



Baltic Sea Research Institute Warnemünde

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

r/v "Gauss"

Cruise- No. 11 / 05 / 07

Monitoring Cruise
20 July – 29 July 2005
Kiel Bight to northern Gotland Sea

This report is based on preliminary data

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1. **Cruise No.:** 11 / 05 / 07
2. **Dates of the cruise:** from 20 July to 29 July 2005
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: Dr. Nausch, Monika
Donath, Jan
Krüger, Siegfried
Topp, Ina
Welz, Anne
Simon, Heike
Beckmann, Sabrina
Kaminska, Magdalena
Olszewska, Anna
Drgas, Natalia
9. **Co-operating institutions:**
All institutions dealing with HELCOM monitoring programmes.
Special agreement with the Inst. of Meteorology and Water Management, Gdynia, Poland, that sent three guest researchers to this cruise.
10. **Scientific equipment**
CTD, water samplers, plankton net

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, two transects along Darss Sill were carried out to study the water exchange through this "bottle-neck" of the Baltic Sea. 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.

The first two days of the cruise took place in Mecklenburg Bight during a deep pressure situation (air pressure decreasing from 1008 to 999 hPa) with cloudy and rainy weather and westerly winds of up to 15 m/s. From the 22.7. to the 23.7.05, in the southern Baltic Proper, air pressure was rather stable at 1000-1002 hPa, the sky covered by clouds and the wind turning from northwest to southwest, 5-14 m/s. The conditions were similar in the eastern and western Gotland Sea (24.-25.7.05: 1000-1004 hPa; wind turning from south-west to south, 5-17 m/s; on 24.7.05 sometimes sunny, on 25.7. in the evening rainy). The meteorological conditions improved on 26.-27.7.05 while crossing the Bornholm Sea, Pomeranian Bight and Arkona Sea: air pressure increased steadily to 1014 hPa while the westerly wind calmed down from 9 to 3 m/s and sunny periods increased. On 28.7.05, in Mecklenburg Bight, wind speed was low (~ 5 m/s) and the sky covered by clouds; air pressure ~1012 hPa.

Air temperature during the whole cruise was in a narrow range of approximately 14-20 °C, only on 28.7.04 increasing to 22 °C. Surface water temperature ranged from 16-19 °C and was near the long-term August means of the period 1971-1990 (in brackets):

Mecklenburg Bight (stat. 012)	18.3 °C (17.7 °C)
Arkona Sea (stat. 113)	17.2 °C (17.0 °C)
Bornholm Sea (stat. 213)	17.8 °C (17.6 °C)
Eastern Gotland Sea (stat. 271)	16.9 °C (17.3 °C)
Farö Deep (stat. 286)	16.4 °C (17.7 °C)
Landsort Deep (stat. 284)	17.1 °C (18.2 °C)
Karlsö Deep (stat. 245)	18.0 °C (16.9 °C)

The pycnocline in Lübeck Bight and the southern Mecklenburg Bight was starting at a depth of 12 m, but in Fehmarn Belt and the northern Mecklenburg Bight at 17 m, which is deeper than in July 2004. It becomes shallower (6-8 m depth) at the northern part of Darss Sill whereas the southern region is mixed to the bottom. In the central Arkona Sea, the upper border of the primary thermocline was found at about 16-22 m depth. At some stations in the Arkona Sea (stat. 115, 113, 102), intrusions of cold (8-10 °C) water at a depth of about 18 m and 25 m was noticed. They were most obvious on 27.7.05 at Stations 111 and 103 at depths of 23 and 33 m. At the central stations of the Baltic Sea basins, the primary thermocline started at a depth of about 14-20 m (Fig. 3a), which is shallower than in July 2004. A slight secondary thermocline was rarely formed due to the unfavourable wind and radiation conditions.

The unusually low bottom layer temperatures in some Baltic basins in July 2003, caused by a strong salt water inflow in January 2003, have approached the long-term means already by July 2004. It exceeded the long-term means in July 2005:

	July 2005	July 2004	July 2003	Mean 1971-1990
Bornholm Deep	6.97°C	5.12 °C	3.71 °C	6.12 °C
Gotland Deep	5.97°C	6.51 °C	4.63 °C	5.62 °C
Farö Deep	6.03°C	5.87 °C	6.00 °C	5.20 °C
Landsort Deep	5.82°C	5.69 °C	5.88 °C	4.76 °C
Karlsö Deep	5.34°C	5.29 °C	4.90 °C	4.18 °C

The halocline begins at a depth of about 25 m in the north-eastern Arkona Sea, at 50 m in the Bornholm Basin and at 55-65 m in the Eastern Gotland Sea (Fig. 3b).

The oxygen concentrations decreased to almost zero in a very thin layer just above bottom in the northern Arkona sea (Stat. TF0105, TF 0104, TF0145), but was zero 10-20 m above ground (= below 75 m depth) in the Bornholm Basin (TF0200, TF 0211, TF0213, TF0220, TF0210, TF0221; see Fig. 3c; "negative oxygen" due to H₂S see Fig. 4). In the southern Gotland Basin (TF0256, TF259, TF0255), oxygen concentrations had a minimum few metres above ground and increased again in the deep water. In the central Gotland Basin and the Farö Deep (TF0263, TF0260, TF0272, TF0271, TF0270, TF0286), oxygen concentrations became zero below 120-130 m depth (H₂S as "negative oxygen see Fig. 4). An intermediate oxygen minimum was found also at 80-100 m depth in the Gotland Basin. Like in the previous year, oxygen depletion occurred at stations TF0285, TF0284, TF0240, TF0242 and TF0245 below approximately 80 m depth.

Concerning the phytoplankton, a bloom of *Dactyliosolen fragilissimus*, together with *Proboscia alata*, occurred in Mecklenburg Bight on 20./21.7.2004. *Chaetoceros impressus* was the dominating diatom in Arkona Sea and Bornholm Sea. A weak cyanobacteria bloom (*Nodularia spumigena*) occurred in the eastern Gotland Sea (Stat. TF0256 to TF0271) and a moderate bloom the northwestern Baltic proper (from north of Gotland to TF0240), but not as surface scums due to the wind.

Attachments

- Tables 1 and 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 20.7.05	TF0360/ 004	18.40	14.71	0.04	0.01
Meckl. Bight 20.7.05	TF0012/ 002	18.34	11.09	0.12	0
Lübeck Bight 20.7.05	TF0022/ 003	18.39	11.32	0.03	0
Arkona Basin 22.7.05	TF0113/ 027	17.15	7.84	0.34	0.34
Pom. Bight 27.7.05	TF0162/ 064	18.61	7.57	0.35	0.17
Bornholm Deep 22.7.05	TF0213/ 038	17.78	7.54	0.22	0
Stolpe Channel 23.7.05	TF0222/ 043	17.40	7.50	0.33	0.03
SE Gotland Basin 23.7.05	TF0259/ 045	17.22	7.37	0.25	0
Gotland Deep 24.7.05	TF0271/ 052	16.88	6.91	0.03	0.06
Fårö Deep 24.7.05	TF0286/ 054	16.43	6.50	0.02	0
Landsort Deep 25.7.05	TF0284/ 056	17.06	6.14	0.04	0
Karlsö Deep 25.7.05	TF0245/ 059	17.35	6.91	0	0.14

* $\Sigma \text{NO}_2^- + \text{NO}_3^-$; NO₂ was present only in traces in most areas under investigation

** Station name see maps (Fig. 1 und 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	cm ³ /dm ³	μmol/dm ³	μmol/dm ³
Kiel Bight 20.7.05	TF0360/ 004	15.0	18.39	14.81	6.08	2.95	0
Meckl. Bight 20.7.05	TF0012/ 002	22.1	8.20	25.12	1.82	0.97	3.76
Lübeck Bight 20.7.05	TF0022/ 003	21.3	7.86	23.47	1.46	0.89	3.66
Arkona Basin 22.7.05	TF0113/ 027	44.4	9.10	19.14	2.55	1.01	1.60
Pom. Bight 27.7.05	TF0162/ 064	12.7	18.61	7.57	6.08	0.31	0.09
Bornholm Deep 22.7.05	TF0213/ 038	86.0	6.97	16.29	-1.94	6.48	0
Stolpe Channel 23.7.05	TF0222/ 043	88.0	5.58	12.39	3.08	1.73	8.04
SE Gotland Basin 23.7.05	TF0259/ 045	85.8	5.23	10.59	2.27	2.17	7.75
Gotland Deep 24.7.05	TF0271/ 052	233.3	5.97	12.73	-2.97	6.30	0
Fårö Deep 24.7.05	TF0286/ 054	186.4	6.03	12.22	-1.42	4.13	0
Landsort Deep 25.7.05	TF0284/ 056	434.1	5.82	11.14	-0.14	3.40	0
Karlsö Deep 25.7.05	TF0245/ 059	105.2	5.34	10.35	-0.81	4.08	0

* $\Sigma \text{NO}_2^- + \text{NO}_3^-$; NO₂ was present only in traces in most areas under investigation

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

Monitoring
 Station map TF110507
 20.07.2005 - 29.07.2005
 59 Station (Part1)

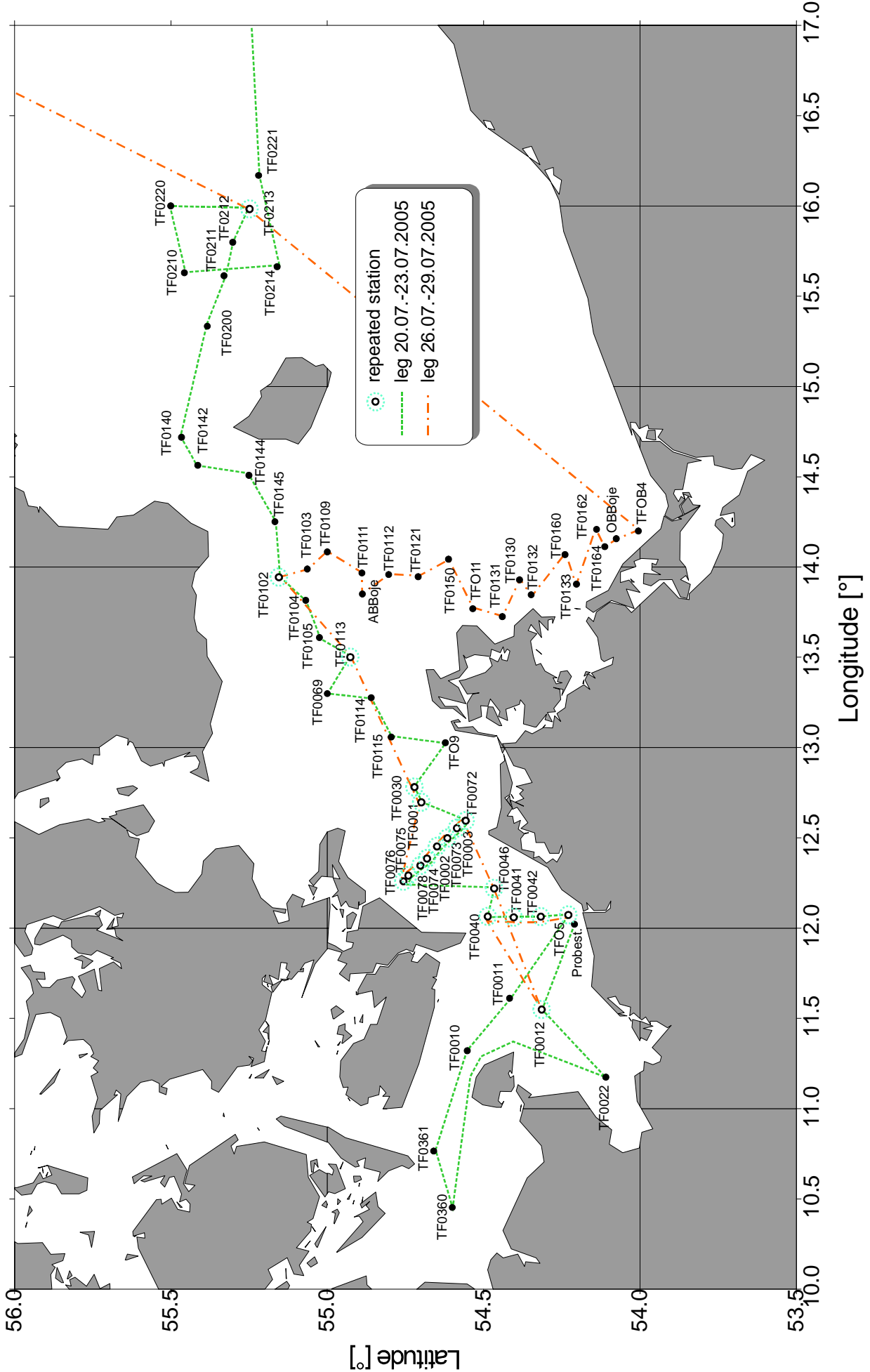
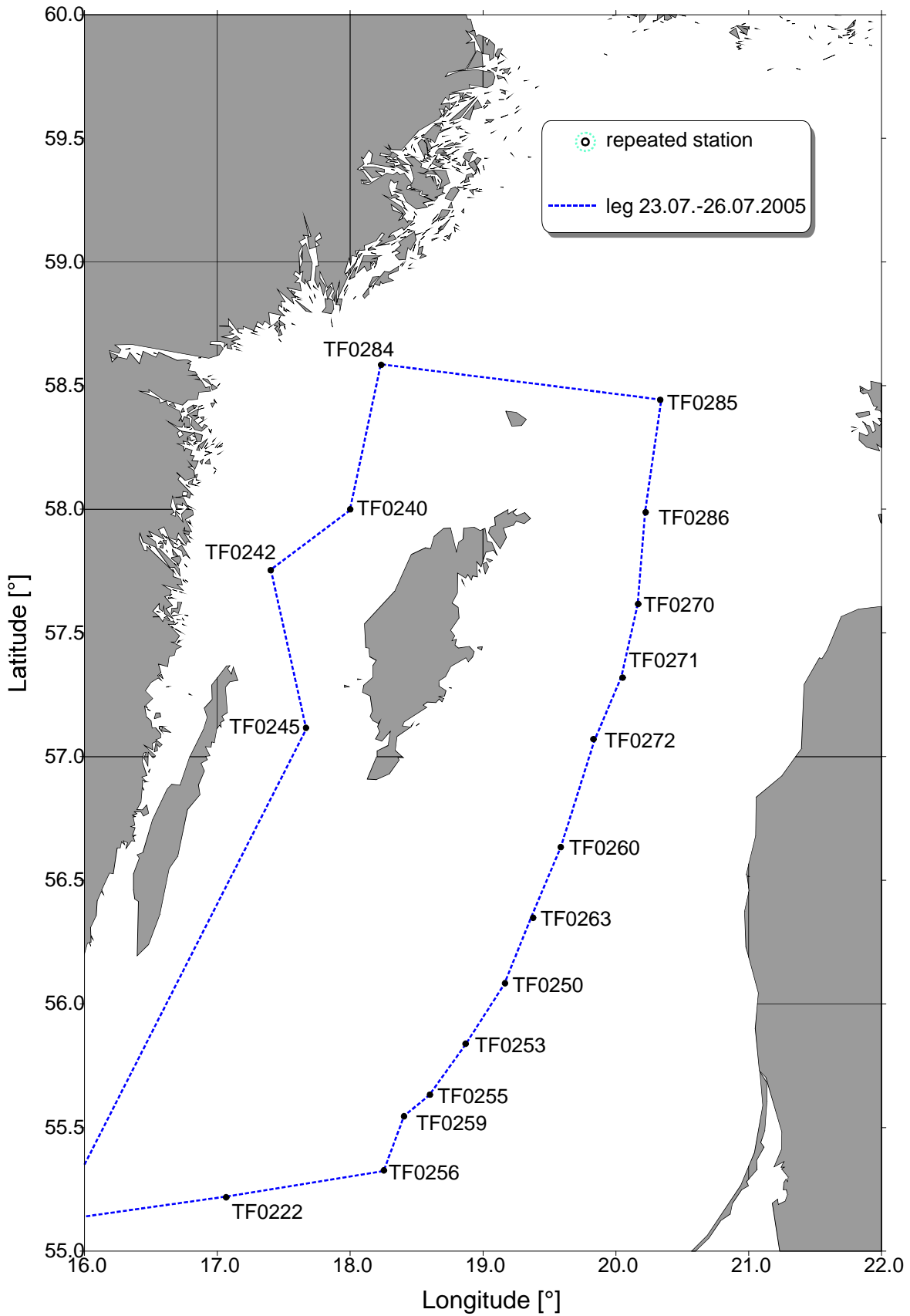


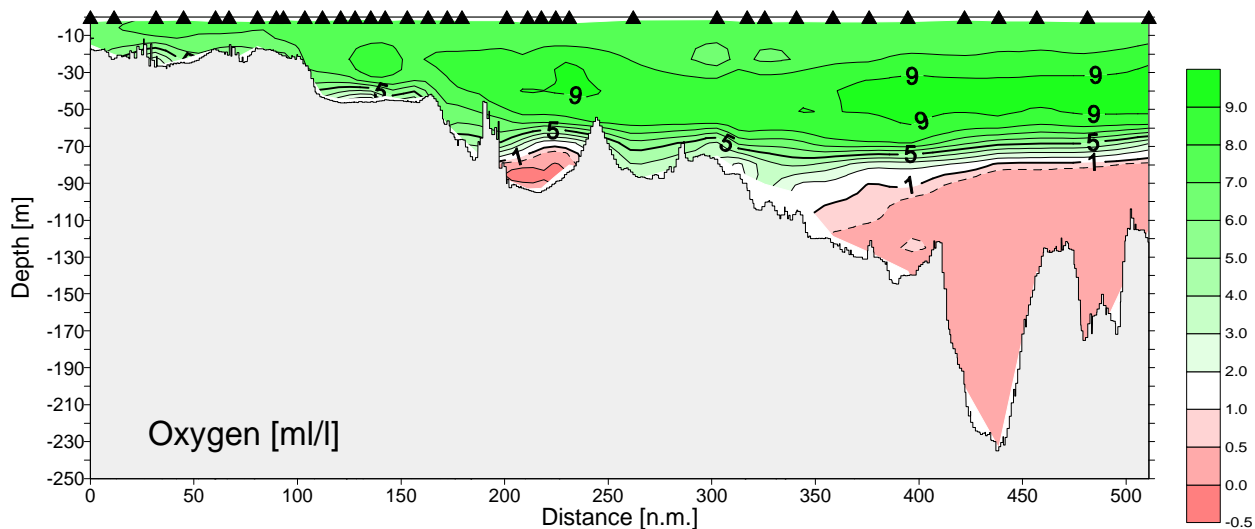
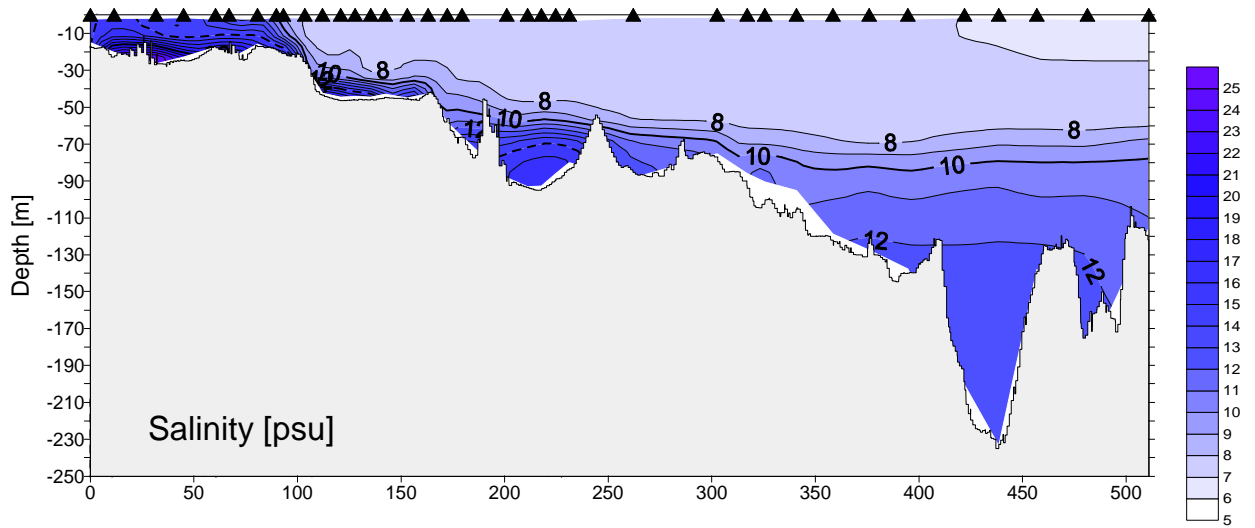
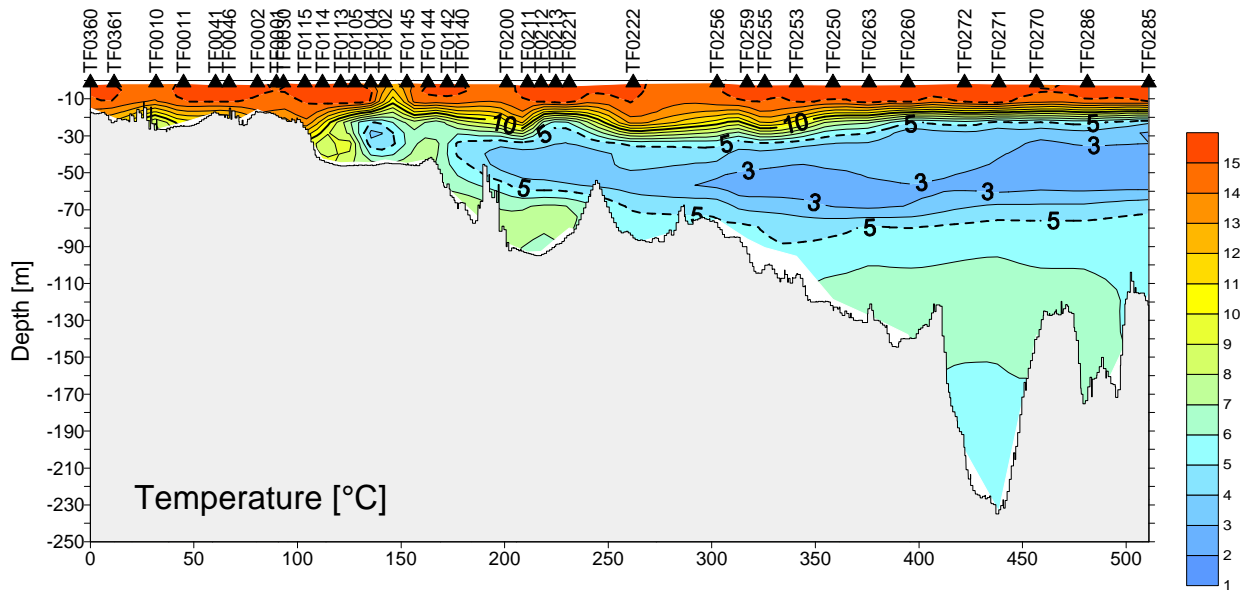
Figure 1



Kiel Bight - Gotland Sea

TF110507

20.07.2005 22:15 - 25.07.2005 01:58 UTC



Monitoring

TF110507

20.07.2005 - 29.07.2005

Oxygen bottom concentration [ml/l]

