



Baltic Sea Research Institute Warnemünde

Cruise Report


r/v "Alexander v. HUmboldt"


Cruise- No. 44 / 03 / 07

Monitoring Cruise
24 July – 3 August 2003
Kiel Bight to northern Gotland Sea

This report is based on preliminary data

Institut für Ostseeforschung Warnemünde
an der Universität Rostock
Seestraße 15
D-18119 Rostock- Warnemünde
GERMANY

 +49-381-5197-0

 +49-381-5197 440

1. **Cruise No.:** 44 / 03 / 07
2. **Dates of the cruise:** from 24 July to 3 August 2003
3. **Particulars of the research vessel:**
 - Name: "Alexander v. Humboldt"
 - Nationality: Germany
 - Operating Authority: Baltic Sea Research Institute (BSRI) Warnemünde
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: G. Herzig
 - Number of crew: 16
8. **Research staff:**
 - Chief scientist: Dr. N. Wasmund

 - Participants: Donath, Jan
Huth, Hartmut
Welz, Anne
Setzkorn, Doris
Schnell, Sabine
Hambach, Bastian
9. **Co-operating institutions:**
All institutions dealing with HELCOM monitoring programmes
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, three west-east transects were carried out in the Eastern Gotland Sea to study the effects of the saltwater inflow from January 2003 on the oxygen situation in the deep water. On the way back, selected stations in the Bornholm Sea, Arkona Sea, Mecklenburg Bight and Kiel 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 air pressure decreased from 1014 hPa at the beginning of the cruise to 1010 hPa on 27.7.03, increased to 1020 hPa by the 29.7.03, and stayed stable until the end of the cruise. The wind speed did not exceed 9 m/s during the whole cruise, with calm and sunny periods from 30.7. to 1.8.03. Air temperature exceeded 18 °C and was 20-22 °C in the area of the Bornholm Sea and Gotland Sea. In these areas, also surface water temperature was highest (cf. Table 1). A special situation was found

at station 046 (eastern Mecklenburg Bight) on 25.7.03, where the surface water had a temperature of only 12.7 °C, but low salinity of 7.8 PSU. A similar phenomenon was already found at this station in the previous year, on 4.8.2002. In general, surface temperatures were much higher than the long-term August mean for the period 1971-1990 (in brackets):

Mecklenburg Bight (stat. 012)	18.2 °C (17.7 °C)
Arkona Sea (stat. 113)	18.5 °C (17.0 °C)
Bornholm Sea (stat. 213)	20.6 °C (17.6 °C)
Eastern Gotland Sea (stat. 271)	20.2 °C (17.3 °C)
Farö Deep (stat. 286)	20.6 °C (17.7 °C)
Landsort Deep (stat. 284)	21.1 °C (18.2 °C)
Karlsö Deep (stat. 245)	21.0 °C (16.9 °C)

In the central Arkona Sea, the upper border of the thermocline was found at 9-10 m depth. At the central stations of the Baltic Sea basins, the primary thermocline was found at a depth of about 20 m (Fig. 3a). A shallow secondary thermocline was formed in 5-10 m depth due to strong warming-up of the surface water in the Bornholm Sea and the Gotland Sea.

The halocline begins at a depth of about 33 m in the central Arkona Sea, 35-40 m in the Bornholm Sea and in 60-65 m in the Eastern Gotland Sea (Fig. 3b). The cold intermediate water between halocline and thermocline has higher oxygen concentrations than the other water layers. Oxygen depletion was found in the Western Gotland Sea, including the Karlsö Deep and Landsort Deep, below 75-85 m, and in the Farö Deep below 100 m depth (Table 2). Also the stations in the northern transect across the Gotland Basin had no oxygen below 85-100 m depth.

The deep water in the southern and medium transects was, however, still influenced by the saltwater inflow, visible by oxygenated deep water below 130-150 m depth. Above this deep water, there is still a layer of 10-30 m thickness without any oxygen. The area of this oxygenated deep water extends from the south to a northern border at stations go19, go 21 and go 23. The western half of the southern transect is excluded from this oxygenation. The stations in the eastern half of this southern transect, as well as stations TF0259, TF0255, TF0253, TF0250, TF0263, TF0260, are completely oxygenated but reveal still oxygen minima more or less in a range of 90-110 m depth (Fig. 3c, Fig. 4).

The bottom layer temperatures do also reflect the penetration of the inflow of the salty, oxygen rich and cold water from January 2003 (cf. G. Nausch: Cruise Report 44/03/03 Mai 2003).

	February 2003	March 2003	May 2003	July 2003	Mean 1971-1990
Bornholm Deep	3.09°C	3.69°C	3.43°C	3.71 °C	6.12 °C
Gotland Deep	6.36°C	6.69°C	4.69°C	4.63 °C	5.62 °C
Farö Deep	6.20°C	6.37°C	6.35°C	6.00 °C	5.20 °C
Landsort Deep	5.44°C	5.41°C	5.40°C	5.88 °C	4.76 °C
Karlsö Deep	5.02°C	4.96°C	4.80°C	4.90 °C	4.18 °C

The inflow had reached the Bornholm Basin already at the end of January and the Eastern Gotland Basin at least in May, indicated by a strong decrease in temperature far below the long-term mean. The slight decrease in temperature from May to July in the Farö Deep could be due to an extension of the inflow into this area. Whereas no nitrate but ammonium was found in February, now 12.82 mmol m⁻³ nitrate and nitrite occurred in the deep water of the Gotland Basin because of oxydation of ammonium.

Concerning the phytoplankton, *Proboscia alata* dominated in Kiel and Mecklenburg Bight

on 24.-25.07.2003, besides of *Prorocentrum minimum*, *Guinardia flaccida*, *Dactyliosolen fragilissimus* and some *Nodularia spumigena*. In contrast to Kiel, Mecklenburg and Pomeranian Bights, some slight cyanobacteria blooms (*Aphanizomenon* sp., *Nodularia spumigena*) were found in the Arkona Sea and northern Bornholm Sea. *Chaetoceros impressus* was the dominating diatom in these seas. Strong cyanobacteria blooms occurred in the whole western and eastern Gotland Sea, at calm situations visible as yellow stripes on the water surface. The bloom became weaker at the backwards turn in the south-eastern Gotland Sea (between stations 253 and 255). In the northern Bornholm Sea, Arkona Sea and in Mecklenburg Bight, the cyanobacteria formed yellow-brownish patches on the water surface.

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
- Fig. 3: Transect 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 25.7.03	360/10	19.6	14.11	0.03	0.04
Meckl. Bight 24.7.03	012/6	18.2	7.52	0.02	0.13
Lübeck Bight 24.7.03	023/2	20.9	12.8	0.01	0.03
Arkona Basin 25.7.03	113/23	18.5	7.31	0.04	0.00
Pom. Bight 26.7.03	162/35	20.9	7.16	0.12	0.01
Bornholm Deep 27.7.03	213/53	20.6	7.25	0.03	0.01
Stolpe Channel 27.7.03	222/55	20.8	7.15	0.02	0.16
SE Gotland Basin 31.7.03	259/90	21.2	6.99	0.04	0.00
Gotland Deep 29.7.03	271/70	20.2	6.79	0.03	0.02
Fårö Deep 29.7.03	286/61	20.6	6.85	0.03	0.03
Landsort Deep 28.7.03	284/58	21.1	6.27	0.04	0.00
Karlsö Deep 28.7.03	245/56	21.0	6.71	0.02	0.01

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

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

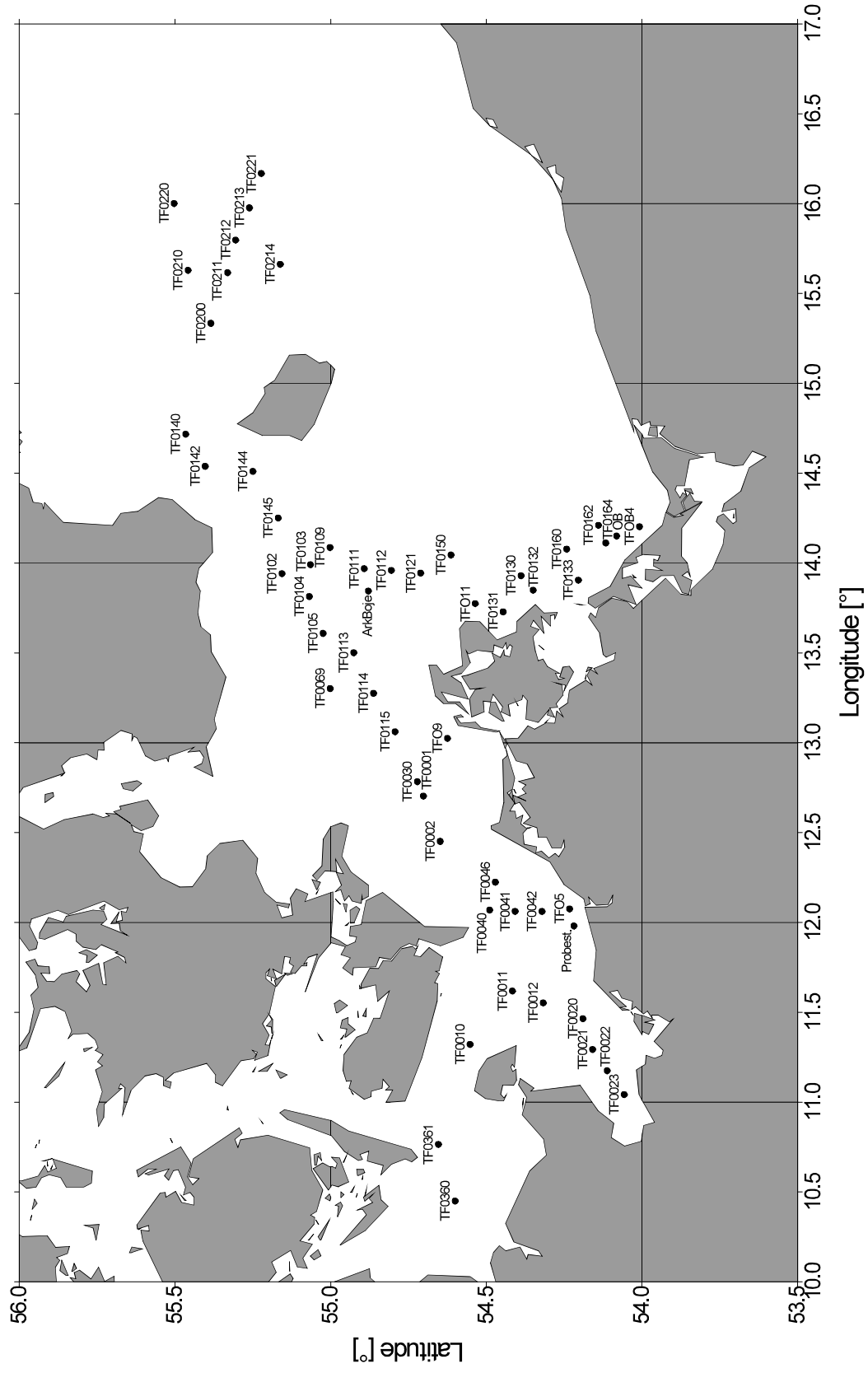
Table 2: Bottom-near water layer

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 25.7.03	360/10	17.3	10.61	23.87	5.39	0.15	0.04
Meckl. Bight 24.7.03	012/6	20.0	12.20	23.61	3.56	0.60	1.10
Lübeck Bight 24.7.03	023/2	23.1	7.83	24.88	0.84	0.67	0.59
Arkona Basin 25.7.03	113/23	43.9	10.01	17.37	3.41	0.94	1.95
Pom. Bight 26.7.03	162/35	13.2	17.23	7.47	4.27	0.34	0.05
Bornholm Deep 27.7.03	213/53	87.2	3.71	19.11	2.31	0.85	13.33
Stolpe Channel 27.7.03	222/55	89.0	3.73	15.14	3.82	1.17	8.05
SE Gotland Basin 31.7.03	259/90	85.7	4.16	11.70	1.04	2.61	6.73
Gotland Deep 29.7.03	271/70	233.1	4.63	12.67	2.33	3.07	12.82
Fårö Deep 29.7.03	286/61	192.5	6.00	11.77	- 1.67	4.75	0.09
Landsort Deep 28.7.03	284/58	437.3	5.88	10.43	- 0.67	3.73	0.05
Karlsö Deep 28.7.03	245/56	105.3	4.90	9.53	- 0.49	4.45	0.04

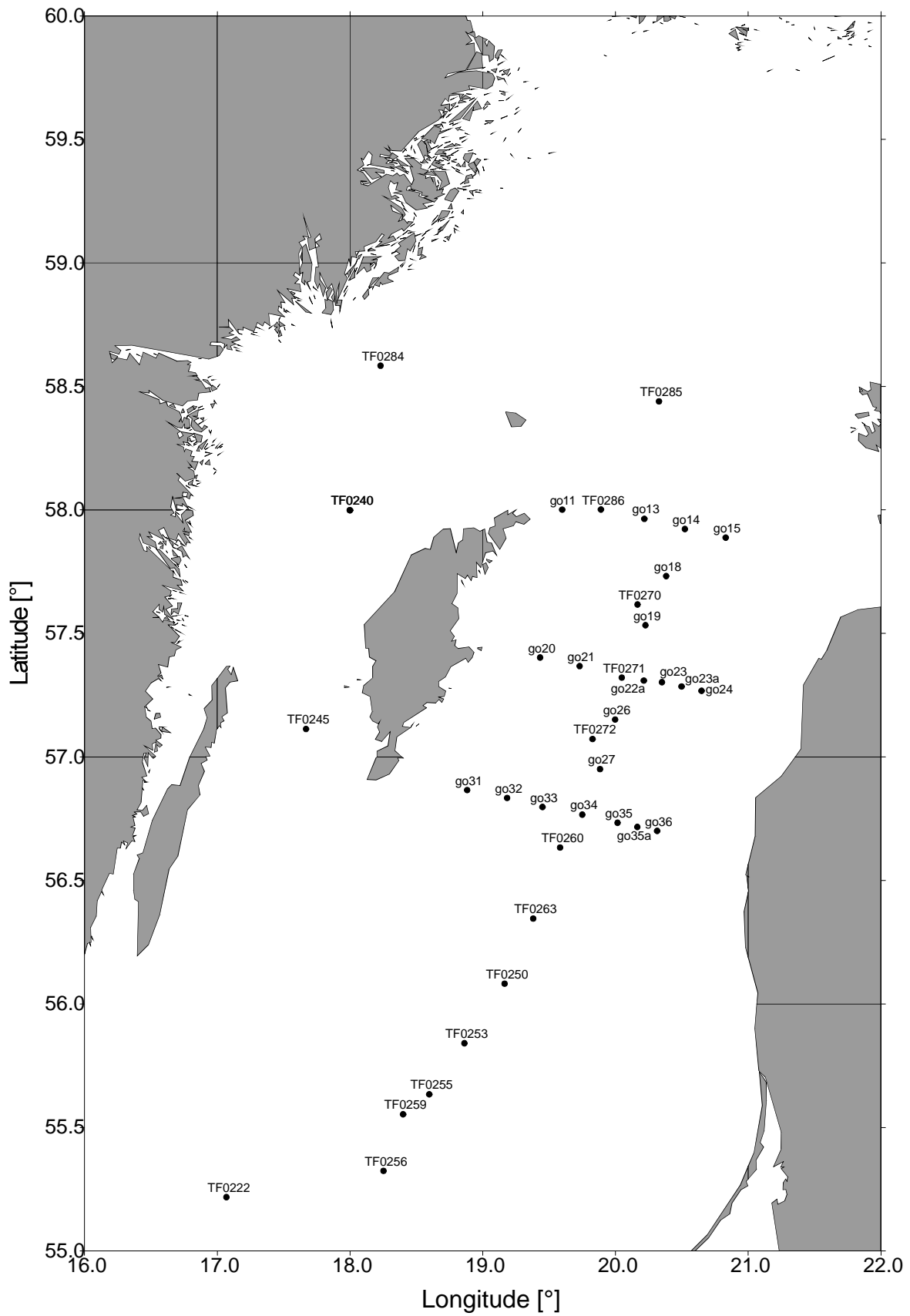
* $\Sigma \text{NO}_2^- + \text{NO}_3^-$; NO₂ was present only in traces in most areas under investigation

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

Monitoring
 Station map TF-440307
 24.07.2003 - 03.08.2003
 77 Stationen (Part 1)



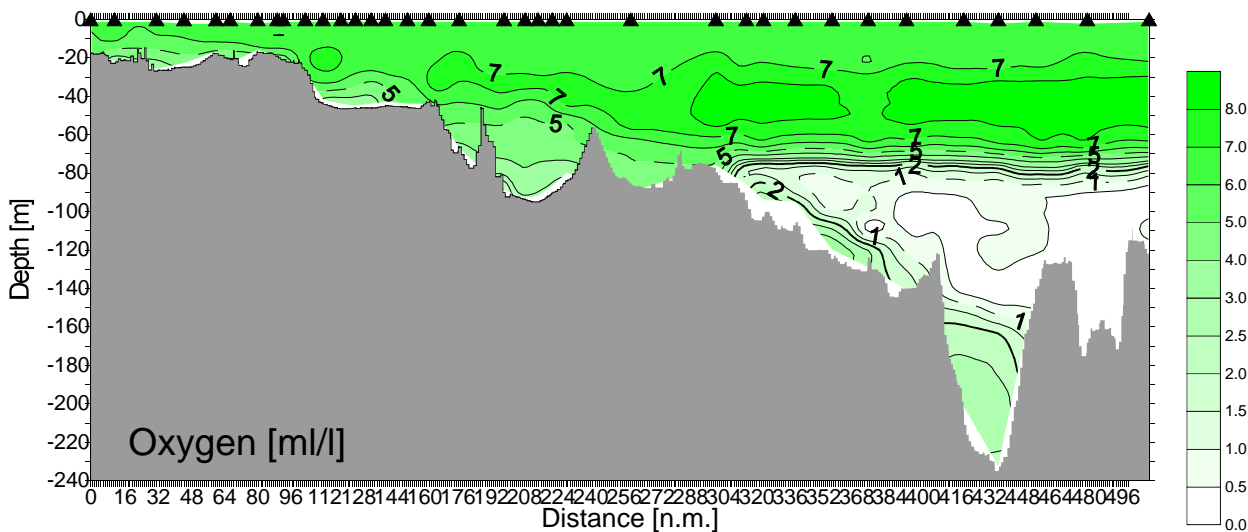
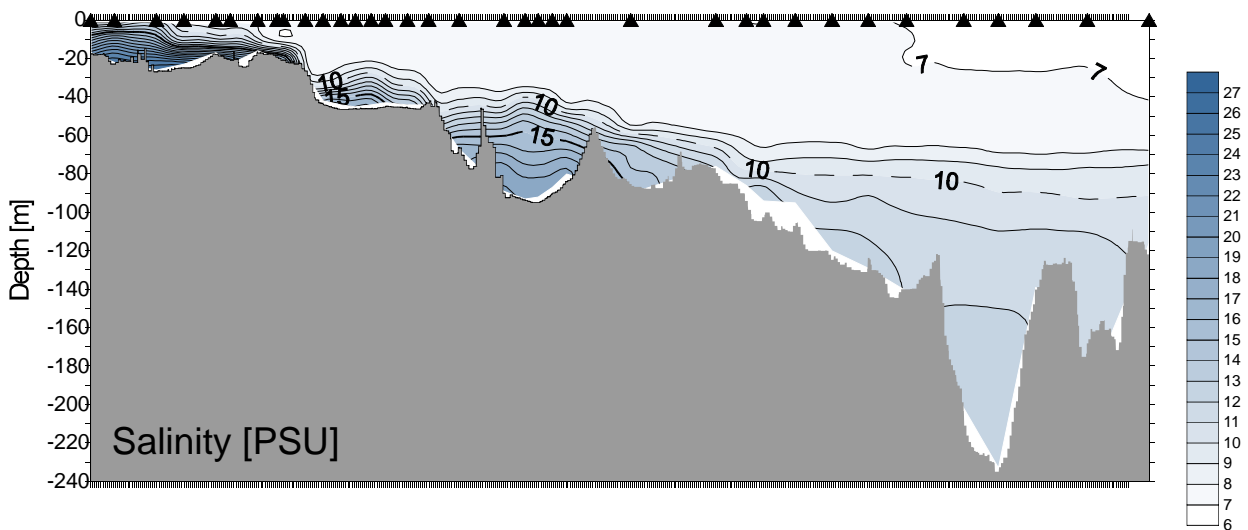
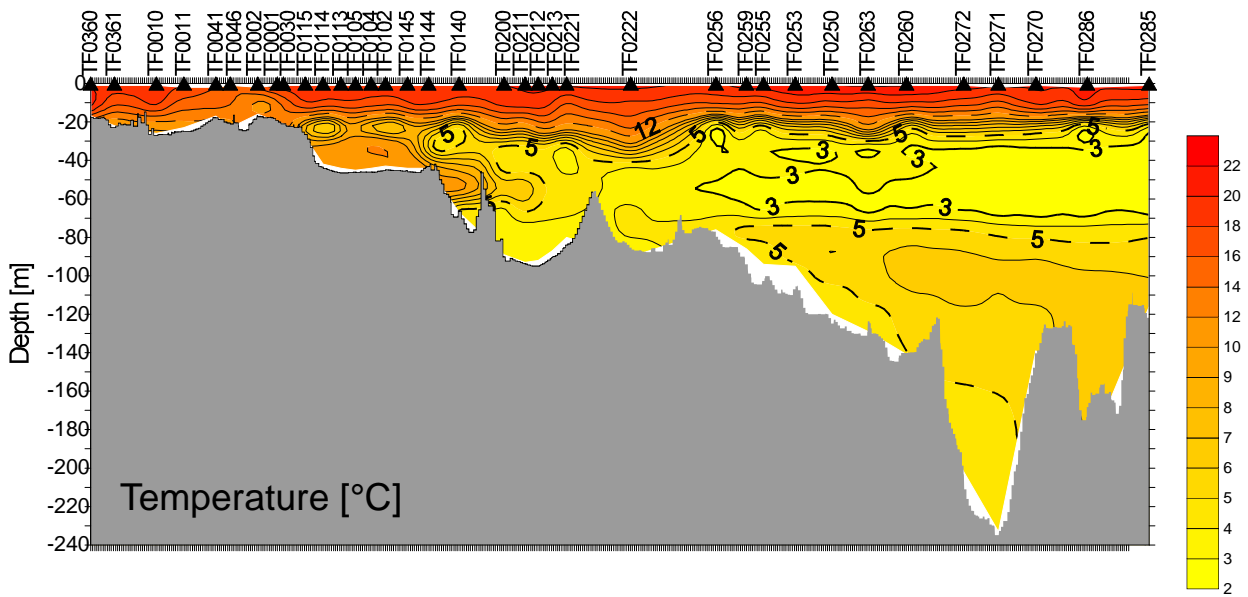
Monitoring
Station map TF440307
24.07.2003 - 03.08.2003
37 Stationen (Part 2)



Gesamte Ostsee

TF440307

24.07.2003 18:23 - 31.07.2003 10:09 UTC



Monitoring
TF440307
24.07.2003 - 03.08.2003
Oxygen bottom concentration [ml/l]

