INSTITUT FÜR OSTSEEFORSCHUNG WARNEMÜNDE
an der Universität Rostock BALTIC SEA RESEARCH INSTITUTE

Baltic Sea Research Institute Warnemünde

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

r/v "Gauss"

Cruise- No. 11 / 06 / 05

Monitoring Cruise
4 May – 12 May 2006
Kiel Bight to northern Gotland Sea

This report is based on preliminary data

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1. **Cruise No.:** 11 / 06 / 05

2. **Dates of the cruise:** from 04 May to 12 May 2006

3. **Particulars of the research vessel:**
   Name: "Gauss"
   Nationality: Germany
   Operating Authority: Federal Maritime and Hydrographic Agency (BSH)

4. **Geographical area in which ship has operated:**
   Kiel Bight to Northern Gotland Sea

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: Langner
   Number of crew: 20

8. **Research staff:**
   Chief scientist: Dr. N. Wasmund

   Participants: Donath, Jan
   Busch, Susanne
   Dr. Deutsch, Barbara
   Hehl, Uwe
   Plüschke, Günter
   Sadkowiak, Birgit
   Schuffenhauer, Ingo

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

10. **Scientific equipment**
CTD, water samplers, plankton net, sediment trap, current meters and current profilers

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). In addition to the normal monitoring track, a transect along Darss Sill was carried out to study the water exchange through this "bottle-neck" of the Baltic Sea. A sediment trap was recovered and another sediment trap deployed at the Gotland Deep. Also two moorings with current meters and one mooring with a current profiler were deployed. On the way back, selected HELCOM stations in the Bornholm Sea, Arkona Sea and Mecklenburg Bight were sampled a second time. The meteorological, hydrographical, chemical and biological investigations were performed according to the Manual of the COMBINE Programme of HELCOM.

A stable high pressure situation persisted during the whole cruise (air pressure increasing from 1026 to 1032 hPa during the first half and dropping to 1016 during the second half of the cruise) with sunny weather and easterly winds of up to 15 m/s turning to north-westerly directions and calming down to about 5 m/s on 9 May 2006.

Air temperature during the whole cruise was in a narrow range of approximately 7-15 °C. Surface water temperature ranged from 5 °C (in the northern Baltic Proper) to almost 11 °C (in the southern Arkona Sea on 11 May) and was mostly below the long-term May means of the period 1971-1990 (in brackets):

Lübeck Bight (stat. O22)	7.70 °C (8.93 °C)
Arkona Sea (stat. 113)	7.09 °C (7.44 °C)
Bornholm Sea (stat. 213)	5.26 °C (6.75 °C)
Eastern Gotland Sea (stat. 271)	5.88 °C (5.66 °C)
Farö Deep (stat. 286)	5.26 °C (5.63 °C)
Landsort Deep (stat. 284)	5.41 °C (6.09 °C)
Karlsö Deep (stat. 245)	5.58 °C (6.76 °C)

The western Baltic Sea showed indications of a salt water inflow. The upper border of the halocline was found at a depth of only 4-8 m in Kiel Bight and Mecklenburg Bight. The salinity exceeded 14 PSU below this depth and increased to 28 PSU at the bottom of the deepest regions of Kiel and Mecklenburg Bights and in the Fehmarn Belt. Temperature and oxygen concentrations were slightly lower in this bottom water in comparison with the surface water. A remarkable fluorescence peak was found in the upper range of the halocline .
The depth of the upper border of the halocline sank down from about 18m in the western Arkona Sea to 24-33m in the central Arkona Sea, while the salinity at the bottom was about 16 PSU. The thermocline had its upper border at a depth of 10-15 m.
In the Bornholm Sea, the thermocline started at 15-20 m and the halocline at about 40 m depth. The bottom water was almost depleted of oxygen. In the southern Gotland Basin, the halocline was as deep as 60-70 m but the bottom water was still well oxygenated, with an increase in oxygen concentration below 85-90 m depth. At the deep stations of the central Gotland Basin and the Farö Deep (stations TF0272, TF0271, TF0270, TF0286), the oxygen was depleted below 120-150 m depth (cf. Fig. 3c; "negative oxygen" due to H_2S see Fig. 4). In the Landsort and Karlsö Deeps the oxygen became zero already at about 100 m depth.

The phytoplankton density was low because of nutrient depletion (cf. Table 1) after the spring bloom. Due to low winter N/P ratios, nitrogen is exhausted in the Baltic Proper, whereas some phosphate remains. The exceptionally high phosphate concentrations of 0.6 µmol/l, found in the Bornholm Sea in Mai 2005, could not be found again in 2006. The phytoplankton minimum is also reflected by high Secchi depths ranging from 6-10 m in Kiel Bight, Mecklenburg Bight and Arkona Sea and from 9-10 m in the Bornholm and Eastern Gotland Sea.

Some remains of the spring blooms are *Chaetoceros* species, which appear "old", e.g. because of many empty cells. Dinoflagellates (*Gymnodinium, Protoperidinium*), the crysophyte *Dinobryon* sp., the ciliate *Mesodinium rubrum* , the cyanobacterium *Woronichinia compacta* and the heterotrophic *Ebria tripartita* were wide-spread in the Baltic. In the western Baltic, also *Dinophysis norvegica*, *Skeletonema costatum, Diatoma eleongatum* and some chlorophytes (*Oocystis, Dictyosphaerium*) occurred, whereas a dinoflagellate like *Peridiniella catenata* was frequent in the northern Baltic Proper (mainly Station 284).

Attachments

Tables 1& 2: Preliminary results for selected parameters in the surface layer and the near bottom layer (unvalidated results)
Figs. 1-2: Station grid and cruise track
Fig. 3 Transsect from the Kiel Bight to the northern Gotland Basin for temperature, salinity and oxygen (unvalidated data)
Fig. 4: Oxygen /hydrogen sulphide concentrations in the bottom near layer for selected stations

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/dm^3	µmol/dm^3
Kiel Bight 4.5.06	TF0360/ 005	7.73	13.63	0.18	0.47
Meckl. Bight 4.5.06	TF0012/ 006	5.96	9.82	0.81	0.03
Lübeck Bight 4.5.06	TF0022/ 007	7.70	14.87	0.03	0.18
Arkona Basin 5.5.06	TF0113/ 019	7.09	7.57	0.09	0.02
Bornholm Deep 6.5.06	TF0213/ 027	5.26	7.43	0.33	0.02
Stolpe Channel 6.5.06	TF0222/ 029	5.22	7.41	0.35	0.01
SE Gotland Basin 6.5.06	TF0259/ 031	5.65	7.30	0.16	0.02
Gotland Deep 7.5.06	TF0271/ 039	5.88	7.34	0.18	0.01
Fårö Deep 8.5.06	TF0286/ 041	5.26	7.09	0.17	0.01
Landsort Deep 9.5.06	TF0284/ 043	5.41	6.40	0.11	0.03
Karlsö Deep 9.5.06	TF0245/ 045	5.58	6.82	0.19	0.01

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

** Station name see maps (Fig. 1 and 2)

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	cm³/dm³	µmol/dm³	µmol/dm³
Kiel Bight 4.5.06	TF0360/ 005	15	4.40	23.16	6.21	0.53	2.27
Meckl. Bight 4.5.06	TF0012/ 006	22	5.25	27.25	5.47	0.77	4.36
Lübeck Bight 4.5.06	TF0022/ 007	20	4.20	23.42	5.60	0.67	3.33
Arkona Basin 5.5.06	TF0113/ 019	45	3.12	16.56	6.12	0.52	0.10
Bornholm Deep 6.5.06	TF0213/ 027	87	8.01	16.23	0.06	2.85	6.29
Stolpe Channel 6.5.06	TF0222/ 029	88	5.54	13.62	3.95	1.61	6.68
SE Gotland Basin 6.5.06	TF0259/ 031	86	5.17	11.70	2.39	2.29	8.97
Gotland Deep 7.5.06	TF0271/ 039	233	5.94	12.64	-3.61	5.05	0
Fårö Deep 8.5.06	TF0286/ 041	188	6.09	12.11	-2.33	4.30	0
Landsort Deep 9.5.06	TF0284/ 043	436	5.73	11.01	-0.50	3.50	0
Karlsö Deep 9.5.06	TF0245/ 045	106	5.13	10.13	-0.86	5.60	0

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

** Station name see maps (Fig. 1 and 2)

Monitoring

Station map TF110605
04.05.2006 - 12.05.2006
53 Station (Part1)

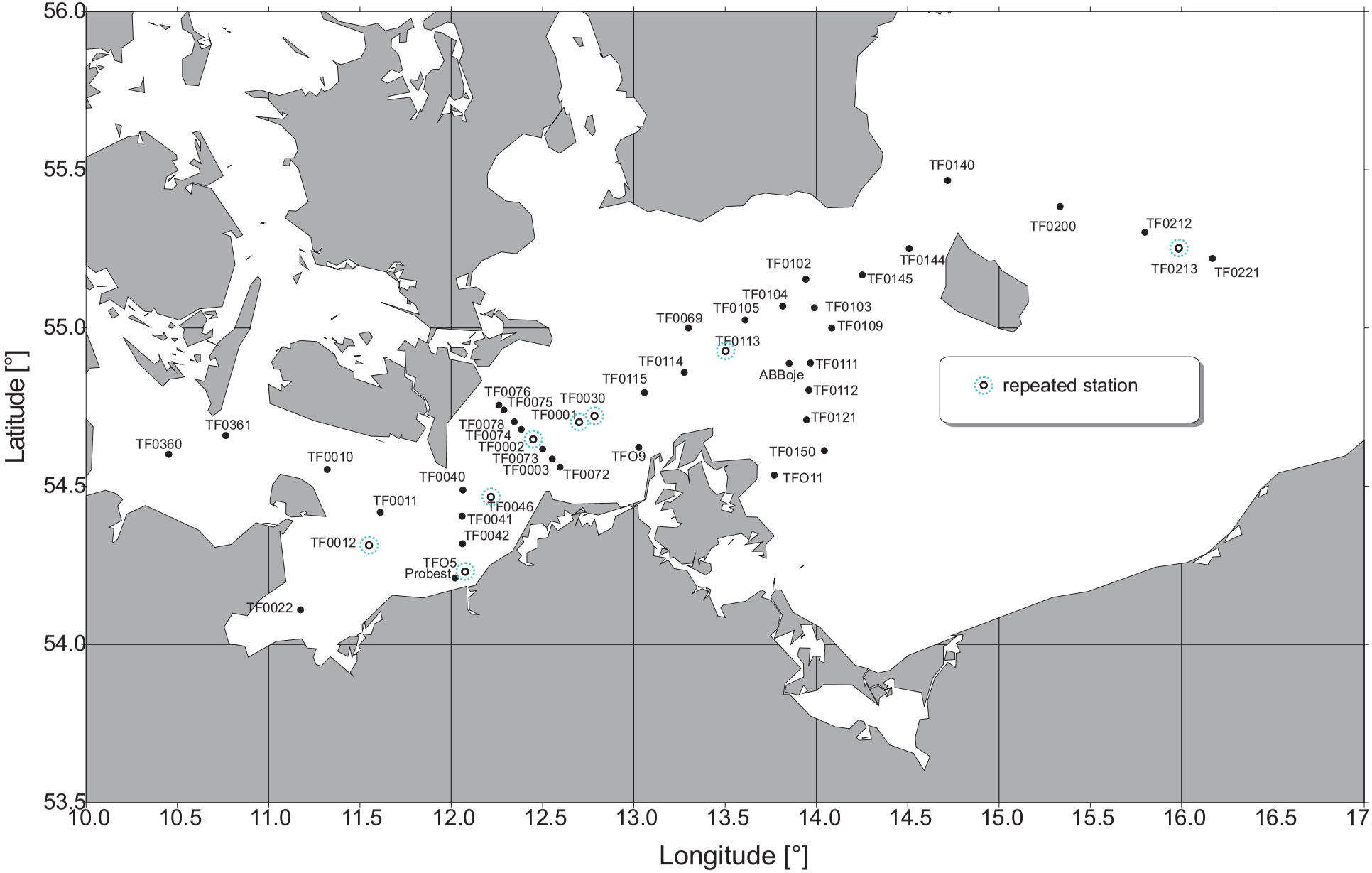

Figure 1

K1.srf

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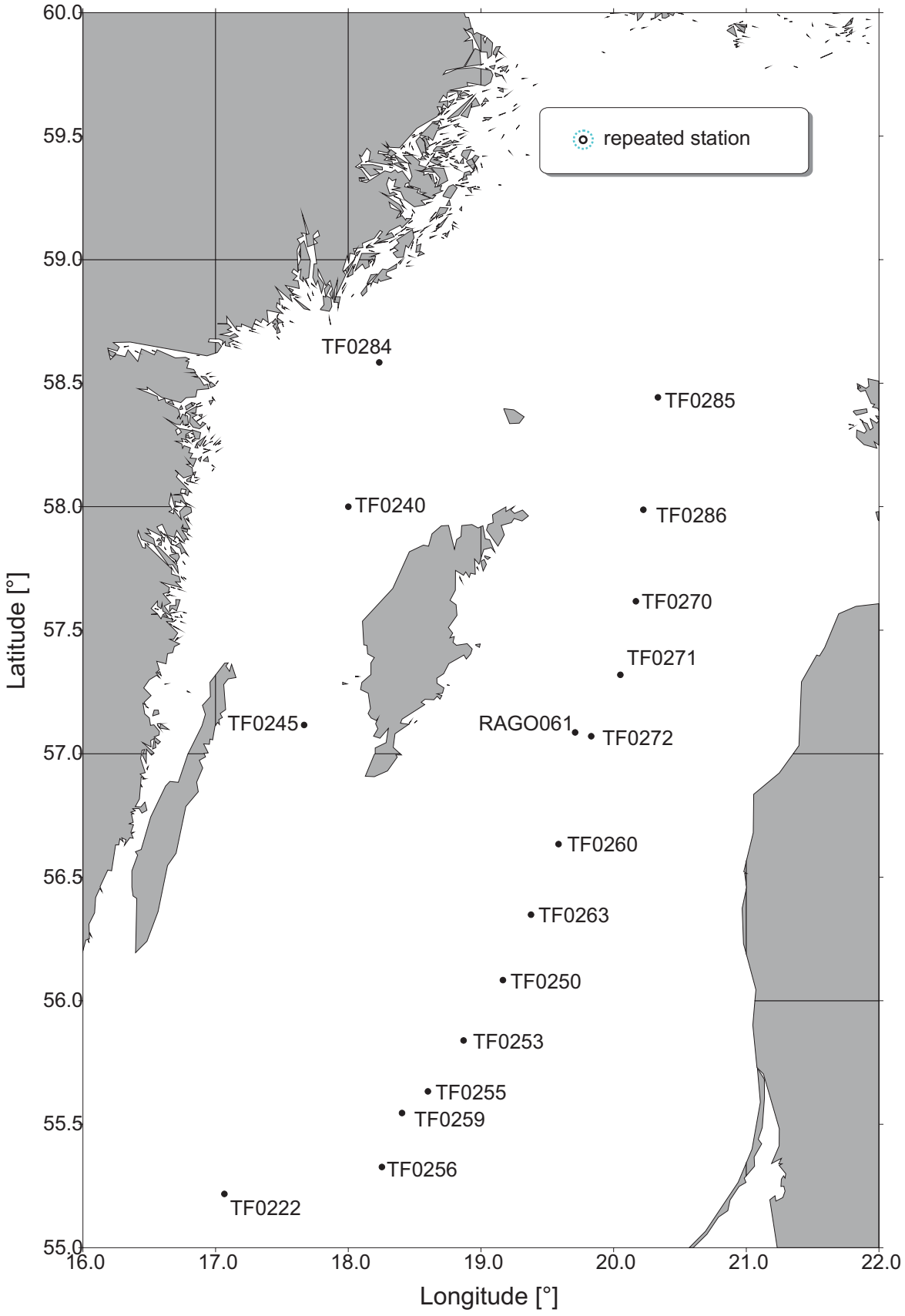
Monitoring

Station map TF110605
04.05.2006 - 12.05.2006
17 Station (Part2)

Figure 2



K2.srf

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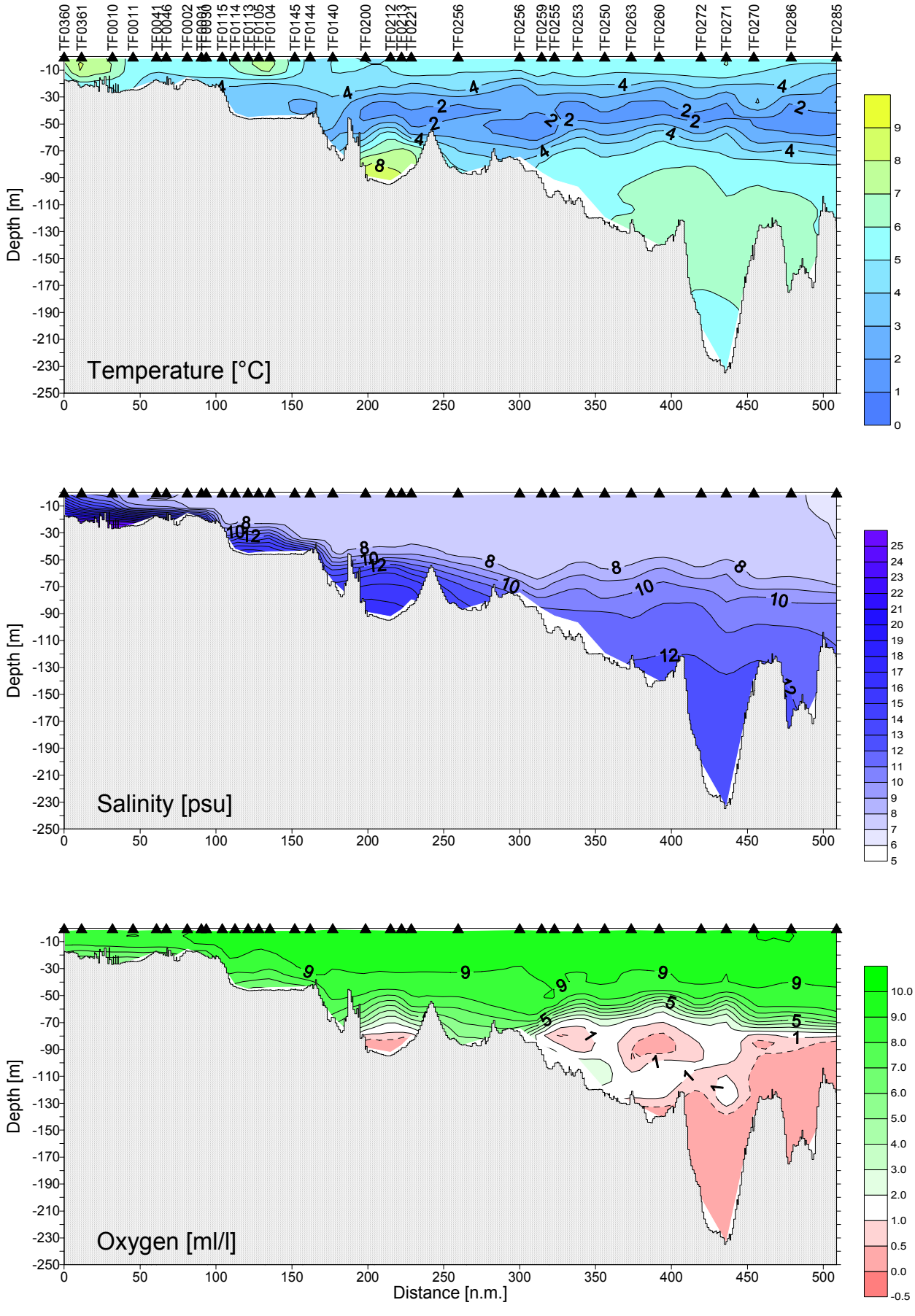
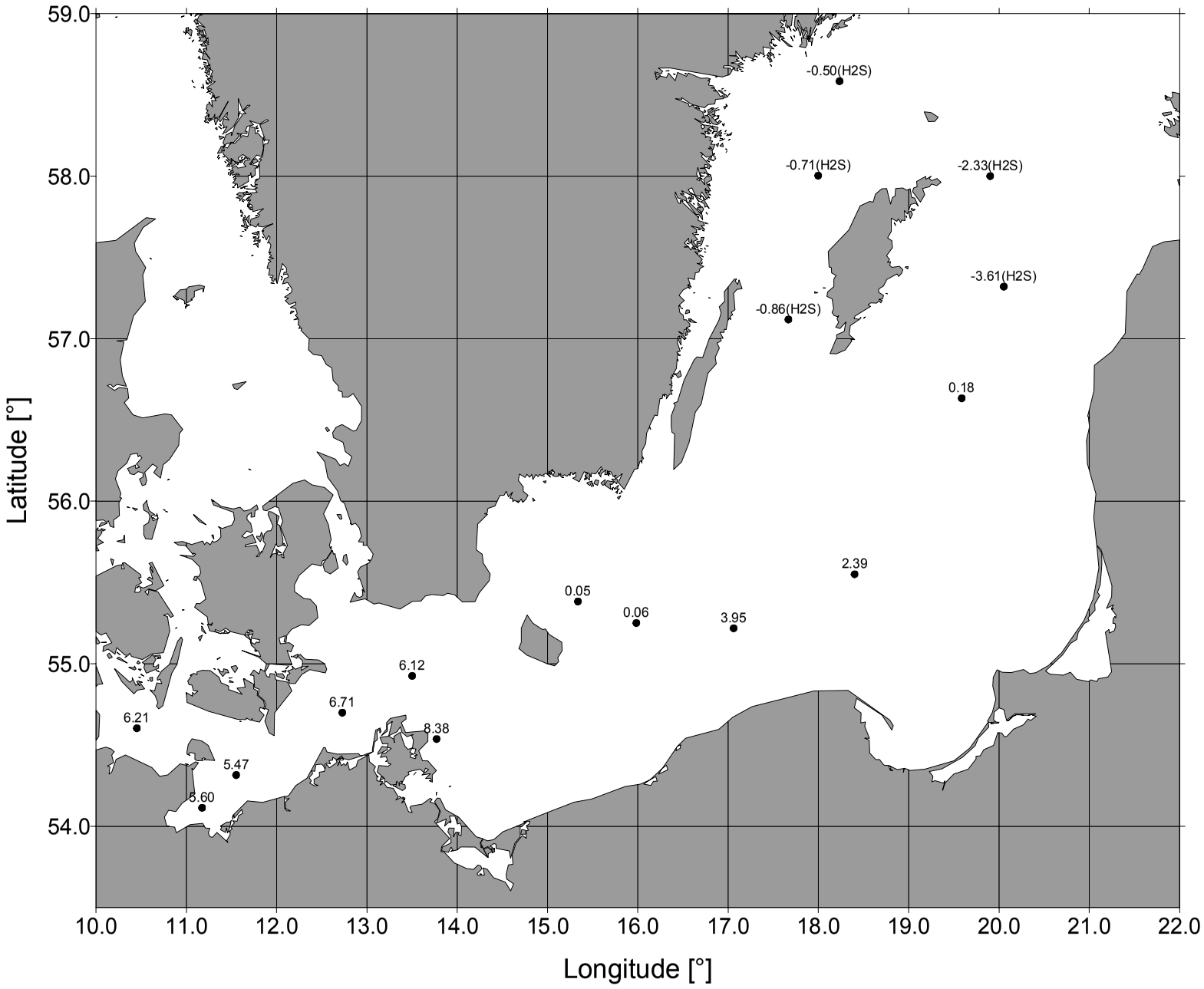
Kiel Bight - Gotland Sea

TF110605
04.05.2006 09:24 - 08.05.2006 21:53 UTC





Monitoring

TF1100605

04.05.2005 - 12.05.2005

Oxygen bottom concentration [ml/l]

O2.srf

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