

Cruise Report

**FRV "Walther Herwig III", cruise no. 354
02.05. – 22.05.2012**

Acoustic Survey on Pelagic Fish Stocks in the Baltic Sea

Scientist in charge: Dr. Uwe Böttcher

1 Background

The main objective of the cruise no. 354 of RV "Walther Herwig III" was to assess the sprat stock in the Baltic Proper. The cruise is part of the **Baltic International Acoustic Spring Survey (BASS)**, which is coordinated within the scope of ICES. This acoustic survey is conducted every year to supply the ICES 'Baltic Fisheries Assessment Working Group (WGBFAS)' with an index value for the stock size of sprat in the Baltic area (Subdivisions 24 - 26 and 28). The acoustic survey was accompanied by extensive hydrographic investigations.

Timing, surveying area and the principal methods of investigations were internationally co-ordinated by the WGBIFS (ICES Baltic International Fish Survey Working Group). Germany covered the ICES Subdivisions 24, 25 and the western parts of Subdivisions 26 and 28 (Figure 1).

Subdivision 24 near the isle of Rügen was investigated additionally with the aim to enlarge the knowledge about distribution and migration of the spring spawning herring in this area in the late spawning time.

Cod was sampled in former dumping sites for chemical warfare agents in the Bornholm and western Gotland Basin in order to investigate endocrine effects of released chemical agents from the dumped ammunition in the frame of the CHEMSA project (Institute of Fisheries Ecology).

Verteiler:

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vTI, Verwaltung Hamburg
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vTI, OSF
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2 Narrative

The cruise started on 02th May in Warnemünde and ended on 22th May in Bremerhaven. Eighteen days were utilized for fulfilling the survey purposes. Additional two days were used for the departure/arrival to the homeport Bremerhaven.

The investigation of RV "W. Herwig" covered the whole Subdivisions 24 and 25 as well the Polish and Swedish areas of Subdivision 26 and 28.

Survey design

The acoustic and ichthyologic sampling stratification was based on ICES statistical rectangles. The size of these rectangles amounts 0.5 degree in latitude and 1 degree in longitude, whereby only areas with water deeper than 10 m were taken into account. The daily surveyed distance amounted to approximately 90-100 nautical miles. In agreement with the rules the acoustic measurements were conducted on parallel transects with a distance of 15 - 18 nautical miles.

The standard acoustic investigations and the fishing hauls were carried out at daylight from 4:00 - 18:00 UTC (6:00 and 20:00 local time). The survey speed was 10 knots. In general, each ICES-rectangle was covered with two transects, corresponding to acoustic measurements of approx. 60 nautical miles per statistical rectangle

Calibration

The hull mounted 38 kHz transducer was calibrated on the 19th April (cruise no. 353) in the coastal area of the Mecklenburg Bay. The ship was anchored to bow and stern to reduce ship movement. The calibration procedure was carried out as described in the 'Manual for International Baltic Acoustic Surveys (IBAS)' (ICES 2012).

Acoustic data collection

Acoustic data were recorded with an echosounder SIMRAD EK60. The standard frequency for the survey was 38 kHz. The specific settings of the acoustic equipment were used according the IBAS-manual.

Biological data – fishing stations

Trawling was done with the pelagic gear "PSN205" in the midwater as well as near the bottom to identify the echo signals. The intention was to conduct at least two hauls per ICES statistical rectangle. The trawling time lasted usually 30 minutes. According to the IBAS-manual codend-inlets with stretched mesh sizes of 20 mm was used in the Subdivision 24 and 12 mm in Subdivision 25 to 28. PSN205 without an inlet in the codend was used in hauls targeting cod in the dumping areas. The stretched mesh size of the pure codend amounted 50 mm.

The trawling depth and the net opening were controlled by an Atlas net probe and Scanmar press sensor. Generally a net opening of about 15 to 18 m was achieved. The trawl depth (headrope below the surface) on the fishing stations which ranged from 15 to 100 m was chosen in accordance to 'characteristic indications' of the echogram. At pelagic trawling positions the bottom depth varied from 31 to 231 m.

Four hauls were carried out with a 140' bottom trawl (20 mm stretched meshes in the codend) in the shallower areas around the isle of Rügen (water depth 18 - 39 m) to sample herring for special investigation.

Samples were taken from each haul in order to determine the length and weight distribution of fish. Sub-samples of herring and sprat were investigated concerning sex, maturity and age. Samples of whole fishes and parts of different organs/tissues were taken for later investigations in the lab.

Hydrography

A Seabird-CTD-probe with a carousel water sampler and oxygen sensor was used for hydrographical measurements. Vertical profiles were acquired on a fixed station grid along the track and after each trawl station. The profiles covered the entire water column to about 2 m above the sea bottom. Additionally, water samples were taken once per day from different depths to check the oxygen data by Winkler titration and to collect reference salinity samples. The hydrological row data were aggregated to

1 m depth strata. Additional meteorological observations of air temperature, atmospheric pressure, wind speed and direction were recorded on all hydrographical stations.

3 First Results

Summarized activities during the survey:

Hydroacoustic transects	1550 nmi
Pelagic trawl hauls	62
Bottom trawl hauls	8
CTD vertical profiles	139
Water bottle samples for oxygen (Winkler titration) and for salinity determination	58

The tracks of the acoustic measurements and the geographical distribution of fishing and CTD-stations are presented in Figures 1 and 2. The results of the trawl hauls are given in Table 1 and Figure 3.

The CPUE ranged from 1 to 638 kg/0.5h. In general the catch composition was dominated by sprat. Herring and cod also occurred regularly in the trawl catches. The average biomass fraction amounted 92 % for sprat and 8 % for herring in hauls related to the acoustic investigations. Hauls with a high proportion of herring occurred in the Arkona Sea, Bornholm Sea and western Gotland Sea. Cod was caught in 43 hauls. The average biomass fraction of cod amounted to 4 %. Most cod was found in the Bornholm basin. Overall 16 fish species were recorded in 62 pelagic hauls. The biomass of species other than herring, sprat and cod was negligible. Haul no. 14, 26 and 28 indicated distinct stickleback layers in the investigated area.

The table below gives the number of investigated individuals. Detailed ichthyological analyses were made according to the standard procedure (i.e. sex, maturity, age).

species	total of hauls with the species	length-measured individuals	detailed ichthyological analyses
AMMODYTES TOBIANUS	1	3	
CLUPEA HARENGUS	64	7057	1968
CYCLOPTERUS LUMPUS	3	3	
GADUS MORHUA	43	427	315
GASTEROSTEUS ACULEATUS	26	1606	
HYPEROPLUS LANCEOLATUS	9	30	
LIMANDA LIMANDA	5	39	
MERLANGIUS MERLANGUS	11	624	
MYOXOCEPHALUS SCORPIUS	4	5	
PLATICHTHYS FLESUS	32	451	
PLEURONECTES PLATESSA	8	168	
POMATOSCHISTUS MINUTUS	1	2	
SALMO SALAR	1	1	
SALMO TRUTTA	1	2	
SCOMBER SCOMBRUS	1	1	618
SPRATTUS SPRATTUS	66	17362	

The length distributions of sprat and herring by Subdivision of the years 2011 and 2012 are presented in Figure 4. The length distribution shows the typical shift to smaller individuals from the western to the eastern areas. However, larger sprat (>11 cm) dominated in all Subdivisions. The contribution of the new incoming year-class (<10 cm) is especially in SD 25 and 26 very low.

The seawater temperature varied from 5 °C to 8 °C in the surface layer (Fig. 5). This is in the normal range of values for this season. However, the winter cooling of the intermediate water layer about the

halocline was lower than in the previous year. Because of that the temperature of this layer was about 1-2 degrees higher in most survey areas.

Compared to last year the oxygen content increased distinctly in the bottom near water of the Bornholm and south-west Gotland basin. This increase can be explained by the inflow event in November/December 2011. Aerobic conditions in the bottom near water layer were found in the whole area of the Bornholm basin and Stolpe Channel as well as in the south western part of the Gotland basin (Fig 6). The salinity of the deepwater also slightly increased in this area due to the inflow event in 2011 (Fig. 5).

The analysis of the acoustic data is still pending.

4 Personnel

Master: R. Behrens

Scientific staff participating:

	Name	Institution	Task
1	Dr. U. Böttcher	vTI-OSF, Rostock	Cruise leader, databases
2	Dr. B. Limmer	vTI-SF, Hamburg	Acoustic, fisheries biology
3	D. Stephan	vTI-OSF, Rostock	Fisheries biology
4	M. Koth	vTI-OSF, Rostock	Fisheries biology
5	B. Stepputtis	vTI-OSF, Rostock	Fisheries biology
6	B. Stefanowitsch	University Hamburg	Hydrography, databases
7	Helge Wehrmann	University Hamburg	Fisheries biology
8	N. Fricke	vTI-FOE, Cuxhaven	Fisheries biology
9	J. Ipse	vTI-FOE, Cuxhaven	Fisheries biology
10	S. Valassas	Volontär	Fisheries biology
11	A. Thoma	Volontär	Fisheries biology, hydrography


Uwe Böttcher

5 Figures and Tables

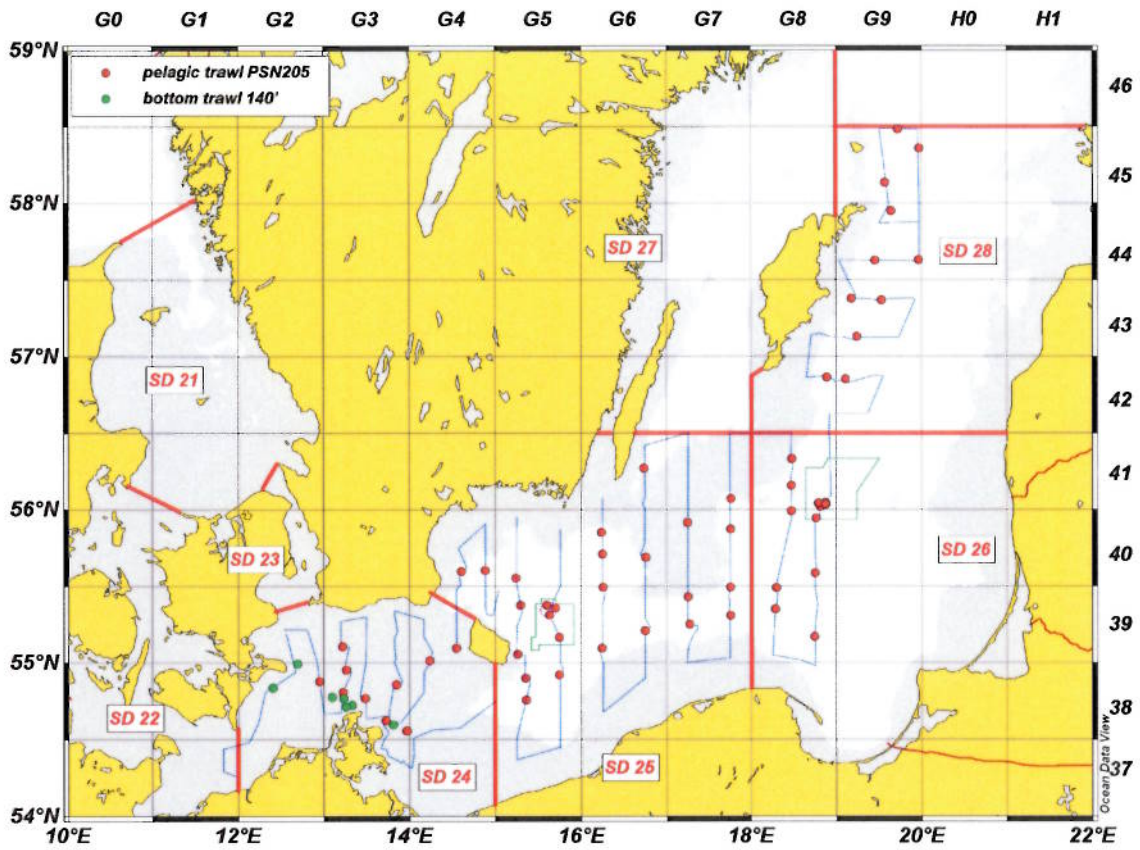


Figure 1: Hydroacoustic tracks and trawl positions (Cruise No. 354 of RV "W. Herwig III" in May 2012).

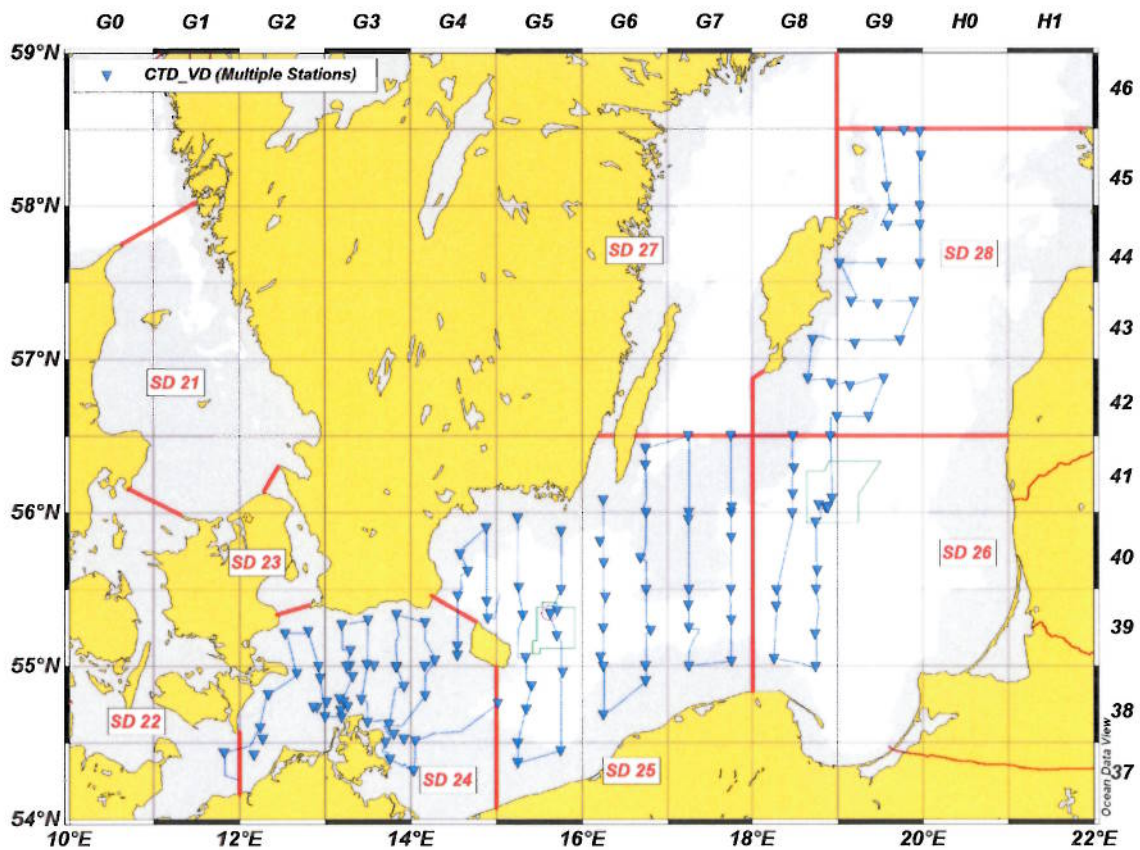


Figure 2: Distribution of CTD- and bottle-stations on the hydroacoustic transects. (Cruise No. 354 of RV "W. Herwig III" in May 2012).

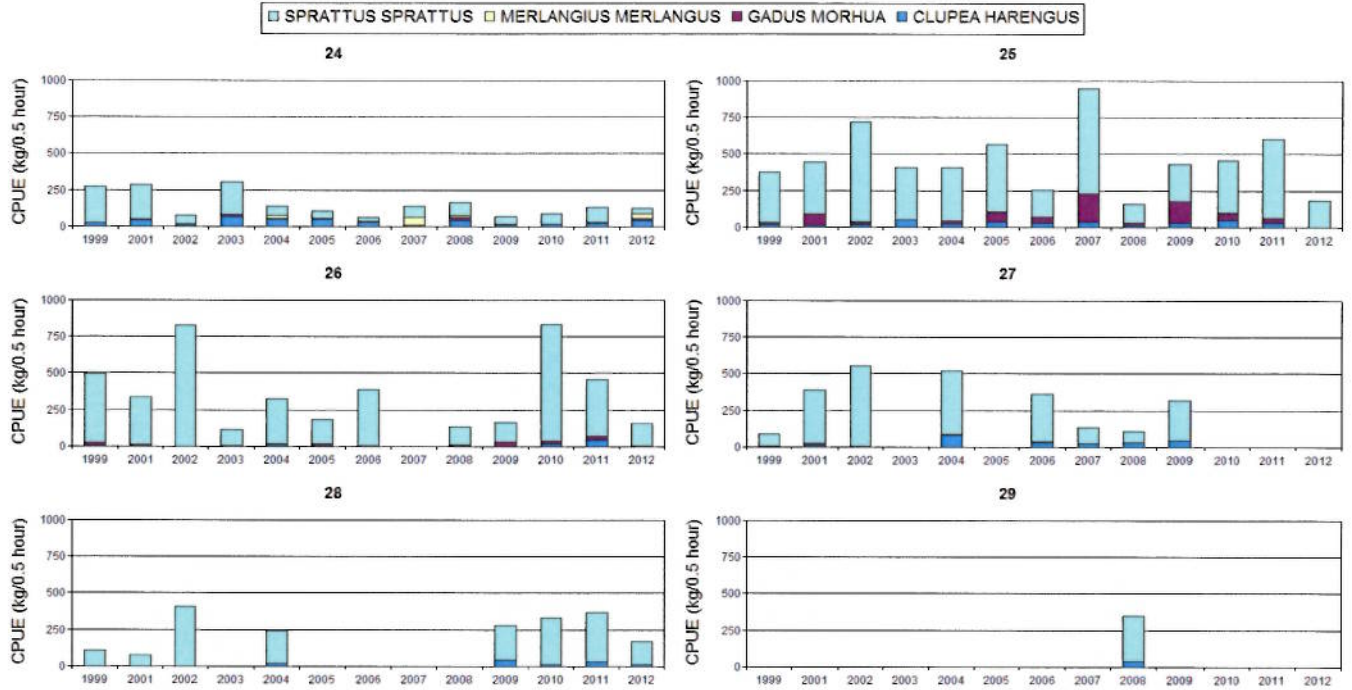


Figure 3: CPUE (kg/0,5 hour) in the ICES-subdivisions on the May hydroacoustic survey 1999 to 2012.

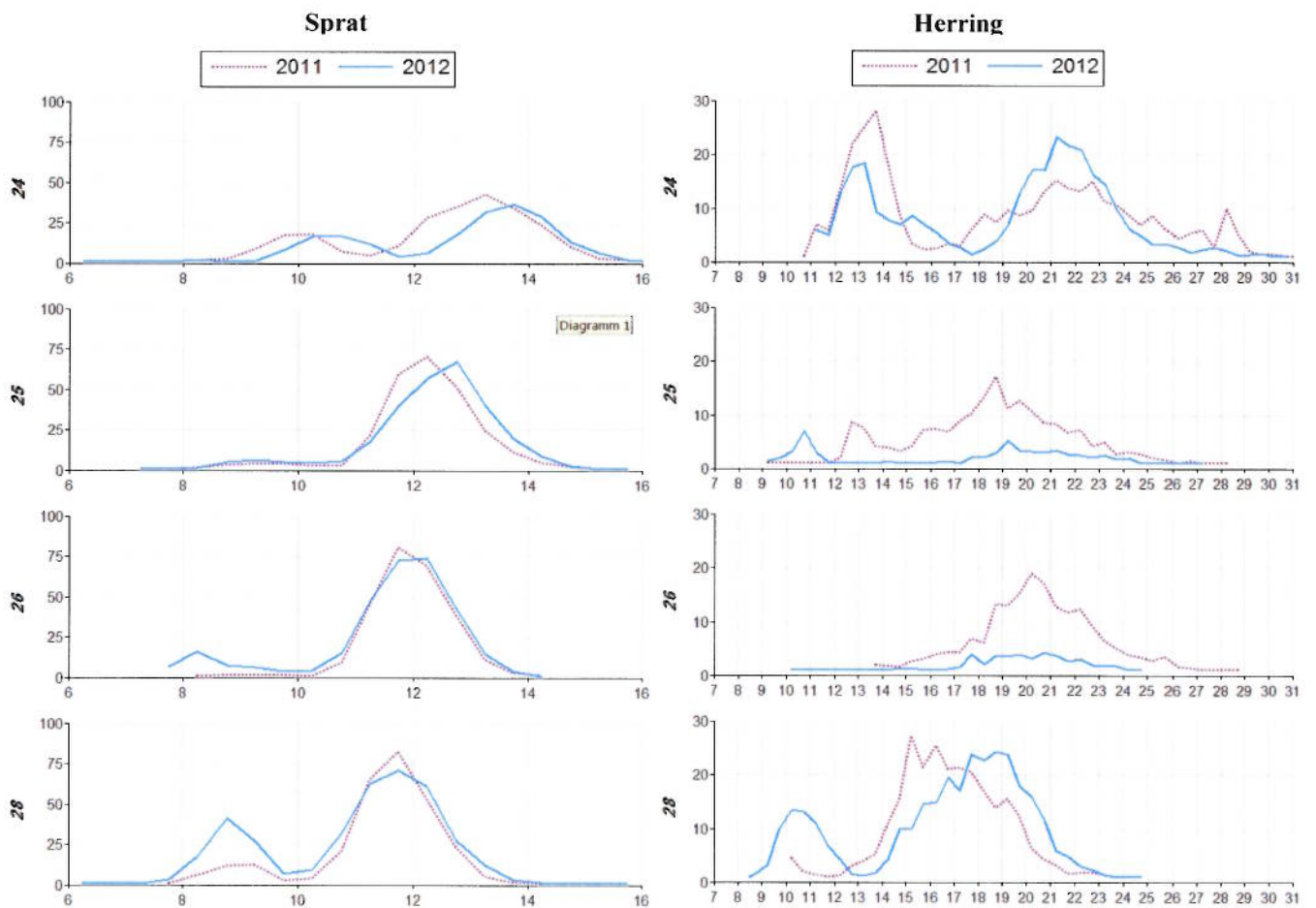


Figure 4: Length distribution in numbers of sprat (left) and herring (right) in Subdivisions 24 - 28 in May 2011 and 2012.

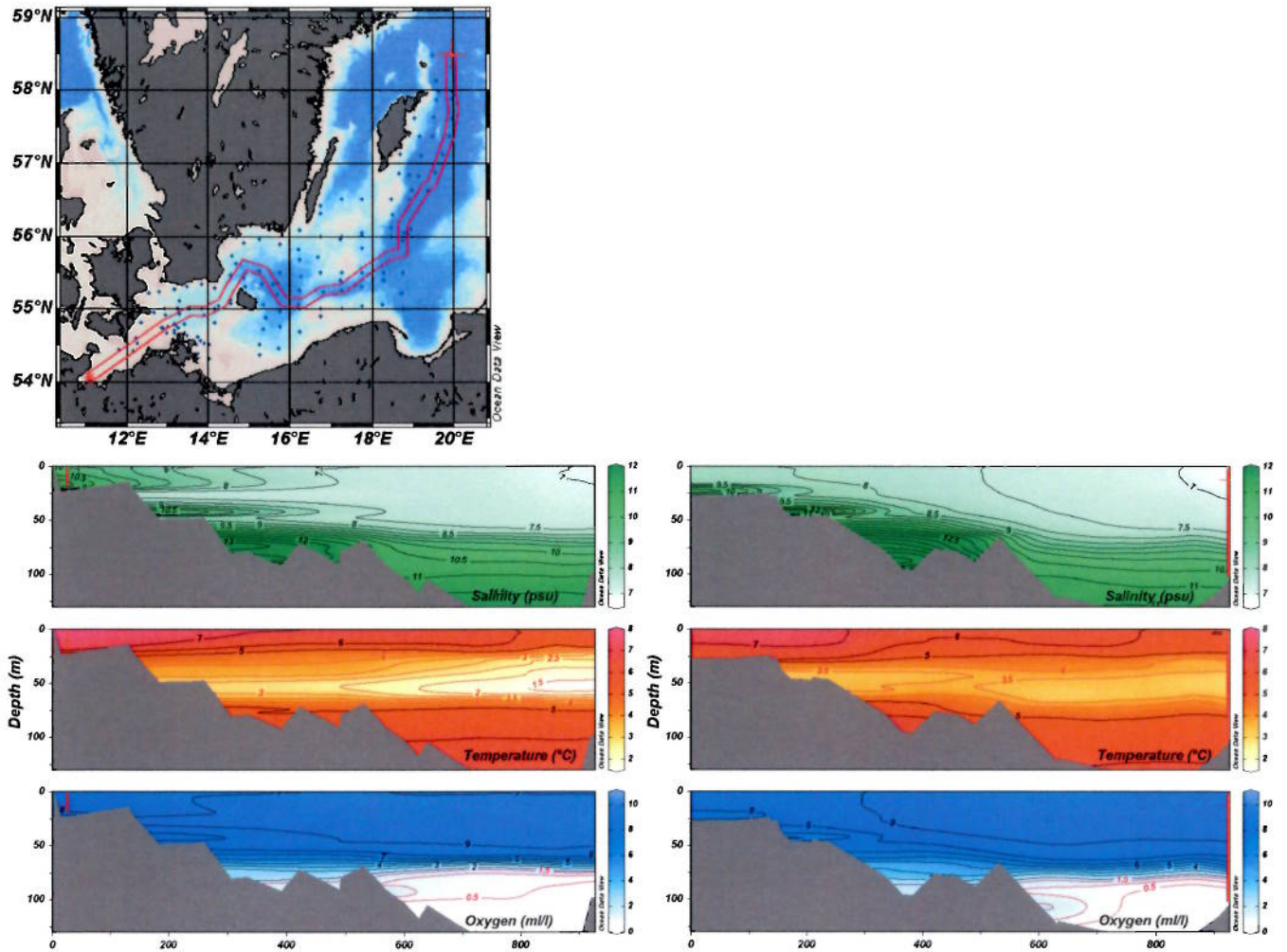


Figure 6: Vertical distribution of salinity, temperature and oxygen on a transect from west to east through the investigated area in 2011 (left) and 2012 (right)

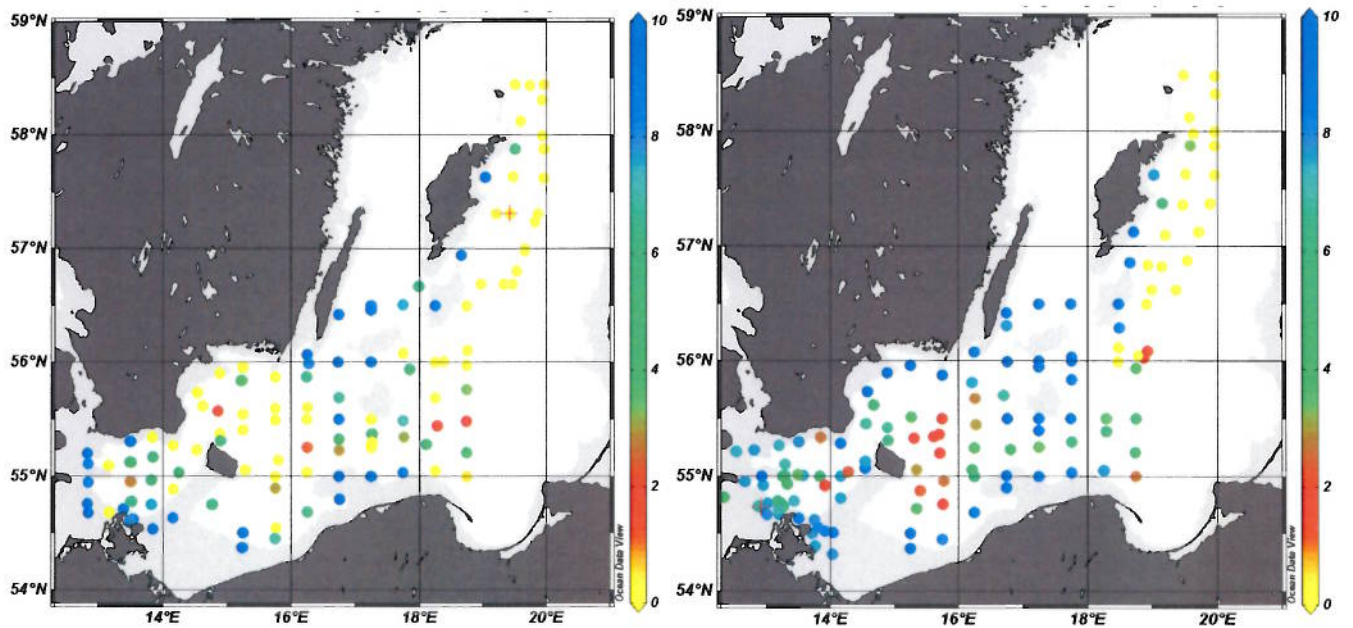


Figure 5: Oxygen content in the bottom-near water on the CTD-stations in 2011 (left) and 2012 (right).

Table 1: Catch composition (kg/0.5 h) per fishing haul (RV "Walther Herwig III", May 2012)

station	1	2	3	4	5	6	7	8	9	10	11	12	13	14	18	15	16	17	1
sub-division	24	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
rectangle	39G4	40G4	40G4	40G5	39G5	39G5	38G5	38G5	38G5	39G5	39G5	39G5	39G5	40G6	39G6	40G6	39G6	39G6	40G
trawl_typ	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN20
cod_end	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm
trawl_time (min)	30	30	30	30	30	30	30	30	30	30	30	60	60	37	30	31	30	30	3
bottom_depth (m)	43.0	67.0	77.5	76.5	90.5	71.0	73.0	68.5	81.5	93.0	96.0	95.5	99.0	55.5	81.0	67.5	72.5	76.5	53.
mean_headline_depth (m)	27.0	48.0	58.0	58.0	72.0	50.0	55.0	50.0	64.0	68.0	75.0	72.0	71.0	36.0	59.0	48.0	56.0	56.0	35.
trawl_distance (n.mi.)	2.15	1.74	1.87	1.83	1.78	1.74	1.75	1.72	1.67	1.74	3.41	3.34	2.10	1.88	1.66	1.91	1.82	1.63	1.8
CLUPEA HARENGUS	11.03	0.48	1.21	0.03	2.07	0.46	2.44	4.97	2.01	1.79	0.84	0.93	0.53	0.31	0.71	0.19	0.82	0.10	0.1
CYCLOPTERUS LUMPUS		0.23																	
GADUS MORHUA			1.36		1.58		0.23		1.67	0.80	0.99	6.76		0.53					
GASTEROSTEUS ACULEATUS		0.00	0.04											0.32		0.07			
MERLANGIUS MERLANGUS					0.24							0.41							
PLATICHTHYS FLESUS				0.19	0.48		0.51												
SPRATTUS SPRATTUS	0.20	51.80	98.60	31.50	610.50	7.80	333.20	395.25	433.20	615.40	269.20	369.30	384.89	0.20	55.30	105.87	154.40	7.10	0.0
Total (kg)	11.23	52.52	101.21	31.72	614.87	8.26	336.37	400.22	436.88	617.98	271.02	377.40	385.42	0.83	56.53	106.13	155.22	7.20	0.1

station	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	3
sub-division	25	25	25	25	25	25	25	25	26	26	26	26	26	26	26	26	26	26	2
rectangle	41G6	40G7	39G7	39G7	39G7	39G7	40G7	41G7	41G8	41G8	40G8	39G8	39G8	39G8	40G8	40G8	41G8	41G8	43G
trawl_typ	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN20
cod_end	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm
trawl_time (min)	30	30	30	30	30	40	30	30	30	30	30	30	30	30	30	30	30	30	3
bottom_depth (m)	62.0	47.0	89.0	89.0	80.0	72.0	61.5	63.5	60.5	99.5	105.5	85.5	81.5	92.0	86.5	119.5	124.5	125.5	118.
mean_headline_depth (m)	42.0	29.0	29.0	29.0	59.0	49.0	38.0	40.0	38.0	68.0	73.0	63.0	62.0	65.0	60.0	90.0	94.0	68.0	77.
trawl_distance (n.mi.)	1.71	1.77	1.54	1.69	1.73	1.83	1.54	1.52	1.86	1.50	1.47	1.61	1.73	1.70	1.77	1.36	1.41	2.81	1.4
CLUPEA HARENGUS	0.27	0.65	0.01	0.33	0.99	4.70			1.81	3.41	1.17	1.81	2.46	2.82		0.26	0.28	1.00	4.1
CYCLOPTERUS LUMPUS																			
GADUS MORHUA				1.32	1.43	2.40			0.90	1.12	0.25	0.33	4.36			0.67	0.95	1.12	0.5
GASTEROSTEUS ACULEATUS	2.21	0.01	0.00				0.07	0.14	1.26	0.49		0.00					0.42	0.2	0.2
PLATICHTHYS FLESUS									0.26	2.05					0.58	0.27	1.76	3.75	2.1
SPRATTUS SPRATTUS	139.90	159.20	106.80	109.80	30.80	45.53		4.05	0.01	474.90	314.28	578.29	66.30	1.67	279.20	9.90	17.30	562.47	83.3
Total (kg)	142.37	159.86	106.81	111.45	33.22	52.62	0.07	4.19	3.08	479.96	318.62	580.35	69.08	8.85	279.78	11.09	20.72	568.35	90.3

station	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	5
sub-division	28	28	28	28	28	28	28	28	28	28	26	26	26	26	26	24	24	24	2
rectangle	43G9	44G9	44G9	44G9	45G9	45G9	45G9	43G9	42G8	42G9	41G8	41G8	41G8	41G8	41G8	38G3	41G4	38G3	38G
trawl_typ	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN20
cod_end	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	50 mm	50 mm	50 mm	50 mm	50 mm	20 mm	20 mm	20 mm	20 mm
trawl_time (min)	30	30	30	30	30	30	30	20	30	30	60	60	60	60	30	30	30	30	3
bottom_depth (m)	85.5	94.5	128.0	132.5	152.5	142.5	114.5	152.5	126.0	158.0	122.0	122.0	123.0	122.0	122.5	44.5	45.5	29.5	42.
mean_headline_depth (m)	62.5	69.0	77.0	78.0	74.0	74.0	74.0	72.0	75.0	75.0	100.0	100.0	100.0	100.0	80.0	28.0	8.0	9.5	24.
trawl_distance (n.mi.)	1.47	1.42	1.38	1.33	1.40	1.32	1.37	1.47	1.41	1.48	2.74	2.64	2.84	2.62	1.35	1.86	1.72	2.03	1.8
CLUPEA HARENGUS	11.27	6.17	11.25	8.68	49.25	16.22	13.31	7.19	14.00	2.38	0.07	0.11	0.12	0.07	3.56	457.25	25.89	2.85	8.4
GADUS MORHUA	0.21		2.02	0.63	1.17	0.51	0.25	3.71		0.35	10.78	10.00	4.32	4.01	3.81				1.0
GASTEROSTEUS ACULEATUS	3.85	0.70	0.26	0.93	2.16	0.76	1.27	0.07	0.83	0.05	0.00	0.01							
HYPEROPLUS LANCEOLATUS									0.20										
MERLANGIUS MERLANGUS																			0.0
PLATICHTHYS FLESUS	0.11	0.25	1.34	3.49	0.54	0.39	0.30	1.62	2.07	2.08	0.13	0.10	0.10		1.37				0.2
SALMO SALAR																	4.56		
SPRATTUS SPRATTUS	578.23	167.20	35.50	25.60	171.27	55.40	51.50	286.20	166.80	91.80	1.94	2.94	3.36	4.12	23.20	181.04	9.30	24.50	86.5
Total (kg)	593.67	174.33	50.37	39.33	224.39	73.28	66.63	298.78	183.90	96.66	12.91	13.17	7.89	8.21	31.94	638.30	39.75	27.35	96.3

station	58	59	60	62	63	64	65	66	67	68	69
sub-division	24	24	24	24	24	24	24	24	24	24	24
rectangle	39G3	38G3	38G3	38G3	38G3	38G3	38G3	38G3	38G3	38G3	38G2
trawl_typ	PSN205	PSN205	PSN205	bottom trawl 140'	bottom trawl	bottom trawl	bottom trawl	bottom trawl	bottom trawl	bottom trawl	bottom trawl
cod_end	20 mm	20 mm	20 mm	20 mm	20 mm	20 mm	20 mm	20 mm	20 mm	20 mm	20 mm
trawl_time (min)	30	30	30	30	30	30	30	30	30	30	30
bottom_depth (m)	40.0	46.5	42.0	19.0	22.0	32.5	26.5	39.0	30.5	25.0	22.0
mean_headline_depth (m)	40.0	46.5	26.0	19.0	17.0	27.5	26.5	39.0	30.5	25.0	22.0
trawl_distance (n.mi.)	2.11	1.90	1.78	2.10	2.00	1.96	2.04	2.00	2.13	2.09	2.03
AMMODYTES TOBIANUS				0.03							
CLUPEA HARENGUS	2.63	7.70	75.58		1.32	33.41	0.25	22.51	2.58	2.27	14.41
CYCLOPTERUS LUMPUS			0.01								0.28
GADUS MORHUA			0.49	1.29	14.86	56.33	43.04	17.78	9.63	7.19	2.60
HYPEROPLUS LANCEOLATUS		0.02		0.06		0.02	0.22		0.05	0.05	0.02
LIMANDA LIMANDA						0.46		1.42	0.56	1.43	3.01
MERLANGIUS MERLANGUS		0.64	19.00			136.00	1.19	20.86	35.64	22.58	1.80
MYOXOCEPHALUS SCORPIUS					0.29	0.25	0.27		0.23		
PLATICHTHYS FLESUS				3.88	7.81	23.60	7.24	11.67	2.98	2.40	2.94
PLEURONECTES PLATESSA				4.48	18.18	17.02	8.75	3.17	1.78	0.36	0.09
POMATOSCHISTUS MINUTUS				0.00							
SALMO TRUTTA					3.63						
SCOMBER SCOMBRUS							0.54				
SPRATTUS SPRATTUS	4.05	91.90	169.96	0.01	8.30	5.25		1.28			