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Cruise Report

International Acoustic Survey for Pelagic Fish Stocks in the North Sea

FRV "SOLEA"
25.06. - 15.07.2014
Cruise No. 690

Participants:

Eckhard Bethke (cruise leader)	Hydroacoustics	Inst. of Sea Fisheries (SF)
Farzaneh Kazemi	Hydroacoustics	SF / student assistant
Norbert Rohlf	Biology	SF
Jörg Appel	Biology	SF
Gitta Hemken	Biology	SF
Svenja Zakrzewski	Biology	SF / student assistant

Objective

The 690th survey of the FRV "Solea" was conducted in the framework of the international hydroacoustic survey on pelagic fish in the North Sea, which is co-ordinated by the ICES Planning Group for Herring Surveys (WGIPS). The main objective was to assess clupeoid resources, mainly herring and sprat, in the North Sea.
The reported acoustic survey is conducted every year to supply to ICES the most important fishery independent data (i.e. biomass estimate) for the assessment of herring and sprat stocks in the area.

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Narrative

We left the port of Cuxhaven at the 25th June 2014. The investigation area covered the southern part of the North Sea from 52°N to 56°N. The acoustic survey was performed during day time. The acoustic equipment was an echosounder EK60 working on 38 kHz and 120 kHz. The hull mounted 38 kHz-transducer and the 120 kHz-transducer was calibrated in the open sea close to the Danish coast at a distance between transducer and calibration sphere of between 14.30 and 18.30 m. The echo integration, i.e. the allocation of the area backscattering strength, s_A, to the species was done by the post-processing system EchoView. The specific settings of the hydroacoustic equipment were used as described in the 'Manual for Herring Acoustic Surveys in ICES Divisions III, IV and VI' (ICES C.M. 2005/G:04, Annex 4).
Pelagic trawl hauls were carried out to identify the target species. From each haul, sub-samples were taken to determine length and weight of fish. Further sub-samples of herring and sprat were examined for sex, maturity and age. After each 30 NM sailed, hydrographical conditions were investigated with a CTD probe. The survey ended on 15th July 2014 in Cuxhaven.

Biological sampling (N. Rohlf)

Altogether, 42 fishery hauls were conducted with a PSN 388 "Krake" pelagic trawl. Trawl duration varied between 10 and 30 minutes, but usually was set to 30 minutes. Fishery hauls were conducted according to echo signals. Additionally, exclusion/validation hauls were shot in areas with echo signals of unclear origin. The positions of all hauls are depicted in Fig. 1. Altogether, fisheries operations were conducted in 26 ICES statistical rectangles (as compared to 23 in the previous survey). Catches were sorted according to species, and length- and weight-distributions of individual species were measured. Of all clupeids (herring, sprat, anchovies), 12 individuals per 0.5 cm length-class were sampled per rectangle. Their individual weight, sex and maturity stage was determined and the otoliths were sampled to enable age estimation. In total, these samples were taken from 4365 individual fishes.

Altogether, 25 different fish species were caught during the survey. A detailed overview on catch composition (CPUE in kg $30min^{-1}$) of all 42 trawl hauls conducted is given in Tab. 1. As in the previous years, sprat showed the highest presence (present in all 42 hauls) and contributed the bulk of biomass of total catch weight (14.4 t, i. e. 81 %). Herring were caught in 40 out of 42 hauls. In addition, whiting were present in 35 hauls and seemed to be much more abundant as in previous years, especially fishes in the size range of 6 and 7 cm. However, catches alone are not representative for abundance of small pelagics. Detailed conclusions on abundance cannot be given until echo integration is accomplished and trawl haul and hydro acoustic data are combined.

A detailed overview on numbers, weights and mean lengths of herrings, sprat and anchovies sampled is given in Tab. 2, together with their proportion of the total catch. Figure 3 - 5 shows length distributions of these species as derived from total catches. Herring lengths ranged from 5 to 24.5 cm. As in previous years, the distribution was dominated by young herring around 8 to 9.5 cm. Sprat lengths ranged from 3.5 to 19.5 cm. Anchovies were present in only a limited number of trawls. No sardines were caught in the survey 2014.

Results

The measured cruise track (Figures 1 and 2) reached in total a length of 2109 nautical miles. 42 trawl hauls were carried out and hydrographical parameters were measured on 62 stations. The surface temperatures were in the typical range between 12 °C and 19 °C

(see Figure 6), with the usual increase in temperature in the coastal area of the German Bight. Close to the channel the body of water was mixed from the bottom to the surface.

Abundance estimates of the pelagic fish species will be presented after further analysis of the data in combining s_A values, and species and size distribution of the fish on ICES statistical rectangle basis.

Eckhard Bethke
(cruise leader)

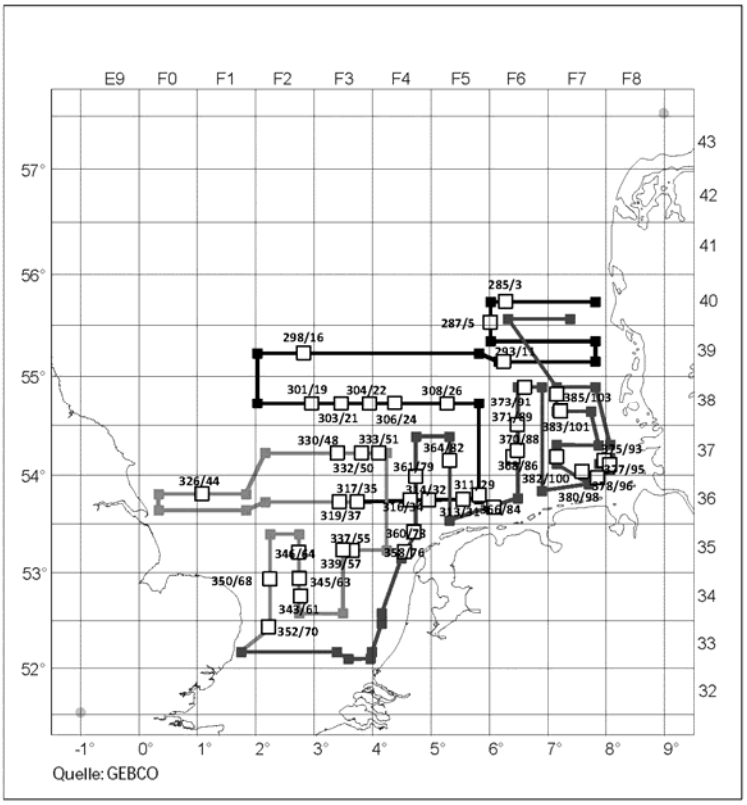

Figure 1: 690. Cruise of FRV “Solea“ – cruise track and fishery stations

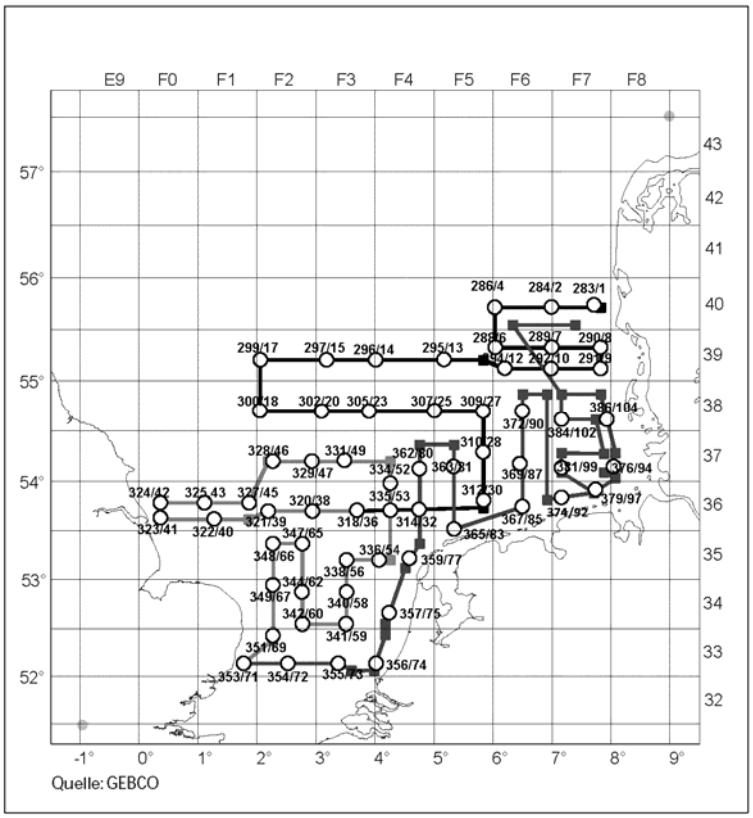

Figure 2: 690. Cruise of FRV “Solea“– Hydrographical stations.

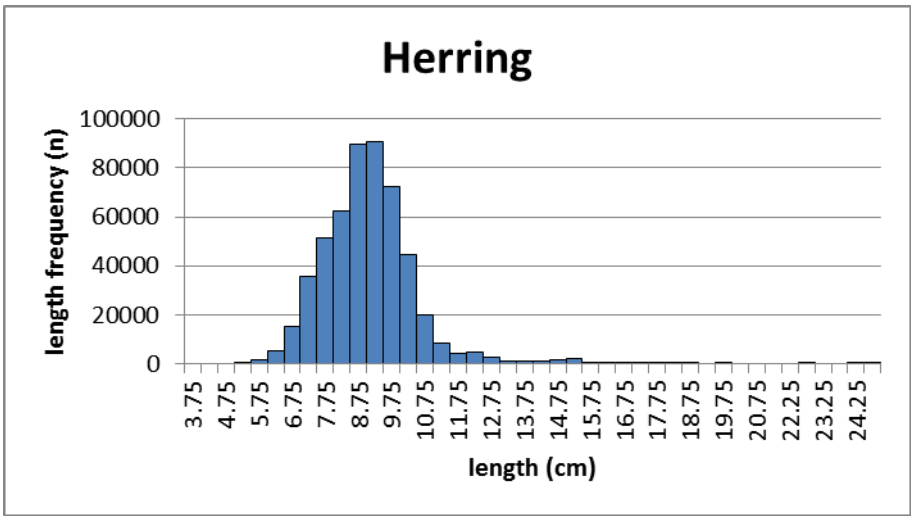

Fig. 3: Herring (*Clupea harengus*) length-frequency distribution FRV "Solea" cruise 690.

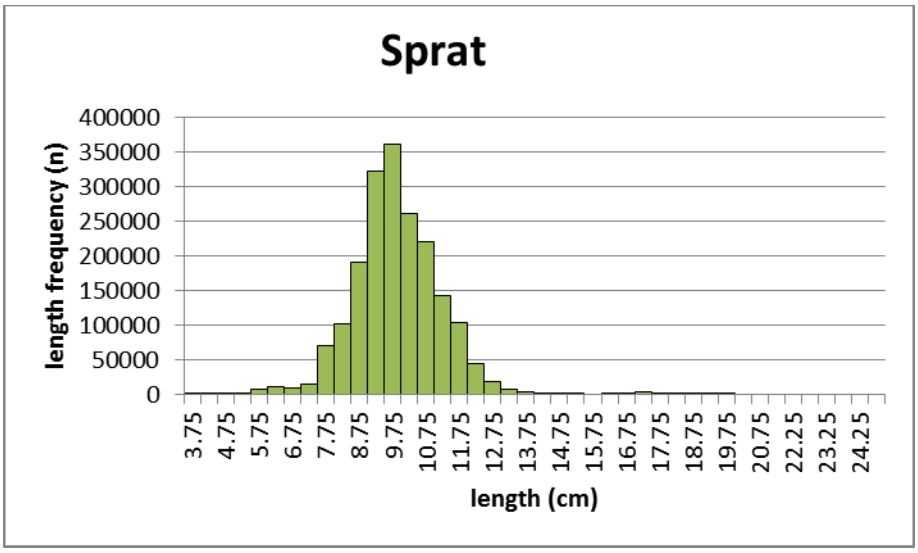

Fig. 4: Sprat (*Sprattus sprattus*) length-frequency distribution FRV "Solea" cruise 690.

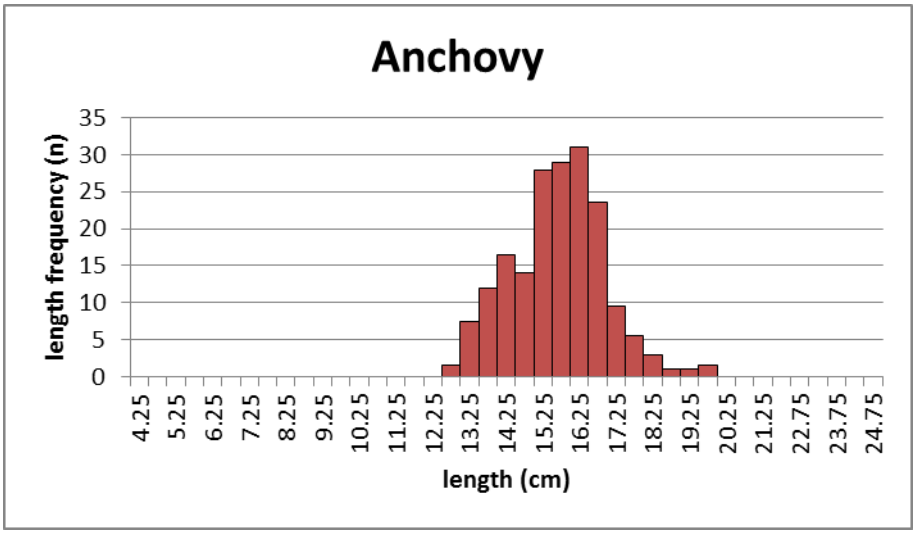

Fig. 5: Anchovies (*Engraulis encrasicolus*) length-frequency distribution FRV "Solea" cruise 690

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Tab. 1: Catch composition (CPUE in kg) FRV "Solea" cruise 690 (normalized to 30 minutes trawl duration).

RECTANGLE	STATION	Total (kg)	*AMMODYTES MARINUS*	*BUGLOSSIDIUM LUTEUM*	*CALLIONYMUS LYRA*	*CLUPEA HARENGUS*	*ECHIICHTHYS VIPERA*	*ENGRAULIS ENCRASICOLUS*	*EUTRIGLA GURNARDUS*	*GADUS MORHUA*	*GOBIIDAE*	*HYPEROPLUS IMMACULATUS*	*HYPEROPLUS LANCEOLATUS*	*LAMPETRA FLUVIATILIS*
40F6	285	245				109.5			1.6					
40F6	287	929				755.5			3.5				0.1	
39F6	293	947				116.6			1.0					
39F2	298	149				1.2			6.0				0.1	
38F2	301	437				0.5			10.1				0.1	
38F3	303	205				25.5			1.2					
38F3	304	49				17.3			2.1					
38F4	306	179				93.9			1.0					
38F5	308	95				83.5			0.3					
36F5	311	210				90.9		2.3	0.2					
36F5	313	237			0.04	60.3			0.4					
36F4	314	223				64.5			0.1					
36F4	316	74				53.6								
36F3	317	117				27.3							0.0	
36F3	319	1316				581.3								
36F1	326	106	0.1			0.1	1.8		1.5			0.0	47.0	
37F3	330	13				0.0			1.2				6.4	
37F3	332	4				0.2			0.8					
37F4	333	101				70.8			0.6					
35F3	337	178					0.2		0.1				0.2	
35F3	339	1170				0.1			0.5				0.1	
34F2	343	118				34.0							0.1	
34F2	345	1192				11.7	0.5		1.4				0.1	
35F2	346	145				0.9								
34F2	350	1254				98.6	1.8						1.7	
33F2	352	678				10.9	1.2				0.0			
35F4	358	213				0.8							0.6	
35F4	360	14	0.6				0.0					0.0	6.8	
37F4	361	86				39.0			0.4		0.0			
37F5	364	151				60.2	0.0		1.2					
36F6	366	236				1.0		2.5					0.1	
37F6	368	522				49.2			0.2					
37F6	370	542			0.04	62.8			0.5					
38F6	371	11				4.7			0.7					
38F6	373	312		0.03		39.5			3.3					
37F8	375	404				5.2							0.2	
37F8	377	386				5.2				0.01	0.0			
36F7	378	1245				57.2		0.1						0.2
37F7	380	571				18.0			2.2					
37F7	382	743				25.1			0.5				0.1	
38F7	383	249	0.1			14.7			0.7				4.5	
38F7	385	1717				148.4			1.0				0.1	
total (kg)		**17769.5**	0.8	0.03	0.1	2840.0	5.6	4.9	44.1	0.01	0.01	0.1	68.1	0.2
proportion (%)			0.0	0.0	0.0	16.0	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.0
number of catches			3	1	2	40	7	3	29	1	3	2	18	1
presence (%)			7	2	5	95	17	7	69	2	7	5	43	2

Tab. 1 continued: Catch composition (CPUE in kg) FRV "Solea" cruise 690 (normalized to 30 minutes trawl duration).

RECTANGLE	STATION	Total (kg)	*MELANOGRAMMUS AEGLEFINUS*	*MERLANGIUS MERLANGUS*	*MERLUCCIUS MERLUCCIUS*	*MICROSTOMUS KITT*	*MULLUS SURMULETUS*	*PLEURONECTES PLATESSA*	*RAJA MONTAGUI*	*SCOMBER SCOMBRUS*	*SPRATTUS SPRATTUS*	*SYNGNATHUS ROSTELLATUS*	*TRACHURUS TRACHURUS*	*TRIGLA LUCERNA*	Number of species
40F6	285	245		0.1	1.4						132.8				3
40F6	287	929		0.1				0.7			169.1				3
39F6	293	947		0.0							829.4				2
39F2	298	149	0.0	139.0		0.2		0.5			1.6				5
38F2	301	437		2.3							422.7				2
38F3	303	205		0.1							177.5				2
38F3	304	49		0.6				0.8		0.2	27.2				4
38F4	306	179		0.0							84.3				2
38F5	308	95		0.1							10.9				2
36F5	311	210		0.6						0.9	112.1		0.8		4
36F5	313	237				0.1					173.7				2
36F4	314	223								14.5	143.5				2
36F4	316	74								0.5	20.0				2
36F3	317	117		0.4							88.3				2
36F3	319	1316		1.0							732.9				2
36F1	326	106		1.0				0.5			53.1		0.2		4
37F3	330	13		0.4							4.6				2
37F3	332	4		0.7				0.2		1.2	0.7				4
37F4	333	101		0.3						0.2	29.4				3
35F3	337	178		0.7				0.1		4.0	172.2				4
35F3	339	1170		0.0						12.9	1156.0				3
34F2	343	118		0.0							83.7				2
34F2	345	1192		2.4				0.8	1.6		1171.5				4
35F2	346	145		0.0							144.4				2
34F2	350	1254		0.3						0.9	1150.5				3
33F2	352	678		0.0							665.9				2
35F4	358	213								0.6	210.7	0.0	0.0		4
35F4	360	14								0.5	4.9	0.0	0.0		4
37F4	361	86		0.2							45.9				2
37F5	364	151		0.6							87.5				2
36F6	366	236								0.8	231.8	0.0	0.1		4
37F6	368	522		0.0						1.9	470.8				3
37F6	370	542		29.2			0.1	0.4			422.8		0.2	0.7	6
38F6	371	11		0.1						0.6	4.5				3
38F6	373	312		0.1				0.6			266.5				3
37F8	375	404		0.2							398.3	0.0			3
37F8	377	386		24.7							355.7	0.0			3
36F7	378	1245		0.1							1187.8				2
37F7	380	571		87.2						5.5	457.2				3
37F7	382	743		16.7							699.4				2
38F7	383	249									227.5				1
38F7	385	1717		0.4							1565.5				2
total (kg)		**17769.5**	0.04	309.5	1.4	0.3	0.1	4.6	1.6	45.3	14394.9	0.02	1.3	0.7	
proportion (%)			0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.3	81.0	0.0	0.0	0.0	
number of catches			1	35	1	2	1	9	1	15	42	5	6	1	
presence (%)			2	83	2	5	2	21	2	36	100	12	14	2	

Tab.2a: Numbers, weights and mean lengths of **herring** (*Clupea harengus*) and according proportion of total clupeid catch (normalized to 30 minutes tow duration)

			total	clupeid	clupeid	herring					herring
			catch	catch	portion	catch	count	range (cm)			(%
Haul	Rect.	Stat.	(kg)	(kg)	(%)	(kg)	(n)	min	max	mean	clups)
1	40F6	285	245	242	99%	109.5	295	6.75	16.75	9.7	45%
2	40F6	287	929	925	100%	755.5	114494	6.75	24.75	9.3	82%
3	39F6	293	947	946	100%	116.6	302	6.75	14.75	9.3	12%
4	39F2	298	149	3	2%	1.2	66	7.75	17.25	10.3	44%
5	38F2	301	437	423	97%	0.5	20	6.75	15.75	10.5	0%
6	38F3	303	205	203	99%	25.5	360	6.75	24.25	8.9	13%
7	38F3	304	49	45	91%	17.3	257	6.25	17.25	8.8	39%
8	38F4	306	179	178	99%	93.9	300	5.25	15.75	7.8	53%
9	38F5	308	95	94	99%	83.5	326	6.75	18.25	14.0	88%
10	36F5	311	210	205	98%	90.9	242	11.25	15.25	13.0	44%
11	36F5	313	237	234	99%	60.3	175	10.75	16.25	12.0	26%
12	36F4	314	223	208	93%	64.5	213	5.75	10.25	8.0	31%
13	36F4	316	74	74	99%	53.6	17739	6.25	17.75	7.8	73%
14	36F3	317	117	116	99%	27.3	7499	5.75	19.75	8.4	24%
15	36F3	319	1316	1314	100%	581.3	40468	6.75	16.25	9.0	44%
16	36F1	326	106	53	50%	0.1	4	9.25	18.75	13.3	0%
17	37F3	330	13	5	37%	0.0	1	9.75	9.75	9.8	0%
18	37F3	332	4	1	22%	0.2	8	14.75	16.75	15.3	23%
19	37F4	333	101	100	99%	70.8	16897	5.75	16.75	7.6	71%
21	35F3	339	1170	1156	99%	0.1	1	17.25	17.25	17.3	0%
22	34F2	343	118	118	100%	34.0	242	8.75	17.25	10.7	29%
23	34F2	345	1192	1183	99%	11.7	2333	6.25	14.25	7.6	1%
24	35F2	346	145	145	100%	0.9	66	8.25	16.25	9.2	1%
25	34F2	350	1254	1249	100%	98.6	7701	7.25	17.25	9.6	8%
26	33F2	352	678	677	100%	10.9	45	7.75	16.25	10.8	2%
27	35F4	358	213	212	99%	0.8	26	10.25	17.75	15.5	0%
29	37F4	361	86	85	99%	39.0	7379	6.25	17.25	9.1	46%
30	37F5	364	151	148	98%	60.2	7054	5.25	17.75	8.5	41%
31	36F6	366	236	235	100%	1.0	22	7.25	10.75	9.6	0%
32	37F6	368	522	520	100%	49.2	182	7.25	12.25	10.0	9%
33	37F6	370	542	486	90%	62.8	144	7.25	15.25	9.6	13%
34	38F6	371	11	9	88%	4.7	247	9.25	12.75	11.0	51%
35	38F6	373	312	306	98%	39.5	146	7.75	16.25	10.6	13%
36	37F8	375	404	404	100%	5.2	83	8.75	12.75	10.0	1%
37	37F8	377	386	361	94%	5.2	307	8.75	18.75	9.6	1%
38	36F7	378	1245	1245	100%	57.2	121	6.75	13.25	7.8	5%
39	37F7	380	571	475	83%	18.0	61	7.75	12.25	9.6	4%
40	37F7	382	743	725	98%	25.1	98	7.75	12.25	9.9	3%
41	38F7	383	249	242	97%	14.7	147	9.25	15.25	10.6	6%
42	38F7	385	1717	1714	100%	148.4	165	9.25	14.25	10.5	9%

Tab.2b: Numbers, weights and mean lengths of **sprat** (*Sprattus sprattus*) and according proportion of total clupeid catch (normalized to 30 minutes tow duration)

			total	clupeid	clupeid	sprat					sprat
			catch	catch	portion	catch	count	range (cm)			(%
Haul	Rect.	Stat.	(kg)	(kg)	(%)	(kg)	(n)	min	max	mean	clups)
1	40F6	285	245	242	99%	132.8	218	9.75	12.75	11.1	55%
2	40F6	287	929	925	100%	169.1	210	8.25	11.75	10.1	18%
3	39F6	293	947	946	100%	829.4	244	8.25	13.25	10.8	88%
4	39F2	298	149	3	2%	1.6	64	10.75	13.75	11.9	56%
5	38F2	301	437	423	97%	422.7	242	8.75	12.75	11.2	100%
6	38F3	303	205	203	99%	177.5	312	8.75	15.25	9.9	87%
7	38F3	304	49	45	91%	27.2	211	8.75	14.25	10.4	61%
8	38F4	306	179	178	99%	84.3	280	8.25	12.75	10.4	47%
9	38F5	308	95	94	99%	10.9	124	7.75	13.75	10.1	12%
10	36F5	311	210	205	98%	112.1	180	9.25	14.25	12.1	55%
11	36F5	313	237	234	99%	173.7	192	16.25	19.75	17.7	74%
12	36F4	314	223	208	93%	143.5	271	5.75	11.75	9.0	69%
13	36F4	316	74	74	99%	20.0	12196	5.25	13.75	6.3	27%
14	36F3	317	117	116	99%	88.3	318	5.75	13.75	9.3	76%
15	36F3	319	1316	1314	100%	732.9	158	8.75	12.25	10.1	56%
16	36F1	326	106	53	50%	53.1	287	9.75	13.75	11.7	100%
17	37F3	330	13	5	37%	4.6	238	3.75	13.25	11.0	100%
18	37F3	332	4	1	22%	0.7	55	7.25	14.25	11.9	77%
19	37F4	333	101	100	99%	29.4	257	4.75	12.25	7.5	29%
20	35F3	337	178	172	97%	172.2	256	10.25	14.75	12.9	100%
21	35F3	339	1170	1156	99%	1156.0	310	10.75	13.75	11.8	100%
22	34F2	343	118	118	100%	83.7	229	9.75	12.75	11.2	71%
23	34F2	345	1192	1183	99%	1171.5	263	6.75	15.25	8.5	99%
24	35F2	346	145	145	100%	144.4	238	7.75	11.75	9.2	99%
25	34F2	350	1254	1249	100%	1150.5	217	8.75	12.25	10.4	92%
26	33F2	352	678	677	100%	665.9	214	9.25	13.75	10.9	98%
27	35F4	358	213	212	99%	210.7	242	11.25	14.25	12.4	100%
28	35F4	360	14	5	36%	4.9	352	9.25	14.25	12.2	100%
29	37F4	361	86	85	99%	45.9	269	5.25	12.75	9.5	54%
30	37F5	364	151	148	98%	87.5	224	4.75	14.25	9.0	59%
31	36F6	366	236	235	100%	231.8	230	6.75	12.75	9.3	98%
32	37F6	368	522	520	100%	470.8	241	8.75	11.75	10.3	91%
33	37F6	370	542	486	90%	422.8	172	7.75	11.25	9.1	87%
34	38F6	371	11	9	88%	4.5	205	8.75	13.25	10.5	49%
35	38F6	373	312	306	98%	266.5	214	8.25	12.25	10.3	87%
36	37F8	375	404	404	100%	398.3	191	9.25	11.25	9.8	99%
37	37F8	377	386	361	94%	355.7	245	8.25	10.75	9.4	99%
38	36F7	378	1245	1245	100%	1187.8	169	6.75	10.25	9.1	95%
39	37F7	380	571	475	83%	457.2	142	8.25	12.25	9.4	96%
40	37F7	382	743	725	98%	699.4	149	9.25	13.75	9.9	97%

Tab.2b continued: Numbers, weights and mean lengths of **sprat** (*Sprattus sprattus*) and according proportion of total clupeid catch (normalized to 30 minutes tow duration)

41	38F7	383	249	242	97%	227.5	218	9.25	12.25	10.4	94%
42	38F7	385	1717	1714	100%	1565.5	251	9.25	13.75	10.4	91%

Tab.2c: Numbers, weights and mean lengths of **anchovy** (*Engraulis encrasicolus*) and according proportion of total clupeid catch (normalized to 30 minutes tow duration)

			total	clupeid	clupeid	anchovies					anchovies
			catch	catch	portion	catch	count	range (cm)			(%
Haul	Rect.	Stat.	(kg)	(kg)	(%)	(kg)	(n)	min	max	mean	clups)
10	36F5	311	210	205	98%	2.3	75	14.75	19.25	14.75	1%
31	36F6	366	236	235	100%	2.5	71	12.75	19.75	12.75	1%
38	36F7	378	1245	1245	100%	0.1	1	14.75	14.75	14.75	0%

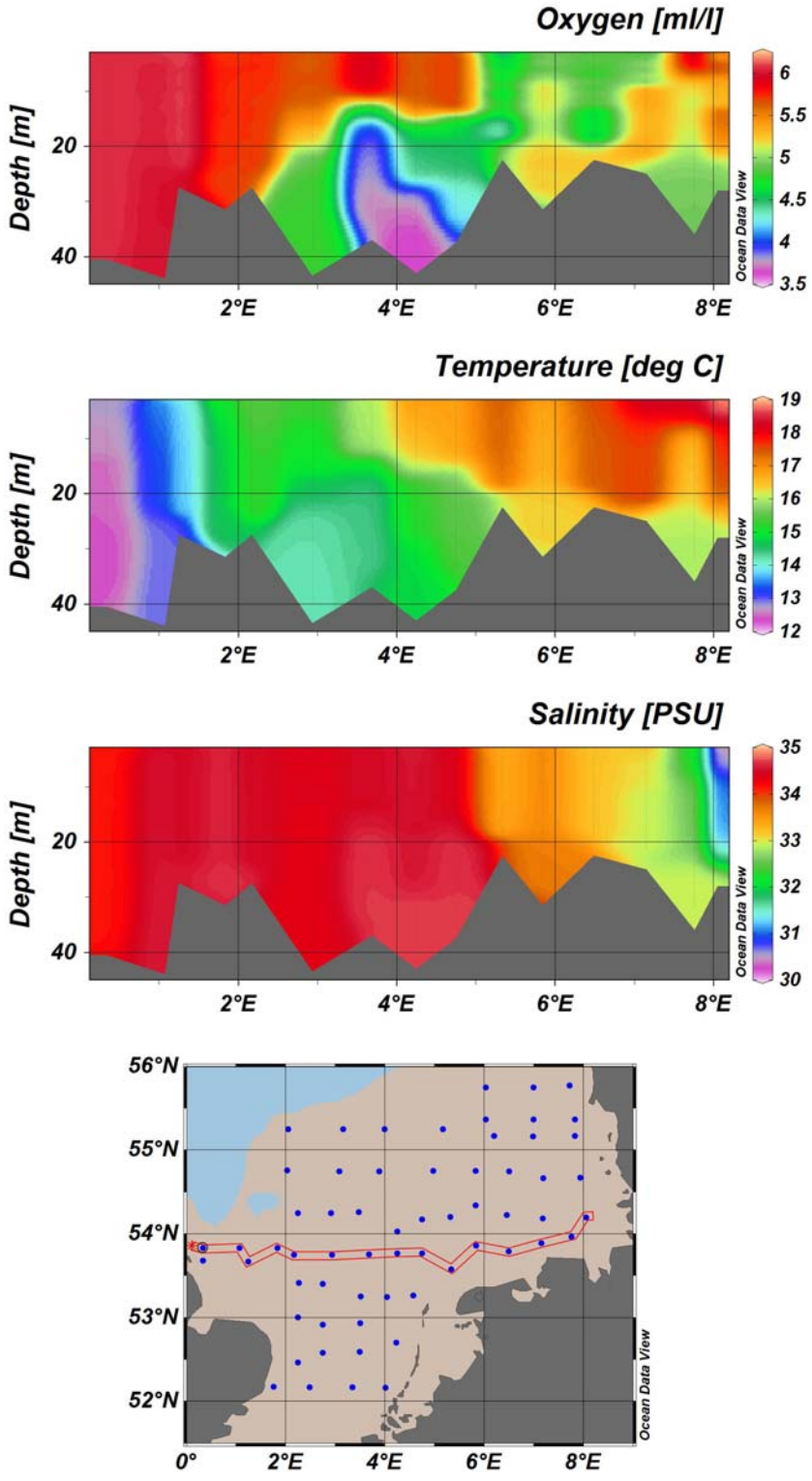

Figure 6: 690. Cruise of FRV "Solea"– oxygen, temperature and salinity at a transect at 54° E (presented with ODV).