



# **Leibniz Institute for Baltic Sea Research Warnemünde**

FS „Elisabeth Mann Borgese“

Monitoring cruise

Cruise- No. EMB-053

30<sup>th</sup> July – 08<sup>th</sup> August 2013

Kiel Bight to northern Gotland Sea

This report is based on preliminary data

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Monitoring cruise  
Cruise No. 06EZ1206  
FS “Elisabeth Mann Borgese“

Warnemünde 09<sup>th</sup> August 2013

The fourth monitoring cruise of the Leibniz Institute for Baltic Sea Research Warnemünde in 2013 was carried out with FS “Elisabeth Mann Borgese“ between July 30<sup>th</sup> and August 08<sup>th</sup> 2013. The cruise is part of the German contribution to the HELCOM COMBINE program and contributes to IOW’s long term data series in the central Baltic Sea.

Scientific staff participating:

Günther Nausch (scientist in charge)	30.07. – 08.08.2013
Antje Cordshagen	30.07. – 08.08.2013
Jan Donath	30.07. – 08.08.2013
Jenny Jeschek	30.07. – 08.08.2013
Lars Kreuzer	30.07. – 08.08.2013
Astrid Lerz	30.07. – 08.08.2013
Susanne Lage	30.07. – 08.08.2013
Michael Poetsch	30.07. – 08.08.2013
Ingo Schuffenhauer	30.07. – 08.08.2013
Walter Wallner	30.07. – 08.08.2013

The area under investigation covered the Baltic Sea between Kiel Bight and the 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.

The weather situation during the cruise was influenced by high pressure over the Baltic Sea. Air pressure ranged between 1013 and 1019 hPa. Wind speed was generally, mostly ranging around 2 – 3 Bft, only occasionally increasing up to 5 Bft. Wind direction was varying. During most parts of the cruise weather was sunny. Morning air temperature was astonishingly high with temperatures between 18 and 20° C.

The following hydrographical and hydrochemical characteristics have been observed during the cruise (cf. Tables 1 and 2 and Figs. 4 and 5):

- Surface temperatures varied between 21.37°C (Lübeck Bight) and 18.74°C (SE Gotland Basin). In all investigated areas, of the Baltic Sea, temperatures are well above the long-term mean for the period 1971-1990 (in brackets) with up to nearly positive anomalies of 4 K. The reason is the long-lasting warm summer. The main

thermocline was normally located between 15 and 20 m. Intensive sunshine caused the development of a secondary thermocline during daytime in the first 10 m layer.

Lübeck Bight	21.37°C (17.45°C)
Arkona Basin	19.41°C (17.00°C)
Bornholm Deep	20.28°C (17.56°C)
Gotland Deep	19.44°C (17.13°C)
Farö Deep	18.92°C (17.69°C)
Landsort Deep	19.01°C (18.20°C)
Karlsö Deep	20.40°C (16.87°C)

- Deep water layer temperatures decreased slightly in western and northern deeps of the central Baltic Sea and remained constant in the Gotland Deep during the last years but are higher as the long-term mean. The inflow event of December 2012 resulted in low deep water temperatures in the Bornholm Basin.

	July 2010	Aug. 2011	July 2012	Aug. 2013	<b>Mean 1971/90</b>
Bornholm D.	7.5 °C	6.1 °C	6.6°C	4.9°C	<b>6.1 °C</b>
Gotland Deep	6.4 °C	6.4 °C	6.4°C	6.4°C	<b>5.6 °C</b>
Farö Deep	6.8 °C	6.4 °C	6.2°C	5.9°C	<b>5.2 °C</b>
Landsort D.	6.1 °C	5.9 °C	5.4°C	5.4°C	<b>4.8 °C</b>
Karlsö Deep	5.5 °C	5.4 °C	5.3°C	5.2°C	<b>4.2 °C</b>

- The major Baltic inflow from January 2003 was the last strong inflow event into the Baltic Sea. However, the effects of the inflows of early winter 2011 and 2012 could not influence the deep basins around Gotland. Thus, the stagnation period continues there documented by further decreasing salinity in the bottom layer of the eastern Gotland Basin whereas values remained relatively constant compared to the year before.

	August 2012	August 2013
Gotland Deep	12.19	12.10
Farö Deep	11.64	11.49
Landsort Deep	10.51	10.50
Karlsö Deep	9.80	9.77

- Thus, the oxygen situation in the deep water of central basins documents the long-lasting stagnation period. Hydrogen sulphide concentrations (expressed as negative oxygen equivalents) in the near-bottom layer remained high, with the exception of the Karlsö Deep, where weak stratification allows vertical mixing down to the bottom from time to time.

	August 2012	August 2013
Gotland Deep	-7.60 ml/l	-7.81 ml/l
Farö Deep	-4.09 ml/l	-3.48 ml/l
Landsort Deep	-0.60 ml/l	-0.82 ml/l
Karlsö Deep	-0.92 ml/l	-0.60 ml/l

- Also the vertical extension of the hydrogen sulphide is remarkable. At stations 271 (Gotland Deep) hydrogen sulphide was found between around 125 m and the bottom. At station 286 (Farö Deep) the layer between 100 m and the bottom was anoxic and at station 284 (Landsort Deep) from 80 m downwards hydrogen sulphide was found. Thus, oxygen situation remains quite worse in the central deep basin.
- The nutrient situation in the surface layer is typical for the season. The spring phytoplankton bloom had exhausted the nitrate reservoir completely. Thus, also in summer the water layer down the halocline shows quite low nitrate concentrations. In the mixed surface layer above the thermocline, phosphate concentrations near to the detection limit were measured, except the western Gotland Basin where somewhat higher phosphate values were found (table 1).
- As typical for summer, blooms of cyanobacteria were observed in the central Baltic Sea but did not accumulate at the surface strongly as could be expected due to calm weather. In the Bornholm Basin and the western Baltic Sea, the cyanobacteria bloom which was detected earlier the season has broken down.
- In the deep waters of the central basins, the hydrographic situation is mirrored. Oxygenation of the Bornholm Basin deep water caused low phosphate and ammonium concentrations and high nitrate values. The permanent stagnation caused the absence of nitrate and very high phosphate and ammonium concentrations in the eastern and western Gotland Basin (table 2). Also silicate concentrations have increased further, reaching more than 100 µmol/l in the bottom layer of the Gotland Deep.

#### Attachments

Tables 1 and 2: Preliminary results of selected parameters in the surface layer and the near bottom water layer - (invalidated results)

Figs. 1-3: Track charts

Fig. 4: Oxygen/hydrogen sulphide in the bottom near layer for selected stations

Fig. 5: Transect from the Kiel Bight to the northern Gotland Basin for temperature, salinity and oxygen (invalidated data)

Günther Nausch

Scientist in charge

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

Area Date	Stat. Name/No.*	Temp. °C	Sal. psu	O <sub>2</sub> ml/l	PO <sub>4</sub> µM	NO <sub>3</sub> µM	SiO <sub>4</sub> µM
Kiel Bight 30.07.2013	360/0005	21.30	11.52	6.07	0.03	0.10	5.0
Meckl.Bight 31.07.2013	012/0007	19.64	8.37	6.32	0.02	0.00	8.1
Lübeck Bight 30.06.2013	022/0006	21.37	9.83	6.17	0.00	0.00	6.6
Darss Sill 31.07.2013	030/0013	17.92	7.76	6.49	0.02	0.12	12.8
Arkona Basin 31.07.2013	113/0017	19.41	7.32	6.59	0.00	0.01	8.5
Bornholm Deep 02.08.2013	213/0039	20.28	7.21	6.53	0.00	0.02	7.8
Stolpe Channel 02.08.2013	222/0041	19.71	7.15	6.43	0.02	0.02	9.0
SE Gotland Basin 03.08.2013	259/0043	18.74	7.13	6.39	0.01	0.05	6.2
Gotland Deep 03.08.2013	271/0050	19.44	6.50	6.21	0.04	0.11	5.2
Farö Deep 04.08.2013	286/0052	18.92	6.49	6.74	0.02	0.12	6.5
Landsort Deep 05.08.2013	284/0054	19.01	6.34	6.67	0.07	0.00	6.6
Karlsö Deep 05.08.2013	245/0056	20.40	6.82	6.62	0.08	0.30	6.5

\* see attached map

Table 2: Deep water layer (bottom near layer depths)

Area Date	Stat. Name/No.*	Depth m	Temp. °C	Sal. psu	O <sub>2</sub> ml/l	PO <sub>4</sub> µM	NO <sub>3</sub> µM	SiO <sub>4</sub> µM
Kiel Bight 30.07.2013	360/0005	17	11.59	21.52	4.97	0.36	0.06	8.9
Meckl.Bight 31.07.2013	012/0007	22	9.81	27.28	3.71	0.87	0.92	20.5
Lübeck Bight 03.05.2012	022/0006	22	7.88	25.49	2.14	1.14	2.59	37.7
Darss Sill 31.07.2013	030/0013	22	11.23	18.50	2.91	0.82	0.82	21.6
Arkona Basin 31.07.2013	113/0017	45	9.30	17.60	1.48	1.49	1.78	51.4
Bornholm Deep 02.08.2013	213/0039	87	4.88	15.68	1.07	1.13	8.52	46.2
Stolpe Channel 02.08.2013	222/0041	88	4.04	12.55	2.84	1.13	4.01	34.3
SE Gotland Basin 03.08.2013	259/0043	86	4.85	10.25	0.54	2.22	4.54	47.9
Gotland Deep 03.08.2013	271/0050	231	6.40	12.10	-7.81**	6.90	0	132.5
Farö Deep 04.08.2013	286/0052	188	5.90	11.49	-3.48**	5.50	0	92.0
Landsort Deep 05.08.2013	284/0054	431	5.39	10.50	-0.82**	3.70	0	65.0
Karlsö Deep 05.08.2013	245/0056	106	5.24	9.77	-0.60**	5.70	0	66.4

\* see attached map

\*\* hydrogen sulphide was converted into negative oxygen equivalents

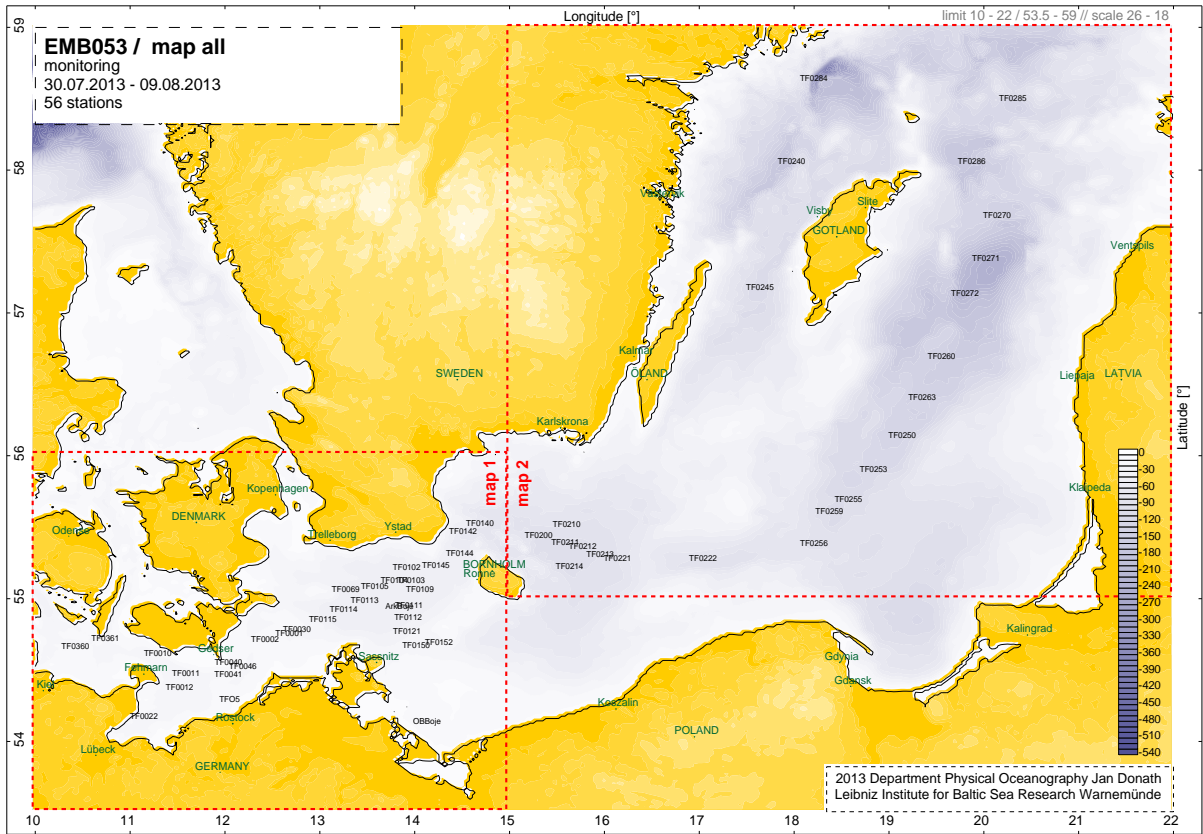


Fig. 1

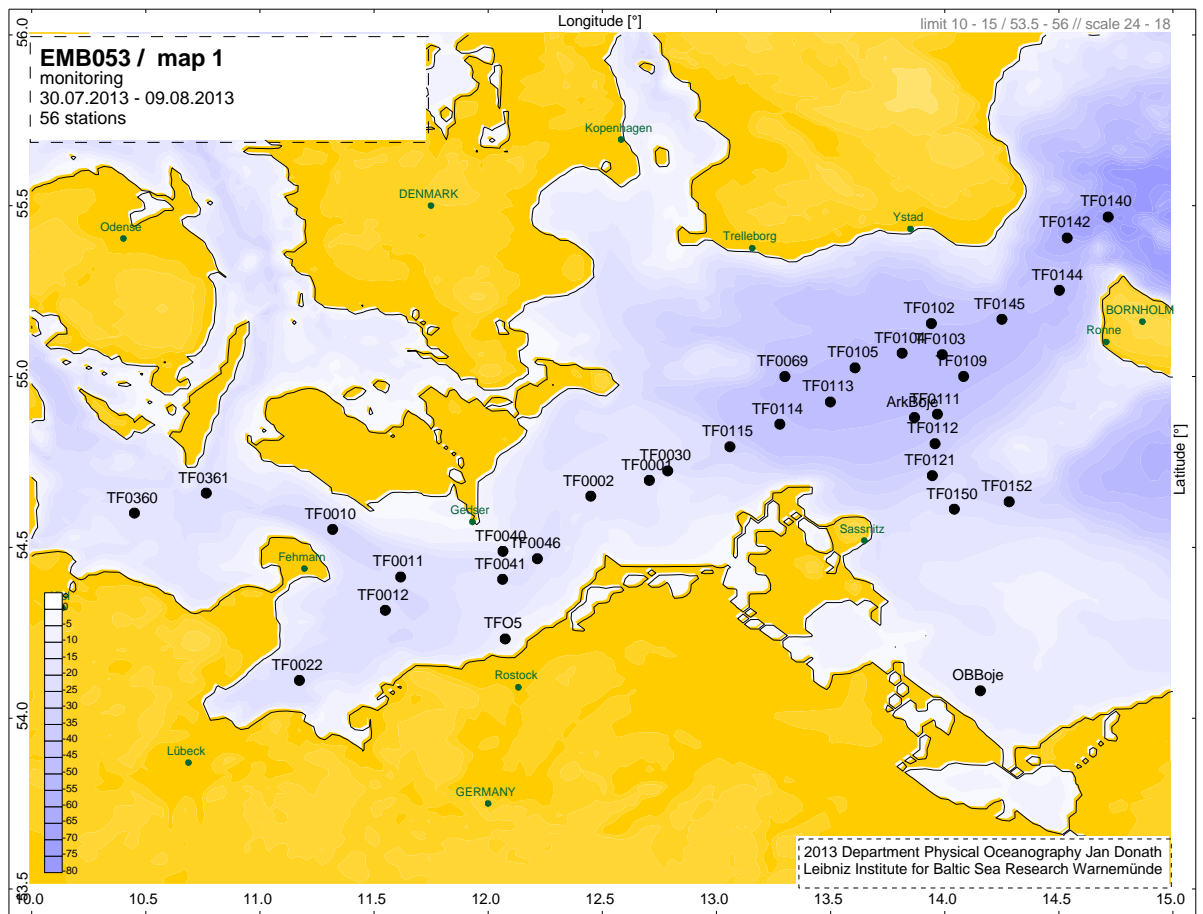


Fig. 2





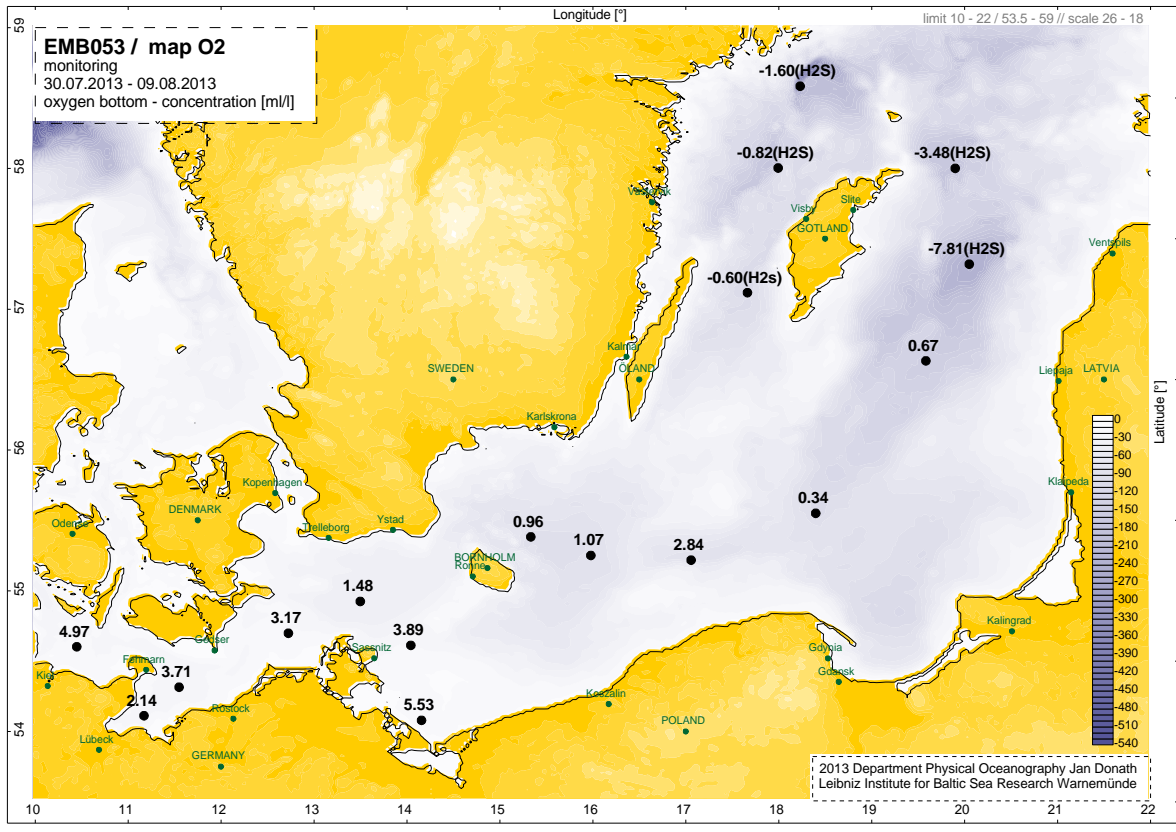
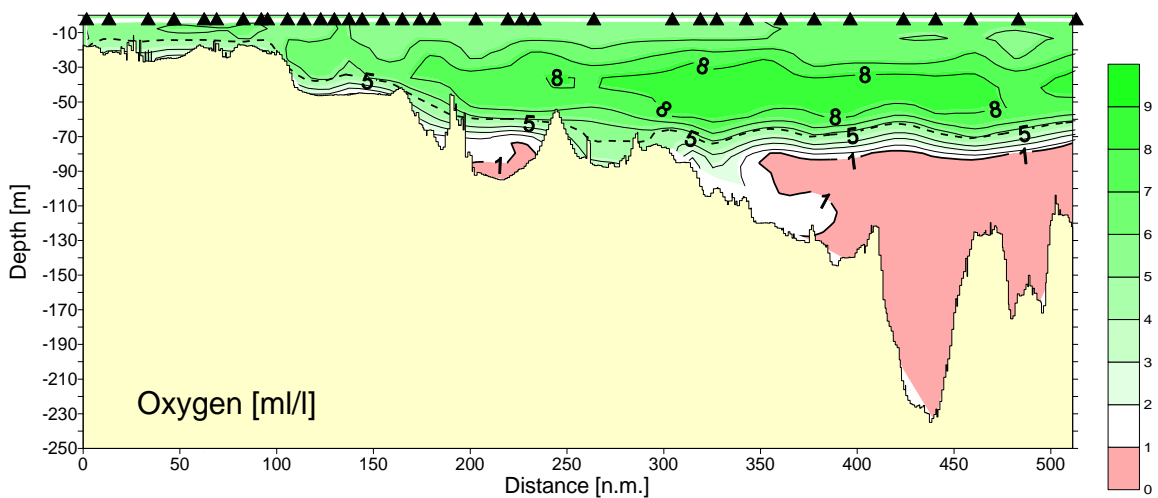
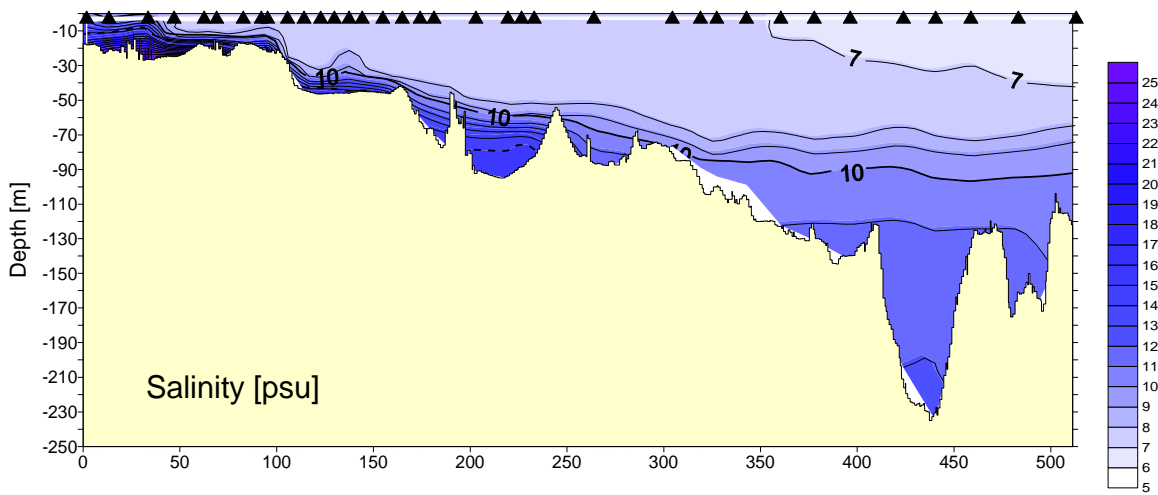
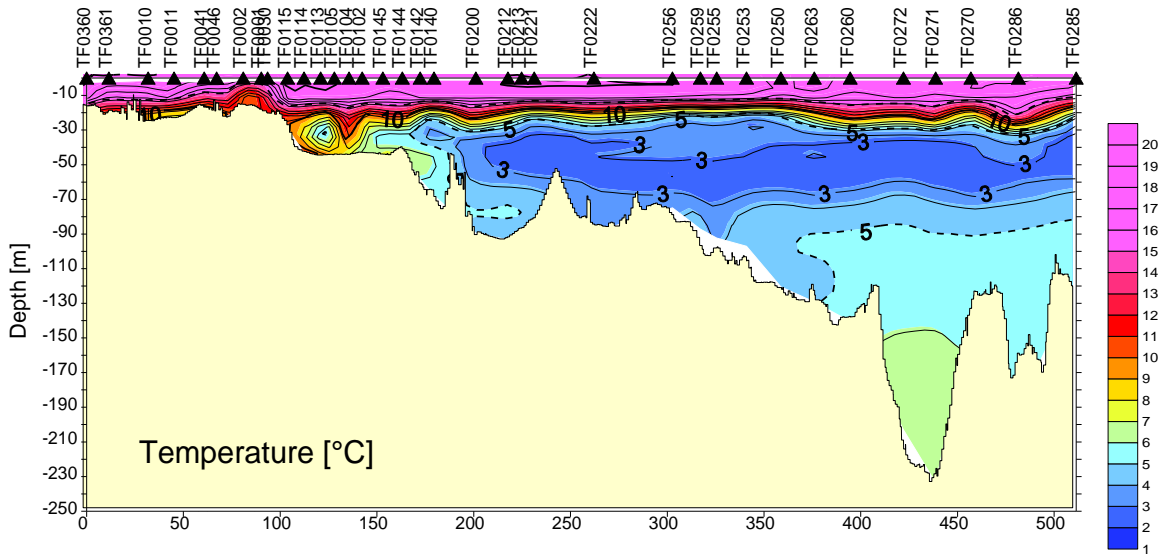


Fig. 4

# MONITORING - EMB053

Kiel Bight - Gotland Sea  
30.07.2013 09:40 - 04.08.2013 19:43 UTC



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Fig. 5