



Cruise Report

Cruise no. 478 of FRV “Walther Herwig III” 02. – 27.05.2024

Baltic acoustic spring survey (BASS)

Scientist in charge: Dr. Stefanie Haase (Thünen-OF)

1. Main purpose of the cruise

Cruise no. 478 of FRV “Walther Herwig III” 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 2024 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.

Distribution list:

Ship management FFS „Walther Herwig III”
BA für Landwirtschaft und Ernährung (BLE) Fischereiforschung
BM für Ernährung und Landwirtschaft (BMEL), Ref. 526
BA für Seeschifffahrt und Hydrographie (BSH), Hamburg
Deutscher Angelfischerverband e.V.
Deutsche Fischfang-Union, Cuxhaven
Deutscher Fischereiverband Hamburg
Doggerbank Seefischerei GmbH, Bremerhaven
Erzeugergemeinschaft der Deutschen Krabbenfischer GmbH
Kutter- und Küstenfisch Sassnitz
LA für Landwirtschaft, Lebensmittels. und Fischerei (LALLF)

LFA für Landwirtschaft und Fischerei MV (LFA)
Leibniz-Institut für Ostseeforschung Warnemünde
GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel
Thünen-Institute - Institute of Fisheries Ecology
Thünen-Institute - Institute of Sea Fisheries
Thünen-Institute – Institute of Baltic Sea Fisheries
Thünen-Institute – Press office, Mrs. Kraft
Thünen-Institute – Presidential office
Thünen-Institute – Scheduling research vessels, Dr. Rohlf
Participants

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)
- Sampling Bongo stations in the Bornholm Basin to cover the Danish ichthyoplankton survey which estimates for example the annual cod egg production

3. Cruise narrative and preliminary results

3.1 Cruise narrative

“Walther Herwig III” departed from the harbour of Bremerhaven on May 2th. The vessel arrived in Warnemünde in the morning of the 4th where scientist boarded, and equipment was loaded.

Acoustic recordings for the BASS started in the afternoon of May 4th after reaching the area of investigation in ICES subdivision 24. Acoustic recordings were continued until all 16 transects were surveyed on the 21th of May. The scientific echosounder equipment was calibrated on May 13th. A map summarizing all daily transects is presented in Figure 1.

45 Bongo hauls paired with 45 CTD stations were conducted between the 22th-24th of May.

Scientists disembarked in the harbour of Warnemünde on the 25th and the vessel arrived in Bremerhaven on the 27th.

3.2 Hydroacoustic recording

The “Walther Herwig III” is equipped with four Simrad EK60 narrowband echosounders (18, 38, 120 and 200 kHz). The BASS was conducted with the 38 kHz frequency narrow band mode (pulse length = 1024 μ s; pingrate = 500 ms) but all frequencies were recorded in continuous wave (CV) mode. Each echosounder was calibrated. The 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 3:45 - 19:30 UTC (5:45 - 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 21 of the 27 rectangles assigned to the German investigation area. This resulted in a total hydroacoustic track length of about 1200 nautical miles. A map of the NASC distribution is shown in Fig. 1.

3.3 Biological sampling

Trawling was done with the pelagic gear “PSN205” 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. Generally, the vertical net opening was around 13 m when deployed. The trawl depth (headrope below the surface) was chosen depending on the densities of fish on the echogram and ranged from 8.1 m to 143.9 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 30.6 m to 203.7.0 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 2023 and BASS 2024 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 2024.

In total 50 standard hauls (including nine invalid hauls due to small catch sizes) were carried out during the BASS 2024:

Subdivision	Hauls (invalid)
24	10 (5)
25	17 (4)
26	3
28	10
29	10

Altogether 37,166 fish were measured and 1,987 additional fish (700 sprat, 1,226 herring, 61 cod) were sampled for further age determination.

Species	Common name	Length measurements	Number of hauls where present
<i>Clupea harengus</i>	Atlantic herring	13,742	49
<i>Cyclopterus lumpus</i>	Lumpfish	2	2
<i>Engraulis encrasicolus</i>	European anchovy	1	1
<i>Gadus morhua</i>	Atlantic cod	90	18
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	3,805	38
<i>Hyperoplus lanceolatus</i>	Great sandeel	3	3
<i>Merlangius merlangus</i>	Whiting	26	2
<i>Myoxocephalus scorpius</i>	Shorthorn sculpin	3	1
<i>Platichthys flesus</i>	European flounder	54	19
<i>Pomatoschistus minutus</i>	Sand goby	1	1
<i>Salmo salar</i>	Atlantic salmon	1	1
<i>Sprattus sprattus</i>	European sprat	19,438	48

Overall catches (kg 0.5 hr⁻¹) during the BASS 2024 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.

3.4 Hydrography

A Seabird-CTD-probe (SE911) 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 146 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 13.5°C (at the surface) to 1.8°C (recorded at 23 m depth). At the deepest CTD cast of the survey (205 m) the bottom temperature was 7.2°C. Overall, intermediate water masses (depth ranging from 14 to 68 m) presented temperatures 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 rectangles 48G9 and 48H0 with temperatures between 1.7°C and 5.0°C. Measured salinity ranged from 5.7 at the surface layer up to a maximum of 17.3 at the bottom of the Arkona Basin and the Bornholm Basin. Oxygen concentrations ranged from 0.0 ml l⁻¹ at the bottom to 10.5 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 m depth. No fish echo was usually observed under these conditions.

4. Cruise participants

Name	Function	Institution
Dr. Stefanie Haase	Cruise leader	Thünen-OF
Dr. Paul Kotterba	Fishery biology	Thünen-OF
Cornelia Albrecht	Fishery biology	Thünen-OF
Verona Henning	Fishery biology	Thünen-OF
Tom Jankiewicz	Fishery biology	Thünen-OF
Simon Wieser	Hydroacoustic	Thünen-SF
Laura Charlotte Thiel	Fishery biology	Thünen-OF (student assistant)
Marcel Bächtiger	Fishery biology	Thünen-OF (student assistant)
Amalia Klein	Fishery biology	Thünen-OF (student assistant)
Emily Sophie Charlotte Martens-Oberwelland	Fishery biology	Thünen-OF (student intern)

5. Acknowledgements

We hereby thank all participants and the crew of FRV “Walther Herwig III” 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. Stefanie Haase (Thünen-OF)

(Scientist in charge)

7. Figures

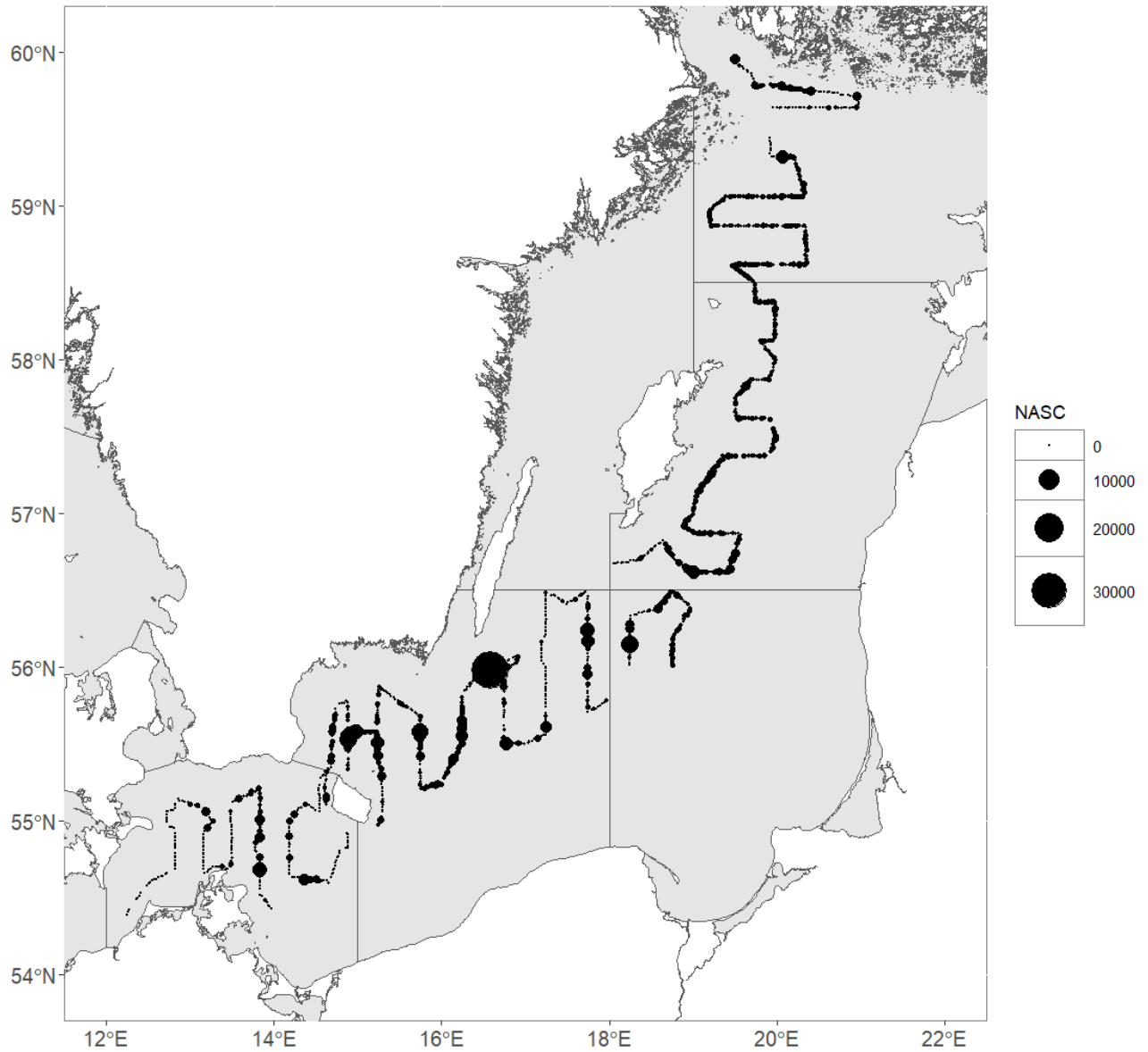


Figure 1: FRV "Walther Herwig III" cruise 478/2024 BASS: hydroacoustic results: NASC (m^2/nm^2) per 1 nmi recorded during the survey.

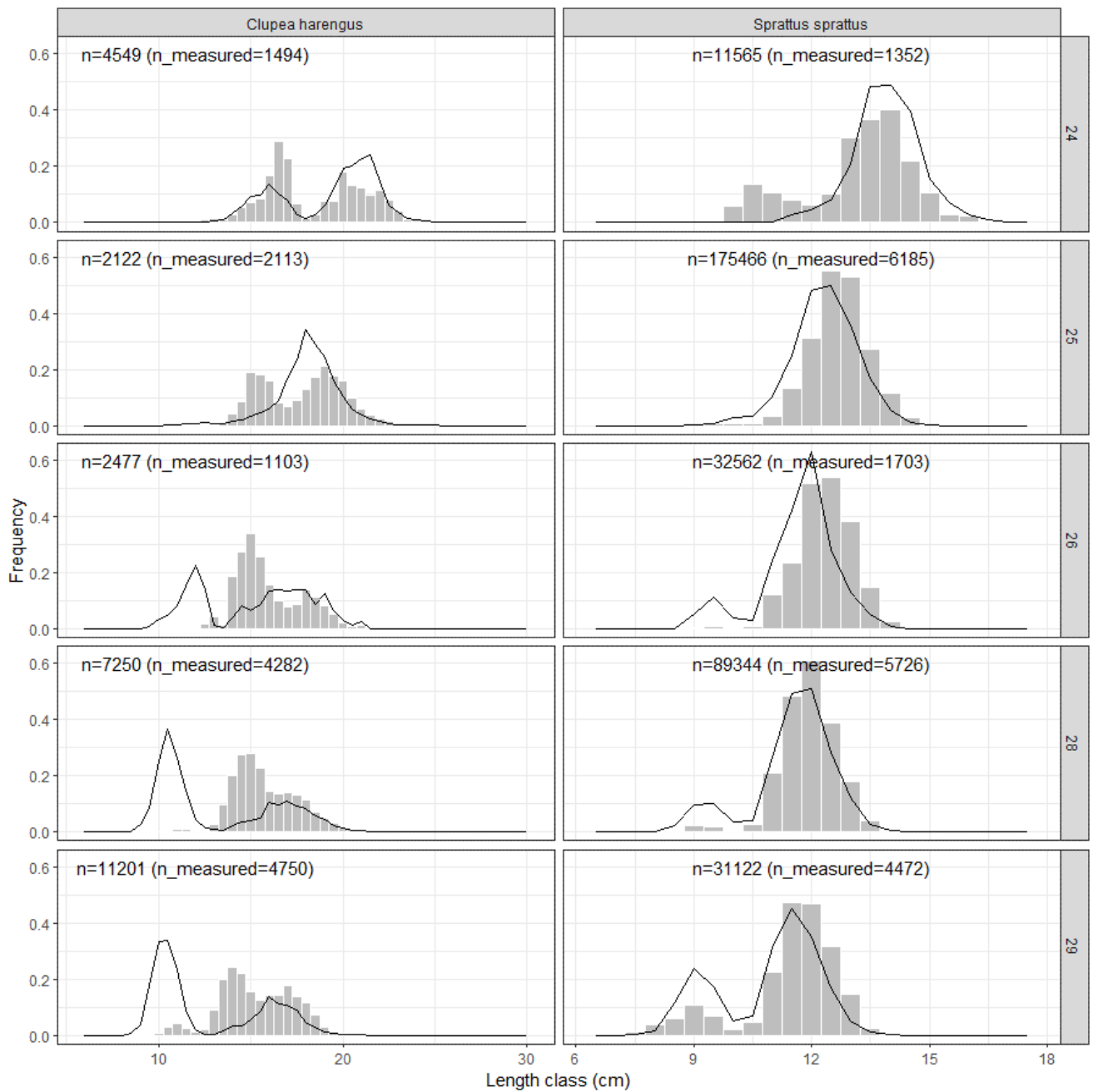


Figure 2: “Walther Herwig III” cruise 478/2024: Herring and sprat length distribution of caught individuals (numbers indicated in the upper left corner) per ICES subdivision during BASS 2023 (black lines) and BASS 2024 (grey bars).

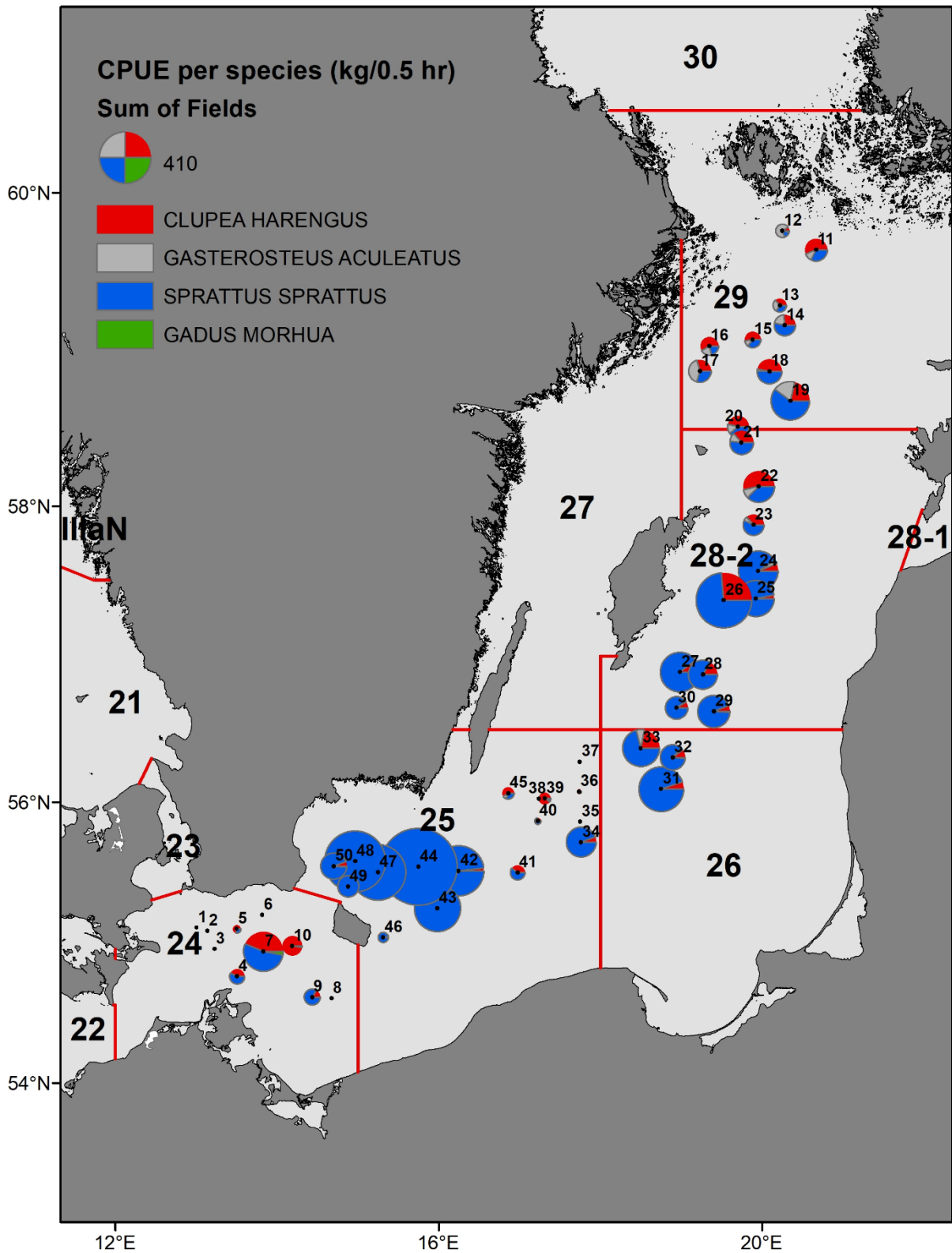


Figure 3: “Walther Herwig III” cruise 478/2024: CPUE (kg/0.5 hr) of catch per species recorded during the BASS 2024. Numbers indicate the haul number.

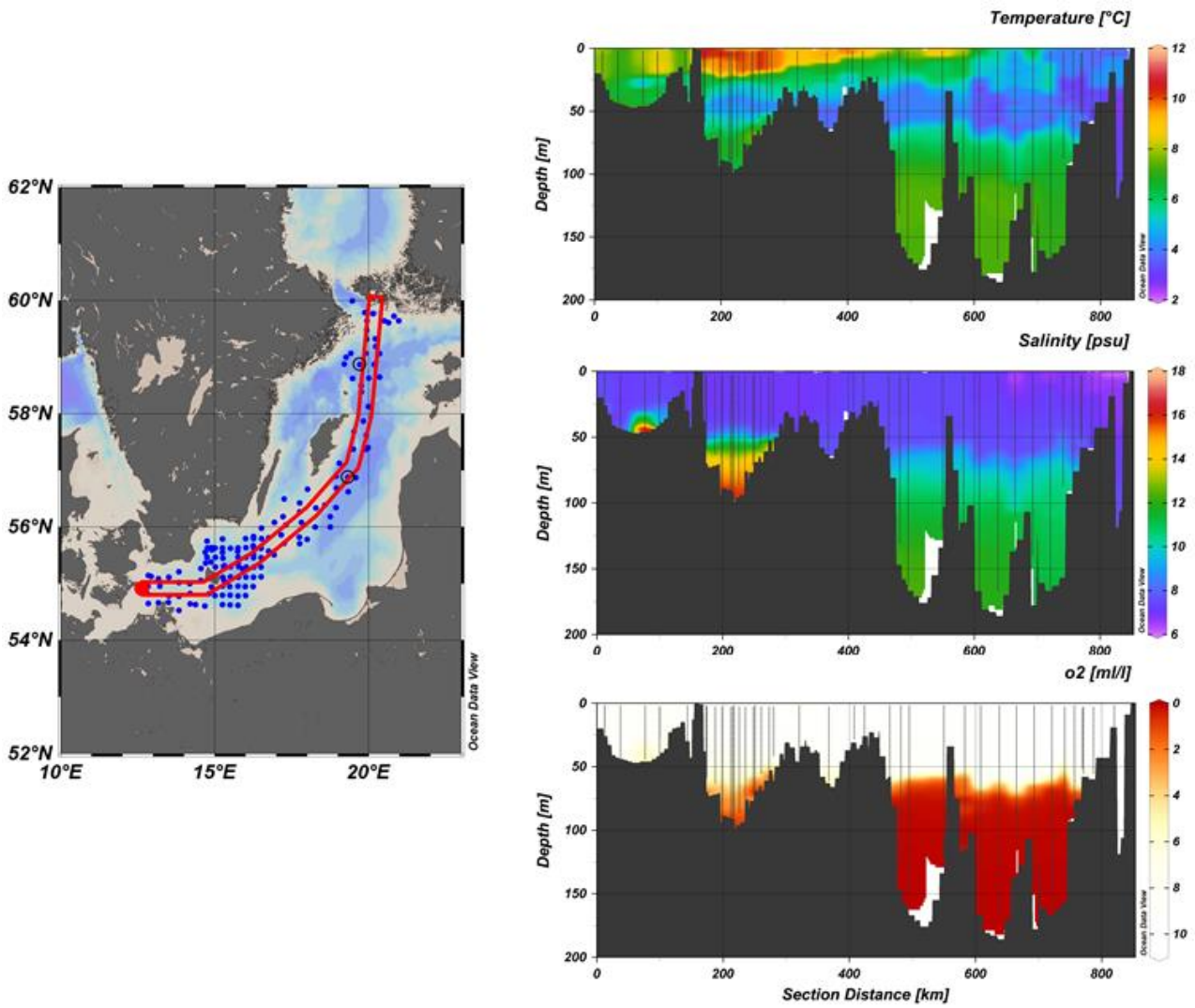


Figure 4: “Walther Herwig III” cruise 478/2024: Temperature (upper right panel), salinity (middle right panel) and oxygen (lower right panel) interpolated from CTD casts along a south/west - north/east transect as shown in the left panel (red line). CTD casts coordinates are displayed as blue dots on the map in the left panel.

8. Tables

Table 1: Vessel “Walther Herwig III” cruise 478/2024: 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*; HER = *Clupea harengus*; LUM = *Cyclopterus lumpus*; POM = *Pomatoschistus minutus*; SCU = *Myxocephalus scorpius*; SAL = *Salmo salar*; SPR = *Sprattus sprattus*; WHG = *Merlangius merlangus*; YEZ = *Hyperoplus lanceolatus*).

Haul No.	ICES SD	ICES rectangle	COD	FLE	ANE	GTA	HER	LUM	POM	SCU	SAL	SPR	WHG	YEZ
1	24	39G2	-	-	-	+	0.17	-	-	-	-	-	-	-
2	24	39G3	-	-	-	+	-	-	-	-	-	+	-	0.02
3	24	38G3	-	-	-	-	0.07	-	-	-	-	0.33	3.30	-
4	24	38G3	-	-	-	+	15.52	-	-	-	-	20.74	-	0.02
5	24	39G3	-	-	-	+	7.22	-	-	-	-	2.82	-	-
6	24	39G3	-	-	-	+	1.04	-	-	-	-	0.37	-	-
7	24	38G3	7.6	-	-	-	106.48	-	-	-	-	127.60	2.93	-
8	24	38G4	-	-	-	-	0.14	-	-	-	-	-	-	0.01
9	24	38G4	-	-	-	0.03	6.21	-	-	-	2.49	31.52	-	-
10	24	38G4	0.18	-	-	-	58.64	-	-	-	-	1.41	-	-
11	29	48H0	0.63	-	-	9.04	44.32	-	-	-	-	25.68	-	-
12	29	48H0	1-11	-	-	19.60	2.57	-	+	-	-	4.22	-	-
13	29	47H0	-	-	-	8.14	10.54	0.12	-	0.21	-	9.75	-	-
14	29	47H0	-	0.52	-	14.40	17.94	-	-	-	-	36.38	-	-
15	29	47G9	-	0.37	-	4.71	22.08	-	-	-	-	14.79	-	-
16	29	47G9	-	0.25	-	10.28	29.94	-	-	-	-	10.82	-	-
17	29	46G9	-	-	-	31.50	22.52	-	-	-	-	22.66	-	-
18	29	46H0	-	0.88	-	2.28	44.66	-	-	-	-	47.86	-	-
19	29	46H0	-	0.48	-	41.71	47.66	-	-	-	-	135.81	-	-
20	29	46G9	-	0.13	-	10.20	33.03	-	-	-	-	27.48	-	-
21	28-2	45G9	-	0.16	-	10.17	32.01	-	-	-	-	45.15	-	-
22	28-2	45G9	0.54	0.55	-	14.12	80.63	-	-	-	-	56.35	-	-
23	28-2	44G9	-	0.37	-	4.14	24.38	-	-	-	-	37.70	-	-
24	28-2	44G9	0.34	-	-	7.50	14.57	-	-	-	-	222.90	-	-
25	28-2	43G9	1.94	0.33	-	0.38	6.11	-	-	-	-	193.00	-	-
26	28-2	43G9	-	1.52	-	0.37	124.98	-	-	-	-	346.86	-	-
27	28-2	42G8	0.30	1.36	-	1.11	24.55	-	-	-	-	213.04	-	-
28	28-2	42G9	0.67	-	-	0.32	21.25	-	-	-	-	110.27	-	-
29	28-2	42G9	1.76	0.56	-	0.24	9.47	-	-	-	-	149.22	-	-
30	28-2	42G8	-	0.31	-	0.80	6.46	-	-	-	-	69.60	-	-
31	26	41G8	-	0.21	-	0.50	15.58	-	-	-	-	292.40	-	-
32	26	41G8	1.48	0.35	-	2.28	10.23	-	-	-	-	83.68	-	-
33	26	41G8	-	0.07	-	15.08	45.73	-	-	-	-	147.30	-	-
34	25	40G7	-	-	-	0.10	7.66	-	-	-	-	130.08	-	-
35	25	40G7	-	-	-	+	0.13	-	-	-	-	1.31	-	-
36	25	41G7	-	-	-	0.01	3.14	-	-	-	-	0.45	-	-
37	25	41G7	-	-	-	0.02	0.35	-	-	-	-	0.05	-	-
38	25	41G7	-	-	-	0.40	1.65	-	-	-	-	0.62	-	-
39	25	41G7	-	-	-	0.66	20.03	-	-	-	-	1.51	-	-
40	25	40G7	-	-	-	0.02	1.81	-	-	-	-	4.47	-	-
41	25	40G6	-	-	-	-	13.94	-	-	-	-	20.49	-	-
42	25	40G6	0.59	0.30	-	-	5.90	-	-	-	-	380.34	-	-
43	25	39G5	0.35	-	-	-	0.57	-	-	-	-	330.30	-	-
44	25	40G5	5.39	-	-	-	5.46	0.47	-	-	-	898.90	-	-
45	25	41G6	-	-	-	2.30	13.09	-	-	-	-	6.54	-	-
46	25	39G5	-	-	-	0.05	0.23	-	-	-	-	15.48	-	-
47	25	40G5	1.31	-	-	-	4.66	-	-	-	-	463.82	-	-
48	25	40G4	0.70	-	+	-	1.44	-	-	-	-	572.22	-	-
49	25	39G4	0.26	-	-	-	0.33	-	-	-	-	68.51	-	-
50	25	40G4	1.43	0.26	-	-	5.84	-	-	-	-	98.52	-	-
Total			26.6	8.96	0.008	212.5	972.9	0.58	0.001	0.21	2.49	5481	6.23	0.05