



Baltic Sea Research Institute Warnemünde

Cruise Report

r/v "Gauss"

Cruise- No. 11 / 02 / 03

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

In case, you want to have the cruise reports in printed form also in future, please inform the institute at:

Dr.Günther Nausch
Institut für Ostseeforschung Warnemünde
Seestraße 15
D – 18119 Rostock-Warnemünde

1. **Cruise No.:** 11 / 02 / 03
2. **Dates of the cruise:** from 16 October 2002 to 29 October 2002
3. **Particulars of the research vessel:**
 - Name: "Gauss"
 - Nationality: Germany
 - Operating Authority: Bundesamt für Seeschifffahrt und Hydrographie (BSH)
4. **Geographical area in which ship has operated:**
Kiel Bight to Northern Gotland Sea
5. **Dates and names of ports of call**
Saßnitz 20 October – 21 October 2002
6. **Purpose of the cruise**
Baltic Monitoring Programme of HELCOM
7. **Crew:**
 - Name of master: K.-P. Walde
 - Number of crew: 12
8. **Research staff:**
 - Chief scientist: Dr. M. Schmidt

 - Participants:
 - 16. October – 29. October 2002
Weinreben, Stefan
Donath, Jan
Sadkowiak, Birgit
Disterheft, Henry
Nkandi, Karina
Schultz, Asterid
Köster, Philipp

 - 16. October – 21. October 2002
Liehr, Gladys
Glockzin, Ines
Dr. Zettler, Michael,
Hambach, Bastian

 - 21. October – 29. October 2002
Hehl, Uwe
Lehnert, Gerhard
9. **Co-operating institutions:** All institutions dealing with HELCOM BMP,
10. **Scientific equipment:** CTD, water samplers, plankton net, sediment trap, video sledge, van-Veen grab, Bongo net
11. **General remarks and preliminary result**

The cruise TF 02/03/01 is part of the Baltic Sea monitoring programme of HELCOM. It started in Warnemünde at October 16th 2002 and ended at October 29th 2002 in Warnemünde. From October 20th to 21th scientists and equipment have been exchanged in Saßnitz. For a cruise track see Figs. 1 and 2.

The area of investigation stretches from the Kiel Bight in the west over the Pommeranian Bay, the Arkona and Bornholm Basin, the Eastern and Northern Gotland Sea to Farö and Landsort Deep. A total of 105 hydrographic stations was worked. At selected stations, phytoplankton, zooplankton and benthic samples were taken. On the way back, some stations in the Bornholm Sea, Arkona Sea and Mecklenburg Bight were sampled again. The station work was supplemented with underway standard meteorologic measurements of ships weather station and measurements of sea surface temperature and salinity with the thermosalinograph. Two moorings, one equipped with a sediment trap below the halocline, a second one with three current meters to measure deep circulation in the Gotland Basin, were recovered and deployed in the Gotland Basin.

The weather conditions during the cruise were governed by a sequence of low pressure systems travelling rapidly eastward over Scandinavia in connection with strong to stormy and gale-forth winds from varying direction. At some stations the sea state in connection with stormy wind prevented plankton net work.

The hydrographic conditions in the area of investigation during the cruise can be shortly characterized as follows:

Near the surface the seasonal thermocline has been destroyed completely by convection and wave mixing and a well mixed surface layer has been generated.

In the Arkona Sea, the Mecklenburg and Lübeck Bight as well as in the Belt Sea the downward extend of the surface layer is limited by a halocline. The more saline water mass extends to the bottom with maximum salinity partly above 25 in the Mecklenburg Bight. High temperatures up to 15 °C indicate, that this water mass had been in contact with the seasonal thermocline during summer. The appearance of a considerable amount of *Lion's mane* nettle threads at the CTD-probe shows, that this water mass must originate from the Kattegat or the Belt Sea. It is the remnant of a saline water mass with low oxygen content formed in the Kattegat, Belt Sea and Western Baltic during the stagnant period in late summer 2002. A patch of saline, low oxygen water is met also off the Darß peninsula. A thin saline layer with low oxygen content was omnipresent also in the central Arkona Basin. Hence, this water mass propagates over Darß sill or through Öresund. The nutrient situation in the surface layer indicates the onset of autumnal deceleration of primary production. In connection with deeper mixing and erosion of the seasonal thermocline, both nitrate and phosphate have started to increase whereby phosphate concentrations seem to be relatively high in the western Baltic Sea up to the Bornholm Basin area. This could be discussed in connection with the low oxygen content of the near bottom water.

After the severe storm in October 27th some stations in the Arkona Sea and the Mecklenburg Bight have been sampled again. The saline bottom water in the Arkona Sea is still present, but the water column in the Mecklenburg Bight and the Fehmarn Belt is completely mixed. Only in the Lübeck Bight there is still some remnant of the saline bottom water with low oxygen content.

In Pommeranian Bay the whole water column is well mixed. As usual, salinity determined by the Odra outflow is much less than in the Arkona Sea.

In the Bornholm Sea and the Northern and Eastern Gotland Sea the seasonal thermocline was completely eroded. In the Bornholm Sea the winter water layer has been almost destroyed by inflow

of warmer saline water in about 50 m to 65 m depth. The inflow happened below the former winter water layer just within the halocline at 60 m depth. The bottom water of the Bornholm Basin was not renewed, bottom salinity is slightly above 15.5.

In the Gotland Sea vertical mixing reaches the winter water layer, which is found between 60 and 80 m depth. From Stolpe Channel to the entrance to the eastern Gotland Basin, at stations TF0256 to TF0253, the bottom water originates from the Bornholm Basin where it must have been displaced by inflowing water. The halocline is found at depth between 55 m and 65 m.

There was only slight indication for hydrogen sulfide in the Bornholm Basin, but the smell of bad eggs was common on deck for almost all stations in the Gotland Sea and the Farö and Landsort Deep as well. The stagnation period lasting since 1995 was only shortly interrupted by a medium-size salt water inflow in autumn 2001. The effects of this event onto the Baltic deep basin waters are traced until summer 2002 with rapidly fading magnitude. At present, hydrogen sulphide concentrations are again extremely high in the bottom waters of the eastern Gotland Basin which is also correlated to high phosphate and ammonium concentrations. The western Gotland Basin was not affected by the inflow.

At seven monitoring stations the macrozoobenthos was sampled with the van Veen grab for endobenthic organisms and by dredging and video camera inspection for epibenthic organisms. As a consequence of the long stagnation period in summer 2002 in the western Baltic, almost all benthic organisms had been extinct at the stations in Mecklenburg Bight and Fehmarn Belt. In the Arkona Basin and at the Rügen-Falster plate the macrozoobenthos is intact and comparable with findings of previous year. Inspection of the seafloor by video camera, shows a large amount of sedimenting detritus and a thick fluffy layer covering mussel banks. No zoobenthos is found at station 213 in the Bornholm Sea because of the anoxic conditions lasting still some years at this station.

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 17.10.2002 | 360/14 | 11.4 | 15.3 | 0.75 | 0.02 |
| Meckl. Bight 17.10.2002 | 012/04 | 11.5 | 11.1 | 0.56 | 0.66 |
| Lübeck Bight 16.10.2002 | 023/08 | 11.6 | 12.3 | 0.16 | 0.05 |
| Arkona Basin 18.10.2002 | 113/26 | 13.4 | 7.8 | 0.38 | 0.34 |
| Pom. Bight 21.10.2002 | OB4/50 | 9.1 | 5.4 | 2.27 | 10.09 |
| Bornholm Deep 19.10.2002 | 213/39 | 11.8 | 7.1 | 0.33 | 0.47 |
| Stolpe Channel 22.10.2002 | 222/59 | 10.60 | 7.26 | 0.34 | 0.34 |
| SE Gotland Basin 23.10.2002 | 259/61 | 9.77 | 7.08 | 0.20 | 0.22 |
| Gotland Deep 23.10.2002 | 271/68 | 7.56 | 6.99 | 0.25 | 0.89 |
| Fårö Deep 24.10.2002 | 286/71 | 8.15 | 6.84 | 0.19 | 0.58 |
| Landsort Deep 25.10.2002 | 284/73 | 7.97 | 6.56 | 0.19 | 0.61 |
| Karlsö Deep 26.10.2002 | 245/75 | 10.10 | 6.66 | 0.17 | 0.71 |

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

** See maps

Table 2: Bottom-near water layer

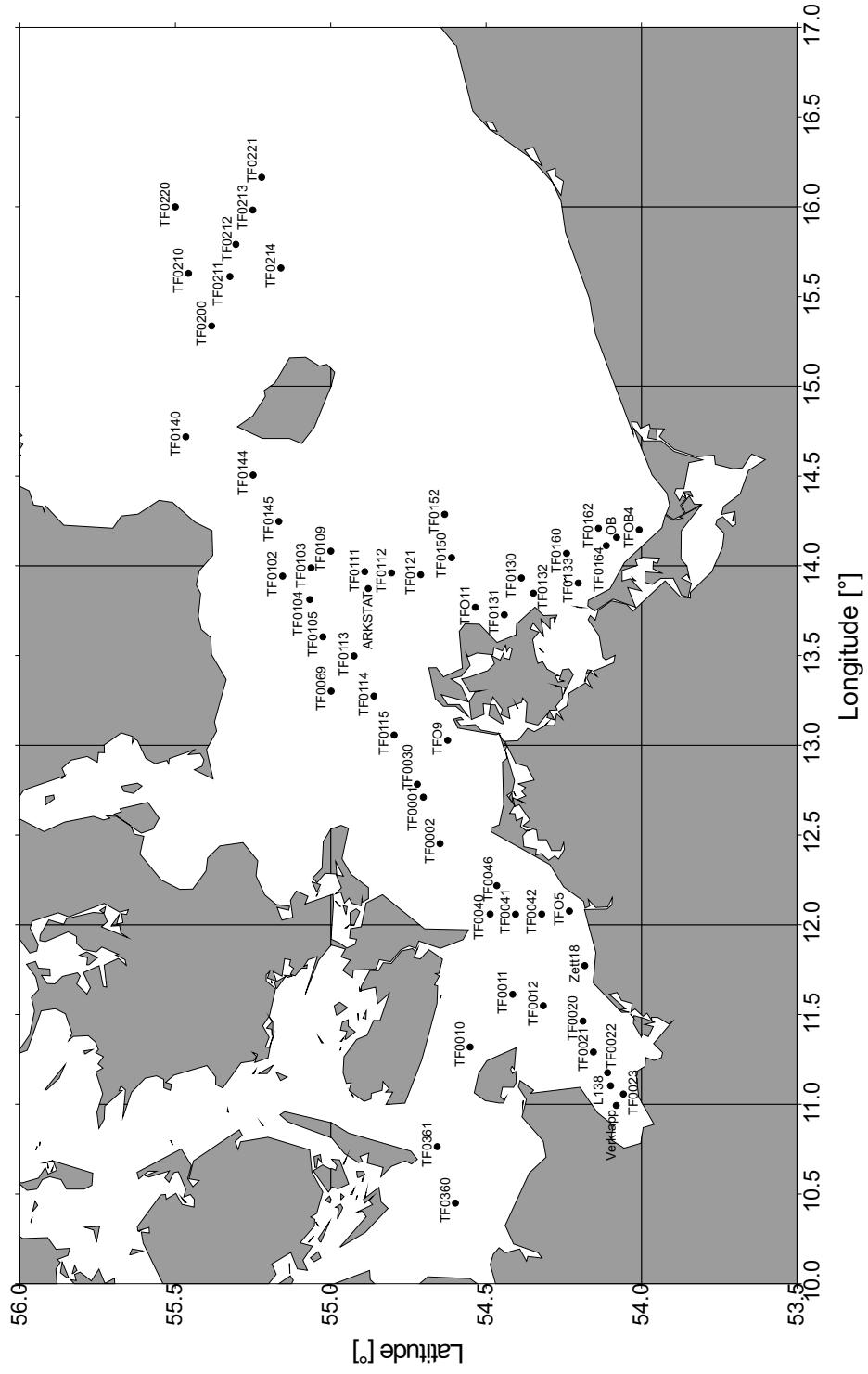
| Area | Station | Sampling depth | Temp | Salinity | O ₂ | PO ₄ ³⁻ | NO ₂₃₋ [*] |
|--------------------------------|--------------|----------------|-------|----------|----------------------------------|-------------------------------|--------------------------------|
| Date | Name/ No. ** | m | °C | PSU | cm ³ /dm ³ | µmol/dm ³ | µmol/dm ³ |
| Kiel Bight 17.10.2002 | 360/14 | 15.6 | 13.64 | 19.59 | 4.28 | 1.22 | 0.30 |
| Meckl. Bight 17.10.2002 | 012/11 | 22.1 | 14.51 | 21.28 | 0.71 | 3.55 | 0.92 |
| Lübeck Bight 16.10.2002 | 023/08 | 22.0 | 14.88 | 20.70 | 0.28 | 2.70 | 0.66 |
| Arkona Basin 18.10.2002 | 113/26 | 44.7 | 15.27 | 15.86 | 4.31 | 1.98 | 3.47 |
| Pom. Bight 21.10.2002 | OB4/50 | 9.8 | 9.35 | 5.79 | 7.54 | 2.06 | 8.99 |
| Bornholm Deep 19.10.2002 | 213/39 | 86.2 | 10.41 | 15.56 | 0.02 | 4.15 | 2.03 |
| Stolpe Channel 22.10.2002 | 222/59 | 88.2 | 10.24 | 13.26 | 1.22 | 2.35 | 8.13 |
| SE Gotland Basin 23.10.2002 | 259/61 | 86.5 | 5.48 | 10.14 | 0.31 | 2.86 | 4.06 |
| Gotland Deep 23.10.2002 | 271/68 | 236.2 | 6.53 | 12.15 | -7.43 | 6.08 | 0.0 |
| Fårö Deep 24.10.2002 | 286/71 | 187.5 | 6.06 | 11.37 | -3.39 | 5.43 | 0.0 |
| Landsort Deep 25.10.2002 | 284/73 | 435.4 | 5.43 | 10.33 | -1.02 | 3.75 | 0.0 |
| Karlsö Deep 26.10.2002 | 245/75 | 105.0 | 4.63 | 9.10 | 0.03 | 3.57 | 1.17 |

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

** See maps

Monitoring 2002

Station map TF110203
16.10.2002 07:09 UTC - 29.10.2002 16:21 UTC
78 Stationen (Part 1)

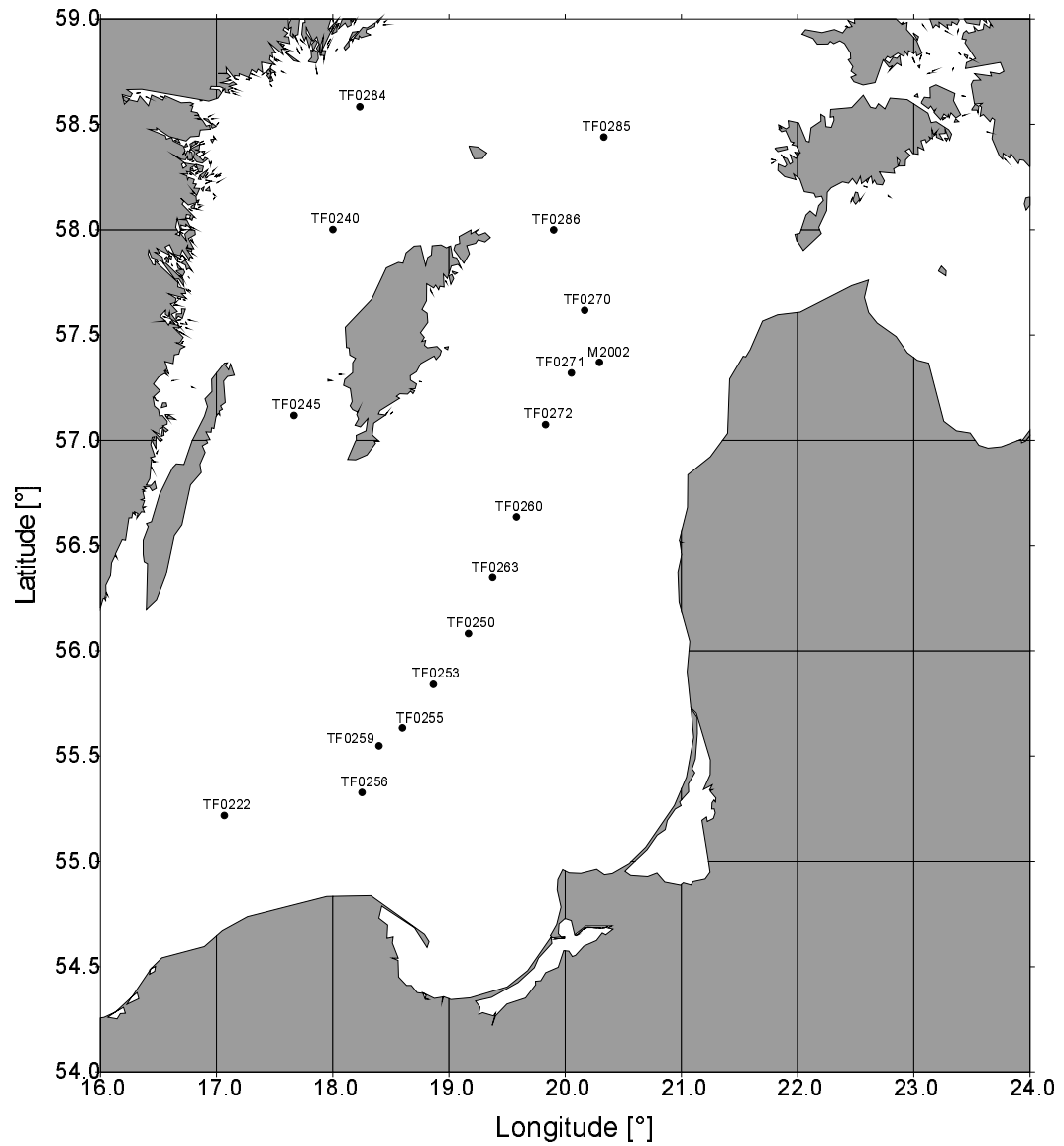


Monitoring 2002

Station map TF110203

16.10.2002 07:09 UTC - 29.10.2002 16:21 UTC

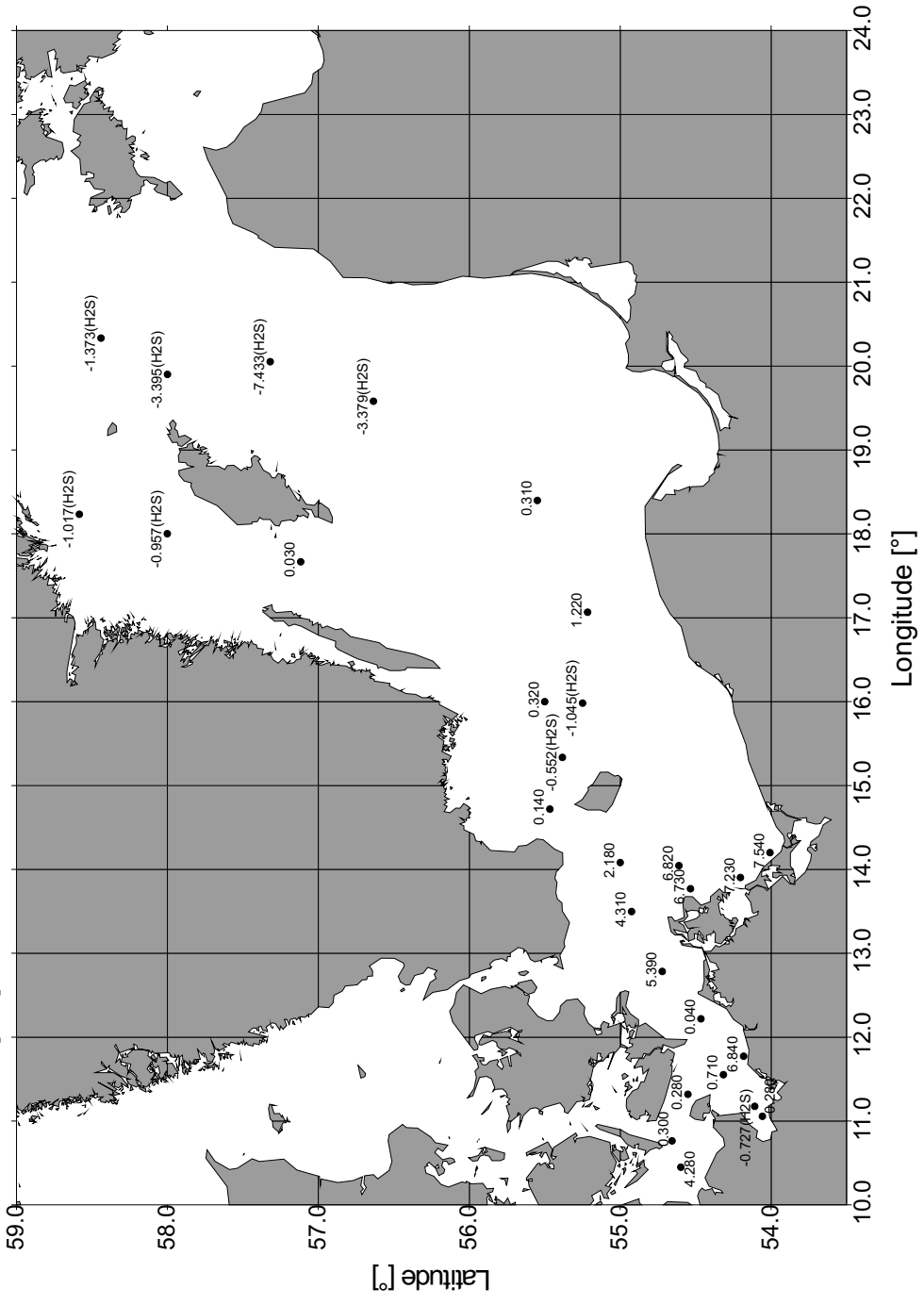
17 Stationen (Part 2)



Monitoring

TF110203 - Station map
16.10.2002 - 29.10.2002

Oxygen bottom concentration [ml/l]



Monitoring

TF110203

16.10.2002 - 29.10.2002

