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Survey Report FRV "Solea" SB812

German Acoustic Autumn Survey (GERAS)

05.10.-24.10.2022

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1. INTRODUCTION

1.1 Background

The cruise was part of an international hydroacoustic survey providing information on stock parameters of small pelagics in the Baltic Sea, coordinated by the ICES Working Group of International Pelagic Surveys (WGIPS) and the ICES Baltic International Fish Survey Working Group (WGBIFS). Further WGBIFS contributors to the Baltic survey are national fisheries research institutes of Sweden, Poland, Finland, Latvia, Estonia and Lithuania. FRV "Solea" participated for the 35th time. The survey area covered the western Baltic Sea including Kattegat, Belt Sea, Sound and Arkona Sea (ICES Subdivisions (SD) 21, 22, 23 and 24).

1.2 Objectives

The survey has the main objective to annually assess the clupeid resources of herring and sprat in the Baltic Sea in autumn. It is conducted every year to supply the ICES Herring Assessment Working Group for the Area South of 62°N (HAWG) and Baltic Fisheries Assessment Working Group (WGBFAS) with an index value for the stock size of herring in the Western Baltic area (Kattegat/Subdivision 21 and Subdivisions 22, 23 and 24) and sprat in the Baltic area (Subdivisions 22-32).

The following objectives were planned for SB812:

- Hydroacoustic measurements for the assessment of small pelagics in the Kattegat and western Baltic Sea including Belt Sea, Sound and Arkona Sea (ICES Subdivisions 21, 22, 23 and 24)
- (Pelagic) trawling according to hydroacoustic registrations
- Hydrographic measurements on hydroacoustic transects and after each fishery haul
- Identification and recording of species- and length-composition of trawl catches
- Collection of biological samples of herring, sprat and additionally sardine, European anchovy and cod for further analyses

1.3 Survey summary

The objectives of the survey were carried out successfully and as planned in all of the covered ICES Subdivisions.

Altogether, 1208 nautical miles of hydroacoustic transects (plus 175 nmi daytime/repeat transects for comparison) were covered. For species allocation and identification as well as to collect biological data for an age stratified abundance estimation of the target species herring and sprat, altogether 49 fishery hauls were conducted. Vertical hydrography profiles were measured on 74 stations.

In all subdivisions covered, mean NASC values per nautical mile per ICES statistical rectangle were mostly either distinctly lower or distinctly higher than the values measured in 2021. Compared to the long-time survey mean since 1991, mean NASC values were lower in 21 out of 28 rectangles covered. On ICES subdivision scale, mean NASC values were overall distinctly higher than in the previous year in subdivisions 21 and 22, while in SD 23 and 24 lower mean NASC values were recorded.

2. SURVEY DESCRIPTION & METHODS APPLIED

2.1 Cruise narrative

The 812th cruise of FRV "Solea" represents the 35th subsequent GERAS survey. Generally, survey operations during the GERAS/BIAS are conducted during nighttime to account for a more pelagic distribution of clupeids at that time. Equipment of the vessel took place on October 5th in Kiel port, when also a calibration of the echosounders had been planned but had to be postponed. On October 6th, survey operations commenced in SD 22 (Belt Sea). After covering some sections of the southwestern area of SD 22 and the northeastern transects in this subdivision, survey operations commenced in SD 24 (Arkona Sea) on October 9th, with that SD fully covered on October 13th. On October 14th and 15th, the remaining transect sections in the southwestern part of SD 22 were accomplished before FRV "Solea" entered Kiel port for a short cruise break (exchange of scientific crew

members) on October 16th. Later that day, the calibration of the echosounders used during the survey took place in Strande Bay. Afterwards, FRV "Solea" continued to SD 23 (the Sound), which was sampled several times during regular night transects (17. & 22.10.) as well as for comparison during daytime (18. & 23.10.). Subdivision 21 (Kattegat) was covered from Oct 18th-21st. Survey operations in SD 21 had to be interrupted for 0.5 nights due to inclement weather, which did not restrict full coverage of the transects in that SD. After accomplishing all planned transects in all SDs, another daytime comparison was conducted in SD 23. FRV "Solea" returned to Rostock harbor, where the survey ended after unloading of the scientific equipment and samples on October 25th.

Altogether, the following survey schedule was accomplished:

Belt Sea	(SD 22)	6.- 8.10. & 14.-15.10.
Arkona Sea	(SD 24)	9.-13.10.
Sound	(SD 23)	17. & 22.10. (23.10.)
Kattegat	(SD 21)	18. - 21.10.

Total survey time	16 nights (incl. 0.5 days loss due to bad weather)
Fishery hauls	49
CTD-casts	74
Hydroacoustic transects	1208 nmi (+ 175 nmi daytime/ repeated transects for comparison)

2.2 Survey design

ICES statistical rectangles were used as strata for all Subdivisions (ICES, 2017). The area was limited by the 10 m depth line. The survey area in the Western Baltic Sea is characterized by a number of islands and sounds. Consequently, parallel transects would lead to an unsuitable coverage of the survey area. Therefore, a zig-zag track was adopted to cover all depth strata regularly and sufficiently. Overall, the covered regular cruise track length was 1208 nautical miles (2021: 1124 nmi) (Figure 1).

2.3 Acoustic data collection

All acoustic investigations were performed during night time to account for the more pelagic distribution of clupeids during that time. Hydroacoustic data were recorded with a Simrad EK80 scientific echosounder with hull-mounted 38, 70, 120 and 200 kHz transducers at a standard ship speed of 10 kn. Post-processing and analysis of hydroacoustic data were conducted with Echoview 13 software (Echoview Software Pty Ltd, 2022). Mean volume backscattering values (S_v) were integrated over 1 nmi intervals from 10 m below the surface to ca. 0.5 m over the seafloor (NASC - Nautical Area Scattering Coefficient). Interferences from surface turbulence, bottom structures and scattering layers were removed from the echogram. In post-processing, no species-specific NASC values were allocated to echo registrations, but a MIX category was used for the combined acoustic backscatter per EDSU. The transducer settings applied were in accordance with the specifications provided in ICES (2015, 2017).

2.4 Calibration

All transducers (38, 70, 120 and 200 kHz) were calibrated in CW and FM mode from a drifting vessel in Strande Bay (54°26.30 N, 10°11.85 E) on October 16th. Overall calibration results were considered very good based on calculated RMS values. Resulting transducer parameters were applied for the post-processing of hydroacoustic survey data.

Calibration results for the 38 kHz transducer are provided in Table 1.

2.5 Biological data – trawl hauls

Trawl hauls were conducted with a pelagic gear "PSN388" in midwater layers as well as near the seafloor. Mesh size in the codend was 10 mm. It was planned to carry out at least two hauls per ICES statistical rectangle. Both trawling depth and net opening were continuously controlled by a net monitoring sensor during fishing operations. Trawl depth was chosen in accordance with echo

distributions on the echogram. Normally, a vertical net opening of about 6-8 m was achieved. Trawling time usually was set to 30 minutes but was shortened when echograms and monitoring sensors indicated large catches. To validate and allocate echorecordings, altogether 49 fishery hauls were conducted (Figure 1). From each haul sub-samples were taken to determine length and weight of fishes. Samples of herring, sprat, sardine and anchovy were frozen for additional investigations (e.g. determining sex, maturity, age).

2.6 Hydrographic data

Vertical profiles of temperature, salinity and oxygen concentration were measured with a SeaBird SBE CTD-probe on a station grid covering the whole survey area. Hydrography measurements were either conducted directly after a trawl haul or, in case of no fishing activity, in regular intervals along the cruise track. Altogether, 74 CTD casts were conducted during this survey (Figure 6).

2.7 Data analysis

All data analyses were conducted using GERIBAS II software (Arivis, 2014) and Microsoft Office.

The pelagic target species sprat and herring are often distributed in mixed layers together with other species. Thus, echorecordings cannot be allocated to a single species. Therefore, an aggregated acoustic category MIX was allocated to the hydroacoustic registrations. The species composition allocated to the MIX category and used for disaggregating NASC measurements to species level was based on corresponding trawl catch results. For each rectangle, species composition and length distributions were determined as the unweighted mean of all trawl results in this rectangle. From these distributions the mean acoustic cross section σ was calculated according to the following target strength-length (TS) relation:

	TS	References
Clupeids	= 20 log L (cm) - 71.2	ICES (1983)
Gadids	= 20 log L (cm) - 67.5	Foote et al. (1986)
Scomber scombrus	= 20 log L (cm) - 84.9	ICES (2017)

All other species that were included in the analysis based on their contribution to the catches per rectangle were allocated the clupeid TS (see table above).

The total number of fish (total N) in one rectangle was estimated as the product of the mean Nautical Area Scattering Coefficient (NASC; S_A) and the rectangle area, divided by the corresponding mean cross section σ. The total number was separated into the categories mentioned above and further into herring and sprat according to the mean catch composition.

All calculations performed were in accordance with the guidelines in the "SISP Manual of International Baltic Acoustic Surveys (IBAS)" (ICES, 2017).

Hauls with very low catches in terms of numbers and biomass as well as hauls conducted with unclear fishing gear were –if applicable- rendered invalid for further analyses. Based on survey design restrictions, comprehensive sampling is not feasible in all statistical rectangles surveyed. Biological information from neighboring rectangles is used for generating estimates in these cases. This mostly applies to rectangles with low abundance as well as to rectangles where low catch hauls required to be omitted.

<u>Stock splitting / Application of the separation function (SF):</u>

In the western Baltic, the distribution areas of two stocks, the Western Baltic Spring Spawning herring (WBSSH) and the Central Baltic herring (CBH) overlap. Survey results from recent years indicated that in SD 24, which is part of the WBSSH management area, a considerable fraction of CBH is present and correspondingly erroneously allocated to WBSSH stock indices (ICES, 2013). Accordingly, a stock separation function (SF) based on growth parameters derived from 2005 to 2010 has been developed to quantify the proportion of CBH and WBSSH in the area (Gröhsler et al., 2013; Gröhsler et al., 2016).

The estimates of the growth parameters from baseline samples of WBSSH and CBH in 2011-2018 and 2020-2022 support the applicability of the SF (Oeberst et al., 2013; Oeberst et al., 2014, 2015, 2016, 2017; Gröhsler and Schaber, 2018, 2019, 2021, 2022, Haase and Schaber, 2023).

The ICES Herring Assessment Working Group for the area south of 62° N (HAWG)) is yearly supplied with an index for this survey (GERAS), which since 2005 excludes CBH and in general covers the total standard survey area, excluding ICES rectangles 43G1 and 43G2 in SD 21 and 37G3 and 37G4 in SD 24, which were not covered in 1994-2004.

3. RESULTS

3.1 Hydroacoustic data (M. Schaber)

Figure 2 depicts the spatial distribution of mean NASC values (5 nmi intervals) measured on the hydroacoustic transects covered in 2022. In general, the majority of these NASC measurements can be allocated to clupeids. Altogether, 28 ICES statistical rectangles were covered in the survey 2022 (25 in 2020). In the rectangles covered in both years, the mean NASC in 2022 was higher than in 2020 (partly significantly) in 14 rectangles. In three rectangles the mean NASC was in the range of 2021. In the 8 other rectangles, mean NASC values were partly well below the already low values measured in 2021. Compared with the long-term survey mean (1991-2021), the mean NASC measured in 2022 was again lower in 21 out of 28 rectangles. On ICES subdivision scale, mean NASC values were overall distinctly higher than in the previous year in subdivisions 21 (Kattegat) and 22 (Belt Sea), while in SD 23 (the Sound) and 24 (Arkona Sea) lower mean NASC values were recorded.

In the rectangles of SD 21 covered both in 2022 and 2021, overall NASC values measured were higher than those measured in the previous year along the Swedish coast of the Kattegat (41G2, 42G2) and in the central Kattegat (42G1). In the southern Kattegat, the mean NASC per 1 nmi EDSU measured was slightly higher (41G0) or distinctly lower (41G1) than the values measured in the previous year. The three rectangles in the northern Kattegat not covered in 2021 showed lower NASC values than the long-term survey average. In general, aggregations of clupeids were mostly observed in the central and northern parts of the SD 21 survey area and along the Swedish coast.

In SD 22, the mean overall NASC values recorded were higher than in the previous years in 10 out of 11 rectangles surveyed. Highest increases were recorded in Kiel Bight (38G0), the western parts of that subdivision (39F9), in areas north of the Belt Sea adjacent to the Kattegat (40G0) as well as in the Belts (39G0, 39G1).

As in the previous years, the large aggregations of big herring that usually could be observed in the inner Sound area of SD 23 were not present in autumn 2022 to the extent observed prior to 2016. NASC values in rectangles 39G2 and 40G2 were again below the survey mean, but in the range of (40G2) or distinctly higher (39G2) than in 2021. Once again, a massive aggregation of herring was detected in rectangle 41G2 located at the narrow isthmus in the northern Sound. In the remaining areas of the rectangle, only very low NASC values were recorded.

In SD 24, mean NASC values were comparable (1) or distinctly lower (7) than the levels measured in the previous year in 8 out of 9 rectangles. Only in 37G3 (east of Rügen Island), the mean NASC values per rectangle were higher than the values measured in 2021. Mean NASC values were lower than the long-term survey average (1991-2021) in all rectangles covered in SD 24. Notable aggregations were detected around Rügen Island, the southeastern Arkona Sea bordering the Bornholm Basin (38G4) and in Faxe Bugt (39G2).

3.2 Biological data (S. Haase)

Fishery hauls according to ICES Subdivision (Figure 1):

SD	Hauls (n)
21	12
22	16
23	5
24	16

Altogether, 1 399 individual herring, 781 sprat, 352 European anchovies and 60 sardines were frozen for further investigations (e.g. determining sex, maturity, age). Results of catch compositions by Subdivision are presented in Tables 1-4. Altogether, 27 different fish species were recorded. Out of 49 hauls in total, herring were caught in 47, sprat in 42, anchovies in 39 and sardines in 5. Again, SD 23 showed amongst the highest mean herring catch rate per station (kg 0.5 h^{-1}) in the data series, which however was only caused by one exceptionally large haul in the northern part of the Sound (Haul 33). Similar to previous years, anchovies (*Engraulis encrasicolus*) were present in most parts of the survey area except from the Sound (SD 23). Sardines (*Sardina pilchardus*) were only present in catches from SD 21, albeit in low numbers. Figure 3 depicts a representation of the standardized clupeid catch per haul.

Altogether, the following fish species were sampled and processed:

Species	Length measurements (n)	Prevalence (n of hauls)
Aphia minuta	591	27
Belone belone	12	9
Clupea harengus	8 578	47
Engraulis encrasicolus	2 771	39
Gadus morhua	95	24
Gasterosteus aculeatus	899	30
Limanda limanda	24	13
Merlangius merlangus	448	33
Platichthys flesus	26	11
Pleuronectes platessa	12	7
Pomatoschistus minutus	396	28
Sardina pilchardus	83	5
Scomber scombrus	5 081	25
Sprattus sprattus	6 308	42
Squalus acanthias	53	2
Trachinus draco	228	13
Trachurus trachurus	169	28
Others	124	-

Figure 4 shows the relative length-frequency distributions of herring and sprat in ICES subdivisions 21, 22, 23 and 24 for the years 2021 and 2022. Compared to results from the previous survey in 2021, the following conclusions for **herring** can be drawn:

- In 2022 catches in SD 21 were dominated by the incoming year class at 12-17 cm length with a mode at 15 cm and only low contributions of larger herring. This is in contrast to 2021, when catches in SD 21 were dominated by herring >15 cm with a mode at 18.75 cm and minor contributions of the incoming year class (ca. ≤15 cm).
- As in the previous year, catches in SD 22 were dominated by the incoming year class (ca. ≤15 cm), but with somewhat higher contributions of small herring <10 cm.
- In SD 23 a significant contribution of herring >20 cm was again recorded. Catches showed a mode at ca. 26.75 cm (2021: 26.25 cm). Other than in the previous year, minor contributions

of very small herring (mode at ca. 7 cm) and the incoming year class (mode at ca. 15 cm) were registered.
- In 2022, catches in SD 24 showed a bimodal distribution with modes at ca. 13 cm and 18 cm, whereas catches in the previous year were characterized by a trimodal distribution with modes at 9.25 cm, 13.25-14.25 cm and 17.25 cm, with also lower contributions of fishes <15 cm than in 2022. Both in 2022 as well as in the previous survey, herring larger than ca. 25 cm were almost absent.

Relative length-frequency distributions of **sprat** in the years 2021 and 2022 (Figure 4) can be characterized as follows:

- In SD 21 the incoming year class (ca. ≤10 cm) had virtually been absent from catches in 2021. In contrast, some contribution of this year class was observed in in 2022. However, both in 2021 and in 2022 catches in SD 21 were dominated by larger sprat (mode at ca. 13 cm in 2022).
- In 2021, catches in SD 22 had shown a tri-modal distribution with contributions of the incoming year class (ca. ≤10 cm, mode at 9.75 cm) as well as of larger sprat (>10 cm, modes at 11.25 cm and at 13.25 cm, respectively) and a general length range of ca. 7.5-15 cm with only minor contributions of smaller fish. This is contrast to the results of 2022, when catches showed a unimodal distribution indicating an exclusive contribution of the incoming year class (ca. ≤10 cm) with a mode at ca. 8.5 cm and virtually no sprat measured >10.5 cm.
- In SD 23, catches of sprat resembled the observations made in 2021 with catches dominated by larger fish (>10 cm) at a mode of ca. 14.25 cm. Other than in 2021, a low but distinct contribution of the incoming year class was observed in 2022.
- In SD 24, catches of sprat also highly resembled the observations made in 2021 and showed a bimodal distribution with a distinct contribution of the incoming year class (ca. ≤10 cm, mode at 8.75 cm) and also a notable contribution of larger, older sprat (>10 cm, mode at ca. 12.75 cm).
- Altogether, the contribution of the incoming year class (ca. ≤10 cm) seemed to be higher than in 2021 and 2020.

For abundance and biomass estimates, the following considerations and calculation steps were included in the analysis:

<u>Fish species considered:</u>

Herring	(*Clupea harengus*)
Transparent goby	(*Aphia minuta*)
European anchovy	(*Engraulis encrasicolus*)
Cod	(*Gadus morhua*)
Three-spined stickleback	(*Gasterosteus aculeatus*)
Haddock	(*Melanogrammus aeglefinus*)
Whiting	(*Merlangius merlangus*)
European hake	(*Merluccius merluccius*)
Sardine	(*Sardina pilchardus*)
Mackerel	(*Scomber scombrus*)
Sprat	(*Sprattus sprattus*)
Greater weever	(*Trachinus draco*)
Norway pout	(*Trisopterus esmarki*)

Exclusion of trawl hauls with very low catches:

Haul No.	Rectangle	Subdivision (SD)
4	40G0	22
10	39G2	24
11	39G3	24
24	38G3	24
45	41G2	21
49	41G2	23

Usage of neighboring trawl information for rectangles which contain only acoustic investigations:

Rectangle/SD to be filled	with Haul No.	of Rectangle/SD
43G2/21	42, 43	43G1/21, 43G2/21
39F9/22	2, 3	39G0/22, 40F9/22
41G2/21	36	41G1/21
38G0/22	30	37G0/22
39G1/22	8	39G0/22

3.3 Stock Splitting / Application of the Separation Function (SF)

The age-length distribution of herring in SD 21, SD 22 and in SD 23 in 2022 indicated only minor contribution of fish of CBH origin. The SF was only applied in SD 24.

The applicability of the SF, which is checked by analyzing the growth parameters based on baseline samples of WBSSH in SDs 21 and 23 (GERAS) and SDs 27-29 (GERBASS), was also tested in 2022. Due to a minor degree of mixing of CBH/WBSSH in SDs 21, 22 and 23, results showed applying the SF for splitting of WBSSH and CBH stocks was feasible (Haase & Schaber, 2023).

3.4 Biomass and abundance estimates

The total abundance of herring and sprat per ICES statistical rectangle and Subdivision is presented in Table 6. Estimated numbers of herring and sprat by age group and SD/rectangle are given in Tables 7 and 10, respectively. Corresponding mean weights by age group and SD/rectangle are provided in Tables 8 and 11. Estimates of herring and sprat biomass by age group and SD/rectangle are summarized in Tables 9 and 12.

3.4.1 Herring incl. Central Baltic Herring (CBH)

The total herring stock in Subdivisions 21-24 was estimated to be 3.3 x 10^9 fish (Table 7) or 86.1 x 10^3 tons (Table 9). For Subdivisions 22-24 the number of herring was calculated at 2.2 x 10^9 fish or 61.6 x 10^3 tons.

3.4.2 Herring excl. Central Baltic Herring (CBH) & incl./excl. large herring accumulation in SD 23

Abundance and biomass indices of herring excluding CBH in SDs 21-24 by age group and SD/rectangle are provided in tables 13-15.

Removal of the CBH fraction in SD 24 yielded the following results:

Abundance (mio)	incl. CBH	excl. CBH in SD24
SDs 21-24	3 257.6	2 822.9
Percentage of Total	100.0%	86.7%
Difference		- 13.3%
Biomass (mt)	incl. CBH	excl. CBH in SD24

SDs 21-24	86 116.6	69 670.9
Percentage of Total	100.0%	80.9%
Difference		-19.1%

Removal of the CBH fraction in SD 24 from the herring HAWG-GERAS index of the standard area (excluding 43G1/43G2 in SD 21 and 37G3/37G4 in SD 24) in 2022 resulted in biomass reductions of 19 % with corresponding reductions in numbers of 13 % (2021: -53% and 55%, 2020: - 37 % and -27 %, 2019: -36 % and -24 %, 2018: -20 % and -11 %, respectively (Figure 6).

Estimated resulting abundance and biomass estimates of herring excluding CBH in SDs 21-24 by age group and SD/rectangle as well as excluding the large aggregation of (presumed) North Sea herring (see below) for 2022 are given in Tables 16-18.

Removal of the CBH fraction in SD 24 as well as the presumed NSAS in rectangle 41G2/SD 23 yielded the following results:

Abundance (mio)	incl. CBH	excl. CBH in SD24 and excl. 41G2/SD23
SDs 21-24	3 257.6	2 744.9
Percentage of Total	100.0%	84.3%
Difference		- 15.7%
Biomass (mt)	incl. CBH	excl. CBH in SD24 and excl. 41G2/SD23
SDs 21-24	86 116.6	58 140.7
Percentage of Total	100.0%	67.5%
Difference		-32.5%

Removal of the CBH fraction in SD 24 as well as the presumed NSAS herring fraction from rectangle 41G2 in SD 23 from the herring HAWG-GERAS index of the standard area (excluding 43G1/43G2 in SD 21 and 37G3/37G4 in SD 24) in 2022 resulted in biomass reductions of 33 % with corresponding reductions in numbers of 16 %.

The time series of HAWG-WBSSH-GERAS indices (standard area) is depicted in Figure 7.

3.4.3 Sprat

The estimated sprat stock in Subdivisions 21-24 was 4.0 x 10^9 fish (Table 10) or 31.9 x 10^3 tons (Table 12). For the included area of Subdivisions 22-24 the number of sprat was calculated at 3.9 x 10^9 fish or 29.7 x 10^3 tons. The overall abundance estimate in 2022 was dominated by zero and three year old sprat (Figure 4 and Table 10).

3.5 Hydrography

Vertical profiles of temperature, salinity and oxygen concentration were measured with a SeaBird SBE CTD-probe on a station grid covering the whole survey area. Hydrography measurements were either conducted directly after a trawl haul or, in case of no fishing activity, in regular intervals along the cruise track. Altogether, 74 CTD casts were conducted during this survey (Figure 7).

Surface temperatures were higher than in the previous year in some areas, ranging from > 12°C in the central Kattegat area (SD 21) to 14°C, and partly higher in the southwestern parts of the survey area

(SD 22) and the Arkona Sea (SD 24). In general, surface temperatures were highest in the southern part of the survey area. Bottom temperatures showed a higher variability due to thermohaline layering and were lowest in the deep parts of the Bornholm Basin area in SD 24 (~ 8°C). The deeper parts of the Sound and the Kattegat were comparatively warm with temperatures around 12°C. Temperatures near the seafloor were generally higher in the shallow areas of SD 21-24, but in the central and eastern parts of the Arkona Sea (SD 24), bottom temperatures were relatively high at ~ 14 °C and exceeded surface temperatures.

As usual, due to the hydrographic nature of the western Baltic Sea, surface salinities showed a large gradient (from ca. 7.5 PSU in the southeastern Arkona Sea to > 25 PSU in the Kattegat). Surface salinities in the western parts of the survey area were comparable to the values recorded in the previous year and exceeded 15 PSU south of the Belt Sea. Salinity near the seafloor ranged from 8 PSU in the Arkona Sea to ca. 34 PSU in the deep parts of the Kattegat. Especially in the Sound (SD 23), a very strong stratification with steep salinity gradients was again observed.

Surface waters were well oxygenated throughout the survey area. In contrast, pronounced oxygen depletion was measured in the inner Mecklenburg Bight (SD 22) and the western SD 22 area of the southern Little Belt as well as in the deep parts of the southeastern Arkona Sea (Bornholm Basin area). In those regions, lowest oxygen concentrations measured near the seafloor were below 0.5 ml/l and occasionally in in the anoxic range.

4. DISCUSSION

Compared to the previous year, the present estimates of herring **incl. CBH** show a distinct increase in abundance and stock biomass (in the standard area covered in both 2021 and 2022):

Herring (incl. CBH)	Difference compared to 2021	
Area	Numbers (%)	Biomass (%)
Subdivisions 21-24	+79	+39

The present results **incl. CBH** are mainly driven by a far higher contribution of the 0-group (+461% in numbers and +714% in biomass).

The present estimates of herring **excl. CBH** and excl. the large haul in 41G2/SD23 show a significant increase in stock biomass and abundance (in the standard area covered in both 2021 and 2022):

Herring (excl. CBH)	Difference compared to 2020	
Area	Numbers (%)	Biomass (%)
Subdivisions 21-24	+231	+98

The high number of 0-group herring together with the exclusion of a large part of 1-8+ years old CBH in the main mixing area of SD 24 (by applying SF) lead to the overall significant increase in stock biomass and abundance values (**excl. CBH** and excl. Rectangle 41G2/SD23) compared to 2021.

The application of the Separation Function (SF) to remove CBH from the index calculation again yielded robust results (Haase & Schaber, 2023 WD). Estimates of parameters of the Bertalanffy-Growth-Function (BGF) in 2022 showed a decreasing trend compared to the period 2005-2010 which can be explained by a distinctly lower contribution of older/larger herring in 2022. The majority of WBSSH could be allocated to the corresponding stock using the SF established with BGF parameters from 2005-2010. Again, mean weights of different age groups that prior to removal showed somewhat untypical growth pattern for WBSSH became distinctly more realistic for older age groups after removing the CBH fraction.

After over 6 years of consecutive decline, the present Western Spring Spawning Herring biomass estimate (HAWG-GERAS Index) in 2022 showed a distinct increase from the lowest recorded value in the time series in 2021 (Figure 7). This trend, however, is strongly driven by the large increase of 0-group herring.

Prior to 2016, high numbers of large herring were usually and regularly recorded in SD 23 (the Sound), which is considered an important transition and aggregation area for the WBSSH stock during its spawning migration (Nielsen, 1996). In 2022, after several years of supposed absence, some of those fishes were present in catches from the Sound again for the third year in a row since 2020. The reason for this re-appearance or for the previous absence in survey hauls can so far not be identified. The lack of large, adult herring in the Sound in previous years has been explained by a possibly delayed immigration of WBSSH from the feeding areas in the Skagerrak. The exceptionally low numbers of large and older herring since 2016 could also be explained by the very low recruitment, which was recorded through the N20 larval survey index during the last years. The sustained downward trend in recruitment could explain the further disappearance of older herring in time. A strong correlation of the N20 index with the 1-age group of the GERAS index (Polte and Gröhsler, 2022) supports this assumption. Methodological biases leading to presence or absence of large herring in the catches can again not be ruled out, but at least in terms of overall acoustic detections of clupeids seem not likely. Possible shifts in the spatial or diurnal distribution of herring aggregations towards shallower areas would be undetected by the current survey and cannot be disregarded. An indication for such possible shifts was again detected during a 2022 parallel survey of the inner Sound transect with FRV “Solea” and FRV “Clupea”, when some large - assumed clupeid- aggregations were detected in shallower areas of SD 23 off the regular transects covered during GERAS (analysis of parallel survey CLU370 with FRV “Clupea” pending). However, the presence of large aggregations in areas not covered by the regular GERAS transects alone is not indicative of a potential shift, since herring may regularly be distributed in that regions and also have been so during years with large aggregations detected on the acoustic transects as well.

Migrations of herring out of the sound can be triggered by hydrographic conditions in a way that barotropic inflow events in late summer and early autumn prevent deoxygenation in the Sound. This leads to prolonged aggregations of herring in the Sound (Miethe et al., 2014). In 2022, no such migration could be assumed since no older and bigger herring were detected in corresponding areas of the adjacent SD 24, nor was there an indication of according hydrographic conditions driving herring out of the Sound.

In the statistical rectangle 41G2 in SD 23, in the “isthmus” of the Sound between Helsingör and Helsingborg, again a large aggregation of fish was recorded on the echosounder along a ridge in less than 20 m depth. A similarly large and smaller aggregations had been recorded at the same position in 2021 and the years before, respectively. Due to navigational constraints as well as the difficult bathymetry, no targeted trawl haul could be conducted on this aggregation before 2021. In 2021, due to the large size of the school and the significant contribution to the overall NASC measured in the rectangle and the whole Subdivision 23, it was attempted to collect a trawl sample from that school. The catch yielded a large amount of large herring that were all spawning (maturity 6). Genetic analysis revealed that this aggregation consisted of North Sea autumn spawning herring (NSAS). Accordingly, both the biological samples and the hydroacoustic records originating from that school of spawning herring were removed from the further analysis of survey indices for WBSSH in 2021. In 2022, herring sampled from that large aggregation were already finished with spawning. Accordingly, it was assumed that these again were North Sea autumn spawning herring. Genetic analysis for the 2022 samples is still ongoing. However, to indicate the effect of that large school (and associated NASC values) on the survey estimates, abundance and biomass indices for WBSSH were estimated including and excluding NASC values of this accumulation and the corresponding haul. Removing the presumed NSAS fraction from the WBSSH estimates resulted in a 3% reduction in total abundance and a 17% reduction in total biomass. However, both indices of WBSSH, i.e. those including the presumed NSAS fraction and those with the presumed NSAS fraction removed, were significantly higher than the estimates for the previous years - largely driven by the increase in 0-group herring, which however are considered not to be representatively sampled/contained within the survey area and show large interannual variation in abundance.

5. SURVEY PARTICIPANTS

Name	Function	Institute
Dr. M. Schaber (16.-24.10.)	Cruise Leader (Hydroacoustics, Hydrography)	TI-SF
L. Hartkens (5.-16.10.)	Cruise Leader (Hydroacoustics, Hydrography)	TI-SF
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A. Georgi	Fishery biology	TI-OF
M. Koth	Fishery biology	TI-OF
N. Lyse (5.-16.10.)	Fishery biology	DTU-Aqua (DK)
S. Niemann (16.-24.10.)	Fishery biology	TI-OF
K. Paetz (5.-16.10.)	Fishery biology	TI-SF
J. Plewka (16.-24.10.)	Fishery biology	TI-SF
J. Stounberg (16.-24.10.)	Fishery biology	DTU-Aqua (DK)

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7. FIGURES

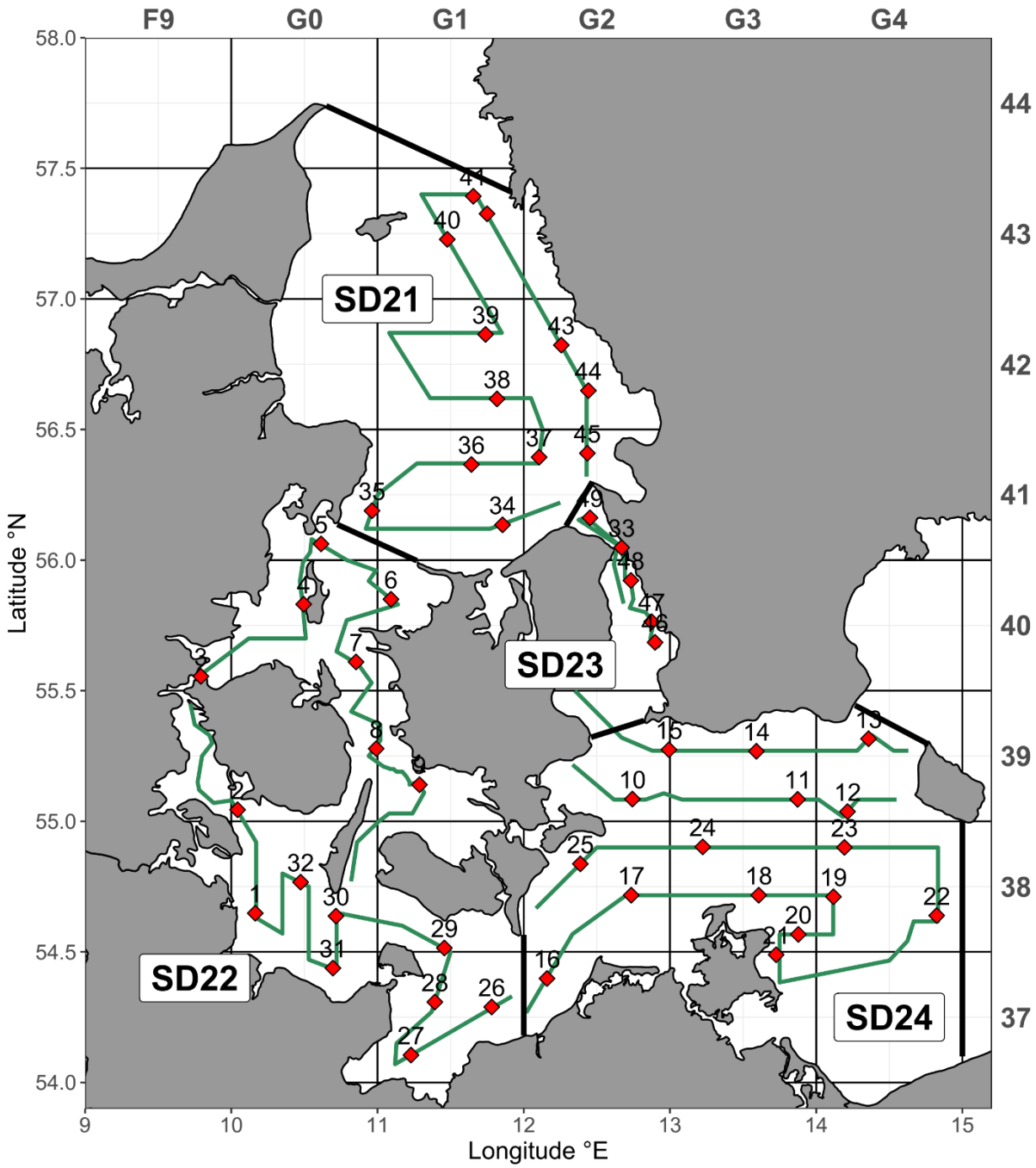

Figure 1: FRV "Solea" cruise 812/2022. Cruise track (dark green lines) and fishery hauls (red diamonds). ICES statistical rectangles are indicated in the top and right axis. Thick black lines separate ICES subdivisions (SD).

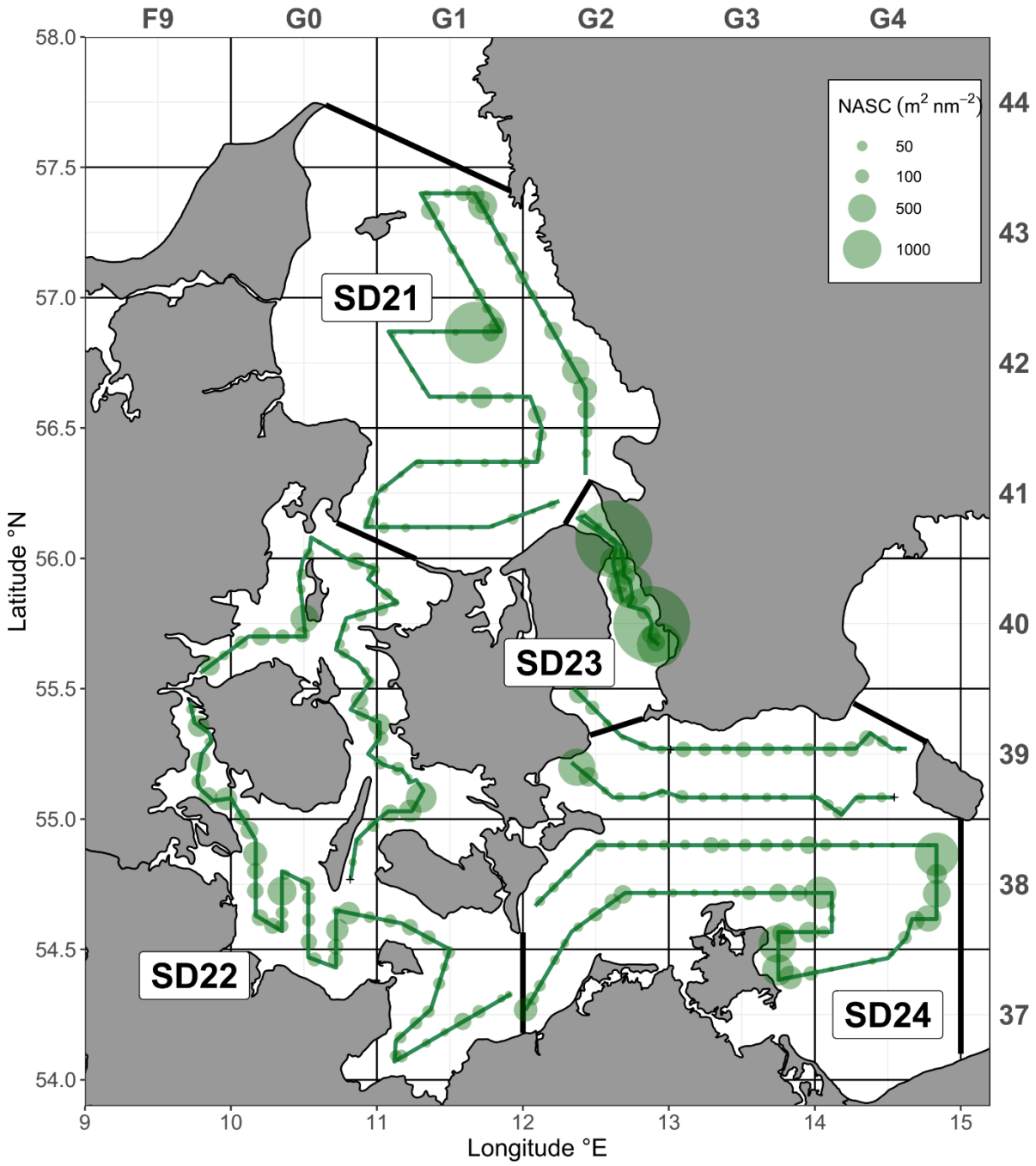

Figure 2: FRV "Solea" cruise 812/2022. Cruise track (thin grey lines) and mean NASC (5 nmi intervals, dots). ICES statistical rectangles are indicated in the top and right axis. Thick black lines separate ICES subdivisions. Note the large NASC value measured in 41G2 (SD 23) which was both included and excluded from the WBSSH estimates (see results).

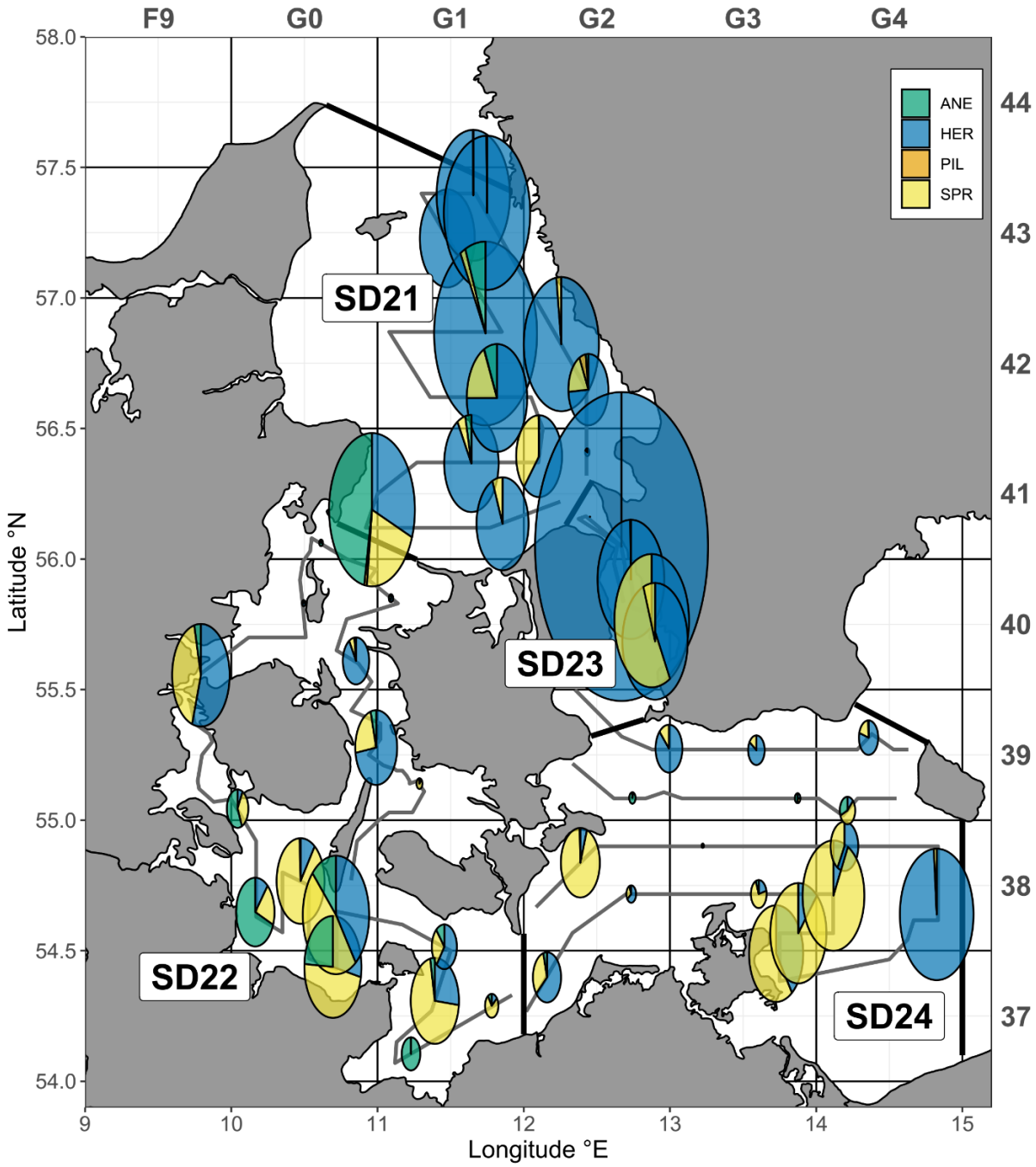

Figure 3: FRV "Solea" cruise 812/2022. Clupeid catch per haul (kg 30min^{-1}). ANE = European anchovy (*Engraulis encrasicolus*), HER = Herring (*Clupea harengus*), PIL = Sardine (*Sardina pilchardus*), SPR = Sprat (*Sprattus sprattus*). ICES statistical rectangles are indicated in the top and right axis. Thick black lines separate ICES subdivisions. Thin grey lines indicate cruise track.

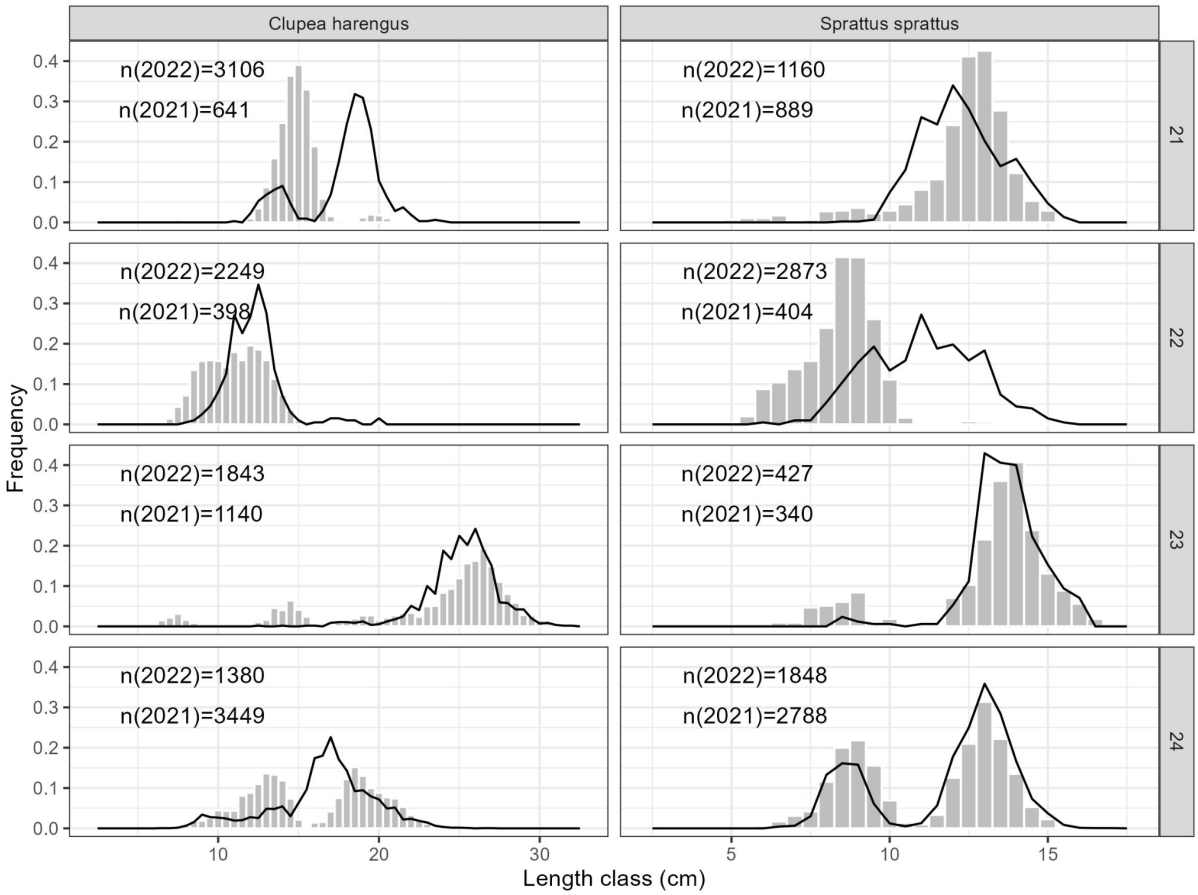

Figure 4: FRV "Solea" cruise 812/2022. Herring (Clupea harengus, left) and sprat (Sprattus sprattus, right) length-frequency distribution (bars) compared to the previous year (cruise 798/2021, lines).

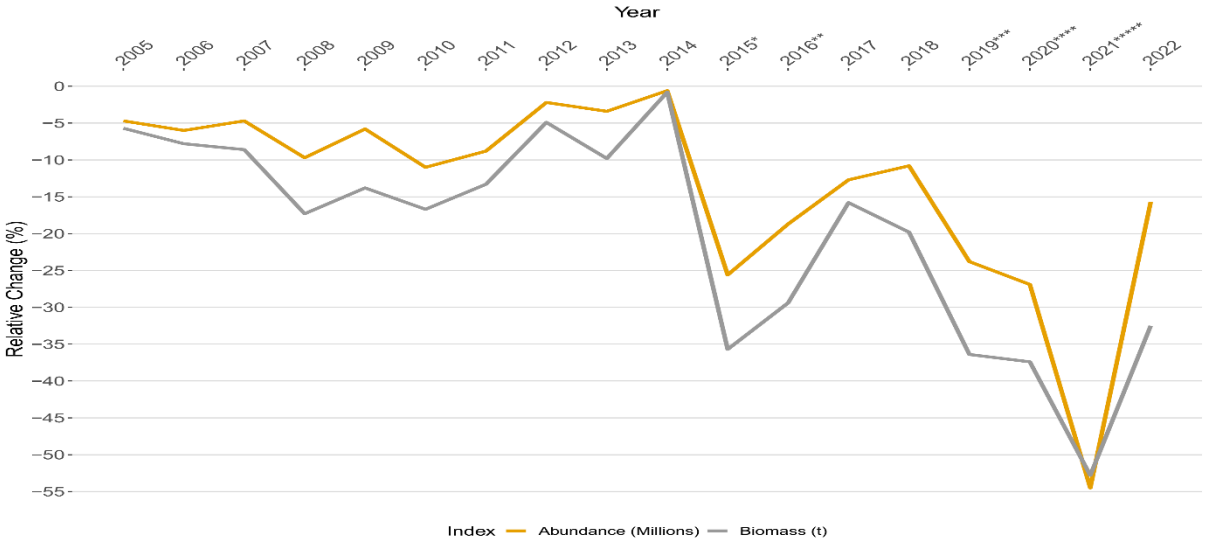

Figure 5: Relative changes in abundance and biomass of Western Baltic Spring Spawning herring in ICES Subdivisions 21-24 (2005-2022) after application of the stock Separation Function (SF, Gröhsler et al., 2013) to the abundance and biomass index generated from German acoustic survey data. In 2022, exclusion comprised CBH in SD 24 as well as rectangle 41G2 in SD 23 (haul 33). **excl. of CBH in SD 22 and mature herring (stages ≥6) in SD 23, **excl. of CBH in SD 22 *** excl. of CBH in SDs 21-23, ****excl. of CBH in SD 21, ******excl. of CBH in SDs 21-22 and excl. haul 32 with almost exclusively mature herring in SD 23.

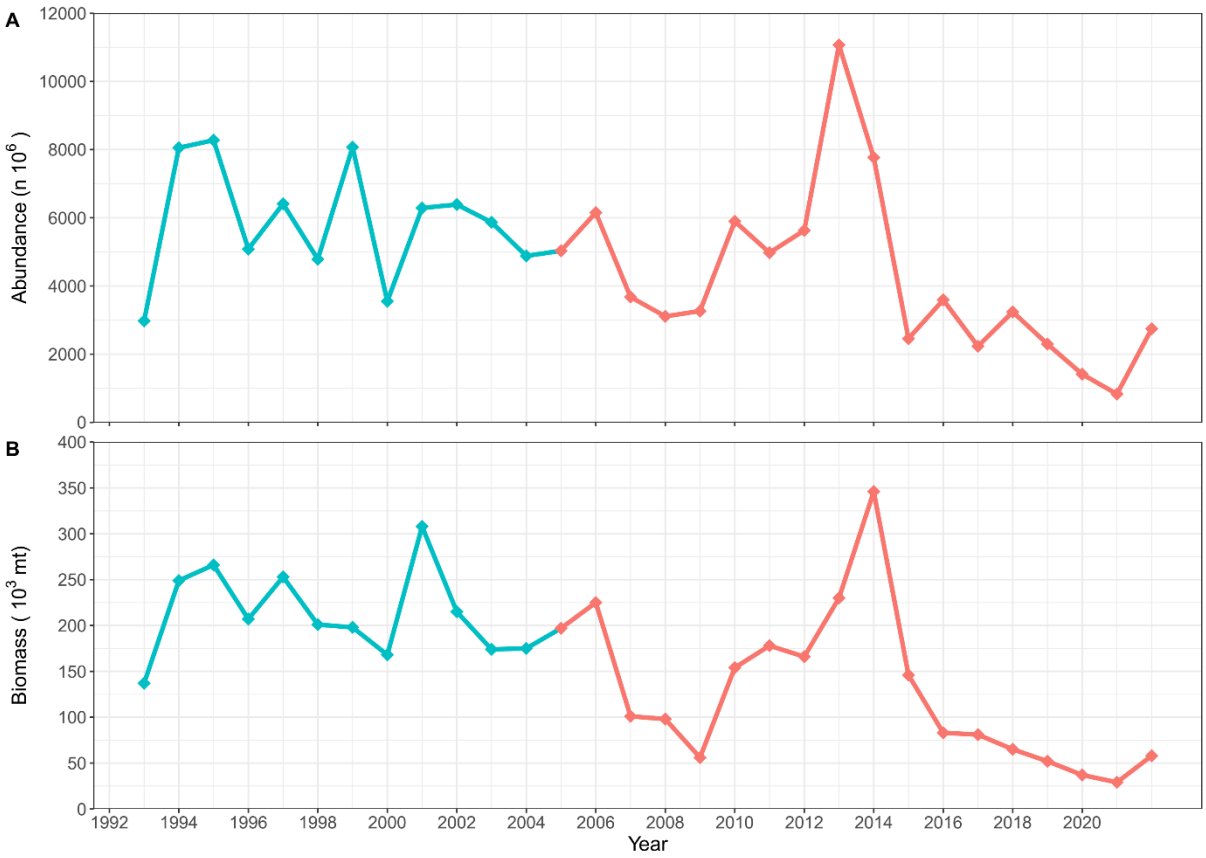

Figure 6: HAWG time series of GERAS survey indices for Western Baltic Spring Spawning Herring (WBSSH) age groups 0-8+. A) Abundance and B) Biomass of herring in ICES Subdivisions 21 (Southern Kattegat, ICES statistical rectangles 41G0 - 42G2) – 24 (excl. ICES statistical rectangles 37G3 & 37G4). Blue line (until 2005): WBSSH including Central Baltic Herring fraction; Red line (from 2005): WBSSH after application of Separation Function (SF).

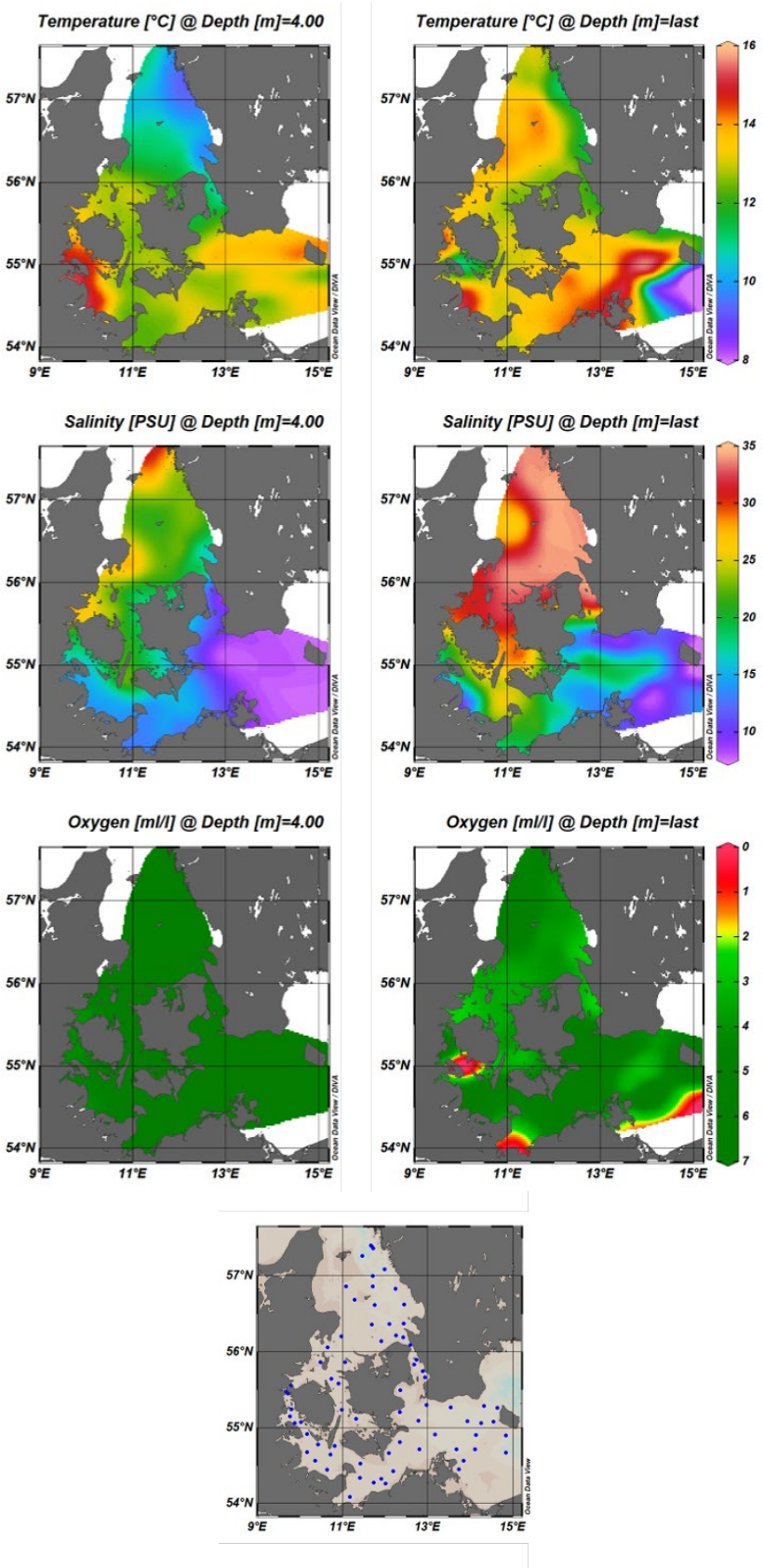

Figure 7: FRV "Solea" cruise 812/2022: Hydrography. CTD stations are depicted as blue dots in the area map. Temperature (°C, top panels), salinity (PSU, middle panels and oxygen concentration (ml/l, lower panels) at the surface (left) and near the seafloor (right). Station overview below surface plots.

8. TABLES

Table 1: FRV “Solea” cruise 812/2022: Simrad EK80 calibration report (38 kHz Transducer).

Date:	16.10.2022		
Calibration Site:	Kiel Bight/ Strande Bay (54°26.30 N, 10°11.85 E)		
Transceiver Type:	WBT		
Software Version:	EK80 21.15.1.0		
Reference Target:	Tungsten (WC-Co) 38.1 mm		
Transducer:	ES38-7 Serial No. 147		
Frequency:	38000 Hz	Beamtype:	Split/Narrow
Depth:	4.20 m		
Pulse Duration:	1.024 ms		
Power:	2000 W		
TS Detection:			
Min. Value:	-50.0 dB	Min. Spacing:	0.0
Mx. Gain Comp.:	3.0 dB	Min. Echolength:	0.8
Max. Echolength:	1.8		
Environment:			
Absorption Coeff.:	0.005521	Sound Velocity:	1487.06m/s
Temperature:	14.4 °C	Salinity:	20.0 PSU
Calibration results:			
Transducer Gain:	26.91 dB	SaCorrection:	-0.0562 dB
Beamwidth Athw.:	6.52 deg	Beamwidth Along.:	6.50 deg
Offset Athw.:	0.08 deg	Offset Along.:	-0.13 deg
RMS-Error:	0.07		

Table 2: FRV "Solea" cruise 812/2022: Catch composition (kg 0.5 h^{-1}) by haul in SD 21 (+ = <0.01 kg).

Haul No.	34	35	36	37	38	39	40	41	42	43	44	45
Species/ICES Rectangle	**41G1**	**41G0**	**41G1**	**41G2**	**42G1**	**42G1**	**43G1**	**43G1**	**43G1**	**42G2**	**42G2**	**41G2**
APHIA MINUTA		0.01	+	0.49	0.02					0.48	0.28	+
CLUPEA HARENGUS	19.38	48.96	21.83	8.59	25.72	399.60	24.49	74.88	243.81	81.80	7.09	0.24
ENGRAULIS ENCRASICOLUS	0.01	74.34	0.86	0.03	2.39	28.09		0.02	0.37	+	0.21	0.02
EUTRIGLA GURNARDUS		0.003		+	+		0.05	+				+
GADUS MORHUA		0.06			0.02							
GASTEROSTEUS ACULEATUS	+	0.01			0.01							
LIMANDA LIMANDA		0.20	0.05					0.09			0.30	
MELANOGRAMMUS AEGLEFINUS							0.03	0.21				
MERLANGIUS MERLANGUS	0.30	0.43	0.20	0.03	1.35	0.63	0.25	0.82	0.95	0.38	1.08	0.06
MERLUCCIUS MERLUCCIUS							0.23		0.16	0.11		
PLEURONECTES PLATESSA		0.95										
POMATOSCHISTUS MINUTUS	+	+			0.01	+	+			+	+	+
SARDINA PILCHARDUS		1.54			0.06					0.02	0.50	0.01
SCOMBER SCOMBRUS	0.20	2.42	7.90	8.65	0.64	10.02	0.04	0.93	0.38	2.93	0.60	0.04
SPRATTUS SPRATTUS	1.03	33.21	1.18	5.35	6.14	7.29		0.00	0.04	1.74	1.79	0.03
SQUALUS ACANTHIAS							1.11		764.24			
TRACHINUS DRACO	25.20		3.40		2.63	0.54	0.04	0.16	0.18	0.34	0.07	0.12
TRACHURUS TRACHURUS	0.07	0.08	0.03		0.04	0.03	0.01	0.02	0.083	0.01	0.06	0.03
TRISOPTERUS ESMARKI							0.04	0.60	0.04			
Total	**46.20**	**162.22**	**35.45**	**23.13**	**39.03**	**446.20**	**26.28**	**77.73**	**1010.25**	**87.81**	**11.98**	**0.53**

Table 3: FRV "Solea" cruise 812/2022: Catch composition (kg 0.5 h^{-1}) by haul in SD 22 (+ = <0.01 kg).

Haul No.	1	2	3	4	5	6	7	8	9	26	27	28	29	30	31	32
Species/ICES Rectangle	**38G0**	**39G0**	**40F9**	**40G0**	**41G0**	**40G1**	**40G0**	**39G0**	**39G1**	**37G1**	**37G1**	**37G1**	**38G1**	**38G0**	**37G0**	**38G0**
AGONUS CATAPHRACTUS													0.02			
APHIA MINUTA				+		+	0.47	+	+	+	+	0.02	+		0.02	0.01
BELONE BELONE							0.06				0.06	0.04			0.03	
CLUPEA HARENGUS	0.96	0.19	15.84	0.16	0.07	0.17	3.41	7.89	0.05	0.17		4.30	2.05	19.69	7.94	1.60
CTENOLABRUS RUPESTRIS		+		0.01					0.03							
CYCLOPTERUS LUMPUS							0.35								0.49	
ENGRAULIS ENCRASICOLUS	5.99	1.45	1.06	0.05	0.18	0.10	0.08	0.47	+	0.12	1.99	0.50	0.38	6.20	6.77	0.10
GADUS MORHUA	6.47	+		+		+		0.01	+			0.26			7.07	0.02
GASTEROSTEUS ACULEATUS	0.07	0.10			+	0.01		+	+		0.03	0.48	0.17		0.12	0.01
GOBIUS NIGER				+												
LIMANDA LIMANDA	0.39	0.11						0.04	0.06		0.25	0.03	0.07			
MERLANGIUS MERLANGUS	0.02			0.02	0.12	0.05		0.04	0.03	0.04		0.09	0.02		0.08	
PLATICHTHYS FLESUS	0.25															
PLEURONECTES PLATESSA		0.05											0.12			
POMATOSCHISTUS MINUTUS	0.01					+		+	0.01			0.01	0.03	+	+	0.01
SCOMBER SCOMBRUS			6.49				0.14				0.06	0.11		0.06	1.38	
SPRATTUS SPRATTUS	1.73	0.91	11.92	0.02		0.03	0.25	2.49	0.37	0.92		11.39	0.96	23.49	13.41	14.27
SYNGNATHUS TYPHLE											+					+
TRACHINUS DRACO					0.09	0.03	0.06									
TRACHURUS TRACHURUS	0.01			+		0.07	0.04	0.04		0.01	0.06	0.06	0.01	0.09	0.09	
Total	**15.90**	**2.82**	**35.31**	**0.26**	**0.46**	**0.47**	**4.85**	**10.99**	**0.57**	**1.26**	**2.45**	**17.29**	**3.83**	**49.52**	**37.40**	**16.03**

Table 4: FRV "Solea" cruise 812/2022: Catch composition (kg 0.5 h^{-1}) by haul in SD 23 (+ = <0.01 kg).

Haul No.	33	46	47	48	49
Species/ICES Rectangle	**41G2**	**40G2**	**40G2**	**40G2**	**41G2**
APHIA MINUTA			0.21	+	+
BELONE BELONE		0.03	0.06		
CLUPEA HARENGUS	27294.00	43.69	33.92	50.44	
CTENOLABRUS RUPESTRIS			0.02		
ENGRAULIS ENCRASICOLUS		0.00			0.00
EUTRIGLA GURNARDUS					0.00
GADUS MORHUA		1.10	2.96		
GASTEROSTEUS ACULEATUS			0.00		0.00
MERLANGIUS MERLANGUS			2.54	0.13	0.01
PLEURONECTES PLATESSA				0.18	
SCOMBER SCOMBRUS	6.42	0.46	1.08		
SPRATTUS SPRATTUS		2.71	47.14	0.16	
TRACHURUS TRACHURUS					0.02
TRISOPTERUS ESMARKI				0.01	
Total	**27300.42**	**47.98**	**87.94**	**50.92**	**0.03**

Table 5: FRV "Solea" cruise 812/2022: Catch composition (kg 0.5 h^{-1}) by haul in SD 24 (+ = <0.01 kg).

Haul No.	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Species/ICES Rectangle	**39G2**	**39G3**	**39G4**	**39G4**	**39G3**	**39G2**	**37G2**	**38G2**	**38G3**	**38G4**	**38G3**	**37G3**	**38G4**	**38G4**	**38G3**	**38G2**
APHIA MINUTA			+				+	0.01	+						+	+
BELONE BELONE	0.07										0.06			0.06		
CLUPEA HARENGUS	0.02	0.10	0.19	1.69	1.40	3.38	2.72	0.50	0.33	2.91	3.06	9.40	75.26	2.40	0.09	0.50
CYCLOPTERUS LUMPUS				0.19	0.16					0.65	0.35			0.28		
ENGRAULIS ENCRASICOLUS	0.43	0.19	0.46	0.01			0.18	0.05	0.09		0.02				0.06	0.04
GADUS MORHUA	+	0.01	+	0.22	0.01		0.04	0.01	0.01			1.71	3.38			0.02
GASTEROSTEUS ACULEATUS	1.17	0.13	2.11		0.02	0.03	0.05		0.12	0.27	0.15	0.06	0.17	0.01	0.17	0.05
GOBIUS NIGER	+		+													
LIMANDA LIMANDA				0.09												0.09
MERLANGIUS MERLANGUS		+	0.01				0.05	0.01	0.01			0.13	0.09			0.05
PLATICHTHYS FLESUS		0.17	0.36	1.00	0.26				0.45	0.72	0.23		0.51		1.10	0.35
PLEURONECTES PLATESSA			0.10						0.21				0.51			
POMATOSCHISTUS MINUTUS	0.01	0.06	0.03	0.01		+		+	0.01		+		+		0.02	0.01
RHINONEMUS CIMBRIUS			0.09													
SCOMBER SCOMBRUS							0.04		0.05			0.19				0.05
SPRATTUS SPRATTUS		0.09	0.83	0.42	0.26	0.48	1.36	0.22	1.11	34.58	23.52	14.06	0.96	1.71		8.42
TRACHURUS TRACHURUS							0.22	0.02	0.01						+	0.01
Total	**1.71**	**0.76**	**4.18**	**3.63**	**2.11**	**3.90**	**4.66**	**0.81**	**2.40**	**39.14**	**27.39**	**25.55**	**80.88**	**4.46**	**1.45**	**9.58**

Table 6: FRV "Solea", cruise 812/2022. Survey statistics by area.

Subdivision	ICES Rectangle	Area (nm²)	Sa (m²/nm²)	Sigma (cm²)	N total (million)	Herring (%)	Sprat (%)	N Herring (million)	N Sprat (million)
21	41G0	108.1	58.5	1.8	34.79	17.4	8.82	6.04	3.07
21	41G1	946.8	27.4	3.8	68.99	60.32	4.95	41.63	3.42
21	41G2	432.3	46.6	1.6	129.58	38.64	5.75	50.08	7.45
21	42G1	884.2	202	2.2	809.28	70.4	10.48	569.74	84.85
21	42G2	606.8	172.7	1	1074.88	33.26	4.32	357.5	46.49
22	37G0	209.9	109.8	1.0	242.07	21.61	50.48	52.31	122.21
22	37G1	723.3	67.9	0.8	598.75	6.21	50.23	37.2	300.75
22	38G0	735.3	152.4	0.9	1312.09	14.14	54.48	185.56	714.84
22	38G1	173.2	112.8	0.8	254.03	32.35	33.14	82.17	84.18
22	39F9	159.3	173.4	0.8	328	19.01	47.07	62.35	154.37
22	39G0	201.7	199.1	0.9	453.19	33.26	31.75	150.75	143.90
22	39G1	250	207.6	0.8	625.93	32.57	52.42	203.83	328.14
22	40F9	51.3	121.8	0.8	73.75	34.1	61.53	25.15	45.38
22	40G0	538.1	118.2	0.2	3401.83	5.59	0.46	190.15	15.67
22	40G1	174.5	55.7	1.1	86.06	25.64	5.13	22.07	4.42
22	41G0	173.1	24.6	1.8	23.37	17.4	8.82	3.96	2.07
23	40G2	164	414.6	3.2	210.55	59.9	27.44	126.11	57.77
23	41G2	72.3	819.6	6.8	86.72	99.99	-	86.72	-
24	37G2	192.4	87.9	1.1	147.65	43.33	40.37	63.98	59.61
24	38G2	832.9	60.5	0.8	643.45	17.35	68.42	111.66	440.25
24	38G3	865.7	120.4	1.1	933.05	6.71	75.16	62.64	701.28
24	38G4	1034.8	243.0	2.4	1054.81	42.09	52.38	443.92	552.49
24	39G2	406.1	60.6	1.8	136.75	72.2	14.8	98.73	20.23
24	39G3	765	63.1	1.9	249.67	61.63	19.77	153.87	49.35
24	39G4	524.8	72.0	1.3	281.93	24.64	18.88	69.46	53.23
22-24	Total	8247.7			11143.65			2232.58	3850.14
21-24	Total	11225.9			13261.17			3257.57	3995.42

Table 7: FRV "Solea", cruise 812/2022. Numbers (millions) of herring incl. CBH by age/W-rings and area.

Subdivision	Rectangle/ Age	0	1	2	3	4	5	6	7	8+	Total
21	**41G0**	5.88	0.05	0.04	0.05	0.02					6.04
21	**41G1**	35.62	4.22	0.94	0.32	0.18	0.35				41.63
21	**41G2**	50.02	0.03		0.02		0.01				50.08
21	**42G1**	561.77	6.45	0.09	0.65	0.25	0.53				569.74
21	**42G2**	353.81	2.83	0.19	0.39	0.09	0.19				357.50
21	**Total**	1007.10	13.58	1.26	1.43	0.54	1.08	0.00	0.00	0.00	1024.99
22	**37G0**	51.93	0.38								52.31
22	**37G1**	36.53	0.67								37.20
22	**38G0**	184.36	1.20								185.56
22	**38G1**	81.07	0.60				0.50				82.17
22	**39F9**	62.24	0.11								62.35
22	**39G0**	150.34	0.41								150.75
22	**39G1**	199.88	3.95								203.83
22	**40F9**	25.06	0.09								25.15
22	**40G0**	186.87	3.28								190.15
22	**40G1**	21.41	0.66								22.07
22	**41G0**	3.93	0.02				0.01				3.96
22	**Total**	1003.62	11.37	0.00	0.00	0.00	0.51	0.00	0.00	0.00	1015.50
23	**40G2**	38.74	13.94	43.98	13.19	8.42	3.19	3.24	1.13	0.28	126.11
23	**41G2**		0.50	48.24	18.04	7.98	4.37	5.47	1.74	0.38	86.72
23	**Total**	38.74	14.44	92.22	31.23	16.40	7.56	8.71	2.87	0.66	212.83
24	**37G2**	51.99	11.90		0.09						63.98
24	**38G2**	101.29	8.37	0.18	0.45	0.36	0.36	0.18	0.27	0.18	111.64
24	**38G3**	37.16	6.90	3.21	5.38	3.45	2.69	1.46	1.09	1.31	62.65
24	**38G4**	82.27	79.72	47.53	67.13	55.80	45.47	20.19	26.30	19.51	443.92
24	**39G2**	59.43	30.10	1.47	2.79	1.75	1.52	0.58	0.76	0.33	98.73
24	**39G3**	65.00	41.81	5.88	14.03	10.61	8.02	2.32	2.52	3.68	153.87
24	**39G4**	19.62	13.11	6.77	8.85	7.43	6.05	2.68	2.29	2.66	69.46
24	**Total**	416.76	191.91	65.04	98.72	79.40	64.11	27.41	33.23	27.67	1004.25
22-24	**Total**	1459.12	217.72	157.26	129.95	95.80	72.18	36.12	36.10	28.33	2232.58
21-24	**Total**	2466.22	231.30	158.52	131.38	96.34	73.26	36.12	36.10	28.33	3257.57

Table 8: FRV "Solea", cruise 812/2022. Mean weight (g) of herring incl. CBH by age/W-rings and area.

Subdivision	Rectangle/ Age	0	1	2	3	4	5	6	7	8+	Total
21	**41G0**	14.75	47.32	101.17	123.01	135.82	44.72				16.89
21	**41G1**	21.71	49.89	60.80	56.57	48.08	46.80				26.04
21	**41G2**	22.40	35.00		35.00		35.00				22.42
21	**42G1**	23.95	41.18	51.93	37.43	44.74	39.62				24.19
21	**42G2**	23.32	44.51	51.93	43.25	44.74	39.61				23.54
21	**Total**	23.52	44.59	60.11	46.26	49.23	41.90				23.91
22	**37G0**	9.67	13.41								9.70
22	**37G1**	10.55	13.41								10.60
22	**38G0**	8.12	13.41								8.15
22	**38G1**	8.30	13.41				35.00				8.50
22	**39F9**	7.83	13.41								7.84
22	**39G0**	7.72	13.41								7.74
22	**39G1**	9.27	13.41								9.35
22	**40F9**	7.69	13.41								7.71
22	**40G0**	13.39	13.41								13.39
22	**40G1**	10.88	13.41								10.96
22	**41G0**	13.95	13.41				35.00				14.00
22	**Total**	9.51	13.41				35.00				9.56
23	**40G2**	12.50	51.61	112.67	128.74	113.45	144.43	162.40	161.42	204.72	79.60
23	**41G2**		84.96	134.68	144.81	153.22	176.22	171.20	200.35	209.40	144.25
23	**Total**	12.50	52.76	124.18	138.02	132.80	162.81	167.93	185.02	207.41	105.94
24	**37G2**	11.33	14.39		23.33						11.92
24	**38G2**	8.51	16.48	40.39	44.57	45.61	50.84	50.84	47.35	40.39	9.77
24	**38G3**	7.55	32.27	43.16	40.41	44.23	44.51	46.70	50.74	45.72	20.99
24	**38G4**	14.45	32.58	50.50	45.46	48.31	50.89	49.54	55.66	51.37	39.90
24	**39G2**	17.07	17.13	48.14	43.61	50.21	78.40	50.25	59.58	48.41	20.46
24	**39G3**	15.99	24.17	41.99	39.37	42.69	44.71	48.91	48.55	48.25	26.48
24	**39G4**	13.80	28.93	47.33	43.53	46.57	45.74	50.48	54.70	51.42	34.20
24	**Total**	12.59	26.23	48.96	44.07	47.25	50.02	49.45	54.92	50.59	29.23
21-24	**Total**	15.80	28.34	92.81	66.43	61.82	61.43	78.02	65.26	54.24	26.44

Table 9: FRV "Solea", cruise 812/2022 biomass (t) of herring incl. CBH by age/W-rings and area.

Subdivision	Rectangle/ Age	0	1	2	3	4	5	6	7	8+	Total
21	**41G0**	86.7	2.4	4.1	6.2	2.7	0.0	0.0	0.0	0.0	102.0
21	**41G1**	773.3	210.5	57.2	18.1	8.7	16.4	0.0	0.0	0.0	1084.1
21	**41G2**	1120.5	1.1	0.0	0.7	0.0	0.4	0.0	0.0	0.0	1122.6
21	**42G1**	13454.4	265.6	4.7	24.3	11.2	21.0	0.0	0.0	0.0	13781.2
21	**42G2**	8250.9	126.0	9.9	16.9	4.0	7.5	0.0	0.0	0.0	8415.1
21	**Total**	23685.7	605.5	75.7	66.2	26.6	45.3	0.0	0.0	0.0	24505.0
22	**37G0**	502.2	5.1								507.3
22	**37G1**	385.4	9.0								394.4
22	**38G0**	1497.0	16.1								1513.1
22	**38G1**	672.9	8.1				17.5				698.4
22	**39F9**	487.3	1.5								488.8
22	**39G0**	1160.6	5.5								1166.1
22	**39G1**	1852.9	53.0								1905.9
22	**40F9**	192.7	1.2								193.9
22	**40G0**	2502.2	44.0								2546.2
22	**40G1**	232.9	8.9								241.8
22	**41G0**	54.8	0.3				0.4				55.4
22	**Total**	9540.9	152.5	0.0	0.0	0.0	17.9	0.0	0.0	0.0	9711.3
23	**40G2**	484.3	719.4	4955.2	1698.1	955.3	460.7	526.2	182.4	57.3	10038.9
23	**41G2**		42.5	6497.0	2612.4	1222.7	770.1	936.5	348.6	79.6	12509.2
23	**Total**	484.3	761.9	11452.2	4310.5	2178.0	1230.8	1462.6	531.0	136.9	22548.1
24	**37G2**	589.1	171.2		2.1						762.4
24	**38G2**	862.0	137.9	7.3	20.1	16.4	18.3	9.2	12.8	7.3	1091.2
24	**38G3**	280.6	222.7	138.5	217.4	152.6	119.7	68.2	55.3	59.9	1314.9
24	**38G4**	1188.8	2597.3	2400.3	3051.7	2695.7	2314.0	1000.2	1463.9	1002.2	17714.0
24	**39G2**	1014.5	515.6	70.8	121.7	87.9	119.2	29.2	45.3	16.0	2020.0
24	**39G3**	1039.4	1010.6	246.9	552.4	452.9	358.6	113.5	122.4	177.6	4074.1
24	**39G4**	270.8	379.3	320.4	385.2	346.0	276.7	135.3	125.3	136.8	2375.8
24	**Total**	5245.0	5034.6	3184.2	4350.6	3751.5	3206.5	1355.5	1824.8	1399.7	29352.3
22-24	**Total**	15270.2	5949.0	14636.4	8661.0	5929.5	4455.1	2818.1	2355.9	1536.6	61611.7
21-24	**Total**	38955.9	6554.5	14712.1	8727.2	5956.1	4500.4	2818.1	2355.9	1536.6	86116.6

Table 10: FRV "Solea", cruise 812/2022. Numbers (millions) of sprat by age and area.

Subdivision	Rectangle/ Age	0	1	2	3	4	5	6	7	8+	Total
21	**41G0**	0.01	0.41	0.89	1.43	0.21	0.08	0.00	0.04	0.00	3.07
21	**41G1**	0.07	0.68	0.99	1.24	0.36	0.05	0.00	0.03	0.00	3.42
21	**41G2**	0.07	1.38	2.26	2.88	0.67	0.12	0.00	0.07	0.00	7.45
21	**42G1**	2.70	15.82	22.31	32.71	8.80	1.42	0.22	0.87	0.00	84.85
21	**42G2**	15.41	7.02	8.31	11.72	3.28	0.54	0.03	0.18	0.00	46.49
21	**Total**	18.26	25.31	34.76	49.98	13.32	2.21	0.25	1.19	0.00	145.28
22	**37G0**	119.76	1.53	0.28	0.55	0.09					122.21
22	**37G1**	300.09	0.37	0.18	0.11						300.75
22	**38G0**	705.38	5.89	1.09	2.14	0.34					714.84
22	**38G1**	84.18									84.18
22	**39F9**	152.10	0.93	0.67	0.56	0.03	0.08				154.37
22	**39G0**	142.69	0.47	0.17	0.47	0.06	0.04				143.90
22	**39G1**	325.39	1.07	0.39	1.07	0.13	0.09				328.14
22	**40F9**	44.05	0.54	0.39	0.33	0.02	0.05				45.38
22	**40G0**	5.15	1.83	3.62	3.74	0.25	0.33	0.75			15.67
22	**40G1**	2.21					2.21	0.00			4.42
22	**41G0**	0.02	0.36	0.65	0.82	0.08	0.09	0.05			2.07
22	**Total**	1881.02	12.99	7.44	9.79	1.00	2.89	0.80	0.00	0.00	1915.93
23	**40G2**	10.23	2.56	10.03	23.51	7.40	2.91	0.71	0.32	0.10	57.77
23	**41G2**										
23	**Total**	10.23	2.56	10.03	23.51	7.40	2.91	0.71	0.32	0.10	57.77
24	**37G2**	57.01	1.13	0.40	0.55	0.29	0.15	0.04	0.04	0.00	59.61
24	**38G2**	436.39	0.00	0.19	1.35	0.97	0.58	0.58	0.19	0.00	440.25
24	**38G3**	342.91	65.90	89.99	93.46	56.22	34.10	9.19	9.51	0.00	701.28
24	**38G4**	0.00	28.01	86.67	169.62	125.39	80.14	35.79	26.87	0.00	552.49
24	**39G2**	1.38	2.10	3.63	4.76	3.89	2.61	1.13	0.73	0.00	20.23
24	**39G3**	2.90	2.47	9.29	12.31	9.81	7.22	3.19	2.16	0.00	49.35
24	**39G4**	1.32	7.13	9.33	13.73	9.36	7.72	2.52	2.12	0.00	53.23
24	**Total**	841.91	106.74	199.50	295.78	205.93	132.52	52.44	41.62	0.00	1876.44
22-24	**Total**	2733.16	122.29	216.97	329.08	214.33	138.32	53.95	41.94	0.10	3850.14
21-24	**Total**	2751.42	147.60	251.73	379.06	227.65	140.53	54.20	43.13	0.10	3995.42

Table 11: FRV "Solea", cruise 812/2022. Mean weight (g) of sprat by age and area.

Subdivision	Rectangle/ Age	0	1	2	3	4	5	6	7	8+	Total
21	**41G0**	8.36	16.08	17.18	17.97	19.88	18.04	0.00	19.61		17.61
21	**41G1**	6.75	13.72	16.04	18.27	21.28	19.13	24.24	19.61		16.83
21	**41G2**	10.20	14.20	16.31	17.88	20.67	18.17	24.24	19.61		16.92
21	**42G1**	8.14	13.38	16.13	18.68	21.12	19.27	24.24	19.61		16.97
21	**42G2**	4.26	12.12	16.04	18.22	21.22	18.89	24.24	19.61		12.51
21	**Total**	4.87	13.13	16.14	18.50	21.11	19.07	24.24	19.61		15.55
22	**37G0**	5.48	10.06	13.74	14.54	16.00					5.60
22	**37G1**	4.92	9.56	13.45	13.45						4.93
22	**38G0**	4.90	10.08	13.74	14.54	16.00					4.99
22	**38G1**	3.89									3.89
22	**39F9**	3.75	12.02	13.48	14.78	16.00	15.22				3.89
22	**39G0**	4.63	10.37	15.48	14.87	16.00	15.22				4.70
22	**39G1**	3.72	10.37	15.48	14.87	16.00	15.22				3.80
22	**40F9**	3.07	12.02	13.48	14.78	16.00	15.22				3.37
22	**40G0**	5.11	13.55	14.12	14.76	16.00	15.22	19.00			11.53
22	**40G1**	1.89									10.44
22	**41G0**	8.41	13.26	14.34	15.12	16.00	15.22	19.00			14.62
22	**Total**	4.53	10.89	14.06	14.73	16.00	18.11	19.00			4.70
23	**40G2**	5.28	17.53	19.33	20.23	22.28	23.63	25.73	26.19	25.37	17.85
23	**41G2**										
23	**Total**	5.28	17.53	19.33	20.23	22.28	23.63	25.73	26.19	25.37	17.85
24	**37G2**	5.95	10.97	12.52	14.18	15.12	14.61	18.53	16.16		6.25
24	**38G2**	3.83		18.53	18.53	18.53	18.53	18.53	18.53		3.96
24	**38G3**	4.43	13.28	14.11	14.91	15.10	15.10	16.42	15.58		9.58
24	**38G4**		13.72	15.32	16.18	16.61	16.70	16.85	16.81		16.17
24	**39G2**	2.51	12.32	14.67	16.35	16.75	16.58	17.15	17.13		14.87
24	**39G3**	1.17	13.87	15.06	16.48	16.86	16.70	16.70	17.16		15.33
24	**39G4**	3.03	12.43	14.48	15.90	16.56	17.26	17.06	17.22		15.29
24	**Total**	4.21	13.31	14.71	15.79	16.22	16.32	16.80	16.58		10.47
21-24	**Total**	4.44	13.14	15.07	16.39	16.70	16.56	16.99	16.74	25.37	7.99

Table 12: FRV "Solea", cruise 812/2022. Total biomass (t) of sprat by age and area.

Subdivision	Rectangle/ Age	0	1	2	3	4	5	6	7	8+	Total
21	**41G0**	0.1	6.6	15.3	25.7	4.2	1.4	0.0	0.8	0.0	54.1
21	**41G1**	0.5	9.3	15.9	22.7	7.7	1.0	0.0	0.6	0.0	57.5
21	**41G2**	0.7	19.6	36.9	51.5	13.9	2.2	0.0	1.4	0.0	126.1
21	**42G1**	22.0	211.7	359.9	611.0	185.9	27.4	5.3	17.1	0.0	1440.2
21	**42G2**	65.7	85.1	133.3	213.5	69.6	10.2	0.7	3.5	0.0	581.6
21	**Total**	88.9	332.3	561.2	924.4	281.1	42.1	6.1	23.3	0.0	2259.5
22	**37G0**	656.3	15.4	3.9	8.0	1.4	0.0	0.0	0.0	0.0	685.0
22	**37G1**	1476.4	3.5	2.4	1.5	0.0	0.0	0.0	0.0	0.0	1483.9
22	**38G0**	3456.4	59.4	15.0	31.1	5.4	0.0	0.0	0.0	0.0	3567.3
22	**38G1**	327.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	327.5
22	**39F9**	570.4	11.2	9.0	8.3	0.5	1.2	0.0	0.0	0.0	600.6
22	**39G0**	660.7	4.9	2.6	7.0	1.0	0.6	0.0	0.0	0.0	676.7
22	**39G1**	1210.5	11.1	6.0	15.9	2.1	1.4	0.0	0.0	0.0	1246.9
22	**40F9**	135.2	6.5	5.3	4.9	0.3	0.8	0.0	0.0	0.0	152.9
22	**40G0**	26.3	24.8	51.1	55.2	4.0	5.0	14.3	0.0	0.0	180.7
22	**40G1**	4.2	0.0	0.0	0.0	0.0	42.0	0.0	0.0	0.0	46.2
22	**41G0**	0.2	4.8	9.3	12.4	1.3	1.4	1.0	0.0	0.0	30.3
22	**Total**	8523.9	141.5	104.6	144.3	16.0	52.3	15.2	0.0	0.0	8997.9
23	**40G2**	54.0	44.9	193.9	475.6	164.9	68.8	18.3	8.4	2.5	1031.2
23	**41G2**								0.0	0.0	0.0
23	**Total**	54.0	44.9	193.9	475.6	164.9	68.8	18.3	8.4	2.5	1031.2
24	**37G2**	339.2	12.4	5.0	7.8	4.4	2.2	0.7	0.7	0.0	372.4
24	**38G2**	1671.4	0.0	3.5	25.0	18.0	10.8	10.8	3.5	0.0	1742.9
24	**38G3**	1519.1	875.2	1269.8	1393.5	848.9	514.9	150.9	148.2	0.0	6720.4
24	**38G4**	0.0	384.3	1327.8	2744.5	2082.7	1338.3	603.1	451.7	0.0	8932.4
24	**39G2**	3.5	25.9	53.3	77.8	65.2	43.3	19.4	12.5	0.0	300.7
24	**39G3**	3.4	34.3	139.9	202.9	165.4	120.6	53.3	37.1	0.0	756.7
24	**39G4**	4.0	88.6	135.1	218.3	155.0	133.3	43.0	36.5	0.0	813.8
24	**Total**	3540.5	1420.6	2934.3	4669.8	3339.6	2163.3	881.1	690.1	0.0	19639.3
22-24	**Total**	12118.5	1607.0	3232.9	5289.6	3520.4	2284.4	914.6	698.5	2.5	29668.3
21-24	**Total**	12207.3	1939.3	3794.0	6214.0	3801.6	2326.5	920.6	721.8	2.5	31927.8

Table 13: FRV "Solea", cruise 812/2022. Numbers (m) of herring excl. CBH in SD 24 by age/W-rings & area.

Subdivision	Rectangle/ Age	0	1	2	3	4	5	6	7	8+	Total
21	**41G0**	5.88	0.05	0.04	0.05	0.02					6.04
21	**41G1**	35.62	4.22	0.94	0.32	0.18	0.35				41.63
21	**41G2**	50.02	0.03		0.02		0.01				50.08
21	**42G1**	561.77	6.45	0.09	0.65	0.25	0.53				569.74
21	**42G2**	353.81	2.83	0.19	0.39	0.09	0.19				357.5
21	**Total**	1007.1	13.58	1.26	1.43	0.54	1.08	0.00	0.00	0.00	1024.99
22	**37G0**	51.93	0.38								52.31
22	**37G1**	36.53	0.67								37.2
22	**38G0**	184.36	1.2								185.56
22	**38G1**	81.07	0.6				0.5				82.17
22	**39F9**	62.24	0.11								62.35
22	**39G0**	150.34	0.41								150.75
22	**39G1**	199.88	3.95								203.83
22	**40F9**	25.06	0.09								25.15
22	**40G0**	186.87	3.28								190.15
22	**40G1**	21.41	0.66								22.07
22	**41G0**	3.93	0.02				0.01				3.96
22	**Total**	1003.62	11.37	0.00	0.00	0.00	0.51	0.00	0.00	0.00	1015.5
23	**40G2**	38.74	13.94	43.98	13.19	8.42	3.19	3.24	1.13	0.28	126.11
23	**41G2**		0.5	48.24	18.04	7.98	4.37	5.47	1.74	0.38	86.72
23	**Total**	38.74	14.44	92.22	31.23	16.4	7.56	8.71	2.87	0.66	212.83
24	**37G2**	51.99									51.99
24	**38G2**	101.29	0.73								102.02
24	**38G3**	37.16	4.72	2.03	0.53	0.2					44.64
24	**38G4**	82.27	51.76	35.15	15.97	3.49	2.16			0.24	191.04
24	**39G2**	59.43	1.1	1.05	0.86	0.38	0.61				63.43
24	**39G3**	65	13.65	2.32	0.97						81.94
24	**39G4**	19.62	7.37	5.3	1.72	0.55					34.56
24	**Total**	416.76	79.33	45.85	20.05	4.62	2.77	0.00	0.00	0.24	569.62
22-24	**Total**	1459.12	105.14	138.07	51.28	21.02	10.84	8.71	2.87	0.9	1797.95
21-24	**Total**	2466.22	118.72	139.33	52.71	21.56	11.92	8.71	2.87	0.9	2822.94

Table 14: FRV "Solea", cruise 812/2022. Mean weight (g) of herring excl. CBH in SD24 by age/W-rings & area.

Subdivision	Rectangle/ Age	0	1	2	3	4	5	6	7	8+	Total
21	**41G0**	14.75	47.32	101.17	123.01	135.82	44.72				16.89
21	**41G1**	21.71	49.89	60.80	56.57	48.08	46.80				26.04
21	**41G2**	22.40	35.00		35.00		35.00				22.42
21	**42G1**	23.95	41.18	51.93	37.43	44.74	39.62				24.19
21	**42G2**	23.32	44.51	51.93	43.25	44.74	39.61				23.54
21	**Total**	23.52	44.59	60.11	46.26	49.23	41.90				23.91
22	**37G0**	9.67	13.41								9.70
22	**37G1**	10.55	13.41								10.60
22	**38G0**	8.12	13.41								8.15
22	**38G1**	8.30	13.41				35.00				8.50
22	**39F9**	7.83	13.41								7.84
22	**39G0**	7.72	13.41								7.74
22	**39G1**	9.27	13.41								9.35
22	**40F9**	7.69	13.41								7.71
22	**40G0**	13.39	13.41								13.39
22	**40G1**	10.88	13.41								10.96
22	**41G0**	13.95	13.41				35.00				14.00
22	**Total**	9.51	13.41				35.00				9.56
23	**40G2**	12.50	49.83	102.75	123.63	118.45	146.87	165.22	174.85	217.07	81.70
23	**41G2**	18.51	38.21	118.23	134.02	140.02	164.84	169.65	193.70	205.89	82.37
23	**Total**	13.03	49.41	103.40	124.24	119.77	148.14	165.57	175.93	216.61	81.75
24	**37G2**	11.33									11.33
24	**38G2**	8.51	44.31								8.77
24	**38G3**	7.55	40.58	47.08	66.01	71.29					13.82
24	**38G4**	14.45	41.54	55.01	65.59	74.88	84.91			115.00	35.55
24	**39G2**	17.07	37.28	54.52	65.41	71.29	124.00				20.05
24	**39G3**	15.99	40.28	47.99	62.78						21.50
24	**39G4**	13.80	39.94	50.25	64.02	71.29					28.38
24	**Total**	12.59	41.08	53.74	65.32	74.00	93.52			115.00	22.66
21-24	**Total**	15.80	28.07	65.58	56.38	57.56	58.97	78.18	62.11	53.47	23.46

Table 15: FRV "Solea", cruise 812/2022. Total biomass (t) of herring excl. CBH in SD 24 by age/W-rings & area.

Subdivision	Rectangle/ Age	0	1	2	3	4	5	6	7	8+	Total
21	**41G0**	86.73	2.37	4.05	6.15	2.72	0	0	0	0	102.01
21	**41G1**	773.31	210.54	57.15	18.1	8.65	16.38	0	0	0	1084.13
21	**41G2**	1120.45	1.05	0	0.7	0	0.35	0	0	0	1122.55
21	**42G1**	13454.39	265.61	4.67	24.33	11.19	21	0	0	0	13781.19
21	**42G2**	8250.85	125.96	9.87	16.87	4.03	7.53	0	0	0	8415.1
21	**Total**	23685.73	605.53	75.74	66.15	26.59	45.26	0.00	0.00	0.00	24504.98
22	**37G0**	502.16	5.1								507.26
22	**37G1**	385.39	8.98								394.38
22	**38G0**	1497	16.09								1513.1
22	**38G1**	672.88	8.05				17.5				698.43
22	**39F9**	487.34	1.48								488.81
22	**39G0**	1160.62	5.5								1166.12
22	**39G1**	1852.89	52.97								1905.86
22	**40F9**	192.71	1.21								193.92
22	**40G0**	2502.19	43.98								2546.17
22	**40G1**	232.94	8.85								241.79
22	**41G0**	54.82	0.27				0.35				55.44
22	**Total**	9540.94	152.48	0.00	0.00	0.00	17.85	0.00	0.00	0.00	9711.28
23	**40G2**	484.25	719.44	4955.23	1698.08	955.25	460.73	526.18	182.4	57.32	10038.88
23	**41G2**		42.48	6496.96	2612.37	1222.7	770.08	936.46	348.61	79.57	12509.24
23	**Total**	484.25	761.92	11452.19	4310.45	2177.95	1230.81	1462.64	531.01	136.89	22548.12
24	**37G2**	589.05									589.05
24	**38G2**	861.98	32.35								894.32
24	**38G3**	280.56	191.54	95.57	34.99	14.26					616.91
24	**38G4**	1188.8	2150.11	1933.6	1047.47	261.33	183.41			27.6	6792.32
24	**39G2**	1014.47	41.01	57.25	56.25	27.09	75.64				1271.71
24	**39G3**	1039.35	549.82	111.34	60.9						1761.41
24	**39G4**	270.76	294.36	266.33	110.11	39.21					980.76
24	**Total**	5244.97	3259.19	2464.09	1309.72	341.89	259.05	0.00	0.00	27.6	12906.48
22-24	**Total**	15270.16	4173.59	13916.28	5620.17	2519.84	1507.71	1462.64	531.01	164.49	45165.88
21-24	**Total**	38955.89	4779.12	13992.02	5686.32	2546.43	1552.97	1462.64	531.01	164.49	69670.86

Table 16: FRV "Solea", cruise 812/2022. Numbers (m) of herring excl. CBH in SD 24 and large herring accumulation in rectangle 41G2/SD 23 by age/W-rings & area.

Subdivision	Rectangle/ Age	0	1	2	3	4	5	6	7	8+	Total
21	**41G0**	5.88	0.05	0.04	0.05	0.02					6.04
21	**41G1**	35.62	4.22	0.94	0.32	0.18	0.35				41.63
21	**41G2**	50.02	0.03		0.02		0.01				50.08
21	**42G1**	561.77	6.45	0.09	0.65	0.25	0.53				569.74
21	**42G2**	353.81	2.83	0.19	0.39	0.09	0.19				357.50
21	**Total**	1007.10	13.58	1.26	1.43	0.54	1.08	0.00	0.00	0.00	1024.99
22	**37G0**	51.93	0.38								52.31
22	**37G1**	36.53	0.67								37.20
22	**38G0**	184.36	1.20								185.56
22	**38G1**	81.07	0.60				0.50				82.17
22	**39F9**	62.24	0.11								62.35
22	**39G0**	150.34	0.41								150.75
22	**39G1**	199.88	3.95								203.83
22	**40F9**	25.06	0.09								25.15
22	**40G0**	186.87	3.28								190.15
22	**40G1**	21.41	0.66								22.07
22	**41G0**	3.93	0.02				0.01				3.96
22	**Total**	1003.62	11.37	0.00	0.00	0.00	0.51	0.00	0.00	0.00	1015.50
23	**40G2**	38.74	13.27	27.55	17.07	12.43	6.30	8.30	1.98	0.47	126.11
23	**41G2**	3.76	0.50	1.21	1.06	0.81	0.48	0.71	0.12	0.02	8.67
23	**Total**	42.50	13.77	28.76	18.13	13.24	6.78	9.01	2.10	0.49	134.78
24	**37G2**	51.99									51.99
24	**38G2**	101.29	0.73								102.02
24	**38G3**	37.16	4.72	2.03	0.53	0.20					44.64
24	**38G4**	82.27	51.76	35.15	15.97	3.49	2.16			0.24	191.04
24	**39G2**	59.43	1.10	1.05	0.86	0.38	0.61				63.43
24	**39G3**	65.00	13.65	2.32	0.97						81.94
24	**39G4**	19.62	7.37	5.30	1.72	0.55					34.56
24	**Total**	416.76	79.33	45.85	20.05	4.62	2.77	0.00	0.00	0.24	569.62
22-24	**Total**	1462.88	104.47	74.61	38.18	17.86	10.06	9.01	2.10	0.73	1719.90
21-24	**Total**	2469.98	118.05	75.87	39.61	18.40	11.14	9.01	2.10	0.73	2744.89

Table 17: FRV "Solea", cruise 812/2022. Mean weight (g) of herring excl. CBH in SD24 and large herring accumulation in in rectangle 41G2/SD 23 by age/W-rings & area.

Subdivision	Rectangle/ Age	0	1	2	3	4	5	6	7	8+	Total
21	**41G0**	14.75	47.32	101.17	123.01	135.82	44.72				16.89
21	**41G1**	21.71	49.89	60.80	56.57	48.08	46.80				26.04
21	**41G2**	22.40	35.00		35.00		35.00				22.42
21	**42G1**	23.95	41.18	51.93	37.43	44.74	39.62				24.19
21	**42G2**	23.32	44.51	51.93	43.25	44.74	39.61				23.54
21	**Total**	23.52	44.59	60.11	46.26	49.23	41.90				23.91
22	**37G0**	9.67	13.41								9.70
22	**37G1**	10.55	13.41								10.60
22	**38G0**	8.12	13.41								8.15
22	**38G1**	8.30	13.41				35.00				8.50
22	**39F9**	7.83	13.41								7.84
22	**39G0**	7.72	13.41								7.74
22	**39G1**	9.27	13.41								9.35
22	**40F9**	7.69	13.41								7.71
22	**40G0**	13.39	13.41								13.39
22	**40G1**	10.88	13.41								10.96
22	**41G0**	13.95	13.41				35.00				14.00
22	**Total**	9.51	13.41				35.00				9.56
23	**40G2**	12.50	49.83	102.75	123.63	118.45	146.87	165.22	174.85	217.07	81.70
23	**41G2**	18.51	38.21	118.23	134.02	140.02	164.84	169.65	193.70	205.89	82.37
23	**Total**	13.03	49.41	103.40	124.24	119.77	148.14	165.57	175.93	216.61	81.75
24	**37G2**	11.33									11.33
24	**38G2**	8.51	44.31								8.77
24	**38G3**	7.55	40.58	47.08	66.01	71.29					13.82
24	**38G4**	14.45	41.54	55.01	65.59	74.88	84.91			115.00	35.55
24	**39G2**	17.07	37.28	54.52	65.41	71.29	124.00				20.05
24	**39G3**	15.99	40.28	47.99	62.78						21.50
24	**39G4**	13.80	39.94	50.25	64.02	71.29					28.38
24	**Total**	12.59	41.08	53.74	65.32	74.00	93.52			115.00	22.66
21-24	**Total**	15.80	28.07	65.58	56.38	57.56	58.97	78.18	62.11	53.47	23.46

Table 18: FRV "Solea", cruise 812/2022. Total biomass (t) of herring excl. CBH in SD 24 and large herring accumulation in in rectangle 41G2/SD 23 by age/W-rings & area.

Subdivision	Rectangle/ Age	0	1	2	3	4	5	6	7	8+	Total
21	**41G0**	86.73	2.37	4.05	6.15	2.72	0.00	0.00	0.00	0.00	102.01
21	**41G1**	773.31	210.54	57.15	18.10	8.65	16.38	0.00	0.00	0.00	1084.13
21	**41G2**	1120.45	1.05	0.00	0.70	0.00	0.35	0.00	0.00	0.00	1122.55
21	**42G1**	13454.39	265.61	4.67	24.33	11.19	21.00	0.00	0.00	0.00	13781.19
21	**42G2**	8250.85	125.96	9.87	16.87	4.03	7.53	0.00	0.00	0.00	8415.10
21	**Total**	23685.73	605.53	75.74	66.15	26.59	45.26	0.00	0.00	0.00	24504.98
22	**37G0**	502.16	5.10								507.26
22	**37G1**	385.39	8.98								394.38
22	**38G0**	1497.00	16.09								1513.10
22	**38G1**	672.88	8.05				17.50				698.43
22	**39F9**	487.34	1.48								488.81
22	**39G0**	1160.62	5.50								1166.12
22	**39G1**	1852.89	52.97								1905.86
22	**40F9**	192.71	1.21								193.92
22	**40G0**	2502.19	43.98								2546.17
22	**40G1**	232.94	8.85								241.79
22	**41G0**	54.82	0.27				0.35				55.44
22	**Total**	9540.94	152.48	0.00	0.00	0.00	17.85	0.00	0.00	0.00	9711.28
23	**40G2**	484.25	661.24	2830.76	2110.36	1472.33	925.28	1371.33	346.20	102.02	10303.79
23	**41G2**	69.60	19.11	143.06	142.06	113.42	79.12	120.45	23.24	4.12	714.17
23	**Total**	553.85	680.35	2973.82	2252.42	1585.75	1004.40	1491.78	369.44	106.14	11017.96
24	**37G2**	589.05									589.05
24	**38G2**	861.98	32.35								894.32
24	**38G3**	280.56	191.54	95.57	34.99	14.26					616.91
24	**38G4**	1188.80	2150.11	1933.60	1047.47	261.33	183.41			27.60	6792.32
24	**39G2**	1014.47	41.01	57.25	56.25	27.09	75.64				1271.71
24	**39G3**	1039.35	549.82	111.34	60.90						1761.41
24	**39G4**	270.76	294.36	266.33	110.11	39.21					980.76
24	**Total**	5244.97	3259.19	2464.09	1309.72	341.89	259.05	0.00	0.00	27.60	12906.48
22-24	**Total**	15339.76	4092.02	5437.91	3562.14	1927.64	1281.30	1491.78	369.44	133.74	33635.72
21-24	**Total**	39025.49	4697.55	5513.65	3628.29	1954.23	1326.56	1491.78	369.44	133.74	58140.70