

Report from the SMHI monitoring cruise with R/V Aranda



Survey period: 2014-08-01 - 2014-08-08
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 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 all investigated areas. Nutrients in the surface layer showed concentrations normal for the season in all sea areas.

Oxygen situation in the bottom water of the Arkona Basin, Bornholm Basin and Hanö Bight were bad, below acute hypoxia (< 2 ml/l). In the Eastern Gotland Basin the oxygen situation had worsened since the last measurement in July. In the Western Gotland Basin hydrogen sulphide was present already at depths from 80 meters. Acute hypoxia was present, in the Baltic Proper, at depths below 70 to 80 meters.

A detailed algal report can be found at:

http://www.smhi.se/oceanografi/oce_info_data/reports/alg/algst14_6.pdf

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

PRELIMINARY RESULTS

The cruise, part of the Swedish regular marine monitoring programme with the Finnish research vessel Aranda, began in Helsinki on August 1st and ended in the same port on the 8th. Winds during the expedition were weak to moderate, of varying direction. Air temperature varied between 19 and 24°C.

The Skagerrak

Surface water temperature was somewhat above normal for the season, ca. 20°C. Salinity in the surface layer varied from 23 to 32 psu, highest in the Baltic Current close to the coast. Thermocline and halocline coincided and were located at depths between 5 and 20 meters, deepest in the western parts.

All nutrients, in the surface layer, showed concentrations typical for the season. Phosphate concentrations varied between 0.03 and 0.16 µmol/l, silicate from < 0.1 to 1.3 µmol/l, while the level of inorganic nitrogen (nitrite + nitrate) were below detection limit (< 0.10 µmol/l), in the whole area.

The lowest oxygen value in the bottom water was registered at the station Släggö at the mouth of the Gullmar fjord, 2.4 ml/l at a depth of 60 meters.

The Kattegat and the Sound

In this area surface water temperatures were clearly above normal, between 21 and 22°C. The salinity of the surface water was below mean for the season and varying from 16.2 to 18.6 psu in the Kattegat, while it was 10.4 psu in the Sound. Thermocline and halocline coincided at a depth of 10 to 15 meters in both areas.

Concentrations of nutrients in the surface layer showed, for the season, normal values. In Kattegat, phosphate concentrations were 0.06 µmol/l and in the Sound 0.19 µmol/l. Silicate values were in the range 1.2 to 1.6 µmol/l in the Kattegat, while it in the Sound was 6.7 µmol/l. The amount of nitrite + nitrate was below the detection limit (< 0.10 µmol/l).

The lowest oxygen concentration in the Kattegat area, 4.19 ml/l, was found at the station Anholt E. In the Sound, 3.96 ml/l was registered at W Landskrona.

The Baltic Proper

Also in this area water temperatures were above normal, varying from 20.1 to 22.6°C. The salinity in the surface layer varied between 6.4 and 7.7 psu, which is normal. The halocline was found at depths between 60 and 80 meters in the Northern, Western and Eastern Gotland Basins, while it was located shallower, between 40 and 60 meters in the southern parts. The thermocline extended from the surface down to a depth of 20 - 30 meters.

All nutrients in the surface layer, showed for the season, normal values. Concentrations of phosphate was in the interval 0.07-0.19 µmol/l and silicate varied between 7.8 and 11.8 µmol/l. Inorganic nitrogen (nitrite + nitrate) was below detection limit in the whole investigated area.

In the Arkona- and Bornholm Basins as well as in the Hanö Bight, oxygen concentrations in the bottom water were below the limit for acute hypoxic conditions (< 2 ml/l). At the station BCSIII-10, in the south-eastern part, oxygen concentration in the bottom water had decreased from 2.8 ml/l during the expedition in June to 1 ml/l. At the station BY10 in the southern part of the Eastern Gotland Basin where an oxygen concentration of 1.99 ml/l was measured in July, hydrogen sulphide was again present at depths exceeding 125 meters. At the Gotland Deep (BY15) an oxygen concentration of 1.23 ml/l was registered in the bottom water in July which now had decreased to 0.18 ml/l. Hydrogen sulphide was here present at depths between 125 and 225 meters. In the



Western Gotland Basin, hydrogen sulphide was present already at a depth of 80 meters. Acute hypoxia (< 2 ml/l) was present in the whole area at depths exceeding 80 meters, in the Arkona Basin deeper than 40 meters.

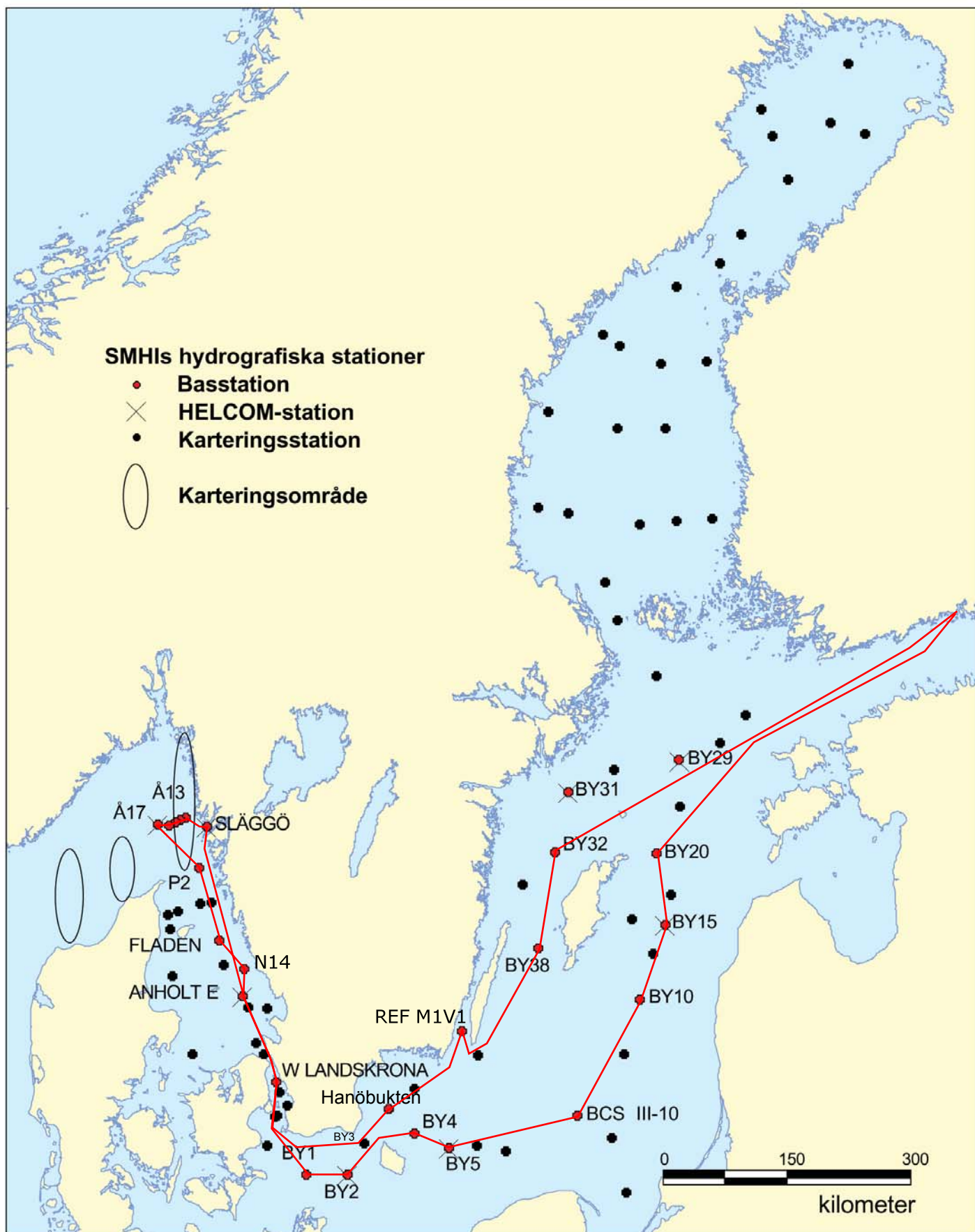
PARTICIPANTS

Name		Institute
Lars Andersson	Chief scientist	SMHI
Kristin Andreasson		SMHI
Marie Johansen		SMHI
Sara Johansson		SMHI
Sari Sipilä		SMHI
Arne Svensson		SMHI

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

TRACKCHART
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Ship: R/V ARANDA
Date: 20140801-20140808
Series: 0472-0497



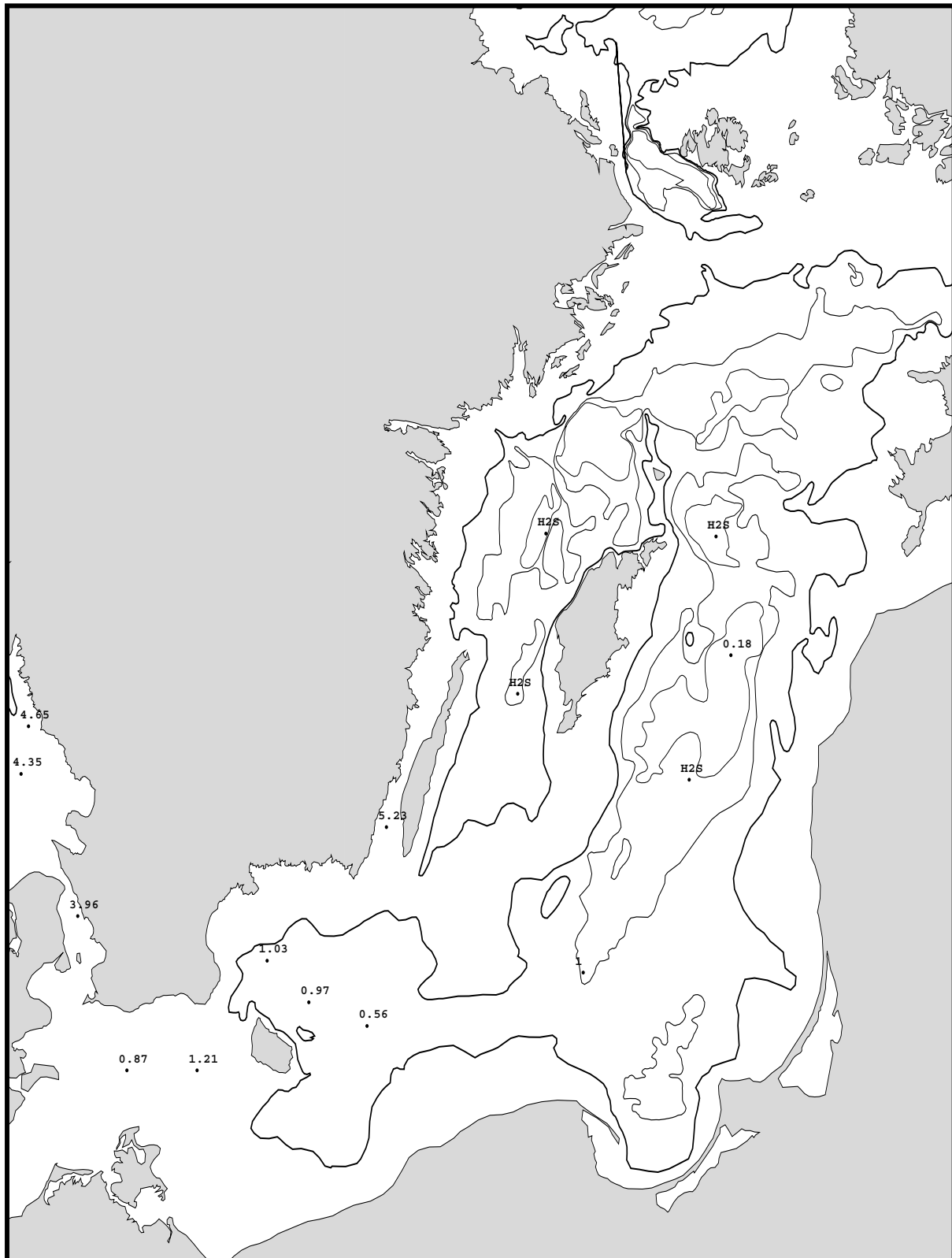
Bottom water oxygen concentration (ml/l)

Country: Finland

Ship : Aranda

Date : 20140802-20140807

Series : 0472-0496



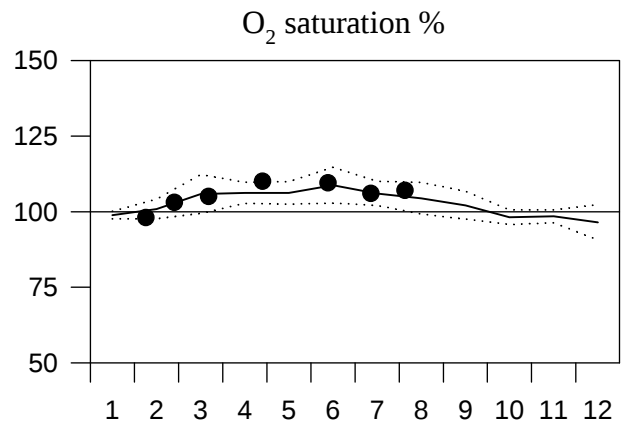
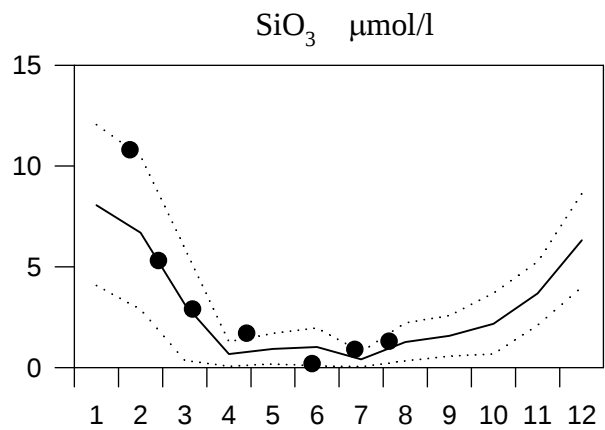
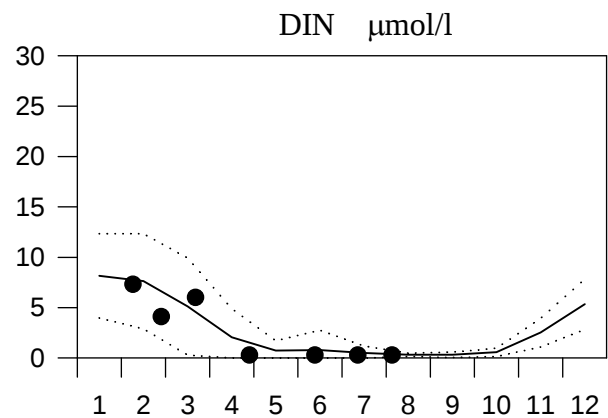
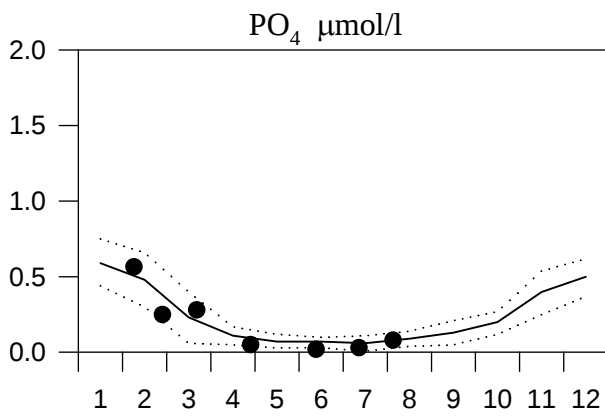
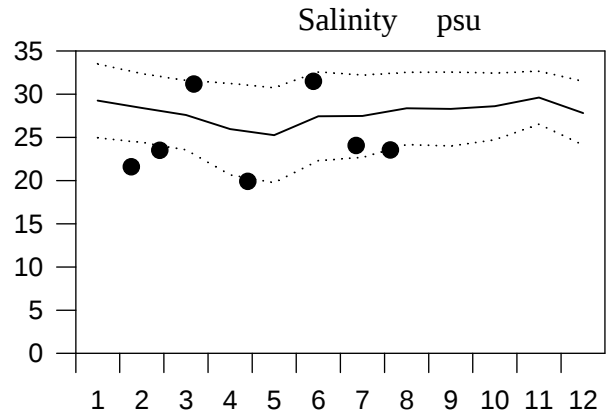
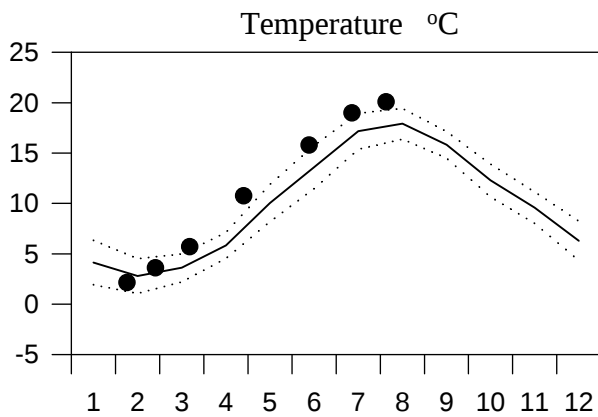
Date: 2014-08-07
Time: 16:55

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0473	BPEX21BAS	BY15	GOTLANDSDJ	N5720	E2003	20140802	1125	239	4	09 7	22.0	1017	4920	x -xxxx--	19	- x x x x x x x x x x x x - - - - x	
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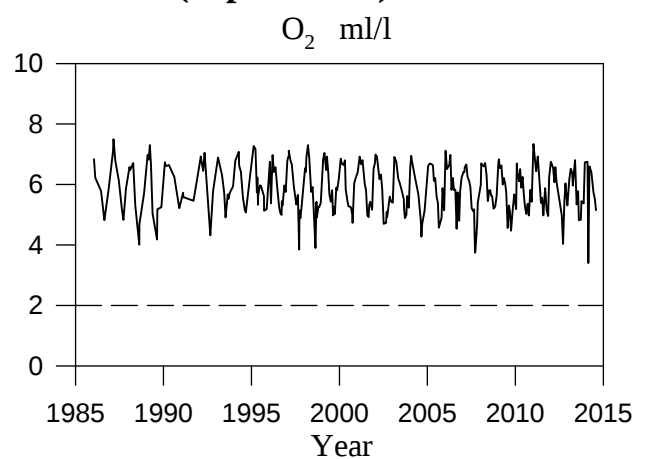
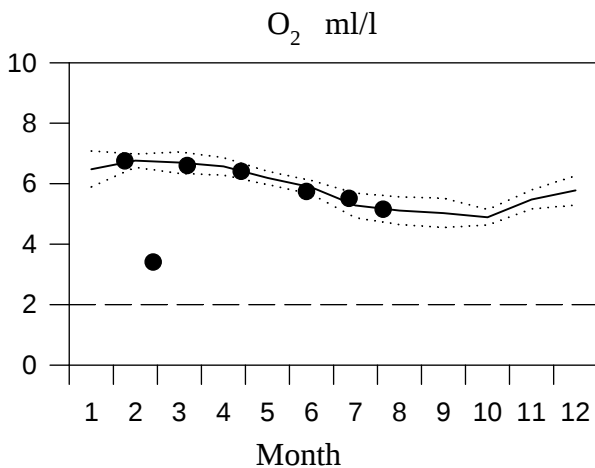
STATION P2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

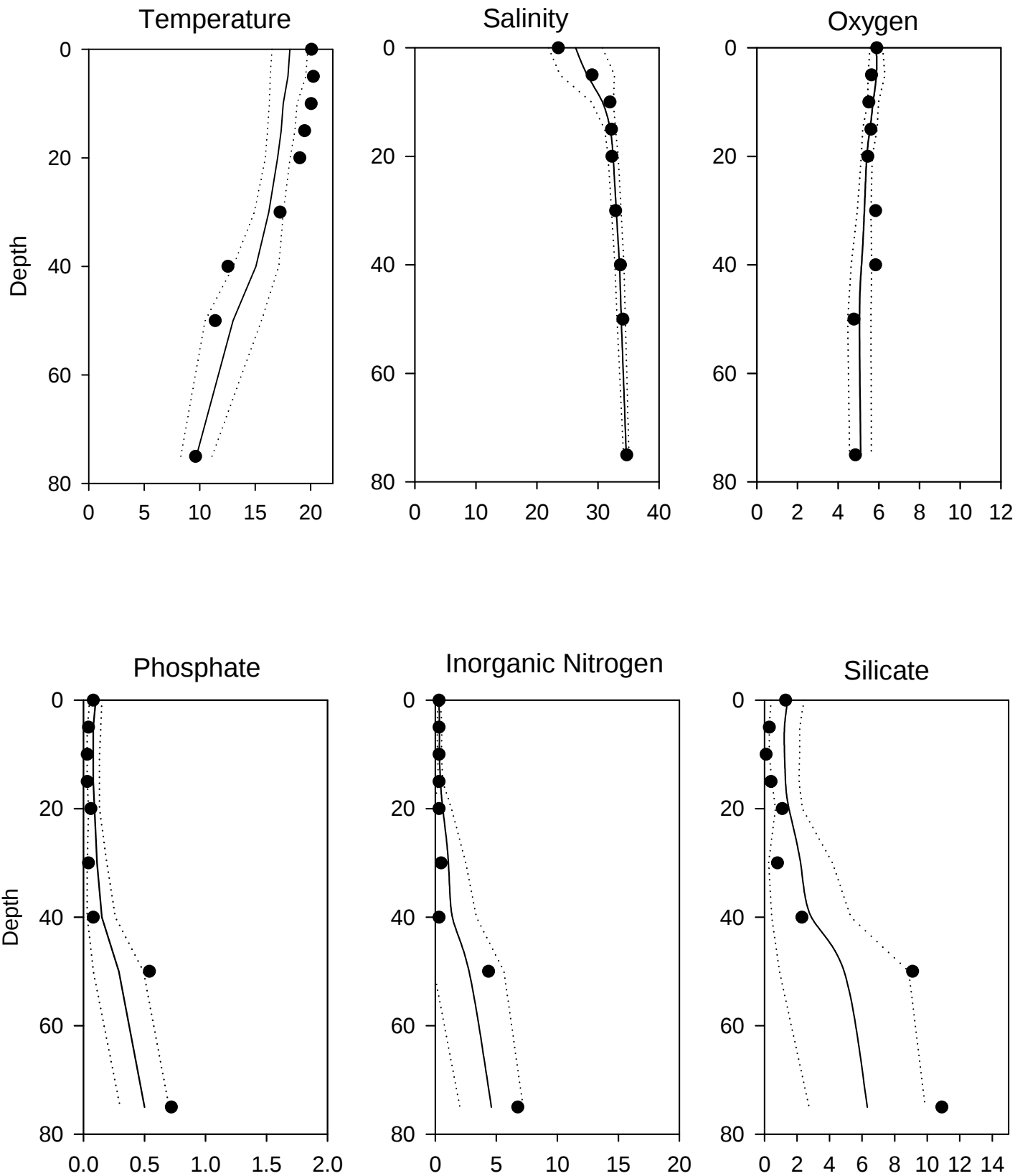


OXYGEN IN BOTTOM WATER (depth >75m)



Vertical profiles P2 August

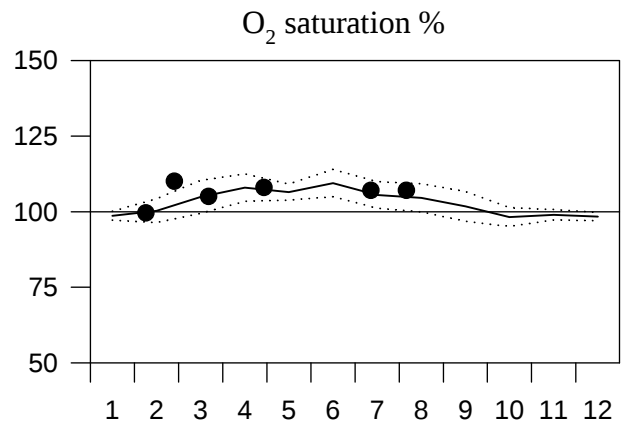
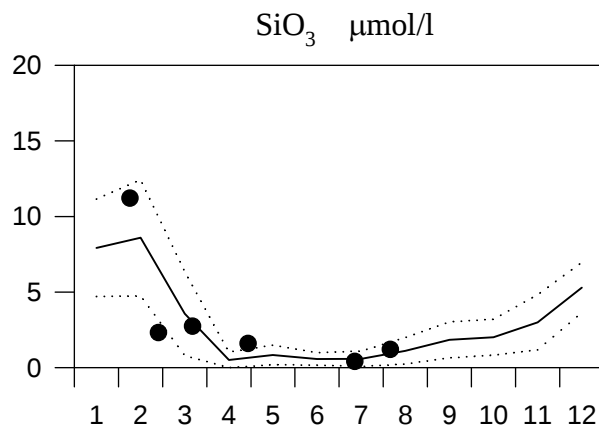
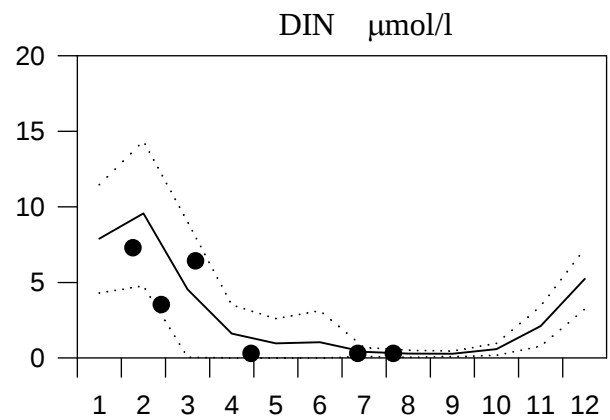
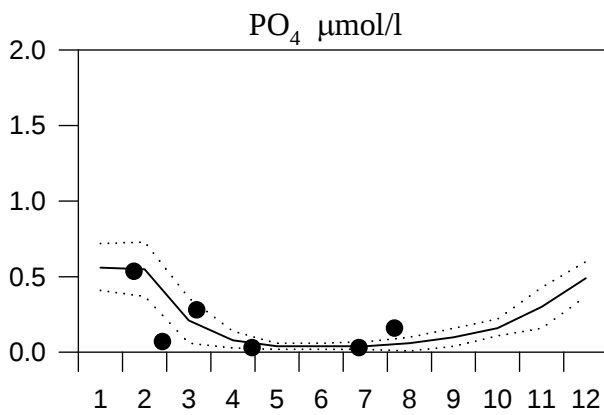
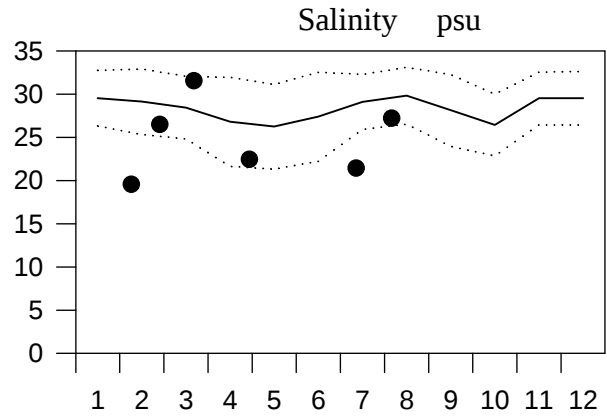
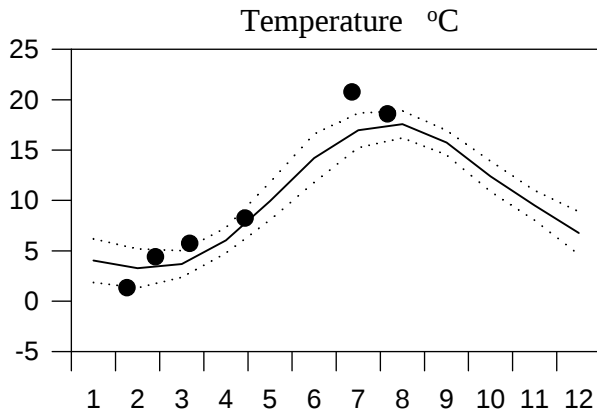
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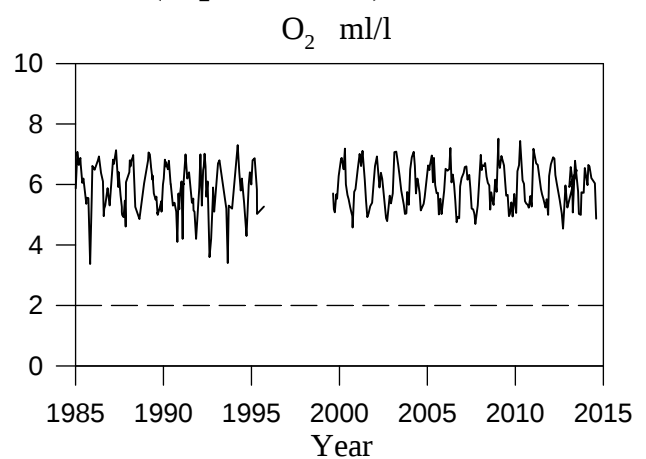
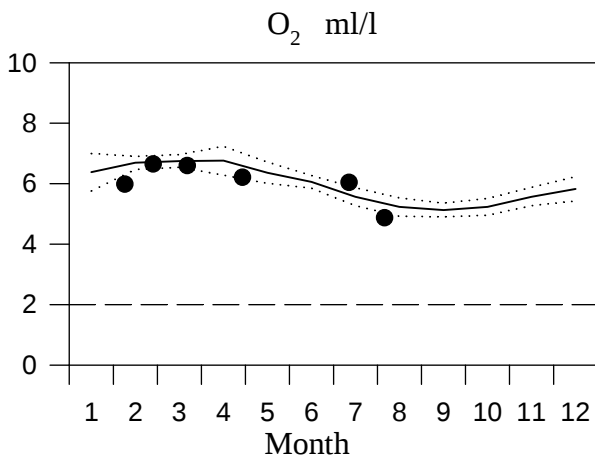
STATION Å13 SURFACE WATER

Annual Cycles

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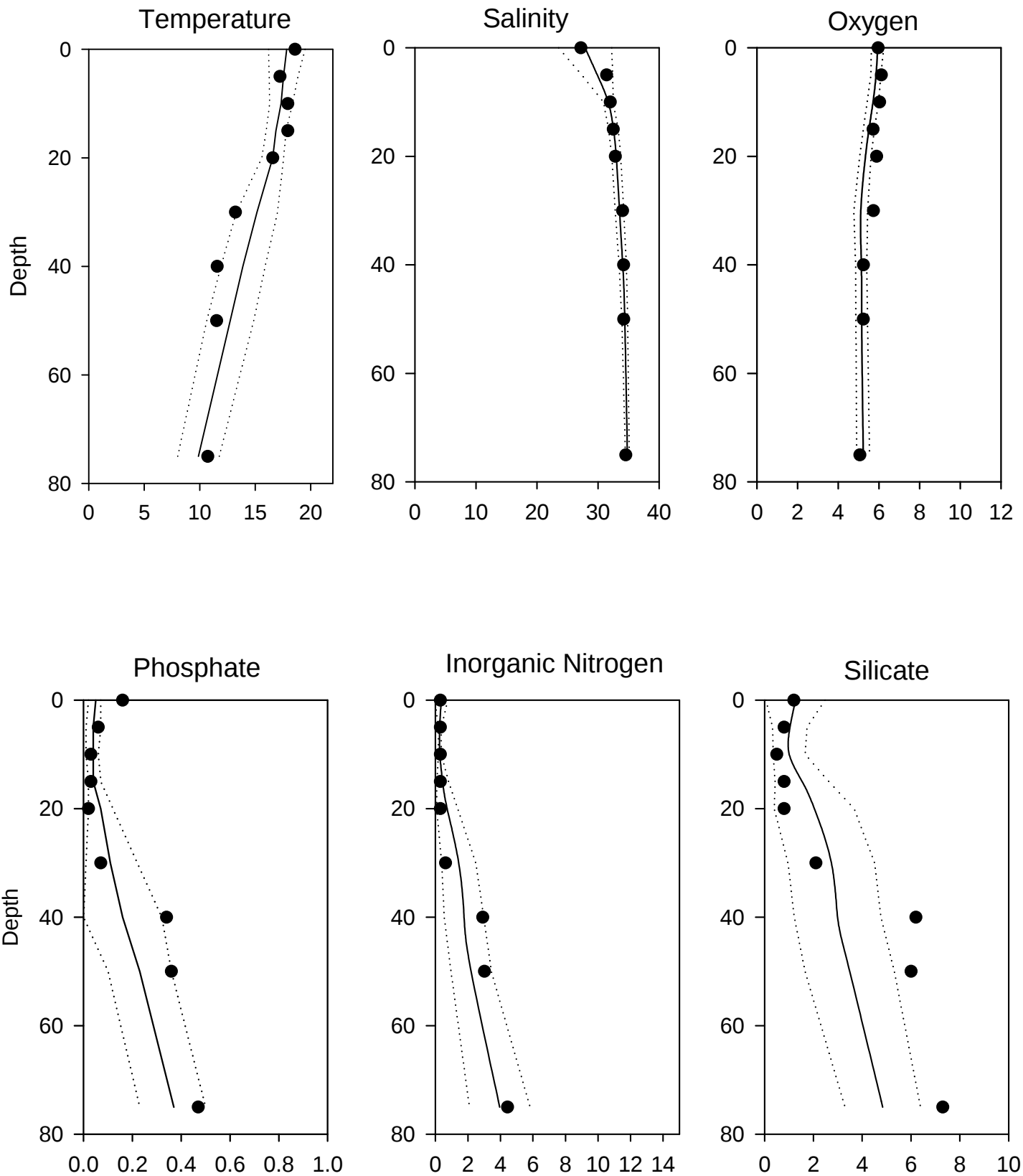


OXYGEN IN BOTTOM WATER (depth >=75m)



Vertical profiles Å13 August

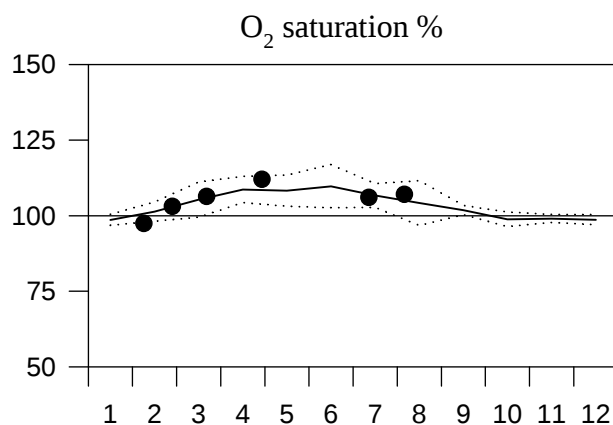
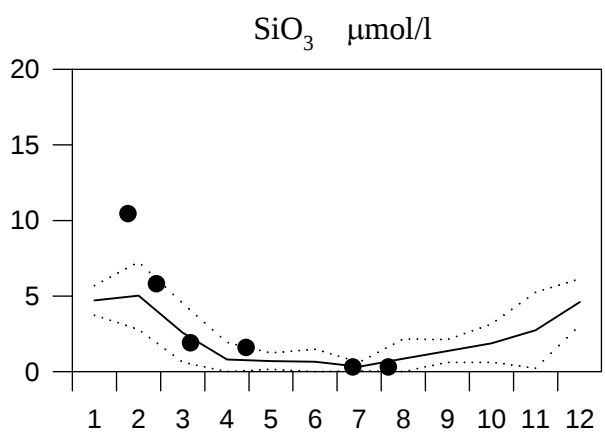
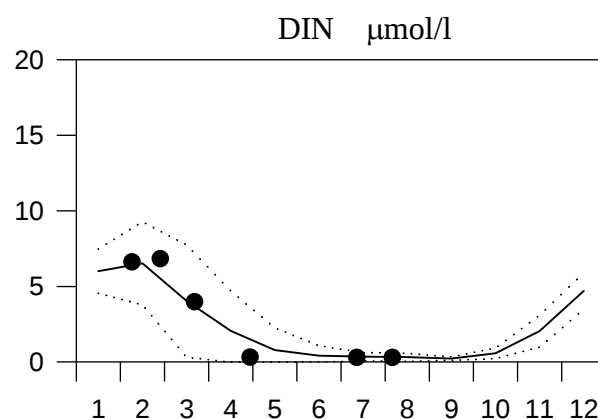
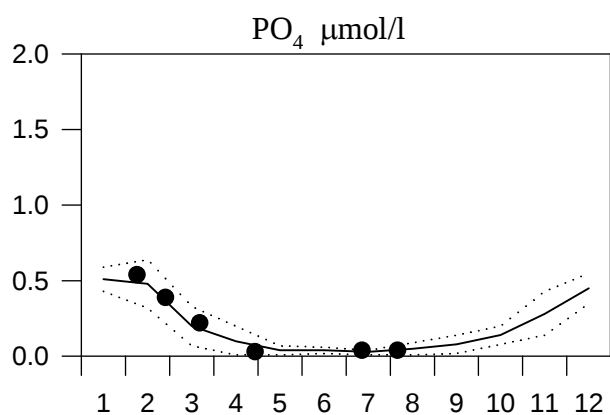
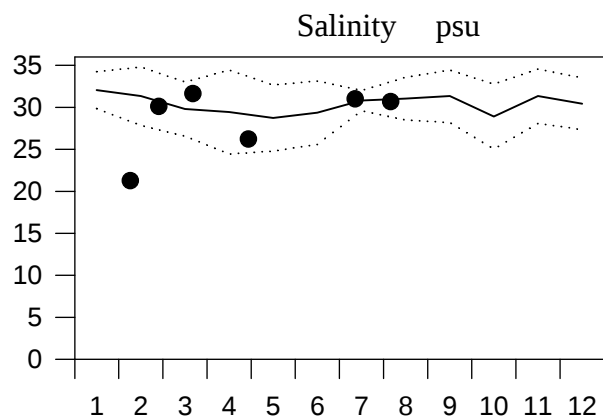
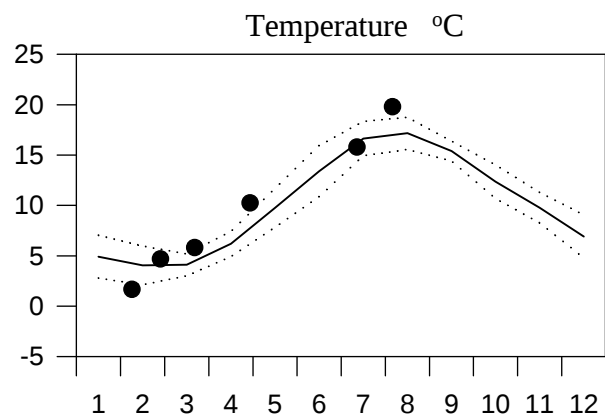
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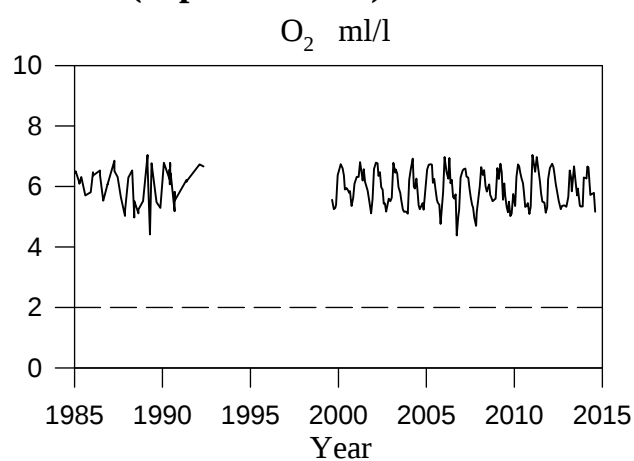
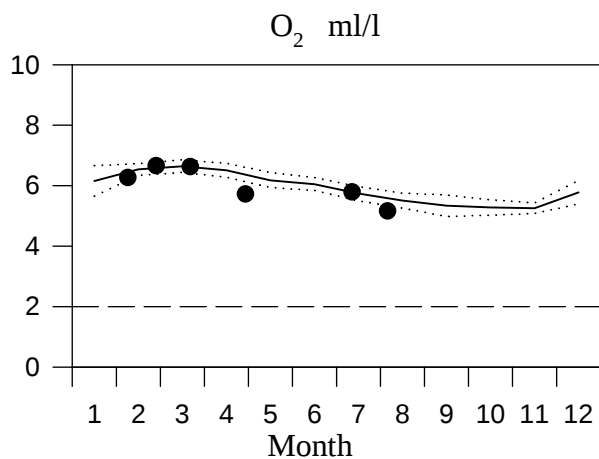
STATION Å15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



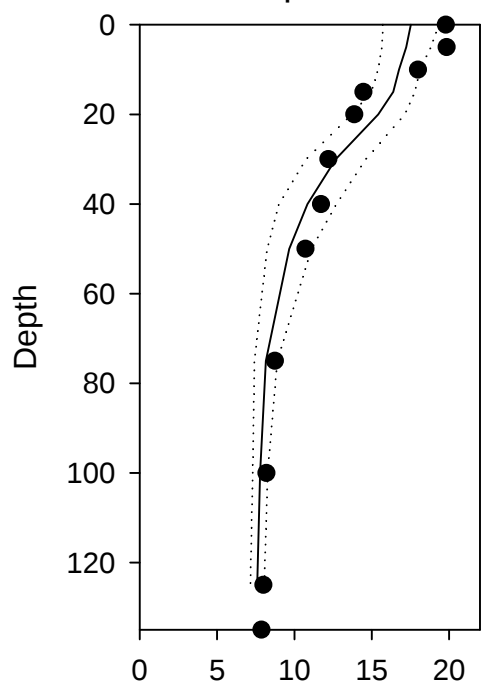
OXYGEN IN BOTTOM WATER (depth ≥125m)



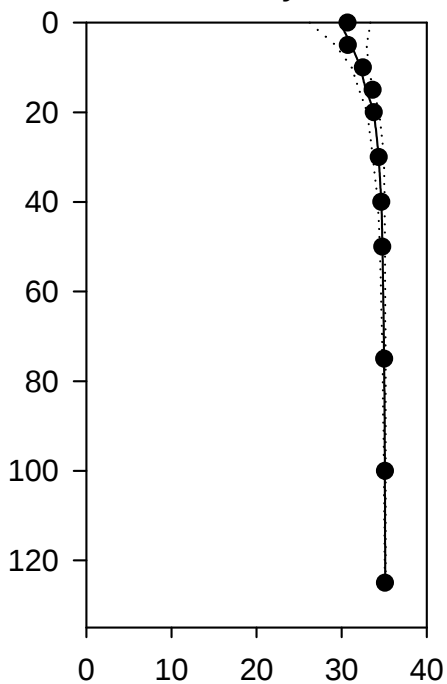
Vertical profiles Å15 August

— Mean 1996-2010 St.Dev. ● 2014

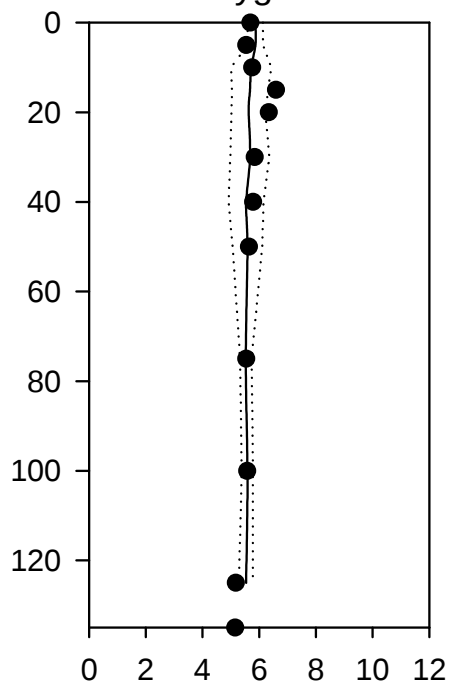
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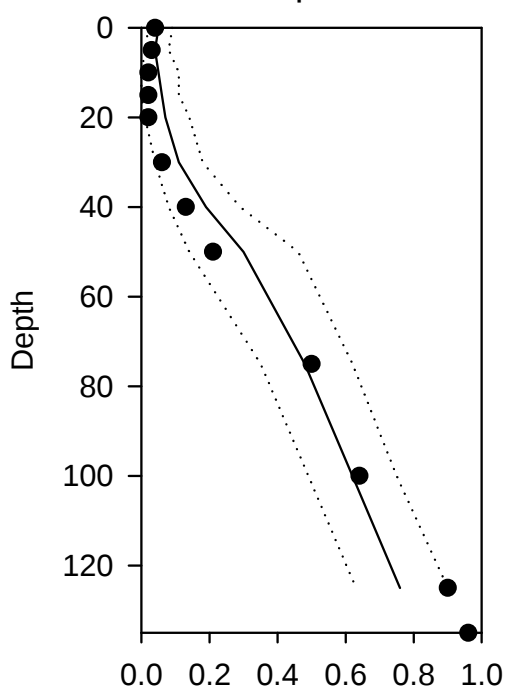
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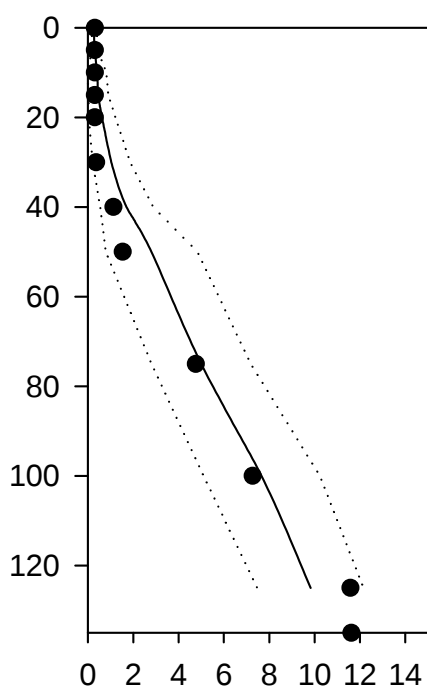
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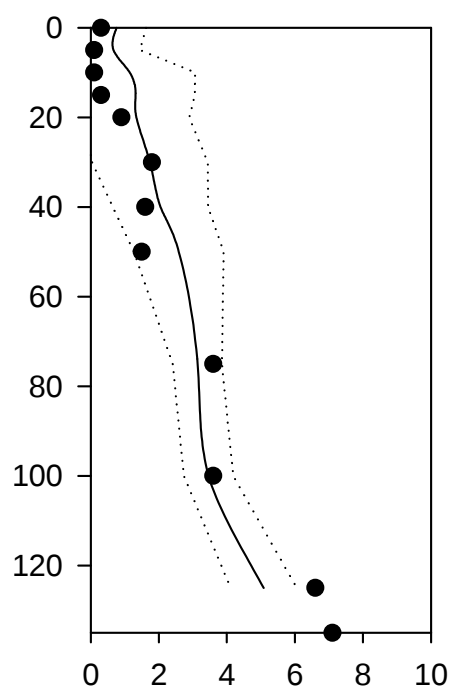
Phosphate



Inorganic Nitrogen



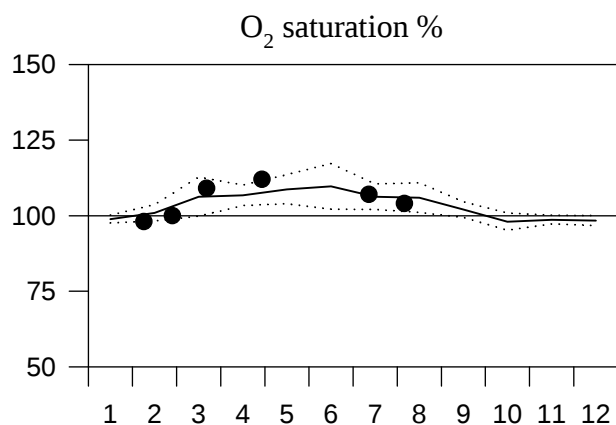
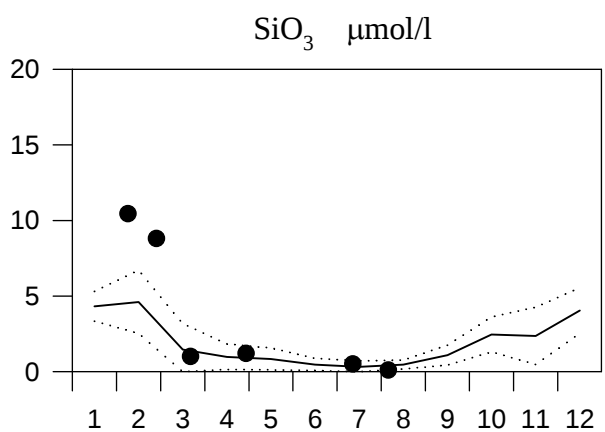
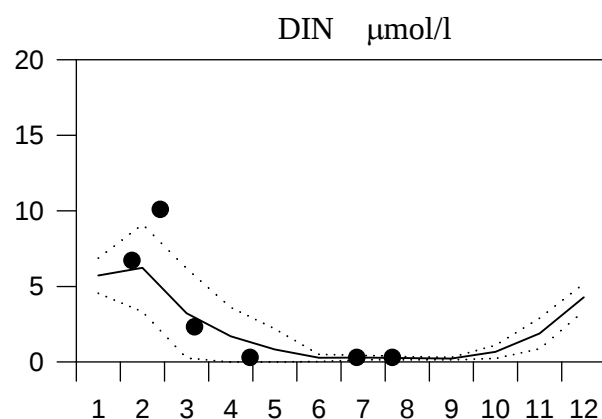
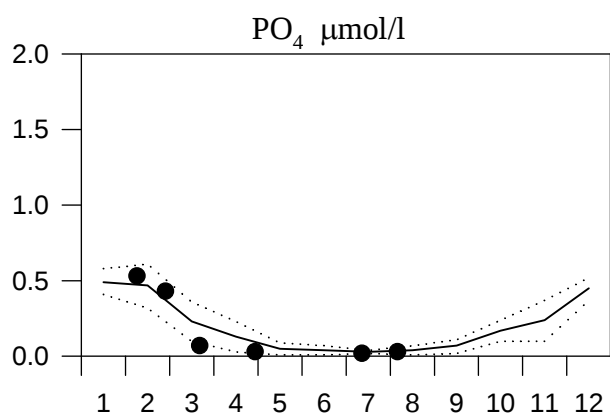
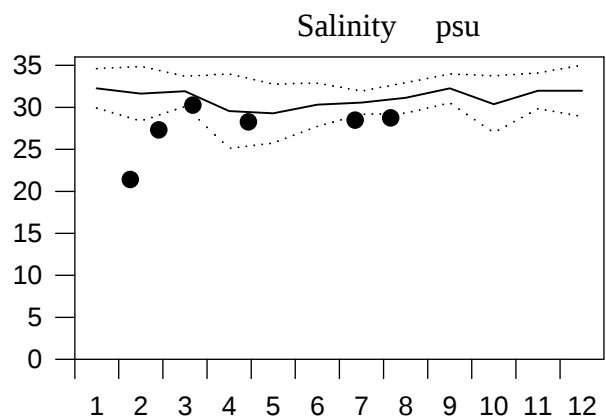
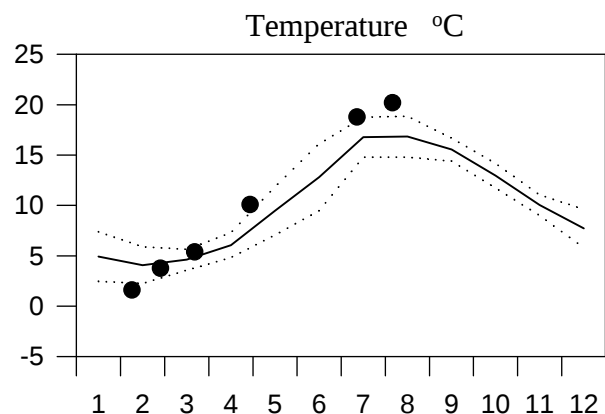
Silicate



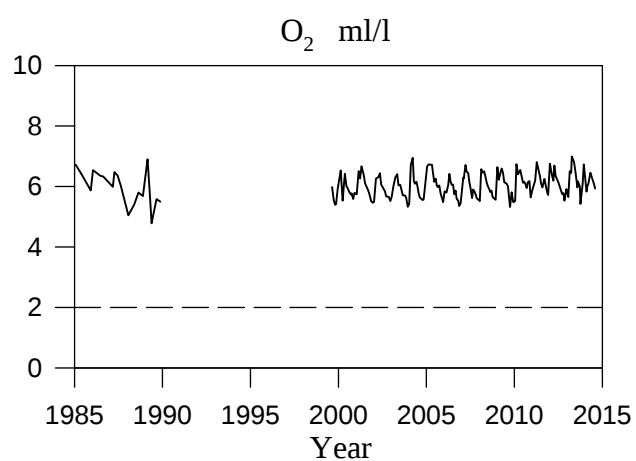
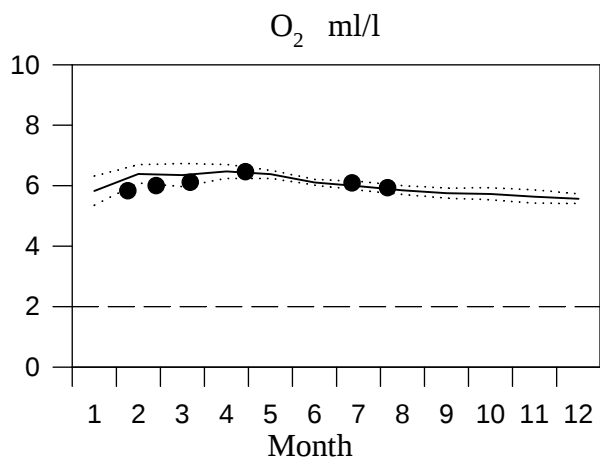
STATION Å17 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



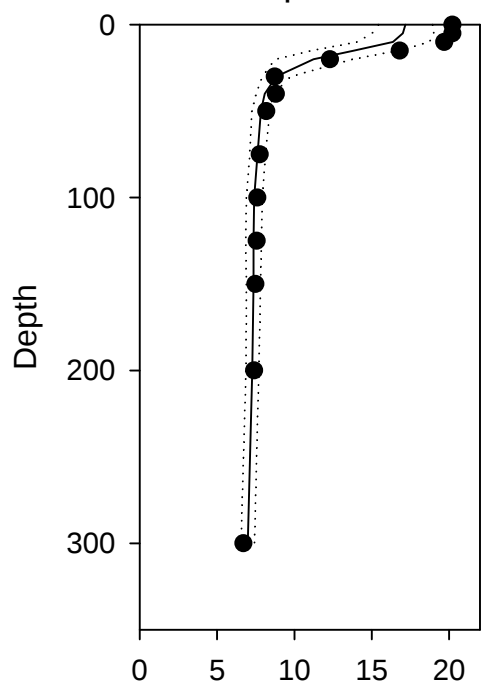
OXYGEN IN BOTTOM WATER (depth = 300m)



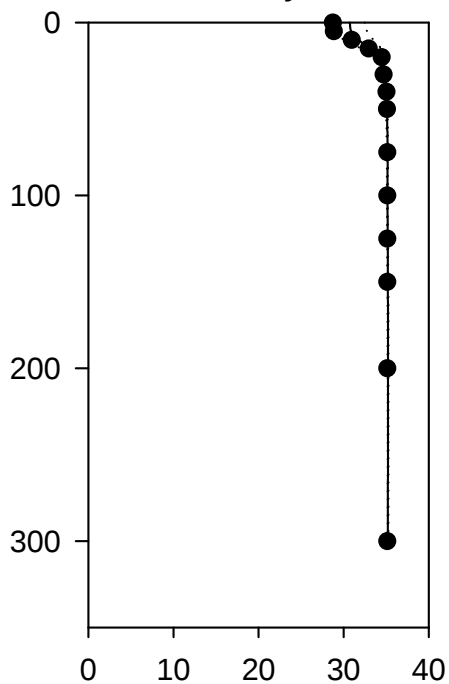
Vertical profiles Å17 August

— Mean 1996-2010 St.Dev. ● 2014

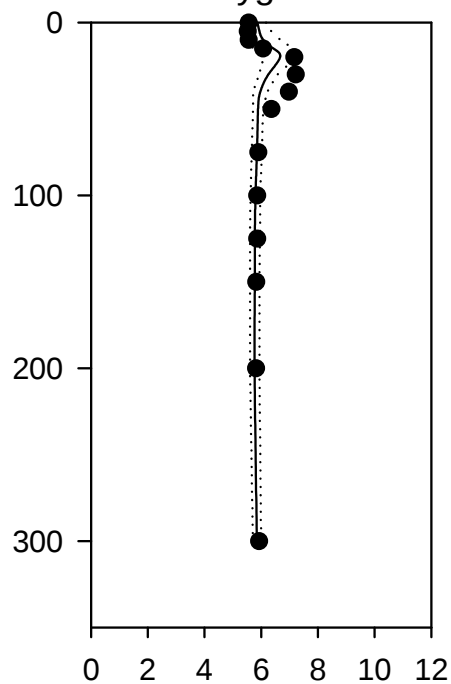
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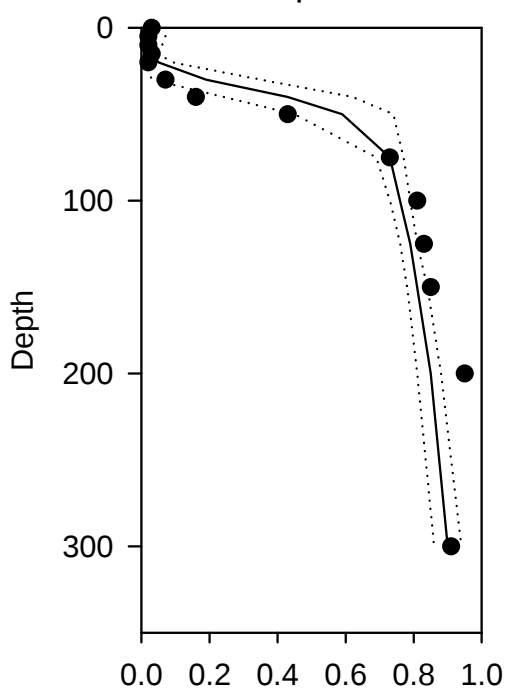
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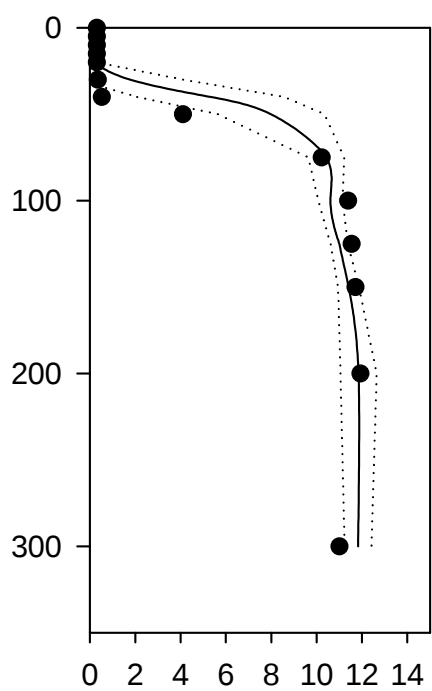
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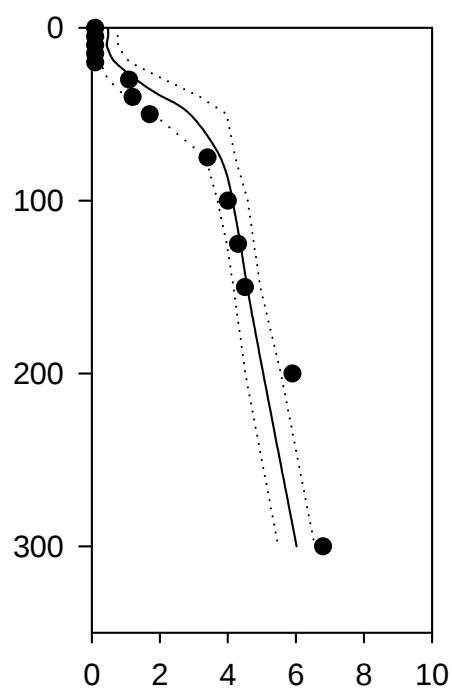
Phosphate



Inorganic Nitrogen



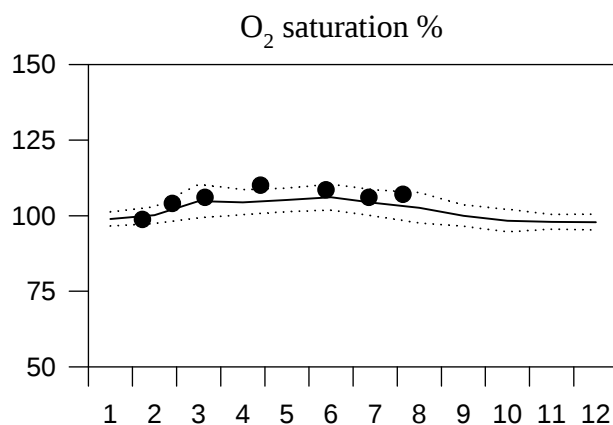
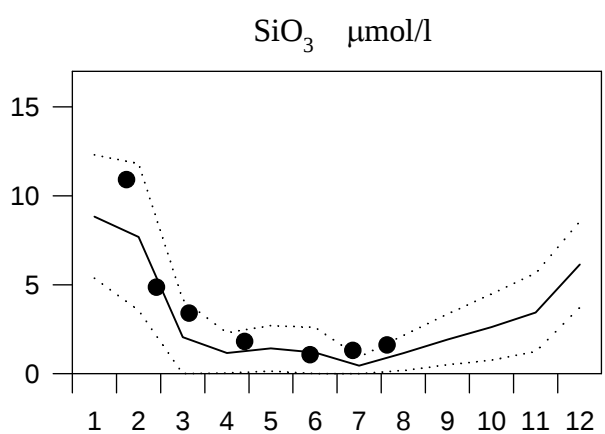
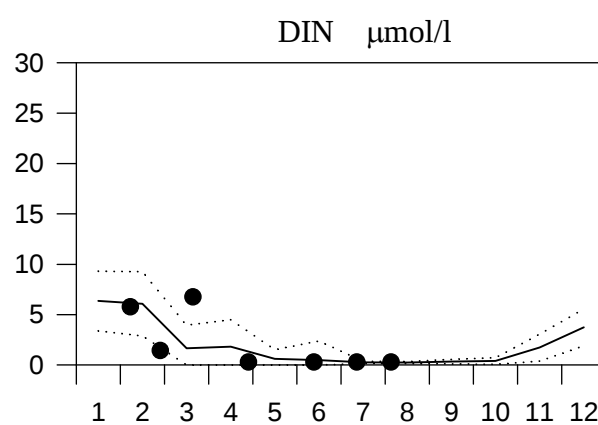
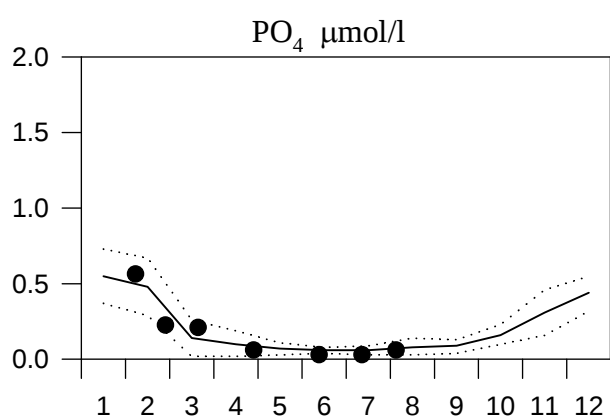
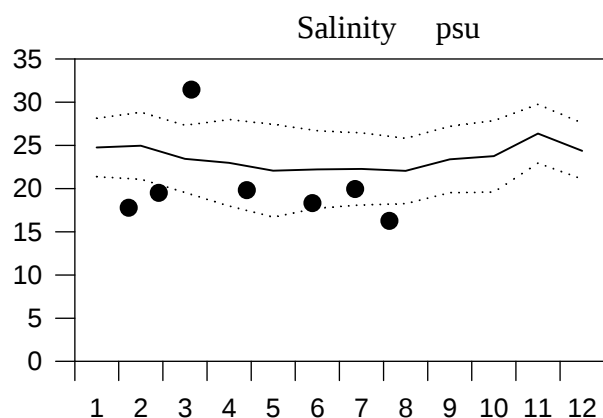
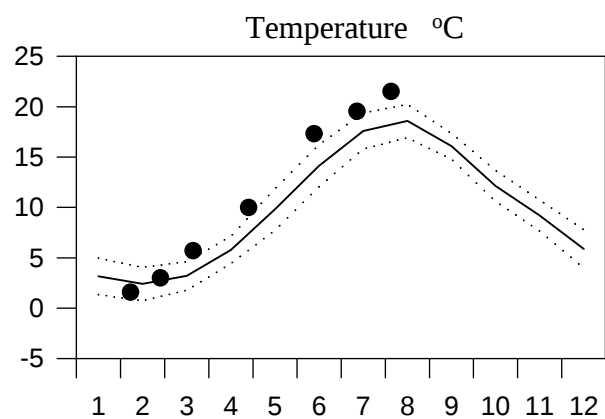
Silicate



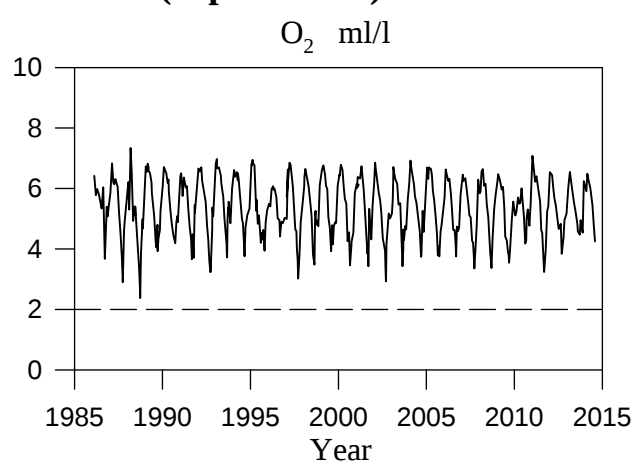
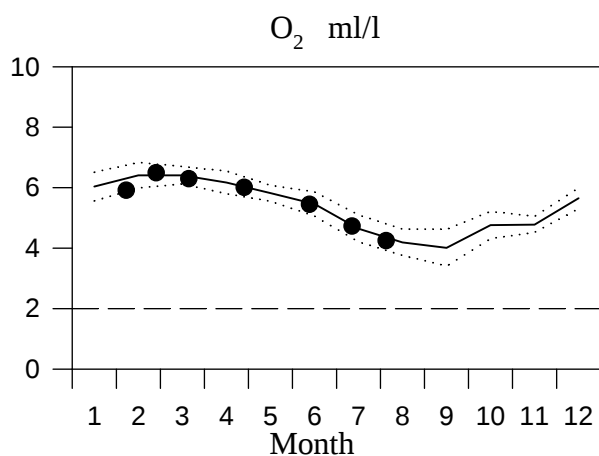
STATION FLADEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

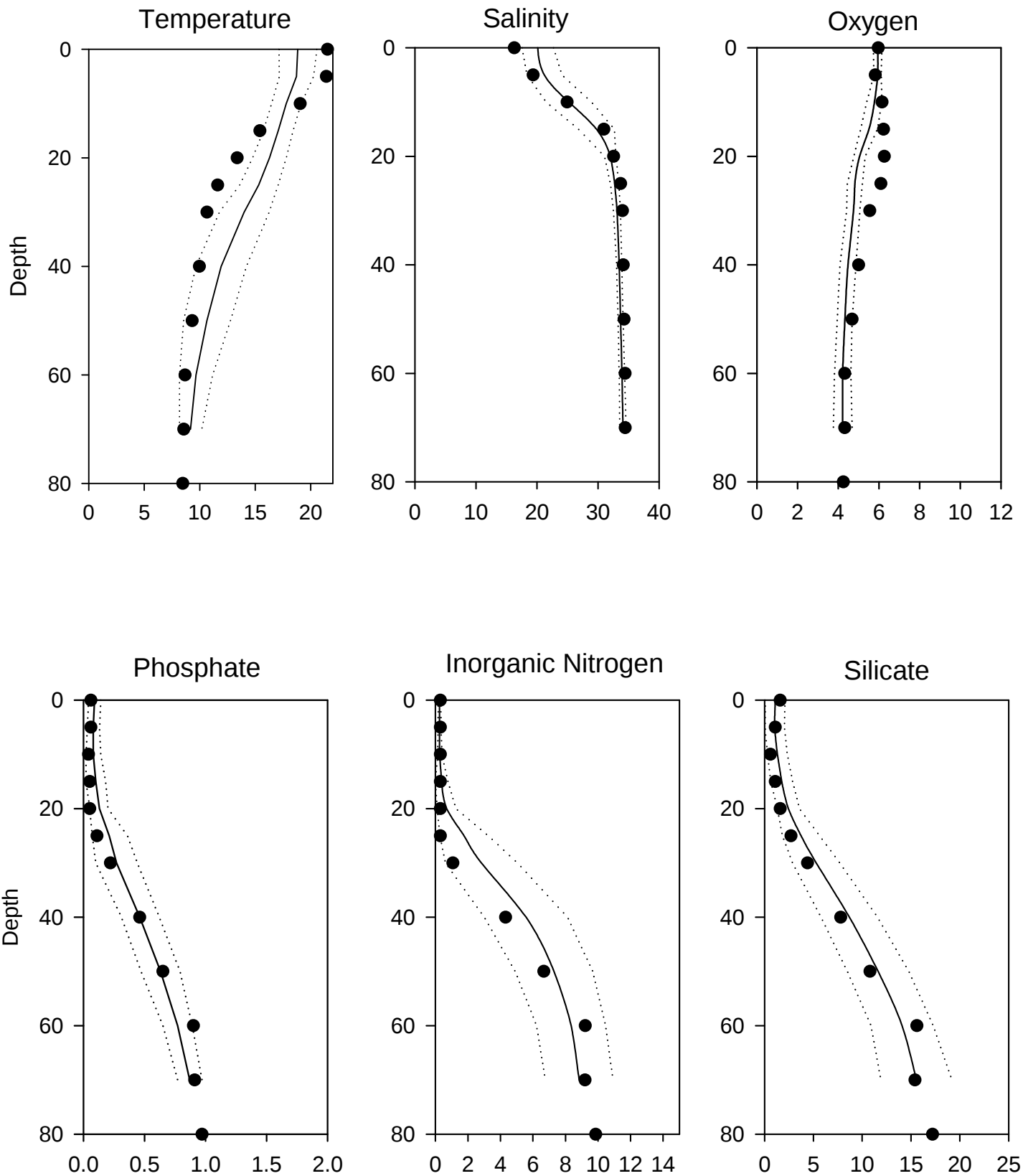


OXYGEN IN BOTTOM WATER (depth > 70m)



Vertical profiles Fladen August

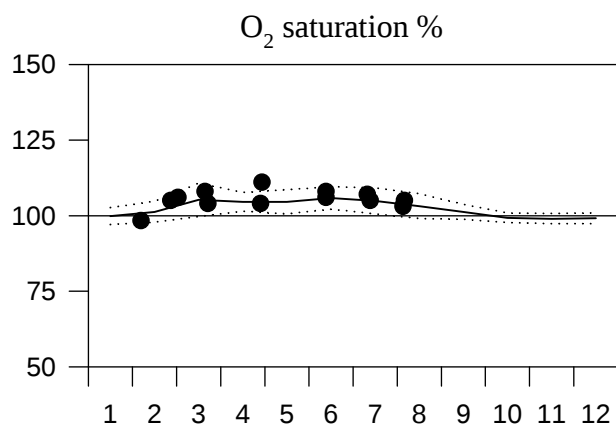
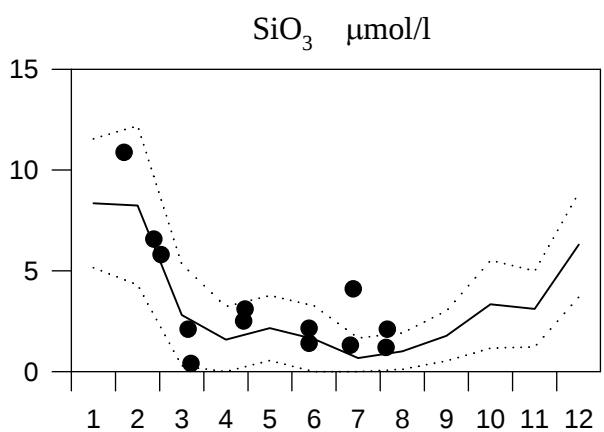
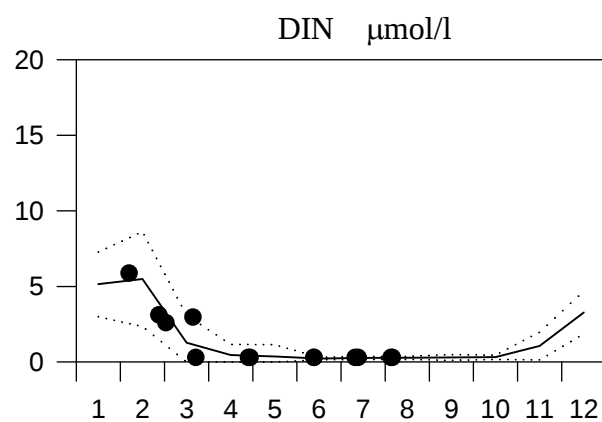
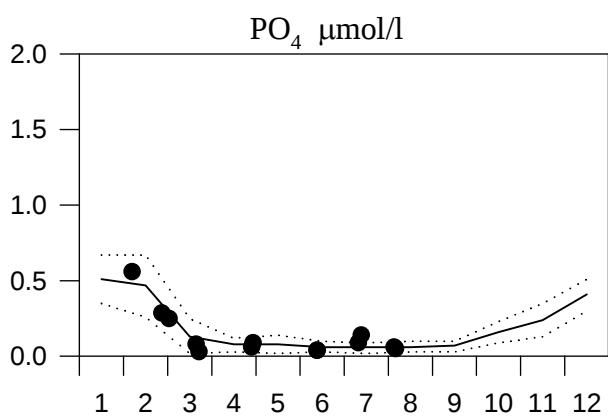
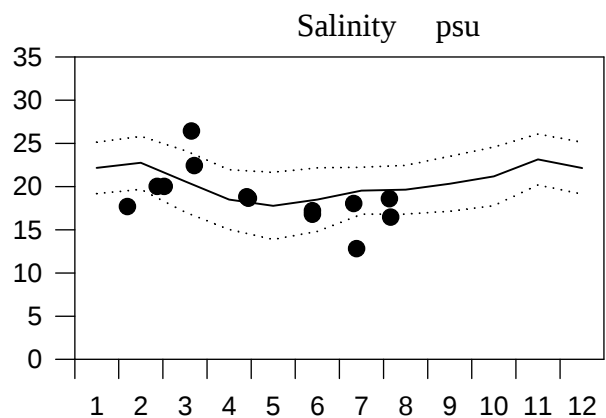
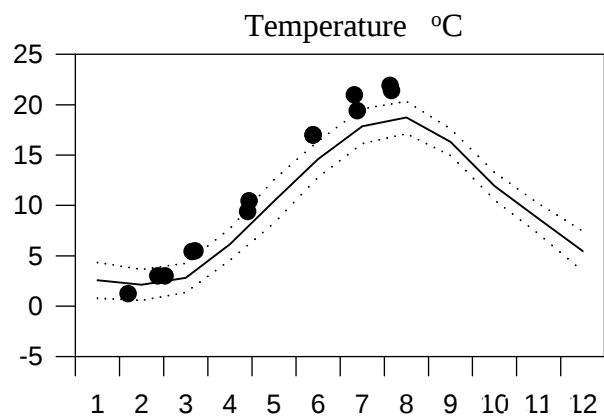
— Mean 1996-2010 St.Dev. ● 2014



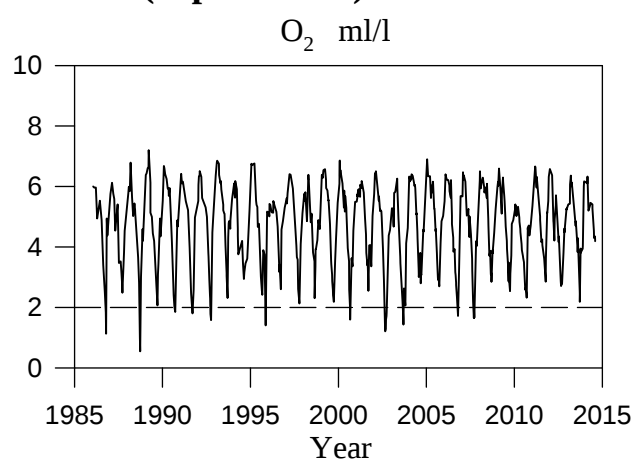
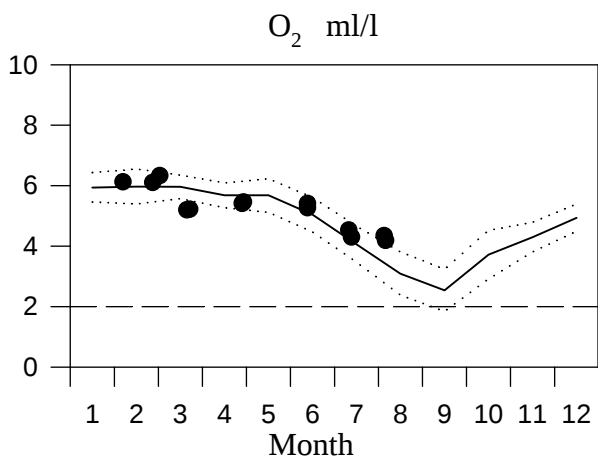
STATION ANHOLT E SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

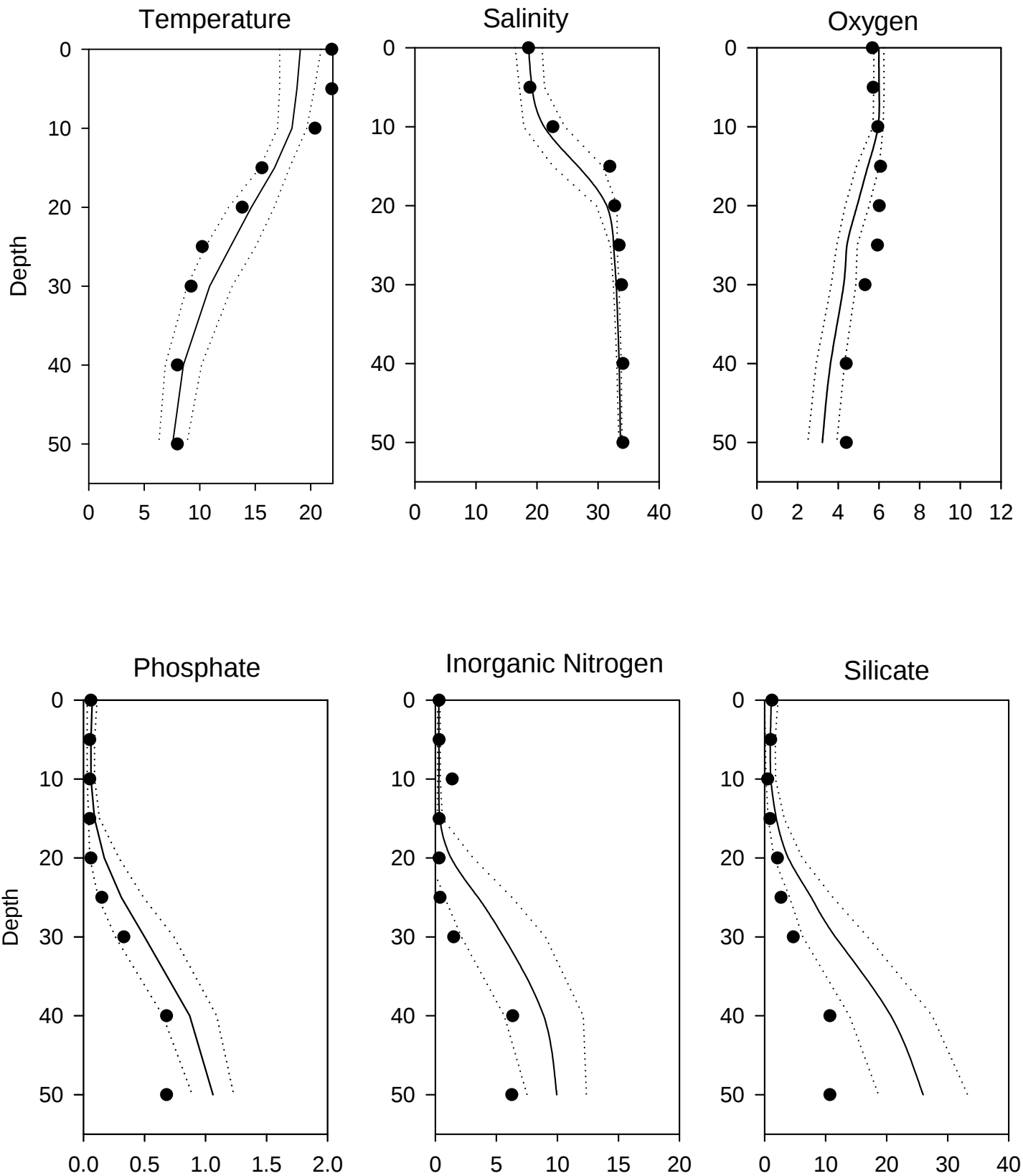


OXYGEN IN BOTTOM WATER (depth > 50m)



Vertical profiles Anholt E August

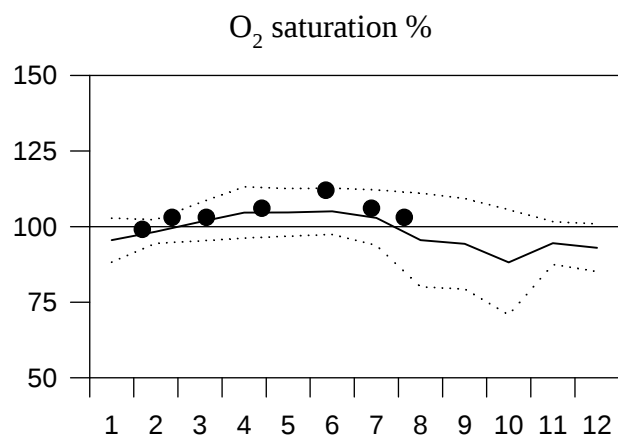
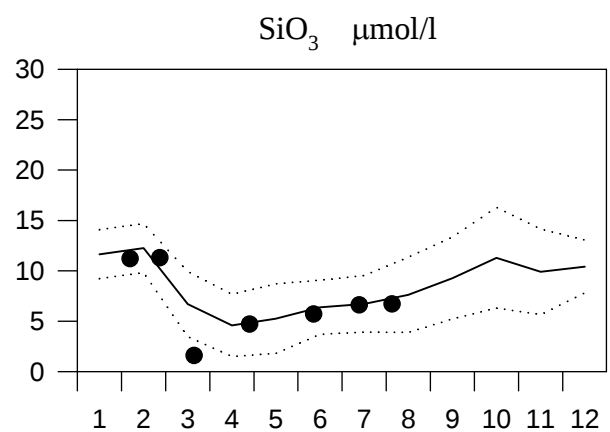
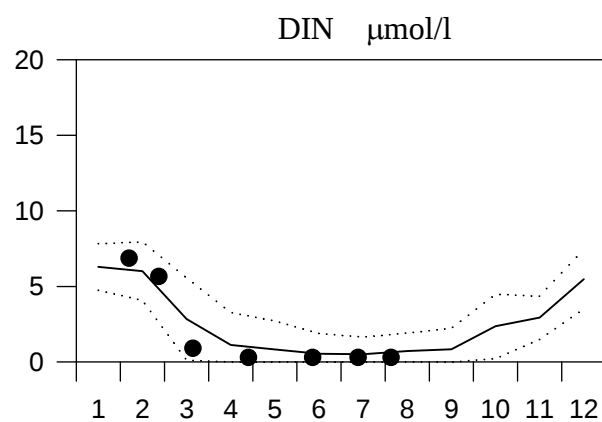
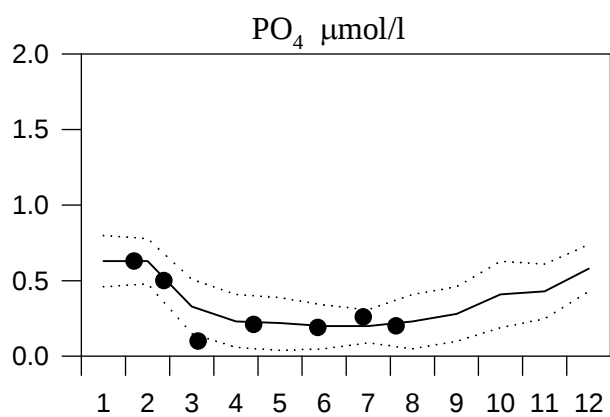
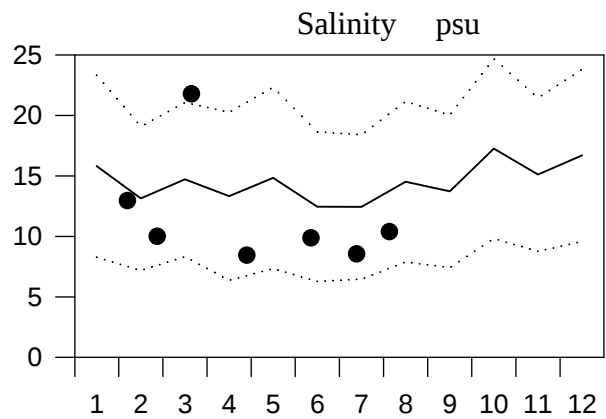
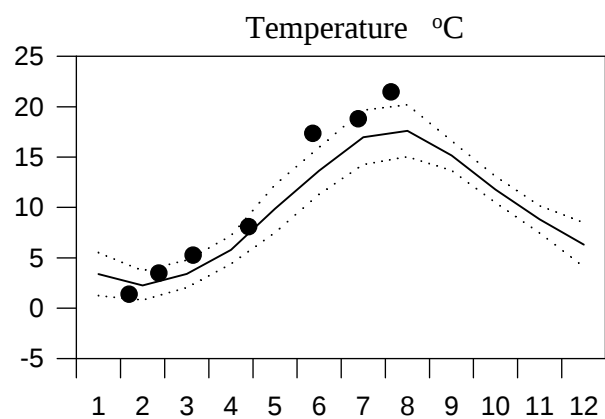
— Mean 1996-2010 St.Dev. ● 2014



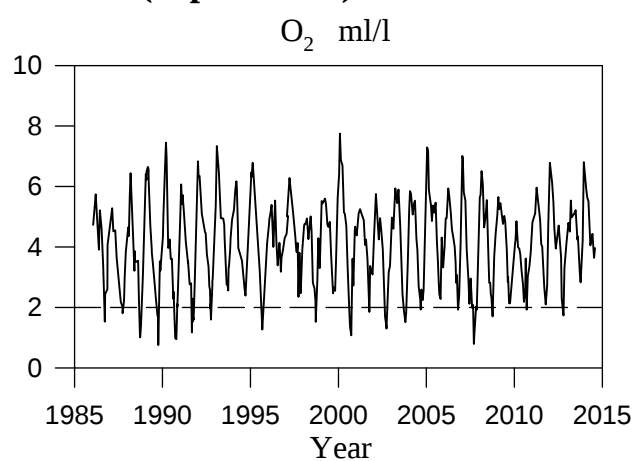
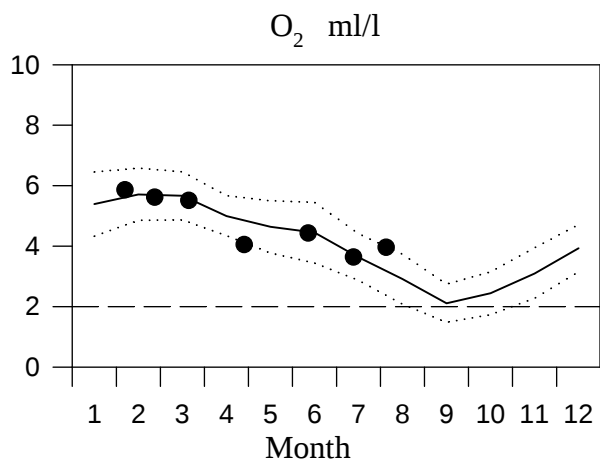
STATION W LANDSKRONA SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

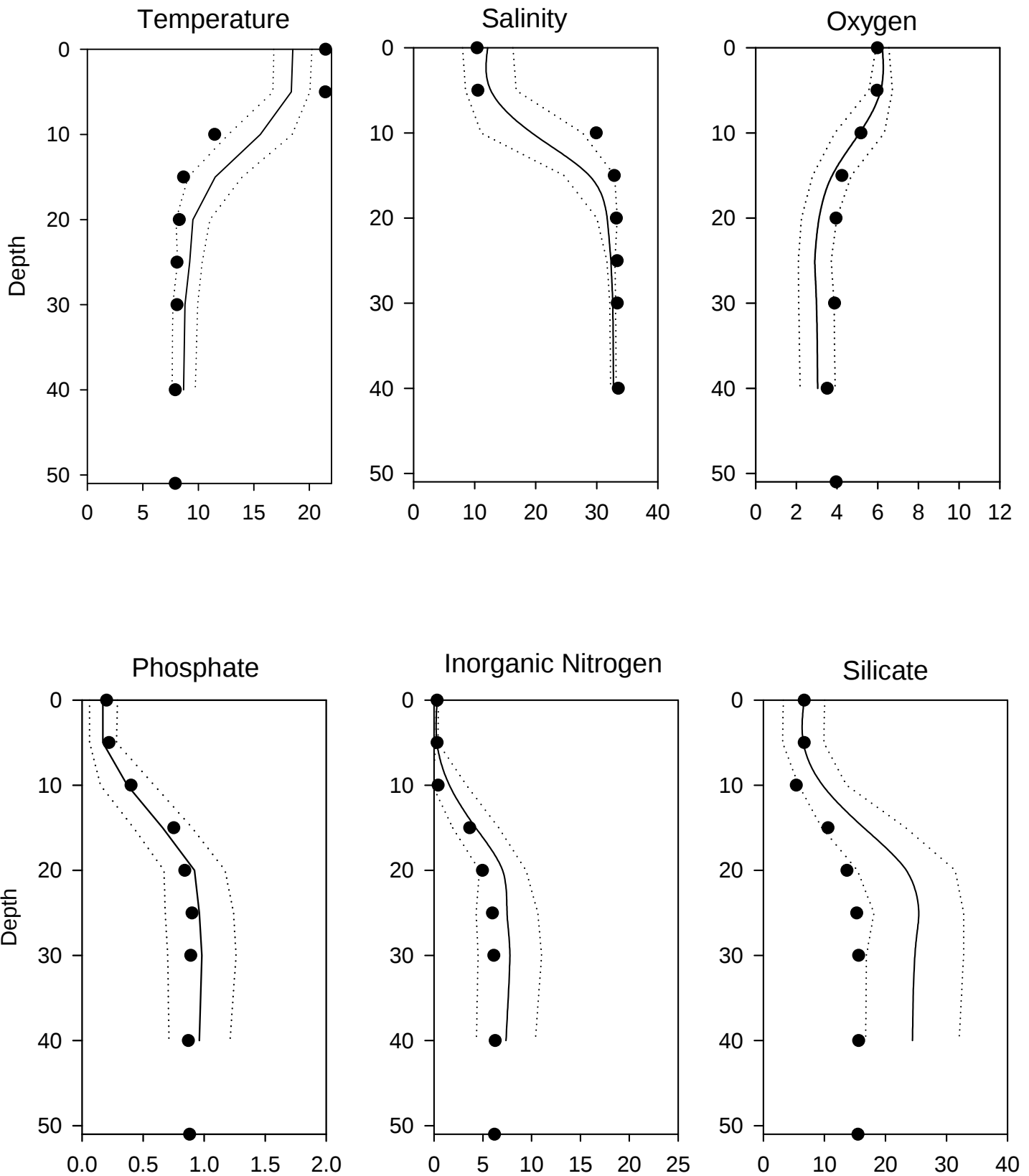


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles W Landskrona August

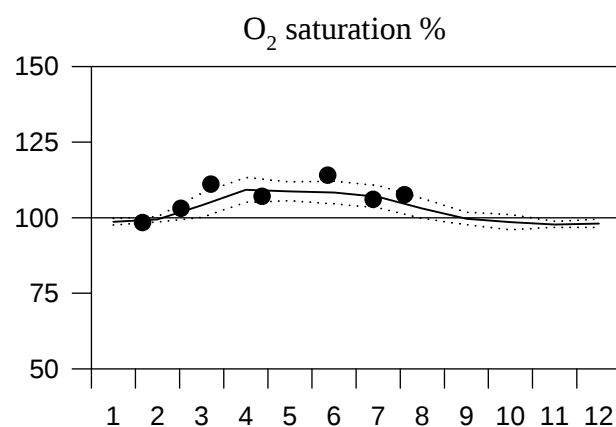
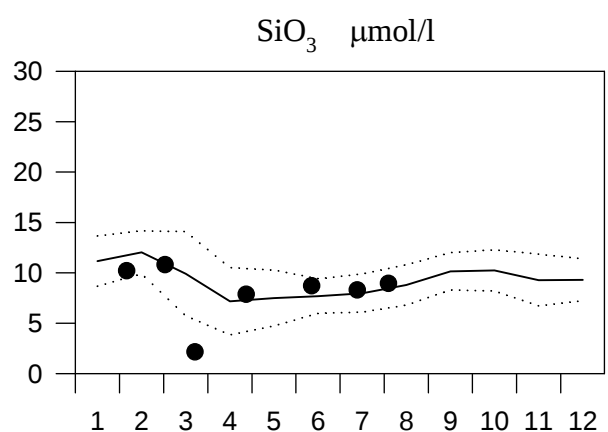
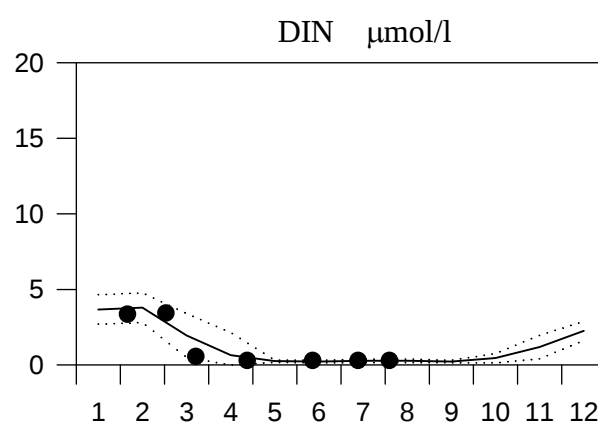
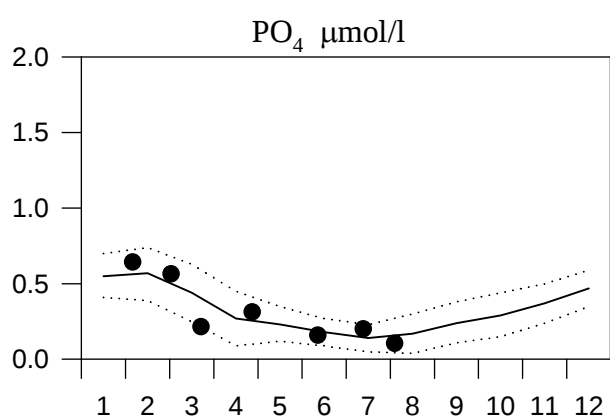
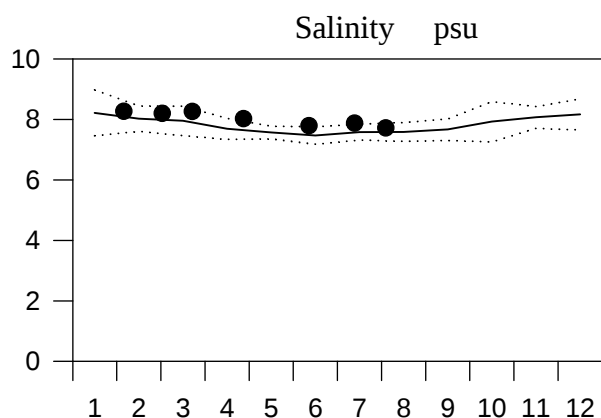
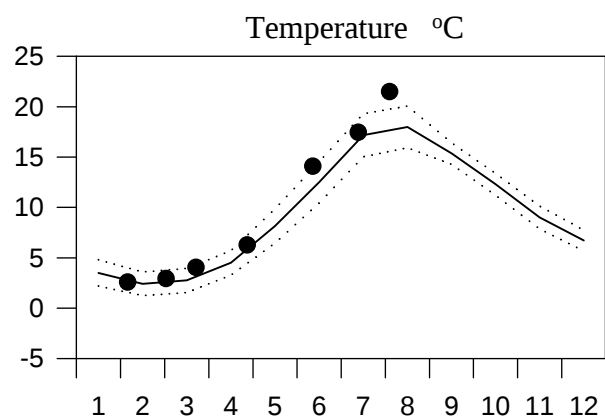
— Mean 1996-2010 St.Dev. ● 2014



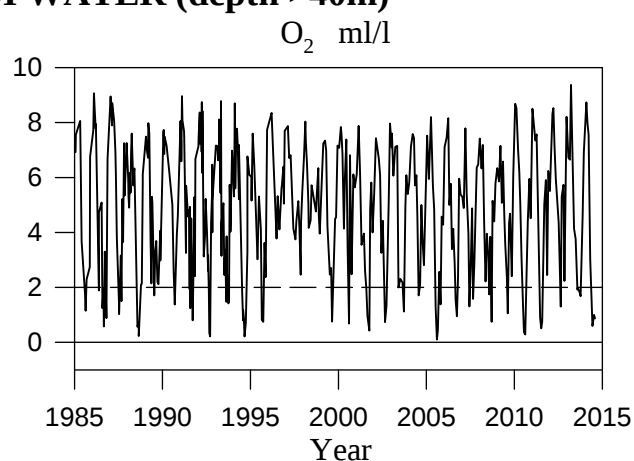
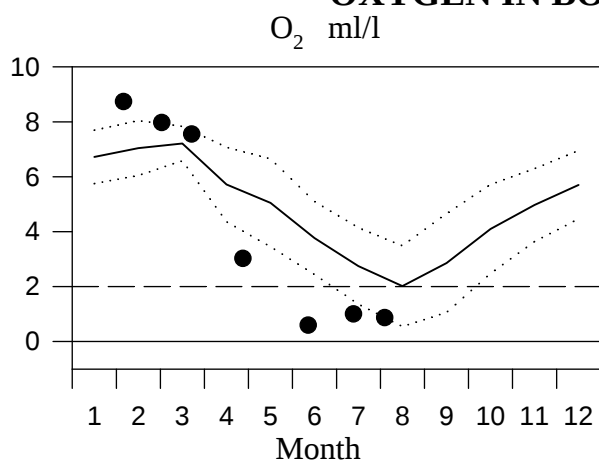
STATION BY1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

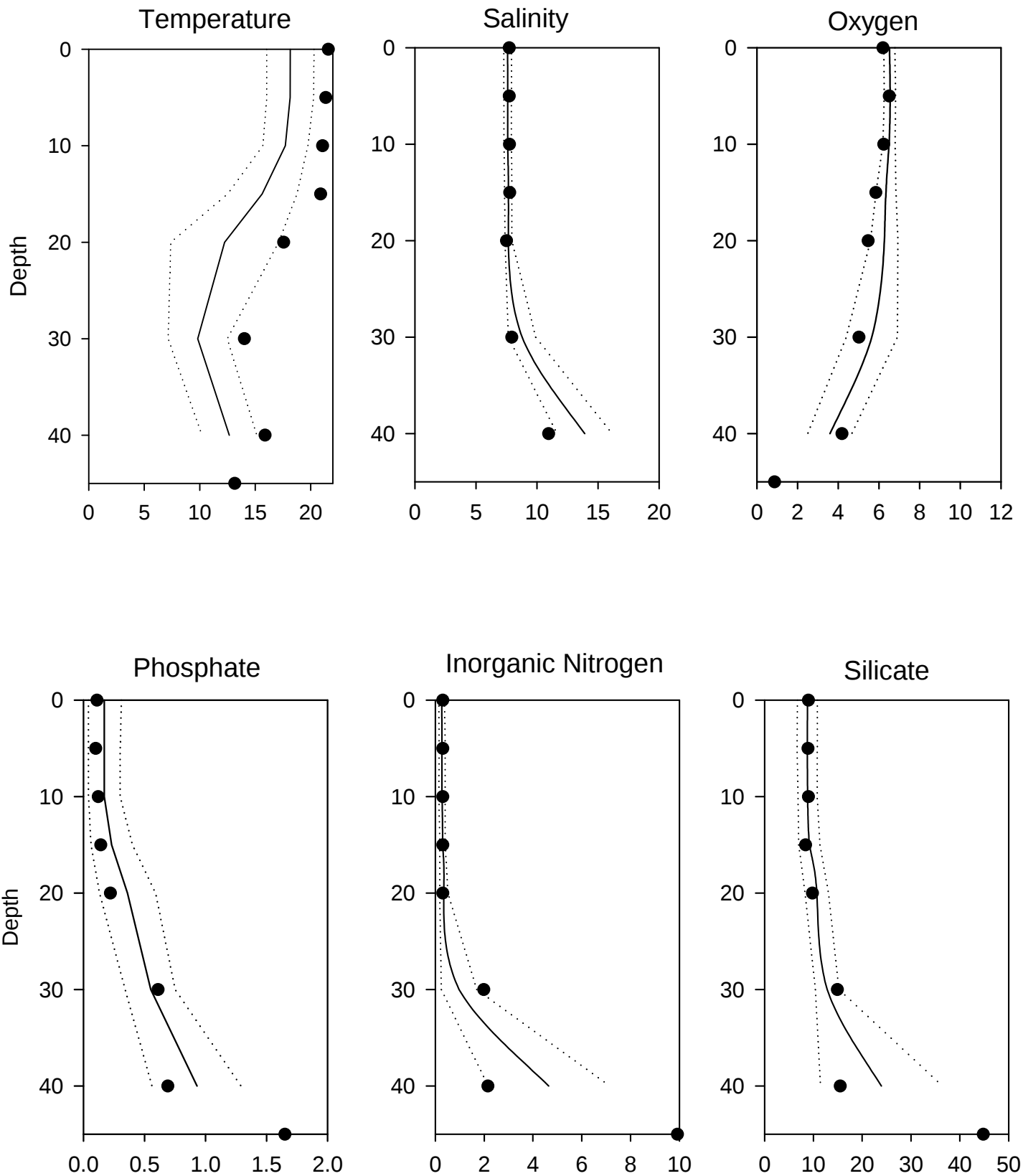


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY1 August

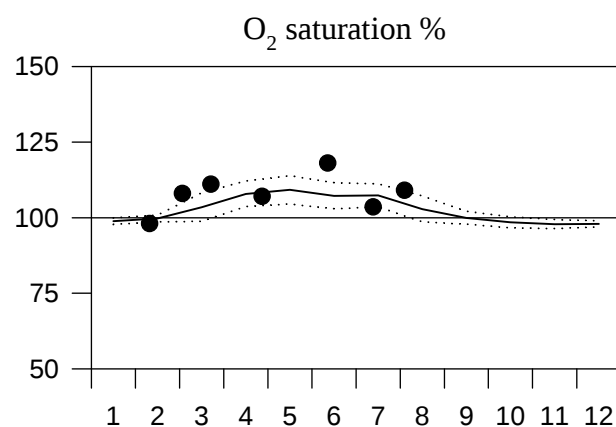
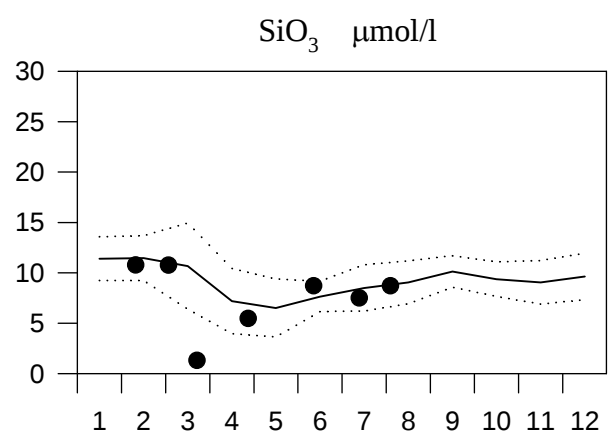
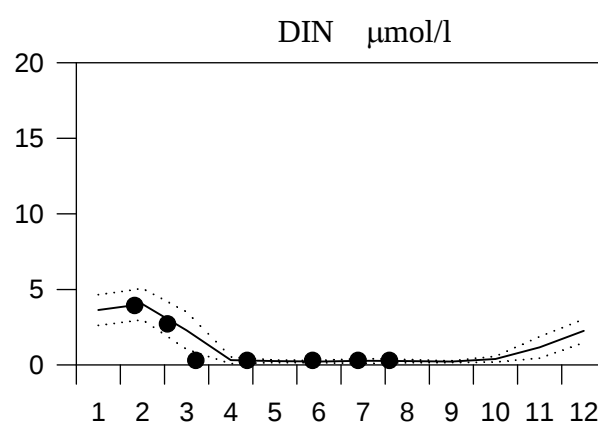
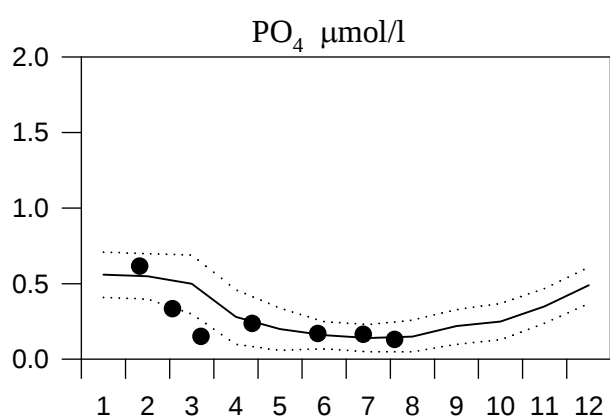
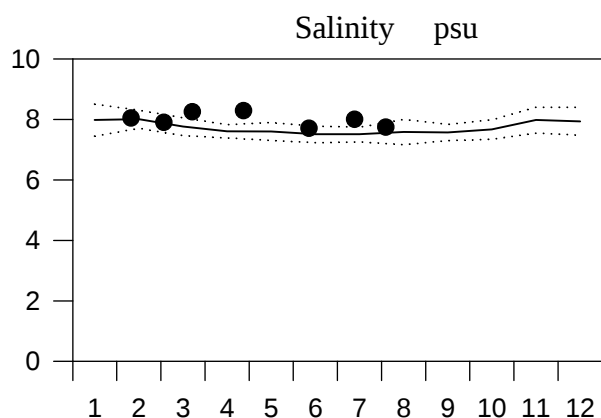
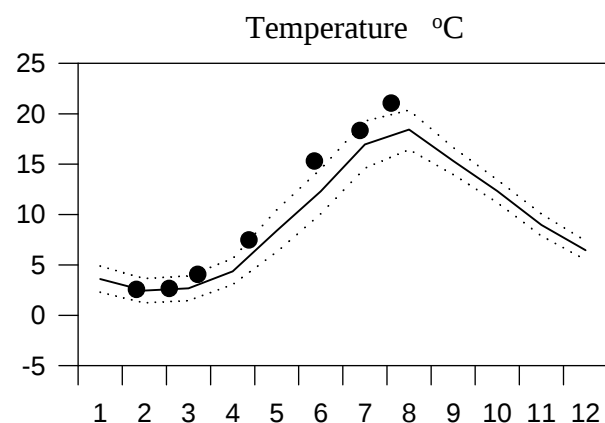
— Mean 1996-2010 St.Dev. ● 2014



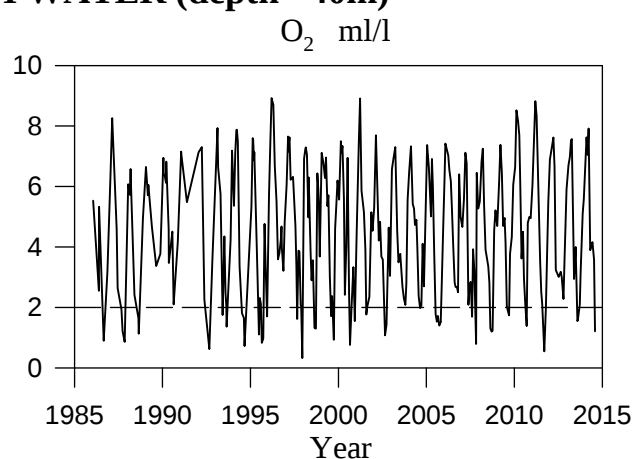
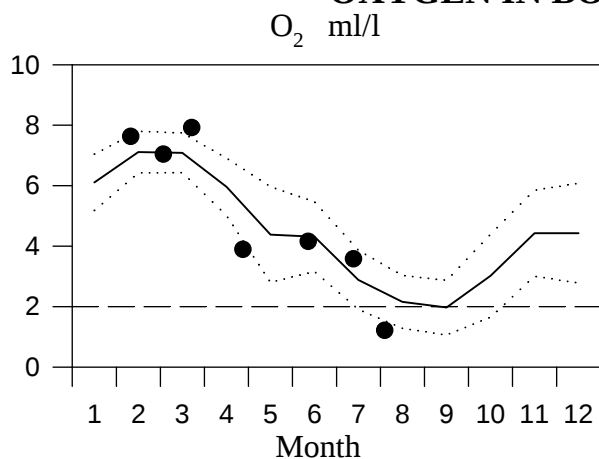
STATION BY2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

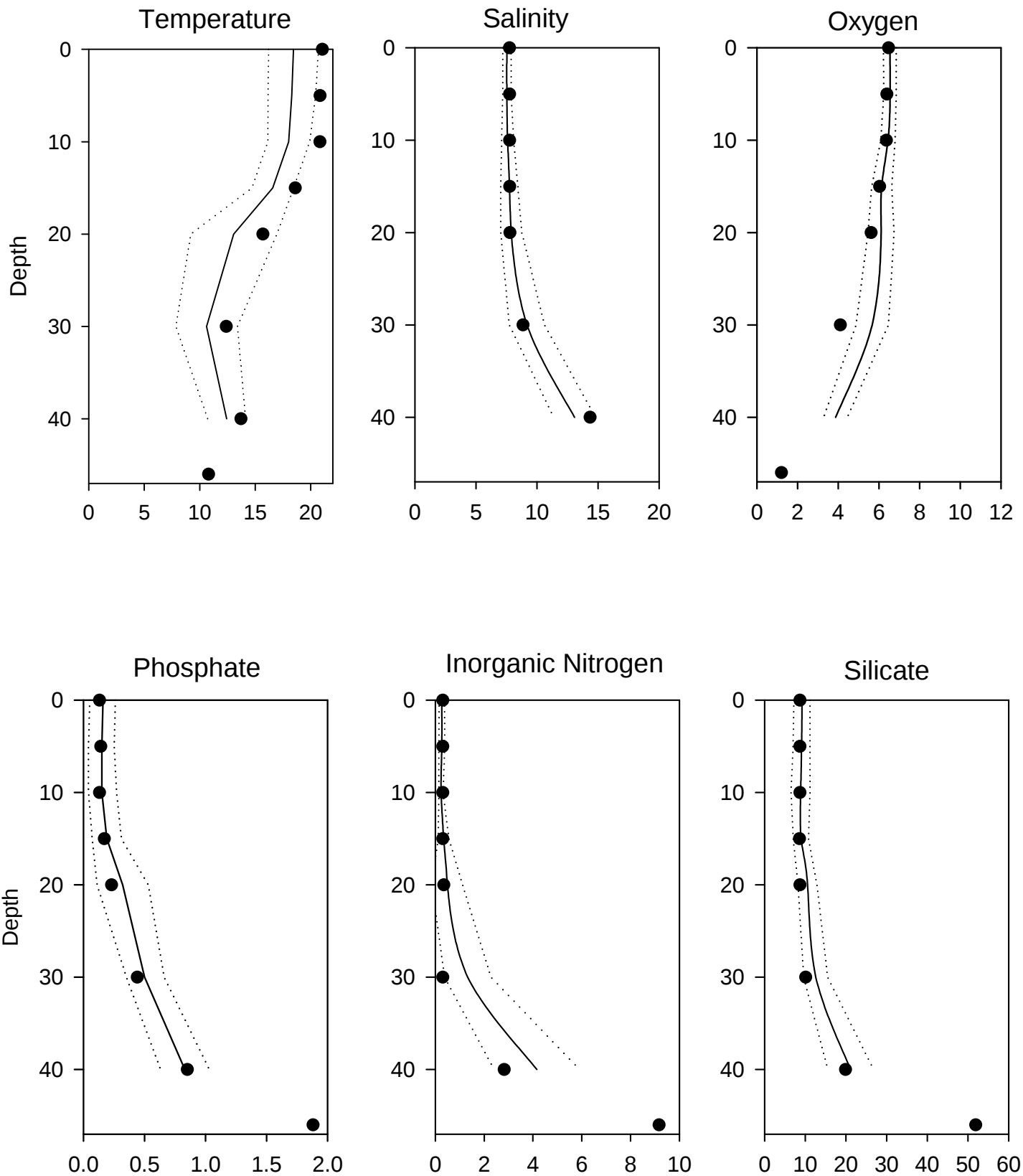


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY2 August

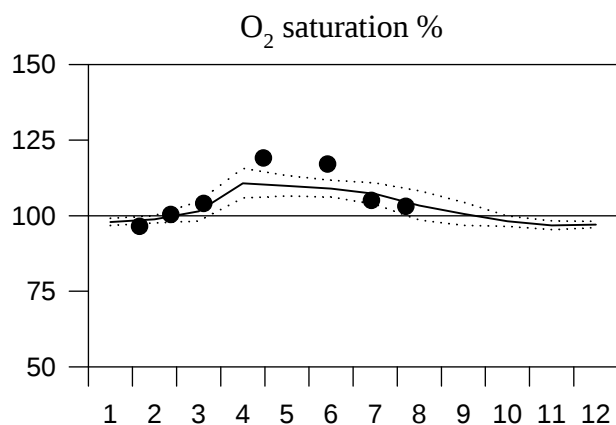
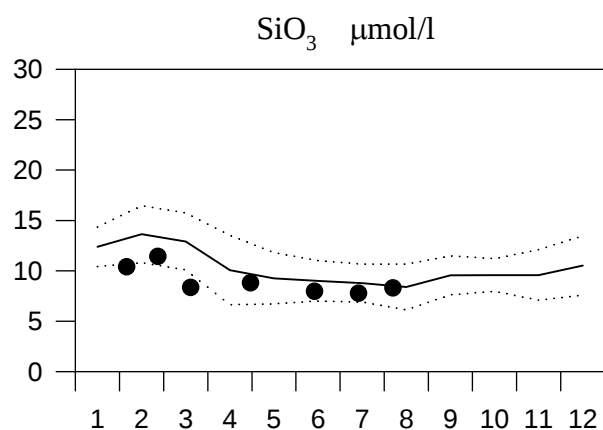
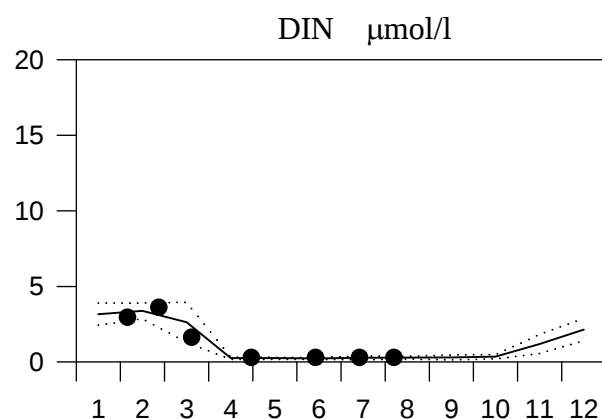
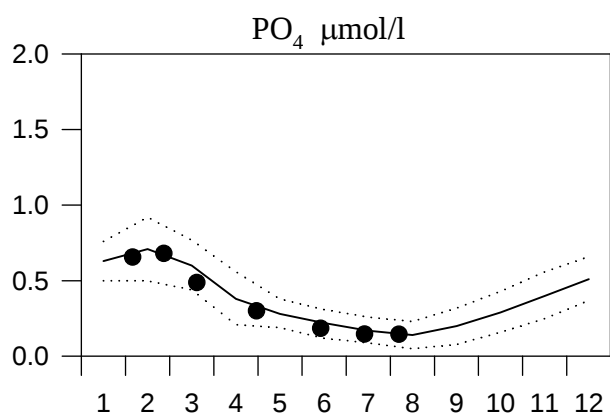
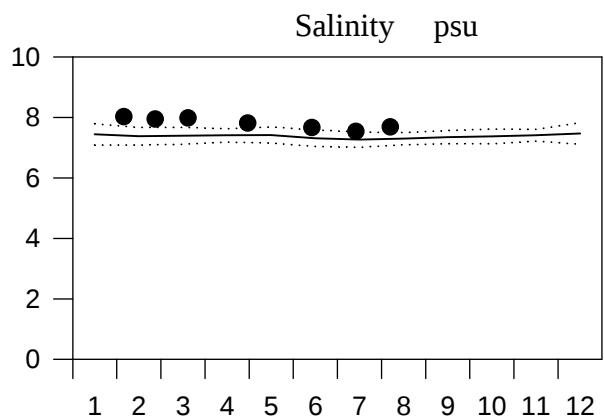
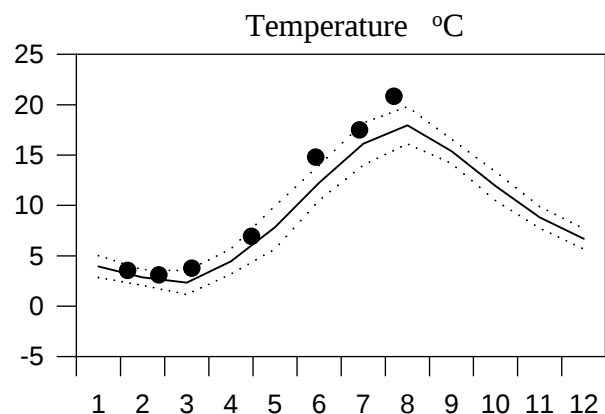
— Mean 1996-2010 St.Dev. ● 2014



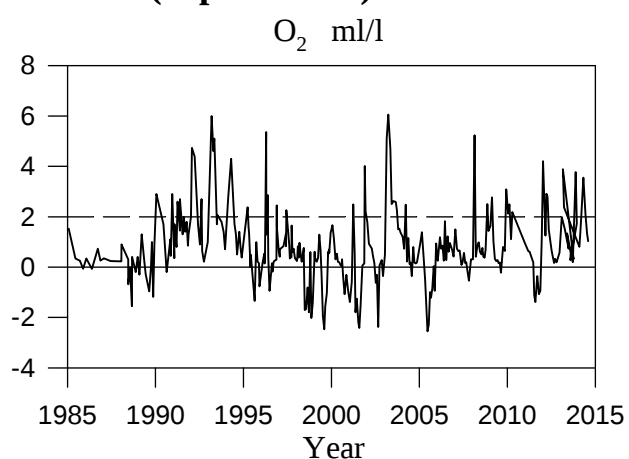
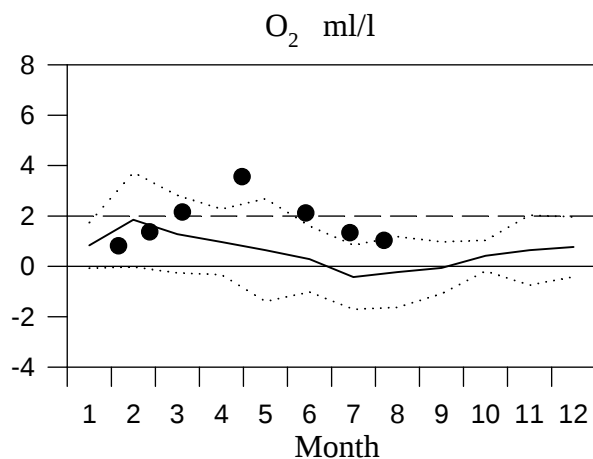
STATION HANÖBUKTEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

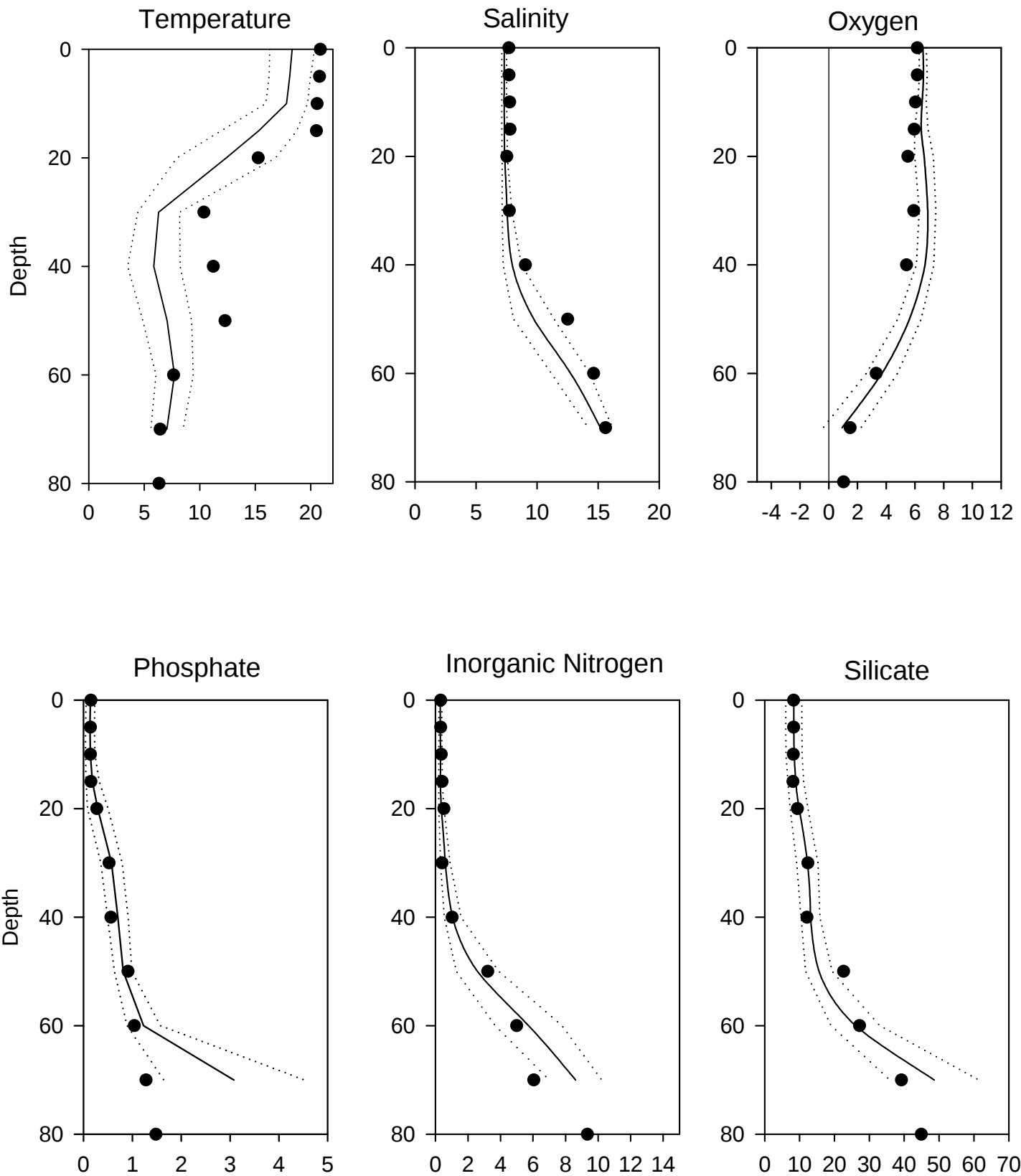


OXYGEN IN BOTTOM WATER (depth > 70m)



Vertical profiles Hanöbukten August

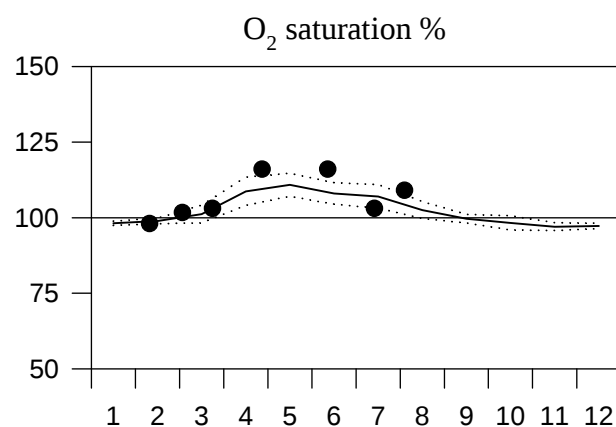
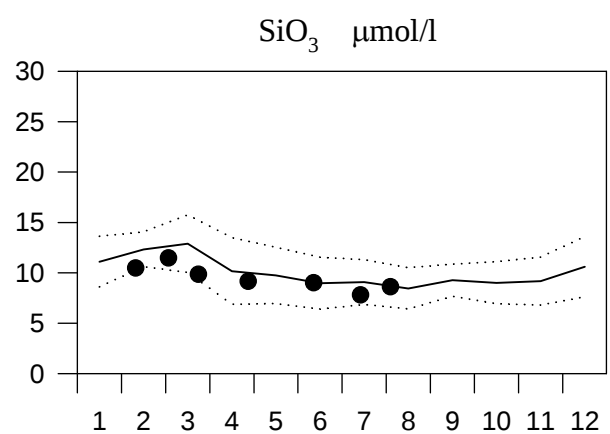
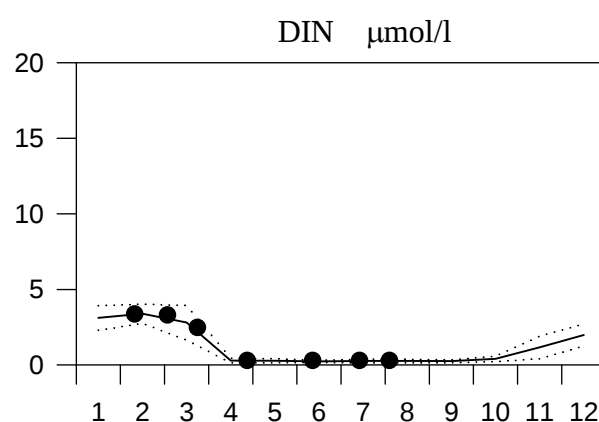
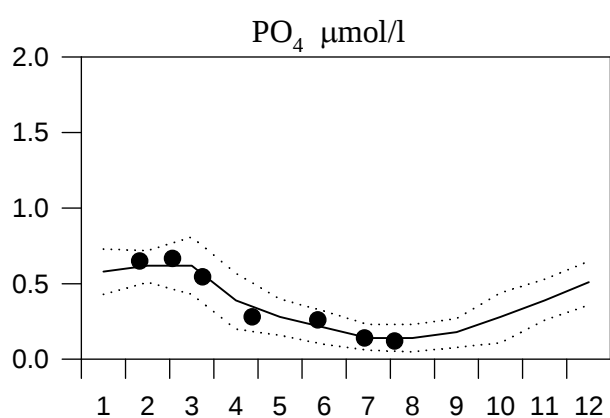
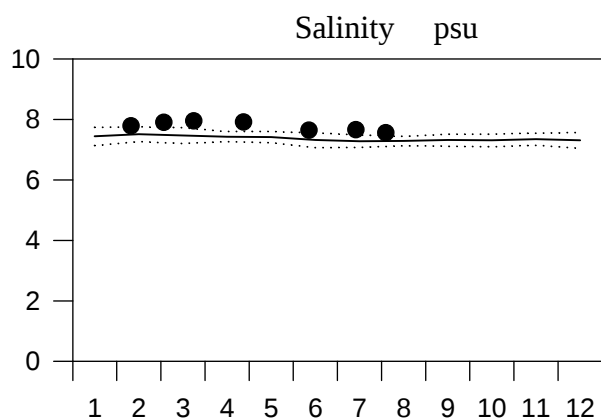
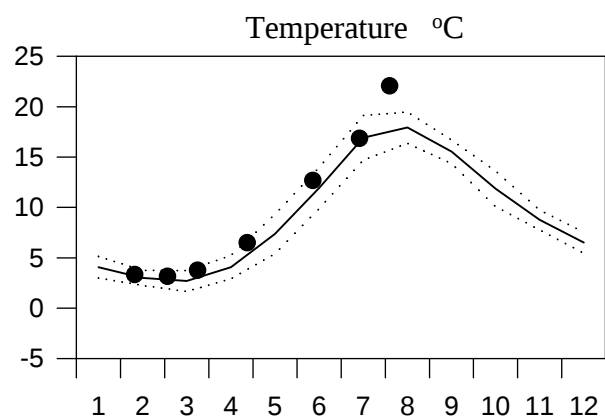
— Mean 1996-2010 St.Dev. ● 2014



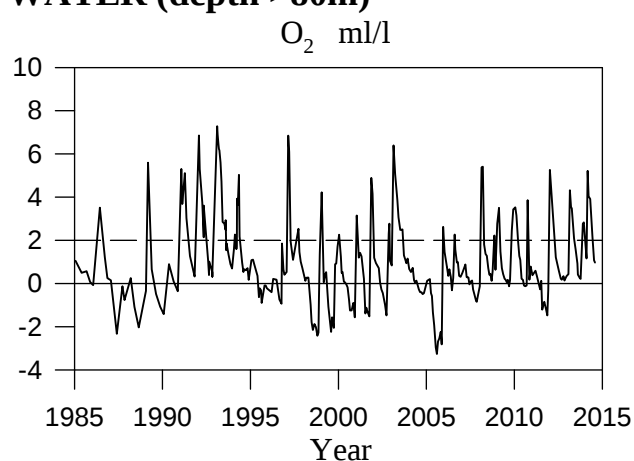
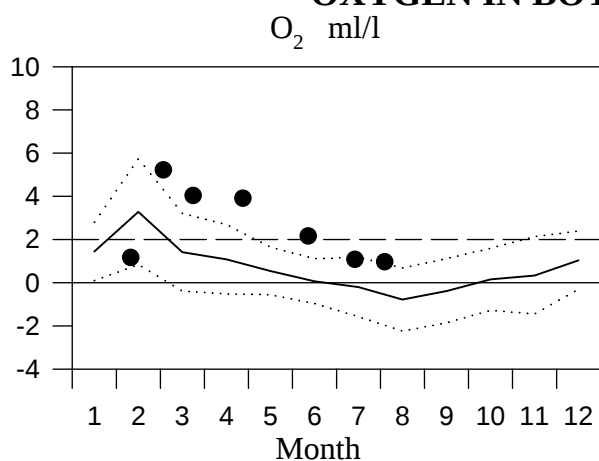
STATION BY4 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



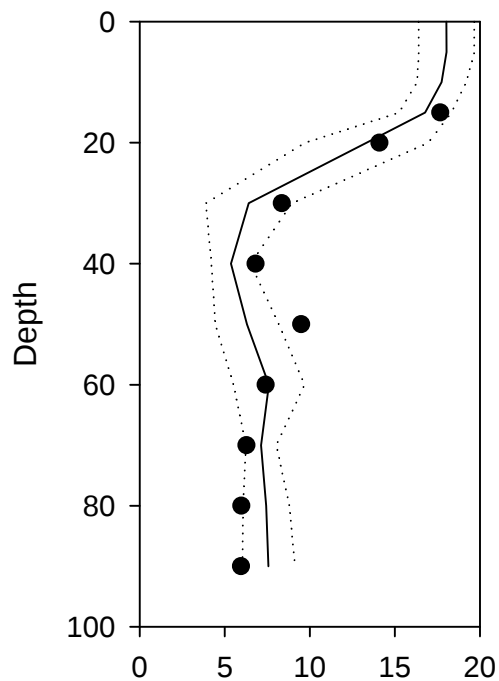
OXYGEN IN BOTTOM WATER (depth >80m)



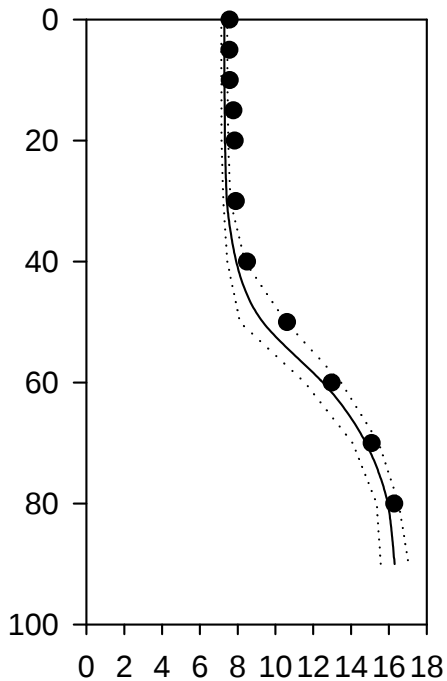
Vertical profiles BY4 August

— Mean 1996-2010 St.Dev. ● 2014

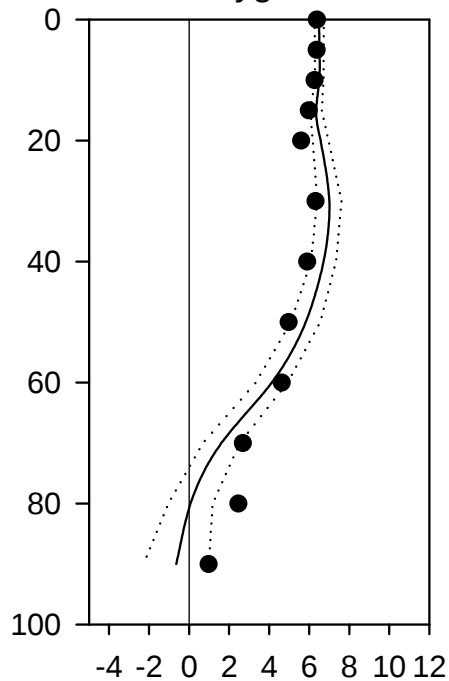
Temperature



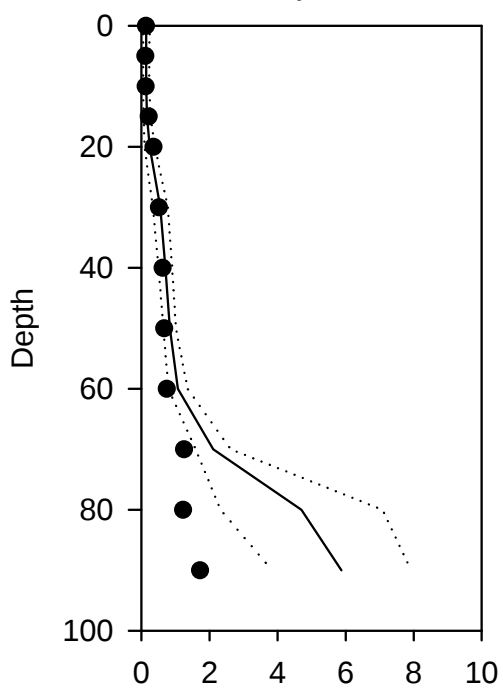
Salinity



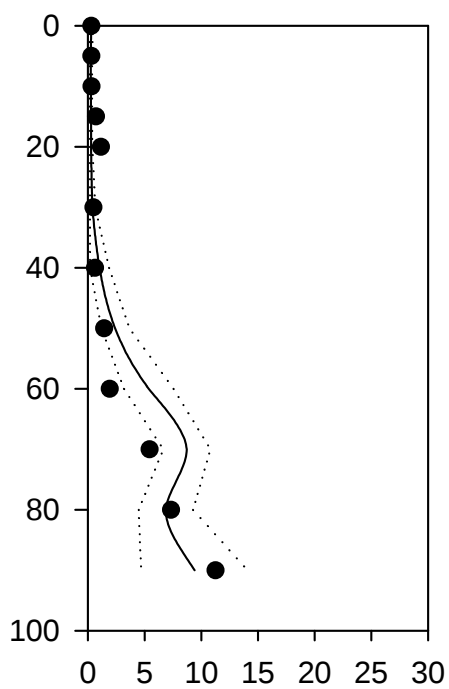
Oxygen



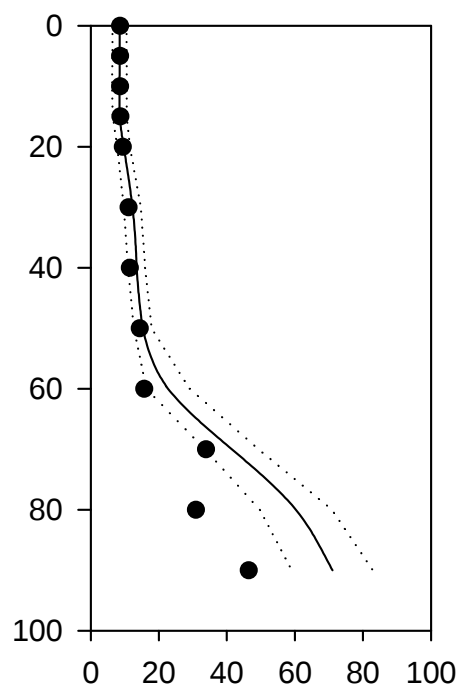
Phosphate



Inorganic Nitrogen



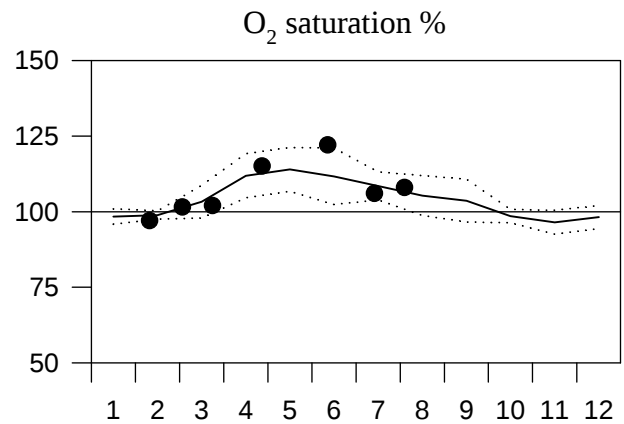
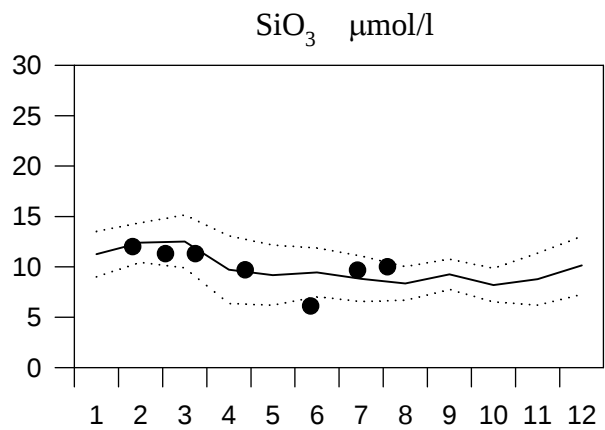
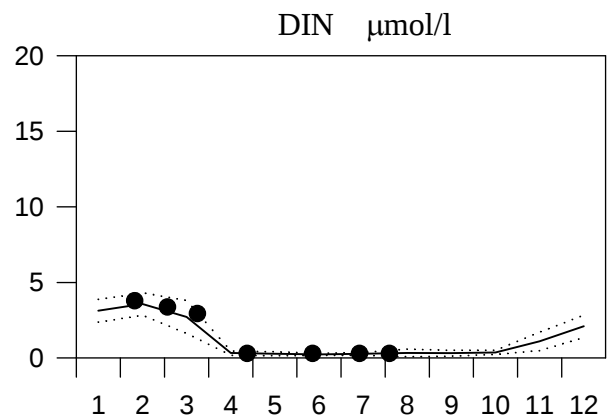
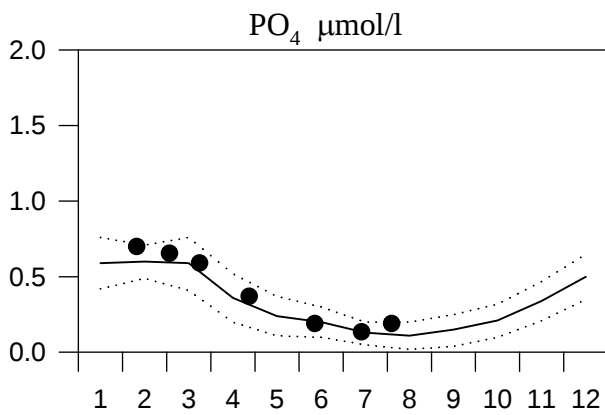
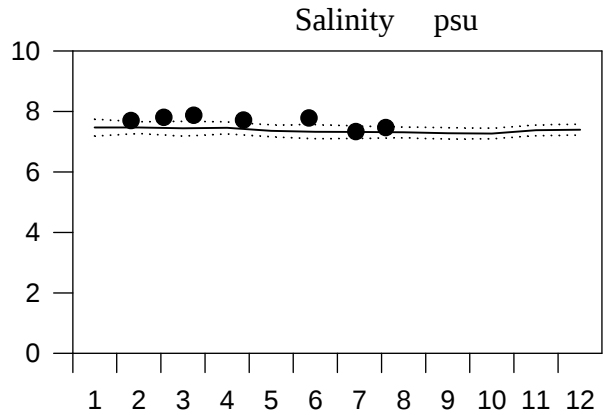
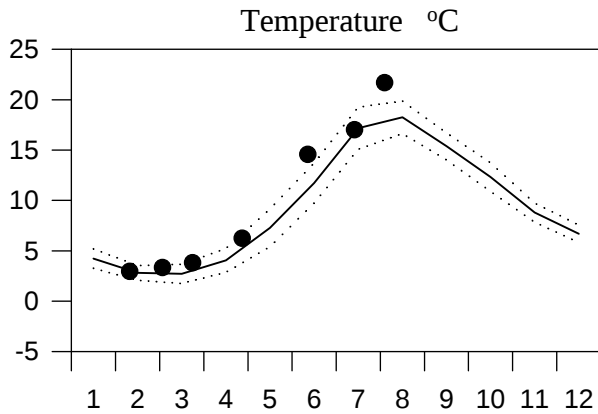
Silicate



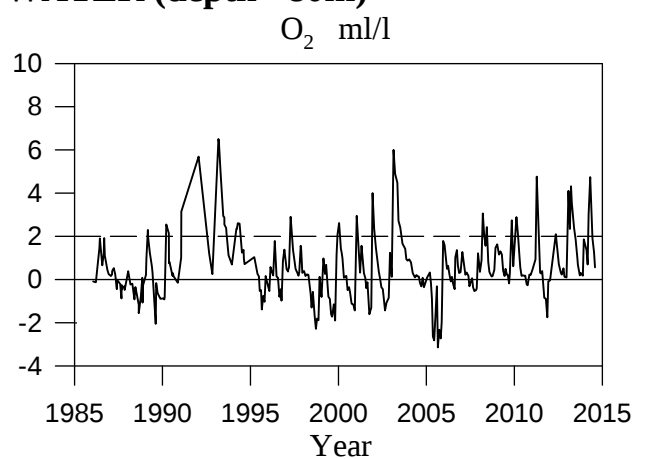
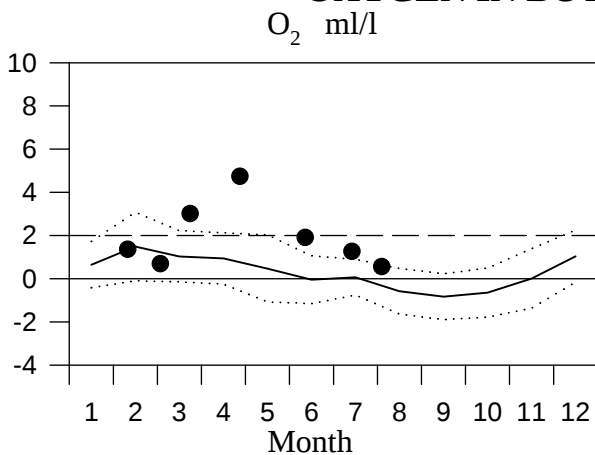
STATION BY5 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

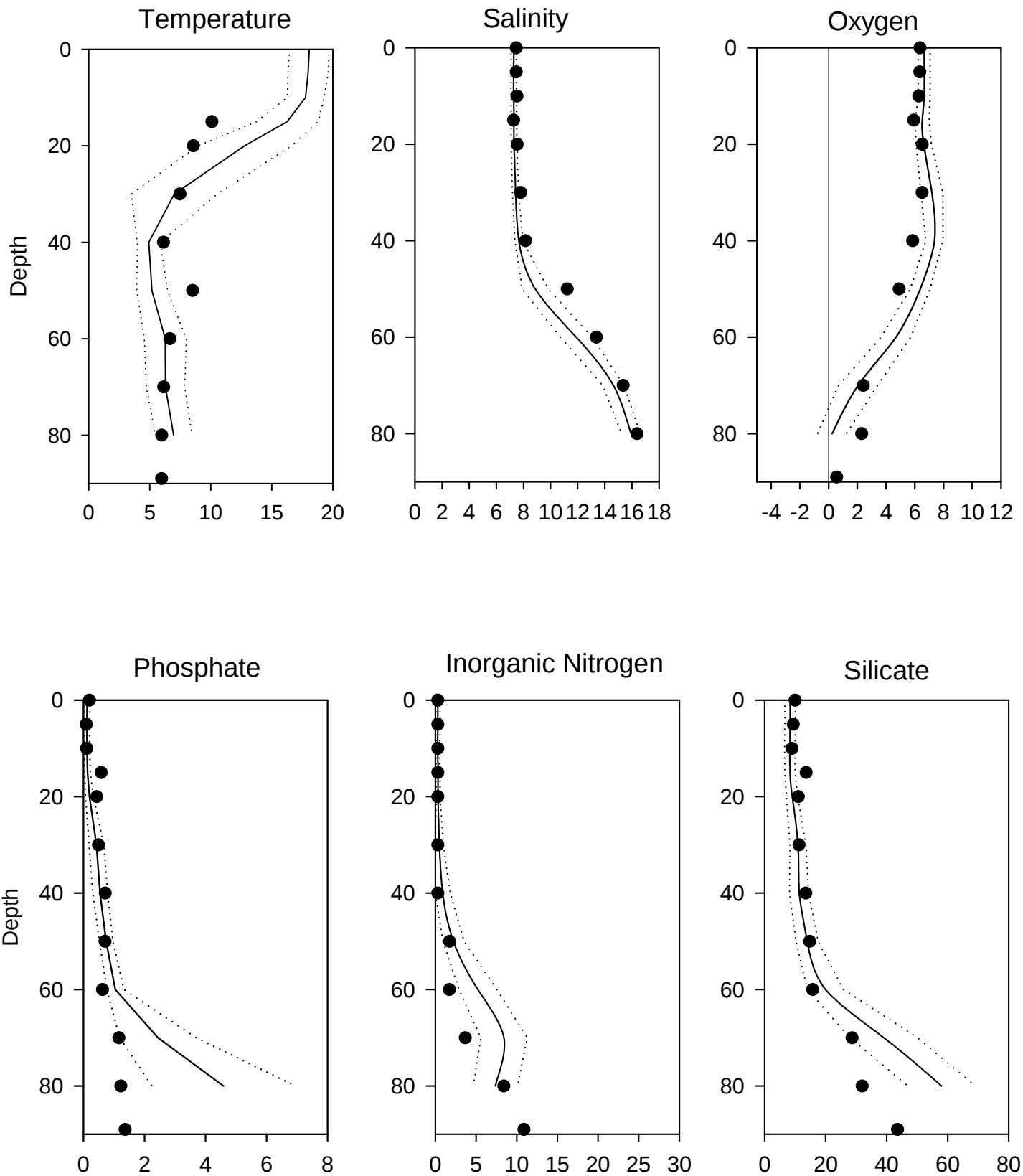


OXYGEN IN BOTTOM WATER (depth >80m)



Vertical profiles BY5 August

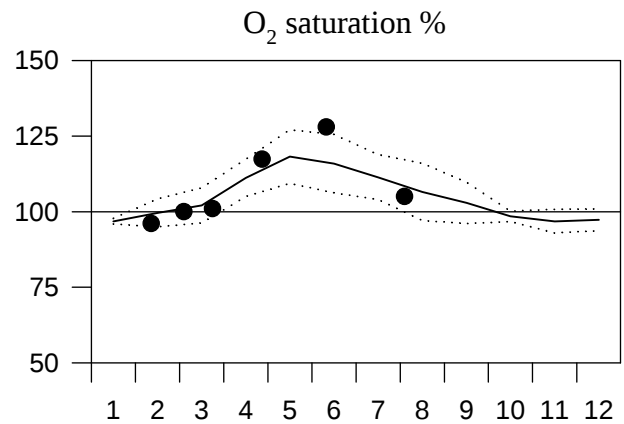
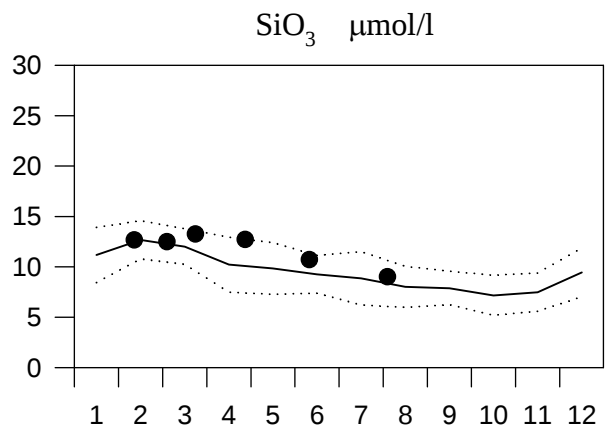
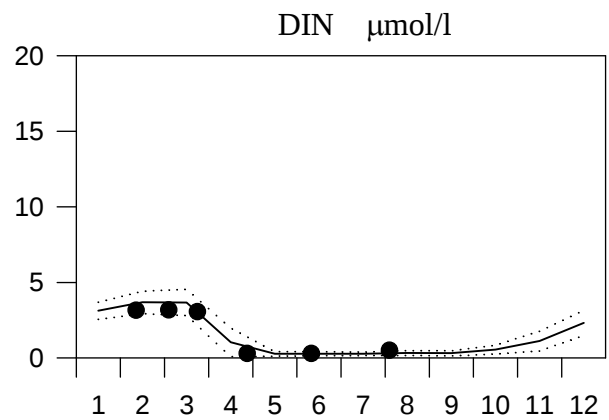
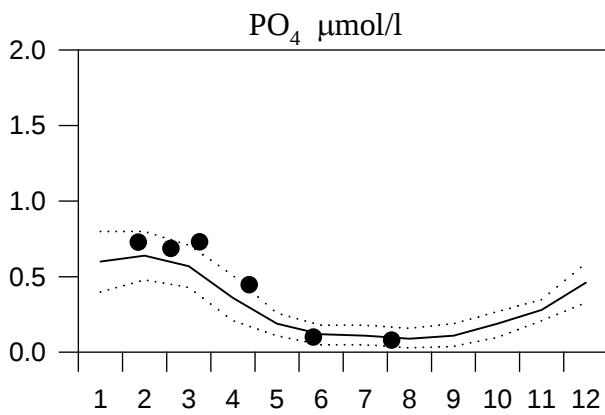
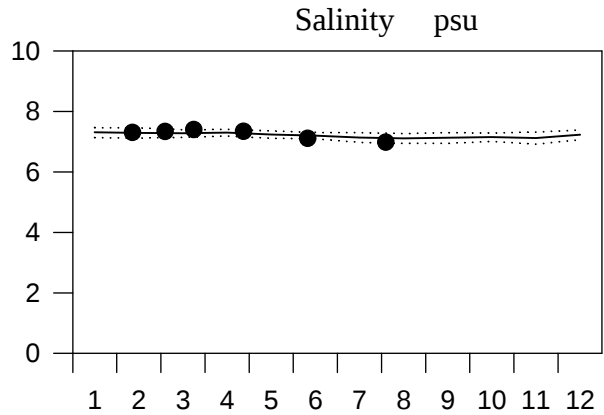
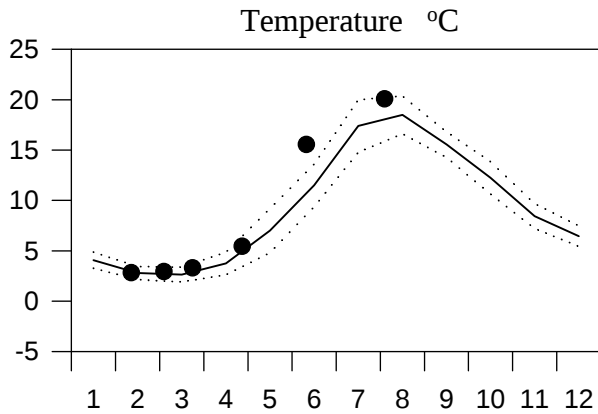
— Mean 1996-2010 St.Dev. ● 2014



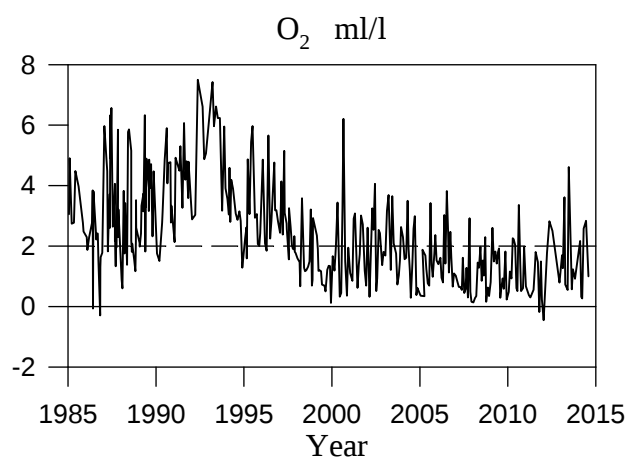
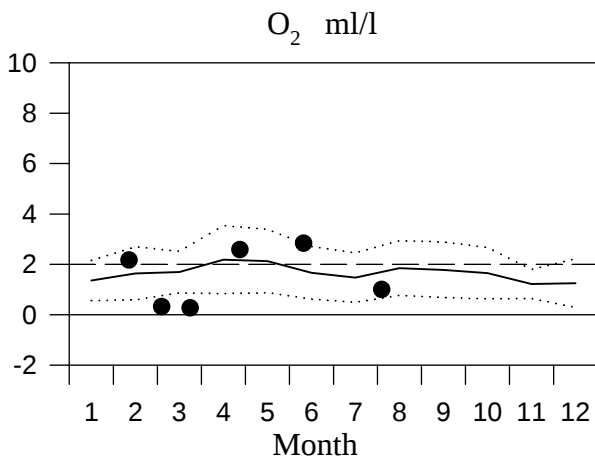
STATION BCS III-10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

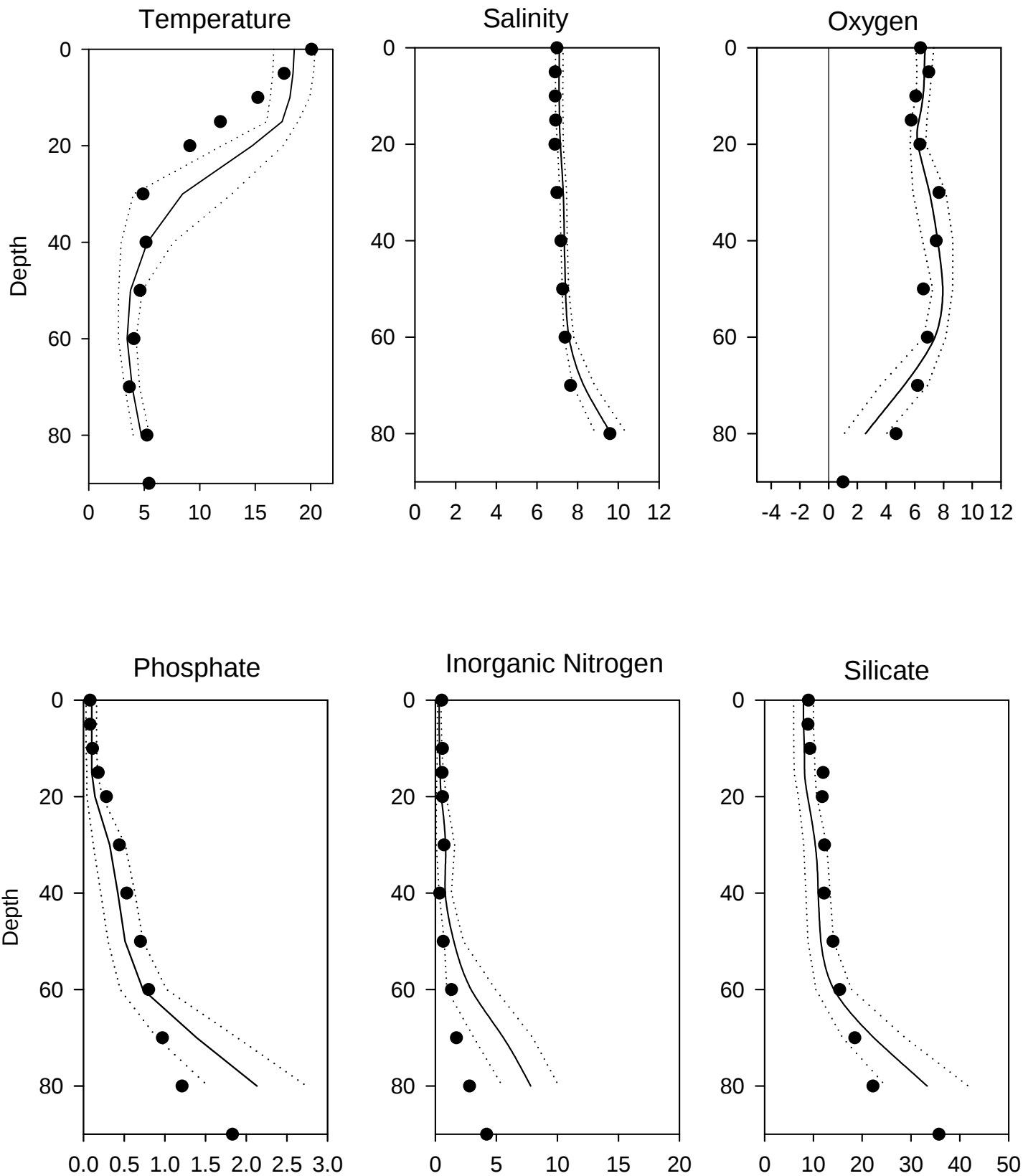


OXYGEN IN BOTTOM WATER (depth > 80m)



Vertical profiles BCS III-10 August

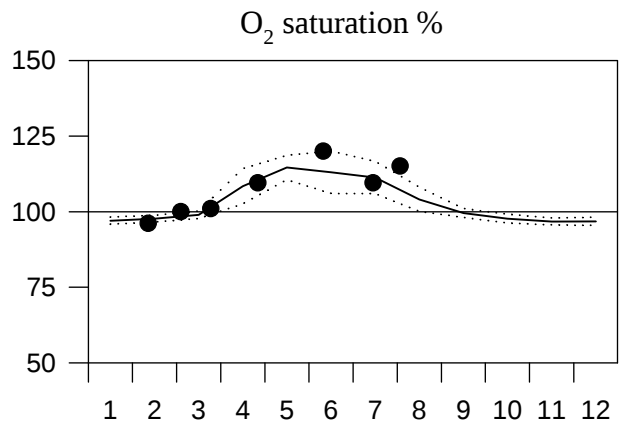
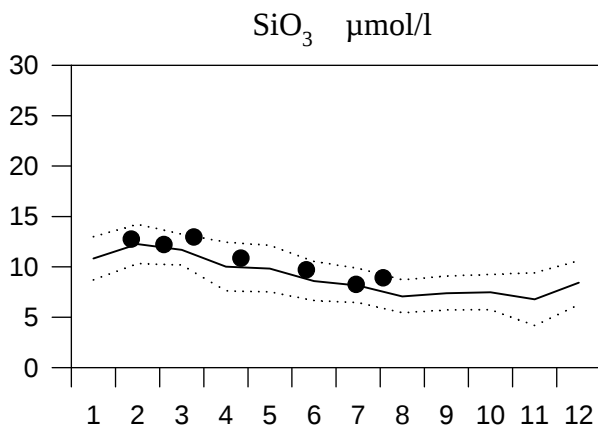
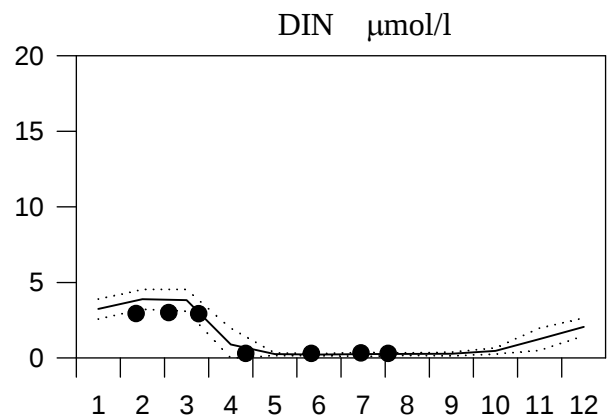
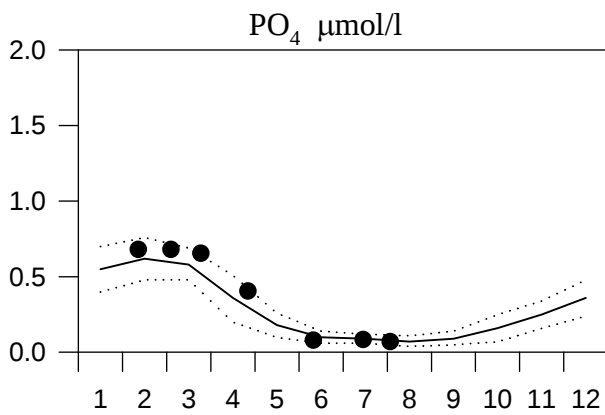
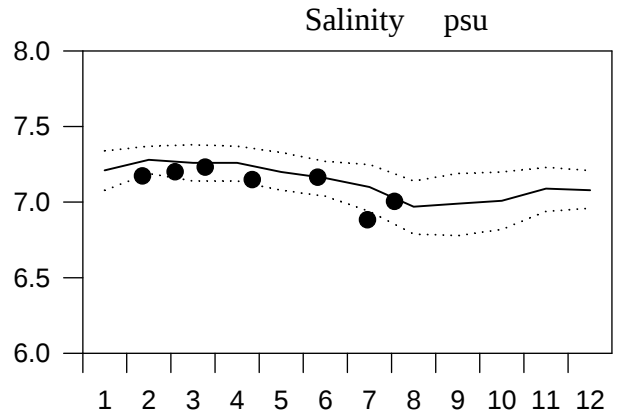
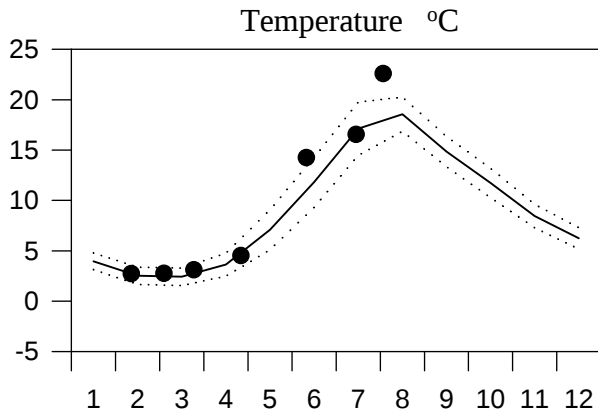
— Mean 1996-2010 St.Dev. ● 2014



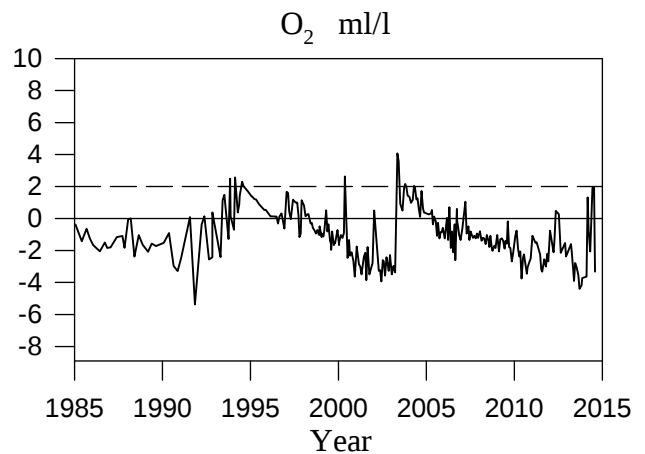
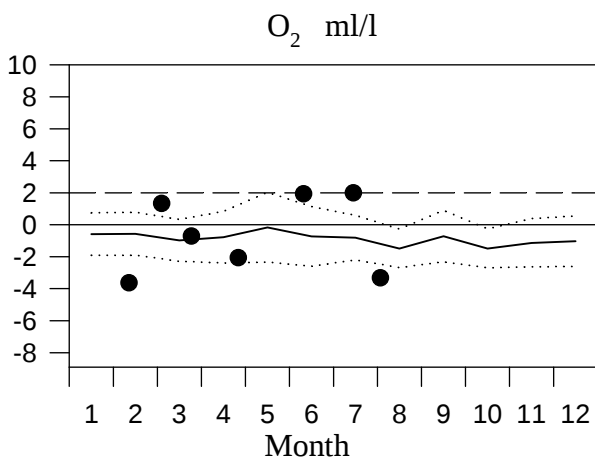
STATION BY10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

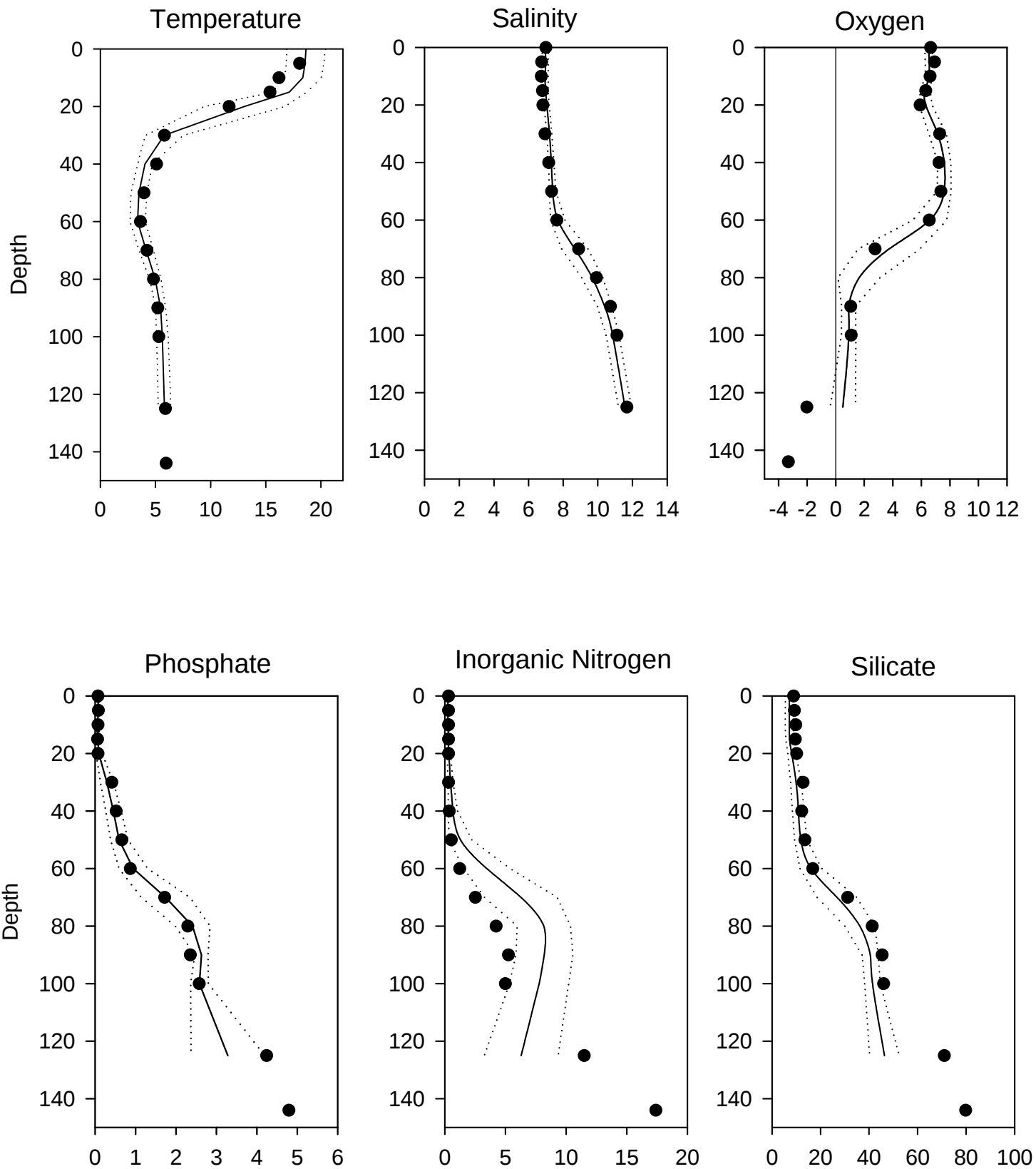


OXYGEN IN BOTTOM WATER (depth >125m)



Vertical profiles BY10 August

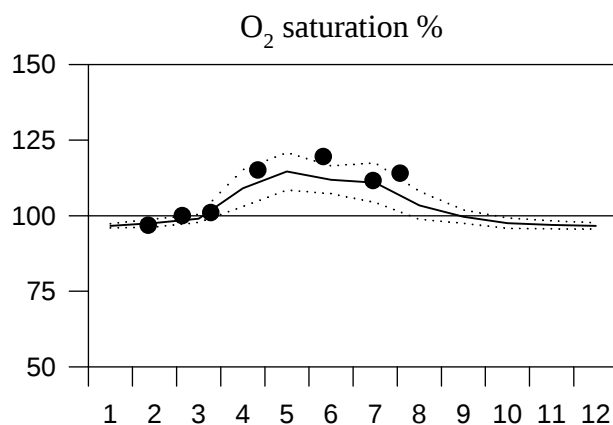
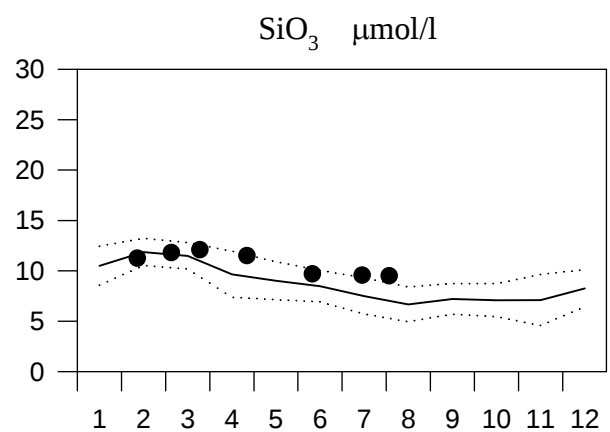
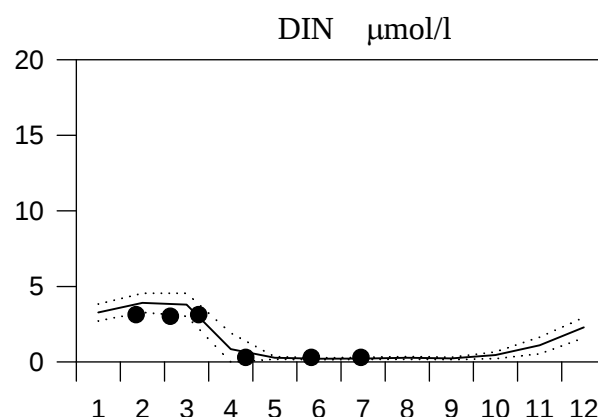
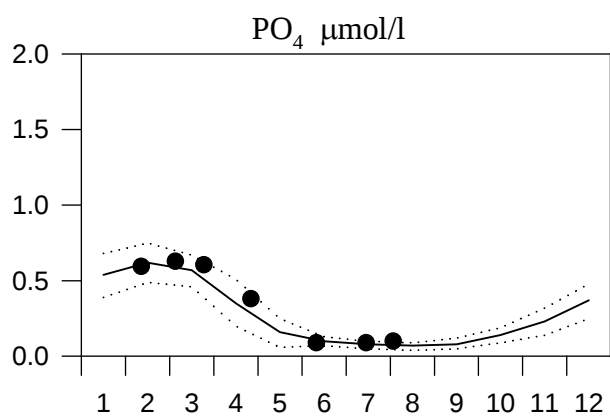
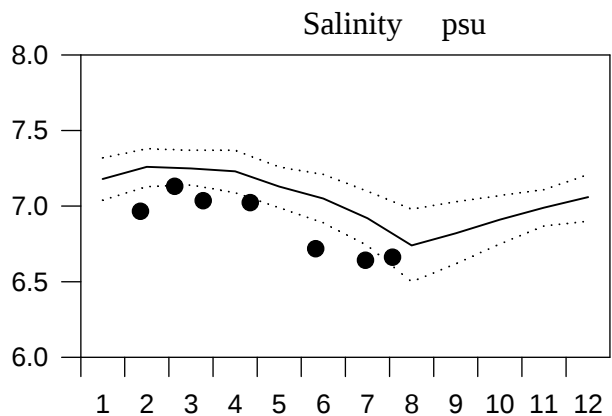
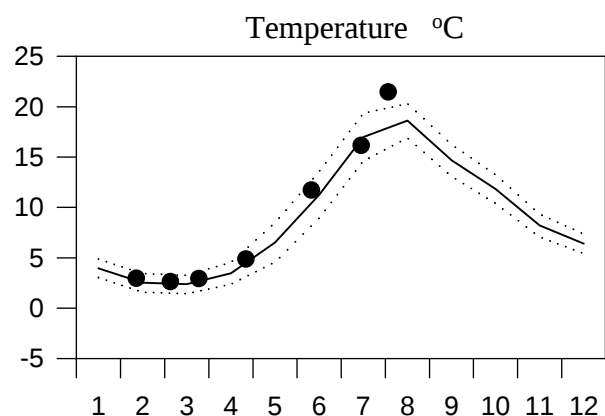
— Mean 1996-2010 St.Dev. ● 2014



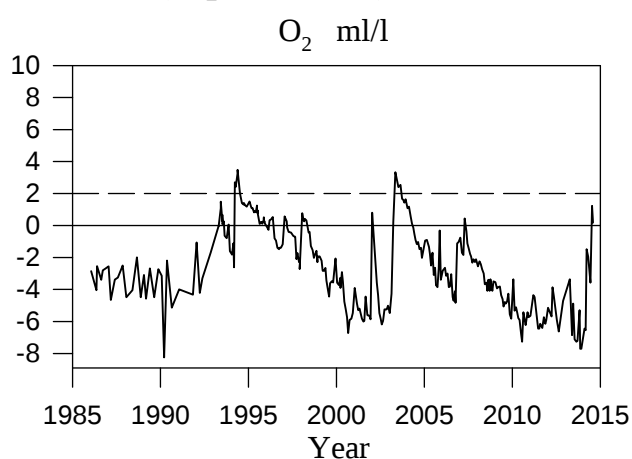
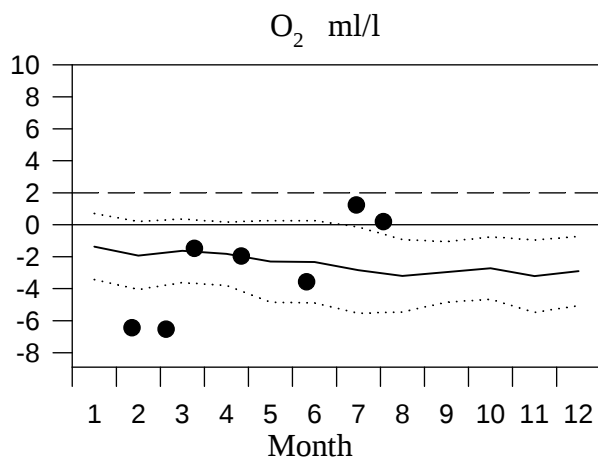
STATION BY15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



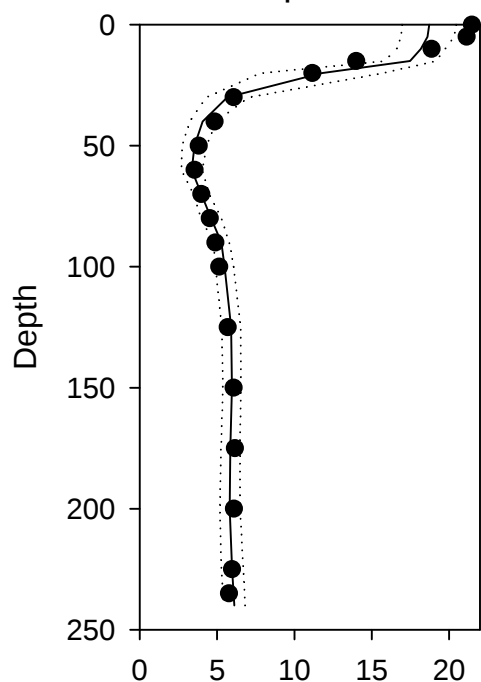
OXYGEN IN BOTTOM WATER (depth >225m)



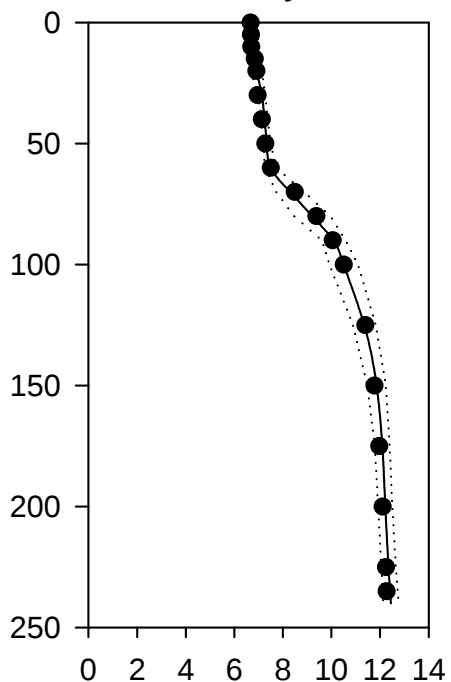
Vertical profiles BY15 August

— Mean 1996-2010 St.Dev. ● 2014

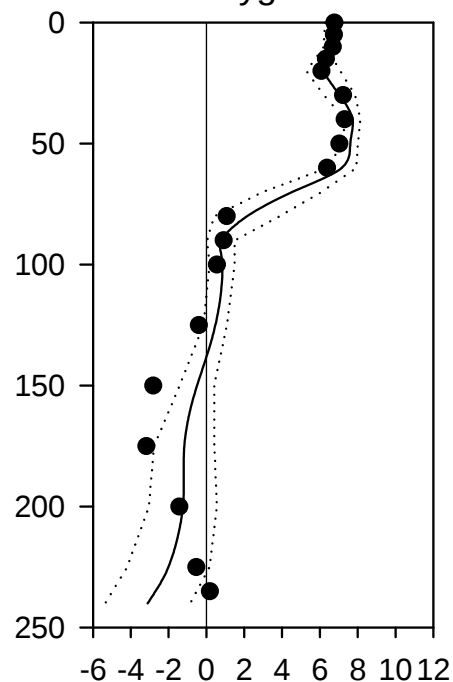
Temperature



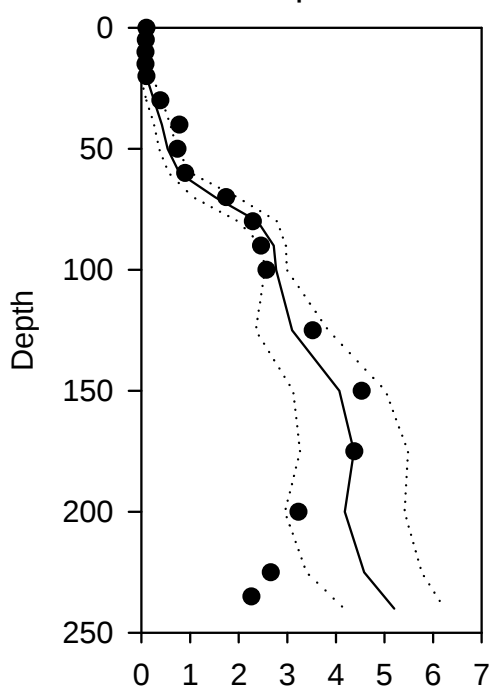
Salinity



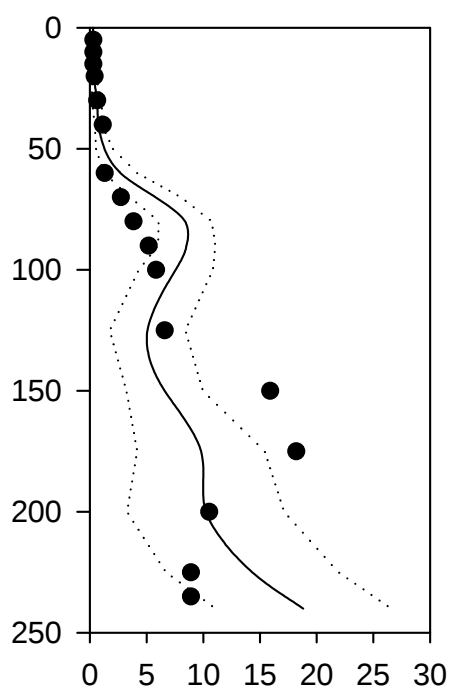
Oxygen



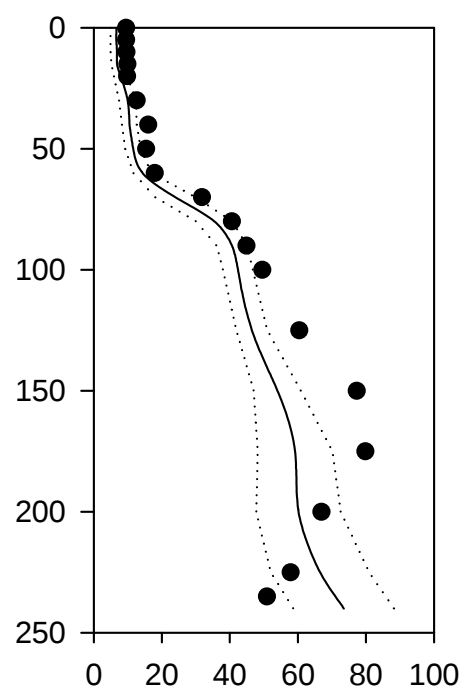
Phosphate



Inorganic Nitrogen



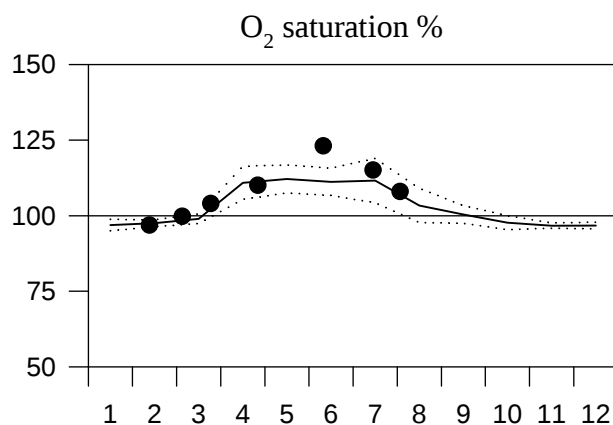
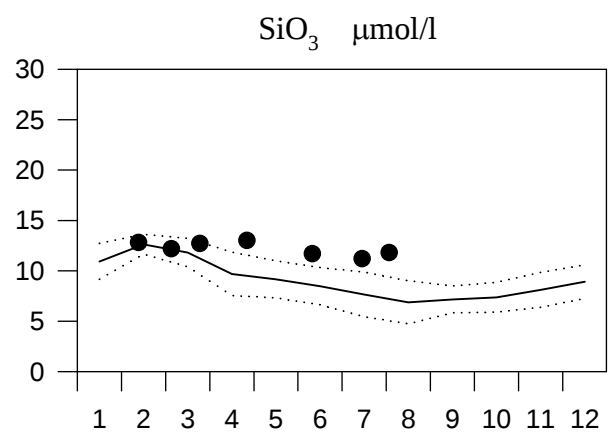
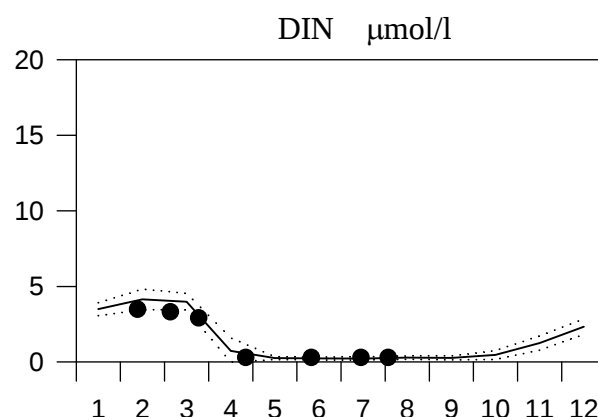
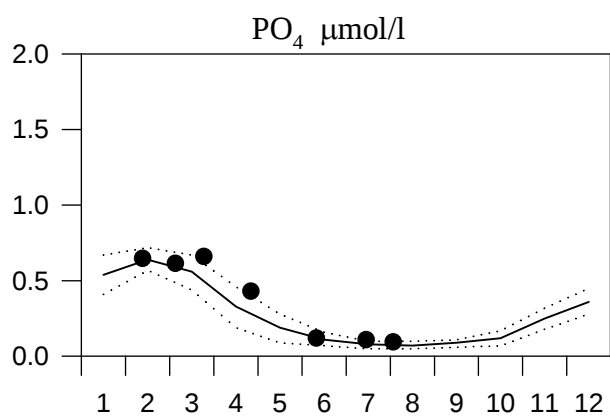
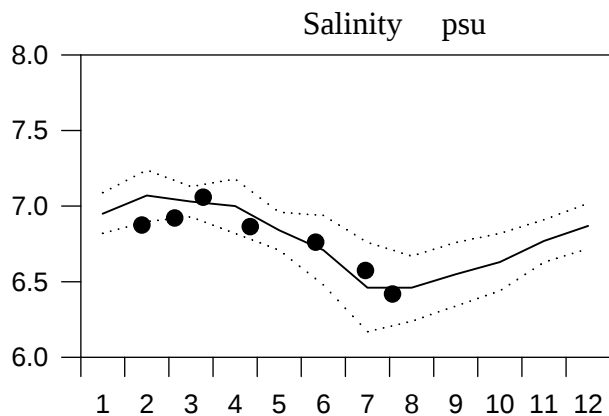
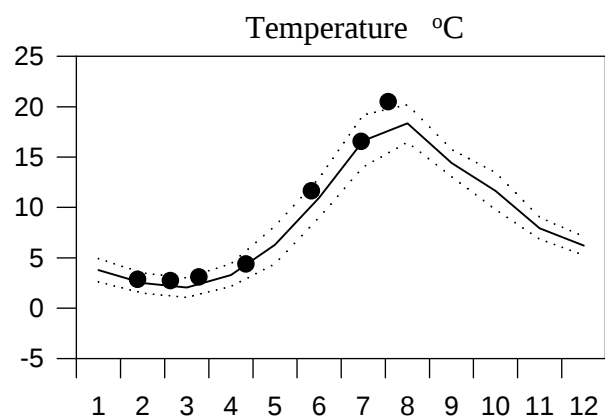
Silicate



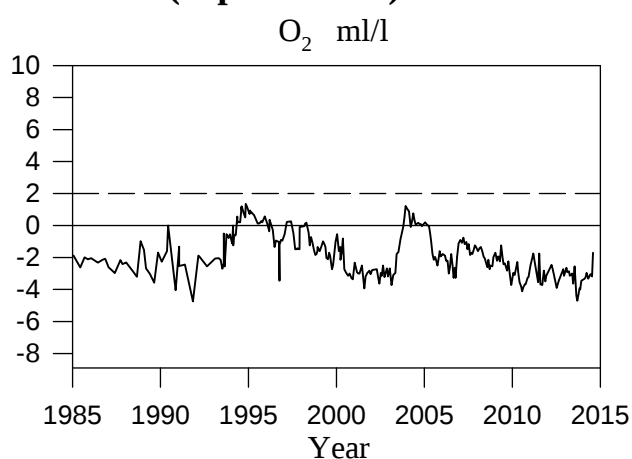
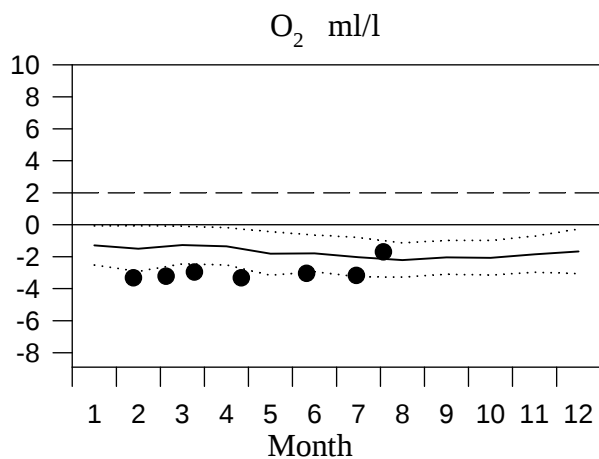
STATION BY20 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



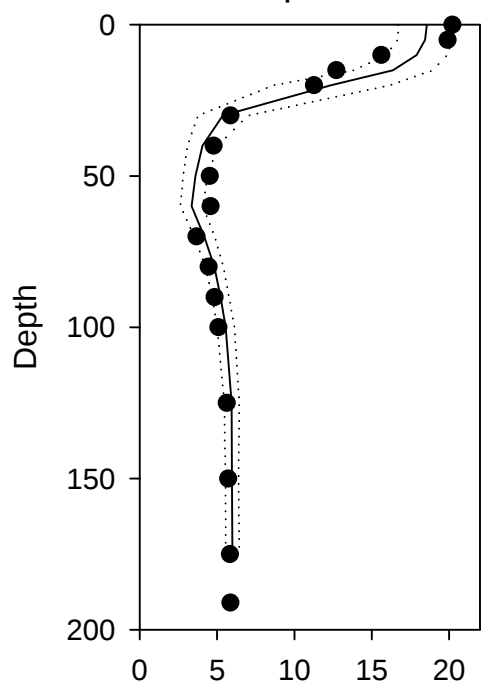
OXYGEN IN BOTTOM WATER (depth >175m)



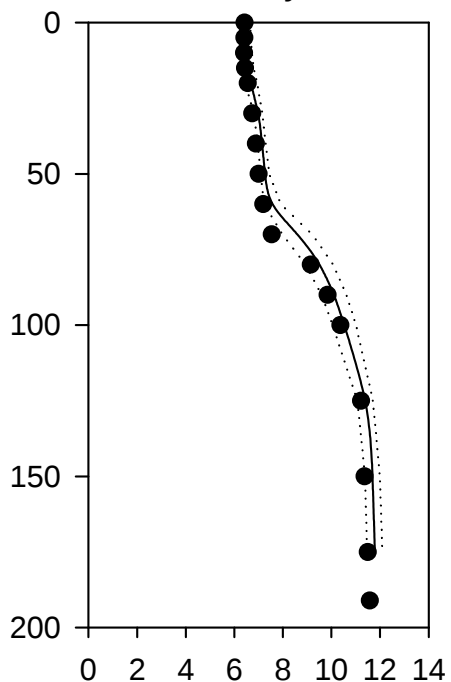
Vertical profiles BY20 August

— Mean 1996-2010 St.Dev. ● 2014

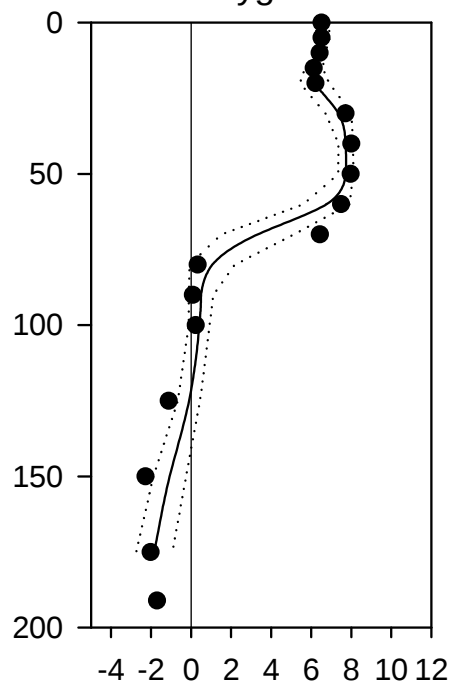
Temperature



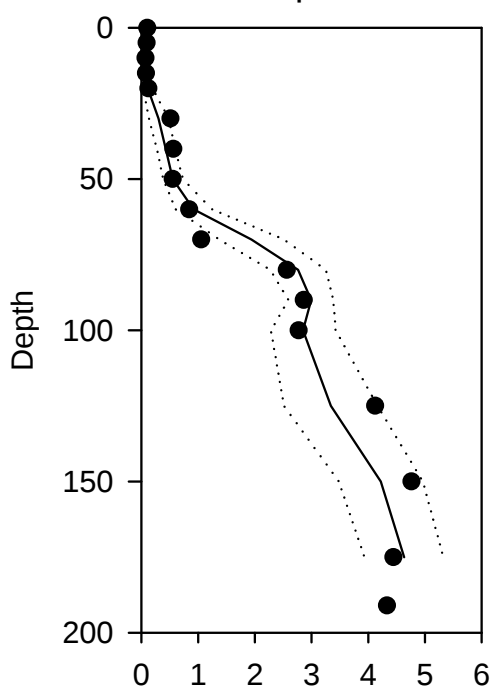
Salinity



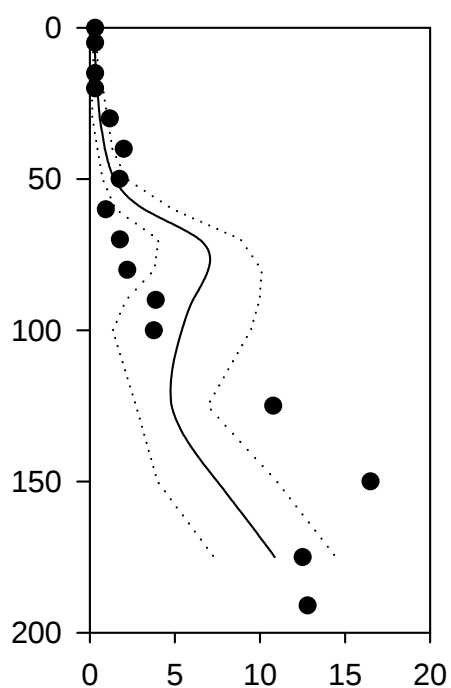
Oxygen



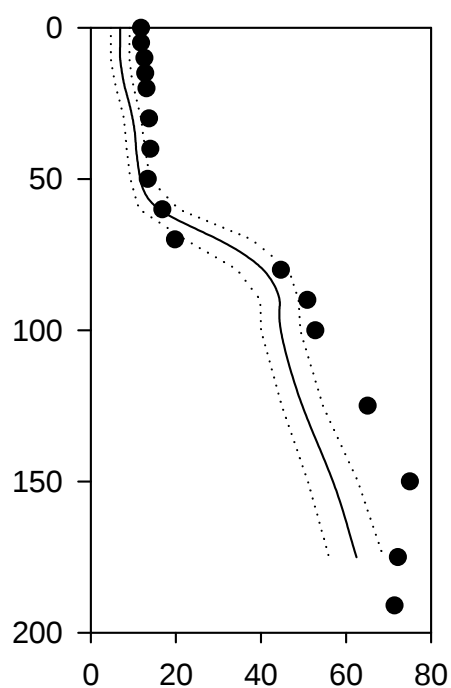
Phosphate



Inorganic Nitrogen



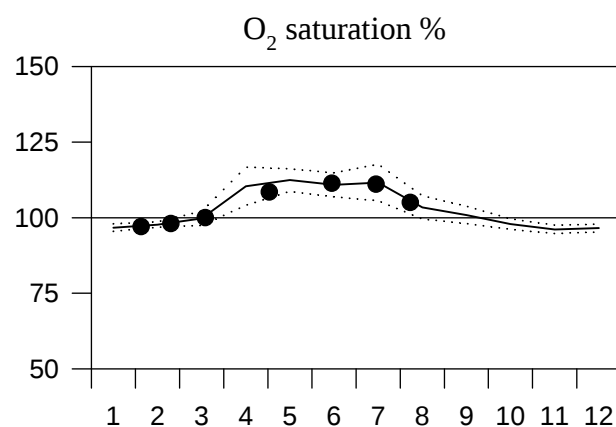
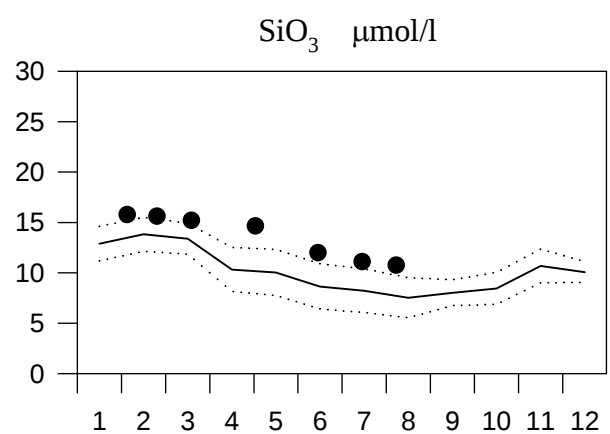
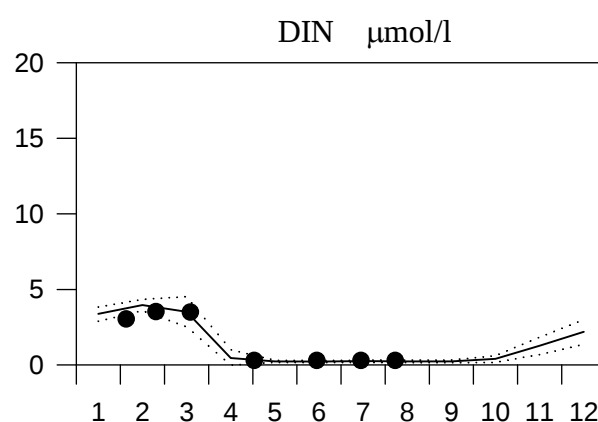
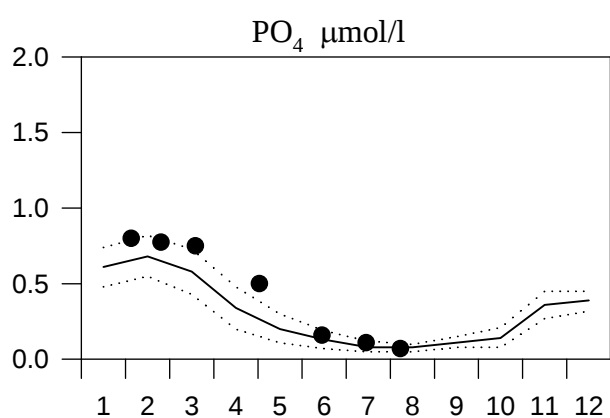
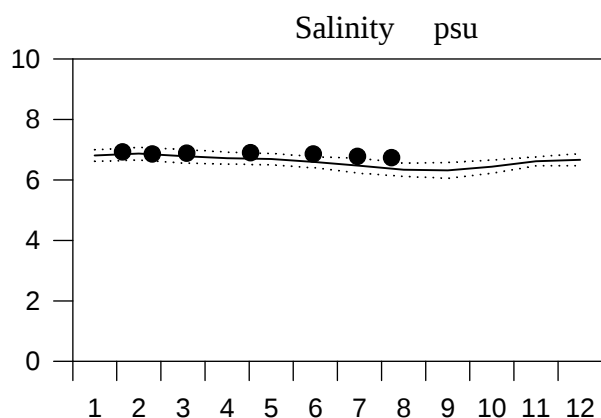
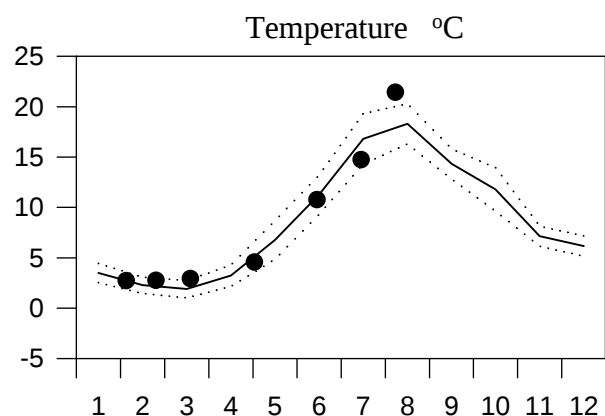
Silicate



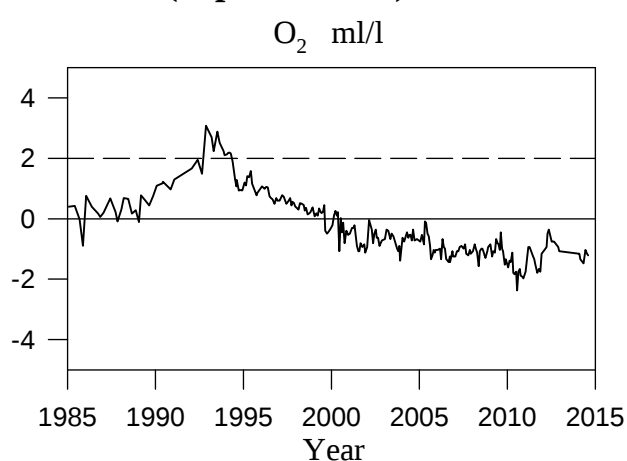
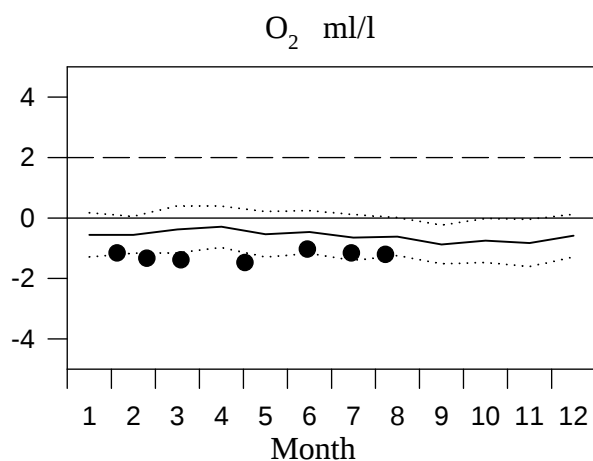
STATION BY32 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



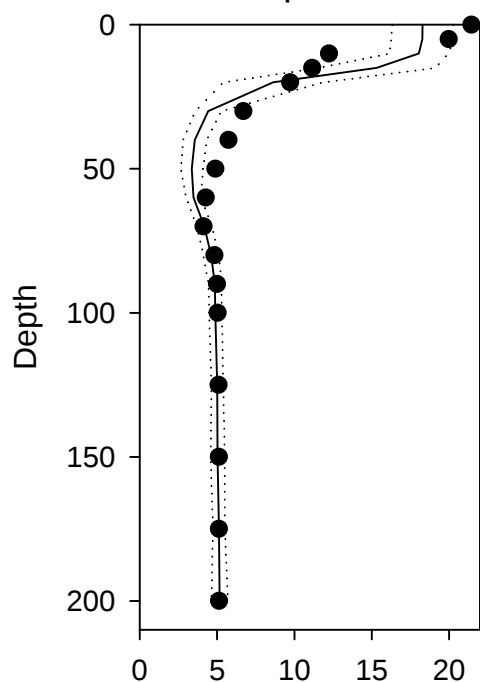
OXYGEN IN BOTTOM WATER (depth > 175m)



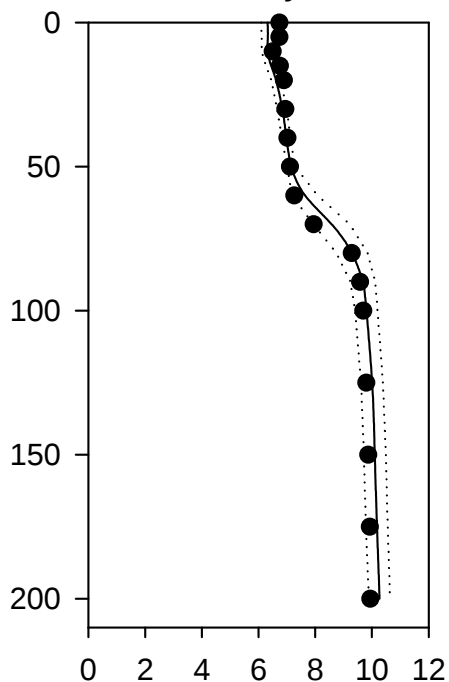
Vertical profiles BY32 August

— Mean 1996-2010 St.Dev. ● 2014

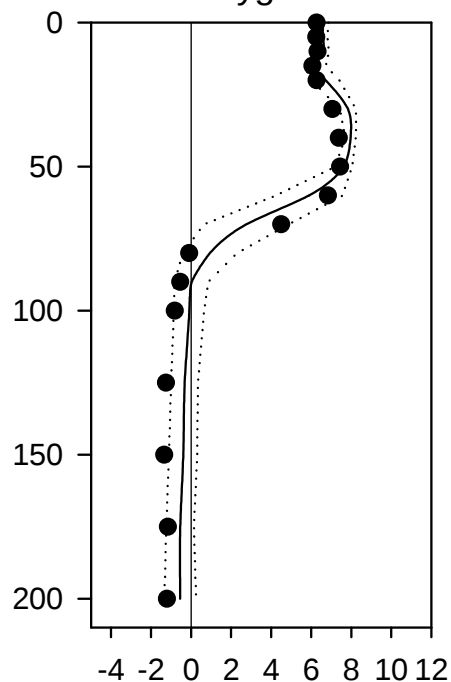
Temperature



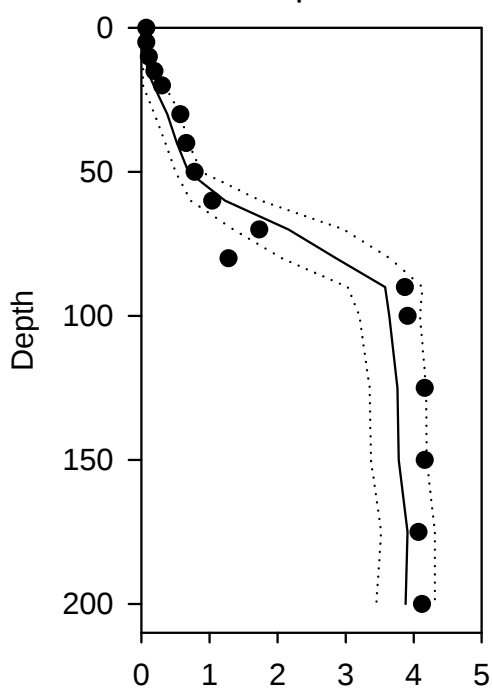
Salinity



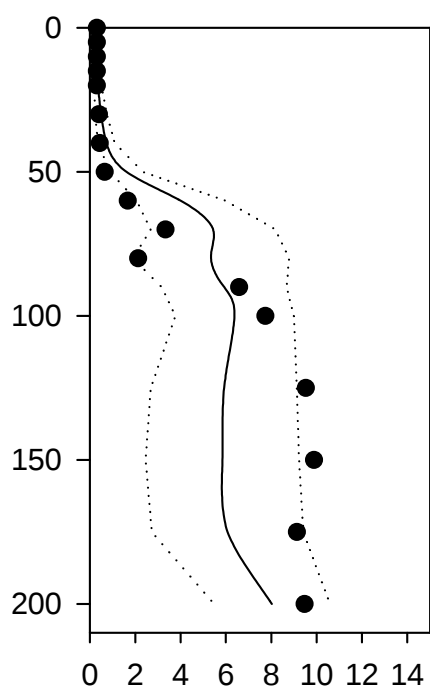
Oxygen



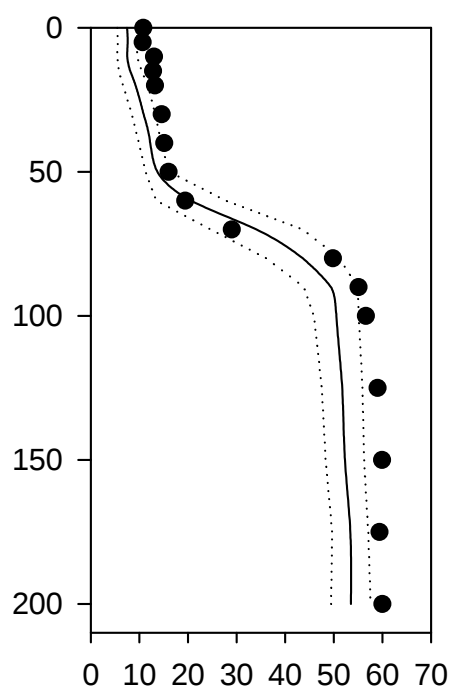
Phosphate



Inorganic Nitrogen



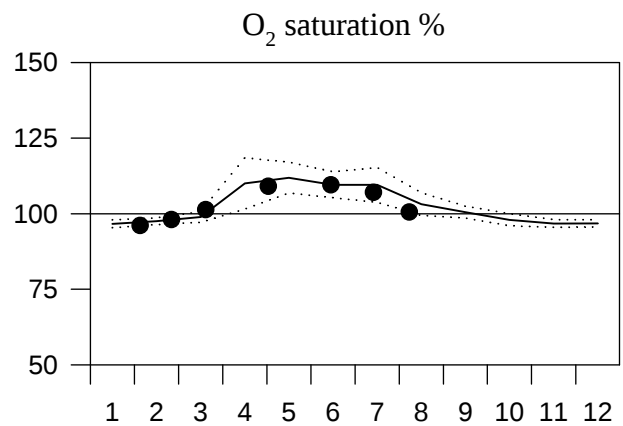
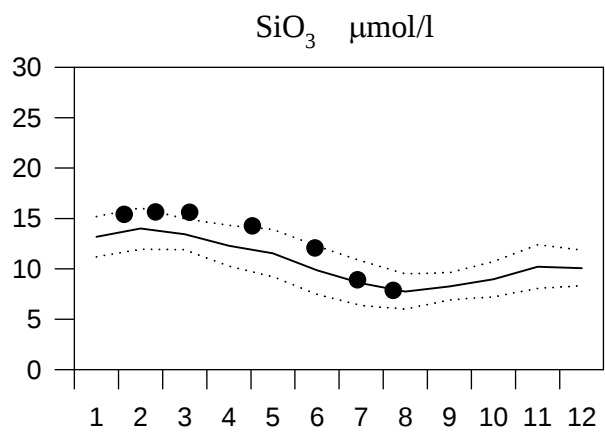
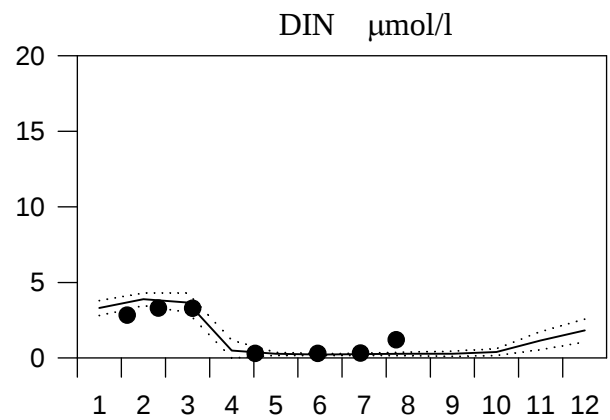
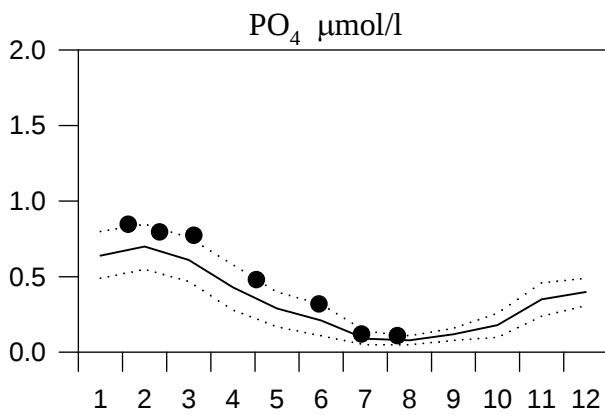
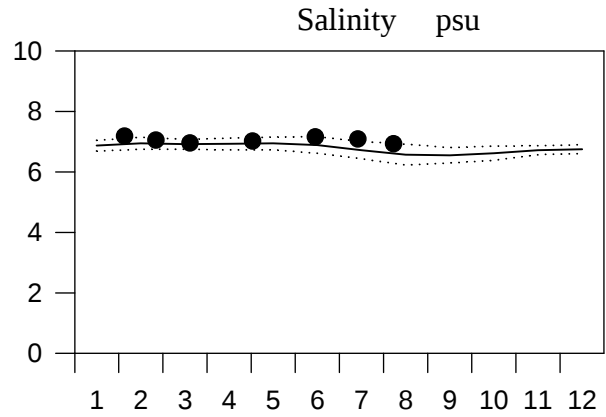
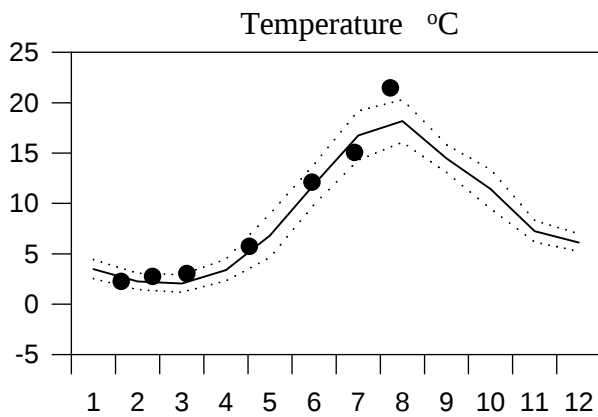
Silicate



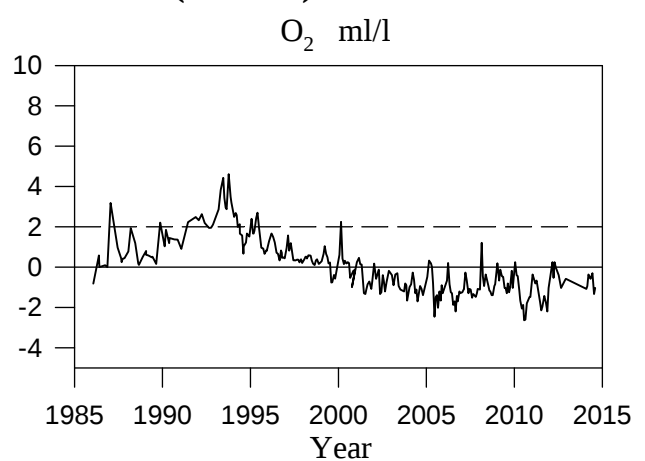
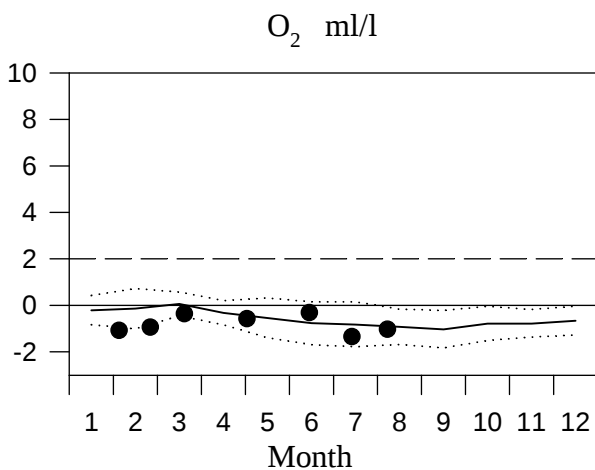
STATION BY38 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



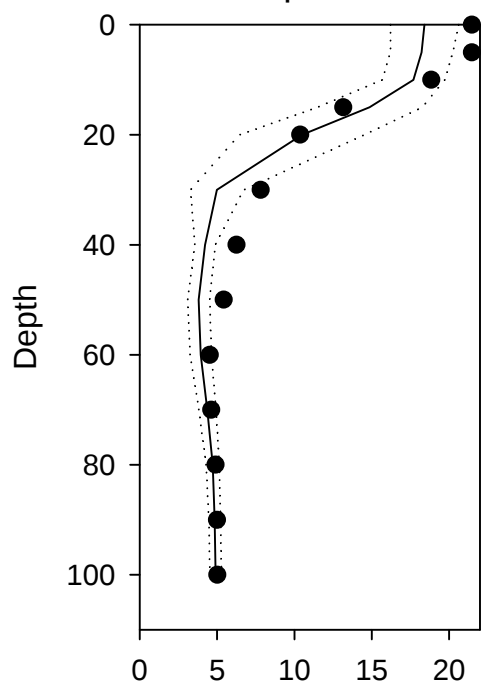
OXYGEN IN BOTTOM WATER (> 100m)



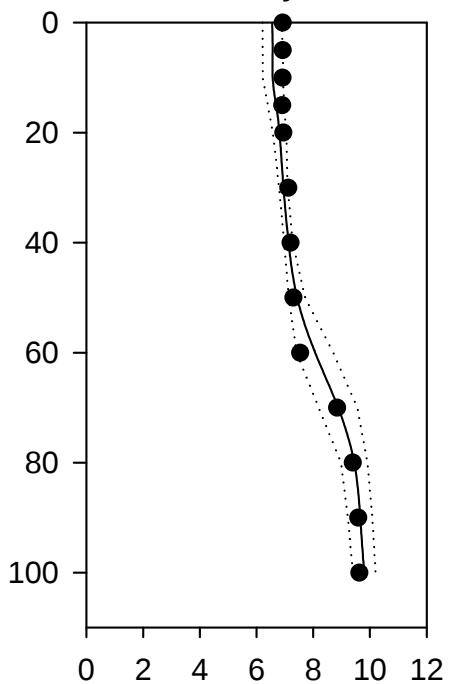
Vertical profiles BY38 August

— Mean 1996-2010 St.Dev. ● 2014

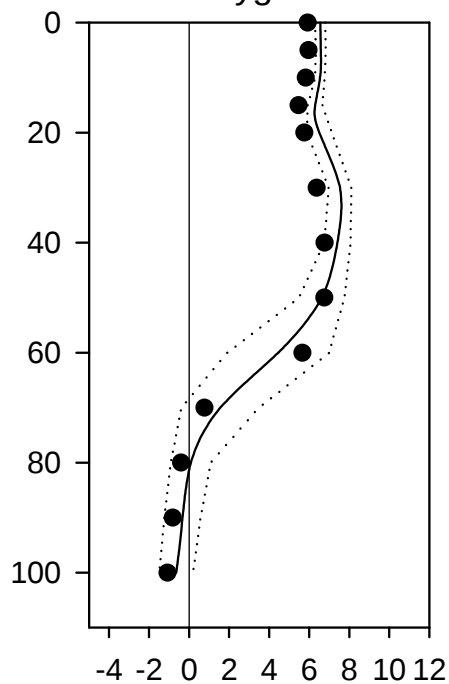
Temperature



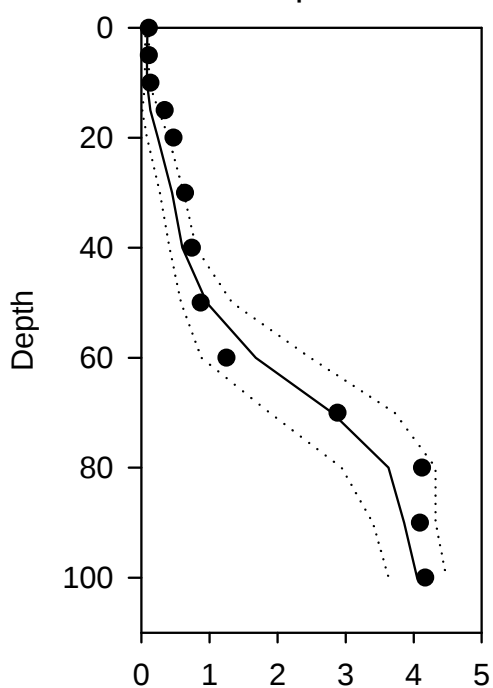
Salinity



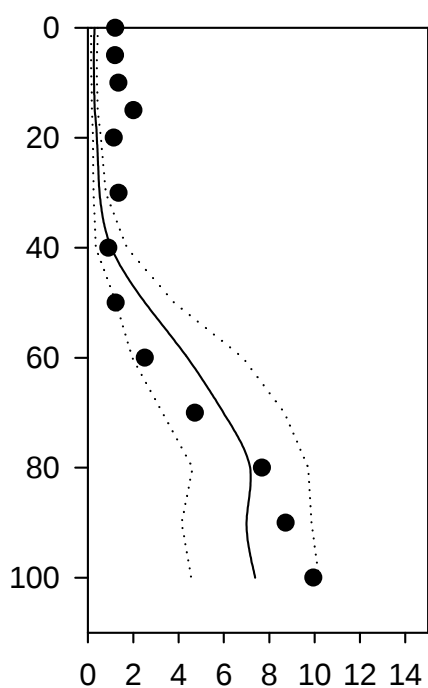
Oxygen



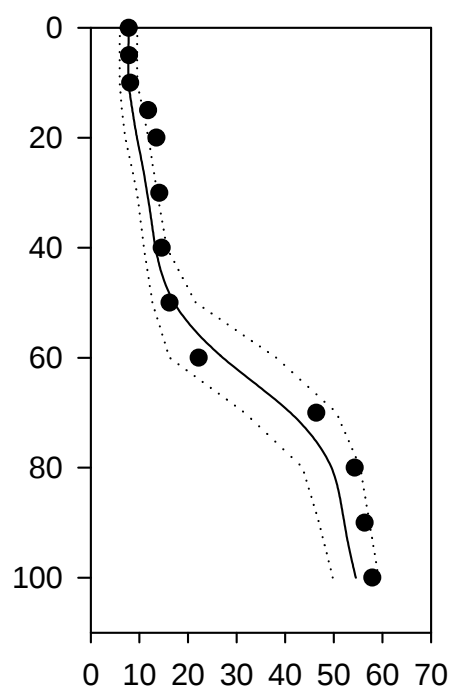
Phosphate



Inorganic Nitrogen



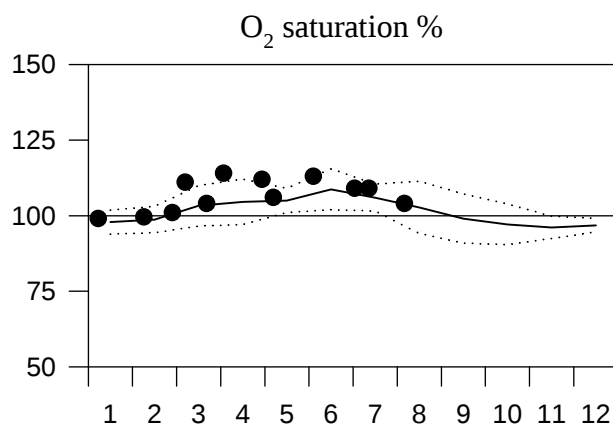
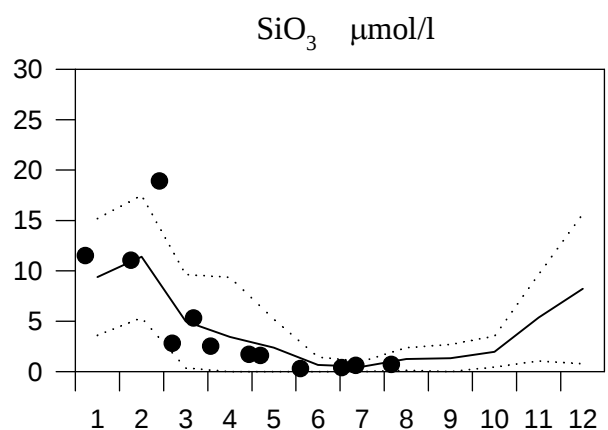
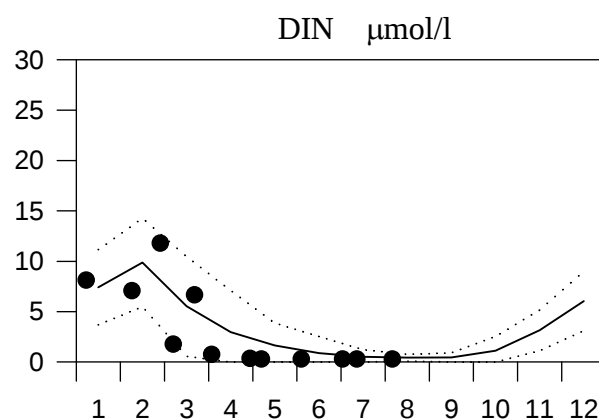
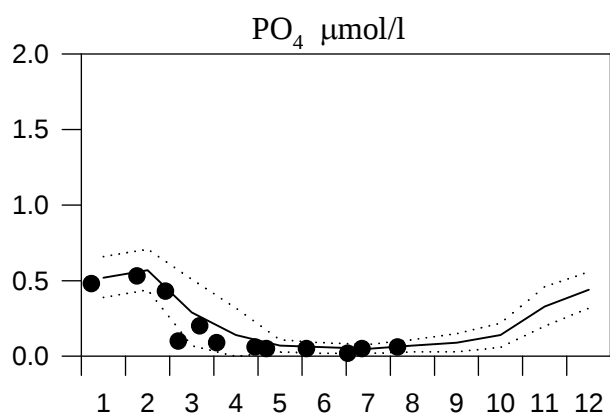
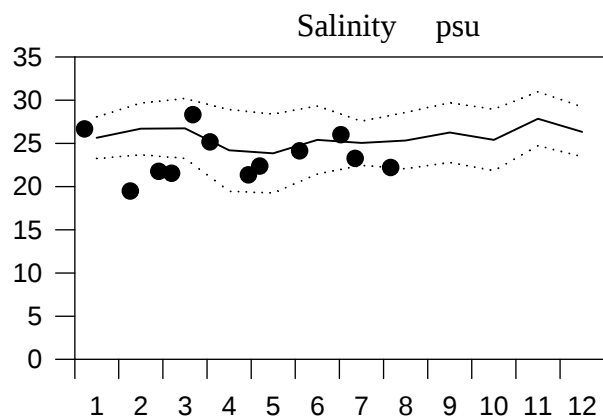
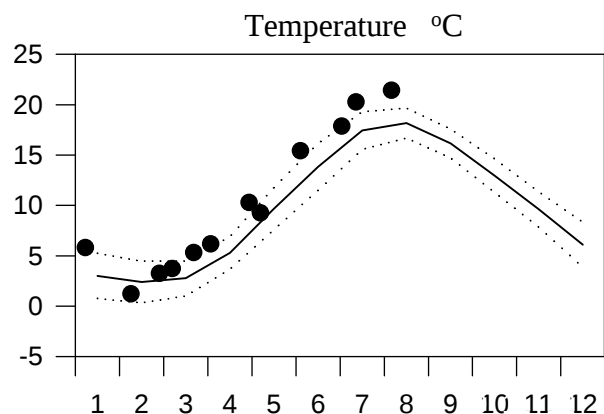
Silicate



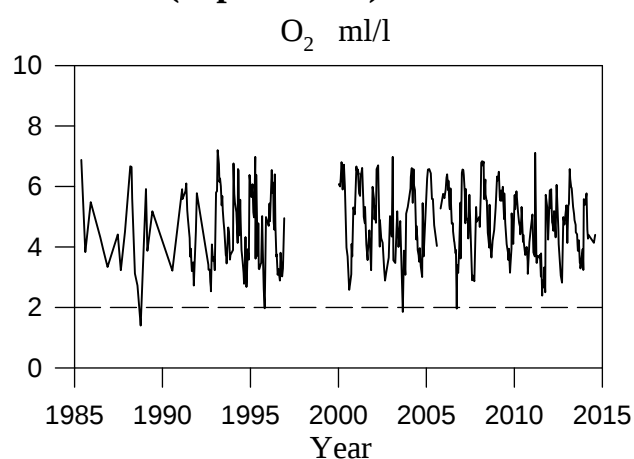
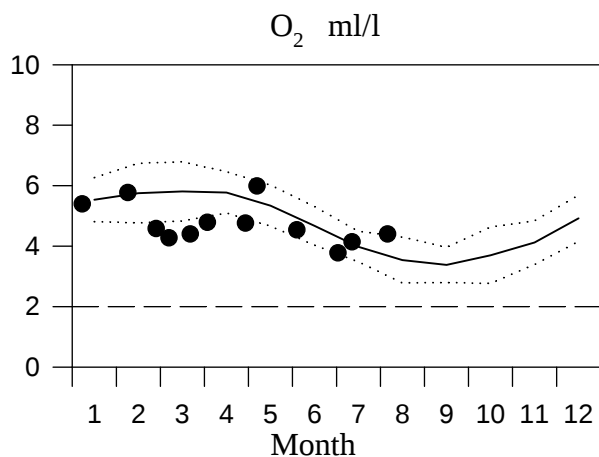
STATION SLÄGGÖ SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

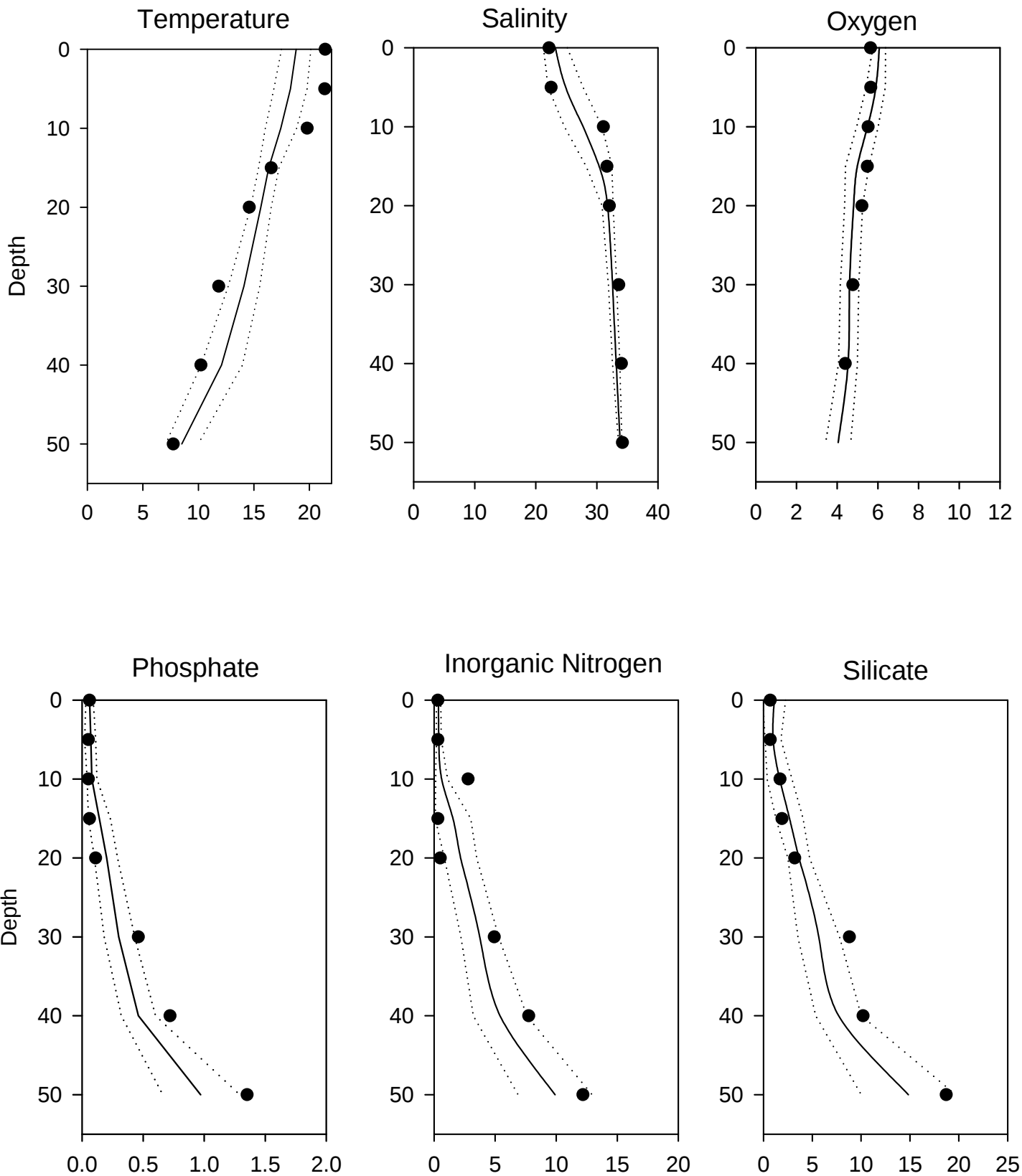


OXYGEN IN BOTTOM WATER (depth >50m)



Vertical profiles Släggö August

— Mean 1996-2010 St.Dev. ● 2014



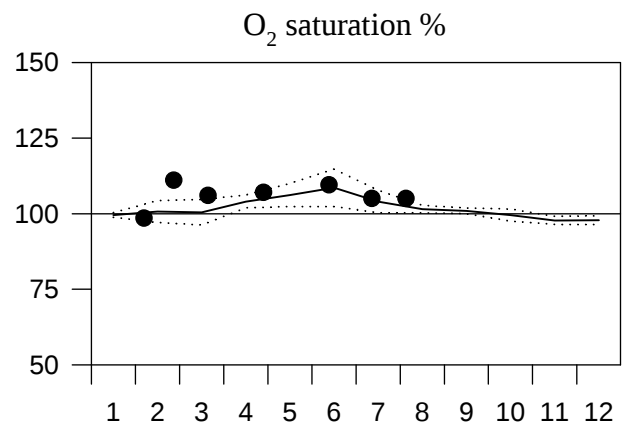
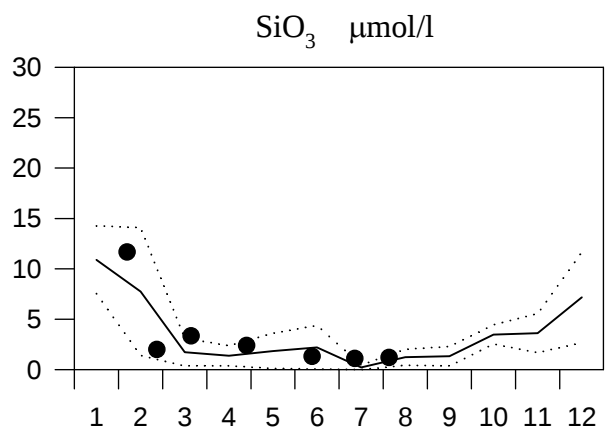
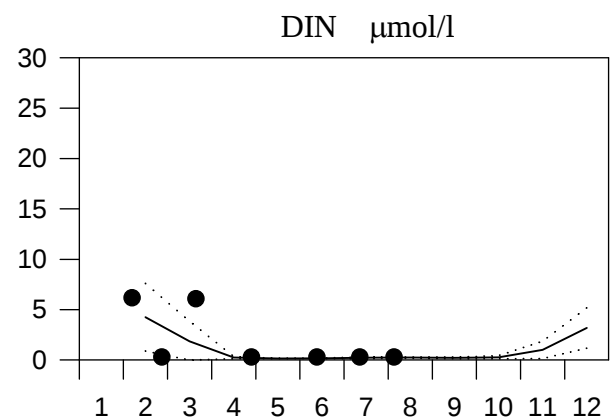
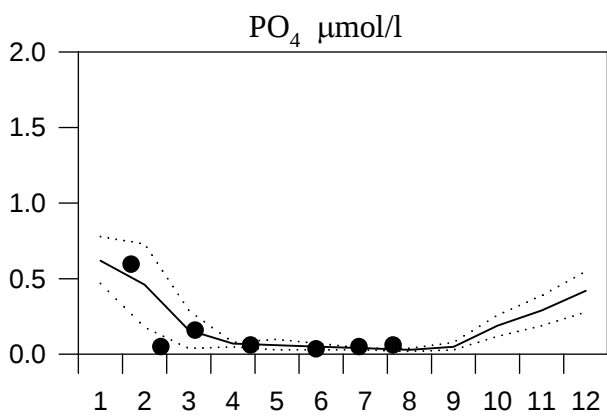
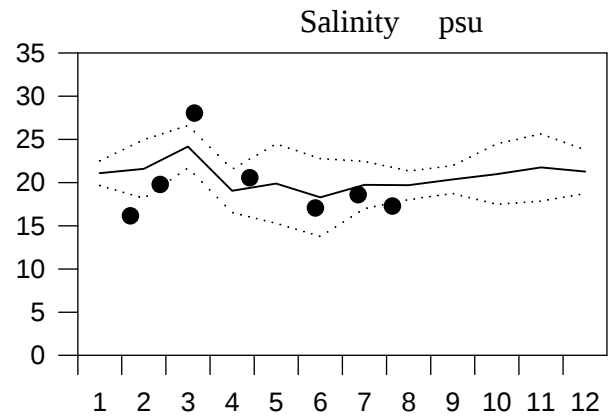
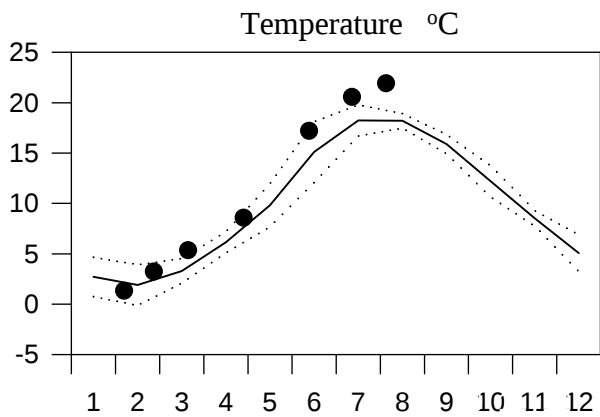
STATION N14 Falkenberg SURFACE WATER

Annual Cycles

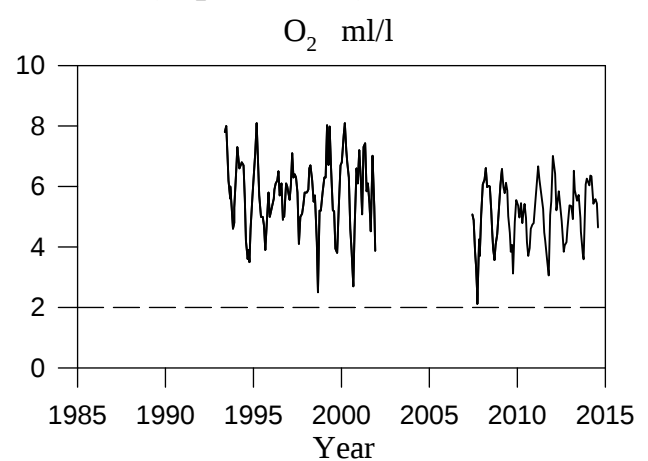
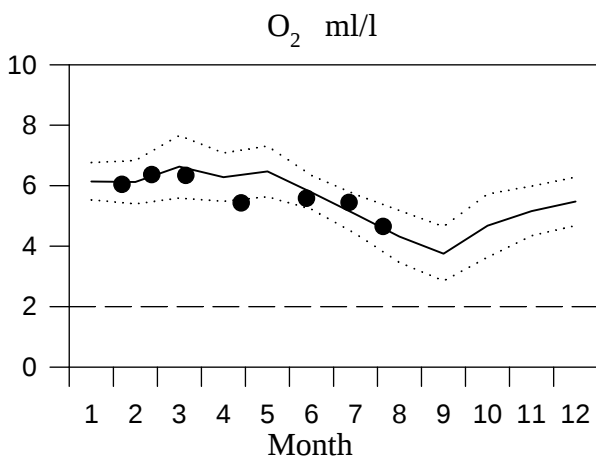
— Mean 2007-2010

..... St.Dev.

● 2014

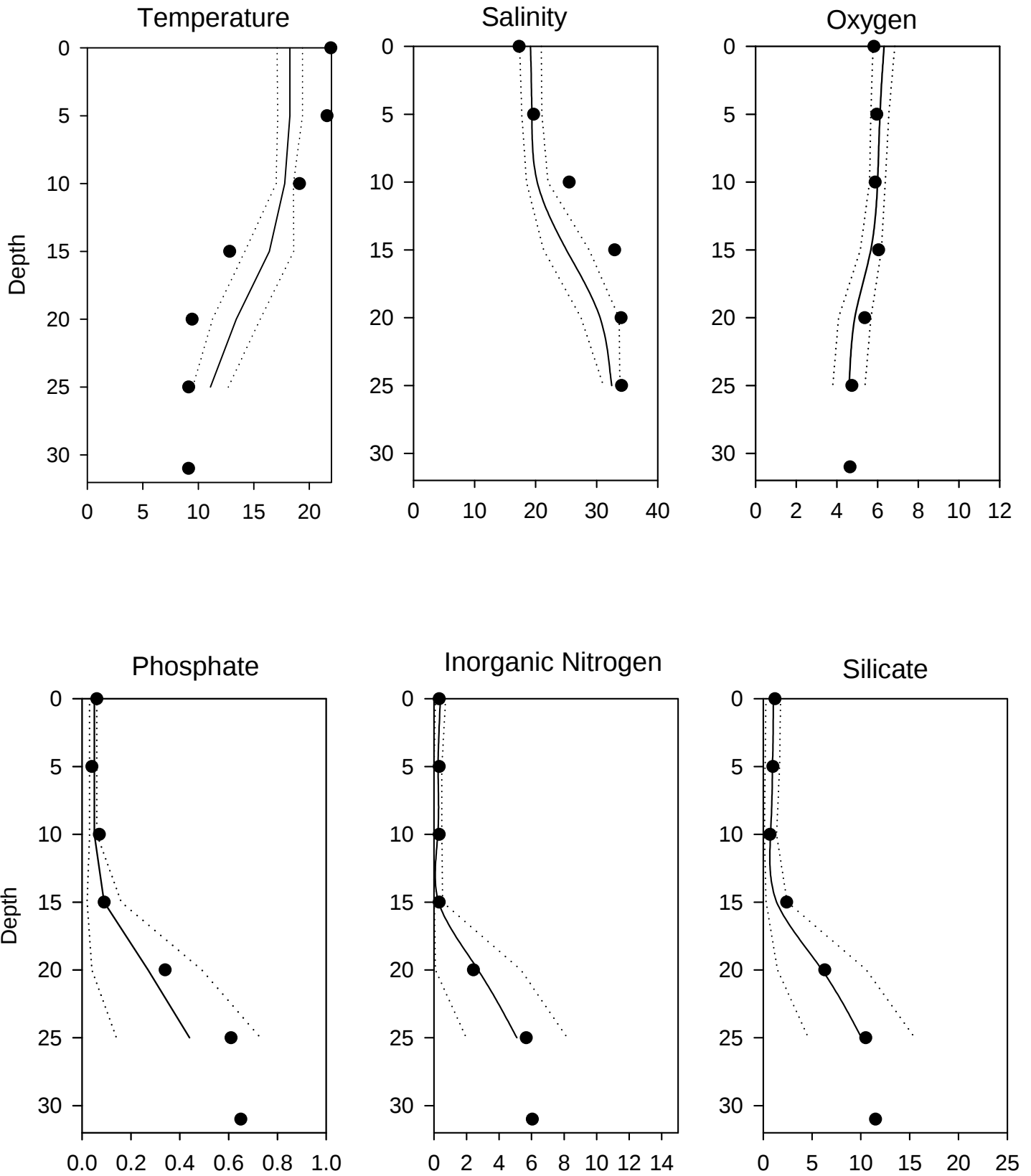


OXYGEN IN BOTTOM WATER (depth > 25m)



Vertical profiles N14 Falkenberg August

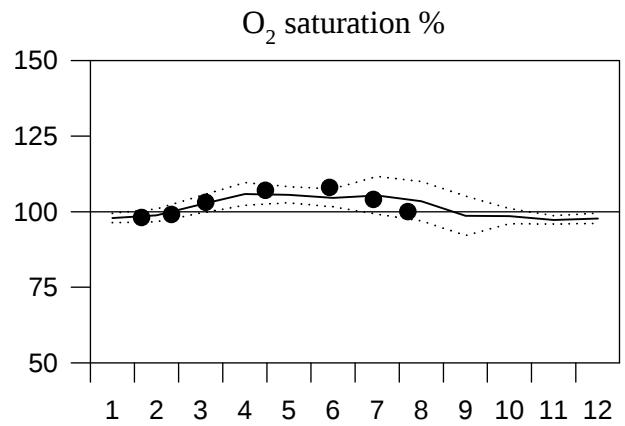
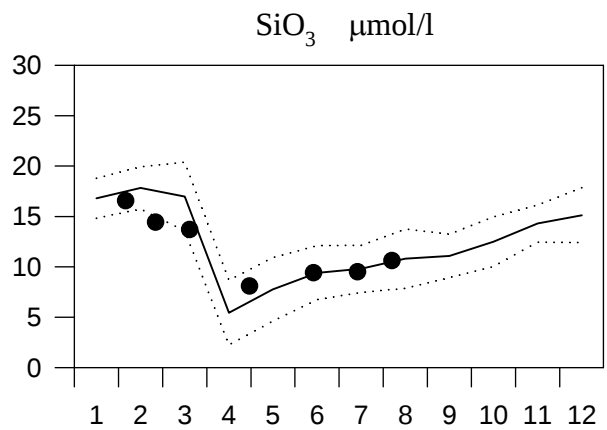
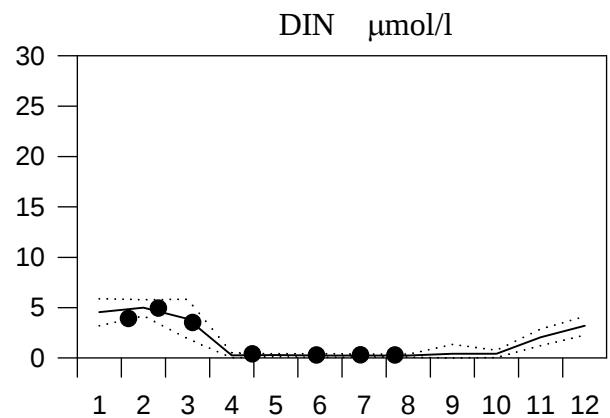
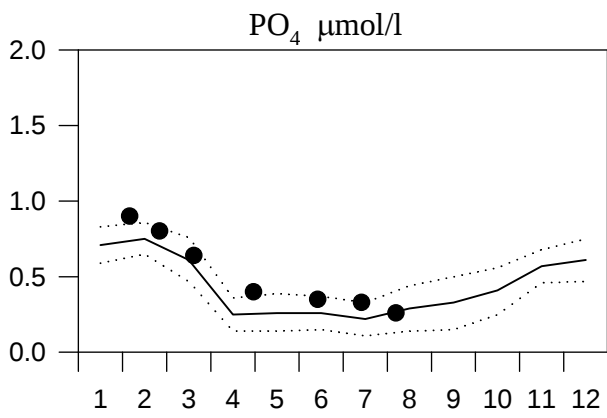
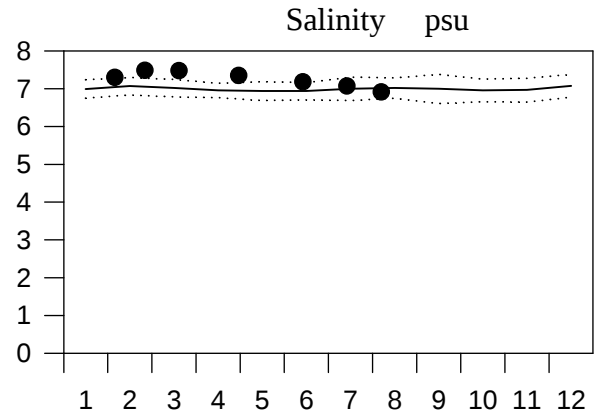
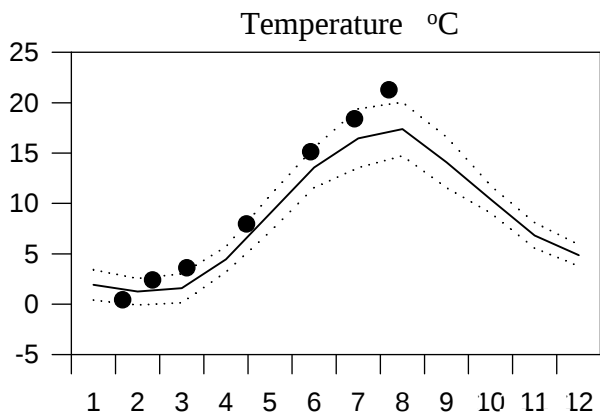
— Mean 1996-2010 St.Dev. ● 2014



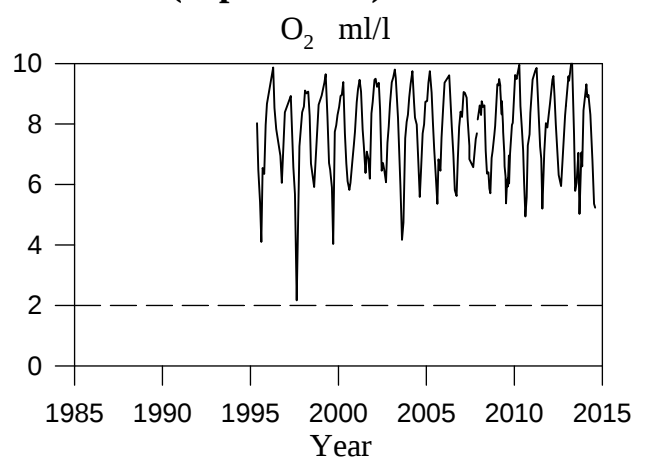
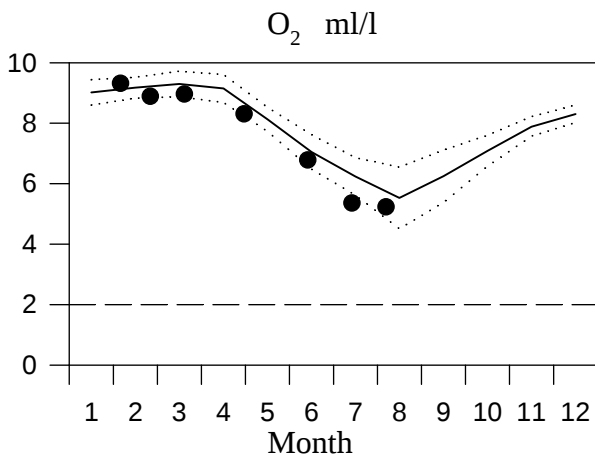
STATION REF M1V1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



OXYGEN IN BOTTOM WATER (depth >15m)



Vertical profiles Ref M1V1 August

— Mean 1996-2010 St.Dev. ● 2014

