

Rapport från SMHIs utsjöexpedition med R/V Aranda



Expeditionens varaktighet: 2016-04-18 - 2016-04-25
Undersökningsområde: Skagerrak, Kattegatt, Öresund, Egentliga Östersjön och Finska viken
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.

Temperaturen i den övre vattenmassan låg något över det normala i hela egentliga Östersjön. Vårblomningen höll fortfarande på i hela det mätta området. Fosfathalterna i sydvästra delen av Östersjöns ytvatten var högre än normalt. Koncentrationen av silikat var fortfarande högre än normalt i hela egentliga Östersjön

Akut syrebrist (< 2 ml/l) uppmättes från 80 meters djup i östra och västra Gotlandsbassängerna samt närmast botten i Hanöbukten och på BY4 Christiansö. Svavelväte uppmättes endast närmast botten i norra delen av Östersjön och intermediärt på Fårödjupet samt från 90 meters djup i västra Gotlandsbassängen.

Nästa ordinarie expedition är planerad starta 16:e maj.

PRELIMINÄRA RESULTAT

Expeditionen genomfördes ombord det finska forskningsfartyget Aranda och startade i Helsingfors den 18:e april samt avslutades i samma hamn den 25:e. Vindarna under expeditionen var i huvudsak västliga till nordliga, i början och i mitten friska och övrig tid svaga. Lufttemperaturen varierade mellan +1 och +9°C.

Under expeditionen byttes Totalförsvarets forskningsinstitut (FOI) hydronfonutrustning ut i Östersjön (se <https://biasproject.wordpress.com/>). Sveriges lantbruks universitets (SLU) arbetsmiljöingenjör för det planerade fartygsbygget studerade hur vi arbetar med våra provtagningar.

Skagerrak

Temperaturen i ytvattnet var normal för årstiden och varierade i området mellan 7,3 och 7,7 °C. Ytsalthalten i yttre Skagerrak var lägre än normalt för årstiden och högre än normalt i södra delen och låg mellan 21,2 och 32,2 psu. Skiktningen, både när det gäller temperatur och salthalt sammanföll mellan 5 och 15 m.

Alla närsaltskoncentrationer var låga i hela området utom kvävekocentrationserna i södra delen som var mycket högre än normalt. I ytvattnet låg halterna av fosfat i intervallet 0,06 – 0,11 µmol/l, oorganiskt kväve (nitrit + nitrat) kring detektionsgränsen (0,1 µmol/l) till 10,0 µmol/l medan silikat varierade från 0,5 µmol/l i utsjön till 6,1 µmol/l nära kusten. Bottenvattnet var väl syresatt, även vid Släggö i Gullmarsfjordens mynning. Fluorescensmätningarna visade på hög biologisk aktivitet i ytlagret. För mer detaljer rörande algsituationen se separat rapport AlgAware.

Kattegatt och Öresund

Temperaturen i ytvattnet var normal för årstiden och varierade mellan 7,0 och 8,1°C. Salthalten i ytlagret var något lägre än normalt för årstiden och varierade mellan 18,3 – 19,6. I Öresund var salthalten omkring 19 psu vilket är högre än normalt. I området låg salt- och temperaturskiktningen på djup mellan 10 och 15 meter. I Öresund återfanns en svag skiktning på 15 meters djup.

Samtliga närsaltshalter i ytvattnet var normala till under det normala för årstiden. Fosfatkoncentrationerna låg på 0,06 till 0,16 µmol/l, summa nitrit+nitrat var under detektionsgränsen (<0,1 µmol/l), och silikat varierade mellan 0,1 och 1,8 µmol/l. Högsta närsaltskoncentrationerna återfanns i Öresund. Syreförhållandena i djupvattnet var goda och lägsta koncentrationen uppmättes i Öresund, 5,02 ml/l. Enligt fluorescensmätningarna var det fortfarande hög planktonaktivitet i området.

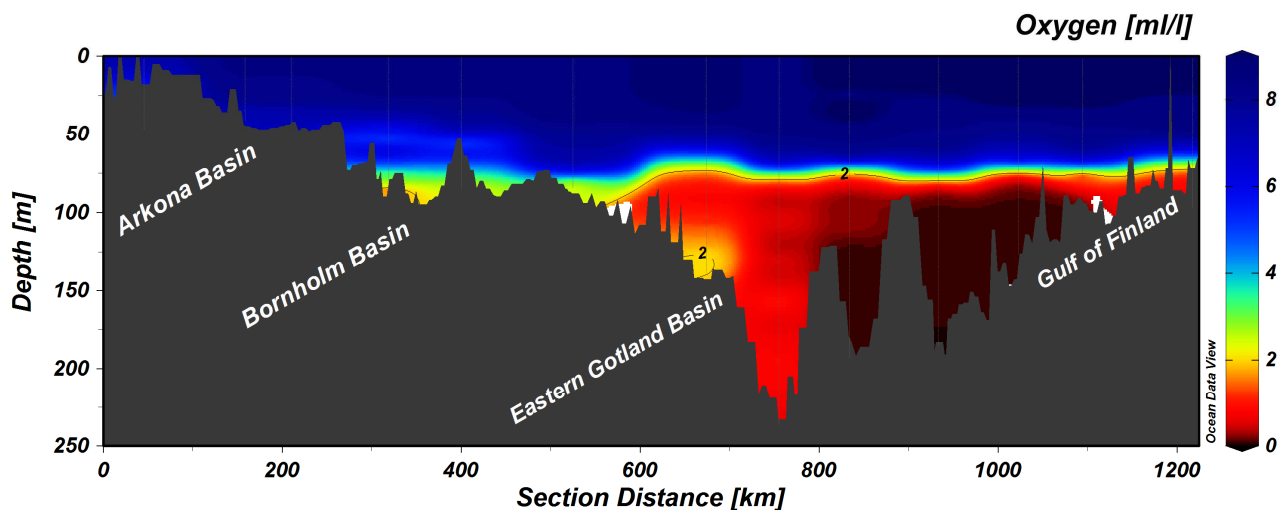
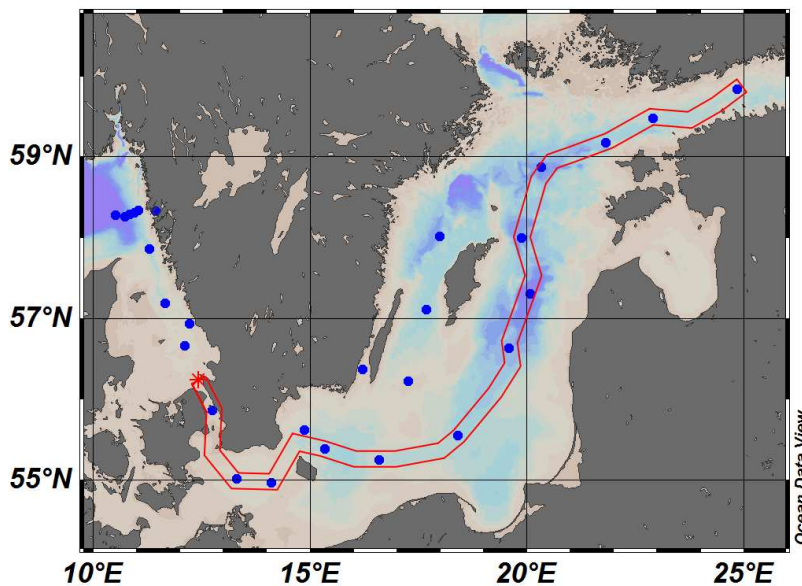
Egentliga Östersjön

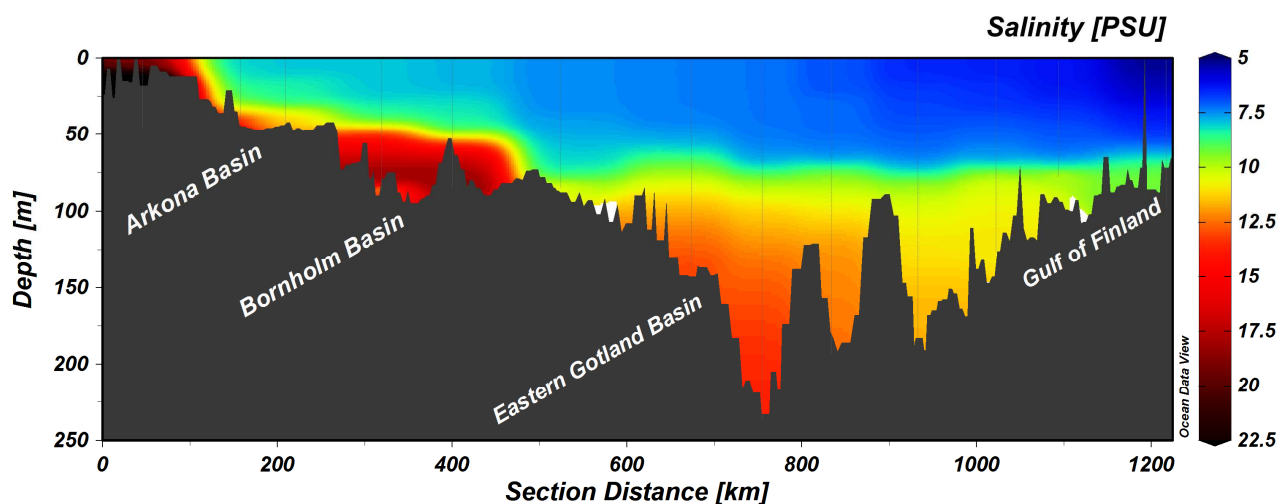
Temperaturen i ytvattnet var något högre än normalt i hela området och varierade från 4,3°C till 7,3°C. Ytsalthalten var också generellt något förhöjd i hela området utom i nordöstra delen där den var något lägre än normalt och varierade mellan 6,4 i norra delen till 7,9 sydvästra delen. Haloklin och termoklin sammanföll och återfanns på 50-80 meters djup i området. I norra och sydvästra delarna fanns även en svag skiktning kring 10-15 meter. I östra Gotlandsbassängen fanns en svag temperaturskiktning runt 40 meter.

Fosfathalterna i ytvattnet var normala för årstiden i hela det undersökta området utom i sydvästra delen där den var högre än normalt och varierade mellan 0,36 och 0,51 $\mu\text{mol/l}$. Halterna av nitrit+nitrat var normala för årstiden och låg under detektionsgränsen ($<0,1 \mu\text{mol/l}$) i hela området. Koncentrationen av silikat var över till mycket över det normala i hela området. Halterna varierade mellan 11,3 och 16,6 $\mu\text{mol/l}$.

I Hanöbukten och på BY4 Christiansö observerades akut syrebrist ($< 2 \text{ ml/l}$) endast närmast botten. Akut syrebrist uppmättes från 80 meters djup i östra och västra Gotlandsbassängerna. Svavelväte uppmättes endast närmast botten i norra delen av Östersjön och intermediärt på Fårödjupet samt från 90 meters djup i västra Gotlandsbassängen.

Fluorescensmätningarna visade en hel del biologisk aktivitet i ytlagret i hela Östersjön, minst i Arkonabassängen.





Figur 1. Snitt som visar syre- och salthalt genom Egentliga Östersjön från Öresund till Finska viken.

DELTAGARE

Namn

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Sara Johansson
Johan Kronsell
Johanna Linders
Daniel Simonsson
Ann-Turi Skjevik
Stefan Andersson
Mathias Andersson

Expeditionsledare

Från

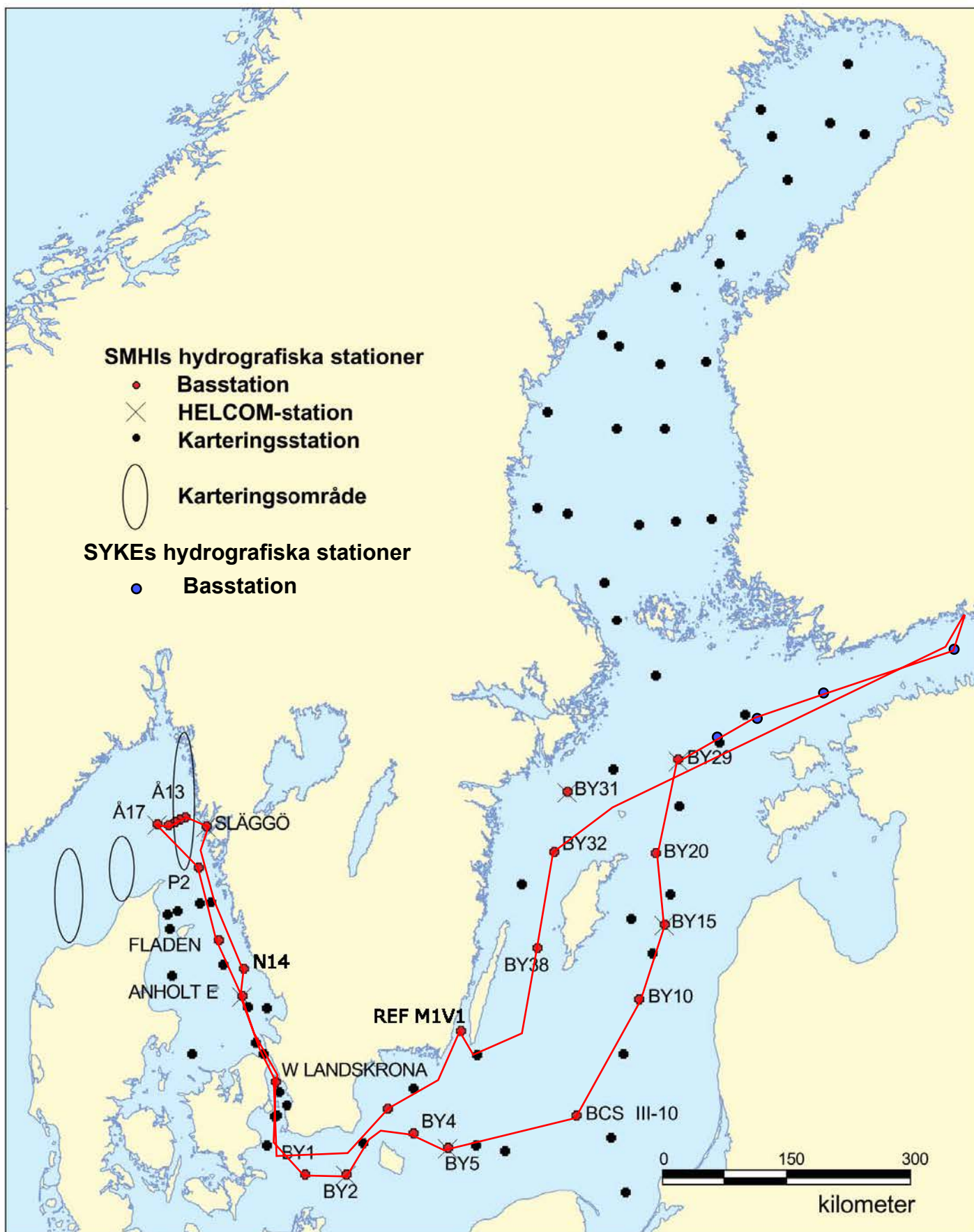
SMHI
SMHI
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SMHI
SLU
FOI

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: 20160418-20160425
 Series: 0212-0240



Date: 2016-04-25
Time: 11:41

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 t aoae d	C PPCPZT Hrhhoo P l	No de	T e a ml p i g n	S o h y s P	O x 2 o o t P N N N T A S H L P T C O
0212	GFXX29EXT	BY23/LL7		N5950.5	E2450.3	20160418	1125	102		25 13	3.5	1001	1640 x	--x----	13	x x - x - x x x x x x - x - - - - x		
0213	BPNX60EXT	LL12		N5929.0	E2254.0	20160418	1730	83		23 12	4.8	1003	1340 x	--x----	11	x x - x x x x x x x - x - - - - - x		
0214	BPNX00BAS	LL15		N5911	E2144.81	20160418	2145	132		23 11	5.2	1001	9990 x	-----	15	x x - x - - - - - - - - - - - x		
0215	BPNX35EXT	BY29		N5853	E2019	20160419	0240	187		24 12	5.1	1000	2740 x	-----	16	- x - x x - - - - - - - - - - - x		
0216	BPEX26BAS	BY20 FÄRÖDJ		N5800	E1953	20160419	0810	192		22 10	5.6	1001	2740 x	--x----	17	x x - x x x x x x x x - x - - - - - x		
0217	BPEX21BAS	BY15 GOTLANDSDJ		N5720	E2003	20160419	1240	240	9	24 11	5.4	1003	2840 x	-xxxx--	19	x x x x - x x x x x x x x x - - - - x		
0218	BPEX13BAS	BY10		N5638	E1935	20160419	1900	145		32 10	5.6	1008	9990 x	--x----	15	x x - x - x x x x x x x - x - - - - x		
0219	BPSE11BAS	BCS IIII-10		N5533.3	E1824	20160420	0230	90		27 10	5.7	1015	1630 x	--x----	12	x x - x - x x x x x x x - x - - - - x		
0220	BPSB07BAS	BY5 BORNHOLMSDJ		N5515	E1559	20160420	1015	91	8	27 9	6.2	1022	1130 x	-xxxx--	12	x x x x - x x x x x x x x x - - - - x		
0221	BPSB06BAS	BY4 CHRISTIANSSÖ		N5523	E1520	20160420	1335	92	7	26 11	7.3	1022	1130 x	--x----	12	x x - x - x x x x x x x - x - - - - x		
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0223	BPSA02BAS	BY1		N5500	E1318	20160420	2300	46		29 8	7.0	1025	9990 x	--x----	8	x x - x - x x x x x x x - x - - - - x		
0224	SOCX39BAS	W LANDSKRONA		N5552.0	E1245.0	20160421	0535	52	7	29 9	6.0	1022	1120 x	--x----	9	x x - x - x x x x x x x - x - - - - x		
0225	KAXE29BAS	ANHOLT E		N5640.0	E1207.0	20160421	1050	63	8	26 9	7.1	1020	2740 x	-xxxx--	10	x x x - x x x x x x x x x - - - - x		
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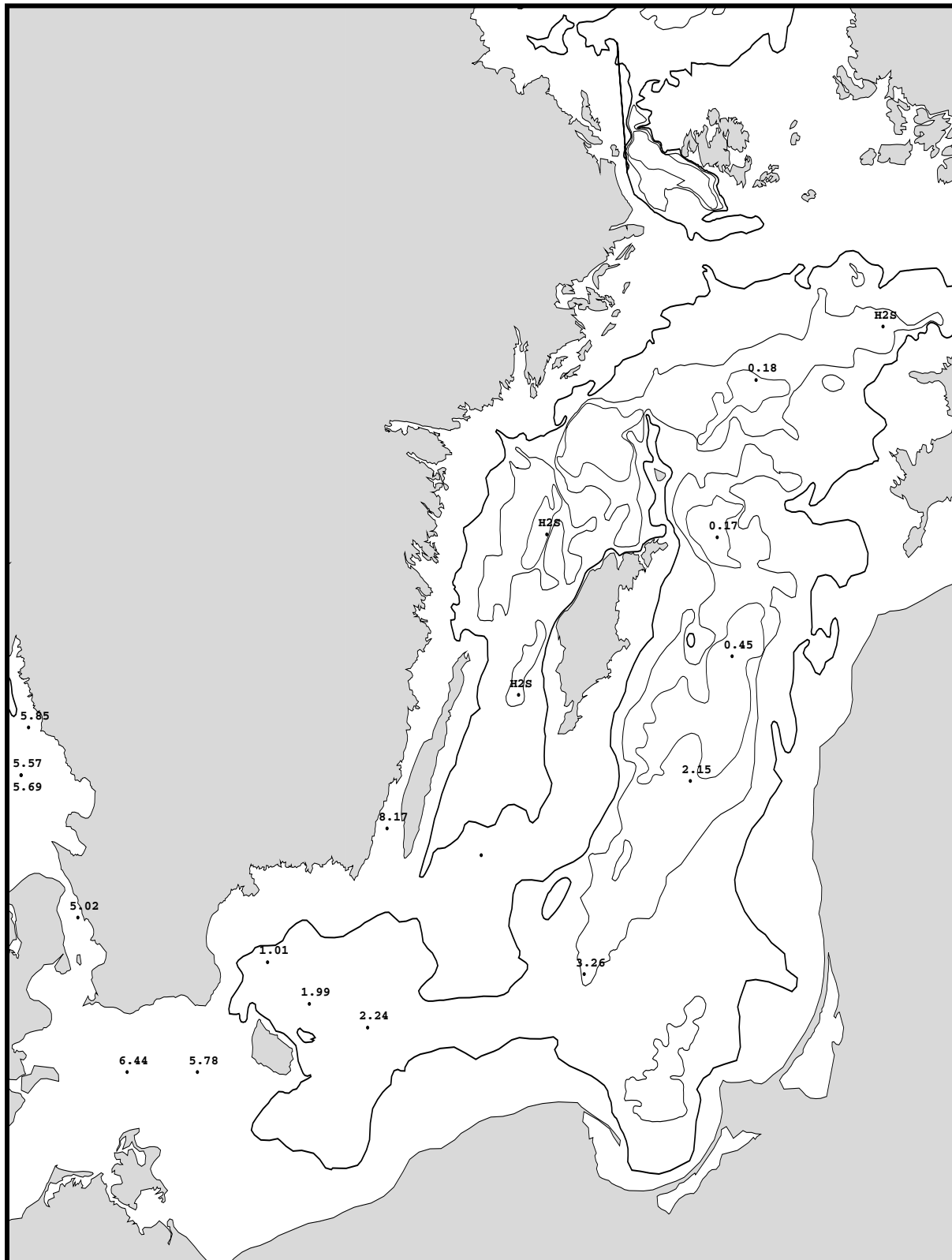
Bottom water oxygen concentration (ml/l)

Country: Finland

Ship : Aranda

Date : 20160418-20160424

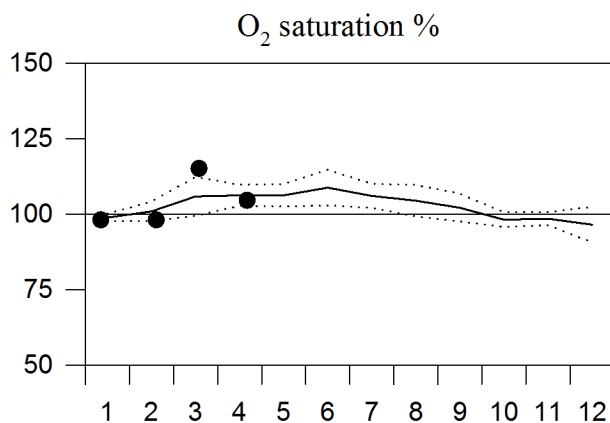
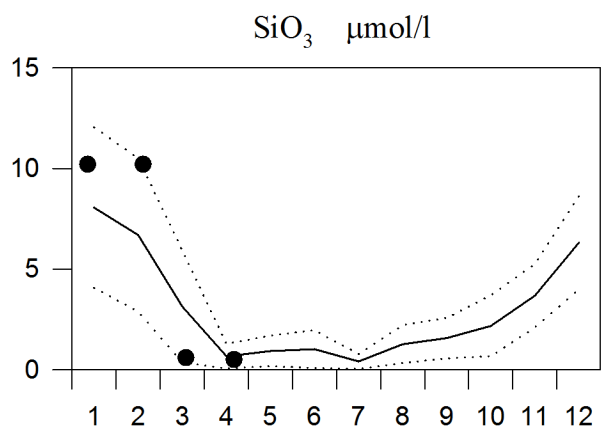
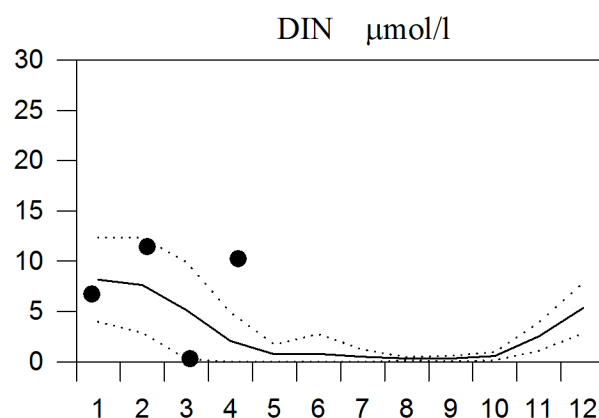
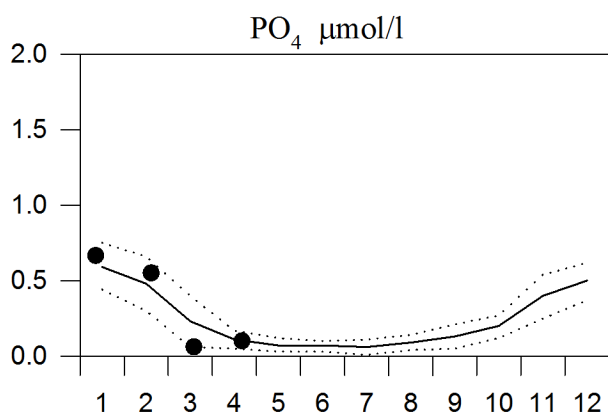
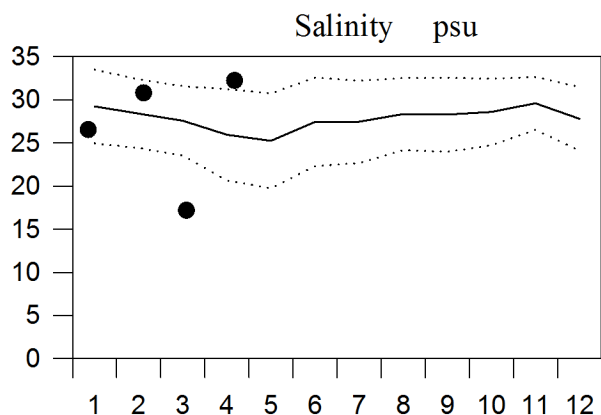
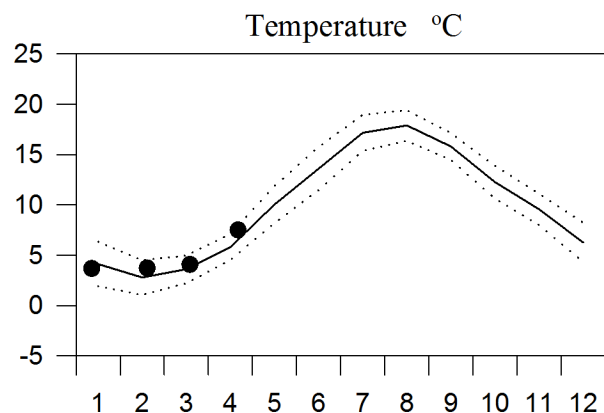
Series : 0212-0240



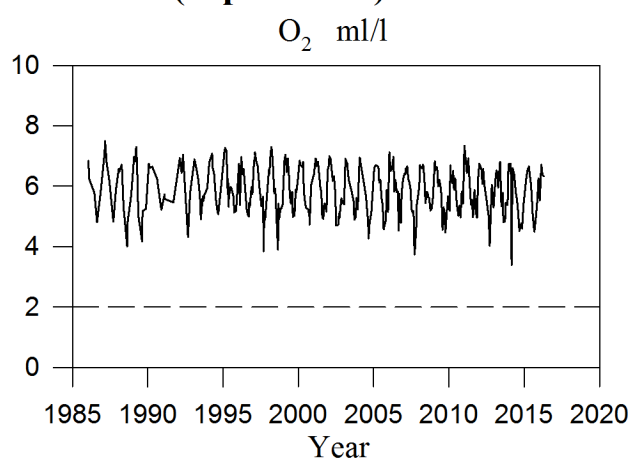
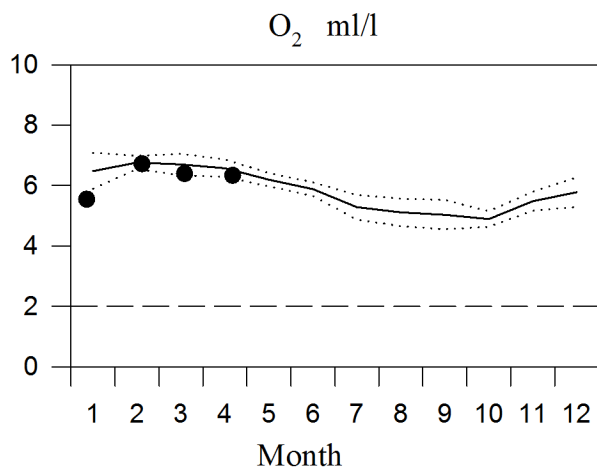
STATION P2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

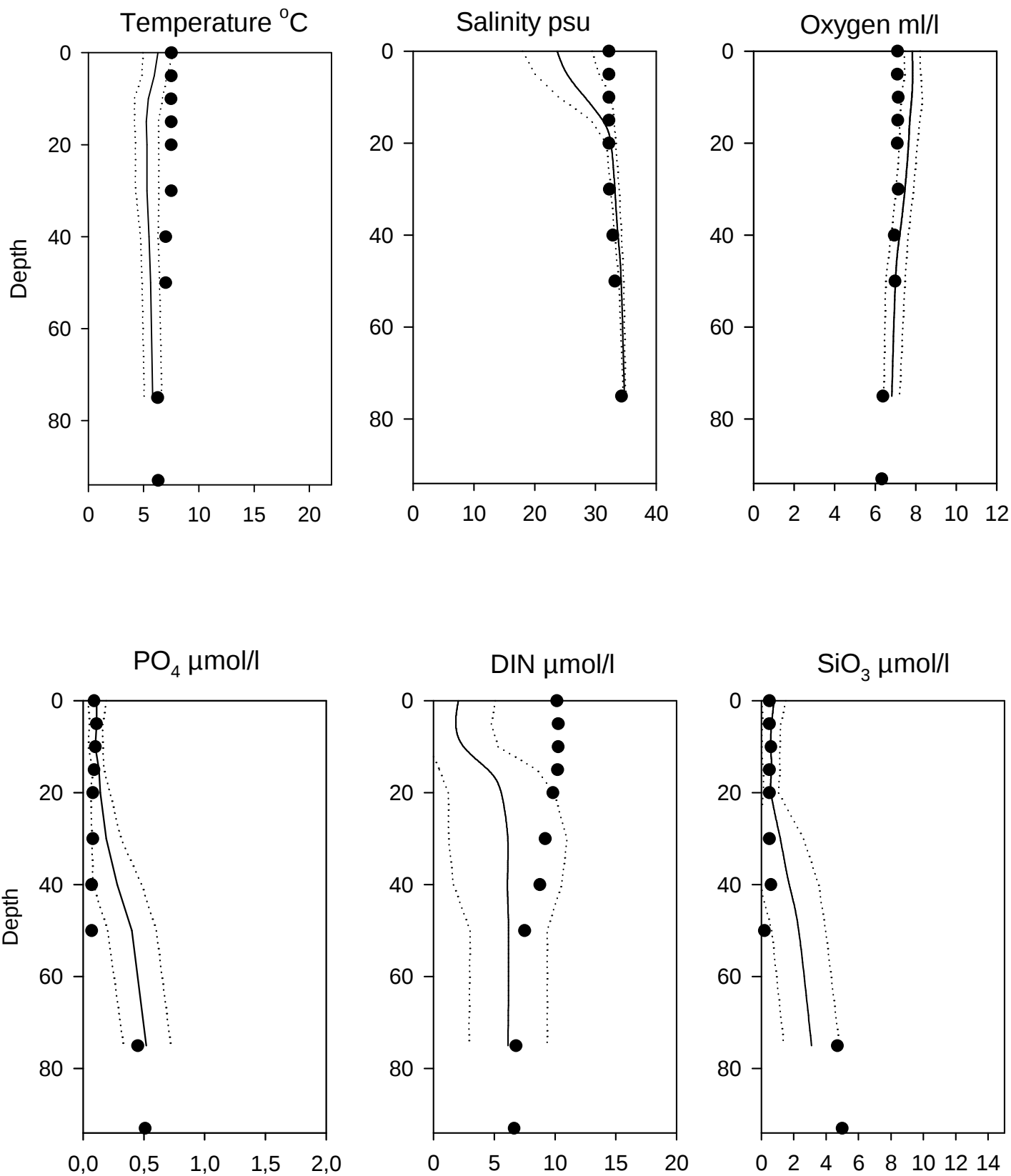


OXYGEN IN BOTTOM WATER (depth >75m)



Vertical profiles P2 April

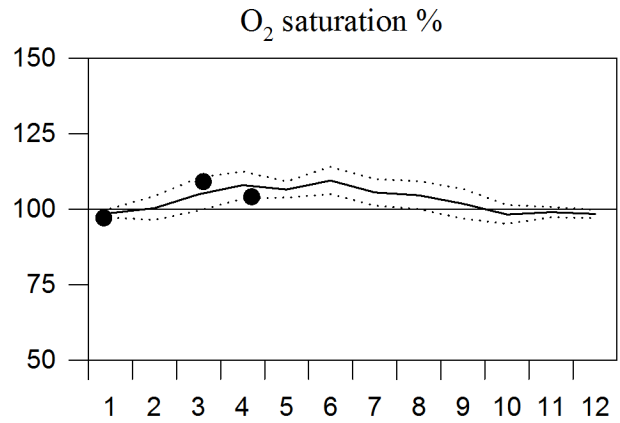
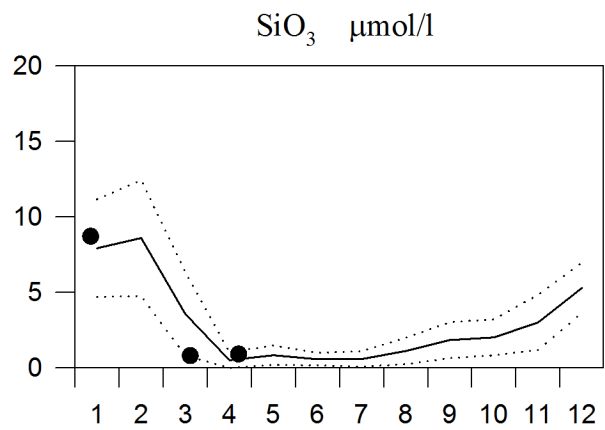
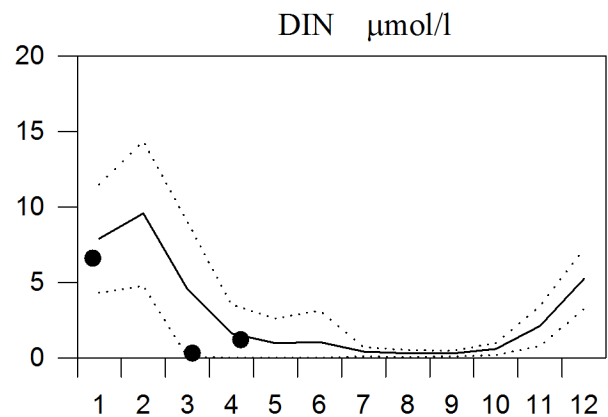
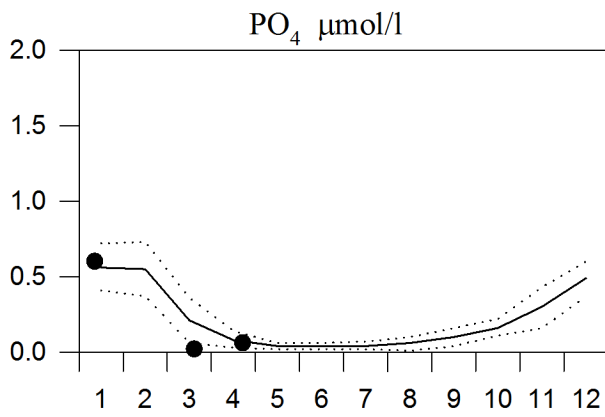
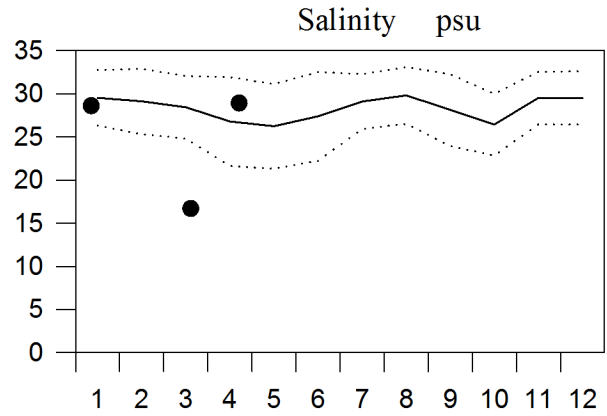
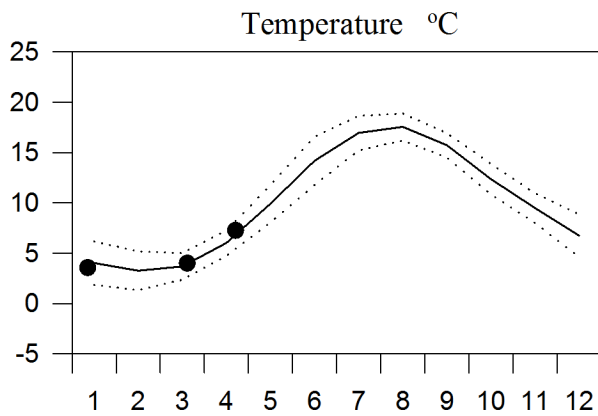
— Mean 1996-2010 St.Dev. ● 2016



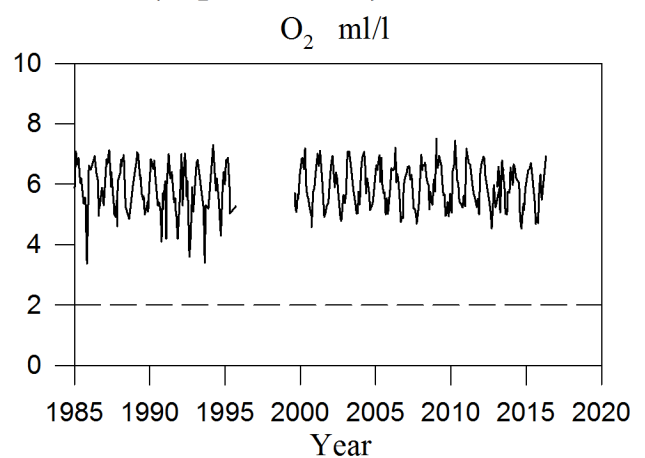
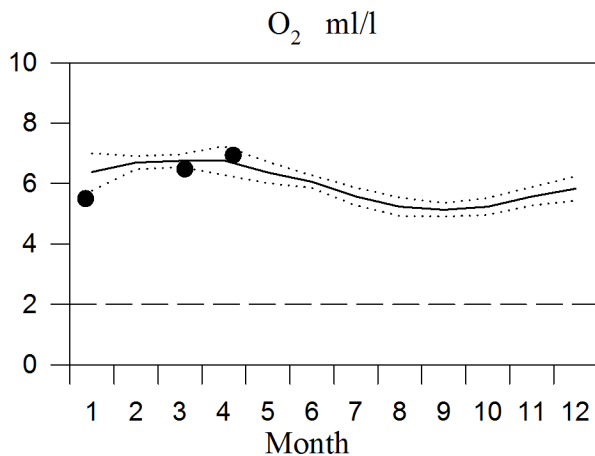
STATION Å13 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

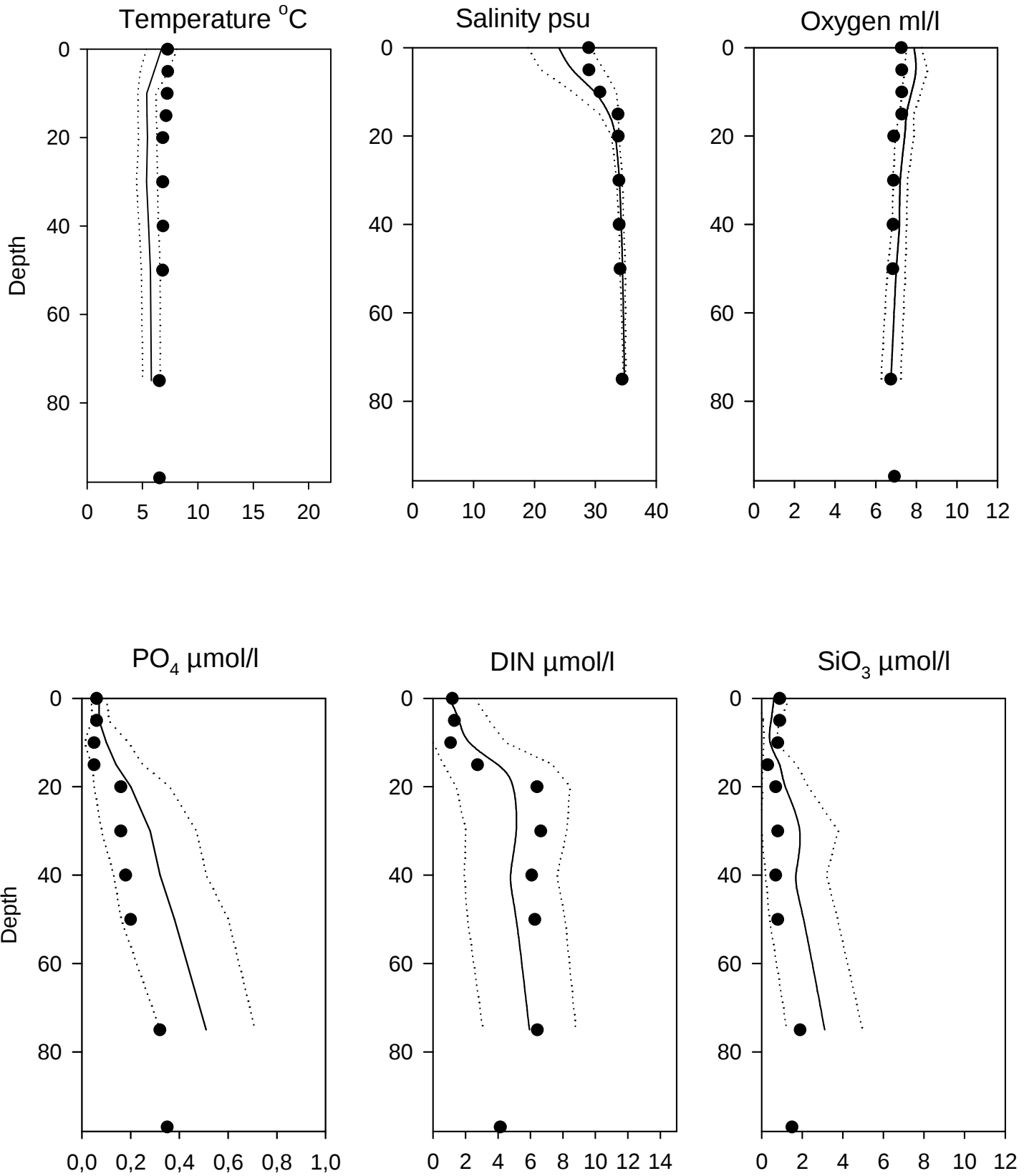


OXYGEN IN BOTTOM WATER (depth >=75m)



Vertical profiles Å13 April

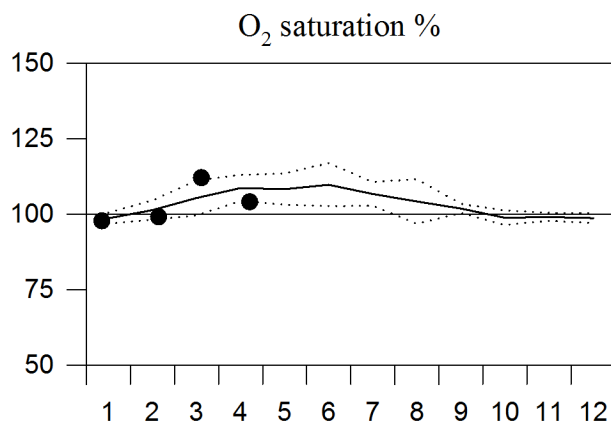
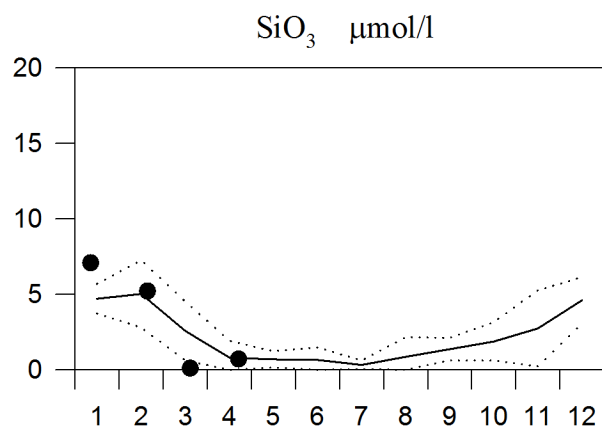
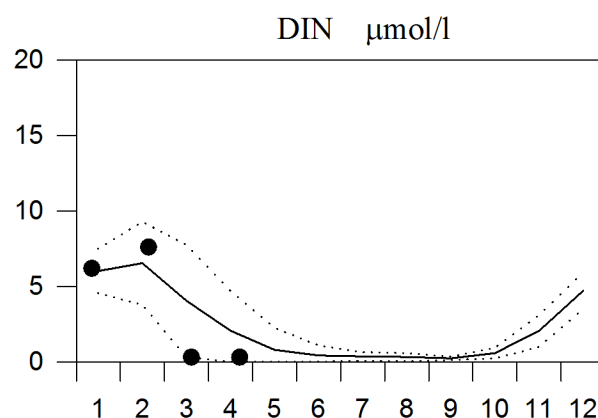
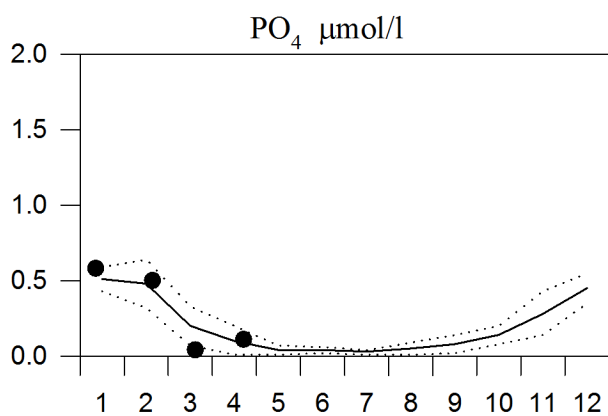
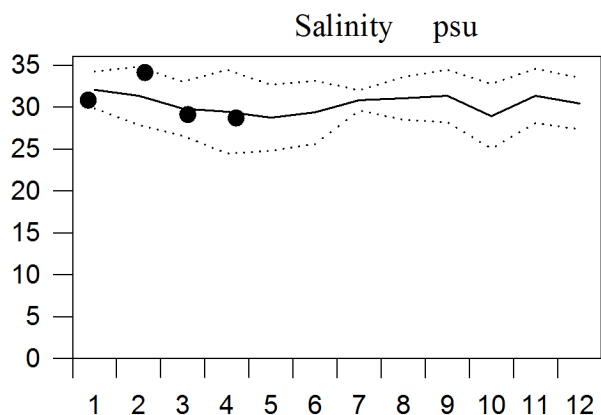
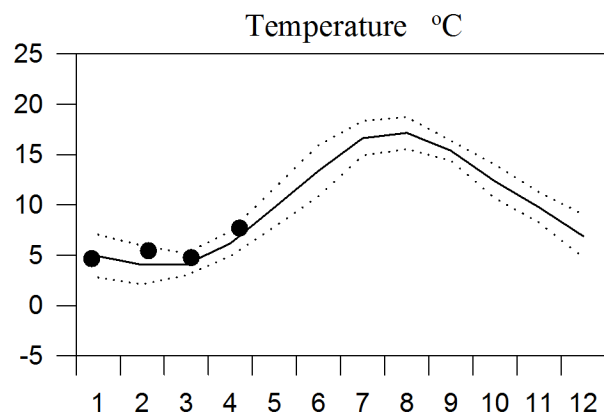
— Mean 1996-2010 St.Dev. ● 2016



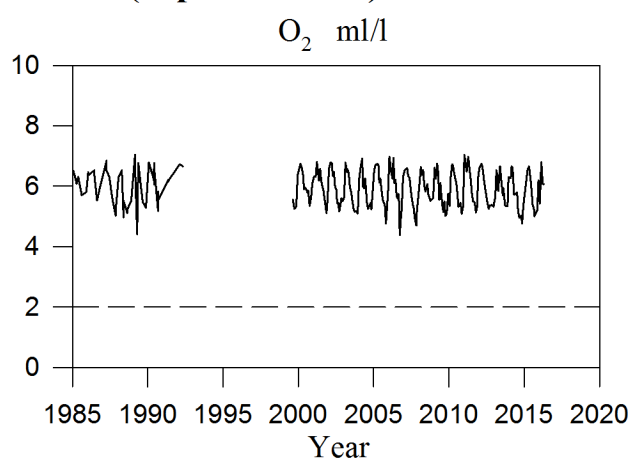
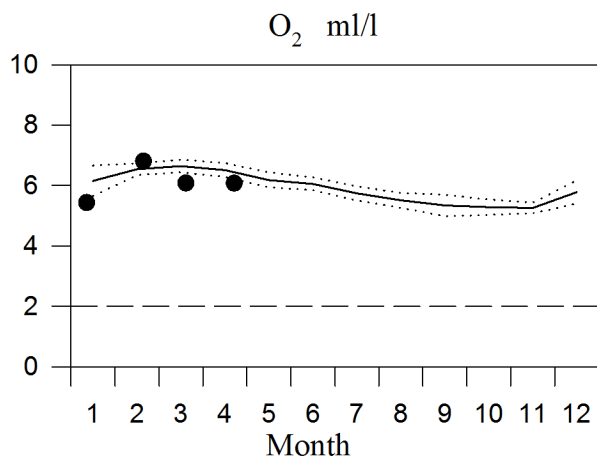
STATION Å15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016



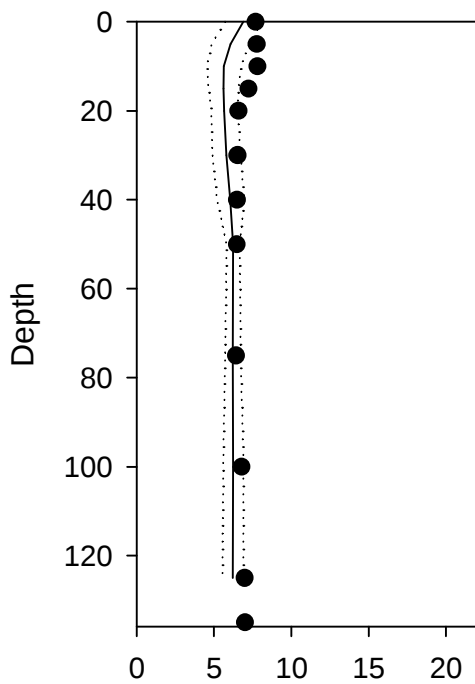
OXYGEN IN BOTTOM WATER (depth >=125m)



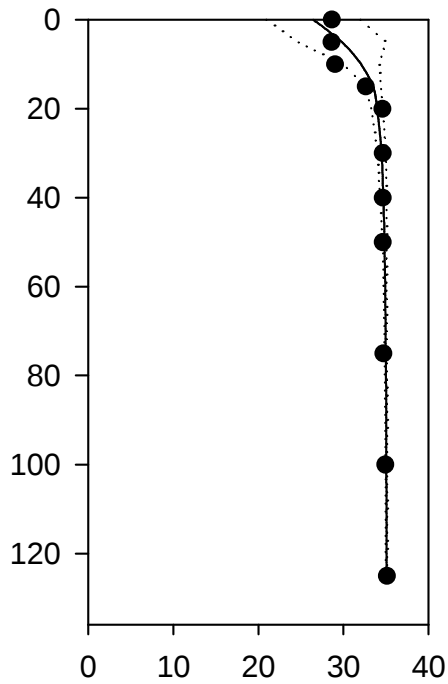
Vertical profiles Å15 April

— Mean 1996-2010 St.Dev. ● 2016

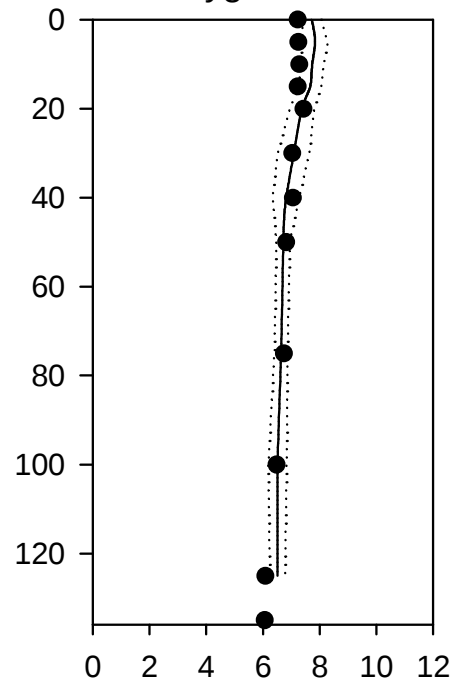
Temperature °C



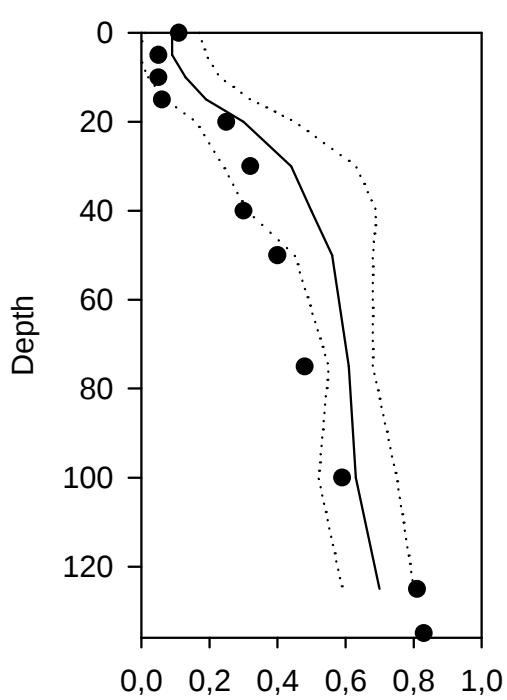
Salinity psu



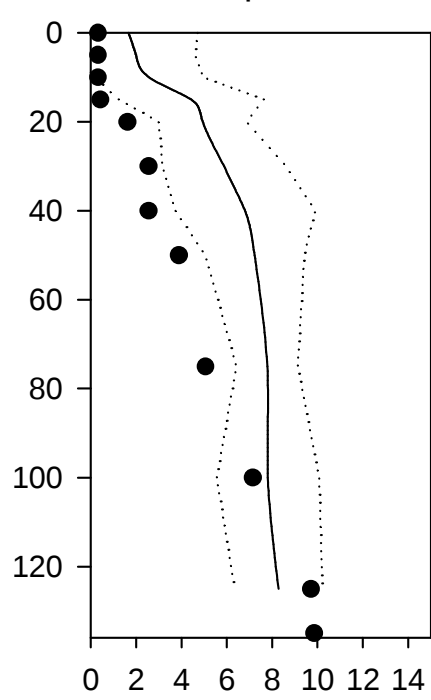
Oxygen ml/l



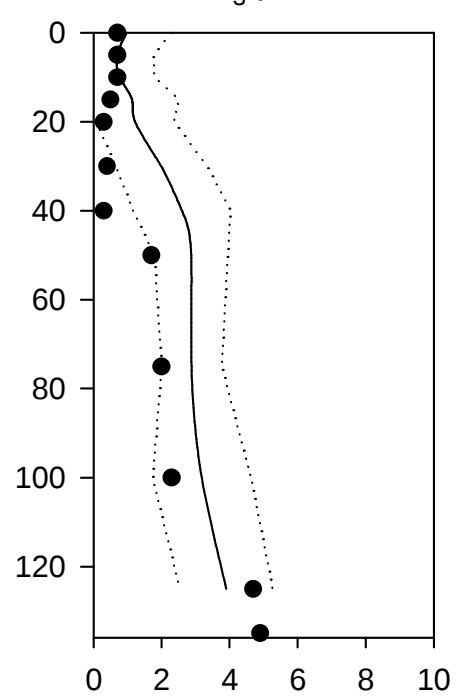
PO₄ μmol/l



DIN μmol/l



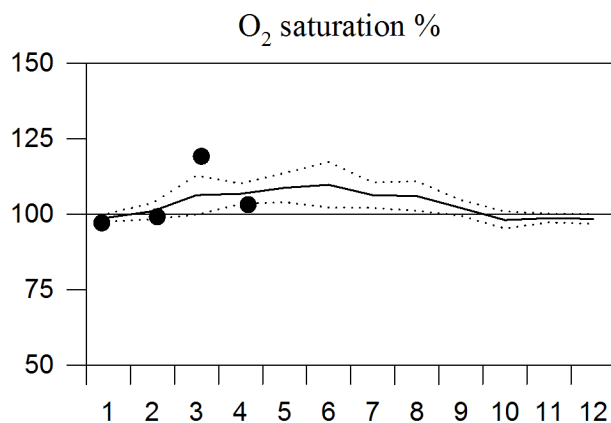
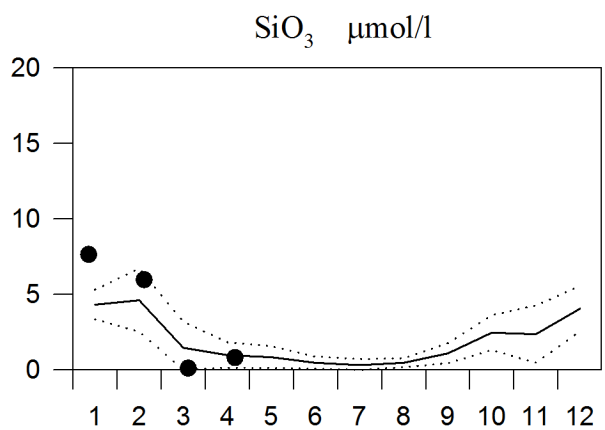
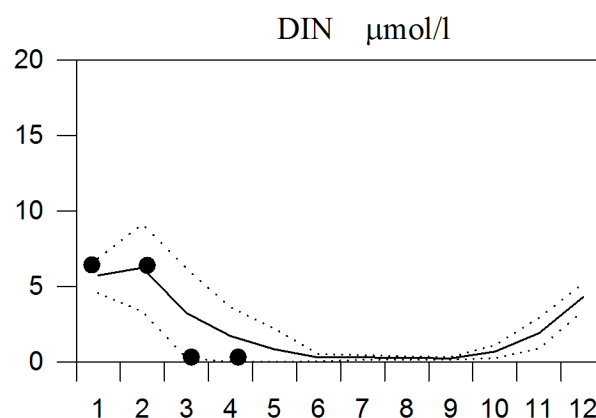
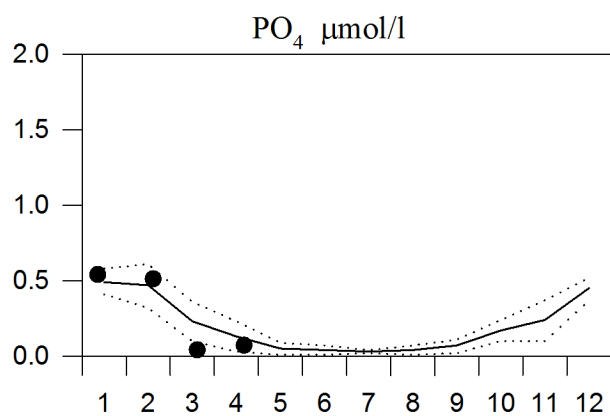
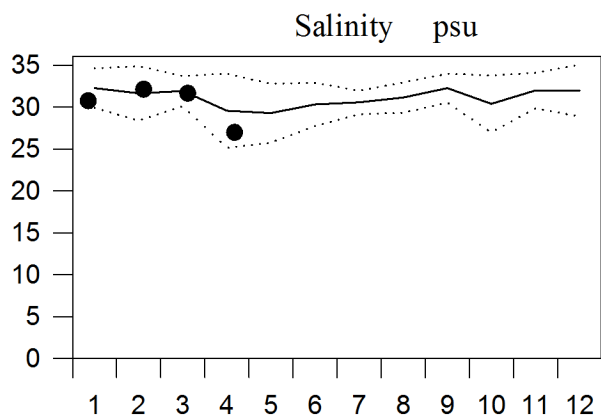
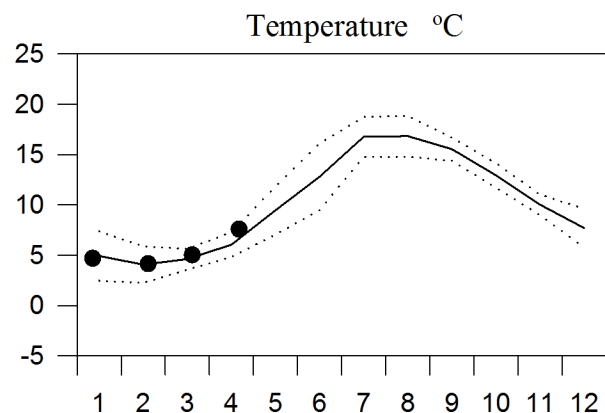
SiO₃ μmol/l



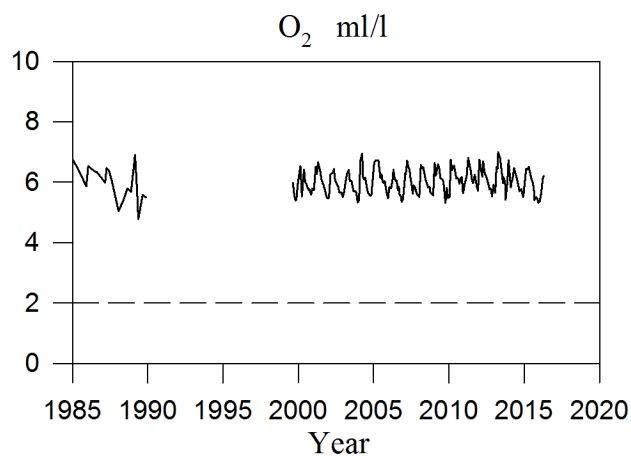
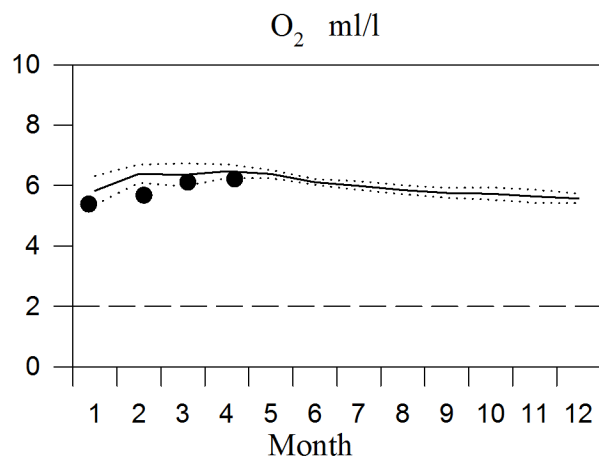
STATION Å17 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016



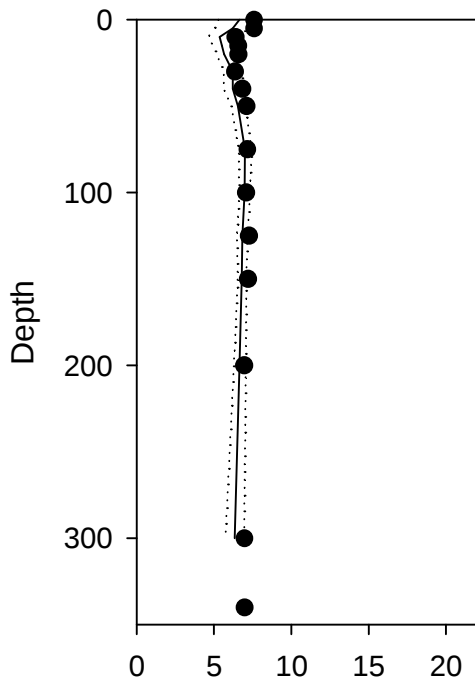
OXYGEN IN BOTTOM WATER (depth = 300m)



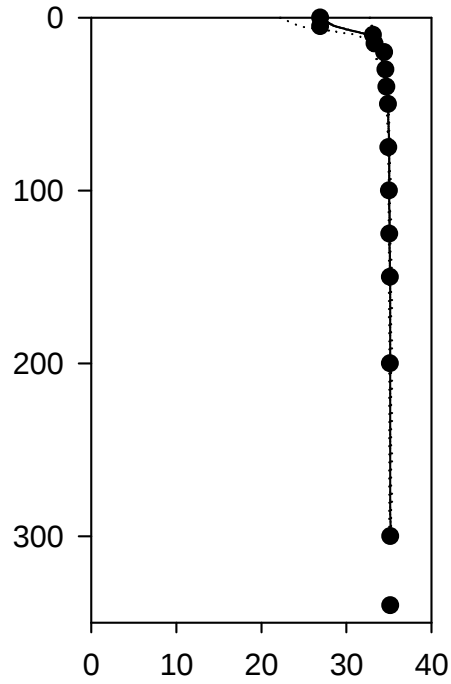
Vertical profiles Å17 April

— Mean 1996-2010 St.Dev. ● 2016

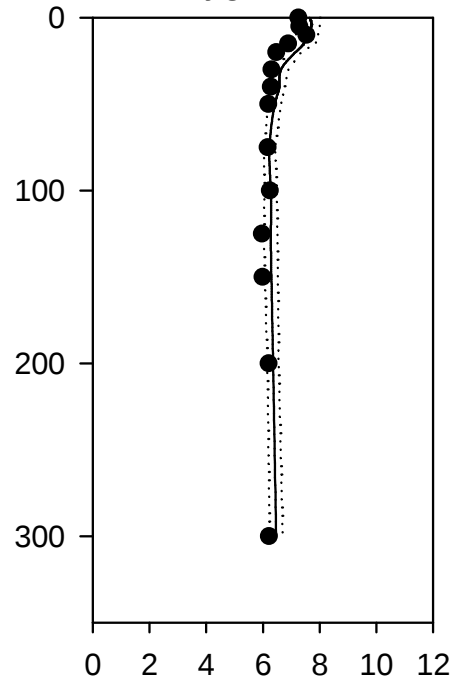
Temperature °C



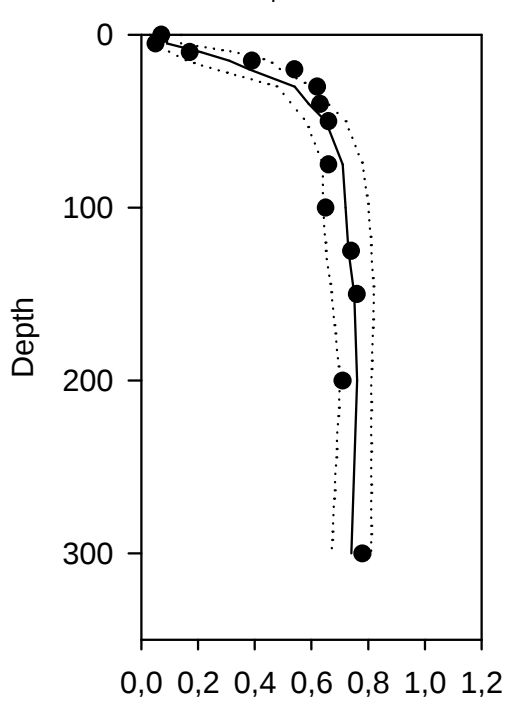
Salinity psu



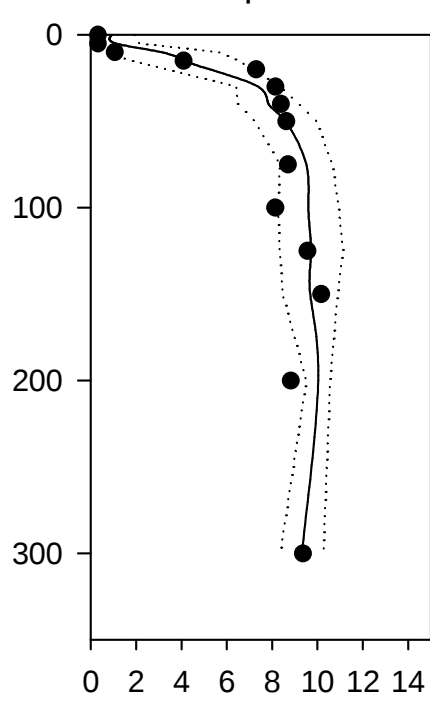
Oxygen ml/l



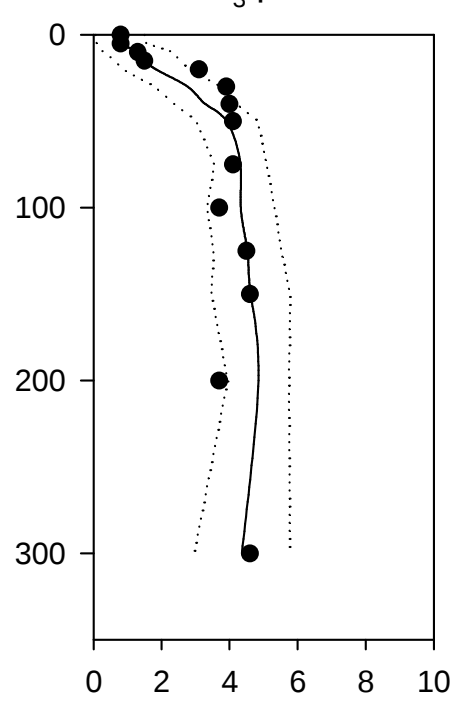
PO₄ µmol/l



DIN µmol/l



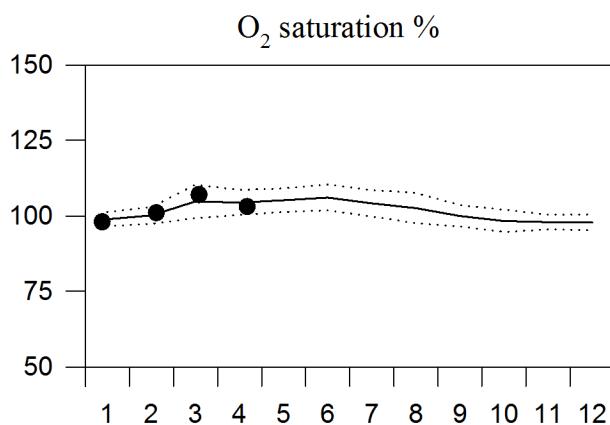
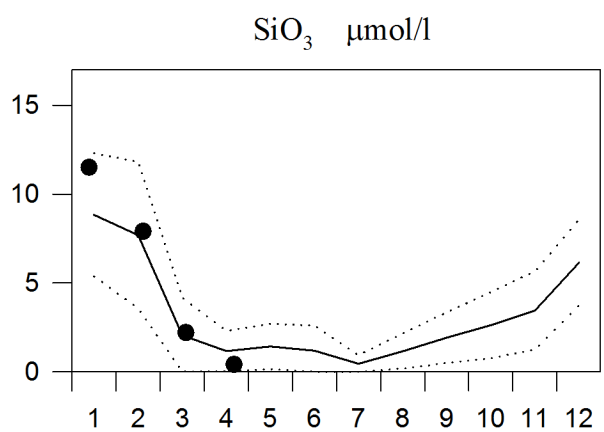
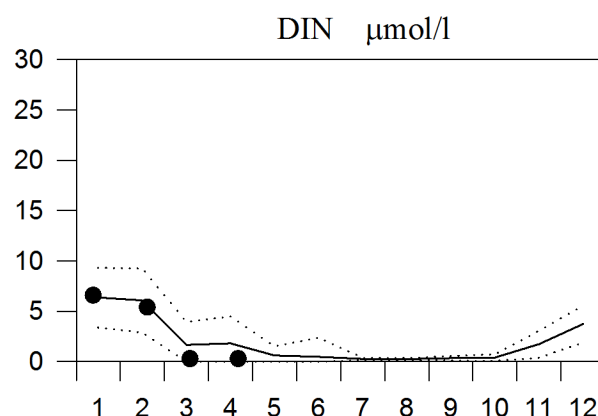
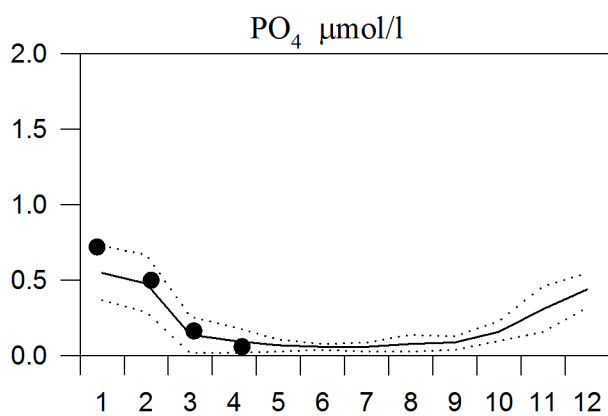
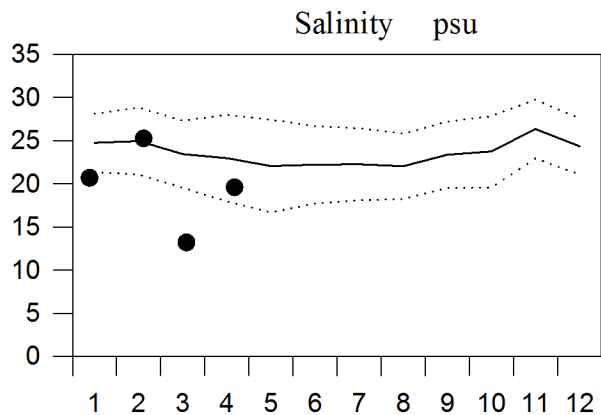
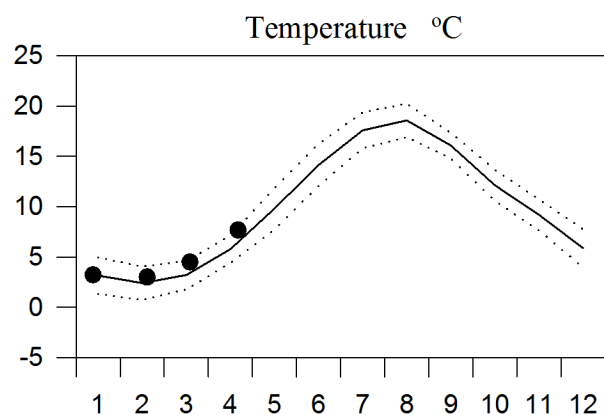
SiO₃ µmol/l



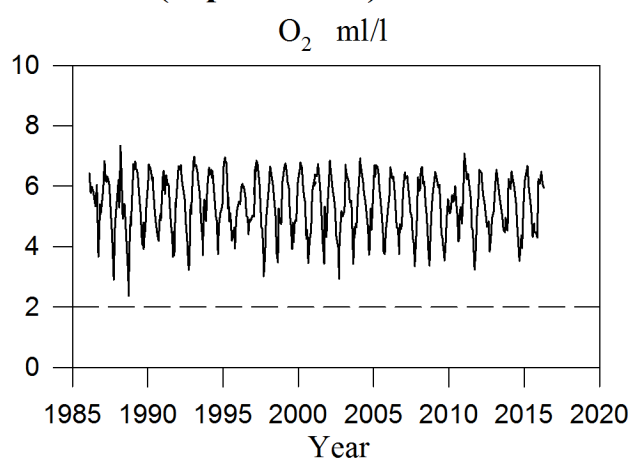
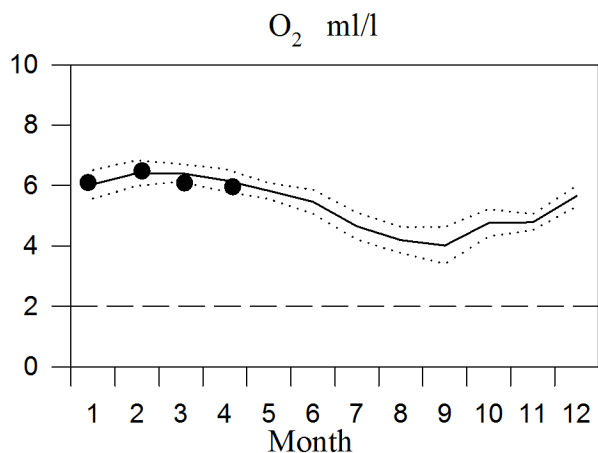
STATION FLADEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

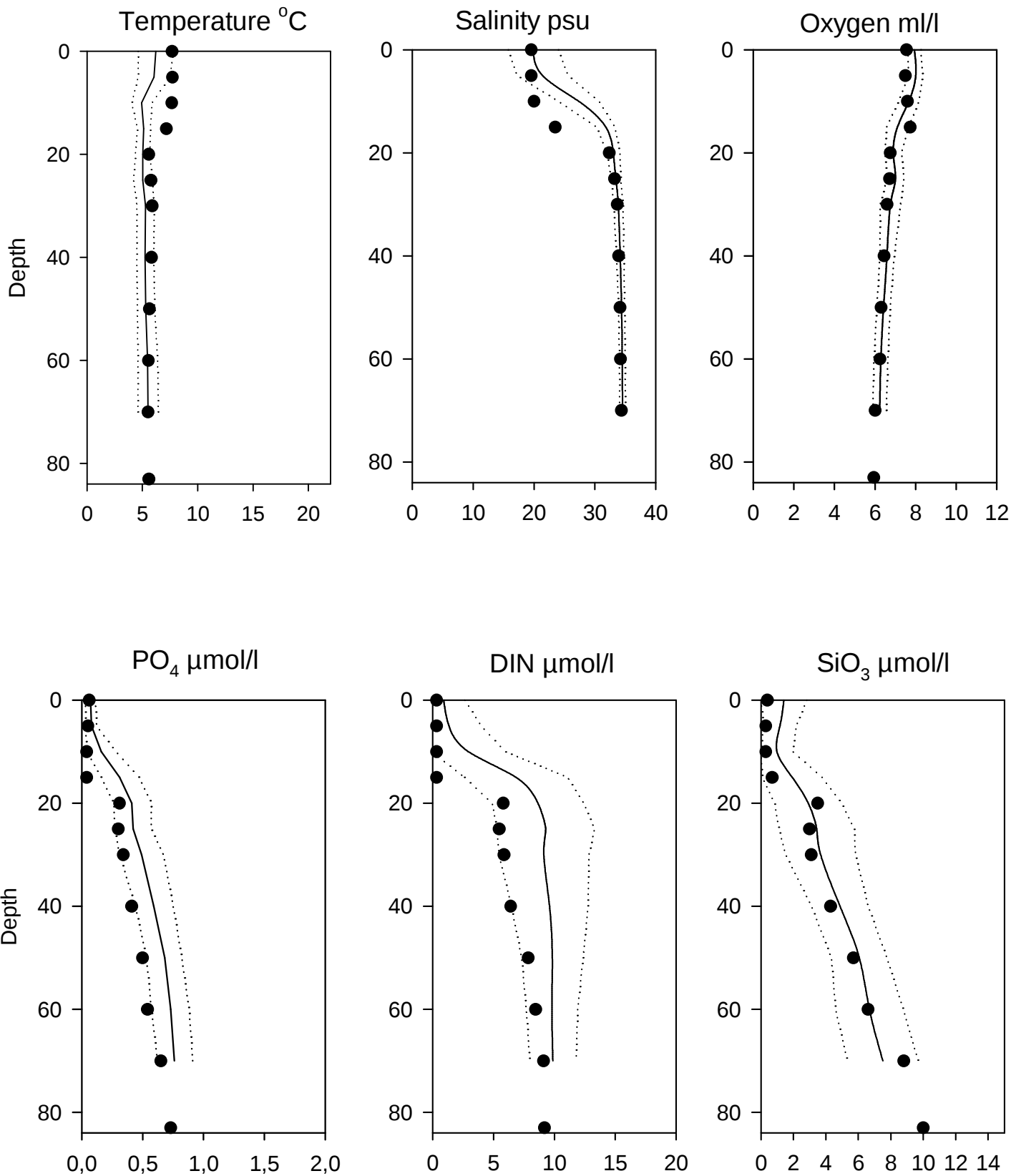


OXYGEN IN BOTTOM WATER (depth > 70m)



Vertical profiles Fladen April

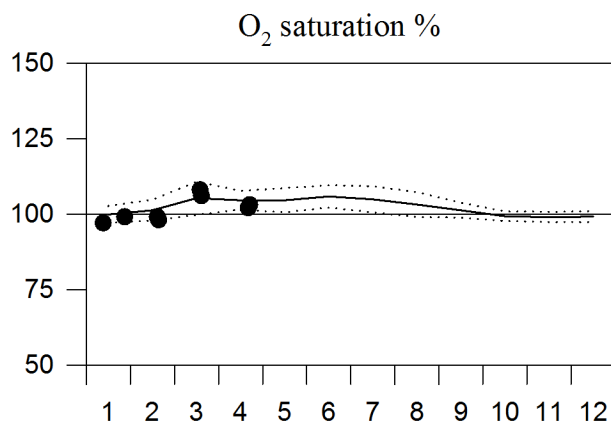
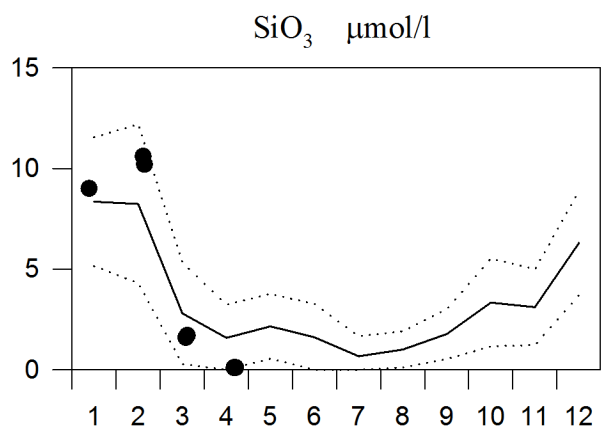
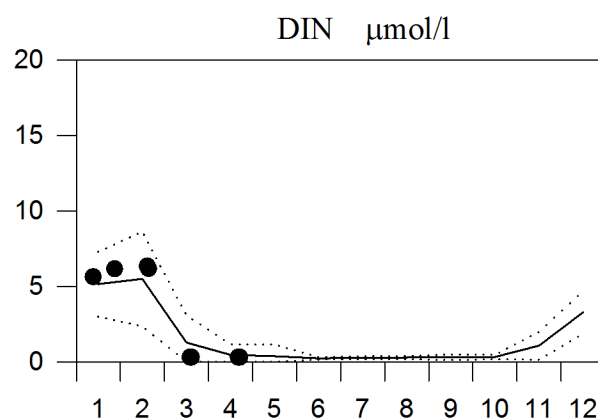
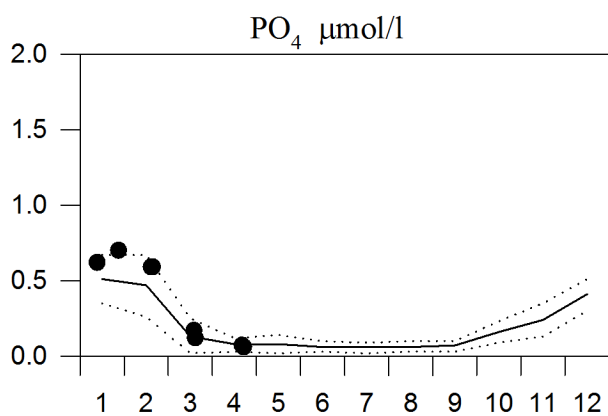
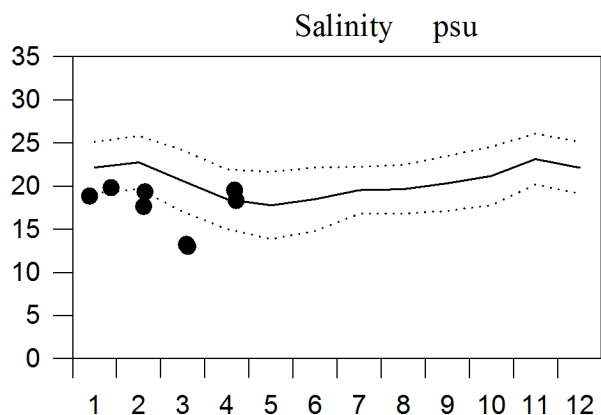
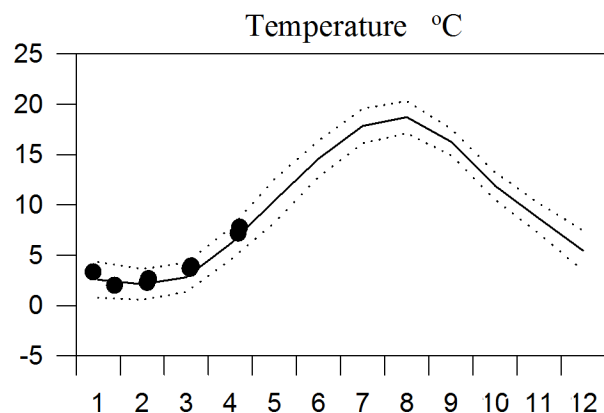
— Mean 1996-2010 St.Dev. ● 2016



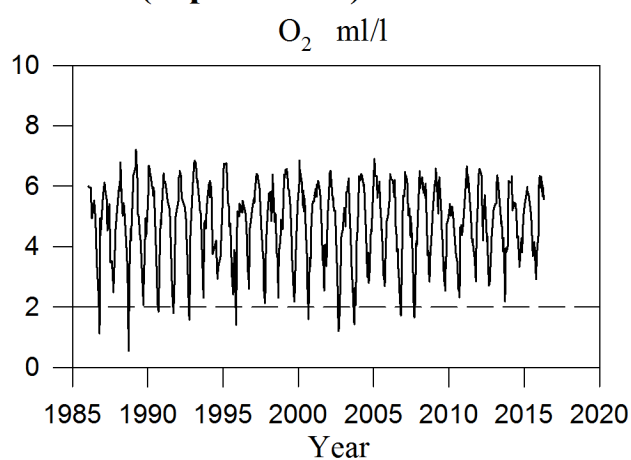
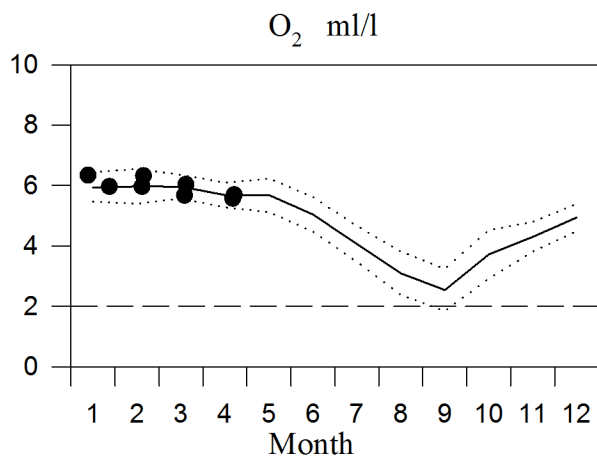
STATION ANHOLT E SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

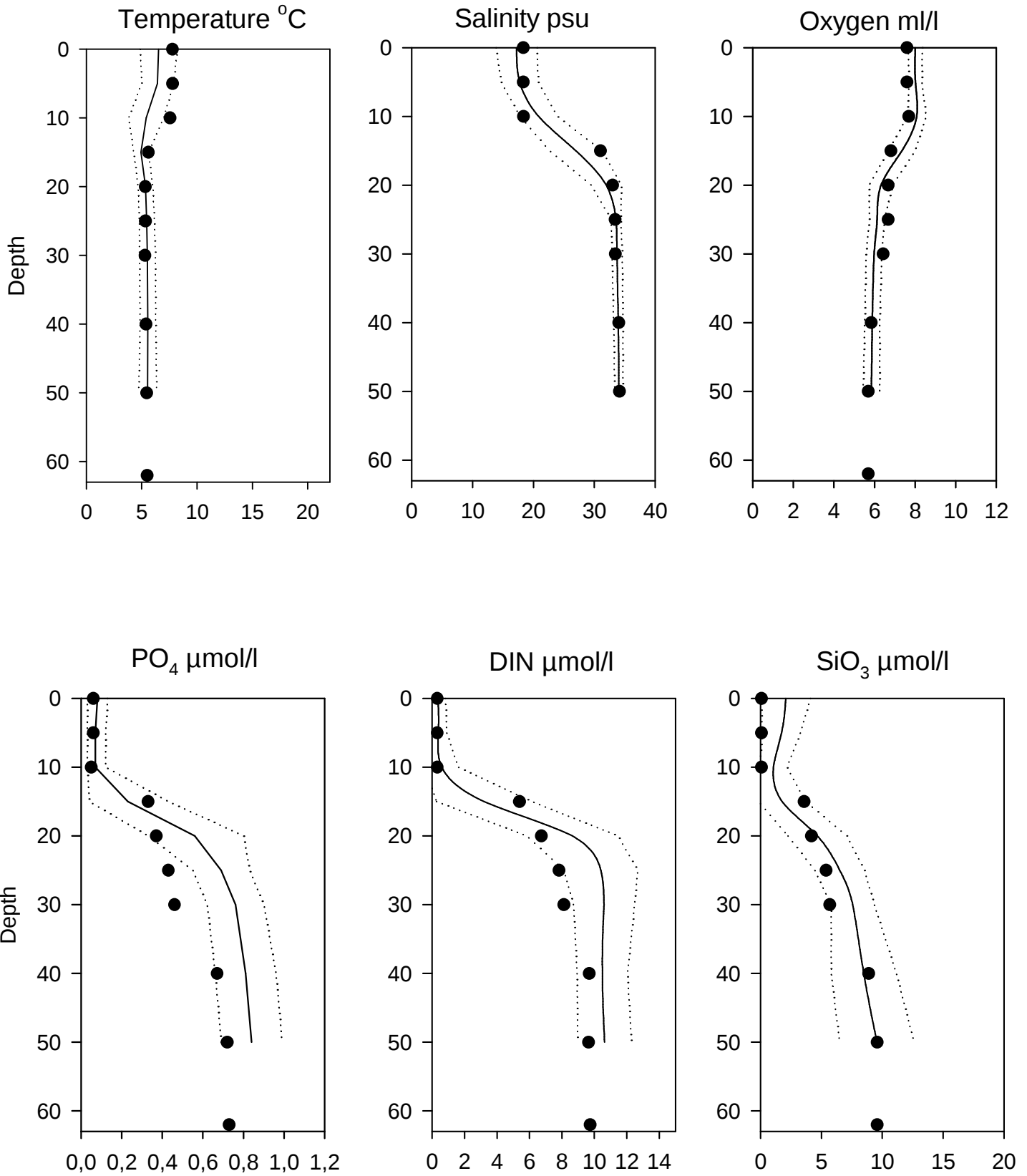


OXYGEN IN BOTTOM WATER (depth > 50m)



Vertical profiles Anholt E April

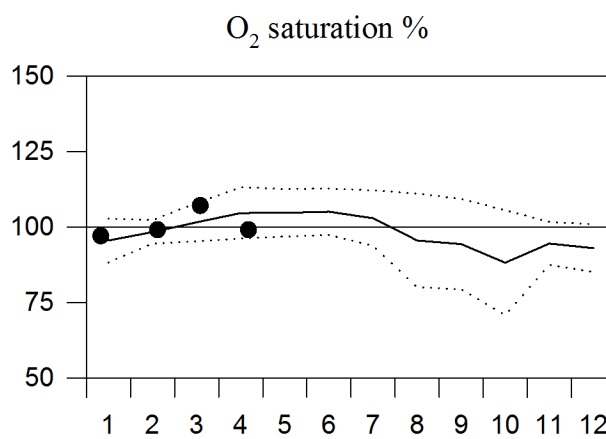
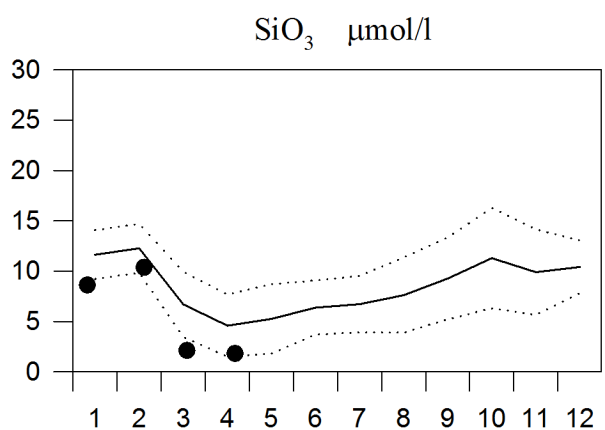
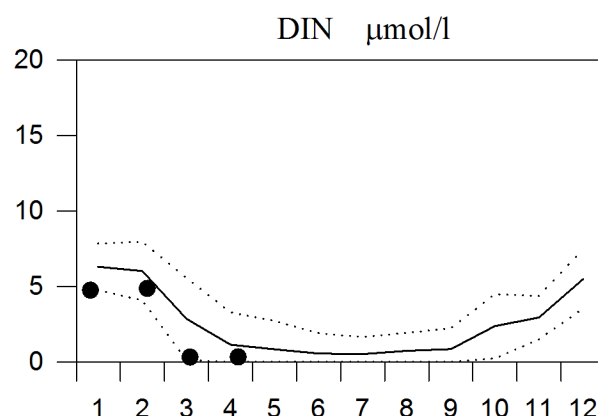
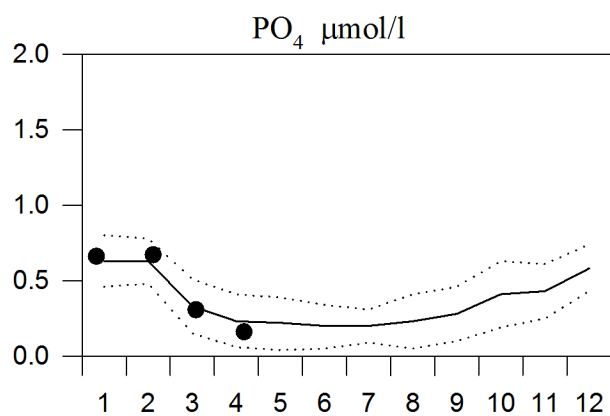
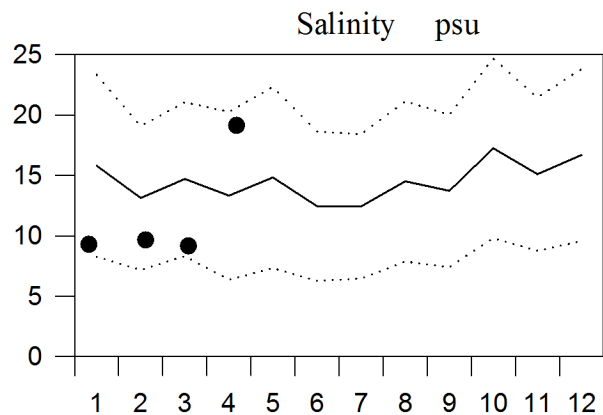
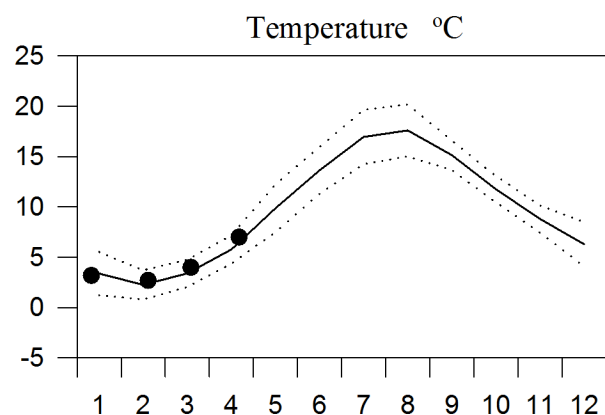
— Mean 1996-2010 St.Dev. ● 2016



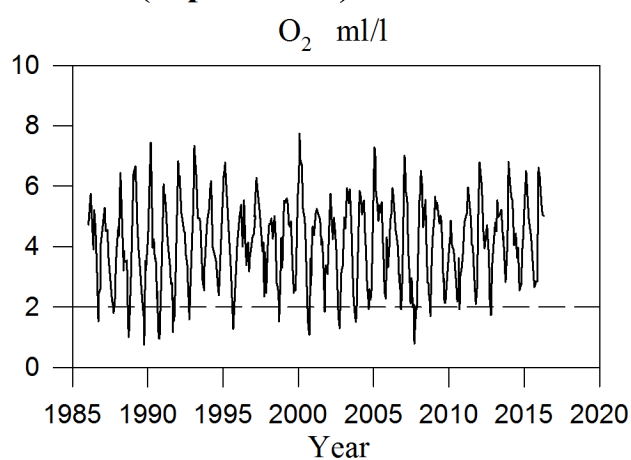
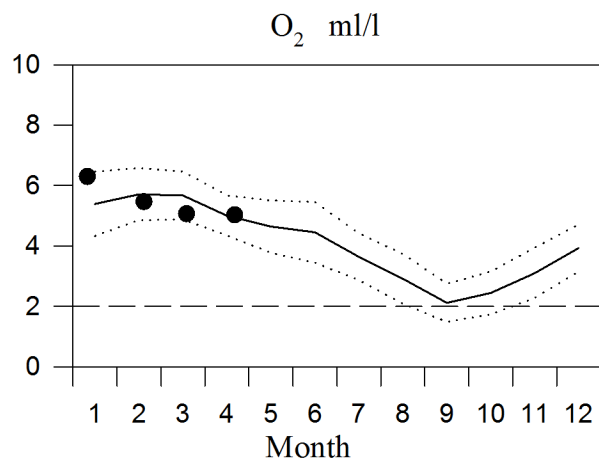
STATION W LANDSKRONA SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

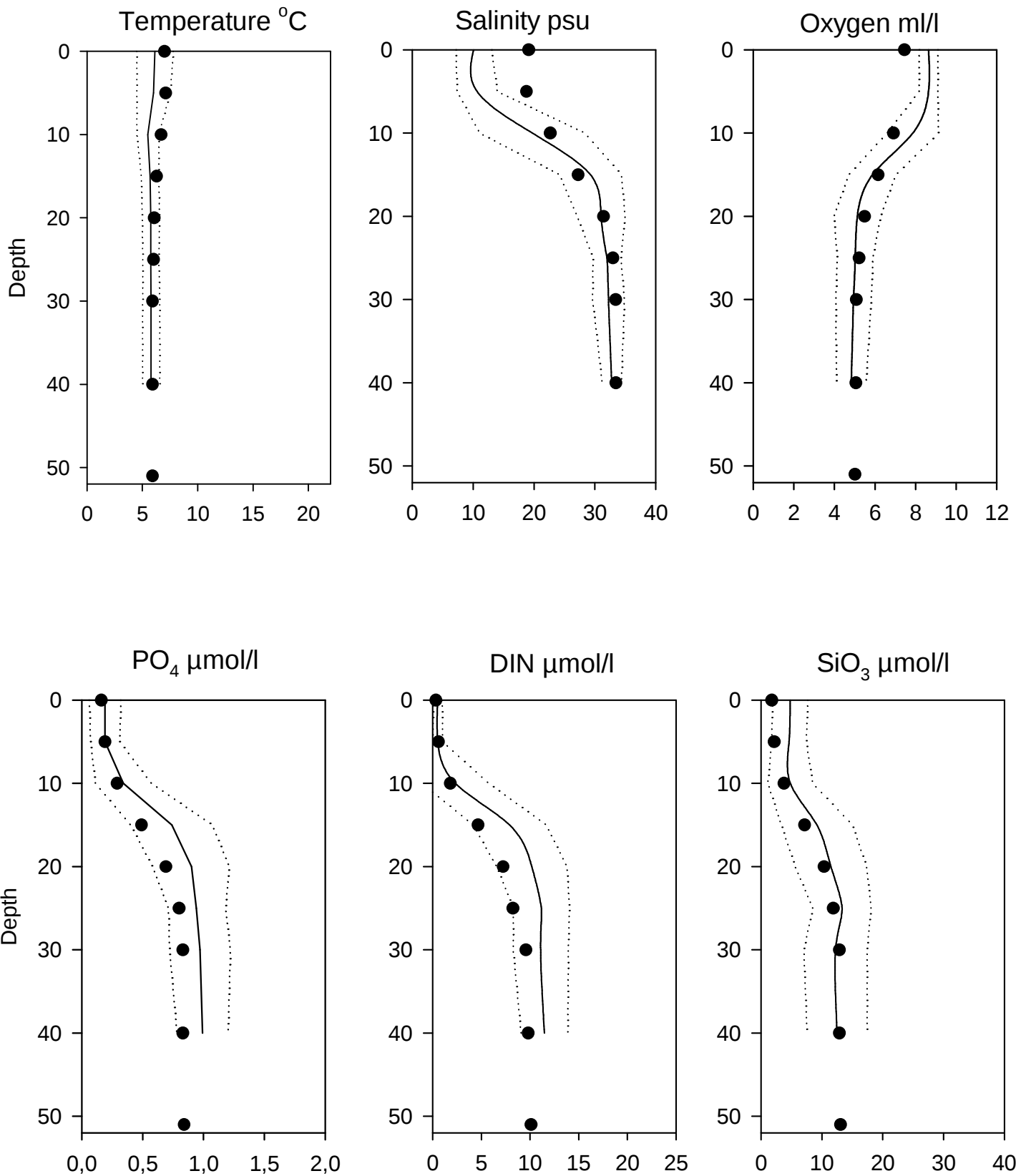


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles W Landskrona April

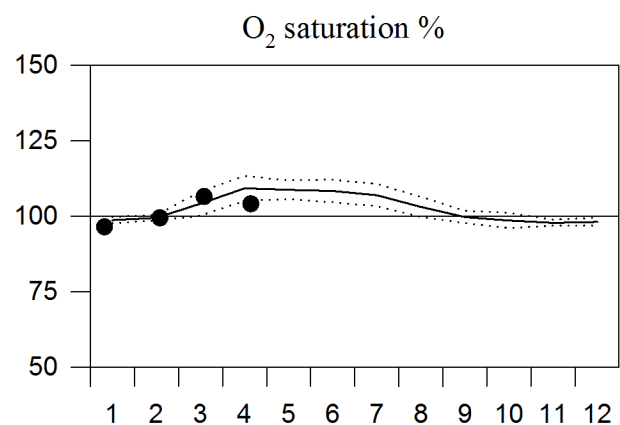
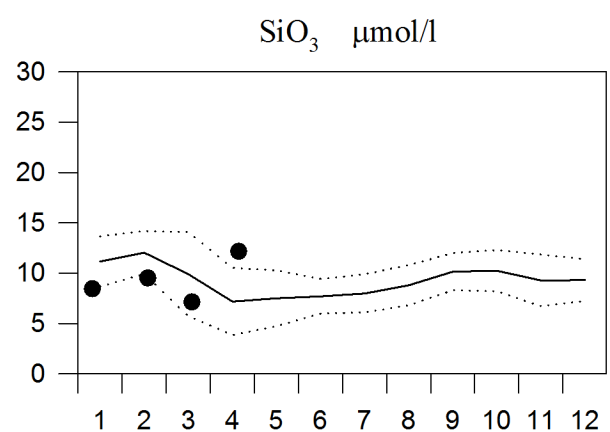
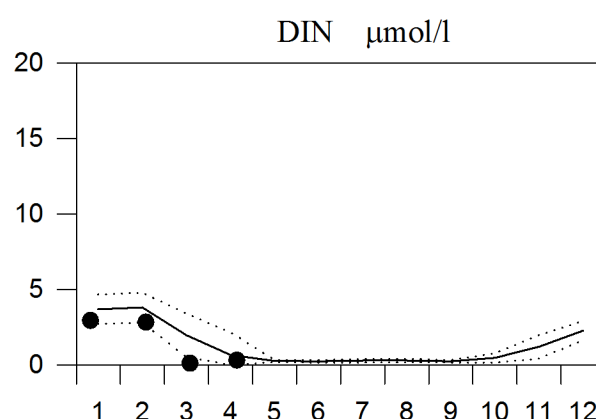
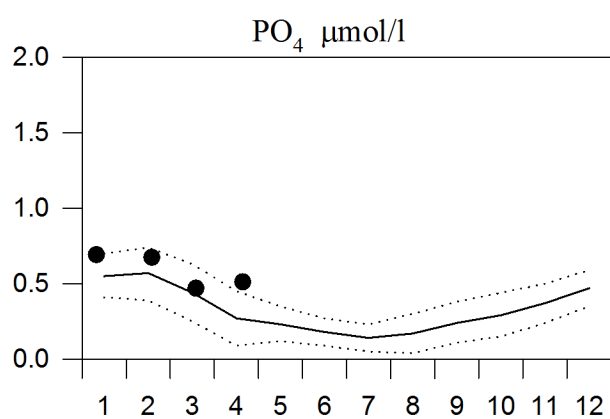
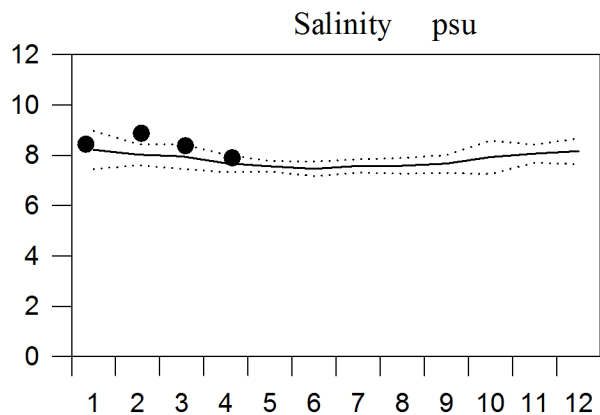
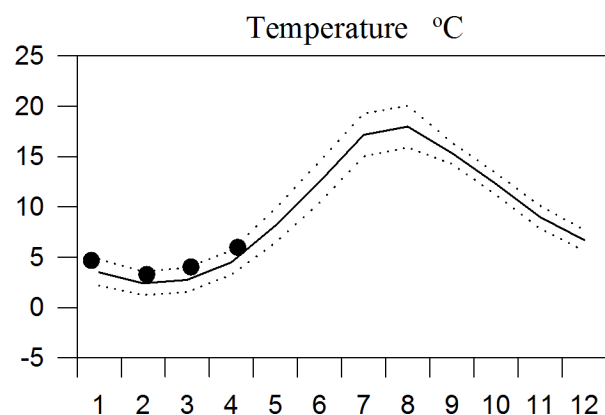
— Mean 1996-2010 St.Dev. ● 2016



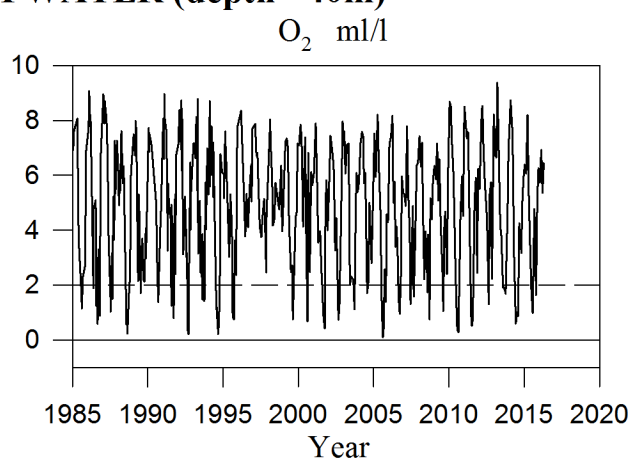
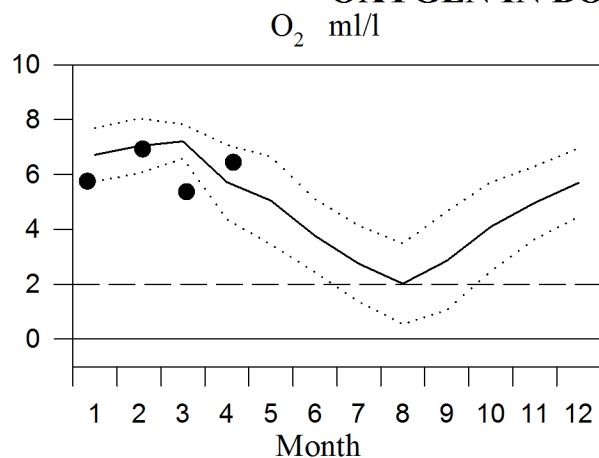
STATION BY1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

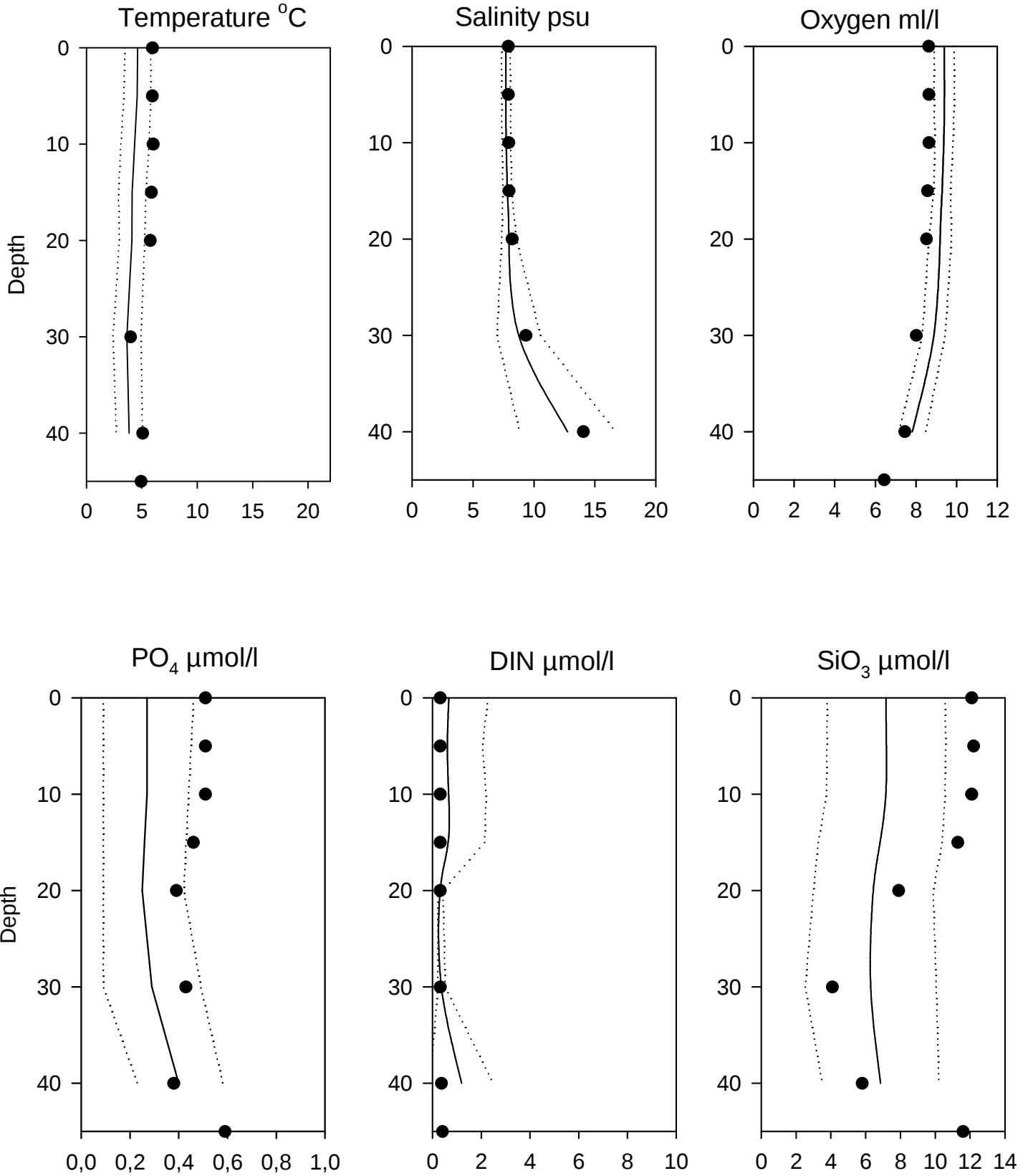


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY1 April

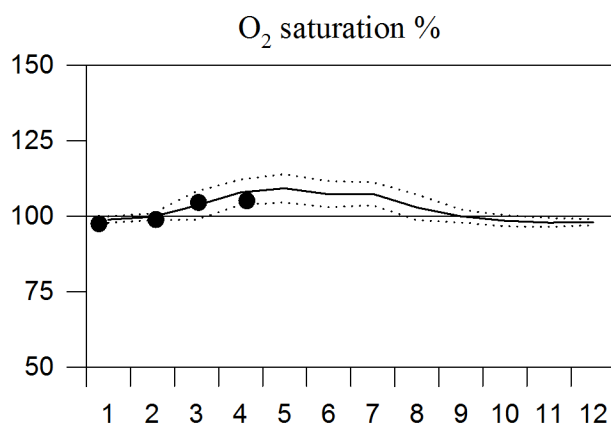
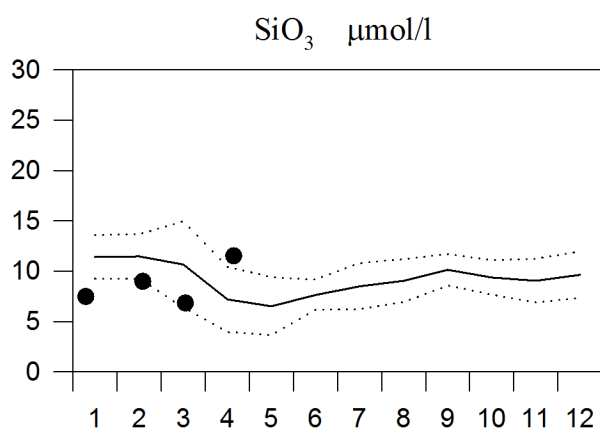
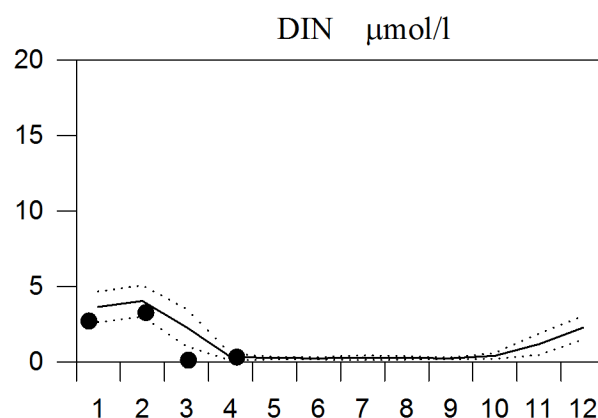
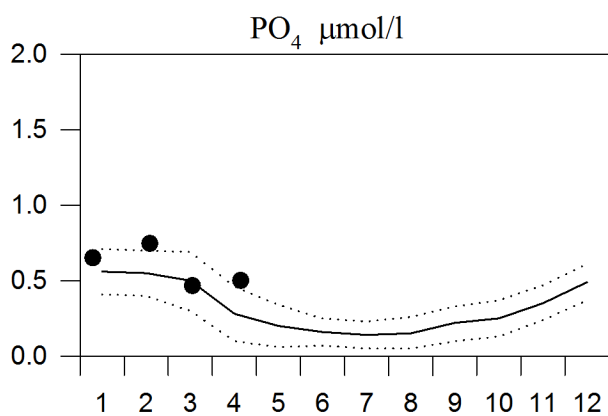
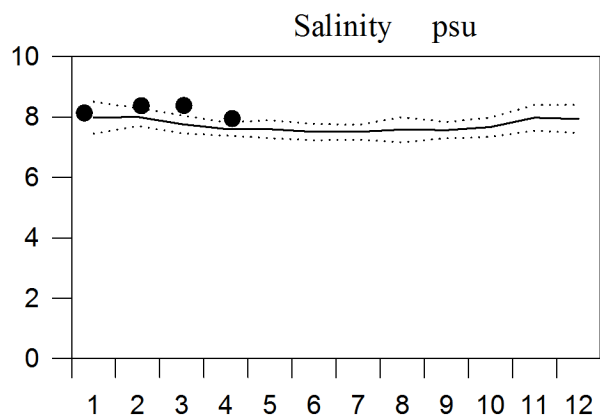
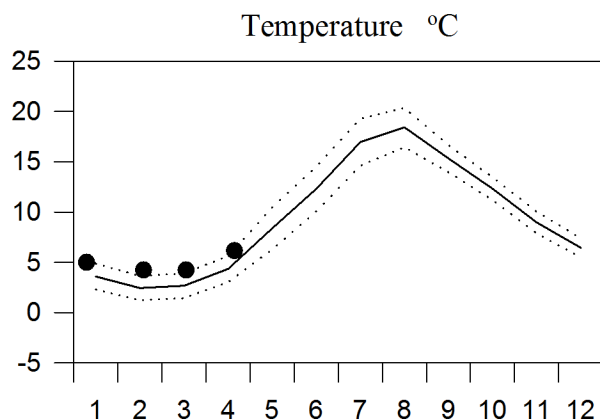
— Mean 1996-2010 St.Dev. ● 2016



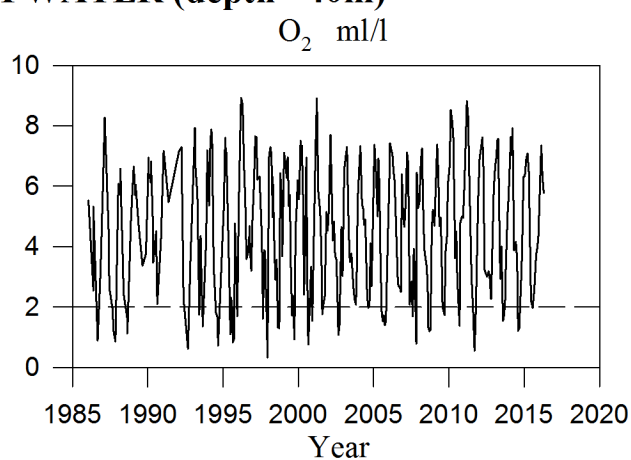
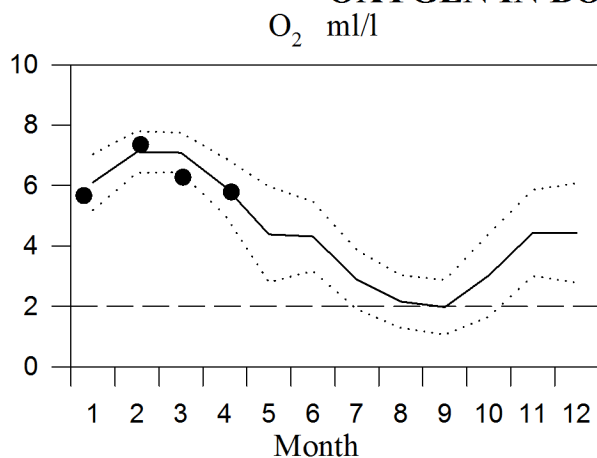
STATION BY2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

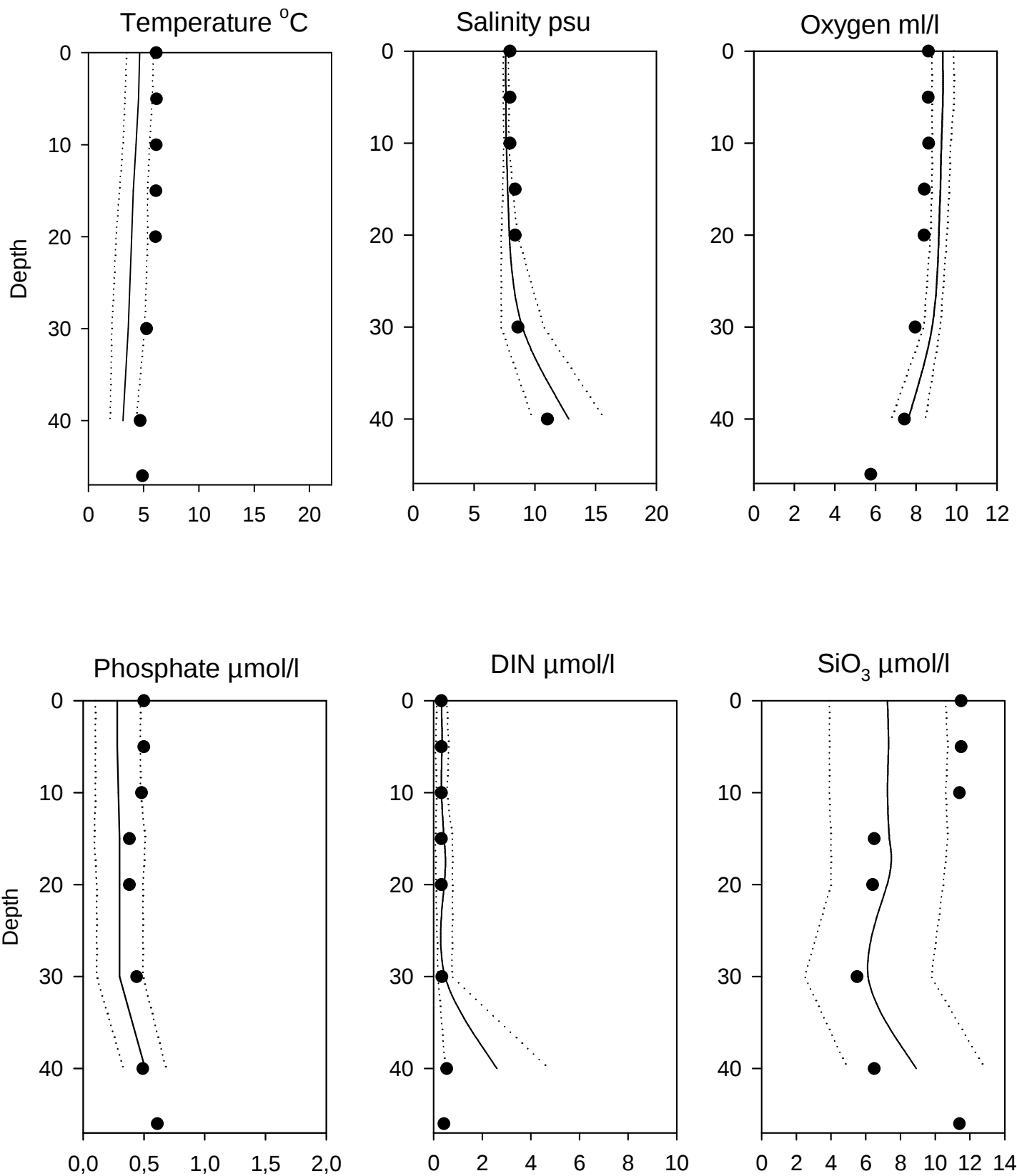


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY2 April

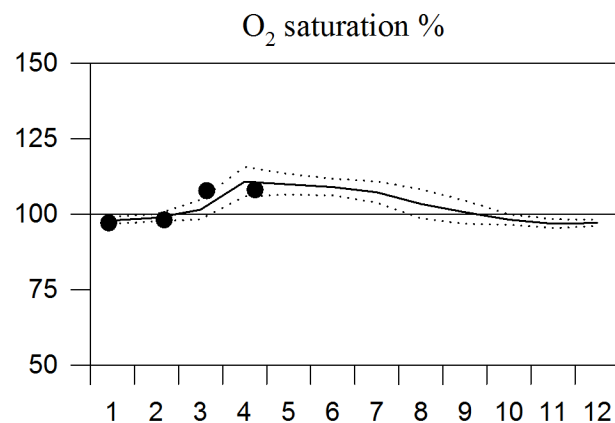
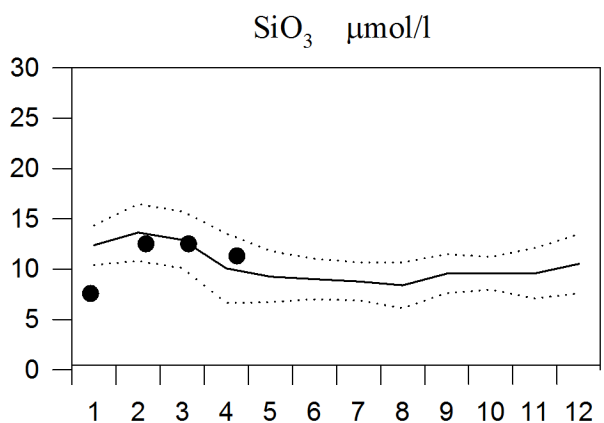
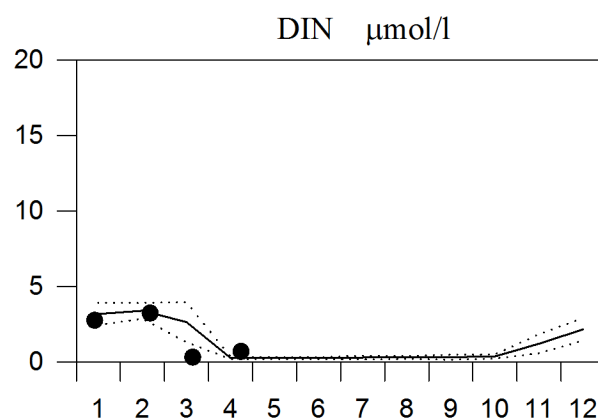
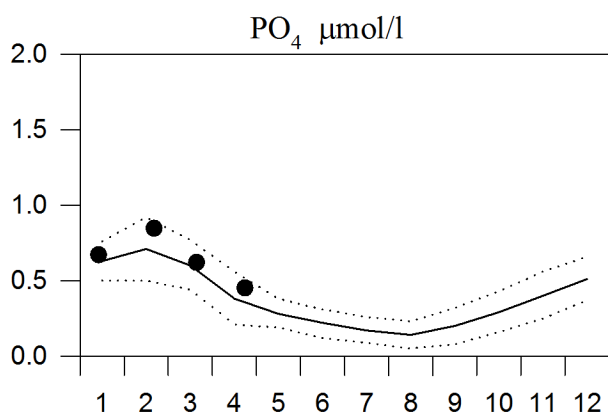
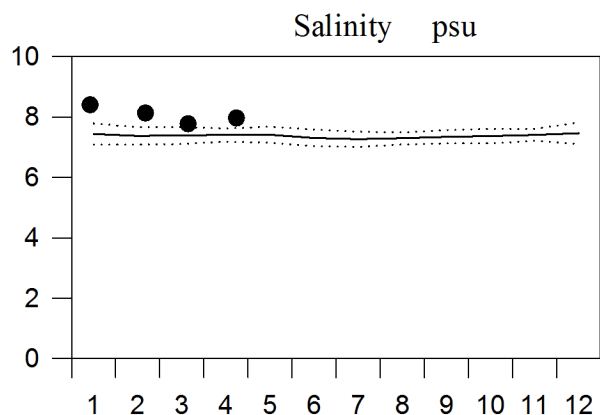
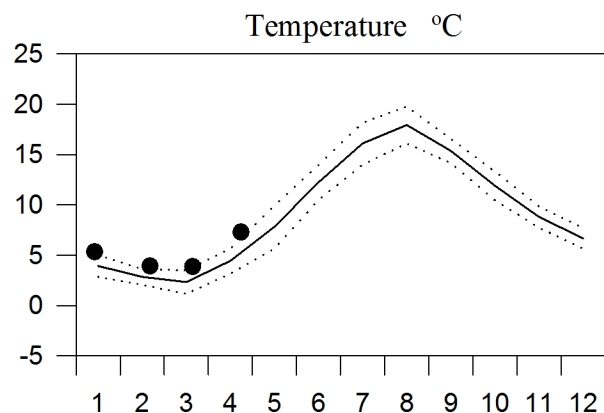
— Mean 1996-2010 St.Dev. ● 2016



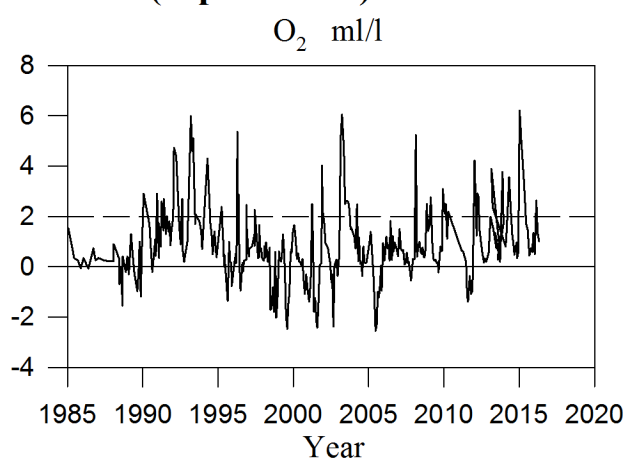
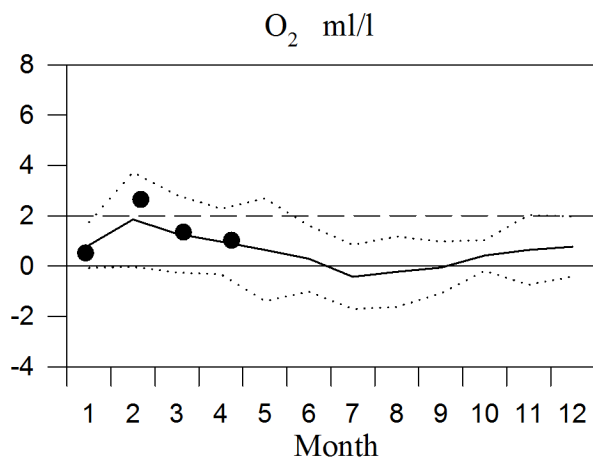
STATION HANÖBUKTEN SURFACE WATER

Annual Cycles

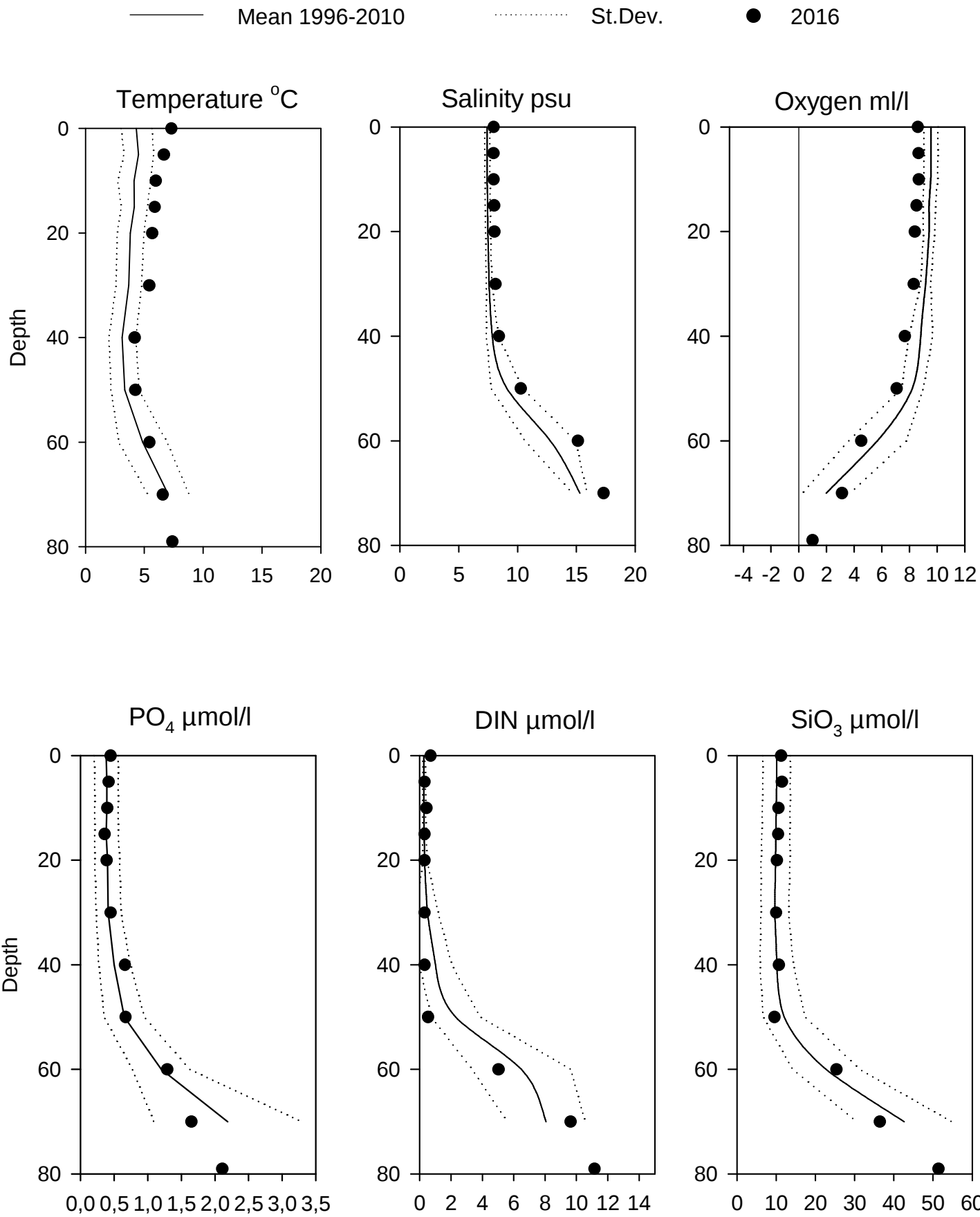
— Mean 1996-2010 St.Dev. ● 2016



OXYGEN IN BOTTOM WATER (depth > 70m)



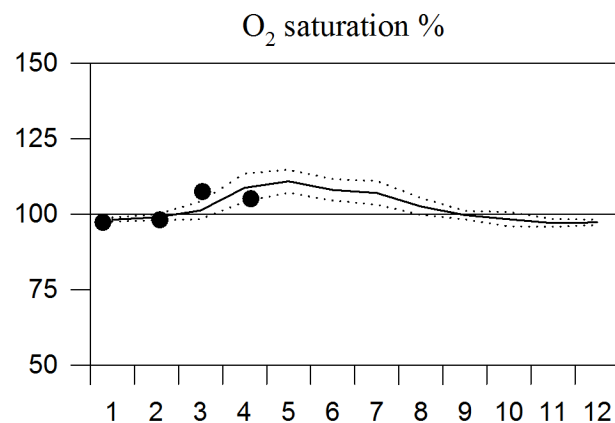
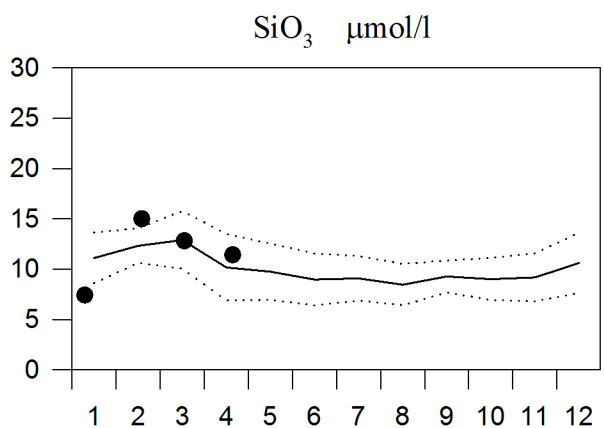
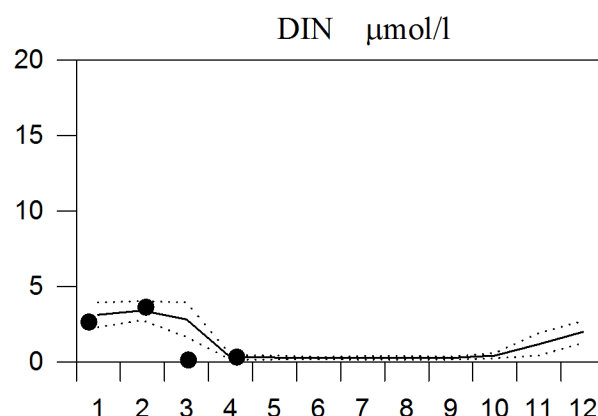
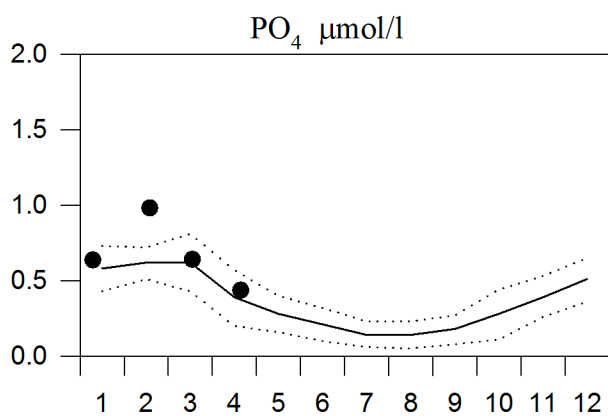
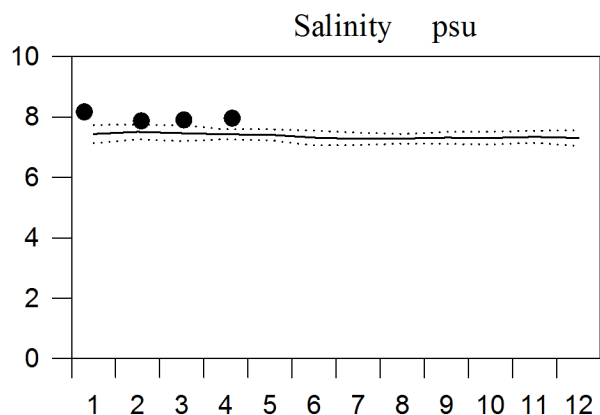
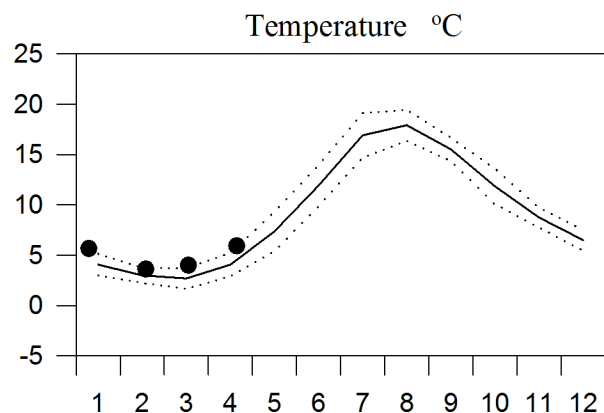
Vertical profiles Hanöbukten April



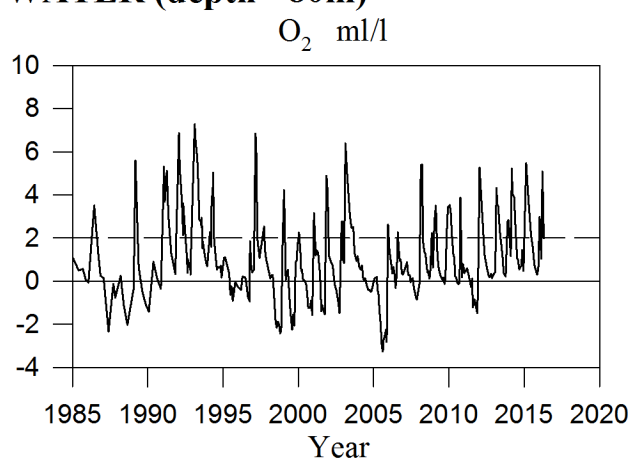
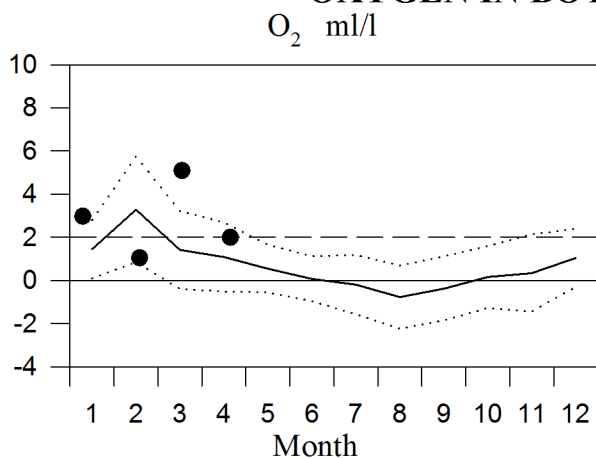
STATION BY4 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

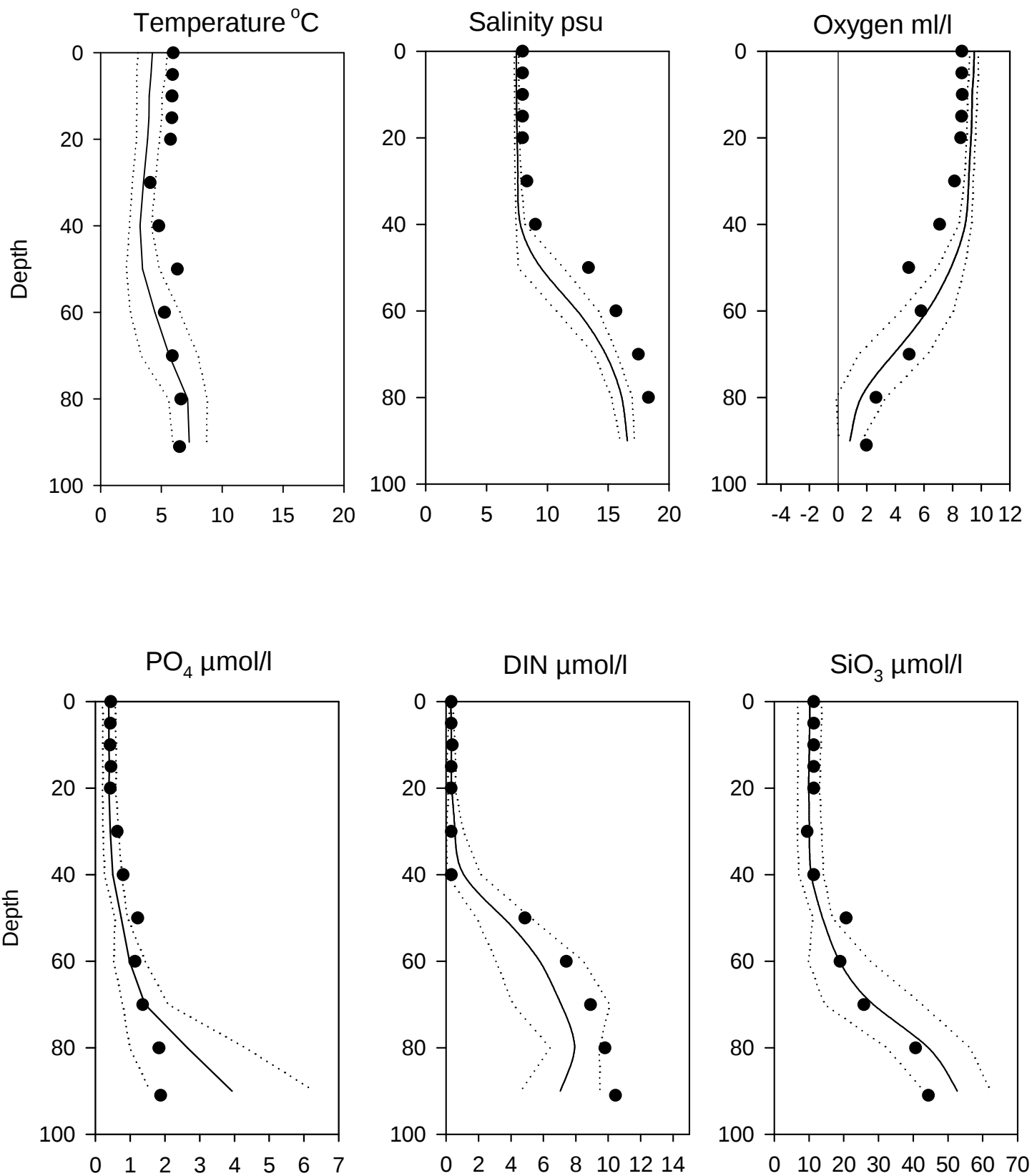


OXYGEN IN BOTTOM WATER (depth >80m)



Vertical profiles BY4 April

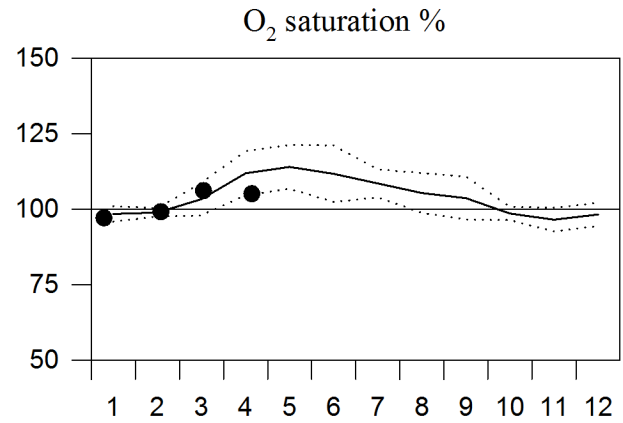
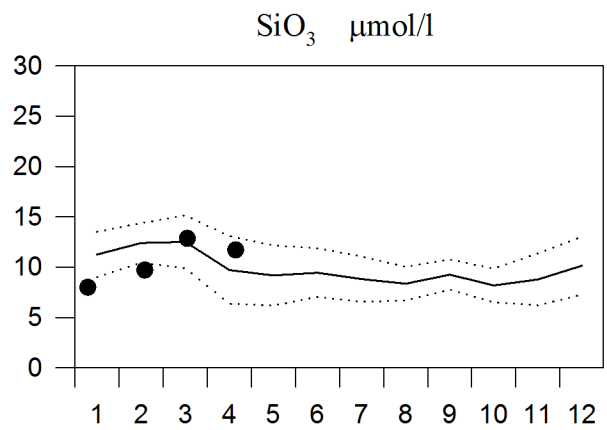
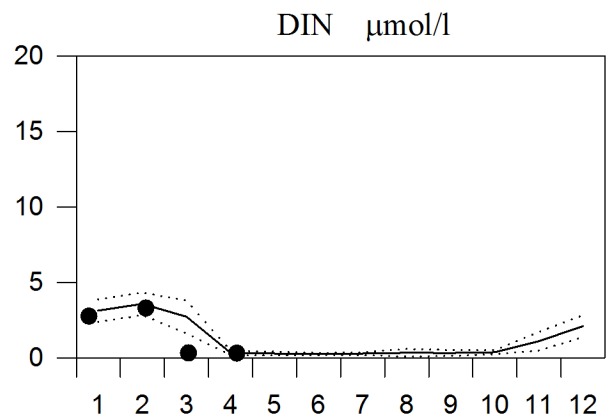
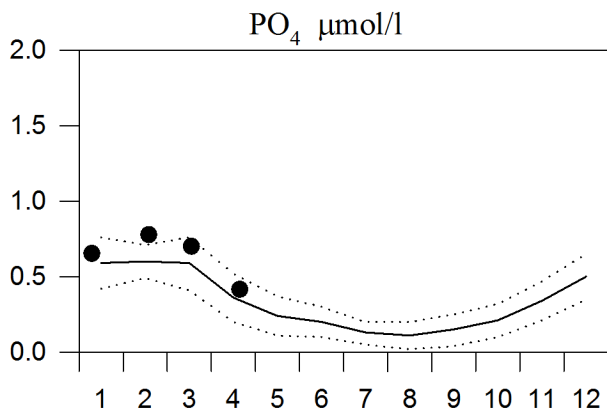
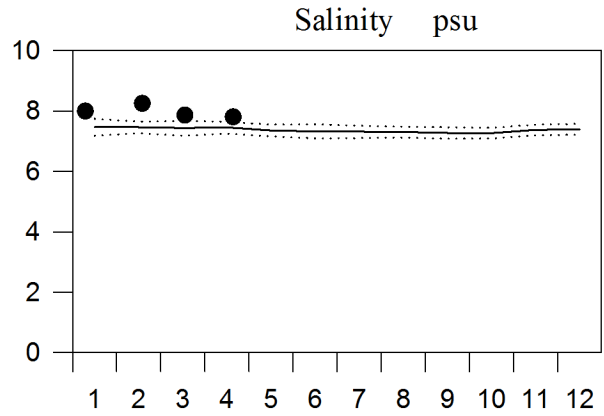
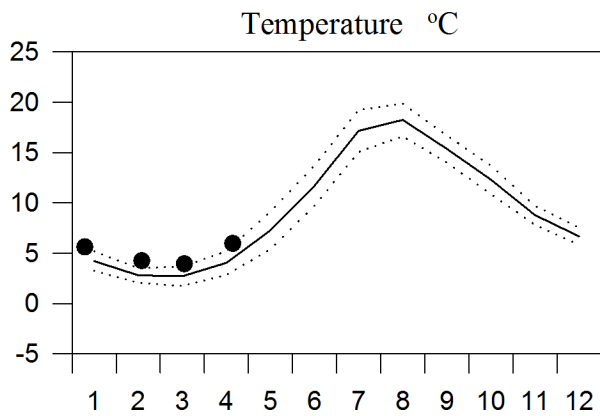
— Mean 1996-2010 St.Dev. ● 2016



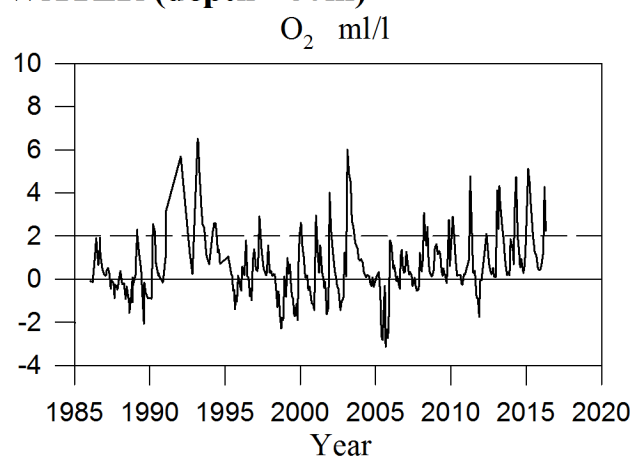
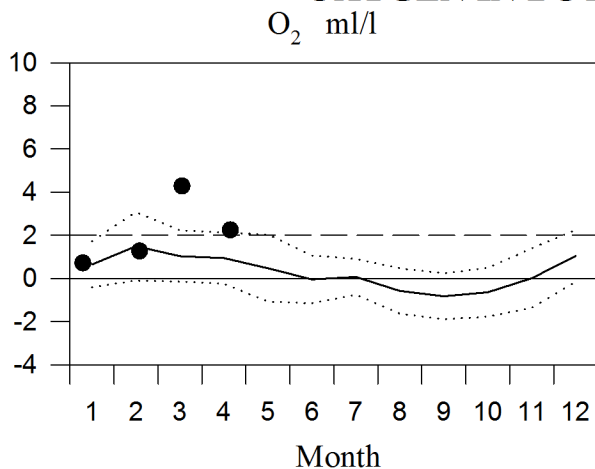
STATION BY5 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

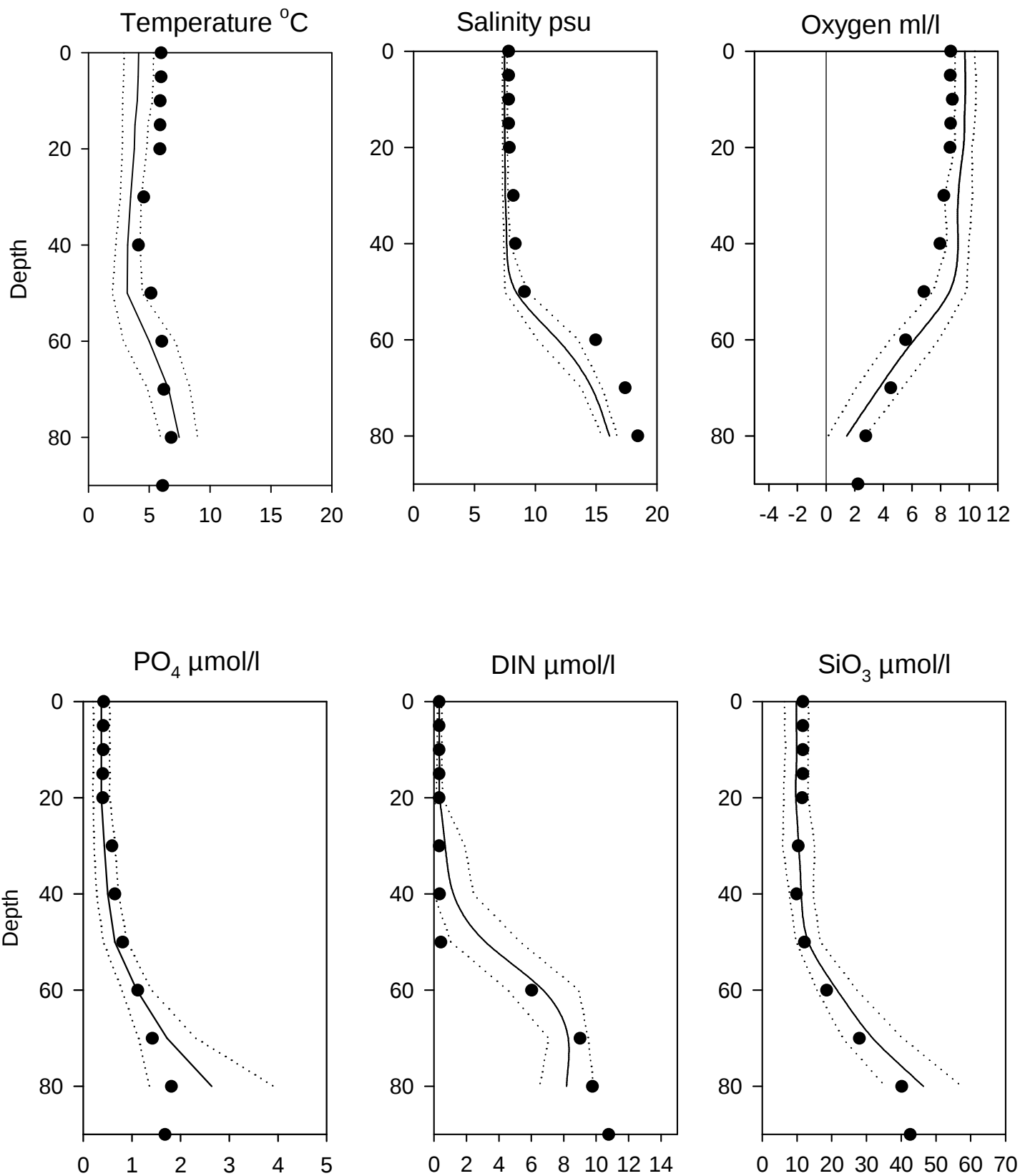


OXYGEN IN BOTTOM WATER (depth >80m)



Vertical profiles BY5 April

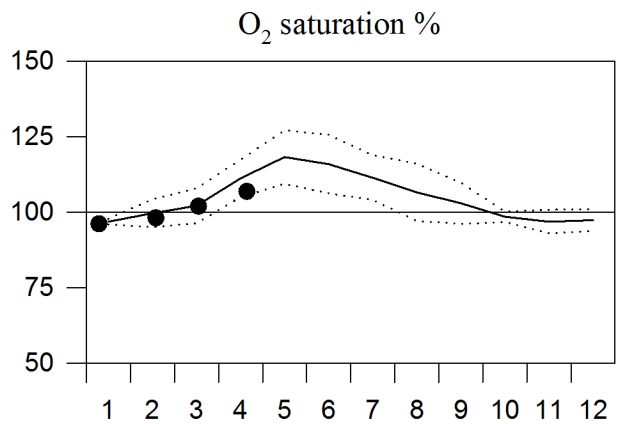
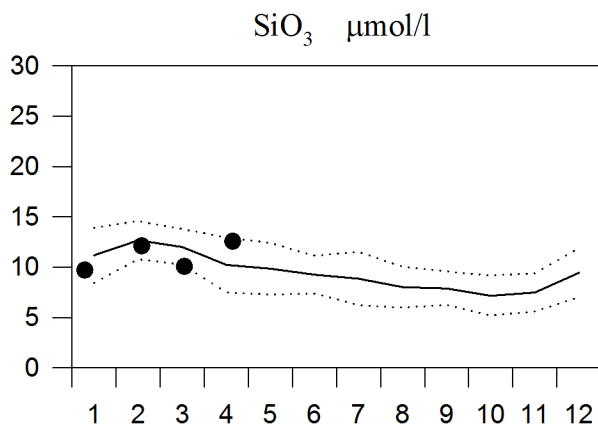
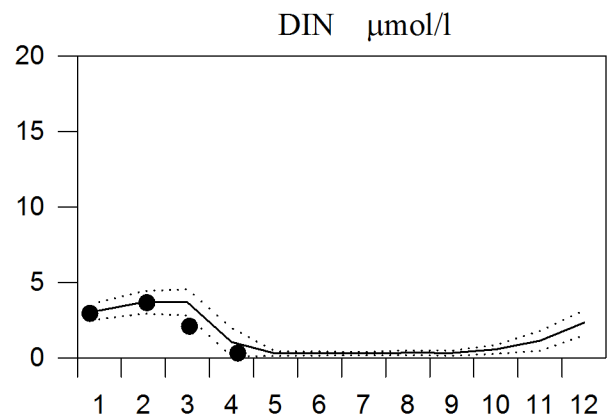
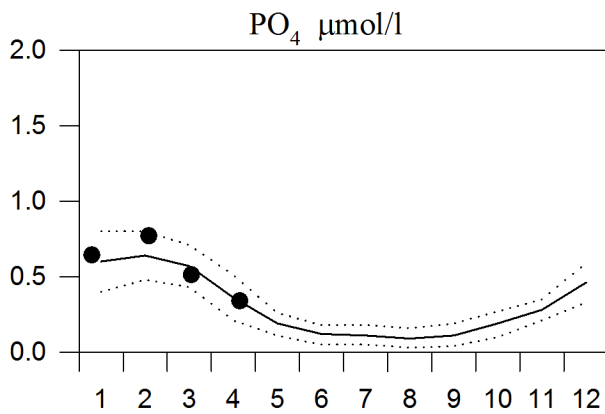
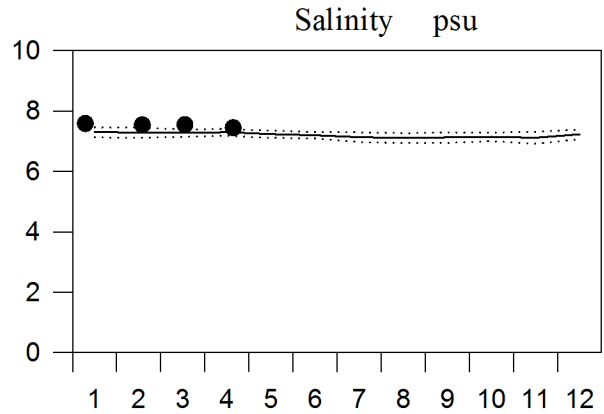
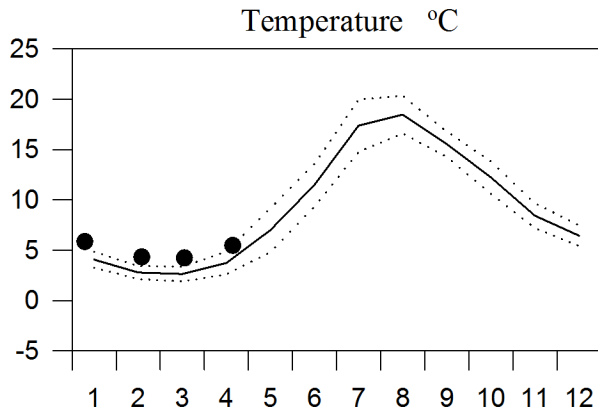
— Mean 1996-2010 St.Dev. ● 2016



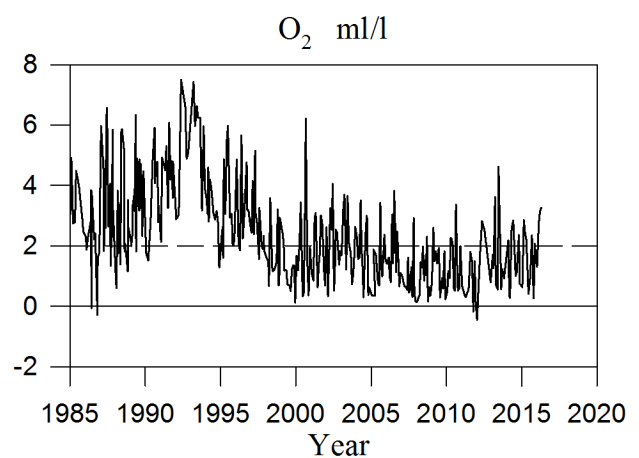
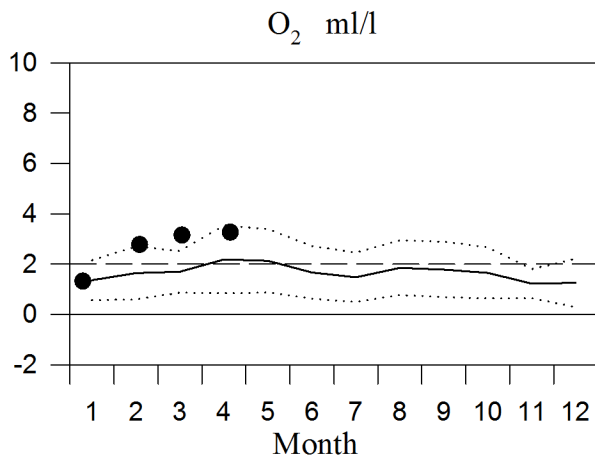
STATION BCS III-10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

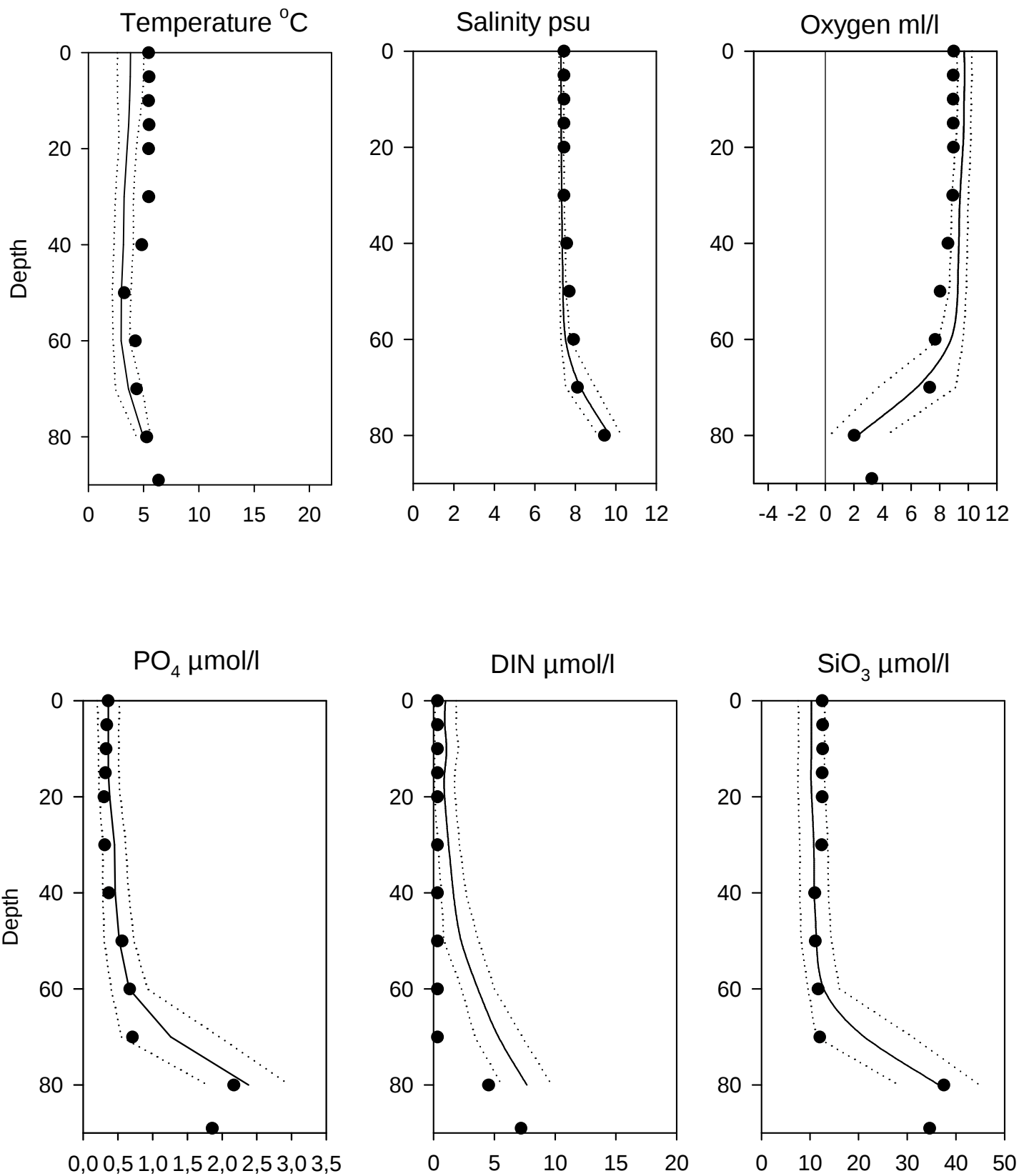


OXYGEN IN BOTTOM WATER (depth > 80m)



Vertical profiles BCS III-10 April

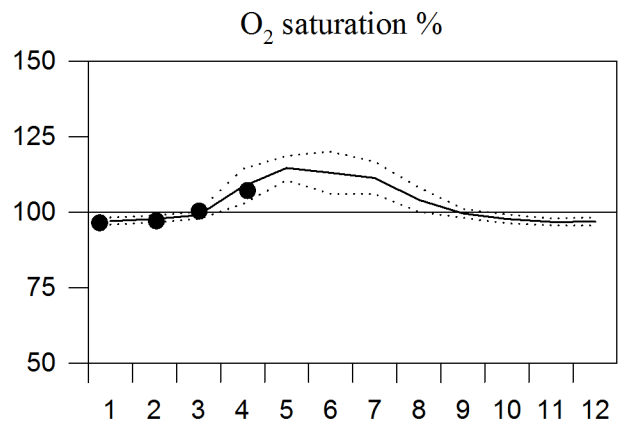
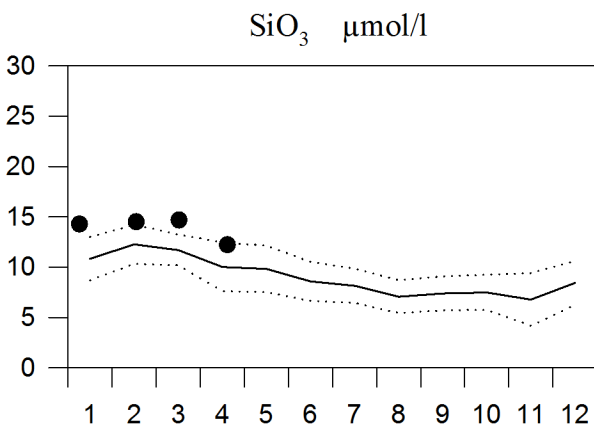
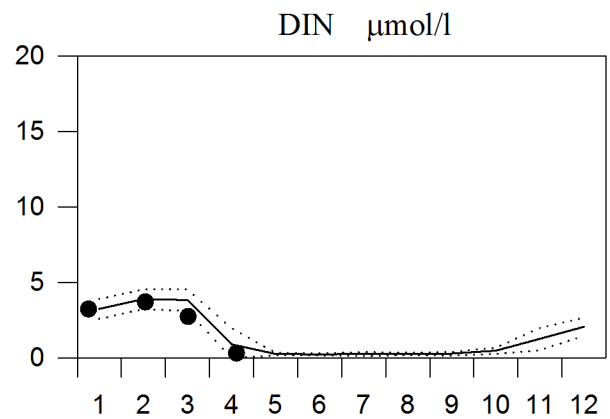
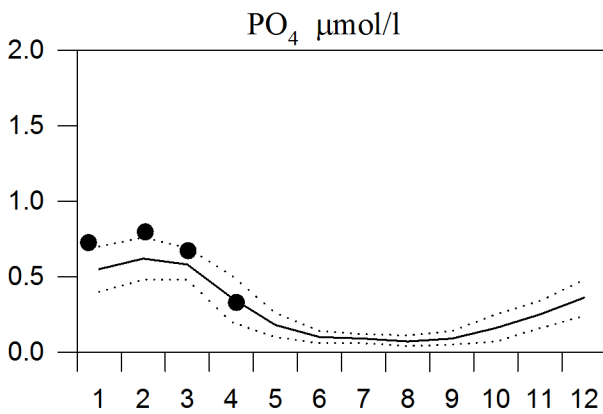
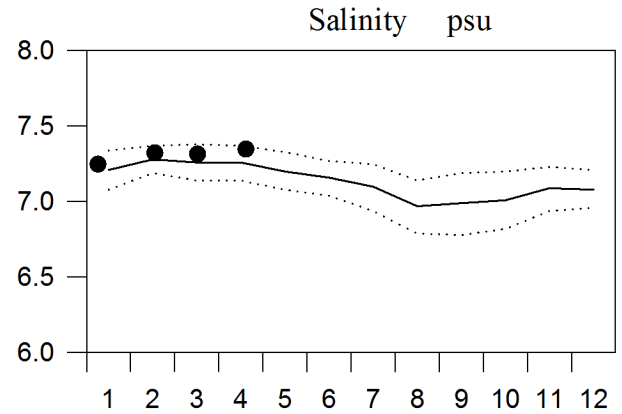
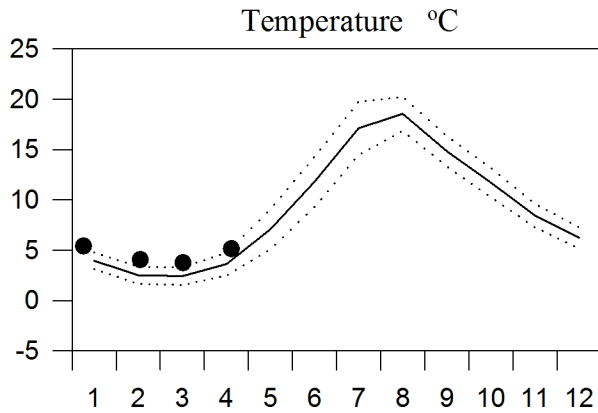
— Mean 1996-2010 St.Dev. ● 2016



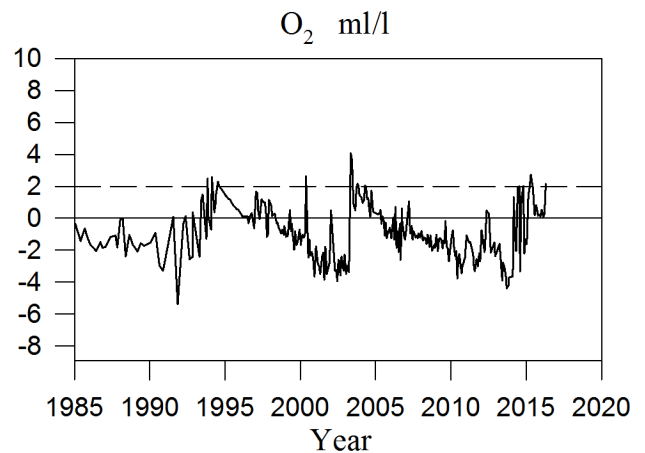
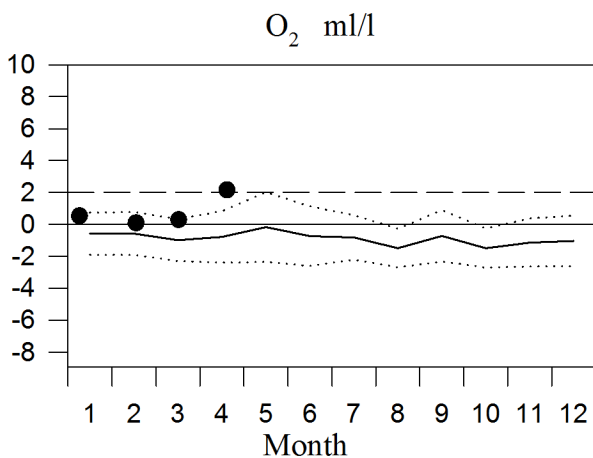
STATION BY10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

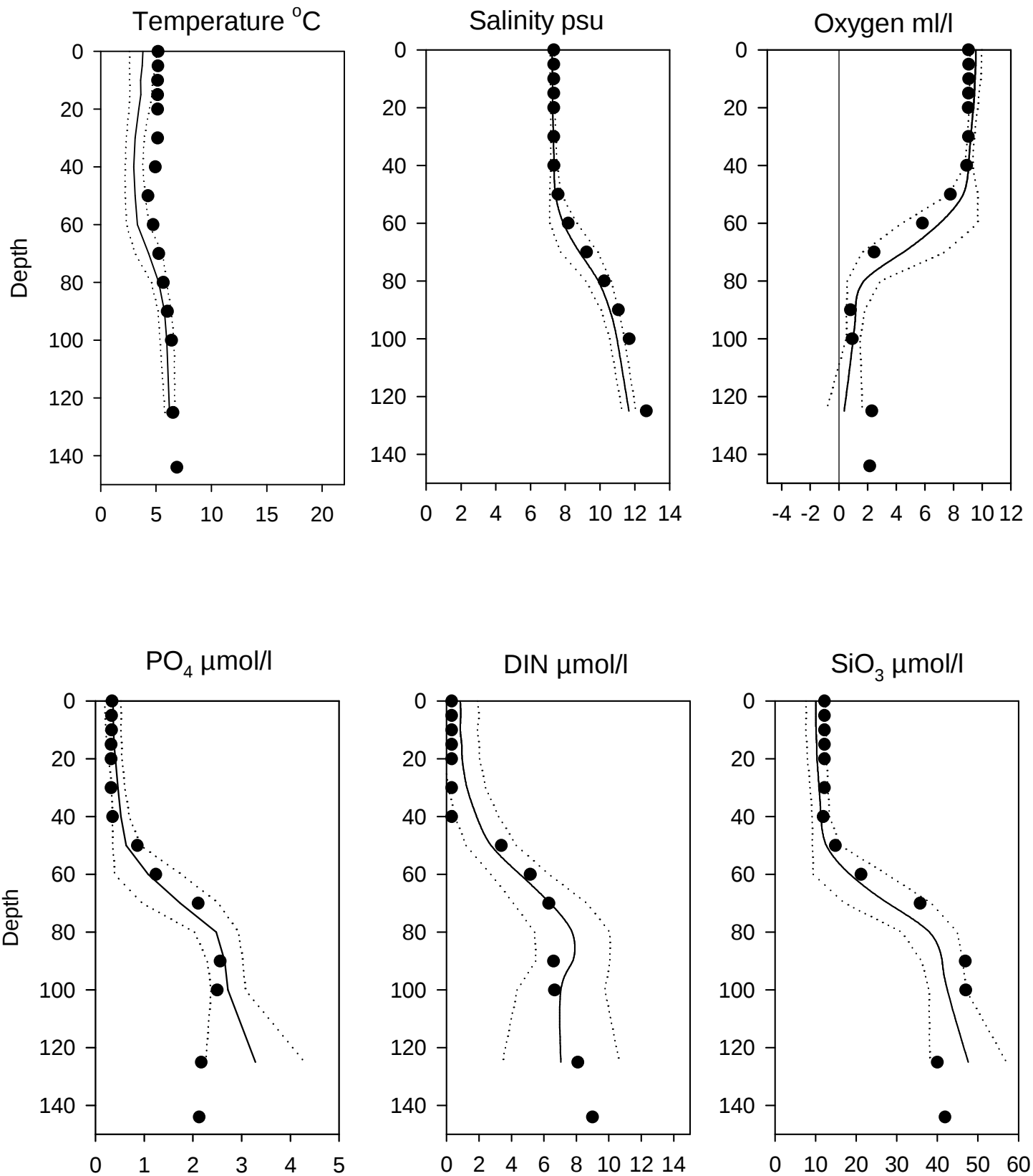


OXYGEN IN BOTTOM WATER (depth >125m)



Vertical profiles BY10 April

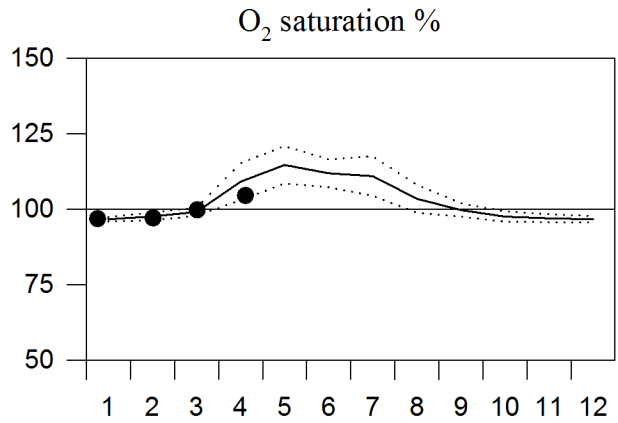
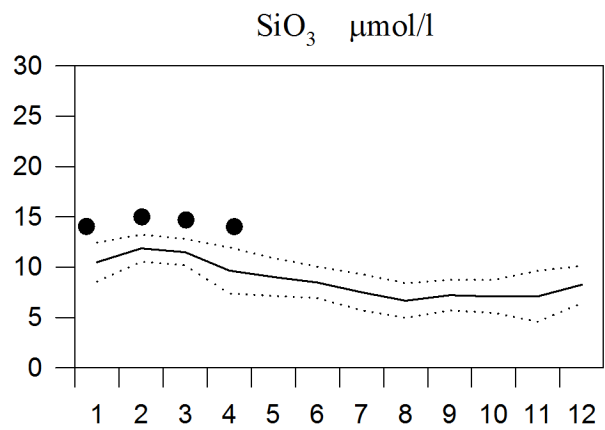
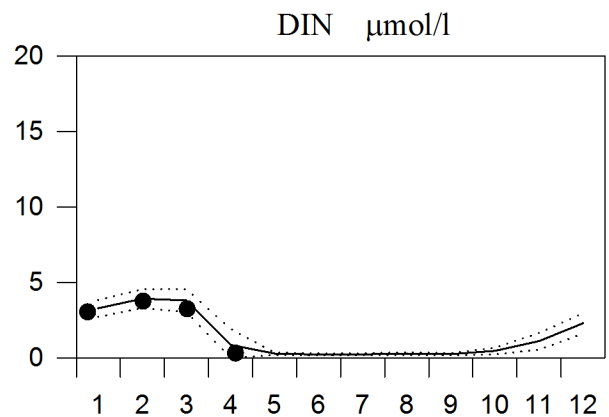
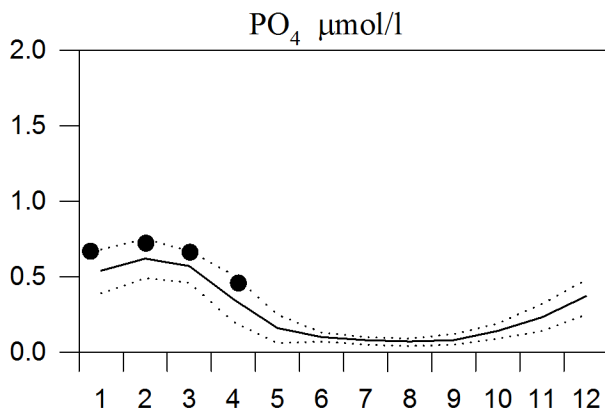
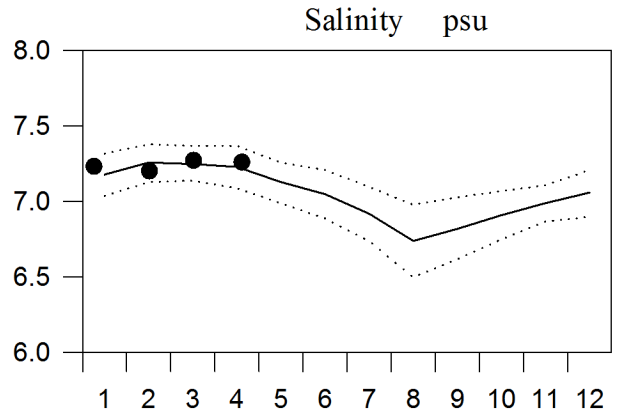
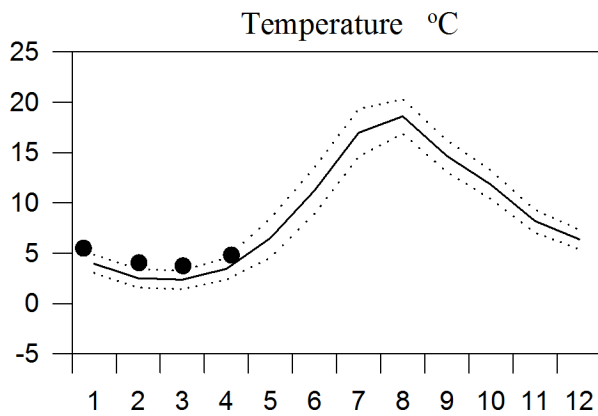
— Mean 1996-2010 St.Dev. ● 2016



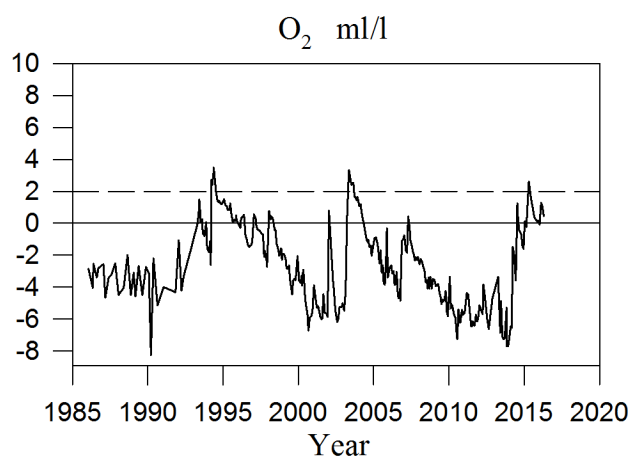
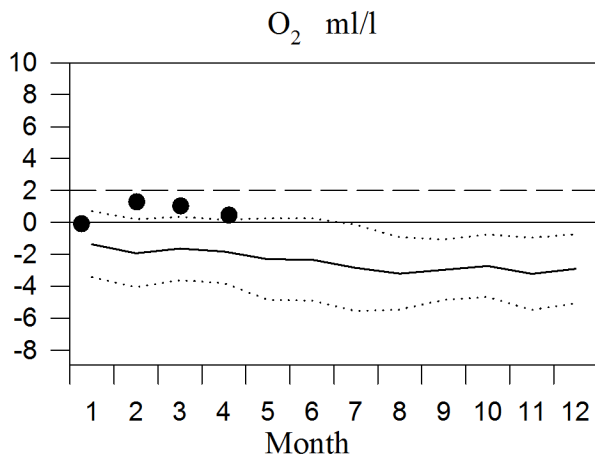
STATION BY15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

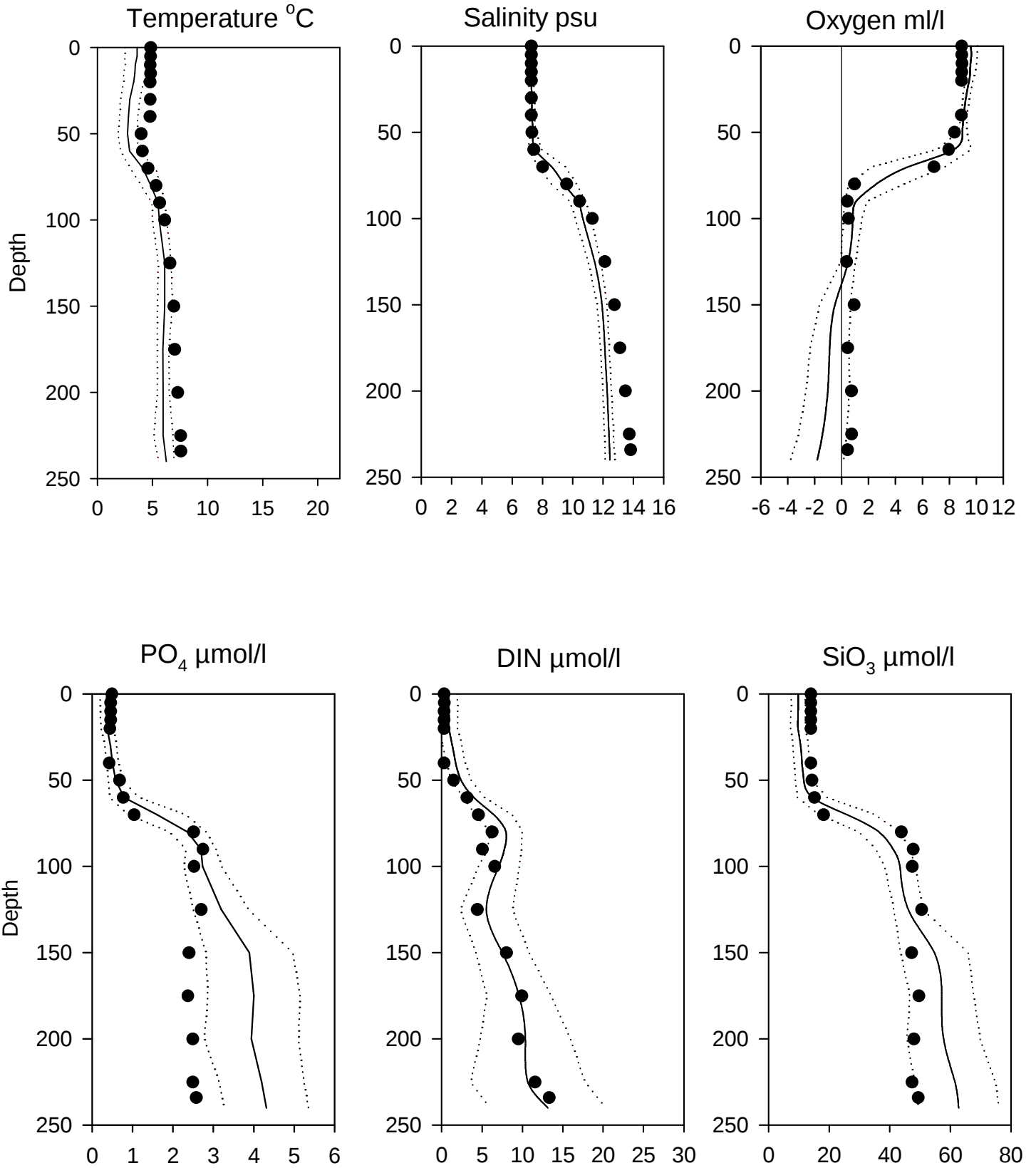


OXYGEN IN BOTTOM WATER (depth >225m)



Vertical profiles BY15 April

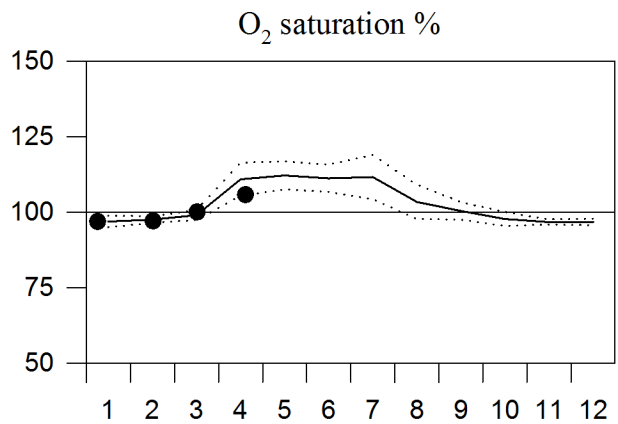
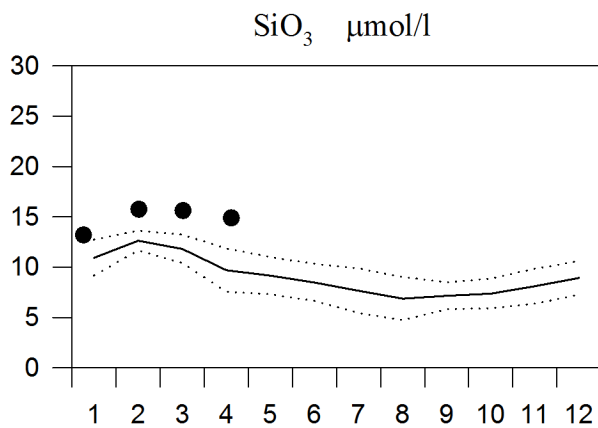
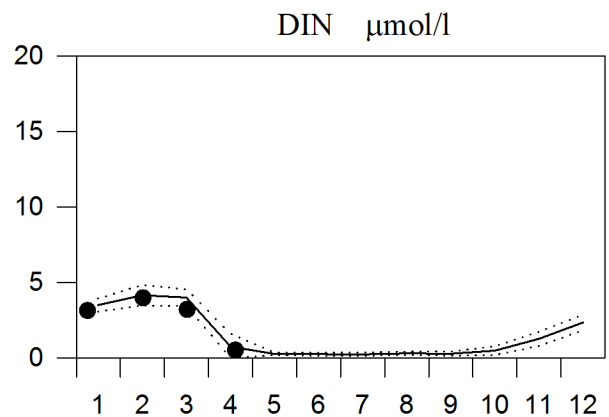
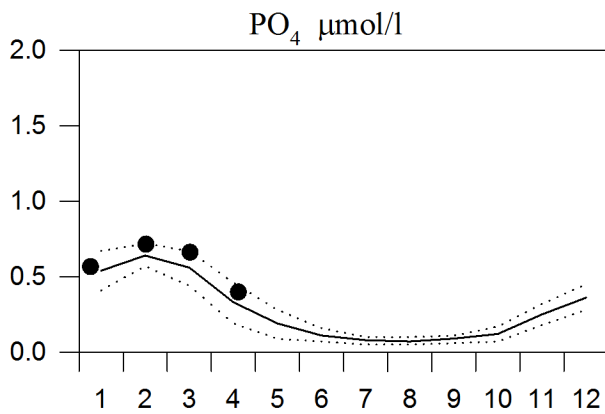
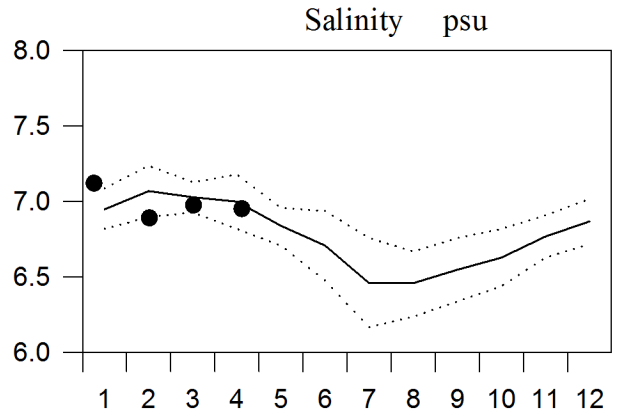
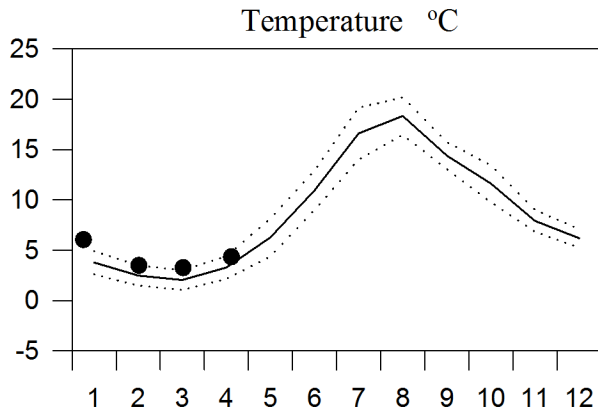
— Mean 1996-2010 St.Dev. ● 2016



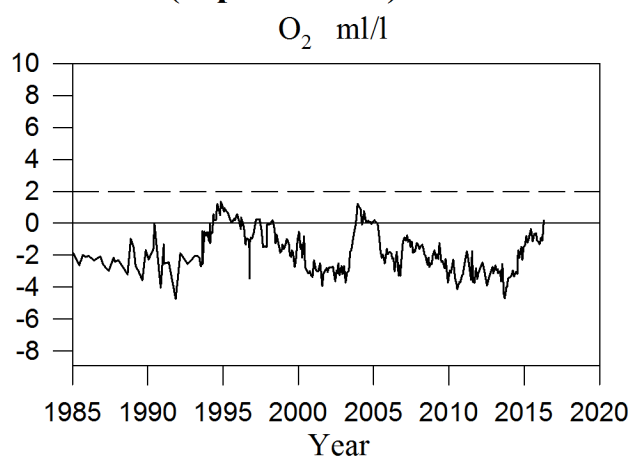
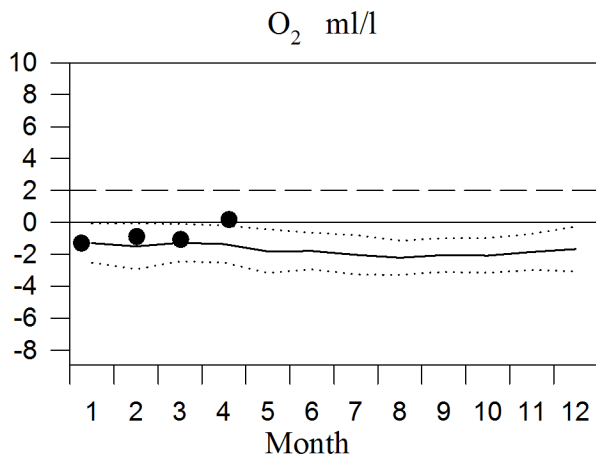
STATION BY20 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016



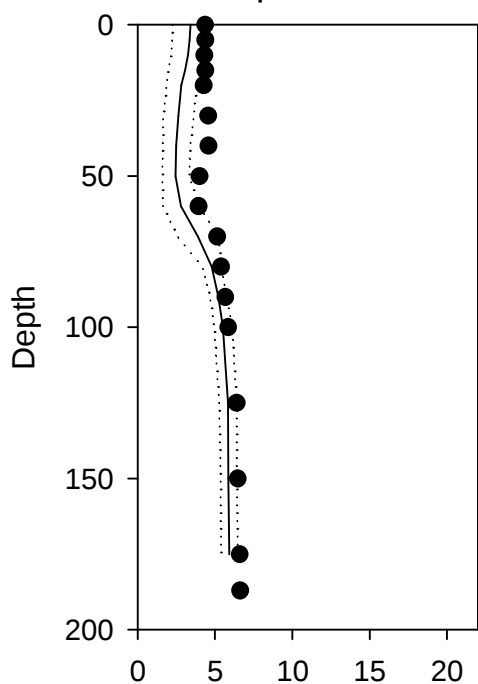
OXYGEN IN BOTTOM WATER (depth >175m)



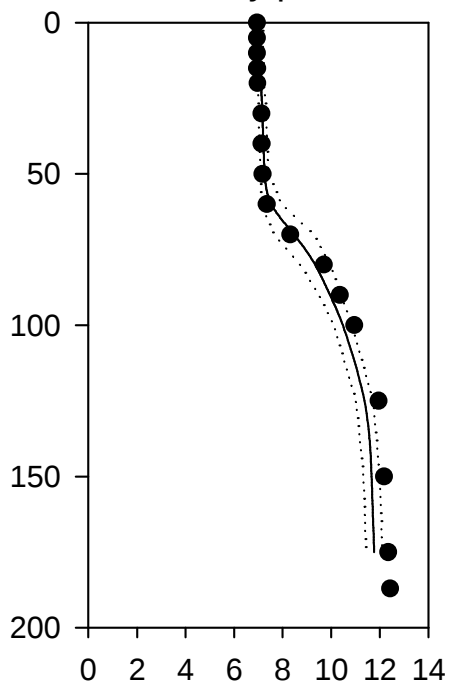
Vertical profiles BY20 April

— Mean 1996-2010 St.Dev. ● 2016

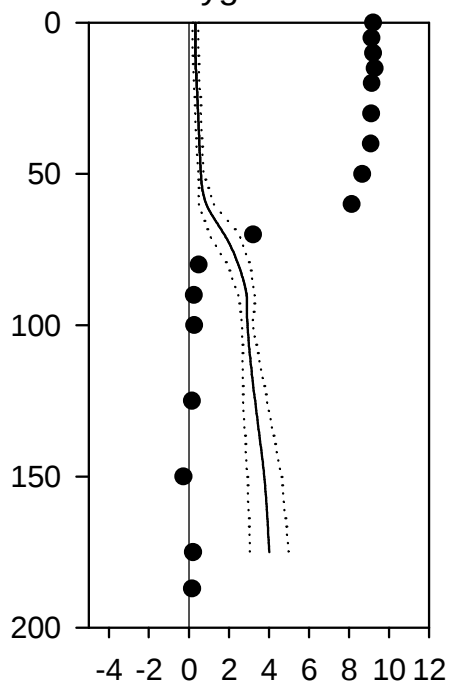
Temperature °C



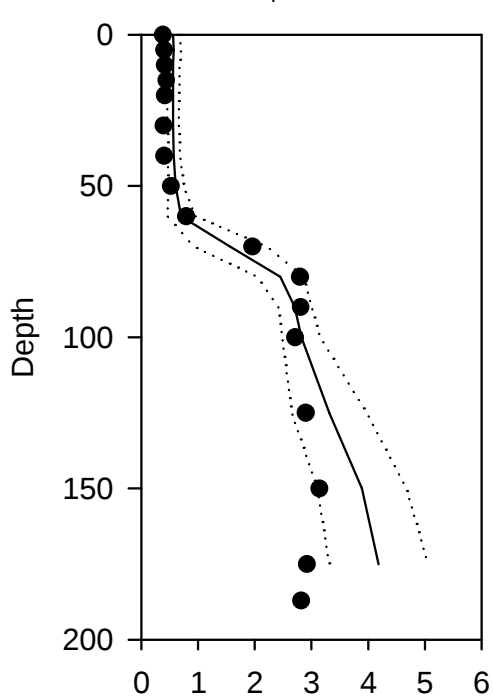
Salinity psu



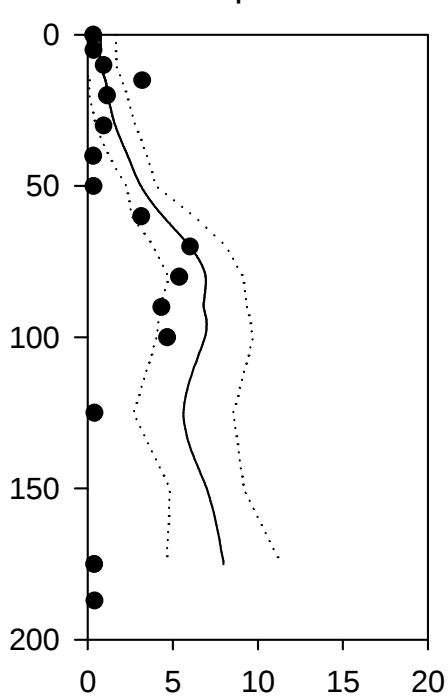
Oxygen ml/l



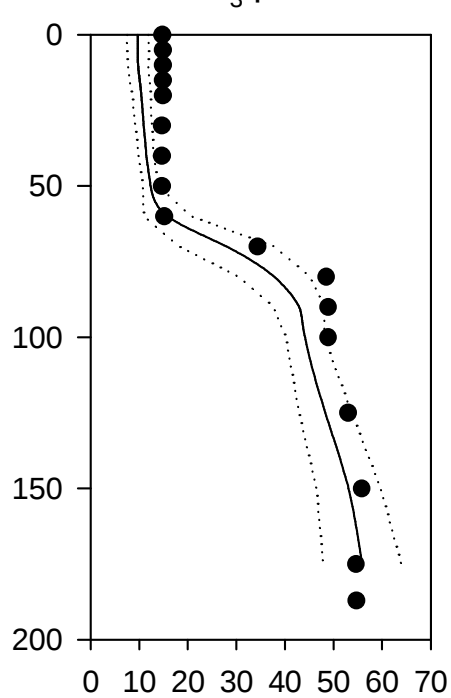
PO₄ μmol/l



DIN μmol/L



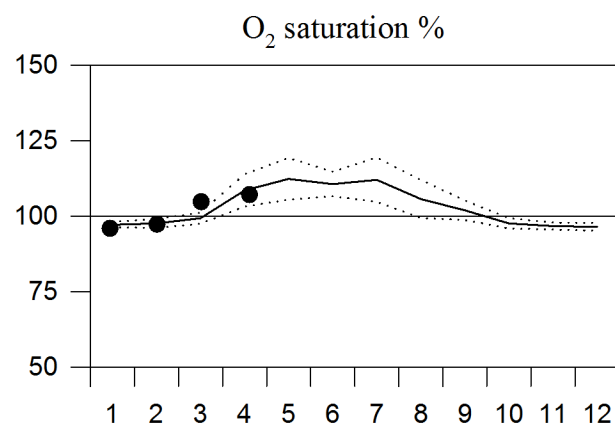
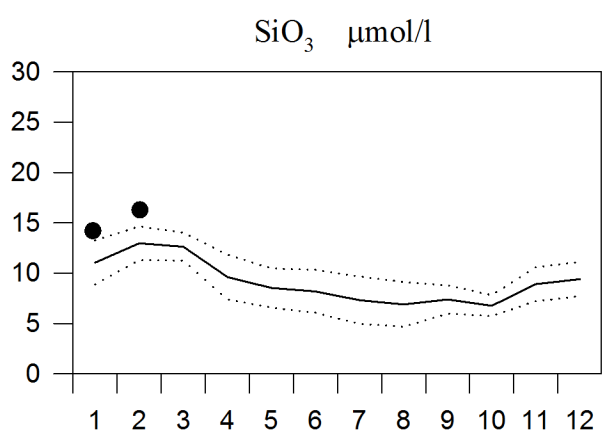
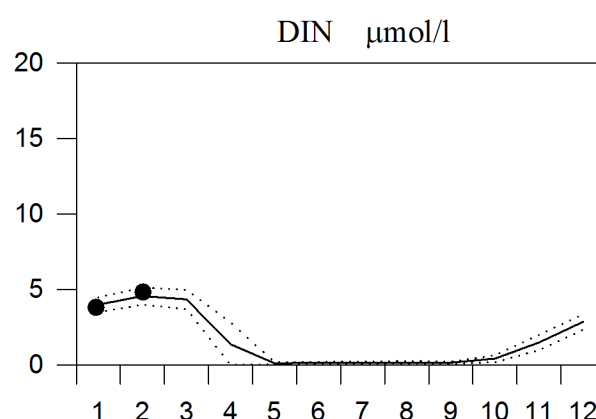
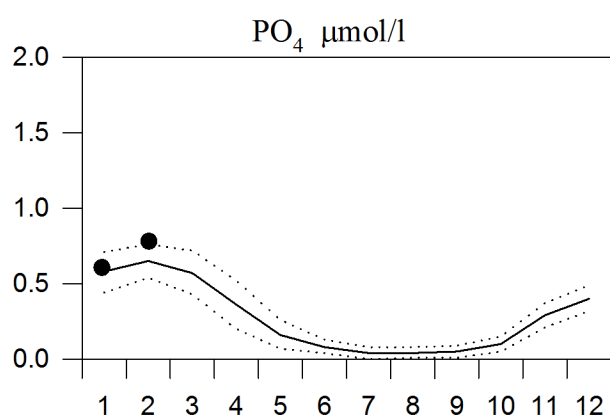
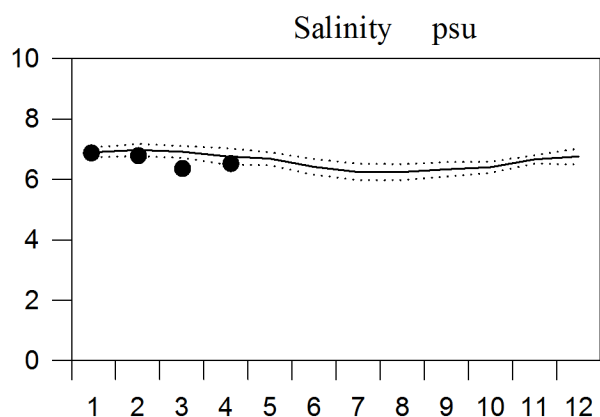
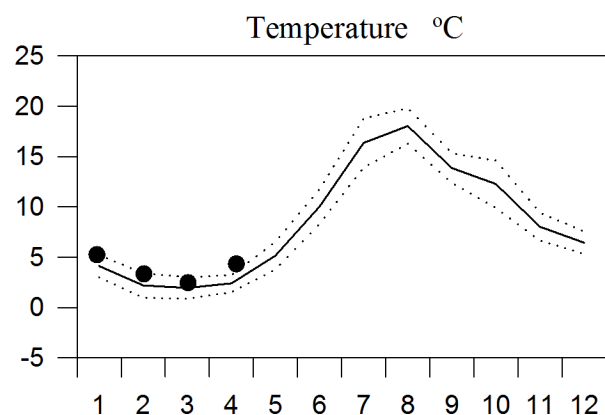
SiO₃ μmol/l



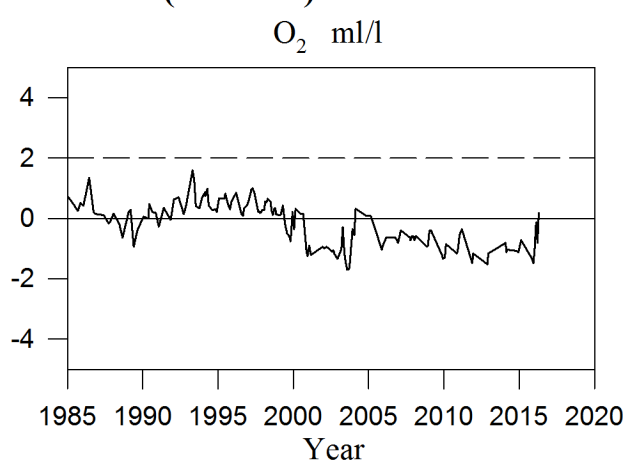
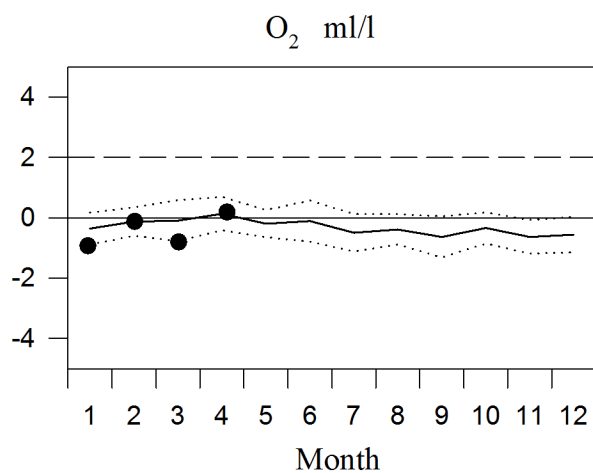
STATION BY29 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

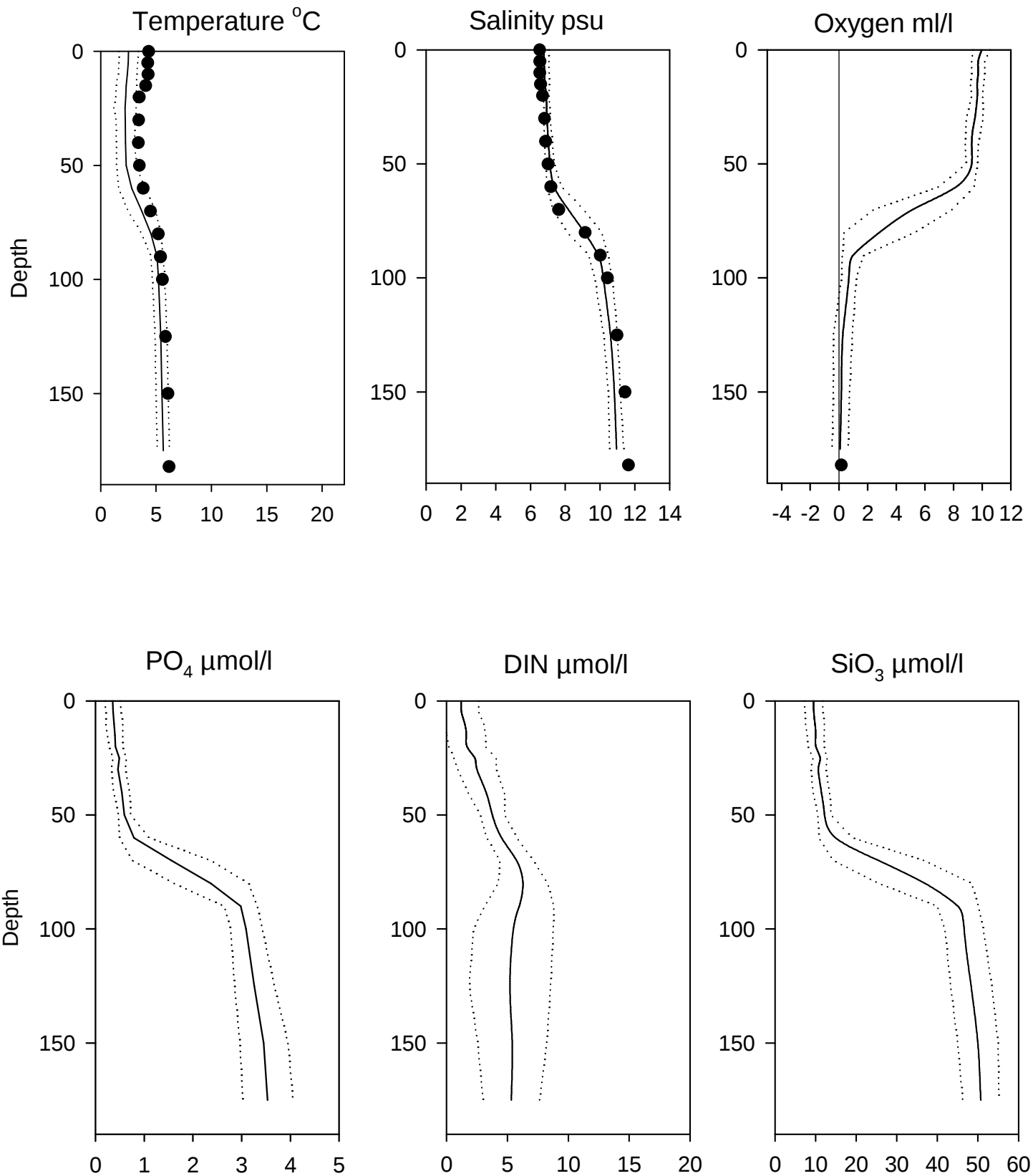


OXYGEN IN BOTTOM WATER (>=150m)



Vertical profiles BY29 April

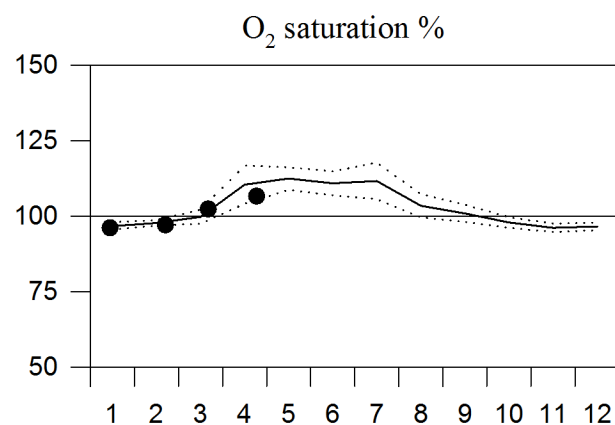
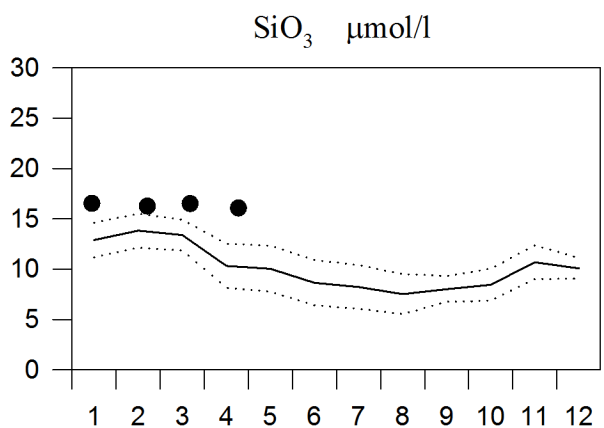
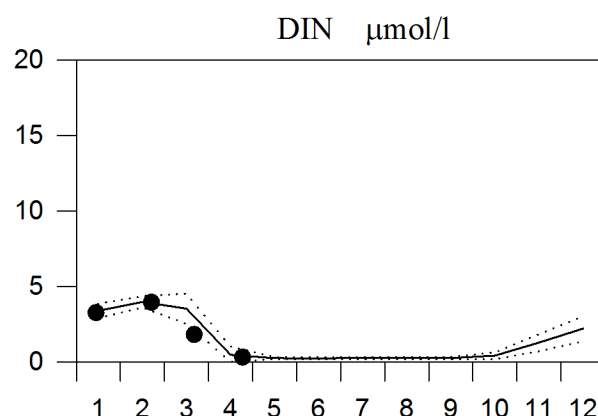
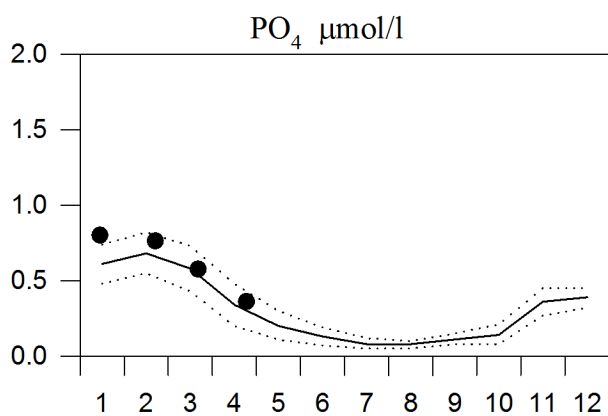
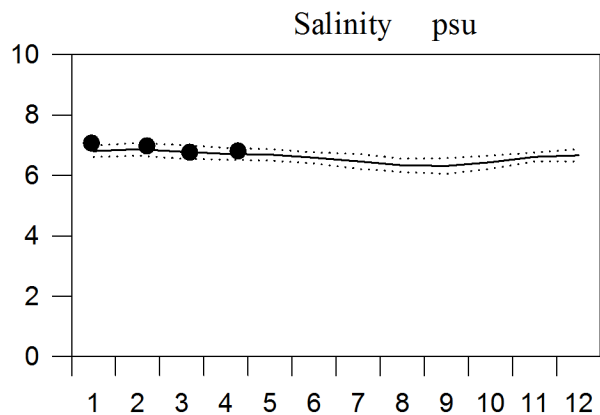
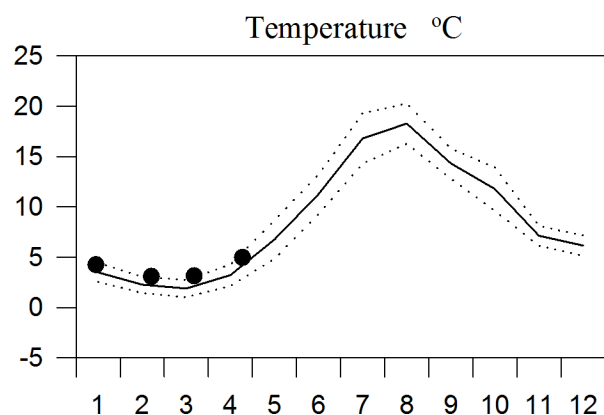
— Mean 1996-2010 St.Dev. ● 2016



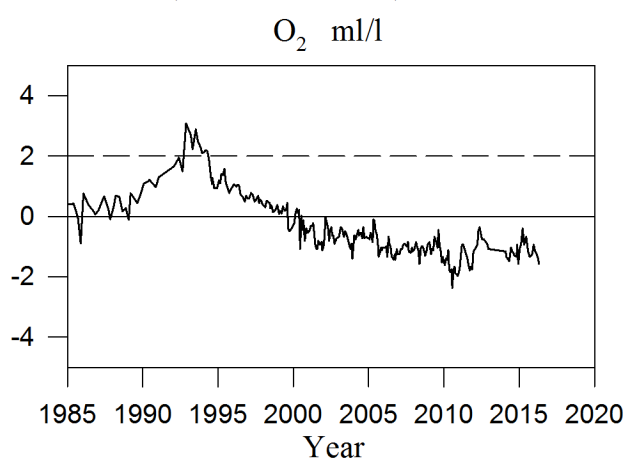
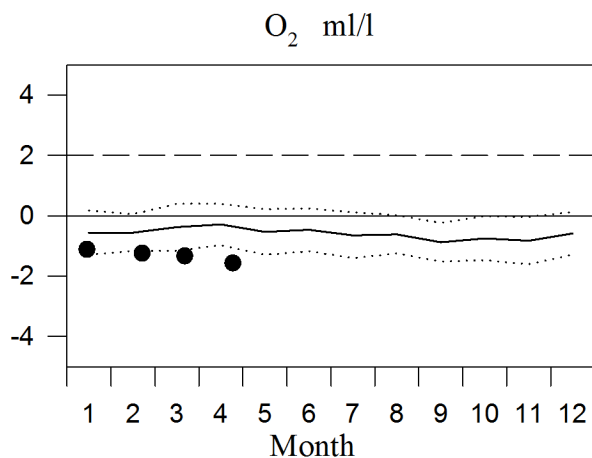
STATION BY32 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016



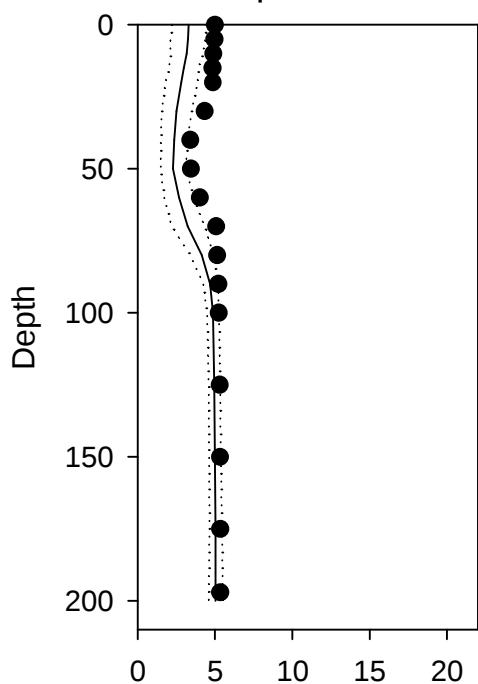
OXYGEN IN BOTTOM WATER (depth > 175m)



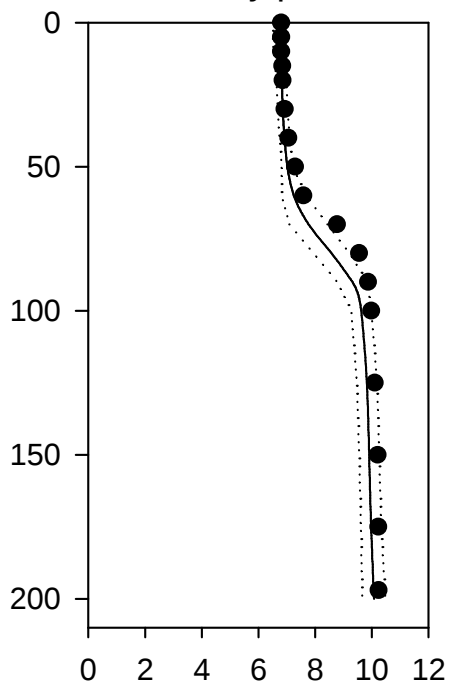
Vertical profiles BY32 April

— Mean 1996-2010 St.Dev. ● 2016

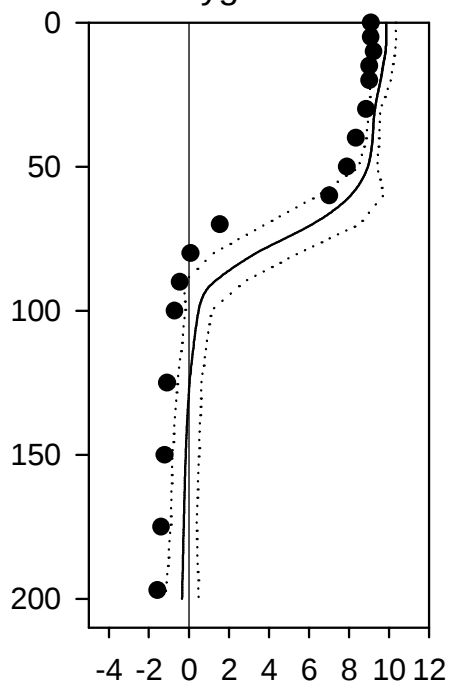
Temperature °C



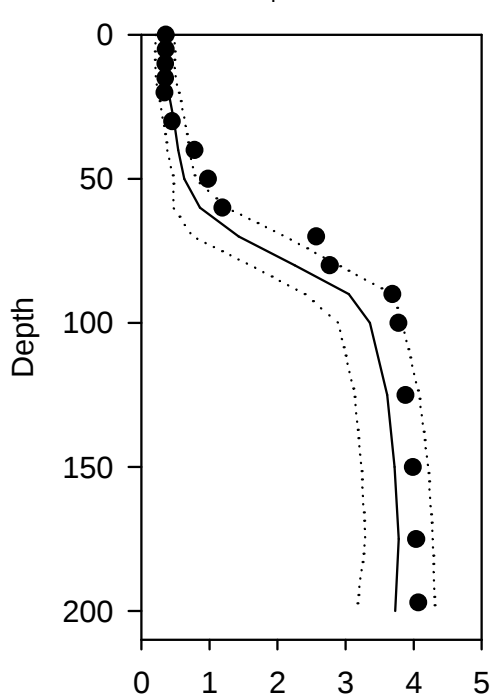
Salinity psu



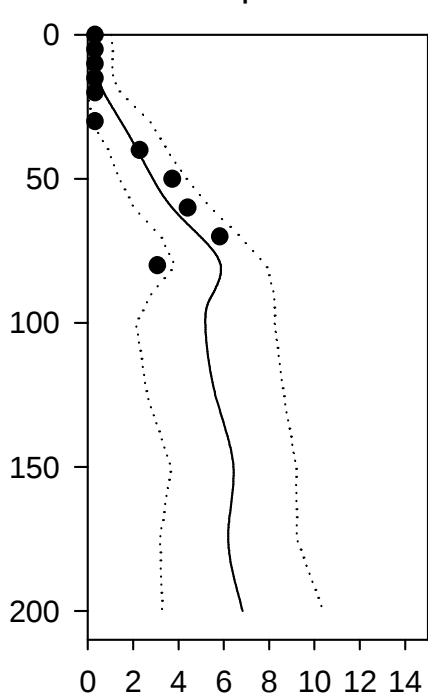
Oxygen ml/l



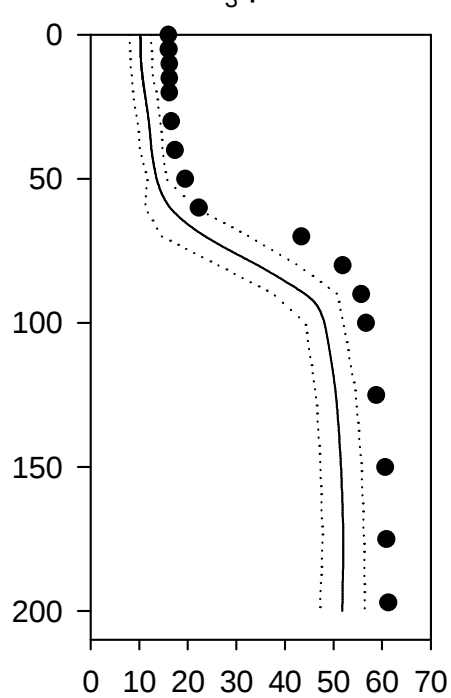
PO₄ μmol/l



DIN μmol/l



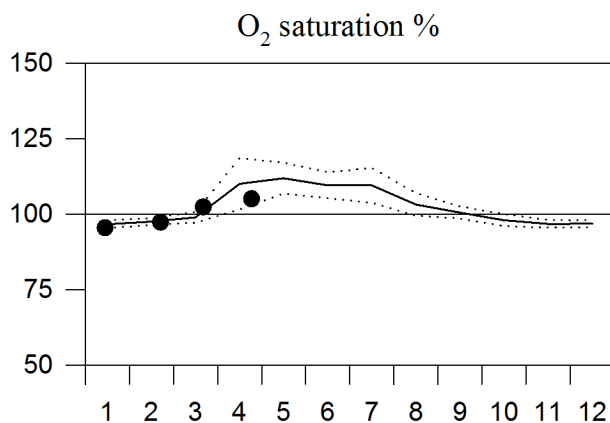
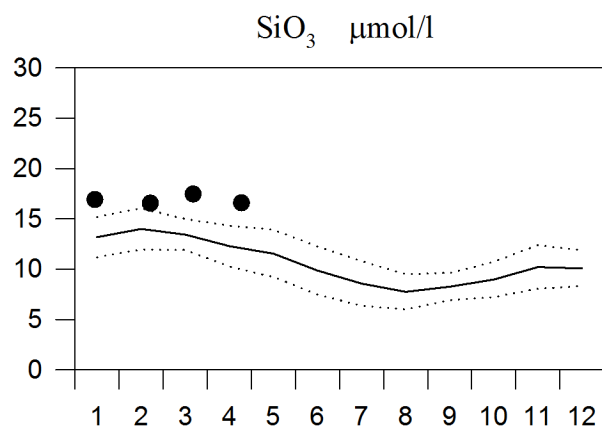
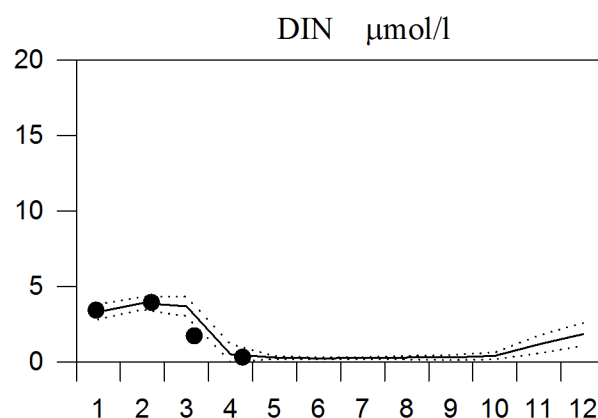
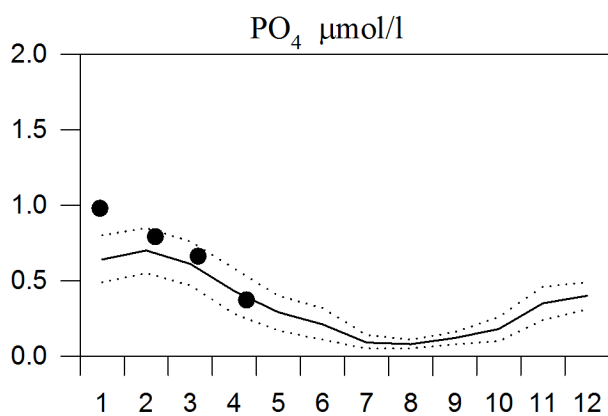
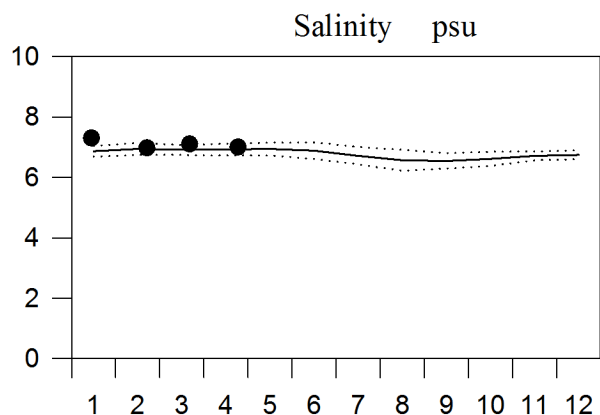
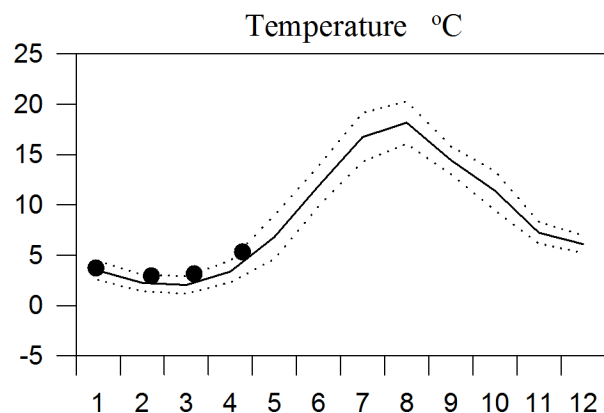
SiO₃ μmol/l



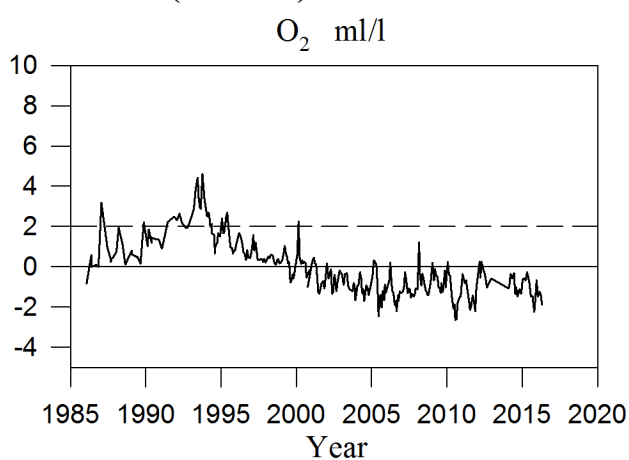
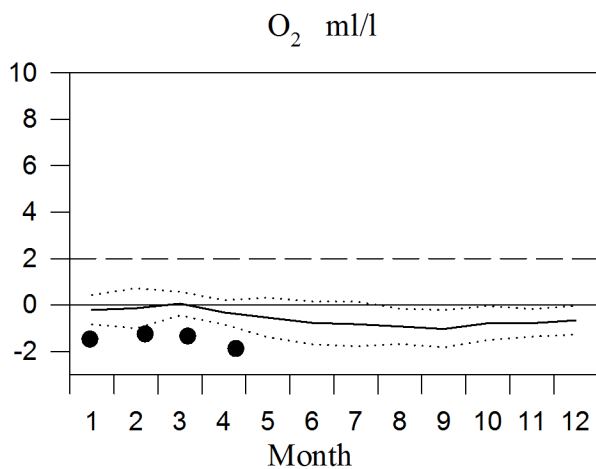
STATION BY38 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

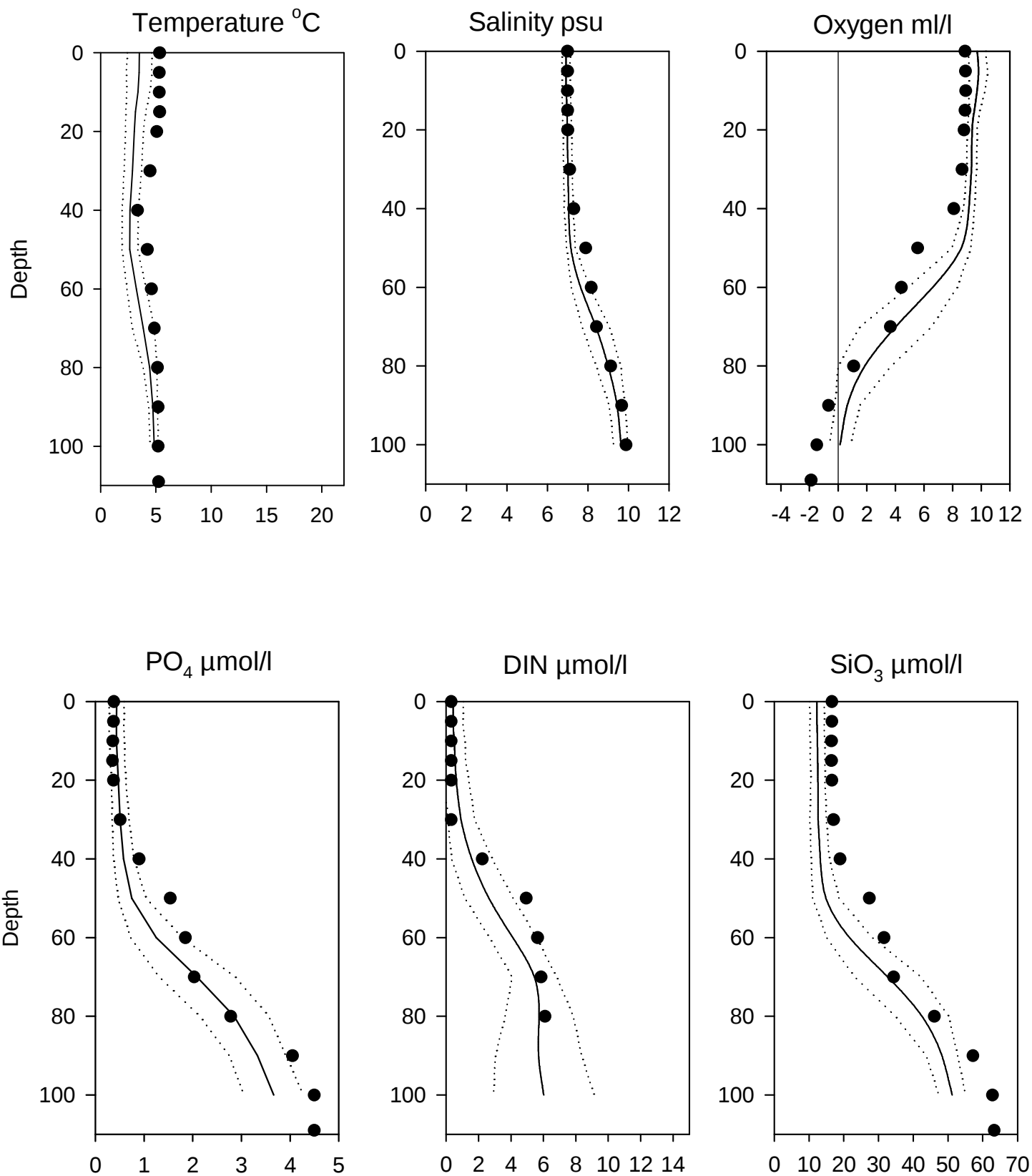


OXYGEN IN BOTTOM WATER (> 100m)



Vertical profiles BY38 April

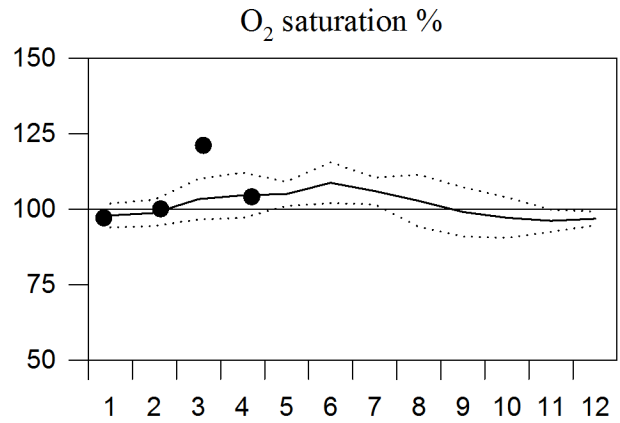
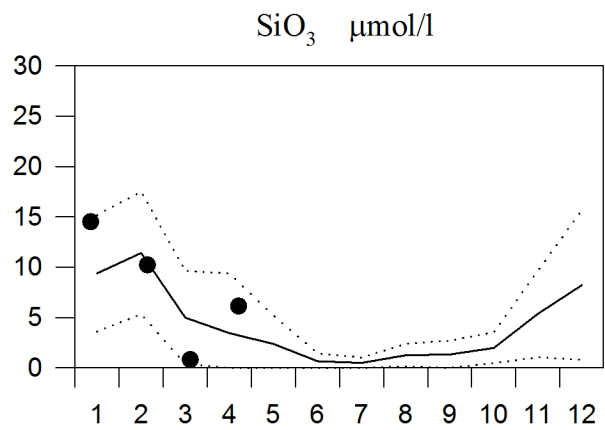
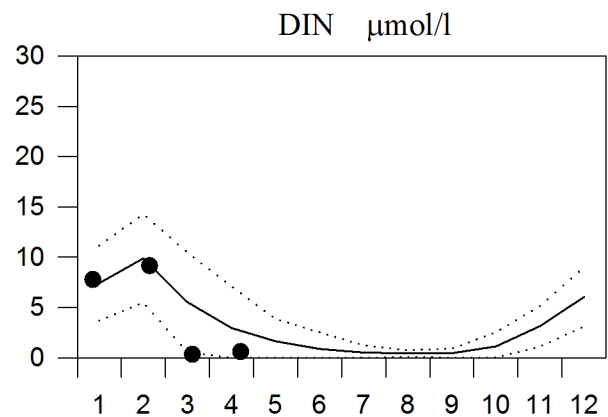
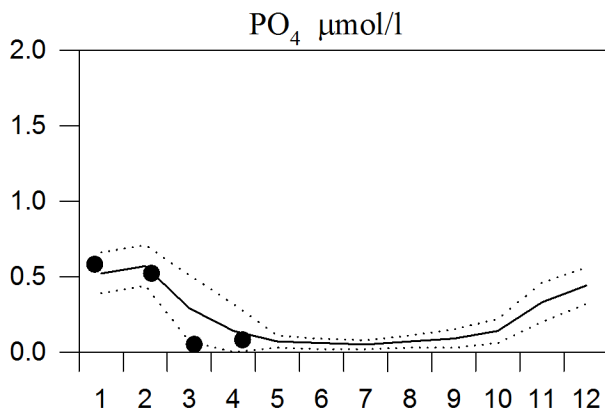
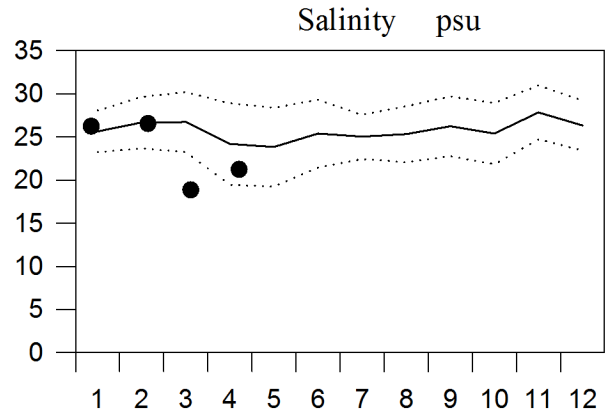
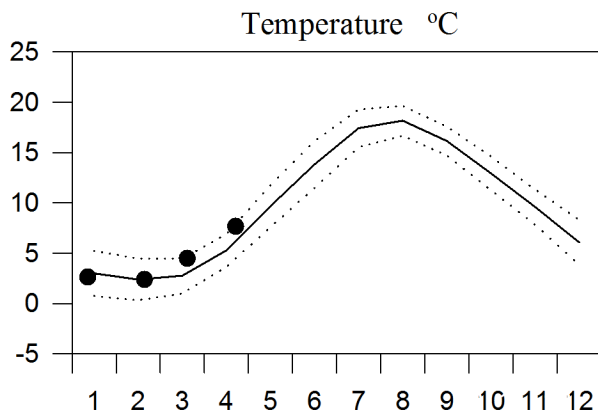
— Mean 1996-2010 St.Dev. ● 2016



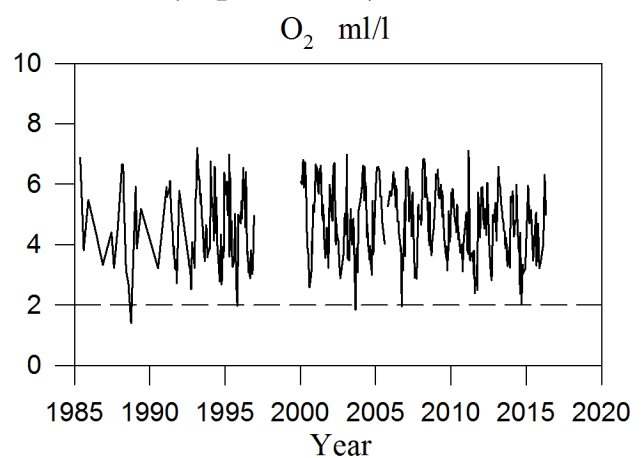
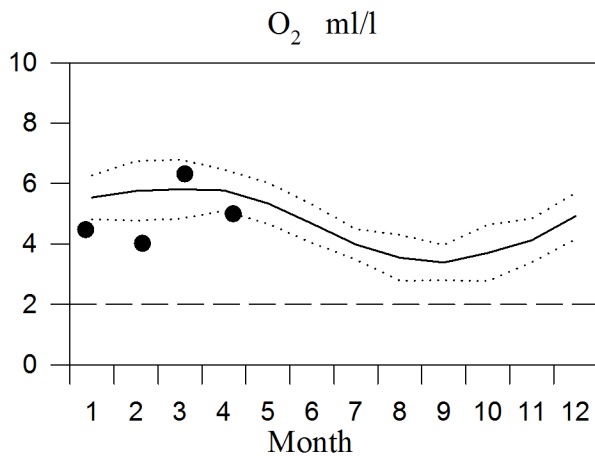
STATION SLÄGGÖ SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

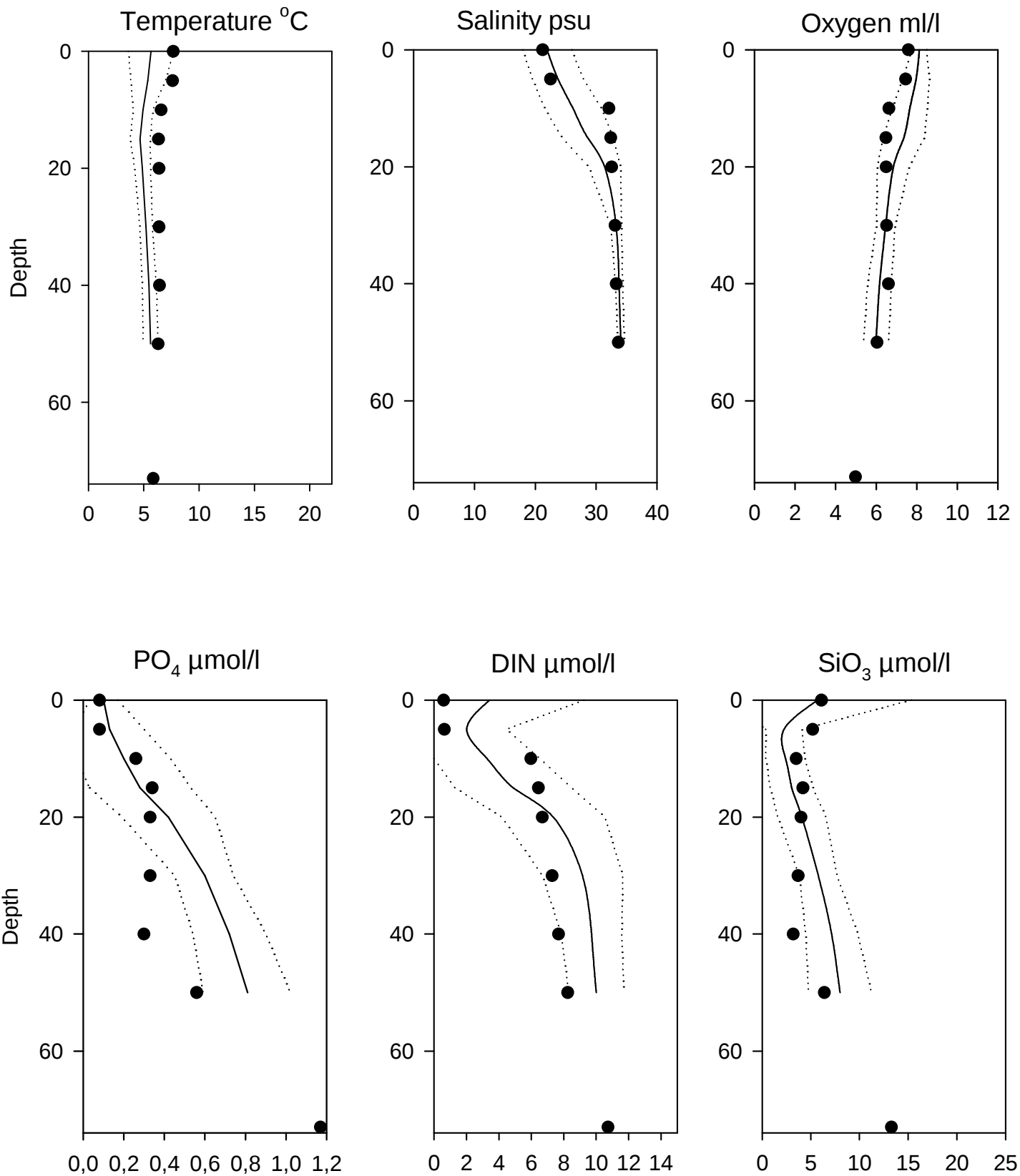


OXYGEN IN BOTTOM WATER (depth >50m)



Vertical profiles Släggö April

— Mean 1996-2010 St.Dev. ● 2016



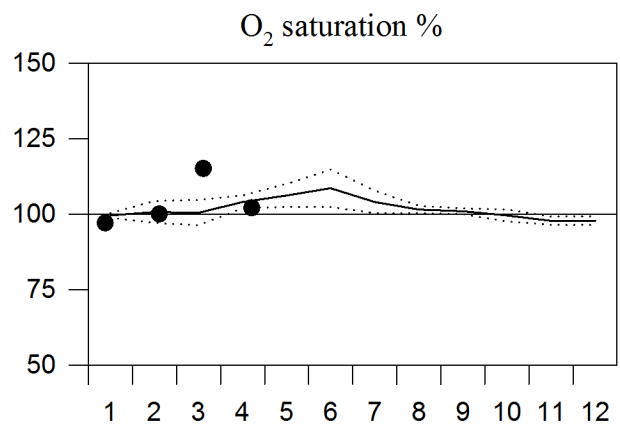
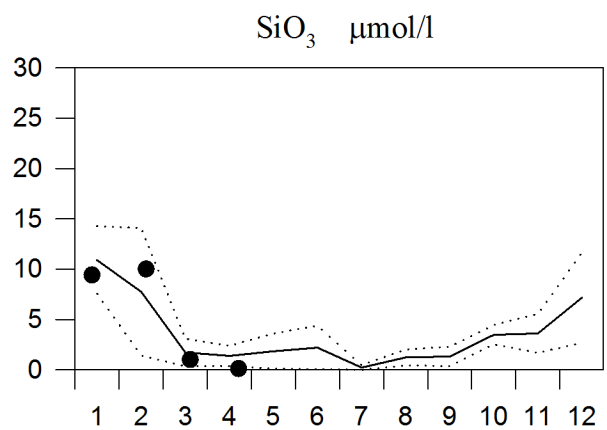
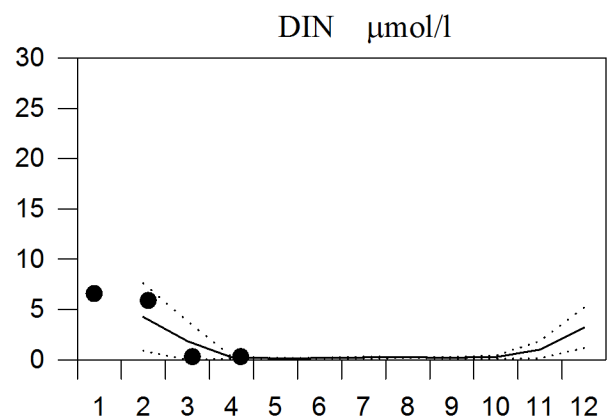
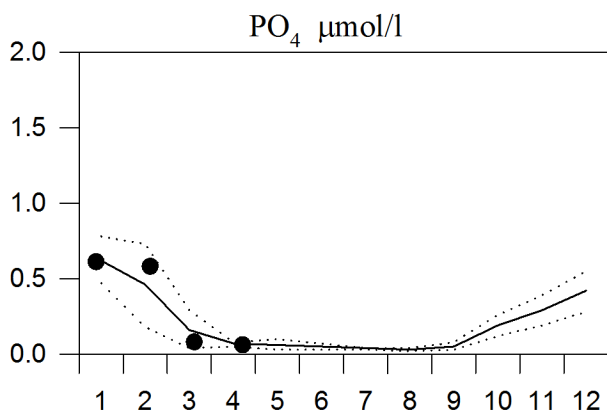
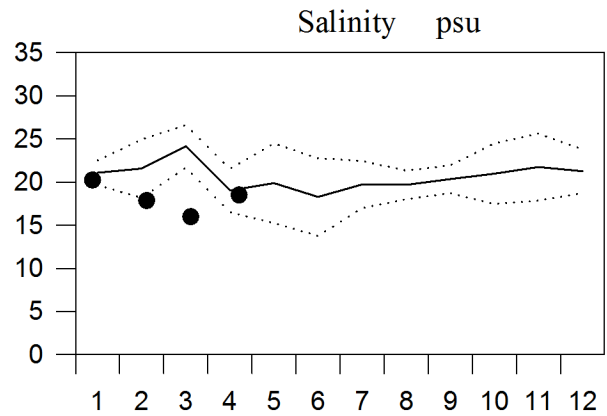
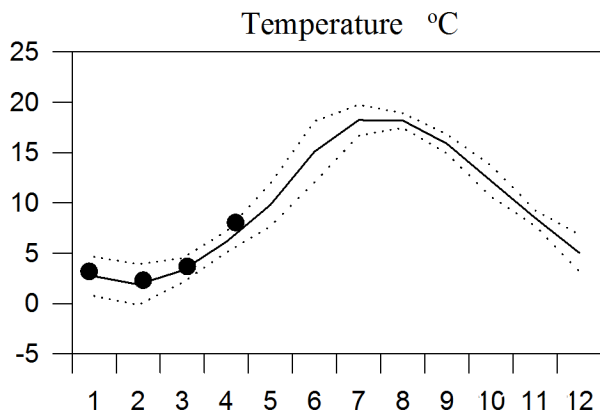
STATION N14 Falkenberg SURFACE WATER

Annual Cycles

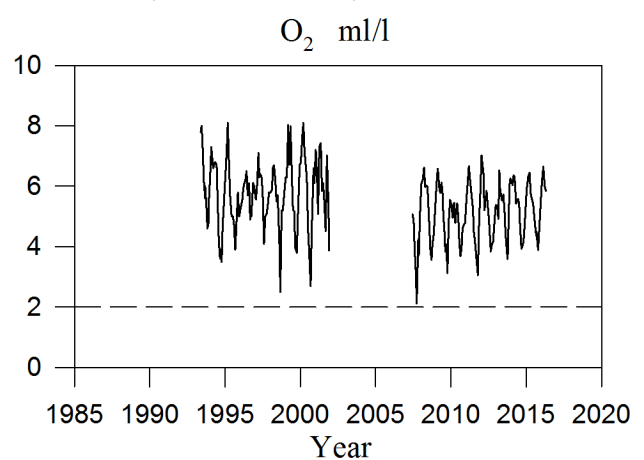
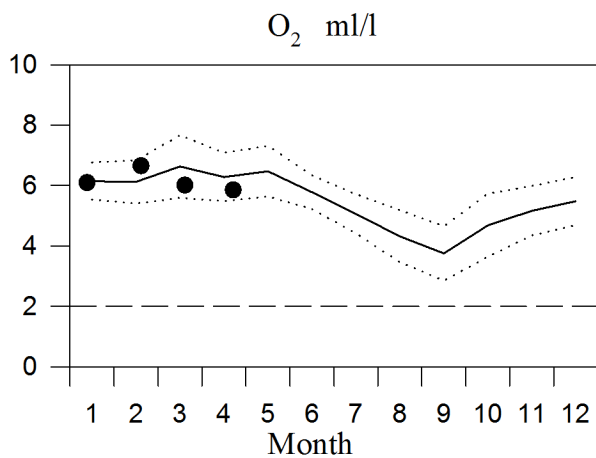
— Mean 2007-2010

..... St.Dev.

● 2016

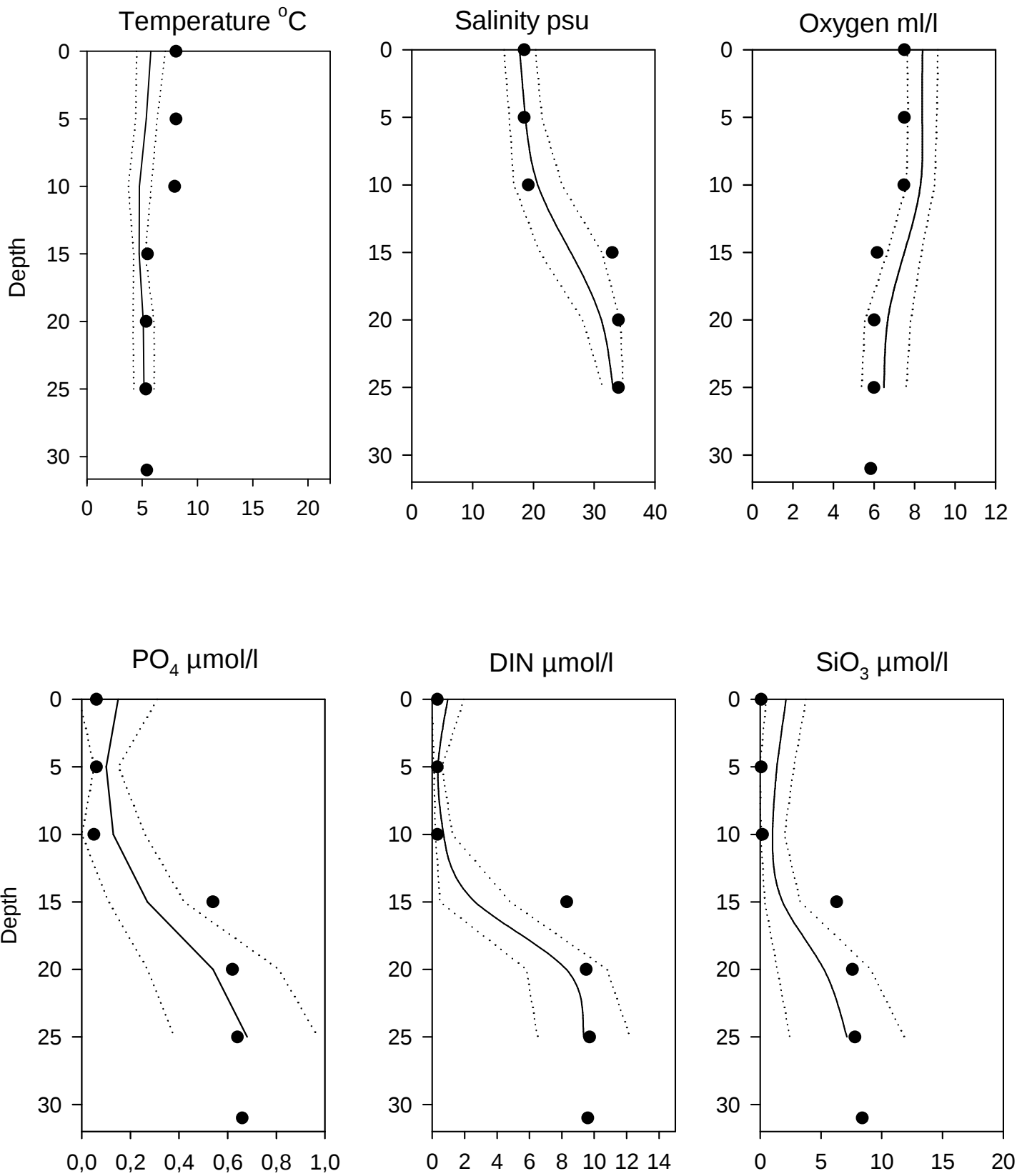


OXYGEN IN BOTTOM WATER (depth > 25m)



Vertical profiles N14 Falkenberg April

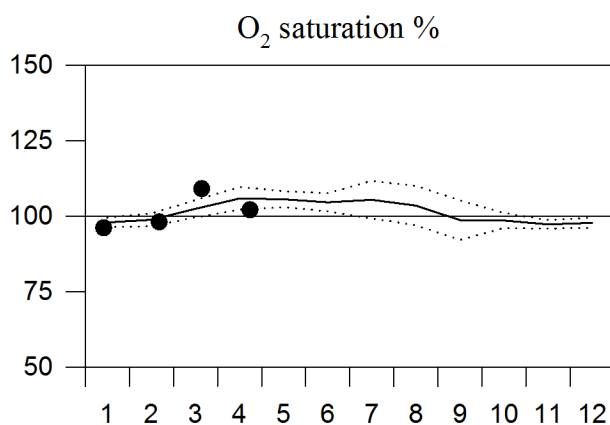
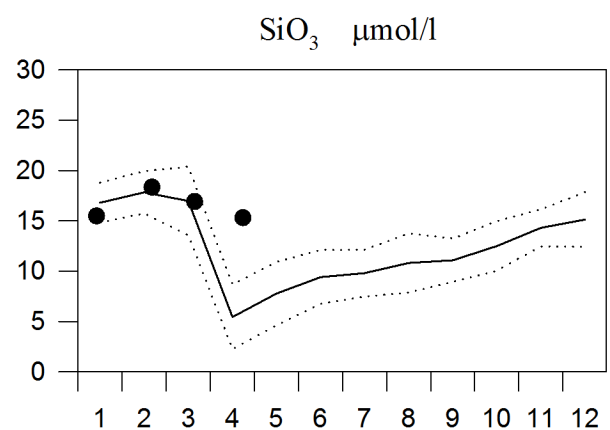
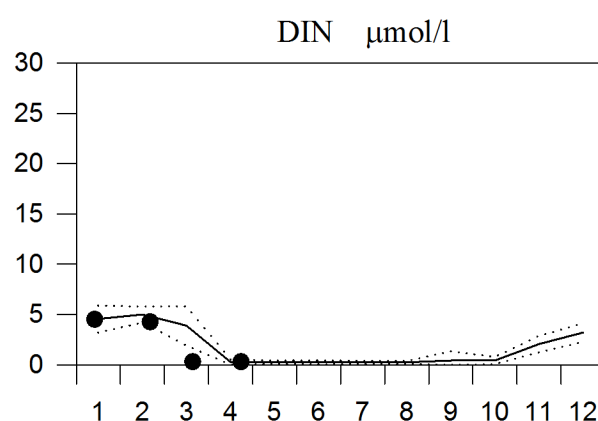
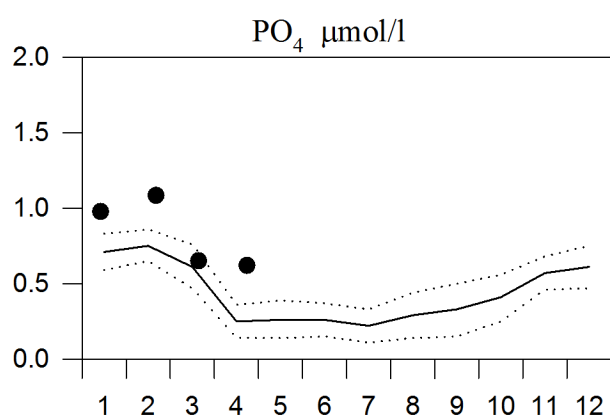
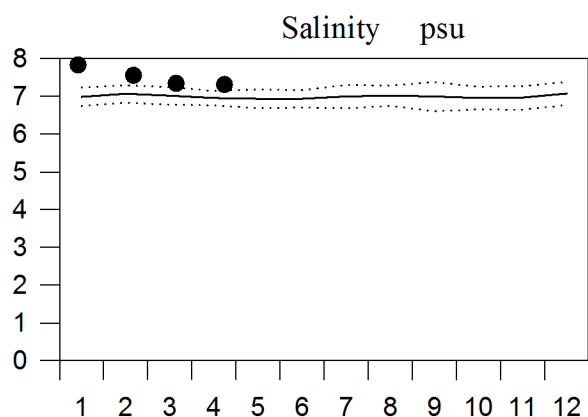
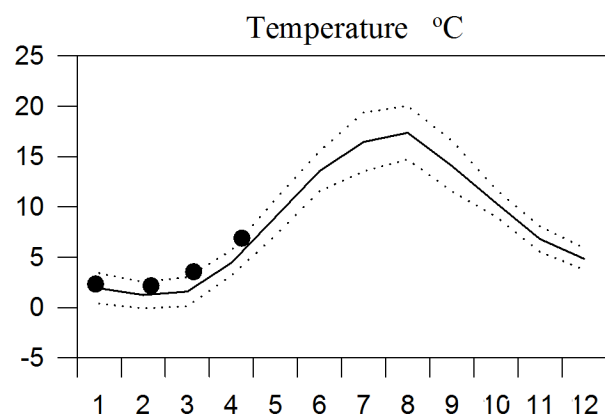
— Mean 1996-2010 St.Dev. ● 2016



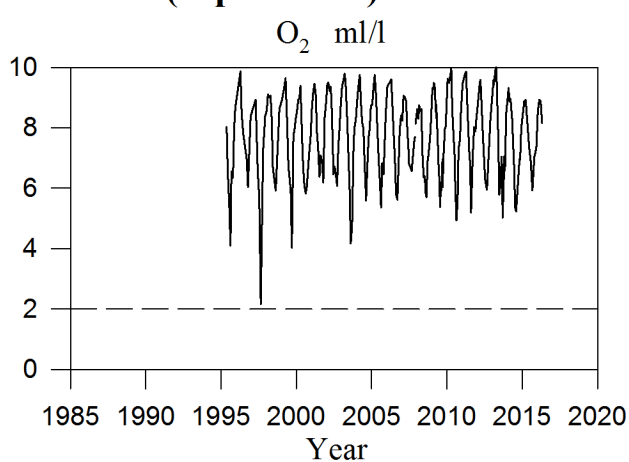
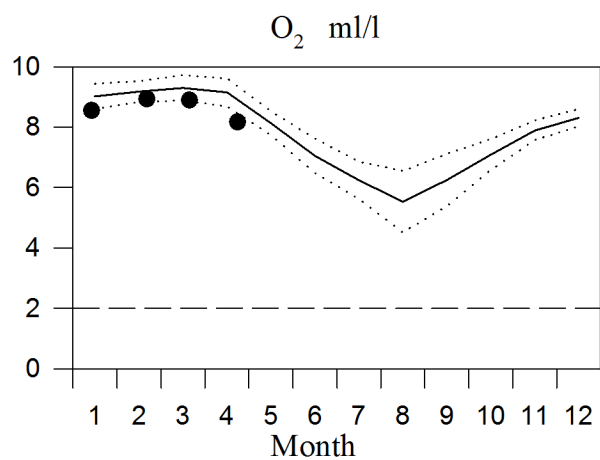
STATION REF M1V1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016



OXYGEN IN BOTTOM WATER (depth >15m)



Vertical profiles Ref M1V1 April

— Mean 1996-2010 St.Dev. ● 2016

