Leibniz Institute for Baltic Sea Research Warnemünde

C r u i s e R e p o r t

r/v "Elisabeth Mann Borgese"

Cruise-No. EMB 154

Monitoring Cruise
09 May – 19 May 2017
Kiel Bight to Northern Baltic Proper

This report is based on preliminary data

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1. **Cruise No.:** EMB 154

2. **Dates of the cruise:** from 09 May to 19 May 2017

3. **Particulars of the research vessel:**
   Name: "Elisabeth Mann Borgese"
   Nationality: Germany
   Operating Authority: Leibniz Institute for Baltic Sea Research (IOW)

4. **Geographical area in which ship has operated:**
   Kiel Bight to Northern Baltic Proper

5. **Dates and names of ports of call**
   11 May 2017 Sassnitz (Germany)

6. **Purpose of the cruise**
   (A) German contribution to the COMBINE Monitoring Programme of HELCOM, financed by the Federal Maritime and Hydrographic Agency (BSH) the and

   (B) long-term observations of the IOW based on institute's funding.

7. **Crew:**
   Name of master: Uwe Scholz
   Number of crew: 10

8. **Research staff:**

Chief scientist:	Dr. Norbert Wasmund
Scientists:	Dr. Peter Holtermann Dr. Natalia Osma Dr. Igor Fernández-Urruzola
Engineers:	Martin Kolbe Jan Donath
Technicians:	Michael Poetzsch Jenny Jeschek Lars Kreuzer
Students:	Elisa Merz
Observer:	Agnieszka Lisiak (Poland)

9. **Co-operating institutions:**
All institutions dealing with HELCOM monitoring programmes.

10. **Scientific equipment**
CTD "SBE 911plus" from Seabird Electronics equipped with Rosette water samplers consisting of 13 free-flow bottles of 5 litres volume each, Hyrobios phytoplankton net (25 µm), zooplankton nets (standard WP2 net, 100µm, and Apstein net), Secchi disk, nutrient analyser Evolution III from Alliance, oxygen analyser Titrino from Metrohm, thermosalinograph, sediment corer "Frahmlot".

11. **General remarks and preliminary results**

11.1 Parameters

This cruise is part of the German contribution to the HELCOM COMBINE program and contributes to IOW's long term data series in the central Baltic Sea. The area under investigation extended from Kiel Bight to the Northern Gotland Sea. Besides the regular station grid, additional stations were sampled in the Eastern and Western Gotland Basin and the northern Baltic Proper to follow the further development of the past mayor salt water inflow (station map see Figs. 1-3, station list Table A3). On the way back, selected HELCOM stations in the Bornholm Basin, Arkona Basin and Mecklenburg Bight were sampled a second time for nutrient, phytoplankton and zooplankton data. A station name and a station number were assigned to all stations. The station name identifies a geographical position. The station number is a running number for each station of the cruise, starting with 001. The standard station at Landsort Deep (TF0284) could not be visited because the Swedish permission was not given.

The hydrographical, chemical and biological investigations were performed according to the Manual of the COMBINE Programme of HELCOM (2016). Continuous measurements by the ship's weather station and the thermosalinograph were conducted in responsibility of the ship.

Standard parameters registered by the CTD system were:

- Pressure
- Temperature (2x SBE 3)
- Conductivity (2x SBE 4)
- Oxygen concentration (2x SBE 43)
- Chlorophyll-a fluorescence (683 nm)
- Turbidity
- Photosynthetic active radiation in water (PAR)

Chemical parameters:

- Nutrient concentrations (phosphate, nitrate, nitrite, ammonium, silicate)
- Oxygen concentration
- Hydrogen sulphide (H_2S) concentration
- Total phosphorus and total nitrogen
- Particulate organic matter (POM) and dissolved organic matter (DOM)
- Additional at selected stations: Nitrous oxide (N_2O), methane (CH_4), carbon dioxide (CO_2), dissolved manganese (Mn)

Biological standard parameters (at biological core stations):

- Chlorophyll-a concentration
- Phytoplankton biomass and species composition
- Zooplankton abundance and species composition
- Secchi depth
- Additional at station TF0271: Samples for flow cytometry, DNA and fluorescence in situ hybridisation (FISH)

Additional research:

- Zooplankton samples for research on population dynamics were taken in the Bornholm Basin (TF0213); responsible scientist Dr. Jörg Dutz.
- Experiments on effects of starvation on $\delta^{15}N$ signature in amino acids of zooplankton; responsible scientists: Dr. Igor Fernandez-Urruzola.
- Experiments on the influence of the elemental composition of nano- and microplankton on the elemental composition and metabolism of zooplankton; responsible scientist: Dr. Natalia Osma.

- Experiments on effects of nitrogen source on $\delta^{15}N$ signature in amino acids in different chemolithoautotrophic communities (including those of the sediment) in comparison with photoautotrophs from the chlorophyll maximum; responsible scientist Dr. Natalie Loick-Wilde.
- Test of new oxygen-, temperature- and conductivity sensors for the DFG project ROBOTRACE during the first two days of the cruise by Dr.Peter Holtermann.

The results of this additional research are not presented in this report.

11.2 Weather conditions:
Concerning the weather conditions, the cruise can roughly be divided into 4 periods:

1.) 09.-10.05.2017, while cruising through Mecklenburg Bight, Kiel Bight and Arkona Basin: air pressure decreasing from 1019 hPa to 1006 hPa, westerly winds between 4 and 12 m/s, air temperature during the day 5-9 °C; cloudy.
2.) 11.05.2017: stay in the port of Sassnitz for almost 12 hours. Weather became sunny and almost calm
3.) 12.05.-16.05.2017: from Sassnitz via Bornholm Basin and the Eastern Gotland Basin to the northern Baltic Proper and the Western Gotland Basin. Air pressure increased continuously from 1008 to 1032 hPa (on 16.05. at noon), wind changed from easterly, meanwhile to northern but finally to southern direction with wind speeds between 2 m/s (on 14.05. and 16.05.2017) and 15 m/s (evening of 15.5.2017); air temperature ranged from 5 °C in the morning of the 16.05.2017 to 10 °C in the evening of the 15.05.2017; mostly sunny.
4.) 17.05.-19.05.2017: Return from the Western Gotland Basin via Bornholm Basin and Arkona Basin to Mecklenburg Bay. Air pressure decreased from 1025 to 1010 hPa, southerly winds turning to north-west with wind speed between 6 and 11 m/s; sunny, but it became cloudy in the evening of the 18.5.2017; air temperature increased strongly from 9 to 23 °C.

11.3 Hydrographical and hydrochemical conditions:
The hydrographical and hydrochemical characteristics during the cruise are summarized in the appendix (Tables A1 and A2 and Figs. 4 and 5). Because of the Mayor Baltic Inflow and smaller inflow events of the previous years, the development of the oxygen situation is of special interest (see Section “Development in comparison with earlier cruises” below).

The typical stratifications of the water column could be found in each of the Baltic basins. The two stations of the central Kiel Bay were rather different: station TF0361 had a stronger salinity gradient reaching from 10.3 psu at the surface to 19.7 psu at the bottom with the steepest change at 13 m depth. At station TF0360, the differences were lower (see Table A1 in the Annex) with a weak halocline starting at 9 m depth. The water column was well-oxygenated with more than 6 ml/l of oxygen above the bottom.

In Lübeck Bight (TF0022), the depth-gradient was very weak, whereas a pycnocline was found at 11 m depth in the central Bay of Mecklenburg (TF0012) and at 9 m depth in the Kadet Channel (TF0046). The oxygen concentrations above the bottom were about 7 ml/l in the Bay of Mecklenburg and were 1.5-3 ml/l higher than in May 2016.

In the Arkona Basin, no pycnocline and high oxygen concentrations of almost 8 ml/l even above the bottom were found at the shallow stations (TF0002, TF0030, TF0115). However, the deep stations (TF0114, TF 0069, TF0113, TF 0102, TF0105) were characterized by a pycnocline at about 34-37 m depth, which is mostly between 5 and 10 m above ground. At some stations (TF0104, TF0103, TF0109, TF0111, AB Boje), it was situated at 28-32 m depth. The oxygen concentrations decreased strongly below the pycnocline but were always higher than 2 ml/l above the ground in the Arkona Basin. In the western part (TF0069, TF0113, TF0114, TF0115), oxygen concentration above bottom was 3-5 ml/l, which is about

2-4 ml/l higher than in May 2016. In the eastern part of the Arkona Basin (TF0105, TF0104, AB Boje, TF0109, TF0103, TF0102) it amounted to 4-6 ml/l, which was similar to the previous year. In the shallower southern part (TF0121, TF0150, TF0152), near-bottom oxygen concentrations were even about 7 ml/l. In the north-eastern Arkona Basin (Bornholmgat, stat. TF0144, TF0142, TF0140), the conditions were highly different, reaching from a lacking pycnocline and oxygen concentrations of 7.5 ml/l above ground (42 m; TF0144) to the presence of a pycnocline below 42 m and oxygen concentrations of only 1.0 ml/l above ground (68 m; TF0140).

The southern part of the Bornholm Basin (TF0202, TF0204, TF0215, TF0214) was generally deeper than the Arkona Basin, but the upper boundary of the pycnocline was situated at nearly the same depth as in the Arkona Basin (35-38 m). A south-north gradient in the bottom-near oxygen concentrations from 3.4 to 0.3 ml/l occurred. In the western Bornholm Basin and Bornholm Deep (TF0213, TF0221, TF0212, TF0211, TF0210, TF0205, TF0200), the pycnocline started even at 45-48 m depth and oxygen concentrations decreased to less than 0.4 ml/l, which is 1-2 ml/l less than in May 2016 and February 2017.

In the Stolpe Channel (stat. TF0222), a sharp salinity gradient occurred at 52-54 m depth, with increasing temperature (6.4°C) and decreasing oxygen concentrations (3.2 ml/l) towards the bottom. This oxygen concentration is 0.5 ml/l higher than in May 2016, but less than in February 2017.

In the southern part of the Eastern Gotland Basin (stat. TF0256), the halocline started below 55 m depth, with increasing salinity (up to 13 psu), increasing temperature (up to 5.5 °C) and decreasing oxygen concentrations (5.0 ml/l) towards the bottom. A water body of higher oxygen concentration (6.3 ml/l) had intruded there at 64-70 m depth. At stations TF0255, TF0253, TF0250, the halocline was identified at 60 m depth. A water body containing higher oxygen concentrations (3.0-4.2 ml/l) and salinity in comparison with the overlaying waters was found below approximately 80 m depth. A similar situation was found in May 2016. During the cruise from May 2016, station TF0263 was the first station where zero oxygen (but no H_2S) was measured in a layer at 114-120 m depth; however the bottom water contained about 2 ml/l oxygen. The oxygen situation has obviously slightly improved at that station.

Further north, near the centre of the Eastern Gotland Basin, the halocline started at 60-70 m depth. The first station with oxygen depletion above the bottom, but still without measurable hydrogen sulphide (H_2S), was station GB_B7. H_2S was measured near the bottom at stations GB_BATRE and GB_B4. At the central station TF0271, visited on 14 and 15 May 2017, oxygen depletion started at about 204 m depth and H_2S was identified at the standard depths of 225 m and above ground. H_2S is indicated as “negative oxygen” for selected stations in Fig. 4, At some shallower stations in the northern region of the Eastern Gotland Basin (GB_B15, TF0270, GB_B16, TF0286), oxygen concentrations were low (about 1 ml/l) from 80 m depth to the bottom. This is an improvement in comparison with the previous year when stations GB_B16, TF0286 and GB_B24 were anoxic below 100m or 110 m depth.

The oxygen situation is worse in the northern Baltic Proper (TF0282, nGB-2, TF0283) where oxygen disappeared in narrower or broader layers below 80 m depth. Even this is an improvement in comparison with May 2016, when most of these stations were anoxic below 75-85 m depth. The Landsort Deep could not be visited, but the nearest Station nGB-1 turned out to be completely anoxic below 80 m depth.

The Western Gotland Basin is still anoxic below approximately 80 m depth (wGB-3, TF0240, TF0242, TF0245, wGB-1, wGB_SW).

11.4 Development in comparison with earlier cruises

After the mayor Baltic inflow from December 2014 (Mohrholz et al. 2015), some weak and moderate inflows were following in March 2015, November 2015, February 2016 and October to December 2016. They affected the salinity, temperature, nutrient and oxygen conditions. The development may roughly be followed by comparison with earlier monitoring cruises, like that from May 2016 (Wasmund 2016) or February 2017 (Naumann 2017).

Salinity

The salinity in the bottom layer has strongly increased (except the Gotland Deep) in comparison to the cruises from Mai 2014, May 2015 and May 2016(Table 1).

Table 1: Salinity in the bottom layer in comparison with former years

Area:	May 2017	May 2016	May 2015	May 2014
Gotland Deep	13.45	13.77	13.54	12.21
Farö Deep	12.90	12.70	12.11	11.42
Landsort Deep	no data	10.99	10.54	10.32
Karlsö Deep	10.24	9.87	9.60	9.48

Temperature

The surface water temperatures of selected stations of this cruise are compared with early long-term mean values (1971-1990) collected during our May cruises in the 1970s and 1980s in Table 2. Surface water temperatures in the first half of May were continuously increasing over the last years (May 2014 not tested). This trend is broken in 2017 because of a rather cold spring.

Table 2: Temperature in the surface layer (°C) in comparison with former years

Area:	May 2017	May 2016	May 2015	May 2013	Mean May 1971-1990
Mecklenburg Bay (TF0012)	8.1	11.3	9.7	8.2	2.6
Arkona Basin (TF0113)	7.0	9.8	8.2	6.2	2.1
Bornholm Basin (TF0213)	6.1	8.9	8.0	4.5	2.4
East.Gotland Basin (TF0271)	5.8	8.7	7.0	4.8	2.6
Farö Deep (TF0286)	5.0	7.9	4.3	5.3	2.3
Karlsö Deep (TF0245)	7.0	8.1	6.6	4.6	2.2

The long-term trend of increasing water temperature [°C], unbiased by short-term variations, is representatively reflected in the deep water layers of the central deeps of the Baltic Proper (Table 3). Despite reductions in deep-water Temperature in the Bornholm Deep in 2016 and in the Gotland deep in 2017, the trend of increasing temperature seems generally to be intact.

Table 3: Temperature in the bottom layer (°C) in comparison with former years

Area:	May 2017	May 2016	May 2015	May 2014	May 2013	Mean May 1971-1990
Bornholm Deep	6.92	6.24	7.00	5.60	5.12	6.12
Gotland Deep	7.14	7.53	6.88	6.62	6.41	5.62
Farö Deep	7.07	6.81	6.50	5.71	5.94	5.20
Landsort Deep	n.d.	5.85	5.42	5.32	5.39	4.76
Karlsö Deep	5.51	5.21	5.01	4.99	5.33	4.18

Oxygen

After the mayor inflow and some smaller inflows into the Baltic Sea, the development of the oxygen concentrations in the deeper layers of the water column is most interesting. We paid special attention to the question whether a net consumption of the new oxygen has already occurred or whether the oxygenated deep water has spread further to the north.

The oxygen concentrations in the bottom water have increased in the central Kiel and Mecklenburg Bay by 1.5-3 ml/l and in the western Arkona Basin by 2-4 ml/l in comparison with May 2016, but it has to be noted that they were especially low in May 2016. In contrast, in the western Bornholm Basin and Bornholm Deep, the oxygen concentrations decreased to less than 0.4 ml/l, which is 1-2 ml/l less than in May 2016 and February 2017. Thus, there was a minor decline in oxygen concentrations in the deep water of Kiel Bay, Mecklenburg Bay and the Arkona Basin, but a strong decline in the Bornholm Basin since February 2017 (cf cruise report by Naumann 2017).

The oxygen situation in the Stolpe Channel and the southern part of the Eastern Gotland Basin was rather stable with slight reduction in oxygen concentrations since February 2017. Smaller intrusions of water containing higher oxygen concentrations might have occurred at distinct layers in the Eastern Gotland Basin. In the central Gotland Deep (stat. TF0271), the situation became worse with oxygen depletion below a depth of 204 m and increasing oxygen deficit (Table 4).

The oxygen situation improved in comparison with May 2016 in the northern region of the Eastern Gotland Basin (GB_B16, TF0286), where conditions became oxic at that time and the situation improved further in comparison with February 2017. However, the western Gotland Basin (e.g. Karlsö Deep) was still not influenced by the Baltic inflows (Table 4).

Table 4: Oxygen concentrations in the bottom layer (ml/l)
Hydrogen sulphide was converted into negative oxygen equivalents.

Area:	May 2017	May 2016	May 2015	May 2014	May 2013
Gotland Deep	-3.44	0.08	2.09	-6.03	-7.59
Farö Deep	0.38	0.05	-1.18	-3.58	-3.57
Landsort Deep	n.d.	-1,05	-0.73	-3.13	-0.78
Karlsö Deep	-1.56	-1.13	-0.84	-0.74	-0.70

Nutrients

Due to the relative shortage of nitrogen in comparison with phosphorus in relation to the Redfield ratio, the combined nitrogen is almost exhausted in the surface water in the Baltic Proper after the spring bloom, whereas phosphorus is still available (Table A1 in Appendix). In the bottom-near layer, the situation changed strongly due to the inflow of oxygenated water: phosphorus is bound by oxygen and therefore phosphate concentrations in the water decreased (e.g. May 2015 in the Gotland Deep, cf. Table 5) whereas nitrate+nitrite concentrations increased in areas which were influenced by the Mayor Baltic Inflow (Table 6). The increase in phosphate concentration and the decrease in nitrate+nitrite concentration is an indication that anoxic conditions established in deep water layers at station 271. On the other hand, the oxygen situation in the Farö Deep (TF0286) has obviously improved.

Table 5: Phosphate concentrations in the bottom layer (µM)

Area	May 2017	May 2016	May 2015	May 2013
Gotland Deep	5.20	2.46	1.95	9.45
Farö Deep	2.63	2.59	3.30	7.45
Landsort Deep	n.d.	3.23	3.70	4.95
Karlsö Deep	3.65	4.75	3.95	3.50

Table 6: Nitrate and nitrite concentrations in the bottom layer (µM)

Area	May 2017	May 2016	May 2015	May 2013
Gotland Deep	0.00	12.53	10.53	0.14
Farö Deep	7.91	4.89	0.25	0.52
Landsort Deep	n.d.	0.00	0.35	0.18
Karlsö Deep	0.00	0.00	0.34	0.11

11.5 Biological Data

The biological data will be analysed and are not available yet. They will be published in the next "Biological Assessment of the Baltic Sea" (https://www.io-warnemuende.de/tl_files/forschung/meereswissenschaftliche-berichte/)

References:

HELCOM, 2016: Manual for marine monitoring in the COMBINE programme of HELCOM: http://www.helcom.fi/Documents/Action%20areas/Monitoring%20and%20assessment/Manuals%20and%20Guidelines/Manual%20for%20Marine%20Monitoring%20in%20the%20COMBINE%20Programme%20of%20HELCOM.pdf

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Appendix

Table A1: Preliminary results for selected parameters in the surface layer (unvalidated results)

Table A2: Preliminary results for selected parameters in the near-bottom layer (unvalidated results)

Table A3: List of stations

Figs. 1-3: Station grid (total grid and two sub-maps)

Fig. 4: Oxygen /hydrogen sulphide concentrations in the near-bottom layer for selected stations

Fig. 5: Transsect from the Kiel Bight to the Farö Deep for temperature, salinity and oxygen (unvalidated data)

Dr. Norbert Wasmund

Scientist in charge

Table 1: Surface layer (0 - 10m)

Area	Station	Temperature	Salinity	PO_4^{3-}	NO_{23}^{-} *
Date	Name/ No. **	°C	PSU	µmol/dm³	µmol/dm³
Kiel Bay 9.5.2017	TF0360/ 005	8.63	14.46	0.09	0.10
Bay of Mecklenburg 10.5.2017	TF0012/ 007	8.10	9.60	0.12	0.12
Lübeck Bight 9.5.2017	TF0022/ 006	8.75	14.48	0.20	0.12
Arkona Basin 10.5.2017	TF0113/ 017	6.97	7.85	0.29	0.01
Bornholm Deep 12.5.2017	TF0213/ 033	6.11	7.48	0.40	0.02
Stolpe Channel 12.5.2017	TF0222/ 036	6.02	7.54	0.29	0.08
SE Gotland Basin 12.5.2017	TF0259/ 039	5.67	7.43	0.29	0.01
Gotland Deep 14.5.2017	TF0271/ 053	5.78	7.89	0.28	0.02
Fårö Deep 15.5.2017	TF0286/ 059	4.95	7.44	0.22	0.06
Karlsö Deep 16.5.2017	TF0245/ 070	7.02	7.05	0.43	0.05

* Σ NO_2^- + NO_3; NO_2 was present only in traces in most areas under investigation

** Station name see maps (Figs. 1 - 3)

Table 2: Bottom-near water layer

Area	Station	Sampl. Depth	Temp.	Salinity	O_2	PO_4^{3-}	NO_{23}^{-} *
Date	Name/ No. **	m	°C	PSU	cm^3/dm^3	$\mu mol/dm^3$	$\mu mol/dm^3$
Kiel Bay 9.5.2017	TF0360/ 005	17	7.03	19.21	6.52	0.24	1.02
Bay of Mecklenburg 10.5.2017	TF0012/ 007	23	7.77	14.62	7.00	0.22	0.08
Lübeck Bight 9.5.2017	TF0022/ 006	22	7.94	14.99	6.99	0.14	0.17
Arkona Basin 10.5.2017	TF0113/ 017	45	4.81	15.28	5.14	0.48	0.20
Bornholm Deep 12.5.2017	TF0213/ 033	87	6.92	18.21	0.36	2.28	7.50
Stolpe Channel 12.5.2017	TF0222/ 036	88	6.43	15.22	3.20	1.45	7.64
SE Gotland Basin 12.5.2017	TF0259/ 039	86	6.04	12.35	1.51	2.05	6.28
Gotland Deep 14.5.2017	TF0271/ 053	234	7.14	13.45	-3.44	5.20	0.00
Fårö Deep 15.5.2017	TF0286/ 059	190	7.07	12.90	0.38	2.63	7.91
Karlsö Deep 16.5.2017	TF0245/ 070	107	5.51	10.24	-1.56	3.65	0.00

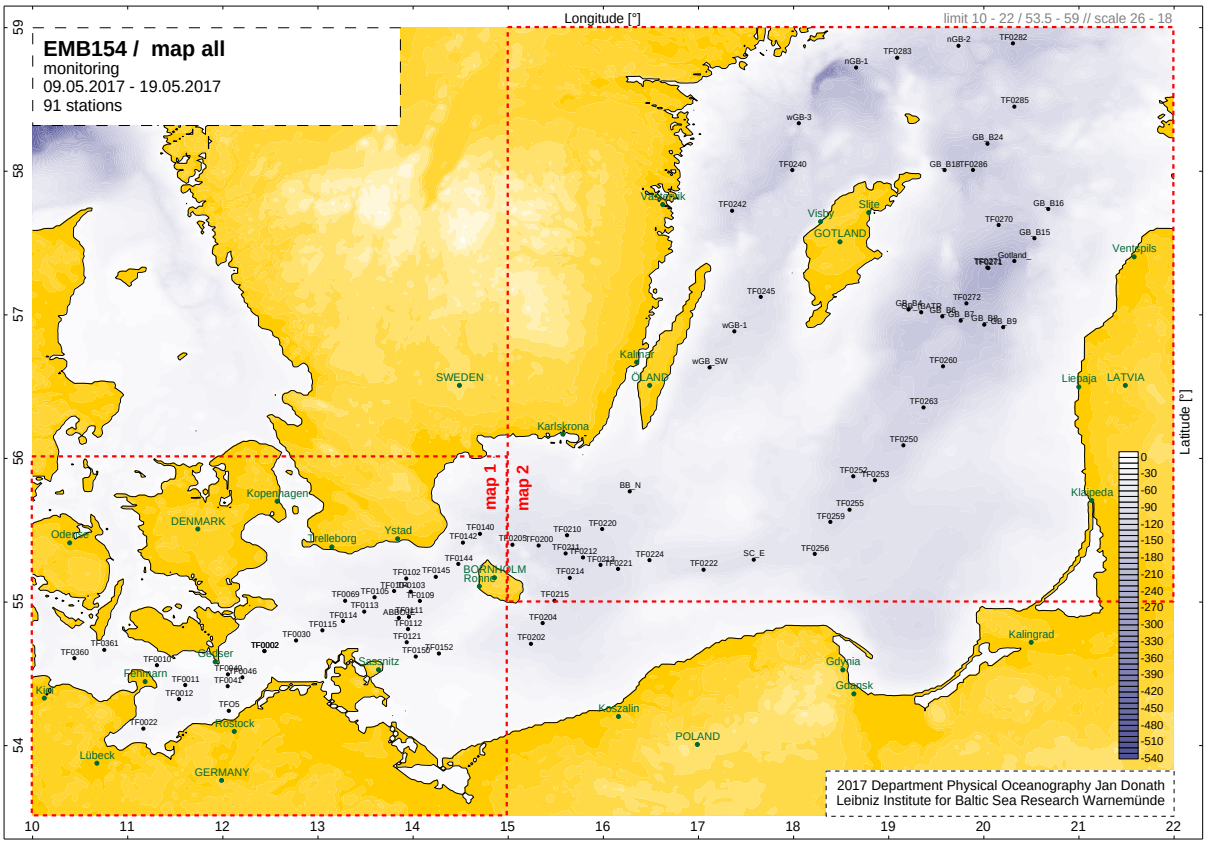
* Σ NO_2^- + NO_3; NO_2 was present only in traces in most areas under investigation

** Station name see maps (Figs. 1 - 3)

Table A3: List of stations

Station number	Station name	Degrees East	Minutes East	Degrees North	Minutes North
1	TFO5	12	4.5	54	13.9
2	TF0011	11	37	54	24.8
3	TF0010	11	19.2	54	33.1
4	TF0361	10	46	54	39.5
5	TF0360	10	27	54	36
6	TF0022	11	10.5	54	6.6
7	TF0012	11	33	54	18.9
8	TF0041	12	3.7	54	24.4
9	TF0040	12	3.9	54	29.3
10	TF0046	12	13	54	28
11	TF0002	12	27	54	39
12	TF0001	12	42.4	54	41.8
13	TF0030	12	47	54	43.4
14	TF0115	13	3.5	54	47.7
15	TF0114	13	16.6	54	51.6
16	TF0069	13	18	55	0
17	TF0113	13	30	54	55.5
18	TF0105	13	36.4	55	1.5
19	TF0104	13	48.8	55	4.1
20	TF0102	13	56.5	55	9.3
21	TF0103	13	59.3	55	3.8
22	TF0109	14	5	55	0
23	TF0111	13	58.1	54	53.4
24	ABBOJE	13	51.5	54	52.9
25	TF0112	13	57.5	54	48.2
26	TF0121	13	56.8	54	42.6
27	TF0150	14	2.6	54	36.7
28	TF0152	14	17	54	38
29	TF0202	15	15	54	42
30	TF0204	15	22.5	54	50.7
31	TF0215	15	30	55	0
32	TF0214	15	39.6	55	9.6
33	TF0213	15	59	55	15
34	TF0221	16	10	55	13.3
35	TF0224	16	30	55	17
36	TF0222	17	4	55	13
37	SC_E	17	35.6205	55	17.1742
38	TF0256	18	15.1	55	19.6
39	TF0259	18	24	55	33
40	TF0255	18	36	55	38
41	TF0252	18	38.4	55	52
42	TF0253	18	52	55	50.4
43	TF0250	19	10	56	5
44	TF0263	19	22.7	56	20.8
45	TF0260	19	35	56	38
46	GB_B9	20	12.9803	56	54.3228
47	GB_B8	20	1.1126	56	55.3813
48	GB_B7	19	46.1855	56	57.1094

49	GB_B6	19	34.6127	56	58.8014
50	GB	19	21.2602	57	0.5642
51	GB_B4	19	13.2594	57	1.7215
52	TF0272	19	49.8	57	4.3
53	TF0271	20	3	57	19.2
54	Gotland	20	20	57	22
55	GB_B15	20	32.6228	57	31.4824
56	TF0270	20	10	57	37
57	TF0271	20	3	57	19.2
58	GB_B16	20	41.4343	57	43.6643
59	TF0286	19	54	58	0
60	GB_B18	19	36	58	0
61	GB_B24	20	3.0692	58	11.0057
62	TF0285	20	20	58	26.5
63	TF0282	20	19	58	53
64	nGB-2	19	44.645	58	51.9452
65	TF0283	19	6	58	47
66	nGB-1	18	40.1882	58	42.7468
67	wGB-3	18	4.0958	58	19.5568
68	TF0240	18	0	58	0
69	TF0242	17	22	57	43
70	TF0245	17	40	57	7
71	wGB-1	17	23.3807	56	52.6289
72	wGB_SW	17	7.8319	56	37.5142
73	BB N	16	17.4229	55	45.7136
74	TF0220	16	0	55	30
75	TF0213	15	59	55	15
76	TF0212	15	47.8	55	18.1
77	TF0211	15	36.9	55	19.8
78	TF0210	15	37.8	55	27.4
79	TF0200	15	20	55	23
80	TF0205	15	3.4	55	23.4
81	TF0140	14	43	55	28
82	TF0142	14	32.2	55	24.3
83	TF0144	14	30.4	55	15
84	TF0145	14	15	55	10
85	TF0121	13	56.8	54	42.6
86	ABBOJE	13	51.5	54	52.9
87	TF0113	13	30	54	55.5
88	TF0030	12	47	54	43.4
89	TF0001	12	42.4	54	41.8
90	TF0046	12	13	54	28
91	TF0012	11	33	54	18.9



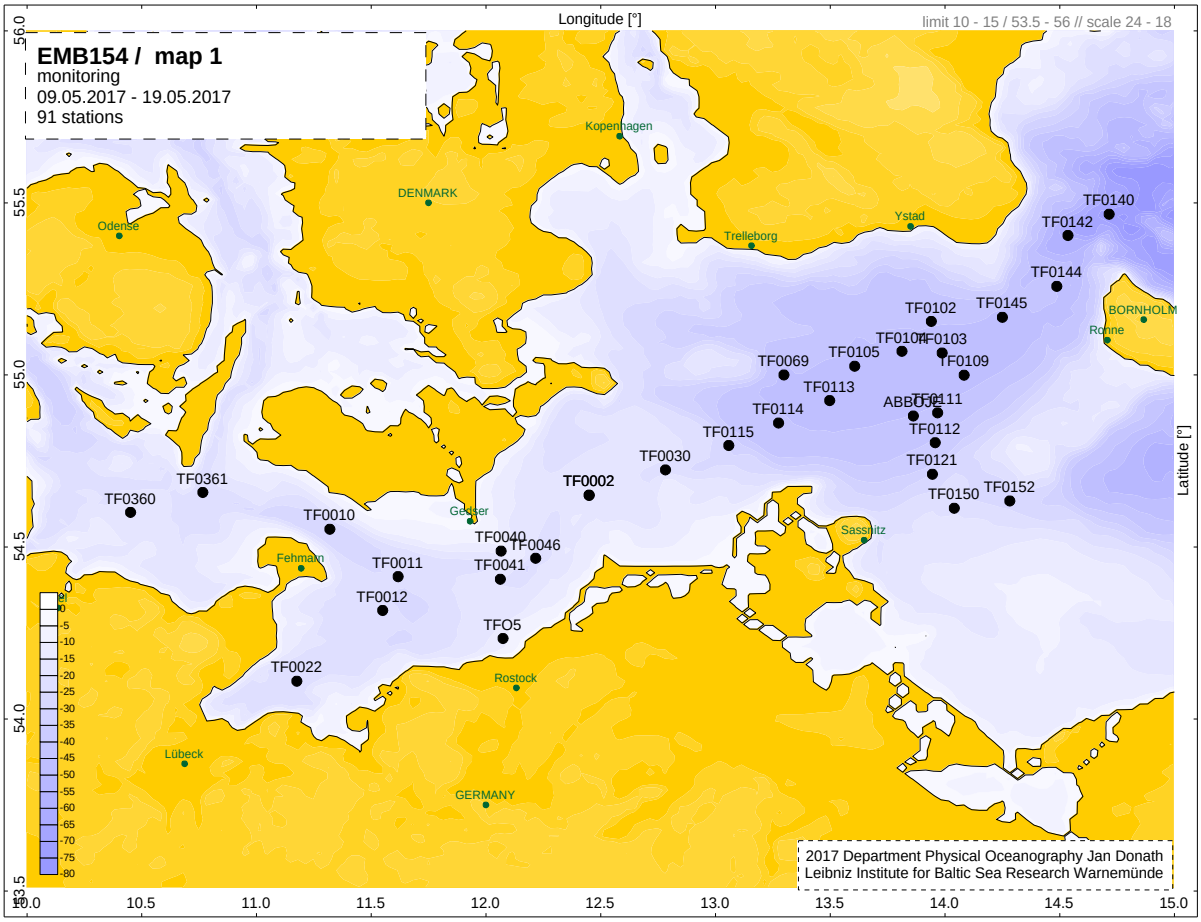


Fig1 and 2: Total station map and detailed map of the western Baltic Sea.

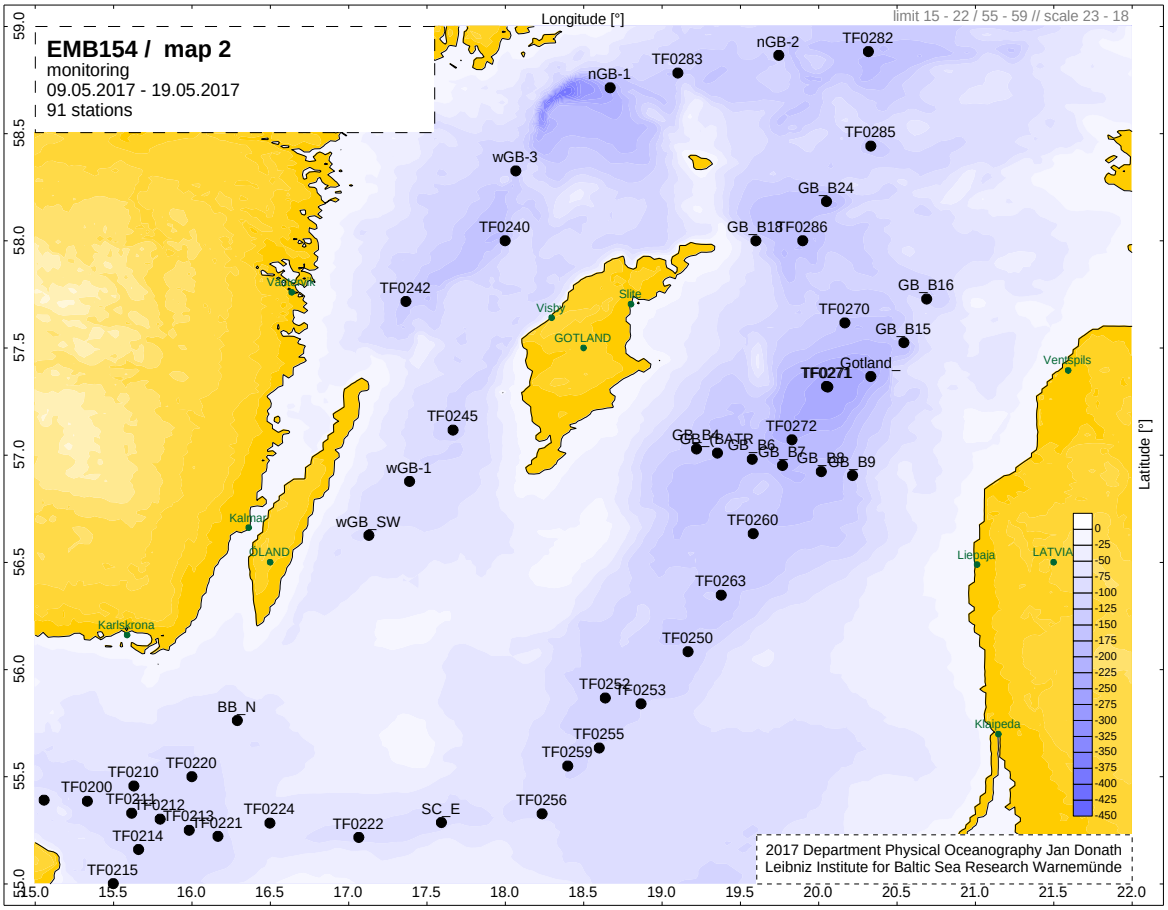


Fig. 3: Map of monitoring stations in the Baltic Proper.

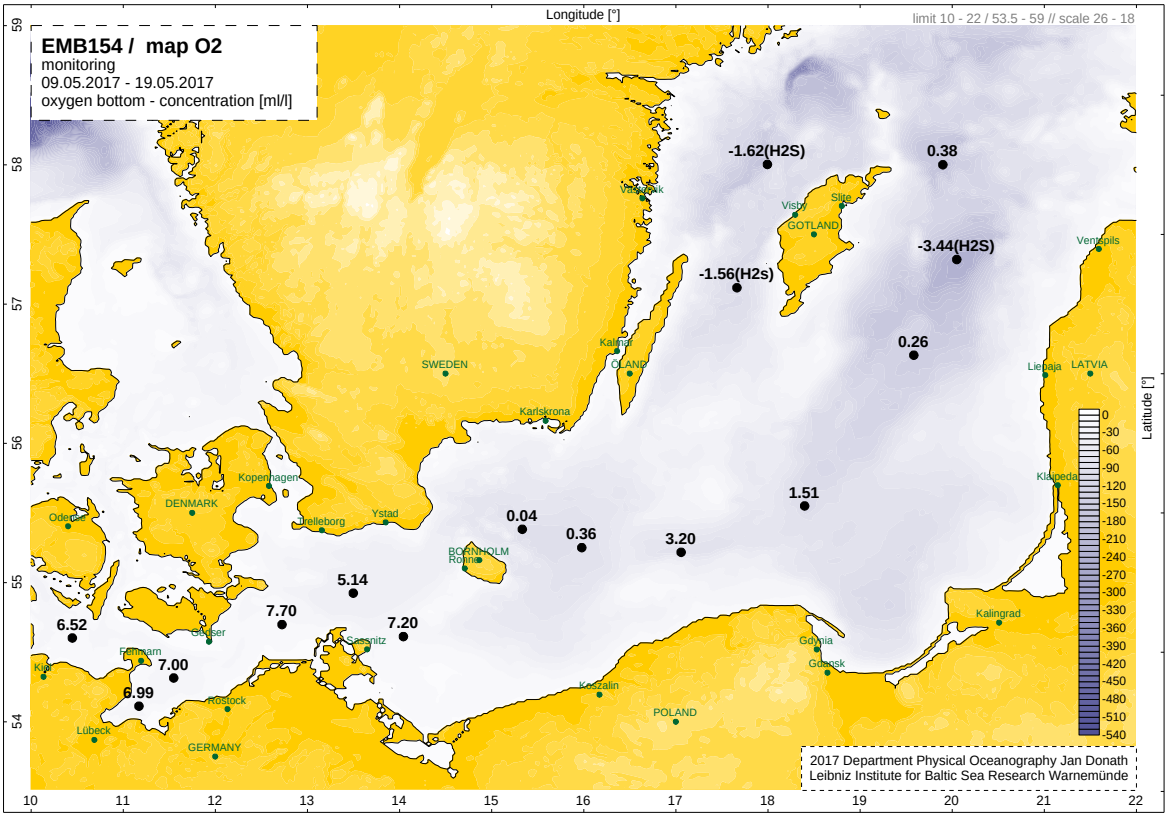
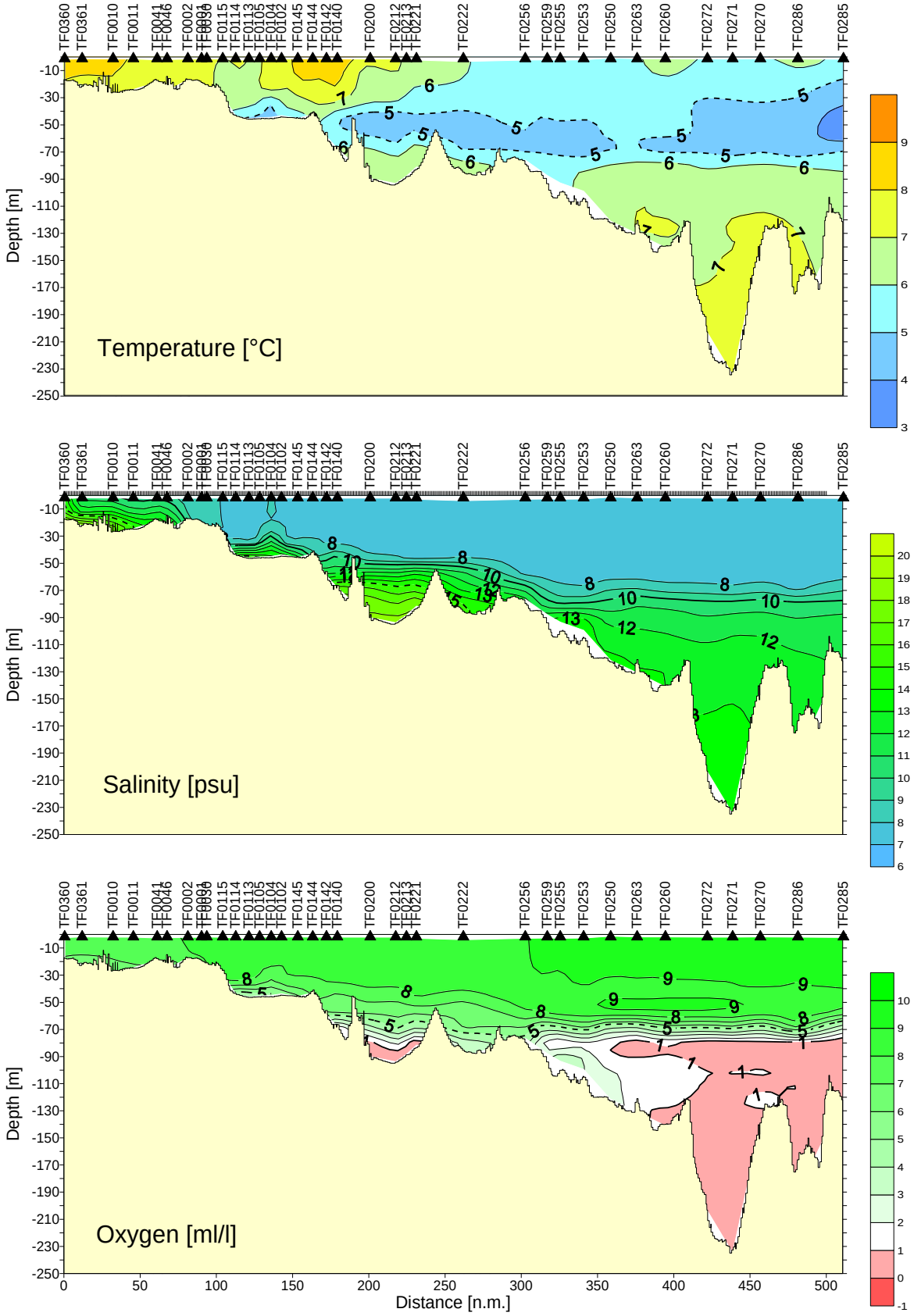


Fig. 4: Oxygen/hydrogen sulphide concentrations in the near-bottom layer (selected stations)

EMB154 - Monitoring

Kiel Bight - Gotland Sea
09.05.2017 09:53 - 17.05.2017 23:00 UTC



KB-GS.srf

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Fig. 5: Transsect from the Kiel Bight to the Farö Deep for temperature, salinity and oxygen.