

Report from the SMHI monitoring cruise with R/V Aranda



Survey period: 2014-07-10 - 2014-07-14
Survey area: Skagerrak, Kattegat and the Baltic Proper
Principal: SMHI and the Swedish Agency for Marine and Water Management

SUMMARY

The expedition was part of the Swedish regular marine monitoring programme and covered the Skagerrak, Kattegat and the Baltic Proper. Data presented in this report have been subject to preliminary quality control procedures only.

Surface water temperatures were above normal in most of the investigated areas, with the exception of the Western Baltic Proper, where temperatures were below normal. Nutrients in the surface layer showed concentrations normal for the season in all areas. The oxygen situation in the Hanö Bight and Bornholm Basins had worsened and was below acute hypoxia. In the south eastern part of the Baltic Proper signs of an earlier inflow were seen and the BY15 deep water was oxygenated for the first time since April 2007. Oxygen free conditions, anoxia, were found from 90 – 125 meters depth and acute hypoxia from ca. 80 meters. No surface accumulations of cyanobacteria were seen but analyses showed large amounts in the water. For a detailed algae report go to:
<http://www.smhi.se/en/Publications/algae-report-number-5-2014-1.38050>

The next cruise will begin on 1st of August and will cover the Skagerrak, Kattegat and the Baltic Proper.

PRELIMINARY RESULTS

The cruise, part of the Swedish regular marine monitoring programme, began in Falkenberg on July 10th and ended in Nynäshamn on July 14th. Due to a wrongly dated permission, Polish waters could not be visited. The winds were weak to moderate with varying directions during the expedition. The air temperature varied between 15 to 23 °C.

The Skagerrak

The surface temperatures were normal or just above normal for the season and varied between 15.8 and 20.8 °C. The salinity in the surface layer was 21.4 – 31.0 psu which ranges from normal to below normal. The thermocline and the halocline were both found between 10 and 30 meters. All nutrients had concentrations that are normal for the season; phosphate varied between 0.02 – 0.05 µmol/l and silicate between 0.3 – 0.9 µmol/l. The amount of nitrite + nitrate was below the detection limit (< 0.10 µmol/l).

Fluorescence maxima were found at about 30 meters depth.

The Kattegat and the Sound

Also in this area surface water temperatures were above normal, around 19°C. The salinity of the surface water was normal or below normal and varied between 12.8 and 19.9 psu in the Kattegat, while it was 8.5 psu in the Sound. Thermocline and halocline coincided at depths between 10 and 15 meters in the whole area.

All nutrients in the surface layer showed, for the season, normal values, except at Anholt E where the silicate concentration had increased and was above normal at the second visit. In the Kattegat phosphate concentrations were between 0.03 – 0.14 µmol/l and in the Sound 0.26 µmol/l. Silicate values were in the range 1.1 to 4.1 µmol/l in the Kattegat, and 6.6 µmol/l in the Sound. The amount of nitrite + nitrate was below the detection limit (< 0.10 µmol/l) in both areas.

Fluorescence maxima were found at 17 meters at stations Fladen and W Landskrona and at 30 meters depth at Anholt E.

The lowest oxygen concentration in the Kattegat area, 4.3 ml/l, was found at the station Anholt E. In the Sound, 3.6 ml/l was the lowest registered concentration.

The Baltic Proper

Surface water temperatures varied from normal to just above normal in the southern and eastern parts (16.2 – 18.3°C). In the western parts temperatures were found to be just below normal (ca. 15°C). The salinity in the surface layer varied between 6.6 – 8.0 psu, normal or just above normal in most areas. However, at the stations BY10 and BY15 surface salinity was below normal, at BY15 this has been the case since last summer. The halocline was found at depths between 70 and 80 meters in the Northern, Western and Eastern Gotland Basins, while it was located shallower, between 50 and 60 meters in the southern parts. A thermocline was found at depths between 15 and 30 meters.

All nutrients in the surface layer showed, for the season, normal values except in the northern and eastern parts where the silicate concentrations were enhanced. Concentrations of phosphate was in the interval 0.09-0.20 µmol/l and silicate varied between 7.5 and 11.2 µmol/l. Inorganic nitrogen (nitrite + nitrate) was close to or below the detection limit in the whole area. In the bottom water of the Arkona Basin, the oxygen situation was better since the previous sampling at station BY1 (0.6 ml/l), and the situation at station BY2 was still relatively good (3.58 ml/l). In the Bornholm Basin and Hanö Bight, oxygen concentrations in the bottom water had decreased and were below the limit for acute hypoxic conditions (< 2 ml/l). During February-March, inflows through the Sound occurred with a total volume of ca. 35 km³. This oxygenated water had now reached BY15 where oxygen was found in the bottom water for the first time since April 2007. At the stations BY10 and



BY15 hydrogen sulphide was present at intermediate depths between 125 - 200 meters. Completely oxygen free conditions, (anoxia) were generally found from 90 - 125 meters depth and acute hypoxia from ca. 80 meters.

No surface accumulations of cyanobacteria were observed due to winds and waves, but analyses revealed large amounts of cyanobacteria in the water that will rise and cause new surface accumulations once the weather is calmer.

PARTICIPANTS

Name		Institute
Anna-Kerstin Thell	Cruise leader	SMHI
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Daniel Bergman-Sjöstrand		SMHI
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Vivi Månsson		SMHI
Ann-Turi Skjevik		SMHI
Yue Hu		KTH

APPENDICES

- Track chart
- Table over stations, parameters and sampling depths
- Map showing bottom oxygen concentrations
- Monthly average surface water plots for selected stations
- Vertical profiles for selected stations

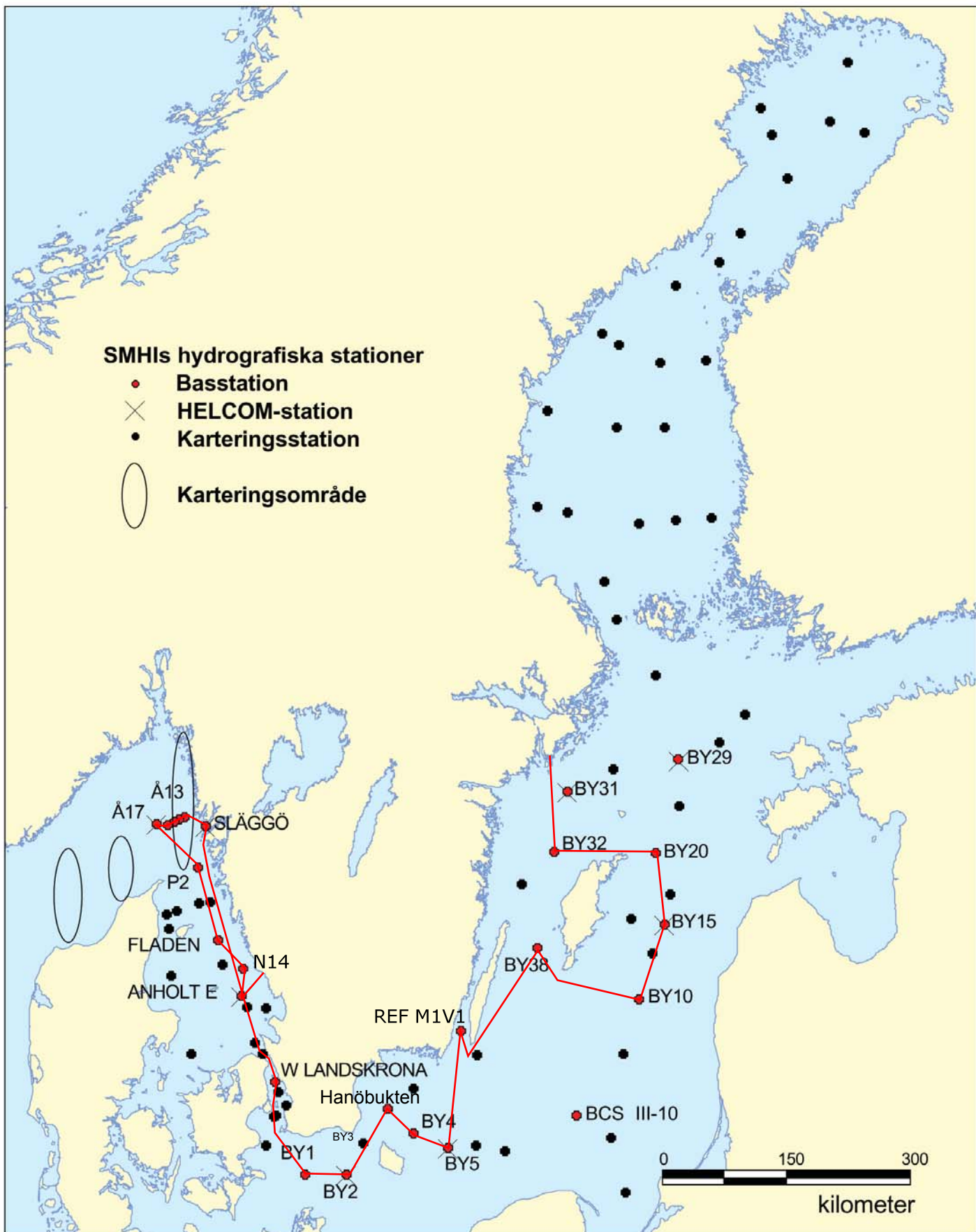
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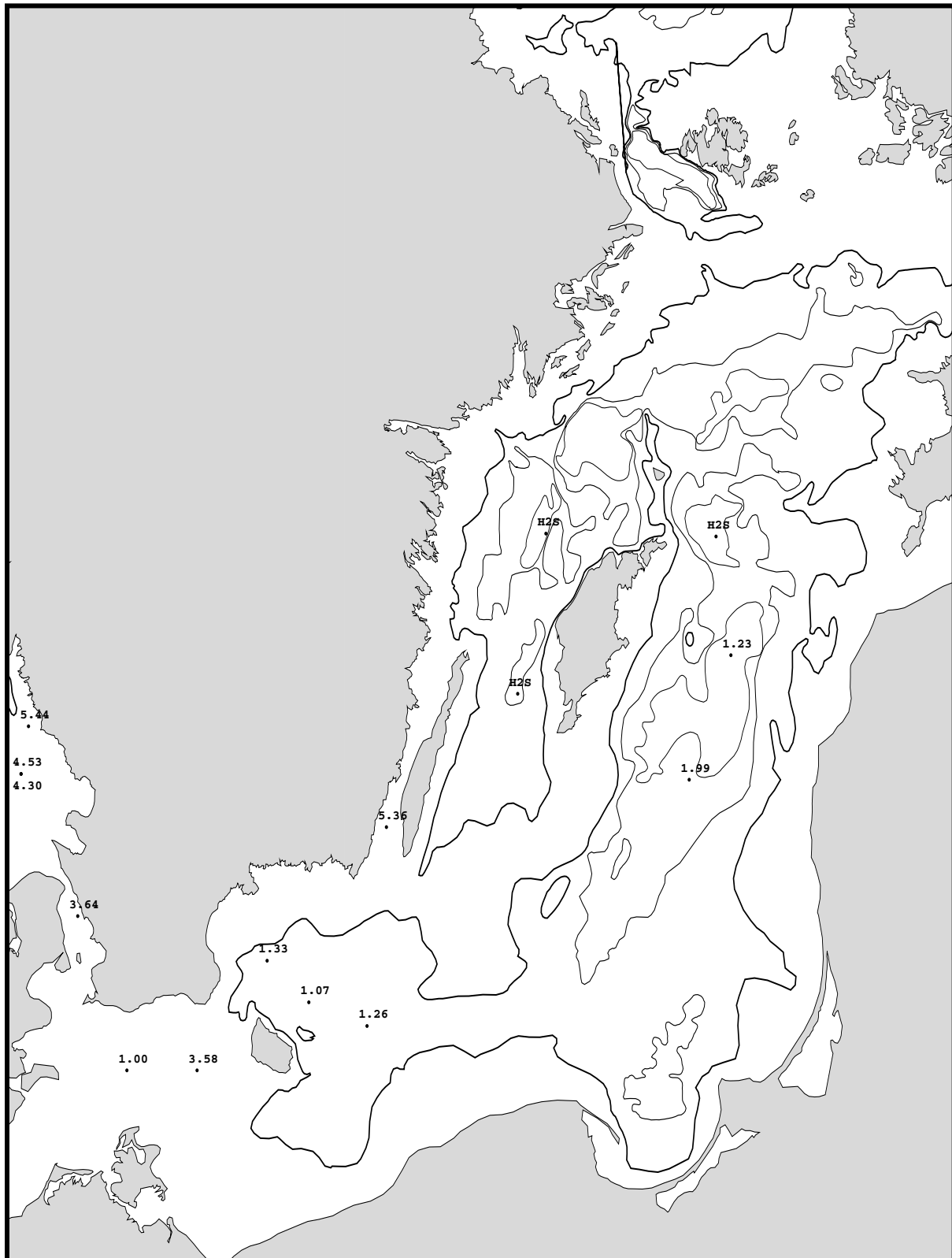
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Series: 0450-0471



Bottom water oxygen concentration (ml/l)

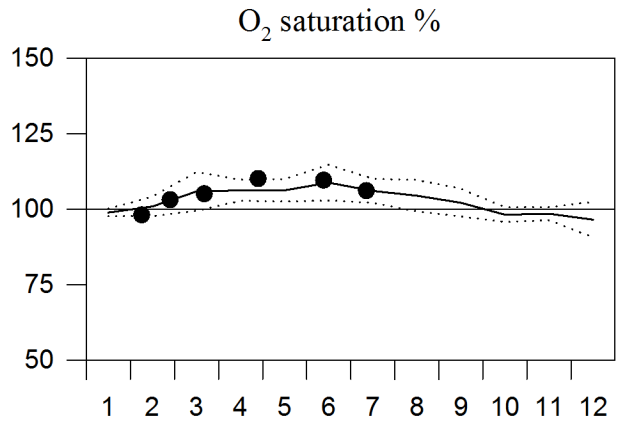
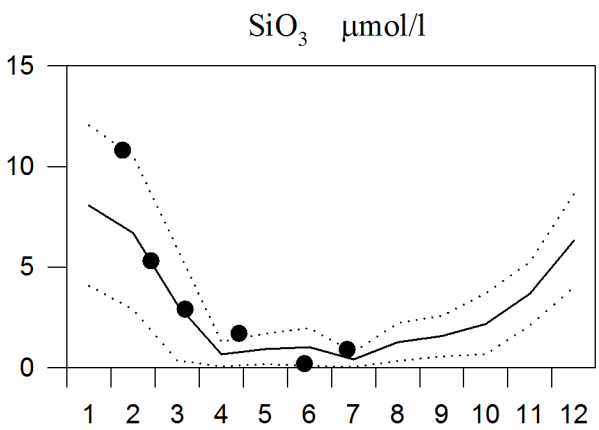
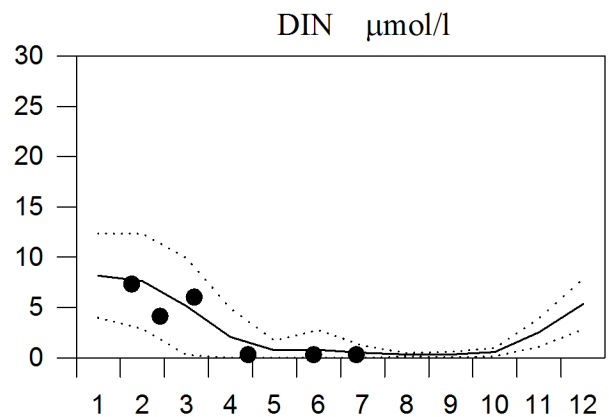
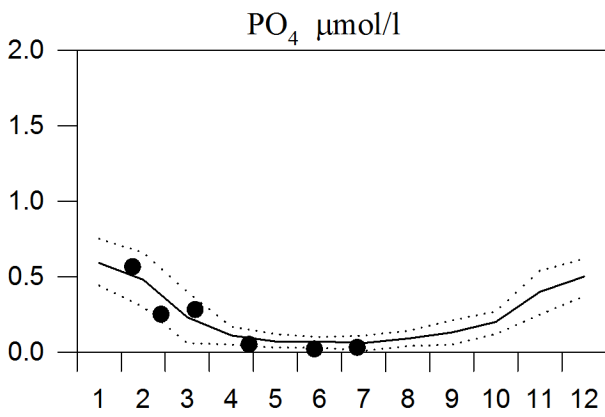
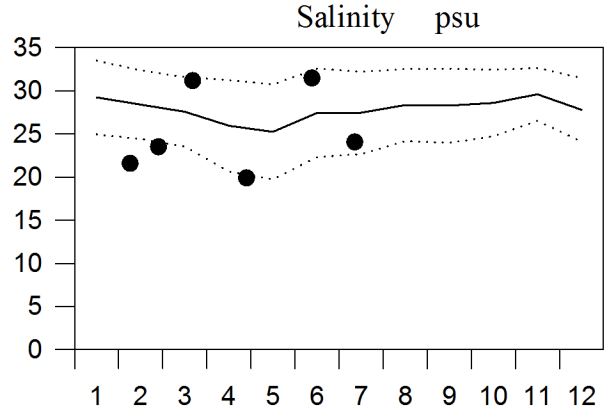
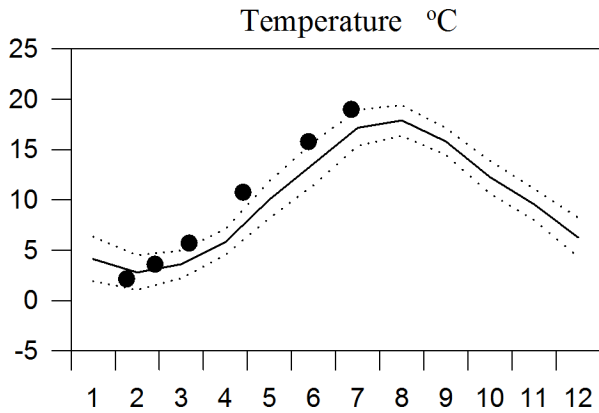
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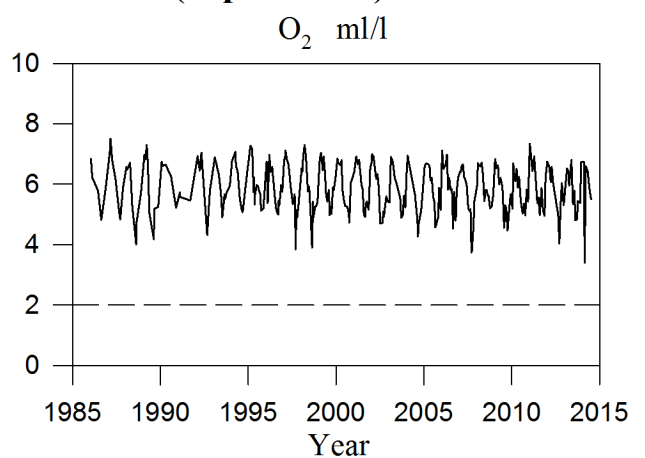
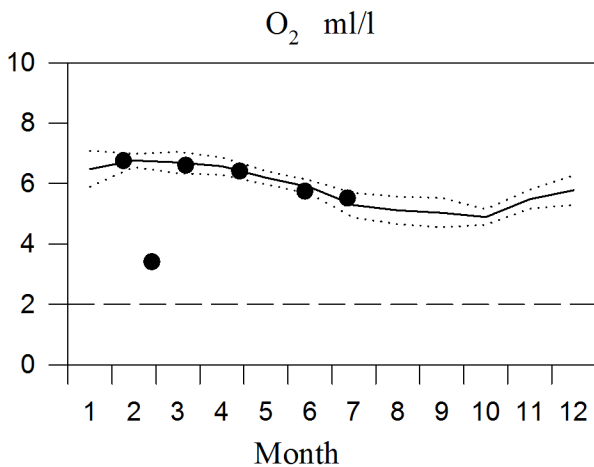
STATION P2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 ····· St.Dev. ● 2014

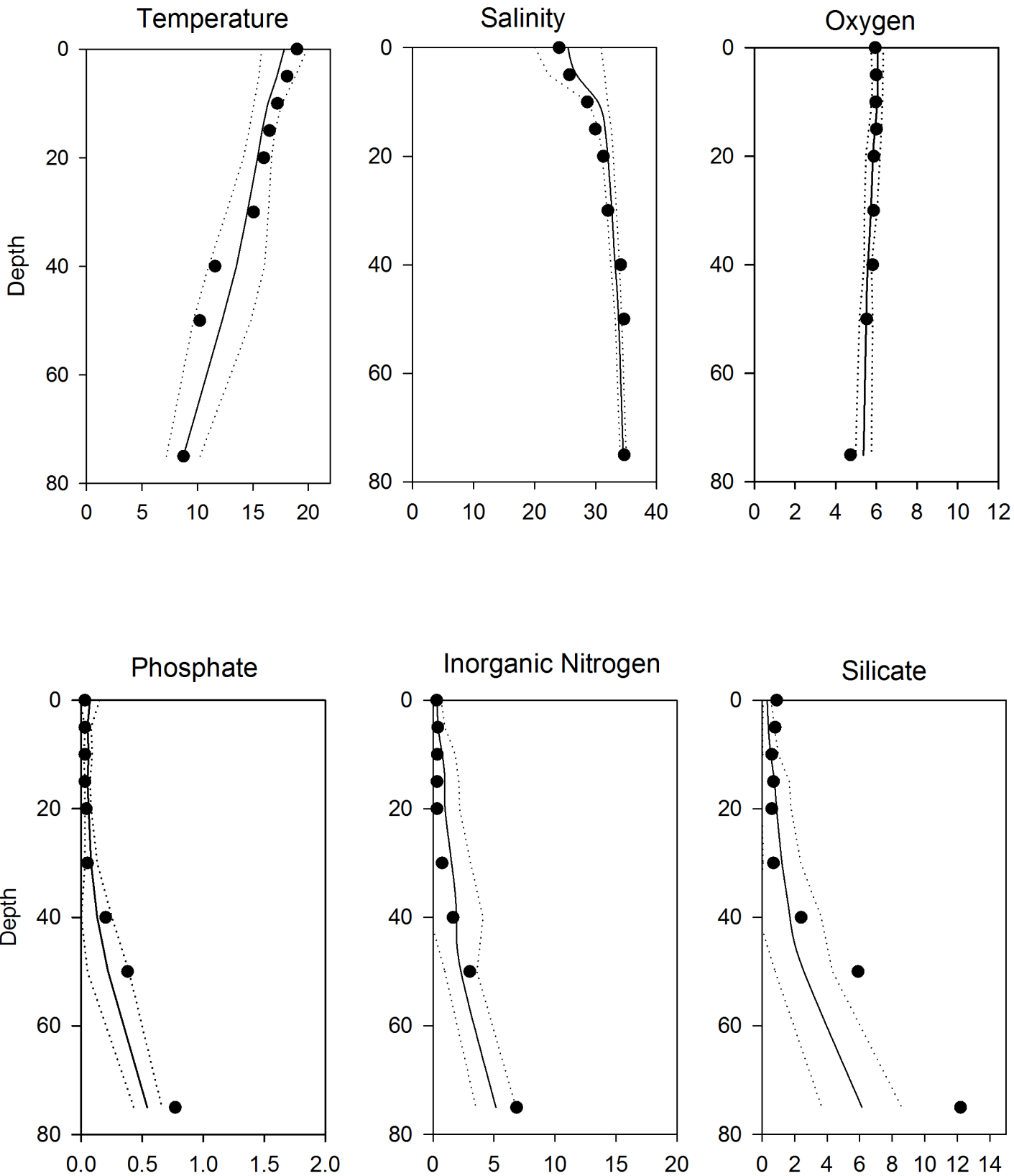


OXYGEN IN BOTTOM WATER (depth >75m)



Vertical profiles P2 July

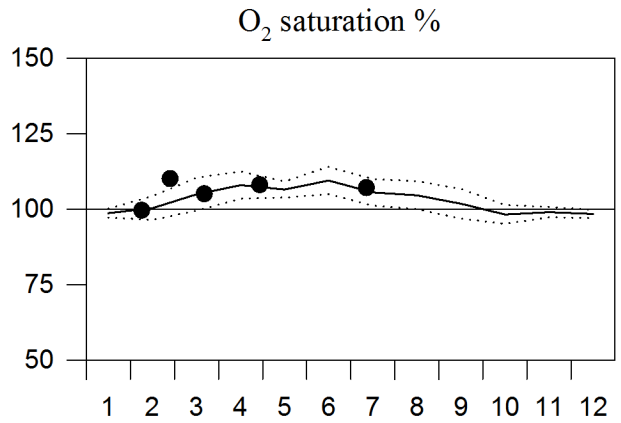
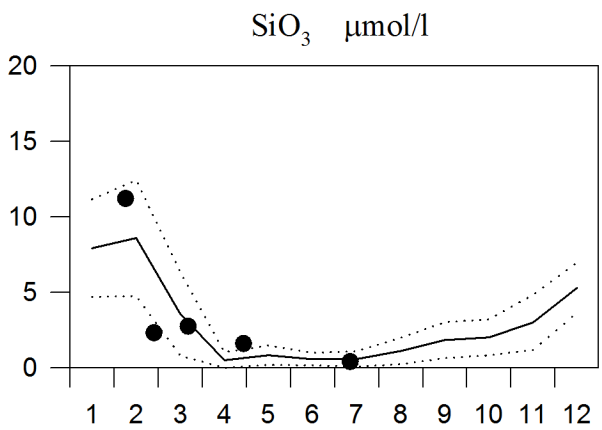
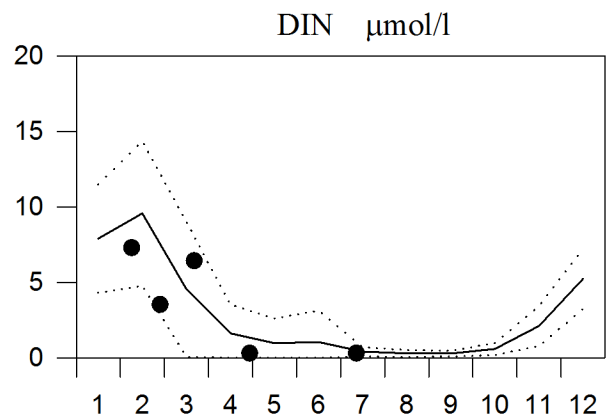
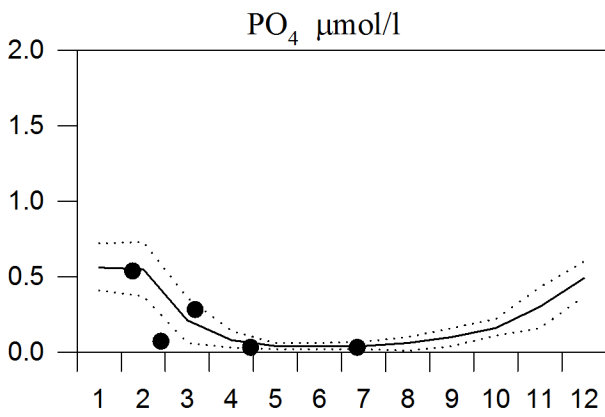
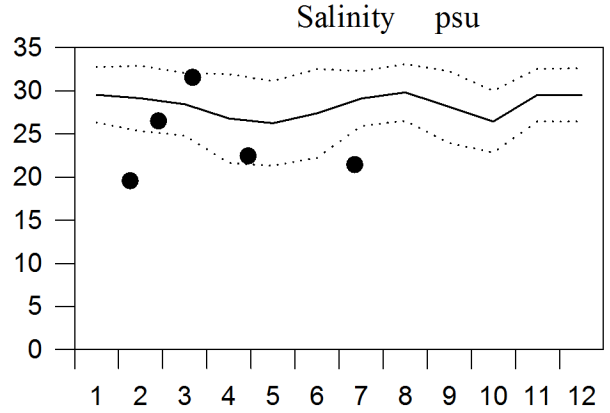
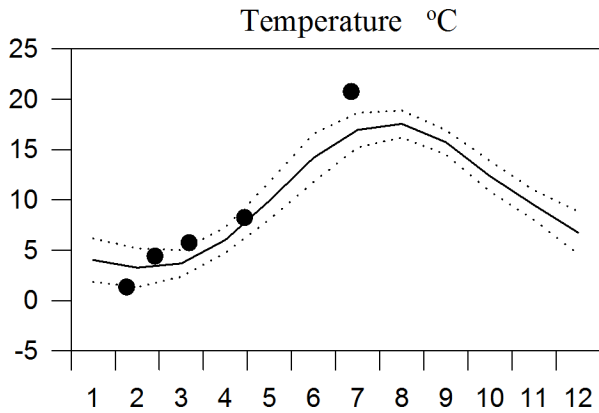
— Mean 1996-2010 St.Dev. ● 2014



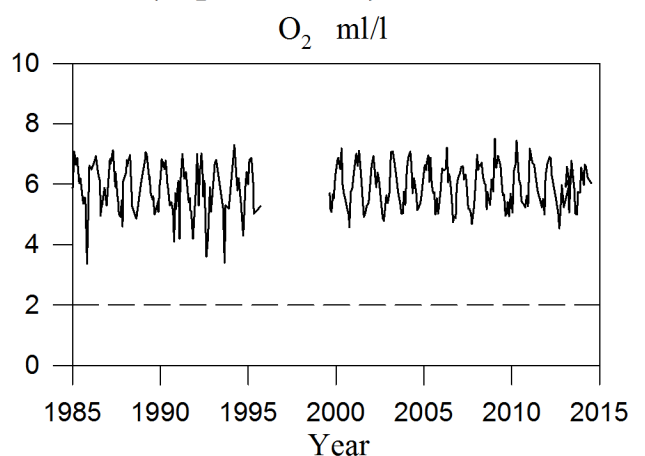
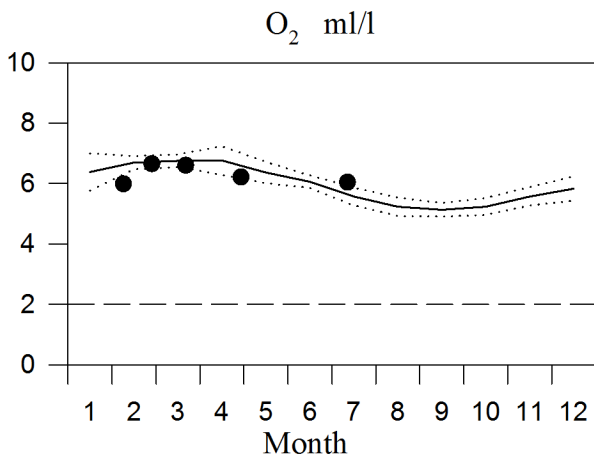
STATION Å13 SURFACE WATER

Annual Cycles

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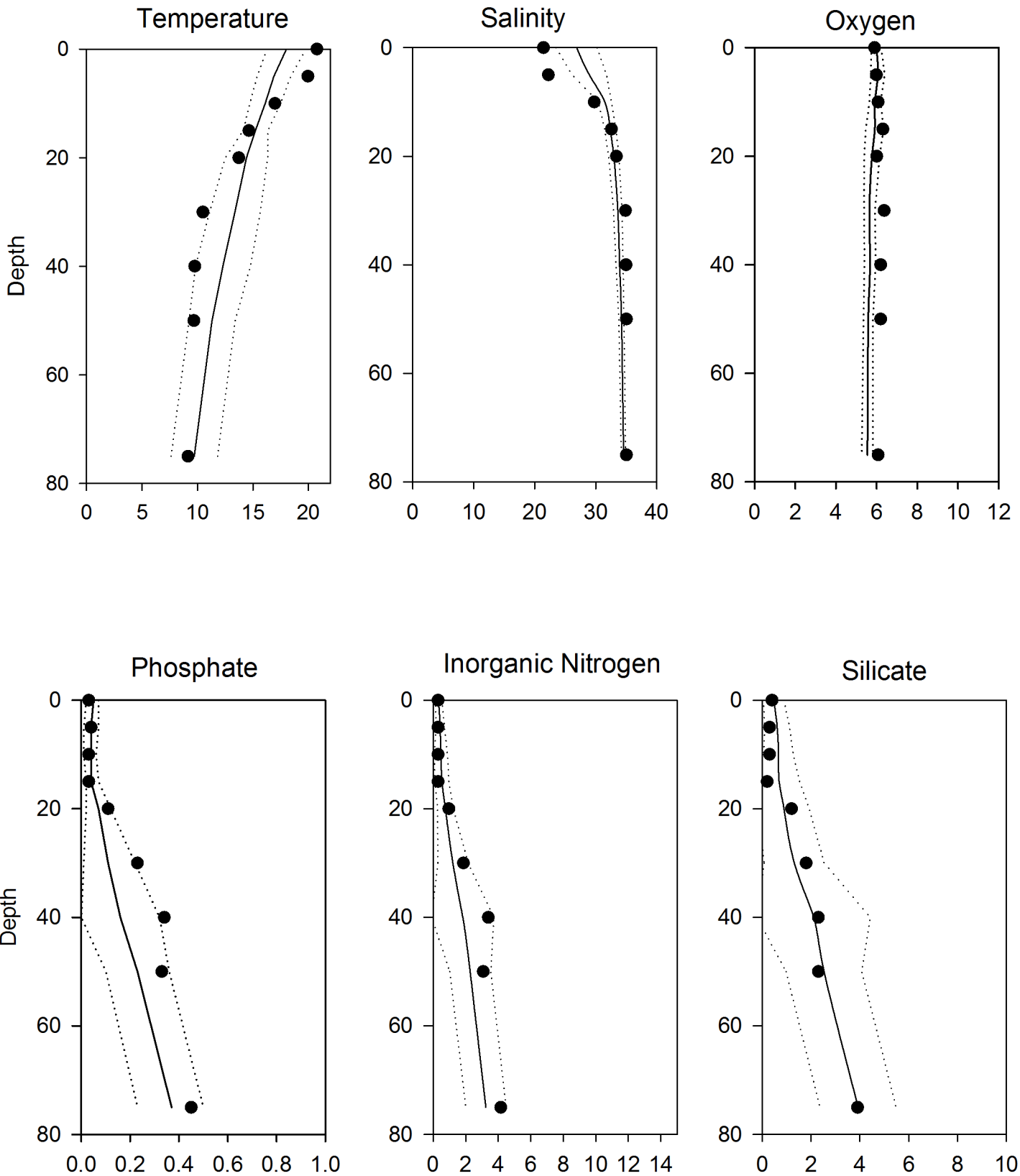


OXYGEN IN BOTTOM WATER (depth >=75m)



Vertical profiles Å13 July

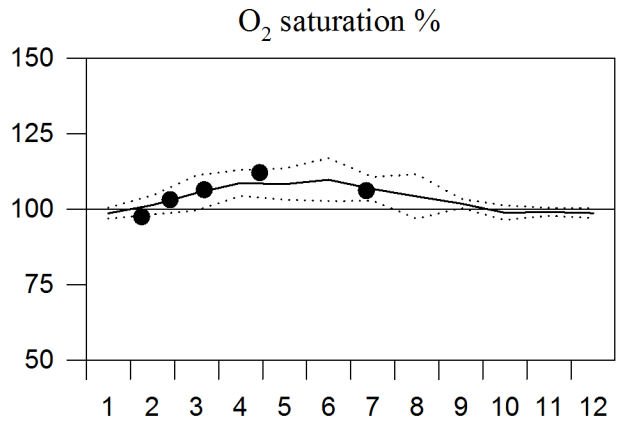
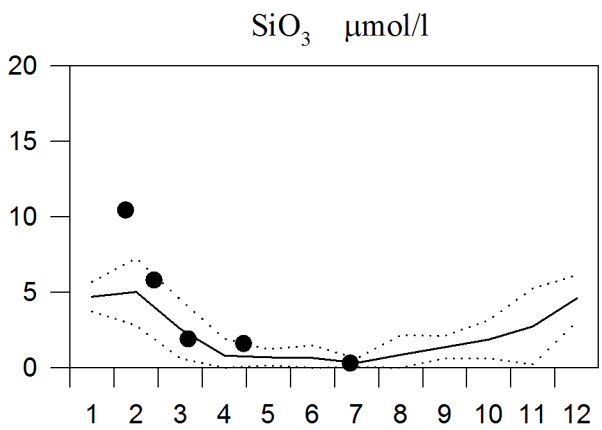
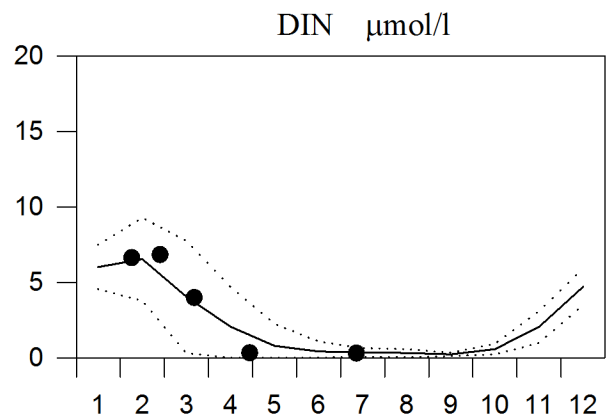
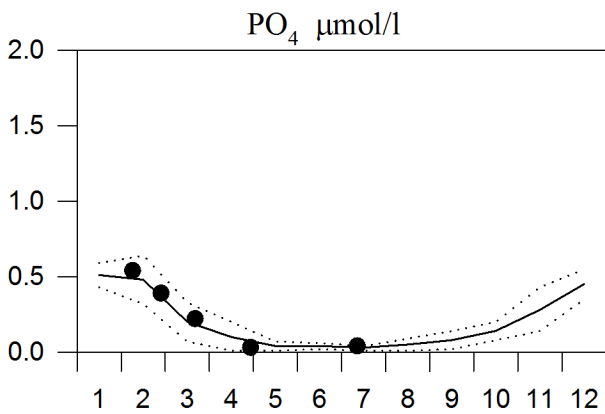
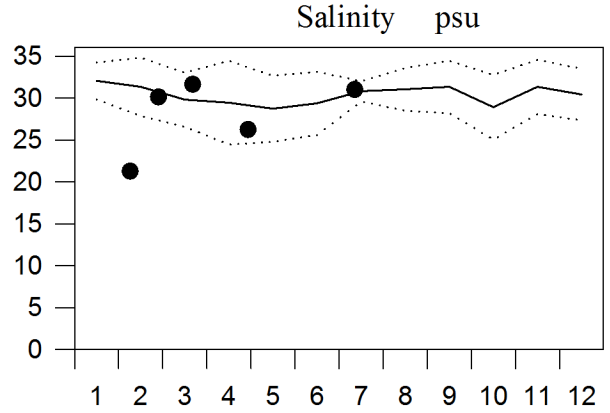
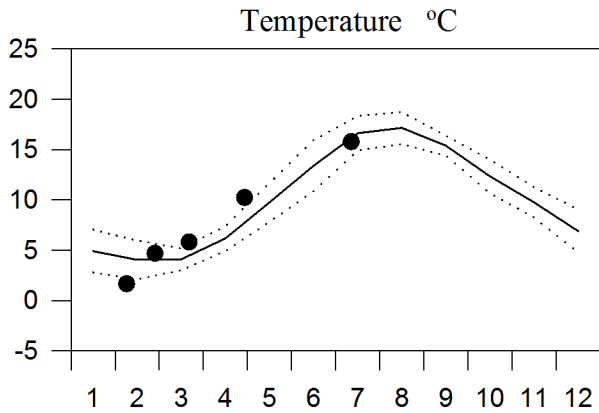
— Mean 1996-2010 St.Dev. ● 2014



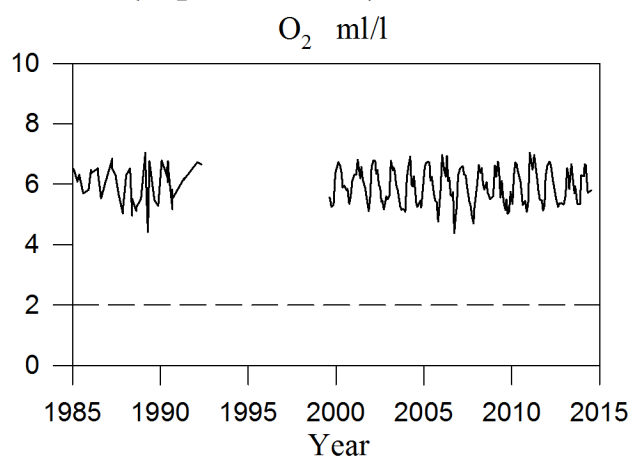
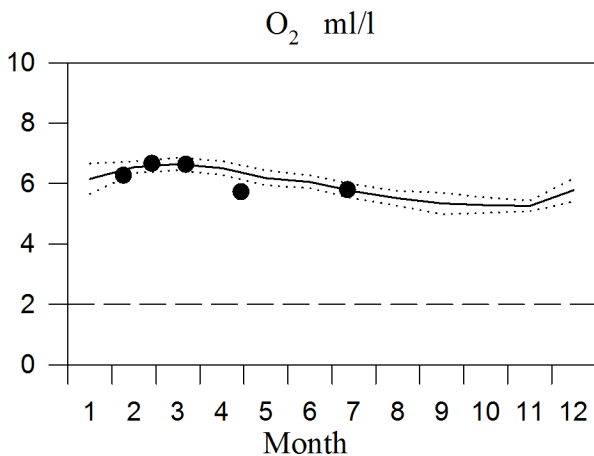
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Annual Cycles

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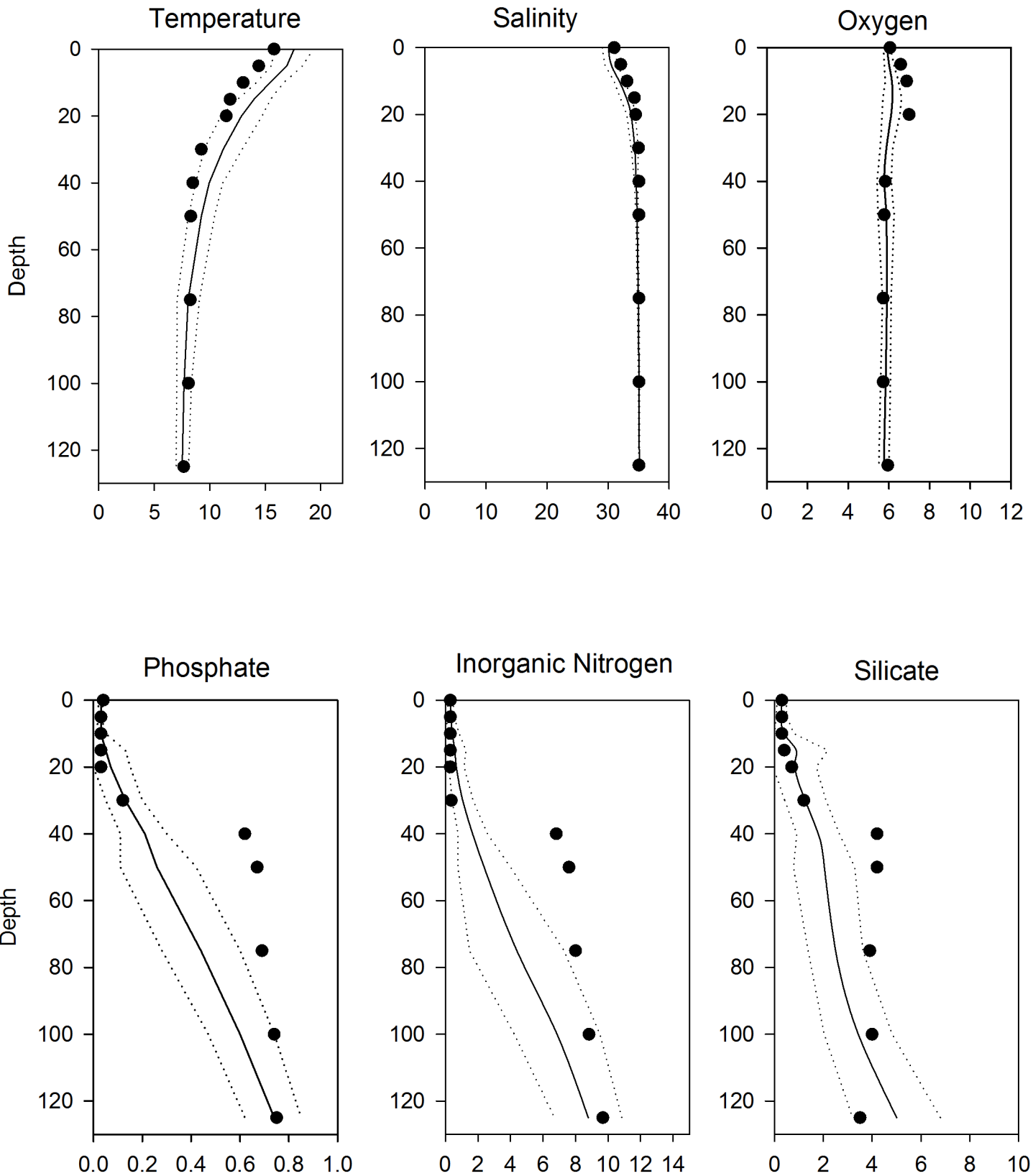


OXYGEN IN BOTTOM WATER (depth >=125m)



Vertical profiles Å15 July

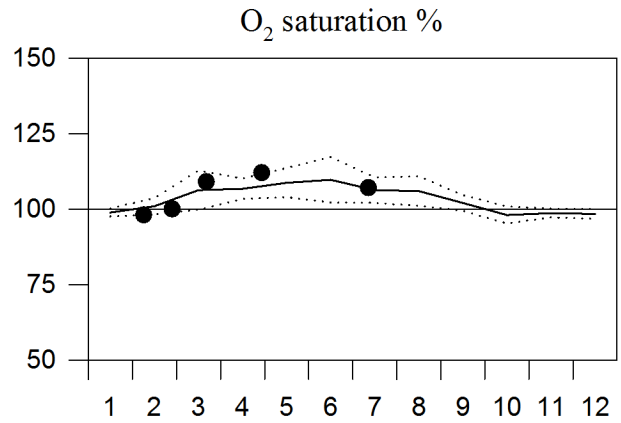
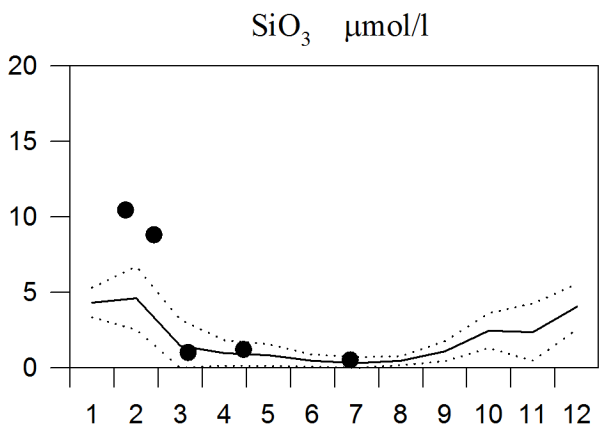
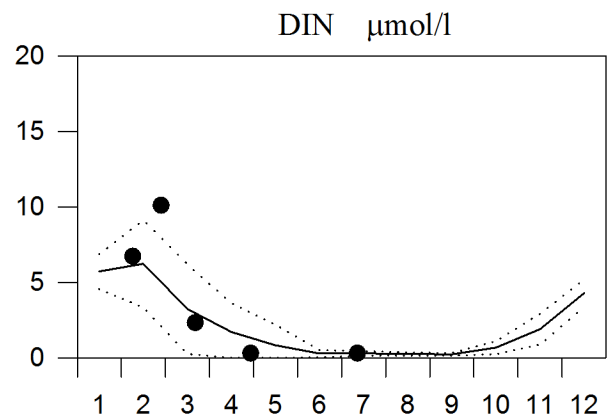
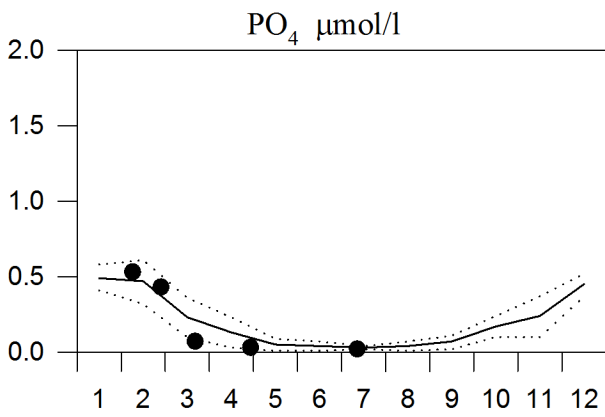
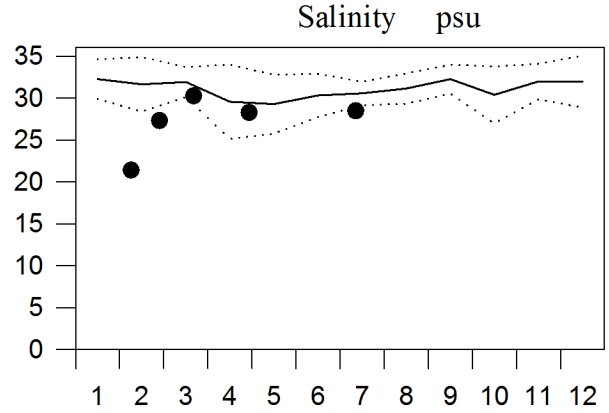
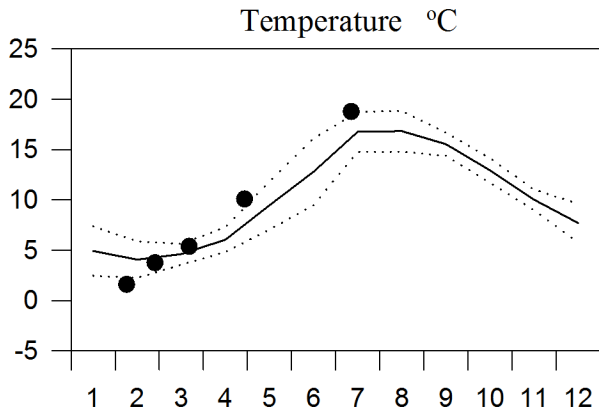
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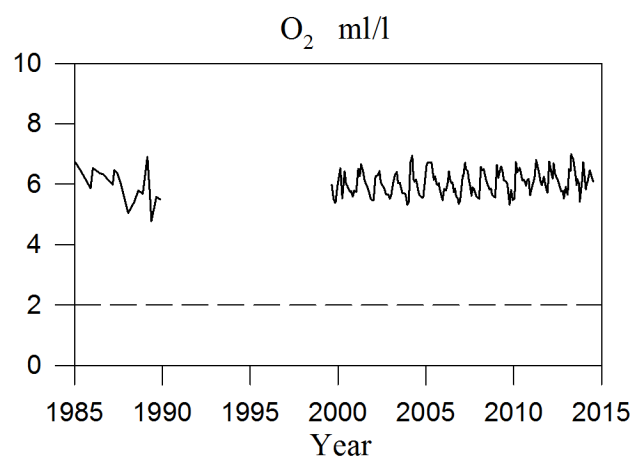
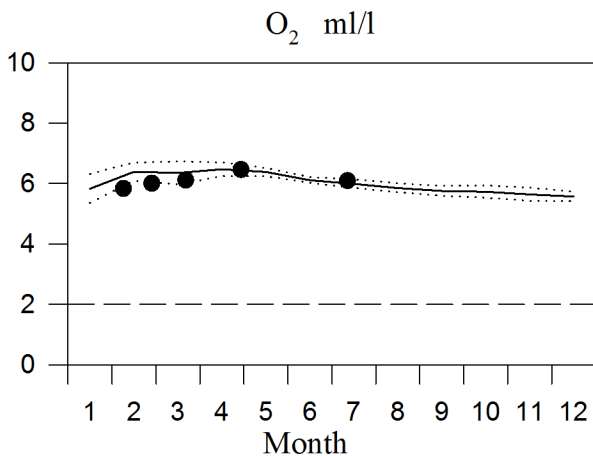
STATION Å17 SURFACE WATER

Annual Cycles

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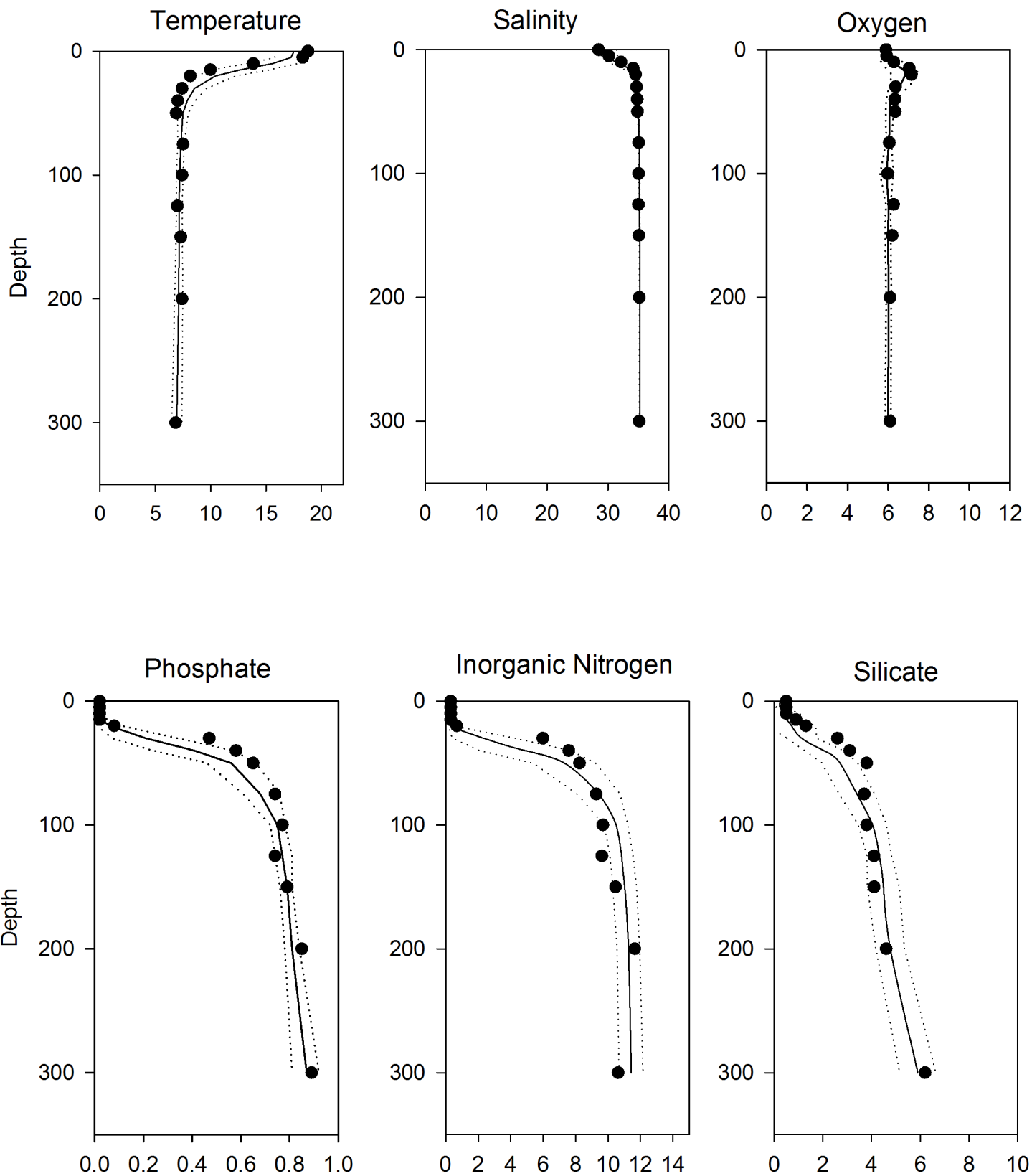


OXYGEN IN BOTTOM WATER (depth = 300m)



Vertical profiles Å17 July

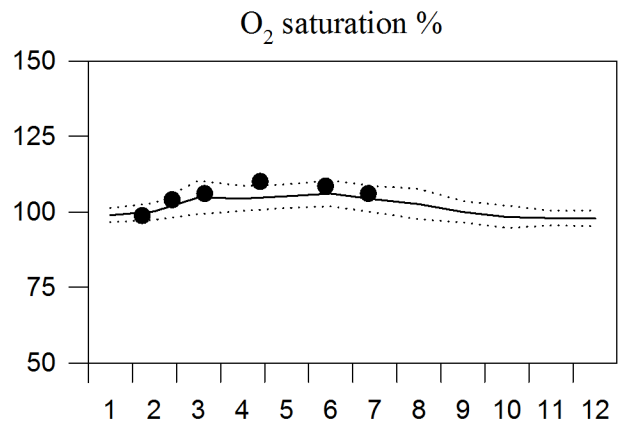
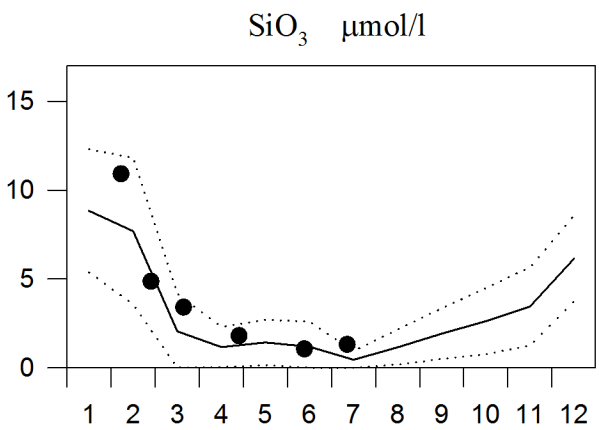
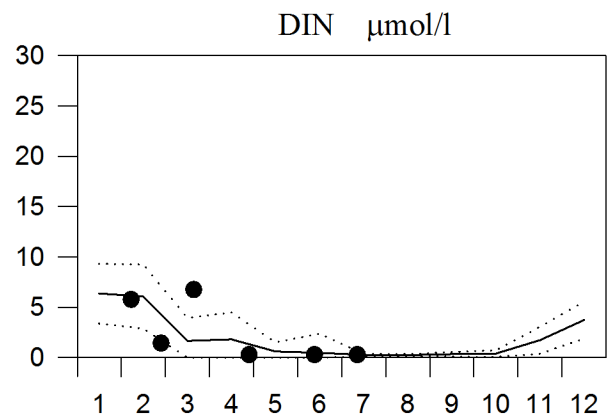
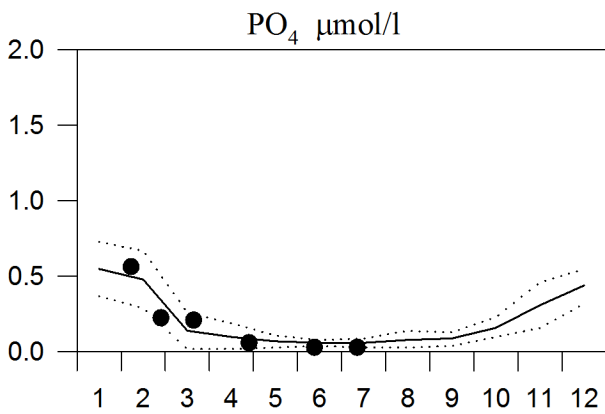
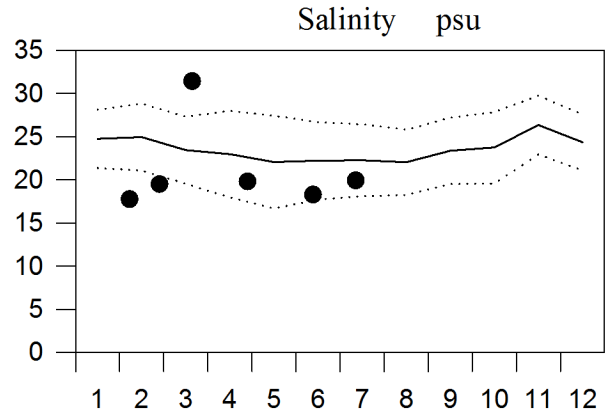
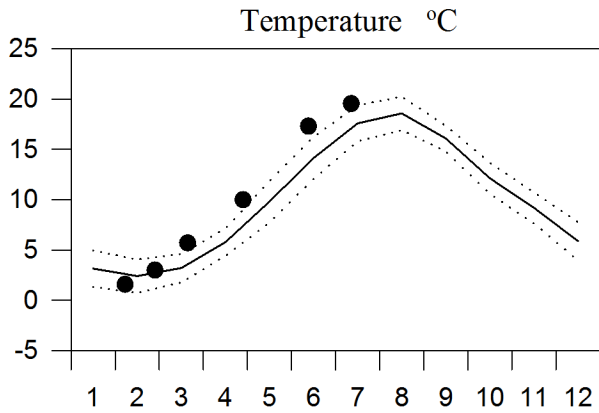
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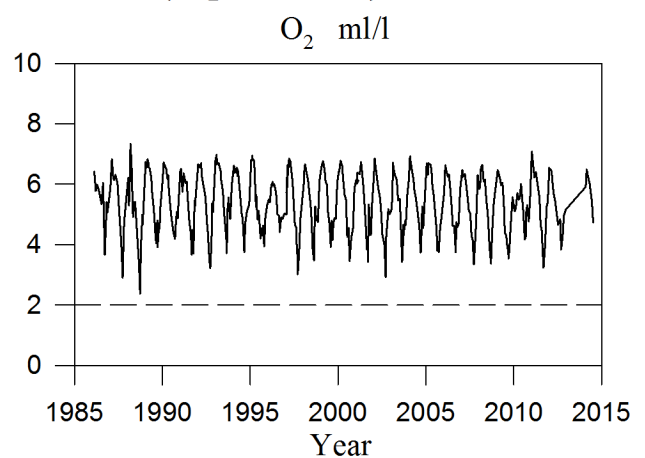
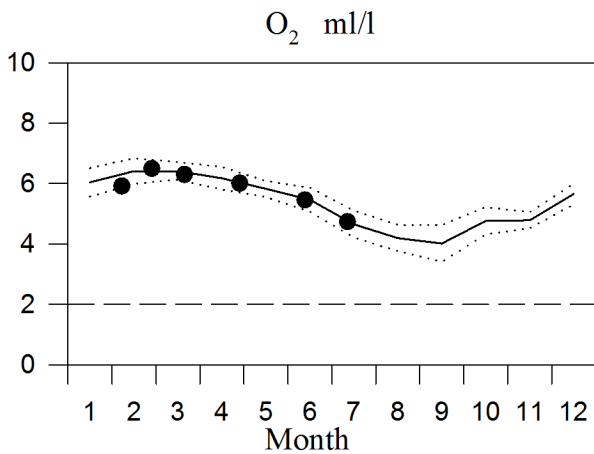
STATION FLADEN SURFACE WATER

Annual Cycles

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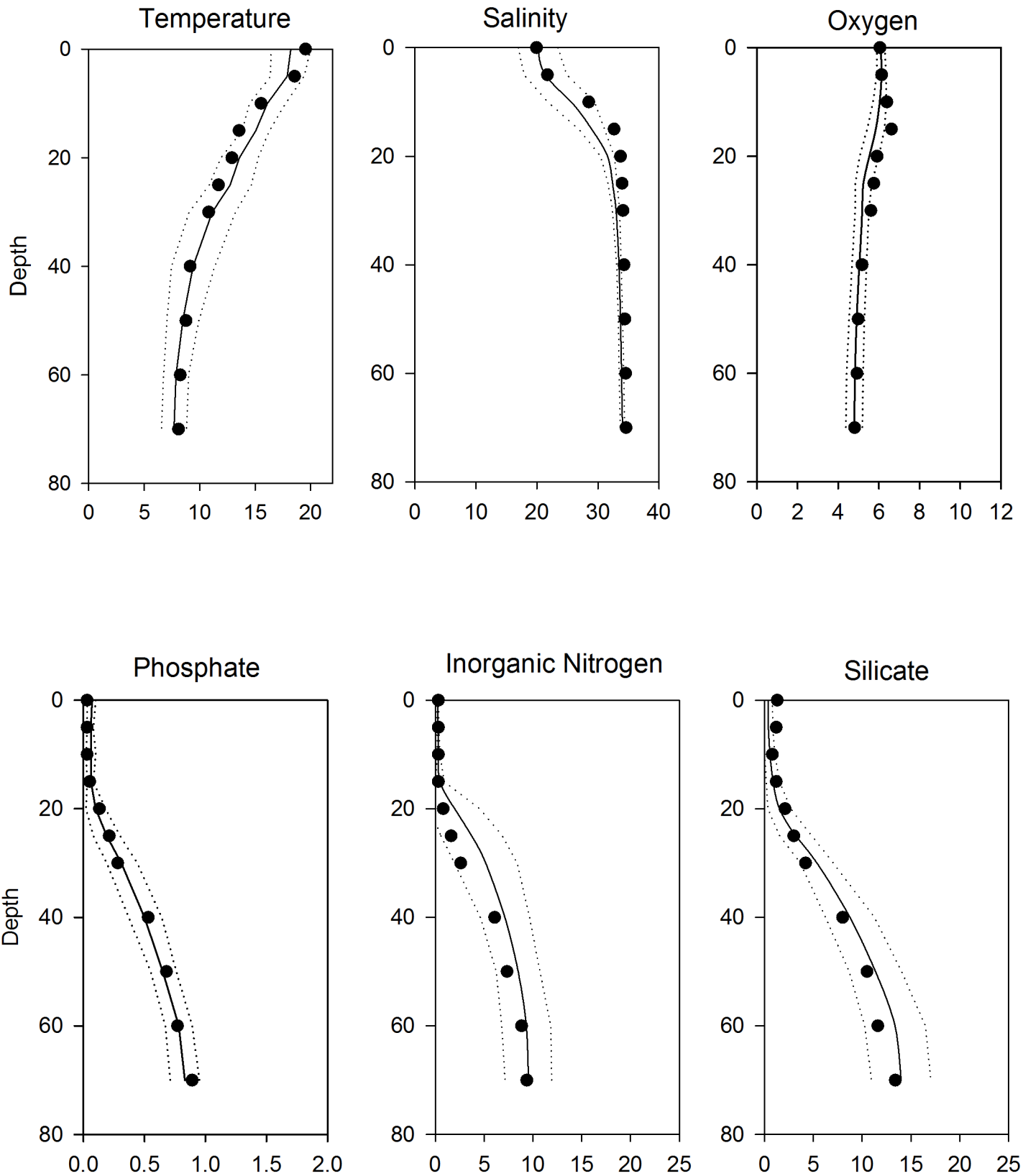


OXYGEN IN BOTTOM WATER (depth > 70m)



Vertical profiles Fladen July

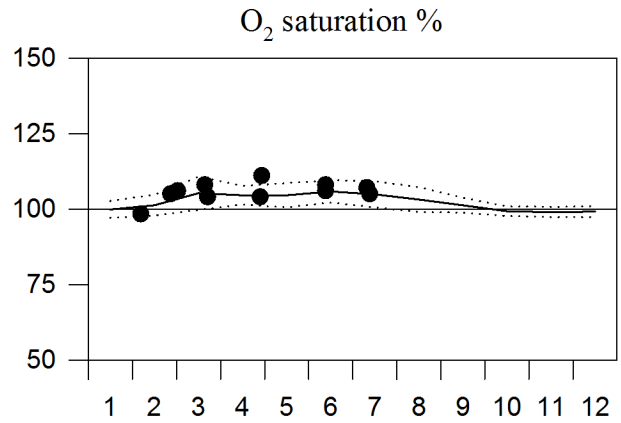
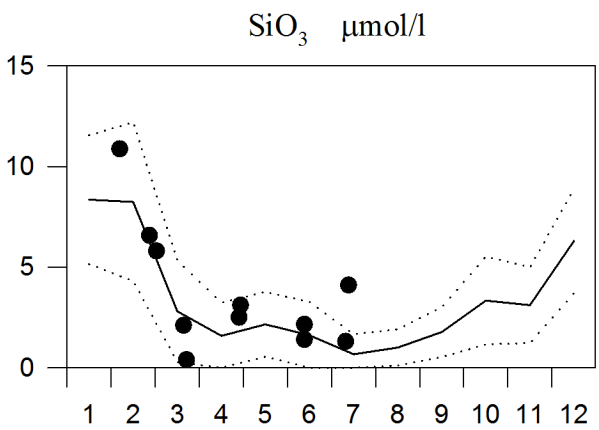
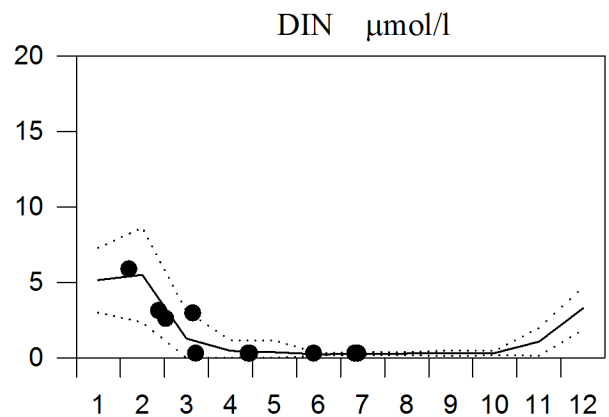
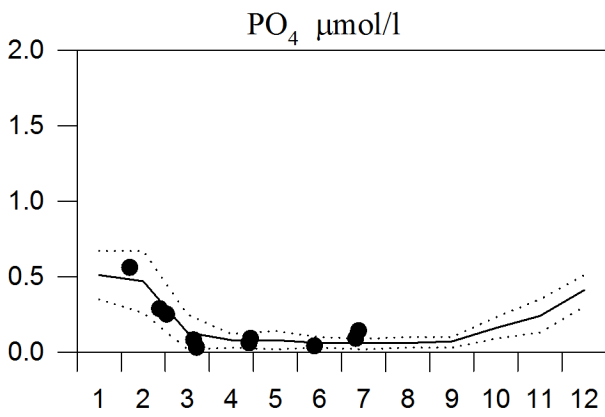
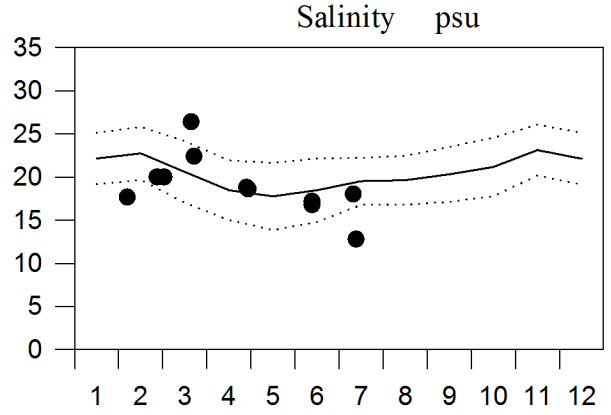
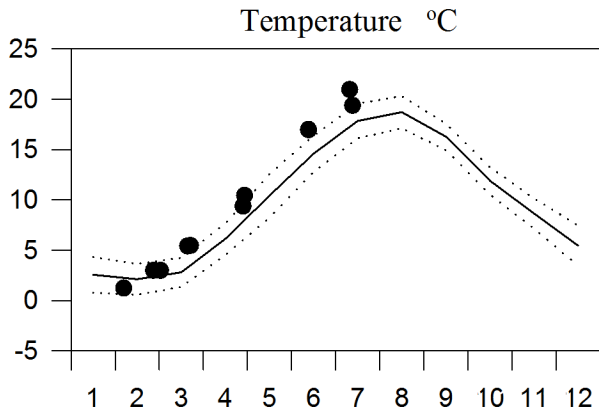
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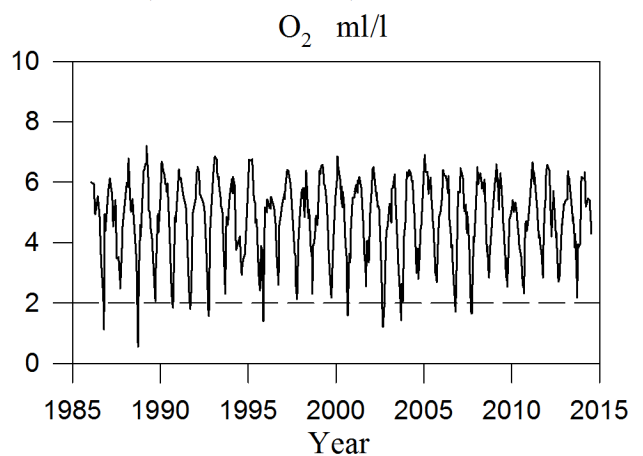
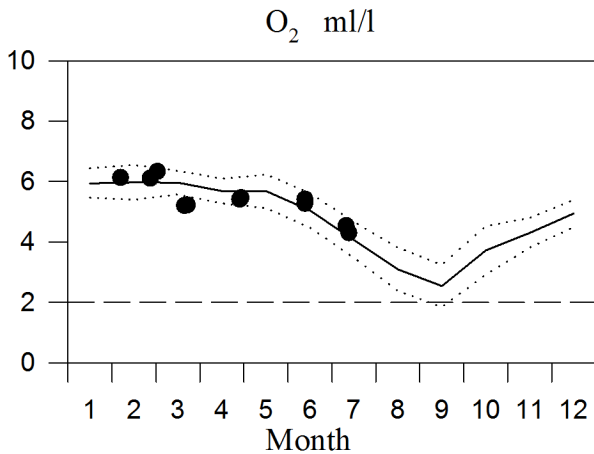
STATION ANHOLT E SURFACE WATER

Annual Cycles

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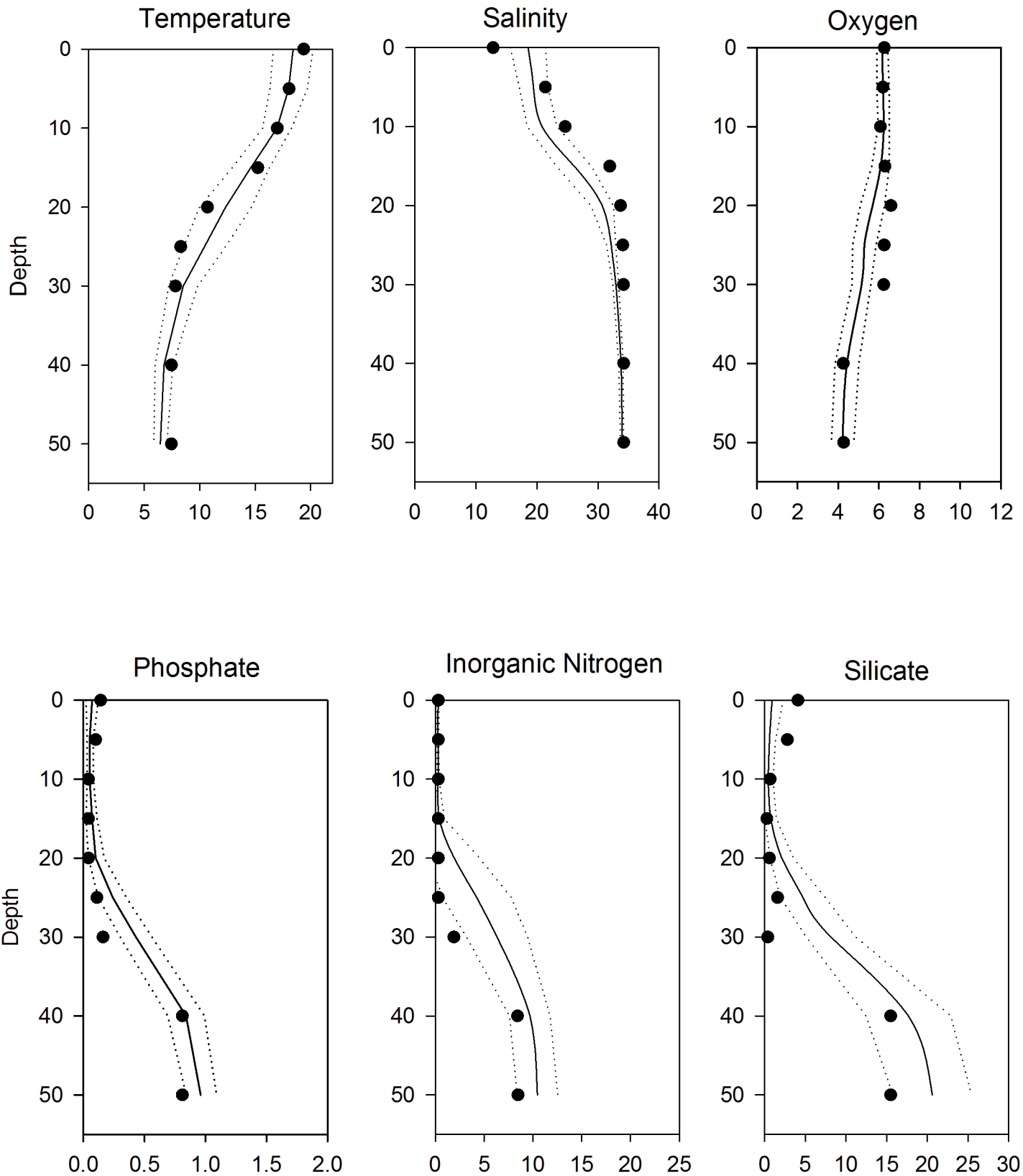


OXYGEN IN BOTTOM WATER (depth > 50m)



Vertical profiles Anholt E July

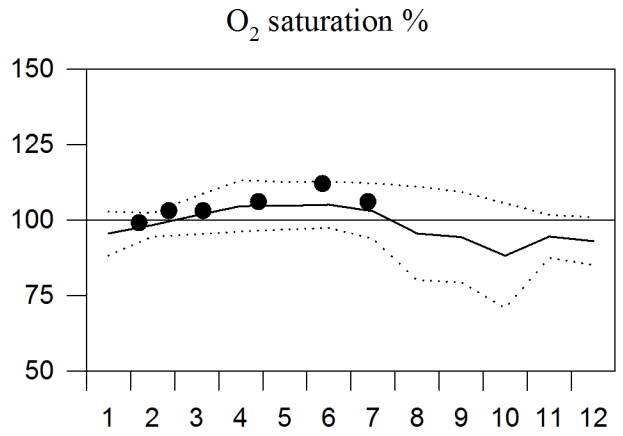
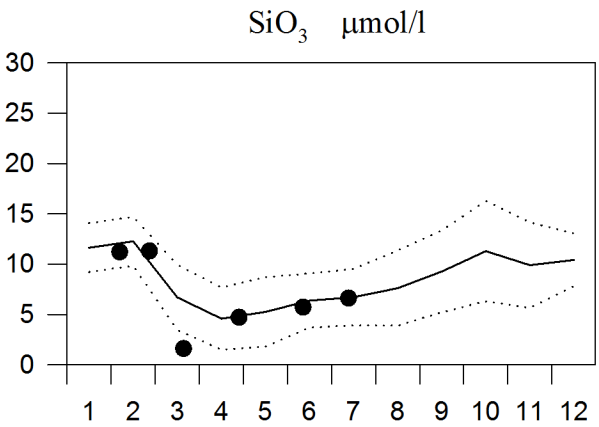
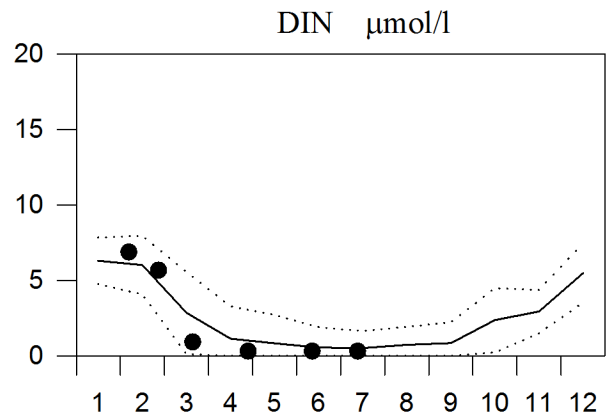
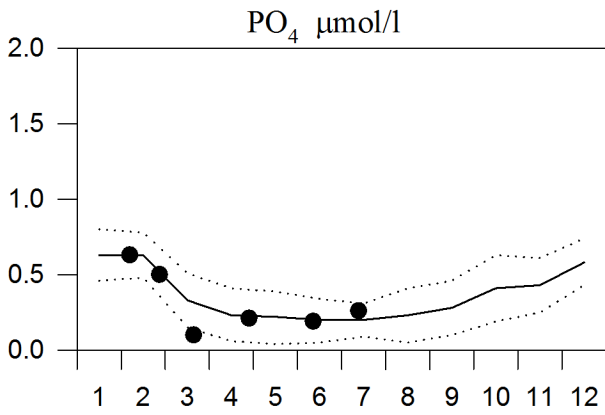
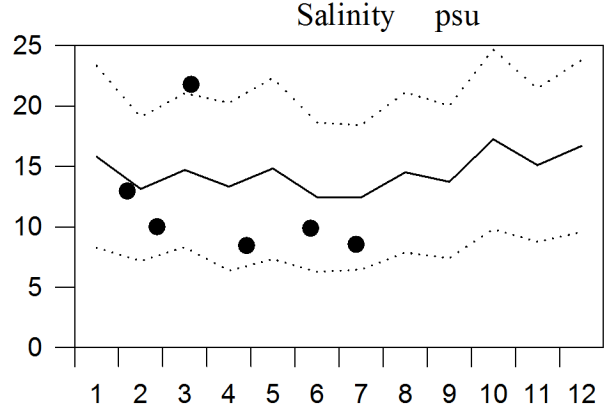
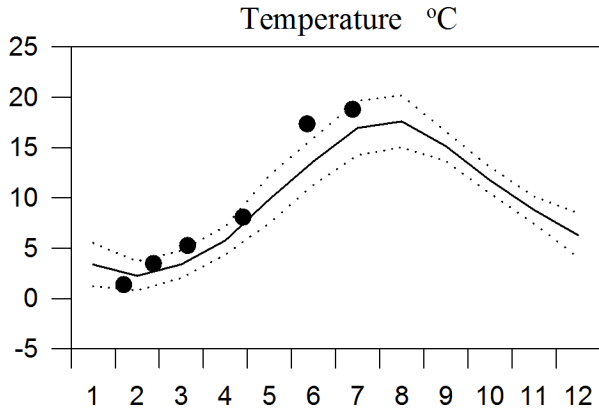
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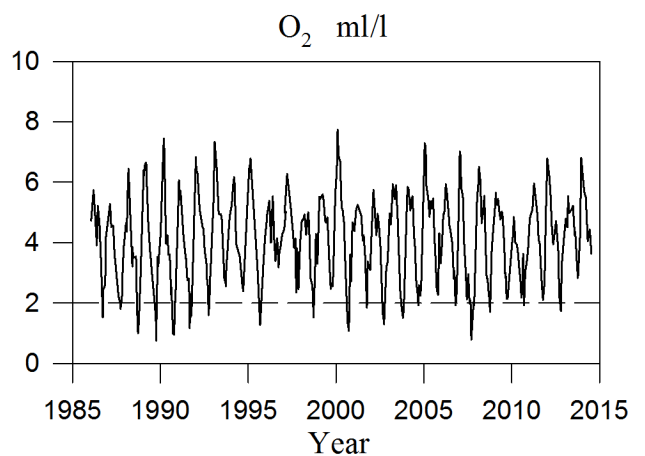
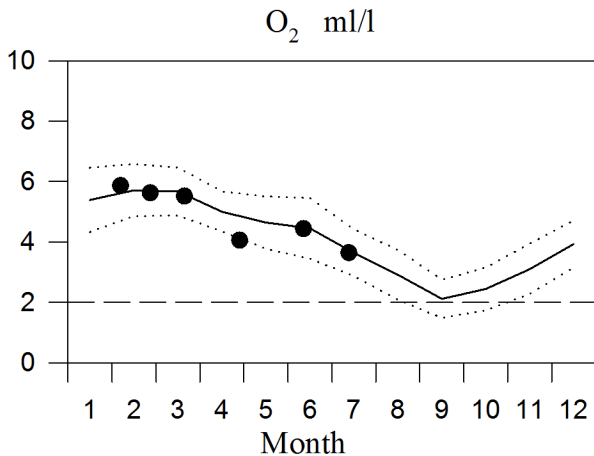
STATION W LANDSKRONA SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

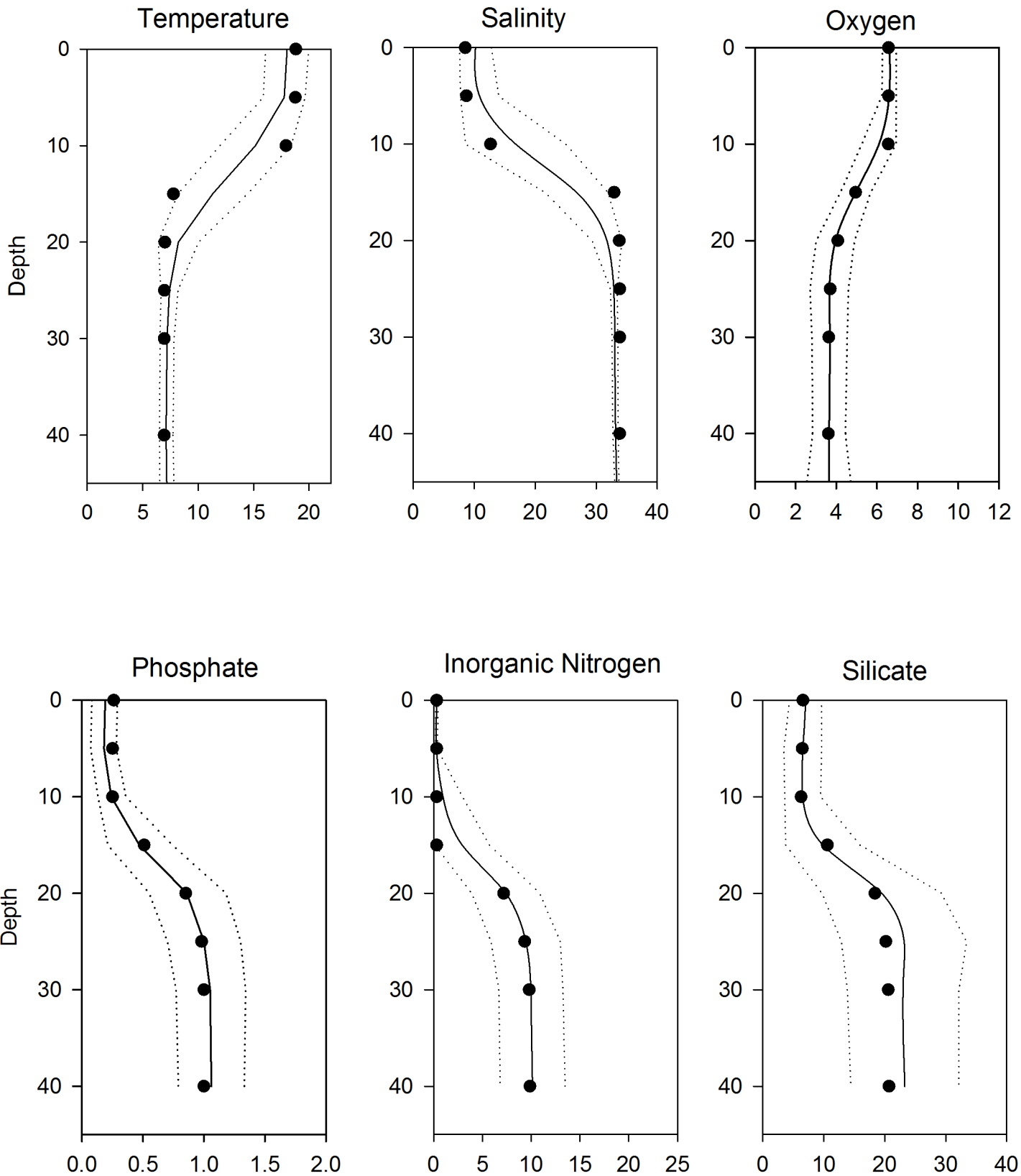


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles W Landskrona July

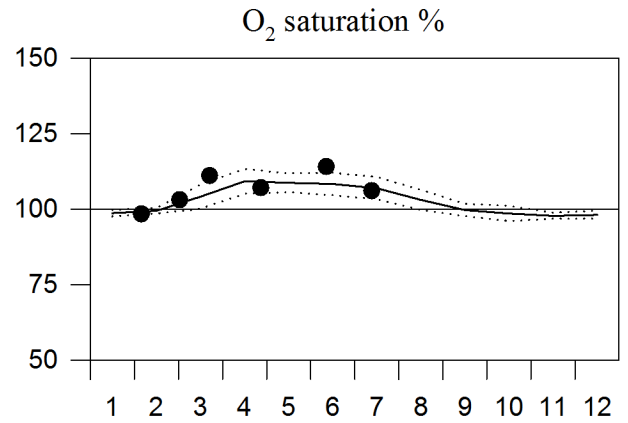
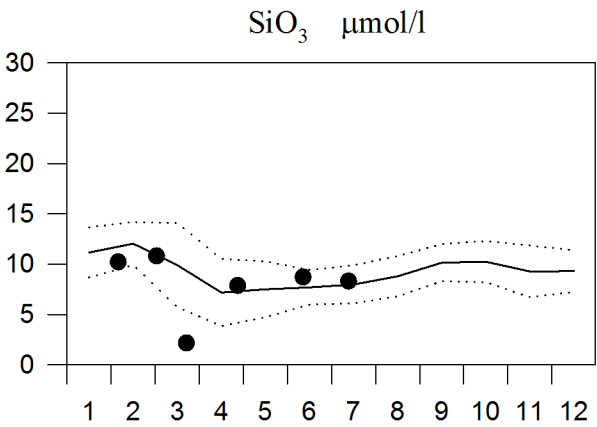
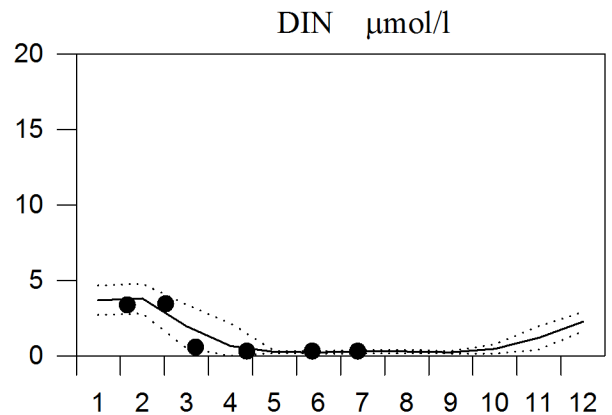
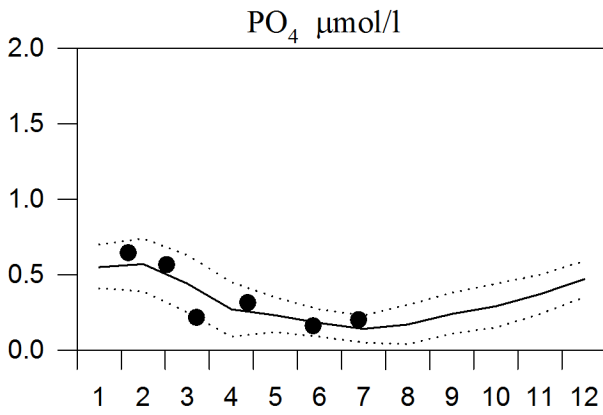
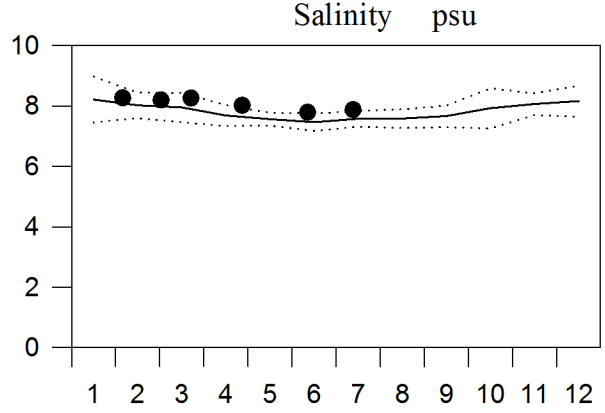
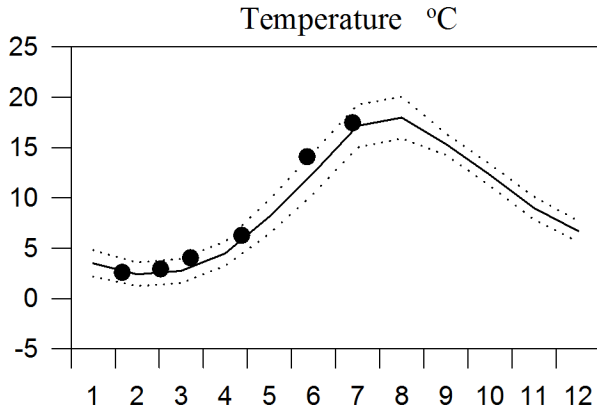
— Mean 1996-2010 St.Dev. ● 2014



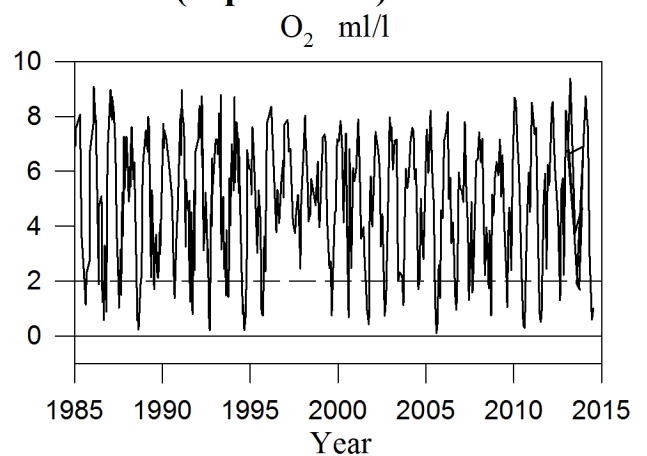
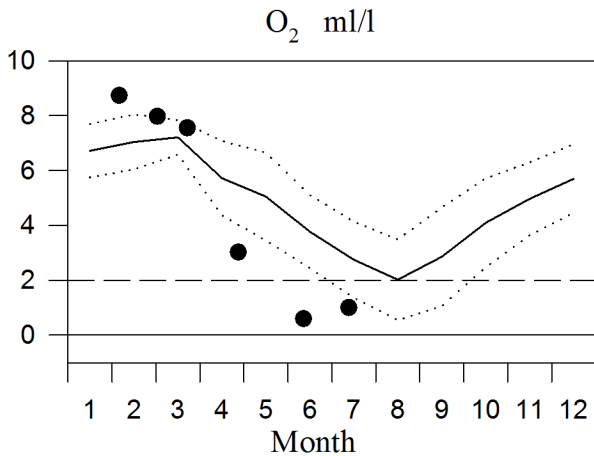
STATION BY1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

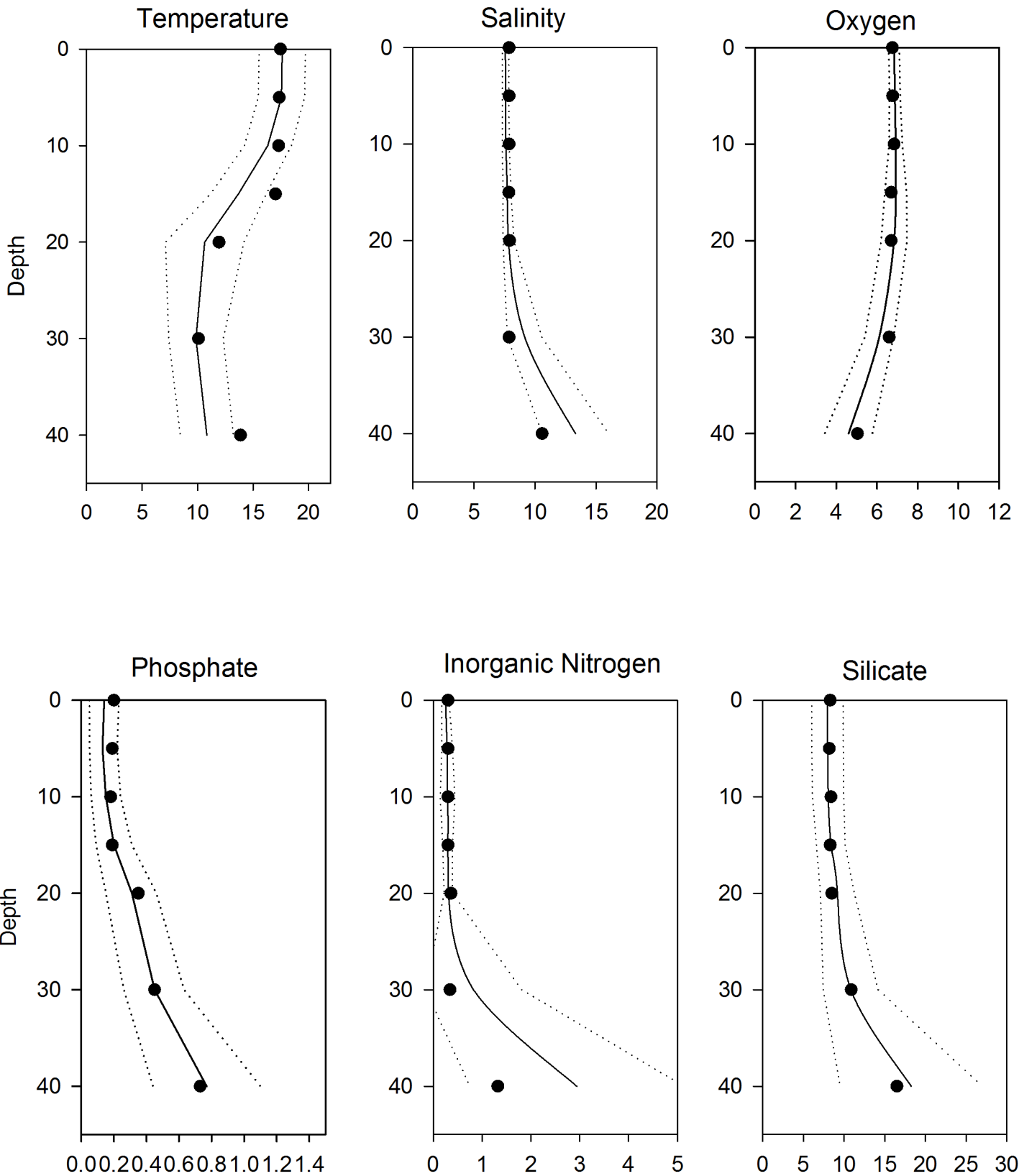


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY1 July

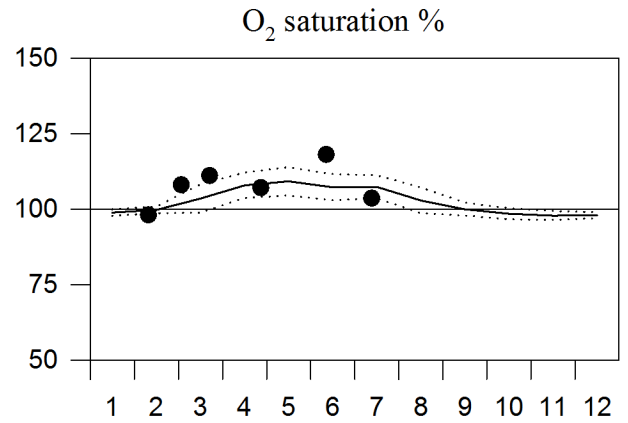
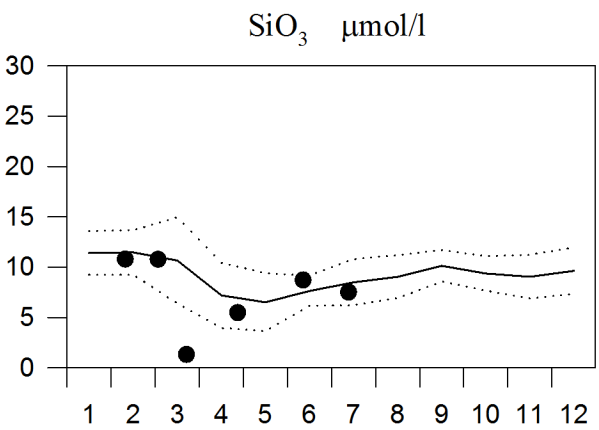
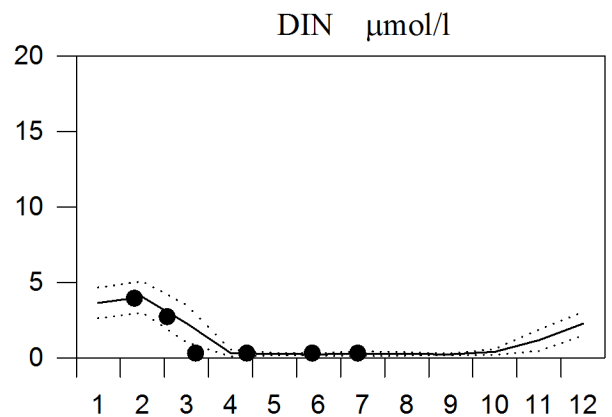
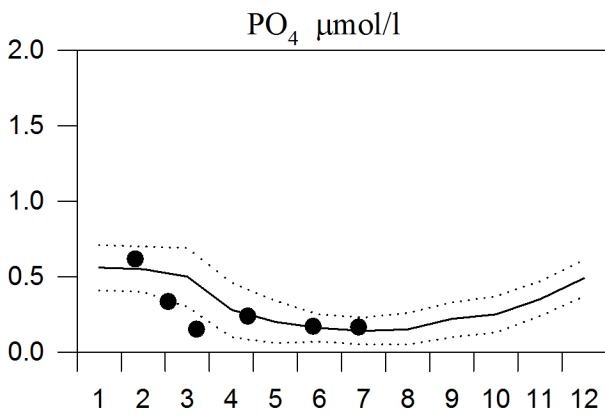
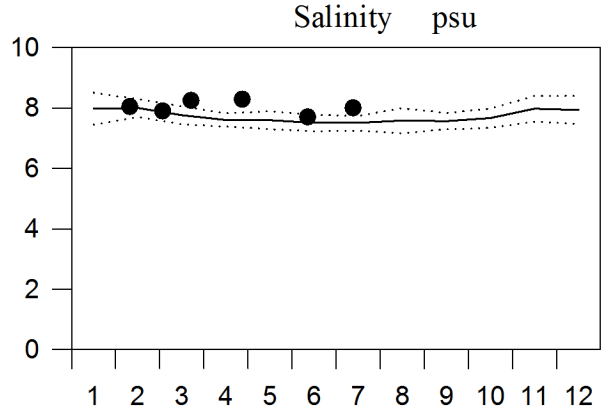
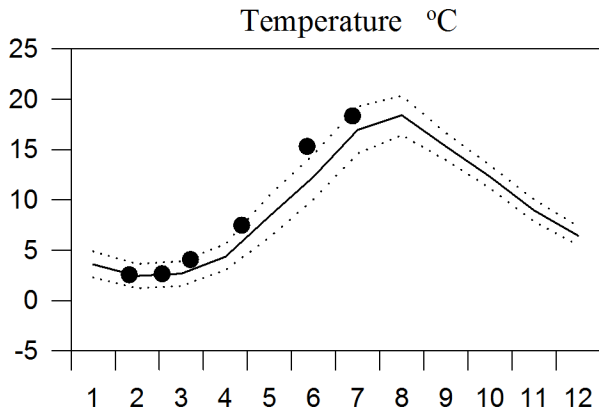
— Mean 1996-2010 ····· St.Dev. ● 2014



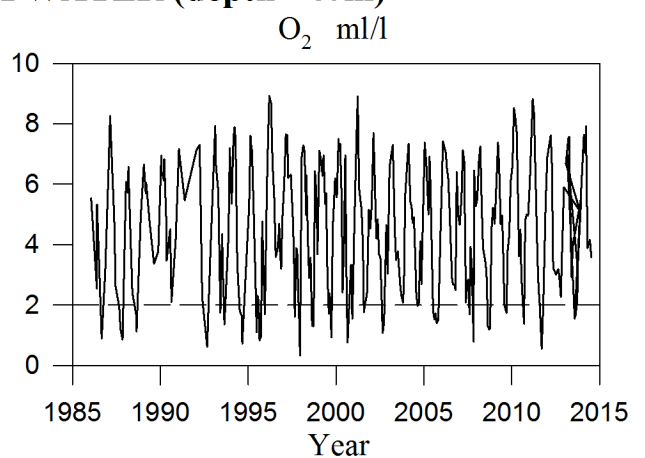
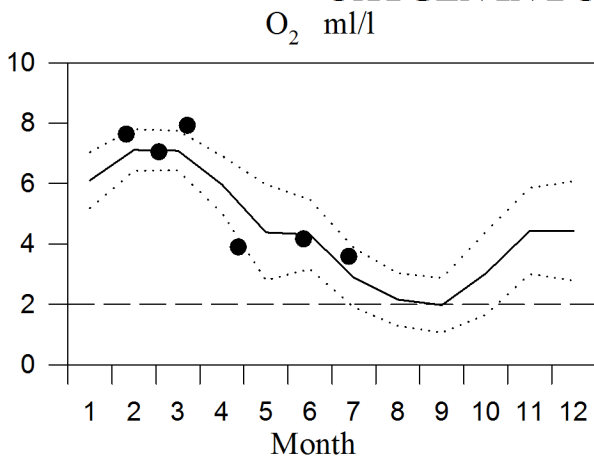
STATION BY2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

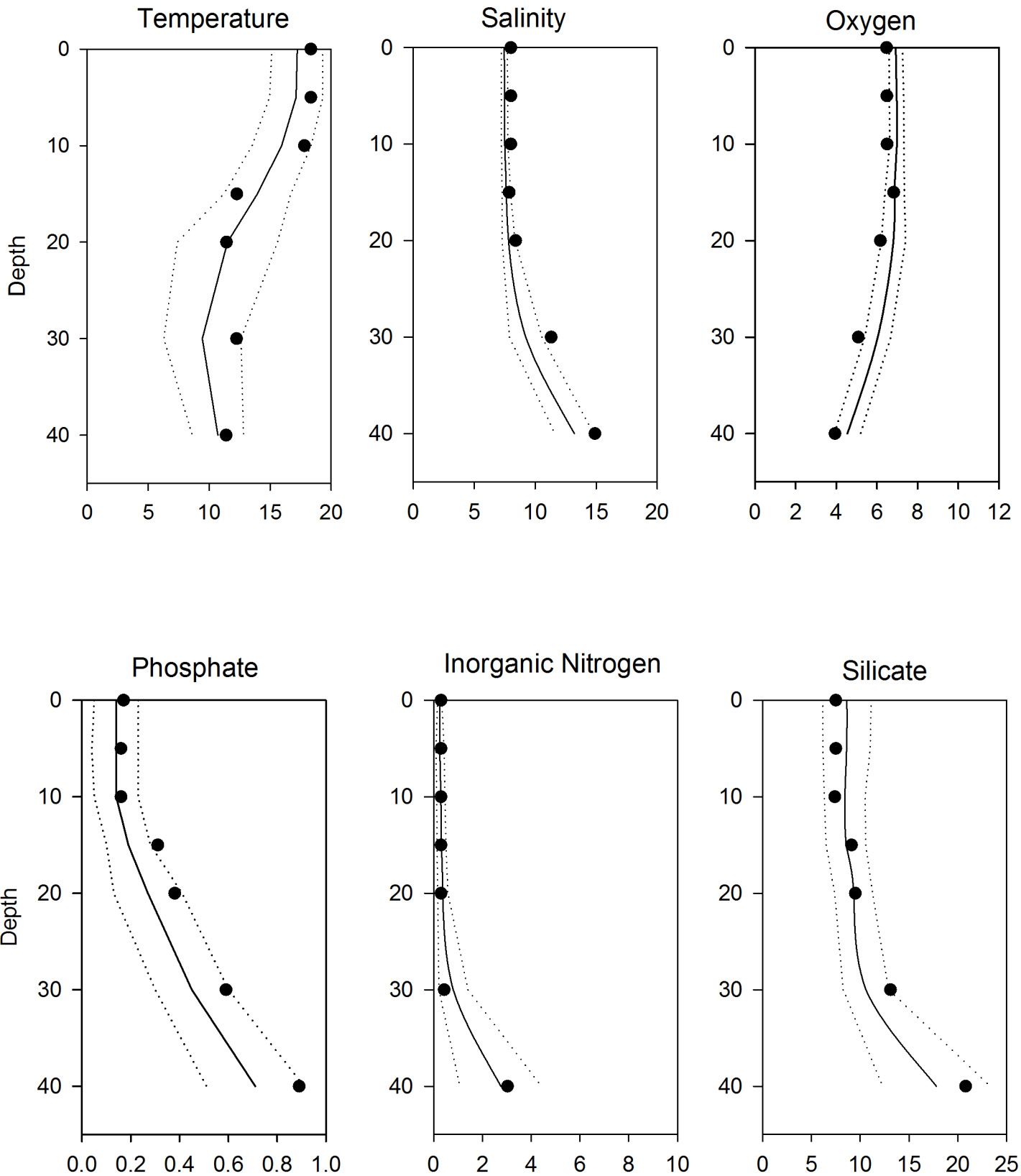


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY2 July

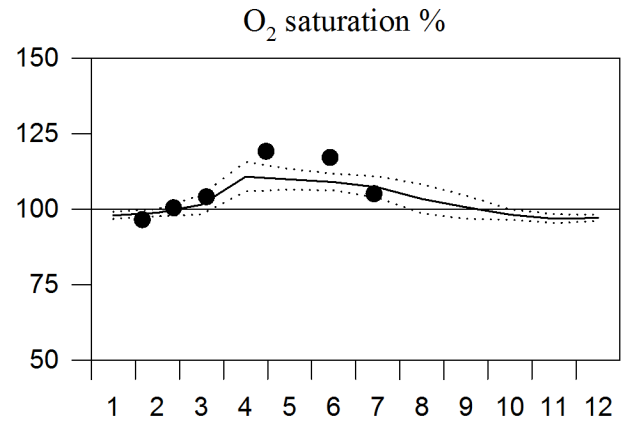
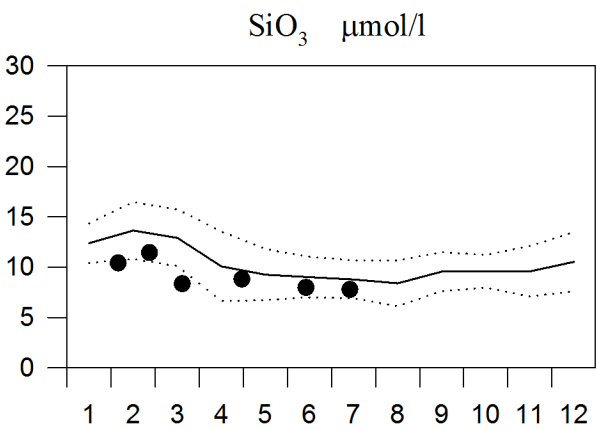
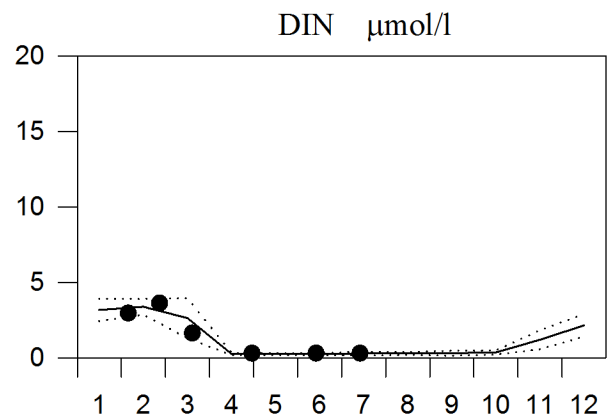
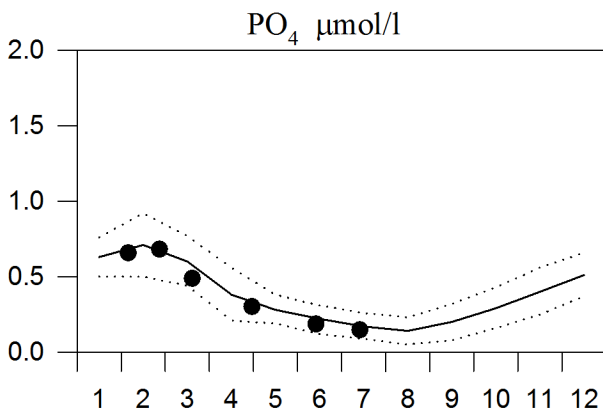
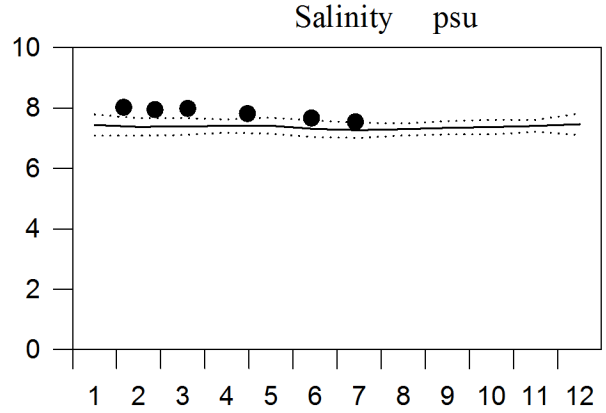
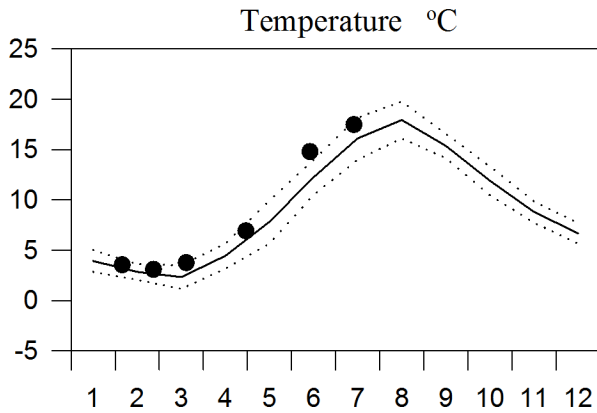
— Mean 1996-2010 ····· St.Dev. ● 2014



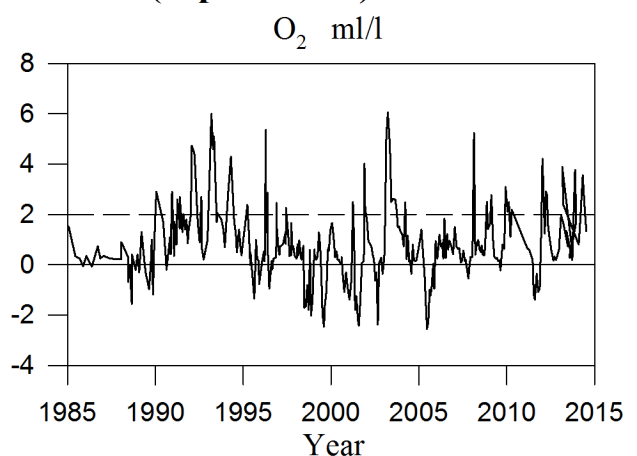
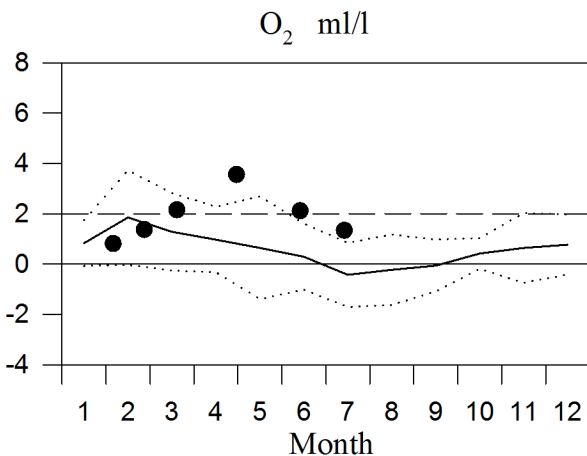
STATION HANÖBUKTEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

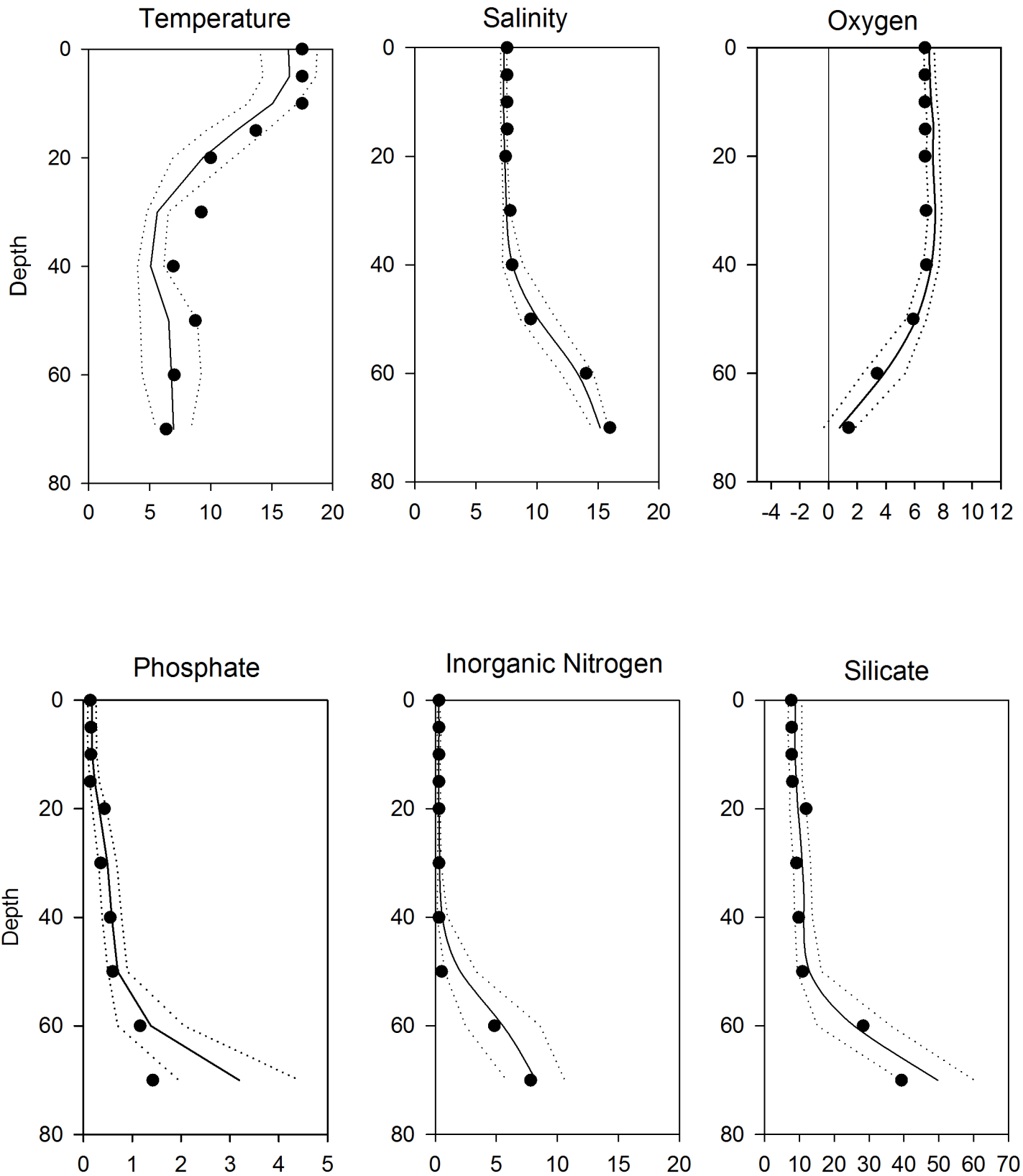


OXYGEN IN BOTTOM WATER (depth > 70m)



Vertical profiles Hanöbukten July

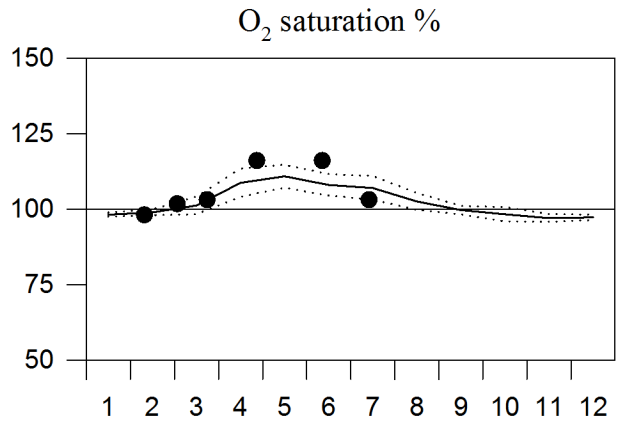
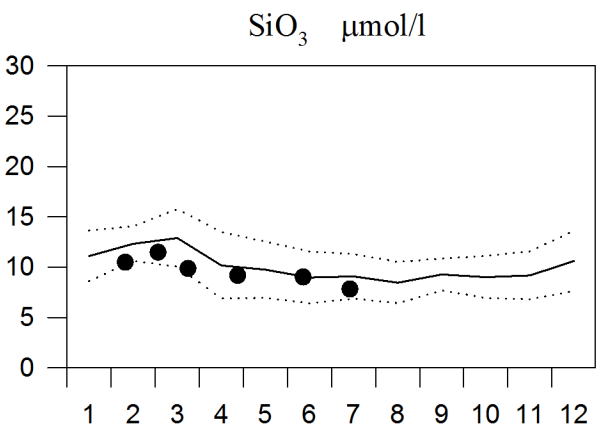
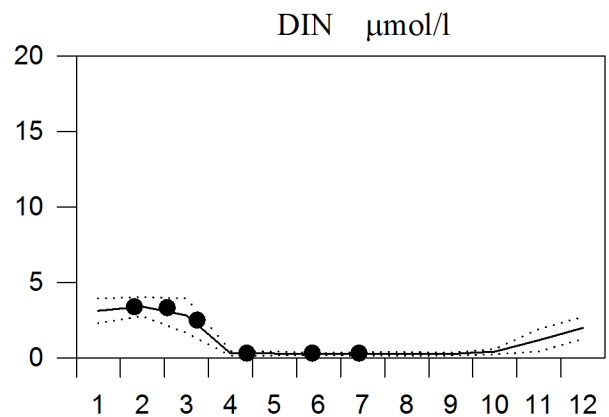
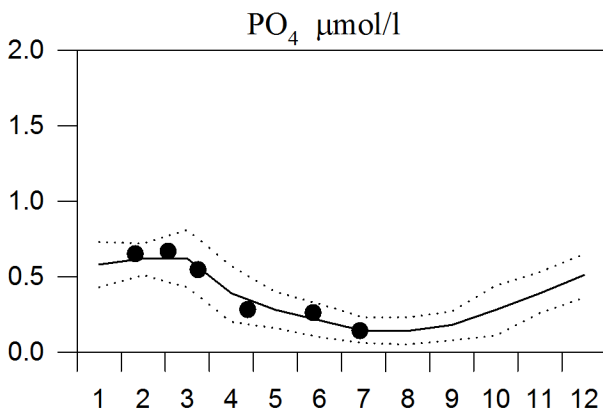
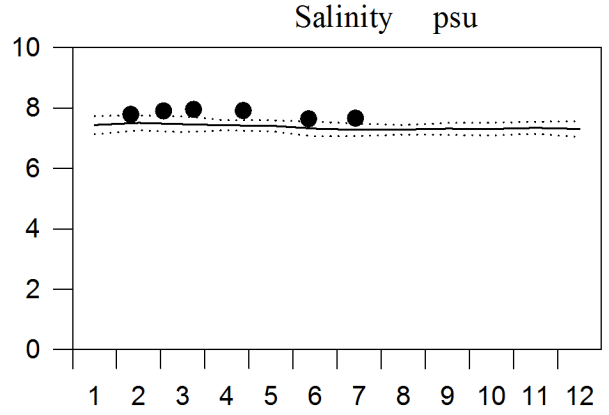
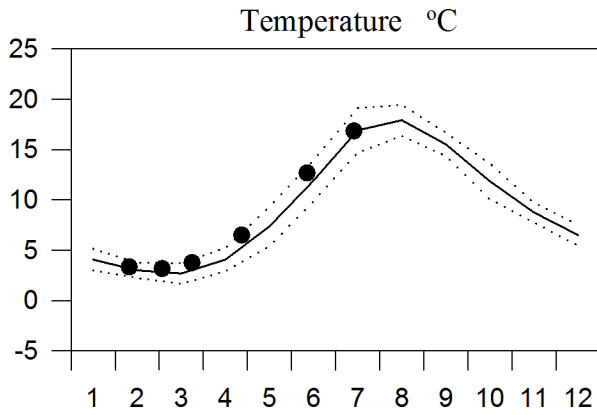
— Mean 1996-2010 ····· St.Dev. ● 2014



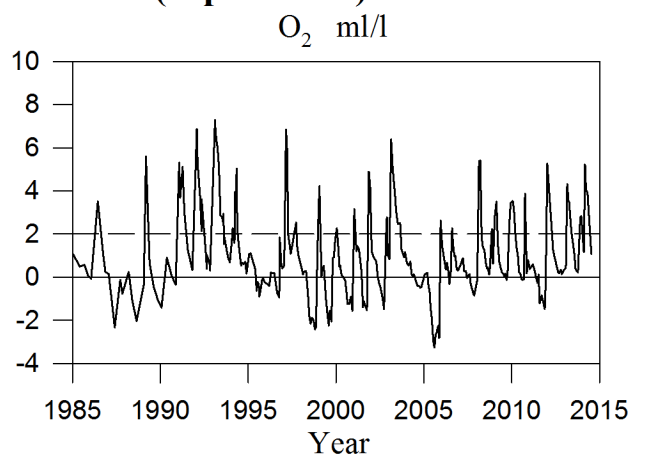
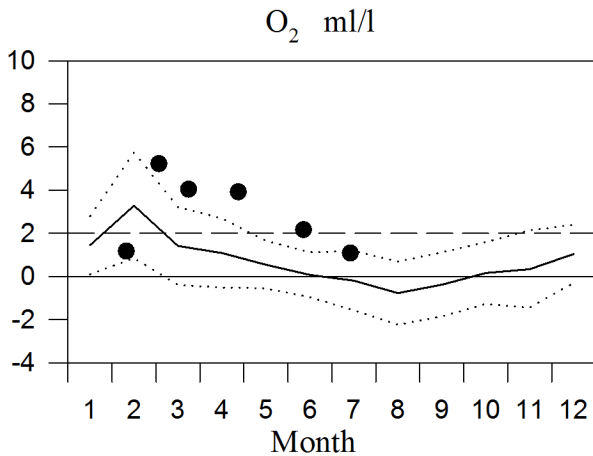
STATION BY4 SURFACE WATER

Annual Cycles

— Mean 1996-2010 ····· St.Dev. ● 2014

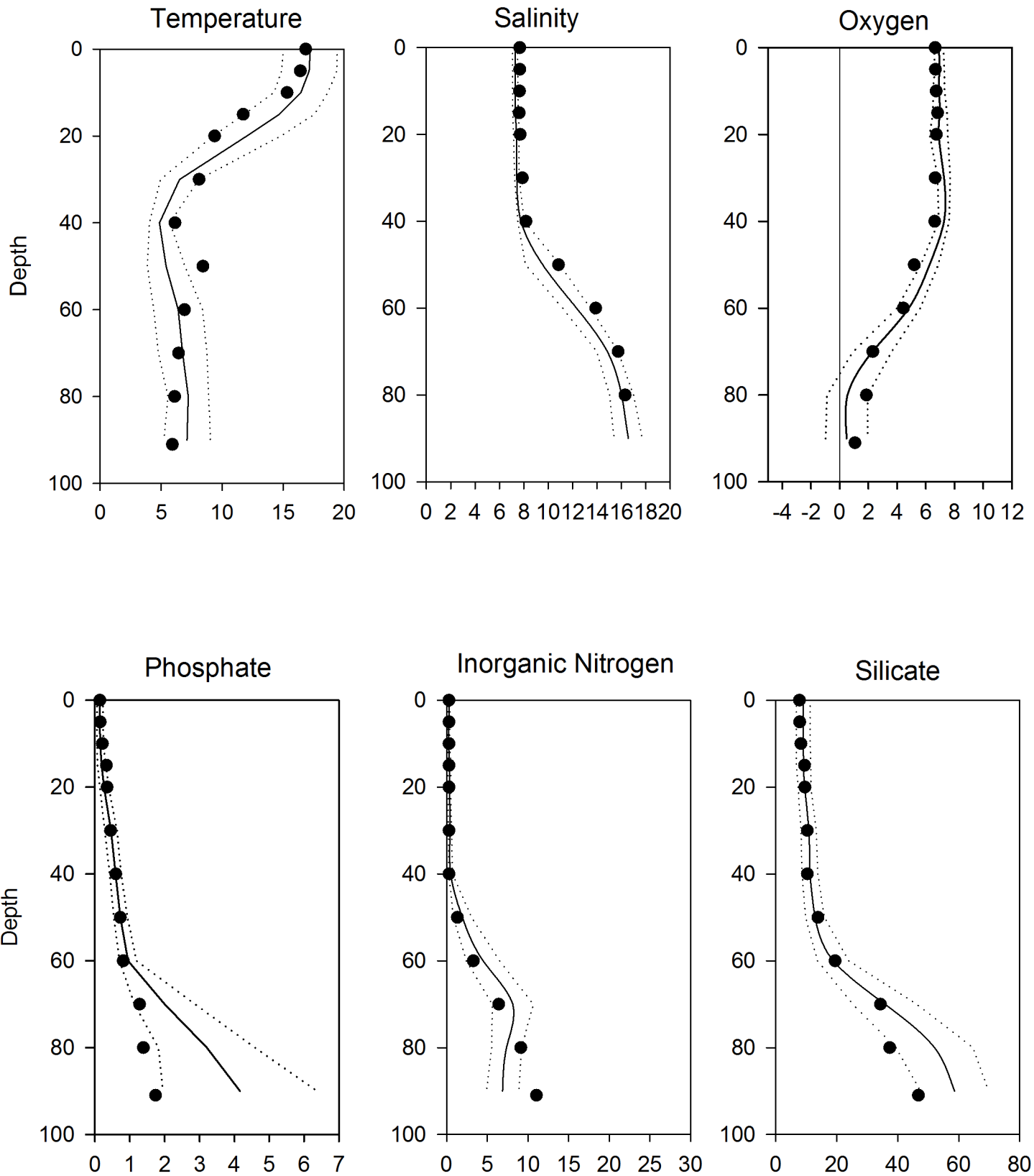


OXYGEN IN BOTTOM WATER (depth >80m)



Vertical profiles BY4 July

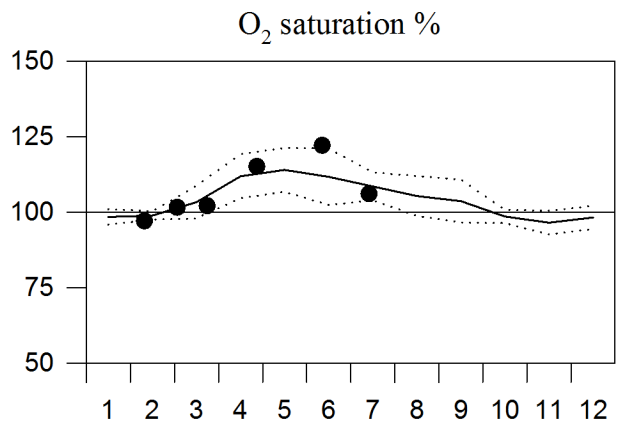
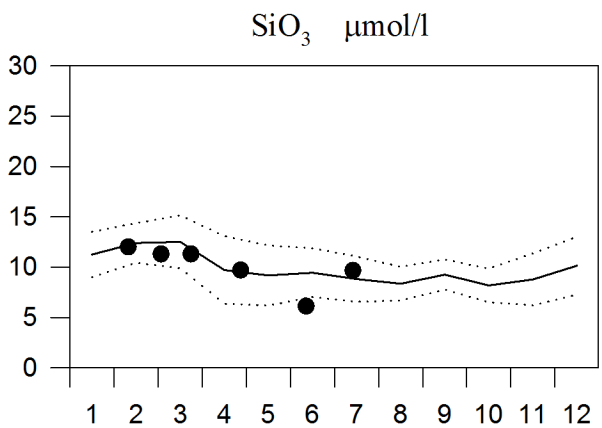
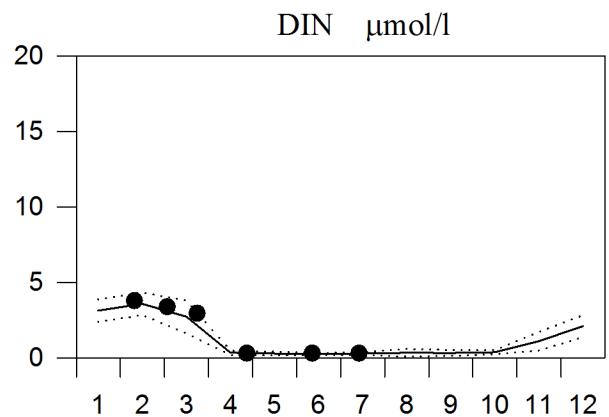
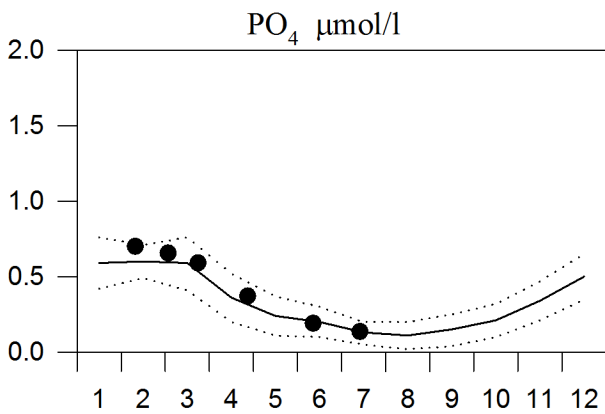
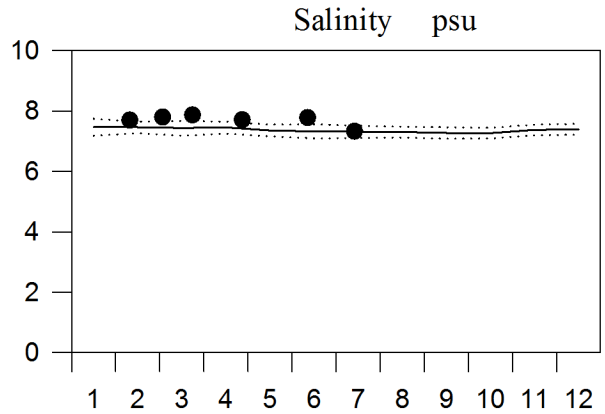
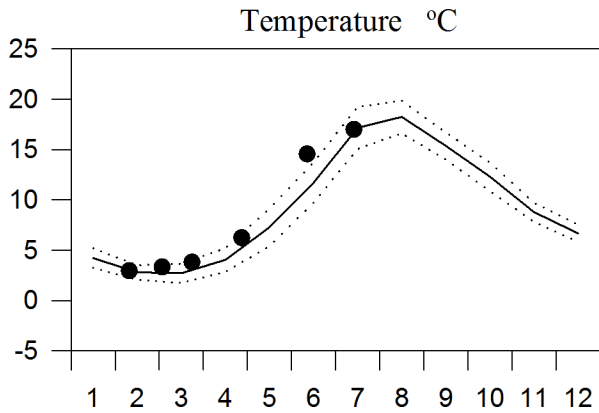
— Mean 1996-2010 ····· St.Dev. ● 2014



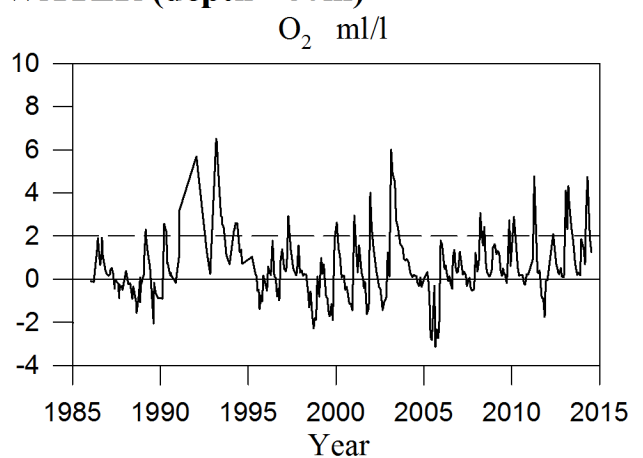
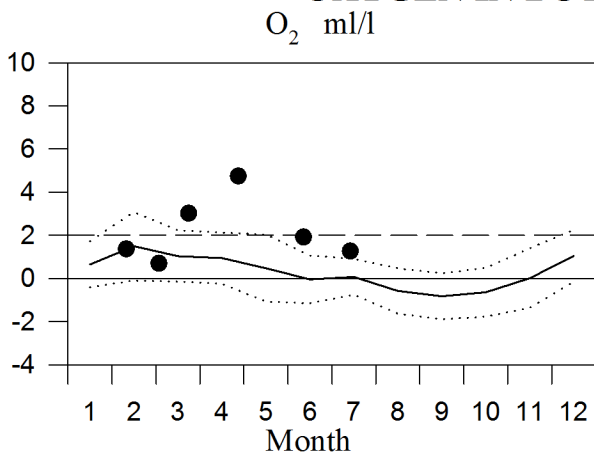
STATION BY5 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

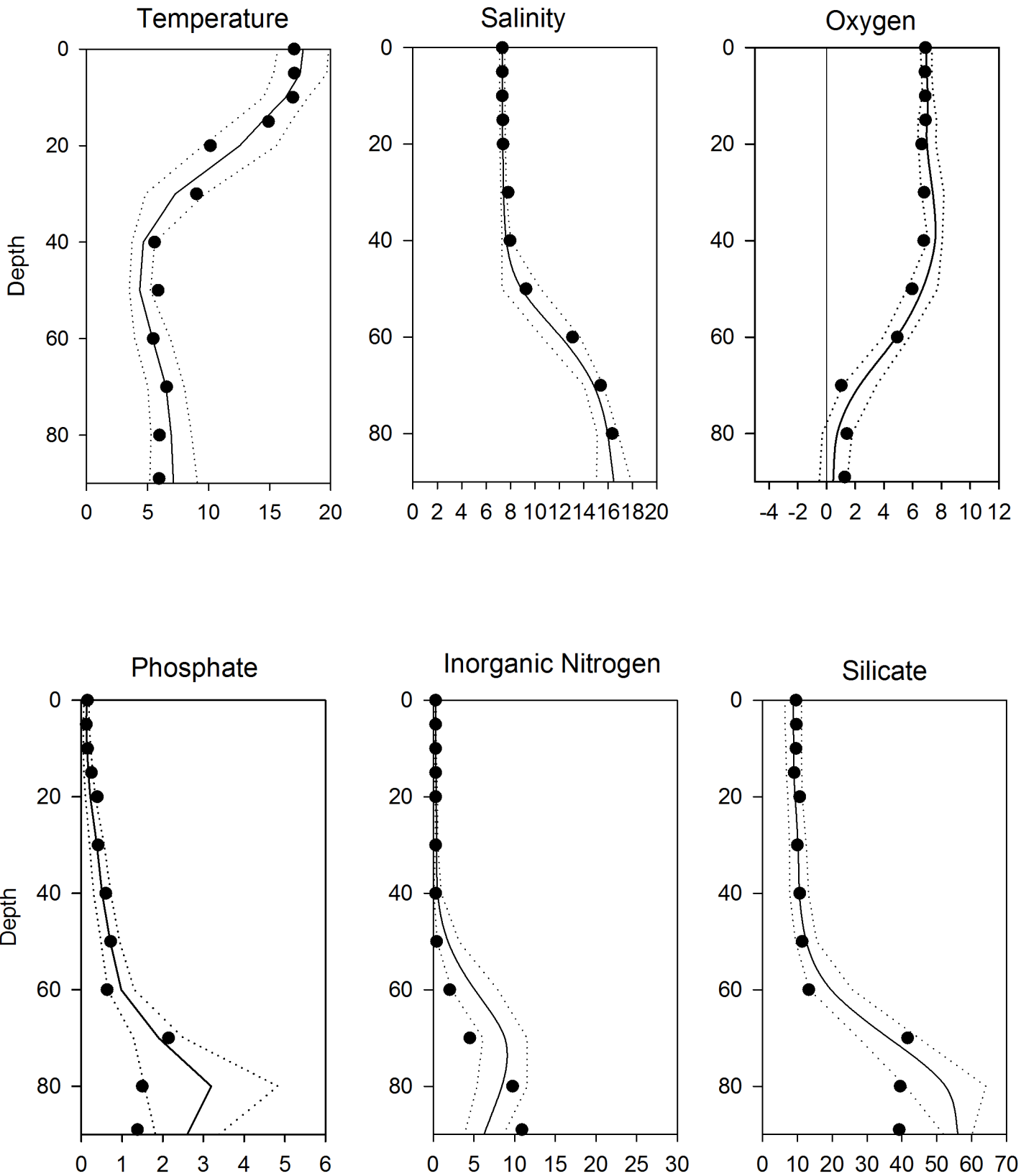


OXYGEN IN BOTTOM WATER (depth >80m)



Vertical profiles BY5 July

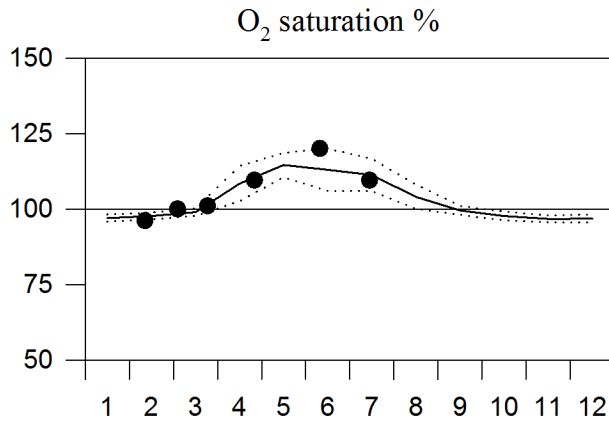
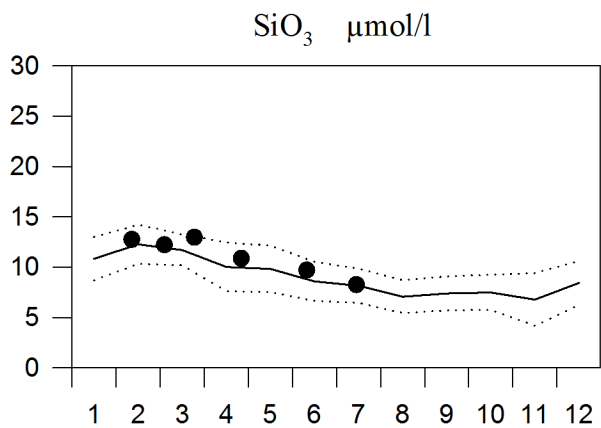
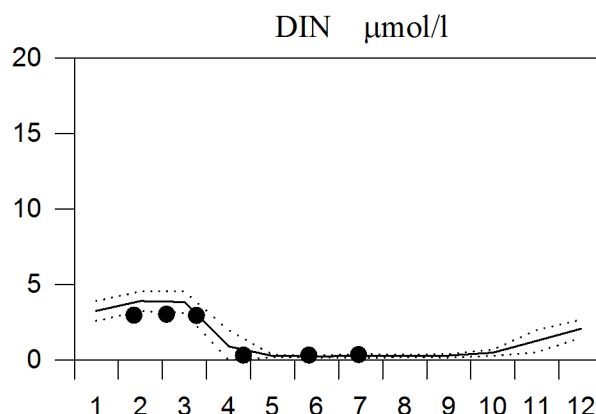
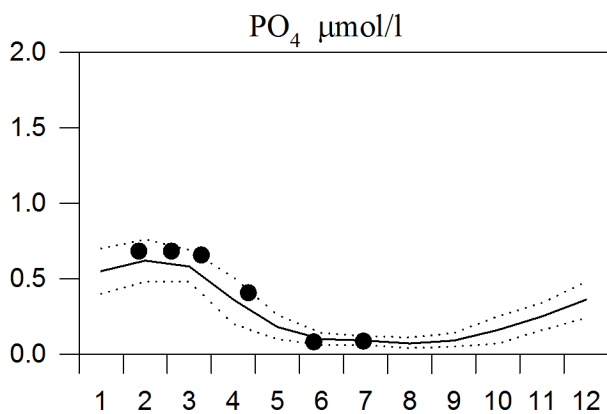
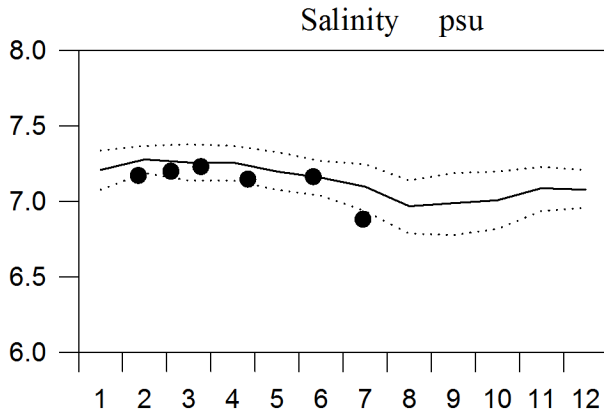
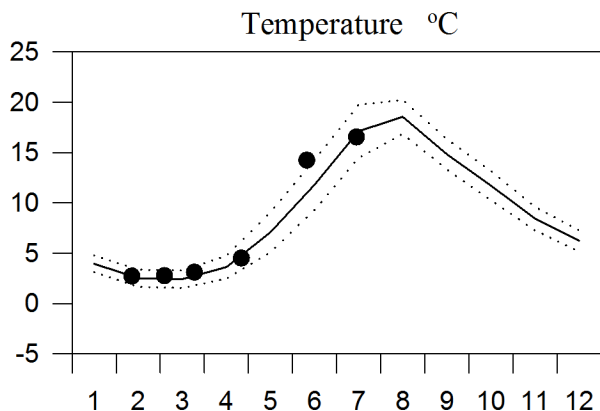
— Mean 1996-2010 ····· St.Dev. ● 2014



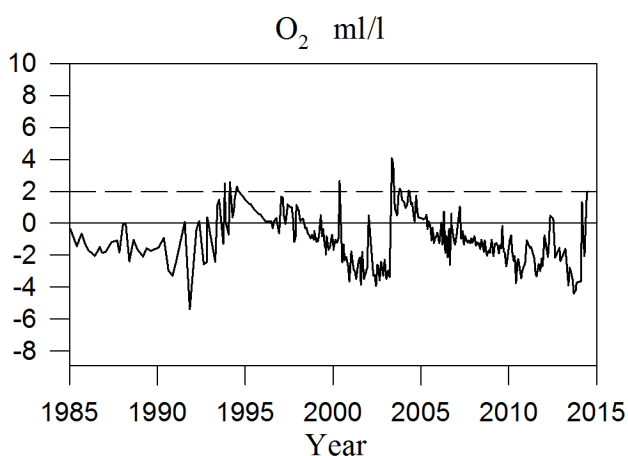
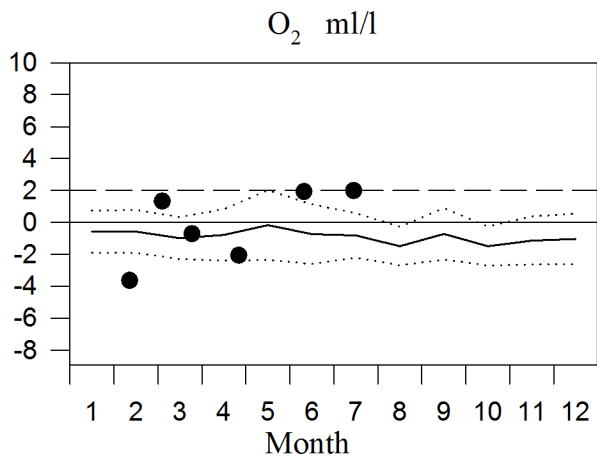
STATION BY10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 ····· St.Dev. ● 2014

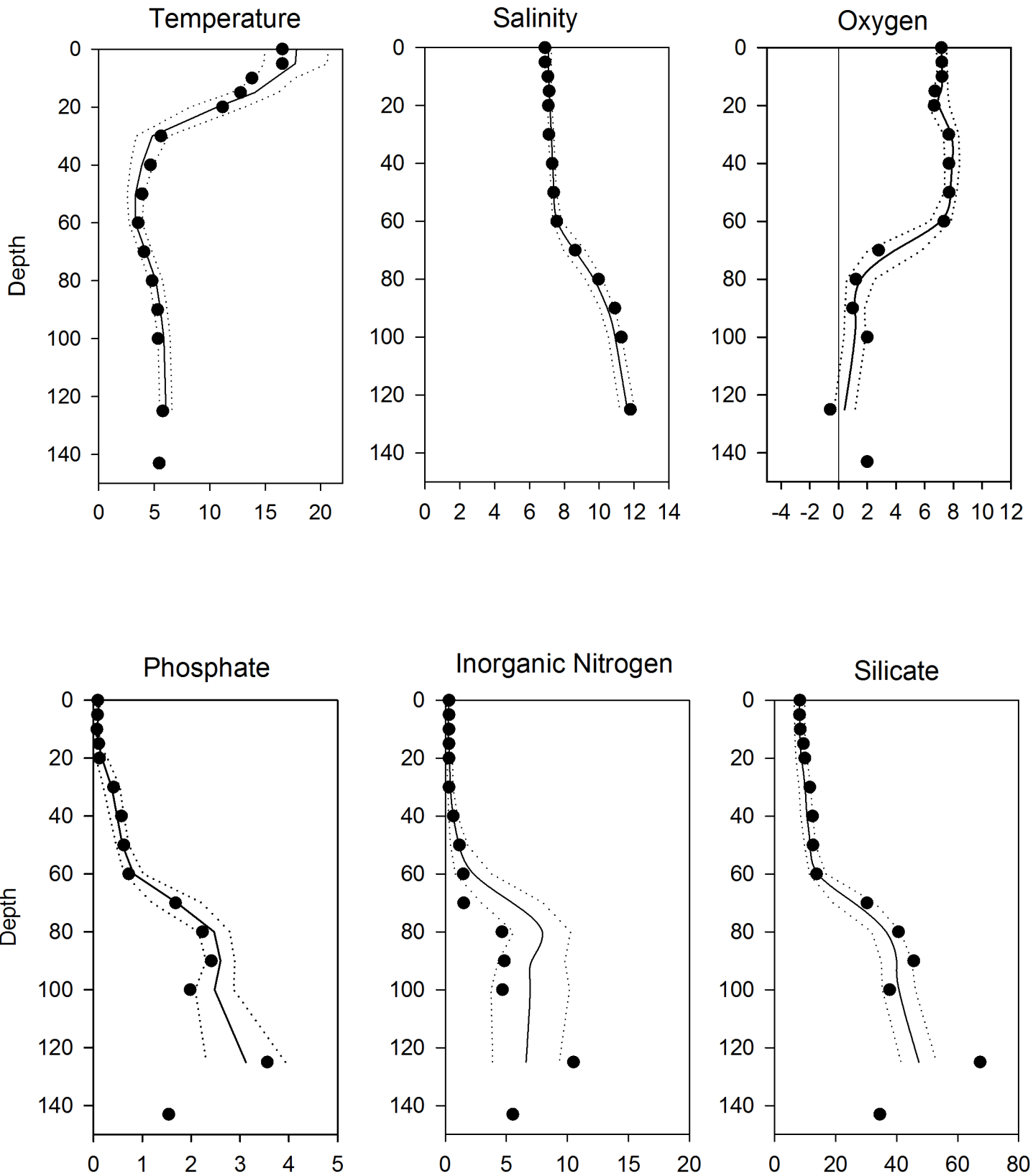


OXYGEN IN BOTTOM WATER (depth >125m)



Vertical profiles BY10 July

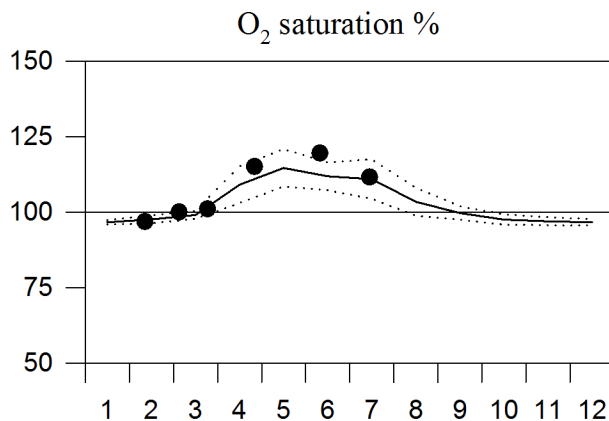
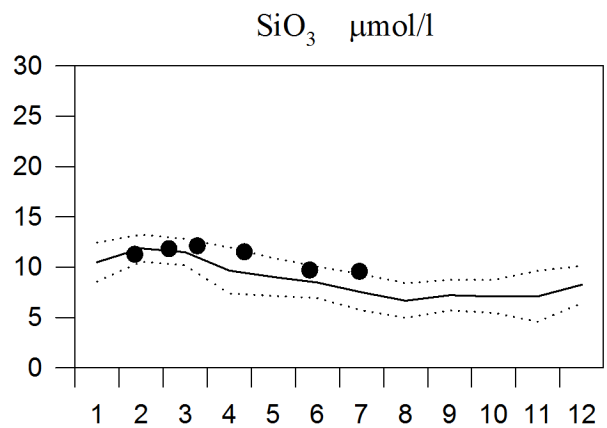
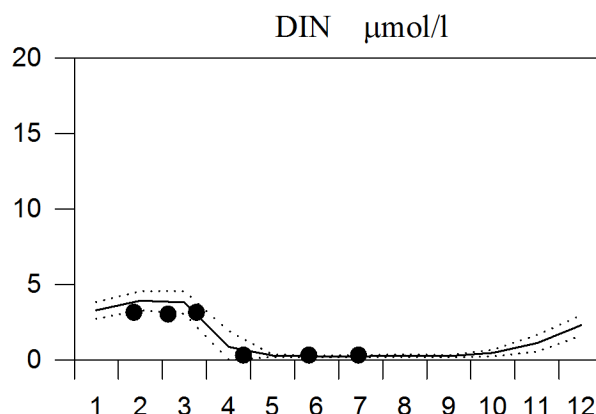
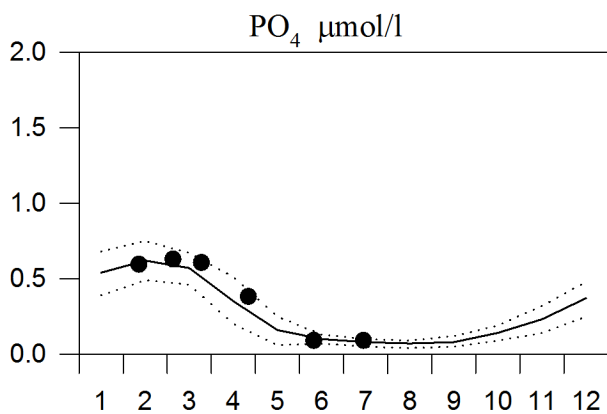
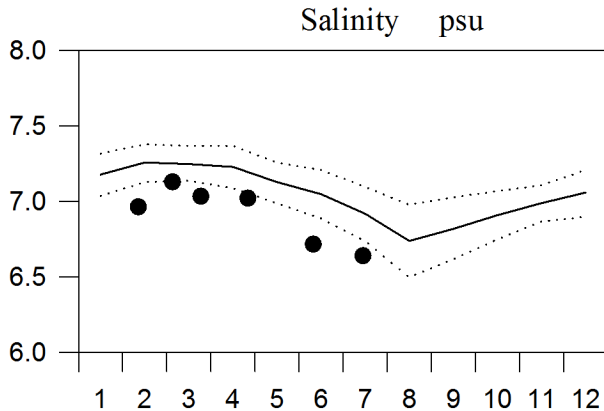
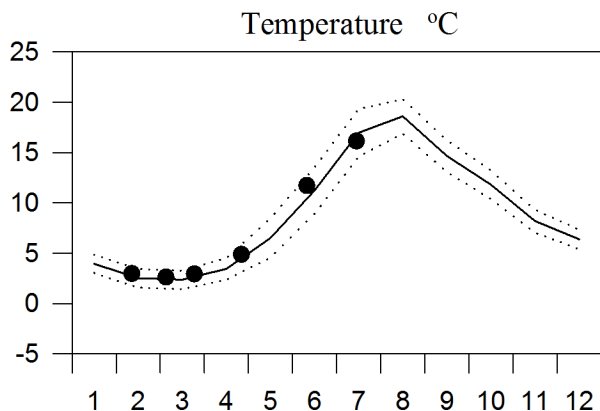
— Mean 1996-2010 ····· St.Dev. ● 2014



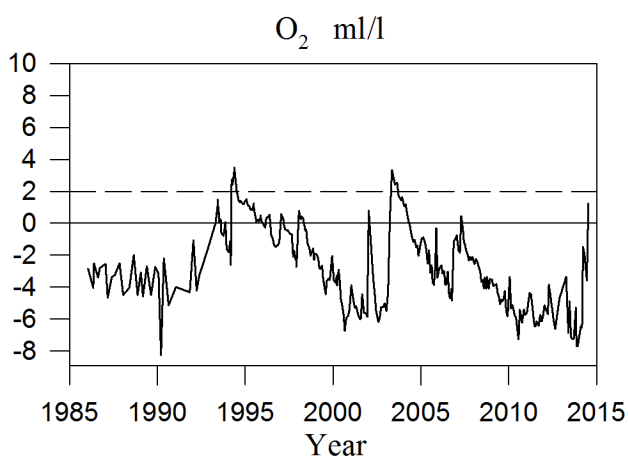
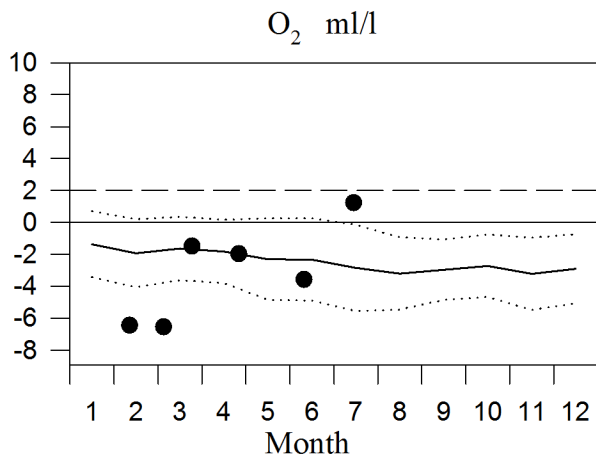
STATION BY15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

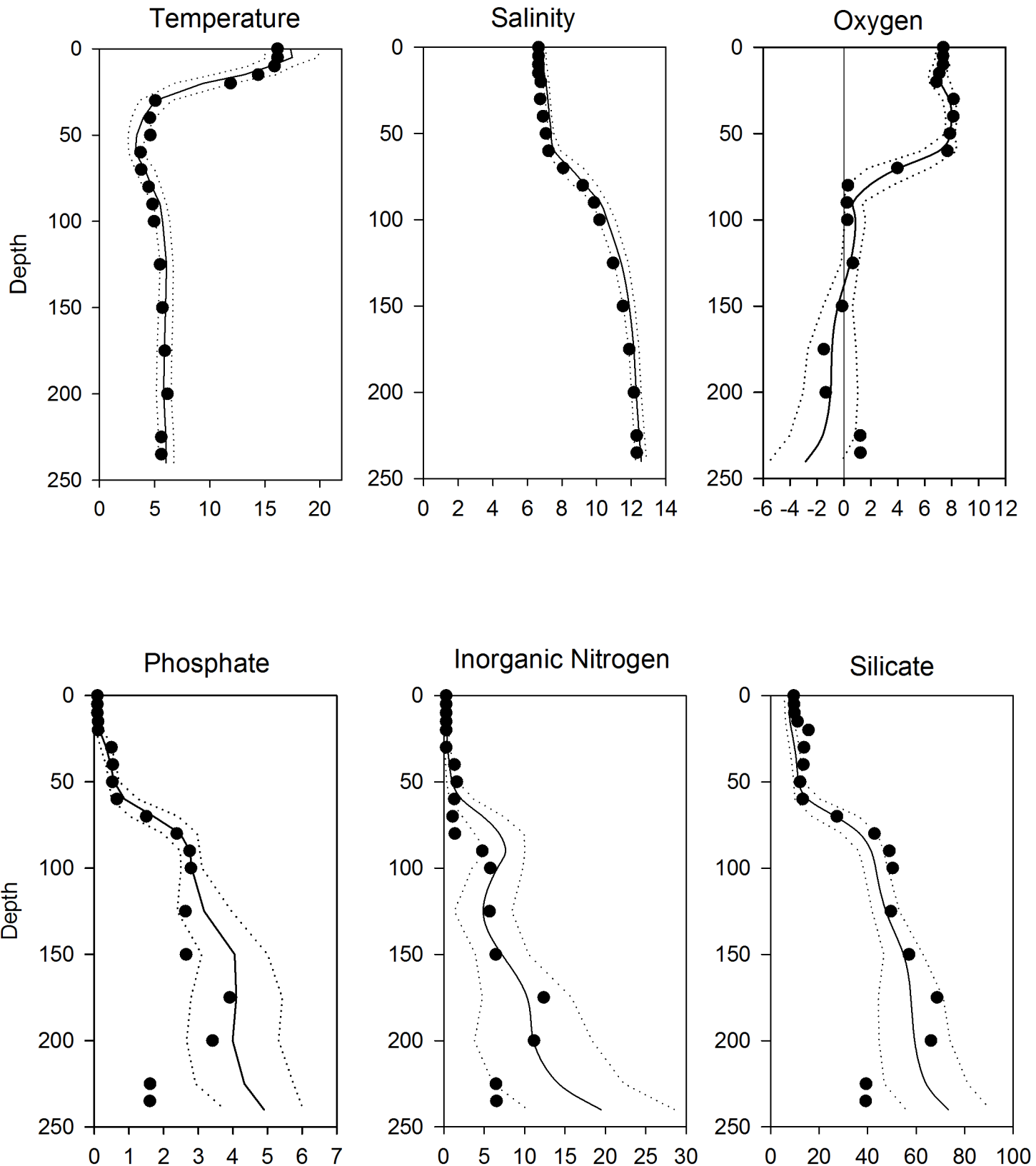


OXYGEN IN BOTTOM WATER (depth >225m)



Vertical profiles BY15 July

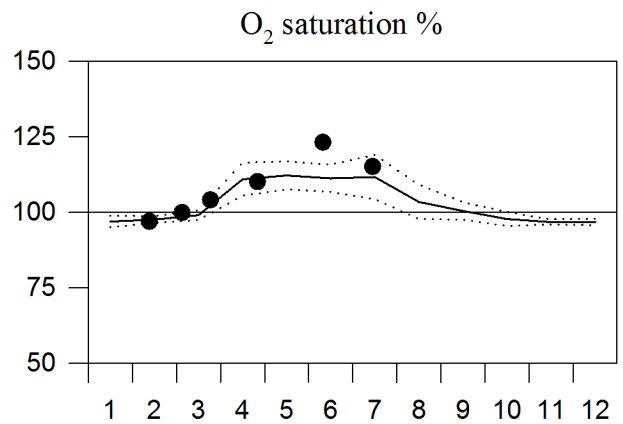
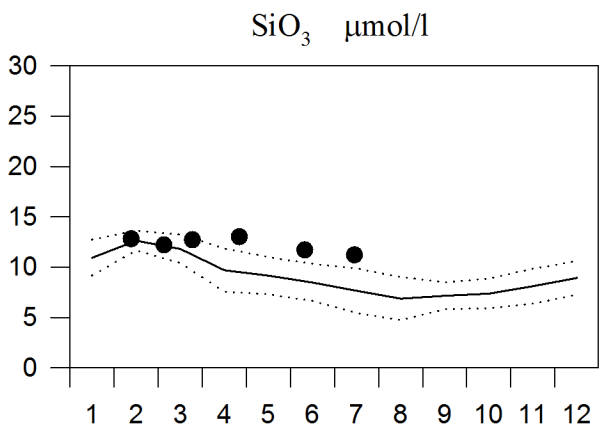
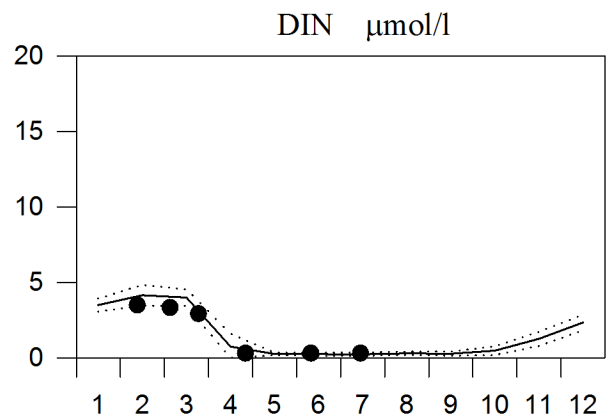
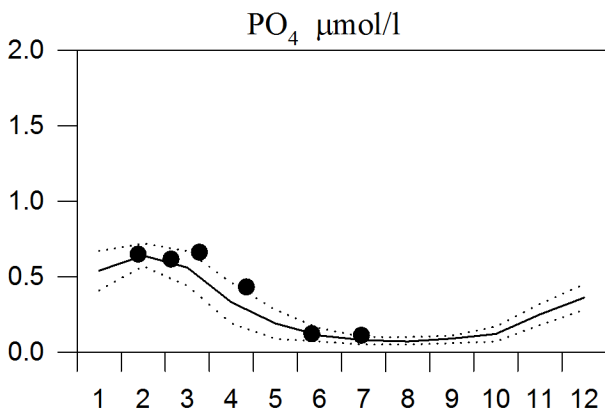
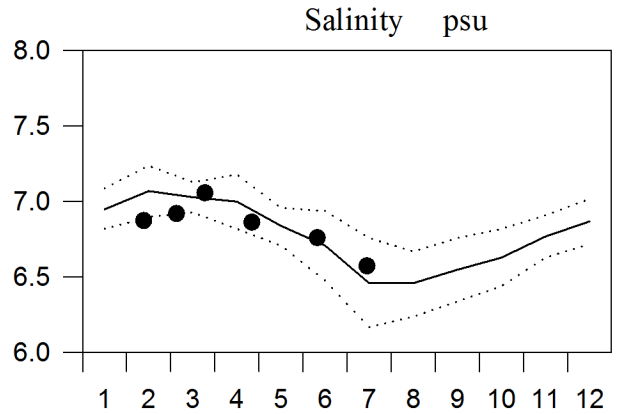
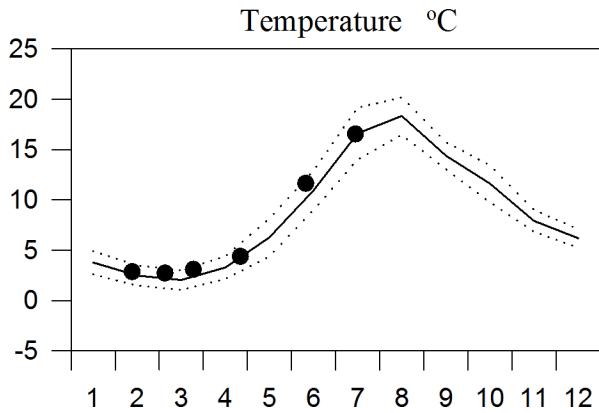
— Mean 1996-2010 ····· St.Dev. ● 2014



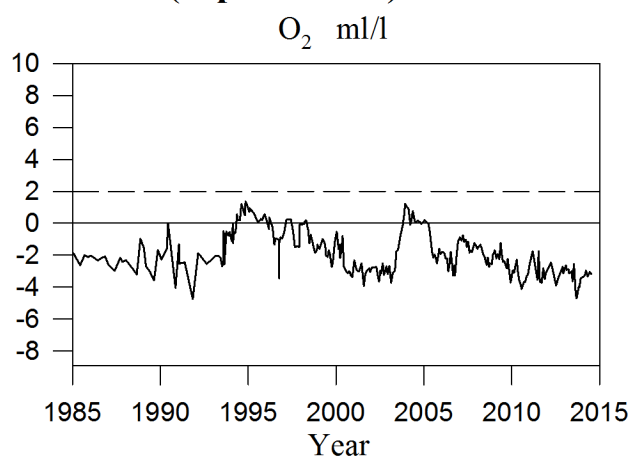
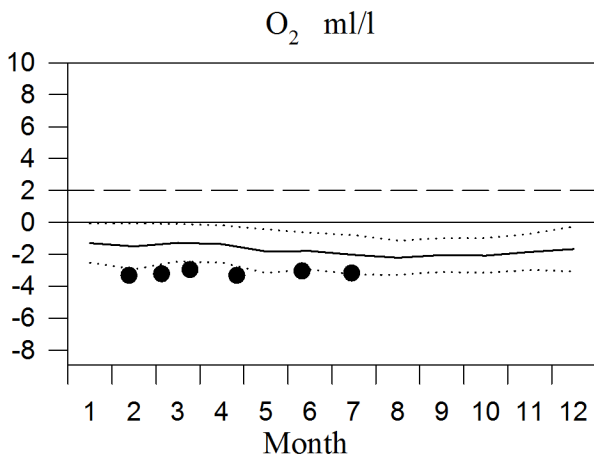
STATION BY20 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

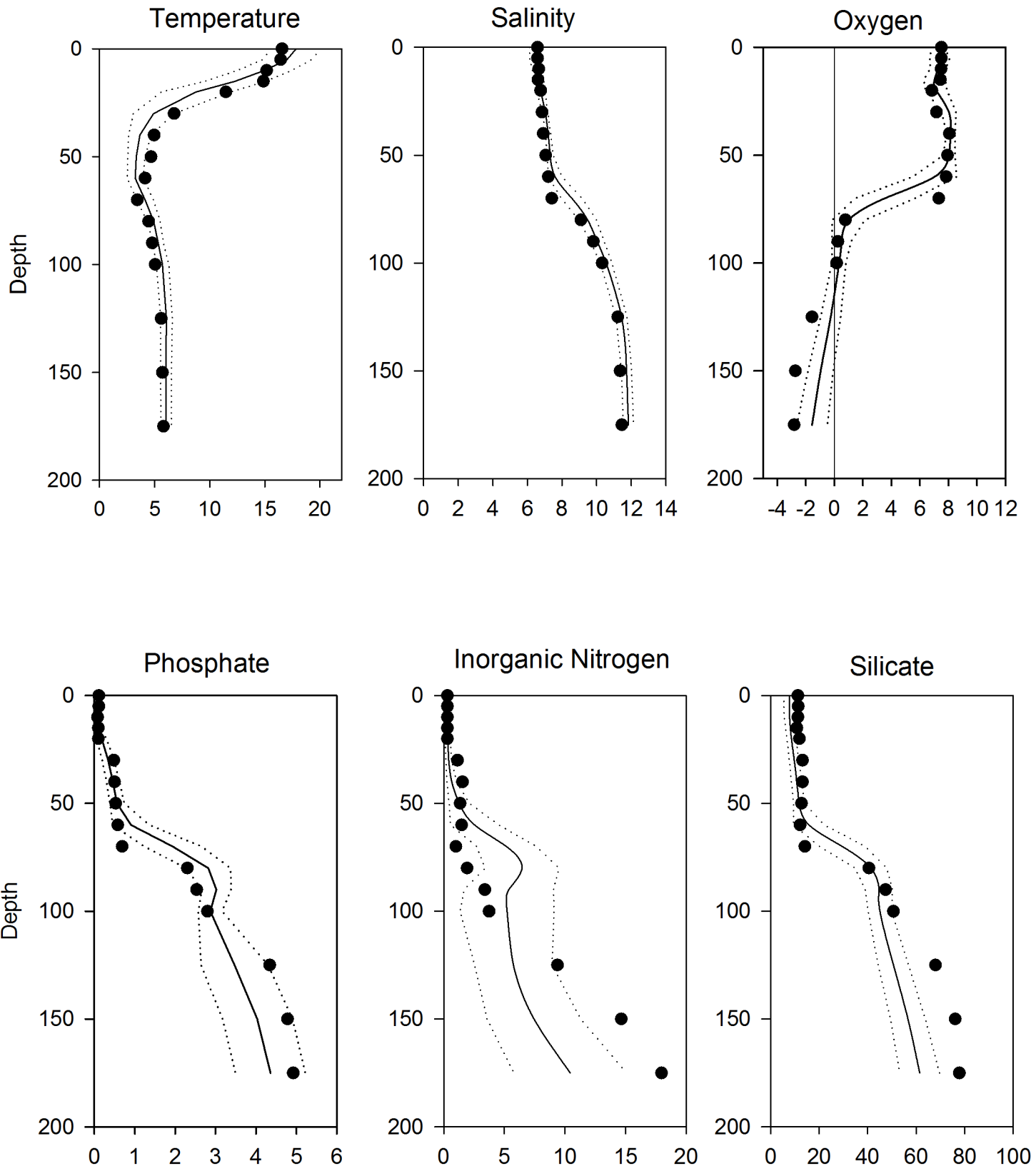


OXYGEN IN BOTTOM WATER (depth >175m)



Vertical profiles BY20 July

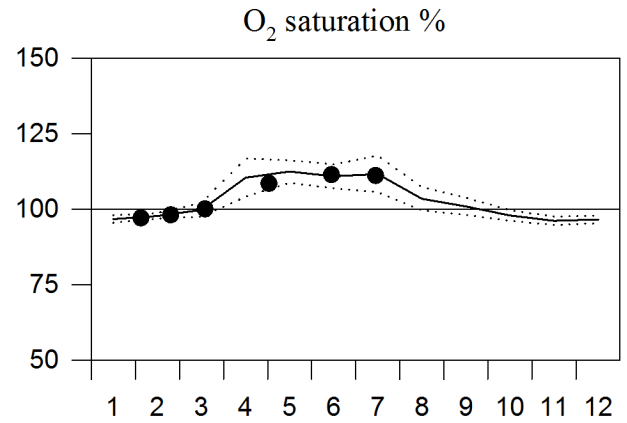
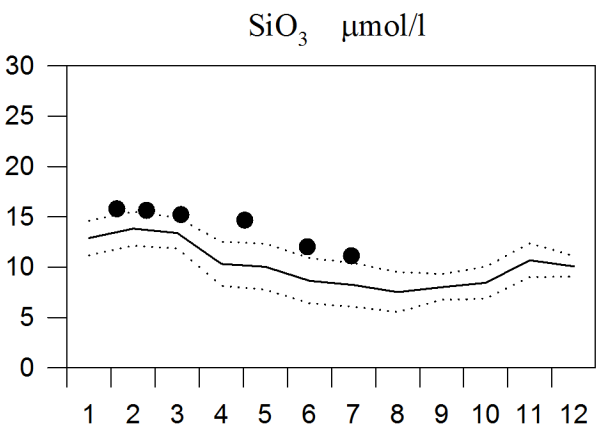
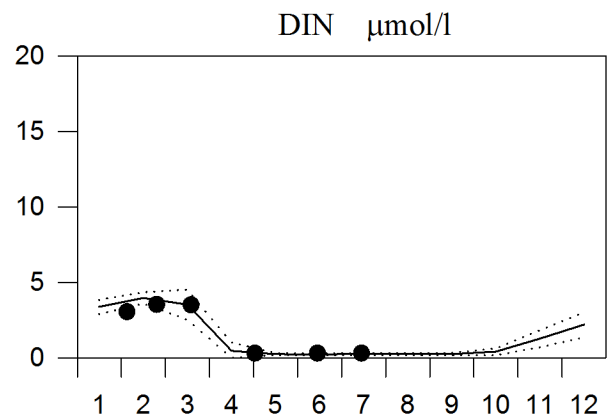
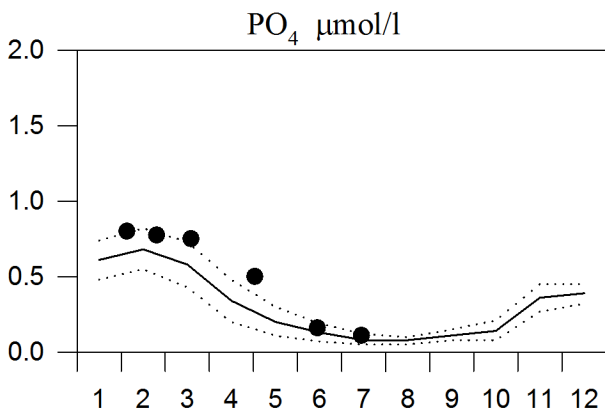
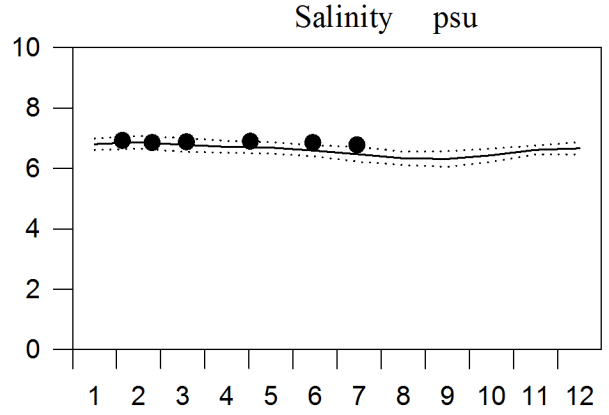
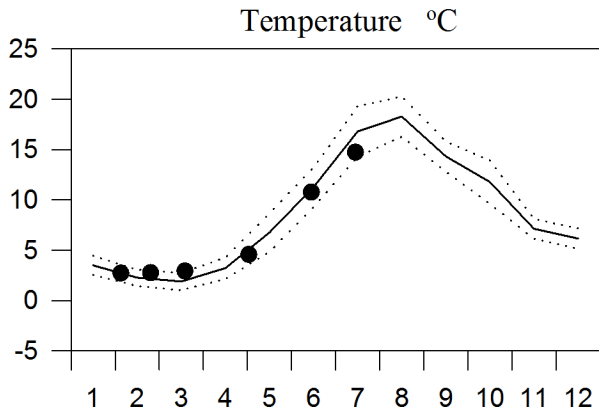
— Mean 1996-2010 ····· St.Dev. ● 2014



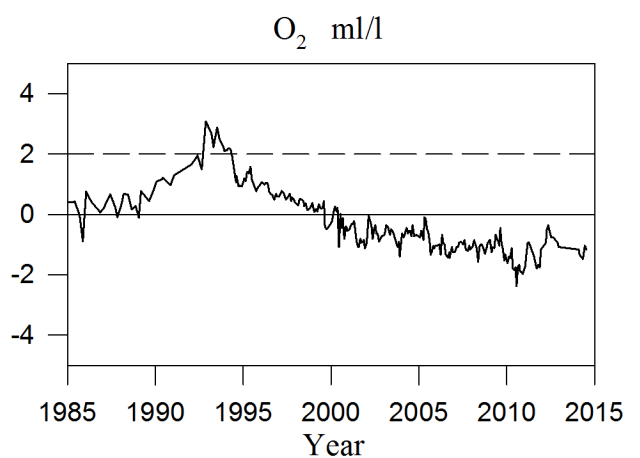
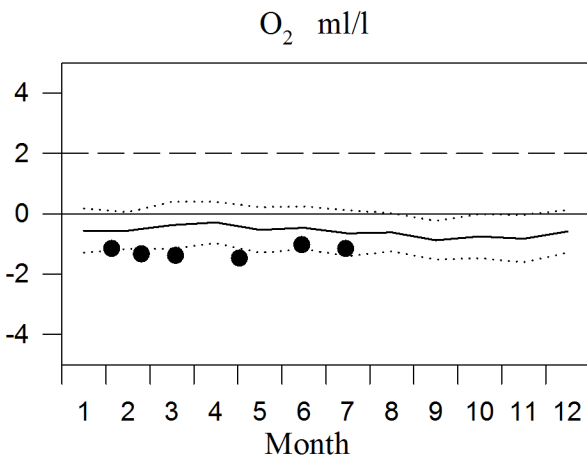
STATION BY32 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

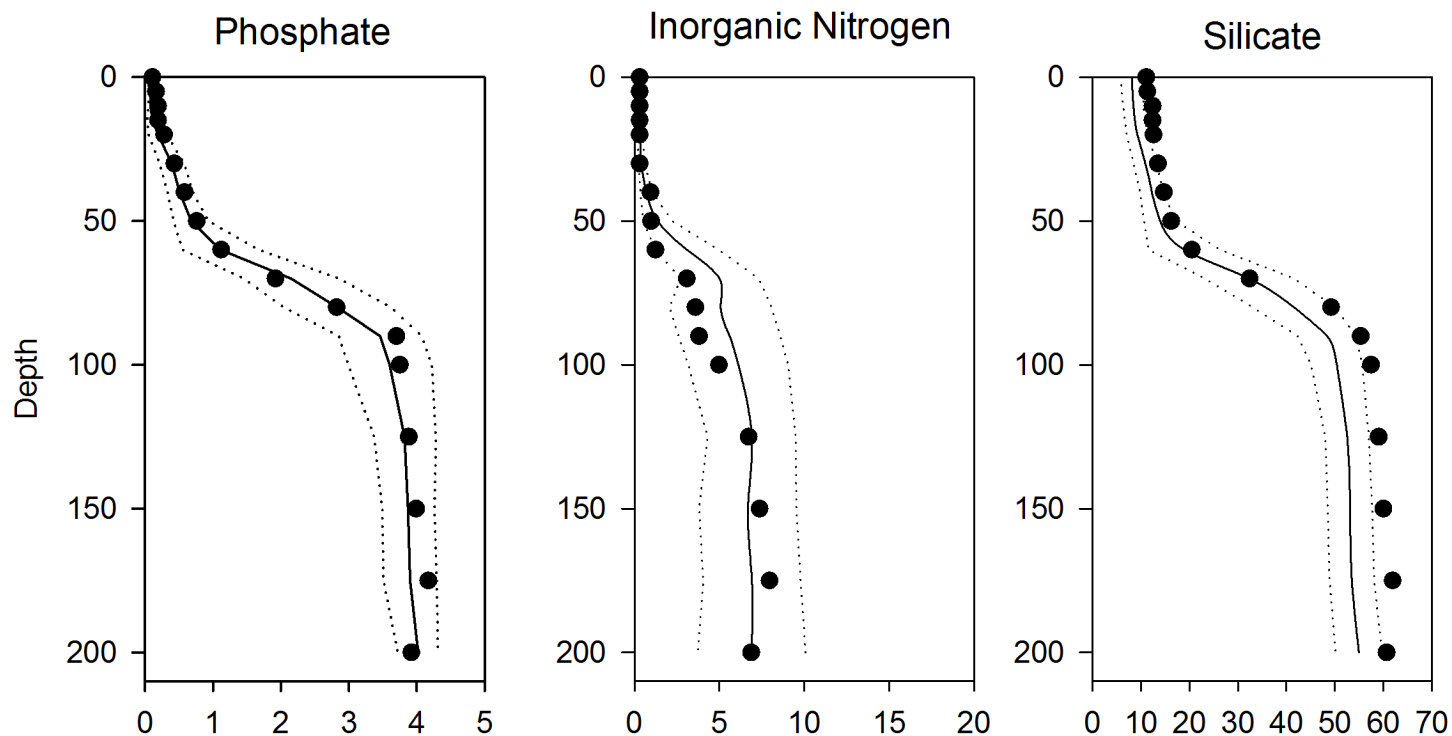
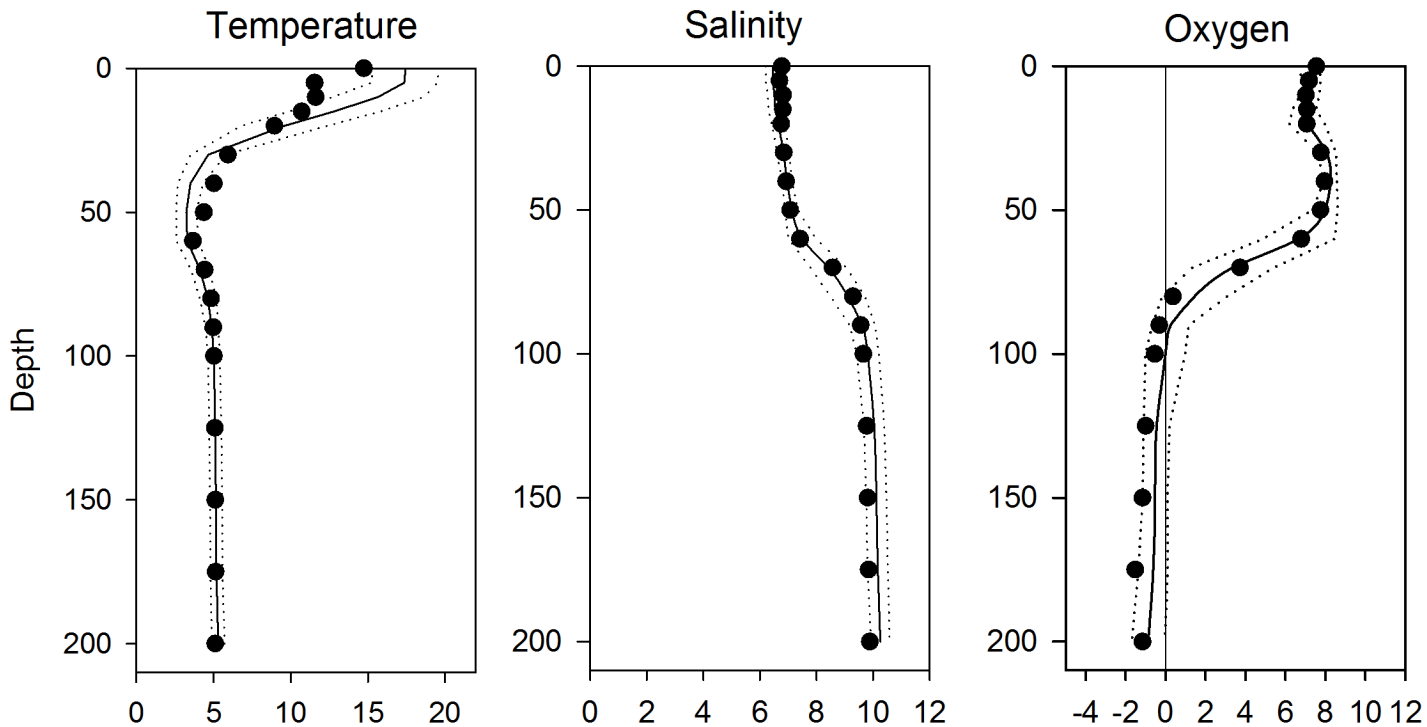


OXYGEN IN BOTTOM WATER (depth > 175m)



Vertical profiles BY32 July

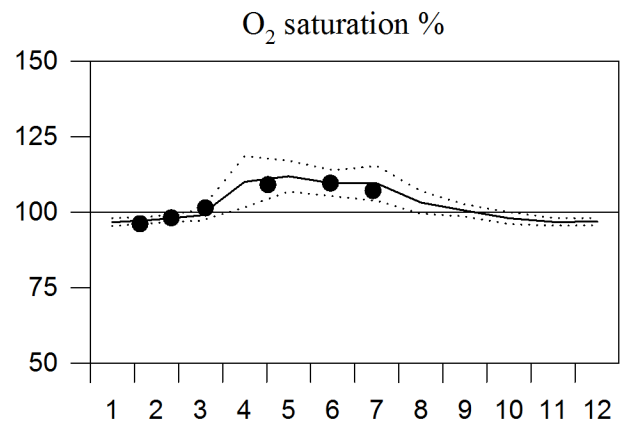
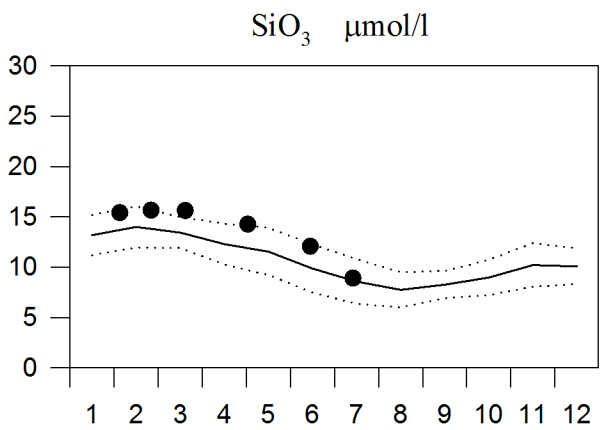
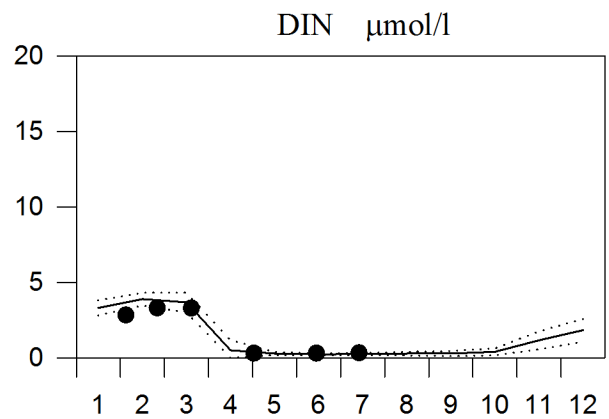
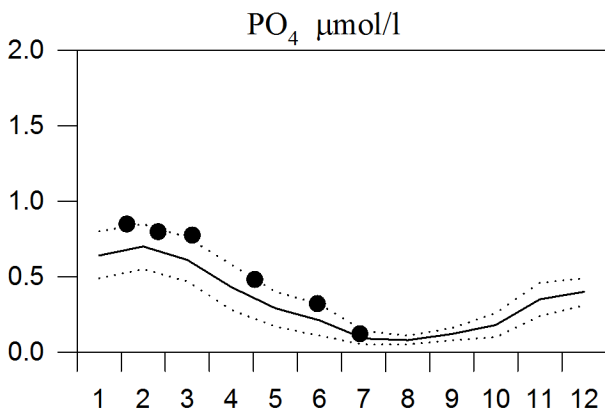
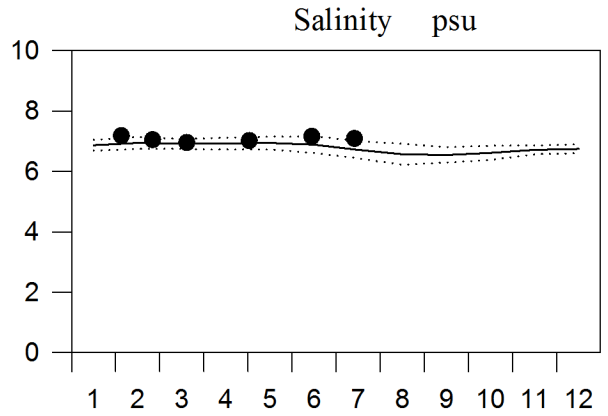
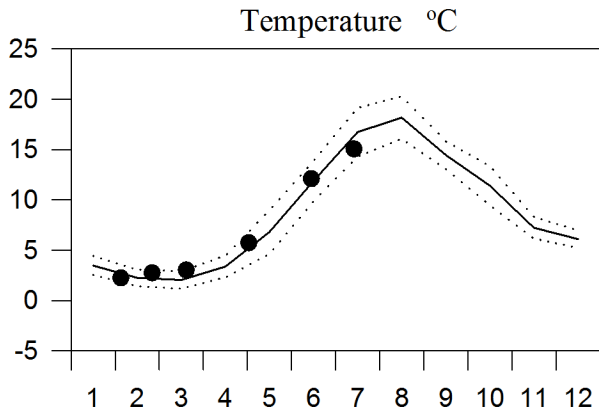
— Mean 1996-2010 ····· St.Dev. ● 2014



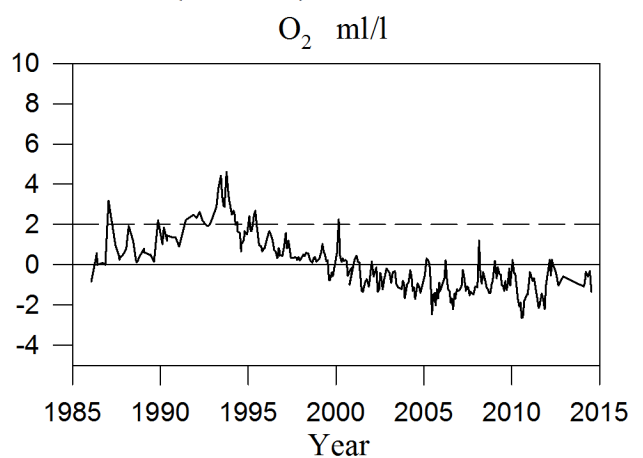
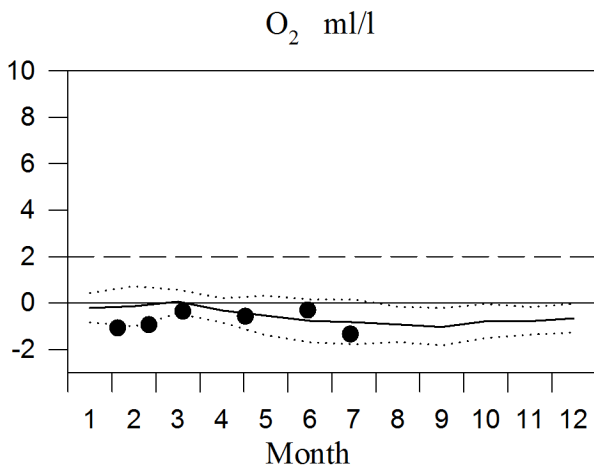
STATION BY38 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

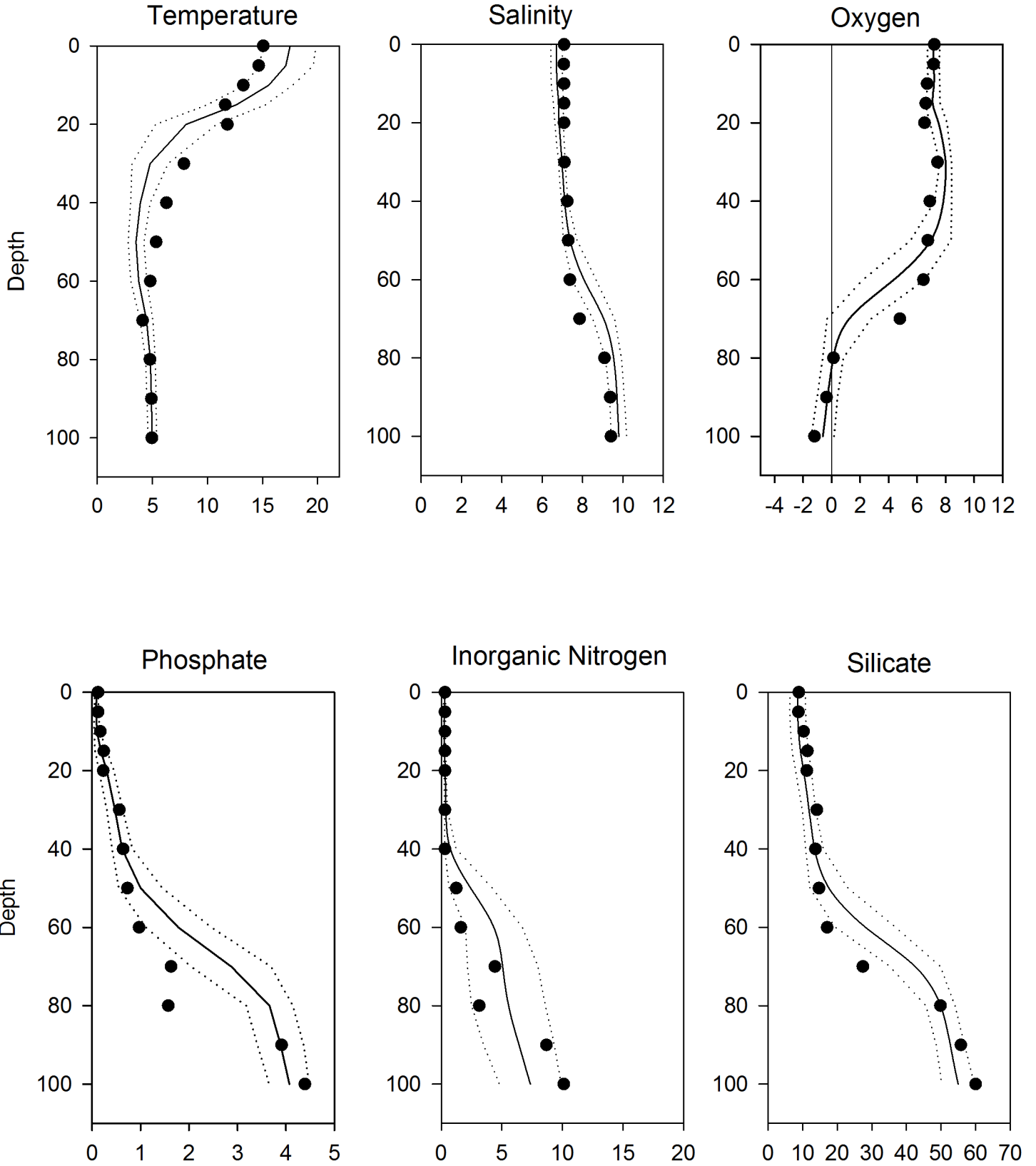


OXYGEN IN BOTTOM WATER (> 100m)



Vertical profiles BY38 July

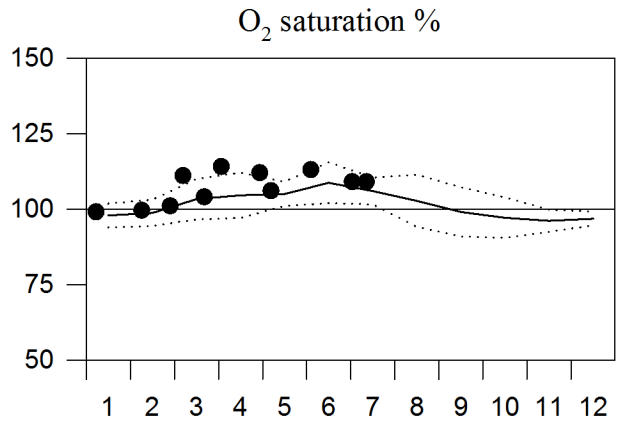
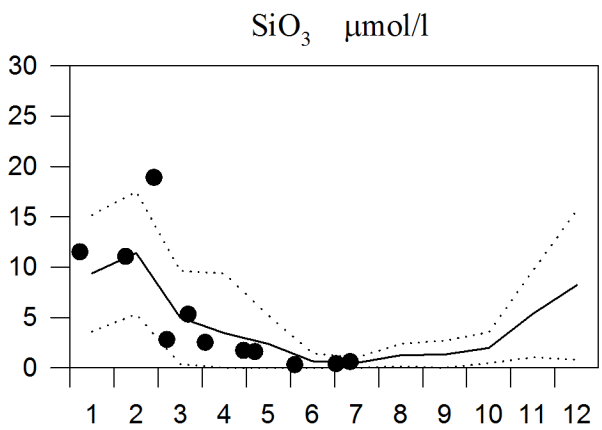
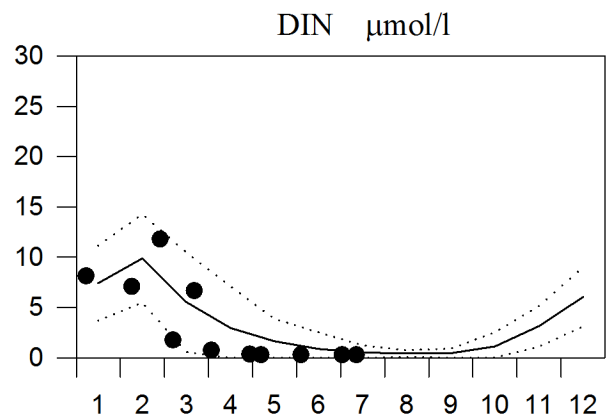
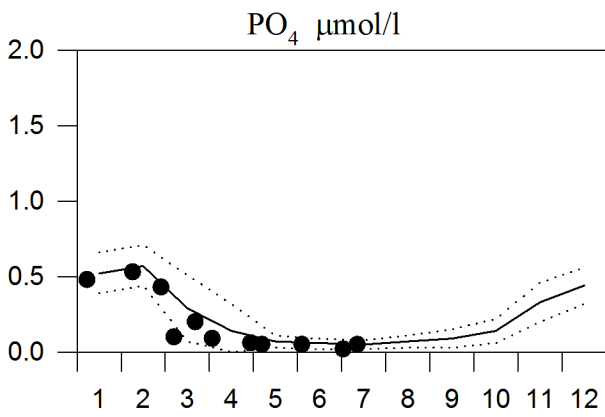
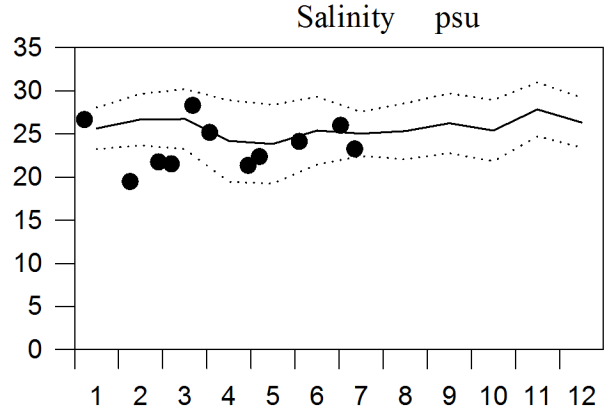
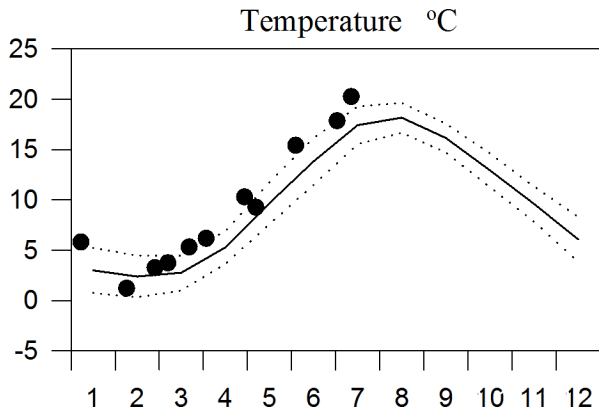
— Mean 1996-2010 ····· St.Dev. ● 2014



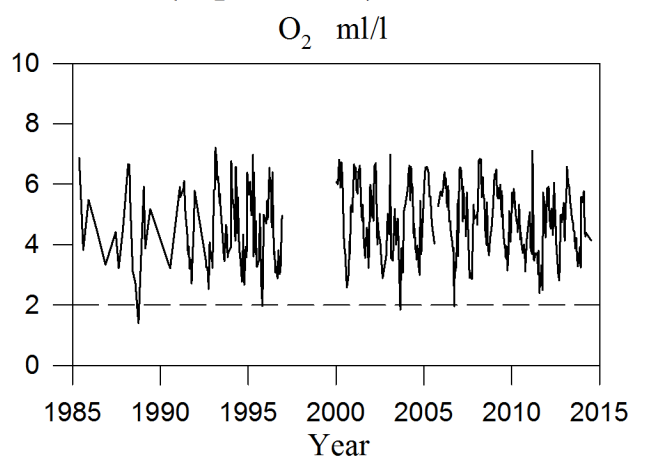
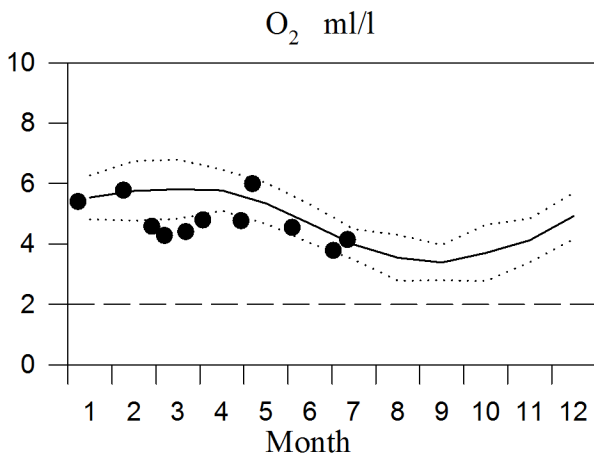
STATION SLÄGGÖ SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

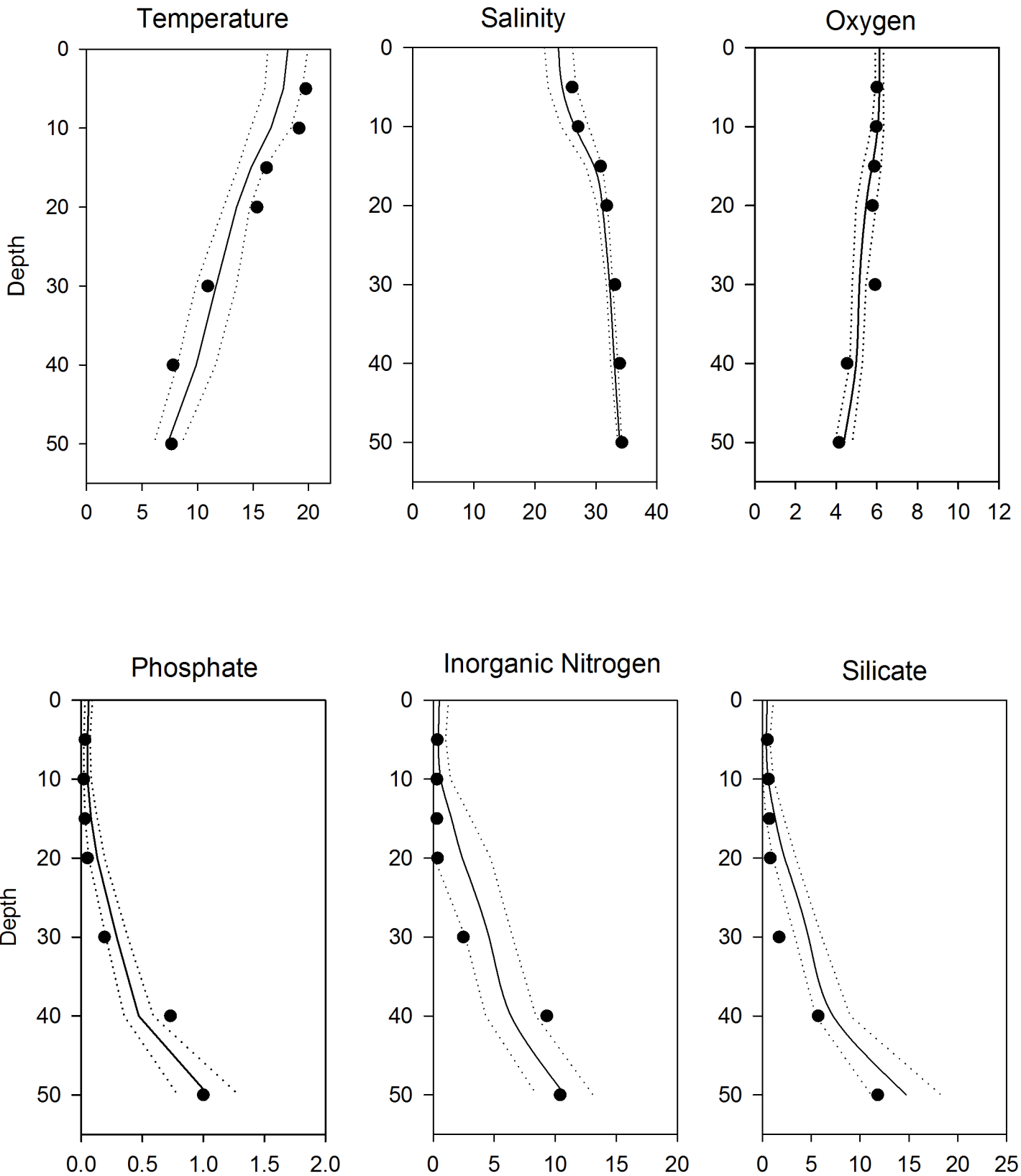


OXYGEN IN BOTTOM WATER (depth >50m)



Vertical profiles Släggö July

— Mean 1996-2010 St.Dev. ● 2014



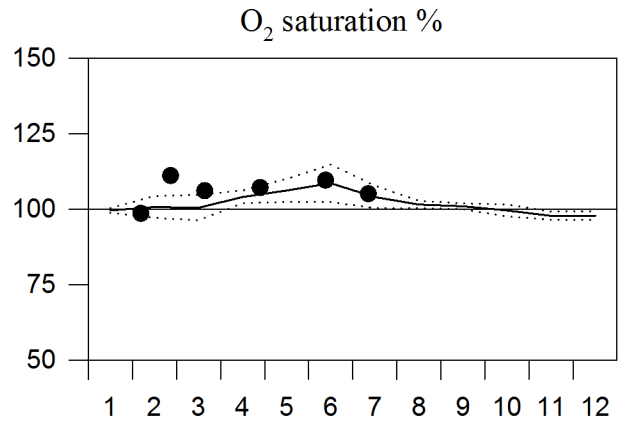
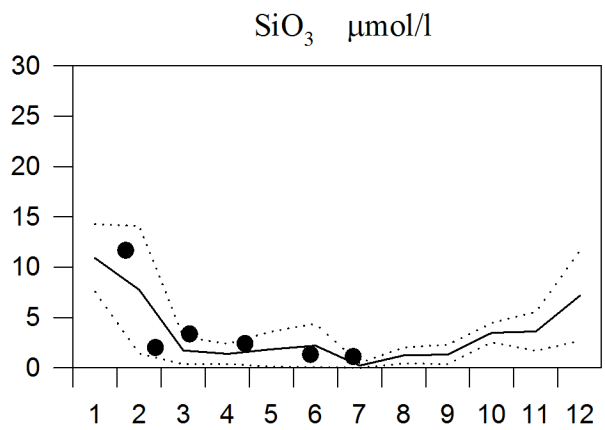
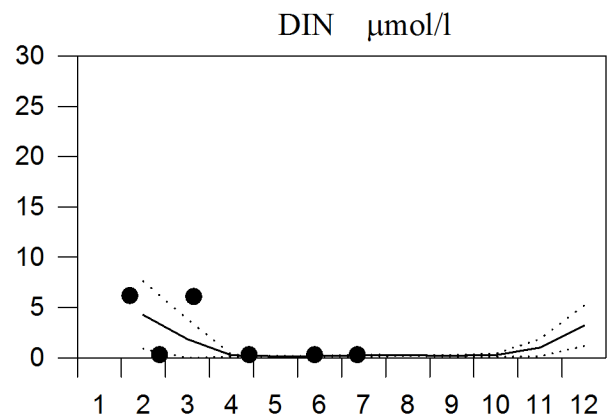
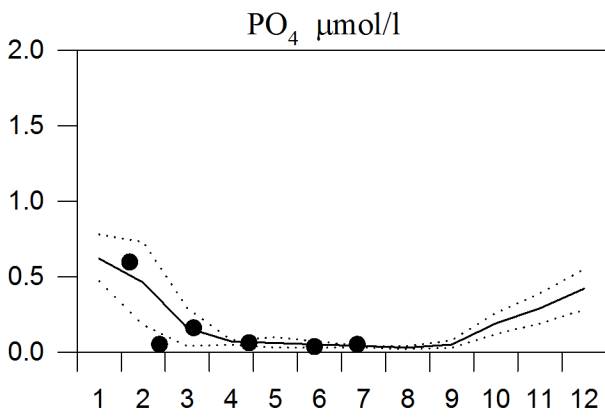
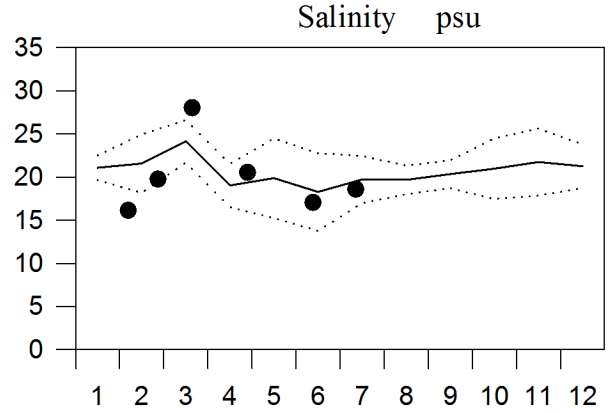
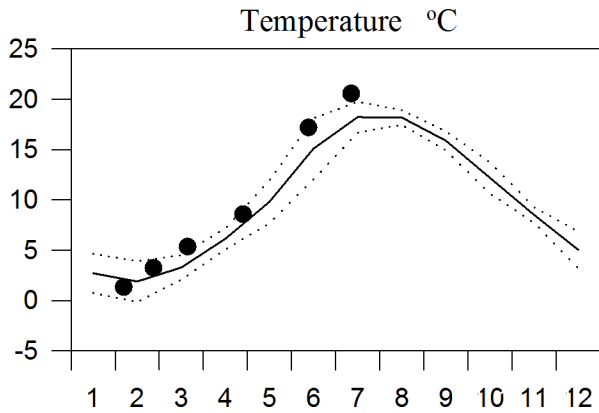
STATION N14 Falkenberg SURFACE WATER

Annual Cycles

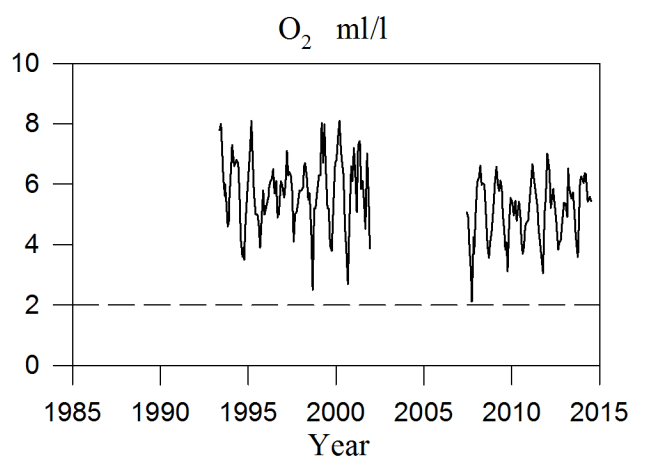
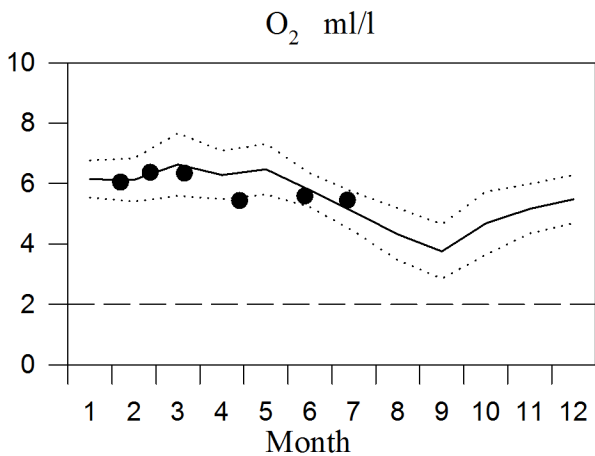
— Mean 2007-2010

..... St.Dev.

● 2014

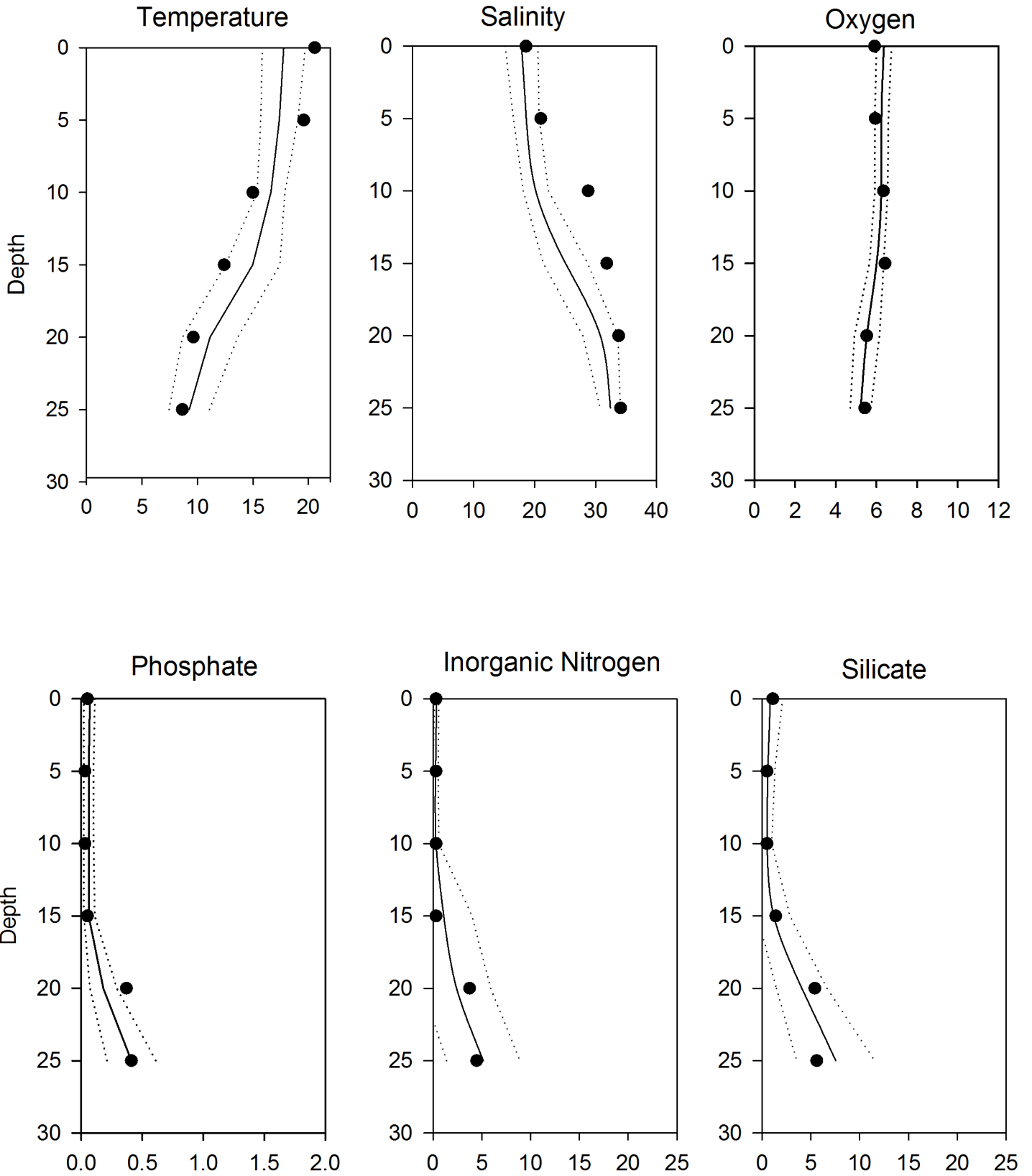


OXYGEN IN BOTTOM WATER (depth > 25m)



Vertical profiles N14 Falkenberg July

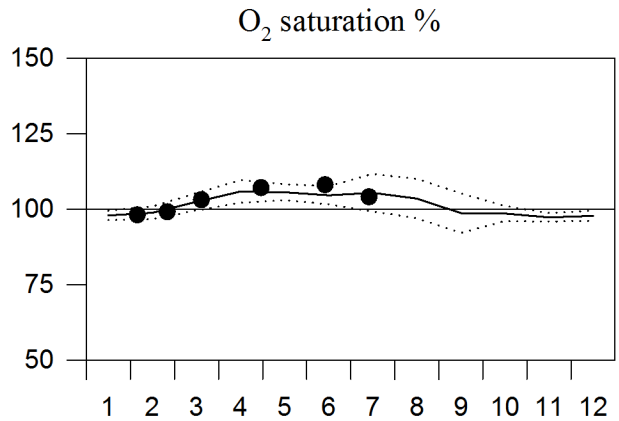
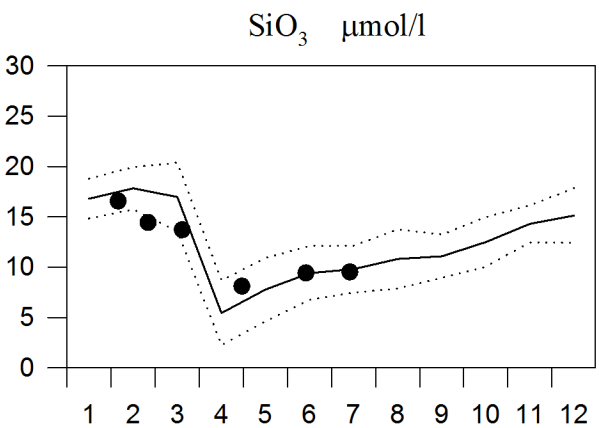
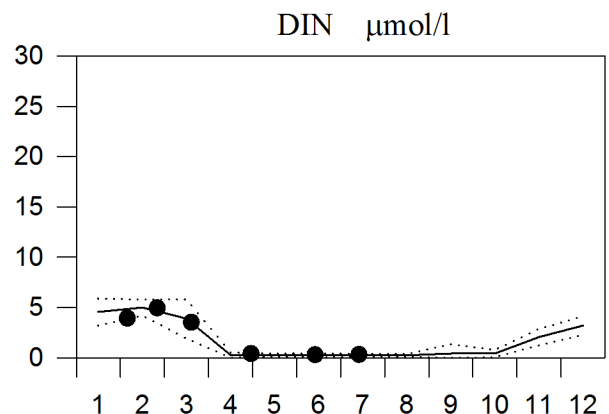
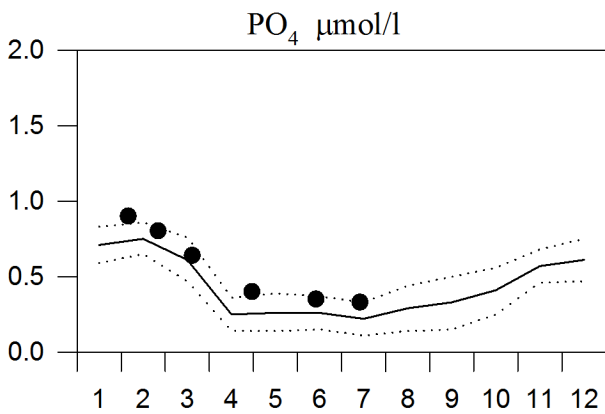
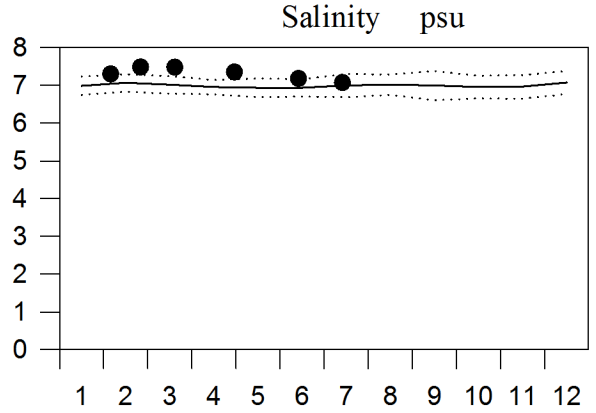
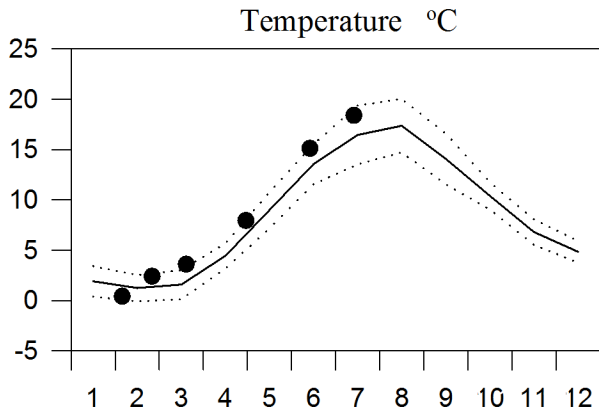
— Mean 1996-2010 St.Dev. ● 2014



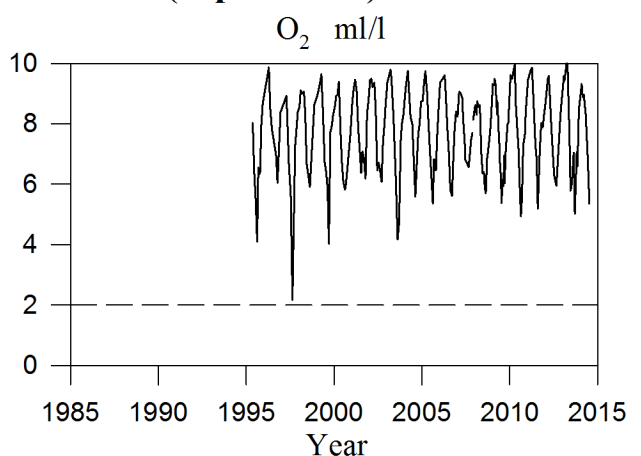
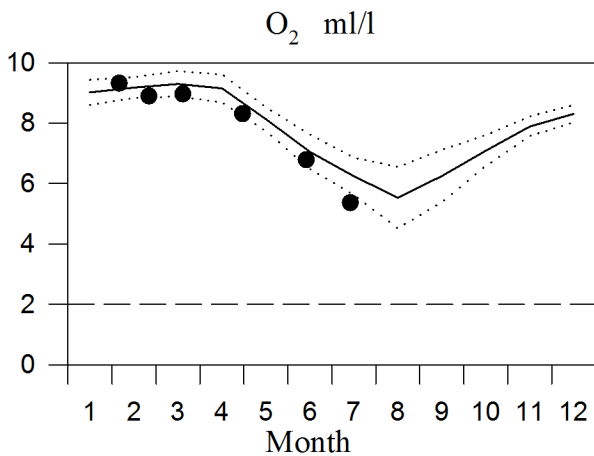
STATION REF M1V1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



OXYGEN IN BOTTOM WATER (depth >15m)



Vertical profiles Ref M1V1 July

— Mean 1996-2010 ····· St.Dev. ● 2014

