Acoustic Herring Survey report for RV "DANA"

25th June – 10th July 2018

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Cruise summary

Total days	15
Days of monitoring	13
Number of nautical miles monitored	2113 + 164 miles for calibration
Number of trawl hauls	41
Number of CTD stations	42
Number of WP2 stations	22
Fish catch in kg	39088
Number of measured herring	6717
Number of measured mackerel	2692
Number of measured sprat	2183
Number of species measured	50
Total number of measured fish	20087
Number of herring frozen for age and race-split	1889
Number of sprat frozen for age	672

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 2018-survey with R/V DANA, covering the Skagerrak and Kattegat, was conducted in the period June 25 June to July 10 2018, while calibration was done during June 25 to June 28 2018.

2. SURVEY

2.1 Personnel

During calibration 25/6– 28/6 2018
Karl-Johan Stæhr (cruise leader)
Torben Filt Jensen (assisting cruise leader)
Ronny Sørensen
Christian Petersen
Heidi Andreasen, noise measurements

Laura Diernæs, student
Ditte Maja Noach, student
Stavros Panoutsopoulus, student
Henrik Søndergaard Mathiesen, MacArtney
Hans Christian Clausen, MacArtney
Claus Halle

During acoustic monitoring 28/6 - 10/7-2018
Karl-Johan Stæhr (cruise leader)
Torben Filt Jensen (assisting cruise leader)
Annegrete D. Hansen (acoustic)
Susanne Hansen(fishlab)
Nina Fuglsang (fishlab)
Søren Larsen Grønby (fishlab)
Jan Wener Thomsen (fishlab)
Laura Diernæs, student
Heidi Andreasen, noise measurements
Ditte Maja Noach, student
Stavros Panoutsopoulus, student
Ronny Sørensen (Technisian)

2.2 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 4 sub-areas.

In principal the survey is designed with parallel survey tracks at right angles to the depth lines with a spacing of 15 nm in strata 151, 17.5 nm in strata 41 and 10 nm in strata 31 and 21. 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.

2.3 Calibration

The echosounders were calibrated at Bornö in the Gullmar Fjord, Sweden during June 25 - June 28 2018. 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 April. 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 April, 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 120 kHz echosounder still showed large differences in the angel discrimination like last year. As the 120 kHz is not the used frequency for the data collection the survey can be conducted with a possible failure on this echosounder.

2.4 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.

2.5 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.

2.6 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

2.7 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.

2.8 Data analysis

The raw data is pre-integrated into 1 m samples for each ping and divided into 1 mile datasets and stored on hard disk 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 (21, 31, 41, 42, 151 and 152 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 ICES SIPS 9: Manual for International Pelagic Surveys (IPS):

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

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

2.9 Test of Flexus

During the transportation to the calibration place technicians fron DTU-Aqua have been trained in operation of the new towed platform Flexus by personal from MacArtney.

2.10 Cruise leader course

Three students from DTU-Aqua`s MSc Eng. In Aquatic Science and Technology have participated in the survey during a 5 ECTS Cruise leader course. One student has been working with linking chlorophyll A and fish abundance, one student has been working camera counting of Jellyfish and one with noise measurements in the sea from Dana.. The students have worked together with the rest of the scientific crew under supervision of Karl-Johan Stæhr.

3. RESULTS & DISCUSSION

3.1 Narrative

The survey of R/V Dana started on June 25th at 19.15 UTC with departure from Hirtshals heading for a position north of Skagen at 200 m depth for test of Flexus. At 10.00 UTC we entered Swedish EEZ towards Bornö in Gullmar Fjord, Sweden for calibration of the acoustic equipment. The vessel was anchored at Bornö in the Gullmar Fjord, Sweden June 26th at 14.00 UTC. The calibration was initiated in the afternoon of June 25th and continued until the morning of June 28th.

At June 28th at 04.00 UTC Dana left Bornö to arrive in Skagen June 28th at 10.04 UTC for exchange of the scientific crew. R/V Dana left Skagen at 12.00 UTC to steam northwest towards the border between Skagerrak and the North Sea.

Monitoring data collection was started the June 29 at 57º 48'N, 7º 03'E at 00.20 UTC with a CTD and a trawl haul.

The North Sea was covered during the period June 29 – July 2, Skagerrak during July 2 - July 7 and Kattegat during July 7-10.

The acoustic integration was ended July 10 at 57º 41'N, 10º 19'E at 9.28 UTC.

R/V Dana arrived at Hirthals at 11.30 UTC on July 10.

Totally the survey covered about miles of monitoring. Data from the 38 kHz echosounder were recorded mainly using a 38 kHz paravane transducer running at depths of 4 – 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. During trawling hull-mounted transducers were used for all three frequencies.

3.2 Acoustic data

The total number of acoustic sample units of 1 nm (ESDU's) collected for the stock size calculation is aprox. 1987 cruise line for integration is given in Figure 2. During the survey acoustic data have been prepared for scrutinization at shore and stock calculation in the Danish program. Data from transect shown in Figure 4 will be used in the stock estimation by StoX.

3.3 Biological data

During the survey in 2018 41 trawl hauls were conducted, 23 surface hauls and 18 bottom hauls. The geographical distribution of hauls and details on the hauls are given in Figure 2 and Table 2. Catches by species is given in Table 3.

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

The total catch for the survey was 39.1 tons. Herring was present in 39 hauls with a total catch of 6.3 tons or 16,2 % of the total catch. Totally 6,402 herring have been measured. Length distributions of herring per haul are given in Table 5.

The total sprat catch was 2,8 tons or 7.0 % of the total catch. Totally 2,183 sprat have been measured. Length distributions of sprat per haul are given in table 6.

Mackerel were present in 31 hauls with a total catch of 20.0 ton or 51.2 % of the total catch. There were one large catch of 14.6 ton mackerel in one haul. Totally 2,692 mackerel have been measured. Length distributions of Mackerel per haul are given in table 7.

For the total survey area herring, mackerel and sprat contributed to the total catch by 16.2 %, 51.2 % and 7.0 % respectively.

Herring maturity

Based on the frozen single fish herring samples (1889 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:

Maturity Autumn spawning herring in Kattegat, Strata 21

WR	0i	1i	1m	2i	2m	3i	3m	4i	4m	5m	6m
%	100.0	100.0	0.0	96.3	3.7	0.0	100.0	37.7	62.3	100.0	100.0

Maturity Autumn spawning herring in Skagerrak, Strata 31, 41 and 42

WR	0i	1i	1m	2i	2m	3i	3m	4i	4m	5m
%	100.0	100.0	0.0	97.1	2.9	80.5	19.5	100.0	0.0	100.0

Maturity Autumn spawning herring in North Sea, Strata 151 and 152

WR	0i	1i	1m	2i	2m	3i	3m	4i	4m	5m	6m
%	100.0	100.0	0.0	91.1	8.9	98.2	1.8	70.3	29.7	100.0	100.0

Baltic Sea spring spawners:

Maturity Spring spawning herring in Kattegat, Stata 21

WR	1i	1m	2i	2m	3i	3m	4i	4m	5m	6m	7m
%	100.0	0.0	89.2	10.8	59.3	40.7	11.4	88.6	100.0	100.0	100.0

Maturity Spring spawning herring in Skagerrak, Stata 31, 41 and 42

WR	1i	1m	2i	2m	3i	3m	4i	4m	5m	6m	7m	8m
%	97.8	2.2	80.7	19.3	76.8	23.2	55.4	44.6	100.0	100.0	100.0	100.0

Maturity Spring spawning herring in North Sea, Stata 151 and 152

WR	1i	1m	2i	2m	3i	3m	4i	4m	5m	6m	7m	8m	9m	10m
%	99.0	1.0	90.6	9.4	35.3	64.7	5.6	94.4	100.0	100.0	100.0	100.0	100.0	100.0

Sprat maturity

Based on 672 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 ≥2 and/or age ≥3 are regarded as mature

Maturity sprat in Kattegat, Strata 21								
WR	0i	1I	1m	2i	2m	3m	4m	5m
%	100.0	2.0	98.0	0.0	100.0	100.0	100.0	100.0

Maturity sprat in North Sea, Strata 151					
WR	1i	1m	2i	2m	3m
%	1.9	98.1	0.0	100.0	100.0

3.3 Biomass estimates

Herring

The total herring biomass estimate for the Danish acoustic survey with R/V Dana in June-July 2018 is 50,664 tonnes of which 53.9 % or 27,333 tonnes is North Sea autumn spawners and 46.1 % or 23,331 tonnes is Baltic Sea spring spawners.
For the total number of herring the survey results give 1,741 mill, of which 84.0 % are North Sea autumn spawners and 16.0 % 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.

Relative distribution on all herring (combined North Sea autumn spawners and Baltic spring spawners) is given in Figure 4.

A comparison for the results of the last 103 years surveys are given in the text table below.

	Autumn spawners		**Spring spawners**	
Year	Number in mill.	Biomass in tons	Number in mill.	Biomass in tons
2006	1530	98786	6407	471850
2007	4443	315176	8847	614048
2008	4473	80469	7367	450505
2009	9679	157707	1326	146590
2010	2723	148946	1461	88597
2011	5156	165589	3699	179898
2012	4805	259947	1955	122901
2013	1070	62126	1013	83601
2014	4576	58974	798	32875
2015	2950	103423	4874	179954
2016	1163	38650	1085	59660
2017	646	31196	703	36687
2018	1463	27333	278	23331

Sprat

The total abundance estimate of sprat for the Danish acoustic survey with R/V Dana in June-July 2018 is 2841 million corresponding to a biomass at 46,105 ton. Sprats were in 2018 found in Kattegat, Strata 21, with 97.6 % and in the North Sea, Strata 151 (ICES 41F6, 42F6, 41F7 and 42F7) with 2.4 %.

Abundance, biomass, mean length and mean weight per WR and strata are given in Table 11. Relative distribution on sprat along the cruise line is given in Figure 5

3.4 Hydrography

42 CTD stations have been taken. Information on the stations and distribution is given in Table 7 and Figure 3. Data from the CTD stations will be delivered to ICES hydrographical data base.

3.5 Plankton

22 WP2 stations have been taken. Information on the stations and distribution is given in Table 8 and Figure 3. Dry weight is measured ashore for each of the three fractions 2000 µm, 1000 µm and 180 µm. Distribution by fraction and station is given in Figure 6.

4 Cruise leader course

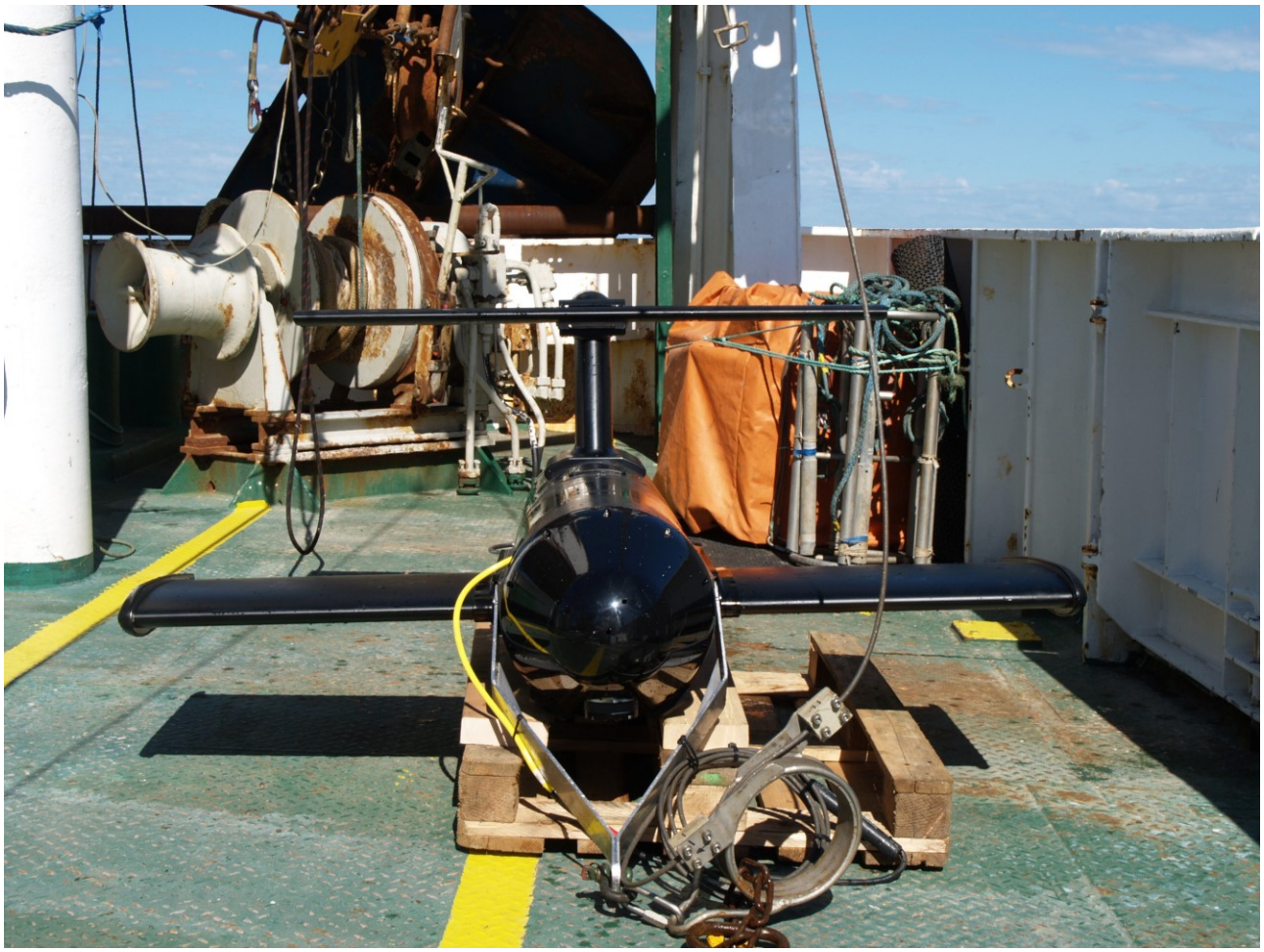
Three students from DTU-Aqua`s MSc Eng. In Aquatic Science and Technology have participated in the survey during a 5 ECTS Cruise leader course. One student has been working with linking

chlorophyll A and fish abundance; one student has been working camera counting of Jellyfish and one with noise measurements in the sea from Dana.The students have worked together with the rest of the scientific crew under supervision of Karl-Johan Stæhr.

For more details see appendix 1.

5 Test of Flexus

Technical training of technicians from DTU-Aqua in running Flexus was conducted the 26 June by personnel from MacArtney.



Appendix 1

Crew's report Dana 2018
Student: Stavros Panoutsopoulos
Supervisor on ship: Karl-Johal Stæhr
Cruise report in accordance with Cruise Leader course

The National Institute of Aquatic Resources (DTU AQUA) is a part of the ICES Working Group of International Pelagic Surveys (WGIPS). This year's survey was conducted between June 26th and July 10th, 2018, while calibration took place during 27th of June. This survey is performed once a year in Danish waters, (North Sea, Skagerrak and Kattegat). It focuses on distribution, abundance and age of pelagic fish like herring and mackerel. In this year's survey it was suggested that we try and study the population structure of jellyfish through video surveying and close comparison with herring abundance, as well as chlorophyll data in the CTD and WP2 stations.

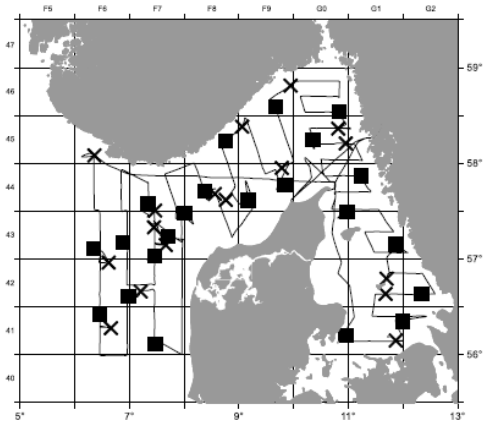


FIGURE 1. MAP SHOWING CTD AND WP2 STATIONS DURING THE DANISH ACOUSTIC SURVEY WITH R/V DANA IN JUNE-JULY 2018. X ARE CTD STATIONS AND SQUARES ARE COMBINED CTD AND WP2 STATIONS.

Aim:

The aim of this project is to see the correlation of chlorophyll location data and herring abundance data and compare it with the jellyfish population data that will be provided by the video surveying.

Methods and Materials:

Overall, 1 GoPro hero 3+ and 2 GoPro hero 4 cameras were used for the video surveying. There was an effort to attach the 2 torchlights and 1 camera on the CTD and record at night on 30 meters depth, but one of the batteries was probably over-pressurized and resulted in leakage of its inner fluids and ultimately destroying our torchlight. Therefore, our data are only daily and limited. On approximately 12:30 every day, I mounted one GoPro hero 4 camera on the CTD with an attachment that came with the equipment. The CTD went at 30 meters and stayed there for 1-2 minutes providing us with the current situation of Jellyfish on that station, while the ship was not moving.

The next target was to mount 2 cameras on the towed body and video survey on the 2 sides of the towed body. One of the ship's mechanics created 2 attachments to be mounted on the 2 sides with attached cameras to them. During the first try, the 2 attachments were creating problems because the towed body was kept going out of the water. So the 2nd solution was to mount one attachment to the center of the body mounted on the screws with a custom on-board fixation with 1 camera attached to it. The results were satisfying as we had a continuous 1,5-hour video for every towed body daily activity.

Results:

For some areas that looked clearly greener, thanks to increased concentrations of chlorophyll, I observed increased abundance of Jellyfishes up to 300 per 17 minutes of video on the towed body. Many videos showed that less concentrations of chlorophyll result in much less numbers of jellyfish (even 0).

As for the CTD, there was an increased activity during the night in some of the stations that were studied (numbers as much as 40 in a 1,5-minute video). When the chlorophyll results from the CTD become available, I will try to find if there is a correlation between chlorophyll and numbers of individuals of jellyfishes. If there is a clear correlation it would mean that chlorophyll is a strong indicator of jellyfishes in the Danish waters.

DANA SUMMER CRUISE 2018
DITTE NOACH
25.06.18 – 10.07.18

SOUND MEASUREMENTS ON DANA

HYDRODROPHONE RECORDINGS FROM MOB BOAT

PROJECT

By using hydrophone, CTD and location recordings Danas Source Level is examined. Combining this with vibration measurements from the vessels propellers, engine and hull it is examined which parts of the machinery contributes to the noise Dana emits to the surrounding waters.

HDF SOUND MEASUREMENTS

The MOB boat was positioned on Danas sailing route, where two hydrophones were hung from floats and adjusted to a certain depth. The HDF depth were decided through an analysis of a sound speed profile based on the data from the closest CTD taken by Dana (a MOB CTD was also taken on-site). Dana would then pass by the hydrophones with approx. 100 meters distance at the closest point. With AIS and GPS recordings from DANA and the MOB it is possible to calculate Danas SL (Source level) to see how much noise Dana emits through the water.

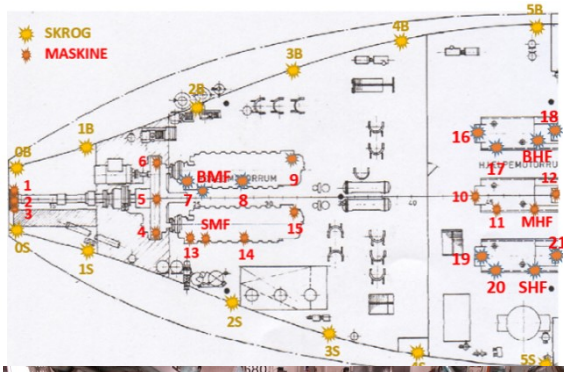
DATE	CONDITION	RECORDINGS
1: 30.06.18	TRAWL	2X HYDROPHONE GPS & AIS 2X CTD
2: 30.06.18	STEAMING 9,8 KN	2X HYDROPHONE GPS & AIS 2X CTD
3: 02.07.18	TRAWL	2X HYDROPHONE GPS & AIS 2X CTD
4: 04.07.18	TRAWL	2X HYDROPHONE GPS & AIS 2X CTD
5: 04.07.18	STEAMING 11 KN	2X HYDROPHONE GPS & AIS 2X CTD

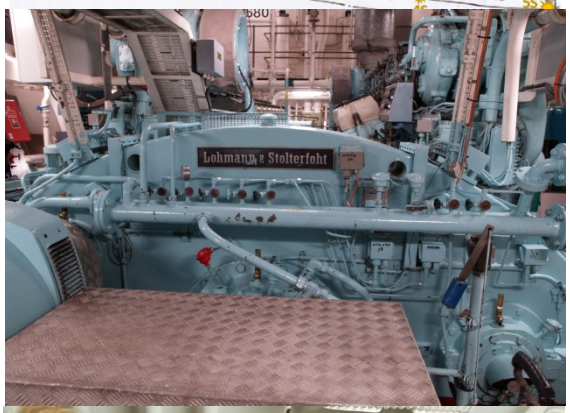
SOUND MEASUREMENTS ON DANA

ACCELEROMETER MEASUREMENTS IN DANAS MACHINERY

ACCELEROMETER MEASUREMENTS

With an Accelerometer, vibrations from Danas engine and hull were measured at different scenarios (trawling/steaming) and set ups (running engines). Recording points were placed near the propeller, at the gear, head engine (portside and starboard), support engines (1, 2 and 3) and at the hull. The accelerometer measurements were tried recorded under the same conditions as the HDF measurements. Communication with the bridge, who then adjusted RPM and Pitch, made this possible. The recordings were of 30 seconds per point. This will let us know how much of the noise from Dana origins from the different parts of the engine, the frequencies, and how it spreads through the hull and into the water medium.





IMPORTANCE FOR DANAS RESEARCH

This project examines the level of noise that the research vessel Dana sends out whilst trawling and steaming through the Danish waters. Dependent on the species, the fish within the Danish waters are able to hear up to 4 kHz. Fish will seek away from the source of the noise if this noise is loud enough and the fish senses danger. In such a scenario it will not be registered by the ships echo sounder nor will it be caught in the trawl net. This will have an influence on the population estimates, that are a part of Danas monitoring.

DATE	CONDITION	MACHINERY SETUP
1: 03.07.18	TRAWL	HVM_SB; HJM_1 ;HJM_2
2: 03.07.18	STEAMING	HVM_SB; HJM_2
3: 05.07.18	STEAMING	HVM_SB; HJM_3
4: 07.07.18	TRAWL	HVM_BB; HJM_2 ;HJM_3
5: 07.07.18	TRAWL	HVM_BB; HJM_2 ;HJM_3
6: 07.07.18	STEAMING	HVM_BB; HJM_2
7: 08.07.18	TRAWL	HVM_SB; HJM_1 ;HJM_3
8: 08.07.18	STEAMING	HVM_SB; HJM_1 ;HJM_3
9: 09.07.18	STEAMING	HVM_SB; HJM_3

Cruise report

Vessel:	R/V DANA
Cruise:	HERAS – DANA summer cruise 2018
Period:	25. June - 10. July 2018
Author	Laura Diernæs
Project	Linking chlorophyll and fish spatial distribution.

Project:

The spatial distribution of herring in Skagerrak and Kattegat have been observed to change between years. The changes in spatial distribution is believed to be related to either, hydrography, spatial

resolution, population size, available resources or production zones. This project will be a part of my master thesis and will seek a relation between these changes in herring spatial distribution and data of the vertically profile of chlorophyll in Skagerrak and Kattegat.

CTD with fluorescence measurement:

Chlorophyll-, temperature-, oxygen- and salinity information from SeaBird SBE11 CDT with fluorescence measurement device have been obtained during the cruise, to make maps of spring layers and chlorophyll peaks in the water column. The water column profile given by the CTD will show how chlorophyll is distributed down the water column. The vertically profile was then used to decide on which depths water were sampled from.

No calibration have been made of the fluorescence measurement device on the CTD, and have therefore unprecise scale of the measured chlorophyll. However, it will be calibrated with use of the real measurements of chlorophyll from the sampled depths afterwards.

Rosette SBS 32 Carousel Water Sampler:

Water samples were collected, with Rosette SBE 32 Carousel Water Sampler at stations in Skagerrak and Kattegat (Appendix 1), from depths decided by use of the profile given at each CTD cast in Skagerrak and Kattegat. Two liters of water were filtered through an 180µm plankton net and then filtered through a glass microfiber filter (GF/F) using a multiple vacuum filtration system, and stored in -80°C freezer. Fluorometric determination of chlorophyll will be conducted afterwards by extracting chlorophyll with ethanol.

Acoustic and fish data:

Acoustic data were collected when steaming using a Simrad EK60 38 kHz echosounder with transducer in a towed body. During trawl hauls, the towed body was taken aboard and the EK60 38 kHz echosounder would run on the hull transducer instead. During a 24 hour circle, four trawl haul were carried out and used for species identification. Time for hauls were set to one hour. Pelagic hauls were carried out during night and at large depths using a FOTÖ trawl (16 mm in the codend) and demersal hauls were carried out during day time and at shallows depths using an EXPO trawl (16 mm in the codend). The total weight of each catch was estimated and the catch were sorted into species. Total weight per species were measured and herring were measured per 0.5 cm length. In addition, herring were collected for each length class, and will be weighted, age determined and decided on origin (North Sea autumn spawners or Baltic Sea spring spawners) afterwards.

Results:

No results have been presented yet due to the measurements that will be done after the cruise.

Appendix I

Cruise information						Position				SBE 32 Carousel Water sample				
DANA station	Date	Time UCT	Day/night	Stat. No	Associated fishery station	ICES square	Latitude	Longitude	Total depth	Depth (m)	Bottle	Liter filtrated	Chlorophyll	Area
2	29-06-2018	00:13	N	2	3	44F7	57.48.121 N	007.03.199 E	411	1	21	2		Skagerak
2	29-06-2018	00:13	N	2	3	44F7	57.48.121 N	007.03.199 E	411	5	17	2		Skagerak
2	29-06-2018	00:13	N	2	3	44F7	57.48.121 N	007.03.199 E	411	10	13	2		Skagerak
2	29-06-2018	00:13	N	2	3	44F7	57.48.121 N	007.03.199 E	411	12	9	NA	NA	Skagerak
2	29-06-2018	00:13	N	2	3	44F7	57.48.121 N	007.03.199 E	411	14	5	2		Skagerak
2	29-06-2018	00:13	N	2	3	44F7	57.48.121 N	007.03.199 E	411	18	1	2		Skagerak
2	29-06-2018	00:13	N	2	3	44F7	57.48.121 N	007.03.199 E	411	konc (18)	1	2,4		Skagerak
15	30-06-2018	10:30	D	261	262	43F6	57.06.182 N	006.44.778 E	62	1	21	NA	NA	Skagerak
15	30-06-2018	10:30	D	261	262	43F6	57.06.182 N	006.44.778 E	62	5	17	2		Skagerak
15	30-06-2018	10:30	D	261	262	43F6	57.06.182 N	006.44.778 E	62	12	13	2		Skagerak
15	30-06-2018	10:30	D	261	262	43F6	57.06.182 N	006.44.778 E	62	14	9	2		Skagerak
15	30-06-2018	10:30	D	261	262	43F6	57.06.182 N	006.44.778 E	62	16	5	2		Skagerak
15	30-06-2018	10:30	D	261	262	43F6	57.06.182 N	006.44.778 E	62	27	3	2		Skagerak
15	30-06-2018	10:30	D	261	262	43F6	57.06.182 N	006.44.778 E	62	35	1	2		Skagerak
15	30-06-2018	10:30	D	261	262	43F6	57.06.182 N	006.44.778 E	62	konc (27)	3	2		Skagerak
18	30-06-2018	20:40	N	337	338	44F7	57.54.039 N	007.06.623 E	343	1	22	2		Skagerak
18	30-06-2018	20:40	N	337	338	44F7	57.54.039 N	007.06.623 E	343	10	17	2		Skagerak
18	30-06-2018	20:40	N	337	338	44F7	57.54.039 N	007.06.623 E	343	18	15	2		Skagerak
18	30-06-2018	20:40	N	337	338	44F7	57.54.039 N	007.06.623 E	343	20	11	2		Skagerak
18	30-06-2018	20:40	N	337	338	44F7	57.54.039 N	007.06.623 E	343	23	9	2		Skagerak
18	30-06-2018	20:40	N	337	338	44F7	57.54.039 N	007.06.623 E	343	25	5	2		Skagerak
18	30-06-2018	20:40	N	337	338	44F7	57.54.039 N	007.06.623 E	343	60	1	2		Skagerak
18	30-06-2018	20:40	N	337	338	44F7	57.54.039 N	007.06.623 E	343	konc (23)	7	4		Skagerak
22	01-07-2018	01:45	N	356	350	44F7	57.40.249 N	007.17.648 E	314	1	22	2		Skagerak
22	01-07-2018	01:45	N	356	350	44F7	57.40.249 N	007.17.648 E	314	5	17	1,5		Skagerak
22	01-07-2018	01:45	N	356	350	44F7	57.40.249 N	007.17.648 E	314	10	15	2		Skagerak
22	01-07-2018	01:45	N	356	350	44F7	57.40.249 N	007.17.648 E	314	16	11	2		Skagerak
22	01-07-2018	01:45	N	356	350	44F7	57.40.249 N	007.17.648 E	314	28	9	2		Skagerak
22	01-07-2018	01:45	N	356	350	44F7	57.40.249 N	007.17.648 E	314	35	5	2		Skagerak
22	01-07-2018	01:45	N	356	350	44F7	57.40.249 N	007.17.648 E	314	55	1	2		Skagerak
22	01-07-2018	01:45	N	356	350	44F7	57.40.249 N	007.17.648 E	314	konc(28)	7	4		Skagerak
33	02-07-2018	10:10	D	619	620	43F7	57.22.367 N	007.30.308 E	80	1	22	2		Skagerak
33	02-07-2018	10:10	D	619	620	43F7	57.22.367 N	007.30.308 E	80	7	17	2		Skagerak
33	02-07-2018	10:10	D	619	620	43F7	57.22.367 N	007.30.308 E	80	16	15	2		Skagerak
33	02-07-2018	10:10	D	619	620	43F7	57.22.367 N	007.30.308 E	80	28	13	2		Skagerak
33	02-07-2018	10:10	D	619	620	43F7	57.22.367 N	007.30.308 E	80	33	9	2		Skagerak
33	02-07-2018	10:10	D	619	620	43F7	57.22.367 N	007.30.308 E	80	36	7	2		Skagerak
33	02-07-2018	10:10	D	619	620	43F7	57.22.367 N	007.30.308 E	80	39	3	2		Skagerak
33	02-07-2018	10:10	D	619	620	43F7	57.22.367 N	007.30.308 E	80	50	1	2		Skagerak
33	02-07-2018	10:10	D	619	620	43F7	57.22.367 N	007.30.308 E	80	Konc (36)	5	4		Skagerak
37	02-07-2018	15:40	D	646	640	43F7	57.27.067 N	007.58.558 E	135	1	22	2		Skagerak
37	02-07-2018	15:40	D	646	640	43F7	57.27.067 N	007.58.558 E	135	7	19	2		Skageark
37	02-07-2018	15:40	D	646	640	43F7	57.27.067 N	007.58.558 E	135	9	15	2		Skageark
37	02-07-2018	15:40	D	646	640	43F7	57.27.067 N	007.58.558 E	135	24	13	2		Skageark
37	02-07-2018	15:40	D	646	640	43F7	57.27.067 N	007.58.558 E	135	34	9	2		Skageark
37	02-07-2018	15:40	D	646	640	43F7	57.27.067 N	007.58.558 E	135	40	7	2		Skageark
37	02-07-2018	15:40	D	646	640	43F7	57.27.067 N	007.58.558 E	135	45	3	2		Skageark
37	02-07-2018	15:40	D	646	640	43F7	57.27.067 N	007.58.558 E	135	50	1	2		Skageark
39	02-07-2018	20:20	N	685	686	44F8	57.32.388 N	008.03.722 E	177	2	22	2		Skagerak
39	02-07-2018	20:20	N	685	686	44F8	57.32.388 N	008.03.722 E	177	6	17	2		Skagerak
39	02-07-2018	20:20	N	685	686	44F8	57.32.388 N	008.03.722 E	177	19	15	2		Skagerak
39	02-07-2018	20:20	N	685	686	44F8	57.32.388 N	008.03.722 E	177	28	13	2		Skagerak
39	02-07-2018	20:20	N	685	686	44F8	57.32.388 N	008.03.722 E	177	31	9	2		Skagerak
39	02-07-2018	20:20	N	685	686	44F8	57.32.388 N	008.03.722 E	177	35	5	2		Skagerak
39	02-07-2018	20:20	N	685	686	44F8	57.32.388 N	008.03.722 E	177	45	3	2		Skagerak
39	02-07-2018	20:20	N	685	686	44F8	57.32.388 N	008.03.722 E	177	55	1	2		Skagerak
43	03-07-2018	01:45	N	708	702	44F8	57.43.950 N	008.01.732 E	447	1	22	2		Skagerak
43	03-07-2018	01:45	N	708	702	44F8	57.43.950 N	008.01.732 E	447	5	17	2		Skagerak
43	03-07-2018	01:45	N	708	702	44F8	57.43.950 N	008.01.732 E	447	9	15	2		Skagerak
43	03-07-2018	01:45	N	708	702	44F8	57.43.950 N	008.01.732 E	447	16	13	2		Skagerak
43	03-07-2018	01:45	N	708	702	44F8	57.43.950 N	008.01.732 E	447	20	9	2		Skagerak
43	03-07-2018	01:45	N	708	702	44F8	57.43.950 N	008.01.732 E	447	30	5	2		Skagerak
43	03-07-2018	01:45	N	708	702	44F8	57.43.950 N	008.01.732 E	447	50	3	2		Skagerak
43	03-07-2018	01:45	N	708	702	44F8	57.43.950 N	008.01.732 E	447	80	1	2		Skagerak

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44	03-07-2018	10:00	D	788	789	44F8	57.32.300 N	008.24.675 E	104	1	22	2		Skagerak
44	03-07-2018	10:00	D	788	789	44F8	57.32.300 N	008.24.675 E	104	8	19	2		Skagerak
44	03-07-2018	10:00	D	788	789	44F8	57.32.300 N	008.24.675 E	104	21	15	2		Skagerak
44	03-07-2018	10:00	D	788	789	44F8	57.32.300 N	008.24.675 E	104	31	13	2		Skagerak
44	03-07-2018	10:00	D	788	789	44F8	57.32.300 N	008.24.675 E	104	35	9	2		Skagerak
44	03-07-2018	10:00	D	788	789	44F8	57.32.300 N	008.24.675 E	104	40	5	2		Skagerak
44	03-07-2018	10:00	D	788	789	44F8	57.32.300 N	008.24.675 E	104	73	3	2		Skagerak
44	03-07-2018	10:00	D	788	789	44F8	57.32.300 N	008.24.675 E	104	80	1	2		Skagerak
44	03-07-2018	10:00	D	788	789	44F8	57.32.300 N	008.24.675 E	104	Konc (31)	11	4		Skagerak
48	03-07-2018	15:05	D	808	803	43F8	57.26.405 N	008.38.888 E	34	1	22	2		Skagerak
48	03-07-2018	15:05	D	808	803	43F8	57.26.405 N	008.38.888 E	34	5	17	2		Skagerak
48	03-07-2018	15:05	D	808	803	43F8	57.26.405 N	008.38.888 E	34	11	15	2		Skagerak
48	03-07-2018	15:05	D	808	803	43F8	57.26.405 N	008.38.888 E	34	13	11	2		Skagerak
48	03-07-2018	15:05	D	808	803	43F8	57.26.405 N	008.38.888 E	34	17	7	2		Skagerak
48	03-07-2018	15:05	D	808	803	43F8	57.26.405 N	008.38.888 E	34	19	3	2		Skagerak
48	03-07-2018	15:05	D	808	803	43F8	57.26.405 N	008.38.888 E	34	30	1	2		Skagerak
49	03-07-2018	20:00	N	854	859	43F8	57.06.330 N	008.21.090 E	26	1	22	2		Skagerak
49	03-07-2018	20:00	N	854	859	43F8	57.06.330 N	008.21.090 E	26	5	17	2		Skagerak
49	03-07-2018	20:00	N	854	859	43F8	57.06.330 N	008.21.090 E	26	8	13	2		Skagerak
49	03-07-2018	20:00	N	854	859	43F8	57.06.330 N	008.21.090 E	26	11	9	2		Skagerak
49	03-07-2018	20:00	N	854	859	43F8	57.06.330 N	008.21.090 E	26	17	5	2		Skagerak
49	03-07-2018	20:00	N	854	859	43F8	57.06.330 N	008.21.090 E	26	19	1	2		Skagerak
57	04-07-2018	09:00	D	960	962	44F9	57.43.717 N	009.39.911 E	34	1	22	2		Skagerak
57	04-07-2018	09:00	D	960	962	44F9	57.43.717 N	009.39.911 E	34	5	19	2		Skagerak
57	04-07-2018	09:00	D	960	962	44F9	57.43.717 N	009.39.911 E	34	9	17	2		Skagerak
57	04-07-2018	09:00	D	960	962	44F9	57.43.717 N	009.39.911 E	34	10,5	13	2		Skagerak
57	04-07-2018	09:00	D	960	962	44F9	57.43.717 N	009.39.911 E	34	14	11	2		Skagerak
57	04-07-2018	09:00	D	960	962	44F9	57.43.717 N	009.39.911 E	34	16	7	2		Skagerak
57	04-07-2018	09:00	D	960	962	44F9	57.43.717 N	009.39.911 E	34	21	5	2		Skagerak
57	04-07-2018	09:00	D	960	962	44F9	57.43.717 N	009.39.911 E	34	32	1	2		Skagerak
61	04-07-2018	16:05	D	987	983	44F9	57.54.311 N	009.22.212 E	169	1	22	2		Skagerak
61	04-07-2018	16:05	D	987	983	44F9	57.54.311 N	009.22.212 E	169	8	19	2		Skagerak
61	04-07-2018	16:05	D	987	983	44F9	57.54.311 N	009.22.212 E	169	20	15	2		Skagerak
61	04-07-2018	16:05	D	987	983	44F9	57.54.311 N	009.22.212 E	169	22	13	2		Skagerak
61	04-07-2018	16:05	D	987	983	44F9	57.54.311 N	009.22.212 E	169	24	11	2		Skagerak
61	04-07-2018	16:05	D	987	983	44F9	57.54.311 N	009.22.212 E	169	30	7	2		Skagerak
61	04-07-2018	16:05	D	987	983	44F9	57.54.311 N	009.22.212 E	169	66	5	2		Skagerak
61	04-07-2018	16:05	D	987	983	44F9	57.54.311 N	009.22.212 E	169	80	3	2		Skagerak
62	04-07-2018	20:10	N	1021	1022	45F8	58.09.823 N	008.54.347 E	425	1	22	2		Skagerak
62	04-07-2018	20:10	N	1021	1022	45F8	58.09.823 N	008.54.347 E	425	6	19	2		Skagerak
62	04-07-2018	20:10	N	1021	1022	45F8	58.09.823 N	008.54.347 E	425	11	17	2		Skagerak
62	04-07-2018	20:10	N	1021	1022	45F8	58.09.823 N	008.54.347 E	425	13	13	2		Skagerak
62	04-07-2018	20:10	N	1021	1022	45F8	58.09.823 N	008.54.347 E	425	18	11	2		Skagerak
62	04-07-2018	20:10	N	1021	1022	45F8	58.09.823 N	008.54.347 E	425	20	7	2		Skagerak
62	04-07-2018	20:10	N	1021	1022	45F8	58.09.823 N	008.54.347 E	425	42	3	2		Skagerak
62	04-07-2018	20:10	N	1021	1022	45F8	58.09.823 N	008.54.347 E	425	56	1	2		Skagerak
66	05-07-2018	01:50	N	1046	1041	45F8	58.22.126 N	008.58.130 E	302	1	22	NA	NA	Skagerak
66	05-07-2018	01:50	N	1046	1041	45F8	58.22.126 N	008.58.130 E	302	10	19	2		Skagerak
66	05-07-2018	01:50	N	1046	1041	45F8	58.22.126 N	008.58.130 E	302	13	17	2		Skagerak
66	05-07-2018	01:50	N	1046	1041	45F8	58.22.126 N	008.58.130 E	302	15	13	2		Skagerak
66	05-07-2018	01:50	N	1046	1041	45F8	58.22.126 N	008.58.130 E	302	21	11	2		Skagerak
66	05-07-2018	01:50	N	1046	1041	45F8	58.22.126 N	008.58.130 E	302	24	7	2		Skagerak
66	05-07-2018	01:50	N	1046	1041	45F8	58.22.126 N	008.58.130 E	302	34	3	2		Skagerak
66	05-07-2018	01:50	N	1046	1041	45F8	58.22.126 N	008.58.130 E	302	50	1	2		Skagerak
67	05-07-2018	09:20	D	1120	1141	44G0	57.43.905 N	010.05.063 E	79	1	19	2		Skagerak
67	05-07-2018	09:20	D	1120	1141	44G0	57.43.905 N	010.05.063 E	79	10	17	2		Skagerak
67	05-07-2018	09:20	D	1120	1141	44G0	57.43.905 N	010.05.063 E	79	18	15	2		Skagerak
67	05-07-2018	09:20	D	1120	1141	44G0	57.43.905 N	010.05.063 E	79	22	11	2		Skagerak
67	05-07-2018	09:20	D	1120	1141	44G0	57.43.905 N	010.05.063 E	79	28	9	2		Skagerak
67	05-07-2018	09:20	D	1120	1141	44G0	57.43.905 N	010.05.063 E	79	32	7	2		Skagerak
67	05-07-2018	09:20	D	1120	1141	44G0	57.43.905 N	010.05.063 E	79	36	3	2		Skagerak
67	05-07-2018	09:20	D	1120	1141	44G0	57.43.905 N	010.05.063 E	79	50	1	2		Skagerak
70	05-07-2018	20:00	N	1206	1207	46F9	58.41.787 N	009.48.907 E	461	1	19	2		Skagerak
70	05-07-2018	20:00	N	1206	1207	46F9	58.41.787 N	009.48.907 E	461	6	17	2		Skagerak
70	05-07-2018	20:00	N	1206	1207	46F9	58.41.787 N	009.48.907 E	461	14	15	2		Skagerak
70	05-07-2018	20:00	N	1206	1207	46F9	58.41.787 N	009.48.907 E	461	18	11	NA	NA	Skagerak
70	05-07-2018	20:00	N	1206	1207	46F9	58.41.787 N	009.48.907 E	461	25	9	2		Skagerak
70	05-07-2018	20:00	N	1206	1207	46F9	58.41.787 N	009.48.907 E	461	30	5	2		Skagerak
70	05-07-2018	20:00	N	1206	1207	46F9	58.41.787 N	009.48.907 E	461	38	3	2		Skagerak
70	05-07-2018	20:00	N	1206	1207	46F9	58.41.787 N	009.48.907 E	461	55	1	2		Skagerak

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74	06-06-2018	02:00	N	1229	1225	46F9	58.51.015 N	009.56.988 E	168	1	19	2		Skagerak
74	06-06-2018	02:00	N	1229	1225	46F9	58.51.015 N	009.56.988 E	168	6	17	2		Skagerak
74	06-06-2018	02:00	N	1229	1225	46F9	58.51.015 N	009.56.988 E	168	10	15	2		Skagerak
74	06-06-2018	02:00	N	1229	1225	46F9	58.51.015 N	009.56.988 E	168	15	13	2		Skagerak
74	06-06-2018	02:00	N	1229	1225	46F9	58.51.015 N	009.56.988 E	168	22	9	2		Skagerak
74	06-06-2018	02:00	N	1229	1225	46F9	58.51.015 N	009.56.988 E	168	32	5	2		Skagerak
74	06-06-2018	02:00	N	1229	1225	46F9	58.51.015 N	009.56.988 E	168	42	3	2		Skagerak
74	06-06-2018	02:00	N	1229	1225	46F9	58.51.015 N	009.56.988 E	168	58	1	2		Skagerak
76	06-07-2018	13:00	D	1322	1317	46G0	58.31.182 N	010.49.234 E	101	1	19	2		Skagerak
76	06-07-2018	13:00	D	1322	1317	46G0	58.31.182 N	010.49.234 E	101	7	17	2		Skagerak
76	06-07-2018	13:00	D	1322	1317	46G0	58.31.182 N	010.49.234 E	101	12,5	13	2		Skagerak
76	06-07-2018	13:00	D	1322	1317	46G0	58.31.182 N	010.49.234 E	101	18	9	2		Skagerak
76	06-07-2018	13:00	D	1322	1317	46G0	58.31.182 N	010.49.234 E	101	23	7	2		Skagerak
76	06-07-2018	13:00	D	1322	1317	46G0	58.31.182 N	010.49.234 E	101	25	5	NA	NA	Skagerak
76	06-07-2018	13:00	D	1322	1317	46G0	58.31.182 N	010.49.234 E	101	29	3	2		Skagerak
76	06-07-2018	13:00	D	1322	1317	46G0	58.31.182 N	010.49.234 E	101	35	1	2		Skagerak
78	06-07-2018	20:10	N	1385	1388	45G0	58.12.316 N	010.57.617 E	142	1	19	NA	NA	Skagerak
78	06-07-2018	20:10	N	1385	1388	45G0	58.12.316 N	010.57.617 E	142	6	17	2		Skagerak
78	06-07-2018	20:10	N	1385	1388	45G0	58.12.316 N	010.57.617 E	142	15	15	2		Skagerak
78	06-07-2018	20:10	N	1385	1388	45G0	58.12.316 N	010.57.617 E	142	18	13	2		Skagerak
78	06-07-2018	20:10	N	1385	1388	45G0	58.12.316 N	010.57.617 E	142	21	9	2		Skagerak
78	06-07-2018	20:10	N	1385	1388	45G0	58.12.316 N	010.57.617 E	142	24	7	2		Skagerak
78	06-07-2018	20:10	N	1385	1388	45G0	58.12.316 N	010.57.617 E	142	30	3	2		Skagerak
78	06-07-2018	20:10	N	1385	1388	45G0	58.12.316 N	010.57.617 E	142	45	1	2		Skagerak
82	07-07-2018	01:55	N	1405	1402	45G1	58.00.304 N	011.12.966 E	75	1	17	2		Skagerak
82	07-07-2018	01:55	N	1405	1402	45G1	58.00.304 N	011.12.966 E	75	6	13	2		Skagerak
82	07-07-2018	01:55	N	1405	1402	45G1	58.00.304 N	011.12.966 E	75	10	11	2		Skagerak
82	07-07-2018	01:55	N	1405	1402	45G1	58.00.304 N	011.12.966 E	75	19	9	2		Skagerak
82	07-07-2018	01:55	N	1405	1402	45G1	58.00.304 N	011.12.966 E	75	23	7	2		Skagerak
82	07-07-2018	01:55	N	1405	1402	45G1	58.00.304 N	011.12.966 E	75	27	5	2		Skagerak
82	07-07-2018	01:55	N	1405	1402	45G1	58.00.304 N	011.12.966 E	75	32	3	2		Skagerak
82	07-07-2018	01:55	N	1405	1402	45G1	58.00.304 N	011.12.966 E	75	38	1	2		Skagerak
83	07-07-2018	08:50	D	1453	1454	44G0	57.51.863 N	010.57.457 E	78	1	17	2		Skagerak
83	07-07-2018	08:50	D	1453	1454	44G0	57.51.863 N	010.57.457 E	78	8	13	2		Skagerak
83	07-07-2018	08:50	D	1453	1454	44G0	57.51.863 N	010.57.457 E	78	15	11	2		Skagerak
83	07-07-2018	08:50	D	1453	1454	44G0	57.51.863 N	010.57.457 E	78	20	9	2		Skagerak
83	07-07-2018	08:50	D	1453	1454	44G0	57.51.863 N	010.57.457 E	78	24	7	2		Skagerak
83	07-07-2018	08:50	D	1453	1454	44G0	57.51.863 N	010.57.457 E	78	27	5	2		Skagerak
83	07-07-2018	08:50	D	1453	1454	44G0	57.51.863 N	010.57.457 E	78	35	3	2		Skagerak
83	07-07-2018	08:50	D	1453	1454	44G0	57.51.863 N	010.57.457 E	78	42	1	2		Skagerak
87	07-07-2018	15:10	D	1482	1478	44G1	57.50.551 N	011.14.787 E	66	1	17	2		Skagerak
87	07-07-2018	15:10	D	1482	1478	44G1	57.50.551 N	011.14.787 E	66	7	13	2		Skagerak
87	07-07-2018	15:10	D	1482	1478	44G1	57.50.551 N	011.14.787 E	66	13	11	2		Skagerak
87	07-07-2018	15:10	D	1482	1478	44G1	57.50.551 N	011.14.787 E	66	17	9	2		Skagerak
87	07-07-2018	15:10	D	1482	1478	44G1	57.50.551 N	011.14.787 E	66	23	7	2		Skagerak
87	07-07-2018	15:10	D	1482	1478	44G1	57.50.551 N	011.14.787 E	66	25	5	2		Skagerak
87	07-07-2018	15:10	D	1482	1478	44G1	57.50.551 N	011.14.787 E	66	28	3	2		Skagerak
87	07-07-2018	15:10	D	1482	1478	44G1	57.50.551 N	011.14.787 E	66	38	1	2		Skagerak
88	07-07-2018	20:30	N	1529	1530	43G0	57.27.502 N	010.51.636 E	40	1	17	2		Kattegat
88	07-07-2018	20:30	N	1529	1530	43G0	57.27.502 N	010.51.636 E	40	6	13	2		Kattegat
88	07-07-2018	20:30	N	1529	1530	43G0	57.27.502 N	010.51.636 E	40	16	11	2		Kattegat
88	07-07-2018	20:30	N	1529	1530	43G0	57.27.502 N	010.51.636 E	40	19	9	2		Kattegat
88	07-07-2018	20:30	N	1529	1530	43G0	57.27.502 N	010.51.636 E	40	23	5	2		Kattegat
88	07-07-2018	20:30	N	1529	1530	43G0	57.27.502 N	010.51.636 E	40	30	3	2		Kattegat
88	07-07-2018	20:30	N	1529	1530	43G0	57.27.502 N	010.51.636 E	40	38	1	2		Kattegat
92	08-08-2018	02:00	N	1552	1547	44G1	57.31.790 N	011.12.640 E	48	2	17	2		Kattegat
92	08-08-2018	02:00	N	1552	1547	44G1	57.31.790 N	011.12.640 E	48	7	13	2		Kattegat
92	08-08-2018	02:00	N	1552	1547	44G1	57.31.790 N	011.12.640 E	48	19	11	2		Kattegat
92	08-08-2018	02:00	N	1552	1547	44G1	57.31.790 N	011.12.640 E	48	25	9	2		Kattegat
92	08-08-2018	02:00	N	1552	1547	44G1	57.31.790 N	011.12.640 E	48	27	5	2		Kattegat
92	08-08-2018	02:00	N	1552	1547	44G1	57.31.790 N	011.12.640 E	48	30	3	2		Kattegat
92	08-08-2018	02:00	N	1552	1547	44G1	57.31.790 N	011.12.640 E	48	43	1	2		Kattegat
93	08-08-2018	10:30	D	1634	1635	43G1	57.08.764 N	011.51.652 E	54	1	17	2		Kattegat
93	08-08-2018	10:30	D	1634	1635	43G1	57.08.764 N	011.51.652 E	54	5	15	2		Kattegat
93	08-08-2018	10:30	D	1634	1635	43G1	57.08.764 N	011.51.652 E	54	18	13	2		Kattegat
93	08-08-2018	10:30	D	1634	1635	43G1	57.08.764 N	011.51.652 E	54	22	11	2		Kattegat
93	08-08-2018	10:30	D	1634	1635	43G1	57.08.764 N	011.51.652 E	54	24	7	2		Kattegat
93	08-08-2018	10:30	D	1634	1635	43G1	57.08.764 N	011.51.652 E	54	26	5	2		Kattegat
93	08-08-2018	10:30	D	1634	1635	43G1	57.08.764 N	011.51.652 E	54	35	3	2		Kattegat
93	08-08-2018	10:30	D	1634	1635	43G1	57.08.764 N	011.51.652 E	54	40	1	2		Kattegat
97	08-07-2018	15:30	D	1657	1652	42G1	56.47.943 N	011.42.001 E	33	1	17	2		Kattegat
97	08-07-2018	15:30	D	1657	1652	42G1	56.47.943 N	011.42.001 E	33	6	13	2		Kattegat
97	08-07-2018	15:30	D	1657	1652	42G1	56.47.943 N	011.42.001 E	33	15	11	2		Kattegat
97	08-07-2018	15:30	D	1657	1652	42G1	56.47.943 N	011.42.001 E	33	18	9	2		Kattegat
97	08-07-2018	15:30	D	1657	1652	42G1	56.47.943 N	011.42.001 E	33	21	5	2		Kattegat
97	08-07-2018	15:30	D	1657	1652	42G1	56.47.943 N	011.42.001 E	33	27	3	2		Kattegat
97	08-07-2018	15:30	D	1657	1652	42G1	56.47.943 N	011.42.001 E	33	30,5	1	2		Kattegat
98	08-07-2018	20:05	N	1699	1700	42G2	56.37.997 N	012.13.624 E	42	1	17	2		Kattegat
98	08-07-2018	20:05	N	1699	1700	42G2	56.37.997 N	012.13.624 E	42	5	13	2		Kattegat
98	08-07-2018	20:05	N	1699	1700	42G2	56.37.997 N	012.13.624 E	42	13	11	2		Kattegat
98	08-07-2018	20:05	N	1699	1700	42G2	56.37.997 N	012.13.624 E	42	22	9	2		Kattegat
98	08-07-2018	20:05	N	1699	1700	42G2	56.37.997 N	012.13.624 E	42	24	5	2		Kattegat
98	08-07-2018	20:05	N	1699	1700	42G2	56.37.997 N	012.13.624 E	42	26	3	2		Kattegat
98	08-07-2018	20:05	N	1699	1700	42G2	56.37.997 N	012.13.624 E	42	36	1	2		Kattegat
103	09-07-2018	09:00	D	1792	1793	41G1	56.21.724 N	011.51.577 E	30	1	17	2		Kattegat
103	09-07-2018	09:00	D	1792	1793	41G1	56.21.724 N	011.51.577 E	30	6	13	2		Kattegat
103	09-07-2018	09:00	D	1792	1793	41G1	56.21.724 N	011.51.577 E	30	16	11	2		Kattegat
103	09-07-2018	09:00	D	1792	1793	41G1	56.21.724 N	011.51.577 E	30	21	9	2		Kattegat
103	09-07-2018	09:00	D	1792	1793	41G1	56.21.724 N	011.51.577 E	30	24	7	2		Kattegat
103	09-07-2018	09:00	D	1792	1793	41G1	56.21.724 N	011.51.577 E	30	27	3	2		Kattegat
103	09-07-2018	09:00	D	1792	1793	41G1	56.21.724 N	011.51.577 E	30	29	1	2		Kattegat
103	09-07-2018	09:00	D	1792	1793	41G1	56.21.724 N	011.51.577 E	30	Konc (24)		4		Kattegat

Figure 1. Map showing the survey area for the Danish acoustic survey with R/V Dana in June-July 2018. The map shows the subareas (strata) used in the abundance estimation.

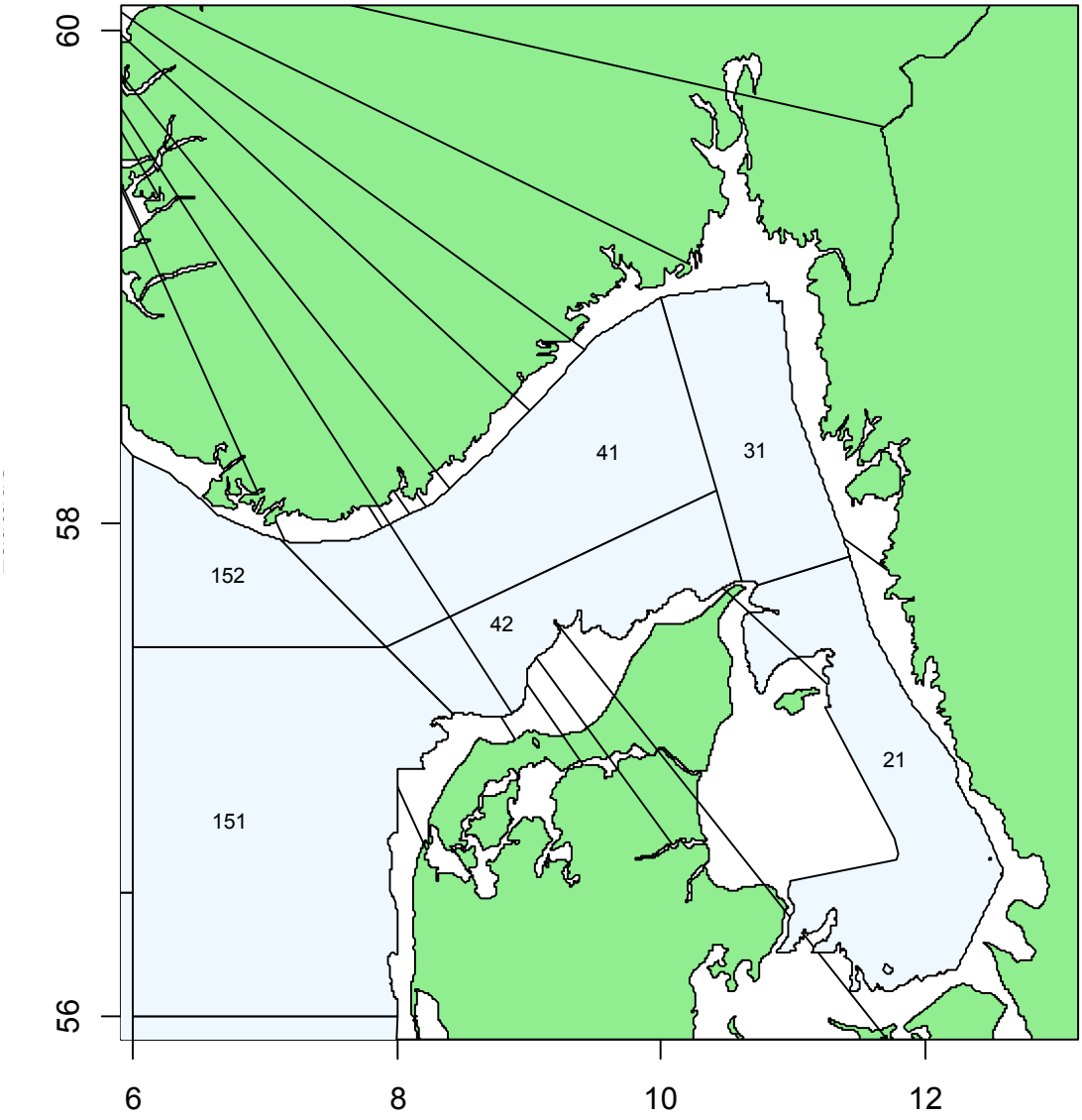

Figure 2. Map showing sailed route and trawl stations during the Danish acoustic survey with R/V Dana in June-July 2018. Read is pelagic hauls and blue is demersal hauls.

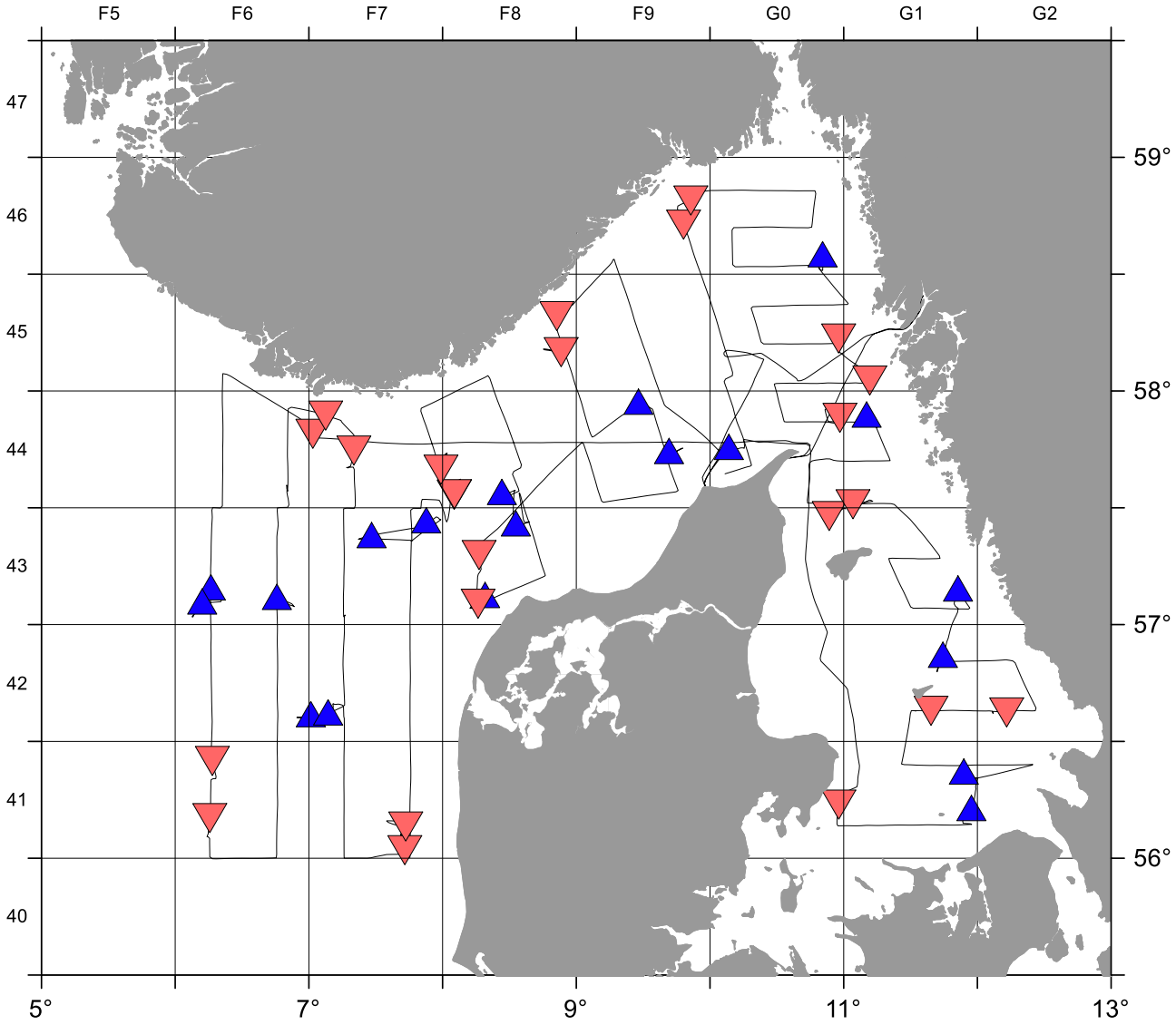

Figure 3. Map showing CTD and WP2 stations during the Danish acoustic survey with R/V Dana in June-July 2018. X are CTD stations and squares are combined CTD and WP2 stations.

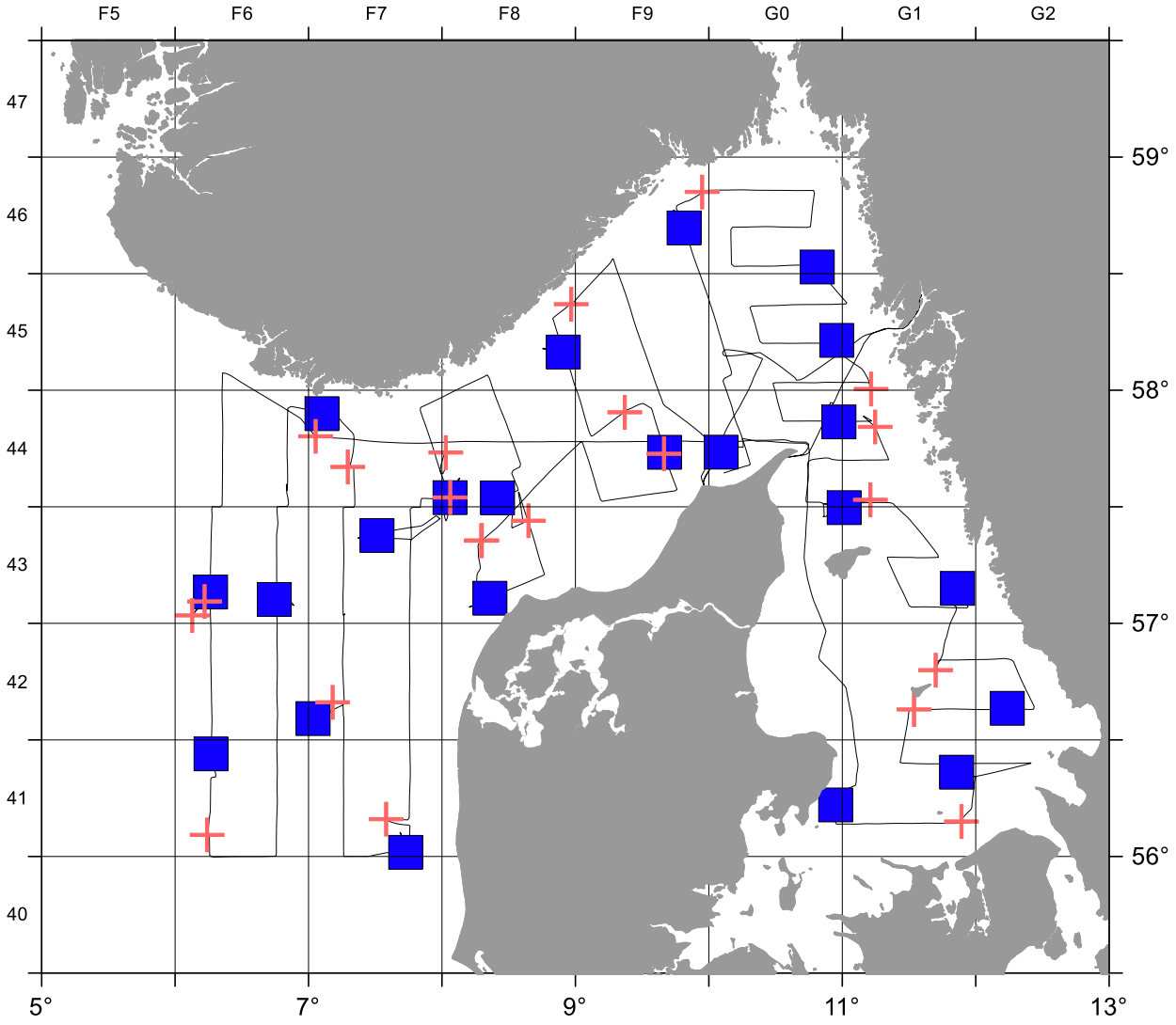

Figure 4. Relative herring density (in numbers per nm²) along the track of the Danish acoustic survey with R/V Dana in June-July 2018. Red circles indicate relative density of herring per ESDU

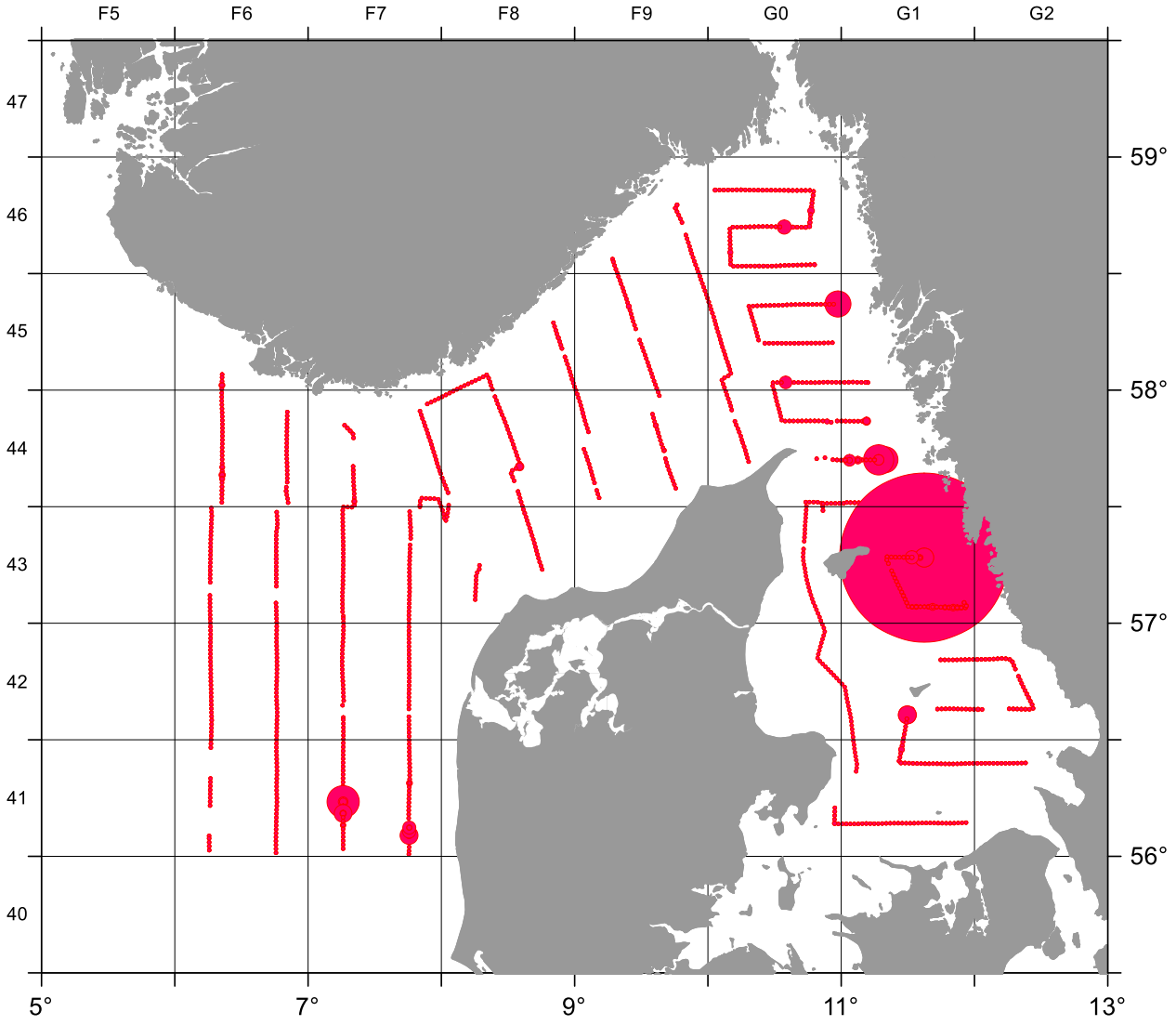

Figure 5. Relative sprat density (in numbers per nm²) along the track of the Danish acoustic survey with R/V Dana in June-July 2018. Red circles indicate relative density of sprat per ESDU.

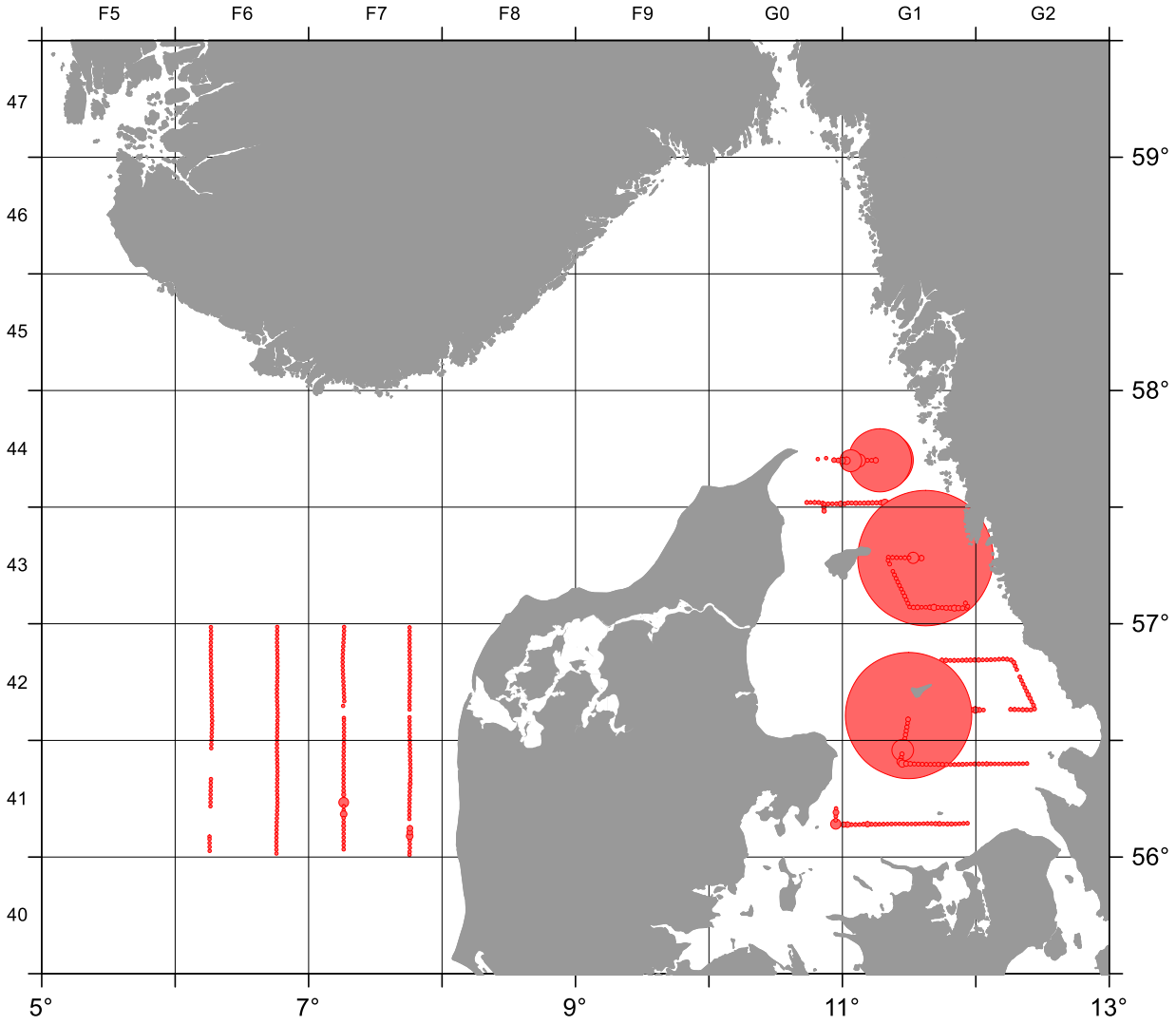

Figure 6. Distribution of dry weight in mg/m^2 in 2018. A: Total weight, B: fractions 2000 µm, C: fraction 1000 µm and D: fraction 180 µm.

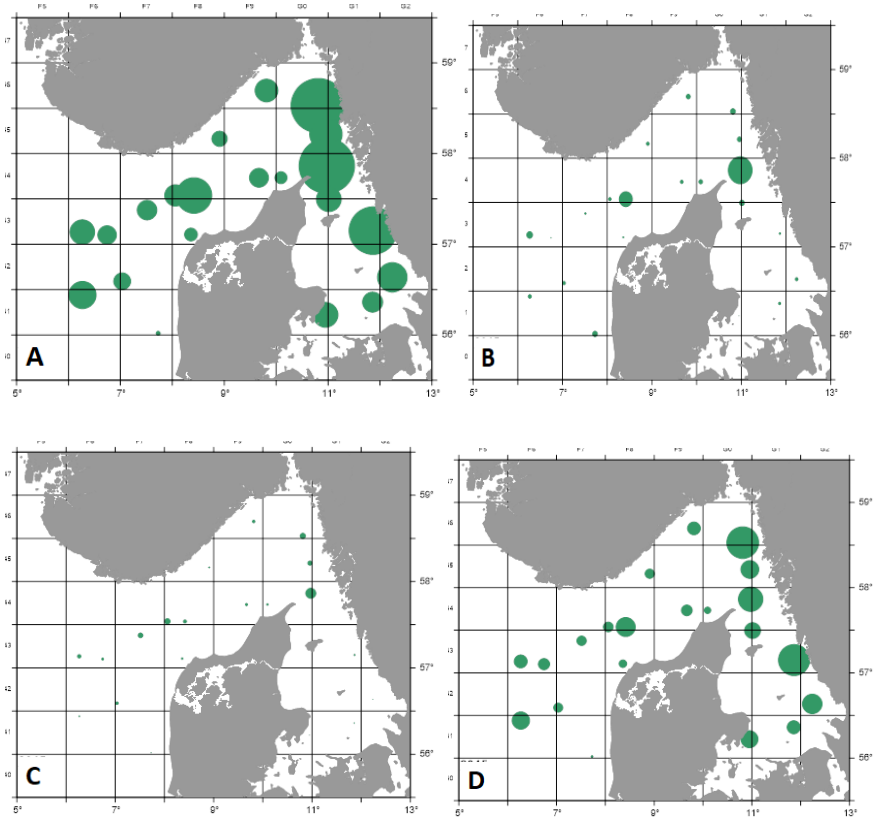

Table 1. . Simrad EK60 and analysis settings used during the Acoustic Herring Survey with R/V Dana Cruise June-July 2018

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. Trawl hauls details for the Danish acoustic survey with R/V Dana in June-July 2018.

Trawl hauls Acoustic survey in Kattegat and Skagerrak 06/2017 25 June to 10 July 2018																
						Trawl	Wire	Trawl	Cath	Mean	Total		Trawling	Trawling	Wind	
Date	Haul	Time	ICES	Position		Direction	length	type	depth	depth	catch	Main Species	speed	duratin	speed	Sea state
dd-mm-yy	no.	UTC	Square	Latitude	Longitude	deg.	m		m	m	kg		Kn	min,	m/s	
29-06-18	3	01:54	44F6	57.48.998 N	007.01.776 E	324	300	Fotö	Surface	412	97	Mackerel, Herring	3.5	60	4.5	5
29-06-18	88	10:48	43F6	57.08.492 N	006.16.016 E	129	400	Expo	Bottom	61	58	Dab	3.1	60	3.4	3
29-06-18	96	14:01	43F6	57.04.869 N	006.08.380 E	221	350	Expo	Bottom	49	127	Sandeel	3.1	60	3.1	3
29-06-18	152	21:40	41F6	56.24.980 N	006.16.665 E	185	300	Fotö	Surface	43	195	Mackerel	3.9	60	5.4	3
30-06-18	166	00:23	41F6	56.10.298 N	006.15.522 E	185	300	Fotö	Surface	41	206	Mackerel	3.9	60	4.9	3
30-06-18	262	11:49	43F6	57.06.036 N	006.45.634 E	114	300	Expo	Bottom	58	600	Sandeel	3.2	70	3.5	2
30-06-18	339	21:54	44F7	57.53.664 N	007.07.523 E	112	300	Fotö	Surface	353	649	Mackerel	4.1	60	2.9	2
01-07-18	350	00:18	44F7	57.44.693 N	007.20.174 E	194	300	Fotö	Surface	355	398	Mackerel	4.2	60	4.7	2
01-07-18	433	10:50	42F6	56.35.920 N	007.00.864 E	268	300	Expo	Bottom	38	52	Gurnard, Herring	3.1	60	5.1	2
01-07-18	444	13:02	42F7	56.36.377 N	007.08.623 E	5	250	Expo	Bottom	36	207	Whiting	3.1	60	7.0	2
01-07-18	507	21:17	41F7	56.02.065 N	007.43.032 E	348	300	Expo	Surface	28	638	Mackerel, Herring	4.1	60	3.5	2
02-07-18	526	00:19	41F7	56.08.146 N	007.43.446 E	292	300	Expo	Surface	30	5812	Herring	4.2	60	2.7	2
02-07-18	620	11:15	43F7	57.21.901 N	007.28.145 E	269	350	Expo	Bottom	85	37	Mixed dermersal	3.0	60	6.4	2
02-07-18	640	14:11	43F7	57.25.720 N	007.52.688 E	52	570	Expo	Bottom	137	1573	Norway pout, Whiting	3.0	60	7.3	4
02-07-18	686	21:26	44F8	57.33.490 N	008.05.303 E	17	300	Fotö	Surface	206	447	Herring, Mackerel	3.9	60	8.3	6
03-07-18	702	00;21	44F8	57.39.791 N	008.01.022 E	14	350	Fotö	Surface	405	970	Mackerel, Herring	4.1	60	9.5	5
03-07-18	789	11:02	44F8	57.32.982 N	008.26.608 E	65	450	Expo	Bottom	103	191	Mixed dermersal	3.1	60	6.4	5
03-07-18	803	13:43	43F8	57.24.914 N	008.32.885 E	62	260	Expo	Bottom	38	69	Sandeel	3.0	60	8.7	4
03-07-18	859	21:40	43F8	57.05.356 N	008.15.935 E	237	340	Expo	Surface	22	133	Jellyfish	4.3	30	7.0	3
04-07-18	875	00:26	43F8	57.17.857 N	008.16.374 E	356	300	Expo	Surface	36	66	Jellyfish	4.0	30	6.0	3
04-07-18	962	10:21	44F9	57..43.506 N	009.41.612 E	59	250	Expo	Bottom	37	360	Whiting	3.0	60	3.0	2
04-07-18	983	14:24	44F9	57.56.163 N	009.27.915 E	248	720	Expo	Bottom	175	350	Norway pout, Blue whiting	3.0	60	5.3	2
04-07-18	1022	21:13	45F8	58.09.961 N	008.53.190 E	280	300	Fotö	Surface	426	220	Jellyfish, Mackerel	3.9	60	7.7	2
05-07-18	1041	00;17	45F8	58.19.217 N	008.51.270 E	45	333	Fotö	Surface	247	173	Mackerel, Jellyfish	4.2	60	7.8	3
05-07-18	1141	12:35	44G0	57.44.553 N	010.08.467 E	76	410	Expo	Bottom	83	1455	Whiting	3.0	60	7.4	3
05-07-18	1207	21:08	46F9	58.42.700 N	009.48.118 E	341	300	Fotö	Surface	404	73	Jellyfish	4.0	60	3.0	3
06-07-18	1225	00:36	46F9	58.48.898 N	009.51.381 E	55	330	Fotö	Surface	242	110	Jellyfish	4.0	60	0.9	2
06-07-17	1317	11:30	46G0	58.34.022 N	010.50.535 E	256	420	Expo	Bottom	90	1600	Krill	3.0	60	0.6	2
06-07-18	1338	22:17	45G0	58.13.466 N	010.57.712 E	175	320	Fotö	Surface	135	1570	Krill	3.9	60	6.2	2
07-07-18	1402	00:51	45G1	58.02.678 N	011.11.708 E	171	320	Fotö	Surface	80	1731	Mackerel	4.1	40	1.8	1
07-07-18	1454	10:15	44G0	57.53.089 N	010.58.295 E	335	320	Fotö	Surface	113	15000	Mackerel	4.1	60	9.0	3
07-07-18	1478	13:50	44G1	57.52.856 N	011.10.292 E	133	300	Expo	Bottom	61	211	Herring	3.0	60	6.9	3
07-07-18	1530	21:38	43G0	57.27.871 N	010.53.501 E	59	310	Fotö	Surface	42	155	Jellyfish, Mackerel	4.2	60	7.1	3
08-07-18	1547	00:34	44G1	57.30.897 N	011.04.153 E	63	300	Fotö	Surface	41	90	Jellyfish, Mackerel	4.1	60	6.3	3
08-07-18	1635	11:27	43G1	57.08.198 N	011.51.300 E	188	280	Expo	Bottom	56	180	Herring	3.0	60	3.4	2
08-07-18	1652	14:07	42G1	56.51.171 N	011.44.515 E	198	280	Expo	Bottom	42	2773	Sprat	3.0	60	4.9	1
08-07-18	1700	21:25	42G2	56.373446 N	012.13.125 E	275	300	Expo	Surface	42	117	Jellyfish, Sprat	3.9	60	10.5	1
09-07-18	1720	00:29	42G1	56.37.868 N	011.39.191 E	271	340	Expo	Surface	30	180	Jellyfish, Garfish	4.0	56	10.6	4
09-07-18	1793	10:13	41G1	56.21.194 N	011.53.904 E	102	340	Expo	Bottom	31	102	Sprat	3.1	60	4.2	4
09-07-18	1806	13:01	41G1	56.11.814 N	011.57.315 E	225	200	Expo	Bottom	25	82	Sprat	3.1	60	8.1	4
09-07-18	1852	20:30	41G1	56.13.767 N	010.57.812 E	36	300	Expo	Surface	22	66	Jellyfish, Mackerel, Sprat	4.2	60	8.9	4

Table 3. Catch composition in trawl hauls for the Danish acoustic survey with R/V Dana in June – July 2018

		Station		3	88	96	152	166	262	339	350	433	444	507	526
		ICES sq.		44F6	43F6	43F6	41F6	41F6	43F6	44F7	44F7	42F6	42F7	41F7	41F7
		Gear		Fotö	Expo	Expo	Fotö	Fotö	Expo	Fotö	Fotö	Expo	Expo	Expo	Expo
		Fishing depth		Surface	Bottom	Bottom	Surface	Surface	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface
		Total depth		419	61	49	43	41	58	353	355	38	36	28	30
		Day/Night		N	D	D	N	N	D	N	N	D	D	N	N
%		Total catch	Total	97.37	58.221	127.17	195.186	206.37	600.037	649	398	52	207.312	638	5812
0.00	Lesser silver smelt	Argentina sphyraena	1.86												
0.40	Blue whiting	Micromesistius poutassou	158.145						0.594	6.48					
7.04	Sprat	Sprattus sprattus	2753.681								0.04		20.054		
0.07	Squids, octopusses	Cephalopoda sp	26.699	0.167	0.25		0.048	0.051	0.054	0.18					0.258
0.05	Northern pink shrimp	Pandalus borealis	21.333												
0.01	Norway lobster	Nephrops norvegicus	4.768												
0.00	Four-bearded rockling	Enchelyopus cimbrius	0.265												
0.06	Common weaver	Trachinus draco	21.636											0.584	
0.00	Solenette	Buglossidium luteum	0.02								0.018				
0.01	Poor-cod	Trisopterus minutus	4.108					0.034			0.028	0.058			
0.01		Anarhichas lupus	2.07												2.07
0.04	Anglerfish	Lophiuspiscatorius	15.906												12.77
0.01	Halibut	Hippoglossus hippoglossus	2.13												2.13
0.02	Horse mackerel	Trachurus trachurus	6.611							0.499			0.158		
0.55	Garfish	Belone belone	214.214				0.682		74.839	1.48					
0.49	Long rough dab	Hippoglosides plattessoides	190.828	2.57							0.656	1.391			
4.20	Whiting	Merlangius merlangus	1643.228	4.93	9.3			4.36			4.27	109.1			1.002
0.68	Invertebrates	Invertebrata	264.02	0.004											
0.62	Dab	Limanda limanda	243.74	36.22	27.5			13.22			13.82	26.4	0.616		0.153
0.22	Hake	Merluccius merluccius	85.654												3.91
0.36	Gurnard	Trigala spp.	139.827	4.55	20.97	11.14	14.78	2.92			14.55	21.8	12.37	1.79	1.448
7.21	Krill	Euphausidae spp.	2819.103												
0.99	Haddock	Melanogrammus aeglefinus	388.872	0.115				2.792							2.45
0.01	Ling	Molva molva	2.64												
0.01	Pollack	Pollachius pollachius	4.08												
0.22	Pearlside	Mauorolicus muelleri	86.69							8.265					
51.18	Mackerel	Scomber scombrus	20005.23			183.1	190.4		474.448	256.35	0.862	0.432	406.223	893.058	0.618
0.32	Saithe	Pollachius virens	124.981		0.65			1.374				2.8	2.976		3.09
0.24	Allis shad	Alosa alose	93.317												
0.00		Callionymus maculatus	0.064									0.064			
0.01	Turbot	Psetta maxima	2.02									2.02			
0.45	Picked Dogfish	Squalus acanthias	177.322							0.278					
0.11	Plaice	Pleuronectes platessa	42.338	2.95	1.09			0.474			5.78	9.54			0.672
0.07	Lemon sole	Microstomus kitt	26.285	4.12	0.75			1.306				1.48			0.724
16.20	Herring	Clupea harengus	6333.756	1.524	0.428	0.946	0.187	0.638	98.32	92.1	8.643	15.058	195.003	4884.813	2.476
0.00	Gray sole	Glyptocephalus cynoglossus	0.851	0.307											
0.00	Flounder	Platichthys flesus	0.796												
0.03	Snake blenny	Lumpenus lampretaeformis	12.638												
0.00	Brill	Scophthalmus rhombe	0.226												
0.00	Hagfish	Myxine glutinosa	0.022												
3.09	Norway pout	Trisopterus esmarki	1209.034	0.024	0.025										1.796
0.19	Lumpsucker	Cyclopterus lumpus	75.658						0.745	1.295					
2.42	Large Medusa	Scyphozoa sp.	946.687							31.073	3.59				
0.05	Twaite shad	Alosa fallax	17.856				0.273						0.482		
0.00	Edible crab	Cancer pagurus	0.674												
0.29	Greater sandeel	Hyperoplus lanceolatus	113.564		0.177			66.143			0.129	0.449			
1.44	Sandeel	Ammodytes marinus	562.177		56.3			505.857							
0.61	Cod	Gadus Morhua	238.127	0.74	9.73			0.868			0.095	16.72			1.72
0.00	Tarry ray	Raja radiata	1.413												
0.00	Butter fish	Phalis qunnellus	0.024												
0.00	Sculpin	Myoxocephalus scorpius	0.194												
0.00		Lycodes vahli	0.322												

Table 3. continued.

		Station		620	640	686	702	789	803	859	875	962	983	1022	1041	1141
		ICES sq.		43F7	43F7	44F8	44F8	44F8	43F8	43F8	43F8	44F9	44F9	45F8	45F8	44G0
		Gear		Expo	Expo	Fotö	Fotö	Expo	Expo	Expo	Expo	Expo	Expo	Fotö	Fotö	Expo
		Fishing depth		Bottom	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom
		Total depth		85	137	206	405	103	38	22	36	37	175	426	247	83
		Day/Night		D	D	N	N	D	D	N	N	D	D	N	N	D
%		Total catch	Total	37.187	1573	447	970	191	69	133	66	360	350	220	173	1455
0.00	Lesser silver smelt	Argentina sphyraena	1.86	1.689								0.164			0.007	
0.40	Blue whiting	Micromesistius poutassou	158.145		20.045	21.9						109.126				
7.04	Sprat	Sprattus sprattus	2753.681													
0.07	Squids, octopusses	Cephalopoda sp	26.699	15.492	0.253	0.63	1.69	0.279	0.05		1.936	0.146	0.138	1.404		0.066
0.05	Northern pink shrimp	Pandalus borealis	21.333									1.78				
0.01	Norway lobster	Nephrops norvegicus	4.768									0.264				
0.00	Four-bearded rockling	Enchelyopus cimbrius	0.265									0.165				
0.06	Common weaver	Trachinus draco	21.636			0.072			0.816	0.082				0.224		
0.00	Solenette	Buglossidium luteum	0.02					0.002								
0.01	Poor-cod	Trisopterus minutus	4.108				0.079								3.775	
0.01		Anarhichas lupus	2.07													
0.04	Anglerfish	Lophiuspiscatorius	15.906					0.156				2.98				
0.01	Halibut	Hippoglossus hippoglossus	2.13													
0.02	Horse mackerel	Trachurus trachurus	6.611													
0.55	Garfish	Belone belone	214.214		0.659	8.14			0.289	0.31			12.46	1.272		
0.49	Long rough dab	Hippoglosides plattessoides	190.828	8.274			7.86	0.225			1.454	3.476			118.865	
4.20	Whiting	Merlangius merlangus	1643.228	279.99			45.9				263.269				803.318	
0.68	Invertebrates	Invertebrata	264.02	6.434			2.986	0.341			3.969				2.717	
0.62	Dab	Limanda limanda	243.74	3.408			0.214	1.486			34.12				43.627	
0.22	Hake	Merluccius merluccius	85.654	43.5			10.13	0.64			15.04	1.44			3.7	
0.36	Gurnard	Trigala spp.	139.827	0.991			0.073	13.97	2.6	0.612	11.33					
7.21	Krill	Euphausidae spp.	2819.103													
0.99	Haddock	Melanogrammus aeglefinus	388.872	111.936			32.2				0.63	2.3			236.434	
0.01	Ling	Molva molva	2.64	2.5												
0.01	Pollack	Pollachius pollachius	4.08									4.08				
0.22	Pearlside	Mauorolicus muelleri	86.69		1.282							0.617	4.263			9.14
51.18	Mackerel	Scomber scombrus	20005.23		187.137	638.668	0.112		18.42	0.316	1.852		62.508	78.1		11.04
0.32	Saithe	Pollachius virens	124.981	88.4			11.19	0.9			1.53		4.28		5.92	
0.24	Allis shad	Alosa alose	93.317						32.317			61				
0.00		Callionymus maculatus	0.064													
0.01	Turbot	Psetta maxima	2.02													
0.45	Picked Dogfish	Squalus acanthias	177.322			1.414						1.3	0.71	0.206		0.335
0.11	Plaice	Pleuronectes platessa	42.338				1.3	1.772			8.8				6.04	
0.07	Lemon sole	Microstomus kitt	26.285	3.67			0.935	0.451			1.174				10.72	
16.20	Herring	Clupea harengus	6333.756	21.238	200.174	240.359	32.7		1.26	0.422	1.566	1.03	12.768	12.124	3.454	1.638
0.00	Gray sole	Glyptocephalus cynoglossus	0.851				0.544									
0.00	Flounder	Platichthys flesus	0.796													
0.03	Snake blenny	Lumpenus lampretaeformis	12.638													
0.00	Brill	Scophthalmus rhombe	0.226													
0.00	Hagfish	Myxine glutinosa	0.022													
3.09	Norway pout	Trisopterus esmarki	1209.034	929.964			24.92					142.617			104.758	
0.19	Lumpsucker	Cyclopterus lumpus	75.658		21.48	1.696						7.88	3.026	1.084	3.358	3
2.42	Large Medusa	Scyphozoa sp.	946.687		15.97	57.121			60.4	63.758			119.847	78.3		47.5
0.05	Twaite shad	Alosa fallax	17.856						16.983							
0.00	Edible crab	Cancer pagurus	0.674													
0.29	Greater sandeel	Hyperoplus lanceolatus	113.564					46.64								
1.44	Sandeel	Ammodytes marinus	562.177					0.02								
0.61	Cod	Gadus Morhua	238.127	52.3			18.24	2.31			13.33	9.26			108.6	
0.00	Tarry ray	Raja radiata	1.413													
0.00	Butter fish	Phalis qunnellus	0.024													
0.00	Sculpin	Myoxocephalus scorpius	0.194													
0.00		Lycodes vahli	0.322									0.322				

Table 3. continued.

		Station		1207	1225	1317	1388	1402	1454	1478	1530	1547	1635	1652	1700	1720	1793	1806
		ICES sq.		46F9	46F9	46G0	45G0	45G1	44G0	44G1	43G0	44G1	43G1	42G1	42G2	42G1	41G1	41G1
		Gear		Fotö	Fotö	Expo	Fotö	Fotö	Fotö	Expo	Fotö	Fotö	Expo	Expo	Expo	Expo	Expo	Expo
		Fishing depth		Surface	Surface	Bottom	Surface	Surface	Surface	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Bottom
		Total depth		404	242	90	135	80	113	61	42	41	56	42	44	30	31	25
		Day/Night		N	N	D	N	N	D	D	N	N	D	D	N	N	D	D
%		Total catch	Total	73	110	1600	1570	1731	15000	211	155	90	180	2773	117	180	102	82
0.00	Lesser silver smelt	Argentina sphyraena	1.86															
0.40	Blue whiting	Micromesistius poutassou	158.145															
7.04	Sprat	Sprattus sprattus	2753.681							0.127	0.18	16.084	2575.561	19.803	1.246	69.148	42.344	9.094
0.07	Squids, octopusses	Cephalopoda sp	26.699		1.599	0.206	0.356		1.356	0.09								
0.05	Northern pink shrimp	Pandalus borealis	21.333		19.553													
0.01	Norway lobster	Nephrops norvegicus	4.768		1.172				0.826			2.122				0.384		
0.00	Four-bearded rockling	Enchelyopus cimbrius	0.265									0.1						
0.06	Common weaver	Trachinus draco	21.636				0.134			2.14	2.23		0.924	2.48	5.97		2.33	3.65
0.00	Solenette	Buglossidium luteum	0.02															
0.01	Poor-cod	Trisopterus minutus	4.108						0.134									
0.01		Anarhichas lupus	2.07															
0.04	Anglerfish	Lophiuspiscatorius	15.906															
0.01	Halibut	Hippoglossus hippoglossus	2.13															
0.02	Horse mackerel	Trachurus trachurus	6.611					5.954										
0.55	Garfish	Belone belone	214.214	2.54		0.312	0.164	31.379			0.79	0.388			78.1			0.41
0.49	Long rough dab	Hippoglosides plattessoides	190.828		12.43				25.513			7.96					0.154	
4.20	Whiting	Merlangius merlangus	1643.228		28.6				45.76			12.83	4.82	0.577		17.54	7.662	
0.68	Invertebrates	Invertebrata	264.02		31.404				21.244			17.903	164.624			3.859	8.535	
0.62	Dab	Limanda limanda	243.74									4.24	24.08			4.57	10.066	
0.22	Hake	Merluccius merluccius	85.654		1.67				4.28			0.312	0.698			0.334		
0.36	Gurnard	Trigala spp.	139.827						0.077			1.692	0.588	0.766		0.458	0.352	
7.21	Krill	Euphausidae spp.	2819.103		1328.744	1490.359												
0.99	Haddock	Melanogrammus aeglefinus	388.872											0.015				
0.01	Ling	Molva molva	2.64										0.14					
0.01	Pollack	Pollachius pollachius	4.08															
0.22	Pearlside	Mauorolicus muelleri	86.69		45.921	17.202												
51.18	Mackerel	Scomber scombrus	20005.23	6.61	6.43	60.5	1687.212	14606.9		62	20.14			1.932	37	0.746	1.054	22.06
0.32	Saithe	Pollachius virens	124.981		1.029				0.728			0.114						
0.24	Allis shad	Alosa alose	93.317															
0.00		Callionymus maculatus	0.064															
0.01	Turbot	Psetta maxima	2.02															
0.45	Picked Dogfish	Squalus acanthias	177.322		13.94			153.537	1.492			3.07						
0.11	Plaice	Pleuronectes platessa	42.338		0.115				0.341			0.356	1.264			0.582	1.262	
0.07	Lemon sole	Microstomus kitt	26.285						0.029			0.44	0.114			0.372		
16.20	Herring	Clupea harengus	6333.756	2.266	73	0.337	0.487	202.23	102.552	3.268	1.03	111.46		3.026	2.146	0.347	0.294	0.814
0.00	Gray sole	Glyptocephalus cynoglossus	0.851															
0.00	Flounder	Platichthys flesus	0.796														0.796	
0.03	Snake blenny	Lumpenus lampretaeformis	12.638		12.44				0.088			0.11						
0.00	Brill	Scophthalmus rhombe	0.226														0.226	
0.00	Hagfish	Myxine glutinosa	0.022		0.022													
3.09	Norway pout	Trisopterus esmarki	1209.034		4.93													
0.19	Lumpsucker	Cyclopterus lumpus	75.658	0.222	15.56	0.966	0.076		6.58					1.87				1.12
2.42	Large Medusa	Scyphozoa sp.	946.687	98.362			42.571			87.375	65.63			86.531	55.538		4.357	28.764
0.05	Twaite shad	Alosa fallax	17.856			0.118												
0.00	Edible crab	Cancer pagurus	0.674									0.674						
0.29	Greater sandeel	Hyperoplus lanceolatus	113.564														0.026	
1.44	Sandeel	Ammodytes marinus	562.177															
0.61	Cod	Gadus Morhua	238.127		0.45								0.104			3.66		
0.00	Tarry ray	Raja radiata	1.413		0.807												0.518	0.088
0.00	Butter fish	Phalis qunnellus	0.024														0.024	
0.00	Sculpin	Myoxocephalus scorpius	0.194										0.084				0.11	
0.00		Lycodes vahli	0.322															

Table 4. Measured length distribution of herring by haul for the Danish acoustic survey with R/V Dana in June-July 2018.

Station	3	88	96	152	166	262	339	350	433	444	507	526	620	686
ICES sq.	44F6	43F6	43F6	41F6	41F6	43F6	44F7	44F7	42F6	42F7	41F7	41F7	43F7	44F8
Gear	Fotö	Expo	Expo	Fotö	Fotö	Expo	Fotö	Fotö	Expo	Expo	Expo	Expo	Expo	Fotö
Fishing depth	Surface	Bottom	Bottom	Surface	Surface	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Surface
Total depth	419	61	49	43	41	58	353	355	38	36	28	30	85	206
Day/Night	N	D	D	N	N	D	N	N	D	D	N	N	D	N
Total catch,kg	97	58	127	195	206	600	649	398	52	207	638	5 812	37	447
Total catch Herring,	1.630	1.524	0.428	0.946	0.187	0.638	98.320	92.100	8.643	15.058	195.003	4884.813	2.476	200.174
Sample Herring,kg	1.630	1.524	0.428	0.946	0.187	0.638	52.273	61.279	8.643	15.058	1.646	18.374	2.476	43.608
5.5														
6														
6.5														
7														
7.5														
8														
8.5													1	
9											3	2		
9.5											7	1		
10											14			
10.5											7	1		
11														
11.5														
12														
12.5											1			
13											12			
13.5											29	7		
14									8	3	66	31		
14.5		3				1			18	7	93	71	1	
15		2		2	1	2			31	30	115	79		
15.5		1	1	4		1			41	39	89	75	1	
16		7	1	2	1	2		1	34	48	57	44	1	
16.5		3			2	3			29	59	33	37	6	1
17		9	2	3		1			21	51	16	30	17	1
17.5		9	3	4	1	2	1		20	51	15	29	7	
18		5	3	1		1	1		11	37	13	42	8	8
18.5		1	1			1	2	1	16	34	10	37	7	3
19		1				1	8	3	8	14	7	25	1	8
19.5							21	4	1	6	2	19	2	15
20							34	19		2		5	1	35
20.5	2						41	35						45
21	2						54	49						61
21.5	2						40	49		1			1	63
22	1					1	48	52						57
22.5	2						44	56						39
23	1						40	47		1				21
23.5	3			1			33	31					1	15
24	1						25	43						13
24.5	1						29	24						9
25	1						17	13						11
25.5							18	27						6
26							14	16						7
26.5	1						15	16						13
27							11	11						3
27.5							6	19						4
28							8	18						5
28.5							5	9	1					11
29							2	4						1
29.5							1	4						1
30				1				4						2
30.5								2						
31														
31.5														
32								1						
32.5														
Total no.	17	41	11	18	5	16	518	558	239	383	589	535	55	458
Mean Length	22.73529	16.79268	17.31818	17.58333	16.3	16.9375	22.70656	23.41129	16.30543933	16.87076	14.98472	16.18972	17.48182	22.16703

Table 4. continued.

Station	702	789	859	875	962	983	1022	1041	1141	1207	1225	1317	1388	1402
ICES sq.	44F8	44F8	43F8	43F8	44F9	44F9	45F8	45F8	44G0	46F9	46F9	46G0	45G0	45G1
Gear	Fotö	Expo	Expo	Expo	Expo	Expo	Fotö	Fotö	Expo	Fotö	Fotö	Expo	Fotö	Fotö
Fishing depth	Surface	Bottom	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Surface	Surface	Bottom	Surface	Surface
Total depth	405	103	22	36	37	175	426	247	83	404	242	90	135	80
Day/Night	N	D	N	N	D	D	N	N	D	N	N	D	N	N
Total catch,kg	970	191	133	66	360	350	220	173	1 455	73	110	1 600	1 570	1 731
Total catch Herring,	240.359	32.700	1.260	0.422	1.566	1.030	12.768	12.124	3.454	1.638	2.266	73.000	0.337	0.487
Sample Herring,kg	41.534	24.366	1.260	0.422	1.566	1.030	12.768	12.124	3.454	1.638	2.266	35.108	0.337	0.487
5.5														
6														
6.5														
7														
7.5														
8														
8.5														
9														
9.5														
10														
10.5														
11														
11.5														
12														
12.5														
13														
13.5														
14														
14.5		1												
15		1												
15.5		2	1											
16		8	4											
16.5		19	1											
17		15	5				1							
17.5	3	21	2											
18	3	19	5						1					
18.5		18	3	1			1					1		
19	17	36	1	2					1			3		
19.5	29	37			1				1			7		
20	45	46		1	2		1	2	3	1		38		
20.5	67	39		1	3			3	8			66		1
21	53	30		1	2	1	4	9	10		1	94		1
21.5	72	26			6		17	19	7	4	1	69	2	2
22	46	17	1		1		16	15	5		3	72	1	
22.5	39	9			2	2	9	13	3	4	6	30		2
23	23	11					17	19	3	3	4	22		
23.5	10	5			2		20	7	1	1	4	13		
24	14	2	1			1	11	6		1	4	6		
24.5	10						11	8	2		1	1	1	
25	5	3				1	6	10	1	2		2		
25.5	5						5	3	2			1		
26	3						1	2						
26.5	4						1			1				
27	3	1				1	1							
27.5	5				1	1		1						
28	2					1		1						
28.5	1													
29	3		1				1	1						
29.5	1													
30								1						
30.5	2													
31							1							
31.5														
32														
32.5														
Total no.	465	366	25	6	20	9	123	120	48	17	24	425	4	6
Mean Length	21.67957	19.70082	18.22	19.66667	21.675	23.83333	23.20325	22.96667	21.58333	22.88235	22.91667	21.40471	22.375	21.58333

Table 4. continued

Station	1454	1478		1530	1547	1635		1700	1720	1793	1806	1852
ICES sq.	44G0	44G1		43G0	44G1	43G1		42G2	42G1	41G1	41G1	41G1
Gear	Fotö	Expo		Fotö	Fotö	Expo		Expo	Expo	Expo	Expo	Expo
Fishing depth	Surface	Bottom		Surface	Surface	Bottom		Surface	Surface	Bottom	Bottom	Surface
Total depth	113	61		42	41	56		44	30	31.3	25	22
Day/Night	D	D		N	N	D		N	N	D	D	N
Total catch,kg	15 000	211		155	90	180		117	180	102	82	66
Total catch Herring,l	202.230	76.436	26.116	3.268	1.030	110.394	1.066	3.026	2.146	0.347	0.294	0.814
Sample Herring,kg	17.594	1.368	26.116	3.268	1.030	0.962	1.066	3.026	2.146	0.347	0.294	0.814
5.5												
6												
6.5												
7		1				11						
7.5		5				31						
8		9				118						
8.5		63				70						
9		87				19						
9.5		58				4						
10		17										
10.5		4										
11		2										
11.5												
12												
12.5												
13												
13.5												
14												
14.5												
15				1			4					1
15.5							2					
16							1				1	
16.5			1				1					
17			1	1			1					
17.5			5	5								
18			11									5
18.5			39	1			1		1		2	1
19			63	4						1		1
19.5	1		47	5			1		4			
20	7		46	7			1	4	5		1	3
20.5	5		54	11			1	13	13	3		3
21	19		58	9	1		2	7	9	1	1	
21.5	49		44	3	2			1		1	1	
22	44		19	4			1	5	1			2
22.5	26		16	2	2			2	2			
23	28		3		3		1	3				
23.5	13		3	1								
24	3		1	1								
24.5	3		1									
25	2											
25.5	4				1		1	1				
26												
26.5	1											
27							1	1				
27.5								1				
28												
28.5					1							
29												
29.5												
30												
30.5												
31												
31.5												
32												
32.5												
Total no.	205	246	412	55	10	253	19	38	35	6	6	16
Mean Length	22.15122	9.02439	20.17233	20.2	23.2	8.132411	18.86842	21.55263	20.54286	20.5	19.25	19.25

Table 5. Measured length distribution of mackerel by haul for the Danish acoustic survey with R/V Dana in June-July 2018.

Station	3	152	166	339	350	433	444	507	526	620	686	702	789	859
ICES sq.	44F6	41F6	41F6	44F7	44F7	42F6	42F7	41F7	41F7	43F7	44F8	44F8	44F8	43F8
Gear	Fotö	Fotö	Fotö	Fotö	Fotö	Expo	Expo	Expo	Expo	Expo	Fotö	Fotö	Expo	Expo
Fishing depth	Surface	Surface	Surface	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Surface	Surface	Bottom	Surface
Total depth	419	43	41	353	355	38	36	28	30	85	206	405	103	22
Day/Night	N	N	N	N	N	D	D	N	N	D	N	N	D	N
Total catch,kg	97	195	206	649	398	52	207	638	5 812	37	447	970	191	133
Total catch Mackerel,kg	89.000	183.100	190.400	474.448	256.350	0.862	0.432	406.223	893.058	0.618	187.137	638.668	0.112	18.420
Sample Mackerel,kg	26.200	17.500	13.990	15.640	13.785	0.862	0.432	7.590	10.020	0.618	16.480	16.700	0.112	18.420
Length in cm														
15														
16														
17														
18		5	2					2				1		1
19		13	7	1	1				1			1		1
20		21	20					5	1		1			2
21		20	12					5	1			2		1
22		18	6					9	2					3
23	3	7		1	2			1	1			1		3
24	13	11	1	6	1			4			3	16	1	8
25	19	21	6	7	8	1		4	1		16	36		30
26	9	10	9	5	15			9	7		26	22		26
27	27	14	20	10	16			12	15	3	22	11		15
28	33	2	8	16	14			4	10		19	9		7
29	19	1	4	11	10			1	7		2	4		2
30	3	3	2	5	3						3	1		2
31	1	1		4	2				2		1	1		1
32	4	1	1	2	2				2		2	2		1
33	2		1	3	1				4		2			5
34	1	1	1	2	1	1			1					2
35	4		2	2							2	1		
36	1					1								
37		1		1			1							3
38														1
39				1										
40														
41														
42														
43														
44														
45														
46														
47														
48														
49														
50														
51														
52														
53														
54														
55														
56														
57														
58														
59														
60														
61														
Total no.	139	150	102	77	76	3	1	56	55	3	99	108	1	114
Mean length	27.47482	23.13333	24.21569	28.2987	27.31579	31.66667	37	24.23214	27.52727	27	27	25.76852	24	26.44737

Table 5. continued

Station	875	962	1022	1041	1207	1317	1388	1402	1454	1530	1547	1700	1720	1793	1806	1852
ICES sq.	43F8	44F9	45F8	45F8	46F9	46G0	45G0	45G1	44G0	43G0	44G1	42G2	42G1	41G1	41G1	41G1
Gear	Expo	Expo	Fotö	Fotö	Fotö	Expo	Fotö	Fotö	Fotö	Fotö	Fotö	Expo	Expo	Expo	Expo	Expo
Fishing depth	Surface	Bottom	Surface	Surface	Surface	Bottom	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Bottom	Bottom	Surface
Total depth	36	37	426	247	404	90	135	80	113	42	41	44	30	31.3	25	22
Day/Night	N	D	N	N	N	D	N	N	D	N	N	N	N	D	D	N
Total catch,kg	66	360	220	173	73	1 600	1 570	1 731	15 000	155	90	117	180	102	82	66
Total catch Mackerel,kg	0.316	1.852	62.508	78.100	11.040	6.430	60.500	1687.212	14606.900	62.000	20.140	1.932	37.000	0.746	1.054	22.06
Sample Mackerel,kg	0.316	1.852	26.600	24.000	11.040	6.430	21.500	21.100	24.200	20.900	20.140	1.932	19.800	0.746	1.054	22.06
Length in cm																
15																
16																
17																
18										2	10					
19			1					1		17	13					
20			1		1		1	2		30	35		1			
21					2		4	5	1	53	51	1	8			
22			1		2		10	14	2	51	36	2	16		2	14
23			7	3	5		27	38	3	31	30	4	31		3	64
24			63	33	32		50	64	4	15	17	6	45		4	82
25	1		78	75	25		14	34	15	6	12	1	10			12
26			15	33	9		10	12	19	7	13					3
27	1		10	11	4		9	6	38	4		1				
28		1	8	7	2		4	3	26	4		1				1
29			2	1	1		2		14				2			2
30					1				3	2						1
31		1							2				2			
32			2		1		1		4				2			
33		1	1	2		1			4				2			
34		1				3	4		1	1						
35					1	1	4						3			
36				1		5	2		3	1			1	2		
37			2			3							5			
38						1							2			
39						1							1			
40													3			
41		1	2													
42																
43																
44																
45																
46																
47																
48																
49																
50																
51																
52																
53																
54																
55																
56																
57																
58																
59																
60																
61																
Total no.	2	5	193	166	86	15	142	179	139	224	217	16	134	2	9	179
Mean length	26	33.4	25.27979	25.40964	24.86047	35.86667	24.98592	23.96648	27.43165	22.09375	21.7788	23.8125	25.32836	36	23.22222	23.69832

Table 6. Measured length distribution of sprat by haul for the Danish acoustic survey with R/V Dana in June-July 2018.

Station	433	507	1530	1547	1635	1652	1700	1720	1793	1806	1852
ICES sq.	42F6	41F7	43G0	44G1	43G1	42G1	42G2	42G1	41G1	41G1	41G1
Gear	Expo	Expo	Fotö	Fotö	Expo	Expo	Expo	Expo	Expo	Expo	Expo
Fishing depth	Bottom	Surface	Surface	Surface	Bottom	Bottom	Surface	Surface	Bottom	Bottom	Surface
Total depth	38	28	42	41	56	42	44	30	31.3	25	22
Day/Night	D	N	N	N	D	D	N	N	D	D	N
Total catch.kg	52	638	155	90	180	2 773	117	180	102	82	66
Total catch Sprat,kg	0.040	20.054	0.127	0.180	16.084	2575.561	19.803	1.246	69.148	42.343	9.904
Sample Sprat,kg	0.040	1.646	0.127	0.180	1.371	4.774	3.280	1.246	5.972	7.167	6.104
Length in cm											
5.5											
6											
6.5							1				
7					6						
7.5					16		4				
8					11		3				
8.5					9		8				
9					27	1	53				
9.5		10			39	2	126	4	4		
10		29	5		31	7	128	6	11		
10.5		62	4	4	21	11	68	7	9		
11		47	2	6	5	9	10	3	10		5
11.5		15	2	4	4	10	1	4	11		10
12		2		1	1	7	3	1	18	8	16
12.5		1		1	1	22	1		33	29	19
13	1				1	52	2	1	71	120	41
13.5		1			1	69	1	11	80	129	70
14	1					55		15	75	74	86
14.5					2	21		22	28	19	49
15					1	6		1	5	4	11
15.5						1			1	2	1
16										1	2
16.5											
17											
17.5											
18											
18.5											
19											
19.5											
20											
20.5											
21											
21.5											
22											
22.5											
23											
23.5											
24											
24.5											
25											
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.	2	167	13	16	176	273	409	75	356	386	310
Mean Length	13.5	10.63174	10.53846	11.15625	9.46875	13.09158	9.794621	12.90667	13.08146	13.4158	13.5629

Table 7. CTD station details for the Danish acoustic survey with R/V Dana in June-July 2018.

Dana station	Date dd-mm-yy	Stat. no.	Time UTC	ICES Square	Position Latitude	Longitude	Bottom depth m	Wind speed m/s	Sea state	Associated fishery station
2	29-06-18	2	00:20	44F7	57.48.121 N	007.03.199 E	411	5.3	5	3
4	29-06-18	85	11:04	43F6	57.08.283 N	006.16.145 E	65	6.1	3	88
9	29-06-18	101	15:40	43F6	57.02.025 N	006.07.713 E	48	4.7	3	96
10	29-06-18	150	20:48	41F6	56.26.632 N	006.16.140 E	45	5.2	3	151
14	30-06-18	171	01:51	41F6	56.05.550 N	006.14.390 E	45	5.3	3	166
15	30-06-18	261	10:31	43F6	57.06.182 N	006.44.778 E	62	2.4	3	262
18	30-06-18	337	20:44	44F7	57.54.039 N	007.06.623 E	350	1.3	2	338
22	01-07-18	356	01:42	44F7	57.40.249 N	007.17.648 E	315	6.1	2	350
23	01-07-18	432	10:13	42F7	56.35.642 N	007.02.118 E	36	6.0	2	433
27	01-07-18	448	14:27	42F7	56.39.667 N	007.10.841 E	33	6.3	2	444
28	01-07-18	506	20:40	41F7	56.01.086 N	007.43.604 E	27	3.3	2	507
32	02-07-18	532	01:48	41F7	56.09.593 N	007.34.904 E	31	2.1	2	526
33	02-07-18	619	10:11	43F7	57.22.367 N	007.30.308 E	83	1.9	2	620
37	02-07-18	646	15:42	43F7	57.27.067 N	007.58.558 E	135	8.9	4	640
39	02-07-18	685	20:23	44F8	57.32.388 N	008.03.722 E	178	9.4	6	686
43	03-07-18	708	01:46	44F8	57.43.950 N	008.01.732 E	447	7.2	5	702
44	03-07-18	788	09:54	44F8	57.32.300 N	008.24.675 E	104	3.4	5	789
48	03-07-18	808	15:05	43F8	57.26.405 N	008.38.888 E	34	6.2	4	803
49	03-07-18	854	20:04	43F8	57.06.330 N	008.21.090 E	26	4.8	4	859
55	04-07-18	879	01:35	43F8	57.21.320 N	008.17.921 E	44	5.1	3	875
57	04-07-18	960	09:01	44F9	57.43.717 N	009.39.911 E	35	3.2	3	962
61	04-07-18	987	16:05	44F9	57.54.311 N	009.22.212 E	169	5.3	2	983
62	04-07-18	1021	20:05	45F8	58.09.823 N	008.54.347 E	426	7.1	2	1022
66	05-07-18	1046	01:44	45F8	58.22.126 N	008.58.130 E	302	8.1	3	1041
67	05-07-18	1120	09:23	44G0	57.43.905 N	010.05.063 E	79	3.5	3	1141
70	05-07-18	1206	20:04	46F6	58.41.787 N	009.48.907 E	461	4.5	3	1207
74	06-07-18	1229	02:00	46F9	58.51.015 N	009.56.988 E	169	0.5	2	1225
76	06-07-18	1322	12:56	46G0	58.31.182 N	010.49.234 E	101	1.9	2	1317
78	06-07-18	1385	20:10	45G0	58.12.316 N	010.57.617 E	140	2.1	2	1388
82	07-07-18	1405	01:55	45G1	58.00.304 N	011.12.966 E	75	0.1	1	1402
83	07-07-18	1453	08:52	44G0	57.51.863 N	010.57.457 E	78	10.2	1	1454
87	07-07-18	1482	15:11	44G1	57.50.551 N	011.14.787 E	66	6.7	3	1478
88	07-07-18	1529	20:36	43G0	57.27.502 N	010.51.636 E	40	8.7	2	1530
92	08-07-18	1552	02:04	44G1	57.31.790 N	011.12.640 E	46	5.1	3	1547
93	08-07-18	1634	10:36	43G1	57.08.764 N	011.51.652 E	54	4.6	3	1635
97	08-07-18	1657	15:30	42G1	56.47.943 N	011.42.001 E	33	4.3	1	1652
98	08-07-18	1699	20:05	42G2	56.37.997 N	012.13.624 E	43	10.4	1	1700
102	09-07-18	1725	01:51	42G1	56.37.825 N	011.32.261 E	26	12.1	4	1720
103	09-07-18	1792	09:00	41G1	56.21.724 N	011.51.577 E	30	8.6	4	1793
107	09-07-18	1810	14:23	41G1	56.08.990 N	011.53.600 E	23	5.8	4	1806
108	09-07-18	1852	19:57	41G0	56.13.362 N	010.57.106 E	21	3.1	4	1852

Table 8. WP2 station details for the Danish acoustic survey with R/V Dana in June-July 2018.

						Mean	WP2	Wind		Associated	Associated	Dry Weight			
Date	Station	Time	ICES	Position		depth	depth	speed	Sea state	CTD	Fishery	mg dry weight/m^2			
dd-mm-yy	no.	UTC	Square	Latitude	Longitude	m	m	m/s		Station	Station	SumDryW	Frac2000	Frac1000	Frac180
29-06-18	86	01:55	43F6	57.08.067 N	006.15.975 E	65	55.8	6.6	3	85	88	3714	308.8	646	2759.2
29-06-18	151	21:09	41F6	56.26.414 N	006.16.143 E	44	37.0	6.5	3	150	151	4145.6	179.2	154	3812.4
30-06-18	261	10:56	43F6	57.06.145 N	006.44.617 E	62	56.6	2.4	3	261	262	2745.2	38.4	368.8	2338
30-06-18	338	21:33	44F7	57.53.966 N	007.06.034 E	Failed				337	339	Failed			
01-07-18	432	10:26	42F7	56.35.487 N	007.02.071 E	36	31.1	5.0	2	432	433	2479.6	164.4	488.8	1826.4
01-07-18	506	20:52	41F7	5601.060 N	007.43.677 E	27	22.3	2.8	2	506	507	424.8	256.8	58.4	109.6
02-07-18	619	10:41	43F7	57.22.605 N	007.30.801 E	85	77.3	1.9	2	619	620	2918.8	93.2	904	1921.6
02-07-18	685	20:11	44F8	57.32.346 N	008.03.597 E	177	96.4	8.6	6	685	686	3198.4	154.8	1043.6	2000
03-07-18	788	10:29	44F8	57.32.286 N	008.24.992 E	103	98.0	4.4	5	788	789	5480.4	671.2	583.6	4225.6
03-07-18	855	20:55	43F8	57.06.46 N	008.21.570 E	24	18.6	6.3	4	854	859	1834.4	73.2	283.6	1477.6
04-07-18	961	09:26	44F9	57.44.024 N	009.40.089 E	35	29.4	3.6	3	960	962	2806.4	162.4	409.2	2234.8
04-07-18	1022	20:40	45F8	58.09.822 N	008.54.557 E	427	151.6	9.3	2	1021	1022	2223.6	164.8	180	1878.8
05-07-18	1121	09:55	44G0	57.44.064 N	010.05.558 E	82	77.4	5.1	3	1120	1141	1710.4	203.6	294.4	1212.4
05-07-18	1206	20:38	46F9	58.41.760 N	009.48.858 E	463	151.4	3.9	3	1206	1207	3426	222	484	2720
06-07-18	1322	13:35	46G0	58.31.715 N	010.48.699 E	102	99.1	1.8	2	1322	1317	8514.4	261.2	1020.4	7232.8
06-07-18	1386	20:48	45G0	58.12.831 N	010.57.506 E	135	128.7	2.1	2	1385	1388	4968	228.8	817.6	3921.6
07-07-18	1454	09:21	44G0	57.51.853 N	010.58.510 E	72	68.9	8.5	1	1453	1454	8638.4	1196.8	1948	5493.6
07-07-18	1535	23:01	43G1	57.29.783 N	011.00.851 E	40	36.1	8.2	3	1529	1530	3739.6	257.2	30.8	3451.6
08-07-18	1634	11:04	43G1	57.09.008 N	011.51.861 E	54	48.1	5.1	3	1634	1635	7408	96	208.4	7103.6
08-07-18	1699	20:33	42G2	56.38.123 N	012.14.219 E	42	37.4	10.4	1	1699	1700	4498	157.6	11.2	4329.2
09-07-18	1792	09:23	41G1	56.21.691 N	011.51.447 E	31	27.9	5.6	4	1792	1793	2994.8	129.2	70	2795.6
09-07-18	1852	20:08	41G0	56.13.267 N	010.57.017 N	22	15	3.5	4	1852	1852	3759.2	28.4	6.8	3724

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 2018

Number Autumn spawning herring in mill.											
WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5m	6m
21	656.2503	0.576843		1.189665	0.045208		0.022762	0.046236	0.076358	0.067812	0.022604
31	390.0403	11.43781		26.85795	0.692079	1.855832	0.481665	0.208988			
41		27.39132		54.76111	1.72716	0.805219	0.119579	1.158239		0.796476	
42		11.87839		9.909747	0.356955		0.044481	0.223023		0.061758	
151	1.889235	196.9048		7.604026	0.009804	0.32295	0.006817	0.001716		0.001716	
152		16.9955		31.31635	3.807997	0.953157	0.969604	1.082995	0.459103	1.349496	0.235815
Biomass Autumn spawning herring in ton.											
WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6
21	2118.331	24.15595		67.06131	4.407761		1.206386	3.259638	6.08074	11.79929	3.322788
31	2066.738	796.0916		2034.038	68.80928	148.4665	56.03338	22.77968			
41		1810.577		4291.288	248.8502	102.2794	17.81727	117.4737		149.7887	
42		597.4987		708.069	43.49413		4.44805	19.28488		5.743507	
151	10.61326	6487.886		428.9253	1.195154	14.85571	0.701381	0.151023		0.159604	
152		1106.446		2676.284	475.6464	78.15884	98.02621	107.5518	74.6435	174.4059	48.24657
Mean length Autumn spaawning herring in cm.											
WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6
21	8.13	17.83		19.98	22.50		22.00	22.50	22.05	27.67	27.00
31	9.02	20.50		21.32	22.89	21.50	23.72	24.00			
41		19.88		21.21	24.85	25.22	25.50	23.19		28.08	
42		18.38		20.82	24.21		25.00	22.60		23.00	
151	9.69	16.07		18.97	24.35	19.00	23.44	23.00		23.00	
152		19.89		21.48	24.23	21.50	24.06	23.80	26.44	25.17	28.25
Mean weight Atumn spawning herring in g.											
WR	0	1i	1m	2i	2m	3i	3m	4i	4m	5	6
21	3.23	41.88		56.37	97.50		53.00	70.50	79.63	174.00	147.00
31	5.30	69.60		75.73	99.42	80.00	116.33	109.00			
41		66.10		78.36	144.08	127.02	149.00	101.42		188.06	
42		50.30		71.45	121.85		100.00	86.47		93.00	
151	5.62	32.95		56.41	121.91	46.00	102.89	88.00		93.00	
152		65.10		85.46	124.91	82.00	101.10	99.31	162.59	129.24	204.60

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 2018

Number of Spring spawning herring in mill.														
WR	1i	1m	2i	2m	3i	3m	4i	4m	5m	6m	7m	8m	9m	10m
21	0.190507		1.06743	0.1294	0.323089	0.221969	0.022604	0.17532	0.030636	0.022604	0.022604			
31	2.390605		16.58502	1.485131	21.05964	5.730956	7.26605	3.065289	3.674848	0.537271	0.272345	0.272345		
41	5.116037		28.27954	9.056857	13.91425	4.618375	5.453045	7.120323	8.173016	1.308492	2.647804	0.410633		
42	3.327211	0.246561	4.889779	1.362483	0.717833	0.453185	0.089683	0.124781	0.236937	0.0803				
151	46.23208	0.006865	5.158152	0.032101	0.001698	0.006865		0.001661	0.003414		0.001716	0.003551		
152	1.882586	0.476578	14.42786	7.169837	5.88343	10.78568	0.501826	8.503016	8.509523	3.662177	2.328901	0.423959	0.088153	0.076384
Biomass of Spring spawning herring in ton.														
WR	1i	1m	2i	2m	3i	3m	4i	4m	5m	6m	7m	8m	9m	10m
21	8.987178		64.5631	9.206593	24.16349	17.52922	1.559659	17.24249	1.899455	2.509044	2.328197			
31	152.2228		1307.733	133.8436	1769.565	484.2278	597.5141	326.3586	332.1719	47.06276	29.68561	28.05154		
41	316.2307		2227.926	872.8208	1253.961	457.81	516.7687	866.7065	1051.526	200.5659	415.9663	65.70015		
42	176.9691	20.83437	348.2333	116.7679	58.60385	38.41915	9.588823	19.41658	24.81428	12.41153				
151	1455.335	0.5492	292.5574	2.657589	0.156216	0.629848		0.39864	0.418602		0.279708	0.561058		
152	109.0888	38.12626	1174.343	657.6129	559.3756	1148.786	43.65888	1169.034	1229.808	569.3049	347.9031	71.76962	13.92817	14.05458
Mean length of Spring spawning herring in cm.														
WR	1i	1m	2i	2m	3i	3m	4i	4m	5m	6m	7m	8m	9m	10m
21	18.56		20.50	21.44	21.46	22.04	21.50	23.14	21.00	24.00	23.00			
31	20.02		21.47	22.06	22.20	22.46	22.17	24.77	22.88	23.90	25.50	25.50		
41	19.73		21.12	22.26	22.48	23.27	22.98	24.77	25.42	27.31	27.32	29.34		
42	18.76	21.50	20.44	21.83	22.41	22.62	24.24	26.59	24.37	27.24				
151	15.93	21.50	18.90	21.85	23.50	22.62		30.00	25.26		28.50	29.00		
152	19.16	21.50	21.16	22.32	22.83	23.59	22.50	25.82	25.98	26.93	26.73	28.61	29.00	29.50
Mean weight of Spring spawning herring in g.														
WR	1i	1m	2i	2m	3i	3m	4i	4m	5m	6m	7m	8m	9m	10m
21	47.17		60.48	71.15	74.79	78.97	69.00	98.35	62.00	111.00	103.00			
31	63.68		78.85	90.12	84.03	84.49	82.23	106.47	90.39	87.60	109.00	103.00		
41	61.81		78.78	96.37	90.12	99.13	94.77	121.72	128.66	153.28	157.10	160.00		
42	53.19	84.50	71.22	85.70	81.64	84.78	106.92	155.61	104.73	154.56				
151	31.48	80.00	56.72	82.79	92.00	91.75		240.00	122.61		163.00	158.00		
152	57.95	80.00	81.39	91.72	95.08	106.51	87.00	137.48	144.52	155.46	149.39	169.28	158.00	184.00

Table 11. 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 2018

Number sprat in mill								
WR	0i	1l	1m	2i	2m	3m	4m	5m
21	0	6.421889	320.3559		848.4405	1210.913	332.9805	6.52038
31								
41								
42								
151		1.374139	72.14228		40.03698	1.561094		
152								
Biomass sprat in ton.								
WR	0i	1l	1m	2i	2m	3m	4m	5m
21	10.80065	26.80311	2892.83		12866.23	22052.81	6992.682	146.9076
31								
41								
42								
151		9.687679	661.318		423.035	22.05548		
152								
Mean length Sprat in cm.								
WR	0i	1l	1m	2i	2m	3m	4m	5m
21	7.57	8.17	10.42		12.67	13.59	14.27	14.68
31								
41								
42								
151		9.50	10.49		10.88	12.46		
152								
Mean weight sprat in g.								
WR	0i	1l	1m	2i	2m	3m	4m	5m
21	2.88	4.17	9.03		15.16	18.21	21.00	22.53
31								
41								
42								
151		7.05	9.17		10.57	14.13		
152								