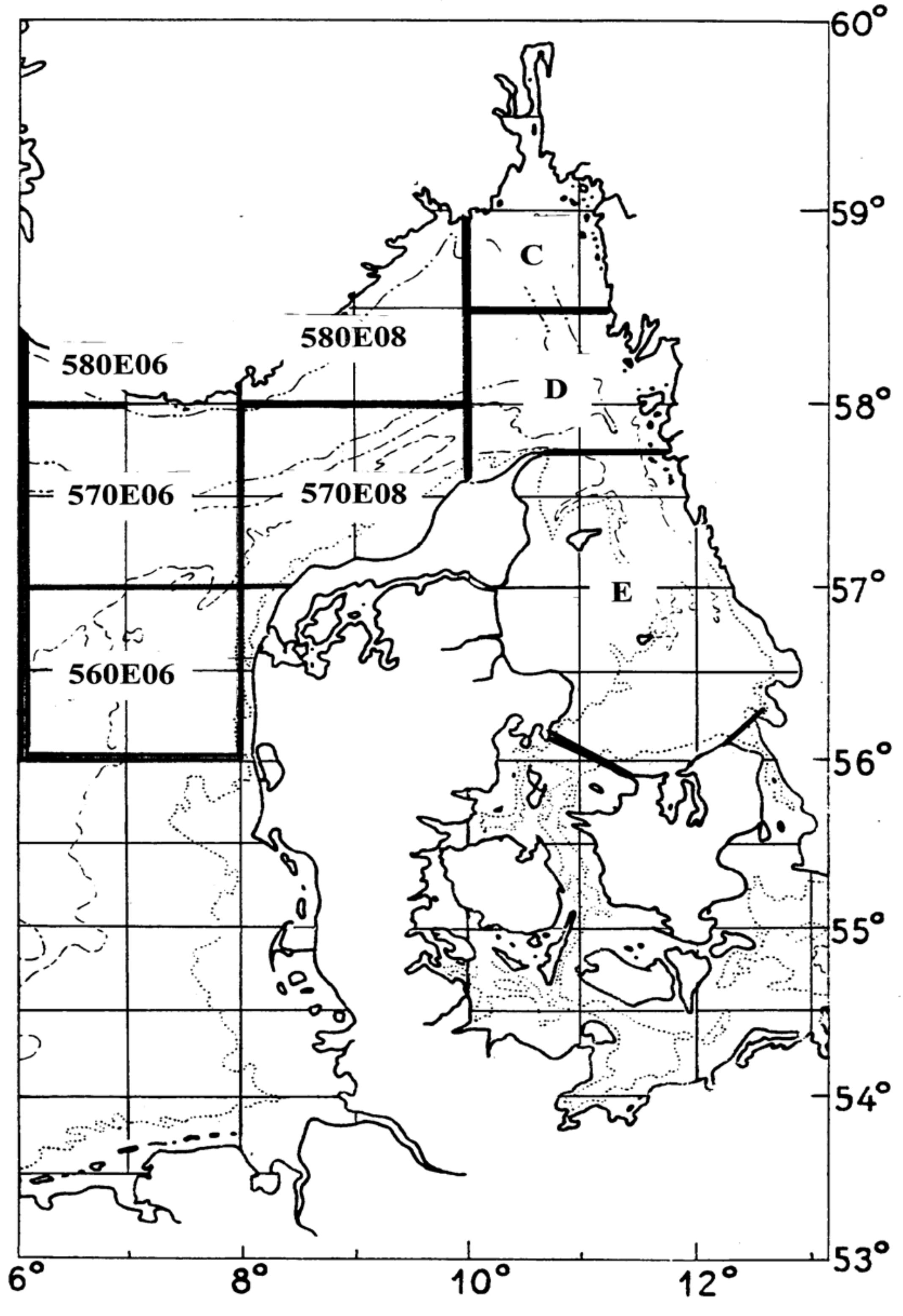

Figure 2. Map showing cruise track and trawl stations during the Danish acoustic survey with R/V Dana in June-July 2008.

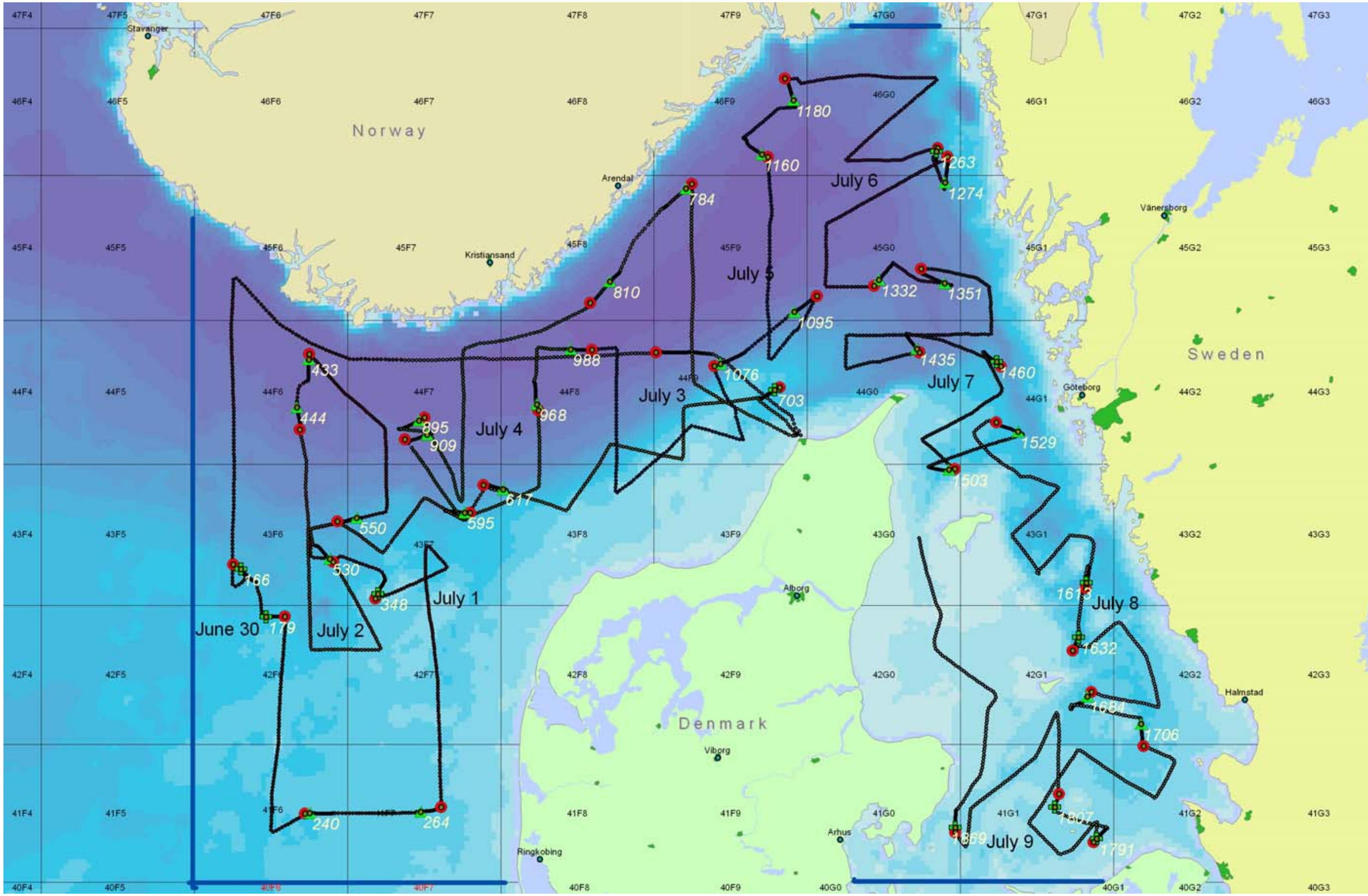

Figure 3. Relative herring density (in numbers per nm²) along the track of the June-July 2008 Danish acoustic survey in the eastern North Sea, Skagerrak and Kattegat. Red circles indicate relative density of herring per ESDU

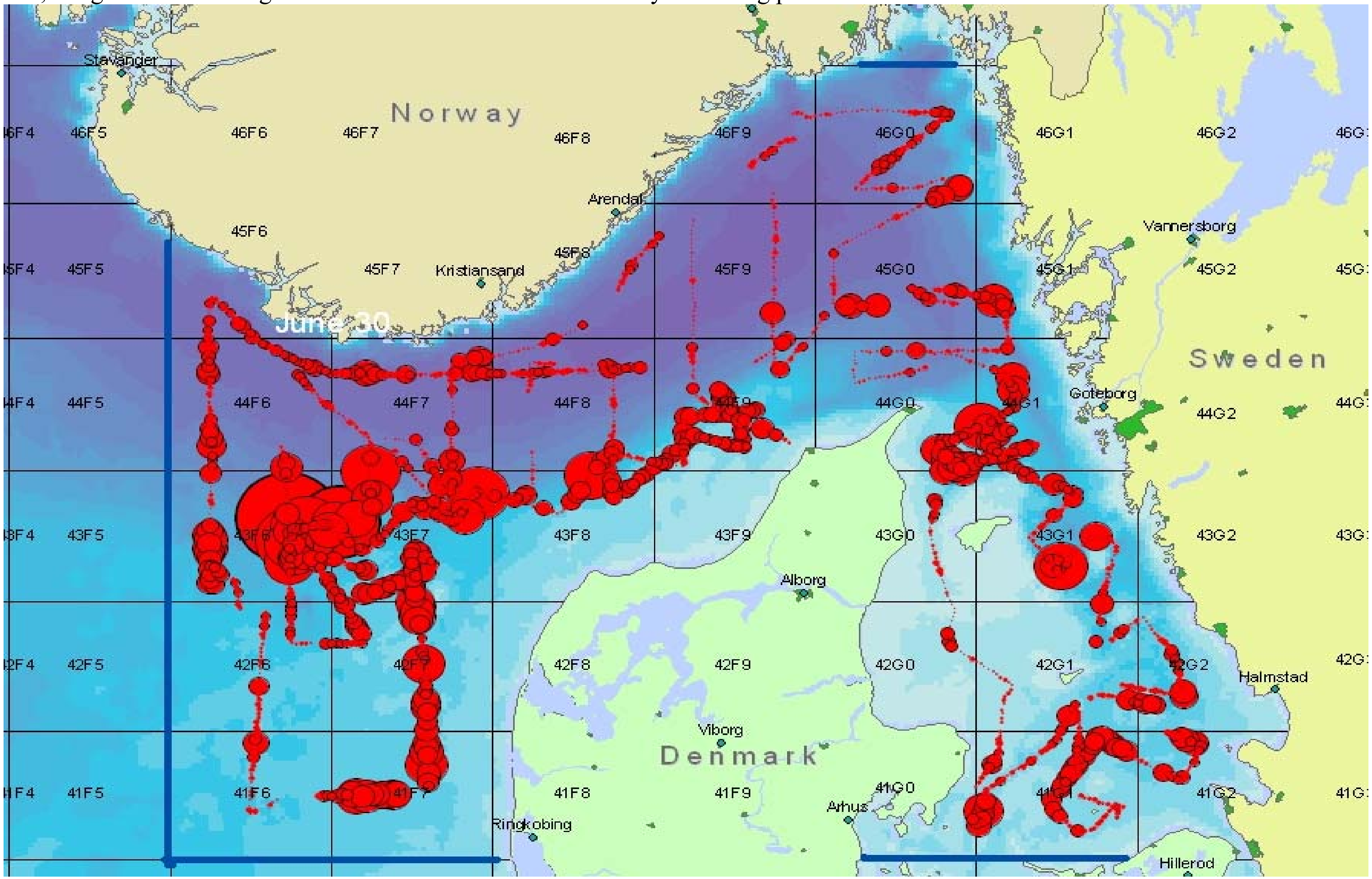

Figure 4. Relative herring density (in numbers per nm²) along the track of the June-July 2007 Danish acoustic survey in the eastern North Sea, Skagerrak and Kattegat. Red circles indicate relative density of herring per ESDU

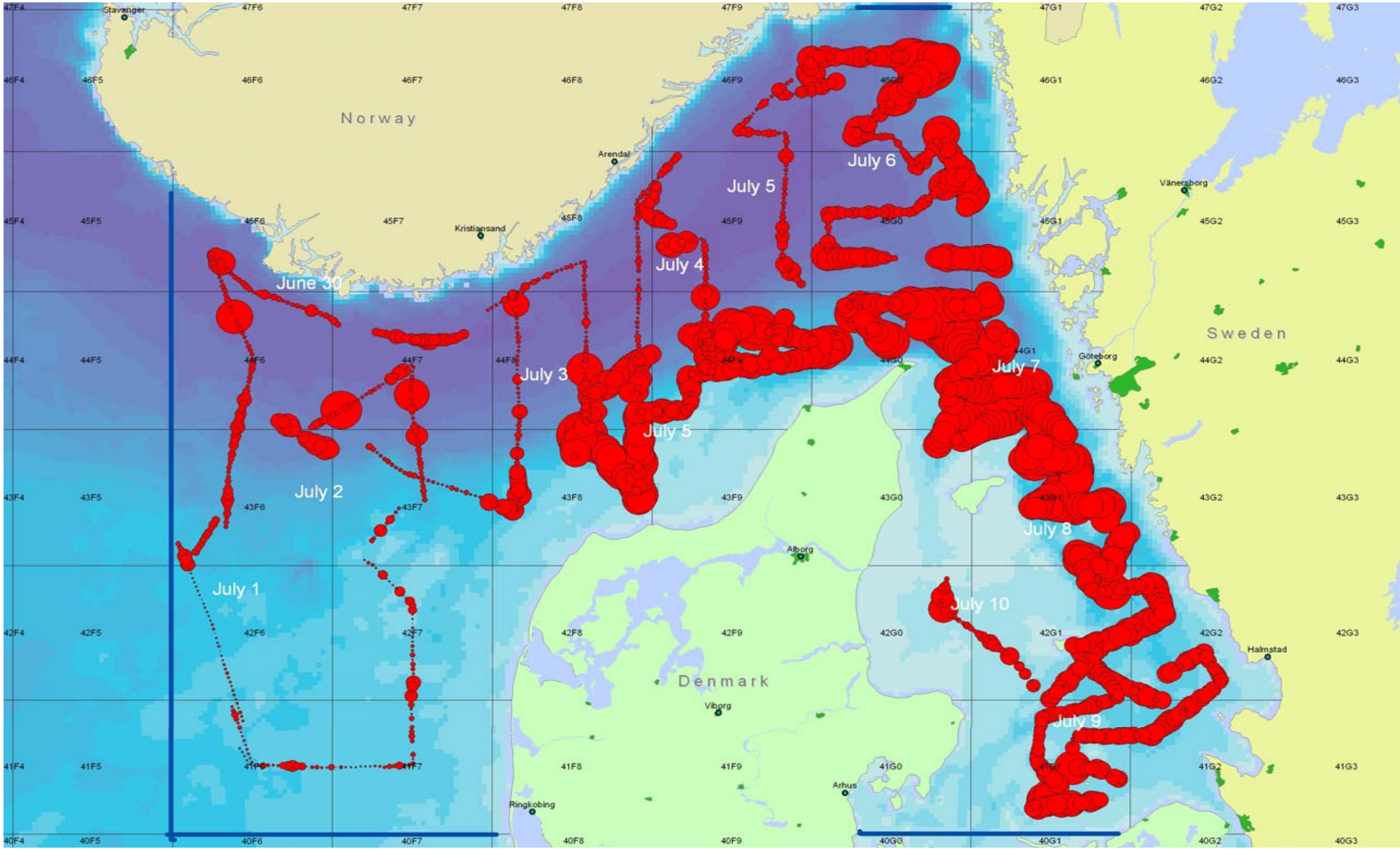

Table 1. . Simrad EK60 and analysis settings used during the the Acoustic Herring Survey with R/V Dana Cruise July 2008

Transceiver Menu	
Frequency	38 kHz
Sound speed	1488 $m.s^{-1}$
Max. Power	2000 W
Equivalent two-way beam angle	-20.5 dB
Default Transducer Sv gain	24.85 dB
3 dB Beamwidth	6.9°
Calibration details	
TS of sphere	-33.6 dB
Range to sphere in calibration	8,70 m
Measured NASC value for calibration	25900 m^2/nmi^2
Calibration factor for NASCs	1.00
Absorption coeff	6,086 dB/km
Log Menu	
Distance	1,0 n.mi. using GPS-speed
Operation Menu	
Ping interval	1 s
Analysis settings	
Bottom margin (backstep)	1.0 m
Integration start (absolute) depth	7 - 9 m
Range of thresholds used	-70 dB

Table 2 Survey statistic for the Danish acoustic survey with R/V Dana in June-July 2008.

Stratum ID	area Nm*2	Number of Logs	Number of Hauls	Mean Sa	Mean TS
560E06	3980	141	3	5,14E-06	1,17E-05
570E06	3600	426	8	8,24E-06	2.05E-05
570E08	3406	287	5	1.07E-05	3.56E-05
580E06	209	21	1	3,78E-06	2,22E-05
580E08	1822	99	5	1,31E-06	2,33E-05
C	988	74	3	3,62E-05	1,73E-05
D	1837	163	7	3,37E-05	2,42E-05
E	5228	408	10	3,75E-05	1,22E-05

Table 3. Trawl haul details for the Danish acoustic survey with R/V Dana in June-July 2008.

Date dd-mm-yy	Haul no.	Time UTC	ICES Square	Position Latitude	Longitude	Trawl Direction deg.	Trawl type	Cath depth m	Mean depth m	Total catch kg	Main Species	Trawling speed Kn	Trawling duratin min,	Wind speed m/s
30-06-08	166	10:43	43F6	57.07.715 N	006.18.182 E	132	Expo	Bottom	60	35	Cod	2.9	61	9
30-06-08	179	13:18	42F6	56.57.497 N	006.28.173 E	94	Expo	Bottom	53	283	Cod	3	60	7
30-06-08	240	20:50	41F6	56.15.090 N	006.45.237 E	89	Fotö	Surface	37	860	Herring, Mackerel	4.5	60	6
01-07-08	264	00:22	41F7	56.15.431 N	007.28.673 E	81	Fotö	Surface	30	280	Herring	4.2	60	5
01-07-08	348	10:46	43F7	57.02.423 N	007.11.859 E	29	Expo	Bottom	33	91	Mackerel	3.1	60	6
07-07-08	433	22:16	44F6	57.51.88 N	006.44.751 E	184	Fotö	Surface	345	380	Mackerel, Herring	4.4	59	6
02-07-08	444	00:21	44F6	57.41.842 N	006.40.226 E	168	Fotö	Surface	240	550	Herring	4.4	60	7
02-07-08	530	10:45	43F6	57.09.875 N	006.52.963 E	296	Fotö	Surface	65	2774	Mackerel	4.2	60	9
02-07-08	550	14:06	43F6	57.18.657 N	007.03.516 E	260	Fotö	Surface	77	13500	Herring	4.5	60	10
02-07-08	595	21:02	43F7	57.19.733 N	007.45.913 E	276	Fotö	Surface	71	77	Mackerel	4.7	60	10
02-07-08	617	00:17	43F7	57.24.715 N	008.00.937 E	285	Fotö	Surface	133	817	Mackerel	4.5	60	10
03-07-08	703	10:48	44F9	57.45.478 N	009.47.229 E	131	Expo	Bottom	37	135	Whiting	3.1	60	10
03-07-08	784	21:10	45F9	58.27.241 N	009.12.542 E	226	Fotö	Surface	419	245	Mackerel, Herring	4.6	60	10
04-07-08	810	00:44	45F8	58.08.110 N	008.42.791 E	220	Fotö	Surface	455	696	Mackerel, Herring	4.4	60	9
04-07-08	895	10:50	44F7	57.39.079 N	007.28.011 E	248	Fotö	Surface	302	172	Herring	4.1	60	9
04-07-08	909	13:21	44F7	57.36.074 N	007.31.109 E	255	Fotö	Surface	279	856	Herring	4.5	60	9
04-07-08	968	21:12	44F8	57.42.451 N	008.14.106 E	358	Fotö	Surface	471	823	Mackerel, Herring	4.4	60	4
05-07-08	988	00:18	44F8	57.54.003 N	008.27.312 E	88	Fotö	Surface	526	632	Mackerel, Herring	4.1	60	5
05-07-08	1076	10:36	44F9	57.50.950 N	009.26.039 E	65	Fotö	Surface	95	27	Large medusa	4	60	1
05-07-08	1095	13:18	45G0	58.01.810 N	009.55.023 E	55	Fotö	Surface	155	23	Large medusa	4.3	60	6
05-07-08	1160	21:10	46F9	58.34.252 N	009.42.277 E	338	Fotö	Surface	527	702	Herring, Mackerel	3.9	60	9
06-07-08	1180	00:23	46F9	58.45.350 N	009.54.584 E	343	Fotö	Surface	256	410	Mackerel, Herring	4.2	60	9
06-07-08	1263	11:19	46G0	58.34.866 N	010.50.620 E	185	Expo	Bottom	86	268	Krill, Norway pout	2.7	60	9
06-07-08	1274	13:45	46G0	58.28.532 N	010.53.980 E	9	Fotö	Surface	71	210	Herring, picked dogfish	3.5	60	12
06-07-08	1332	21:11	45G0	58.08.452 N	010.28.008 E	38	Fotö	Surface	259	993	Herring	4.6	60	4
07-07-08	1351	00:18	45G0	58.07.775 N	010.53.765 E	290	Fotö	Surface	219	909	Mackerel, Herring	4.3	60	5
07-07-08	1435	10:44	44G0	57.54.087 E	010.42.894 E	323	Fotö	Surface	156	37	Herring	3.8	60	6
07-07-08	1460/1436	14:57	44G1	57.51.420 N	011.14.146 E	315	Expo	Bottom	59	69	Large meduse, Norway pout	2.9	60	8
07-07-08	1503	20:53	43G0	57.28.829 N	010.55.507 E	60	Fotö	Surface	33	623	Herring	3.7	60	6
08-07-08	1529	00:41	44G1	57.36.737 N	011.22.506 E	288	Fotö	Surface	43	564	Mackerel, Herring	4.3	60	10
08-07-08	1613	10:47	43G1	57.04.811 N	011.49.283 E	0	Expo	Bottom	53	100	Herring, Large medusa	3.2	60	4
08-07-08	1632	13:56	42G1	56.53.101 N	011.46.226 E	202	Expo	Bottom	44	182	Large medusa, Herring	2.9	60	3
08-07-08	1684	20:46	42G1	56.40.418 N	011.49.570 E	224	Fotö	Surface	38	119	Large medusa	4.2	60	3
09-07-08	1706	00:05	42G2	56.34.462 N	012.10.695 E	177	Fotö	Surface	41	87	Large medusa, Mackerel	4.2	60	8
09-07-08	1791	10:33	41G1	56.09.517 N	011.53.391 E	46	Expo	Bottom	26	65	Large medusa	3.2	60	5
09-07-08	1807	13:12	41G1	56.16.386 N	011.36.879 E	26	Expo	Bottom	30	123	Dab, Large medusa	2.9	60	3
09-07-08	1869	20:57	41G0	56.11.954 N	010.58.017 E	5	Expo	Surface	20	644	Large Medusa	3.9	60	5

Table 4. Catch composition in trawl hauls for the Danish acoustic survey with R/V Dana in June-July 2008.

	Station	166	179	240	264	348	433	444	530	550	595	617	703
	ICES sq.	43F6	42F6	41F6	41F7	43F7	44F6	44F6	43F6	43F6	43F7	43F7	44F9
	Gear	Expo	Expo	Fotö	Fotö	Expo	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Expo
	Fishing depth	Bottom	Bottom	Surface	Surface	Bottom	Surface	Surface	Surface	Surface	Surface	Surface	Bottom
	Total depth	60	53	37	30	33	345	240	65	77	71	133	37
	Day/Night	D	D	N	N	D	N	N	D	D	N	N	D
	Total catch	35	283	860	280	91	380	550	2,774	13,500	77	817	135
Herring	*Clupea harengus*			505.127	161.457		107.8	372.215	200.28	13440.04	2.694	154.62	0.194
Mackerel	*Scomber scombrus*		0.182	314.234	69.704	34.625	146.6	105.685	2558.017	59.956	57.6	624.692	1.326
Large Medusa	*Medusa, spp*		107.446	10.882	10.789	21.43	11.084	51.353	14.91		12.3	26.838	
Pearlside	*Mauorolicus muelleri*						83.977	3.361					
Krill	*Euphausidae spp.*						14.93	2.951					
Lumpsucker	*Cyclopterus lumpus*			0.058				0.424			1.184	1.832	
Cod	*Gadus Morhua*	18.7	155.4			1.982							7.9
Whiting	*Merlangius merlangus*	0.26	0.516		0.182	0.196		0.029			0.012	0.002	80.3
Garfish	*Belone belone*			0.718	0.43		15.23	5.022	0.37		1.112	1.112	
Norway pout	*Trisopterus esmarki*										0.006		
Dab	*Limanda limanda*	1.714	0.968		0.168	5.426							15.6
Picked Dogfish	*Squalus acanthias*												
Gurnard	*Trigala spp.*	1.444	1.764	14.546	10.579	24.4			0.412		0.898	0.082	2.934
Horse mackere	*Trachurus trachurus*			11.283	19.4			0.318					3.382
Sprat	*Sprattus sprattus*				6.703								
Saithe	*Pollachius virens*		0.136									6.9	
Invertebrates	*Inv*	3.03			0.072								0.336
Common weav	*Trachinus draco*												
Haddock	*Melanogrammus aeglefinus*	2.742	4.09									0.006	8.385
Long rough dal	*Hippoglosides plattessoides*												
Hake	*Merluccius merluccius*	3.878											5.758
Plaice	*Pleuronectes platessa*	0.748			0.44	2.124							8.855
Anglerfish	*Lophiuspiscatorius*		9.7										
	Salmon solar							5.308					
Twaite shad	*Alosa fallax*			3.152									
Blue whiting	*Micromesistius poutassou*						0.378	3.098					
	Pandalus borealis												
	Cephalopoda sp	0.372	0.71		0.043	0.038					0.708	0.915	
Greater sandee	*Hyperoplus lanceolatus*	0.034	1.826			0.028							
Lemon sole	*Microstomus kitt*	0.944	0.262			0.524							
Flounder	*Platichthys flesus*												
Snake blenny	*Lumpenus lampretaeformis*												
	Myoxocephalus scorpius												
Pollack	*Pollachius pollachius*												
	Lampetra fluviatilis							0.238					
Norway lobster	*Nephrops norvegicus*												
	Trisopterus minutus												
	Phalis qunnellus												
	Ammodytes marinus				0.019								
Pipefish	*Entelurus aequoreus*							0.006	0.011				
	Buglossidium luteum				0.014								

Table 4. continued.

	Station	784	810	895	909	968	988	1076	1095	1160	1180	1263	1274
	ICES sq.	45F9	45F8	44F7	44F7	44F8	44F8	44F9	45G0	46F9	46F9	46G0	45G0
	Gear	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Expo	Fotö
	Fishing depth	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Bottom	Surface
	Total depth	419	455	302	279	471	526	95	155	527	256	86	71
	Day/Night	N	N	D	D	N	N	D	D	N	N	D	D
	Total catch	245	696	172	856	823	632	27	23	702	410	268	210
Herring	*Clupea harengus*	73.075	252.208	142.6	760.581	293.469	142.785	1.194	1.804	365.286	64.466	4.084	89.22
Mackerel	*Scomber scombrus*	110.178	341.881		13.954	318.776	314.284	0.142	0.38	158.731	251.832		14.444
Large Medusa	*Medusa, spp*	30.958	75.55	11.965	63.954	113.493	40.566	22.215	14.895	29.472	25.299	54.019	44.504
Pearlside	*Mauorolicus muelleri*	1.674				49.518	92.699			89.957	57.077		
Krill	*Euphausidae spp.*	12.084				9.169	24.675			25.679	1.813	97.513	
Lumpsucker	*Cyclopterus lumpus*	9.7	7.974	17.4	16.4	36.8	12.5	1.988	3.418	18	6.51		0.132
Cod	*Gadus Morhua*											1.55	
Whiting	*Merlangius merlangus*	0.044	0.087	0.026	0.086	0.013	0.026	0.022	0.04		0.072	2.908	
Garfish	*Belone belone*	7.195	18.3	0.296	0.24	1.764	4.432		1.156	2.102	0.33		
Norway pout	*Trisopterus esmarki*											79.507	
Dab	*Limanda limanda*												
Picked Dogfish	*Squalus acanthias*											1.012	61.7
Gurnard	*Trigala spp.*							0.93	1.016				
Horse mackere	*Trachurus trachurus*												
Sprat	*Sprattus sprattus*												
Saithe	*Pollachius virens*				0.76					12.4	2.6	1.376	
Invertebrates	*Inv*											10.99	
Common weav	*Trachinus draco*							0.05					
Haddock	*Melanogrammus aeglefinus*			0.004	0.025		0.032					0.706	
Long rough dal	*Hippoglosides plattessoides*											11.299	
Hake	*Merluccius merluccius*											0.36	
Plaice	*Pleuronectes platessa*											0.068	
Anglerfish	*Lophiuspiscatorius*												
	Salmon solar												
Twaite shad	*Alosa fallax*											0.614	
Blue whiting	*Micromesistius poutassou*												
	Pandalus borealis												
	Cephalopoda sp	0.092											
Greater sandee	*Hyperoplus lanceolatus*												
Lemon sole	*Microstomus kitt*												
Flounder	*Platichthys flesus*												
Snake blenny	*Lumpenus lampretaeformis*											0.929	
	Myoxocephalus scorpius												
Pollack	*Pollachius pollachius*									0.374			
	Lampetra fluviatilis												
Norway lobster	*Nephrops norvegicus*												
	Trisopterus minutus												
	Phalis qunnellus												
	Ammodytes marinus												
Pipefish	*Entelurus aequoreus*												
	Buglossidium luteum												

Table 4. continued.

	Station	**1332**	**1351**	**1435**	**1460/1436**	**1503**	**1529**	**1613**	**1632**	**1684**	**1706**	**1791**	**1807**	**1869**	
	ICES sq.	**45G0**	**45G0**	**44G0**	**44G1**	**43G0**	**43G1**	**43G1**	**42G1**	**42G1**	**42G2**	**41G1**	**41G1**	**41G0**	
	Gear	**Fotö**	**Fotö**	**Fotö**	**Expo**	**Fotö**	**Fotö**	**Expo**	**Expo**	**Fotö**	**Fotö**	**Expo**	**Expo**	**Expo**	
	Fishing depth	**Surface**	**Surface**	**Surface**	**Bottom**	**Surface**	**Surface**	**Bottom**	**Bottom**	**Surface**	**Surface**	**Bottom**	**Bottom**	**Surface**	
	Total depth	**259**	**219**	**156**	**59**	**33**	**43**	**53**	**52**	**38**	**41**	**26**	**30**	**20**	**Total**
	Day/Night	**N**	**N**	**D**	**D**	**N**	**N**	**D**	**D**	**N**	**N**	**D**	**D**	**N**	**Catch**
	Total catch	**993**	**909**	**37**	**69**	**623**	**564**	**100**	**182**	**119**	**87**	**65**	**123**	**644**	**29357.24**
Herring	*Clupea harengus*	438.547	244.288	20.796	8.369	513.122	148.162	39.1	33.092	4.644	14.8	5.922	7.084	29.264	18642.39
Mackerel	*Scomber scombrus*	128.797	642.236	2.2		14.49	357.221	1.97	0.61	11.242	19.106	7.075		2.34	6684.51
Large Medusa	*Medusa, spp*	116.288	19.058	13.94	28.077	79.475	43.794	28.725	110.957	92.522	48.246	38.021	40.141	601.703	2054.869
Pearlside	*Mauorolicus muelleri*	227.18						0.06							605.503
Krill	*Euphausidae spp.*	29.447													218.261
Lumpsucker	*Cyclopterus lumpus*	24.7	0.15		3.63	0.152		15.9	10.1			2.094	4.038	1.738	196.822
Cod	*Gadus Morhua*				0.497			1.744	0.622						188.395
Whiting	*Merlangius merlangus*	0.041	0.067	0.01	7.809	3.691		5.372	13.916	0.234	0.916	0.688	1.277	0.052	118.894
Garfish	*Belone belone*	23.3	2.644			5.304	6.29			5.274	1.644				104.265
Norway pout	*Trisopterus esmarki*				13.017										92.53
Dab	*Limanda limanda*							0.669	8.701	0.034		3.992	51.415	0.028	88.715
Picked Dogfish	*Squalus acanthias*														62.712
Gurnard	*Trigala spp.*			0.188				0.13			0.096	0.836			60.255
Horse mackere	*Trachurus trachurus*		0.556				1.846								36.785
Sprat	*Sprattus sprattus*					2.731		0.028	0.354	1.036	0.458	1.056	11.815	8.53	32.711
Saithe	*Pollachius virens*	4.7												0.124	28.996
Invertebrates	*Inv*				0.262			1.833	0.88			1.564	3.77		22.737
Common weav	*Trachinus draco*					2.731	6.6878			4.014	1.734	3.136	0.397	0.168	18.9178
Haddock	*Melanogrammus aeglefinus*				1.587			0.044	0.456			0.002			18.079
Long rough dal	*Hippoglosides plattessoides*				2.188			0.544	1.701				0.591		16.323
Hake	*Merluccius merluccius*				2.434	0.802		0.299							13.531
Plaice	*Pleuronectes platessa*							0.532	0.51						13.277
Anglerfish	*Lophiuspiscatorius*														9.7
	Salmon solar											0.396			5.704
Twaite shad	*Alosa fallax*				0.972										4.738
Blue whiting	*Micromesistius poutassou*														3.476
	Pandalus borealis							2.974							2.974
	Cephalopoda sp					0.043						0.01			2.931
Greater sandee	*Hyperoplus lanceolatus*											0.19	0.101		2.179
Lemon sole	*Microstomus kitt*				0.152								0.13		2.012
Flounder	*Platichthys flesus*												1.346		1.346
Snake blenny	*Lumpenus lampretaeformis*														0.929
	Myoxocephalus scorpius												0.833		0.833
Pollack	*Pollachius pollachius*														0.374
	Lampetra fluviatilis														0.238
Norway lobster	*Nephrops norvegicus*							0.014	0.1						0.114
	Trisopterus minutus							0.068							0.068
	Phalis gunnellus												0.06		0.06
	Ammodytes marinus											0.018		0.02	0.057
Pipefish	*Entelurus aequoreus*														0.017
	Buglossidium luteum														0.014

Table 4. Measured length distribution of herring by haul for the Danish acoustic survey with R/V Dana in June-July 2008.

Station	240	264	433	444	530	550	595	617	703	784	810	895	909	968	988	1076	1095	1160	1180	1263	1274	1332	1351	1435	1460/1436	1503	1529	1613	1632	1684	1706	1807	1869
ICES sq.	41F6	41F7	44F6	44F6	43F6	43F6	43F7	43F7	44F9	45F9	45F8	44F7	44F7	44F8	44F8	44F9	45G0	46F9	46F9	46G0	45G0	45G0	45G0	44G0	44G1	43G0	43G1	43G1	42G1	42G1	42G2	41G1	41G0
Gear	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Expo	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Fotö	Expo	Fotö	Fotö	Fotö	Fotö	Expo	Fotö	Fotö	Expo	Expo	Fotö	Fotö	Expo	Expo
Fishing depth	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Bottom	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Bottom	Surface	Surface	Surface	Surface	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Surface
Total depth	37	30	345	240	65	77	71	133	37	419	455	302	279	471	526	95		527	256	86	71	259	219	156	59	33	43	53	52	38	41	30	20
Day/Night	N	N	N	N	D	D	N	N	D	N	N	D	D	N	N	D	D	N	N	D	D	N	N	D	D	N	N	D	D	N	N	D	N
Total catch,kg	860	280	433	550	2,774	13,500	77	817	135	245	696	172	856	823	632	27	22,709	702	410	268	210	993	909	37	69	623	564	100	182	119	87	123	644
Total catch Herrin	505.127	161.457	107.8	372.215	200.28	13440.04	2.694	154.62	0.194	73.075	252.208	142.6	760.581	293.469	142.785	1.194	10804	365.286	64.466	4.084	89.22	438.547	244.288	20.796	8.369	513.122	148.162	39.1	33.092	4.644	14.8	7.084	29.264
Sample Herring,k	36.156	9.647	58.32	56.825	19.814	40.35	2.694	19.46	0.194	30.64	48.076	60.847	63.094	56.674	54.382	1.194	1.804	43.125	24.959	4.084	35.305	60.1	50.01	20.796	2.24	9.226	29.272	29.028	5.204	4.644	14.8	2.108	29.264
Length in cm																																	
5.5																																	
6																				52													
6.5																				26						1			1				
7																										2			4				
7.5		12																								3			21				
8		71																								4			65				
8.5		217																								7			75				
9		185																							8	8			88				
9.5		152																							4	7			102				
10		96																							8	27			68				
10.5		35																							8	47			63				
11		7																							14	112			34				
11.5		2																							11	212			8				
12																									10	147							
12.5																									7	49			1				
13																										12							
13.5																										1							
14		1																															
14.5		2																								1							
15		11					1																						1				
15.5	3	27						1																		2			2				
16	29	38			7		1	16		1				1	5											2						1	
16.5	164	41	1		39	25	9	81				3	6	1	7		1					1		1		2							1
17	284	31	3		92	53	11	109				3	5	1	8		4						4	1			3	1		1			18
17.5	166	6	4		113	59	16	76		1		4	2	3	13		4		1	1		1				3	2		1	5		3	60
18	136	4	1	3	71	80		44		1		7	3	2	12				1		1	1	5			7	13	2	1	4		4	112
18.5	79	2	1		48	53	3	31			2	8	2	1	5				4			1	3	1	1	1	17	28	4	22	2	2	138
19	26	1	1	1	16	48		12			1	4	6	3	4				4		1		6	2		6	65	93	12	30	2	4	92
19.5	12		1	2	13	51	1	3		3		10	4	6	7				5	1	16		15	1		4	109	108	2	9	3	1	48
20	2		4	2	12	57		1		12	16	11	12	11	14		1		15	4	49	7	35	1	4	3	108	65	1	8	4	3	47
20.5			2	1	6	50		4		20	8	19	10	8	14			10	30	6	93	7	40	6	5	1	65	57	5	6	3	4	32
21	1	1	16	2	8	56		5		26	30	13	15	16	20	2	1	22	39	11	102	35	74	18	8		32	53	6	4	1	3	30
21.5			31	6		26	3	7		41	36	7	33	14	25	2	4	35	65	6	82	64	109	32	1		21	37		1	5	2	18
22	1		15	11		19	2	5		46	55	16	34	20	44	2		62	42	5	47	90	86	30	2	1	8	19	2	2	3	3	11
22.5			69	27		13	1	3	2	29	53	27	37	13	48	2		80	41	5	34	121	92	37	1		5	7			1	1	4
23			71	31		9	1			28	48	39	41	20	56	1	1	70	16	4	18	106	59	28		1	1	5			2	2	
23.5			79	40		8	2	1		26	39	38	55	27	44	1		56	21	1	11	67	28	26			3	5		1	4	1	
24			50	45		5	1			26	37	40	53	21	43	1	1	31	5	1	3	39	12	10			2	1			2		
24.5			39	40		2		1		6	35	31	30	20	31	2	2	18	2	1	1	21	10	11			2	1			4		
25			25	32		2		1		7	23	20	25	26	27			11	2	1	2	10	5	6			4				4		
25.5			23	40		4		2		13	15	31	18	19	23		1	10		1	1	9	2	5							4		
26			19	40	1			1		10	27	34	37	34	13		1	10	1			9	2	3							14		
26.5			16	48		1				4	10	47	32	26	15				1			8	1	1							16		
27			6	32		1				6	10	28	25	31	20			5				6									9		
27.5			8	20		2				4	5	28	23	25	12			2	2		1	2									14		
28			3	9				1		1	2	7	10	12	11									2							8		
28.5			8	10				1		1	1	13	13	21	3			2				4		1							3		
29				4							1	2	2	7																			
29.5				3						1		2	1	10																	1		
30			1					1				3	1	9	1		1																
30.5						1						1	1	1	1							2											
31								1				1		2																			
31.5														3																			
32								1																									
32.5													1																				
Total no.	903	942	497	449	426	625	52	409	2	313	454	497	537	414	526	13	22	424	297	126	462	611	588	223	92	673	460	482	567	93	109	34	611
Mean Length	17.35326689	10.33015	23.57545	24.92984	17.78756	19.4216	18.20192	17.7934		22.71086	23.25551	24.14185	23.88641	24.86473	22.97909	22.57692	20.86364	22.95165	21.7138	12.04762	21.23701	22.82815	21.77211	22.60987	13.25	11.70505	19.97826	20.0778	9.95679	19.19355	25.09174	19.97059	20.8789

Table 5. Abundance, mean weight, mean length and biomass by age group and sub area for North Sea autumn spawning herring in the Danish acoustic survey with R/V Dana in June-July 2008.

Numbers in millions															
	WR														
Strata	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10
580E06	0	5.759368	0	3.480536	1.78999	0.893362	0.243644	0	0	0	0	0	0	0	0
570E06	0	233.3463	0	29.0668	14.94864	7.953745	2.169203	1.598667	0.228381	0.97172	1.166064	0	0	0	0
580E08	0	14.77055	0	0.527494	0.271282	0.74947	0.204401	0	0	0	0	0	0	0	0
570E08	0	30.46026	0	23.4449	12.05738	12.00792	3.274887	10.69737	1.528195	0	0	0	0	0	0
C	0	16.99621	0	1.192675	0.613376	0.22778	0.062122	0	0	0	0	0	0	0	0
D	11.87653	61.8407	0	8.106213	4.16891	2.872055	0.783288	1.013811	0.14483	0.706254	0	0	0	0	0
E	2347.35	13.78818	0	1.011825	0	2.096488	1.572366	0	0	0	0	0	0	0	0
560E06	1556.124	26.99296	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean weigth in gram															
	WR														
Strata	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10
580E06	0.0	93.4	93.4	105.1	105.1	103.0	103.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
570E06	0.0	70.4	70.4	104.2	104.2	115.7	115.7	120.9	120.9	119.0	136.0	0.0	0.0	0.0	0.0
580E08	0.0	95.6	95.6	122.6	122.6	126.5	126.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
570E08	0.0	75.7	75.7	142.9	142.9	186.9	186.9	104.5	104.5	0.0	0.0	0.0	0.0	0.0	0.0
C	0.0	85.6	85.6	87.8	87.8	120.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	8.5	89.6	89.6	99.6	99.6	99.2	99.2	108.5	108.5	120.0	0.0	0.0	0.0	0.0	0.0
E	10.7	47.8	47.8	74.1	74.1	76.8	76.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
560E06	4.7	38.6	38.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mean length in cm															
	WR														
Strata	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10
580E06	0.0	22.4	22.4	23.6	23.6	23.5	23.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
570E06	0.0	20.3	20.3	23.0	23.0	24.5	24.5	25.5	25.5	25.5	25.5	0.0	0.0	0.0	0.0
580E08	0.0	22.6	22.6	24.5	24.5	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
570E08	0.0	20.8	20.8	24.9	24.9	27.2	27.2	24.2	24.2	0.0	0.0	0.0	0.0	0.0	0.0
C	0.0	21.9	21.9	22.7	22.7	24.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	10.8	22.2	22.2	23.2	23.2	23.3	23.3	24.2	24.2	24.0	0.0	0.0	0.0	0.0	0.0
E	11.2	18.3	18.3	21.3	21.3	21.6	21.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
560E06	9.1	17.0	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biomass in tonn															
	WR														
Strata	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10
580E06	0	537.8728	0	365.7019	188.0753	92.01627	25.09535	0	0	0	0	0	0	0	0
570E06	0	16425.11	0	3028.174	1557.346	920.2199	250.9691	193.3559	27.62228	115.6347	158.5848	0	0	0	0
580E08	0	1411.56	0	64.66284	33.25517	94.82227	25.86062	0	0	0	0	0	0	0	0
570E08	0	2305.293	0	3350.354	1723.039	2243.757	611.9339	1117.478	159.6397	0	0	0	0	0	0
C	0	1454.537	0	104.7758	53.88471	27.33358	7.454613	0	0	0	0	0	0	0	0
D	100.3812	5542.808	0	807.4947	415.283	284.7674	77.66383	109.9927	15.71324	84.75048	0	0	0	0	0
E	25029.34	658.7248	0	74.97878	0	161.0291	120.7718	0	0	0	0	0	0	0	0
560E06	7268.57	1042.235	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6. Abundance, mean weight, mean length and biomass by age group and sub area for Baltic Sea spring spawning herring in the Danish acoustic survey with R/V Dana in June-July 2008

Numbers in millions															
	WR														
Strata	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10
580E06	0	4.397147	0.350271	12.29409	10.07069	4.13648	7.307781	0.684736	3.959558	1.626579	0.23028	0	0	0	0
570E06	0	2096.724	167.0221	207.7732	170.1972	42.14208	74.45101	7.581251	43.83941	23.76703	13.53144	5.641147	2.240824	0.168337	0.142474
580E08	0	46.11512	3.673466	32.92637	26.9716	13.33691	23.56187	1.054662	6.098695	5.018811	1.894965	0.9969	0.476556	0.132367	0
570E08	0	649.948	51.77395	125.7643	103.0197	53.20398	93.9937	10.51712	60.81637	46.00456	41.0344	15.90546	6.888062	5.642334	0
C	0	100.6947	8.021198	53.26785	43.6343	9.40576	16.61684	1.06412	6.15339	5.06947	0.579803	0.339799	0	0	0.337388
D	1.378056	115.5073	9.201148	83.49441	68.39436	21.68065	38.30249	2.956288	17.09506	11.58314	3.955683	1.210712	0	0	0.28923
E	23.86369	201.6199	14.60006	92.09093	33.01373	14.34586	27.03642	0.391481	10.96147	6.158667	3.854107	0.451898	0.678876	0.362604	0
560E06	81.1742	1903.126	0	3.749727	1.874864	0	0	0	0	0	0	0	0	0	0
Mean weigth in gram															
	WR														
Strata	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10
580E06	0.0	72.7	72.7	100.4	100.4	119.5	119.5	129.6	129.6	165.5	210.5	0.0	0.0	0.0	0.0
570E06	0.0	53.7	53.7	84.9	84.9	102.9	102.9	121.4	121.4	158.3	152.5	180.6	245.2	156.0	240.0
580E08	0.0	84.7	84.7	95.7	95.7	101.2	101.2	127.2	127.2	135.0	146.2	158.6	136.4	152.6	0.0
570E08	0.0	45.1	45.1	101.7	101.7	123.9	123.9	147.5	147.5	162.3	189.5	196.1	212.0	187.6	0.0
C	0.0	71.0	71.0	78.3	78.3	85.3	85.3	95.2	95.2	96.5	101.5	118.0	0.0	0.0	166.0
D	10.0	75.0	75.0	86.6	86.6	92.6	92.6	108.0	108.0	110.6	129.0	202.9	0.0	0.0	166.0
E	11.4	47.7	47.7	58.9	58.9	71.0	71.0	100.1	100.1	117.6	113.6	126.7	120.4	195.0	0.0
560E06	4.8	37.1	37.1	67.3	67.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mean length in cm															
	WR														
Strata	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10
580E06	0.0	20.5	20.5	23.2	23.2	24.8	24.8	25.6	25.6	27.6	29.3	0.0	0.0	0.0	0.0
570E06	0.0	18.6	18.6	21.7	21.7	23.5	23.5	24.7	24.7	26.7	26.9	28.2	30.5	28.0	31.0
580E08	0.0	21.7	21.7	22.7	22.7	23.6	23.6	25.3	25.3	25.7	26.6	27.2	26.8	28.0	0.0
570E08	0.0	17.7	17.7	23.1	23.1	24.7	24.7	26.2	26.2	26.9	28.3	29.0	29.3	28.8	0.0
C	0.0	20.7	20.7	21.6	21.6	22.4	22.4	22.8	22.8	23.8	24.0	26.0	0.0	0.0	27.5
D	11.4	21.1	21.1	22.2	22.2	23.1	23.1	23.6	23.6	24.5	25.5	29.1	0.0	0.0	27.5
E	11.1	18.4	18.4	20.1	20.1	21.4	21.4	22.9	22.9	24.2	24.1	25.5	24.5	28.0	0.0
560E06	9.2	17.2	17.2	21.3	21.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biomass in tonn															
	WR														
Strata	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10
580E06	0	319.6322	25.46146	1234.027	1010.852	494.4562	873.5393	88.72068	513.037	269.1477	48.47392	0	0	0	0
570E06	0	112562	8966.532	17634.12	14444.97	4336.11	7660.462	920.1134	5320.656	3763.432	2063.524	1018.82	549.4884	26.26052	34.19376
580E08	0	3907.468	311.2635	3149.804	2580.158	1349.672	2384.42	134.1329	775.638	677.7815	277.1181	158.1033	65.02055	20.20512	0
570E08	0	29311.16	2334.886	12789.06	10476.15	6592.466	11646.69	1551.449	8971.425	7466.087	7777.444	3119.028	1460.558	1058.691	0
C	0	7148.282	569.4222	4172.858	3418.192	802.616	1417.955	101.2967	585.7592	489.4134	58.85002	40.09628	0	0	56.00635
D	13.84893	8660.597	689.8911	7234.437	5926.081	2006.749	3545.257	319.1429	1845.478	1281.003	510.4807	245.6675	0	0	48.01224
E	272.7827	9619.892	696.6129	5424.951	1944.794	1018.319	1919.139	39.19094	1097.346	724.0486	437.7261	57.23668	81.733	70.70778	0
560E06	387.3042	70623.54	0	252.4148	126.2074	0	0	0	0	0	0	0	0	0	0

Table 7. Age distribution in estimate of Autumn spawners during the Danish acoustic survey with R/V Dana in June-July from 2006 to 2008 given as number per age and strata in mill.and % of total abundance given by age and strata.

Autumn spawners in 2006

Number in millions

Strata	WR 0	1	2	3	4	5	6	7	8	9	Totalt
580E06	0	0	0	0	0	0	0	0	0	0	0
570E06	0	313.2245	77.82016	1.310689	0	0	0	0	0	0	392.3554
580E08	0	72.47082	5.607853	0	0	0.280924	0	0	0	0	78.3596
570E08	30.98883	425.0991	40.40881	2.000434	0	0	0	0	0	0	498.4972
C	0	125.2478	21.22575	0	0	0.317077	0	0	0	0	146.7906
D	0	265.6062	13.03738	1.528584	0	0	0	0	0	0	280.1722
E	6.566309	107.84	17.38965	1.233393	0	0	1.086413	0	0	0	134.1158
560E06	0	0	0	0	0	0	0	0	0	0	0
All stratas	37.55514	1309.488	175.4896	6.073101	0	0.598001	1.086413	0	0	0	1530.291

Age distribution in % of total abundance

Strata	WR 0	1	2	3	4	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
570E06	0.00	79.83	19.83	0.33	0.00	0.00	0.00	0.00	0.00	0.00
580E08	0.00	92.48	7.16	0.00	0.00	0.36	0.00	0.00	0.00	0.00
570E08	6.22	85.28	8.11	0.40	0.00	0.00	0.00	0.00	0.00	0.00
C	0.00	85.32	14.46	0.00	0.00	0.22	0.00	0.00	0.00	0.00
D	0.00	94.80	4.65	0.55	0.00	0.00	0.00	0.00	0.00	0.00
E	4.90	80.41	12.97	0.92	0.00	0.00	0.81	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
All stratas	2.45	85.57	11.47	0.40	0.00	0.04	0.07	0.00	0.00	0.00

Autumn spawners in 2007

Number in millions

Strata	WR 0	1	2	3	4	5	6	7	8	9	Totalt
580E06	0	4.275523	0.777364	0	0	0	0	0	0	0	5.052887
570E06	0	121.3957	56.68901	5.730107	0.081208	0	0	0	0	0	183.896
580E08	0	59.14779	26.5337	0	0	0	0	0	0	0	85.68149
570E08	0	753.575	118.4236	0	0	0	0	0	0	0	871.9986
C	0	75.62764	7.928773	0	0	0	0	0	0	0	83.55641
D	0	1365.499	109.4435	5.590177	0	0	0	0	0	0	1480.533
E	0	1542.982	46.9248	7.764333	0	0	0	0	0	0	1597.671
560E06	0	134.8495	0	0	0	0	0	0	0	0	134.8495
All stratas	0	4057.353	366.7207	19.08462	0.081208	0	0	0	0	0	4443.239

Age distribution in % of total abundance

Strata	WR 0	1	2	3	4	5	6	7	8	9
580E06	0.00	84.62	15.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00
570E06	0.00	66.01	30.83	3.12	0.04	0.00	0.00	0.00	0.00	0.00
580E08	0.00	69.03	30.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
570E08	0.00	86.42	13.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C	0.00	90.51	9.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D	0.00	92.23	7.39	0.38	0.00	0.00	0.00	0.00	0.00	0.00
E	0.00	96.58	2.94	0.49	0.00	0.00	0.00	0.00	0.00	0.00
560E06	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
All stratas	0.00	91.32	8.25	0.43	0.00	0.00	0.00	0.00	0.00	0.00

Autumn spawners in 2008

Numbers in millions

Strata	WR 0	1	2	3	4	5	6	7	8	9	Totalt
580E06	0	5.759368	5.270526	1.137006	0	0	0	0	0	0	12.1669
570E06	0	233.3463	44.01544	10.12295	1.827048	0.97172	1.166064	0	0	0	291.4496
580E08	0	14.77055	0.798776	0.95387	0	0	0	0	0	0	16.5232
570E08	0	30.46026	35.50228	15.28281	12.22556	0	0	0	0	0	93.47091
C	0	16.99621	1.806051	0.289902	0	0	0	0	0	0	19.09216
D	11.87653	61.8407	12.27512	3.655343	1.158641	0.706254	0	0	0	0	91.51258
E	2347.35	13.78818	1.011825	3.668854	0	0	0	0	0	0	2365.818
560E06	1556.124	26.99296	0	0	0	0	0	0	0	0	1583.117
All stratas	3915.35	403.9546	100.68	35.11073	15.21125	1.677974	1.166064	0	0	0	4473.151

Age distribution in % of total abundance

Strata	WR 0	1	2	3	4	5	6	7	8	9
580E06	0.00	47.34	43.32	9.35	0.00	0.00	0.00	0.00	0.00	0.00
570E06	0.00	80.06	15.10	3.47	0.63	0.33	0.40	0.00	0.00	0.00
580E08	0.00	89.39	4.83	5.77	0.00	0.00	0.00	0.00	0.00	0.00
570E08	0.00	32.59	37.98	16.35	13.08	0.00	0.00	0.00	0.00	0.00
C	0.00	89.02	9.46	1.52	0.00	0.00	0.00	0.00	0.00	0.00
D	12.98	67.58	13.41	3.99	1.27	0.77	0.00	0.00	0.00	0.00
E	99.22	0.58	0.04	0.16	0.00	0.00	0.00	0.00	0.00	0.00
560E06	98.29	1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
All stratas	87.53	9.03	2.25	0.78	0.34	0.04	0.03	0.00	0.00	0.00