

Cruise Report

FRV "Walther Herwig III", cruise no. 374 14.05. – 04.06.2014

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. 374 of FRV "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 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. The acoustic survey was accompanied by extensive hydrographic investigations.

Timing, survey area and the principal methods of investigations are internationally co-ordinated by the WGBIFS (ICES Baltic International Fish Survey Working Group). Germany covered the ICES-Subdivisions 24, 25, the western parts of Subdivisions 26 and 28 and one Rectangle of ICES-Subdivision 29 (Figure 1).

Verteiler:

BLE, Hamburg
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BMEL, Ref. 614
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TI, Verwaltung Hamburg
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TI, FIZ-Fischerei
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2 Narrative

The cruise started on 14 May and ended on 4th May in Bremerhaven. The scientific team embarked in Warnemünde on 15 May half a day behind schedule because of technical problems with the ship engine and disembarked on 2th June in the same harbour. The ship entered the port of Warnemünde at the 16th May for a half day again to solve problems with the ship's computer network. Seventeen days were utilized for fulfilling the survey purposes (calibration of the transducer, acoustic tracks, fishing hauls and hydrographical measurements). Additional 4 days were necessary for crossings between the home port Bremerhaven and the area of investigation.

Survey design

The investigation of FRV "Solea" covered the whole Subdivisions 24 and 25 as well the Polish and Swedish areas of Subdivision 26 and 28 Rectangle and 46G9 of ICES Subdivision 29 (Fig. 1).

The acoustic and ichthyological sampling stratification was based on ICES statistical rectangles. The size of these rectangles is 0.5 degrees 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 15 May in the coastal area of the Mecklenburg Bay. The calibration procedure was carried out as described in the 'Manual for International Baltic Acoustic Surveys (IBAS)' (ICES 2014).

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 were used in Subdivision 24 and 12 mm in Subdivision 25 to 28.

The trawling depth and the net opening were controlled by a Scanmar net probe. Generally a net opening of about 11 to 13 m was achieved. The trawl depth (headrope below the surface) on the fishing stations which ranged from 18 to 78 m was chosen in accordance to 'characteristic indications' of the echogram. At pelagic trawling positions the bottom depth varied from 32 to 213 m.

Samples were taken from each haul in order to determine the length and weight distribution of fish. Sub-samples of cod, 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. Detailed ichthyological analyses were made according to the standard procedure (i.e. sex, maturity, otolith dissection).

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

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.

Summarized activities during the survey:

Hydroacoustic transects	1445 nmi
pelagic trawl hauls valid/invalid	53/2
CTD vertical profiles	115
Water bottle samples for oxygen (Winkler titration) and for salinity determination	56

Presence of species in the hauls and number of investigated individuals

species	total of hauls with the species	total of length-measured individuals	total of detailed ichthyological analyses
CLUPEA HARENGUS	51	9734	967
CYCLOPTERUS LUMPUS	12	24	
GADUS MORHUA	25	467	386
GASTEROSTEUS ACULEATUS	11	577	
HYPEROPLUS LANCEOLATUS	4	162	
MERLANGIUS MERLANGUS	6	10	
MERLUCIUS MERLUCIUS	1	1	
MYXOCEPHALUS SCORPIUS	1	1	
PLATICHTHYS FLESUS	11	31	
SALMO SALAR	1	3	
SCOMBER SCOMBRUS	2	2	
SPRATTUS SPRATTUS	53	13144	600

The CPUE ranged from 6 to 3288 kg/0.5h. The mean CPUE amounted 436 kg/0.5h. Overall 12 fish species were recorded in 53 valid pelagic hauls.

The catch composition was dominated by sprat. Herring also occurred regularly in the trawl catches. Cod was present in 25 hauls. The biomass of species other than herring, sprat and cod was negligible.

The length distributions of sprat in Subdivision 25, 26 and 28 of the years 1999 and 2014 are presented in Figure 4. The contribution of the new incoming year-class (<10 cm) is very low especially in SD 25 and 26 and there are no indication for a new strong year class of sprat.

In spring sprat of the Baltic basins usually is concentrated below the halocline. This year sprats were distributed in the most parts of the investigated area in loose schools far above the halocline between 10 and 40 m water depth. The remaining little fish targets under the halocline contained significantly higher proportions of herring then in other years. Another remarkable finding was the increasing number small cod in the south-western Gotland Sea. The first indications of this trend could be seen already in the previous year.

Caused by a very mild winter the seawater temperature in the surface layer ranged with 7 °C to 11 °C about the usual temperature for this season (Fig. 5). Also the intermediate water layer about the halocline (old winter water) was characterized by exceptionally high temperature (4-5 °C). In "normal" years the temperature of this layer varied between 2 and 4 °C. It is known that water layers with a temperature < 3.5 °C delayed the migration of sprat in the upper water layer. The absence of this layer is probably the cause for the conspicuous vertical distribution of sprat in this year. The complete analysis of the acoustic data is still pending.

The oxygen content shows in the last three years a slightly increasing trend in the bottom near water of the Bornholm basin and south-western Gotland basin. Aerobic conditions were found in the bottom near water layer 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).

4 Personnel

Master: J. Vandrey

Scientific staff participating:

	Name	Institution	Task
1	Dr. U. Böttcher	TI-OF, Rostock	Cruise leader, hydrography, databases
2	M. Koth	TI-OF, Rostock	Fisheries biology
3	B. Stepputtis	TI-OF, Rostock	Fisheries biology
4	D. Stephan	TI-OF, Rostock	Fisheries biology
5	E. Bethke *	TI-SF, Hamburg	Acoustic
6	T. Kirchner	TI-SF, Hamburg	Acoustic
7	D. Schuschkow	Volunteer	Fisheries biology
8	P. Hilber	TI-OF, Rostock	Fisheries biology
9	R. Wildermuth	Volunteer	Fisheries biology
10	A. Schütze	Volunteer	Fisheries biology
11	L. Weirup	Volunteer	Fisheries biology
12	J. Friedl	Volunteer	Hydrography/databases

* only 15-16 May 2014

Uwe Böttcher

5 Figures and Tables

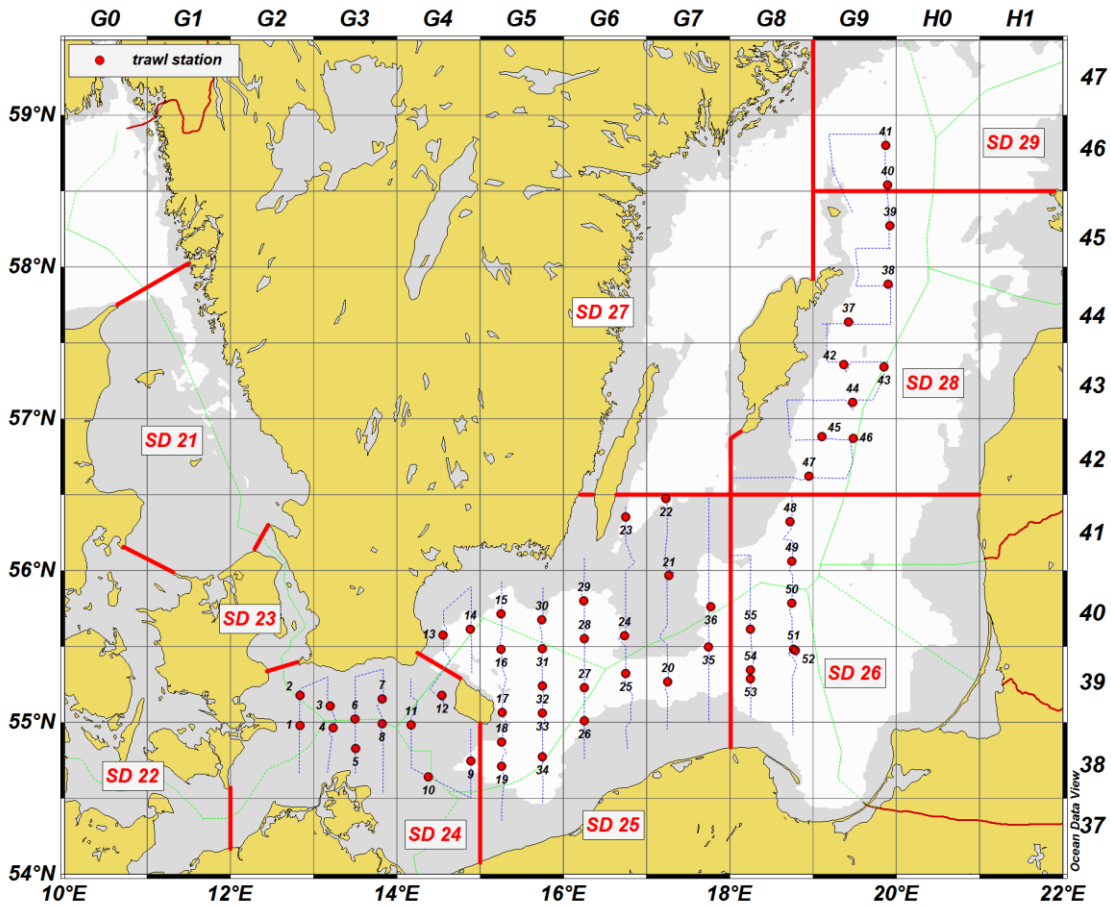


Figure 1: Hydroacoustic tracks, trawl stations and the position where the calibration was carried out (red square). Cruise No. 374 of FRV "W. Herwig", May 2014.

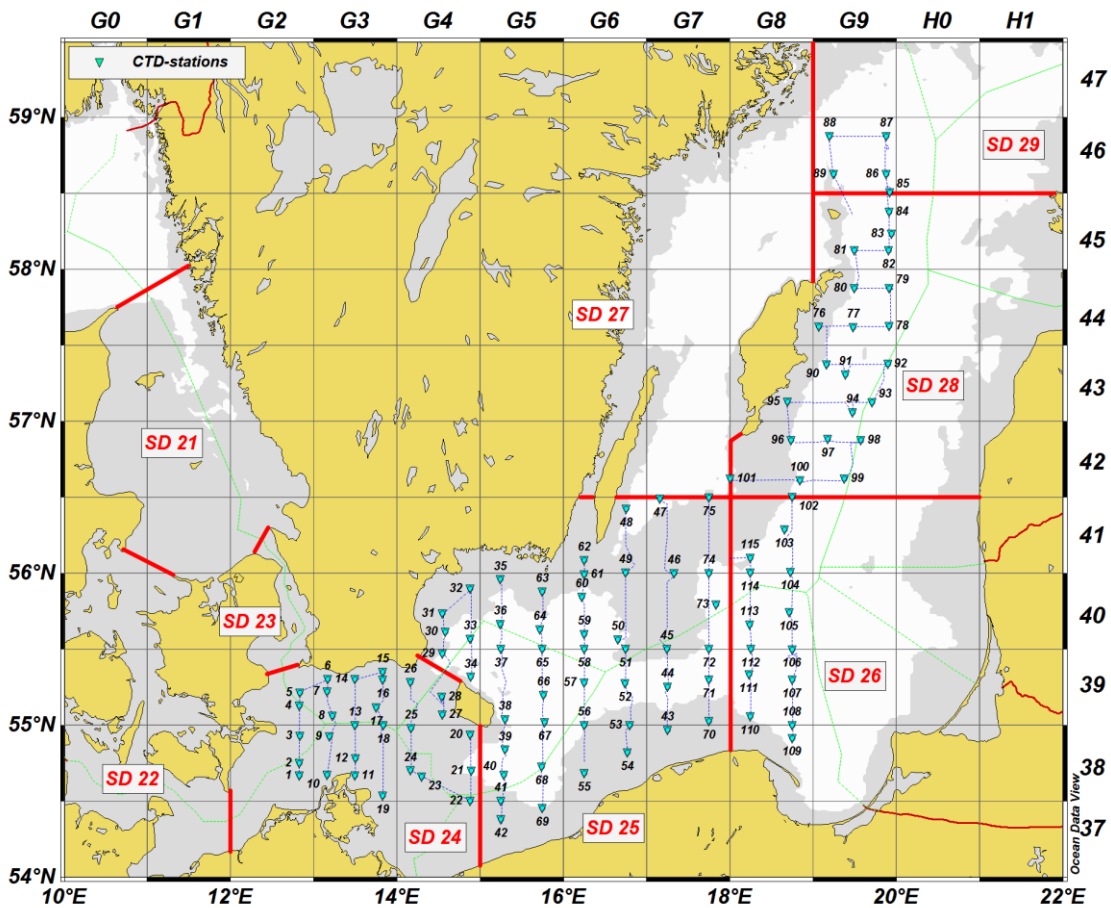


Figure 2: CTD-stations on the hydroacoustic transects. Cruise No. of FRV "W. Herwig", May 2014).

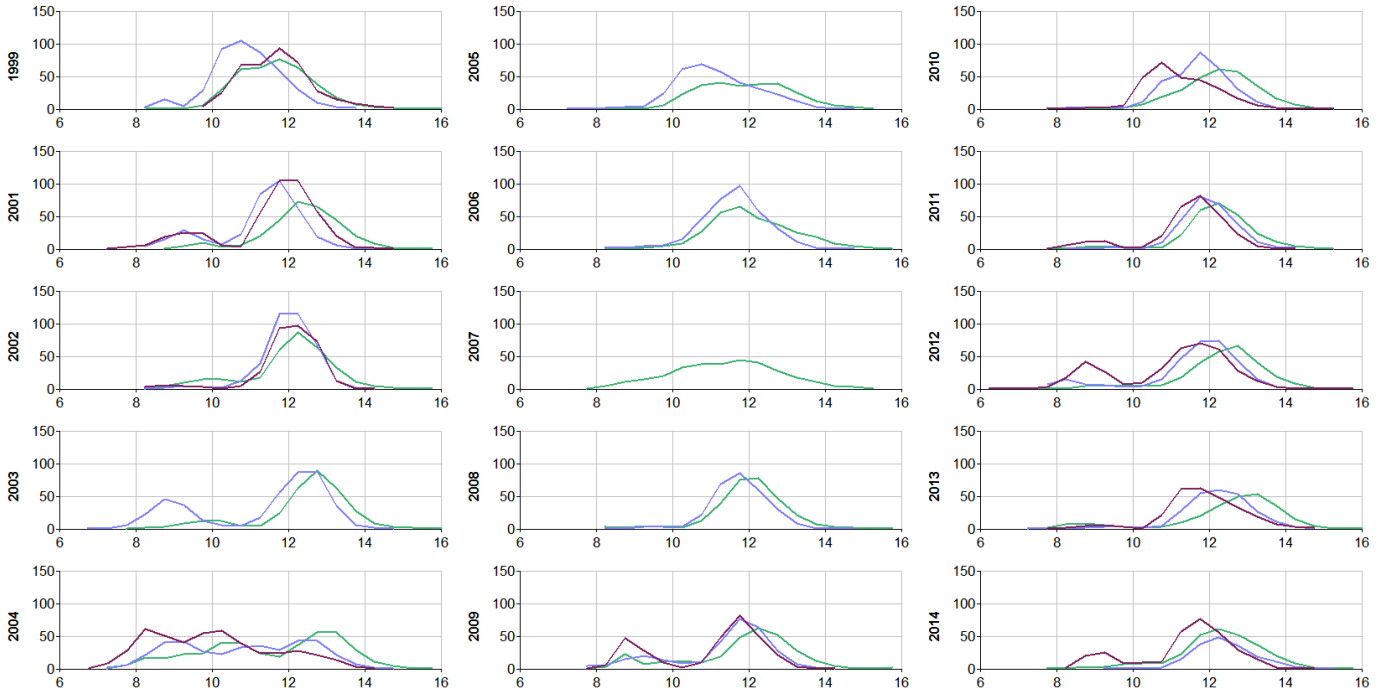


Figure 3: Length distribution of sprat (in numbers) in Subdivisions 25, 26 and 28 on May acoustic survey in 1999 to 2014.

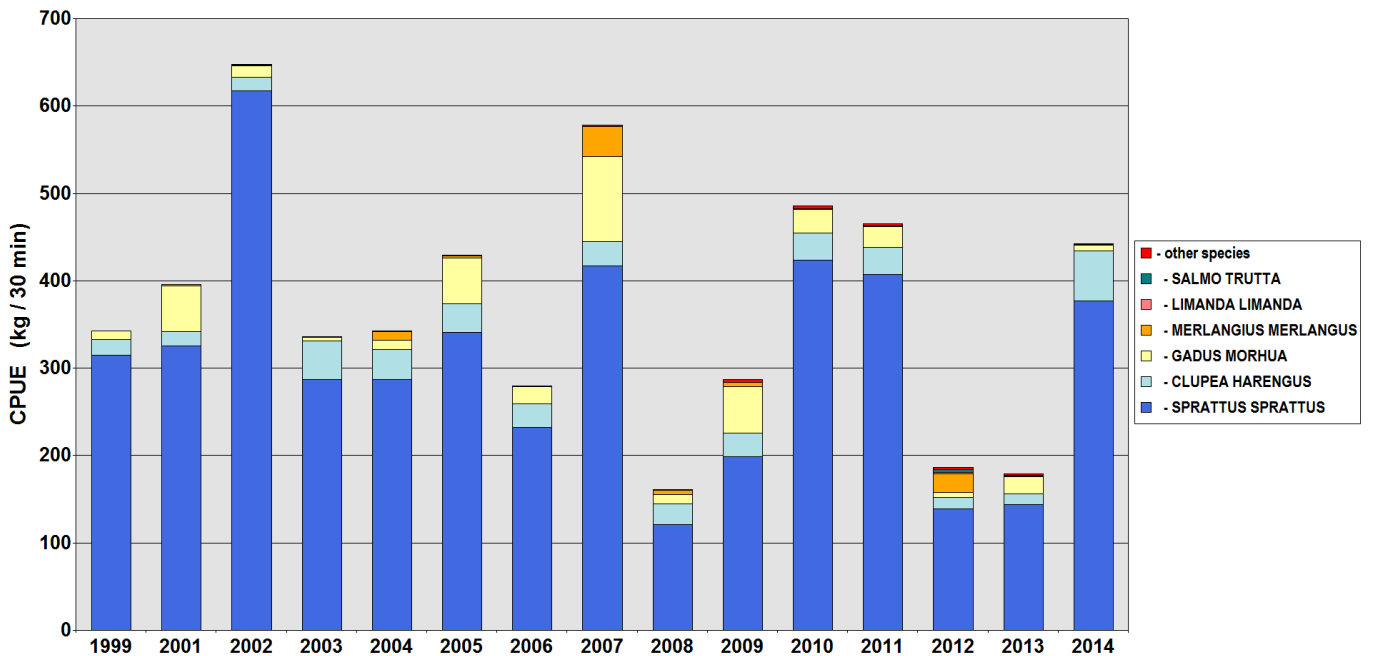


Fig. 4: CPUE (kg/0,5 hour) on the May acoustic survey in 1999 to 2014.

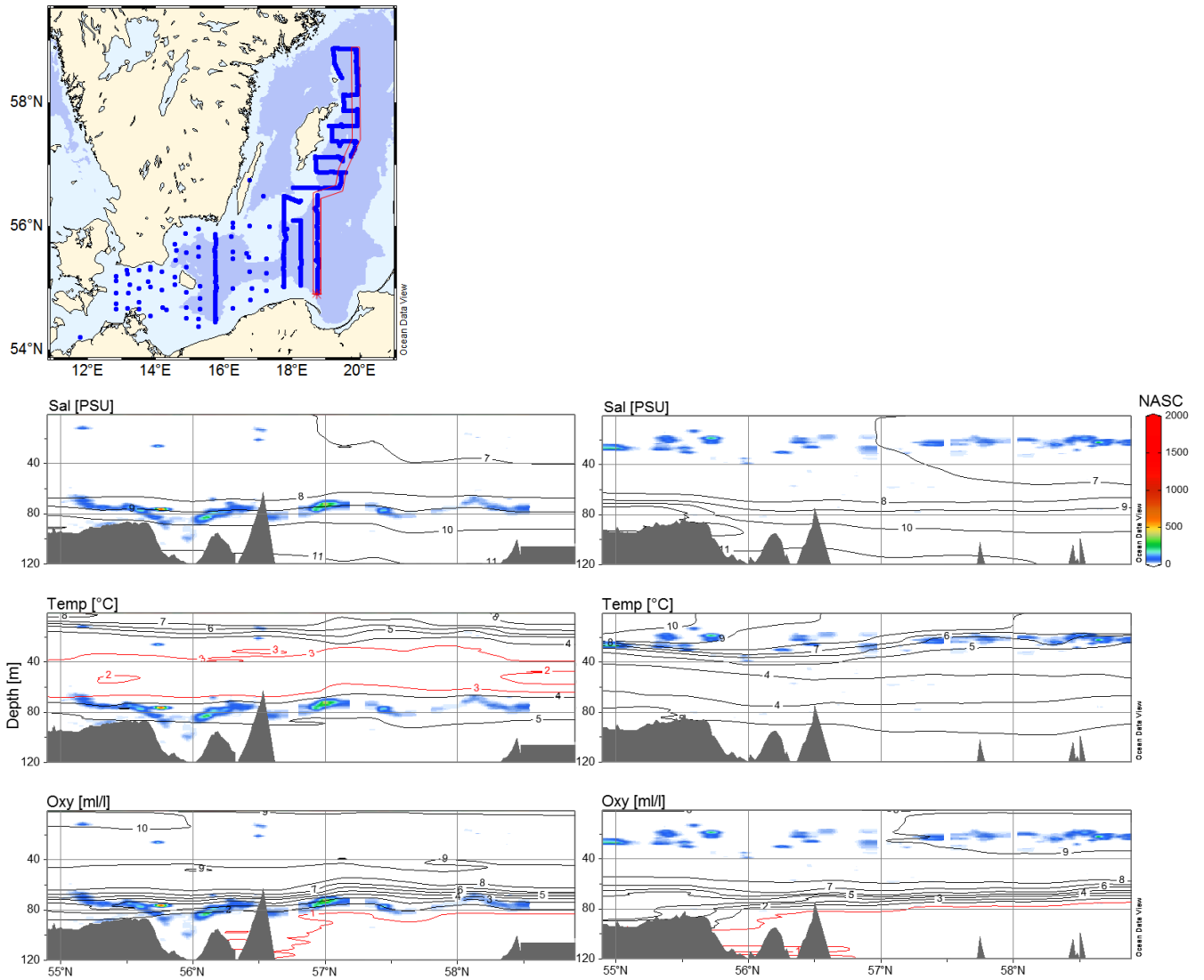


Figure 5: Vertical distribution of salinity, temperature and oxygen related to the echoes of fish (blue clouds) on a transect from south to north through the Gotland sea in 2013 (left) and 2014 (right)

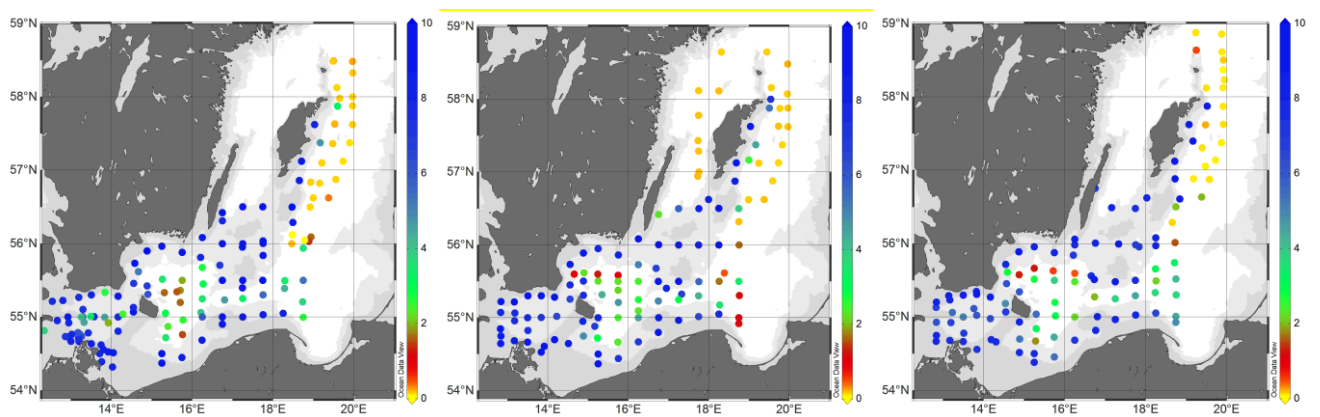


Figure 6: Oxygen content in the bottom-near water on the CTD-stations in 2012 (left) 2013 (mid) and 2014 (right).

Table 1: Catch composition (kg/0.5 h) per fishing haul (Cruise No. 628 of FRV "SOLEA", May 2013)

station	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	25	26	27	28	29
ICES-subdivision	24	24	24	24	24	24	24	24	24	24	24	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
rectangle	39G2	39G3	38G3	38G3	39G3	39G3	38G3	38G4	38G4	38G4	39G4	40G4	40G4	40G5	39G5	39G5	38G5	38G5	39G7	40G7	41G7	41G6	39G6	39G6	39G6	40G6	40G6
trawl-type																											
# cod-end	10	10	10	10	10	10	10	10	10	10	10	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
haul	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	25	26	27	28	29
trawl-time	30	30	30	30	30	30	30	30	30	31	31	30	30	30	20	20	30	30	20	30	30	30	30	30	30	30	30
bottom-depth	32.5	41	46.5	45	45.5	45.5	48	57.5	32.5	44	45.5	61.5	78	64	86	70.5	70.5	64.5	82	44.5	51	62	72.5	68	75	74.5	58
mean-headlineDepth	18	20	30	30	30	30	30	41	15	30	34	50	60	50	71	50	50.5	51	61	25	10.5	45	53	56	56	59	43
trawl-distance	2.31	2.35	2.30	2.28	2.14	2.30	2.05	2.03	2.21	2.16	2.22	2.08	2.07	2.06	1.30	1.26	1.93	2.03	2.29	2.15	2.11	2.05	2.04	1.98	2.11	1.96	2.01
CLUPEA HARENGUS	52.00	6.26	205.61	26.80	49.30	30.20	132.38	0.90	35.35	13.00	18.08	33.24	160.45	33.55	3.66	3.00	12.59	68.32		0.05	1.36	32.38	940.45	83.24	128.03	84.97	
CYCLOPTERUS LUMPUS	0.28			0.90	1.07		0.98				0.52				0.55								0.80			0.22	
GADUS MORHUA							0.32				0.33	0.96	28.84	0.78			0.42	2.62	3.99			0.92	1.62		8.38		
GASTEROSTEUS ACULEATUS																						0.03					
HYPEROPLUS LANCEOLATUS	3.38										0.08																
MERLANGIUS MERLANGUS			0.07	0.28	1.54						0.87												0.13				
MERLUCCIIUS MERLUCCIIUS																											
MYOXOCEPHALUS SCORPIUS																											
PLATICHTHYS FLESUS																											
SALMO SALAR									3.99																		
SCOMBER SCOMBRUS				1.11						0.59																	
SPRATTUS SPRATTUS	0.15	0.04	65.64	43.02	20.20	14.10	223.52	167.20	409.54	79.55	51.81	91.56	2 794.12	464.95	2 597.99	1634.37	277.22	267.32	700.19	341.35	41.20	1317.16	363.15	345.87	410.25	1061.65	392.36
total	55.81	6.30	271.32	72.10	72.11	44.30	357.20	168.10	448.88	94.08	70.75	125.76	2 983.41	499.28	2 602.20	1637.37	290.23	338.26	704.17	341.35	41.25	1318.54	396.58	1288.74	493.49	1 198.06	477.55

station	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
ICES-subdivision	25	25	25	25	25	25	25	28	28	28	29	29	28	28	28	28	28	28	26	26	26	26	26	26	26	26
rectangle	40G5	39G5	39G5	39G5	38G5	39G7	40G7	44G9	44G9	45G9	46G9	46G9	43G9	43G9	43G9	42G9	42G9	42G8	41G8	41G8	40G8	39G8	39G8	39G8	39G8	40G8
trawl-type													PSN205													
# cod-end	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
haul	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
trawl-time	30	20	30	30	30	30	30	30	30	40	40	40	30	30	30	30	40	30	30	30	30	30	30	30	30	30
bottom-depth	67	85	95.5	86.5	69.5	70	58.5	89.5	136.5	156	140	149	135	213	180.5	161	149	107.5	119.5	115.5	105	87.5	86	74	83.5	87
mean-headlineDepth	52	42	82	70	55	53	42	20	26	20	20	17.5	70	70	20	75	20	70	75	78	78	68	55	30	63	30
trawl-distance	2.07	1.34	1.86	1.97	2.12	2.04	2.01	1.60	1.40	1.75	1.56	1.29	1.89	2.03	2.00	1.90	2.65	1.97	1.97	1.94	1.73	1.85	2.02	1.95	1.98	2.03
CLUPEA HARENGUS	6.59	3.05	83.74	66.37	71.26	12.45	0.31	4.35	0.91	4.23	2.71	33.68	84.98	5.25	0.48	9.08	26.16	11.23	18.36	6.18	12.78	28.82	0.87	0.67	299.80	0.05
CYCLOPTERUS LUMPUS								1.09		0.10			0.20	0.12												
GADUS MORHUA			32.74	10.75		0.31							1.44	1.33		5.06	8.56	5.60	4.81	20.59	4.10	11.47	4.77		1.29	
GASTEROSTEUS ACULEATUS								0.18	0.15	0.43	0.62	1.17	0.00	0.01	0.02				0.01	0.00						
HYPEROPLUS LANCEOLATUS								0.03														0.46				
MERLANGIUS MERLANGUS				0.10																						
MERLUCCIIUS MERLUCCIIUS			0.45																							
MYOXOCEPHALUS SCORPIUS											0.17															
PLATICHTHYS FLESUS			0.30							0.21			0.48	0.68			0.18	0.10	0.98	0.89		0.11		0.27	0.12	
SALMO SALAR																										
SCOMBER SCOMBRUS																										
SPRATTUS SPRATTUS	146.31	3 254.60	248.80	777.94	92.15	1.67	19.76	145.28	20.20	34.76	45.90	128.66	21.72	17.50	225.86	16.80	0.86	45.14	0.09	0.01	4.90	4.11	27.60	342.58	25.22	138.40
total	152.90	3 257.65	366.02	855.16	163.41	14.42	20.07	160.92	21.26	39.73	49.40	163.51	108.82	24.88	226.36	30.93	35.76	62.06	24.25	27.66	21.79	44.97	33.24	343.52	326.43	138.45