

Cruise report

RV “DANA” - Cruise 05/2022

Herring Acoustic Survey in the North Sea, Kattegat and Skagerrak (HERAS)

22 June – 8 July 2022

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Cruise summary

Total days	16
Days of monitoring	12
Number of nautical miles monitored	1 561 monitoring part + 152 for calibration + 255 transit
Number of trawl hauls	46
Number of CTD stations	50
Number of WP2 plankton stations	45
Fish catch in kg	21 835
Number of measured herring	14 118
Number of measured mackerel	4 670
Number of measured sprat	2 534
Number of species encountered	47
Total number of measured fish	27 705
Number of herring frozen for age and stock-split	2261
Number of sprat frozen for age	729

1 Background

This cruise is part of an international hydro acoustic survey for herring and sprat (HERAS) coordinated by the ICES Working Group of International Pelagic Surveys (WGIPS). The survey is carried out annually by national fisheries institutes from Scotland, Germany, Netherlands, Norway, Ireland and Denmark within the last week of June and the first 3 weeks of July. Geographically it covers most of the continental shelf north of 52°N in the North Sea and to the west of Scotland and Ireland to a northern limit of 62°N. The eastern edge of the survey area is bounded by the Norwegian, Danish, Swedish and German coastline and to the west by the shelf edge at around 200 m depth.

The DTU National Institute of Aquatic Resources (DTU AQUA) has participated in the herring acoustic survey of the North Sea and adjacent waters with the responsibility for surveying the Skagerrak and Kattegat area since 1991. The 2022 cruise with R/V DANA, was conducted in the period June 25 June to July 8 2022, while calibration was done during June 22 to June 24 2022.

2 Objectives

The objective of the survey is to provide age aggregated abundance and biomass estimates as well as maturity levels and weight at age for the herring and sprat stocks covered by the survey. These indices are used in the assessments of sprat and herring stocks carried out in the ICES Herring Assessment Working Group (HAWG) and underpin the management of North Sea herring, Western Baltic Spring Spawning herring, Malin Shelf herring as well as sprat in the North Sea and Skagerrak.

In addition to hydro-acoustic estimates of sprat and herring abundance, the survey also collects information on hydrography and plankton abundance in the survey area to facilitate studies into drivers of herring and sprat abundance and distribution.

The following standard objectives were planned for cruise 05/2022 on Dana:

- Collect continuous hydro-acoustic measurements along pre-defined transects
- Carry out trawl sampling with bottom and pelagic trawls to verify species and size composition of acoustic registrations
- Collect biological samples of herring and sprat for further analysis of age, stock and maturity composition as well as individual lengths and weights
- Carry out hydrographic sampling along transects (Thermo-Salinograph measurements) and associated with fishing stations (CTD casts) for pelagic habitat description
- Collect plankton samples for water-column integrated dry weight estimates for pelagic habitat description

In addition the following objectives were achieved on cruise 05/2022:

- Collected 438 fish of different sizes of 11 different species for stable isotope analysis and energy content measurements for a study into the feeding habits of tuna in Danish waters (for Brian MacKenzie, DTU Aqua)

- Collected specimens of *Illex* and *Loligo* squids for a PhD thesis project on stock definitions (for Bianca Bobowski, Thuenen Institute, Germany)
- Provided practical shipboard training in acoustic survey, biological and hydrological sampling methodologies for trainee from Nigeria that participated in the survey through the Eurofleets fellowship programme.

3 Survey Description and Results

3.1 Time table

22/6 kl 06:30	Departure from Hirtshals for calibration trip
22/6 kl 13:00	Arrive at Bornö and start calibration
24/6 kl 15:55	End calibration and depart from Bornö
25/6 kl 04:30	Arrive Hirtshals for crew change
25/6 kl 06:00	Departure Hirtshals for acoustic monitoring part
25/6 kl 20:15	Start monitoring work
30/6 kl 05:20	Stop off Hanstholm for Crew change by small vessel
30/6 kl 10:30	Resume monitoring work
07/7 kl 11:40	End monitoring work
08/7 kl 08:00	Arrive Hirtshals - end of trip

All times in UTC

3.2 Survey participants

During calibration 22/6– 24/6 2022

Name	Section	Function
Susan Mærsk Lusseau	DTU Aqua, Monitoring Hirtshals	Cruise leader
Torben Filt Jensen	DTU Aqua, Monitoring Hirtshals	Acoustics
Eik Ehlert Britsch	DTU Aqua, Monitoring Hirtshals	Technician
Christian Petersen	DTU Aqua, Monitoring Hirtshals	Technician

During acoustic monitoring 25/6 - 8/7-2022

Name	Section	Function
Susan Mærsk Lusseau	DTU Aqua, Monitoring Hirtshals	Cruise leader
Laura Diernæs	DTU Aqua, Hirtshals	Acoustics, CTD
Svea Winning	Thunen Institute, Germany	Acoustics, CTD
Eik Ehlert Britsch	DTU Aqua, Monitoring Hirtshals	Technician, CTD
Helle Rasmussen*	DTU Aqua, Monitoring Hirtshals	Fish lab, WP2
Jan Werner Thomsen	DTU Aqua, Monitoring Hirtshals	Fish lab, WP2
Jesper Knudsen	DTU Aqua, Monitoring Hirtshals	Fish lab, WP2
Mads Bluhm	DTU Aqua, Monitoring Hirtshals	Fish lab, WP2
Hans Henrik Bang Jørgensen	DTU Aqua, Monitoring Hirtshals	Fish lab, WP2
Mette Kjellerup Schiønning	DTU Aqua, Monitoring Lyngby	Fish lab, WP2
Søren Grønby**	DTU Aqua, Monitoring Hirtshals	Fish lab, WP2
Toyosi Fadekemi Igejongbo	Eurofleets/POGO partnership trainee	Acoustics, CTD, Fish lab.

*Til 30/6/2022. **Fra 30/6/2022

3.3 Cruise Narrative

The survey on R/V Dana started on June 22nd at 08:30 with departure from Hirtshals heading for Bornö in Gullmar Fjord, Sweden for calibration of the acoustic equipment. The vessel was anchored at Bornö in the Gullmar Fjord, Sweden June 22nd at 13:00 UTC. The calibration was initiated the same evening and continued until the evening of June 24th when Dana left Bornö. Dana arrived back in Hirtshals June 25th at 04:20 UTC for exchange of the scientific crew.

Dana left Hirtshals at 06:00 UTC again same day and steamed towards the start of the first transect (56° 14.18N, 07° 56.09E). Enroute to the first transect a stop was made in water depths characteristic of the survey area to test the pelagic trawl and the associated trawl monitoring sensors where a CTD deployment to determine the environmental settings for the EK60 was also carried out. Monitoring was started on June 25 at 20.15 UTC.

The North Sea (strata 151 and 152) was covered during the period June 25 – June 30. This year the transects in the southern part of this strata, below 57° were in an East-West direction rather than

a North-South direction. This was agreed in the coordination group to better capture the gradients in stock structure and herring size as well as spatial distribution.

The outer Skagerrak (strata 41 and 42) was covered during June 30 - July 2. The Inner Skagerrak (Strata 31) and Kattegat (Strata 21) was covered in the period July 3 to 7th.

The acoustic integration was ended July 7 at 56° 06.81'N, 011° 26.35'E at 11.40 UTC and Dana arrived back in Hirtshals at 08:00 UTC on July 8 2022.

All primary objectives of the cruise were achieved with full coverage of the proposed transects.

3.4 Calibration

The echosounders were calibrated at Bornö in the Gullmar Fjord, Sweden, between June 22 - June 24 2022. 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. Calibration of the towed body split-beam transducer at 38 kHz that is used for integration for abundance estimation as well as the two hull-mounted split-beam transducers at 38 and 120 kHz were carried out against a 38.1 mm tungsten sphere. The results were close to those from the previous calibration earlier in April. The calibration and setup data for the EK60 38 kHz used during the survey are shown in Table 1.

3.5 Acoustic data collection

The survey covered about 1968 nautical miles resulting in 1161 nautical miles of integrated transect track for use in stock size calculation (Figure 1). Data for use in the abundance estimation were recorded using the 38 kHz transducer mounted in a towed paravane running at depths of 4 – 6 m, the depth depending on the sea state and sailing direction relative to the waves, and at a standard ship speed of 9.6 kn. Simultaneously, data from the 120 kHz and 18 kHz echosounders using hull-mounted transducers were also recorded. During trawling operations the paravane was secured on deck and acoustic data was recorded from hull-mounted transducers at 18, 38 and 120 kHz. Data recorded during trawling operations are not included in the abundance estimation process, it is collected to aid echotrace species verification.

The acoustic data were processed during the survey in LSSS to prepare the echograms for further scrutinization and analysis on shore. This included removing interference from surface turbulence, bottom structures and scattering layers from the echogram as well as removing the sections such as trawling and passage between transects (inter-transects) not used in the abundance estimate.

3.6 Biological Data - Trawl Hauls

During the 2022 survey 45 trawl hauls were conducted, 36 with a pelagic trawl anywhere between the surface and immediately above the bottom and 9 hauls with a demersal trawl. One trawl was invalid as the net broke.

The geographical distribution of hauls and details on the hauls are in Figure 2 and Table 2. Catches by species are in Table 3. Length distributions of herring, mackerel and sprat by haul are in tables 4 to 6. Maps with catches of main pelagic species including herring and sprat in are in Figure 5.

The total catch for the survey was 28.2 tons. Herring was present in 33 hauls with a total catch of 16.0 tons or 57 % of the total catch. Totally 14 118 herring were measured and 2 261 frozen for age and stock splitting analysis back on land. Length distributions of herring per haul are in Table 4 and a map of catches in figure 5.

Sprat were present in 14 hauls with a total catch of 1.9 tons and 6.9 % of the total catch. Totally 2 534 sprat were measured and 729 were frozen for age determination back in the laboratory. Length distributions of sprat per haul are given in table 5 and a map of catches in figure 5.

Mackerel were present in 33 hauls with a total catch of 6.5 ton and 23.1 % of the total catch. A total of 4 670 mackerel were measured. Ages are not provided for mackerel in this survey. Length distributions of mackerel per haul are given in table 6 and a map of catches in figure 5.

3.7 Zooplankton

A total of 45 WP2 stations were completed. Information on the stations and distribution is given in Table 7 and Figure 4. Dry weight will be measured ashore for each of the three fractions 2000 µm, 1000 µm and 180 µm.

3.8 Hydrography

During the survey 45 CTD stations were completed. Information on the stations and distribution is given in Table 7 and Figure 3. Data from the CTD stations will be uploaded to the ICES hydrography database once quality control checks have been carried out.

3.9 Biomass estimates

Biomass estimates for herring (spring and autumn spawners) and sprat will be produced based on scrutiny of the acoustic integration, catch data and stock split of herring. The estimates will be finalised at the Post Cruise Meeting for the International Acoustic Survey in the North Sea, West of

Scotland and Malin Shelf in Bergen, November 2022 and reported in the combined report to the Working Group for International Pelagic Surveys (WGIPS) in Belfast in January 2023.

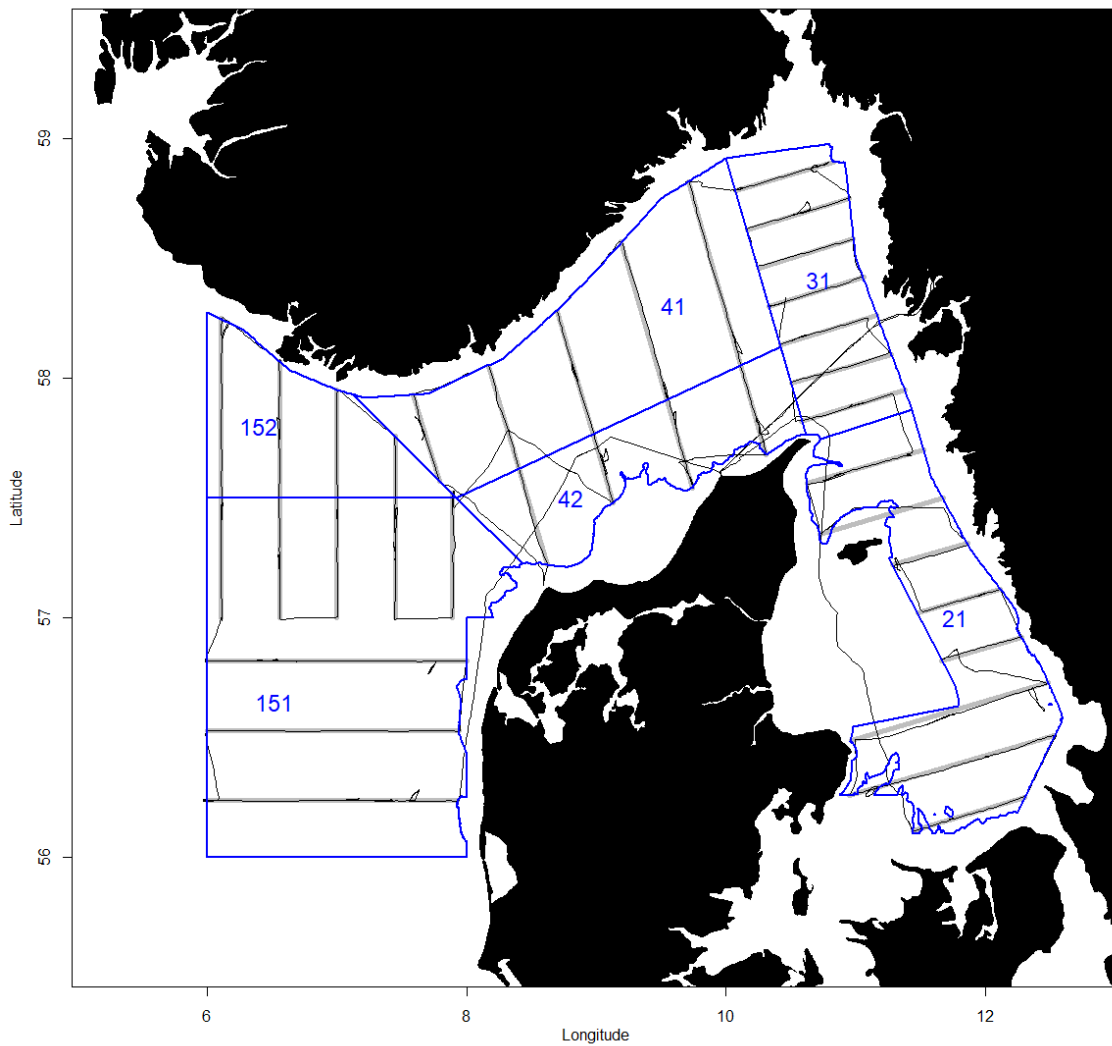


Figure 1. Survey track for the Danish acoustic survey with R/V Dana in June-July 2022. The numbered subareas indicates the strata used in the abundance estimation, the thick grey lines the planned transects for use in the abundance estimation and the think black line is the actual route sailed.

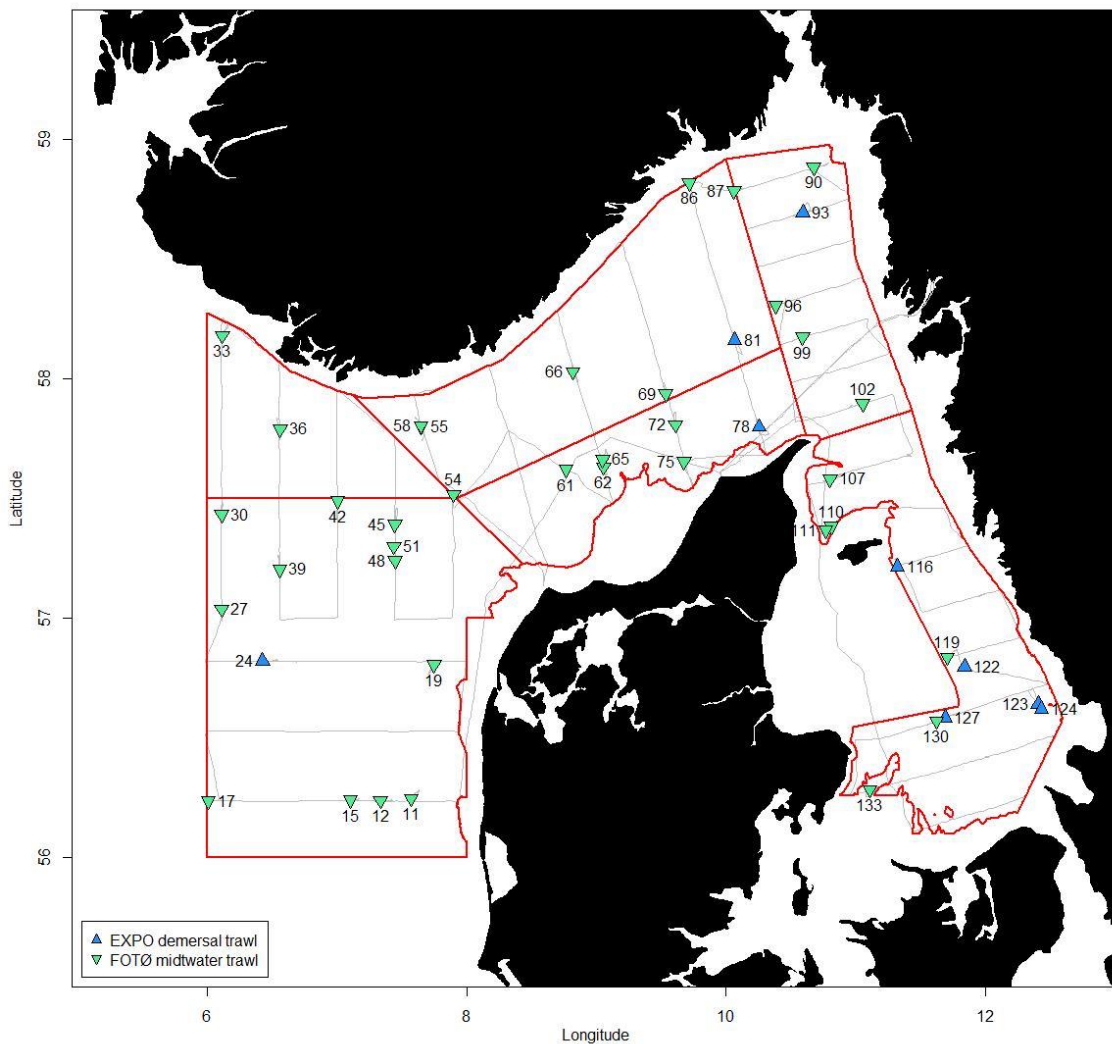


Figure 2. Vessel track and trawl stations during the Danish acoustic survey with R/V Dana in June-July 2022. Green triangles indicate stations with pelagic midwater Fotø trawl and blue triangles indicate locations where the Expo demersal trawl was used.

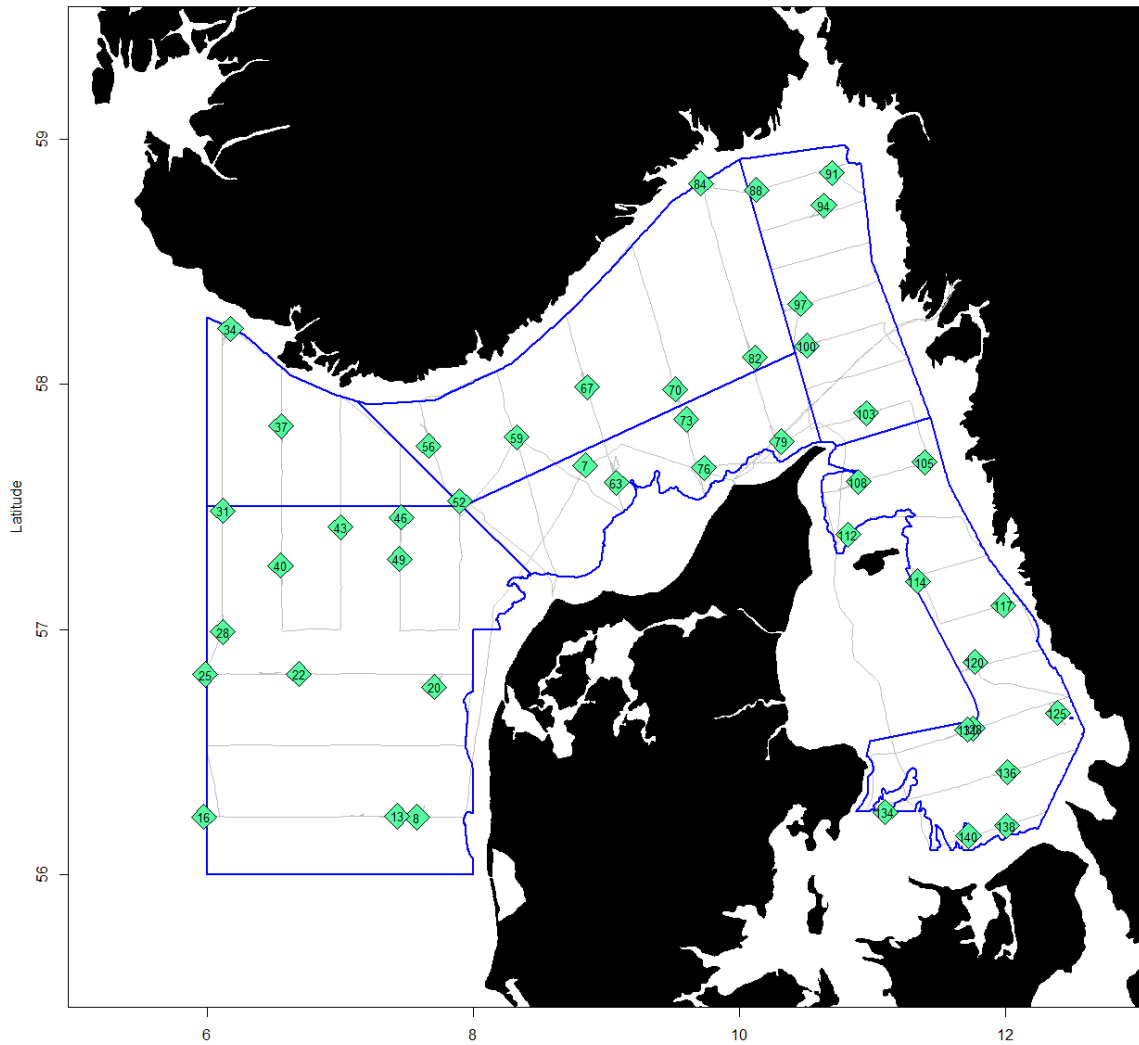


Figure 3. CTD stations during the Danish acoustic survey with R/V Dana in June-July 2022.

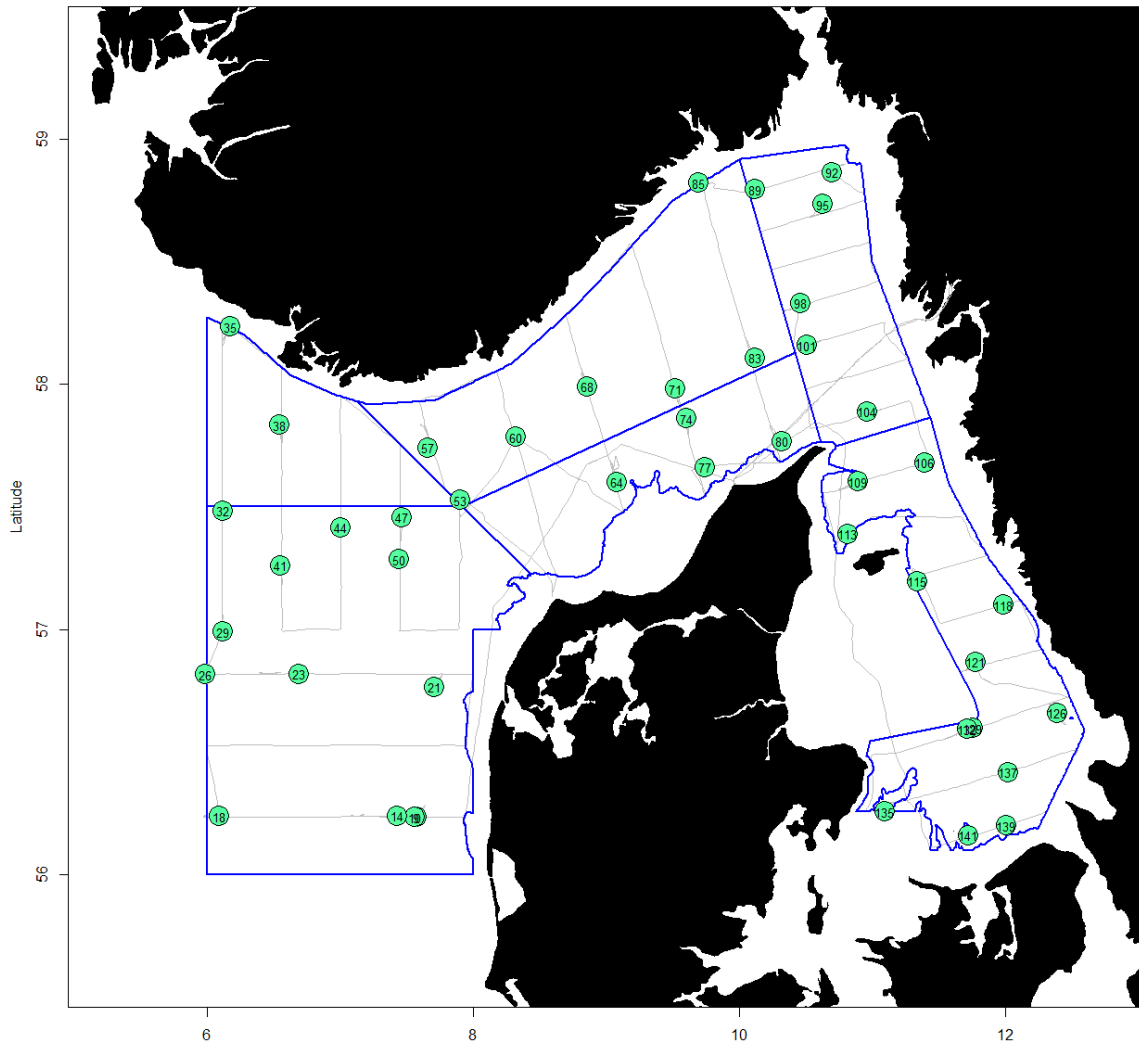


Figure 4. WP2 stations during the Danish acoustic survey with R/V Dana in June-July 2022.

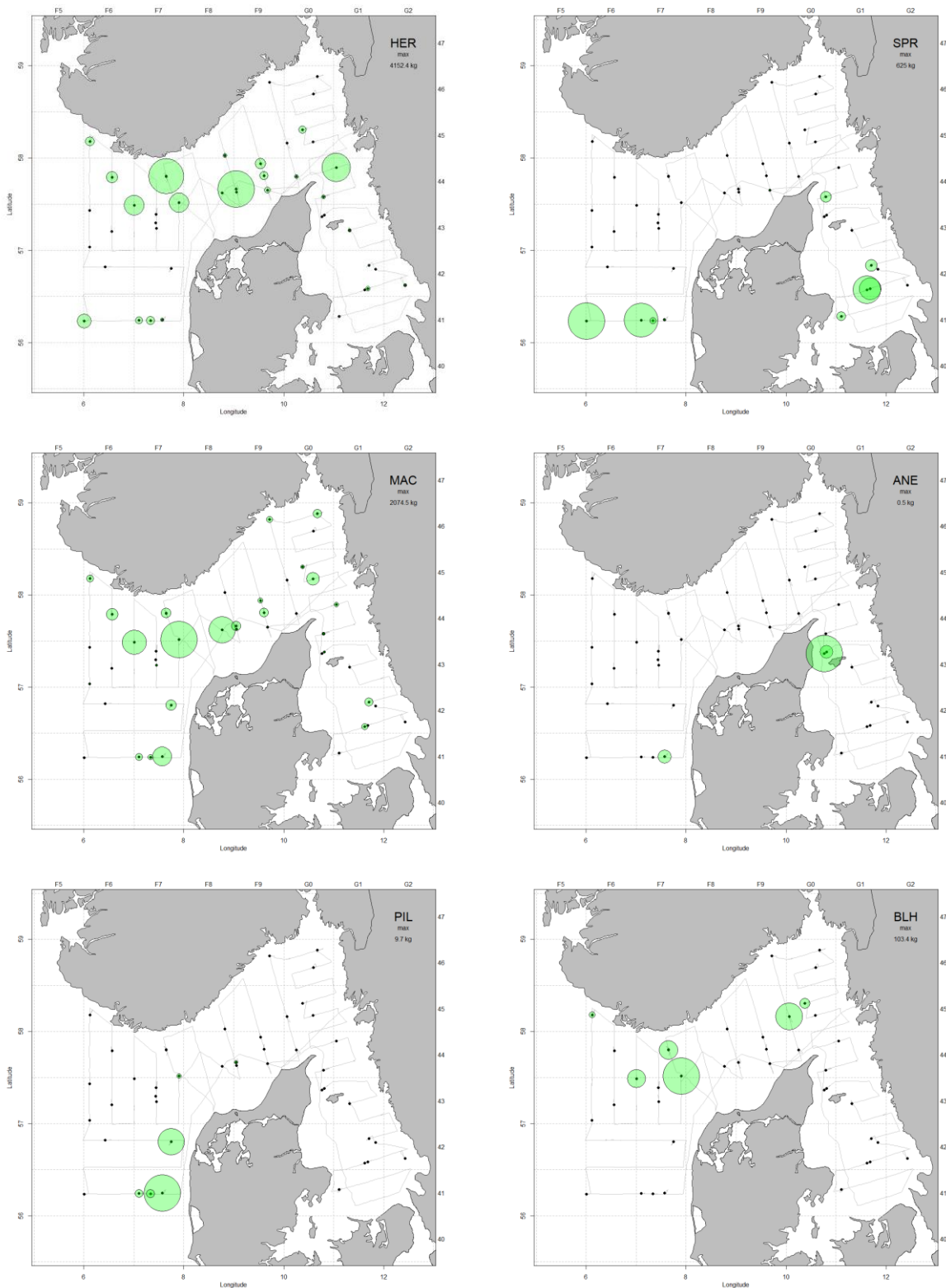


Figure 5. Catches of main pelagic species during the Danish acoustic survey with R/V Dana in June-July 2022. Black circles indicate trawl positions, green circles catches with the size of bubble representing the size of the catch. Catches are not to scale between plots, largest catch for each species is annotated on each map.

Table 1. Simrad EK60 and analysis settings used during the Herring Acoustic Survey with R/V Dana in June-July 2022

Transceiver Menu	
Frequency	38 kHz
Sound speed (North Sea and Skagerrak)	1423.3 m.s ⁻¹
Sound speed (Kattegat)	1501.2 m.s ⁻¹
Max. Power	2000 W
Equivalent two-way beam angle	-20.5 dB
Transducer Sv gain	25.27 dB
3 dB Beamwidth	6.82°
Calibration details	
TS of sphere	-42.39 dB
Range to sphere in calibration	13.9 m
Measured NASC value for calibration	1390 m ² /nmi ²
Calibration factor for NASCs	1.00
Absorption coeff	6.817 dB/km
Log Menu	
Distance	1.0 n.mi. using GPS-speed
Operation Menu	
Ping interval	0.6 - 1 s external trig
Analysis settings	
Bottom margin (backstep)	0.5 m
Integration start (absolute) depth	6 - 8 m
Range of thresholds used	-70 dB

Table 2. Trawl station details for the Danish acoustic survey with R/V Dana in June-July 2022.

Station no.	Date dd-mm-yy	Time UTC	ICES Square	Position		Trawl Direction deg.	Wire length m	Trawl type	Headline depth	Trawl height	Bottom depth m	Total catch kg	Main catch composition by weight	Trawling speed Kn	Trawling duration min.	Wind speed m/s	Sea state	Trawling distance NM
				Latitude	Longitude													
11	25-06-22	22:24	41F7	56.14.812 N	007.34.28 E	29	250	FOTØ	0	21	31.2	661.990	Mackerel, clupeids	4.0	30	4.1		2.2
12	26-06-22	01:10	41F7	56.14.343 N	007.20.16 E	87	270	FOTØ	0	22	29.9	359.999	Clupeids, mackerel	4.1	30	5.5		2.2
15	26-06-22	04:10	41F7	56.14.459 N	007.06.17 E	90	280	FOTØ	0	25	33	794.995	Clupeids, mackerel	4.5	20	10.3		1.5
17	26-06-22	10:29	41F6	56.14.186 N	006.00.52 E	91	250	FOTØ	13	26	46.2	1260.002	Clupeids	3.8	30	2.3		2.0
19	26-06-22	23:18	42F7	56.48.333 N	007.44.88 E	218	270	FOTØ	0	21	32	189.871	Mackerel, clupeids, grey gurnard	4.4	30	3.2		2.1
24	27-06-22	06:55	42F6	56.49.321 N	006.25.68 E	99	290	EXPO	36	7	43	79.899	Gadoids	3.9	38	7.2		2.6
27	27-06-22	12:49	43F6	57.02.210 N	006.06.79 E	186	270	FOTØ	14	25	46	20.667	Grey gurnard, mackerel	4.4	30	6.7		2.2
30	27-06-22	18:38	43F6	57.25.949 N	006.06.76 E	0	385	FOTØ	43	25	88	3.200	Gadoids, grey gurnard	4.3	30	6.5		2.1
33	28-06-22	00:43	45F6	58.10.841 N	006.07.10 E	12	280	FOTØ	0	20	279	384.505	Clupeids, mackerel	4.3	31	4.6		2.4
36	28-06-22	08:39	44F6	57.47.411 N	006.33.76 E	2	320	FOTØ	0	25	313	655.007	Clupeids, mackerel	4.4	20	5.3		1.5
39	28-06-22	14:44	43F6	57.12.238 N	006.33.58 E	359	350	FOTØ	30	22	66	50.527	Gadoids, clupeids, grey gurnard	4.4	33	1.9		2.4
42	28-06-22	22:51	43F7	57.29.353 N	007.00.33 E	183	300	FOTØ	0	20	134	2195.027	Clupeids, mackerel, blue whiting	4.2	44	3.3		3.4
45	29-06-22	09:14	43F7	57.23.484 N	007.26.82 E	1	590	FOTØ	70	22	104	2.388	Gadoids, grey gurnard, squid, mackerel	4.0	42	4.5		3.1
48	29-06-22	12:52	43F7	57.14.370 N	007.26.99 E	0	300	FOTØ	17	24	53.8	17.362	Mackrrel, grey gurnard	4.0	30	8.5		2.1
51	29-06-22	14:37	43F7	57.17.934 N	007.26.35 E	168	450	FOTØ	31	21	60	3.730	Gadoids, grey gurnard	4.5	30	8.4		2.2
54	29-06-22	22:46	44F7	57.30.967 N	007.54.05 E	189	330	FOTØ	0	20	159	3390.038	Mackerel, clupeids, blue whiting	4.5	40	6.6		2.8
55	30-06-22	12:28	44F7	57.48.046 N	007.38.92 E	161	1050	FOTØ	200	15	454	68.089	Great silver smelt, blue whiting, krill	3.2	30	8.1		2.2
58	30-06-22	15:29	44F7	57.48.225 N	007.38.93 E	331	365	FOTØ	5	27	467	4000.006	Clupeids, mackerel	4.1	23	7.1		1.6
61	30-06-22	23:51	44F8	57.37.279 N	008.45.87 E	113	270	FOTØ	0	24	76	1110.020	Mackerel	4.2	31	4.8		2.2
62	01-07-22	03:37	44F9	57.37.888 N	009.03.36 E	165	300	FOTØ	15	23	46	17.084	Grey gurnard, gadoids	3.9	19	6.7		1.3
65	01-07-22	05:27	44F9	57.39.789 N	009.02.86 E	169	300	FOTØ	20	21	59	4302.009	Clupeids, mackerel	4.7	51	4.4		4.0
66	01-07-22	10:28	45F8	58.01.689 N	008.49.07 E	155	300	FOTØ	3	22	553	70.551	Clupeids, lump sucker, mackerel	4.5	30	3.8		2.3
69	01-07-22	21:23	44F9	57.56.202 N	009.32.03 E	345	280	FOTØ	2	27	174	409.969	Clupeids, mackerel	4.1	30	10.9		2.1
72	02-07-22	00:37	44F9	57.48.420 N	009.36.53 E	352	300	FOTØ	5	24	50	389.997	Clupeids, mackerel	3.9	30	11.4		2.2
75	02-07-22	05:08	44F9	57.39.195 N	009.40.45 E	78	280	FOTØ	34	17	46	134.927	Clupeids, mackerel, gadoids	3.5	10	9.6		0.8
78	02-07-22	09:17	44G0	57.47.944 N	010.15.30 E	179	390	EXPO	71	7	78	879.996	Norway pout, gadoids, clupeids	3.6	30	12.2		1.7
81	02-07-22	14:40	45G0	58.09.700 N	010.03.91 E	173	1100	EXPO	207	6	214	89.453	Blue whiting, shrimp, velvet belly, great silver smelt	3.6	49	8.8		2.9
86	02-07-22	23:00	46F9	58.49.098 N	009.42.83 E	89	310	FOTØ	0	20	215	135.007	Mackerel, krill	4.5	30	12.1		1.8
87	03-07-22	01:04	46G0	58.47.054 N	010.03.58 E	86	320	FOTØ	0	21	242	0		4.5	30	11.9		1.7
90	03-07-22	06:40	46G0	58.53.026 N	010.40.41 E	244	270	FOTØ	0	20	123	153.860	Mackerel, clupeids	4.5	30	10.6		1.9
93	03-07-22	11:33	46G0	58.41.581 N	010.35.48 E	82	556	EXPO	95	7	102	1181.510	Krill, gadoids, norway pout	3.3	32	13.1		1.9
96	03-07-22	22:41	45G0	58.18.288 N	010.22.83 E	73	310	FOTØ	0	22	337	314.998	Clupeids, lump sucker, mackerel, blue whiting	3.3	30	5.8		2.1
99	04-07-22	02:50	45G0	58.10.442 N	010.35.33 E	247	250	FOTØ	0	23	224	278.684	Mackerel, clupeids	4.1	32	7.1		2.2
102	04-07-22	13:51	44G1	57.53.717 N	011.03.08 E	257	450	FOTØ	46	20	76.4	2545.010	Clupeids, mackerel	4.8	49	12.9		3.0
107	04-07-22	22:35	44G0	57.34.888 N	010.47.98 E	66	265	FOTØ	0	22	26.5	200.005	Clupeids, mackerel, garfish, squid, great weever	4.2	30	9.8		2.1
110	05-07-22	03:34	43G0	57.23.020 N	010.48.53 E	229	235	FOTØ	0	20	33.2	73.109	Mackerel, great weever, garfish, clupeids	4.3	11	10.0		0.9
111	05-07-22	04:27	43G0	57.21.993 N	010.46.08 E	56	250	FOTØ	10	23	36.1	37.243	Clupeids, gadoids, mackerel, great weever	4.1	30	11.5		1.9
116	05-07-22	13:09	43G1	57.12.941 N	011.19.09 E	355	250	EXPO	25	5.6	31.2	110.736	Great weever, clupeids, flatfish, spurdog, gadoids, squid	4.5	30	11.3		1.9
119	05-07-22	23:22	42G1	56.50.221 N	011.42.29 E	45	270	FOTØ	0	21	40.3	409.981	Mackerel, clupeids, great weever, garfish	4.4	30	11.9		2.1
122	06-07-22	01:11	42G1	56.47.854 N	011.50.26 E	120	353	EXPO	40	5.8	45.4	47.032	Flatfish, gadoids, mackerel, blennies, clupeids	3.3	30	12.4		2.0
123	06-07-22	05:07	42G2	56.38.550 N	012.24.14 E	145	46	EXPO	24	6	29.6	-	invalid haul	4.5	8	9.7		0.5
124	06-07-22	06:05	42G2	56.37.295 N	012.25.75 E	328	250	EXPO	24	5.3	29.4	140.953	Clupeids, gadoids, flatfish	3.3	30	8.8		2.0
127	06-07-22	10:59	42G1	56.35.099 N	011.41.23 E	71	260	EXPO	29	5.6	35	356.963	Clupeids, gadoids, flatfish	3.0	30	9.7		1.7
130	06-07-22	13:45	42G1	56.34.275 N	011.37.17 E	70	335	FOTØ	5	21	32	594.995	Clupeids, mackerel, great weever	4.5	30	8.8		2.2
133	06-07-22	20:59	41G1	56.16.999 N	011.06.47 E	221	200	FOTØ	5	21	29.8	81.488	Clupeids, flatfish, mackerel	4.3	30	13.5		1.8

Not recorded in 2022

TABLE 3. CATCH COMPOSITION IN TRAWL HAULS FOR THE DANISH ACOUSTIC SURVEY WITH R/V DANA IN JUNE –JULY 2022

			Station	11	12	15	17	19	24	27	30	33	36	39	42	45	48	51
			Stratum	151	151	151	151	151	151	151	151	152	152	151	151	151	151	151
			ICES Sq	41F7	41F7	41F7	41F6	42F7	42F6	43F6	43F6	45F6	44F6	43F6	43F7	43F7	43F7	43F7
			Trawl type	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	EXPO	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ
			Headline depth	0	0	0	13	0	36	14	43	0	0	30	0	70	17	31
			Seabed depth	31.2	29.9	33	46.2	32	43	46	88	279	313	66	134	104	53.8	60
			Day/Night	Day	Night	Night	Day	Night	Day	Day	Day	Night	Day	Day	Night	Day	Day	Day
% of catches	Common Name	Scientific Name	Total catch (kg)	661.990	359.999	794.995	1260.002	189.871	79.899	20.667	3.200	384.505	655.007	50.527	2195.027	2.388	17.362	3.730
56.66	Herring	<i>Clupea harengus</i>	15979.202	49.730	222.303	164.162	619.276	0.515				261.608	423.767	12.455	1247.427			
23.14	Mackerel	<i>Scomber scombrus</i>	6526.473	579.753	48.191	79.715		176.515		4.780		87.186	218.676		918.889	0.113	12.200	
6.88	Sprat	<i>Sprattus sprattus</i>	1940.762	3.960	20.940	535.858	624.973	0.491										
3.28	Scyphozoans	<i>Scyphozoa</i>	925.305	16.397	61.109	8.333	5.224					27.220	7.750		0.212	0.176		
2.62	Krill	<i>Euphausiidae</i>	738.966															
2.11	Haddock	<i>Melanogrammus aeglefinus</i>	594.925	0.005					76.488	0.386	2.060			30.580		0.983		1.692
2.00	Norway pout	<i>Trisopterus esmarkii</i>	562.653															
0.80	Blue whiting	<i>Micromesistius poutassou</i>	224.899									2.807			26.096			
0.51	Whiting	<i>Merlangius merlangus</i>	144.736	0.037	0.156		1.729	0.016	2.016	0.002	0.002	0.119	0.134	5.702			0.002	0.524
0.36	Greater weever fish	<i>Trachinus draco</i>	100.776															
0.25	Lumpfish	<i>Cyclopterus lumpus</i>	71.595										3.298					
0.20	Grey gurnard	<i>Eutrigla gurnardus</i>	57.674	1.770	2.664	6.440	8.800	7.040	0.686	15.160	1.138			1.594		0.757	5.160	1.514
0.19	Cod	<i>Gadus morhua</i>	54.600						0.103									
0.18	Northern pink shrimp	<i>Pandalus borealis</i>	49.600															
0.14	Great silver smelt	<i>Argentina silus</i>	40.722															
0.12	Garfish	<i>Belone belone</i>	34.521	0.206	3.516							5.280	0.632	0.196	1.960			
0.10	Common dab	<i>Limanda limanda</i>	29.345	0.269	0.444			0.156										
0.10	Hake	<i>Merluccius merluccius</i>	27.880															
0.06	Pilchard	<i>Sardina pilchardus</i>	16.108	9.694	0.518	0.487		5.120										
0.05	Shrimps	<i>Caridea</i>	14.850															
0.04	Spurdog	<i>Squalus acanthias</i>	10.610										0.750					
0.03	Saithe	<i>Pollachius virens</i>	8.713						0.606									
0.03	American plaice	<i>Hippoglossoides platessoides</i>	7.319															
0.02	Plaice	<i>Pleuronectes platessa</i>	5.829															
0.02	European common squid	<i>Alloteuthis subulata</i>	5.437															
0.02	Velvet belly	<i>Etmopterus spinax</i>	5.302															
0.02	Invertebrates	<i>Invertebrata</i>	4.737	0.023	0.120													
0.01	Southern shortfin squid	<i>Illex coindetii</i>	3.990		0.037													
0.01	Norway lobster	<i>Nephrops norvegicus</i>	3.777												0.279	0.359		
0.01	Pearlside	<i>Maurolicus muelleri</i>	2.513															
0.01	Snake blenny	<i>Lumpenus lampretaeformis</i>	1.449															
0.00	Lemon sole	<i>Microstomus kitt</i>	0.875															
0.00	Greater forkbeard	<i>Phycis blennoides</i>	0.832															
0.00	Northern squid	<i>Loligo forbesii</i>	0.715							0.339		0.212			0.164			
0.00	Vahls eelpout	<i>Lycodes gracilis</i>	0.695															
0.00	Edible crab	<i>Cancer pagurus</i>	0.618															
0.00	Sculpin	<i>Myoxocephalus scorpius</i>	0.616															
0.00	Anchovy	<i>Engraulis encrasicolus</i>	0.585	0.063														
0.00	Flounder	<i>Platichthys flesus</i>	0.521															
0.00	Turbot	<i>Scophthalmus maximus</i>	0.505															
0.00	Witch	<i>Glyptocephalus cynoglossus</i>	0.442															
0.00	Horse mackerel	<i>Trachurus trachurus</i>	0.424	0.076														
0.00	Hagfish	<i>Myxine glutinosa</i>	0.276															
0.00	Sea trout	<i>Salmo trutta</i>	0.200															
0.00	Common shrimp	<i>Crangon crangon</i>	0.073															
0.00	Lancet fish	<i>Natoscopelus kroyeri</i>	0.058															
0.00	Rabbitfish	<i>Chimaera monstrosa</i>	0.040															
0.00	Common dragonet	<i>Callionymus lyra</i>	0.039															
0.00	Sars' wolf eel	<i>Lycenchelys sarsii</i>	0.023															
0.00	Four-bearded rockling	<i>Enchelyopus cimbrius</i>	0.019															
0.00	Lesser sandeel	<i>Ammodytes marinus</i>	0.018					0.018										
0.00	Greater sandeel	<i>Hyperoplus lanceolatus</i>	0.013															
0.00	Scaldfish	<i>Arnoglossus laterna</i>	0.013															
0.00	Black goby	<i>Gobius niger</i>	0.009															
0.00		<i>Sepietta oweniana</i>	0.007	0.007														
100.00			28202.883	661.990	359.999	794.995	1260.002	189.871	79.899	20.667	3.200	384.505	655.007	50.527	2195.027	2.388	17.362	3.730

TABLE 3. CONTINUED.

			Station	54	55	58	61	62	65	66	69	72	75	78	81	86	87	90
			Stratum	41	41	41	42	42	42	41	41	42	42	42	41	41	41	31
			ICES Sq	44F7	44F7	44F7	44F8	44F9	44F9	45F8	44F9	44F9	44F9	44G0	45G0	46F9	46G0	46G0
			Trawl type	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	EXPO	EXPO	FOTØ	FOTØ	FOTØ
			Headline depth	0	200	5	0	15	20	3	2	5	34	71	207	0	0	0
			Seabed depth	159	454	467	76	46	59	553	174	50	46	78	214	215	242	123
			Day/Night	Night	Day	Day	Night	Night	Day	Day	Day	Night	Day	Day	Day	Night	Night	Day
% of catches	Common Name	Scientific Name	Total catch (kg)	3390.038	68.089	4000.006	1110.020	17.084	4302.009	70.551	409.969	389.997	134.927	879.996	89.453	135.007	0.000	153.860
56.66	Herring	<i>Clupea harengus</i>	15979.202	1205.446		3840.964			4152.436	52.033	359.517	220.039	122.598	54.493				0.314
23.14	Mackerel	<i>Scomber scombrus</i>	6526.473	2074.526		155.457	1101.230		143.357	2.307	47.656	132.404	2.874		64.790			124.291
6.88	Sprat	<i>Sprattus sprattus</i>	1940.762										2.675					
3.28	Scyphozoans	<i>Scyphozoa</i>	925.305	4.422	0.377	0.177	7.132	17.000	5.180	7.350	2.022	35.280	5.020	0.030		65.000		29.200
2.62	Krill	<i>Euphausiidae</i>	738.966		0.890											5.130		
2.11	Haddock	<i>Melanogrammus aeglefinus</i>	594.925				0.528		0.209					180.521	1.572			
2.00	Norway pout	<i>Trisopterus esmarkii</i>	562.653											515.241				
0.80	Blue whiting	<i>Micromesistius poutassou</i>	224.899	103.362	27.945											56.128		
0.51	Whiting	<i>Merlangius merlangus</i>	144.736		0.009		0.227	0.014		0.068		0.763		73.448				0.055
0.36	Greater weever fish	<i>Trachinus draco</i>	100.776			0.074					0.074	0.814						
0.25	Lumpfish	<i>Cyclopterus lumpus</i>	71.595			3.334				8.540	0.586							
0.20	Grey gurnard	<i>Eutrigla gurnardus</i>	57.674					0.070	0.501			0.150	0.224					
0.19	Cod	<i>Gadus morhua</i>	54.600										1.536	25.600				
0.18	Northern pink shrimp	<i>Pandalus borealis</i>	49.600													4.720		
0.14	Great silver smelt	<i>Argentina silus</i>	40.722		38.354											2.368		
0.12	Garfish	<i>Belone belone</i>	34.521	0.528			0.525			0.253		0.359						
0.10	Common dab	<i>Limanda limanda</i>	29.345											0.362				
0.10	Hake	<i>Merluccius merluccius</i>	27.880											26.020	1.166			
0.06	Pilchard	<i>Sardina pilchardus</i>	16.108	0.188					0.101									
0.05	Shrimps	<i>Caridea</i>	14.850		0.093											14.757		
0.04	Spurdog	<i>Squalus acanthias</i>	10.610															
0.03	Saithe	<i>Pollachius virens</i>	8.713											1.185	1.722			
0.03	American plaice	<i>Hippoglossoides platessoides</i>	7.319											1.639				
0.02	Plaice	<i>Pleuronectes platessa</i>	5.829											0.699				
0.02	European common squid	<i>Alloteuthis subulata</i>	5.437															
0.02	Velvet belly	<i>Etmopterus spinax</i>	5.302													5.302		
0.02	Invertebrates	<i>Invertebrata</i>	4.737											0.438				
0.01	Southern shortfin squid	<i>Illex coindetii</i>	3.990	1.566			0.378		0.225		0.114	0.188				0.087		
0.01	Norway lobster	<i>Nephrops norvegicus</i>	3.777											0.165				
0.01	Pearlside	<i>Maurolicus muelleri</i>	2.513		0.363											0.212		
0.01	Snake blenny	<i>Lumpenus lampretaeformis</i>	1.449															
0.00	Lemon sole	<i>Microstomus kitt</i>	0.875											0.157				
0.00	Greater forkbeard	<i>Phycis blennoides</i>	0.832													0.832		
0.00	Northern squid	<i>Loligo forbesii</i>	0.715															
0.00	Vahls eelpout	<i>Lycodes gracilis</i>	0.695															
0.00	Edible crab	<i>Cancer pagurus</i>	0.618															
0.00	Sculpin	<i>Myoxocephalus scorpius</i>	0.616															
0.00	Anchovy	<i>Engraulis encrasicolus</i>	0.585															
0.00	Flounder	<i>Platichthys flesus</i>	0.521															
0.00	Turbot	<i>Scophthalmus maximus</i>	0.505															
0.00	Witch	<i>Glyptocephalus cynoglossus</i>	0.442													0.442		
0.00	Horse mackerel	<i>Trachurus trachurus</i>	0.424															
0.00	Hagfish	<i>Myxine glutinosa</i>	0.276													0.096		
0.00	Sea trout	<i>Salmo trutta</i>	0.200															
0.00	Common shrimp	<i>Crangon crangon</i>	0.073													0.073		
0.00	Lancet fish	<i>Natoscopelus kroyeri</i>	0.058		0.058													
0.00	Rabbitfish	<i>Chimaera monstrosa</i>	0.040													0.040		
0.00	Common dragonet	<i>Callionymus lyra</i>	0.039															
0.00	Sars' wolf eel	<i>Lycenchelys sarsii</i>	0.023													0.023		
0.00	Four-bearded rockling	<i>Enchelyopus cimbrius</i>	0.019															
0.00	Lesser sandeel	<i>Ammodytes marinus</i>	0.018															
0.00	Greater sandeel	<i>Hyperoplus lanceolatus</i>	0.013															
0.00	Scaldfish	<i>Arnoglossus laterna</i>	0.013															
0.00	Black goby	<i>Gobius niger</i>	0.009															
0.00		<i>Sepietta oweniana</i>	0.007															
100.00			28202.883	3390.038	68.089	4000.006	1110.020	17.084	4302.009	70.551	409.969	389.997	134.927	879.996	89.453	135.007	0.000	153.860

TABLE 3. CONTINUED.

			Station	93	96	99	102	107	110	111	116	119	122	124	127	130	133
			Stratum	31	31	31	31	21	21	21	21	21	21	21	21	21	21
			ICES Sq	46G0	45G0	45G0	44G1	44G0	43G0	43G0	43G1	42G1	42G1	42G2	42G1	42G1	41G1
			Trawl type	EXPO	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	EXPO	FOTØ	EXPO	EXPO	EXPO	FOTØ	FOTØ
			Headline depth	95	0	0	46	0	0	10	25	0	40	24	29	5	5
			Seabed depth	102	337	224	76.4	26.5	33.2	36.1	31.2	40.3	45.4	29.4	35	32	29.8
			Day/Night	Day	Night	Night	Day	Night	Night	Day	Day	Night	Night	Day	Day	Day	Day
% of catches	Common Name	Scientific Name	Total catch (kg)	1181.510	314.998	278.684	2545.010	200.005	73.109	37.243	110.736	409.981	47.032	140.953	356.963	594.995	81.488
56.66	Herring	<i>Clupea harengus</i>	15979.202	4.530	191.541	10.502	2504.824	59.875	0.059	8.483	33.832	21.880	0.201	35.057	80.099	3.910	15.325
23.14	Mackerel	<i>Scomber scombrus</i>	6526.473		29.753	259.256	40.186	20.053	12.180	2.216	0.310	115.885	2.776		0.108	67.211	1.631
6.88	Sprat	<i>Sprattus sprattus</i>	1940.762					56.772	0.010					0.146	226.196	363.235	40.265
3.28	Scyphozoans	<i>Scyphozoa</i>	925.305		30.623	7.280		48.981	58.080	20.080		190.756	24.750	88.357	16.231	114.880	20.675
2.62	Krill	<i>Euphausiidae</i>	738.966	732.946													
2.11	Haddock	<i>Melanogrammus aeglefinus</i>	594.925	295.407						2.682	0.304		0.012	0.841	0.656		
2.00	Norway pout	<i>Trisopterus esmarkii</i>	562.653	47.402						0.010							
0.80	Blue whiting	<i>Micromesistius poutassou</i>	224.899		8.560												
0.51	Whiting	<i>Merlangius merlangus</i>	144.736	15.190				0.162	0.020	1.310	8.881		3.584	7.650	22.917		
0.36	Greater weever fish	<i>Trachinus draco</i>	100.776			0.108		1.648	1.720	1.804	38.764	11.268	0.322		1.055	42.801	0.325
0.25	Lumpfish	<i>Cyclopterus lumpus</i>	71.595		52.360	0.426								1.172	0.209	1.670	
0.20	Grey gurnard	<i>Eutrigla gurnardus</i>	57.674					0.082			0.352		0.231	0.401	1.740	0.354	0.846
0.19	Cod	<i>Gadus morhua</i>	54.600	26.584						0.011			0.003	0.763			
0.18	Northern pink shrimp	<i>Pandalus borealis</i>	49.600	44.880													
0.14	Great silver smelt	<i>Argentina silus</i>	40.722													0.880	
0.12	Garfish	<i>Belone belone</i>	34.521		1.794	1.112		10.580	0.982		0.368	5.350					
0.10	Common dab	<i>Limanda limanda</i>	29.345								12.542		6.709	2.065	5.350	0.054	1.394
0.10	Hake	<i>Merluccius merluccius</i>	27.880	0.433							0.187			0.074			
0.06	Pilchard	<i>Sardina pilchardus</i>	16.108														
0.05	Shrimps	<i>Caridea</i>	14.850														
0.04	Spurdog	<i>Squalus acanthias</i>	10.610								9.860						
0.03	Saithe	<i>Pollachius virens</i>	8.713	5.200													
0.03	American plaice	<i>Hippoglossoides platessoides</i>	7.319	3.389							0.148		0.429	1.622	0.019		0.073
0.02	Plaice	<i>Pleuronectes platessa</i>	5.829	1.446				0.070		0.348			0.894	1.560			0.812
0.02	European common squid	<i>Alloteuthis subulata</i>	5.437					1.756		0.017	3.640	0.018					0.006
0.02	Velvet belly	<i>Etmopterus spinax</i>	5.302														
0.02	Invertebrates	<i>Invertebrata</i>	4.737					0.026		0.045			3.930		0.155		
0.01	Southern shortfin squid	<i>Illex coindetii</i>	3.990	0.315	0.368												
0.01	Norway lobster	<i>Nephrops norvegicus</i>	3.777	0.349							0.093		2.174	0.996			
0.01	Pearlside	<i>Maurolicus muelleri</i>	2.513	1.938													
0.01	Snake blenny	<i>Lumpenus lampretaeformis</i>	1.449	0.258									1.191				
0.00	Lemon sole	<i>Microstomus kitt</i>	0.875	0.350							0.184		0.184				
0.00	Greater forkbeard	<i>Phycis blennoides</i>	0.832														
0.00	Northern squid	<i>Loligo forbesii</i>	0.715														
0.00	Vahls eelpout	<i>Lycodes gracilis</i>	0.695	0.695													
0.00	Edible crab	<i>Cancer pagurus</i>	0.618											0.618			
0.00	Sculpin	<i>Myoxocephalus scorpius</i>	0.616								0.058			0.275	0.283		
0.00	Anchovy	<i>Engraulis encrasicolus</i>	0.585						0.058	0.464							
0.00	Flounder	<i>Platichthys flesus</i>	0.521												0.385		0.136
0.00	Turbot	<i>Scophthalmus maximus</i>	0.505								0.505						
0.00	Witch	<i>Glyptocephalus cynoglossus</i>	0.442														
0.00	Horse mackerel	<i>Trachurus trachurus</i>	0.424								0.348						
0.00	Hagfish	<i>Myxine glutinosa</i>	0.276	0.180													
0.00	Sea trout	<i>Salmo trutta</i>	0.200								0.082		0.118				
0.00	Common shrimp	<i>Crangon crangon</i>	0.073														
0.00	Lancet fish	<i>Natoscopelus kroyeri</i>	0.058														
0.00	Rabbitfish	<i>Chimaera monstrosa</i>	0.040														
0.00	Common dragonet	<i>Callionymus lyra</i>	0.039							0.039							
0.00	Sars' wolf eel	<i>Lycenchelys sarsii</i>	0.023														
0.00	Four-bearded rockling	<i>Enchelyopus cimbrius</i>	0.019	0.019													
0.00	Lesser sandeel	<i>Ammodytes marinus</i>	0.018														
0.00	Greater sandeel	<i>Hyperoplus lanceolatus</i>	0.013											0.013			
0.00	Scaldfish	<i>Arnoglossus laterna</i>	0.013							0.013							
0.00	Black goby	<i>Gobius niger</i>	0.009											0.009			
0.00		<i>Sepietta oweniana</i>	0.007														
100.00			28202.883	1181.510	314.998	278.684	2545.010	200.005	73.109	37.243	110.736	409.981	47.032	140.953	356.963	594.995	81.488

Table 4. Raised length distribution of herring by haul for the Danish acoustic survey with R/V Dana in June-July 2022.

Station	11	12	15	17	19	33	36	39	42	54	58	65	66	69	72	75
Stratum	151	151	151	151	151	152	152	151	151	41	41	42	41	41	42	42
ICES Sq	41F7	41F7	41F7	41F6	42F7	45F6	44F6	43F6	43F7	44F7	44F7	44F9	45F8	44F9	44F9	44F9
Trawl type	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ
Headline depth	0	0	0	13	0	0	0	30	0	0	5	20	3	2	5	34
Seabed depth	31.2	29.9	33	46.2	32	279	313	66	134	159	467	59	553	174	50	46
Day/Night	Day	Night	Night	Day	Night	Night	Day	Day	Night	Night	Day	Day	Day	Day	Night	Day
Total catch (kg)	661.990	359.999	794.995	1260.002	189.871	384.505	655.007	50.527	2195.027	3390.038	4000.006	4302.009	70.551	409.969	389.997	134.927
Total weight herring (kg)	49.730	222.303	164.162	619.276	0.515	261.608	423.767	12.455	1247.427	1205.446	3840.964	4152.436	52.033	359.517	220.039	122.598
Subsample weight herring (kg)	4.687	4.104	4.502	17.439	0.515	63.282	56.912	12.455	88.470	73.922	89.221	30.240	52.033	68.129	23.396	5.891
6																
6.5																
7																
7.5																
8																
8.5																
9	140															
9.5	1983	1009	246													
10	3836	10990	4594		2											
10.5	1142	14747	10172		1											4391
11	75	2187	3937		5											1998
11.5		56	164													1041
12		56			3											83
12.5				107	4											250
13			329	1065	6											354
13.5			4	888	5			3								1124
14			1	1349	3			1								895
14.5			4	2486	2			1								187
15			1	3977				1								
15.5				4616				25								160
16			1	4226	1			54								348
16.5			2	1634				55								273
17	1		1	959				38								103
17.5				213				12								103
18			1	213				6								414
18.5		1						4				12358		5		762
19				71				3		114		23756		11		846
19.5			1					8			86	21971		63		893
20			1					14			86	5767		142		216
20.5								22	85	179	43	1510		121		132
21	1					107		14		130	344			116		
21.5						298	82	6			1033			174		
22						401	179		268	228	646	1510		201		
22.5						500					277			259	75	
23						405	506	1			2153		33	174		
23.5						384	45				408	1722	412	27		
24						294	380			1043	473	3444		27		
24.5		1				103	350			945	848	3358	687	39		
25						99	298			1438	1305	4219		50		
25.5						41	395			1579	1647	3401		28		
26						37	357			874	962	3057				
26.5						4	231			1128	783	1980	18			
27						8				550	783	775				
27.5							186			268	196	387	24			
28							156			127	179	387				
28.5										56	43					
29							60			85	86					
29.5										85	49	43	60			
30							30									
30.5									14		86		31			
31																
31.5																
32																
32.5										16						
Number measured	668	520	492	614	32	649	437	268	606	526	636	495	337	538	460	496
Raised number	7178	29048	19459	21804	32	2683	3254	268	8545	8577	27380	67971	337	2839	4326	10322
Mean length (cm)	9.9	10.3	10.5	15.3	12.6	22.4	24.4	17.4	25.0	24.7	24.3	19.3	25.7	23.6	18.4	11.5

Table 4. continued

Station	78	90	93	96	99	102	107	110	111	116	119	122	124	127	130	133
Stratum	42	31	31	31	31	31	21	21	21	21	21	21	21	21	21	21
ICES Sq	44G0	46G0	46G0	45G0	45G0	44G1	44G0	43G0	43G0	43G1	42G1	42G1	42G2	42G1	42G1	41G1
Trawl type	EXPO	FOTØ	EXPO	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	EXPO	FOTØ	EXPO	EXPO	EXPO	FOTØ	FOTØ
Headline depth	71	0	95	0	0	46	0	0	10	25	0	40	24	29	5	5
Seabed depth	78	123	102	337	224	76.4	26.5	33.2	36.1	31.2	40.3	45.4	29.4	35	32	29.8
Day/Night	Day	Day	Day	Night	Night	Day	Night	Night	Day	Day	Night	Night	Day	Day	Day	Day
Total catch (kg)	879.996	153.860	1181.510	314.998	278.684	2545.010	200.005	73.109	37.243	110.736	409.981	47.032	140.953	356.963	594.995	81.488
Total weight herring (kg)	54.493	0.314	4.530	191.541	10.502	2504.824	59.875	0.059	8.483	33.832	21.880	0.201	35.057	80.099	3.910	15.325
Subsample weight herring (kg)	3.065	0.314	4.530	74.183	10.502	35.546	7.414	0.059	6.187	33.832	21.880	0.201	4.875	5.712	3.910	5.088
6																20
6.5																20
7								8								98
7.5								24	1							276
8								81								807
8.5	1316							202	1			1				2265
9	836							501								5160
9.5	1067							767	5							3644
10	676							1373								1182
10.5	249							1179	2				1602			118
11								1341					1205			392
11.5								921					763		1	369
12								218					351			203
12.5								32					122		1	61
13								8					46			3
13.5															1	
14																5
14.5								32					6			4
15								32					3		1	1
15.5								32							2	9
16								146							2	2
16.5								291							1	7
16.5								583							1	2
17								1821							1	7
17.5								536							1	3
18								10562							4	10
18.5								13768							7	9
19								9397							4	14
19.5								3497							4	5
20								1748							4	8
20.5								101							4	2
21								947							4	5
21.5								183							2	1
22								364							1	2
22.5								150							1	4
23								253							1	2
23.5								219							1	2
24								146							1	2
24.5								146							1	2
25								160							1	2
25.5								160							1	2
26								73							3	
26.5								147							1	
27								134							7	
27.5								80							1	
28								49							2	
28.5								26							4	
29								15							1	
29.5								3							1	
30								10							1	
30.5								13							1	
31								3							1	
31.5								1							1	
32								1							1	
32.5								1							1	
Number measured	261	4	61	748	111	688	847	9	531	855	344	3	545	731	93	512
Raised number	4640	4	61	1931	111	49470	6840	9	774	855	344	3	4116	13687	93	1687
Mean length (cm)	10.4	21.4	20.4	22.5	22.4	18.5	10.5	9.4	11.2	17.1	19.5	18.0	10.6	9.1	17.4	10.5

Table 5. Raised length distribution of sprat by haul for the Danish acoustic survey with R/V Dana in June-July 2022.

Station	11	12	15	17	19	75	107	110	119	122	124	127	130	133
Stratum	151	151	151	151	151	42	21	21	21	21	21	21	21	21
ICES Sq	41F7	41F7	41F7	41F6	42F7	44F9	44G0	43G0	42G1	42G1	42G2	42G1	42G1	41G1
Trawl type	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	EXPO	EXPO	EXPO	FOTØ	FOTØ
Headline depth	0	0	0	13	0	34	0	0	0	40	24	29	5	5
Seabed depth	31	30	33	46	32	46	27	33	40	45	29	35	32	30
Day/Night	Day	Night	Night	Day	Night	Day	Night	Night	Night	Night	Day	Day	Day	Day
Total catch (kg)	661.990	359.999	794.995	1260.002	189.871	134.927	200.005	73.109	409.981	47.032	140.953	356.963	594.995	81.488
Total weight Sprat (kg)	3.960	20.940	535.858	624.973	0.491	2.675	56.772	0.010	64.707	0.535	0.146	226.196	363.235	40.265
Subsample weight sprat (kg)	1.966	2.265	2.179	2.569	0.491	2.675	4.452	0.010	3.867	0.535	0.146	3.891	4.043	4.075
8.5											2	58		
9							89				4	291		
9.5	58	111	246			1	370		33	1	1	465		
10	187	638	3935	243	2	12	1594		100			407		
10.5	151	998	14755	3892	8	23	2117	1	351		1	814	90	
11	28	296	23854	16786	4	67	931		201		2	1163	270	
11.5		37	6148	16786	3	44	102		151			3023	2066	69
12				8028		18	13		134	6	3	3895	3863	217
12.5			246	3406	2	18	13		720	5	1	2674	7008	652
13				973	3	4			770	7		2035	5391	682
13.5					6	8			519	4		930	2066	336
14				243	4				502	2	1	465	988	277
14.5					1				318	7		174	539	59
15						2			84			116	180	10
15.5						1						58		20
Number measured	211	225	200	207	33	198	410	1	232	32	15	285	250	235
Raised number	425	2080	49184	50358	33	198	5228	1	3882	32	15	16568	22461	2322
Mean length (cm)	10.2	10.4	10.8	11.4	12.1	11.4	10.4	10.5	12.7	13.1	10.5	12.0	12.6	13.0

Table 6. Raised length distribution of mackerel by haul for the Danish acoustic survey with R/V Dana in June-July 2022.

Station	11	12	15	19	27	33	36	42	45	48	54	58	61	65	66	69	72	75	86	90	96	99	102	107	110	111	116	119	122	127	130	133		
Stratum	151	151	151	151	151	152	152	151	151	151	41	41	42	42	41	41	42	42	41	31	31	31	31	21	21	21	21	21	21	21	21	21		
ICES Sq	41F7	41F7	41F7	42F7	43F6	45F6	44F6	43F7	43F7	43F7	44F7	44F7	44F8	44F9	45F8	44F9	44F9	44F9	46F9	46G0	45G0	44G1	44G0	43G0	43G0	43G1	42G1	42G1	42G1	42G1	41G1			
Trawl type	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ	FOTØ			
Headline depth	0	0	0	0	14	0	0	0	70	17	0	5	0	20	3	2	5	34	0	0	0	0	46	0	0	10	25	0	40	29	5	5		
Seabed depth	31.2	29.9	33	32	46	279	313	134	104	53.8	159	467	76	59	553	174	50	46	215	123	337	224	76.4	26.5	33.2	36.1	31.2	40.3	45.4	35	32	29.8		
Day/Night	Day	Night	Night	Night	Day	Night	Day	Night	Day	Day	Night	Day	Night	Day	Day	Day	Night	Day	Night	Day	Night	Night	Day	Night	Night	Day	Night	Night	Night	Day	Day	Day		
Total catch (kg)	662.0	360.0	795.0	189.9	20.7	384.5	655.0	2195.0	2.4	17.4	3390.0	4000.0	1110.0	4302.0	70.6	410.0	390.0	134.9	135.0	153.9	315.0	278.7	2545.0	200.0	73.1	37.2	110.7	410.0	47.0	357.0	595.0			
Total weight Mackerel (kg)	579.8	48.2	79.7	176.5	4.8	87.2	218.7	918.9	0.1	12.2	2074.5	155.5	1101.2	143.4	2.3	47.7	132.4	2.9	64.8	124.3	29.8	259.3	40.2	20.1	12.2	2.2	0.3	115.9	2.8	0.1	67.2	1.6		
Subsample weight Mackerel (kg)	36.1	48.2	33.7	36.8	4.8	32.4	35.5	68.6	0.1	12.2	49.0	34.5	69.0	30.3	2.3	38.9	41.1	2.9	41.0	26.8	29.8	39.3	40.2	20.1	12.2	2.2	0.3	69.8	2.8	0.1	33.5	1.6		
17												14				1						5												
18				7	14		22	111			22	42	23			2					32		7	8										
19			38	129		129	314	40		101		95				7				3	241	2	4	38		4			8			2		
20			3	123	172		75	166	40		58	42	59	16		4	2			3	144	4	13	102		4			27			2		
21	16		5	52	38		3	37			5	85	14							3	74		5						35			12		
22			1	21	5					13		1									19		1	37		5	1		17			16		
23			1	9			6					42	18			1	3		1	8	162	1	4	17		14	1		17	1		98		
24			1	2			6	13	1			36					11	10			73	357	15	13	6	26	6		58	2		237		
25												36									134	167	14	84	2	2	15	2		20			156	
26			1				6	13				14				1		1	43	9	13	21	128	2	1				3	1		24		
27	64	3	5	38		5						85		144	33	1	9	16		6		2	35		8			2						
28	257	46	43	125	10	24	62	616			888	41	1308	142	2	18	97	1	8		11	125	1	13	6		3			2				
29	273	66	45	211	5	40	166	1125		1	1311	108	1372	335	2	62	93		27		19	307	1	16	5	2		15						
30	273	11	28	81	4	54	117	750		1	1988	81	1037	66		39	61		27		18	153		17	6	1		12						
31	64	8	28	91	2	70	105	415			1354	59	542	38		25	90		11		18	98	2	8			1	46		4	1			
32	129	3	26	62		35	68	214			1058	72	191	14		18	58		19		11	84		5			53	2						
33	32	6	5	34		22	49	147			296	27		14		6	48				3			1			23	2			2			
34	96	6	12	10		8	43	80			212	23	64			2	6		2		3	21	1				13							
35	80	4	7			3	12	40			254	5									2		2			1		28	1		2			
36	80	4	7			5	12	40			127	14				6		1	3		1	42					8	1			1			
37	193	4	14	5		3	6	54			85	14			1	1	3								6			22				1		
38	193	2				3	6	27			85											7	1					33				1		
39	16	3		5		3	12	27				9										1						5	1					
40	16	4					6					9						6				14	2					13						
41												14										1												
42	16	1																	1										2					
43				2																									2					
44																																		
45			2																															
Number measured	112	183	202	213	21	187	213	273	1	189	188	173	293	142	20	168	157	15	231	261	139	176	354	84	86	14	1	280	11	1	278	4		
Raised number	1800	183	478	1020	21	503	1311	3655	1	189	7953	780	4675	671	20	206	505	15	365	1210	139	1024	354	84	86	14	1	465	11	1	558	4		
Mean length (cm)	32.2	29.8	25.4	26.2	28.9	25.6	25.3	29.8	24.0	19.4	30.4	27.3	29.3	28.9	22.2	29.2	30.2	24.9	26.5	22.1	28.3	29.3	22.9	29.3	24.5	25.9	31.0	29.3	30.6	23.0	24.2	35.5		

Table 7. CTD station details for the Danish acoustic survey with R/V Dana in June-July 2022.

Stat. no.	Date dd-mm-yy	Time UTC	ICES Square	Position		Bottom depth m	Wind speed m/s	Seastate	Associated fishery station
				Latitude	Longitude				
8	25-06-2022	21:37	41F7	56.14.116 N	007.34.463 E	31	3.11	Not recorded in 2022	11
13	26-06-2022	02:16	41F7	56.14.353 N	007.25.573 E	30	6.45		12, 15
16	26-06-2022	09:22	41F5	56.14.210 N	005.58.366 E	46	7.33		17
20	27-06-2022	00:10	42F7	56.45.950 N	007.42.209 E	32	2.99		19
22	27-06-2022	04:47	42F6	56.49.081 N	006.41.227 E	36	6.87		24
25	27-06-2022	10:14	42F5	56.49.051 N	005.59.062 E	47	7.41		-
28	27-06-2022	13:42	42F6	56.59.410 N	006.06.968 E	41	6.96		27
31	27-06-2022	19:33	43F6	57.28.990 N	006.06.903 E	84	7.22		30
34	28-06-2022	01:45	45F6	58.13.624 N	006.10.384 E	289	4.29		33
37	28-06-2022	09:29	44F6	57.49.777 N	006.33.223 E	320	4.35		36
40	28-06-2022	15:41	43F6	57.15.679 N	006.32.973 E	72	2.27		39
43	29-06-2022	00:07	43F7	57.25.099 N	007.00.023 E	117	4.89		42
46	29-06-2022	10:21	43F7	57.27.463 N	007.27.433 E	145	4.21		45
49	29-06-2022	13:44	43F7	57.17.197 N	007.26.662 E	62	8.23		48, 51
52	29-06-2022	21:53	44F7	57.31.400 N	007.53.860 E	175	7.52		54
56	30-06-2022	13:32	44F7	57.44.930 N	007.39.712 E	432	7.47		55, 58
59	30-06-2022	21:18	44F8	57.47.071 N	008.19.480 E	447	6.99		-
63	01-07-2022	04:15	44F9	57.35.989 N	009.04.594 E	37	4.59		62, 65
67	01-07-2022	11:16	44F8	57.59.344 N	008.51.265 E	292	3.67		66
70	01-07-2022	22:19	44F9	57.58.752 N	009.31.122 E	213	10.71		69
73	02-07-2022	01:31	44F9	57.51.436 N	009.35.977 E	70	11.63		72
76	02-07-2022	05:38	44F9	57.39.573 N	009.44.056 E	43	7.96		75
79	02-07-2022	10:30	44G0	57.45.997 N	010.18.877 E	83	9.76		78
82	02-07-2022	16:33	45G0	58.06.550 N	010.07.018 E	164	5.09		81
84	02-07-2022	22:02	46F9	58.49.089 N	009.42.544 E	158	11.96		86
88	03-07-2022	01:56	46G0	58.47.531 N	010.07.696 E	216	12.8		87
91	03-07-2022	07:34	46G0	58.51.675 N	010.41.679 E	102	9.86		90
94	03-07-2022	12:42	46G0	58.43.735 N	010.38.101 E	96	10.62		93
97	03-07-2022	23:41	45G0	58.19.584 N	010.27.590 E	325	5.76		96
100	04-07-2022	03:43	45G0	58.09.367 N	010.30.461 E	202	6.07		99
103	04-07-2022	15:22	44G0	57.52.981 N	010.57.239 E	87	6.43		102
105	04-07-2022	18:44	44G1	57.40.897 N	011.23.534 E	93	11.68		-
108	04-07-2022	23:34	44G0	57.36.174 N	010.53.717 E	27	11.95		107
112	05-07-2022	05:22	43G0	57.23.240 N	010.49.161 E	33	11.6		110, 111
114	05-07-2022	12:28	43G1	57.11.827 N	011.20.384 E	50	13.15		116
117	05-07-2022	17:11	43G1	57.05.875 N	011.59.032 E	57	12.38		-
120	06-07-2022	00:18	42G1	56.52.022 N	011.46.375 E	48	13.26		119, 122
125	06-07-2022	07:00	42G2	56.39.594 N	012.23.673 E	30	8.52		124
128	06-07-2022	11:56	42G1	56.35.823 N	011.45.371 E	36	11.66		127
131	06-07-2022	14:46	42G1	56.35.547 N	011.42.779 E	35	10.53		130
134	06-07-2022	21:52	41G1	56.15.342 N	011.05.748 E	23	11.72		133
136	07-07-2022	02:21	41G2	56.25.139 N	012.01.090 E	33	9.15		-
138	07-07-2022	08:08	41G2	56.12.057 N	012.00.645 E	26	8.88		-
140	07-07-2022	10:04	41G1	56.09.581 N	011.43.344 E	25	7.51		-

Table 8. WP2 station details for the Danish acoustic survey with R/V Dana in June-July 2022.

Station no.	Date dd-mm-yy	Time UTC	ICES Square	Position		Bottom depth m	Wind speed m/s	Seastate
				Latitude	Longitude			
9	25-06-2022	21:50	41F7	56.14.116 N	007.34.305 E	31	2.83	Not recorded in 2022
10	25-06-2022	22:04	41F7	56.14.075 N	007.33.646 E	30	3.12	
14	26-06-2022	02:26	41F7	56.14.385 N	007.25.478 E	30	6	
18	26-06-2022	11:34	41F6	56.14.280 N	006.05.248 E	45	6.59	
21	27-06-2022	00:23	42F7	56.45.984 N	007.42.277 E	32	3.04	
23	27-06-2022	04:58	42F6	56.49.121 N	006.41.389 E	36	6.39	
26	27-06-2022	10:32	42F5	56.49.023 N	005.59.039 E	48	6.99	
29	27-06-2022	13:54	42F6	56.59.414 N	006.06.913 E	41	6.8	
32	27-06-2022	19:48	43F6	57.28.999 N	006.07.048 E	83	5.97	
35	28-06-2022	02:17	45F6	58.14.031 N	006.10.249 E	281	3.97	
38	28-06-2022	10:00	44F6	57.49.989 N	006.32.573 E	320	3.64	
41	28-06-2022	15:56	43F6	57.15.640 N	006.32.873 E	72	2.89	
44	29-06-2022	00:27	43F7	57.24.961 N	007.00.017 E	114	4.89	
47	29-06-2022	10:43	43F7	57.27.495 N	007.27.651 E	147	4.72	
50	29-06-2022	13:57	43F7	57.17.127 N	007.26.652 E	61	6.61	
53	29-06-2022	22:16	44F7	57.31.645 N	007.53.979 E	178	7.64	
57	30-06-2022	14:12	44F7	57.44.501 N	007.39.366 E	426	6.77	
60	30-06-2022	21:42	44F8	57.47.030 N	008.19.227 E	447	6.78	
64	01-07-2022	04:27	44F9	57.36.096 N	009.04.959 E	37	5.64	
68	01-07-2022	12:02	44F8	57.59.481 N	008.51.316 E	236	4.1	
71	01-07-2022	22:44	44F9	57.58.873 N	009.31.088 E	224	9.14	
74	02-07-2022	01:46	44F9	57.51.655 N	009.36.311 E	72	10.63	
77	02-07-2022	05:50	44F9	57.39.720 N	009.44.385 E	45	8.43	
80	02-07-2022	10:46	44G0	57.46.092 N	010.19.432 E	84	8.24	
83	02-07-2022	16:53	45G0	58.06.490 N	010.07.077 E	164	4.97	
85	02-07-2022	22:25	46F9	58.49.189 N	009.41.604 E	189	10.8	
89	03-07-2022	02:23	46G0	58.47.610 N	010.07.197 E	233	12.29	
92	03-07-2022	07:53	46G0	58.51.840 N	010.41.755 E	102	9.69	
95	03-07-2022	12:59	46G0	58.43.985 N	010.37.763 E	99	12.25	
98	04-07-2022	00:10	45G0	58.19.898 N	010.27.668 E	312	5.96	
101	04-07-2022	04:12	45G0	58.09.491 N	010.30.477 E	203	6.47	
104	04-07-2022	15:37	44G0	57.53.270 N	010.57.729 E	88	9.58	
106	04-07-2022	19:00	44G1	57.40.791 N	011.23.754 E	92	11.67	
109	04-07-2022	23:45	44G0	57.36.203 N	010.53.680 E	27	12.22	
113	05-07-2022	05:32	43G0	57.23.329 N	010.49.104 E	34	10.64	
115	05-07-2022	12:40	43G1	57.11.792 N	011.20.411 E	50	11.91	
118	05-07-2022	17:22	43G1	57.05.967 N	011.59.194 E	58	10.94	
121	06-07-2022	00:30	42G1	56.52.055 N	011.46.534 E	47	12.59	
126	06-07-2022	07:10	42G2	56.39.639 N	012.23.641 E	29	8.21	
129	06-07-2022	12:06	42G1	56.35.891 N	011.45.435 E	36	10.71	
132	06-07-2022	14:55	42G1	56.35.603 N	011.42.760 E	35	11.61	
135	06-07-2022	22:03	41G1	56.15.412 N	011.05.775 E	23	11.66	
137	07-07-2022	02:32	41G2	56.25.105 N	012.01.213 E	33	8.26	
139	07-07-2022	08:20	41G2	56.12.046 N	012.00.611 E	26	9.65	
141	07-07-2022	10:13	41G1	56.09.608 N	011.43.312 E	26	5.6	