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 182

Monitoring Cruise
08 May – 17 May 2018
Kiel Bight to Northern Baltic Proper

This report is based on preliminary data

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1. **Cruise No.:** EMB 182

2. **Dates of the cruise:** from 08 May to 17 May 2018

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**
No port

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. Jörg Dutz
BSc. Daniel Pönisch

Engineers: Martin Kolbe
Jan Donath

Technicians: Michael Poetzsch
Birgit Sadkowiak
Jenny Jeschek

Trainee: Madleen Dierken

Observer: Piotr Rembarz (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 net (WP2, 100µm), Apstein net (50 µm), Secchi disk, nutrient analyser FlowSys from Alliance, oxygen analyser Titrino IV from Metrohm, Microscope Wild MZ8 from Leica.

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 (station map see Figs. 1-3). On the way back, selected stations in the Stolpe Channel, Bornholm Basin, Arkona Basin and Mecklenburg Bight were sampled a second time for hydrographic, nutrient, phytoplankton and/or 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. Station map see Figs. 1-3, station list Table A3.

The hydrographical, chemical and biological investigations were performed according to the Manual of the COMBINE Programme of HELCOM (2017).
Water samples were collected by means of a Rosette Sampler containing 13 free-flow bottles of 5 litres each, combined with a CTD system.
Standard parameters registered by the CTD system were:

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

Biological standard parameters (at biological core stations):

- Chlorophyll-a concentration
- Phytoplankton biomass and species composition
- Zooplankton abundance and species composition
- Secchi depth
- Additional at stations TF0271 and TF0284: Samples for flow cytometry, DNA and fluorescence in situ hybridisation (FISH)

Additional research:

- To support a study of the long-term changes in the population dynamics of key copepod species in the Bornholm Basin (*Temora longicornis, Acartia bifilosa, Centropages hamatus* and *Pseudocalanus acuspes*), zooplankton nets (Apstein, mesh size 50 µm, WP-2 mesh size 100 µm) were deployed to quantitatively sample nauplii and copepodites; responsible scientist Dr. Jörg Dutz.
- Selected copepod species (*Temora longicornis*, *Acartia bifilosa*) were isolated from net catches in order to establish cultures for physiological studies on salinity and temperature tolerance. They were sampled from Kiel Bay and Bornholm Basin to enable investigations of local adaptations; responsible scientist Dr. Jörg Dutz.

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

11.2 Weather conditions

Stable high-pressure conditions prevailed during the entire cruise. Only at the beginning of the cruise (8-10 May 2018), air pressure was dropping from 1018 hPa (in Bay of Mecklenburg) to 1010 hPa (in Bornholm Basin). It increased from 1010 to 1014 hPa during the night from 10 to 11 May and stayed above 1013 hPa during the remaining cruise with air pressure above 1020 hPa from 12-14 May (in Eastern Gotland Basin and northern Baltic Proper).
It was sunny during almost the entire cruise, with denser clouds occurring only on 10 May and 15 May 2018.
The wind speed was mostly below 10 m/s and never exceeded 15 m/s. The highest wind speeds (above 10 m/s) occurred in the evenings/nights of the 8 May and 9 May (easterly winds) as well as 10 May (south-easterly winds).
Air temperature was in the range of 9-15 °C.
No rain during the whole cruise.

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 Major Baltic Inflow and other inflows of the previous years, the development of the oxygen situation is of special interest and the situation is compared with that of May 2017 (Wasmund 2017).

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 10.5 psu at the surface to 29.3 psu at the bottom with the steepest change at 18-20 m depth. The deep water layer was lower in temperature (6.0 °C) and oxygen concentration (5.5 ml/l) than the upper water layer (10.9 °C and 7.7 ml/l, respectively). At station TF0360, the vertical differences were lower (see Table A1 in the Annex) with a narrow deep-water layer just above the bottom.

Lübeck Bight (station TF0022), had a cold intermediate water layer between 13 and 21 m depth (3.4-3.9 °C). This cold intermediate water layer was not found in the central Bay of Mecklenburg (TF0012). In contrast, a warm-water intrusion (up to 12 °C) occurred at 3-10 m depth in the Kadet Channel (TF0046; to a lesser degree also at Station TF0002). The oxygen concentrations above the bottom were still fairly high (5.3-8 ml/l) in the Bay of Mecklenburg.

At the shallow stations of the Arkona Basin, a week pycnocline established at 16 m depth (TF0001, TF0030) or 22 m depth (TF0115), but oxygen concentrations were still high below that depth (> 8 ml/l) even down to the bottom. However, the deep stations (TF0114, TF 0069, TF0113, TF0123, TF0111, TF0112, AB Boje, TF0122, TF 0102, TF0103, TF0105, TF0109) were characterized by a more or less continuous increase in salinity from about 25-30 m depth to the bottom. The oxygen concentrations decreased within this salinity gradient towards the bottom but were still in the range of 4-6 ml/l above the bottom, which is higher than in May 2016 and May 2017 at the western stations (TF0069, TF0113, TF0114) and at least equal to the previous years at the eastern stations (TF0105, TF0104, AB Boje, TF0109, TF0103, TF0102). In the shallower southern part (TF0121, TF0150), near-bottom oxygen concentrations were 6-8 ml/l. In the north-eastern Arkona Basin (Bornholmgat, stat. TF0144, TF0142, TF0140), near-bottom oxygen concentrations ranged from about 7.5 ml/l (42 m; TF0144) to 5.0 ml/l (68 m; TF0140). The oxygen condition at the latter station improved significantly in comparison to May 2017.

In the western Bornholm Basin and Bornholm Deep (TF0200, TF0211, TF0212, TF0213, TF0214, TF0221), the pycnocline started at 45-55 m depth and oxygen concentrations decreased to zero below 80-82 m depth, which is 10-15 m above ground. Hydrogen sulphide enriched above the ground.

In the Slupsk Furrow ("Stolpe Channel", stat. TF0222), salinity increased steadily from 50 m depth to the bottom, whereas the oxygen concentration decreased to 0.7 ml/l above the ground (89 m). This is 2.5 ml/l less than in May 2017. In the eastern part of Slupsk Furrow (TF0267 = the former station SC_E) and in the southern part of the Eastern Gotland Basin (stat. TF0256), a strong pycnocline established below 68 m depth, which is deeper than in May 2017. Oxygen concentration is rather high in the deep water layer (3.7 ml/l) at station TF0256.

At many stations of the southern part of the Eastern Gotland Basin, the oxygen concentration increased from almost zero at 83 m depth to 1-2 ml/l at about 100 m depth. Stations that are situated at that water depth of approximately 100 m (TF0255, TF0253), show this oxygen concentration near the bottom, but at deeper stations (TF0250, TF0260, TF0404 to TF0408), an secondary oxygen peak shows up at about 100 m depth. Oxygen concentrations decrease below 100 m and become zero at about 122-130 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 already in May 2016 and 2017, but the oxygen concentrations are reduced meanwhile.

In the Gotland Deep (station TF0271), visited on 12 May 2018, the secondary oxygen maximum was found at 110 m depth (0.6 ml/l) and oxygen depletion started at about 140 m depth (in comparison to 204 m depth in May 2017). Whereas H_2S was identified in May 2017 only at the standard depths of 225 m and above ground, it was now found already from 163 m downwards. A small secondary oxygen maximum of 0.2-0.7 ml/l at 100-110 m depth was also found further north (stations TF0270, Gotland_NE, TF0286), indicating the influence of the Major Baltic Inflow up to here. Below this secondary oxygen maximum (i.e. below 130 m depth), oxygen concentrations became zero in contrast to May 2017, when low (about 1 ml/l) oxygen concentrations occurred from 80 m depth to the bottom. That means the effect of the Major Baltic Inflow is fading. At the most northern stations (TF0285, TF0282, nGB-2, TF0283, nGN-1), a deep secondary oxygen maximum was lacking and oxygen became almost zero at 90 m depth and was replaced by hydrogen sulphide in the deeper layers.

In the Landsort Deep (TF0284), the halocline started at 60 m depth, indicated by a strong increase in salinity and temperature but a strong decrease in oxygen concentrations. H_2S was identified below 77 m depth.

The Western Gotland Basin (wGB-3, TF0240, TF0242, TF0245, wGB-1) is nearly anoxic (0.05 ml/l O_2) at approximately 90 m depth and oxygen disappears completely with greater depth.

11.4 Development in comparison with earlier cruises

The Major Baltic inflow from December 2014 (Mohrholz et al. 2015) and following weak and moderate inflows affected the salinity, temperature, nutrient and oxygen conditions.
Also the long-term climatic change becomes clearly visible in the temperature development from year to year

Salinity

The salinity increase in the bottom has reversed in the Gotland Deep since 2017 and in the Farö Deep in 2018 whereas it continued in the Landsort and Karlsö Deeps from Mai 2014 to May 2018 (Table 1). The influence of the Major Baltic Inflow is fading in the Gotland Deep.

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

Area:	May 2018	May 2017	May 2016	May 2015	May 2014
Gotland Deep	13.29	13.45	13.77	13.54	12.21
Farö Deep	12.69	12.90	12.70	12.11	11.42
Landsort Deep	11.46	no data	10.99	10.54	10.32
Karlsö Deep	10.40	10.24	9.87	9.60	9.48

Temperature
According to the weather evaluation, the May 2018 was the warmest of the last 100 years at least in the German region. The surface water layer was permanently heated during the cruise, leading to a strong shallow thermocline even within the upper 10 m. In order to make the data from Table 1 comparable with earlier cruise reports, the mean values of the upper 10 m are presented there. However, the temperature near the surface (approximately 1 m depth) was still up to 2 °C higher than in the 0-10 m layer, e.g. in Arkona Basin 9.2 °C, Eastern Gotland Basin 9.1 °C, Farö Deep 9.5 °C, Karlsö Deep 10.7 °C. The 0-10 m surface water temperatures of selected stations of this cruise are compared with earlier cruises and long-term mean values (1971-1990) collected during IOW's 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 included). This trend was broken in 2017 because of a rather cold spring in 2017. Temperatures increased again since 2017.

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

Area:	May 2018	May 2017	May 2016	May 2015	May 2013	Mean May 1971-1990
Mecklenburg Bay (TF0012)	8.2	8.1	11.3	9.7	8.2	2.6
Arkona Basin (TF0113)	7.1	7.0	9.8	8.2	6.2	2.1
Bornholm Basin (TF0213)	8.4	6.1	8.9	8.0	4.5	2.4
East.Gotland Basin (TF0271)	7.4	5.8	8.7	7.0	4.8	2.6
Farö Deep (TF0286)	8.6	5.0	7.9	4.3	5.3	2.3
Karlsö Deep (TF0245)	8.1	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 at least in the western Gotland Basin..

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

Area:	May 2018	May 2017	May 2016	May 2015	May 2014	May 2013	Mean May 1971-1990
Bornholm Deep	6.93	6.92	6.24	7.00	5.60	5.12	6.12
Gotland Deep	6.91	7.14	7.53	6.88	6.62	6.41	5.62
Farö Deep	6.77	7.07	6.81	6.50	5.71	5.94	5.20
Landsort Deep	6.27	n.d.	5.85	5.42	5.32	5.39	4.76
Karlsö Deep	5.66	5.51	5.21	5.01	4.99	5.33	4.18

Oxygen
After the Major Baltic 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 and is specifically reported in Section 11.3. A special map of bottom water oxygen concentrations (including "negative" oxygen) is inserted as Fig. 4. 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 are still relatively high in the central Kiel and Mecklenburg Bay, but they decrease already in the Arkona Basin and are depleted in the Bornholm Basin in comparison with May 2017 when the Bornholm Deep had still an oxygen concentration of 0.4 ml/l. The oxygen situation became worse also in the Stolpe Channel and in the southern part of the Eastern Gotland Basin. The comparison with May 2017 pretends no worsening in the Eastern Gotland Basin (Table 4). However, as explained in Section 11.3, the thickness of the anoxic layer has strongly increased from about 30 m in May 2017 to 95 m in May 2018 in the central Gotland Deep (stat. TF0271).

The Major Baltic Inflow has reached the Farö Deep (stat. TF0286) in 2016 and improved the oxygen conditions even in 2017, but the introduced oxygen has been consumed and the Farö Deep was anoxic below 130 m depth in May 2018. In the western Gotland Basin (e.g. Karlsö Deep), the oxygen deficit increased further.

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

Area:	May 2018	May 2017	May 2016	May 2015	May 2014	May 2013
Gotland Deep	-3.26	-3.44	0.08	2.09	-6.03	-7.59
Farö Deep	-2.53	0.38	0.05	-1.18	-3.58	-3.57
Landsort Deep	-0.16	n.d.	-1,05	-0.73	-3.13	-0.78
Karlsö Deep	-2.10	-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, but surprisingly also phosphorus concentrations are already very low (Table A1 in Appendix). After the inflow of oxygenated water, phosphorus was 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 Major Baltic Inflow (Table 6). After the consumption of the oxygen, the reverse processes led to a new increase in phosphate concentration and the decrease in nitrate+nitrite concentration is an indication that anoxic conditions established in the deep water layers.

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

Area	May 2018	May 2017	May 2016	May 2015	May 2013
Gotland Deep	4.87	5.20	2.46	1.95	9.45
Farö Deep	4.25	2.63	2.59	3.30	7.45
Landsort Deep	2.85	n.d.	3.23	3.70	4.95
Karlsö Deep	3.50	3.65	4.75	3.95	3.50

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

Area	May 2018	May 2017	May 2016	May 2015	May 2013
Gotland Deep	0.00	0.00	12.53	10.53	0.14
Farö Deep	0.00	7.91	4.89	0.25	0.52
Landsort Deep	0.00	n.d.	0.00	0.35	0.18
Karlsö Deep	0.00	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/)

In the Eastern Gotland Basin, a dinoflagellate bloom was observed in the surface water. The cyanobacteria *Aphanizomenon* and to a lesser degree even *Nodularia* were already present and floated to the surface under calm conditions (wind speed <3 m/s), as found on 12 May in the Eastern Gotland Basin (station TF0271). Yellow flocs on the surface, observed on 16 May in the western Arkona Basin, turned out to be pine and spruce pollen.

A first screening of the zooplankton composition revealed primarily adult organisms of *Acartia bifilosa*, *A. longiremis*, *Pseudocalanus acuspes* and *Oithona similis* in Kiel Bay. Further east, in the Bornholm Basin, the dominance of early development stages of copepods of *Temora longicornis, Centropages hamatus* and *Acartia bifilosa* indicate an earlier stage in the seasonal development. Apart from copepods, rotifers, appendicularians and the mixotrophic ciliate *Mesodinium rubrum* were quite common.

References:

HELCOM, 2017: 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 concentrations in the near-bottom layer for selected stations. Hydrogen sulphide (H_2S) is indicated as “negative oxygen”.

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

Area	Station	Temperature	Salinity	PO_4^{3-}	NO_{23}^{-} *
Date	Name/ No. **	°C	PSU	µmol/dm³	µmol/dm³
Kiel Bay 8.5.2018	TF0360/ 005	8.72	13.43	0.00	0.10
Lübeck Bight 8.5.2018	TF0022/ 008	9.84	11.27	0.00	0.11
Bay of Mecklenburg 9.5.2018	TF0012/ 009	8.22	11.35	0.00	0.07
Arkona Basin 9.5.2018	TF0113/ 020	7.09	7.85	0.08	0.11
Bornholm Deep 10.5.2018	TF0213/ 041	8.39	7.47	0.03	0.17
Stolpe Channel 11.5.2018	TF0222/ 044	7.10	7.54	0.35	0.05
SE Gotland Basin 11.5.2018	TF0259/ 047	8.68	7.39	0.02	0.04
Gotland Deep 12.5.2018	TF0271/ 063	7.40	7.04	0.05	0.01
Fårö Deep 13.5.2018	TF0286/ 066	8.63	7.06	0.03	0.12
Landsort Deep 13.5.2018	TF0284/ 073	7.76	6.15	0.01	0.02
Karlsö Deep 14.5.2018	TF0245/ 077	8.06	7.02	0.03	0.05

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

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

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

Area	Station	Sampl. Depth	Temp.	Salinity	O_2 ***	PO_4^{3-}	NO_{23}^{-} *
Date	Name/ No. **	m	°C	PSU	cm³/dm³	µmol/dm³	µmol/dm³
Kiel Bay 8.5.2018	TF0360/ 005	17.5	6.62	19.25	6.51	0.13	0.55
Lübeck Bight 8.5.2018	TF0022/ 008	22.6	5.68	19.60	(5.73)	0.20	1.22
Bay of Mecklenburg 9.5.2018	TF0012/ 009	23.9	5.85	22.64	5.77	0.41	2.89
Arkona Basin 9.5.2018	TF0113/ 020	45.9	6.35	17.78	4.94	0.33	0.02
Bornholm Deep 10.5.2018	TF0213/ 041	88.0	6.93	16.84	-0.30	6.80	0
Stolpe Channel 11.5.2018	TF0222/ 044	89.3	7.47	13.46	(0.74)	1.99	7.48
SE Gotland Basin 11.5.2018	TF0259/ 047	87.7	6.20	11.01	0.16	2.71	5.10
Gotland Deep 12.5.2018	TF0271/ 063	234.5	6.91	13.29	-3.26	4.87	0
Fårö Deep 13.5.2018	TF0286/ 066	190.1	6.77	12.69	-2.53	4.25	0
Landsort Deep 13.5.2018	TF0284/ 073	437.5	6.27	11.46	-0.16	2.85	0
Karlsö Deep 14.5.2018	TF0245/ 077	106.4	5.66	10.40	-2.10	3.50	0

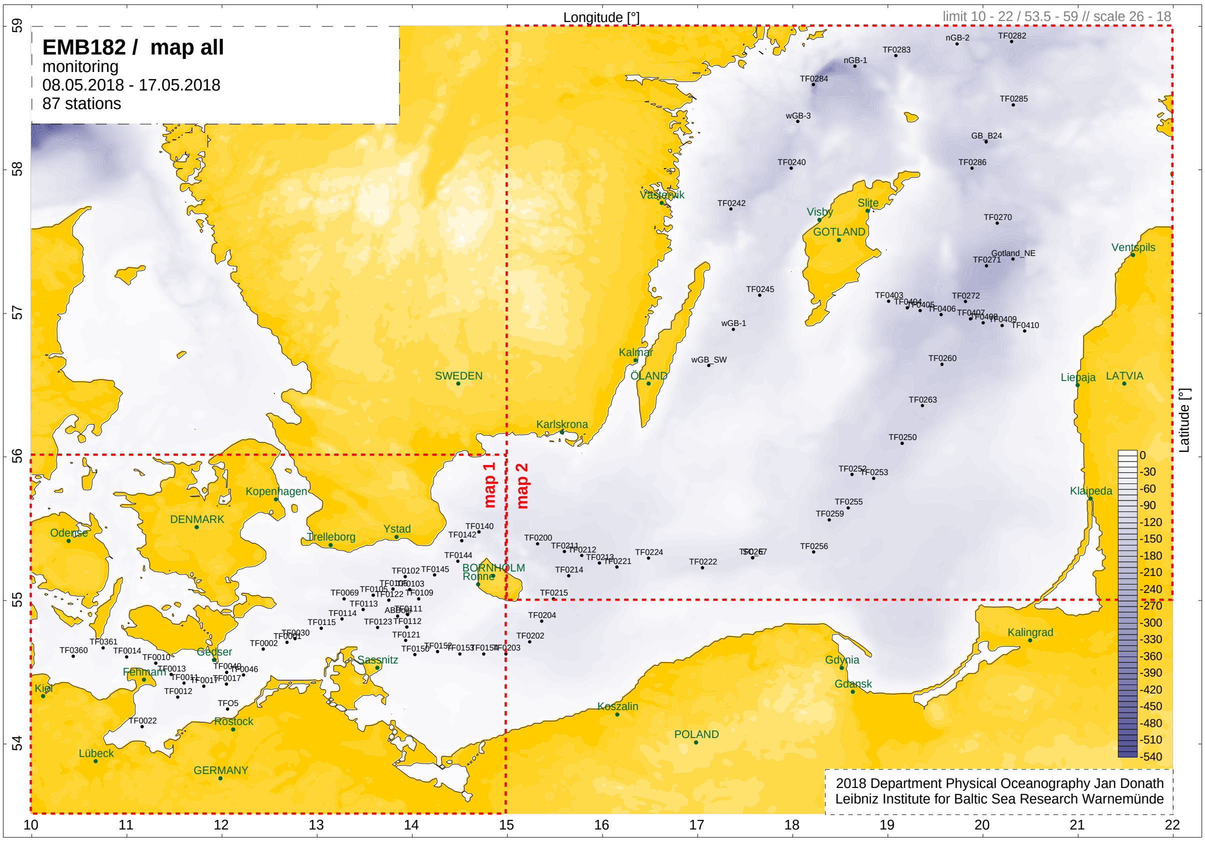
* Σ NO_2^- + NO_3; NO_2 was present only in traces in most areas under investigation
** Station name see maps (Fig. 1 - 3)
*** Oxygen data from titration; only those in brackets are unvalidated data from CTD probe

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	TF0014	11	0.8	54	35.7
7	TF0013	11	28.9	54	28.4
8	TF0022	11	10.5	54	6.6
9	TF0012	11	33	54	18.9
10	TF0017	11	49.4	54	23.5
11	TF0041	12	3.7	54	24.4
12	TF0040	12	3.9	54	29.3
13	TF0046	12	13	54	28
14	TF0002	12	27	54	39
15	TF0001	12	42.4	54	41.8
16	TF0030	12	47	54	43.4
17	TF0115	13	3.5	54	47.7
18	TF0114	13	16.6	54	51.6
19	TF0069	13	18	55	0
20	TF0113	13	30	54	55.5
21	TF0123	13	39	54	48
22	TF0150	14	2.6	54	36.7
23	TF0121	13	56.8	54	42.6
24	TF0112	13	57.5	54	48.2
25	TF0111	13	58.1	54	53.4
26	ABBOJE	13	51.5	54	52.9
27	TF0122	13	46.2	54	59.4
28	TF0105	13	36.4	55	1.5
29	TF0104	13	48.8	55	4.1
30	TF0102	13	56.5	55	9.3
31	TF0103	13	59.3	55	3.8
32	TF0109	14	5	55	0
33	TF0145	14	15	55	10
34	TF0144	14	30.4	55	15
35	TF0142	14	32.2	55	24.3
36	TF0140	14	43	55	28
37	TF0200	15	20	55	23
38	TF0211	15	36.9	55	19.8
39	TF0214	15	39.6	55	9.6
40	TF0212	15	47.8	55	18.1
41	TF0213	15	59	55	15
42	TF0221	16	10	55	13.3
43	TF0224	16	30	55	17
44	TF0222	17	4	55	13
45	TF0267	17	35.62	55	17.17
46	TF0256	18	15.1	55	19.6
47	TF0259	18	24	55	33
48	TF0255	18	36	55	38

49	TF0252	18	38.4	55	52
50	TF0253	18	52	55	50.4
51	TF0250	19	10	56	5
52	TF0263	19	22.7	56	20.8
53	TF0260	19	35	56	38
54	TF0403	19	1.5	57	4.4
55	TF0404	19	13.3	57	1.7
56	TF0405	19	21.3	57	0.5
57	TF0406	19	34.6	56	58.8
58	TF0407	19	53	56	57
59	TF0408	20	1.1	56	55.4
60	TF0409	20	13	56	54.3
61	TF0410	20	27	56	52
62	TF0272	19	49.8	57	4.3
63	TF0271	20	3	57	19.2
64	Gotland_NE	20	19.8	57	22.02
65	TF0270	20	10	57	37
66	TF0286	19	54	58	0
67	TF0277	20	3	58	11
68	TF0285	20	20	58	26.5
69	TF0282	20	19	58	53
70	nGB-2	19	44.64	58	51.94
71	TF0283	19	6	58	47
72	nGB-1	18	40.1882	58	42.7468
73	TF0284	18	14	58	35
74	wGB-3	18	4.0958	58	19.5568
75	TF0240	18	0	58	0
76	TF0242	17	22	57	43
77	TF0245	17	40	57	7
78	wGB-1	17	23.3807	56	52.6289
79	wGB_SW	17	7.8319	56	37.5142
80	TF0267	17	35.62	55	17.17
81	TF0222	17	4	55	13
82	TF0224	16	30	55	17
83	TF0221	16	10	55	13.3
84	TF0213	15	59	55	15
85	TF0214	15	39.6	55	9.6
86	TF0215	15	30	55	0
87	TF0204	15	22.5	54	50.7
88	TF0202	15	15	54	42
89	TF0203	15	0	54	37
90	TF0154	14	46	54	37
91	TF0153	14	31	54	37
92	TF0152	14	17	54	38
93	TF0150	14	2.6	54	36.7
94	TF0121	13	56.8	54	42.6
95	TF0112	13	57.5	54	48.2
96	TF0111	13	58.1	54	53.4
97	ABBOJE	13	51.5	54	52.9
98	TF0109	14	5	55	0
99	TF0113	13	30	54	55.5
100	TF0030	12	47	54	43.4

101	TF0001	12	42.4	54	41.8
102	TF0002	12	27	54	39
103	TF0046	12	13	54	28
104	TF0012	11	33	54	18.9



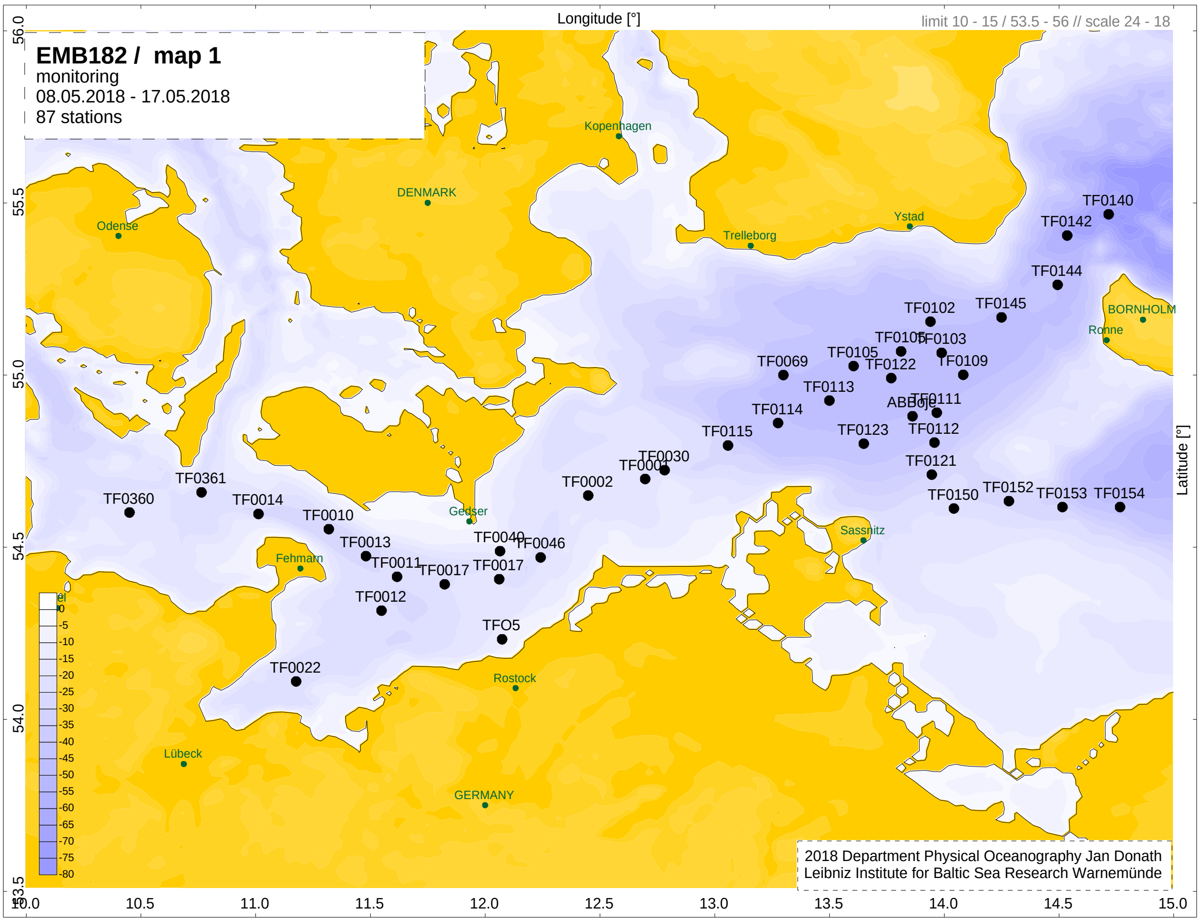


Fig1 and 2: Total station map and detailed map of the western Baltic Sea.

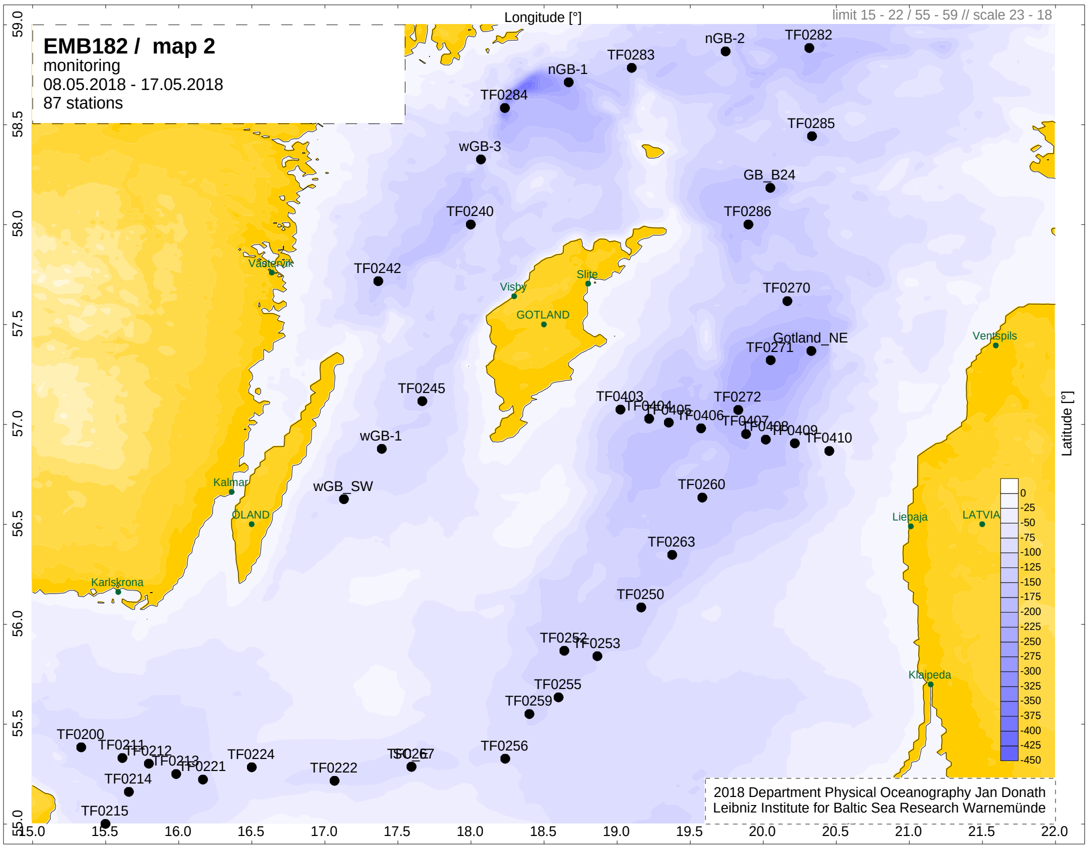


Fig. 3: Detailed map of monitoring stations in the Baltic Proper.

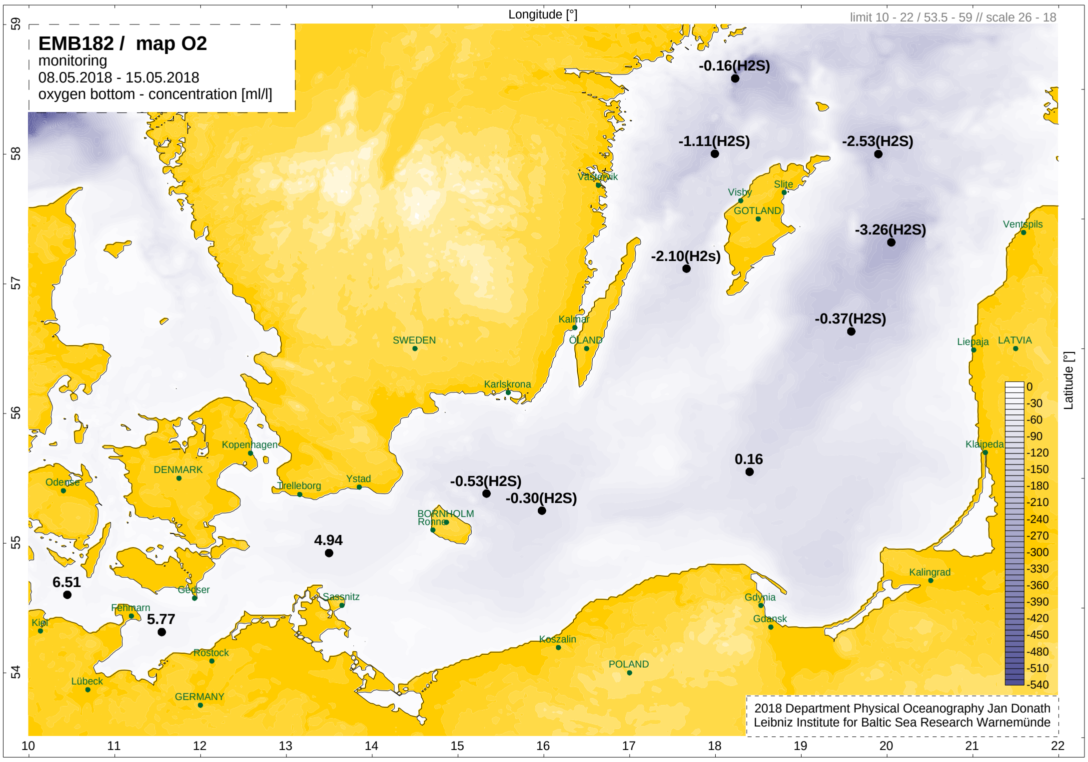


Fig. 4: Oxygen/hydrogen sulphide concentrations in the near-bottom layer (selected stations). H_2S is indicated as “negative oxygen”.

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08.05.2018 09:21 - 13.05.2018 04:27 UTC

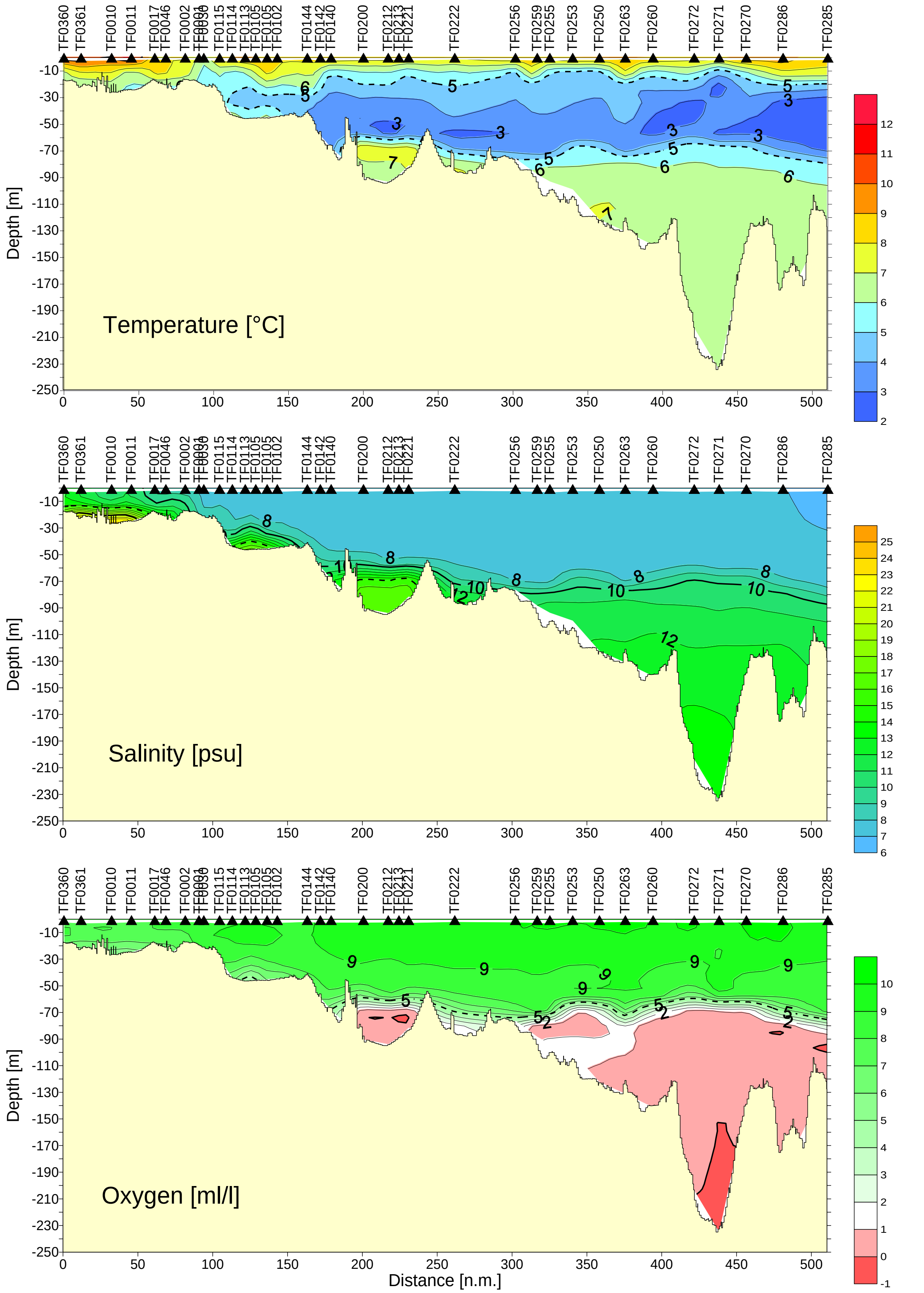

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Fig. 5: Transsect from the Kiel Bight to the Farö Deep for temperature, salinity and oxygen.