Federal Research Institute for Rural Areas,

Forestry and Fisheries

Thünen-Institute of Baltic Sea Fisheries

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Cruise Report

for the FRV Solea cruise number 715 , from 25.01.2016 to 12.02.2016

Person in charge:

Dr. Daniel Oesterwind

Cruise leader:

Part A: Dr. Stepputtis (25.01. – 29.01.2016)

Part B: Dr. Oesterwind (03.02. – 07.02.2016)

Part C: Dr. Schaber (08.02. – 12.02.2016)

Part A

Purpose of the cruise part A

The main aim of the cruise SO 715 Part A was to

i) finalize the installation of the new scientific echosounder Simrad EK80,
ii) test of the new EK80 at sea
iii) calibrate the EK80
iv) test the new trawl-multisampler for pelagic trawls (in this case PSN Krake) on FFS Solea

Narrative

The installation of the echosounder was finalized in Rostock-Marienehe and included installation of hardware, integration in the network and data distribution system (Datadis).

Verteiler:
BLE, Hamburg
Schiffsführung FFS „Clupea“
BMEL, Ref. 614
Thünen-Institut - Präsidialbüro (M. Welling)
Thünen-Institut - Fischereiökologie
Thünen-Institut - Seefischerei
Thünen-Institut - Ostseefischerei
Thünen-Institut - FIZ
Thünen-Institut – Einsatzplanung, Forschungsschiffe
BSH Hamburg
BFEL Hamburg, FB Fischqualität
IFM-GEOMAR, Kiel
Institut für Fischerei der Landesforschungsanstalt
LA für Landwirtschaft, Lebensmittels. u. Fischerei
Deutscher Fischerei-Verband e. V., Hamburg
Leibniz Institut für Ostseeforschung
Doggerbank GmbH
Mecklenburger Hochseefischerei Sassnitz
Kutter- und Küstenfisch Sassnitz
Landesverband der Kutter- und Küstenfischer
Sassnitzer Seefischer
Deutsche Fischfang Union Cuxhaven
Fahrtteilnehmer
Eurobaltic Mukran

In the morning of 25.01.2016, the vessel left the Harbour Rostock-Marienehe. On the way to the desired calibration location in Kiel Fjord, the echosounder was tested intensively at sea.

In the morning of 26.01.2016, FRV Solea arrived in Kiel Fjord and TI hydroacoustician Dr. Schaber (TI-SF) was taken onboard to join the initial calibration of the EK80. During 26.01.2016, calibration was conducted in the deeper area of the inner Kiel Fjord, in front of the 'ThyssenKrupp Marine Systems GmbH' shipyard (Figure 1). Here, FRV Solea got the permission to anchor. The sufficient depth, the possibility to anchor and the sheltered and calm area in the inner Kiel Fjord resulted in excellent calibration conditions.
Due to the perfect conditions, the calibration went smooth and the frequencies used by the echosounder were calibrated sufficiently for different sounder settings. Technical and software issues during that originated during calibration of the new broadband functionality of the echosounder were discussed and analysed with the manufacturer. Corresponding results and settings were adapted, while other findings were announced to be addressed in forthcoming software updates for the echosounder.

In the evening of 26.01.2016, FRV Solea moored close the "Hörnbrücke" in the inner Kiel Fjord. In the morning of 27.01.2016, the vessel left Kiel towards Rostock-Marienehe (where the vessel arrived in the evening).

During the 28.01.2016, a day trip was conducted to test a new Multisampler for pelagic trawls, which was developed at the gear- and surveytechnology working group at the Thünen-Institute of Baltic Sea Fisheries. The test was successful. In the evening of 28.01.2016, the first part of SO715 ended.

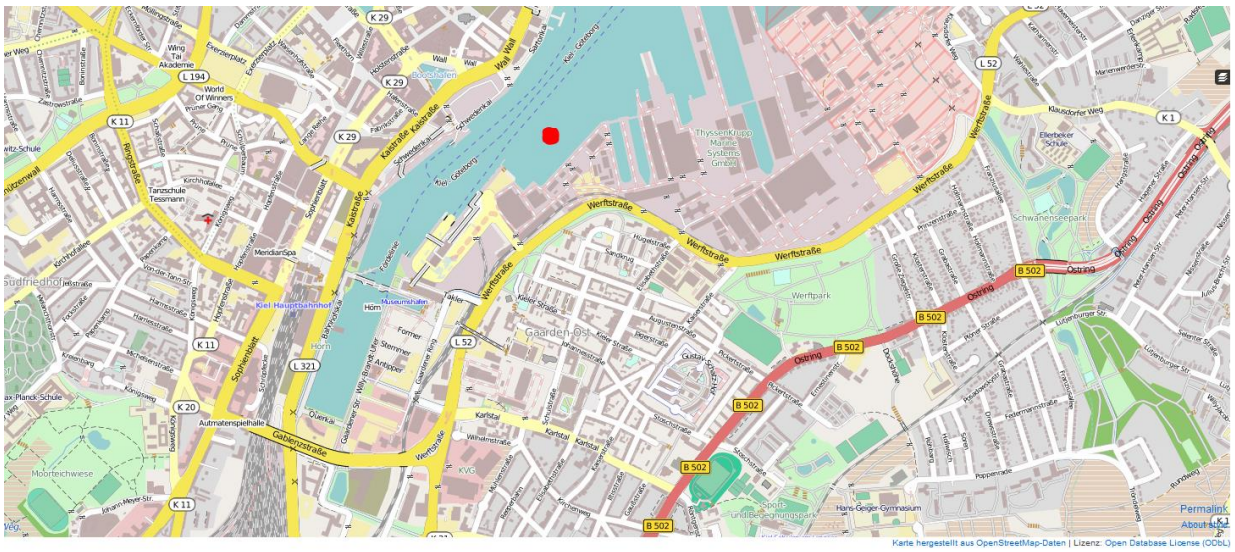

Figure 1: Calibration site within the inner Kiel Fjord, used during SO715

Figure 2: Multisampler for pelagic trawls (here: PSN Krake) during test at SO715

Personal

Dr. Daniel Stepputtis	TI-OF	Cruise leader	25.01.-28.01.2016
Dr. Matthias Schaber	TI-SF	hydroacoustics	26.01.2016
Bernd Mieske	TI-OF	scientist / gear technologist	28.01.2016
Dr. Daniel Oesterwind	TI-OF	scientist	28.01.2016

Part B

Purpose of the cruise part B

In the frame of the ICES-coordinated "Baltic International Acoustic Survey", Germany annually conducts a hydroacoustic survey in September and October to assess the clupeid stocks in the Baltic Sea.
The aim of the cruise SO 715 Part B was to complement these existing monitoring programmes with an additional investigation during the spring spawning migration period to reveal migration and pre-spawning aggregation patterns of spring-spawning herring in the Western Baltic Sea. The research was performed within the EU-Project BIO-C³, where herring biology and migration patterns are an important task to cover. Our major focus was to observe the spawning aggregation and migration at the area of the Öresund and the Island of Rügen.
In addition genetic samples were retrieved from lumpsucker for a master thesis at the University of Copenhagen.

Area of investigation

The area of the investigation was ICES SD 24. Recorded transects were similar to the transects of the hydroacoustic survey in September and October. However, small modifications were done (Fig. 3).

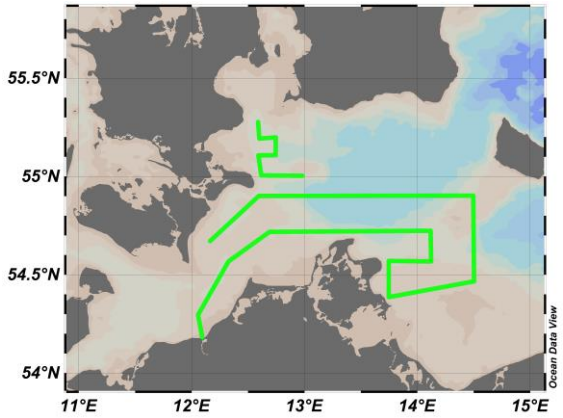

Figure 3. Cruise track of SO 715 part B

Cruise schedule and preliminary results

FRV Solea left port Marienehe on the 3rd of February to steam to the first acoustic transect. On the first day approximately 35 nautical miles were recorded and 3 CTD measurements were performed (Fig. 4). On the second day FRV shipped eastwards to continue hydroacoustic records on the transect and a total of 3 fishery and 5 CTD stations were realized. Weather conditions were stable and FRV Solea carried on the survey and performed 3 fishery and 6 CTD stations in the eastern area of the island of Rügen on the 5th of February. On the next day the FRV Solea shipped western and conducted 3 fishery and 5 CTD hauls. During the following night FRV Solea steamed northern to start hydroacoustic records close to the Öresund on the next morning and performed 2 fishery hauls and 7 CTD stations. Afterwards, FRV Solea shipped back to Warnemünde where part B finished at the evening of the 7th of February and the scientific personnel changed.

Preliminary results show relative low NASC values during the survey. Highest NASC values were measured close to the Island of Rügen and close to the Öresund (Fig. 4). A total of 1300kg of fish were caught. Fish composition consists of 10 different species; most abundant were *S. sprattus* and *C. harengus*, followed by *G. morhua* (Table 1).

Table 1. Caught fish (in kg) by station and in total for Solea cruise 715b.

Species	Fishery Stations										Total
	1	3	4	5	6	7	8	9	10	11	
Clupea harengus	19.864	21.188	85.17	57.02	33.98	24.6	53.352	26.81	91.051	127.818	**540.853**
Cyclopterus lumpus		0.421		0.254		0.433	0.909	0.458			**2.475**
Engraulis encrasicolus					0.026						**0.026**
Gadus morhua		2.417		10.56			6.859		0.378		**20.214**
Gasteroteus aculeatus	0.004										**0.004**
Merlangius merlangus						0.235			0.053		**0.288**
Osmerus eperlanus			0.373								**0.373**
Platichthys flesus			0.086		0.257		0.799				**1.142**
Salmo salar					3.088						**3.088**
Sprattus sprattus	514.131	4.004	31.03	0.479	7.635		110.108	53.14	15.799	26.532	**762.858**
Total	**533.999**	**28.03**	**116.659**	**68.313**	**44.986**	**25.268**	**172.027**	**80.408**	**107.281**	**154.35**	**1331.321**

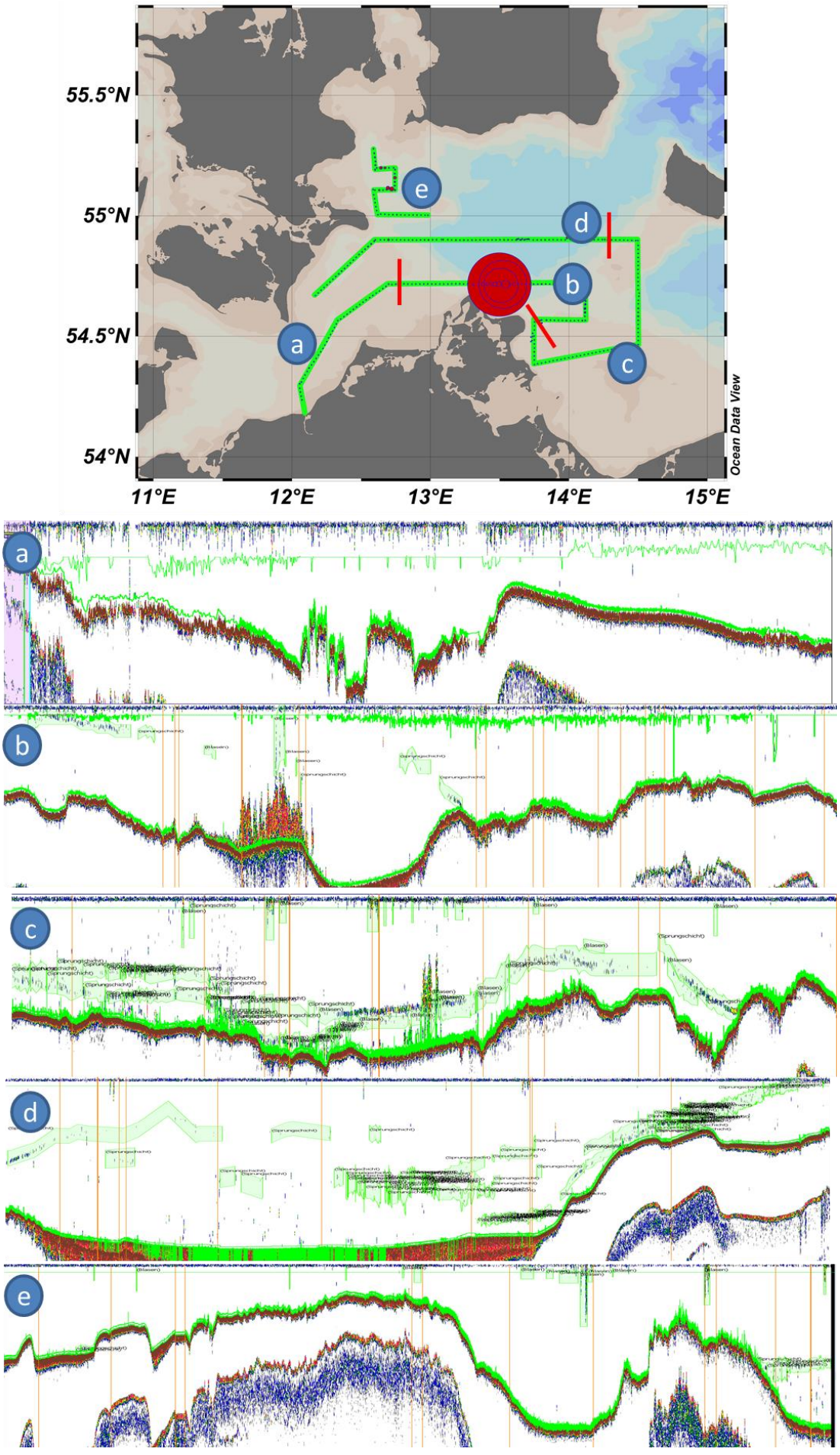

Figure 4. Upper chart: cruise track and preliminary relative NASC values. Lower charts: acoustic transects per day (a: 03.02.; b: 04.02.; c: 05.02.; d: 06.02.; e: 07.02.2016).

Participants

03.02.2015 – 08.02.2015

Dr. Daniel Oesterwind	TI-OF	Cruise leader
Kerstin Schöps	TI-OF	technician
Mario Koth	TI-OF	technician
Christian Schmidt		apprentice
Lea Wietrzynski		apprentice

Part C

Purpose of the cruise part C

The aim of the cruise SO 715 Part C was to familiarize with and test the performance of the newly installed Simrad EK80 scientific broadband echosounder system. Additionally an initial day-night comparison of clupeid distribution patterns as a step towards shifting survey operations during the BIAS survey from night- to daytime was performed.

Area of investigation

The area of investigation was the same as the one covered in cruise part B. As the planned tests and investigations did not require the coverage of a large area, the hydroacoustic transect to be sampled with both acoustic measurements and trawl hauls was chosen based on initial results from the previous survey leg. As representative fish densities were required for the analyses and as overall registrations during the previous cruise leg were low, it was chosen to cover a section of the previous cruisetrack north of Rügen Island. There, highest NASC values had been measured during the previous leg.

Narrative and preliminary results

After preparation for night-time fishing operations, FRV “Solea” left Marienehe port on 8.2.2016 and steamed towards the starting point of the transect section identified to cover areas of highest fish densities (North of Kap Arkona, Rügen). During survey operations, the transect (22 nmi length) was covered in east-west and west-east direction respectively. Trawl hauls conducted with a pelagic trawl net PSN Krake were conducted targeting representative fish aggregations identified on the echosounder screen. During survey operations, temporarily adverse weather conditions required a change of the intended sampling schedule but did not affect the oeverall operations. Altogether, using echosounder standard settings for the BIAS acoustic survey, the transect was covered 8 times (total length) at night and 5 times (total length) at daytime for a day-night comparison. The newly introduced wideband functionality was tested on 3 full and one shorter coverages of the transect during night time. During the last daytime sampling, the multisampler was mounted on the pelagic trawlnet and utilized to sample different individual schools of clupeids. After accomplishing survey operations, FRV “Solea” returned to Marienehe port on 12.02.2016. Altogether, 324 nmi of acoustic transects were covered, 12 trawl hauls (3 utilizing the multisampler) and 14 CTD casts were conducted.

Preliminary results of the comparison between day- and night-time distribution of clupeids in the area show differences in NASC recordings attributed to and indicating clupeid abundance and distribution: While echoes of single fishes or loose aggregations of fishes (NASC – nautical scattering coefficient- per 1 nmi sampling distance) were usually more evenly

distributed in the water column during night-time recordings – both vertically as well as along the cruisetrack- the distribution was more patchy during daytime. Then, clupeids aggregated in dense schools, mostly on or near the seafloor. Comparatively empty sections alternated with sections of high fish school densities and accordingly high NASC values (see figures 5 and 6).

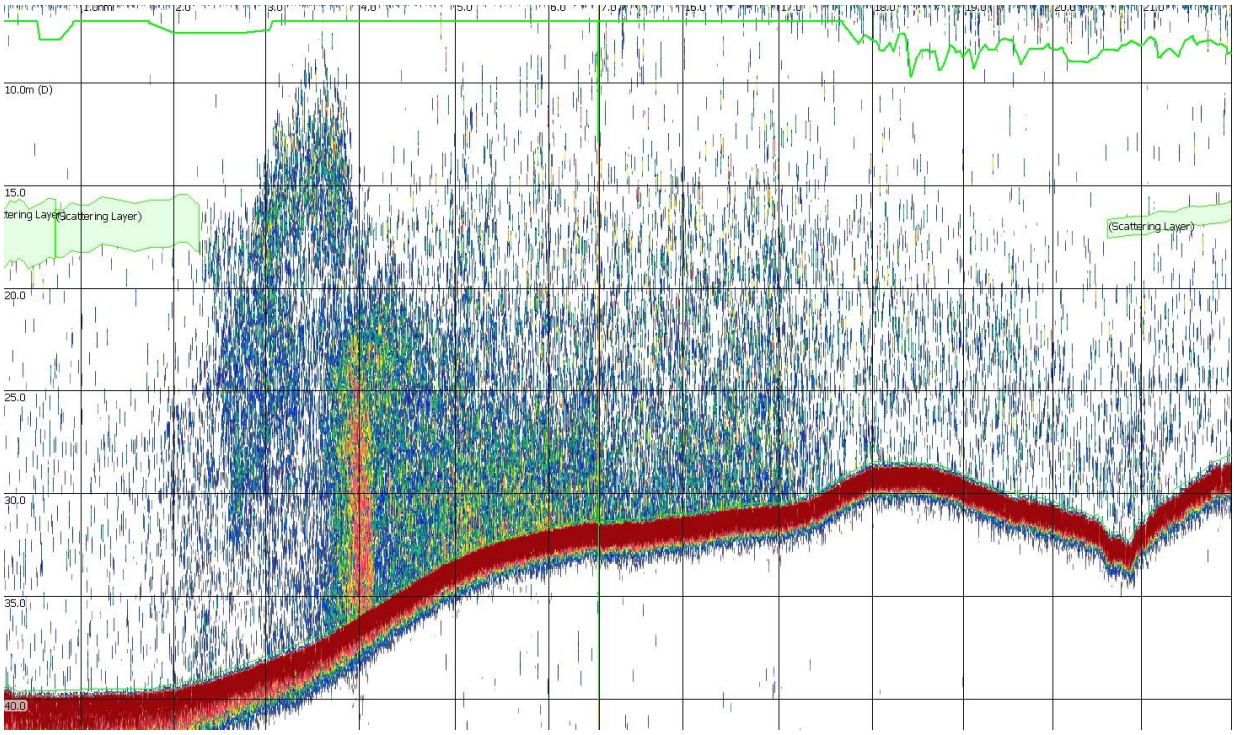

Figure 5: SO715. Exemplary echogram (east-westward) of clupeid distribution patterns along the survey transect during night-time. During the first days of the survey, a large school of sprat was rather stationary along 13°30E. Unlike usual observations, sprat did not fully dissolve the school during night-time but at least in parts remained aggregated.

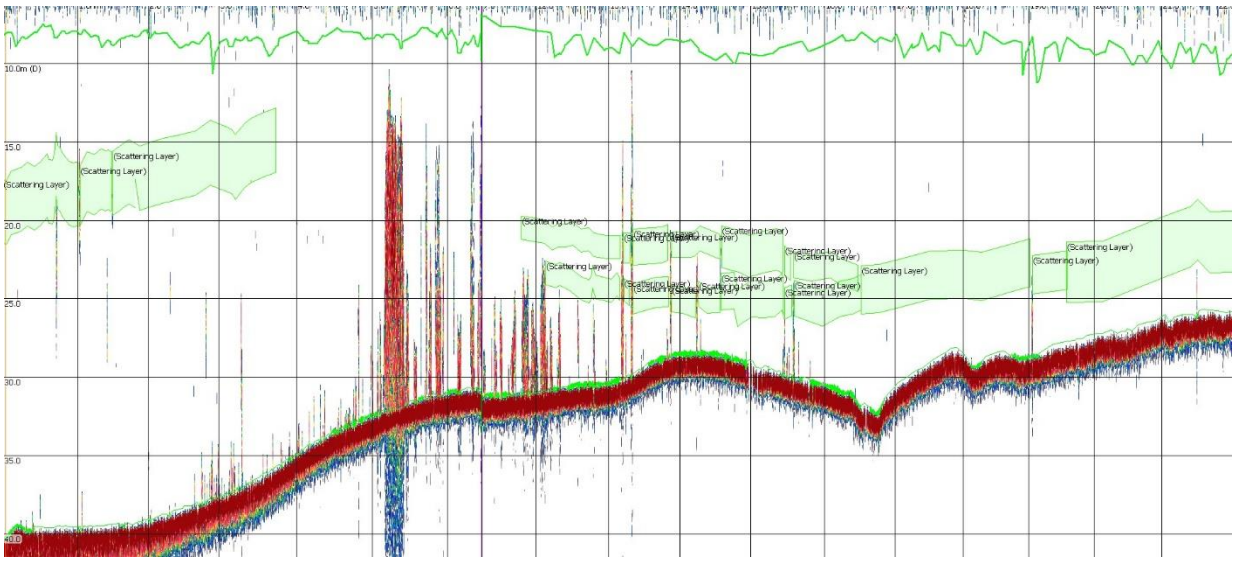

Figure 6: SO715. Exemplary echogram (east-westward) of clupeid distribution patterns along the survey transect during daytime. The large sprat school at 13°30E is clearly visible. Clupeids are rather patchily distributed in dense schools during daytime (compare night-time echogram).

A comparison of both day- and night-time distributions of NASC values recorded along the cruisetrack throughout the sampling showed especially high densities of fishes at ca. 13°30E. There, a massive school of sprat (validated by trawl hauls) was located over the course of several days/nights that disappeared towards the end of survey operations. Generally, there seemed to be movement/migration of fishes during the survey period with NASC values increasing in westerly parts of the survey transect with NASC values in easterly parts decreasing (see both day- and night-time NASC figures 7 and 8).

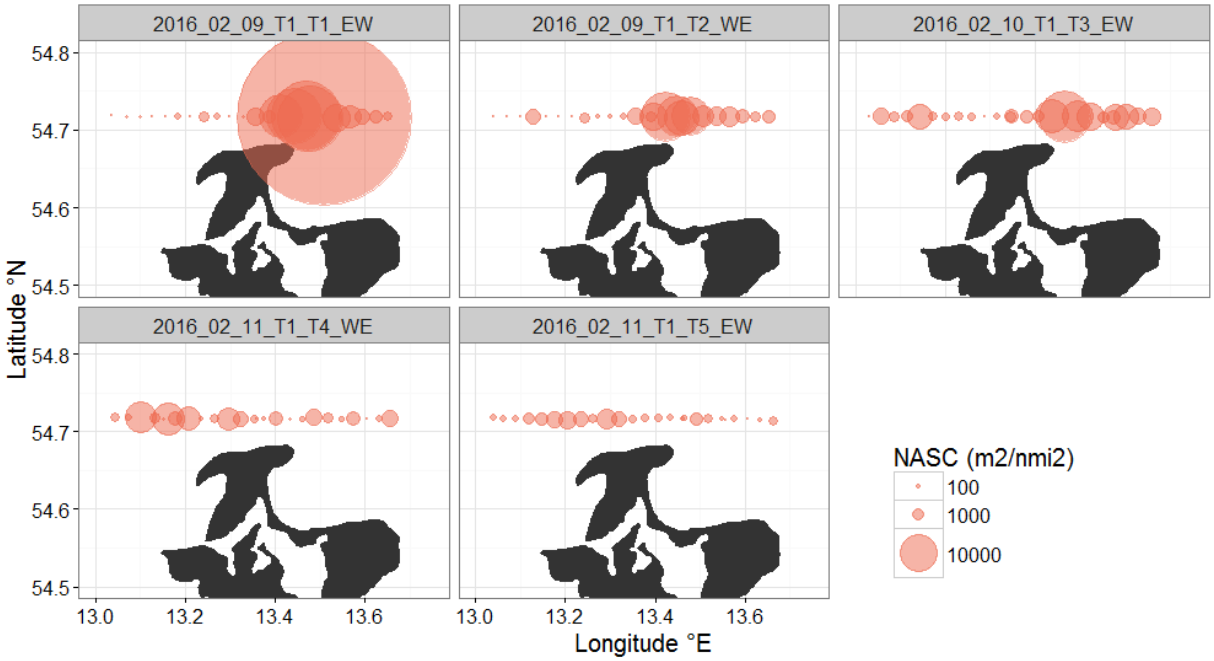

Figure 7: SO715. Distribution of NASC (Nautical Area Scattering Coefficient) measurements indicating fish density and abundance during daytime transects of the survey period. The large sprat school evident during the first pass gradually dissolves in consecutive passes of the area. Additionally, movements and migration of clupeids as indicated by changing NASC measurements in different sections of the survey transect are evident throughout the survey period.

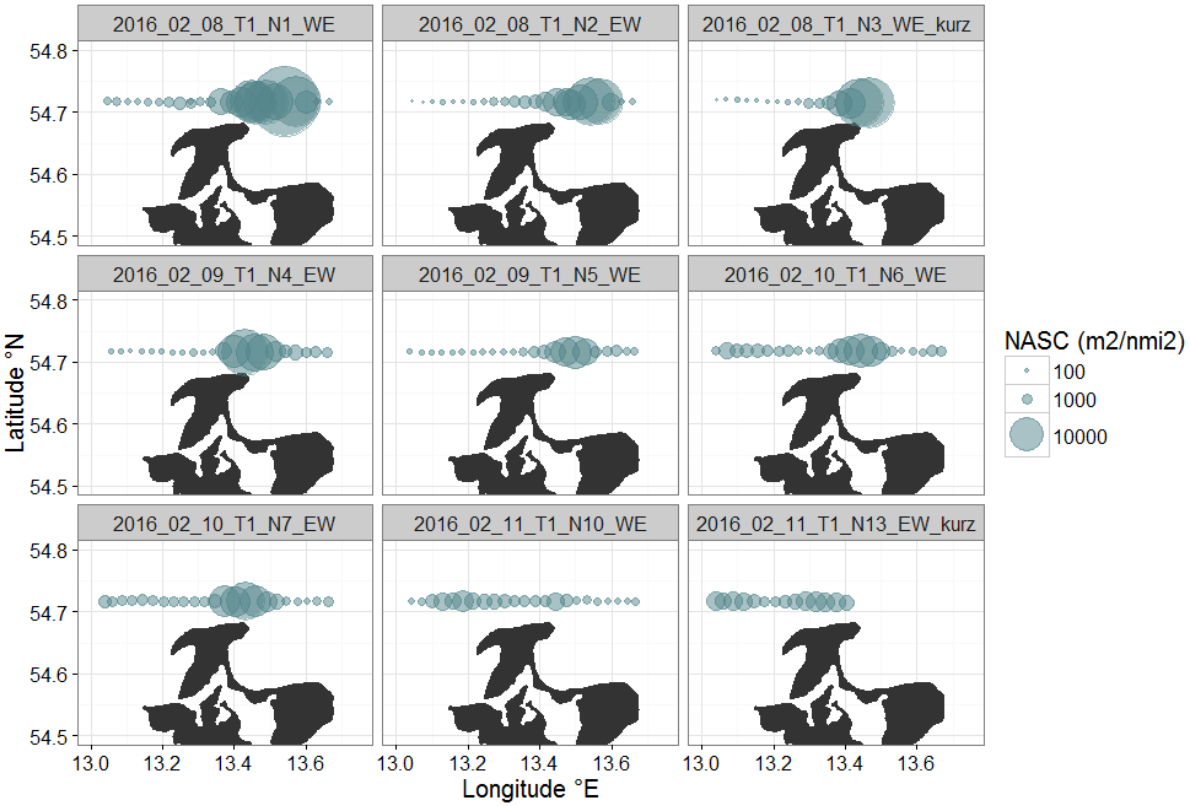

Figure 8: SO715. Distribution of NASC (Nautical Area Scattering Coefficient) measurements indicating fish density and abundance during night-time transects of the survey period. The large sprat school is also evident, as well as migration/movement of clupeids in the course of the survey period. Additionally, despite areas of high aggregations of fishes being evident, overall NASC values along the transect seem to be more evenly distributed in comparison to daytime recordings.

The unusually large sprat school resulted in enormously high NASC values for that particular sampling interval – which were evident in both day- and night-time recordings. However, due to the high numbers and density of sprat in that school, daytime NASC values for that sampling interval were significantly higher than night-time recordings.

Altogether, a comparison of the mean NASC values recorded along the cruisetrack both during day and night shows comparable values (see figure 9), with daytime measurements showing slightly higher variability due to the aggregated and patchy distribution of clupeids as opposed to the loosely aggregated but more regular distribution during night. However, in both cases, there were single sampling intervals with significant differences in measurements between both periods which for a final evaluation have to be quantified.

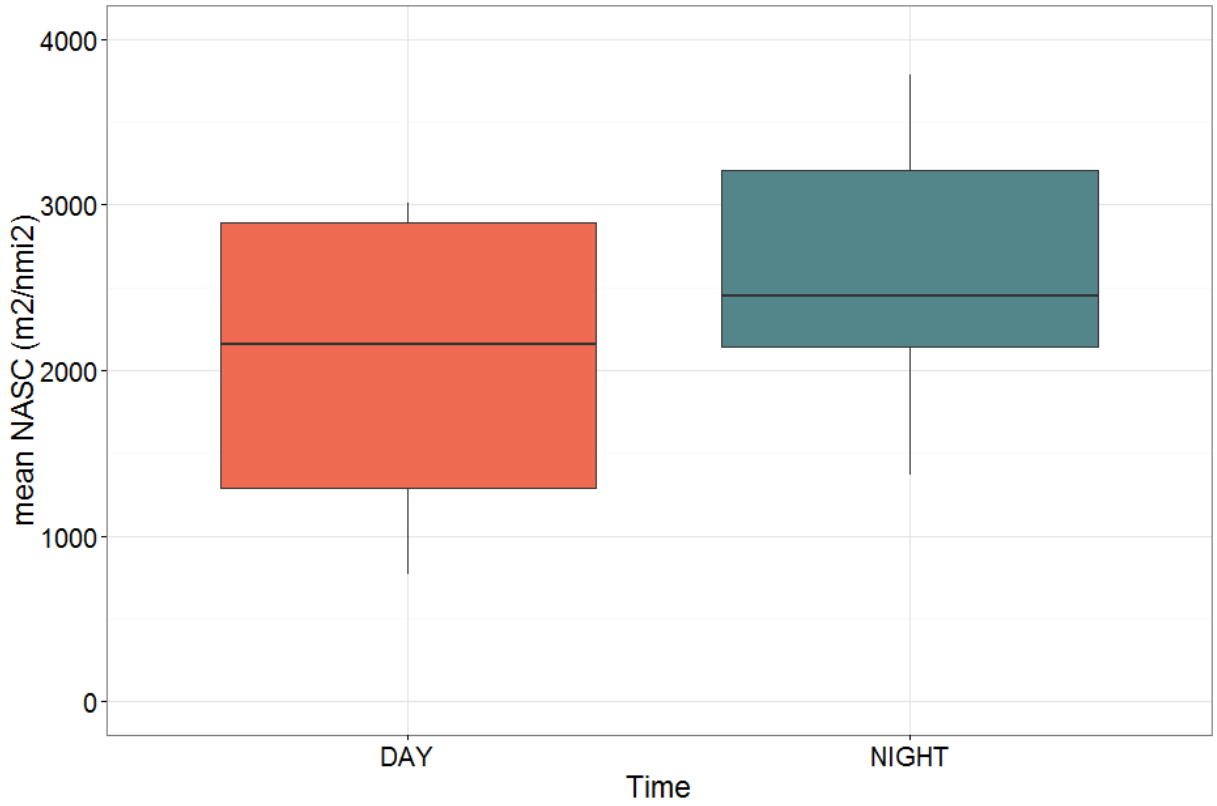

Figure 9: SO715. Day/night-comparison of mean NASC (Nautical Area Scattering Coefficient) measurements of the total survey transect. Outliers (one high value per time period) removed for better comparability.

Final evaluation of survey results, i.e. the allocation of trawl haul results to clupeid species for biomass estimates along the survey transect, the comparison of broadband and narrowband acoustic data, as well as the allocation of multisampler haul contents to concurrently recorded echosignatures, is currently ongoing.

Personal

08.02.2015 – 12.02.2015

Dr. Matthias Schaber	TI-SF	Cruise leader
Mario Koth	TI-OF	technician
Kerstin Schöps	TI-OF	technician
Frederik Kaiser	Uni-Rostock	student

Rostock 05.01.2016

Daniel Oesterwind
(scientist in charge)

Appendix

Table 2. Station information Solea Cruise 715 part B.

Cruise	station no.	station-year	Device	Bem. Gebiet	Date	time	start long.	start Lat.
715	120	2	CTD	SD 24 Darßer Schwelle	03.02.16	13:31:51	54°18,186N	012°03,497E
715	121	3	CTD	SD 24 Darßer Schwelle	03.02.16	15:25:33	54°33,948N	012°19,948E
715	122	4	CTD	SD 24 Darßer Schwelle	03.02.16	17:09:55	54°42,998N	012°41,930E
715	123	5	CTD	SD 24 Arkonasee	04.02.16	09:27:27	54°42,910N	013°18,595E
715	124	6	pelagic gear	SD 24 Arkonasee	04.02.16	10:22:10	54°42,929N	013°31,501E
715	125	7	CTD	SD 24 Arkonasee	04.02.16	10:50:23	54°42,776N	013°29,999E
715	126	8	CTD	SD 24 Arkonasee	04.02.16	13:11:36	54°42,964N	014°06,898E
715	127	9	pelagic gear	SD 24 Arkonasee	04.02.16	13:57:45	54°36,554N	014°07,121E
715	128	10	CTD	SD 24 Arkonasee	04.02.16	15:17:11	54°33,948N	014°07,090E
715	129	11	pelagic gear	SD 24 Arkonasee	04.02.16	16:35:58	54°33,641N	013°48,160E
715	130	12	CTD	SD 24 Arkonasee	04.02.16	17:32:15	54°33,976N	013°44,998E
715	131	13	pelagic gear	SD 24 Arkonasee	05.02.16	08:11:05	54°30,210N	013°43,733E
715	132	14	CTD	SD 24 Arkonasee	05.02.16	08:43:03	54°28,494N	013°43,642E
715	133	15	CTD	SD 24 E-lich Rügen	05.02.16	09:48:44	54°22,960N	013°45,083E
715	134	16	CTD	SD 24 E-lich Rügen	05.02.16	12:34:22	54°27,933N	014°30,010E
715	135	17	pelagic gear	SD 24 Arkonasee	05.02.16	13:41:07	54°38,340N	014°30,074E
715	136	18	CTD	SD 24 Arkonasee	05.02.16	14:30:10	54°40,739N	014°30,461E
715	137	19	CTD	SD 24 Arkonasee	05.02.16	15:57:22	54°53,862N	014°29,877E
715	138	20	pelagic gear	SD 24 Arkonasee	05.02.16	16:43:21	54°53,977N	014°19,141E
715	139	21	CTD	SD 24 Arkonasee	05.02.16	17:20:10	54°54,042N	014°15,550E
715	140	22	pelagic gear	SD 24 Arkonasee	06.02.16	08:11:56	54°54,013N	014°02,968E
715	141	23	CTD	SD 24 Arkonasee	06.02.16	08:50:21	54°54,464N	013°59,263E
715	142	24	pelagic gear	SD 24 Arkonasee	06.02.16	10:33:28	54°54,339N	013°37,366E
715	143	25	CTD	SD 24 Arkonasee	06.02.16	11:20:22	54°54,271N	013°42,203E
715	144	26	pelagic gear	SD 24 Arkonasee	06.02.16	13:31:55	54°54,021N	013°08,234E
715	145	27	CTD	SD 24 Arkonasee	06.02.16	14:06:29	54°54,113N	013°05,100E
715	146	28	CTD	SD 24 Arkonasee	06.02.16	15:55:48	54°53,988N	012°36,212E
715	147	29	CTD	SD 24 Arkonasee	06.02.16	18:04:19	54°40,000N	012°10,201E
715	148	30	CTD	SD 24 Arkonasee	07.02.16	07:29:20	55°16,782N	012°35,033E
715	149	31	pelagic gear	SD 24 Arkonasee	07.02.16	08:04:35	55°13,480N	012°36,209E
715	150	32	CTD	SD 24 Arkonasee	07.02.16	08:45:29	55°11,423N	012°36,002E
715	151	33	CTD	SD 24 Arkonasee	07.02.16	09:20:45	55°11,954N	012°44,051E
715	152	34	CTD	SD 24 Arkonasee	07.02.16	10:01:40	55°06,400N	012°44,671E
715	153	35	pelagic gear	SD 24 Arkonasee	07.02.16	10:07:34	55°06,537N	012°44,428E
715	154	36	CTD	SD 24 Arkonasee	07.02.16	11:09:03	55°06,373N	012°35,228E
715	155	37	CTD	SD 24 Arkonasee	07.02.16	11:56:22	55°00,290N	012°37,233E
715	156	38	CTD	SD 24 Arkonasee	07.02.16	13:16:42	55°00,148N	012°59,743E