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THÜNEN

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Cruise Report
FRV „Solea" cruise 808
01. – 19.07.2022

The 2022 ICES Coordinated Acoustic Survey in the Skagerrak and Kattegat, the North Sea, West of Scotland and the Malin Shelf area (HERAS)

Cruise Leader: Dr. Matthias Schaber

Summary

The survey was part of an international hydroacoustic survey providing information on stock parameters of small pelagics (Acoustic Survey in the Skagerrak and Kattegat, the North Sea, West of Scotland and the Malin Shelf area, HERAS) coordinated by the ICES Working Group of International Pelagic Surveys (WGIPS). Denmark, Ireland, the Netherlands, Norway and Scotland also participated in the survey. In general, this survey provides the most important fisheries independent contribution to the assessment of herring stocks in the North Sea, Western Baltic Sea, Skagerrak/Kattegat as well as areas west of Scotland and the Irish Sea. The total survey area largely covers ICES Divisions 27.3.a, 27.4.a, 27.4.b and 27.6.a.

The survey design has been standardized across participants and the survey area is partitioned into 23 strata out of which four strata comprising the southern North Sea have been allocated to Germany and were covered during this survey. Main focus was set on herring (*Clupea harengus*) and sprat (*Sprattus sprattus*), whereas distribution patterns and abundance of anchovy (*Engraulis encrasicolus*) as well as sardine (*Sardina pilchardus*) were another objective of the survey.

Altogether, 1061 nautical miles of hydroacoustic transects were covered, which is substantially less than planned. Delays/interruptions due to Covid issues, adverse weather conditions and technical problems on board led to the loss of multiple survey days. These could not be fully compensated through an adapted survey design but ultimately led to only partial coverage of stratum 51 (1 transect dropped) and the omitting of stratum 131. Accordingly, the survey area could not be covered as planned.

Verteiler:

Schiffsführung FFS „Solea"
BA für Landwirtschaft und Ernährung (BLE) Fischereiforschung
BM für Ernährung und Landwirtschaft (BMEL), Ref. 614
BA für Seeschifffahrt und Hydrographie (BSH), Hamburg
Deutscher Angelfischerverband e.V.
Deutsche Fischfang-Union, Cuxhaven
Deutscher Fischereiverband Hamburg
Doggerbank Seefischerei GmbH, Bremerhaven
Erzeugergemeinschaft der Deutschen Krabbenfischer GmbH
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GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel
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LA für Landwirtschaft, Lebensmittels. und Fischerei (LALLF)
LFA für Landwirtschaft und Fischerei MV (LFA)
Landesverband der Kutter- u. Küstenfischer MV e.V.
Leibniz-Institut für Ostseeforschung Warnemünde
Thünen-Institut - Institut für Fischereiökologie
Thünen-Institut - Institut für Seefischerei
Thünen-Institut - Institut für Ostseefischerei
Thünen-Institut - Pressestelle, Dr. Welling
Thünen-Institut - Präsidialbüro
Thünen-Institut - Reiseplanung Forschungsschiffe, Dr. Rohlf
Fahrtteilnehmer*innen

The distribution of backscatter values allocated to clupeid fishes in general followed the observations made in previous years, with highest concentrations of schools in the southwestern stratum and along coastal areas in the southern German Bight. In the northern coastal stratum 71, overall NASC values registered were again higher than in the previous year, but with more detections of clupeid aggregations especially towards the western boundary of the stratum and occasionally more coastal in the northeastern area of that stratum.

To allocate biological information to echorecordings and for the collection of biological samples, 26 fishery hauls were conducted. As in the previous years, sprat contributed the bulk biomass to total catch weight and had -together with herring- the most frequent occurrence in the hauls. Herring mostly co-occurred with sprat in mixed schools. Herring catches were -despite the reduced coverage- distinctly higher than those in the previous year, and herring was widely distributed in the area. Sardines and anchovies were caught only on occasion and in relatively small quantities.

Vertical profiles of ambient hydrographic parameters were measured on 64 stations.

1. Cruise objectives

The following objectives were planned for SB808 HERAS:

- Calibration of hydroacoustic equipment
- Hydroacoustic measurements for the estimation of stock parameters (indices of abundance, SSB etc.) for the assessment of small pelagics (herring, sprat, sardine, anchovy) in the allocated survey area (strata 51, 61, 71 and 131)
- (Targeted) biological sampling including species composition and length-frequency/age distribution of key species in the survey area
- Measurements of hydrographic parameters (e.g. temperature and salinity) in the survey area

1.1 Survey design

The survey design has been standardized across participants. Where applicable, systematic parallel transect lines with randomized starting points and with transects running perpendicular to lines of bathymetry were followed. Planned survey effort was maintained at a similar level to the previous years. Altogether, 23 strata were covered by all participants in the 2022 HERAS survey, out of which four had been allocated to Germany by the HERAS survey coordinator of the ICES Working Group of International Pelagic Surveys WGIPS (Fig. 1) (ICES, 2022).

2. Cruise narrative and preliminary results

2.1 Cruise narrative

The scientific equipment was loaded in the morning of July 1st. Unlike planned, the departure of FRV “Solea” was delayed by one day on short notice due to a lack of personnel after a mandatory Covid-rapid test was positive. FRV “Solea” left Cuxhaven port on July 2nd to sail to the starting point of the easternmost transect in stratum 61 (area around Helgoland Island) where survey operations commenced. On this day, the calibration of the hydroacoustic equipment/scientific echosounders was also accomplished. Survey operations in S61 then were interrupted and the vessel continued to northernmost transect in stratum 71, where survey operations commenced on July 3rd. In the following days, that stratum was covered in partly inclement weather and accomplished on the evening of July 6th. Due to severe weather preventing further survey operations, the survey was interrupted and FRV “Solea” sought shelter on Helgoland Island. On July 8th, the vessel was transferred to stratum 51, where due to improved weather conditions survey operations were deemed feasible in the following period (unlike in the more easterly strata).

Stratum 51 was covered from July 9th on, with minor technical issues on July 11th requiring interruption of survey operations for about 1 hour and severe technical issues on the next day requiring a stop of survey operations and a return of FRV “Solea” to Cuxhaven port for repair. This led to stratum 51 being not fully covered with the two northernmost transects missing.

After repair, the missing transects in stratum 61 were covered from July 14th on. Due to distinctly improved weather conditions during the survey operations in that stratum, it was feasible to make use of the remaining survey time to relocate to stratum 51 and cover one of the missing transects there, as well as (for comparison and for acoustic data allocation) to sample a short section of ca. 30 nautical miles in stratum 131 while switching transects in stratum 61. Altogether, stratum 61 was accomplished in the afternoon of July 18th. The remaining survey time did not allow to accomplish further transects in strata 51 or 131, since this would require long steaming distances to get to the transects as well as on the transects and on the way back to port. Accordingly, HERAS 2022 survey operations ended in the evening of July 18th and FRV "Solea" steamed back to Cuxhaven port where the survey ended on July 19th.

Colleagues on board FRV "Tridens" (NL) offered to cover that transect during their HERAS survey in order to have that stratum fully sampled.

Altogether, the strata allocated for the 2022 HERAS survey during SB808 were not fully covered as planned, with stratum 131 remaining largely unsampled. The total transect distance covered was 1061 nautical miles, which is ca 700 nautical miles short of the planned coverage.

2.2 Hydroacoustics

2.2.1 Calibration

All transducers of the Simrad EK80 scientific echosounder (38, 70, 120 and 200 kHz) were calibrated on July 2nd in the northeastern German Bight (54°32'300'' N, 007°51'460'' E). All transducers were calibrated in CW-mode as well as in FM-mode with good/acceptable results based on calculated RMS-values. Transducer parameters from combined calibration results were applied for data-collection and post-processing of survey data.

2.2.2 Echo recording

Hydroacoustic data were recorded continuously along the transects with a Simrad EK80 scientific echosounder with hull-mounted 38, 70, 120 and 200 kHz transducers at a standard ship speed of 10 kn. Transducer and sample settings applied were in accordance with the specifications provided in the HERAS survey manual (ICES, 2015).

Survey operations were conducted during daytime between 4 am and 6 pm UTC to allocate for the diurnal activity patterns of clupeids schooling at daytime and dispersing and migrating into shallower water layers during nighttime, rendering the fishes indiscernible from other scattering sources and distributed within the transducer nearfield. Post-processing and analysis of data were conducted with Echoview 12 software (Echoview Software Pty Ltd, 2021).

Clupeids in the survey area are discernible on echograms by their typical pillar shaped schools, either sitting on the seafloor or in pelagic layers. The Nautical Area Scattering Coefficient (NASC) values measured and allocated to clupeids through post-processing of the data were not distributed evenly throughout the survey area. As in the previous years, transect sections and regions with particularly high clupeid densities alternated with sections without any detections of clupeid schools. The overall distribution of clupeid NASC measured mostly resembled patterns observed in the previous years, but appeared slightly different in some strata: In S51, dense aggregations of clupeids were mostly recorded on the western boundary off the British coast and towards the center of the stratum on more northerly transects. Registrations on the eastern stratum boundary off the Dutch coast were lower but included occasional detections of large schools. In stratum 61, registrations on the easternmost transect in the vicinity of Helgoland were dense as in the previous years. Other than in 2021, NASC values measured on the more westerly transects in that stratum appeared both higher as well as more aggregated in the southwestern stratum area and closer to the coast. Registrations in the northern stratum 71 once again appeared higher than in the previous year but in contrast to 2021 were mostly recorded in the "offshore" areas along the western boundary of that stratum, with occasional high densities measured in northeastern coastal areas. Stratum 131 was not covered with the exception of ca. 30 nautical miles of transect that appeared similar in fish densities as the transect sections in adjacent strata of in region. Other than in previous years, when NASC values were generally highest in the two southern strata

51 and 61 with fishes concentrating in the warm, mixed layers in the shallow southern and southeastern North Sea (see hydrography), notable densities were also observed in stratum 71 in 2022. While echoes from the former two strata can based on corresponding targeted pelagic trawl hauls largely be allocated to sprat (see below) with some contributions of herring, the proportions of herring were occasionally distinctly higher in stratum 71.

2.3 Biological sampling (N. Rohlf)

Altogether, twenty-five valid trawl hauls were conducted during the summer acoustic survey. Trawling was carried out using a PSN 388 pelagic trawl ("Krake"). Trawl duration varied between 5 and 33 minutes, but usually was set to 30 minutes. Hauls were conducted according to echo signals. Additionally, exclusion/validation hauls were shot in areas with echo signals of unclear origin. The positions of all hauls are depicted in Figures 2-4. Catches were sorted according to species, and length- and weight-distributions of individual species were measured. Of all clupeids (herring, sprat, sardine and anchovy), 10 individuals per 0.5 cm length-class were sampled per trawl. Their individual weight, sex and maturity stages were determined and the otoliths were sampled to enable age estimation.

In total, 15 different fish species, one cephalopod species and one cyclostome were caught during the survey. A detailed overview on catch compositions (CPUE in kg $30min^{-1}$) of all 25 valid trawl hauls is given in Tab. 1.

As in the previous years, sprat contributed the bulk of biomass of total catch weight (7.935 t, i. e. 82%). Sprat were, together with herring, most present in the catches (occurring in 21 hauls, resp. 84%). The amount of Herring was at 1.274 t. This is 13% of total catches, and herring was widely distributed in the area occurring in 84% of the catches. However, catches alone are not representative for abundance of small pelagics. Detailed conclusions on abundance cannot be given until echo integration is accomplished and trawl haul and hydroacoustic data are combined.

A detailed overview on numbers, weights and mean lengths of herring, sprat, sardines and anchovies sampled is given in Tab. 2a-d, together with their proportion of the total catch. Figures 5 - 8 show length distributions of these species as derived from total catches. Herring lengths ranged from 5 to 17 cm. The length distribution was dominated by small fish below 11 cm total length at peaks around 7.75 and 10.25 cm. Larger herring were present in the area, but only in small numbers. Sprat lengths ranged from 4 to 14 cm. Their length frequency distribution was highly comparable to the preceding year.

Sardines and anchovies were caught only on occasion and in relatively small quantities (1 and 6 hauls, respectively).

In 2021, blue whiting (*Micromesistius poutassou*) was caught for the first time in the southern area (mainly stratum 51) of the HERAS survey. However, this species did not occur in pelagic trawl hauls in 2022.

Individual and combined abundance estimates for herring and sprat derived from survey data will be available after a final evaluation, combination and analysis of acoustic and trawl data with StoX software (Johnsen et al., 2019). This will be accomplished during a post-cruise meeting scheduled for November 2022 at the Institute of Marine Research IMR, Bergen/Norway. Results will subsequently be presented to ICES WGIPS.

2.4 Hydrography

Vertical profiles of temperature and salinity were measured with a SeaBird SBE CTD-probe on a station grid covering the covered survey area. Hydrography measurements were either conducted directly after (or before) a trawl haul or in regular intervals along the cruise track as well as the starting and end point of each transect. Altogether, 64 CTD casts were conducted during this survey.

Surface temperatures in the survey area ranged from around 16° C in the northerly Southern Bight area as well as the outer German Bight to over 19° C off the southern Dutch coast. Temperatures exceeding 18 °C

were generally measured along the Dutch coasts and in the southern areas of stratum 51 (Fig. 9). As in the previous years in summer, the water column was mixed in shallow coastal areas and in the shallow southern part of the North Sea south of ca 54° N. Further northward, a distinct thermocline appeared separating the warm surface water from cold deeper layers where temperatures partly dropped to around 9° C in the area measured.

Salinities ranged from ca. 31 to 35 PSU, with the lower salinities measured along the Danish and German coasts in the eastern German bight. No stratification in salinity was evident.

3. Survey participants

Dr. Matthias Schaber (cruise leader)	Hydroacoustics/Hydrography	TI-SF
Dr. Sven Gastauer	Hydroacoustics/Hydrography	TI-SF
Dr. Norbert Rohlf	Fish lab/Biology	TI-SF
Jörg Appel	Fish lab/Biology	TI-SF
Lea Hartkens	Hydroacoustics/Fish lab	TI-SF
Gitta Hemken	Fish lab/Biology	TI-SF

4. References

Echoview Software Pty Ltd (2021). Echoview software, version 12.1.74. Echoview Software Pty Ltd, Hobart, Australia.

ICES (2022). Working Group of International Pelagic Surveys (WGIPS). ICES Scientific Reports 4(82). 622 pp. http://doi.org/10.17895/ices.pub.20502822

ICES (2015). Manual for International Pelagic Surveys (IPS). Series of ICES Survey Protocols SISP 9 – IPS. 92 pp.

Johnsen, E., Totland, A., Skålevik, Å., Holmin, A. J., Dingsør, G. E., Fuglebakk, E., & Handegard, N. O. (2019). StoX: An open source software for marine survey analyses. Methods in Ecology and Evolution. 10:1523 –1528. https://doi.org/10.1111/2041-210X.13250

5. Acknowledgements

I hereby thank the crew of FRV “Solea” and Captain S. Meier, Captain M. Jakobi as well as all participants for their outstanding cooperation and commitment that facilitated the accomplishment of this survey.

(Dr. M. Schaber, TI-SF / Scientist in charge)

Figures

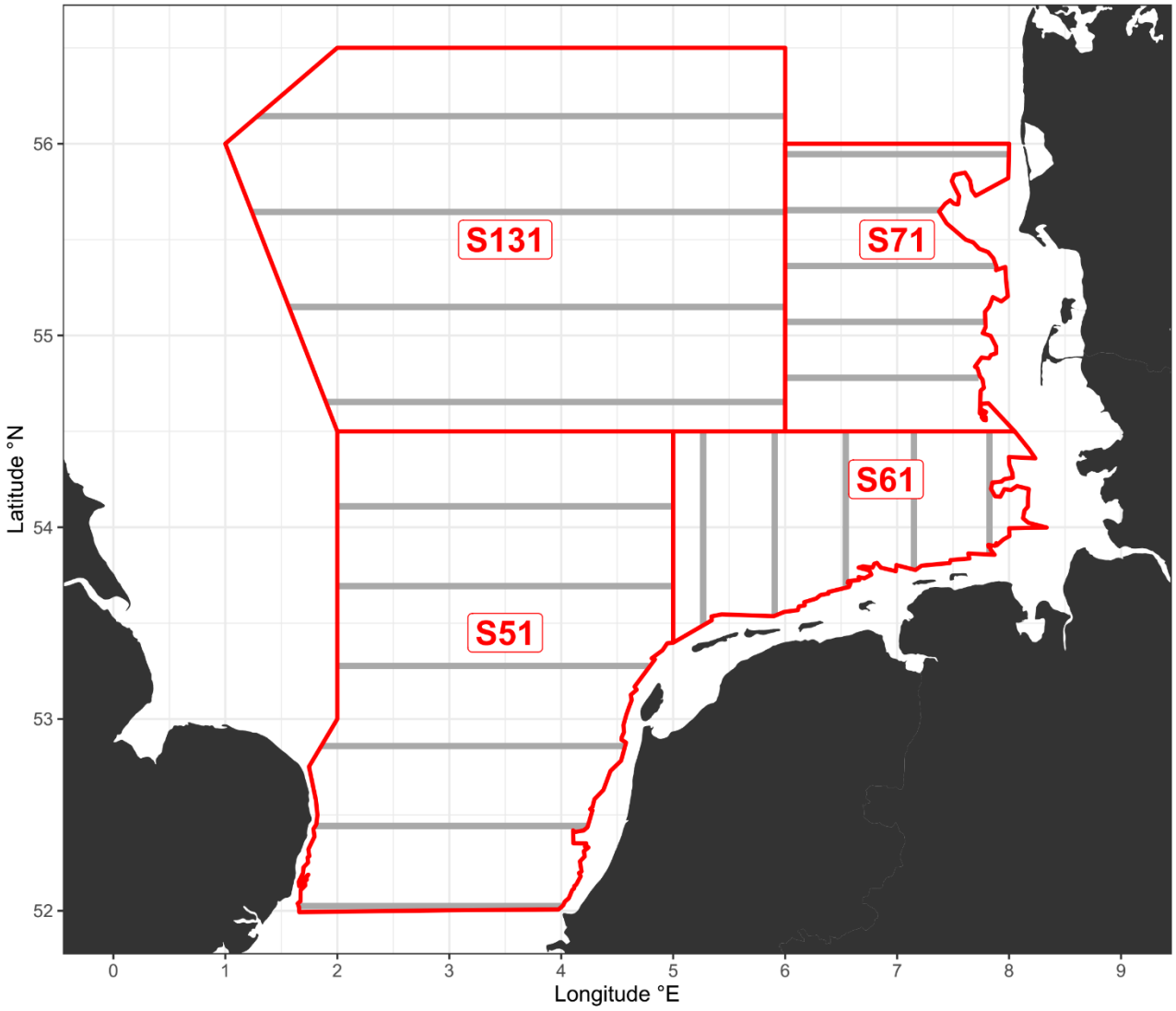

Figure 1: FRV "Solea" cruise 808/2022. Survey plan. Total survey area and strata covered (S51, S61, S71, S131) outlined in red. Planned transect lines depicted as grey lines. Refer to Figures 2 and 3 for realized transects/accomplished strata.

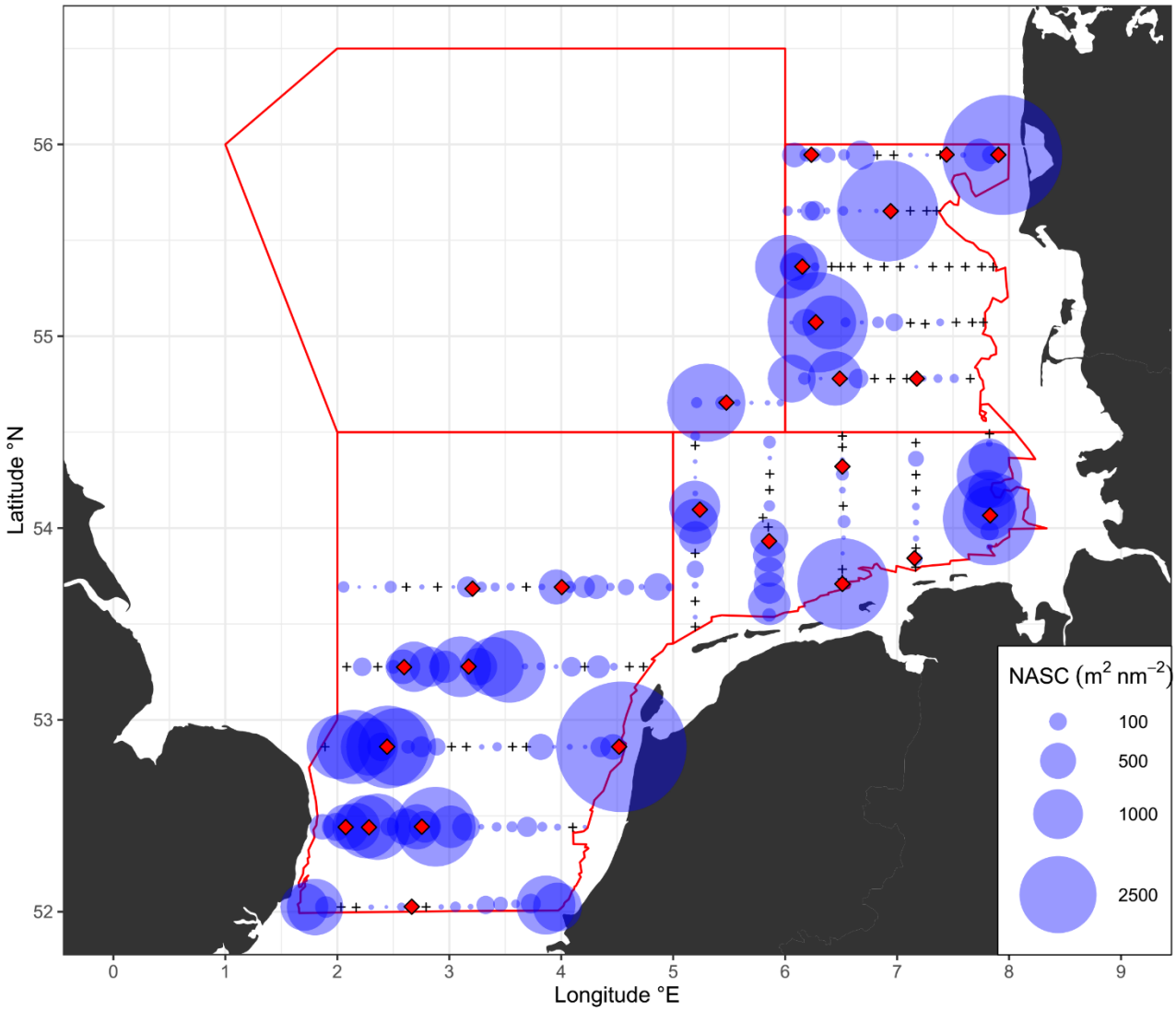

Figure 2: FRV "Solea" cruise 808/2022. Mean aggregated Nautical Area Scattering Coefficient (NASC in m^2nm^{-2}) measured (blue dots, 5 nmi intervals) along the realized transects allocated to clupeids for further dis-aggregation and to be used in abundance/biomass estimates. Empty intervals indicated by crosses. Red dots indicate (valid) trawl hauls targeting the registered fish aggregations. Total survey area and strata outlined in red.

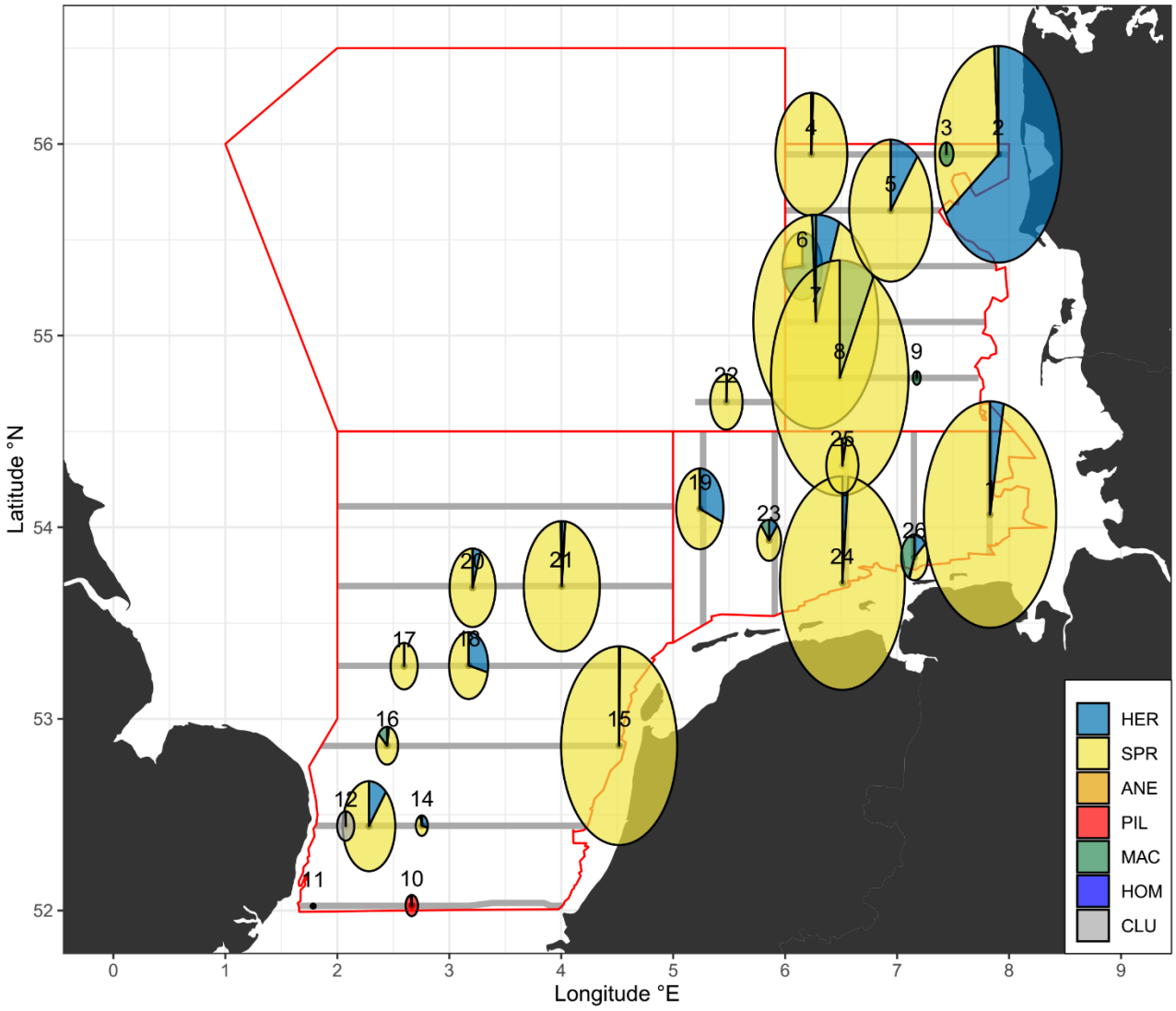

Figure 3: FRV "Solea" cruise 808/2022. Catches (kg 30min^{-1}) and catch composition of pelagic/schooling fishes (ANE - anchovy *Engraulis encrasicolus*, HER - herring *Clupea harengus*, HOM - horse mackerel *Trachurus trachurus*, MAC - mackerel *Scomber scombrus*, PIL - sardine *Sardina pilchardus*, SPR - sprat *Sprattus sprattus*, CLU – aggregated mixture of mostly juvenile herring and sprat). Numbers indicate haul/station number. Survey area/strata outlined in red. Accomplished transects depicted as grey lines.

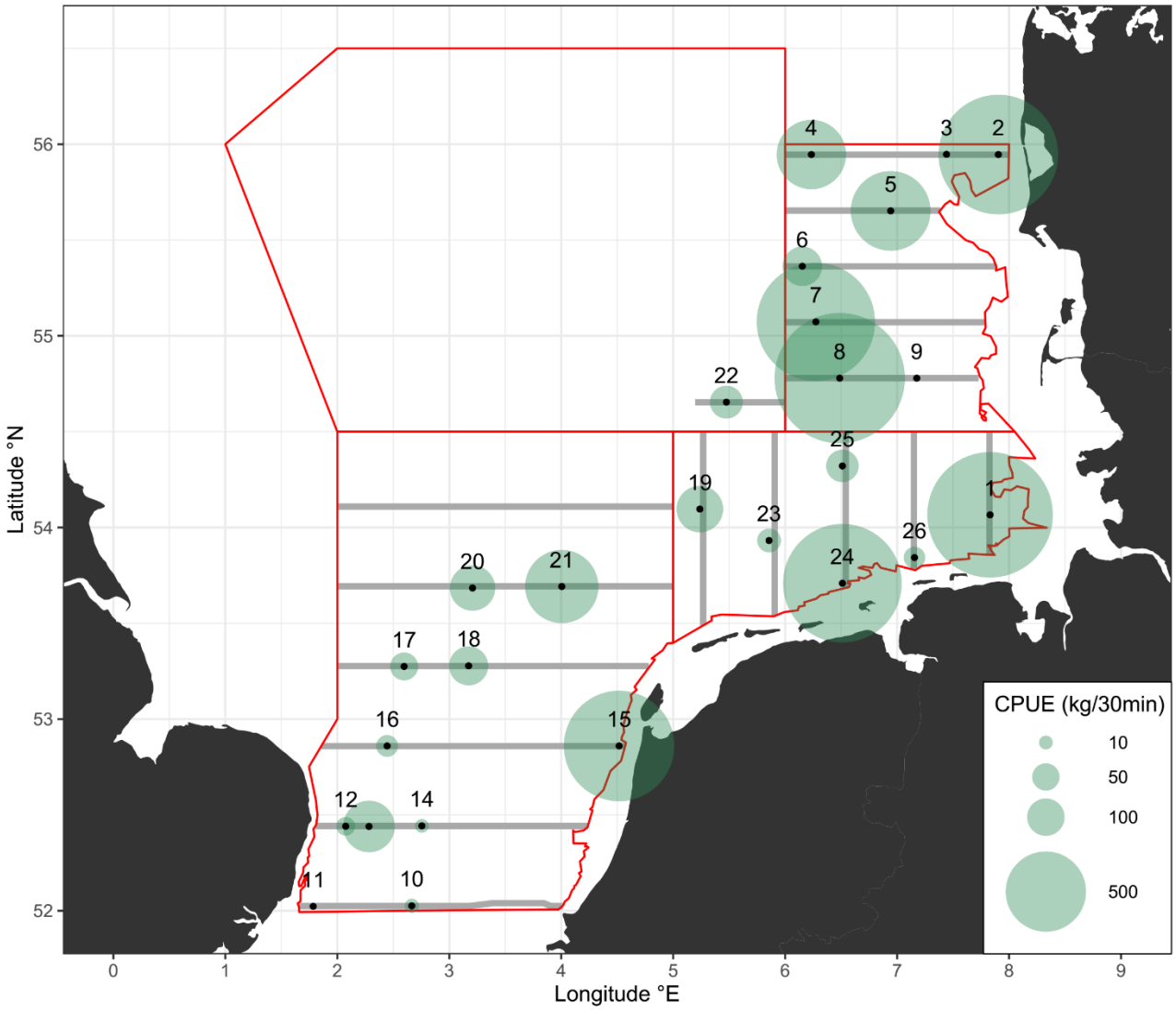

Figure 4: FRV "Solea" cruise 808/2022. Combined clupeid (herring *Clupea harengus*, sprat *Sprattus sprattus*, sardine *Sardina pilchardus*, and anchovy *Engraulis encrasicolus*) catches (kg 30min^{-1}). Numbers indicate haul/station number. Survey area/strata outlined in red. Accomplished transects depicted as grey lines.

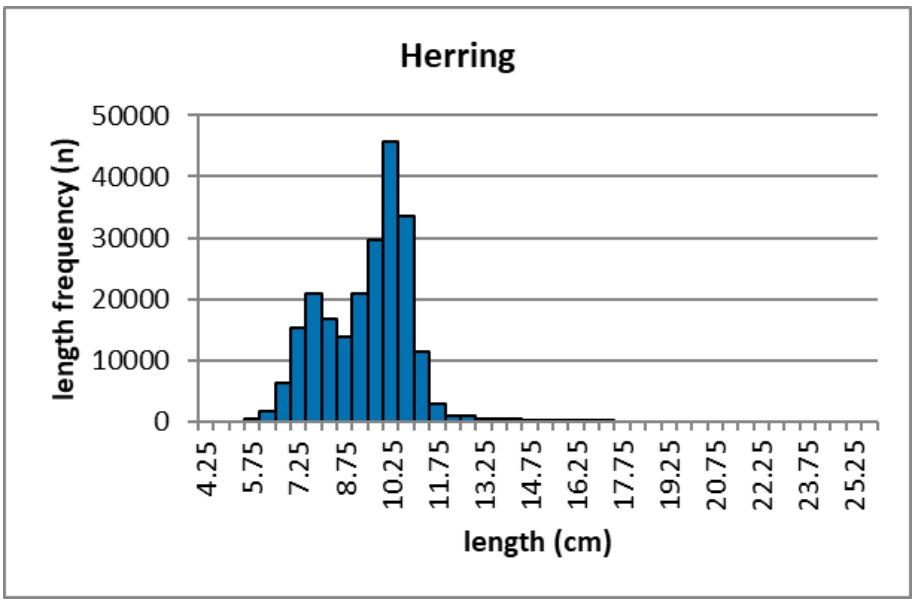

Figure 5: FRV "Solea" cruise 808/2022. Herring (*Clupea harengus*) combined length-frequency distribution.

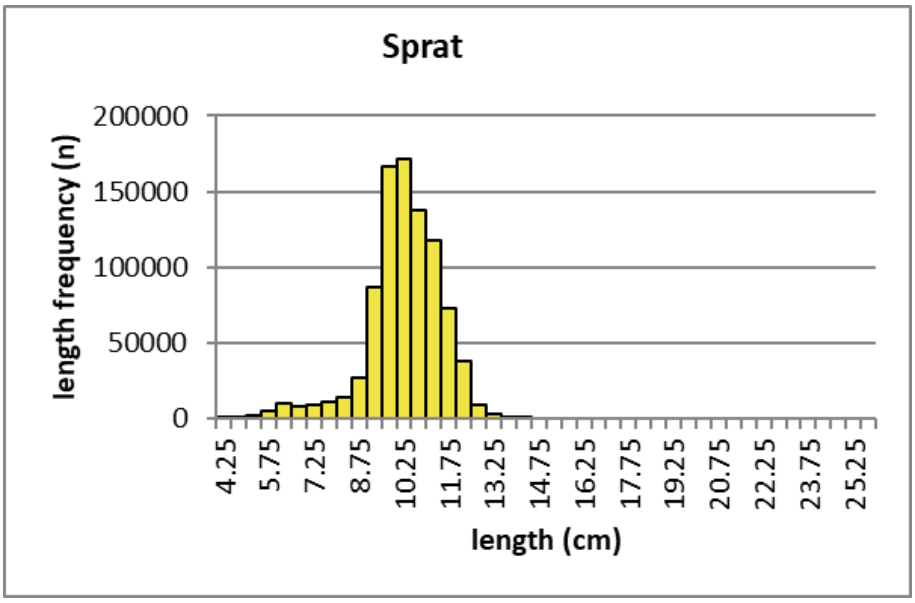

Figure 6: FRV "Solea" cruise 808/2022. Sprat (*Sprattus sprattus*) combined length-frequency distribution.

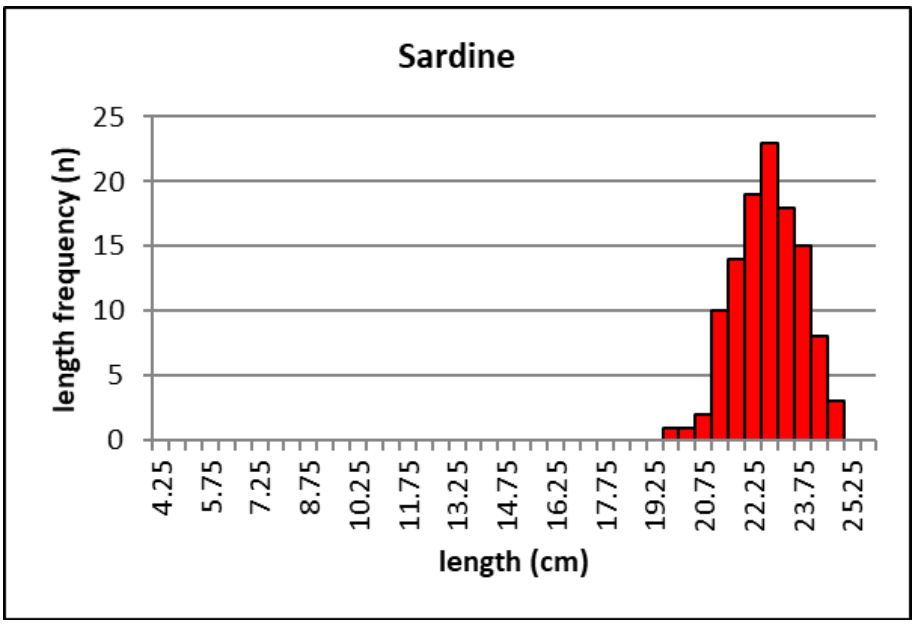

Figure 7: FRV "Solea" cruise 808/2022. Sardine (*Sardina pilchardus*) combined length-frequency distribution.

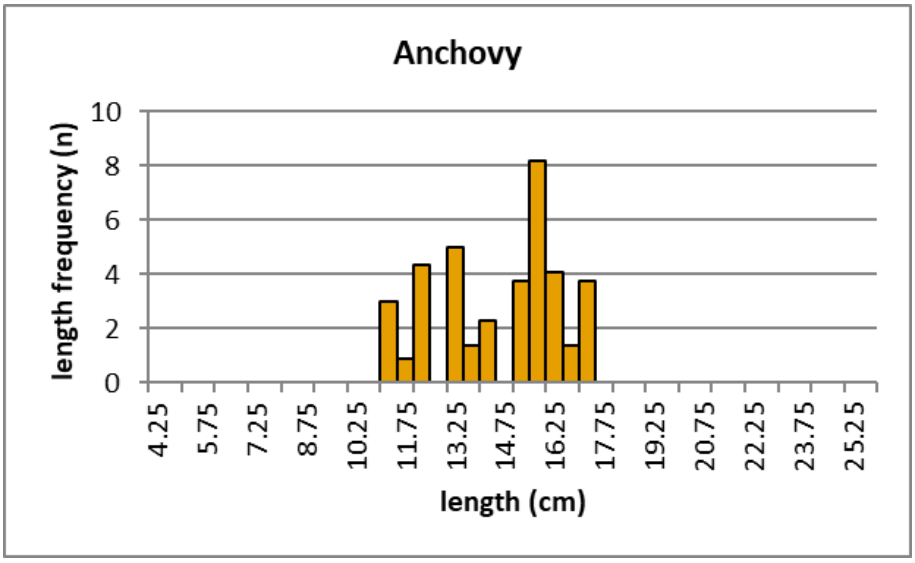

Figure 8: FRV "Solea" cruise 808/2022. Anchovy (*Engraulis encrasicolus*) combined length-frequency distribution.

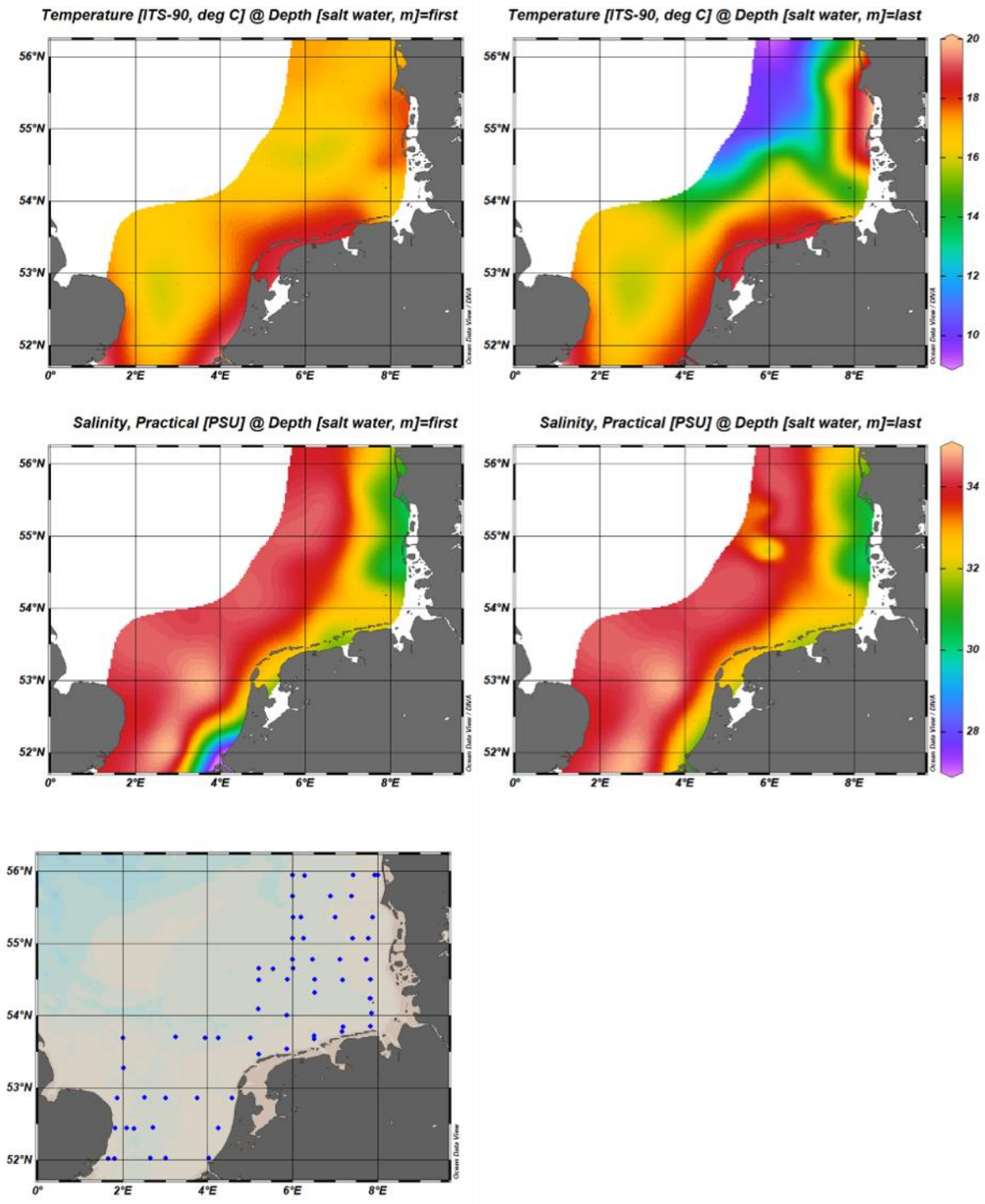

Figure 9: FRV "Solea" cruise 808/2022. Hydrography. CTD stations are depicted as blue dots in the area map (lower panel). Temperature (°C) (upper panels) and Salinity (PSU) (middle panels) near the surface (left) and near the seafloor (right).

Tables

Table 1: FRV "Solea" cruise 808/2022. Catch composition (CPUE in kg) standardized to 30 minutes tow duration (valid hauls).

HAUL	STATION	TOTAL (kg/30 min)	*ALLOTEUTHIS SUBULATA*	*AMMODYTES MARINUS*	*BELONE BELONE*	*CLUPEA HARENGUS*	*CLUPEIDAE*	*ECHIICHTHYS VIPERA*	*ENGRAULIS ENCRASICOLUS*	*EUTRIGLA GURNARDUS*	*GOBIIDAE*	*HYPEROPLUS LANCEOLATUS*	*LAMPETRA FLUVIATILIS*	*LIMANDA LIMANDA*	*MERLANGIUS MERLANGUS*	*SARDINA PILCHARDUS*	*SCOMBER SCOMBRUS*	*SPRATTUS SPRATTUS*	*SYNGNATHUS ROSTELLATUS*	*TRACHURUS TRACHURUS*	NUMBER OF SPECIES
1	2	1256.3				41.8									0.1		0.4	1214.0			4
2	6	1151.3		0.1		755.5			0.14	1.3							11.6	382.6			6
3	7	30.1		16.3						0.1		0.0		0.1	0.0		13.5				6
4	8	371.1			0.4	2.8				0.9					0.0		0.3	366.6			6
5	11	494.3				55.1				0.8							0.3	438.1			4
6	15	112.8				81.9				0.7					0.7			29.5			4
7	18	1122.4				68.6				0.1					0.5		10.7	1042.4			5
8	22	1356.8				112.1				0.7								1244.1			3
9	23	4.5													0.0		4.5				2
10	27	11.0						0.0								10.7	0.2			0.0	4
12	31	386.1	1.5				21.0	1.0			0.0			0.5	362.1						6
13	32	157.4	0.0			17.1		2.1		0.2					2.5			135.5			6
14	33	11.2				2.9		0.4							0.7		0.4	6.9		0.0	6
15	35	967.5				2.7			0.06									964.8			3
16	38	39.1	0.0			0.9		0.1		0.1					4.0		5.0	29.0			7
17	41	53.2	0.0			0.3		0.3			0.0				0.0			52.6			6
18	42	109.8				30.9			0.08					0.4				78.4			4
19	45	145.4	0.1			44.0			0.02	0.2		0.0			0.0		0.2	100.9			8
20	50	151.4	0.0			8.7			0.02	0.2		0.1	0.1					142.4			7
21	51	415.8	0.2			6.1				0.1					0.0		1.9	407.5			6
22	53	77.3			0.5	0.3				1.5		0.0			0.1			75.0			6
23	57	41.5				5.0				0.1							4.8	31.6			4
24	60	1118.7	0.1			17.2												1101.5			3
25	61	73.9	0.0			2.9									0.0		0.4	70.6	0.0		6
26	64	51.2				7.6			0.49								21.9	21.2	0.0	0.0	6
total (kg)		**9710.1**	1.9	16.4	0.8	1264.2	21.0	3.8	0.8	7.1	0.0	0.2	0.1	1.0	370.8	10.7	76.2	7935.0	0.0	0.0	
proportion (%)			0.0	0.2	0.0	13.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	3.8	0.1	0.8	81.7	0.0	0.0	
number of catches			9	2	2	21	1	6	6	14	2	4	1	3	15	1	15	21	2	3	
presence (%)			36	8	8	84	4	24	24	56	8	16	4	12	60	4	60	84	8	12	

Table 2a: FRV "Solea" cruise 808/2022. Numbers, weights and mean lengths of **herring** (*Clupea harengus*) and according proportion of total clupeid catch (normalized to 30 minutes tow duration), if clupeid catch >0.

		Total	clupeid	clupeid	herring					herring
		Catch	catch	portion	catch	count	range (cm)			(% clups)
Haul	Stat	(kg)	(kg)	(%)	(kg)	(n)	min	max	mean	
1	2	1256.3	1255.8	100%	41.8	14277	6.25	9.75	7.7	3%
2	6	1151.3	1138.3	99%	755.5	107569	8.75	12.75	10.3	66%
4	8	371.1	369.4	100%	2.8	178	7.75	16.25	12.8	1%
5	11	494.3	493.2	100%	55.1	5782	9.25	15.25	11.2	11%
6	15	112.8	111.4	99%	81.9	28755	5.75	11.25	7.7	74%
7	18	1122.4	1111.0	99%	68.6	10129	8.75	14.25	10.1	6%
8	22	1356.8	1356.2	100%	112.1	26087	6.25	15.25	8.7	8%
13	32	157.4	152.6	97%	17.1	2746	6.75	17.25	9.4	11%
14	33	11.2	9.8	87%	2.9	1000	5.75	11.75	7.5	30%
15	35	967.5	967.5	100%	2.7	367	8.25	13.25	10.2	0%
16	38	39.1	29.9	76%	0.9	125	7.75	14.75	10.0	3%
17	41	53.2	52.9	99%	0.3	42	7.75	15.25	9.7	1%
18	42	109.8	109.4	100%	30.9	5895	7.75	10.75	9.2	28%
19	45	145.4	144.9	100%	44.0	8683	6.75	12.25	9.1	30%
20	50	151.4	151.0	100%	8.7	1461	7.25	15.25	9.6	6%
21	51	415.8	413.5	99%	6.1	1311	7.25	16.75	9.1	1%
22	53	77.3	75.3	97%	0.3	26	9.75	14.25	11.7	0%
23	57	41.5	36.6	88%	5.0	447	9.75	16.25	11.6	14%
24	60	1118.7	1118.7	100%	17.2	6139	6.75	11.75	7.8	2%
25	61	73.9	73.5	99%	2.9	344	8.25	16.25	10.5	4%
26	64	51.2	29.2	57%	7.6	1487	8.25	10.25	9.2	26%

Table 2b: FRV "Solea" cruise 808/2022. Numbers, weights and mean lengths of **sprat** (*Sprattus sprattus*) and according proportion of total clupeid catch (normalized to 30 minutes tow duration), if clupeid catch >0.

		Total	clupeid	clupeid	sprat					sprat
		Catch	catch	portion	catch	count	range (cm)			(% clups)
Haul	Stat	(kg)	(kg)	(%)	(kg)	(n)	min	max	mean	
1	2	1256.3	1255.8	100%	1214.0	89378	8.25	11.25	9.5	97%
2	6	1151.3	1138.3	99%	382.6	39874	9.75	11.75	10.7	34%
4	8	371.1	369.4	100%	366.6	36660	9.75	13.25	11.0	99%
5	11	494.3	493.2	100%	438.1	39403	9.75	14.25	11.2	89%
6	15	112.8	111.4	99%	29.5	3471	8.75	13.75	10.5	26%
7	18	1122.4	1111.0	99%	1042.4	124158	9.25	13.25	10.7	94%
8	22	1356.8	1356.2	100%	1244.1	166155	8.75	12.25	10.1	92%
13	32	157.4	152.6	97%	135.5	41511	5.75	11.75	7.6	89%
14	33	11.2	9.8	87%	6.9	3933	4.25	13.75	5.8	70%
15	35	967.5	967.5	100%	964.8	80010	8.25	12.75	11.5	100%
16	38	39.1	29.9	76%	29.0	3450	7.75	12.75	10.2	97%
17	41	53.2	52.9	99%	52.6	5306	6.75	13.25	10.9	99%
18	42	109.8	109.4	100%	78.4	19794	5.75	11.75	8.1	72%
19	45	145.4	144.9	100%	100.9	12821	8.25	12.75	10.2	70%
20	50	151.4	151.0	100%	142.4	15292	9.25	13.25	10.7	94%
21	51	415.8	413.5	99%	407.5	41116	8.25	13.75	11.0	99%
22	53	77.3	75.3	97%	75.0	6785	10.25	12.75	11.3	100%
23	57	41.5	36.6	88%	31.6	2677	9.75	13.25	11.5	86%
24	60	1118.7	1118.7	100%	1101.5	149035	8.25	13.25	10.1	98%
25	61	73.9	73.5	99%	70.6	5585	9.25	14.25	11.8	96%
26	64	51.2	29.2	57%	21.2	2206	9.75	12.25	10.8	72%

Table 2c: FRV "Solea" cruise 808/2022. Numbers, weights and mean lengths of **sardine** (*Sardina pilchardus*) and according proportion of total clupeid catch (normalized to 30 minutes tow duration).

		total	clupeid	clupeid	pilchard					pilchard
		catch	catch	portion	catch	count	range (cm)			(% clups)
Haul	Stat	(kg)	(kg)	(%)	(kg)	(n)	min	max	mean	
10	27	11.0	10.7	97%	10.7	114	19.75	24.75	22.7	100%

Table 2d: FRV "Solea" cruise 808/2022. Numbers, weights and mean lengths of **anchovy** (*Engraulis encrasicolus*) and according proportion of total clupeid catch (normalized to 30 minutes tow duration).

		total	clupeid	clupeid	anchovy					anchovy
		catch	catch	portion	catch	count	range (cm)			(% clups)
Haul	Stat	(kg)	(kg)	(%)	(kg)	(n)	min	max	mean	
2	6	1151.3	1138.3	99%	0.14	4	17.25	17.25	17.25	0.01%
15	35	967.5	967.5	100%	0.06	6	11.25	12.25	11.75	0.01%
18	42	109.8	109.4	100%	0.08	5	13.25	13.25	13.25	0.07%
19	45	145.4	144.9	100%	0.02	2	11.75	14.25	13.00	0.02%
20	50	151.4	151.0	100%	0.02	1	15.25	15.25	15.25	0.01%
26	64	51.2	29.2	57%	0.49	21	12.25	16.75	15.38	1.67%