



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

FS „Alkor“

Monitoring cruise

Cruise- No. Al 430a

4<sup>th</sup> February – 14<sup>th</sup> February 2014

Kiel Bight to northern Gotland Sea

This report is based on preliminary data

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Warnemünde 14<sup>th</sup> February 2014

The first monitoring cruise of the Leibniz Institute for Baltic Sea Research Warnemünde in 2014 was carried out with FS “Alkor“ between February 4<sup>th</sup> and February 14<sup>th</sup> 2014. 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)	04.02. – 14.02.2014
Jan Donath	04.02. – 14.02.2014
Ines Hand	04.02. – 14.02.2014
Uwe Hehl	04.02. – 14.02.2014
Jenny Jeschek	04.02. – 14.02.2014
Lars Kreuzer	04.02. – 14.02.2014
Michael Naumann	04.02. – 14.02.2014
Michael Poetsch	04.02. – 14.02.2014
Johann Ruickoldt	04.02. – 14.02.2014
Andrea Tschakste	04.02. – 14.02.2014

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 program of HELCOM. The station map is attached to this report.

The weather situation during the cruise was influenced by a chain of low pressure cells over the Atlantic Ocean, but affected the Baltic Sea only randomly. Air pressure ranged between 989 and 1006 hPa. Wind speed mostly ranged between 4 and 6 Bft, only occasionally increasing up to 7 Bft. Wind direction was from SW to SE eastern direction, on 11<sup>th</sup> February from E. Morning air temperature was astonishingly high for the season with temperatures always above 0°C and up to 4°C. Weather conditions did not hamper the station work.

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 0.69°C (Lübeck Bight) and 2.99°C (Bornholm Basin). In all investigated areas of the Baltic Sea, temperatures are well above the

long-term mean. The reason is the mild winter so far. The water column in the main basins is mixed completely down to the halocline.

Lübeck Bight	0.69°C
Arkona Basin	1.60°C
Bornholm Deep	2.99°C
Gotland Deep	2.75°C
Farö Deep	2.86°C
Landsort Deep	2.63°C
Karlsö Deep	2.51°C

- Deep water layer temperatures decreased slightly in the central Baltic Proper during the last years due to the absence of major barotropic inflow events. But they are still higher as the long-term mean. Repeated inflow events during last summer resulted in high deep water temperatures in the Bornholm Basin. However, these inflows could not proceed further east.

	Febr 2013	Aug. 2013	Febr. 2014	<b>Mean 1971/90</b>
Bornholm D.	5.82°C	4.88°C	8.65°C	<b>6.1 °C</b>
Gotland Deep	6.41°C	6.40°C	6.36°C	<b>5.6 °C</b>
Farö Deep	5.98°C	5.90°C	5.76°C	<b>5.2 °C</b>
Landsort D.	5.58°C	5.39°C	5.34°C	<b>4.8 °C</b>
Karlsö Deep	5.29°C	5.24°C	5.08°C	<b>4.2 °C</b>

- The major Baltic inflow from January 2003 was the last strong inflow event into the Baltic Sea. Inflows in 2012 and 2013 could not influence the deep basins around Gotland. Thus, the stagnation period continues there, documented by further decreasing salinity in the bottom layer in the central Baltic Proper:

	Feb. 2013	August 2013	Feb. 2014
Gotland Deep	12.12	12.10	12.04
Farö Deep	11.45	11.49	11.40
Landsort Deep	10.40	10.50	10.36
Karlsö Deep	9.80	9.77	9.67

- 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, and increased further in the western Gotland Basin.

	Feb. 2013	August 2013	Feb. 2014
Gotland Deep	-6.48 ml/l	-7.81 ml/l	-6.74 ml/l
Farö Deep	-2.86 ml/l	-3.48 ml/l	-3.46ml/l
Landsort Deep	-1.31 ml/l	-0.82 ml/l	-2.09ml/l
Karlsö Deep	-0.60 ml/l	-0.60 ml/l	-2.10ml/l

- Also the vertical extension of hydrogen sulphide is remarkable. At stations 271 (Gotland Deep) hydrogen sulphide was found between around 115 m and the bottom.

At station 286 (Farö Deep), station 284 (Landsort Deep) and station 245 (Karlsö Deep) the layer from 100 m downwards contained hydrogen sulphide. Thus, oxygen situation remains quite worse in the central deep basins.

In contrast to that, storm events in autumn and early winter 2013 ventilated the western Baltic Sea and the Arkona Basin down to the bottom. Thus, high oxygen concentrations were measured in the bottom near layer (Fig. 4).

- The nutrient situation in the surface layer is typical for the season. High phosphate and nitrate concentrations represent the winter plateau phase which is used for trend analysis (table 1).
- In the deep waters of the central basins, the hydrographic situation is mirrored. Continued 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  $\mu\text{mol/l}$  in the bottom layer of the Gotland Basin.
- During the cruise, samples for the determination of organic pollutants at 7 stations as well as on 8 surface water transects were taken. Samples for phyto- and zooplankton (14 stations) as well as for the carbonate system (1 station) were collected for later analysis in the laboratory.
- At 7 stations in the western Baltic, surface sediment samples were taken which will be analyzed for trace metals and organic pollutants in the laboratory later on.
- On February 10<sup>th</sup>, a sediment trap equipped with several microcats has been recovered and re-layered again at position 57°18,37'N and 020°04,75E.

#### Attachments

Tables 1 and 2: Preliminary results of selected parameters in the surface layer and the near bottom water layer - (unvalidated 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 (unvalidated 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 04.02.2014	360/0005	1.50	14.06	8.65	0.56	4.66	15.2
Meckl.Bight 05.02.2014	012/0007	1.49	9.72	8.81	0.58	4.56	14.6
Lübeck Bight 04.02.2014	022/0006	0.69	12.30	8.92	0.68	6.51	18.6
Darss Sill 05.02.2014	030/0013	2.25	8.46	8.76	0.59	4.22	13.9
Arkona Basin 05.02.2014	113/0017	1.60	7.97	9.08	0.54	5.40	14.9
Bornholm Deep 07.02.2014	213/0040	2.99	7.60	8.55	0.69	3.93	13.3
Stolpe Channel 11.02.2014	222/0057	2.80	7.57	8.62	0.78	4.26	14.6
SE Gotland Basin 11.02.2014	259/0055	2.80	7.30	8.59	0.60	3.36	12.8
Gotland Deep 09.02.2014	271/0048	2.75	7.05	8.70	0.52	3.96	11.4
Farö Deep 09.02.2014	286/0046	2.86	6.86	8.61	0.78	4.54	16.6
Landsort Deep 08.02.2014	284/0043	2.63	6.75	8.83	0.84	3.78	17.8
Karlsö Deep 07.02.2014	245/0041	2.51	7.15	8.82	0.86	3.58	17.2

\* 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 04.02.2014	360/0005	17	2.04	19.21	8.17	0.58	5.20	17.0
Meckl.Bight 05.02.2014	012/0007	22	4.38	17.20	7.23	0.78	5.85	26.3
Lübeck Bight 04.02.2014	022/0006	21	4.81	17.99	6.61	0.74	6.78	28.1
Darss Sill 05.02.2014	030/0013	20	2.26	8.46	8.75	0.53	3.90	13.4
Arkona Basin 05.02.2014	113/0017	44	5.17	14.94	7.68	0.56	5.22	13.3
Bornholm Deep 07.02.2014	213/0040	86	8.65	15.99	0.84	1.68	6.69	51.0
Stolpe Channel 11.02.2014	222/0057	86	8.19	13.74	1.98	1.85	9.97	44.0
SE Gotland Basin 11.02.2014	259/0055	85	7.90	13.36	2.07	1.72	8.69	42.0
Gotland Deep 09.02.2014	271/0048	231	6.36	12.04	-6.74**	7.20	0	122.5
Farö Deep 09.02.2014	286/0046	186	5.76	11.40	-3.46**	6.69	0	110.0
Landsort Deep 08.02.2014	284/0043	429	5.34	10.36	-2.09**	5.05	0	67.0
Karlsö Deep 07.02.2014	245/0041	103	5.08	9.67	-2.10**	4.90	0	60.9

\* see attached map

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

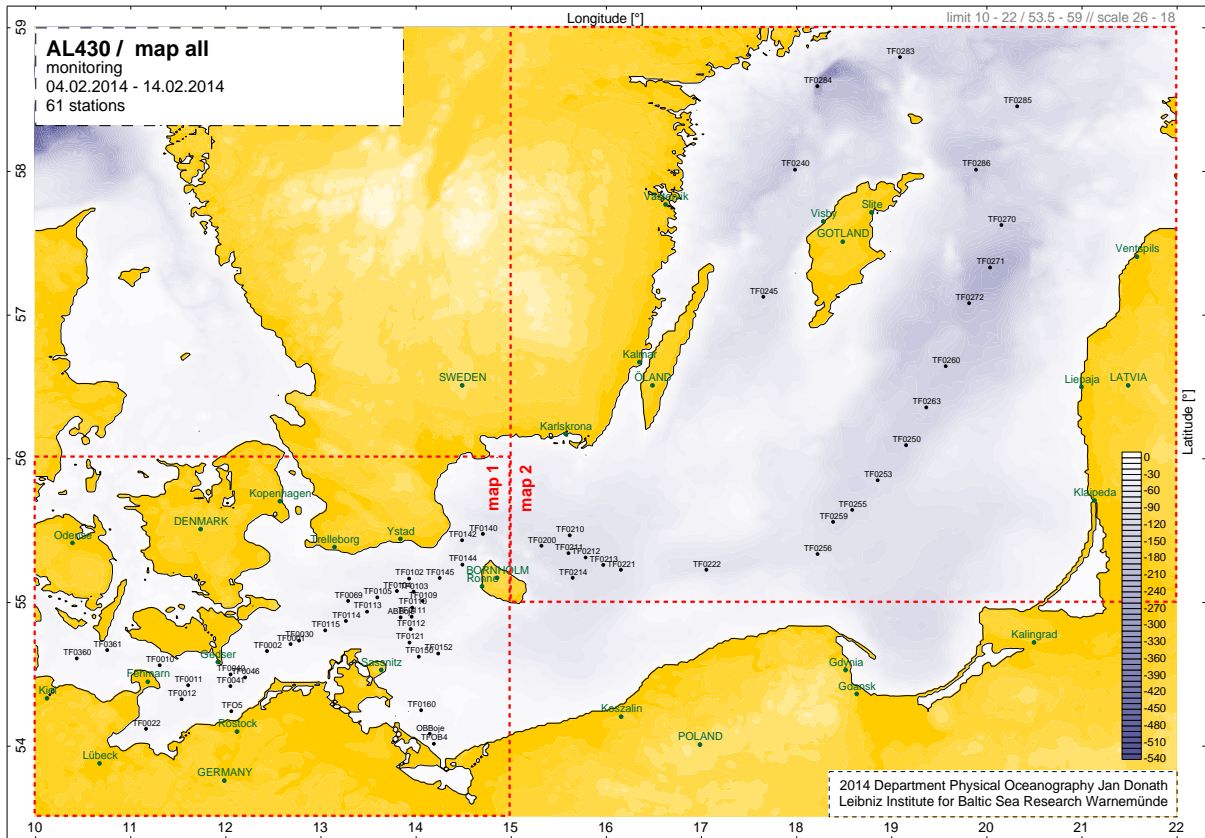


Fig. 1

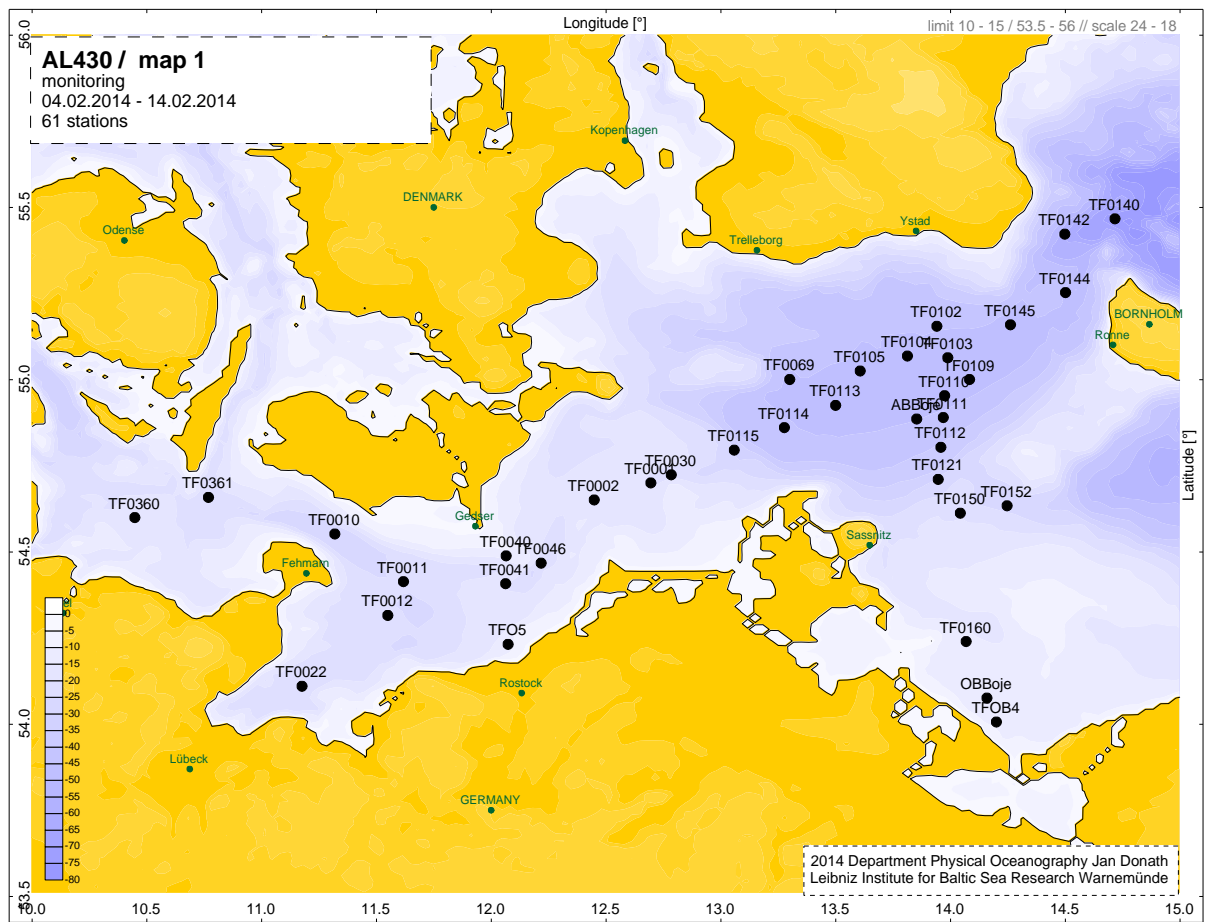


Fig. 2

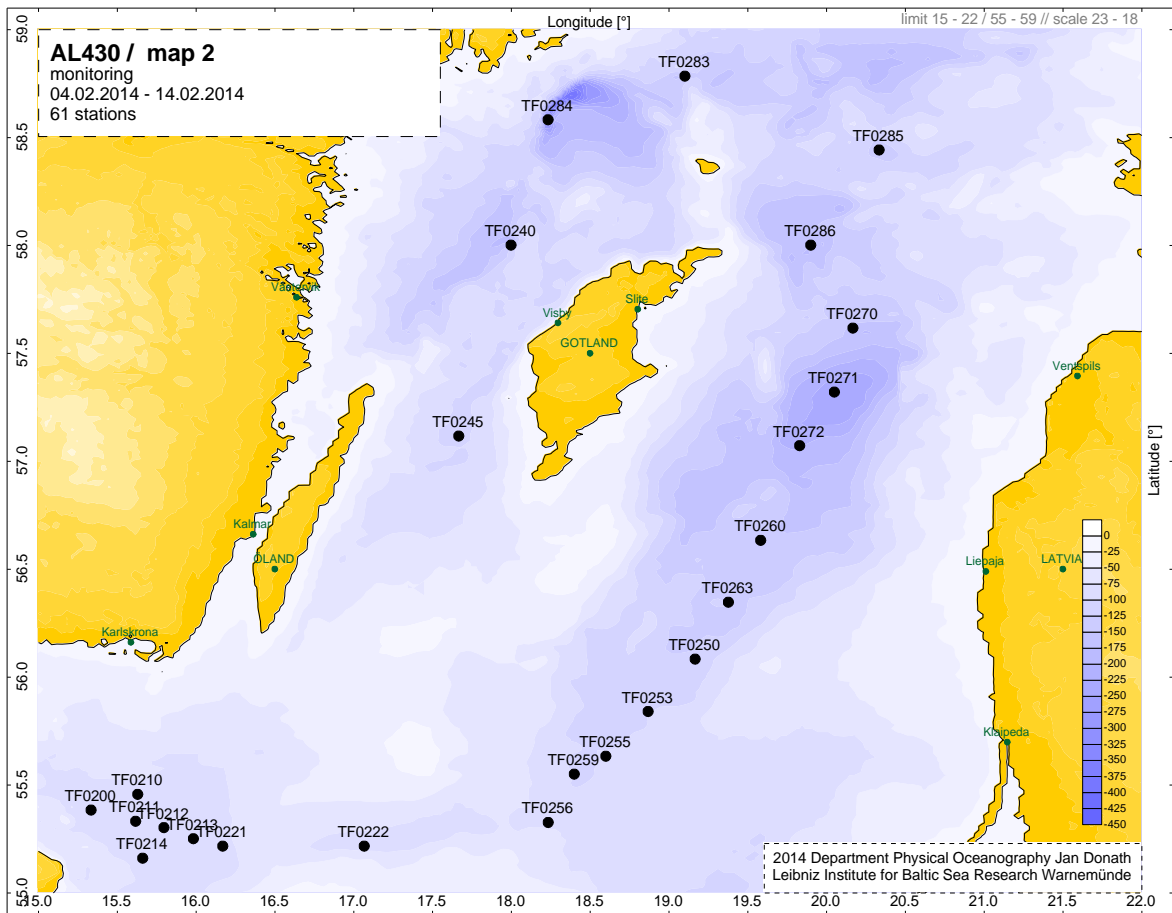


Fig. 3

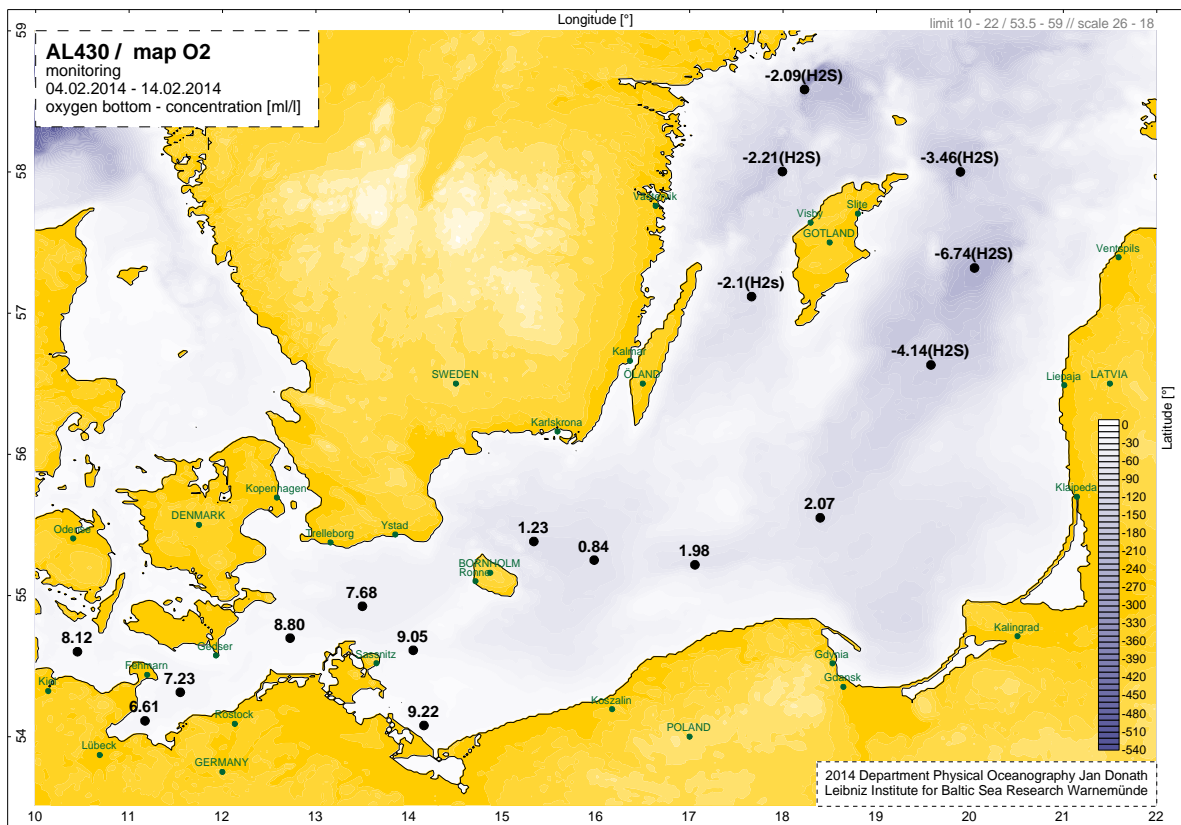


Fig. 4



# Monitoring AL430

Kiel Bight - Gotland Sea

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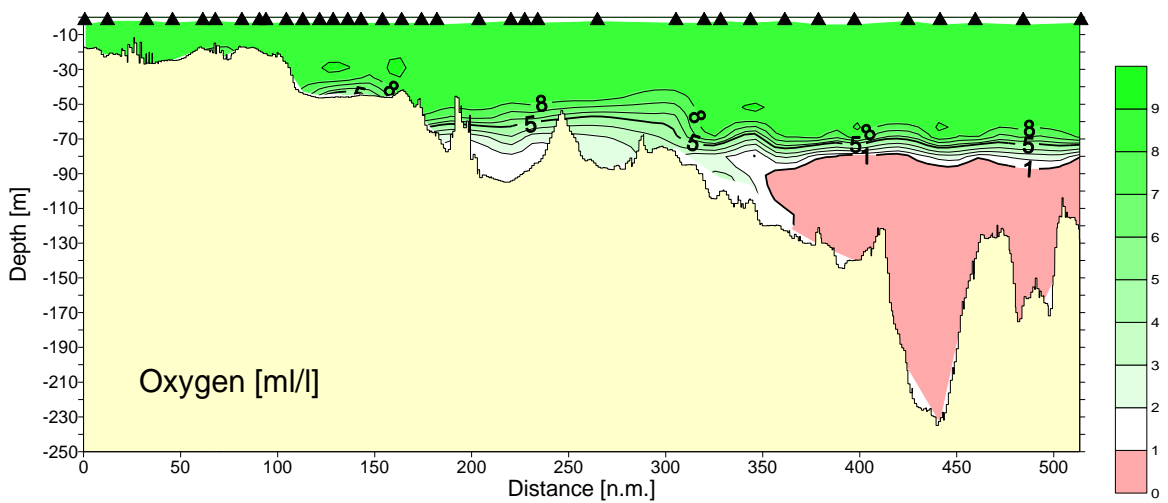
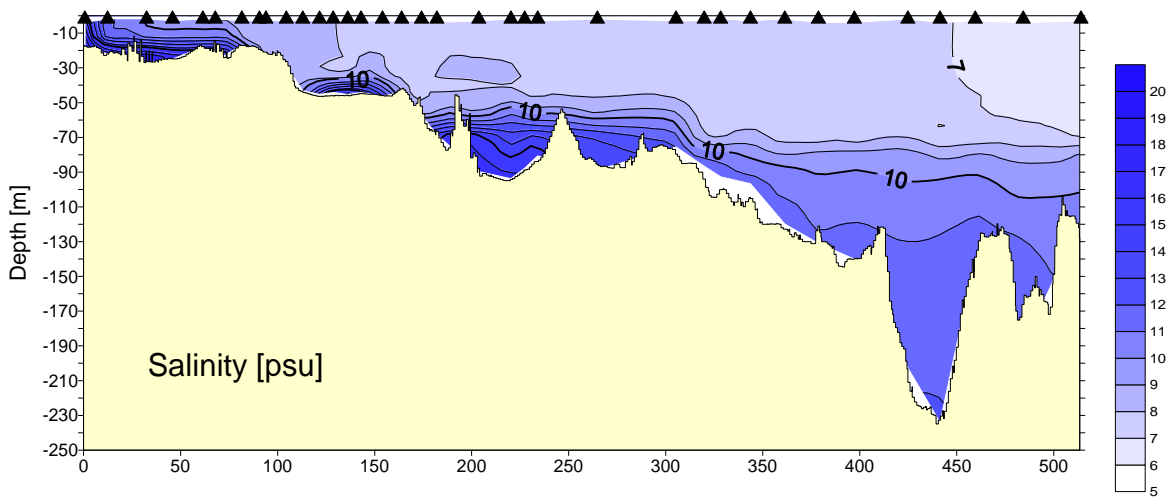
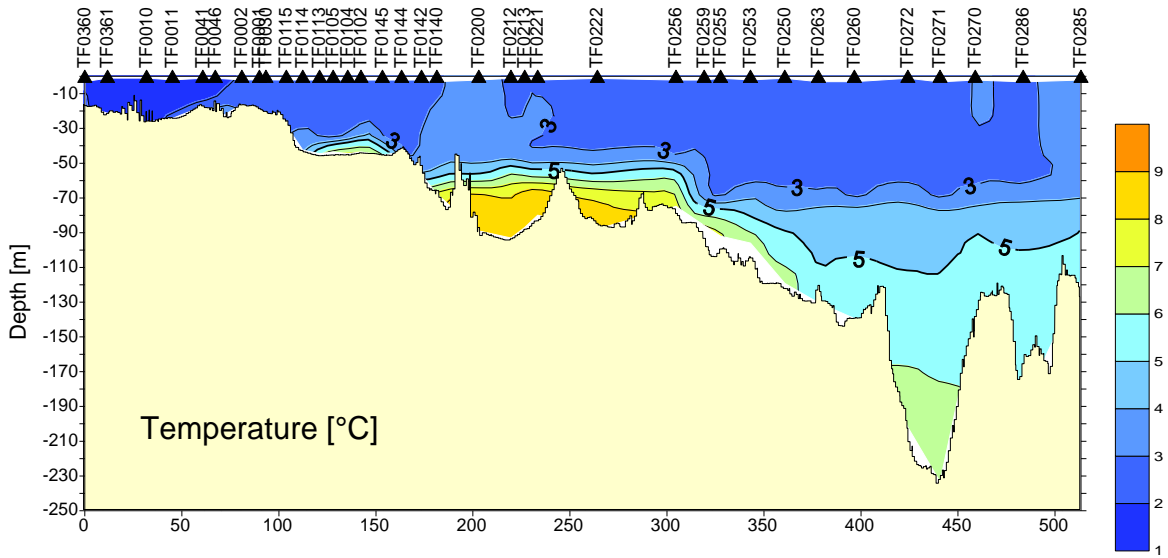


Fig. 5