



Cruise Report
FRV „Walther Herwig“ Cruise 435
06. – 28.05.2020

**Hydroacoustic survey for the assessment of small pelagics
in the Baltic Sea**

Scientists in charge: Paco Rodriguez-Tress (TI-OF) & Stefanie Haase (TI-OF)

1. Introduction

Cruise no. 435 of the FRV “Walther Herwig III” was conducted as part of the annual ICES Baltic International Acoustic Spring Survey (BASS). The main objective of this hydroacoustic survey is the yearly assessment of small pelagic fish stocks, especially sprat, in the Baltic proper. BASS is coordinated at the international level by the ICES Baltic International Fish Survey Working Group (WGBIFS) where timing, surveyed area and the principal methods of investigations are discussed and decided.

German investigation area in 2019 covered ICES subdivisions 24, 25, 26, 27, 28 and 29. Other areas in the Baltic Sea were covered by Lithuania, Latvia, Estonia and Poland.

Distribution list:

Ship management FFS „Walther Herwig“
BA für Landwirtschaft und Ernährung (BLE) Fischereiforschung
BM für Ernährung und Landwirtschaft (BMEL), Ref. 614
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
Euro-Baltic Mukran
GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel
Kutter- und Küstenfisch Sassnitz

LA für Landwirtschaft, Lebensmittels. und Fischerei (LALLF)
LFA für Landwirtschaft und Fischerei MV (LFA)
Landesverband der Kutter- u. Küstenfischer MV e.V.
Leibniz-Institut für Ostseeforschung Warnemünde
Thünen-Institute - Institute of Fisheries Ecology
Thünen-Institute - Institute of Sea Fisheries
Thünen-Institute - Institute of Baltic Sea Fisheries
Thünen-Institute - Press office, Dr. Welling
Thünen-Institute - Presidential office
Thünen-Institute - Scheduling research vessels, Dr. Rohlf
Participants

2. Cruise objectives

Main objectives of the cruise were:

- Hydroacoustic measurements for the assessment of small pelagics from the Arkona Sea to Gotland Sea (ICES subdivisions 24 to 29).
- Fishing with a pelagic trawl according to hydroacoustic visual display and subsequent biological measurement of catches (species, length composition, sex, maturity and age).
- Sampling of herring, sprat and cod (whole fish, otoliths, stomachs and gonads) for further analysis at the TI-OF.
- Hydrographic measurements with a CTD probe on predetermined station and after each fishing station when away from the station (circa 5 nmi).
- Bongo stations to cover the Danish ichthyoplankton survey which estimates for example the annual cod egg production which could otherwise not been covered due to COVID-19.

3. Cruise narrative and preliminary results

3.1 Cruise narrative

The FRV “Walther Herwig III” departed from Bremerhaven harbour on May 5th in the morning, subsequently crossing the Kiel Channel in direction of Kiel harbour where the scientific team boarded the ship on May 6th. The ship left Kiel harbour May 7th in the early morning. Due to good weather conditions on the 6th of May, the day was used to start calibrating the echosounder in the Kiel bight. Unfortunately, the calibration sphere was lost, likely because the water depth was too shallow to calibrate the echosounder of the “Walther Herwig III”. The ship steamed to the survey area in the afternoon.

Acoustic recording for the BASS started in the morning of the 7th May after reaching the area of investigation in ICES subdivision 24. Good weather conditions on the 8th of May enabled us to calibrate the echosounder successfully. Acoustic recording were continued on the 9th of May until all 17 transects were finished on 24th of May. A map summarizing all daily transects is presented in Figure 1.

39 Bongo hauls paired with 13 CTD stations were conducted between the 24th-27th of May and are shown in Figure 5.

The cruise ended the 28th of May after a total of 18 days of hydroacoustic monitoring (including calibration) and four days of Bongo stations when scientists disembarked in the morning in the harbour of Warnemünde.

3.2 Hydroacoustic sampling

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). However, each echosounder was calibrated. Calibration procedure itself was carried out as described in the “Manual for International Baltic Acoustic Surveys (IBAS)” (ICES 2017). EK60 operated at 38, 70,120 and 200 kHz in continuous wave (CW) mode during recording.

The acoustic and ichthyologic 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 of 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 during acoustic measurements while fishing operation were conducted at 3 to 3.5 knots. The standard acoustic investigations and the fishing hauls were carried out at daylight from 4:00 - 19:00 UTC (6:00 and 21:00 local time).

With the exception of rectangle 43G8 (SD 28) where fishing license were not granted all rectangles assigned to German investigation in subdivisions 24 to 29 were covered by hydroacoustic transects. For some rectangles, due to spatial constrains the total hydroacoustic track length was however lower than the recommended 60 nautical miles (see Figure 1). Absence of licence delivery for all specific planned station in the Swedish EEZ due to military exercises forced significant track changes. This resulted in total hydroacoustic track lengths below 60 nautical miles in 18 of the 27 rectangles assigned as German investigation area.

At the time of writing the hydroacoustic data are still being processed and the final analysis will be accomplished by the end of 2020.

3.3 Biological sampling

Trawling was done with the pelagic gear "PSN205" in the midwater as well as near the bottom to identify the echo signals. The aim was to conduct at least two fishing hauls per ICES statistical rectangle. The trawling time lasted usually 30 minutes at a speed of 3 to 3.5 knots. The fishing time was however in most cases decreased because of abundant echo observed with the Scanmar-net-probe. In accordance to the IBAS manual codend inlets with stretched 20 mm mesh sizes in Subdivision 24 and 12 mm in Subdivision 25 to 28 were used.

The trawling depth and the net opening were controlled by a Scanmar-net-probe. Generally the net opening was around 12 m when deployed. The trawl depth (headrope below the surface) was chosen regarding the highest density of fish on the echogram and ranged from 14 m to 83 m. The bottom depth at the trawling positions varied from 33 m to 252 m.

Samples were taken from each haul in order to determine the length and weight distribution of fish. Comparison of length distribution of herring and sprat between BASS 2019 and BASS 2020 is presented in Figure 2. Sub-samples of cod, 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 otolith to estimate fish age are still being processed and the final analysis will be accomplished by the end of 2020.

In total 55 standard hauls were (55 valid) carried out for the BASS:

Subdivision	Hauls (n)
24	9
25	19
26	3
27	4
28	12
29	8

Altogether 34,344 fish were measured and 2,297 additional fish (709 sprats, 1,434 herrings and 154 cods) were sampled for further age determination.

Species	Length measurements	Number of hauls were present
<i>Ammodytes</i>	2	2
<i>Belone belone</i>	5	2
<i>Clupea harengus</i>	16,833	55
<i>Cyclopterus lumpus</i>	3	3
<i>Engraulis encrasicolus</i>	5	3
<i>Gadus morhua</i>	154	30
<i>Gasterosteus aculeatus</i>	1,446	38
<i>Hyperoplus lanceolatus</i>	4	3
<i>Merlangius merlangus</i>	114	5
<i>Platichthys flesus</i>	24	14
<i>Pleuronectes platessa</i>	6	1
<i>Scomber scombrus</i>	1	1
<i>Sprattus sprattus</i>	15,745	54
<i>Trachurus trachurus</i>	1	1

Overall catch (kg.0.5 hr⁻¹) during the BASS per haul, ICES rectangle, ICES subdivision and species is represented in Table 1 and spatial distribution of the catches per species is presented in Figure 3.

3.4 Hydrography

A Seabird-CTD-probe equipped with a carousel water sampler and oxygen sensor was used for hydrographical measurements. Vertical profiles were taken on a fixed station grid along the track. Additional CTD casts were done after or before each trawl if distance from the planned station was high enough (ca. 5 nmi). The profiles covered the entire water column to about 2 m above the sea bottom. Water samples were taken once or twice per day from different depths to check the oxygen data by Winkler titration and to collect reference salinity samples. The hydrological raw data were aggregated to 1 m depth strata. Altogether 109 CTD casts were performed during the hydroacoustic part of the cruise and thirteen CTD casts during the bongo sampling resulting in 122 CTD casts in total.

Measurements showed a regular stratification of the water column during the survey (Figure 4). Temperature, salinity and oxygen profiles are represented in Figure 4. Seawater temperature ranged from 13.9 °C at the surface to 4.6°C (recorded at 40.3 m depth). At the deepest CTD cast of the survey (178.6 m) temperature was measured at 7.3°C. Overall intermediate water masses (depth ranging from 25.5 to 84.6 m) presented temperature below 6°C, which is higher than in previous years where temperatures below 4°C were recorded. Temperatures below 4°C are considered as a temperature threshold limit for the distribution of sprat in the water column. Higher temperature were recorded above and below this stratum. Measured salinity ranged from 3.6 psu at the surface layer up to a maximum of 16.8 psu at the bottom of the Bornholm Basin. Oxygen concentrations ranged from 0.05 to 9.7 mL.L⁻¹. Overall hypoxic conditions (<1.4 mL.L⁻¹) were observed below 60 m depth all along the survey. No fish echo was usually observed under these conditions.

4. Survey participants

Name	Function	Institution
P. Rodriguez-Tress	Co-Cruise leader	TI-OF
S. Haase	Co-Cruise leader	TI-OF
L. Hartkens	Acoustics	TI-SF
M. Koth	Fishery biology	TI-OF
S. Niemann	Fishery biology	TI-OF
M. Bächtiger	Fishery biology	TI-OF (student assistant)
A. Fiek	Fishery biology	TI-OF (student assistant)
K. Heinatz	Fishery biology	TI-OF (student assistant)
L. Scherffenberg Lundgaard	Fishery biology	DTU Aqua

5. Acknowledgements

We hereby thank all participants, the crew of FRV “Walther Herwig III” and Captain S. Meier for their outstanding cooperation and commitment.

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>

7. Figures

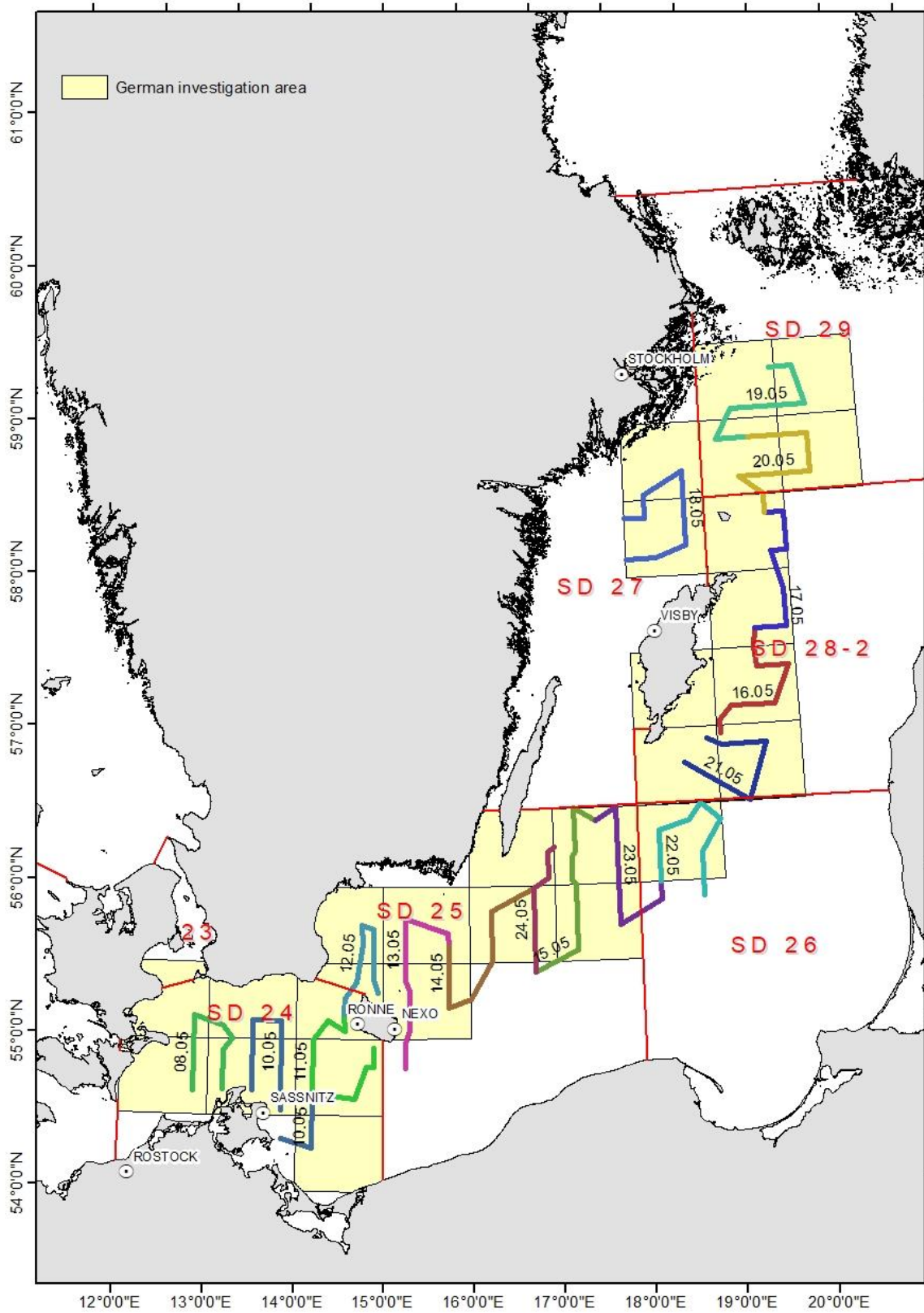


Figure 1: FRV “Walther Herwig III” cruise 435/2020: Daily hydroacoustic tracks done during the BASS survey 2020 (WH435).

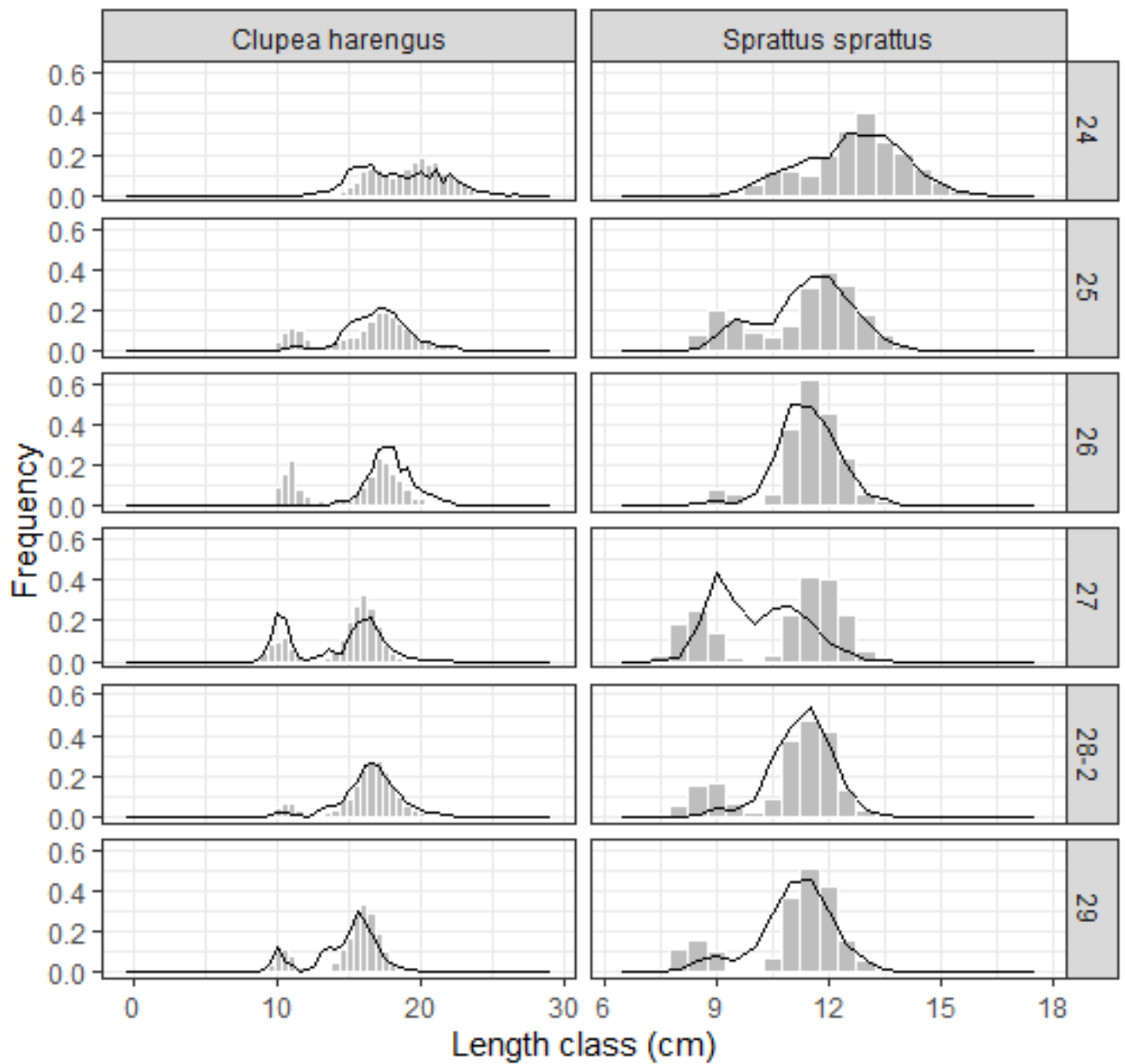


Figure 2: FRV “Walther Herwig III” cruise 435/2020: Herring and sprat length distribution measured per ICES subdivision during BASS 2019 (black lines) and BASS 2020 (grey bars).

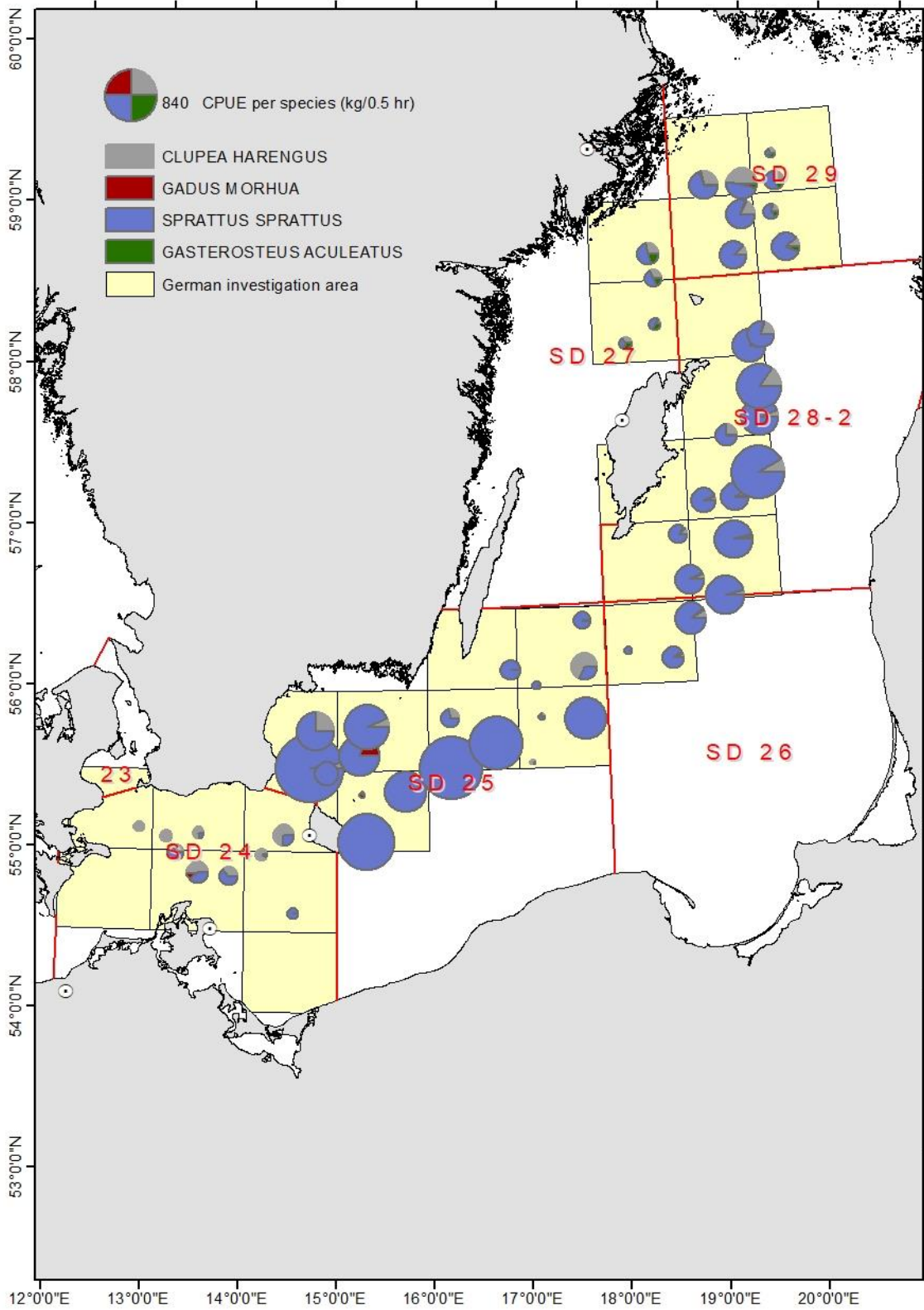


Figure 3: FRV “Walther Herwig III” cruise 435/2020: CPUE (kg.0.5 hr⁻¹) of catch per species recorded during the BASS survey 2020 with the FRV Walther Herwig III.

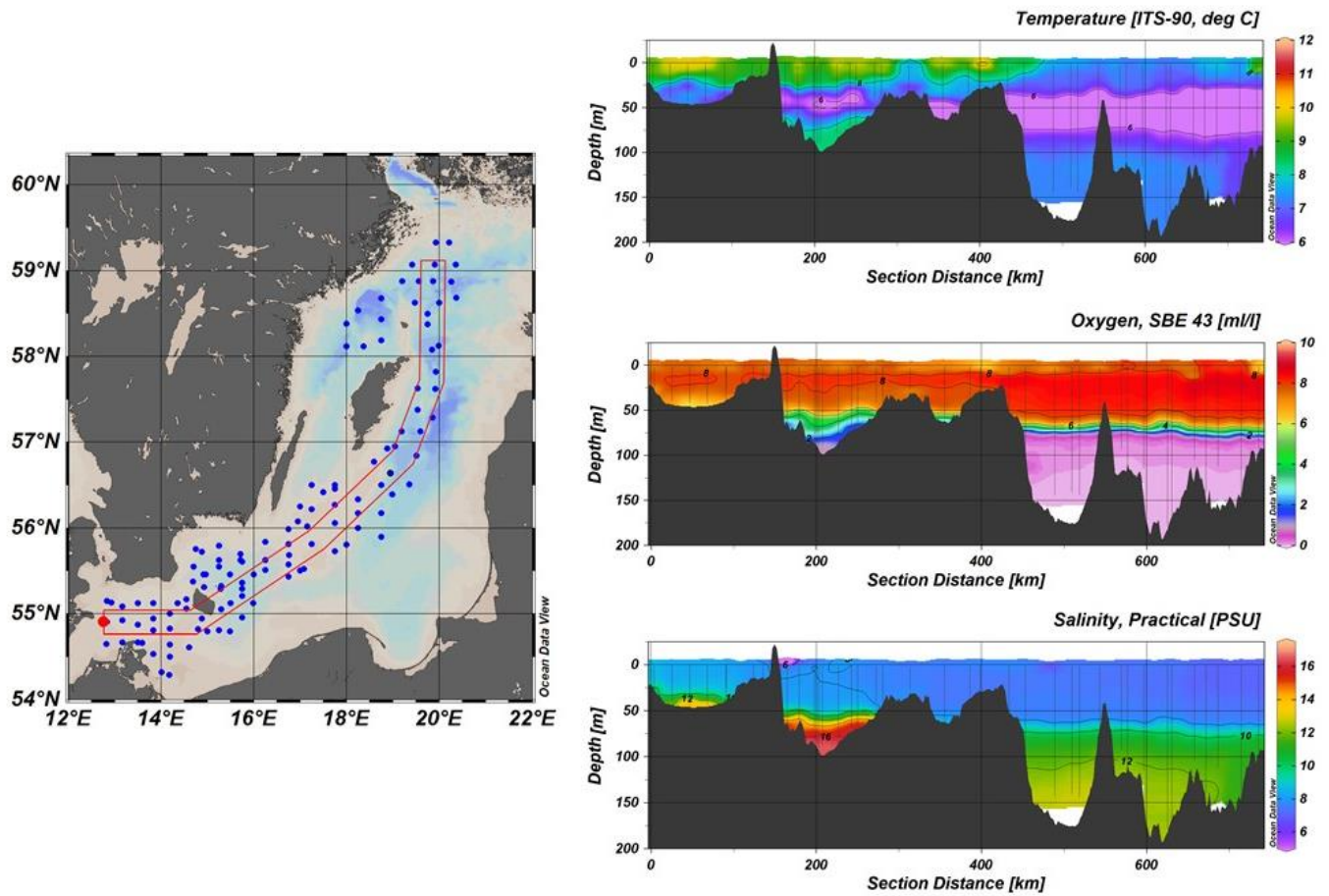


Figure 4: FRV “Walther Herwig III” cruise 435/2020: Temperature (upper right panel), oxygen (middle right panel) and salinity (lower right panel) interpolated from CTD casts along a south/west - north/east transect as shown in the left panel (red line). CTD casts coordinates are display as blue dots on the map in the left panel.

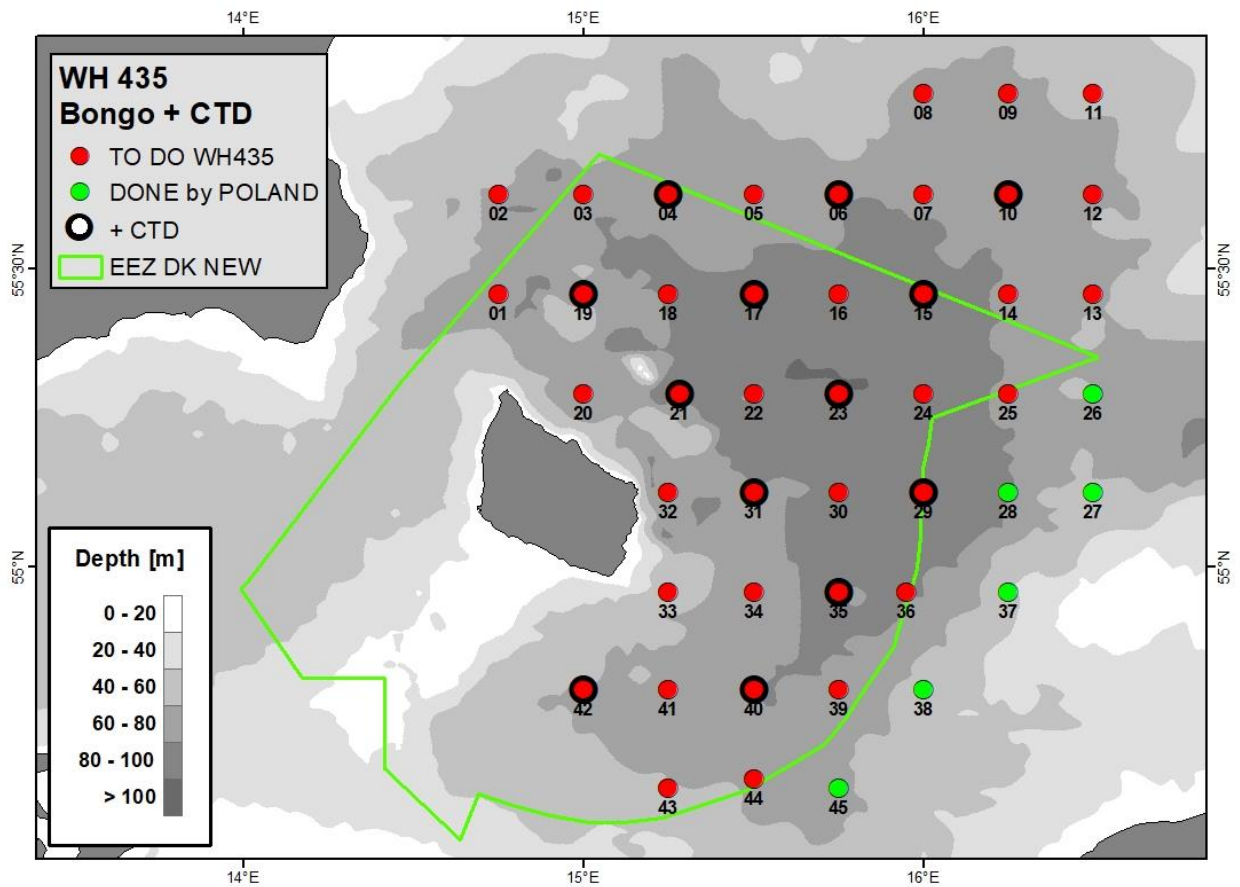


Figure 5: FRV “Walther Herwig III” cruise 435/2020: Bongo stations (red circles) done during the BASS survey 2020 (WH435). Green circled stations were done by Poland. Bold-framed circles indicate CTD-stations and the green line indicates the Danish exclusive economic zone (EEZ).

8. Tables

Table 1: FRV “Walther Herwig III” cruise 435/2020: 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 (ANE = *Engraulis encrasicolus*; COD = *Gadus morhua*; FLE = *Platichthys flesus*; GAR = *Belone belone*; GTA = *Gasterosteus aculeatus*; HER = *Clupea harengus*; HOM = *Trachurus trachurus*; LUM = *Cyclopterus lumpus*; MAC = *Scomber scombrus*; PLE = *Pleuronectes platessa*; SPR = *Sprattus sprattus*; WHG = *Merlangius merlangus*; YEZ = *Hyperoplus lanceolatus*). Ammo. stands for *Ammodytes sp.*.

Haul No.	ICES SD	ICES rectangle	Ammo.	ANE	COD	FLE	GAR	GTA	HER	HOM	LUM	MAC	PLE	SPR	WHG	YEZ
1	24	39G2	-	-	-	-	-	-	29.74	-	-	-	-	0.18	-	-
2	24	39G3	-	-	-	-	-	-	41.5	-	-	-	-	0.27	-	-
3	24	38G3	-	-	-	-	-	-	22.27	-	-	-	-	49.90	3.41	-
4	24	38G3	-	-	13.80	3.33	-	-	65.92	-	-	-	3.41	49.88	29.28	-
5	24	39G3	-	-	-	-	0.83	-	29.85	-	-	-	-	7.70	0.71	-
6	24	38G3	-	-	-	0.32	0.78	-	36.67	-	0.01	-	-	66.07	-	-
7	24	39G4	-	-	-	-	-	-	94.65	-	-	-	-	31.59	-	-
8	24	38G4	-	-	0.39	-	-	-	36.92	-	-	-	-	4.21	-	0.02
9	24	38G4	-	-	-	-	-	-	1.41	-	-	-	-	33.81	-	-
10	25	39G4	-	-	1.36	-	-	-	10.43	-	-	-	-	253.41	-	-
11	25	40G4	-	-	1.92	-	-	-	39.21	-	-	-	-	1368.18	0.24	-
12	25	40G4	-	-	-	-	-	-	106.46	-	-	-	-	332.14	-	-
13	25	39G4	-	0.02	-	-	-	-	1.04	-	-	-	-	167.85	-	-
14	25	39G5	-	-	0.85	-	-	-	4.31	-	-	0.6	-	964.05	-	-
15	25	39G5	-	0.21	9.01	2.20	-	-	1.60	0.11	-	-	-	0.00	-	-
16	25	40G5	-	-	98.10	-	-	-	5.29	-	-	-	-	387.60	-	-
17	25	40G5	-	-	0.82	-	-	0.01	39.52	-	-	-	-	560.02	0.31	-
18	25	39G5	-	-	4.89	3.21	-	0.03	4.95	-	-	-	-	495.90	-	-
19	25	40G6	-	0.07	4.99	-	-	-	3.10	-	-	-	-	1199.00	-	-
20	25	40G6	-	-	-	-	-	0.18	28.45	-	-	-	-	73.40	-	-
21	25	40G7	-	-	-	-	-	-	6.43	-	-	-	-	0.94	-	0.02
22	25	40G7	-	-	-	-	-	0.05	2.72	-	+	-	-	8.80	-	0.03
23	25	41G7	-	-	-	-	-	0.14	0.89	-	-	-	-	19.82	-	-
24	28-2	43G9	-	-	4.40	0.20	-	0.11	9.83	-	-	-	-	170.16	-	-
25	28-2	43G9	-	-	0.98	0.88	-	2.95	20.61	-	-	-	-	208.12	-	-
26	28-2	43G9	-	-	3.06	0.56	-	0.53	76.29	-	0.71	-	-	788.34	-	-
27	28-2	44G9	-	-	-	-	-	1.51	33.87	-	-	-	-	99.50	-	-
28	28-2	44G9	-	-	0.82	0.39	-	0.02	24.51	-	-	-	-	388.68	-	-
29	28-2	44G9	-	-	1.23	0.53	-	0.11	91.08	-	-	-	-	511.44	-	-
30	28-2	45G9	-	-	-	-	-	5.40	58.50	-	-	-	-	267.42	-	-
31	28-2	45G9	-	-	3.14	0.33	-	0.61	41.42	-	-	-	-	158.94	-	-
32	27	45G8	+	-	-	-	-	14.24	15.54	-	-	-	-	14.72	-	-
33	27	45G8	-	-	0.48	-	-	14.08	6.56	-	-	-	-	20.02	-	-
34	27	46G8	-	-	1.22	-	-	15.06	27.19	-	-	-	-	43.42	-	-
35	27	46G8	0.01	-	-	-	-	28.01	40.33	-	-	-	-	72.35	-	-
36	29	47H0	-	-	-	-	-	11.30	9.62	-	-	-	-	8.50	-	-
37	29	47H0	-	-	-	-	-	17.11	25.04	-	-	-	-	60.08	-	-
38	29	47G9	-	-	2.06	-	-	16.22	142.82	-	-	-	-	138.96	-	-
39	29	47G9	-	-	4.74	-	-	2.67	67.68	-	-	-	-	160.62	-	-
40	29	46G9	-	-	5.35	-	-	2.15	47.04	-	-	-	-	206.88	-	-

41	29	46H0	-	-	2.07	-	-	10.11	14.65	-	-	-	-	42.18	-	-
42	29	46H0	-	-	-	0.36	-	16.14	27.74	-	-	-	-	190.02	-	-
43	29	46G9	-	-	0.79	0.31	-	1.55	27.63	-	-	-	-	194.70	-	-
44	28-2	42G8	-	-	4.26	-	-	0.66	11.94	-	-	-	-	81.51	-	-
45	28-2	42G9	-	-	6.08	0.21	-	2.01	14.89	-	-	-	-	418.02	-	-
46	28-2	42G9	-	-	1.86	-	-	1.78	19.81	-	-	-	-	412.35	-	-
47	28-2	42G8	-	-	2.48	-	-	2.07	16.05	-	-	-	-	224.10	-	-
48	26	41G8	-	-	4.97	-	-	0.14	9.05	-	-	-	-	122.16	-	-
49	26	41G8	-	-	5.90	0.23	-	0.05	29.01	-	-	-	-	266.70	-	-
50	26	41G8	-	-	-	-	-	0.05	0.54	-	-	-	-	14.64	-	-
51	25	40G7	-	-	-	-	-	0.01	0.58	-	-	-	-	530.82	-	-
52	25	41G7	-	-	0.67	-	-	0.01	144.76	-	-	-	-	65.32	-	-
53	25	41G7	-	-	-	-	-	1.17	0.44	-	-	-	-	88.98	-	-
54	25	41G6	-	-	-	-	-	0.20	1.43	-	-	-	-	115.56	-	-
55	25	40G6	-	-	-	-	-	-	4.25	-	-	-	-	856.13	-	-