



Baltic Sea Research Institute Warnemünde


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


r/v "Professor Albrecht Penck"

Cruise- No. 40 / 02 / 18

This report is based on preliminary data

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This is the last cruise report of the Baltic Sea Research Institute Warnemünde which is sent out in printed form. New reports can be found from now within 10 days after the cruise under <http://www.io-warnemuende.de> "under {dates&images}"

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

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1. **Cruise No.:** 40 / 02 / 18
2. **Dates of the cruise:** from 25 July 2002 to 4 August 2002
3. **Particulars of the research vessel:**
 - Name: "Professor Albrecht Penck"
 - 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 Programme of HELCOM
7. **Crew:**
 - Name of master: O.Albrecht
 - Number of crew: 10
8. **Research staff:**
 - Chief scientist: Dr. N. Wasmund

 - Participants: Welz, Anne
Dankert, Jutta
Kayser, Bernd
Huth, Hartmut
Schnell, Sabine
Hambach, Bastian
Gerber, Anke
Lehnert, Gerhard
9. **Co-operating institutions:** All institutions dealing with HELCOM BMP
10. **Scientific equipment:** CTD, water samplers, plankton net, sediment trap
11. **General remarks and preliminary result**

The area under investigation extended from Kiel Bight to the Northern Gotland Sea (cruise track see Figs. 1 and 2). On the way back, selected stations of the Eastern Gotland Sea, 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. From the Gotland Deep, a sediment trap was recovered and a new sediment trap deployed on 31 July 2002.

On the first two days of the cruise (25-26 July 2001), low air pressure (1011-1017 hPa) and cloudy, relatively cool weather with westerly wind up to 11 m/s prevailed in the western Baltic Sea. The surface water temperature was about 17 °C. On 27 July, high pressure conditions (1017-1024 hPa) developed, with sunny sky and wind speed declining to 2 m/s while changing to southerly directions. Salinity was about 13.5 in the central Mecklenburg Bight (Stat. 012) and even 14.5 in front of Warnemünde (Stat. O5), but declined strongly towards Station 046 in the eastern Mecklenburg Bight perhaps because of outflowing water. At station 046, a shallow halocline (in only 4-5 m depth) was found, dividing the freshly outflowing surface water (salinity 10) from deeper subsurface water (5-17 m, salinity 13-15). The bottom water (17-25 m, salinity up

to 22) might be inflowing water, indicated by marine Ctenophora in the zooplankton samples. The shallow halocline was also found in the western Arkona Sea (Stat. 030) in 4 m depth with a surface salinity of 8. A strong inflow of Oder water into the Pomeranian Bight could not be proved on 29 July as there was no stratification with low-saline surface water found.

The sunny weather caused a warming-up of the upper water layers, leading to shallow secondary thermoclines (in 4-6 m depth) in the Bornholm Sea (Stat. 213, 28-07-02) and the eastern Arkona Sea (Stat. 109, 29-07-02) with a temperature gradient of 2-4 K (depending on day-time). There was low wind (3-7 m/s) from eastern or north-eastern directions and air pressure decreasing from 1026 to 1014 hPa in the period from 28 to 31 July.

On 2 August (western Gotland Sea), it became cloudy, with north-easterly wind of up to 11 m/s. Surface water temperature exceeded 20 °C. On 3 August (Bornholm Sea to Pomeranian Bight), the wind slowed down to 4 m/s and it was rainy, afterwards dusty. The secondary thermocline has deepened to 9 m depth in the Bornholm Sea in comparison to 1 week ago. On 4 August, the surface water temperature dropped from 18.4 to 12.0 °C within 2 hours (16 miles) while approaching the Station 046. Secchi depth increased to 7.5 m, wind speed decreased from 6 to 2.5 m/s, and air pressure was 1014 hPa. Surface salinity was stable at 7.7 with a halocline in 10 m depth.

The primary thermocline was found in only 17-18 m depth in the Arkona Sea, in 19 m depth in the eastern Gotland Sea and in 21 m depth in the Bornholm Sea (Fig. 3 a). The halocline started at about 12-13 m depth in the central Mecklenburg Bay (Stat. 012), 20 m in the Arkona Basin, approximately 48 m in the Bornholm Basin and 65 m in the Gotland Basin (Fig. 3 b). Below the halocline, the oxygen concentration decreased quickly with depth. Hydrogen sulfide started to appear in 80-90 m depth in the Bornholm Basin (cf. Fig. 3 c), in 125-150 m depth in the Gotland Basin, in 110 m depth in the Fårö Deep, in 125 m depth in the Landsort Deep and in 100 m depth in the Karlsö Deep.

The equivalent of oxygen, that is necessary to oxidize the hydrogen sulphide completely, is given in Fig. 4 as negative oxygen.

The surface water temperature during the cruise (Table 1) was lower than the long-term mean of August 1971-1990 from Mecklenburg Bight to the Bornholm Sea but higher in the eastern and western Gotland Sea. The temperature of the bottom-near water (Table 2), is, however, higher than the long-term August mean in all investigated regions of the Baltic Sea. In comparison with the year 2001, recent surface temperature is lower (except for the western Gotland Sea) but deep-water temperature is higher. Salinity in the surface water was higher than the long-term August data from 1971-1990 in Mecklenburg Bight (incl. Lübeck Bight) but lower in the Baltic proper. Salinity in the bottom-near water was lower in comparison with both the August 1971-1990 means and the August 2001 means in Mecklenburg Bight but considerably higher in the Arkona Basin, perhaps due to a fresh saltwater inflow. In the four deeps of the Gotland Sea, the recent salinity is lower than the long-term mean.

In comparison to August 2001, oxygen concentrations have strongly increased near the bottom (Table 2) in Mecklenburg Bight, Arkona Sea, Pomeranian Bight and Bornholm Sea. Hydrogen sulfide concentrations had decreased in the Bornholm Deep, Gotland Deep, Fårö Deep, Landsort Deep and Karlsö Deep and the depth of H₂S appearance decreased (compare Fig. 4 with last year's report). Because of a damage of the nutrient analyser, we are able to report only nutrient concentration up to the Bornholm Sea. The lacking data are not analysed yet. Surface and bottom-near water nitrate concentrations were very low in the investigated area except for Lübeck Bight and Arkona Sea. Phosphate concentrations both in surface and bottom-near water were low in the Mecklenburg Bight but much times higher than the 1971-1990 August means in the Arkona and Bornholm Sea.

Local concentrations of jellyfish were noticed in Mecklenburg Bight (incl. Lübeck Bight) and some areas of the Arkona Sea on 26-27 July. Cyanobacteria blooms were not found. Cyanobacterial aggregates in moderate concentrations occurred north of Rügen (Stat. 114, 115), north of Bornholm (Stat. 140, 200) and north-east of Gotland (Stat. 286, 285). The crew reported from big cyanobacterial blooms in the eastern Gotland and Bornholm Sea only one week before this cruise.

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 26.7.2002	360/02	16,62	14,17	0,02	0,09
Meckl. Bight 26.7.2002	012/06	16,77	13,49	0,04	0,06
Lübeck Bight 26.7.2002	023/08	17,28	13,22	0,02	0,09
Arkona Basin 27.7.2002	113/24	14,66	7,37	0,21	0,08
Pom. Bight 29.7.2002	OB4/37	18,84	6,13	0,64	0,05
Bornholm Deep 28.7.2002	213/34	15,96	7,17	0,17	0,01
Stolpe Channel 30.7.2002	222/56	18,53	7,10		
SE Gotland Basin 30.7.2002	259/58	18,24	7,02		
Gotland Deep 31.7.2002	271/65	19,40	6,75		
Fårö Deep 1.8.2002	286/67	20,00	6,20		
Landsort Deep 1.8.2002	284/69	20,25	5,84		
Karlsö Deep 2.8.2002	245/71	20,19	6,31		

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

** See maps

Table 2: Bottom-near water layer

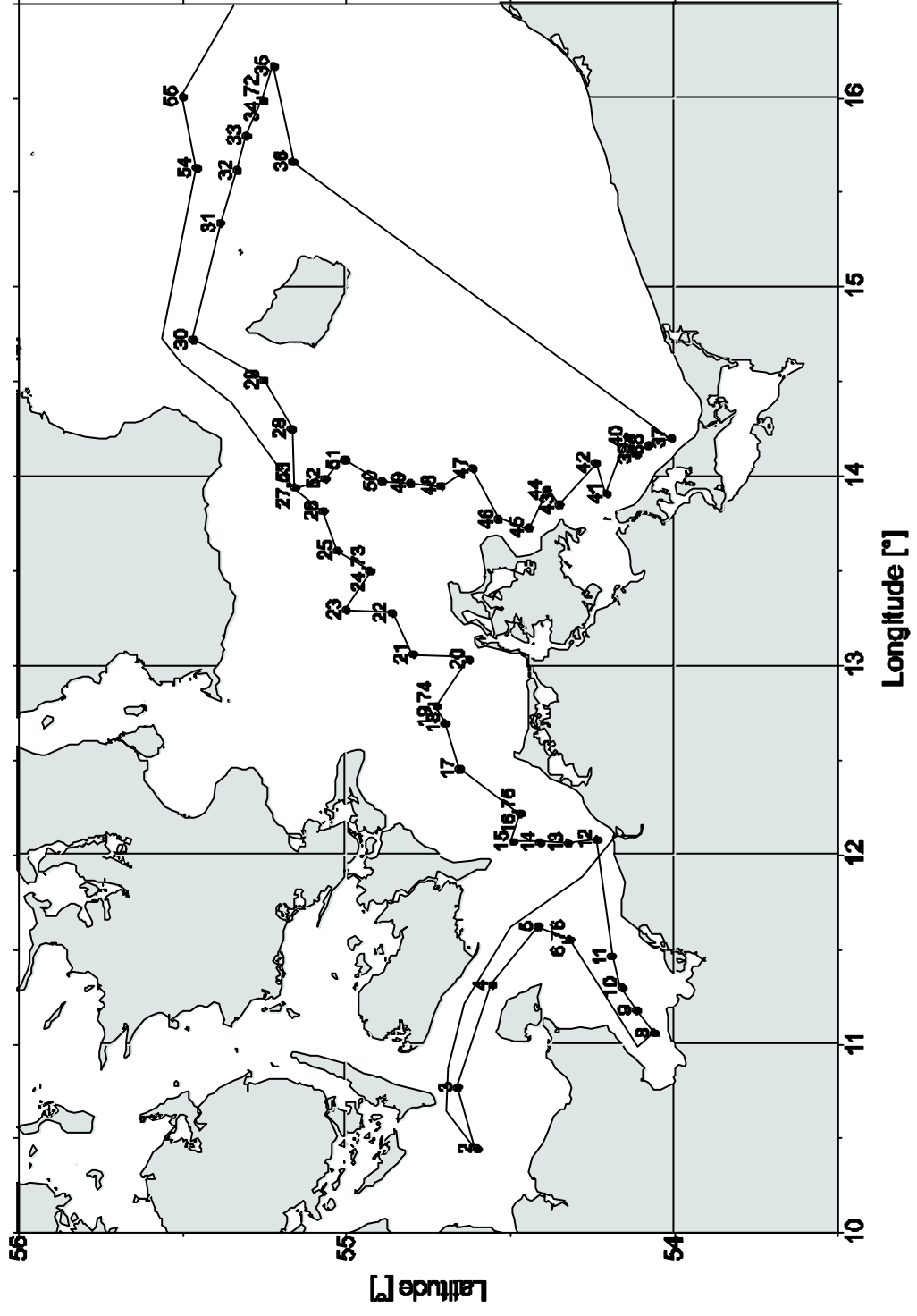
Area	Station	Sampling depth	Temp.	Salinity	O ₂	PO ₄ ³⁻	NO ₂₃₋ [*]
Date	Name/ No. ^{**}	m	°C	PSU	cm ³ /dm ³	µmol/dm ³	µmol/dm ³
Kiel Bight 26.7.2002	360/02	17,6	13,20	21,40	3,79	0,41	1,29
Meckl. Bight 26.7.2002	012/06	21,7	14,94	19,08	5,46	0,10	0,22
Lübeck Bight 26.7.2002	023/08	21,4	9,62	22,95	1,64	0,63	4,91
Arkona Basin 27.7.2002	113/24	45,0	11,87	18,88	1,95	1,32	6,73
Pom. Bight 29.7.2002	OB4/37	10,3	17,77	6,74	5,23	0,62	0,81
Bornholm Deep 28.7.2002	213/34	85,8	8,58	15,36	- 0,32	6,55	0,23
Stolpe Channel 30.7.2002	222/56	38,1	6,27	12,19	2,21		
SE Gotland Basin 30.7.2002	259/58	86,0	5,35	10,14	1,02		
Gotland Deep 31.7.2002	271/65	232,6	6,58	12,18	- 6,85		
Fårö Deep 1.8.2002	286/67	184,5	6,07	11,38	- 2,76		
Landsort Deep 1.8.2002	284/69	419,0	5,45	10,35	- 0,68		
Karlsö Deep 2.8.2002	245/71	104,8	4,84	9,43	- 0,79		

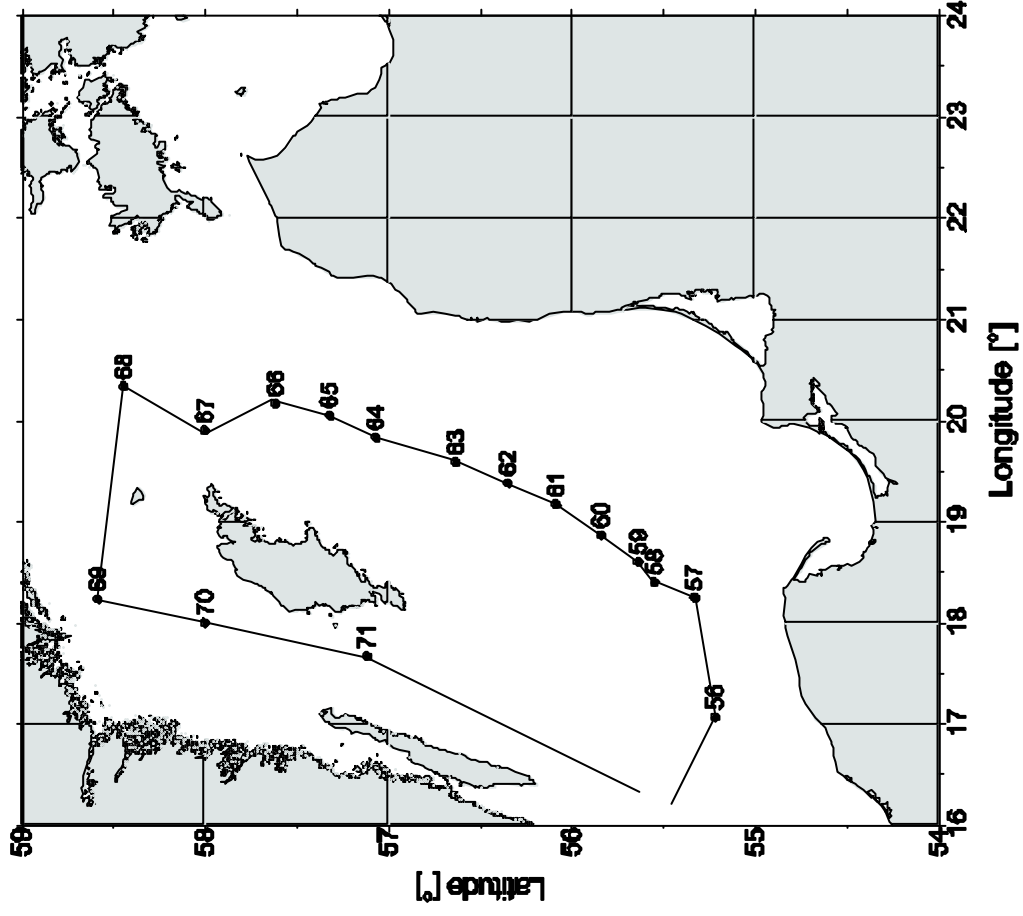
* $\Sigma \text{NO}_2^- + \text{NO}_3^-$; NO₂ was present only in traces in most areas under investigation

** See maps

Station map
Monitoring 2002

74 stations (part 1)
25.07.02 - 04.08.02



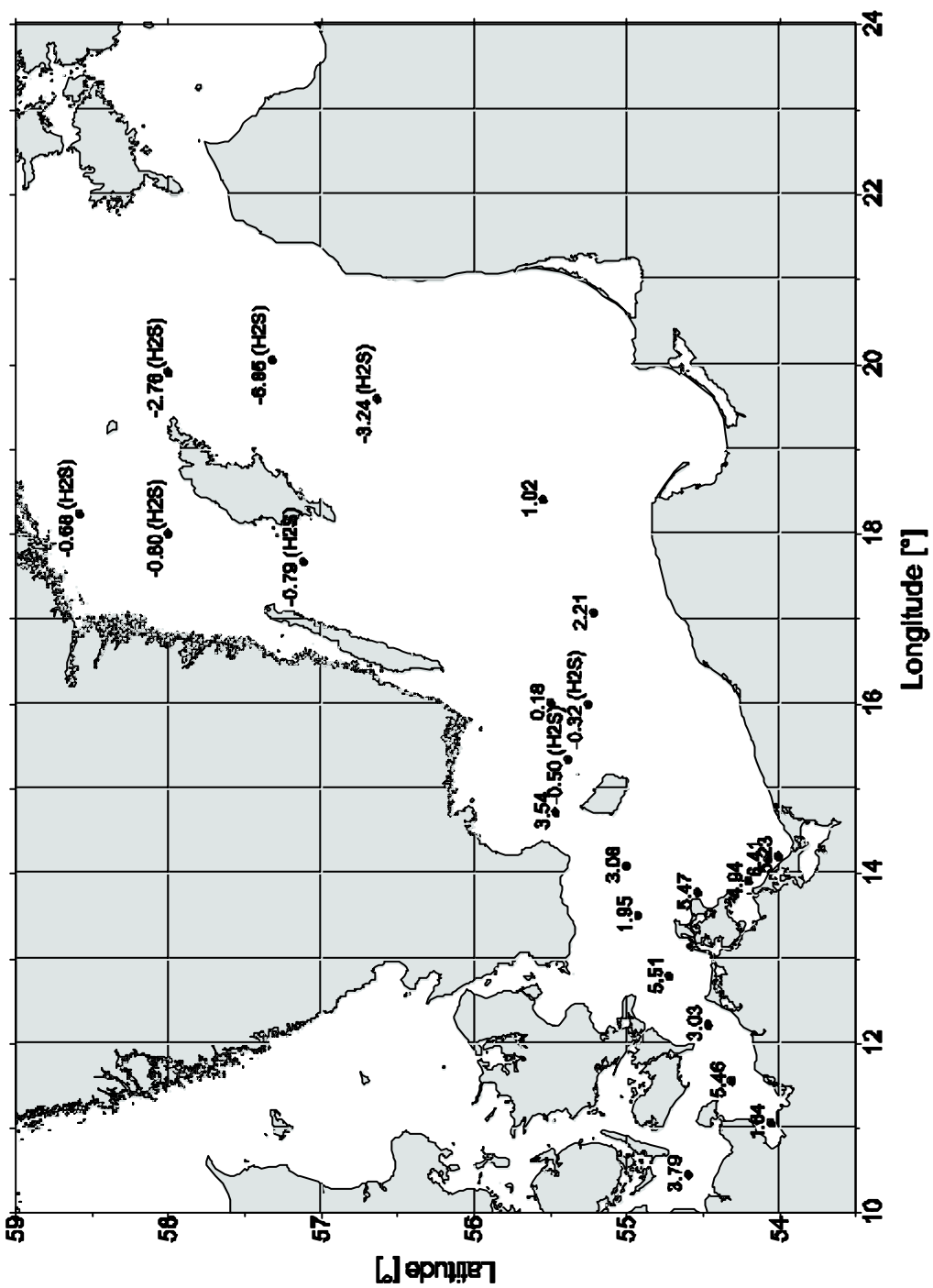


Station map

Monitoring 2002

74 stations (part 2)

25.07.02 - 04.08.02



Station map
Monitoring 2002
Oxygen bottom concentration [ml/l]
25.07.02 - 04.08.02

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