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 045

Monitoring Cruise
3 May – 12 May 2013
Kiel Bight to Northern Baltic Proper

This report is based on preliminary data

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1. **Cruise No.:** EMB 045

2. **Dates of the cruise:** from 03 May to 12 May 2013

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 of call

6. **Purpose of the cruise**
   Baltic monitoring in the frame of the COMBINE Programme of HELCOM

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

8. **Research staff:**
   Chief scientist: Dr. Wasmund, Norbert

   Scientists: Dr. Kuss, Joachim

   Engineers: Ruickoldt, Johann
   Donath, Jan
   Beier, Sebastian

   Technicians: Kreuzer, Lars
   Lage, Susanne
   Pötzsch, Michael
   Jürgensmann, Susanne,
   Henseler, Christina
   Scholz, Christian

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

10. **Scientific equipment**
CTDO bathysonde, water samplers, plankton nets

11. **General remarks and preliminary results**
The area under investigation extended from Kiel Bight to the Northern Gotland Sea (station map see Figs. 1-3). On the way back, selected HELCOM stations in the Bornholm Sea, Arkona Sea and Mecklenburg Bight were sampled a second time for nutrient, phytoplankton and zooplankton data. The hydrographical, chemical and biological investigations were performed according to the Manual of the COMBINE Programme of HELCOM.
Concerning the weather conditions, the cruise can roughly be divided into 4 periods:

1.) 03.05.2013, while cruising through Mecklenburg Bight and Kiel Bight: high air pressure (1015-1020 hPa), low easterly wind (<7 m/s), air temperature during the day 7-9 °C, sunny. Due to the rather calm conditions, the water column was strongly

stratified. In shallower coastal areas (e.g. TFO5), the halocline started already at a depth of 7 m, but the strongest gradient was found between 15 and 20 m in the deeper central stations of Kiel Bight and Mecklenburg Bight (Stat. TF 0361, TF0360, TF0012). The salinity increased at the most westerly station TF0360 from 14 g/kg at the surface to 27 g/kg near the bottom with oxygen concentrations in the bottom water of 5-8 ml/l. The relatively high Secchi depth of 9 to 13 m indicated that no phytoplankton bloom occurred at that time.

2.) 04.05.2013, Mecklenburg Bight and western Arkona Sea: lower air pressure (1014-1015 hPa), southerly winds up to 10 m/s, air temperature 6-8 °C, sunny. The halocline starts in the central Arkona Sea at about 17 m depth. Salinity reaches 20 g/kg near the bottom with oxygen concentrations still higher than 5 ml/l.

3.) 05.05.-08.05.2013: This main part of the cruise covered the eastern Arkona Sea (5.5.2013), Bornholm Sea (6.5.2013), Eastern Gotland Basin and northern Baltic Proper (7.-8.5.2013). The weather was still sunny, with high air pressure (1019-1026 hPa), low south-westerly winds up to 10 m/s and air temperature of 5-10 °C. Only in the afternoon of the 8.5.2013 it became cloudy with slight rain.

The halocline started in the western part of the Bornholm Basin at a depth of 50 m, where water temperature was 1.5 - 2 °C. Below that depth, water temperature increased by 3-4 grd and oxygen concentration decreased to a minimum of 1.5 - 2 ml/l at a depth of 70 m.

In the southern part of the Gotland Basin (station TF 0259, TF0255), the halocline started at 60 m depth at a water temperature of 2 °C, which increased to 5 °C at about 84 m depth, where oxygen concentration decreased to almost zero. Below this minimum level, the oxygen concentration increased to over 3 ml/l. Up to station TF0263, oxygen concentrations were relatively high near the bottom. In the deepest part of the Gotland Basin (stations TF0272, TF0271), the oxygen concentrations became zero at 115 m depth. At stations TF0286 and TF0285, oxygen was depleted below 100 m depth.

The Secchi depth was high (11 m in Eastern Gotland Sea, 9 m in Bornholm Sea).

4.) 09.05.-11.05.2013, from the Landsort Deep and western Gotland Sea back to the Bornholm Sea (10.5.2013), Arkona Sea and Mecklenburg Bight (11.5.2013): It was cloudy; air pressure ranged from 1008 to 1010 hPa on 9.5.-10.5.2013 with increase to 1013 hPa on 11.5.13. The south-westerly winds decreased from 8 m/s to 2 m/s on 10.5.2013. Similar to the Eastern Gotland Sea, the temperature increased sharply below the halocline (60 m) whereas the oxygen concentration decreased strongly to zero at a depth of 86 m also in the Western Gotland Sea (station TF0284, TF0240).

The surface water temperatures (0-10 m; °C) 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 the table below. Because of the rather cold and long winter, surface water temperatures in the first half of May of 2013 were lower than long-term data from the beginning of the systematic monitoring programme.

Area:	2013	1971-1990
Mecklenburg Bight (stat. TF0012)	8.2	8.24
Arkona Sea (stat. TF0113)	6.2	7.44
Bornholm Sea (stat. TF0213)	4.5	6.75
Eastern Gotland Sea (stat. TF0271)	4.8	5.66
Farö Deep (stat. TF0286)	5.3	5.63
Karlsö Deep (stat. TF0245)	4.6	6.76

The long-term trend of increasing water temperature [°C] is representatively reflected in the deep water layers of the central deeps of the Baltic Proper. Only in the Bornholm Deep, the bottom-near water was warmer than the historical long-term mean of the 1970s and 1980s:

	May 2013	Mean 1971-1990
Bornholm Deep	5.12	6.12
Gotland Deep	6.41	5.62
Farö Deep	5.94	5.20
Landsort Deep	5.39	4.76
Karlsö Deep	5.33	4.18

Appendix

Tables 1& 2: Preliminary results for selected parameters in the surface layer and the near-bottom layer (unvalidated results)

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)

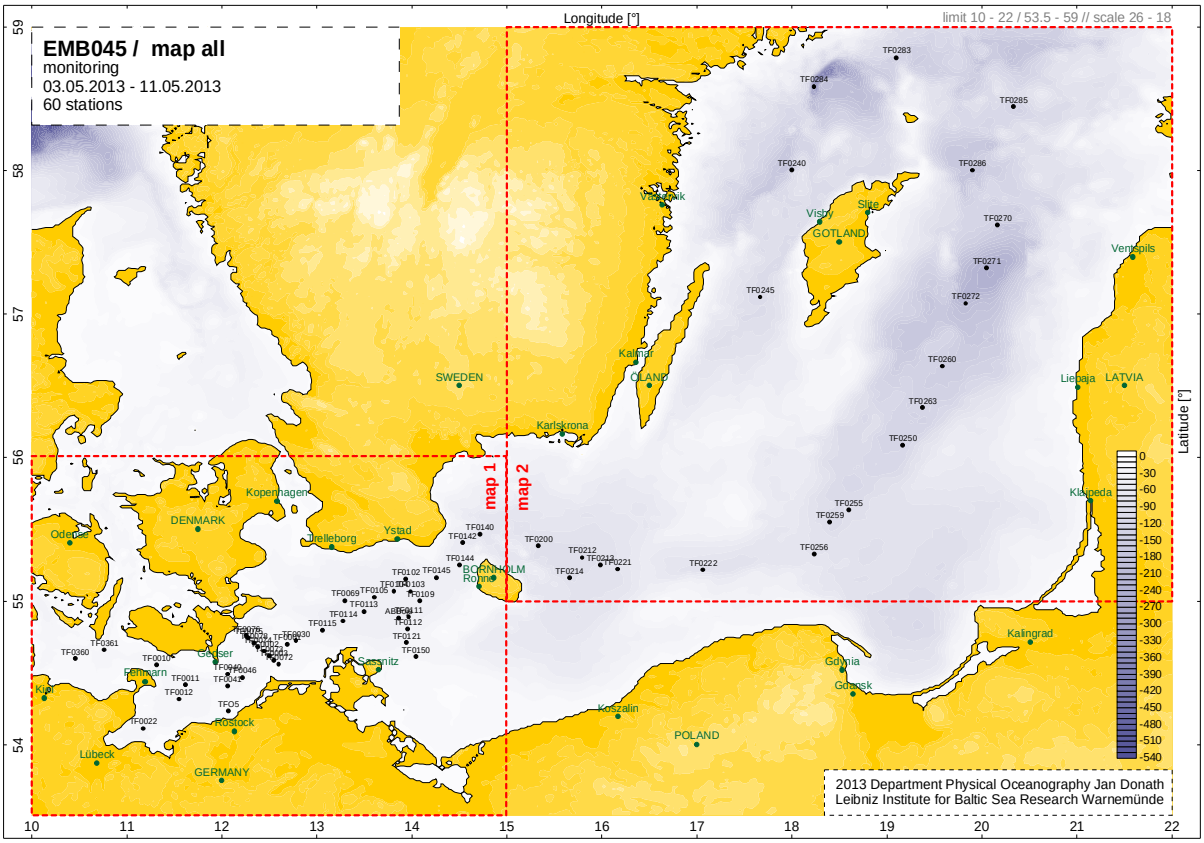
Area	Station	Temperature	Salinity	PO_4^{3-}	NO_{23}^{-} *
Date	Name/ No. **	°C	PSU	µmol/dm³	µmol/dm³
Kiel Bight 03.05.2013	TF0360/ 005	7.0	13.90	0.03	0.02
Meckl. Bight 04.05.2013	TF0012/ 007	8.2	11.49	0.06	0.11
Lübeck Bight 04.05.2013	TF0022/ 006	7.8	11.73	0.04	0.06
Arkona Basin 04.05.2013	TF0113/ 017	6.2	7.57	0.03	0.04
Bornholm Deep 05.05.2013	TF0213/ 035	4.5	7.31	0.23	0.04
Stolpe Channel 06.05.2013	TF0222/ 037	5.0	7.23	0.40	0.10
SE Gotland Basin 06.05.2013	TF0259/ 039	4.8	7.27	0.27	0.02
Gotland Deep 07.05.2013	TF0271/ 046	4.8	6.91	0.07	0.05
Fårö Deep 08.05.2013	TF0286/ 048	5.3	6.59	0.16	0.06
Landsort Deep 09.05.2013	TF0284/ 051	5.6	6.61	0.21	1.25
Karlsö Deep 10.05.2013	TF0245/ 053	4.6	6.73	0.65	0.60

* 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 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 Bight 03.05.2013	TF0360/ 005	17	5.11	21.32	6.91	0.21	0.01
Meckl. Bight 04.05.2013	TF0012/ 007	23	4.85	23.31	5.08	0.58	2.01
Lübeck Bight 04.05.2013	TF0022/ 006	21	3.69	21.34	5.54	0.51	0.73
Arkona Basin 04.05.2013	TF0113/ 017	45	5.12	19.45	5.67	0.41	0.12
Bornholm Deep 05.05.2013	TF0213/ 035	87	5.12	15.73	2.13	0.86	7.95
Stolpe Channel 06.05.2013	TF0222/ 037	88	4.97	12.72	3.19	1.53	8.88
SE Gotland Basin 06.05.2013	TF0259/ 039	86	4.96	10.05	0.68	2.50	4.57
Gotland Deep 07.05.2013	TF0271/ 046	232	6.41	12.12	-7.59	9.45	0.14
Fårö Deep 08.05.2013	TF0286/ 048	187	5.94	11.50	-3.57	7.45	0.52
Landsort Deep 09.05.2013	TF0284/ 051	431	5.39	10.53	-0.78	4.95	0.18
Karlsö Deep 10.05.2013	TF0245/ 053	106	5.33	9.98	-0.70	3.50	0.11

* Σ NO_2^- + NO_3; NO_2 was present only in traces in most areas under investigation
** Station name see maps (Fig. 1 - 3)



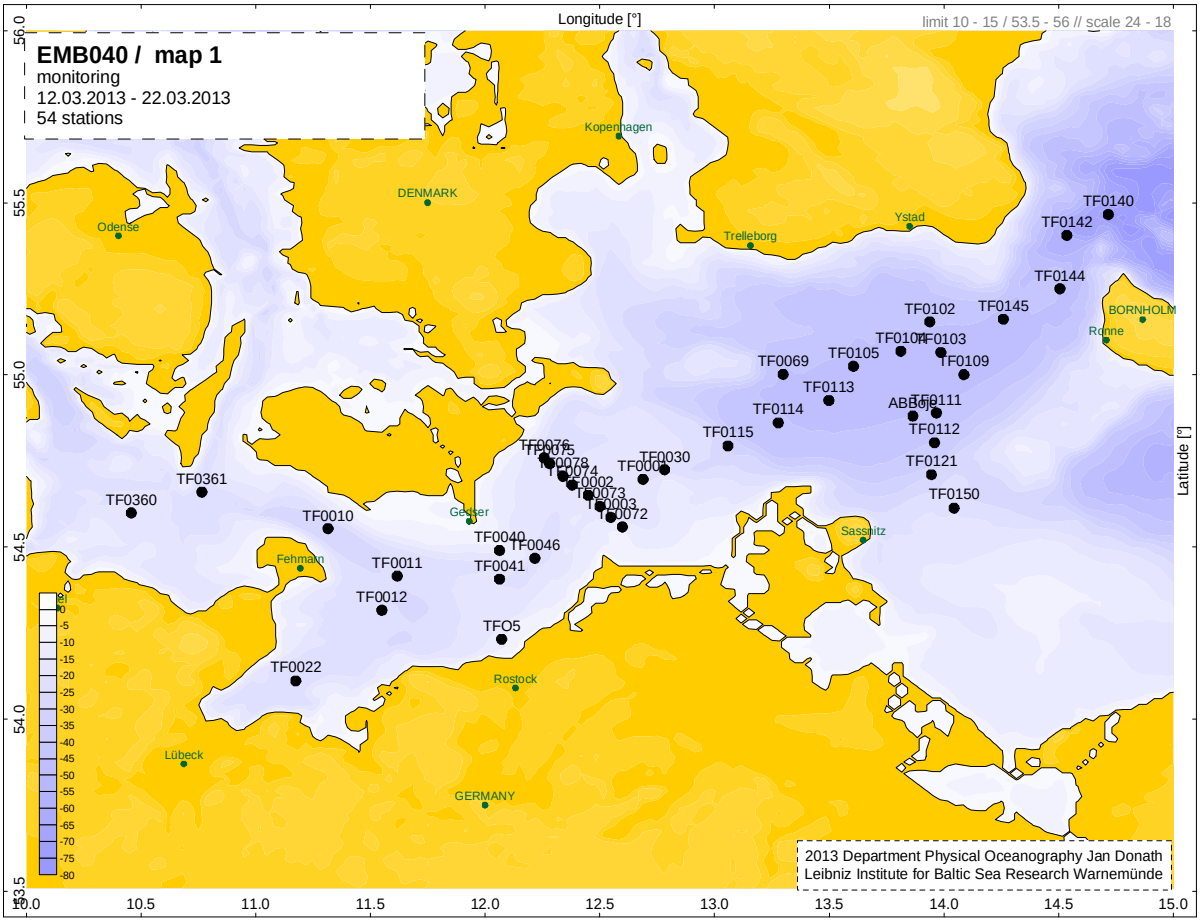


Fig1 and 2: Total station map and detailed map of the western Baltic Sea .

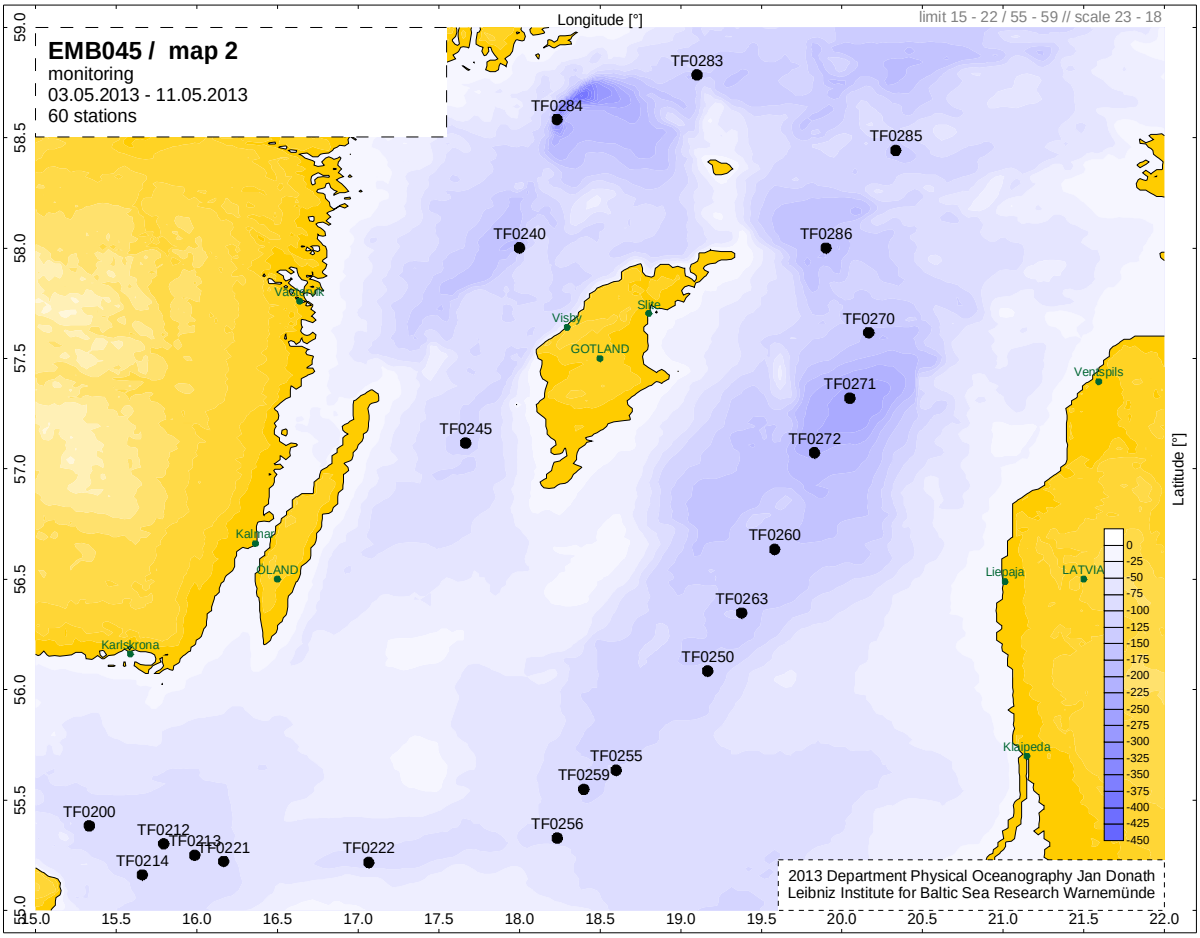


Fig. 3: Map of monitoring stations in the Baltic Proper.

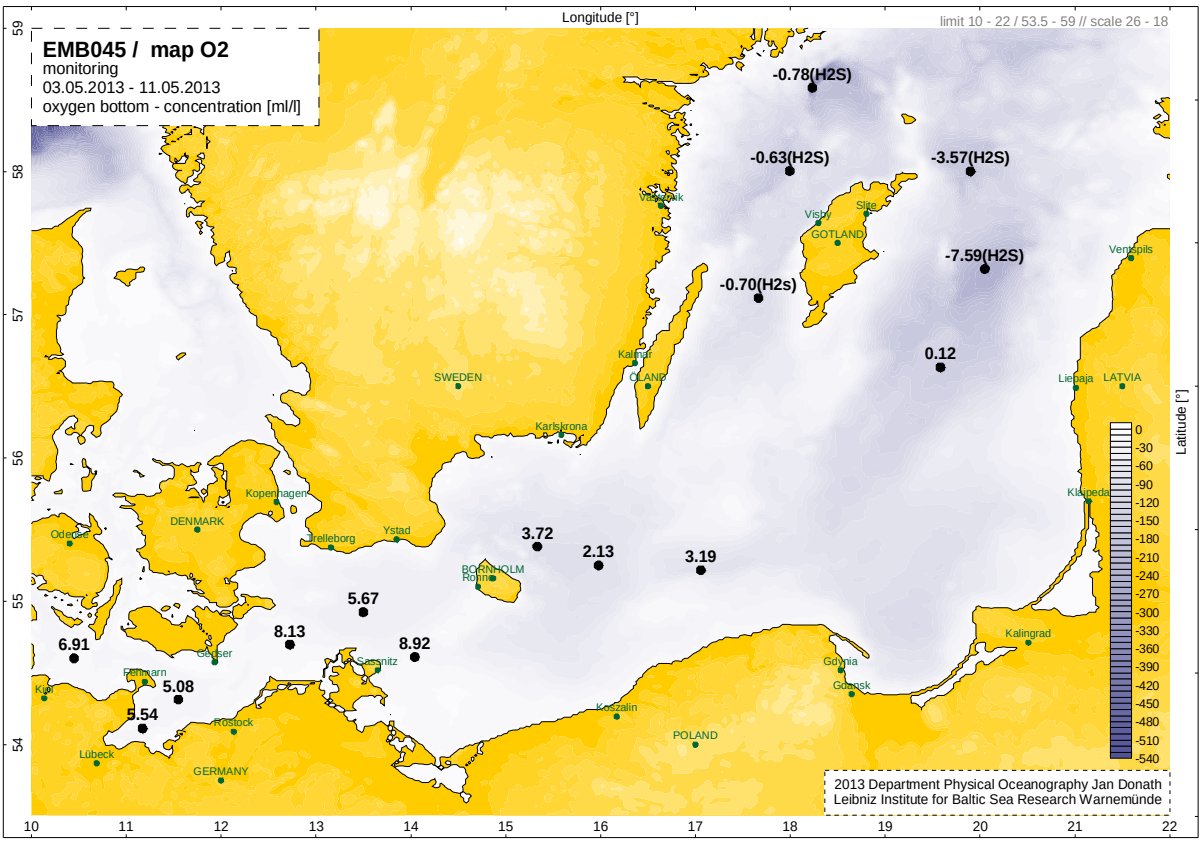


Fig. 4: Oxygen/hydrogen sulphide concentrations in the near-bottom layer (selected stations)

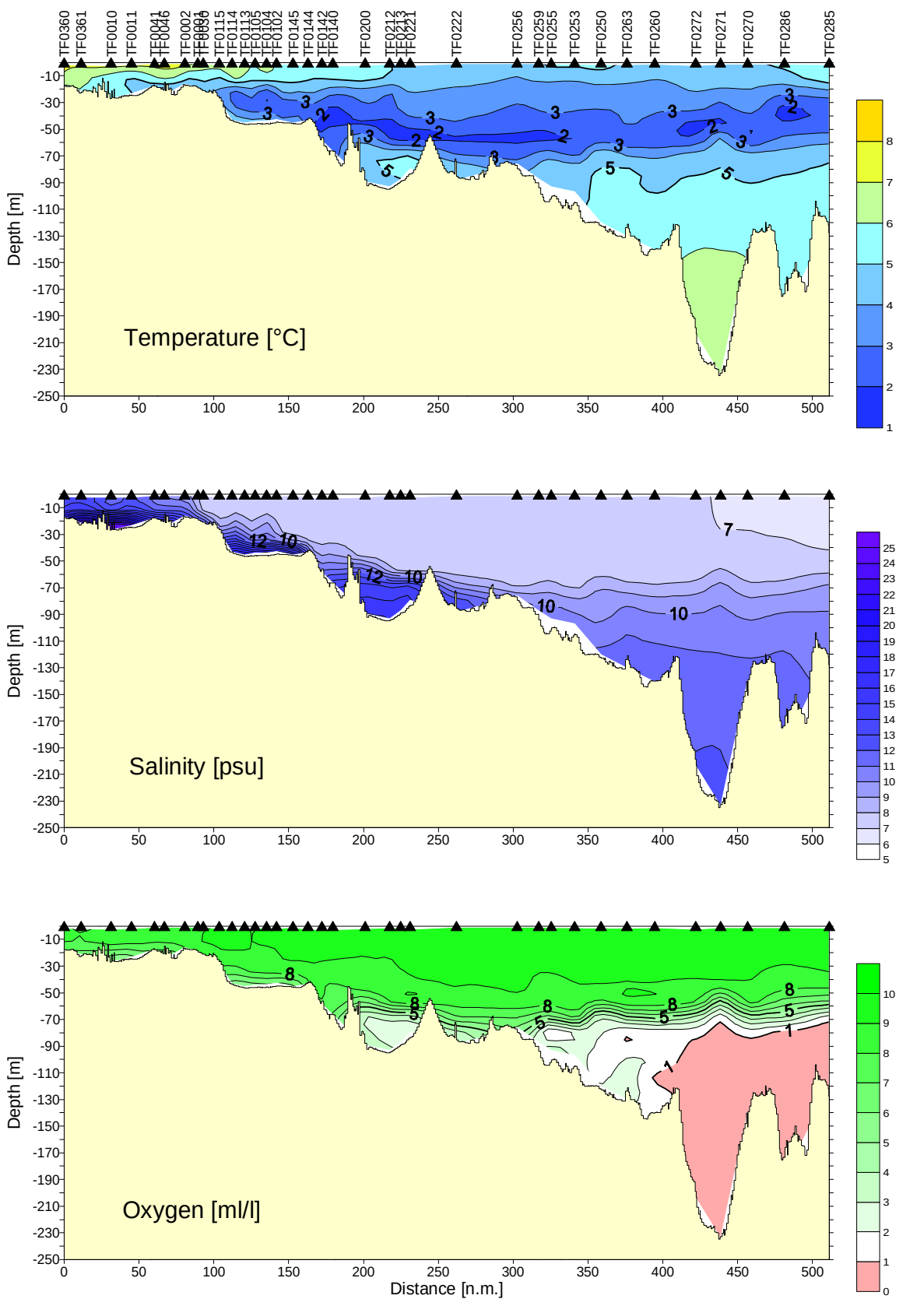


Fig. 5: Transsect from the Kiel Bight to the Farö Deep for temperature, salinity and oxygen.