



# Leibniz Institute for Baltic Sea Research Warnemünde

## Cruise Report

r/v "Elisabeth Mann Borgese"

Cruise-No. 06EZ/11/05

Monitoring Cruise  
3 August – 14 August 2011  
Kiel Bight to Northern Baltic Proper

This report is based on preliminary data

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1. **Cruise No.:** 06EZ/11/05
2. **Dates of the cruise:** from 3 August to 14 August 2011-08-16
3. **Name:** "Elisabeth Mann Borgese"  
**Nationality:** Germany  
**Operating Authority:** Leibniz Institute of 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**  
06.08.2011: Saßnitz

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. N. Wasmund (leg 1)  
Dr. Oliver Schmale (leg 2)

**Participants:** Donath, Jan  
Ruickoldt, Johann  
Kreuzer, Lars  
Kubsch, Hildegard  
Lerz, Astrid  
Tschakste, Andrea  
Jeschek, Jenny  
Jakobs, Gunnar  
Wagner, Carola  
Meyer, David  
Kießlich, Katrin  
Berndmeyer, Christine  
Blumenberg, Martin

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

10. **Scientific equipment**  
CTD, water samplers, plankton nets, in-situ-pump, sediment sampler

11. **General remarks and preliminary results**

The area under investigation extended from Kiel Bight to the Northern Gotland Sea (station map see Figs. 1 and 2). On the way back, selected HELCOM stations in the Bornholm Sea, Arkona Sea and Mecklenburg Bight were sampled a second time for nutrient and phytoplankton data. The meteorological, hydrographical, chemical and biological investigations were performed according to the Manual of the COMBINE Programme of HELCOM.

The cruise was divided into two parts. The first part covered the western Baltic and the Arkona Sea and ended on 6 August 2011. Four participants (including the cruise leader of

the 1<sup>st</sup> leg), whose tasks were fulfilled, were replaced by four new participants (including the cruise leader of the 2<sup>nd</sup> leg). The ship continued the cruise on 6 August with its track into the Bornholm Sea, Eastern Gotland Sea, northern Baltic Proper and Western Gotland Sea. In the second part of the cruise, the Baltic monitoring program was supplemented by investigations that are targeting the methane cycle in the Gotland- and Landsort-Deep. This multidisciplinary approach combines gas chemistry, molecular biology and organic geochemistry.

The weather conditions during the cruise changed from high air pressure (1018 hPa on 3.8.2011) to low air pressure (997 hPa on 9.8.2011) and increased again to 1012 hPa on 13.8.2011). Air temperature was rather stable, ranging from 15 to 21 °C. The first two days of the cruise were warm and mostly sunny with easterly winds up to 14 m/s. On the evening of the 5.8.2011 and the morning of the 6.8.2011 (eastern Arkona Sea), the wind calmed down to 2-4 m/s. The wind changed to westerly directions on 7.8.2011 (up to 14 m/s) and to north-east on 11.8.2011 and stayed between about 6 to 12 m/s until the end of the cruise. It was mostly cloudy with some sunshine temporarily.

In open areas of Kiel Bight, the mixed layer extended to 9-12 m depth, in Mecklenburg Bight to 7-8 m and in the central Arkona Sea to 10-18 m depth. A cold water body was situated at 20-30 m depth in the western Arkona Sea with salinity and oxygen concentration not much higher than in the overlaying water (Fig. 4a). The deep water layers were substantially warmer but with oxygen concentrations of less than 1 mg/l near the bottom (Fig. 4c). The halocline became deeper and more distinct from west to east (Fig. 4b). It started in the deeper regions of the Arkona Sea at 30 m depth, in the Bornholm Basin at 45 m, and in the Gotland Basin at 55-65 m depth. Oxygen concentrations became zero below approximately 80 m depth in the Bornholm Basin. In the shallower southern part of the Eastern Gotland Basin (Stat. TF0256 to TF 253), an oxygen minimum of almost zero was found at 75-85 m depth, but an increase in oxygen concentration (up to approximately 3 ml/l) below 85 m. In the deep part of the Gotland basin (Stat. TF0250), the oxygen concentrations became nearly zero already below 70 m, increased only slightly between 90 and 110 m and became zero below 110 m depth (in the Gotland and Farö Deep below 120 m). At the northern Stations (TF0283, TF0285, TF0284), the oxygen concentration was zero below 85 m.

The surface water temperatures (0-10 m; °C) of selected stations of this cruise are compared with early long-term mean values (1971-1990, numbers in brackets) collected during our summer cruises (end of July-beginning of August) in the 1970s and 1980s in the table below. They reflect that the summer 2011 was cold (cloudy and rainy), especially in the western Baltic:

Area:	2011:	2010:	1971-1990:
Mecklenburg Bight (stat. TF0012)	17.2	19.0	17.7
Arkona Sea (stat. TF0113)	17.3	22.6	17.0
Bornholm Sea (stat. TF0213)	18.5	18.4	17.6
Eastern Gotland Sea (stat. TF0271)	19.1	22.0	17.3
Farö Deep (stat. TF0286)	19.4	20.9	17.7
Landsort Deep (stat. TF0284)	17.9	19.4	18.2
Karlsö Deep (stat. TF0245)	17.3	20.9	16.9

The long-term trend of increasing water temperature [°C] in the deep water layers in the western and northern deeps was not continuing. but not in the Bornholm and Gotland Deep:

	August 2011	July 2010	July 2007	July 2005	July 2003	Mean 1971-1990
Bornholm Deep	6.1	7.5	8.8	7.0	3.7	6.1

Gotland Deep	6.4	6.4	6.8	6.0	4.6	5.6
Farö Deep	6.4	6.8	6.1	6.0	6.0	5.2
Landsort Deep	5.9	6.1	5.7	5.8	5.9	4.8
Karlsö Deep	5.4	5.5	5.1	5.3	4.9	4.2

A Cyanobacteria bloom was not noticed during the whole cruise. Obviously, the typical bloom occurred already before this cruise, indicated by the exhausted nutrients.

The Secchi Depth was highly variable, reaching from 2.5 m in the Bornholm Sea (Stat. TF0213) to 7.5 m in the southern Gotland Sea (Stat. TF0259).

### **Attachments**

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

Fig. 5: Oxygen /hydrogen sulphide concentrations in the near-bottom layer for selected stations

Dr. Norbert Wasmund

Scientist in charge

**Table 1: Surface layer (0 - 10m)**

Area	Station	Temperature	Salinity	PO <sub>4</sub> <sup>3-</sup>	NO <sub>23</sub> <sup>-*</sup>
Date	Name/ No. **	°C	PSU	µmol/dm <sup>3</sup>	µmol/dm <sup>3</sup>
Kiel Bight 03.08.2011	TF0360/ 005	18.1	14.97	0.02	0.05
Meckl. Bight 04.08.2011	TF0012/ 007	17.2	9.9	0.08	0.06
Lübeck Bight 04.08.2011	TF0022/ 006	18.5	10.73	0.01	0.04
Arkona Basin 04.08.2011	TF0113/ 017	17.3	7.30	0.03	0.03
Bornholm Deep 06.08.2011	TF0213/ 038	18.5	7.09	0.00	0.02
Stolpe Channel 07.08.2011	TF0222/ 040	18.8	7.16	0.05	0.09
SE Gotland Basin 07.08.2011	TF0259/ 042	19.4	7.07	0.01	0.07
Gotland Deep 08.08.2011	TF0271/ 049	19.1	6.97	0.01	0.02
Fårö Deep 10.08.2011	TF0286/ 051	19.4	7.00	0.00	0.05
Landsort Deep 11.08.2011	TF0284/ 054	17.9	6.03	0.03	0.04
Karlsö Deep 13.08.2011	TF0245/ 056	17.3	6.4	0.02	0.01

\*  $\Sigma \text{NO}_2^- + \text{NO}_3^-$ ; NO<sub>2</sub> 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 <sub>2</sub>	PO <sub>4</sub> <sup>3-</sup>	NO <sub>23</sub> <sup>-*</sup>
Date	Name/ No. **	m	°C	PSU	cm <sup>3</sup> /dm <sup>3</sup>	μmol/dm <sup>3</sup>	μmol/dm <sup>3</sup>
Kiel Bight 03.08.2011	TF0360/ 005	17	12.7	21.1	3.37	0.46	0.31
Meckl. Bight 04.08.2011	TF0012/ 007	23	8.5	24.9	2.50	1.17	8.62
Lübeck Bight 04.08.2011	TF0022/ 006	21	8.3	23.1	2.24	0.84	4.48
Arkona Basin 04.08.2011	TF0113/ 017	45	9.7	15.9	0.94	1.36	3.51
Bornholm Deep 06.08.2011	TF0213/ 038	92	6.1	15.3	-0.58	5.30	0.00
Stolpe Channel 07.08.2011	TF0222/ 040	88	4.5	12.5	-0.03	0.93	3.19
SE Gotland Basin 07.08.2011	TF0259/ 042	86	4.6	11.2	1.73	2.35	2.50
Gotland Deep 08.08.2011	TF0271/ 049	232	6.4	12.3	-8.22	6.60	0.00
Fårö Deep 10.08.2011	TF0286/ 051	186	6.4	11.9	-6.72	4.25	0.00
Landsort Deep 11.08.2011	TF0284/ 054	431	5.9	10.7	-1.43	4.95	0.00
Karlsö Deep 13.08.2011	TF0245/ 056	106	5.4	9.9	-1.64	5.45	0.00

\*  $\Sigma \text{NO}_2^- + \text{NO}_3^-$ ; NO<sub>2</sub> was present only in traces in most areas under investigation

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

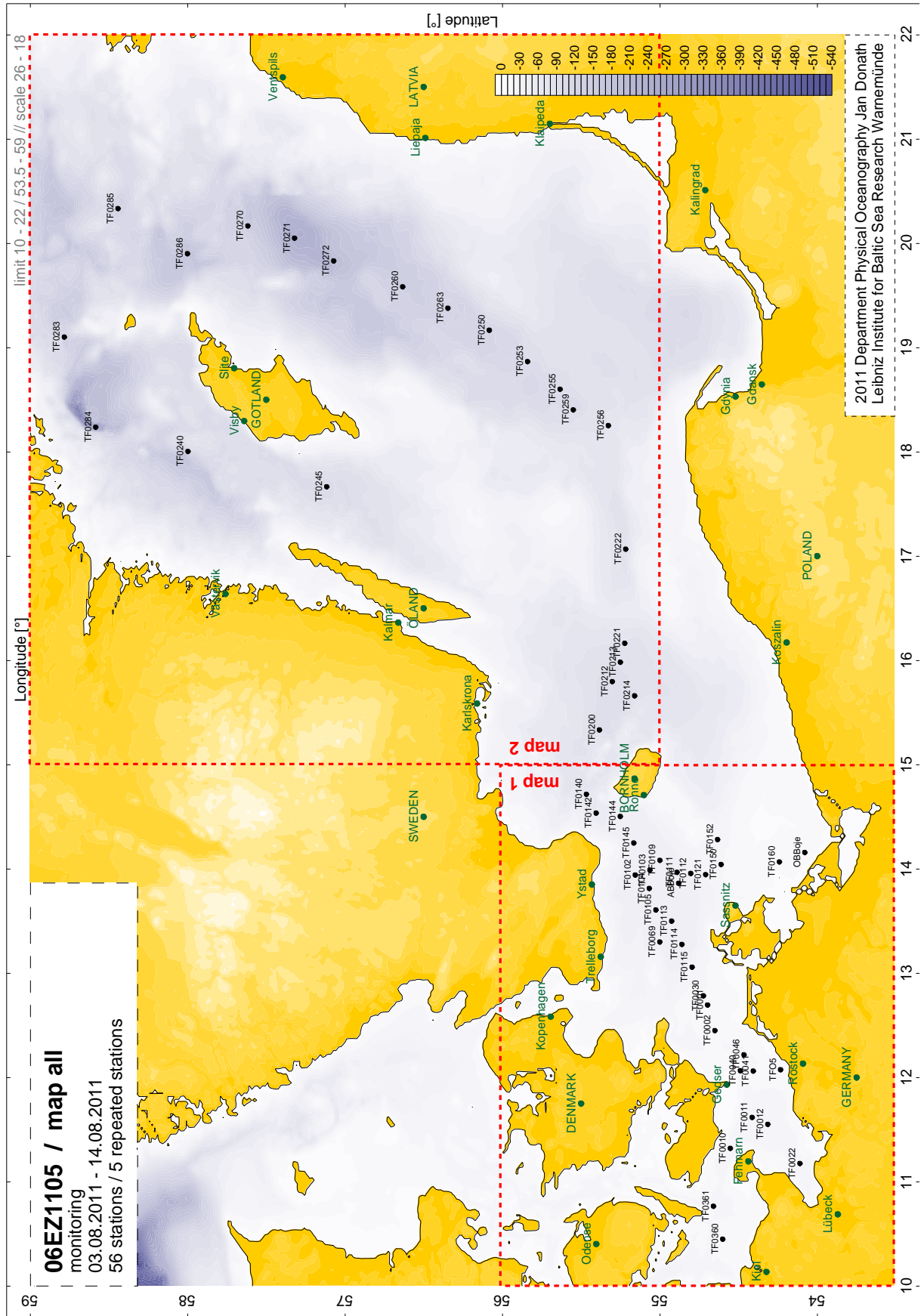


Fig. 1

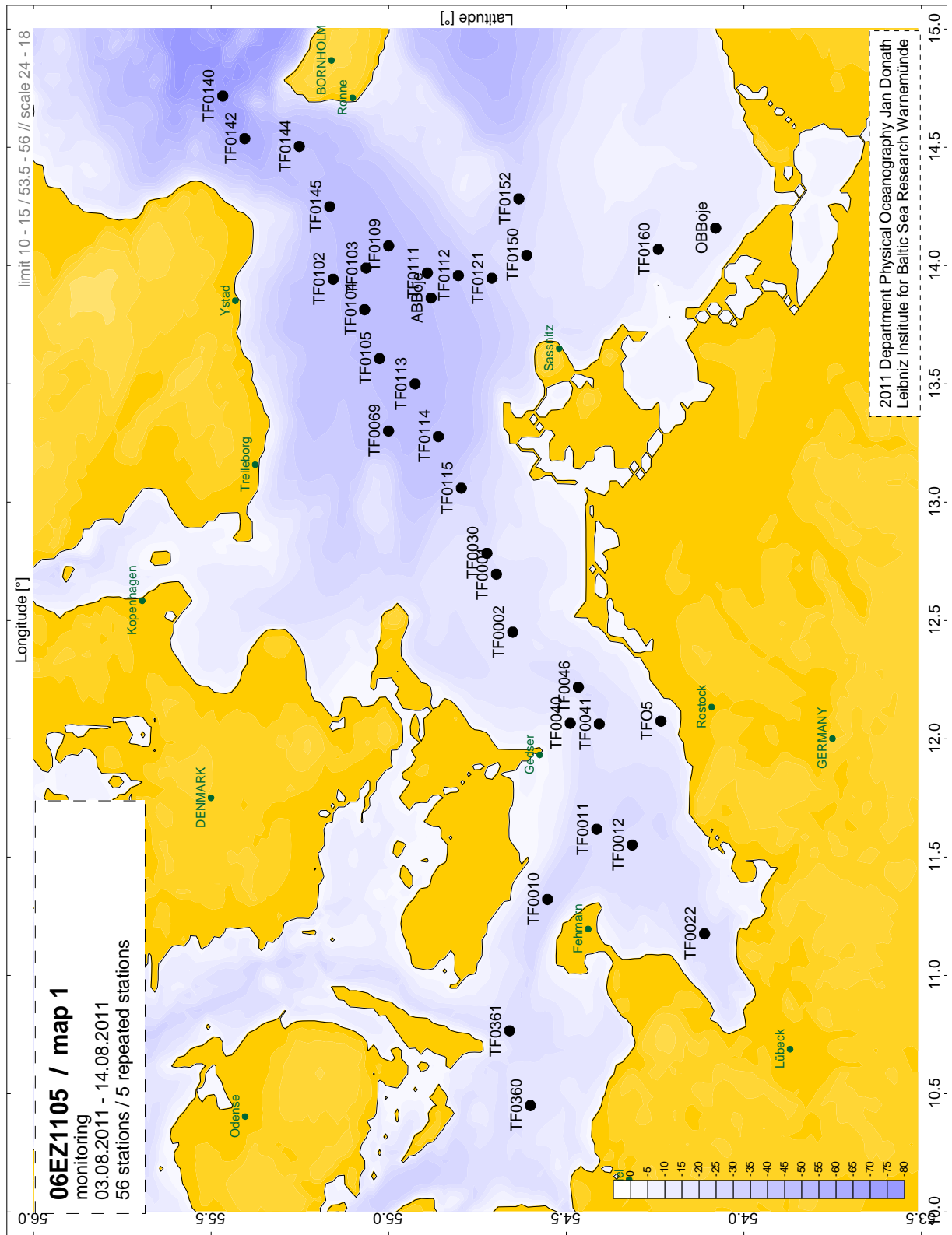


Fig. 2



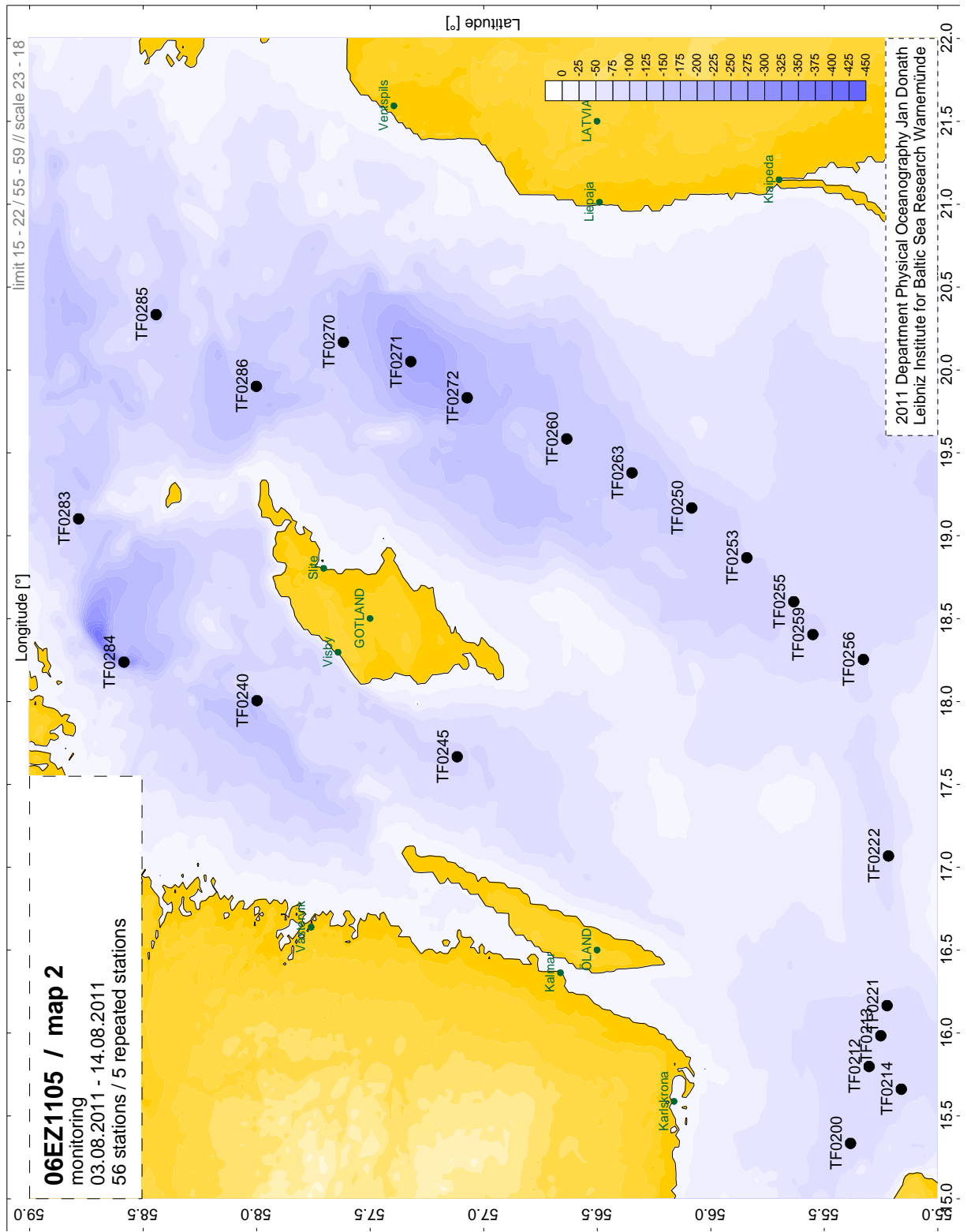
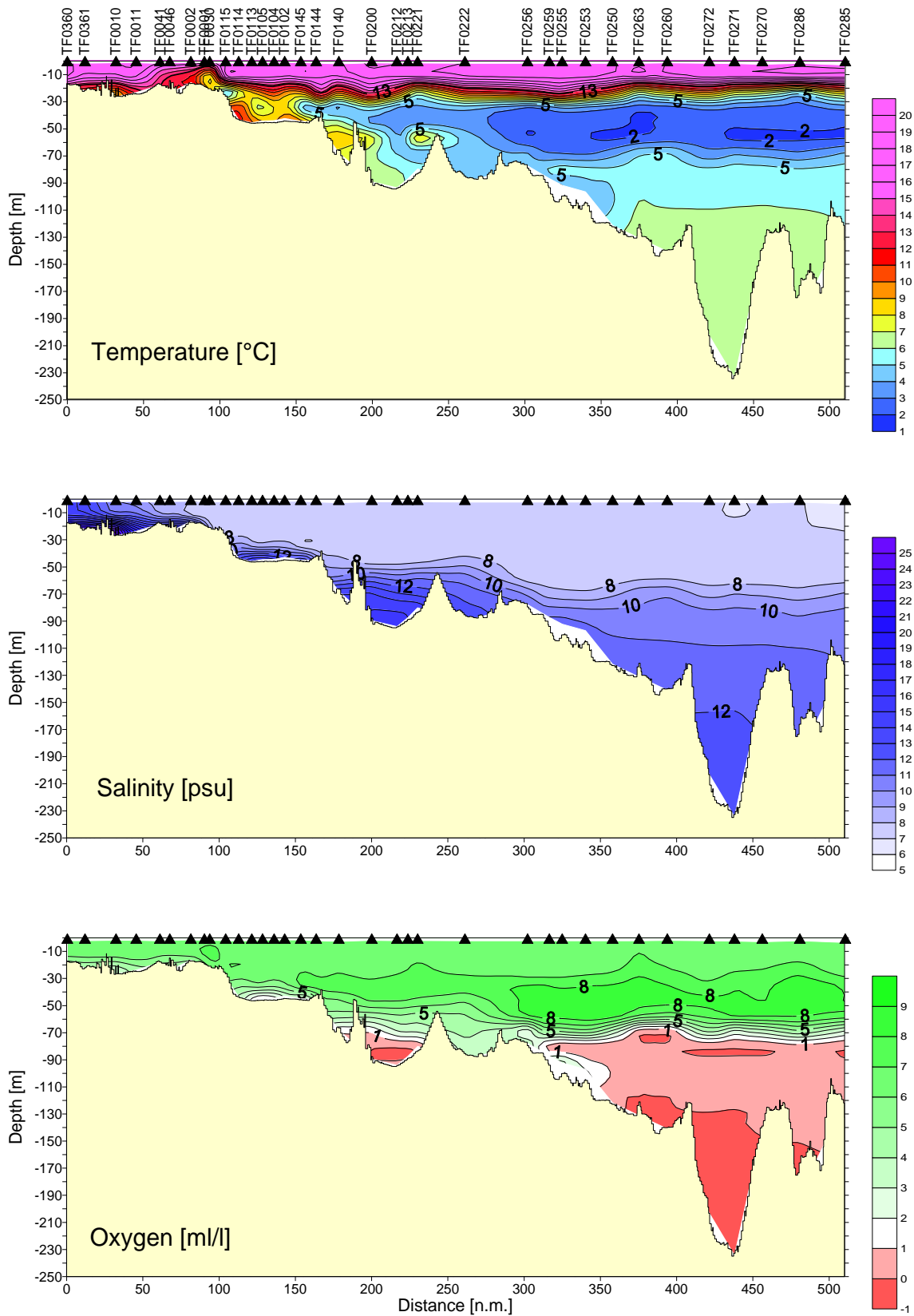


Fig. 3

# 06EZ1105

Kiel Bight - Gotland Sea  
03.08.2011 13:59 - 10.08.2011 18:04 UTC



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Fig. 4

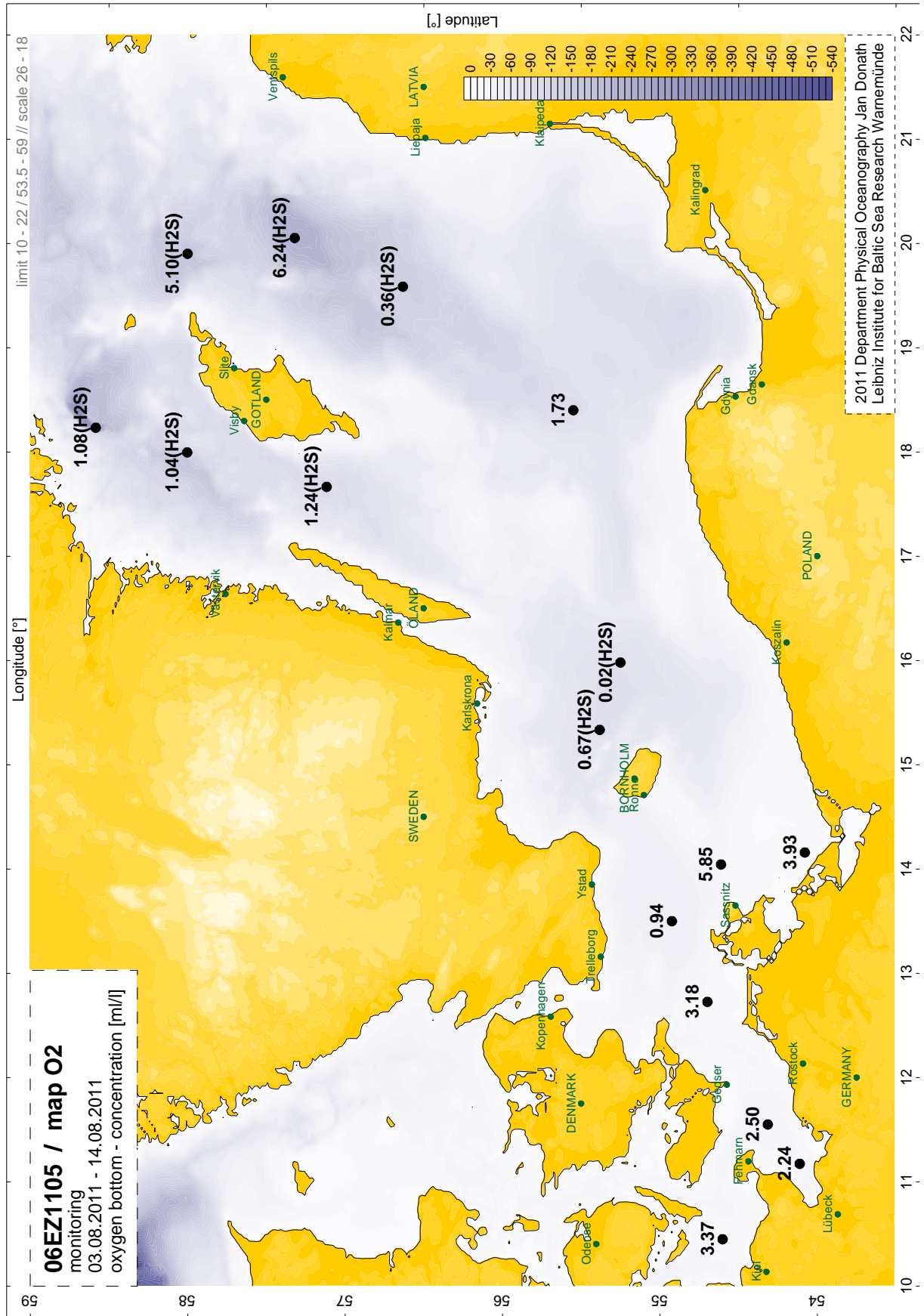


Fig. 5