

Rapport från SMHIs utsjöexpedition med R/V Aranda



Expeditionens varaktighet: 2016-02-15 - 2016-02-23
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. I egentliga Östersjön genomfördes kartering av vinterhalter av näringsämnen. Denna rapport är baserad på preliminära, endast delvis kvalitetskontrollerade data.

Temperaturen i den övre vattenmassan låg över det normala i hela egentliga Östersjön. Halterna av närsalter i ytvattnet var generellt normala för årstiden i Västerhavet. I Östersjön uppvisade fosfat halter över det normala utom i de västra delarna. Silikatkoncentrationerna var förhöjda i hela området utom i södra delen där de låg klart under medel för årstiden. Effekten av det stora inflödet under december 2014 kunde fortfarande inte följas längre norrut än till stationen BY20 i östra Gotlandsbassängen. Gotlandsdjupet BY15 var åter syresatt i bottenvattnet. I västra samt norra Gotlandsbassängen var syresituationen fortsatt mycket allvarlig då helt syrefria förhållanden uppmättes från djup överstigande 70-100 meters djup. Det uppmättes även svavelväte på provtagningspunkten i Gdanskbukten vilket inte registrerats där sedan 2008. Enligt fluorescensmätningar har vårbloomingen börjat i centrala och södra Skagerrak samt norra delen av Kattegatt.

Nästa ordinarie expedition är planerad starta 15:e mars.

PRELIMINÄRA RESULTAT

Expeditionen genomfördes ombord det finska forskningsfartyget Aranda och startade i Helsingfors den 15:e februari samt avslutades i samma hamn den 23:e. Vindarna under expeditionen var huvudsakligen svaga utom i Skagerrak där det blåste upp till stormstyrka och 2 stationer fick strykas. Lufttemperaturen varierade mellan -1 och +4°C. I Östersjön genomfördes kartering av vintertillståndet av närsalter.

Skagerrak

Temperaturen i ytvattnet var normal för årstiden och varierade mellan 2,4 och 5,4 °C, lägst vid kusten. Salthalten i ytlagret var normal till något över normal, mellan 26,5 och 34,1 psu. Salt- och temperatursprångskikten sammanföll och fanns på mellan 10 och 25 meters djup.

Närsalthalterna uppvisade typiska koncentrationer för årstiden förutom silikat där koncentrationen var något över det normala i södra delarna. I ytvattnet låg halterna av fosfat på ca 0,5 µmol/l, oorganiskt kväve (nitrit + nitrat) mellan 6,2 och 11,2 µmol/l medan silikat varierade från 5,2 till 10,2 µmol/l. De lägsta syrehalterna i bottenvattnet uppmättes vid Släggö i Gullmarsfjordens mynning, 4,0 ml/l. Fluorescensmätningarna visade något ökad biologisk aktivitet i ytlagret i de södra och västra delarna av mätområdet. För mer detaljer rörande algsituationen se separat rapport AlgAware.

Kattegatt och Öresund

Temperaturen i ytvattnet var normal för årstiden och varierade mellan 2,3 och 3,0°C. Salthalten i ytlagret var lägre än normalt förutom i norra delen där den var normal, mellan 17,8 och 25,3. I Öresund var salthalten omkring 10 psu vilket är lägre än normalt. Öresund hade en starkt pyknoklin vid ca 14 meter medan den i övriga delarna återfanns vid ca 20 meter.

Halterna av närsalter i ytvattnet var normala till något förhöjda för årstiden. Fosfatkoncentrationerna låg mellan 0,5 och 0,7 µmol/l. Summa nitrit+nitrat i intervallet 4,6 – 6,1 µmol/l och silikat mellan 7,9 och 10,6 µmol/l.

Syreförhållandena i djupvattnet var goda vid samtliga stationer, lägst halt uppmättes i Öresund, 5,5 ml/l. Fluorescensmätningarna visade en början till vårblooming i norra delen av området.

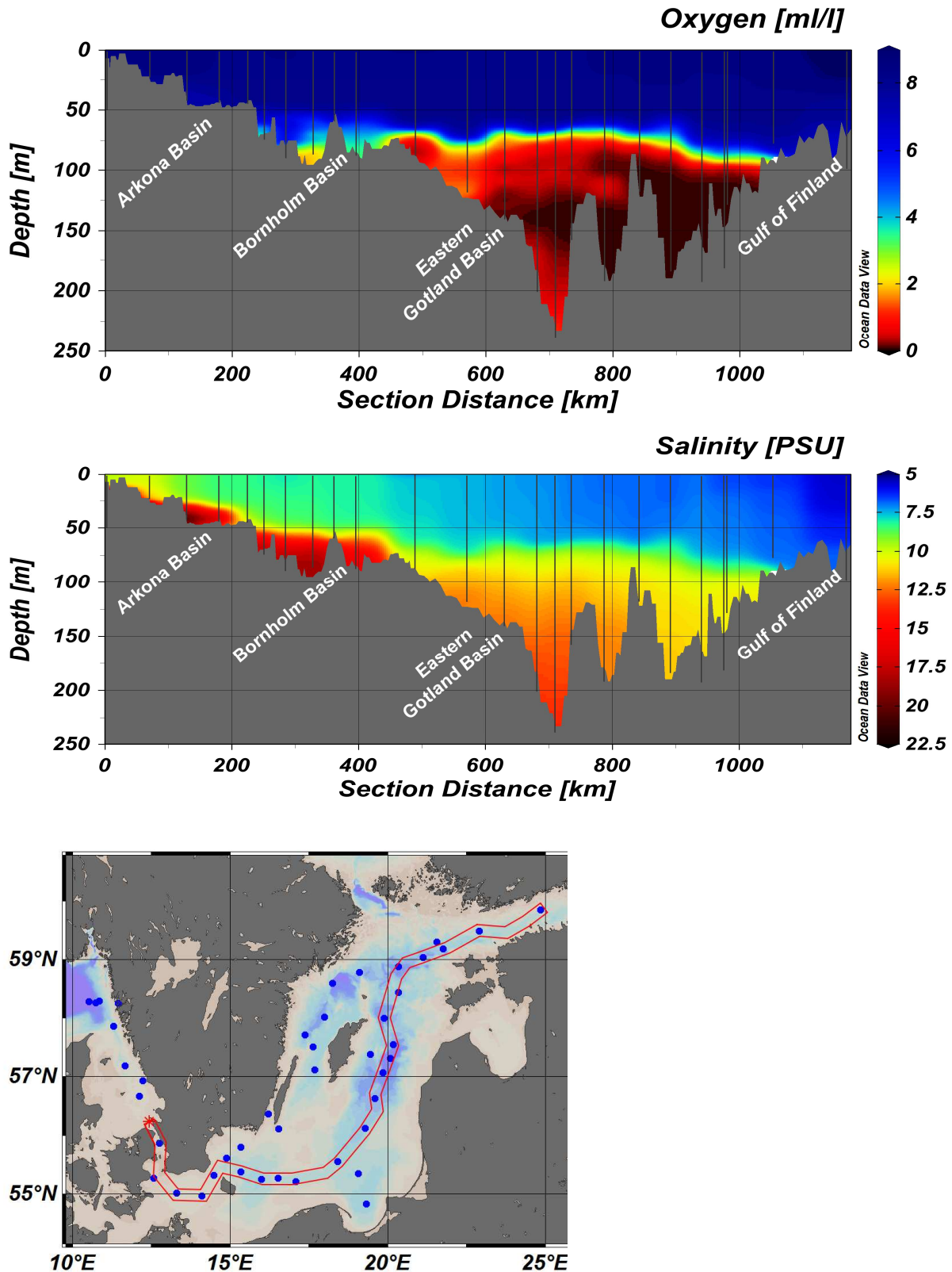
Egentliga Östersjön

Temperaturen i vattenmassan över språngskiktet var fortfarande något högre än normalt i hela området och varierade från 3,0 till 4,5°C. Ytsalthalten var något förhöjd i Hanöbukten, Bornholmsbassängen samt Arkonabassängen, i norra delen av östra Gotlandsbassängen något lägre än normalt och i övriga områden normal. Haloklin och termoklin sammanföll och återfanns på 40-60 meters djup i västra- och på 60-90 meters djup i östra- och norra Gotlandsbassängen, medan de låg något grundare i de södra delarna.

Fosfathalterna i ytvattnet låg fortfarande över det normala förutom i västra Gotlandsbassängen där den var normal för årstiden. Koncentrationerna låg mellan 0,6 och 1,1 µmol/l. Halterna av nitrit+nitrat var normala i hela det undersökta området och varierade från 2,6 till 4,7 µmol/l. Precis som vid förra besöket i januari var koncentrationen av silikat lägre än normalt i de södra delarna medan de var förhöjda i övriga områden. Halterna varierade mellan 9,0 och 17,2 µmol/l.

I hela det undersökta området observerades akut syrebrist (< 2 ml/l) på djup överstigande 60-90 meter. Vid Gotlandsdjupet BY15 uppmättes inget svavelväte i bottenvattnet den här gången men mycket låga syrehalter (<1 ml/l) uppmättes mellan 80 och 200 meter. Inflödet i december 2014 syns fortfarande inte längre norrut än BY20 i östra Gotlandsbassängen.

I västra samt norra Gotlandsbassängen var syresituationen fortfarande mycket allvarlig. I västra Gotlandsbassängen återfanns helt syrefria förhållanden, då svavelväte bildas, från 90-100 meter och den norra delen hade helt syrefria förhållanden från 90 meters djup. Svavelväte mättes vid den polska stationen PL-P1 i Gdanskbukten, vilken inte har uppmäts vid en karteringsexpedition sedan 2008



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



DELTAGARE

Namn

Anna-Kerstin Thell

Örjan Bäck

Johan Kronsell

Jenny Lycken

Sari Sipilä

Expeditionsledare

Från

SMHI

SMHI

SMHI

SMHI

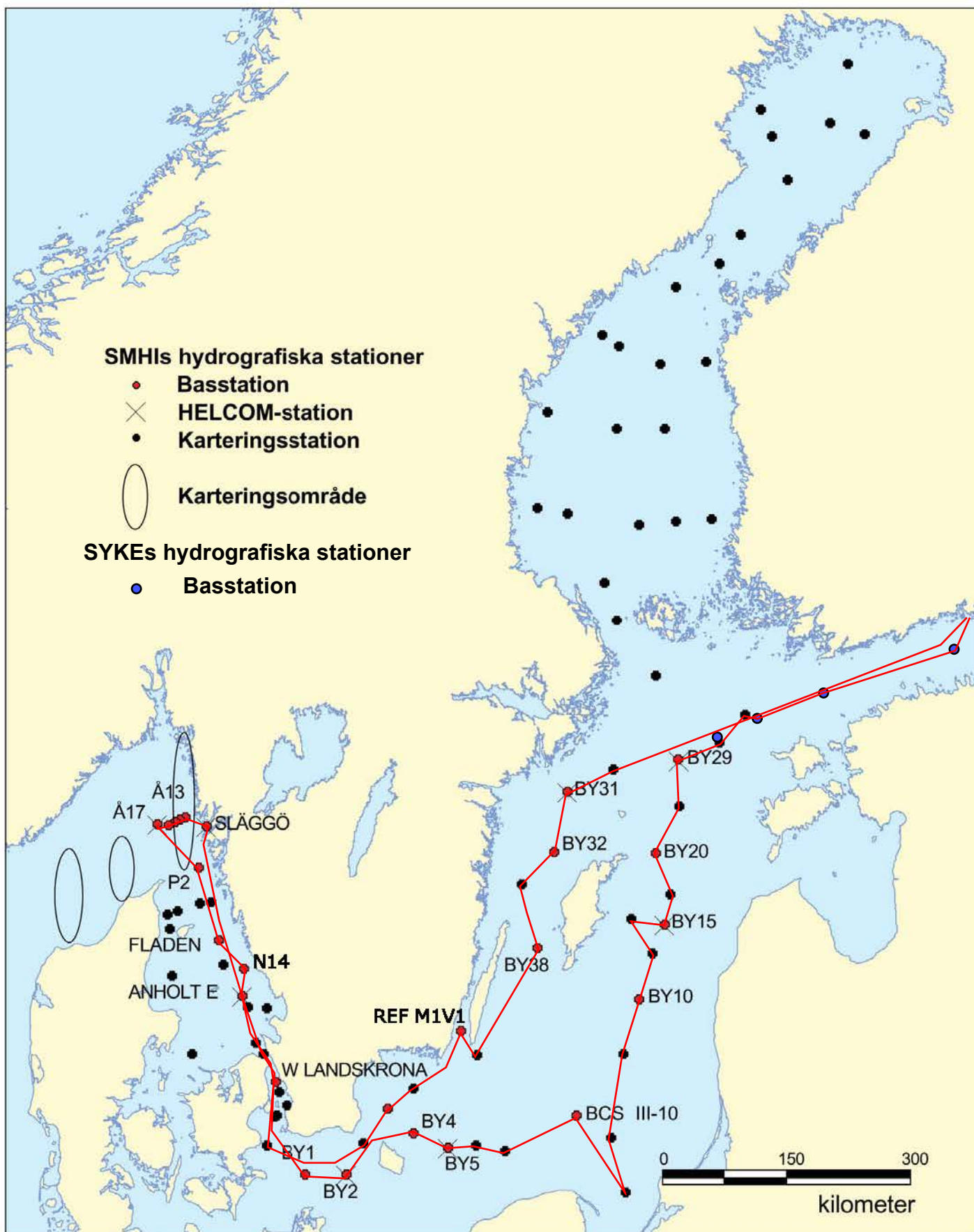
SMHI

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: 20160215-20160223
 Series: 0098-0142



Date: 2016-02-23
Time: 17:29

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 t	PPCPZZT Hrhhoo Cilyooa motPBw PrP l	No de	T e a	S h	P o	H x 2	P y	T o o	N o o	N t 3	N t 4	N t 5	N t 6	A t k	S h o l i	S h u i	L o m g	P u n	P t O O	T C C	O m m		
0098	GFX	X29EXT	BY23/LL7	N5950.79	E2450.27	20160215	1300	102		29 3	1.1	1009	2820	x	--x----	13	x	x	-	x	-	x	x	x	x	x	x	-	x	-	-	-	-	-	-	x	
0099	BP	NX00EXT	LL12	N5929.01	E2253.81	20160215	1900	84		34 8	-1.0	1016	9999	x	--x----	11	x	x	-	x	-	x	x	x	x	x	x	-	x	-	-	-	-	-	-	x	
0100	BP	WX00EXT	LL15	N5911.00	E2144.81	20160215	2320	132		35 8	-0.4	1021	9999	x	-----	15	x	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	
0101	BP	NX33BAS	BY27	N5917.8	E2134	20160216	0035	182		34 6	-0.5	1022	9999	x	-----	16	x	x	-	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-	x	
0102	BP	NX34BAS	BY28	N5902	E2105	20160216	0325	192		33 6	0.0	1023	9999	x	-----	17	x	x	-	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-	x	
0103	BP	NX35BAS	BY29	N5853	E2019	20160216	0700	183		31 6	-0.4	1027	1530	x	--x----	16	x	x	-	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-	-	
0104	BP	NX27BAS	BY21	N5826.5	E2020	20160216	1030	123		32 5	3.6	1030	1330	x	-----	14	x	x	-	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-	x	
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0106	BPE	X25BAS	BY19	N5737	E2010	20160216	1720	156		28 4	1.5	1035	9999	x	-----	15	x	x	-	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-	-	
0107	BP	EX21BAS	BY15	GOTLANDSDJ	N5720	E2003	20160216	1940	237	27 6	1.5	1036	9999	x	--xxx--	19	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	x
0108	BPE	X19BAS	BY13	N5723.5	E1926	20160217	0000	122		26 7	2.1	1036	9990	x	-----	14	x	x	-	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-	-	
0109	BPE	X14BAS	BY11	N5704	E1950	20160217	0250	201		24 9	2.3	1037	9990	x	-----	17	x	x	-	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-	-	
0110	BPE	X13BAS	BY10	N5638	E1935	20160217	0615	144		22 8	1.8	1036	1130	x	--x----	15	x	x	-	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-	-	
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0113	BP	SG71BAS	PL-P1	N5450	E1818.93	20160217																															

Bottom water oxygen concentration (ml/l)

Country: Finland

Ship : Aranda

Date : 20160215-20160223

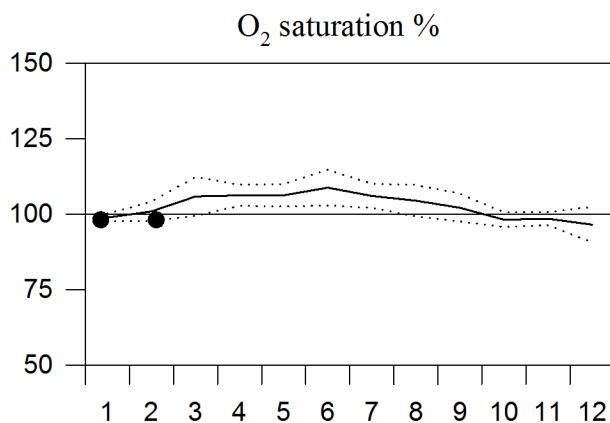
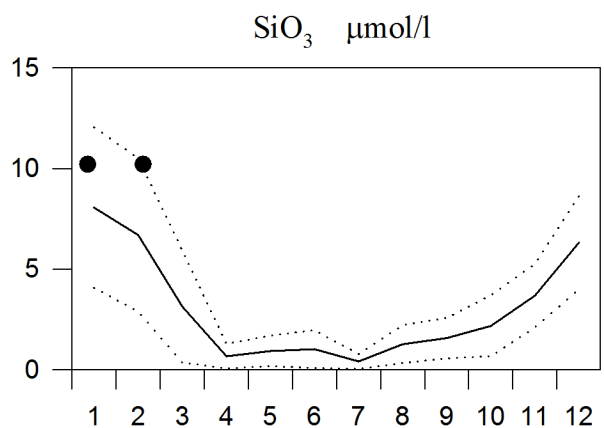
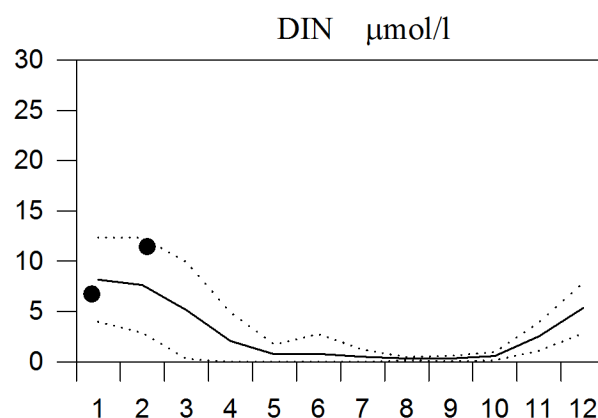
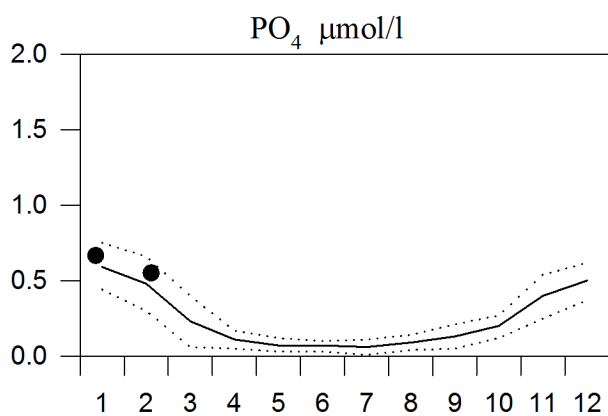
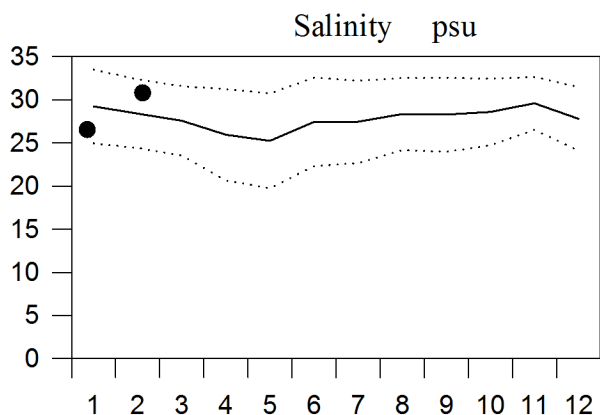
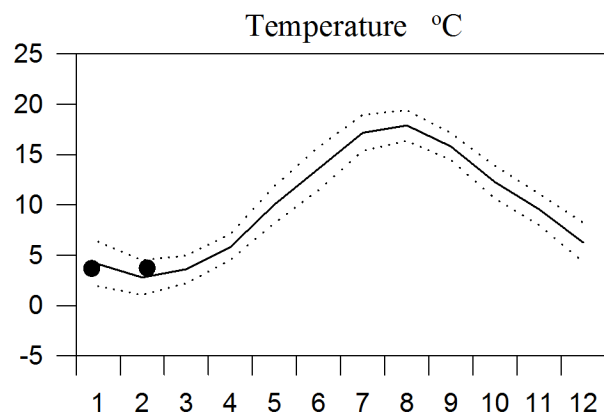
Series : 0098-0142



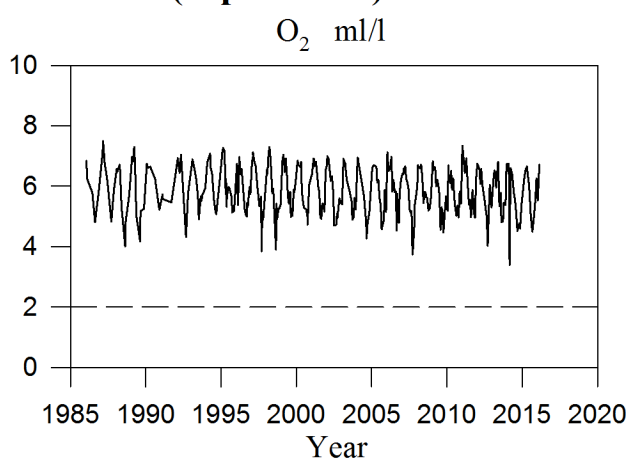
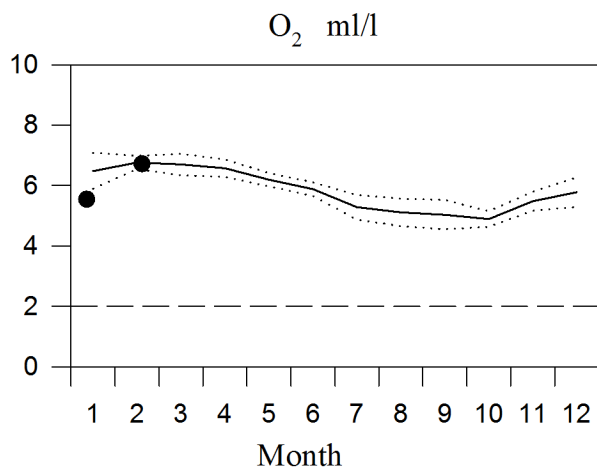
STATION P2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

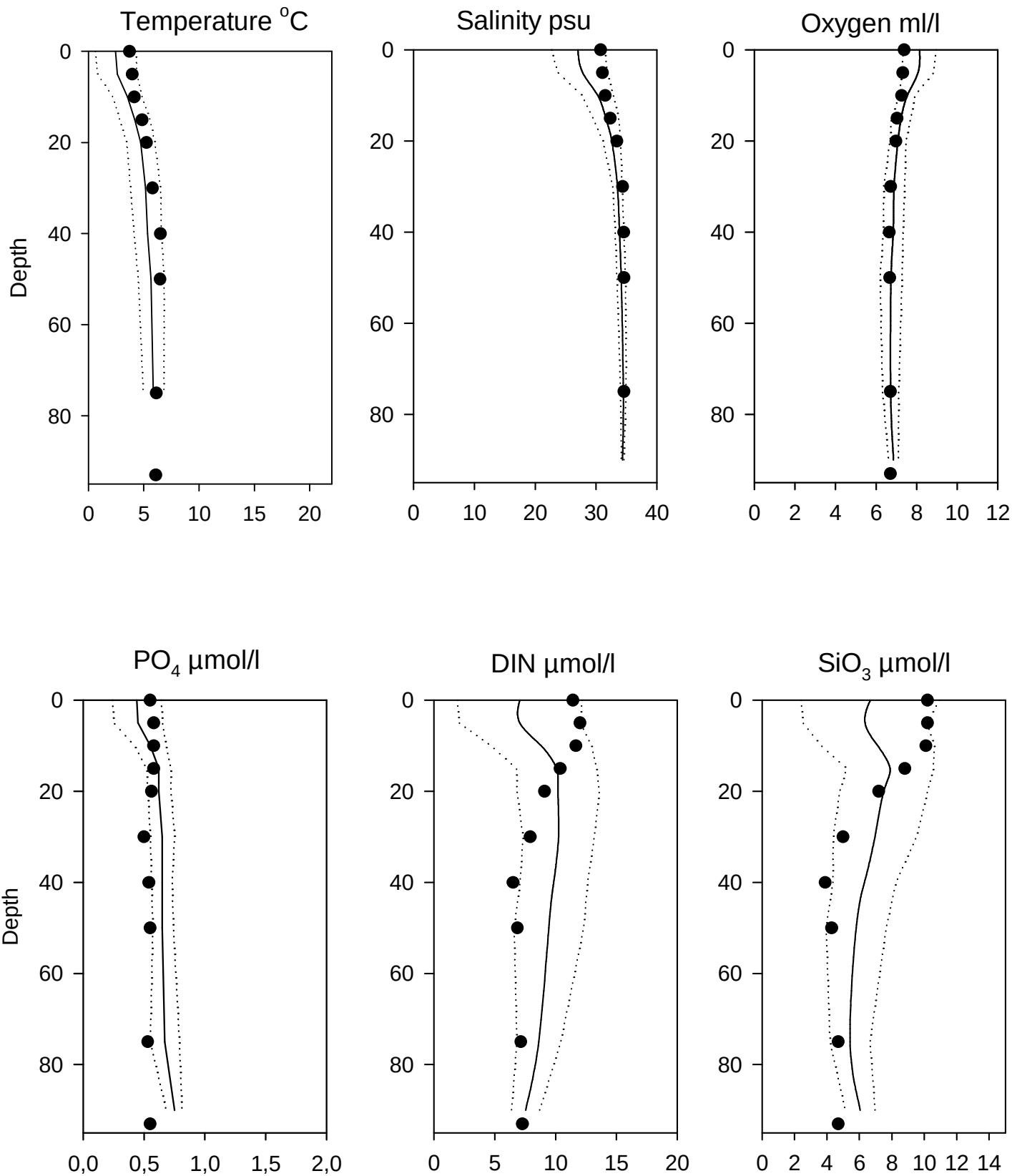


OXYGEN IN BOTTOM WATER (depth >75m)



Vertical profiles P2 February

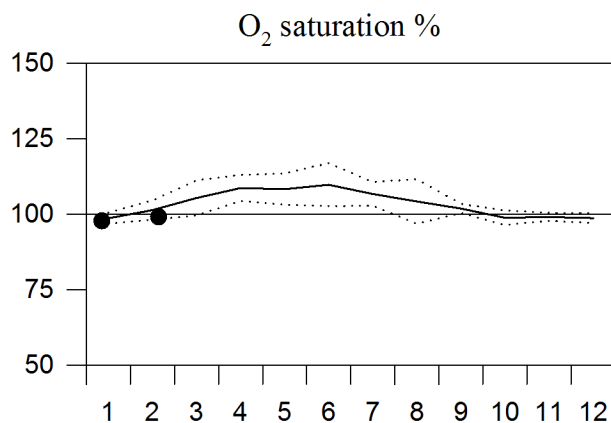
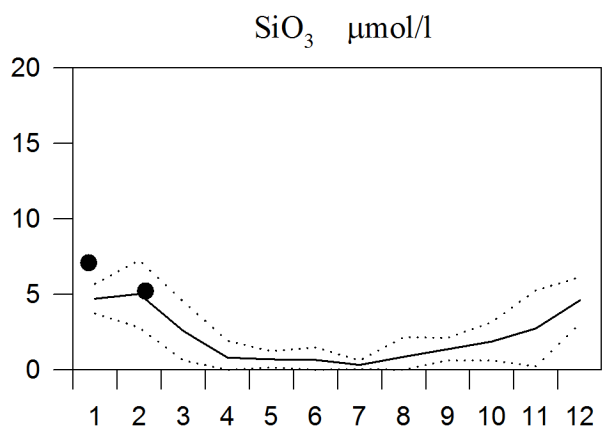
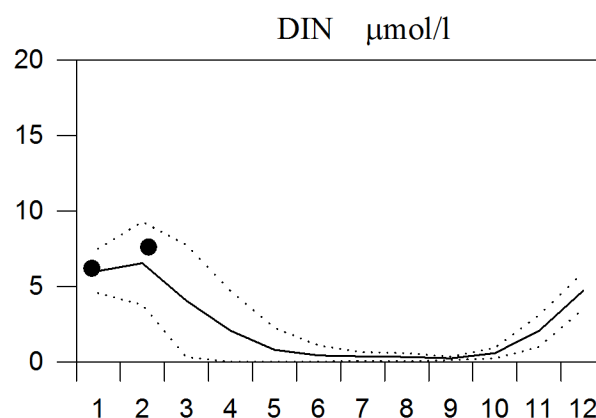
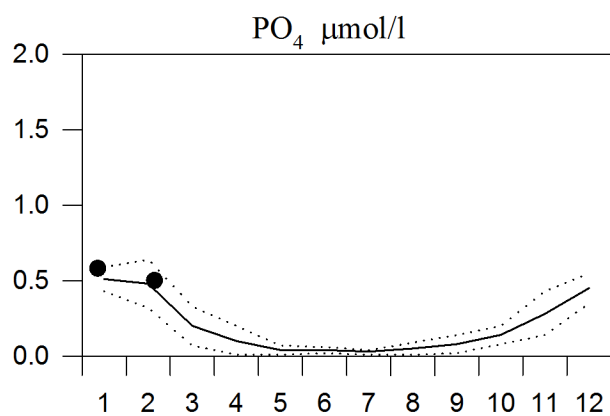
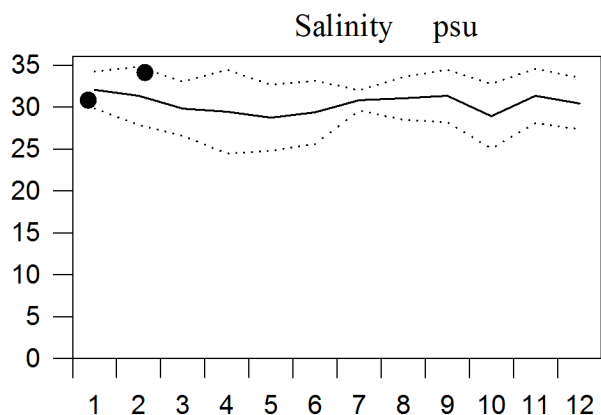
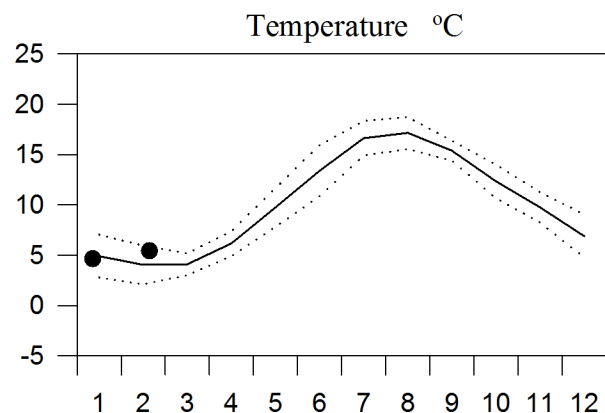
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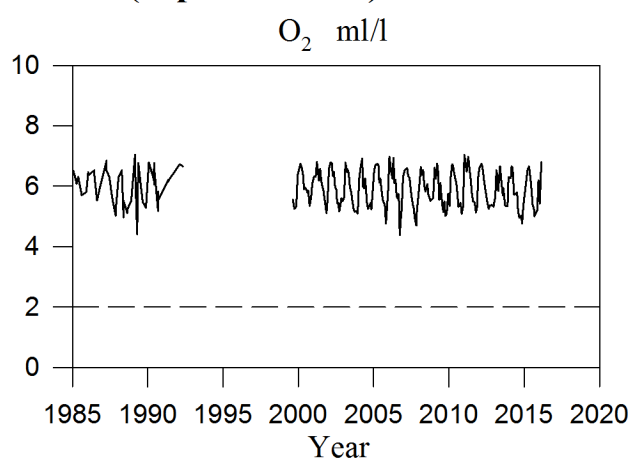
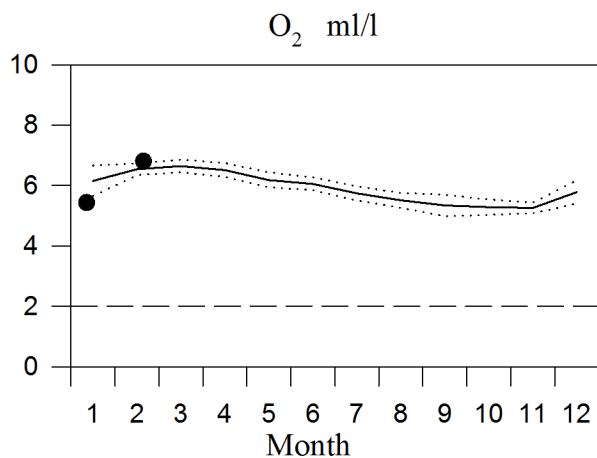
STATION Å15 SURFACE WATER

Annual Cycles

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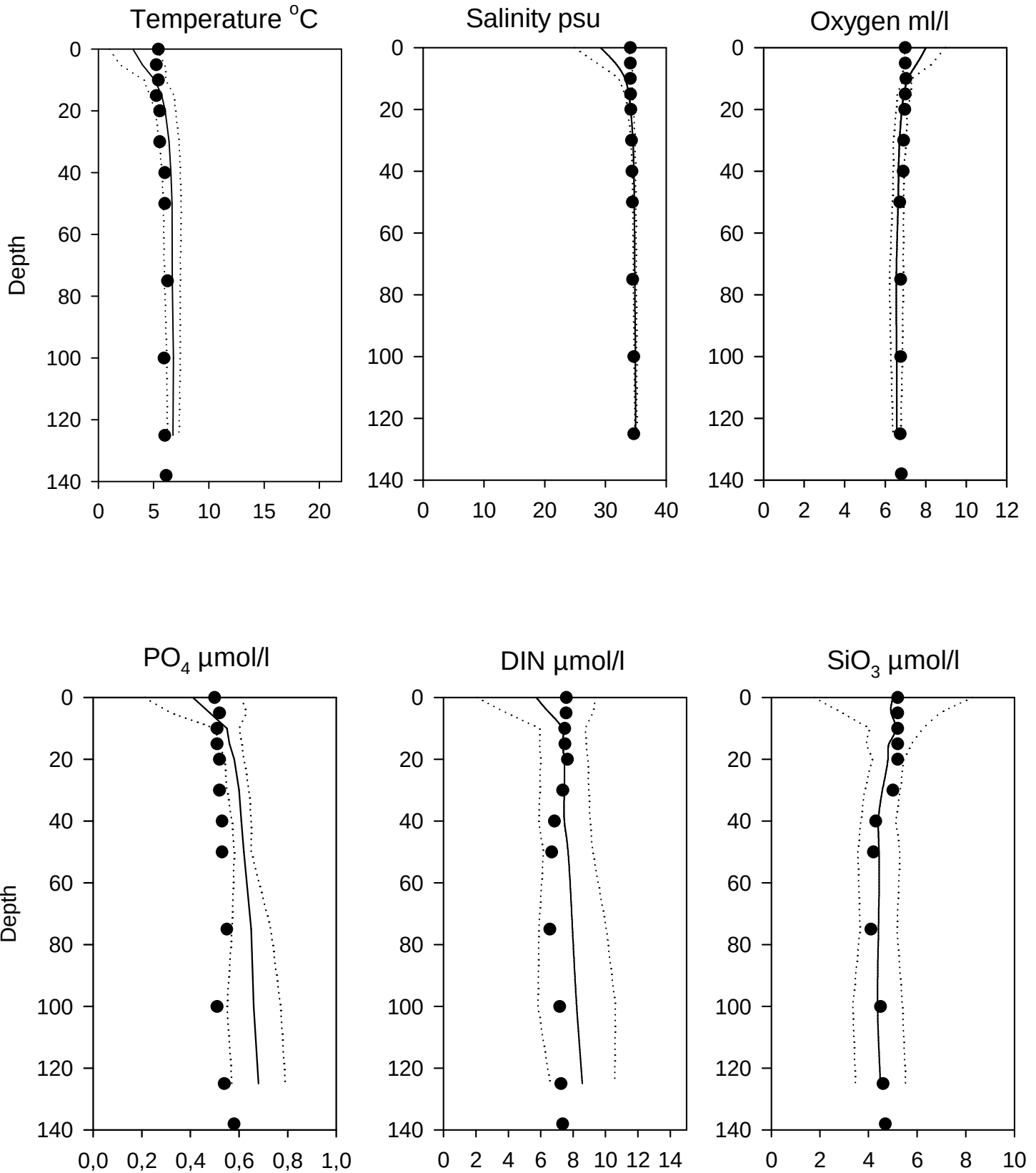


OXYGEN IN BOTTOM WATER (depth >=125m)



Vertical profiles Å15 February

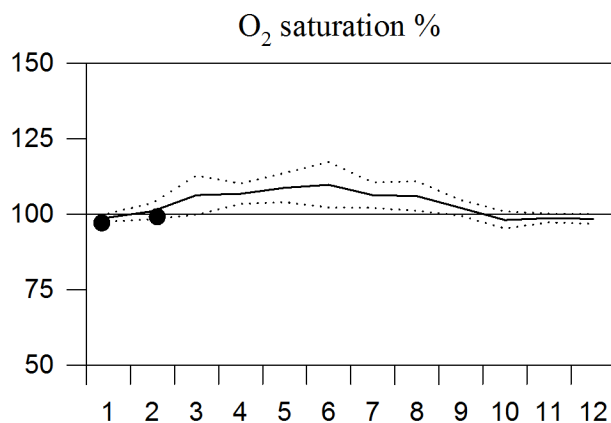
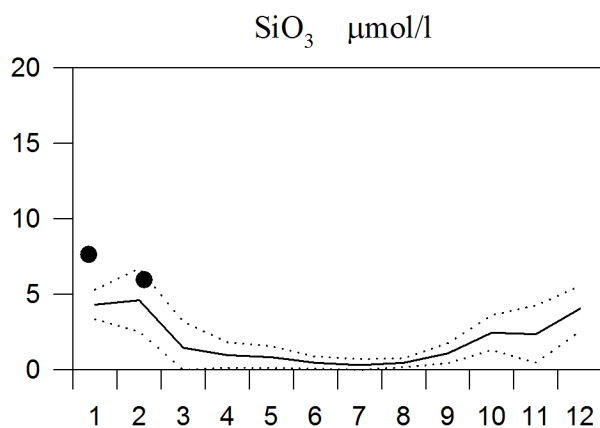
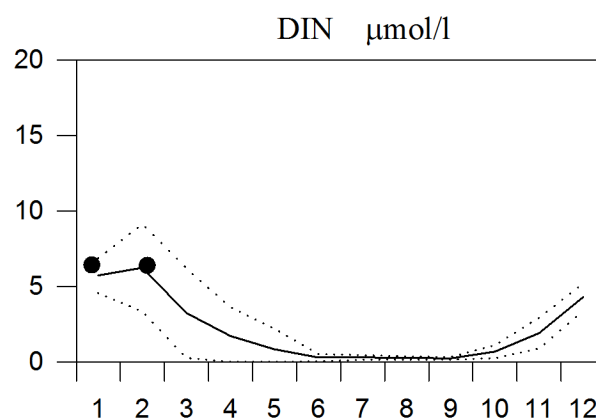
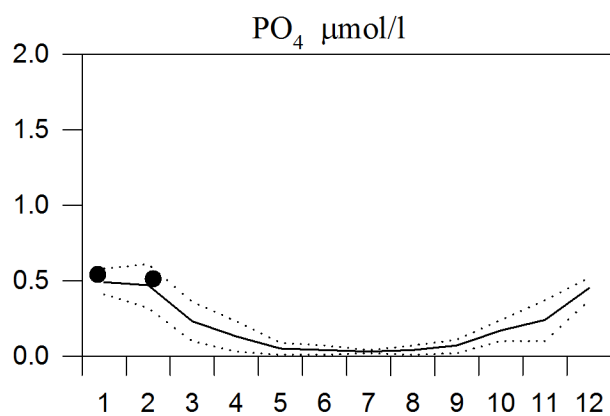
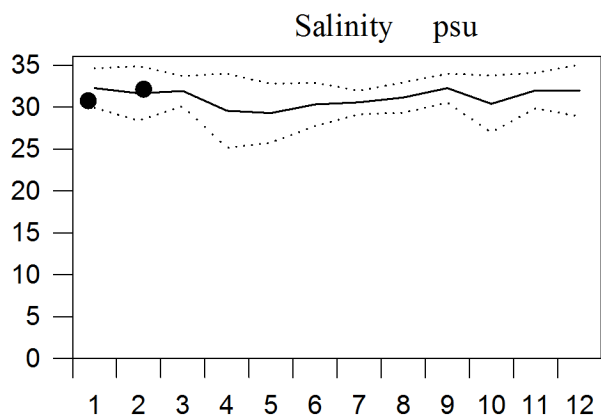
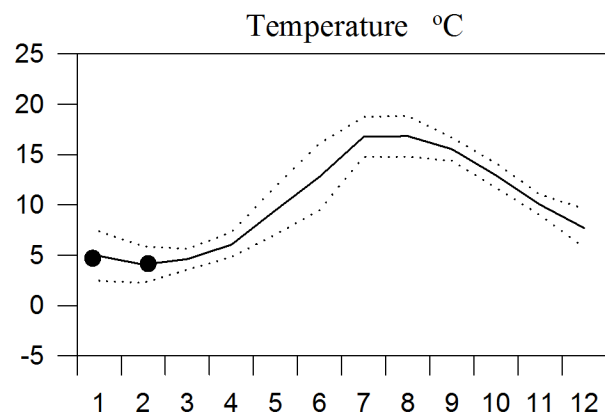
— Mean 1996-2010 St.Dev. ● 2016



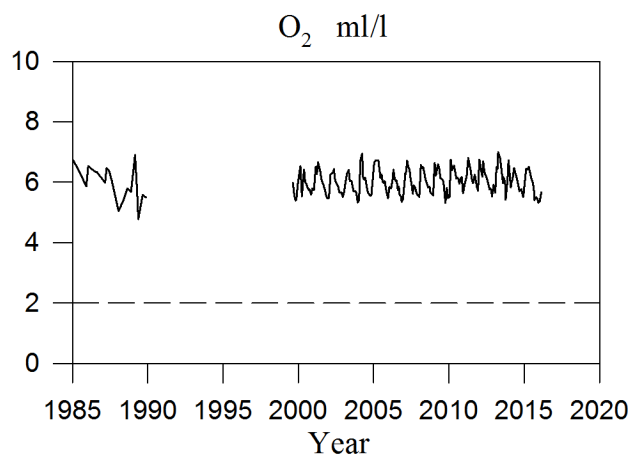
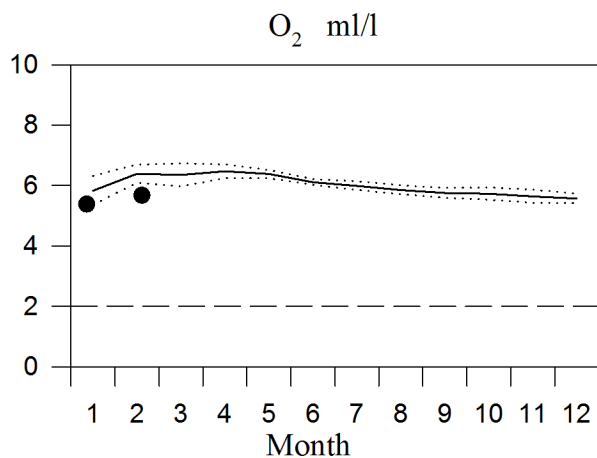
STATION Å17 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016



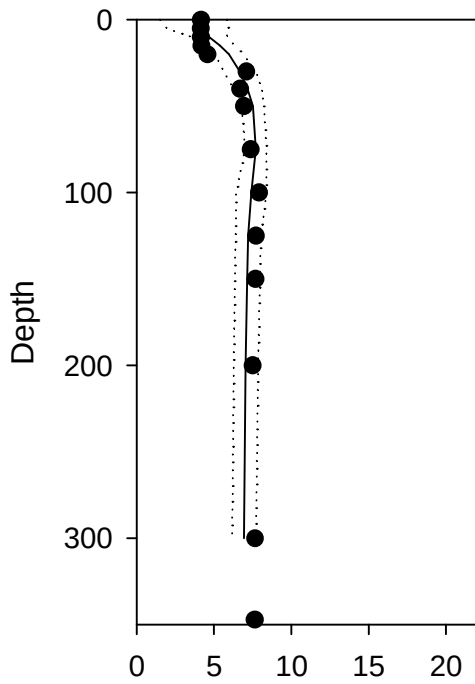
OXYGEN IN BOTTOM WATER (depth = 300m)



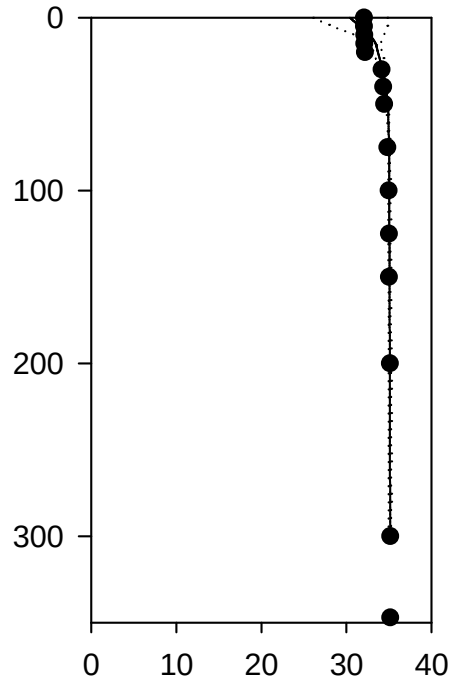
Vertical profiles Å17 February

— Mean 1996-2010 St.Dev. ● 2016

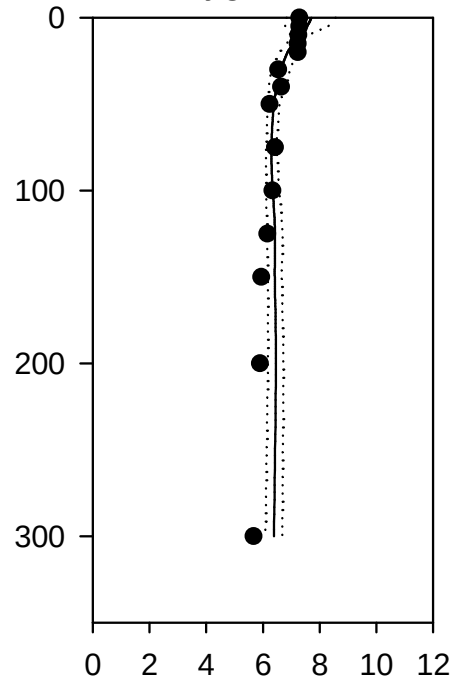
Temperature °C



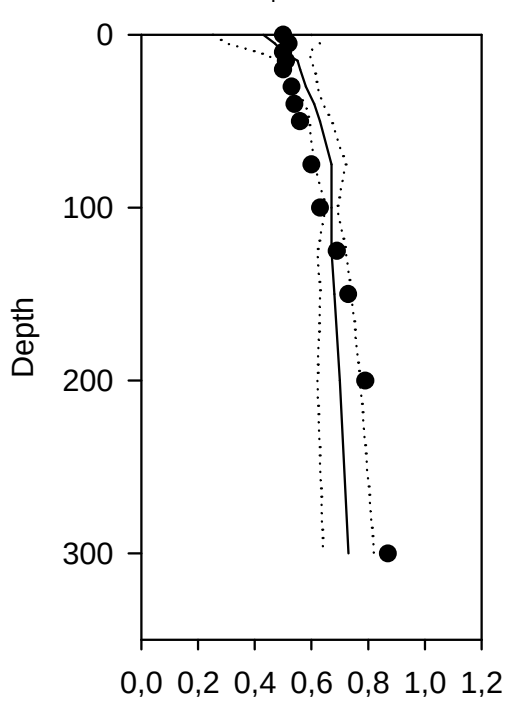
Salinity psu



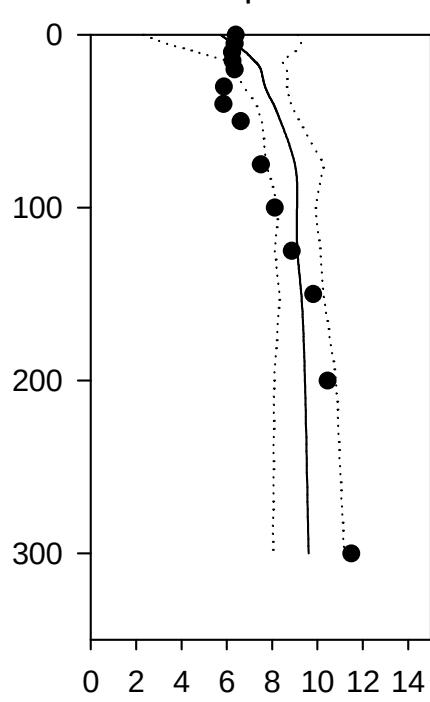
Oxygen ml/l



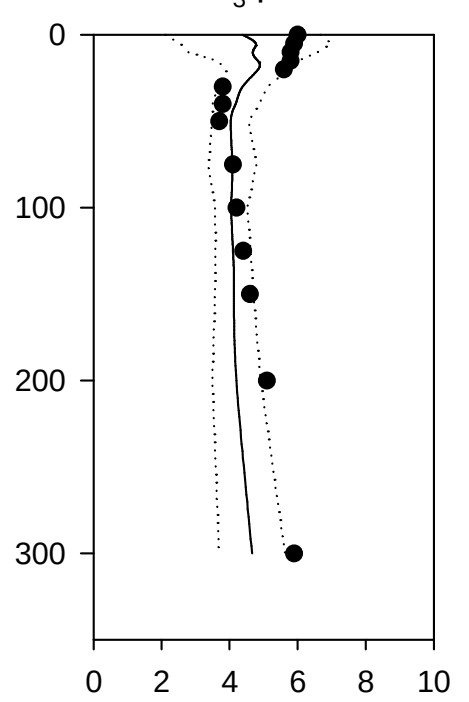
PO₄ μmol/l



DIN μmol/l



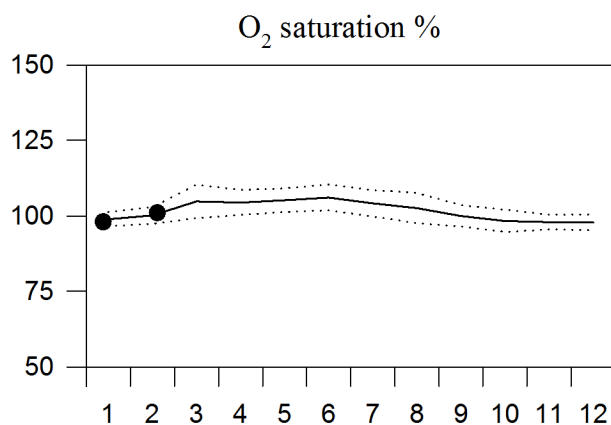
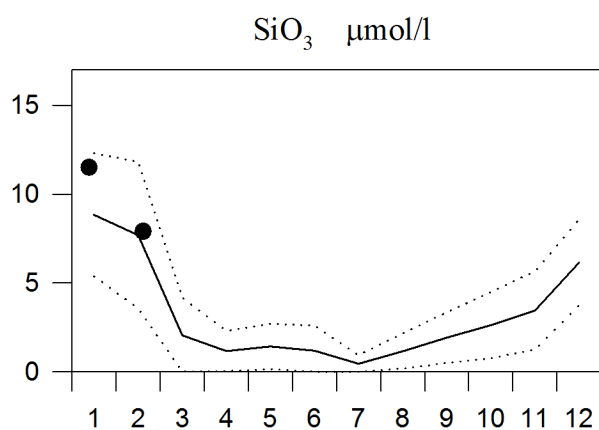
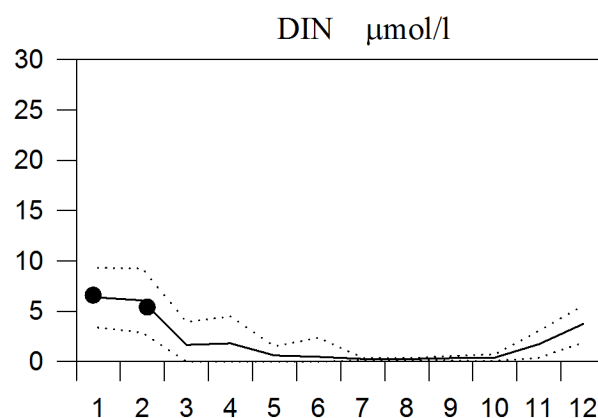
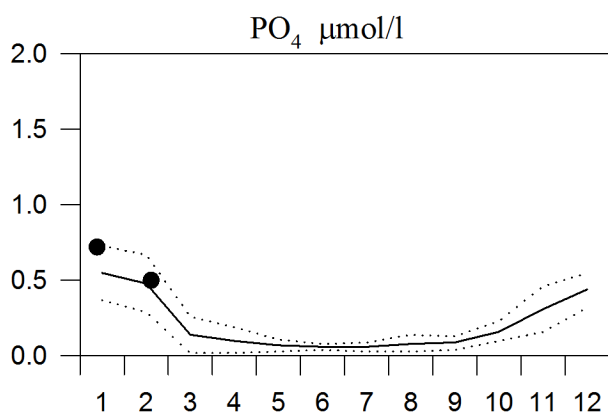
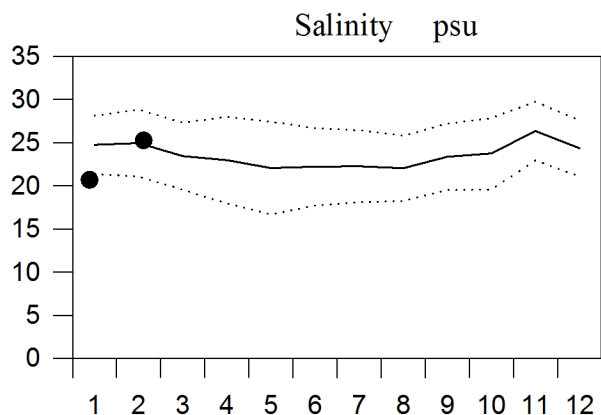
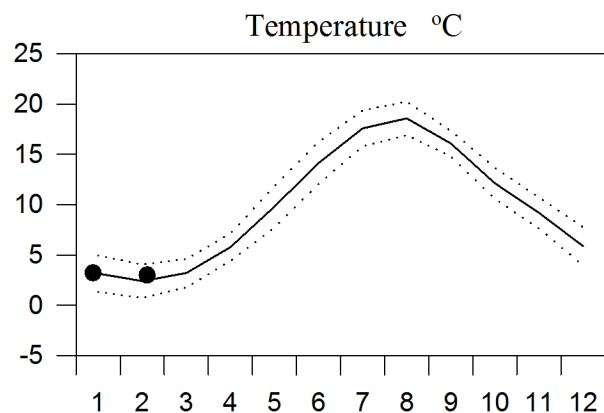
SiO₃ μmol/l



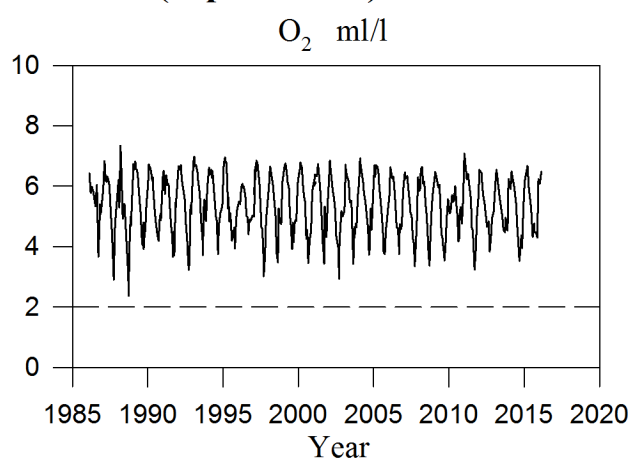
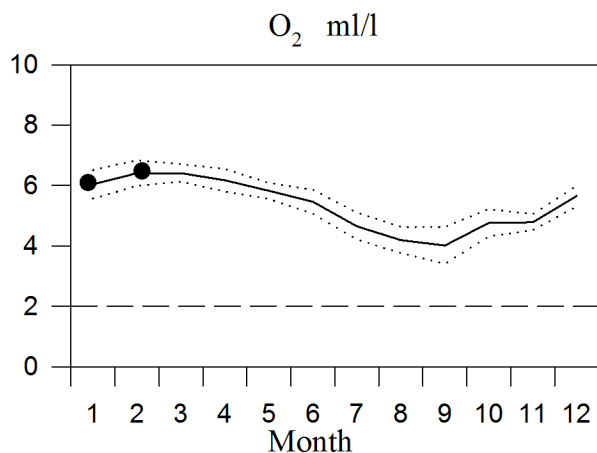
STATION FLADEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

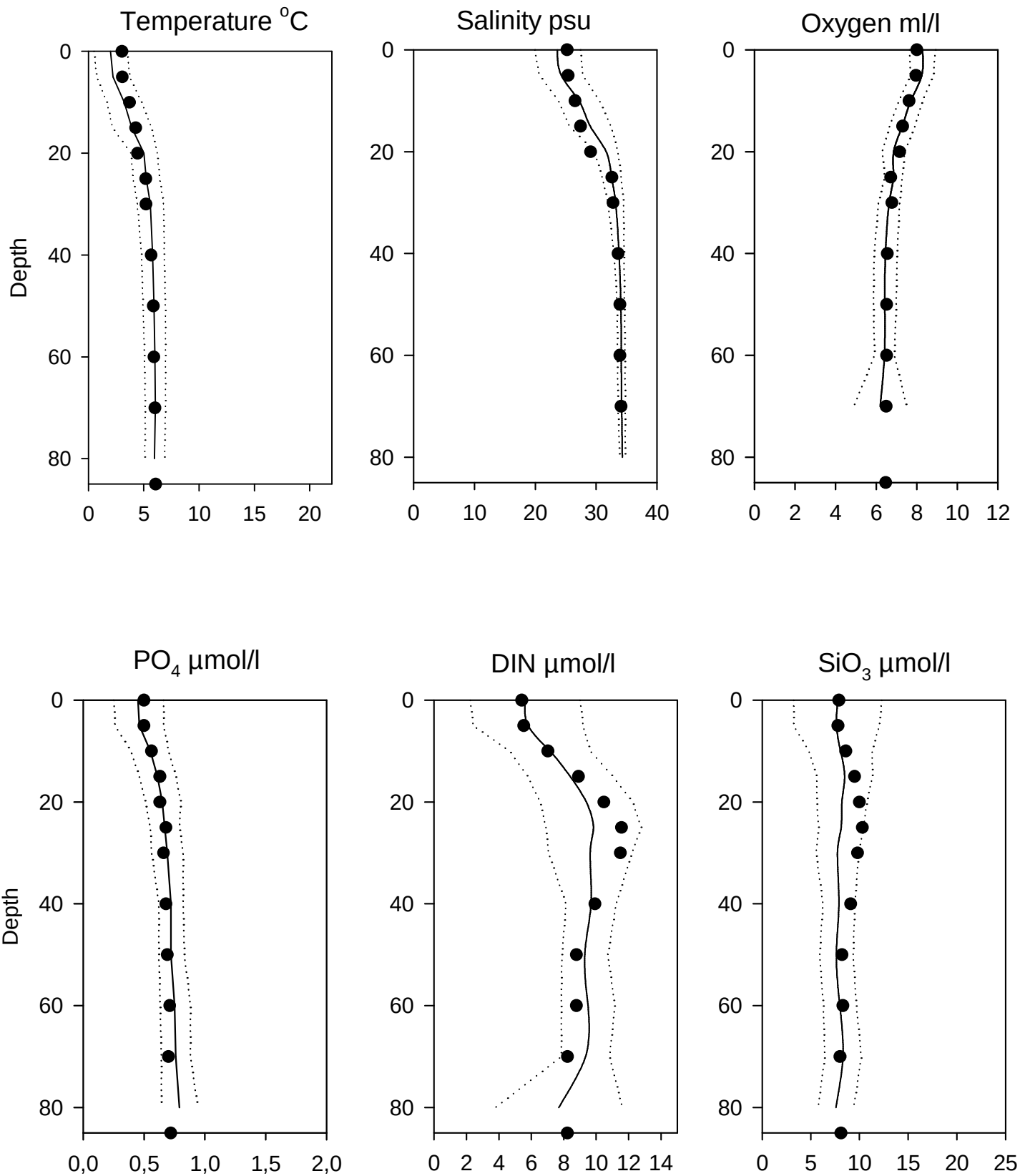


OXYGEN IN BOTTOM WATER (depth > 70m)



Vertical profiles Fladen February

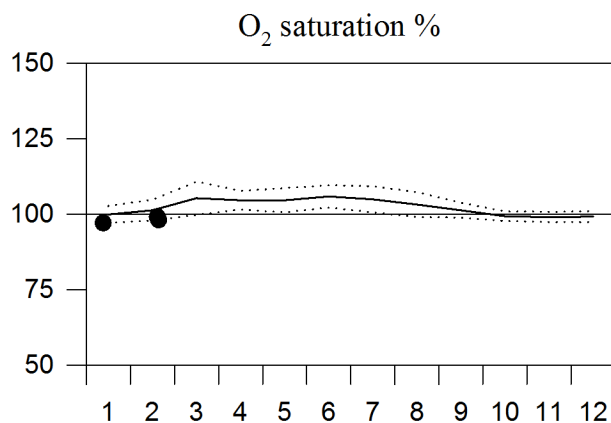
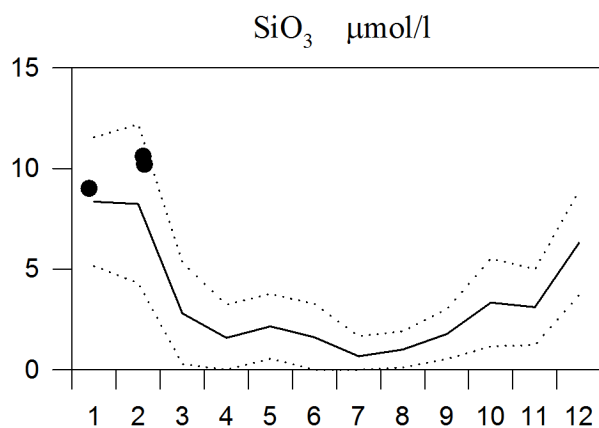
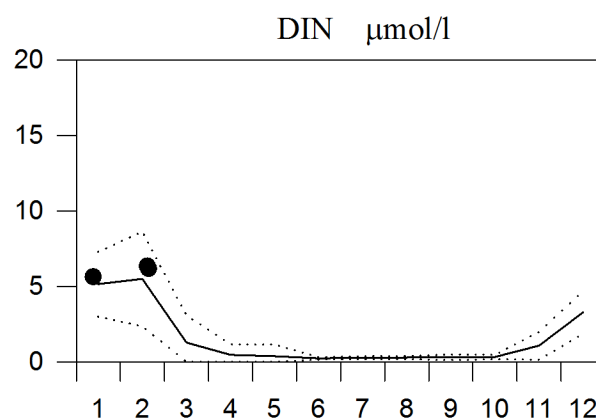
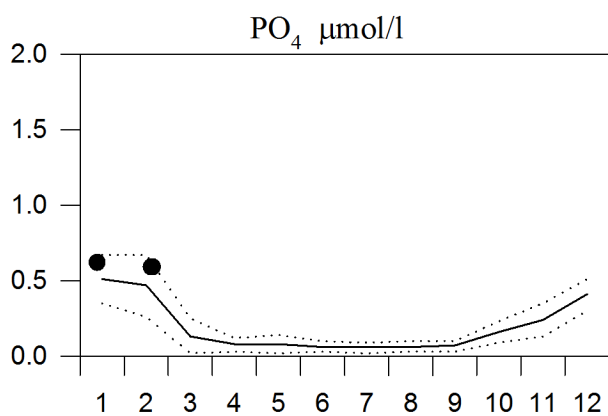
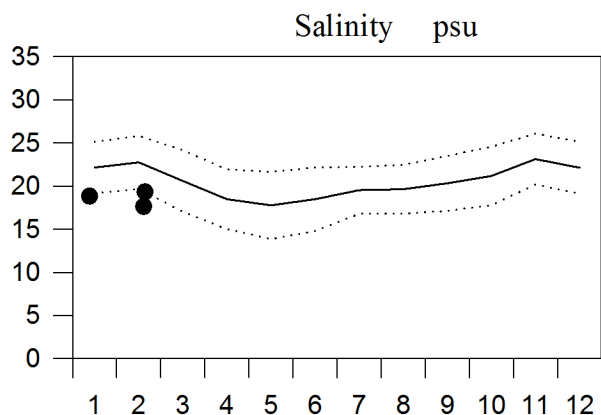
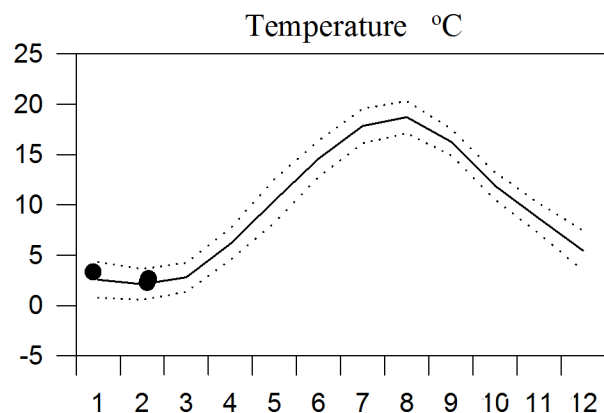
— Mean 1996-2010 St.Dev. ● 2016



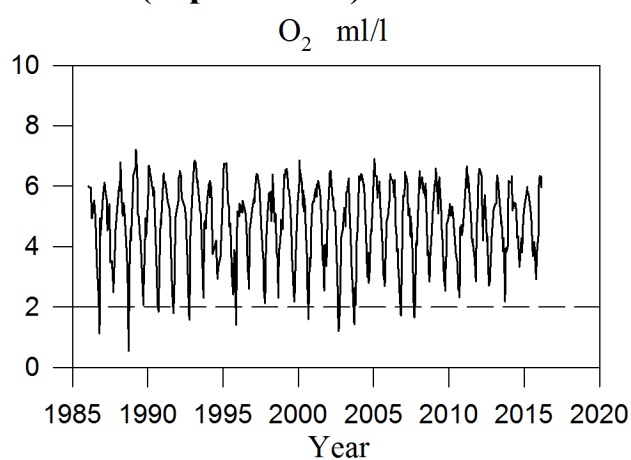
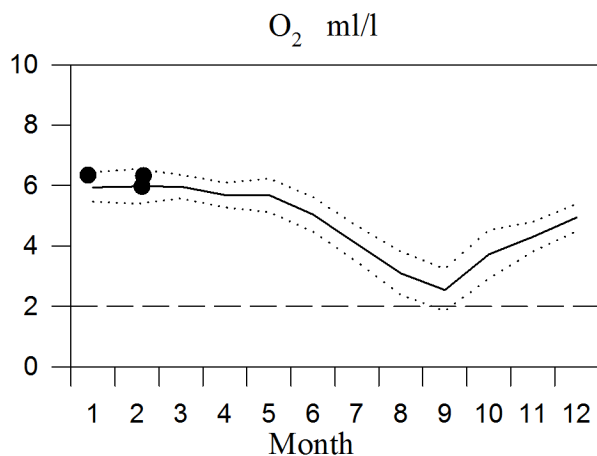
STATION ANHOLT E SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

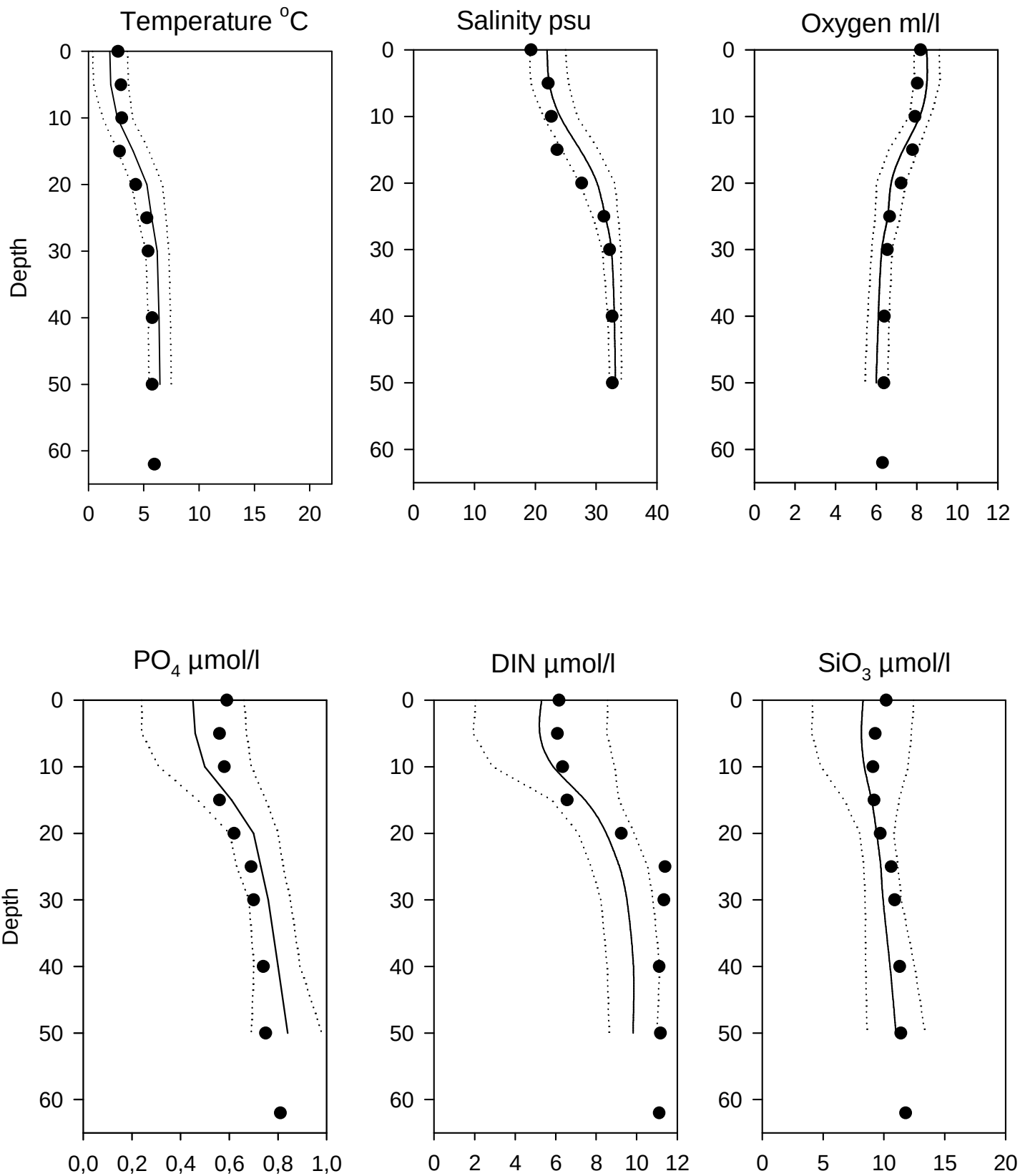


OXYGEN IN BOTTOM WATER (depth > 50m)



Vertical profiles Anholt E February

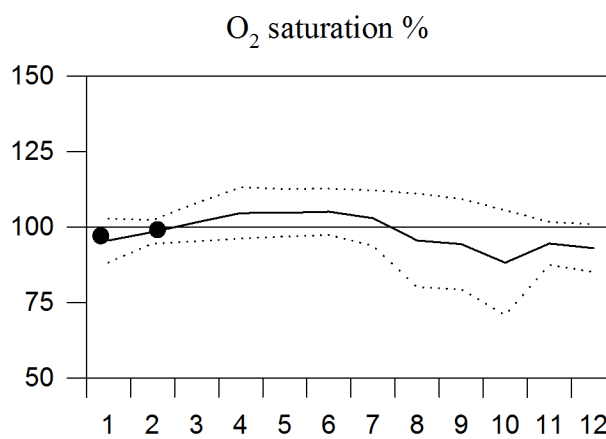
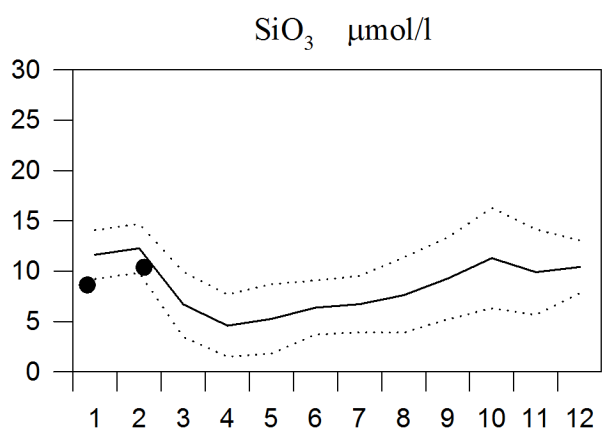
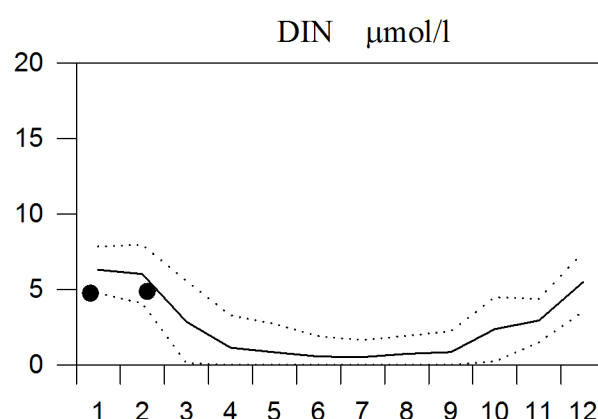
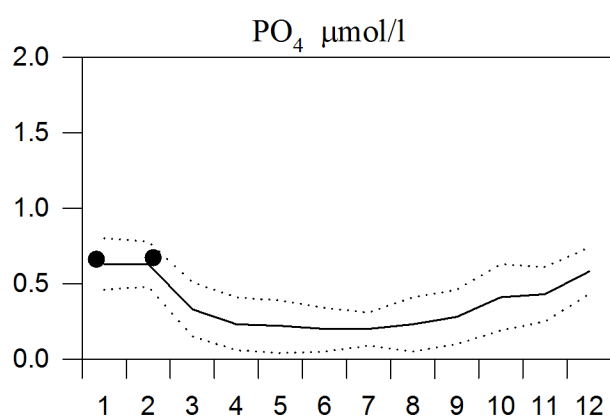
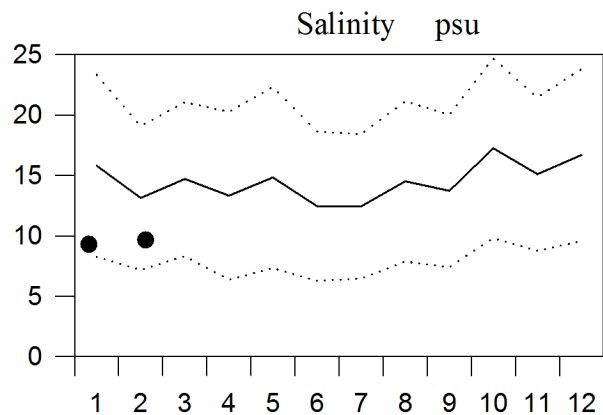
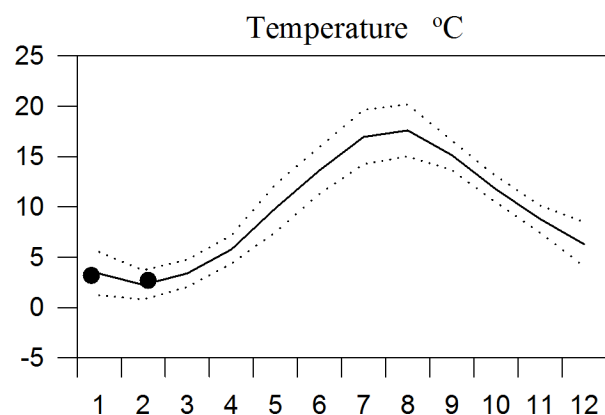
— Mean 1996-2010 St.Dev. ● 2016



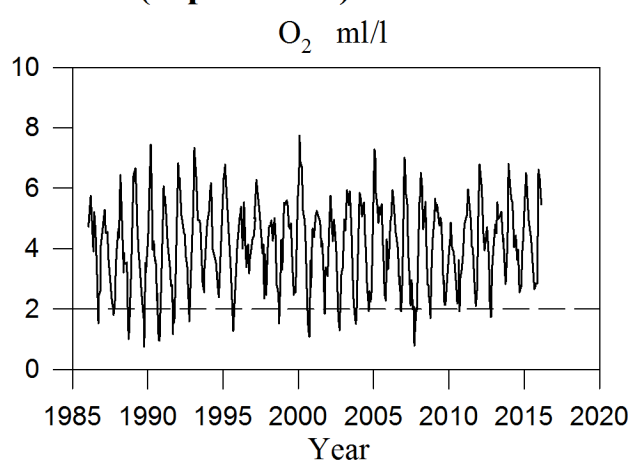
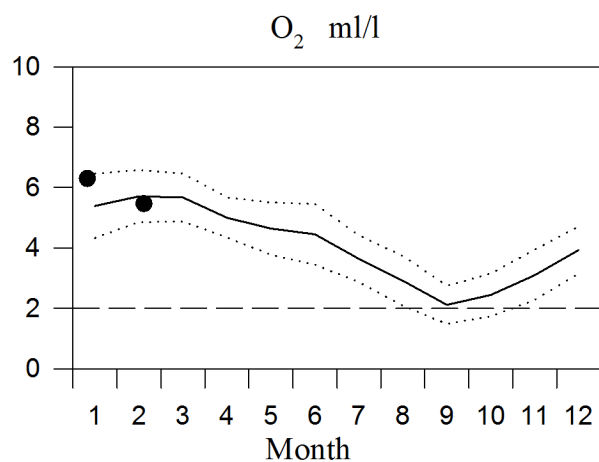
STATION W LANDSKRONA SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

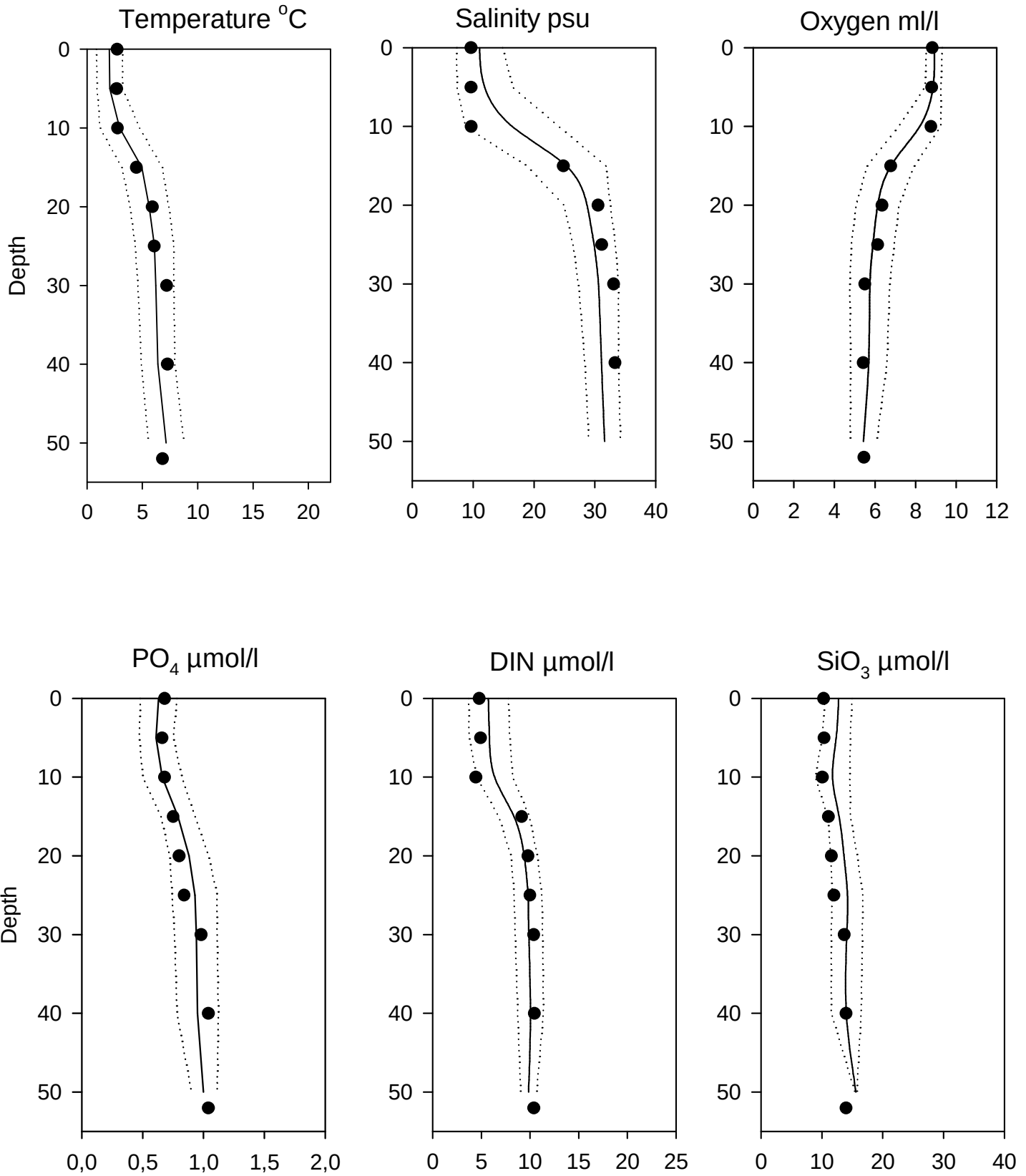


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles W Landskrona Febuary

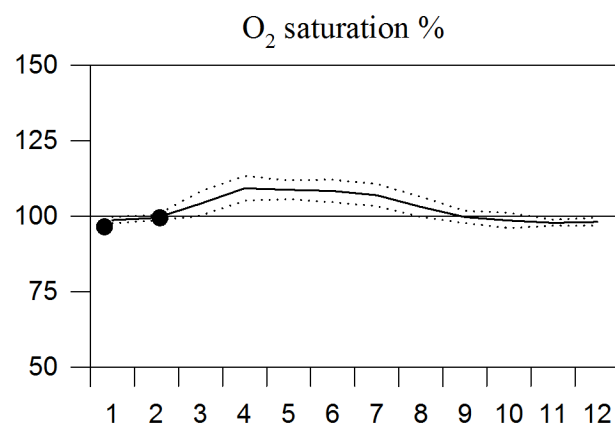
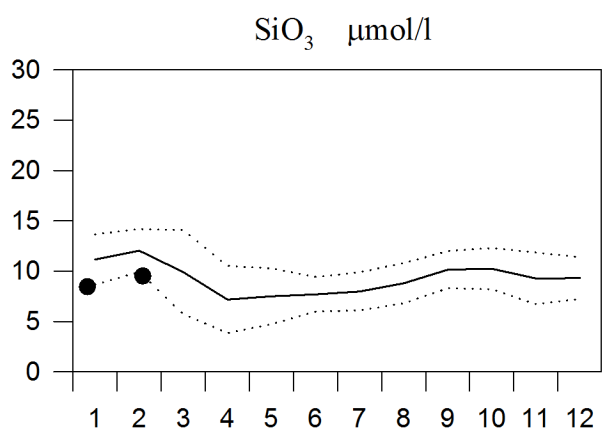
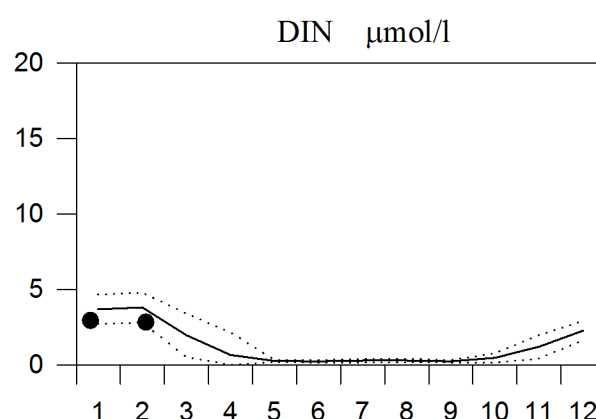
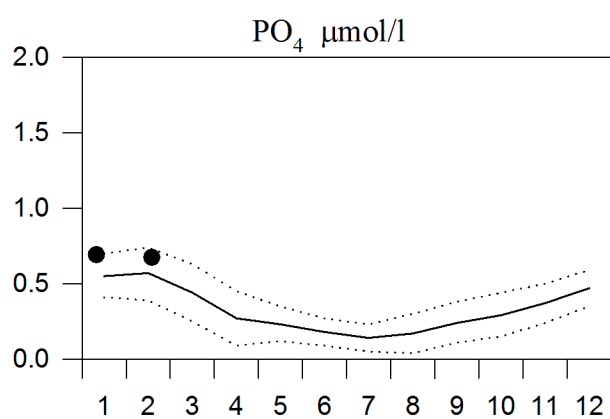
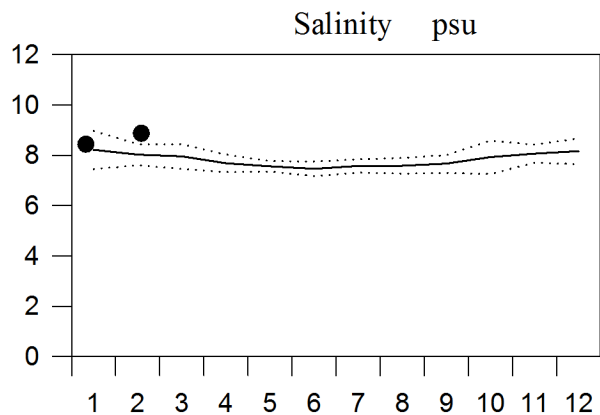
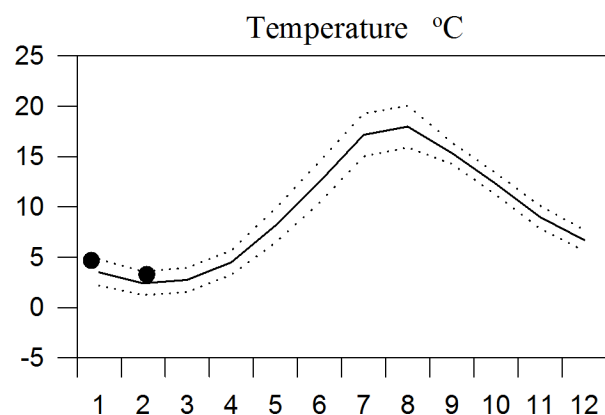
— Mean 1996-2010 St.Dev. ● 2016



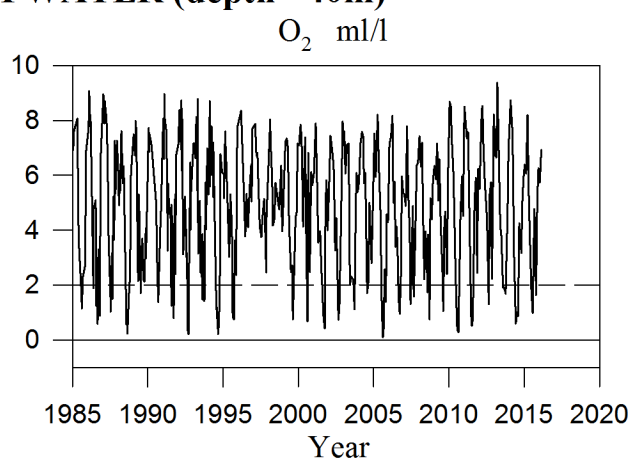
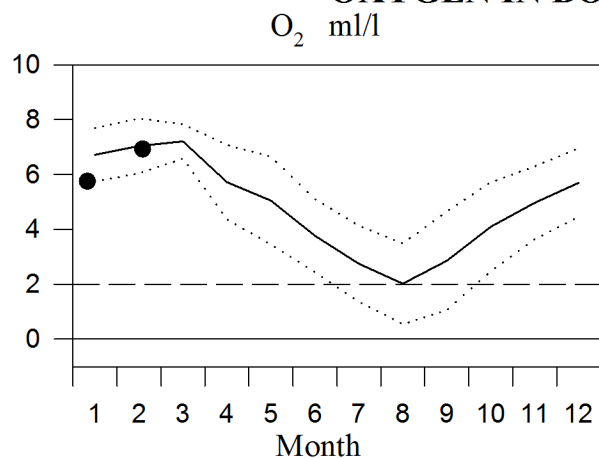
STATION BY1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

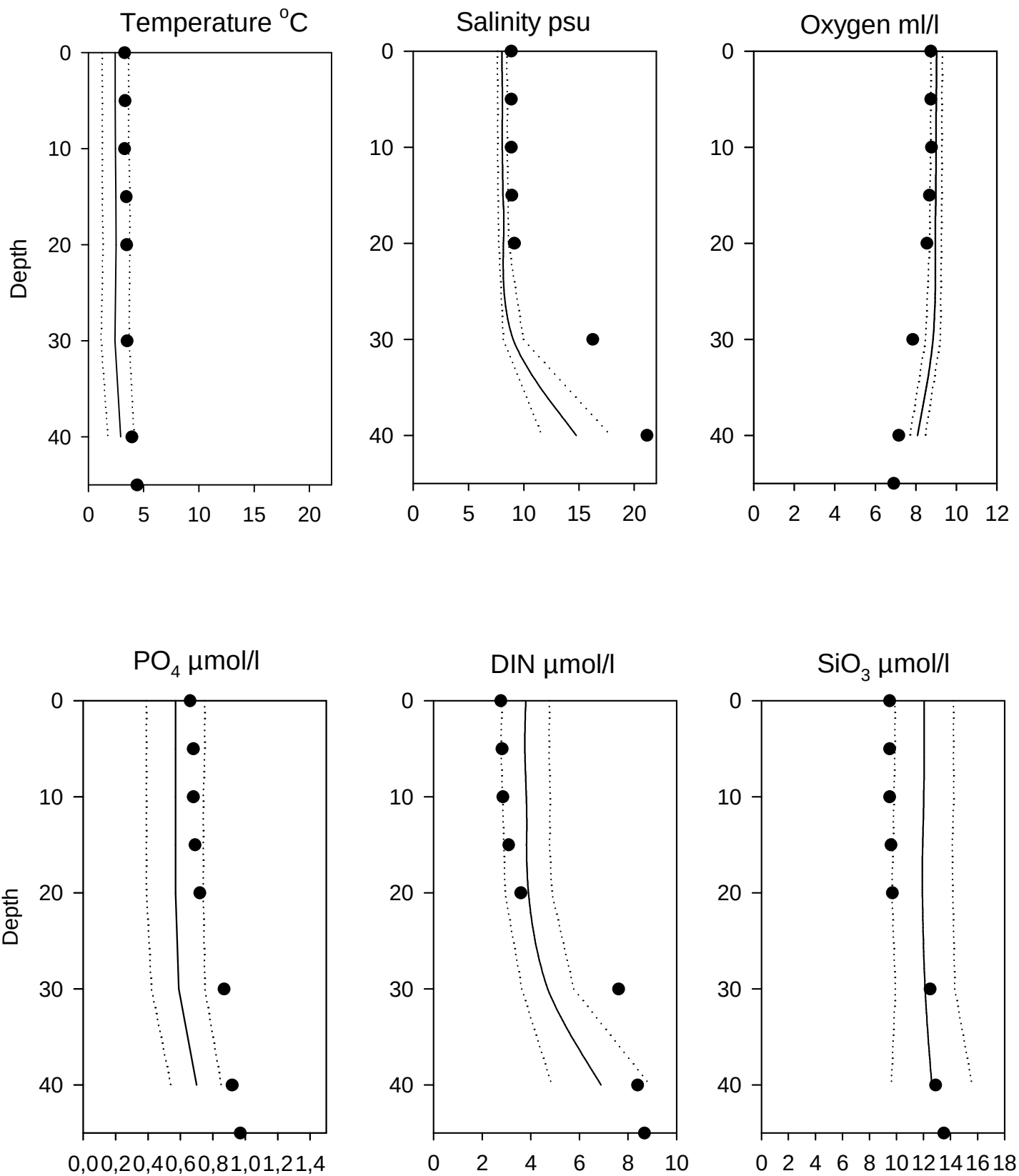


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY1 February

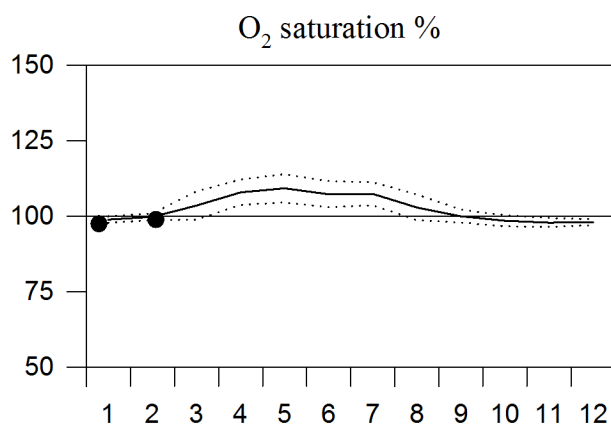
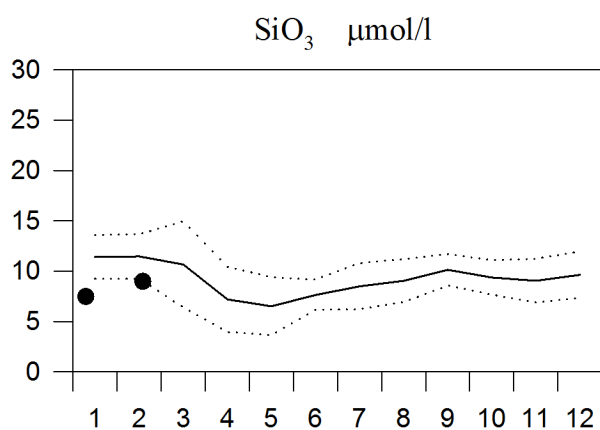
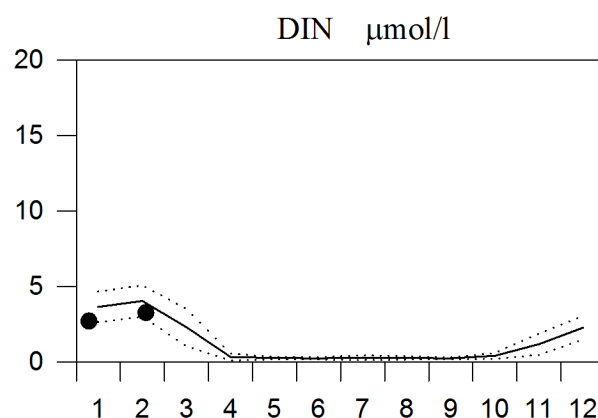
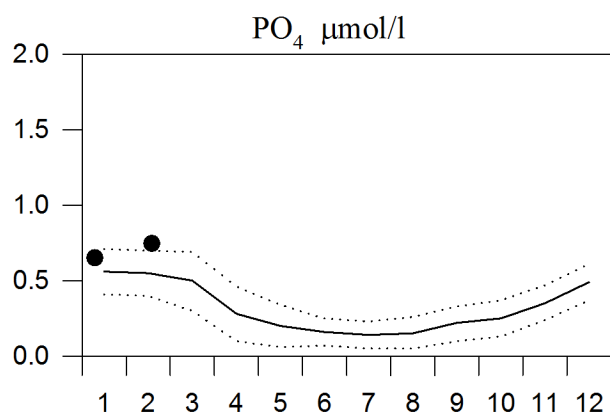
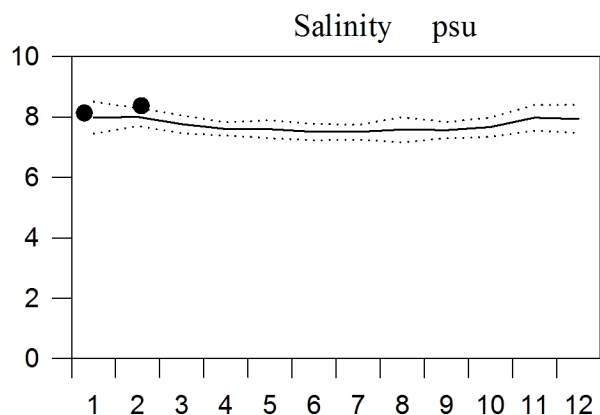
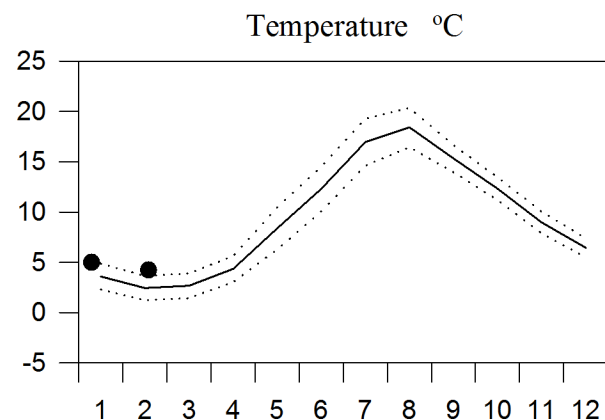
— Mean 1996-2010 St.Dev. ● 2016



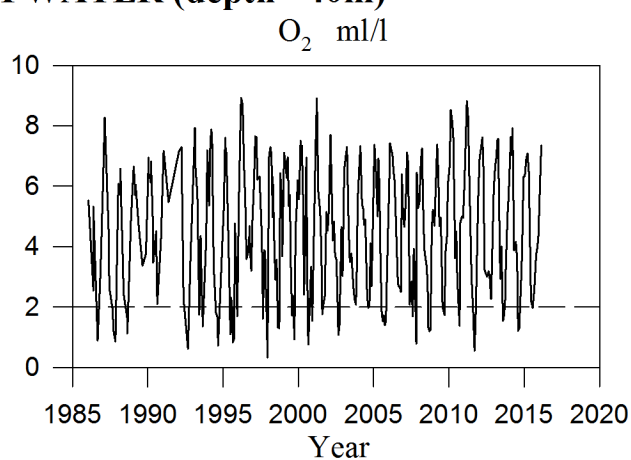
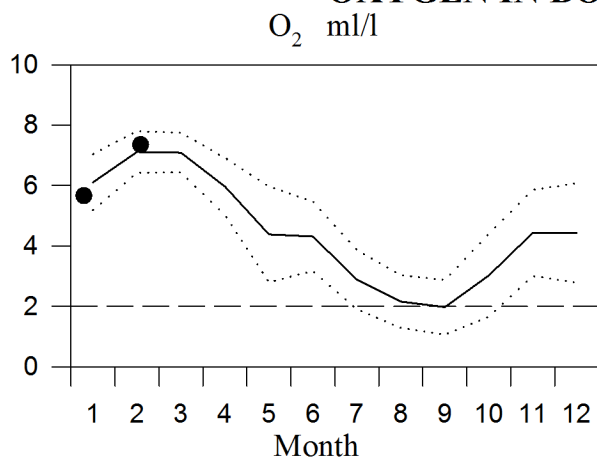
STATION BY2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

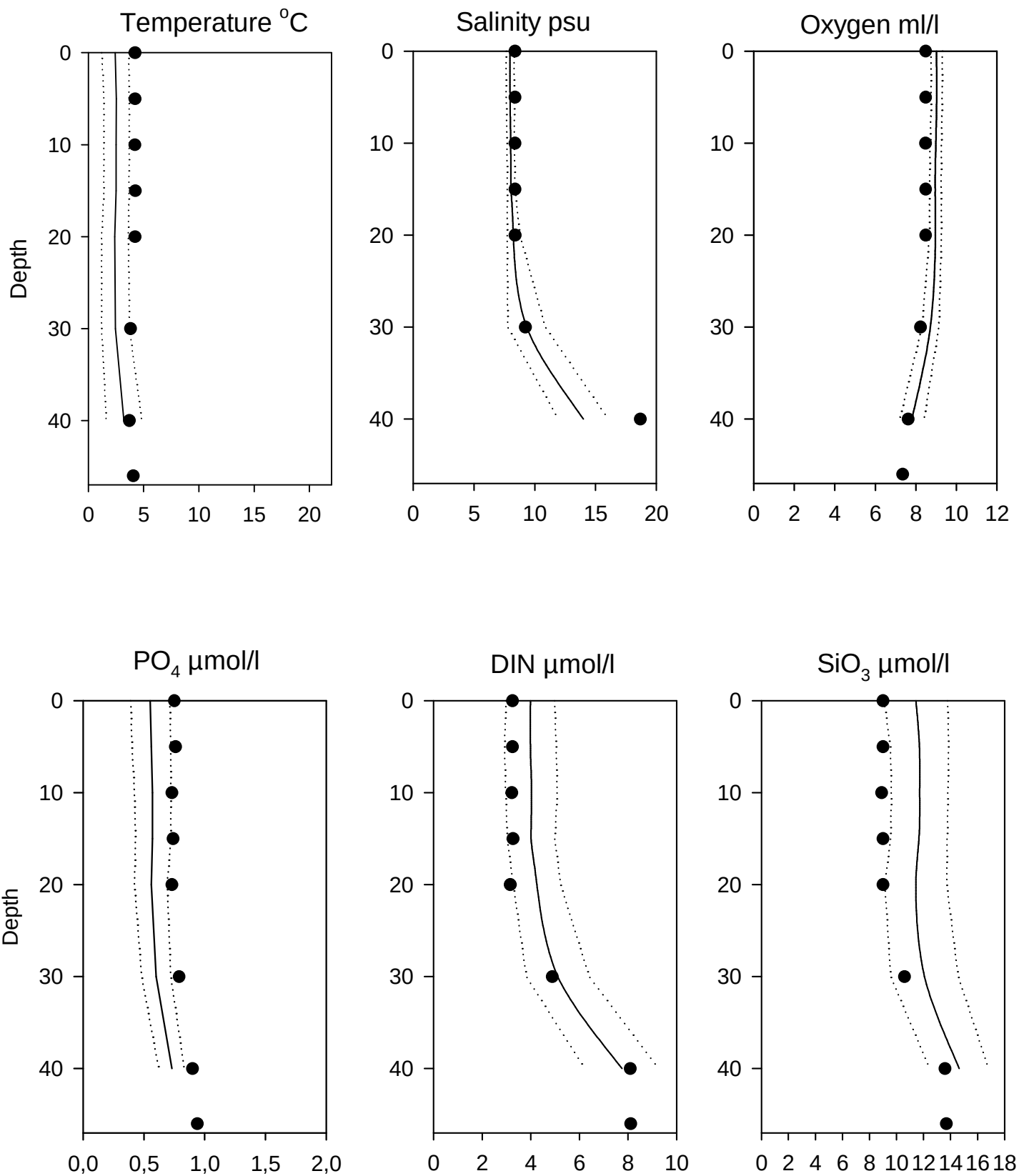


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY2 February

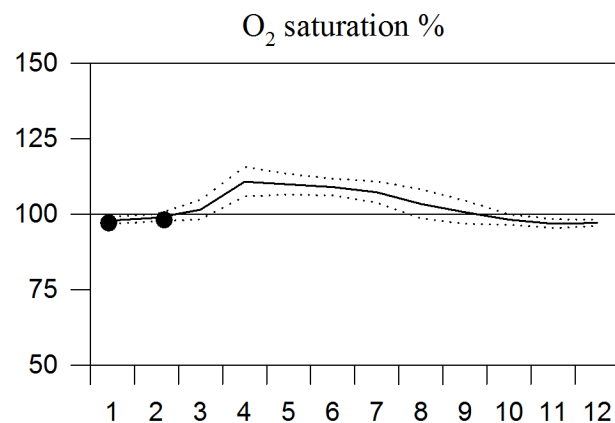
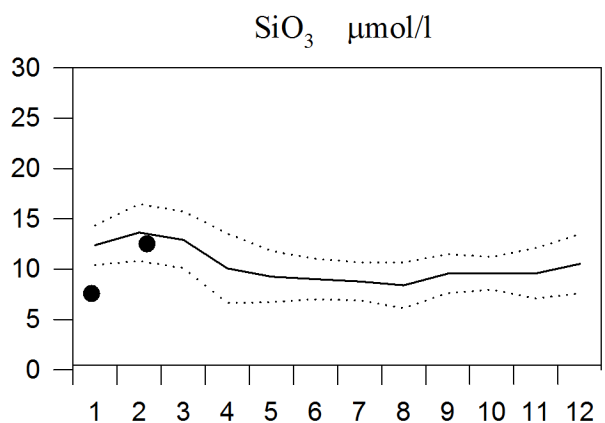
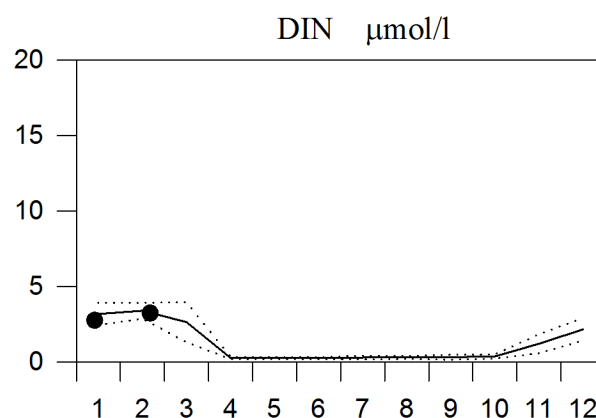
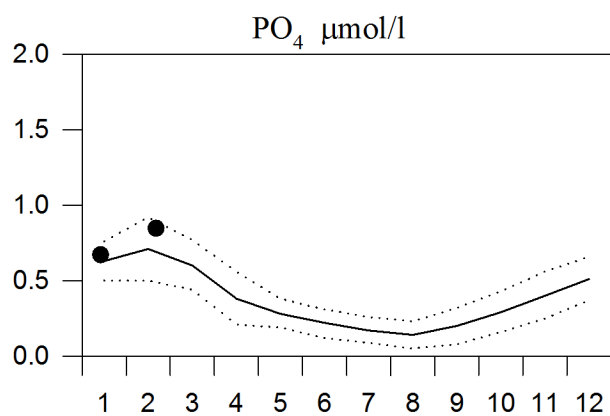
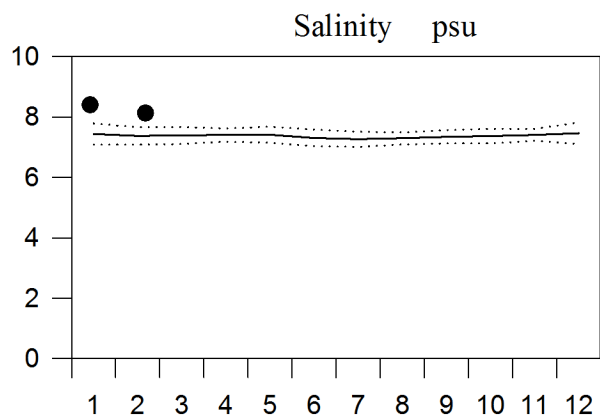
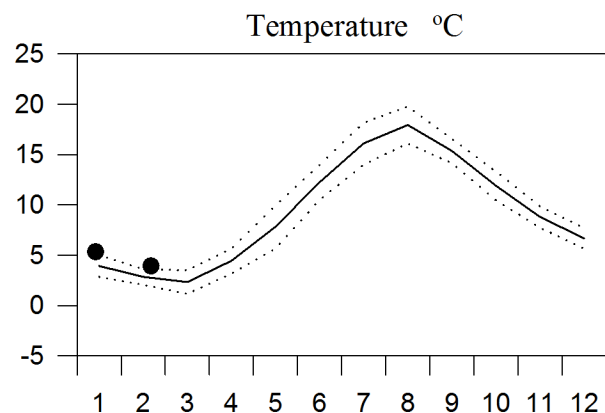
— Mean 1996-2010 St.Dev. ● 2016



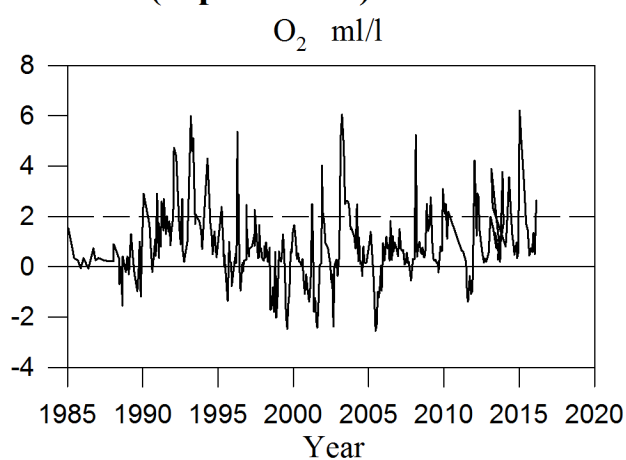
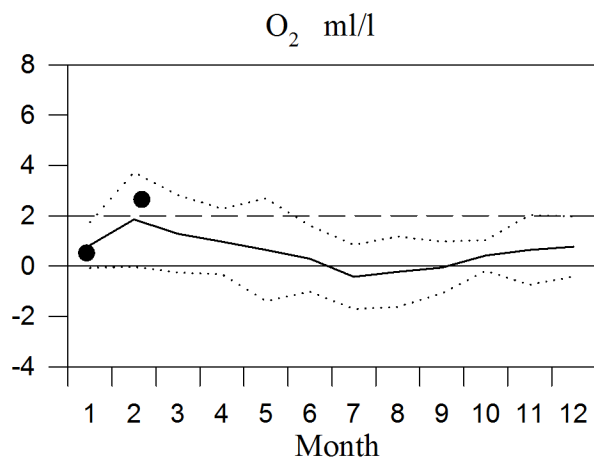
STATION HANÖBUKTEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

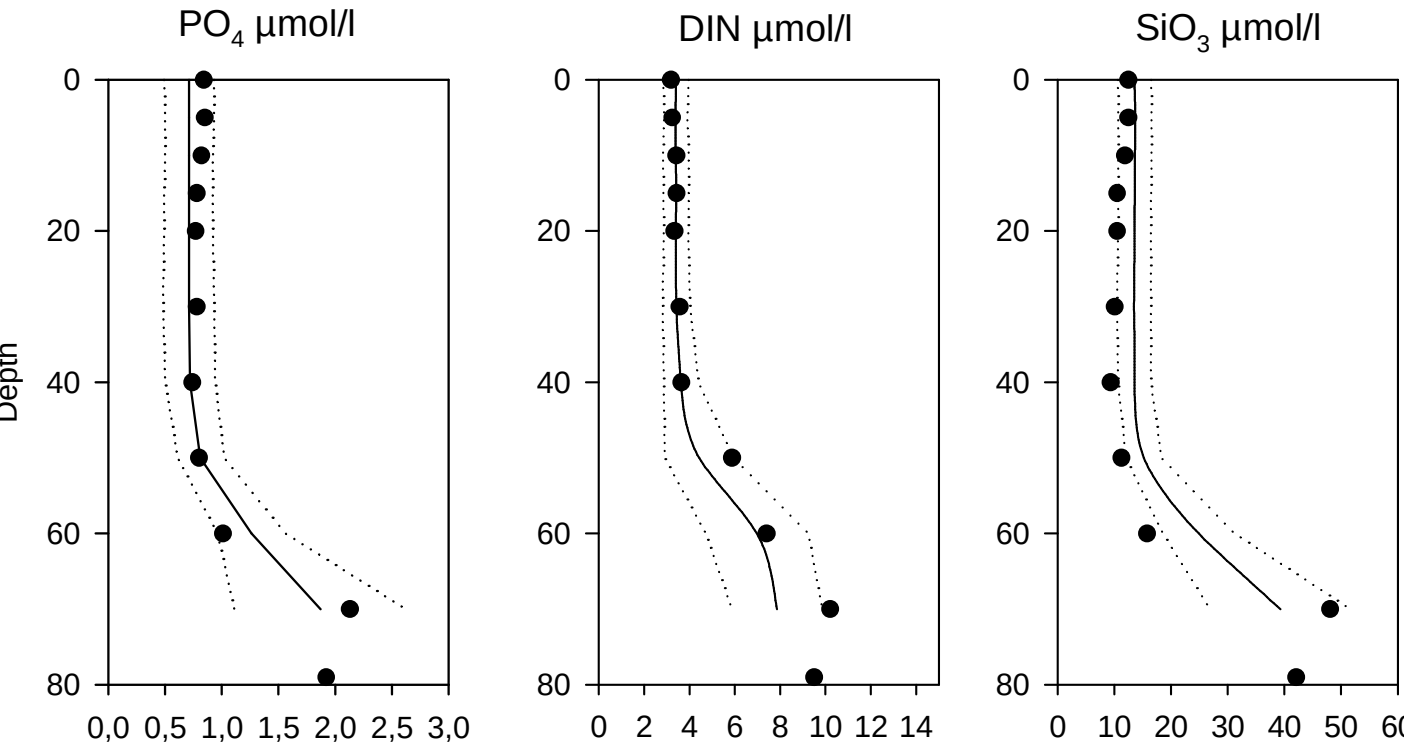
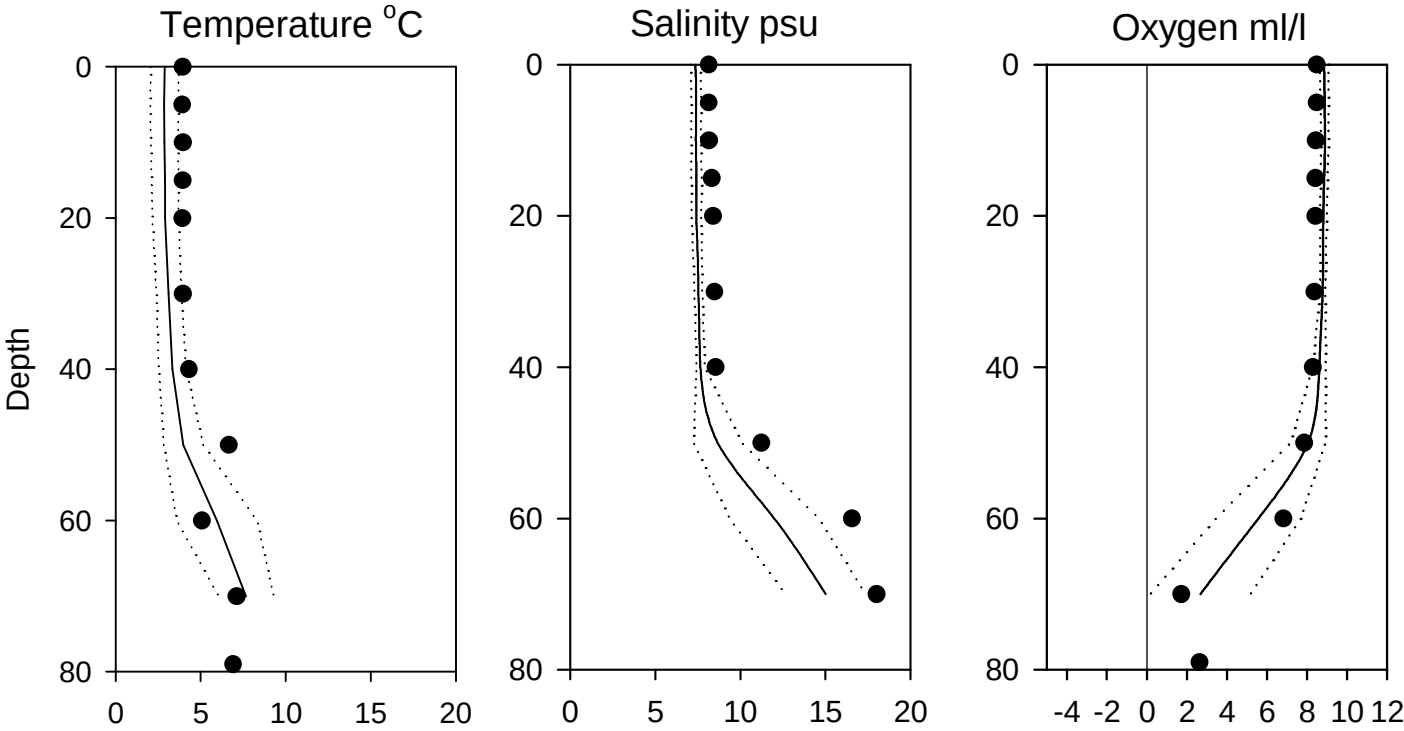


OXYGEN IN BOTTOM WATER (depth > 70m)



Vertical profiles Hanöbukten February

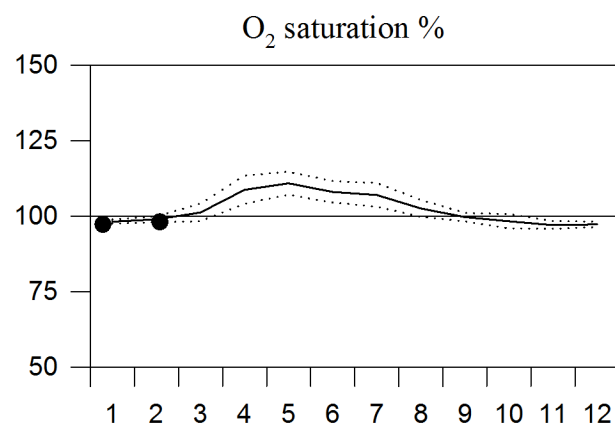
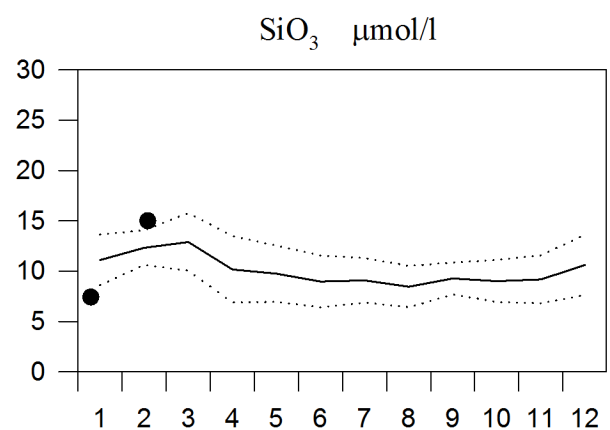
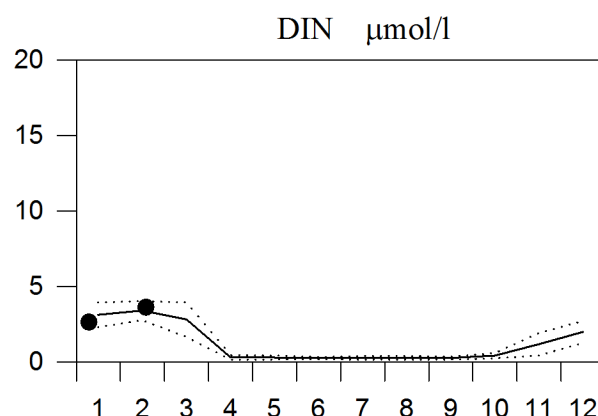
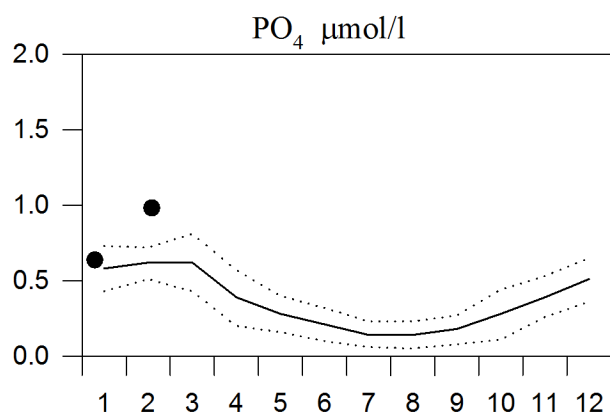
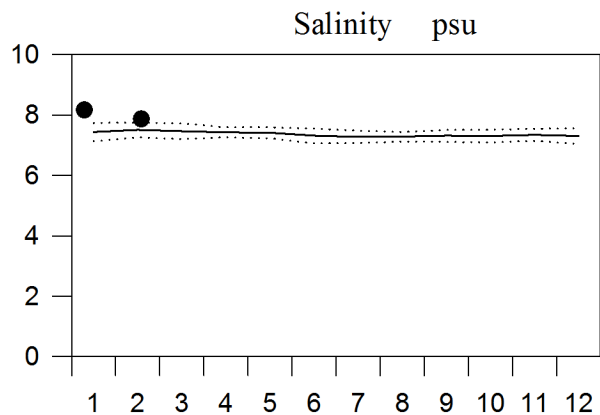
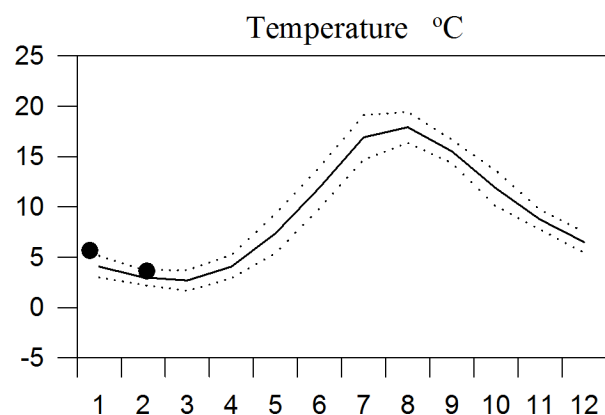
— Mean 1996-2010 St.Dev. ● 2016



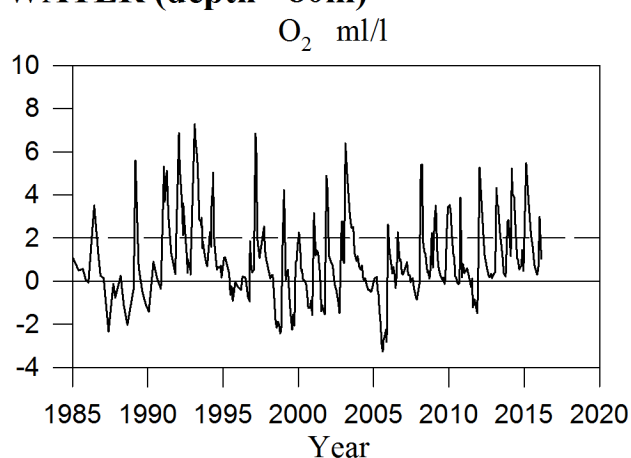
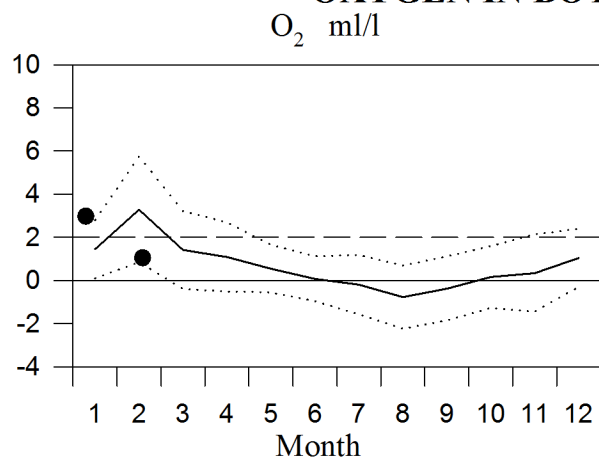
STATION BY4 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

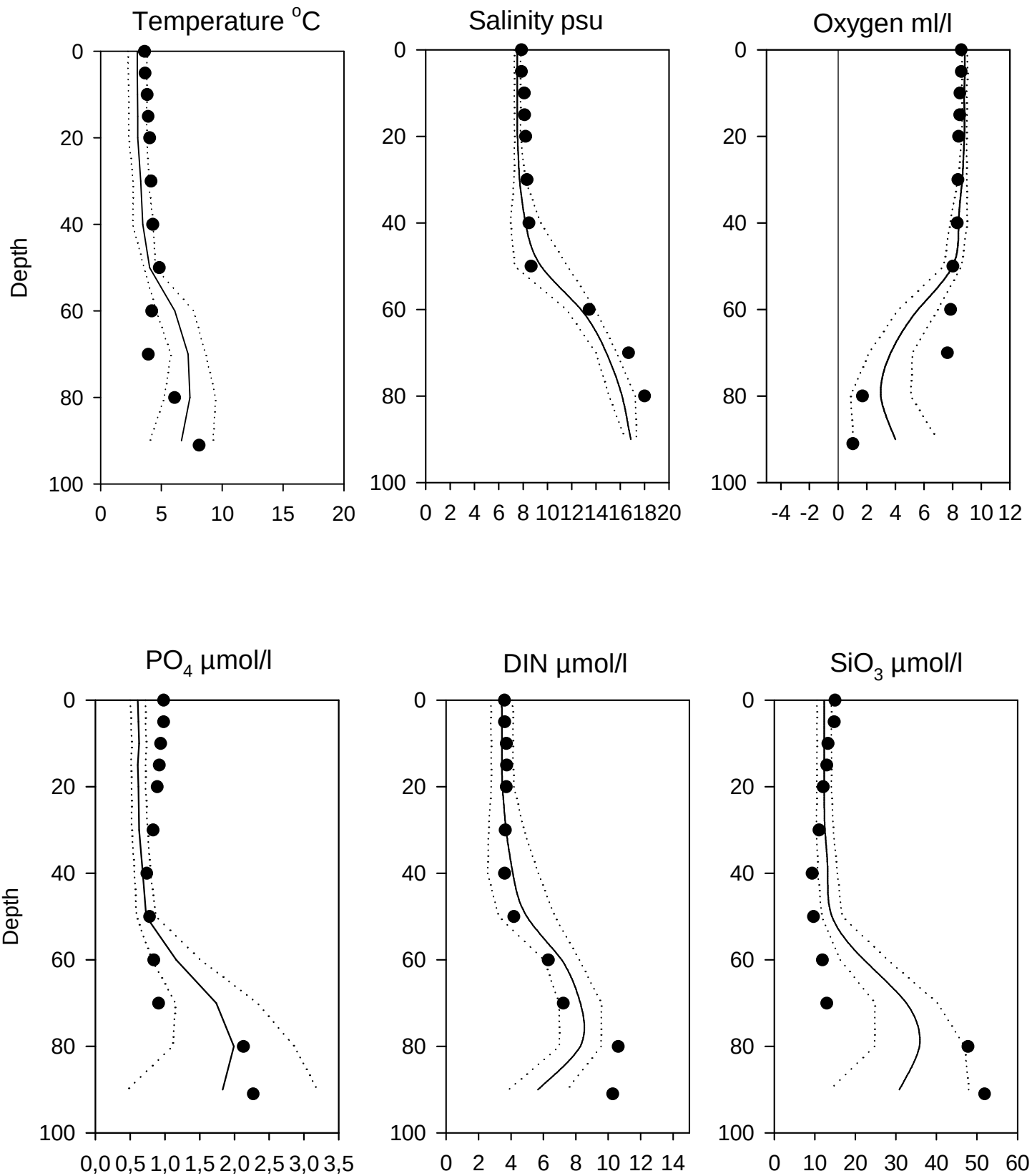


OXYGEN IN BOTTOM WATER (depth >80m)



Vertical profiles BY4 February

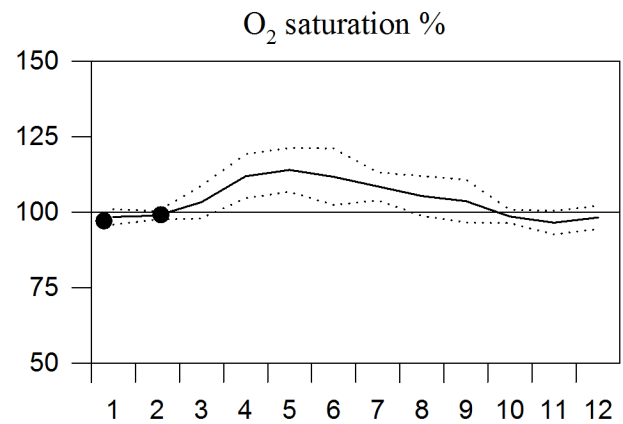
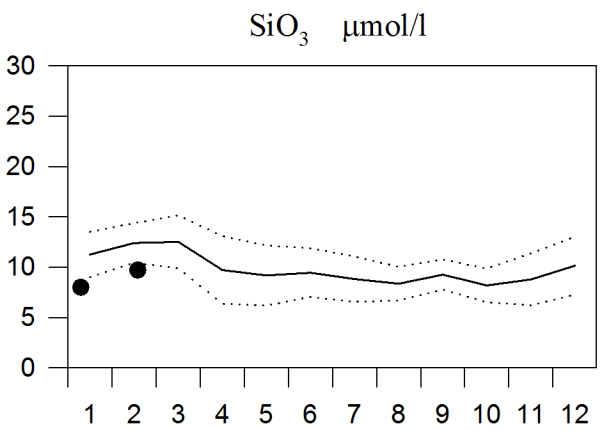
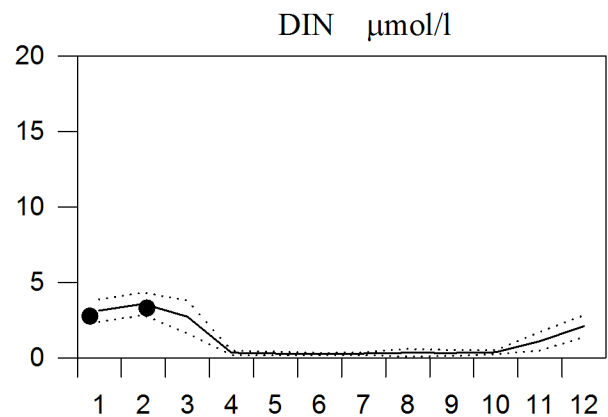
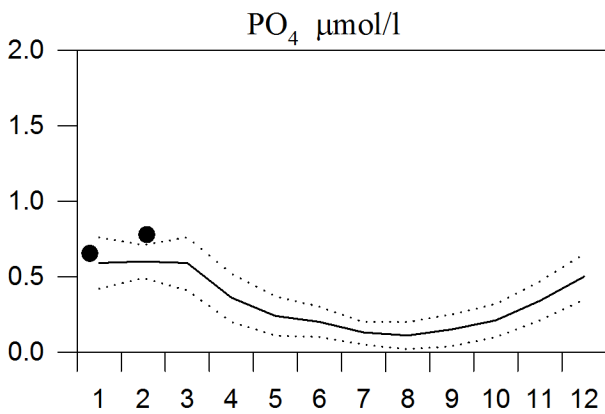
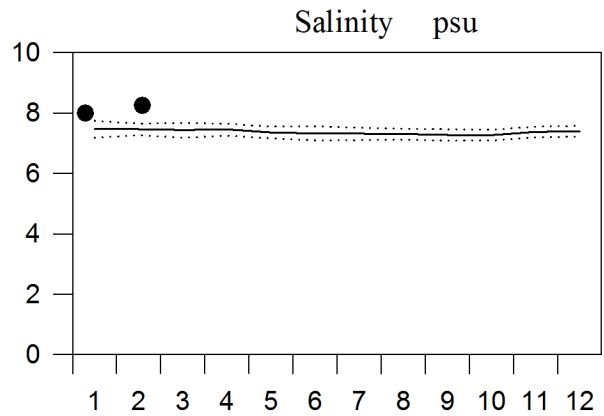
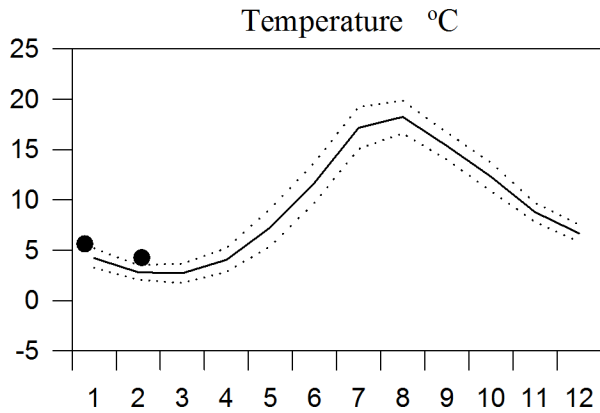
— Mean 1996-2010 St.Dev. ● 2016



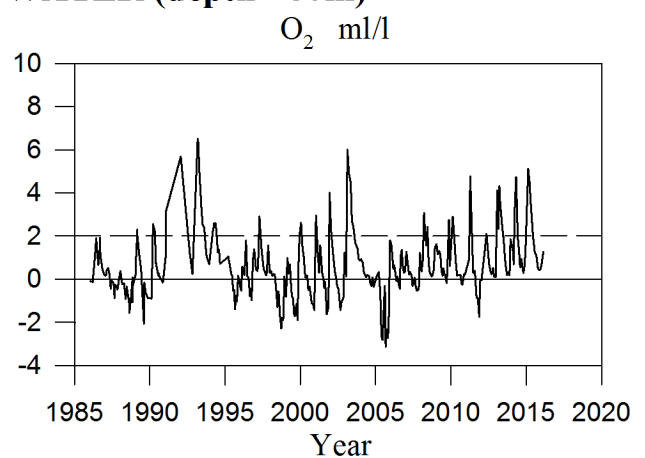
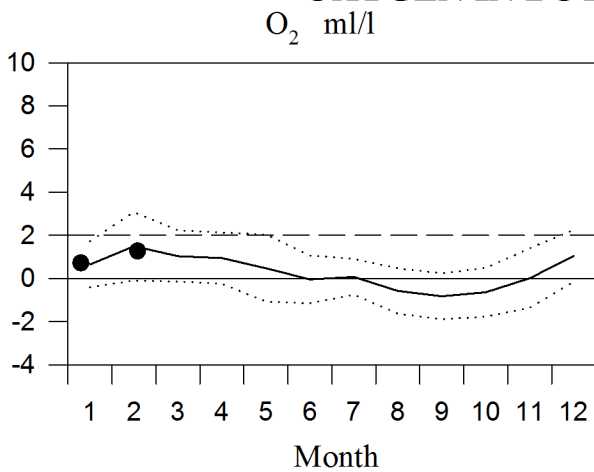
STATION BY5 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

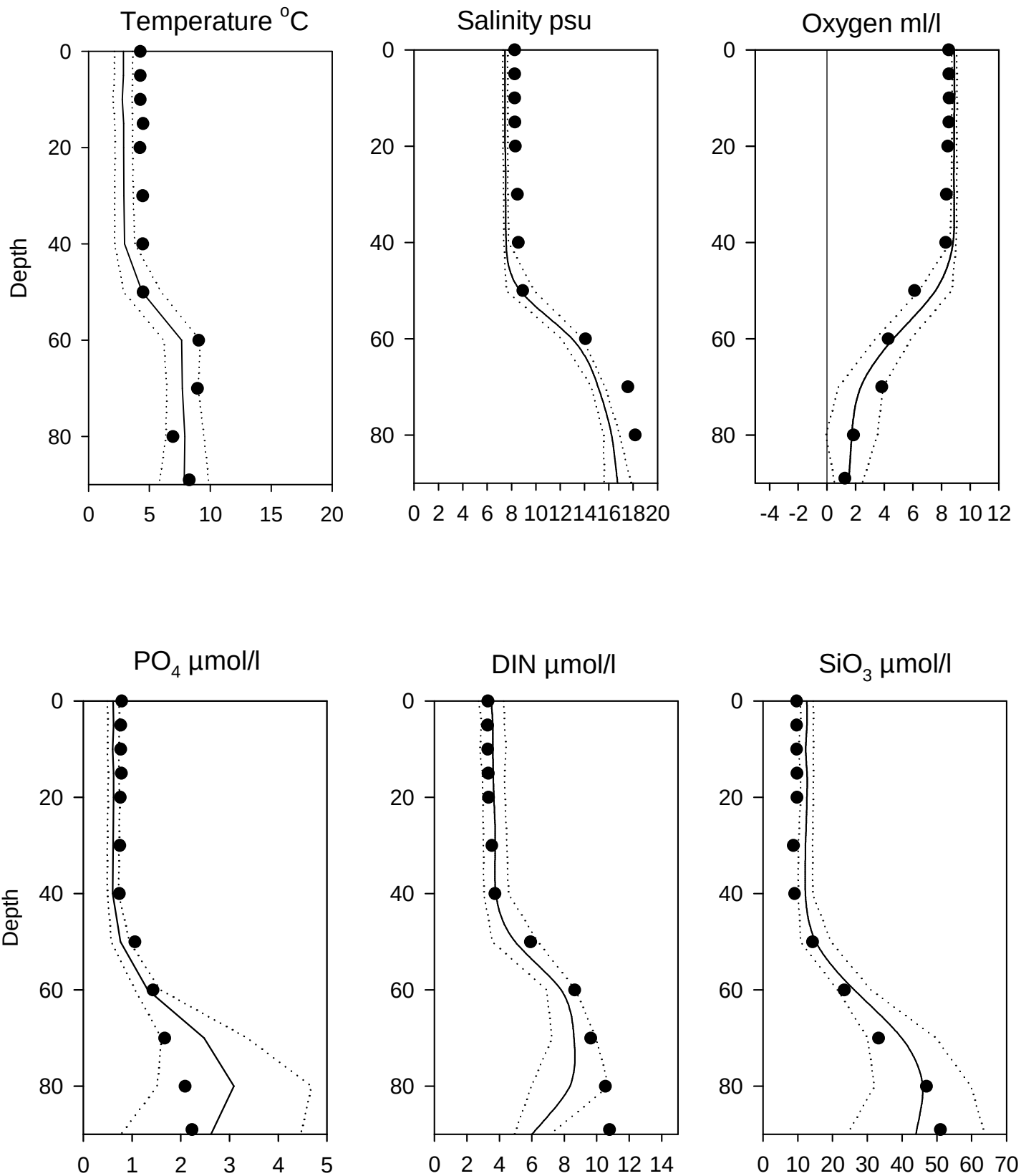


OXYGEN IN BOTTOM WATER (depth >80m)



Vertical profiles BY5 February

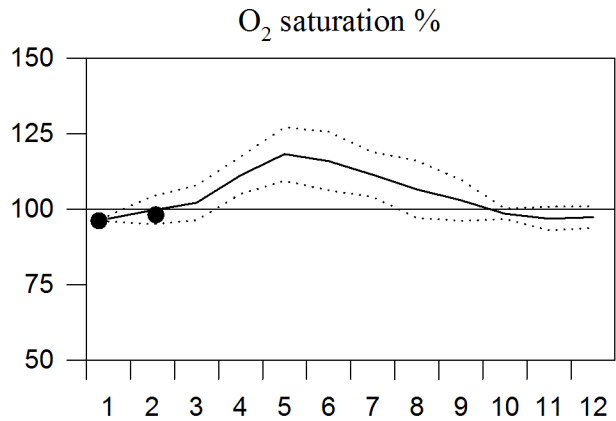
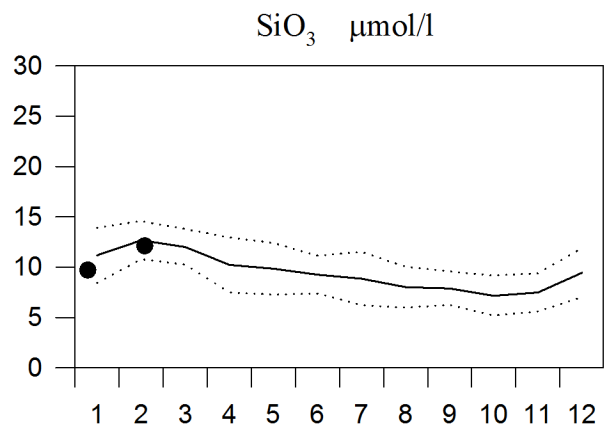
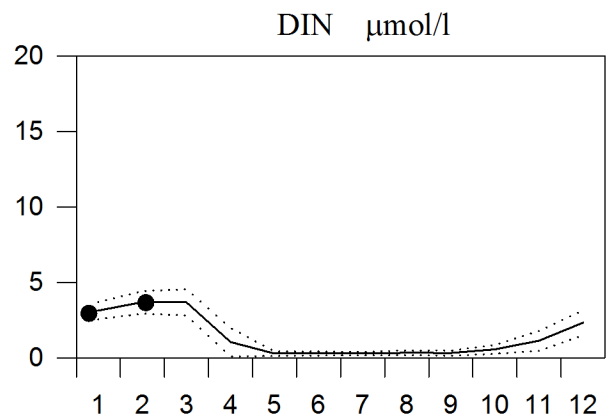
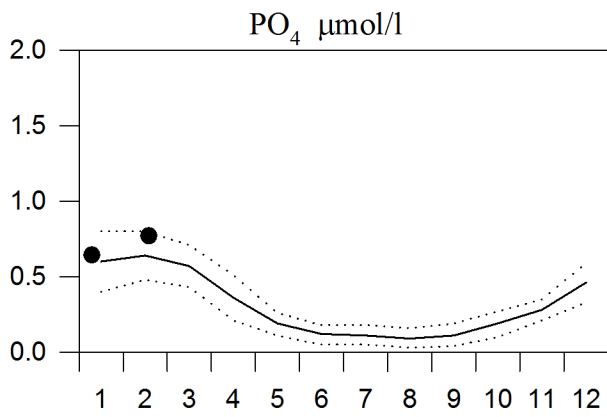
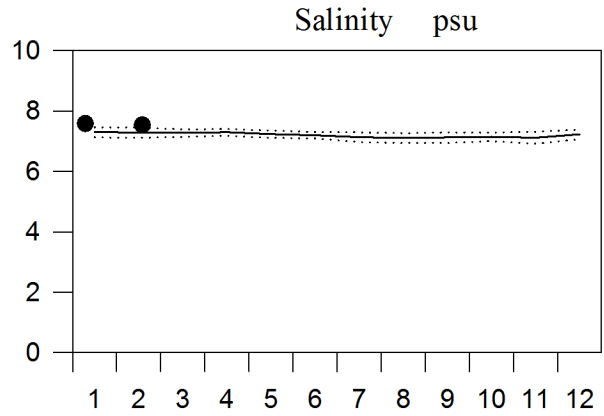
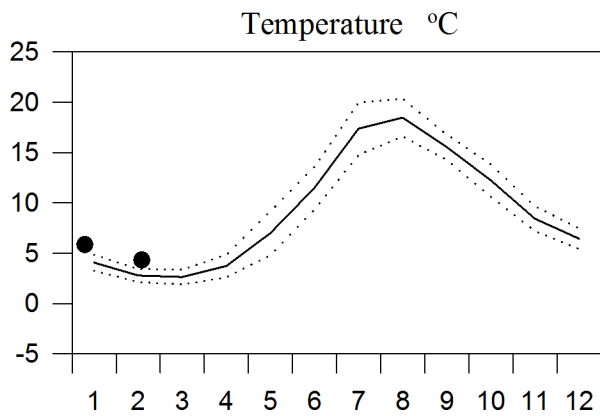
— Mean 1996-2010 St.Dev. ● 2016



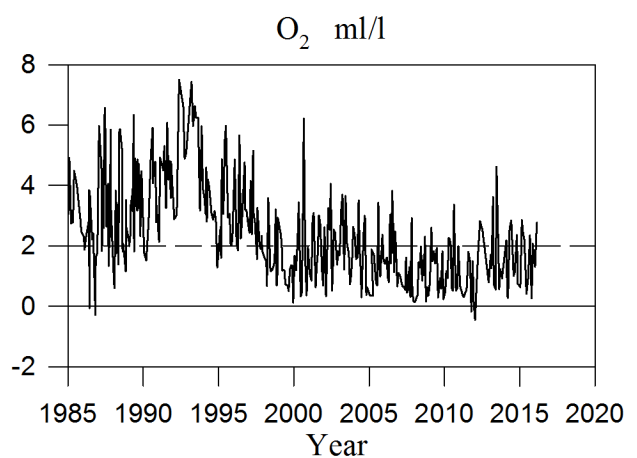
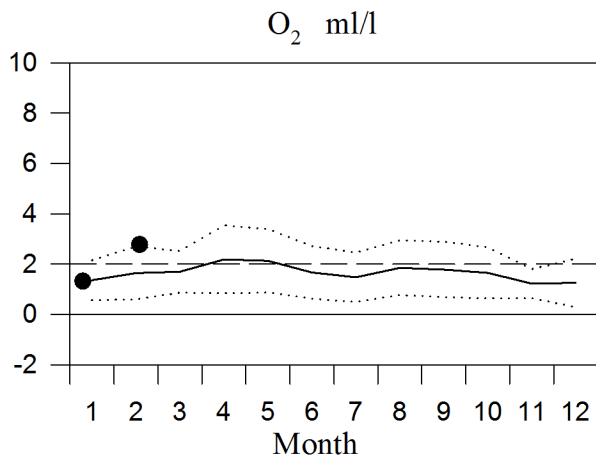
STATION BCS III-10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

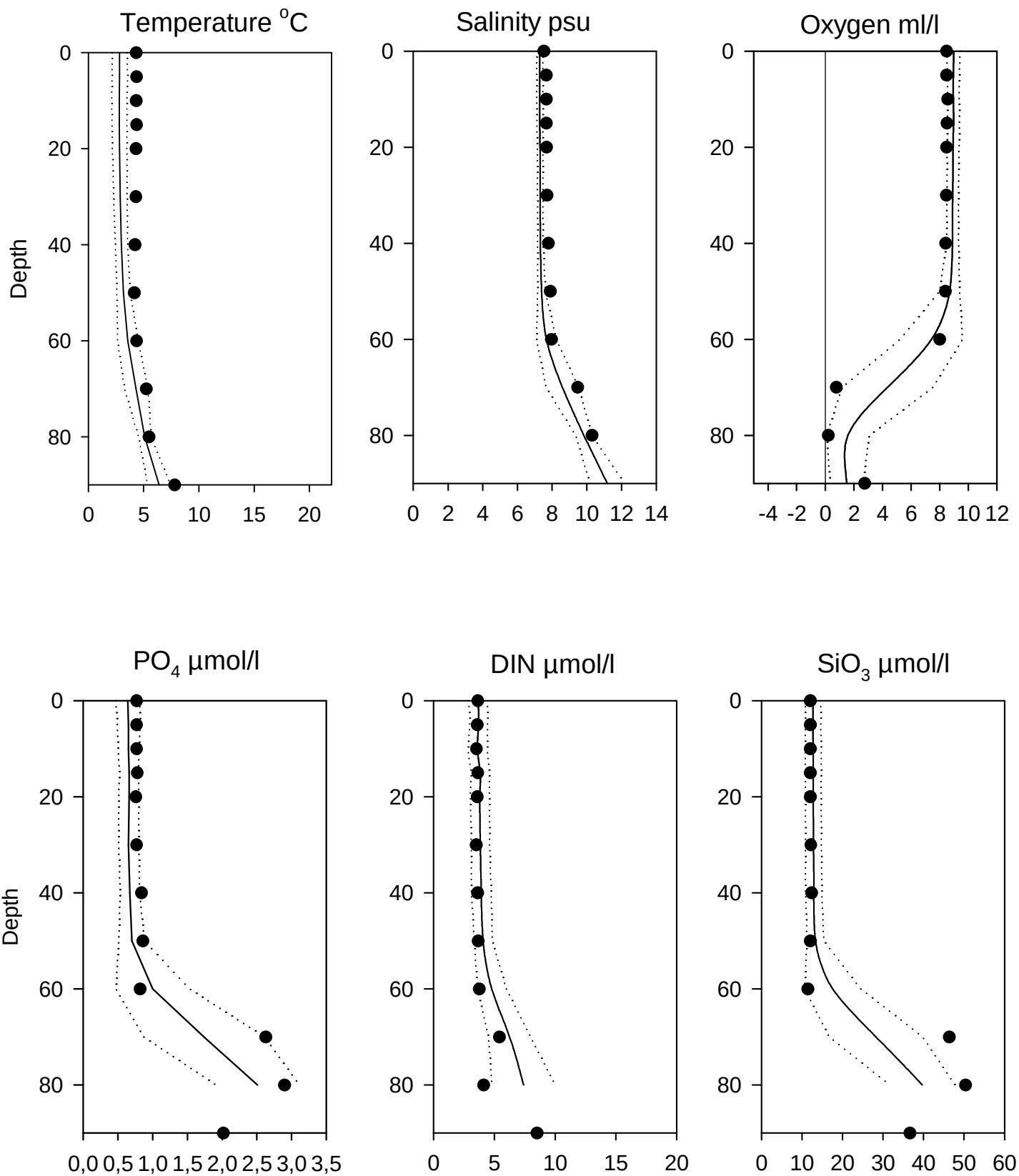


OXYGEN IN BOTTOM WATER (depth > 80m)



Vertical profiles BCS III-10 February

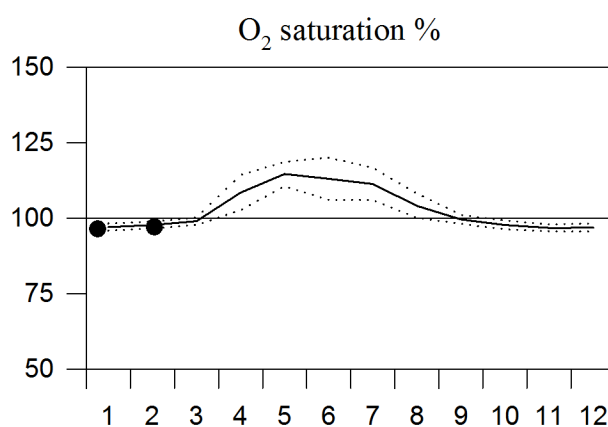
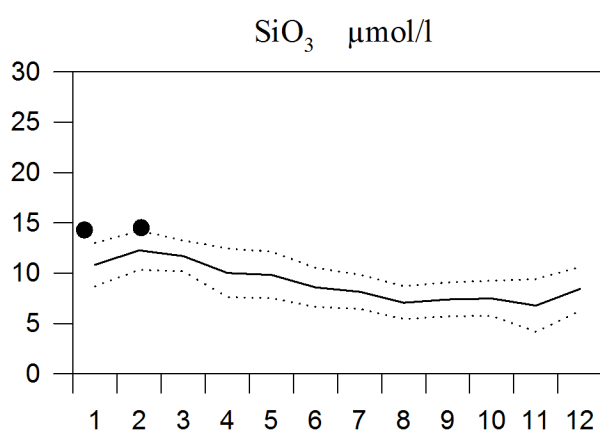
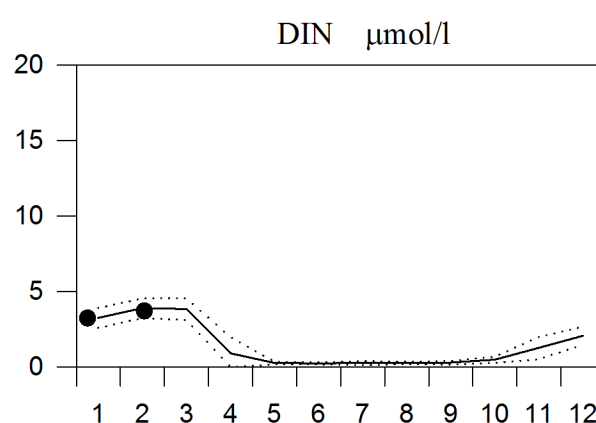
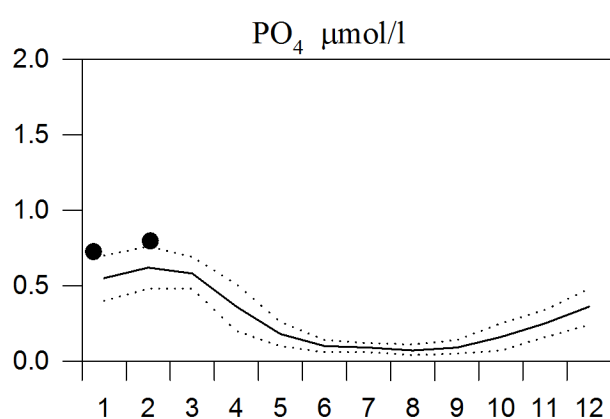
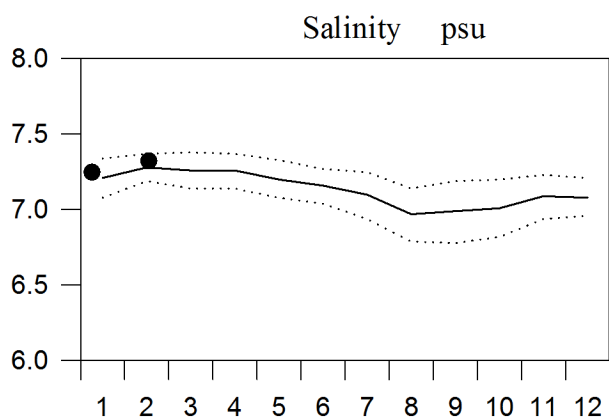
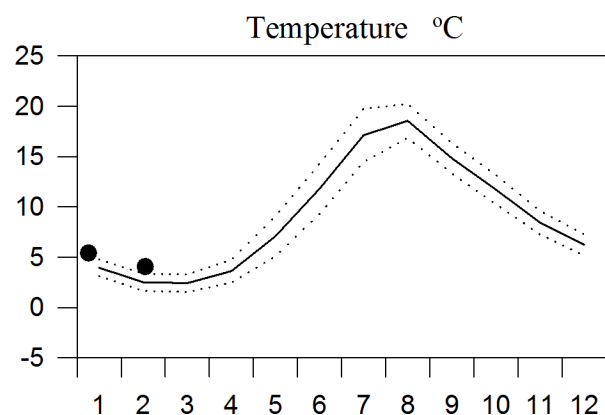
— Mean 1996-2010 St.Dev. ● 2016



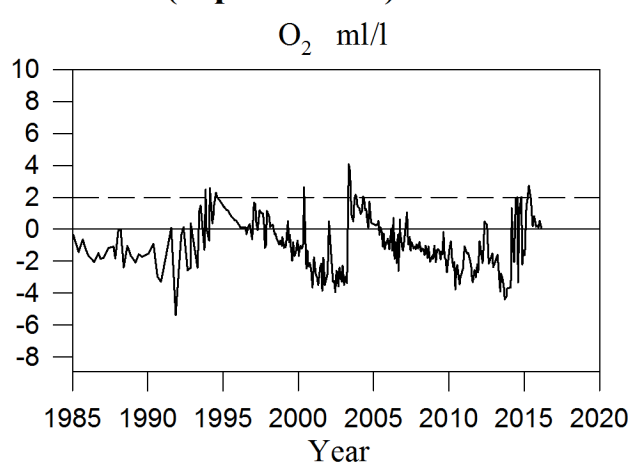
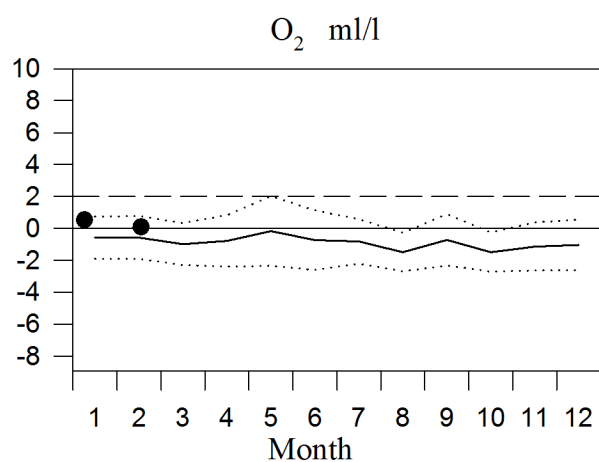
STATION BY10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016



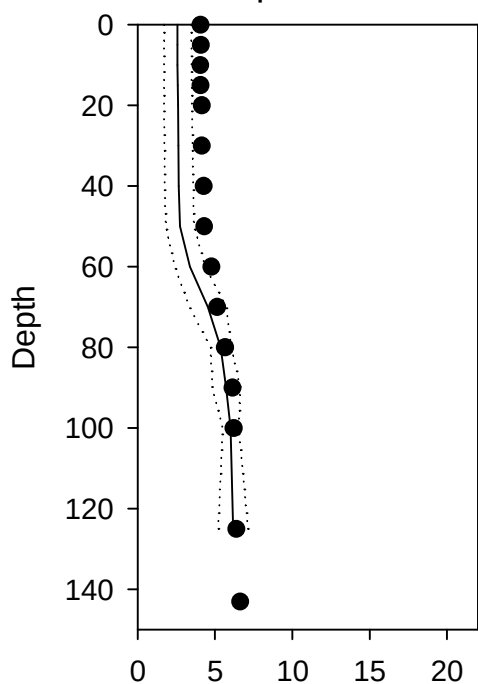
OXYGEN IN BOTTOM WATER (depth >125m)



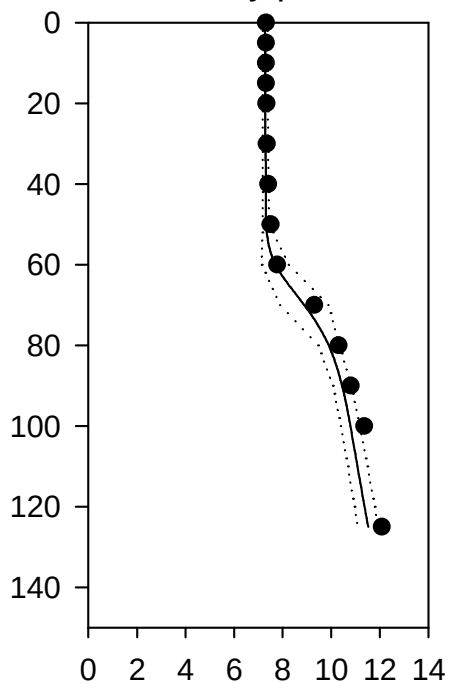
Vertical profiles BY10 February

— Mean 1996-2010 St.Dev. ● 2016

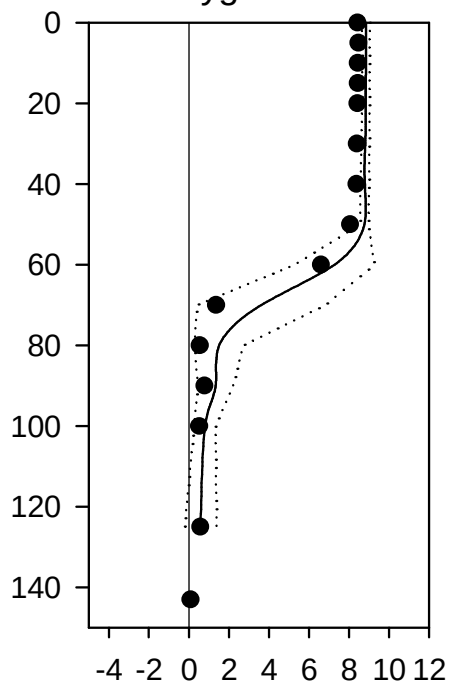
Temperature °C



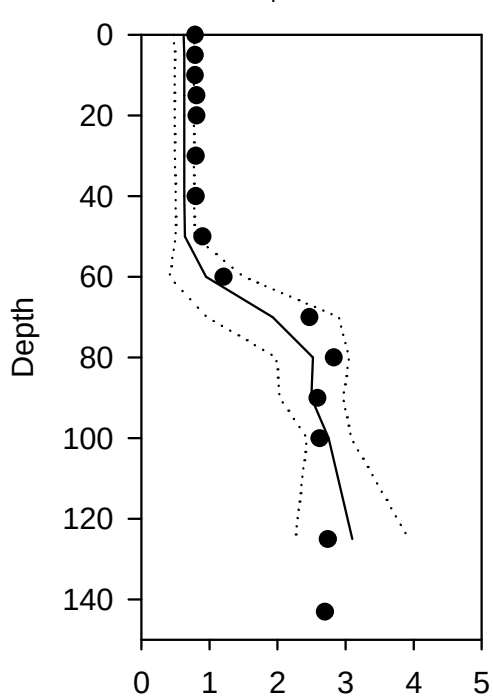
Salinity psu



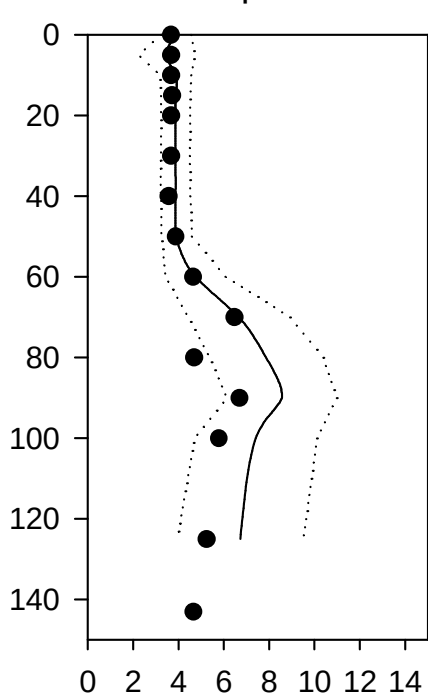
Oxygen ml/l



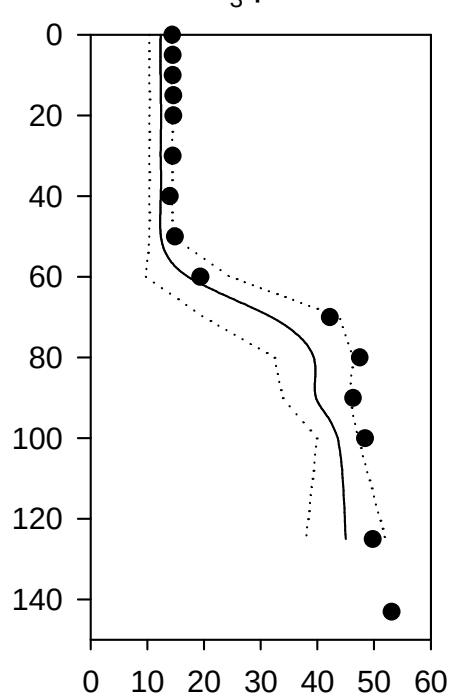
PO₄ μmol/l



DIN μmol/l



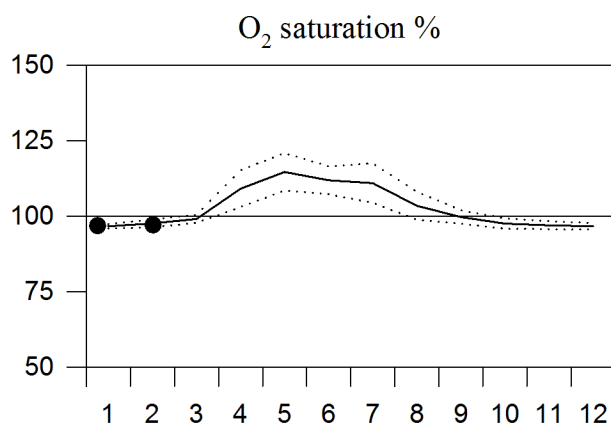
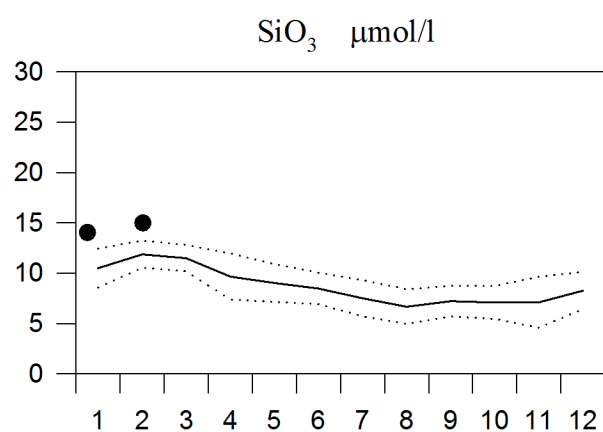
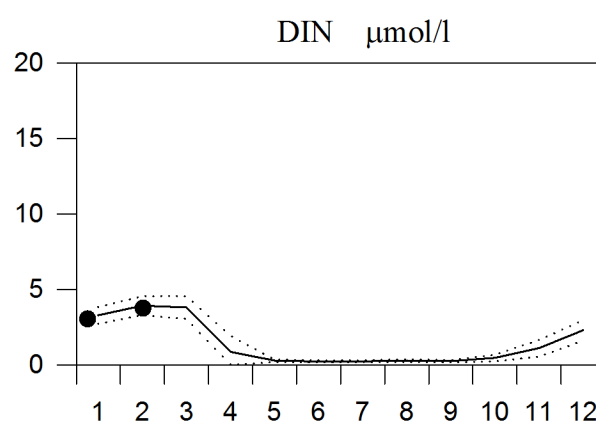
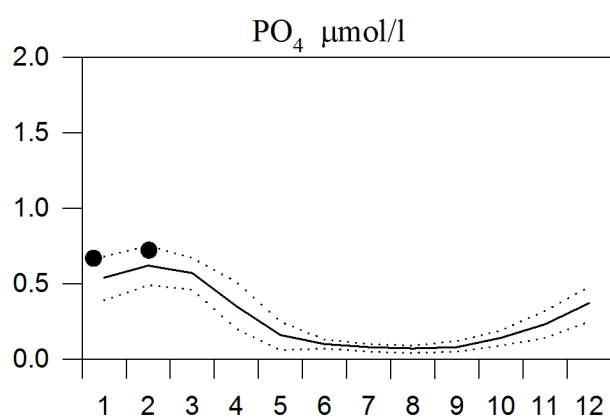
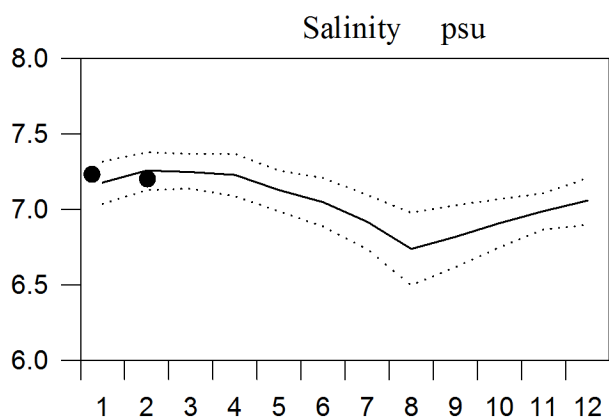
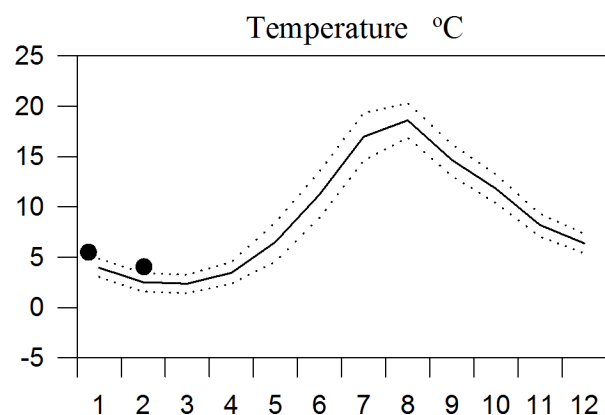
SiO₃ μmol/l



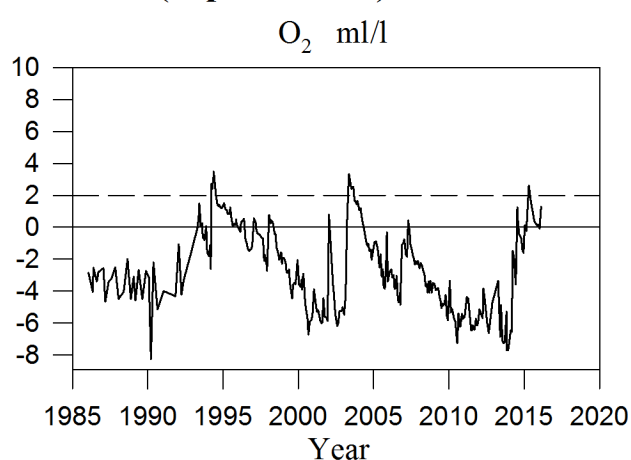
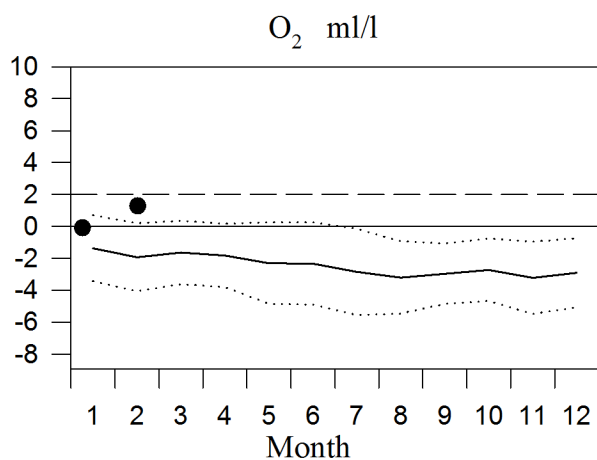
STATION BY15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016



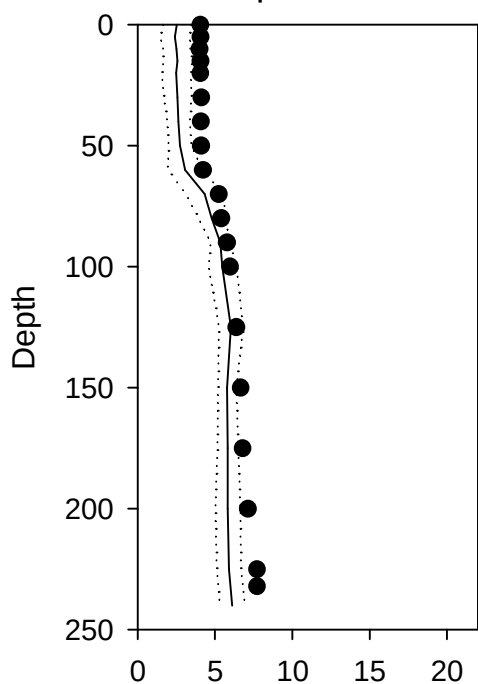
OXYGEN IN BOTTOM WATER (depth >225m)



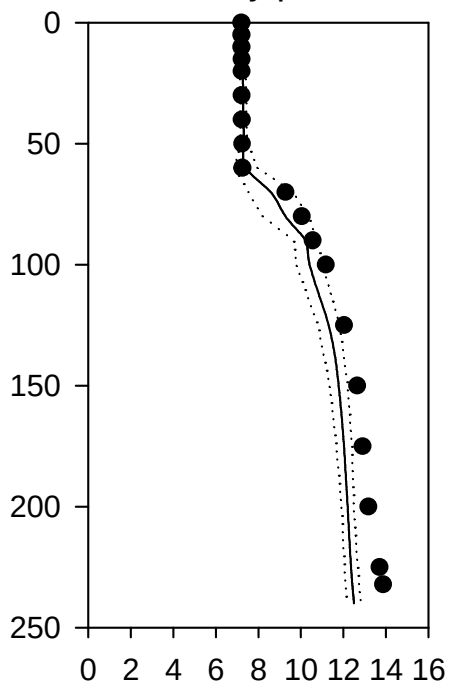
Vertical profiles BY15 February

— Mean 1996-2010 St.Dev. ● 2016

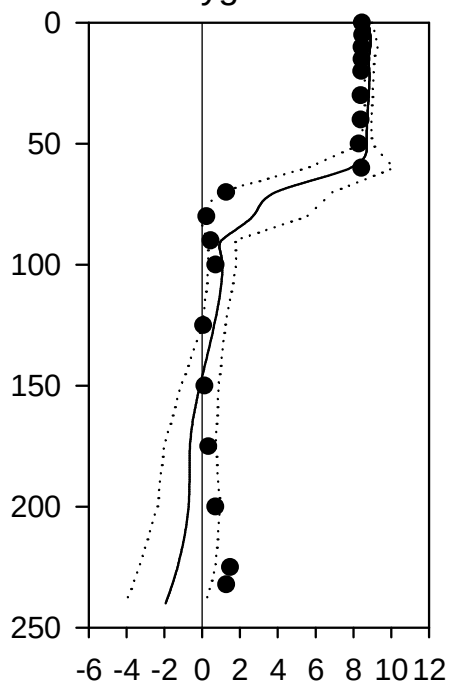
Temperature °C



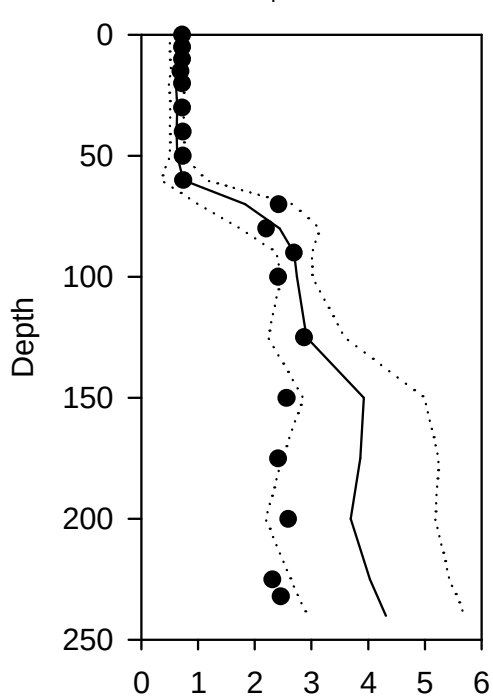
Salinity psu



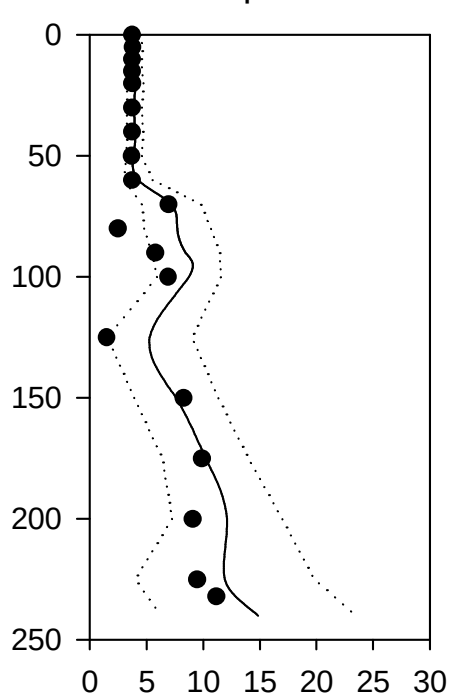
Oxygen ml/l



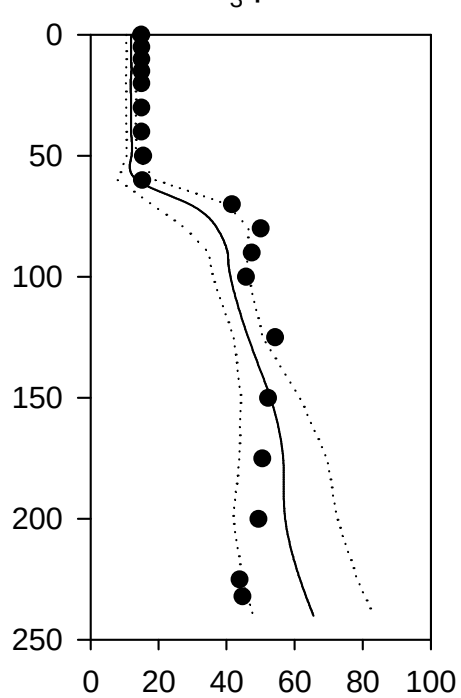
PO₄ μmol/l



DIN μmol/l



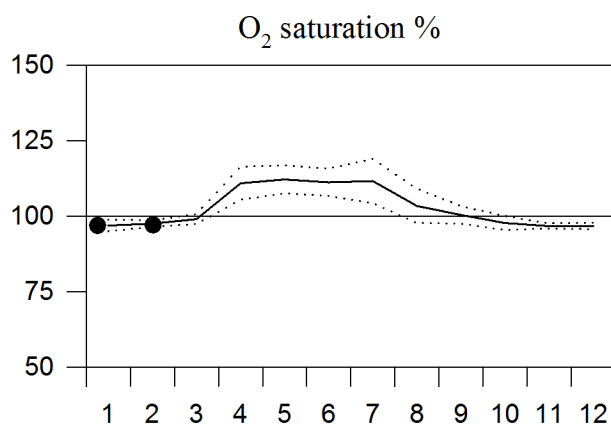
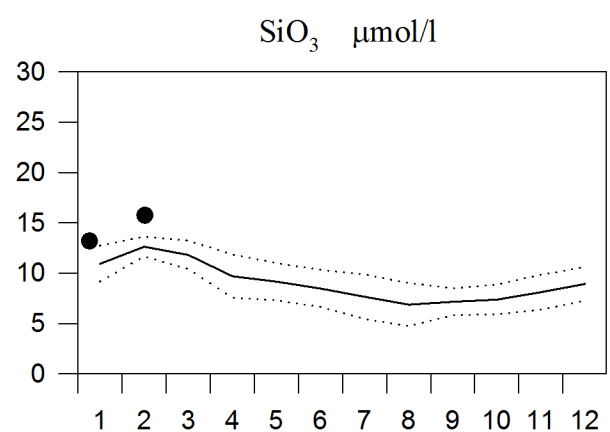
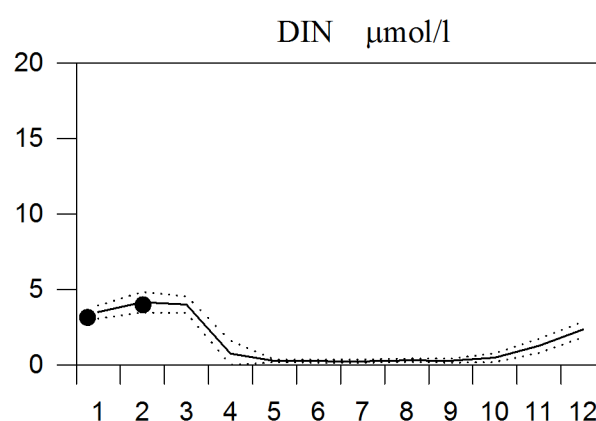
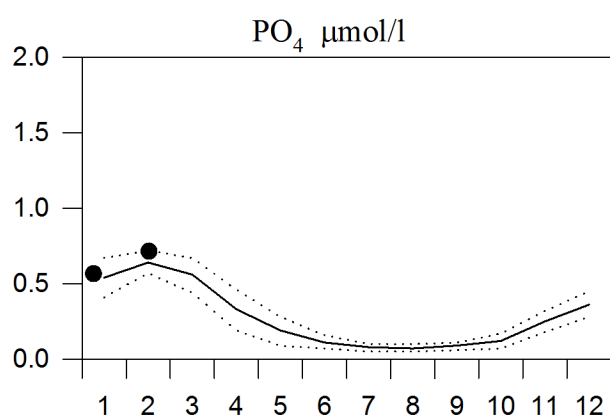
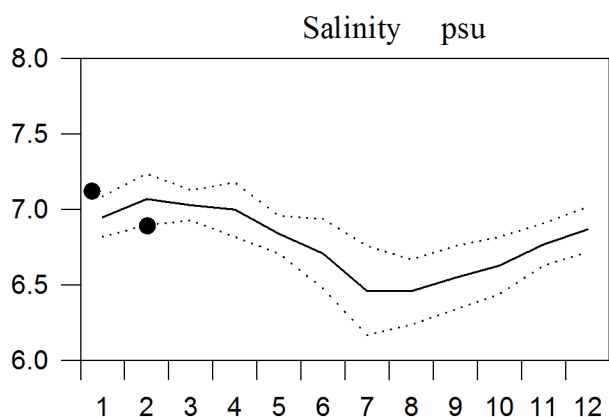
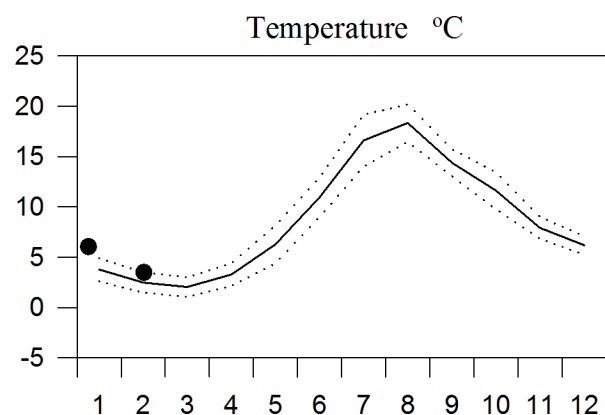
SiO₃ μmol/l



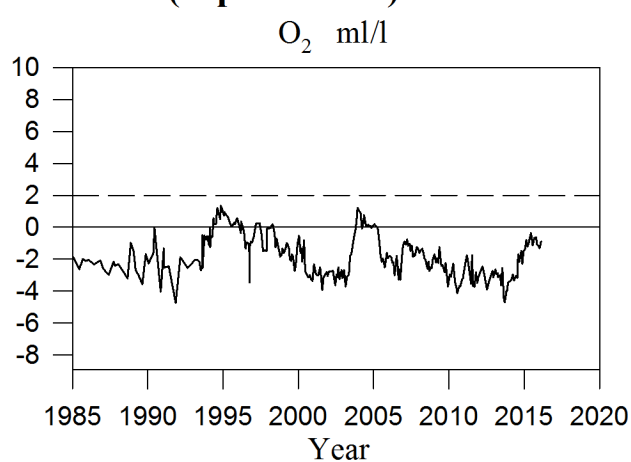
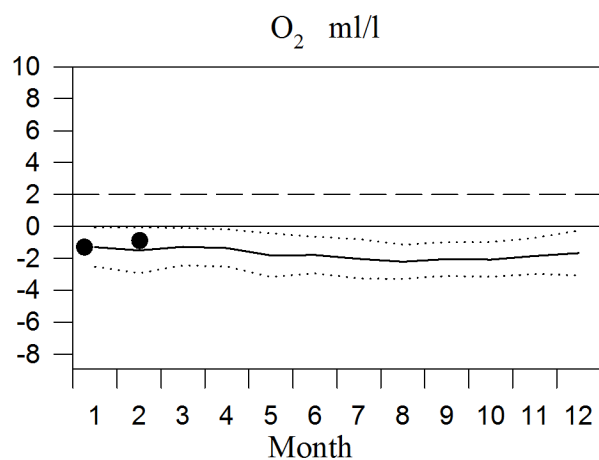
STATION BY20 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016



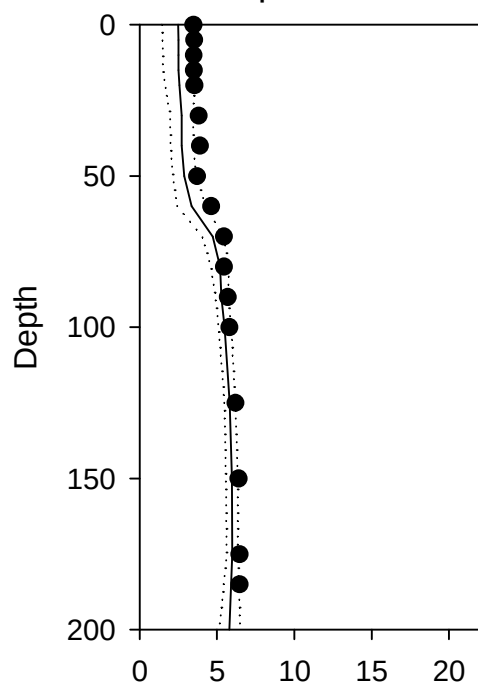
OXYGEN IN BOTTOM WATER (depth >175m)



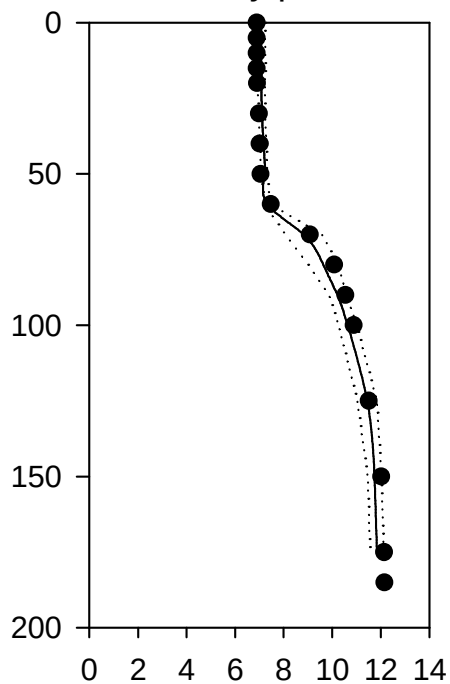
Vertical profiles BY20 February

— Mean 1996-2010 St.Dev. ● 2016

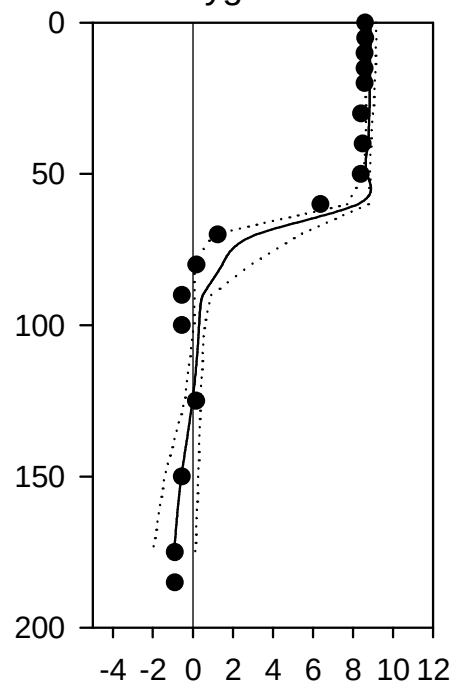
Temperature °C



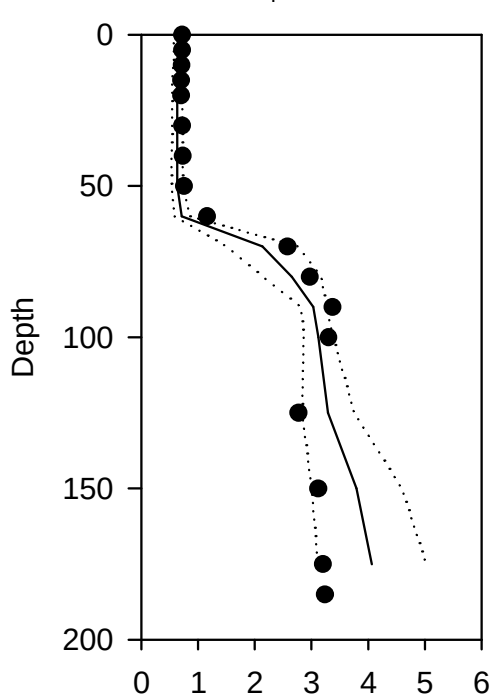
Salinity psu



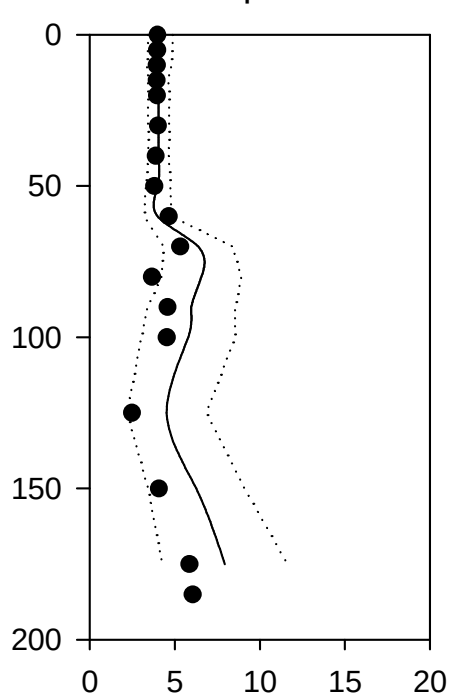
Oxygen ml/l



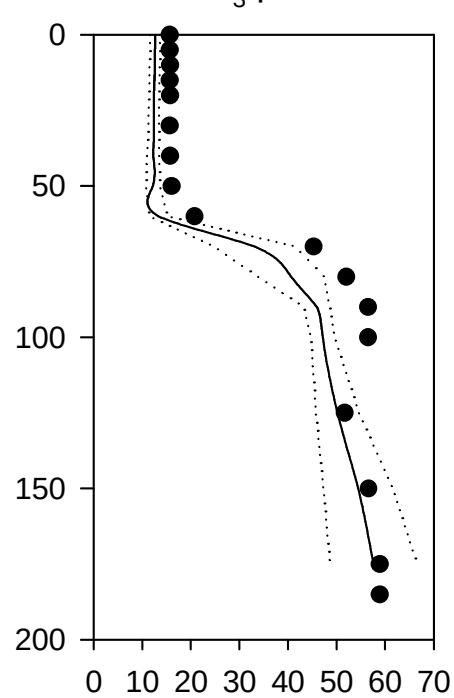
PO₄ μmol/l



DIN μmol/l



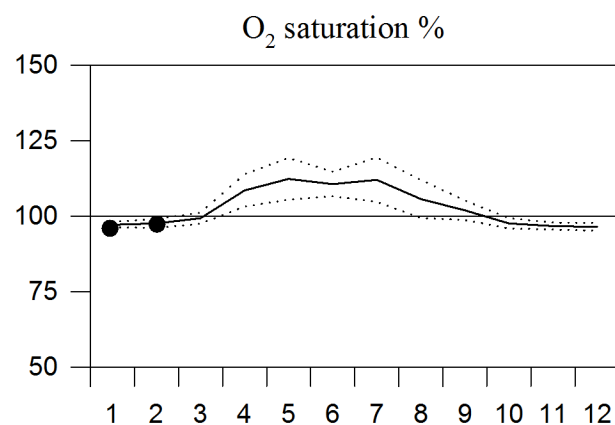
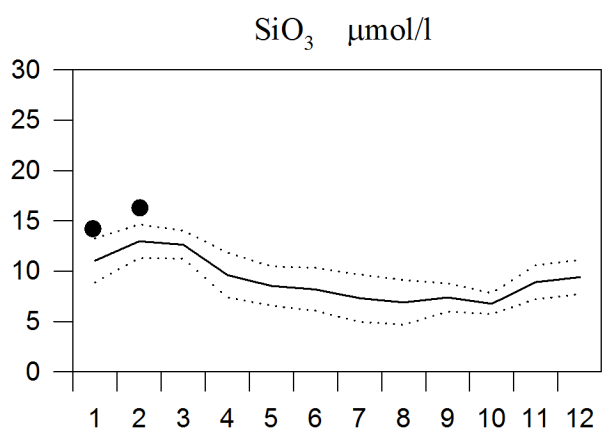
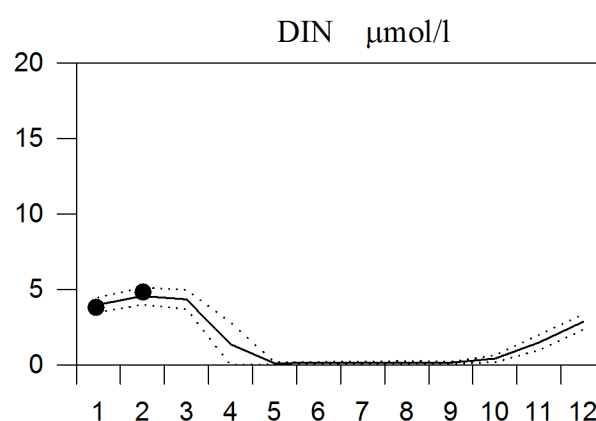
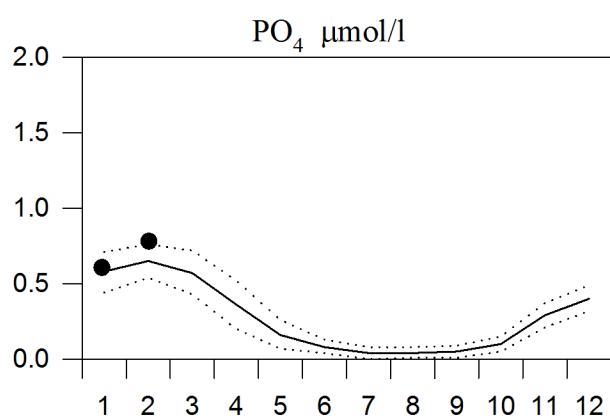
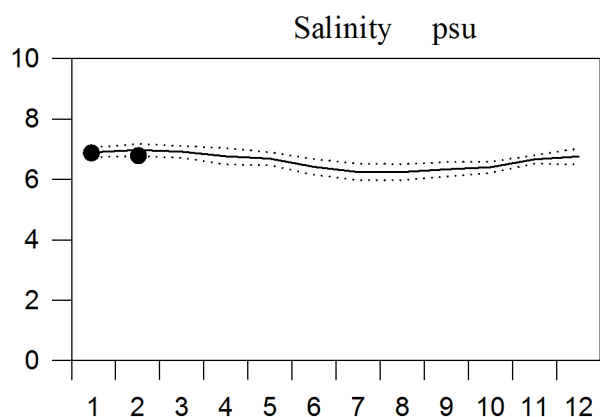
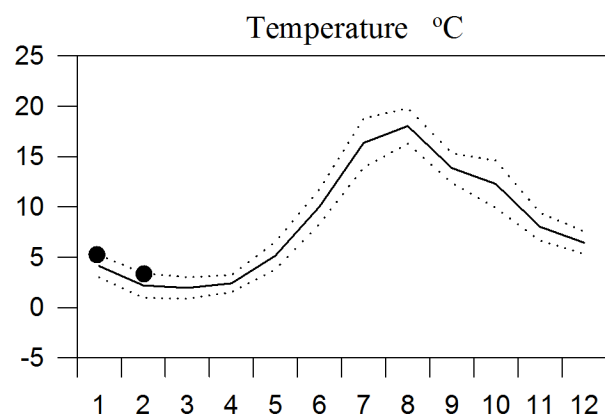
SiO₃ μmol/l



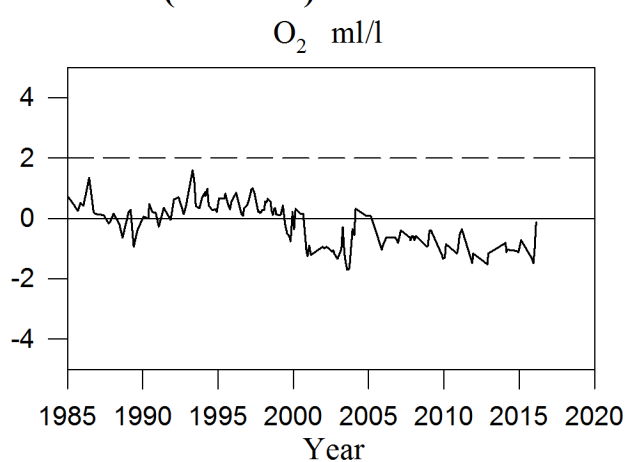
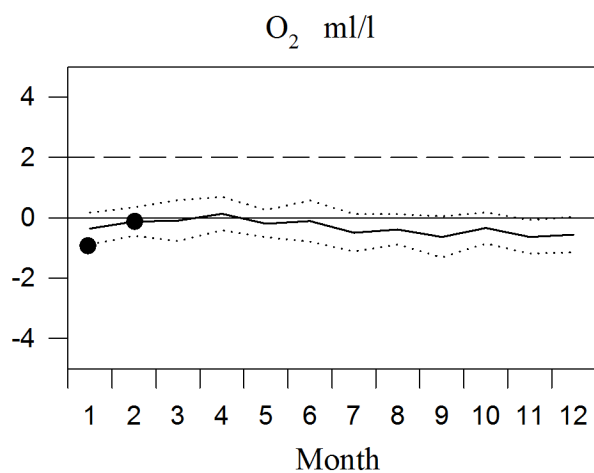
STATION BY29 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

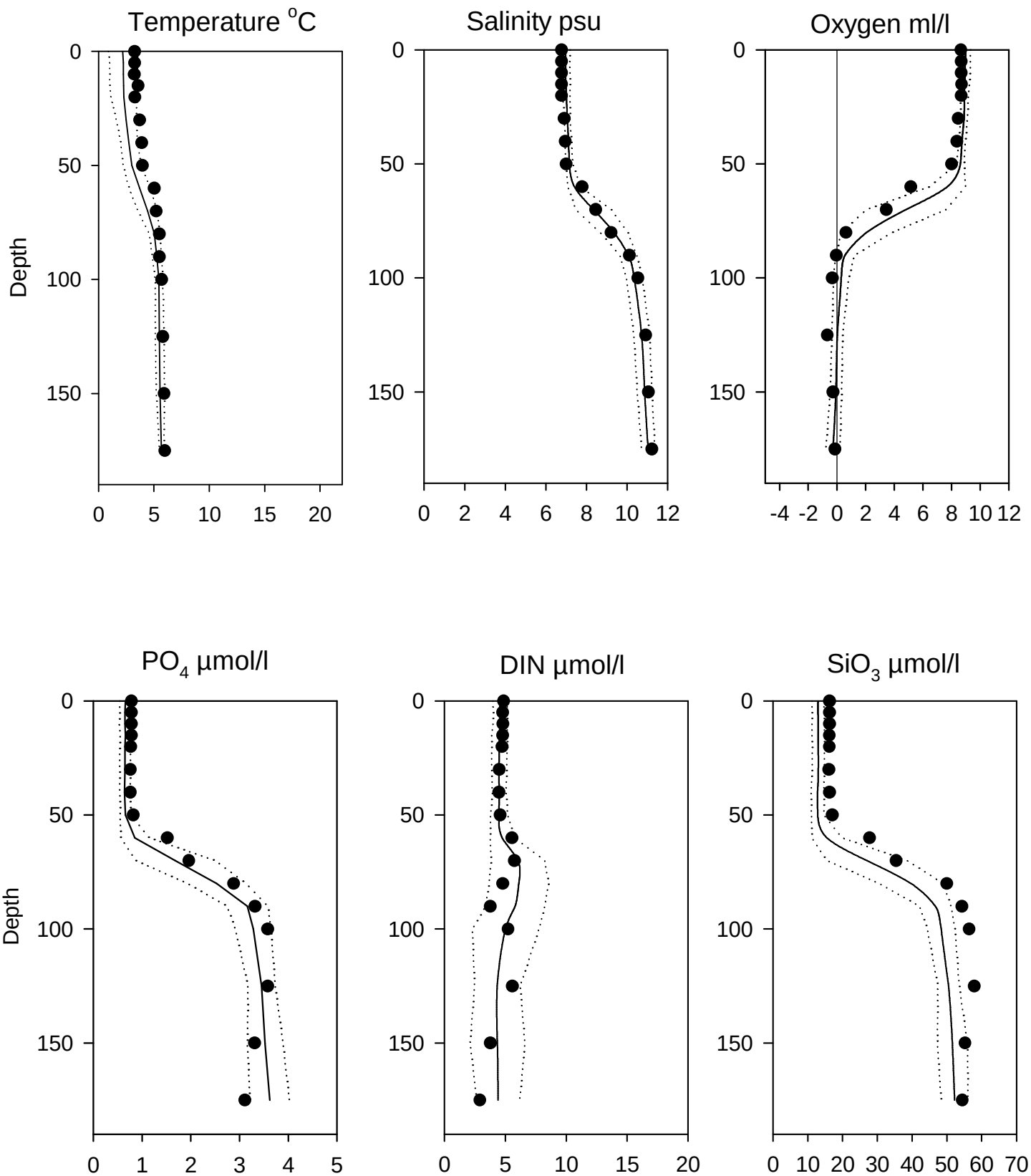


OXYGEN IN BOTTOM WATER (>=150m)



Vertical profiles BY29 February

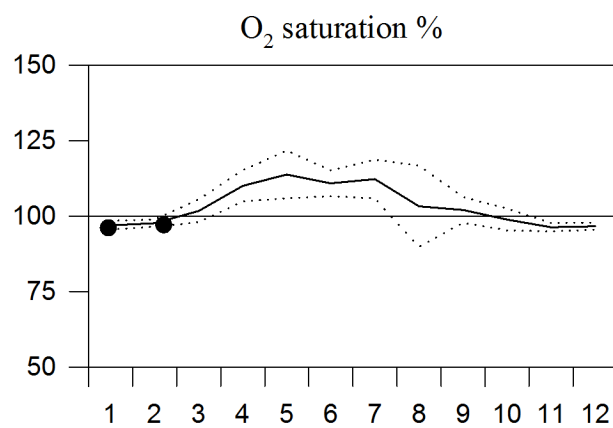
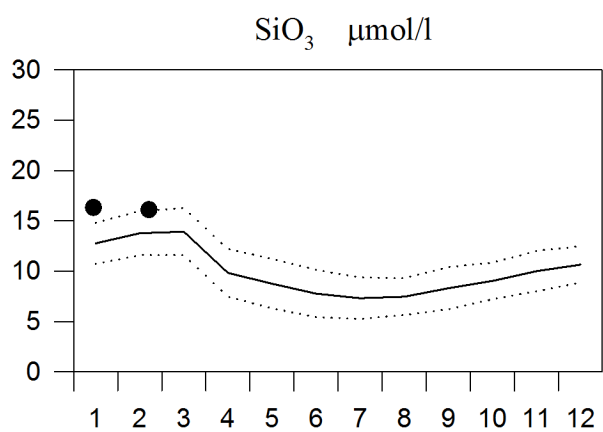
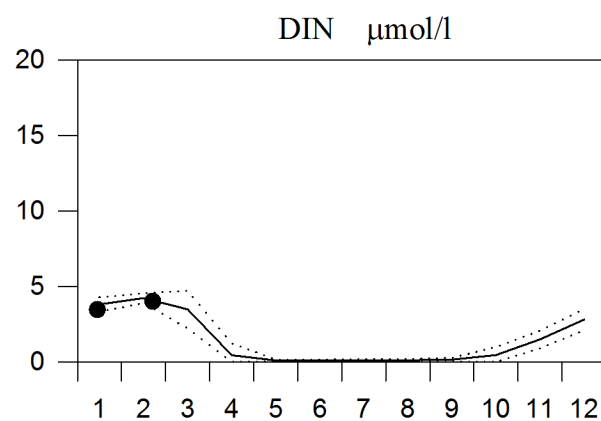
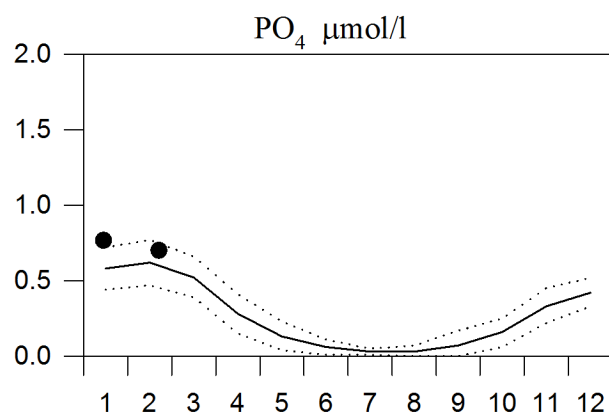
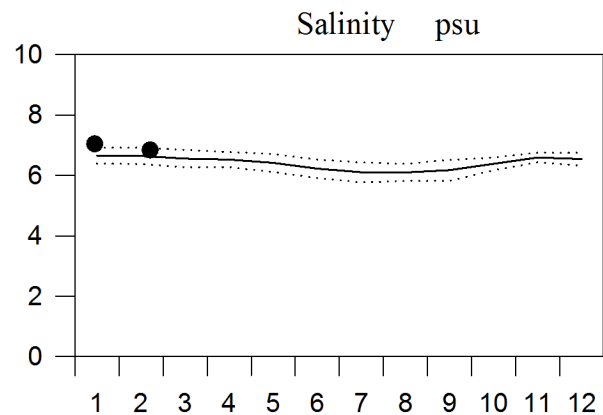
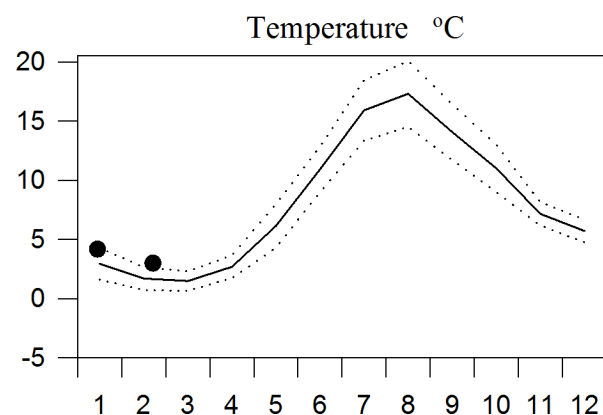
— Mean 1996-2010 St.Dev. ● 2016



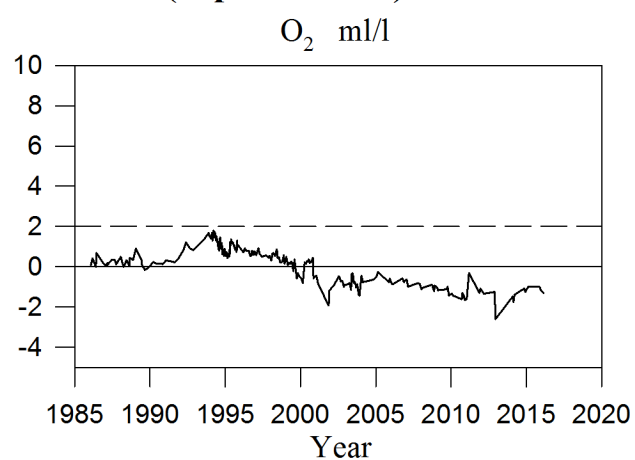
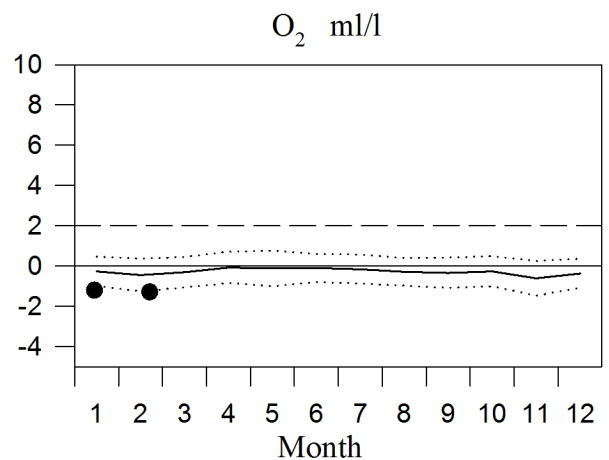
STATION BY31 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

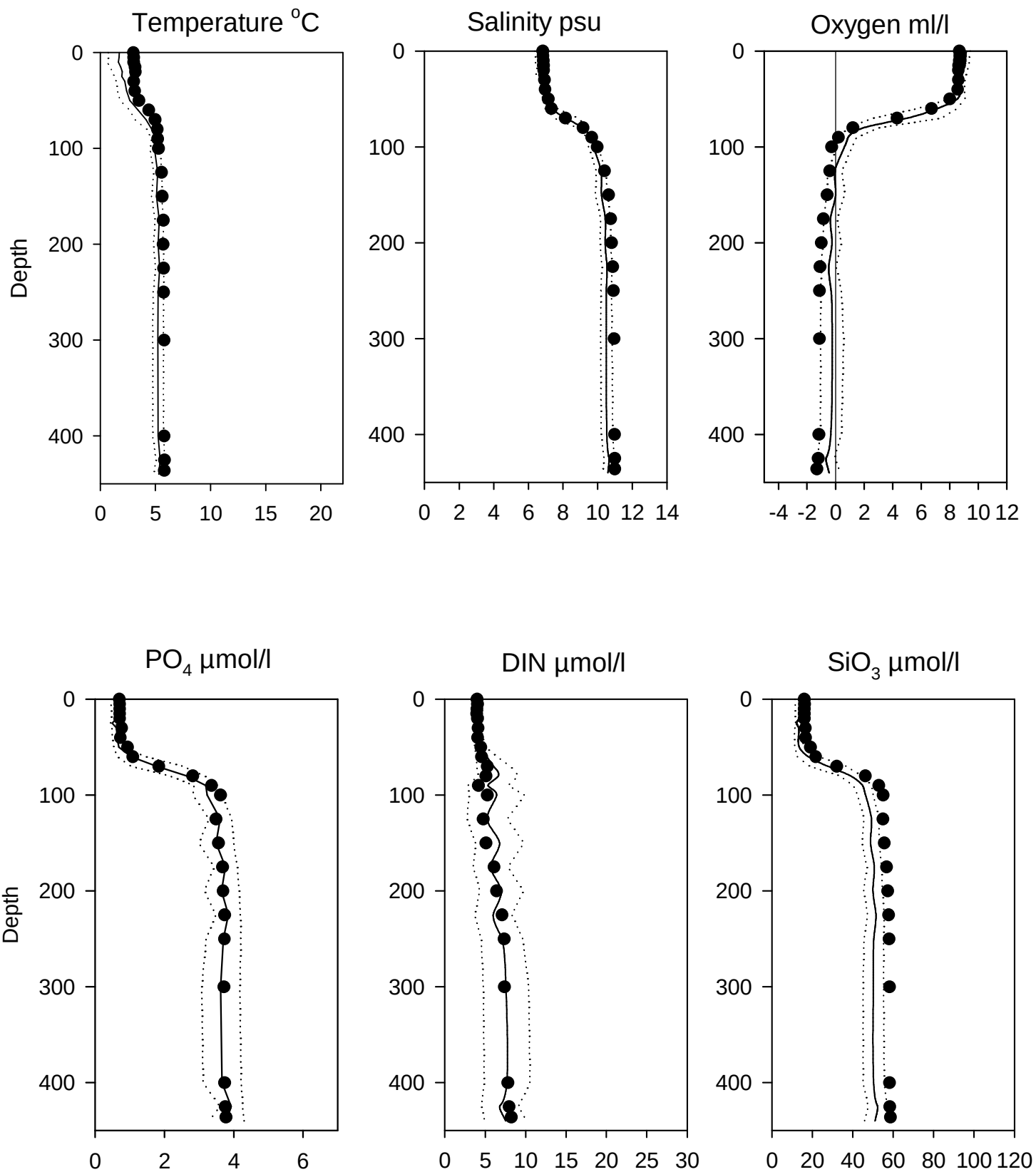


OXYGEN IN BOTTOM WATER (depth = 440m)



Vertical profiles BY31 February

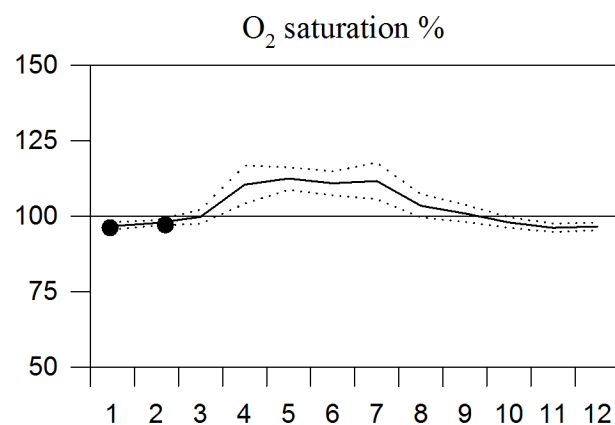
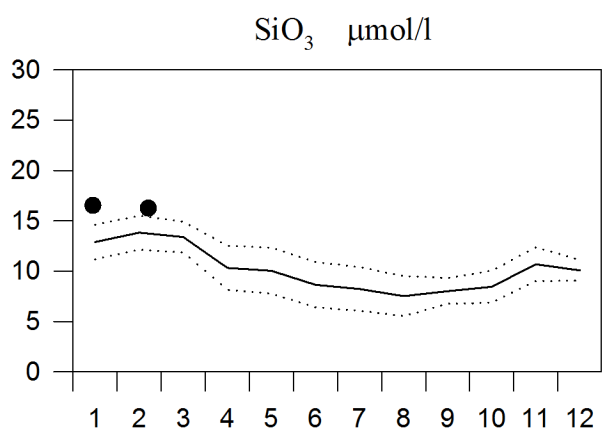
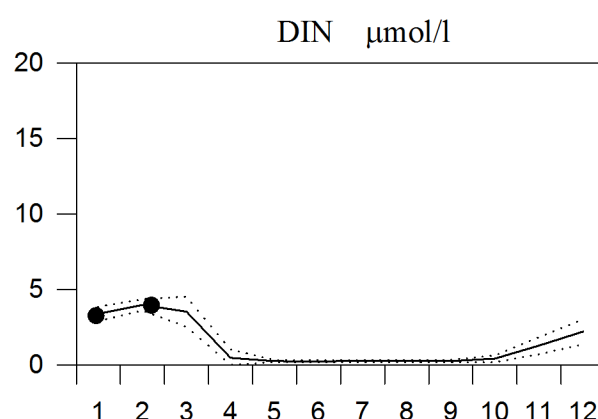
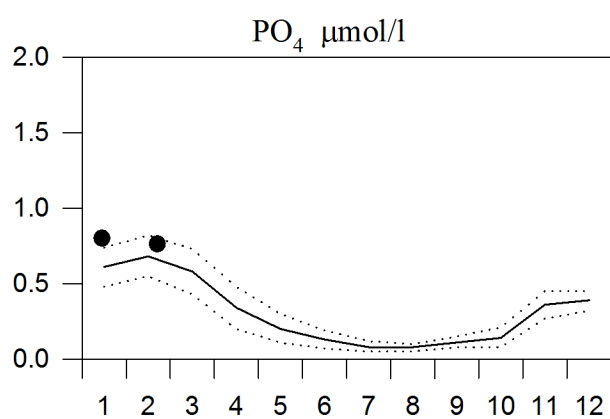
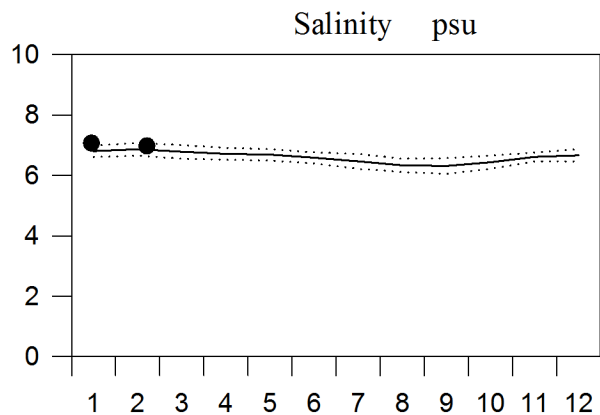
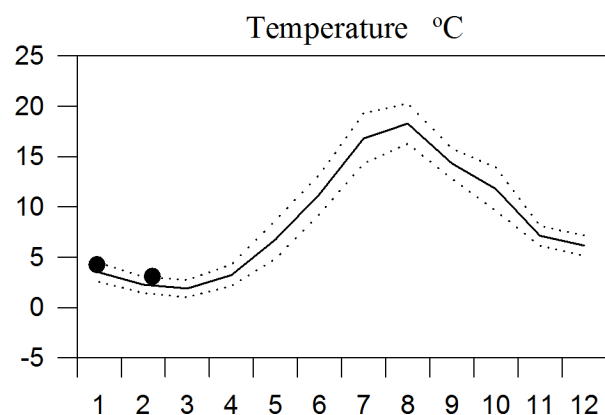
— Mean 1996-2010 St.Dev. ● 2016



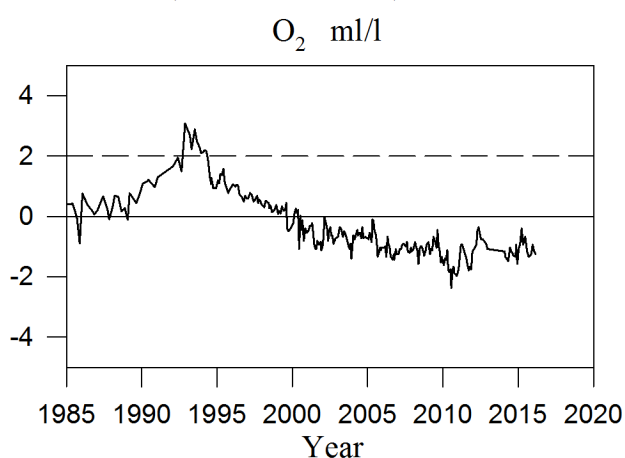
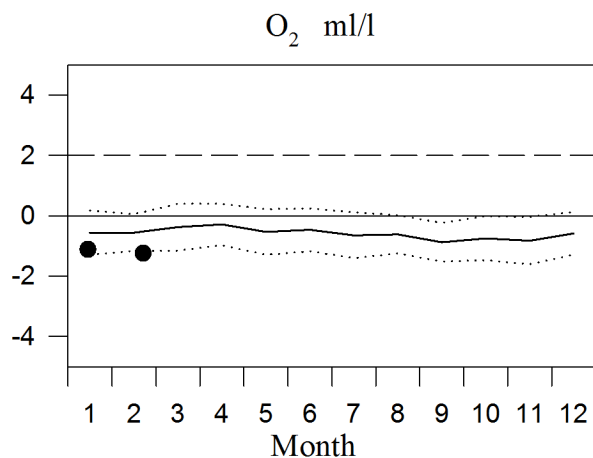
STATION BY32 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

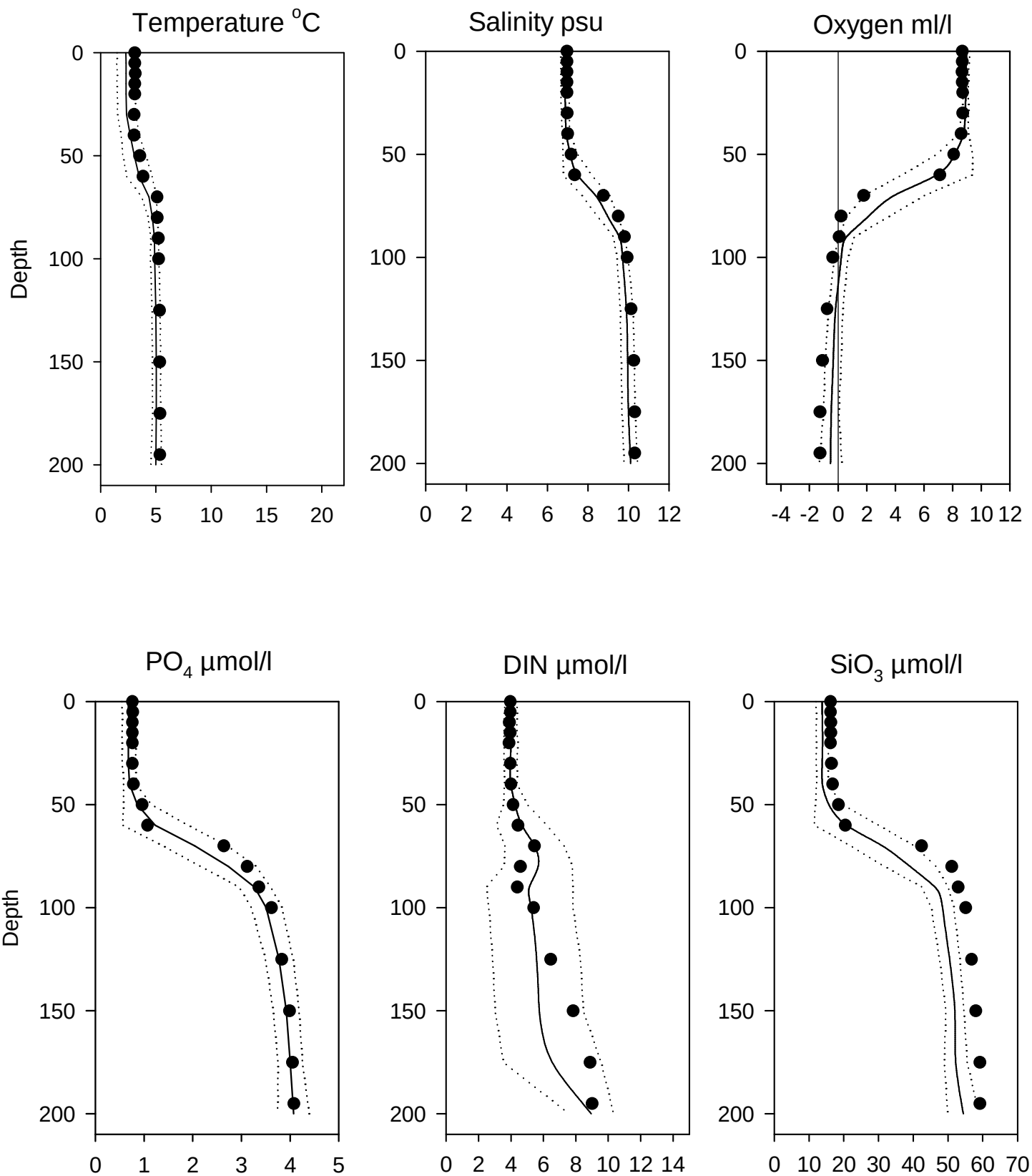


OXYGEN IN BOTTOM WATER (depth > 175m)



Vertical profiles BY32 February

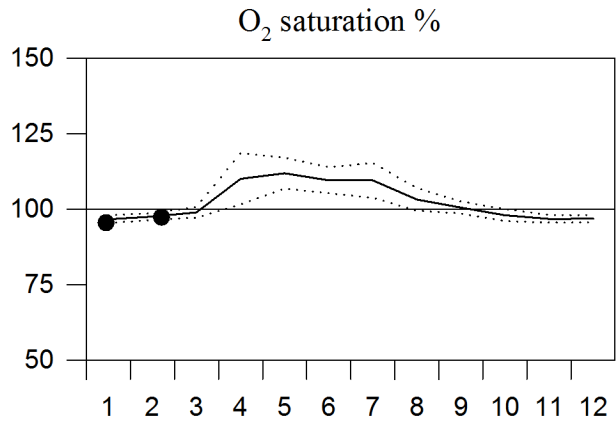
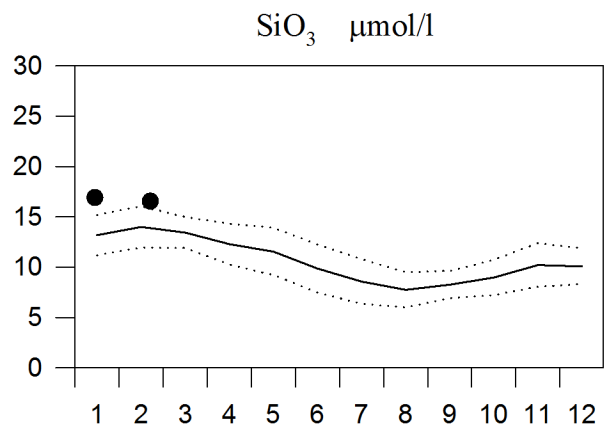
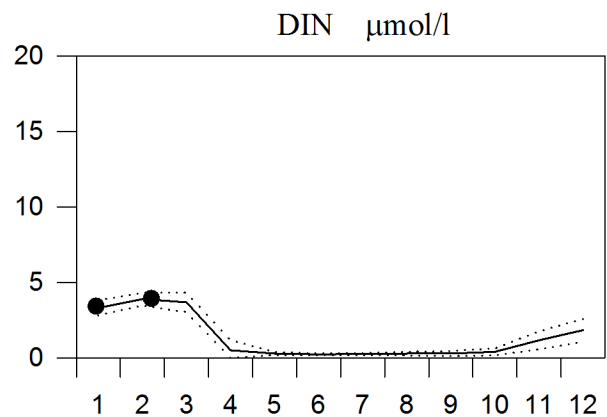
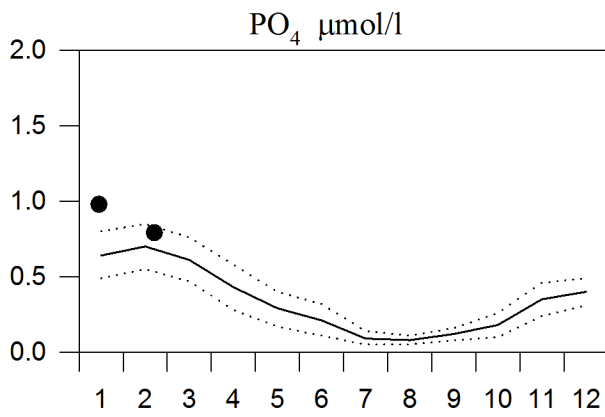
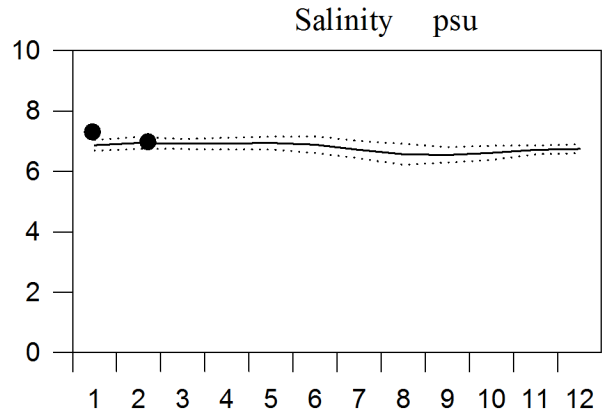
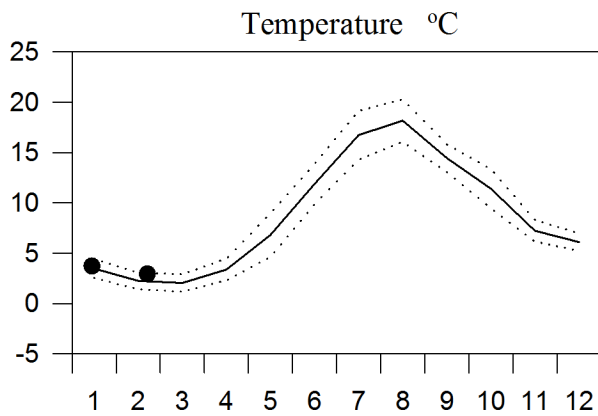
— Mean 1996-2010 St.Dev. ● 2016



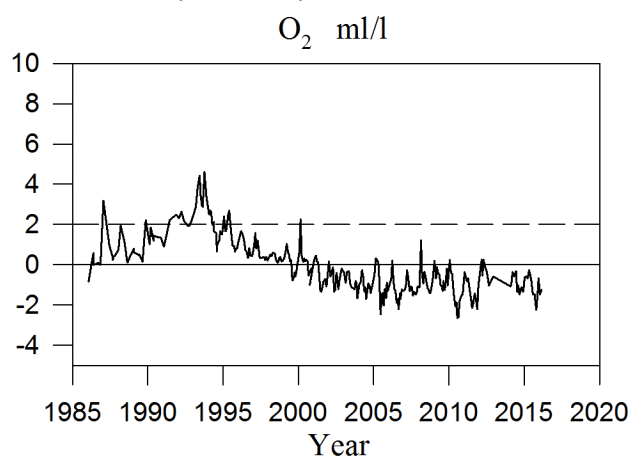
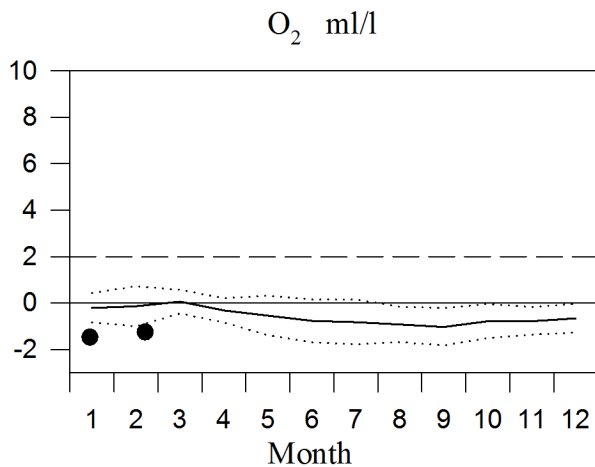
STATION BY38 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

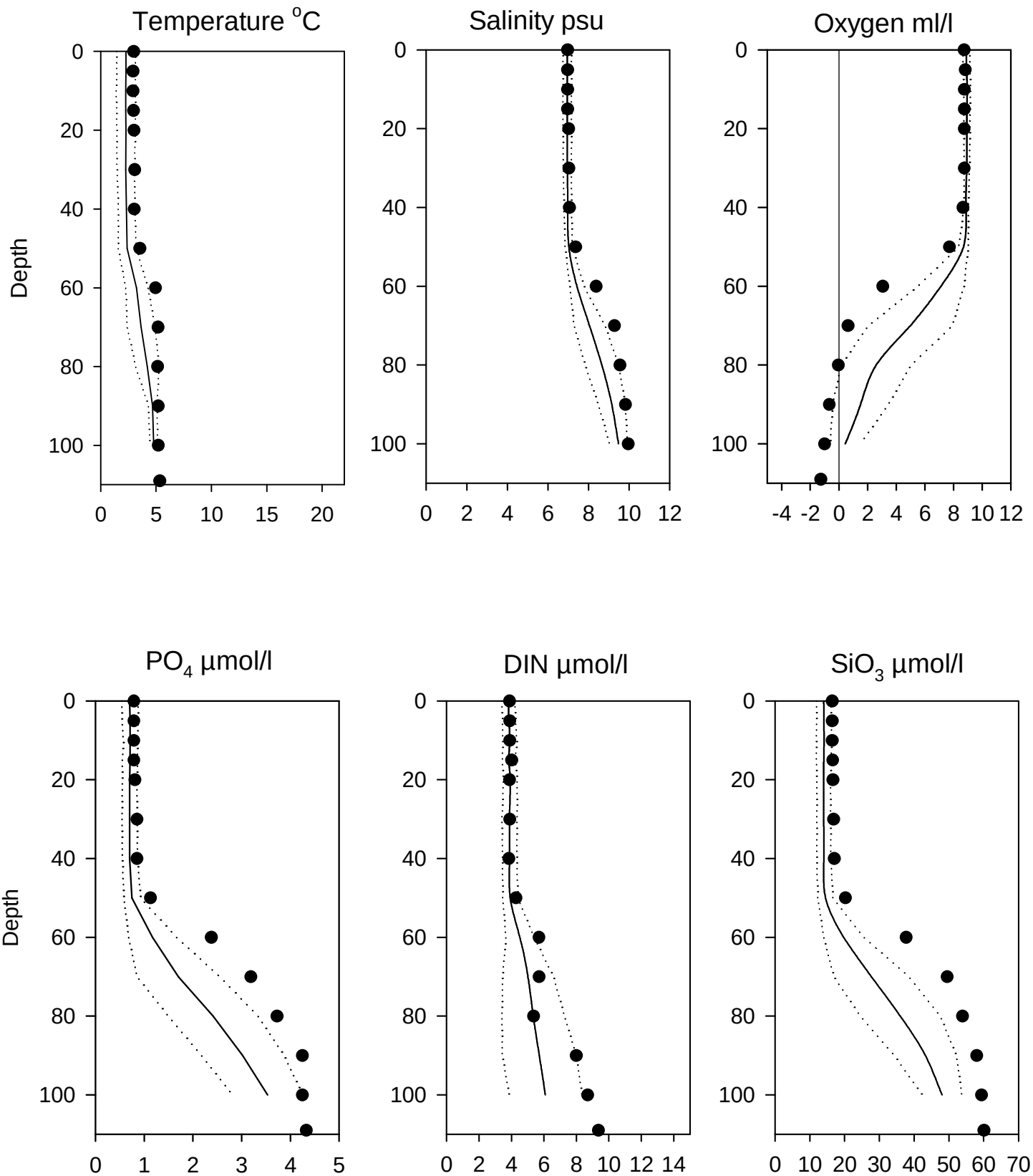


OXYGEN IN BOTTOM WATER (> 100m)



Vertical profiles BY38 February

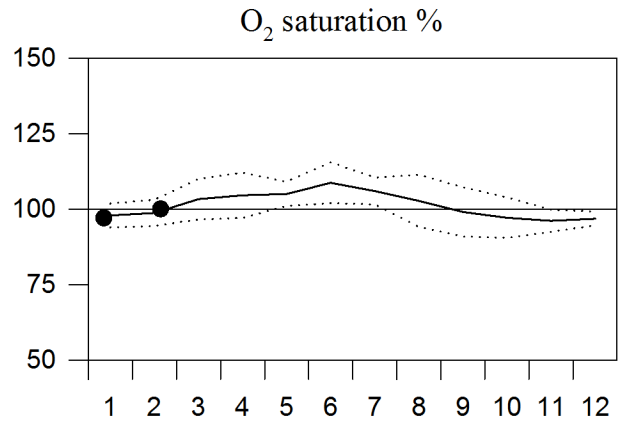
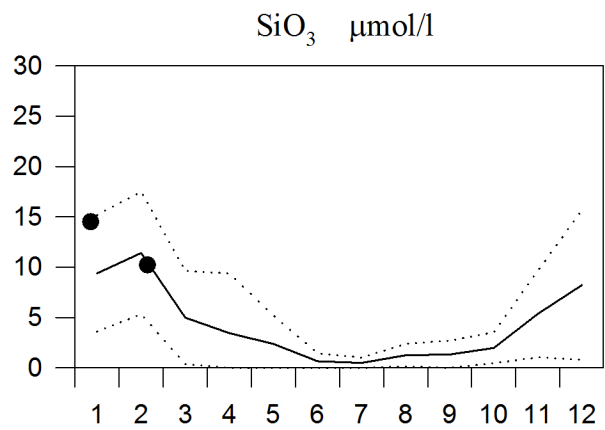
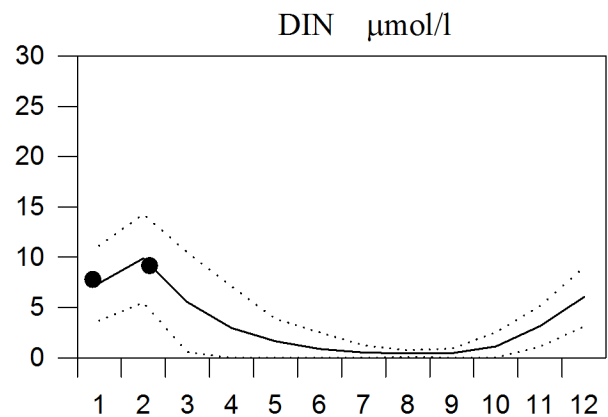
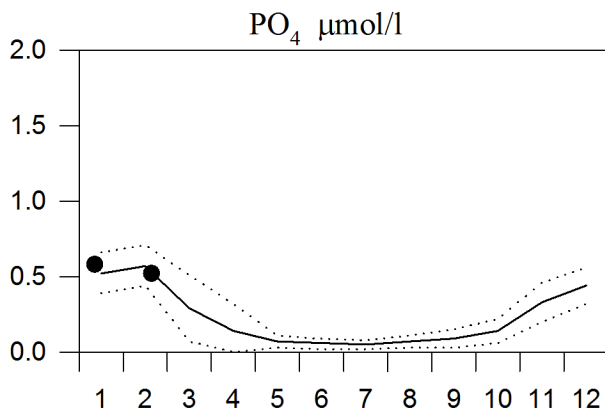
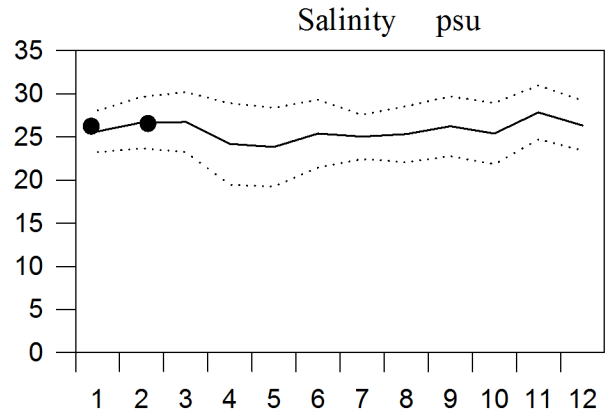
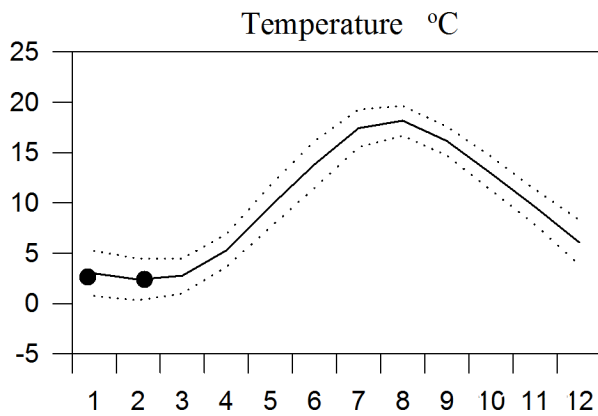
— Mean 1996-2010 St.Dev. ● 2016



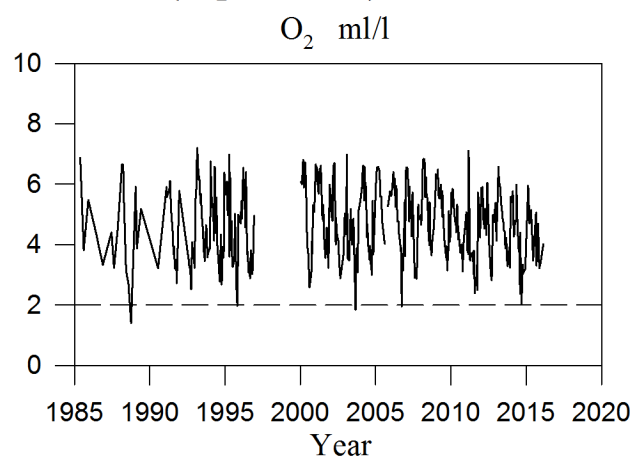
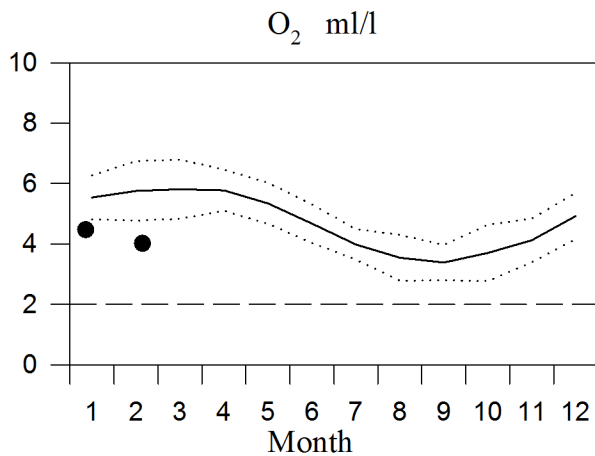
STATION SLÄGGÖ SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016

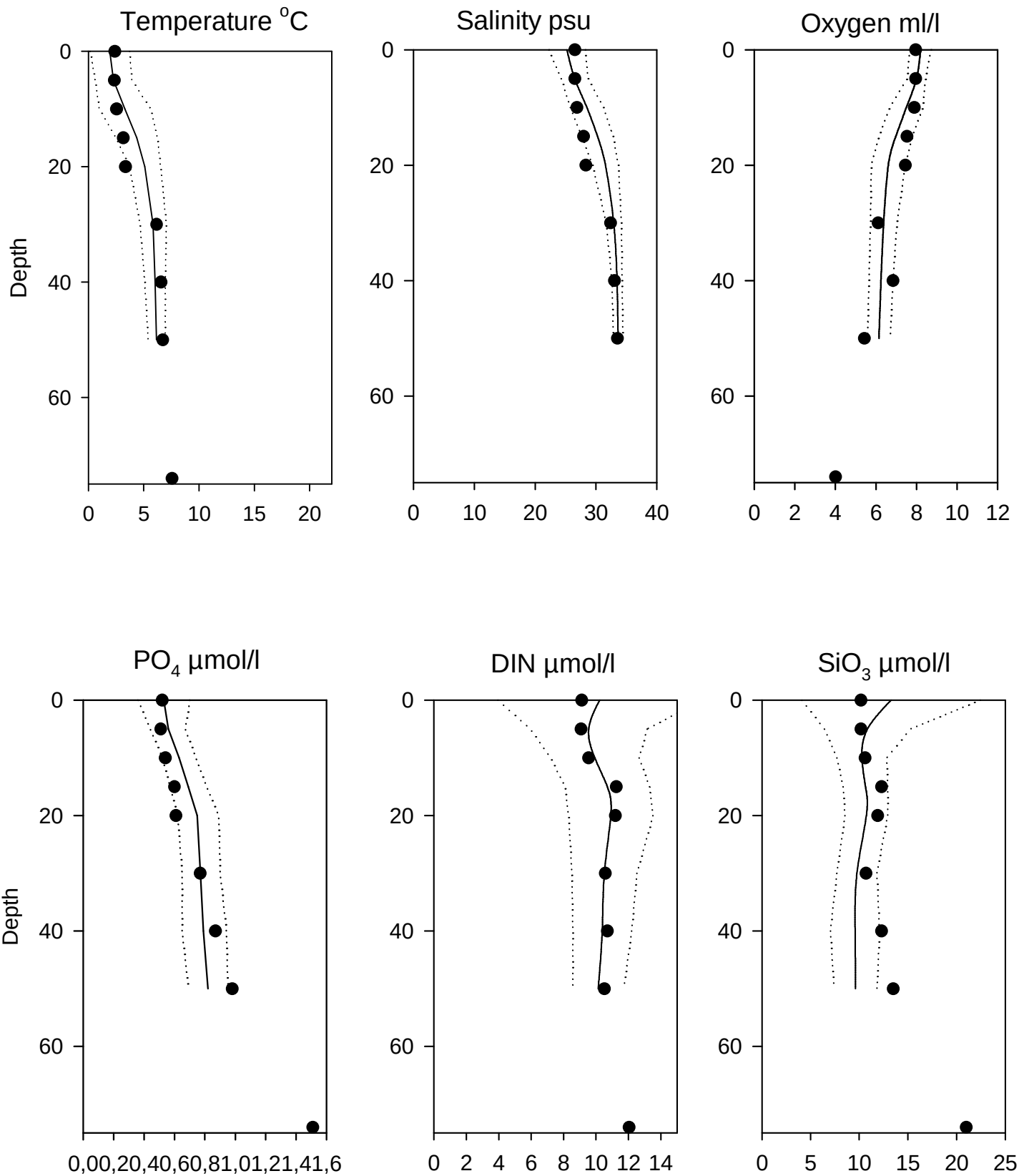


OXYGEN IN BOTTOM WATER (depth >50m)



Vertical profiles Släggö February

— Mean 1996-2010 St.Dev. ● 2016



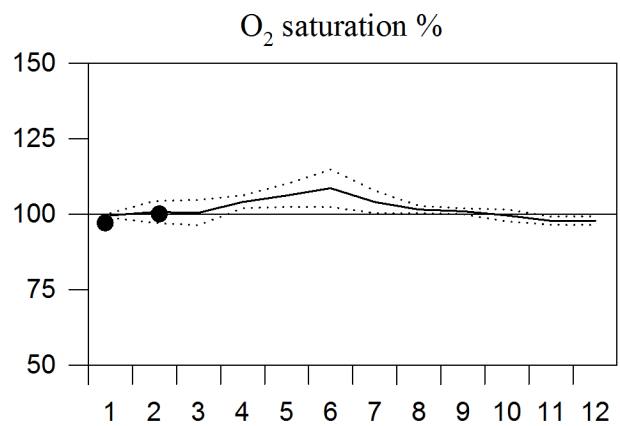
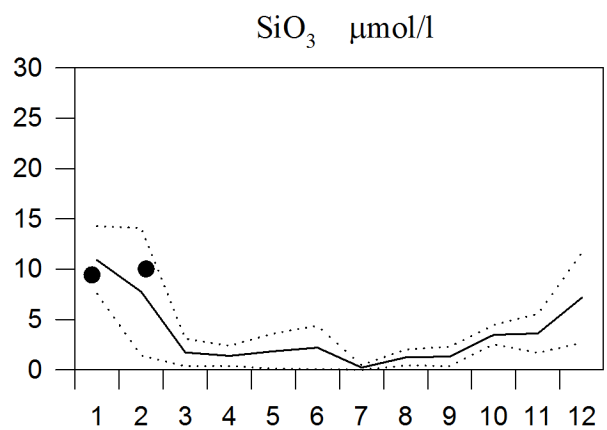
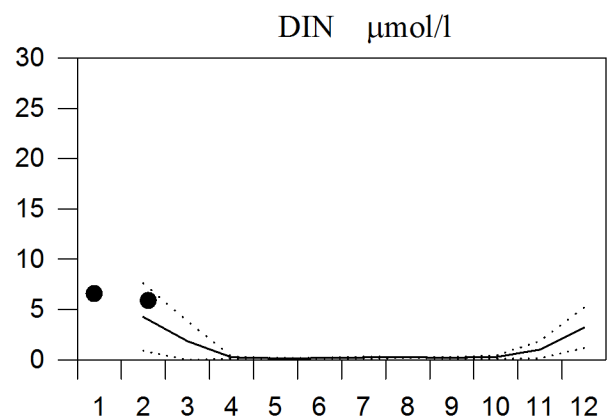
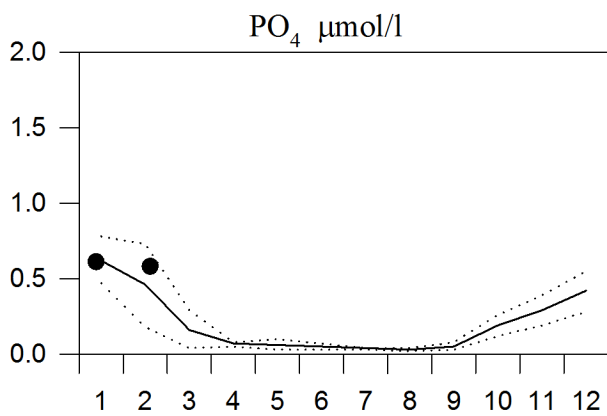
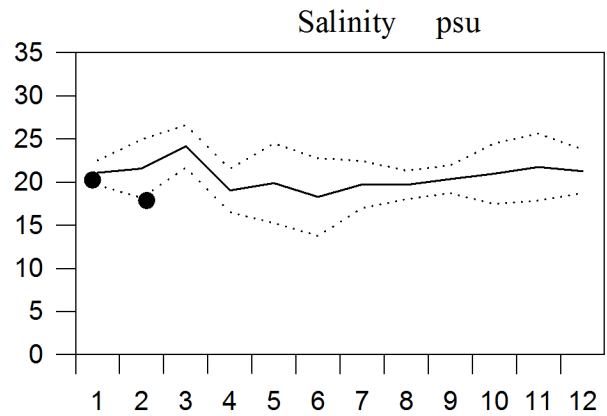
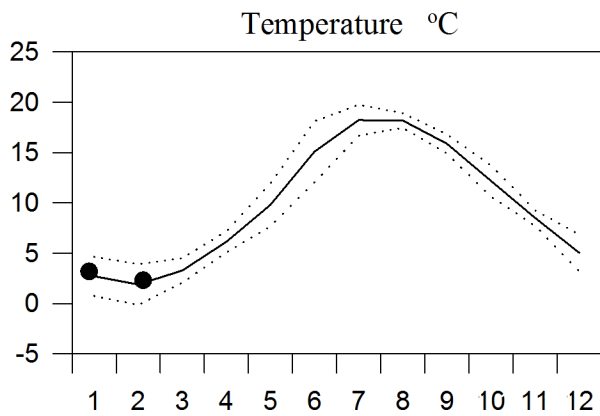
STATION N14 Falkenberg SURFACE WATER

Annual Cycles

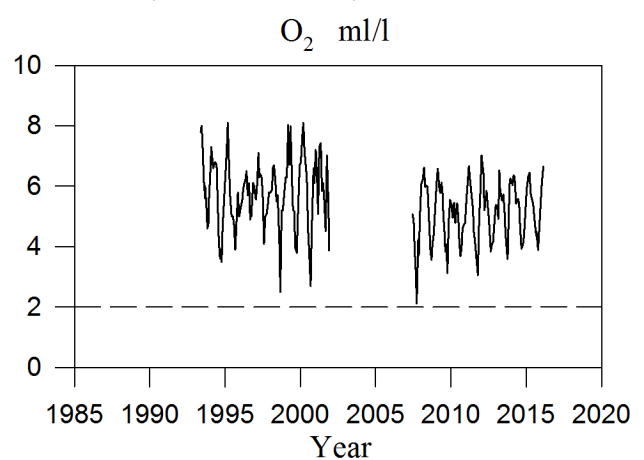
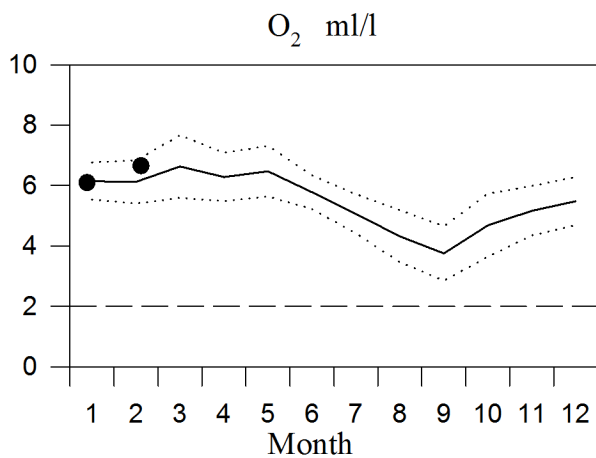
— Mean 2007-2010

..... St.Dev.

● 2016

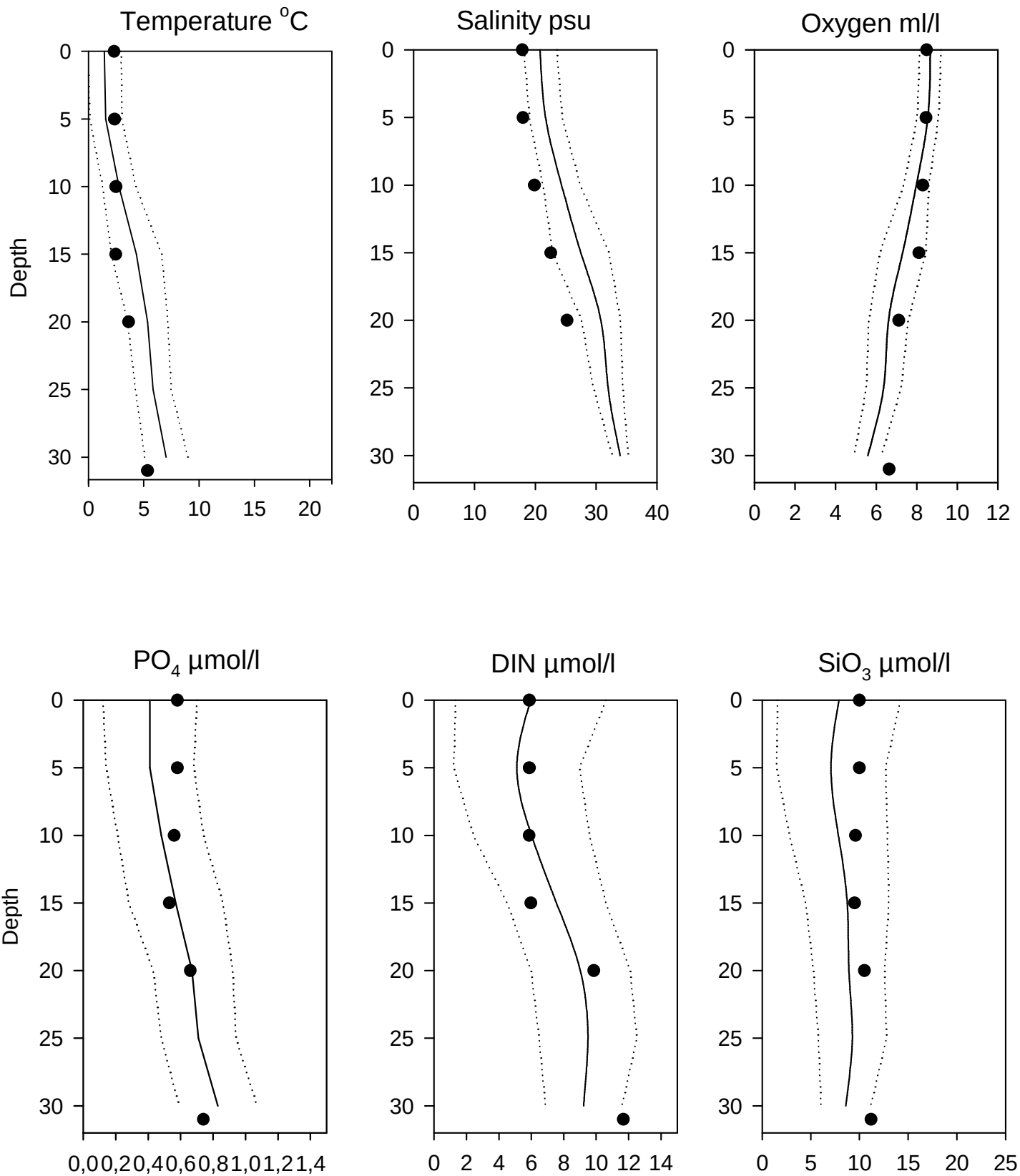


OXYGEN IN BOTTOM WATER (depth > 25m)



Vertical profiles N14 Falkenberg February

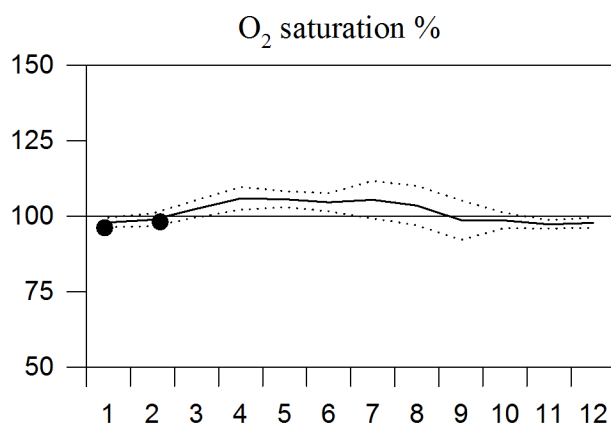
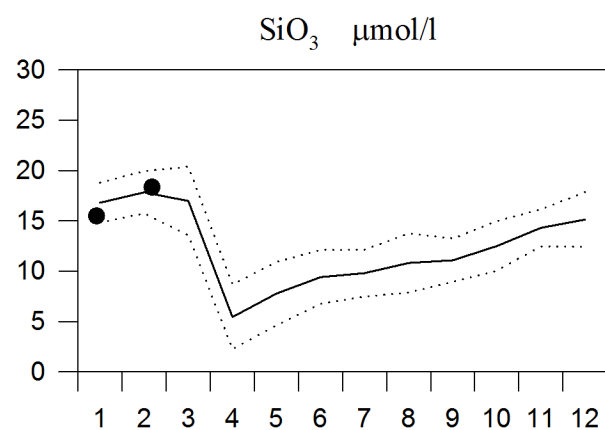
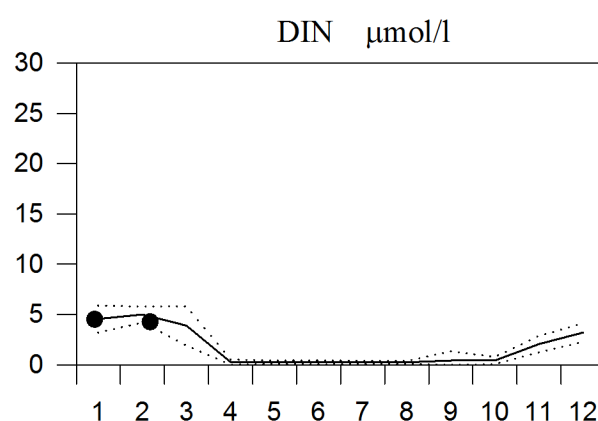
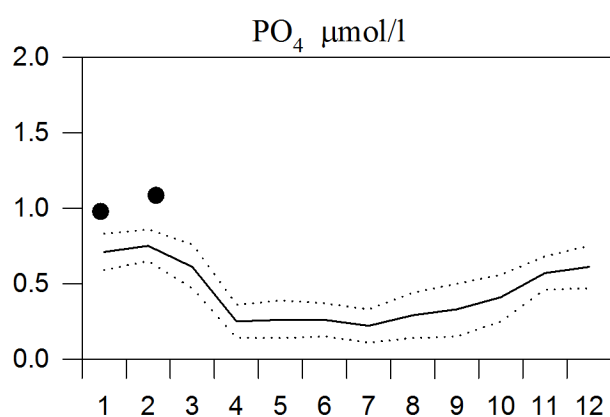
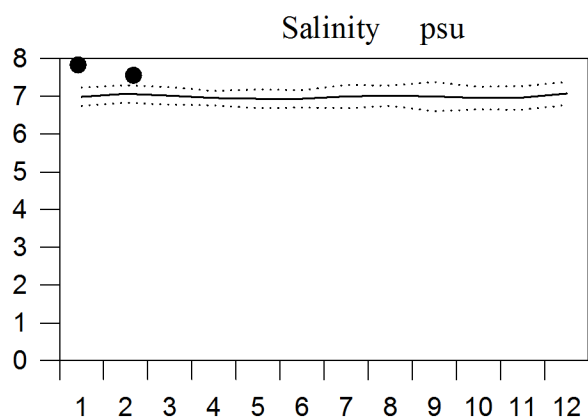
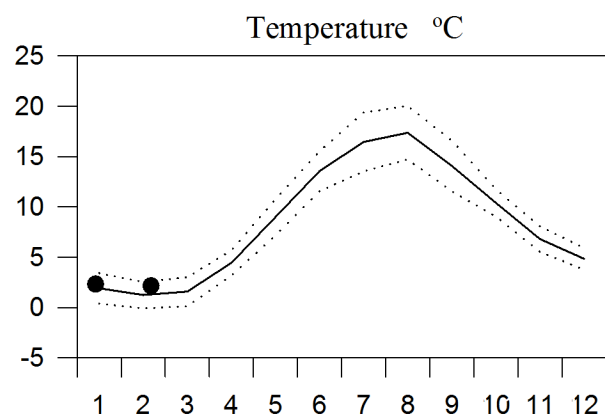
— Mean 1996-2010 St.Dev. ● 2016



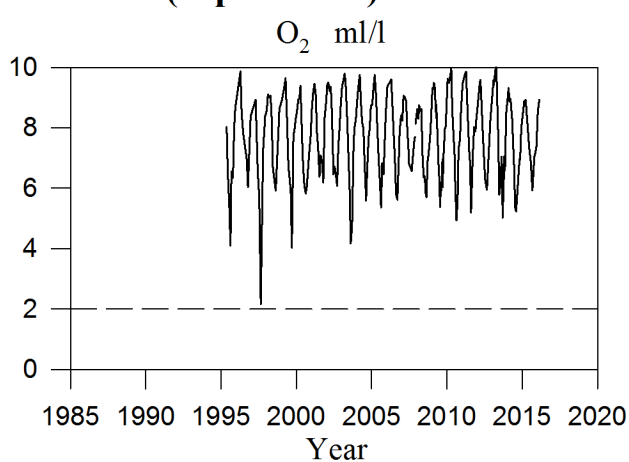
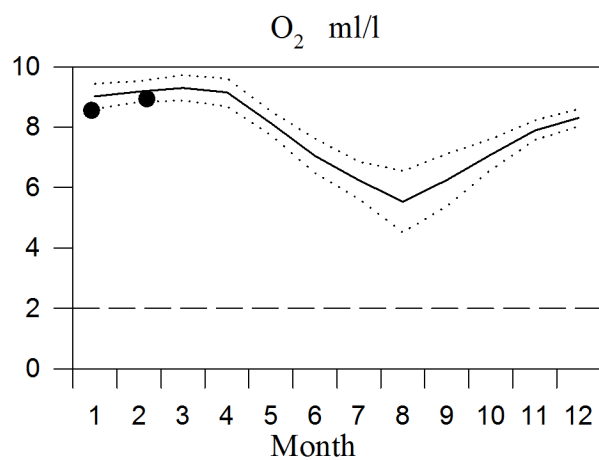
STATION REF M1V1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2016



OXYGEN IN BOTTOM WATER (depth >15m)



Vertical profiles Ref M1V1 February

— Mean 1996-2010 St.Dev. ● 2016

