

Cruise Report
FRV „Solea“ cruise 794
30.06. – 20.07.2021

The 2021 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 IIIa, IVa, IVb and VIa.

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, 1612 nautical miles of hydroacoustic transects were covered, which is slightly less than planned. Adverse weather conditions during the survey led to the loss of a few survey days which had to be compensated through an adapted survey design. Accordingly, transect spacing was increased and transects were dropped in stratum 131 reducing the amount of transects covered in that stratum from four (planned) to three. In general, the whole survey area was covered and all strata were sampled.

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
 Euro-Baltic Mukran
 GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel
 Kutter- und Küstenfisch Sassnitz

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 southern strata and along coastal areas. In the northern coastal stratum 71, overall NASC values registered were higher than in the previous year, with more detections of clupeid aggregations throughout the stratum and especially towards the eastern coastal boundary of the stratum. The other strata sampled showed highly similar NASC distributions as in 2020. To allocate biological information to echorecordings and for the collection of biological samples, 42 fishery hauls were conducted. As in previous years, sprat contributed the bulk biomass to total catch weight, although whiting had the most frequent occurrence in the hauls. Herring often co-occurred with sprat in mixed schools. Herring catches were lower than those in the previous year, but herring was widely distributed in the area. Sardines and anchovies were caught only on occasion and in relatively small quantities. A first was the observation of an unprecedented occurrence and distribution of juvenile blue whiting (*Micromesistius poutassou*) in the southern and southwestern survey area.

Vertical profiles of ambient hydrographic parameters were measured on 99 stations.

1. Cruise objectives

The following objectives were planned for SB794 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 2021 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, 2021).

2. Cruise narrative and preliminary results

2.1 Cruise narrative

The scientific equipment was loaded in the morning of June 30th. Then, FRV "Solea" left Cuxhaven port to sail to the area around Helgoland Island for the calibration of the hydroacoustic equipment/scientific echosounders. After accomplishing the calibration in the evening, the vessel continued to the northernmost transect in stratum 71, where survey operations commenced on July 1st.

Stratum 71 was accomplished on the afternoon of July 4th, when sampling was continued in stratum 61 (southern German Bight). In the following days, survey operations had to be interrupted for a certain time due to deteriorating weather conditions on several occasions. After covering all transects in that stratum, survey operations commenced on transect 3 in stratum 51 (southwestern North Sea/English Channel) on July 8th. That transect was interrupted in the evening of July 8th and FRV "Solea" continued to the southernmost transect of that stratum to successively cover and accomplish the stratum from south to north. Due to the preceding loss of survey time due to occasional bad weather periods, the survey effort in stratum 131 had to be reduced, i.e. one transect (out of the 4 planned) had to be omitted and the transect spacing had to be increased. On July 15th, hydroacoustic sampling started on the southwestern transect 1 of stratum 131. Survey work was interrupted on 4°15' E in the afternoon due to deteriorating weather conditions. Since weather forecast predicted unsuitable conditions in the eastern part of stratum 131, FRV "Solea" continued northward to transect 2 to commence the survey the following day, but then sea state and weather

conditions prevented continuation of survey work. Instead, the vessel steamed to the northernmost transect 3 to accomplish ca. 30 nautical miles of sampling in the western section of that transect on July 16th. Afterwards, the remaining transects/transect sections were accomplished and stratum 131 as well as the overall survey work were accomplished in the afternoon of July 19th, when FRV "Solea" set sail for Cuxhaven port. There the 2021 German HERAS survey ended on July 20th.

Altogether, all planned strata were covered during SB794, however with a reduced overall transect length and increased inter-transect spacing in one stratum (S131). The total transect distance measured (excluding inter-transects and maneuvering) was 1612 nautical miles (ca. 150 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 prior to the beginning of the survey on June 30th near Helgoland Island in the German Bight. 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. In some instances, the sampling of hydroacoustic data was extended to ca. 9 – in two instances 10:00 and 10:50- pm in areas with low or no clupeid signals to make up lost survey time (see below) or to be able to accomplish a transect without losing time steaming to the next transect the following day. This is considered uncritical since the light intensity during that time was still high without any dispersion of schools occurring until after the end of daily survey operations. 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 sometimes long 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 recorded on the western boundary off the British coast as well as in the center of the stratum on more northerly transects, including occasional registrations of schools on the eastern stratum boundary off the Dutch coast. While NASC values were again particularly high on the easternmost transect in S61 around Helgoland, values measured along the southern, coastal boundaries of that stratum were comparatively low. Instead, apart from the dense aggregations of fishes around Helgoland and in the east, densities of fishes appeared highest rather distant from the coast. Overall higher NASC values than in the previous year were registered in the northern coastal stratum 71, with more detections of clupeid aggregations throughout the stratum and especially towards the eastern coastal boundary of the stratum. In stratum 131, echorecordings attributable to clupeids were low and mostly restricted to the eastern part of the southernmost transect as a continuation of the aggregations recorded in the southerly adjacent stratum 51. As in previous years, 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). Echoes from those two strata can mostly be allocated to sprat (see below), although in this area - based on corresponding targeted hauls - herring (in S61) and blue whiting

(*Micromesistius poutassou*, in S51) occasionally contributed significantly to the overall aggregated NASC measured and allocated to clupeids/small pelagics.

2.3 Biological sampling (N. Rohlf)

Forty-two trawl hauls (41 valid) were conducted during the German HERAS 2021 survey. Trawling was carried out using a PSN 388 pelagic trawl ("Krake"). Trawl duration varied between 5 and 40 minutes, but usually was set to 30 minutes. Hauls were conducted according to echo registrations with supporting information collected through employing an omnidirectional sonar CS90 during the hauls. Additionally, exclusion/validation hauls were shot in areas with echo signals of unclear origin. The positions of all hauls are depicted in Fig. 1. 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 stage was determined and the otoliths were sampled to enable age estimation.

Altogether, 32 different fish species, two cephalopod species and one cyclostome were caught during the survey. A detailed overview on catch composition (CPUE in kg 30min⁻¹) of all 41 trawl hauls is given in Tab. 1.

As in the previous years, sprat contributed the bulk of biomass of total catch weight (11.3 t, i. e. 85%). However, whiting (*Merlangius merlangus*) showed the highest frequency of occurrence (present in 35 hauls or 85% of the total 41). The amount of Herring was 0.7 t. This is just 5% of total catches, but herring was widely distributed in the area and present in 75% of the catches. However, catches alone are not representative for the 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 on the total catch. Figures 5 - 8 show length distributions of these species as derived from total catches. Herring lengths ranged from 5 to 21 cm. The length distribution is dominated by small fish below 10 cm total length. Larger herring were present in the area, but not in high numbers. Sprat lengths ranged from 3 to 15 cm. Their length frequency distribution is highly comparable to the preceding year.

Sardines and anchovies were caught only on occasion and in relatively small quantities. A first was the observation of an unprecedented occurrence and distribution of juvenile blue whiting (*Micromesistius poutassou*) in the southern and southwestern survey area, which had not been observed and registered during previous HERAS surveys in the southern North Sea.

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 (Stox, 2019). This will be accomplished during a post-cruise meeting scheduled for November 2021 at the ICES Headquarter in Copenhagen/Denmark. 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 whole 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, 99 CTD casts were conducted during this survey.

Surface temperatures in the survey area ranged from around 14° C in the area south and southwest of the Dogger Bank to almost 19° C. Highest surface temperatures were measured in the German Bight and the northern part of the survey area (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 below 8° C. As in the previous year, the water appeared rather well mixed on the shallow Dogger Bank with bottom temperatures similar to surface temperatures.

Salinity measurements indicated a sensor drift due to an undetected contamination of the sensor that could not be corrected afterwards and are accordingly not presented.

3. Survey participants

Dr. Matthias Schaber (cruise leader)	Hydroacoustics/Hydrography	TI-SF
Dr. Norbert Rohlf	Fish lab/Biology	TI-SF
Svea Winning	Hydroacoustics/Hydrography	TI-SF
Jana Bäger	Fish lab/Biology	TI-SF
Philipp Schweizer	Fish lab/Biology	TI-SF

4. References

- Echoview Software Pty Ltd (2021). Echoview software, version 12.0.34 Echoview Software Pty Ltd, Hobart, Australia.
- ICES (2021). Working Group of International Pelagic Surveys (WGIPS). ICES Scientific Reports 3(40). 481 pp. <http://doi.org/10.17895/ices.pub.8055>
- 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 as well as all participants for their outstanding cooperation and commitment that facilitated the successful accomplishment of this survey.

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

Figures

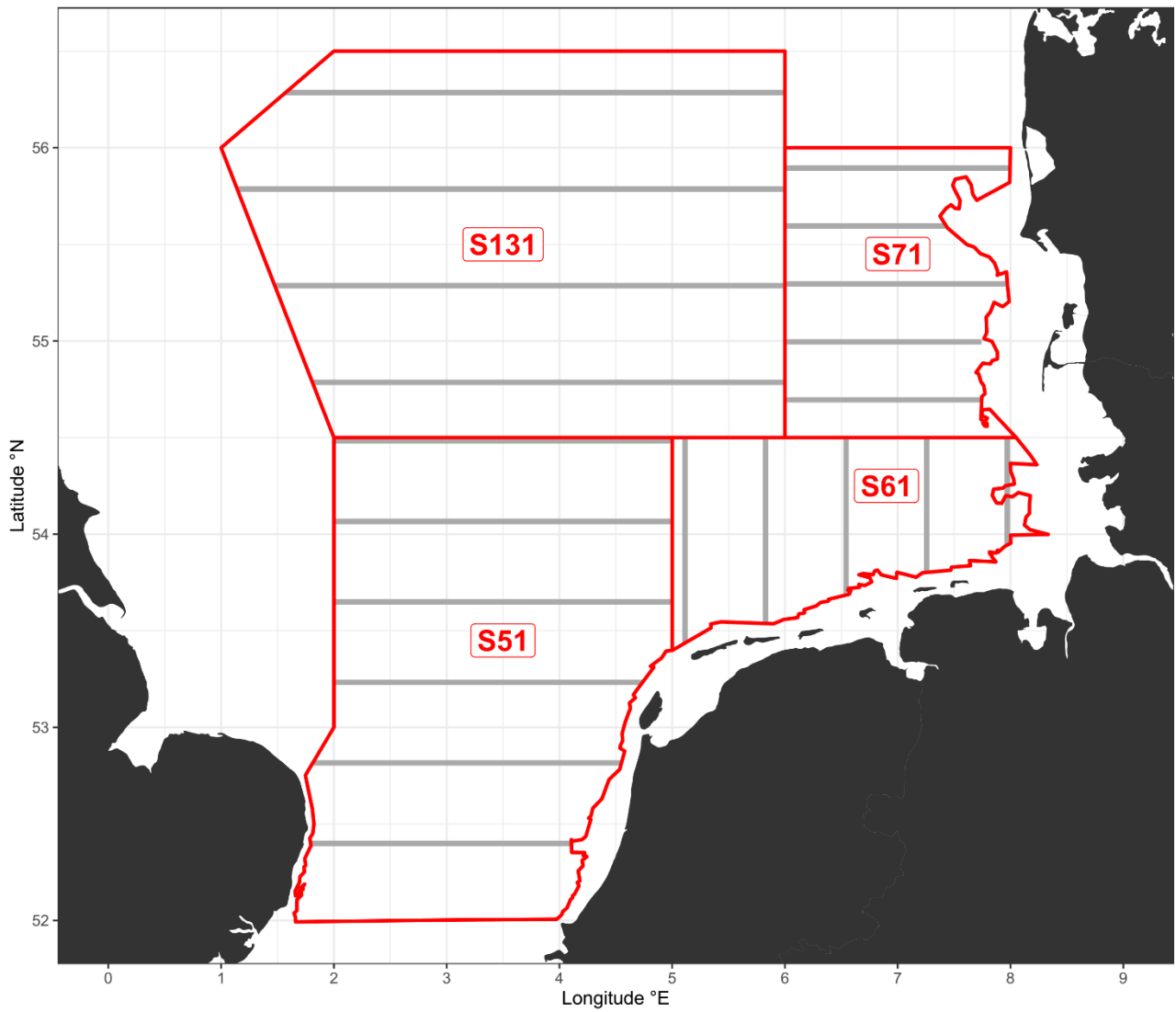


Figure 1: FRV "Solea" cruise 794/2021. Survey plan. Total survey area and strata covered (S51, S61, S71, S131) outlined in red. Planned transect lines depicted as grey lines. Refer to Figures 2 and 3 for realized transects.

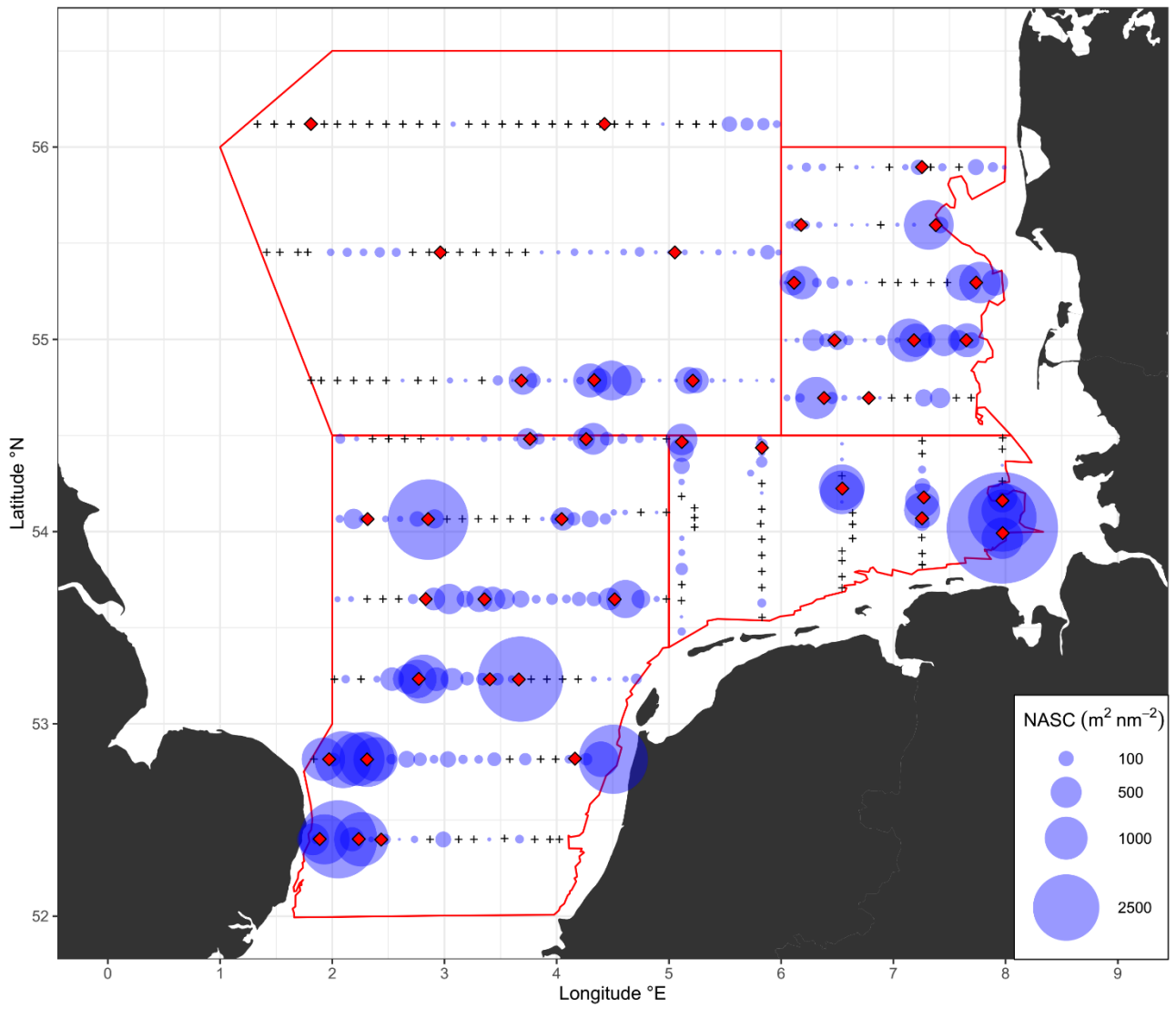


Figure 2: FRV "Solea" cruise 794/2021. Mean aggregated Nautical Area Scattering Coefficient (NASC) measured (blue dots, 5 nmi intervals) along the realized transects allocated to clupeids/small pelagics for further dis-aggregation and to be used in abundance/biomass estimates. Empty intervals indicated by crosses. Total survey area and strata outlined in red.

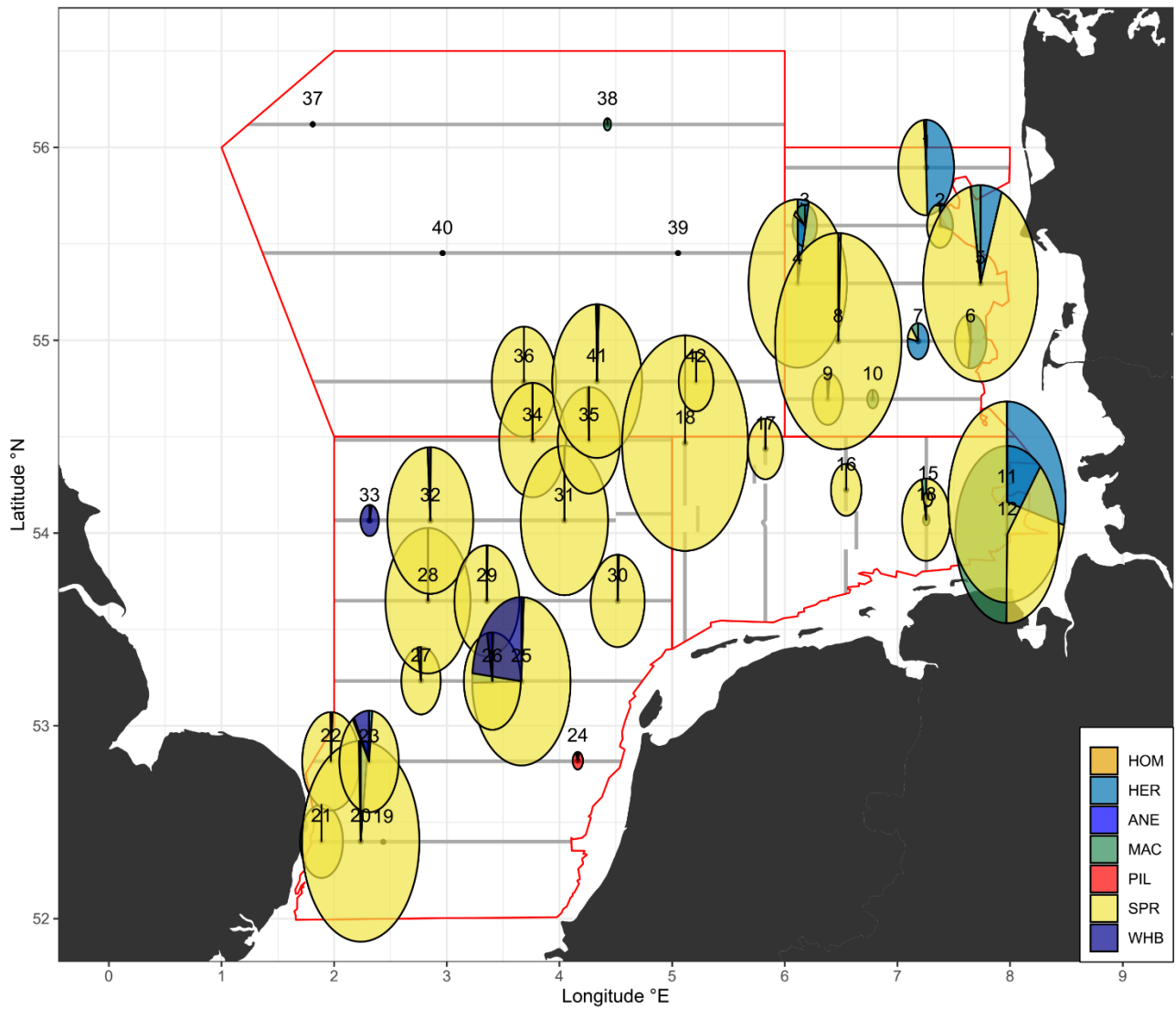


Figure 3: FRV “Solea” cruise 794/2021. Catches (kg/30 min) and catch composition of pelagic/schooling fishes (ANE - anchovy *Engraulis encrasicolus*, HER - herring *Clupea harengus*, HOM - horse mackerel *Trachurus trachurus*, MAC - mackerel *Scomber scombrus*, PIL - sardine *Sardina pilchardus*, SPR - sprat *Sprattus sprattus*, WHB – blue whiting *Micromesistius poutassou*). Numbers indicate haul/station number. Survey area/strata outlined in red. Accomplished transects depicted as grey lines.

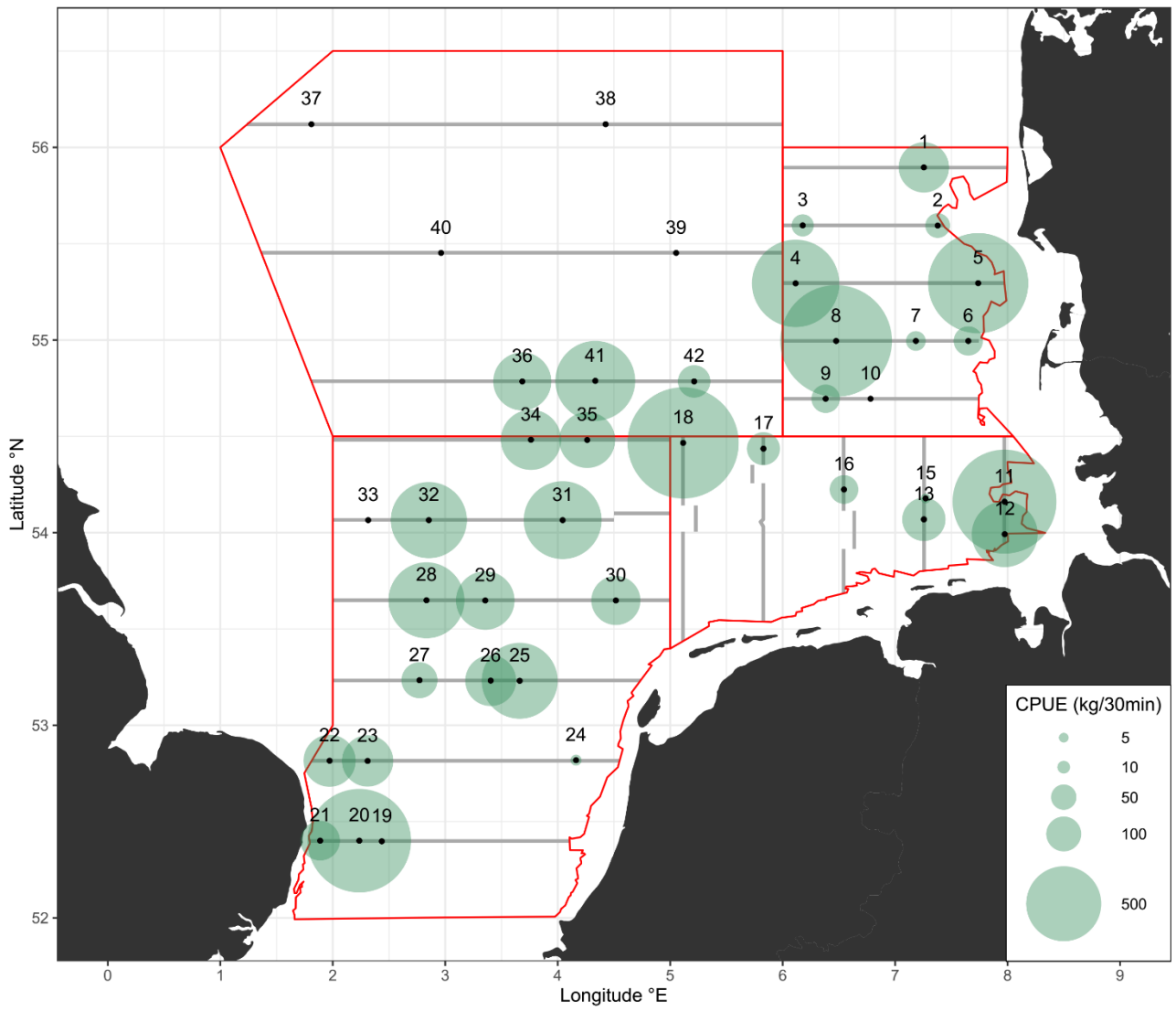


Figure 4: FRV "Solea" cruise 794/2021. Combined clupeid (herring *Clupea harengus*, sprat *Sprattus sprattus*, sardine *Sardina pilchardus*, and anchovy *Engraulis encrasicolus*) catches (kg/30 min). Numbers indicate haul/station number. Survey area/strata outlined in red. Accomplished transects depicted as grey lines.

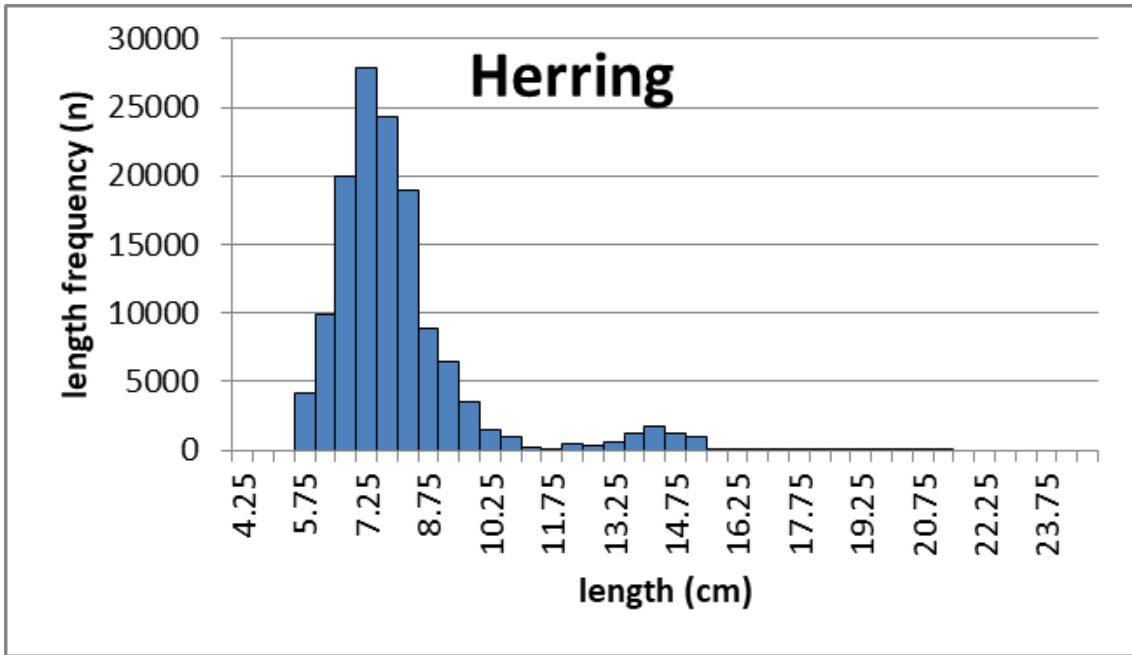


Figure 5: FRV "Solea" cruise 794/2021. Herring (*Clupea harengus*) length-frequency distribution.

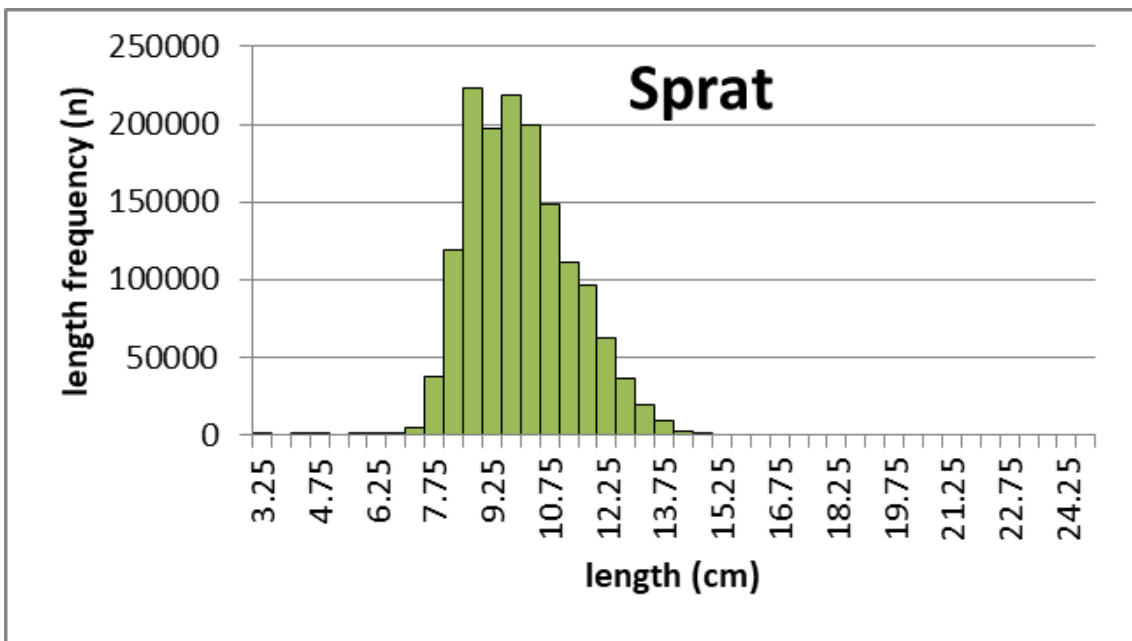


Figure 6: FRV "Solea" cruise 794/2021. Sprat (*Sprattus sprattus*) length-frequency distribution.

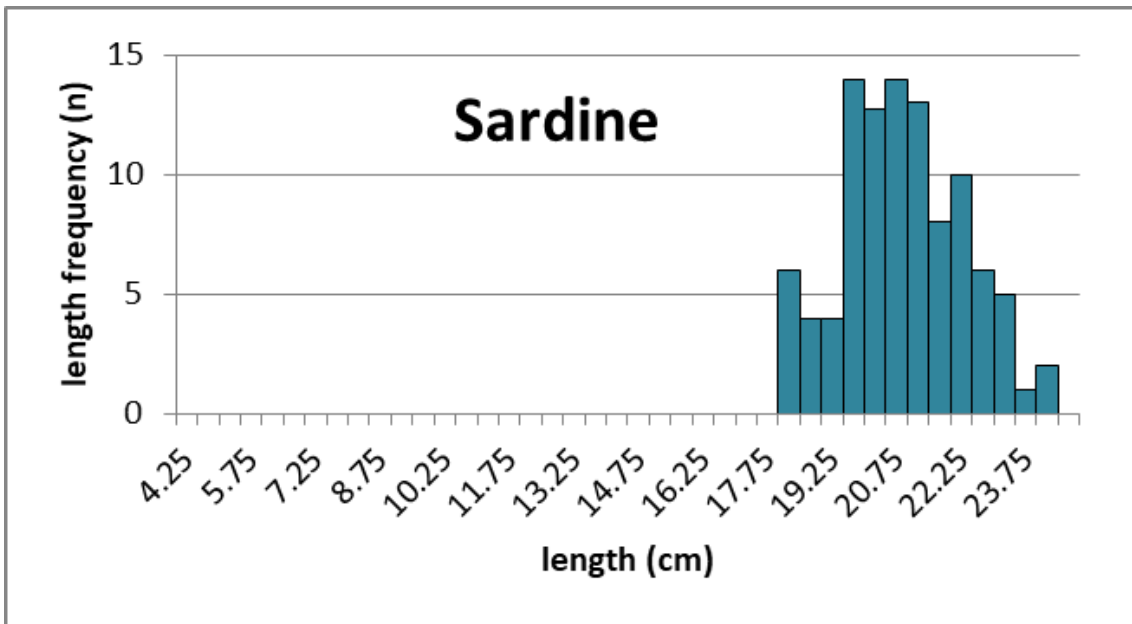


Figure 7: FRV "Solea" cruise 794/2021. Sardine (*Sardina pilchardus*) length-frequency distribution.

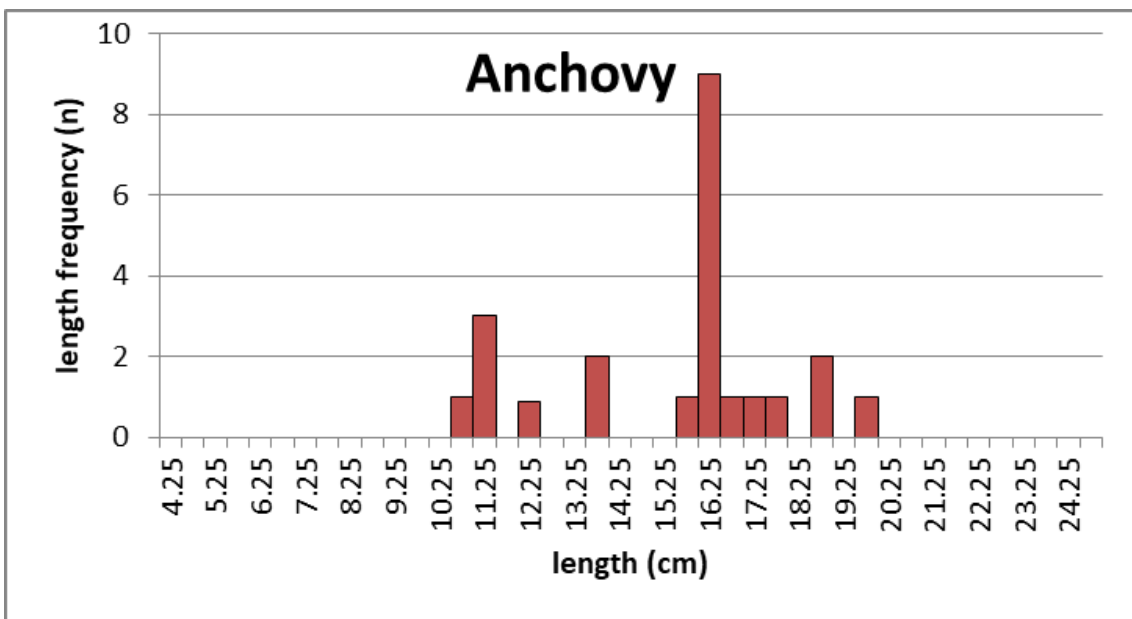


Figure 8: FRV "Solea" cruise 794/2021. Anchovy (*Engraulis encrasicolus*) length-frequency distribution.

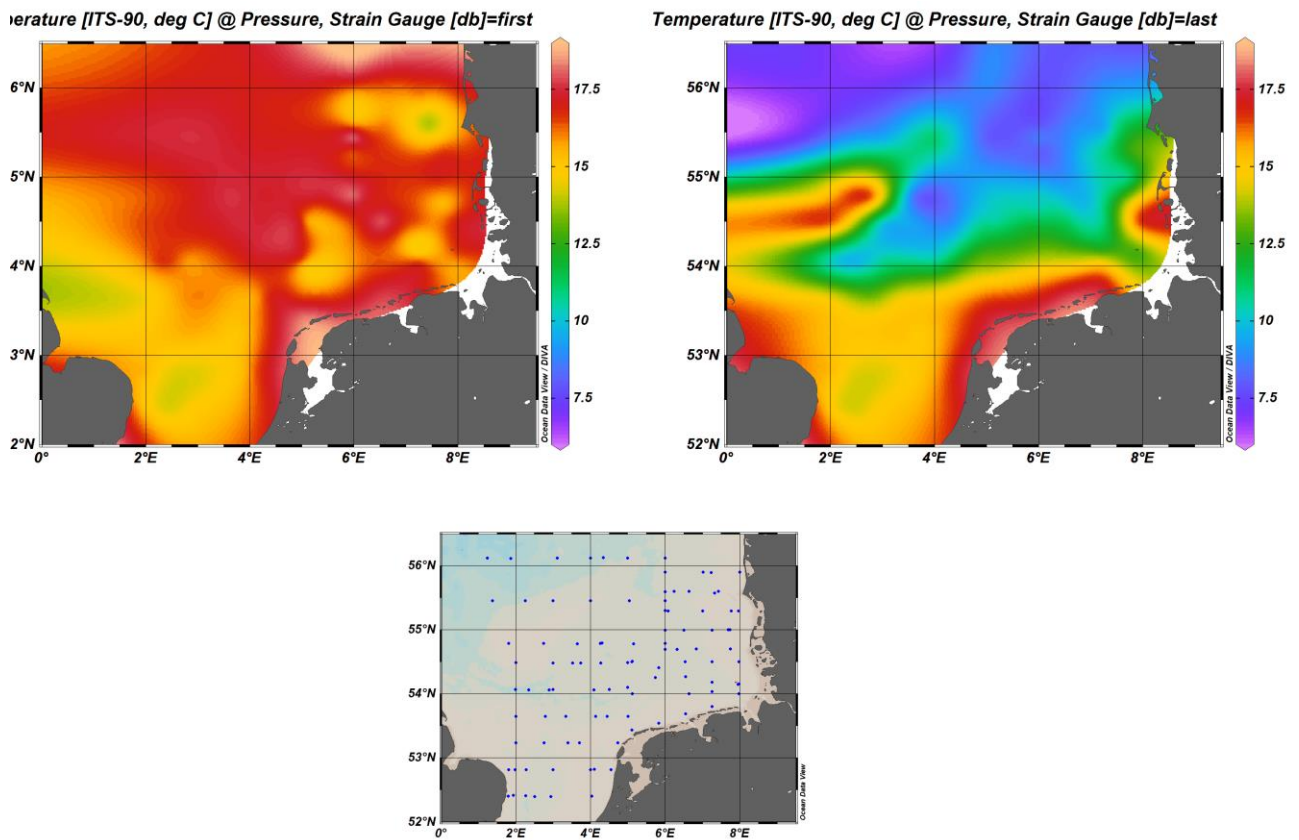


Figure 9: FRV “Solea” cruise 794/2021. Hydrography. CTD stations are depicted as blue dots in the area map (lower panel). Temperature (°C) near the surface (upper left panel) and near the seafloor (upper right panel).

Tables

Table 1: FRV “Solea” cruise 794/2021. Catch composition (CPUE in kg) standardized to 30 minutes tow duration.

HAUL	STATION	TOTAL (kg/30 min)	ALLOTEUTHIS SUBULATA	AMMODYTES spec.	ARNOGLOSSUS LATERNA	CALLIONYMUS LYRA	CANCER PAGURUS	CLUPEA HARENGUS	CRYSTALLOGOBIUS LINEARIS	CYCLOPTERUS LUMPIUS	ECHIICHTHYS VIPERA	ENGRAULIS ENCRASICOLLUS	ENTELURUS AEQUOREUS	EUTRIGLA GURNARDUS	GADUS MORHUA	HELICOLENUS DACTYLOPTERUS	HIPPOGLOSSOIDES PLATESSOIDES	HYPEROPLUS LANCEOLATUS	
1	4	223.2	0.1					108.7					0.1	1.8					0.2
2	7	47.5						13.4						0.2					0.0
3	9	44.2				0.0		34.3						1.6					
4	12	689.0						25.0	0.0					2.5					
5	15	934.4						56.2						0.1					
6	17	71.5						37.2											
7	18	32.0						24.6						0.1					
8	19	1134.8						7.5						1.2					
9	22	65.7						1.5						1.0					
10	23	11.5												3.0					
11	26	978.6						280.8											
12	27	765.2	0.2					84.3											
13	29	3.2												0.1					
14	30	163.8						0.1						0.1					
15	31	5.7	0.0					0.3						0.3					
16	34	65.5						0.1						0.1					
17	39	100.7	0.0											0.6					
18	41	1124.9						0.3						0.4					
19	48	10.2									0.1								
20	49	976.9						19.9			0.8								
21	50	131.4	0.1					0.1			0.3								
22	53	236.1						1.9			1.7	0.1							
23	54	339.0	0.2					4.3			0.5								
24	57	7.5										0.3							
25	60	690.5	0.4	0.5				5.4				0.2		2.9					0.1
26	61	229.6	0.1					1.3		0.0	0.1								
27	62	110.1	0.1					1.3				0.0		0.1					
28	65	513.8	0.0					0.3						0.2					
29	66	301.5						1.0						0.9					0.2
30	67	263.8	1.1		0.0	0.2	0.4	1.5				0.1		5.7					
31	70	541.2												0.4					
32	72	521.5						1.0						0.5					
33	73	41.7	0.0					0.1											
34	78	388.6												1.6					0.1
35	79	280.7						0.0						1.9					
36	83	293.7							0.0										0.1
37	86	117.9						0.5						0.7	0.0	0.1	0.6		
38	89	3.7												0.1					
39	94	0.9												0.9					
40	99	583.3						3.9						2.0					
41	100	305.9						0.1						1.5					
total (kg)		13350.9	2.3	0.5	0.0	0.2	0.4	717.0	0.0	0.0	3.4	0.6	0.1	32.6	0.0	0.1	0.6	0.8	
proportion (%)			0.0	0.0	0.0	0.0	0.0	5.4	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	
number of catches			12	1	1	2	1	31	2	1	6	5	1	29	1	1	1	1	6
presence (%)			29	2	2	5	2	76	5	2	15	12	2	71	2	2	2	15	

Table 1 cont'd: FRV "Solea" cruise 794/2021. Catch composition (CPUE in kg) standardized to 30 minutes tow duration.

HAUL	STATION	TOTAL (kg/30 min)	HIPPOGLOSSOIDES PLATISSOIDES	HYPEROPLUS LANCEOLATUS	LAMPETRA FLUVIATILIS	LIMANDA LIMANDA	LOLIGO FORBESI	MELANOGRAMMUS AEGLEFINUS	MERLANGIUS MERLANGUS	MICROMESISTIUS POUTASSOU	MICROSTOMUS KITT	MULLUS SURMULETUS	PLEURONECTES PLATESSA	POMATOSCHISTUS MINUTUS	PSETTA MAXIMA	RAJA CLAVATA
1	4	223.2		0.2					0.5							
2	7	47.5		0.0												
3	9	44.2				0.1		0.3	0.9							
4	12	689.0							1.2							
5	15	934.4				0.2			0.0							
6	17	71.5				0.4			0.0							
7	18	32.0				0.1			0.1							
8	19	1134.8							0.3							
9	22	65.7							0.0							
10	23	11.5							0.0							
11	26	978.6														
12	27	765.2				0.6			3.7							
13	29	3.2			0.0				0.0							
14	30	163.8							0.0							
15	31	5.7				0.0			0.0							
16	34	65.5							0.0							
17	39	100.7				1.2			10.2							
18	41	1124.9				0.0			0.3							
19	48	10.2							10.1							
20	49	976.9							0.3	4.6						
21	50	131.4								0.0						
22	53	236.1								0.4						
23	54	339.0							88.5	21.0						
24	57	7.5							0.0							
25	60	690.5		0.1			0.1		0.2	161.1						
26	61	229.6								6.7						
27	62	110.1							0.1	3.2						
28	65	513.8				0.6			0.1							
29	66	301.5		0.2					1.1	0.5						
30	67	263.8				21.2		0.0	15.3			0.2	1.9	0.0	0.5	7.5
31	70	541.2							0.2							
32	72	521.5							0.1	5.4						
33	73	41.7				0.1		0.7	17.0	22.8						
34	78	388.6		0.1		2.8		9.5	57.2	0.2						
35	79	280.7				0.2			4.1	0.1						
36	83	293.7		0.1												
37	86	117.9	0.6				0.0	23.0	50.1	0.0	0.6					
38	89	3.7							0.0							
39	94	0.9							0.0	0.0						
40	99	583.3				0.7		0.3	8.4	2.0	0.5					
41	100	305.9				0.4		105.9	112.5		0.1		0.1			
total (kg)		13350.9	0.6	0.8	0.0	28.7	0.1	139.8	382.4	228.2	1.1	0.2	2.0	0.0	0.5	7.5
proportion (%)			0.0	0.0	0.0	0.2	0.0	1.0	2.9	1.7	0.0	0.0	0.0	0.0	0.0	0.1
number of catches			1	6	1	15	2	7	35	15	3	1	2	1	1	1
presence (%)			2	15	2	37	5	17	85	37	7	2	5	2	2	2

Table 1 cont'd: FRV "Solea" cruise 794/2021. Catch composition (CPUE in kg) standardized to 30 minutes tow duration.

HAUL	STATION	TOTAL (kg/30 min)	RAJA MONTAGUI	RHINONEMUS CIMBRIUS	SARDINA PILCHARDUS	SCOMBER SCOMBRUS	SCYLIORHINUS CANICULA	SEBASTES VIVIPARUS	SPRATTUS SPRATTUS	TRACHURUS TRACHURUS	TRISOPTERUS ESMARKI	TRISOPTERUS LUSCUS	TRISOPTERUS MINUTUS	NUMBER OF SPECIES
1	4	223.2				2.8			108.9					8
2	7	47.5				0.1			33.8					5
3	9	44.2				5.5			1.5					8
4	12	689.0				0.2			660.0					6
5	15	934.4			0.3	26.3			851.3					7
6	17	71.5				3.0			31.0					5
7	18	32.0				3.5			3.6					6
8	19	1134.8				0.2			1125.6					5
9	22	65.7				0.6			62.6					5
10	23	11.5				8.4								3
11	26	978.6							697.8					2
12	27	765.2				378.5			297.9					6
13	29	3.2			0.1	2.5				0.4				6
14	30	163.8				5.0			158.7					5
15	31	5.7				0.3			4.8					7
16	34	65.5							65.3					4
17	39	100.7							88.7					5
18	41	1124.9							1123.7	0.1				6
19	48	10.2												2
20	49	976.9				1.3			950.0					6
21	50	131.4				0.8			130.0					6
22	53	236.1				0.2			231.9					6
23	54	339.0							222.1	2.4				7
24	57	7.5			6.7	0.5								4
25	60	690.5				12.0			507.3	0.2				12
26	61	229.6							221.4	0.1				7
27	62	110.1							105.4					7
28	65	513.8							512.6					6
29	66	301.5							297.7					6
30	67	263.8	0.5				2.6		204.9					18
31	70	541.2							540.6					3
32	72	521.5							514.5					5
33	73	41.7		0.1					0.8		0.0			9
34	78	388.6							317.2					7
35	79	280.7				2.9			271.6					7
36	83	293.7							293.6					3
37	86	117.9						0.4			41.5	0.2	0.1	14
38	89	3.7				3.6								3
39	94	0.9												3
40	99	583.3							565.5					8
41	100	305.9							85.4					8
total (kg)		13350.9	0.5	0.1	7.1	458.3	2.6	0.4	11287.7	3.2	41.5	0.2	0.1	
proportion (%)			0.0	0.0	0.1	3.4	0.0	0.0	84.5	0.0	0.3	0.0	0.0	
number of catches			1	1	3	21	1	1	34	5	2	1	1	
presence (%)			2	2	7	51	2	2	83	12	5	2	2	

Table 2a: FRV “Solea” cruise 794/2021. 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.

Haul	Stat	Total Catch (kg)	clupeid catch (kg)	clupeid portion (%)	herring					herring (% clups)
					catch (kg)	count (n)	range (cm)			
							min	max	mean	
1	4	223.2	217.7	98%	108.7	9266	6.75	15.25	11.0	108.7
2	7	47.5	47.3	99%	13.4	3293	6.75	18.25	8.6	13.4
3	9	44.2	35.8	81%	34.3	1565	9.75	16.25	14.3	34.3
4	12	689.0	685.0	99%	25.0	3244	8.25	17.75	10.0	25.0
5	15	934.4	907.8	97%	56.2	20606	6.25	9.75	7.7	56.2
6	17	71.5	68.2	95%	37.2	16062	5.75	14.25	7.3	37.2
7	18	32.0	28.2	88%	24.6	7481	6.75	9.75	8.2	24.6
8	19	1134.8	1133.0	100%	7.5	1502	7.25	10.25	9.2	7.5
9	22	65.7	64.1	98%	1.5	262	7.25	16.25	9.5	1.5
11	26	978.6	978.6	100%	280.8	25644	6.25	10.25	7.5	280.8
12	27	765.2	382.2	50%	84.3	39324	5.75	12.25	7.1	84.3
14	30	163.8	158.7	97%	0.1	4	13.25	14.25	13.6	0.1
15	31	5.7	5.1	89%	0.3	25	8.75	15.75	11.6	0.3
16	34	65.5	65.4	100%	0.1	16	8.25	13.75	10.6	0.1
18	41	1124.9	1124.0	100%	0.3	32	8.25	14.75	10.3	0.3
20	49	976.9	970.0	99%	19.9	2289	7.75	17.25	10.6	19.9
21	50	131.4	130.1	99%	0.1	6	11.75	17.25	14.1	0.1
22	53	236.1	233.9	99%	1.9	54	12.25	19.25	16.3	1.9
23	54	339.0	226.4	67%	4.3	752	6.75	21.25	9.3	4.3
25	60	690.5	512.9	74%	5.4	882	8.25	17.75	9.7	5.4
26	61	229.6	222.6	97%	1.3	185	7.75	13.25	9.9	1.3
27	62	110.1	106.7	97%	1.3	185	6.75	14.75	10.0	1.3
28	65	513.8	512.8	100%	0.3	8	14.75	17.25	15.7	0.3
29	66	301.5	298.7	99%	1.0	138	7.75	12.25	10.1	1.0
30	67	263.8	206.6	78%	1.5	379	6.75	10.25	8.4	1.5
32	72	521.5	515.5	99%	1.0	35	7.25	17.75	15.5	1.0
33	73	41.7	0.9	2%	0.1	3	15.25	18.25	17.1	0.1
35	79	280.7	271.6	97%	0.1	6	6.75	9.25	8.0	0.0
37	86	117.9	0.5	0%	0.5	9	18.75	20.75	19.8	0.5
40	99	583.3	569.4	98%	3.9	201	6.75	16.25	13.6	3.9
41	100	305.9	85.5	28%	0.1	8	9.7	14.75	13.1	0.1

Table 2b: FRV “Solea” cruise 794/2021. 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.

Haul	Stat	Total Catch (kg)	clupeid catch (kg)	clupeid portion (%)	sprat					sprat (% clups)
					catch (kg)	count (n)	range (cm)			
							min	max	mean	
1	4	223.2	217.7	98%	108.9	12664	8.25	12.75	10.3	50%
2	7	47.5	47.3	99%	33.8	6096	8.25	12.25	10.0	72%
3	9	44.2	35.8	81%	1.5	110	9.25	14.25	12.3	4%
4	12	689.0	685.0	99%	660.0	75986	9.25	12.75	10.4	96%
5	15	934.4	907.8	97%	851.3	148635	7.75	10.25	9.2	94%
6	17	71.5	68.2	95%	31.0	5771	8.25	13.75	8.9	45%
7	18	32.0	28.2	88%	3.6	485	8.25	13.75	9.9	13%
8	19	1134.8	1133.0	100%	1125.6	156866	8.25	13.75	9.9	99%
9	22	65.7	64.1	98%	62.6	6760	9.25	13.75	10.8	98%
11	26	978.6	978.6	100%	697.8	141330	8.25	9.75	8.8	71%
12	27	765.2	382.2	50%	297.9	116610	7.25	11.75	8.3	78%
14	30	163.8	158.7	97%	158.7	18383	9.25	13.75	10.5	100%
15	31	5.7	5.1	89%	4.8	453	8.75	13.75	11.4	94%
16	34	65.5	65.4	100%	65.3	6198	8.75	14.25	11.2	100%
17	39	100.7	88.7	88%	88.7	9065	8.75	13.75	10.9	100%
18	41	1124.9	1124.0	100%	1123.7	90049	9.75	14.25	11.8	100%
20	49	976.9	970.0	99%	950.0	120066	7.75	14.25	10.1	98%
21	50	131.4	130.1	99%	130.0	15567	5.75	13.25	10.3	100%
22	53	236.1	233.9	99%	231.9	21948	9.25	13.75	11.3	99%
23	54	339.0	226.4	67%	222.1	41356	5.75	14.75	9.0	98%
25	60	690.5	512.9	74%	507.3	72370	7.75	13.75	9.8	99%
26	61	229.6	222.6	97%	221.4	34058	8.25	14.25	9.5	99%
27	62	110.1	106.7	97%	105.4	17256	3.25	12.25	9.2	99%
28	65	513.8	512.8	100%	512.6	40825	10.25	13.75	11.9	100%
29	66	301.5	298.7	99%	297.7	31710	8.75	12.75	10.8	100%
30	67	263.8	206.6	78%	204.9	37945	7.25	12.75	8.9	99%
31	70	541.2	540.6	100%	540.6	54972	8.25	14.25	11.1	100%
32	72	521.5	515.5	99%	514.5	40556	10.25	14.75	11.9	100%
33	73	41.7	0.9	2%	0.8	70	9.75	14.25	11.6	88%
34	78	388.6	317.2	82%	317.2	27982	10.25	14.25	11.6	100%
35	79	280.7	271.6	97%	271.6	31464	8.75	13.75	10.6	100%
36	83	293.7	293.6	100%	293.6	30860	9.75	13.75	10.9	100%
40	99	583.3	569.4	98%	565.5	64833	9.25	13.75	10.7	99%
41	100	305.9	85.5	28%	85.4	7634	8.75	13.75	11.4	100%

Table 2c: FRV “Solea” cruise 794/2021. Numbers, weights and mean lengths of **sardine** (*Sardina pilchardus*) and according proportion of total clupeid catch (normalized to 30 minutes tow duration).

Haul	Stat	total catch (kg)	clupeid catch (kg)	clupeid portion (%)	sardine					sardine (% clups)
					catch (kg)	count (n)	range (cm)			
							min	max	mean	
5	15	934.4	907.8	97%	0.3	4	20.25	20.25	20.25	0.03%
13	29	3.2	0.1	4%	0.1	1	24.25	24.25	24.25	100%
24	57	7.5	7.0	93%	6.7	95	18.25	24.25	20.89	96%

Table 2d: FRV “Solea” cruise 794/2021. Numbers, weights and mean lengths of **anchovy** (*Engraulis encrasicolus*) and according proportion of total clupeid catch (normalized to 30 minutes tow duration).

Haul	Stat	total catch (kg)	clupeid catch (kg)	clupeid portion (%)	anchovy					anchovy (% clups)
					catch (kg)	count (n)	range (cm)			
							min	max	mean	
22	53	236.1	233.9	99%	0.1	3	16.25	16.25	16.25	0.03%
24	57	7.5	7.0	93%	0.3	9	15.75	19.75	16.92	4.47%
25	60	690.5	512.9	74%	0.2	8	11.25	18.75	15.00	0.04%
27	62	110.1	106.7	97%	0.01	1	12.25	12.25	12.25	0.01%
30	67	263.8	206.6	78%	0.1	2	10.75	11.25	11.00	0.03%