



# Baltic Sea Research Institute Warnemünde

## Cruise Report


R/V "GAUSS"


Cruise- No. 11 / 04 / 01 (Gauss 413)

11 February - 22 February 2004

This report is based on preliminary data

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1. **Cruise No.:** 11 / 04 / 01 (GAUSS 413)
2. **Dates of the cruise:** from 11/02/2004 to 22/02/2004
3. **Particulars of the research vessel:**
  - Name: r/v 'GAUSS'
  - Nationality: Germany
  - Operating Authority: Bundesamt für Seeschifffahrt und Hydrographie (BSH), Hamburg
4. **Geographical area in which ship has operated:**  
Baltic Sea between Kiel Bight and northern Gotland Sea
5. **Dates and names of ports of call**
6. **Purpose of the cruise**  
Monitoring cruise in the frame of the HELCOM COMBINE program
7. **Crew:**
  - Name of master: K.- P. Walde
  - Number of crew: 20
8. **Research staff:**
  - Chief scientist: Klaus Nagel
  
  - Participants :

Anne Baumgart	Uwe Hehl
Bärbel Buuk	Ursula Hennings
Jan Donath	Johann Ruickoldt
Sarah Gebhardt	Birgit Sadkowiak
Ines Hand	Erika Trost
9. **Co-operating institutions:**  
All institutions dealing with HELCOM BMP
10. **Scientific equipment :** CTD , water samplers, plankton net

## 11. General remarks and preliminary result

The area under investigation covered the Baltic Sea between Kiel Bight and the northern Gotland Basin as shown in the attached maps. Marine meteorological, hydrographic, chemical and biological investigations were performed at 80 stations according to both, the Baltic Monitoring Program (BMP) and the Coastal Monitoring Program (CMP) of HELCOM. The measurements were supplemented by continuous registration of standard meteorological parameters as well as surface water temperature and salinity

For selected stations, which are characteristic for different regions of the Baltic Sea, preliminary data of hydrographic and hydrochemical parameters in the surface and the near-bottom layer are compiled in the attached tables. These results are also compared with mean values calculated from the measurements performed during the February cruises of the years 1971 to 1990.

The weather during the cruise was dominated by stable high pressure systems in the north eastern Atlantic region which extend to the Baltic area for the time of the cruise. Air pressure varied between 1010 hPa and 1035 hPa except one day (18/02/2004), when a small front passed by. This was the only day when wind speed significantly exceeded 15 m/s for some hours. The other time of the cruise was unusually calm for this time of the year with wind speeds varying between 5 m/s and 15 m/s. Northerly or westerly winds dominated during this cruise, only on the last two days southerly to easterly winds were observed. Air temperatures varied around 2°C with a minimum of -2°C and a maximum of +4°C. Surface water temperature in the whole area under investigation varied only between 2.2°C and 3.9°C except the Pomeranian Bight, where surface temperatures between 0.8°C and 2°C were measured.

Salinity in the western parts of the Baltic Sea – Kiel Bight, Fehmarn Belt area, Mecklenburg Bight – varied between 16 PSU and 18 PSU in the surface layer while 18 PSU to 22 PSU were measured near the bottom. In the surface layer salinity was slightly above the values expected from long term observations, while salinity measured near the bottom was close to the long term means but approximately 4 PSU lower than those observed in February 2003 shortly after the saltwater inflow, which took place in January 2003. Nitrate concentrations in this area varied between 5.5 µM and 8.5 µM and are within the range predicted from long term observations, in the surface layer as well as in the bottom layer. Like in February 2003, phosphate concentrations in the whole water column were significantly lower than long term means and vary around 0.5 µM. The water in this area was well oxygenated and oxygen concentrations are close to saturation.

At the Darss Sill a bottom layer of water with salinities between 17 PSU – 18 PSU and temperatures of 3°C was found. The thickness of this layer was approximately 5 m. Salinity in the top 10 m of the water column was close to 10 PSU

In the Arkona Basin a halocline was found between 30 m and 40 m. Above the halocline salinity varied between 8 PSU and 9 PSU and temperature was close to 3°C. In the water below the halocline salinities of more than 18 PSU and temperatures between 4°C and 6°C were measured. The salinity in the bottom layer was significantly higher than expected from long term observations and close to the value found in February 2003 shortly after the saltwater inflow of January 2003. In the surface layer concentrations of nitrate and phosphate were below the values expected from long term observations, whereas they were close to the long term means at the bottom. The water column was well oxygenated at all stations.

The halocline in the Bornholm Basin was located between 40 m and 50 m. The top 40 m of the water column were well mixed showing salinities of 7 PSU to 8 PSU and a temperature of 3°C. A lens of relatively warm water was found just below the halocline with temperatures of 8°C to 10°C, salinities between 12 PSU and 14 PSU and oxygen concentrations of approximately 5 ml/l. The bottom layer was colder again with temperatures of approximately 5°C and salinities close to 18 PSU. Near the bottom oxygen concentrations below 1 ml/l were measured. Nutrient concentrations in the surface layer of the Bornholm Basin are close to the long term means. Due to the saltwater inflow in 2003 nitrate concentrations at the bottom were above the values expected from long term observations, while those of phosphate were lower.

As a result of the saltwater inflow of January 2003 the Eastern Gotland Basin and the Fårö Deep were now oxygenated down to the sea floor and no hydrogen sulphide was detected in this area. Bottom oxygen concentrations between 0.7 ml/l and 1.3 ml/l were measured. In the central Eastern Gotland Basin and in the Fårö Deep minimum of oxygen concentration was found in depths between 80 m and 110 m (0.04 ml/l – 0.8 ml/l, respectively). The halocline was located between 50 m and 70 m. The water above the halocline has a salinity of approximately 7 PSU and a temperature close to 2.5°C. In the near bottom layer salinities of 12 PSU – 13 PSU and temperatures of 5°C – 6°C were measured. As the saltwater inflow had uplifted water masses which were rich in phosphate but poor in nitrate, nitrate concentrations in the surface were below the long term mean, whereas that of phosphate was slightly higher. Vice versa, in the bottom layer phosphate concentrations decreased significantly while that of nitrate were much higher than expected from long term means due to the shift from an anoxic to an oxic regime.

During this cruise H<sub>2</sub>S was only detected in the Western Gotland Basin at depths below 90 m – 100 m. H<sub>2</sub>S concentrations were rather low compared to that observed in the Eastern Gotland Basin during the last stagnation period and were significantly lower than 1 mg/l. The halocline at a depth around 60 m separated water masses of approximately 7 PSU and 2°C in the surface from those of 10 PSU and 5°C – 6°C at the bottom.

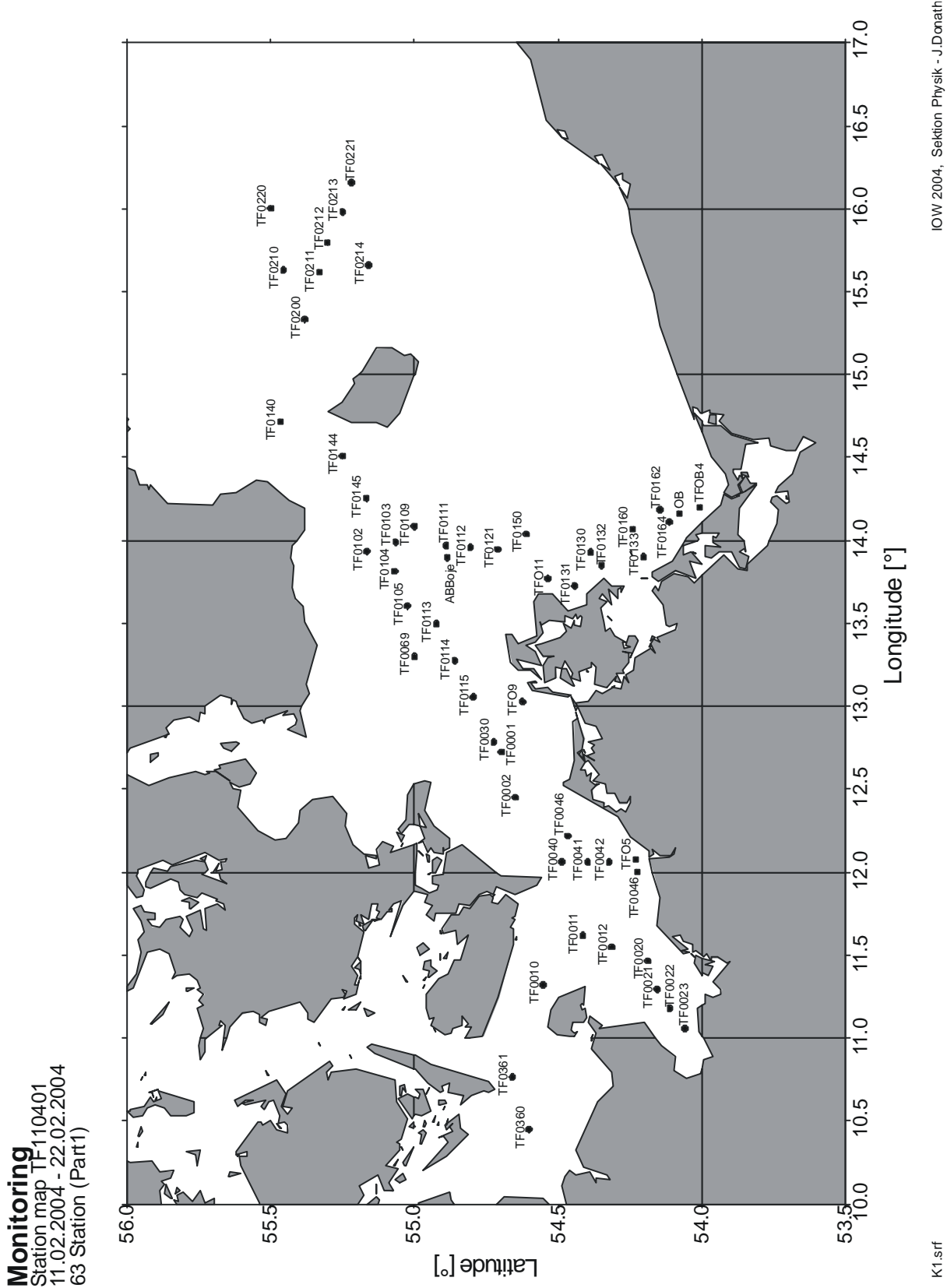
Lowest surface temperatures had been found in the Pomeranian Bight. The situation in the bight was characterized by water delivered from the river Odera and spreading in the surface layer, which was rather cold (<1°C) and low in salinity (5 PSU – 6 PSU). Nutrient concentration in this water was high (nitrate up to 43 µM, phosphate up to 1.2 µM). In the bottom layer (water depth 10 m – 20 m) salinities between 7 PSU and 8 PSU were measured whereas the water temperature was fairly constant in the whole water column. Nutrient concentrations in the bottom layer were significantly lower than in the surface but high compared to the inner basins of the Baltic Sea (nitrate 7 µM – 18 µM, phosphate 0.4 µM – 0.8 µM),.

During this cruise a sediment trap was recovered and laid out again close to station TF0271 and an ADCP was recovered east of station TF0221.

Klaus Nagel  
Scientist in charge

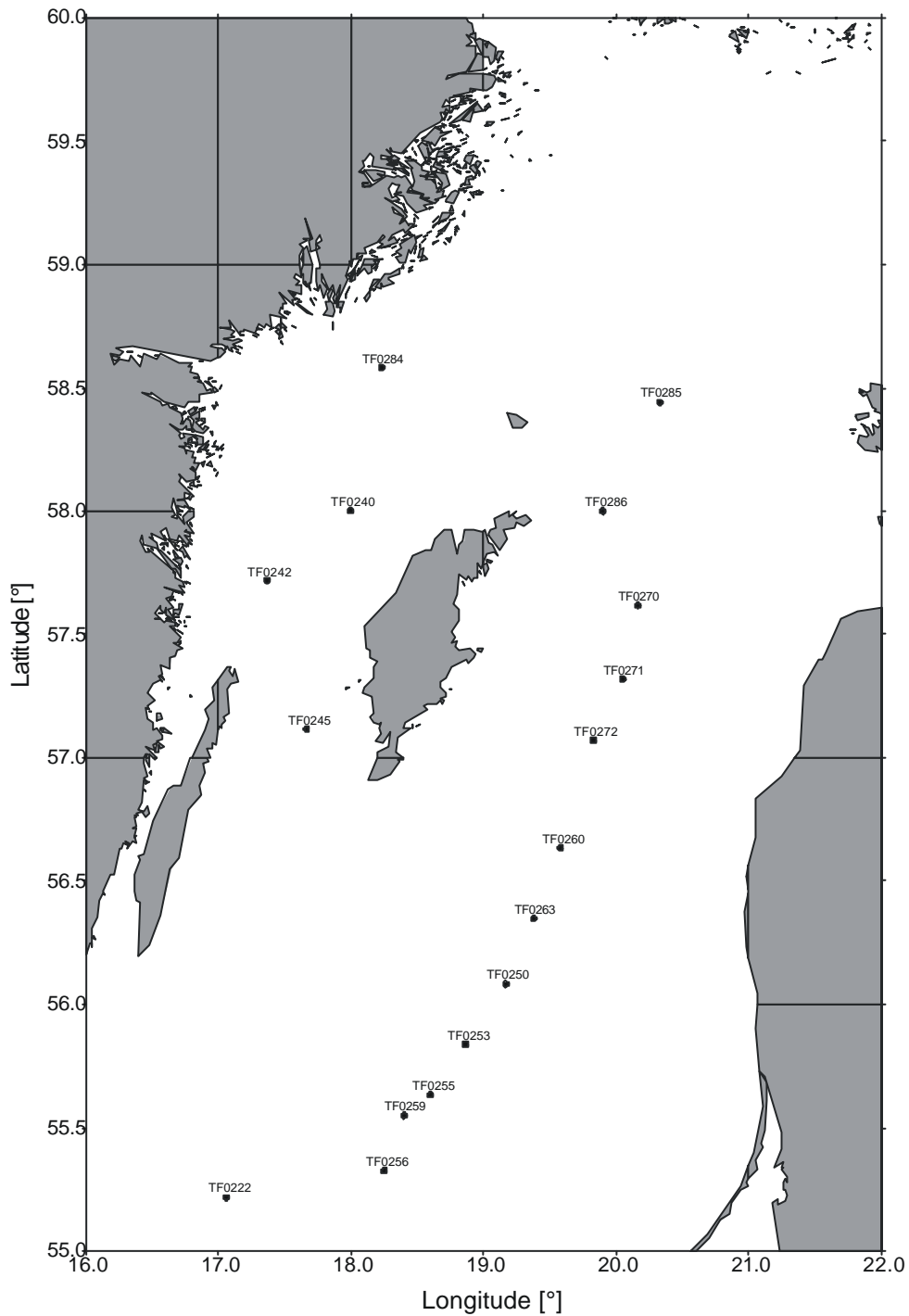
Attachments :

- track charts
- tables of preliminary results (surface layer and near bottom layer)
- comparison of actual data with mean values calculated from the measurements during the February cruises of the years 1971 – 1990 (surface layer and near bottom layer)
- transects of temperature and salinity between Kiel Bight and northern Gotland Sea
- map showing oxygen concentrations in near the bottom water layer



Monitoring  
Station map TF110401  
11.02.2004 - 22.02.2004  
63 Station (Part1)

**Monitoring**  
Station map TF110401  
11.02.2004 - 22.02.2004  
17 Station (Part2)



K2.srf

IOW 2004, Sektion Physik - J.Donath

Preliminary results of hydrographic and hydrochemical parameters at selected stations -  
**surface layer -**

Station Date	Stat.Name Stat.No. **)	Temp. °C	Salinity PSU	NO <sub>3</sub> *) µmol/l	PO <sub>4</sub> µmol/l	SiO <sub>4</sub> µmol/l	O <sub>2</sub> ml/l
Kiel Bight 11/02/04	TF0360 5	2.96	18.65	5.56	0.44	11.3	8.40
Mecklenburg Bight 12/02/04	TF0012 6	2.40	16.34	5.80	0.49	15.7	8.59
Lübeck Bight 12/02/04	TF0023 7	2.72	16.72	10.25	0.52	18.3	8.42
Arkona Basin 13/02/04	TF0113 23	2.40	8.21	2.68	0.34	8.8	9.01
Pomeranian Bight 21/02/04	TFOB4 75	(0.89 #)	(5.80 #)	43.85	1.19	67.6	9.80
Bornholm Deep 14/02/04	TF0213 37	3.16	7.63	2.48	0.48	11.0	8.80
Stolpe Channel 15/02/04	TF0222 40	2.82	7.33	2.70	0.67	14.6	8.97
SE Gotland Basin 15/02/04	TF0259 42	2.99	7.27	2.75	0.59	12.6	8.78
Gotland Deep 16/02/04	TF0271 49	2.40	7.09	2.93	0.65	14.0	8.77
Fårö Deep 17/02/04	TF0286 51	2.33	7.05	3.15	0.65	14.1	8.83
Landsort Deep 18/02/04	TF0284 53	1.69	6.86	3.24	0.83	17.8	9.14
Karlsö Deep 19/02/04	TF0245 56	2.03	7.04	3.44	1.26	20.9	8.91

\*) NO<sub>3</sub> is given as sum of NO<sub>3</sub><sup>-</sup> and NO<sub>2</sub><sup>-</sup> (in most samples NO<sub>2</sub><sup>-</sup> was present only in traces)

\*\*\*) see attached maps



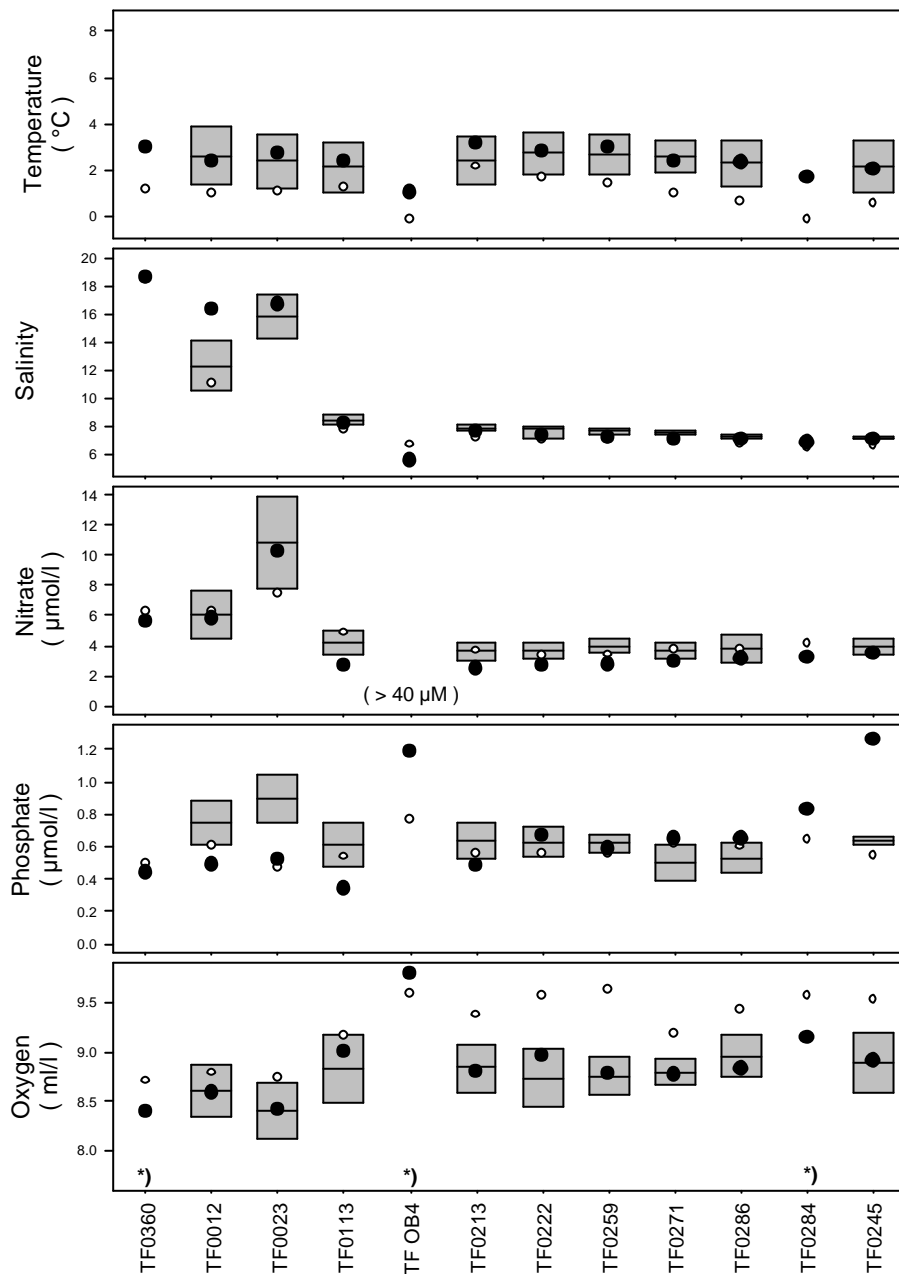
Preliminary results of hydrographic and hydrochemical parameters at selected stations  
– near bottom layer -

Station Date	Stat.Name Stat.No. **)	Depth m	Temp. °C	Salinity PSU	NO <sub>3</sub> *) µmol/l	PO <sub>4</sub> µmol/l	SiO <sub>4</sub> µmol/l	O <sub>2</sub> ml/l
Kiel Bight 11/02/04	TF0360 5	17	3.02	18.75	5.53	0.44	11.3	8.33
Mecklenburg Bight 12/02/04	TF0012 6	23	2.94	18.22	6.57	0.54	15.4	8.07
Lübeck Bight 12/02/04	TF0023 7	22	3.24	17.77	8.43	0.57	19.1	7.90
Arkona Basin 13/02/04	TF0113 23	44	3.87	19.33	6.53	0.58	13.4	7.62
Pomeranian Bight 21/02/04	TFOB4 75	10	0.89	7.13	18.18	0.78	31.5	9.48
Bornholm Deep 14/02/04	TF0213 37	87	4.64	17.96	10.86	1.07	46.1	0.90
Stolpe Channel 15/02/04	TF0222 40	87	8.23	13.4	7.18	0.94	23.4	4.49
SE Gotland Basin 15/02/04	TF0259 42	86	6.15	11.04	7.18	2.46	40.2	0.88
Gotland Deep 16/02/04	TF0271 49	234	6.13	12.90	12.16	2.09	42.4	0.86
Fårö Deep 17/02/04	TF0286 51	189	5.43	12.15	9.86	2.57	44.2	0.77
Landsort Deep 18/02/04	TF0284 53	437	5.64	10.58		3.70	56.3	-0.87 ( H <sub>2</sub> S )
Karlsö Deep 19/02/04	TF0245 56	106	4.95	9.56		4.07	57.5	-0.73 ( H <sub>2</sub> S )

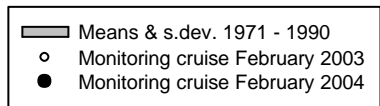
\*) NO<sub>3</sub> is given as sum of NO<sub>3</sub><sup>-</sup> and NO<sub>2</sub><sup>-</sup> (in most samples NO<sub>2</sub><sup>-</sup> was present only in traces)

\*\*) see attached maps

Monitoring stations / February cruises : near-surface layer

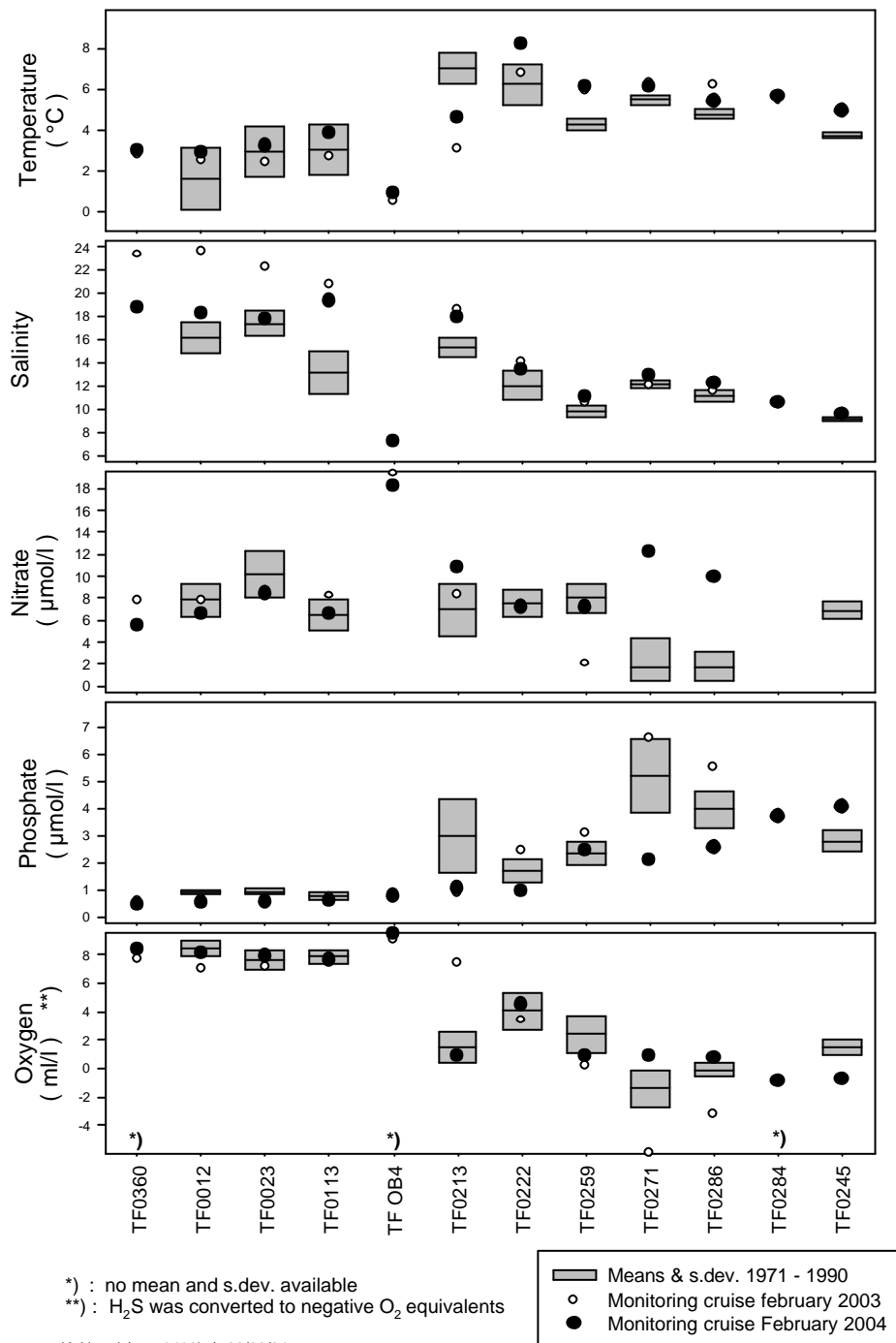


\*) : no mean and s.dev. available



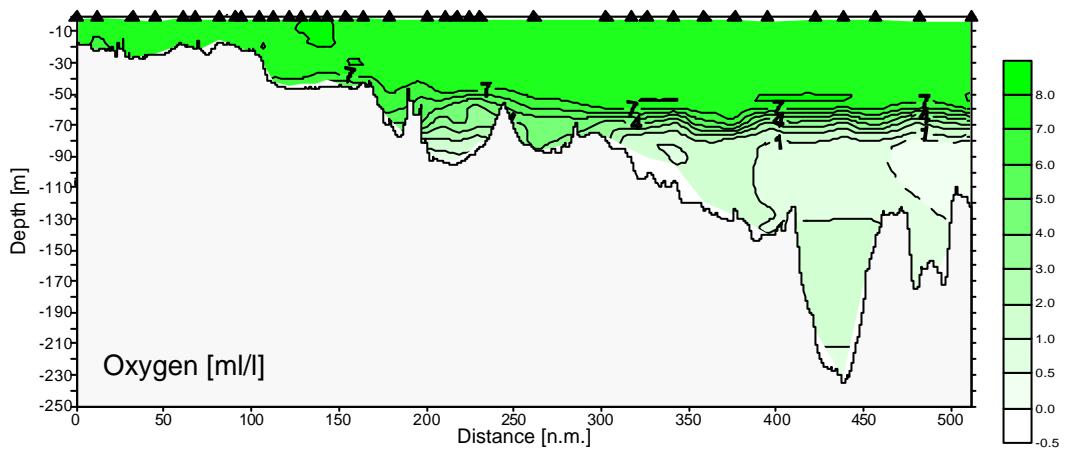
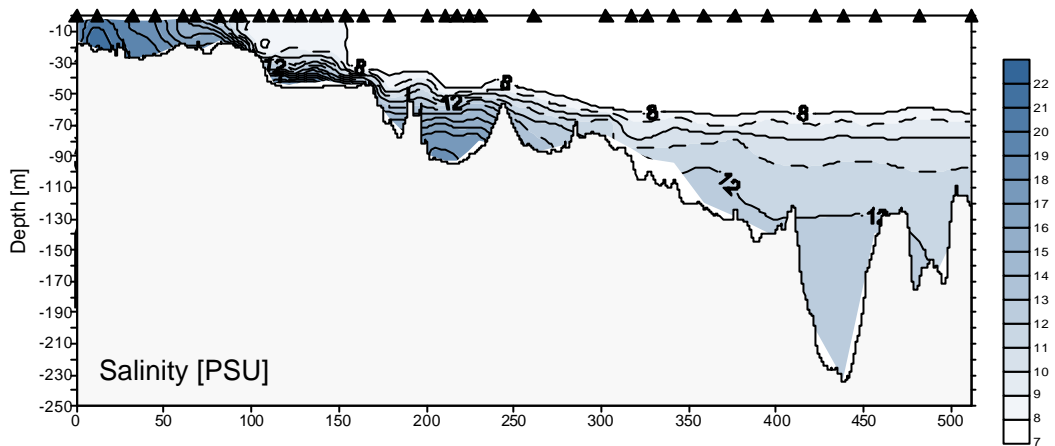
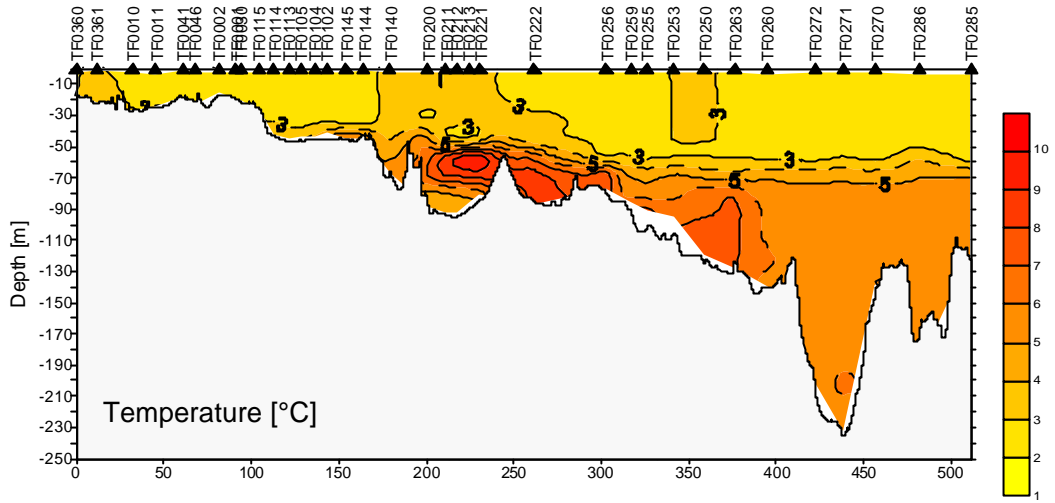
K. Nagel \ st\_0402s \ 22/02/2004

Monitoring stations / February cruises : near-bottom layer



**Kiel Bight - Gotland Sea**

TF110401  
 11.02.2004 12:24 - 18.02.2004 05:38 UTC



**Monitoring**  
TF110401  
11.02.2004 - 22.02.2004  
Oxygen bottom concentration [ml/l]

