WORKING GROUP OF INTERNATIONAL PELAGIC SURVEYS (WGIPS)

VOLUME 3 | ISSUE 40

ICES SCIENTIFIC REPORTS

RAPPORTS
SCIENTIFIQUES DU CIEM

ICES INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA
CIEM CONSEIL INTERNATIONAL POUR L'EXPLORATION DE LA MER

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

H.C. Andersens Boulevard 44-46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

ISSN number: 2618-1371

ICES Scientific Reports

Volume 3 | Issue 40

WORKING GROUP OF INTERNATIONAL PELAGIC SURVEYS (WGIPS)

Recommended format for purpose of citation:

ICES. 2021. Working Group of International Pelagic Surveys (WGIPS).
ICES Scientific Reports. 3:40. 481pp. https://doi.org/10.17895/ices.pub.8055

Editors

Michael O'Malley • Bram Couperus

Authors

Michael O'Malley • Bram Couperus • Urbano Auton • Florian Berg • Benoit Berges • Sigurvin Bjarnason
Fabio Campanella • Pablo Carrera • Solva Karadottir Eliasen • Edward Farrell • Eydna Homrum
Åge Høines • Arne Johannes Holmin • Jan Arge Jakobsen • Espen Johnsen • Ruth Kelly
Alexander Krysov • Cecilie Kvamme • Susan Mærsk Lusseau • Steven Mackinson • Gavin McNeill
Colin Millar • Leif Nøttestad • Steven O'Connell • Ciaran O'Donnell • Anna H Olafsdottir • Hjalte Parner
Mark Payne • Maxim Rybakov • Are Salthaug • Matthias Schaber • Erling Kåre Stenevik • Aleksei Stesko
Jeroen van der Kooji • Sindre Vatnehol • Alina Wieczorek

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

Contents

Annex 7: 2020 GERAS Survey Summary Table and Survey Report

Document 7a: GERAS 2020 survey summary table

Survey Summary Table WGIPS 2021	
Name of the survey (abbreviation):	GERAS / BIAS (GER) (FRV "Solea" SB783)
Target Species:	Herring (*Clupea harengus,* Western Baltic Spring Spawning Herring WBSSH; Central Baltic Herring CBH), Sprat (*Sprattus sprattus*) Anchovy (*Engraulis encrasicolus*), Sardine (*Sardina pilchardus*)
Survey dates:	02-21 Oct 2020
Summary:	
The objectives of the survey were carried out successfully and as planned in all of the covered ICES Subdivisions. Altogether, 1204 nautical miles of hydroacoustic transects (plus 41 nmi daytime transects for comparison) were covered (2019: 1124 nmi). 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 55 fishery hauls were conducted. Vertical hydrography profiles were measured on 98 stations. In the majority of all sampled rectangles, mean NASC values per nautical mile were –often distinctly- lower than the values measured in 2019. Compared to the long-time survey mean since 1991, mean NASC values were lower in all rectangles covered. On ICES subdivision scale, mean NASC values were overall distinctly lower than in the previous year in all subdivisions but SD23, where the mean NASC measured had almost doubled compared to 2019. After excluding the Central Baltic Herring fraction from the estimates via the Separation Function, the present Western Spring Spawning Herring biomass estimate despite distinct increases in SD 21 and SD 23 (compared to 2019) represents the lowest recorded value in the whole time series since 1993.	
	Description
Survey design	Stratified systematic (parallel where applicable) design. Start point not randomized. ICES statistical rectangles used as strata for all ICES subdivisions

Index Calculation method	GERIBAS II Software. Index based on mean NASC per ICES statistical rectangle.
Random/systematic error issues	Survey design and transects restricted by area topography. No fully systematic coverage of survey area possible. Indications of large herring aggregations outside the surveyed transects/time period are regularly registered.
Specific survey error issues (acoustic)	*There are some bias considerations that apply to acoustic-trawl surveys only, and the respective SISP should outline how these are evaluated:*
Bubble sweep down	Bubble sweep down due to adverse weather conditions occurred and required interruption of survey operations (SD 21). Due to the continuation of the survey in improved conditions, this is not considered to affect integration results.
Extinction (shadowing)	No particular issues as targets are scattered in loose aggregations in most of the surveyed areas during the survey operations.
Blind zone	Due to the night-time distribution of clupeids also in surface layers, registrations of clupeids occur in the blind zone but are not quantified (integration start depth 10 m). In some parts of the survey area, the blind zone exclusion exceeds more than half of the total water column.
Dead zone	No particular issue as clupeids are mostly distributed pelagically and away from seafloor during night-time survey operations.
Allocation of backscatter to species	Directed trawling. Mixed species category applied throughout survey. Species allocations and splitting of NASC values based on combined trawl haul composition per ICES statistical rectangle.
Target strength	Clupeids: TS = 20 log10 (L) - 71.2 Gadids: TS = 20 log10 (L) - 67.5 Mackerel: TS = 20 log10 (L) – 84.9 see SISP Survey manual (ICES, 2017). Clupeid TS allocated to other species included in analysis (see above).
Calibration	All survey frequencies calibrated and results within recommended tolerances (Demer et al., 2015).
Specific survey error issues (biological)	*There are some bias considerations that apply to acoustic-trawl surveys only, and the respective SISP should outline how these are evaluated:*
Stock containment	Time series: It is assumed that WBSSH (primary target species) is contained within the survey area. An unquantified but assumedly low degree of mixing of WBSSH and CBH (Central Baltic Herring) can occur outside of the survey area (east of SD 24). Due to transects often determined by topography/bathymetry, aggregations of WBSSH in shallower areas not sampled by the survey may have been missed.

	2020 survey: Survey area was covered as planned resulting in a full sampling of all rectangles/Subdivisions and the standard area of the GERAS-Index for HAWG.
Stock ID and mixing issues	Time series: WBSSH and CBH mix at varying degrees in different parts of the survey area (especially in SD 24). Separation of stocks is achieved through application of an age-growth based stock separation function (SF) (Gröhsler et al. 2013). 2020 survey: The present results support the continued applicability of the SF despite repeated occurrence of some CBH in the GERAS baseline samples of WBSSH in SDs 21 and 23. CBH were identified in herring samples from throughout the survey area, but only in SD 24 contributed significantly to the overall herring abundance (ca. 50% !). Mean weights became distinctly more typical for the growth pattern of WBSSH after removal of CBH, and peaks in abundance of year classes 3-6 also vanished through removal of CBH by the SF.
Measures of uncertainty (CV)	none
Biological sampling	Time series: 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. 2020 survey: Biological information for ICES statistical rectangles 37G3, 37G4 (SD 24), 39G2 (SD 23), 40F9, 40G1 (SD 22) and 43G1 (SD 21) used/amended from neighbouring rectangles.
Were any concerns raised during the meeting regarding the fitness of the survey for use in the assessment either for the whole times series or for individual years? (please specify)	*To be answered by Assessment Working Group*
Did the Survey Summary Table contain adequate information to allow for	*To be answered by Assessment Working Group*

evaluation of the quality of the survey for use in assessment? Please identify short-falls	

Document 7b: GERAS 2020 survey report

Please see the report on the next page.

Federal Research Institute for Rural Areas, Forestry and Fisheries

Thünen Institute of Sea Fisheries (TI-SF)[1]
Thünen Institute of Baltic Sea Fisheries (TI-OF)[2]

Survey Report FRV "Solea" SB783

German Acoustic Autumn Survey (GERAS)

01 – 21 October 2020

Matthias Schaber[1] & Tomas Gröhsler[2]

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 33rd 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. The reported acoustic survey 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 and sprat in the Western Baltic area (Kattegat/Subdivisions 21 and Subdivisions 22, 23 and 24).

The following objectives were planned for SB783:

- 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, 1204 nautical miles of hydroacoustic transects (plus 41 nmi daytime 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 55 fishery hauls were conducted. Vertical hydrography profiles were measured on 98 stations.

In the majority of all sampled rectangles, mean NASC values per nautical mile were –often distinctly- lower than the values measured in 2019. Compared to the long-time survey mean since 1991, mean NASC values were lower in all rectangles covered. On ICES subdivision scale, mean NASC values were overall distinctly lower than in the previous year in all subdivisions but SD23, where the mean NASC measured had almost doubled compared to 2019.

2 SURVEY DESCRIPTION & METHODS APPLIED

2.1 Cruise narrative

The 783rd cruise of FRV "Solea" represents the 33rd subsequent GERAS survey. Due to a delay in the transit of "Solea" to Kiel harbor because of shipping impairments in the Kiel Channel, the begin of the cruise had to be postponed. Equipment of the vessel as well as calibration of echosounders took place on October 3rd, and survey operations commenced on October 4th in SD 24 (Arkona Sea).

Generally, survey operations were conducted during nighttime to account for the more pelagic distribution of clupeids during that time. Weather conditions at the beginning of the survey allowed to start survey operations in the Arkona Sea. Due to a prescheduled change in the scientific crew a few days after the survey begin, surveying of SD 24 was interrupted after largely accomplishing the southern

part of the Arkona Sea, and survey operations continued in SD 22 (Mecklenburg Bight, Kiel Bight), where the crew change took place on October 9th (Kiel harbor). Afterwards, SD 22 was accomplished before FRV "Solea" continued monitoring unfinished transects in SD 24 (north). Due to deteriorating weather, it was decided to continue the survey in the comparatively sheltered Sound (SD 23) before accomplishing SD 24. Afterwards, survey operations commenced in SD 21 (Kattegat) but had to be interrupted for one night due to prevailing inclement weather. On October 15th, survey work commenced in SD 21 and was accomplished on October 18th. Afterwards, the remaining unfinished transects in SD 24 were sampled. Survey operations were accomplished on October 20th. A second calibration of the hydroacoustic equipment was conducted on October 21st. After the calibration, FRV "Solea" entered Rostock port, where the survey ended.

Altogether, the following survey schedule was accomplished:

Arkona Sea	(SD 24)	04. - 07.10. & 12.-13.10 & 19.-20.10.
Belt Sea	(SD 22)	07. - 11.10.
Sound	(SD 23)	13. - 14.10.
Kattegat	(SD 21)	15. - 18.10.

Total survey time	17 nights (incl. 1 day loss due to bad weather)
Fishery hauls	55
CTD-casts	98
Hydroacoustic transects	1204 nmi (+ 41 nmi daytime 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 1204 nautical miles (2019: 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 11 software (Echoview Software Pty Ltd, 2020). Mean volume back scattering values (S_v) were integrated over 1 nmi intervals from 10 m below the surface to ca. 0.5 m over the seafloor. Interferences from surface turbulence, bottom structures and scattering layers were removed from the echogram. 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 prior to the beginning of the survey in suboptimal weather conditions from a drifting vessel in Howacht Bight, southwest of Fehmarn Island (Strande Bay/Kiel Bight (54°23.4 N, 10°52.9 E) on October 3rd. Overall calibration results were considered acceptable based on calculated RMS values. However, a second calibration in good weather conditions was conducted after accomplishing survey operations on October 21st, again from a drifting vessel off Kühlungsborn in the Mecklenburg Bight (54°14.5 N, 11°46.2 E). Resulting transducer parameters were applied for the post-processing of hydroacoustic survey data. Calibration results for the 38 kHz transducer are given 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 netsonde 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. The trawling time usually lasted 30 minutes but was shortened when echograms and netsonde indicated large catches. To validate and allocate echorecordings, altogether 55 fishery hauls were conducted (Figure 1). From each haul sub-samples were taken to determine length and weight of fish. Samples of herring, sprat, sardine and anchovy were frozen for additional investigations (e.g. determining sex, maturity, age).

2.6 Hydrographic data

Hydrographic conditions were measured after each trawl haul and in regular distances on the survey transect. On each corresponding station, vertical profiles of temperature, salinity and oxygen concentration were measured using a "Seabird SBE 19 plus" CTD. Water samples for calibration purposes (salinity) were taken on every station. Altogether, 98 CTD-profiles were measured (Figure 8).

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 the species composition allocated to echorecordings 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 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 and invalid hauls need to be omitted.

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

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 support the applicability of the SF (Oeberst et al., 2013; Oeberst et al., 2014, 2015, 2016, 2017; Gröhsler and Schaber, 2018, 2019, 2021).

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 2020. In general, the majority of these NASC measurements can be allocated to clupeids. Altogether, 27 ICES statistical rectangles were covered in the survey 2020 (25 in 2019). In 5 of those, the mean NASC was higher than in 2019 (partly significantly), in one rectangle mean NASC was in the range of 2019. In the 19 other rectangles, mean NASC values were partly well below the comparatively low values measured in 2019. In all rectangles, the mean NASC measured in 2020 was below the long term survey mean (1991-2019). On ICES subdivision scale, mean NASC values were distinctly lower than in the previous year in all subdivisions but SD 23 (the Sound).

In the rectangles covered both in 2020 and 2019 in SD 21, overall NASC values measured were mostly lower than those measured in the previous year. Only in one rectangle (42G1), mean NASC per 1 nmi EDSU was about twice as high as those measured in 2019. Highest NASC-levels in SD 21 were measured in the northernmost part of SD21 (43G1, unsampled in 2019). As in previous years, aggregations were mostly patchy along the cruisetrack.

In SD 22, mean overall NASC values recorded were lower than in 2019 in 10 out of 11 rectangles surveyed. Only in one rectangle (39G0), mean NASC was increased. This originated from rather unusual aggregations of herring in the northern part of the Great Belt. Subdivision 22 is usually characterized by rather low NASC levels, but in comparison with the long term survey mean, mean NASC was even lower in all of the sampled rectangles.

As in the previous years, the large aggregations of big herring that usually could be observed in SD 23 in the Sound were not present in autumn 2020 to the extent observed prior to 2016. However, mean NASC values in rectangle 40G2 were distinctly higher than the levels measured in 2017-2019 (but still well below the survey mean). In the southern part and northern parts of the Sound (39G2, 41G2), NASC levels however were even lower than the 2019 measurements.

In SD 24, mean NASC values were comparable (1) or distinctly lower (7) than the levels measured in 2018 in 8 out of 9 rectangles. Only in rectangle 37G3 (east of Rügen Island, Sassnitz Trench), a noteworthy (but not significant) increased of NASC was measured. As in the years before, somewhat notable aggregations (including the rectangle with the higher 2020 NASC) were detected around Rügen Island.

3.2 Biological data (T. Gröhsler)

Fishery hauls according to ICES Subdivision (Figure 1):

SD	Hauls (n)
21	14
22	16
23	4
24	21

Altogether, 1 718 individual herring, 943 sprat, 301 European anchovies and 7 sardines were frozen for further investigations (e.g. determining sex, maturity, age). Results of catch compositions by Subdivision

are presented in Tables 2-5. Altogether, 36 different species were recorded. Herring were caught in 54, sprat in 53 hauls. SD 23, which is typically characterized by the highest mean herring catch rates per station (kg 0.5 h^{-1}), showed the third lowest value in the data series since 2002. Sardines (*Sardina pilchardus*) only appeared in catches from SD 21, whereas they were caught in SD 22 and SD 23 in 2019. As in previous years, anchovy (*Engraulis encrasicolus*) were present in the whole survey area.

Altogether, the following fish species were sampled and processed:

Species	Length measurements (n)	Prevalence (n of hauls)
Belone belone	4	4
Clupea harengus	10,092	54
Crystallogobius linearis	124	14
Ctenolabrus rupestris	14	6
Cyclopterus lumpus	3	3
Engraulis encrasicolus	1,577	33
Eutrigla gurnardus	11	9
Gadus morhua	123	23
Gasterosteus aculeatus	836	30
Gobius niger	50	7
Limanda limanda	376	29
Merlangius merlangus	362	32
Merluccius merluccius	5	3
Platichthys flesus	50	21
Pleuronectes platessa	14	8
Pomatoschistus minutus	76	24
Scomber scombrus	301	15
Sprattus sprattus	7,533	53
Syngnathus typhle	3	3
Trachinus draco	580	18
Trachurus trachurus	67	21
Others	24	-

Figure 3 depicts the catch (CPUE) of clupeid fishes sampled during the 2020 survey. Figures 4 and 5 show relative length-frequency distributions of herring and sprat in ICES subdivisions 21, 22, 23 and 24 for the years 2019 and 2020. Compared to results from the previous survey in 2019, the following conclusions for **herring** can be drawn (Figure 4):

- In 2020 catches in SD 21 were dominated by the incoming year class (ca. ≤15 cm) with a mode at 13.75 cm. These catches further showed some contribution of larger herring >15 cm. This is in contrast to the results in 2019, which showed a bimodal distribution with modes at 15.25-15.75 cm and 18.75 cm.
- Catches in SD 22, which were dominated by the incoming year class (ca. ≤15 cm) with a mode at 12.75-13.25 cm in 2019 were dominated by larger herring >15 cm in 2020 with a mode at 22.25-22.75 cm.
- In contrast to the years 2016-2019, where larger herring (>20 cm) were almost absent from catches conducted in SD 23, catches in 2020 now showed at least some contribution of these larger length classes. Catches in 2019 showed a bimodal distribution with modes at 14.25 cm and 18.75 cm, whereas in 2020 catches constituted of herring >15 cm - 32.25 cm with a mode at 19.25 cm.
- Catches in SD 24 showed a similar bimodal distribution with modes at 13.25-14.25 cm and 17.75-18.75 cm in both years, accompanied by a virtual absence of herring larger than ca. 23 cm.

Relative length-frequency distributions of **sprat** in the years 2019 and 2020 (Figure 5) can be characterized as follows:

- In SD 21 catches of the incoming year class (ca. ≤10 cm) were virtually absent in 2019, whereas only some contributed to the catches in 2020. The catches were dominated by larger sprat in both years with a mode of 12.25-13.25 cm in 2019 and 11.25 cm in 2020, respectively.
- Catches in SD 22 were dominated in 2019 by the incoming year class (ca. ≤10 cm, mode at 9.75 cm). This is contrast to the results in 2020, where catches showed a bimodal distribution of both the incoming year class (ca. ≤10 cm, mode at 6.75 cm) and of larger sprat (>10 cm, mode at 11.25 cm).
- In SD 23, the catches in 2019 showed a bimodal distribution with a higher contribution of the incoming year class (ca. ≤10 cm, mode at 8.75 cm) compared to lower amounts of larger sprat (>10 cm, mode at 12.15 cm). This is in contrast to the results in 2020 where catches almost exclusively consisted of larger sprat (>10 cm).
- The catches In SD 24 were characterized by a bimodal length-frequency distribution with a lower contribution of the incoming year class (ca. ≤10 cm, mode at 8.75 cm) and higher contribution of larger older sprat (>10 cm, mode at 13.75 cm) in 2019. In contrast, the results in 2020 also almost exclusively consisted of larger sprat (>10 cm) in that subdivision.
- Altogether, the present contribution of the incoming year class (ca. ≤10 cm) seemed to be lower than the one observed in 2019.

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

Fish species considered:

Herring	(*Clupea harengus*)
Crystal goby	(*Crystallogobius linearis*)
European anchovy	(*Engraulis encrasicolus*)
Cod	(*Gadus morhua*)
Three-spined stickleback	(*Gasterosteus aculeatus*)
Whiting	(*Merlangius merlangus*)
Mackerel	(*Scomber scombrus*)
Sprat	(*Sprattus sprattus*)
Greater weever	(*Trachinus draco*)
Poor cod	(*Trisopterus minutus*)

Exclusion of trawl hauls with very low catches:

Haul No.	Rectangle	Subdivision (SD)
2	38G2	24
5	38G4	24
11	37G1	22
27	39G4	24
48	42G2	21

Inclusion of hauls with low catches:

Despite low catches of both herring and sprat, the following hauls were not excluded from the analysis as they were the only trawl hauls conducted in the corresponding rectangles and thus provided the only available information on species composition in the following rectangles:

Haul No.	Rectangle	Subdivision (SD)
1	37G2	24
11, 12, 13	37G1	22
14	38G1	22
15	37G0	22
16, 17	38G0	22
18	39F9	22
41	42G2	21

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

Rectangle/SD to be filled	with Haul No.	of Rectangle/SD
37G3/24	6, 7	38G3/24
37G4/24	6, 8	38G3/24, 38G4/24
39G2/23	31	39G2/24
40F9/22	19	40G0/22
40G1/22	21	40G0/22
43G2/21	42	43G1/21

3.3 Stock Splitting / Application of the Separation Function

The age-length distribution of herring in SDs 21 and in SD 23 in 2020 indicated also some contribution of fish of CBH origin. Besides the standard procedure to use the SF in SD 24 and in SD 23/39G2 (since biological samples of that rectangle were also used to raise the corresponding mean NASC values in the SD 24 area of the rectangle), the SF was accordingly also applied in SD 21 in 2020.

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 2020. Despite some degree of mixing of CBH/WBSSH in SDs 21 and 23, results showed applying the SF for splitting of WBSSH and CBH stocks was feasible (Gröhsler & Schaber, 2021).

3.4 Biomass and abundance estimates

The total abundance of herring and sprat is presented in Table 6. Estimated numbers of herring and sprat by age group and SD/rectangle are given in Table 7 and Table 10. Corresponding mean weights by age group and SD/rectangle are shown in Table 8 and Table 11. Estimates of herring and sprat biomass by age group and SD/rectangle are summarized in Table 9 and Table 12.

3.4.1 Herring incl. Central Baltic Herring (CBH)

The total herring stock in Subdivisions 21-24 was estimated to be 2.5×10^9 fish (Table 7) or 73.2×10^3 tons (Table 9). For the included area of Subdivisions 22-24 the number of herring was calculated at be 1.8×10^9 fish or 60.7×10^3 tons.

3.4.2 Herring excl. Central Baltic Herring (CBH)

Estimated numbers of herring excluding CBH in SDs 21-24 by age group and SD/rectangle for 2020 are given in Table 13. Corresponding herring mean weights by age group and SD/rectangle are shown in

Table 14. Estimates of herring biomass excluding CBH by age group and SD/rectangle are summarized in Table 15.

Removal of the CBH fraction in different SDs (total survey area) yielded the following results:

Numbers (millions)	Total	excluding CBH in SD:	
	incl. CBH	24 & 23(39G2)	24 & 23(39G2) and 21
SDs 21-24	2 532.2	1 896.9	1 888.7
Percentage of Total	100.0%	74.9%	74.6%
Difference		-25.1%	-25.4%
Biomass (t)	Total	excluding CBH in SD:	
	incl. CBH	24 & 23(39G2)	24 & 23(39G2) and 21
SDs 21-24	73 157.7	46 561	45 885
Percentage of Total	100.0%	63.6%	62.7%
Difference		-36.4%	-37.3%

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

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

3.4.3 Sprat

The estimated sprat stock in Subdivisions 21-24 was 2.6 x 10^9 fish (Table 10) or 25.7 x 10^3 tons (Table 12). For the included area of Subdivisions 22-24 the number of sprat was calculated at 1.9 x 10^9 fish or 19.1 x 10^3 tons. The overall abundance estimate in 2020 was dominated by one year old sprat (Figure 6 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, 98 CTD casts were conducted during this survey (Figure 5).

Surface temperatures were comparatively high and ranged from ca. 12°C in the northern Kattegat area (SD 21) to > 16°C in the eastern Arkona Basin (SD 24). 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 (ca. 7°C) and the northern Kattegat (ca. 9°C) but distinctly higher in the shallower areas of SD 21-24. Also in the central parts of the Arkona Sea, bottom temperatures were relatively high at almost 16 °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 > 21 PSU in the Kattegat). Unlike the previous years, surface salinities in the Western Baltic were not particularly high and mostly were around 15 PSU or lower south of the Belt Sea. Salinity near the seafloor ranged from 8 PSU in the Arkona Sea to ca. 35 PSU in the deep parts of the Kattegat. Especially in the Sound (SD 23), a very strong stratification with steep salinity gradients was observed.

Surface waters were well oxygenated throughout the survey area. In contrast, oxygen depletion was measured in the Mecklenburg Bight (SD 22) and the western SD 22 area between the Little Belt and Kiel Bight. In those regions, lowest oxygen concentrations measured near the seafloor were below 0.5 ml/l and around 0.7 ml/l, respectively.

4 DISCUSSION

Compared to 2019, the present estimates of herring **incl. CBH** show a decrease in stock biomass and abundance estimate (ICES rectangles 43G1 and 43G2 in SD21 were removed in 2020 for comparison):

Herring (incl. CBH)	Difference compared to 2019	
Area	Numbers (%)	Biomass (%)
Subdivisions 21-24	-35	-26

This present decrease of 35 % in numbers and 26 % biomass was mainly driven by distinctly lower estimates in SD 22 (-73 % in numbers and -54 % in biomass) and SD 24 (-30 % in numbers and -25 % in biomass) as compared to 2019.

Compared to 2019, the present estimates of herring **excl. CBH** now show a significant decrease in stock biomass and abundance values (ICES rectangles 43G1 and 43G2 in SD21 were removed in 2020 for comparison):

Herring (excl. CBH)	Difference compared to 2019	
Area	Numbers (%)	Biomass (%)
Subdivisions 21-24	-38	-28

The application of the Separation Function to remove CBH from the index calculation yields robust results, even though the actual applicability of the SF could not be tested in 2020 due to a lack of "clean" baseline samples from SDs 21 and in 23 (39G2). However, several issues were resolved and results corroborated after applying the SF and removing CBH from the samples from in SD 21, SD 23 (39G2) and SD 24 in 2020: 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. Additionally, a conspicuous peak of abundance of 6 years old herring that otherwise could not be explained vanished after removing the CBH fraction. The 2014 year class represents only a weak year class in the WBSSH assessment (ICES, 2020a). The assumption of this peak originating from CBH is realistic, since latest assessment results for CBH show a very strong (strongest in the time series) 2014 year class (ICES, 2020b).

After over 5 years of consecutive decline, the present Western Spring Spawning Herring biomass estimate (HAWG-GERAS Index) represents the lowest recorded value in the whole time series since 1993 (Figure 7).

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 2020, after several years of supposed absence, some of those fishes were present in catches from the Sound again. 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 2016-2020 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, 2020) supports this assumption. Methodological biases leading to presence or absence 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. In indication for such possible shifts was detected during a 2019 parallel survey of the inner Sound transect with FRV "Solea" and FRV "Clupea", when length distributions of herring caught differed between night- and daytime with larger herring in the daytime catches. Additionally, also in 2020 large - assumed clupeid - aggregations were detected in shallower areas of SD 23 while steaming to the starting point of the transect.

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 2020, 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.

5 SURVEY PARTICIPANTS

Name	Function	Institute
Dr. M. Schaber (9.-21.10.)	Cruise Leader (Hydroacoustics, Hydrography)	TI-SF
L. Hartkens (2.-9.10.)	Cruise Leader (Hydroacoustics, Hydrography)	TI-SF
M. Koth	Fishery biology	TI-OF
A. Georgi	Fishery biology	TI-OF
A. Fiek	Fishery biology	TI-SF
I. Kratzer	Fishery biology	DTU-Aqua (DK)

6 REFERENCES

Arivis (2014) GERIBAS II software, version 2.1.0.

Echoview Software Pty Ltd (2020) Echoview software, version 11 (11.1.34). Echoview Software Pty Ltd, Hobart, Australia.

Foote, K.G., Aglen, A. and Nakken, O. (1986) Measurement of fish target strength with a split-beam echosounder. Journal of the Acoustical Society of America, 80(2): 612-621.

Gröhsler, T., Oeberst, R., Schaber, M., Larson, N. and Kornilovs, G. (2013) Discrimination of western Baltic spring-spawning and central Baltic herring (*Clupea harengus* L.) based on growth vs. natural tag information. ICES Journal of Marine Science, 70 (6): 1108-1117. doi:19.1093/icesjms/fst064.

Gröhsler, T., Schaber, M., Larson, N. and Oeberst, R. (2016) Separating two herring stocks from growth data: long-term changes in survey indices for Western Baltic Spring Spawning Herring (*Clupea harengus*) after application of a stock separation function. Journal of Applied Ichthyology 32: 40-45; doi: 10.1111/jai.12924

Gröhsler, T. and Schaber, M. (2018) Applicability of the Separation Function (SF) in 2017. WD for WGBIFS 2018.

Gröhsler, T. and Schaber, M. (2019) Applicability of the Separation Function (SF) in 2018. WD for WGBIFS 2019.

Gröhsler, T. and Schaber, M. (2021) Applicability of the Separation Function (SF) in 2020. WD for WGIPS 2021.

ICES (2020a) Herring Assessment Working Group for the Area South of 62° N (HAWG). ICES Scientific Reports. 2:60. 1054 pp. http://doi.org/10.17895/ices.pub.6105

ICES (2020b) Baltic Fisheries Assessment Working Group (WGBFAS). ICES Scientific Reports. 2:45. 643 pp. http://doi.org/10.17895/ices.pub.6024

ICES (2017) SISP Manual of International Baltic Acoustic Surveys (IBAS). Series of ICES Survey Protocols SISP 8 – IBAS. 47pp.

ICES (2015) Report of the Workshop on scrutinisation procedures for pelagic ecosystem surveys (WKSCRUT). ICES CM 2015 / SSGIEOM: 18

ICES (2013) Report of the Benchmark Workshop on Pelagic Stocks (WKPELA 2013). ICES Document CM 2013/ACOM: 46

ICES (1983) Report of the Planning Group on ICES coordinated herring and sprat acoustic surveys. ICES Document CM 1983/H:12.

Miethe, T., Gröhsler, T., Böttcher, U. and von Dorrien, C. (2014) The effects of periodic marine inflow into the Baltic Sea on the migration patterns of Western Baltic spring-spawning herring. ICES Journal of Marine Science, 71(3): 519-527.

Nielsen, J. R. (1996) Acoustic monitoring of herring related to the establishment of a fixed link across the Sound between Copenhagen and Malmö. DFU-rapport Nr. 11-96, ISSN 1395-8216, 93pp.

Oeberst, R., Gröhsler, T., Schaber, M. and Larsen, N. (2013) Applicability of the Separation Function (SF) in 2011 and 2012. WD 01 for HAWG. ICES Document CM 2013/ACOM06: Sec 14: 819-825 & WD for WGBIFS. ICES Document CM 2013/SSGESST:08: Annex 9: 399-405.

Oeberst, R., Gröhsler, T. and Schaber, M. (2014) Applicability of the Separation Function (SF) in 2013. WD for WGIPS 2014.

Oeberst, R., Gröhsler, T. and Schaber, M. (2015) Applicability of the Separation Function (SF) in 2014. WD for WGIPS 2015.

Oeberst, R., Gröhsler, T. and Schaber, M. (2016) Applicability of the Separation Function (SF) in 2015. WD for WGBIFS 2016.

Oeberst, R., Gröhsler, T. and Schaber, M. (2017) Applicability of the Separation Function (SF) in 2016. WD for WGIPS 2017.

Polte, P. and Groehsler, T. (2020) 2019 Western Baltic spring spawning herring recruitment monitored by the Rügen Herring Larvae Survey. WD 02 in HAWG 2020. ICES Scientific Reports. 2:60/Annex 5: 1041-1043. http://doi.org/10.17895/ices.pub.6105

7 FIGURES

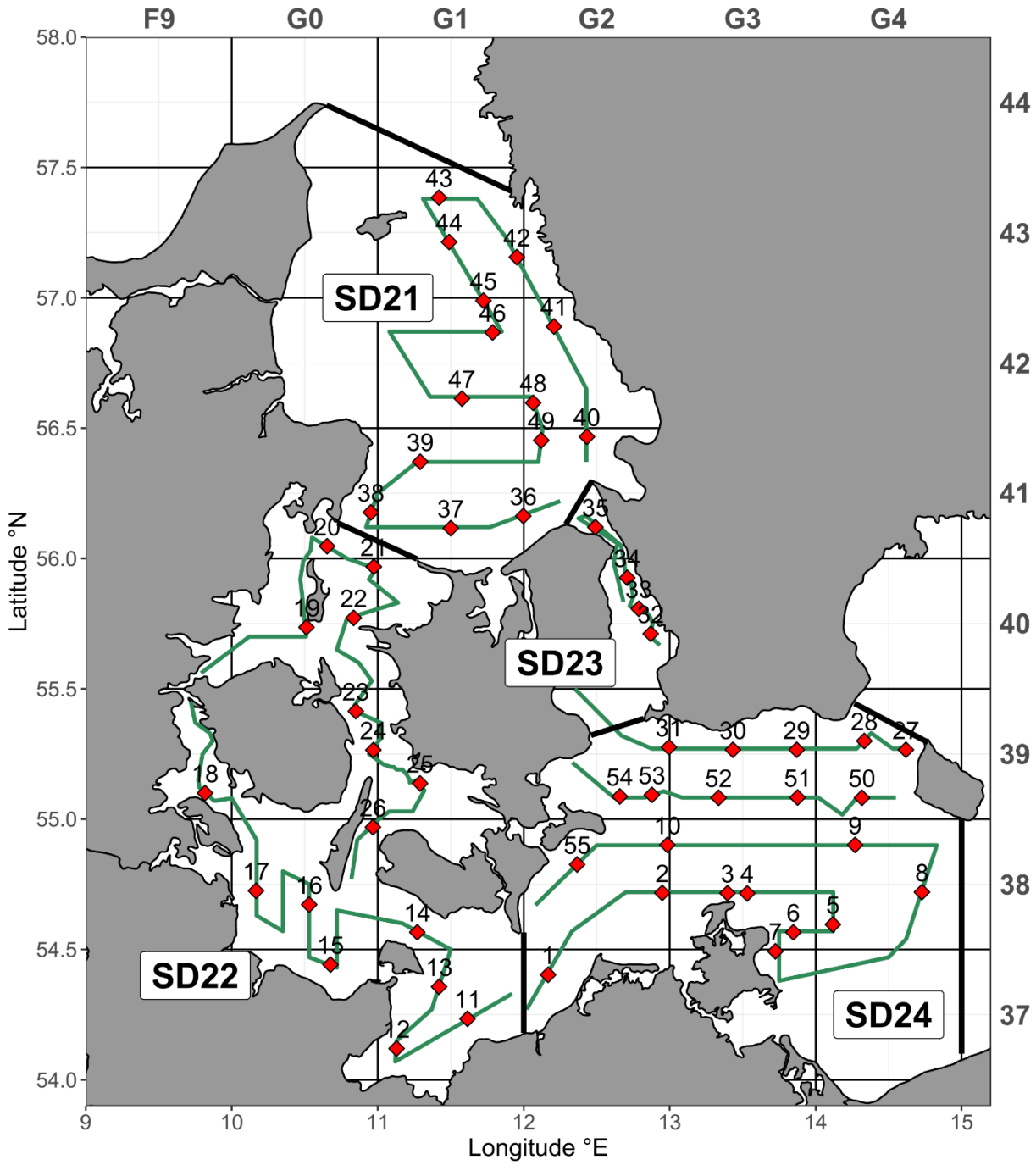

Figure 1: FRV "Solea" cruise 783/2020. Cruise track (dark green lines) and fishery hauls (red diamonds). ICES statistical rectangles are indicated in the top and right axis. Thick black lines separate ICES subdivisions (SD).

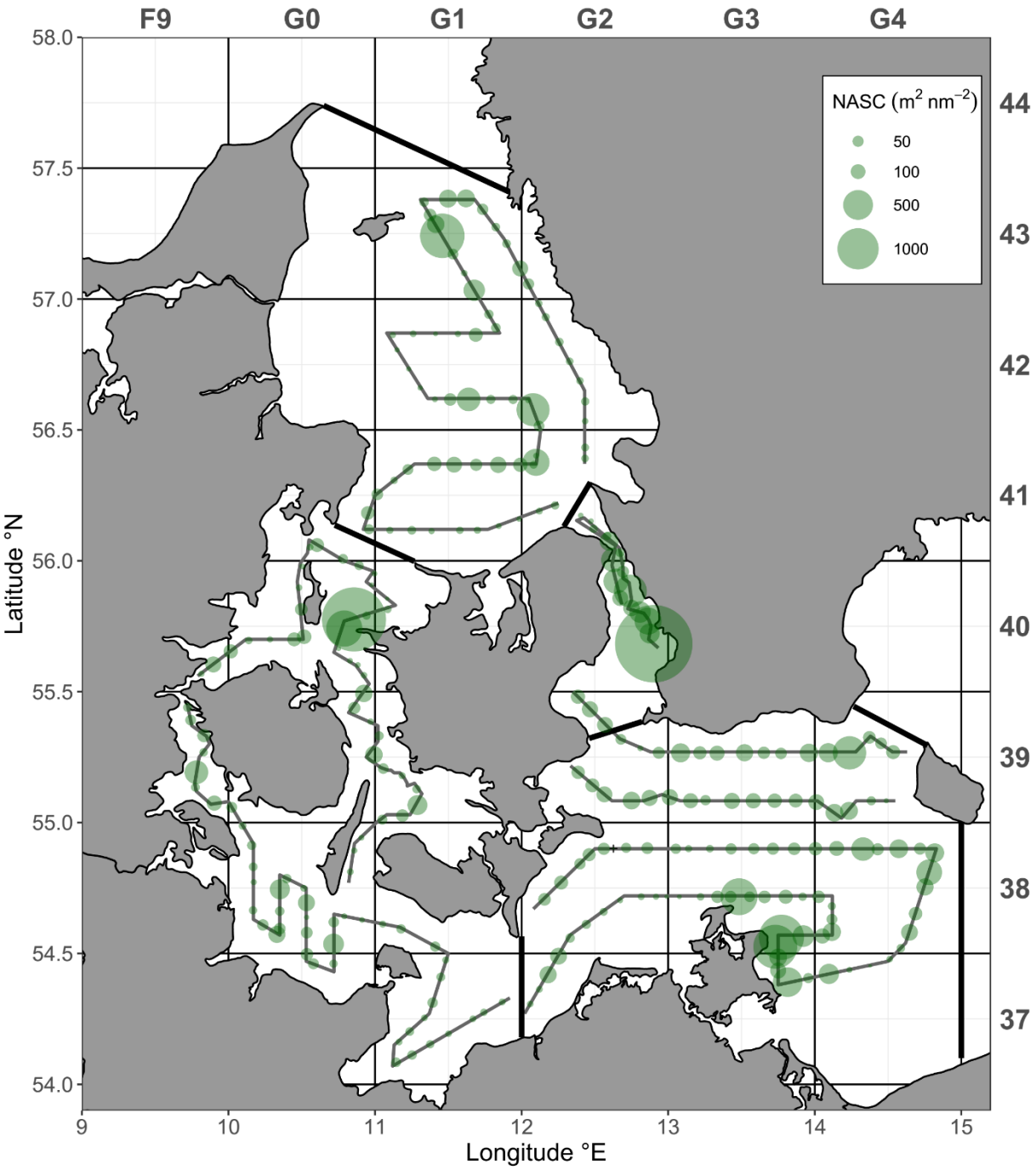

Figure 2: FRV "Solea" cruise 783/2020. Cruise track (thin grey lines) and mean NASC (5 nmi intervals, dots). ICES statistical rectangles are indicated in the top and right axis. Thick black lines separate ICES subdivisions.

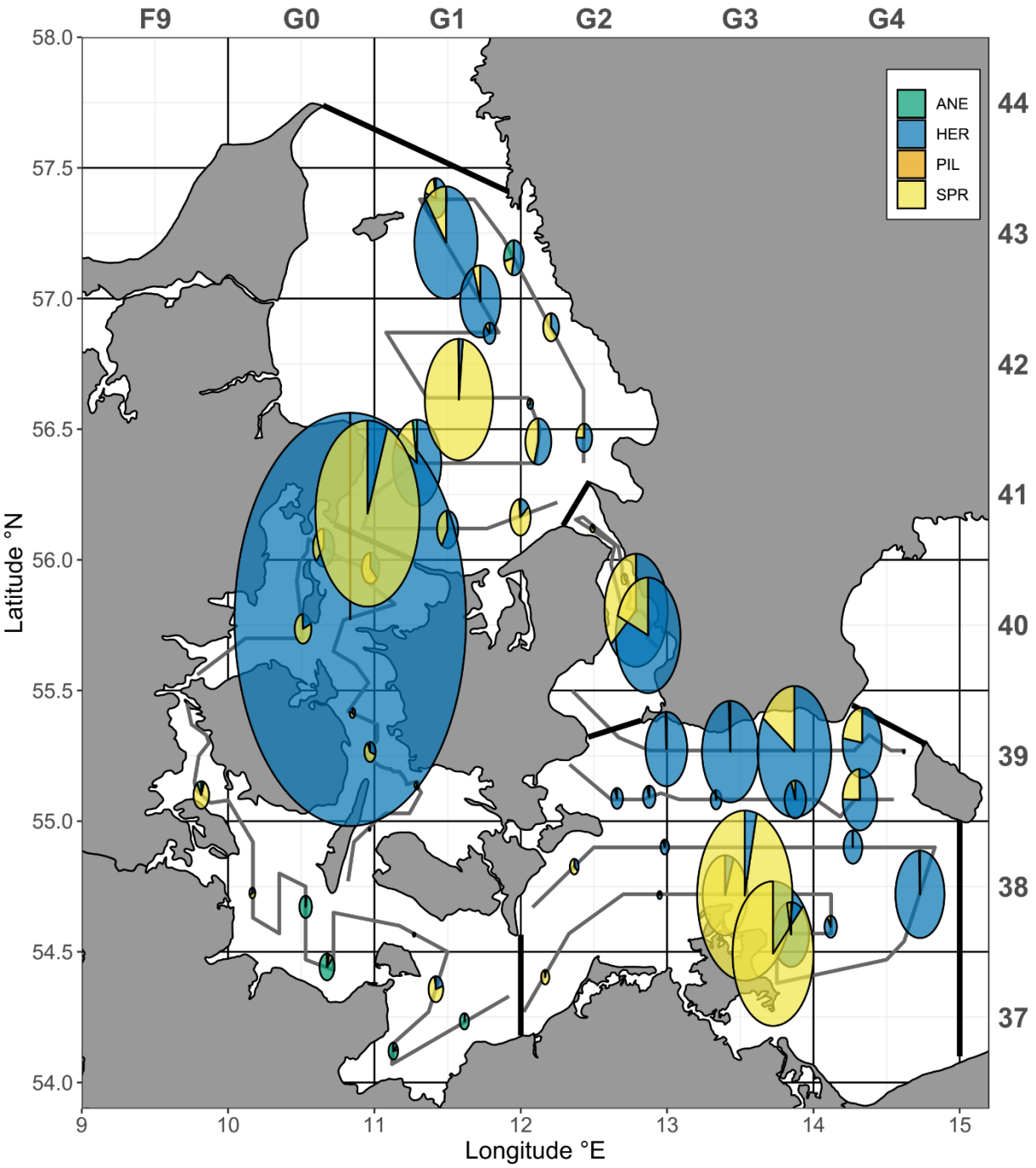

Figure 3: FRV "Solea" cruise 783/2020. Clupeid catch per haul (kg 30min^{-1}). ANE = European anchovy (*Engraulis encrasicolus*), HER = Herring (*Clupea harengus*), PIL = Sardine (*Sardina pilchardus*), SPR = Sprat (*Sprattus sprattus*). ICES statistical rectangles are indicated in the top and right axis. Thick black lines separate ICES subdivisions. Thin grey lines indicate cruise track.

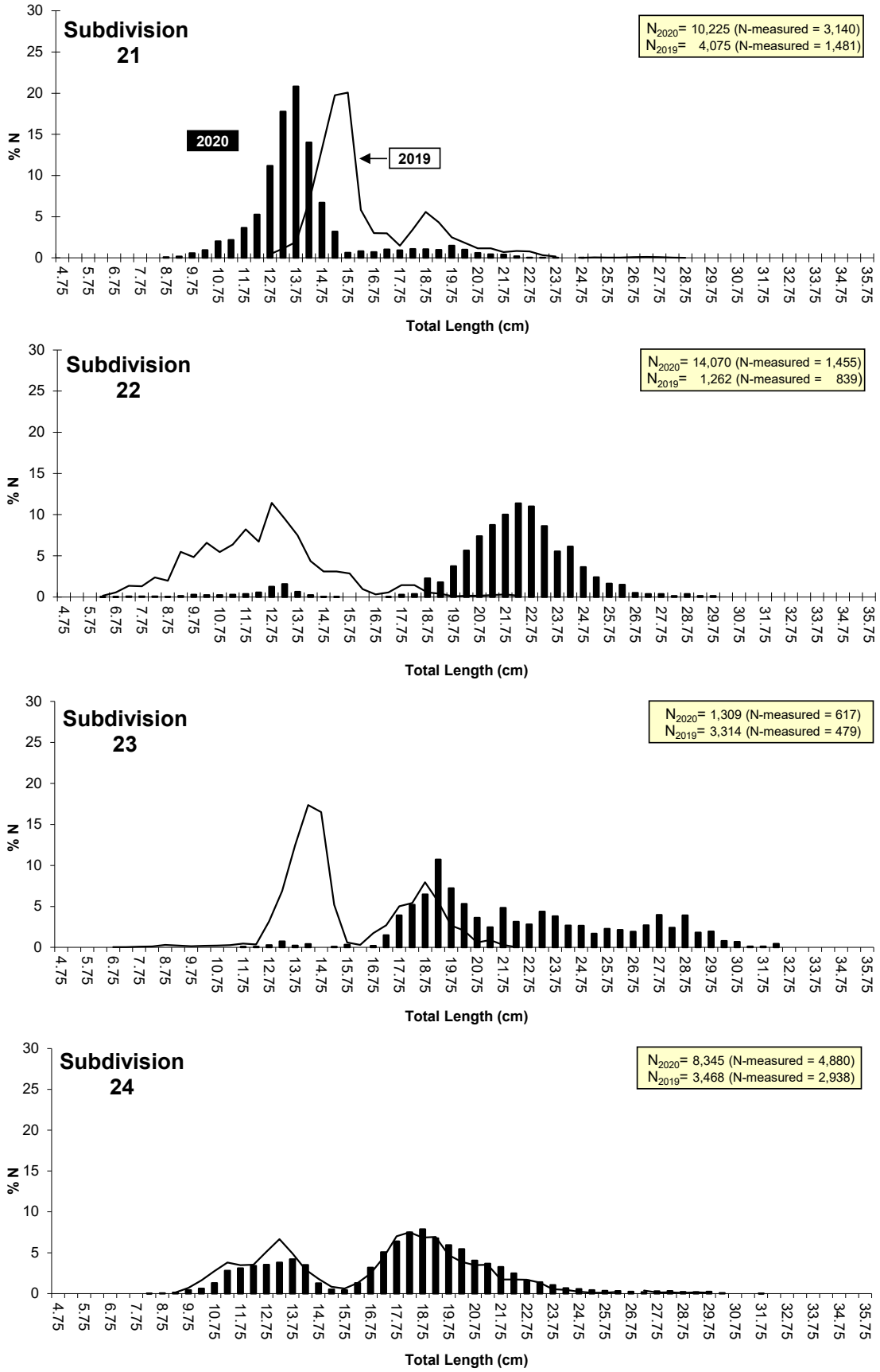

Figure 4: FRV "Solea" cruise 783/2030. Herring (*Clupea harengus*) length-frequency distribution (bars) compared to the previous year (cruise 768/2019, lines).

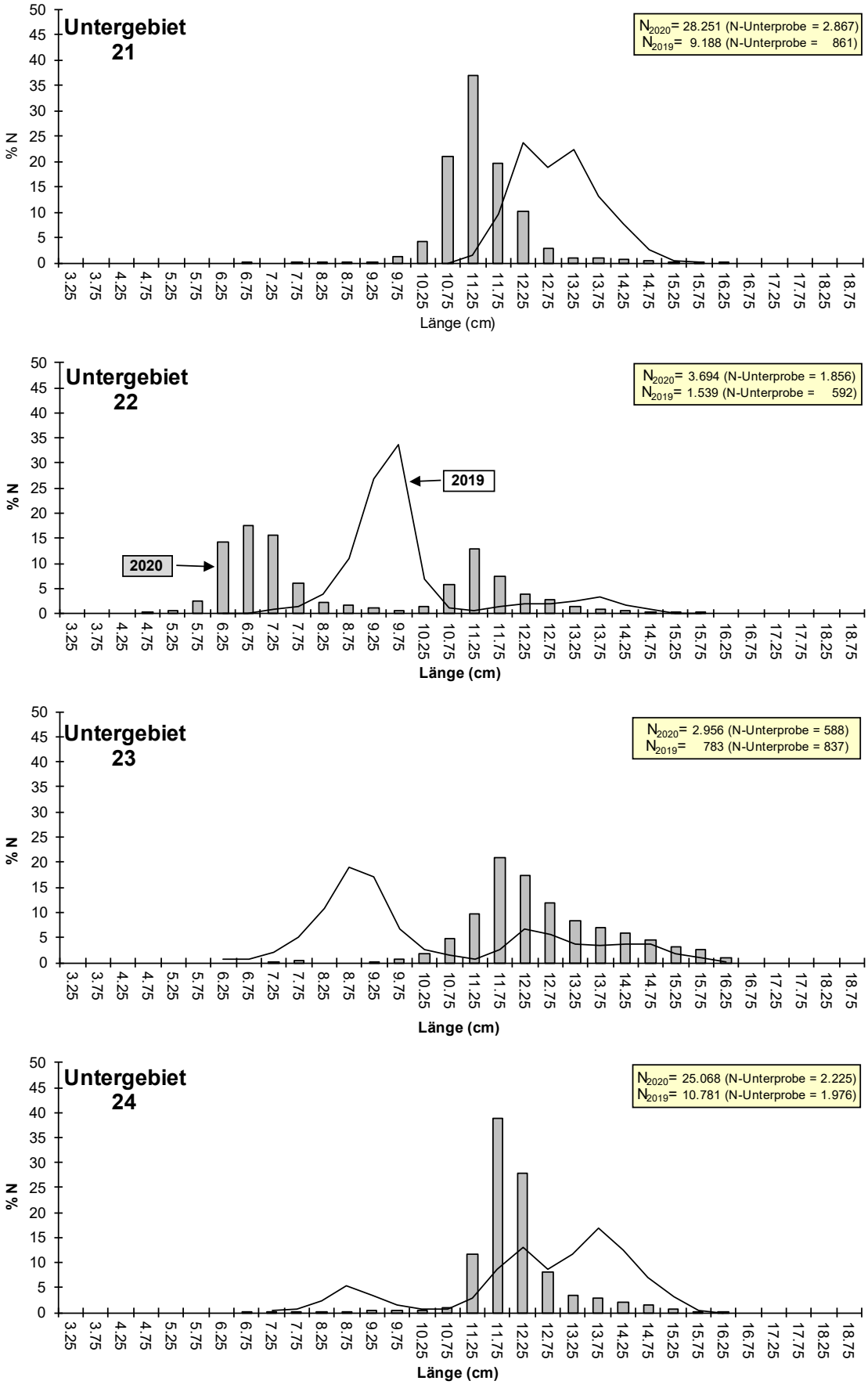

Figure 5: FRV "Solea" cruise 783/2020. Sprat (*Sprattus sprattus*) length-frequency distribution (bars) compared to the previous year (cruise 768/2019, lines).

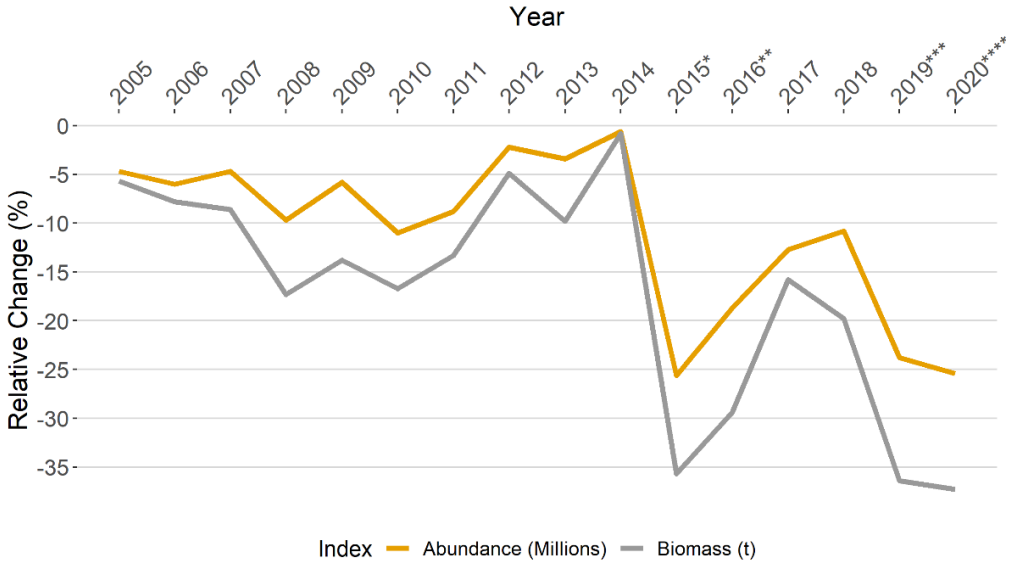

Figure 6: Relative changes in abundance and biomass of Western Baltic Spring Spawning herring in ICES Subdivisions 21-24 (2005-2020) after application of the stock Separation Function (SF, Gröhsler et al., 2013) to the abundance and biomass index generated from German acoustic survey data (GERAS) from SD24 and SD23/39G2. ** 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 SDs 21*.

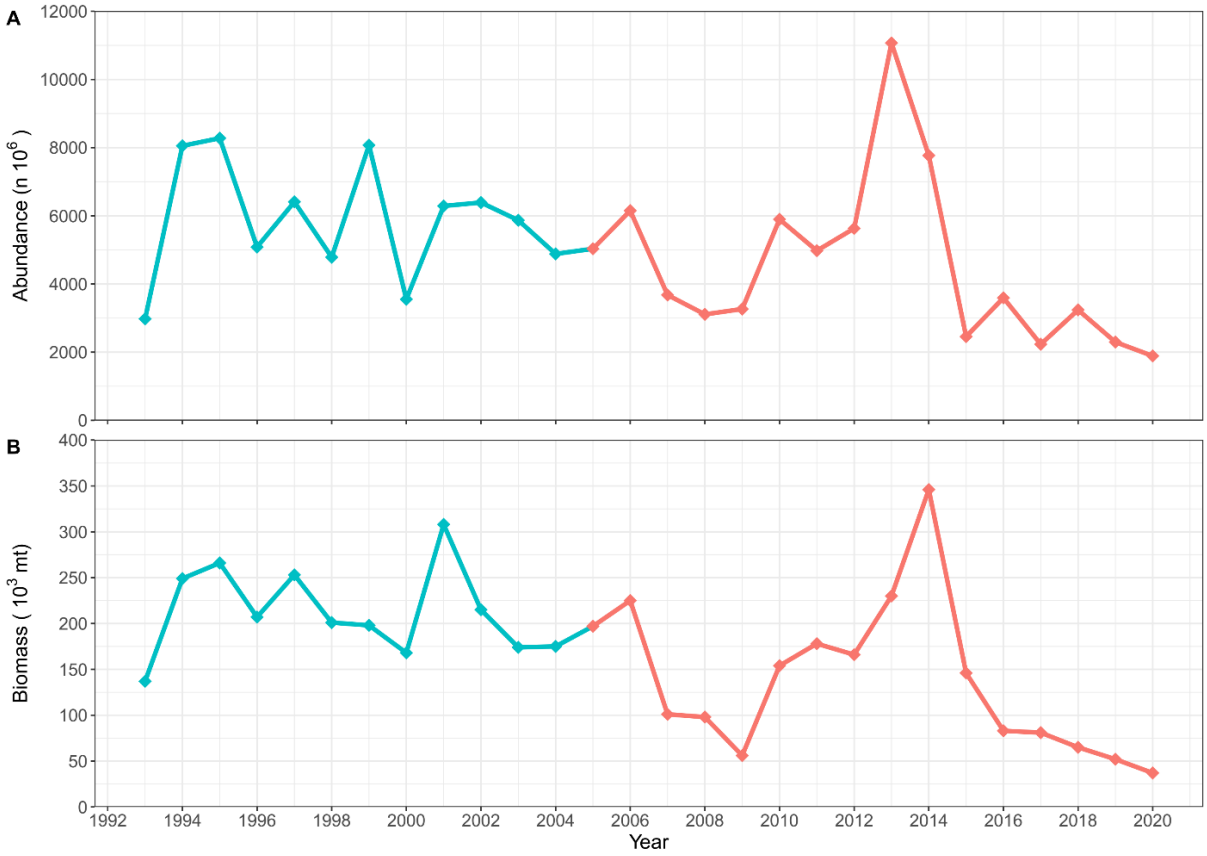

Figure 7: Time series of GERAS survey indices for Western Baltic Spring Spawning Herring (WBSSH) age groups 0-8+. A) Abundance and B) Biomass of herring in ICES Subdivisions 21 (Southern Kattegat, ICES statistical rectangles 41G0 - 42G2) – 24 (excl. ICES statistical rectangles 37G3 & 37G4). Blue line (until 2005): WBSSH including Central Baltic Herring fraction; Red line (from 2005): WBSSH after application of Separation Function (SF).

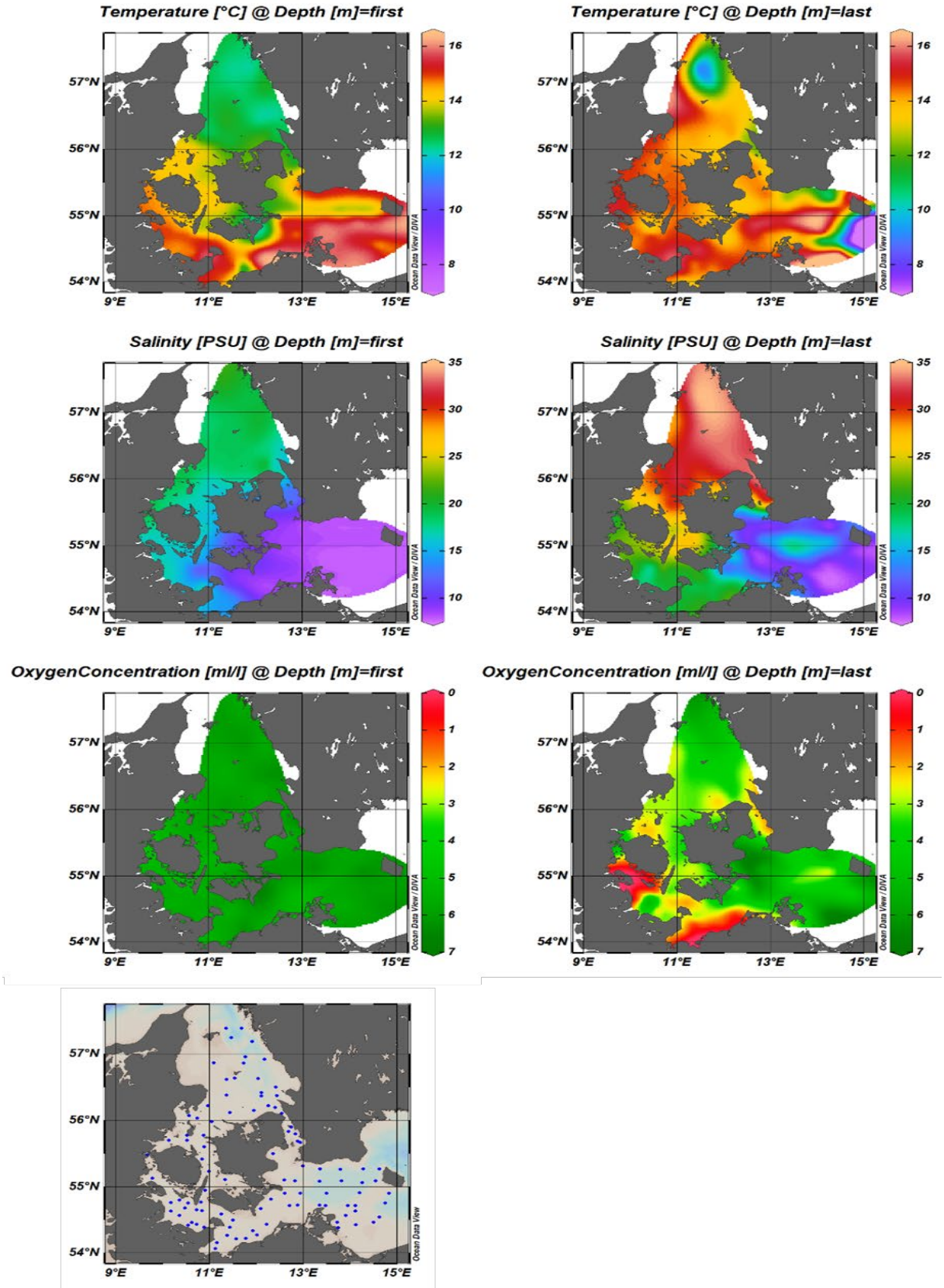

Figure 8: FRV "Solea" cruise 783/2020: Hydrography. CTD stations are depicted as blue dots in the area map. Temperature (°C, top panels), salinity (PSU, middle panels and oxygen concentration (ml/l, lower panels) at the surface (left) and near the seafloor (right).

8 TABLES

Table 1: FRV "Solea" cruise 783/2020: Simrad EK80 calibration report (38 kHz Transducer). Parameters for this transducer were retrieved from the second calibration at the end of the survey.

Date:	21.10.2020		
Calibration Site:	Kühlungsborn/Mecklenburg Bight (54°14.5 N, 11°46.2 E)		
Transceiver Type:	WBT		
Software Version:	EK80 1.12.4.0		
Reference Target:	Tungsten (WC-Co) 38.1 mm		
Transducer:	ES38-7 Serial No. 147		
Frequency:	38000 Hz	Beamtype:	Split/Narrow
Gain:	26.65 dB	Equivalent Beam Angle:	-20.7 dB
Beamwidth Athw.:	6.35 deg	Beamwidth Along.:	6.27 deg
Offset Athw.:	0.33 deg	Offset Along.:	-0.26 deg
Depth:	4.20 m		
Pulse Duration:	1.024 ms		
Power:	2000 W		
TS Detection:			
Min. Value:	-50.0 dB	Min. Spacing:	0.0
Max. Gain Comp.:	3.0 dB	Min. Echolength:	0.8
Max. Echolength:	1.8		
Environment:			
Absorption Coeff.:	0.004934	Sound Velocity:	1483.45m/s
Temperature:	14.1 °C	Salinity:	17.0 PSU
Calibration results:			
Transducer Gain:	27.11 dB	SaCorrection:	-0.1008 dB
Beamwidth Athw.:	6.48 deg	Beamwidth Along.:	6.60 deg
Offset Athw.:	0.07 deg	Offset Along.:	-0.18 deg
RMS-Error:	0.08		

Table 2: FRV "Solea" cruise 783/2020: Catch composition (kg 0.5 h^{-1}) by haul in SD 21.

Haul No.	36	37	38	39	40	41	42	43	44	45	46	47	48
Species/ICES Rectangle	41G1	41G1	41G0	41G1	41G2	42G2	43G1	43G1	43G1	42G1	42G1	42G1	42G2
BELONE BELONE								0.03		0.34			
CLUPEA HARENGUS	1.19	4.89	12.68	36.24	3.56	1.67	3.88	7.43	65.92	28.60	2.32	1.65	0.45
CRANGON CRANGON		+		+		+	0.01						
CRYSTALLOGOBIUS LINEARIS	+	+	+	+	0.01	+	+						
ENGRAULIS ENCRASICOLUS	0.14	0.12	0.20	1.31		0.01	2.03	0.29		0.02	0.01	0.21	
EUTRIGLA GURNARDUS	0.05	0.06	0.20	0.03	0.13	+							
GADUS MORHUA	0.01	0.08											
GASTEROSTEUS ACULEATUS		+	+	+							+		
LIMANDA LIMANDA	0.22	0.13	8.27	0.14	0.20		0.02	0.05					
LOLIGO	0.01	0.13	0.11	0.05	0.02	0.07	0.02	0.09	0.01	0.03	0.16	0.02	0.01
MERLANGIUS MERLANGUS	+	+	0.16		1.00	0.07	0.46	0.21	0.29	0.15	0.09	0.19	0.19
MERLUCCIUS MERLUCCIUS					0.05				0.17	+			
NEPHROPS NORVEGICUS					0.20								
PLATICHTHYS FLESUS													
PLEURONECTES PLATESSA			0.34	0.06									
POMATOSCHISTUS MINUTUS				+	+	+		+		+			+
PSETTA MAXIMA	0.16												
SARDINA PILCHARDUS							0.04						
SCOMBER SCOMBRUS		0.02		1.93		1.43		15.50	1.01	3.24	0.91	0.86	8.88
SEPIOLA							0.01				+	0.01	
SPRATTUS SPRATTUS	6.56	3.27	189.85	6.20	1.18	2.94	1.30	1.65	8.20	1.77	0.32	84.68	0.19
TRACHINUS DRACO	1.21	2.40	1.74	1.17	0.28	0.18		0.10	0.05	0.02	0.61	5.14	2.08
TRACHURUS TRACHURUS	0.02	0.06	0.18	0.07		+		0.04	0.17		0.01	0.01	0.01
TRISOPTERUS MINUTUS							0.01		0.01				
Total	**9.57**	**11.16**	**213.73**	**47.20**	**6.63**	**6.37**	**7.78**	**25.39**	**75.83**	**34.17**	**4.43**	**92.77**	**11.81**
Medusae	0.02	0.05	0.00	0.00	0.33	0.79	1.43	0.48	0.08	0.00	0.00	0.00	0.26

Haul No.	49	Total
Species/ICES Rectangle	41G2	
BELONE BELONE		**0.37**
CLUPEA HARENGUS	6.91	**177.39**
CRANGON CRANGON		**0.01**
CRYSTALLOGOBIUS LINEARIS		**0.01**
ENGRAULIS ENCRASICOLUS		**4.34**
EUTRIGLA GURNARDUS	+	**0.47**
GADUS MORHUA		**0.09**
GASTEROSTEUS ACULEATUS		**+**
LIMANDA LIMANDA	0.08	**9.11**
LOLIGO	0.06	**0.79**
MERLANGIUS MERLANGUS	0.01	**2.82**
MERLUCCIUS MERLUCCIUS		**0.22**
NEPHROPS NORVEGICUS		**0.20**
PLATICHTHYS FLESUS	0.27	**0.27**
PLEURONECTES PLATESSA		**0.40**
POMATOSCHISTUS MINUTUS	+	**+**
PSETTA MAXIMA		**0.16**
SARDINA PILCHARDUS		**0.04**
SCOMBER SCOMBRUS		**33.78**
SEPIOLA		**0.02**
SPRATTUS SPRATTUS	5.61	**313.72**
TRACHINUS DRACO	2.32	**17.30**
TRACHURUS TRACHURUS	0.05	**0.62**
TRISOPTERUS MINUTUS		**0.02**
Total	**15.31**	**562.15**
Medusae	0.00	3.44

+ = < 0.01 kg

Table 3: FRV "Solea" cruise 783/2020: Catch composition (kg 0.5 h^{-1}) by haul in SD 22.

Haul No.	11	12	13	14	15	16	17	18	19	20	21	22	23
Species/ICES Rectangle	37G1	37G1	37G1	38G1	37G0	38G0	38G0	39F9	40G0	41G0	40G0	40G0	39G0
AGONUS CATAPHRACTUS													
BELONE BELONE													
CLUPEA HARENGUS	0.02	0.24	0.83	0.02	0.21	0.06	0.15	0.26	1.00	5.25	2.05	1000.62	0.20
CRANGON CRANGON										+			
CRYSTALLOGOBIUS LINEARIS										+			
CTENOLABRUS RUPESTRIS			+										
CYCLOPTERUS LUMPUS										0.15			
ENGRAULIS ENCRASICOLUS	1.51	1.32	0.12	0.08	3.64	2.83	0.22	0.42	0.04	0.02	0.03	0.04	0.12
GADUS MORHUA		2.62	0.12	0.32	3.01					0.08	0.06		
GASTEROSTEUS ACULEATUS	+	+		+	2.20	0.06	0.16	0.08	0.03	0.02	+		
GOBIUS NIGER				0.01				0.01					+
LIMANDA LIMANDA		0.15	6.49	0.44	0.34	0.43	0.05	0.49	0.02	0.24	0.37	0.20	0.07
LOLIGO										0.06	0.02		+
LUMPENUS LAMPRETAEFORMIS			0.05										
MERLANGIUS MERLANGUS			1.17		0.10		0.08				0.07		0.01
MYOXOCEPHALUS SCORPIUS				0.02									
NEOGOBIUS MELANOSTOMUS													
PLATICHTHYS FLESUS	0.57	0.31	1.47	0.17		0.20							
PLEURONECTES PLATESSA			0.48							0.22	0.07		
POMATOSCHISTUS MINUTUS			+										
PSETTA MAXIMA	0.58												
SCOMBER SCOMBRUS										0.80	0.17	0.16	
SPRATTUS SPRATTUS	0.02	0.13	3.03	0.01	0.33	0.01	0.30	3.81	4.11	3.16	3.53		0.24
SYNGNATHUS ROSTELLATUS		+											
SYNGNATHUS TYPHLE	+							+	+				
TRACHINUS DRACO										0.52	1.34	0.67	0.03
TRACHURUS TRACHURUS				0.03	0.08					0.02	0.09	0.04	0.01
Total	**2.70**	**4.77**	**13.76**	**1.10**	**9.91**	**3.59**	**0.96**	**5.07**	**5.20**	**10.54**	**7.80**	**1001.73**	**0.68**
Medusae	0.27	0.82	0.43	0.70	0.65	0.38	0.63	0.88	0.34	0.00	0.00	0.00	1.14

Haul No.	24	25	26	Total
Species/ICES Rectangle	39G0	39G1	38G0	
AGONUS CATAPHRACTUS			0.02	**0.02**
BELONE BELONE	0.05		0.05	**0.10**
CLUPEA HARENGUS	0.70	0.23		**1011.84**
CRANGON CRANGON		+	+	**+**
CRYSTALLOGOBIUS LINEARIS	+	+	0.01	**0.01**
CTENOLABRUS RUPESTRIS	0.02	0.03	+	**0.05**
CYCLOPTERUS LUMPUS				**0.15**
ENGRAULIS ENCRASICOLUS	0.17	+	0.03	**10.59**
GADUS MORHUA	0.04			**6.25**
GASTEROSTEUS ACULEATUS	0.01	0.17	0.03	**2.76**
GOBIUS NIGER	+	+	+	**0.02**
LIMANDA LIMANDA	0.12	+	1.09	**10.50**
LOLIGO	0.01	0.01	0.02	**0.12**
LUMPENUS LAMPRETAEFORMIS				**0.05**
MERLANGIUS MERLANGUS				**1.43**
MYOXOCEPHALUS SCORPIUS				**0.02**
NEOGOBIUS MELANOSTOMUS		+	+	**+**
PLATICHTHYS FLESUS		0.09		**2.81**
PLEURONECTES PLATESSA				**0.77**
POMATOSCHISTUS MINUTUS		+	0.01	**0.01**
PSETTA MAXIMA				**0.58**
SCOMBER SCOMBRUS	1.02			**2.15**
SPRATTUS SPRATTUS	1.48	0.17	0.03	**20.36**
SYNGNATHUS ROSTELLATUS				**+**
SYNGNATHUS TYPHLE				**+**
TRACHINUS DRACO				**2.56**
TRACHURUS TRACHURUS			0.01	**0.28**
Total	**3.62**	**0.70**	**1.30**	**1073.43**
Medusae	0.08	1.08	2.57	9.97

+ = < 0.01 kg

Table 4: FRV "Solea" cruise 783/2020: Catch composition (kg 0.5 h^{-1}) by haul in SD 23.

Haul No.	32	33	34	35	Total
Species/ICES Rectangle	40G2	40G2	40G2	41G2	
APHIA MINUTA	0.01				**0.01**
CLUPEA HARENGUS	60.97	48.36	0.26	0.05	**109.64**
CRANGON CRANGON			+		**0.00**
ENGRAULIS ENCRASICOLUS				+	**0.00**
EUTRIGLA GURNARDUS	43.50		16.59		**60.09**
GADUS MORHUA			0.41		**0.41**
GASTEROSTEUS ACULEATUS		+	+	0.01	**0.01**
LIMANDA LIMANDA	0.19	1.43	0.31		**1.93**
LOLIGO		+			**0.00**
MELANOGRAMMUS AEGLEFINUS	1.28				**1.28**
MERLANGIUS MERLANGUS	15.27	26.38	0.44	0.30	**42.39**
MYSIDACEA				0.15	**0.15**
POMATOSCHISTUS MINUTUS	0.03		+		**0.03**
Total	**121.25**	**76.17**	**18.01**	**0.51**	**215.94**
Medusae	0.03	0.00	0.00	0.87	**0.90**

+ = < 0.01 kg

Table 5: FRV "Solea" cruise 783/2020: Catch composition (kg 0.5 h^{-1}) by haul in SD 24.

Haul No.	1	2	3	4	5	6	7	8	9	10	27	28	29
Species/ICES Rectangle	37G2	38G2	38G3	38G3	38G4	38G3	38G3	38G4	38G4	38G2	39G4	39G4	39G3
CLUPEA HARENGUS	0.03	0.36	2.37	6.82	2.56	23.62	9.90	44.53	6.48	1.80	0.06	74.38	25.09
CRANGON CRANGON	+									0.00		+	
CRYSTALLOGOBIUS LINEARIS	+												
CTENOLABRUS RUPESTRIS	+												
CYCLOPTERUS LUMPUS			0.25									0.09	
ENGRAULIS ENCRASICOLUS	0.03		0.04							0.03			
EUTRIGLA GURNARDUS		0.06											
GADUS MORHUA			0.20	0.03	3.84	12.69	14.16	+				11.15	1.24
GASTEROSTEUS ACULEATUS		0.15	0.25	0.15	0.08	0.01	+			+			
GOBIUS NIGER	0.07												
LEANDER	+												
LIMANDA LIMANDA	2.81	0.14								0.15			
MERLANGIUS MERLANGUS							1.30		0.68			0.97	1.55
PLATICHTHYS FLESUS	0.37	0.44	1.24				0.34		0.67	0.21		0.32	0.71
PLEURONECTES PLATESSA	0.25		0.14										
POMATOSCHISTUS MINUTUS	+	+	+					+		0.02		+	
SCOMBER SCOMBRUS													
SOLEA VULGARIS		0.07											
SPRATTUS SPRATTUS	1.16	+	35.24	162.61	0.26	0.86	63.55	0.26	0.02	0.13		14.63	7.46
TRACHURUS TRACHURUS	+												
Total	**4.72**	**1.22**	**39.73**	**169.61**	**6.74**	**37.18**	**89.25**	**44.79**	**7.85**	**2.34**	**0.06**	**101.54**	**36.05**
Medusae	10.89	3.11	10.46	1.68	57.04	39.42	26.23	4.70	5.38	1.90	6.15	1.56	1.96

Haul No.	30	31	50	51	52	53	54	55	Total
Species/ICES Rectangle	39G3	39G2	39G4	39G3	39G3	39G2	39G2	38G2	
CLUPEA HARENGUS	59.73	32.14	16.63	7.91	2.11	2.72	2.38	0.50	**322.12**
CRANGON CRANGON					0.02	0.01	+		**0.03**
CRYSTALLOGOBIUS LINEARIS						+	+		**+**
CTENOLABRUS RUPESTRIS									**+**
CYCLOPTERUS LUMPUS									**0.34**
ENGRAULIS ENCRASICOLUS			0.06		0.03	0.11	0.05		**0.35**
EUTRIGLA GURNARDUS									**0.06**
GADUS MORHUA	3.51			+			0.13	0.01	**46.96**
GASTEROSTEUS ACULEATUS			1.94	0.22	0.07	0.34	0.12	0.19	**3.52**
GOBIUS NIGER									**0.07**
LEANDER									**+**
LIMANDA LIMANDA					0.08			0.16	**3.34**
MERLANGIUS MERLANGUS	0.21	0.06	0.33	0.42	0.05		0.04	0.03	**5.64**
PLATICHTHYS FLESUS		0.15	0.17	0.18	0.38	0.72		2.65	**8.55**
PLEURONECTES PLATESSA							0.18		**0.57**
POMATOSCHISTUS MINUTUS	+	+		0.01	+	+	+	+	**0.03**
SCOMBER SCOMBRUS					0.62				**0.62**
SOLEA VULGARIS									**0.07**
SPRATTUS SPRATTUS	0.60	0.21	5.43	0.53	0.04	0.08	0.13	0.92	**294.12**
TRACHURUS TRACHURUS									**+**
Total	**64.05**	**32.56**	**24.56**	**9.27**	**3.40**	**3.98**	**3.03**	**4.46**	**686.39**
Medusae	5.94	4.42	6.48	4.34	4.81	1.51	10.15	23.36	**231.49**

+ = < 0.01 kg

Table 6: FRV "Solea", cruise 783/2020. Survey statistics by area.

Sub-division	ICES Rectangle	Area (nm^2)	Sa (m^2/NM^2)	Sigma (cm^2)	N total (million)	Herring (%)	Sprat (%)	NHerring (million)	NSprat (million)
21	41G0	108.1	32.0	1.249	27.70	4.53	94.92	1.25	26.29
21	41G1	946.8	47.6	2.072	217.51	41.45	44.49	90.15	96.77
21	41G2	432.3	51.8	1.758	127.38	49.66	38.81	63.25	49.44
21	42G1	884.2	53.1	1.913	245.43	51.59	38.38	126.63	94.20
21	42G2	606.8	66.1	1.287	311.65	19.64	70.31	61.22	219.13
21	43G1	699.0	153.7	1.560	688.69	56.34	22.51	388.00	155.06
21	43G2	107.0	34.8	1.441	25.84	38.24	20.45	9.88	5.28
21	**Total**	**3,784.2**			**1644.20**			**740.38**	**646.17**
22	37G0	209.9	30.0	0.665	94.69	1.25	1.71	1.18	1.62
22	37G1	723.3	21.4	1.795	86.23	15.28	39.09	13.18	33.71
22	38G0	735.3	54.8	0.752	535.83	4.09	16.79	21.89	89.97
22	38G1	173.2	28.2	1.954	25.00	3.13	3.13	0.78	0.78
22	39F9	159.3	101.4	0.469	344.41	2.33	89.44	8.01	308.04
22	39G0	201.7	72.3	1.271	114.74	17.71	49.69	20.32	57.01
22	39G1	250.0	69.0	0.435	396.55	2.59	25.39	10.27	100.68
22	40F9	51.3	93.8	1.282	37.53	19.02	75.87	7.14	28.47
22	40G0	538.1	116.6	2.079	301.79	48.91	46.28	147.60	139.67
22	40G1	174.5	12.3	1.789	12.00	27.86	62.98	3.34	7.56
22	41G0	173.1	21.8	1.571	24.02	52.39	40.67	12.58	9.77
22	**Total**	**3,389.7**			**1972.79**			**246.29**	**777.28**
23	39G2	130.9	118.5	2.974	52.16	96.35	3.55	50.26	1.85
23	40G2	164.0	619.6	6.438	157.84	27.66	64.16	43.66	101.27
23	41G2	72.3	45.6	1.929	17.09	8.33	80.56	1.42	13.77
23	**Total**	**367.2**			**227.09**			**95.34**	**116.89**
24	37G2	192.4	85.2	1.627	100.75	4.60	89.66	4.63	90.33
24	37G3	167.7	229.6	2.583	149.07	47.49	51.21	70.79	76.34
24	37G4	875.1	57.4	3.604	139.37	93.40	5.38	130.17	7.49
24	38G2	832.9	42.8	1.077	330.99	51.61	29.99	170.84	99.25
24	38G3	865.7	166.9	1.850	781.00	25.48	72.45	199.02	565.82
24	38G4	1034.8	123.7	4.112	311.30	97.53	1.23	303.61	3.82
24	39G2	406.1	93.8	1.713	222.37	69.12	3.19	153.70	7.08
24	39G3	765.0	106.6	2.434	335.04	73.95	12.67	247.77	42.45
24	39G4	524.8	179.1	2.405	390.82	43.41	30.33	169.65	118.54
24	**Total**	**5,664.5**			**2,760.71**			**1450.18**	**1011.12**
22-24	**Total**	**9,421.4**			**4,960.59**			**1791.81**	**1905.29**
21-24	**Total**	**13,205.6**			**6,604.79**			**2532.19**	**2551.46**

Table 7: FRV "Solea", cruise 783/2020. Numbers (millions) of herring incl. CBH by age/W-rings and area.

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total
21	41G0	1.19	0.06								1.25
21	41G1	79.60	8.99	0.64	0.34	0.23	0.05	0.30			90.15
21	41G2	61.95	1.15	0.09	0.02	0.02	0.01	0.01			63.25
21	42G1	119.03	7.34	0.04	0.06	0.06	0.02	0.09			126.64
21	42G2	52.32	7.62	0.46	0.28	0.21	0.10	0.23			61.22
21	43G1	344.20	37.94	1.97	1.05	1.45	0.19	1.20			388.00
21	43G2	9.81	0.06								9.87
21	Total	668.10	63.16	3.20	1.75	1.97	0.37	1.83	0.00	0.00	740.38
22	37G0	1.15	0.03								1.18
22	37G1	13.00	0.18								13.18
22	38G0	21.41	0.48								21.89
22	38G1	0.78									0.78
22	39F9	8.01									8.01
22	39G0	15.32	3.06	0.98	0.76		0.10	0.10			20.32
22	39G1	5.77	0.39	2.46	1.23		0.21	0.21			10.27
22	40F9	6.74	0.29	0.08	0.02	0.01					7.14
22	40G0	90.90	25.93	21.38	5.59	2.57	0.84	0.32	0.07		147.60
22	40G1	3.01	0.31	0.01							3.33
22	41G0	11.47	1.05	0.03	0.03						12.58
22	Total	177.56	31.72	24.94	7.63	2.58	1.15	0.63	0.07	0.00	246.28
23	39G2	11.70	7.06	3.00	7.66	6.45	5.34	6.87	0.99	1.19	50.26
23	40G2	12.58	9.29	7.5	5.21	3.46	3.12	1.25	0.94	0.3	43.65
23	41G2	0.95	0.44	0.03							1.42
23	Total	25.23	16.79	10.53	12.87	9.91	8.46	8.12	1.93	1.49	95.33
24	37G2	4.63									4.63
24	37G3	26.61	8.39	3.20	7.05	7.52	6.21	8.96	1.44	1.42	70.80
24	37G4	7.43	21.74	9.34	20.83	20.59	17.81	24.35	4.00	4.08	130.17
24	38G2	161.42	2.91	0.23	1.87	1.41	1.12	1.53	0.19	0.16	170.84
24	38G3	91.04	21.62	6.96	18.00	18.95	14.86	21.20	3.31	3.08	199.02
24	38G4	2.61	42.60	27.77	54.42	48.70	47.60	55.44	13.52	10.94	303.60
24	39G2	97.00	11.93	3.89	11.06	9.31	7.54	9.98	1.43	1.57	153.71
24	39G3	113.20	26.31	12.13	22.31	21.06	19.53	24.95	4.08	4.22	247.79
24	39G4	42.04	17.47	9.92	29.20	21.03	20.35	20.13	5.20	4.31	169.65
24	Total	545.98	152.97	73.44	164.74	148.57	135.02	166.54	33.17	29.78	1,450.21
22-24	Total	748.77	201.48	108.91	185.24	161.06	144.63	175.29	35.17	31.27	1,791.82
21-24	Total	1,416.87	264.64	112.11	186.99	163.03	145.00	177.12	35.17	31.27	2,532.20

Table 8: FRV "Solea", cruise 783/2020. Mean weight (g) of herring incl. CBH by age/W-rings and area.

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total
21	41G0	13.45	41.47								14.79
21	41G1	15.39	44.38	56.42	49.42	50.90	42.48	52.89			18.93
21	41G2	13.61	39.23	71.94	46.03	38.63	42.48	34.31			14.18
21	42G1	16.40	32.13	32.59	37.73	39.21	42.48	37.28			17.36
21	42G2	14.41	44.14	54.21	47.75	48.03	42.48	55.78			18.88
21	43G1	13.03	40.19	60.48	46.21	74.19	42.48	51.94			16.38
21	43G2	13.61	33.37								13.73
21	Total	14.08	40.30	58.74	46.79	67.26	42.48	51.76			16.84
22	37G0	10.39	12.88								10.45
22	37G1	8.74	13.44								8.80
22	38G0	8.94	14.97								9.07
22	38G1	15.19	0.00								15.19
22	39F9	5.30	0.00								5.30
22	39G0	9.82	42.30	90.82	97.19		119.05	119.05			22.96
22	39G1	10.04	12.97	95.67	107.36		119.05	119.05			46.78
22	40F9	9.77	25.62	72.22	47.73	49.89					11.28
22	40G0	11.33	48.34	79.33	98.01	107.53	135.62	151.35	175.67		33.73
22	40G1	12.91	23.10	48.83							13.97
22	41G0	13.50	17.15	91.70	91.70						14.18
22	Total	10.53	45.10	81.37	99.28	107.31	131.15	135.46	175.67		26.85
23	39G2	14.59	36.04	42.70	39.75	39.99	45.43	43.01	47.09	48.57	34.98
23	40G2	14.88	40.19	70.16	128.96	135.39	148.23	170.47	185.07	213.55	71.95
23	41G2	11.56	34.40	34.40							19.12
23	Total	14.62	38.29	62.23	75.86	73.30	83.34	62.63	114.29	81.79	51.67
24	37G2	7.95									7.95
24	37G3	10.23	38.55	47.23	41.13	41.46	45.01	42.47	45.89	46.62	30.24
24	37G4	12.01	38.87	48.13	41.86	41.97	47.05	44.71	49.69	48.08	41.80
24	38G2	9.33	31.70	32.15	30.44	34.64	37.21	37.81	37.90	37.30	10.68
24	38G3	9.56	38.05	43.88	38.15	39.28	42.85	41.59	43.70	44.89	26.28
24	38G4	16.13	39.98	53.51	53.22	48.99	53.94	48.67	58.58	56.24	50.02
24	39G2	12.53	33.89	40.81	37.99	38.95	43.83	42.40	46.00	47.29	22.48
24	39G3	14.56	35.27	45.82	44.20	44.83	50.08	46.82	54.21	50.57	30.84
24	39G4	15.89	35.31	46.55	56.65	58.75	74.34	63.67	81.40	78.96	48.30
24	Total	11.63	37.50	48.69	47.73	46.42	53.21	47.92	57.85	55.40	33.89
22-24	Total	11.47	38.76	57.48	51.80	49.05	55.60	48.91	61.20	56.68	33.87
21-24	Total	12.70	39.13	57.52	51.76	49.27	55.56	48.94	61.20	56.68	28.89

Table 9: FRV "Solea", cruise 783/2020. Total biomass (t) of herring incl. CBH by age/W-rings and area.

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total
21	41G0	16.0	2.5								18.5
21	41G1	1,225.0	399.0	36.1	16.8	11.7	2.1	15.9			1,706.6
21	41G2	843.1	45.1	6.5	0.9	0.8	0.4	0.3			897.2
21	42G1	1,952.1	235.8	1.3	2.3	2.4	0.9	3.4			2,198.0
21	42G2	753.9	336.4	24.9	13.4	10.1	4.3	12.8			1,155.8
21	43G1	4,484.9	1,524.8	119.2	48.5	107.6	8.1	62.3			6,355.4
21	43G2	133.5	2.0								135.5
21	Total	9,408.7	2,545.6	188.0	81.9	132.5	15.7	94.7	0.0	0.0	12,467.0
22	37G0	12.0	0.4								12.3
22	37G1	113.6	2.4								116.0
22	38G0	191.4	7.2								198.6
22	38G1	11.9									11.9
22	39F9	42.5									42.5
22	39G0	150.4	129.4	89.0	73.9		11.9	11.9			466.6
22	39G1	57.9	5.1	235.4	132.1		25.0	25.0			480.4
22	40F9	65.9	7.4	5.8	1.0	0.5					80.5
22	40G0	1,029.9	1,253.5	1,696.1	547.9	276.4	113.9	48.4	12.3		4,978.3
22	40G1	38.9	7.2	0.5							46.5
22	41G0	154.9	18.0	2.8	2.8						178.4
22	Total	1,869.1	1,430.6	2,029.5	757.49	276.9	150.8	85.34	12.30	0.0	6,611.9
23	39G2	170.7	255.4	127.6	304.6	257.3	242.7	294.3	47.21	58.4	1,758.2
23	40G2	187.2	373.4	526.2	671.9	468.5	462.5	213.1	174.0	64.1	3,140.7
23	41G2	11.0	15.1	1.0							27.2
23	Total	368.9	643.9	654.8	976.4	725.8	705.1	507.4	221.2	122.4	4,926.0
24	37G2	36.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8
24	37G3	272.2	323.4	151.1	290.0	311.8	279.5	380.5	66.1	66.2	2,140.9
24	37G4	89.2	845.0	449.5	871.9	864.2	838.0	1,088.7	198.8	196.2	5,441.5
24	38G2	1,506.1	92.3	7.4	56.9	48.8	41.7	57.9	7.2	6.0	1,824.2
24	38G3	870.3	822.6	305.4	686.7	744.4	636.8	881.7	144.7	138.3	5,230.8
24	38G4	42.1	1,703.2	1,486.0	2,896.2	2,385.8	2,567.5	2,698.3	792.0	615.3	15,186.3
24	39G2	1,215.4	404.3	158.8	420.2	362.6	330.5	423.2	65.8	74.3	3,454.9
24	39G3	1,648.2	928.0	555.8	986.1	944.1	978.1	1,168.2	221.2	213.4	7,643.0
24	39G4	668.0	616.9	461.8	1,654.2	1,235.5	1,512.8	1,281.7	423.3	340.3	8,194.5
24	Total	6,348.4	5,735.6	3,575.8	7,862.2	6,897.2	7,184.8	7,980.0	1,918.9	1,649.9	49,152.8
22-24	Total	8,586.4	7,810.1	6,260.1	9,596.1	7,899.8	8,040.8	8,572.8	2,152.4	1,772.3	60,690.7
21-24	Total	17,995.0	10,355.7	6,448.0	9,678.0	8,032.3	8,056.5	8,667.5	2,152.4	1,772.3	73,157.7

Table 10: FRV "Solea", cruise 783/2020. Numbers (millions) of sprat by age and area.

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
21	41G0		25.21	0.63	0.33	0.06	0.06				26.29
21	41G1		69.79	14.02	9.98	1.93	0.99		0.07		96.78
21	41G2	1.16	44.05	1.93	1.88	0.32	0.10				49.44
21	42G1		62.47	15.18	12.20	2.45	1.77		0.12		94.19
21	42G2	1.07	213.54	2.53	1.71	0.24	0.05				219.14
21	43G1	1.47	147.76	2.26	2.58	0.60	0.39				155.06
21	43G2	0.04	5.03	0.09	0.10	0.02					5.28
21	Total	3.74	567.85	36.64	28.78	5.62	3.36	0.00	0.19	0.00	646.18
22	37G0	0.37	0.25	0.30	0.43	0.16	0.12				1.63
22	37G1	12.92	15.42	2.50	1.89	0.70	0.28				33.71
22	38G0	67.78	18.00	3.39	0.60	0.20					89.97
22	38G1		0.34	0.34	0.08	0.03					0.79
22	39F9	307.84	0.20								308.04
22	39G0	10.97	37.25	5.38	2.18	0.96	0.27				57.01
22	39G1	98.21	2.47								100.68
22	40F9	0.71	22.24	3.45	1.33	0.59	0.14				28.46
22	40G0	3.95	116.43	13.07	3.94	1.75	0.53				139.67
22	40G1	0.24	6.70	0.50	0.07	0.03	0.02				7.56
22	41G0	0.15	8.88	0.63	0.07	0.03	0.01				9.77
22	Total	503.14	228.18	29.56	10.59	4.45	1.37	0.00	0.00	0.00	777.29
23	39G2	1.35	0.27	0.09	0.09	0.03	0.02	0.01			1.86
23	40G2	3.09	71.11	11.61	7.16	4.73	2.23	0.45	0.71	0.20	101.29
23	41G2	0.65	12.69	0.36		0.07					13.77
23	Total	5.09	84.07	12.06	7.25	4.83	2.25	0.46	0.71	0.20	116.92
24	37G2	0.77	33.60	18.63	20.02	8.45	6.54	1.62	0.69		90.32
24	37G3	1.82	50.61	11.72	8.67	1.58	1.48	0.40	0.06		76.34
24	37G4	0.01	2.24	1.88	1.84	0.77	0.52	0.18	0.06		7.50
24	38G2	63.78	20.85	6.26	5.86	1.24	1.26				99.25
24	38G3	19.39	413.69	66.25	50.59	7.12	6.71	1.81	0.27		565.83
24	38G4		0.14	0.63	0.91	0.70	1.06	0.26	0.13		3.83
24	39G2	1.79	2.78	1.01	0.91	0.29	0.22	0.07	0.02		7.09
24	39G3		3.47	9.44	15.44	7.37	5.24	0.93	0.54		42.43
24	39G4	0.04	9.98	25.05	39.08	22.23	14.08	5.05	3.04		118.55
24	Total	87.60	537.36	140.87	143.32	49.75	37.11	10.32	4.81	0.00	1,011.14
22-24	Total	595.83	849.61	182.49	161.16	59.03	40.73	10.78	5.52	0.20	1,905.35
21-24	Total	599.57	1,417.46	219.13	189.94	64.65	44.09	10.78	5.71	0.20	2,551.53

Table 11: FRV "Solea", cruise 783/2020. Mean weight (g) of sprat by age and area.

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
21	41G0		10.32	14.07	16.46	18.84	20.34				10.53
21	41G1		11.66	14.51	16.10	17.93	20.73		22.83		12.76
21	41G2	2.32	9.31	15.10	16.11	16.54	19.81				9.70
21	42G1		11.75	14.82	16.61	18.33	20.98		22.83		13.23
21	42G2	4.16	9.22	14.49	15.94	15.65	18.22				9.32
21	43G1	3.79	8.29	15.02	17.26	17.94	21.50				8.56
21	43G2	4.08	8.62	14.89	16.36	16.35					8.87
21	Total	3.44	9.61	14.69	16.42	17.93	20.88		22.83		10.30
22	37G0	3.18	11.87	14.78	17.08	16.68	17.85				12.67
22	37G1	4.67	10.33	13.55	16.61	16.56	17.31				8.94
22	38G0	2.73	11.81	12.65	12.79	12.79					5.01
22	38G1		12.79	12.79	12.79	12.79					12.79
22	39F9	2.00	5.16								2.00
22	39G0	2.58	11.18	13.33	14.77	14.39	15.43				9.94
22	39G1	3.23	5.92								3.30
22	40F9	7.64	10.65	12.83	14.97	14.45	15.76				11.14
22	40G0	7.45	10.45	12.35	14.95	14.55	16.23				10.75
22	40G1	7.29	10.28	11.48	14.83	15.01	17.14				10.35
22	41G0	7.50	10.54	11.27	14.39	14.20	15.40				10.59
22	Total	2.48	10.64	12.71	15.16	14.80	16.39				5.53
23	39G2	2.94	12.63	14.53	15.88	17.74	16.88	18.20			5.94
23	40G2	7.20	12.93	16.79	19.79	19.08	21.41	19.27	22.51	23.41	14.27
23	41G2	6.70	10.62	9.76	0.00	11.63					10.42
23	Total	6.01	12.58	16.56	19.74	18.96	21.37	19.25	22.51	23.41	13.68
24	37G2	10.68	12.68	15.23	16.26	17.42	17.48	17.59	19.47		14.91
24	37G3	10.79	12.27	14.18	14.53	16.67	15.99	16.55	18.20		12.97
24	37G4	11.32	13.19	15.22	16.11	17.13	16.57	16.87	18.99		15.19
24	38G2	4.65	12.66	14.60	15.42	17.05	16.42				7.90
24	38G3	10.41	12.05	13.76	13.94	16.66	15.98	16.54	18.20		12.48
24	38G4		14.06	16.54	18.13	19.56	20.61	20.26	20.92		18.91
24	39G2	3.20	12.55	14.78	15.69	17.03	16.52	17.02	18.20		11.28
24	39G3		13.68	16.01	16.89	17.48	17.34	18.02	19.23		16.64
24	39G4	11.32	13.69	15.74	17.04	17.91	17.72	18.51	19.27		16.84
24	Total	6.08	12.18	14.57	15.59	17.53	17.26	17.91	19.26		13.01
22-24	Total	3.03	11.81	14.40	15.75	17.44	17.45	17.94	19.69	23.41	10.00
21-24	Total	3.04	10.93	14.45	15.85	17.48	17.72	17.94	19.78	23.41	10.07

Table 12: FRV "Solea", cruise 783/2020. Total biomass (t) of sprat by age and area.

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
21	41G0		260.3	8.8	5.4	1.1	1.3				276.9
21	41G1		813.7	203.4	160.7	34.6	20.6		1.5		1,234.5
21	41G2	2.7	410.2	29.2	30.3	5.3	1.9				479.6
21	42G1		734.2	225.0	202.6	45.0	37.2		2.8		1,246.7
21	42G2	4.4	1,968.6	36.6	27.3	3.7	0.9				2,041.5
21	43G1	5.6	1,224.7	33.9	44.6	10.7	8.5				1,327.9
21	43G2	0.2	43.4	1.4	1.6	0.3					46.8
21	Total	12.9	5,455.1	538.2	472.5	100.6	70.3	0.0	4.3	0.0	6,653.9
22	37G0	1.2	2.9	4.5	7.3	2.7	2.1				20.5
22	37G1	60.3	159.3	33.9	31.3	11.5	4.9				301.3
22	38G0	185.2	212.7	42.9	7.7	2.6					451.0
22	38G1	0.0	4.3	4.3	1.0	0.3					10.0
22	39F9	614.3	1.0								615.3
22	39G0	28.3	416.4	71.7	32.2	13.9	4.2				566.6
22	39G1	317.5	14.6								332.1
22	40F9	5.4	236.8	44.3	19.9	8.5	2.2				317.2
22	40G0	29.4	1,217.2	161.4	58.9	25.5	8.6				1,501.0
22	40G1	1.7	68.9	5.7	1.1	0.5	0.3				78.2
22	41G0	1.1	93.7	7.1	1.0	0.4	0.1				103.4
22	Total	1,244.4	2,427.7	375.8	160.3	65.9	22.5	0.0	0.0	0.0	4,296.6
23	39G2	4.0	3.4	1.3	1.4	0.5	0.4	0.1			11.0
23	40G2	22.2	919.7	194.8	141.8	90.2	47.7	8.6	15.9	4.6	1,445.5
23	41G2	4.4	134.8	3.5		0.8					143.5
23	Total	30.6	1,057.9	199.6	143.2	91.5	48.0	8.7	15.9	4.6	1,599.9
24	37G2	8.3	426.2	283.6	325.4	147.2	114.4	28.5	13.5		1,347.1
24	37G3	19.6	620.9	166.2	126.0	26.4	23.7	6.7	1.1		990.5
24	37G4	0.1	29.5	28.7	29.6	13.1	8.6	3.0	1.2		113.8
24	38G2	296.7	264.0	91.4	90.4	21.2	20.6				784.2
24	38G3	201.8	4,983.8	911.8	705.3	118.6	107.1	29.9	4.9		7,063.2
24	38G4		1.9	10.5	16.5	13.7	21.8	5.3	2.6		72.2
24	39G2	5.7	34.9	14.9	14.3	4.9	3.7	1.1	0.3		79.8
24	39G3		47.5	151.2	260.9	128.9	90.9	16.7	10.5		706.5
24	39G4	0.4	136.6	394.2	665.9	398.2	249.5	93.4	58.6		1,996.8
24	Total	532.5	6,545.2	2,052.3	2,234.2	872.1	640.3	184.6	92.8	0.0	13,154.0
22-24	Total	1,807.5	10,030.8	2,627.7	2,537.7	1,029.4	710.8	193.3	108.7	4.6	19,050.5
21-24	Total	1,820.4	15,485.9	3,165.9	3,010.2	1,130.0	781.1	193.3	113.0	4.6	25,704.4

Table 13: FRV "Solea", cruise 783/2020. Numbers (m) of herring excl. CBH in SD 21, SD 23/39G2and SD-24 by age/W-rings & area.

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total	
21	41G0	1.19	0.06	0.002							1.24	
21	41G1	79.60	8.88	0.59	0.05						89.13	
21	41G2	61.95	1.10	0.08							63.13	
21	42G1	119.02	6.55								125.57	excl. CBH
21	42G2	52.31	7.62	0.42							60.35	
21	43G1	344.13	36.36	1.73	0.18	0.54					382.95	
21	43G2	9.81	0.03								9.84	
21	Total	668.02	60.60	2.83	0.23	0.54	0.00	0.00	0.00	0.00	732.22	
22	37G0	1.15	0.03								1.18	
22	37G1	12.94	0.18								13.12	
22	38G0	21.41	0.48								21.89	
22	38G1	0.78									0.78	
22	39F9	8.01									8.01	
22	39G0	15.32	3.06	0.98	0.76		0.10	0.10			20.32	
22	39G1	5.77	0.39	2.46	1.23		0.21	0.21			10.27	
22	40F9	6.74	0.29	0.08	0.02	0.01					7.14	
22	40G0	90.90	25.93	21.38	5.59	2.57	0.84	0.32	0.07		147.60	
22	40G1	3.01	0.31	0.01							3.33	
22	41G0	11.47	1.05	0.03	0.03						12.58	
22	Total	177.50	31.72	24.94	7.63	2.58	1.15	0.63	0.07	0.00	246.22	
23	39G2	11.70	6.54	1.79	1.50	0.39	0.13	0.06	0.01	0.01	22.13	
23	40G2	12.58	9.29	7.5	5.21	3.46	3.12	1.25	0.94	0.3	43.65	
23	41G2	0.95	0.44	0.03							1.42	
23	Total	25.23	16.27	9.32	6.71	3.85	3.25	1.31	0.95	0.31	67.20	
24	37G2	4.63									4.63	
24	37G3	26.61	8.32	2.52	1.50	0.34	0.18	0.04	0.01	0.01	39.53	
24	37G4	7.43	21.70	7.53	5.23	1.08	0.50	0.34	0.06	0.01	43.88	
24	38G2	161.42	2.24	0.04							163.70	
24	38G3	91.04	21.51	4.57	2.81	0.48	0.25	0.06	0.02	0.01	120.75	excl. CBH
24	38G4	2.61	42.60	24.61	28.46	7.22	3.95	1.59	0.47	0.19	111.70	
24	39G2	97.00	9.84	2.05	1.68	0.44	0.18	0.11	0.01	0.01	111.32	
24	39G3	113.20	22.05	9.10	6.28	1.47	1.10	0.64	0.22	0.05	154.11	
24	39G4	42.04	15.37	6.51	12.43	5.56	6.01	3.25	1.47	0.80	93.44	
24	Total	545.98	143.63	56.93	58.39	16.59	12.17	6.03	2.26	1.08	843.06	
22-24	Total	748.71	191.62	91.19	72.73	23.02	16.57	7.97	3.28	1.39	1,156.48	
21-24	Total	1,416.73	252.22	94.02	72.96	23.56	16.57	7.97	3.28	1.39	1,888.70	

Table 14: FRV "Solea", cruise 783/2020. Mean weight (g) of herring excl. CBH in SD 21, SD 23/39G2 and SD 24 by age/W-rings & area.

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total	
21	41G0	12.89	42.03	52.89							14.29	
21	41G1	14.72	44.73	57.19	56.63						18.02	
21	41G2	13.06	39.94	75.12							13.61	
21	42G1	15.75	33.38								16.67	excl. CBH
21	42G2	13.82	44.54	55.17							17.99	
21	43G1	12.55	41.17	63.66	56.63	113.00					15.67	
21	43G2	13.08	47.00								13.19	
21	Total	13.54	41.25	61.38	56.63	113.00					16.10	
22	37G0	10.39	12.88								10.45	
22	37G1	8.74	13.44								8.80	
22	38G0	8.94	14.97								9.07	
22	38G1	15.19									15.19	
22	39F9	5.30									5.30	
22	39G0	9.82	42.30	90.82	97.19		119.05	119.05			22.96	
22	39G1	10.04	12.97	95.67	107.36		119.05	119.05			46.78	
22	40F9	9.77	25.62	72.22	47.73	49.89					11.28	
22	40G0	11.33	48.34	79.33	98.01	107.53	135.62	151.35	175.67		33.73	
22	40G1	12.91	23.10	48.83							13.97	
22	41G0	13.50	17.15	91.70	91.70						14.18	
22	Total	10.53	45.10	81.37	99.28	107.31	131.15	135.46	175.67		26.85	
23	39G2	13.98	38.85	53.10	71.09	79.94	103.30	101.41	101.57	101.57	30.37	
23	40G2	14.88	40.19	70.16	128.96	135.39	148.23	170.47	185.07	213.55	71.95	
23	41G2	11.56	34.40	34.40							19.12	
23	Total	14.34	39.49	66.77	116.02	129.77	146.43	167.31	184.19	209.94	57.14	
24	37G2	7.80									7.80	
24	37G3	9.78	39.92	51.87	67.05	91.73	102.92	120.10	105.25	101.57	22.27	
24	37G4	11.38	40.06	52.65	66.08	84.55	109.17	155.76	177.54	101.57	43.45	
24	38G2	8.89	37.78	44.67							9.29	
24	38G3	9.15	39.41	51.71	64.90	91.73	102.92	120.10	105.25	101.57	18.05	excl. CBH
24	38G4	15.84	41.12	57.14	70.44	80.27	95.97	122.69	126.33	101.57	57.62	
24	39G2	11.93	38.87	52.96	71.53	81.20	100.51	97.51	101.57	101.57	16.48	
24	39G3	13.95	39.88	52.14	70.83	103.45	129.49	155.63	155.00	148.17	24.74	
24	39G4	15.31	38.76	56.93	90.26	111.44	135.90	158.96	145.20	170.27	53.88	
24	Total	11.12	39.99	54.89	73.99	93.64	119.57	147.10	142.36	154.62	28.04	
22-24	Total	11.09	40.79	63.35	80.52	101.22	125.65	149.50	155.20	166.98	29.48	
21-24	Total	12.24	40.90	63.29	80.44	101.49	125.65	149.50	155.20	166.98	24.29	

Table 15: FRV "Solea", cruise 783/2020. Total biomass (t) of herring excl. CBH in SD 21, SD23/39G2 and SD 24 by age/W-rings & area.

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total	
21	41G0	15.3	2.4	0.1							17.8	
21	41G1	1,172.0	397.4	34.0	2.6						1,606.0	
21	41G2	809.1	44.0	6.2							859.3	
21	42G1	1,874.5	218.7								2,093.1	
21	42G2	723.0	339.4	23.0							1,085.4	
21	43G1	4,320.5	1,496.9	110.3	10.3	61.4					5,999.4	
21	43G2	128.3	1.5								129.8	
21	Total	9,042.7	2,500.2	173.6	12.9	61.4	0.0	0.0	0.0	0.0	11,790.8	
22	37G0	12.0	0.4								12.3	
22	37G1	113.1	2.4								115.5	
22	38G0	191.4	7.2								198.6	
22	38G1	11.9									11.9	
22	39F9	42.5									42.5	
22	39G0	150.4	129.4	89.0	73.9		11.9	11.9			466.6	
22	39G1	57.9	5.1	235.4	132.1		25.0	25.0			480.4	
22	40F9	65.9	7.4	5.8	1.0	0.5					80.5	
22	40G0	1,029.9	1,253.5	1,696.1	547.9	276.4	113.9	48.4	12.3		4,978.3	
22	40G1	38.9	7.2	0.5							46.5	
22	41G0	154.9	18.0	2.8	2.8						178.4	
22	Total	1,868.6	1,430.6	2,029.5	757.49	276.9	150.8	85.34	12.30	0.0	6,611.4	
23	39G2	163.6	254.1	95.1	106.6	31.2	13.4	6.1	1.02	1.0	672.1	
23	40G2	187.2	373.4	526.2	671.9	468.5	462.5	213.1	174.0	64.1	3,140.7	
23	41G2	11.0	15.1	1.0							27.2	
23	Total	361.7	642.6	622.3	778.5	499.6	475.9	219.2	175.0	65.1	3,839.9	
24	37G2	36.1									36.1	
24	37G3	260.3	332.1	130.7	100.6	31.2	18.5	4.8	1.1	1.0	880.3	
24	37G4	84.6	869.3	396.5	345.6	91.3	54.6	53.0	10.7	1.0	1,906.4	
24	38G2	1,435.0	84.6	1.8							1,521.4	
24	38G3	833.0	847.7	236.3	182.4	44.0	25.7	7.2	2.1	1.0	2,179.5	excl. CBH
24	38G4	41.3	1,751.7	1,406.2	2,004.7	579.6	379.1	195.1	59.4	19.3	6,436.4	
24	39G2	1,157.2	382.5	108.6	120.2	35.7	18.1	10.7	1.0	1.0	1,835.0	
24	39G3	1,579.1	879.4	474.5	444.8	152.1	142.4	99.6	34.1	7.4	3,813.4	
24	39G4	643.6	595.7	370.6	1,121.9	619.6	816.8	516.6	213.4	136.2	5,034.6	
24	Total	6,070.3	5,743.1	3,125.1	4,320.2	1,553.5	1,455.2	887.0	321.8	167.0	23,643.1	
22-24	Total	8,300.6	7,816.2	5,776.9	5,856.2	2,330.0	2,082.0	1,191.5	509.0	232.1	34,094.4	
21-24	Total	17,343.3	10,316.4	5,950.5	5,869.1	2,391.3	2,082.0	1,191.5	509.0	232.1	45,885.3	