

Annex 5: Individual survey cruise reports

Annex 5a: Western Baltic

Survey report for FRV “Solea”

German Acoustic Autumn Survey (GERAS)

01 – 19 October 2015

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1 INTRODUCTION

Background: The joint German/Danish GERAS survey is part of the Baltic International Acoustic Survey (BIAS), which is co-ordinated by the Baltic International Fish Survey Working Group (WGBIFS) and is conducted within the scope of the ICES Working Group for International Pelagic Surveys (WGIPS). Further WGBIFS contributors to the Baltic survey are national fisheries research institutes of Sweden, Poland, Finland, Latvia, Estonia, Lithuania and Russia. FRV “Solea” participated for the 28th time. The survey area covered the western Baltic Sea including Kattegat, Belt Sea, Sound and Arkona Sea (ICES Subdivisions 21, 22, 23 and 24). The survey effort was comparable to former years.

Objectives: The survey has the main objective to annually assess the clupeoid 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).

2 SURVEY DESCRIPTION & METHODS

2.1 Personnel

Calibration of acoustic equipment (01.-03.10.2015)

Matthias Schaber	Scientist in charge	TI-SF
Verena Kalter	Acoustics	TI-SF
Ben Stefanowitsch	Acoustics	TI-SF

Acoustic survey (03.-19.10.2015)

Matthias Schaber	Scientist in charge (03.-12.10.2015)	TI-SF
Tomas Gröhsler	Scientist in charge (12.-19.10.2015)	TI-OF
Ina Hennings	Biology (12.-19.10.2015)	TI-OF
Steffen Hagemann	Biology (03.-12.10.2015)	TI-OF
Verena Kalter	Biology	TI-SF
Mario Koth	Biology	TI-OF
Thomas Møller	Biology	DTU Aqua/Denmark
Ben Stefanowitsch	Acoustics	TI-SF

2.2 Narrative

The 710th cruise of FRV “SOLEA” represents the 28th subsequent GERAS survey. FRV “SOLEA” left the port of Rostock/Marienehe on 01 October 2015. The acoustic survey covered the whole area of Subdivisions (SD) 21, 22, 23 and 24. Due to varying weather conditions in the survey area the following survey schedule was accomplished:

- Arkona Sea	(SD 24)	03. - 06.10.
- Belt Sea	(SD 22)	06. - 07.10
- Sound	(SD 23)	07. - 08.10.
- Arkona Sea	(SD 24)	08. - 10.10.
- Belt Sea	(SD 22)	10. - 14.10.
- Kattegat	(SD 21)	14. - 18.10.

The survey ended on 19 October 2015 in Rostock/Marienehe.

2.3 Survey design

ICES statistical rectangles were used as strata for all Subdivisions (ICES, 2014). The area was limited by the 10 m depth line. The survey area in the Western Baltic Sea is characterised 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 regular cruise track length was 1 230 nm covering a survey area of 13 206 nm² (Figure 1).

2.4 Calibration

Calibration of both 38 and 120 kHz transducer took place off Kühlungsborn at good overall weather conditions. The 38 kHz transducer was calibrated three times at two different pulse lengths, the 120 kHz transducer twice at two different pulse lengths. Calibration results were considered very good based on the calculated RMS values.

The calibration procedure was carried out as described in the “Manual for the Baltic International Acoustic Surveys (BIAS)” (ICES, 2014). Calibration results for the 38 kHz transducer are given in Table 1.

2.5 Acoustic data collection

All acoustic investigations were performed during night time to account for the more pelagic distribution of clupeids during that time. The main pelagic species of interest were herring and sprat. The acoustic equipment used was a Simrad scientific echosounder EK60 operated at 38 kHz (120 kHz). Specific settings of the hydroacoustic equipment were used as described in the “Manual for the Baltic International Acoustic Survey (BIAS)” (ICES, 2014). Corresponding settings are listed in Table 1. Echo-integration, i.e. the integration and allocation of NASC values to species abundance and biomass was accomplished using Myriax Echoview 6.0 post-processing software. Mean volume back scattering values (s_v) were integrated over 1 nm intervals from ca. 8 m below the surface (depending on surface turbulence) to ca. 0.5 m over the seafloor. Interferences from surface turbulence, bottom structures and scattering layers were removed from the echogram.

2.6 Biological data – fishing trawls

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 7-9 m was achieved. The trawling time usually lasted 30 minutes but was shortened when echograms and netsonde indicated large catches. From each haul sub-samples were taken to determine length and weight of fish. Samples of herring and sprat were frozen for additional investigations (e.g. determining sex, maturity, age).

2.7 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, while water samples for Winkler titration and calibration of oxygen measurements were taken and processed at least once per day. Altogether, 80 CTD-profiles were measured (Fig. 5).

2.8 Data analysis

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
Clupeoids	$= 20 \log L \text{ (cm)} - 71.2$	ICES 1983
Gadoids	$= 20 \log L \text{ (cm)} - 67.5$	Foot et al. 1986

The total number of fish (total N) in one rectangle was estimated as the product of the mean area scattering cross section (s_A) and the rectangle area, divided by the corresponding mean cross section. The total number was separated into herring and sprat according to the mean catch composition. In accordance with the guidelines in the “Manual for the Baltic International Acoustic Surveys (BIAS)” (ICES, 2014) further calculations were performed as follows:

Fish species considered:

Clupea harengus
Engraulis encrasicolus
Gadus morhua
Gasterosteus aculeatus

Melanogrammus aeglefinus

Merlangius merlangus

Sprattus sprattus

Trachinus draco

Trisopterus esmarkii

Exclusion of trawl hauls with very low catch level:

Haul No.	Rectangle	Subdivision (SD)
29, 31	38G0	22
44, 45	41G1	21
47, 49	42G2	21
54	43G1	21

Despite low catch levels 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 these rectangles:

Haul No.	Rectangle	Subdivision (SD)
12	39G1	22
13, 34	39G0	22
25	37G1	22
32, 33	38G0	22
35	39F9	22
36, 37, 40	40G0	22
38	41G0	22
39	40G1	22
43	41G0	21

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

Rectangle/SD to be filled	with Haul No.	of Rectangle/SD
40F9/22	36, 37, 40	40G0/22
39G2/23	17, 24	39G2/24
37G4/24	5, 8, 9	38G4/24

3 RESULTS

3.1 Acoustic data

Statistics on survey area, mean S_A (NASC), mean scattering cross section σ , estimated total number of fish, as well as proportion of herring and sprat per SD/rectangle are shown in Table 6.

Figure 4 depicts the spatial distribution of mean NASC values (5 nm intervals) along the transectes measured in 2015.

In almost all rectangles surveyed, mean NASC values per nautical mile were distinctly below the observations recorded in 2014 and also below the long-time survey average. On ICES subdivision scale, mean NASC values were lower than in the previous year in SD 21, 22 and 24 while in SD 23 mean NASC values were higher than in 2014.

In SD 21, mean NASC per 1 nm EDSU was lower in than both the previous year and the long-time survey average in all rectangles surveyed. As in the previous year, increased aggregations of clupeids were measured in the northern part of the Kattegat (rectangle 43G1), but mean and overall NASC values also in this area were significantly lower than in 2014.

Also in SD 22, mean NASC values recorded were lower than the previous year and the survey average in all rectangle surveyed. Notable but small aggregations of clupeids were only recorded in the western part of Kiel Bight (38G0) and north/east of Fehmarn Island (38G1, 37G1) while the distribution was irregular along the rest of the survey transect in the remaining parts of the subdivision.

The large aggregations of big herring that can be observed annually in SD 23 in the Öre Sound were again present in autumn 2015. NASC values in rectangle 40G2 covering the aggregation hotspot in this area were slightly lower than the high levels measured in 2014 but still significantly higher than the long-time survey average. Like in 2014 the herring aggregations expanded north towards the narrow Helsingör/Helsingborg strait into rectangle 41G2 with corresponding NASC values similar to the previous year.

As in 2014, highest fish densities in SD 24 were recorded north and east of Rügen Island and also in the central parts of the Arkona Sea (37G3, 38G3 and southern 39G3). In most of the rectangles surveyed however, mean NASC values were lower than in the previous year. In rectangles 38G4

(southeastern Arkona Sea) and 39G2 (northwestern Arkona Sea, near Öre Sound mouth), NASC values were above the 2014 results (but below average).

3.2 Biological data

In total 59 trawl hauls were conducted:

Subdivision	No. of Hauls
21	19
22	18
23	3
24	19

Altogether, 1 745 individual herring, 904 sprat and 272 European anchovies were frozen for further investigations (e.g. determining sex, maturity, age). Results of catch compositions by Subdivision are presented in Tables 2-5. Altogether, 39 different species were recorded. Herring were caught in 58, sprat in 54 hauls. As in the previous year, mean catch rates per station ($\text{kg } 0.5 \text{ h}^{-1}$) were lowest in SD 22 and highest in SD 23. In contrast to the last year where sardines (*Sardina pilchardus*) were caught in SD 21, this species did not appear in 2015 catches. As in last year anchovy (*Engraulis encrasicolus*) was present in most catches. Anchovies were caught throughout the survey area (exception SD 23) in 43 out of 59 hauls, including the majority of hauls in SD 21. In some hauls in SD 22, anchovies contributed the bulk of clupeid catches.

Figures 2 and 3 show relative length-frequency distributions of **herring** and sprat in ICES subdivisions 21, 22, 23 and 24 for the years 2014 and 2015. Compared to results from the previous survey in 2014, the following conclusions for herring can be drawn (Fig. 2):

- Catches in SD 21 show a bimodal distribution characterized by the presence of the incoming year class ($\leq 15 \text{ cm}$) and older herring ($> 15 \text{ cm}$) in 2015. This is in contrast to 2014, where the fraction of older herring was mostly absent.
- SD 22 shows the incoming year class with only one mode at 10.75 cm while in 2014 two modes were observed at 12.75 cm and 15.25 cm. Older fishes show another mode at 16.75 cm (17.75 cm in 2014). In contrast to previous year this year's results show fewer larger herring.
- In SD 23, larger herring ($> 20 \text{ cm}$) dominate catches. The contribution of larger herring is more pronounced compared to the previous year when herring of the incoming year class were present with two modes at ca. 7.25 cm and at 11.75 cm.
- In SD 24, the herring length-frequency distribution is characterized by the incoming year class ($\leq 15.00 \text{ cm}$) and older herring ($> 15 \text{ cm}$), whereas in 2014 it was dominated by the incoming year class (mode at 11.25 cm) with only few older fishes.
- Altogether, the present contribution of the incoming year class (ca. $< 15 \text{ cm}$) seemed to be less pronounced than in the previous year.

Relative length-frequency distributions of **sprat** in the years 2014 and 2015 (Fig. 3) can be characterized as follows:

- In SD 21, 22 and 23 catch numbers of the incoming year class ($\leq 10 \text{ cm}$) are virtually absent in 2015. The catches are now mostly dominated by the contribution of larger sprat (ca. $> 10 \text{ cm}$). The highest contribution of very large sprat is found in SD 23 (mode at 15.75 cm).
- In SD 24, the sprat length-frequency distribution is similar compared to 2014 with a bimodal distribution of both incoming year class ($< 10 \text{ cm}$) and older sprat.
- Altogether, the present contribution of the incoming year class (ca. $< 10 \text{ cm}$) is very low.

3.3 Biomass and abundance estimates

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 based on baseline samples of WBSSH and CBH in 2011-2014 and in 2015 support the applicability of SF (Oeberst et al., 2013, WD Oeberst et al., 2014; WD Oeberst et al., 2015; WD Oeberst et al., 2016). Beside in SD 24, the SF was finally also applied to ICES rectangle 39G2 (SD 23 area) since biological samples of 39G2 (SD 24 area) were used to raise the corresponding recorded Sa values.

The age-length distribution of herring in SD 22 in 2015 for the first time indicated a higher contribution of older fish of CBH origin. Thus, the SF was also applied in SD 22.

The present results in SD 23 further show an unusual, very high contribution of mature herring (percentage of maturity stages ≥ 6 in 2015: 31 %; mean 1994-2014: 3 %), which cannot be considered of WBSSH origin. Accordingly, the fraction of 'mature' herring has not been taken into account in the final analysis.

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 now excludes CBH in 2005-2015 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.

3.3.1 Estimates incl. Central Baltic herring

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 summarised in Table 9 and Table 12.

The **herring** stock in Subdivisions 21-24 was estimated to be 3.7×10^9 fish (Table 7) or 240.5×10^3 tonnes (Table 9). For the included area of Subdivisions 22-24 the number of herring was calculated to be 3.35×10^9 fish or 229.1×10^3 tonnes. In contrast to former years, where the overall abundance estimate was dominated by young herring (age 0-1), the results in 2015 show a higher contribution of age 2 (Figure 2 and Table 7).

The estimated **sprat** stock in Subdivisions 21-24 was 7.4×10^9 fish (Table 10) or 75.6×10^3 tonnes (Table 12). For the included area of Subdivisions 22-24 the number of sprat was calculated to be 6.8×10^9 fish or 69.3×10^3 tonnes. The overall abundance estimate was dominated by the incoming year class (Figure 3 and Table 10).

3.3.2 Estimates excl. Central Baltic herring in SDs 22&24 and mature herring in SD 23

Estimated numbers of **herring excluding CBH** in SDs 22-24 or mature herring (stages ≥ 6) in SD 23 by age group and SD/rectangle for 2015 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 summarised in Table 15. Removal of the CBH fraction in SDs 22 and 24 from herring GERAS indices in 2015 resulted in biomass reductions of 10.1 % with corresponding reductions in numbers of 13.9 % (0.8 and 0.7 %, respectively in 2014; Fig. 5). Further removal of all mature herring in SD 23 from herring GERAS indices in 2015 gave an overall biomass reduction of 35.7 % with corresponding reductions in numbers of 25.6 % (Fig. 5).

3.4 Hydrographic data

In addition to the trawl hauls, vertical profiles of temperature, salinity and oxygen concentration were measured on a station grid covering the whole survey area. Altogether, hydrography profiles were measured on 84 stations. CTD stations as well as horizontal gradients of temperature, salinity and oxygen concentration both at the surface and at the seafloor are displayed in Figure 6.

Like in 2014, surface temperatures were comparatively high especially in the Arkona Sea. Overall surface temperatures ranged from ca. 11.5 °C in SD 21 to 15.5 °C in the southeastern SD 24. Bottom

temperatures in the southern Kattegat were higher than surface temperatures with values around 14.5 °C, while in the northern Kattegat in deeper water temperatures at the seafloor were around 8.5 °C. In the remaining survey area, especially in SD 22 and SD 24, seafloor temperatures were similar to surface temperatures. Surface salinities ranged from ca. 22 psu in the Kattegat to ca. 8 psu in the eastern Arkona Sea. Bottom salinities showed a similar gradient but were generally higher in the range of 35 psu (northern part of survey area in SD 21) to ca. 9.5 psu (SD 24). Surface layers were well oxygenated throughout the survey area. Signs of oxygen depletion were as in previous years evident in bottom layers of some areas in SD 22. In SD 22, oxygen depletion in the inner and southern Mecklenburg Bight as well as the southern part of the little Belt and the eastern Kiel Bight had proceeded to almost anoxic conditions near the seafloor.

4 DISCUSSION

Compared to 2014, the present estimates of **herring (incl. CBH)** show a significant decrease in stock biomass or abundance:

Herring	Difference compared to 2014	
	Numbers (%)	Biomass (%)
Area		
Subdivisions 22-24	-28	-27
Subdivisions 21-24	-70	-40

The significant decrease in 2015 was mainly driven by lower numbers or biomass estimates of age groups 0-1 and 4-6, which were somehow compensated by higher values of age groups 2-3 and 7-8+. The strength of the new incoming year class in 2015 was the lowest observed in the time series since 1994.

As in the years before 2014, some older and bigger herring were detected in the northern and northwestern parts of SD 24. These were herring that already had started to migrate out of the Sound (SD 23). It is assumed that these migrations are 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 2015, such migration of big herring was already partially detected during the survey period, indicating that according hydrographic conditions were met driving herring out of the Sound (see also bottom oxygen concentrations measured in the area, Figure 6). The higher contribution of older herring (ages 3-8+) diminished when excluding CBH by applying the SF but remained clearly detectable. Elimination of CHB in SD 24 lead – regarding the GERAS index covering the standard survey area - to differences of -9.9 % in numbers or -13.6 % in biomass.

The overall decrease in numbers and biomass was also evident in SD 22, showing far lower estimates of age groups 0 and 1 than in 2014. Before 2014 this area was characterised by almost exclusively small, young herring. Since 2014 the amount of older, small sized herring (TL < 20 cm and ages 3-8) - most likely of CBH origin – steadily increased and now showed the highest contribution in 2015. Therefore it was decided for the first time in 2015 to apply the SF also in SD 22 when compiling the final GERAS index. However, excluding CBH by applying the SF also in SD 22 further lead to only very small differences of <-1 % in numbers or biomass (overall -10.1 % in numbers or -13.9 % in biomass).

As in former years, SD 23, which is seen as an important transition and aggregation area for the WBSSH stock during its spawning migration – showed a high contribution of large herring. However, in contrast to former years, which only gave a small fraction of mature herring (maturity stages ≥ 6 : mean contribution 1994 – 2014: 3 %), this year's estimates increased to 31 %. The presence of distinct numbers of mature herring in SD 23 most likely could be related to North Sea autumn spawning herring, which could have migrated into this area, probably driven by prolonged inflow events

bringing high salinity water masses into this area. This would not be in contrast to other herring already migrating southward out of the Sound driven by hydrographic conditions as immigration by NSAS and emigration by WBSSH could be driven by temporally decoupled hydrographic factors discussed above. It has been suggested that variations in temperature and salinity, indicating changes in water masses, could affect distribution patterns of herring in the North Sea (Maravelias and Reid, 1995; Röckmann et al., 2011).

Since the present high fraction of mature herring at the survey time of GERAS cannot be assigned to WBSSH, it was decided to remove all mature herring from the final index results. This further reduction lead to overall final differences of -25.6 % in numbers or -35.7 % in biomass.

5 REFERENCES

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6 FIGURES AND TABLES

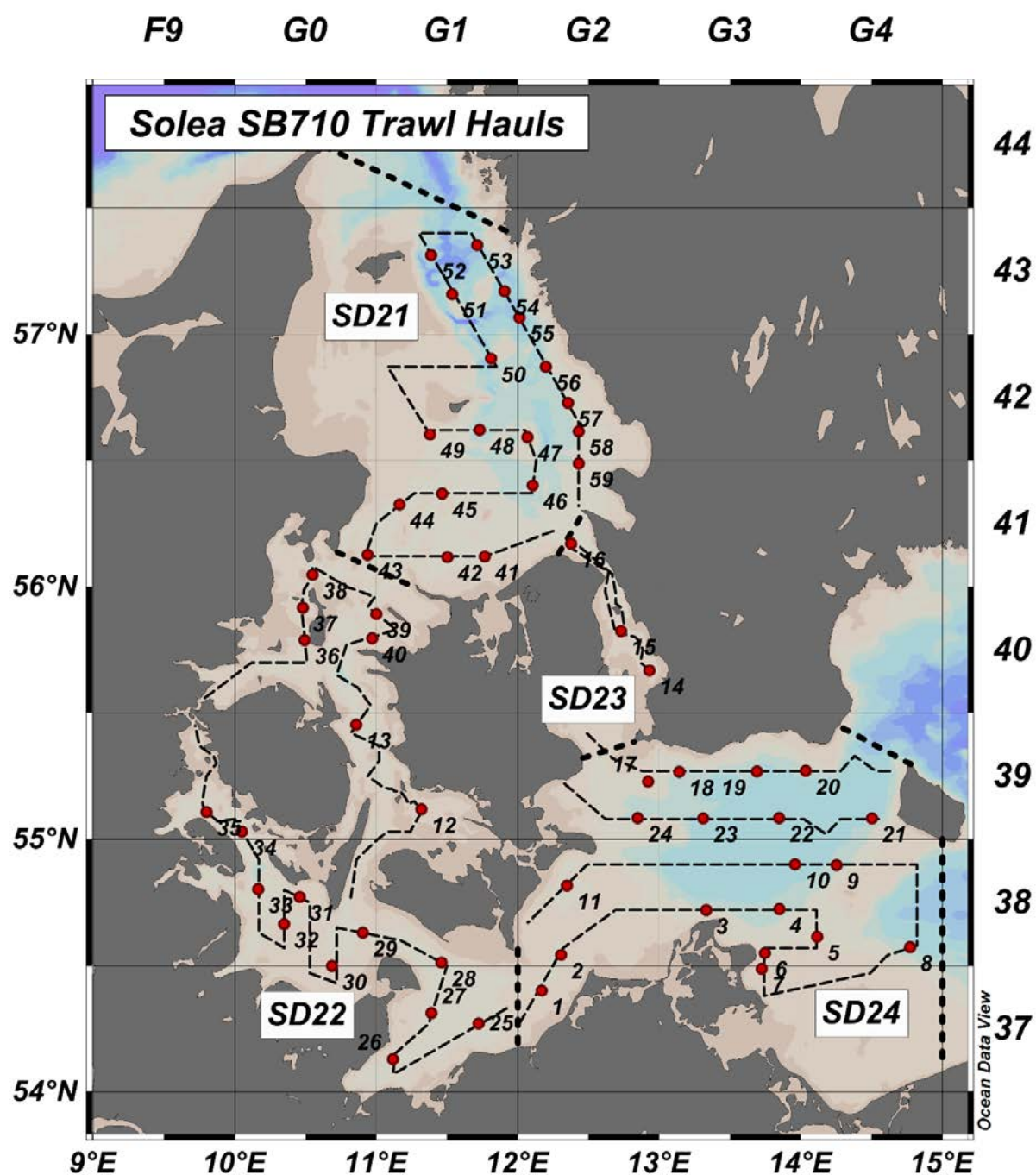


Figure 1: FRV "Solea", cruise 710/2015. Cruise track (lines) and fishery hauls (dots). ICES statistical rectangles are indicated in the top and right axis. Thick dashed lines separate ICES subdivisions (SD).

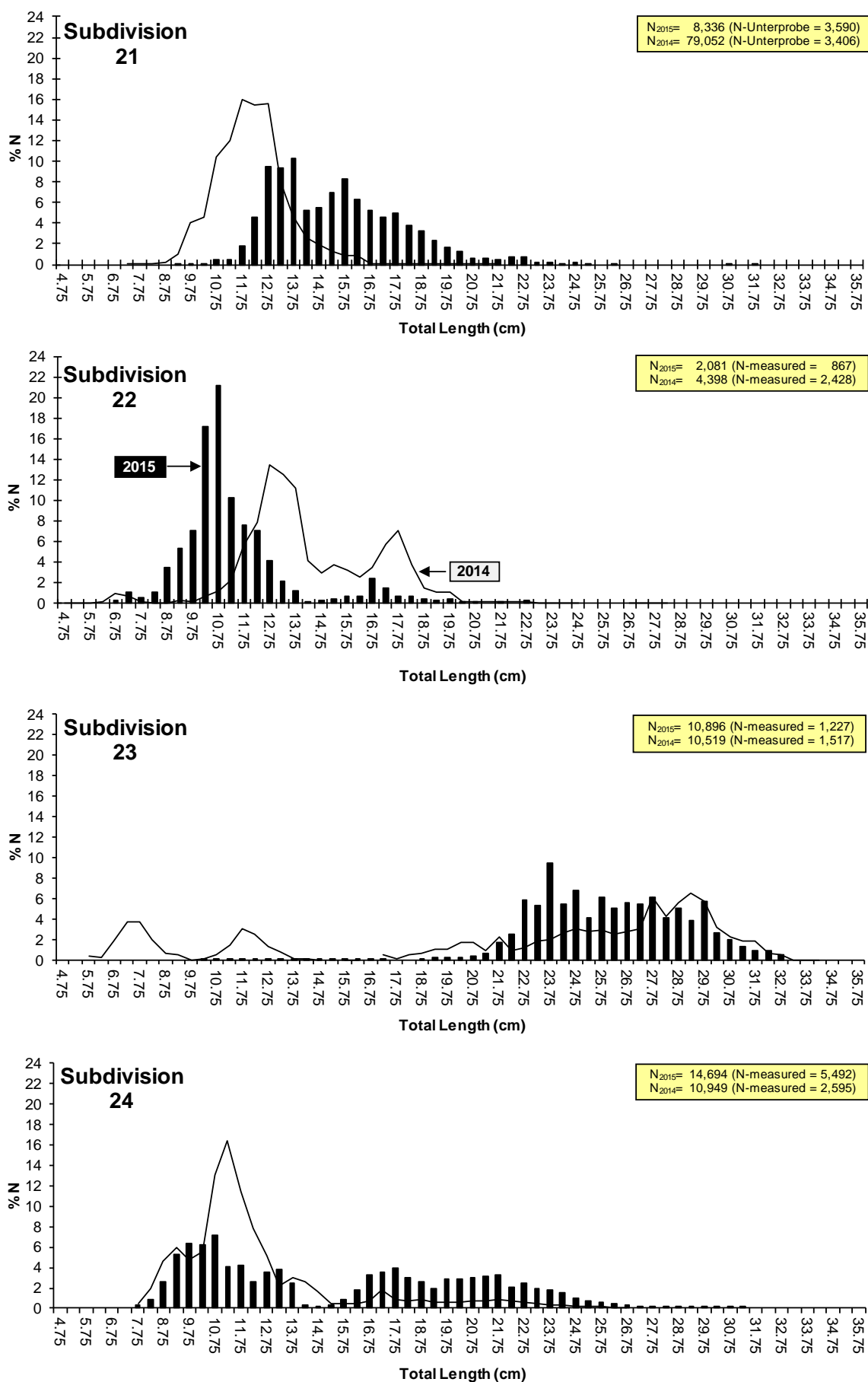


Figure 2: FRV "Solea," cruise 710/2015: Herring (*Clupea harengus*) length-frequency distribution compared to previous year (cruise 694/2014).

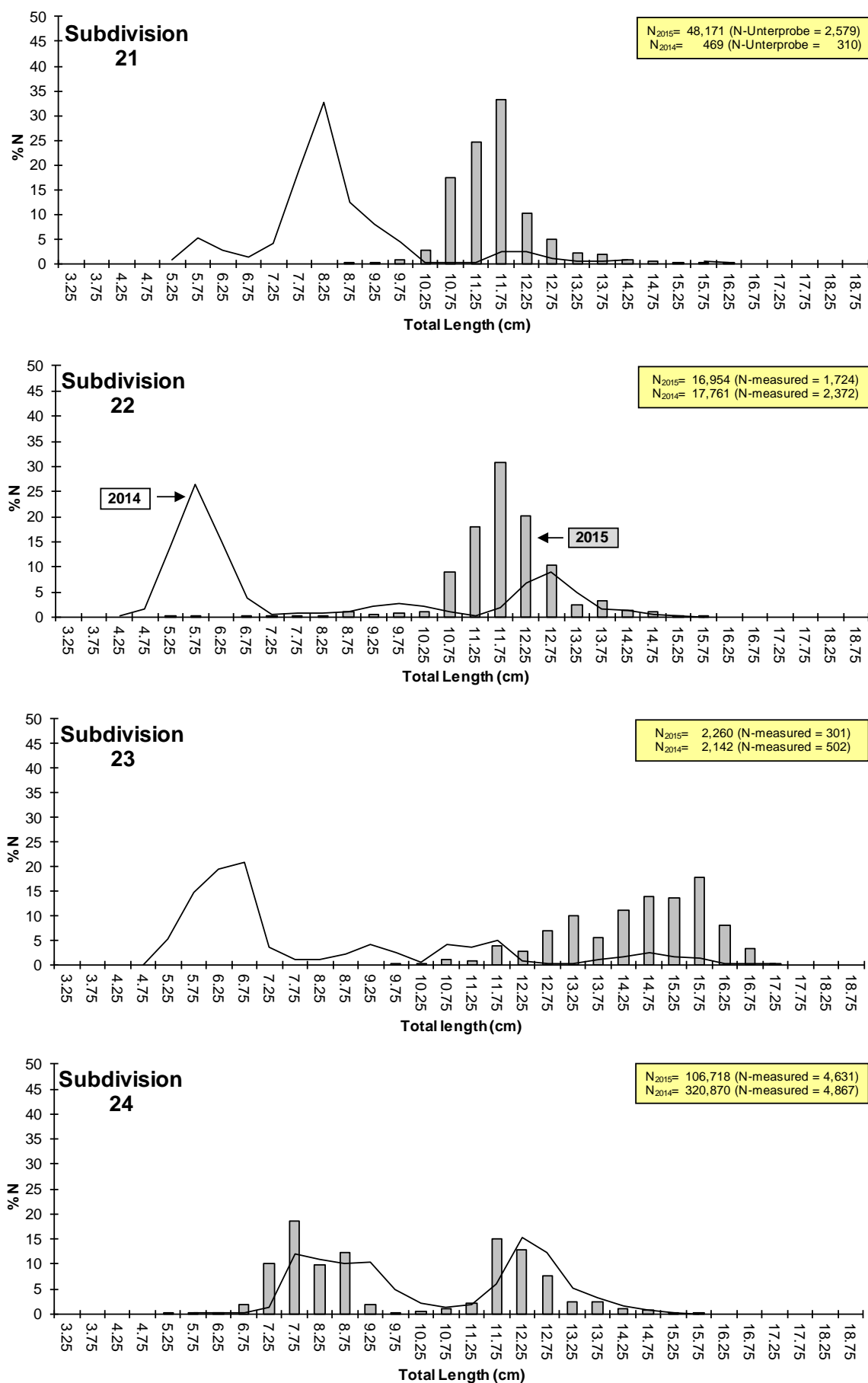


Figure 3: FRV "Solea", cruise 710/2015: Sprat (*Sprattus sprattus*) length-frequency distribution compared to previous year (cruise 694/2014).

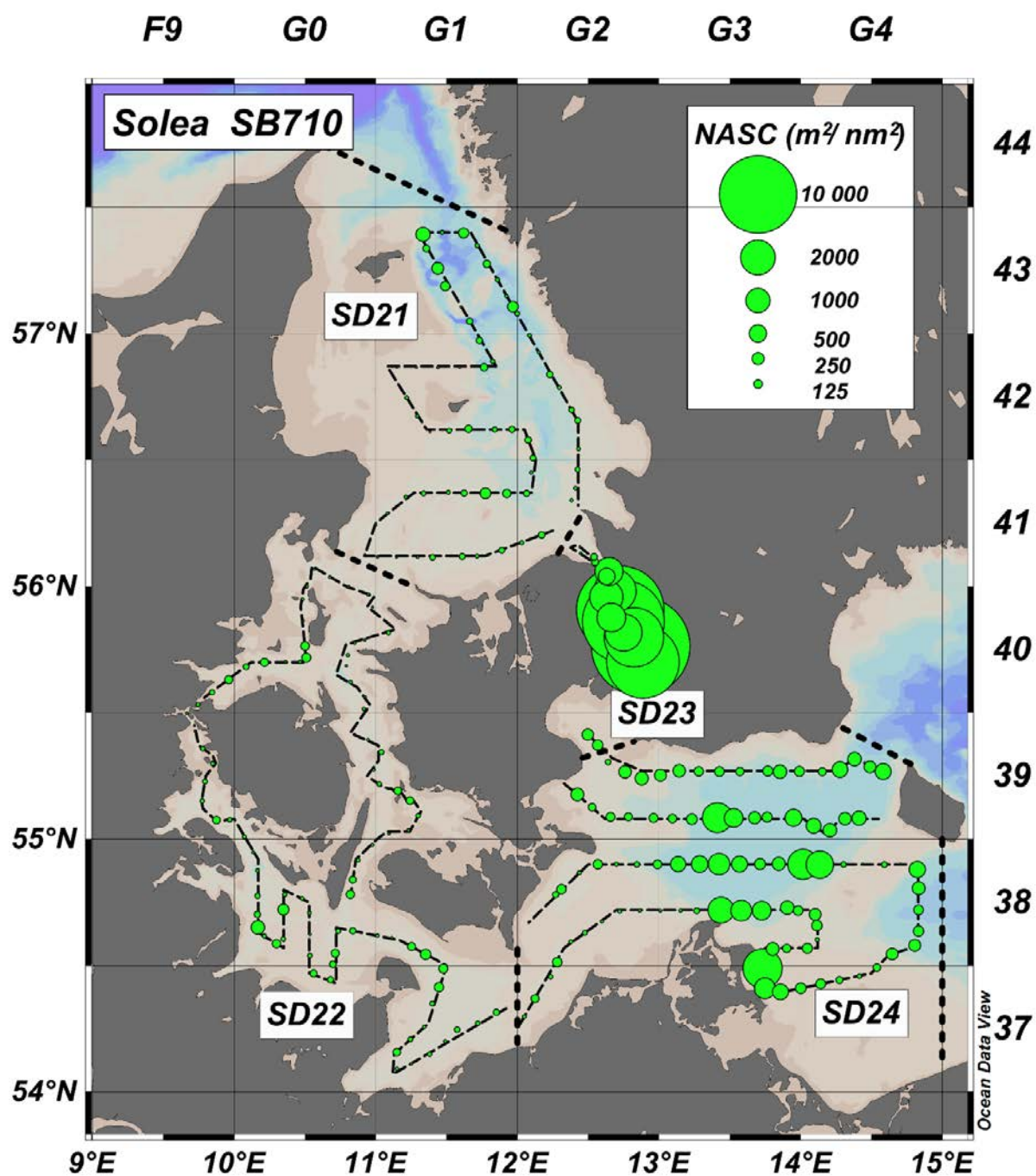


Figure 4: FRV "Solea", cruise 710/2015. Cruisetrack (lines) and mean NASC (5 nm intervals). ICES statistical rectangles are indicated in the top and right axis. Thick dashed lines separate ICES subdivisions (SD).

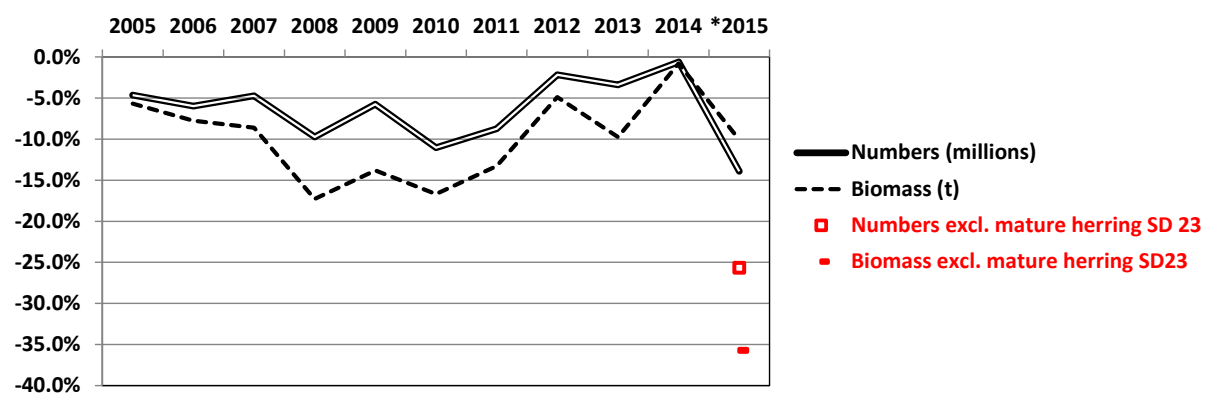


Figure 5 Relative changes in abundance and biomass of Western Baltic Spring Spawning herring in ICES Subdivisions 21-24 (2005-2015) after application of the stock separation function (SF, Gröhsler et al., 2013) to the abundance and biomass index generated from German acoustic survey data (GERAS).
*2015 = excl. CBH also in SD 22.

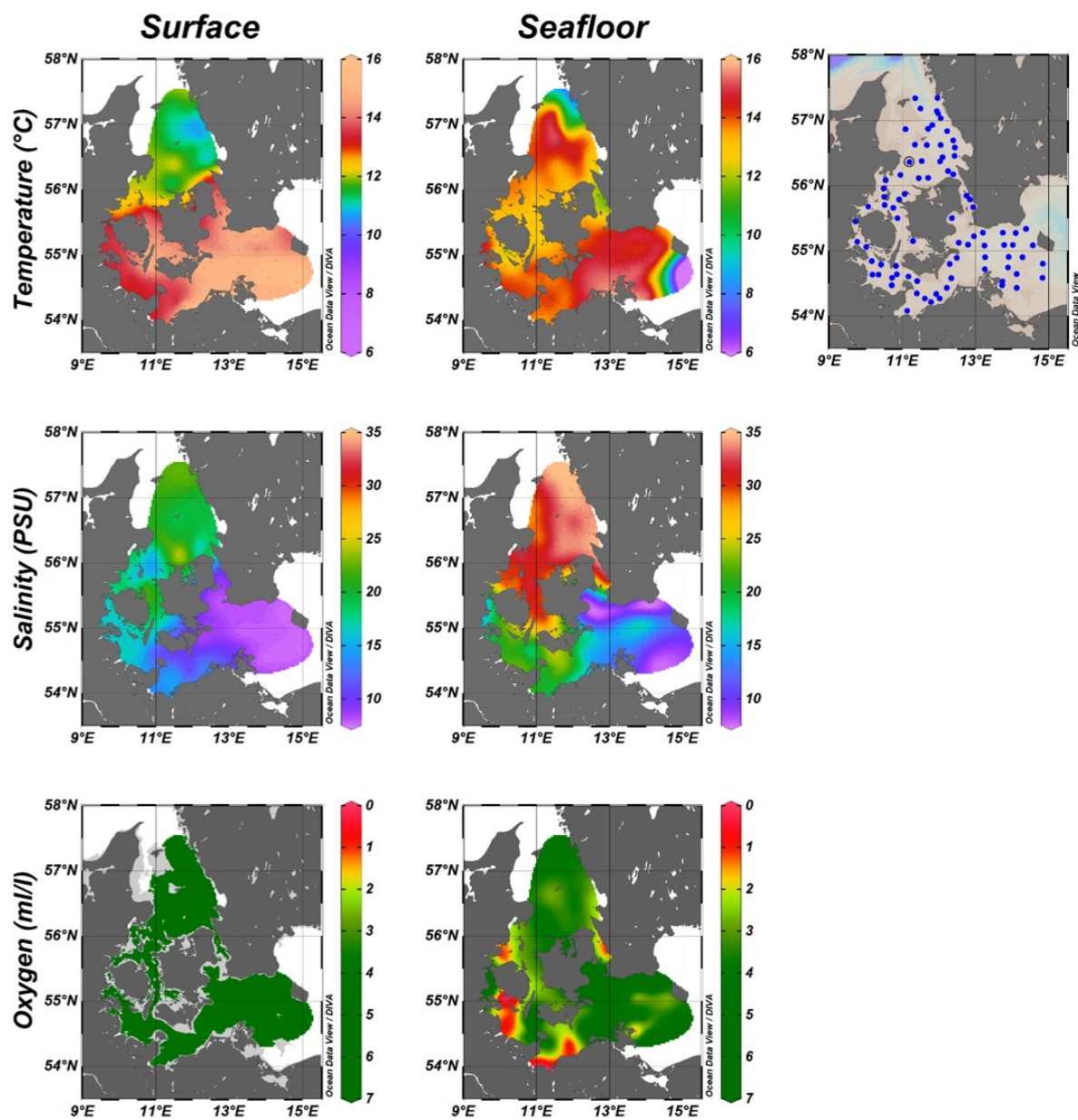


Figure 6: FRV "Solea" cruise 710/2015: Hydrography. CTD stations are depicted as blue dots in the area map (far right). Temperature (°C, top panels), salinity (PSU, middle panels and oxygen concentration (ml/l, lower panels) at the surface (left) and near the seafloor (right). Surface oxygen concentration levels are displayed at 5 m depth.

Table 1: FRV "Solea", cruise 710/2015. Simrad EK60 calibration report.

```

# Calibration Version 2.1.0.12
#
# Date: 01.10.2015
#
# Comments: Querab Kühlungsborn, 54°11.5 N, 11°47.8 E, treibend
#
#
# Reference Target:
# TS -42.37 dB Min. Distance 16.00 m
# TS Deviation 2.0 dB Max. Distance 18.00 m
#
# Transducer: ES38B Serial No. 30545
# Frequency 38000 Hz Beamtype Split
# Gain 26.16 dB Two Way Beam Angle -20.6 dB
# Athw. Angle Sens. 21.70 Along. Angle Sens. 21.70
# Athw. Beam Angle 7.06 deg Along. Beam Angle 7.03 deg
# Athw. Offset Angle -0.03 deg Along. Offset Angle -0.03 deg
# SaCorrection -0.58 dB Depth 4.20 m
#
# Transceiver: GPT 38 kHz 009072056b06 2-1 ES38B
# Pulse Duration 1.024 ms Sample Interval 0.190 m
# Power 2000 W Receiver Bandwidth 2.43 kHz
#
# Sounder Type:
# EK60 Version 2.2.0
#
# TS Detection:
# Min. Value -50.0 dB Min. Spacing 100 %
# Max. Beam Comp. 6.0 dB Min. Echolength 80 %
# Max. Phase Dev. 8.0 Max. Echolength 180 %
#
# Environment:
# Absorption Coeff. 4.3 dB/km Sound Velocity 1487.0 m/s
#
# Beam Model results:
# Transducer Gain = 26.25 dB SaCorrection = -0.50 dB
# Athw. Beam Angle = 7.16 deg Along. Beam Angle = 7.15 deg
# Athw. Offset Angle = -0.04 deg Along. Offset Angle = -0.01 deg
#
# Data deviation from beam model:
# RMS = 0.21 dB
# Max = 0.63 dB No. = 152 Athw. = -2.9 deg Along = 4.0 deg
# Min = -1.26 dB No. = 133 Athw. = 3.3 deg Along = 3.2 deg
#
# Data deviation from polynomial model:
# RMS = 0.17 dB
# Max = 0.55 dB No. = 152 Athw. = -2.9 deg Along = 4.0 deg
# Min = -1.12 dB No. = 133 Athw. = 3.3 deg Along = 3.2 deg

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Table 2: FRV "Solea", cruise 710/2015. Catch composition (kg 0.5h⁻¹) by trawl haul in SD 21.

Haul No.	41	42	43	44	45	46	47	48	49	50	51
Species/ICES Rectangle	41G1	41G1	41G0	41G1	41G1	41G2	42G2	42G1	42G1	42G1	43G1
CLUPEA HARENGUS	2.59	55.21	1.55	1.52	1.31	8.87	1.41	8.9	0.18	6.86	5.71
CRANGON CRANGON											
CRYSTALLOGOBIUS LINEARIS											+
CTENOLABRUS RUPESTRIS	0.01										
CYCLOPTERUS LUMPUS	0.19										
ENGRAULIS ENCRASICOLUS	0.01		0.02	0.16	0.02	0.16	0.02	0.82		0.08	0.070
EUTRIGLA GURNARDUS			0.02		0.11			0.22			
GADUS MORHUA				2.30	2.48		0.75				
GASTEROSTEUS ACULEATUS	0.01	0.01									
HIPPOGLOSSOIDES PLATESSOIDES											
LIMANDA LIMANDA	0.06		0.44					4.98	0.11		
LOLIGO FORBESI	0.01	+	0.01	+			+	+		0.05	0.08
MERLANGIUS MERLANGUS	0.01	0.02	0.00	0.01	+	+	0.41	2.71	0.12	0.05	0.07
MERLUCCIIUS MERLUCCIIUS											
MYSIDACEA											
NEPHROPS NORVEGICUS											
PLEURONECTES PLATESSA								0.09			
POMATOSCHISTUS MINUTUS											0
SCOMBER SCOMBRUS				8.77	16.92	5.66	1.1		7.57	0.64	17.54
SCOPHTHALMUS RHOMBUS											
SEPIOLA											0.01
SPRATTUS SPRATTUS	2.07	1.91	1.31	0.05	0.09	109.16	0.09	216.67		0.07	1.98
SQUALUS ACANTHIAS											6.51
SYNGNATHUS TYPHLE	+										
TRACHINUS DRACO	1.09	0.21	0.07	0.17	0.12	0.2	0.28	7.64	0.43	0.26	2.62
TRACHURUS TRACHURUS	0.03	0.01	+	+	+	0.01	+	+		0.01	0.13
TRISOPTERUS ESMARKI											+
Total	6.08	57.37	3.42	12.98	21.05	124.06	4.06	242.03	8.41	8.02	34.72
Medusae	4.55	0.78	1.83	3.05	0.00	0.27	0.36	1.34	3.67	0.54	0.03

Haul No.	52	53	54	55	56	57	58	59	Total
Species/ICES Rectangle	43G1	43G1	43G1	43G2	42G2	42G2	42G2	41G2	
CLUPEA HARENGUS	3.58	36.20		5.64	16.64	16.32	5.92	26.72	205.13
CRANGON CRANGON		0.07						+	0.07
CRYSTALLOGOBIUS LINEARIS			+	+	+		+		+
CTENOLABRUS RUPESTRIS									0.01
CYCLOPTERUS LUMPUS									0.19
ENGRAULIS ENCRASICOLUS	0.02	0.03	0.31	+	0.08	0.05	0.08	0.01	1.94
EUTRIGLA GURNARDUS	0.18				0.10	0.04	0.22	0.29	1.18
GADUS MORHUA				0.65	3.92	16.00	8.90	9.04	44.04
GASTEROSTEUS ACULEATUS									0.02
HIPPOGLOSSOIDES PLATESSOIDES	0.02	0.17							0.19
LIMANDA LIMANDA	0.13	0.03			0.34	0.37	0.36	0.03	6.85
LOLIGO FORBESI	0.04	0.01	0.10	0.01	0.01	0.02	0.05	0.03	0.42
MERLANGIUS MERLANGUS	0.61	5.32	0.21	0.59	0.81	0.30	1.25	0.44	12.93
MERLUCCIIUS MERLUCCIIUS		0.14	0.00	0.02		0.23	0.37	0.09	0.85
MYSIDACEA	+	0.02	+						0.02
NEPHROPS NORVEGICUS				0.05					0.05
PLEURONECTES PLATESSA						0.66	1.26		2.01
POMATOSCHISTUS MINUTUS		+	+				+		+
SCOMBER SCOMBRUS	1.28				0.15	0.16			59.79
SCOPHTHALMUS RHOMBUS						0.56			0.56
SEPIOLA	0.02	0.01	+	+	0.11		0.03	0.01	0.19
SPRATTUS SPRATTUS	9.28	0.46		0.44	61.88	79.34	29.18	26.34	540.32
SQUALUS ACANTHIAS		1.35			2.25				10.11
SYNGNATHUS TYPHLE									+
TRACHINUS DRACO	0.31		0.07	0.9	1.06	1.04	1.05	0.59	18.11
TRACHURUS TRACHURUS	0.01	+	+			0.02	0.02		0.24
TRISOPTERUS ESMARKI	0.14	0.84		0.01					0.99
Total	15.62	44.65	0.69	8.31	87.35	115.11	48.69	63.59	906.21
Medusae	0.12	0.00	0.43	0.10	0.00	0.00	0.00	0.33	17.40

+ = < 0.01 kg

Table 3: FRV "Solea", cruise 710/2015. Catch composition (kg 0.5h⁻¹) by trawl haul in SD 22.

Haul No.	12	13	25	26	27	28	29	30	31	32	33
Species/ICES Rectangle	39G1	39G0	37G1	37G1	37G1	38G1	38G0	37G0	38G0	38G0	38G0
AGONUS CATAPHRACTUS											
CARCINUS						0.07	0.05				
CLUPEA HARENGUS	0.01	0.11	0.46	1.54	2.49	11.40	0.52	2.62	0.09	0.50	0.51
CRANGON CRANGON									+		+
CRYSTALLOGOBIUS LINEARIS	+						+	+			
CTENOLABRUS RUPESTRIS	0.05										
CYCLOPTERUS LUMPUS							0.32				
ENGRAULIS ENCRASICOLUS	0.09	0.03	0.11	0.03	0.20	3.02	0.72	0.03	0.28	0.72	2.89
GADUS MORHUA					3.27	0.16		5.90			
GASTEROSTEUS ACULEATUS	2.48		0.08		0.03	0.17				0.04	+
GOBIUS NIGER	0.03					0.06					
HIPPOGLOSSOIDES PLATESSOIDES					0.17						
LIMANDA LIMANDA	0.56		0.05		2.58	4.19	0.13	19.26	1.94	3.57	
LOLIGO FORBESI										0.00	
MELANOGRAMMUS AEGLEFINUS				0.66							
MERLANGIUS MERLANGUS			0.11		0.55	0.18		0.39	+	+	0.01
MYOXOCEPHALUS SCORPIUS	0.21										
PLATICHTHYS FLESUS					0.23			6.22	0.42	0.80	
PLEURONECTES PLATESSA								11.35			
POMATOSCHISTUS MINUTUS	0.01				+	+		0.01	+	+	
PSETTA MAXIMA								2.18			
SCOPHTHALMUS RHOMBUS											
SOLEA VULGARIS						0.06		0.36			
SPRATTUS SPRATTUS	+	0.06	7.61	0.06	94.09	41.47	0.05	38.42	0.09	4.59	0.10
SYMPHODUS MELOPS	0.02										
SYNGNATHUS TYPHLE	+					+			+	+	+
TRACHINUS DRACO											
TRACHURUS TRACHURUS			0					0.08		0.02	0
Total	3.46	0.20	8.42	2.29	103.61	60.78	1.79	86.82	2.82	10.24	3.51
Medusae	0.01	0.63	2.78	0.33	0.16	0.60	0.49	7.86	4.47	1.22	1.47

Haul No.	34	35	36	37	38	39	40	Total
Species/ICES Rectangle	39G0	39F9	40G0	40G0	41G0	40G1	40G0	
AGONUS CATAPHRACTUS						0.02		0.02
CARCINUS								0.12
CLUPEA HARENGUS	0.05	0.46	0.10	0.12	0.03	0.21	0.03	21.25
CRANGON CRANGON								+
CRYSTALLOGOBIUS LINEARIS			+					+
CTENOLABRUS RUPESTRIS					0.01	+	0.02	0.08
CYCLOPTERUS LUMPUS								0.32
ENGRAULIS ENCRASICOLUS		0.24	0.02	0.03	0.09	0.01	0.09	8.60
GADUS MORHUA					0.09			9.42
GASTEROSTEUS ACULEATUS	0.77	4.51		0.01	0.01	+	0.02	8.12
GOBIUS NIGER					+			0.09
HIPPOGLOSSOIDES PLATESSOIDES								0.17
LIMANDA LIMANDA	0.02	0.72		0.06	0.56	0.31	0.08	34.03
LOLIGO FORBESI					0.02	0.01	+	0.03
MELANOGRAMMUS AEGLEFINUS								0.66
MERLANGIUS MERLANGUS		+	0.01	+		+	0.01	1.26
MYOXOCEPHALUS SCORPIUS					0.14			0.35
PLATICHTHYS FLESUS					0.12			7.79
PLEURONECTES PLATESSA								11.35
POMATOSCHISTUS MINUTUS						0.00		0.02
PSETTA MAXIMA								2.18
SCOPHTHALMUS RHOMBUS				0.16				0.16
SOLEA VULGARIS								0.42
SPRATTUS SPRATTUS	0.14	0.14		0.01		0.72		187.55
SYMPHODUS MELOPS							0.10	0.12
SYNGNATHUS TYPHLE								+
TRACHINUS DRACO				0.04	0.05	1.14	0.09	1.42
TRACHURUS TRACHURUS				0.01	+	+		0.01
Total	0.98	6.07	0.13	0.44	1.12	2.42	0.44	295.54
Medusae	0.49	3.23	15.90	6.00	5.15	2.50	0.18	53.47

+ = < 0.01 kg

Table 4: FRV "Solea", cruise 710/2015. Catch composition (kg 0.5h⁻¹) by trawl haul in SD 23.

Haul No.	14	15	16	Total
Species/ICES Rectangle	40G2	40G2	41G2	
CARCINUS	0.07			0.07
CLUPEA HARENGUS	644.34	778.58	0.72	1423.64
CTENOLABRUS RUPESTRIS			0.02	0.02
EUTRIGLA GURNARDUS			0.06	0.06
GADUS MORHUA	289.41	114.47		403.88
LIMANDA LIMANDA	0.24		6.73	6.97
LOLIGO FORBESI			0.01	0.01
MELANOGRAMMUS AEGLEFINUS		2.29		2.29
MERLANGIUS MERLANGUS		1.27	0.15	1.42
PLATICHTHYS FLESUS		0.56		0.56
SPRATTUS SPRATTUS	0.85	41.90	0.64	43.39
SYNGNATHUS TYPHLE		+		+
TRACHINUS DRACO			0.39	0.39
TRACHURUS TRACHURUS			+	+
Total	934.91	939.07	8.72	1882.70
Medusae	0.00	0.00	0.24	0.24

+ = < 0.01 kg

Table 5: FRV "Solea", cruise 710/2015. Catch composition (kg 0.5h⁻¹) by trawl haul in SD 24.

Haul No.	1	2	3	4	5	6	7	8	9	10	11
Species/ICES Rectangle	37G2	38G2	38G3	38G3	38G4	38G3	37G3	38G4	38G4	38G3	38G2
AGONUS CATAPHRACTUS											
CLUPEA HARENGUS	1.85	7.05	4.61	10.10	58.99	13.25	52.54	68.34	7.95	12.02	7.74
CRANGON CRANGON				+							
CRYSTALLOGOBIUS LINEARIS											
CYCLOPTERUS LUMPUS		0.32									
ENGRAULIS ENCRASICOLUS	0.05	0.01	0.06		0.04	0.04	0.05				
EUTRIGLA GURNARDUS											
GADUS MORHUA			0.77		20.86	8.06	4.41	2.63	4.48	0.49	
GASTEROSTEUS ACULEATUS		+	+	+							0.19
GوبيUS NIGER											0.03
LEANDER											
LIMANDA LIMANDA			0.46			0.07					0.65
MERLANGIUS MERLANGUS	0.01	0.01	0.20	3.85	0.42	0.19			0.56	2.72	
MYOXOCEPHALUS SCORPIUS								0.18			
OSMERUS EPERLANUS				0.04	0.01	0.06					
PLATICHTHYS FLESUS			0.45	0.84	0.13	1.58	1.06	0.13	0.26	0.16	1.14
PLEURONECTES PLATESSA		0.18	1.64								0.21
POMATOSCHISTUS MINUTUS		+	0.01	+				+	+	+	+
PSETTA MAXIMA											0.68
RUTILUS RUTILUS							3.42				
SCOMBER SCOMBRUS				0.97							
SPRATTUS SPRATTUS	0.47	20.5	108.06	233.89	2.64	51.59	131.01	1.64	6.35	27.26	18.76
SYNGNATHUS TYPHLE											
TRACHINUS DRACO											0.04
TRACHURUS TRACHURUS			0.01								
Total	2.38	28.07	116.27	249.69	83.09	74.84	192.49	72.92	19.60	42.65	29.44
Medusae	0.99	0.07	0.52	0.67	0.08	1.90	0.02	1.39	7.85	1.10	0.31

Haul No.	17	18	19	20	21	22	23	24	Total
Species/ICES Rectangle	39G2	39G3	39G3	39G4	39G4	39G3	39G3	39G2	
AGONUS CATAPHRACTUS								+	+
CLUPEA HARENGUS	13.46	11.27	12.83	36.08	77.74	34.78	12.63	20.33	463.56
CRANGON CRANGON	+	+		+			+	+	+
CRYSTALLOGOBIUS LINEARIS									+
CYCLOPTERUS LUMPUS									0.32
ENGRAULIS ENCRASICOLUS				0.01			0.01	0.02	0.29
EUTRIGLA GURNARDUS	0.06								0.06
GADUS MORHUA	1.02	3.17	7.58	1.70	0.47	1.35			56.99
GASTEROSTEUS ACULEATUS								+	0.19
GوبيUS NIGER								+	0.03
LEANDER	0.01								0.01
LIMANDA LIMANDA				0.14			0.09		1.41
MERLANGIUS MERLANGUS			0.33		6.43	19.91	+	0.03	34.66
MYOXOCEPHALUS SCORPIUS									0.18
OSMERUS EPERLANUS									0.11
PLATICHTHYS FLESUS	0.26	0.64		0.22		1.36	0.85		9.08
PLEURONECTES PLATESSA			0.33	0.09					2.45
POMATOSCHISTUS MINUTUS	0.00	0.01	0.01	0.02			0.22	0.01	0.28
PSETTA MAXIMA				0.48					1.16
RUTILUS RUTILUS									3.42
SCOMBER SCOMBRUS			0.24						1.21
SPRATTUS SPRATTUS	22.25	21.83	48.8	10.61	0.34	16.86	10.61	49.67	783.14
SYNGNATHUS TYPHLE								+	+
TRACHINUS DRACO									0.04
TRACHURUS TRACHURUS									0.01
Total	37.06	36.92	70.12	49.35	84.98	74.26	24.41	70.06	1358.60
Medusae	4.52	2.26	0.40	3.64	0.30	1.02	2.36	0.96	30.34

+ = < 0.01 kg

Table 6: FRV "Solea", cruise 710/2015. 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	7.3	1.732	4.56	34.08	58.1	1.55	2.65
21	41G1	946.8	56.0	2.621	202.29	60.17	28.16	121.71	56.97
21	41G2	432.3	43.0	1.518	122.46	18.61	80.75	22.79	98.89
21	42G1	884.2	34.4	2.162	140.69	45.69	49.26	64.28	69.3
21	42G2	606.8	41.2	1.498	166.89	11.2	87.28	18.69	145.66
21	43G1	699.0	123.1	2.281	377.23	47.27	40.64	178.33	153.32
21	43G2	107.0	30.0	2.786	11.52	83.4	7.78	9.61	0.9
21	Total	3,784.2			1,025.64			416.96	527.69
22	37G0	209.9	74.4	1.472	106.09	3.43	96.16	3.64	102.02
22	37G1	723.3	57.4	1.315	315.72	31.96	64.43	100.91	203.43
22	38G0	735.3	55.4	0.913	446.17	6.86	29.93	30.6	133.55
22	38G1	173.2	84.8	1.189	123.53	21.42	67.55	26.46	83.44
22	39F9	159.3	36.7	0.327	178.79	1.3	0.68	2.33	1.22
22	39G0	201.7	20.9	0.829	50.85	21.09	21.23	10.72	10.79
22	39G1	250.0	43.7	0.262	416.98	0.08	0.04	0.35	0.18
22	40F9	51.3	43.6	0.985	22.71	23.86	1.23	5.42	0.28
22	40G0	538.1	39.2	0.985	214.15	23.86	1.23	51.11	2.64
22	40G1	174.5	19.1	2.846	11.71	8.49	52.83	0.99	6.19
22	41G0	173.1	13.1	0.923	24.57	5.17	0	1.27	0
22	Total	3,389.7			1,911.27			233.80	543.74
23	39G2	130.9	205.6	1.691	159.15	28.14	71.68	44.79	114.07
23	40G2	164.0	6018.4	7.534	1310.08	84.21	12.74	1103.23	166.95
23	41G2	72.3	426.0	1.997	154.23	35.54	46.99	54.82	72.47
23	Total	367.2			1,623.46			1,202.84	353.49
24	37G2	192.4	57.7	1.039	106.85	73	24.04	78	25.68
24	37G3	167.7	506.1	0.687	1235.41	5.69	94.25	70.3	1164.40
24	37G4	875.1	86.1	3.655	206.15	67.65	30.61	139.46	63.10
24	38G2	832.9	57.9	1.125	428.67	30.36	67.41	130.13	288.97
24	38G3	865.7	472.1	1.336	3059.11	4.56	95.15	139.45	2910.70
24	38G4	1034.8	308.8	3.655	874.27	67.65	30.61	591.45	267.58
24	39G2	406.1	173.7	1.691	417.15	28.14	71.68	117.40	298.99
24	39G3	765.0	322.0	2.137	1152.69	28.22	70.60	325.29	813.79
24	39G4	524.8	299.4	4.263	368.58	71.09	27.53	262.02	101.47
24	Total	5,664.5			7,848.88			1,853.50	5,934.68
22-24	Total	9,421.4			11,383.61			3,290.14	6,831.91
21-24	Total	13,205.6			12,409.25			3,707.10	7,359.60

Table 7: FRV "Solea", cruise 710/2015. 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	0.97	0.39	0.14	0.04						1.54
21	41G1	26.59	77.15	16.09	1.20	0.45				0.23	121.71
21	41G2	12.64	9.18	0.83	0.12	0.02					22.79
21	42G1	9.10	52.82	2.21	0.07	0.07				0.01	64.28
21	42G2	9.76	8.48	0.40	0.02	0.01				0.02	18.69
21	43G1	74.88	91.01	11.42	0.40	0.26	0.14			0.21	178.32
21	43G2	3.40	5.96	0.25	0.01						9.62
21	Total	137.34	244.99	31.34	1.86	0.81	0.14	0.00	0.00	0.47	416.95
22	37G0	1.58	1.31	0.23	0.22	0.19	0.05	0.01	0.03	0.01	3.63
22	37G1	88.98	4.79	2.05	0.83	2.01	0.42	1.26	0.48	0.11	100.93
22	38G0	29.12	0.97	0.23	0.06	0.12	0.05			0.05	30.60
22	38G1	25.29	0.88	0.05	0.04	0.20					26.46
22	39F9	2.33									2.33
22	39G0	8.12	2.10	0.11	0.14	0.25					10.72
22	39G1	0.35									0.35
22	40F9	5.16		0.17		0.09					5.42
22	40G0	48.68		1.62		0.81					51.11
22	40G1	0.66	0.13	0.08	0.04	0.08					0.99
22	41G0	1.27									1.27
22	Total	211.54	10.18	4.54	1.33	3.75	0.52	1.27	0.51	0.17	233.81
23	39G2	29.29	6.94	2.11	2.49	1.46	0.64	0.81	0.80	0.26	44.80
23	40G2	1.07	59.79	400.02	261.05	115.76	88.25	101.7	43.69	31.9	1,103.23
23	41G2	42.74	10.22		0.93	0.93					54.82
23	Total	73.10	76.95	402.13	264.47	118.15	88.89	102.51	44.49	32.16	1,202.85
24	37G2	75.18	1.48	0.33	0.45	0.33	0.04	0.09	0.09		77.99
24	37G3	46.32	5.92	6.06	3.11	2.75	1.38	1.65	2.08	1.04	70.31
24	37G4	15.08	23.15	34.70	16.08	13.91	8.80	10.62	10.86	6.27	139.47
24	38G2	126.01	2.77	0.43	0.57	0.13	0.04	0.11	0.07		130.13
24	38G3	44.36	25.00	21.85	13.27	11.36	5.70	6.61	7.68	3.62	139.45
24	38G4	63.95	98.16	147.18	68.18	59.01	37.32	45.02	46.05	26.57	591.44
24	39G2	76.78	18.18	5.53	6.53	3.82	1.67	2.11	2.10	0.67	117.39
24	39G3	154.72	48.42	41.20	22.95	17.05	9.95	11.34	12.93	6.74	325.30
24	39G4	7.23	30.25	54.06	39.19	42.38	24.74	25.57	22.56	16.05	262.03
24	Total	609.63	253.33	311.34	170.33	150.74	89.64	103.12	104.42	60.96	1,853.51
22-24	Total	894.27	340.46	718.01	436.13	272.64	179.05	206.90	149.42	93.29	3,290.17
21-24	Total	1,031.61	585.45	749.35	437.99	273.45	179.19	206.90	149.42	93.76	3,707.12

Table 8: FRV "Solea", cruise 710/2015. 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	12.35	37.59	64.35	84.14	40.30					25.33
21	41G1	14.23	35.30	56.23	63.91	40.30				56.40	33.80
21	41G2	12.99	27.77	57.49	93.53	40.30				56.40	21.01
21	42G1	15.32	27.54	31.95	40.30	40.30				56.40	25.99
21	42G2	14.00	25.04	46.63	65.78	40.30				195.37	19.97
21	43G1	14.48	30.58	49.90	54.40	40.30	232.00			56.40	25.31
21	43G2	15.75	24.37	33.16	58.67	40.30					21.59
21	Total	14.33	30.97	51.97	63.31	40.30	232.00			62.31	27.33
22	37G0	9.82	27.77	40.06	35.39	34.07	39.01	43.67	37.79	41.00	21.85
22	37G1	8.82	30.30	39.96	34.44	37.17	40.06	44.08	41.78	41.00	12.01
22	38G0	8.47	26.49	39.16	25.21	34.47	41.00			41.00	9.51
22	38G1	7.40	27.21	29.00	28.64	54.42					8.49
22	39F9	10.72									10.72
22	39G0	9.30	27.40	29.56	25.67	30.30					13.76
22	39G1	7.60									7.60
22	40F9	10.07		61.33		61.33					12.53
22	40G0	10.07		61.33		61.33					12.51
22	40G1	12.09	32.17	58.87	33.93	45.39					22.08
22	41G0	10.49									10.49
22	Total	8.99	28.77	48.31	33.07	43.36	40.05	44.08	41.55	41.00	11.65
23	39G2	9.85	29.09	45.12	34.35	44.17	51.10	47.79	46.42	63.95	19.21
23	40G2	14.00	81.21	106.07	130.00	150.49	170.17	186.74	183.70	203.77	133.42
23	41G2	11.90	19.05		30.00	28.00					13.81
23	Total	11.11	68.25	105.75	128.75	148.21	169.31	185.64	181.23	202.64	123.72
24	37G2	6.97	28.11	37.30	29.97	35.84	48.31	38.18	38.18		7.85
24	37G3	6.96	31.09	54.20	45.30	47.56	55.16	57.29	52.18	64.29	20.66
24	37G4	7.77	33.25	57.92	53.33	62.08	68.19	68.92	59.86	75.59	50.72
24	38G2	7.09	25.09	26.52	28.72	34.37	33.13	33.89	34.31		7.70
24	38G3	6.57	32.49	54.87	45.96	51.47	62.82	59.99	54.29	67.77	35.24
24	38G4	7.77	33.25	57.92	53.33	62.08	68.19	68.92	59.86	75.59	50.72
24	39G2	9.85	29.09	45.12	34.35	44.17	51.10	47.79	46.42	63.95	19.20
24	39G3	12.17	29.24	54.66	47.74	56.89	61.77	61.87	56.75	68.29	31.13
24	39G4	12.13	32.73	63.23	89.34	101.79	93.87	91.82	78.24	87.58	76.91
24	Total	8.81	31.88	57.83	59.27	71.06	73.68	72.57	62.58	77.15	41.86
22-24	Total	9.04	40.01	84.61	101.32	104.11	121.06	128.42	97.83	120.35	69.64
21-24	Total	9.75	36.23	83.24	101.16	103.92	121.15	128.42	97.83	120.06	64.88

Table 9: FRV "Solea", cruise 710/2015. 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	12.0	14.7	9.0	3.4						39.0
21	41G1	378.4	2,723.4	904.7	76.7	18.1				13.0	4,114.3
21	41G2	164.2	254.9	47.7	11.2	0.8					478.9
21	42G1	139.4	1,454.7	70.6	2.8	2.8				0.6	1,670.9
21	42G2	136.6	212.3	18.7	1.3	0.4				3.9	373.3
21	43G1	1,084.3	2,783.1	569.9	21.8	10.5	32.5			11.8	4,513.8
21	43G2	53.6	145.3	8.3	0.6						207.7
21	Total	1,968.4	7,588.3	1,628.9	117.8	32.6	32.5	0.0	0.0	29.3	11,397.8
22	37G0	15.5	36.4	9.2	7.8	6.5	2.0	0.4	1.1	0.4	79.3
22	37G1	784.8	145.1	81.9	28.6	74.7	16.8	55.5	20.1	4.5	1,212.1
22	38G0	246.7	25.7	9.0	1.5	4.1	2.1			2.1	291.1
22	38G1	187.2	23.9	1.5	1.2	10.9					224.6
22	39F9	25.0									25.0
22	39G0	75.5	57.5	3.3	3.6	7.6					147.5
22	39G1	2.7									2.7
22	40F9	52.0		10.4		5.5					67.9
22	40G0	490.2		99.4		49.7					639.2
22	40G1	8.0	4.2	4.7	1.4	3.6					21.9
22	41G0	13.3									13.3
22	Total	1,900.8	292.9	219.3	43.99	162.6	20.8	55.98	21.18	7.0	2,724.5
23	39G2	288.5	201.9	95.2	85.53	64.5	32.7	38.71	37.14	16.6	860.8
23	40G2	15.0	4,855.6	42,430.1	33,936.5	17,420.7	15,017.5	18,991.5	8,025.9	6,500.3	147,192.9
23	41G2	508.6	194.7		27.9	26.0					757.2
23	Total	812.1	5,252.1	42,525.3	34,049.9	17,511.3	15,050.2	19,030.2	8,063.0	6,516.9	148,811.0
24	37G2	524.0	41.6	12.3	13.5	11.8	1.9	3.4	3.4		612.0
24	37G3	322.4	184.1	328.5	140.9	130.8	76.1	94.5	108.5	66.9	1,452.6
24	37G4	117.2	769.7	2,009.8	857.6	863.5	600.1	731.9	650.1	474.0	7,073.8
24	38G2	893.4	69.5	11.4	16.4	4.5	1.3	3.7	2.4		1,002.6
24	38G3	291.5	812.3	1,198.9	609.9	584.7	358.1	396.5	417.0	245.3	4,914.1
24	38G4	496.9	3,263.8	8,524.7	3,636.0	3,663.3	2,544.9	3,102.8	2,756.6	2,008.4	29,997.4
24	39G2	756.3	528.9	249.5	224.3	168.7	85.3	100.8	97.5	42.9	2,254.2
24	39G3	1,882.9	1,415.8	2,252.0	1,095.6	970.0	614.6	701.6	733.8	460.3	10,126.6
24	39G4	87.7	990.1	3,418.2	3,501.2	4,313.9	2,322.3	2,347.8	1,765.1	1,405.7	20,152.0
24	Total	5,372.2	8,075.7	18,005.3	10,095.4	10,711.2	6,604.7	7,483.2	6,534.3	4,703.4	77,585.4
22-24	Total	8,085.1	13,620.7	60,749.9	44,189.3	28,385.1	21,675.7	26,569.4	14,618.5	11,227.2	229,120.8
21-24	Total	10,053.5	21,209.0	62,378.8	44,307.1	28,417.7	21,708.2	26,569.4	14,618.5	11,256.5	240,518.6

Table 10: FRV "Solea", cruise 710/2015. 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		2.15	0.24	0.26						2.65
21	41G1		36.46	11.14	8.77	0.57	0.03				56.97
21	41G2		84.26	8.10	5.73	0.68	0.11				98.88
21	42G1		41.80	10.58	4.97	6.06	5.09	0.79			69.29
21	42G2		131.52	6.64	5.65	1.38	0.45	0.01			145.65
21	43G1		119.36	10.95	9.38	8.01	5.02	0.59			153.31
21	43G2		0.22	0.21	0.20	0.18	0.08	0.01			0.90
21	Total	0.00	415.77	47.86	34.96	16.88	10.78	1.40	0.00	0.00	527.65
22	37G0		93.56	3.34	1.35	3.46	0.32				102.03
22	37G1	64.60	125.82	7.24	2.17	3.12	0.50				203.45
22	38G0	0.03	117.21	6.72	1.09	7.59	0.91				133.55
22	38G1	3.70	78.96	0.58	0.16	0.05					83.45
22	39F9	0.31	0.91								1.22
22	39G0	4.53	6.26								10.79
22	39G1	0.18									0.18
22	40F9		0.28								0.28
22	40G0		2.64								2.64
22	40G1		6.09	0.07	0.03	0.01					6.20
22	41G0										0.00
22	Total	73.35	431.73	17.95	4.80	14.23	1.73	0.00	0.00	0.00	543.79
23	39G2	0.42	68.33	26.02	12.14	5.31	0.81	0.79	0.03	0.22	114.07
23	40G2		52.23	19.39	23.05	42.46	17.43	7.65	3.37	1.37	166.95
23	41G2		69.52	1.09	0.86	0.75	0.12	0.05	0.09		72.48
23	Total	0.42	190.08	46.50	36.05	48.52	18.36	8.49	3.49	1.59	353.50
24	37G2	17.48	6.68	0.84	0.27	0.29	0.06	0.03	0.02		25.67
24	37G3	1,147.61	14.75	1.62	0.21	0.21					1,164.40
24	37G4	0.36	21.42	18.33	12.36	6.84	1.69	1.45	0.28	0.37	63.10
24	38G2	94.21	152.75	27.38	8.82	5.19	0.24	0.24		0.14	288.97
24	38G3	738.30	1,686.12	336.60	88.30	52.71	3.88	3.95	0.16	0.69	2,910.71
24	38G4	1.53	90.82	77.72	52.43	29.03	7.15	6.15	1.20	1.56	267.59
24	39G2	1.09	179.11	68.19	31.83	13.92	2.13	2.08	0.08	0.56	298.99
24	39G3	0.82	343.46	247.76	132.13	58.66	13.76	13.41	0.57	3.20	813.77
24	39G4	0.27	18.17	31.83	29.02	15.79	2.65	2.37	0.31	1.06	101.47
24	Total	2,001.67	2,513.28	810.27	355.37	182.64	31.56	29.68	2.62	7.58	5,934.67
22-24	Total	2,075.44	3,135.09	874.72	396.22	245.39	51.65	38.17	6.11	9.17	6,831.96
21-24	Total	2,075.44	3,550.86	922.58	431.18	262.27	62.43	39.57	6.11	9.17	7,359.61

Table 11: FRV "Solea", cruise 710/2015. 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		11.88	13.89	13.84						12.25
21	41G1		12.38	15.02	14.54	17.76	19.55				13.29
21	41G2		10.63	15.33	14.86	18.25	19.55				11.32
21	42G1		10.95	16.89	16.78	22.55	24.02	25.33			14.41
21	42G2		10.72	15.30	15.35	19.93	20.96	23.80			11.23
21	43G1		8.64	16.87	17.88	21.79	23.38	24.60			11.02
21	43G2		11.80	17.43	18.95	21.49	22.76	24.28			17.75
21	Total		10.28	15.95	15.96	21.63	23.53	25.00			11.84
22	37G0		11.00	15.54	15.99	16.99	17.85				11.44
22	37G1	4.11	11.43	14.46	14.77	16.75	18.64				9.35
22	38G0	5.75	10.28	16.18	16.19	16.26	16.23				11.00
22	38G1	4.26	10.35	13.90	13.96	15.00					10.11
22	39F9	1.87	7.75								6.26
22	39G0	3.74	10.23								7.51
22	39G1	3.38									3.38
22	40F9		8.46								8.46
22	40G0		8.46								8.46
22	40G1		11.60	13.43	13.57	15.00					11.64
22	41G0										
22	Total	4.08	10.78	15.28	15.40	16.54	17.23				10.24
23	39G2	1.46	12.95	14.53	15.46	15.76	17.24	17.17	20.65	17.21	13.74
23	40G2		14.11	17.98	20.33	22.63	23.14	23.33	22.81	24.89	19.21
23	41G2		9.17	16.7	17.07	19.66	18.57	21.34	21.34		9.52
23	Total	1.46	11.89	16.02	18.61	21.83	22.85	22.75	22.75	23.83	15.46
24	37G2	3.19	11.41	12.22	14.42	15.88	20.65	20.65	20.65		5.96
24	37G3	3.09	9.57	10.50	12.25	12.25					3.19
24	37G4	5.10	13.06	15.59	16.89	18.17	18.56	18.26	22.09	17.21	15.38
24	38G2	3.57	11.66	12.76	14.29	13.53	16.72	16.72		17.21	9.25
24	38G3	3.55	11.77	12.61	14.26	13.98	17.44	17.55	20.65	17.21	9.91
24	38G4	5.10	13.06	15.59	16.89	18.17	18.56	18.26	22.09	17.21	15.39
24	39G2	1.46	12.95	14.53	15.46	15.76	17.24	17.17	20.65	17.21	13.74
24	39G3	2.39	13.21	15.26	16.25	17.00	17.28	17.22	20.65	17.21	14.75
24	39G4	4.09	14.10	16.18	17.24	18.24	18.38	18.13	22.32	17.21	16.53
24	Total	3.28	12.10	14.08	15.83	16.27	17.75	17.60	21.66	17.21	9.82
22-24	Total	3.31	11.91	14.20	16.08	17.38	19.55	18.74	22.28	18.36	10.14
21-24	Total	3.31	11.72	14.29	16.07	17.66	20.23	18.96	22.28	18.36	10.27

Table 12: FRV "Solea", cruise 710/2015. 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		25.5	3.3	3.6						32.5
21	41G1		451.4	167.3	127.5	10.1	0.6				756.9
21	41G2		895.7	124.2	85.2	12.4	2.2				1,119.6
21	42G1		457.7	178.7	83.4	136.7	122.3	20.0			998.7
21	42G2		1,409.9	101.6	86.7	27.5	9.4	0.2			1,635.4
21	43G1		1,031.3	184.7	167.7	174.5	117.4	14.5			1,690.1
21	43G2		2.6	3.7	3.8	3.9	1.8	0.2			16.0
21	Total	0.0	4,274.1	763.5	557.9	365.1	253.6	35.0	0.0	0.0	6,249.2
22	37G0		1,029.2	51.9	21.6	58.8	5.7				1,167.2
22	37G1	265.5	1,438.1	104.7	32.1	52.3	9.3				1,902.0
22	38G0	0.2	1,204.9	108.7	17.7	123.4	14.8				1,469.7
22	38G1	15.8	817.2	8.1	2.2	0.8					844.0
22	39F9	0.6	7.1								7.6
22	39G0	16.9	64.0								81.0
22	39G1	0.6									0.6
22	40F9		2.4								2.4
22	40G0		22.3								22.3
22	40G1		70.6	0.9	0.4	0.2					72.1
22	41G0										0.0
22	Total	299.6	4,655.9	274.3	73.9	235.4	29.8	0.0	0.0	0.0	5,568.9
23	39G2	0.6	884.9	378.1	187.7	83.7	14.0	13.6	0.6	3.8	1,566.9
23	40G2		737.0	348.6	468.6	960.9	403.3	178.5	76.9	34.1	3,207.9
23	41G2		637.5	18.2	14.7	14.8	2.2	1.1	1.9		690.4
23	Total	0.6	2,259.3	744.9	671.0	1,059.3	419.5	193.1	79.4	37.9	5,465.1
24	37G2	55.8	76.2	10.3	3.9	4.6	1.2	0.6	0.4		153.0
24	37G3	3,546.1	141.2	17.0	2.6	2.6					3,709.4
24	37G4	1.8	279.8	285.8	208.8	124.3	31.4	26.5	6.2	6.4	970.8
24	38G2	336.3	1,781.1	349.4	126.0	70.2	4.0	4.0		2.4	2,673.5
24	38G3	2,621.0	19,845.6	4,244.5	1,259.2	736.9	67.7	69.3	3.3	11.9	28,859.3
24	38G4	7.8	1,186.1	1,211.7	885.5	527.5	132.7	112.3	26.5	26.9	4,116.9
24	39G2	1.6	2,319.5	990.8	492.1	219.4	36.7	35.7	1.7	9.6	4,107.1
24	39G3	2.0	4,537.1	3,780.8	2,147.1	997.2	237.8	230.9	11.8	55.1	11,999.8
24	39G4	1.1	256.2	515.0	500.3	288.0	48.7	43.0	6.9	18.2	1,677.5
24	Total	6,573.5	30,422.7	11,405.2	5,625.5	2,970.7	560.2	522.3	56.8	130.5	58,267.2
22-24	Total	6,873.6	37,337.9	12,424.4	6,370.4	4,265.3	1,009.5	715.4	136.2	168.3	69,301.1
21-24	Total	6,873.6	41,612.0	13,187.9	6,928.3	4,630.4	1,263.1	750.4	136.2	168.3	75,550.3

Table 13: FRV "Solea", cruise 710/2015. Numbers (m) of herring excl. CBH and mature herring (maturity stages ≥6) in SD 23 by age/W-rings and area.

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total
21	41G0	0.97	0.39	0.14	0.04						1.54
21	41G1	26.59	77.15	16.09	1.20	0.45				0.23	121.71
21	41G2	12.64	9.18	0.83	0.12	0.02					22.79
21	42G1	9.10	52.82	2.21	0.07	0.07				0.01	64.28
21	42G2	9.76	8.48	0.40	0.02	0.01				0.02	18.69
21	43G1	74.88	91.01	11.42	0.40	0.26	0.14			0.21	178.32
21	43G2	3.40	5.96	0.25	0.01						9.62
21	Total	137.34	244.99	31.34	1.86	0.81	0.14	0.00	0.00	0.47	416.95
22	37G0	1.58	1.23	0.09							2.90
22	37G1	88.68	4.39	1.12							94.19
22	38G0	29.37	0.68								30.05
22	38G1	25.29	0.75			0.13					26.17
22	39F9	2.33									2.33
22	39G0	8.04	2.16								10.20
22	39G1	0.35									0.35
22	40F9	5.15		0.18							5.33
22	40G0	48.55		1.70							50.26
22	40G1	0.66	0.13	0.07							0.87
22	41G0	1.27									1.27
22	Total	211.28	9.35	3.16	0.00	0.13	0.00	0.00	0.00	0.00	223.92
23	39G2	29.29	6.33	1.21	0.14	0.15	0.07	0.05	0.01	0.02	37.27
23	40G2	1.10	57.20	243.02	148.00	66.59	67.14	64.06	39.24	29.21	715.55
23	41G2	42.75	10.21	0.00	0.93	0.93	0.00	0.00	0.00	0.00	54.82
23	Total	73.14	73.75	244.23	149.07	67.66	67.21	64.11	39.25	29.23	807.64
24	37G2	75.18	1.28	0.14							76.60
24	37G3	46.32	5.02	5.30	0.86	0.38	0.19	0.26	0.03	0.03	58.39
24	37G4	15.08	22.65	31.76	7.17	5.40	2.51	2.05	0.49	0.73	87.84
24	38G2	126.01	1.81								127.82
24	38G3	44.36	24.36	18.65	3.80	2.34	1.19	0.88	0.23	0.26	96.07
24	38G4	63.95	96.08	134.71	30.39	22.91	10.63	8.70	2.08	3.09	372.54
24	39G2	76.78	16.60	3.18	0.36	0.40	0.19	0.14	0.02	0.05	97.72
24	39G3	154.72	40.71	35.53	7.31	4.54	1.97	1.62	0.57	0.62	247.59
24	39G4	7.23	28.85	50.75	29.02	31.29	14.42	10.73	4.96	4.39	181.64
24	Total	609.63	237.36	280.02	78.91	67.26	31.10	24.38	8.38	9.17	1,346.21
22-24	Total	894.05	320.46	527.41	227.98	135.05	98.31	88.49	47.63	38.40	2,377.76
21-24	Total	1,031.39	565.45	558.75	229.84	135.86	98.45	88.49	47.63	38.87	2,794.71

Table 14: FRV "Solea", cruise 710/2015. Mean weight (g) of herring excl. CBH and mature herring (maturity stages ≥6) in SD 23 by age/W-rings and area.

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total
21	41G0	12.35	37.59	64.35	84.14	40.30					25.33
21	41G1	14.23	35.30	56.23	63.91	40.30				56.40	33.80
21	41G2	12.99	27.77	57.49	93.53	40.30				56.40	21.01
21	42G1	15.32	27.54	31.95	40.30	40.30				56.40	25.99
21	42G2	14.00	25.04	46.63	65.78	40.30				195.37	19.97
21	43G1	14.48	30.58	49.90	54.40	40.30	232.00			56.40	25.31
21	43G2	15.75	24.37	33.16	58.67	40.30					21.59
21	Total	14.33	30.97	51.97	63.31	40.30	232.00			62.31	27.33
22	37G0	9.57	28.08	47.38							18.55
22	37G1	8.51	31.08	42.64							9.96
22	38G0	7.56	27.70								8.01
22	38G1	7.14	28.06			66.00					8.03
22	39F9	10.34									10.34
22	39G0	9.38	27.11								13.14
22	39G1	7.29									7.29
22	40F9	9.92		63.00							11.71
22	40G0	9.92		63.00							11.71
22	40G1	11.88	32.15	63.00							19.32
22	41G0	11.88									11.88
22	Total	8.66	29.30	55.38		66.00					10.21
23	39G2	9.51	30.74	56.96	81.46	99.25	90.09	91.82	91.31	105.04	15.62
23	40G2	13.75	78.63	90.44	111.33	130.88	174.72	185.95	192.68	208.84	124.36
23	41G2	11.64	18.61		29.00	26.00					13.48
23	Total	10.82	66.21	90.27	110.79	129.37	174.63	185.88	192.65	208.77	111.81
24	37G2	6.63	29.52	51.36							7.09
24	37G3	6.56	34.18	59.58	71.97	80.88	87.50	89.04	100.17	100.17	15.92
24	37G4	7.37	34.32	62.54	76.49	89.99	89.28	100.16	99.11	123.39	50.97
24	38G2	6.75	27.96								7.05
24	38G3	6.18	33.50	60.96	76.41	91.75	95.47	93.44	99.29	96.15	30.98
24	38G4	7.37	34.32	62.54	76.49	89.99	89.28	100.16	99.11	123.39	50.97
24	39G2	9.51	30.74	56.96	81.46	99.25	90.09	91.82	91.31	105.04	15.63
24	39G3	11.82	32.19	60.76	77.96	95.45	94.53	96.25	102.80	108.99	27.34
24	39G4	11.85	34.19	67.15	104.16	117.15	109.79	118.40	117.96	116.61	83.24
24	Total	8.45	33.53	62.92	86.77	103.06	99.35	107.52	110.51	118.22	38.80
22-24	Total	8.70	40.92	75.54	102.48	116.20	150.81	164.29	178.20	187.14	60.91
21-24	Total	9.45	36.61	74.22	102.16	115.75	150.93	164.29	178.20	185.63	55.90

excl. CBH

excl. maturity ≥6

excl. CBH

Table 15: FRV "Solea", cruise 710/2015. Total biomass (t) of herring excl. CBH and mature herring (maturity stages ≥ 6) in SD 23 by age/W-rings and area.

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total
21	41G0	12.0	14.7	9.0	3.4						39.0
21	41G1	378.4	2723.4	904.7	76.7	18.1				13.0	4114.3
21	41G2	164.2	254.9	47.7	11.2	0.8					478.9
21	42G1	139.4	1454.7	70.6	2.8	2.8				0.6	1670.9
21	42G2	136.6	212.3	18.7	1.3	0.4				3.9	373.3
21	43G1	1084.3	2783.1	569.9	21.8	10.5	32.5			11.8	4513.8
21	43G2	53.6	145.3	8.3	0.6						207.7
21	Total	1968.4	7588.3	1628.9	117.8	32.6	32.5	0.0	0.0	29.3	11397.8
22	37G0	15.2	34.6	4.1							53.8
22	37G1	754.4	136.5	47.6							938.5
22	38G0	221.9	18.9								240.8
22	38G1	180.6	21.0			8.6					210.2
22	39F9	24.1									24.1
22	39G0	75.4	58.6								134.0
22	39G1	2.6									2.6
22	40F9	51.1		11.4							62.4
22	40G0	481.4		107.3							588.8
22	40G1	7.8	4.3	4.6							16.7
22	41G0	15.1									15.1
22	Total	1829.5	273.9	175.0	0.0	8.6	0.0	0.0	0.0	0.0	2287.0
23	39G2	278.6	194.6	68.9	11.4	14.9	6.3	4.6	0.9	2.1	582.3
23	40G2	15.2	4498.0	21978.3	16477.2	8714.4	11729.7	11911.3	7560.5	6099.6	88984.1
23	41G2	497.7	190.1		27.0	24.1					738.8
23	Total	791.4	4882.7	22047.2	16515.5	8753.4	11736.0	11915.8	7561.4	6101.7	90305.1
24	37G2	498.4	37.8	7.2	0.0	0.0	0.0	0.0	0.0	0.0	543.4
24	37G3	303.9	171.6	315.8	61.9	30.7	16.6	23.2	3.0	3.0	929.6
24	37G4	111.1	777.4	1986.3	548.4	486.0	224.1	205.3	48.6	90.1	4477.2
24	38G2	850.6	50.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	901.2
24	38G3	274.1	816.1	1136.9	290.4	214.7	113.6	82.2	22.8	25.0	2975.8
24	38G4	471.3	3297.5	8424.8	2324.5	2061.7	949.1	871.4	206.2	381.3	18987.6
24	39G2	730.2	510.3	181.1	29.3	39.7	17.1	12.9	1.8	5.3	1527.7
24	39G3	1828.8	1310.5	2158.8	569.9	433.3	186.2	155.9	58.6	67.6	6769.6
24	39G4	85.7	986.4	3407.9	3022.7	3665.6	1583.2	1270.4	585.1	511.9	15118.9
24	Total	5154.1	7958.0	17618.7	6847.2	6931.7	3089.9	2621.3	926.1	1084.1	52231.0
22-24	Total	7775.0	13114.6	39840.9	23362.7	15693.6	14825.9	14537.2	8487.5	7185.8	144823.1
21-24	Total	9743.4	20702.9	41469.8	23480.4	15726.3	14858.4	14537.2	8487.5	7215.1	156220.9

excl. CBH

excl.
maturity ≥ 6

excl. CBH