

Rapport från SMHIs utsjöexpedition med R/V Aranda



Expeditionens varaktighet: 2014-11-08 - 2014-11-15
Undersökningsområde: Skagerrak, Kattegatt, Öresund och egentliga Östersjön
Uppdragsgivare: SMHI samt Havs- och Vattenmyndigheten

SAMMANFATTNING

Under expeditionen, vilken ingick i det svenska havsövervakningsprogrammet, besöktes Skagerrak, Kattegatt, Öresund och egentliga Östersjön. Denna rapport är baserad på preliminära, endast delvis kvalitetskontrollerade data.

Vattentemperaturen i ytlagret låg fortsatt över det normala i samtliga områden. Närsalterna i ytvattnet uppvisade för årstiden i stort sett normala värden, förutom silikat i egentliga Östersjön. Vid stationen BY1 i Arkonabassängen uppvisade samtliga närsalter förhöjda värden. I Bornholmsbassängen och Hanöbukten förekom akut syrebrist (<2 ml/l) från djup överstigande 70 meter. I östra Gotlandsbassängen förekom helt syrefria förhållanden från djup överstigande 125 meter (vid BY20 redan från 80 m) och akut syrebrist från 60 -80 meters djup. I västra Gotlandsbassängen var syresituationen allvarlig då akut syrebrist redan förekom från djup överstigande 70 meter och svavelväte från 80-90 meters djup.

Nästa ordinarie expedition är planerad till vecka 50, då kommer Skagerrak, Kattegatt, Öresund och egentliga Östersjön att besökas.

PRELIMINÄRA RESULTAT

Expeditionen genomfördes ombord det finska forskningsfartyget Aranda och startade i Helsingfors den 8:e oktober och avslutades i Åbo den 15:e. Vindarna under expedition var i huvudsak friska, kring 10 m/s, varierande i riktning mellan ost och syd. Lufttemperaturen varierade mellan 6-10°C.

På grund av problem med en vinsch kunde inga CTD-mätningar utföras i norra Kattegatt eller Skagerrak, vilket innebär att inga CTD-profiler eller data på salthalt kan presenteras från dessa områden. Dessutom medförde problem med närsaltsanalysatorn att fosfat- och ammoniumdata saknas från stationerna i Skagerrak.

Skagerrak

Temperaturen, ända ner till ett djup av ca 100 meter, var klart högre än normalt för årstiden. I ytvattnet låg temperaturen mellan 10.5 och 13.5 °C.

Närsalthalterna i ytlagret uppvisade koncentrationer normala för årstiden. Koncentrationerna av oorganiskt kväve (nitrit + nitrat) varierade mellan 0.9 och 1.3 µmol/l, medan silikalthalterna låg i intervallet 2.1 till 2.7 µmol/l. Data på fosfat saknas från området.

Det lägsta syrevärdet i bottenvattnet uppmättes vid stationen Släggö, i Gullmarfjordens mynning, där syrehalten sjunkit från 3.1 ml/l vid föregående tillfälle i oktober till 2.3 ml/l.

Kattegatt och Öresund

I Kattegatt var temperaturen högre än normalt i hela vattenpelaren, med ytvärden varierande i intervallet 10.5 till 11.5 °C. Termoklin och haloklin återfanns båda på djup mellan 15 och 20 meter. Salthalten i ytvattnet var normal ca 23 psu, i Öresund 9.5 psu.

Halterna av fosfat och oorganiskt kväve (nitrit + nitrat) uppvisade värden typiska för årstiden, medan silikalthalterna var lägre än normalt. Fosfat varierade mellan 0.16 och 0.19 µmol/l, oorganiskt kväve från under detektionsgränsen (< 0.10 µmol/l) till 0.6 µmol/l. I Öresund låg halterna generellt högre, fosfat 0.38 µmol/l och nitrit + nitrat på 1.7 µmol/l. Silikalthalterna i Kattegatt var lägre än normalt, 0.7 – 2 medan de var normala i Öresund 8.8 µmol/l.

Fluorescensmätningar visade på viss planktonaktivitet i ytlagret.

De lägsta syrehalterna i bottenvattnet uppmättes vid Anholt E i södra Kattegatt samt i Öresund, 3.81 ml/l.

Egentliga Östersjön

Vattentemperaturen i hela ytskiktet, ner till termoklinen på 30 till 40 meters djup, låg klart över det normala i hela området, varierande från 8.7°C i norr till 12.7 i söder. Salthalten i ytvattnet var normal i större delen av området, mellan 6.5 och 8.2 psu. I östra Gotlandsbassängen är ytsalthalten fortfarande ca 0.15 psu under det normala vilket är ca 7 psu. Haloklinen återfanns på omkring 60 till 70 meters djup i västra och östra Gotlandsbassängen, medan den låg grundare i de södra delarna, på djup mellan 30 och 50 meter.

Närsalterna uppvisade i stort sett normala halter för årstiden i ytlagret, fosfathalterna låg i intervallet 0.25 – 0.39 µmol/l, medan halterna av oorganiskt kväve (nitrit + nitrat) varierade från 0.16 till 1.26 µmol/l. Silikat uppvisade något förhöjda halter i de norra och centrala delarna, medan koncentrationerna i de södra delarna var lägre än normalt. Halterna varierade mellan 4.7 och 12.5 µmol/l. Stationen BY1 i Arkona avvek helt från mönstret och hade klart förhöjda halter av samtliga närsalter. Fosfatkoncentrationen var här 0.68 µmol/l, silikat låg på 12.9 µmol/l och halterna av nitrit + nitrat på 3.05 µmol/l.

Fluorescensmätningar visade att planktonaktiviteten var låg i hela området.



Effekterna av ett inflöde genom Öresund på ca 25 km³, vilket ägde rum i oktober, syntes vid BY2 i Arkonabassängen där salthalten i djupvattnet var så hög som 22 psu. Även i Bornholmsbassängen syntes effekterna, vid BY4 var syrehalten i bottenvattnet högre än i vattnet ovan, 1.45 ml/l mot 0.65 ml/l. Akut syrebrist förekom i Bornholmsbassängen och Hanöbukten från 70 meters djup.

I de centrala delarna av östra Gotlandsbassängen noterades akut syrebrist från 60 - 80 meters djup och svavelväte i djup överstigande 125 - 135 meter, Vid stationen BY20, i norra delen, förekom svavelväte redan på 80 meters djup. I västra Gotlandsbassängen förekom akut syrebrist på djup överstigande 70 meter och svavelväte från 80 - 90 meters djup.

DELTAGARE

Namn

Anna_Kerstin Thell

Expeditionsledare

Lars Andersson

Sara Johansson (Lysekil-Åbo)

Mikael Krysell (Helsingfors-Lysekil)

Vivi Månsson

Sari Sipilä

Från

SMHI

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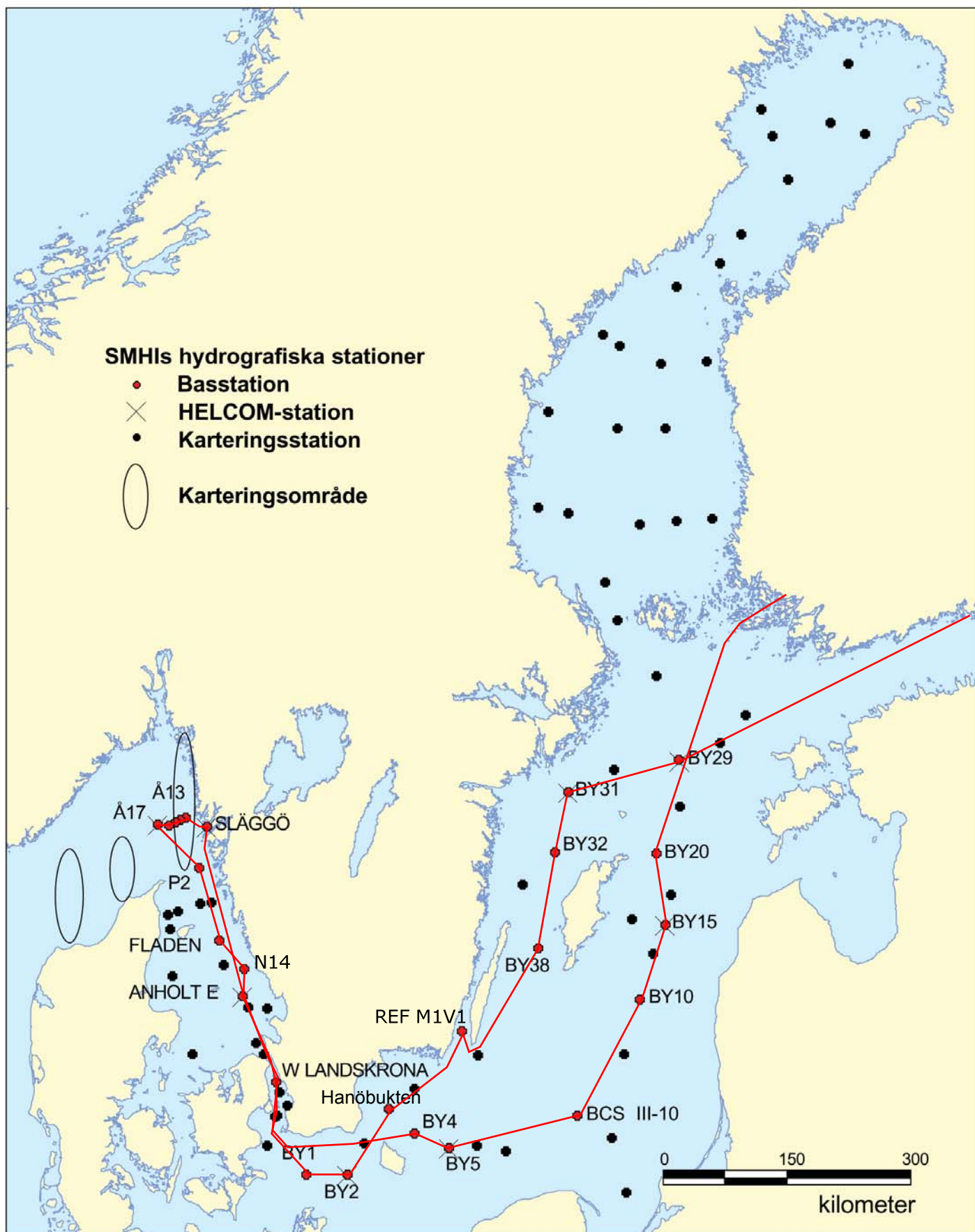
SMHI

SMHI

BILAGOR

- Färdkarta
- Tabell över stationer, antal parametrar och provtagningsdjup
- Karta över syrehalter i bottenvattnet
- Vertikalprofiler för basstationer
- Månadsmedelvärdesplottar för ytvatten

TRACKCHART
 Country: Sweden
 Ship: R/V ARANDA
 Date: 20141108-20141115
 Series: 0747-0771



Date: 2014-11-15
Time: 07:05

Ser no	Stat code	P r o j	Station-----	Lat-----	Lon-----	Date yyyymmdd	Time hhmm utc	Bottom depth m	Secchi depth m	Wind di ve	Air temp C	Air pres hPa	WCSI elec aoae hd	C PPCPZT C Cilyooa motPBw PrP l	No de	T S e a m l p i g n	P O h x 2 y S P	H O o o P P	T N N N	N N N N	N T N N	A S h o l i u o 3 u n g	S H L P o m g N	L P T C O O C C m m						
0747	BPNX35BAS	BY29		N5853	E2019	20141108	2300	175		19 6	8.8	1015	9990	x --x----	16	x	x	x	x	x	x	x	x	-	x	-	-	-	-	x
0748	BPNX37BAS	BY31	LANDSORTSDJ	N5835	E1814	20141109	0720	447	10	29 7	9.4	1017	4930	x -xxxx--	23	x	x	x	x	x	x	x	x	x	x	-	-	-	-	x
0749	BPWX38BAS	BY32	NORRKÖPINGS	N5801	E1759	20141109	1310	200	10	19 6	9	1018	2730	x --x----	17	x	x	x	x	x	x	x	x	x	-	-	-	-	-	x
0750	BPWX45BAS	BY38	KARLSÖDJ	N5707	E1740	20141109	2010	109		15 13	9.2	1017	9990	x --x----	14	x	x	x	x	x	x	x	x	x	-	-	-	-	-	-
0751	BPWK01BAS	REF M1V1		N5622.25	E1612.1	20141110	0615	18		18 8	10.6	1012	2830	x -xxxx--	5	x	x	x	x	-	x	x	x	x	x	x	-	-	-	-
0752	BPSH05BAS	HANÖBUKTEN		N5537	E1452	20141110	1325	78	7	20 7	11.1	1009	2830	x --x----	11	x	x	-	x	x	x	x	x	x	-	x	-	-	-	-
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0754	BPSA02BAS	BY1		N5500	E1318	20141110	2210	46		23 10	10.3	1011	9990	x --x----	8	x	x	-	x	x	x	x	x	x	-	x	-	-	-	-
0755	SOCX39BAS	W	LANDSKRONA	N5552.0	E1245.0	20141111	0420	50		21 5	9.5	1011	9990	x --x----	9	x	x	-	x	x	x	x	x	x	-	x	-	-	-	-
0756	KAEX29BAS	ANHOLT E		N5640.0	E1207.0	20141111	1000	63	9	20 9	9.6	1013	2730	x -xxxx--	10	x	x	x	-	x	x	x	x	x	x	-	-	-	-	-
0757	KANX50BAS	N14	FALKENBERG	N5656.40	E1212.70	20141111	1212	31	8.5	19 7	9.6	1014	2830	x -xxxx--	7	x	x	x	x	-	x	x	x	x	x	x	-	-	-	x
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0763	FIBG27BAS	SLÄGGÖ		N5815.5	E1126.0	20141112	0645	76	5	08 10	7.2	1015	2730	- -xxx---	9	x	x	-	x	-	x	x	x	-	x	x	-	-	-	x
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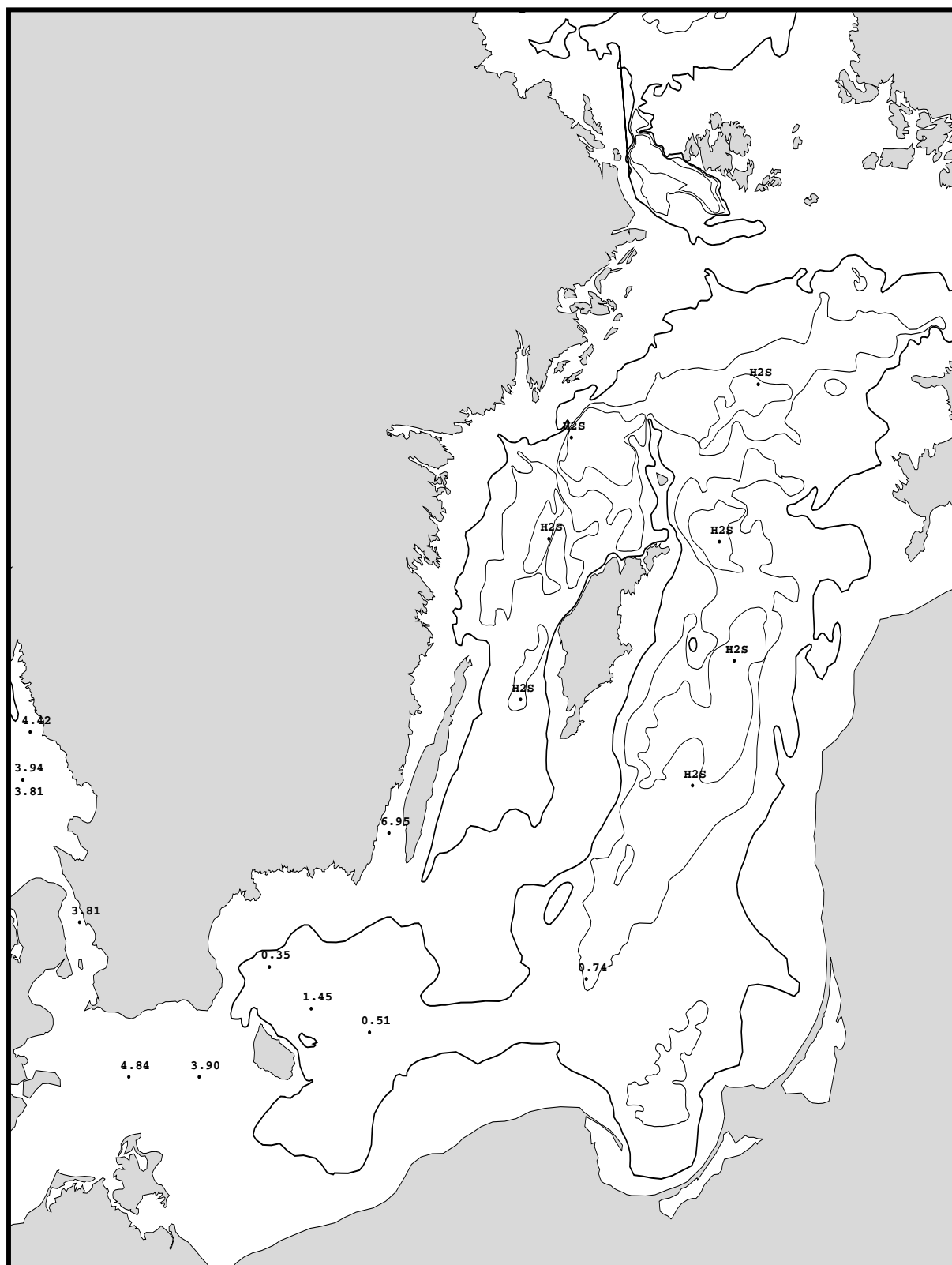
Bottom water oxygen concentration (ml/l)

Country: Finland

Ship : Aranda

Date : 20141108-20141114

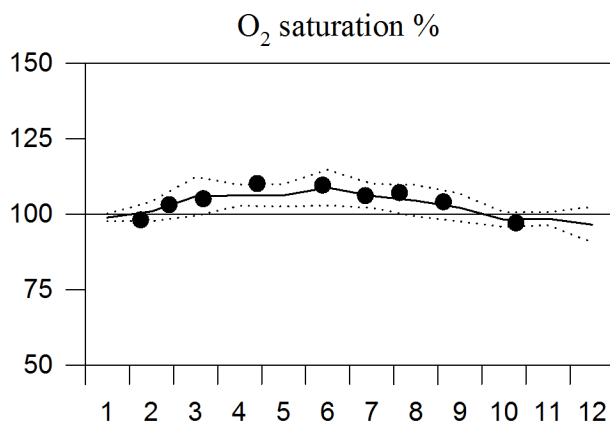
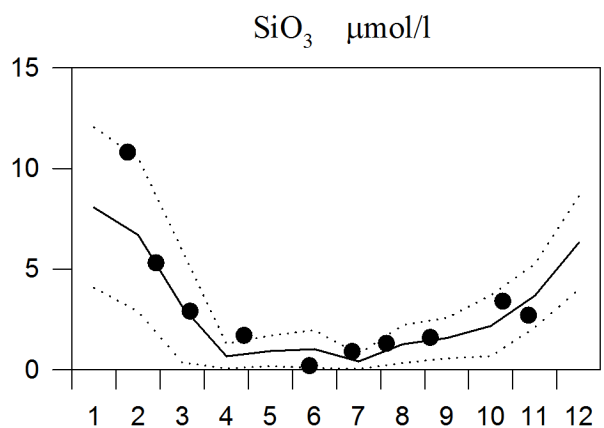
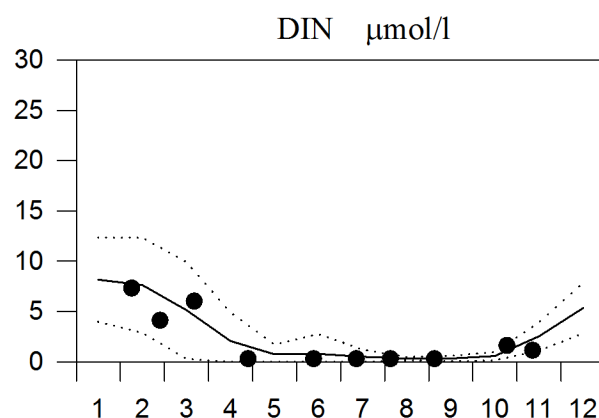
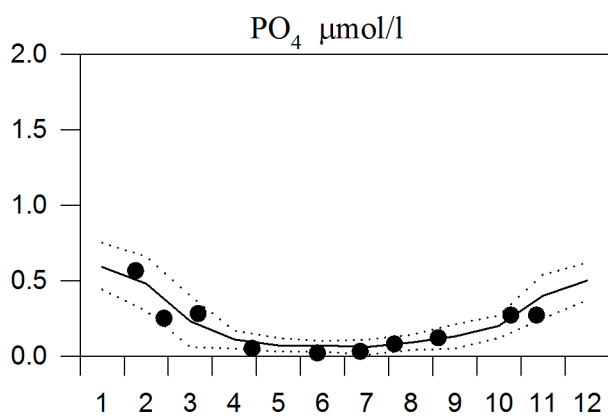
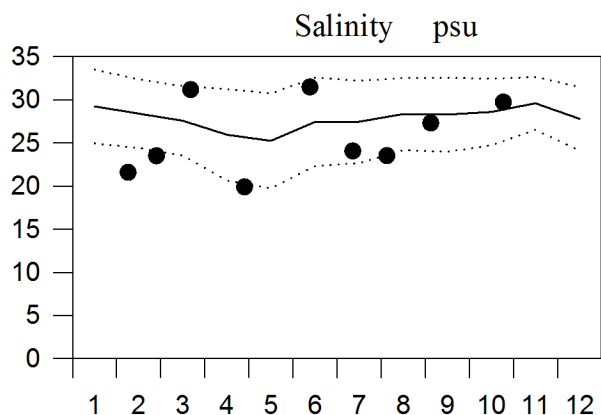
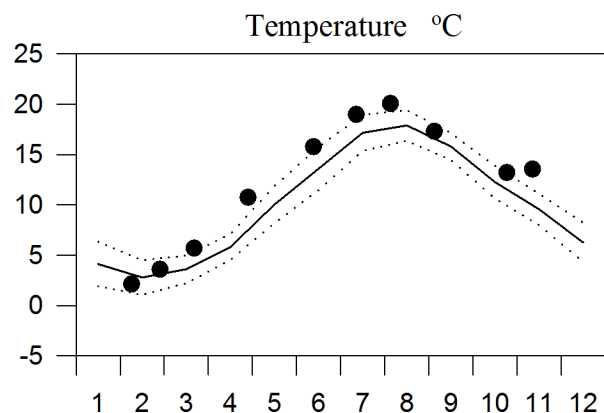
Series : 0747-0771



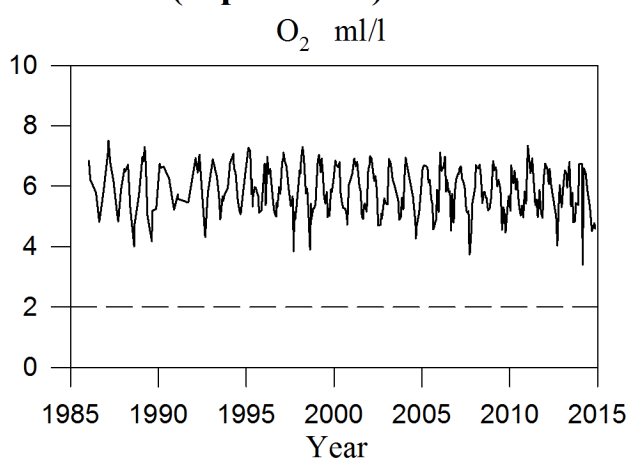
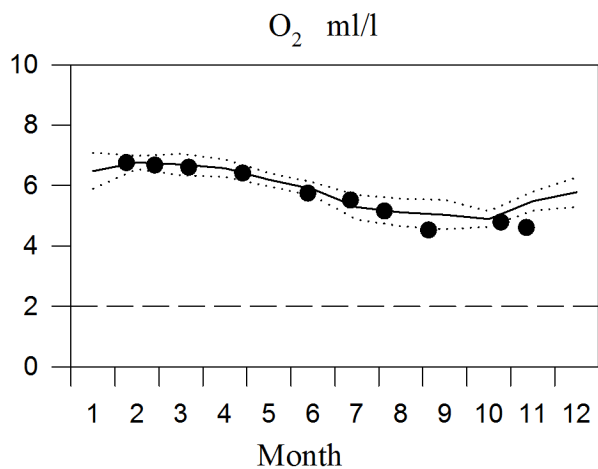
STATION P2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

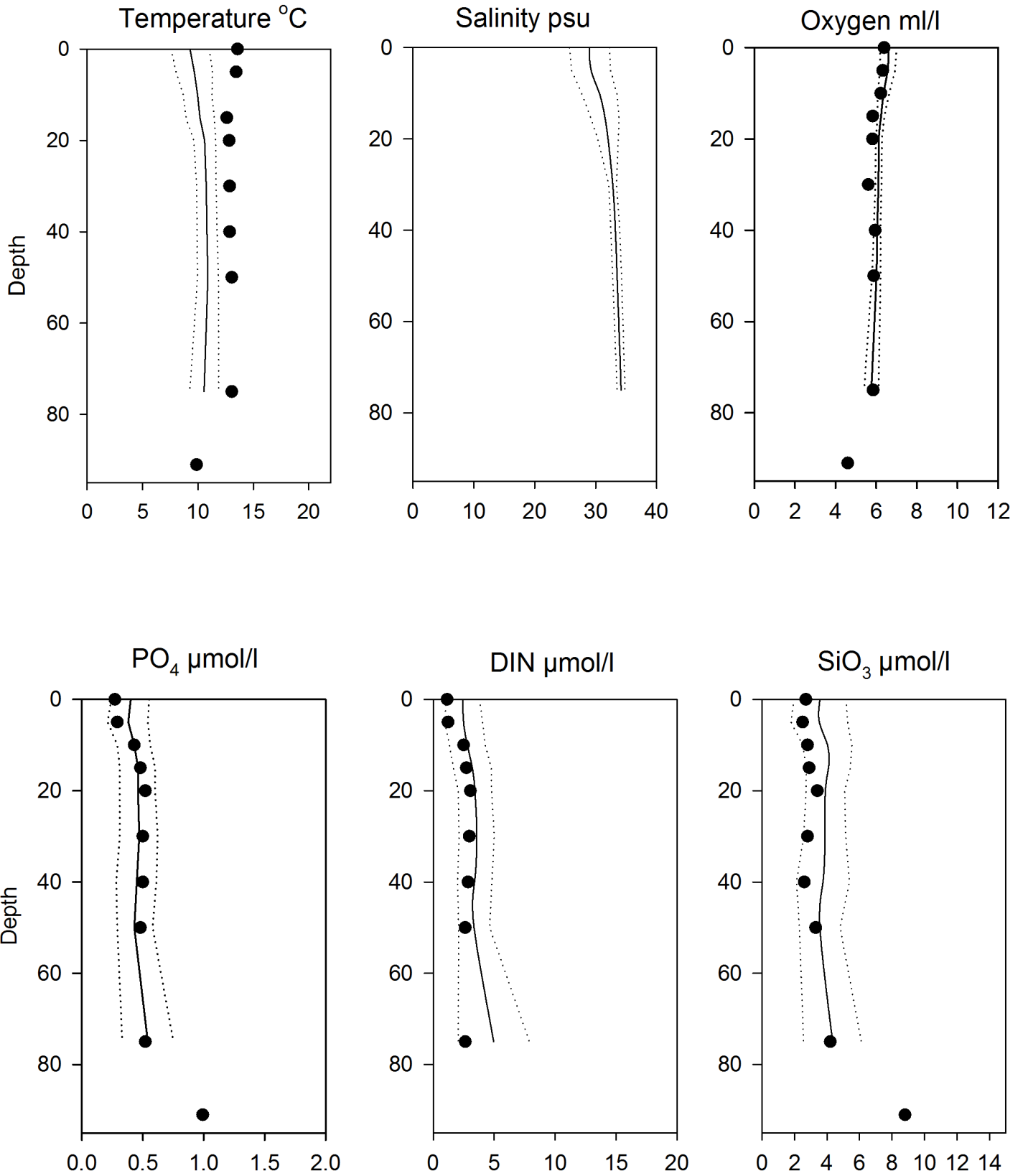


OXYGEN IN BOTTOM WATER (depth >75m)



Vertical profiles P2 November

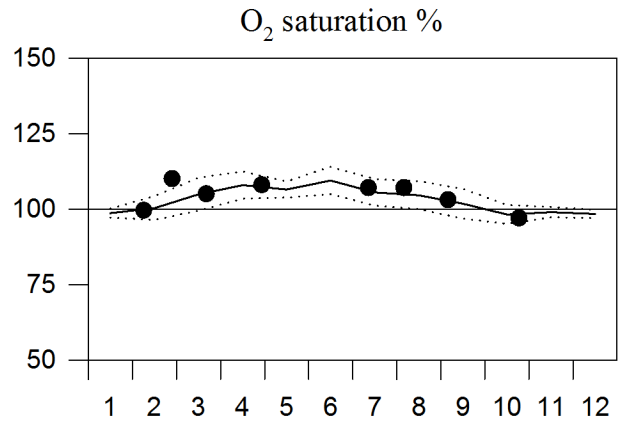
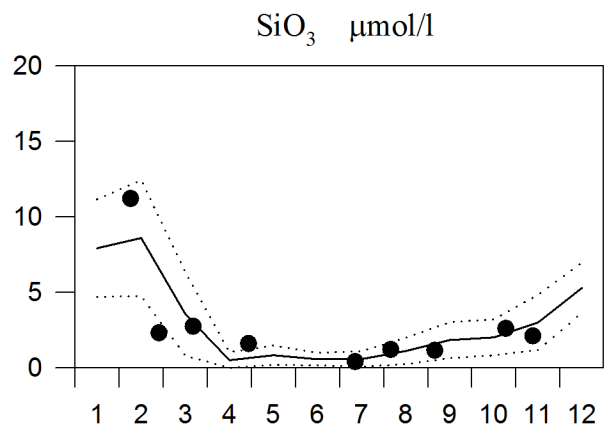
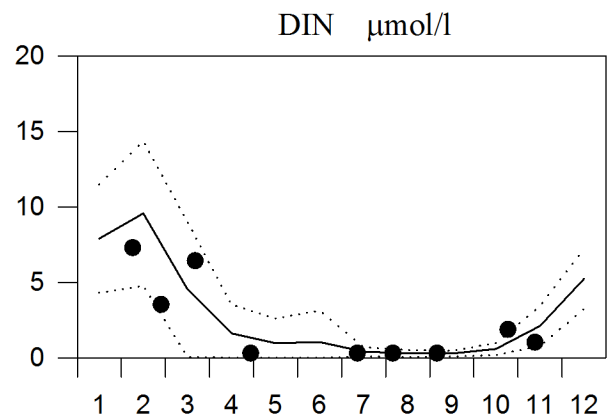
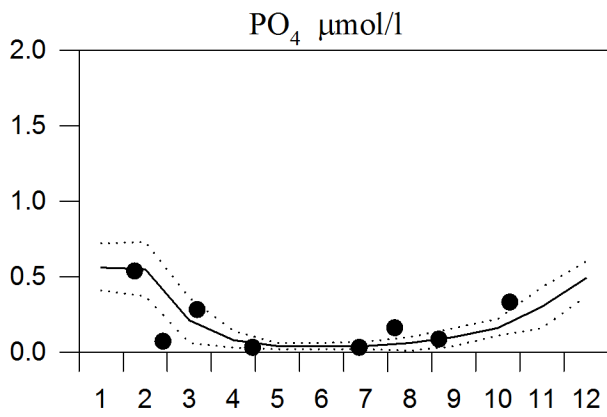
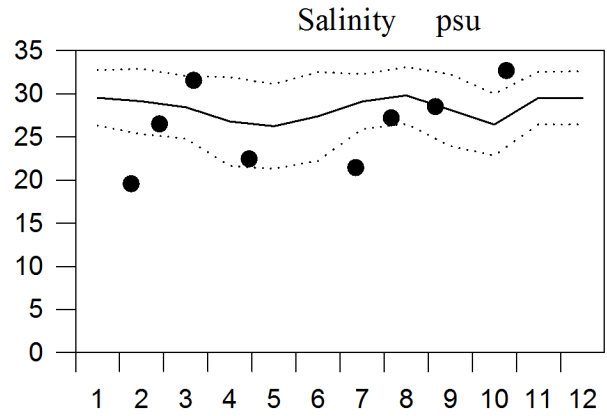
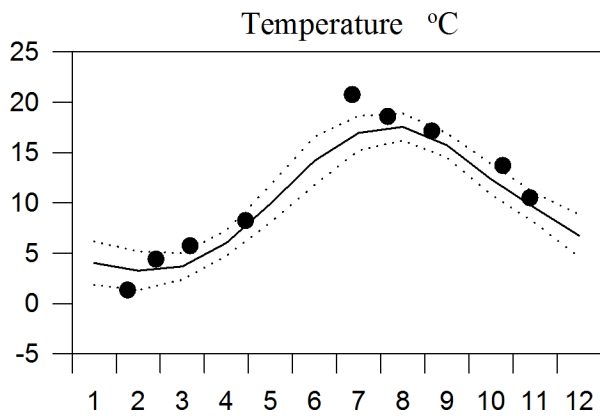
— Mean 1996-2010 St.Dev. ● 2014



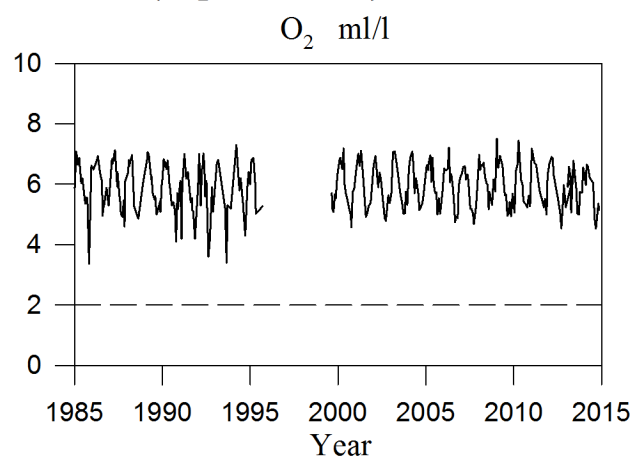
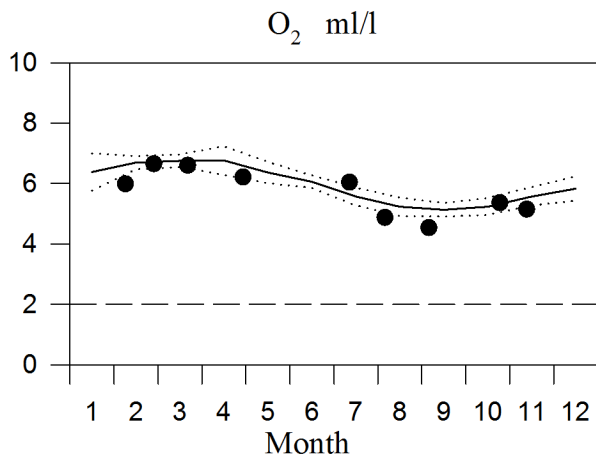
STATION Å13 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

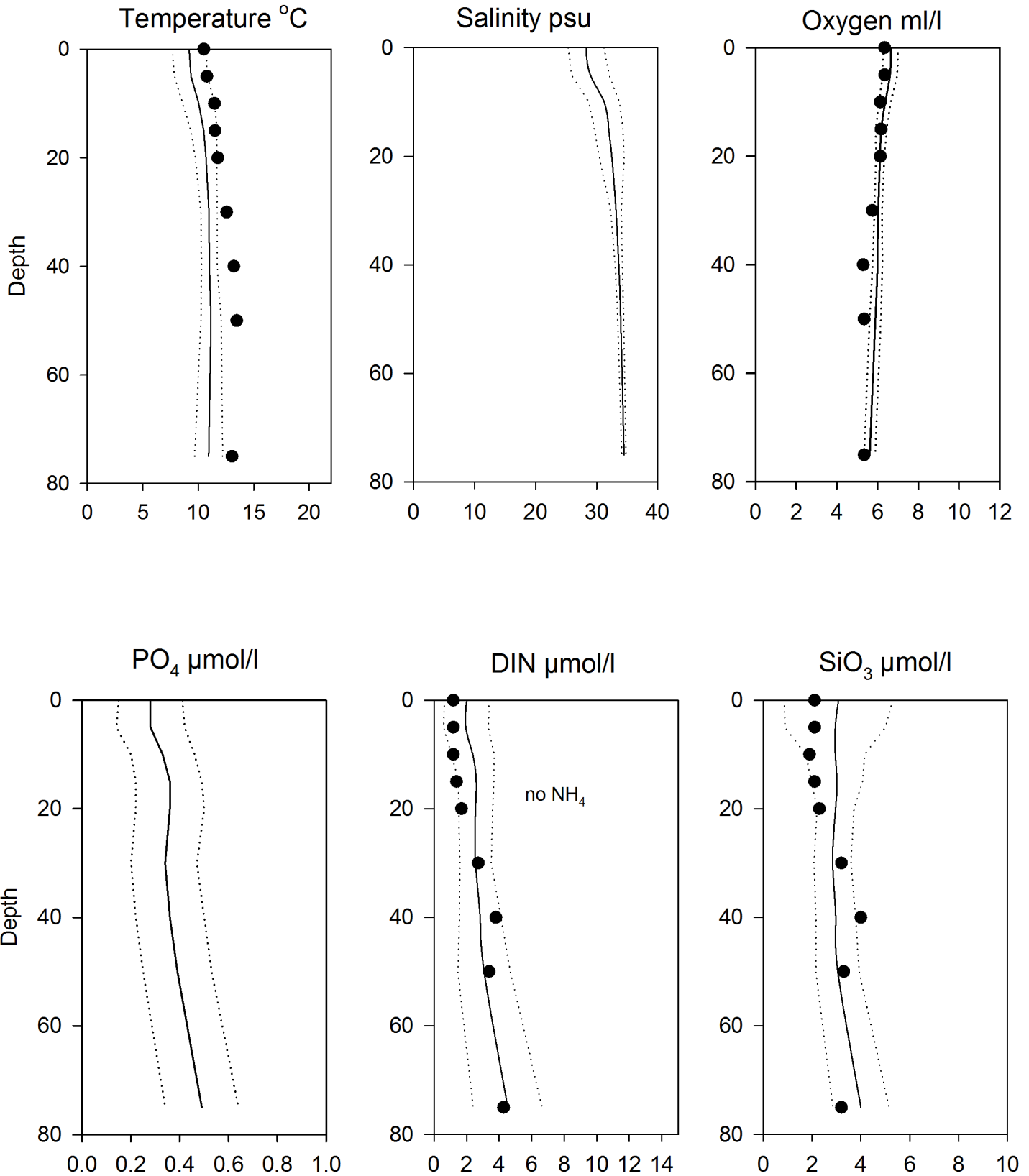


OXYGEN IN BOTTOM WATER (depth >=75m)



Vertical profiles Å13 November

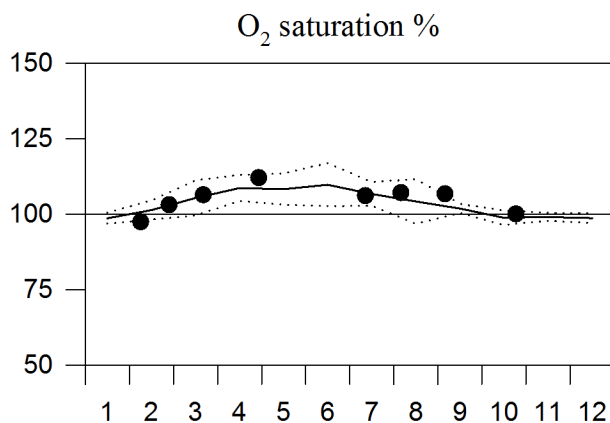
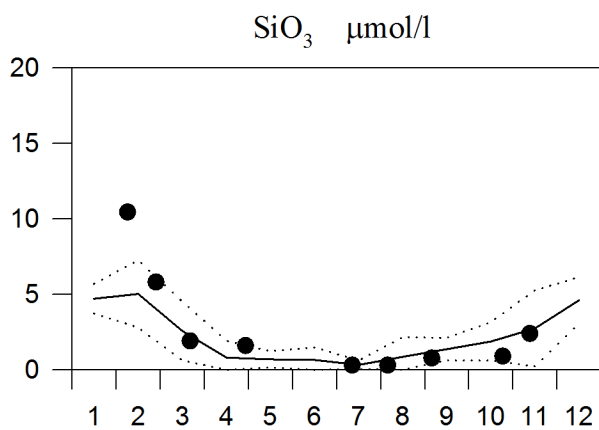
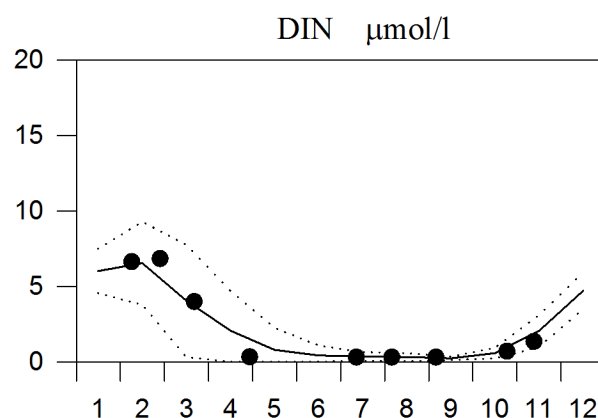
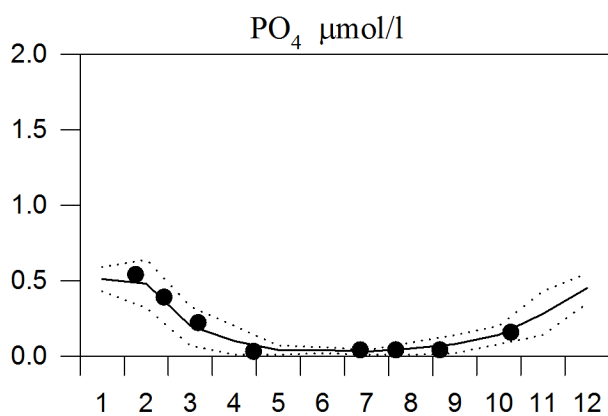
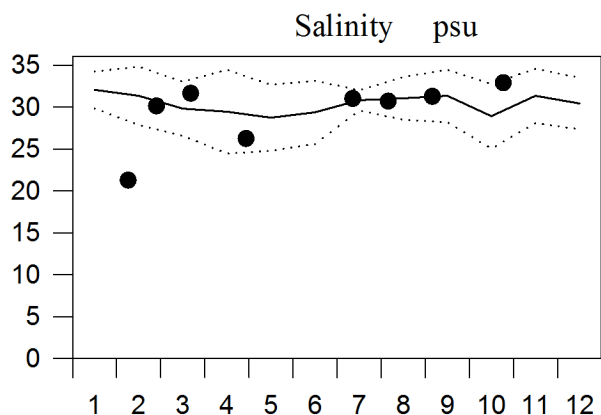
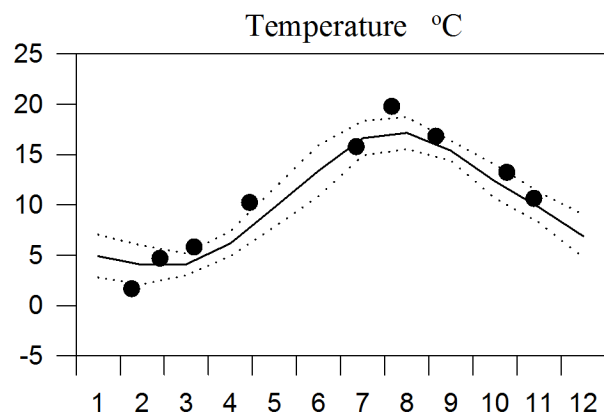
— Mean 1996-2010 St.Dev. ● 2014



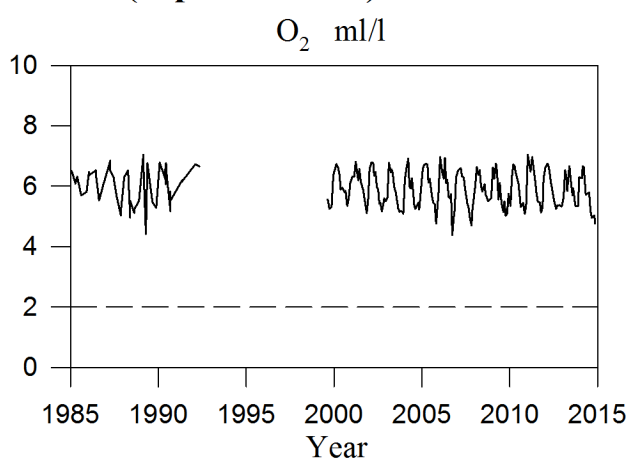
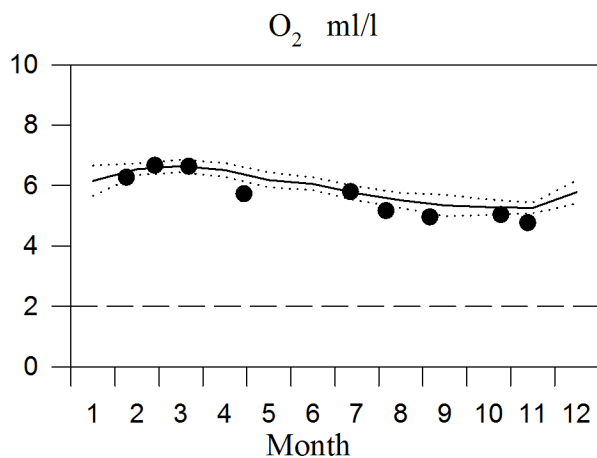
STATION Å15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



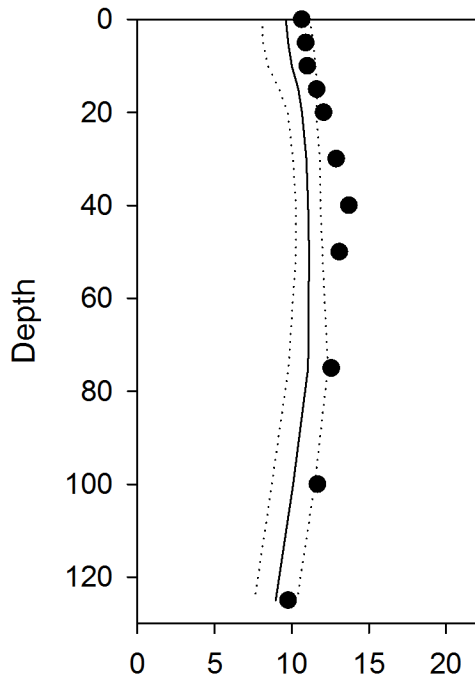
OXYGEN IN BOTTOM WATER (depth >=125m)



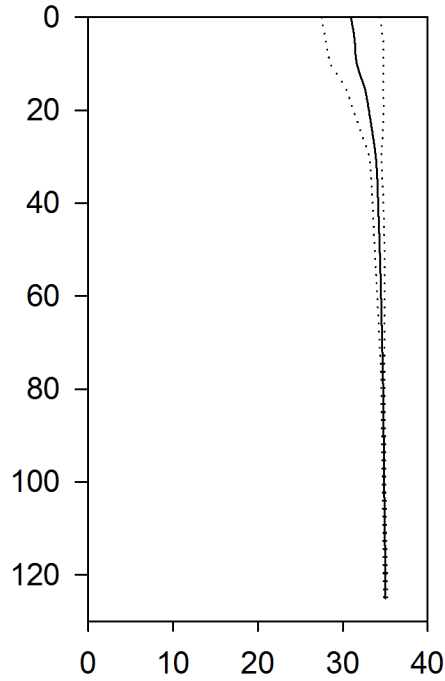
Vertical profiles Å15 November

— Mean 1996-2010 St.Dev. ● 2014

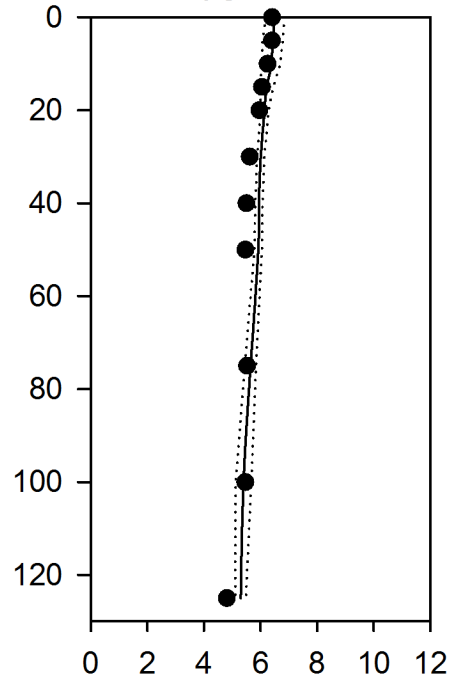
Temperature °C



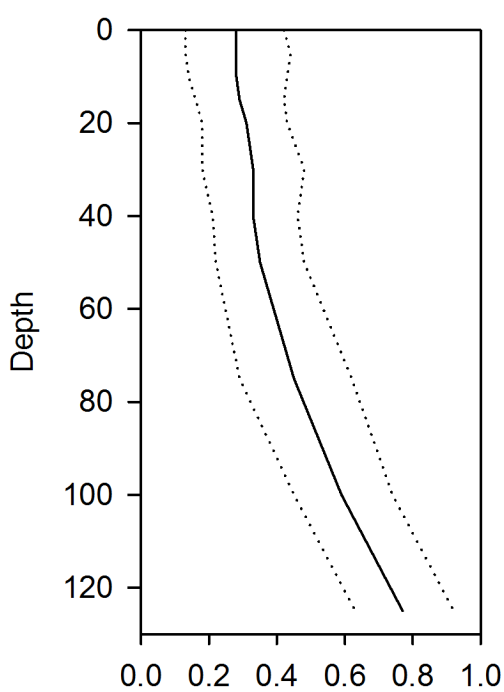
Salinity psu



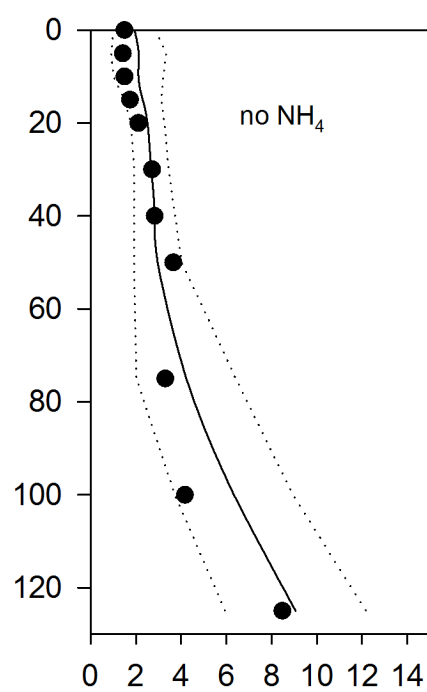
Oxygen ml/l



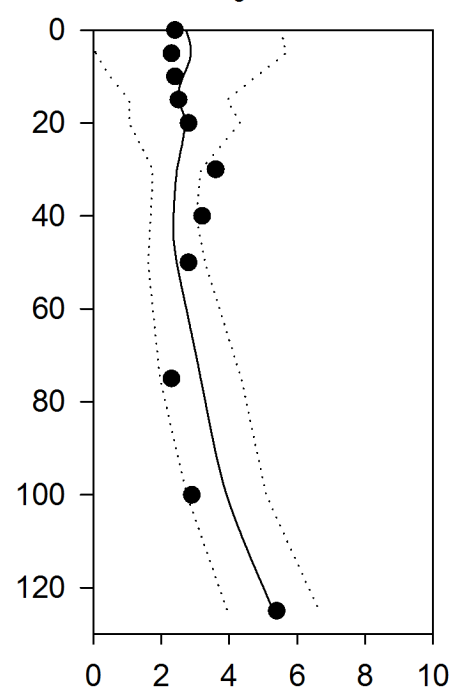
PO₄ µmol/l



DIN µmol/l



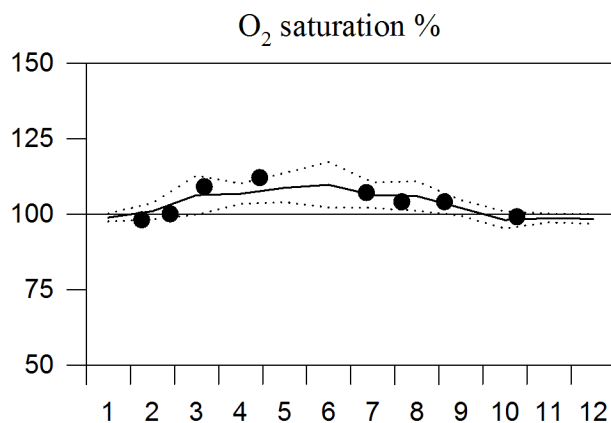
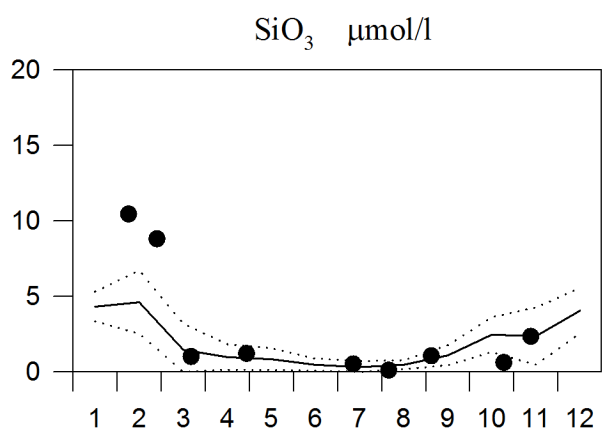
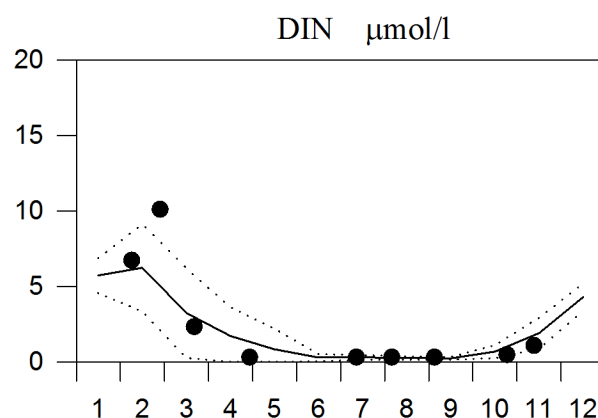
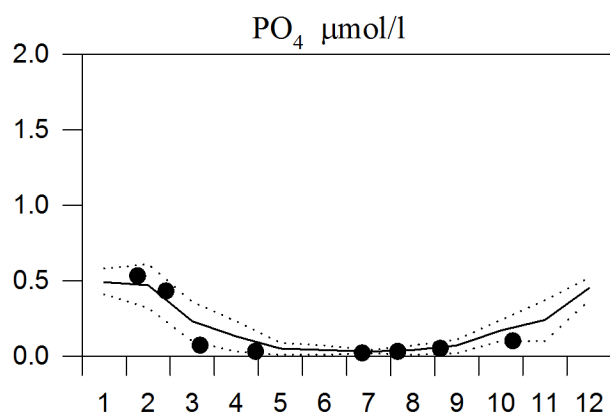
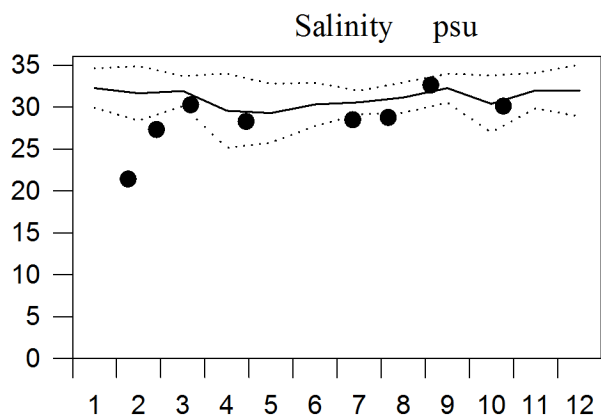
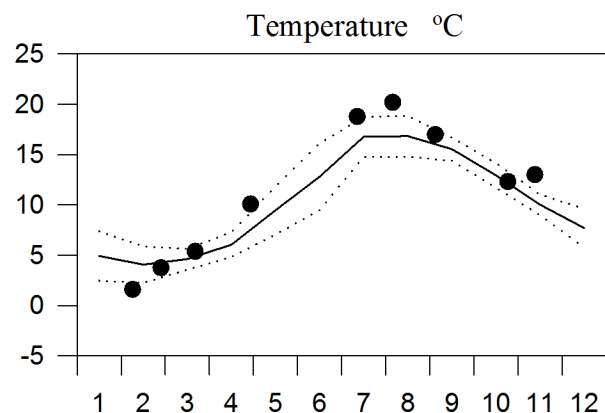
SiO₃ µmol/l



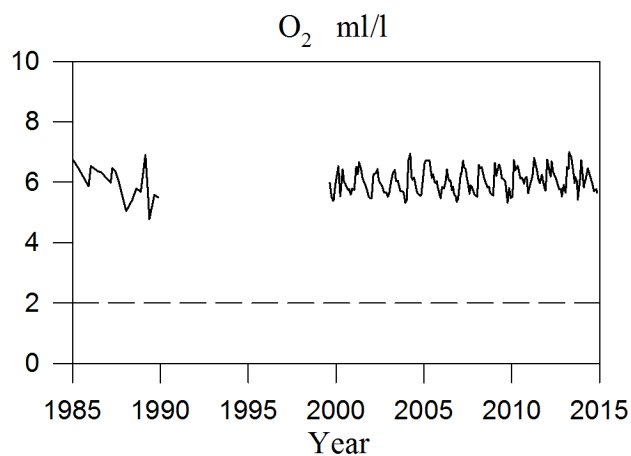
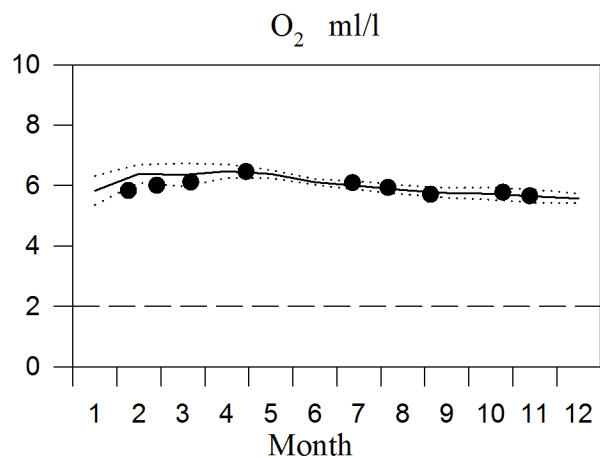
STATION Å17 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



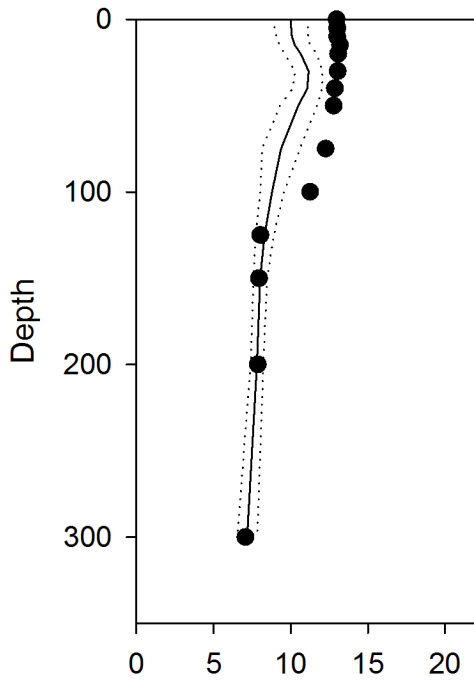
OXYGEN IN BOTTOM WATER (depth = 300m)



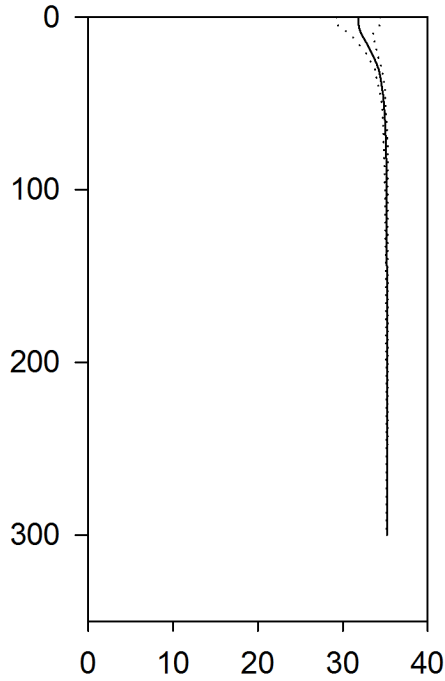
Vertical profiles Å17 November

— Mean 1996-2010 St.Dev. ● 2014

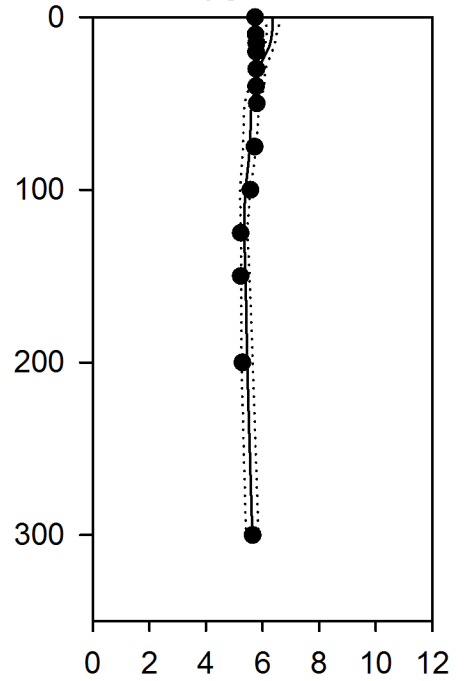
Temperature °C



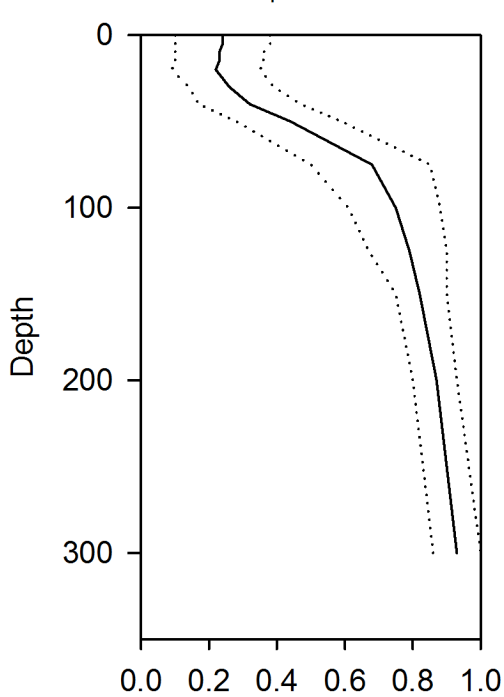
Salinity psu



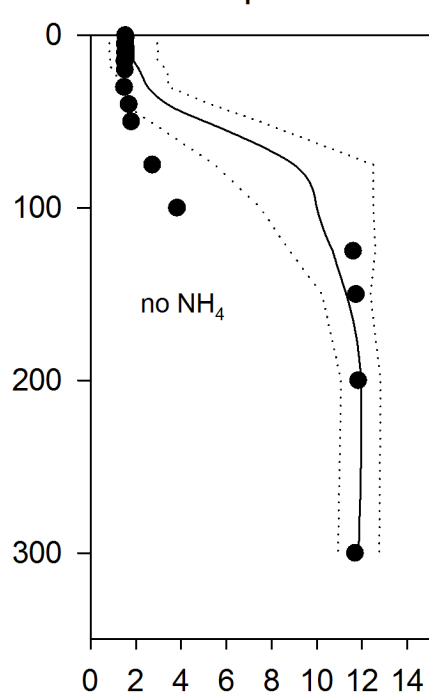
Oxygen ml/l



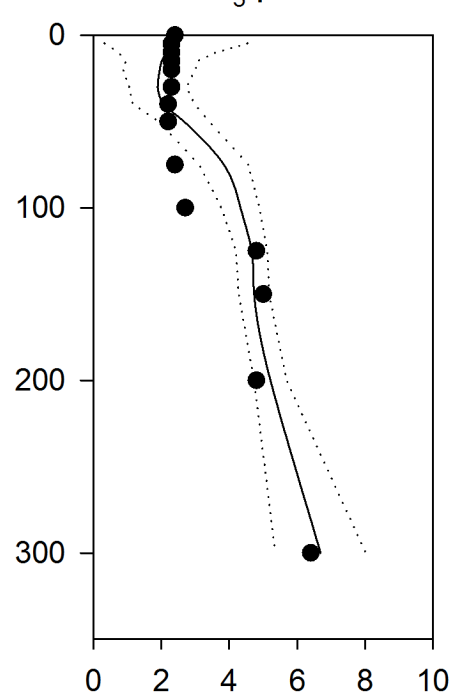
PO₄ µmol/l



DIN µmol/l



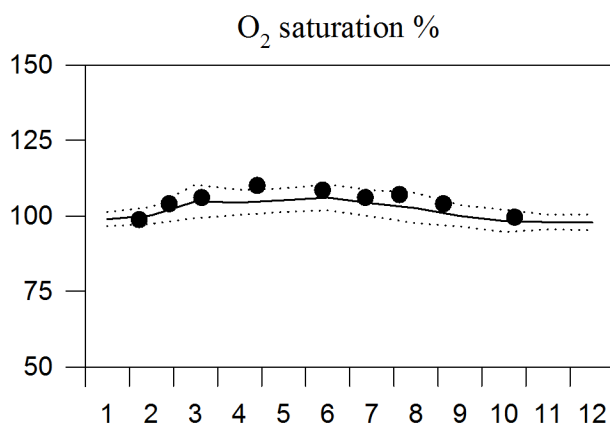
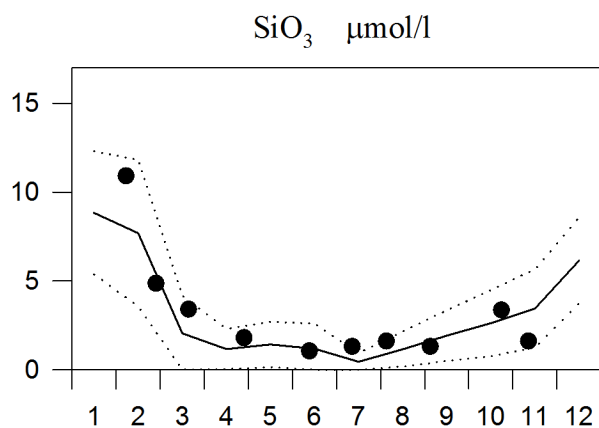
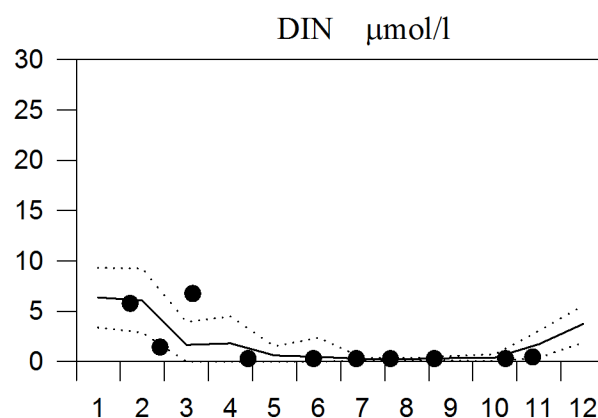
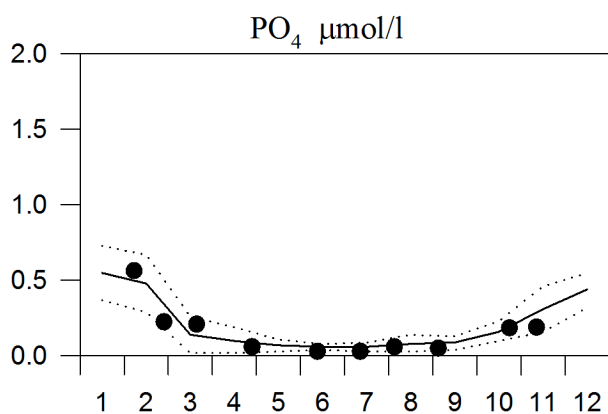
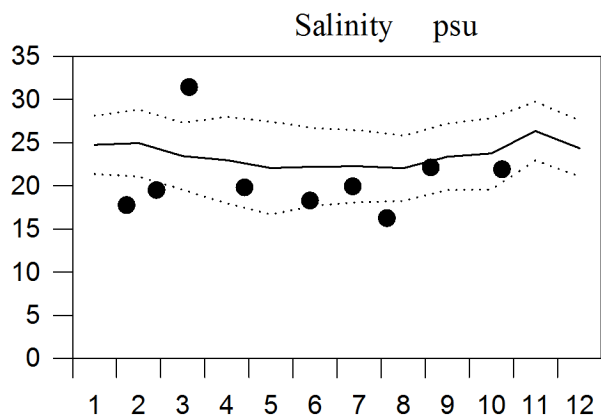
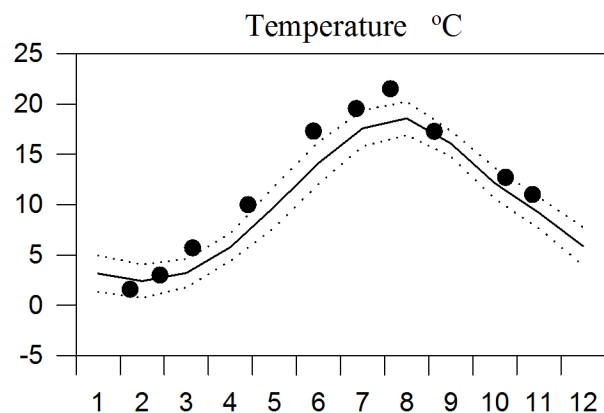
SiO₃ µmol/l



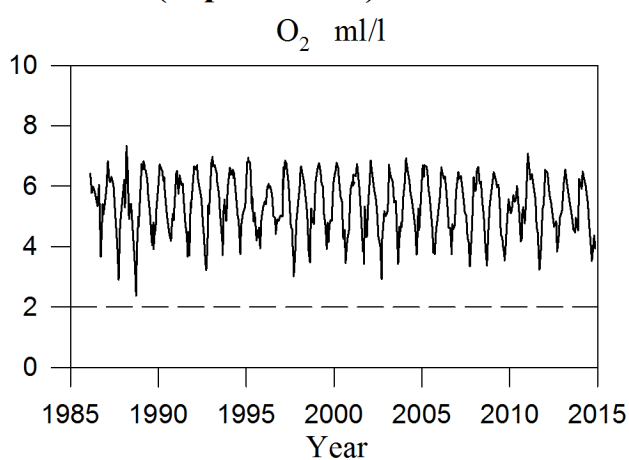
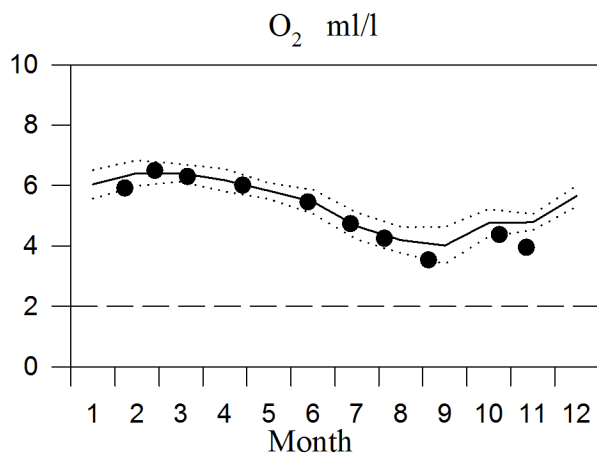
STATION FLADEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

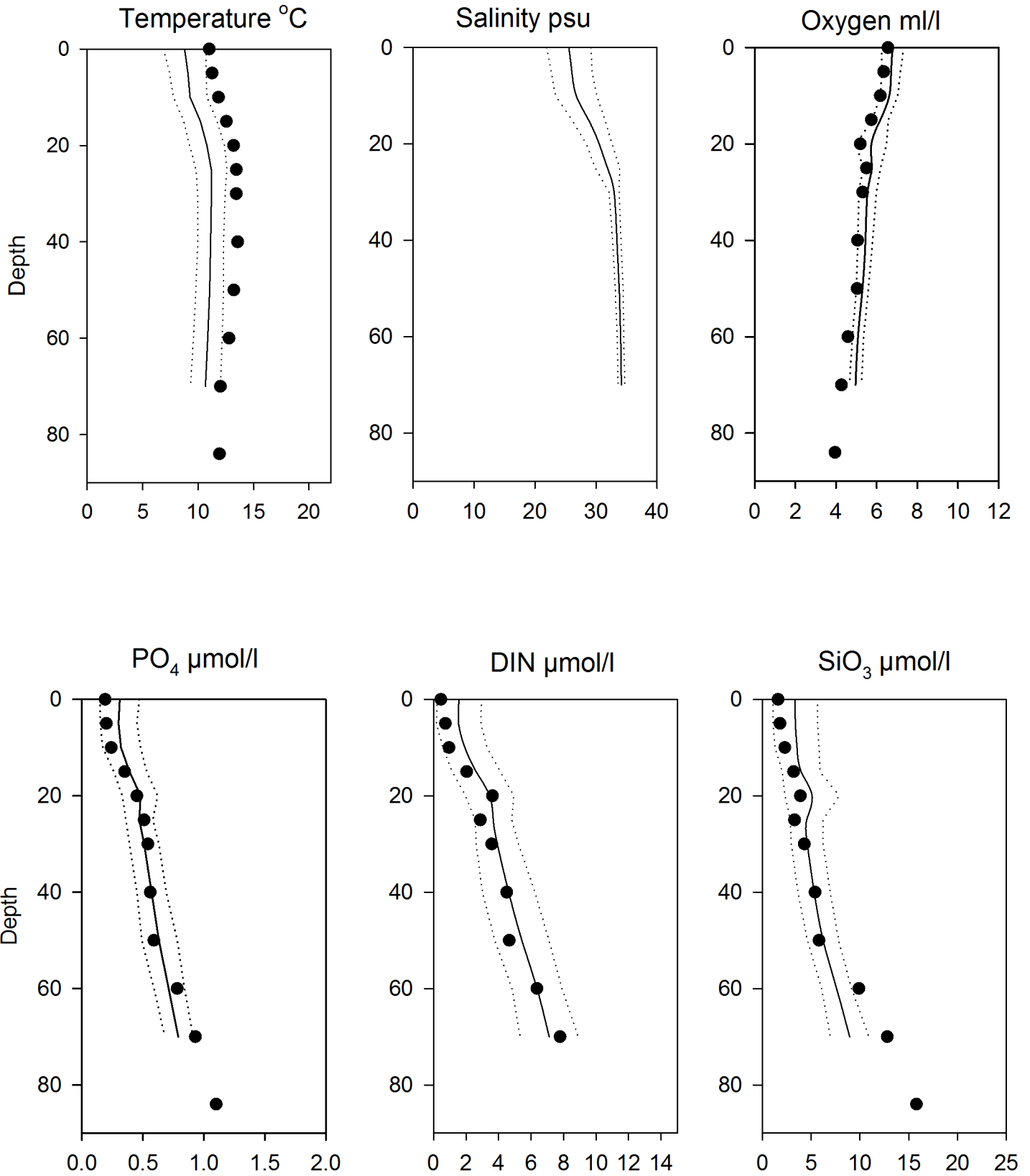


OXYGEN IN BOTTOM WATER (depth > 70m)



Vertical profiles Fladen November

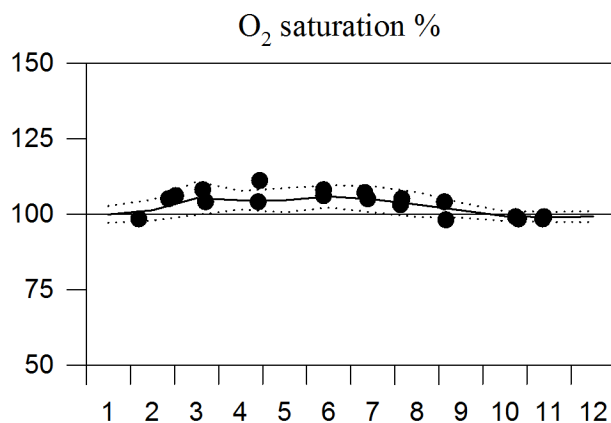
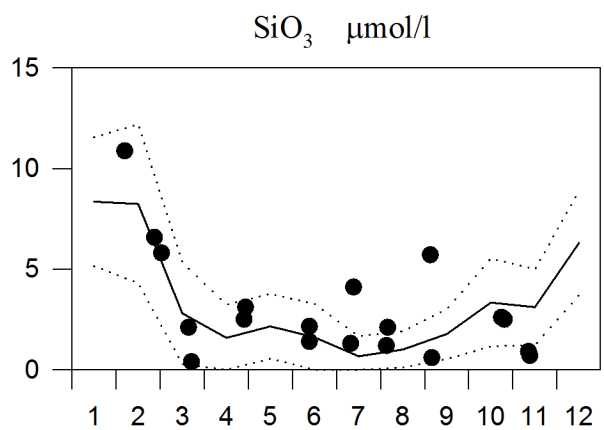
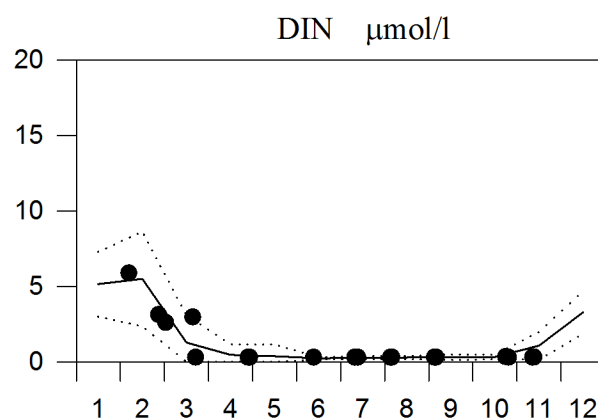
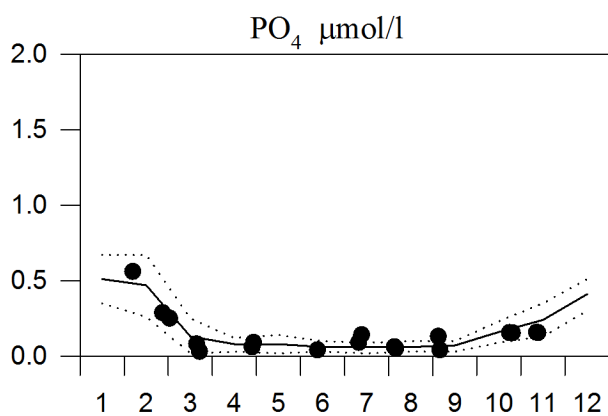
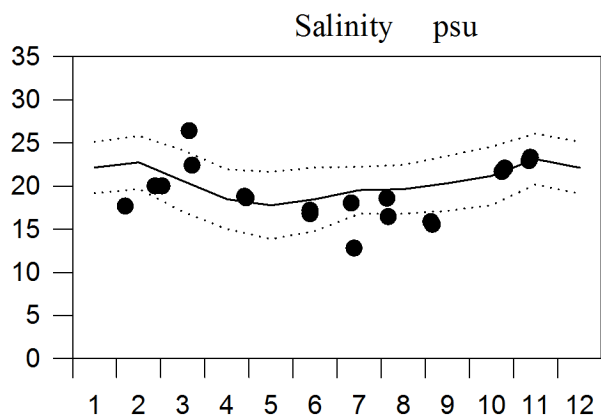
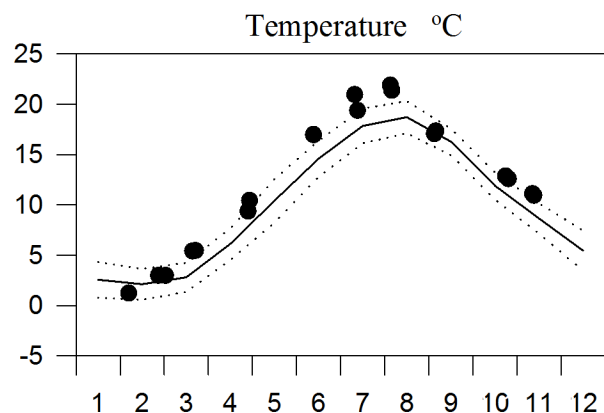
— Mean 1996-2010 St.Dev. ● 2014



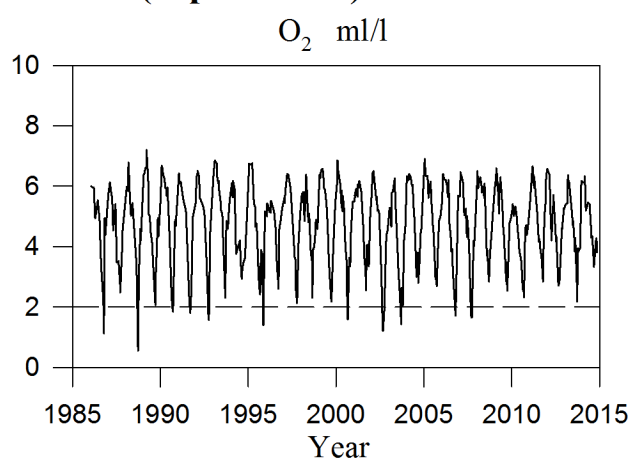
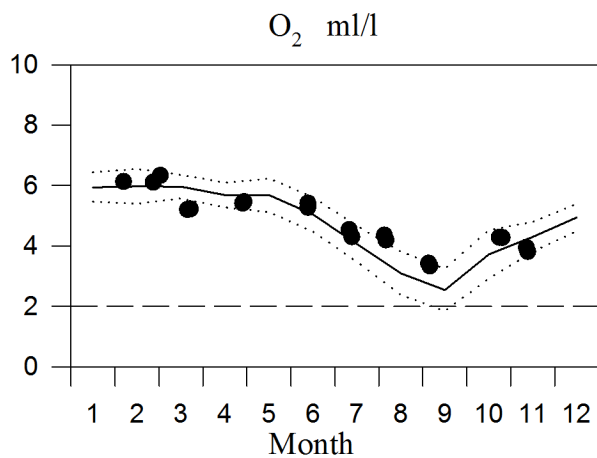
STATION ANHOLT E SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

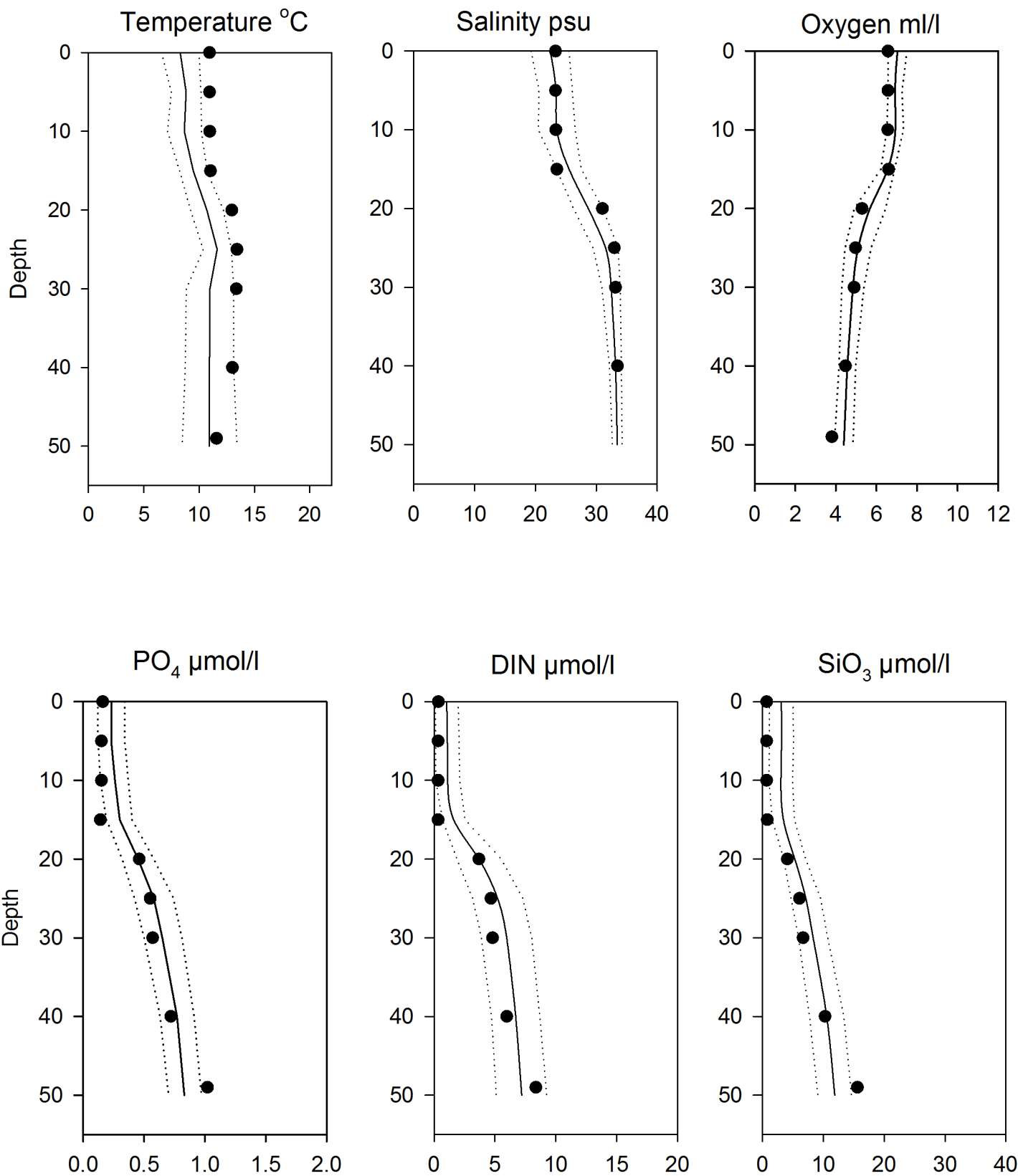


OXYGEN IN BOTTOM WATER (depth > 50m)



Vertical profiles Anholt E November

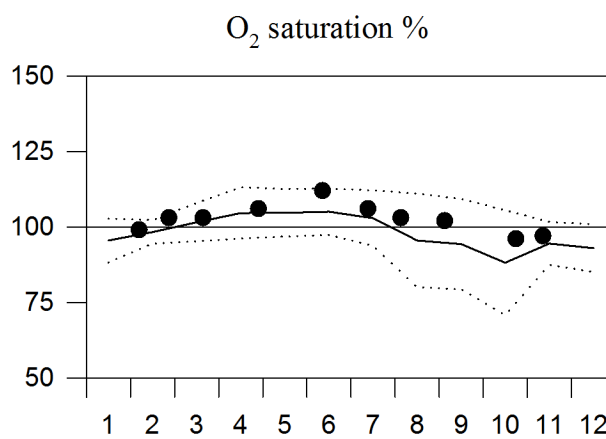
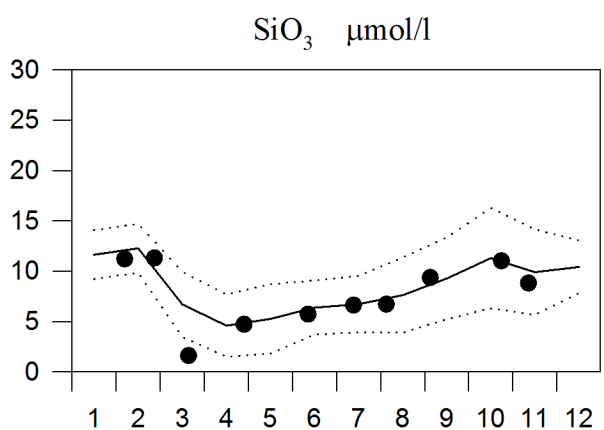
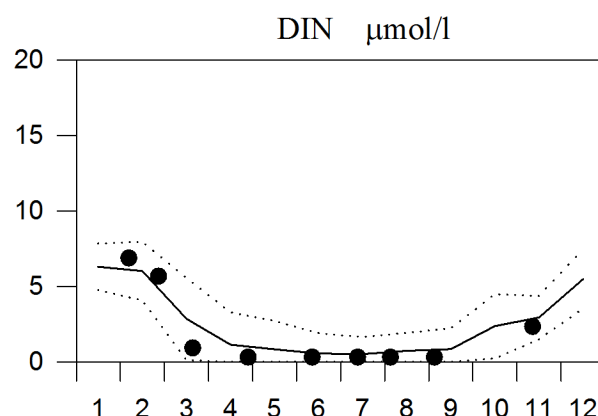
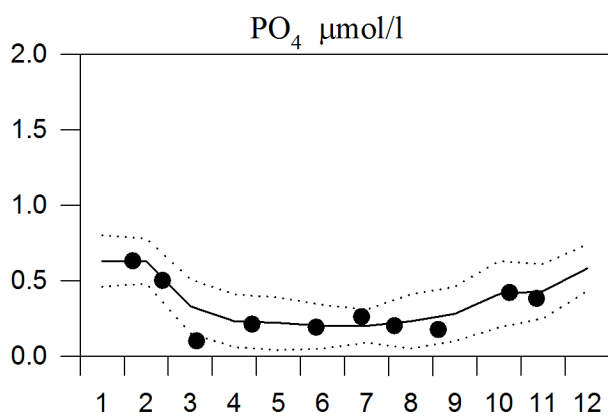
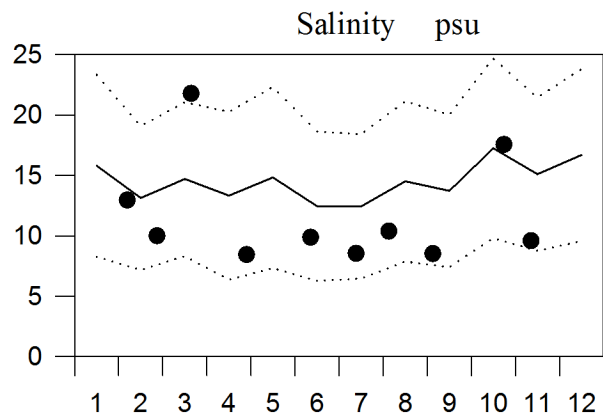
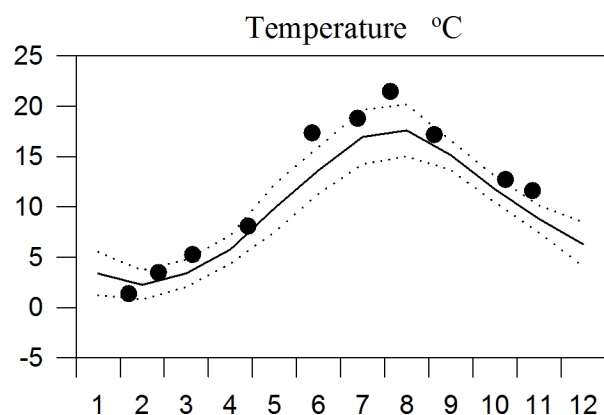
— Mean 1996-2010 St.Dev. ● 2014



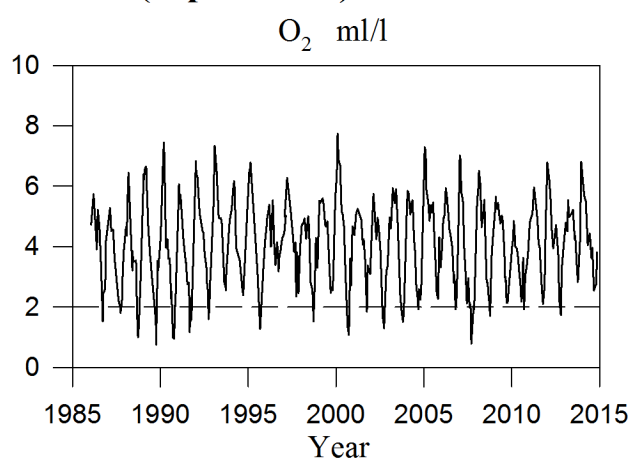
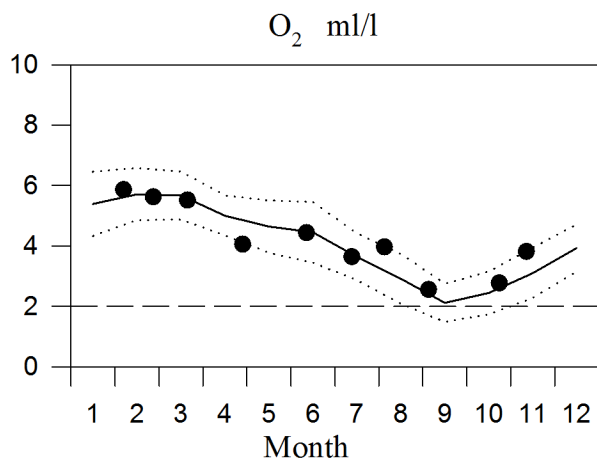
STATION W LANDSKRONA SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

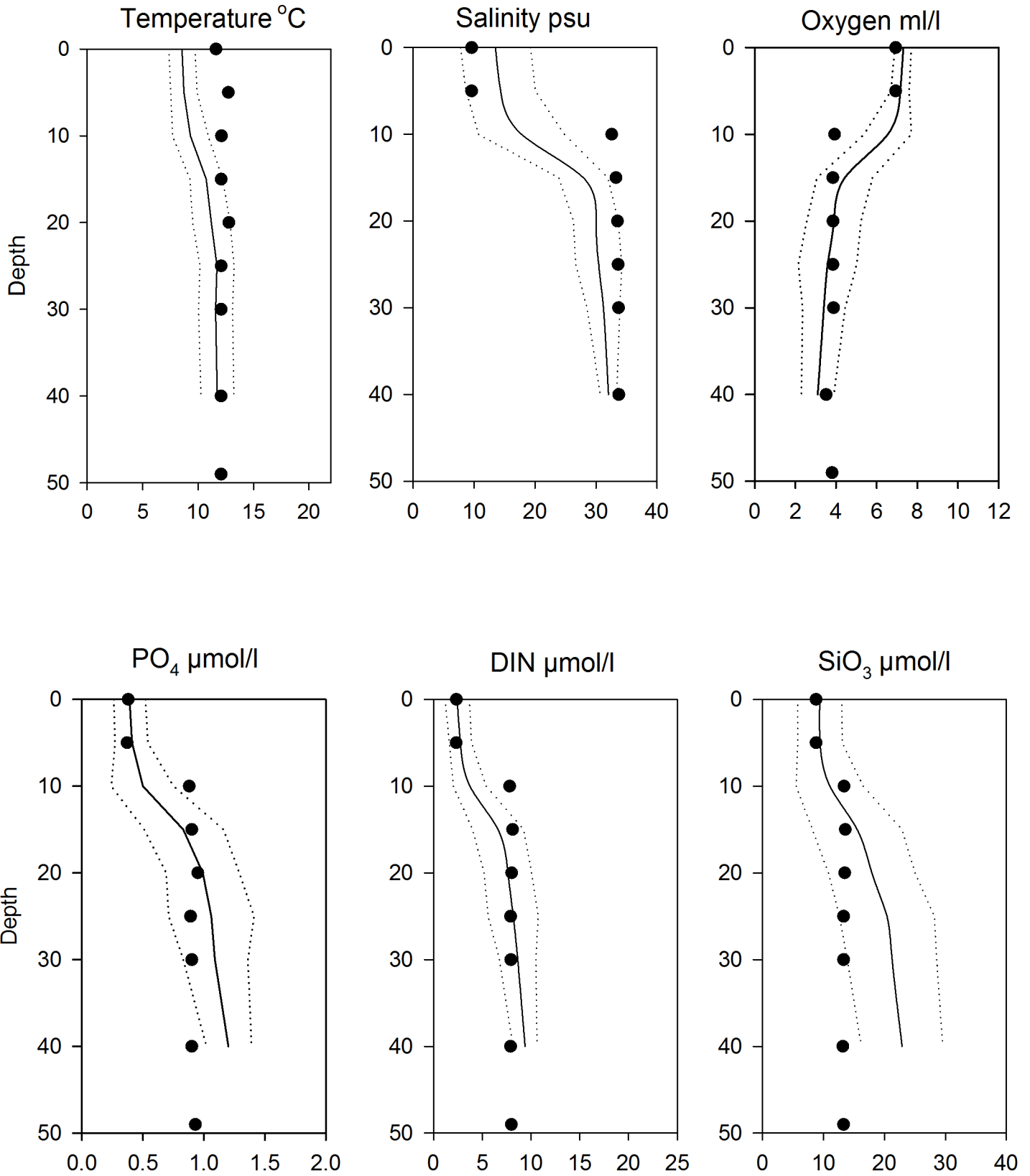


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles W Landskrona November

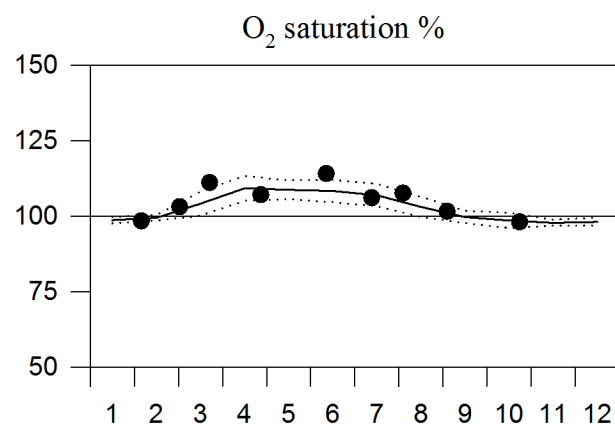
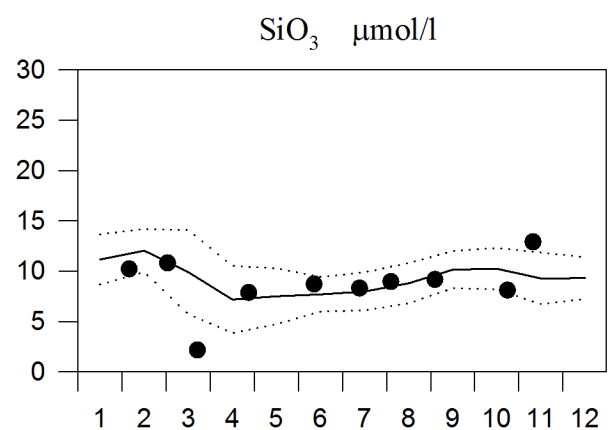
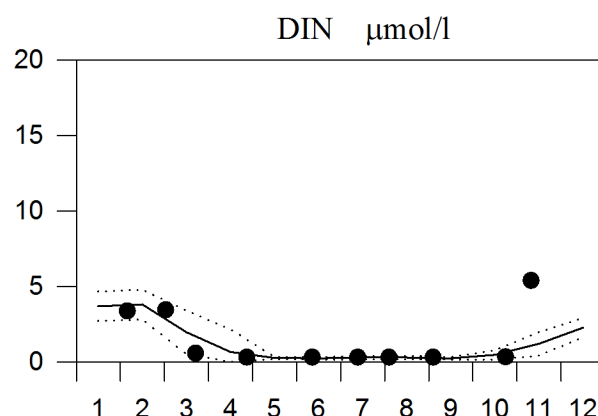
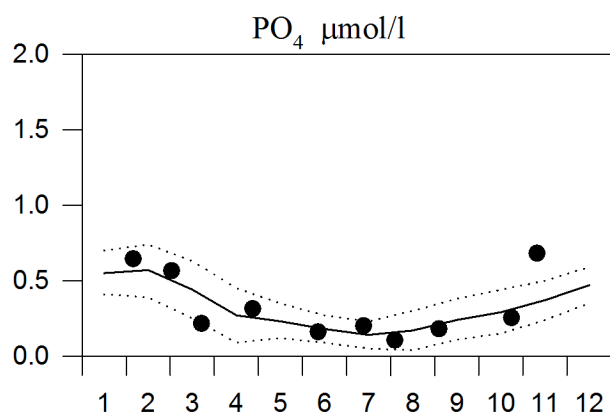
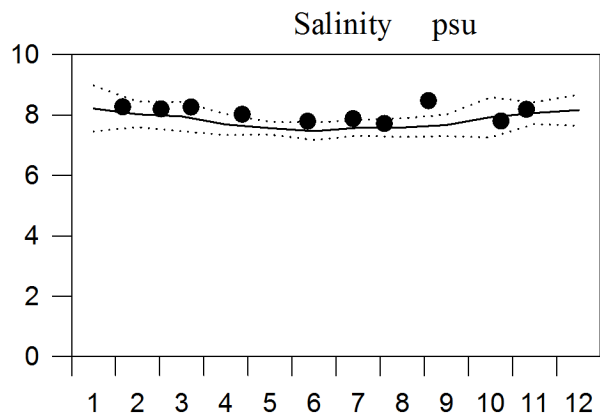
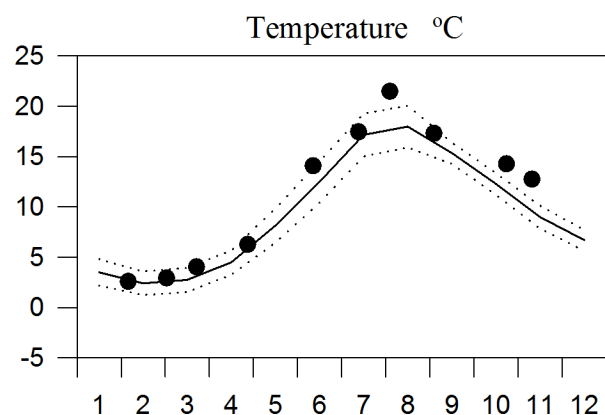
— Mean 1996-2010 St.Dev. ● 2014



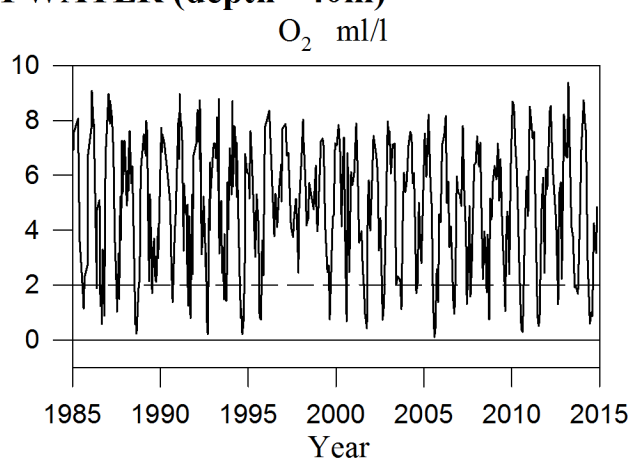
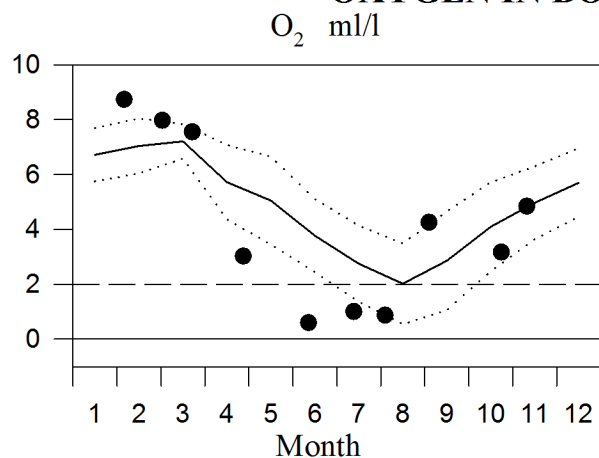
STATION BY1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

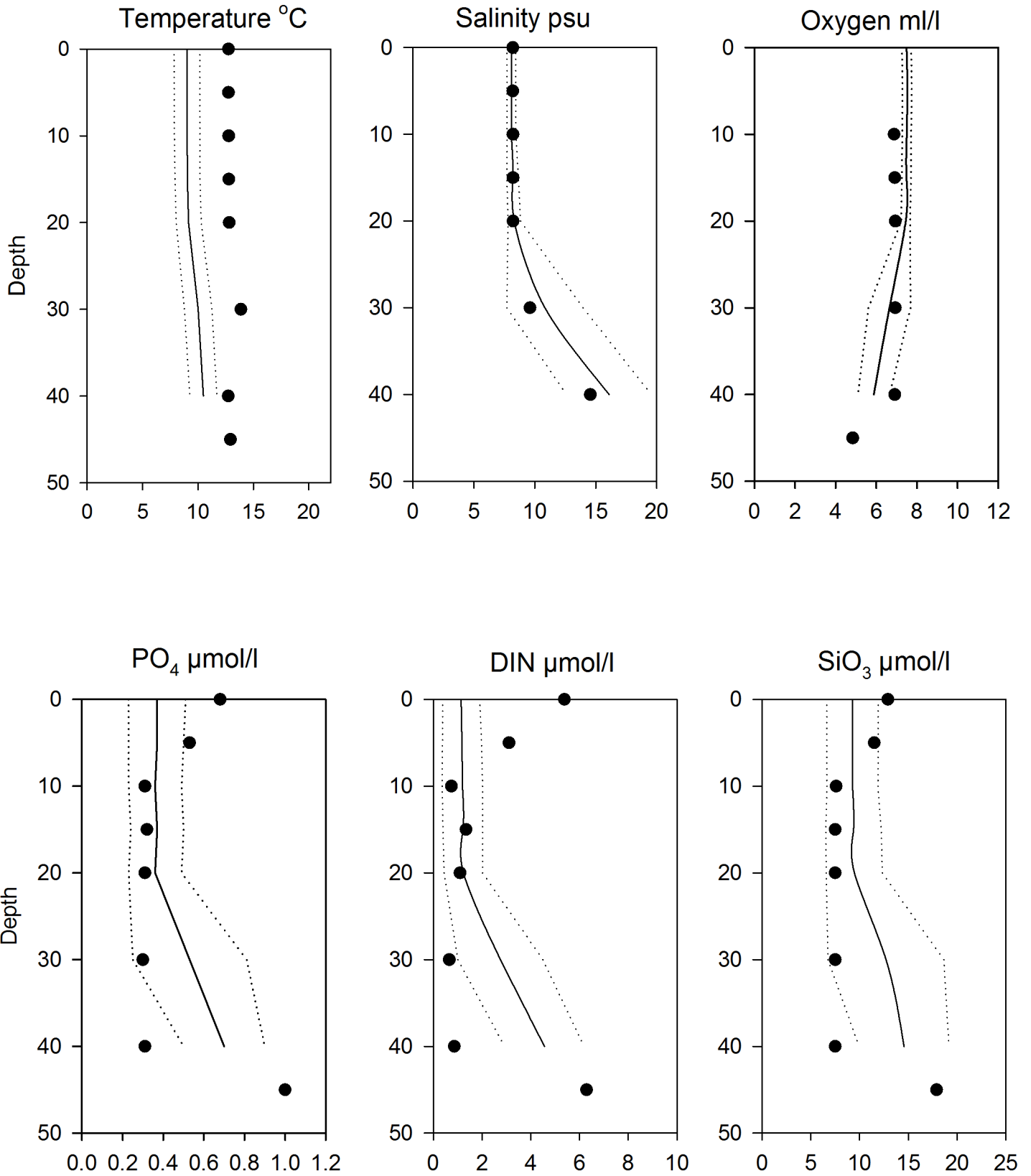


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY1 November

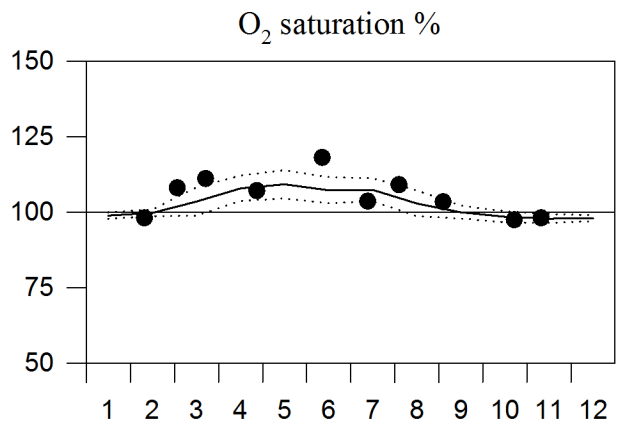
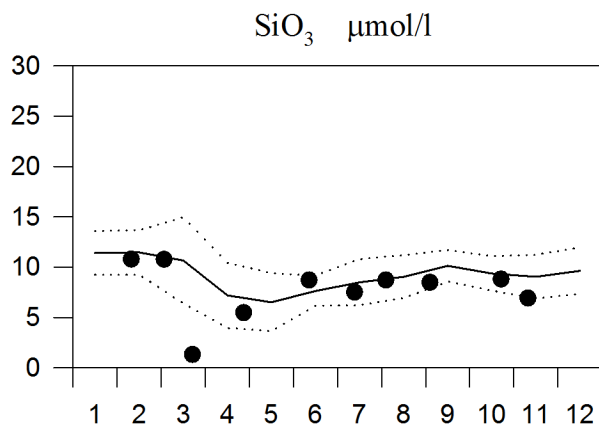
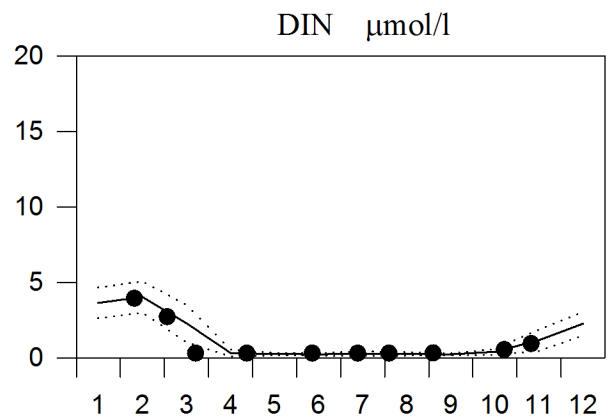
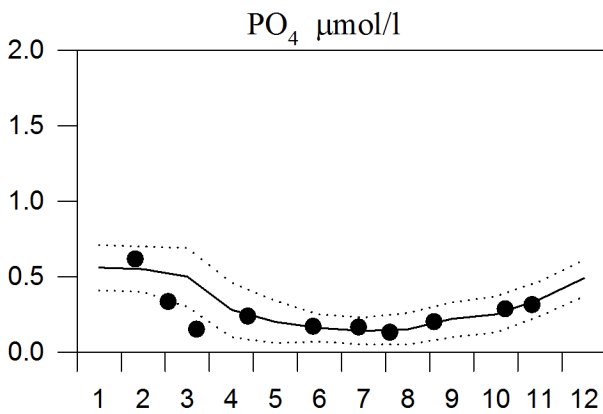
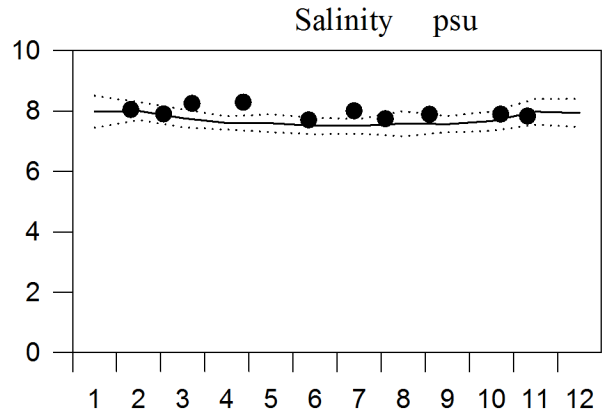
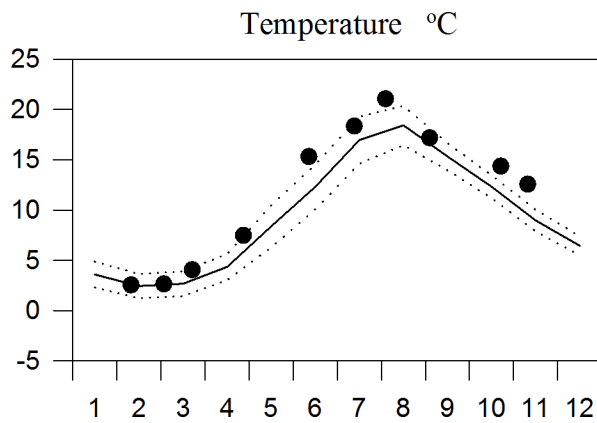
— Mean 1996-2010 St.Dev. ● 2014



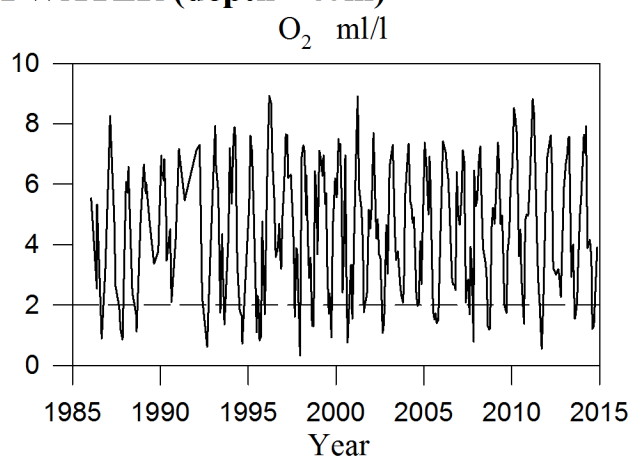
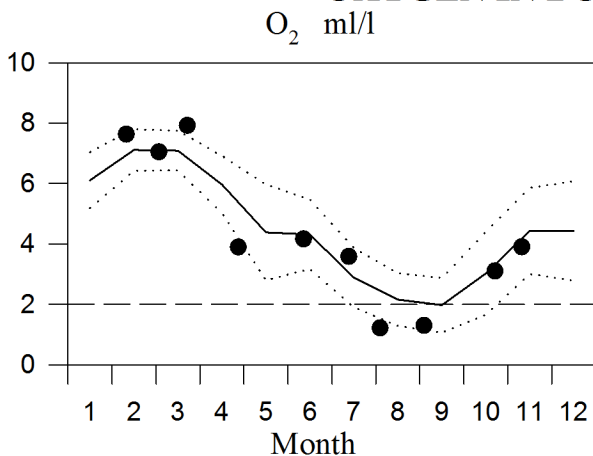
STATION BY2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

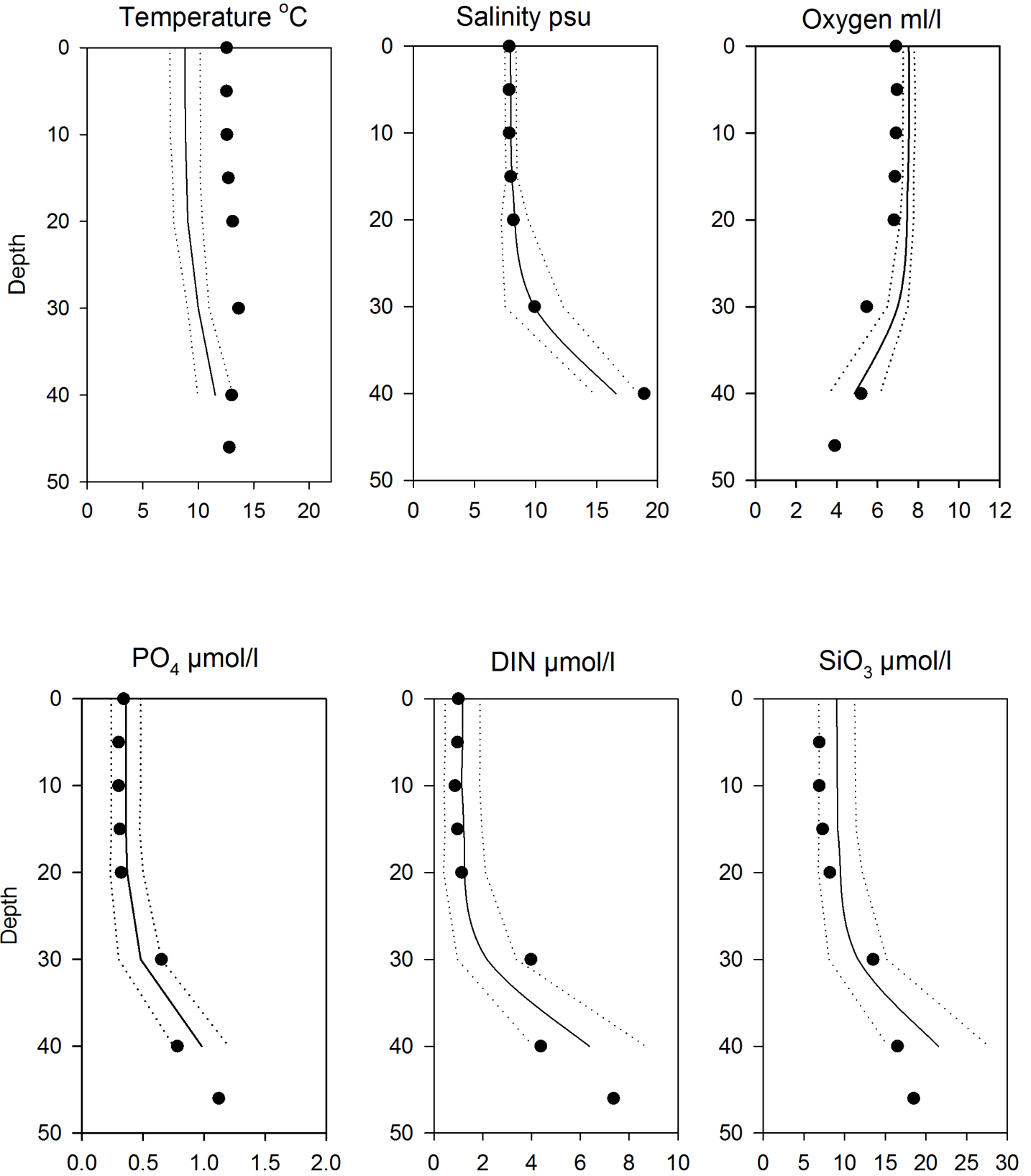


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY2 November

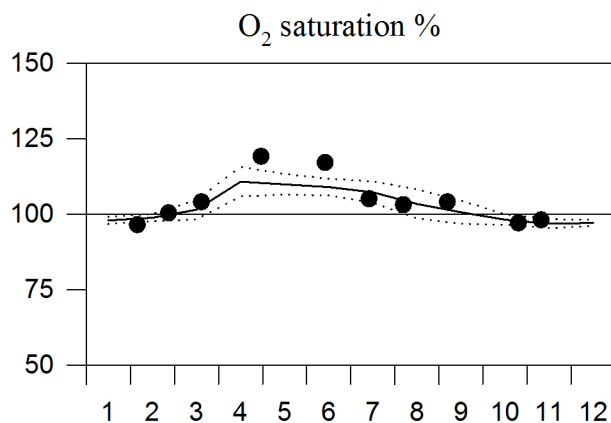
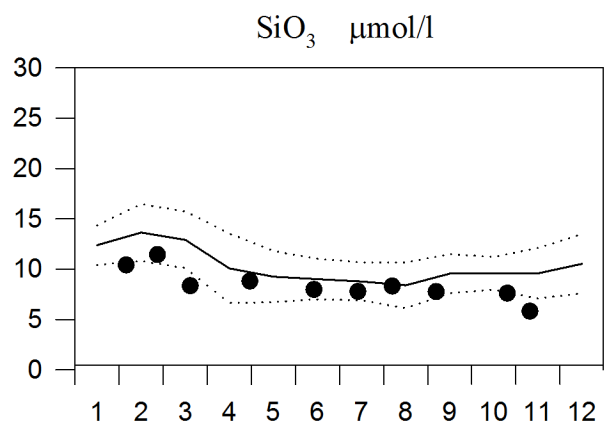
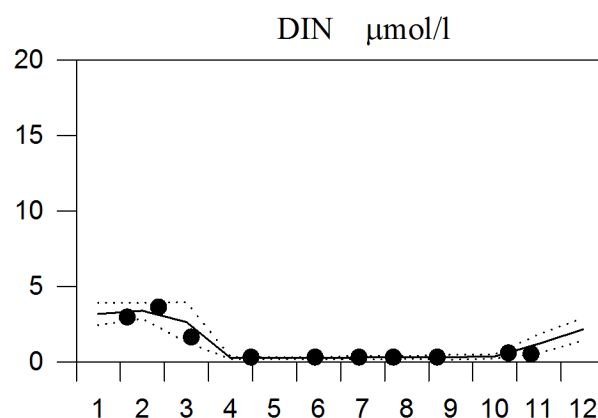
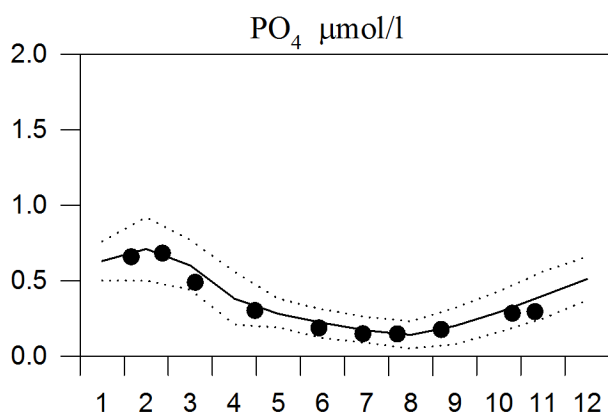
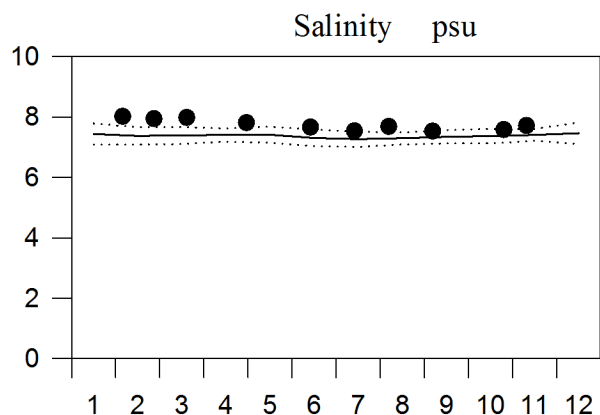
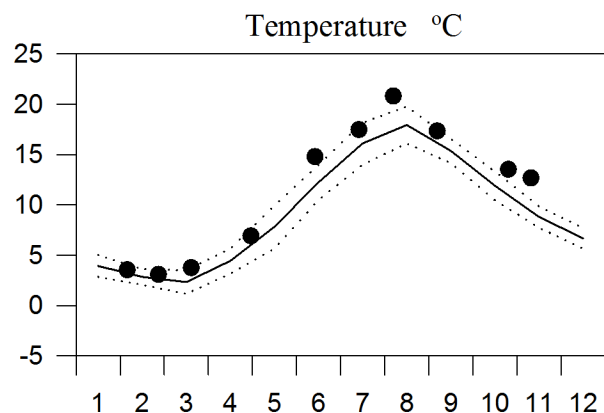
— Mean 1996-2010 St.Dev. ● 2014



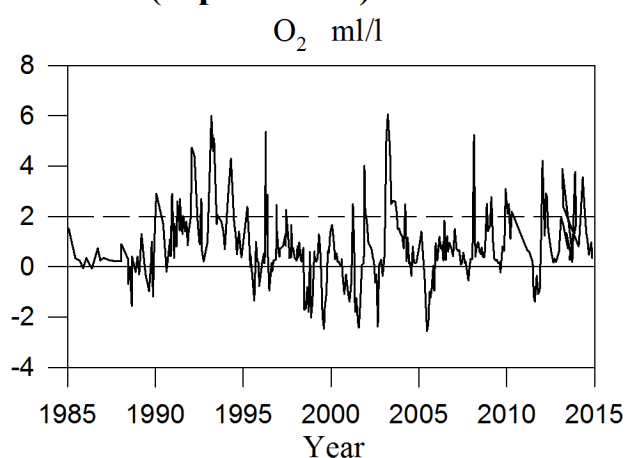
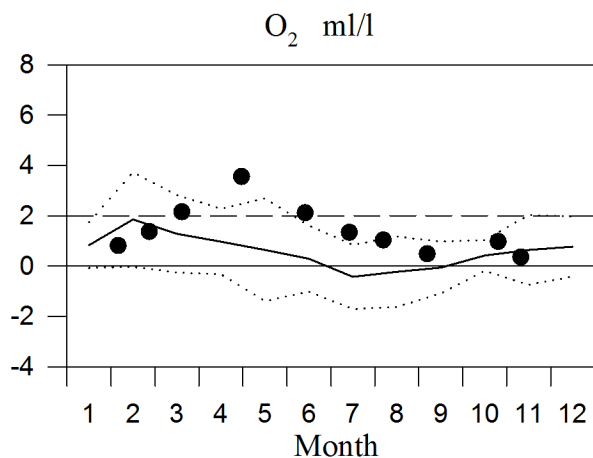
STATION HANÖBUKTEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

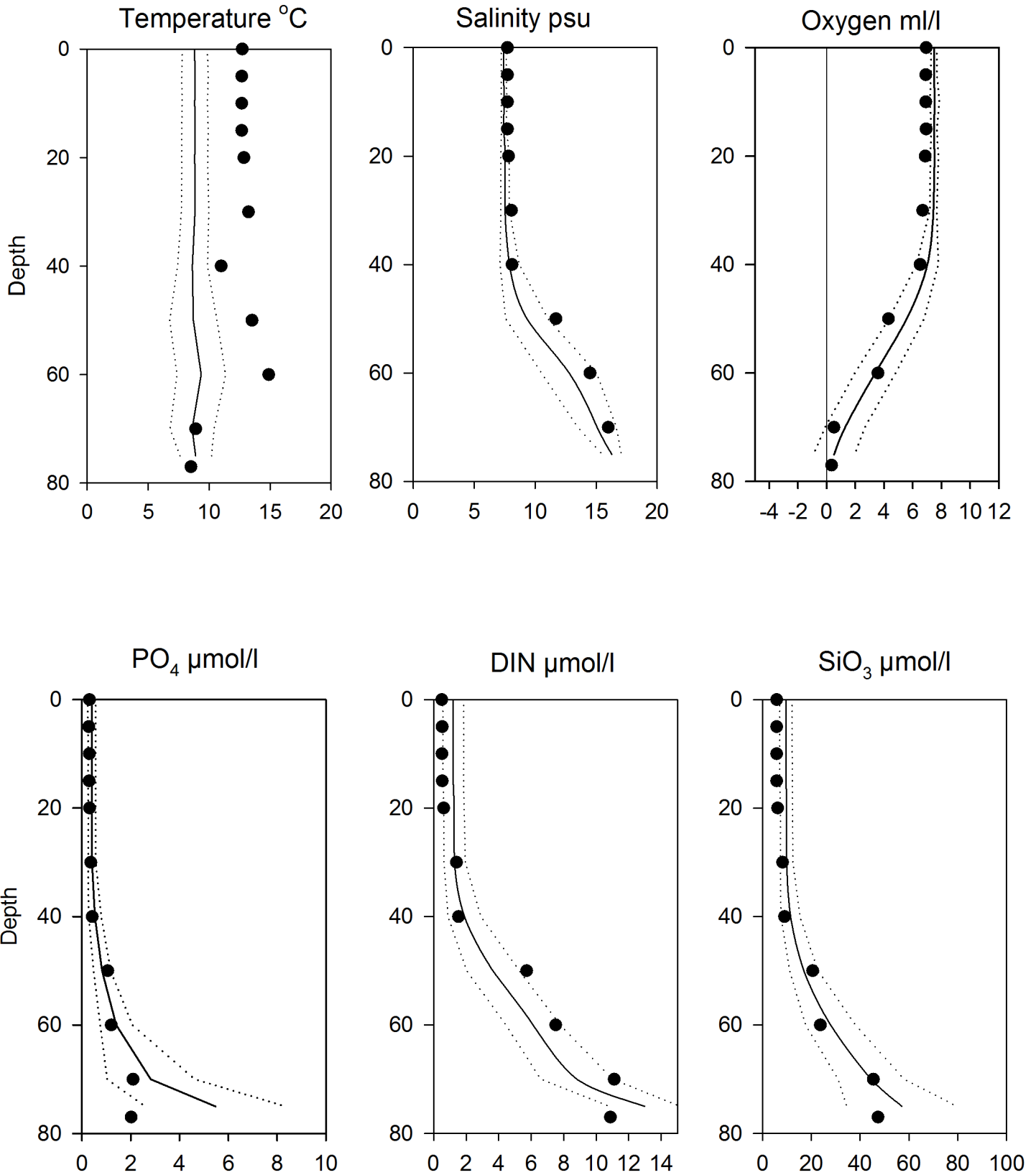


OXYGEN IN BOTTOM WATER (depth > 70m)



Vertical profiles Hanöbukten November

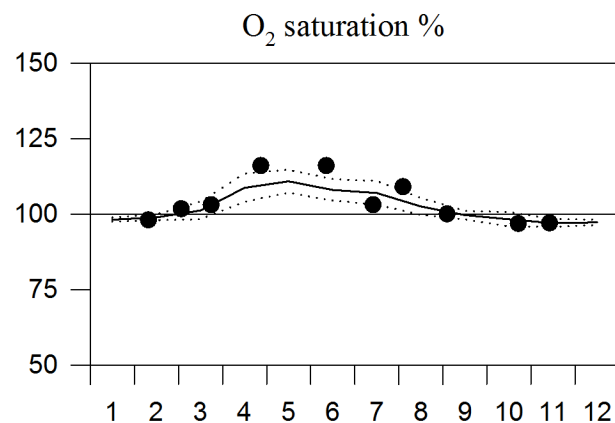
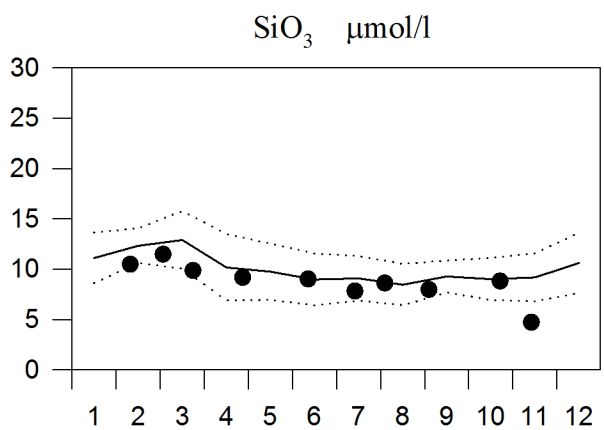
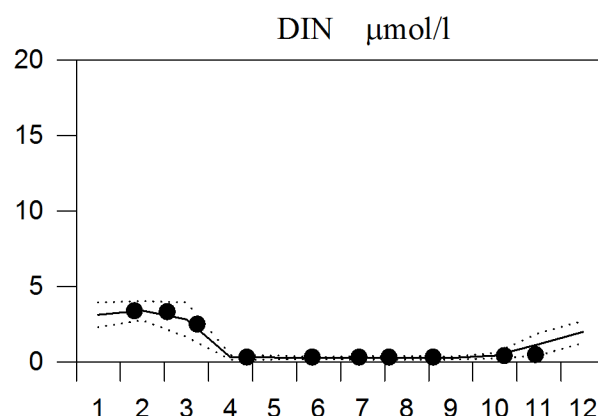
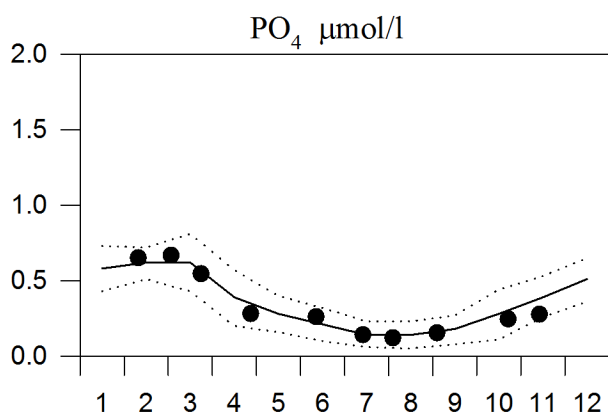
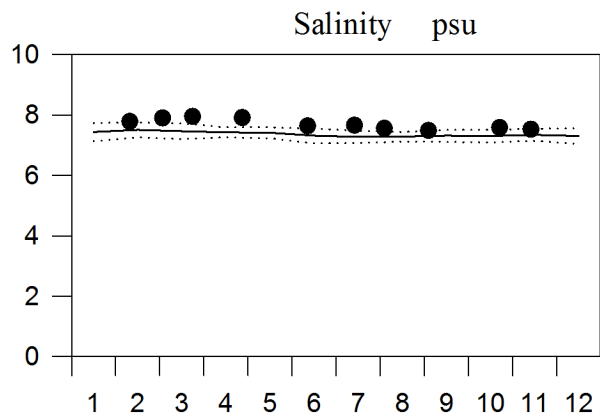
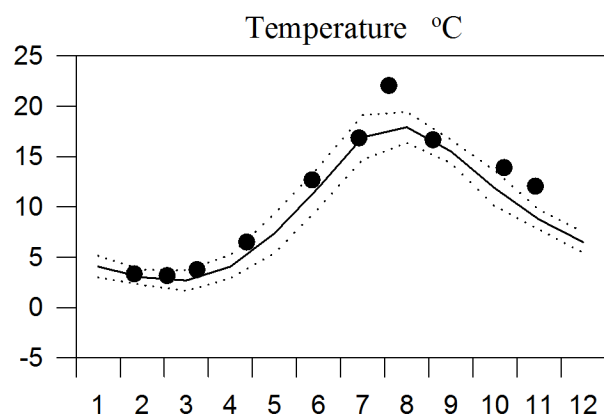
— Mean 1996-2010 St.Dev. ● 2014



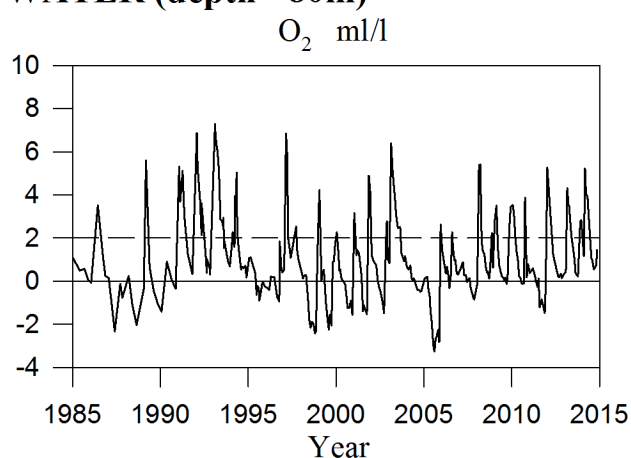
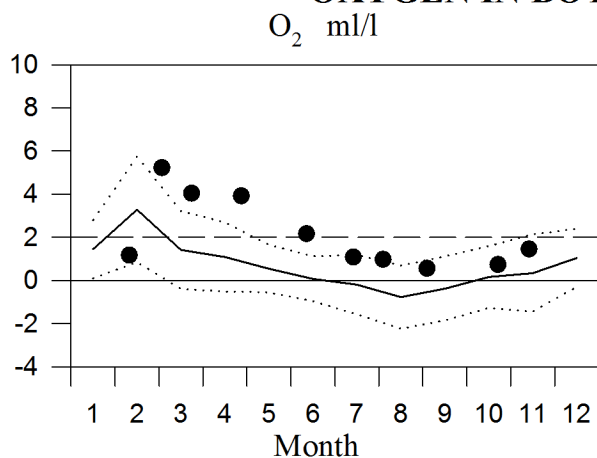
STATION BY4 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



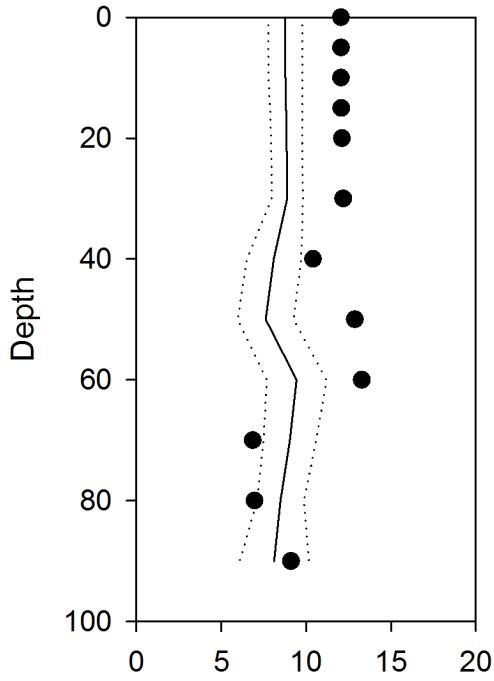
OXYGEN IN BOTTOM WATER (depth >80m)



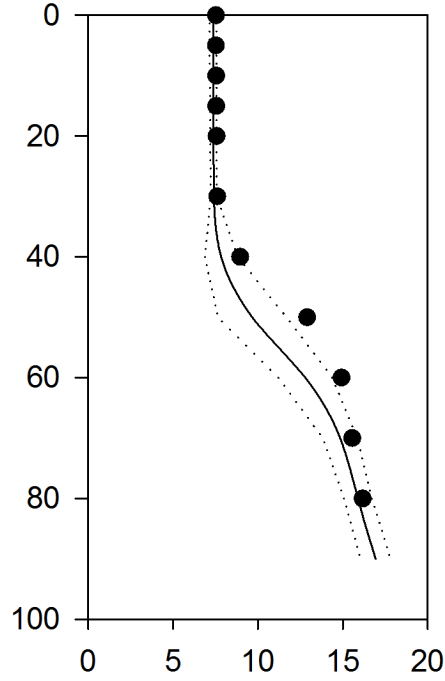
Vertical profiles BY4 November

— Mean 1996-2010 St.Dev. ● 2014

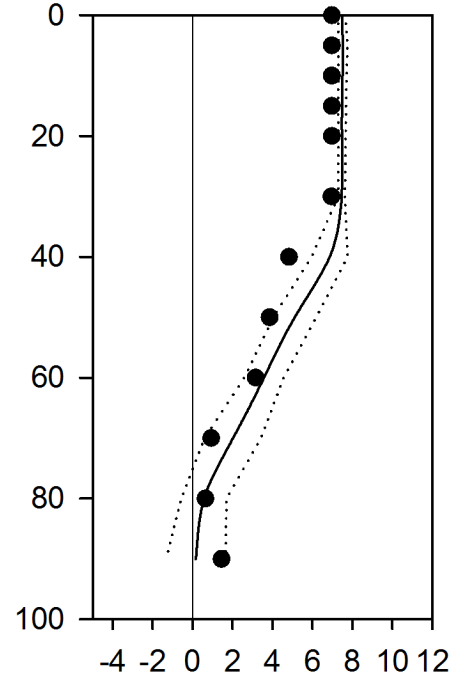
Temperature °C



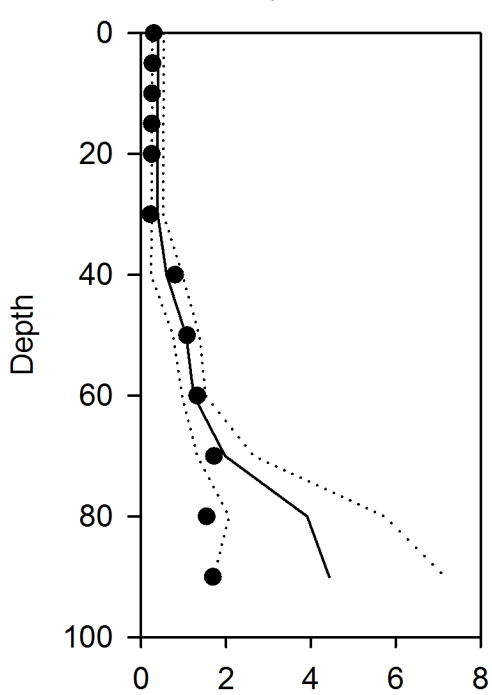
Salinity psu



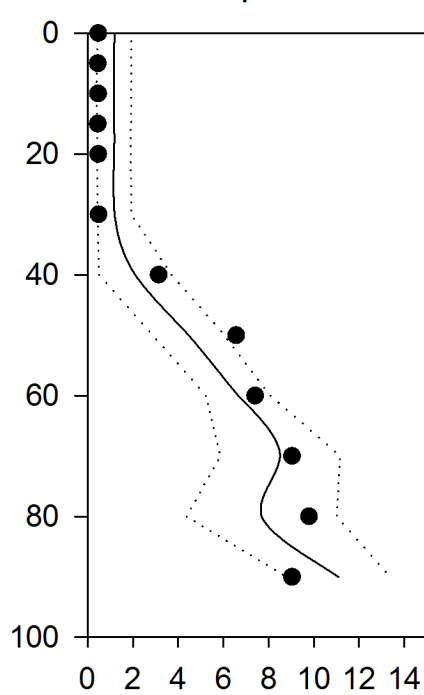
Oxygen ml/l



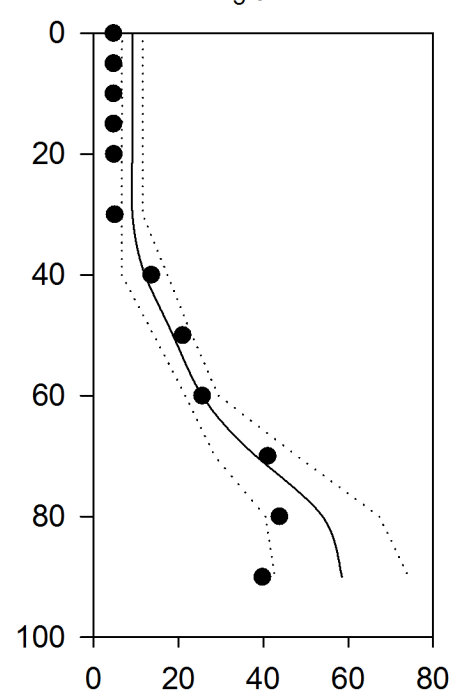
PO₄ μmol/l



DIN μmol/l



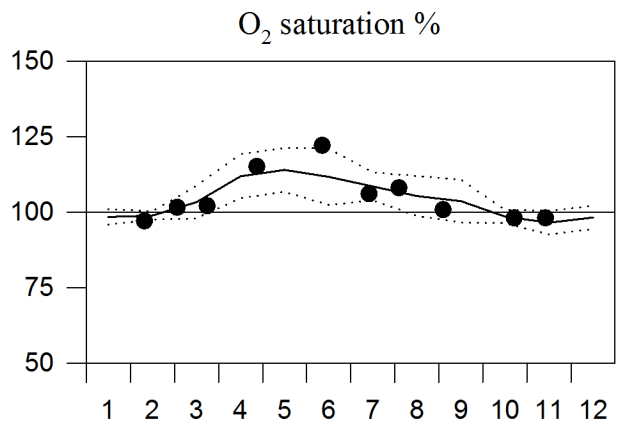
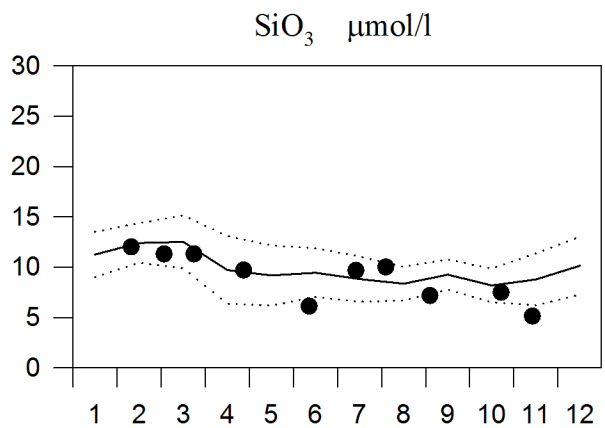
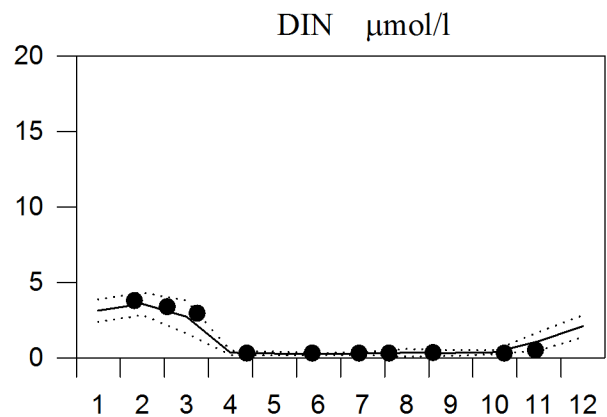
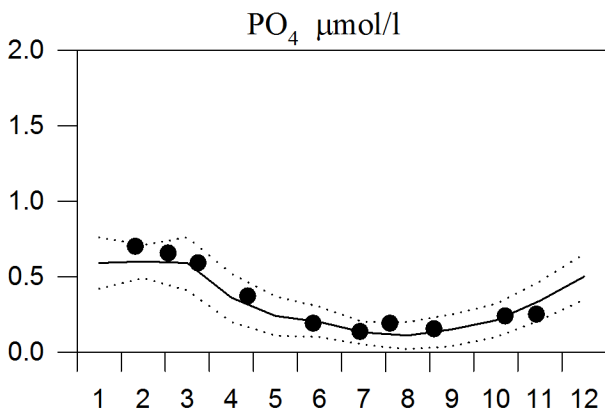
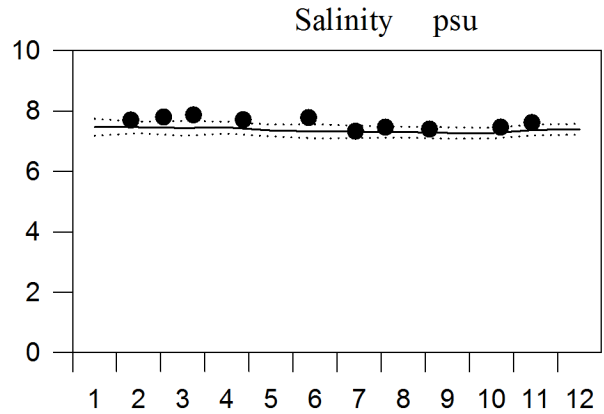
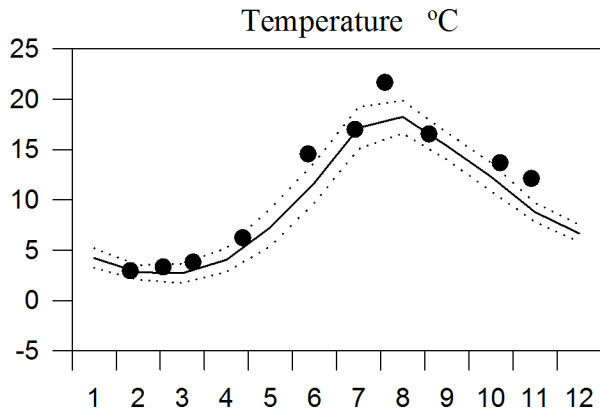
SiO₃ μmol/l



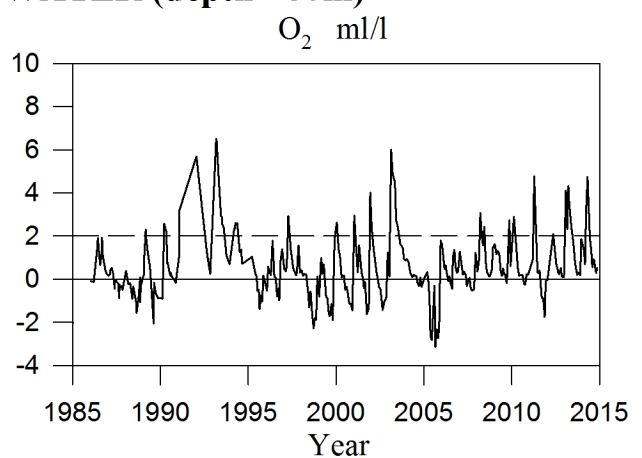
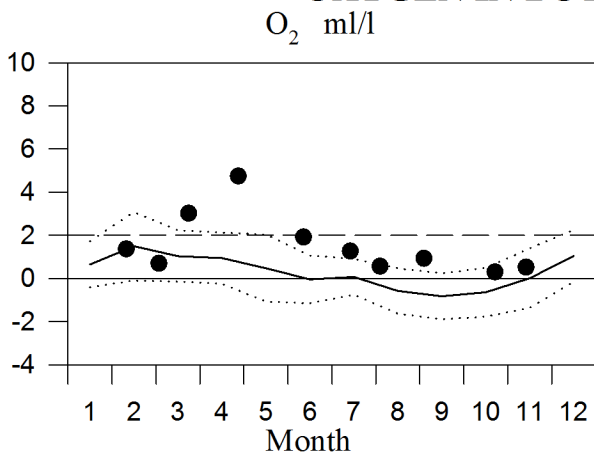
STATION BY5 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

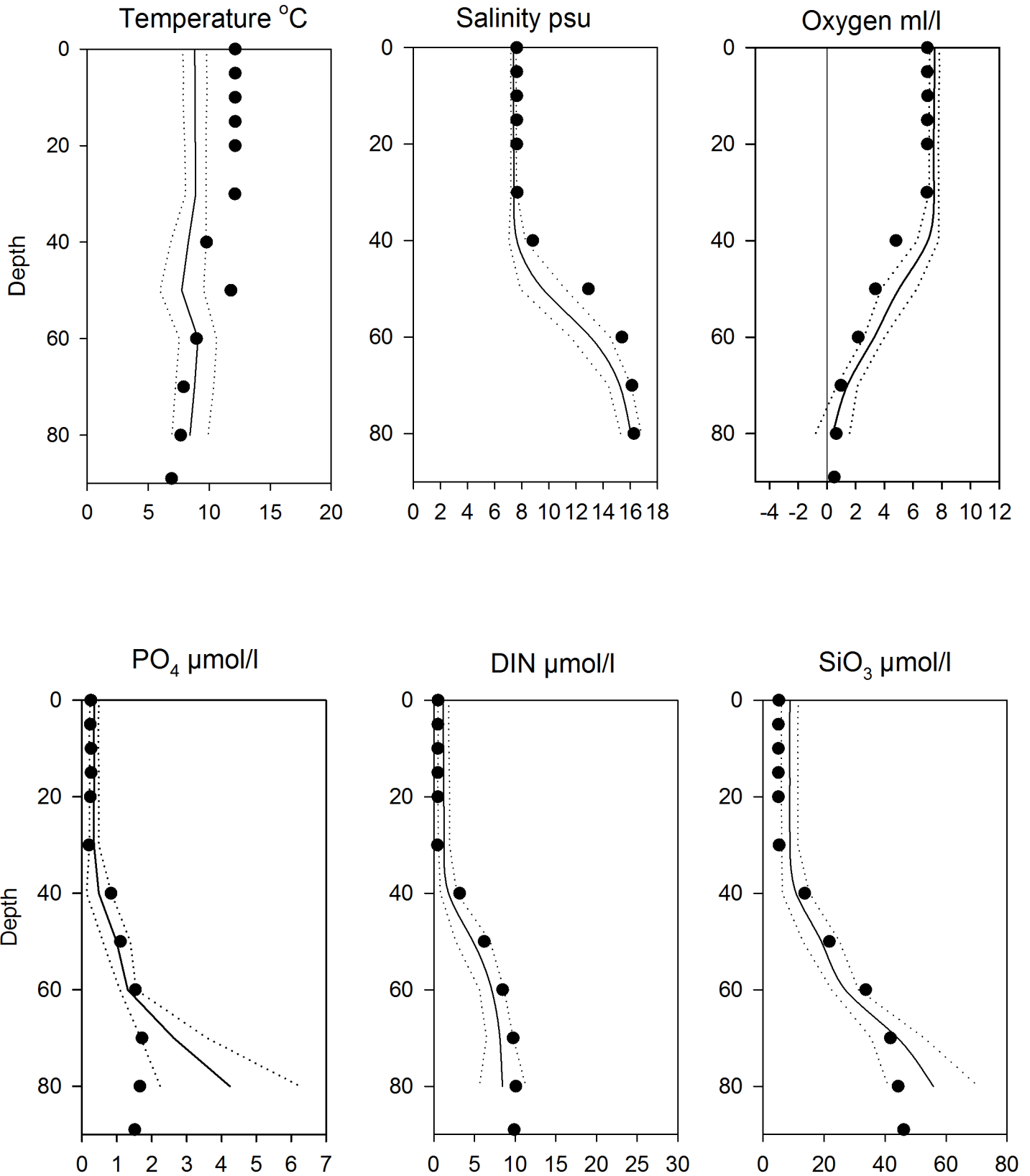


OXYGEN IN BOTTOM WATER (depth >80m)



Vertical profiles BY5 November

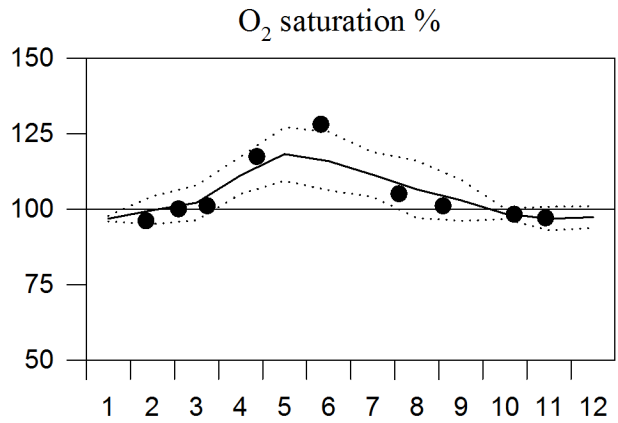
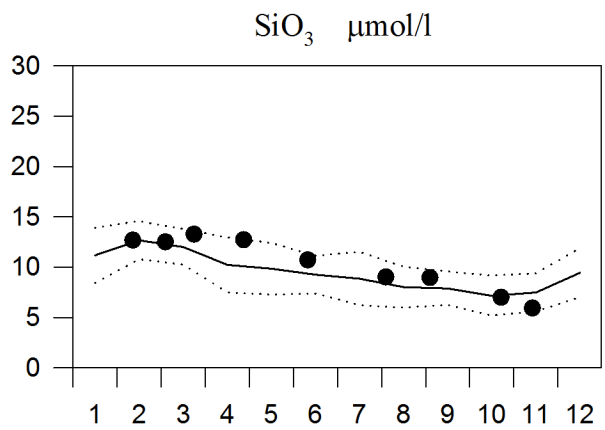
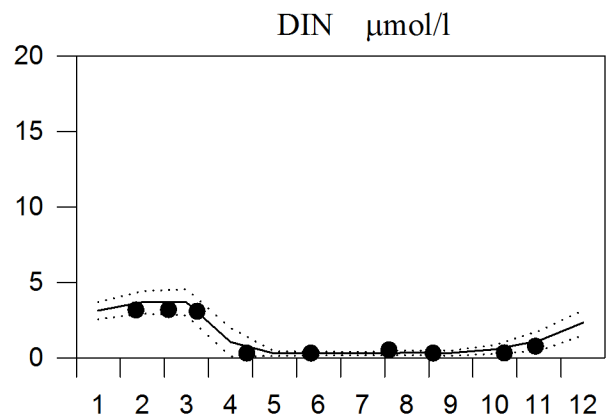
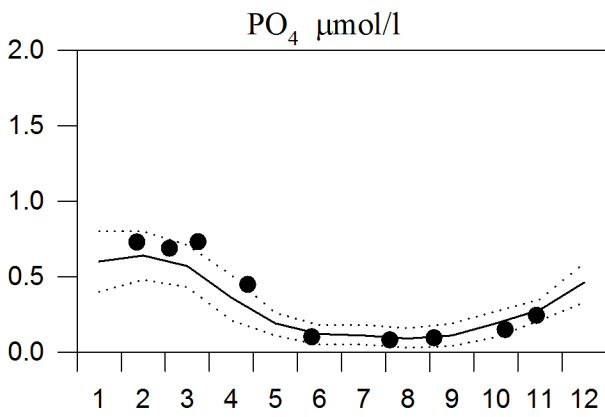
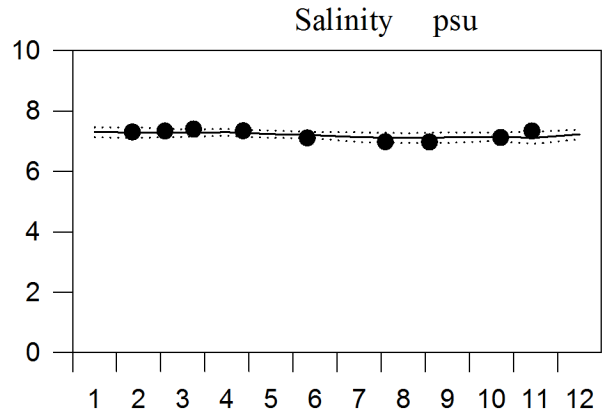
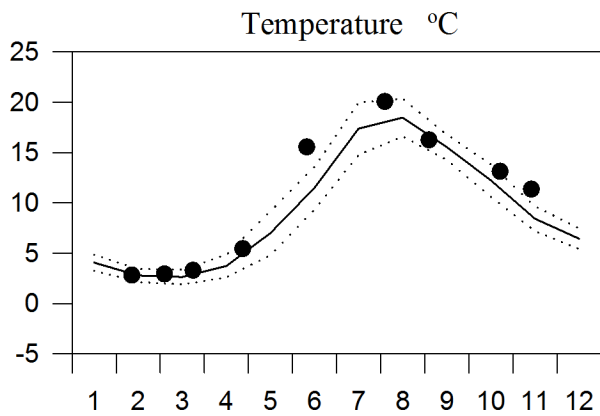
— Mean 1996-2010 St.Dev. ● 2014



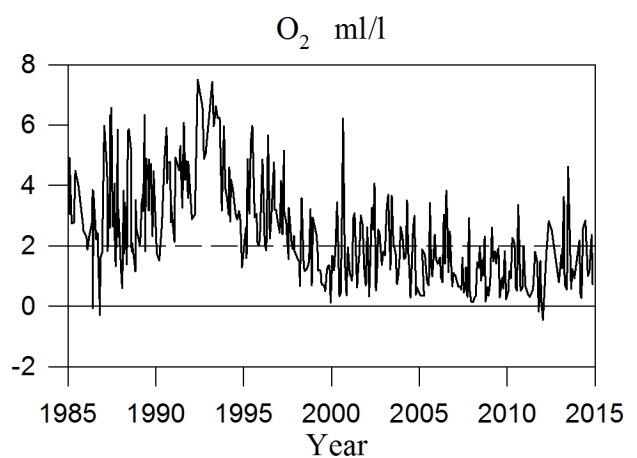
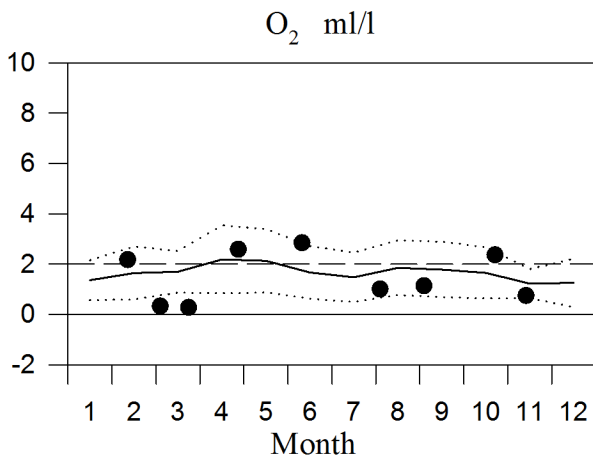
STATION BCS III-10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

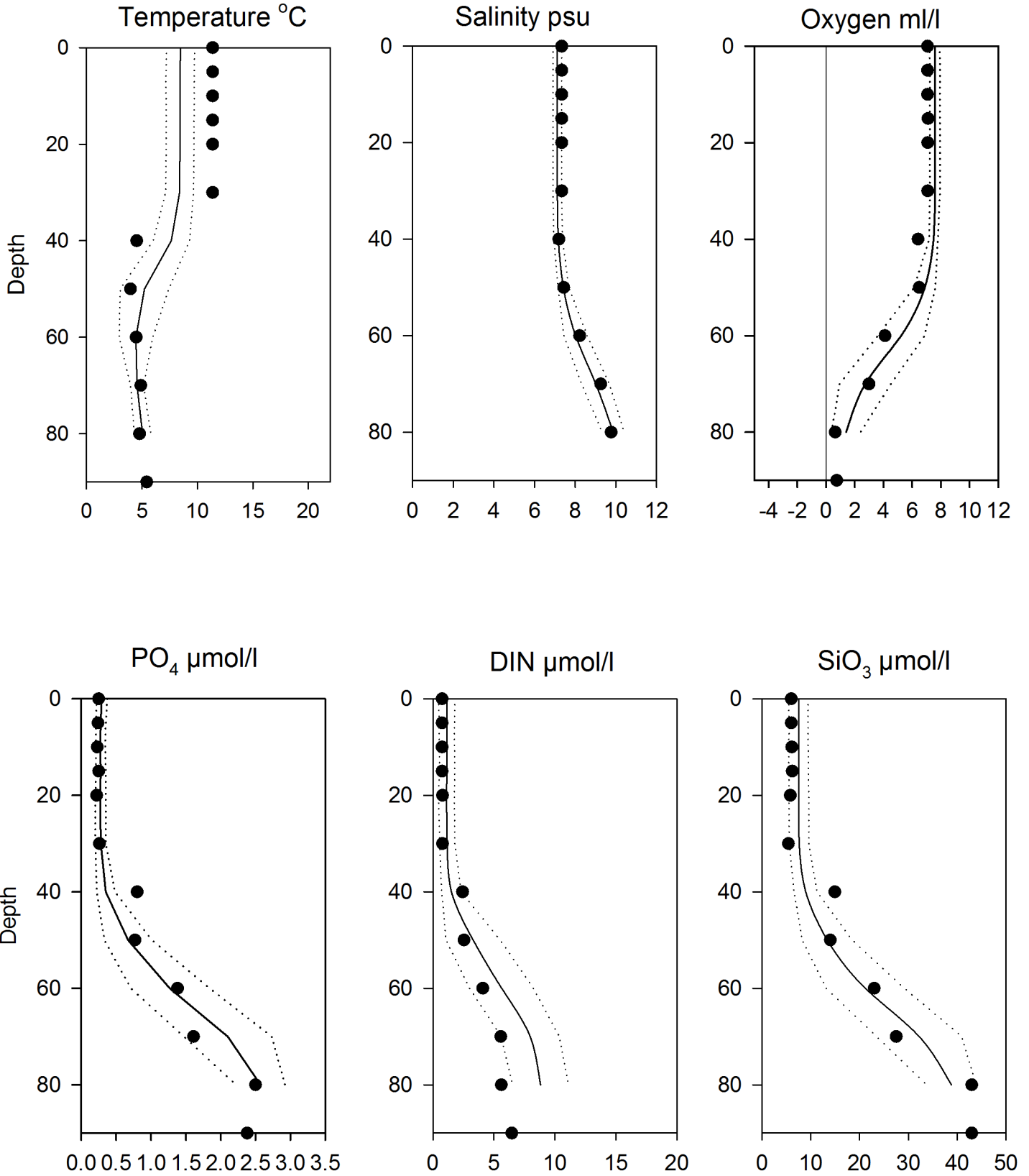


OXYGEN IN BOTTOM WATER (depth > 80m)



Vertical profiles BCS III-10 November

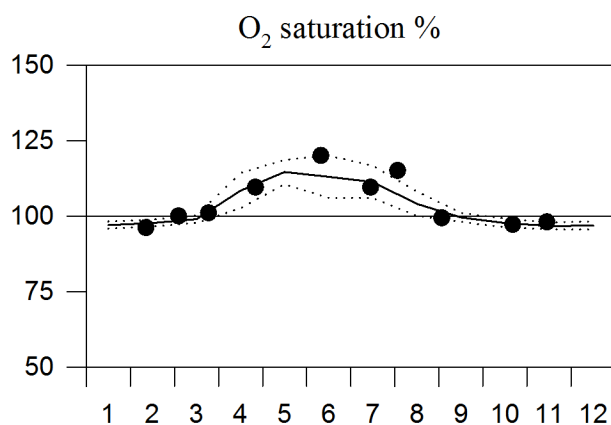
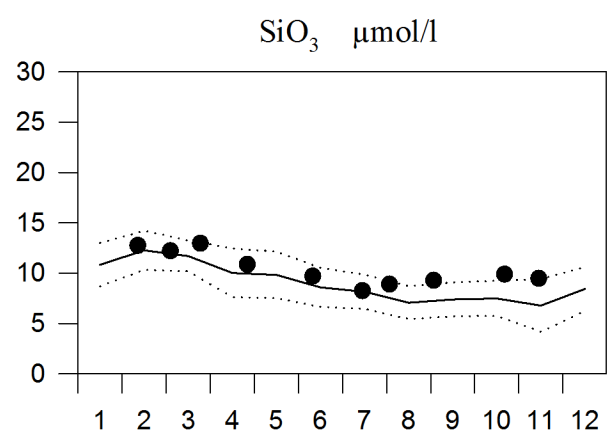
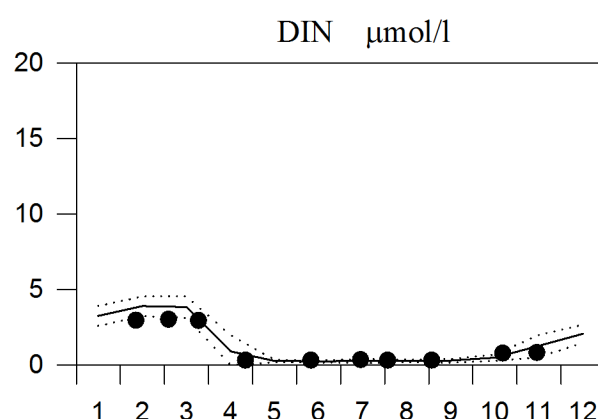
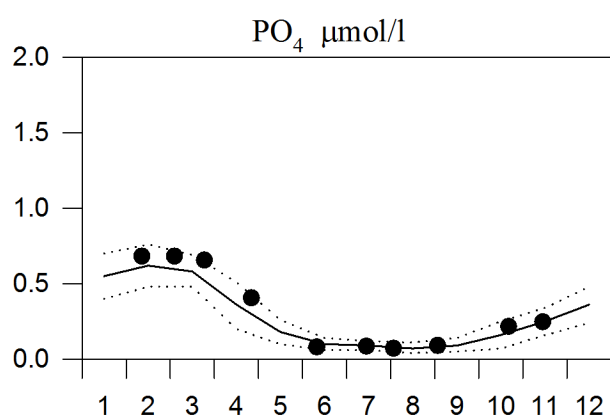
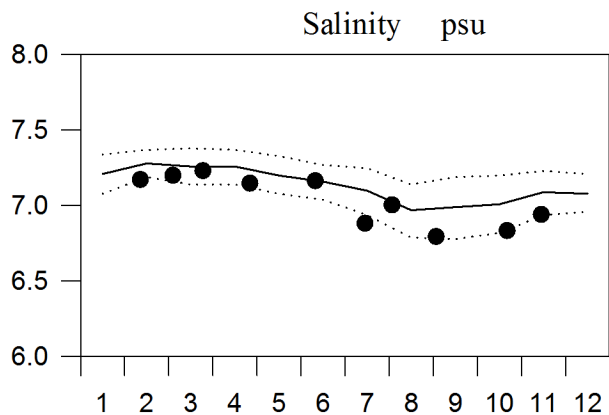
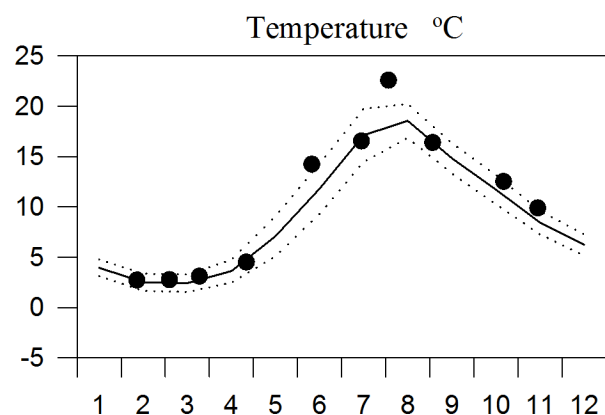
— Mean 1996-2010 St.Dev. ● 2014



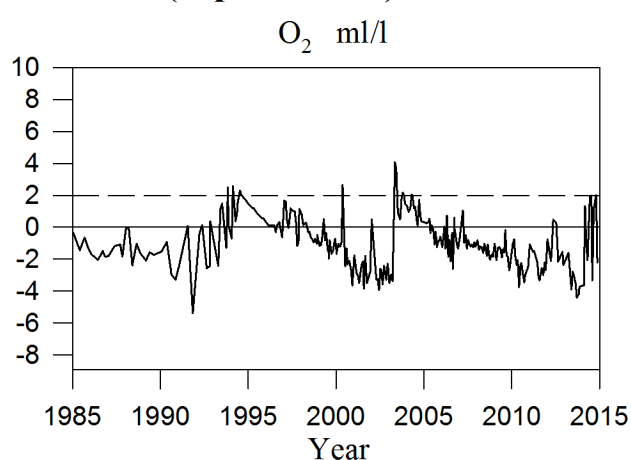
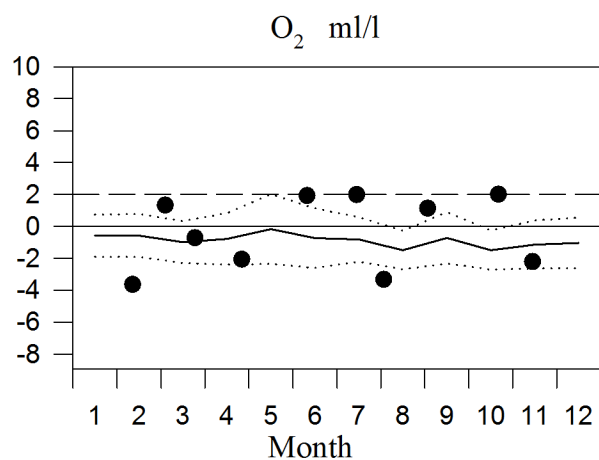
STATION BY10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

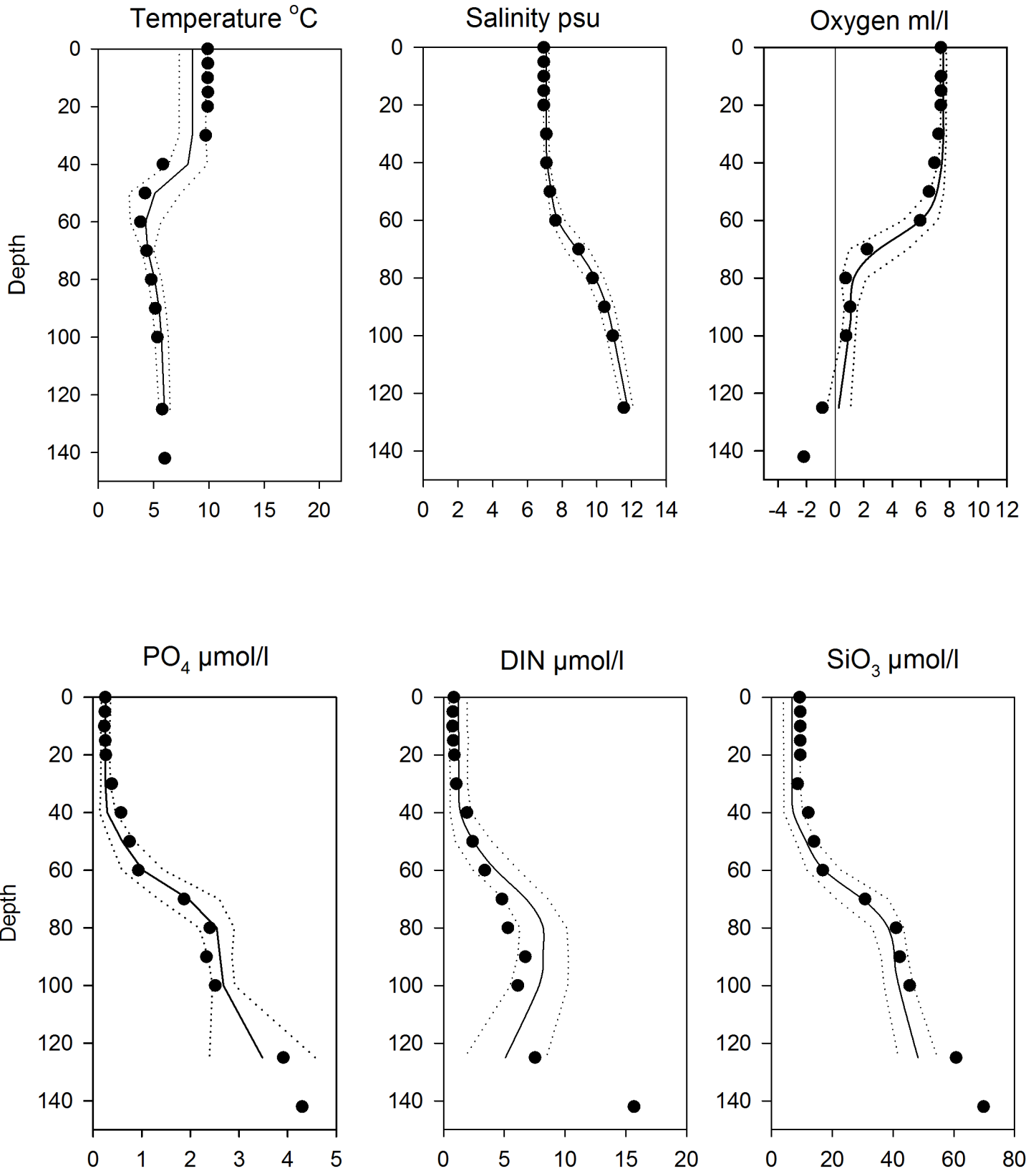


OXYGEN IN BOTTOM WATER (depth >125m)



Vertical profiles BY10 November

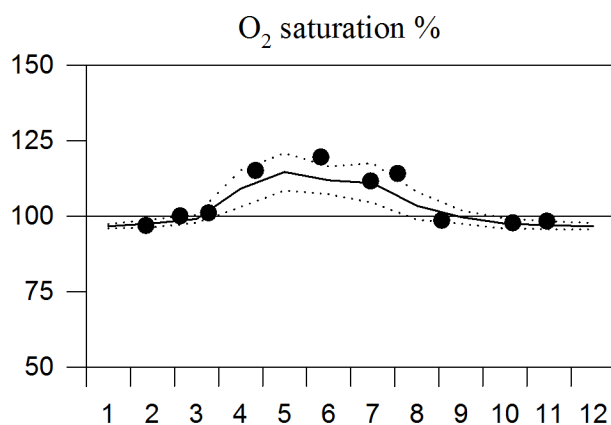
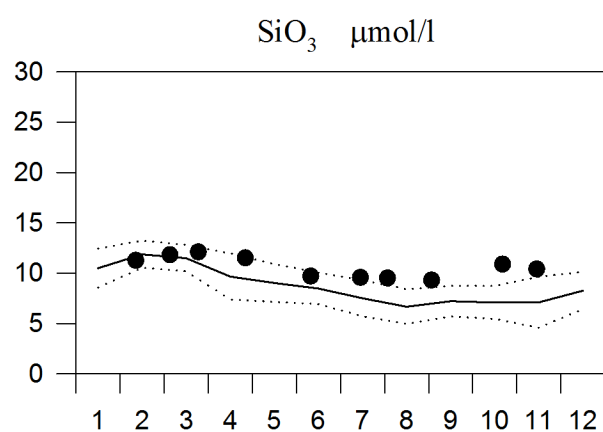
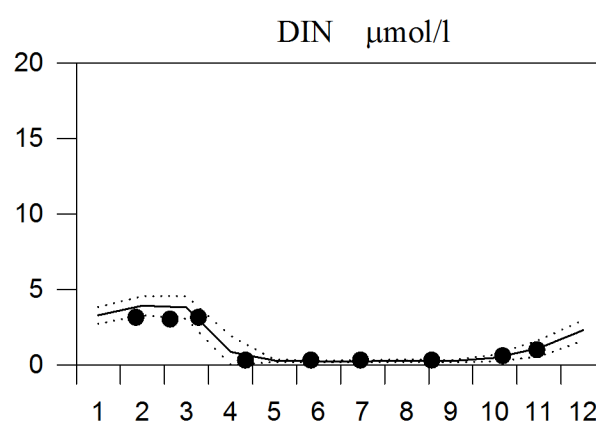
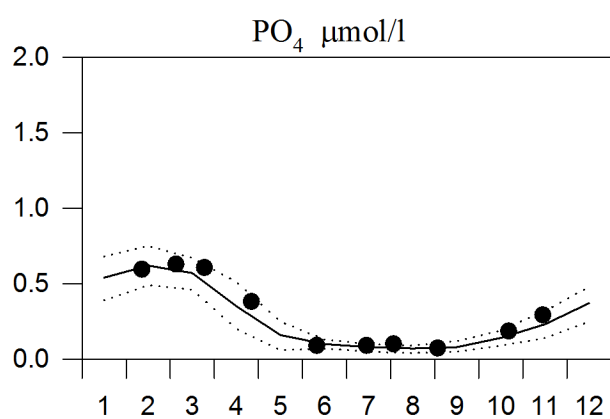
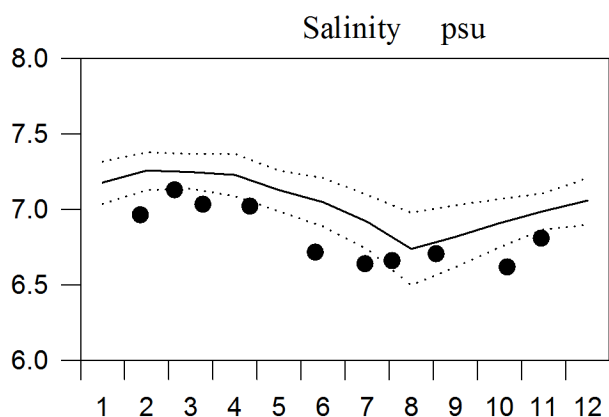
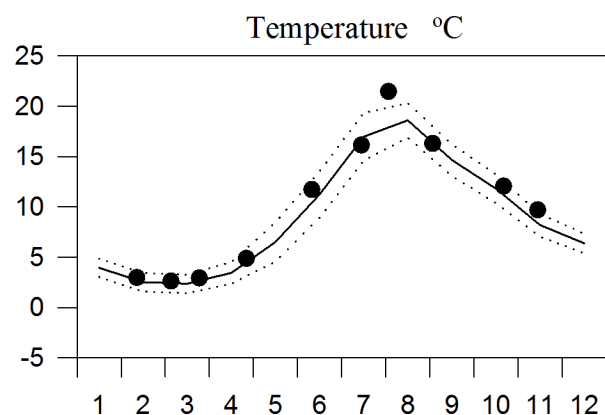
— Mean 1996-2010 St.Dev. ● 2014



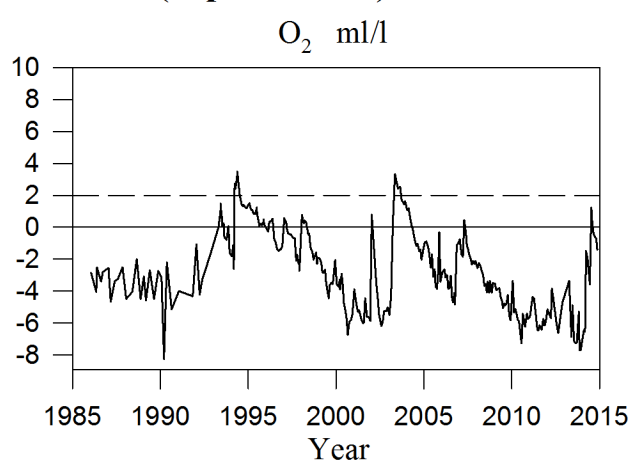
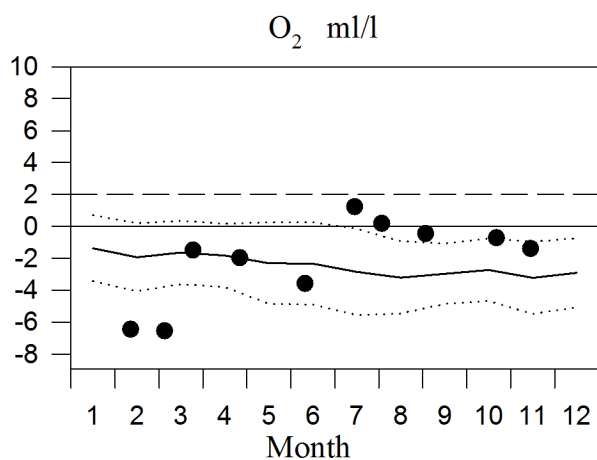
STATION BY15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



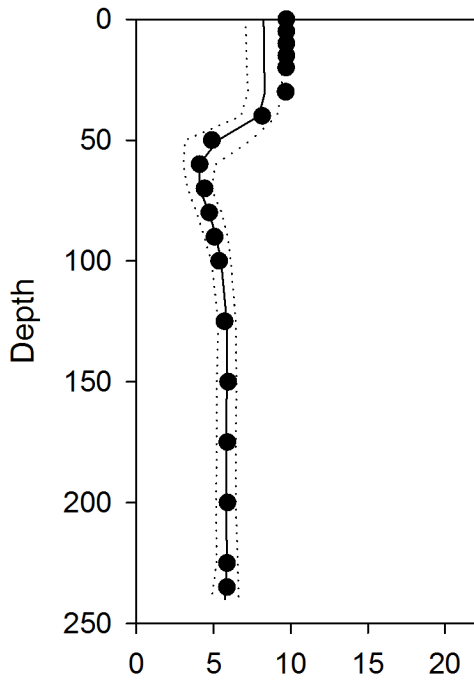
OXYGEN IN BOTTOM WATER (depth >225m)



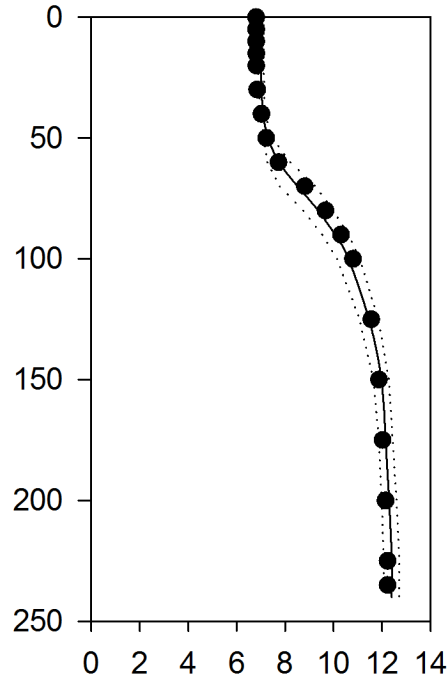
Vertical profiles BY15 November

— Mean 1996-2010 St.Dev. ● 2014

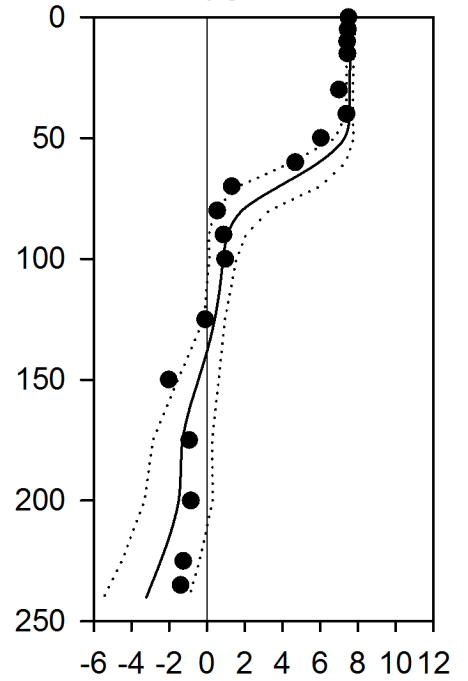
Temperature °C



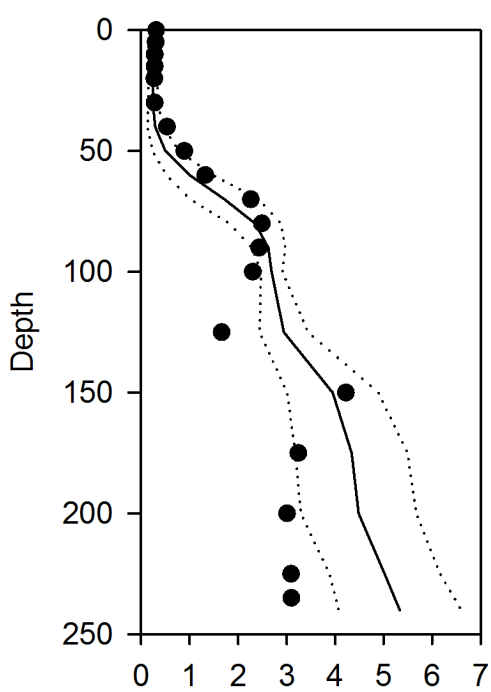
Salinity psu



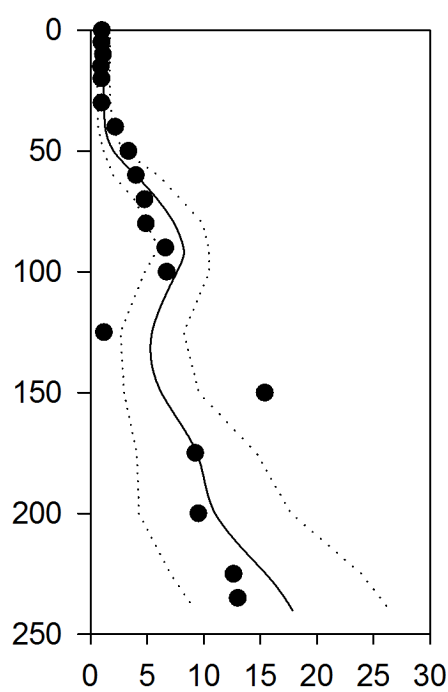
Oxygen ml/l



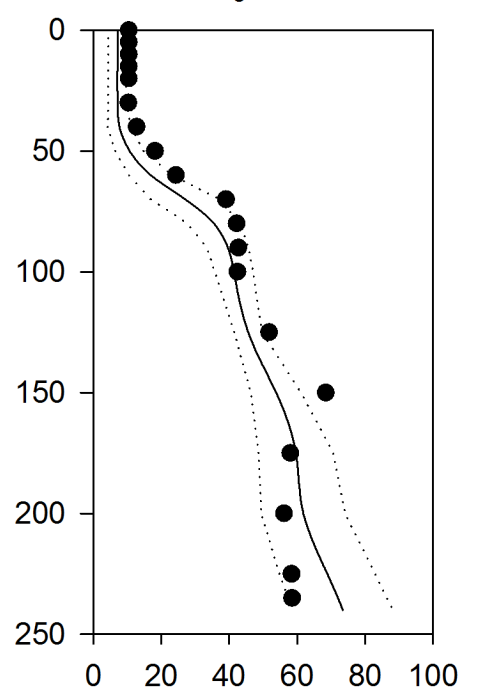
PO₄ μmol/l



DIN μmol/l



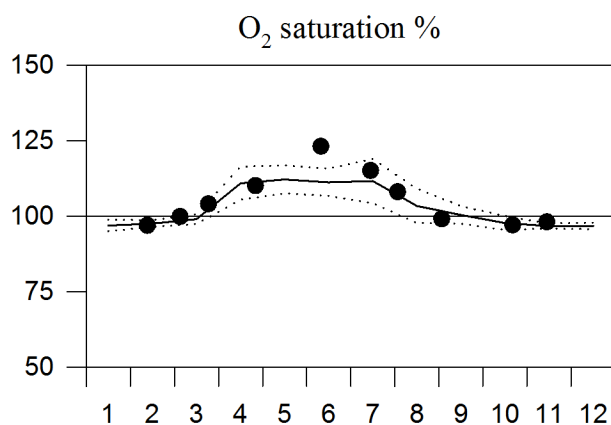
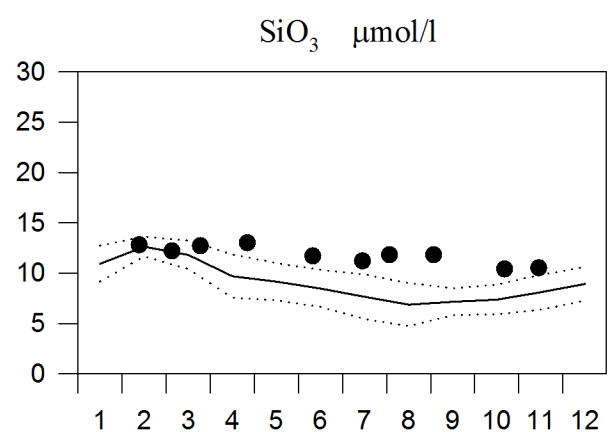
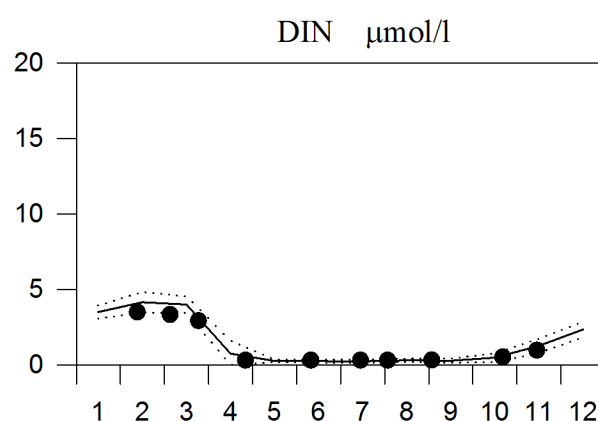
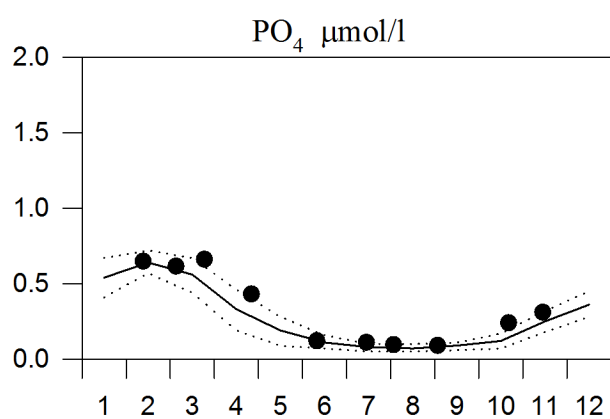
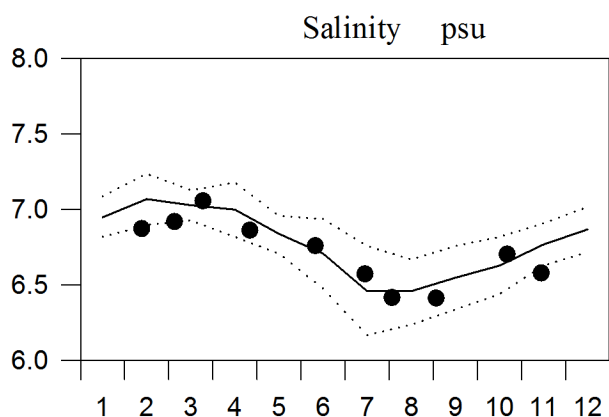
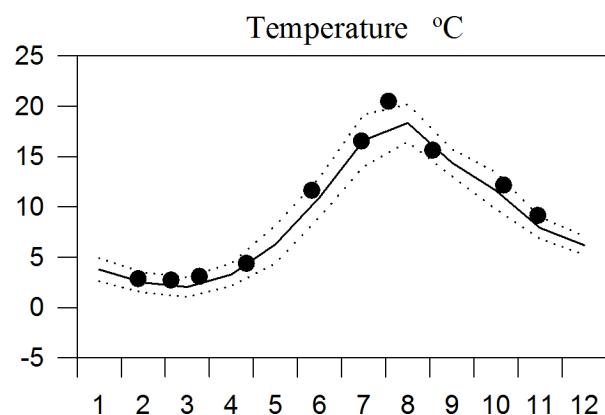
SiO₃ μmol/l



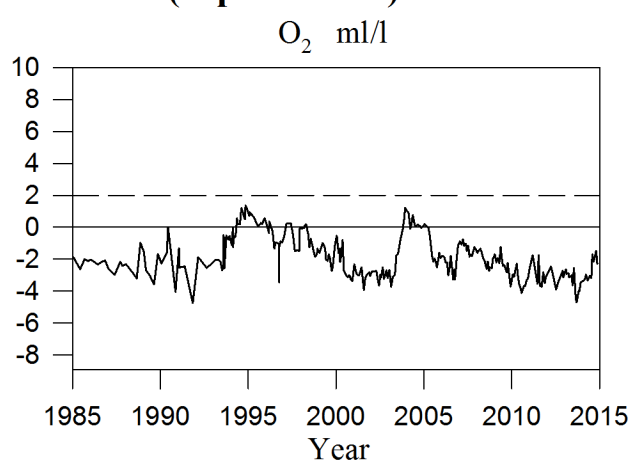
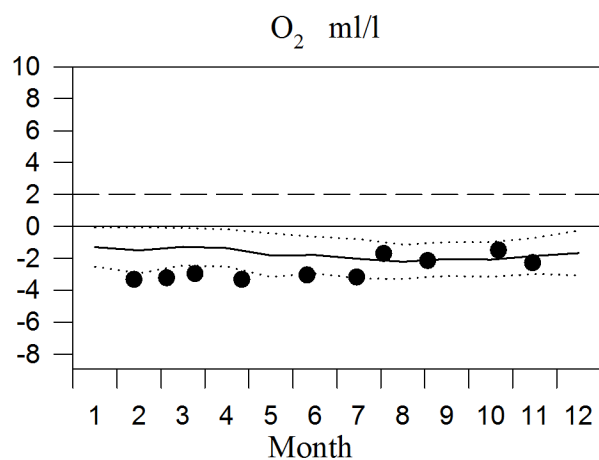
STATION BY20 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



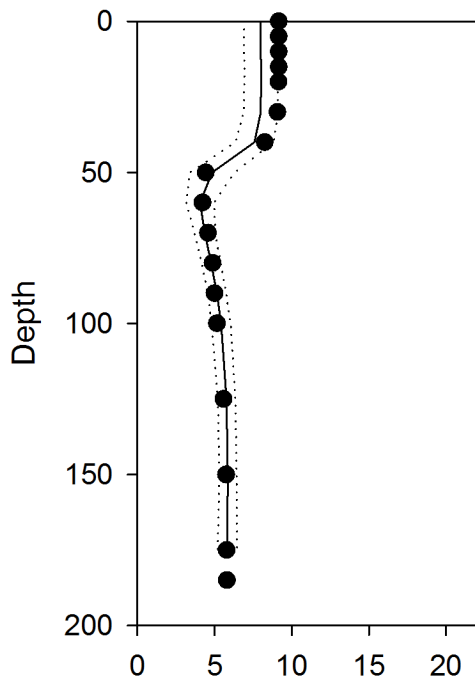
OXYGEN IN BOTTOM WATER (depth >175m)



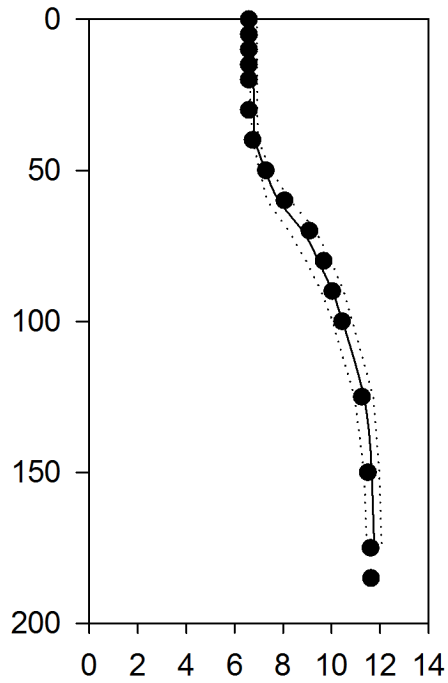
Vertical profiles BY20 November

— Mean 1996-2010 St.Dev. ● 2014

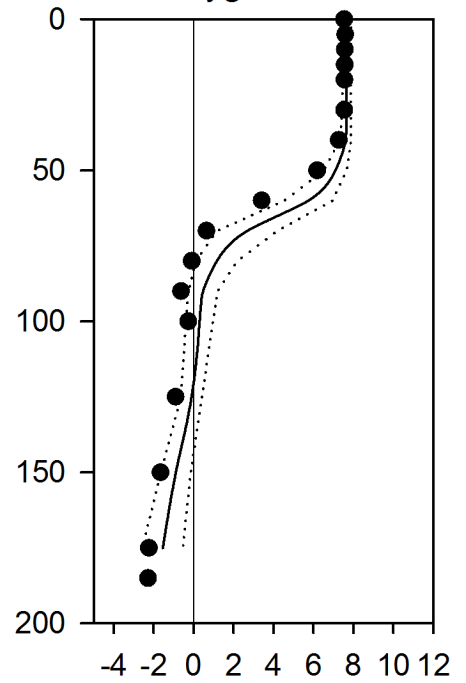
Temperature °C



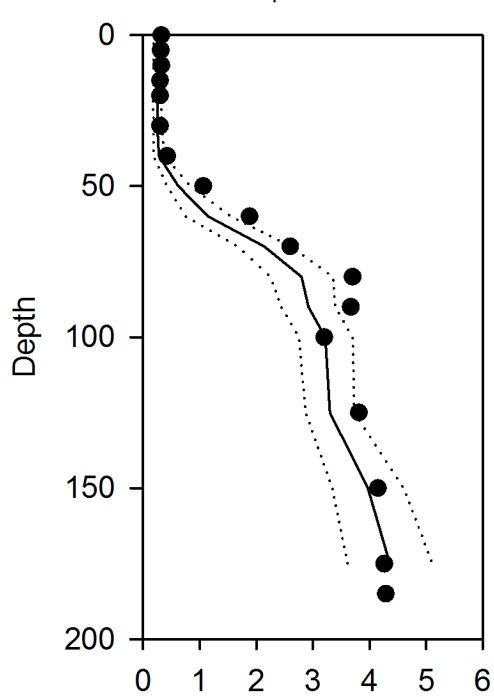
Salinity psu



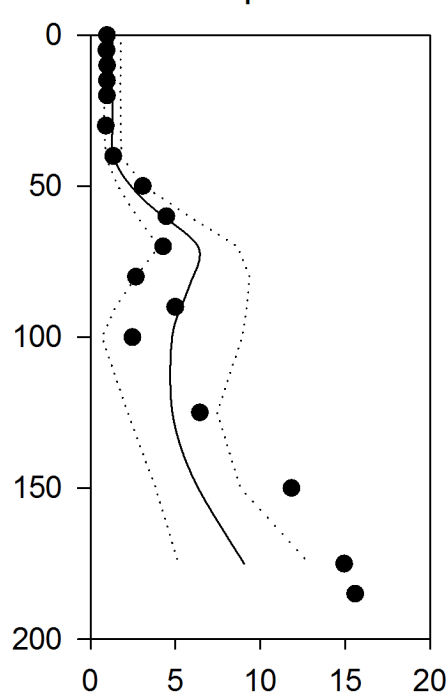
Oxygen ml/l



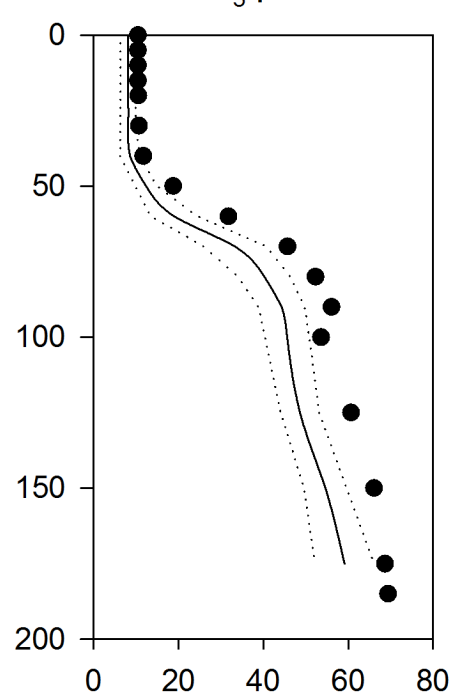
PO₄ μmol/l



DIN μmol/l



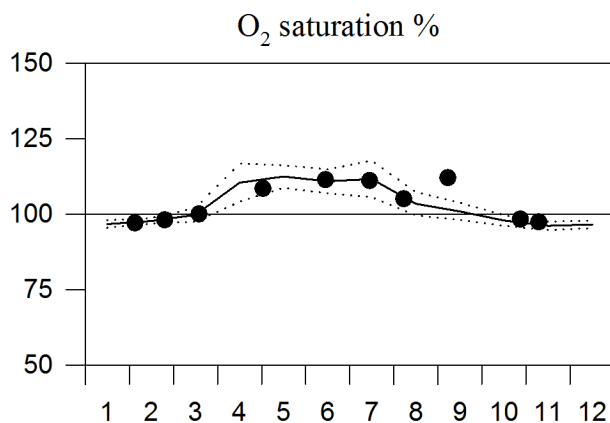
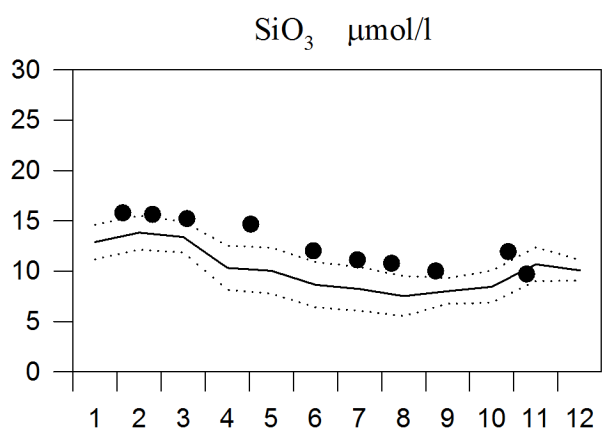
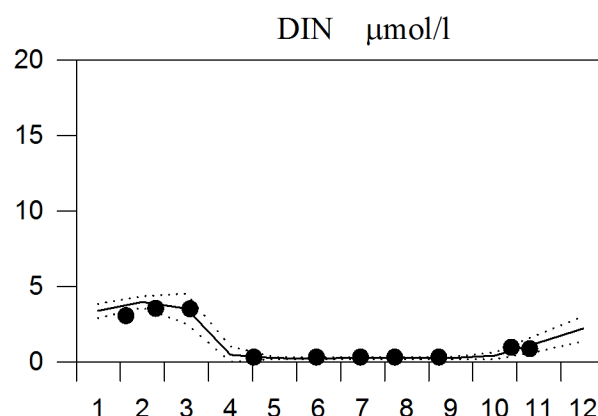
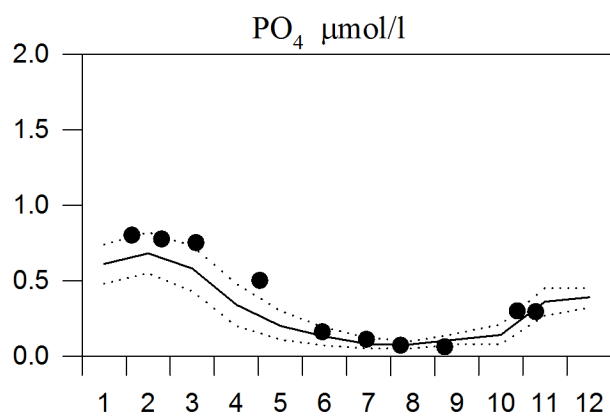
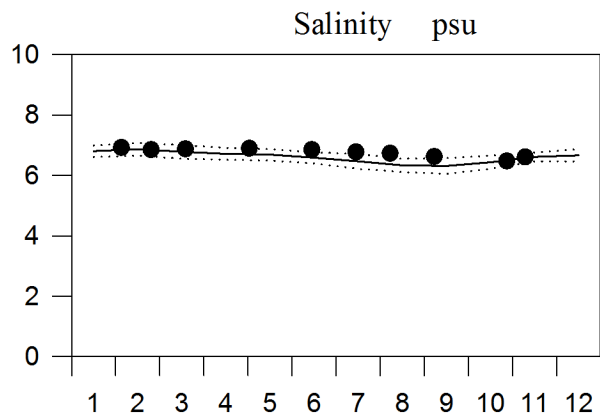
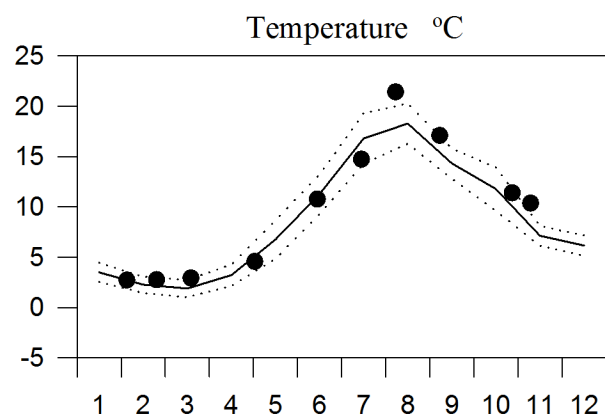
SiO₃ μmol/l



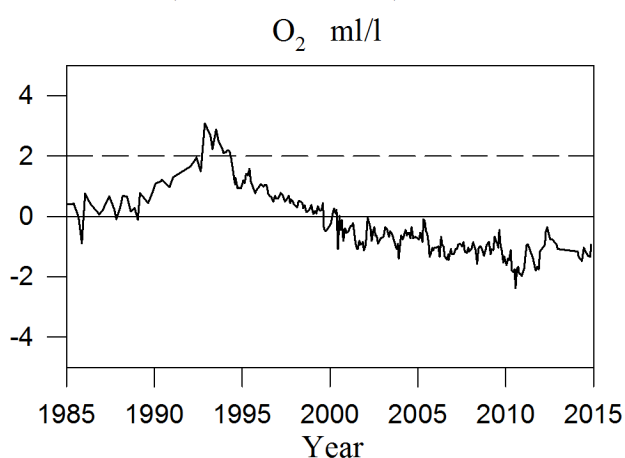
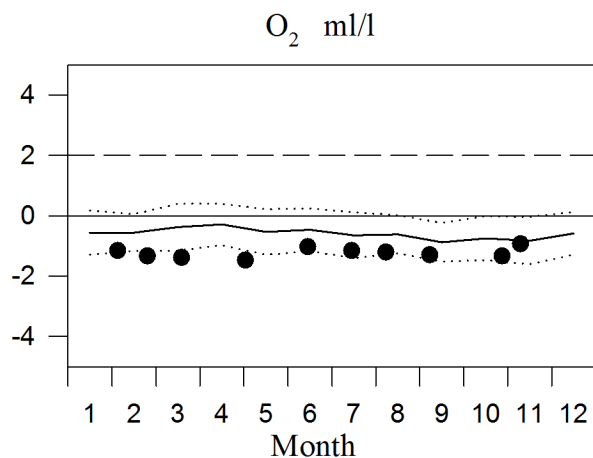
STATION BY32 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



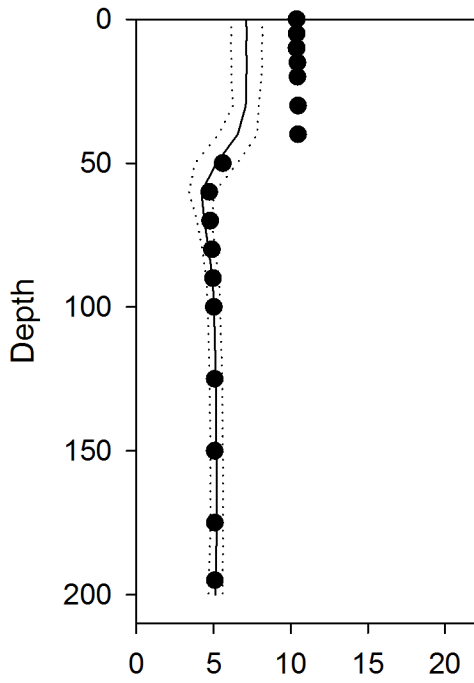
OXYGEN IN BOTTOM WATER (depth > 175m)



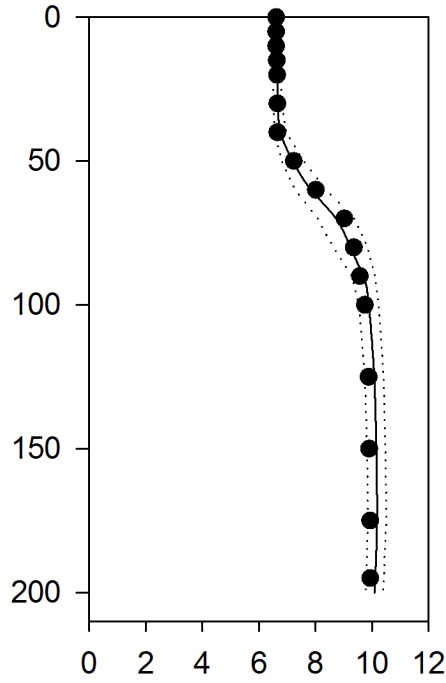
Vertical profiles BY32 November

— Mean 1996-2010 St.Dev. ● 2014

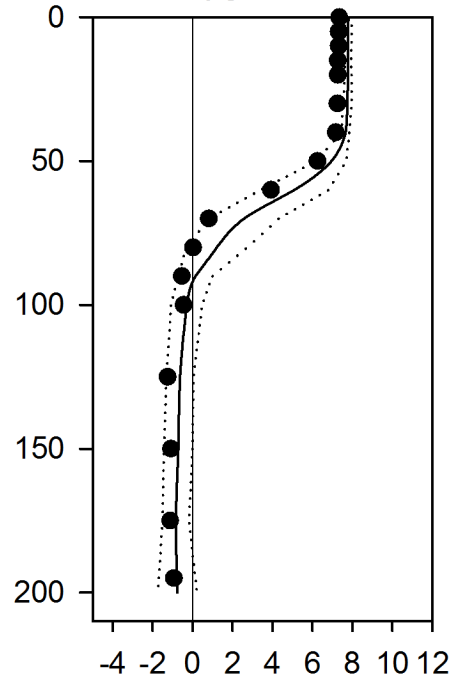
Temperature °C



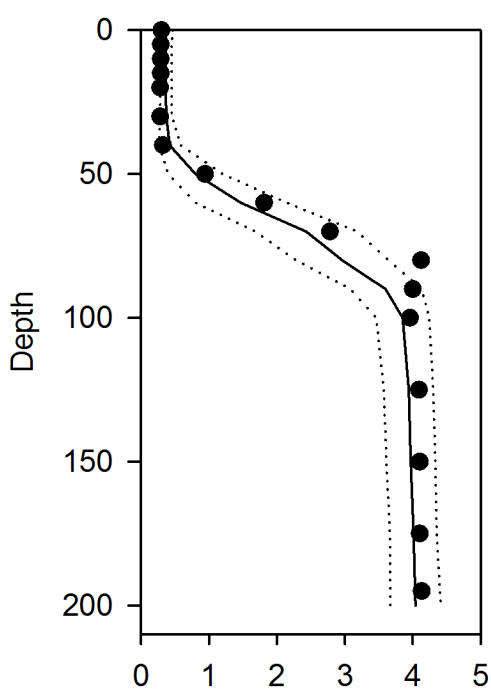
Salinity psu



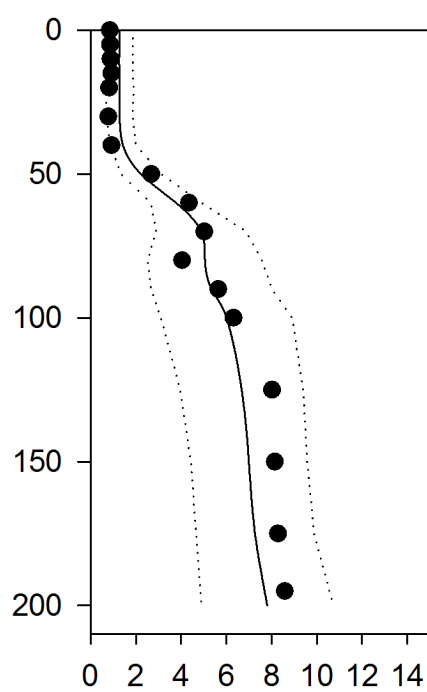
Oxygen ml/l



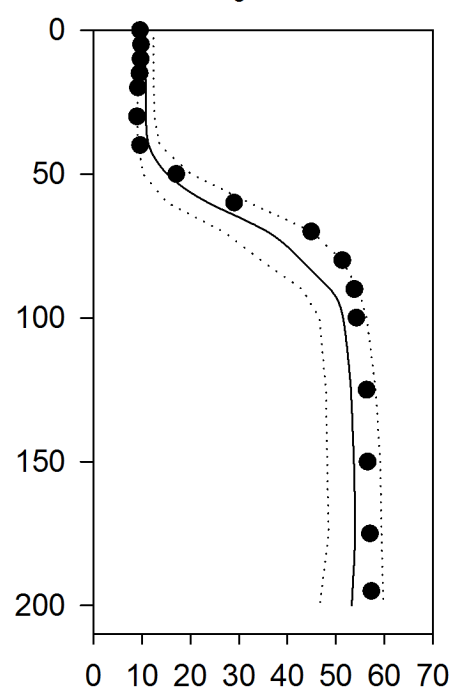
PO₄ μmol/l



DIN μmol/l



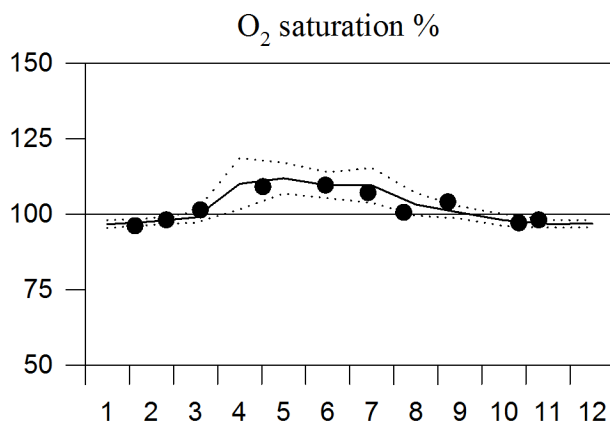
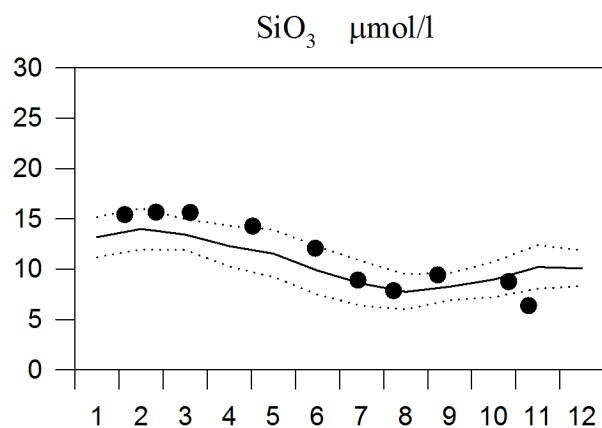
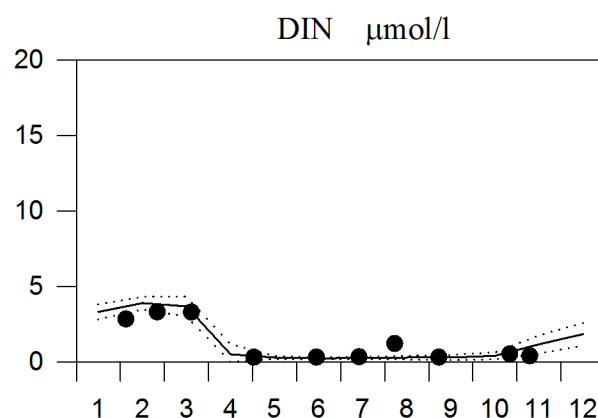
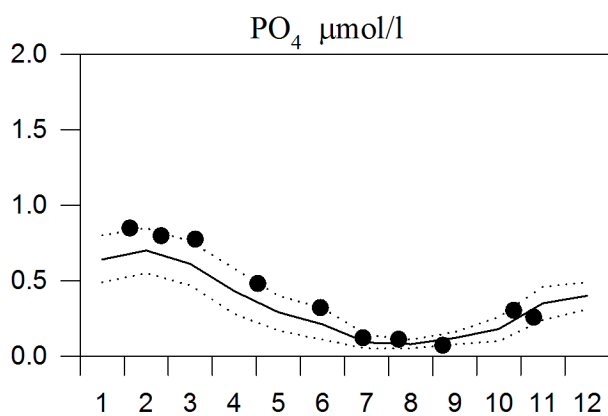
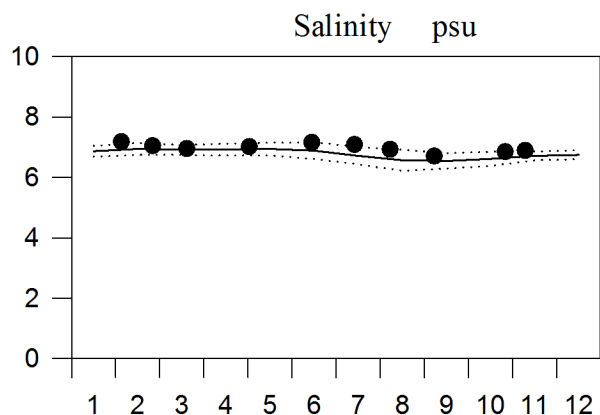
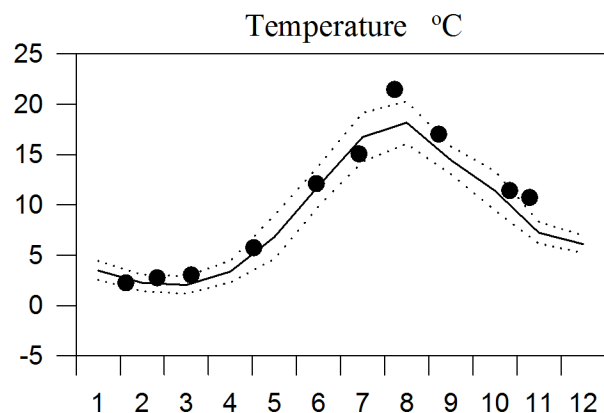
SiO₃ μmol/l



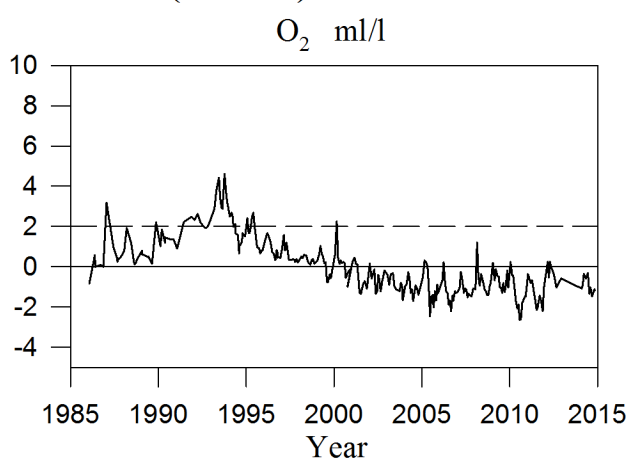
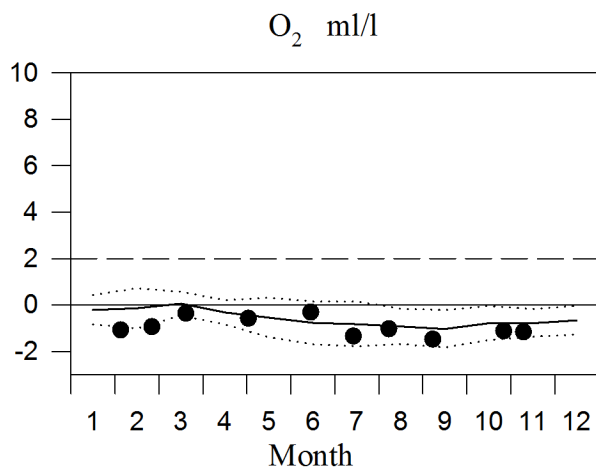
STATION BY38 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

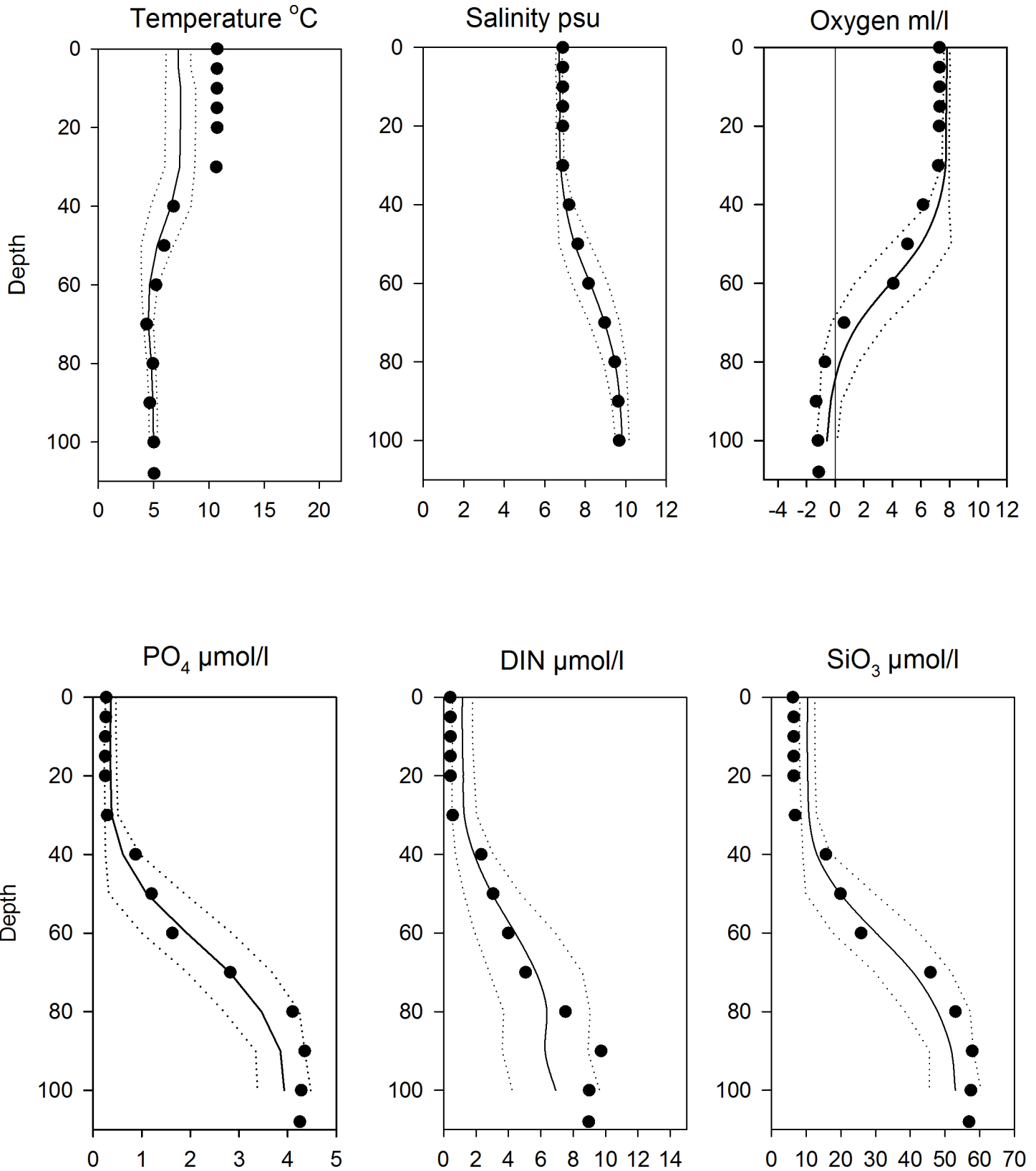


OXYGEN IN BOTTOM WATER (> 100m)



Vertical profiles BY38 November

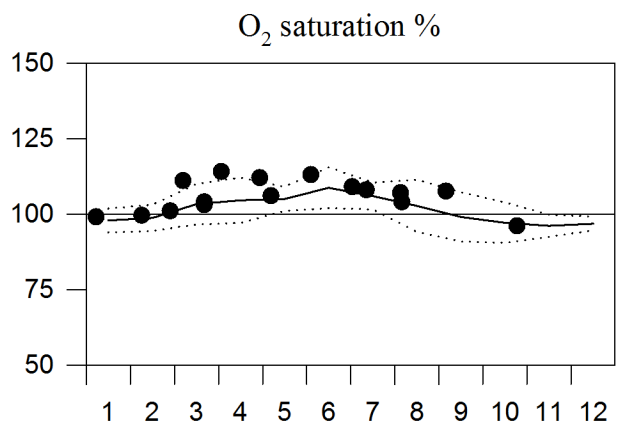
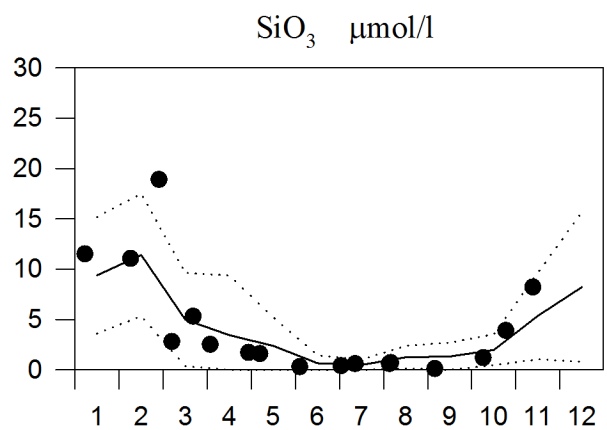
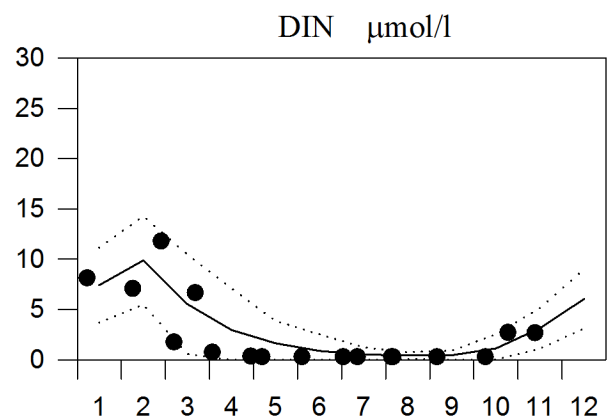
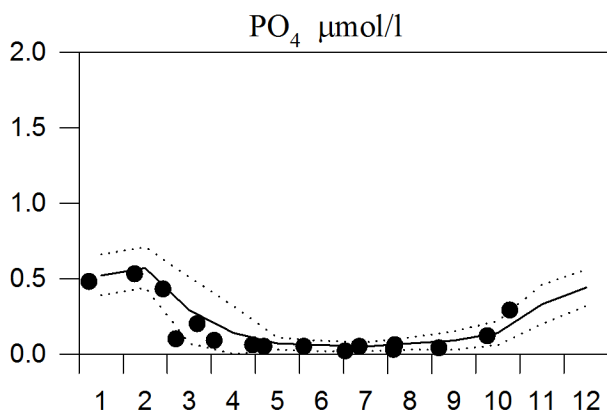
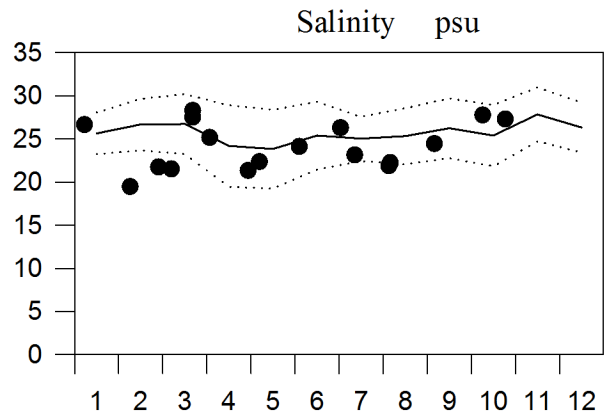
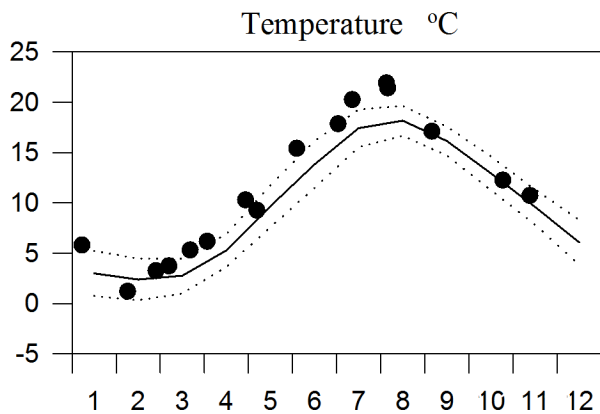
— Mean 1996-2010 St.Dev. ● 2014



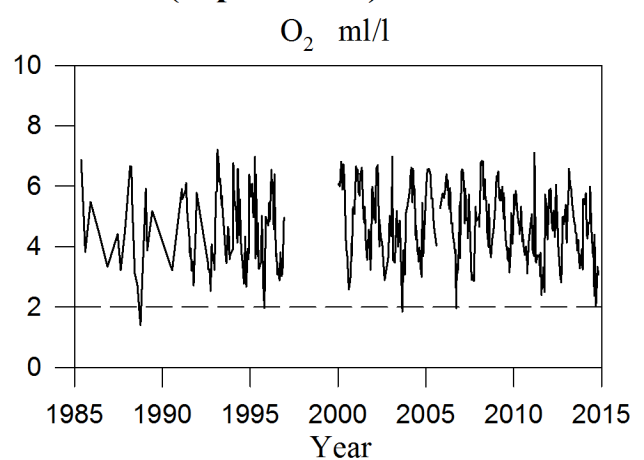
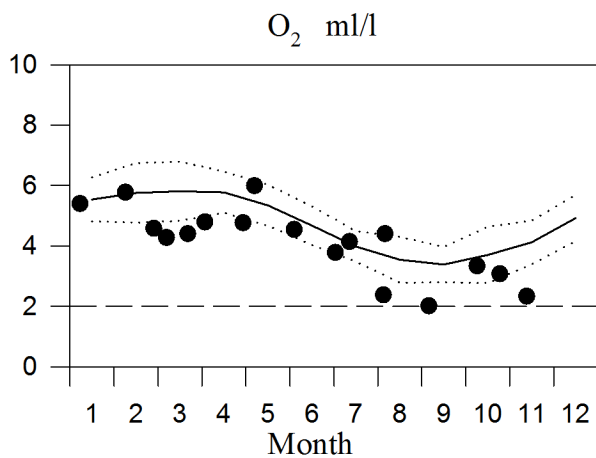
STATION SLÄGGÖ SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

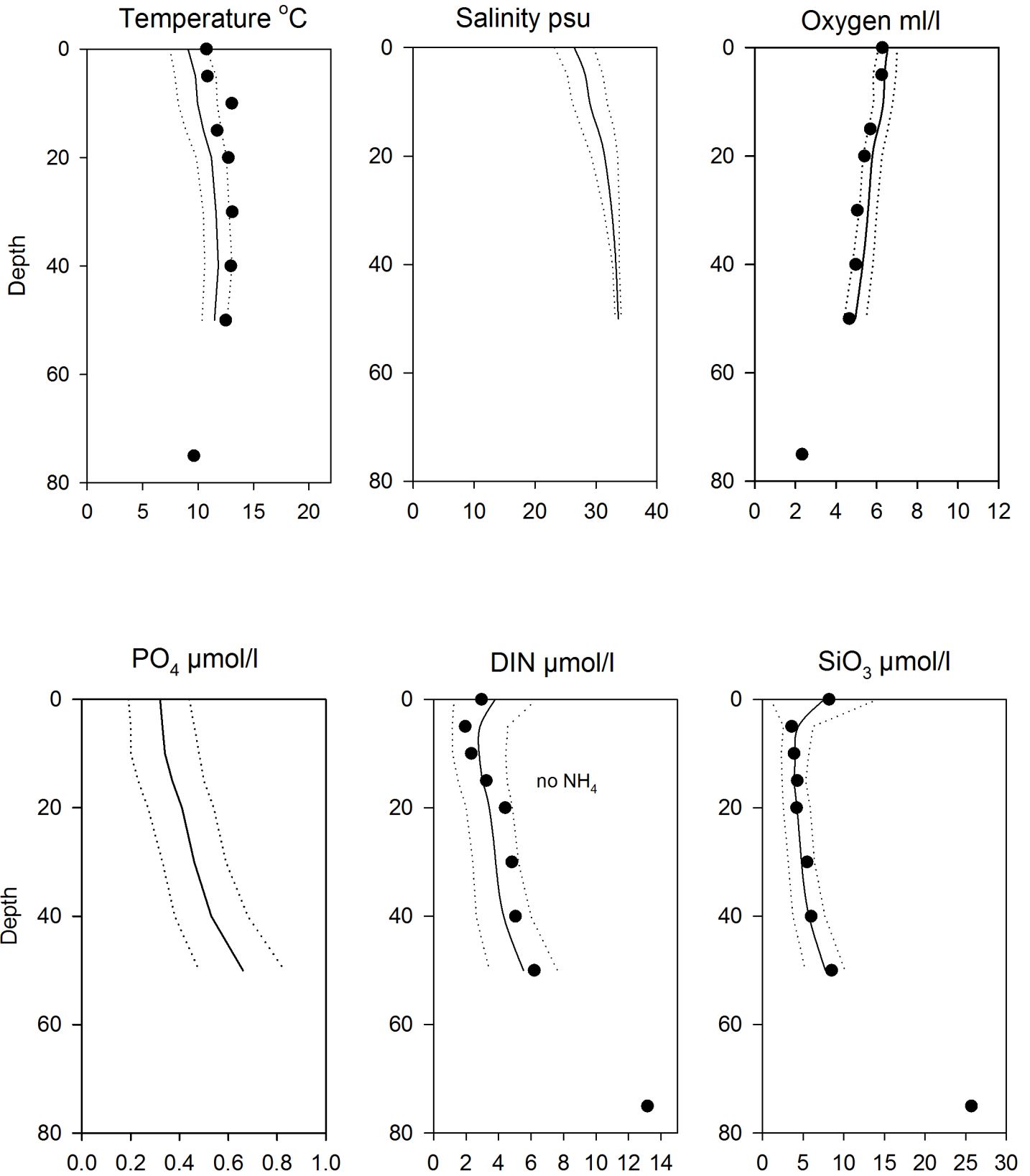


OXYGEN IN BOTTOM WATER (depth >50m)



Vertical profiles Släggö November

— Mean 1996-2010 St.Dev. ● 2014



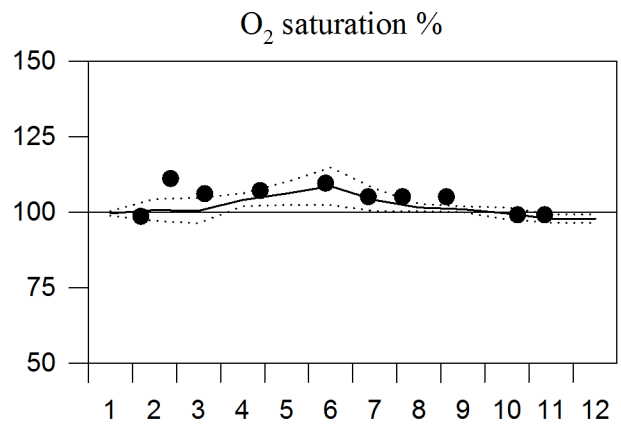
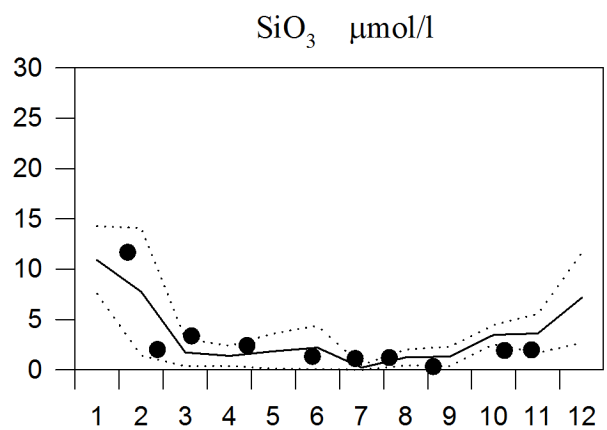
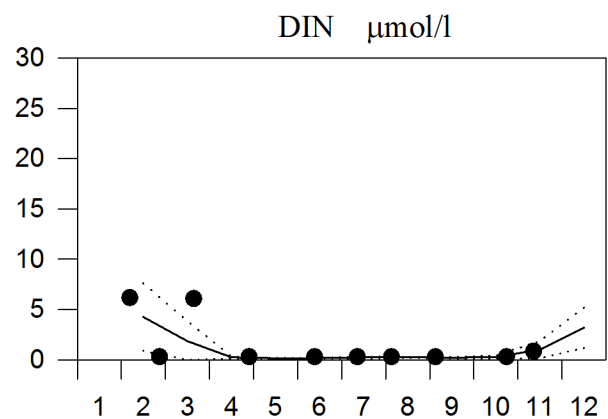
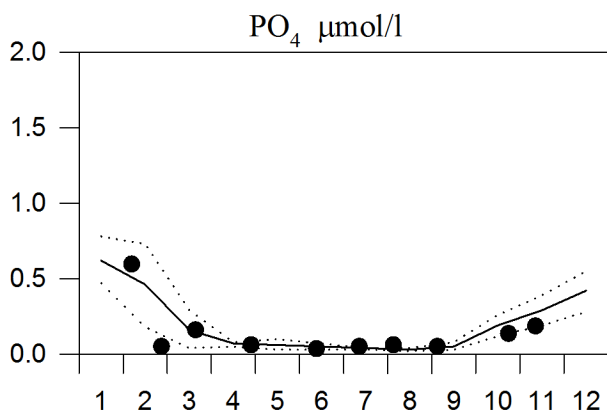
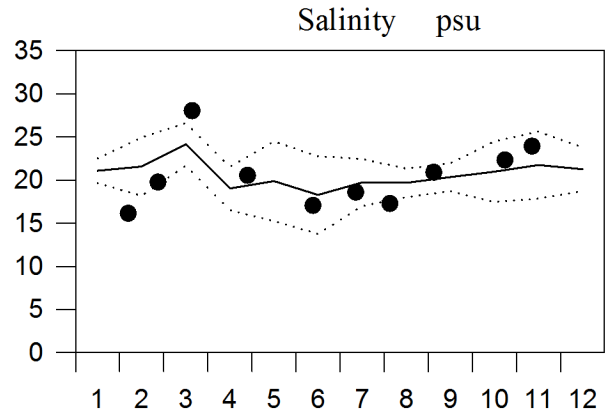
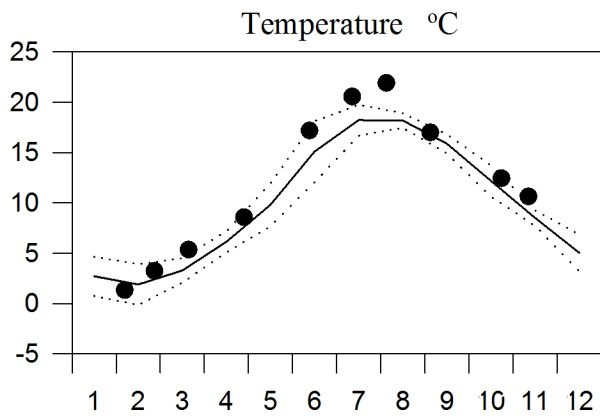
STATION N14 Falkenberg SURFACE WATER

Annual Cycles

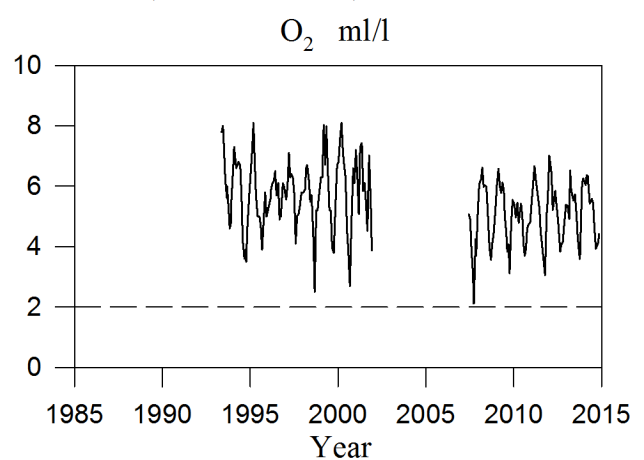
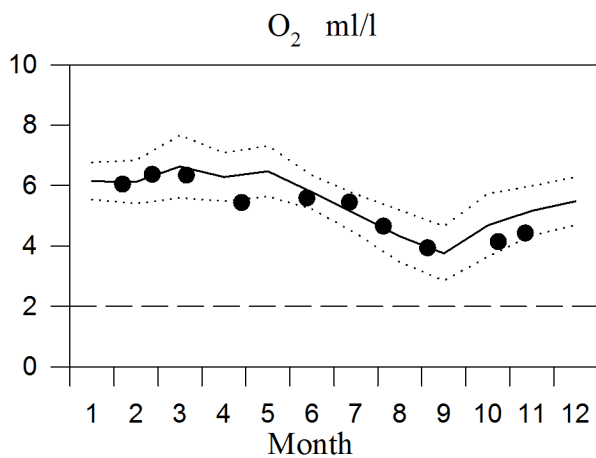
— Mean 2007-2010

..... St.Dev.

● 2014

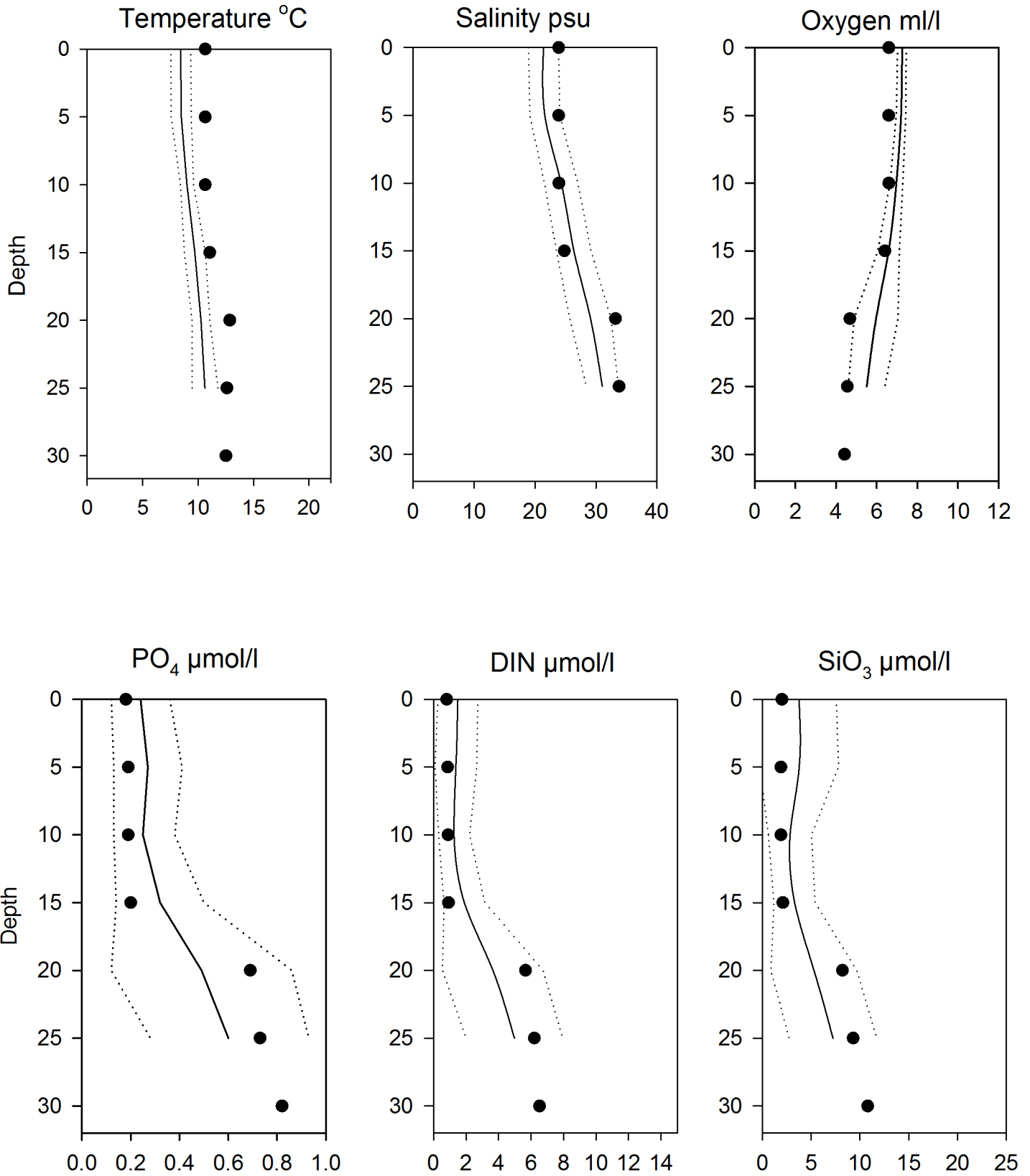


OXYGEN IN BOTTOM WATER (depth > 25m)



Vertical profiles N14 Falkenberg November

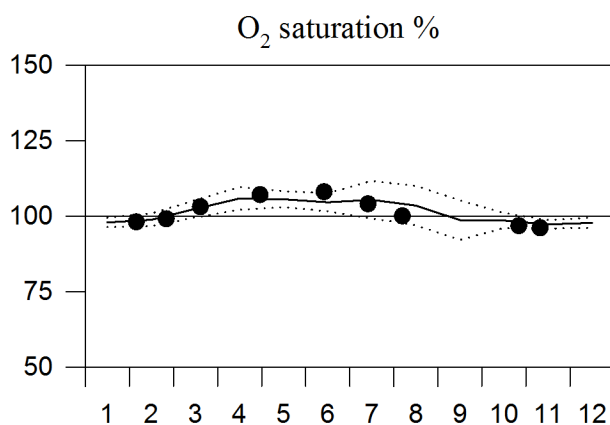
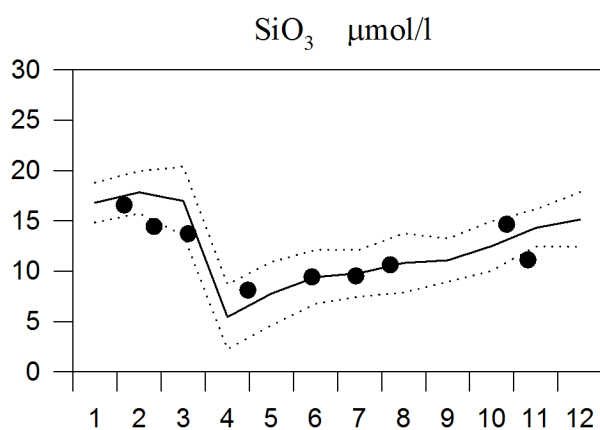
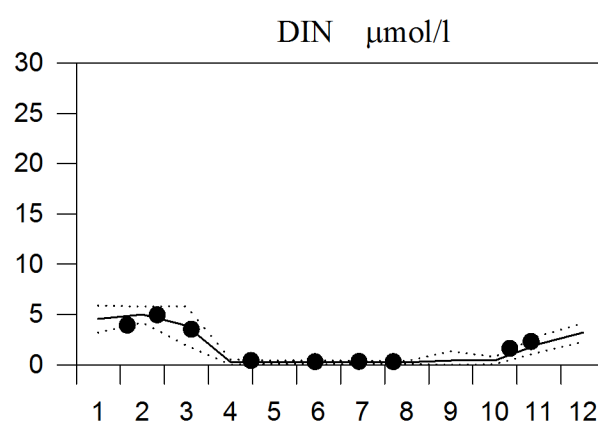
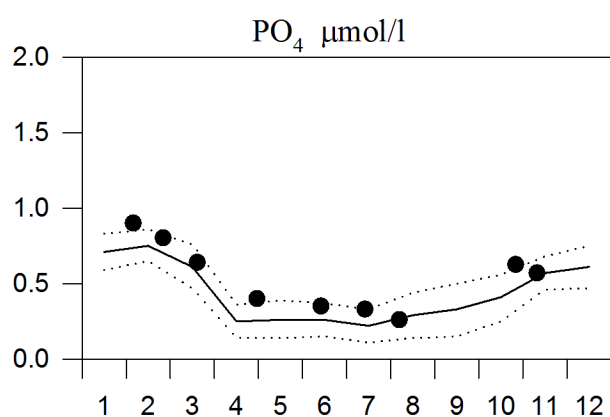
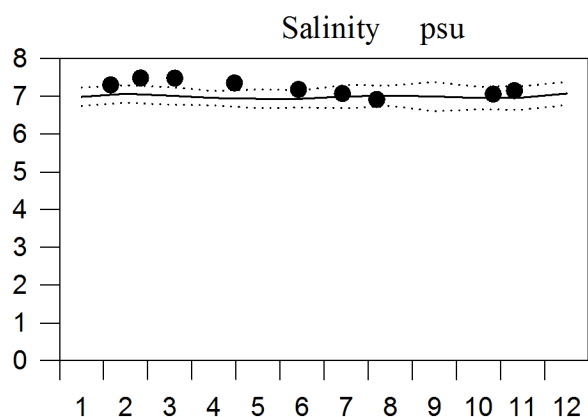
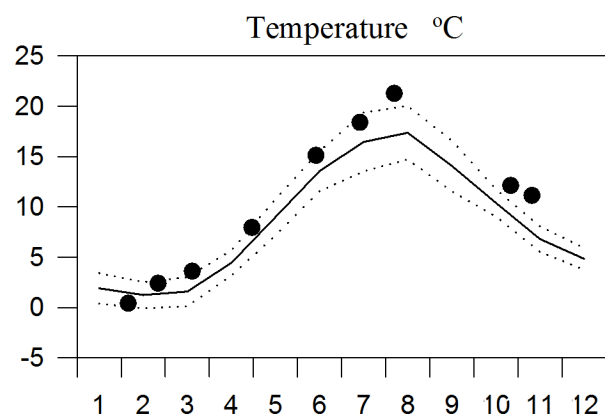
— Mean 1996-2010 St.Dev. ● 2014



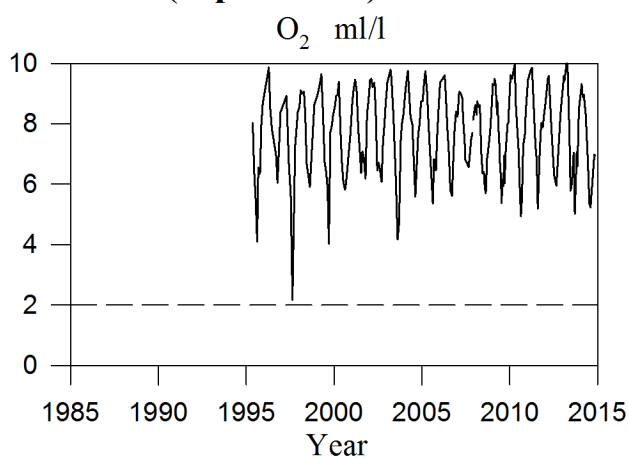
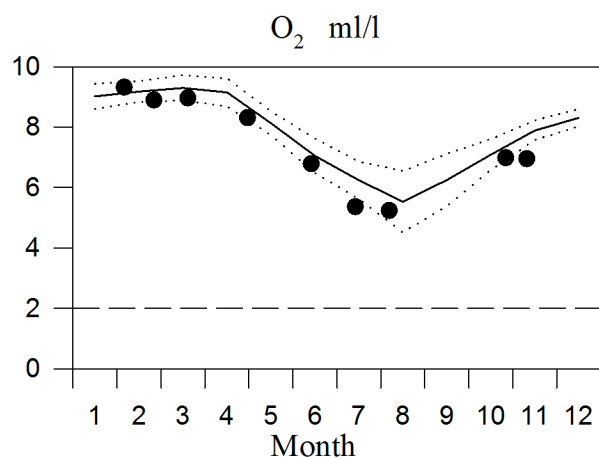
STATION REF M1V1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



OXYGEN IN BOTTOM WATER (depth >15m)



Vertical profiles Ref M1V1 November

— Mean 1996-2010 St.Dev. ● 2014

