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Cruise Report

Cruise no. 848 of FRV "Solea"
07. – 31.05.2025

Baltic acoustic spring survey (BASS)

Scientist in charge: Dr. Paul Kotterba (Thünen-OF)

1. Main purpose of the cruise

Cruise no. 848 of FRV "Solea" was conducted as part of the international "Baltic Acoustic Spring Survey (BASS)". The main objective of this hydroacoustic survey is the annual assessment of small pelagic fish stocks, especially sprat, in the Baltic Sea. The BASS is coordinated by the ICES Working Group on Baltic International Fish Surveys (WGBIFS) where timing, survey area and the principal methods of investigation are discussed and decided. The survey has been conducted annually since 2001 and delivers the most important fisheries-independent abundance index for the annual ICES stock assessment of Baltic sprat.

The German investigation area in 2025 covered ICES subdivisions 24, 25, 26, 28, and 29, and thus the major part of the investigation area of the international survey. Other parts were covered by Sweden, Lithuania, Latvia, Estonia, and Poland.

2. Cruise objectives

Main objectives of the cruise were:

- Hydroacoustic measurements in the Baltic Sea for the assessment of small pelagic fish from the Arkona Sea to Gotland Sea (ICES subdivisions 24 to 26 and SD 28-29)
- Fishing with a pelagic trawl according to hydroacoustic indications and subsequent biological measurement of catches (species, length composition, sex, maturity and age)
- Sampling of herring and sprat (whole fish, otoliths, stomachs and gonads) for further analysis at the Thünen-OF
- Hydrographic measurements with a CTD probe on predetermined stations and after each fishing station when distant from the planned CTD station (approx. every 10 nmi)
- Comparative diurnal and nocturnal hydroacoustic measurements and sampling of pelagic fishes in the Bornholm Basin to investigate daily vertical distribution patterns of sprat and herring.

3. Cruise narrative and preliminary results

3.1 Cruise narrative

"Solea" departed from the harbour of Rostock-Marienehe in the morning of May 7th after the boarding of the scientist and the loading of the equipment. After a stopover in the Überseehafen in Rostock, where the acoustic system was calibrated and a hydroacoustic measurement of net beads was carried out, the ship left the Warnow in the evening and moved to the study area in ICES subdivision 24, where work on the hydroacoustic transects began in the morning of the following day. The scientific echosounder equipment was calibrated on May 11th. A map summarizing all daily transects is presented in Figure 1. Due to poor weather conditions, occasional problems with disrupted GPS satellite reception and staffing problems, there were several days of downtime during the cruise on which work had to be interrupted. For this reason, the program for the depth distribution of pelagic fish in the Bornholm Sea could not be implemented as planned at the end of the cruise because the time was needed to successfully complete the core tasks of the cruise. On May 31st, the vessel returned to Rostock-Marienehe, where the scientific equipment was unloaded and most of the scientists disembarked.

3.2 Hydroacoustic recording

The "Solea" is equipped with four Simrad EK80 wideband echosounders (18, 38, 120 and 200 kHz). The BASS was conducted with the 38 kHz frequency narrow band mode (pulse length = 1024 µs; pingrate = 500 ms) but all frequencies were recorded. Each echosounder was calibrated. Calibration procedure itself was carried out as described in the "Manual for International Baltic Acoustic Surveys (IBAS)" (ICES 2017).

The acoustic and ichthyological sampling stratification was based on ICES statistical rectangles (0.5 degree in latitude and 1 degree in longitude). The daily surveyed distance amounted to approximately 70-90 nautical miles with an objective to cover 60 nautical miles per statistical rectangle. In general, each ICES-rectangle was covered with two parallel transects spaced by a maximum of 15-18 nm whenever possible. Ship's speed was 10 knots (range 9.5 – 10.5 knots) during acoustic measurements while fishing operations were conducted at 3 to 4 knots. The standard acoustic investigations and the fishing hauls were carried out at daylight from 3:00 - 19:30 UTC (5:00 - 21:30 local time). Additional hydroacoustic measurements were conducted during night-time, mostly when the vessel was drifting.

All rectangles assigned to the German investigation area in subdivisions 24 to 26, 28 and 29 were covered by hydroacoustic transects. For some rectangles, due to spatial constraints, the total hydroacoustic track length was however lower than the recommended 60 nautical miles (see Figure 1). The lack of a granted research licence for planned stations in the Swedish EEZ caused minor track changes. Hydroacoustic track lengths less than 60 nautical miles were conducted in 14 of the 26 rectangles assigned to the 2025 German investigation area. This resulted in a total hydroacoustic track length of about 1399 nautical miles. A map of the echo distributions is shown in Figure 1.

3.3 Biological sampling

Trawling was done with the pelagic gear "PSN388" in the midwater as well as near the bottom to sample and identify the echo signals. In accordance with the IBAS manual, codend inlets with 20 mm stretched mesh size in Subdivision 24 and 12 mm in Subdivision 25 to 29 were used. The aim was to conduct at least two fishing hauls per ICES statistical rectangle. The trawling time usually lasted 30 minutes at fishing depth and at a speed of 3 to 4 knots. However, the fishing time was in some cases reduced because of abundant fish echoes observed with the Marport-net-probe.

The trawling depth and the vertical net opening were controlled by the Marport-net-probe. The trawl depth (headrope below the surface) was chosen depending on the densities of fish on the echogram and ranged

from 12.8 m to 85.1 m. Trawl depth could vary within a haul when more than one layer of fish was sampled. The bottom depth at the trawling positions ranged from 30.8 m to 203 m.

Samples were taken from each haul in order to determine the length and weight distribution of fish. A comparison of length distribution of herring and sprat between BASS 2024 and BASS 2025 is presented in Figure 2. Sub-samples of herring and sprat were taken to investigate the distribution of sex, maturity and age of the catches. Samples of whole fish and parts of different organs/tissues were also taken for later investigations in the laboratory. Detailed biological analyses were made according to the standard procedure (i.e. sex, maturity, otolith dissection). At the time of writing, the fish otoliths are still being processed to analyse individual fish age and the final analysis will be accomplished by the end of 2025.

In total 43 standard hauls (including six invalid hauls due to small catch sizes) were carried out during the BASS 2025:

Subdivision	**Hauls 9 (invalid)**
24	9
25	14 (4)
26	2
28	9 (1)
29	9 (1)

Altogether 20,353 fish were measured and 2,351 additional fish (1,019 sprat, 1,268 herring, 64 cod) were sampled for further age determination. Overall catches (kg 0.5 hr^{-1}) during the BASS 2025 per haul, ICES rectangle, ICES subdivision and species are displayed in Table 1. The spatial distribution of the catches per species is presented in Figure 3.

Species	Common name	Length measurements	Number of hauls where present
Clupea harengus	Atlantic herring	6,378	36
Cyclopterus lumpus	Lumpfish	3	3
Engraulis encrasicolus	European anchovy	1	1
Gadus morhua	Atlantic cod	82	18
Gasterosteus aculeatus	Three-spined stickleback	1,962	23
Hyperoplus lanceolatus	Great sandeel	6	3
Merlangius merlangus	Whiting	39	4
Platichthys flesus	European flounder	11	9
Pungitius pungitius	Ninespine stickleback	1	1
Rhinonemus cimbrius	Fourbeard rockling	1	1
Sprattus sprattus	European sprat	11,869	40

3.4 Hydrography

A Seabird-CTD-probe (SBE 19plus V2) equipped with a water sampler and oxygen sensor was used for hydrographic measurements. Vertical profiles were taken on a fixed station grid along the track. Additional CTD casts were performed after or before each trawl if the distance from the planned station was sufficient (ca. 5 nmi). The profiles covered the entire water column to about 2 m above the seafloor. One to three water samples from different depths were taken per day to validate the oxygen data by Winkler titration, and to collect reference salinity samples. Altogether 128 CTD casts were performed during the cruise.

Measurements showed a regular stratification of the water column during the survey. Temperature, salinity and oxygen profiles are presented in Figure 4. Seawater temperature ranged from 12.6°C (at the surface) to 3.3°C (recorded at 56 m depth). At the deepest CTD cast of the survey (201 m) the bottom temperature was 7.3°C. Overall, intermediate water masses (depth ranging from 40 to 68 m) presented temperatures around or below 4°C, which is considered as a temperature threshold limit for the distribution of sprat in the water column. Higher temperatures were recorded above and below the midwater stratum. The water column was less stratified in the northern parts of the rectangles 48G9 and 48H0 with temperatures between 3.6°C and 6.5°C. Measured salinity ranged from 5.7 at the surface layer up to a maximum of 16.3 at the bottom of the Arkona Basin and the Bornholm Basin. Oxygen concentrations ranged from 0.0 ml l^{-1} at the bottom to 9.3 ml l^{-1} (recorded at the surface). Apart from the rectangles 48G9 and 48H0, where the whole water column was well oxygenated, hypoxic conditions (<1.4 ml l^{-1}) were observed approximately below 60-70 m depth. No fish echo was usually observed under these conditions.

4. Cruise participants

Name	Function	Institution
Dr. Paul Kotterba	Cruise leader	Thünen-OF
Verona Henning	Fishery biology	Thünen-OF
Cornelia Albrecht	Fishery biology	Thünen-OF
Matthias Woltering	Fishery biology	Thünen-OF
Marcel Bächtiger	Fishery biology	Thünen-OF (student assistant)
Katharina Schienbein	Fishery biology	Thünen-OF (student assistant)
Lea Hartkens	Hydroacoustic	Thünen-SF
Theresa Peters	Hydroacoustic	Thünen-SF
Jan Meischner	Fishery biology	University of Rostock
Dr. Danial Stepputtis	Hydroacoustic	Thünen-OF (May 7th only)
Sebastian Mammitzsch	Electronics	Thünen-OF (May 7th only)

5. Acknowledgements

We hereby thank all participants and the crew of FRV “Solea” for their outstanding cooperation and commitment. We also thank Dr. Matthias Schaber and Lea Hartkens for the analysis of acoustic data.

6. Literature

ICES. 2017. Manual for the International Baltic Acoustic Surveys (IBAS). Series of ICES Survey Protocols SISP 8 - IBAS. 47 pp.; http://doi.org/10.17895/ices.pub.3368;

Dr. Paul Kotterba (Thünen-OF)

(Scientist in charge)

7. Figures

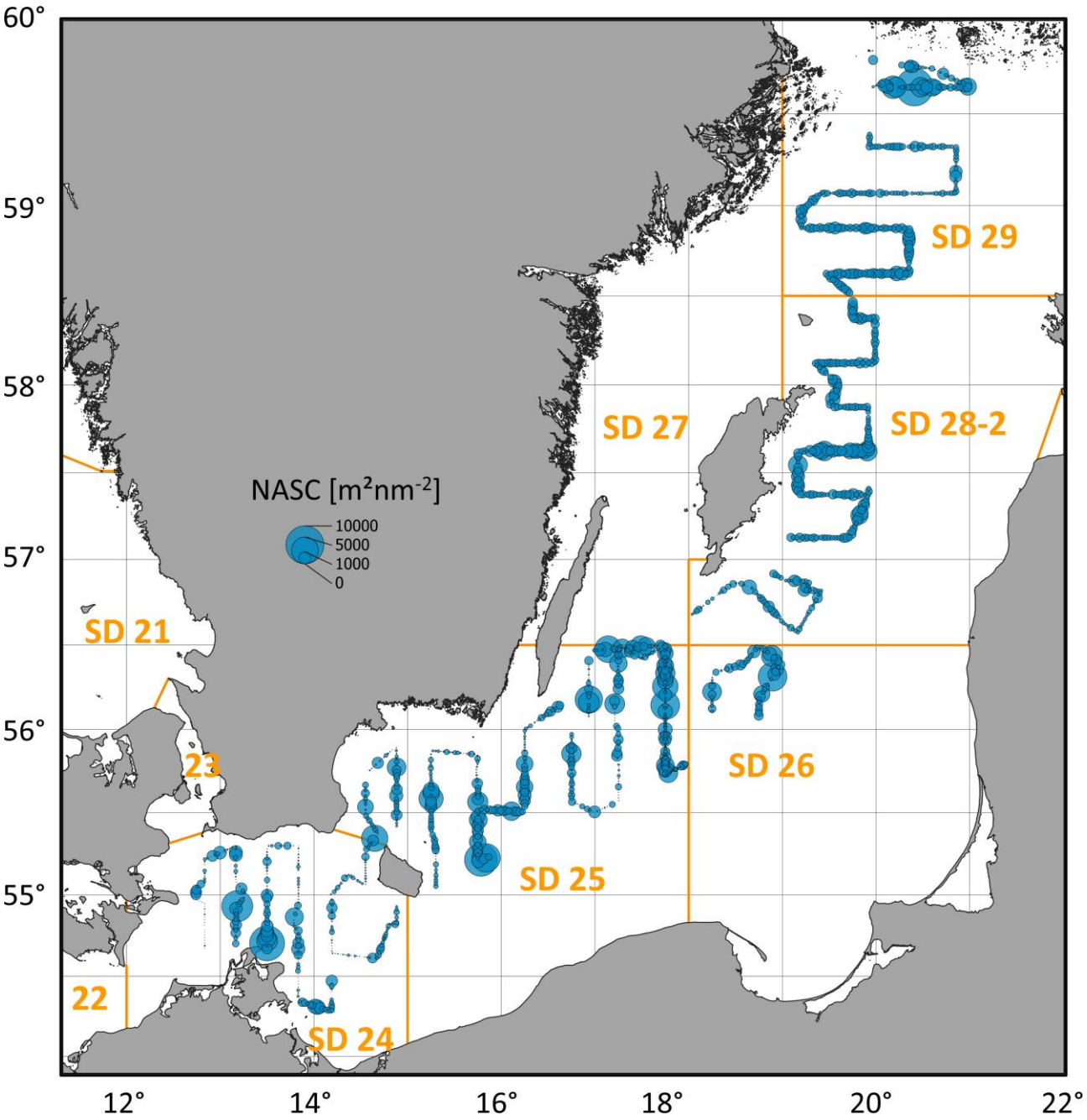

Figure 1: FRV "Solea" cruise 848/2025 BASS: hydroacoustic results: NASC (m²/nm²) per 1 nm recorded during the survey.

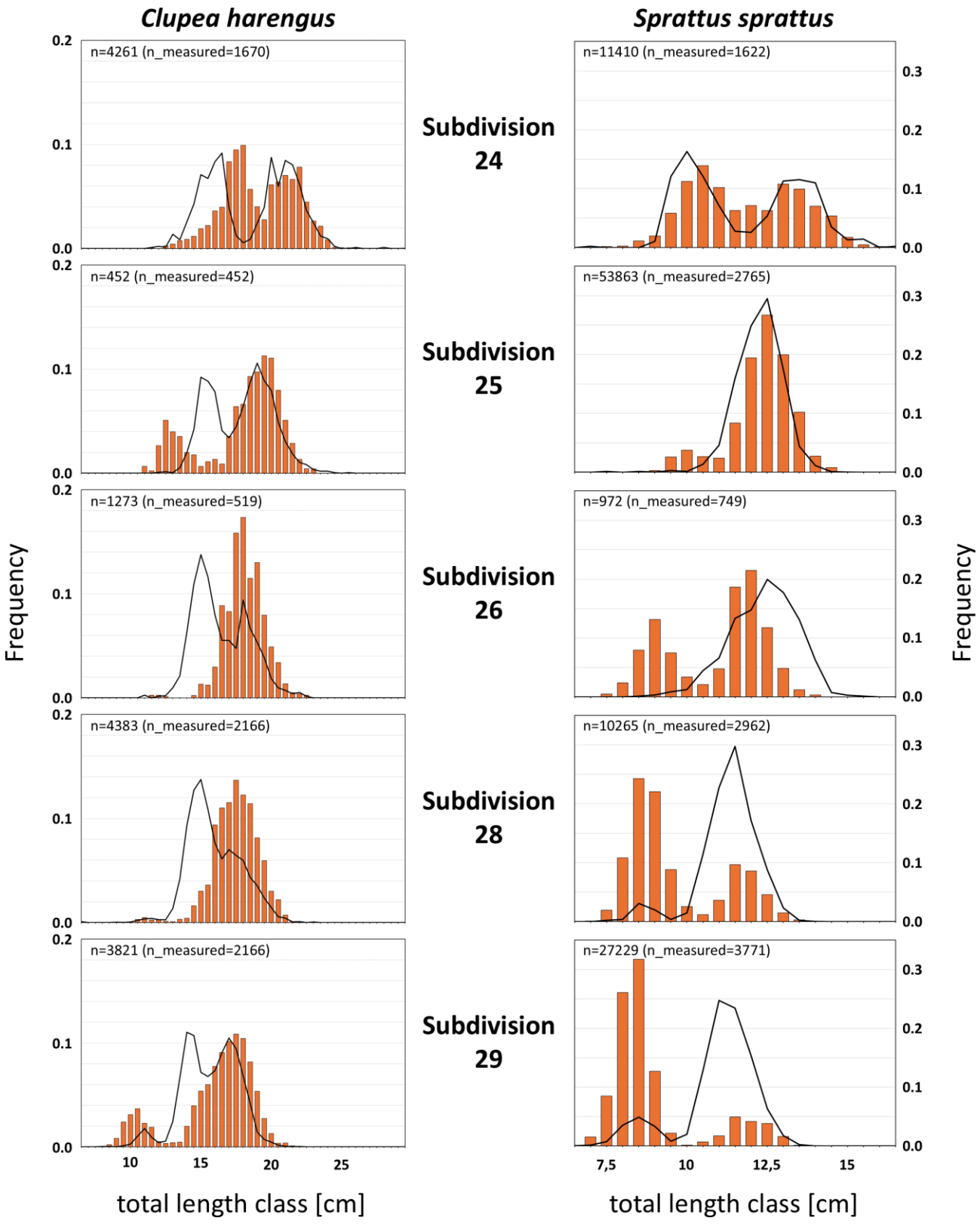

Figure 2: "Solea" cruise 848/2025 BASS: Herring and sprat length distribution of caught individuals (numbers indicated in the upper left corner) per ICES subdivision during BASS 2024 (black lines) and BASS 2025 (orange bars).

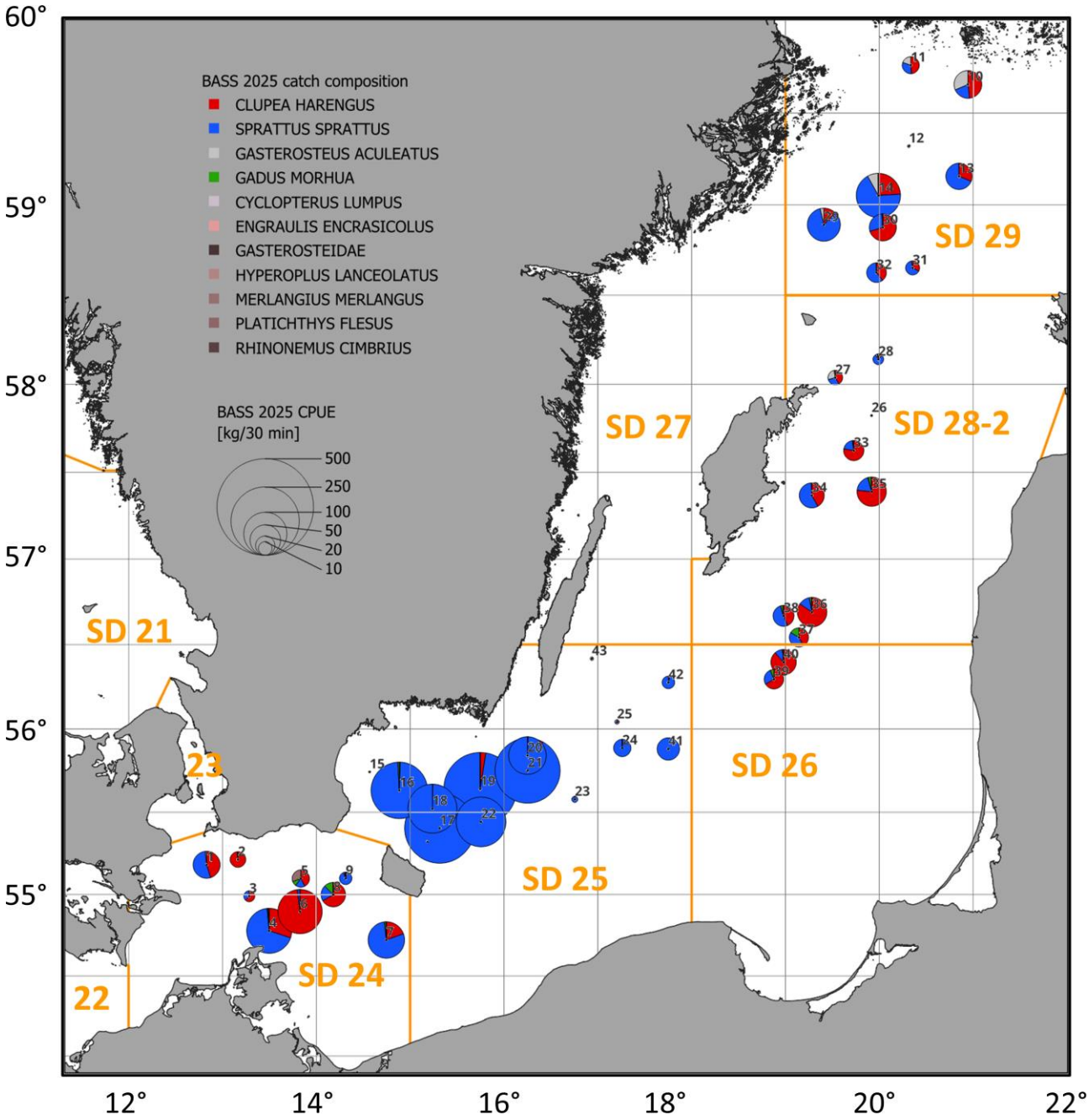

Figure 3: "Solea" cruise 848/2025 BASS: CPUE (kg/0.5 hr) of catch per species recorded during the BASS 2025. Numbers indicate the haul number.

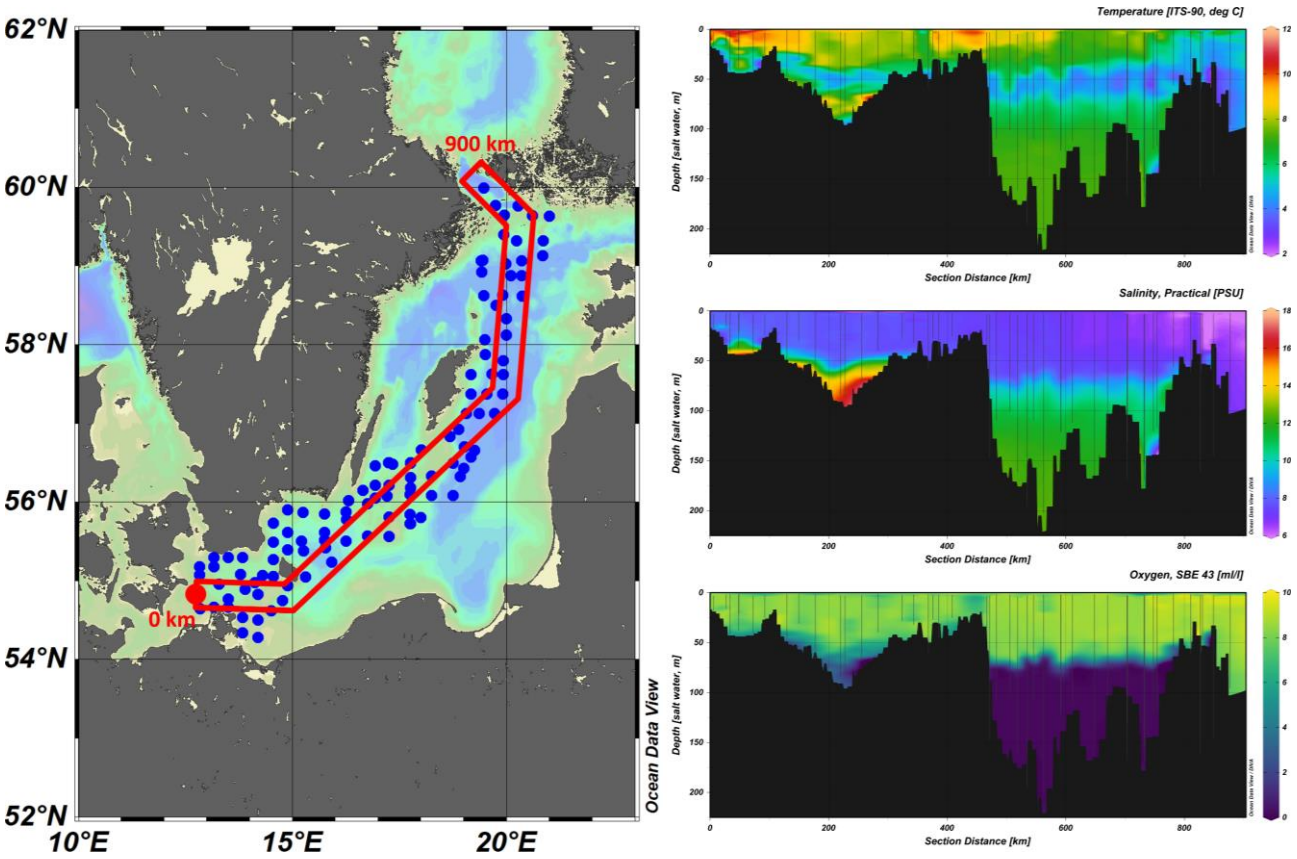

Figure 4: "Solea" cruise 848/2025 BASS: Temperature (upper right panel), salinity (middle right panel) and oxygen (lower right panel) interpolated from CTD casts along a south/west - north/east transect as shown in the left panel (red line). CTD casts coordinates are displayed as blue dots on the map in the left panel.

8. Tables

Table 1: FRV "Solea" cruise 848/2025 BASS: Catch composition (kg 0.5 h^{-1}) per haul, ICES subdivision (SD), ICES rectangle. No catch are indicated by "-" and values lower than 0.01 by "+". Species are indicated by their 3-alpha code (COD = *Gadus morhua*; FLE = *Platichthys flesus*; ANE = *Engraulis encrasicolus*; GTA = *Gasterosteus aculeatus*; GPT = *Pungitius pungitius*; HER = *Clupea harengus*; LUM = *Cyclopterus lumpus;* SPR = *Sprattus sprattus*; WHG = *Merlangius merlangus*; ENC = *Enchelyopus cimbrius;* YEZ = *Hyperoplus lanceolatus*).

Haul No.	ICES SD	ICES rectangle	COD	FLE	ANE	GTA	GPT	HER	LUM	SPR	WHG	ENC	YEZ	total
1	24	39G2	-	-	-	0.55	-	17.72	-	20.87	-	-	-	**39.15**
2	24	39G3	-	0.18	-	+	-	13.01	-	0.02	-	-	-	**13.21**
3	24	38G3	-	-	-	-	-	4.09	-	2.39	-	0.05	-	**6.53**
4	24	38G3	0.47	0.44	-	-	-	32.70	-	74.39	0.66	-	-	**108.66**
5	24	39G3	1.42	-	-	-	-	6.84	-	2.94	4.95	-	-	**16.15**
6	24	38G3	0.17	-	-	-	-	103.08	-	1.79	-	-	-	**105.03**
7	24	38G4	0.99	-	-	-	-	13.90	-	56.17	0.20	-	-	**71.26**
8	24	38G4	3.85	-	-	-	-	21.35	+	6.66	0.14	-	-	**32.00**
9	24	39G4	-	0.15	-	-	-	0.21	0.26	7.67	-	-	0.08	**8.36**
10	29	48H0	-	-	-	12.98	-	19.89	-	8.43	-	-	-	**41.29**
11	29	48H0	-	-	-	3.08	-	7.61	-	4.90	-	-	-	**15.60**
12	29	47H0	-	-	-	0.51	-	-	-	-	-	-	-	**0.51**
13	29	47H0	-	-	-	0.06	-	11.60	-	25.50	-	-	-	**37.16**
14	29	47G9	-	0.22	-	8.26	-	25.27	-	71.24	-	-	-	**104.98**
15	25	40G4	-	-	-	-	-	-	-	-	-	-	-	**-**
16	25	40G4	1.38	-	-	-	-	0.95	-	168.62	-	-	-	**170.96**
17	25	39G5	-	0.33	-	-	-	1.21	-	261.92	-	-	-	**263.46**
18	25	40G5	-	-	-	-	-	0.33	-	128.76	-	-	-	**129.09**
19	25	40G5	0.24	0.17	-	-	-	7.01	-	276.62	-	-	-	**284.04**
20	25	40G6	+	-	-	+	-	0.45	-	75.65	-	-	-	**76.11**
21	25	40G6	0.32	-	0.03	-	-	17.54	-	208.99	-	-	-	**226.89**
22	25	39G5	-	-	-	-	-	-	-	132.93	-	-	-	**132.93**
23	25	40G6	-	-	-	-	-	-	-	1.99	-	-	0.02	**2.01**
24	25	40G7	-	-	-	+	-	-	-	16.14	-	-	0.02	**16.16**
25	25	41G7	-	-	-	+	-	0.37	-	0.70	-	-	-	**1.08**
26	28	44G9	-	-	-	-	-	-	-	-	-	-	-	**-**
27	28	45G9	0.28	-	-	3.10	-	4.81	-	3.37	-	-	-	**11.56**
28	28	45G9	0.07	-	-	0.36	-	0.79	0.12	4.77	-	-	-	**6.11**
29	29	46G9	-	-	-	2.11	-	7.48	-	48.96	-	-	-	**58.54**
30	29	46H0	-	-	-	0.36	+	27.49	-	11.21	-	-	-	**39.06**
31	29	46H0	-	-	-	0.25	-	3.46	-	6.88	-	-	-	**10.59**
32	29	46G9	-	-	-	0.18	-	8.19	-	12.36	-	-	-	**20.73**
33	28	44G9	0.25	-	-	0.21	-	17.03	-	4.42	-	-	-	**21.91**
34	28	43G9	-	-	-	0.17	-	14.03	-	19.28	-	-	-	**33.48**
35	28	43G9	1.48	0.29	-	0.20	-	35.16	-	8.80	-	-	-	**45.93**
36	28	42G9	1.06	0.31	-	+	-	39.50	-	5.89	-	-	-	**46.77**
37	28	42G9	3.22	-	-	-	-	8.34	-	8.18	-	-	-	**19.73**
38	28	42G9	0.91	0.18	-	0.02	-	10.31	-	12.15	-	-	-	**23.56**
39	26	41G8	1.20	-	-	-	-	13.55	-	5.60	-	-	-	**20.36**
40	26	41G8	0.44	-	-	+	-	30.58	-	3.58	-	-	-	**34.61**
41	25	40G7	-	-	-	-	-	-	-	26.88	-	-	-	**26.88**
42	25	41G7	-	-	-	-	-	0.33	-	8.20	-	-	-	**8.52**
43	25	41G6	-	-	-	0.46	+	0.07	-	0.18	-	-	-	**0.70**
Total			**17.75**	**2.27**	**0.03**	**32.90**	**0.00**	**526.22**	**0.38**	**1746.0**	**5.95**	**0.05**	**0.12**	**2331.6**