

**Standard and Cruise Reports of BITS surveys at the WGBIFS 2023 annual meeting** Note:

Authors are fully responsible for quality of the prepared text and all kind of presented data

List of standard reports:

- 1. BITS 2022 Quarter 4 Standard Report of Lithuania.
- 2. BITS 2022 Quarter 4 Standard Report of Germany.
- 3. BITS 2022 Quarter 4 Standard Report of Estonia;
- 4. BITS 2022 Quarter 4 Standard Report of Poland.
- 5. BITS 2022 Quarter 4 Standard Report of Latvia-Poland.
- 6. BITS 2022 Quarter 4 Standard Report of Denmark.
- 7. BITS 2022 Quarter 4 Standard Report of Sweden.
- 8. BITS 2023 Quarter 1 Standard Report of Germany.
- 9. BITS 2023 Quarter 1 Standard Report of Poland.
- 10. BITS 2023 Quarter 1 Standard Report of Latvia-Poland.
- 11. BITS 2023 Quarter 1 Standard Report of Denmark.
- 12. BITS 2023 Quarter 1 Standard Report of Sweden.
- 13. BITS 2023 Quarter 1 Standard Report of Lithuania

List of cruise reports:

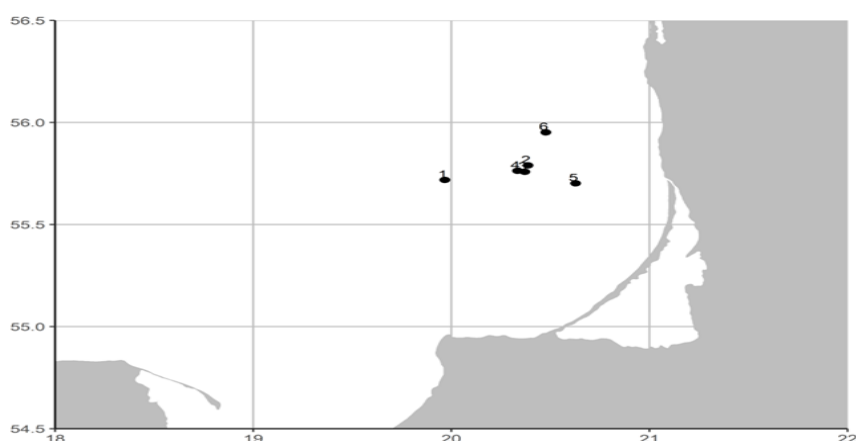
- 1. BITS 2022 Quarter 4 Cruise Report of Sweden.
- 2. BITS 2022 Quarter 4 Cruise Report of Latvia and Poland.
- 3. BITS 2022 Quarter 4 Cruise Report of Germany.
- 4. BITS 2022 Quarter 4 Cruise Report of Poland.
- 5. BITS 2022 Quarter 4 Cruise Report of Denmark.
- 6. BITS 2023 Quarter 1 Cruise Report of Sweden.
- 7. BITS 2023 Quarter 1 Cruise Report of Poland.
- 8. BITS 2023 Quarter 1 Cruise Report of Latvia and Poland.
- 9. BITS 2023 Quarter 1 Cruise Report of Germany.

<b>NATION:</b>	<b>LITHUANIA</b>	<b>VESSEL:</b>	<b>FV ATLANT</b>
Survey:	BITS2022Q4	Dates:	17 <sup>th</sup> – 18 <sup>th</sup> November 2022

Cruise	
Gear details:	The small (520#) standard TV3 trawl was used.
Notes from survey (e.g. problems, additional work etc.):	<p>Survey made with Lithuania commercial fishery vessel Atlant. Total 6 fishing hauls was performed. The duration of the hauls were from 30 to 40 minutes and the velocity was 2.7 - 3 knots.</p> <p>The total catch of each haul was analysed to determine the species composition in weight and number, as well as length distribution among all species. Total 11 fish species were registered during survey.</p> <p>Sub-samples of cod and flatfishes were investigated concerning sex, maturity and age. Cod also were investigated cod liver parasites.</p> <p>All survey was done as planed without issues.</p>
Additional comments:	

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (2–6)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING “STANDARD” GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
26	TVS	2	1	1	-	-	-	-	100
26	TVS	3	4	4	-	-	-	-	100
26	TVS	4	1	1	-	-	-	-	100

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):		
SPECIES	LENGTH	AGE
<i>Alosa fallax</i>	284	
<i>Clupea harengus</i>	930	
<i>Gadus morhua</i>	1951	311
<i>Gasterosteus aculeatus</i>	2	
<i>Myoxocephalus scorpius</i>	22	
<i>Neogobius melanostomus</i>	1	
<i>Osmerus eperlanus</i>	406	
<i>Platichthys flesus</i>	899	272
<i>Pleuronectes platessa</i>	6	
<i>Pomatoschistus minutus</i>	4	
<i>Scophthalmus maximus</i>	19	6
<i>Sprattus sprattus</i>	185	



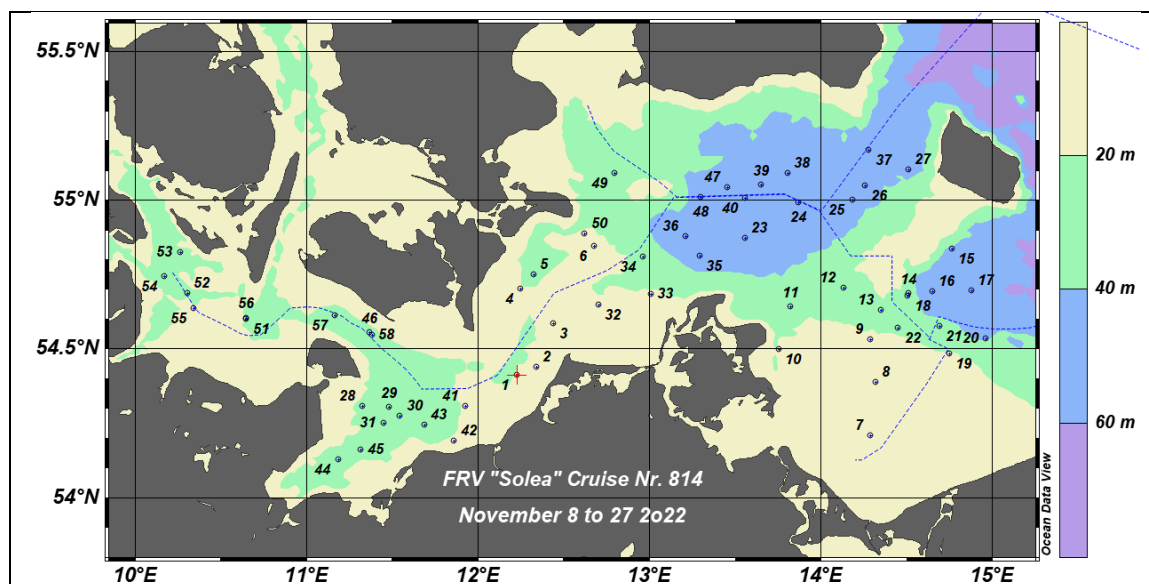
NATION:	GERMANY	VESSEL:	FRV "SOLEA"
Survey:	BITS 2022, quarter 4	Dates:	8 <sup>th</sup> – 27 <sup>th</sup> November 2022

Cruise	
Gear details:	The small (520#) standard TV3 trawl was used. All Tow Database stations were fished without rock-hoppers. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	A total of 57 fishing hauls and 58 hydrographic stations of out of a total 58 fishing hauls and 58 hydrographic stations planned were performed. Three hauls in Polish waters since five years fishing again. Bad weather caused two days downtime.
Additional comments:	

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (1–3)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING "STANDARD" GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATION S FISHED
22	TVS	1	1	1	-	-	-	-	100
22	TVS	2	17	17	-	-	-	-	100
24	TVS	1	6	6	-	-	-	-	100
24	TVS	2	15	14	-	-	-	-	93
24	TVS	3	19	19	-	-	-	-	100

**NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, \*MATURITY ONLY):**

SPECIES	LENGTH	AGE
<i>Gadus morhua</i>	10880	759
<i>Platichthys flesus</i>	3577	600
<i>Pleuronectes platessa</i>	9770	872
<i>Limanda limanda</i>	7221	610
<i>Psetta maxima</i>	189	189
<i>Scophthalmus rhombus</i>	13	13
<i>Clupea harengus</i>	3859	-
<i>Sprattus sprattus</i>	3580	-



<b>NATION:</b>	<b>ESTONIA</b>	<b>VESSEL:</b>	<b>CEV</b>
Survey:	BITS21IVQRT	Dates:	12.- 14. November 2022

Cruise	
Gear details:	The TV3 (530) standard trawl was used during the survey. The construction of the trawl follows the specifications described in the BITS manual.
Notes from survey (e.g. problems, additional work etc.):	The survey was carried out onboard of the chartered FV KAIRE (Stern trawler, L= 25.5 m; 221 kW), from 12 to 14 November 2022 as planned. Survey started late evening of 12 November 2022 from the Port of Haapsalu, steaming to the Sub-division 28-2. The weather conditions were initially very good for steaming to the work area: moderate NE-E wind from <10 m/s. By the time of commencing of survey hauls, the wind speed increased but still, it was possible to start working. During the survey the two allocated for Estonia and 5 additional hauls were carried out. All hauls were carried out as planned and without problems. The survey was finished in the morning of hours of 14 November 2022 in the Port of Virtsu. No technical problems were observed during the survey this year. All catches were worked up and biologically analysed at the Pärnu Laboratory of the Estonian Marine Institute. The biological and other obligatory information (marine litter) collected during the survey has been uploaded to the DATRAS database.

ICES SUB-DIVISIONS	GEAR (TVL,TVS)	DEPTH STRATA (1-6)	NUMBER OF HAULS PLANNED	NUMBER OF VALID HAULS REALIZED USING "STANDARD" GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACEMENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
28	TVS	4	1	1	0	0	0	0	100
28	TVS	5	1	1	0	0	0	0	100

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):			
SPECIES	AGE	LENGTH	LIVER PARASITES COUNTED
<i>Gadus morhua</i>	235	235	235
<i>Sprattus sprattus</i>	0	174	0
<i>Clupea harengus</i>	0	353	0
<i>Platichthys flesus</i>	201	1267	0
<i>Scophthalmus maximus</i>	8	8	0





Approximate positions of realised hauls during Estonian BITS survey in 4 QRT 2022

Estonian BITS IV Quarter 2022: Overview of catches.

EST BITS 2022 4. Qrt		Catch composition, kg per 30 min haul						
Haul no.		1*	2*	3*	4*	5*	6	7
Haul ID		28091	28030	28029	28192	28077	28190	28061
Sd		28_2	28_2	28_2	28_2	28_2	28_2	28_2
Depth, m		46	47	58	68	74	86	60
Actual LAT ↓		57° 56,4'	57° 55,4'	57° 55,2'	57° 58,42'	58° 03,5'	57° 59,54'	58° 27,1'
Actual LON ↓		21°39,17'	21°35,6'	21°31,3'	21°18,39'	21°1,24'	21° 0'	21°34,2'
Date		13.11.2022	13.11.2022	13.11.2022	13.11.2022	13.11.2022	13.11.2022	13.11.2022
Catch, kg		57,14	39,44	69,97	27,06	25,11	3,08	0,31
Platichthys flesus		52,790	32,300	54,340	20,300	13,140	1,610	0,170
Gadus morhua		1,820	4,680	15,210	5,800	8,660	1,100	0,000
Scophthalmus maximus		0,440	0,520	0,000	0,000	0,450	0,000	0,000
Clupea harengus		0,046	0,016	0,075	0,050	0,065	0,100	0,062
Sprattus sprattus		0,010	0,010	0,000	0,002	0,068	0,050	0,075
Osmerus eperlanus		0,411	0,024	0,068	0,045	0,000	0,000	0,000
Trigloporus quadricornis		0,126	0,270	0,000	0,000	0,000	0,000	0,000
Myoxocephalus scorpius		0,000	0,598	0,209	0,586	2,633	0,222	0,000
Cyclopterus lumpus		0,000	0,000	0,000	0,000	0,000	0,000	0,000
Zoarces viviparus		0,112	0,132	0,045	0,161	0,000	0,000	0,000
Gobius sp.		0,982	0,519	0,019	0,077	0,090	0,000	0,000
Pungitius pungitius		0,000	0,000	0,000	0,000	0,000	0,000	0,000
Acerina cernua		0,000	0,000	0,000	0,000	0,000	0,000	0,000
Gasterosteus aculeatus		0,009	0,000	0,000	0,002	0,002	0,000	0,003
Neogobius melanostomus		0,273	0,097	0,000	0,000	0,000	0,000	0,000
Trigloporus quadricornis		0,126	0,270	0,000	0,000	0,000	0,000	0,000
Alosa fallax		0,000	0,000	0,000	0,000	0,000	0,000	0,000
Lumpenus lampretaeformis		0,000	0,000	0,000	0,037	0,000	0,000	0,000
Pungitius pungitius		0,000	0,000	0,000	0,000	0,001	0,000	0,000
Total		57,14	39,44	69,97	27,06	25,11	3,08	0,31
* Hauls 1-5 are the additional hauls								

<b>NATION:</b>	<b>POLAND</b>	<b>VESSEL:</b>	<b>RV “BALTICA”</b>
Survey:	BITS-4Q/2022	Dates:	16/11-08/12/2022
Cruise	No. 20/2022/MIR		
Gear details:	The standard rigging cod ground trawl type TV-3#930, with 10-mm mesh bar length in the codend was applied for fish control-catches realisation. The construction of the trawl follows the specifications in the manual.		
Notes from survey (e.g. problems, additional work etc.):	<p>According to the WGBIFS recent (April 2022) recommendations, the vessel “Baltica” was designated to cover in November/December 2022 survey, the Polish part of ICES Sub-divisions 25 and 26 with 11 and 40, respectively randomly selected bottom research hauls, and also in the Swedish EEZ to cover Swedish part of ICES Sub-divisions 25 and 26 with 1 and 10 hauls, respectively. The R/V Baltica realized 62 of the 62 planned hauls for this survey. Due to oxygen level on the bottom below 0.5 ml/l, hauls No 26141, 26076, 26140, 26221, 26110, 26107, 26094, 26045 and 26257 were not realized. These hauls were classified as “Assumed zero catch hauls”. In total 62 fish catch-stations can be accepted as representative.</p> <p>Due to rocky bottom, commercial fishing activity or large fish concentrations observed in echosounder – 3, 5 and 4 hauls were shortened to 10, 15 and 20 min, respectively. Weather conditions were good during the whole survey.</p> <p>Every control-haul was preceded by the seawater temperature, salinity and oxygen content measurements, made continuously from the sea-surface to a bottom. Overall, 62 fish catch-stations starting positions and 23 standard hydrographic stations were controlled by the SeaBird SBE 911 CTD-probe combined with the rosette sampler (the bathometer rosette). Oxygen content was determined by the standard Winkler’s method.</p>		
Additional comments:			

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (2–6)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING “STANDARD” GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACEMENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
25	TVL	2	11	11	0	0	0	0	100
25	TVL	3	1	1	0	0	0	0	100
26	TVL	2	11	10	0	0	0	0	91
26	TVL	3	9	10	0	0	0	0	111
26	TVL	4	11	11	0	2	0	0	118
26	TVL	5	14	9	0	3	0	0	86
26	TVL	6	5	1	0	4	0	0	100

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):		
SPECIES (LATIN NAME)	Length	Age and maturity
<i>Gadus morhua</i>	6098	335
<i>Clupea harengus</i>	8109	749
<i>Sprattus sprattus</i>	5052	430
<i>Platichthys flesus</i>	3594	676
<i>Pleuronectes platessa</i>	202	198
<i>Zoarces viviparus</i>	10	
<i>Enchelyopus cimbrius</i>	12	
<i>Perca fluviatilis</i>	1	
<i>Gasterosteus aculeatus</i>	777	
<i>Myoxocephalus scorpius</i>	190	
<i>Neogobius melanostomus</i>	3	

<i>Osmerus eperlanus</i>	12	
<i>Alosa fallax</i>	24	
<i>Scophthalmus maximus</i>	17	17
<i>Engraulis encrasicolus</i>	11	
<i>Hyperoplus lanceolatus</i>	39	
<i>Cyclopterus lumpus</i>	1	
<i>Agonus cataphractus</i>	2	
<i>Merlangius merlangus</i>	4	
<i>Pomatoschistus minutus</i>	1	

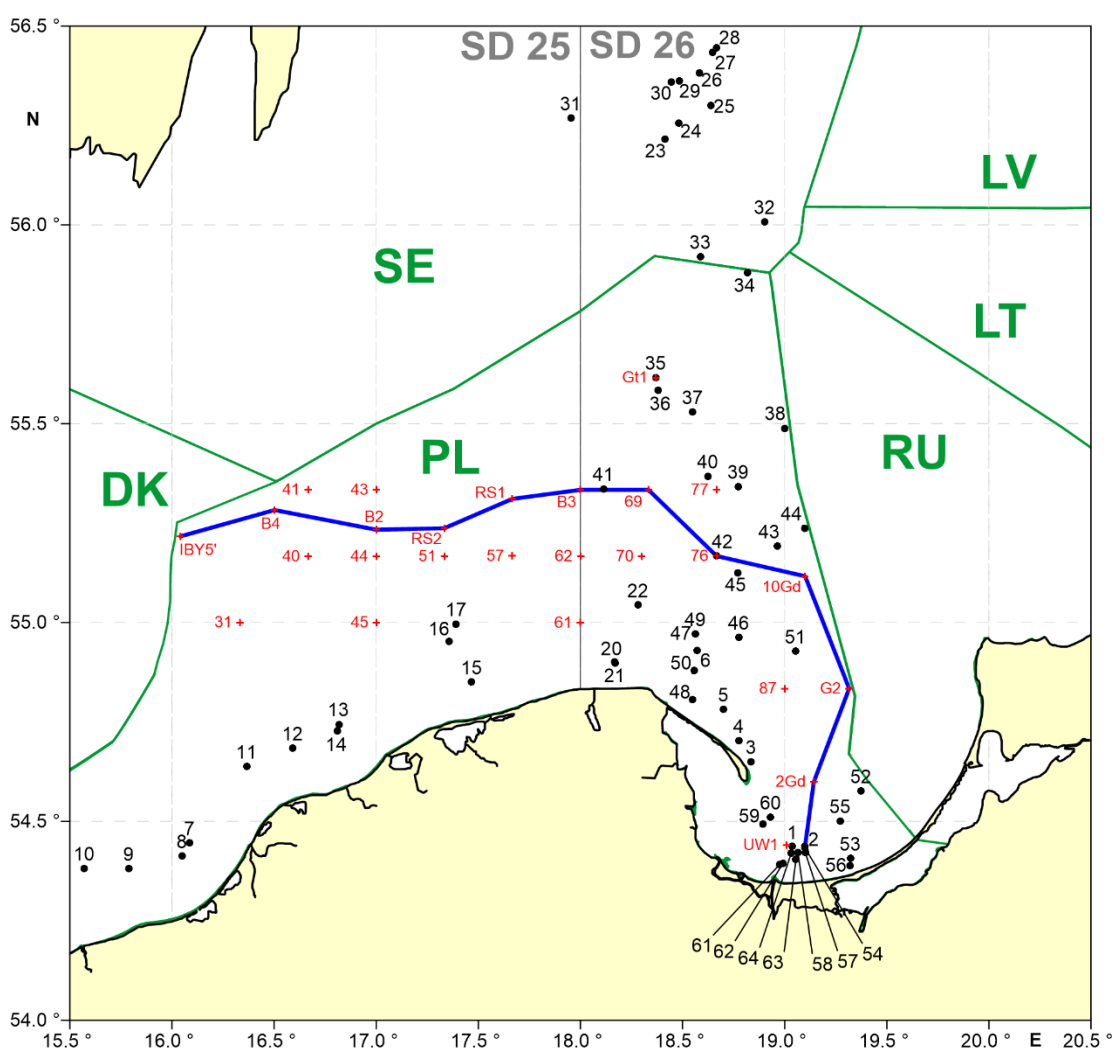


Fig. 1. Location of the bottom trawl hauls (black crosses) and the hydrological standard stations (red dots) investigated by the r.v. “Baltica” during the BITS-4Q 2022 survey (blue line – hydrological profile). (DK – Denmark, LT – Lithuania, LV – Latvia, PL – Poland, RU – Russia, SE – Sweden)

<b>NATION:</b>	<b>LATVIA</b>	<b>VESSEL:</b>	<b>RV “BALTICA”</b>
Survey:	BITS-Q4/2022	Dates:	11-21/12/2022

Cruise	No. 2/2022
Gear details:	The hard bottom ground-rope (rockhopper) trawl, type TV-3#930 (with 10-mm mesh bar length in the codend) was applied for fish catches. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	<p>The original survey plan specified that 24 control-hauls will be realized in the Latvian EEZ (8 trawls in SD 26, 16 trawls in SD 28).</p> <p>The r.v. “Baltica” realized 21-bottom trawl control-hauls including the Latvian territorial waters (Fig.1). Four catch-stations were only initiated due to hydrological parameters measurement and due to very low oxygen concentration (below 0.5 ml/l) near bottom, fishing was omitted.</p> <p>All trawl catches were performed during daylight hours. The hard-bottom ground-rope (rockhopper) trawl, type TV-3#930 (with 10-mm mesh bar length in the codend) was applied for fish catches. The mean speed of vessel while trawling was 2.9 knots. For all realized hauls, their duration was shortened to 10-20 minutes, due to dense clupeid fish concentrations observed on the echosounder or bad weather.</p> <p>The length measurements in the 1.0cm classes were realised for 495 cod and 1898 flounder. Length measurements in the 0.5cm classes were realized for 1719 herring and 1639 sprat. In total, 341 cod and 431 flounder individuals were taken for biological analysis. Stomachs from the 277 cod were taken for investigation of cod feeding.</p> <p>Acoustic data, i.e., the echo-integration records (SA = NASCs; Nautical Area Scattering (Strength) Coefficient) were collected with the EK-60 scientific echosounder during fishing operations as well as the distances between consecutive hauls. The echosounder data collected during the BITS survey were delivered to the Latvian researchers for further analysis.</p> <p>Directly before every haul, the seawater temperature, salinity, and oxygen content were measured continuously from the sea surface to a bottom. The seawater samples were taken also at the standard HELCOM stations. Totally, 26 hydrological stations were inspected with the Neil-Brown CTD-probe combined with the rosette sampler (the bathometer rosette). Oxygen content was determined by the standard Winkler’s method.</p> <p>Meteorological observations such as wind velocity, direction and the sea state were realized at the actual geographic position of each control-haul.</p>
Additional comments:	

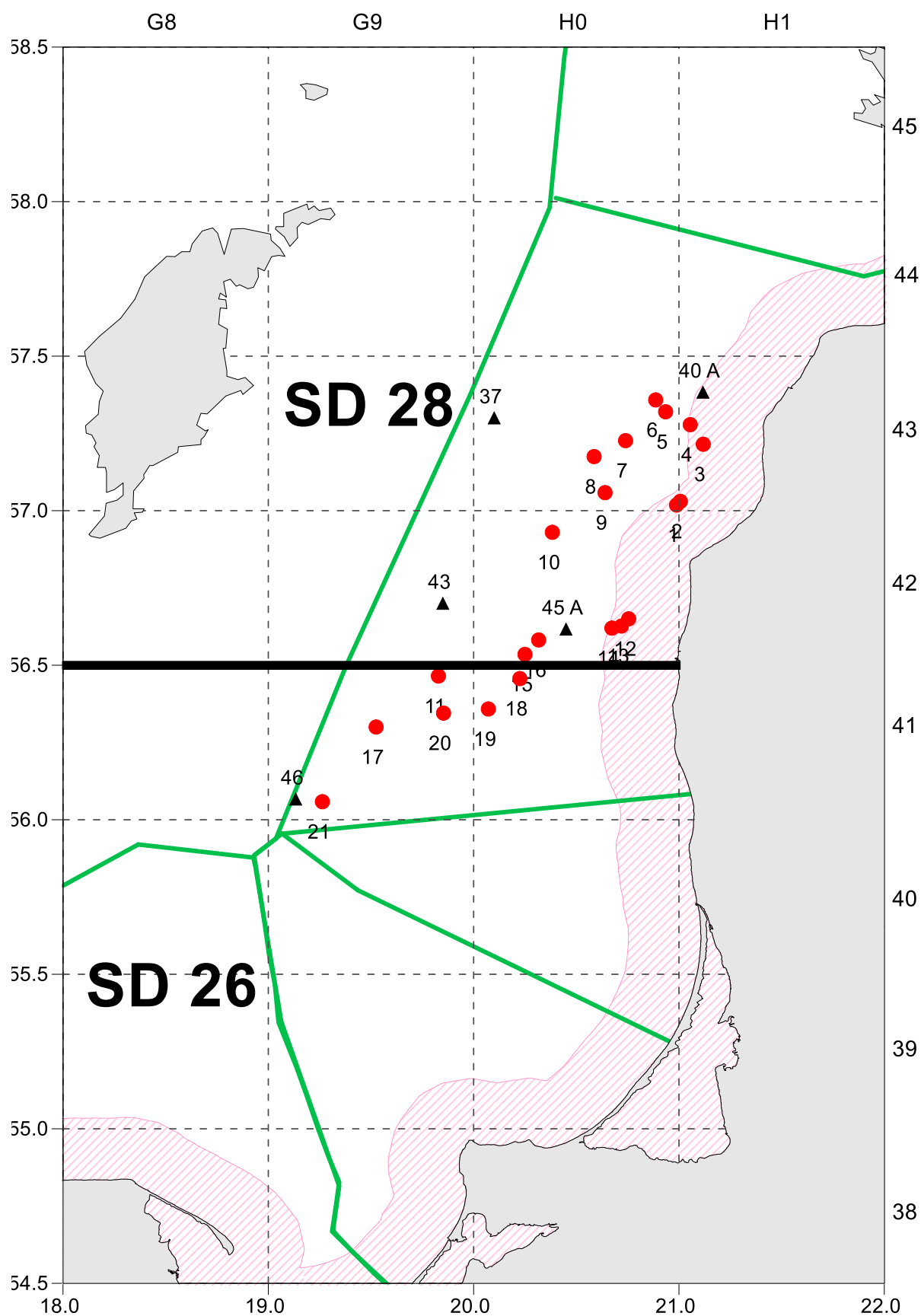


Figure 1. Location of the realized fish control-hauls (marked with red dots) and the HELCOM standard hydrological stations (marked with black triangles), green lines - national fishing zone borders, coloured area in pink - territorial waters.

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (2–6)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING “STANDARD” GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
26	TVL	4	2	0	2	0	0	0	100
26	TVL	5	3	0	1	0	0	0	33.3
26	TVL	6	3	0	0	3	0	0	100
28	TVL	2	5	0	3	0	0	0	60
28	TVL	3	4	0	3	0	0	0	75
28	TVL	4	2	0	5	0	0	0	250
28	TVL	5	5	0	3	1	0	0	80

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):		
SPECIES	LENGTH	AGE
<i>Alosa alosa</i>	22	0
<i>Clupea harengus</i>	1719	0
<i>Cyclopterus lumpus</i>	5	0
<i>Enchelyopus cimbrius</i>	2	0
<i>Engraulis encrasicolus</i>	3	0
<i>Gadus morhua</i>	495	341
<i>Gasterosteus aculeatus</i>	115	0
<i>Myoxocephalus scorpius</i>	59	0
<i>Neogobius melanostomus</i>	3	0
<i>Osmerus eperlanus</i>	16	0
<i>Platichthys flesus</i>	1898	0
<i>Pomatoschistus minutus</i>	1	0
<i>Scophthalmus maximus</i>	10	0
<i>Sprattus sprattus</i>	1639	0
<i>Zoarces viviparus</i>	10	0

<b>NATION:</b>	<b>DENMARK</b>	<b>VESSEL:</b>	<b>HAVFISKEN</b>
Survey:	Kasu	Dates:	17/10 - 6/11 2022

Cruise	Kasu 2-2022
Gear details:	The small (#520) standard TV3 trawl is used. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	2 stations in division 22 were moved due to problems with stones or other problems at the stations. 1 station in subdivision 22 was invalid and was not replaced.
Additional comments:	

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (1-6)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING "STANDARD" GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
20	TVS	3	1	1					100%
21	TVS	1	7	7					100%
21	TVS	2	13	13					100%
21	TVS	3	4	4					100%
21	TVS	4	1	1					100%
22	TVS	1	11	10				1	91%
22	TVS	2	20	20					100%
23	TVS	1	4	4					100%
23	TVS	2	1	1					100%
24	TVS	1	5	5					100%
24	TVS	2	3	3					100%

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL) * MATURITY AND SEX ONLY		
SPECIES	LENGTH	AGE
<i>RSP*</i>		1076
<i>TOR*</i>		431
<i>ISG*</i>		342
<i>HVL*</i>		297
<i>TNG*</i>		213
<i>PGH*</i>		149
<i>SLH*</i>		104
<i>KUL*</i>		13
<i>SKI*</i>		6
<i>KLM*</i>		0
<i>MSI*</i>		0

<b>NATION:</b>	<b>DENMARK</b>	<b>VESSEL:</b>	<b>DANA</b>
Survey:	BITSQ4	Dates:	31-10-2022 - 17-11-2022

Cruise	
Gear details:	The big (#920) standard TV3 trawl is used. The construction of the trawl follows the specifications in the manual. No rock hopper was used
Notes from survey (e.g. problems, additional work etc.):	Stomack sampling from cod, plankton fishing during night.
Additional comments:	

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (1-6)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING "STANDARD" GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
25	TVL	2	3	4	0	0	0	0	133.3
25	TVL	3	17	18	0	0	0	1	105.9
25	TVL	4	18	19	0	1	0	1	111.1
25	TVL	5	13	10	0	3	0	0	100.0
26	TVL	4	2	3	0	0	0	1	150.0
26	TVL	5	2	1	0	0	0	0	50.0

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):		
SPECIES	LENGTH	AGE
<i>plaice</i>	2732	415
<i>cod</i>	26316	1227
<i>flounder</i>	3062	198
<i>turbot</i>	33	92

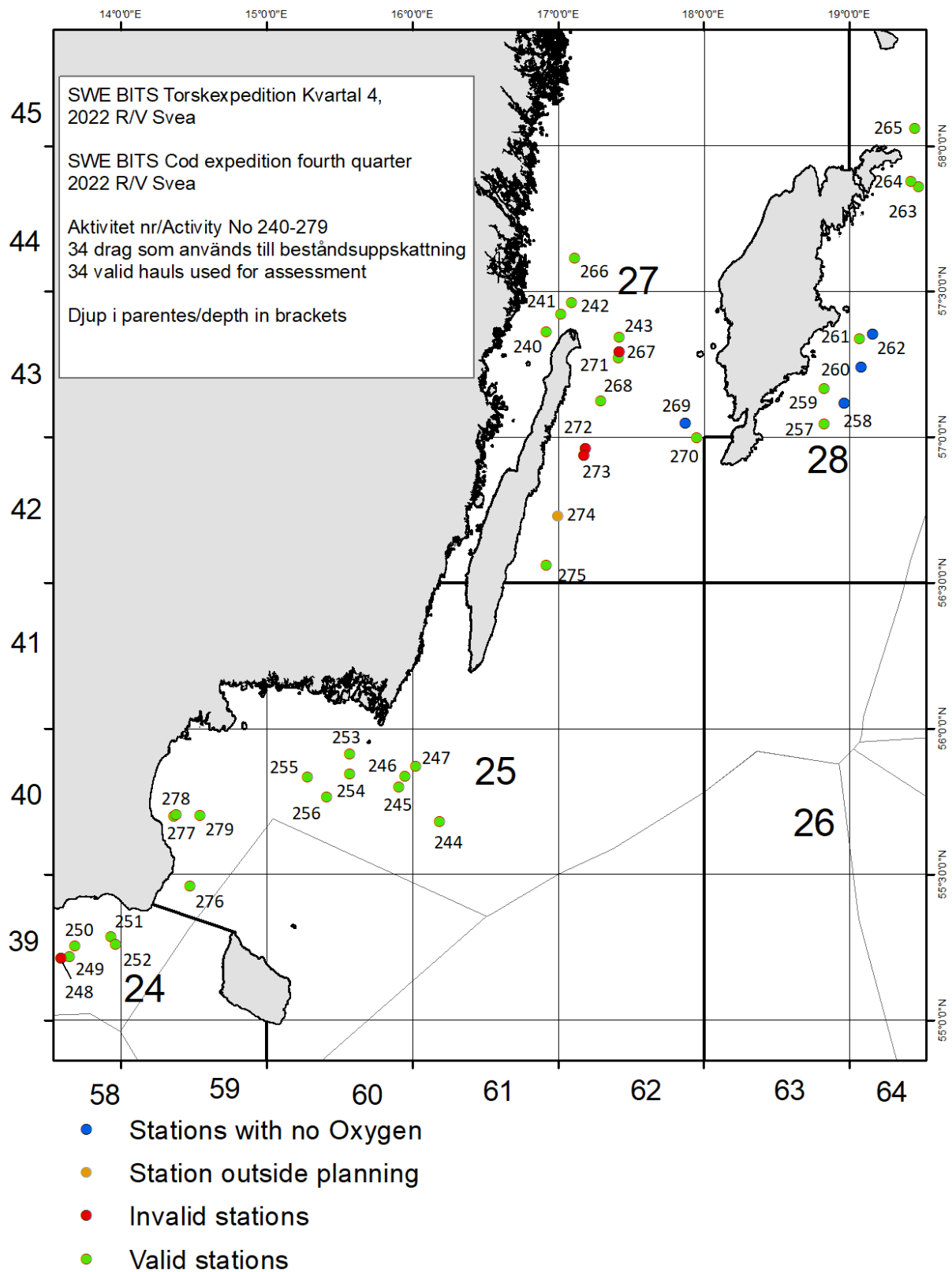


<b>NATION:</b>	<b>SWEDEN</b>	<b>VESSEL:</b>	<b>RV "SVEA"</b>
Survey:	BITS Q4 2022	Dates:	17-28 November 2022
Cruise			
Gear details:	The large (930#) standard TV3 trawl was used. No tows are done with the rock hopper ground gear on harder ground stations. The trawl construction is according to the specification in the BITS manual.		
Notes from survey (e.g. problems, additional work etc.):	33 stations were allocated, 33 of these were trawled. four hauls were replaced due to duplicate stations and poor seabed conditions. Two hauls in SD 27 and five hauls in SD 28 had oxygen deficiency.		
Additional comments:	Oxygen conditions were poor but not so bad that it was not possible to fish.		

ICES SUB- DIVISIONS	GEAR (TVL, TVS)	DEPTH (2-6)	NUMBER OF HAULS PLANNED	NUMBER OF VALID HAULS REALIZED USING "STANDARD " GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ZERO- CATCH HAULS	NUMBER OF REPLACE- MENT HAULS	NUMBER OF INVALID HAULS	STATIONS FISHED %
24	TVL	2	2	2	-	0	0	0	100
24	TVL	3	1	1	-	0	0	0	100
25	TVL	2	3	3	-	0	0	0	100
25	TVL	3	2	2	-	0	0	0	100
25	TVL	4	5	4		0	1	0	100
27	TVL	3	3	2	-	0	0	0	66
27	TVL	4	5	5	-	0	0	0	100
27	TVL	5	1	0	-	1	0	0	100
27	TVL	6	1	0		1	0	0	100
28	TVL	3	3	3	-	0	0	0	100
28	TVL	4	4	2	-	1	1	0	100
28	TVL	5	3	0	-	3	0	0	100
28	TVL	6	1	0	-	1	0	0	100

Remark. The % number deviates from 100 because the depth varied from before.

Number of biological samples (maturity, age and stomachs material, *maturity only):			
<i>Specname sci.</i>	<b>Lenght</b>	<b>Age</b>	<b>Stomachs</b>
<i>alosa fallax</i>	61		
<i>ammodytes tobianus</i>	1		
<i>anguilla anguilla</i>	1		
<i>clupea harengus</i>	5372		
<i>cyclopterus lumpus</i>	6		
<i>enchelyopus cimbrius</i>	10		
<i>engraulis encrasicolus</i>	170		
<i>gadus morhua</i>	2286	509	386
<i>gasterosteus aculeatus</i>	271		
<i>limanda limanda</i>	115		
<i>lumpenus lampretaeformis</i>	1		
<i>merlangius merlangus</i>	210		
<i>myoxocephalus quadricornis</i>	423		
<i>myoxocephalus scorpius</i>	387		
<i>osmerus eperlanus</i>	1		
<i>platichthys flesus</i>	1482	371	277
<i>pleuronectes platessa</i>	657		
<i>pomatoschistus</i>	78		
<i>pungitius pungitius</i>	2		
<i>scomber scombrus</i>	8		
<i>scophthalmus maximus</i>	42		
<i>solea solea</i>	1		
<i>sprattus sprattus</i>	3383		
<i>trachurus trachurus</i>	29		
<i>zoarces viviparus</i>	21		



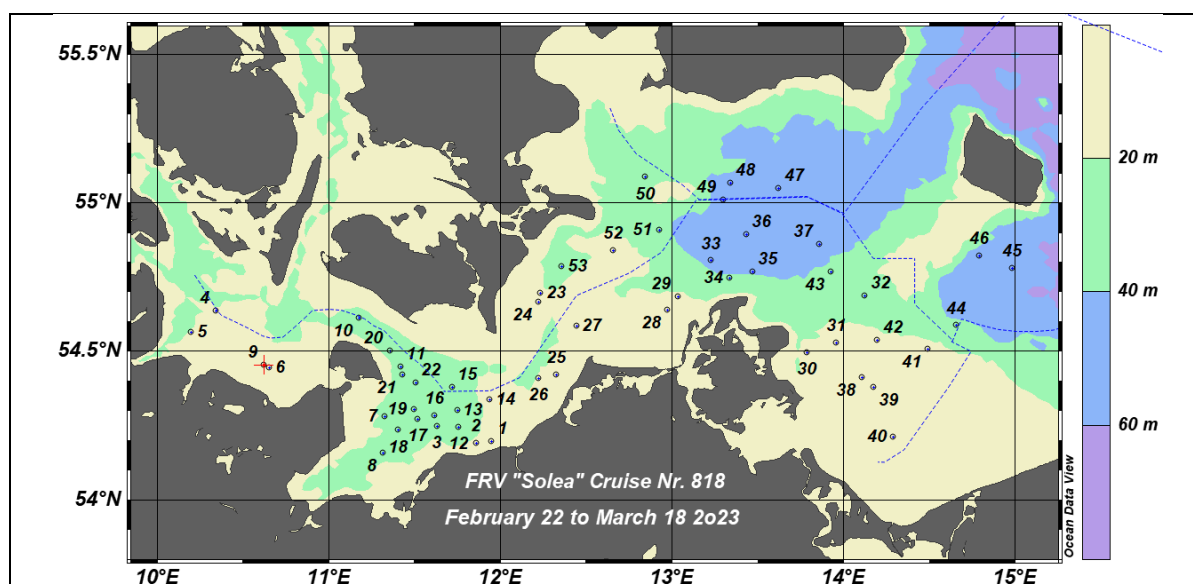
<b>NATION:</b>	<b>GERMANY</b>	<b>VESSEL:</b>	<b>FRV "SOLEA"</b>
Survey:	BITS 2023, quarter 1	Dates:	22 <sup>th</sup> to 28 <sup>th</sup> February, 1 <sup>st</sup> to 18 <sup>th</sup> March 2022

Cruise	
Gear details:	The small (520#) standard TV3 trawl was used. All Tow Database stations were fished without rock-hoppers. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	A total of 53 fishing hauls and 53 hydrographic stations of out of a total of 60 planned were performed. Station 22072 is currently not fishable due to Fehmarn tunnel construction activities. Bad weather and illness caused five days downtime.
Additional comments:	

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (1–3)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING "STANDARD" GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
22	TVS	1	2	2	-	-	-	-	100
22	TVS	2	20	20	-	-	-	-	100
24	TVS	1	6	6	-	-	-	-	100
24	TVS	2	16	13	-	-	-	-	81
24	TVS	3	16	12	-	-	-	-	82

**NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, \*MATURITY ONLY):**

SPECIES	LENGTH	AGE
<i>Gadus morhua</i>	6871	712
<i>Platichthys flesus</i>	3814	770
<i>Pleuronectes platessa</i>	8454	927
<i>Psetta maxima</i>	113	110
<i>Limanda limanda</i>	6696	635
<i>Scophthalmus rhombus</i>	10	10
<i>Clupea harengus</i>	3879	-
<i>Sprattus sprattus</i>	4296	-



<b>NATION:</b>	<b>POLAND</b>	<b>VESSEL:</b>	<b>RV "BALTICA"</b>
Survey:	BITS-1Q/2023	Dates:	08/02-02/03/2023

Cruise	No. 2/2023/MIR
Gear details:	The standard rigging cod ground trawl type TV-3#930, with 10-mm mesh bar length in the codend was applied for fish control-catches realisation. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	<p>According to the WGBIFS recent (April 2022) recommendations, the vessel "Baltica" was designated to cover in the Polish EEZ parts of the ICES Sub-divisions 25 and 26 with 17 and 43 hauls, respectively, as well as in Latvian and Lithuanian EEZs to cover part of ICES Sub-division 26 with 7 and 3 research hauls, respectively. The R/V Baltica realized 67 of the 70 planned hauls for this survey. Hauls no 26060, 26064 and 26122 in the Lithuanian EEZ (SD 26) were the only stations not realized due to non-response from Lithuanian authorities to application. In total 11 hauls (ICES no 26086, 26090, 26091, 26093, 26094, 26107, 26273, 26142, 26144, 26199, 26257) were not realized due to oxygen content in the near bottom zone below 0.5 ml/l. These hauls were classified as "Assumed zero catch hauls". In total, all the 67 fish catch-stations can be accepted as representative. Due to stormy weather, rocky bottom or large fish concentrations observed in echosounder – 1, 8, 7, 4 and 2 fishing hauls were shortened to 5, 10, 15, 20 and 25 min, respectively.</p> <p>Every control-haul was preceded by the seawater temperature, salinity and oxygen content measurements, made continuously from the sea-surface to a bottom. Overall, 67 fish catch-stations starting positions and 25 standard hydrographic stations were controlled by the SeaBird SBE 911 CTD-probe combined with the rosette sampler (the bathometer rosette). Oxygen content was determined by the standard Winkler's method.</p>
Additional comments:	

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (2–6)	NUMBER OF HAULS PLANNED	NUMBER OF VALID HAULS REALIZED USING "STANDARD" GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
25	TVL	2	12	12	0	0	0	0	100
25	TVL	3	4	4	0	0	0	0	100
25	TVL	4	0	0	0	0	0	0	---
25	TVL	5	1	1	0	0	0	0	100
26	TVL	2	12	13	0	0	0	0	108
26	TVL	3	14	12	0	0	0	0	86
26	TVL	4	11	9	0	0	0	0	82
26	TVL	5	11	4	0	7	0	0	100
26	TVL	6	5	1	0	4	0	0	100

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):		
SPECIES (LATIN NAME)	Length	Age and maturity
<i>Gadus morhua</i>	6987	427
<i>Clupea harengus</i>	7797	714
<i>Sprattus sprattus</i>	5102	338
<i>Platichthys flesus</i>	3686	655
<i>Pleuronectes platessa</i>	214	213
<i>Zoarces viviparus</i>	86	20
<i>Enchelyopus cimbrius</i>	40	13
<i>Perca fluviatilis</i>	3	3
<i>Gasterosteus aculeatus</i>	12	
<i>Myoxocephalus scorpius</i>	171	29
<i>Neogobius melanostomus</i>	8	5
<i>Alosa fallax</i>	67	17

<i>Scophthalmus maximus</i>	27	27
<i>Engraulis encrasicolus</i>	3	2
<i>Hyperoplus lanceolatus</i>	169	8
<i>Cyclopterus lumpus</i>	35	9
<i>Agonus cataphractus</i>	4	4
<i>Merlangius merlangus</i>	24	11
<i>Limanda limanda</i>	1	1
<i>Scomber scombrus</i>	4	2

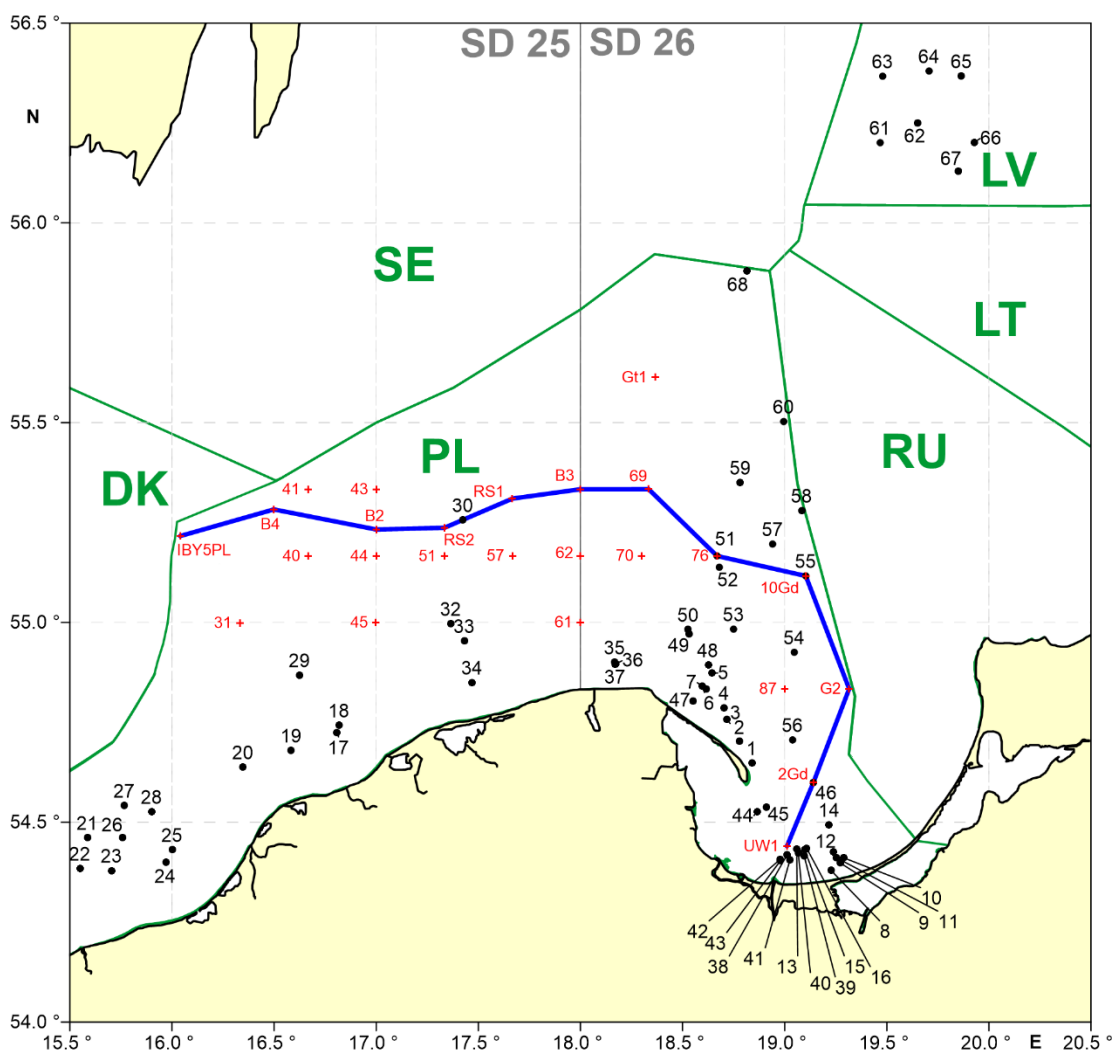
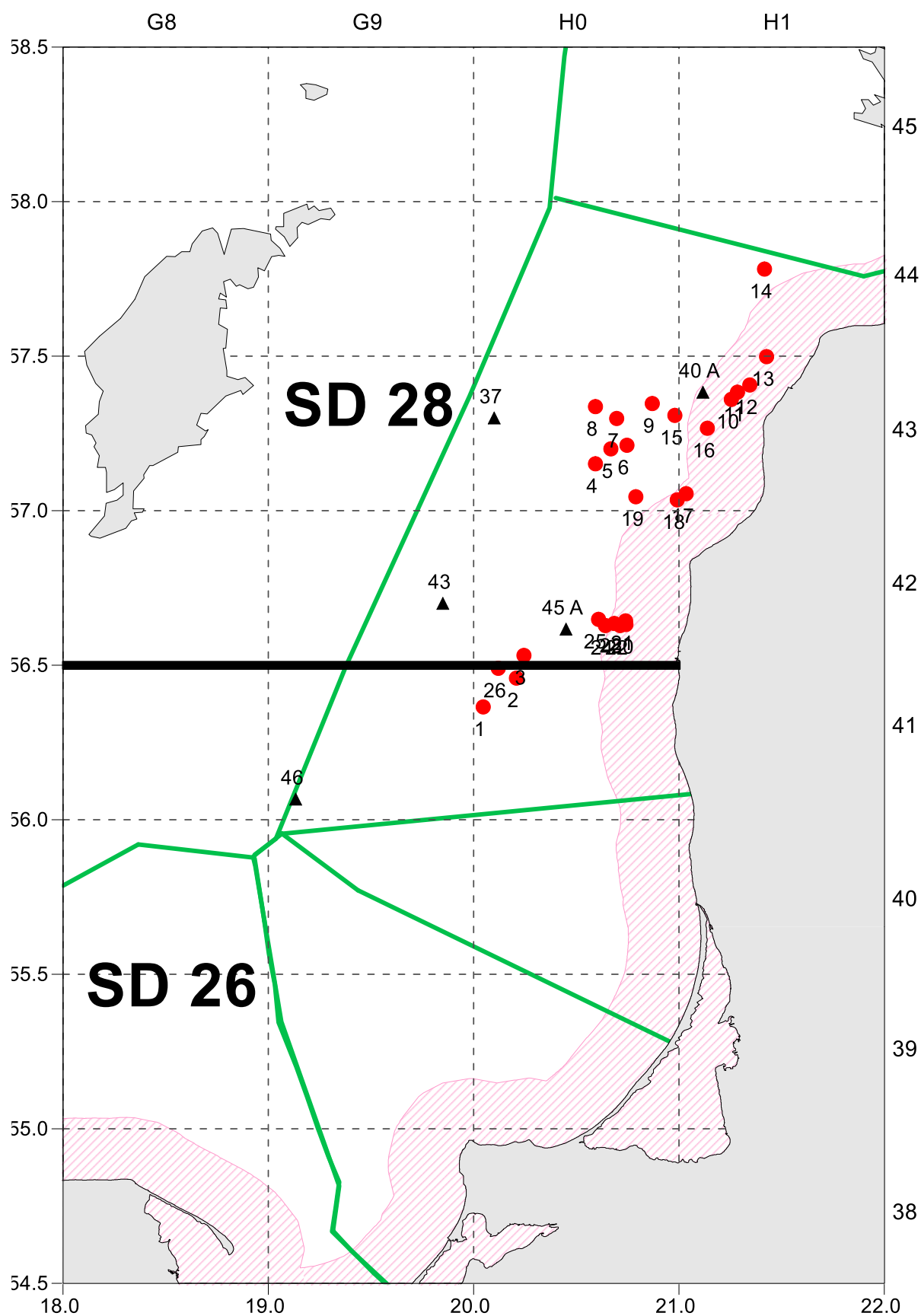


Fig. 1. Location of the bottom trawl hauls (black dots) and the hydrological standard stations (red crosses) investigated by the r.v. “Baltica” during the BITS-1Q/2023 survey (blue line – hydrological profile). (SE – Sweden, LV – Latvia, LT – Lithuania, RU – Russia, DK – Denmark, PL – Poland)

<b>NATION:</b>	<b>LATVIA</b>	<b>VESSEL:</b>	<b>RV "BALTICA"</b>
Survey:	BITS-Q1/2023	Dates:	08-16/03/2023

Cruise	No. 1/2023
Gear details:	The hard bottom ground-rope (rockhopper) trawl, type TV-3#930 (with 10-mm mesh bar length in the codend) was applied for fish catches. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	<p>The original survey plan specified that 25 control-hauls will be realized in the Latvian EEZ (2 trawls in SD 26, 23 trawls in SD 28). Five additional trawls were planned in the SD 26, in the Latvian EEZ.</p> <p>The r.v. "Baltica" realized 26-bottom trawl control-hauls including the Latvian territorial waters (all randomly selected hauls and one additional) (Fig.1). Two catch-stations were only initiated due to hydrological parameters measurement and due to very low oxygen concentration (below 0.5 ml/l) near bottom, fishing was omitted.</p> <p>All trawl catches were performed during daylight hours. The hard-bottom ground-rope (rockhopper) trawl, type TV-3#930 (with 10-mm mesh bar length in the codend) was applied for fish catches. The mean speed of vessel while trawling was 2.9 knots. For almost all realized hauls, their duration was shortened to 15-20 minutes, due to dense clupeid fish concentrations observed on the echosounder or bad weather.</p> <p>The length measurements in the 1.0cm classes were realised for 477 cod and 4991 flounder. Length measurements in the 0.5cm classes were realized for 2508 herring and 2246 sprat. In total, 380 cod and 472 flounder individuals were taken for biological analysis. Stomachs from the 2313 cod were taken for investigation of cod feeding.</p> <p>Acoustic data, i.e., the echo-integration records (SA = NASCs; Nautical Area Scattering (Strength) Coefficient) were collected with the EK-60 scientific echosounder during fishing operations as well as the distances between consecutive hauls. The echosounder data collected during the BITS survey were delivered to the Latvian researchers for further analysis.</p> <p>Directly before every haul, the seawater temperature, salinity, and oxygen content were measured continuously from the sea surface to a bottom. The seawater samples were taken also at the standard HELCOM stations. Totally, 26 hydrological stations were inspected with the Neil-Brown CTD-probe combined with the rosette sampler (the bathometer rosette). Oxygen content was determined by the standard Winkler's method.</p> <p>Meteorological observations such as wind velocity, direction and the sea state were realized at the actual geographic position of each control-haul.</p>
Additional comments:	





ICES SUB- DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (2–6)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING “STANDARD” GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO- CATCH HAULS	NUMBER OF REPLACE- MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
26	TVL	4	1	0	1	0	0	0	100
26	TVL	5	1	0	1	0	0	0	100
28	TVL	2	6	0	6	0	0	0	100
28	TVL	3	8	0	7	0	0	0	87.5
28	TVL	4	5	0	6	0	0	0	120
28	TVL	5	4	0	3	1	0	0	100

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):		
SPECIES	LENGTH	AGE
<i>Gadus morhua</i>	477	380
<i>Platichthys flesus</i>	4991	472
<i>Clupea harengus</i>	2508	
<i>Sprattus sprattus</i>	2246	
<i>Neogobius melanostomus</i>	1	
<i>Scophthalmus maximus</i>	16	
<i>Enchelyopus cimbrius</i>	1	
<i>Zoarces viviparus</i>	205	
<i>Lumpenus lampretæformis</i>	2	
<i>Hyperoplus lanceolatus</i>	1	
<i>Osmerus eperlanus</i>	7	
<i>Gasterosteus aculeatus Linnaeus</i>	81	
<i>Cyclopterus lumpus</i>	33	
<i>Myoxocephalus scorpius</i>	289	
<i>Pleuronectes platessa</i>	2	
<i>Pomatoschistus minutus</i>	3	
<i>Myoxocephalus quadricornis</i>	1	
<i>Gasterosteus pungitius</i>	2	
<i>Alosa falax</i>	1	
<i>Liparis liparis</i>	1	

<b>NATION:</b>	<b>DENMARK</b>	<b>VESSEL:</b>	<b>HAVFISKEN</b>
Survey:	Kasu	Dates:	12/02 - 07/03/ 2023

Cruise	Kasu-1 2023
Gear details:	The small (#520) standard TV3 trawl is used. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	3 stations in division 22 were moved due to problems with stones or other problems at the stations.
Additional comments:	

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (1–6)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING “STANDARD” GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
20	TVS	2	2	2					100%
20	TVS	3	1	1					100%
21	TVS	1	7	7					100%
21	TVS	2	9	9					100%
21	TVS	3	3	3					100%
21	TVS	4	3	3					100%
22	TVS	1	12	12					100%
22	TVS	2	16	16					100%
23	TVS	1	4	4					100%
23	TVS	2	1	1					100%
24	TVS	1	4	4					100%
24	TVS	2	3	3					100%

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL) * MATURITY AND SEX ONLY		
SPECIES	LENGTH	AGE
Sole		53
Cod		699
Withing		303
Witch		0
Hake		0
Plaice		1128
Saith		0
Dab *		350
Haddock		0
Turbot		52
Brill		44

<b>NATION:</b>	<b>DENMARK</b>	<b>VESSEL:</b>	<b>DANA</b>
Survey:	BITSQ1	Dates:	7/3-/23/3 - 2023

Cruise	
Gear details:	The big (#920) standard TV3 trawl is used. The construction of the trawl follows the specifications in the manual. No rock hopper was used
Notes from survey (e.g. problems, additional work etc.):	Stomack sampling from cod, plankton fishing during night.
Additional comments:	

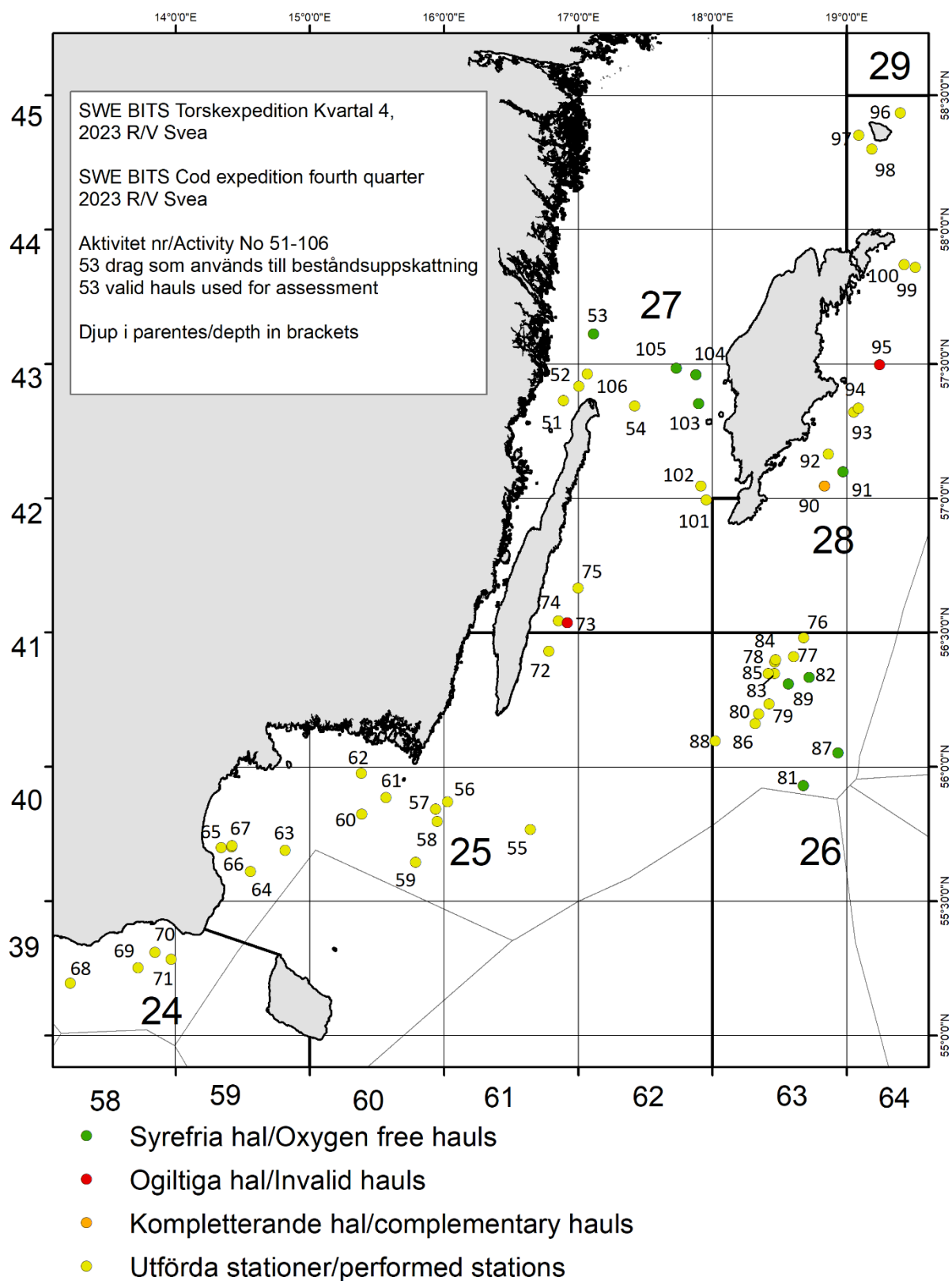
ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (1-6)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING "STANDARD" GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
25	TVL	2	2	2	0	0	0	0	100.0
25	TVL	3	11	11	0	0	0	0	100.0
25	TVL	4	18	18	0	0	0	0	100.0
25	TVL	5	12	12	0	0	0	0	100.0
26	TVL	4	3	3	0	0	0	1	100.0
26	TVL	5	6	6	0	1	0	1	116.7
26	TVL	6	0	0	0	0	0	1	
24	TVL	2	3	3	0	0	0	0	100.0

<b>NATION:</b>	<b>SWEDEN</b>	<b>VESSEL:</b>	<b>RV "DANA"</b>
Survey:	BITS Q1 2023	Dates:	20 February - 6 March 2023

Cruise	
Gear details:	The large (930#) standard TV3 trawl was used. No tows are done with the rock hopper ground gear on harder ground stations. The trawl construction is according to the specification in the BITS manual.
Notes from survey (e.g. problems, additional work etc.):	52 stations were randomly allocated, of 53 were trawled. Four hauls in SD 26, four hauls in SD 27 and one haul in SD28 had oxygen deficiency. One haul in SD 27 and one in SD28 were invalid, we teared a big hole in the bottom of the trawl in one and in the other we filled the trawl with mud and gravel.
Additional comments:	One complementary haul was made in SD 28.

ICES SUB- DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (2-6)	NUMBER OF HAULS PLANNED	NUMBER OF VALID HAULS USING "STANDARD" GROUND GEAR	NUMBER OF VALID HAULS USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO- CATCH HAULS	NUMBER OF REPLACE- MENT HAULS	NUMBER OF INVALID HAULS	STATIONS FISHED %
24	TVL	2	2	2	-	0	0	0	100
24	TVL	3	2	2	-	0	0	0	100
25	TVL	2	3	3	-	0	0	0	100
25	TVL	3	7	6	-	0	1	0	100
25	TVL	4	4	3	-	0	1	0	100
26	TVL	2	2	2	-	0	0	0	100
26	TVL	3	2	2		0	1	0	133
26	TVL	4	5	5		0	0	0	100
26	TVL	5	2	1		1	0	0	100
26	TVL	6	3	0		3	0	0	100
27	TVL	3	2	1	-	0	1	0	100
27	TVL	4	5	4	-	0	2	1	115
27	TVL	5	1	0		1	0	0	100
27	TVL	6	3	0	-	3	0	0	100
28	TVL	3	3	3	-	0	0	0	100
28	TVL	4	5	3	-	0	1	1	100
28	TVL	5	1	0	-	1	0	0	100

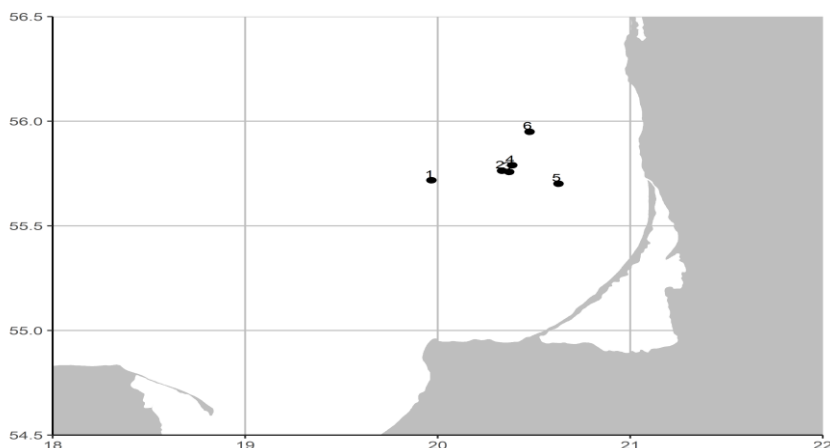
Number of biological samples (maturity and age material, *maturity only):			
<i>Specname sci.</i>	<i>Lenght</i>	<i>Age</i>	<i>Stomachs</i>
agonus cataphractus	4		
alosa fallax	25		
ammodytes	7		
clupea harengus	7337		
cyclopterus lumpus	7		
enchelyopus cimbrius	22		
engraulis encrasicolus	2		
eutrigla gurnardus	1		
gadus morhua	4545	736	632
gasterosteus aculeatus	378		
limanda limanda	165		
lumpenus lampretaeformis	7		
merlangius merlangus	20		
myoxocephalus quadricornis	449		
myoxocephalus scorpius	909		
osmerus eperlanus	1		
platichthys flesus	3766	536	536
pleuronectes platessa	1233		
pomatoschistus	102		
pungitius pungitius	10		
scomber scombrus	3		
scophthalmus maximus	65		
solea solea	6		
sprattus sprattus	4252		
zoarces viviparus	124		
agonus cataphractus	4		
alosa fallax	25		
ammodytes	7		
clupea harengus	7337		
cyclopterus lumpus	7		



<b>NATION:</b>	<b>LITHUANIA</b>	<b>VESSEL:</b>	<b>FV ATLANT</b>
Survey:	BITS2023Q1	Dates:	15 <sup>th</sup> – 16 <sup>th</sup> February 2023
Cruise			
Gear details:	The small (520#) standard TV3 trawl was used.		
Notes from survey (e.g. problems, additional work etc.):	<p>Survey made with Lithuania commercial fishery vessel Atlant. Total 6 fishing hauls was performed. The duration of the hauls were 30 minutes and the velocity were 2.8 – 2.9 knots. The total catch of each haul was analysed to determine the species composition in weight and number, as well as length distribution among all species.</p> <p>Total 11 species were registered during survey. Sub-samples of cod and flatfishes were investigated concerning sex, maturity and age. Cod also were investigated cod liver parasites. 119 cod stomach were collected.</p>		
Additional comments:			

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (2–6)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING “STANDARD” GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
26	TVS	2	1	1	-	-	-	-	100
26	TVS	3	4	4	-	-	-	-	100
26	TVS	4	1	1	-	-	-	-	100

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):		
SPECIES	LENGTH	AGE
<i>Alosa fallax</i>	11	
<i>Cyclopterus lumpus</i>	9	
<i>Clupea harengus</i>	1103	
<i>Gadus morhua</i>	1161	330
<i>Myoxocephalus scorpius</i>	28	
<i>Osmerus eperlanus</i>	19	
<i>Platichthys flesus</i>	618	251
<i>Pleuronectes platessa</i>	1	1
<i>Scophthalmus maximus</i>	1	1
<i>Sprattus sprattus</i>	1266	
<i>Zoarces viviparus</i>	3	



# **Baltic International Trawl Survey (BITS), R/V Svea, 20 – 30 November 2022**

Cruise leader : Olof Lövgren  
Scientific leader : Michele Casini

---

## **Summary**

The survey was conducted by the R/V Svea using the TV3L demersal trawl in accordance with the Baltic International Trawl Survey (BITS) manual (ICES. 2017). Sweden was assigned 33 randomly selected hauls.

In total 36 hauls were performed with TV3L demersal trawl including four hauls with oxygen deficiency and one complementary haul, one in Subdivision 27. The complementary haul was made to collect enough fish in order to perform relevant biological analyses. This year's expedition was carried out without complications. One haul was declared invalid. Two hauls were not trawled because the bottom was judged to be too risky to trawl on. Sweden covered parts of the areas SD 24, 25, 27 and 28 this year.

During this survey, a total of 25 fish species were caught. Herring, sprat, cod, fourhorn sculpin and flounder dominated the total catch, in terms of weight.

The hydrographic conditions were measured on every station. Only the oxygen concentration at the bottom is presented in the report.

## **Introduction**

The institute of marine research trawl expeditions in the Baltic Sea are carried out in collaboration with the countries around the Baltic Sea within the framework of one of ICES 'trawl survey programs, the Baltic International Trawl Survey, BITS. Sweden is responsible for the surveys in parts of the southern Baltic Sea, SD 24 and 25, central SD 26 and is responsible for all sampling in SD 27 and the western part of SD 28. The expedition is carried out twice a year, in quarters 1 and 4 according to the BITS manual (ICES, 2017) Quarter 1 is performed in February, March and quarter 4 in the last two weeks of November.

The trawl survey is coordinated by the WGBIFS working group, which meet once a year for planning and analysis. <https://www.ices.dk/community/groups/pages/wgbifs.aspx>

The surveys, which in their current form have been ongoing since the early 2000s, first used the Swedish research vessel U / F Argos. U / F Argos was taken out of service in 2010 and between 2011 and 2019, Sweden chartered the Danish state vessel Dana to fulfil the Swedish commitments. Since the autumn of 2019, we have had Sweden's new research vessel R / V Svea at our disposal.

The main purpose of the expedition is to map and monitor the spatial distribution and size of the year classes of mainly demersal species such as cod and flounder in the Baltic Sea.



The expedition in the Baltic Sea has been going on for about 40 years, which has created an unbroken time series that is very important for the stock estimation work. Due to the fact that in 2011–2019 we used another nation's vessels (U/F Dana), some of the regular stations were banned from fishing (Decision Swedish Armed Forces FM2018-22193: 6) by the Swedish Armed Forces, which resulted in a break in the time series.

All Swedish expedition data is stored in the FD2 database at the Sea Fishing Laboratory and transferred to ICES databases for international data storage; DATRAS for fish and marine litter. Hydrographic data is uploaded to Oceanography by SMHI. Data collected from this expedition are used by several working groups within ICES, mainly the Baltic Fisheries Assessment Working Group (WGBFAS).

<https://www.ices.dk/community/groups/Pages/default.aspx>

## Method

The expedition started from Kalmar on November 17th and ended in Kalmar on November 27th.

Sweden had been assigned to 33 randomly placed stations (stratified by depth from an international database that randomly selects trawl hauls to all participating countries) and was distributed as follows: Four stations in the Baltic Sea subdivision, SD 24, twelve stations in SD 25, ten in SD 27 and seven stations in SD 28 (see Figure 1, table 1).

Two of the randomly selected stations were replaced due to stations are deleted from the trawl database, another was replaced due to duplicates (two stations with different station numbers but located at exactly the same positions. The doublets were replaced with similar stations within the same depth and area. The fishing is performed with a TV3 bottom trawl with a 16 mm mesh in the codend (which is the last part of the trawl where the fish is collected before it is lifted on board). All fish species in the catch as well as some invertebrates are measured, and biological samples of the target species specified in the manual (mainly cod and flounder) are taken with respect to sexual maturity and age. <http://datras.ices.dk/Documents/Manuals/Manuals.aspx>.

Otoliths for age determination were collected with the goal of 1 individual per cm class and haul in the areas where there are enough stations to take samples from. In other areas, the number of sampled individuals is increased up to 2/3 per cm class and haul. On other fish species, a length distribution was made. Total weight was registered per species and haul.

Hydrography examination with CTD and oxygen probe was performed at most stations during the expedition. Oxygen-free stations are stations that are not trawled because the oxygen concentration near the bottom (measured approx. 1 m above the bottom) is less than 0.5 ml / l, an oxygen content that is considered too low for cod to stay there. However, the stations are included in calculations of stock estimates as 0-catch (Table 1).

One additional haul were made in SD 27 to collect biological samples for, among other things, age determination and other biological parameters such as liver parasites, stomachs for gastric sampling and so on.

### Other sampling

At all trawled stations, the presence of litter that accumulates on the bottom and that accompanies the trawl is documented, litter is separated into different categories such as plastic, glass, metal, etc. Marine litter collection was carried out in accordance with the marine litter working group (WGML) latest manual.

Other surveys and provincial collections were conducted as follows:

- Collection of stomachs from cod and flounder for food selection analysis.

- Visual assessment of liver parasites in cod.
- Baltic isopod (*Saduria entomon*) was collected for food selection analysis.

## Results

The weather during the expedition was calm with exception for a couple of days with strong wind and high sea. Which affected the expedition so we had to go towards shore to find shelter from the wind and sea.

A total of 33 of the 33 preselected stations could be performed, including four oxygen-free stations (Figure 2, Table 1). Results from hydrography examination with CTD and oxygen probe are shown in Table 1. The oxygen concentration at the bottom is shown in Figure 2. Oxygen varies greatly between seasons and in November the oxygen conditions were slightly above the limit values in most of the areas. As expected, the oxygen concentration was lower in the deeper parts of SD 27 and in the deeper part of SD 28. The oxygen levels were low in other areas as SD 25 but were well above the limit values for trawling.

A total of 18,1 tonnes of fish were caught, of which 918 Kg were cod and corresponded to a total of 5 741 individuals. The catches of herring and sprat were 10,6 and 5 tonnes respectively. During the expedition, a total of 25 different fish species were caught. Captured species with weight and number distribution are reported separately in Table 2.

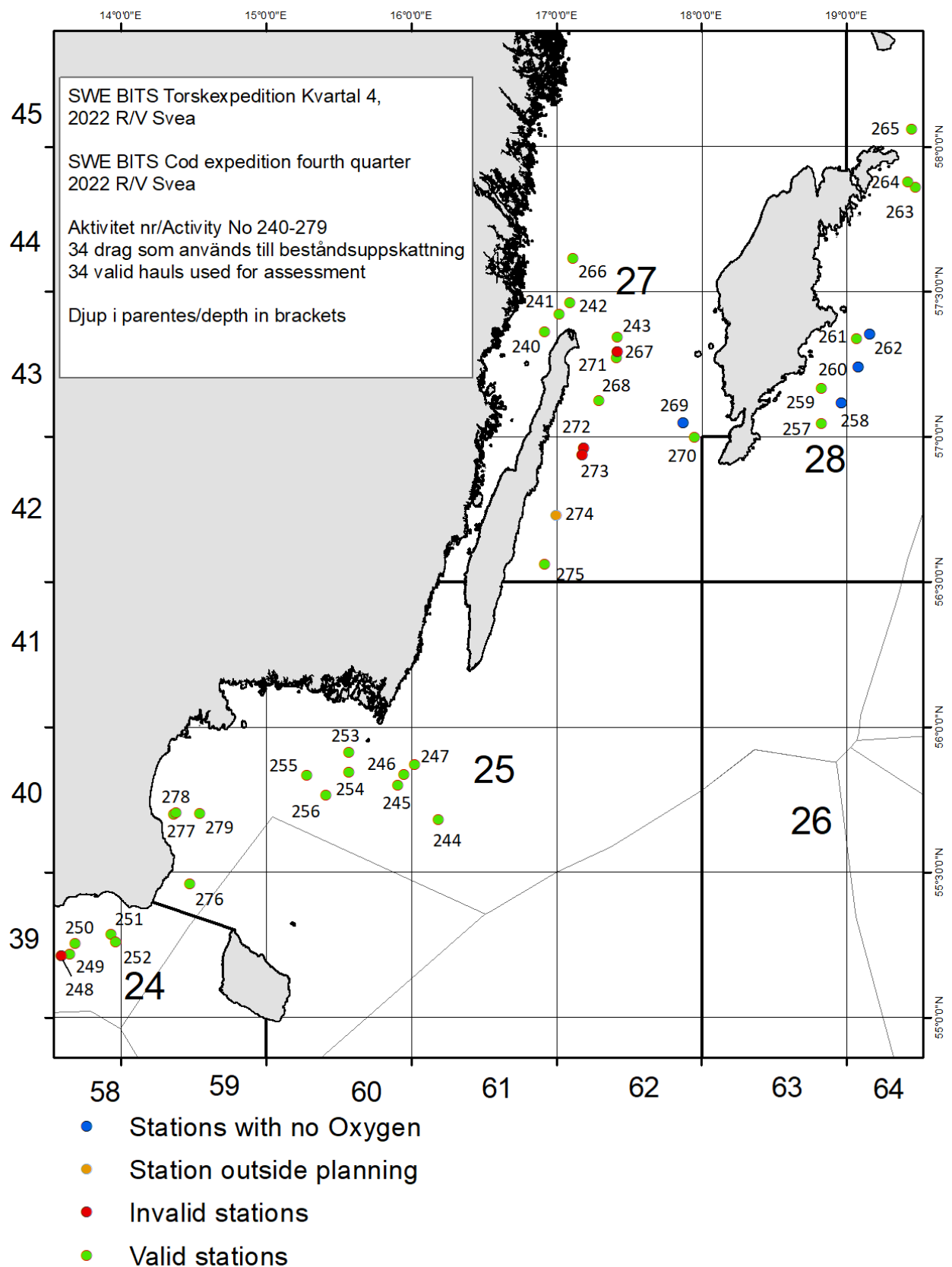


Figure 1. Map of the trawl stations performed during the Swedish BITS Quarter 4 2022. Trawled stations including 1 complementary haul, four invalid hauls and four with no oxygen.

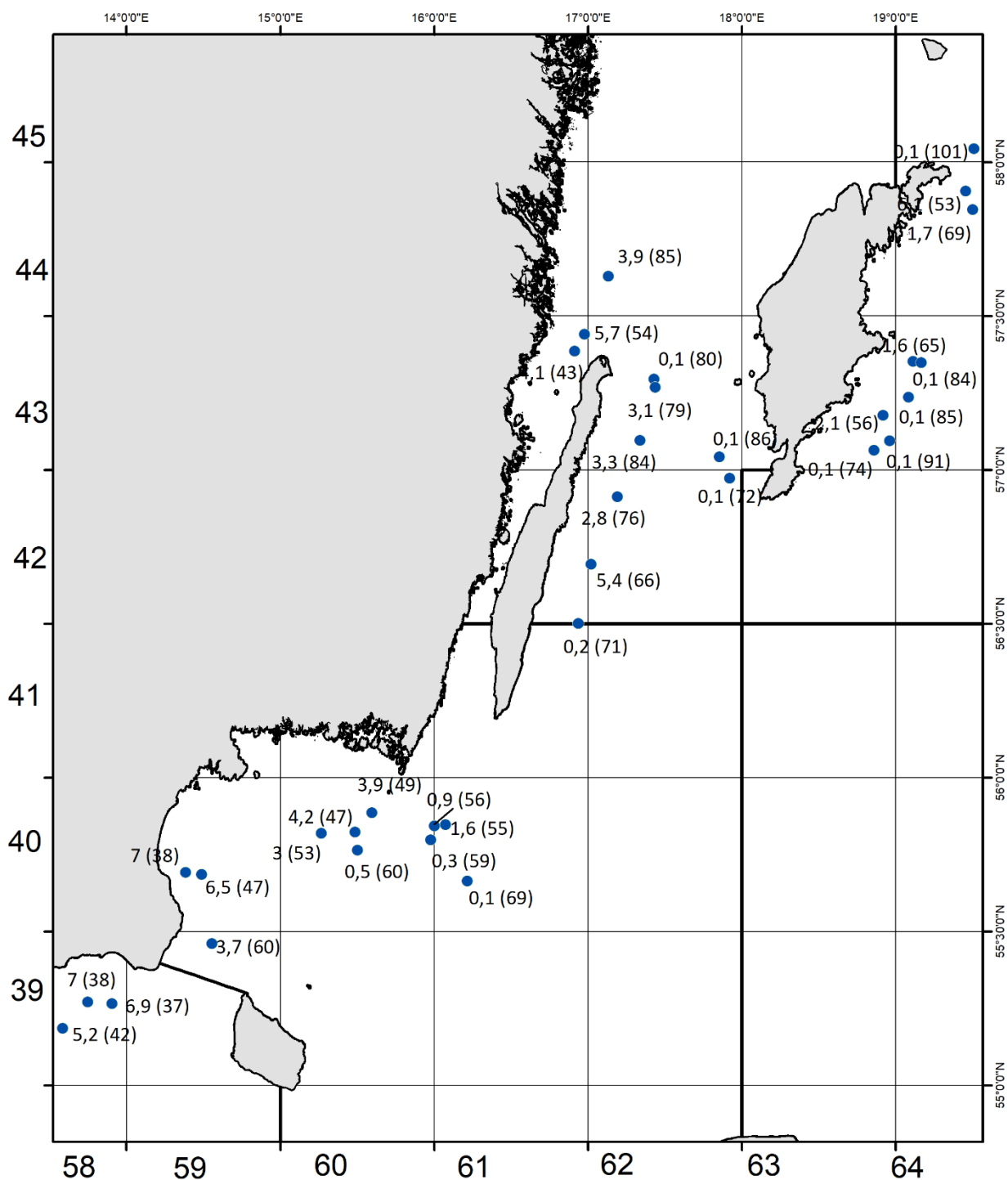


Figure 2. Oxygen concentration (ml/l) at the bottom at the trawl stations. Numbers in brackets indicate bottom depth. Swedish BITS, Quarter 4 2022.

The catch of cod is reported in kg and number per haul and SD in table 3. In the hauls where the catch of cod has been registered, the length of all cod is measured. In the case of large catches, only parts of the catch are measured (sample), which is then counted up to the total catch. Otoliths for age determination were collected with the aim of one individual per cm class, area and haul (SD 25 is divided into 3 sub-areas: 25W, 25C and 25E, see figure 1). 509 otoliths and 386 stomachs were taken from cod.

## Other sampling

A large part of the litter collected this year consisted of plastic. The Miscellaneous category includes clothing and shoes (see Figure 3). The information about the occurrence of rubbish is entered into a database on ices:

[https://datras.ices.dk/Data\\_products/Download/Download\\_Data\\_public.aspx](https://datras.ices.dk/Data_products/Download/Download_Data_public.aspx).

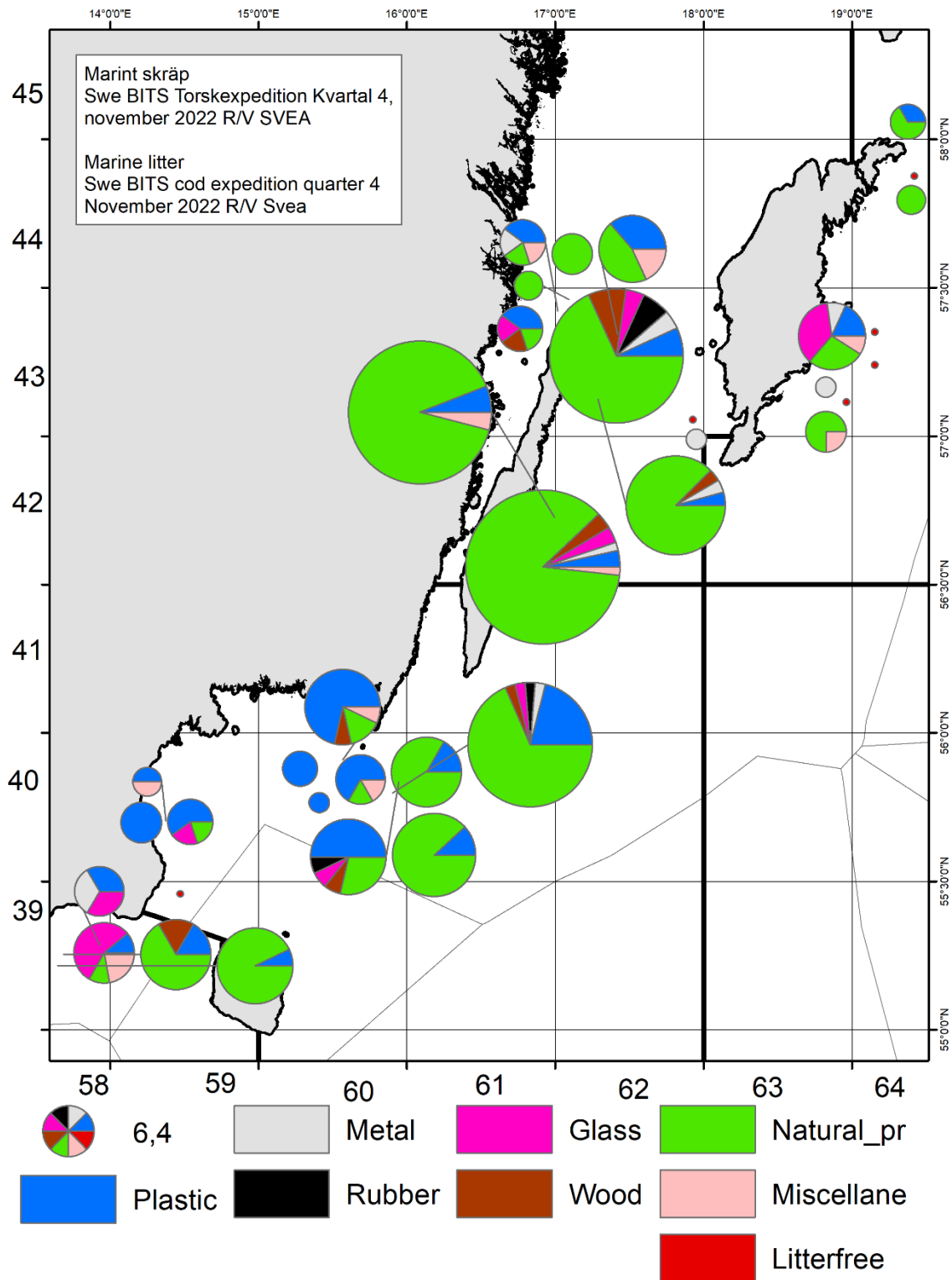
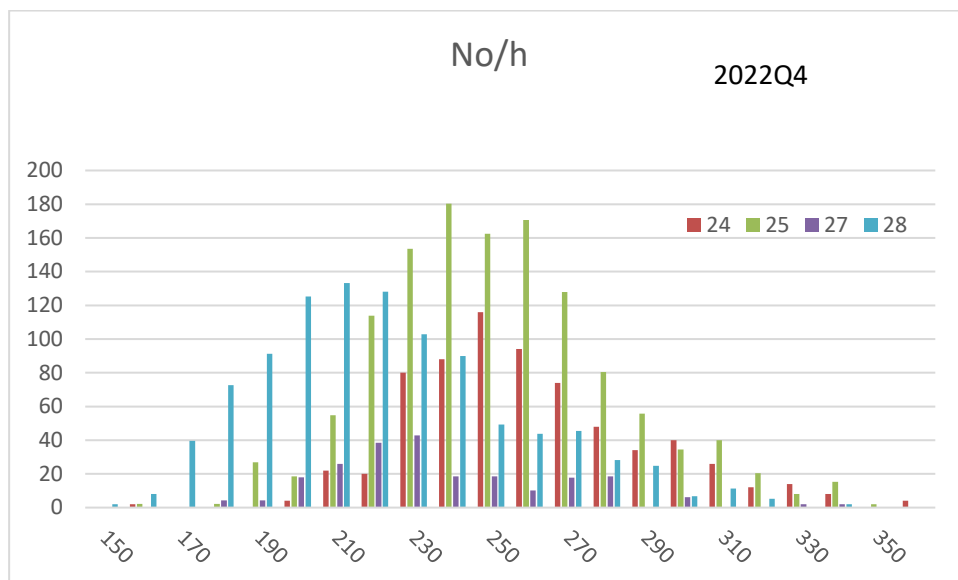


Figure 3. Marine litter presented as the number of pieces of litter per trawl haul. The size of the circles shows the total amount of litter at each station.

The length distribution of flounder per hour and area is shown in Figure 4. 371 otoliths and 277 stomachs were taken from flounder.



Figur 4. Length distribution for flounder per hour and subdivision

## Participants

Lövgren Olof	SLU, Havsfiskelaboratoriet
Landfors Fredrik	SLU, Kustlaboratoriet
Jakobsson Peter	SLU, Havsfiskelaboratoriet
Wikström Karolina	SLU, Havsfiskelaboratoriet
Andersson Linda	SLU, Havsfiskelaboratoriet
Svensson Anders	SLU, Havsfiskelaboratoriet
Hjelm Axel	SLU, Havsfiskelaboratoriet
Wernbo Anders	SLU, Havsfiskelaboratoriet
Eiler Stefan	SLU, Kustlaboratoriet
Lövgren Olof	SLU, Havsfiskelaboratoriet

## References

- ICES. 2017. Manual for the Baltic International Trawl Surveys (BITS). Series of ICES Survey Protocols SISP 7 - BITS. 95 pp. <http://doi.org/10.17895/ices.pub.2883>
- ICES. 2018. Report of the Baltic International Fish Survey Working Group (WGBIFS). ICES WGBIFS report 2018 24-28 March 2018. Lyngby, Copenhagen, Denmark. 380 pp.

Table 1. Summary of all stations. Swedish BITS quarter 4 2022.

Tråldrag som används för beståndsuppskattning/ Valid hauls used for	35	Tråldrag som används för beståndsuppskattning/ Valid hauls used	
Slumpade trålade stationer/Randomized trawled hauls	28	Slumpade tilldelade	SD28 7 SD27 10 SD25 12 SD24 4
Ersättningsdrag/Replacement hauls	4		
Slumpade syrefria drag/Random anoxic hauls	4	Tråldrag som används för	SD28 9 SD27 10 SD25 12 SD24 4
Kompletteringsdrag/additional hauls	1		
Ogiltiga drag/invalid hauls	3		
Slumpade stationer, ej trålade/random stations, not trawled	4		
			Ogiltigt Kompletteringshal TV3 Trål station Syrefritt tråldrag Hydro station (CTD)

Datum	Akt. nr	Om-råde	Ruta	Position N	Position E	Stat. nr	Stations namn	Trål ning	Trål tid	Trål djup	Hydro Djup	Hydro O2	Kommen tar	Re marks
Date	Act. no	Area	Rect.	Latitude	Longitude	Haul	Station name	Gear	Time min	Trawl depth	Depth m	Ox ml/l		
22-11-18	240	27	43G6	57 21,726	16 55,130	27020	4NW Byxelkrok	TV3	30	44,5		4,1		
22-11-18	533	27	43G6	57 23,162	16 54,673	27020	4NW Byxelkrok	CTD			43	4,1		
22-11-18	241	27	43G7	57 25,312	17 01,055	27003	5N Byxelkrok	TV3	30	56,3		5,7		
22-11-18	534	27	43G6	57 26,398	16 58,574	27003	5N Byxelkrok	CTD			54	5,7		
22-11-18	242	27	43G7	57 27,659	17 05,483	27025	3SW Ölands Norra Grund	TV3	26	65,9		5,7		
22-11-18	243	27	43G7	57 20,617	17 25,196	27029	11ESE Ölands Norra Udde	TV3	30	72,7		1,2		
22-11-18	535	27	43G7	57 17,711	17 25,705	27029	11ESE Ölands Norra Udde	CTD			80	0,1		
22-11-19	536	25	40G6	55 39,884	16 12,837	25301	11E Tången	CTD			69	0,1		
22-11-19	244	25	40G6	55 40,845	16 11,087	25301	11E Tången	TV3	30	68,8		0,1		
22-11-19	245	25	40G5	55 47,857	15 54,226	25299	Inre U10	TV3	30	60,1		0,3		
22-11-19	537	25	40G5	55 47,846	15 58,516	25299	Inre U10	CTD			59	0,3		
22-11-19	246	25	40G5	55 50,098	15 56,740	25347	11SE Utklippan	TV3	30	56,6		0,9		
22-11-19	538	25	40G6	55 50,565	16 00,002	25347	11SE Utklippan	CTD			56	0,9		
22-11-19	247	25	40G6	55 52,137	16 01,402	25431	Argos Track	TV3	30	54,1		1,3		
22-11-19	539	25	40G6	55 50,858	16 04,391	25431	Argos Track	CTD			55	1,6		
22-11-20	540	24	39G3	55 11,166	13 35,007	24321	Y17	CTD			42	5,2		
22-11-20	248	24	39G3	55 12,673	13 35,301	24321	Y17	TV3	9	43,5		5,2	Ogiltigt! Fyllde med lera	Invalid, filled with sediment

Datum	Akt. nr	Om-råde	Ruta	Position N	Position E	Stat. nr	Stations namn	Trål ning	Trål tid	Trål djup	Hydro Djup	Hydro O2	Kommen tar	Re marks
Date	Act.	Area	Rect.	Latitude	Longitude	Haul		Gear	Time		Depth	Ox		
	no	SD				No	Station name		min	Trawl depth	m	ml/l		
22-11-20	249	24	39G3	55 12,939	13 38,890	24321	Y17	TV3	30	43,4		5,2		
22-11-20	250	24	39G3	55 15,244	13 41,105	24130	Ystadkroken	TV3	30	40,6		7		
22-11-20	541	24	39G3	55 16,307	13 44,758	24130	Ystadkroken	CTD			38	7		
22-11-20	251	24	39G3	55 17,099	13 55,665	24288	E Ystadkroken	TV3	30	37,3		6,9		
22-11-20	542	24	39G3	55 15,930	13 54,338	24288	E Ystadkroken	CTD			37	6,9		
22-11-20	252	24	39G3	55 15,581	13 57,637	24267	8,9SE Klostergrundet	TV3	30	38,0		6,9		
22-11-21	543	25	40G5	55 53,184	15 35,570	25405	5SSW Utklippan	CTD			49	3,9		
22-11-21	253	25	40G5	55 54,648	15 34,079	25405	5SSW Utklippan	TV3	25	50,0		3,9		
22-11-21	254	25	40G5	55 50,597	15 33,971	25140	Klippebanken	TV3	30	39,9		5,3		
22-11-21	544	25	40G5	55 49,433	15 29,059	25140	Klippebanken	CTD			47	4,2		
22-11-21	255	25	40G5	55 49,956	15 16,782	25426	3NW Västra Nabben	TV3	30	51,7		2,5		
22-11-21	545	4B	01G5	00 00,000	15 15,853	25426	3NW Västra Nabben	CTD			53	3		
22-11-21	256	25	40G5	55 45,936	15 24,577	25392	3S Yttertorpet	TV3	30	61,3		0,5		
22-11-21	546	25	40G5	55 45,869	15 29,996	25392	3S Yttertorpet	CTD			60	0,5		
22-11-22	257	28	43G8	57 02,655	18 49,479	28101	10SE När	TV3	22	67,4		0,3		
22-11-22	547	28	43G8	57 03,794	18 51,438	28101	10SE När	CTD			74	0,1		
22-11-22	548	28	43G8	57 05,684	18 57,582	28067	11ESE När	CTD			91	0,1		
22-11-22	258	28	43G8	57 06,933	18 57,715	28067	11ESE När	TV3	3	86,4		0,1	syrefri N	No Ox
22-11-22	259	28	43G8	57 09,946	18 49,421	28016	5SE När	TV3	30	48,9		3,7		
22-11-22	549	28.2	43G8	57 10,590	18 54,918	28016	5SE När	CTD			56	2,1		
22-11-22	550	28.2	43G9	57 14,149	19 04,928	28072	13E Ljugarn	CTD			85	0,1		
22-11-22	260	28	43G9	57 14,447	19 04,762	28072	13E Ljugarn	TV3	3			0,1	syrefri N	No Ox
22-11-22	261	28	43G9	57 20,272	19 03,916	28181	6SE Östergarn	TV3	22	63,7		1,7		
22-11-22	551	28.2	43G9	57 21,094	19 06,691	28181	6SE Östergarn	CTD			65	1,6		
22-11-22	552	28.2	43G9	57 20,885	19 09,923	28098	8SE Östergarn	CTD			84	0,1		
22-11-22	262	28	43G9	57 21,142	19 09,436	28098	8SE Östergarn	TV3	3	79,1		0,1	syrefri N	No Ox
22-11-23	553	28.2	44G9	57 50,759	19 29,939	28104	6,5SE Fårö	CTD			69	1,7		
22-11-23	263	28	44G9	57 51,476	19 28,419	28104	6,5SE Fårö	TV3	30	69,0		2		



Date	Act. no	Area SD	Rect.	Latitude	Longitude	Haul No	Station name	Gear	Time min	Depth Trawl depth m	Ox ml/l	Remarks
22-11-23	264	28	44G9	57 52,584	19 25,158	28027	5SE Fårö	TV3	30	48,3	6,2	
22-11-23	554	28.2	44G9	57 54,319	19 27,262	28027	5SE Fårö	CTD		53	6,1	
22-11-23	555	28.2	45G9	58 02,551	19 30,352	28078	E Salvorev	CTD		101	0,1	
22-11-23	265	28	45G9	58 03,539	19 26,688	28078	E Salvorev	TV3	30	73,7	0,9	
22-11-24	556	27	44G7	57 37,706	17 07,876	27014	9SE Kungsgundet	CTD		85	3,9	
22-11-24	266	27	44G7	57 36,861	17 06,823	27014	9SE Kungsgundet	TV3	30	85,5	3,9	
22-11-24	267	27	43G7	57 17,534	17 24,923	27030	11E Böda	TV3	5	75,6	4	Ogiltig! Fyllde med lera!
22-11-24	268	27	43G7	57 07,487	17 17,338	27010	7ESE Högbys Fyr	TV3	30	72,3	5,4	
22-11-24	557	27	43G7	57 05,733	17 20,160	27010	7ESE Högbys Fyr	CTD		84	3,3	
22-11-24	558	27	43G7	57 02,523	17 51,198	27013	11,5NW Hoburg	CTD		86	0,1	
22-11-24	269	27	43G7	57 02,827	17 52,323	27013	11,5NW Hoburg	TV3	3	85,6	0,1	syrefri N No Ox
22-11-25	559	27	42G7	56 58,380	17 55,073	27007	8NW Hoburg	CTD		72	0,1	
22-11-25	270	27	42G7	56 59,793	17 57,032	27007	8NW Hoburg	TV3	30	64,9	0,1	
22-11-25	271	27	43G7	57 16,262	17 24,664	27030	11E Böda	TV3	18	75,2	4	
22-11-25	560	27	43G7	57 16,062	17 26,150	27030	11E Böda	CTD		79	3,1	
22-11-25	272	27	42G7	56 57,557	17 11,045	27005	10E Kårehamn	TV3	6	72,4	3,7	Ogiltig! Fyllde med lera!
22-11-26	561	27	42G7	56 54,765	17 11,312	27005	10E Kårehamn	CTD		76	2,8	
22-11-26	273	27	42G7	56 56,140	17 10,390	27005	10E Kårehamn	TV3	13	73,2	3,4	Ogiltig! Fyllde med lera!
22-11-26	274	27	42G6	56 43,648	16 59,665	27022	9SE Kapelludden	TV3	30	65,7	5,4	
22-11-26	562	27	42G7	56 41,639	17 01,053	27022	9SE Kapelludden	CTD		66	5,4	
22-11-26	275	27	42G6	56 33,570	16 54,993	27004	8SE Bläsinga	TV3	26	72,9	0,2	
22-11-26	563	27	42G6	56 30,065	16 56,090	27004	8SE Bläsinga	CTD		71	0,2	
22-11-27	564	25	39G4	55 27,672	14 33,258	25502/25073	8E Skillinge	CTD		60	3,7	
22-11-27	276	25	39G4	55 27,499	14 28,382	25502/25073	8E Skillinge	TV3	30	54,9	2,9	
22-11-27	277	25	40G4	55 41,915	14 21,808	25419	3,5NE Stens Huvud	TV3	27	34,5	7	
22-11-27	565	25	40G4	55 41,535	14 22,920	25419	3,5NE Stens Huvud	CTD		38	7	
22-11-27	278	25	40G4	55 42,184	14 22,530	25401	5NE Stens Huvud	TV3	17	38,0	7	
22-11-27	279	25	40G4	55 42,052	14 32,458	25305	Rackaputten Nord	TV3	20	46,4	6,5	

Table 2. Summary of the species in the catches. Swedish BITS, Q4 2022.

Namn	Latinskt namn	24		25W		25C		25E		27		28		Total	
		Antal	Vikt	Antal	Vikt	Antal	Vikt	Antal	Vikt	Antal	Vikt	Antal	Vikt	Antal	Vikt
Local name	Species	No.	Weight	No.	Weight	No.	Weight	No.	Weight	No.	Weight	No.	Weight	No.	Weight
torsk	gadus morhua	1593	258,6	2083	393,6	1718	224,6	139	15,7	31	6,4	178	19,2	5741	918,1
sill / strömming	clupea harengus	29836	760,1	17442	483,8	96437	3552,7	6959	240,3	55053	1554,2	179097	4067,6	384823	10658,7
skarspill / brisling / vassbuk	sprattus sprattus	37711	597,2	32940	531,9	95689	1341,2	93755	1315,7	3882	41,6	156336	1225,6	420313	5053,3
staksill	alosa fallax	15	2,1	16	2,4	30	4,4							61	8,9
tobis, kusttobis	ammodytes tobianus					1	0,04							1	0,0
ål	anguilla anguilla									1	0,3			1	0,3
sjurygg (stenbit och kvabbso)	cyclopterus lumpus	1	0,4			2	0,6	1	0,2	2	0,5			6	1,7
fyrtömmad skärlånga	enchelyopus cimbrius	4	0,2			4	0,1	1	0,01			1	0,1	10	0,4
ansjovis	engraulis encrasicolus	430	6,2	35	0,5	16	0,5							482	7,2
storspigg	gasterosteus aculeatus					2764	3,9	805	1,7	982	1,9	81	0,2	4633	7,6
sandskädda	limanda limanda	46	5,5	53	8,7	16	2,3							115	16,5
spetslångebarn	lumpenus lampretaeformis									1	0,01			1	0,0
vitling	merlangius merlangus	201	22,9	9	1,4									210	24,3
hornsimpa	myoxocephalus quadricornis									321	33,5	6994	780,4	7315	813,9
rötsimpa	myoxocephalus scorpius	9	0,6	23	2,4	133	24,1			68	9,1	633	84,9	866	121,0
nors	osmerus eperlanus									1	0,1			1	0,1
skrubbskädda	platichthys flesus	343	68,3	359	66,8	161	29,8	24	4,4	110	19,4	485	69,5	1482	258,2
rödspätta	pleuronectes platessa	1103	163,8	452	64,5	64	8,4	10	1,4			7	0,8	1636	238,8
pomatoschistus (släkte)	pomatoschistus	151	0,2	1	0,0									152	0,2
småspigg	pungitius pungitius									11	0,01			11	0,0
makrill	scomber scombrus	5	1,1			3	0,2							8	1,3
piggvar	scophthalmus maximus	16	4,9	24	8,2	2	0,4							42	13,5
äkta tunga	solea solea	1	0,2											1	0,2
taggmakrill	trachurus trachurus	29	0,3											29	0,3
Tånglake	zoarces viviparus					3	0,2			16	0,4	2	0,2	21	0,8
Totalsumma		71494,2	1892,625	53436,2	1564,047	197043,5	5193,575	101693,7	1579,385	60479,3	1667,344	343812,8	6248,407	827959,7	18145,4

Table 3 Cod catch in

		Komplettering/complementary			TV3 trålstation/TV3 trawl station				
		Ogiltigt/Invalid			Syrefattig trålstation/oxygen deficiency trawl station				
Akt. nr	Position N	Position E	Stationsnamn	Trål-tid	Trål-djup	Hydro O2	Totalfångst (kg)	Torskfångst	
Act. no	Latitude	Longitude	Station name	trawl min	Trawl depth	O2 ml/l	Total catch (kg)	Cod catch kg	antal/no.
SD 24									
248	55 12,673	13 35,301	Y17	9	43,5	5,2			
249	55 12,939	13 38,890	Y17	30	43,4	5,2	237,5	19,1	246
250	55 15,244	13 41,105	Ystadkroken	30	40,6	7	477,7	39,1	449
251	55 17,099	13 55,665	E Ystadkroken	30	37,3	6,9	849,6	46,1	202
252	55 15,581	13 57,637	8,9SE Klostergrund	30	38,0	6,9	327,9	154,4	695
SD 25									
244	55 40,845	16 11,087	11E Tången	30	68,8	0,1	3,5	1,8	8
245	55 47,857	15 54,226	Inre U10	30	60,1	0,3	672,0	8,4	42
246	55 50,098	15 56,740	11SE Utklippan	30	56,6	0,9	2 227,0	5,0	97
247	55 52,137	16 01,402	Argos Track	30	54,1	1,3	1 575,9	13,9	131
253	55 54,648	15 34,079	5SSW Utklippan	25	50,0	3,9	587,5	25,8	250
254	55 50,597	15 33,971	Klippebank	30	39,9	5,3	438,1	5,7	80
255	55 49,956	15 16,782	3NW Västra Nabb	30	51,7	2,5	1 106,6	126,5	1007
256	55 45,936	15 24,577	3S Yttertorpet	30	61,3	0,5	162,4	53,0	241
276	55 27,499	14 28,382	8E Skillinge	30	54,9	2,9	548,2	244,3	1302
277	55 41,915	14 21,808	3,5NE Stens Huvud	27	34,5	7	687,4	65,2	322
278	55 42,184	14 22,530	5NE Stens Huvud	17	38,0	7	81,3	44,2	222
279	55 42,052	14 32,458	Rackaputt Nord	20	46,4	6,5	247,1	39,9	237
SD 27									
240	57 21,726	16 55,130	4NW Byxelkrok	30	44,5	4,1	201,5	0,4	3
241	57 25,312	17 01,055	5N Byxelkrok	30	56,3	5,7	448,3	0,3	1
242	57 27,659	17 05,483	3SW Ölands Norra	26	65,9	5,7	59,1	0,4	2
243	57 20,617	17 25,196	11ESE Ölands Norra	30	72,7	1,2	107,4	1,5	8
266	57 36,861	17 06,823	9SE Kungsgrundet	30	85,5	3,9	123,4	1,3	6
267	57 17,534	17 24,923	11E Böda	5	75,6	4			
268	57 07,487	17 17,338	7ESE Högby Fyr	30	72,3	5,4	132,6	0,4	3
269	57 02,827	17 52,323	11,5NW Hoburg	3	85,6	0,1			
270	56 59,793	17 57,032	8NW Hoburg	30	64,9	0,1	5,6		
271	57 16,262	17 24,664	11E Böda	18	75,2	4	94,5	0,5	1
272	56 57,557	17 11,045	10E Kårehamn	6	72,4	3,7			
273	56 56,140	17 10,390	10E Kårehamn	13	73,2	3,4			
274	56 43,648	16 59,665	9SE Kapelludden	30	65,7	5,4	387,4	0,9	4
275	56 33,570	16 54,993	8SE Bläsinga	26	72,9	0,2	107,5	0,8	3
SD 28									
257	57 02,655	18 49,479	10SE När	22	67,4	0,3	716,8	0,9	7
258	57 06,933	18 57,715	11ESE När	3	86,4	0,1			
259	57 09,946	18 49,421	5SE När	30	48,9	3,7	723,2	1,4	7
260	57 14,447	19 04,762	13E Ljugarn	3		0,1			
261	57 20,272	19 03,916	6SE Östergarn	22	63,7	1,7	1 204,6	3,4	20
262	57 21,142	19 09,436	8SE Östergarn	3	79,1	0,1			
263	57 51,476	19 28,419	6,5SE Fårö	30	69,0	2	875,9	10,5	112
264	57 52,584	19 25,158	5SE Fårö	30	48,3	6,2	1 443,4	1,6	19
265	58 03,539	19 26,688	E Salvorev	30	73,7	0,9	1 284,5	1,4	13
Catch, weight (kg) and numbers					39		18 145	918,1	5 741

Institute of Food Safety, Animal Health and Environment (BIOR), Riga (Latvia)  
National Marine Fisheries Research Institute (NMFRI), Gdynia (Poland)

## **THE CRUISE REPORT**

**FROM THE JOINT LATVIAN-POLISH BITS 4Q SURVEY ON THE POLISH R.V.  
“BALTICA” IN THE CENTRAL-EASTERN BALTIC (11-21 December 2022)**

by  
Ivo Sics\*, Radosław Zaporowski\*\* and Tycjan Wodzinowski\*\*

\* Institute of Food Safety, Animal Health and Environment (BIOR), Riga (Latvia),

\*\* National Marine Fisheries Research Institute (NMFRI), Gdynia (Poland)



Riga – Gdynia, January 2023

photo: Włodzimierz Gryziel

## Introduction

The joint Latvian-Polish BITS survey was conducted during the period 11-21.12.2022 on the r.v. “Baltica” and was based on the agreement between the Institute of Food Safety, Animal Health and Environment (BIOR) in Riga and the National Marine Fisheries Research Institute (NMFRI) in Gdynia. The joint Latvian-Polish BITS 4Q survey was conducted in the Latvian EEZs which correspond to the ICES sub-divisions (SDs) 26 and 28. It was part of the Baltic International Trawl Survey (BITS), which was coordinated by the ICES Baltic International Fish Survey Working Group [WGBIFS] (Anon. 2022).

The main aims of reported cruise were:

1. To collect materials to investigate the distribution, abundance, and biological structure of the cod stock.
2. To determine the distribution and abundance of cod recruits. Estimates of year – class strength of cod.
3. To collect materials for the investigation of the distribution, abundance, and biological structure of flounder stock.
4. To collect data on cod feeding.
5. To analyse the hydro-meteorological conditions (seawater temperature, salinity, oxygen content, air temperature, atmospheric pressure, wind velocity and directions) in the ICES SDs 26N and 28.
6. Record acoustical data during trawling and on the distance between consecutive catch-stations.
7. To collect information about marine litter.

## Materials and Methods

### *Personnel*

The BITS Q4 - 2022 survey scientific staff was composed of nine persons, i.e.:

Radosław Zaporowski, NMFRI, Poland - cruise leader,

Władysław Gawęł, NMFRI, Poland - ichthyologist,

Anetta Ameryk, NMFRI, Poland - hydrologist,

Maciej Bielak, NMFRI, Poland – acoustician,

Ivo Sics, BIOR, Latvia - ichthyologist,

Martins Plikss, BIOR, Latvia - ichthyologist,

Karlis Heimrats, BIOR, Latvia - ichthyologist,

Laura Briekmane, BIOR, Latvia – ichthyologist,

Janis Gruduls, BIOR, Latvia – ichthyologist.

### *Narrative*

The reported survey research tasks were conducted during the period from the 11<sup>th</sup> to 21<sup>st</sup> of December 2022 and overall, eleven full days were devoted to the survey plan accomplishment. The at sea research was conducted within the Latvian EEZ (the ICES SD26 and SD28), and inside the Latvian territorial waters (the ICES SD28. Trawling was not conducted

where the depth was shallower than 20 m.

The vessel left the Gdynia port (Poland) on 11.12.2022 and was navigated towards the south-western corner of the Latvian EEZs (Fig. 1). The direct at sea research began on 14.12.2022 and was concluded on 20.12.2022. On 21.12.2022 r.v. “Baltica” returned to the homeport. Due to the very bad weather conditions, 3 working days during the survey were lost.

### *Survey design and realization*

The original survey plan specified that 24 control-hauls will be realized in the Latvian EEZ (8 trawls in SD 26, 16 trawls in SD 28).

The r.v. “Baltica” realized 21-bottom trawl control-hauls including the Latvian territorial waters (Fig. 1). Four catch-stations were only initiated due to hydrological parameters measurement and due to very low oxygen concentration (below 0.5 ml/l) near bottom, fishing was omitted.

All trawl catches were performed during daylight hours. The hard-bottom ground-rope (rockhopper) trawl, type TV-3#930 (with 10-mm mesh bar length in the codend) was applied for fish catches. The mean speed of vessel while trawling was 2.9 knots. For all realized hauls, their duration was shortened to 10-20 minutes, due to dense clupeid fish concentrations observed on the echosounder or bad weather.

The length measurements in the 1.0 cm classes were realised for 495 cod and 1898 flounder. Length measurements in the 0.5 cm classes were realized for 1719 herring and 1639 sprat. In total, 341 cod and 431 flounder individuals were taken for biological analysis. Stomachs from the 277 cod were taken for investigation of cod feeding.

Acoustic data, i.e., the echo-integration records (SA = NASCs; Nautical Area Scattering (Strength) Coefficient) were collected with the EK-60 scientific echosounder during fishing operations as well as the distances between consecutive hauls. The echo-sounder data collected during the BITS survey were delivered to the Latvian researchers for further analysis.

Directly before every haul, the seawater temperature, salinity, and oxygen content were measured continuously from the sea surface to a bottom. The seawater samples were taken also at the standard HELCOM stations. Totally, 26 hydrological stations were inspected with the Neil-Brown CTD-probe combined with the rosette sampler (the bathometer rosette). Oxygen content was determined by the standard Winkler’s method.

Meteorological observations such as wind velocity, direction and the sea state were realized at the actual geographic position of each control-haul.

## **Results**

### *Fish catches and biological data*

The control-catches basic results collected in December 2022 during the Latvian-Polish BITS-4Q survey are presented in Table 1. Twenty-one hauls were realized during the survey, 15 hauls in SD28, 6 hauls in SD26 with. Overall, 15 fish species were recognised in the performed hauls in the central-eastern Baltic. In the realized 14 hauls in SD28, sprat, herring, cod, and flounder were the most frequently occurring fish species - 100%, 100%, 86% and 100% respectively (Table 1.). Sprat, herring, flounder, and cod also dominated with respect to mass of the catch (kg) and efficiency (CPUE) in SD28 (Fig. 1.A.). By-catch of other fish species was insignificant. Sprat dominated by mass in the ICES SD28 with the average share of 58%. Herring was the next species most frequently represented in terms of mass - 31.3%. The share of flounder and

cod in control-catches made out in the ICES SD28 was 9.4% and 0.9%, respectively. The mean CPUE for all species in SD28 amounted 1772.8 kg/h, and in this 1198.3, 498.9, 140.6 and 14.9 kg/h were for sprat, herring, flounder, and cod respectively (Fig. 1.A.).

Sprat, herring, flounder, and cod were the most frequently occurring fish species in the catches of all 3 realized hauls in SD26 (Table 1.). Sprat, herring, cod, and flounder, and cod dominated also with respect to mass of the catch (kg) and efficiency (CPUE) in SD26 (Fig. 1.A.).

Sprat dominated by mass in the ICES SD26 with the average share of 54%. Herring was the next species most frequently represented in terms of mass, i.e., 41.4%. The share of flounder and cod in control-catches made out in the ICES SD26 was 2.4% and 2.1%, respectively. The mean CPUE for all species in SD28 amounted to 1627 kg/h, and in this 878.7, 673.6, 38.4 and 33.5 kg/h were for sprat, herring, flounder, and cod, respectively (Fig. 1.A.).

Total catch of fishes and the number of realized hauls in the Latvian EEZ, during reported BITS survey is presented in the text-table below:

SD	Number of hauls	Total catch (kg)				
		Cod	Herring	Sprat	Flounder	Others
26	3	25.11	505.2	659	28.8	2.1
28	14	50.3	1741.2	3228.4	521.8	25.2

The distribution of cod and flounder during the survey in kg/h are presented in Figures 2 and 3. The length distribution of cod, flounder, herring, and sprat, according to the ICES SDs are illustrated in Figures 5-8 and Tables 3-6.

## Cod

The total length of cod in the scrutinised samples ranged from 5 to 50 cm and specimens from the length classes of 21-32 cm dominated in samples from the ICES SD28 (Fig. 5, Table 3). In total, 241 cod were analysed from hauls in SD28.

Only 3 hauls were realized in SD26. The total length of cod in scrutinized samples ranged from 5 to 52 cm and specimens from the length classes of 17-30 cm dominated in samples from the ICES SD26, respectively (Fig. 5, Table 3). In total, 100 cod were analysed from hauls in SD26.

A very low number of small cod (< 19 cm) was observed in the hauls. Almost all cod were below minimum size (BMS) 35 cm, 95.8% in SD26 and 95.1% in SD28 (Fig. 4).

## Flounder

The total length of flounder in scrutinized samples ranged from 8 to 37 cm and specimens from the length classes of 18-26 cm dominated in samples from the ICES SD28 (Fig. 6, Table 4).

The total length of flounder in scrutinized samples ranged from 19 to 37 cm and specimens from the length classes of 21-28 cm dominated in the samples from the ICES SD26 (Fig. 6, Table 4).

A very low number of small flounder (< 21cm) was observed in the hauls. The share of flounder less than minimal commercial fishing size (< 21cm) was 5.9% in SD26 and 25.9% in SD28 (Fig. 4).

## Herring

The length range of collected herring was 10.5-23.5 cm, and specimens from the length classes of 16.0-19.0 cm were most frequently represented in samples from the ICES SD28 (Fig. 7, Table 5).

The length range of collected herring was 14.5-23.0 cm, and specimens from the length classes of 16.5-19.5 cm were most frequently represented in samples from the ICES SD28 (Fig. 7, Table 5).

### **Sprat**

The length range of collected sprat was 7.0-14.5 cm, and specimens from the length classes of 11.0-13.0 cm were most frequently represented in samples from the ICES SD28 (Fig. 8, Table 6).

The length range of collected sprat was 8.5-14.5 cm, and specimens from the length classes of 11.5-13.0 cm were most frequently represented in samples from the ICES SD26 (Fig. 8, Table 6).

### **HYDROLOGICAL SYTUATION IN DECEMBER 2022**

The main hydrological parameters were measured at each trawling (21) and additional hydrological stations (5) (Fig. 1). Measurements were conducted with the CTD SeaBird 911-probe combined with the rosette sampler. Oxygen content was determined by the standard Winkler's method. The STD data were aggregated to the 1-m depth strata. The salinity parameter was presented in Practical Salinity Unit (PSU). Meteorological parameters were measured by MicroStep-MIS AMS 111 automatic weather station.

The most frequent winds (Fig. 9) were from direction WSW-SSW. The average (10 min) wind speed varied from 1.0 m/s to 11.4 m/s (up to 30.8 m/s). The air temperature ranged from -4.0 °C to 6.8 °C, and average temperature was 1.6 °C.

The lowest value of temperature at the surface layer was observed at station 46, while the warmest surface water was at the trawl 5. The temperature varied from 5.49 °C to 6.72 °C, while the average value was 6.09 °C. The average surface salinity was 7.36 in the PSU. The minimum value was 7.25 at the trawl 4 and maximum 7.47 at the station 45A. The highest oxygen content in surface water layer was 8.01 ml/l at the hydrographic station 46 and trawl 21, while the lowest one 7.56 ml/l at the trawl 6. Mean value of dissolved oxygen equalled 7.79 ml/l.

Near - bottom layer conditions are presented in the Figure 10. Water temperature varied from 7.99 °C (station 46) to 5.34 °C (trawl 5). The mean value calculated for the whole area covered during the cruise was 6.22 °C. The average salinity in the close-to-the-bottom water layers was 9.38 PSU. The highest value was measured at the hydrological station 37 (12.83). The lowest one was 7.29 (haul 4). The dissolved oxygen varied from 0.00 ml/l (hydrological stations 37 and 43) to 7.95 ml/l (trawl 3). The mean value was 3.39 ml/l. Figure 11 shows vertical distribution of the seawater temperature, salinity and oxygen content along the hydrological transect of the Gotland Deep.



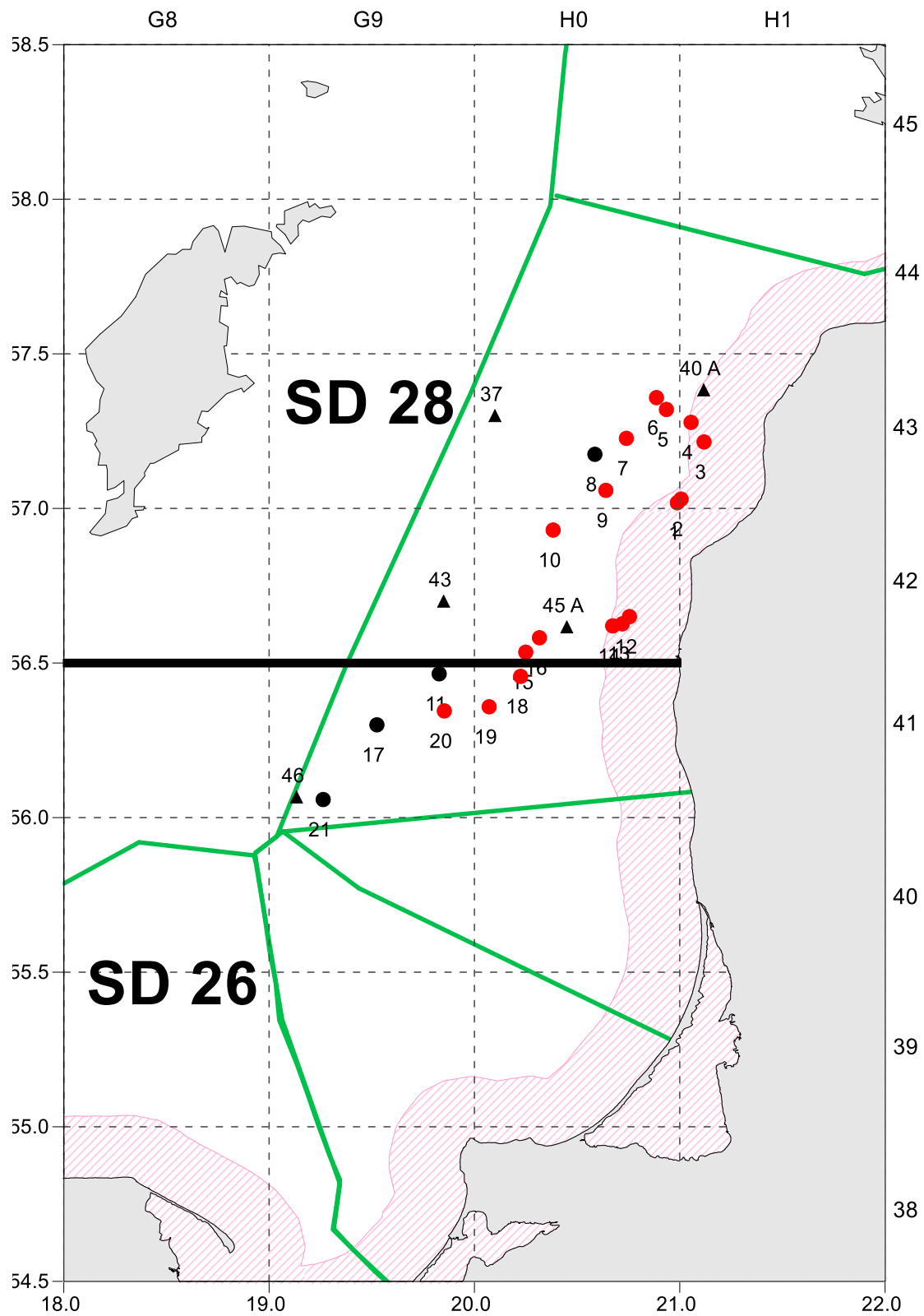


Figure 1. Location of the realized fish control-hauls (marked with red dots), hauls with low oxygen concentration (below 0.5 ml/l, marked with black dots) and the HELCOM standard hydrological stations (marked with black triangles), green lines indicate national fishing zone borders.

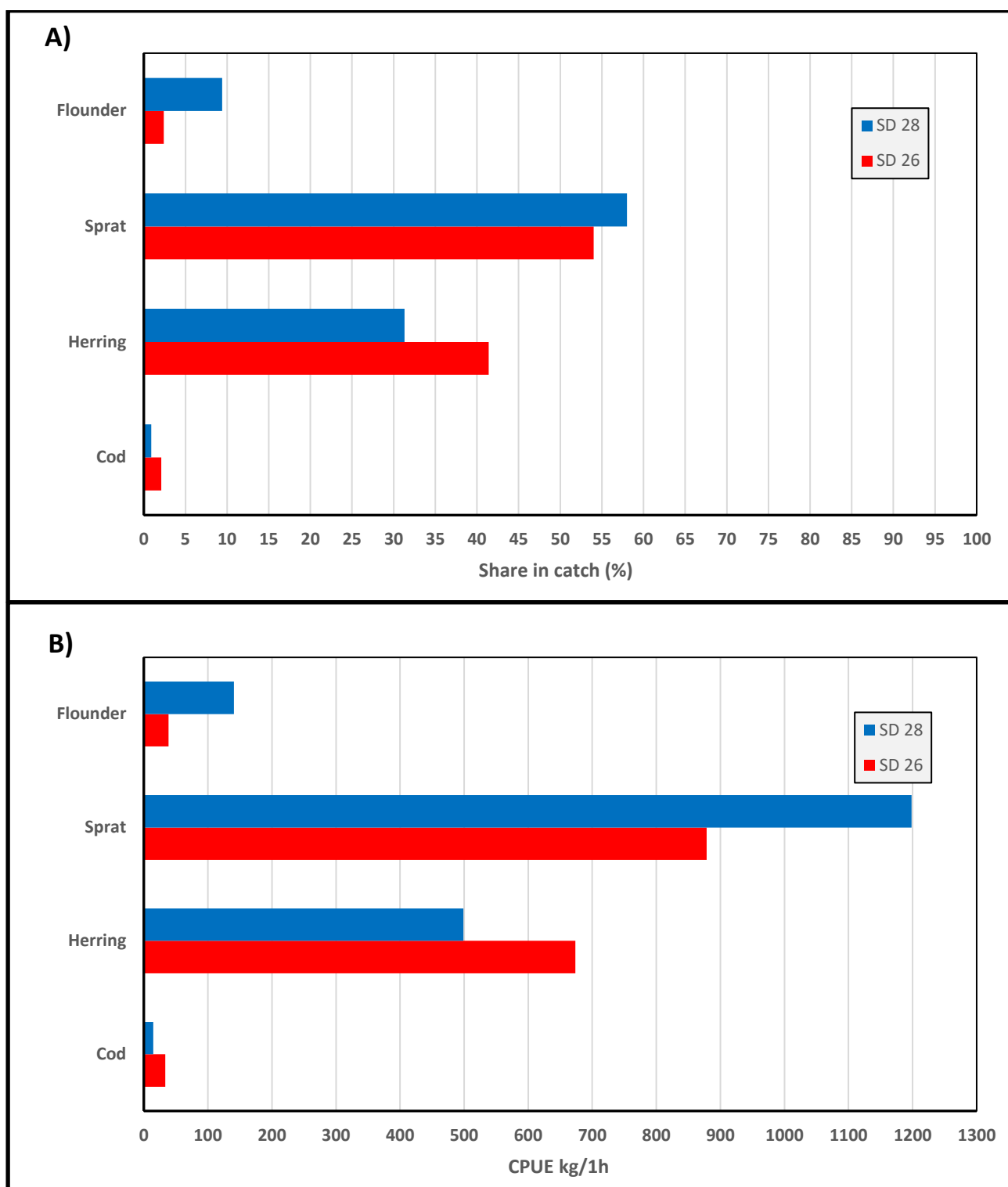


Fig. 1.A. Mean share in mass of control hauls (A), and mean CPUE (B) of dominant fish species in catches conducted during the BITS 4Q survey; r.v. "Baltica" (11th-21st December 2022).

Table 1. Catch results from the Latvian-Polish BITS 4Q survey; r.v. "Baltica", 11-21 December 2022

Haul number	Date of catch	EEZ	ICES rectangle	ICES SD	Depth to the bottom [m]	The ship's course during fishing [°]	Geographical position of the catch station				Time of		Haul duration [ min.]	Total catch	all species CPUE [kg/0.5h]	CATCH of particular fish species [kg]				
							start		end		shutting net	pulling up net				Sprat	Herring	Cod	Flounder	Others
							latitude 00°00' N	longitude 00°00' E	latitude 00°00' N	longitude 00°00'E										
1	14/12/2022	LAT	43H0	28	30	010	57°01.1	20°59.3	57°02.0	20°59.7	08:30	08:50	20	168.69	253.035	62.934	23.826	3.45	73.69	4.79
2	14/12/2022	LAT	43H1	28	33	020	57°01.8	21°00.4	57°02.5	21°01.1	09:45	10:00	15	116.615	233.23	53.83	34.09	4.67	23.31	0.715
3	15/12/2022	LAT	43H1	28	44	020	57°12.9	21°07.1	57°13.6	21°07.7	08:25	08:40	15	182.235	364.47	8.358	45.869	5.03	117.73	5.248
4	15/12/2022	LAT	43H1	28	62	355	57°16.7	21°03.3	57°17.4	21°03.4	09:50	10:05	15	435.46	870.92	65.199	339.731	9.53	19.57	1.43
5	15/12/2022	LAT	43H0	28	60	320	57°19.2	20°56.1	57°19.9	20°55.2	11:30	11:50	20	489.041	733.5615	257.304	194.056	9.38	28.08	0.221
6	15/12/2022	LAT	43H0	28	60	020	57°21.5	20°53.2	57°22.2	20°53.7	13:05	13:20	15	1198.105	2396.21	968.197	218.603	0.275	11.03	0
7	16/12/2022	LAT	43H0	28	64	200	57°13.6	20°44.4	57°12.8	20°44.0	08:30	08:50	20	292.925	439.3875	69.797	191.793	9.82	21.1	0.415
8	16/12/2022	LAT	43H0	28	95	-9	57°10.5	20°35.2	57°10.5	20°35.2	09:50	09:55	5	0	0	0	0	0	0	0
9	16/12/2022	LAT	43H0	28	87	035	57°03.5	20°38.4	57°04.0	20°39.1	11:45	12:00	15	147.17	294.34	111.339	32.951	1.67	1.21	0
10	16/12/2022	LAT	42H0	28	78	200	56°55.8	20°23.0	56°55.2	20°22.6	14:15	14:30	15	470.185	940.37	103.205	339.435	2.74	24.54	0.265
11	16/12/2022	LAT	41G9	26	110	-9	56°27.9	19°49.7	56°27.9	19°49.7	20:00	20:05	5	0	0	0	0	0	0	0
12	17/12/2022	LAT	42H0	28	40	210	56°39.0	20°45.3	56°38.5	20°44.5	08:30	08:45	15	93.585	187.17	0	6.32	0.925	84.02	2.32
13	17/12/2022	LAT	42H0	28	39	215	56°37.6	20°43.2	56°37.1	20°42.5	09:25	09:40	15	104.037	208.074	0.043	15.22	0.29	86.62	1.864
14	17/12/2022	LAT	42H0	28	43	320	56°37.2	20°40.4	56°37.7	20°39.6	10:25	10:40	15	117.945	235.89	0.742	84.539	2.475	28.78	1.409
15	17/12/2022	LAT	42H0	28	92	030	56°32.1	20°15.0	56°32.5	20°15.4	13:30	13:40	10	1581.863	4745.589	1380.18	195.659	0	0.52	5.504
16	17/12/2022	LAT	42H0	28	92	030	56°34.9	20°19.0	56°35.3	20°19.3	14:40	14:50	10	169.033	507.099	147.247	19.069	0	1.563	1.154
17	17/12/2022	LAT	41G9	26	116	-9	56°18.0	19°31.5	56°18.0	19°31.5	21:10	21:15	5	0	0	0	0	0	0	0
18	18/12/2022	LAT	41H0	26	76	050	56°27.4	20°13.5	56°27.9	20°14.5	08:30	08:45	15	707.138	1414.276	335.901	341.636	13.28	14.847	1.474
19	18/12/2022	LAT	41H0	26	71	070	56°21.5	20°04.3	56°21.8	20°05.6	11:25	11:40	15	414.805	829.61	252.669	141.021	9.86	10.72	0.535
20	19/12/2022	LAT	41G9	26	80	025	56°20.7	19°51.2	56°21.4	19°51.9	08:35	08:50	15	98.295	196.59	70.471	22.548	1.97	3.265	0.041
21	20/12/2022	LAT	41G9	26	100	-9	56°03.5	19°15.8	56°03.5	19°15.8	08:00	08:05	5	0	0	0	0	0	0	0

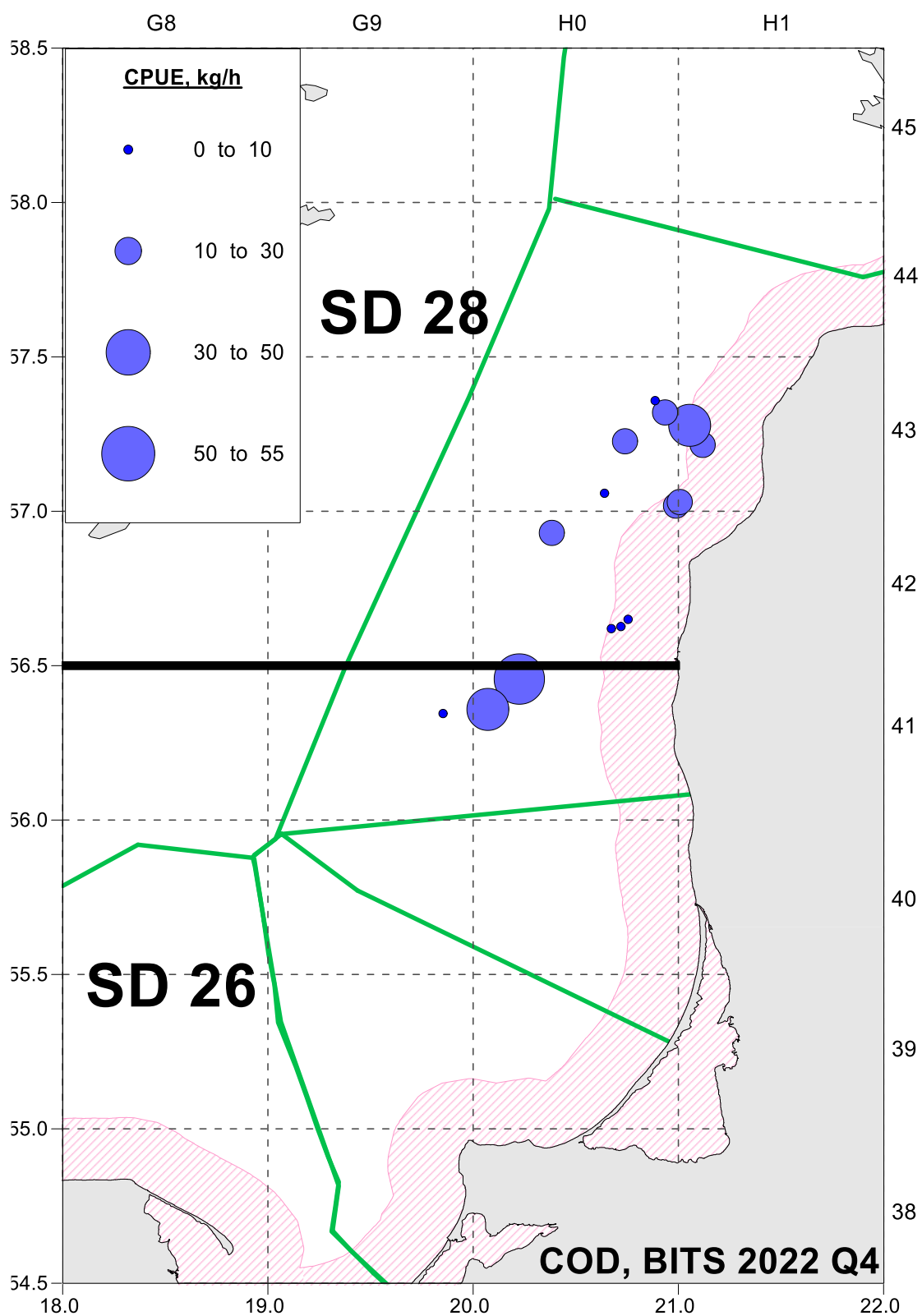
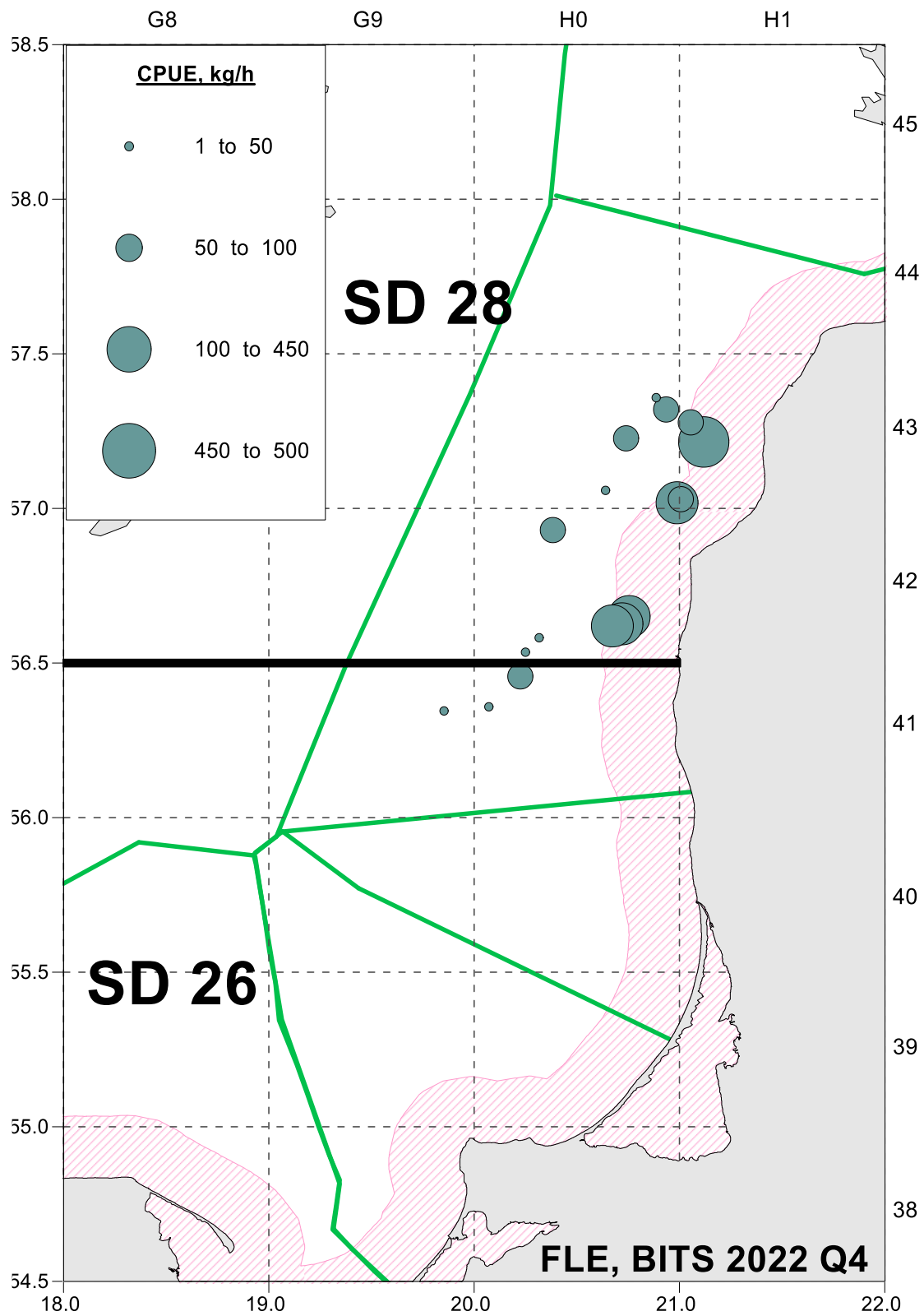


Figure 2. Distribution of cod during the BITS 2022 Q4 survey.



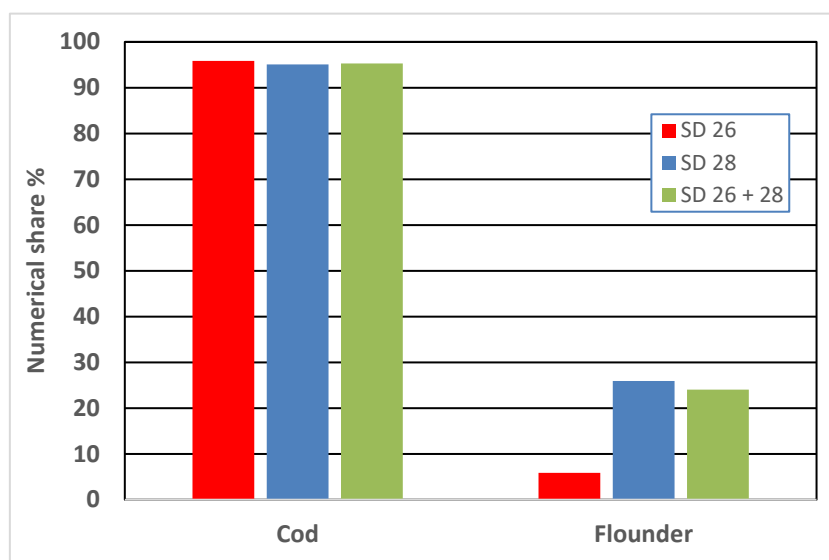


Figure. 4. Fraction of undersized cod and flounder during the BITS 4Q survey; r.v. "Baltica" (11th-21st December 2022).

Table 2. Numbers of fish biologically analysed during the BITS 4Q survey; r.v. "Baltica" (11th-21st December 2022).

Species	Number of samples			Number of fish								
	SD 26	SD 28	Total	measured			analyzed			stomach samples		
				SD 26	SD 28	Total	SD 26	SD 28	Total	SD 26	SD 28	Total
Cod	3	12	15	44	110	154	100	241	341	99	178	277
Flounder	3	14	17	34	1433	1467	136	295	431			
Herring	3	14	17	311	1408	1719						
Sprat	3	13	16	340	1299	1639						
Round Goby	0	2	2	0	3	3						
Turbot	0	3	3	0	10	10						
Four Bearded Rockling	0	1	1	0	2	2						
Eelpout	0	3	3	0	10	10						
Smelt	0	5	5	0	16	16						
Three-spined Stickleback	0	3	3	9	106	115						
Lumpfish	0	5	5	0	5	5						
Sea Scorpion	0	7	7	0	59	59						
Sand Goby	0	1	1	0	1	1						
Twaite Shad	0	4	4	13	9	22						
Anchovy	0	2	2	0	3	3						
Total	12	89	101	751	4474	5225	236	536	772	99	178	277

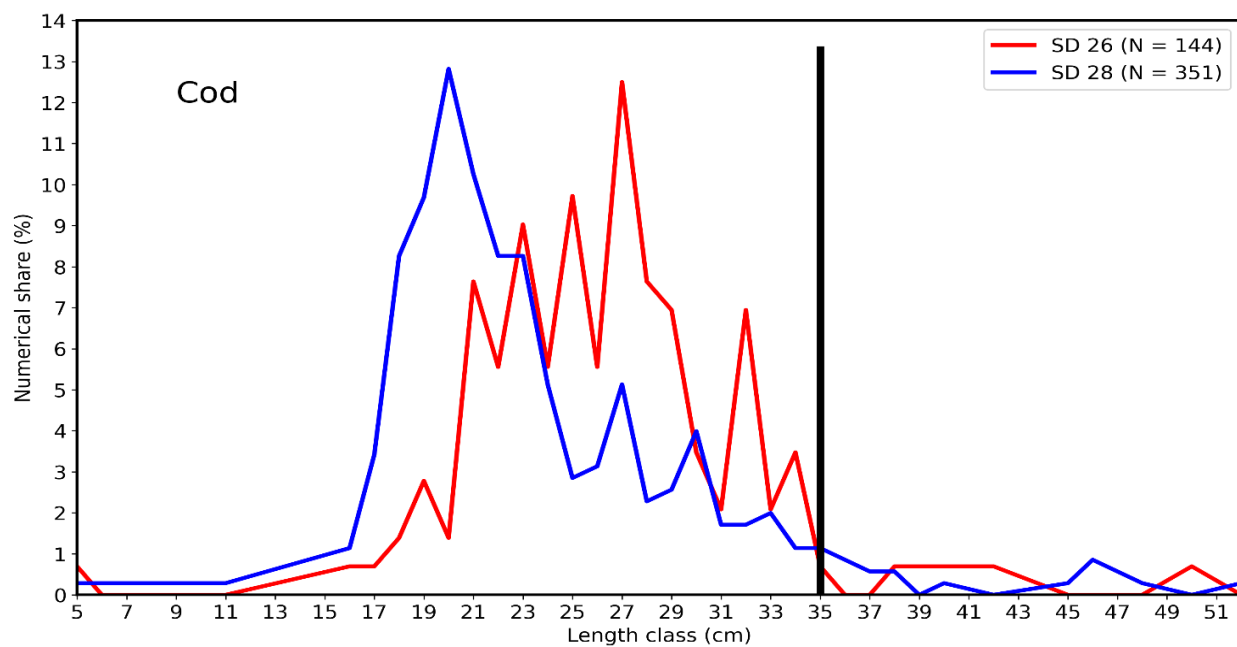


Figure 5. Length frequency of cod from SD26 and SD28 in the control catches.

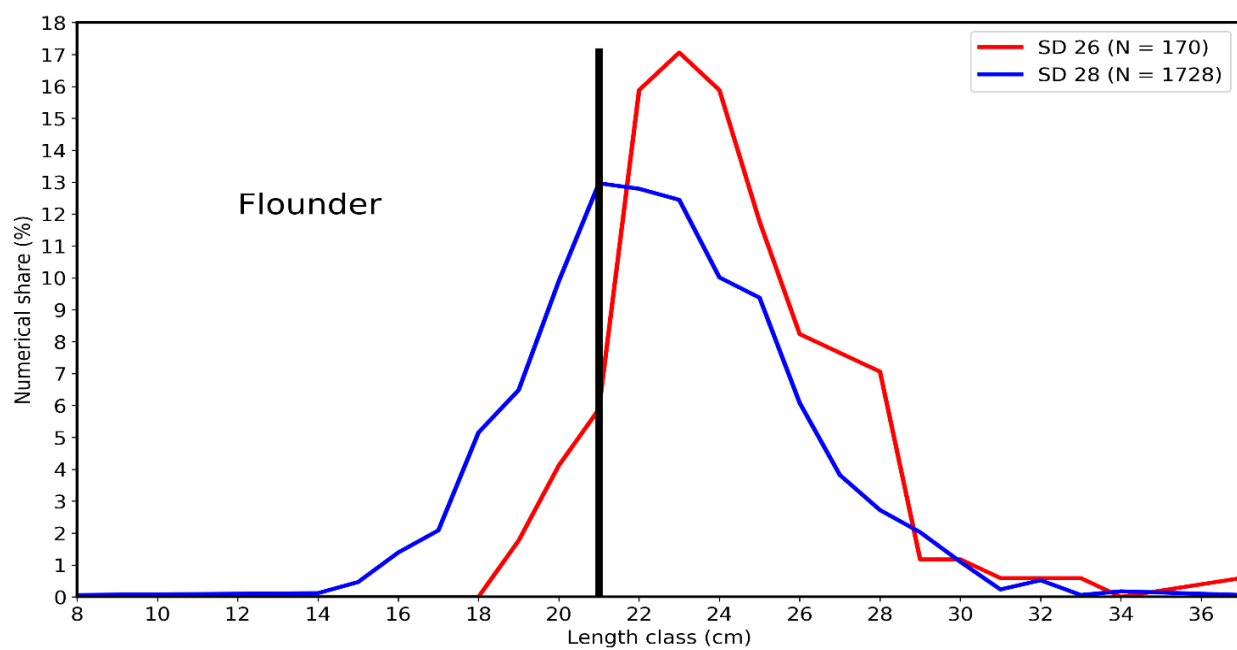


Figure 6. Length frequency of flounder from SD26 and SD28 in the control catches.

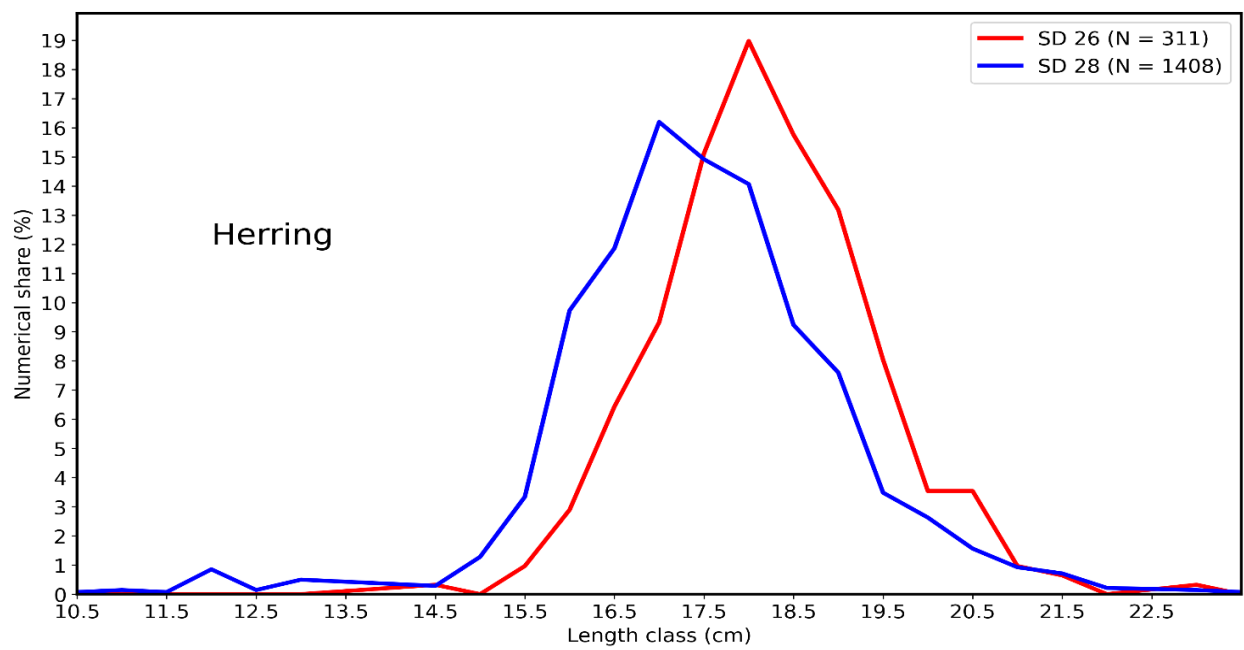


Figure 7. Length frequency of herring from SD26 and SD28 in the control catches.

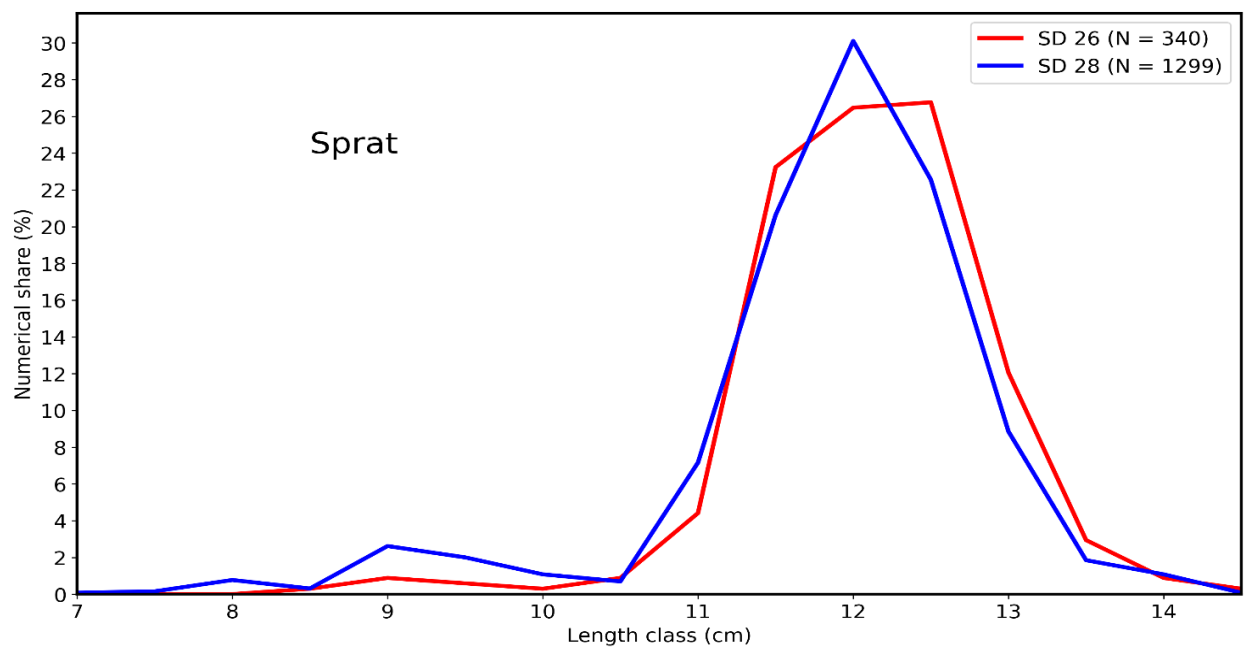


Figure 8. Length frequency of sprat from SD26 and SD28 in the control catches.



Table 3. Cod length measurements by consecutive hauls in the r.v. “Baltica” Latvian - Polish BITS survey (11th-21st December 2022); specimens grouped by 1 cm length classes.

		cm_group																																																				
Haul no	SD	5	6	7	11	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	42	45	46	48	50	52	Sum																	
1	28						1		3	4	3	3	2	2	1	2				1														1														23						
2	28						3	3	2	3	4	1	2		2					1	1	4	1		1	1																						29						
3	28	1	1		1		2	4	3	4	6	1	3	1	1		1			1			1		1		1																				1	34						
4	28					2	6	13	3	11	9	8	9	8	3	4	2	2	3	2			1	1																									87					
5	28							6	1	1	2	2	1				5	2	1	3	2	1		2	1	1	1	2																					37					
6	28							1												1																													2					
7	28					1	3	2	10	12	7	9	8	3	4	3	4	3	2	4	1		2	1		1																							80					
9	28							1		1		1							1				1																									6						
10	28					1	1	1	2	7	3		1			1	2	1	1	1	1				1																								24					
12	28						1						1				1			1		1		1																								5						
13	28													1			1																																2					
14	28			1				4	5	5	2	2									1		1																										22					
18	26						1	2	1	8	5	8	3	4	4	13	4	3	5	3	6		3	1				1																					76					
19	26						1	1	2	1	1	3	3	5	9	3	5	5	5			3	3	1						1	1	1																	54					
20	26	1				1					2		2		1	1		2	2			1	1																										14					
SD 26		1				1	1	2	4	2	11	8	13	8	14	8	18	11	10	5	3	10	3	5	1				1	1	1	1																	144					
SD 28		1	1	1	1	4	12	29	34	45	36	29	29	18	10	11	18	8	9	14	6	6	7	4	4	3	2	2		1																			351					
Total		2	1	1	1	5	13	31	38	47	47	37	42	26	24	19	36	19	19	19	9	16	10	9	5	3	2	3	1	2	1	1	3	1	1	1	1	1										495						

Table 4. Flounder length measurements by consecutive hauls in the r.v. “Baltica” Latvian - Polish BITS survey (11th-21st December 2022); specimens grouped by 1 cm length classes.

Haul no	SD	cm_group																																				Sum																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		8	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	37																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
1	28	1	1	3	1	11	9	9	12	5	8	9	8	8	5	4	5	4		4		1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			

Table 5. Herring length measurements by consecutive hauls in the r.v. “Baltica” Latvian - Polish BITS survey (11th-21st December 2022); specimens grouped by 0.5 cm length classes.

		cm_group																										
Haul no	SD	10.5	11	11.5	12	12.5	13	14.5	15	15.5	16	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22	23	23.5	Sum		
1	28			1	4				2	3	8	6	24	21	11	14	6		1								101	
2	28		2		4	2		2	1	6	6	11	16	25	13	12	3	2		1				1			107	
3	28	1			3		5	2	1	1	9	13	16	13	18	7	7	3	2			2					103	
4	28								2	6	16	13	18	17	13	4	5	2	1	1	1	1		1			101	
5	28				1		1		7	4	14	18	24	12	12	2	5	2									102	
6	28								2	7	18	19	25	8	5	4	8	1									97	
7	28								2	7	10	18	15	12	15	9	11	1	3								103	
9	28								1	5	12	18	22	20	13	4	7	1									103	
10	28									5	18	19	18	16	16	6	5		1								104	
12	28									1	5	8	10	14	21	20	7	7	3	4	3	1					104	
13	28									1	2	2	3	5	12	11	15	16	12	12	4	5	1			1	102	
14	28						1				4	3	8	15	13	15	16	10	9	2	3	1	2				102	
15	28										7	10	15	24	21	9	6	3	3								98	
16	28									1	8	9	14	8	15	13	6	1	2	2	2						81	
18	26										1	2	13	15	16	17	17	13	6	3	2						105	
19	26									1	2	6	7	12	24	20	12	9	3	5	1	1					103	
20	26							1		2	6	12	9	20	19	12	12	3	2	3		1		1			103	
SD 26								1		3	9	20	29	47	59	49	41	25	11	11	3	2		1			311	
SD 28		1	2	1	12	2	7	4	18	47	137	167	228	210	198	130	107	49	37	22	13	10	3	2	1		1408	
Total		1	2	1	12	2	7	5	18	50	146	187	257	257	257	179	148	74	48	33	16	12	3	3	1		1719	

Table 6. Sprat length measurements by consecutive hauls in the r.v. “Baltica” Latvian - Polish BITS survey (11th-21st December 2022); specimens grouped by 0.5 cm length classes.

December 20227, specimens grouped by 0.5 cm long classes.

Haul no	SD	cm_group																Sum
		7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	
1	28	1		3	2	11	6	4	3	11	21	34	17	6		1		120
2	28		1	1		7	4	2	1	10	21	33	26	5				111
3	28			3		2	5		1	12	39	25	19	5	1			112
4	28						3	1		4	13	37	25	23	4	1		111
5	28					1	2	1		8	23	26	30	16	3	3	1	114
6	28									4	17	40	31	15		2		109
7	28				1	3	1	4		7	20	34	21	9	6	4		110
9	28					1			1	8	30	39	29	7	3			118
10	28					3	1	1	1	8	28	32	24	10	5	2		115
13	28			1	1	4	1	1			1							9
14	28		1	2		1	2			2	5	10	4	1				28
15	28					1	1		1	14	32	38	30	6				123
16	28								1	5	18	43	37	12	2	1		119
18	26				1	2	2		1	5	24	26	39	11				111
19	26							1	1	5	31	37	22	11	5			113
20	26					1			1	5	24	27	30	19	5	3	1	116
SD 26					1	3	2	1	3	15	79	90	91	41	10	3	1	340
SD 28		1	2	10	4	34	26	14	9	93	268	391	293	115	24	14	1	1299
Total		1	2	10	5	37	28	15	12	108	347	481	384	156	34	17	2	1639

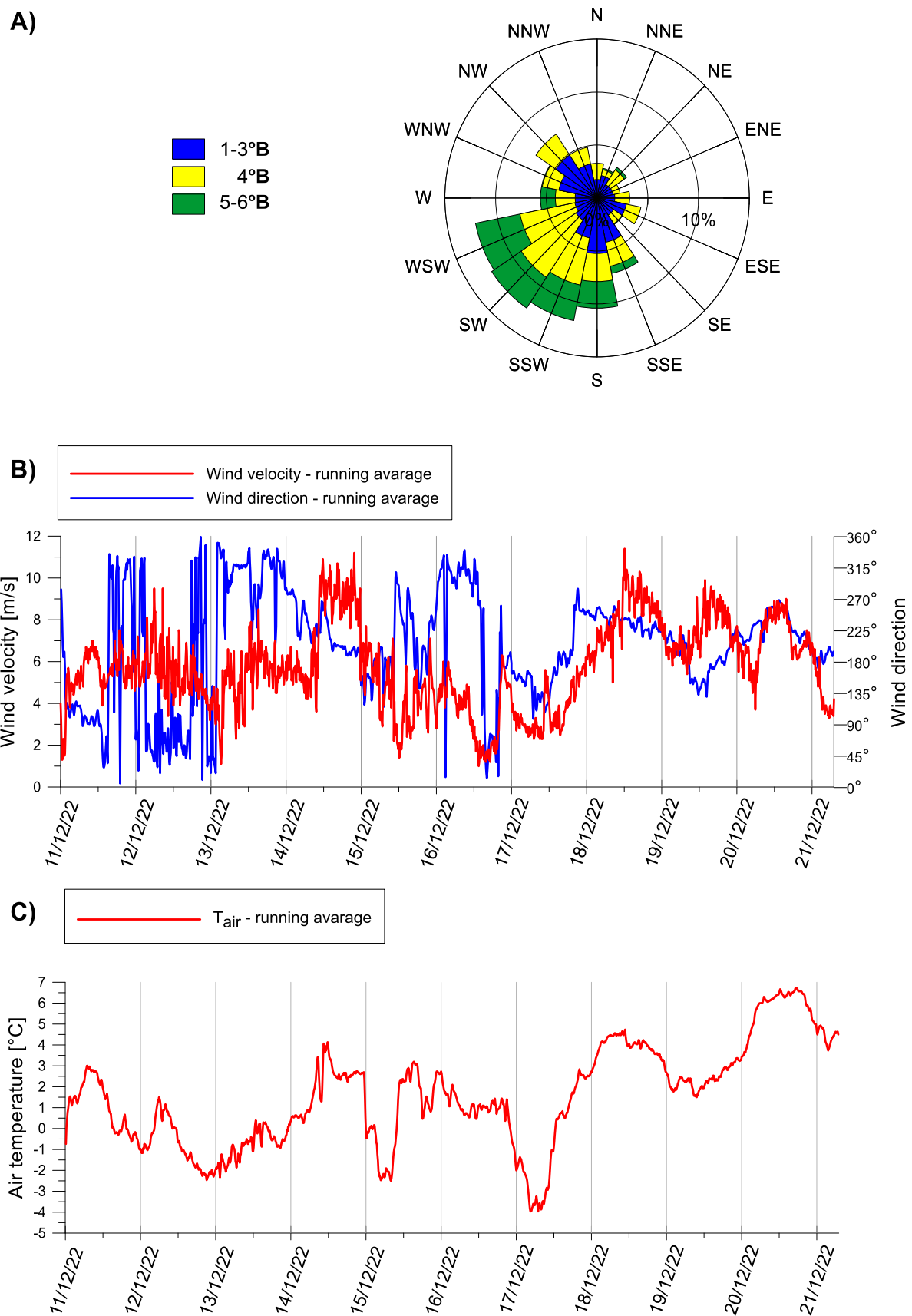


Figure 9. Changes of the main meteorological parameters (December 2022)

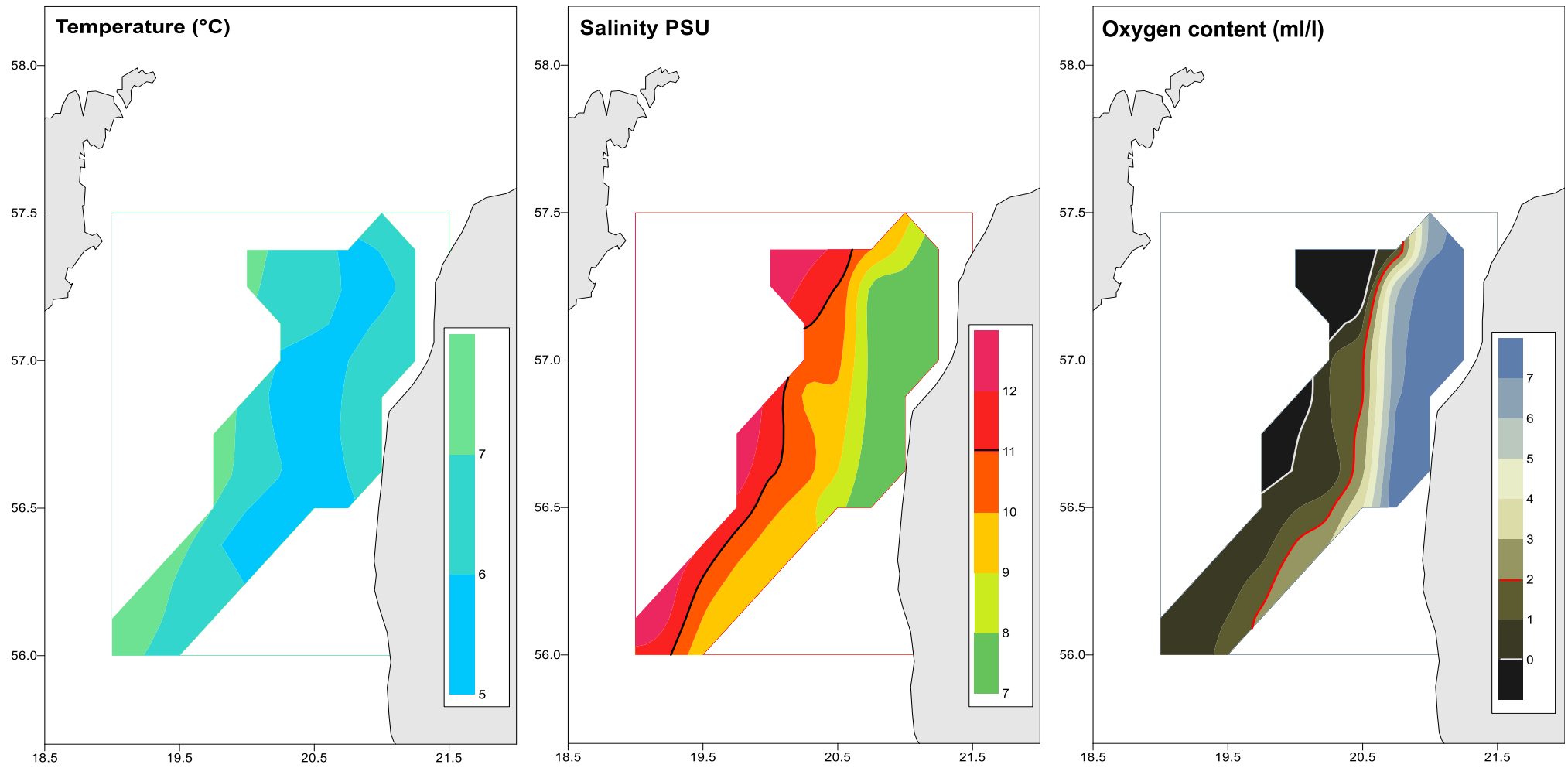


Figure 10. Distribution of the seawater temperature, salinity and oxygen content in the near bottom waters (December 2022)

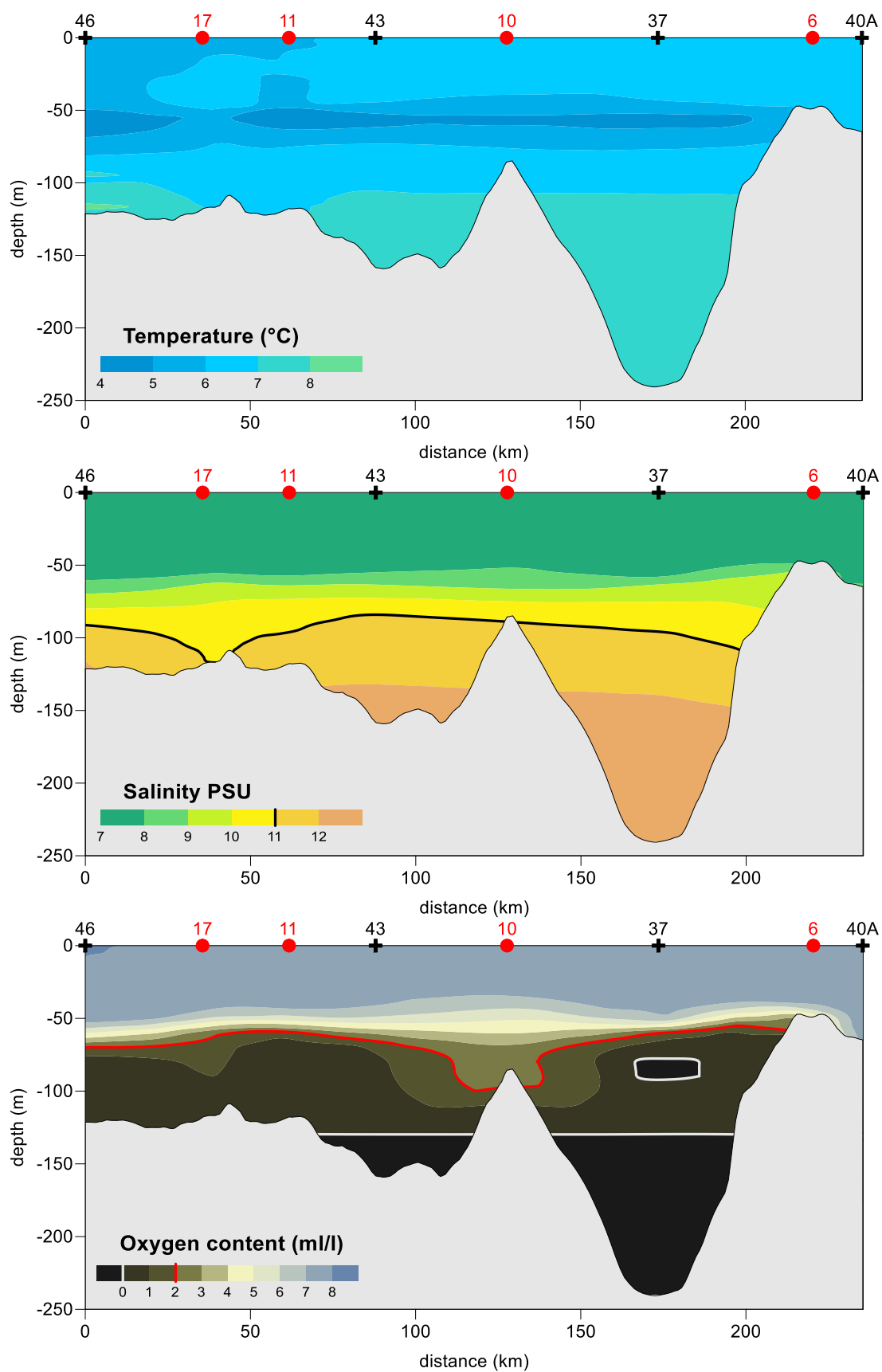


Figure 11. Vertical distribution of the seawater temperature, salinity and oxygen content along the hydrological transect of the Gotland Deep (December 2022)

**Cruise Report**  
**FRV „SOLEA“ Cruise 814**  
**08. – 27.11.2022**

**Baltic International Trawl Autumn Survey (BITS) in the  
Arkona Sea, Mecklenburg- and Kiel Bight (ICES SD 24+22)**

Scientist in charge: **Dr. A Velasco** (Thünen-OF)

**1. In a nutshell**

The 814<sup>th</sup> cruise of the FRV „SOLEA“ is the 41<sup>th</sup> November survey since 1981. It was part of the Baltic International Trawl Survey (BITS) which is coordinated by ICES WGBIFS. The main objective of the survey was the estimation of fishery independent stock indices for both Baltic cod stocks, flounder and other flat fish.

In total 58 fishery and 58 hydrography stations were carried out.

A preliminary analysis of the survey results suggests a better year class of cod in 2022 as compared with the previous weak year class 2021 (recruits at length range 10-25 cm). The proportion of cod between 26-40 cm was lower in all depth layers as compared to the previous year, with the exception of the depth layer of 10–29 meters in subdivision 22.

The abundance of flounder as compared to the previous year decreased in SD 22 and in SD 24.

The oxygen concentration close to the bottom was between 1.3-7.2 ml/l

---

**Distribution list:**

Ship management FRV „SOLEA“  
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

LA für Landwirtschaft, Lebensmittels. und Fischerei (LALLF)  
LA für Landwirtschaft und Fischerei MV (LFA)  
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

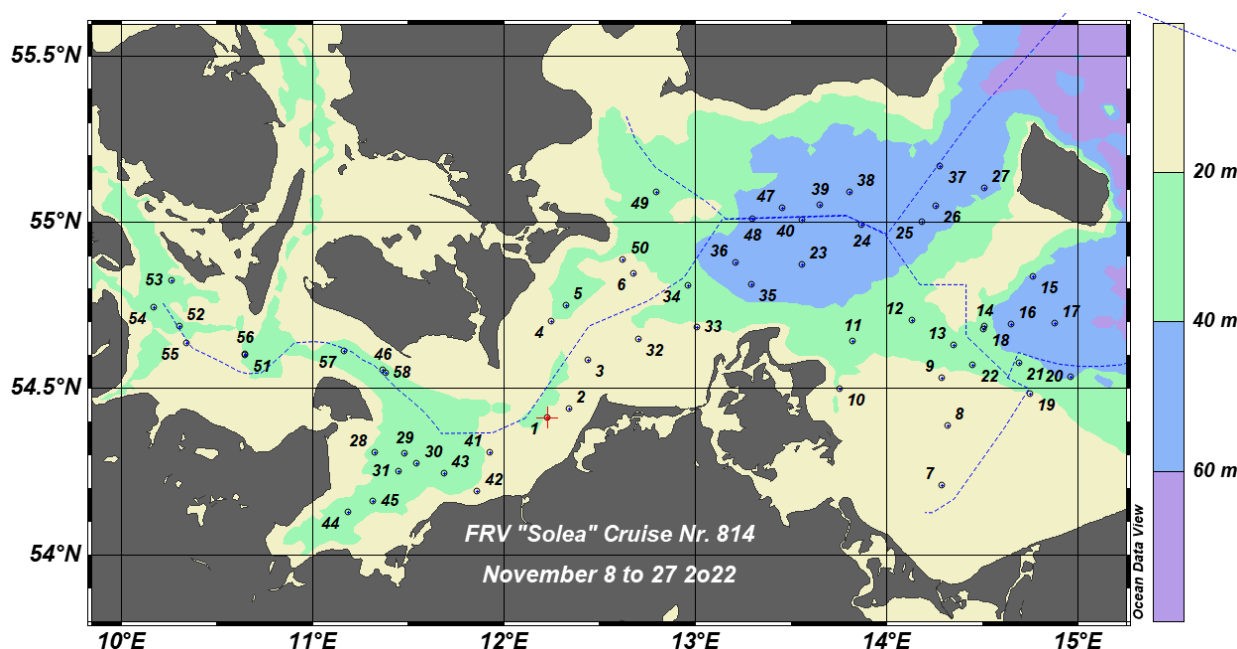
The cruise took place from 8<sup>th</sup> until 27<sup>rd</sup> November 2022. Corresponding to the recommendations of the WGBIFS in 2007, the survey of the FRV "SOLEA" covered the subdivisions 22 and 24 (Figure 1).

The following stock assessment objectives were covered during the survey:

- Collecting data for assessing stock indices, the structure and recruitment of the stocks, especially for cod and flatfish
- Monitoring the composition of fish species in the western Baltic Sea
- Collecting samples of cod, flounder, plaice, dab and turbot for biological investigations (i.e. sex, maturity, fecundity, age)
- Monitoring the actual hydrographical situation in the survey area

## 3. Cruise narrative

The internationally coordinated trawl survey is planned as a Stratified Random Survey where ICES subdivisions and depth layers are used as strata. A total of 58 stations (40 in subdivision 24 and 18 in subdivision 22) were planned for the German part of the survey which covered the southern part of ICES subdivision 22 and subdivision 24. The haul positions were selected from the TOW Database by the coordinator of the BITS surveys (ICES 2008, WGBIFS report as reference). 58 fishing stations were realized and can be used for stock assessment. The fishing hauls were carried out between 7:00 and 15:00 UTC (8:00 and 16:00 local time).



**Fig. 1 Stations of the 814<sup>th</sup> FRV "SOLEA" cruise** (Ocean Data View, R. Schlitzer, [www.awi-bremerhaven.de/GEO/ODV](http://www.awi-bremerhaven.de/GEO/ODV))

The positions of the trawl hauls are shown in Figure 1. 18 fishing hauls and 18 hydrographic stations were conducted in subdivision 22, and 40 fishing hauls and 40 hydrographic stations were realized in subdivision 24.

The numbers of fishing hauls and hydrographic stations by subdivision and 10 m depth layers are given in Table 1. 17 of 18 hauls in subdivision 22 were located at depths of 20–29 m and 19 of 40 hauls in subdivision 24 at 40–59 m.

**Tab. 1 Sampling intensity (evaluated fishing stations)**

Area		Stations		
Subdivision	Stratum Depth [m]	Total trawl distance [sm]	Fishing [n]	Hydrography [n]
22	1 [10-19]	1.5	1	1
	2 [20-29]	25.9	17	17
24	1 [10-19]	9.2	6	6
	2 [20-39]	22.3	15	14
	3 [40-59]	29.4	19	19

Trawling was done with the standard BITS trawl "TV3 520 #". The stretched mesh size in the codend was 20 mm. The duration of each haul was 30 minutes at a velocity of 3 kts as required in the BITS manual. The total catch of a haul was analysed to determine species composition in weight and number as well as the length distribution of all species.

Subsamples of cod, flounder, plaice, dab and turbot were investigated concerning sex, maturity and age.

Vertical profiles of the hydrographical parameters temperature, salinity and oxygen were sampled from the surface to the bottom immediately before every fishing haul with a CTDO probe (Sea Bird SBE 19 plus).

## 4. Preliminary results

### 4.1. Biological data

In total 759 cod, 600 flounder, 872 plaice, 610 dab, 189 turbot and 13 brill were collected for measuring length, weight, sex, maturity and age. The total catches and numbers of length samples of cod and flounder are given in Table 2 by subdivision and depth stratum.

**Tab. 2 Numbers of length measurements of cod, flounder, plaice and dab by ICES subdivision and depth stratum**

Area		Sample			
		Cod		Flounder	
Subdivision	Depth [m]	Weight [kg]	Number [n]	Weight [kg]	Number [n]
22	10-29	62.9	1083	60.7	273
24	10-19	39.1	937	162.2	739
	20-39	259.1	3632	344.2	1447
	40-59	1394.1	10171	565.2	2578



Area		Sample			
		Plaice		Dab	
Subdivision	Depth [m]	Weight [kg]	Number [n]	Weight [kg]	Number [n]
22	10-29	2377.8	31076	1447.3	19034
24	10-19	155.0	1722	67.5	839
	20-39	375.3	3936	222.8	2451
	40-59	840.5	5821	139.0	937

The mean catch per hour (CPUE) was 39.7 kg of cod and 84.9 kg of plaice. In general the catch composition was dominated by plaice and dab. However, cod and flounder were also abundant in the catches. The mean fraction of cod biomass in the hauls was 16.5 % and the mean fraction of plaice, dab and flounder was 35.3 %, 17.7% and 10.7 %, respectively. sprat and herring represented 10.1 % of the total biomass in mean.

The highest abundances in weight and number of cod, and flounder were observed in subdivision 24 in depths between 20 - 59 m and of plaice and dab between 10-29 m in subdivision 22.

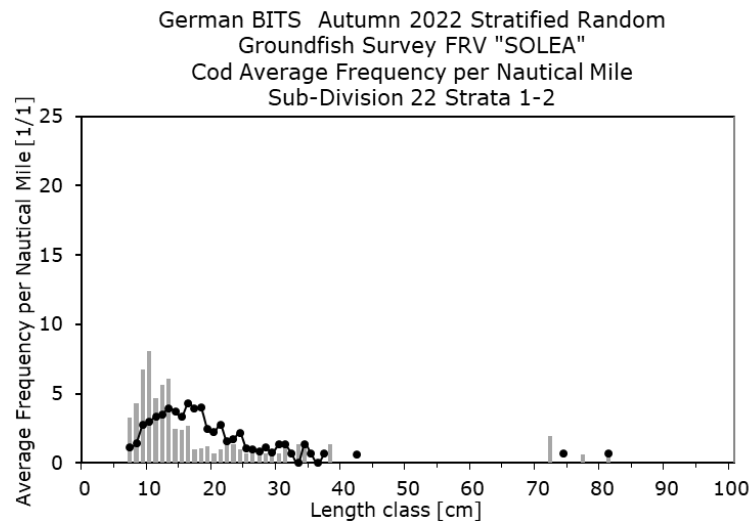
Mean CPUE are given in Table 3 by subdivision and depth stratum.

**Tab. 3 Mean CPUE of cod, flounder, plaice and dab and average individual weights by ICES sub-division and depth stratum**

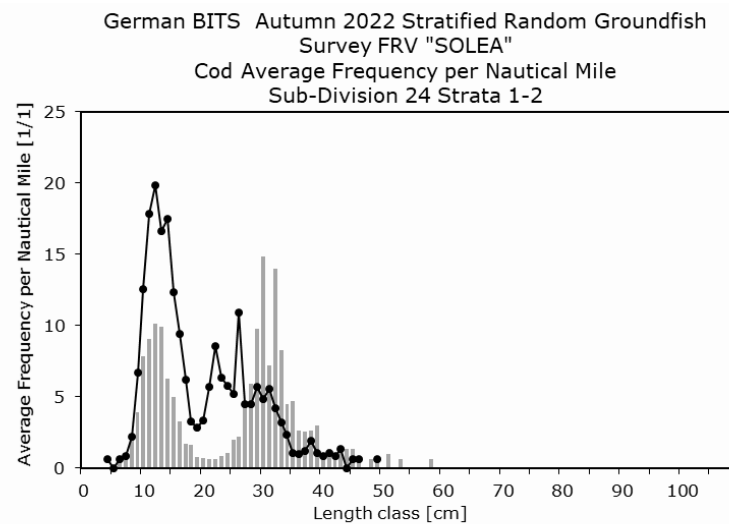
Area		Catch							
		Cod				Flounder			
Subdivision	Depth [m]	Weight [kg/sm]	Number [n/sm]	Average Weight [g]	Stations [n]	Weight [kg/sm]	Number [n/sm]	Average Weight [g]	Stations [n]
22	10-29	2.3	39	58.1	18	2.2	10	222.2	18
24	10-19	4.2	102	41.7	6	17.6	80	219.5	6
	20-39	11.6	163	71.3	15	15.5	65	237.9	15
	40-59	47.4	346	137.1	19	19.2	32	603.2	19

Area		Catch							
		Plaice				Dab			
Subdivision	Depth [m]	Weight [kg/sm]	Number [n/sm]	Average Weight [g]	Stations [n]	Weight [kg/sm]	Number [n/sm]	Average Weight [g]	Stations [n]
22	10-29	86.6	1132	76.5	18	52.7	693	76.0	18
24	10-19	16.8	187	90.0	6	7.3	91	80.5	6
	20-39	16.9	177	95.4	15	10.0	110	90.9	15
	40-59	28.6	198	144.4	19	4.7	32	148.4	19

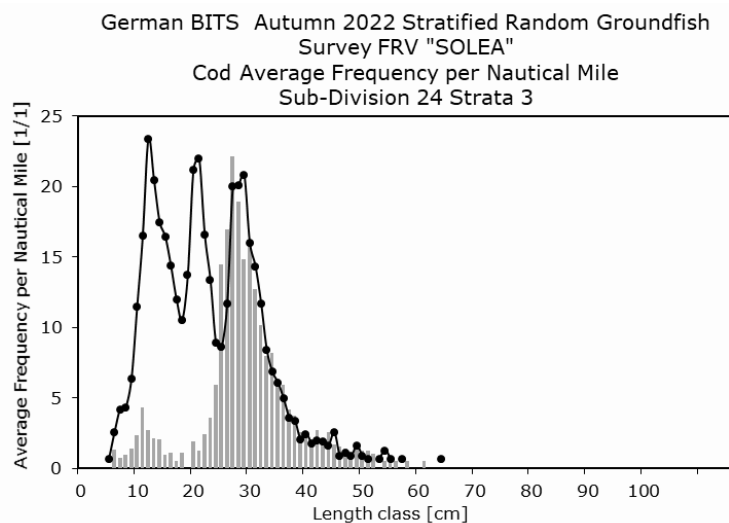
The frequencies of cod grouped by subdivision and depth strata are presented in Figures 2 to 4. The length range 10–25 cm of young cod compared to the previous year has strong increased in all depths layers. The length range 26–40 cm of cod recruits compared to the previous year was lower in all depths layers in the subdivisions 24 and 22, with the exception of the depth layer of 10–29 meters in subdivision 22 (Table 4 and Figures 2 to 4).



**Fig. 2 Length frequencies of cod in number per mile in depth strata 10 m to 29 m in SD 22 2022 (line) and 2021 (bars), (18 Hauls)**



**Fig. 3 Length frequencies of cod in number per mile in depth strata 10 m to 39 m in SD 24 2022 (line) and 2021 (bars), (21 Hauls)**



**Fig. 4 Length frequencies of cod in number per mile in depth strata 40 m to 59 m in SD 24 2022 (line) and 2021 (bars), (19 Hauls)**

**Tab. 4 Recruitment of length groups of the year 2022 in comparison to the previous year**

Area		Catch	2022		
Subdivision	Depth [m]	Length range [cm]	Number [n]	Number/ Mile [n/sm]	Trawl distance [sm]
22	10-29	26 - 40	50	1.8	27.4
24	10-19		48	5	9.2
	20-39		561	25	22.3
	40-59		3570	121	29.4
22 - 24	10-59		4229	48	88.3
22	10-29	10 - 25	960	35	27.4
24	10-19		862	94	9.2
	20-39		2867	129	22.3
	40-59		6114	208	29.4
22 - 24	10-59		10803	122	88.3

Area		Catch	2021		
Subdivision	Depth [m]	Length range [cm]	Number [n]	Number/ Mile [n/sm]	Trawl distance [sm]
22	10-29	26 - 40	19	1	24.4
24	10-19		154	17	9.0
	20-39		586	28	21.1
	40-59		4186	163	25.6
22 - 24	10-59		4945	62	80.1
22	10-29	10 - 25	542	22	24.4
24	10-19		329	37	9.0
	20-39		901	43	21.1
	40-59		930	36	25.6
22 - 24	10-59		2702	34	80.1

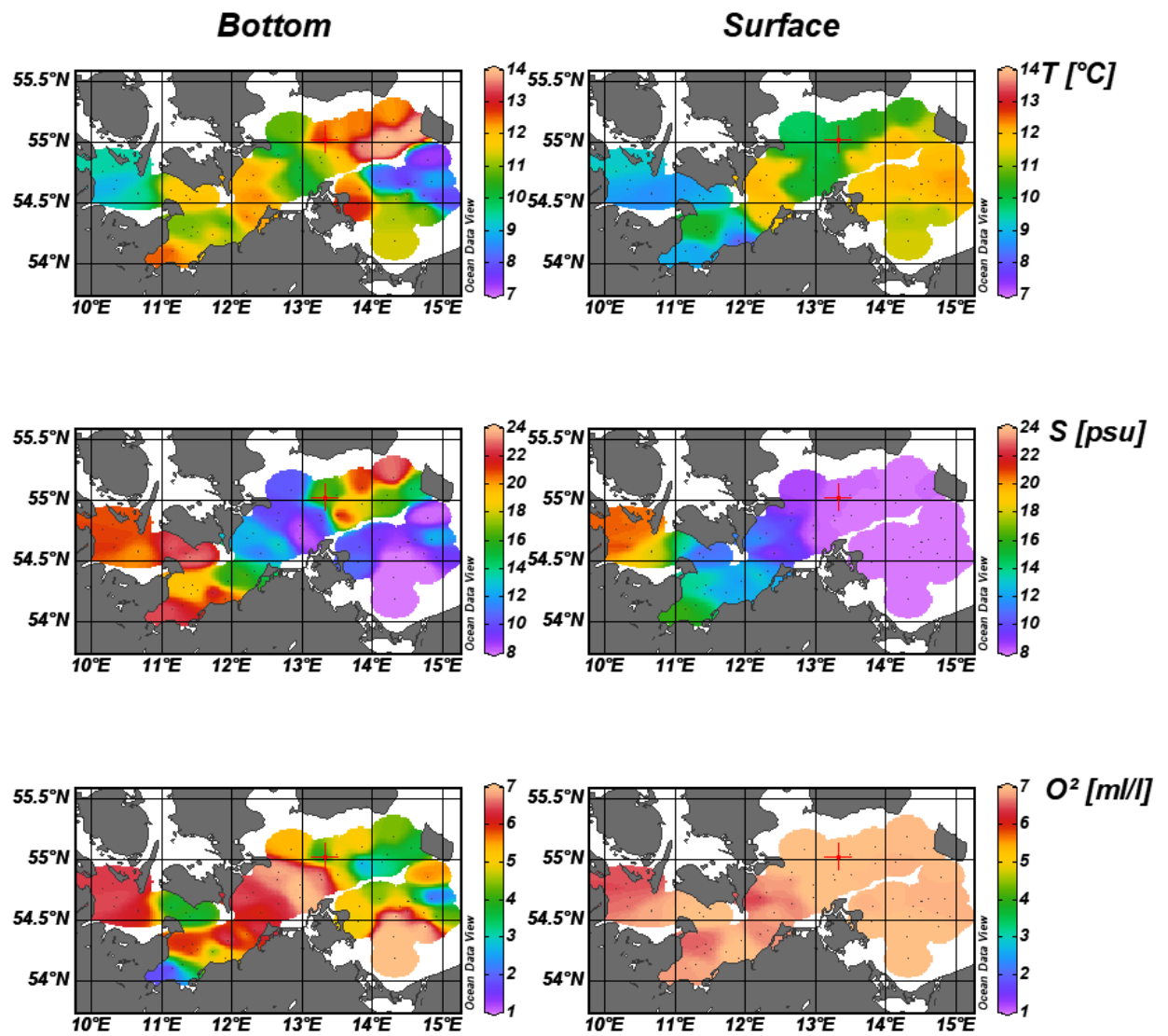
Under the assumption that the survey covered all nursery grounds of cod, a better year class 2022 (table above) compared to the weak year class 2021 (table below) can be assumed.

## 4.2 Hydrographical data

Figure 5 shows the distribution of temperature, salinity and oxygen near the bottom and at the surface in the area covered.

The hydrography was characterised by atypical autumn conditions with surface temperatures between 8.1 °C and 12.3 °C. The salinity of the surface water decreased from 21.2 to 7.5 from west to east. The lowest temperature value was found South of Bornholm at 7.3 °C. The lowest salinity value was 7.5 in Oderbank at a water depth of 11 m. The salinity increased below the halocline at a depth of 30 m in Fehmarnbelt up to 23.5

The oxygen concentration close to the bottom was between 1.3-7.1 ml/l.



**Fig. 5 Hydrography of the survey near the bottom (left) and at the surface (right)**

## 5. Cruise Participants

A. Velasco	Thünen-OF	Scientist in charge
T. Høgh	Thünen-OF	Technician leader
C. Albrecht	Thünen-OF	Technician
S. Dressler	Thünen-OF	Technician
T. Jankiewicz	Thünen-OF	Technician
M. Bächtiger	Uni Hamburg	Student helper
K. Möller	Uni Hamburg	Student helper

## 6. Acknowledgements

I would like to express my gratitude to Captain Koops and his crew on the FRV "Solea" for their good cooperation.

sgd. Scientist in charge



**Working Document**

ICES Baltic International Fish Survey

Working Group

Cádiz, Spain, 20-24.03.2023

**RESEARCH REPORT**

from the Polish part of the Baltic International Trawl Survey (BITS-4Q)

in the Southern Baltic

(16 November - 08 December 2022)

by

Krzysztof Radtke and Tycjan Wodzinowski

NATIONAL MARINE FISHERIES RESEARCH INSTITUTE



Gdynia, 16 January 2023

## INTRODUCTION

Since 1995, permanent participation of Polish R/V Baltica operated by the National Marine Fisheries Research Institute (NMFRI) in Gdynia, has taken place in autumn and winter Baltic International Trawl Surveys (BITS-4Q and BITS-1Q) realised in the southern Baltic. In March 2000 when the research standard fishing gear in the Baltic Sea - the cod bottom trawl type TV-3, has been applied by the vessels assigned to the BITS surveys realization, the principal methods of investigations within BITS-4Q ground-trawl surveys designated to particular national laboratories, including the NMFRI were designed and co-ordinated by the Baltic International Fish Survey Working Group (WGBIFS; ICES 2001). The main aim of the BITS-4Q survey planned in autumn 2022 was to monitor abundance and spatial distribution of the main demersal fish species and to some extent also clupeids in the bottom zone of the Baltic, taking into account hydrological parameters. The R/V Baltica BITS-4Q 2022 survey, which was realized in the Polish and Swedish part of the ICES Sub-divisions 25 and 26, was aimed at determination of the spatial distribution of cod, flounder, herring and sprat in the near bottom zone of the southern and central Baltic during autumn 2022 applying method of random selection of research hauls,

- estimation of the fishing efficiency, i.e. catch per unit effort (CPUE), the share of particular species in total mass of bottom research catches,
- collecting biological samples of dominated fish for the determination of the age-length-mass relationship, sex, sexual maturation, feeding conditions and externally visible diseases,
- analysis of the vertical and horizontal changes of the basic hydrological parameters (temperature, salinity, oxygen content) in the areas of fish catches and in neighbouring standard hydrological stations,
- collect and identify the abundance of marine litter present in the fishing hauls.

## MATERIAL AND METHODS

The above purposes of the November/December BITS-4Q 2022 cruise aboard of R/V Baltica were realized by the NMFRI nine members of scientific team, with Krzysztof Radtke as a cruise leader. The scientific team was composed of seven ichthyologists including technicians, responsible for determination of fish species composition of catches, fish biological analyses and data processing and one hydrologist, responsible for seawater sampling and analysing as well as for meteorological monitoring.

### Narrative

The reported Polish ground-trawl survey on board of R/V Baltica, marked with the number 20/2022/MIR took place during the period of 18.11-08.12. 2022 within the framework of the ICES Baltic International Trawl Surveys (BITS) long-term programme (ICES 2021) and the Polish Fisheries Data Collection Programme for 2022. The vessel left the port of Gdynia on 18.11.2022 in the morning and during the same day, the at sea investigations began in the Bay of Gdańsk in the Polish EEZ (Fig. 1, Tab. 2). During the period of 24-26.11.2022, the investigations were conducted in Swedish waters. The survey ended on 08.12.2022 in the morning in Gdynia harbour. The R/V Baltica operated mostly in the Polish EEZ. Overall, 23 days were utilized for fulfilling the BITS-4Q 2022 survey, including time spent for the vessel translocation from the Gdynia port to research area and in the final phase of the survey, a return way to the vessel home-port. The weather conditions during the survey were good.

## Survey design and realization – sampling description

According to the WGBIFS plan, the Polish vessel was recommended to cover during BITS-4Q 2022 survey, the Polish part of ICES Sub-divisions 25 and 26 with 11 and 40, respectively randomly selected bottom research hauls, and also in the Swedish EEZ to cover Swedish part of ICES Sub-divisions 25 and 26 with one and 10 hauls, respectively. The R/V Baltica realized 62 of the 62 planned fishing hauls for this survey. In total, nine hauls were not realized due to oxygen level near the bottom below 0.5 ml/l (Tab. 2). The hauls were classified as „No oxygen” and the catch result was considered as „zero catch haul”. Finally, it can be concluded that the hauls realized during the survey corresponded to the plan and could be therefore accepted as fully representative from the technical point of view (Fig. 1, Tab. 2) taking into account gear performance during hauls.

Trawling was done with the standard rigging- ground trawl type TV-3#930 (without bobbins and additional chains connected to the footrope), with 10-mm mesh bar length in the codend. A standard vertical fish-sounder was used to monitor the trawling depth. Usually a 6-7 m vertical net opening was achieved, which was monitored by the net echosounder. The catch stations were located on the depth range from 20 to 120 m (including no-oxygen hauls). Fish research hauls were conducted at the daylight only, lasting maximum 30 minutes, at approximately 3.0 knots vessel speed.

Each research catch was sorted out for the determination of the fish species composition. Mean CPUE of each fish species and their average share in mass of catches was calculated. From each catch station, representative samples of dominated fishes were collected to determine age-length-mass relationships, sex, sexual maturation, feeding conditions, externally visible diseases and additionally stomach samples for food composition estimation of cod were collected for further examinations in the Institute. The length of all the fish species represented in the catches was determined.

In the case of cod, turbot and plaice all the caught specimens were taken for total length and mass measurements. In the case of clupeids and flounder, the representative sub-samples of these fish species were investigated. Overall, 6098 cod, 3594 flounder, 202 plaice, 17 turbot, 5052 sprat and 8109 herring were taken for the length and mass determination. In total, 335, 676, 198, 17, 430 and 749 individuals of the above-mentioned species were aged. Biological analyses of fishes were performed directly on board of surveying vessel, according to standard methodological procedures. The length of 35 cm, 23 cm (ICES SD 25) and 21 cm (ICES SD 26), 16 cm and 10 cm was taken into account as a separation (protective) length between juvenile and commercial size of cod, flounder (differed by the ICES Sub-divisions), herring and sprat, respectively.

Externally visible diseases of fish's skin and their vertebral column anomalies were monitored for 6098 cod, 3594 flounder, 5052 sprat and 8109 herring. Data on pathological symptoms were registered based on the visual inspection of fish taken for length measurements.

Every research haul was preceded by the measurements of basic hydrological parameters continuously from the sea surface to the bottom. Overall, 85 hydrological stations (including hydrographic standard stations) were inspected with the automatic CTD probe SeaBird 911 combined with the rosette sampler (the bathometer rosette). Oxygen content was determined using the standard Winkler's method. The seawater temperature and salinity row data was aggregated to the 1-m depth stratum while oxygen content was aggregated to the 10-m intervals. Temperature, salinity and oxygen content was the source of information on abiotic factors potentially influencing fish spatial distribution. Distribution of all hydrological stations inspected by the R/V Baltica cruise conducted in November/December 2022 is presented in Figure 1.

## RESULTS

### Fish catches and biological data

Hauls no. 25, 27, 32-33, 36, 38, 43-44 and 51 were not conducted due to oxygen deficiency ( $< 0.5$  ml/l) observed in the near bottom zone (Tab. 2). Oxygen level below 0.5 ml indicates lack of fish occurrence. It is therefore assumed that fishing result would be “zero”, haul is not conducted and “zero” catch is accepted in catch calculations.

In total, twenty different fish species were recognized in 62 scrutinized valid bottom catches (Tab. 2). Only European anchovy represented fish species permanently inhabiting Atlantic Ocean. The European anchovy was present in eight hauls (three hauls in ICES SD 25 and five in ICES SD 26).

The frequency of the most important fish species occurrence in the hauls - herring, sprat, cod and flounder was similar and the fish species were represented in 80%, 78%, 73% and 78% of the hauls, respectively (Tab. 2).

The average CPUE of cod in ICES SDs 25 and 26 was very similar and amounted to 47.7 kg/1h and 50.8 kg, respectively (Fig. 2). The average CPUE of cod, in analogous survey in November/December 2021 was lower (31.6 kg/1h) in ICES SD 25, whereas in ICES SD 26 in November/December 2021 it was slightly higher (52.0 kg/1h) than in November/December 2022.

Low CPUEs of cod obtained during the described survey, similarly like in 2019-2020, resulted most probably from a low oxygen content in the near bottom zone observed in a large part of the ICES SDs 25 and 26 (Fig. 7). The area of low oxygen content (below 2 ml/l and also below 0.5 ml/l) was even observed in the Słupsk Furrow, where oxygen content above 2 ml/l prevailed in the deepest part of the Furrow in the previous BITS-4Q surveys.

The average CPUE of herring in ICES SD 25 was 175.3 kg/1h. Markedly higher CPUE of herring was obtained in ICES SD 26 – 371.1 kg/1h. The average CPUEs of herring were the highest obtained among all the fish species which occurred in the catches. Large catches of herring were noted in the hauls conducted in particular in Gdańsk Bay and in the Swedish waters. The average CPUEs of herring obtained in November/December 2021 were markedly lower in ICES SDs 26 and 25 – 12.9 and 168.6 kg/1h, respectively.

The average CPUEs of sprat in ICES SDs 25 and 26 were low and differed considerably amounting to 7.2 and 42.9, respectively. In the ICES SD 25, the average CPUE of sprat was the lowest as compared to the other three main fish species investigated. In the same type of survey from November/December 2021 the CPUEs of sprat in ICES SD 25 was 3.1 kg/1h, whereas in ICES SD 26 the average CPUE of sprat was 734.3 kg/1h, which was the highest value out of all the fish species in the survey.

The average CPUE of flounder in both the ICES SDs 25 and 26 was low amounting to 22.8 and 34.5 kg/1h, respectively. The average CPUEs of flounder in November/December 2021 cruise were of similar magnitude in ICES SDs 25 and 26, amounting to 37.3 kg/1h and 5.7 kg/1h, respectively.

Length distributions of the main fish species according to the ICES Sub-divisions are illustrated in Figure 3. The curves of cod length distributions for both of the ICES SDs were of similar shape, but the curve for ICES SD 25 was shifted to the right along the horizontal axis as compared to the curve for ICES SD 26. It indicated that larger cod inhabited the area of investigations in the ICES SD 25. The average length of cod was higher in ICES SD 25 than in ICES SD 26 (table below). However, in ICES SD 25 and in 26 dominated definitely cod from length classes 20-40 cm, representing 96.5% and 96.9% of the numerical share of cod of the corresponding ICES SDs. The prevalence of cod from length classes 20-40 cm has not changed for several recent BITS-4Q cruises. The body condition of cod individuals was poor. Mean mass of cod has declined by several percent since the last BITS-4Q survey (table below).

Two length fractions of herring in the length distribution curves from ICES SD 25 and 26 were distinguished. In the ICES SD 25, the first fraction - small size herring (13.0-15.5 cm) and



second fraction - larger ones (16.0-28.5 cm). In the ICES SD 26 the first fraction of small size herring (9.5-15.0 cm) was much less distinctive on the length curve than in ICES SD 25. The second fraction of larger herring in ICES SD 25 consisted of fish from length classes 15.5-27.0 cm. The numerical share of the herring in the smaller fraction was higher in ICES SD 25 (14.6%) than in the ICES SD 26 – 5.8%, similarly as in the last year survey.

Sprat length distribution curves in both ICES SDs 25 and SD 26 indicated that two sprat length fractions inhabited the ICES SDs, similarly as in the case of herring. In ICES SD 25 and in SD 26, the first length fraction - smaller size sprat was – 8.5-11.5 cm and 7.0-10.5 cm, respectively. The second length fraction - larger sprat in ICES SD 25 and in SD 26 was 12.0-15.0 cm and 11.0-14.5 cm, respectively. Smaller length fraction of sprat was more numerous in the ICES SD 25 (51.2%) than in the ICES SD 26 – 23.5%. Sprat of more favourable length size for commercial fishery was observed in ICES SD 25, similarly like in the former BITS surveys.

Flounder length distributions indicated large differences of flounder size depending on the ICES SD they inhabited. In respect of flounder length distribution in ICES SD 26, a marked shift of the length distribution curve to the left along the horizontal axis was noted as compared to the length distribution curve from ICES SD 25, what indicated that higher share of smaller flounder inhabited ICES SD 26. The mean length of flounder in ICES SD 26 was by 5 cm lower than in ICES SD 25. Length range of flounder in ICES SD 25 was 16-41 cm, whereas in ICES SD 26 was broader, covering also smaller flounder – 9-40 cm.

Figure 4 shows the numerical shares of the undersized fish fractions of cod, herring, sprat and flounder. In cod catches from ICES SDs 25 and 26 the undersized fraction of cod prevailed. Their numerical share in the above-mentioned ICES SDs was significant – 77.8% and 86.0%, respectively. In the same cruise from November/December 2021, the share of undersized cod was also very high and amounted to 79.0% and 83.9%, respectively. The share of undersized fraction of herring in ICES SD 25 and 26 amounted to 14.6% and 6.9%, respectively. The larger share of undersized sprat was observed in samples from ICES SD 26 (19.6%), than in ICES SD 25 - 14.0%. Flounder undersized share was much higher in the ICES SD 26 (33.3%), than the share of undersized flounder in the ICES SD 25 – 8.9%.

Mean length (l.t.) and mean mass of sprat, herring, cod and flounder calculated for the whole cruise and separately for ICES SDs 25 and 26 are presented in the text table below (in parenthesis are shown parameters from November/December 2021 cruise):

Subdivision ICES	parameter	sprat	herring	cod	flounder
24	mean length [cm]	-	-	-	-
25		11.8 (11.2)	19.1 (18.0)	32.1 (32.0)	27.5 (28.1)
26		11.9 (11.9)	18.9 (17.5)	30.0 (30.4)	22.5 (23.1)
whole cruise		11.9 (11.9)	18.9 (17.6)	30.4 (30.5)	23.4 (23.7)
24	mean mass [g]	-	-	-	-
25		11.1 (8.4)	46.9 (40.8)	307.0 (321.3)	228.7 (255.5)
26		10.8 (10.6)	43.9 (34.6)	222.9 (246.2)	134.1 (141.9)
whole cruise		10.8 (10.3)	44.5 (35.9)	237.6 (251.7)	151.2 (155.0)

The measurement of the length of the main fish species was accompanied by a macroscopic analysis of the presence of symptoms of visible diseases of fish's skin. i.e. anatomopathological changes (Fig. 5). The highest prevalence of fish with externally visible pathological changes was recorded for flounder (7.0%) and next for cod (1.07%). The share of cod with externally visible diseases was slightly higher than in November/December 2021 – 0.7%. The share of herring and sprat with observed pathological symptoms was very low and amounted to 0.28% and 0.02%, respectively in the whole area investigated.

### **Hydrological situation in the southern Baltic**

In the near-bottom water layer (Fig. 6) temperatures in the range from 4.72°C to 11.96°C were noted. The lowest temperature was observed in the fishing haul no 29 at the depth of 43 m, while the highest in hydrological station IBY5' at the depth of 86 m. At the same hydrological station the highest salinity was recorded (Bornholm Basin) (15.38 on the PSU scale). The salinity measured at the deepest hydrological station in Słupsk Furrow (RS2) was 13.87 near the bottom. Salinity measured in Gdańsk Deep amounted to 11.59 in hydrological station (G2), while in Gotland Deep in Polish EEZ (Gt1) salinity was 11.77 on the PSU scale. At the deepest hydrological station in Gotland Deep (118 m) in the haul no 32 in Swedish EEZ the salinity near the bottom was 11.57 on the PSU scale. In that location no oxygen was observed. The hydrological situation with regard to oxygen content was generally considered as very unfavourable for fish inhabitancy. The range of hypoxic waters was very extended (Fig 7). It is the fourth year in row since 2019, when large area of hypoxia is observed in autumn. Even the deepest part of Słupsk Furrow was for the first time affected by hypoxia during this type of survey.

### **Marine litter**

Marine litter distribution and number of litter recoded is presented on Figure 8. The distribution of litter was very uneven and indicted that most of the litter was found in coastal waters where the depth was 40-49 m.

### **CONCLUSIONS**

The data collected during Polish BITS-4Q 2022 cruise is considered as representative. taking into account the degree of the survey plan realization. Therefore the data can be used by the ICES Baltic International Fish Survey Working Group (WGBIFS) and the Baltic Fisheries Assessment Working Group (WGBFAS) for evaluation of fish species abundance and their distribution. The survey data collected during the survey is stored in the international DATRAS database publicly available and managed by the ICES Secretariat.

### **References:**

- ICES. 2001. Report of the Baltic International Fish Survey Working Group. Baltic Committee. ICES CM 2001/H:02. Ref.: D. Kaliningrad, Russia. 5-9 February 2001. 249 pp.
- ICES. 2021. ICES Working Group on Baltic International Fish Survey (WGBIFS).

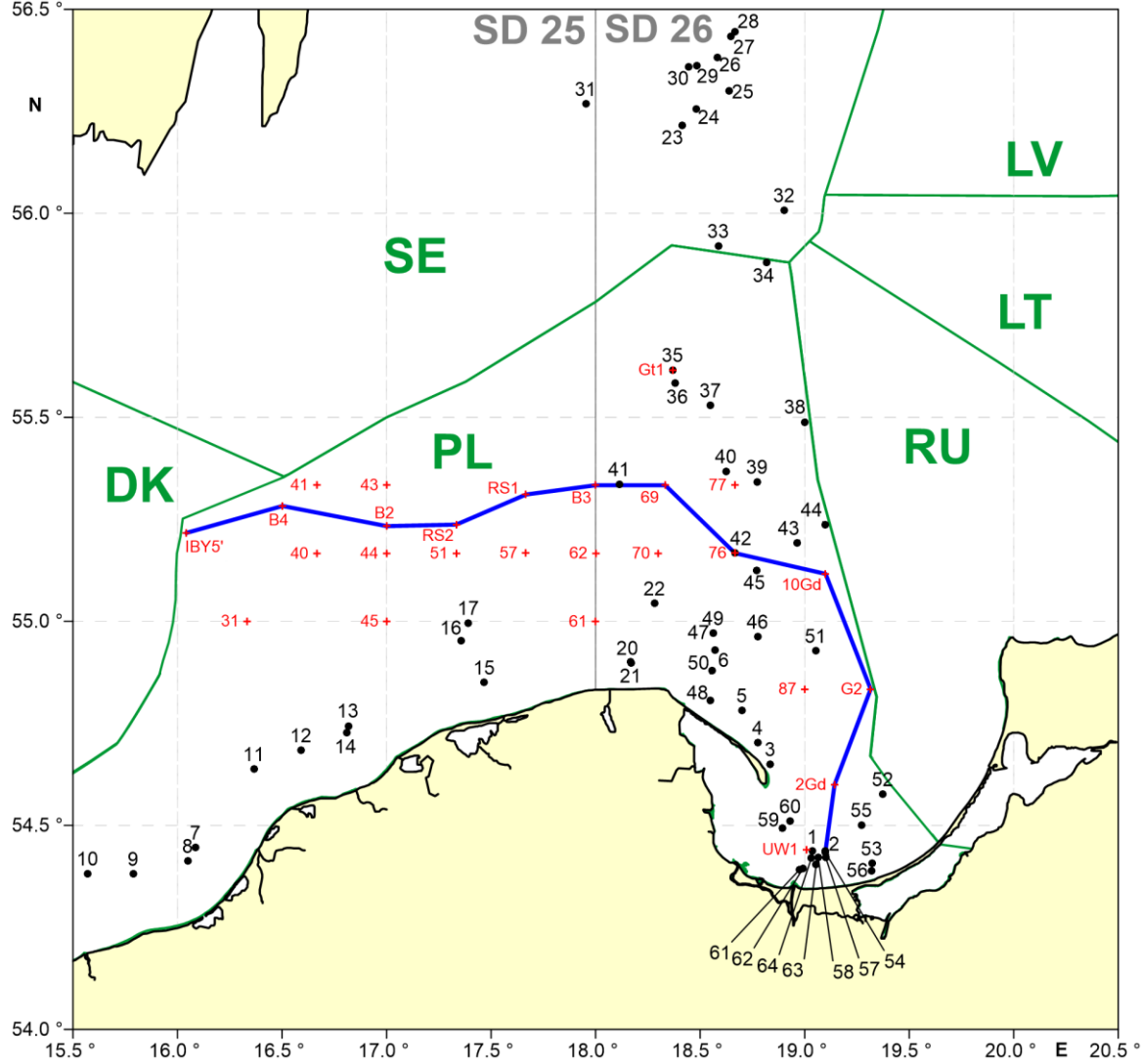


Fig. 1. Location of fish research hauls (black crosses) and hydrological standard stations (red dots) realised during the r/v Baltica BITS-4Q cruise (16.11-08.12. 2022). (blue solid line indicates hydrological research profile).

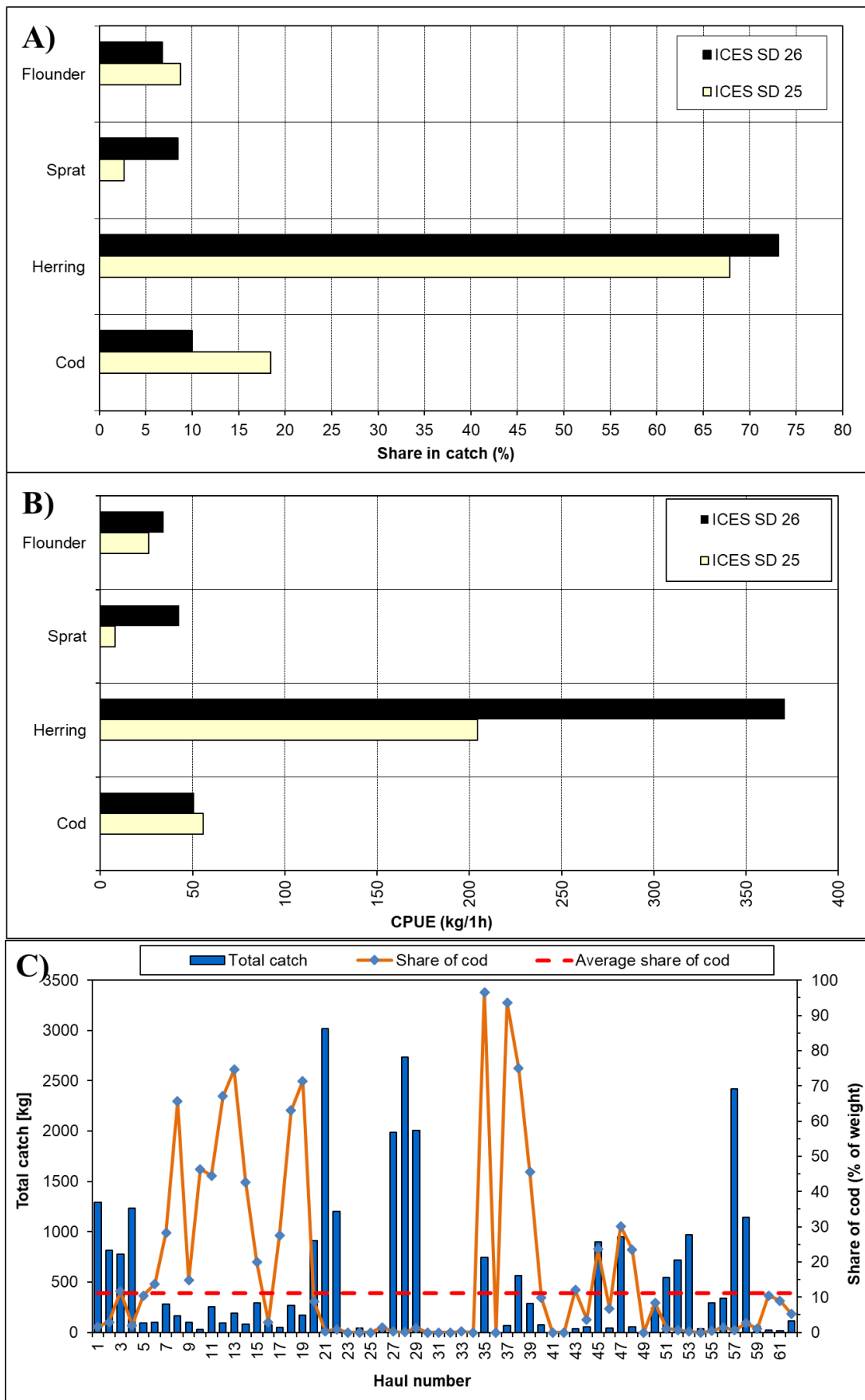


Fig. 2. Mean share in mass of research hauls (A) and mean CPUE (B) of dominant fish species, and share of cod (C) in particular catches conducted during r/v Baltica BITS-4Q cruise (16.11-08.12. 2022).

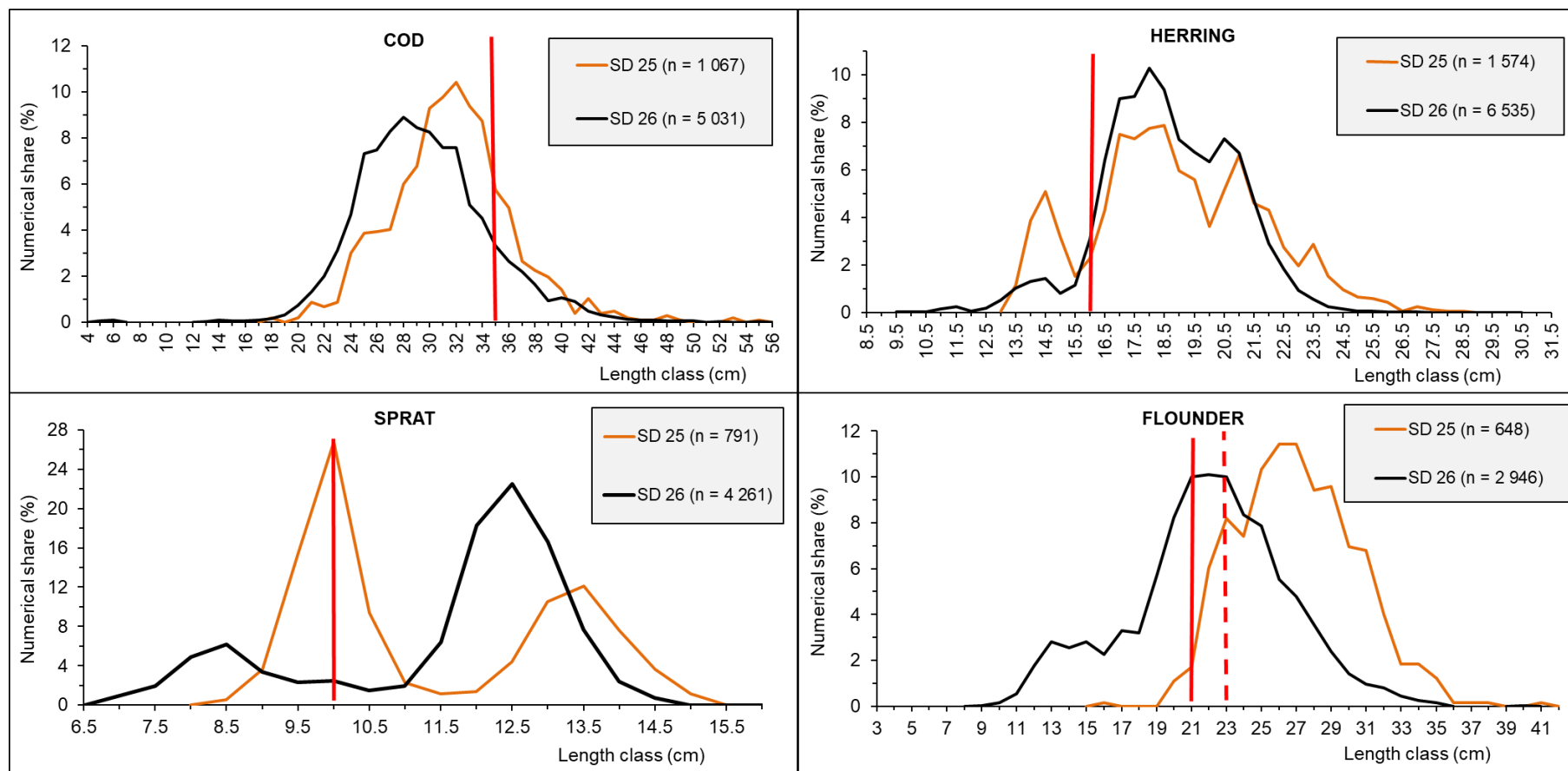


Fig. 3. Length distributions of cod, herring, sprat and flounder in samples from fish research hauls conducted during r/v Baltica BITS-4Q cruise (16.11-08.12. 2022). (red vertical lines indicate minimum landing size).

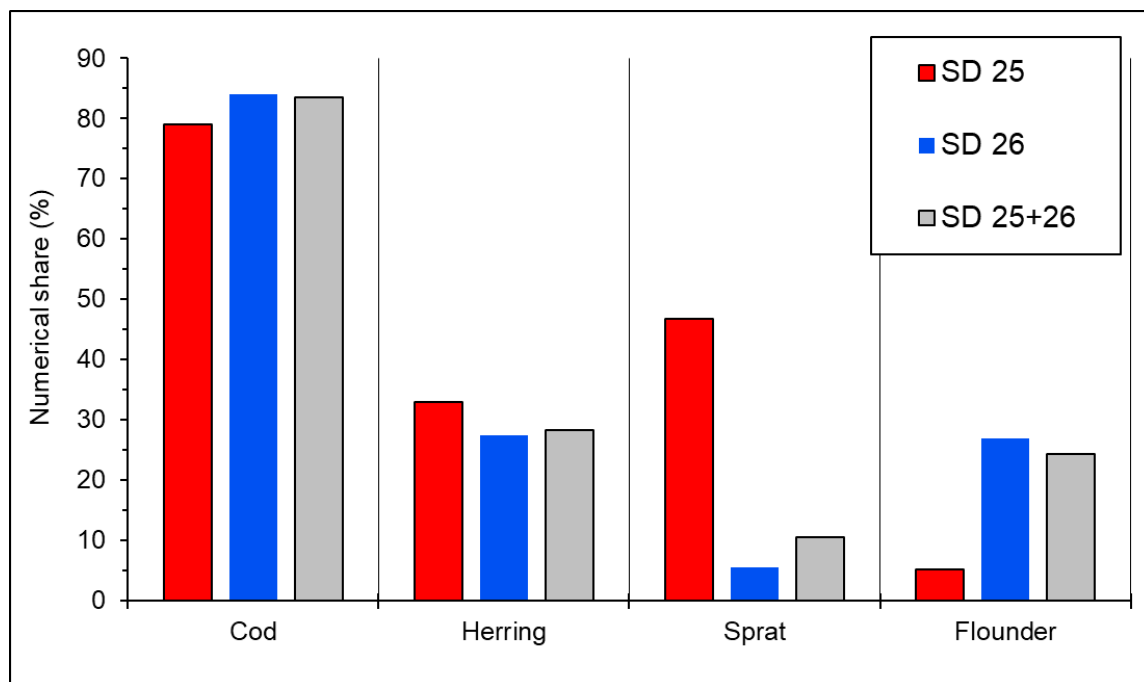


Fig. 4. Mean numerical share (in %) of undersized fish species in samples from fish research hauls conducted during r/v Baltica BITS-4Q cruise (16.11-08.12. 2022).

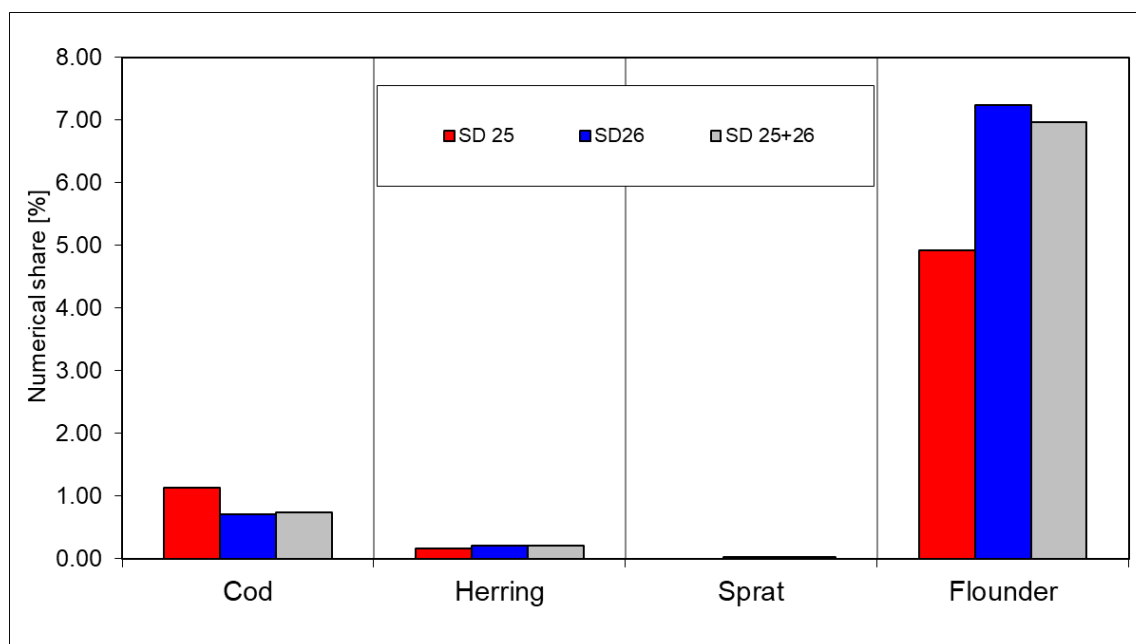


Fig. 5. Mean prevalence (in %-indiv.) of fish with externally visible diseases in samples from fish research hauls conducted during r/v Baltica BITS-4Q cruise (16.11-08.12. 2022).

Tab. 1. Number of fish species individuals measured and aged during r/v Baltica BITS-4Q cruise (16.11-08.12. 2022).

Species name	Number of fish mesured (l.t)			Nuner of fish aged and weighed (g)		
	25 ICES Sub-division	26 ICES Sub-division	total	25 ICES Sub-division	26 ICES Sub-division	total
Cod	1067	5031	6098	140	195	335
Baltic herring	1574	6535	8109	315	434	749
Sprat	791	4261	5052	152	278	430
Flounder	648	2946	3594	241	435	676
Plaice	131	71	202	127	71	198
Eelpout	0	10	10	0	0	0
Fourbeard rockling	1	11	12	0	0	0
European perch	1	0	1	0	0	0
Three-spined stickleback	22	755	777	0	0	0
Short-horn scorpion	67	123	190	0	0	0
Round goby	0	3	3	0	0	0
Smelt	0	12	12	0	0	0
Twaite shad	0	24	24	0	0	0
Turbot	5	12	17	5	12	17
European anchovy	6	5	11	0	0	0
Greater sandeel	32	7	39	0	0	0
Lumpfish	1	0	1	0	0	0
Hooknose	2	0	2	0	0	0
Whiting	4	0	4	0	0	0
Sand goby	0	6	6	0	0	0
<b>TOTAL</b>	4352	19812	24164	980	1425	2405

Tab. 2. Fish research hauls data obtained during r/v Baltica BITS-4Q cruise (16.11-08.12. 2022)

[illegible]



Tab. 2. (continued) Fish research hauls data obtained during r/v Baltica BITS-4Q cruise (16.11-08.12. 2022)

Haul number according to survey order	Haul number according to ICES database	Catch date	ICES rectangle	ICES Sub-division	Trawling depth [m]	Geographical position of the catch-station				Time of		Trawling duration [min]	Total catch [kg]	Weight of the catch by fish species [kg]																				
						start/shoot		end		shooting net	hauling up net			Cod	Baltic herring	Sprat	Flounder	Plaice	Eelpout	Fourbeard rockling	European perch	Three-spined stickleback	Short-horn scorpion	Round goby	Smelt	Twaite shad	Turbot	European anchovy	Greater sandeel	Lumpfish	Hooknose	Whiting	Sand goby	
						latitude (N)	longitude (E)	latitude (N)	longitude (E)																									
34	26138	2022-11-26	40G8	26	115	55°53.2'	18°46.9'	55°53.3'	18°45.6'	11:18	11:33	15	1.059		0.770	0.285																		
35	26136	2022-11-27	40G8	26	92	55°36'	18°22.8'	55°34.7'	18°23.9'	08:20	08:50	30	0.940	0.002	0.630	0.306																		
36	26110	2022-11-27	40G8	26	92	55°35'	18°22.9'			09:30				no oxygen -> haul not conducted																				
37	26165	2022-11-27	40G8	26	87	55°30.8'	18°33'	55°29.9'	18°33'	10:55	11:15	20	248.418	239.970	6.765	0.308	1.375																	
38	26107	2022-11-27	39G8	26	87	55°29.3'	19°0'			13:47				no oxygen -> haul not conducted																				
39	26105	2022-11-28	39G8	26	89	55°21.1'	18°47.4'	55°22.1'	18°49.3'	08:10	08:40	30	34.970	32.750	0.168	1.741		0.175									0.013							
40	26104	2022-11-28	39G8	26	83	55°22.4'	18°36.1'	55°22.9'	18°33.8'	10:24	10:54	30	280.722	210.330	49.464	14.332			0.182															
41	26046	2022-11-28	39G8	26	76	55°18.3'	18°9.5'	55°19.3'	18°7.8'	14:07	14:37	30	142.808	64.980	62.787	11.646	2.678	0.700																
42	26093	2022-11-29	39G8	26	87	55°10.7'	18°38.4'	55°11.7'	18°36.5'	08:15	08:45	30	36.199	3.546	16.080	14.720	0.240	0.170			0.256					0.117		0.010						
43	26094	2022-11-29	39G8	26	87	55°11.6'	18°57.7'			11:12				no oxygen -> haul not conducted																				
44	26045	2022-11-29	39G9	26	81	55°14.2'	19°5.9'			12:19				no oxygen -> haul not conducted																				
45	26272	2022-11-30	39G8	26	94	55°7.9'	18°44.5'	55°8.2'	18°42'	08:15	08:45	30	17.368	2.086	2.801	11.250	0.088																	
46	26278	2022-11-30	38G8	26	94	54°58.7'	18°45.9'	55°0'	18°44.9'	11:23	11:53	30	27.046	0.995	10.217	15.740			0.076															
47	26268	2022-11-30	38G8	26	71	54°58.9'	18°32.6'	54°59.8'	18°30.7'	13:30	14:00	30	450.760	106.540	331.723	6.566	5.800									0.131								
48	26266	2022-12-1	38G8	26	20	54°48.9'	18°31.7'	54°50.1'	18°30.3'	08:24	08:54	30	22.066	1.504			19.390	0.092					0.995		0.085									
49	26186	2022-12-1	38G8	26	70	54°58.7'	18°32.6'	54°59.6'	18°30.7'	10:39	11:09	30	475.696	143.540	306.237	7.491	16.830	1.462							0.136									
50	26007	2022-12-1	38G8	26	30	54°52.4'	18°33.7'	54°51.2'	18°34.9'	13:04	13:34	30	27.261	6.416			18.760	1.001	0.348						0.736									
51	26257	2022-12-2	38G9	26	103	54°55.7'	19°3.1'			08:28				no oxygen -> haul not conducted																				
52	26285	2022-12-2	38G9	26	80	54°34.5'	19°21.4'	54°34.5'	19°19'	12:57	13:27	30	121.711	10.215	98.644	10.562	2.290																	
53	26216	2022-12-3	37G9	26	34	54°24.2'	19°18'	54°23.9'	19°15.5'	08:18	08:48	30	272.484	2.905	226.140	5.165	37.830	0.252					0.081	0.028				0.083						
54	26265	2022-12-3	37G9	26	49	54°26'	19°4.3'	54°26'	19°6.7'	10:41	11:11	30	359.019	2.391	200.580	141.466	8.760	0.345							1.427	4.050								
55	26218	2022-12-3	38G9	26	72	54°30'	19°17.3'	54°30.1'	19°18.5'	12:57	13:12	15	242.834	0.560	148.907	91.783	0.945									0.639								
56	26001	2022-12-4	37G9	26	23	54°23.2'	19°18.2'	54°23'	19°15.6'	08:17	08:47	30	18.167	0.001	0.551		16.8		0.105	0.027			0.681	0.002										
57	26220	2022-12-4	37G9	26	40	54°25.1'	19°4.8'	54°25.1'	19°2.3'	10:12	10:42	30	146.838	0.605	130.511	4.771	10.94							0.011										
58	26282	2022-12-4	37G9	26	44	54°25.2'	19°4.3'	54°25.6'	19°1.8'	11:51	12:21	30	169.861	2.520	148.05	6.094	12.91	0.253															0.001	
59	26280	2022-12-5	38G8	26	66	54°30.4'	18°52.8'	54°30.8'	18°52.5'	08:21	08:31	10	402.677	2.289	273.721	29.224	95.96	0.235			0.248			0.098	0.354	0.548								
60	26279	2022-12-5	38G8	26	67	54°31.8'	18°56.1'	54°32.5'	18°56.6'	11:18	11:33	15	285.434	7.459	270.448	0.84	5.44	0.097								1.150								
61	26219	2022-12-6	37G8	26	34	54°24.2'	18°58.6'	54°25.5'	18°59.5'	08:23	08:53	30	30.683	0.322	20.94	0.01	9.25								0.161									
62	26263	2022-12-6	37G9	26	32	54°23.9'	19°0.1'	54°25.2'	18°58.7'	10:01	10:31	30	12.990	1.361	2.345	0.126	8.82				0.029		0.009	0.265		0.032						0.003		
63	26131	2022-12-6	37G9	26	32	54°24.3'	19°2.1'	54°24.5'	18°59.5'	11:06	11:36	30	7.264	0.655			6.415	0.145			0.007							0.034				0.001		
64	26264	2022-12-7	37G9	26	42	54°25.3'	19°1.5'	54°25.2'	19°4.2'	08:26	08:56	30	57.663	3.077	41.79		12.56				0.010		0.002	0.138	0.048	0.038								

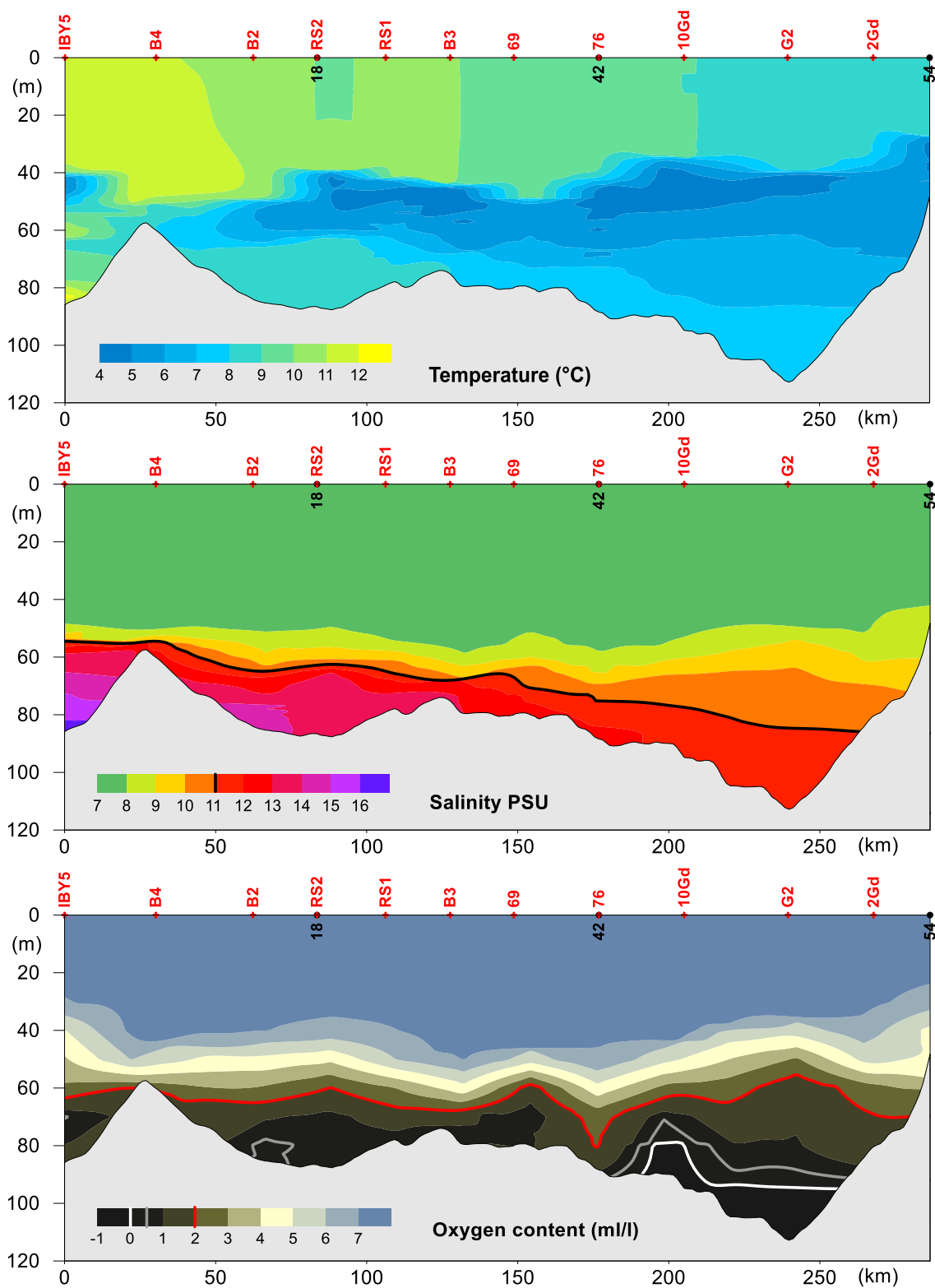


Fig. 6. Vertical distribution of the seawater temperature, salinity and oxygen content along the hydrological research profile during r/v Baltica BITS-4Q cruise (16.11-08.12. 2022).

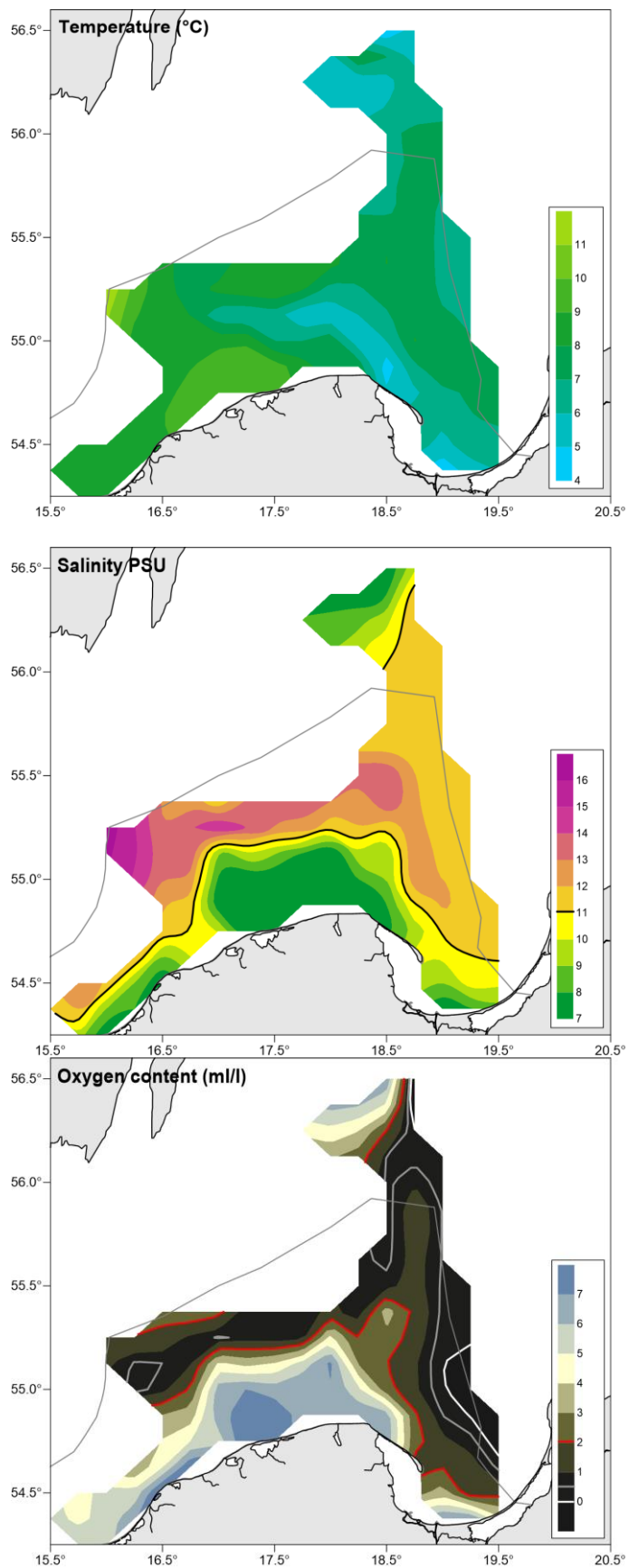


Fig. 7. Horizontal distribution of the seawater temperature, salinity and oxygen content in the near bottom layer during r/v Baltica BITS-4Q cruise (16.11-08.12. 2022).

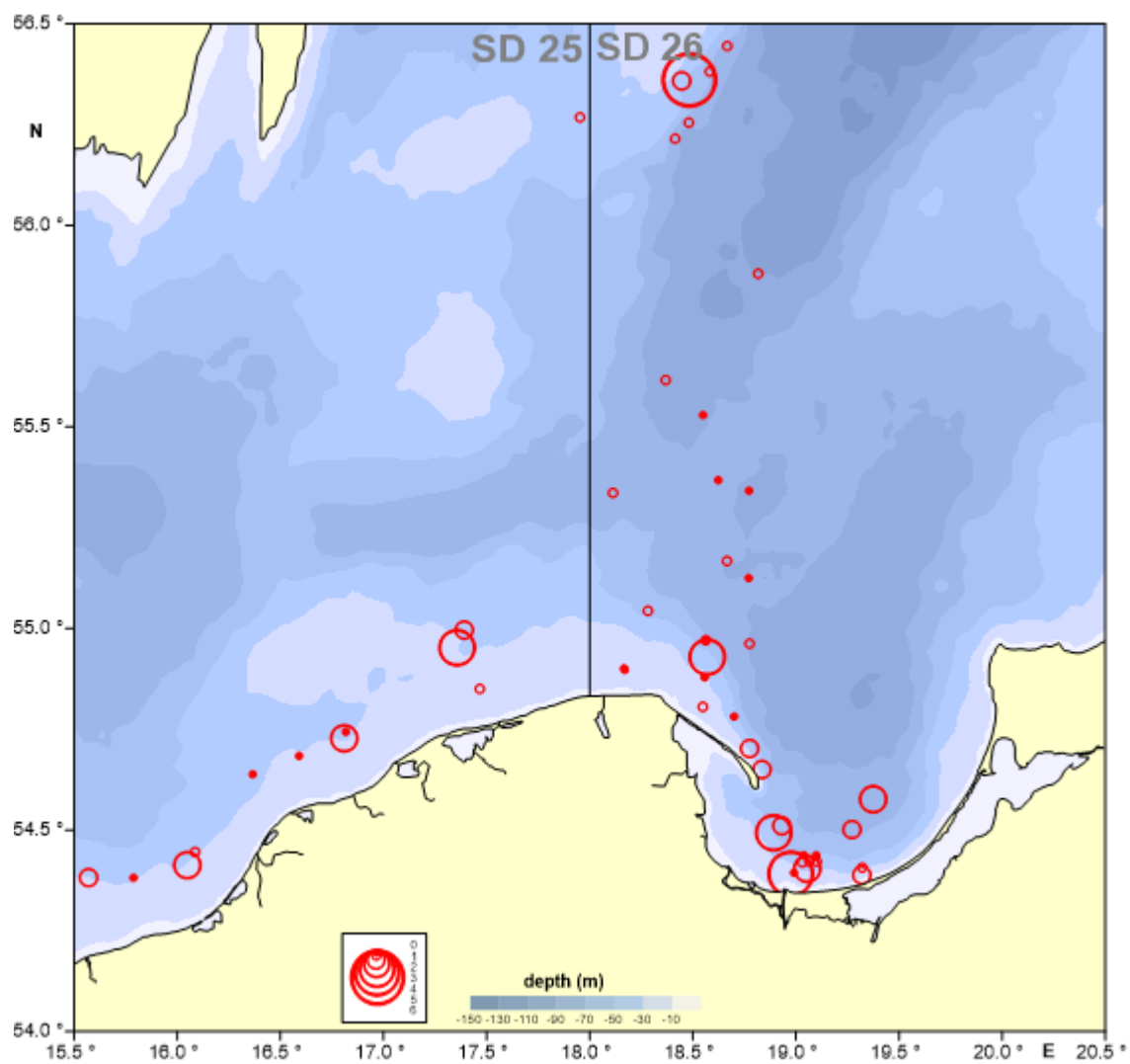


Fig. 8. Marine litter collected during r/v Baltica BITS-4Q cruise (16.11-08.12. 2022).



DTU Aqua - Cruise report

## **BITS 4Q 2022**

*Baltic International Trawl Survey*

## **DANA Denmark**

*Cruise no. 7*

From 2022-10-31 to 2022-11-17

**DTU Aqua**  
National Institute of Aquatic Resources

---

DTU Aqua  
Kemitorvet, Building 202  
2800 Kgs. Lyngby  
Denmark

# Contents

<b>Cruise Summary</b>	<b>2</b>
General Information . . . . .	2
Location and Time . . . . .	2
Participants . . . . .	2
<b>Introduction</b>	<b>3</b>
<b>Objectives</b>	<b>3</b>
Daytime . . . . .	3
Nighttime . . . . .	3
<b>This Survey</b>	<b>4</b>
Weather Conditions . . . . .	4
Gear performance . . . . .	4
Oxygen Conditions . . . . .	4
Stations . . . . .	5
Haul Summary . . . . .	5
Station Map . . . . .	6
<b>Catch</b>	<b>9</b>
Overview . . . . .	9
Species Caught . . . . .	11

## Cruise Summary

### General Information

Cruise	BITS
Cruise Number	7
Research Vessel	DANA
Year and Quarter	4Q 2022
Country	Denmark

### Location and Time

	Date	Time
Departure	2022-10-31	00-00
Arrival	2022-11-17	00-00
Staff and crew Exchange	2022-11-09	

### Participants

Name	Institute	Function tasks
<b>Leg 1</b>		
Marie Storr-Paulsen	DTU-Aqua	Cruise-leader
Stina B.S Hansen	DTU-Aqua	Assistant cruise-leader
Thomas Møller	DTU-Aqua	Length measurements
Nikolaj K. Pedersen	DTU-Aqua	Individual fish measurements
Dennis Andersen	DTU-Aqua	Individual fish measurements
Basti Huwer	DTU-Aqua	Night assistant cruise leader
Svend-Erik Levinsky	DTU-Aqua	Night assistant cruise leader
<b>Leg 2</b>		
Hans Jakob Olesen	DTU-Aqua	Cruise-leader
Stina B.S Hansen	DTU-Aqua	Assistant cruise-leader
Dennis Andersen	DTU-Aqua	Maturity estimates
Helle Rasmussen	DTU-Aqua	Individual fish measurements
Anne-Mette Kroner	DTU-Aqua	Individual fish measurements
Christian Pedersen	DTU-Aqua	CTD

## Introduction

The Danish research vessel Dana R/V was built in 1980-81 and is a versatile multipurpose vessel with five large laboratories and 38 cabins. The Baltic cod stock has been monitored annually since 1982 through bottom trawl surveys carried out by most countries surrounding the Baltic. The national research vessels have each surveyed part of the area with some overlap in coverage and applied a depth stratified sampling design. However, different gears and design were applied and in 1985 ICES established a Study Group on Young Fish Surveys in the Baltic in order to standardize the surveys. After agreement a common standard trawl gear and standard sampling procedures were implemented in 2000 resulting in the consistent coverage of the western and central Baltic Sea.

To calibrate the national surveys from before 2000 with the TV3 gear used from 2000, a set of conversion factors are produced by making comparative hauls. The work with standardizing gear and creating conversion factors for old data was done under the EU project ISDBITS and gear specifications and conversion factors can be found in the report (ISDBITS 2001). The type of trawl is called "TV3L" with 930 meshes in the opening. The design and construction of the standard trawls are given in ICES (1997) and can also be found in the BITS manual (Anon. 2000). Until November 2007 Denmark was still using the rock hopper gear on hard fishing ground but since 2008 only the standard TV3L has been used.

The BITS is conducted as a depth-stratified survey. The strata are based on Sub divisions and depth layers. Each year the necessary stations are randomly selected before the beginning of the international trawl surveys from a list of clear haul data. These stations are a stratified random selected sub-sample of the possible trawl tracks. The standard haul is a 30 minute haul with a towing speed of 3 knots. Trawling is only taking place during daylight, defined as the time between 15 minutes past sunrise until 15 minutes before sunset.

## Objectives

### Daytime

- To estimate the abundance and the year class strength of the Baltic cod and flatfish stocks in ICES Sub-divisions 21-32. The 4th quarter survey is together with the spring survey the Danish contribution to the "Baltic International Trawl Survey"(BITS) and takes place mainly in Sub-division 25 and 26. The main goal of the surveys is to provide the Baltic assessment working group fishery independent data to use for assessment in ICES the working group in April. Furthermore, all fish species are species determination, measured and weighted.
- To measure temperature, salinity and oxygen at the fishing location. The measurements are conducted with a CTD. Calibration of the CTD is conducted before the survey.
- To take individual samples of cod to analyses of age determination, sex, weight and liver condition. Data is used to produce maturity ogive, mean weights per age and condition which is used for Eastern Baltic stock assessment.

### Nighttime

- To investigate the abundance and distribution of zooplankton in the central Baltic Sea. The analysis is conducted with a bongo net where the stations are allocated in accordance to the Kiel grid net covering most of SD 25. Trawling speed is 3 kn and the three nets are 150, 335 and 500 µm in cod end.



- To investigate the distribution of juvenile cod caught in a IKMT.
- To catch live zooplankton with a WP2 net.

## **This Survey**

During the cruise, apart from recording a complete set of factual information concerning haul information, gear performance, catch results, hydrographic information etc., the cruise leader keeps a logbook taking notes about circumstances (unusual gear performance, special catches, non-conformities etc. during the survey. The haul summary below is the overview from this logbook

### **Weather Conditions**

No remarks on the Weather conditions

### **Gear performance**

The gear performance is monitored during any trawl station. All relevant parameters describing the gear geometry during the fishing is logged to verify that the observed trawl geometry values are within the defined ranges for acceptance.

No further remarks on the Gear performance

### **Oxygen Conditions**

No remarks on the Oxygen conditions

## Stations

An overview of the Trawl and Bongo stations are shown in figure 1, 2 and 3, followed by a haul summary of all gears used onboard.

## Haul Summary

		Number
Trawl activity		
	Planned Trawl Hauls	55
	Trawl Related CTD	55
	Valid Trawl Hauls	55
	Invalid Trawl Hauls	3
	No Oxygen Stations	4
Other activity		
	CTD Hauls	16
	Bongo Hauls	50
	WP2 Hauls	0
	Aptstein Hauls	0

## Station Map

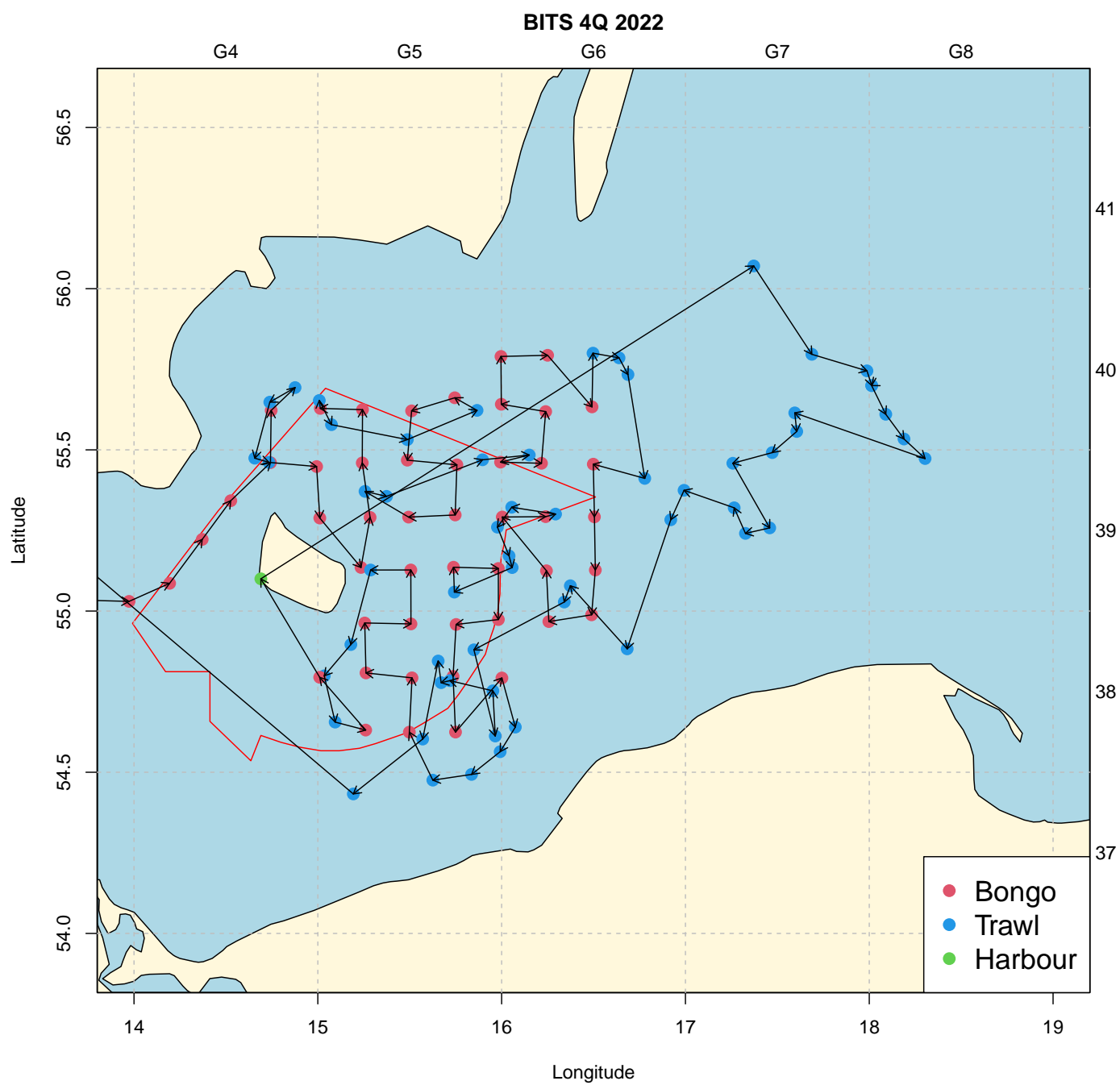


Figure 1. Survey map with the route drawn in.

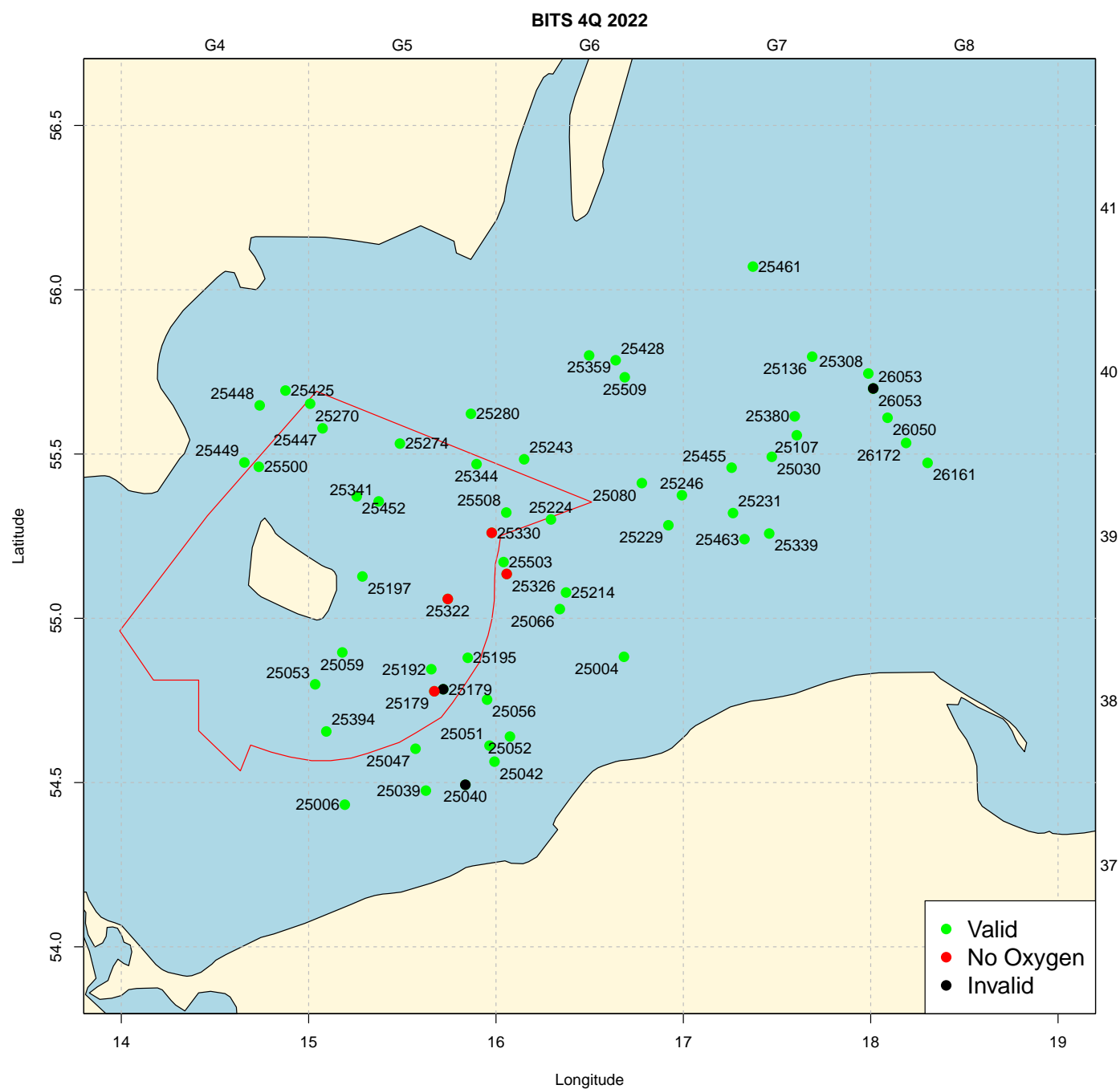


Figure 2. Survey map with trawl stations. Indicated is the status of the station and whether oxygen was present at the bottom

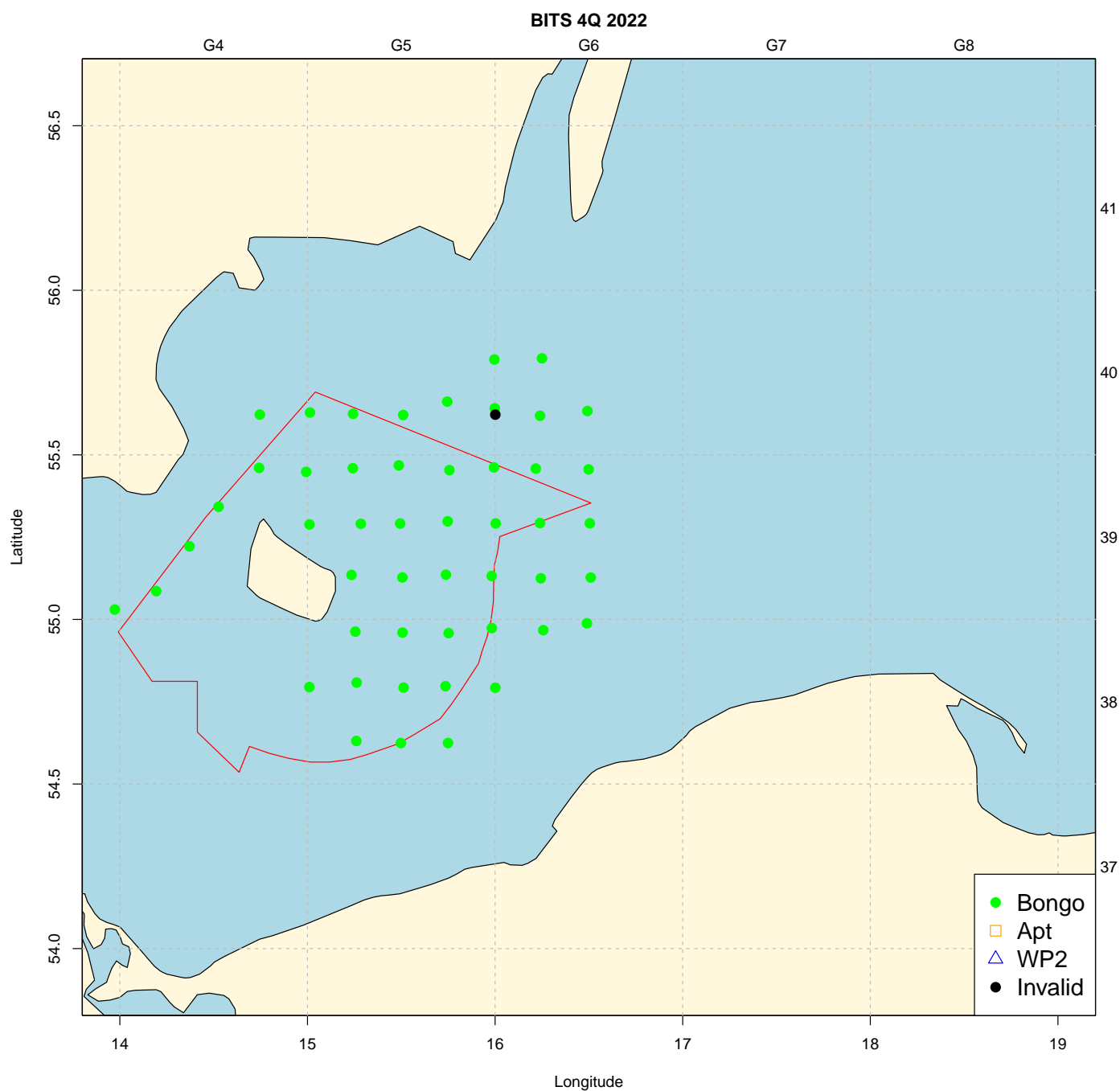


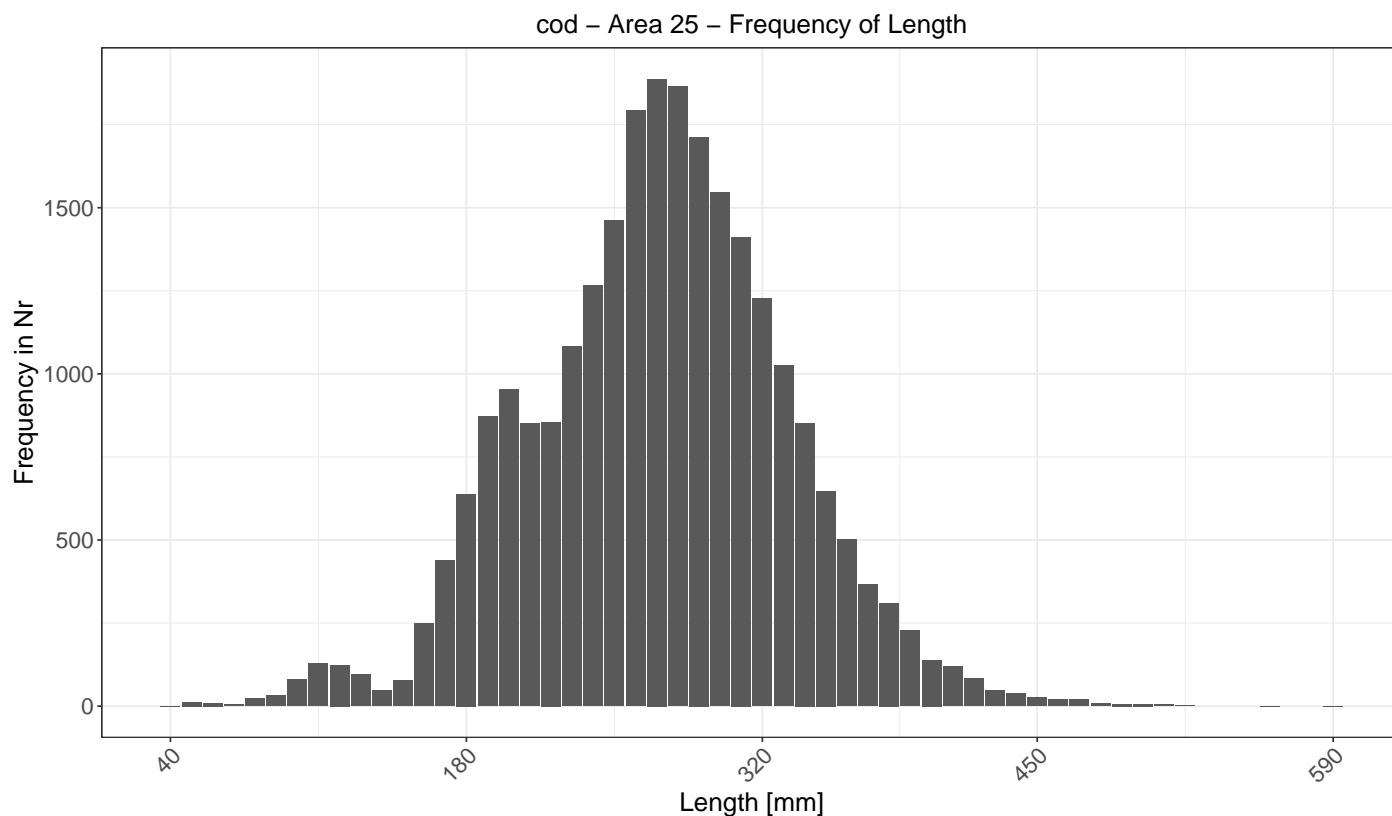
Figure 3: Survey map with bongo, Aptstein and WP2 stations, as well as station status.

## Catch

### Overview

The total catch of all species, cod, plaice and sole are presented below. followed by a length frequency plot for COD caught shown in figure 4.

	Weight (kg)	Number	Aged	Genetics sampled
Total Catch	21512.8	630776	700	0
Cod	5045	26316	0	0
Plaice	377.8	2732	412	0
Sole	0	0	0	0



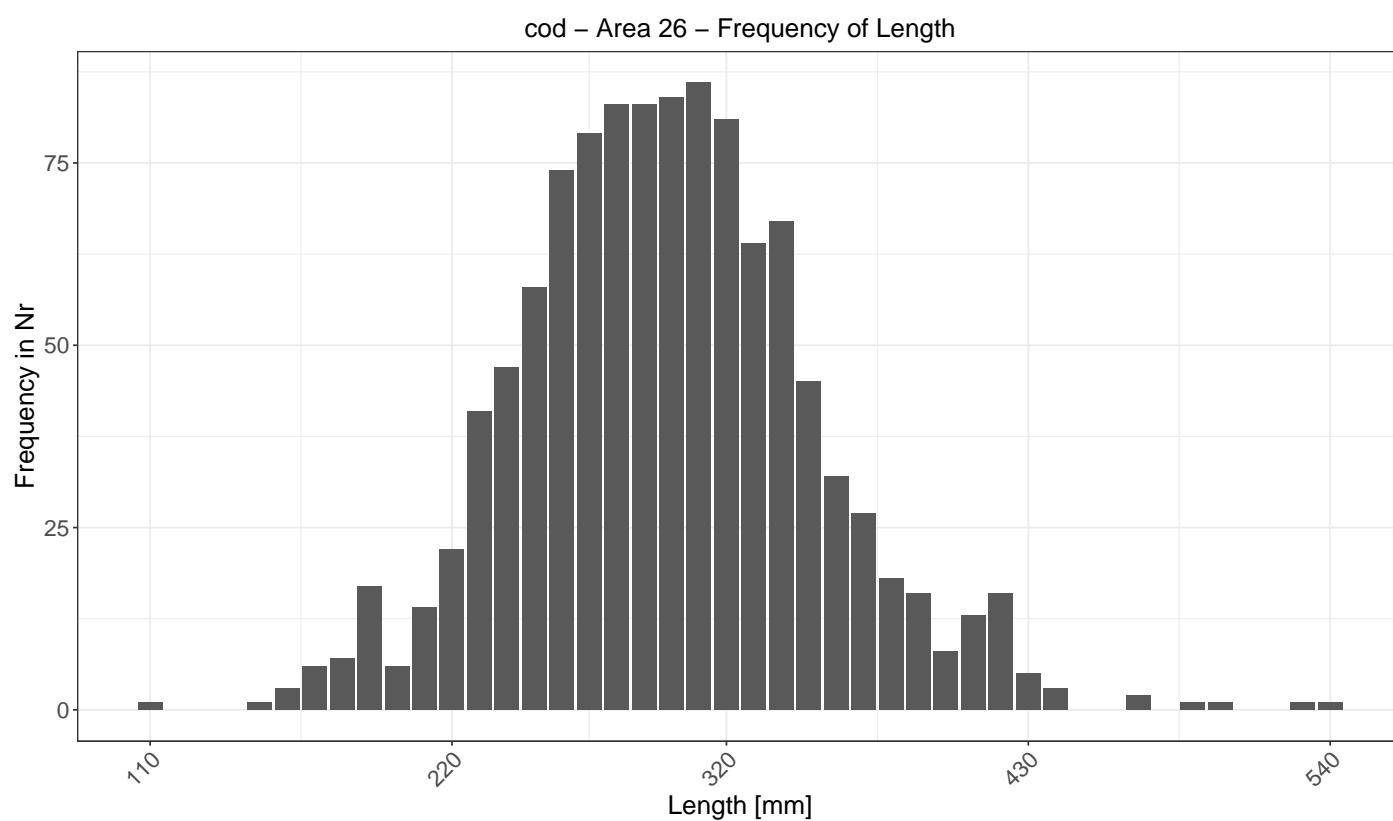


Figure 4. Length frequency of the COD caught in the respective areas.

## Species Caught

The total catch per species per ICES area are presented in table 1-2.

Table 1: Species Caught in area 25

Latin name	English name	Danish name	Number	Weight (kg)
<i>Engraulis encrasicolus</i>	Anchovy	Ansjos	15	0.3
<i>Mytilus edulis</i>	Blue mussel	Blåmusling	NA	92.0
<i>Sprattus sprattus</i>	Sprat	Brisling	373663	5400.4
<i>Enchelyopus cimbrius</i>	Four-bearded rockling	Firetrådet havkvabbe	108	5.5
<i>Anguilla anguilla</i>	Eel	Ål	1	0.7
<i>Merlangius merlangus</i>	Whiting	Hvilling	255	54.6
<i>Limanda limanda</i>	Common dab	Ising	2	0.3
<i>Zoarces viviparus</i>	Eelpout	Ålekvabbe	7	0.8
<i>Salmo salar</i>	Salmon	Laks	1	1.1
<i>Scomber scombrus</i>	Mackerel	Makrel	3	1.2
<i>Pollachius virens</i>	Saithe	Sej	1	0.3
<i>Scophthalmus maximus</i>	Turbot	Pighvarre	92	32.9
<i>Agonus cataphractus</i>	Pogge	Panser ulk	4	0.1
<i>Pleuronectes platessa</i>	Plaice	Rødspætte	2731	377.6
<i>Saduria entomon</i>	Saduria	Saduria	597	1.4
<i>Pomatoschistus</i>	Sand gobies	*Sandkutlinger	12	0.0
<i>Clupea harengus</i>	Herring	Sild	189196	8204.0
<i>Platichthys flesus</i>	Flounder	Skrubbe	3034	694.4
<i>Cyclopterus lumpus</i>	Lumpfish	Stenbider	10	3.2
<i>Scyphozoa</i>	Scyphozoans	*Storgopler	NA	45.7
<i>Alosa fallax</i>	Twaite shad	Stavsild	242	34.7
<i>Hyperoplus lanceolatus</i>	Greater sandeel	Plettet tobiskonge	997	17.2
<i>Ammodytes marinus</i>	Lesser sandeel	Havtobis	1	0.0
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	Trepigget hundestejle	4428	10.0
<i>Gadus morhua</i>	Cod	Torsk	25203	4791.7
<i>Myoxocephalus scorpius</i>	Sculpin	Almindelig ulk	854	136.9

Table 2: Species Caught in area 26

Latin name	English name	Danish name	Number	Weight (kg)
<i>Sprattus sprattus</i>	Sprat	Brisling	5077	67.2
<i>Enchelyopus cimbrius</i>	Four-bearded rockling	Firetrådet havkvabbe	3	0.2



<i>Pleuronectes platessa</i>	Plaice	Rødspætte	1	0.2
<i>Pomatoschistus</i>	Sand gobies	*Sandkutlinger	1	0.0
<i>Clupea harengus</i>	Herring	Sild	22802	900.0
<i>Platichthys flesus</i>	Flounder	Skrubbe	28	4.8
Scyphozoa	Scyphozoans	*Storgopler	NA	4.9
<i>Alosa fallax</i>	Twaite shad	Stavsild	2	0.3
<i>Gasterosteus aculeatus</i>	Three-spined stickleback	Trepigget hundestejle	279	1.1
<i>Gadus morhua</i>	Cod	Torsk	1113	253.3
<i>Myoxocephalus scorpius</i>	Sculpin	Almindelig ulk	13	1.9

# **Baltic International Trawl Survey (BITS), R/V Svea, 20 February – 6 March 2023**

Cruise leader : Olof Lövgren  
Scientific leader : Michele Casini

---

## **Summary**

### **Summary**

The survey was conducted by the R/V Svea using the TV3L demersal trawl according to the Baltic International Trawl Survey (BITS) manual (ICES. 2017). Sweden was assigned 51 randomly selected hauls.

In total 53 hauls were performed with TV3L demersal trawl including nine hauls with oxygen deficiency (which were not trawled because the oxygen concentration close to the bottom was almost zero), one complementary haul in SD 28 were made. The complementary haul was made to get enough cod and flounder (target species) to be able to perform all biological analysis in a conventional manner. One station was declared invalid due to the trawl being torn. One haul because we had to stop before the 15 minutes had passed. We covered parts of the areas SD 24, 25, 26, 27 and 28 this year. During the whole survey, acoustic data were continuously recorded.

During this survey a total of 25 fish species were caught. Herring, sprat, cod and flounder dominated the total catch, in terms of weight.

The hydrographic conditions were observed and measured on every station. Only the oxygen concentration at the bottom is presented in the report.

## **Introduction**

The institute of marine research trawl expeditions in the Baltic Sea are carried out in collaboration with the countries around the Baltic Sea within the framework of one of ICES 'trawl survey programs, the Baltic International Trawl Survey, BITS. Sweden is responsible for the surveys in parts of the southern Baltic Sea SD 24 and 25, central SD 26 and is responsible for all sampling in SD 27 and the western part of SD 28. The expedition is carried out twice a year, in quarters 1 and 4 according to the BITS manual (ICES, 2017) Quarter 1 is performed in February, March and quarter 4 the last week of November.

The trawl survey is coordinated by the WGBIFS working group, which meet once a year for planning and analysis. <https://www.ices.dk/community/groups/pages/wgbifs.aspx>

The surveys, which in their current form have been ongoing since the early 1990s, first used the Swedish research vessel U / F Argos. U / F Argos was taken out of service in 2010 and between 2011 and 2019, Sweden chartered the Danish state vessel Dana to fulfil the Swedish commitments. Because in 2011–2019 we used another nation's vessels (U / F Dana), some of the

regular stations were banned from fishing (Decision Swedish Armed Forces FM2018-22193: 6) by the Swedish Armed Forces, which led to interruptions in the long time series. Since Autumn 2019, we have had Sweden's new research vessel R/V Svea at our disposal.

All Swedish expedition data is stored in the FD2 database at the Sea Fishing Laboratory and transferred to ICES databases for international data storage; DATRAS for fish and marine litter. Hydrographic data is uploaded to Oceanography by SMHI. Data collected from this expedition are used by several working groups within ICES, mainly the Baltic Fisheries Assessment Working Group (WGBFAS). <https://www.ices.dk/community/groups/Pages/default.aspx>

## Method

The expedition started from Kalmar on February 21st and ended in Kalmar on March 5th.

Sweden had been assigned to 52 randomly placed stations (stratified by depth from an international database that randomly selects trawl hauls to all participating countries) and was distributed as follows: Four stations in the Baltic Sea subdivision, SD 24, 14 stations in SD 25, 14 in SD 26, 11 in SD 27 and 9 stations in SD 28 (see Figure 1, table 1).

Eight of the randomly selected stations were replaced, one station because of duplicates in the trawl database (two stations with different station numbers but located at the same position), two because submarine cables were drawn over the trawl path, three because the seabed is rocky and bad at these stations and two invalid hauls were replaced with hauls similar to depth and area. All stations were replaced with similar stations within the same depth and area. The fishing is performed with a TV3 bottom trawl with a 16 mm mesh in the codend (which is the last part of the trawl where the fish is collected before it is lifted on board). All fish species in the catch as well as some invertebrates are measured, and biological samples of the target species specified in the manual (mainly cod and flounder) are taken with respect to sexual maturity and age. <http://datras.ices.dk/Documents/Manuals/Manuals.aspx>.

Otoliths for age determination were collected with the goal of 1 individual per cm class and haul in the areas where there are enough stations to take samples from. In other areas, the number of sampled individuals is increased up to 2-3 per cm class and haul. A length distribution is made for all fish species. Total weight was registered per species and haul.

Hydrography examination with CTD and oxygen probe was performed at most stations during the expedition. Oxygen-free stations are stations that are not trawled because the oxygen concentration near the bottom (measured approx. 1 m above the bottom) is less than 0.5 ml / l, an oxygen content that is considered too low for cod to stay there. However, the stations are included in calculations of stock estimates as 0-catch (Table 1).

One supplementary haul were made in SD 28 to collect biological samples for, among other things, age determination and other biological parameters such as liver parasites, stomachs for gastric sampling.

## Other sampling

At all trawled stations, the presence of litter that accumulates on the bottom and that accompanies the trawl is documented, litter is separated into different categories such as plastic, glass, metal, etc. Marine litter collection was carried out in accordance with the Marine Directive's guidelines (MFSD) on behalf of the Swedish Maritime Administration.

Other surveys and provincial collections were conducted as follows:

- Collection of stomachs from cod and flounder for food selection analysis.
- Visual assessment of liver parasites in cod.
- Baltic isopod (*Saduria entomon*) was collected for food selection analysis.
- SVA (National Veterinary Institute) was collecting samples, liver, marrow, muscle etc, for analysis.

## Results

The weather during the expedition was rough in the beginning but the wind abated during the expedition and did not affect the outcome of the expedition.

A total of 52 of the 52 preselected stations could be performed, including eight oxygen-free stations (Figure 2, Table 1). Results from hydrography examination with CTD and oxygen probe are shown in Table 1. The oxygen concentration at the bottom is shown in Figure 2. Oxygen varies between seasons and in feb/ march the oxygen conditions were slightly above the limit values in most of the areas. As expected, the oxygen concentration was lower in the deeper parts of SD 27 and in the deeper part of SD 28. The oxygen levels were low in other areas SD24 and 25 but were well above the limit values for trawling.

A total of 33 tonnes of fish were caught, of which 2 715 Kg were cod and corresponded to a total of 22 741 individuals. The catches of herring and sprat were 17,0 and 12,2 tonnes respectively. During the expedition, a total of 25 different fish species were caught. Captured species with weight and number distribution are reported separately in Table 2.

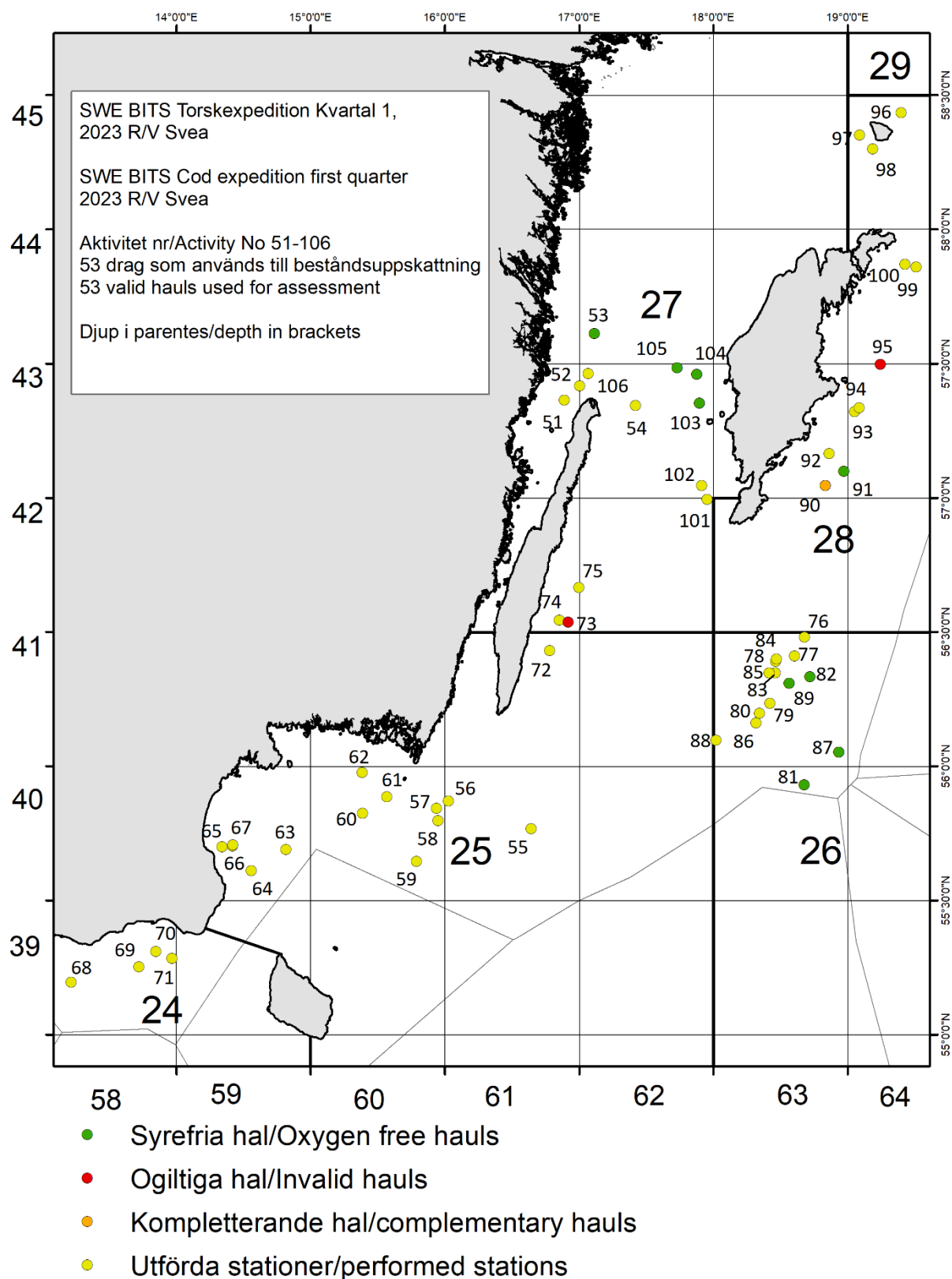


Figure 1. Map of the trawl stations performed during the Swedish BITS Quarter 1 2023. Trawled stations including one complementary haul, two invalid hauls and 9 oxygen free hauls.

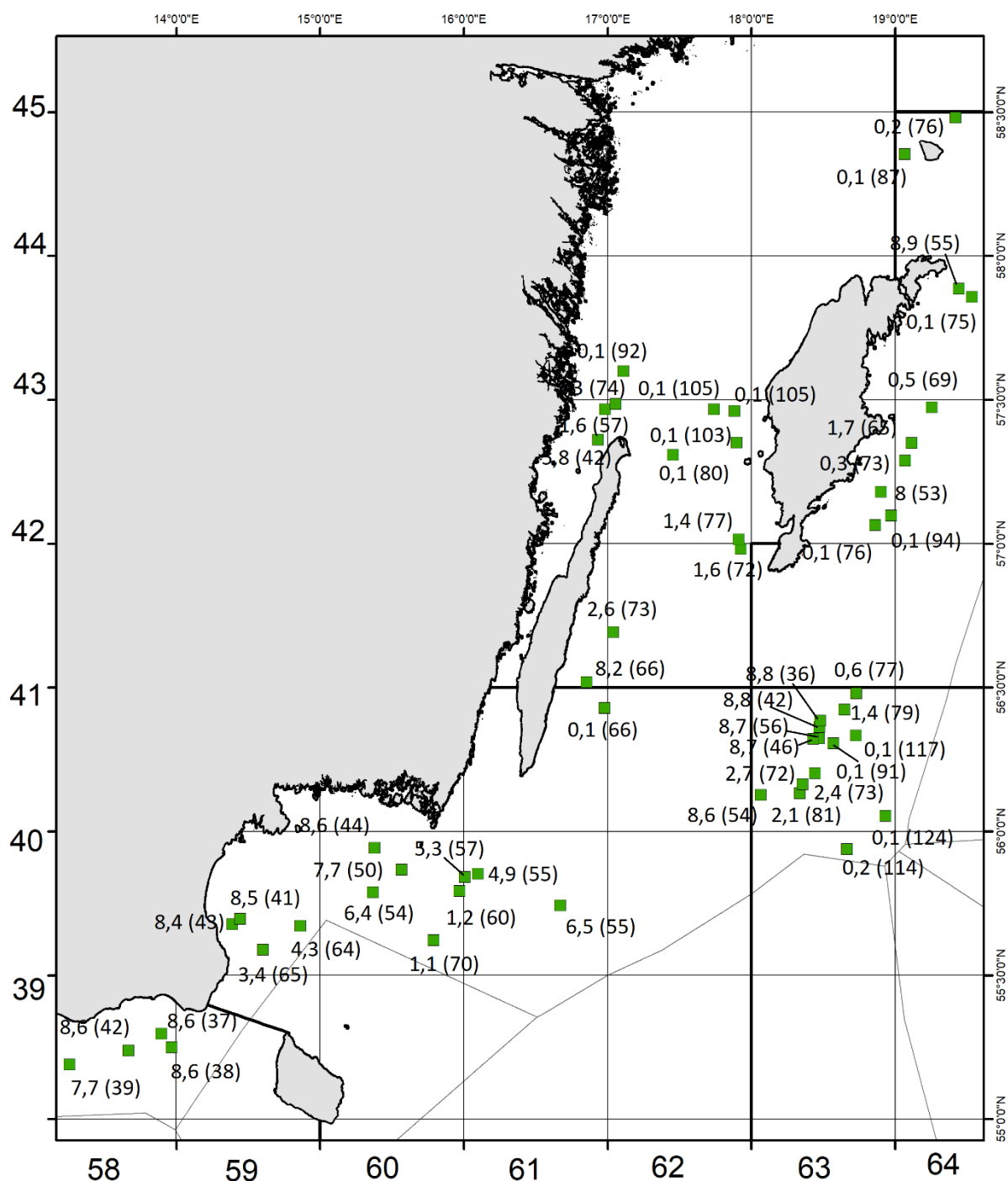


Figure 2. Oxygen concentration (ml/l) at the bottom at the trawl stations. Numbers in brackets indicate bottom depth. Swedish BITS, Quarter 1 2023.

The catch of cod is reported in kg and number per haul and SD in table 3. In the hauls where the catch of cod has been registered, the length of all cod is measured. In the case of large catches, only parts of the catch are measured (subsample), which is then counted to the total catch. Otoliths for age determination were collected with the aim of one individual per cm class, area and haul (SD 25 divided into 3 sub-areas: 25W, 25C and 25E, see figure 1). In total, otoliths were taken from 736 cod.

## Other sampling

A large part of the litter collected this year consisted of cinder. The Miscellaneous category includes clothing and shoes (see Figure 3). The information about the occurrence of rubbish is entered into a database on ices:

[https://datras.ices.dk/Data\\_products/Download/Download\\_Data\\_public.aspx](https://datras.ices.dk/Data_products/Download/Download_Data_public.aspx).

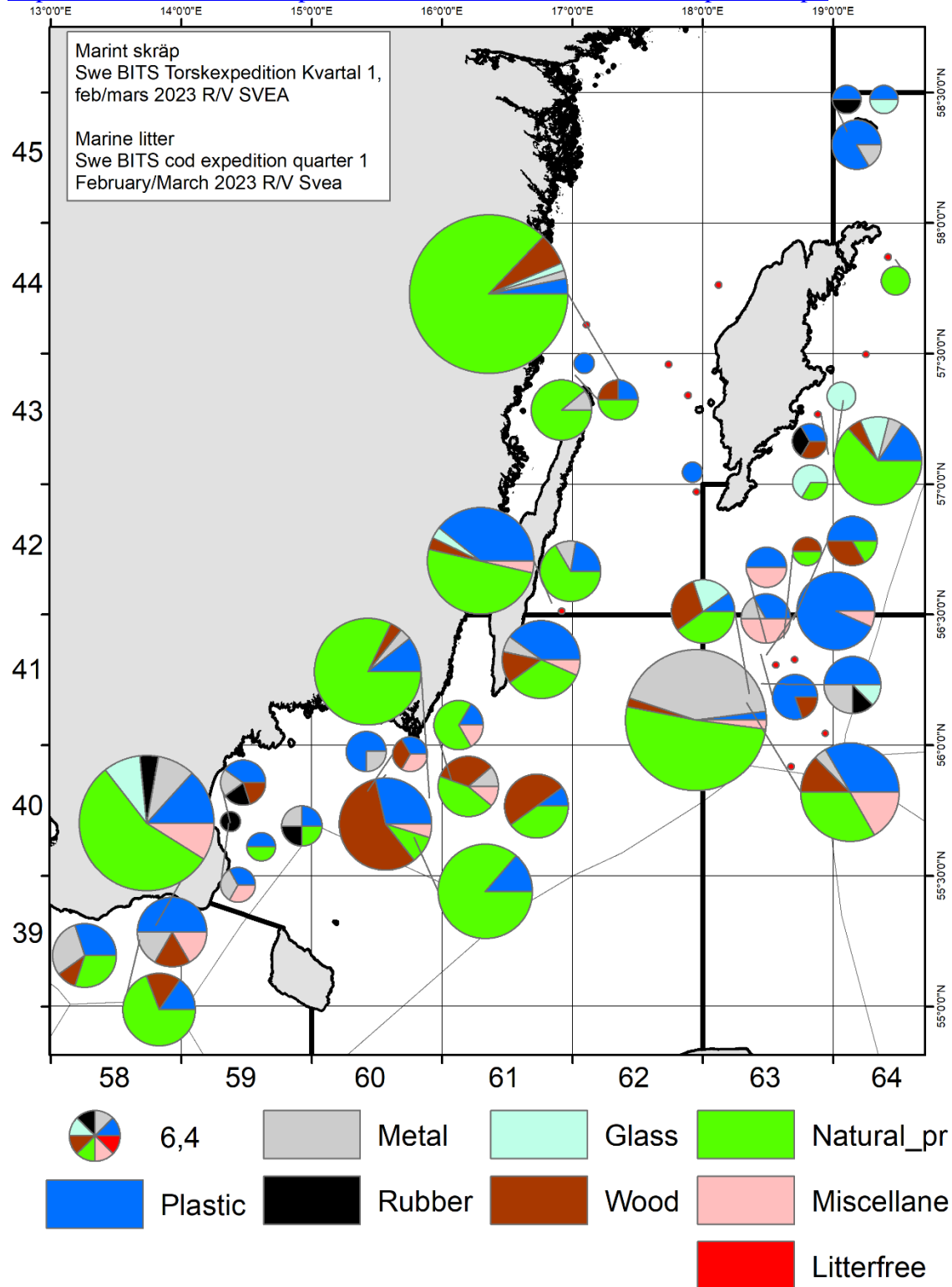
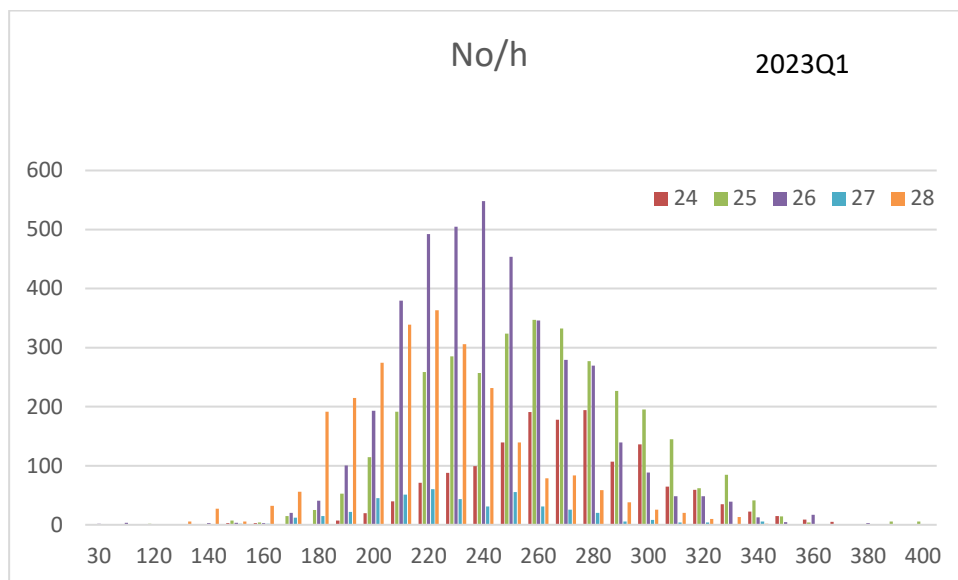


Figure 3. Marine litter presented as the number of pieces of litter per trawl haul. The size of the circles shows the total amount of litter at each station.

The length distribution of flounder per hour and area is shown in Figure 4. In total, otoliths were taken from 536 flounder.



Figur 4. Lengtdistribution for flounder per hour and subdivision

## Participants

Anders Svenson	SLU, Havsfiskelaboratoriet
Fredrik Landfors	SLU, Kustlaboratoriet
Magnus Andersson	SLU, Havsfiskelaboratoriet
Per Andersson	SLU, Havsfiskelaboratoriet
Axel Hjelm	SLU, Havsfiskelaboratoriet
Anders Wernbo	SLU, Havsfiskelaboratoriet
Peter Johannesen	SLU, Havsfiskelaboratoriet
Olof Lövgren	SLU, Havsfiskelaboratoriet
Linda Andersson	SLU, Havsfiskelaboratoriet
Ludvig Orsén	SVA, National Veterinary Institute

## References

- ICES. 2017. Manual for the Baltic International Trawl Surveys (BITS). Series of ICES Survey Protocols SISP 7 - BITS. 95 pp. <http://doi.org/10.17895/ices.pub.2883>
- ICES. 2018. Report of the Baltic International Fish Survey Working Group (WGBIFS). ICES WGBIFS report 2018 24-28 March 2018. Lyngby, Copenhagen, Denmark. 380 pp.



Table 1. Summary of all stations. Swedish BITS quarter 1 2023.

**Bilaga 1. Stationslista. SVE BITS torskexpedition i Östersjön 20 feb - 6 feb 2023 med R/V SVEA****App. 1. Station list. SWE BITS cruise with R/V SVEA in the Baltic 20 Feb - 6 March 2023.**

Tråldrag som används för beståndsuppskattning/ Valid hauls used for Slumpade trålade stationer/Randomized trawled hauls						53	Tråldrag som används för beståndsuppskattning /Valid hauls used for assessment										
						44	Slumpade	SD28	9		Ogiltigt						
							tilldelade	SD27	11								
							drag/Randomized	SD26	14								
								SD25	14								
8		SD24	4														
Ersättningsdrag/Replacement hauls Slumpade syrefria drag/Random anoxic Kompletteringsdrag/additional hauls						9											
						1		SD24	4								
						2	Tråldrag som	SD28	9								
						5	används för	SD27	12								
							bestånds	SD26	14								
Slumpade stationer, ej trålade/random stations, not trawled							uppskattning/Valid	SD25	14								
							hauls used for	SD24	4								
Datum	Akt. nr	Om råde	Ruta	Position N	Position E	Stat. nr	Stationsnamn	Trål ning	Trål tid	Trål djup	Hydro Djup	Hydro O2	Komm entar	Rem arks			
Date	Act.	Area	Rect.	Latitude	Longitude	Haul	Station name	Gear	Time	Trawl depth	Depth	Ox					
	no	SD				No			min		m	ml/l					
21-feb	125	27	43G6	57 21,633	16 58,190	27020	4 NW Byxelkrok	CTD			42	5,8					
21-feb	51	27	43G6	57 21,853	16 54,988	27020	4 NW Byxelkrok	Tv3L	30	44,8		5,8					
21-feb	52	27	43G7	57 25,020	17 01,337	27003	5 N Byxelkrok	Tv3L	30	56,5		1,7					
21-feb	126	27	43G6	57 28,008	16 58,839	27003	5 N Byxelkrok	CTD			57	1,6					
21-feb	127	27	44G7	57 35,997	17 06,587	27014	9 SE Kungsgundet	CTD			92	0,1					
21-feb	53	27	44G7	57 36,695	17 06,645	27014	9 SE Kungsgundet	Tv3L	30	83,9		0,1	Syrefritt	OxFree			
21-feb	54	27	43G7	57 20,674	17 25,198	27029	11 ESE Ölands Norra Udde	Tv3L	22	73,8		0,1					
21-feb	128	27	43G7	57 18,529	17 27,441	27029	11 ESE Ölands Norra Udde	CTD			80	0,1					
22-feb	129	25	40G6	55 44,590	16 40,245	25428	1 S Teneriffa	CTD			55	6,5					
22-feb	55	25	40G6	55 46,032	16 39,541	25428	1 S Teneriffa	Tv3L	20	56,4		6,5					
22-feb	130	25	40G6	55 51,193	16 05,660	25431	Argos Track	CTD			55	4,9					
22-feb	56	25	40G6	55 52,221	16 04,257	25431	Argos Track	Tv3L	30	55,0		4,9					
22-feb	131	25	40G6	55 50,463	16 00,476	25413	11 SE Utklippan	CTD			57	5,3					
22-feb	57	25	40G5	55 50,559	15 58,321	25413	11 SE Utklippan	Tv3L	27	57,5		5,3					
22-feb	58	25	40G5	55 47,859	15 54,236	25299	Inre U10	Tv3L	30	60,8		1,2					
22-feb	132	25	40G5	55 47,542	15 58,196	25299	Inre U10	CTD			60	1,2					
23-feb	133	25	40G5	55 37,330	15 47,420	25279	Tången	CTD			70	1,1					
23-feb	59	25	40G5	55 38,740	15 47,220	25279	Tången	Tv3L	30	68,2		1,2					
23-feb	60	25	40G5	55 49,447	15 25,679	25404	Yttertorpet	Tv3L	30	52,0		6,5					
23-feb	134	25	40G5	55 47,351	15 22,047	25404	Yttertorpet	CTD			54	6,4					
23-feb	135	25	40G5	55 52,050	15 33,973	25405	5 SSW Utklippan	CTD			50	7,7					
23-feb	61	25	40G5	55 53,136	15 34,018	25405	5 SSW Utklippan	Tv3L	30	51,3		7,7					
23-feb	136	25	40G5	55 56,582	15 22,687	25429	1 S Innertorpet	CTD			44	8,6					
23-feb	62	25	40G5	55 58,590	15 25,163	25429	1 S Innertorpet	Tv3L	30	47,4		8,6					

Datum	Akt. nr	Om råde	Ruta	Position N	Position E	Stat. nr	Stationsnamn	Trålning	Tråltid	Tråldjup	Hydro Djup	Hydro O2	Komm entar	Rem arks
Date	Act. no	Area	Rect.	Latitude	Longitude	Haul No	Station name	Gear	Time min	Trawl depth	Depth m	Ox ml/l		
24-feb	137	25	40G4	55 40,320	14 51,750	25425	18 ENE Stens Huvud	CTD			64	4,3		
24-feb	63	25	40G4	55 41,433	14 51,656	25425	18 ENE Stens Huvud	Tv3L	30	58,5		4,8		
24-feb	64	25	40G4	55 36,646	14 35,827	25439	8 ENE Simrishamn	Tv3L	30	65,9		3,4		
24-feb	138	25	40G4	55 35,354	14 36,270	25439	8 ENE Simrishamn	CTD			65	3,4		
24-feb	139	25	40G4	55 40,685	14 23,310	25419	3,5 NE Stens Huvud	CTD			43	8,4		
24-feb	65	25	40G4	55 42,001	14 21,721	25419	3,5 NE Stens Huvud	Tv3L	27	35,1		8,5		
24-feb	66	25	40G4	55 42,184	14 22,436	25401	5 NE Stens Huvud	Tv3L	30	38,9		8,4		
24-feb	67	25	40G4	55 42,442	14 22,708	25418	Rackaputt - 38m	Tv3L	30	38,0		8,5		
24-feb	140	25	40G4	55 41,800	14 26,563	25418	Rackaputt - 38m	CTD			41	8,5		
25-feb	141	24	39G3	55 11,408	13 15,449	24252	S Trelleborg	CTD			39	7,7		
25-feb	68	24	39G3	55 11,690	13 14,758	24252	S Trelleborg	Tv3L	30	41,4		7,7		
25-feb	142	24	39G3	55 14,275	13 40,092	24107	Ystadkroken	CTD			42	8,6		
25-feb	69	24	39G3	55 15,189	13 40,963	24107	Ystadkroken	Tv3L	30	42,0		8,6		
25-feb	70	24	39G3	55 18,638	13 48,204	24303	5 S Klostergrundet	Tv3L	30	38,7		8,6		
25-feb	143	24	39G3	55 17,784	13 51,617	24303	5 S Klostergrundet	CTD			37	8,6		
25-feb	71	24	39G3	55 17,086	13 55,798	24288	E Ystadkroken	Tv3L	30	38,4		8,6		
25-feb	144	24	39G3	55 14,941	13 58,113	24288	E Ystadkroken	CTD			38	8,6		
26-feb	145	25	41G6	56 25,722	16 58,709	25169	15 NE Segerstad	CTD			66	0,1		
26-feb	72	25	41G6	56 25,849	16 45,644	25169	6,5 NE Segerstad	Tv3L	30	62,1		0,3		
26-feb	146	27	42G6	56 31,079	16 51,171	27004	8 SE Bläsinge	CTD			66	8,2		
26-feb	73	27	42G6	56 32,187	16 55,008	27004	8 SE Bläsinge	Tv3L	9	73,4		8,2	Ogiltigt	Invalid
26-feb	74	27	42G6	56 32,648	16 50,340	27021	6,5 SE Bläsinge	Tv3L	30	63,7		8,6		
26-feb	75	27	42G6	56 39,980	16 59,077	27028	10 SSE Kapelludden	Tv3L	30	67,7		5,5		
26-feb	147	27	42G7	56 41,588	17 02,228	27028	10 SSE Kapelludden	CTD			73	2,6		
27-feb	148	26	41G8	56 28,779	18 43,761	26076	8 S Hoburg Bank	CTD			77	0,6		
27-feb	76	26	41G8	56 28,868	18 41,767	26076	8 S Hoburg Bank	Tv3L	25	75,9		0,8		
27-feb	149	26	41G8	56 25,419	18 39,242	26074	10,5 S Hoburg Bank	CTD			79	1,4		
27-feb	77	26	41G8	56 24,658	18 37,229	26074	10,5 S Hoburg Bank	Tv3L	30	77,9		1,8		
27-feb	78	26	41G8	56 23,464	18 29,227	26013	11 S Hoburg Bank	Tv3L	30	38,7		8,8		
27-feb	150	26	41G8	56 21,763	18 28,298	26013	11 S Hoburg Bank	CTD			42	8,8		
27-feb	79	26	41G8	56 14,108	18 26,927	26069	20 S Hoburg Bank	Tv3L	30	71,8		2,7		

Datum	Akt. nr	Om råde	Ruta	Position N	Position E	Stat. nr	Stationsnamn	Trålning	Tråltid	Tråldjup	Hydro Djup	Hydro O2	Komm entar	Rem arks
Date	Act. no	Area	Rect.	Latitude	Longitude	Haul No	Station name	Gear	Time min	Trawl depth	Depth m	Ox ml/l		
27-feb	151	26	41G8	56 12,139	18 26,425	26069	20 S Hoburg Bank	CTD			73	2,4		
27-feb	80	26	41G8	56 09,728	18 20,110	26170	15 W Bananbanken	Tv3L	30	76,7		2,3		
27-feb	152	26	41G8	56 07,913	18 20,155	26170	15 W Bananbanken	CTD			81	2,1		
27-feb	153	26	40G8	55 56,275	18 39,879	26221	11 SSW Bananbanken	CTD			114	0,2		
27-feb	81	26	40G8	55 55,867	18 40,396	26221	11 SSW Bananbanken	Tv3L	30	114,6		0,2	Syrefritt	OxFree
28-feb	154	26	41G8	56 19,970	18 43,651	26141	6 NW Bananbanken	CTD			117	0,1		
28-feb	82	26	41G8	56 20,037	18 43,548	26141	6 NW Bananbanken	Tv3L	30	117,6		0,1	Syrefritt	OxFree
28-feb	83	26	41G8	56 20,849	18 29,260	26032	14 S Hoburg Bank	Tv3L	30	54,4		8,7		
28-feb	155	26	41G8	56 19,407	18 28,140	26032	14 S Hoburg Bank	CTD			56	8,7		
28-feb	84	26	41G8	56 23,950	18 28,983	26224	12 SSW Hoburg Bank	Tv3L	17	35,2		8,8		
28-feb	156	26	41G8	56 23,072	18 28,749	26224	12 SSW Hoburg Bank	CTD			36	8,8		
28-feb	85	26	41G8	56 20,879	18 26,578	26225	16 SSW Hoburg Bank	Tv3L	30	42,7		8,7		
28-feb	157	26	41G8	56 19,327	18 25,746	26225	16 SSW Hoburg Bank	CTD			46	8,7		
28-feb	86	26	41G8	56 11,829	18 21,411	26010	14 W Bananbanken	Tv3L	25	71,2		2,8		
28-feb	158	26	41G8	56 09,852	18 21,404	26010	14 W Bananbanken	CTD			72	2,7		
28-feb	159	26	41G8	56 03,207	18 55,928	26140	5 SE Bananbanken	CTD			124	0,1		
28-feb	87	26	41G8	56 03,166	18 55,919	26140	5 SE Bananbanken	Tv3L	30	122,7		0,1	Syrefritt	OxFree
01-mar	160	26	41G8	56 07,552	18 03,838	26029	23 E Norra Midsjöbanken	CTD			54	8,6		
01-mar	88	26	41G8	56 05,778	18 02,228	26029	23 E Norra Midsjöbanken	Tv3L	18	56,8		8,6		
01-mar	161	26	41G8	56 18,340	18 34,510	26124	16 S Hoburg Bank	CTD			91	0,1		
01-mar	89	26	41G8	56 18,532	18 33,623	26124	16 S Hoburg Bank	Tv3L	30	85,6		0,1	Syrefritt	OxFree
01-mar	90	28	43G8	57 02,728	18 49,399	28101	10 SE När	Tv3L	25	67,6		0,3	Komplettering	Complementary
01-mar	162	28	43G8	57 03,859	18 51,549	28101	10 SE När	CTD			76	0,1		
01-mar	163	28	43G8	57 05,814	18 58,211	28067	11 ESE När	CTD			94	0,1		
01-mar	91	28	43G8	57 05,935	18 58,181	28067	11 ESE När	Tv3L	30	94,4		0,1	Syrefritt	OxFree
02-mar	164	28	43G8	57 10,770	18 54,032	28016	5 SE När	CTD			53	8		
02-mar	92	28	43G8	57 09,848	18 49,123	28016	5 SE När	Tv3L	30	48,8		8,7		
02-mar	93	28	43G9	57 19,239	19 04,477	28103	12 E Ljugarn	Tv3L	30	68,6		0,8		
02-mar	165	28	43G9	57 17,301	19 04,097	28103	12 E Ljugarn	CTD			73	0,3		
02-mar	94	28	43G9	57 20,166	19 03,783	28181	6 SE Östergarn	Tv3L	30	64,2		1,7		
02-mar	166	28	43G9	57 21,021	19 06,792	28181	6 SE Östergarn	CTD			65	1,7		

Datum	Akt. nr	Om råde	Ruta Rect.	Position N Latitude	Position E Longitude	Stat. nr Haul	Stationsnamn Station name	Trål ning Gear	Trål tid Time min	Trål djup Trawl depth	Hydro Djup Depth m	Hydro O2 Ox ml/l	Komm entar	Rem arks
02-mar	95	28	43G9	57 29,854	19 14,990	28053	9 NE Östergarn	Tv3L	16	67,1		0,9	Ogiltigt	Invalid
02-mar	167	28	43G9	57 28,420	19 15,180	28053	9 NE Östergarn	CTD			69	0,5		
03-mar	168	28	45G9	58 28,830	19 25,163	28060	4 E Gotska Sandön	CTD			76	0,2		
03-mar	96	28	45G9	58 26,049	19 23,315	28060	4 E Gotska Sandön	Tv3L	30	71,5		0,8		
03-mar	97	28	45G9	58 21,068	19 06,261	28189	4 W Gotska Sandön	Tv3L	28	72,3		0,1		
03-mar	169	28	45G9	58 21,239	19 03,901	28189	4 W Gotska Sandön	CTD			87	0,1		
03-mar	98	28	45G9	58 18,000	19 10,717	28100	4 SW Gotska Sandön	Tv3L	30	55,6		1,1		
03-mar	99	28	44G9	57 51,640	19 28,694	28104	6,5 SE Fårö	Tv3L	30	70,0		0,5		
03-mar	170	28	44G9	57 51,444	19 32,055	28104	6,5 SE Fårö	CTD			75	0,1		
04-mar	100	28	44G9	57 52,195	19 25,141	28027	5 SE Fårö	Tv3L	30	49,8		8,9		
04-mar	171	28	44G9	57 53,178	19 26,524	28027	5 SE Fårö	CTD			55	8,9		
05-mar	172	27	42G7	56 58,910	17 55,429	27007	8 NW Hoburg	CTD			72	1,6		
05-mar	101	27	42G7	56 59,643	17 57,029	27007	8 NW Hoburg	Tv3L	15	65,1		1,6		
05-mar	173	27	43G7	57 00,850	17 54,711	27023	9 NW Hoburg	CTD			77	1,4		
05-mar	102	27	43G7	57 02,729	17 55,186	27023	9 NW Hoburg	Tv3L	20	75,9		1,4		
05-mar	174	27	43G7	57 21,115	17 53,744	27016	4 NW Stora Karlsö	CTD			103	0,1		
05-mar	103	27	43G7	57 21,131	17 53,727	27016	4 NW Stora Karlsö	Tv3L	30	106,0		0,1	Syrefritt: OxFree	
05-mar	175	27	43G7	57 27,620	17 52,957	27027	10 NW Visby	CTD			105	0,1		
05-mar	104	27	43G7	57 27,633	17 52,883	27027	10 NW Visby	Tv3L	30	104,9		0,1	Syrefritt: OxFree	
05-mar	176	27	43G7	57 27,982	17 44,318	27026	10 S Knolls Grund	CTD			105	0,1		
05-mar	105	27	43G7	57 29,03	17 43,64	27026	10 S Knolls Grund	Tv3L	30	109,2		0,1	Syrefritt: OxFree	
05-mar	106	27	43G7	57 27,766	17 05,430	27025	3 SW Ölands Norra Grund	Tv3L	25	66,6		8,8		
05-mar	177	27	43G7	57 29,115	17 03,362	27025	3 SW Ölands Norra Grund	CTD			74	2,3		

Table 2. Summary of the species in the catches. Swedish BITS, Q1 2023.

Namn	Latinskt namn	24		25W		25C		25E		26		27		28		Total	
		Antal	Vikt	Antal	Vikt	Antal	Vikt	Antal	Vikt	Antal	Vikt	Antal	Vikt	Antal	Vikt	Antal	Vikt
Local name	Species	No.	Weight	No.	Weight	No.	Weight	No.	Weight	No.	Weight	No.	Weight	No.	Weight	No.	Weight
torsk	<i>gadus morhua</i>	3733,8	388,156	2792,9	548,998	8788,1	889,721	4481,2	521,784	807	101,718	13	3,444	2124,9	261,98	22740,9	2715,801
sill / strömming	<i>clupea harengus</i>	14087,8	631,182	18290,9	709,47	102872,3	3610,52	67594,8	2416,453	64379,7	2406,567	115344,4	3480,456	120572,5	3831,965	503142,4	17086,61
skarpsill	<i>sprattus sprattus</i>	3744,1	62,349	61391,8	853,582	348473,2	3166,323	20087,5	244,428	365128,9	3951,185	301071	3358,6	53973	543,909	1153870	12180,38
ansjovis	<i>engraulis encrasicolus</i>			1	0,028	1	0,026									2	0,054
fyrtömmad skärlånga	<i>enchelyopus cimbrius</i>	2	0,126	3	0,266	10	0,586	3	0,206	1	0,02	2	0,108	1	0,036	22	1,348
hornsimpa	<i>myoxocephalus quadricornis</i>									1	0,266	364,8	37,906	1926,6	191,393	2292,4	229,565
knöt / knorrhane	<i>eutrigla gurnardus</i>					1	0,06									1	0,06
makrill	<i>scomber scombrus</i>					2	0,914			1	0,07					3	0,984
nors	<i>osmerus eperlanus</i>											1	0,022			1	0,022
piggvar	<i>scophthalmus maximus</i>	8	3,226	43	17,236	7	2,588			5	1,314			2	0,308	65	24,672
pomatoschistus (släkte)	<i>pomatoschistus</i>									102	0,113					102	0,113
rödspätta	<i>pleuronectes platessa</i>	537	54,142	850,6	109,96	91	10,886	46	4,398	16	1,604	4	0,298	4	0,496	1548,6	181,784
rötsimpa	<i>Myoxocephalus scorpius</i>	13	1,252	28	3,47	151	29,224	17	2,544	727	123,094	88	14,944	285,4	40,005	1309,4	214,533
sandskädda	<i>limanda limanda</i>	57	4,564	68	8,956	39	5,354	1	0,04							165	18,914
sjurygg	<i>cyclopterus lumpus</i>			3	0,914	2	0,74	1	0,232	1	0,188					7	2,074
skrubbskädda	<i>platichthys flesus</i>	742,8	166,26	917,6	204,9	433	82,084	213,1	41,984	1843,9	330,088	171	24,998	1239,7	169,85	5561,1	1020,164
skäggsimpa	<i>agonus cataphractus</i>	2	0,078	1	0,066	1	0,028									4	0,172
småspigg	<i>pungitius pungitius</i>							6	0,012	2	0,002	14	0,018	9	0,009	31	0,041
spetslågebarn	<i>lumpenus lampretaeformis</i>					4	0,094							3	0,07	7	0,164
stakill	<i>alosa fallax</i>			6	0,85	19	2,884									25	3,734
storspigg	<i>gasterosteus aculeatus</i>					191	0,316	330,9	0,65	3	0,006	3439,3	6,424	726,9	1,001	4691,1	8,397
tobisar (släkte)	<i>ammodytes</i>	3	0,054	3	0,054					1	0,014					7	0,122
vitling	<i>merlangius merlangus</i>	6	0,416	11	2,766	14,9	1,086									31,9	4,268
tånglake	<i>zoarces viviparus</i>					21	1,384	16	0,31	38	1,436	14	0,526	35	1,564	124	5,22
äkta tunga	<i>solea solea</i>	6	0,748													6	0,748
Totalsumma		22942,5	1312,553	84410,8	2461,52	461121,5	7804,818	92797,5	3233,041	433057,5	6917,685	420526,5	6927,744	180903	5042,586	1695759	33699,94

Table 3 Cod catch in kg and numbers/haul in SDs 24-28

		Komplettering/complementary				TV3 trålstation/TV3 trawl station			
		Ogiltigt/Invalid				Syrefattig/oxygen deficiency			
Akt. nr	Position N	Position E	Stationsnamn	Trål-tid	Trål-djup	Hydro O2	Total (kg)	Torskfångst	
Act. no	Latitude	Longitude	Station name	trawl min	Trawl depth	O2 ml/l	Total (kg)	Vikt kg	Antal no.
SD 24									
68	55 11,690	13 14,758	S Trelleborg	30	41	7,7	460,8	79,9	1 162
69	55 15,189	13 40,963	Ystadkroken	30	42	8,6	317,2	178,9	1 672
70	55 18,638	13 48,204	5 S Klostergrundet	30	39	8,6	191,7	90,9	579
71	55 17,086	13 55,798	E Ystadkroken	30	38	8,6	342,8	38,4	321
SD 25									
55	55 46,032	16 39,541	1 S Teneriffa	20	56	6,5	1 103,5	514,2	4 413
56	55 52,221	16 04,257	Argos Track	30	55	4,9	144,4	7,6	68
57	55 50,559	15 58,321	11 SE Utklippan	27	57	5,3	952,8	335,2	4 333
58	55 47,859	15 54,236	Inre U10	30	61	1,2	2 129,2	334,3	2 420
59	55 38,740	15 47,220	Tången	30	68	1,2	262,6	7,6	63
60	55 49,447	15 25,679	Yttertorpet	30	52	6,5	2 835,3	93,3	933
61	55 53,136	15 34,018	5 SSW Utklippan	30	51	7,7	1 387,8	9,9	135
62	55 58,590	15 25,163	1 S Innertorpet	30	47	8,6	237,1	109,4	905
63	55 41,433	14 51,656	18 ENE Stens Huvud	30	58	4,8	1 185,5	74,6	522
64	55 36,646	14 35,827	8 ENE Simrishamn	30	66	3,4	609,7	111,3	828
65	55 42,001	14 21,721	3,5 NE Stens Huvud	27	35	8,5	250,7	196,8	710
66	55 42,184	14 22,436	5 NE Stens Huvud	30	39	8,4	240,0	108,0	425
67	55 42,442	14 22,708	Rackaputt -38m	30	38	8,5	175,6	58,2	308
72	56 25,849	16 45,644	6,5 NE Segerstad	30	62	0,3	1 985,1		
SD 26									
76	56 28,868	18 41,767	8 S Hoburg Bank	25	76	0,8	629,1	19,6	178
77	56 24,658	18 37,229	10,5 S Hoburg Bank	30	78	1,8	409,0	10,2	91
78	56 23,464	18 29,227	11 S Hoburg Bank	30	39	8,8	132,4	6,2	42
79	56 14,108	18 26,927	20 S Hoburg Bank	30	72	2,7	210,1	14,5	147
80	56 09,728	18 20,110	15 W Bananbanken	30	77	2,3	497,6	7,1	34
81	55 55,867	18 40,396	11 SSW Bananbanken	30	115	0,2			
82	56 20,037	18 43,548	6 NW Bananbanken	30	118	0,1			
83	56 20,849	18 29,260	14 S Hoburg Bank	30	54	8,7	153,2	9,1	75
84	56 23,950	18 28,983	12 SSW Hoburg Bank	17	35	8,8	41,1	1,6	18
85	56 20,879	18 26,578	16 SSW Hoburg Bank	30	43	8,7	113,7	9,7	57
86	56 11,829	18 21,411	14 W Bananbanken	25	71	2,8	2 260,8	17,1	131
87	56 03,166	18 55,919	5 SE Bananbanken	30	123	0,1			
88	56 05,778	18 02,228	23 E Norra Midsjöbanken	18	57	8,6	2 470,7	6,5	34
89	56 18,532	18 33,623	16 S Hoburg Bank	30	86	0,1			

Akt.	Position	Position	Stationsnamn	Trål-	Trål-	Hydro	Total	Torskfångst	
nr	N	E		tid	djup	O2	(kg)	Vikt	Antal
Act.	Latitude	Longitude	Station name	trawl	Trawl	O2	Total	Cod catch	
no				min	depth	ml/l	(kg)	kg	no.
SD 27									
51	57 21,853	16 54,988	4 NW Byxelkrok	30	45	5,8	1 479,7	0,002	1
52	57 25,020	17 01,337	5 N Byxelkrok	30	56	1,7	1 355,8	0,2	1
53	57 36,695	17 06,645	9 SE Kungsgrundet	30	84	0,1			
54	57 20,674	17 25,198	11 ESE Ölands Norra Udde	22	74	0,1	17,8		
73	56 32,187	16 55,008	8 SE Bläsinga	9	73	8,2			
74	56 32,648	16 50,340	6,5 SE Bläsinga	30	64	8,6	323,1	1,1	4
75	56 39,980	16 59,077	10 SSE Kapelludden	30	68	5,5	833,0	0,9	3
101	56 59,643	17 57,029	8 NW Hoburg	15	65	1,6	2 771,5	0,1	1
102	57 02,729	17 55,186	9 NW Hoburg	20	76	1,4	102,5		
103	57 21,131	17 53,727	4 NW Stora Karlsö	30	106	0,1			
104	57 27,633	17 52,883	10 NW Visby	30	105	0,1			
105	57 29,03	17 43,64	10 S Knolls Grund	30	109	0,1			
106	57 27,766	17 05,430	3 SW Ölands Norra Grund	25	67	8,8	44,4	1,2	3
SD 28									
90	57 02,728	18 49,399	10 SE När	25	67,6	0,3	1 467,9	6,1	30
91	57 05,935	18 58,181	11 ESE När	30	94,4	0,1			
92	57 09,848	18 49,123	5 SE När	30	48,8	8,7	540,5	10,1	98
93	57 19,239	19 04,477	12 E Ljugarn	30	68,6	0,8	1 085,9	16,3	75
94	57 20,166	19 03,783	6 SE Östergarn	30	64,2	1,7	271,3	212,9	1 790
95	57 29,854	19 14,990	9 NE Östergarn	16	67,1	0,9			
96	58 26,049	19 23,315	4 E Gotska Sandön	30	71,5	0,8	699,8	5,6	51
97	58 21,068	19 06,261	4 W Gotska Sandön	28	72,3	0,1	8,1		
98	58 18,000	19 10,717	4 SW Gotska Sandön	30	55,6	1,1	455,6	1,3	14
99	57 51,640	19 28,694	6,5 SE Fårö	30	70,0	0,5	86,5	6,6	50
100	57 52,195	19 25,141	5 SE Fårö	30	49,8	8,9	427,0	3,0	17
Catch, weight (kg) and numbers							33 700	2 715,8	22 741





**Working Document**

ICES Baltic International Fish Survey

Working Group

Cádiz, Spain, 20-24.03.2023

**RESEARCH REPORT**  
FROM THE POLISH R/V BALTICA BITS 1Q 2023 SURVEY  
IN THE SOUTHERN BALTIC  
(08 February - 02 March 2023)

by

Krzysztof Radtke and Tycjan Wodzinowski



Gdynia, 14 March 2023



## **INTRODUCTION**

Since 1995, the permanent participation of Polish R/V Baltica operated by the National Marine Fisheries Research Institute (NMFRI) in Gdynia, has taken place in autumn and winter Baltic International Trawl Surveys (BITS-4Q and BITS-1Q) realised in the southern Baltic. In March 2000 when the research standard fishing gear in the Baltic Sea - the cod bottom trawl type TV-3, has been applied by the vessels assigned to the BITS surveys realization, the principal methods of investigations within BITS-1Q ground-trawl surveys designated to particular national laboratories, including the NMFRI were designed and co-ordinated by the Baltic International Fish Survey Working Group (ICES, 2001). The main aim of the BITS-1Q survey planned in winter 2023 was to monitor abundance and spatial distribution of the main demersal fish species and to some extent also clupeids in the bottom zone of the Baltic, taking into account hydrological parameters. The R/V Baltica BITS-1Q 2023 survey, which was realized in the Polish part of the ICES Sub-divisions 25 and 26 and in Latvian part of the ICES Sub-division 26, was aimed at:

- determination of the spatial distribution of cod, flounder, herring and sprat in the near bottom zone of the southern and central Baltic during winter 2023 applying method of random selection of research hauls, estimation of the fishing efficiency, i.e. catch per unit effort (CPUE), the share of particular species in total mass of bottom control-catches,
- collecting biological samples of dominated fish for the determination of the age-length-mass relationship, sex, sexual maturation, feeding conditions and externally visible diseases,
- analysis of the vertical and horizontal changes of the basic hydrological parameters (temperature, salinity, oxygen content) in the areas of fish catches and in neighbouring standard hydrological stations,
- collecting and identifying the abundance of marine litter present in the fishing hauls.

## **MATERIAL AND METHODS**

The above purposes of the February/March 2023 BITS 1Q survey aboard of R/V Baltica were realized by the NMFRI nine members of the scientific team, with Krzysztof Radtke as a cruise leader. The scientific team was also composed of seven ichthyologists including technicians, responsible for determination of fish species composition of catches, fish biological analyses and data processing and one hydrologist, responsible for seawater sampling and analysing as well as for meteorological monitoring.

### **Narrative**

The reported Polish ground-trawl survey on board of R/V Baltica, marked with the number 2/2023/MIR took place during the period of 08.02-02.03.2023 within the framework of the ICES Baltic International Trawl Surveys (BITS) long-term programme (ICES, 2023) and the Polish Fisheries Data Collection Programme for 2023. The vessel left the port of Gdynia on 08.02.2023 in the morning and at sea investigations began in the southern part of the Gulf of Gdańsk (Fig. 1, Tab. 1). During the period of 28.02-01.03.2023, the investigations were conducted in Latvian waters. Hauls no 26060, 26064 and 26122 planned in the Lithuanian EEZ (SD 26) were the only stations not realized during the Polish BITS due to non-response from Lithuanian authorities to application. The survey ended on 02.03.2023 (morning) in Gdynia harbour. The R/V Baltica operated mostly in the Polish EEZ. Overall, 23 days were utilized for fulfilling the tasks of the BITS 1Q 2023 survey, including six days spent at sea without investigations due to heavy

weather conditions and including also time spent for the vessel translocation from the Gdynia harbour to research area and a return way to the vessel home-port.

### **Survey design and realization – sampling description**

According to the WGBIFS plan, the Polish vessel was recommended to cover in February/March 2023 survey, the Polish part of ICES Sub-divisions 25 and 26 with 17 and 43, respectively randomly selected bottom research hauls, as well as in Latvian and Lithuanian EEZs to cover part of the ICES Sub-division 26 with 7 and 3 research hauls, respectively. The R/V Baltica realized 67 out of the 70 planned hauls for this survey. All the hauls realized were considered as „Valid” from the technical point of view. In total 11 hauls (ICES no 26086, 26090, 26091, 26093, 26094, 26107, 26273, 26142, 26144, 26199, 26257) were not realized due to oxygen level in the near bottom zone below 0.5 ml/l. They were classified as “Assumed zero catch hauls”. Finally, it can be concluded that the hauls realized during the survey corresponded to the plan and could be therefore accepted as fully representative from the technical point of view, (Fig. 1, Table 1) taking into account gear performance observed during trawling.

Trawling was done with the standard rigging ground trawl type TV-3#930 (without bobbins and additional chains connected to the footrope). In the codend 10-mm mesh bar length was used. A standard vertical fish-sounder was used to monitor the trawling depth. Usually a 6-7 m vertical net opening was achieved, which was monitored by the net echosounder. The catch stations were located on the depth range from 20 to 143 m. Fish research hauls were conducted at the daylight only (starting trawling 15 minutes after sunrise and ending trawling not later than 15 minutes before sunset), lasting maximum 30 minutes, at 3.0 knots vessel speed.

Each research catch was sorted out for the determination of the species composition. Mean CPUE of each fish species and their average share in mass of catches was calculated. From each catch station, representative samples of dominated fishes were collected to determine age-length-mass relationships, sex, sexual maturation, feeding conditions, externally visible diseases and additionally stomach samples for food composition estimation of cod were collected for further examinations in the Institute.

In the case of turbot and plaice all the caught specimens were taken for total length and mass measurements. In the case of cod, clupeids and flounder, the representative sub-samples of these fish species were investigated. Overall, 6987 cod, 3686 flounder, 214 plaice, 27 turbot, 5102 sprat and 7797 herring were taken for the length and mass determination. In total, 427, 655, 213, 27, 338 and 714 individuals of the above-mentioned species were aged. Biological analyses of fishes were performed directly on board of the surveying vessel, according to standard methodological procedures. The length of 35 cm, 23 cm (ICES SD 25) and 21 cm (ICES SD 26), 16 cm and 10 cm was taken into account as a separation (protective) length between juvenile and commercial size of cod, flounder (differed by the ICES Sub-divisions), herring and sprat, respectively.

Externally visible diseases of fish's skin and their skeletal anomalies were monitored for 6987 cod, 3686 flounder, 5102 sprat and 7797 herring. Data on pathological symptoms were registered based on the visual inspection of fish taken for length measurements.

Every control-haul was preceded by the measurements of basic hydrological parameters continuously from the sea surface to the bottom. Overall, 92 hydrological stations (including hydrographic standard stations) were inspected with the automatic CTD probe SeaBird 911 combined with the rosette sampler (the bathometer rosette). Oxygen content was determined using the standard Winkler's method. The seawater temperature and salinity row data was aggregated to the 1-m depth stratum while oxygen content was aggregated to the 10-m intervals. Temperature, salinity and oxygen content was the source of information on abiotic factors potentially influencing fish spatial distribution. Distribution of all hydrological stations inspected by the R/V Baltica in February/March 2023 is presented in Figure 1. The results of marine litters collected in the fishing hauls are presented in Figure 8.

## RESULTS

### Fish catches and biological data

In total, twenty different fish species was recognized in 67 scrutinized valid bottom catches (Table 1). European anchovy recorded in two fishing hauls was the only fish species permanently inhabiting in Atlantic Ocean that occurred in the research catches.

The frequency of the occurrence of the most important commercial species in the all hauls realized – flounder, cod, herring and sprat was - 82%, 78%, 75% and 53%, respectively (Table 1). Cod, flounder, herring and sprat dominated also with respect to the mass of the catch (kg) and efficiency (CPUE – kg/1h). By-catch of other fish species was insignificant.

The average CPUEs of cod in ICES SDs 25 and 26 were 95,4 kg/1h and 40,6 kg/1h, respectively (Fig. 2). The average CPUEs of cod, in analogous survey in February/March 2022 were lower in the ICES SD 25 (69.3 kg/1h) and also in the ICES SD 26 (18.7 kg/1h) than in February/March 2023 survey. Higher cod CPUEs in February/March 2023 can be explained by much more abundant occurrence of twenty-something centimetres cod. That size cod was also present in previous surveys, but its abundance was less prominent. Almost twice lower CPUE of cod in ICES SD 26 may result from the very low oxygen content in the near bottom zone (deeper than 80 m) observed in a large part of the ICES SD 26 (Fig. 7). The area of low oxygen content (below 2 ml/l and also below 0.5 ml/l in some areas) was extended during the described survey.

The average CPUE of herring in ICES SD 25 was 159.8 kg/1h. Markedly higher average CPUE was obtained in ICES SD 26 – 580.1 kg/1h. During the last year's survey, the CPUEs of herring were much lower in the ICES SDs 25 and 26 – 33.4 kg/1h and 151.8 kg/1h, respectively.

The average CPUEs of sprat in ICES SDs 25 and 26 varied considerably in terms of magnitude – 9.0 and 622.1 kg/1h, respectively. Sprat CPUE in ICES SD 26 was the highest among all the species which was obtained in the survey. Low catch of sprat observed in ICES SD 25 might most probably result from sprat migration to deeper waters (outside of the mainly coastal sampling stations), where sprat was preparing for spawning and also already participated in the spawning. In the same type of the survey from February/March 2022 the CPUE of sprat in ICES SD 25 was higher - 29.1 kg/1h and in the ICES SD 26 it was much higher – 728.3.6 kg/1h.

The average CPUE of flounder in ICES SDs 25 and 26 was 24.4 and 62.5 kg/1h, respectively. Thus the flounder CPUE results in both ICES Subdivisions were the third in row of CPUEs as compared to the other three species CPUEs examined. The average CPUE of flounder in February/March 2022 in ICES SD 25 was higher – 77.4 kg/1h, whereas in ICES SD 26 flounder CPUE was lower - 37.9 kg/1h.

Length distributions of the main fish species according to the ICES Sub-divisions are illustrated in Figure 3. The shape of the cod curve length distributions were very similar in both of the ICES Subdivisions investigated, indicating for resemble sizes of cod inhabiting the study area in the ICES SD 25 and 26. A characteristic feature of both length distributions, as compared to previous surveys, is a definite dominance of cod from length range 20-30 cm. The numerical share of cod from that length range was 72% in ICES SD 25 and 75% in ICES SD 26. Cod of that length range was much less abundant in previous surveys in the eastern Baltic studied area. However, it should be emphasized that only six 50 cm and larger cod was observed in the measured cod sample consisting of 6987 cod specimens in the survey.

Two herring length fractions in the length distribution curves from ICES SD 25 and 26 were clearly distinguished. In the ICES SD 25, the first fraction of small size herring (11.5-15.5 cm) and the second fraction of larger ones (16.0-29.5 cm). In the ICES SD 26 exactly the same length fractions as in ICES SD 25 were distinguished. The numerical share of the first fraction was considerably lower than the share of the larger fraction and amounted to only 4.8% and 12.5% in ICES SD 25 and in ICES SD 26, respectively. Thus, the smaller size fraction numerical share of herring was even lower than in BITS survey in February/March 2022 - 5.1% and 16.7%, respectively. The results presented might indicate low abundance of young herring.

Sprat length distribution curves from ICES SD 25 and 26 were characterized by a single peaks clearly visible corresponding to length class 13.0 cm (frequency 24.3%) and to 12.0 cm (frequency 31.6%), respectively. However, neither in the ICES SD 26 nor in the ICES SD 25 a fraction of smaller size sprat was clearly evident, similarly as in February/March 2022, but contrary to the same type of the survey results observed in 2020-2021. Length distribution curves indicate that sprat of more favourable size for commercial fishery was observed in ICES SD 25, similarly as in previous surveys.

Flounder length distributions indicated large differences of flounder size depending on the ICES SD they occupied. Analogous observations were found in the previous BITS surveys. Flounder length distribution curve in the ICES SD 25 covered narrower length range (17-37 cm) than the curve from the ICES SD 26, where the length range was 9-45 cm. Flounder length ranges obtained during this survey were almost identical as the length ranges from the previous winter BITS survey (16-38 cm and 9-38 cm, in the ICES SDs 25 and 26, respectively). Numerical share of smaller flounder (<20 cm) was much higher in the ICES SD 26 (24.4%) than in ICES SD 25 (1.4%), what indicated that more smaller flounder inhabited ICES SD 26. Single peaks of frequency in the length distribution curves of flounder from ICES SDs 25 and 26 were close to each other, corresponding to length class 25 cm and 23-24 cm in ICES SD 25 and 26, respectively (frequency of 13.0% and 9.0%, respectively).

Figure 4 shows the numerical shares of the undersized fish fractions of cod, herring, sprat and flounder. In cod catches from ICES SDs 25 and 26 the undersized fraction of cod prevailed markedly. Their numerical share in the above-mentioned ICES SDs was record high as compared to previous surveys, and was 91.5% and 93.4%, respectively. In the same type of cruise from February/March 2022, the share of undersized cod in ICES SD 25 was markedly lower - 71.6% and in ICES SD 26 it was less lower – 80.4%. The total share of undersized cod from the February/March 2023 survey was also very high and amounted to 92.6%. The undersized cod increase in February/March 2023 was the consequence of the contribution of high abundant cod from length range 20-30 cm. The contribution of small size cod induced decrease in mean length and mean mass of cod in February/March 2023 as compared to last year survey (see the parameters table below). The share of the undersized fraction of herring in ICES SD 25 and 26 amounted to 4.8% and 12.5%, respectively. The largest share of undersized sprat was observed in samples from ICES SD 26 (5.3%). The share of undersized sprat in the ICES SD 25 was only 0.4% individuals. Flounder undersized share was higher in the ICES SD 26 (30.8%) than in the ICES SD 25 - 14.9%.

Mean length (l.t.) and mean mass of sprat, herring, cod and flounder calculated for the whole cruise and separately for ICES SDs 25 and 26 are presented in the text table below (in parenthesis are shown parameters from February/March 2022 cruise):

ICES Sub-division	parameter	sprat	herring	cod	flounder
25	mean length [cm]	13.0 (12.1)	20.9 (20.2)	28.5 (32.4)	26.6 (26.6)
26		12.3 (11.6)	19.2 (18.0)	27.2 (30.2)	23.1 (23.4)
whole cruise		12.4 (10.6)	19.6 (18.3)	27.8 (31.2)	23.7 (23.9)
25	mean mass [g]	12.7 (10.3)	58.3 (51.9)	216.1 (320.8)	193.2 (203.7)
26		11.1 (9.4)	44.7 (37.2)	193.7 (269.3)	140.4 (147.1)
whole cruise		11.3 (9.5)	47.8 (37.1)	204.2 (291.2)	149.5 (154.8)

The measurement of the length of the main fish species was accompanied by a macroscopic analysis of the presence of symptoms of visible diseases of fish's skin, i.e. anatomopathological changes (Fig. 5). The highest prevalence of fish with externally visible pathological changes was recorded for flounder (6.9% on average) and next for cod - 0.8%. The

share of herring with observed pathological symptoms was very low and amounted to 0.06%. In case of sprat. no externally visible diseases were found.

### **Hydrological situation in the southern Baltic**

In the near-bottom water layer (Fig. 6) temperatures in the range from 3.52°C to 10.46°C were noted. The lowest temperature was noted in the control hauls no 36 and 37 at the depth 23 and 22 m, respectively. The highest temperature was observed in the control haul no 27 at the depth 55 m. The highest salinity was recorded at the hydrological station IBY5PL (Bornholm Basin) (16.70 on the PSU scale). At the deepest place in Słupsk Furrow (hydrological station RS2) the salinity was 13.90. Salinity measured in Gdańsk Deep in the near bottom zone amounted to 11.79 at the hydrological station (G2), whereas in Gotland Deep in the Polish EEZ it was 10.67 at the hydrological station Gt1. In the deepest station examined in Gotland Deep (haul no 63), in Latvian EEZ the salinity was 12.04. In general the deepest parts of the bottom were to large extent poorly oxygenated (Fig 7). Areas of oxygen content below 2 ml/l covered Gdańsk and Gotland Deep and partially also Słupsk Furrow. Limited hydrological data collected in the Bornholm Basin also suggest poor oxygen conditions near the bottom in that area.

### **CONCLUSIONS**

The data collected during Polish BITS-1Q 2023 cruise is considered as representative. taking into account the degree of the survey plan realization. and therefore can be used by the ICES Baltic International Fish Survey Working Group (WGBIFS) and the Baltic Fisheries Assessment Working Group (WGBFAS) for evaluation of fish species abundance and their distribution. The survey data collected during the cruise is stored in the international DATRAS database publicly available and managed by the ICES Secretariat.

### **References:**

ICES. 2001. Report of the Baltic International Fish Survey Working Group. Baltic Committee. ICES CM 2001/H:02. Ref.: D. Kaliningrad. Russia. 5-9 February 2001. 249 pp.

ICES. 2023. Working Group on Baltic International Fish Survey (WGBIFS; outputs from 2022 meeting). ICES Scientific Reports. Report. <https://doi.org/10.17895/ices.pub.22068821.v1>

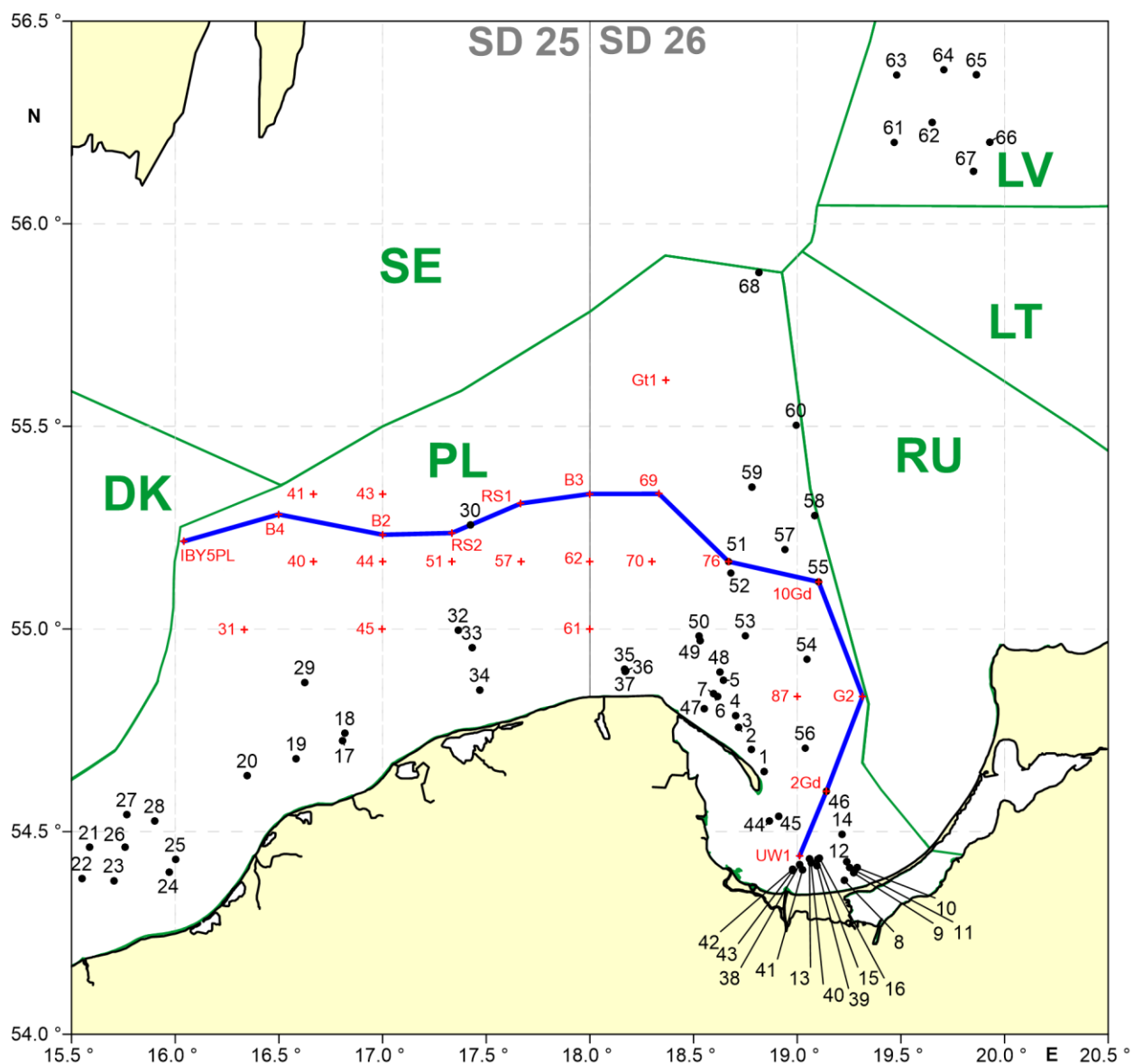


Fig. 1. Location of fish control-hauls (black crosses) and hydrological standard stations (red dots) realised during the r/v Baltica BITS-1Q cruise (08.02-02.03. 2023). (blue solid line indicates hydrological research profile).

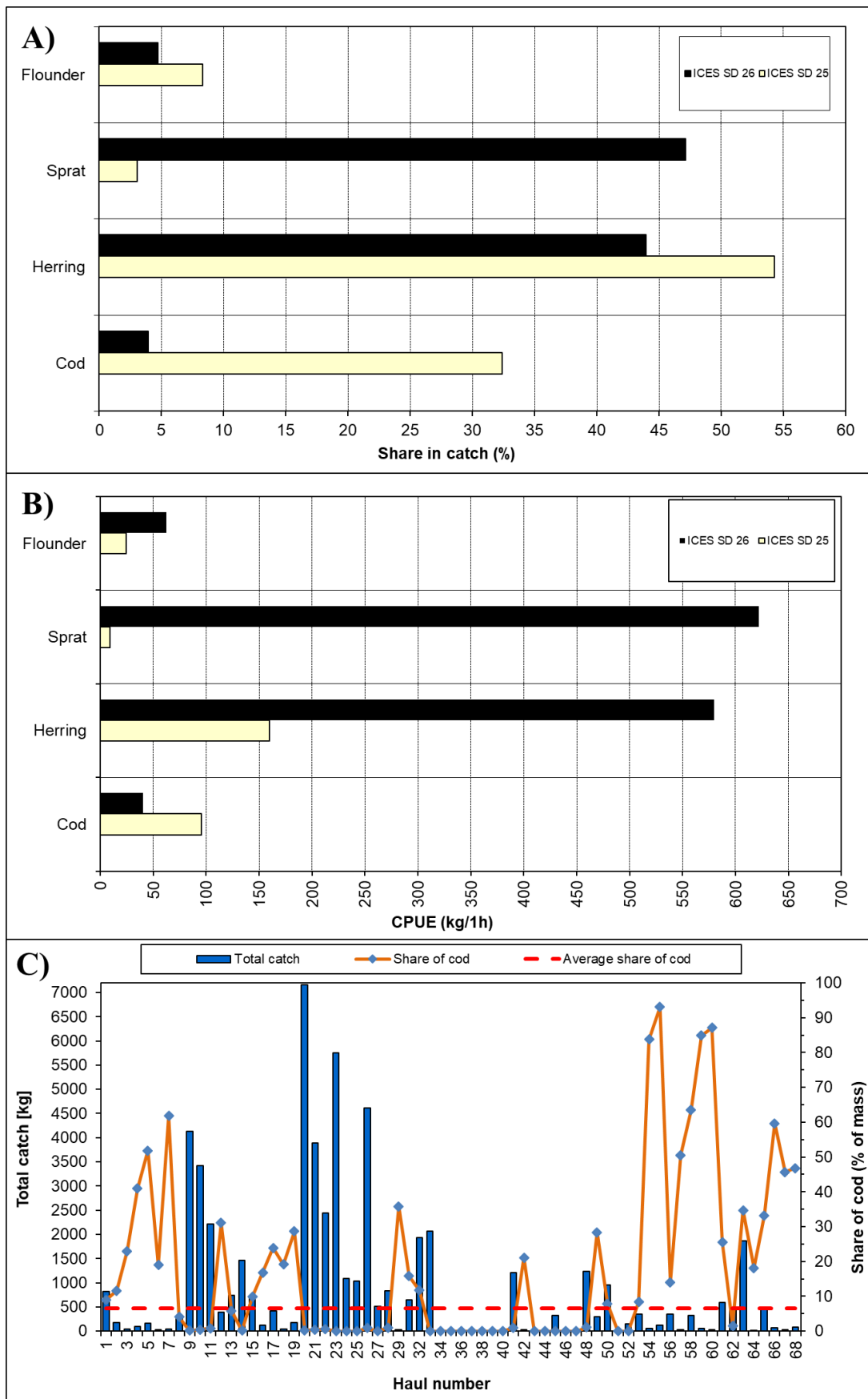


Fig. 2. Mean share in mass of control hauls (A). and mean CPUE (B) of dominant fish species. and share of cod (C) in particular catches conducted during r/v Baltica BITS-1Q cruise (08.02-02.03. 2023).

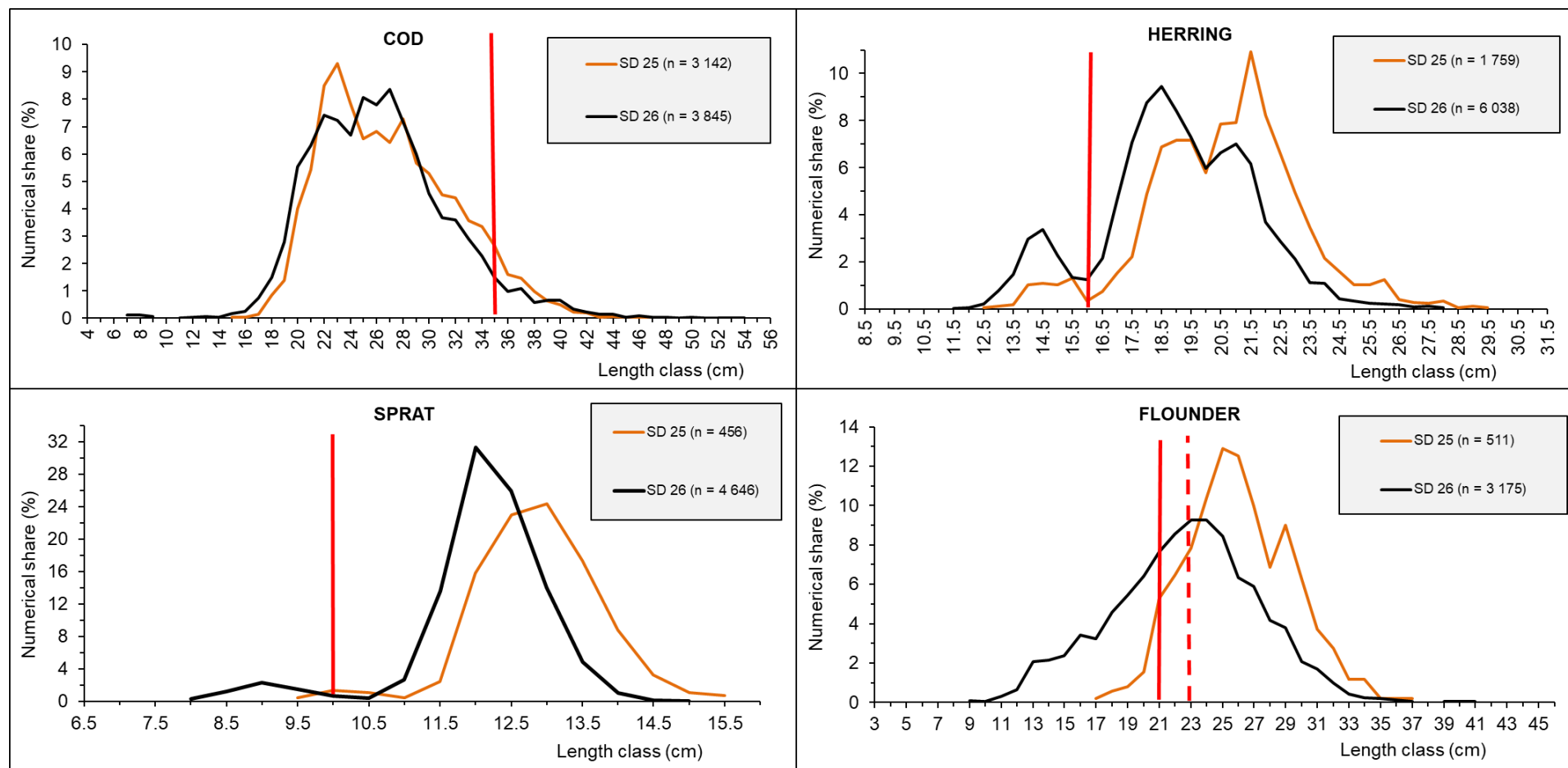


Fig. 3. Length distributions of cod, herring, sprat and flounder in samples from fish control hauls conducted during r/v Baltica BITS-1Q cruise (08.02-02.03. 2023). (red vertical lines indicate minimum landing size).



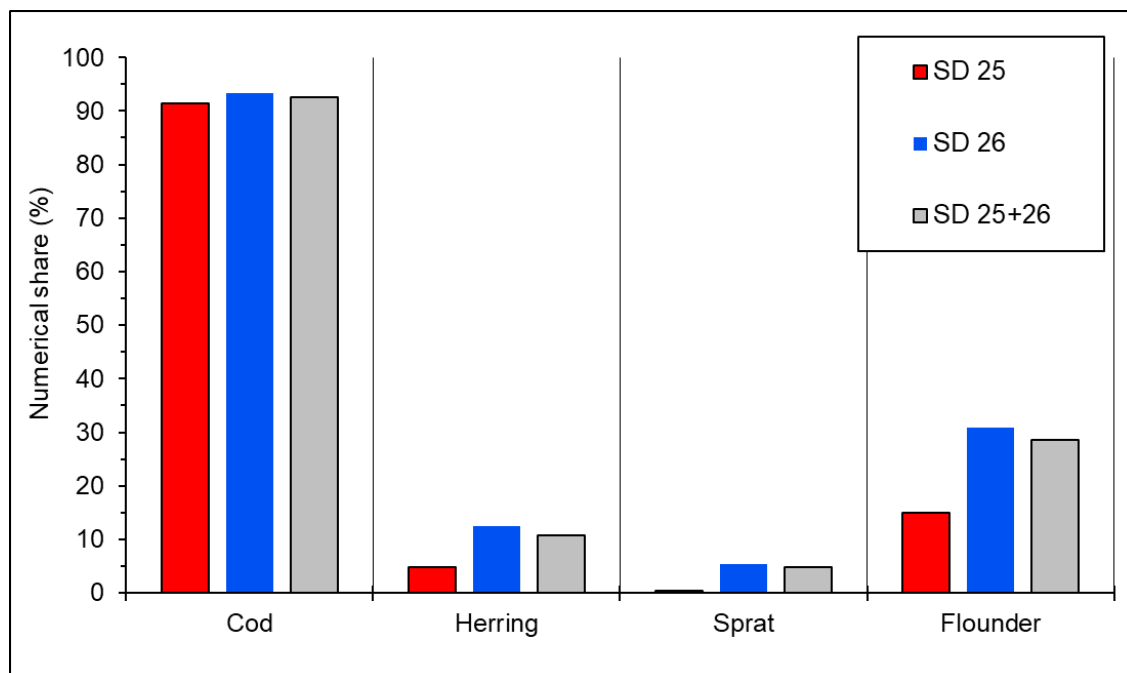


Fig. 4. Mean numerical share (in %) of undersized fish species in samples from fish control hauls conducted during r/v Baltica BITS-1Q cruise (08.02-02.03. 2023).

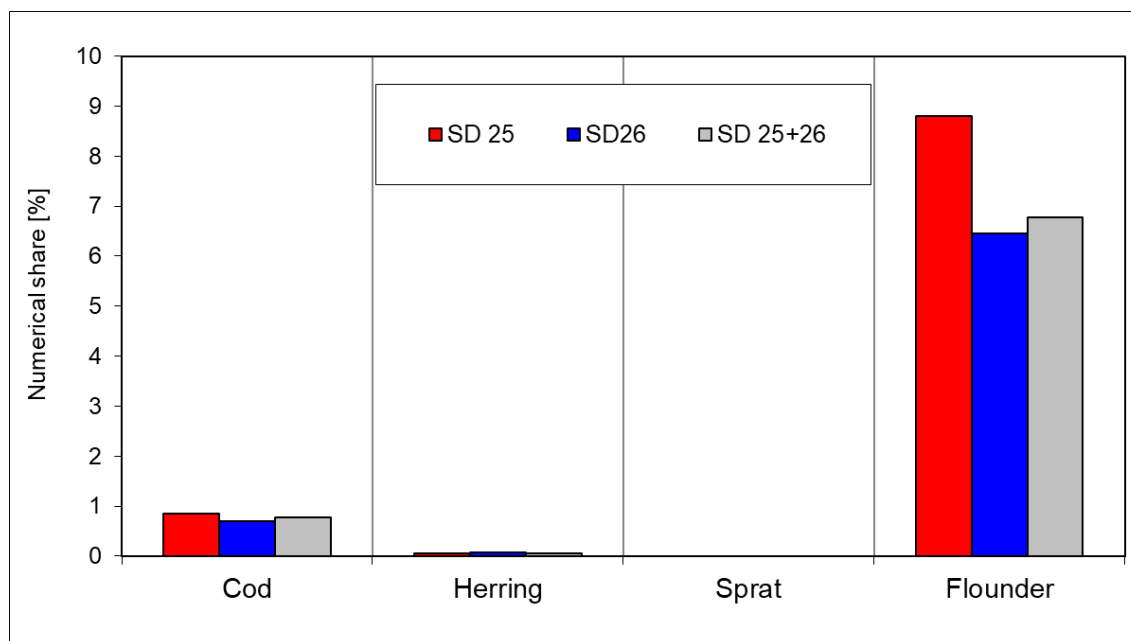


Fig. 5. Mean prevalence (in %-indiv.) of fish with externally visible diseases in samples from fish control hauls conducted during r/v Baltica BITS-1Q cruise (08.02-02.03. 2023).

Tab. 1. Number of fish species individuals measured and aged during r/v Baltica BITS-1Q cruise (08.02-02.03. 2023).

Species name	Number of fish mesured (lt)			Nuner of fish aged and weighed (g)		
	25 ICES Sub-division	26 ICES Sub-division	total	25 ICES Sub-division	26 ICES Sub-division	total
Cod	3142	3845	6987	230	197	427
Baltic herring	1759	6038	7797	279	435	714
Sprat	456	4646	5102	95	243	338
Flounder	511	3175	3686	224	431	655
Plaice	134	80	214	133	80	213
Eelpout	0	86	86	0	20	20
Fourbeard rockling	36	4	40	11	2	13
European perch	2	1	3	2	1	3
Three-spined stickleback	0	12	12	0	0	0
Short-horn scorpion	95	76	171	13	16	29
Round goby	0	8	8	0	5	5
Twaite shad	24	43	67	7	10	17
Turbot	7	20	27	7	20	27
European anchovy	2	1	3	1	1	2
Greater sandeel	167	2	169	6	2	8
Lumpfish	4	31	35	3	6	9
Hooknose	3	1	4	3	1	4
Whiting	24	0	24	11	0	11
Common dab	0	1	1	0	1	1
Atlantic mackerel	2	2	4	1	1	2
<b>TOTAL</b>	6368	18072	24440	1026	1472	2498

Tab. 2. Fish control-hauls data obtained during r/v Baltica BITS-1Q cruise (08.02-02.03. 2023) (**Hauls no. 1-35**)

Haul number according to survey order	Haul number according to ICES database	Catch date	ICES rectangle	ICES Sub-division	Trawling depth [m]	Geographical position of the catch-station				Time of		Trawling duration [min]	Total catch [kg]	Weight of the catch by fish species [kg]																									
						start/shoot		end		shooting net	hauling up net			Cod	Baltic herring	Sprat	Flounder	Plaice	Eelpout	Fourbeard rockling	European perch	Three-spined stickleback	Short-horn	Round goby	Twaite shad	Turbot	European anchovy	Greater sandeel	Lumpfish	Hooknose	Whiting	Common dab	Atlantic mackerel						
						latitude (N)	longitude (E)	latitude (N)	longitude (E)																														
1	26168	2023-2-8	38G8	26	61	54°39.4'	18°49.7'	54°40.6'	18°48.5'	11:21	11:51	30	406.719	36.560	191.137	8.999	164.620	0.816	0.397	3.190														0.496					
2	26133	2023-2-8	38G8	26	57	54°42.8'	18°46.2'	54°43.9'	18°45'	14:27	14:57	30	85.434	9.880	20.890		47.860	1.416	0.799	0.467														1.482					
3	26169	2023-2-9	38G8	26	34	54°45.8'	18°42.3'	54°47'	18°41'	07:35	08:05	30	23.354	5.365	6.798	0.010	10.300	0.285	0.360				0.147		0.010														
4	26020	2023-2-9	38G8	26	44	54°45.7'	18°43.1'	54°47.1'	18°42.5'	09:13	09:43	30	45.843	18.770	0.938		23.800	0.621	0.216														0.562		0.052	0.218			
5	26019	2023-2-9	38G8	26	49	54°53.2'	18°38.3'	54°54.5'	18°37.2'	11:19	11:49	30	81.210	42.090	0.599		35.370	0.922																2.126					
6	26183	2023-2-9	38G8	26	30	54°50.5'	18°37'	54°51.8'	18°35.9'	13:12	13:42	30	14.290	2.706			10.510	0.401	0.105	0.033														0.354					
7	26007	2023-2-9	38G8	26	30	54°50.8'	18°35.5'	54°52.1'	18°34.2'	14:33	15:03	30	20.132	12.440			6.675	0.300	0.108																				
8	26001	2023-2-10	37G9	26	23	54°22.9'	19°14.8'	54°23.1'	19°17.3'	07:33	08:03	30	141.147	5.770	123.370	0.196	11.655							0.029															
9	26216	2023-2-10	37G9	26	32	54°23.8'	19°15.4'	54°23.9'	19°16.4'	09:30	09:45	15	1032.080	1.185	797.308		231.392		2.149																0.046				
10	26217	2023-2-10	37G9	26	42	54°24.6'	19°14.8'	54°24.6'	19°16.8'	11:25	11:40	25	1426.445	6.310	343.750		1068.390		7.187																0.708	0.051			
11	26163	2023-2-10	37G9	26	41	54°24.6'	19°16.6'	54°24.7'	19°17.8'	13:43	13:58	15	554.820	4.320	273.264		271.278		4.901	0.483				0.040											0.409				
12	26261	2023-2-10	37G9	26	53	54°25.4'	19°15.6'	54°25.5'	19°16.4'	15:26	15:36	10	64.716	20.120	41.424		0.322		2.160																0.276		0.164		
13	26014	2023-2-11	37G9	26	49	54°26.1'	19°5'	54°26.1'	19°6.2'	07:37	07:52	15	183.982	10.720	133.859		5.427		32.900																0.750		0.042	0.204	
14	26034	2023-2-11	37G9	26	72	54°29.9'	19°14.7'	54°30.1'	19°15.9'	09:25	09:40	15	366.460	0.715	117.924		236.841		7.760						0.065											3.155			
15	26265	2023-2-11	37G9	26	51	54°26'	19°6.1'	54°26.1'	19°8.6'	11:35	12:05	30	346.148	34.120	273.579		11.640		26.100	0.083															0.500		0.118		
16	26289	2023-2-11	37G9	26	50	54°26.1'	19°4.3'	54°26.3'	19°6.6'	13:27	13:57	30	57.713	9.720	25.840		0.568		20.020	0.193	0.593	0.015													0.312		0.036		0.416
17	25017	2023-2-12	38G6	25	29	54°43.7'	16°49.4'	54°44.3'	16°51.6'	07:39	08:09	30	72.717	13.440	55.870		0.020		2.466	0.464	0.146														0.221		0.090		
18	25016	2023-2-12	38G6	25	30	54°45.2'	16°50.3'	54°46.3'	16°51.9'	09:26	09:56	30	178.021	14.920	161.880				0.626																0.563		0.032		
19	25014	2023-2-12	38G6	25	29	54°41.1'	16°36.2'	54°41.7'	16°38.7'	12:06	12:36	30	29.303	24.530	2.824			1.055	0.358															0.314		0.222			
20	25013	2023-2-12	38G6	25	33	54°38.6'	16°22.1'	54°39.1'	16°24.5'	14:43	15:13	30	63.818	59.380	1.736			1.732	0.271															0.308		0.020	0.371		
21	25039	2023-2-13	37G5	25	50	54°27.5'	15°36.5'	54°27.3'	15°38.9'	07:48	08:18	30	176.668	24.780	127.423	1.226		21.140	1.109	0.275																0.715			
22	25008	2023-2-13	37G5	25	29	54°22.9'	15°34.8'	54°22.9'	15°37.4'	10:19	10:49	30	17.106	8.640	1.161			2.074	3.180	0.108															1.880				
23	25009	2023-2-13	37G5	25	30	54°22.7'	15°43.6'	54°22.9'	15°46.1'	10:10	12:20	30	164.747	104.500	52.300			2.283	2.623	0.151															2.620		0.270		
24	25011	2023-2-13	37G5	25	27	54°24.1'	15°59.5'	54°24.5'	16°2'	14:22	14:52	30	28.585	24.270	2.797			0.342	0.228	0.106															0.730		0.032		
25	25010	2023-2-13	37G6	25	27	54°26'	16°1.3'	54°26.4'	16°3.9'	15:47	16:17	30	16.267	14.175				1.086	0.654																	0.352			
26	25040	2023-2-14	37G5	25	50	54°27.9'	15°46.3'	54°28.8'	15°48.3'	07:48	08:18	30	297.898	76.320	207.887	2.441		8.460	0.622																	0.043			
27	25049	2023-2-14	38G5	25	56	54°32.6'	15°47'	54°33.5'	15°48.9'	10:01	10:31	30	212.205	3.225	137.036			68.050	3.730																	0.164			
28	25042	2023-2-14	38G5	25	50	54°31.8'	15°55'	54°32.8'	15°56.7'	11:45	12:15	30	932.570	323.870	589.393	2.400		13.210	1.841																	1.740		0.116	
29	25004	2023-2-14	38G6	25	20	54°52.1'	16°35.3'	54°52.1'	16°36.9'	16:20	16:40	20	3.094	0.560				1.741	0.443																	0.350			
30	25339	2023-2-16	39G7	25	88	55°15.4'	17°23.9'	55°15.5'	17°21.4'	07:46	08:16	30	222.444	73.890	0.510	2.758		138.120	1.046																	3.820			
32	25364	2023-2-16	38G7	25	31	54°59.8'	17°23.1'	54°59.8'	17°25.7'	14:22	14:52	30	33.801	20.160	0.659			6.670	3.889																2.130				
33	25022	2023-2-16	38G7	25	27	54°57.1'	17°22.4'	54°57.3'	17°25'	15:54	16:24	30	12.484	5.705				1.589	0.526	0.244															1.820		2.600		
34	25024	2023-2-17	38G7	25	24	54°51.2'	17°29.5'	54°51.3'	17°32.1'	07:40	08:10	30	39.670	18.560	16.600			1.163	0.880																1.275		0.234		
35	26177	2023-2-17	38G8	26	24	54°54'	18°11.3'	54°54.1'	18°13.9'	11:22	11:52	30	206.622	49.400	154.300			1.643	0.494																	0.367		0.418	

**continued** Tab. 2. Fish control-hauls data obtained during r/v Baltica BITS-1Q cruise (08.02-02.03. 2023) (**Hauls no. 36-68**)

Haul number according to survey order	Haul number according to ICES database	Catch date	ICES rectangle	ICES Sub-division	Trawling depth [m]	Geographical position of the catch-station				Time of		Trawling duration [min]	Total catch [kg]	Weight of the catch by fish species [kg]																			
						start/shoot latitude (N)	longitude (E)	latitude (N)	longitude (E)	shooting net	hauling up net			Cod	Baltic herring	Sprat	Flounder	Plaice	Eelpout	Fourbeard rockling	European perch	Three-spined stickleback	Short-horn	Round goby	Twaite shad	Turbot	European anchovy	Greater sandeel	Lumpfish	Hooknose	Whiting	Common dab	Atlantic mackerel
36	26274	2023-2-17	38G8	26	23	54°53.8'	18°11.7'	54°54'	18°14.2'	12:47	13:17	30	21.550	4.130	16.140		0.684	0.539	0.057														
37	26005	2023-2-17	38G8	26	22	54°53.7'	18°11.4'	54°53.8'	18°13.9'	14:09	14:39	30	88.458	25.340	61.480		0.997	0.226					0.415										
38	26264	2023-2-19	37G9	26	39	54°25.1'	19°1.9'	54°25.1'	19°2.8'	07:37	07:47	10	1194.423	3.405	274.168	915.512	1.158	0.180															
39	26220	2023-2-19	37G9	26	43	54°25.3'	19°2.1'	54°25.3'	19°3.1'	09:23	09:33	10	647.534	2.455	321.506	322.754	0.509			0.021			0.049										
40	26282	2023-2-19	37G9	26	47	54°25.6'	19°2.2'	54°25.5'	19°3.9'	11:22	11:42	20	814.975	4.905	267.749	541.661	0.600						0.060										
41	26131	2023-2-19	37G8	26	32	54°24.5'	18°58.8'	54°24.5'	18°59.6'	13:11	13:21	10	959.097		319.022	638.748	1.327																
42	26263	2023-2-19	37G8	26	31	54°24.4'	18°58.6'	54°24.3'	18°59.4'	14:59	15:09	10	180.317		24.306	155.175	0.617	0.156					0.063										
43	26219	2023-2-19	37G8	26	30	54°24.3'	18°58.8'	54°24.1'	18°59.5'	16:05	16:15	10	173.053		80.457	92.012	0.511						0.073										
44	26280	2023-2-21	38G8	26	66	54°30.7'	18°52.4'	54°30.4'	18°52.5'	12:55	13:00	5	384.083	3.450	294.913	78.110	5.870			0.248				0.126	1.366								
45	26132	2023-2-21	38G8	26	66	54°31.1'	18°55'	54°30.2'	18°55.3'	14:08	14:23	15	128.154	37.612	2.895		87.350			0.076			0.097		0.124								
46	26288	2023-2-21	38G9	26	83	54°36'	19°9.6'	54°36'	19°10.9'	16:28	16:43	15	208.532	2.165	189.141	10.916	6.310																
47	26266	2023-2-23	38G8	26	20	54°49.1'	18°31.5'	54°50.5'	18°29.8'	07:45	08:15	30	13.260	4.745	6.813	0.050	0.938	0.407	0.159									0.014					
48	26267	2023-2-23	38G8	26	48	54°54.4'	18°37'	54°55.2'	18°35.5'	09:39	09:59	20	216.164	34.006	144.797	30.503	6.315	0.019	0.263														
49	26167	2023-2-23	38G8	26	62	54°58.5'	18°31.5'	54°59.1'	18°30.3'	11:30	11:50	20	644.473	75.440	179.506	163.344	223.410	1.649	0.250		0.091		0.386							0.300			0.097
50	26186	2023-2-23	38G8	26	71	54°58.8'	18°32.7'	54°59.7'	18°30.8'	13:37	14:07	30	1033.704	239.220	569.276	203.524	21.380	0.171		0.133													
51	26093	2023-2-24	39G8	26	90	55°10'	18°40.3'			07:28						no oxygen --> haul not conducted																	
52	26273	2023-2-24	39G8	26	93	55°8.4'	18°41.1'			08:18						no oxygen --> haul not conducted																	
53	26086	2023-2-24	38G8	26	94	54°59'	18°45.3'			09:59						no oxygen --> haul not conducted																	
54	26257	2023-2-24	38G9	26	102	54°55.5'	19°3'			11:43						no oxygen --> haul not conducted																	
55	26091	2023-2-24	39G9	26	94	55°7'	19°6.4'			13:30						no oxygen --> haul not conducted																	
56	26090	2023-2-25	38G9	26	92	54°42.4'	19°2.4'			07:32						no oxygen --> haul not conducted																	
57	26094	2023-2-27	39G8	26	88	55°11.7'	18°56.4'			07:31						no oxygen --> haul not conducted																	
58	26045	2023-2-27	39G9	26	83	55°15.9'	19°5.2'	55°15.5'	19°5.4'	09:08	09:18	10	202.006	2.000	6.079	178.43	15.41	0.087															
59	26105	2023-2-27	39G8	26	90	55°21.4'	18°47.9'	55°22.4'	18°49.8'	11:41	12:11	30	11.557	2.435	0.621	6.24	2.008						0.253										
60	26107	2023-2-27	40G8	26	87	55°30.1'	18°59.6'			13:56						no oxygen --> haul not conducted																	
61	26142	2023-2-28	41G9	26	102	56°12.1'	19°28.3'			07:29						no oxygen --> haul not conducted																	
62	26073	2023-2-28	41G9	26	74	56°15.7'	19°39.9'	56°17.2'	19°40.6'	08:46	09:16	30	158.966	28.920	19.47	81.32	28.43	0.826															
63	26144	2023-2-28	41G9	26	143	56°22.1'	19°29.1'			11:09						no oxygen --> haul not conducted																	
64	26199	2023-2-28	41G9	26	111	56°22.8'	19°42.8'			12:24						no oxygen --> haul not conducted																	
65	26259	2023-2-28	41G9	26	82	56°20.5'	19°50.1'	56°21'	19°50.7'	14:01	14:11	10	204.756	2.135	50.121	143.806	8.626																
66	26031	2023-3-1	41G9	26	62	56°11.2'	19°55.3'	56°10'	19°54.6'	07:43	08:08	25	123.722	35.090	24.686	50.442	11.59	0.102					1.170										0.068
67	26030	2023-3-1	41G9	26	64	56°7.8'	19°52.2'	56°7.9'	19°54.9'	09:15	09:45	30	478.764	37.86	361.056	52.174	27.07	0.158					0.446										
68	26138	2023-3-1	40G8	26	114	55°53.4'	18°45.7'	55°53.5'	18°44.4'	16:12	16:27	15	1.107				1.107																

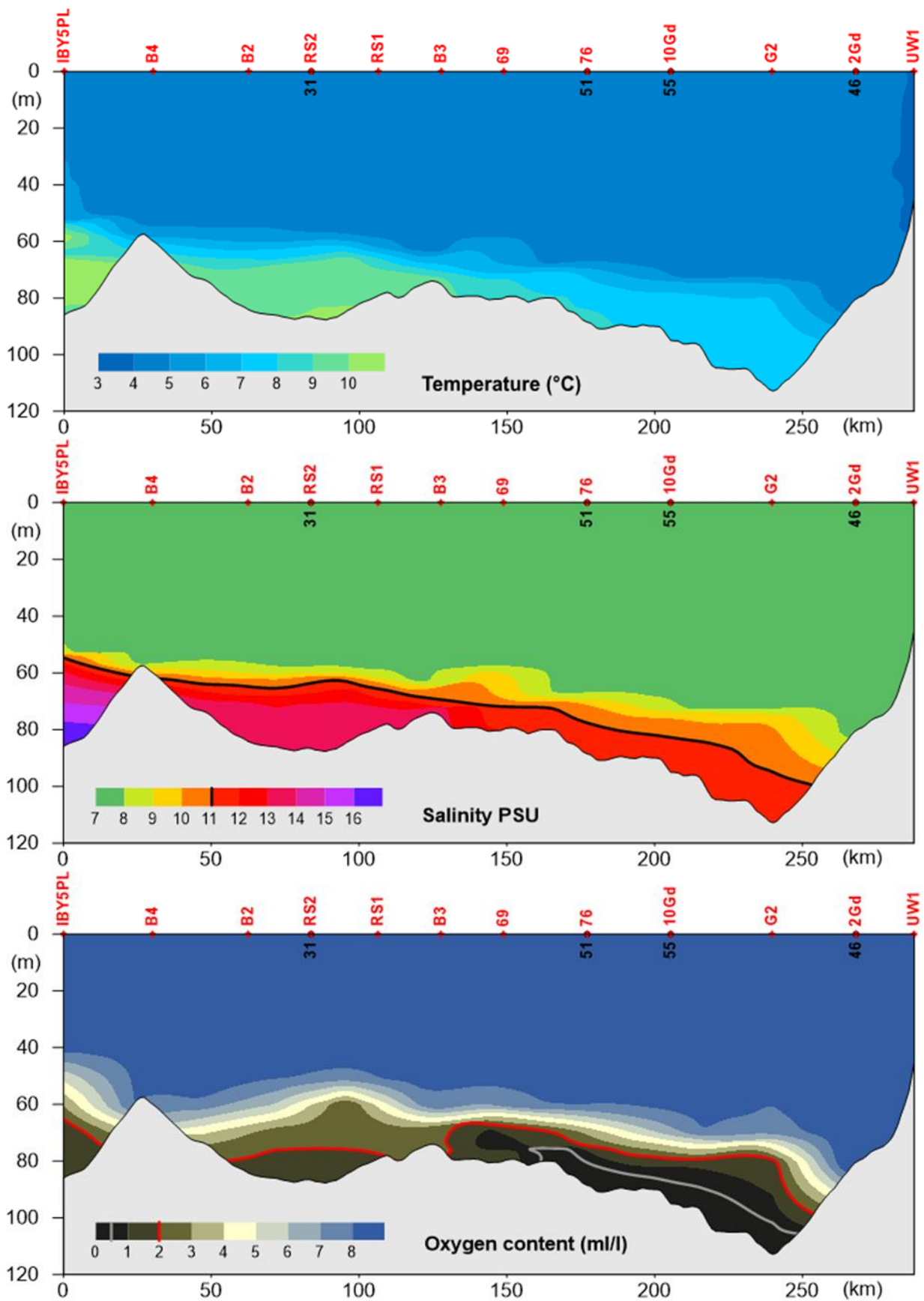


Fig. 6. Vertical distribution of the seawater temperature, salinity and oxygen content along the hydrological research profile during r/v Baltica BITS-1Q cruise (08.02-02.03. 2023).

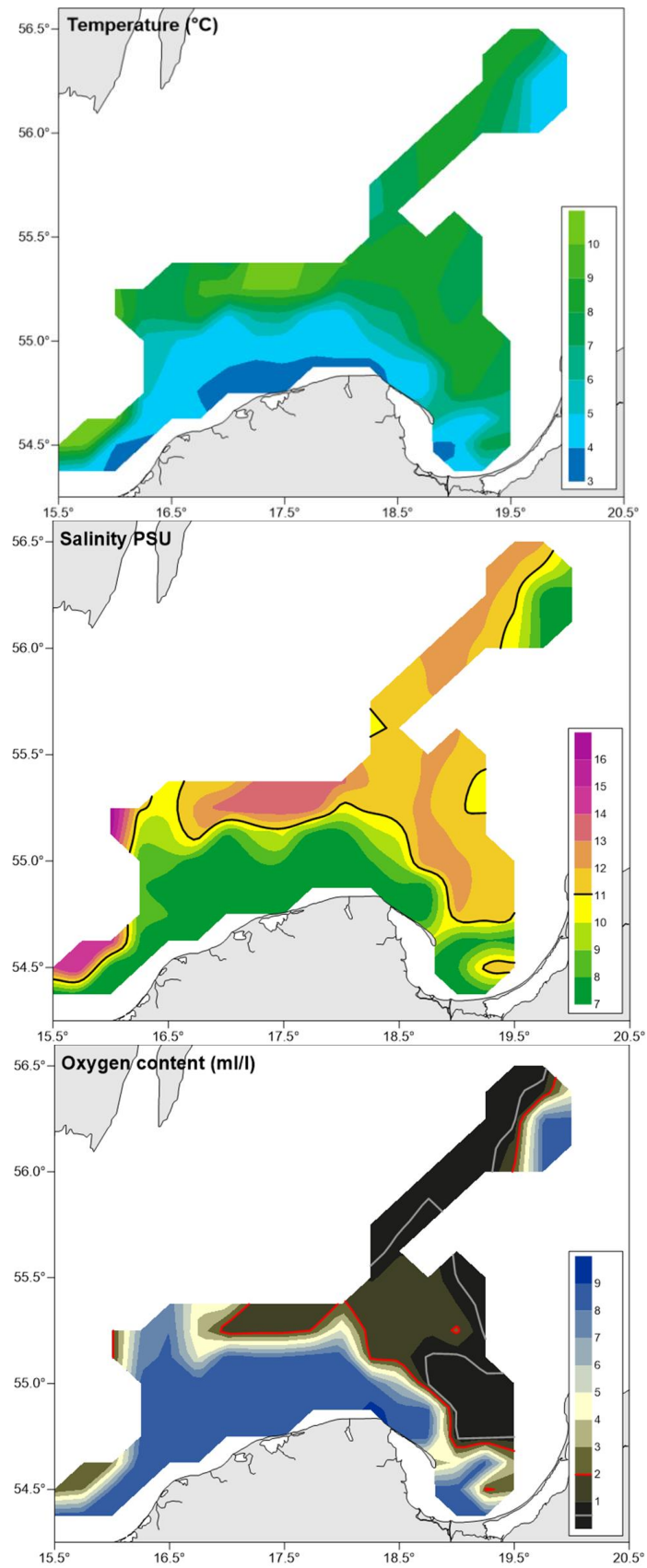


Fig. 7. Horizontal distribution of the seawater temperature. salinity and oxygen content in the near bottom layer during r/v Baltica BITS-1Q cruise (08.02-02.03. 2023).

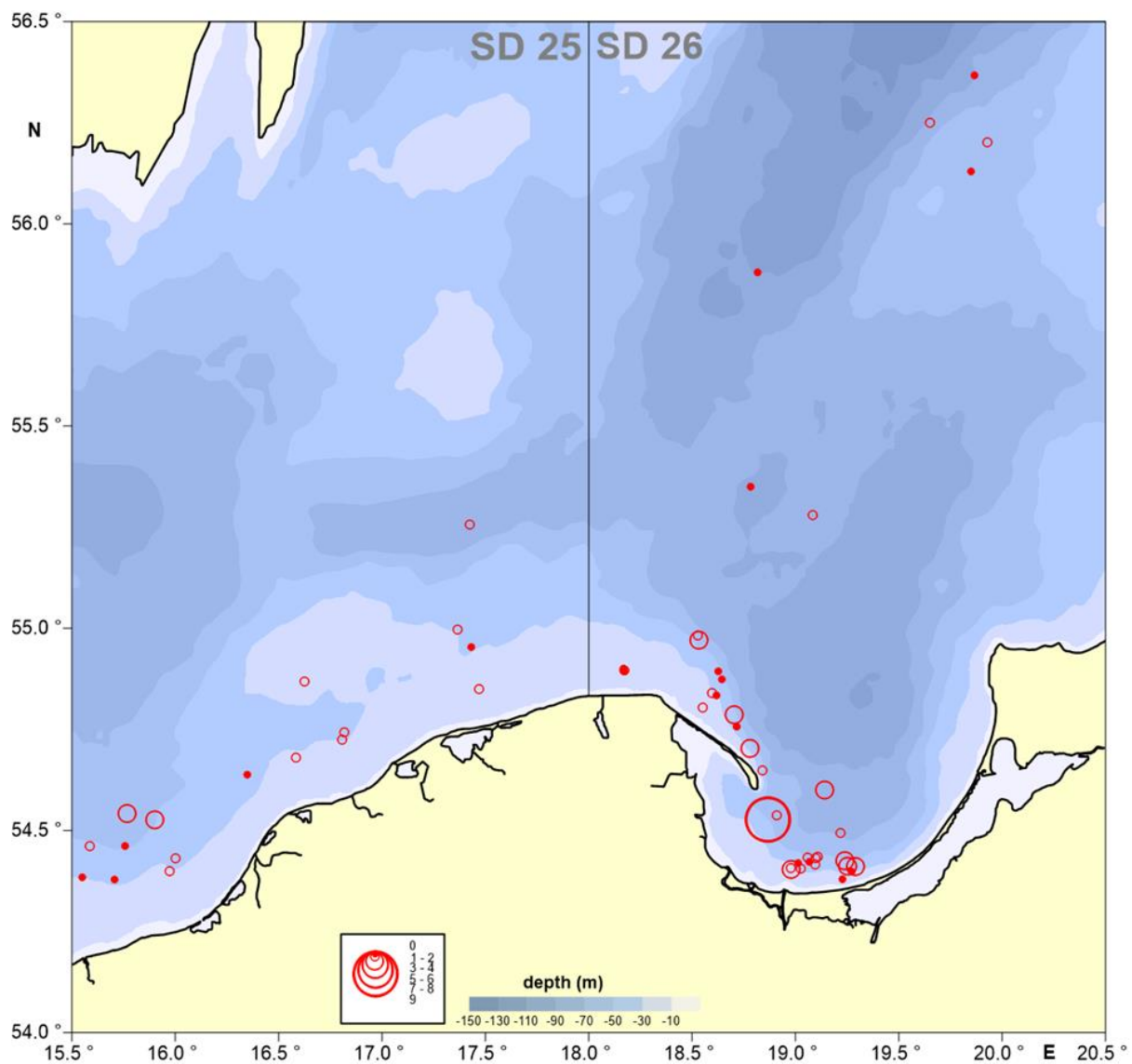


Fig. 8. Marine litter collected during r/v Baltica BITS-1Q cruise (08.02-02.03. 2023).

Institute of Food Safety, Animal Health and Environment (BIOR), Riga (Latvia)  
National Marine Fisheries Research Institute (NMFRI), Gdynia (Poland)

## **THE CRUISE REPORT**

**FROM THE JOINT LATVIAN-POLISH BITS 1Q SURVEY ON THE POLISH R.V.  
“BALTICA” IN THE CENTRAL-EASTERN BALTIC (08-16 March 2023)**

by  
Ivo Sics\*, Radosław Zaporowski\*\* and Tycjan Wodzinowski

\* Institute of Food Safety, Animal Health and Environment (BIOR) Riga (Latvia)

\*\* National Marine Fisheries Research Institute (NMFRI), Gdynia (Poland)



Riga - Gdynia, April 2023



## Introduction

The joint Latvian-Polish BITS survey was conducted during the period 08-16.03.2023 on the r/v Baltica and was based on the agreement between the Institute of Food Safety, Animal Health and Environment (BIOR) in Riga and the National Marine Fisheries Research Institute (NMFRI) in Gdynia. The joint Latvian-Polish BITS 1Q survey was conducted in the Latvian EEZs which correspond to the ICES Sub-divisions (SDs) 26 and 28. It was part of the Baltic International Trawl Survey (BITS), which was coordinated by the ICES Baltic International Fish Survey Working Group [WGBIFS] (Anon. 2022).

The main aims of reported cruise were:

1. To collect materials to investigate the distribution, abundance, and biological structure of the cod stock.
2. To determine the distribution and abundance of cod recruits. Estimates of year – class strength of cod.
3. To collect materials for the investigation of the distribution, abundance, and biological structure of flounder stock.
4. To collect data on cod feeding.
5. To analyse the hydro-meteorological conditions (seawater temperature, salinity, oxygen content, air temperature, atmospheric pressure, wind velocity and directions) in the ICES SDs 26N and 28.
6. Record acoustical data during trawling and on the distance between consecutive catch-stations.
7. To collect information about marine litter.
8. Collection of ichthyoplankton samples.

## Materials and Methods

### *Personnel*

The BITS Q1 - 2023 survey scientific staff was composed of nine persons, i.e.:

Radosław Zaporowski, NMFRI, Poland - cruise leader,

Wojciech Deluga, NMFRI, Poland - ichthyologist,

Anetta Ameryk, NMFRI, Poland - hydrologist,

Maciej Bielak, NMFRI, Poland – acoustician,

Ivo Sics, BIOR, Latvia - ichthyologist,

Jurgis Matiss Petersons, BIOR, Latvia - ichthyologist,

Karlis Heimrats, BIOR, Latvia - ichthyologist,

Laura Briekmane, BIOR, Latvia – ichthyologist,

Janis Gruduls, BIOR, Latvia – ichthyologist.

### *Narrative*

The reported survey research tasks were conducted during the period from the 08<sup>th</sup> to 16<sup>th</sup> of March 2023 and overall, nine full days were devoted to the survey plan accomplishment. The at sea research was conducted within the Latvian EEZ (the ICES SD26 and SD28), and inside the Latvian territorial waters (the ICES SD28). It was not trawled where the

depth was shallower than 20 m.

The vessel left the Gdynia port (Poland) on 08.03.2023 and was navigated towards the south-western corner of the Latvian EEZs (Fig. 1). The direct at sea research began on 09.03.2023 and was concluded on 15.03.2023. On 16.03.2023 r.v. “Baltica” returned to the homeport.

### *Survey design and realization*

The original survey plan specified that 25 control-hauls will be realized in the Latvian EEZ (2 trawls in SD 26, 23 trawls in SD 28). Totally – 25 randomly selected hauls. Five additional trawls were planned in ICES Sub-division 26, in the Latvian EEZ.

The r.v. “Baltica” realized 26 bottom trawl control-hauls including the Latvian territorial waters (all randomly selected hauls and one additional) (Fig.1). Two catch-stations were only initiated due to hydrological parameters measurement and due to very low oxygen concentration (below 0.5 ml/l) near bottom, fishing was omitted.

All trawl catches were performed during daylight hours. The hard-bottom ground-rope (rockhopper) trawl, type TV-3#930 (with 10-mm mesh bar length in the codend) was applied for fish catches. The mean speed of vessel during trawling was 2.9 knots. For almost all realized hauls, their duration was shortened to 15-20 minutes, due to dense clupeid fish concentrations observed on the echosounder or bad weather.

The length measurements in the 1.0 cm classes were realised for 477 cod and 4991 flounder. Length measurements in the 0.5 cm classes were realized for 2508 herring and 2246 sprat. In total, 380 cod and 472 flounder individuals were taken for biological analysis. Stomachs from the 313 cod were taken for investigation of cod feeding.

Acoustic data, i.e., the echo-integration records (SA = NASCs; Nautical Area Scattering (Strength) Coefficient) were collected with the EK-60 scientific echosounder during fishing operations as well as the distances between consecutive hauls. The echo-sounder data collected during the BITS survey were delivered to the Latvian researchers for further analysis.

Directly before every haul, the seawater temperature, salinity, and oxygen content were measured continuously from the sea surface to the bottom. The seawater samples were taken also at the standard HELCOM stations. Totally, 31 hydrological stations were inspected with the Neil-Brown CTD-probe combined with the rosette sampler (the bathometer rosette). Oxygen content was determined by the standard Winkler’s method.

Meteorological observations such as wind velocity, direction and the sea state were realized at the actual geographic position of each control-haul.

## **Results**

### *Fish catches and biological data*

The control-catches basic results collected in March 2023 during the Latvian-Polish BITS-1Q survey are presented in Table 1. Twenty-six hauls were realized during the survey, 23 hauls in SD28, 3 hauls in SD26. Overall, 20 fish species were recognised in the performed hauls in the central-eastern Baltic. In the realized 23 hauls in SD28, sprat, herring, cod, and flounder were the most frequently occurring fish species - 91%, 91%, 83% and 96% respectively (Table 1). Sprat, herring, flounder, and cod also dominated with respect to mass of the catch (kg) and efficiency (CPUE) in SD28 (Fig. 1.A.). By-catch of other fish species was insignificant.

Herring dominated by mass in the ICES SD28 with the average share of 63.3%. Flounder was the next species most frequently represented in terms of mass – 17.9%. The share of sprat and cod in control-catches made out in the ICES SD28 was 16.5% and 1.3%, respectively. By-catch

of other fishes was insignificant. The mean CPUE for all species in SD28 amounted 1035.3 kg/h, and in this 653.6, 186, 180.2 and 16.4 kg/h were for herring, sprat, flounder, and cod respectively (Fig. 1.A.B.).

Herring, flounder, sprat and cod were the most frequently occurring fish species in the catches of all realized 3 hauls in SD26 (Table 1). Herring, flounder, sprat, and cod dominated also with respect to mass of the catch (kg) and efficiency (CPUE) in SD26 (Fig. 1.A.). By-catch of other fish species was insignificant.

Herring dominated by mass in the ICES SD26 with the average share of 49.1%. Flounder was the next species most frequently represented in terms of mass, i.e. 36.8%. The share of sprat and cod in control-catches made out in the ICES SD26 was 11.7% and 2.1%, respectively. By-catch of other fishes was insignificant. The mean CPUE for all species in SD26 amounted to 1482.4 kg/h, and in this 728.6, 545.8, 174 and 31.5 kg/h were for herring, flounder, sprat and cod, respectively (Fig. 1.A.B.).

Total catch of fishes and the number of realized hauls in the Latvian EEZ, during reported BITS survey is presented in the text-table below:

SD	Number of hauls	Total catch (kg)				
		Cod	Herring	Sprat	Flounder	Others
26	3	15.74	364.3	87	272.9	1.3
28	23	79.9	3818.3	996.4	1077.4	57

The distribution of cod and flounder during the survey in kg/h is presented in Figure 2 and Figure 3. The length distribution of cod, flounder, herring and sprat, according to the ICES SDs are illustrated in Figures 5-8 and Tables 3-6.

## Cod

The total length of cod in the scrutinised samples ranged from 5 to 51cm and specimens from the length classes 6-9 and 18-34 cm dominated in samples from the ICES SD28 (Fig.5, Table 3). In total, 411 cod were analysed from hauls in SD28.

Only 3 hauls were realized in SD26. One haul was only initiated due to hydrological parameters measurement and due to very low oxygen concentration (below 0.5 ml/l) near bottom, fishing was omitted.

The total length of cod in scrutinized samples ranged from 9 to 43 cm and specimens from the length classes of 17-38 cm dominated in samples from the ICES SD26, respectively (Fig.5, Table 3). In total, 66 cod were analysed from hauls in SD26.

Almost all cod were less than minimal industrial fishing size 35 cm, 86.4% in SD26 and 90.9% in SD28, respectively (Figure 4).

## Flounder

The total length of flounder in scrutinized samples ranged from 11 to 34 cm and specimens from the length classes of 16-26 cm dominated in samples from the ICES SD28 (Fig.6, Table 4).

The total length of flounder in scrutinized samples ranged from 17 to 34 cm and specimens from the length classes of 19-30 cm dominated in samples from the ICES SD26 (Fig.6, Table 4).

The share of flounder less than minimal industrial fishing size (< 21cm) was 13.8% in SD26 and 45.8% in SD28, respectively (Figure 4.).

## Herring

The length range of collected herring was 10.0-24.0 cm, and specimens from the length classes of 16.0-21.0 cm were most frequently represented in samples from the ICES SD28 (Fig. 7, Table 5).

The length range of collected herring was 16.0-22.5 cm, and specimens from the length classes of 17.0-20.5 cm were most frequently represented in samples from the ICES SD26 (Fig. 7, Table 5).

## **Sprat**

The length range of collected sprat was 7.0-14.5 cm, and specimens from the length classes of 9.5-13.5 cm were most frequently represented in samples from the ICES SD28 (Fig. 8, Table 6).

The length range of collected sprat was 11.0-14.0 cm, and specimens from the length classes of 11.5-13.0 cm were most frequently represented in samples from the ICES SD26 (Fig. 8, Table 6).

### ***Hydrological situation in March 2023***

The main hydrological parameters were measured at each trawling (21) and hydrological stations (5) (Fig. 1). Measurements were conducted with the CTD SeaBird 911-probe combined with the rosette sampler. Oxygen content was determined by the standard Winkler's method. The CTD data were aggregated to the 1-m depth strata. The salinity parameter was presented in Practical Salinity Unit (PSU). Meteorological parameters were measured by MicroStep-MIS AMS 111 automatic weather station.

The most frequent winds (Fig. 9) were from direction WNW and S. The average (10 min) wind speed varied from 0.6 m/s to 10.4 m/s (up to 23.7 m/s). The air temperature ranged from -2.5 °C to 6.0 °C, and average temperature was 1.5 °C.

The lowest value of temperature at the surface layer was observed at trawl 11, while the warmest surface water was at the trawl 3. The temperature varied from 2.07 °C to 3.96 °C, while the average value was 3.02 °C. The average surface salinity was 7.41 in the PSU. The minimum value was 7.18 at the trawl 11 and maximum 7.60 at the trawl 3. The highest oxygen content in surface water layer was 9.05 ml/l at the trawl 21, while the lowest one 8.50 ml/l at the trawl 3. Mean value of dissolved oxygen equalled 8.76 ml/l.

Near - bottom layer conditions are presented in the (Fig. 10). Water temperature varied from 8.09 °C (station 46) to 2.26 °C (trawl 21). The mean value calculated for the whole area covered during the cruise was 4.09 °C. The average salinity in the close-to-the-bottom water layers was 8.43 PSU. The highest value was measured at the hydrological station 37 (12.71). The lowest one was 7.21 (haul 21). The dissolved oxygen varied from 0.00 ml/l (hydrological stations 37 and 43) to 8.97 ml/l (trawl 21). The mean value was 6.50 ml/l. Vertical distribution of the seawater temperature, salinity and oxygen content along the hydrological transect of the Gotland Deep (March 2023) is presented in Fig. 11.

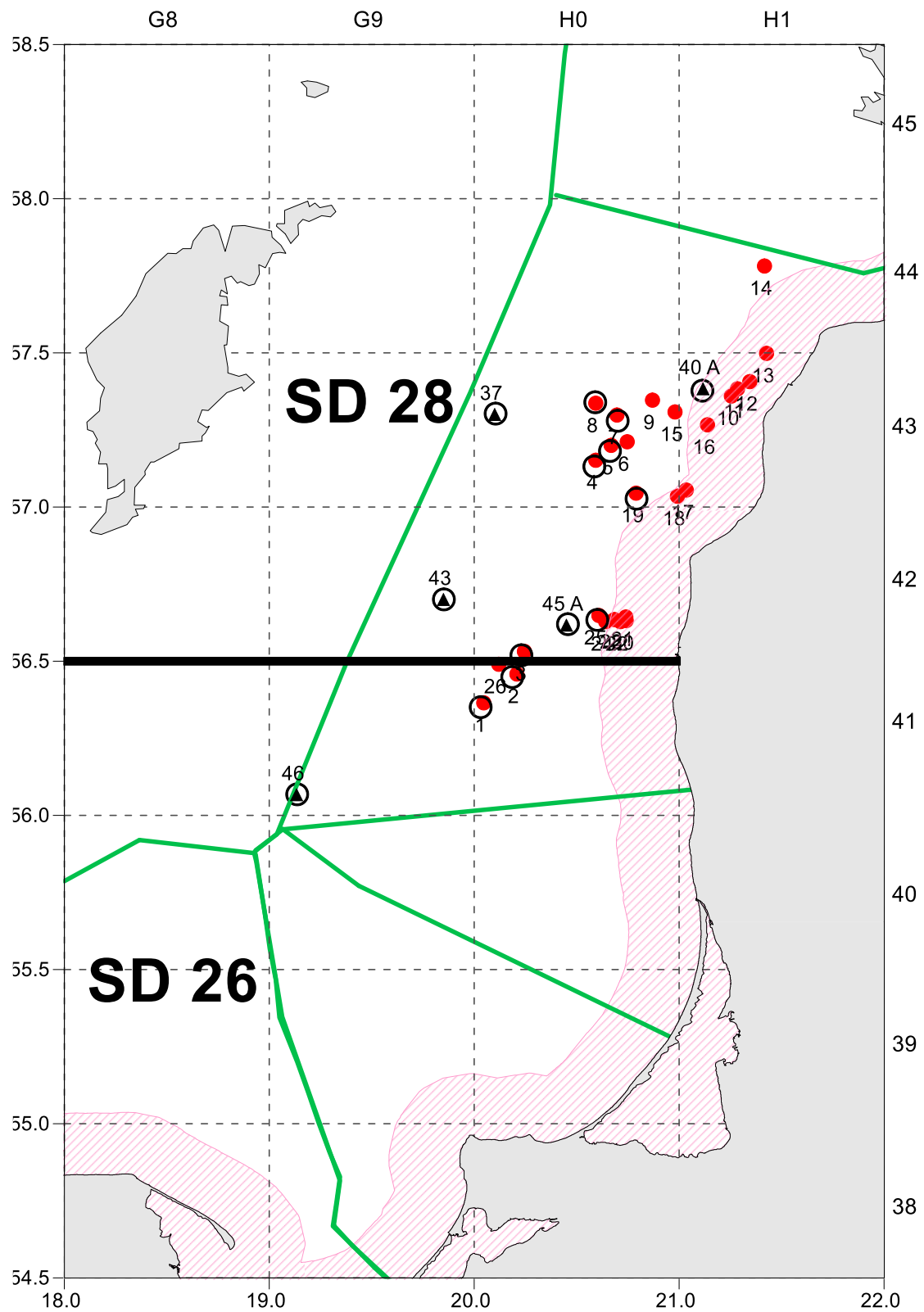


Figure 1. Location of the realized fish control-hauls (marked with red dots) and the HELCOM standard hydrological stations (marked with black triangles), ichthyoplankton stations marked with black circles, green lines - national fishing zone borders, coloured area in pink - territorial waters.

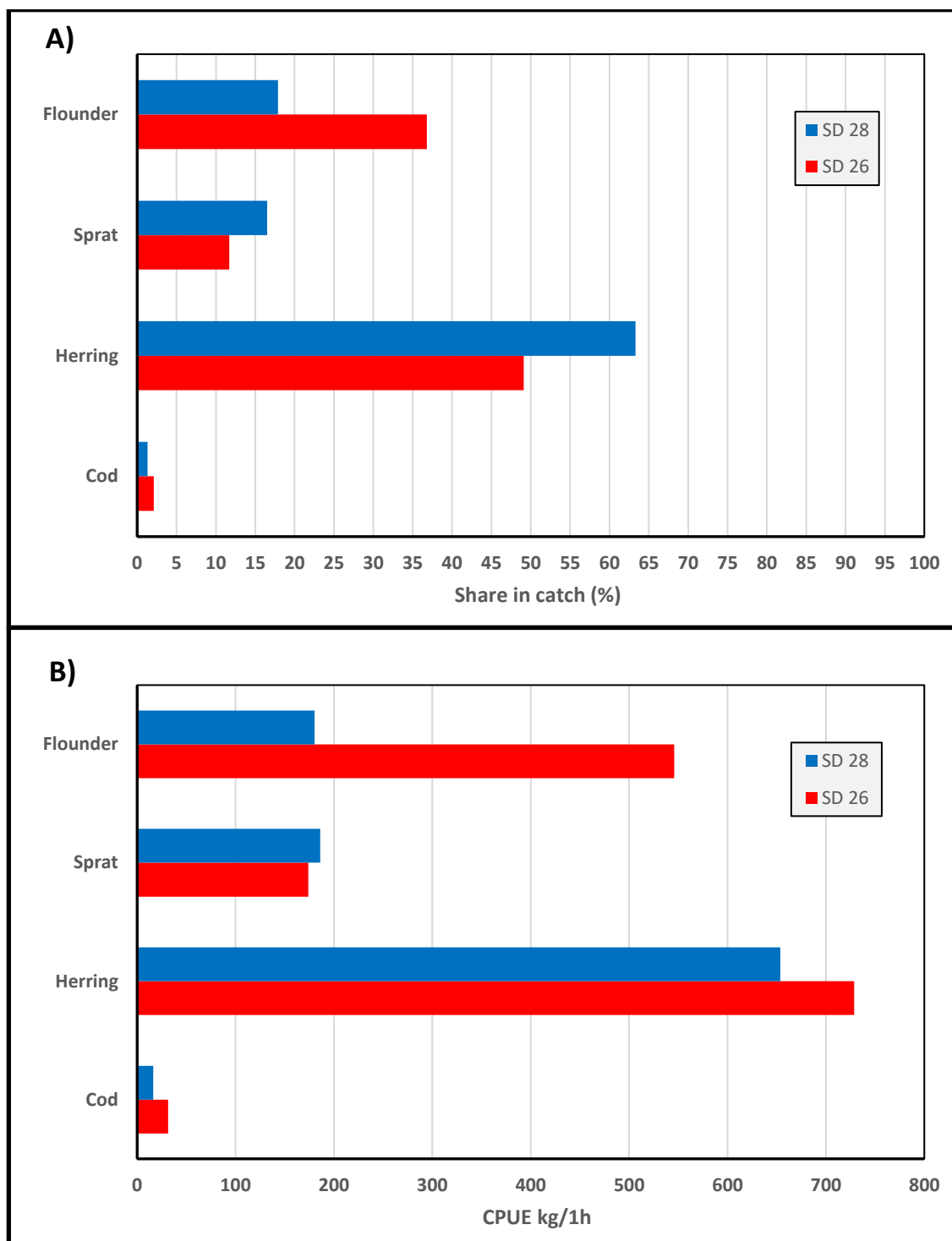


Fig. 1.A. Mean share in mass of control hauls (A), and mean CPUE (B) of dominant fish species in catches conducted during the BITS 1Q survey; r.v. "Baltica" (8-16 March 2023).

Table 1. Catch results from the Latvian-Polish BITS 1Q survey; r.v. "Baltica", 8-16 March 2023

Haul number	Date of catch	EEZ	ICES rectangle	ICES SD	Depth to the bottom [m]	The ship's course during fishing [°]	Geographical position of the catch station				Time of		Haul duration [ min.]	Total catch	all species CPUE [kg/0.5h]	CATCH of particular fish species [kg]				
							start		end		shutting net	pulling up net				Sprat	Herring	Cod	Flounder	Others
							latitude 00°00' N	longitude 00°00' E	latitude 00°00' N	longitude 00°00'E										
1	09/03/2023	0	41H0	26	75	030	56°21.9	20°02.8	56°22.5	20°03.5	12:55	13:10	15	257.81	515.62	81.289	102.681	6.34	66.54	0.96
2	09/03/2023	0	41H0	26	80	050	56°27.5	20°12.5	56°28.0	20°13.3	14:50	15:05	15	483.386	966.772	5.719	261.641	9.4	206.37	0.256
3	09/03/2023	0	42H0	28	93	035	56°31.9	20°14.7	56°32.4	20°15.3	16:25	16:40	15	85.154	170.308	49.366	25.784	0	9.97	0.034
4	10/03/2023	0	43H0	28	94	005	57°09.1	20°35.6	57°09.7	20°35.8	07:55	08:10	15	77.745	155.49	36.96	34.68	0.285	5.82	0
5	10/03/2023	0	43H0	28	84	010	57°12.0	20°40.1	57°12.6	20°40.3	09:30	09:45	15	355.85	711.7	255.26	77.14	0	23.45	0
6	10/03/2023	0	43H0	28	58	345	57°12.7	20°44.8	57°13.7	20°44.5	11:05	11:25	20	472.252	708.378	52.695	318.735	1.7	92.94	6.182
7	10/03/2023	0	43H0	28	71	005	57°17.9	20°41.8	57°18.5	20°41.8	12:45	13:00	15	297.155	594.31	46.591	205.137	2.555	42.54	0.332
8	10/03/2023	0	43H0	28	95	-9	57°20.2	20°35.6	57°20.2	20°35.6	13:50	13:55	5	0	0	0	0	0	0	0
9	10/03/2023	0	43H0	28	62	020	57°20.8	20°52.2	57°21.5	20°52.4	16:00	16:15	15	257.315	514.63	37.503	206.018	2.88	9.26	1.654
10	11/03/2023	0	43H1	28	55	010	57°21.6	21°15.3	57°22.2	21°15.4	08:40	08:55	15	417.154	834.308	18.776	288.434	6.11	102.91	0.924
11	11/03/2023	0	43H1	28	47	010	57°23.0	21°17.1	57°23.8	21°17.4	09:50	10:05	15	566.729	1133.458	67.824	406.629	3.235	86.95	2.091
12	11/03/2023	0	43H1	28	32	360	57°24.4	21°20.7	57°25.3	21°20.6	11:15	11:35	20	375.254	562.881	12.216	302.075	0	60.1	0.863
13	11/03/2023	0	43H1	28	26	345	57°29.9	21°25.6	57°31.2	21°24.9	12:50	13:20	30	196.486	196.486	0.418	114.058	0.747	80.2	1.063
14	11/03/2023	0	44H1	28	65	170	57°46.9	21°25.0	57°45.2	21°23.2	16:05	16:25	20	99.205	148.8075	14.418	45.244	4.22	32.88	2.443
15	12/03/2023	0	43H0	28	65	125	57°18.5	20°58.8	57°18.1	20°59.7	06:45	07:00	15	523.913	1047.826	30.292	455.218	5.407	31.12	1.876
16	12/03/2023	0	43H1	28	61	210	57°16.0	21°08.3	57°15.5	21°07.8	08:20	08:35	15	411.888	823.776	4.3	258.012	2.215	144.63	2.731
17	12/03/2023	0	43H1	28	28	210	57°03.3	21°02.1	57°02.7	21°01.5	11:05	11:20	15	46.617	93.234	0	9.79	0.966	35.15	0.711
18	12/03/2023	0	43H0	28	30	210	57°02.1	20°59.5	57°01.4	20°59.1	12:15	12:30	15	57.143	114.286	0.33	12.63	0.607	42.52	1.056
19	13/03/2023	0	43H0	28	73	360	57°02.7	20°47.4	57°03.4	20°47.4	07:50	08:05	15	274.432	548.864	18.687	188.021	6.695	60.22	0.809
20	13/03/2023	0	42H0	28	39	360	56°37.9	20°44.5	56°38.6	20°44.6	12:40	12:55	15	73.43	146.86	2.963	41.429	4.19	22.08	2.768
21	14/03/2023	0	42H0	28	39	015	56°38.6	20°44.4	56°39.3	20°44.9	07:45	08:00	15	64.935	129.87	0.285	22.87	5.88	31.44	4.46
22	14/03/2023	0	42H0	28	41	030	56°37.7	20°42.8	56°38.4	20°43.5	09:30	09:45	15	65.199	130.398	1.475	23.86	1.77	30.8	7.294
23	14/03/2023	0	42H0	28	47	020	56°38.1	20°41.1	56°38.9	20°41.7	11:10	11:25	15	182.384	364.768	14.923	105.877	14.56	38.2	8.824
24	14/03/2023	0	42H0	28	49	025	56°37.7	20°38.5	56°38.4	20°39.0	12:45	13:00	15	252.376	504.752	26.981	180.528	7.24	31.2	6.427
25	14/03/2023	0	42H0	28	58	015	56°38.9	20°36.5	56°39.6	20°36.9	14:15	14:30	15	876.433	1752.866	304.091	0	8.64	31.2	532.502
26	15/03/2023	0	41H0	26	92	-9	56°29.4	20°07.2	56°29.4	20°07.2	06:15	06:20	5	0	0	0	0	0	0	0

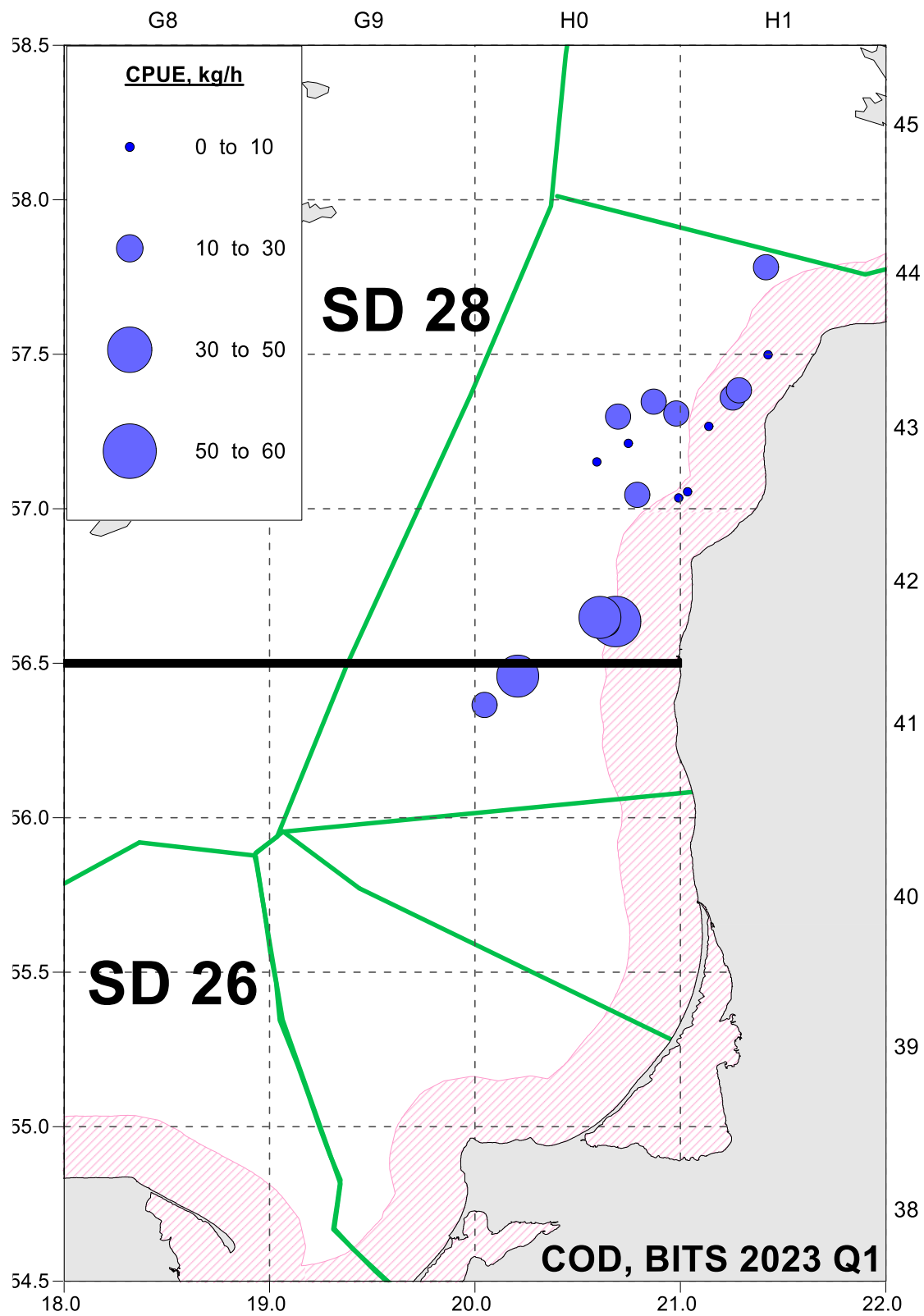


Figure 2. Distribution of cod during the BITS 2023 Q1 survey.



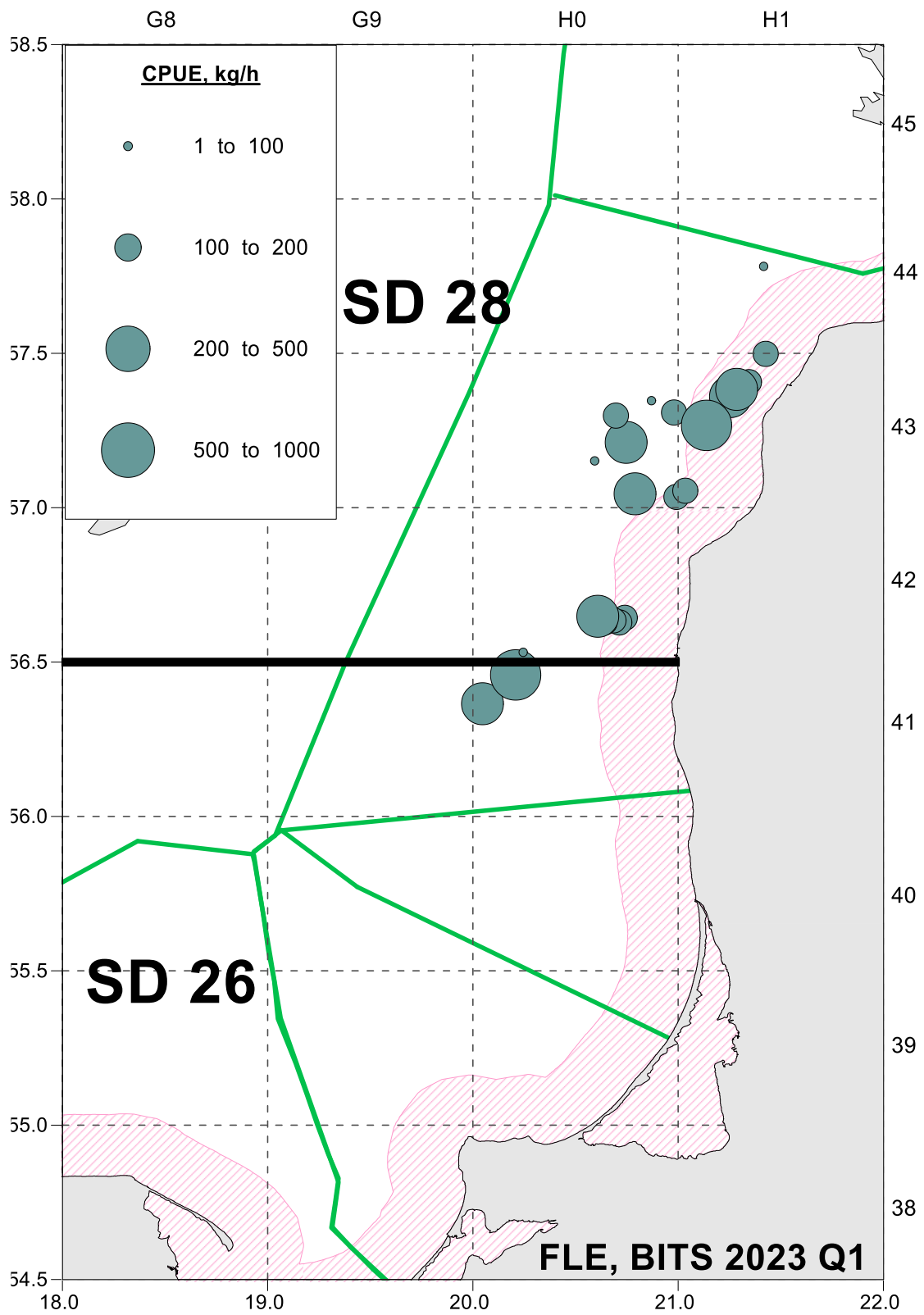


Figure 3. Distribution of flounder during the BITS 2023 Q1 survey.

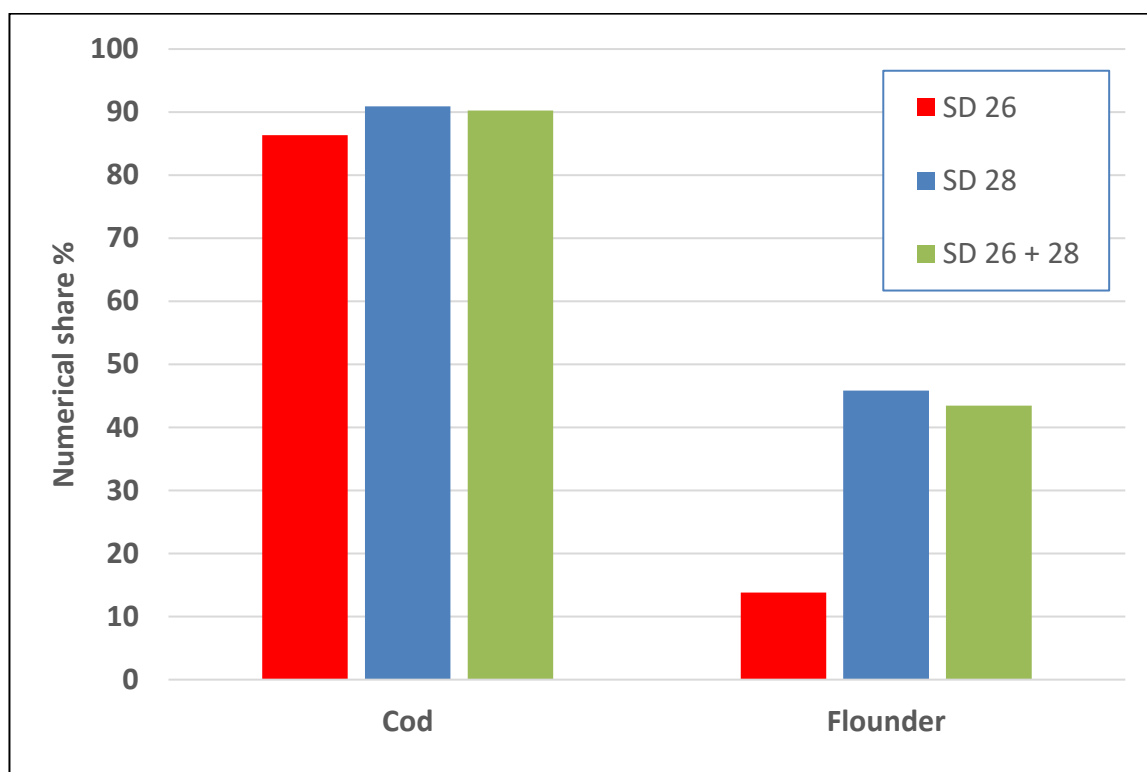


Figure. 4. Fraction of undersized cod and flounder during the BITS 1Q survey; r.v. "Baltica" (8-16 March 2023).

Table 2. Numbers of fish biologically analysed during the BITS 1Q survey; r.v. "Baltica" (8-16 March 2023).

Species	Number of samples			Number of fish								
	SD 26	SD 28	Total	measured			analyzed			stomach samples		
				SD 26	SD 28	Total	SD 26	SD 28	Total	SD 26	SD 28	Total
Cod	2	19	21	7	90	97	59	321	380	58	255	313
Flounder	2	22	24	246	4273	4519	109	363	472			
Herring	2	22	24	208	2300	2508						
Sprat	2	21	23	179	2067	2246						
Round Goby	0	1	1	0	1	1						
Turbot	0	9	9	0	16	16						
Four Bearded Rockling	0	1	1	0	1	1						
Eelpout	0	16	16	0	205	205						
Snake Blenny	0	1	1	0	2	2						
Greater Sandeel	0	1	1	0	1	1						
Smelt	0	5	5	0	7	7						
Three-spined Stickleback	0	16	16	0	81	81						
Lumpfish	1	13	14	1	32	33						
Sea Scorpion	2	18	20	8	281	289						
Plaice	0	2	2	0	2	2						
Sand Goby	0	2	2	0	3	3						
Four-horned Sculpin	0	1	1	0	1	1						
Nine-spined Stickleback	0	2	2	0	2	2						
Twaite Shad	1	0	1	1	0	1						
Striped sea snail	0	1	1	0	1	1						
Total	12	173	185	650	9366	10016	168	684	852	58	255	313

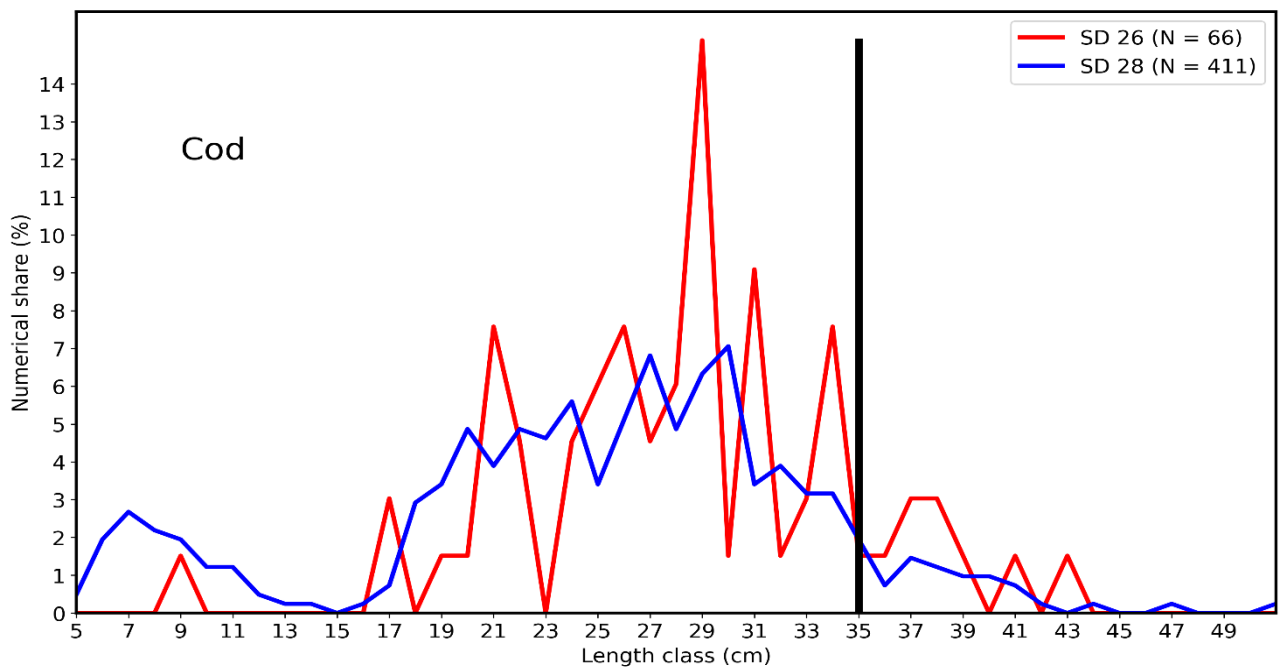


Figure 5. Length frequency of cod from SD26 and SD28 in the control catches.

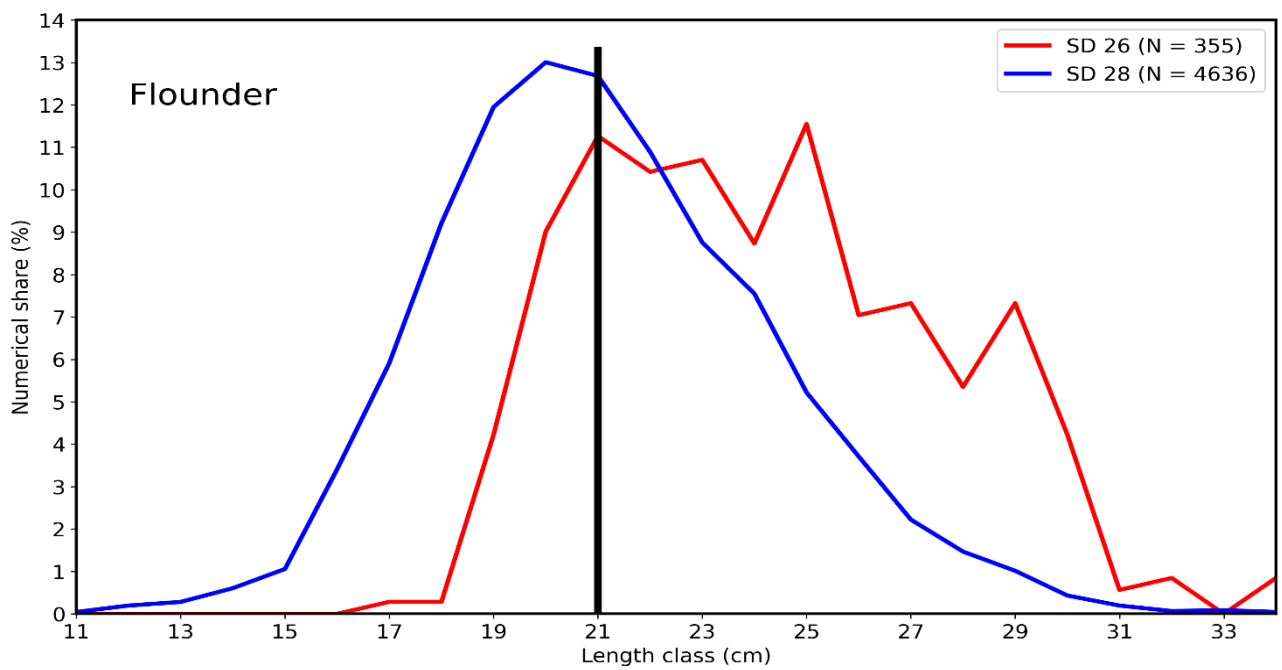


Figure 6. Length frequency of flounder from SD26 and SD28 in the control catches.

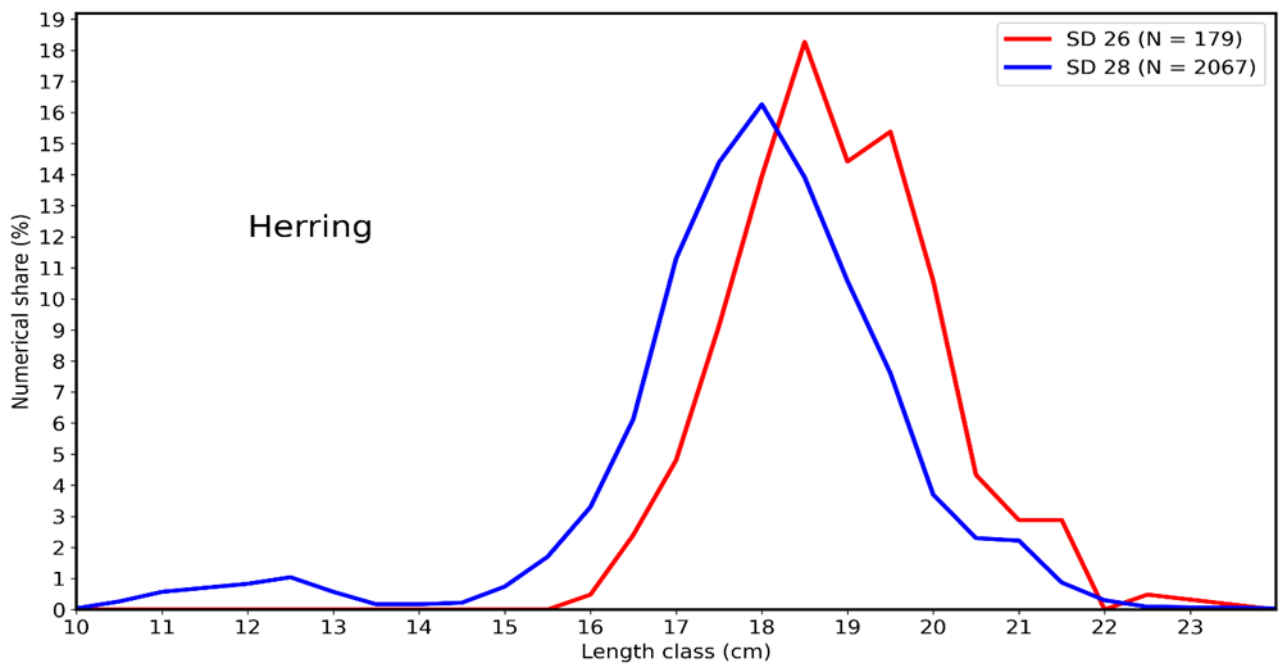


Figure 7. Length frequency of herring from SD26 and SD28 in the control catches.

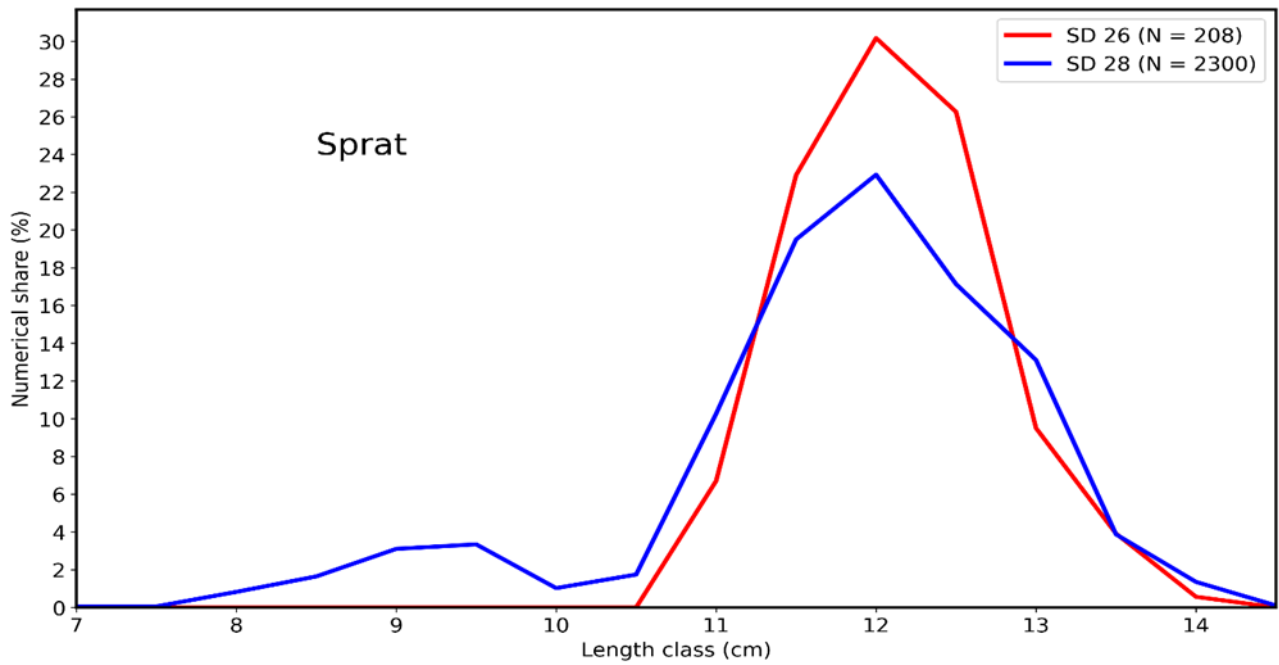
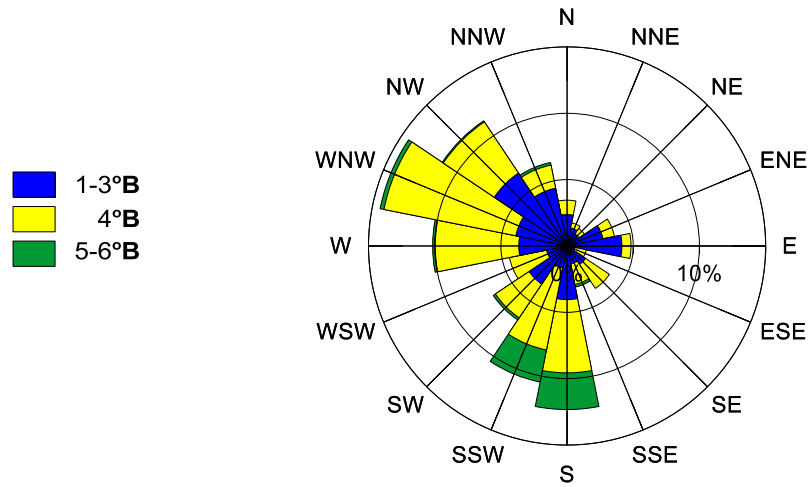
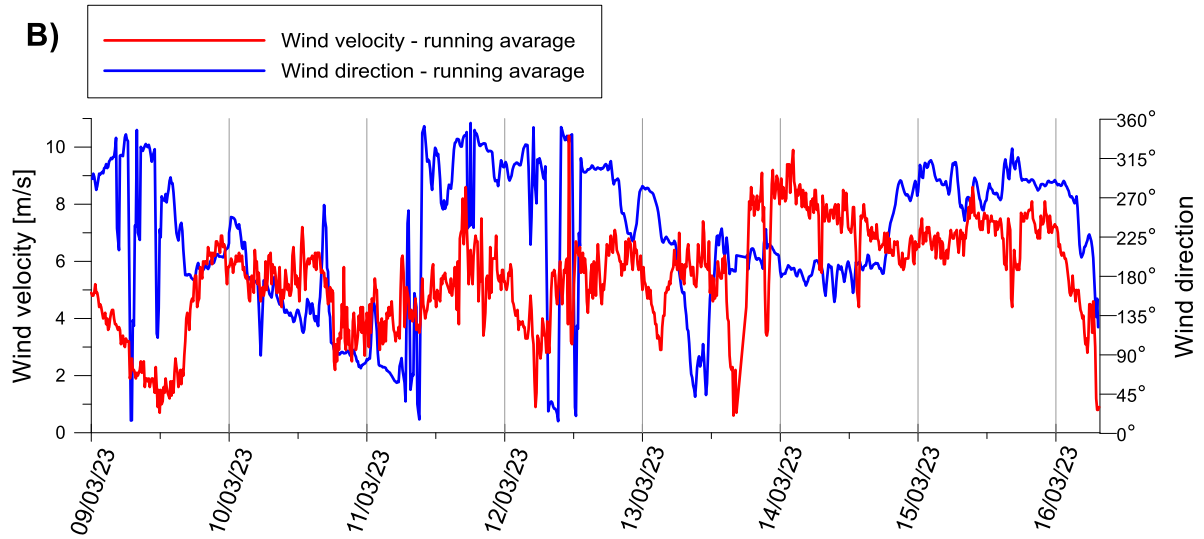


Figure 8. Length frequency of sprat from SD26 and SD28 in the control catches.

A)



B)



C)

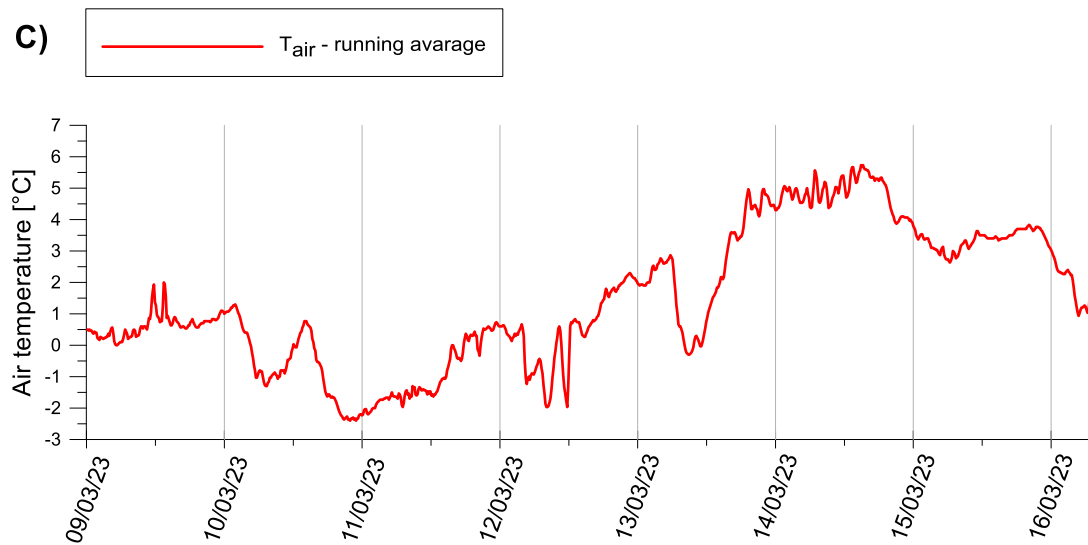


Figure 9. Changes of the main meteorological parameters (March 2023)

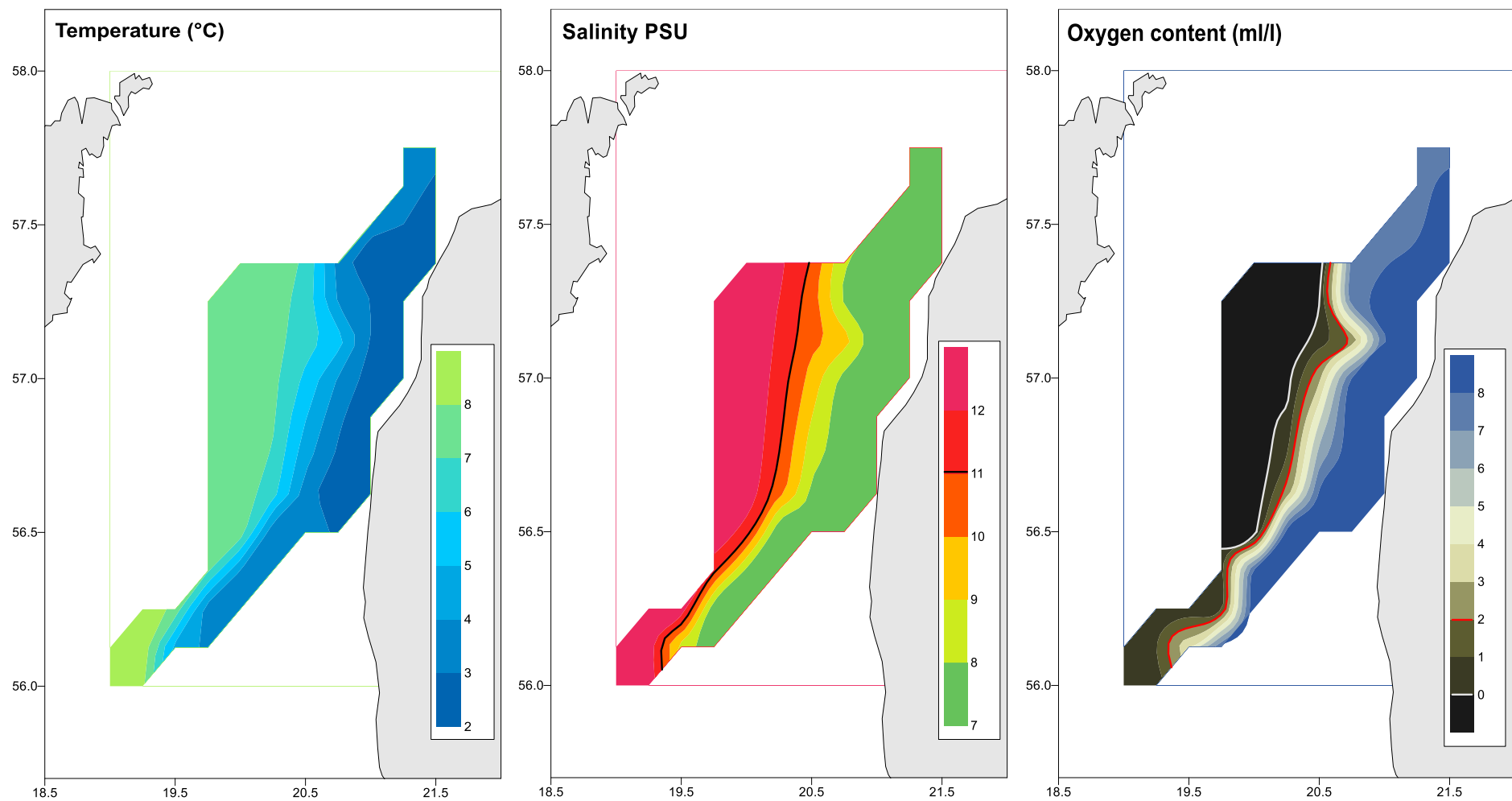


Figure 10. Distribution of the seawater temperature, salinity and oxygen content in the near bottom waters (March 2023)

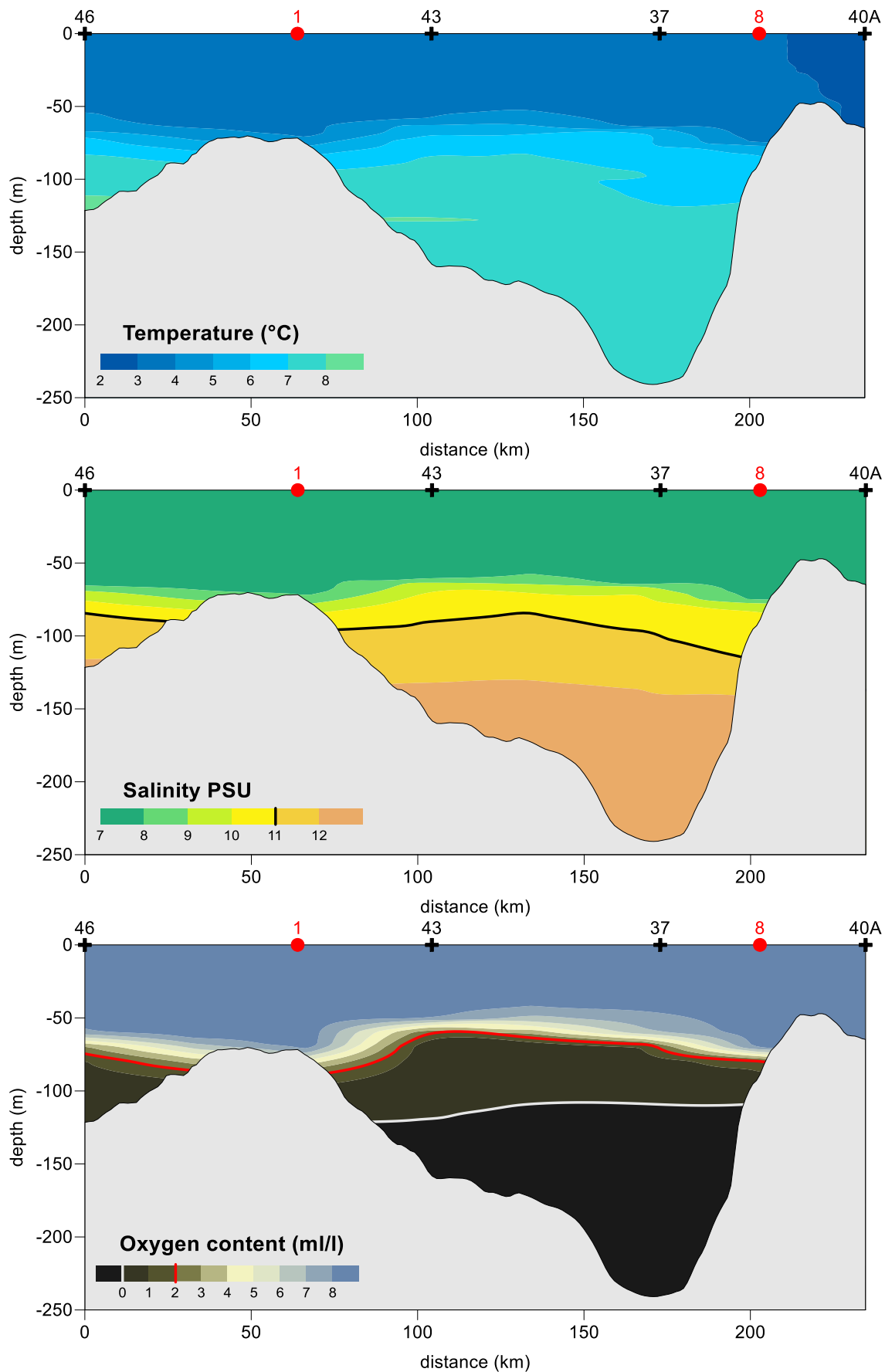


Figure 11. Vertical distribution of the seawater temperature, salinity and oxygen content along the hydrographic transect of the Gotland Deep (March 2023)

Table 3. Cod length measurements by consecutive hauls in the r.v. “Baltica” Latvian - Polish BITS survey (8-16 March 2023); specimens grouped by 1cm length classes.

Haul no	SD	cm_group																																																			Sum
		5	6	7	8	9	10	11	12	13	14	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	47	51											
1	26														1	1	1				2	2	2	2	4		4			2			1	2	1											25							
2	26				1								2				4	3		3	2	3	1	2	6	1	2	1	2	3	1	1	1				1		1							41							
4	28																				2																									2							
6	28						1	1						1		1			3		1	3			1			1																		13							
7	28										1		1		1		2				1		1	2	1	1		1	1		1															14							
9	28				1	1								1	1	1	1	1	1	1	1	2			1	2								1		1										17							
10	28				2											1	4	3	2	1			7	1	1		3		1		1	1	1					1								30							
11	28											1	1		2		1		1		1		1	2	1		3								1											15							
13	28	1																												1	1																3						
14	28				1							1		1		1	3	2	1	1		1	1		2	1	2	2												1							21						
15	28						1	1		1			6	7	5	2	2	1	4		3	2	1	2	3	2	1																				44						
16	28	1				2								1		1	1	3		1		1	1		3	1																					16						
17	28																											2		1																	3						
18	28	1	1		1			1																		1			1																		6						
19	28					1	1					1	1	2	2	4	1					4	2	4	4	2	3			1	1	1					1									36							
20	28																1						1	1	2	1		1	4							1	1									13							
21	28	1	2	5	2	3	1	1		1						1	2	1		1	1	1	3		3	1	2		3	2			2														39						
22	28			2										1		2		1	1	1								1		1						1											11						
23	28		2	3	2										1	3		3	4	6	2	1	4	2	4	6	2	2	1	4	2		1	2		2	1		2	1					1		61						
24	28		1	1		2	1												6	4	2	4	3	2	5		1			2				1				1				1				36							
25	28				1	1								1	1		1	2	1		4	2	3	3	1		1		3												1	1					31						
SD 26					1								2		1	1	5	3		3	4	5	3	4	10	1	6	1	2	5	1	1	2	2	1		1										66						
SD 28		2	8	11	9	8	5	5	2	1	1	1	3	12	14	20	16	20	19	23	14	21	28	20	26	29	14	16	13	13	8	3	6	5	4	4	3	1			1	1	1			411							
Total		2	8	11	9	9	5	5	2	1	1	1	5	12	15	21	21	23	19	26	18	26	31	24	36	30	20	17	15	18	9	4	8	7	5	4	4	1	1	1	1	1	1			477							

Table 4. Flounder length measurements by consecutive hauls in the ./v. “Baltica” Latvian - Polish BITS survey (8-16 March 2023); specimens grouped by 1cm length classes.

Haul no	SD	cm_group																																		Sum
		11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34											
1	26							1	1	4	17	11	13	21	16	22	12	12	11	15	8	1	3		1	169										
2	26									11	15	29	24	17	15	19	13	14	8	11	7	1			2	186										
3	28							1	3	3	4	8	7	13	15	8	6	3	3		1					75										
4	28						1		3	2	9	8	6	4	2	3	2	1	1	3	1					46										
5	28						1	8	9	21	27	28	27	29	20	9	10	6	1	4	1					201										
6	28						1	7	5	11	20	24	33	18	35	23	17	8	9	4	2	1		2		220										
7	28				1	1	1	6	9	23	32	31	32	32	27	15	17	9	8	5						249										
9	28						1	2	9	9	6	13	2	12	8	4	5	2	1	1	1					76										
10	28		1				7	9	23	26	33	28	25	12	14	7	4	5	1	2						197										
11	28			1	1	5	14	8	31	30	34	33	27	17	21	11	5	4	1	2	2					247										
12	28			2	1	4	9	9	13	36	25	34	25	18	11	9	12	6	3	1		1	1	1		221										
13	28		2	3	4	9	22	18	31	14	36	25	28	17	7	7	4	3	4	5		2				241										
14	28						1	2	15	20	10	14	34	28	16	9	8	6	5	3		1				172										
15	28				1		7	11	25	35	29	29	27	18	24	21	10	10	2	4	1	1		1	1	257										
16	28						5	12	21	27	49	48	39	35	26	13	11	4	3	2	1					296										
17	28		1		3	3	8	20	35	16	31	25	7	14	11	10	4	1	1	1						191										
18	28			2	3	8	20	51	33	36	33	30	19	15	11	7	6	4	2							280										
19	28					1	5	7	14	31	21	21	20	21	13	17	11	7	6		2	1				198										
20	28		2		1	3	8	24	21	35	30	29	22	20	10	11	3	1	3	1	1	1				226										
21	28		2	1	7	5	15	27	38	45	56	40	31	11	18	13	7	1	3	3	2	1	1			327										
22	28	2		3	3	3	10	22	28	35	40	29	21	21	14	8	6	5	1	4						255										
23	28		1		3	5	14	18	30	38	28	27	16	11	10	7	6	4	3		2					223										
24	28					1	7	11	9	31	24	33	34	14	13	10	5	7	2	1					1	203										
25	28			1		1	1	1	22	30	26	31	23	26	24	20	13	6	5	1	3		1			235										
SD 26								1	1	15	32	40	37	38	31	41	25	26	19	26	15	2	3		3	355										
SD 28		2	9	13	28	49	158	274	427	554	603	588	505	406	350	242	172	103	68	47	20	9	3	4	2	4636										
Total		2	9	13	28	49	158	275	428	569	635	628	542	444	381	283	197	129	87	73	35	11	6	4	5	4991										



Table 5. Herring length measurements by consecutive hauls in the r.v. “Baltica” Latvian - Polish BITS survey (8-16 March 2023); specimens grouped by 0.5 cm length classes.

		cm_group																											
Haul no	SD	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15	15.5	16	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22	22.5	24	Sum
1	26													1	2	5	12	15	20	15	13	10	3	3	5				104
2	26														3	5	7	14	18	15	19	12	6	3	1		1		104
3	28													1	2	9	11	24	23	15	13	2	1	3					104
4	28													1	2	9	14	26	21	16	8	6	1	1					105
5	28													3	5	10	17	24	19	16	8	3	1	2					108
6	28											1	1	3	2	12	8	22	22	16	12	1	2	1	1				104
7	28			1			1	1			2			3	3	13	30	16	12	9	8	2	2	1					104
9	28					1							4	4	7	14	22	26	13	7	3		1						102
10	28		5	3	2	1	4					2	4	1	5	8	13	17	16	8	8	3	1	2					103
11	28				4		4				1	1	4	5	11	13	17	10	11	14	6	1	2	1				1	106
12	28				2		3	2	1			1	2	6	8	10	12	12	13	11	6	6	5	2	1	1			104
13	28											1	3	2	10	15	20	17	12	10	9	2	3						104
14	28			2	2	1							6	6	7	14	13	24	16	8	10		1	3					113
15	28			1		2	3					2	1	8	3	8	23	18	18	8	6			1	2				104
16	28	1			1	3				2		2	2	5	11	17	19	17	10	6	3	2	1	1		1			104
17	28												1	5	1	10	8	20	7	20	9	9	6	5	2	1			104
18	28			1	1	1	2	1			1	1		3	6	12	11	10	10	15	9	6	5	4	2		2		103
19	28		1	3	1	6	1	1					1		8	9	15	16	16	13	7	3	4	1					106
20	28			1	2	1		1				1	5	4	11	7	12	18	13	9	5	9	2	2	1				104
21	28							1				1	1	3	7	9	14	6	11	11	12	11	3	9	3	1			103
22	28					2	3	1	1			1	1	1	4	14	8	14	13	12	10	6	3	5	3	1			103
23	28			1				2	1				1	1	7	13	17	15	13	8	7	3	5	6	3	1			104
24	28					1	1	3	1	1	1	3	1	4	14	17	9	10	12	6	11	4	2	1	1	1			104
25	28				1		2			1			1	7	7	17	18	12	19	5	5	6	2		1				104
SD 26														1	5	10	19	29	38	30	32	22	9	6	6		1		208
SD 28		1	6	13	16	19	24	13	4	4	5	17	39	76	141	260	331	374	320	243	175	85	53	51	20	7	2	1	2300
Total		1	6	13	16	19	24	13	4	4	5	17	39	77	146	270	350	403	358	273	207	107	62	57	26	7	3	1	2508

Table 6. Sprat length measurements by consecutive hauls in the r.v. “Baltica” Latvian - Polish BITS survey (8-16 March 2023); specimens grouped by 0.5 cm length classes.

		cm_group																
Haul no	SD	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	Sum
1	26									8	24	34	36	13	5	1		121
2	26									4	17	20	11	4	2			58
3	28						3		1	18	29	33	18	13	6	1		122
4	28									11	36	36	14	16	2	3		118
5	28				1					14	27	42	29	10	1			124
6	28	1		2	8	14	11	5	1	16	19	20	10	7	2			116
7	28						3		2	15	27	27	24	13	2			113
9	28			1	2	5	7	2		15	25	23	18	13	2			113
10	28				1	8	2	3	5	11	34	26	10	7	3	2		112
11	28					1	2	1	5	14	30	18	22	22	3			118
12	28			3		5				11	12	26	27	12	7	3	1	107
13	28								2		1	1	2	3	1			10
14	28			1	6	9	13	4	5	20	23	16	12	7				116
15	28				2	1	1		1	19	28	29	13	11	2	1		108
16	28			1	3	7	9	2	4	6	7	10	8	4				61
18	28		1	3	3		2	1		2	3	9	7	3	1			35
19	28			2	4	5	9	2	1	12	19	30	13	9	8	1		115
20	28			3	4	1	4			4	6	21	23	27	8	5		106
21	28								1	1	5	7	3	8	1			26
22	28								2	4	17	24	24	18	9	5	1	104
23	28								2	7	25	25	25	19	5	2		110
24	28									1	10	24	23	35	15	5		113
25	28			1		8	3	1	4	11	20	27	29	14	2			120
SD 26										12	41	54	47	17	7	1		179
SD 28		1	1	17	34	64	69	21	36	212	403	474	354	271	80	28	2	2067
Total		1	1	17	34	64	69	21	36	224	444	528	401	288	87	29	2	2246

## **Cruise report**

### **Cruise number 818 FRV „Solea“ 22/02 –18/03/2023**

#### **Baltic International Trawl Spring Survey (BITS) in the Arkona Sea, Mecklenburg and Kiel Bight (ICES SD 24 & 22)**

Scientists in charge: **Dr A Velasco**

## **1. Summary**

The 818rd cruise of the FRV “Solea” is the 42th German Spring survey since 1981. It was part of the Baltic International Trawl Survey (BITS), which is coordinated by ICES (WGBIFS). The main objective of the survey was to estimate fishery independent stock indices for the two Baltic cod stocks, flounder and plaice.

In total, 53 fishery hauls and 53 hydrography stations were carried out.

A first evaluation of the survey results suggests that the cod year-class 2022 (recruits at length range 10 - 25 cm) is not as weak as the year-class 2021. The recruitment by length group 10 - 25 cm TL was higher in all depth layers between 10 - 59 m in SD 24 compared to the previous year. The recruitment by length group 26 - 40 cm TL was, with exception of depth layer 10 - 29 m in SD 22, in all other depth layers in SD 24 lower compared to the previous year.

The abundance of flounder decreased in all depth layers in SD 24 and in SD 22 with exception of depth layer 10 - 19 m in SD 22 compared to the previous year.

The maturity development of cod during the BITS survey in ICES SD 24 corresponded to the long-term average. In the middle of the main spawning season, numbers of spawning cod in SD 22 were low. Only 27% of the females spawned. During the survey habitual salinity-gradients were observed. The oxygen concentration was sufficient down to the bottom at the stations in subdivisions 22 and 24.

---

### **Verteiler:**

Ship management FRV „Solea“  
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  
GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel

LA für Landwirtschaft, Lebensmittels. und Fischerei (LALLF)  
LA für Landwirtschaft und Fischerei MV (LFA)  
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. Research program

The cruise took place from the 22<sup>nd</sup> February to the 18<sup>th</sup> March 2023. Corresponding to the recommendations of the WGBIFS in 2007, the survey of the FRV "Solea" covered the subdivisions 22 and 24 (Figure 1).

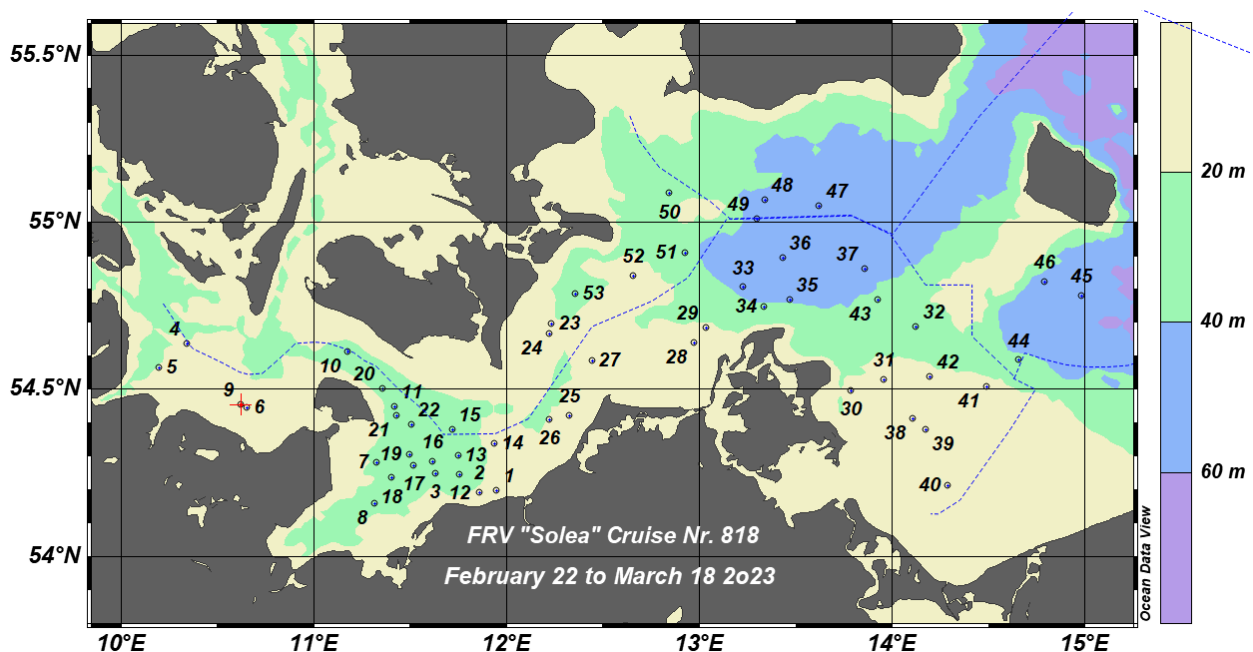
The following stock assessment objectives were covered during the survey:

- Collecting data for assessing stock indices, the structure and recruitment of the stocks, especially for cod and flatfish
- Monitoring the composition of fish species in the western Baltic Sea
- Collecting samples of cod and flounder for biological investigations (i.e. sex, maturity, fecundity, age)
- Monitoring the actual hydrographical situation in the survey area

## 3. Narrative

The internationally coordinated trawl survey is planned as a Stratified Random Survey where ICES subdivisions and depth layers are used as strata. A total of 60 stations (38 in subdivision 24 and 22 in subdivision 22) were planned for the German part of the survey, which covered the southern part of ICES subdivision 22 and subdivision 24 in total. The haul positions were selected from the TOW Database by the coordinator of the BITS surveys (ICES 2008, WGBIFS report). 53 fishing stations were covered and can be used for stock assessment. The fishing hauls were carried out between 7:00 and 15:00 UTC (8:00 and 16:00 local time).

The positions of the trawl hauls are shown in Figure 1. 22 fishing hauls and 22 hydrographic stations were done in subdivision 22, and 31 fishing hauls and 31 hydrographical stations were realized in subdivision 24.



**Figure 1: BITS Stations of the 818<sup>rd</sup> FRV "SOLEA" cruise** (Ocean Data View, R. Schlitzer, [www.awi-bremerhaven.de/GEO/ODV](http://www.awi-bremerhaven.de/GEO/ODV))

The numbers of fishing hauls and hydrographic stations by subdivision and 20 m depth layers are given in Table 1. Most hauls in subdivision 22 were located at depths from 10 m to 29 m and 21 of 38 hauls in subdivision 24 between 40 and 59 m.

**Table 1: Sampling intensity (evaluated fishing stations)**

Area		Stations		
Subdivision	Stratum Depth [m]	Total trawl distance [nm]	Fishing [n]	Hydrography [n]
22	1 [10-19]	3.0	2	2
	2 [20-29]	30.2	20	20
24	1 [10-19]	9.3	6	6
	2 [20-39]	19.2	13	13
	3 [40-59]	18.7	12	12

Trawling was done following the standard BITS trawl “TV3 520# “. The stretched mesh size in the cod end was 20 mm. The duration of each haul was 30 minutes at a velocity of 3 kn as required in the BITS manual. The total catch of each haul was analysed to determine species composition in weight and number as well as the length distribution of all species. Subsamples of cod, flounder, plaice, dab and turbot were investigated concerning sex, maturity and age.

Vertical profiles of the hydrographical parameter’s temperature, salinity and oxygen were sampled from the surface to the bottom immediately after every fishing haul with a CTDO probe (Sea Bird 19+ s/n 8024).

## 4. Preliminary results

### 4.1 Biological data

In total 712 cod, 770 flounder, 927 plaice, 635 dab, 110 turbot and 10 brill were collected for measuring length, weight, sex, maturity and age. The total catches and numbers of length samples of cod, flounder, plaice and dab are given in Table 2 by subdivision and depth stratum.

The mean catch per hour (CPUE) was 26.3 kg of cod and 126.9 kg of plaice. In general, the catch composition was dominated by plaice. However, cod, flounder and dab were not abundant in the catches. The mean fraction of plaice biomass in the hauls was 33.2 % and mean fraction of cod, dab and flounder were 6.9 %, 10.3 % and 5.0 % respectively. Sprat and herring represented 42.3 % of the total biomass in mean.

**Table 2: Numbers of length measurements of cod, flounder, plaice and dab by depth stratum and ICES subdivision**

Area		Sample			
		Cod		Flounder	
Subdivision	Depth [m]	Weight [kg]	Number [n]	Weight [kg]	Number [n]
22	10-29	41.9	591	263.8	1199
24	10-19	16.5	225	34.3	235
	20-39	147.1	1037	55.6	291
	40-59	850.2	6505	410.2	2544

Area		Sample			
		Plaice		Dab	
Subdivision	Depth [m]	Weight [kg]	Number [n]	Weight [kg]	Number [n]
22	10-29	4414.2	62888	1382.0	15599
24	10-19	158.0	2351	46.1	488
	20-39	282.2	3941	93.7	1068
	40-59	240.5	2575	55.4	529

The highest abundances in weight and number of cod and flounder were observed in subdivision 24 in depths between 40 - 59 m. The highest abundances in weight and number of plaice and dab were observed in 22 in depths between 10 - 29 m.

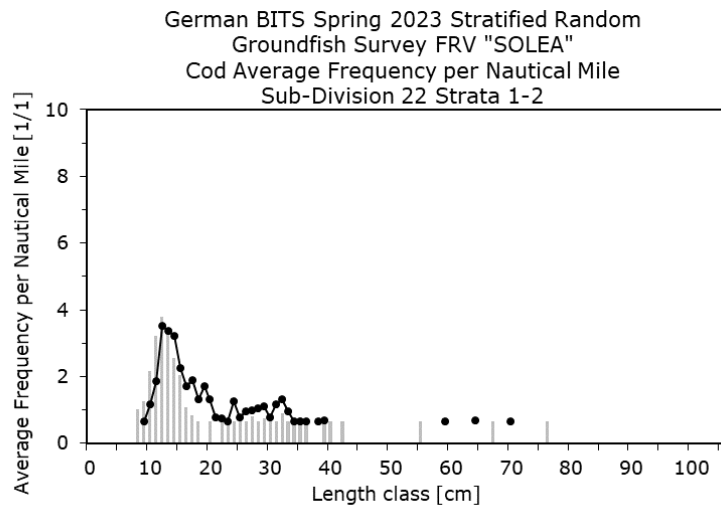
Mean CPUE of cod and flounder are given in Table 3 by subdivision and depth stratum.

**Table 3: Mean CPUE of cod and flounder, plaice and dab and average individual weights by sub-division and depth**

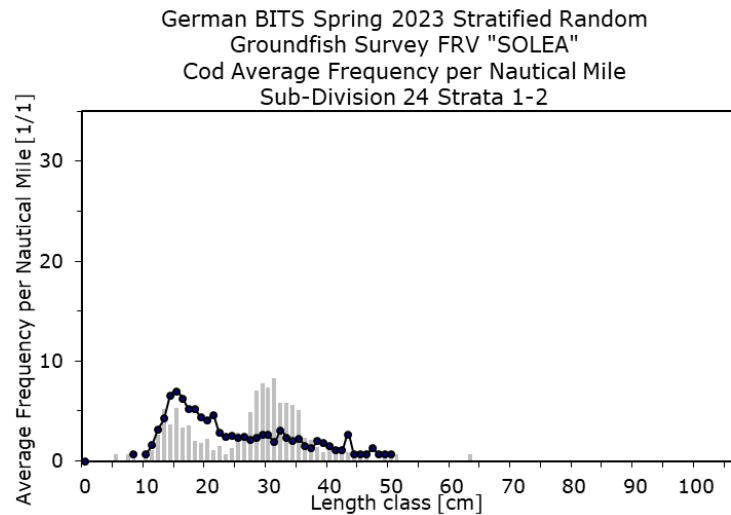
Area		Catch							
		Cod				Flounder			
Subdivision	Depth [m]	Weight [kg/nm]	Number [n/nm]	Average Weight [g]	Stations [n]	Weight [kg/nm]	Number [n/nm]	Average Weight [g]	Stations [n]
22	10-29	1.3	18	70.9	22	8.0	36	220.0	22
24	10-19	1.8	24	73.4	6	3.7	25	145.8	6
	20-39	7.7	54	141.9	13	2.9	15	190.9	13
	40-59	45.6	349	130.7	12	22.0	136	161.2	12

Area		Catch							
		Plaice				Dab			
Subdivision	Depth [m]	Weight [kg/nm]	Number [n/nm]	Average Weight [g]	Stations [n]	Weight [kg/nm]	Number [n/nm]	Average Weight [g]	Stations [n]
22	10-29	133.0	1895	70.2	22	41.6	470	88.6	22
24	10-19	17.1	254	67.2	6	5.0	53	94.5	6
	20-39	14.7	205	71.6	13	4.9	56	87.7	13
	40-59	12.9	138	93.4	12	3.0	28	104.8	12

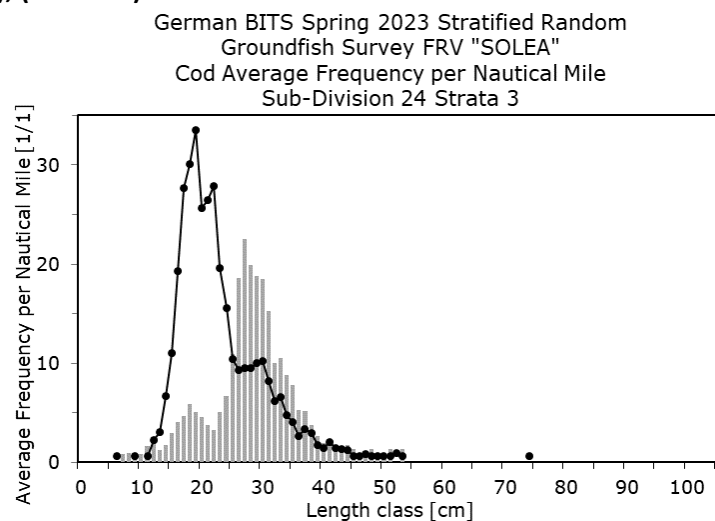
The frequencies of cod grouped by subdivision and depth strata are presented in figures 2 to 4. Noteworthy is the abundance of cod ranging in length from 15 to 2 cm in subdivision 24. Compared to last year, the frequency of cod in the length range 26–40 decreased in all depth layers with exception of depth layer 10 – 29 m in subdivision 22 (Table 4 and Figures 2 to 4).



**Figure 2: Length frequencies of cod in number per mile in depth strata 10 m to 29 m in SD 22 2023 (line) and 2022 (bars), (22 Hauls)**



**Figure 3: Length frequencies of cod in number per mile in depth strata 10 m to 39 m in SD 24 2023 (line) and 2022 (bars), (19 Hauls)**



**Figure 4: Length frequencies of cod in number per mile in depth strata 40 m to 59 m in SD 24 2023 (line) and 2022 (bars), (12 Hauls)**

**Table 4: Recruitment by length group of the year 2023 in comparison to the previous year**

Area		Catch	2023		
Subdivision	Depth [m]	Length range [cm]	Number [n]	Number/ Mile [n/nm]	Trawl distance [nm]
22	10-29	26 - 40	68	2	33.2
24	10-19	26 - 40	22	2	9.3
	20-39	26 - 40	333	17	19.2
	40-59	26 - 40	1642	88	18.7
22 - 24	10-59	26 - 40	2065	26	80.3
22	10-29	10 - 25	518	16	33.2
24	10-19	10 - 25	398	43	9.3
	20-39	10 - 25	997	52	19.2
	40-59	10 - 25	4780	256	18.7
22 - 24	10-59	10 - 25	6175	77	80.3
Area		Catch	2022		
Subdivision	Depth [m]	Length range [cm]	Number [n]	Number/ Mile [n/nm]	Trawl distance [nm]
22	10-29	26 - 40	50	2	21.9
24	10-19	26 - 40	45	4	10.1
	20-39	26 - 40	762	39	19.5
	40-59	26 - 40	4003	165	24.3
22 - 24	10-59	26 - 40	4860	64	75.8
22	10-29	10 - 25	57	3	21.9
24	10-19	10 - 25	58	6	10.1
	20-39	10 - 25	811	42	19.5
	40-59	10 - 25	4714	194	24.3
22 - 24	10-59	10 - 25	5640	74	75.8

Under the assumption that the survey covered the entire nursery ground of one-year old cod, a better year class 2022 to the previous year weak class 2021 can be assumed.

#### 4.2. Spawning of cod in SD 22

In total, only 184 cod were caught in sub-division 22. Of these, 82 were juvenile (<20 cm) in SD 22. Of the 102 adult cod, 37 were females, of these 37 females, 9 individuals spawned (27%). This describes the catastrophic situation of the western Baltic cod.

#### 4.3. Spawning of cod in SD 24

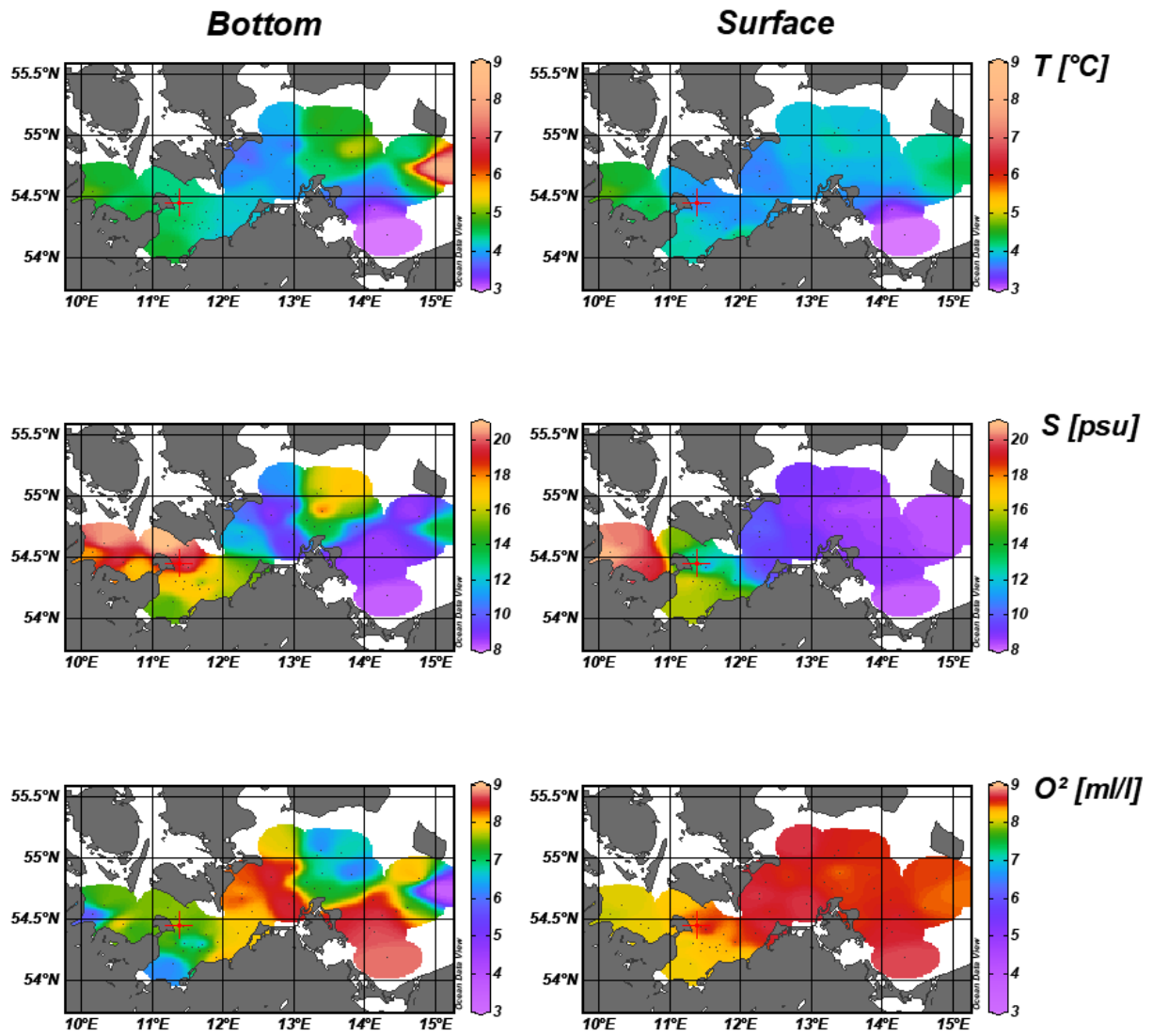
The maturity development of the cod during the BITS survey in ICES SD 24 corresponded to the long-term average. Overall, 70 % of captured male cod spawned, but only 11 % of females (ICES maturity key, stage 63). Most of the females (70 %) were in pre-spawning conditions.

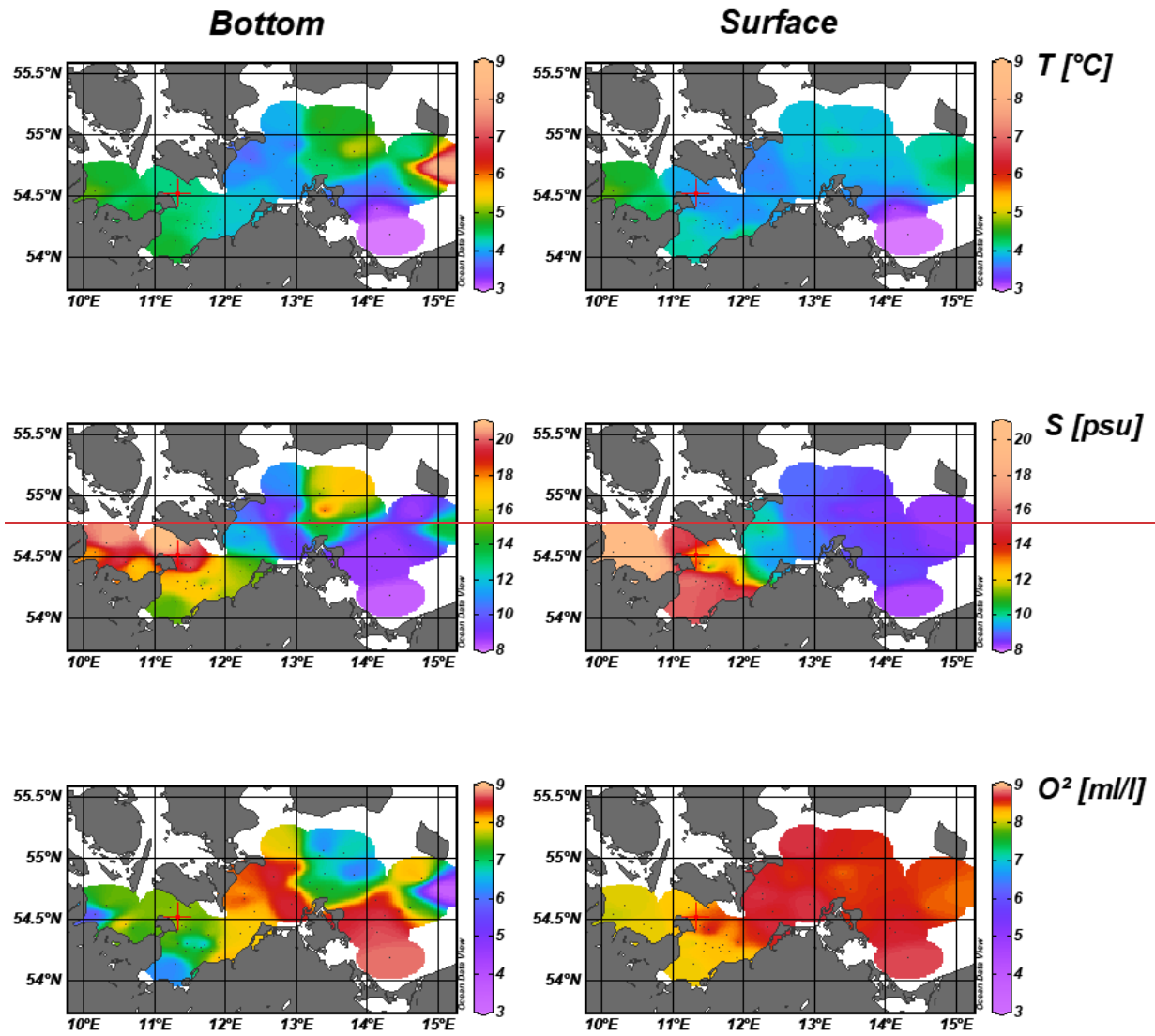
#### **4.4. Hydrographical data**

Figure 5 shows the distribution of temperature, salinity and oxygen near the bottom and at the surface in the covered area.

The hydrography was characterised by atypical winter conditions with surface temperatures between 2.7 °C and 4.7 °C. The salinity of the surface water decreased from 21.0 to 8.2 from west to east. The lowest temperature was found at Oderbank 2.7 °C (at 16 m water depth).







**Figure 5: Hydrography of the survey near the bottom (left) and at the surface (right)**

The salinity above the permanent halocline at a depth of 33.8 m in the Arkona Basin was approximately 8.6. The salinity in the Kiel Bight increased below the halocline up to 21.0 at a depth of 21 m (Figure 5). The oxygen concentration close to the bottom was high (3.5 – 8.8 ml\*L<sup>-1</sup>) at all stations in the Belt Sea and Arkona Sea.

## 5. Participants

Participant	Function	Institution
Dr. A. Velasco	Cruise leader	Thünen-OF
T. Hogh	Head Technician	Thünen-OF
C. Albrecht	Technician	Thünen-OF
S. Dressler	Technician	Thünen-OF
T. Burmester	Technician	Thünen-OF
M. Bächtiger	Student assistant	University of Hamburg
M. Bierkar	Student assistant	University of Bremen

## 6. Acknowdgements

We would like to express our gratitude to captains Meier and Koops and his crew on the FRV "Solea" for their good cooperation. Many thanks to the scientific team for their reliable processing of catches.

sgd. scientist in charge