



# Baltic Sea Research Institute Warnemünde

Cruise report  
No. 44/03/03

r/v „A.v.Humboldt“

Monitoring Cruise

02 May – 12 May 2003

Kiel Bight to northern Gotland Sea

This report is based on preliminary data.

The third monitoring cruise in 2003 performed by the Baltic Sea Research Institute Warnemünde in the frame of the HELCOM COMBINE programme was carried out with r/v „A.v.Humboldt“ between May 2<sup>nd</sup> and May 12<sup>th</sup> 2003.

Scientific staff participating:

G. Nausch (scientist in charge)	02.05. – 12.05.2003
J. Donath	02.05. – 12.05.2003
A. Gerber	02.05. – 12.05.2003
P. Köster	02.05. – 12.05.2003
G. Plüschke	02.05. – 12.05.2003
B. Sadkowiak	02.05. – 12.05.2003
K.-P. Wlost	02.05. – 12.05.2003

Master: G. Herzig

The area under investigation covered the Baltic Sea between Kiel Bight and northern Gotland Sea. Marine meteorological, hydrographic, hydrochemical and hydrobiological investigations were performed according to the COMBINE programme of HELCOM. The station map is attached to this report. Additionally to the standard programme 2 current meters were recovered and layed out again in the eastern Gotland Basin and in the Arkona Basin.

The weather situation was influenced by a high pressure cell laying over Poland and moving slowly northeastwards during the cruise causing air pressure between 1015 and 1025 hPa. Calm weather with wind speed up to 4 Bft from varying directions prevailed except May 3<sup>th</sup> where wind speed increased shortly up to 7 Bft. Air temperature was low, ranging normally only between 4 and 8 °C.

The following hydrographic, hydrochemical and hydrobiological characteristics have been observed during the cruise (c.f. Tables 1 and 2 and Figs. 3, 4 and 5):

- Surface temperatures varied between 2.55 °C (Gotland Deep) and 11.06 °C in the Pomeranian Bight. Due to the long and cold winter these temperatures were well below the long-term mean for the period 1971-1990 (in brackets):

Bornholm Deep	4.73 °C (6.75 °C)
Gotland Deep	2.55 °C (5.66 °C)
Farö Deep	2.85 °C (5.63 °C)
Landsort Deep	3.72 °C (6.09 °C)
Karlsö Deep	3.39 °C (6.76 °C)
- The nutrient situation in the surface layer is characterized by low phosphate and nitrate concentrations in the western Baltic Sea due to the spring bloom earlier in the year. In the central Baltic Sea a remarkable situation was observed. In the Bornholm Basin and Stolpe Channel area nitrate concentrations were depleted and a certain phosphate pool remains in the surface layer as usual for that time of the year. In the eastern and western Gotland Basin however, high phosphate concentrations were still measured despite the nitrate reservoir is more or less exhausted.
- Beside the regular monitoring tasks the cruise was focused on the effects of the recent saltwater inflow from January 2003. For that purpose additional stations were sampled in the eastern Gotland Basin.
- In the Bornholm Basin the halocline was located relatively high and comparable to observations in March. The 8 PSU isohaline was found at 34 m and the 15 PSU isohaline at 65 m giving good preconditions for the further penetration of the salty water into the deeper basins. Also the bottom salinity was with 19.28 PSU similar to March (19.5 PSU). The whole water column below the halocline was well oxygenated with concentrations between 7.43 ml/l at 50 m depth and 5.27 ml/l near to the bottom.
- Compared to March, the inflow has penetrated further into the eastern Gotland Basin. There do still stations exist which show anoxic conditions in the deeper water layers. However, at the central station 271 (BY 15) between 200 m and the bottom remarkable amounts of oxygen were found with up to 3.96 ml/l at 232 m depth. Similar amounts of oxygen were found in May 1994 for the last time. Above this oxic layer uplifted older waters were found, but only at 175 m oxygen was near to zero and no measurable hydrogen sulphide was there. The nutrient situation in the bottom layer reflects these changes as well. Thus, phosphate decreased in the bottom near water from 6.60 µmol/l in February to 1.71 µmol/l; silicate dropped from 86.0 µmol/l to 32.7 µmol/l. Whereas due to anoxic conditions no nitrate was found in February, now 7.7 µmol/l were measured near to the bottom. On contrast, ammonium decreased from 36.0 µmol/l to 1.25 µmol/l in May.
- The water renewal had not reached the Farö Deep yet. Therefore, salinity and hydrogen sulphide did not differ remarkable from the last observation in March. The same is valid for the situation at Landsort Deep where the stagnation period is also continuing.

- The bottom layer temperatures do also reflect the penetration of the inflow of the salty, oxygen rich and cold water from January 2003.

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

The inflow had reached the Bornholm Basin already at the end of January resulting in a strong decrease in temperature. During that time and also still in March where first sign of the inflow were recorded in the eastern Gotland Basin temperature remained above the long term mean. The decrease was measured in May 2003. Temperatures in all the other deeps, not affected by the inflow up to now, are lying above the long term average.

#### Attachments

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

Figs. 1-2: Track charts

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

Fig. 5: Areas of oxygen deficiency and hydrogen sulphide in the near bottom layer. Histograms show the maximum oxygen and hydrogen sulphide concentrations of this layer; the figure contains additionally the 70 m-depth line resp. 20 m-depth line (small picture)

Günther Nausch  
Scientist in charge

Table 1: Surface water layer (about 1 m depth)

Area Date	Stat. Name/No. **	Temp. °C	Sal. PSU	PO <sub>4</sub> <sup>3-</sup>	NO <sub>32</sub> <sup>-</sup> *	SiO <sub>4</sub>
Kiel Bight 02.05.2003	360/0007	8.90	12.28	0	0.05	3.7
Meckl. Bight 02.05.2003	012/0002	7.95	12.30	0	0.04	2.4
Lübeck Bight 02.05.2003	023/0006	9.18	11.35	0	0.34	3.1
Arkona Basin 03.05.2003	113/0022	5.09	7.47	0.14	0.03	6.1
Pom. Bight 11.05.2003	162/0103	11.06	6.52	0.02	8.27	0.8
Bornholm Deep 04.05.2003	213/0039	4.73	7.41	0.14	0.06	9.8
Stolpe Channel 04.05.2003	222/0041	4.25	7.30	0.20	0.04	10.0
SE Gotland Basin 05.05.2003	259/0043	3.30	7.22	0.31	0	10.6
Gotland Deep 06.05.2003	271/0060	2.55	7.05	0.40	0.13	12.9
Fårö Deep 07.05.2003	286/0068	2.85	6.90	0.38	0.04	10.9
Landsort Deep 08.05.2003	284/0075	3.72	6.30	0.28	0	8.0
Karlsö Deep 08.05.2003	245/0078	3.39	6.83	0.38	0.06	12.7

\*  $\sum \text{NO}_2^- + \text{NO}_3^-$ 

\*\* see attached map

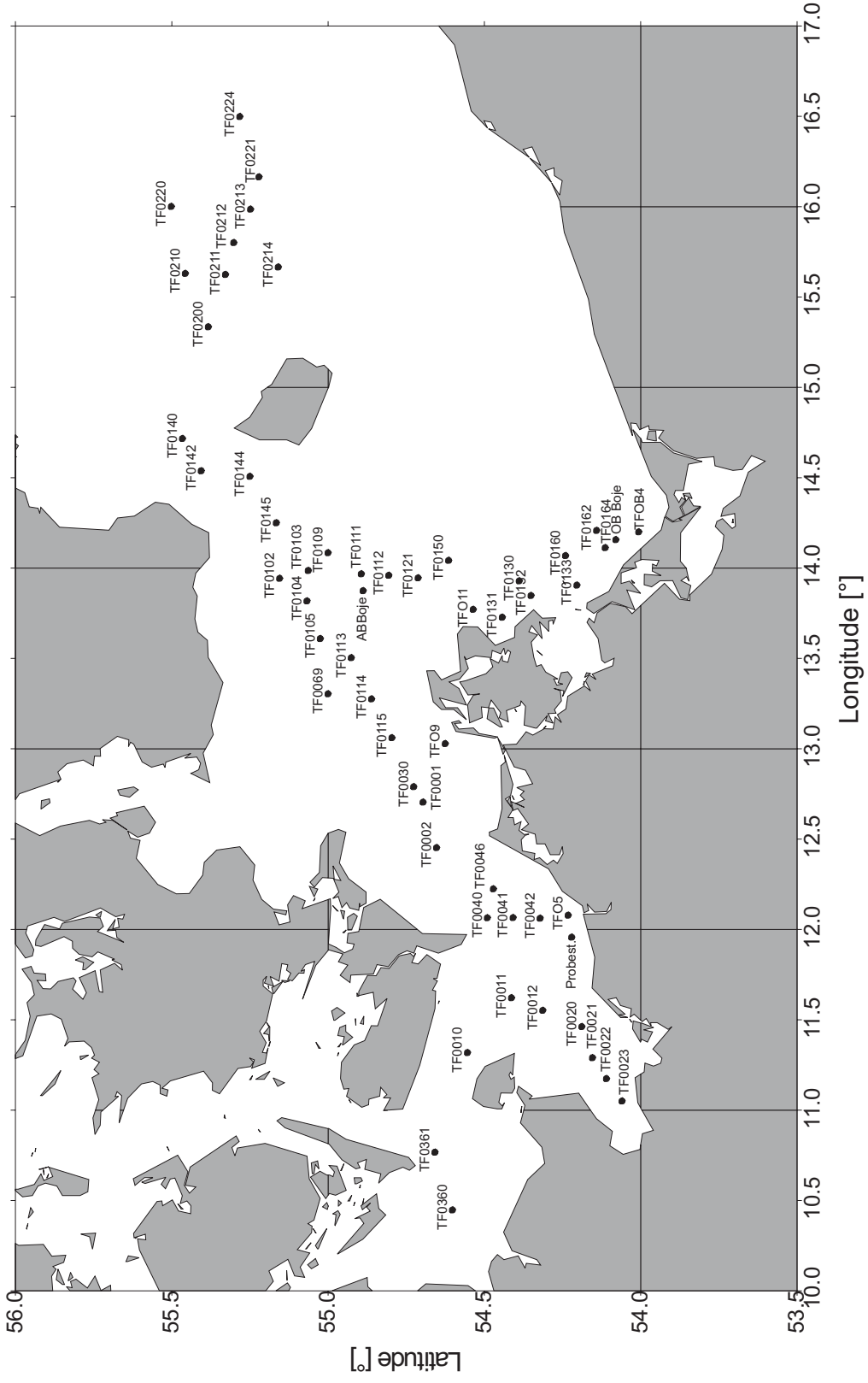
Table 2: Bottom near water

Area Date	Stat. Name/No.**	Depth m	Temp °C	Sal. PSU	O <sub>2</sub> ml/l	PO <sub>4</sub> <sup>3-</sup>	NO <sub>32</sub> <sup>-</sup> *	SiO <sub>4</sub>
Kiel Bight 02.05.2003	360/0007	17	5.03	19.13	7.61	0.20	0.95	7.0
Meckl. Bight 03.05.2003	012/0002	23	4.76	21.73	6.05	0.20	2.39	11.7
Lübeck Bight 02.05.2003	023/0006	22	4.36	22.03	5.40	0.06	0.26	3.8
Arkona Basin 03.05.2003	113/0022	45	3.46	19.02	3.86	1.06	0.42	18.9
Pom. Bight 11.05.2003	162/0103	13	8.21	6.88	6.93	0.01	3.98	5.7
Bornholm Deep 04.05.2003	213/0039	87	3.43	19.28	5.27	0.66	9.25	18.2
Stolpe Channel 04.05.2003	222/0041	88	3.88	15.30	5.12	1.18	6.71	24.7
SE Gotland Basin 05.05.2003	259/0043	88	4.72	11.76	1.61	2.75	5.72	45.0
Gotland Deep 06.05.2003	271/0060	232	4.69	12.55	3.96	1.71	7.67	32.7
Fårö Deep 07.05.2003	286/0068	187	6.35	11.66	-3.33	5.40	0	74.9
Landsort Deep 08.05.2003	284/0075	443	5.40	10.22	-1.16	4.25	0	57.43
Karlsö Deep 08.05.2003	245/0078	105	4.80	9.36	-0.36	4.15	0	54.3

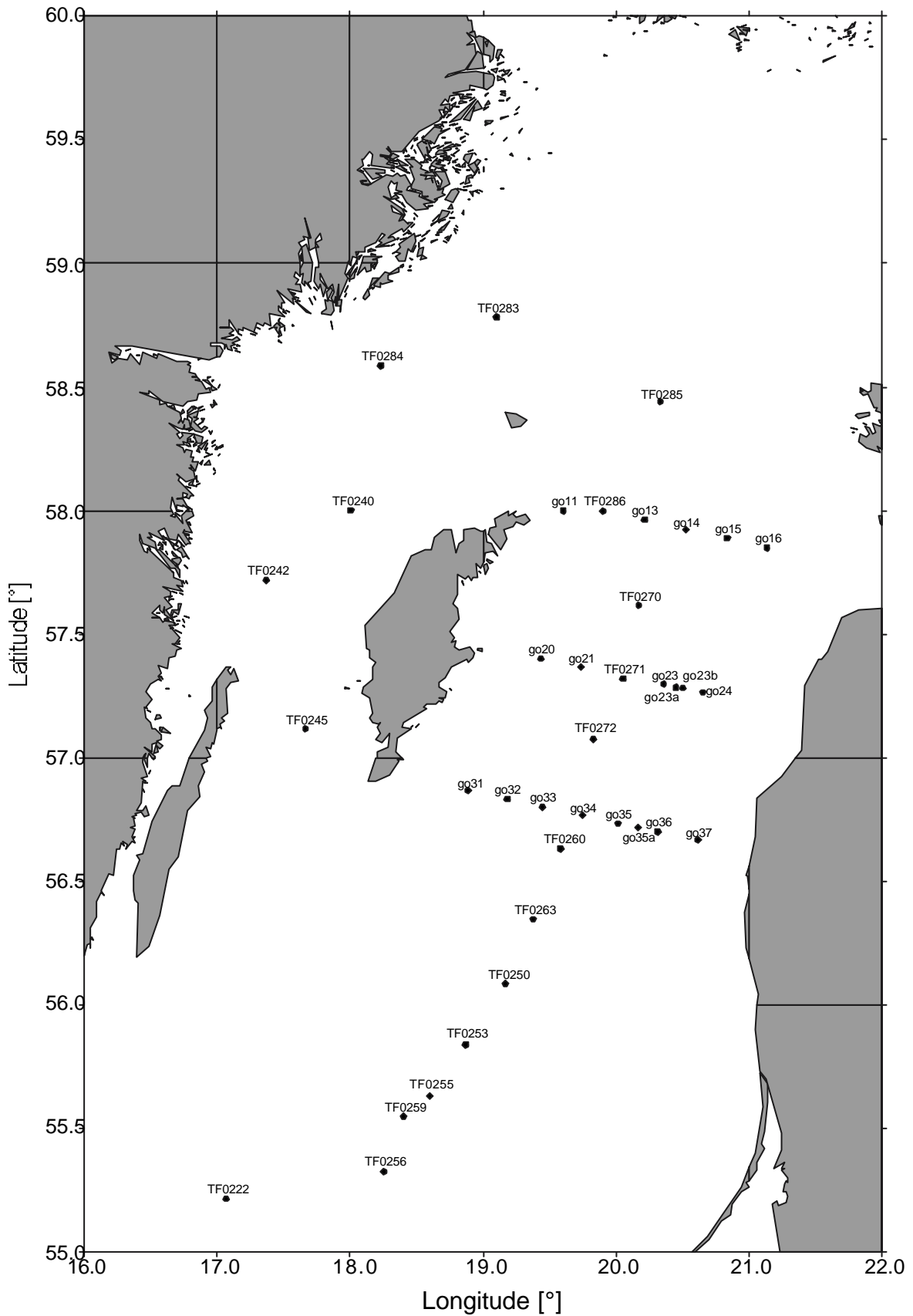
\*  $\sum \text{NO}_2^- + \text{NO}_3^-$ 

\*\* see attached map

**Monitoring**  
 Station map TF440303  
 02.05.2003 - 12.05.2003  
 72 Stationen (Part 1)



**Monitoring**  
Stationmap TF440303  
02.05.2003 - 12.05.2003  
39 Stationen (Part 2)

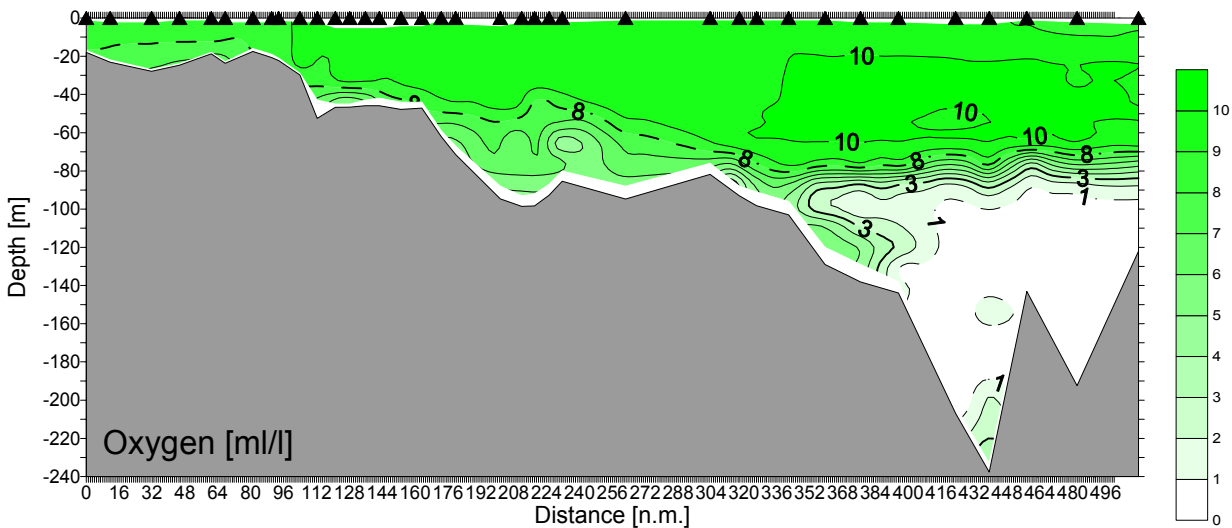
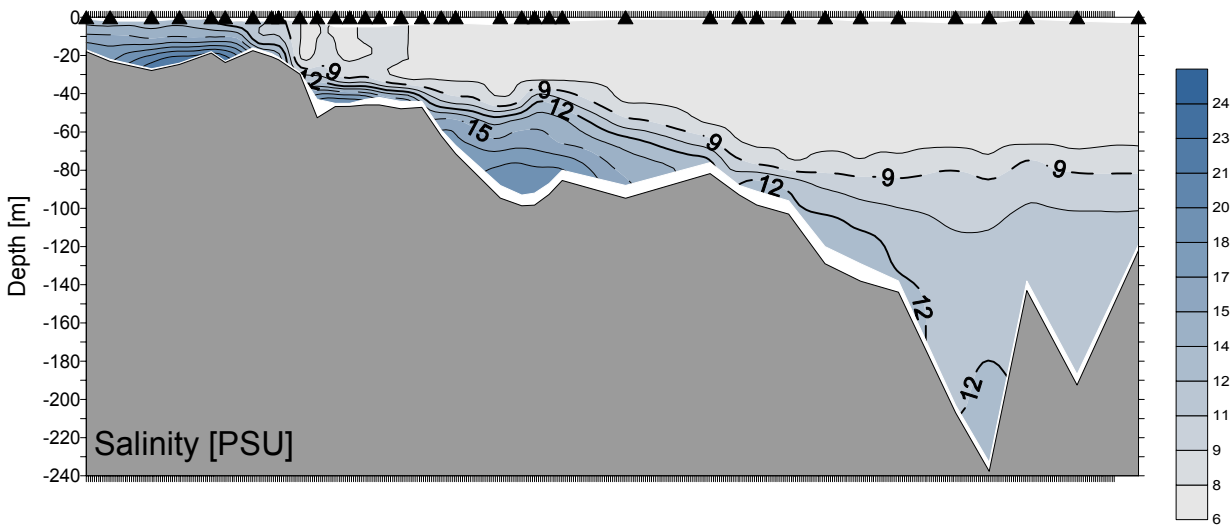
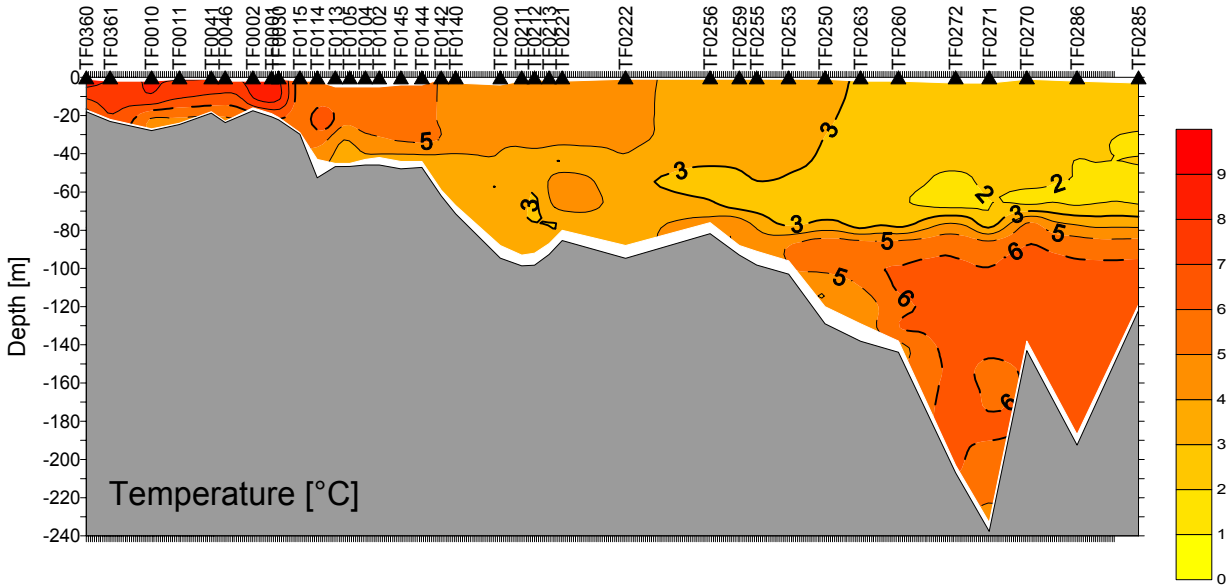




# TF440303

Kiel Bight - Gotland Sea

02.05.2003 20:36 - 07.05.2003 23:49 UTC

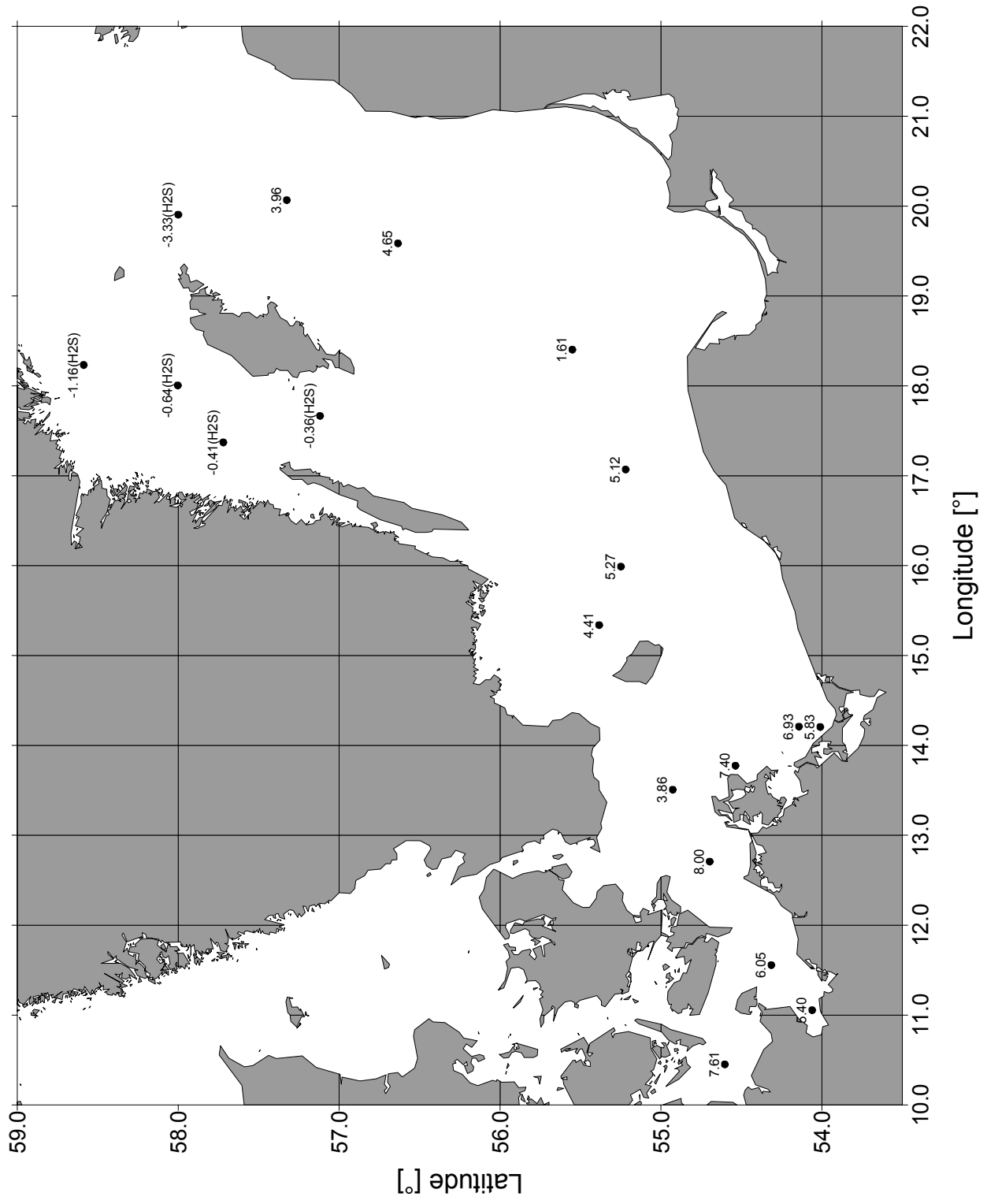


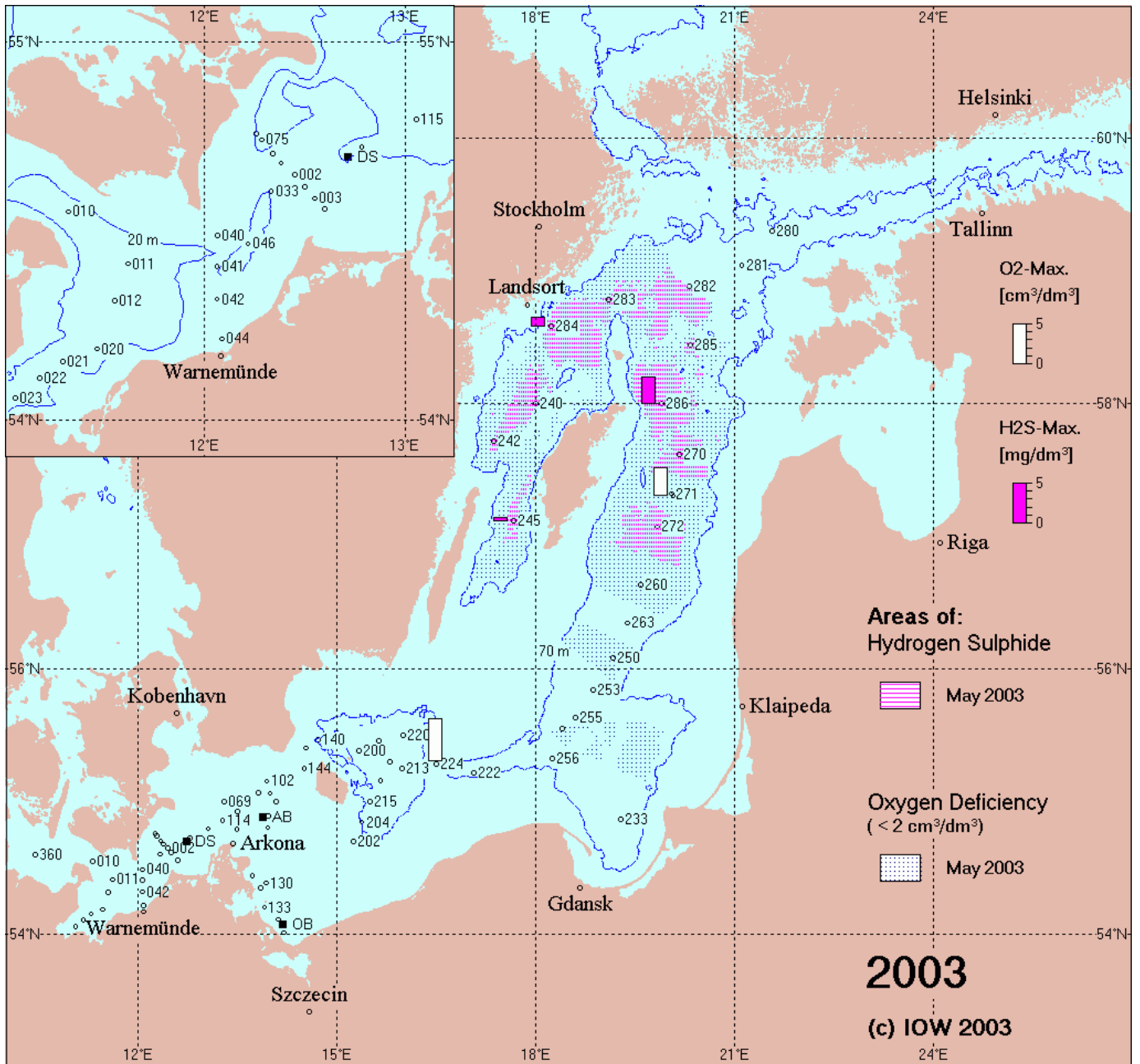
# Monitoring

TF440303

02.05.2003 - 12.05.2003

Oxygen bottom concentration [ml/l]





**Monitoring - TF440303 - 02.05.-12.05.2003**

Areas of oxygen deficiency and hydrogen sulphide in the near bottom layer. Histograms show the maximum oxygen and hydrogen sulphide concentrations of this layer; the figure contains additionally the 70 m-depth line resp. 20 m-depth line