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THÜNEN

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Cruise report
FRV "Walther Herwig III"
Cruise 412
03.01. – 12.01.2018

German Small-scale Bottom Trawl Survey and International Herring Larvae Survey in the North Sea

Scientist in charge: Dr. Norbert Rohlf

Summary

The German Small-scale Bottom Trawl Survey (GSBTS) continued the long-term investigation of winter bottom fish assemblages in "Box A" in the German Bight. The mean catch yielded per half hour trawling (65 kg) is relatively low when compared to the long term mean (137 kg). Dab (*Limanda limanda*), whiting (*Merlangius merlangius*) and herring (*Clupea harengus*) dominated in the catches. Whiting is the only species for which abundance has considerably for increased in the Box as compared to recent years, while all other species were reduced in terms of total biomass.
The epifauna in Box A was dominated by high numbers of the starfish *Asterias rubens*, the solenette *Buglossidium luteum* and the brittle star *Ophiura ophiura*. Abundances of the shrimp *Crangon crangon* and the dragonet *Callionymus lyra* were strikingly low, and the bivalve *Nucula nitidosa* was completely absent. The mean weight of the starfish *Asterias rubens* was higher than usual, while smaller individuals were less abundant within the population. This is in good accordance with an observed recruitment failure of this species in last spring/summer.

The international herring larvae surveys in the North Sea (IHLS) are conducted annually during the autumn and winter herring spawning activity and monitor the spatial distribution and abundance of herring larvae. The survey index is used as an important estimator of herring spawning stock biomass and provides valuable information for herring stock assessment and the fixation of fishing quotas.
Newly hatched larvae were distributed in the whole survey area. Their total abundance was higher when compared to 2017 and more in line with the estimates found in the preceding years.

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2. Research programme

2.1 Herring larvae survey

One aim of the cruise was the German contribution to the international herring larvae surveys in the North Sea (IHLS) in January. Parts of ICES area 4.c and 7.d should be sampled by double oblique tows with the "Nackthai" (modified GULF III sampler), resulting in herring larval abundance estimates and their spatial distribution. In the survey area in the southern North Sea and the English Channel, 65 plankton tows were done. Sampling was achieved according to the manual of the IHLS. Physical measurements, e.g. temperature, salinity and conductivity, were conducted via a CTD mounted directly onto the gulf sampler.

2.2 GSBTS Monitoring (TI-SF)

21 GOV hauls were taken to qualitatively and quantitatively analyze the development of abundance and diversity in the bottom fish assemblages. Methods are in accordance with the International Bottom Trawl Survey, in order to allow comparison of results between the two surveys. Epibenthos sampling with a 2-m beam trawl complemented the GOV hauls in order to allow simultaneous investigations of benthic invertebrates and bottom fish.

2.3 Epibenthos (Senckenberg Research Institute)

The 2-m beam trawl for the sampling of epibenthos had a mesh size of 20 x 20 mm in the main net and 4 x 4 mm in the cod end and was applied with five minutes towing duration at 1.5 knots. Samples were sieved over 5 mm and 2 mm mesh. The 5 mm fraction was analysed aboard, the 2 mm fraction was preserved in 70% alcohol for analysis in the laboratory ashore.

2.4 Sediments and benthic infauna (Senckenberg Research Institute)

Investigations of epibenthos were accompanied by sampling of sediments using a 0.1 m^2 Van Veen grab for the analysis of sediment composition and total organic carbon (TOC).

3. Narrative

FRV "Walther Herwig III" was embarked and prepared for the cruise on Wednesday, 01/03/18. Due to strong wind speeds, the vessel left Bremerhaven one day later and started trawling in Box A on Friday morning, 01/05/18. Weather conditions improved with time and fishing activities and benthos monitoring could be finished within three days. They amount to 21 randomly assigned GOV trawl hauls and nine beam trawls and sediment grab samples.

Having completed the Box programme, the vessel steamed into the English Channel to conduct the second cruise part. The herring larvae survey started on Monday morning, 01/08/18. Without any technical or meteorological disturbances, the herring larvae programme was finished in the early morning of 01/11/18. The vessel was back in Bremerhaven at noon on Friday, 01/12/18, three days earlier than expected.

4. Preliminary results

4.1 Ichthyoplankton (TI-SF)

Fish eggs and larvae were sorted from the plankton samples after the end of the cruise. Herring larvae were counted and length measured to millimetre below and their abundance per square metre estimated.
The samples yielded in total 12,564 herring larvae, which is much higher compared to 2017 (3,235) and more in line with preceding years (12,000-20,000 larvae). Fish larvae of other taxa amounted to 543 and 2512 fish eggs were caught, too. Plaice was by far the dominate species of all "none-herring larvae". Their catch summed to 451 larvae. Species identification of fish eggs hasn't finished yet.

The cruise track by station number is given in Figure 1 and the spatial distribution of herring larvae in Figure 3. Abundance estimates and available physical parameters are listed in Table 4. Figure 4 depicts the distribution of near-bottom water temperature and salinity.

4.2 Bottom Fishes (TI-SF)

The mean total catch of all bottom fishes in Box A is at 65 kg per half hour trawl duration (Figure 2). This mean catch is relatively low when compared to the long term mean (137 kg). Dab (*Limanda limanda*), whiting (*Merlangius merlangius*) and herring (*Clupea harengus*) dominated the catches with on average 23.3, 21.6 and 13.2 kg, respectively (Table 3). Sprat (*Sprattus sprattus*), cod (*Gadus morhua*) and plaice (*Pleuronectes platessa*) were caught with 4.0, 2.9 and 1.5 kg. Whiting is the only species for which abundance has considerably increased in the Box as compared to recent years, while all other species are reduced in terms of total biomass (Figure 2).

4.3 Epibenthos (Senckenberg Research Institute)

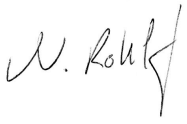
Nine beam trawl hauls and nine van Veen grab samples were taken in Box A. The sediment consisted of muddy fine sand with a slightly increasing trend towards muddy sediments in the south-eastern part of Box A. Epifauna assemblages were dominated by high numbers of the starfish *Asterias rubens*, the solenette *Buglossidium luteum* and the brittle star *Ophiura ophiura*. Particularly evident this year were the extremely low abundances of the shrimp *Crangon crangon* and the dragonet *Callionymus lyra*, as well as the complete absence of the bivalve *Nucula nitidosa*. The latter was never absent in any sample of Box A since 1998. In contrast, the mean weight of the starfish *Asterias rubens* was as high as never before indicating the occurrence of rather large individuals within the population, which is in line with an observed recruitment failure of this species in the last spring/summer.

5. Participants

Name	Institution	Function
1. Norbert Rohlf	TI-SF	Cruise leader
2. Birgit Suer	TI-SF	Technician
3. Michael Sasse	TI-SF	Technician
4. Karin Krüger	TI-SF	Technician
5. Jessica Pickhard	TI-SF	Student
6. Britta Lüdke	TI-SF	Technician
7. Dr. Hermann Neumann	Senckenberg	Scientist

6. Acknowledgement

Thanks to Captain Hans-Otto Janßen and FRV "Walther Herwig III" crew members for their great support and hospitality and to all participants for their reliable and responsible teamwork.



(Dr. Norbert Rohlf)

7. Tables and Figures

Table 1: Boundaries of Box A in the German EEZ

LATITUDE		LONGITUDE		Center	
From	**To**	**From**	**to**		
54°17.00´ N	54°27.00´ N	006°58.00´E	007°15.00´E	54°22.00´N	007°06.50´E

Table 2: Type and amount of samples obtained in Box A

Number of stations	GOV	2-m Beam trawl	Hydrography	Sediment + Meiofauna
9	X	X	X	X
12	X			
Total sets	**21**	**9**	**9**	**9**

Table 3: Total catch and average catch by species per 30 minutes trawl duration

STATION	1	2	3	4	5	6	7	8	9	10
AGONUS CATAPHRACTUS			0.026					0.002		
ALLOTEUTHIS SUBULATA			0.008	0.004	0.011					
ALOSA FALLAX										
AMMODYTES MARINUS	0.008		0.004				0.011			
ARNOGLOSSUS LATERNA					0.008					
BUGLOSSIDIUM LUTEUM		0.028		0.013		0.018		0.026	0.012	
CALLIONYMUS LYRA								0.012		
CALLIONYMUS MACULATUS										
CANCER PAGURUS				0.573	1.007		1.415	0.738	0.666	0.980
CLUPEA HARENGUS	7.541	8.406	8.077	6.281	14.098	7.506	9.441	24.618	25.934	22.966
EUTRIGLA GURNARDUS	0.121	0.004			0.005				0.113	
GADUS MORHUA					1.072			12.800		
GASTEROSTEUS ACULEATUS							0.034	0.005		
LAMPETRA FLUVIATILIS										
LIMANDA LIMANDA	41.600	41.260	14.960	25.100	20.600	21.760	18.640	62.400	15.900	2.825
LOLIGO FORBESI			0.085						0.088	
MERLANGIUS MERLANGUS	5.820	8.720	20.120	5.304	1.637	8.160	17.500	25.480	12.520	14.160
MULLUS SURMULETUS										
MYOXOCEPHALUS SCORPIUS										
NEPHROPS NORVEGICUS	0.048			0.033					0.033	
OSMERUS EPERLANUS		0.002				0.002	0.004			
PLATICHTHYS FLESUS						0.271	0.645		0.551	0.940
PLEURONECTES PLATESSA	0.194	1.033	1.053	0.217	0.103	0.541	0.790	4.339	1.161	0.614
POMATOSCHISTUS MINUTUS	0.004	0.002	0.002	0.002		0.003	0.002	0.007	0.002	0.002
RHINONEMUS CIMBRIUS										
SCYLIORHINUS CANICULA								0.290	0.976	
SEPIOLA ATLANTICA								0.003		
SPRATTUS SPRATTUS	13.519	2.994	1.523	3.019	6.342	2.014	1.719	9.222	1.726	4.934
SYNGNATHUS ROSTELLATUS	0.006			0.002				0.001		
TRACHURUS TRACHURUS			0.016		0.020	0.004	0.018			0.020
ZEUS FABER										
Total (kg)	**68.861**	**62.449**	**45.874**	**40.548**	**44.903**	**40.279**	**50.219**	**139.943**	**59.682**	**47.441**

Table 3 continued: Total catch and average catch by species per 30 minutes trawl duration

STATION	11	12	13	14	15	16	17	18	19	20	21
AGONUS CATAPHRACTUS		0.033			0.016					0.002	0.018
ALLOTEUTHIS SUBULATA											
ALOSA FALLAX									0.146		
AMMODYTES MARINUS	0.007		0.011				0.005		0.004		
ARNOGLOSSUS LATERNA			0.019						0.014		
BUGLOSSIDIUM LUTEUM	0.005				0.004	0.027	0.013		0.025	0.010	
CALLIONYMUS LYRA											
CALLIONYMUS MACULATUS					0.006						
CANCER PAGURUS						0.338	0.452	1.314	0.719	1.006	
CLUPEA HARENGUS	10.102	8.392	6.057	14.142	18.814	33.712	11.303	16.475	11.043	4.768	6.776
EUTRIGLA GURNARDUS		0.054	0.212		0.076		0.041		0.345		
GADUS MORHUA	3.340		0.701		0.040	4.340		0.400			
GASTEROSTEUS ACULEATUS											
LAMPETRA FLUVIATILIS										0.044	
LIMANDA LIMANDA	7.365	10.160	10.260	11.040	70.900	36.760	15.060	5.725	28.880	20.240	8.150
LOLIGO FORBESI		0.102	0.163				0.343				
MERLANGIUS MERLANGUS	55.350	104.920	47.480	22.600	4.900	7.560	12.480	16.280	19.040	22.260	20.660
MULLUS SURMULETUS						0.012					
MYOXOCEPHALUS SCORPIUS							0.107				
NEPHROPS NORVEGICUS		0.023									
OSMERUS EPERLANUS										0.002	0.002
PLATICHTHYS FLESUS		0.553	0.458	0.263	0.267	0.466		0.455		1.467	
PLEURONECTES PLATESSA	1.088	3.890	0.213	0.101	2.870	0.860	0.514		0.274	0.264	0.479
POMATOSCHISTUS MINUTUS			0.002		0.002					0.001	
RHINONEMUS CIMBRIUS	0.084										
SCYLIORHINUS CANICULA			0.967			0.927				1.317	
SEPIOLA ATLANTICA											
SPRATTUS SPRATTUS	3.678	1.528	2.583	4.058	4.406	5.048	5.317	3.645	1.897	2.172	2.024
SYNGNATHUS ROSTELLATUS			0.001	0.001	0.001				0.001		0.001
TRACHURUS TRACHURUS	0.011	0.021									0.006
ZEUS FABER	0.513										
Total (kg)	**81.543**	**129.676**	**69.127**	**52.205**	**102.302**	**90.050**	**45.635**	**44.294**	**62.388**	**53.553**	**38.116**

Table 4: Main data Ichthyoplankton hauls WH 412

Stat. No.	Haul No.	Lat. (° N)	Long.	Date (UTC)	Time (UTC)	Duration (min)	Water depth (m)	Catch depth (m)	Flow (m^3)	Hela (n/m^2)	Surface		Bottom	
											T (°C)	Sal (psu)	T (°C)	Sal (psu)
22	1	52°25.03N	003°30.15E	08.01.18	04:02	3.05	27	24	17.0	48	7.89	34.98	7.91	34.98
23	2	52°24.18N	003°10.19E	08.01.18	05:06	5.48	43	39	29.9	86	8.10	35.09	8.16	34.72
24	3	52°25.09N	002°50.05E	08.01.18	06:17	5.00	38	35	27.2	34	8.28	35.09	8.31	34.95
25	4	52°14.90N	002°49.45E	08.01.18	07:29	6.14	38	35	34.4	55	8.37	35.09	8.38	35.02
26	5	52°14.71N	003°09.52E	08.01.18	08:45	4.07	32	29	22.2	59	8.05	34.89	8.07	34.57
27	6	52°14.80N	003°29.43E	08.01.18	09:57	2.56	23	21	15.0	43	7.01	33.72	7.70	34.84
28	7	52°11,94N	003°43,23E	08.01.18	10:51	3.05	24	21	16.9	34	6.57	32.43	7.17	33.89
29	8	52°05.91N	003°49.83E	08.01.18	11:40	2.43	22	19	14.3	9	6.41	31.37	6.96	32.96
30	9	52°04.32N	003°30.55E	08.01.18	12:44	3.22	27	24	17.6	9	6.79	33.62	7.04	33.75
31	10	52°04.41N	003°10.61E	08.01.18	13:45	4.33	32	29	28.1	98	7.65	34.57	7.87	34.58
32	11	52°04.93N	002°50.50E	08.01.18	14:49	4.38	37	34	25.2	69	8.27	35.09	8.29	34.84
33	12	52°05.05N	002°30.33E	08.01.18	15:56	5.35	39	37	31.4	41	8.34	35.12	8.35	34.26
34	13	51°55.62N	002°29.24E	08.01.18	16:57	5.00	38	34	28.7	119	8.85	35.17	8.86	34.53
35	14	51°55.07N	002°48.70E	08.01.18	18:04	4.23	34	30	26.7	38	8.39	35.04	8.37	34.62
36	15	51°54.79N	003°09.33E	08.01.18	19:14	3.26	29	26	18.4	87	7.75	34.58	7.73	34.22
37	16	51°56.85N	003°23.73E	08.01.18	20:02	2.52	28	25	13.0	67	6.88	33.41	6.93	33.39
38	17	51°45.38N	003°10.36E	08.01.18	21:30	2.59	29	27	13.0	60	7.86	34.71	7.89	34.72
39	18	51°45.98N	002°50.37E	08.01.18	22:43	4.06	32	29	21.7	91	8.50	34.98	8.52	34.43
40	19	51°45.35N	002°30.20E	09.01.18	00:00	4.32	34	31	25.1	54	8.89	35.11	8.91	34.58
41	20	51°44.77N	002°09.85E	09.01.18	01:14	7.07	46	43	40.2	402	9.56	35.26	9.58	34.47
42	21	51°35.27N	002°10.52E	09.01.18	02:08	4.51	36	33	26.5	295	9.37	35.23	9.39	34.58
43	22	51°35.49N	001°50.48E	09.01.18	03:16	5.45	43	39	33.6	51	9.26	35.23	9.27	34.52
44	23	51°25.21N	001°50.20E	09.01.18	04:27	6.02	43	39	34.3	160	9.79	35.28	9.82	34.56
45	24	51°15.24N	001°50.02E	09.01.18	05:24	5.48	43	39	32.3	564	9.76	35.26	9.77	34.57
46	25	51°05.25N	001°30.47E	09.01.18	07:06	8.10	55	52	40.3	85	8.88	35.08	8.88	34.58
47	26	50°55.17N	001°10.40E	09.01.18	08:41	3.57	33	30	20.2	127	9.90	35.25	9.92	34.70
48	27	50°45.50N	001°10.27E	09.01.18	09:38	5.09	38	38	25.3	318	9.84	35.13	9.85	34.39
49	28	50°44.95N	000°50.44E	09.01.18	10:46	4.10	33	30	23.2	144	9.89	35.21	9.89	34.49
50	29	50°35.26N	000°50.47E	09.01.18	11:42	5.22	42	39	30.9	368	10.05	35.20	10.01	34.49
51	30	50°35.02N	000°30.60E	09.01.18	12:53	8.03	55	52	44.1	67	9.92	35.18	9.94	34.50
52	31	50°28.03N	000°30.50E	09.01.18	13:40	5.22	40	37	29.3	85	10.00	35.19	10.01	34.52
53	32	50°25.04N	000°10.51E	09.01.18	15:02	6.53	52	48	38.3	69	10.14	35.26	10.15	34.55
54	33	50°16.44N	000°10.17E	09.01.18	15:56	6.10	46	42	37.1	332	10.38	35.27	10.39	34.46
55	34	50°15.16N	000°09.38W	09.01.18	17:09	7.07	53	49	40.4	255	10.81	35.21	10.82	34.19
56	35	50°05.35N	000°10.12W	09.01.18	18:07	6.56	50	46	37.8	290	10.94	35.17	10.96	34.34
57	36	50°05.03N	000°29.44W	09.01.18	19:11	7.03	47	44	37.1	242	10.89	35.21	10.91	34.25
58	37	49°55.59N	000°30.15W	09.01.18	20:08	5.59	45	42	29.3	470	10.69	35.08	10.70	34.34
59	38	49°45.55N	000°29.82W	09.01.18	21:07	5.09	38	35	26.7	21	9.55	33.86	10.13	33.99
60	39	49°35.39N	000°30.07W	09.01.18	22:04	3.22	29	26	17.1	14	9.09	33.07	9.50	33.18
61	40	49°34.94N	000°10.30W	09.01.18	23:15	3.02	27	24	16.2	8	8.49	32.08	9.53	33.57
62	41	49°44.99N	000°09.98W	10.01.18	00:10	4.49	36	33	29.0	43	9.44	34.15	10.00	34.09
63	42	49°54.71N	000°09.98W	10.01.18	01:06	5.51	47	44	31.1	552	10.73	35.13	10.74	34.25
64	43	49°45.61N	000°08.22E	10.01.18	02:22	3.41	30	27	21.5	46	8.96	33.21	9.06	33.28
65	44	49°54.91N	000°10.15E	10.01.18	03:10	5.39	39	35	34.9	256	9.88	34.73	10.15	34.28
66	45	50°05.12N	000°10.04E	10.01.18	04:02	5.07	43	39	30.4	362	10.64	35.21	10.64	34.21
67	46	50°14.87N	000°29.09E	10.01.18	05:19	5.53	44	40	34.2	836	10.45	35.24	10.45	34.42
68	47	50°05.08N	000°30.00E	10.01.18	06:21	4.51	38	34	28.0	647	10.16	35.09	10.15	34.54
69	48	49°55.47N	000°30.00E	10.01.18	07:15	3.31	31	28	17.2	36	9.13	33.63	9.15	33.34
70	49	49°56.31N	000°44.42E	10.01.18	08:08	2.41	27	24	13.7	14	8.83	33.00	8.85	32.86

Table 4 continued: Main data Ichthyoplankton hauls WH 412														
Stat. No.	**Haul No.**	**Lat. (° N)**	**Long.**	**Date (UTC)**	**Time (UTC)**	**Duration (min)**	**Water depth (m)**	**Catch depth (m)**	**Flow (m^3)**	**Hela (n/m^2)**	**T (°C)**	**Sal (psu)**	**T (°C)**	**Sal (psu)**
71	50	50°04.66N	000°49.93E	10.01.18	08:59	3.45	30	27	21.1	252	9.17	34.31	9.27	34.22
72	51	50°14.68N	000°50.01E	10.01.18	09:52	5.10	36	33	28.1	1733	9.69	34.98	9.79	34.56
73	52	50°24.47N	000°49.88E	10.01.18	10:47	4.03	35	32	22.0	504	10.14	35.19	10.15	34.47
74	53	50°15.20N	001°09.90E	10.01.18	12:13	3.02	27	23	18.5	918	9.03	34.38	9.09	34.18
75	54	50°24.87N	001°09.95E	10.01.18	13:06	3.53	31	28	22.8	689	9.55	35.01	9.77	34.61
76	55	50°34.89N	001°10.12E	10.01.18	13:59	7.52	55	52	44.2	351	9.86	35.12	9.81	34.52
77	56	50°35.51N	001°22.95E	10.01.18	15:17	3.33	31	27	20.6	454	9.25	34.81	9.34	34.52
78	57	50°45.34N	001°26.22E	10.01.18	16:07	7.20	48	44	43.3	2338	9.04	34.64	9.58	34.42
79	58	50°54.45N	001°30.71E	10.01.18	16:55	5.54	48	44	35.0	657	8.39	33.99	9.23	34.27
80	59	51°05.74N	001°49.48E	10.01.18	18:09	3.47	32	28	22.5	67	8.88	34.71	8.88	34.53
81	60	51°14.74N	002°09.51E	10.01.18	19:18	4.55	37	34	25.9	146	8.41	34.81	8.46	34.27
82	61	51°24.55N	002°10.32E	10.01.18	20:08	4.04	35	32	20.3	88	9.14	35.18	9.15	34.41
83	62	51°21.98N	002°29.06E	10.01.18	21:19	4.29	33	30	23.0	37	8.43	34.88	8.42	34.69
84	63	51°27.75N	002°49.45E	10.01.18	22:37	3.00	26	23	16.6	33	7.70	34.43	7.70	34.15
85	64	51°34.60N	002°50.02E	10.01.18	23:15	3.01	25	22	16.1	30	8.28	34.84	8.30	34.59
86	65	51°35.04N	002°30.03E	11.01.18	00:21	3.45	29	26	22.0	58	8.75	35.12	8.77	34.75

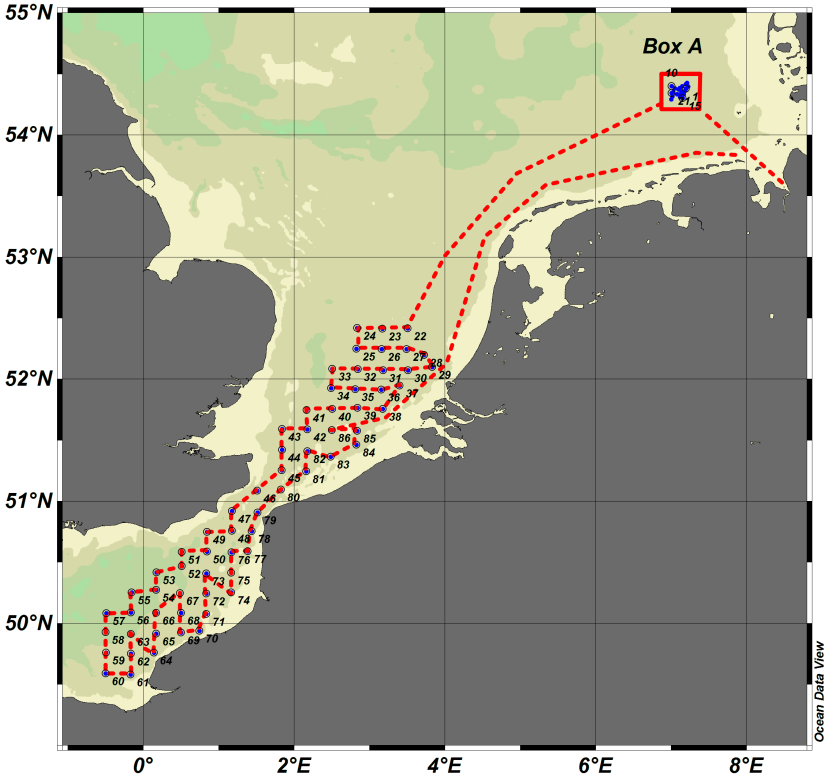


Figure 1: Location of Box A in the German Bight and positions of herring larvae stations in the southern North Sea and the English Channel.

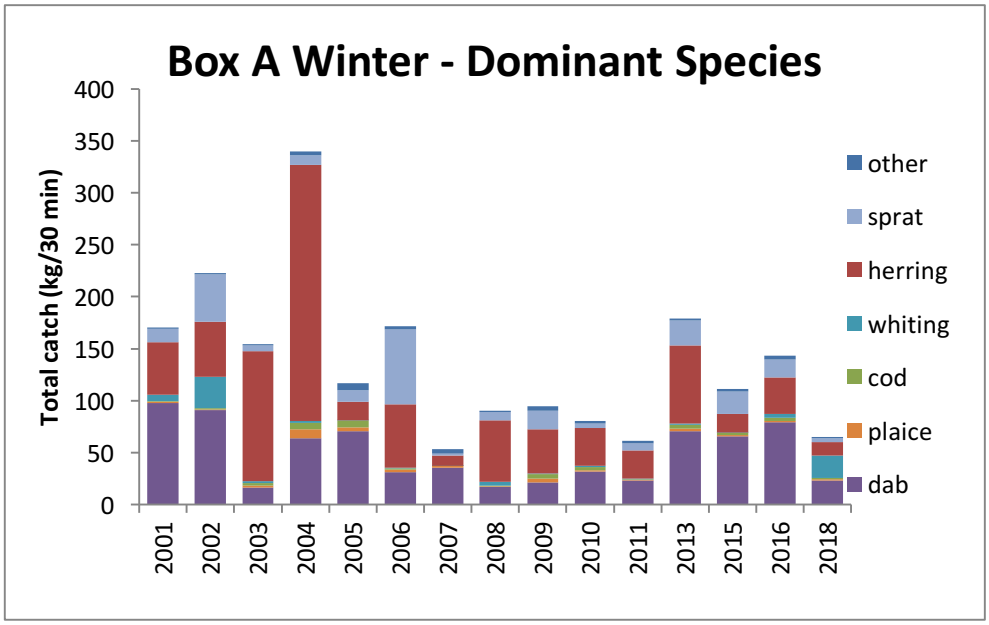


Figure 2: Catch ratios (kg/30min) in Box A in the German Bight from January 2001 to January 2018.

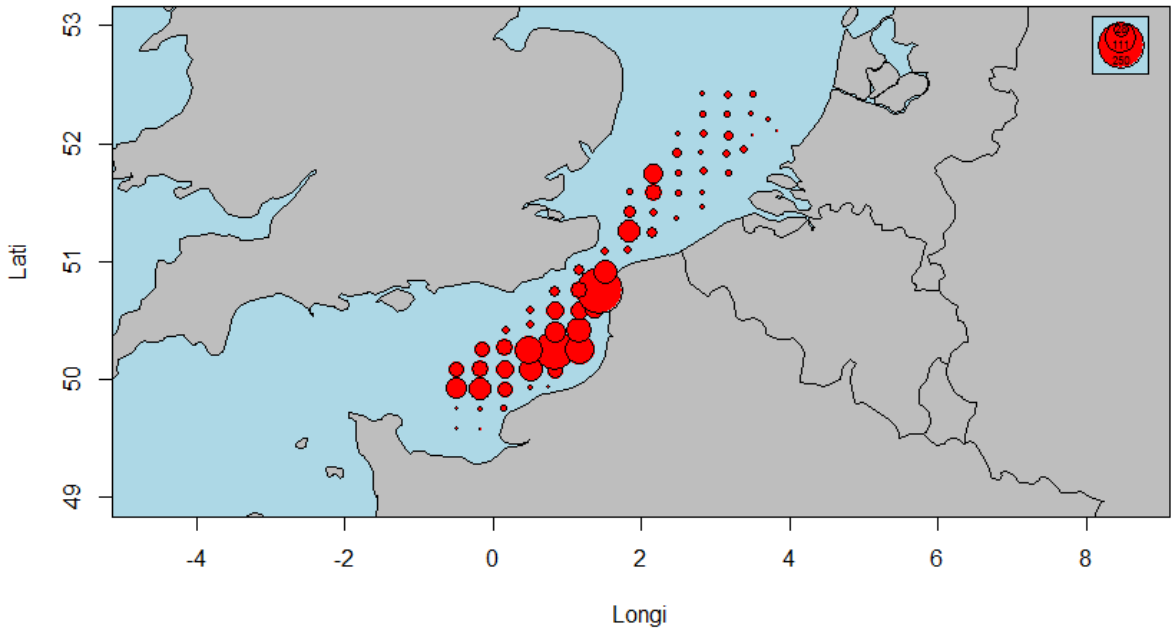


Figure 3: Distribution and abundance of herring larvae (n/m², all length classes) in the southern North Sea and the English Channel. The circle size equivalent to 250 larvae per square metre is indicated.

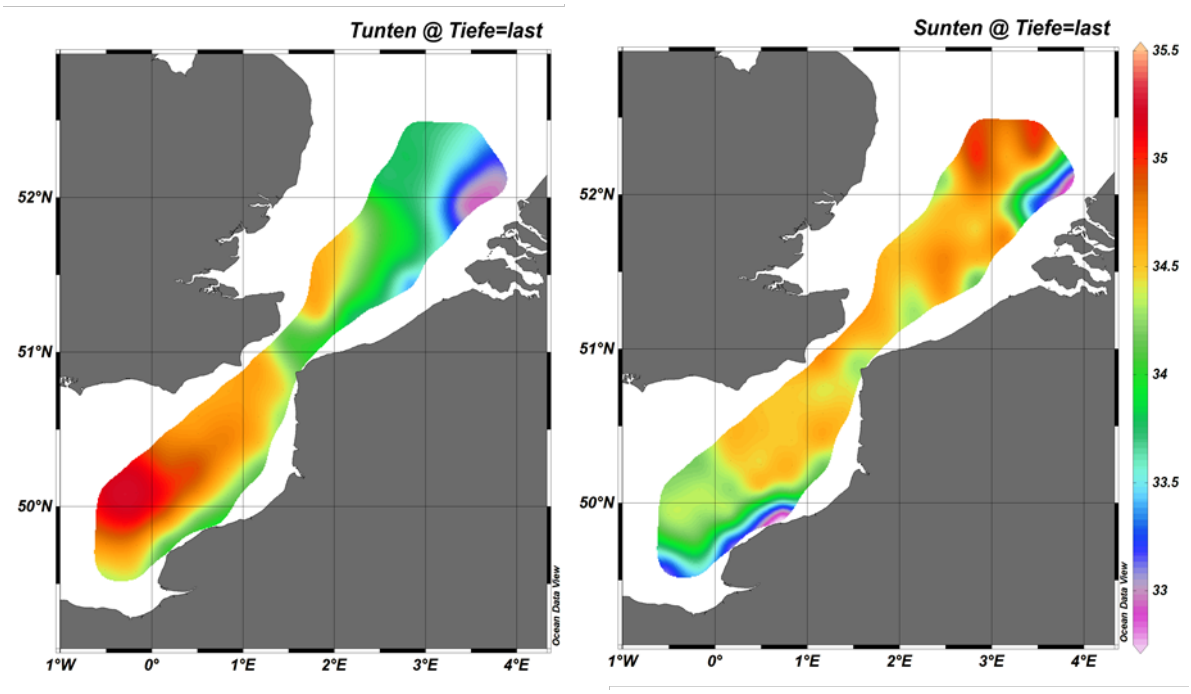


Figure 4: Distribution of near-bottom temperature (°C, left panel) and salinity (psu, right panel) in the southern North Sea.