Acoustic Herring Survey report for RV "DANA"

3rd – 16th July 2012

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Cruise summary

Total days	14
Days of monitoring	11
Number of acoustic samples, ESDU monitored	1972
Number of trawl hauls	37
Number of CTD stations	39
Number of WP2 stations	20
Fish catch in kg	23964
Fish catch in number	378035
Number of measured fish	27298
Number of aged and race-split herring.	2730
Number of aged sprat	595

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 2012-survey with R/V DANA, covering the Skagerrak and Kattegat, was conducted in the period July 5 to July 16 2012, while calibration was done during July 3 to July 5 2012.

2. SURVEY

2.1 Personnel

During calibration 3/7– 5/7-2012
Karl-Johan Stæhr (cruise leader)
Torben Filt Jensen (assisting cruise leader)
Tommy Nielsen
Peter Faber
Thyge Dyrnesli
Ronny Sørensen
Eik Ehlert Britsch
Thomas Thomsen
Claus Halle

During acoustic monitoring 5/7 - 16/7-2012
Karl-Johan Stæhr (cruise leader)
Torben Filt Jensen (assisting cruise leader)
Annegrete D, Hansen
Thyge Dyrnesli
Lise Sindahl
Helle Andersen
Tom Svoldgaard
Lotte Worsøe Clausen

2.2 Narrative

The survey of R/V Dana started on July 3rd at 06.00 UTC with departure from Hirtshals heading towards Bornö in Gullmar Fjord, Sweden for calibration of the acoustic equipment. The vessel was anchored at Bornö in the Gullmar Fjord, Sweden July 3rd at 12.30 UTC. The calibration was initiated in the afternoon of July 3rd and continued until the morning of July 5th.

At July 5th noon the scientific crew was exchanged outside the harbour of Skagen. After the short break, R/V Dana steamed northwest towards the border between Skagerrak and the North Sea. The acoustic integration was initiated on July 5th at 20.07 UTC at 57º49.4'N, 008º38.4'E with a CTD-station followed by integration for the north-western corner of the survey area.

The North Sea and western Skagerrak area was covered during the period July 5 – 9, eastern Skagerrak during July 9-13 and Kattegat during July 13-16.

At July 7th one of the ground ropes brook on the Expo trawl during the second afternoon hauls. This was repaired immediately by chain and the trawl was ready for next bottom haul.

At July 9th the hole bottom of the Expo trawl were torn. Due to excellent work from the crew at the deck a new bottom for the trawl were inserted during the next 24 hours and the trawl could be used again for the day hauls at July 11th , but three bottom hauls had to be cancelled.

The acoustic integration was ended July 16 at 57º 09'N, 10º 47'E at 04.35 UTC as the termination of the towed body brook. The towed body was recovered.

R/V Dana arrived at Hirthals at 1100 UTC on July 16.

Totally the survey covered about 1972 nautical miles. Data from the 38 kHz echosounder were recorded mainly using a 38 kHz paravane transducer running at depths of 3 – 5 m, the depth depending on the sea state and sailing direction relative to the waves. Simultaneously, data from the 120 kHz and 18 kHz echosounders using 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 Skagerrak area, east of 6° E and north of 56° N (Fig. 1). The area 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 limitations regarding available time periods and places for fishing (late morning, early afternoon and immediately before and after midnight; and a 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 pattern adapted to the depth curves and the relatively heavy ship traffic.

2.4 Calibration

The echosounders were calibrated at Bornö in the Gullmar Fjord, Sweden during 3-5 July 2012. The calibration was performed according to the procedures established for EK60 with three frequencies (18, 38 and 120 kHz). This was the second calibration of the year, the previous one just before 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. The 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 close to those from the previous calibration earlier in May, 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.

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. They have not been directly used for the survey estimate, but as an aid during judging when distinguishing between fish and plankton. The acoustic data were recorded as raw data on hard disk 24 hours a day also during fishing operations. During trawl hauls the towed body is taken aboard and the EK60 38 kHz echosounder run on the hull transducer, but data taken during fishing periods 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 pre-integrated into 1 m meter samples for each ping. These samples are 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 500 m depth.

2.6 Biological data - fishing trawls

The 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 2030 to 0300 UTC , usually two day hauls (pelagic on larger depth and demersal in shallow waters) and two night hauls (mostly surface or midwater). The strategy was to cover most depth

zones within each geographical stratum with trawl hauls. One-hour hauls were used as a standard during the survey.
The total weight of each catch was estimated and the catch sorted into species. Total weight per species and length measurements were made. 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. From each trawl haul 6 herring (if available) per 0.5 cm length class were collected and frozen for individual determination in land-laboratory of length, weight, age, race (North Sea autumn spawners or Baltic Sea spring spawners) and maturity. Fourier Shape Analyses calibrated to micro-structure formed in the otoliths during the larval period was used for the discrimination of herring race. 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. 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 similar to trawl hauls and shown in Table 8.

2.8 Plankton data

During the survey WP2 samples has been taken 2 times a day late evening and noon. Sampling has been conducted from 150 m or 5 m above bottom to surface with a 180 µm netting. The samples have been fractionised in size groups by filters of 2000 µm, 1000 µm and 180 µm. The samples have been dried for 24 hours and frozen for dry weight measurements at shore.
20 WP2 stations have been taken, see Table 9.

2.9 Data analysis

The raw data is pre-integrated into 1 m 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. The software allows ignoring data from layers and/or intervals with interference from wave- or ship wake-bubbles or rarely with interference from bottom-integration. In areas with heavy abundance of jellyfish or zooplankton, usually krill, manually adjustable thresholds are applied separately to each layer to suppress background echoes.

For each subarea (56E06 – 58E08, C – E in Fig.1) the mean backscattering cross section was estimated for herring, sprat, gadoids and mackerel based on the standardized 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 combined 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 age and race analysis made on the frozen samples of single fish 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) collected for the stock size calculation is 1972. . The numbers of ESDU's per stratum are given in Table 2. Table 2 also shows the mean Sa and mean TS per stratum used in the abundance estimation. The outline of the strata is shown in Figure 1 and the cruise track for the survey is shown in Figure 2.

Historically, herring and sprat have not been observed in midwater trawl hauls at depths below 150 meters. Therefore, layers below 150 meter have been excluded from the estimation.

The relative herring density in numbers per nm^2 along the cruise track is shown in Figure 3.

3.2 Biological data

During the survey in 2012 38 hauls were conducted, 24 surface hauls and 1 bottom hauls. The geographical distribution of hauls and details on the hauls and catches are given in Table 3 and 4.

Length distributions of herring, mackerel and sprat by haul are given in table 5 to 7.

The total catch for the survey was 24.0 tons. Herring was present in 35 hauls with a total catch of 13.8 tons or 58 % of the total catch. Totally 15,139 herring have been measured. Length distributions of herring per haul are given in Table 5.

Sprat was only present in the hauls in Kattegat (stratum E). The total sprat catch was 209 kg or 0.1 % of the total catch in Kattegat. Totally 1,060 sprat have been measured. Length distributions of sprat per haul are given in table 7.

Mackerel were present in 29 hauls with a total catch of 5.3 ton or 22.1 % of the total catch. Totally 4,700 mackerel have been measured. Length distributions of Mackerel per haul are given in table 6.

For the total survey area herring, mackerel and sprat contributed to the total catch by 58%, 22 % and 0.1 % respectively.

For other species 357,136 individuals has been measured all together.

Herring maturity

Based on the frozen single fish herring samples (2730 specimens) from each haul, where race analysis of the otoliths was used to differentiate between North Sea herring and Western Baltic herring, a maturity by age key was made for both races. It is given in the text table below. For North Sea autumn spawners specimens with maturity stage ≥3 and/or age ≥5 are regarded as mature and for Baltic spring spawners specimens with maturity stage ≥2 and/or age ≥5 are regarded as mature.

North Sea autumn spawners:

Skagerrak

WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7
%	100.00	100.00	0.00	85.55	14.45	58.33	41.67	28.57	71.43	100.00	100.00	100.00

North Sea

WR	0	1i	1m	2i	2m
%	100.00	100.00	0.00	100.00	0.00

Kattegat

WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5
%	100.00	100.00	0.00	60.00	40.00	25.00	75.00	0.00	100.00	100.00

Baltic Sea spring spawners:

Skagerrak

WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10	11	12
%	100.00	100.00	0.00	66.39	33.61	12.58	87.42	1.54	98.46	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

North Sea

WR	0	1i	1m	2i	2m
%	100.00	100.00	0.00	33.33	66.67

Kattegat

WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7
%	100.00	100.00	0.00	79.83	20.17	34.78	65.22	11.11	88.89	100.00	100.00	100.00

Sprat maturity

Based on 595 sprat collected over all length classes and hauls including sprat age, weight and maturity keys were established. The maturity key for sprat is shown in the text table below. Sprat with maturity stage ≥3 and/or age ≥3 are regarded as mature

WR	0	1i	1m	2i	2m	3	4	5	6
%	100.00	98.06	1.94	86.99	13.01	100.00	100.00	100.00	100.00

3.3 Biomass estimates

Herring

The total herring biomass estimate for the Danish acoustic survey with R/V Dana in July 2012 is 382,848 tonnes of which 67,9% or 259,947 tonnes is North Sea autumn spawners and 32.1 % or 122,901 tonnes is Baltic Sea spring spawners.
For the total number of herring the survey results give 6,759 mill, of which 71.1 % are North Sea autumn spawners and 28.9 % 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 Table 9 and 10 for North Sea autumn spawners and Baltic spring spawners respectively.

A comparison for the results of the last 7 years surveys are given in the text table below.

	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Autumn spawners							
Number in mill.	1530	4443	4473	9679	2723	5156	4805
Biomass in tons	98786	315176	80469	157707	148946	165589	259947
Spring spawners							
Number in mill.	6407	8847	7367	1326	1461	3699	1955
Biomass in tons	471850	614048	450505	146590	88597	179898	122901

North Sea autumn spawners

From 2006 to 2007 there was an increase in the abundance of autumn spawners of 190 % and in the biomass of 219 %. The age structure in the abundance for 2006 and 2007 showed the same pattern with 86 % and 91 % of the total abundance as 1 WR for the two years respectively. This increase corresponds to an overall increase of the abundance of autumn spawners in the survey area.

From 2007 to 2008 the abundance of autumn spawners showed an increase of 0.7% whereas the biomass showed a decrease of 74%. As it can be seen from Table 8 this contradictory development between abundance and biomass is the result of a dramatic change in age composition of the abundance from 2007 to 2008. In 2007 1 WR contributed to 91 % of the abundance of autumn spawners, whereas the 0 WR contributes to 88 % of the abundance in 2008. (Table 11).

From 2008 to 2009 the abundance of autumn spawners showed an increase of 116 % and the biomass showed an increase of 96%. As it can be seen from Table 8 the abundance in 2009 is dominated by 0 and 1 WR (81 and 19 % respectively). The abundance of 0 WR are the double of what was seen in 2008 and 1 WR are than 4 times the abundance in 2008.

From 2009 to 2010 the abundance of autumn spawners has decreased by 72 % whereas the biomass has decreased with 6%. From Table 8 it can be seen that the abundance is dominated by 1 WR in 2010 where it was dominated by 0 WR in 2008 and 2009. It looks as if the age structure in the abundance is on it way back to the structure seen in 2006 and 2007 (see Table 11)

From 2010 to 2011 the abundance of autumn spawners has increased by 89% whereas the biomass has increased with 7%. From table 11 it can be seen that the abundance of autumn spawners are dominated by 1 WR as in 2010 but the abundance of 0 WR and 2 WR has increased compared to 2010.

From 2011 to 2012 the abundance of autumn spawners has decreased by 7% whereas the biomass has increased with 11%. Table 11 shows that the fraction of 0 WR has decreased drastically from 2011 to 2012 whereas the fractions of 1WR and older have increased.

Baltic Sea spring spawners

For the spring spawners no large changes in the age structure over the years from 2006 to 2008 have been seen (see Text table).

From 2008 to 2009 there has been a decrease in the abundance of 82 % and in the biomass of 67 %. From Table 12 it can be seen that the major part of the difference in abundance between 2008 and 2009 lies in a decrease in the abundance of 0-3 WR.

From2009 to 2010 the abundance has increased with 9 %, whereas the biomass has decreased with 39.6%. From Table 12 it can be seen that there has been a change in the age structure of the spring spawners from 2009 to 2010. The abundance of 0-3 WR has increased with 39 % and the abundance of 4-13 WR has decreased with 83 %. This shift in the age structure of the abundance is reflected in the biomass.

From 2010 to 2011 the abundance has increased with 153 % and the biomass has increased with 96%. 2009 was the year with the lowest abundance in a period of the last 6 years and 2010 was the year with the lowest biomass. 2009 was exceptional with a very lower percentage of 0-3 WR compared to 4-13 WR. Whereas the age structure from 2010 and 2011 are back to the age structure seen before 2009 with abundance with approx.95 % 0-3WR and approx.5% 4-14 WR (see Table 12)

From 2011 to 2012 the abundance has decrease with 47% and the biomass has decreased with 32% compared with 2011. The abundance of 0-3 WR has decreased with 46% and the abundance of 4-13 WR has decreased with 67%, thereby the spring spawning herring are back to an age distribution like the one seen in 2010 (Table 12)

Sprat

The total abundance estimate of sprat for the Danish acoustic survey with R/V Dana in July 2012 is 1930.44 million corresponding to a biomass at 38144 ton. Sprats were in 2012 found in Kattegat Strata E with 98.2 %, Skagerrak Strata D (ICES 44G0) with 0.3 % and in the North Sea Strata 560E06 with 1.5 % during the Danish Acoustic survey in Kattegat and Skagerrak June-July 2012.

Abundance, biomass, mean length and mean weight per WR and strata are given in Table 13.

The DTU-Aqua Hawaii'an Summer Acoustic Survey crew thanks for a good and productive survey.

Figure 1. Map showing the survey area for the Danish acoustic survey with R/V Dana in July 2012. The map shows the subareas (strata) used in the abundance estimation.

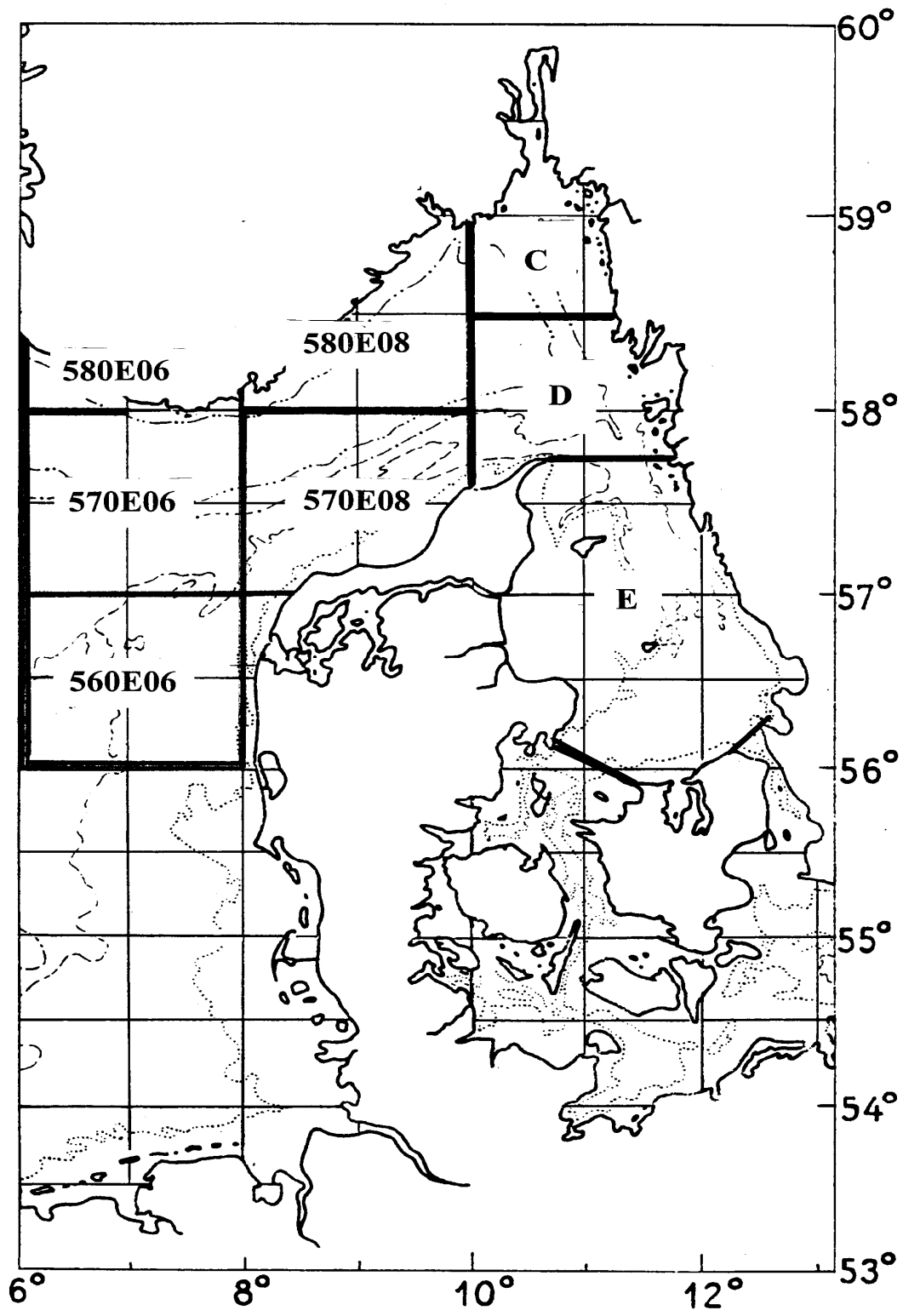

Figure 2. Map showing cruise track and trawl stations during the Danish acoustic survey with R/V Dana in July 2012.

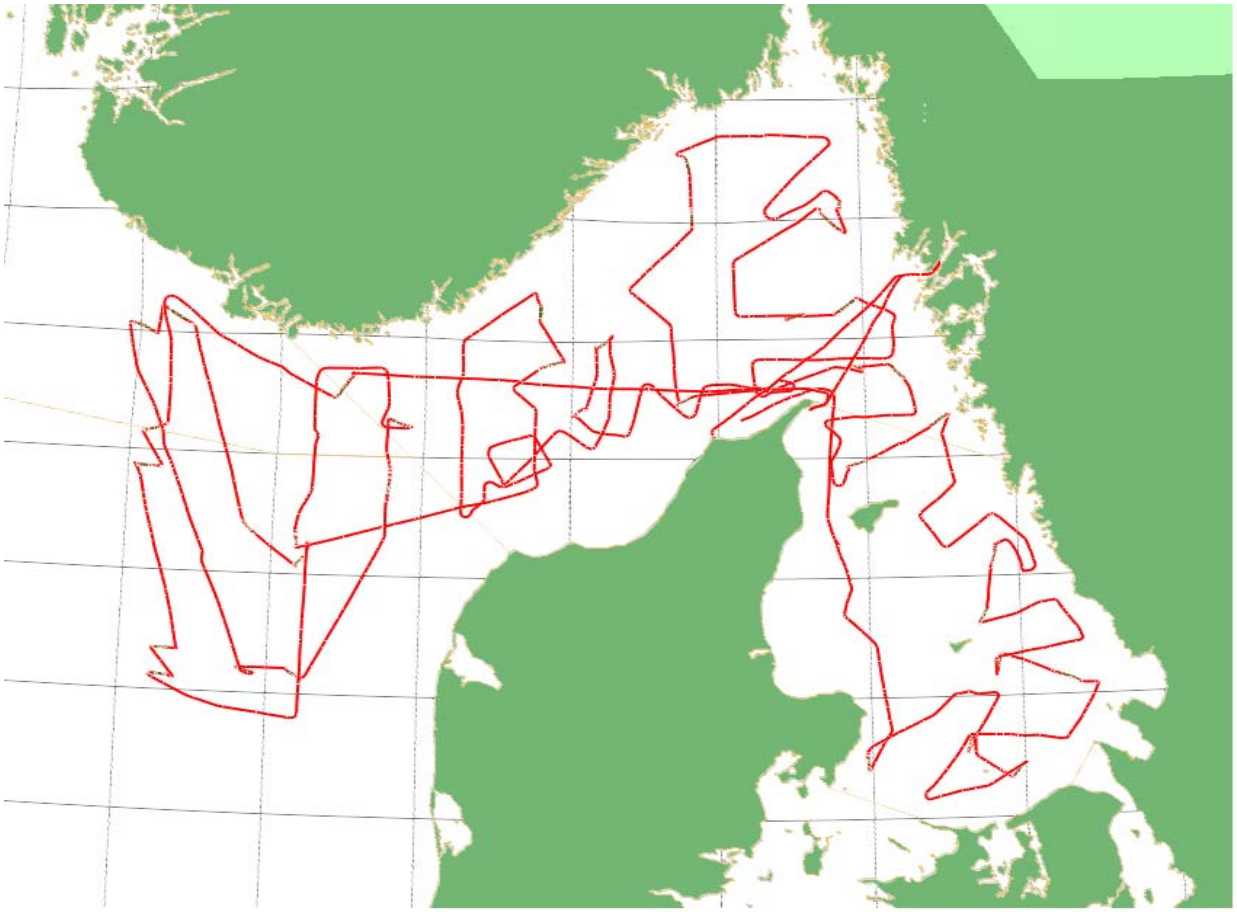

Table 1. . Simrad EK60 and analysis settings used during the Acoustic Herring Survey with R/V Dana Cruise July 2012

Transceiver Menu	
Frequency	38 kHz
Sound speed	1508 $m.s^{-1}$
Max. Power	2000 W
Equivalent two-way beam angle	-20.5 dB
Transducer Sv gain	25.40 dB
3 dB Beamwidth	6.9°
Calibration details	
TS of sphere	-33.6 dB
Range to sphere in calibration	9.56 m
Measured NASC value for calibration	19300 m^2/nmi^2
Calibration factor for NASCs	1.00
Absorption coeff	6.063 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 2 Survey statistics for the Danish acoustic survey with R/V Dana in July 2012

Stratum	Area, Nm*2	ESDU	Hauls	Mean Sa	Mean TS
560E06	3980	148	4	1.34E-06	1.57E-05
570E06	3600	347	7	2.28E-06	2.61E-05
570E08	3406	289	5	4.84E-06	2.83E-05
580E06	209	29	2	2.44E-06	2.08E-05
580E08	1822	73	3	2.84E-06	2.24E-05
C	988	73	4	2.87E-06	1.34E-05
D	1837	173	6	7.19E-06	1.79E-05
E	5228	414	9	5.02E-06	1.57E-05

Table 3. Trawl haul details for the Danish acoustic survey with R/V Dana in July 2012.

Trawl hauls Acoustic survey in Kattegat and Skagerrak 06/2012 5 July to 16 July 2012																
Date	Haul	Time	ICES	Position		Trawl Direction	Wire length	Trawl type	Cath depth	Mean depth	Total catch	Main Species	Trawling speed	Trawling duratin	Wind speed	Sea state
dd-mm-yy	no.	UTC	Square	Latitude	Longitude	deg.	m		m	m	kg		Kn	min,	m/s	
06-07-12	64	00:38	44F7	57.48.569 N	007.28.243 E	216	300	Fotö	Surface	426	973	Herring, Mackerel	3.6	61	10.4	3
06-07-12	148	11:13	44F6	57.36.162 N	006.12.544 E	250	300	Fotö	Surface	144	1500	Herring	4.2	61	10.3	5
06-07-12	164	13:57	43F6	57.26.166 N	006.10.935 E	272	300	Fotö	Surface	82	22	Mackerel	4.0	58	9.5	5
06-07-12	218	21:47	42F6	56.40.775 N	006.20.310 E	260	300	Fotö	Surface	48	475	Mackerel	3.8	60	4.7	2
07-07-12	231	00:31	42F6	56.33.897 N	006.20.594 E	273	300	Fotö	Surface	32	730	Mackerel., Gurnard	3.5	59	2.5	2
07-07-12	319	11:02	43F7	57.04.937 N	007.13.195 E	219	250	Expo	Bottom	28	135	Gurnard	3.0	60	5.5	2
07-07-12	335	13:55	43F6	57.10.597 N	006.51.791 E	317	370	Expo	Bottom	65	31 (Failed)	Large Medusa	3.2	60	7.3	2
07-07-12	392	21:45	45F6	58.03.081 N	006.19.444 E	307	300	Fotö	Surface	337	600	Mackerel	3.7	60	2.5	2
08-07-12	405	00:25	45F5	57.59.990 N	006.06.121 E	288	300	Fotö	Surface	312	945	Herring, Mackerel	3.8	60	5.5	2
08-07-12	502	11:45	42F6	56.35.612 N	006.52.955 E	288	250	Expo	Bottom	42	304	Herring	3	60	5	2
08-07-12	520	14:19	42F7	56.36.236 N	007.07.642E	124	200	Expo	Bottom	34	67	Gurnard	3.3	60	7.5	2
08-07-12	573	21:10	43F7	57.20.382 N	007.45.674 E	0	300	Fotö	Surface	87	810	Herring, Mackerel	3.7	60	3.8	2
09-07-12	593	00:18	44F7	57.39.262 N	007.47.195 E	108	300	Fotö	Surface	328	880	Herring	3.7	60	4.5	2
09-07-12	674	10:07	43F7	57.10.749 N	007.09.085 E	173	320	Expo	Bottom	58	690 (failed)	Herring	3	60	3	2
09-07-12	768	21:39	44F8	57.53.137 N	008.48.315 E	72	300	Fotö	Surface	411	675	Mackerel, Herring	4	60	4.4	1
10-07-12	784	00:41	45F8	58.05.370 N	008.46.470 E	356	300	Fotö	Surface	422	600	Herring, Mackerel	3.8	60	1	1
10-07-12	969	21:36	44F9	58.00.041 N	009.15.159 E	233	300	Fotö	Surface	495	68	Saithe, Lumpsucker	3.4	60	11.7	4
11-07-12	989	01:05	44F9	57.42.619 N	009.03.927 E	225	300	Fotö	Surface	84	3120	Herring	3	60	11.3	4
11-07-12	1066	10:44	44G0	57.49.662 N	010.23.436 E	239	380	Expo	Bottom	80	202	Haddock, Norway pout, Herring	3.0	60	1.2	2
11-07-12	1085	13:44	44F9	57.45.737 N	009.48.815 E	237	200	Expo	Bottom	37	171	Herring	3.4	60	2.7	2
11-07-12	1202	21:29	46F9	58.29.214 M	009.49.009 E	357	300	Fotö	Surface	631	440	Herring	3.7	60	2.1	1
12-07-12	1213	00:00	46F9	58.42.186 N	009.47.875 E	339	300	Fotö	Surface	384	230	Krill, herring, Mackerel	3.6	60	4.9	1
12-07-12	1299	11:04	46G0	58.34.833 N	010.50.788 E	183	430	Expo	Bottom	84	310	Norvay pout	2.5	60	7.5	3
12-07-12	1309	13:51	46G0	58.27.763 N	010.49.584 E	320	300	Fotö	Surface	130	160	Herring, Mackerel	3.4	60	6.1	3
12-07-12	1370	21:34	45G0	58.06.100 N	010.33.097 E	247	300	Fotö	Surface	161	545	Mackerel, Herring	3.6	60	10.6	3
13-07-12	1384	00:23	45G0	58.06.980 N	010.49.556 E	48	300	Fotö	Surface	165	1600	Mackerel	3.9	60	8.4	3
13-07-12	1474	10:59	44G0	57.52.766 N	010.57.556 E	278	300	Fotö	Surface	99	1122	Herring	4.0	60	9.9	3
13-07-12	1486	13:27	44G1	57.53.043 N	011.10.621 E	131	320	Expo	Bottom	60	2936	Herring	3.3	60	8.1	3
13-07-12	1546	21:10	43G0	57.28.491 N	010.53.420 E	64	300	Fotö	Surface	40	615	Herring, Large medusa	3.8	60	4.5	2
14-07-12	1565	00:25	44G1	57.38.323 N	011.26.831 E	51	300	Fotö	Surface	65	575	Herring, Large medusa	3.7	60	8.4	2
14-07-12	1653	10:49	43G1	57.07.222 N	011.50.210 E	191	280	Expo	Bottom	57	202	Large Medusa	3.2	60	3.9	2
14-07-12	1668	13:35	42G1	56.52.296 N	011.46.212 E	210		Expo	Bottom	47	150	Large Medusa, Herring	3.7	60	2.6	2
14-07-12	1726	21:00	42G1	56.36.726 N	011.49.634 E	5	300	Fotö	Surface	35	470	Large medusa	3.6	60	12.1	2
14-07-12	1743	23:58	42G2	56.35.449 N	012.14.226 E	116	300	Fotö	Surface	38	160	Large Medusa	4.0	60	12.1	2
15-07-12	1833	10:55	41G1	56.13.396 N	011.58.782 E	224		Expo	Bottom	26	386	Large Medusa, Herring	3.9	60	10.3	2
15-07-12	1852	13:51	41G1	56,19,968 N	011.38.725 E	204	210	Expo	Bottom	29	375	Large medusa	3.5	60	9.8	3
15-07-12	1907	21:10	41G0	56.15.536 N	010.57.497 E	183	300	Expo	Surface	21	690	Large Medusa, Herring	3.0	60	11.5	3

Table 4. Catch composition in trawl hauls for the Danish acoustic survey with R/V Dana in July 2012.

		Station		64	148	164	218	231	319	335	392	405	502	520	573	593
		ICES sq.		44F7	44F6	43F6	42F6	42F6	43F7	43F6	45F6	44F6	42F6	42F7	43F7	44F7
		Gear		Fotø	Fotø	Fotø	Fotø	Fotø	Expo	Expo	Fotø	Fotø	Expo	Expo	Fotø	Fotø
		Fishing depth		Surface	10	10	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface
		Total depth		426	144	82	48	32	28	65	337	312	42	34	87	328
		Day/Night		N	D	D	N	N	D	D	N	N	D	D	N	N
%		Total catch	kg	973	1500	22	475	730	135	31	600	945	304	67	810	880
0.00	Anchovy	*Engraulis encrasicolus*	0.042													
0.00	Lesser silver smelt	*Argentina sphyraena*	0.042													
0.11	Blue whiting	*Micromesistius poutassou*	26.060	2.465							0.342	8.015				6.3
0.87	Sprat	*Sprattus sprattus*	209.191				0.014							0.652		
0.16	Common weaver	*Trachinus draco*	37.390						3.548							
0.00	Four-bearded rockling	*Enchelyopus cimbrius*	0.476													
0.00	Poor-cod	*Trisopterus minutus*	0.125													
0.04	Horse mackerel	*Trachurus trachurus*	10.054								0.43					
0.15	Garfish	*Belone belone*	36.875	0.572		1.512	0.228	0.516			0.694	0.23				0.252
0.27	Long rough dab	*Hippoglosides plattessoides*	65.725										23.74			0.026
0.36	Whiting	*Merlangius merlangus*	85.420	0.105	0.055	0.04	0.03		0.162	0.4	0.53	0.08	2.836	0.34	0.206	
0.33	Invertebrates	*Invertebrata*	78.226										8.89			
0.40	Dab	*Limanda limanda*	96.133						11.295	0.084			62.8	1.01		
0.17	Hake	*Merluccius merluccius*	41.903										4.8	1.7		
1.78	Gurnard	*Trigala spp.*	427.152				7.08	249.445	99.6				32.6	33.6		0.35
0.44	Haddock	*Melanogrammus aeglefinus*	104.693	0.007						3.78			0.006	0.048		
0.02	Pollack	*Pollachius pollachius*	5.100													
22.09	Mackerel	*Scomber scombrus*	5292.549	210.16	9.015	13.805	392.399	478.72			421.634	262.905	0.768	11.655	295.247	73.873
0.31	Saithe	*Pollachius virens*	75.128									5.198				12.2
0.19	Plaice	*Pleuronectes platessa*	46.598				0.296		2.96	0.614			18.5	1.3		
0.02	Lemon sole	*Microstomus kitt*	4.840						1.446				1.08			
57.64	Herring	*Clupea harengus*	13811.947	752.318	1479.956	0.3	73.5	0.842			72.7	624.685	115.8	6.075	424.125	710.38
0.00	Gray sole	*Glyptocephalus cynoglossus*	0.204													
0.00		*Dasyatis pastinaca*	1.148													
0.75	Norway pout	*Trisopterus esmarki*	179.879													
0.94	Lumpsucker	*Cyclopterus lumpus*	225.721		5.586	1.644					0.146	33.6			4.472	62.2
11.56	Large Medusa	*Scyphozoa sp.*	2769.295	7.352	5.388	4.726	1.404	0.346	2	26.308	103.336	10.048			85.95	10.712
0.01	Greater sandeel	*Hyperoplus lanceolatus*	1.584						1.422				0.036	0.088		
0.45	Cod	*Gadus Morhua*	107.906						11.7				32.476	10.1		
0.01	Pearlside	*Mauorolicus muelleri*	1.733	0.021							0.177	0.24				0.009
0.00	Ling	*Molva molva*	0.384													
0.74	Krill	*Euphausidae spp.*	176.694													
0.10	Picked Dogfish	*Squalus acanthias*	24.270													
0.01	Turbot	*Psetta maxima*	2.784													
0.00	Tarry ray	*Raja radiata*	0.934													
0.03	Anglerfish	*Lophiuspiscatorius*	6.270													
0.01	Norway lobster	*Nephrops norvegicus*	1.658													
0.00	Hagfish	*Myxine glutinosa*	0.056													
0.00	Squids, octopusses	*Cephalopoda sp*	0.571				0.049	0.132		0.128			0.034			
0.00	Sandeel	*Ammodytes marinus*	0.506						0.474		0.011					
0.02	Salmon	*Salmon solar*	5.160													3.7
0.01	Snake blenny	*Lumpenus lumpretaeformis*	1.750													

Table 4. continued.

		Station		674	768	784	969	989	1066	1085	1202	1213	1299	1309	1370
		ICES sq.		43F7	44F8	45F8	45F9	44F9	44G0	44F9	45F9	46F9	46G0	45G0	45G0
		Gear		Expo	Fotø	Fotø	Fotø	Fotø	Expo	Expo	Fotø	Fotø	Expo	Fotø	Fotø
		Fishing depth		Bottom	Surface	Surface	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Surface	Surface
		Total depth		58	411	422	485	84	80	37	631	384	84	130	161
		Day/Night		D	N	N	N	N	D	D	N	N	D	D	N
%		Total catch	kg	690	675	600	67	3120	202	171	440	230	310	160	545
0.00	Anchovy	*Engraulis encrasicolus*	0.042												
0.00	Lesser silver smelt	*Argentina sphyraena*	0.042						0.024				0.018		
0.11	Blue whiting	*Micromesistius poutassou*	26.060				8.55								0.17
0.87	Sprat	*Sprattus sprattus*	209.191												
0.16	Common weaver	*Trachinus draco*	37.390											0.21	
0.00	Four-bearded rockling	*Enchelyopus cimbrius*	0.476						0.054				0.018		
0.00	Poor-cod	*Trisopterus minutus*	0.125						0.125						
0.04	Horse mackerel	*Trachurus trachurus*	10.054			0.528									0.47
0.15	Garfish	*Belone belone*	36.875		0.628						0.34	0.146			0.856
0.27	Long rough dab	*Hippoglosides plattessoides*	65.725						7.575				18.4		
0.36	Whiting	*Merlangius merlangus*	85.420	3.198	0.034	0.512	0.188	0.382	1.72	7.954	0.392	2.636	30.909		0.129
0.33	Invertebrates	*Invertebrata*	78.226						37.001	1.31			26.836		
0.40	Dab	*Limanda limanda*	96.133						7.4	3.246					
0.17	Hake	*Merluccius merluccius*	41.903	0.374					7.165	1.38			2.684		
1.78	Gurnard	*Trigala spp.*	427.152							1.83	0.032		0.608		
0.44	Haddock	*Melanogrammus aeglefinus*	104.693	14.771					36.403	6.7			13.392		0.014
0.02	Pollack	*Pollachius pollachius*	5.100	5.1											
22.09	Mackerel	*Scomber scombrus*	5292.549		357.407	143.219	1.984	128.498		4.114	76.973	23.97		53.3	284.96
0.31	Saithe	*Pollachius virens*	75.128				25.2		2.15				28.644		
0.19	Plaice	*Pleuronectes platessa*	46.598						21.7	0.688			0.44		
0.02	Lemon sole	*Microstomus kitt*	4.840	0.546					1.174				0.416		
57.64	Herring	*Clupea harengus*	13811.947	648.175	284.75	402.476	0.784	2966.92	27.844	138.8	307.59	21.61	34.015	73.4	225.111
0.00	Gray sole	*Glyptocephalus cynoglossus*	0.204						0.204						
0.00		*Dasyatis pastinaca*	1.148						1.148						
0.75	Norway pout	*Trisopterus esmarki*	179.879	1.031					32.606		0.013	2.116	139.276		
0.94	Lumpsucker	*Cyclopterus lumpus*	225.721		9.2	22.8	21.9				47	8.625		0.276	
11.56	Large Medusa	*Scyphozoa sp.*	2769.295		22.982	30.465	1.83	24.2			7.655			10.814	33.291
0.01	Greater sandeel	*Hyperoplus lanceolatus*	1.584												
0.45	Cod	*Gadus Morhua*	107.906	16.805					17.644	5.22			10.598		
0.01	Pearlside	*Mauorolicus muelleri*	1.733				0.312				0.006	0.968			
0.00	Ling	*Molva molva*	0.384												
0.74	Krill	*Euphausidae spp.*	176.694				6.765					169.929			
0.10	Picked Dogfish	*Squalus acanthias*	24.270										0.488	22	
0.01	Turbot	*Psetta maxima*	2.784												
0.00	Tarry ray	*Raja radiata*	0.934										0.47		
0.03	Anglerfish	*Lophiuspiscatorius*	6.270												
0.01	Norway lobster	*Nephrops norvegicus*	1.658										0.898		
0.00	Hagfish	*Myxine glutinosa*	0.056						0.056						
0.00	Squids, octopusses	*Cephalopoda sp*	0.571												
0.00	Sandeel	*Ammodytes marinus*	0.506												
0.02	Salmon	*Salmon solar*	5.160												
0.01	Snake blenny	*Lumpenus lumpretaeformis*	1.750										1.75		

Table 4. continued.

		Station		1384	1474	1486	1546	1565	1653	1668	1726	1743	1833	1852	1907
		ICES sq.		45G0	44G0	44G1	43G0	44G1	43G1	42G1	42G1	42G2	41G1	41G1	41G0
		Gear		Fotø	Fotø	Expo	Fotø	Fotø	Expo	Expo	Fotø	Fotø	Expo	Expo	Expo
		Fishing depth		Surface	Surface	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Bottom	Pelagic
		Total depth		165	99	60	40	65	53	47	35	38	26	29	21
		Day/Night		N	D	D	N	N	D	D	N	N	D	D	N
%		Total catch	kg	1600	1122	2936	615	575	202	150	470	160	386	375	690
0.00	Anchovy	*Engraulis encrasicolus*	0.042									0.042			
0.00	Lesser silver smelt	*Argentina sphyraena*	0.042												
0.11	Blue whiting	*Micromesistius poutassou*	26.060	0.218											
0.87	Sprat	*Sprattus sprattus*	209.191			1.438	1.935	3.798	0.586	25.6	2.676	0.932	115.158	1.969	54.433
0.16	Common weaver	*Trachinus draco*	37.390		0.756		7.558			0.392	14.38	6.7	1.492	2.354	
0.00	Four-bearded rockling	*Enchelyopus cimbrius*	0.476			0.404									
0.00	Poor-cod	*Trisopterus minutus*	0.125												
0.04	Horse mackerel	*Trachurus trachurus*	10.054	3.69	0.242	4.694									
0.15	Garfish	*Belone belone*	36.875	1.806	22.9		6.195								
0.27	Long rough dab	*Hippoglosides plattessoides*	65.725			15.116			0.658	0.162				0.048	
0.36	Whiting	*Merlangius merlangus*	85.420			22.257	0.731	0.337	2.384	0.822	3.454	1.254	0.107	0.504	0.92
0.33	Invertebrates	*Invertebrata*	78.226			4.189									
0.40	Dab	*Limanda limanda*	96.133			6.788			1.13	1.008		0.222	0.046	0.506	0.598
0.17	Hake	*Merluccius merluccius*	41.903			23.8									
1.78	Gurnard	*Trigala spp.*	427.152			1.565			0.168	0.046	0.178			0.05	
0.44	Haddock	*Melanogrammus aeglefinus*	104.693			28.742			0.306	0.068	0.116	0.046		0.02	0.274
0.02	Pollack	*Pollachius pollachius*	5.100												
22.09	Mackerel	*Scomber scombrus*	5292.549	1344.697	344.049	10.952	206.83	103.891			16.7	15.36	0.974		4.49
0.31	Saithe	*Pollachius virens*	75.128			0.58	0.244	0.776	0.088	0.048					
0.19	Plaice	*Pleuronectes platessa*	46.598							0.1					
0.02	Lemon sole	*Microstomus kitt*	4.840						0.178						
57.64	Herring	*Clupea harengus*	13811.947	232.06	729.203	2801.065	208.577	254.801	13.328	17.032	2.638	6.39	79.055	4.108	71.534
0.00	Gray sole	*Glyptocephalus cynoglossus*	0.204												
0.00		*Dasyatis pastinaca*	1.148												
0.75	Norway pout	*Trisopterus esmarki*	179.879			2.473	1.266		0.96	0.11		0.028			
0.94	Lumpsucker	*Cyclopterus lumpus*	225.721					0.04	5.188	0.128	0.232	0.11	1.02	0.164	1.39
11.56	Large Medusa	*Scyphozoa sp.*	2769.295	17.529	23.391		181.655	211.356	176.25	104.416	429.624	128.831	187.682	365.177	554.577
0.01	Greater sandeel	*Hyperoplus lanceolatus*	1.584											0.038	
0.45	Cod	*Gadus Morhua*	107.906			2.725			0.564	0.068	0.002	0.004			
0.01	Pearlside	*Mauorolicus muelleri*	1.733												
0.00	Ling	*Molva molva*	0.384			0.384									
0.74	Krill	*Euphausidae spp.*	176.694												
0.10	Picked Dogfish	*Squalus acanthias*	24.270			1.782									
0.01	Turbot	*Psetta maxima*	2.784												2.784
0.00	Tarry ray	*Raja radiata*	0.934										0.464		
0.03	Anglerfish	*Lophiuspiscatorius*	6.270			6.27									
0.01	Norway lobster	*Nephrops norvegicus*	1.658			0.548			0.212						
0.00	Hagfish	*Myxine glutinosa*	0.056												
0.00	Squids, octopusses	*Cephalopoda sp*	0.571			0.228									
0.00	Sandeel	*Ammodytes marinus*	0.506									0.021			
0.02	Salmon	*Salmon solar*	5.160		1.46										
0.01	Snake blenny	*Lumpenus lumpretaeformis*	1.750												

Table 5. Measured length distribution of herring by haul for the Danish acoustic survey with R/V Dana in July 2012.

Station	64	148	164	218	231	392	405	502	520	573	593	674	768	784	969	989	1066	1085	1202	1213	1299	1309	1370	1384	1474	1486	1546	1565	1653	1668	1726	1743	1833	1852	1907
ICES sq.	44F7	44F6	43F6	42F6	42F6	45F6	44F6	42F6	42F7	43F7	44F7	43F7	44F8	45F8	45F9	44F9	44G0	44F9	45F9	46F9	46G0	45G0	45G0	45G0	44G0	44G1	43G0	44G1	43G1	42G1	42G1	42G2	41G1	41G1	41G0
Gear	Fotø	Fotø	Fotø	Fotø	Fotø	Fotø	Fotø	Expo	Expo	Fotø	Fotø	Expo	Fotø	Fotø	Fotø	Fotø	Expo	Expo	Fotø	Fotø	Expo	Fotø	Fotø	Fotø	Fotø	Expo	Fotø	Fotø	Expo	Expo	Fotø	Fotø	Expo	Expo	Expo
Fishing depth	Surface	10	10	Surface	Surface	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Surface	Surface	S urface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Surface	Surface	Surface	Surface	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Bottom	Pelagic
Total depth	426	144	82	48	32	337	312	41.6	34.1	87	328	58	411	422	485	84	80	37	631	384	84	130	161	165	99	60	40	65	53	47	35	38	26	29	21
Day/Night	N	D	D	N	N	N	N	D	D	N	N	D	N	N	N	N	D	D	N	N	D	D	N	N	D	D	N	N	D	D	N	N	D	D	N
Total catch,kg	973	1500	22	475	730	600	945	304	67	810	880	690	675	600	67	3120	202	171	440	230	310	160	545	1600	1122	2936	615	575	202	150	470	160	386	375	690
Total catch Herring,kg	752.318	1480	0.300	73500	0.842	73	624685	115.8	6075	424125	710.34	648175	284750	402476	0.784	2966.92	27844	138.8	307590	21610	13758	20260	73.4	225111	232060	729203	2801065	1353	207224	1072	253729	13328	17032	2638	6390	79055	4.108	71534
Sample Herring,kg	48.414	36	0.300	37473	0.842	35951	51430	25051	6075	31536	75657	36032	51757	47114	0.784	34498	27844	37064	44429	21610	13758	0.468	55751	66.2	32116	42484	29832	0.344	26524	0.210	28673	13328	17032	2638	6390	17986	4.108	15543
Length in cm																																					
5.5																																					
6																												1								
6.5																											1	2								
7																												2				2				
7.5																											5	7				2				
8																					11						5	6				2				
8.5																					25						11	11								
9																					22						14	3								
9.5																				2	35						13									
10																					12						10							3		
10.5																											4							1		
11																											1									
11.5																											1									
12																																		1		
12.5																																				
13																																				
13.5																																				
14																												3		1						
14.5					1																4							3		1						
15				1								1						2			6							5		1						
15.5				8	1			4										1			4							4		1	2					
16	1			83	4			37	5									6			15							11			3			3		4
16.5				365	6		1	253	35	4	1			1				9			16					5		25	1	1	3			10		6
17	5			278	9	4	1	167	59	25	1	6		4			7	20			14				1	12		33	1	1	8			42		77
17.5	3	13		114	1	9	2	144	36	22	8	8	3	6			12	23	3		19					23		80	16		25			97		166
18	10	42		32	1	4	7	51	14	74	8	8		6		1	18	59	3	2	36		4			68		153	66		41	3	1	105		95
18.5	10	88		9	1	5	8	6	9	55	17	31	1	8		13	29	62	7	7	57		23		7	18	190	150	190	11	95	1		72	3	31
19	5	94				7	11			50	12	42	4	16		59	30	124	6	10	33		63		27	78	118	54	152	18	65	4	2	23	2	5
19.5	16	98		1		15	11			38	17	52	6	29		132	52	147	33	36	23		75	29	41	137	63	15	68	30	20	3		14	3	2
20	35	75	1	1		34	23			51	38	64	16	31		123	58	83	56	31	11		63	29	56	132	30	5	26	19	19	1	3	11	3	2
20.5	49	64				67	21			35	60	78	28	64		80	66	57	87	44	12		85	51	76	79	22	11	13	19	11	8	3	12	4	2
21	91	45				97	54		1	28	73	82	50	88	1	78	71	29	113	45	12		93	65	85	69	25	10	21	13	20	8	4	13	5	
21.5	93	33				106	76			27	76	53	78	101		48	47	14	93	50	9		73	87	74	75	10	12	13	12	6	6	10	4	5	
22	80	9				57	55	1		21	81	36	86	76		11	23	3	56	29	3		45	74	42	36	6	8	2	15	7	6	12		1	
22.5	46	4	1			28	53		1	22	69	29	82	36		6	6		41	12	2		21	51	17	23	2	7	7	11	3	3	13	4	2	
23	27	5				25	46			17	67	12	60	46	1		3	2	27	11			8	48	7	8	1	2	4	15	1		8		4	
23.5	20	1	1			11	45			9	60	1	39	22	1		2		15	6	1		2	22	9	2	1	1	1	13			3		3	
24	7	1				3	18			12	32	1	19	6					6	4				16	1		2			3			3		3	
24.5	17	2				5	17				21		17	7					6	4				3	1		1		1	2	2				3	
25	6	1				1	10				12		5	4					4	1			1	5	2					2	1		4		3	
25.5	3	2					17				11		7	4					2	1				2									1		1	
26	6						11				17		9	2					6					1					1	1					2	
26.5	6	1				2	12				11		6	4					3					1									3			
27	2						7				10		3	4						1				2												
27.5	4					1	5				15		7	3	3									2						1						
28	7						8				10		1	2										2					1				1			
28.5	1						1				10		3	2																						
29	3						5				10		1	1															1						
29.5	1						2				7		6																						
30	1										8		2	1																					
30.5							3				4		2	1																					
31	1						2				1		3																						
31.5							1				3		2																						
32																																			
32.5																																			
Total no.	556	578	3	892	24	481	533	663	160	490	770	504	546	575	6	551	424	641	567	296	277	105	556	490	445	658	579	65	593	32	583	192	332	43	77	410	52	390
Mean Length	21.79586	19.68339	22	16.80774	16.66667	21.21102	23.25516	16.95098	17.20313	19.73469	22.67792	20.42659	22.63278	21.5513	25	20.1461	20.1533	19.21139	21.2963	20.91892	18.44224	9.057143	20.5045	21.78367	20.83933	20.31155	18.97323	9.1	18.28668	7.9375	19.04803	20.85938	18.96235	20.63953	21.26623	18.22317	20.89423	17.62949

Table 6. Measured length distribution of mackerel by haul for the Danish acoustic survey with R/V Dana in July 2012.

Station	64	148	164	218	231	392	405	502	520	573	593	768	784	969	989	1085	1202	1213	1309	1370	1384	1474	1486	1546	1565	1726	1743	1833	1907
ICES sq.	44F7	44F6	43F6	42F6	42F6	45F6	44F6	42F6	42F7	43F7	44F7	44F8	45F8	45F9	44F9	44F9	45F9	46F9	45G0	45G0	45G0	44G0	44G1	43G0	44G1	42G1	42G2	41G1	41G0
Gear	Fotø	Fotø	Fotø	Fotø	Fotø	Fotø	Fotø	Expo	Expo	Fotø	Fotø	Fotø	Fotø	Fotø	Fotø	Expo	Fotø	Fotø	Fotø	Fotø	Fotø	Fotø	Expo	Fotø	Fotø	Fotø	Fotø	Expo	Expo
Fishing depth	Surface	10	10	Surface	Surface	Surface	Surface	Bottom	Bottom	Surface	Surface	Surface	Surface	S urface	Surface	Bottom	Surface	Surface	Surface	Surface	Surface	Surface	Bottom	Surface	Surface	Surface	Surface	Bottom	Pelagic
Total depth	426	144	82	48	32	337	312	41.6	34.1	87	328	411	422	485	84	37	631	384	130	161	165	99	60	40	65	35	38	26	21
Day/Night	N	D	D	N	N	N	N	D	D	N	N	N	N	N	N	D	N	N	D	N	N	D	D	N	N	N	N	D	N
Total catch,kg	973	1500	22	475	730	600	945	304	67	810	880	675	600	67	3120	171	440	230	160	545	1600	1122	2936	615	575	470	160	386	690
Total catch Mackerel,kg	210.16	9.015	13805	392399	478720	421634	262905	0.768	11655	295247	73873	357407	143219	1984	128,.498	4144	76973	23.97	53.3	284959	1334697	344049	10952	206830	103891	16.7	15.36	0.974	4.49
Sample Mackerel,kg	33.084	9.015	13805	46144	40241	26393	28539	0.768	11655	30926	17.2	29035	30745	1984	8740	4144	24374	23.97	26332	22051	28.97	29565	0.868	32453	20.35	16.7	15.36	0.974	4.49
Length in cm																													
15																													
16																													
17																													
18																			1										
19			2																										
20	4		5	3	1	3	2					2	5				4	4		3	1	1		2	1		1		
21	23	1	22	11	6	13	4			3	1	21	21	1	4		28	15	15	8	6	3	1	20	10	1	5		1
22	54	1	42	35	16	49	20			14	1	75	51	5	14		54	31	103	31	30	48		76	37	4	13		2
23	45	2	13	25	16	78	21		1	12	4	66	125	1	20		76	55	126	84	74	73	2	108	52	16	42		22
24	26		2	15	4	42	12		2	10	3	32	78	2	6		56	44	30	45	61	59	2	62	32	42	31		11
25	12		1	12	12	16	5		3	6	2	8	13	2	2	3	12	15	2	25	14	28		19	11	17	26		6
26	21	3	12	73	47	10	22		5	31	24	20	6	1	4	1	2	10		6	17	15		5	8	12	8		
27	61	18	23	99	103	22	63		12	80	44	20	8	3	14	9	4	14	2	8	26	21		10	10				
28	20	7	2	41	41	11	19		10	29	18	15	2		7	8	5	11		2	14	12		3	10	1			
29	2			4	5	3	1		1	2		1			1			1		1		1		3	5		1		
30		1			2	1			3	1																1	1		
31	1			1	2		3		2	1	1			1	1														
32	1	2			1				1	1	1					1		1	1	1						1	4		1
33	1				2		1		1	2																	3	1	
34		3					1	1	2	1	1					1		2					1		1				
35	2	1			1		2		2																	5	1		
36		2							2	1								1									1		
37																		1								2	1		
38		1						1			1	1						1								1			
39		2									2															1			
40									1																				
41																													
42							1																			1			
43																													
44																												1	
45																													
46							1																						
47							1																						
48																	1												
49																													
50																													
51																													
52																													
53																													
54																													
55																													
56																													
57																													
58																													
59																													
60																													
61																													
Total no.	273	44	124	319	259	248	179	2	48	194	103	261	309	16	73	23	242	206	280	214	243	261	6	308	178	111	132	2	42
Mean length	24.49451	28.81818	23.26613	25.58621	26.30502	23.75806	26.02793	36	28.66667	26.29897	27.04854	23.61686	23.18123	24.375	24.43836	27.56522	23.12397	24.07282	22.68929	23.53271	24.107	23.96935	24.83333	23.21429	23.88764	25.9009	24.08333	38	23.45238

Table 7. Measured length distribution of sprat by haul for the Danish acoustic survey with R/V Dana in July 2012.

Station	520	1486	1546	1565	1653	1668	1726	1743	1833	1852	1907
ICES sq.	42F7	44G1	43G0	44G1	43G1	42G1	42G1	42G2	41G1	41G1	41G0
Gear	Expo	Expo	Fotø	Fotø	Expo	Expo	Fotø	Fotø	Expo	Expo	Expo
Fishing depth	Bottom	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Bottom	Pelagic
Total depth	34.1	60	40	65	53	47	35	38	26	29	21
Day/Night	D	D	N	N	D	D	N	N	D	D	N
Total catch.kg	67	2936	615	575	202	150	470	160	386	375	690
Total catch Sprat,kg	0.652	1438	1935	3798	0.586	25.6	2676	0.932	115158	1.969	54433
Sample Sprat,kg	0.652	0.114	0.492	0.744	0.586	3492	2676	0.932	3712	1969	3.44
Length in cm											
5.5											
6					1						
6.5											
7					2						
7.5											
8			2		1			2			
8.5			2								
9			5	2	1		3				
9.5			14	17			1				
10			11	25							
10.5			16	27		1					
11			8	6		1					
11.5	1			1						1	
12	4			1	1		1		4	2	3
12.5	9				1		9	7	22	9	21
13	8		1	1	6	16	20	8	48	41	24
13.5	10			2	6	40	18	10	68	29	57
14	2	2			3	47	21	6	43	21	43
14.5	2	1			9	29	21	15	20	8	15
15		1				20	21	1	7	5	8
15.5		1			2	8	6	1	1	1	3
16					1	2	4				
16.5							1				
17											
17.5											
18											
18.5											
19											
19.5											
20											
20.5											
21											
21.5											
22											
22.5											
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24.5											
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25.5											
26											
26.5											
27											
27.5											
28											
28.5											
29											
29.5											
30											
30.5											
31											
31.5											
32											
32.5											
Total no.	36	5	59	82	34	164	126	50	213	117	174
Mean Length	13	14.6	10	10.27439	12.94118	14.04878	13.89683	13.49	13.50939	13.44444	13.5977

Table 8. CTD Station details for the Danish acoustic survey with R/V Dana in July 2012.

Date	Haul	Time	ICES	Position		Bottom depth	Wind speed	Sea state
dd-mm-yy	no.	UTC	Square	Latitude	Longitude	m	m/s	
05-07-12	**26**	**20:07**	**44F8**	57.49.419 N	008.38.384 E	447	**6.9**	**3**
06-07-12	72	02:11	44F7	57.44.713 N	007.22.583 E	392	10.6	3
06-07-12	148	10:11	44F6	57.37.369 N	006.15.111 E	154	12.9	5
06-07-12	170	15:22	43F6	57.26.624 N	006.02.453 E	84	9.4	5
06-07-12	217	20:37	42F6	56.40.752 N	006.23.395 E	45	5.9	2
07-07-12	237	02:07	42F6	56.33.935 N	006.12.417 E	32	3.1	2
07-07-12	315	10:05	43F7	57.08.327 N	007.14.001 E	54	5.9	2
07-07-12	339	13:55	43F6	57.13.390 N	006.47.749 E	65	5.6	2
07-07-12	388	20:40	45F6	58.01.411 N	006.23.910 E	344	1.4	2
08-07-12	411	01:55	45F5	58.01.819 N	005.57.114 E	307	4	2
08-07-12	501	10:40	42F6	56.35.501 N	006.49.910 E	42	5	2
08-07-12	524	15:39	42F7	56.34.111 N	007.13.170 E	34	7.9	2
08-07-12	573	20:23	43F7	57.18.601 N	007.45.323 E	57	5.9	2
09-07-12	598	01:47	44F7	57.37.605 N	007.54.733 E	279	4.5	2
09-07-12	674	10:01	43F7	57.11.591 N	007.08.937 E	63	3.1	2
09-07-12	767	20:27	44F8	57.52.381 N	008.45.691 E	475	3.4	2
10-07-12	788	02:05	45F8	58.08.690 N	008.46.381 E	394	1.3	1
10-07-12	870	10:08	43F8	57.23.192 N	008.31.567 E	32	10.3	1
10-07-12	968	20:25	45F9	58.00915 N	009.16.116 E	501	13.2	4
11-07-12	993	02:44	44F9	57.40.806 N	009.01.705 E	79	9.0	4
11-07-12	1066	10:02	44G0	57.49.931 N	010.23.891 E	86	2.6	4
11-07-12	1090	15:09	44F9	57.43.730 N	009.42.705 E	36	3.0	1
11-07-12	1200	20:27	45F9	58.27.874 N	009.49.138 E	561	2	1
12-07-12	1218	01:29	46F9	58.46.194 N	009:44:604 E	413	4.0	1
12-07-12	1297	10:06	46G0	58.35.162 N	010.49.794 E	84	5.6	1
12-07-12	1317	15:20	46G0	58.32.573 N	010.42.343 E	134	5.6	3
12-07-12	1369	20:37	45G0	58.06.107 N	010.34.705 E	182	10	3
13-07-12	1390	01:49	45G0	58.10.155 N	010.56.943 E	143	9.6	3
13-07-12	1473	10:07	44G0	57.51.741 N	010.58.246 E	70	6.1	3
13-07-12	1491	14:51	44G1	57.50.310 N	011.15.532 E	70	7.8	3
13-07-12	1544	20:28	43G0	57.28.116 N	010.51.885 E	38	5.5	2
14-07-12	1570	01:48	44G1	57.40.698 N	011.33.300 E	40	7.8	2
14-07-12	1652	10:04	43G1	57.07.980 N	011.50.099 E	53	3.6	2
14-07-12	1672	14:59	42G1	56.48.536 N	011.43.080 E	38	1.3	2
14-07-12	1726	20:22	42G1	56.35.511 N	011.49.057 E	33	6.8	1
15-07-12	1749	01:22	42G2	56.33.118 N	012.22.338 E	34	12.0	2
15-07-12	1833	10:24	41G2	56.13.499 N	012.00.122 E	26	8.3	2
15-07-12	1856	15:09	41G1	56.16.312 N	011.37.008 E	27	10.3	3
15-07-12	1906	20:28	41G0	56.16.997 N	010.57.595 E	19	9.2	3

Table 8. WP2 Station details for the Danish acoustic survey with R/V Dana in July 2012.

Date	Station	Time	ICES	Position		Mean depth	WP2 depth	Wind speed	Sea state
dd-mm-yy	no.	UTC	Square	Latitude	Longitude	m	m	m/s	
06-07-12	148	10:39	44F6	57.36.898 N	006.14.732 E	153	148	11.3	3
06-07-12	217	20:55	42F6	56.40.633 N	006.23.468 E	43	38	6.3	2
07-07-12	319	10:14	43F7	57.08.369 N	007.14.109 E	54	38	7.2	2
07-07-12	388	21:02	45F6	58.01.777 N	006.23.205 E	343	150	1	2
08-07-12	501	10:52	42F6	56.35.452 N	006.49.994 E	43	38	6	2
08-08-12	573	20:34	43F7	57.18.714 N	007.45.455 E	60	55	5.8	2
09-07-12	674	10:12	43F7	57.11.669 N	007.09.069 E	63	55	3.5	2
09-07-12	767	20:52	44F8	57.52.545 N	008.45.845 E	450	150	4.8	1
10-07-12	870	10:17	43F8	57.23.342 N	008.31.784 E	34	29	8.2	1
10-07-12	968	20:47	45F9	58.01.081 N	009.16.360 E	501	150	13.2	4
11-07-12	1066	10:17	44G0	57.50.043 N	010.24.143 E	87	83	3.0	4
11-07-12	1200	20:27	45F9	58.27.874 N	009.49.138 E	562	150	2	1
12-07-12	1297	10:19	46G0	58.35.528 N	010.49.221 E	85	65	4.9	2
12-07-12	1369	20:58	45G0	58.06.458 N	010.34.626 E	187	150	10.3	3
13-07-12	1473	10:20	44G0	57.51.997 N	010.58.595 E	72	67	5.5	3
13-07-12	1544	20:37	43G0	57.28.158 N	010.51.956 E	39	31	6.2	2
14-07-12	1652	10:21	43G1	57.08.113 N	011.50.079 E	53	48	3.8	2
14-07-12	1726	20:31	42G1	56.35.540 N	011.49.052 E	33	23	7.1	1
15-07-12	1833	10:36	41G1	56.13.556 N	011.59.919 E	27	22	9.5	2
15-07-12	1906	20:37	41G0	56.17.058 N	010.57.581 E	19	14	9.2	3

Table 9. 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 2012

Number of Autumn Spawners in 2012 in mill.												
WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7
580E06	0	11.54137	0	6.171554	1.042492	0.175897	0.125641	0.021779	0.054448	0	0.065335	0.065337
570E06	0	539.5887	0	110.9881	18.748	4.500165	3.214403	0.991815	2.479537	0.686366	0.203799	0.5765
580E08	0.096755	208.4165	0	42.38224	7.159162	0.9948	0.710571	0.214623	0.536558	0.379682	0.41329	0
570E08	0	1247.079	0	98.20187	16.58815	1.78809	1.277207	0.992438	2.481094	0.263434	0	0.191724
C	132.4174	62.44638	0	8.912714	1.505526	0	0	0.063761	0.159402	0	0	0
D	0	992.3268	0	24.8546	4.198412	0.152592	0.108994	0.218111	0.545277	0	0	0
E	54.99148	722.619	0	4.428387	2.952258	0.333076	0.999227	0	1.19729	0.436518	0	0
560E06	0	457.3597	0	0.20641	0	0	0	0	0	0	0	0

Biomass of Autumn Spawners in 2012 in ton.												
WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7
580E06	0	758.9695	0	548.6355	92.67492	22.93717	16.3837	3.332202	8.330504	0	17.90179	12.87143
570E06	0	32853.23	0	10301.81	1740.171	644.6685	460.4775	200.4789	501.1972	144.1368	55.84105	133.9504
580E08	0.435398	13699.84	0	3691.628	623.5859	127.2766	90.91188	33.0552	82.638	55.43351	84.72445	0
570E08	0	75710.81	0	8516.183	1438.544	286.6135	204.7239	174.3285	435.8213	55.32111	0	56.94215
C	493.173	3717.163	0	727.5008	122.8886	0	0	5.355896	13.38974	0	0	0
D	0	51476.61	0	1888.884	319.0682	15.71696	11.2264	27.97117	69.92791	0	0	0
E	270.282	29987.15	0	285.1817	190.1212	32.38499	97.15497	0	164.8294	34.48495	0	0
560E06	0	16097.62	0	12.3846	0	0	0	0	0	0	0	0

Mean length of Autumn Spawners in 2012 in cm.												
WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7
580E06	0.00	20.39	20.39	22.14	22.14	25.33	25.33	27.00	27.00	0.00	31.50	29.00
570E06	0.00	19.76	19.76	22.32	22.32	26.13	26.13	28.47	28.47	29.46	31.50	29.88
580E08	9.50	20.41	20.41	22.12	22.12	24.96	24.96	26.65	26.65	26.50	30.00	0.00
570E08	0.00	19.93	19.93	21.94	21.94	26.77	26.77	27.20	27.20	30.00	0.00	31.50
C	9.06	19.90	19.90	21.83	21.83	0.00	0.00	23.50	23.50	0.00	0.00	0.00
D	0.00	19.09	19.09	21.41	21.41	23.50	23.50	24.85	24.85	0.00	0.00	0.00
E	9.40	18.09	18.09	20.47	20.47	23.31	23.31	24.92	24.92	22.00	0.00	0.00
560E06	0.00	16.92	16.92	20.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mean weight of Autumn Spawners in 2012 in g.												
WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7
580E06	0.00	65.76	65.76	88.90	88.90	130.40	130.40	153.00	153.00	0.00	274.00	197.00
570E06	0.00	60.89	60.89	92.82	92.82	143.25	143.25	202.13	202.13	210.00	274.00	232.35
580E08	4.50	65.73	65.73	87.10	87.10	127.94	127.94	154.01	154.01	146.00	205.00	0.00
570E08	0.00	60.71	60.71	86.72	86.72	160.29	160.29	175.66	175.66	210.00	0.00	297.00
C	3.72	59.53	59.53	81.63	81.63	0.00	0.00	84.00	84.00	0.00	0.00	0.00
D	0.00	51.87	51.87	76.00	76.00	103.00	103.00	128.24	128.24	0.00	0.00	0.00
E	4.91	41.50	41.50	64.40	64.40	97.23	97.23	137.67	137.67	79.00	0.00	0.00
560E06	0.00	35.20	35.20	60.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 10. 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 2012

Number of Spring Spawners in 2012 in mill.																	
WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10	11	12
580E06	0	0.087092	0	8.455258	4.280255	0.516597	3.588991	0.028013	1.79285	0.829154	0.45281	0.4138	0.348465	0	0	0	0
570E06	0	0.802243	0	35.30991	17.87473	2.331341	16.19668	0.110534	7.074166	5.635533	2.636946	1.493843	1.144496	0.253156	0	0	0.136995
580E08	0	6.383919	0	84.4334	42.74222	3.960894	27.51779	0.171328	10.96498	2.074474	2.282799	0	0	0	0	0	0
570E08	0	37.48913	0	122.8636	62.19649	2.303588	16.00388	0.061603	3.942601	8.209331	4.197072	1.393759	0.811651	1.05264	0	0	0.158431
C	0	2.799729	0	46.81447	23.69861	1.470867	10.21866	0.057094	3.65403	0.557371	0.432322	0	0	0	0	0	0
D	0	122.3632	0	99.5524	50.39582	1.38234	9.603625	0.02642	1.690868	1.383418	0.19891	0	0	0	0	0	0
E	0.966142	687.1796	0	195.2742	49.33244	6.301715	11.81571	0.275346	2.202767	2.874318	0.68307	0.124434	0	0	0	0	0
560E06	0	67.84021	0	0.232373	0.464745	0	0	0	0	0	0	0	0	0	0	0	0

Biomass of Spring Spawners in 2012 in ton.																	
WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10	11	12
580E06	0	3.222302	0	737.5392	373.3601	56.23335	390.6738	3.853983	246.6549	114.6157	57.39641	76.18277	69.69298	0	0	0	0
570E06	0	33.66986	0	3150.634	1594.927	295.6627	2054.078	15.55821	995.7257	921.0763	450.9723	266.5925	233.3364	55.88932	0	0	28.22094
580E08	0	400.305	0	6638.423	3360.529	362.8379	2520.769	18.51983	1185.269	247.2699	376.0197	0	0	0	0	0	0
570E08	0	2083.718	0	9948.618	5036.23	287.1829	1995.165	9.080964	581.1817	1402.645	700.6489	264.0513	173.3577	231.1442	0	0	32.63668
C	0	128.9543	0	3355.108	1698.437	127.6351	886.7283	5.426585	347.3014	60.04836	54.94084	0	0	0	0	0	0
D	0	6109.413	0	7277.139	3683.863	125.2523	870.1738	2.427396	155.3533	157.2304	31.12942	0	0	0	0	0	0
E	2.898425	28653.78	0	11692.59	2953.917	507.2177	951.0332	26.6974	213.5792	295.8698	66.99472	21.65152	0	0	0	0	0
560E06	0	2307.637	0	16.30577	32.61154	0	0	0	0	0	0	0	0	0	0	0	0

Mean length of Spring Spawners in 2012 in cm.																	
WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10	11	12
580E06	0.00	17.00	17.00	22.38	22.38	24.20	24.20	26.22	26.22	26.35	25.38	29.34	29.50	0.00	0.00	0.00	0.00
570E06	0.00	17.64	17.64	22.32	22.32	25.26	25.26	26.18	26.18	27.48	28.25	28.96	29.66	30.22	0.00	0.00	31.00
580E08	0.00	20.38	20.38	21.81	21.81	23.29	23.29	24.68	24.68	25.42	27.83	0.00	0.00	0.00	0.00	0.00	0.00
570E08	0.00	19.43	19.43	21.78	21.78	25.08	25.08	26.60	26.60	27.78	27.84	28.26	30.67	30.37	0.00	0.00	31.00
C	0.00	18.41	18.41	21.36	21.36	23.02	23.02	23.85	23.85	24.64	26.53	0.00	0.00	0.00	0.00	0.00	0.00
D	0.00	18.73	18.73	21.20	21.20	22.86	22.86	23.34	23.34	24.87	27.50	0.00	0.00	0.00	0.00	0.00	0.00
E	8.50	18.18	18.18	20.34	20.34	22.49	22.49	23.36	23.36	24.37	23.85	29.00	0.00	0.00	0.00	0.00	0.00
560E06	0.00	16.76	16.76	21.92	21.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mean weight of Spring Spawners in 2012 in g.																	
WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6	7	8	9	10	11	12
580E06	0.00	37.00	37.00	87.23	87.23	108.85	108.85	137.58	137.58	138.23	126.76	184.11	200.00	0.00	0.00	0.00	0.00
570E06	0.00	41.97	41.97	89.23	89.23	126.82	126.82	140.76	140.76	163.44	171.02	178.46	203.88	220.77	0.00	0.00	206.00
580E08	0.00	62.71	62.71	78.62	78.62	91.61	91.61	108.10	108.10	119.20	164.72	0.00	0.00	0.00	0.00	0.00	0.00
570E08	0.00	55.58	55.58	80.97	80.97	124.67	124.67	147.41	147.41	170.86	166.94	189.45	213.59	219.59	0.00	0.00	206.00
C	0.00	46.06	46.06	71.67	71.67	86.78	86.78	95.05	95.05	107.73	127.08	0.00	0.00	0.00	0.00	0.00	0.00
D	0.00	49.93	49.93	73.10	73.10	90.61	90.61	91.88	91.88	113.65	156.50	0.00	0.00	0.00	0.00	0.00	0.00
E	3.00	41.70	41.70	59.88	59.88	80.49	80.49	96.96	96.96	102.94	98.08	174.00	0.00	0.00	0.00	0.00	0.00
560E06	0.00	34.02	34.02	70.17	70.17	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 11. Age distribution in estimate of autumn spawners during the Danish acoustic survey with R/V Dana in June-July from 2007 to 2012 given as number per age and strata in mill.and % of total abundance given by age and strata.

Autumn spawners in 2007

Number in millions

	WR								
Strata	0	1	2	3	4	5	6	7	Totalt
580E06	0.00	4.28	0.78	0.00	0.00	0.00	0.00	0.00	5.05
570E06	0.00	121.40	56.69	5.73	0.08	0.00	0.00	0.00	183.90
580E08	0.00	59.15	26.53	0.00	0.00	0.00	0.00	0.00	85.68
570E08	0.00	753.58	118.42	0.00	0.00	0.00	0.00	0.00	872.00
C	0.00	75.63	7.93	0.00	0.00	0.00	0.00	0.00	83.56
D	0.00	1365.50	109.44	5.59	0.00	0.00	0.00	0.00	1480.53
E	0.00	1542.98	46.92	7.76	0.00	0.00	0.00	0.00	1597.67
560E06	0.00	134.85	0.00	0.00	0.00	0.00	0.00	0.00	134.85
All stratas	0.00	4057.35	366.72	19.08	0.08	0.00	0.00	0.00	4443.24

Age distribution in % of total abundance

	WR							
Strata	0	1	2	3	4	5	6	7
580E06	0.00	84.62	15.38	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
580E08	0.00	69.03	30.97	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
C	0.00	90.51	9.49	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
E	0.00	96.58	2.94	0.49	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
All stratas	0.00	91.32	8.25	0.43	0.00	0.00	0.00	0.00

Autumn spawners in 2008

Numbers in millions

	WR								
Strata	0	1	2	3	4	5	6	7	Totalt
580E06	0.00	5.76	5.27	1.14	0.00	0.00	0.00	0.00	12.17
570E06	0.00	233.35	44.02	10.12	1.83	0.97	1.17	0.00	291.45
580E08	0.00	14.77	0.80	0.95	0.00	0.00	0.00	0.00	16.52
570E08	0.00	30.46	35.50	15.28	12.23	0.00	0.00	0.00	93.47
C	0.00	17.00	1.81	0.29	0.00	0.00	0.00	0.00	19.09
D	11.88	61.84	12.28	3.66	1.16	0.71	0.00	0.00	91.51
E	2347.35	13.79	1.01	3.67	0.00	0.00	0.00	0.00	2365.82
560E06	1556.12	26.99	0.00	0.00	0.00	0.00	0.00	0.00	1583.12
All stratas	3915.35	403.95	100.68	35.11	15.21	1.68	1.17	0.00	4473.15

Age distribution in % of total abundance

	WR							
Strata	0	1	2	3	4	5	6	7
580E06	0.00	47.34	43.32	9.35	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
580E08	0.00	89.39	4.83	5.77	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
C	0.00	89.02	9.46	1.52	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
E	99.22	0.58	0.04	0.16	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
All stratas	87.53	9.03	2.25	0.78	0.34	0.04	0.03	0.00

Autumn sawners in 2009

Numbers in millions

	WR							
	0	1	2	3	4	5	6	7	Total
580E06	0.00	0.69	0.09	0.02	0.00	0.00	0.00	0.00	0.81
570E06	31.06	171.89	42.79	7.42	0.00	0.00	0.00	0.00	253.16
580E08	0.00	9.70	4.14	0.27	0.53	0.26	0.05	0.00	14.95
570E08	108.09	747.46	8.76	0.31	0.68	0.27	0.06	0.00	865.63
C	260.15	0.59	0.06	0.00	0.00	0.00	0.00	0.00	260.80
D	3864.97	482.56	3.47	0.16	0.85	0.37	0.00	0.00	4352.38
E	3409.91	277.26	0.30	0.00	0.00	0.00	0.00	0.00	3687.48
560E06	138.33	103.89	1.80	0.00	0.00	0.00	0.00	0.00	244.03
All Strata	7812.52	1794.04	61.42	8.18	2.07	0.91	0.10	0.00	9679.24

Age distribution in % of total abundance

	WR							
	0	1	2	3	4	5	6	7
580E06	0.00	85.88	11.60	2.53	0.00	0.00	0.00	0.00
570E06	12.27	67.90	16.90	2.93	0.00	0.00	0.00	0.00
580E08	0.00	64.85	27.70	1.84	3.55	1.75	0.31	0.00
570E08	12.49	86.35	1.01	0.04	0.08	0.03	0.01	0.00
C	99.75	0.23	0.02	0.00	0.00	0.00	0.00	0.00
D	88.80	11.09	0.08	0.00	0.02	0.01	0.00	0.00
E	92.47	7.52	0.01	0.00	0.00	0.00	0.00	0.00
560E06	56.69	42.57	0.74	0.00	0.00	0.00	0.00	0.00
All Strata	80.71	18.53	0.63	0.08	0.02	0.01	0.00	0.00

Autumn sawners in 2010

Numbers in millions

	WR							
	0	1	2	3	4	5	6	7	Total
580E06	0.00	5.16	0.21	0.10	0.04	0.00	0.00	0.00	5.50
570E06	0.00	19.01	6.15	0.66	0.70	0.14	0.00	0.11	26.76
580E08	0.00	6.73	2.03	0.71	0.66	0.17	0.00	0.00	10.30
570E08	0.00	1222.33	5.96	1.17	0.02	0.04	0.00	0.01	1229.52
C	0.26	3.03	0.51	0.11	0.21	0.00	0.00	0.00	4.12
D	0.06	202.86	7.37	1.70	0.02	0.01	0.00	0.00	212.02
E	49.68	966.47	8.69	2.14	0.00	0.00	0.00	0.00	1026.98
560E06	205.36	2.89	0.00	0.00	0.00	0.00	0.00	0.00	208.25
All Strata	255.37	2428.48	30.91	6.58	1.64	0.36	0.00	0.12	2723.45

Age distribution in % of total abundance

	WR							
	0	1	2	3	4	5	6	7
580E06	0.00	93.80	3.77	1.75	0.67	0.00	0.00	0.00
570E06	0.00	71.02	22.96	2.45	2.60	0.54	0.00	0.43
580E08	0.00	65.40	19.74	6.85	6.39	1.62	0.00	0.00
570E08	0.00	99.42	0.48	0.09	0.00	0.00	0.00	0.00
C	6.34	73.59	12.37	2.70	5.01	0.00	0.00	0.00
D	0.03	95.68	3.48	0.80	0.01	0.00	0.00	0.00
E	4.84	94.11	0.85	0.21	0.00	0.00	0.00	0.00
560E06	98.61	1.39	0.00	0.00	0.00	0.00	0.00	0.00
All Strata	9.38	89.17	1.14	0.24	0.06	0.01	0.00	0.00

Autumn spawners in 2011

Numbers in millions

	WR							
	0	1	2	3	4	5	6	7	Total
580E06	0.00	4.52	4.15	0.21	0.19	0.00	0.00	0.00	9.07
570E06	0.00	510.31	22.96	0.79	1.08	0.34	0.00	0.00	535.48
580E08	0.00	29.05	33.80	0.97	1.58	0.00	0.00	0.00	65.41
570E08	0.00	1095.58	86.44	3.23	1.29	0.20	0.00	0.00	1186.75
C	4.54	48.45	13.21	2.00	1.53	0.00	0.00	0.00	69.73
D	513.19	145.16	25.80	3.62	1.20	0.30	0.30	0.00	689.56
E	767.38	162.48	0.25	0.05	0.00	0.00	0.00	0.00	930.15
560E06	0.00	1669.55	0.00	0.00	0.00	0.00	0.00	0.00	1669.55
All Strata	1285.12	3665.10	186.62	10.87	6.87	0.85	0.30	0.00	5155.72

Age distribution in % of total abundance

	WR							
	0	1	2	3	4	5	6	7
580E06	0.00	49.85	45.80	2.27	2.07	0.00	0.00	0.00
570E06	0.00	95.30	4.29	0.15	0.20	0.06	0.00	0.00
580E08	0.00	44.42	51.68	1.48	2.42	0.00	0.00	0.00
570E08	0.00	92.32	7.28	0.27	0.11	0.02	0.00	0.00
C	6.52	69.48	18.95	2.87	2.19	0.00	0.00	0.00
D	74.42	21.05	3.74	0.53	0.17	0.04	0.04	0.00
E	82.50	17.47	0.03	0.01	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
All Strata	24.93	71.09	3.62	0.21	0.13	0.02	0.01	0.00

Autumn spawners in 2012

Numbers in millions

	WR							
	0	1	2	3	4	5	6	7	Total
580E06	0.00	11.54	7.21	0.30	0.08	0.00	0.07	0.07	19.26
570E06	0.00	539.59	129.74	7.71	3.47	0.69	0.20	0.58	681.98
580E08	0.10	208.42	49.54	1.71	0.75	0.38	0.41	0.00	261.30
570E08	0.00	1247.08	114.79	3.07	3.47	0.26	0.00	0.19	1368.86
C	132.42	62.45	10.42	0.00	0.22	0.00	0.00	0.00	205.51
D	0.00	992.33	29.05	0.26	0.76	0.00	0.00	0.00	1022.40
E	54.99	722.62	7.38	1.33	1.20	0.44	0.00	0.00	787.96
560E06	0.00	457.36	0.21	0.00	0.00	0.00	0.00	0.00	457.57
All Strata	187.51	4241.38	348.34	14.38	9.96	1.77	0.68	0.83	4804.84

Age distribution in % of total abundance

	WR							
	0	1	2	3	4	5	6	7
580E06	0.00	59.91	37.45	1.57	0.40	0.00	0.34	0.34
570E06	0.00	79.12	19.02	1.13	0.51	0.10	0.03	0.08
580E08	0.04	79.76	18.96	0.65	0.29	0.15	0.16	0.00
570E08	0.00	91.10	8.39	0.22	0.25	0.02	0.00	0.01
C	64.44	30.39	5.07	0.00	0.11	0.00	0.00	0.00
D	0.00	97.06	2.84	0.03	0.07	0.00	0.00	0.00
E	6.98	91.71	0.94	0.17	0.15	0.06	0.00	0.00
560E06	0.00	99.95	0.05	0.00	0.00	0.00	0.00	0.00
All Strata	3.90	88.27	7.25	0.30	0.21	0.04	0.01	0.02

Table 12. Age distribution in estimate of spring spawners during the Danish acoustic survey with R/V Dana in June-July from 2006 to 2010 given as number per age and strata.

Spring spawners in 2008															
Numbers in millions															
	WR														
Strata	0	1	2	3	4	5	6	7	8	9	10	11	12	13	total
580E06	0	4.75	22.36	11.44	4.64	1.63	0.23	0	0	0	0	0	0	0	45.06
570E06	0	2263.75	377.97	116.59	51.42	23.77	13.53	5.64	2.24	0.17	0.14	0	0	0	2855.22
580E08	0	49.79	59.90	36.90	7.15	5.02	1.89	1.00	0.48	0.13	0.00	0	0	0	162.26
570E08	0	701.72	228.78	147.20	71.33	46.00	41.03	15.91	6.89	5.64	0.00	0	0	0	1264.51
C	0	108.72	96.90	26.02	7.22	5.07	0.58	0.34	0	0	0.34	0	0	0	245.18
D	1.38	124.71	151.89	59.98	20.05	11.58	3.96	1.21	0	0	0.29	0	0	0	375.05
E	23.86	216.22	125.10	41.38	11.35	6.16	3.85	0.45	0.68	0.36	0	0	0	0	429.43
560E06	81.17	1903.13	5.62	0	0	0	0	0	0	0	0	0	0	0	1989.92
All stratas	106.42	5372.77	1068.54	439.52	173.17	99.23	65.08	24.55	10.28	6.31	0.77	0	0	0	7366.64
													Total 4-13 WR		379.39
													Total 0-3 WR		6987.25
Spring spawners in 2009															
Number in millions															
	WR														
Strata	0	1	2	3	4	5	6	7	8	9	10	11	12	13	total
580E06	0	0.18	0.85	0.44	0.32	0.19	0.02	0	0	0.01	0	0	0	0	2.01
570E06	0	60.72	136.57	138.97	116.99	51.61	44.13	15.51	11.38	1.72	2.16	1.16	0	1.52	582.44
580E08	0	0.00	17.81	9.09	7.78	3.76	2.29	0.71	0.16	0.24	0.05	0	0	0	41.88
570E08	0	87.86	59.76	19.24	13.05	6.39	3.68	1.12	0.21	0.28	0.07	0	0	0	191.66
C	0	0.00	2.61	1.01	0.64	0.09	0.03	0.03	0.03	0	0	0	0	0	4.43
D	0	1.12	66.37	22.03	14.97	5.02	3.51	1.26	0.23	0.39	0.12	0	0	0	115.03
E	0.94	155.35	27.00	5.35	1.99	0.68	0.65	0	0	0	0	0	0	0	191.95
560E06	0	194.39	1.80	0.72	0	0	0	0	0	0	0	0	0	0	196.91
All stratas	0.94	499.62	312.76	196.86	155.73	67.73	54.30	18.63	12.01	2.64	2.40	1.16	0	1.52	1326.32
													Total 4-13 WR		316.13
													Total 0-3 WR		1010.19
Spring spawners in 2010															
Number in millions															
	WR														
Strata	0	1	2	3	4	5	6	7	8	9	10	11	12	13	total
580E06	0	0.64	3.58	2.90	1.33	0.58	0.32	0.04	0	0	0	0	0	0	9.40
570E06	0	2.63	14.71	22.37	8.57	4.51	2.24	0.75	0.39	0.49	0.24	0.01	0.10	0	57.00
580E08	0	0.38	11.76	18.76	6.75	3.59	1.62	1.56	0.70	0.38	0	0	0	0	45.51
570E08	0	111.66	55.59	19.63	0.29	0.10	0.06	0.02	0	0.01	0	0	0	0	187.35
C	0	0.15	4.09	5.31	1.54	1.05	0.45	0.46	0.24	0.15	0	0	0	0	13.43
D	0	45.94	92.39	15.31	1.60	0.38	0.10	0.07	0.03	0.01	0	0	0	0	155.82
E	0.66	611.21	307.14	59.42	7.44	3.49	0.57	0.39	0.12	0.00	0	0	0	0	990.43
560E06	0	1.82	0.01	0	0	0	0	0	0	0	0	0	0	0	1.83
All stratas	0.66	774.43	489.28	143.70	27.52	13.70	5.36	3.28	1.47	1.04	0.25	0.01	0.10	0	1460.78
													Total 4-13 WR		52.72
													Total 0-3 WR		1408.06
Spring spawners in 2011															
Number in millions															
	WR														
Strata	0	1	2	3	4	5	6	7	8	9	10	11	12	13	total
580E06	0	0.12	7.73	4.40	1.00	1.63	0.45	0.08	0	0	0	0	0	0	15.69
570E06	0	79.66	66.92	40.88	20.10	10.79	3.52	3.01	2.02	0.00	0.00	0	0	0	226.90
580E08	0	4.51	76.89	47.55	39.76	14.16	14.12	2.04	0.29	0.46	1	0	0	0	200.30
570E08	0	484.27	121.20	55.94	40.75	14.81	9.01	2.30	1	0.20	0	0	0	0	730.09
C	0	6.74	59.20	16.36	6.87	0.63	0.31	0.00	0.00	0.00	0	0	0	0	90.11
D	0	55.88	63.59	27.43	16.10	4.60	2.34	0.30	0.00	0.00	0	0	0	0	170.23
E	0.00	419.21	18.63	2.92	0.56	0.27	0.05	0.11	0.00	0.05	0	0	0	0	441.81
560E06	0	1824.43	0.00	0	0	0	0	0	0	0	0	0	0	0	1824.43
All stratas	0.00	2874.83	414.17	195.48	125.13	46.89	29.80	7.83	3.88	0.72	0.84	0	0	0	3699.57
													Total 4-13 WR		215.09
													Total 0-3 WR		3484.48
Spring spawners in 2012															
Number in millions															
	WR														
Strata	0	1	2	3	4	5	6	7	8	9	10	11	12	13	total
580E06	0	0.09	12.74	4.11	1.82	0.83	0.45	0.41	0	0	0	0	0		20.79
570E06	0	0.80	53.18	18.53	7.18	5.64	2.64	1.49	1.14	0.25	0.00	0	0		91.00
580E08	0	6.38	127.18	31.48	11.14	2.07	2.28	0.00	0.00	0.00	0	0	0		180.53
570E08	0	37.49	185.06	18.31	4.00	8.21	4.20	1.39	1	1.05	0	0	0		260.68
C	0	2.80	70.51	11.69	3.71	0.56	0.43	0.00	0.00	0.00	0	0	0		89.70
D	0	122.36	149.95	10.99	1.72	1.38	0.20	0.00	0.00	0.00	0	0	0		286.60
E	0.97	687.18	244.61	18.12	2.48	2.87	0.68	0.12	0.00	0.00	0	0	0		957.03
560E06	0	67.84	0.70	0	0	0	0	0	0	0	0	0	0		68.54
All stratas	0.97	924.95	843.92	113.21	32.05	21.56	10.88	3.43	2.30	1.31	0.00	0.00	0.30	0	1954.88
													Total 4-13 WR		71.83
													Total 0-3 WR		1883.04

Table 13. Abundance, mean weight, mean length and biomass by age group and sub area for sprat in the Danish acoustic survey with R/V Dana in June-July 2011.

Number of Sprat in 2012 in mill.									
WR	0	1i	1m	2i	2m	3	4	5	6
580E06									
570E06									
580E08									
570E08									
C									
D	0.000	4.487	0.089	0.004	0.001	0.297	0.722	0.172	0.150
E	0.326	116.975	2.309	252.397	37.742	813.713	603.436	47.201	22.343
560E06	0.000	0.831	0.016	9.103	1.361	12.309	4.273	0.188	0.000

Biomass of Sprat in 2012 in ton.									
WR	0	1i	1m	2i	2m	3	4	5	6
580E06									
570E06									
580E08									
570E08									
C									
D	0.000	40.281	0.795	0.084	0.013	6.780	17.160	4.396	3.811
E	0.490	1119.467	22.095	4384.499	655.626	16351.017	13550.305	911.276	567.552
560E06	0.000	11.097	0.219	147.474	22.052	233.423	91.194	2.395	0.000

Mean length of Sprat in 2012 in cm.									
WR	0	1i	1m	2i	2m	3	4	5	6
580E06									
570E06									
580E08									
570E08									
C									
D	0.0	9.9	9.9	13.5	13.5	14.118	14.4	15.2	15.4
E	6.5	10.2	10.2	12.8	12.8	13.445	14.1	14.6	15.4
560E06	0.0	11.9	11.9	12.5	12.5	13.163	13.8	14.3	0.0

Mean weight of Sprat in 2012 in g.									
WR	0	1i	1m	2i	2m	3	4	5	6
580E06									
570E06									
580E08									
570E08									
C									
D	0.0	9.0	9.0	20.8	20.8	22.824	23.8	25.6	25.5
E	1.5	9.6	9.6	17.4	17.4	20.094	22.5	19.3	25.4
560E06	0.0	13.4	13.4	16.2	16.2	18.964	21.3	12.8	0.0