Lars Andersson

Swedish Meteorological and Hydrological Institute
Oceanographic Laboratory

2014-08-08
Dnr: Sh-2014-124

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/algsit14_6.pdf

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

Address:
Sven Källfelts gata 15
SE-426 71 Vastra Frolunda
SWEDEN

Telephone:
+46 11 4958000

E-mail:
shark@smhi.se
WWW:
http://www.smhi.se/

SMHI

PRELIMINARY RESULTS

The cruise, part of the Swedish regular marine monitoring programme with the Finnish research vessel Aranda, began in Helsinki on August 1th and ended in the same port on the 8th. Winds during the expedition were week 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.

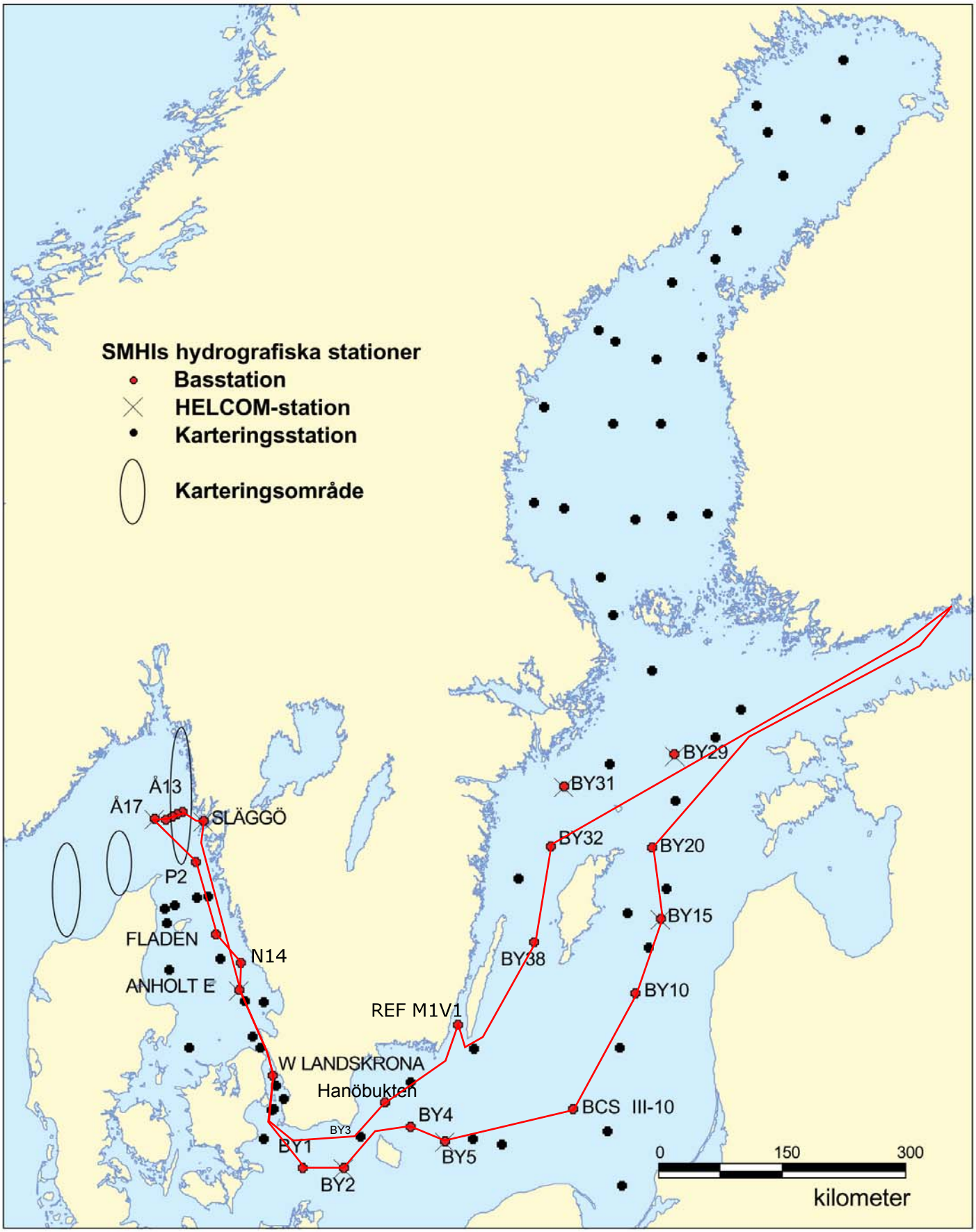
PARTICIPANTS

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

APPENDICES

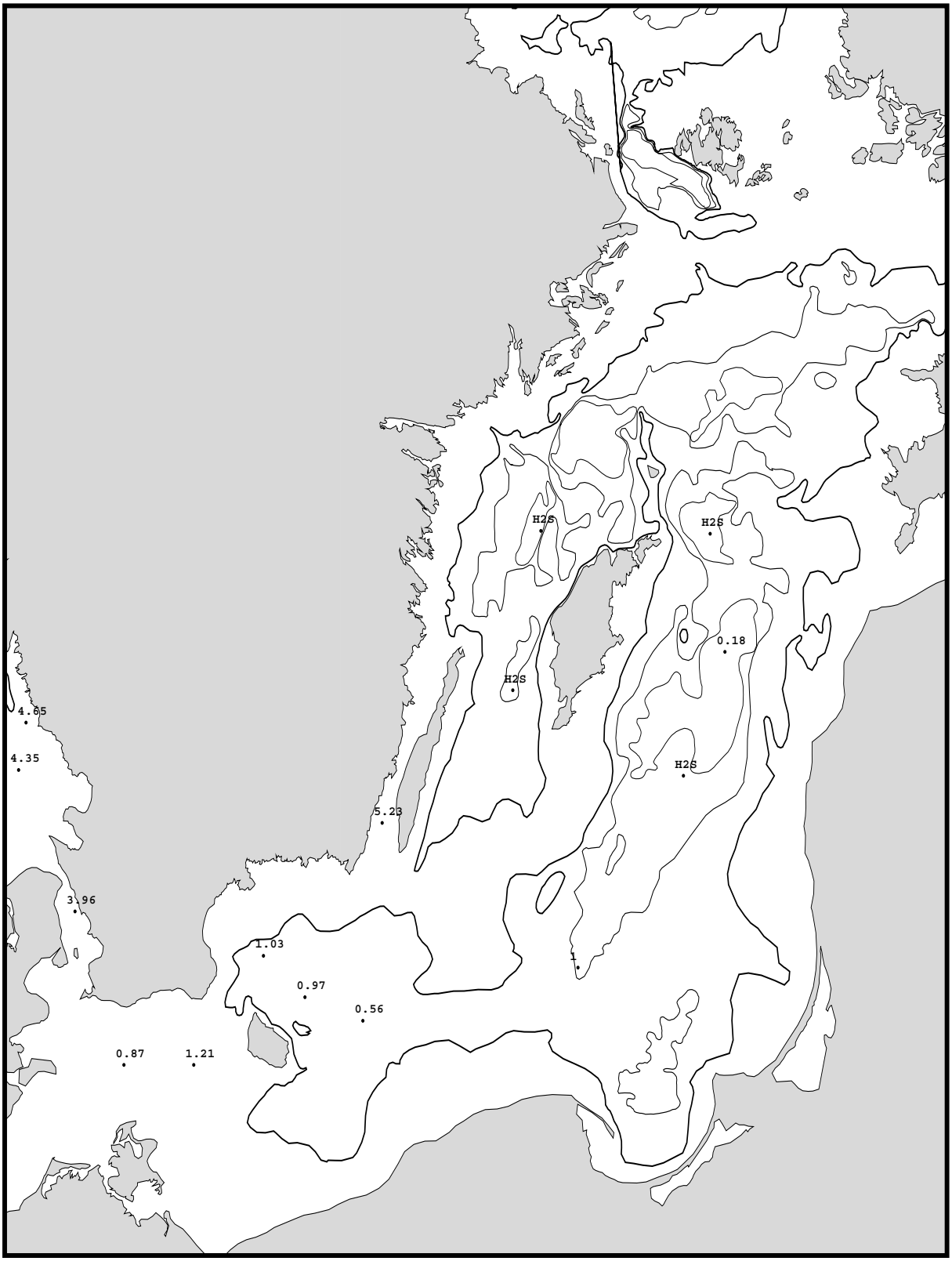
- Track chart
- Table over stations, parameters and sampling depths
- Map showing bottom oxygen concentrations
- Monthly average surface water plots for selected stations
- Vertical profiles for selected stations

TRACKCHART
Country: Sweden
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

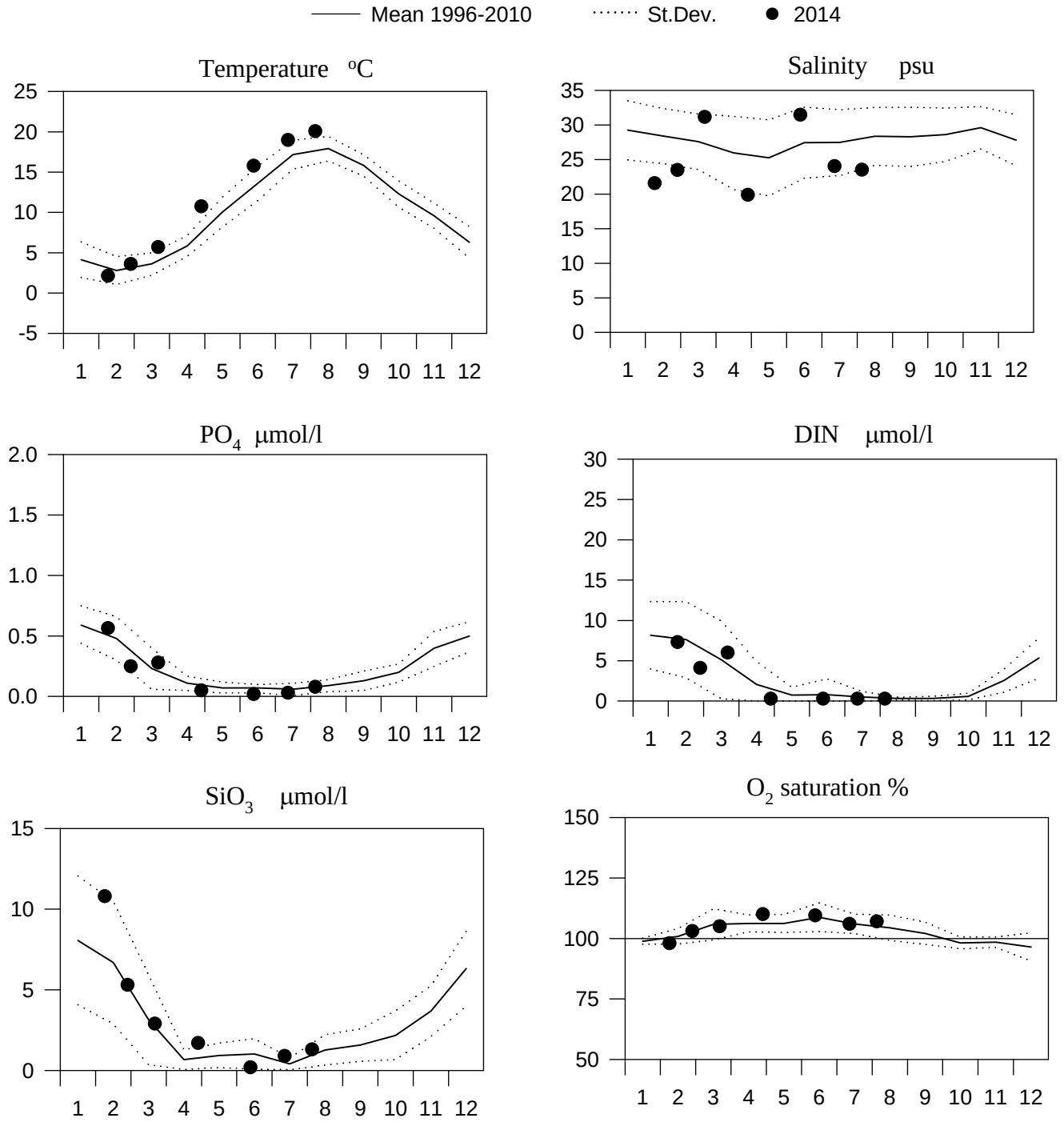


SMHI ***** Hydrographic Ship: 01-Aranda ****** Date: 2014-08-07
Ocean enh ***** series Year: 2014 ****** Time: 16:55

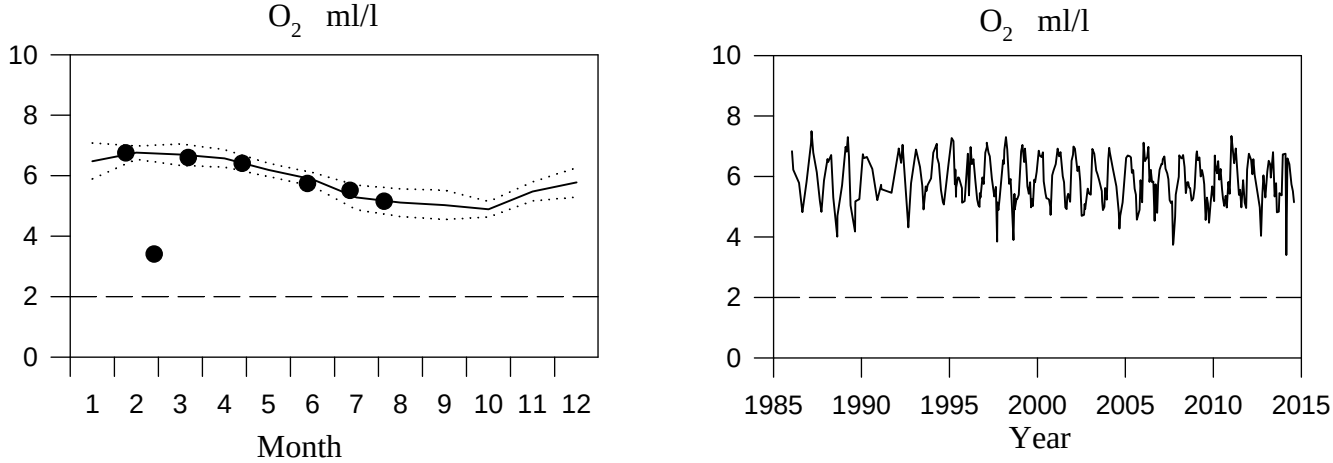
Ser no	Stat code	Proj	Station	Lat	Lon	Date yyyymmdd	Time hhmm utc	Bottom depth m	Secchi depth m	Wind dir	Wind vel	Air temp C	Air pres hPa	WCSI elec aoae tu hd	Ctd	PPCPZZT Hrhhoor Cilyooa motPBw PrP l	Node	Tem p	Sal in	Phx g	Oxy g	H2S	PO4P	Too t P	Too P	NO2N	NO3N	NH4N	Tot N	Alk al	SiO3	Hum us	Lign i	PON	POC	TOC	Com m
0472	BPEX26BAS	BY20	FÅRÖDJ	N5800	E1953	20140802	0555	196		18	5	20.8	1018	1520	x	--x----	17	x	x	-	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	x
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
0474	BPEX21EXT	BY15	GOTLANDSDJ	N5720	E2003	20140802	1250	239		07	7	22.0	1016	4920	x	-------	5	-	x	-	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	x
0475	BPEX13BAS	BY10		N5638	E1935	20140802	1800	145		08	6	24.3	1014	1220	x	--x----	15	x	x	-	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	x
0476	BPSE11BAS	BCS III-10		N5533.3	E1824	20140803	0145	91		12	6	23.1	1012	9990	x	--x----	12	x	x	-	x	-	x	x	x	x	x	x	-	x	x	-	-	-	-	-	x
0477	BPSB07BAS	BY5	BORNHOLMSDJ	N5515	E1559	20140803	1000	90	6	13	8	23.7	1010	4130	x	-xxxx--	12	x	x	x	x	-	x	x	x	x	x	x	x	x	x	-	-	-	-	-	-
0478	BPSB06BAS	BY4	CHRISTIANSÖ	N5523	E1520	20140803	1350	91	7.5	09	5	23.8	1009	1320	x	--x----	12	x	x	-	x	-	x	x	x	x	x	x	-	x	-	-	-	-	-	-
0479	BPSA03BAS	BY2	ARKONA	N5500	E1405	20140803	2020	47		25	8	21.9	1010	9990	x	--xxx--	8	x	x	-	x	-	x	x	x	x	x	x	-	x	x	-	-	-	-	-	-
0480	BPSA02BAS	BY1		N5500	E1318	20140803	2340	46		33	6	21.4	1009	9990	x	--x----	8	x	x	-	x	-	x	x	x	x	x	x	-	x	-	-	-	-	-	-
0481	SOCX39BAS	W LANDSKRONA		N5552.0	E1245.0	20140804	0540	52		36	9	20.3	1010	2820	x	--x----	9	x	x	-	x	-	x	x	x	x	x	x	-	x	-	-	-	-	-	-
0482	KAEX29BAS	ANHOLT E		N5640.0	E1207.0	20140804	1125	63		04	4	19.3	1012	6830	x	-xxx---	10	x	x	x	x	-	x	x	x	x	x	x	x	x	x	-	-	-	-	-	x
0483	KANX50BAS	N14 FALKENBERG		N5656.40	E1212.70	20140804	1400	32		34	9	19.3	1012	2830	x	-xxxx--	7	x	x	x	x	-	x	x	x	x	x	x	x	x	-	-	-	-	-	-	-
0484	KANX25BAS	FLADEN		N5711.5	E1140	20140804	1715	85		31	4	20.1	1013	1330	x	--x----	12	x	x	-	x	-	x	x	x	x	x	x	-	x	-	-	-	-	-	-
0485	SKEX23BAS	P2		N5752	E1118	20140804	2200	94		28	8	19.6	1013	9990	x	--x----	10	x	x	-	x	-	x	x	x	x	x	x	-	x	-	-	-	-	-	-
0486	SKEX18BAS	Å17		N5816.5	E1030.8	20140805	0210	310		26	11	19.4	1013	9990	x	--xxx--	14	x	x	x	x	-	x	x	x	x	x	x	x	x	-	-	-	-	-	-	-
0487	SKEX17BAS	Å16		N5816	E1043.5	20140805	0420	205		26	11	18.9	1014	1440	x	-------	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0488	SKEX16BAS	Å15		N5817.7	E1051	20140805	0540	136	9	27	11	19.0	1014	2740	x	--x----	12	x	x	-	x	-	x	x	x	x	x	x	-	x	-	-	-	-	-	-	-
0489	SKEX15BAS	Å14		N5819	E1056.5	20140805	0642	110		27	10	18.8	1014	2740	x	-------	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0490	SKEX14BAS	Å13		N5820.2	E1102	20140805	0740	93	8	26	9	18.9	1014	1640	x	--x----	10	x	x	-	x	-	x	x	x	x	x	x	-	x	-	-	-	-	-	-	-
0491	FIBG27BAS	SLÄGGÖ		N5815.5	E1126.0	20140805	0955	74	8	25	7	18.9	1015	1530	x	-xxxx--	9	x	x	-	x	-	x	x	x	x	x	x	-	x	-	-	-	-	-	-	x
0492	KAEX29BAS	ANHOLT E		N5640.0	E1207.0	20140805	2030	62		00	0	19.6	1016	9990	x	---xx--	10	x	x	x	x	-	x	x	x	x	x	x	-	x	x	-	-	-	-	-	-
0493	BPSH05BAS	HANÖBUKTEN		N5537	E1452	20140806	1240	78	7	22	5	20.0	1015	2720	x	-------	11	x	x	-	x	-	x	x	x	x	x	x	-	x	-	-	-	-	-	-	x
0494	BPWK01BAS	REF M1V1		N5622.25	E1612.1	20140806	1925	19		26	4	22.4	1014	9990	x	-x-xx--	5	x	x	x	x	-	x	x	x	x	x	x	x	x	-	-	-	-	-	-	x
0495	BPWX45BAS	BY38	KARLSÖDJ	N5707	E1740	20140807	0455	111		35	5	20.2	1013	2720	x	-------	14	x	x	-	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-	x
0496	BPWX38BAS	BY32	NORRKÖPINGSDJ	N5801	E1759	20140807	1045	201	7	25	5	21.2	1014	1630	x	-------	17	x	x	-	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-	x

STATION P2 SURFACE WATER

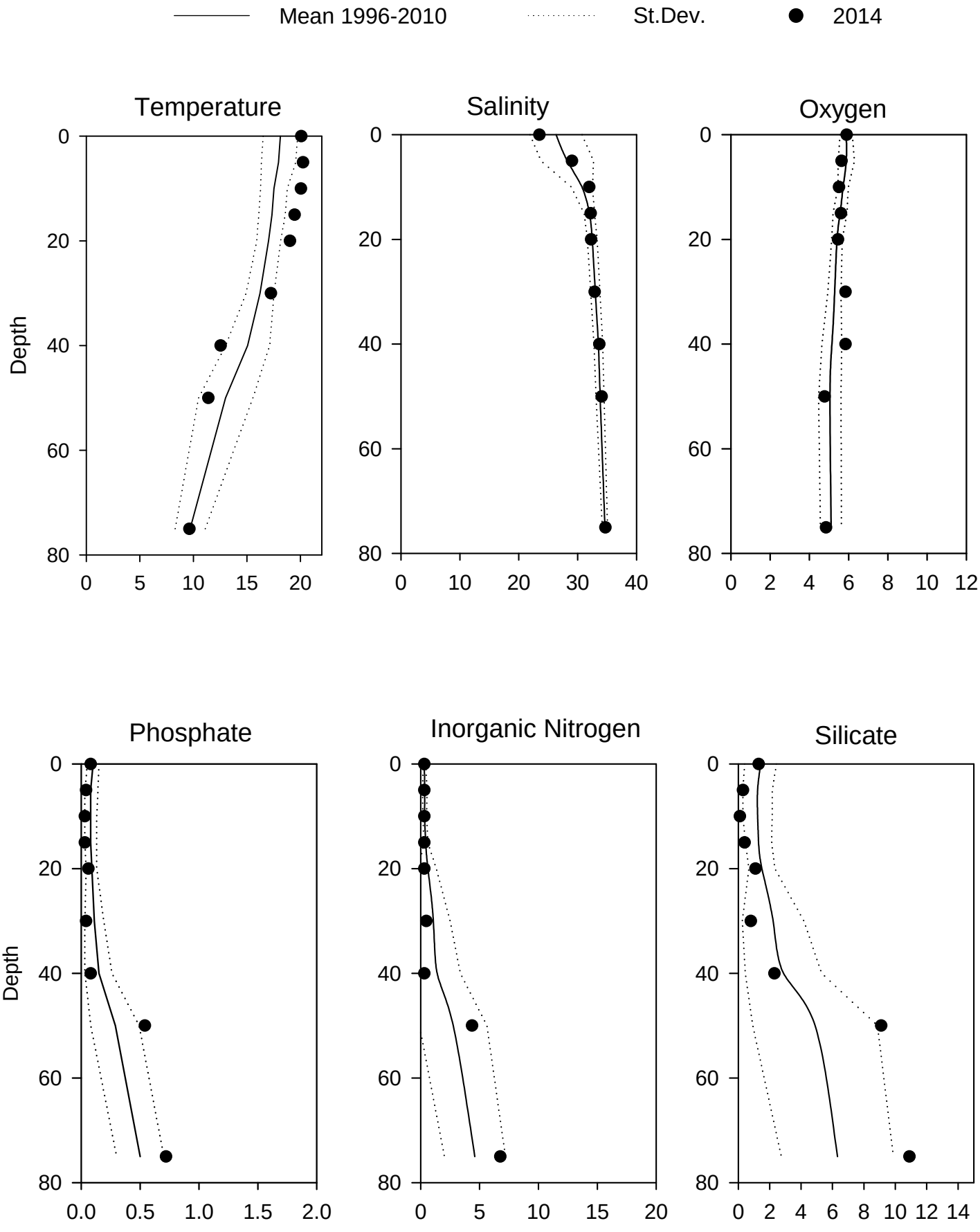
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >75m)

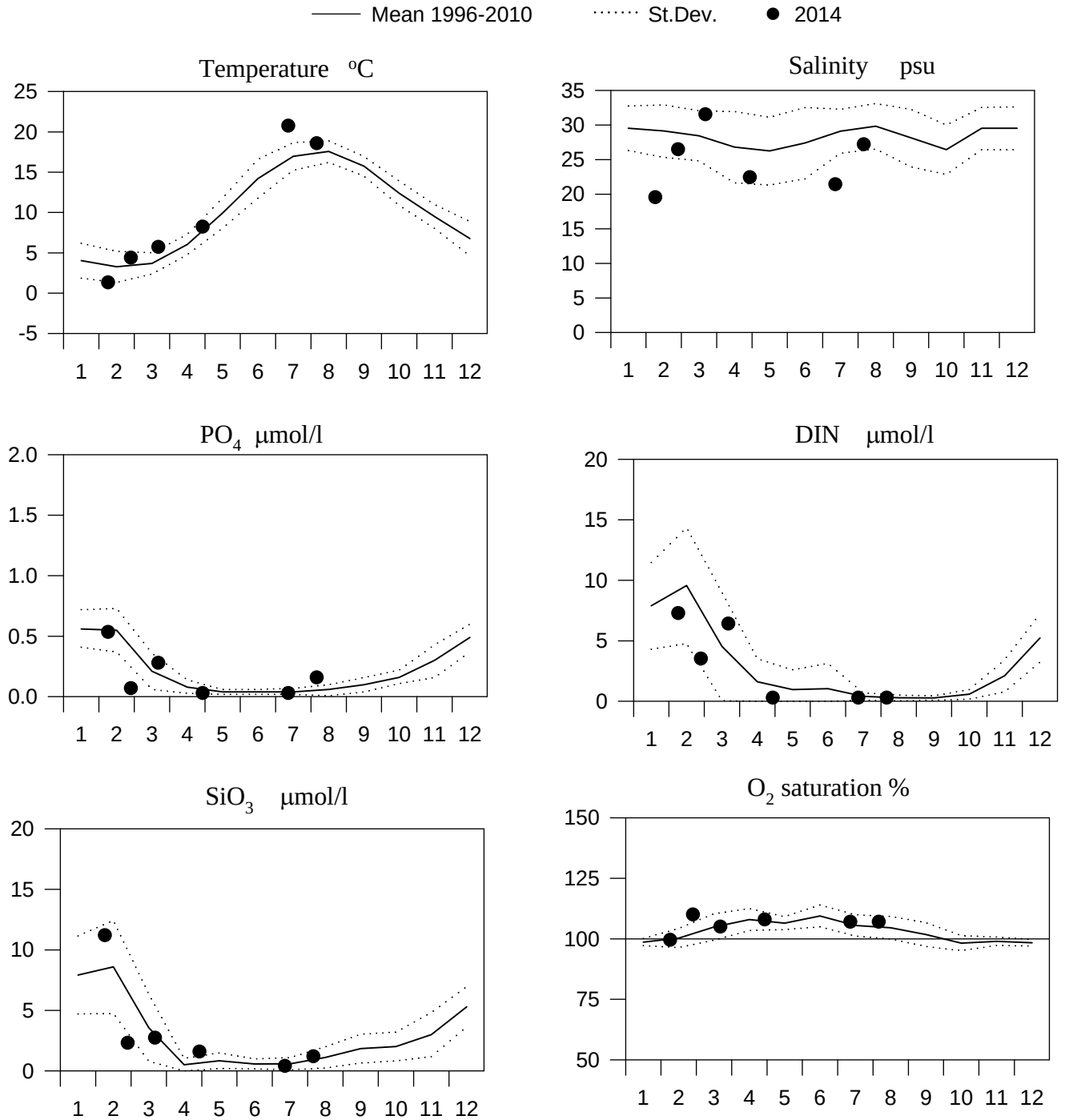


Vertical profiles P2 August

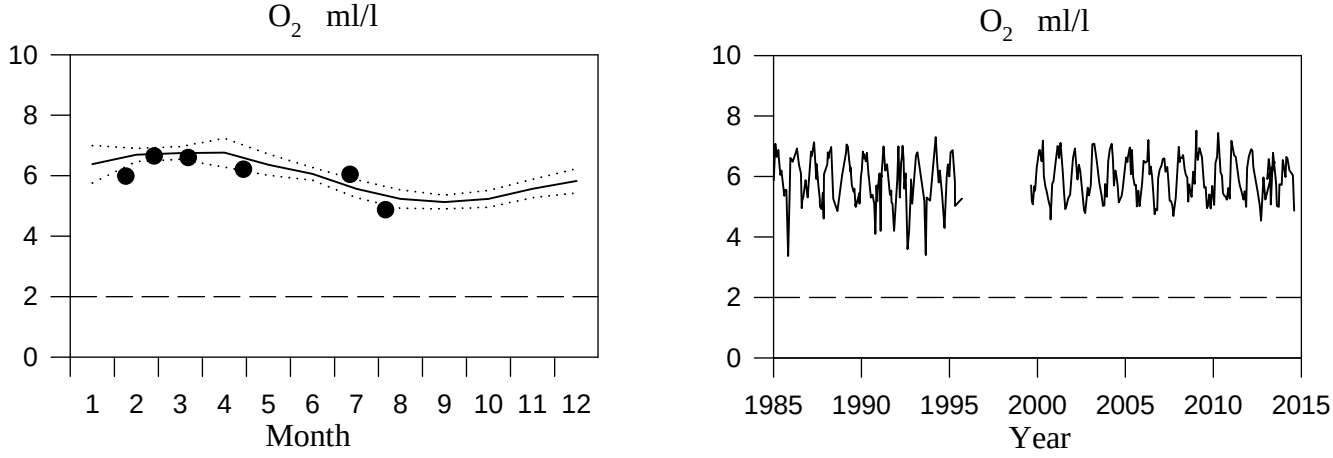


STATION Å13 SURFACE WATER

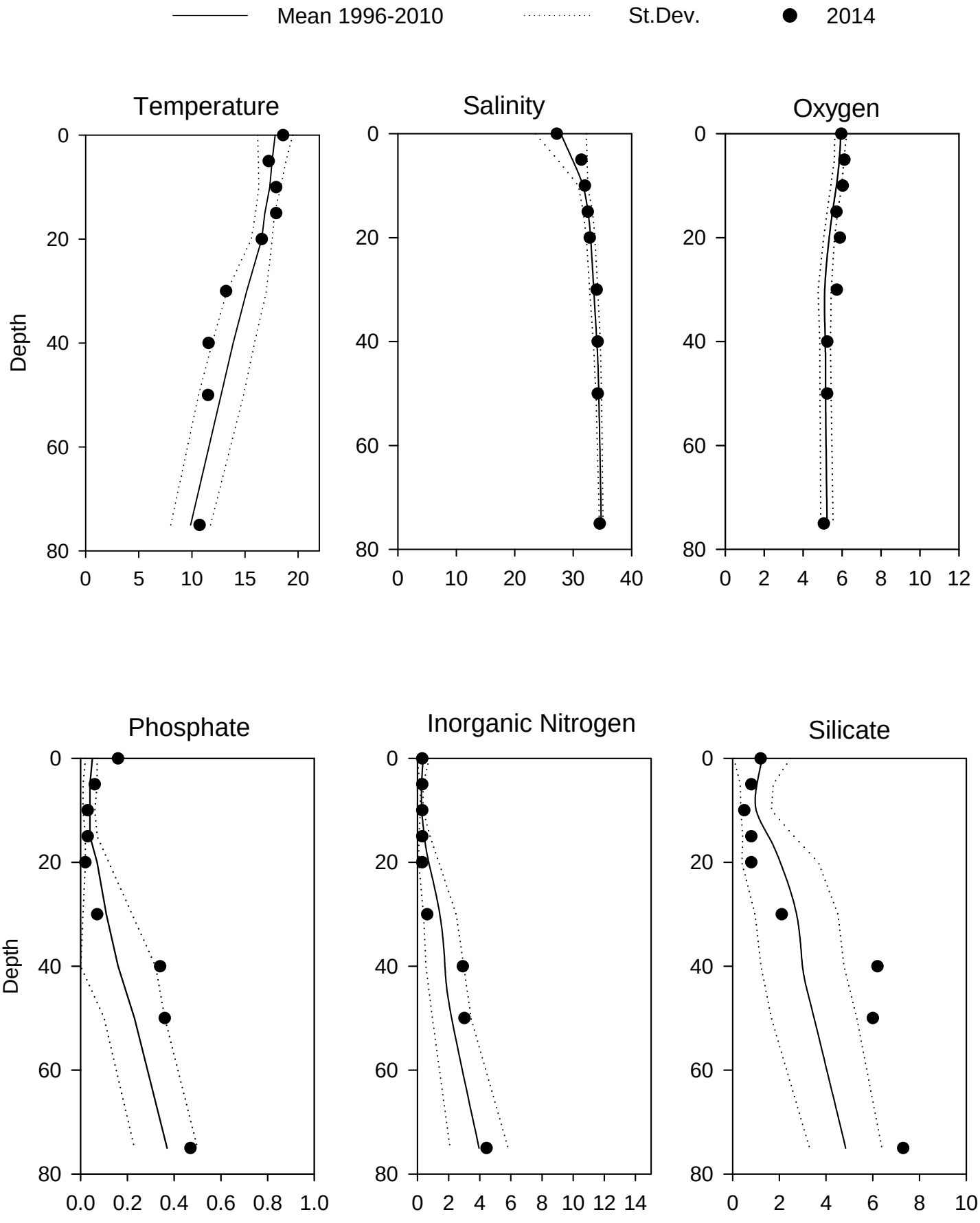
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >=75m)



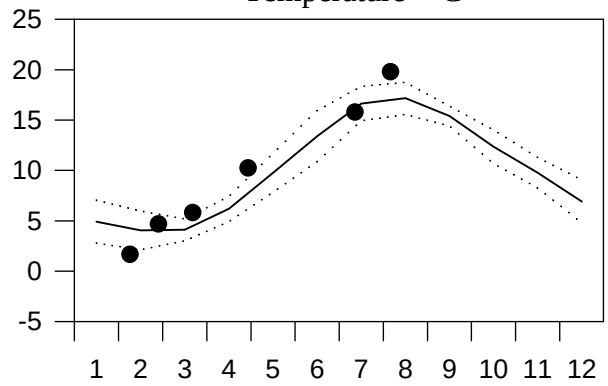
Vertical profiles Å13 August



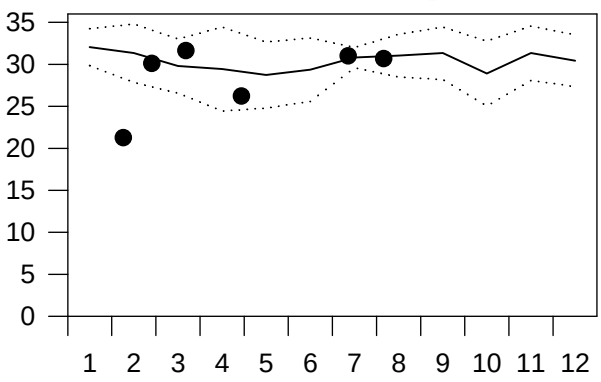
STATION Å15 SURFACE WATER

Annual Cycles

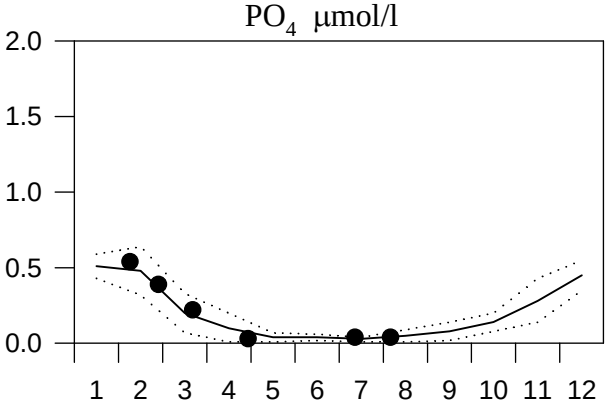
Temperature °C



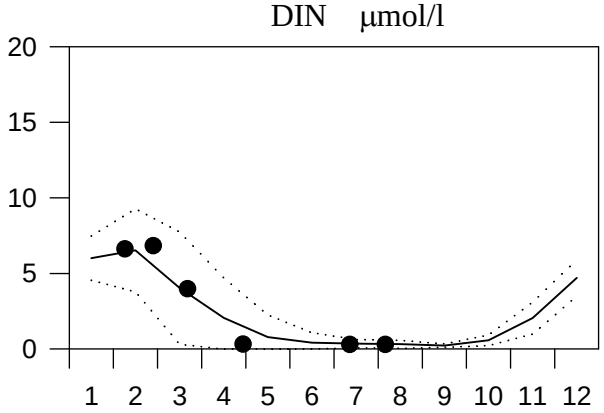
Salinity psu



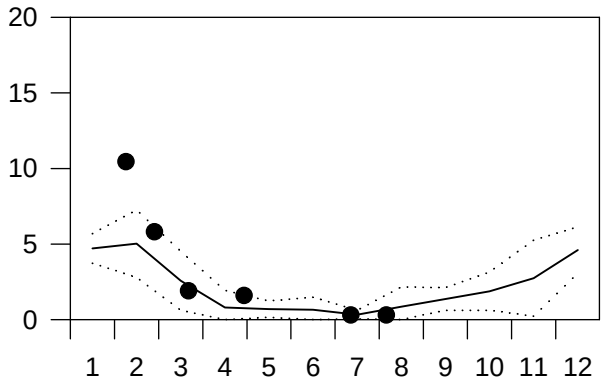
PO_4 µmol/l



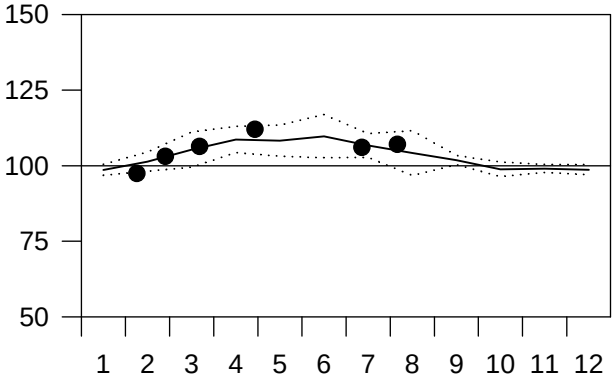
DIN µmol/l



SiO_3 µmol/l

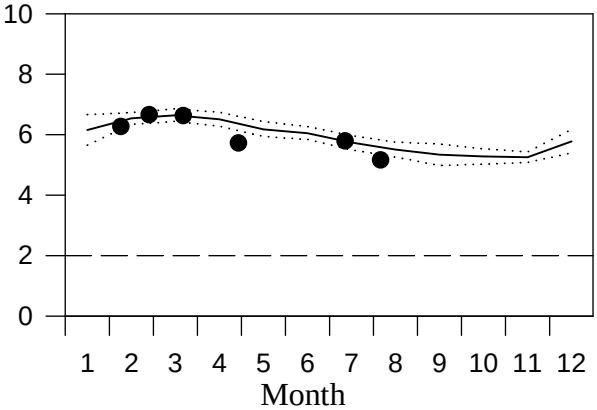


O_2 saturation %

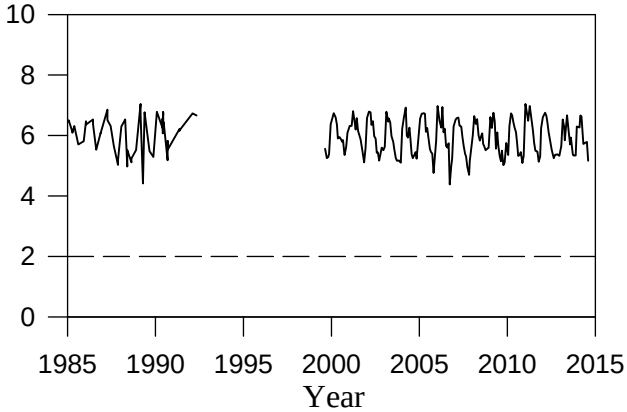


OXYGEN IN BOTTOM WATER (depth >=125m)

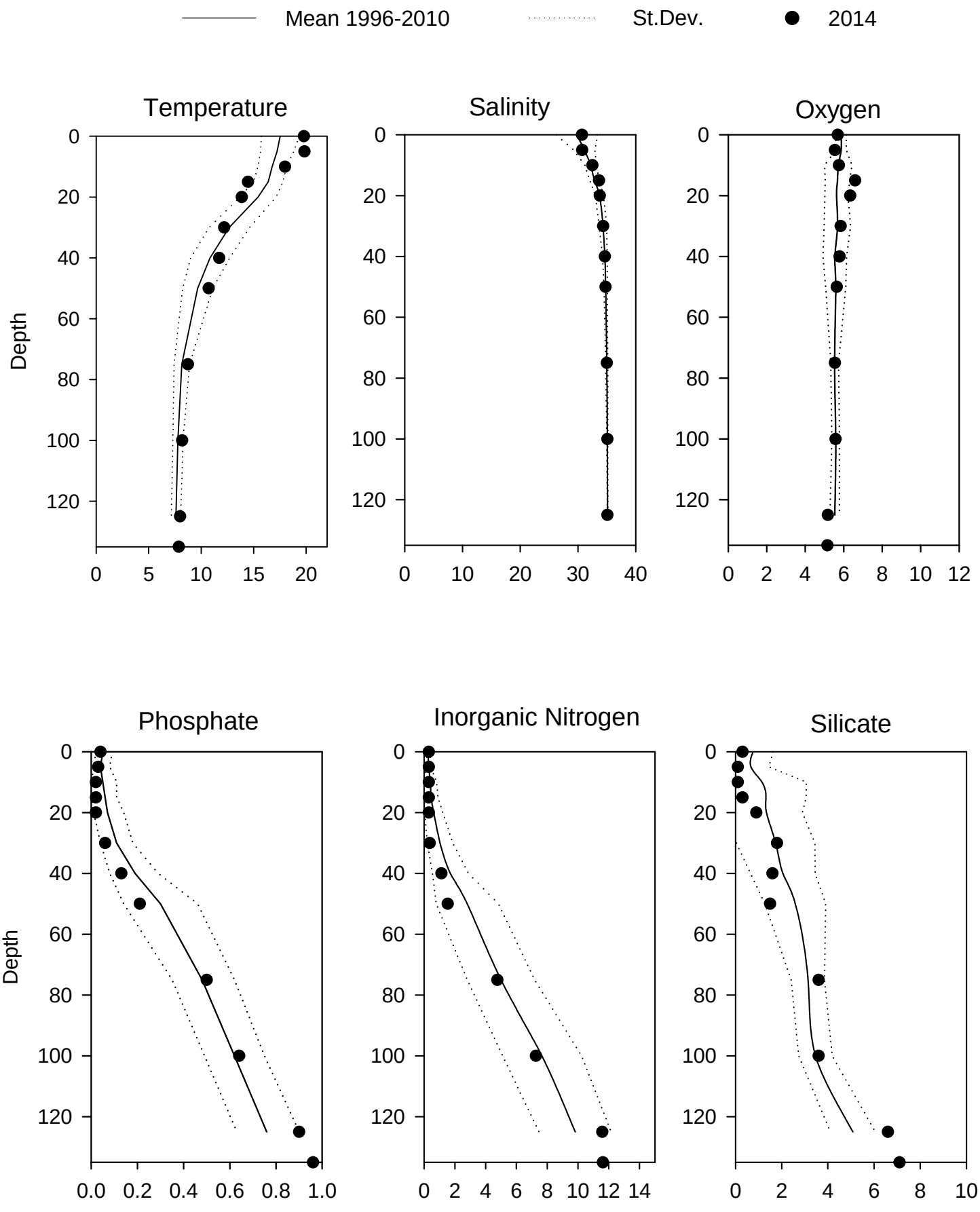
O_2 ml/l



O_2 ml/l

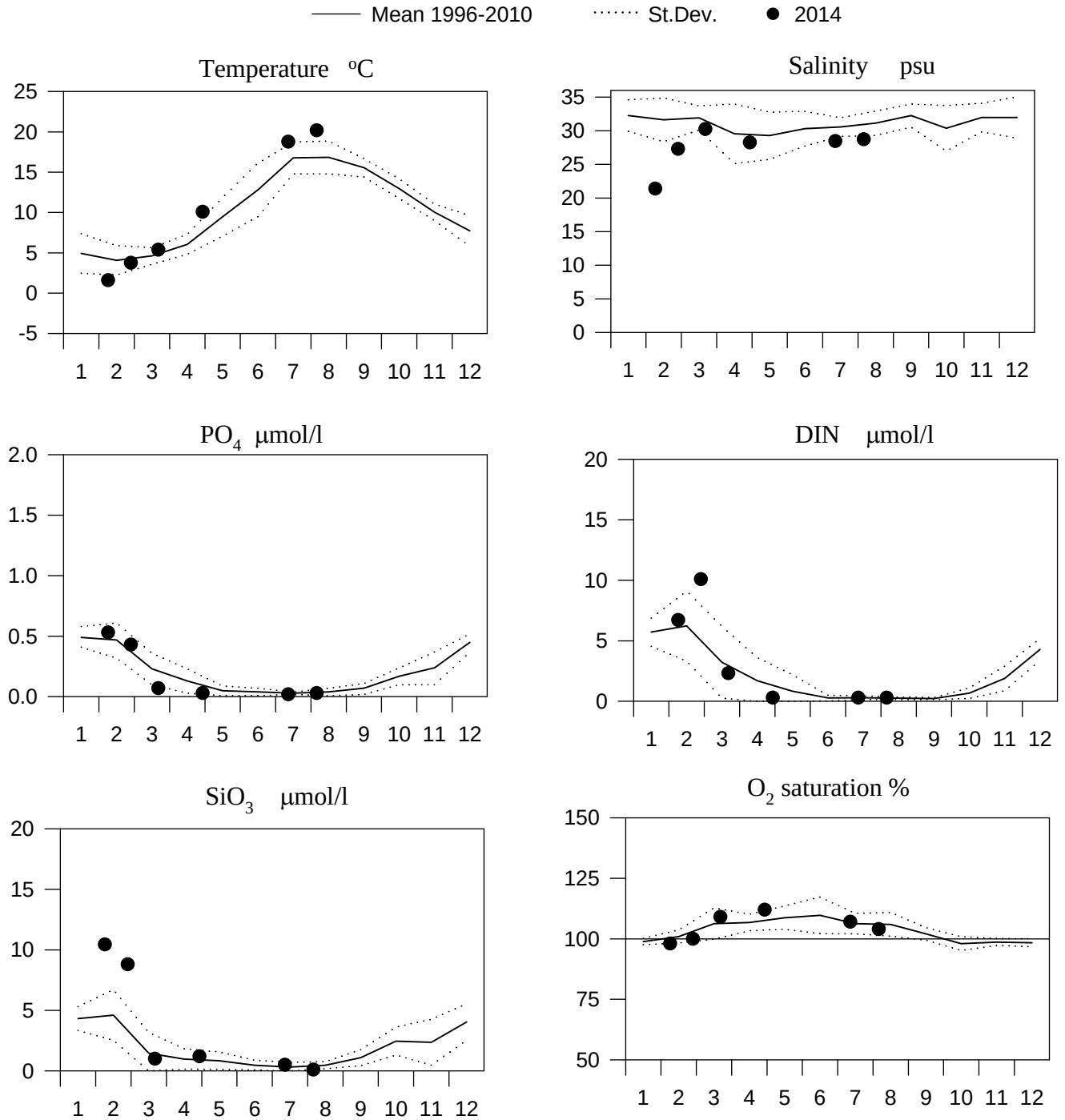


Vertical profiles Å15 August

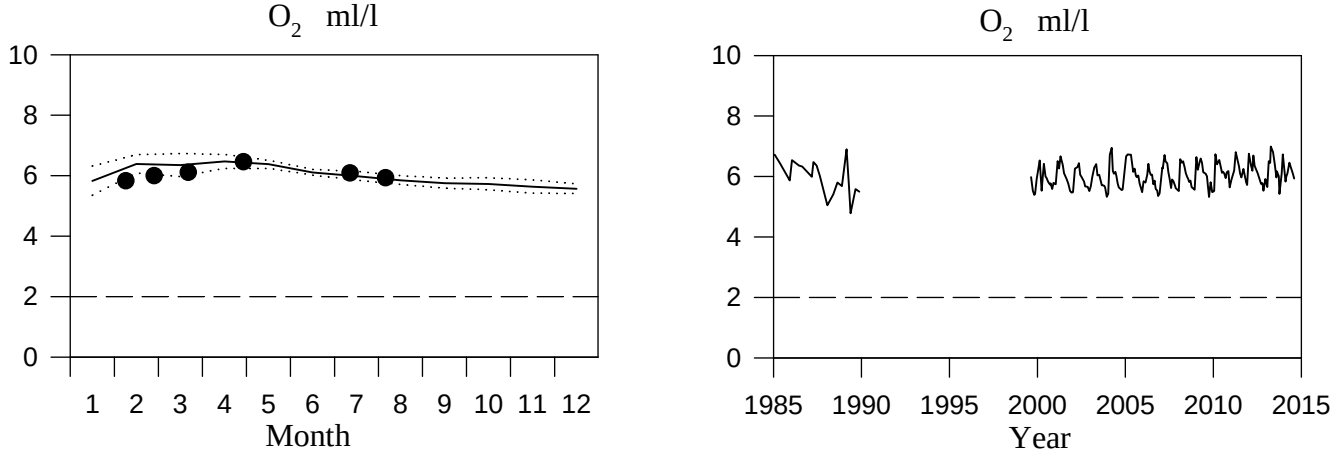


STATION Å17 SURFACE WATER

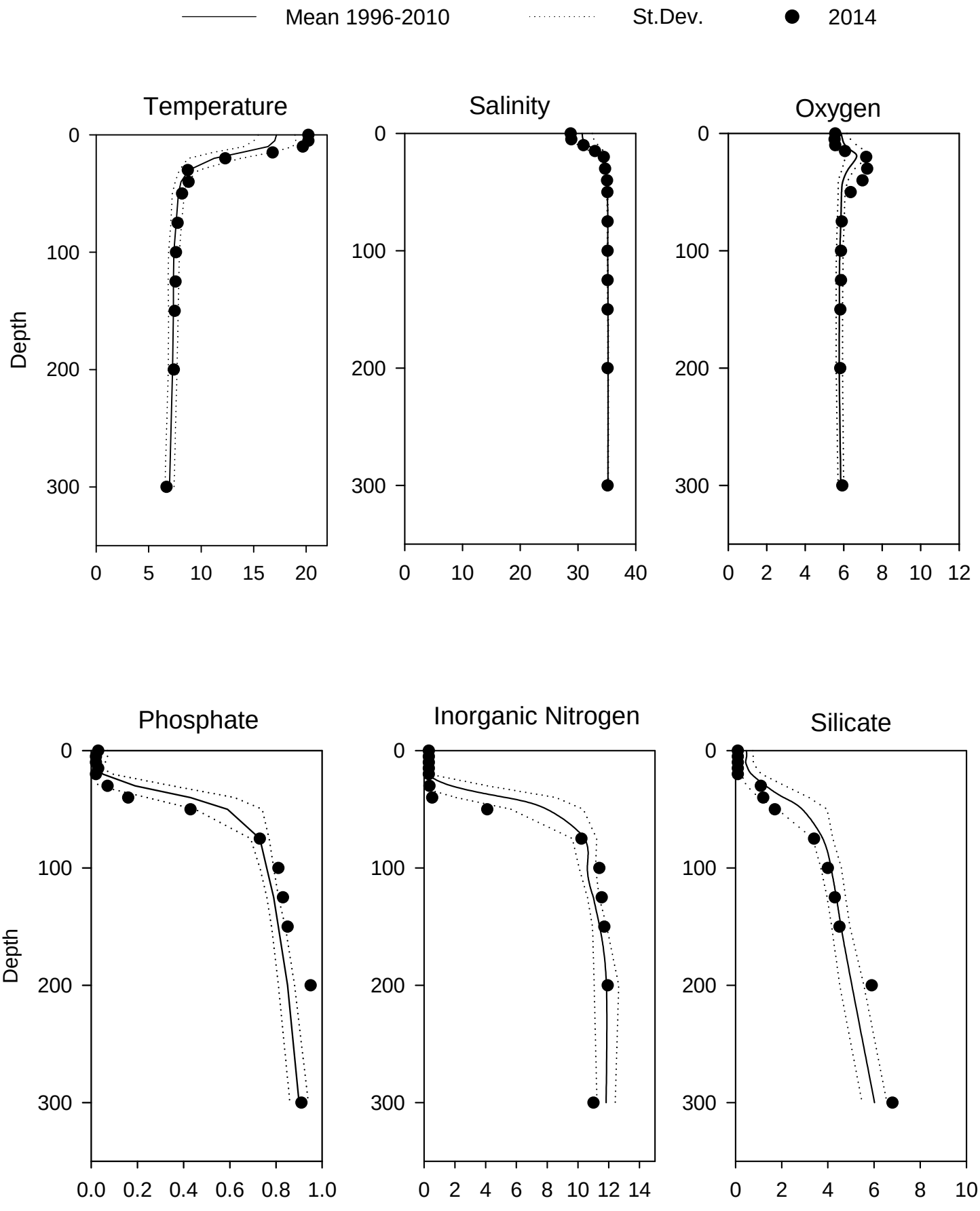
Annual Cycles



OXYGEN IN BOTTOM WATER (depth = 300m)

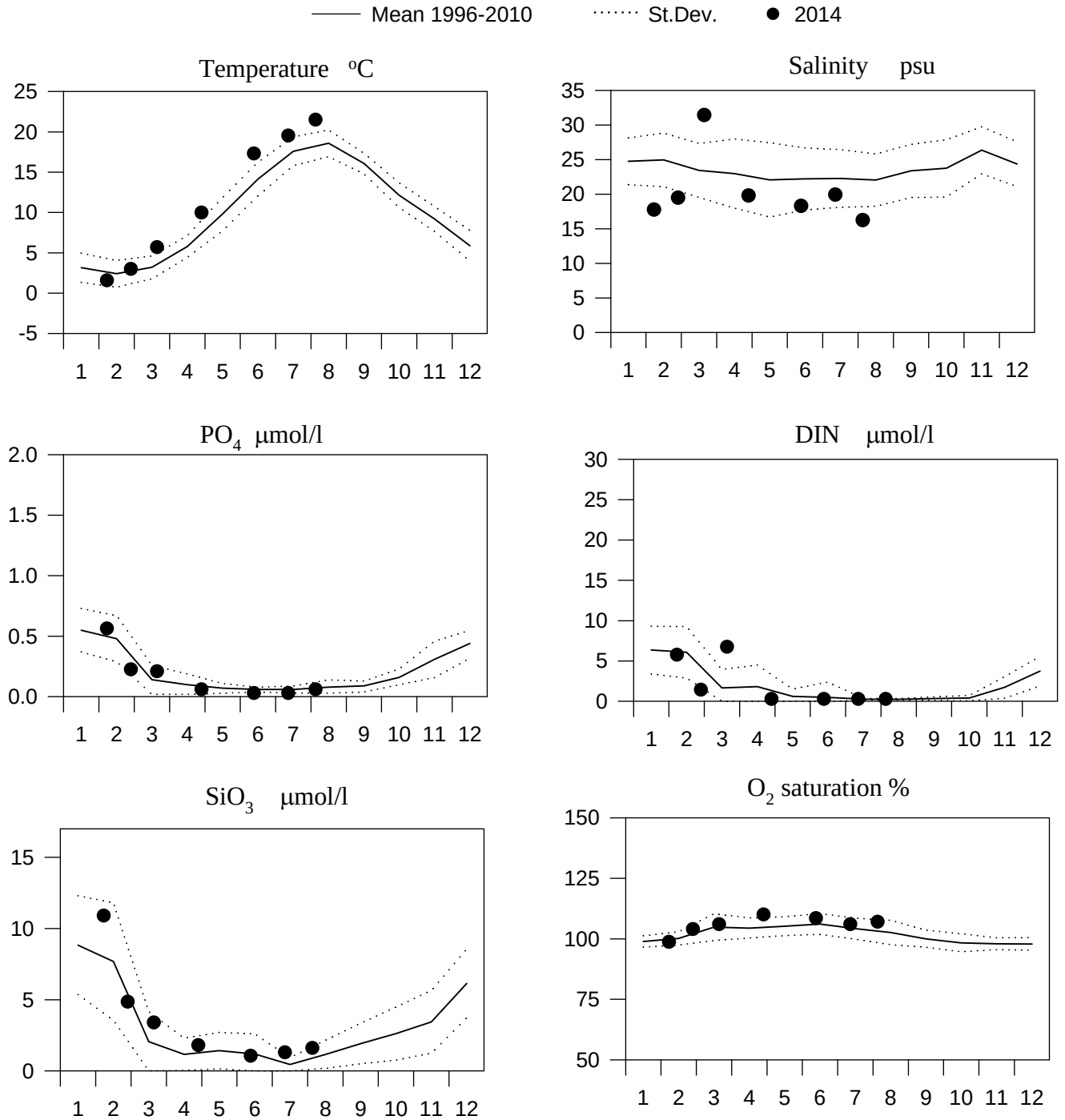


Vertical profiles Å17 August

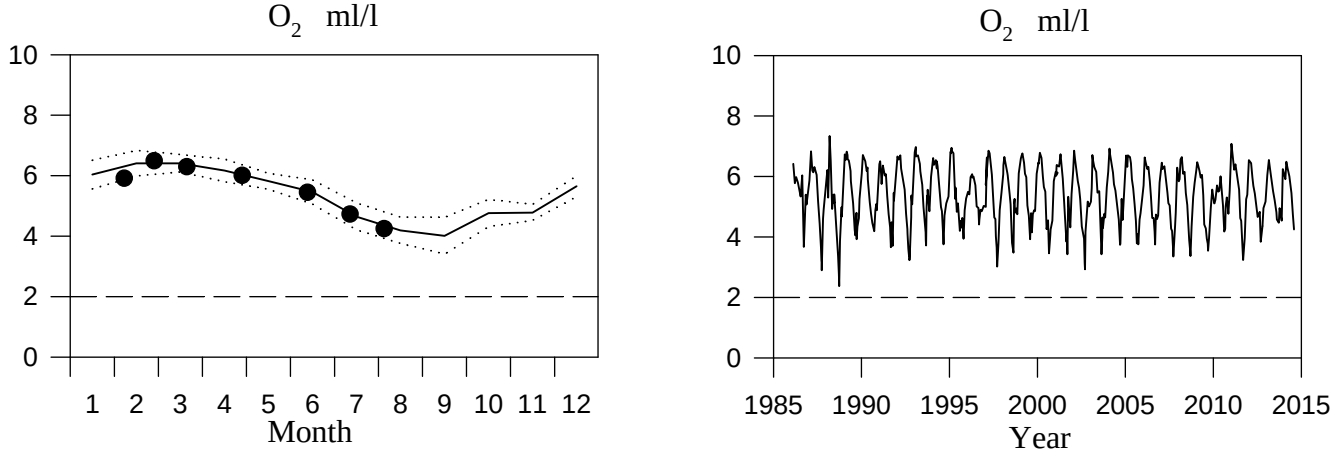


STATION FLADEN SURFACE WATER

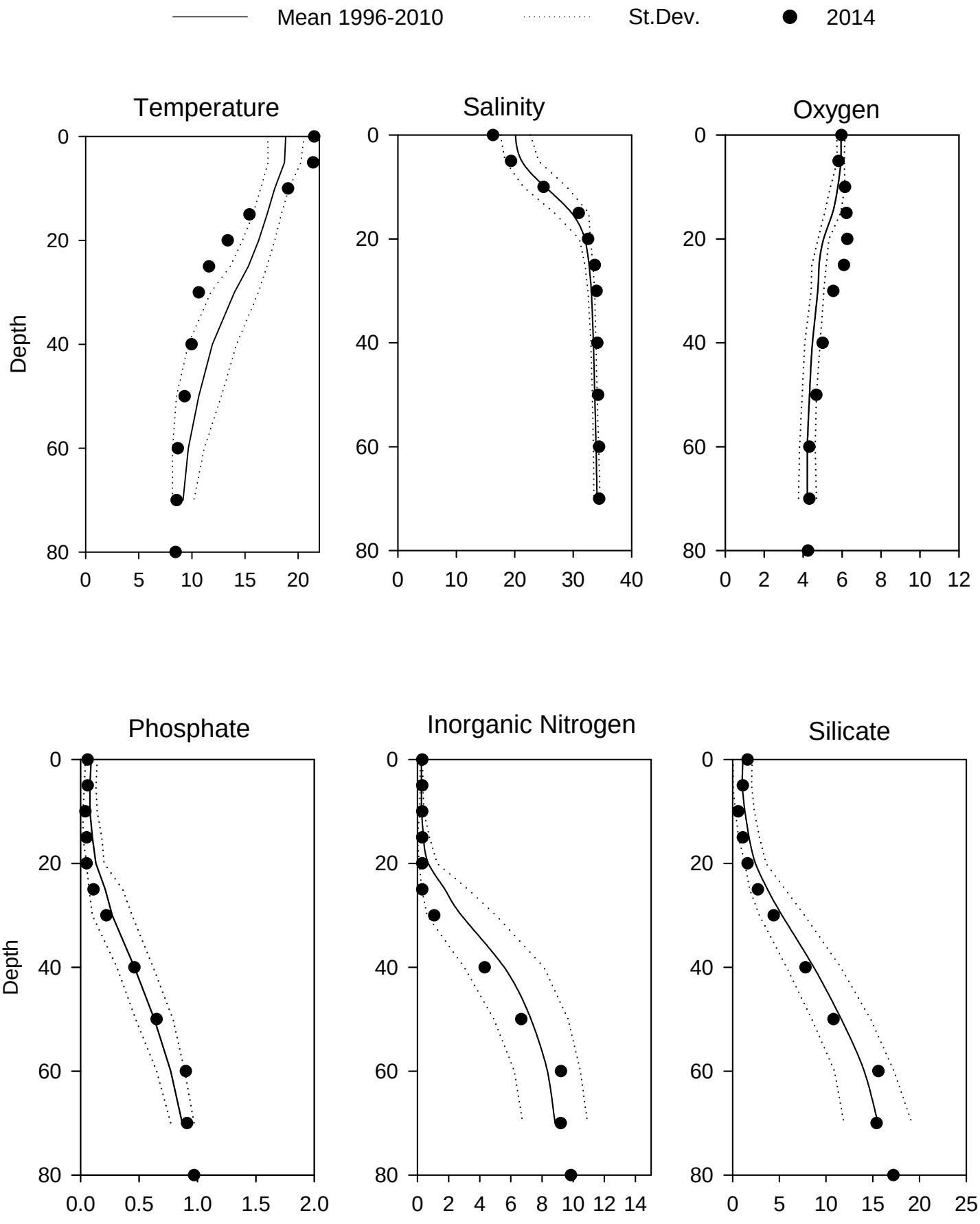
Annual Cycles



OXYGEN IN BOTTOM WATER (depth > 70m)

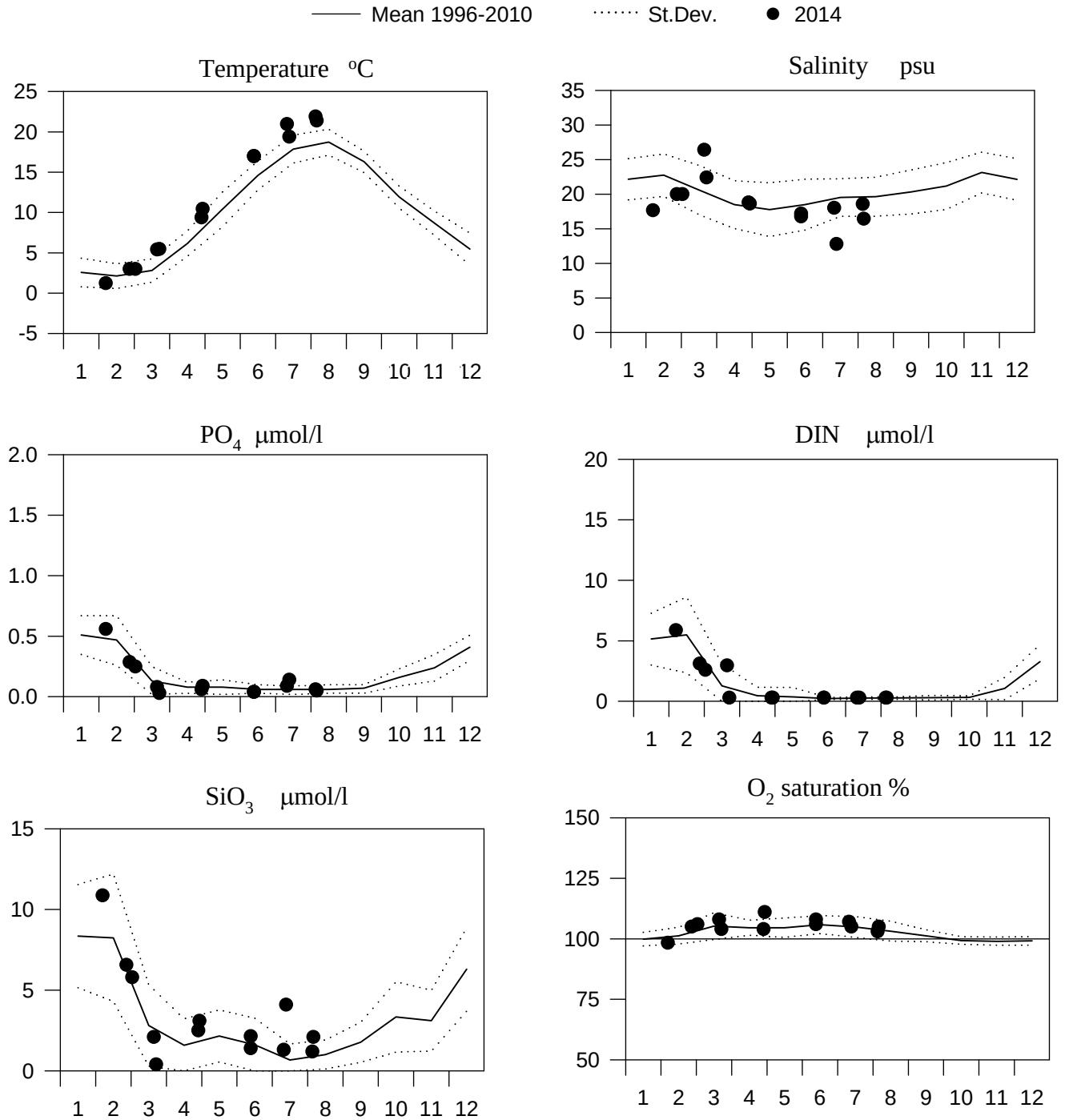


Vertical profiles Fladen August

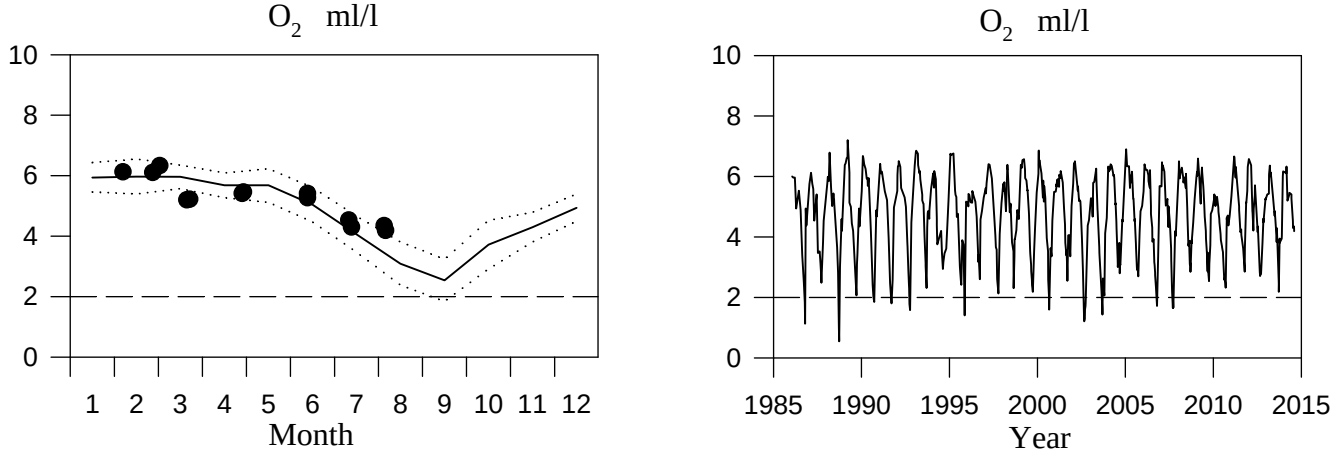


STATION ANHOLT E SURFACE WATER

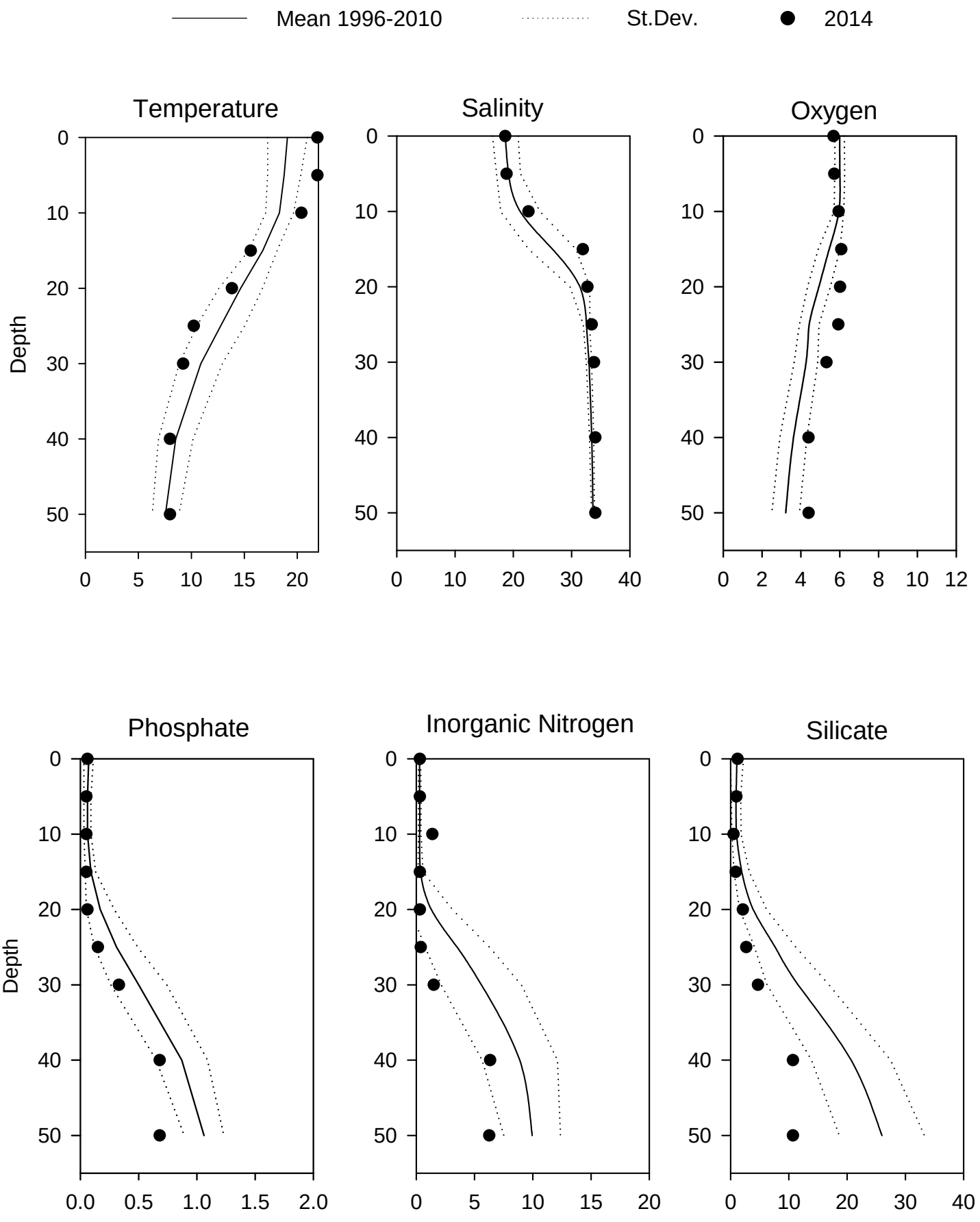
Annual Cycles



OXYGEN IN BOTTOM WATER (depth > 50m)



Vertical profiles Anholt E August

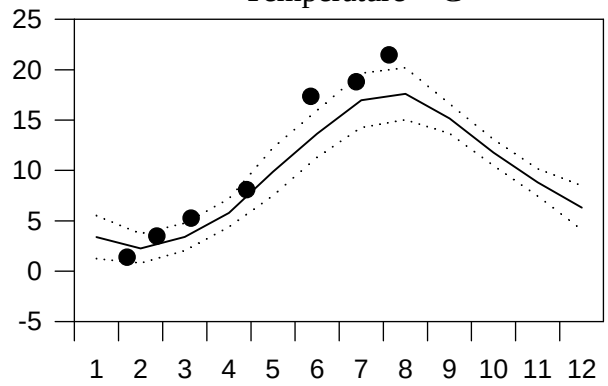


STATION W LANDSKRONA SURFACE WATER

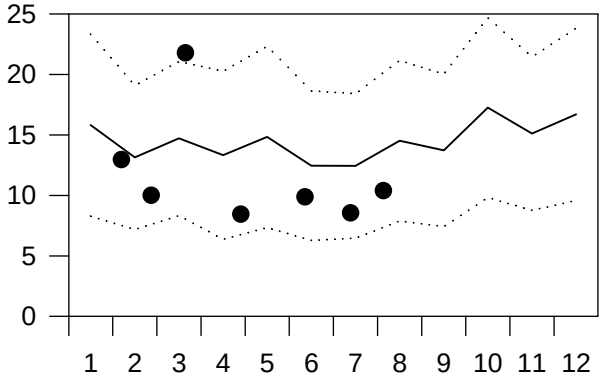
Annual Cycles

Mean 1996-2010 ····· St.Dev. ● 2014

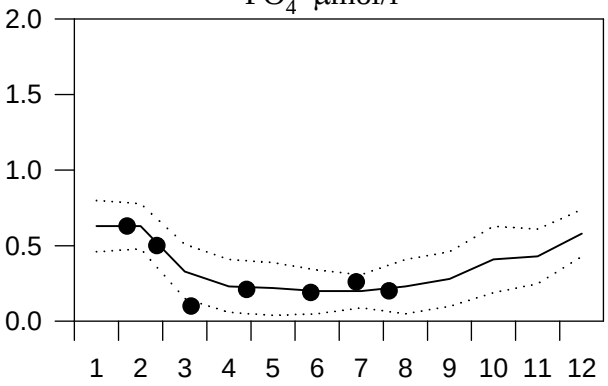
Temperature °C



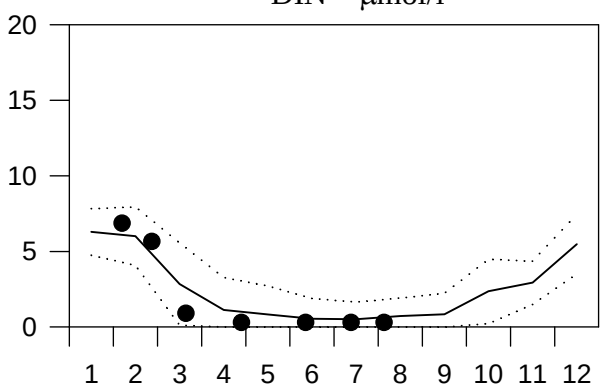
Salinity psu



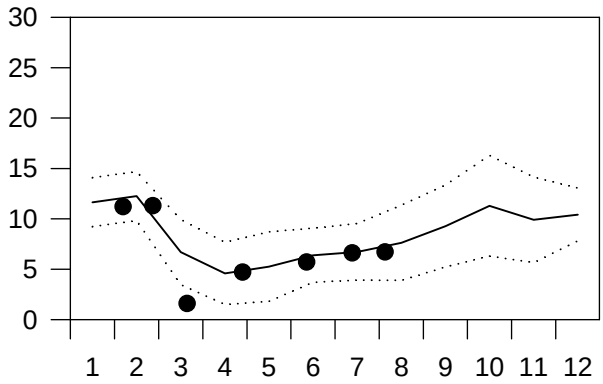
PO_4 µmol/l



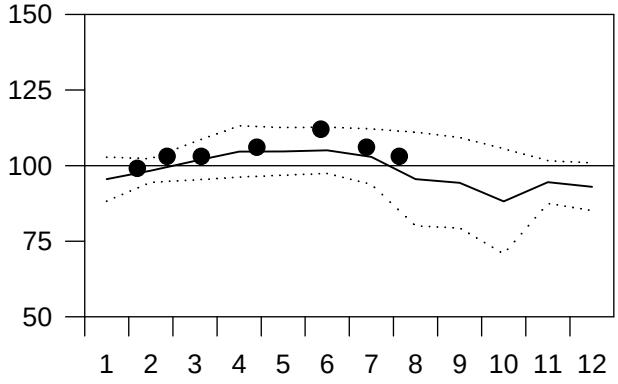
DIN µmol/l



SiO_3 µmol/l

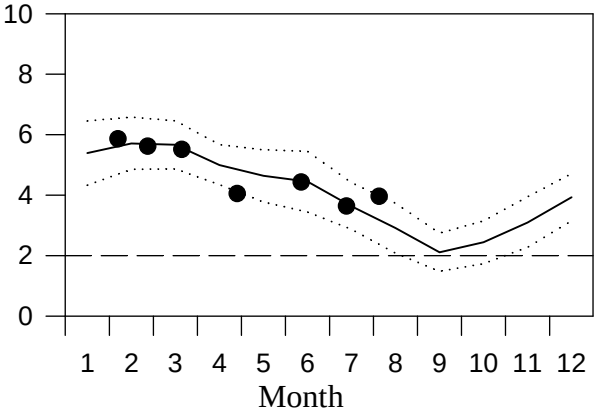


O_2 saturation %

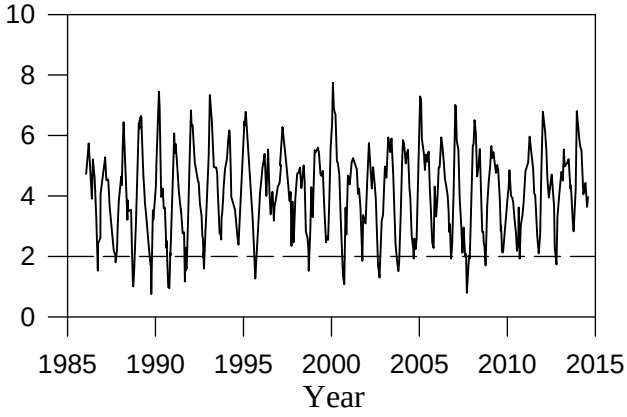


OXYGEN IN BOTTOM WATER (depth >40m)

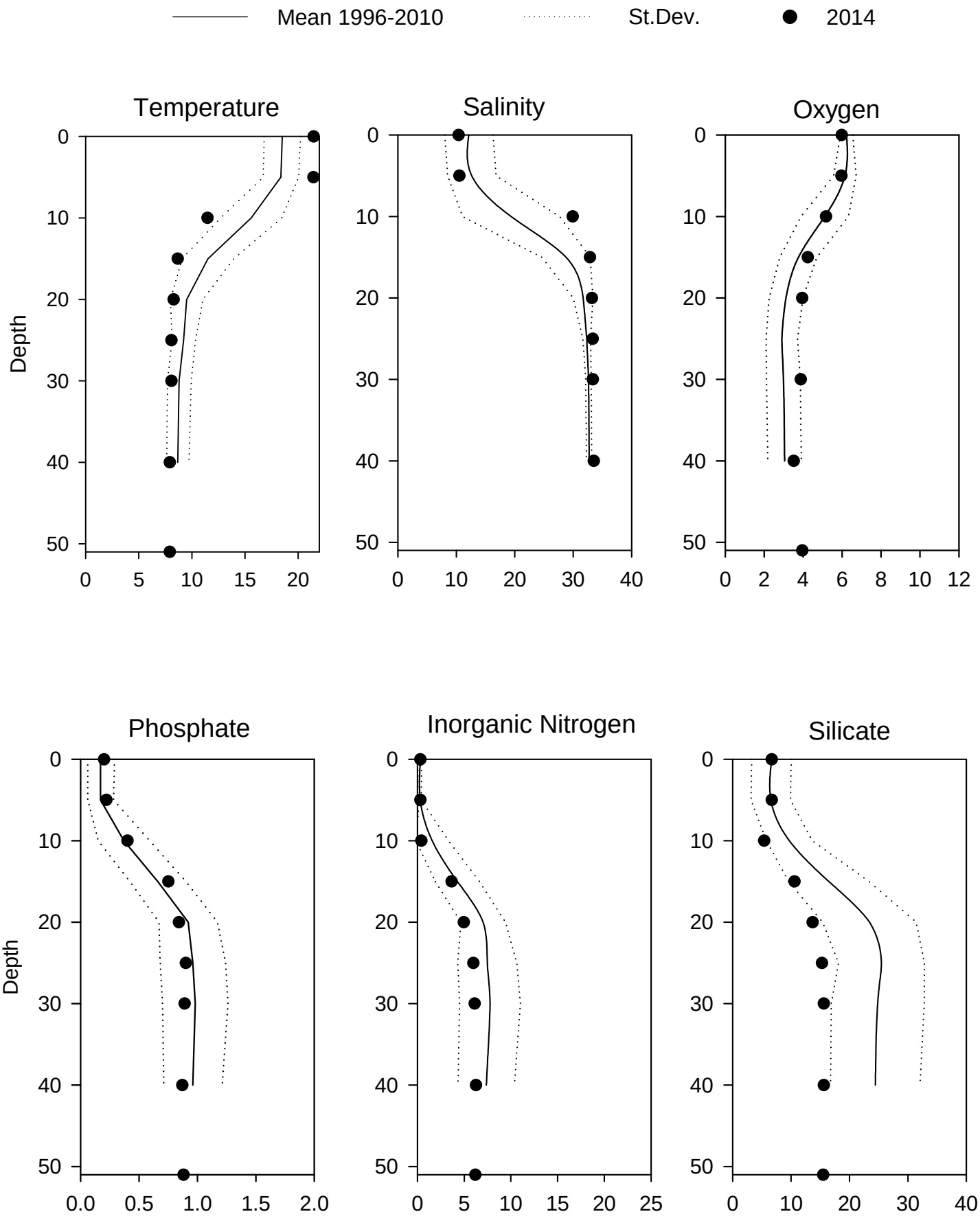
O_2 ml/l



O_2 ml/l



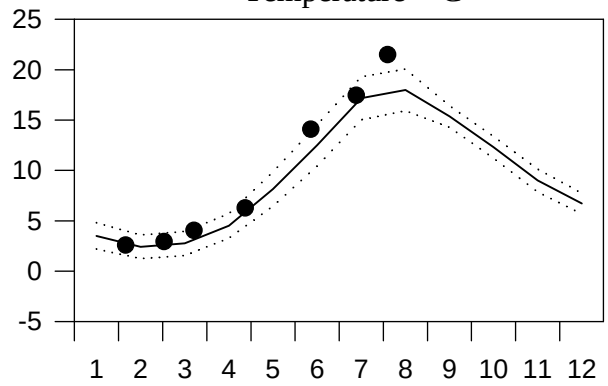
Vertical profiles W Landskrona August



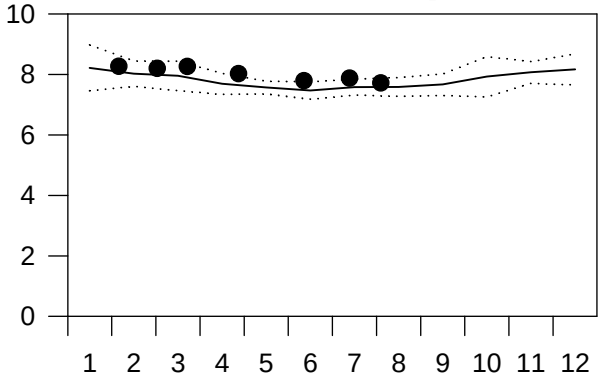
STATION BY1 SURFACE WATER

Annual Cycles

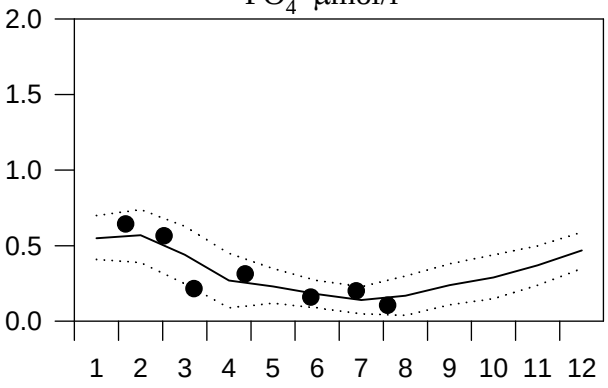
Temperature °C



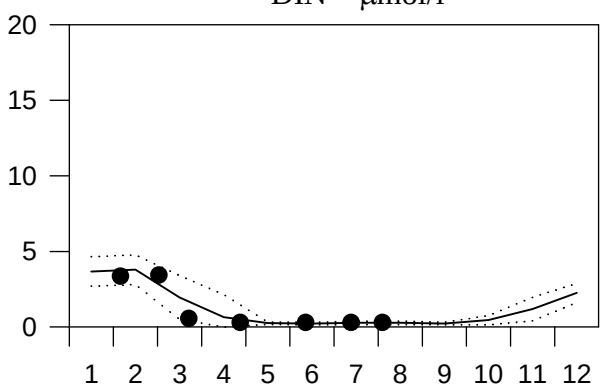
Salinity psu



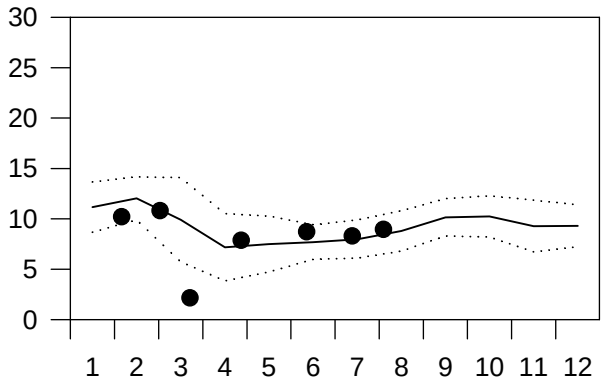
PO_4 µmol/l



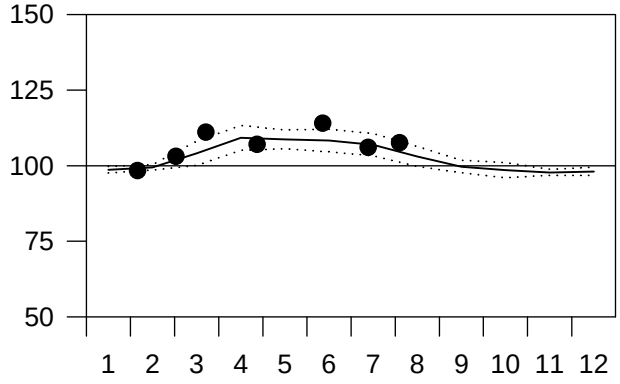
DIN µmol/l



SiO_3 µmol/l

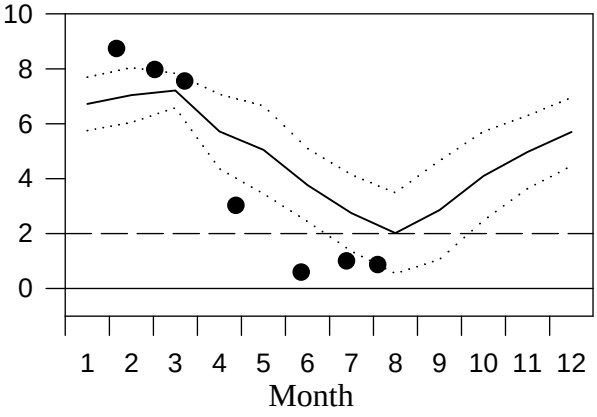


O_2 saturation %

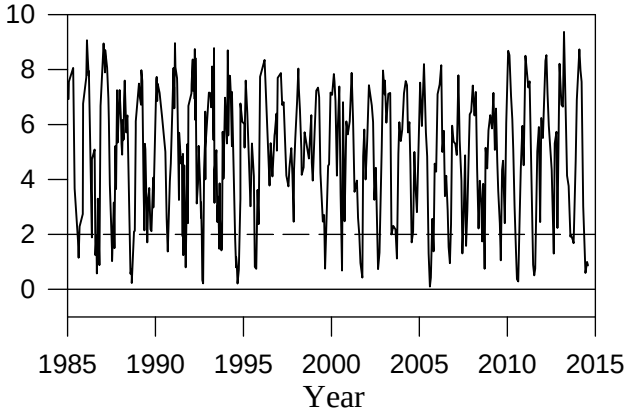


OXYGEN IN BOTTOM WATER (depth >40m)

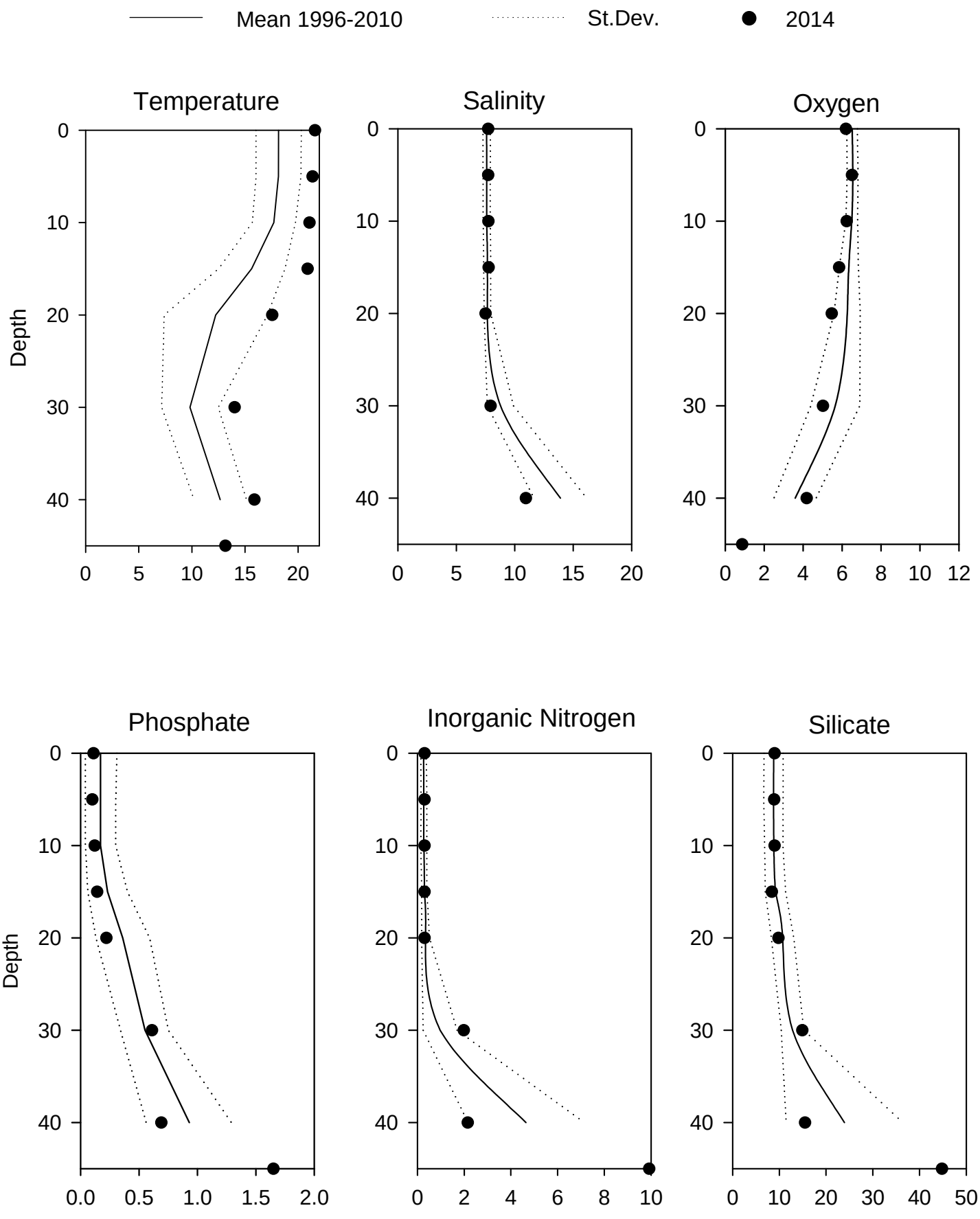
O_2 ml/l



O_2 ml/l



Vertical profiles BY1 August

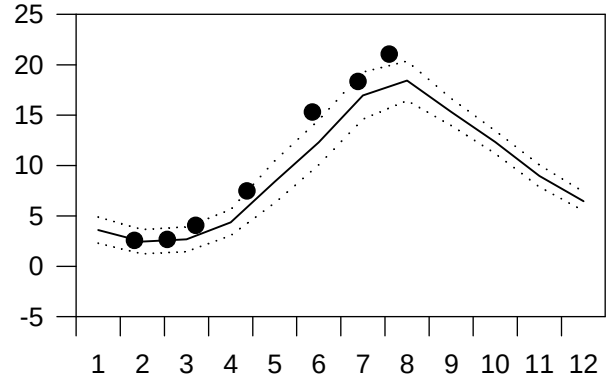


STATION BY2 SURFACE WATER

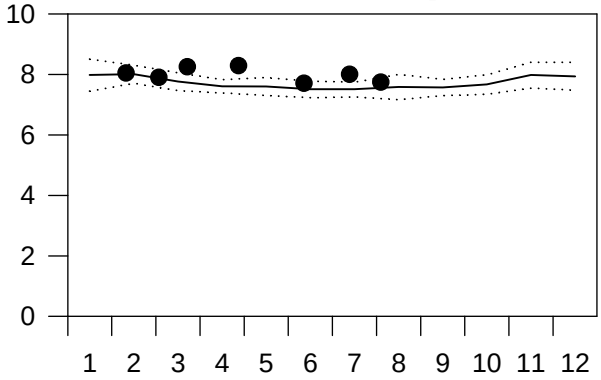
Annual Cycles

Mean 1996-2010 ····· St.Dev. ● 2014

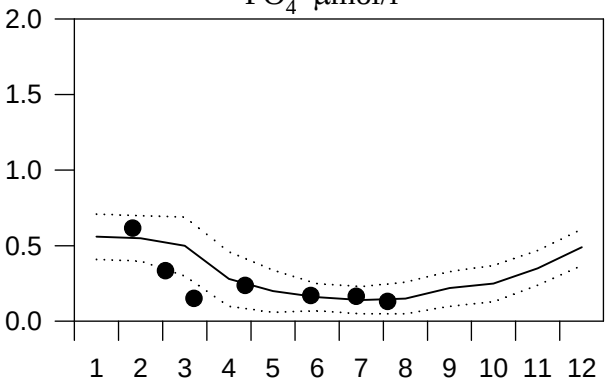
Temperature °C



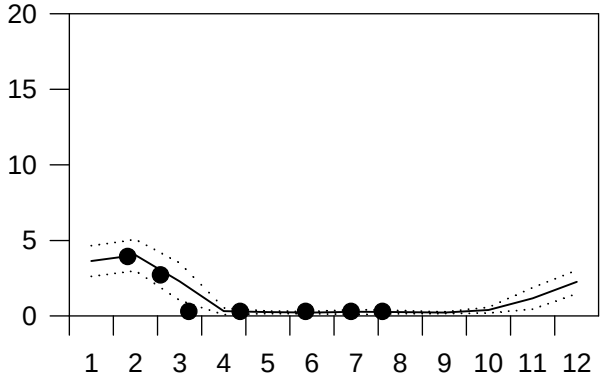
Salinity psu



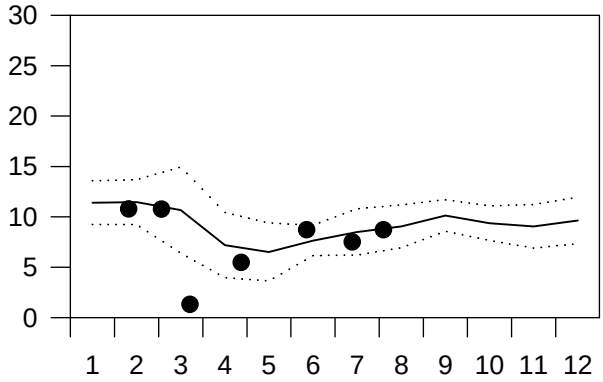
PO_4 µmol/l



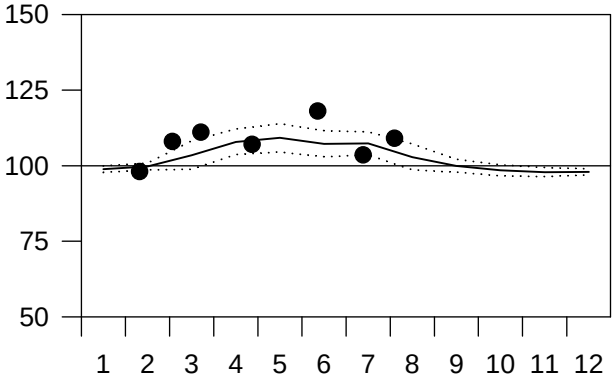
DIN µmol/l



SiO_3 µmol/l

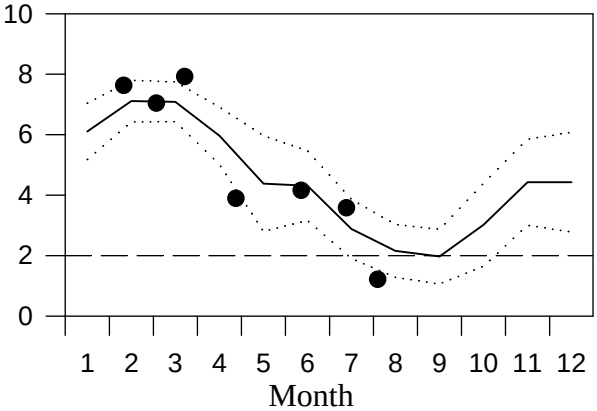


O_2 saturation %

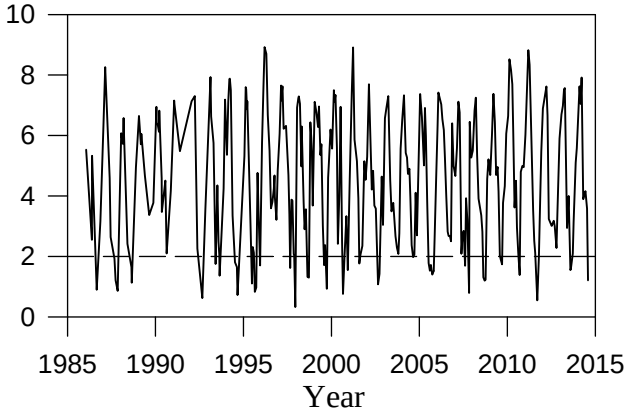


OXYGEN IN BOTTOM WATER (depth >40m)

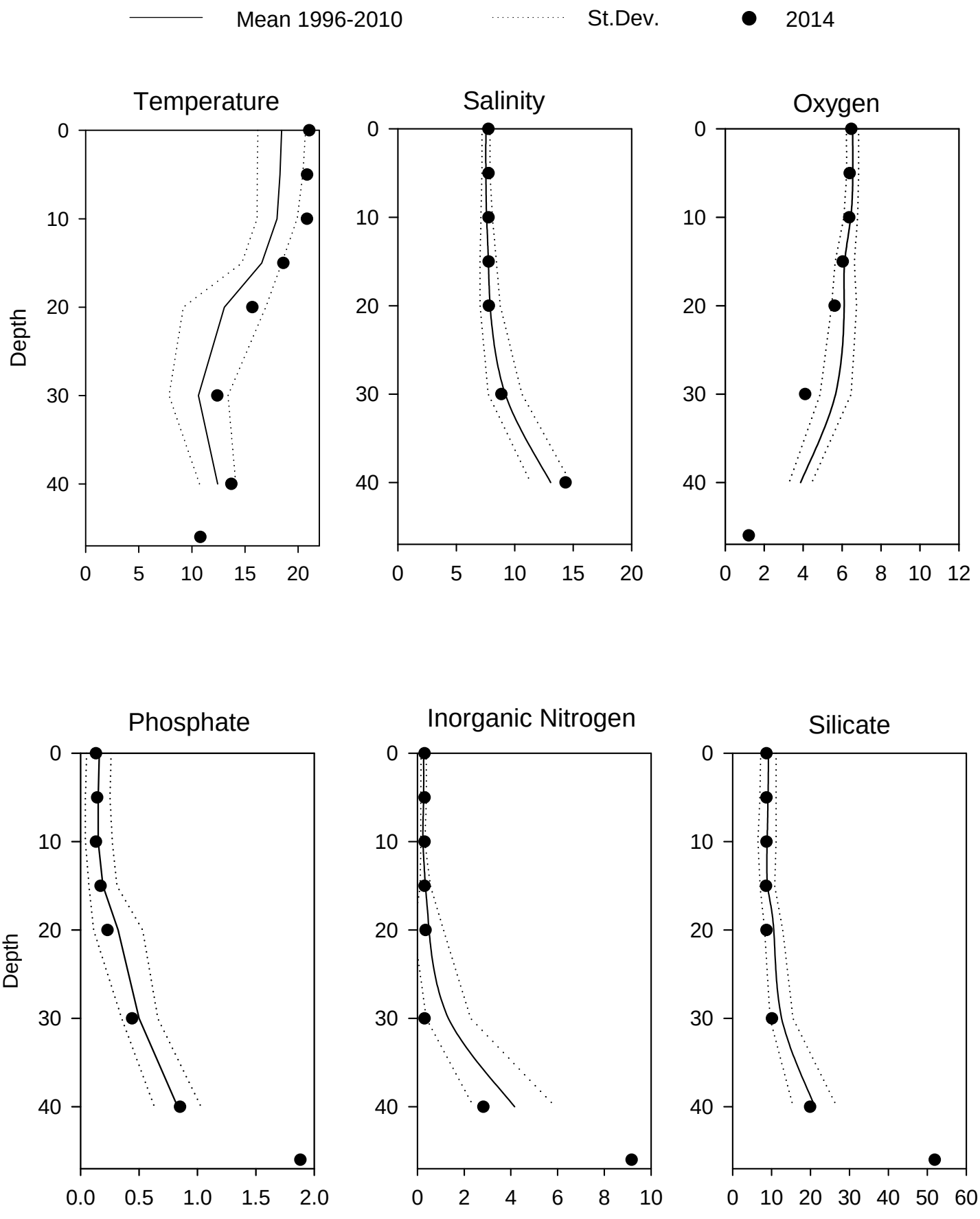
O_2 ml/l



O_2 ml/l

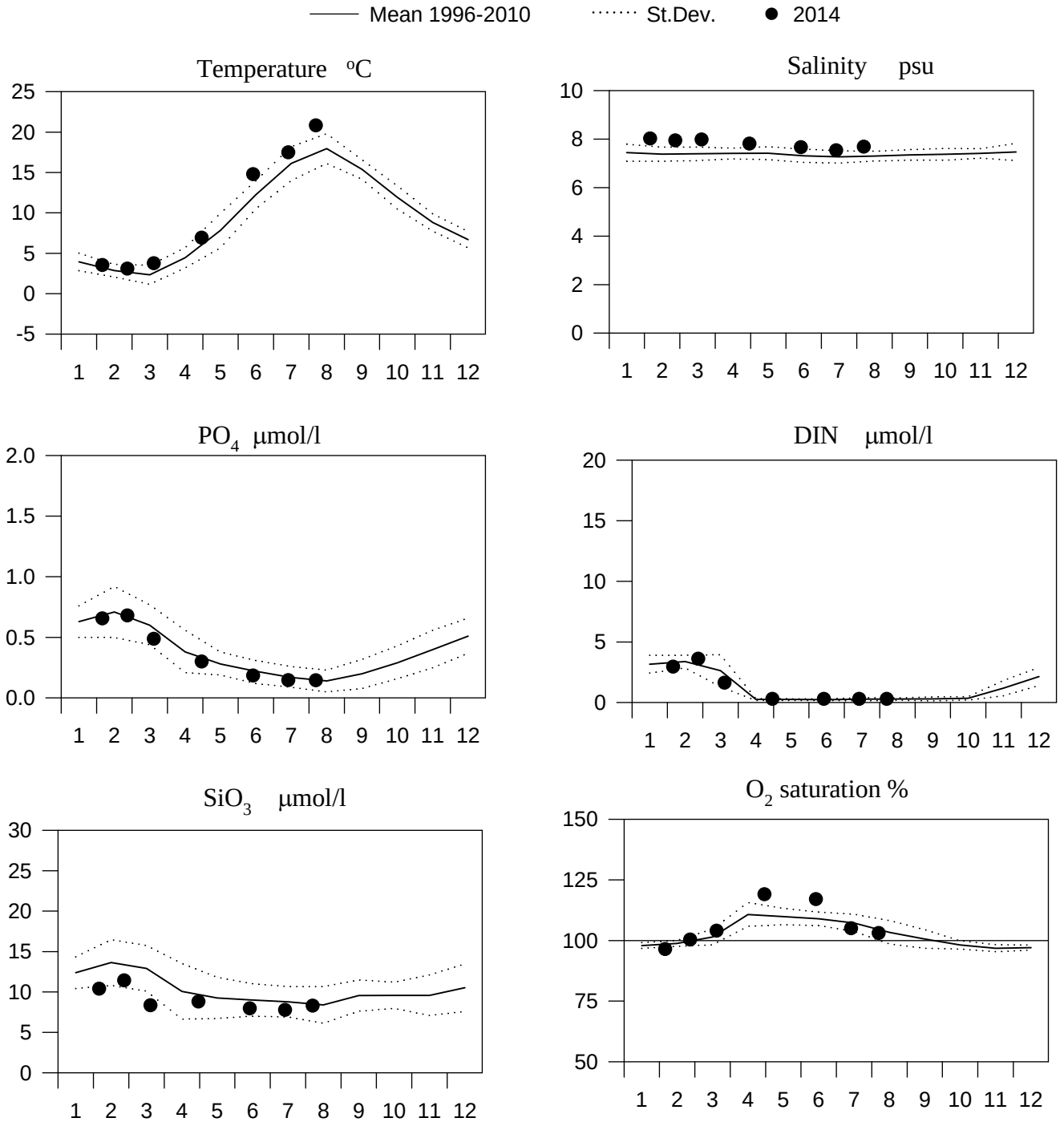


Vertical profiles BY2 August

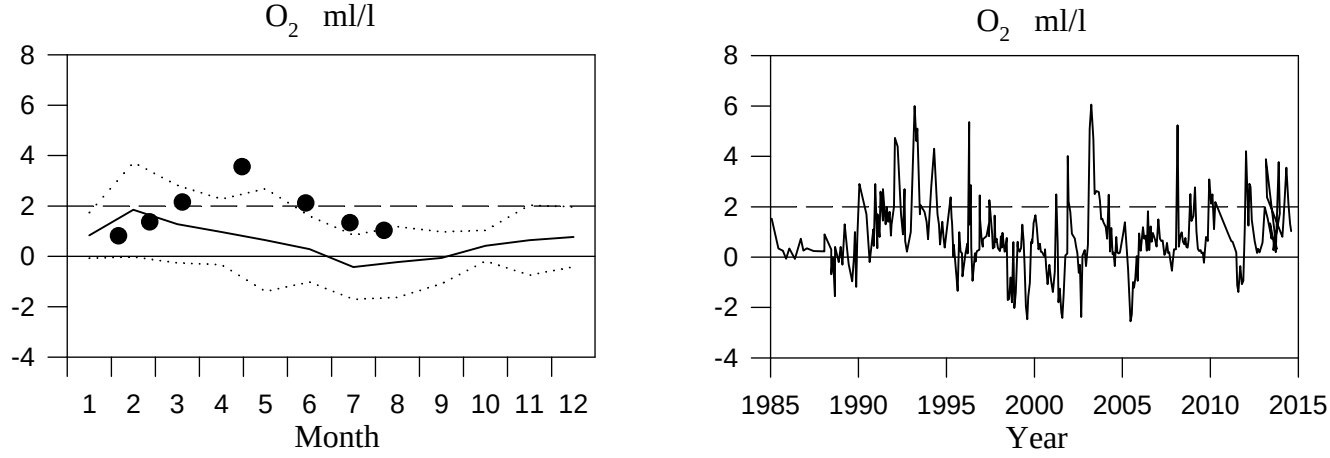


STATION HANÖBUKTEN SURFACE WATER

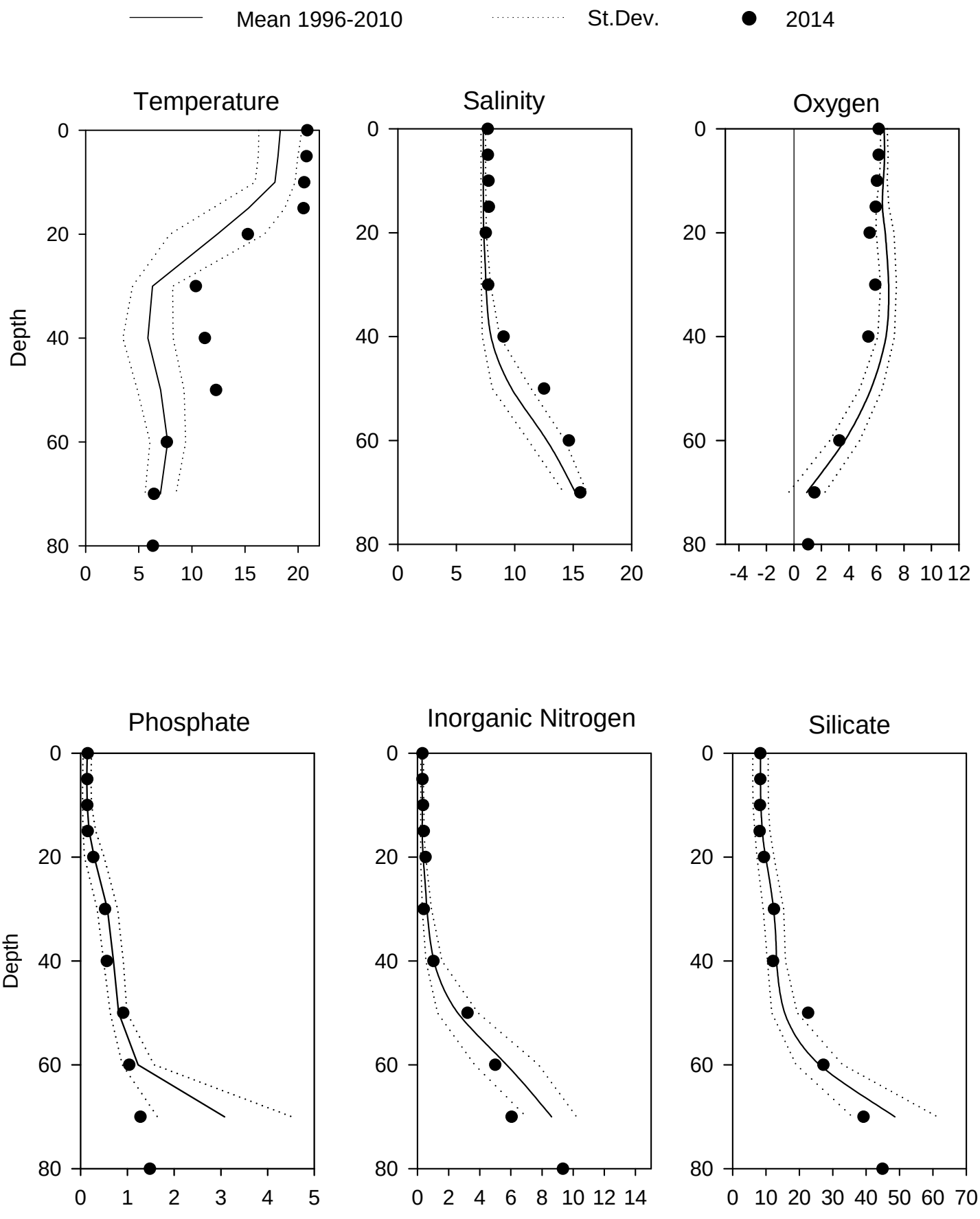
Annual Cycles



OXYGEN IN BOTTOM WATER (depth > 70m)



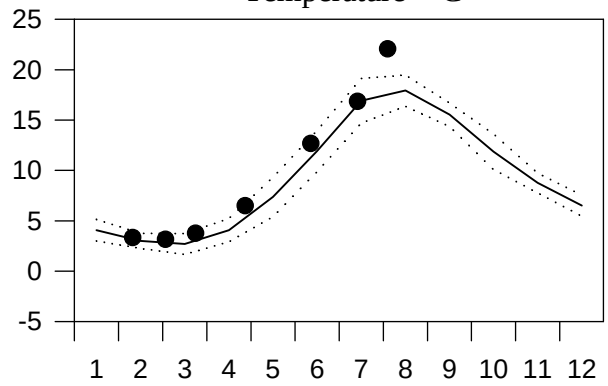
Vertical profiles Hanöbukten August



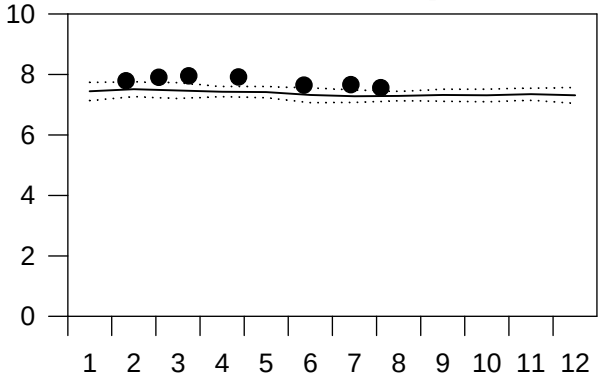
STATION BY4 SURFACE WATER

Annual Cycles

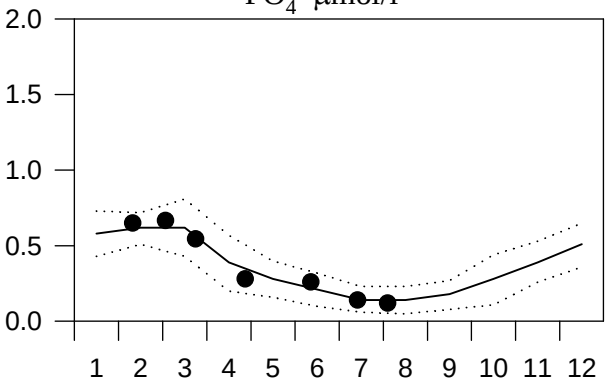
Temperature °C



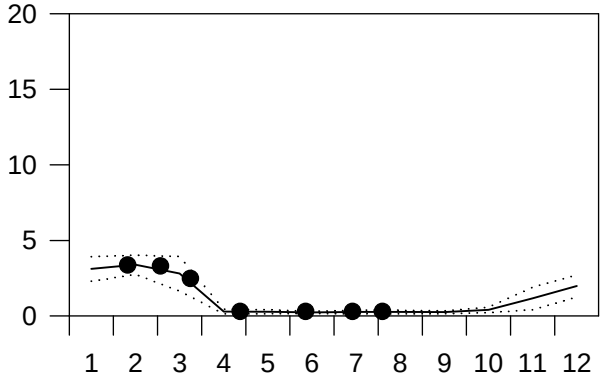
Salinity psu



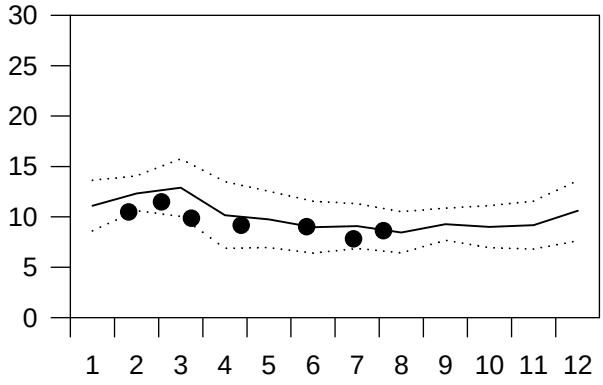
PO_4 µmol/l



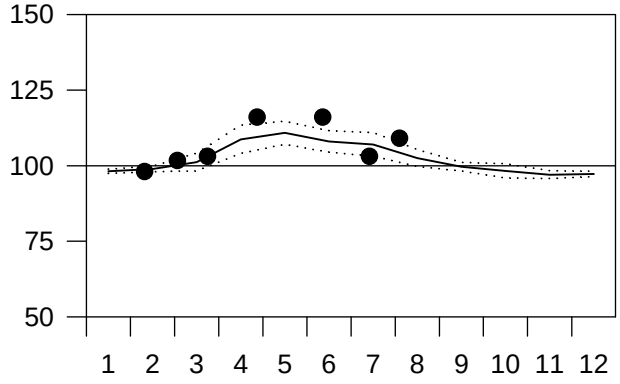
DIN µmol/l



SiO_3 µmol/l

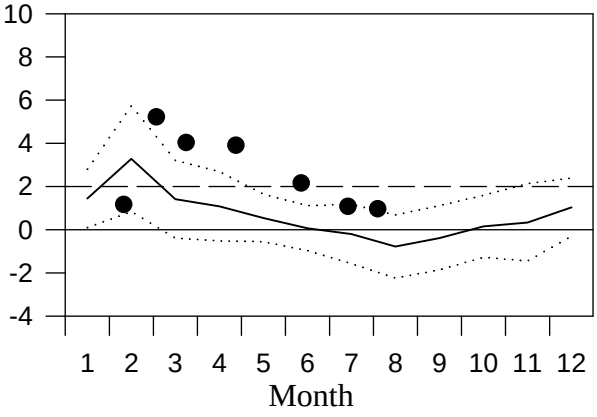


O_2 saturation %

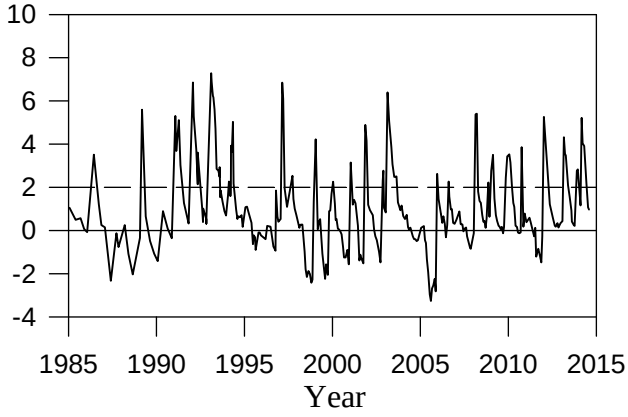


OXYGEN IN BOTTOM WATER (depth >80m)

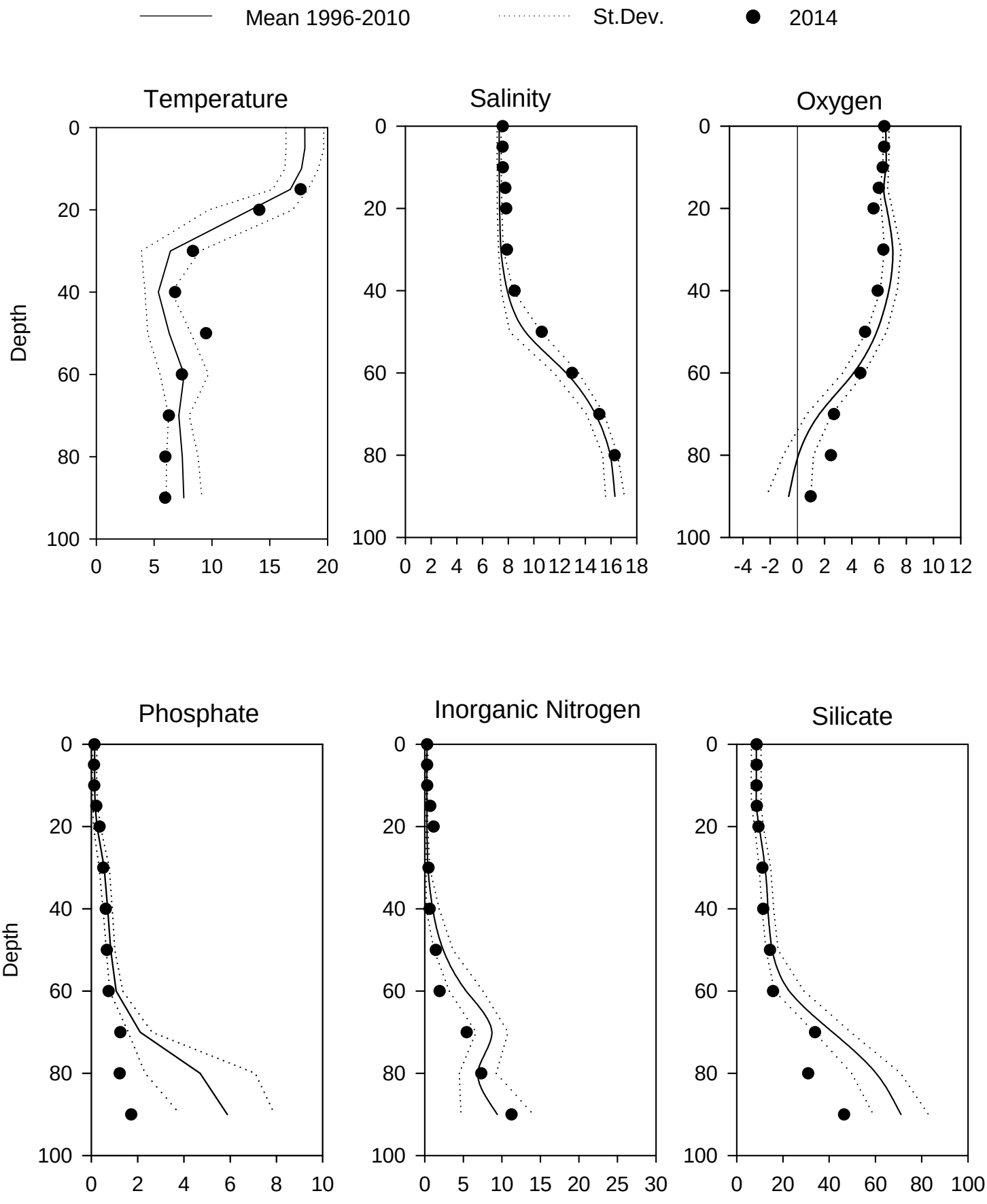
O_2 ml/l



O_2 ml/l



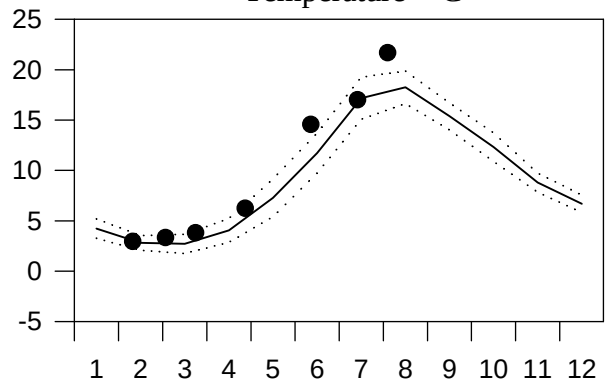
Vertical profiles BY4 August



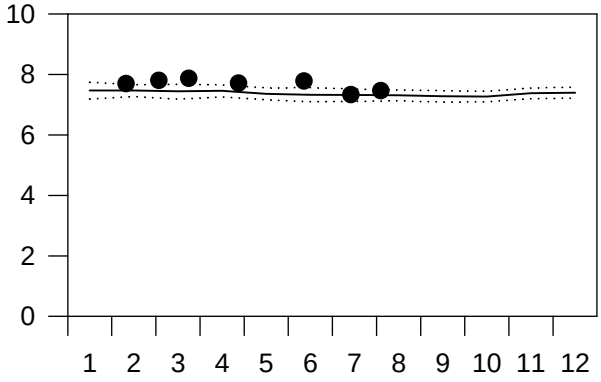
STATION BY5 SURFACE WATER

Annual Cycles

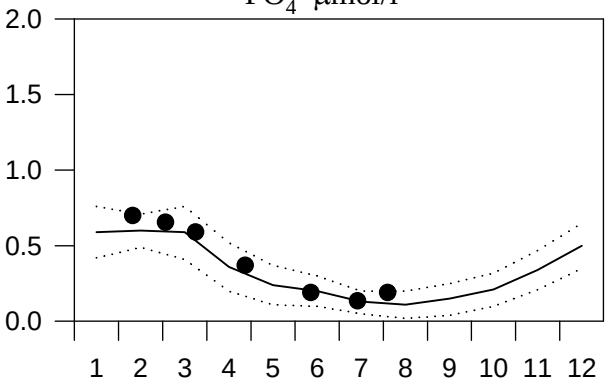
Temperature °C



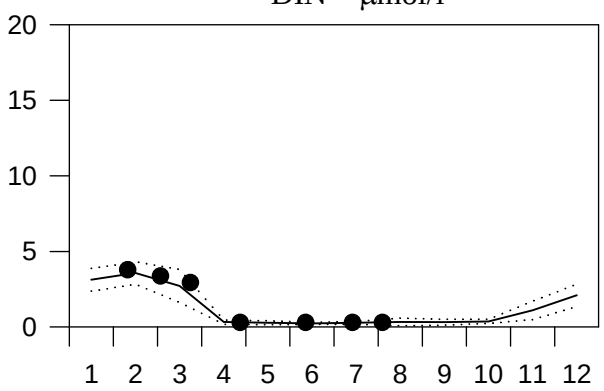
Salinity psu



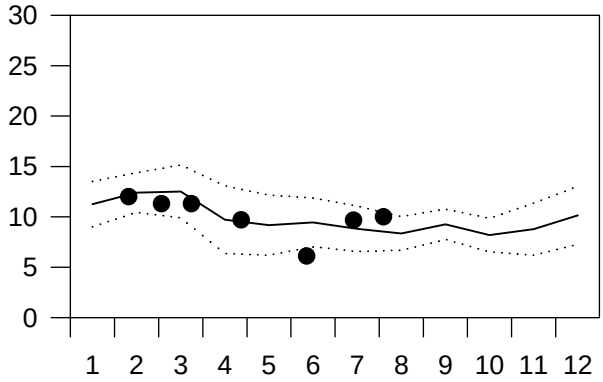
PO_4 µmol/l



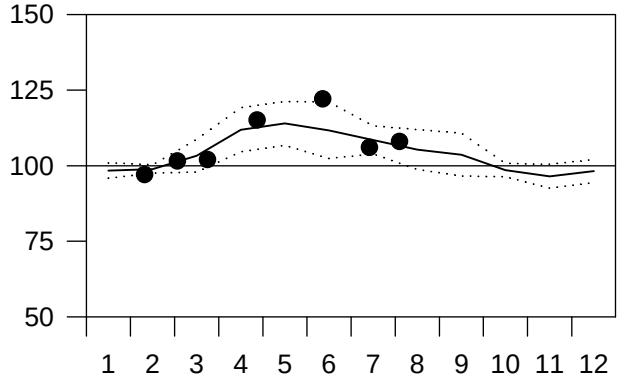
DIN µmol/l



SiO_3 µmol/l

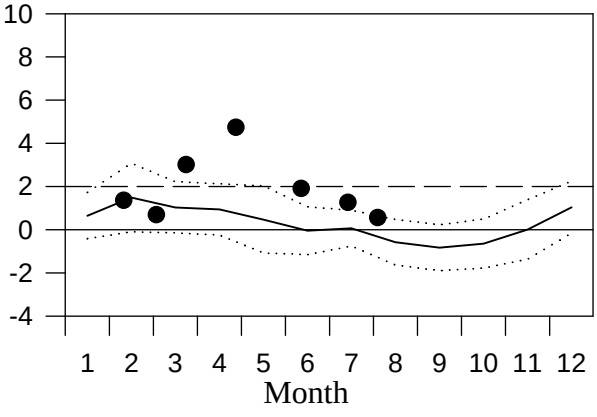


O_2 saturation %

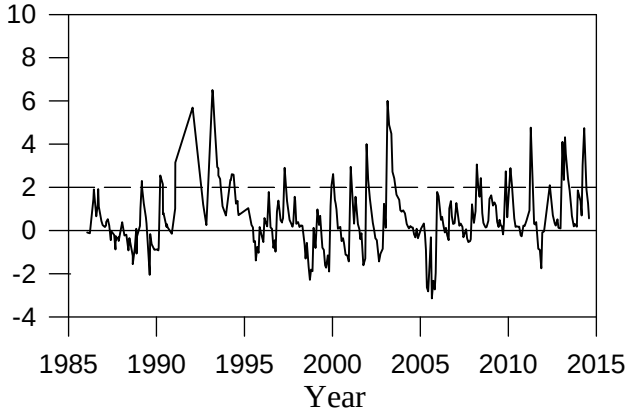


OXYGEN IN BOTTOM WATER (depth >80m)

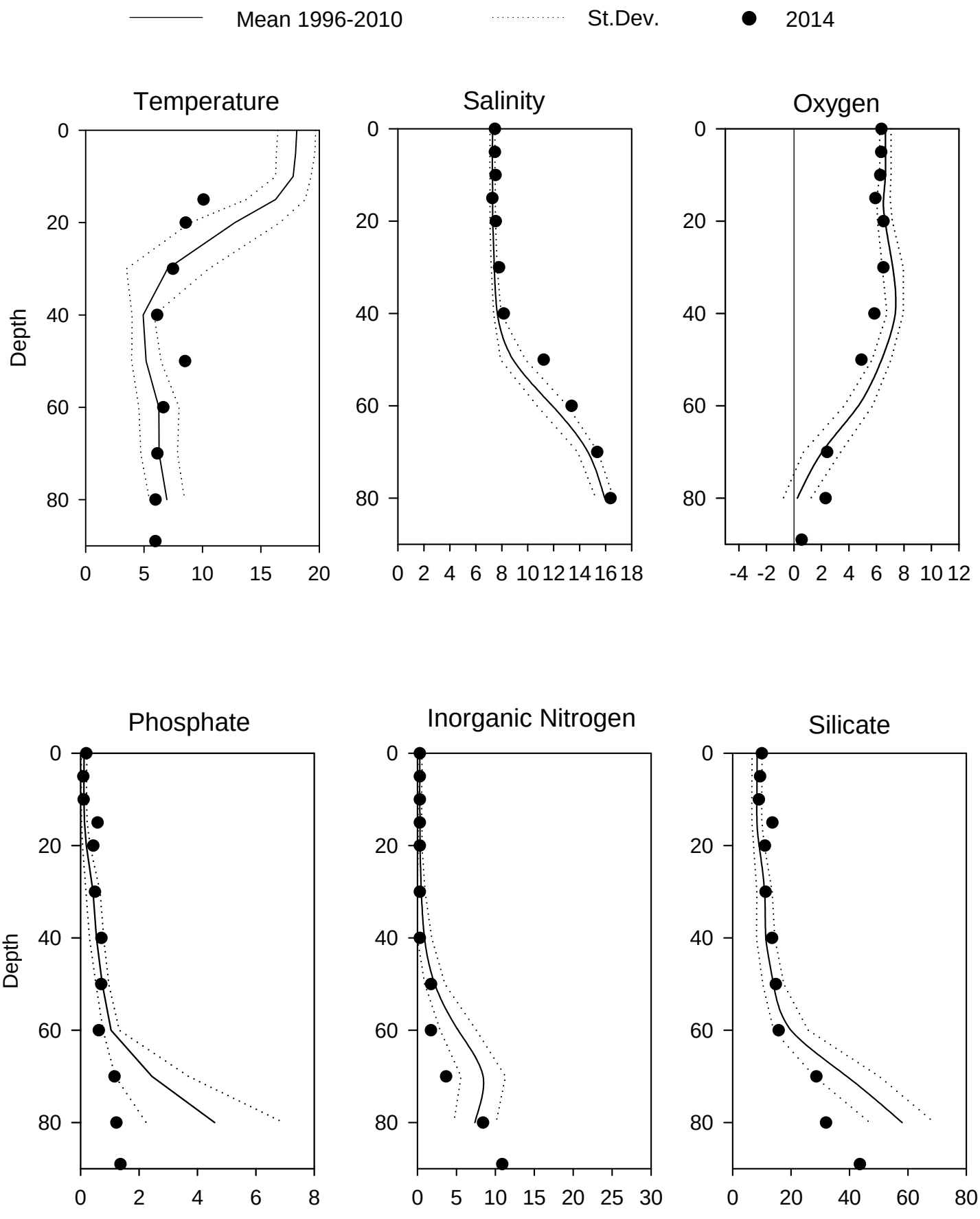
O_2 ml/l



O_2 ml/l



Vertical profiles BY5 August

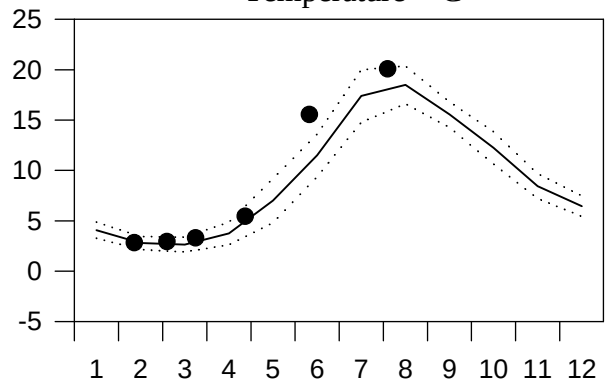


STATION BCS III-10 SURFACE WATER

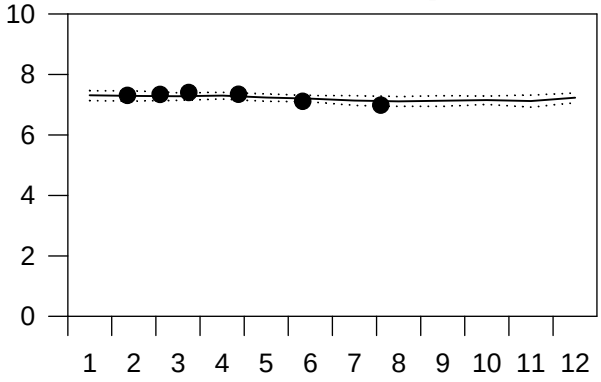
Annual Cycles

Mean 1996-2010 ····· St.Dev. ● 2014

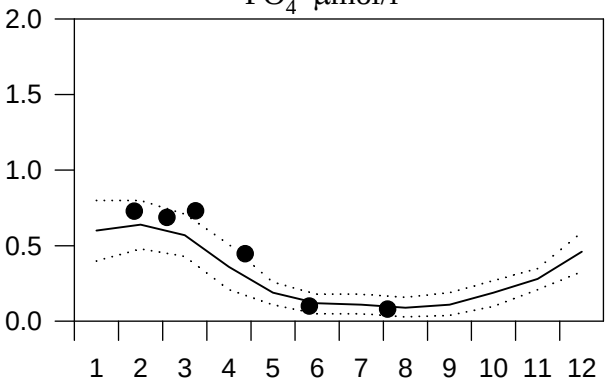
Temperature °C



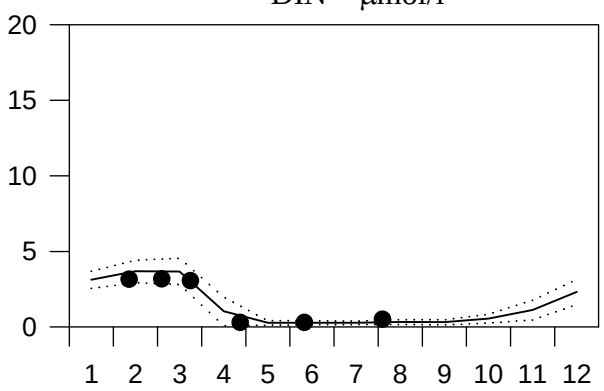
Salinity psu



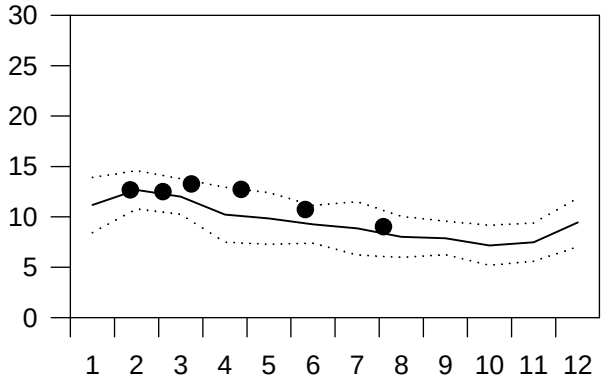
PO_4 µmol/l



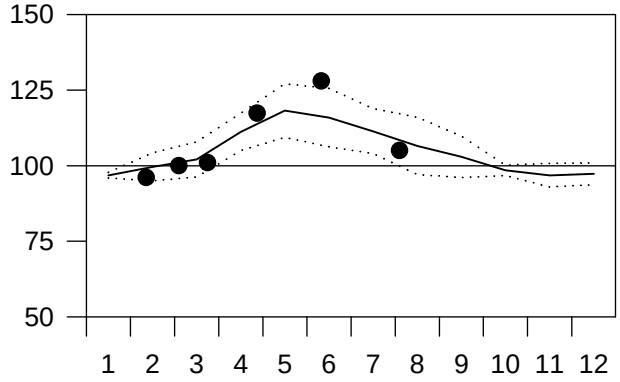
DIN µmol/l



SiO_3 µmol/l

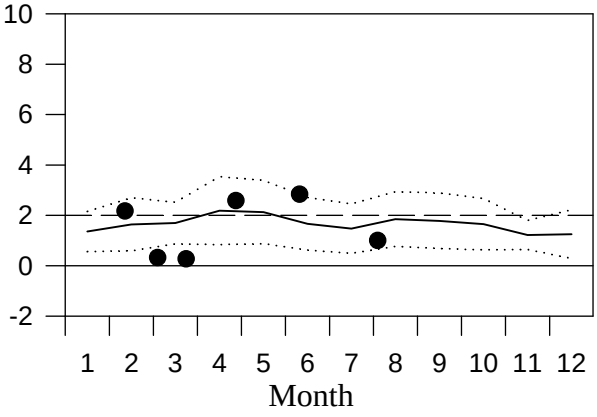


O_2 saturation %

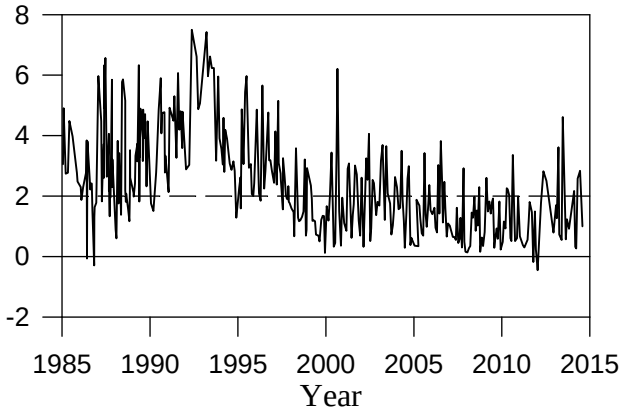


OXYGEN IN BOTTOM WATER (depth > 80m)

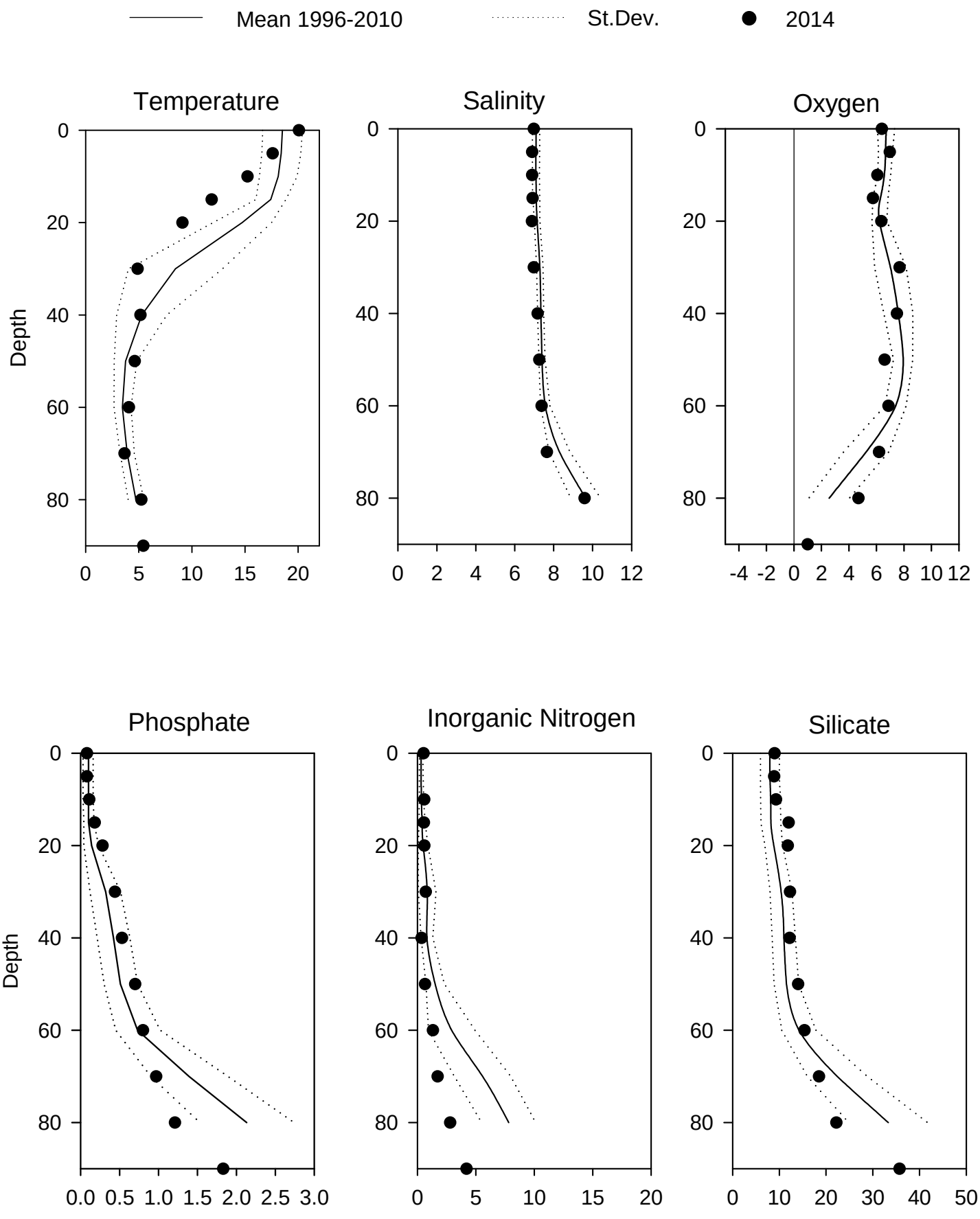
O_2 ml/l



O_2 ml/l

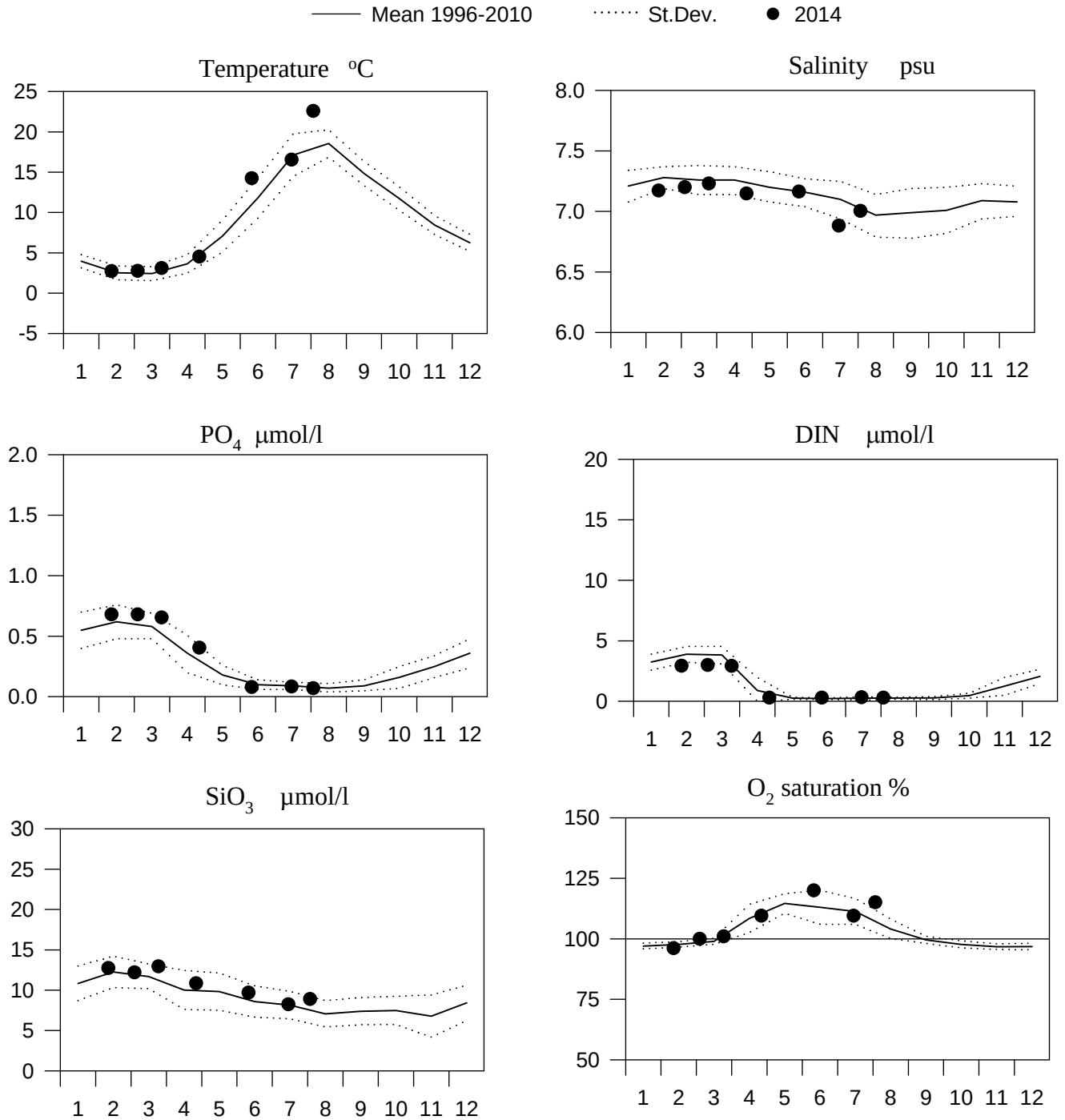


Vertical profiles BCS III-10 August

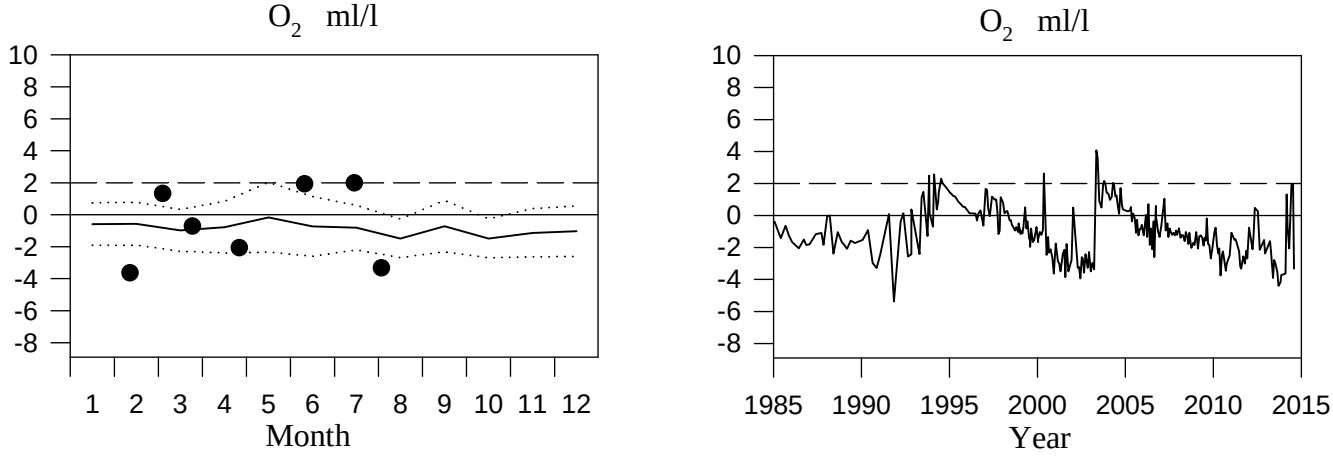


STATION BY10 SURFACE WATER

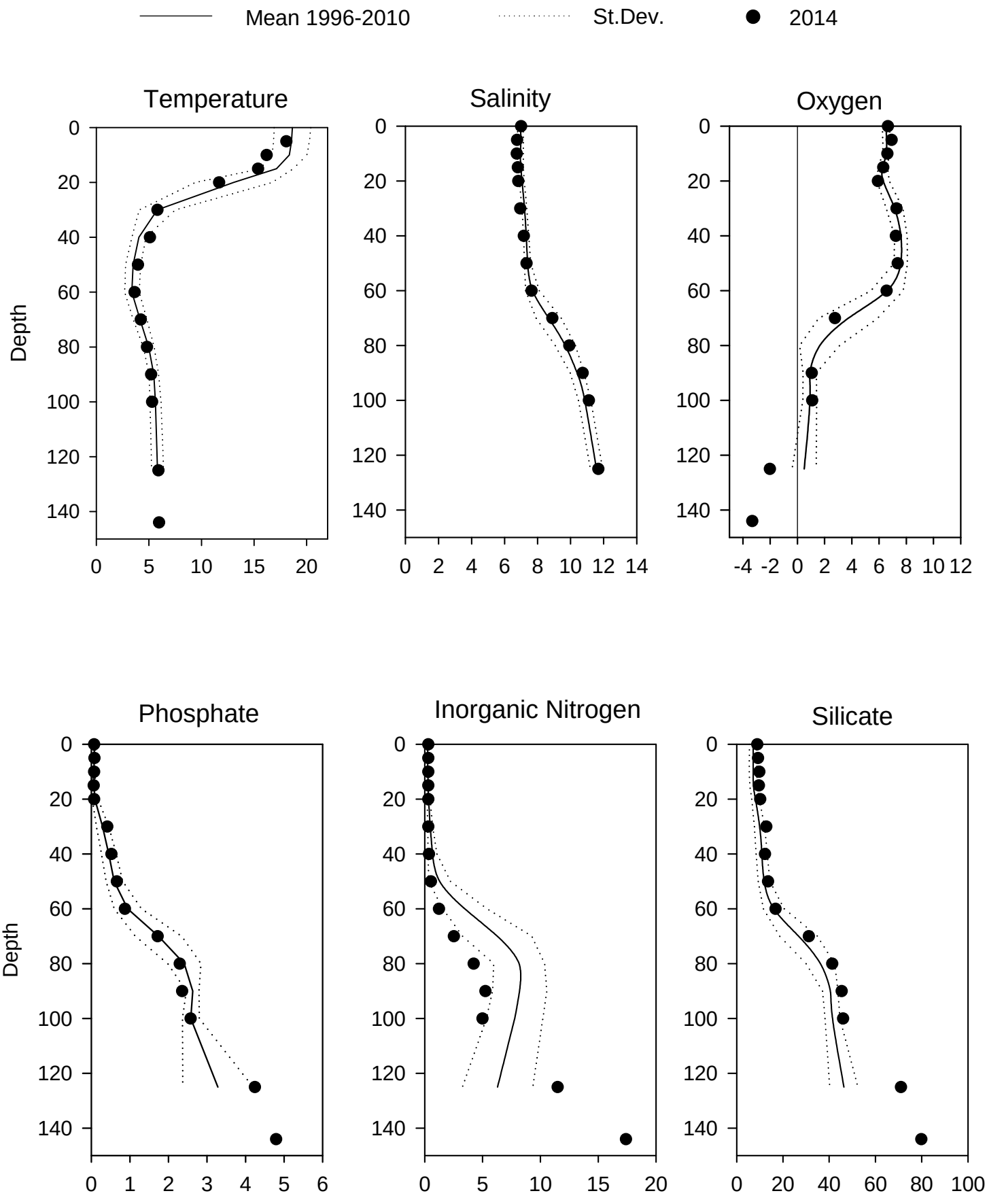
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >125m)

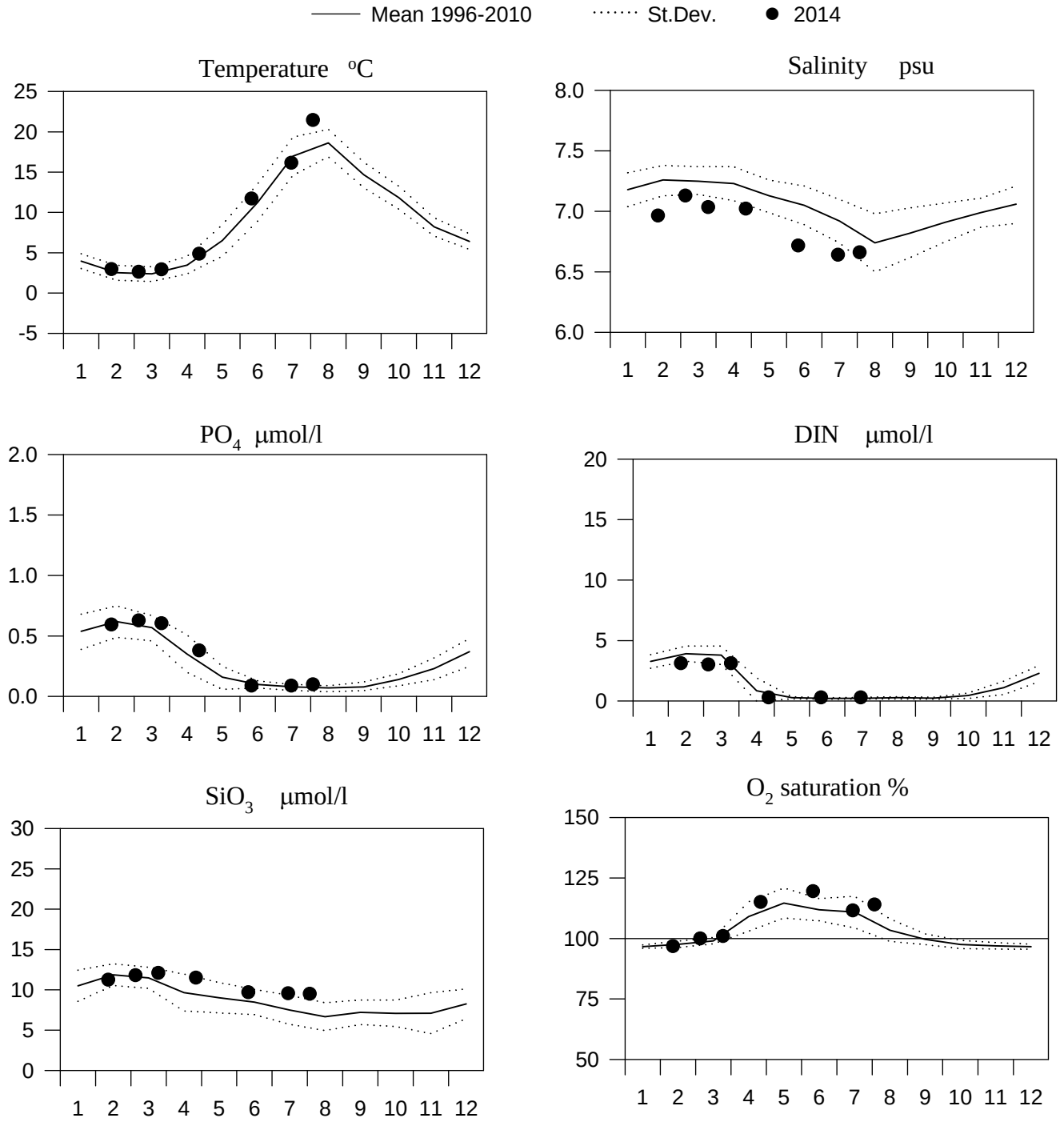


Vertical profiles BY10 August

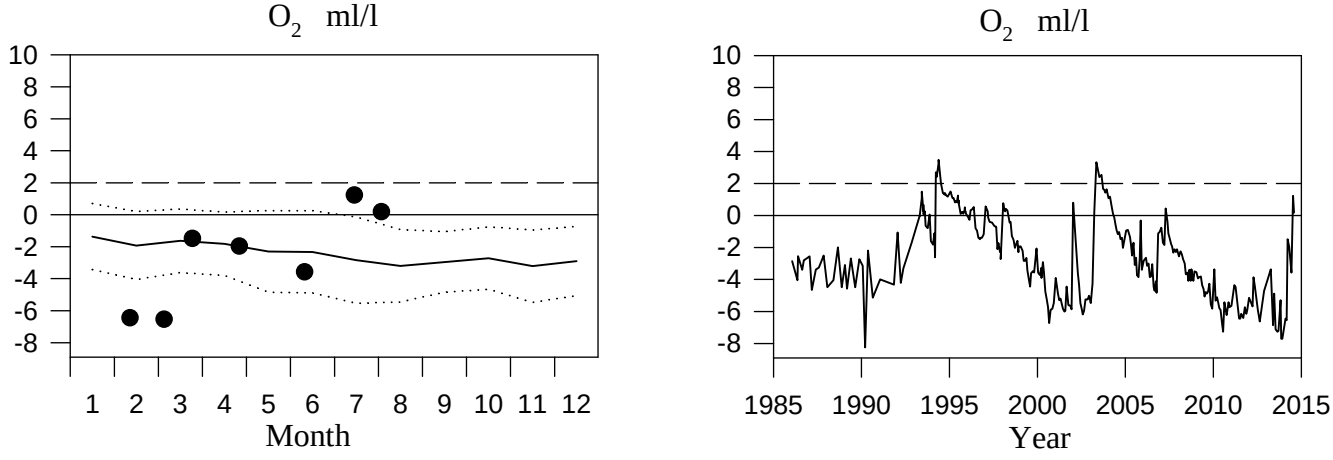


STATION BY15 SURFACE WATER

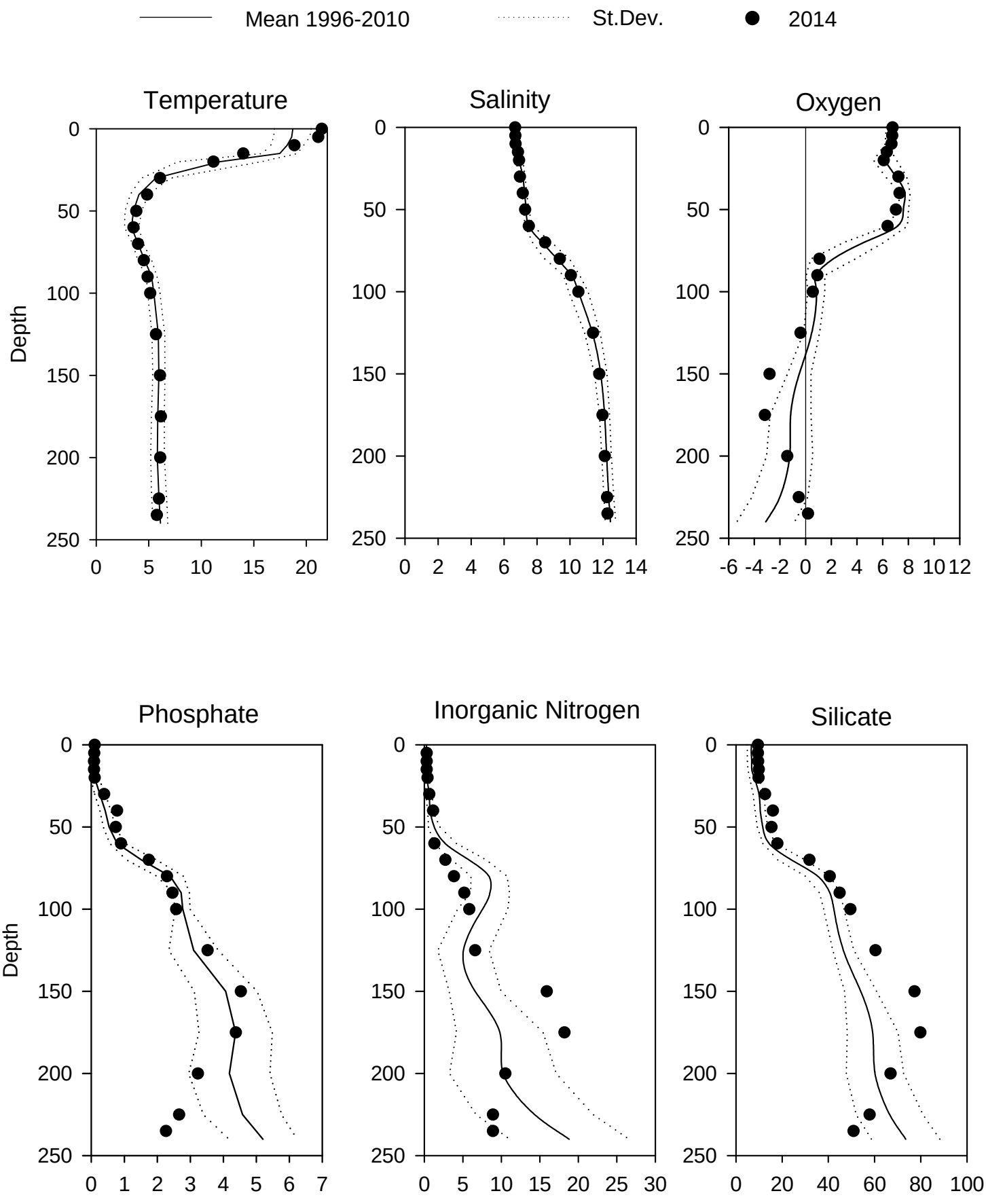
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >225m)



Vertical profiles BY15 August

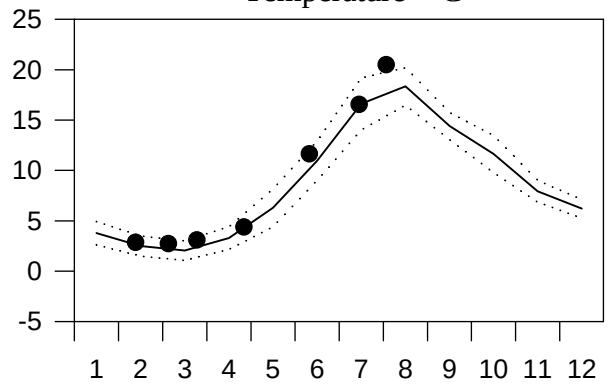


STATION BY20 SURFACE WATER

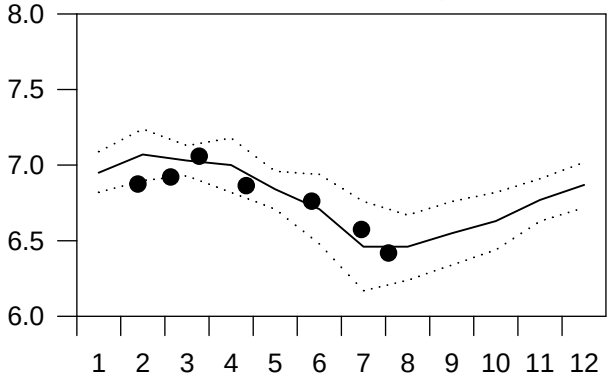
Annual Cycles

Mean 1996-2010 ····· St.Dev. ● 2014

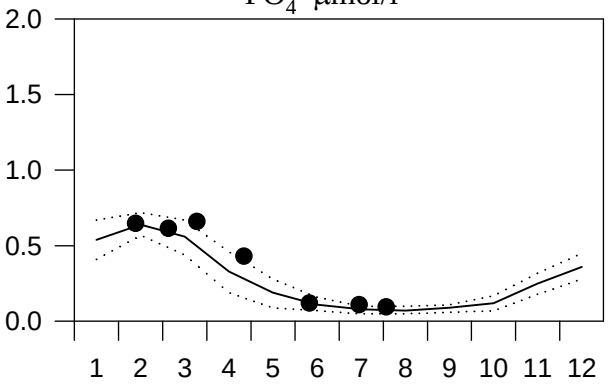
Temperature °C



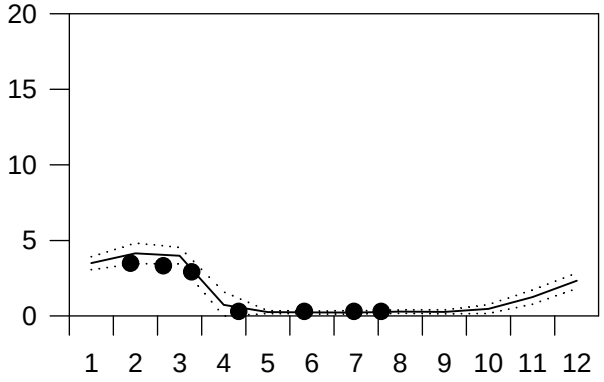
Salinity psu



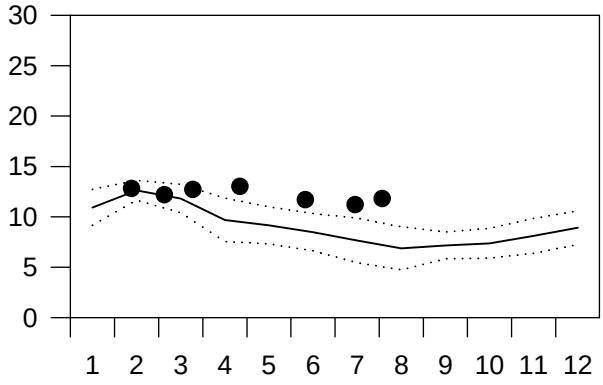
PO_4 µmol/l



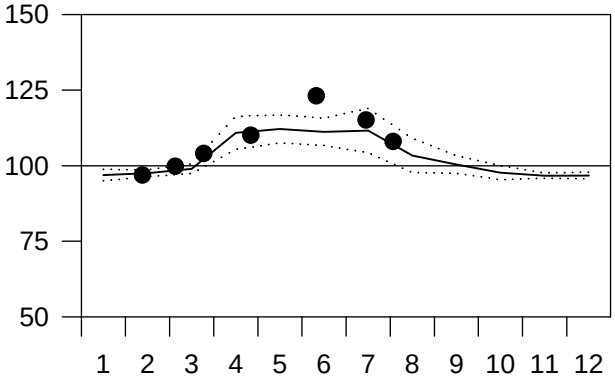
DIN µmol/l



SiO_3 µmol/l

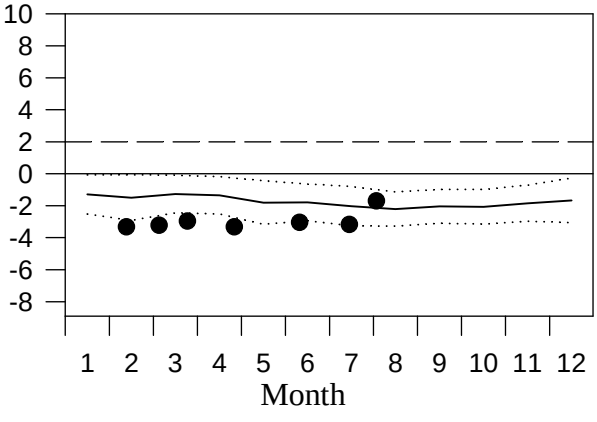


O_2 saturation %

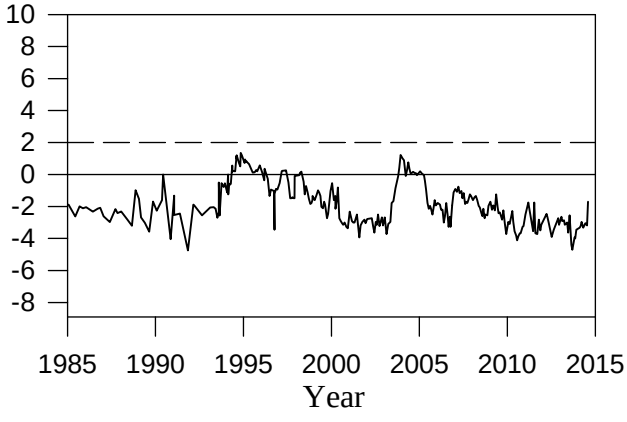


OXYGEN IN BOTTOM WATER (depth >175m)

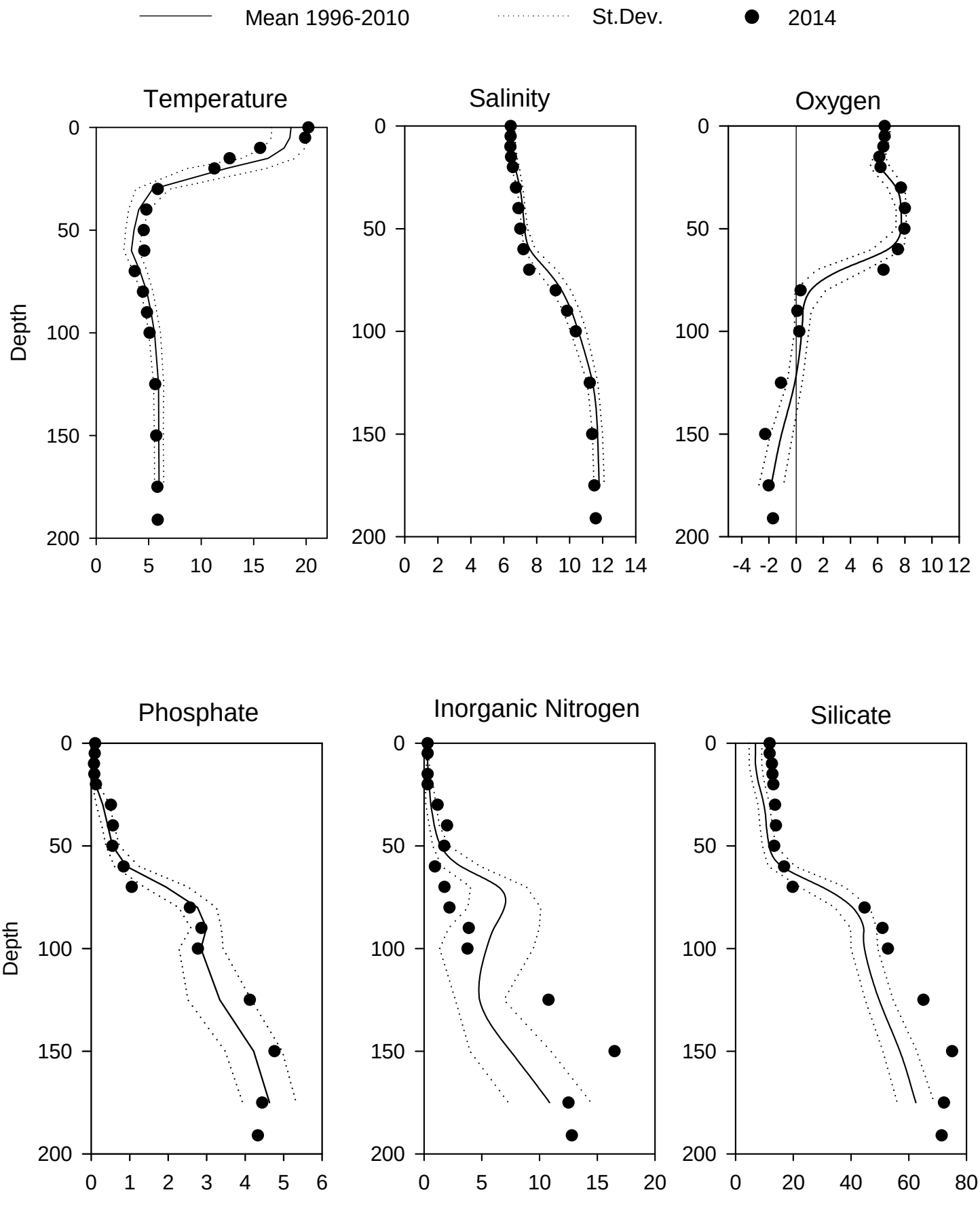
O_2 ml/l



O_2 ml/l

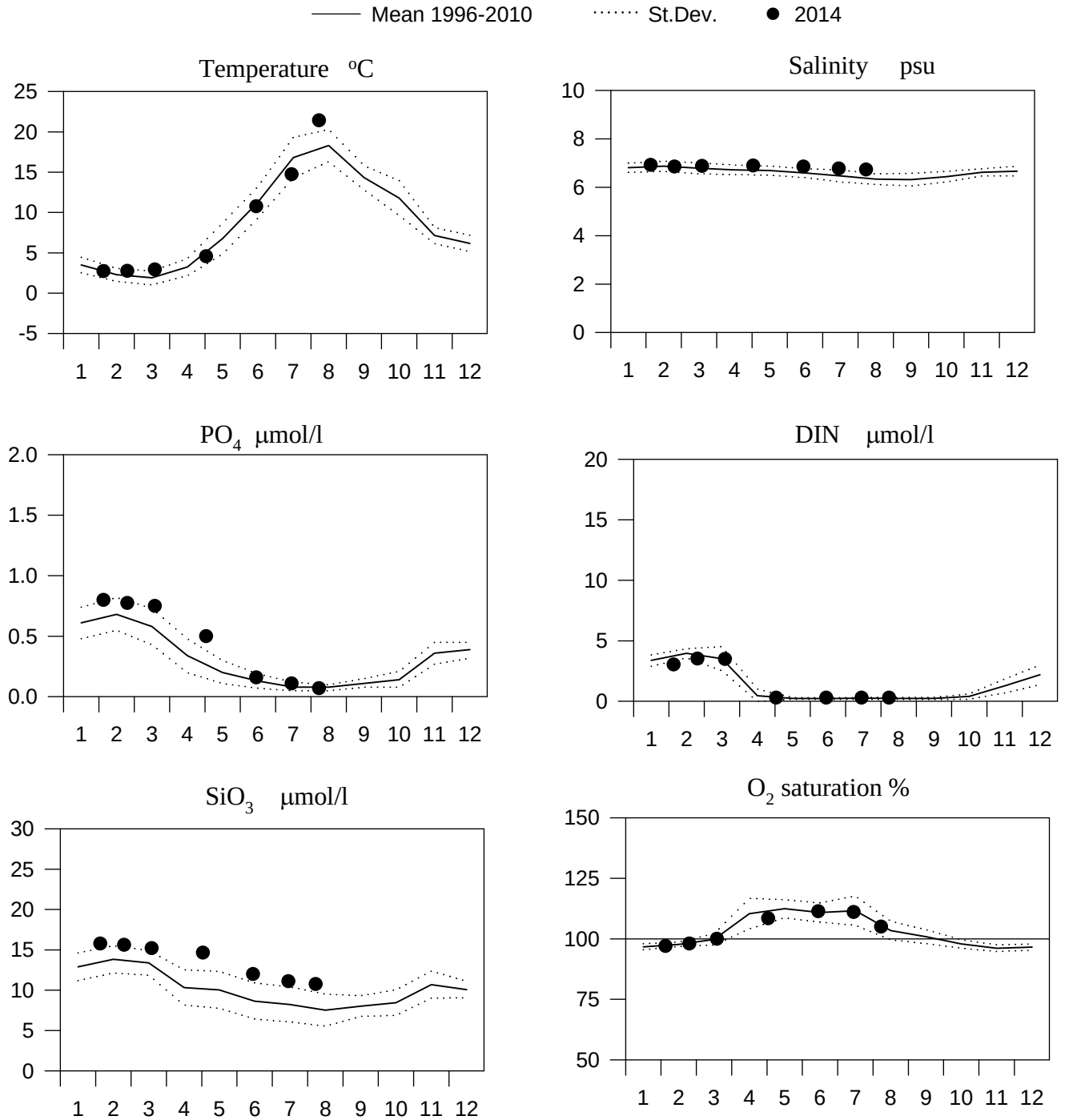


Vertical profiles BY20 August

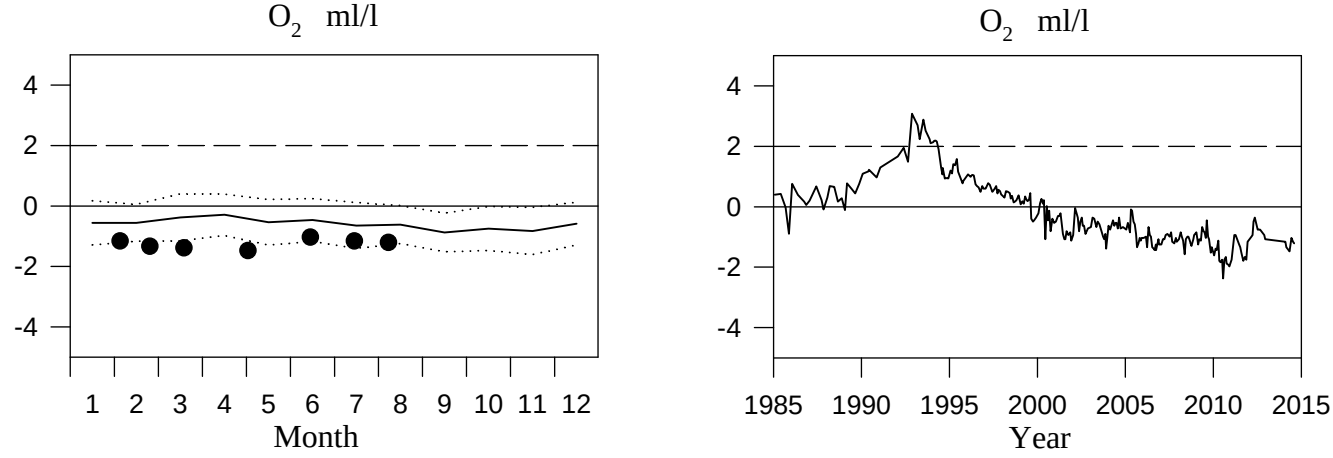


STATION BY32 SURFACE WATER

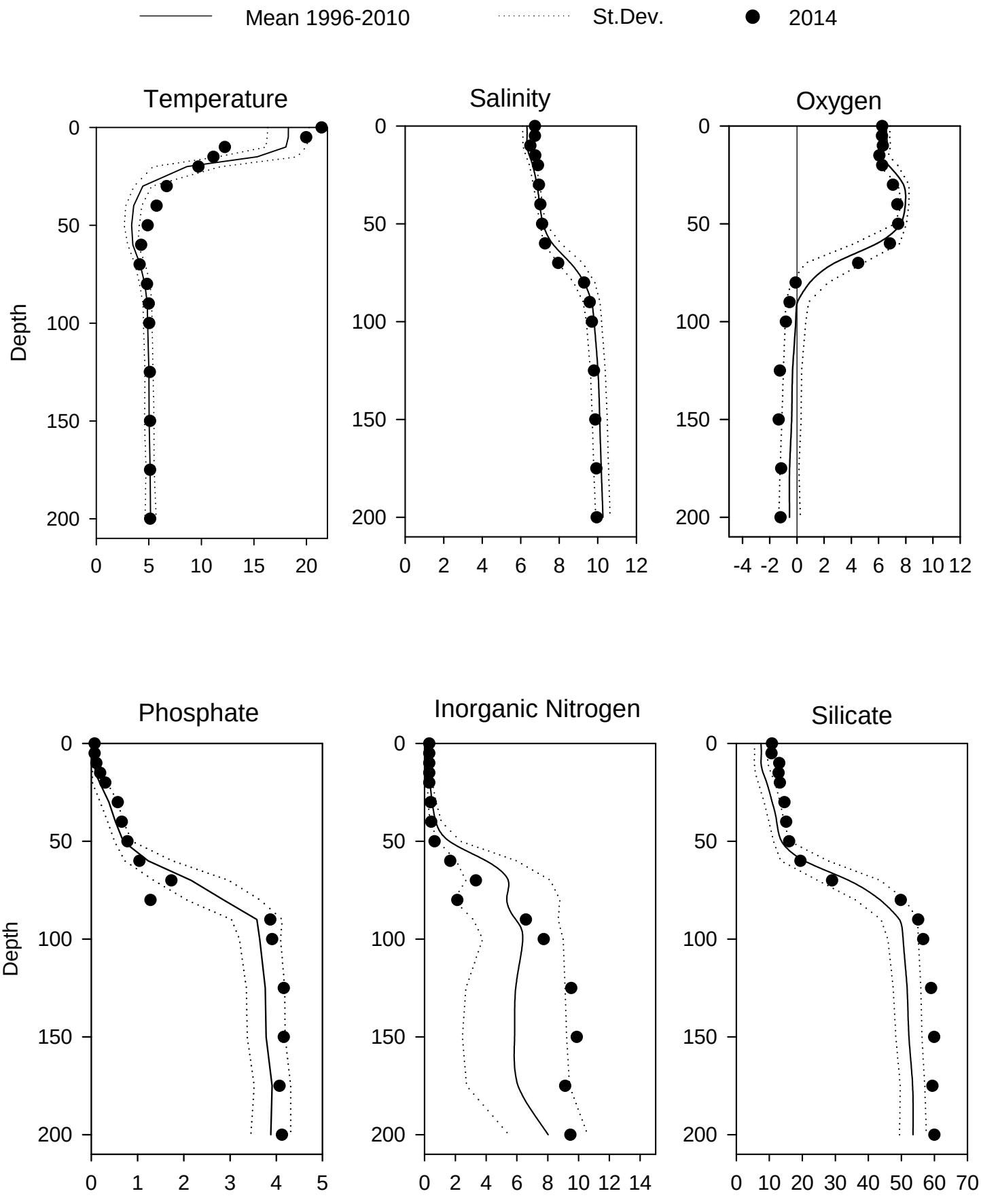
Annual Cycles



OXYGEN IN BOTTOM WATER (depth > 175m)



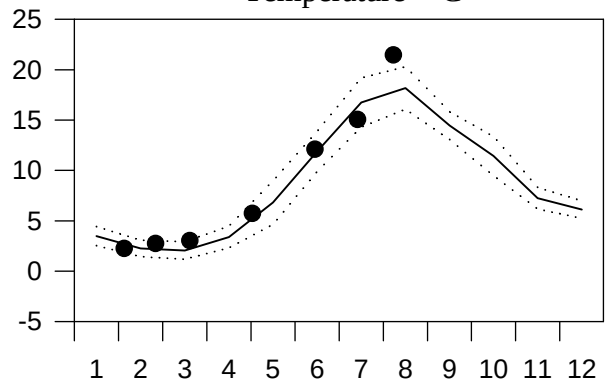
Vertical profiles BY32 August



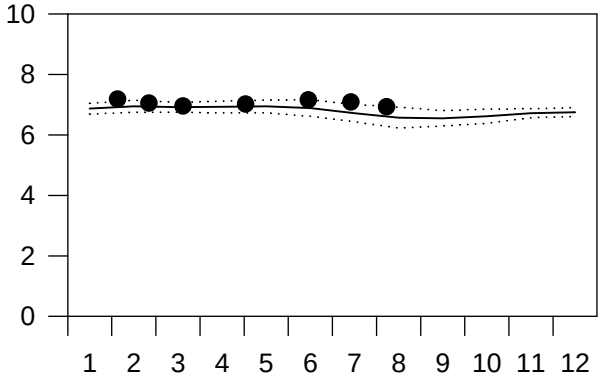
STATION BY38 SURFACE WATER

Annual Cycles

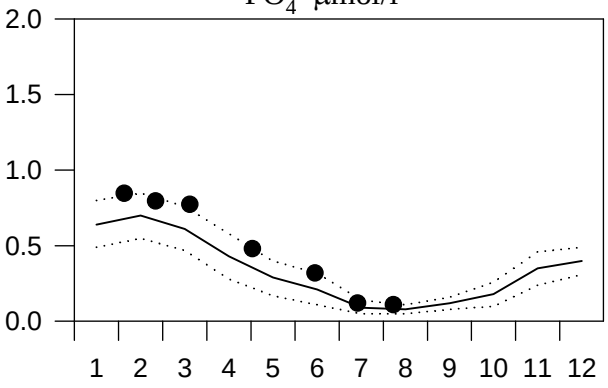
Temperature °C



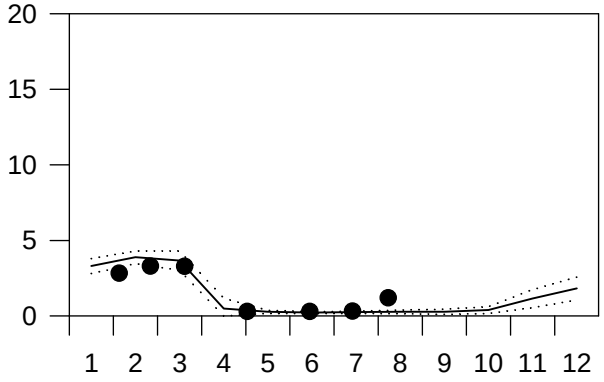
Salinity psu



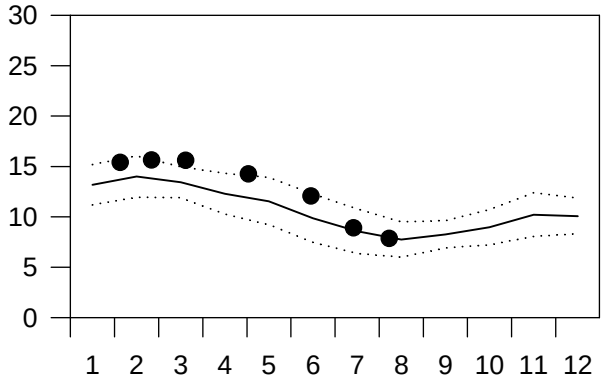
PO_4 µmol/l



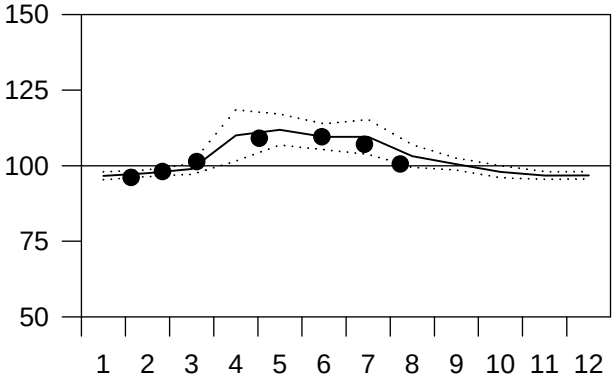
DIN µmol/l



SiO_3 µmol/l

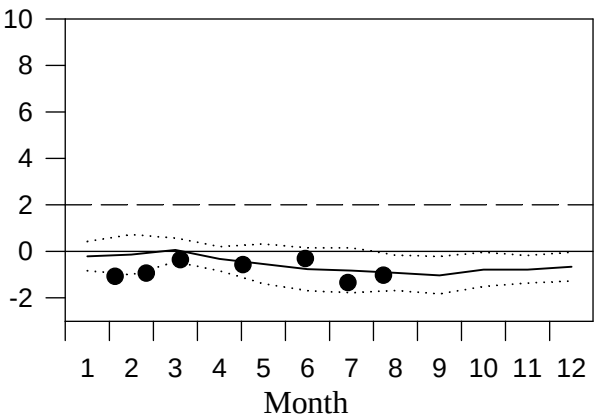


O_2 saturation %

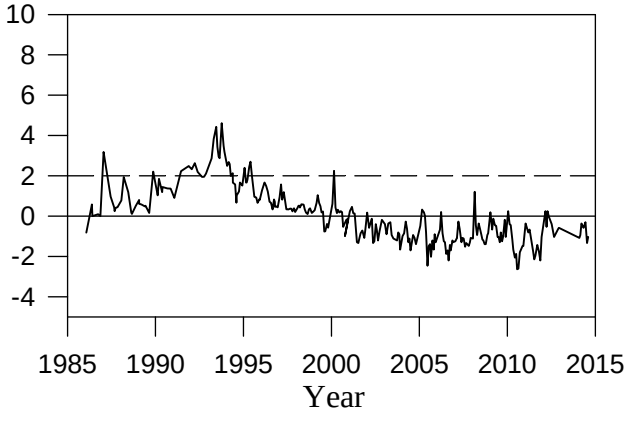


OXYGEN IN BOTTOM WATER (> 100m)

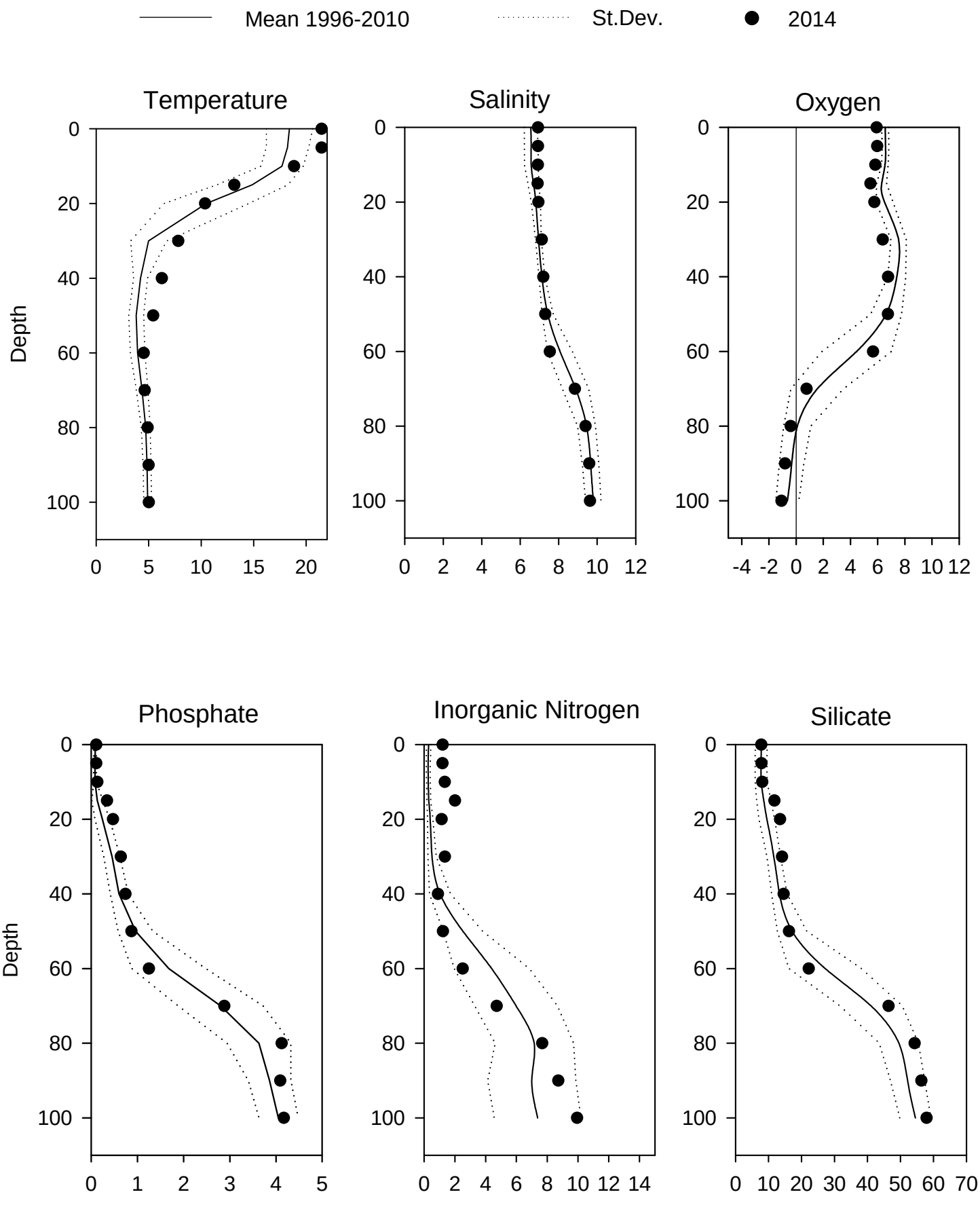
O_2 ml/l



O_2 ml/l



Vertical profiles BY38 August

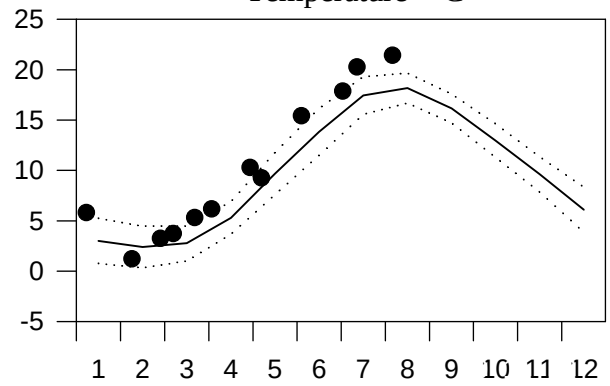


STATION SLÄGGÖ SURFACE WATER

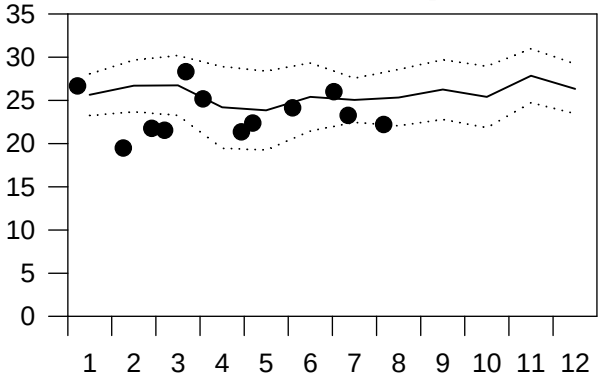
Annual Cycles

Mean 1996-2010 ····· St.Dev. ● 2014

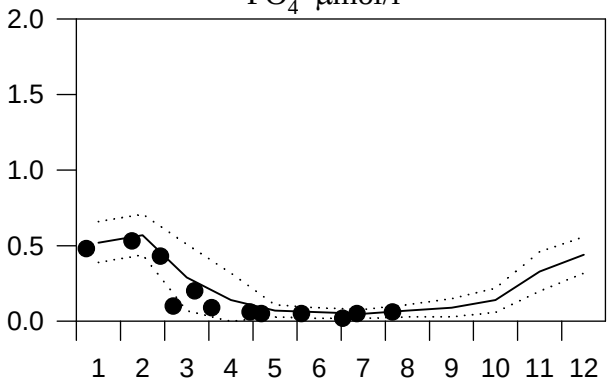
Temperature °C



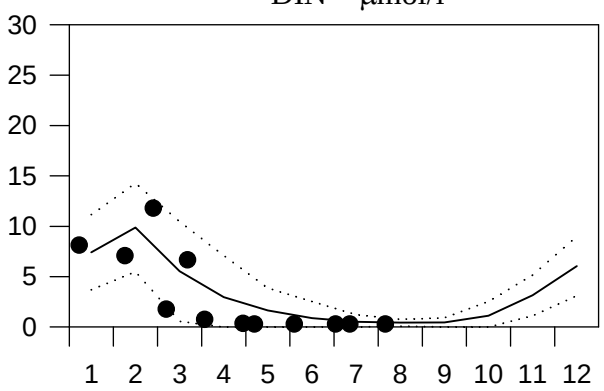
Salinity psu



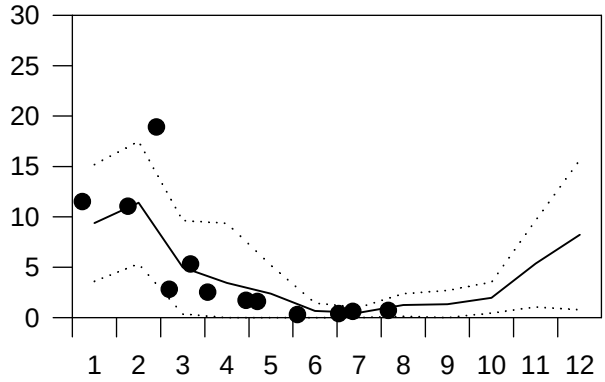
PO_4 µmol/l



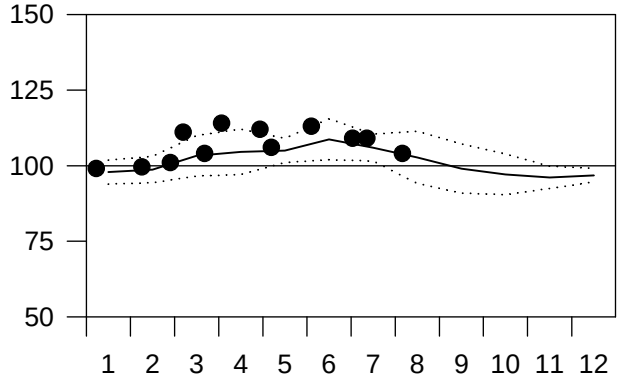
DIN µmol/l



SiO_3 µmol/l

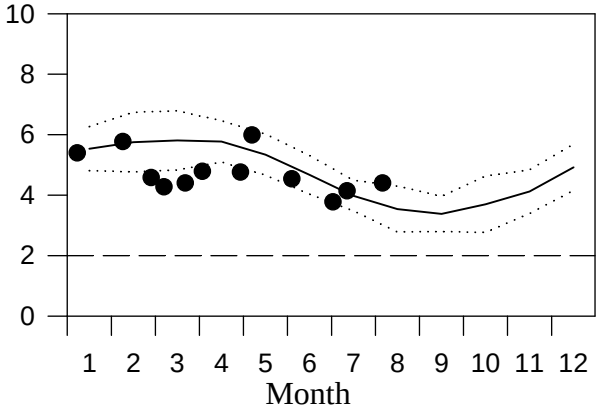


O_2 saturation %

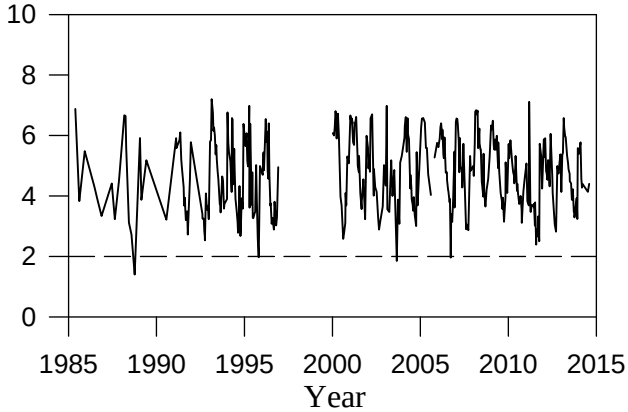


OXYGEN IN BOTTOM WATER (depth >50m)

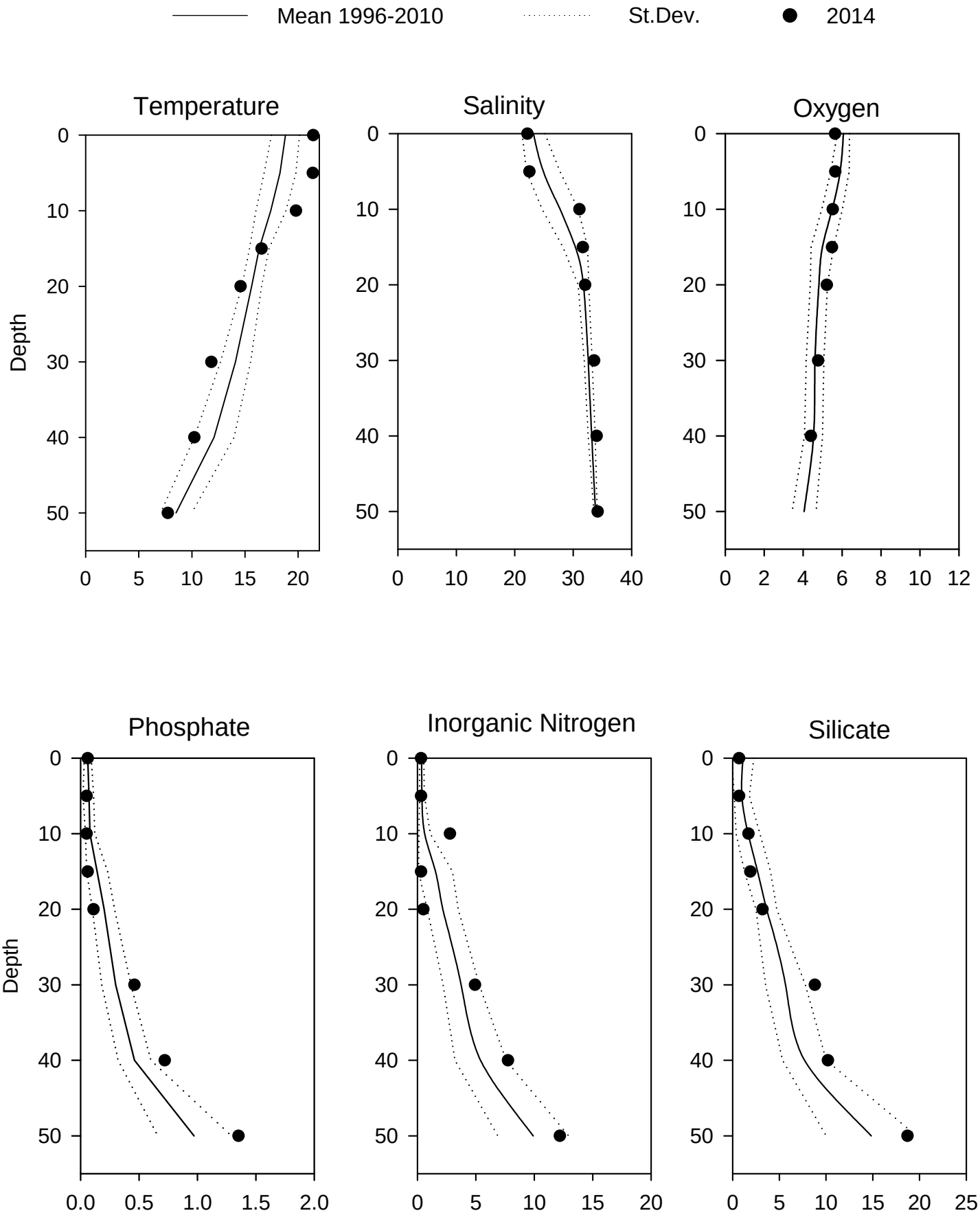
O_2 ml/l



O_2 ml/l

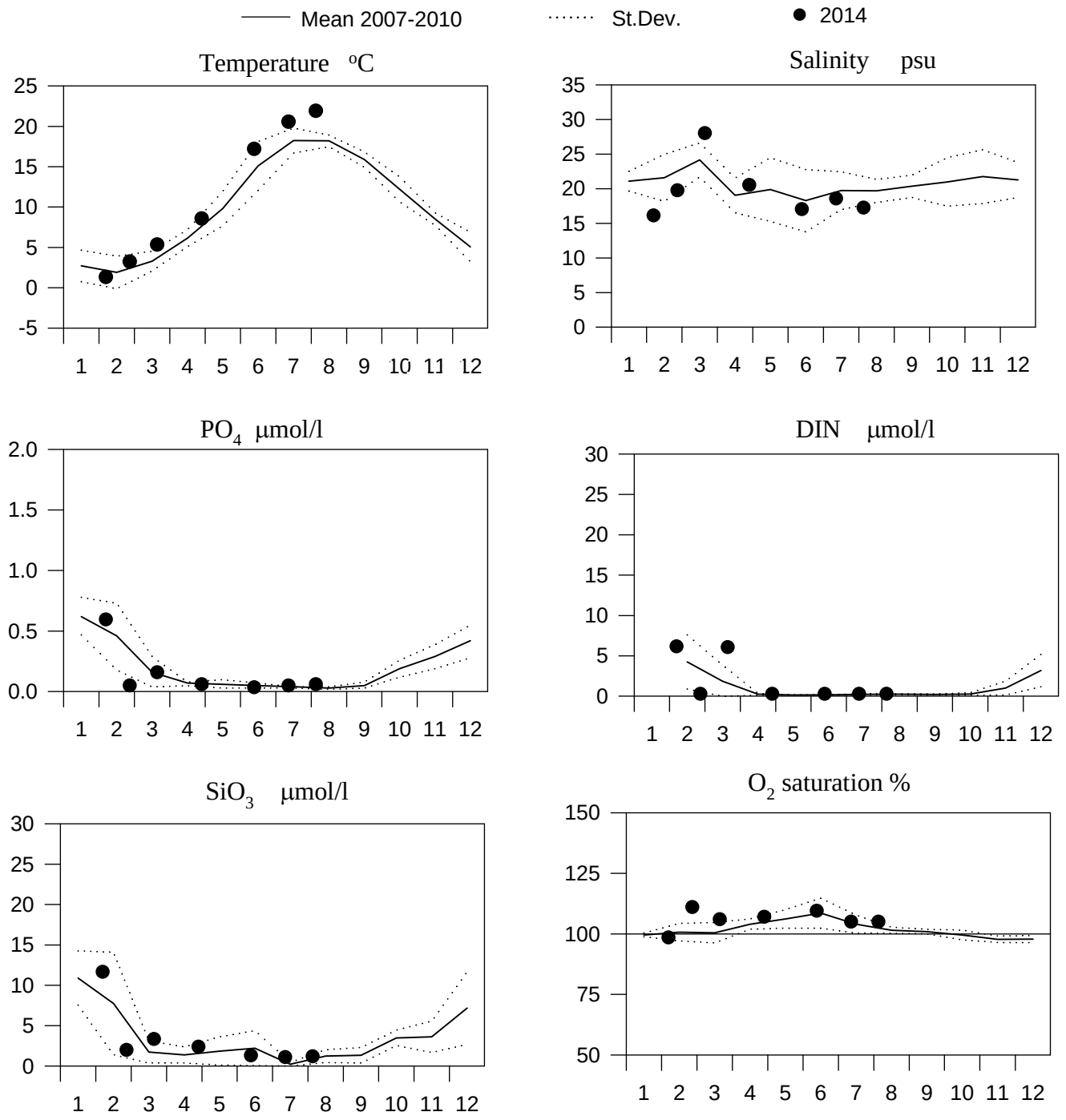


Vertical profiles Släggö August

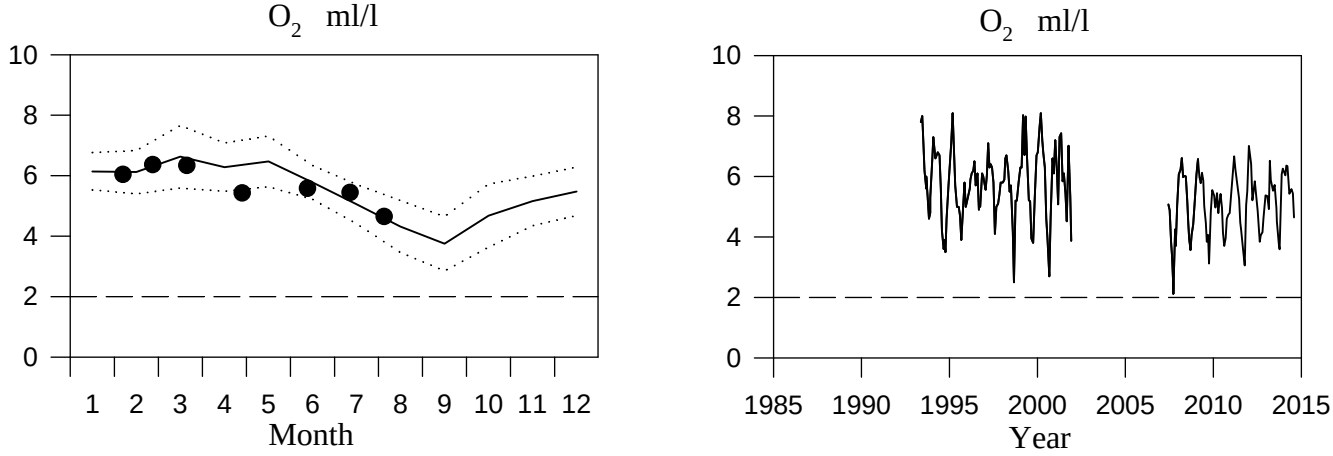


STATION N14 Falkenberg SURFACE WATER

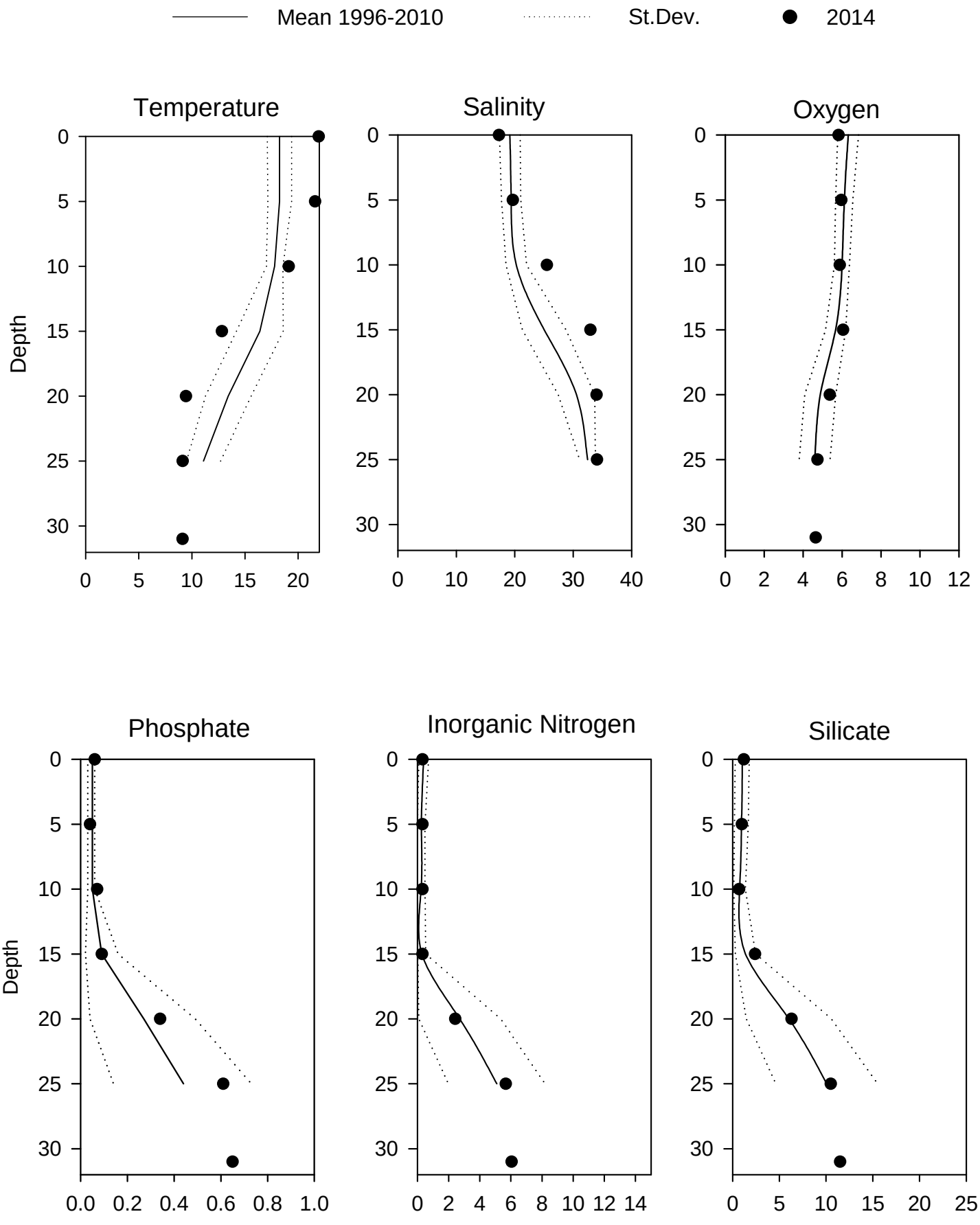
Annual Cycles



OXYGEN IN BOTTOM WATER (depth > 25m)

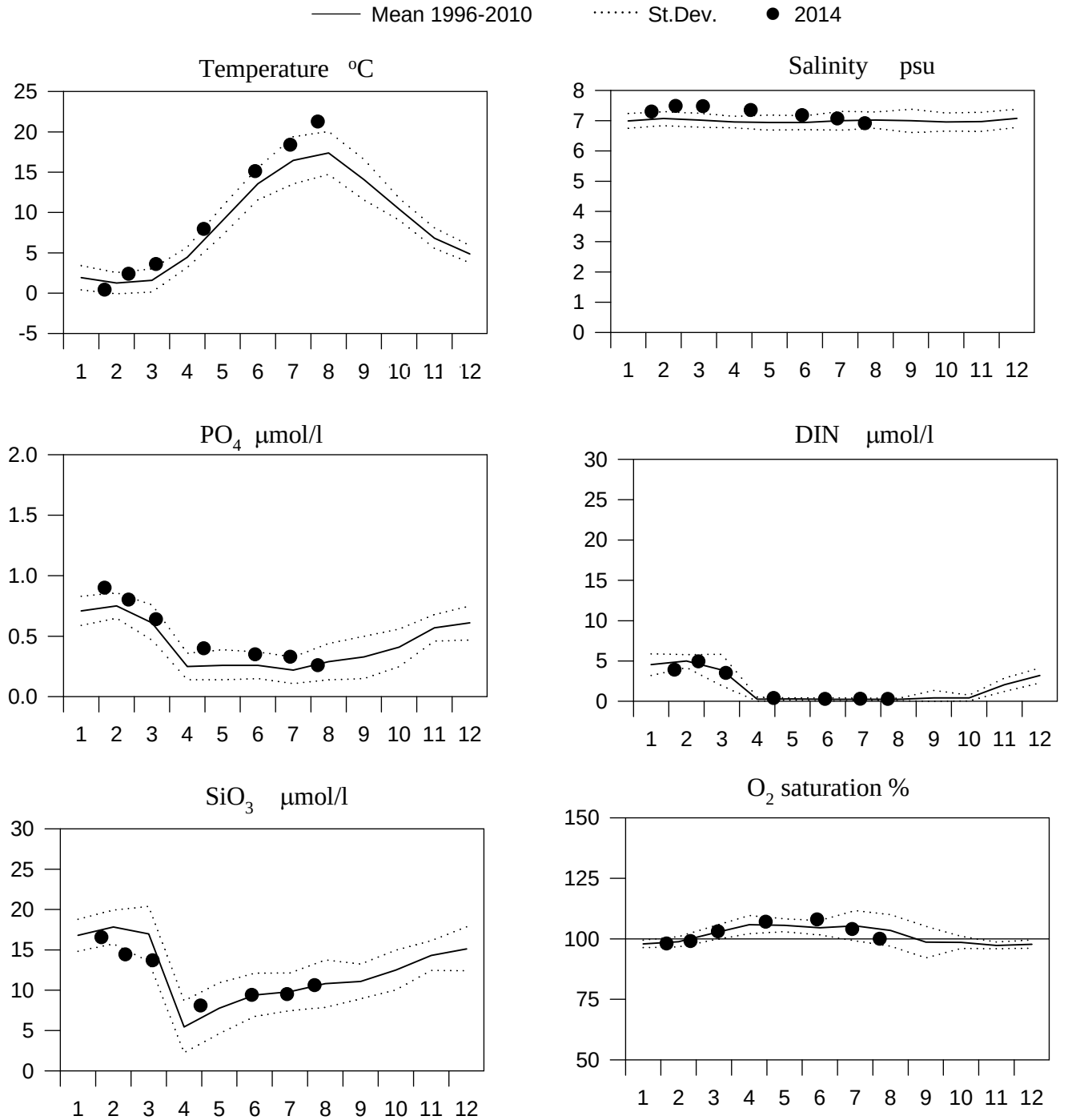


Vertical profiles N14 Falkenberg August

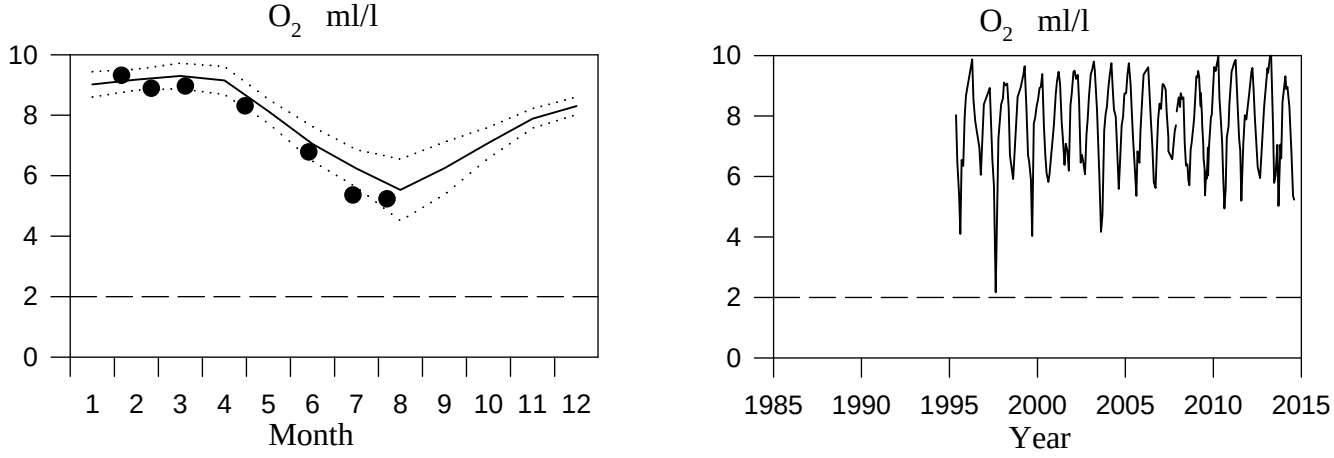


STATION REF M1V1 SURFACE WATER

Annual Cycles



OXYGEN IN BOTTOM WATER (depth >15m)



Vertical profiles Ref M1V1 August