



Leibniz Institute for Baltic Sea Research Warnemünde

FS „Elisabeth Mann Borgese“

Monitoring cruise

Cruise- No. 06EZ1206

03rd – 12th May 2012

Kiel Bight to northern Gotland Sea

This report is based on preliminary data

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Warnemünde 14th May 2012

The third monitoring cruise of the Leibniz Institute for Baltic Sea Research Warnemünde in 2012 was carried out with FS “Elisabeth Mann Borgese“ between May 3rd and May 12th 2012. 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)	03.05. – 12.05.2012
Sebastian Beier	03.05. – 12.05.2012
Christian Burmeister	03.05. – 12.05.2012
Jan Donath	03.05. – 12.05.2012
Susanne Feistel	03.05. – 12.05.2012
Lars Kreuzer	03.05. – 12.05.2012
David Meyer	03.05. – 12.05.2012
Jan Oestmann	03.05. – 12.05.2012
Michael Poetsch	03.05. – 12.05.2012
Ingo Schuffenhauer	03.05. – 1.05.2012

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 deep “Svenja” during the first days of the cruise, but caused only moderate wind between 2 and 5 Bft from SW and W directions. Air pressure decreased from 1007 to 999 hPa on May 4th. Deep “Svenja” was followed by a high pressure cell moving over of the Baltic Sea. Air pressure increased to 1020 hPa on May 8th and wind speed was low (3 – 4 Bft) from southern directions; weather was sunny. At the end of cruise deep “Ute” passed the area of investigation, but forecasted high wind speed was not reached.

The following hydrographical and hydrochemical characteristics have been observed during the cruise (cf. Tables 1 and 2 and Figs. 3 and 4):

- Surface temperatures varied between 8.83°C (Lübeck Bight) and 4.90°C (Gotland Deep). In the western Baltic Sea and in the Arkona Basin, temperatures are above the

long-term mean for the period 1971-1990 (in brackets). The cold winter period in February had decrease the surface temperature in the in the Bornholm, Gotland and Karlsö Deep area below this average. During day time a weak thermal stratification in the first 10 m layer developed due to sunny weather conditions.

Lübeck Bight	8.83°C (4.71°C)
Arkona Basin	6.14°C (4.30°C)
Bornholm Deep	5.84°C (6.12°C)
Gotland Deep	4.90°C (5.62°C)
Farö Deep	5.80°C (5.20°C)
Landsort Deep	5.48°C (4.76°C)
Karlsö Deep	6.10°C (6.76°C)

- The major Baltic inflow from January 2003 was the last strong inflow event into the Baltic Sea. However, the effects of these inflows could not influence the deep basins around Gotland. Thus, the stagnation period continues there documented by further decreasing salinity in the bottom layer.

	May 2008	May 2009	May 2010	May 2011	May 2012
Gotland Deep	12.68 psu	12.54 psu	12.44 psu	12.27 psu	12.20 psu
Farö Deep	12.13 psu	12.13 psu	11.77 psu	11.88 psu	11.66 psu
Landsort Deep	10.91 psu	10.84 psu	10.77 psu	10.65 psu	10.50 psu
Karlsö Deep	9.98 psu	10.00 psu	10.16 psu	10.02 psu	9.47 psu

- In November/December 2001, a relative strong inflow occurred which had ventilated the Bornholm Basin already in February 2012. The effects of this inflow can be seen also during the present cruise. In the near bottom layer, salinity was 15.57 psu and oxygen content was 2.81 ml/l compared to around 03.0 ml/l at the end of 2011. At the end of March/ beginning of April, effects of this inflow could be seen in the eastern Gotland Basin until station TF0250. During the present cruise, one station further north (TF 0263), which was anoxic at the bottom (-0.26 ml/l) at 128 m depth) was ventilated now with an bottom-near oxygen content of 1.86 ml/l. Also salinity changed from 11.6 psu to 11.7 psu and temperature decreased from 6.1 °C to 5.55 °C. However, it remains questionable, if the intensity of the inflow is strong enough to reach the Gotland Deep.
- 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.

	May 2008	May 2009	May 2010	May 2011	May 2012
Gotland Deep	- 4.25 ml/l	- 5.33 ml/l	-8.60 ml/l	-5.63 ml/l	-6.46 ml/l
Farö Deep	- 2.47 ml/l	- 1.27 ml/l	-4.83 ml/l	-3.62 ml/l	-4.04 ml/l
Landsort Deep	- 1.81 ml/l	- 1.34 ml/l	-1.18 ml/l	-1.67 ml/l	-1.87 ml/l
Karlsö Deep	- 1.57 ml/l	- 0.71 ml/l	-2.88 ml/l	-1.25 ml/l	0.06 ml/l

- Also the vertical extension of the hydrogen sulphide is remarkable and had extended since May last year. At stations 271 (Gotland Deep) and 284 (Landsort Deep)

hydrogen sulphide was found between around 100 m and the bottom. At station 286 (Farö Deep) the layer between 100 m and the bottom (434 m) was anoxic. Thus, oxygen situation remains quite worse in the central deep basin.

- As a result of the major Baltic inflow 2003, bottom water temperature had decreased in the Baltic deep water. Meanwhile, several baroclinic inflow events have increased the temperature again exceeding the long-term mean again. Due to the inflow of November/December 2011 the bottom temperature in the Bornholm Basin remained relatively low. The bottom temperature in the Gotland Deep remained with 6.43°C completely unchanged since the beginning of 2011, whereas the other deeps showed a remarkable decrease in the bottom temperature.

	May 2008	May 2009	May 2010	May 2011	May 2012	Mean 1971/90
Bornholm D.	7.15 °C	8.66 °C	8.88°C	6.33°C	6.63°C	6.12 °C
Gotland Deep	6.45 °C	6.31 °C	6.33°C	6.44°C	6.43°C	5.62 °C
Farö Deep	6.16 °C	6.74 °C	6.78°C	6.45°C	6.26°C	5.20 °C
Landsort D.	5.61 °C	5.71 °C	6.06°C	6.02°C	5.74°C	4.76 °C
Karlsö Deep	5.18 °C	5.32 °C	5.49°C		5.08°C	4.18 °C

- The nutrient situation in the surface layer showed astonishing peculiarities. The spring phytoplankton bloom had exhausted the nitrate reservoir completely. However, phosphate concentrations were extremely high for the season, especially in the western Baltic, the Arkona and Bornholm Basin. Also silicate concentrations were on a high level. Because also oxygen values were not so high as in the years before, may be indicating an early breakdown of the spring bloom by some reason. Only in the Kiel Bight, Lübeck Bight and Pommeranian Bight values were typical for the season. Phosphate concentrations in the Gotland Basin were lying between these two extrema.
- 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, higher than the year before (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 ₂ ml/l	PO ₄ µM	NO ₃ µM	SiO ₄ µM
Kiel Bight 03.05.2012	360/0005	8.99	11.39	7.80	0.29	0.00	5.4
Meckl.Bight 04.05.2012	012/0007	7.24	8.54	8.28	0.50	0.02	10.8
Lübeck Bight 03.05.2012	022/0006	8.81	12.02	7.80	0.12	0.01	3.8
Darss Sill 04.05.2012	030/0013	6.34	8.07	8.71	0.51	0.04	11.4
Arkona Basin 04.05.2012	113/0017	6.14	7.86	8.72	0.69	0.02	14.1
Bornholm Deep 05.05.2012	213/0034	5.84	7.64	8.89	0.48	0.02	14.4
Stolpe Channel 06.05.2012	222/0036	5.68	7.52	9.00	0.46	0.02	12.2
SE Gotland Basin 06.05.2012	259/0038	5.26	7.31	9.18	0.39	0.02	12,4
Gotland Deep 07.05.2012	271/0045	4.90	7.12	9.40	0.24	0.06	12.4
Farö Deep 08.05.2012	286/0047	5.80	7.00	9.60	0.24	0.08	11.8
Landsort Deep 09.05.2012	284/0050	5.48	6.58	9.30	0.20	0.38	12.6
Karlsö Deep 10.05.2012	245/0052	5.88	7.20	8.99	0.42	0.52	17.4

* see attached map

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

Area Date	Stat. Name/No.*	Depth m	Temp. °C	Sal. psu	O ₂ ml/l	PO ₄ µM	NO ₃ µM	SiO ₄ µM
Kiel Bight 03.05.2012	360/0005	17	7.18	16.36	7.52	0.16	0.00	3.0
Meckl.Bight 04.05.2012	012/0007	22	5.47	17.73	5.55	0.35	0.00	12.5
Lübeck Bight 03.05.2012	022/0006	21	7.80	13.17	7.48	0.06	0.03	3.1
Darss Sill 04.05.2012	030/0013	20	5.49	8.37	8.06	0.56	0.03	12.1
Arkona Basin 04.05.2012	113/0017	45	3.18	14.94	3.69	0.76	0.08	29.2
Bornholm Deep 05.05.2012	213/0034	85	6.63	15.57	2.81	1.41	..9.29	36.8
Stolpe Channel 06.05.2012	222/0036	88	5.91	13.84	2.19	2.10	8.21	49.9
SE Gotland Basin 06.05.2012	259/0036	85	4.45	10.81	4.00	1.64	5.20	35.6
Gotland Deep 07.05.2012	271/0045	231	6.43	12.20	-6.46**	6.45	0	106.0
Farö Deep 08.05.2012	286/0047	187	6.26	11.66	-4.04**	5.15	0	90.5
Landsort Deep 09.05.2012	284/0050	400	6.01	10.65	-1.87**	4.50	0	59.2
Karlsö Deep 10.05.2012	245/0052	105	5.08	9.47	0.06	3.05	2.75	55.8

* see attached map

** hydrogen sulphide was converted into negative oxygen equivalents

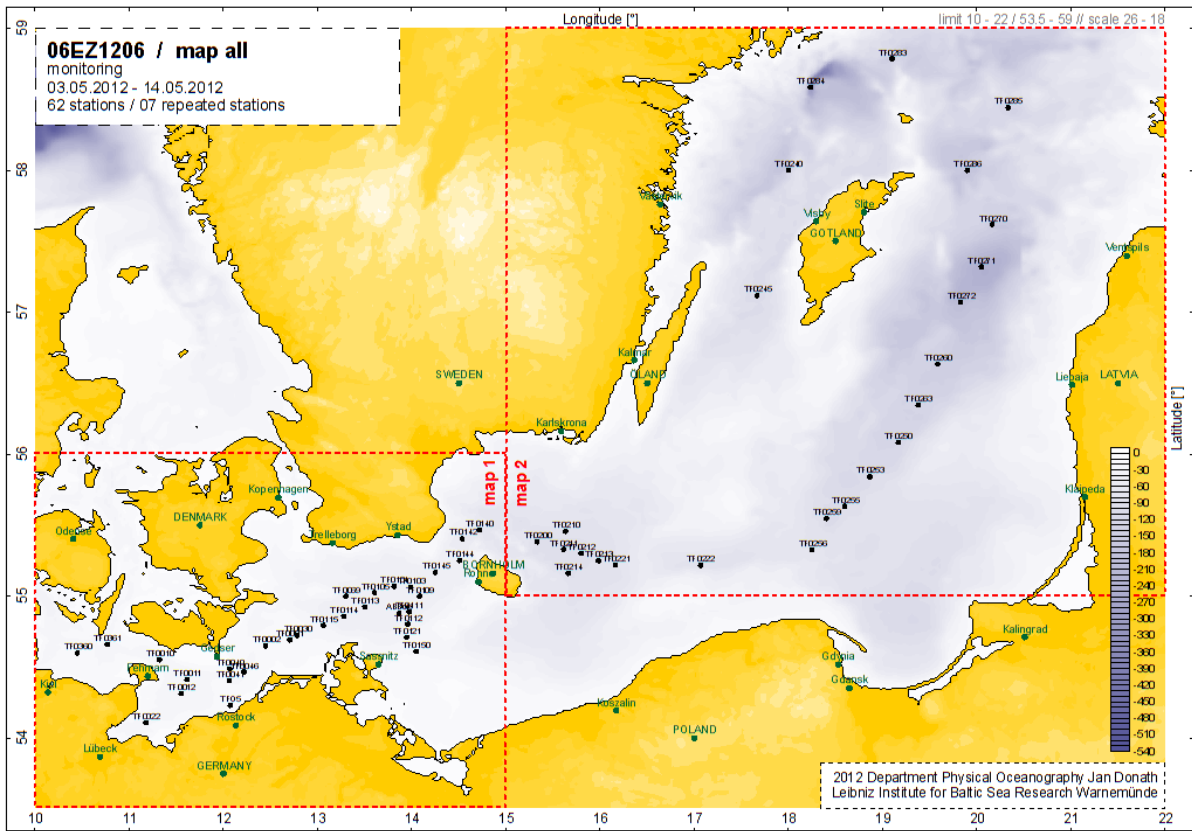


Fig. 1

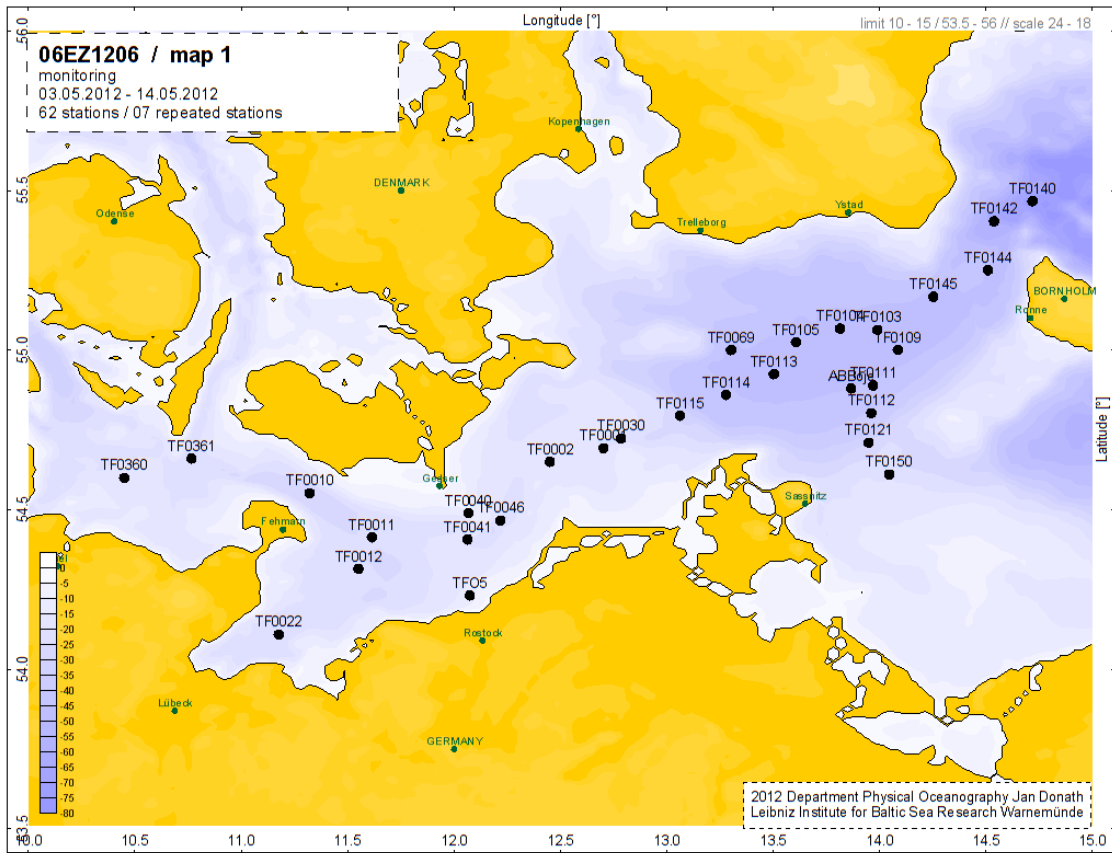


Fig. 2

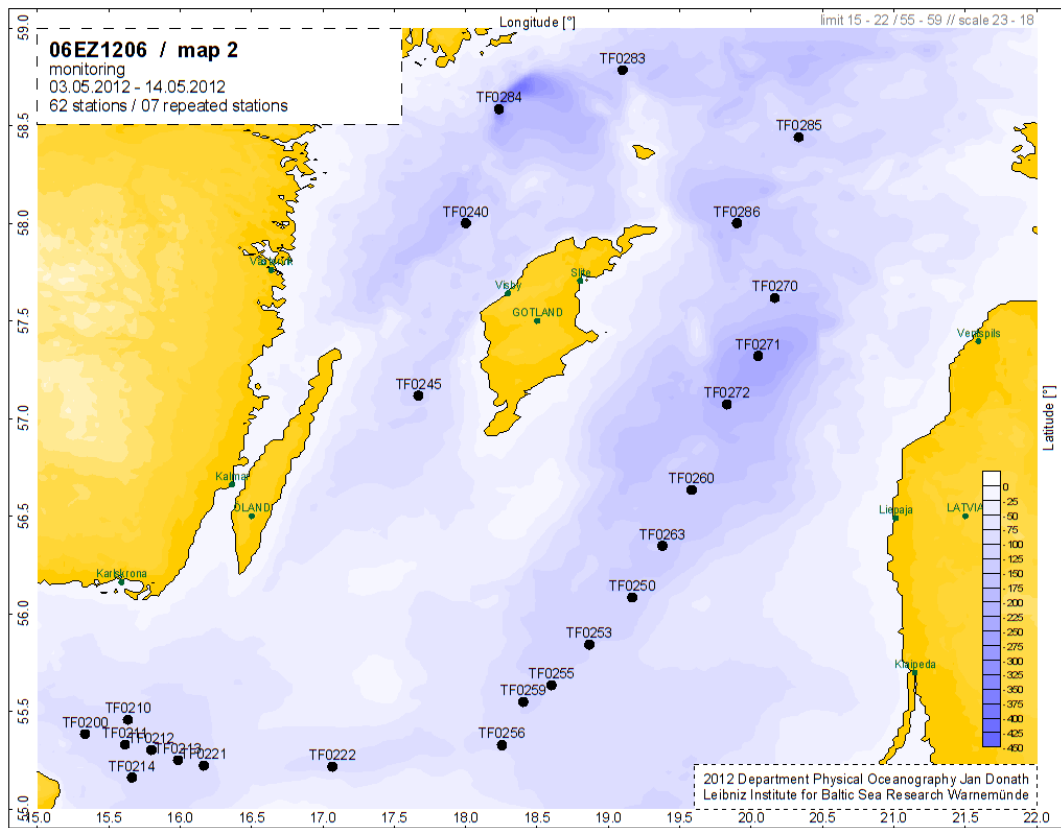


Fig. 3

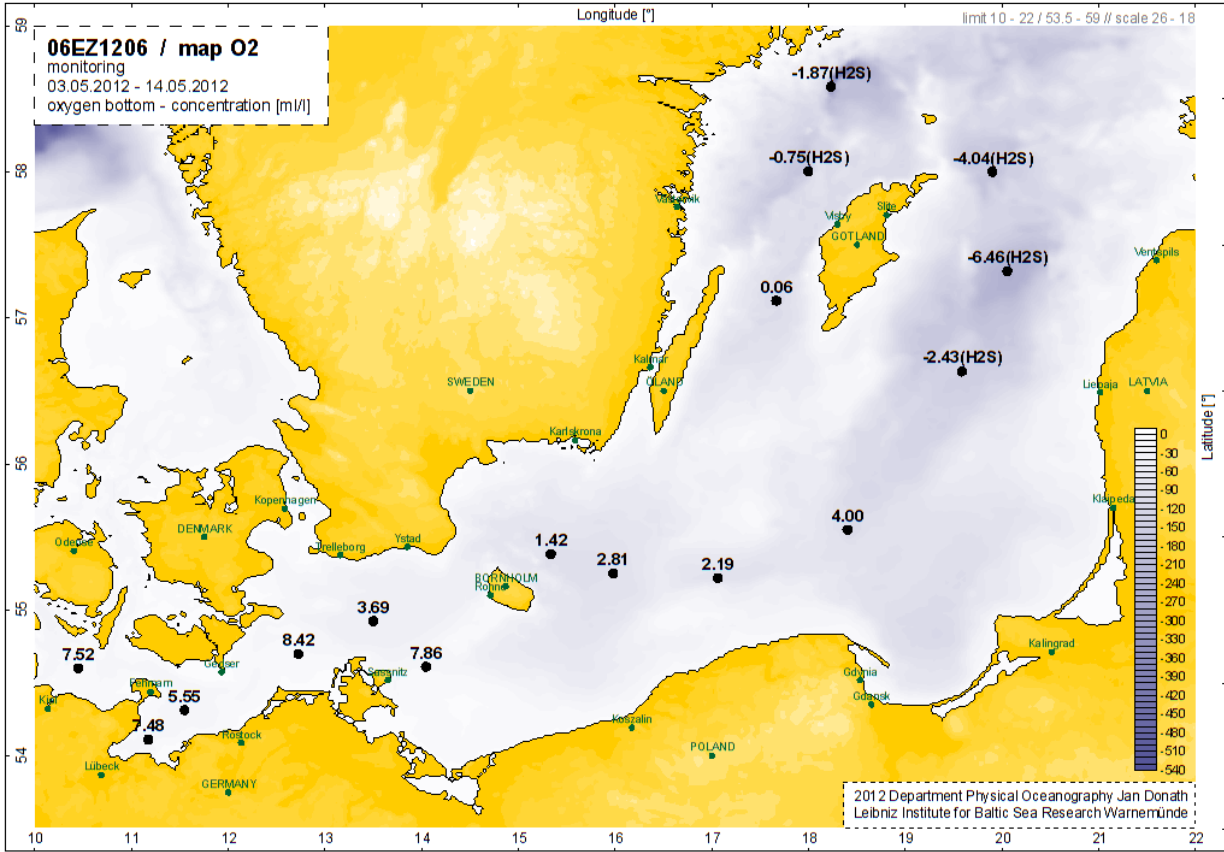
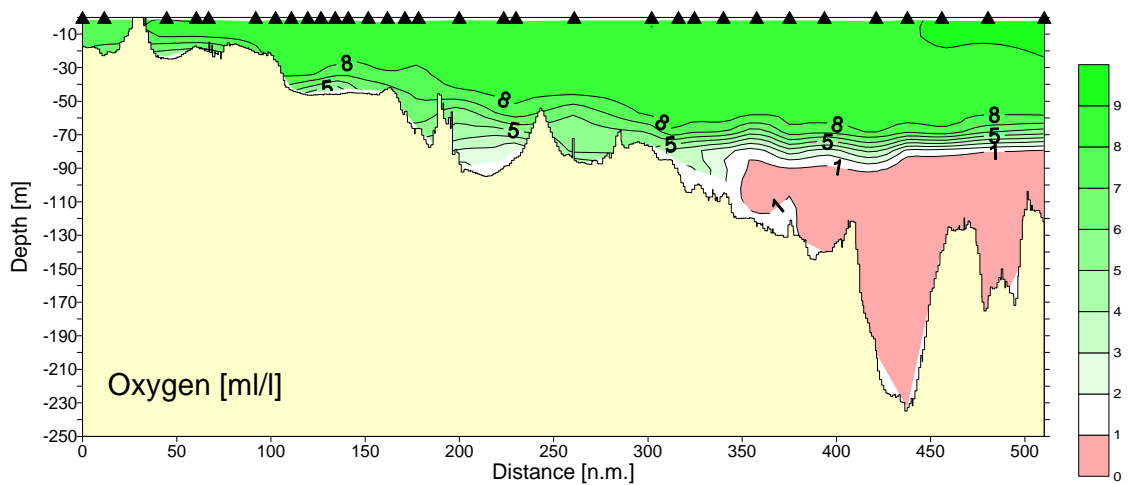
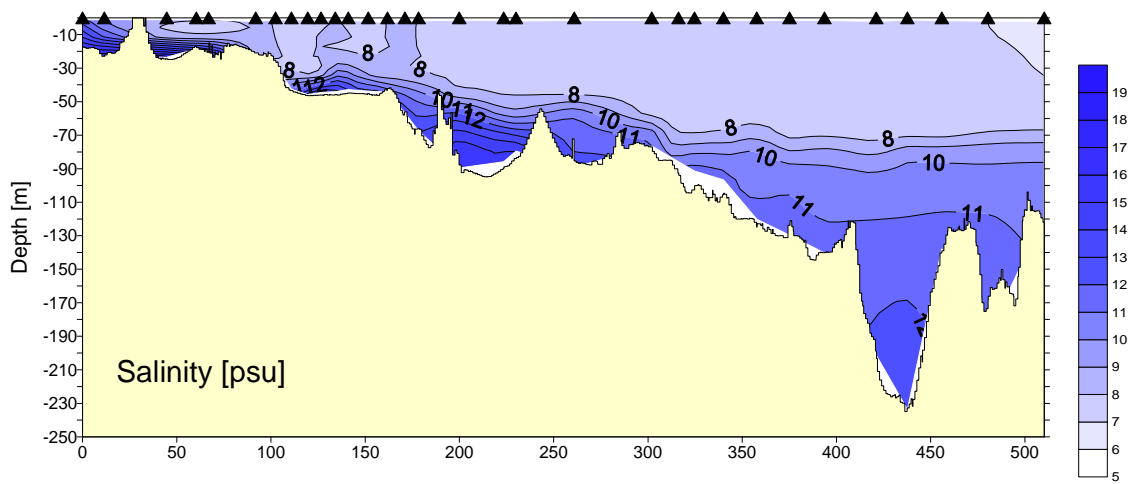
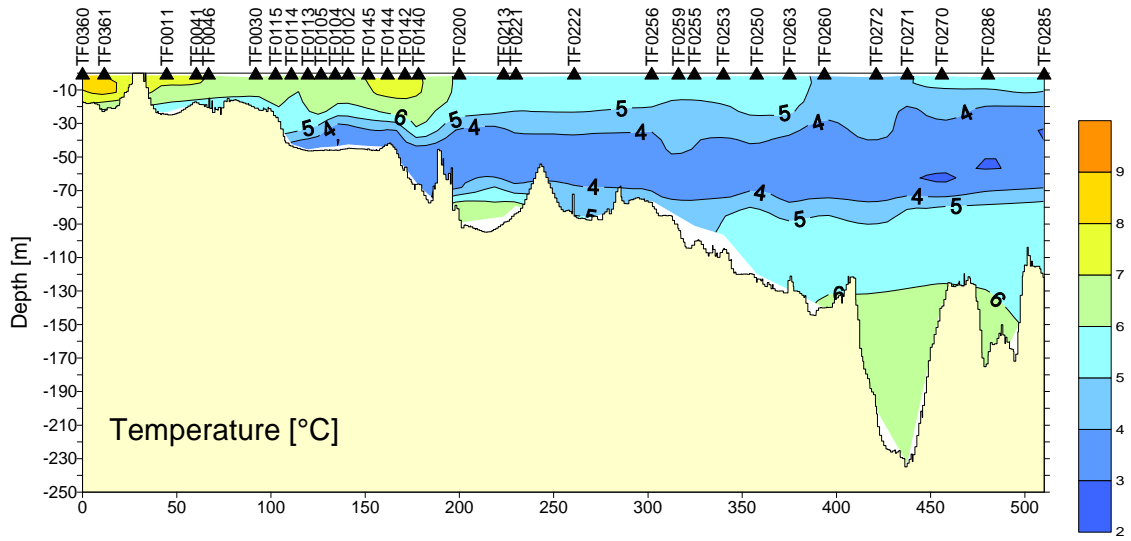


Fig. 4

06EZ1206

Kiel Bight - Gotland Sea

03.05.2012 11:06 - 08.05.2012 19:10 UTC



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Fig. 5