

Rapport från SMHIs utsjöexpedition med R/V Aranda



Expeditionens varaktighet: 2015-02-14 - 2015-02-22
Undersökningsområde: Kattegatt, Öresund och egentliga Östersjön
Uppdragsgivare: SMHI samt Havs- och Vattenmyndigheten

SAMMANFATTNING

Under expeditionen, vilken ingick i det svenska havsövervakningsprogrammet, besöktes Kattegatt, Öresund och egentliga Östersjön. I egentliga Östersjön genomfördes kartering av vinterhalter av näringsämnen. Denna rapport är baserad på preliminära, endast delvis kvalitetskontrollerade data.

Vattentemperaturen i ytlagret var normala i Västerhavet medan den låg strax över det normala i Östersjön. Närsalterna i ytvattnet uppvisade för årstiden i stort sett normala värden, förutom silikat och fosfat vilka, i delar av egentliga Östersjön, var förhöjda.

Effekterna av inflödet under december 2014 syntes tydligt under expeditionen.

Bornholmsbassängen var nu fylld upp till tröskeldjupet med vatten med en salthalt av ca 18 psu och en syrehalt på 5.5 ml/l. I Stolpe Ränna återfanns vatten med en salthalt på 16 psu och en syrehalt på 4 ml/l på djup överstigande 60 meter. Vid stationen BCSIII-10 i sydost uppmättes en salthalt av 12 psu, och en syrekonzentration på 2.8 ml/l på djup överstigande 82 m.

Nästa ordinarie expedition är planerad till vecka 12 i mars 2015.

PRELIMINÄRA RESULTAT

Expeditionen genomfördes ombord det finska forskningsfartyget Aranda och startade i Helsingfors den 14:e februari och avslutades i samma hamn den 22:e.

Vindarna under expeditionen var i huvudsak friska till hårda, i början av expeditionen nordostliga därefter vred vinden över till sydväst. Lufttemperaturen varierade mellan 0 - 5°C.

På grund av problem med närsaltsanalysatorn saknas fosfat-, nitrat- samt silikatdata från västra Gotlandsbassängen.

Skagerrak

Ytvattentemperaturen som nu åter var normal för årstiden, efter att ha varit förhöjd under slutet av förra året, varierade mellan 3.2 och 4.2 °C. Salthalten i ytlagret låg mellan 28.7 och 32.4 psu, vilket är normalt. Termoklin och haloklin låg på ca 30 meters djup.

Närsalthalterna i ytvattnet, ner till språngskiktet, var lägre än normalt invid kusten, medan de uppvisade normala halter längre västerut. Fosfatkoncentrationerna i ytvattnet varierade mellan 0.3 och 0.5 µmol/l, nitrit + nitrat låg i intervallet 5.1 - 7.1 µmol/l, medan halterna av silikat varierade från 1.5 till 5.4 µmol/l.

Fluorescensmätningar tillsammans med närsalthalter visade att vårblomningen var i full gång i kustzonen, samt att den var i startskedet i de centrala delarna.

Kattegatt och Öresund

Temperaturen i ytvattnet, normal för årstiden låg kring 2.5°C. Även ytsalthalten var normal, i Kattegatt varierade den mellan 22.5 och 25.5 psu, medan den i Öresund uppmättes till 9.7 psu. I norra Kattegatt låg haloklin och termoklin på 20 meters djup, båda relativt skarpt utvecklade, medan skiktningen i de södra delarna var betydligt svagare och återfanns på djup mellan 20 och 30 meter. En mycket skarp haloklin registrerades i Öresund på ett djup av 15 meter.

Halterna av näringsämnen hade börjat sjunka från vinternivåer och vårblomningen var i full gång, vilket också indikerades av höga fluorescensvärden. Fosfat låg kring 0.4 µmol/l, oorganiskt kväve i intervallet 6.0 – 6.5 µmol/l och silikalthalterna varierade mellan 5.6 och 6.2. Vid stationen Anholt E, vilken besöktes två gånger, sjönk oorganiskt kväve från 6 till 4.8 µmol/l och silikat från 6.7 till 3.8 µmol/l under ett dygn.

De lägsta syrehalterna i bottenvattnet uppmättes vid Anholt E i Kattegatt, 6.4 ml/l samt vid W Landskrona i Öresund, 6.5 ml/l.

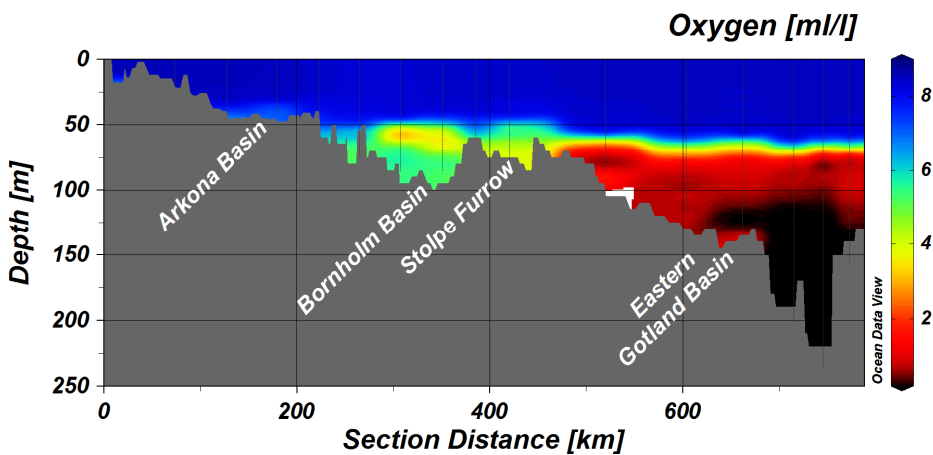
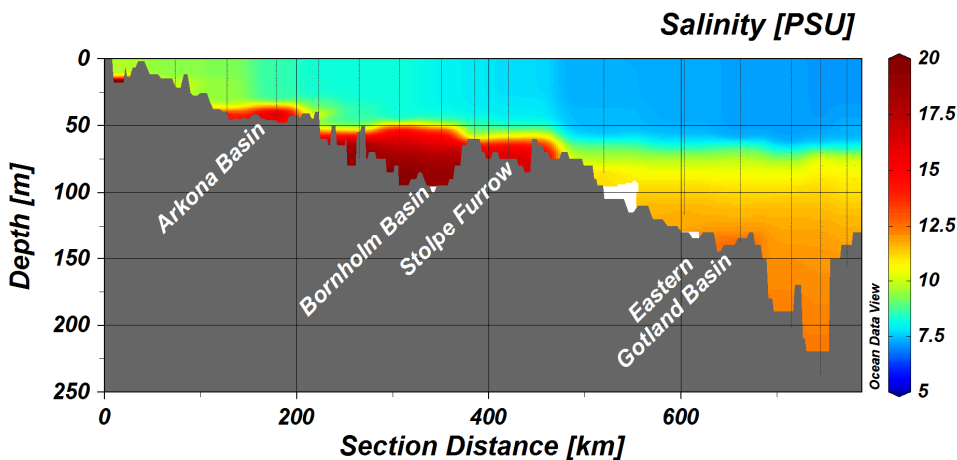
Egentliga Östersjön

Vattentemperaturen i ytskiktet var något över det normala och låg i intervallet 3.4 till 4.1°C.

Ytsalthalten var normal, 6.7 - 8.0 psu, förutom i Arkonabassängen (8.5 till 9.5 psu), samt i Bornholmsbassängen och Hanöbukten (drygt 8 psu) vilket är högre än normalt. Detta beroende på den kraftiga omblandning som skedde under stormen Egon i januari. Haloklinen återfanns på omkring 60 till 80 meters djup i västra och östra Gotlandsbassängen samt i norra delen, medan den låg grundare i de södra delarna, på djup mellan 30 och 60 meter.

Närsalterna uppvisade i stort sett normala halter för årstiden i ytlagret med något förhöjda halter av fosfat och silikat. Fosfalthalterna låg i intervallet 0.60 – 0.85 µmol/l med de högsta koncentrationerna i norr. Halterna av oorganiskt kväve (nitrit + nitrat) varierade från 3.0 till 4.6 µmol/l, i Gdanskbukten 5.5 µmol/l. Silikat uppvisade något förhöjda halter i de norra och centrala delarna, medan koncentrationerna var normala i övriga områden. Halterna varierade i intervallet 10 till 16 µmol/l.

I december 2014 skedde ett inflöde till Östersjön genom Öresund och Bälten, vilket var ett av de största på 60 år. Totalt strömmade över 200 km³ vatten in i Östersjön vid detta tillfälle. I januari ägde ytterligare ett inflöde till Östersjön rum, när det genom Öresund kom in ca 18 km³. Dessa inflöden föregicks av ett på ca 70 km³, vilket skedde i oktober. Effekterna av dessa inflöden syntes nu tydligt i södra och sydöstra delarna. Bornholmsbassängen var nu fylld upp till tröskeldjupet med vatten med en salthalt av ca 18 psu och en syrehalt på 5.5 ml/l. I Stolpe Ränna återfanns vatten med en salthalt på 16 psu och en syrehalt på 4 ml/l på djup överstigande 60 meter. Vid stationen BCSIII-10 i sydost uppmättes hög salthalt, 12 psu, och en syrekonzentration på 2.8 ml/l på djup överstigande 80 m, även Gdanskbukten var väl syresatt på djup överstigande 90 m. Effekterna här torde dock härröra från de tidigare inflödena under hösten. Även i de södra delarna av östra Gotlandsbassängen syntes vatten med syrehalt på 2 ml/l närmast botten, även om svavelväte förekom i vattnet ovan.



I de centrala delarna av östra Gotlandsbassängen, BY15, noterades akut syrebrist från 70 meters djup och svavelväte i djup överstigande 125 meter. Vid stationen BY29, i norra delen, förekom svavelväte redan på 90 meters djup. I västra Gotlandsbassängen är syresituationen fortfarande allvarlig då akut syrebrist förekom från djup överstigande 50 - 60 meter och svavelväte från ca 85 meters djup.



DELTAGARE

Namn

Lars Andersson
Kristin Andreasson
Örjan Bäck (Lysekil-Helsingfors)
Mikael Krysell (Helsingfors-Lysekil)
Sari Sipilä
Anna-Kerstin Thell

Expeditionsledare

Från

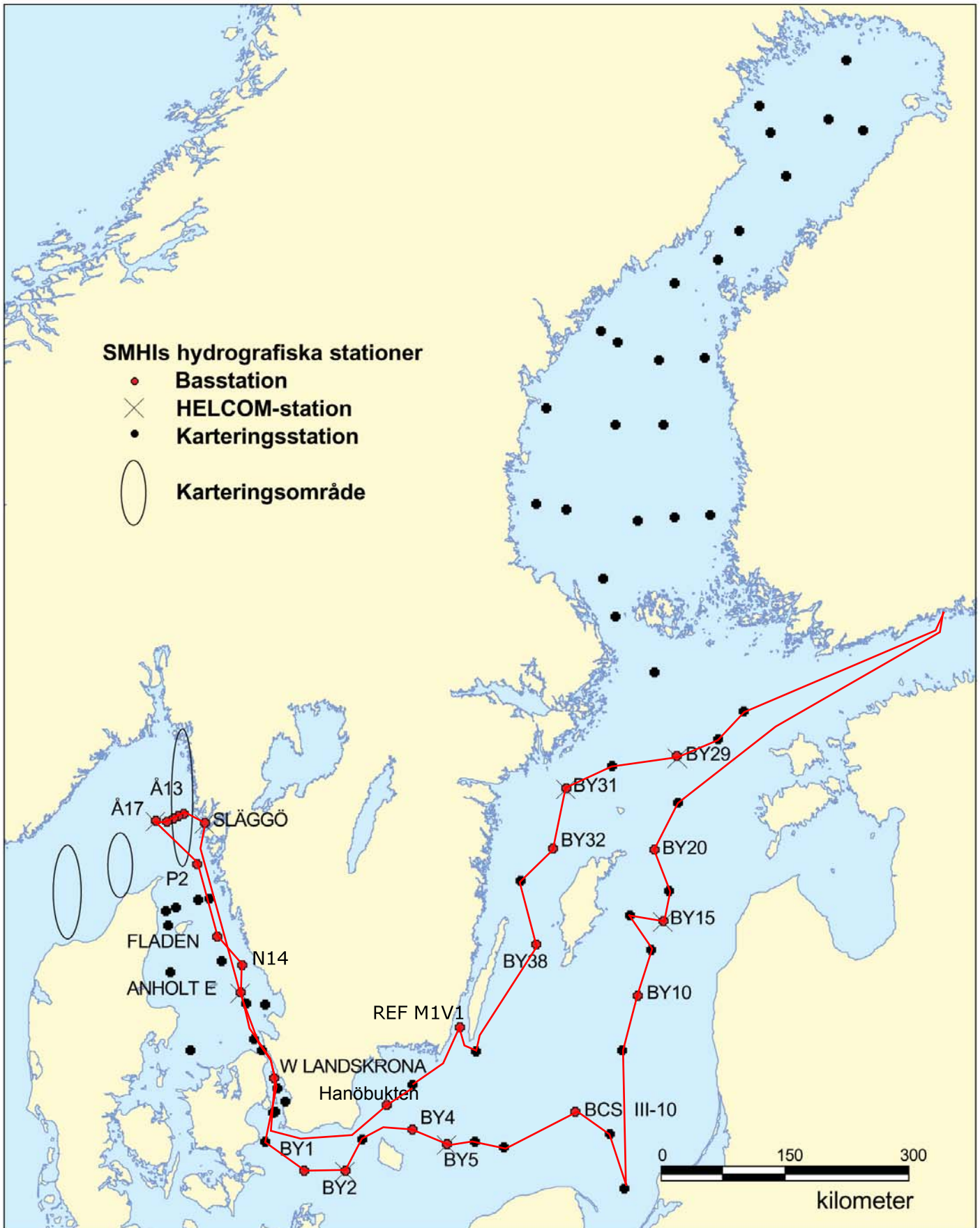
SMHI
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BILAGOR

- 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: 20150214-20150222
Series: 0100-0144



SMHI
Ocean enh

Hydrographic
series

Ship: 01-Aranda
Year: 2015

Date: 2015-02-22
Time: 16:44

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	C d	P Cilyooa	P m l	P y S 4 t	O 2	H x	P x	T x	N x	N x	N x	T x	A x	S x	H x	L x	P x	P x	T x	C x	
0127	BPSA03BAS	BY2	ARKONA	N5500	E1405	20150219	1410	46	8	25 12	3.8	1021	1240	x	--xxx--	8	x	x	-	x	x	x	x	x	x	x	-	x	x	-	-	-	-	-
0128	BPSA04BAS	BY3	HAMRARNE SUND	N5517.5	E1424	20150219	1730	45		25 11	4.3	1018	9999	x	-----	8	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-	-	-	
0129	BPSB06BAS	BY4	CHRISTIANSÖ	N5523	E1520	20150219	2045	91		23 11	4.3	1017	9999	x	--x----	12	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-	-	-	
0130	BPSB07BAS	BY5	BORNHOLMSDJ	N5515	E1559	20150219	2345	89		24 11	3.6	1016	9999	x	--xxx--	12	x	x	x	-	x	x	x	x	x	x	x	x	-	-	-	-	-	
0131	BPSE08BAS		STOLPE TRÖSKEL	N5516.5	E1631	20150220	0310	63		25 12	2.8	1014	9990	x	-----	9	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-	-	-	
0132	BPSE09BAS	BY7	STOLPE RÄNNA	N5513	E1704	20150220	0530	91		23 9	2.7	1013	9990	x	-----	12	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-	-	-	
0133	BPSE11BAS		BCS III-10	N5533.3	E1824	20150220	1040	89		23 12	1.9	1010	2840	x	--x----	12	x	x	-	x	x	x	x	x	x	x	-	x	x	-	-	-	-	-
0134	BPSE70BAS		PL-P63	N5521	E1903.5	20150220	1340	83		21 9	2.9	1009	4140	x	-----	11	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-	-	-	
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Bottom water oxygen concentration (ml/l)

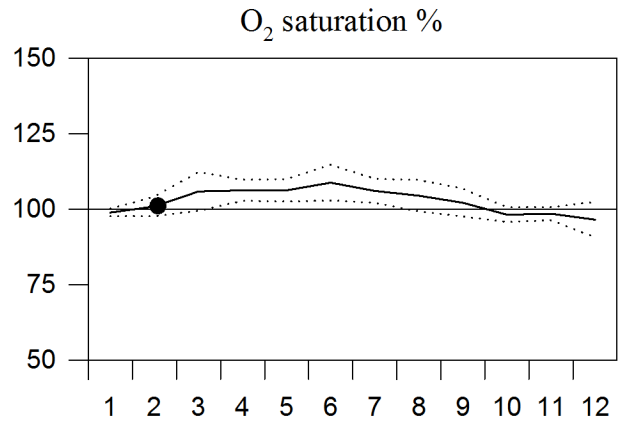
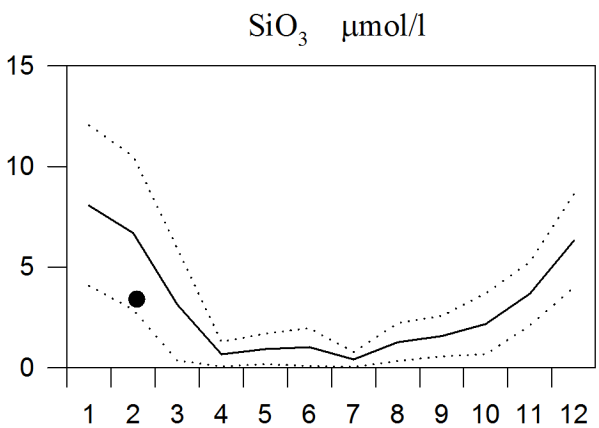
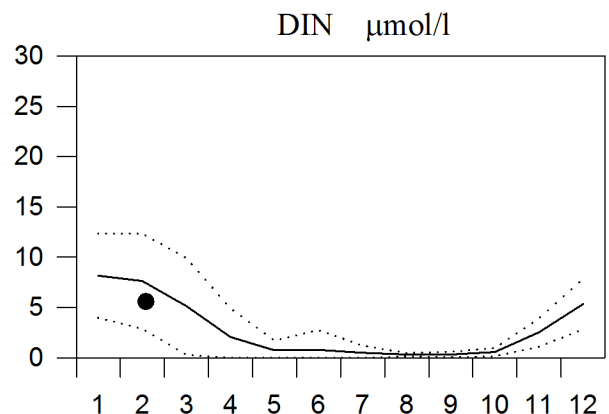
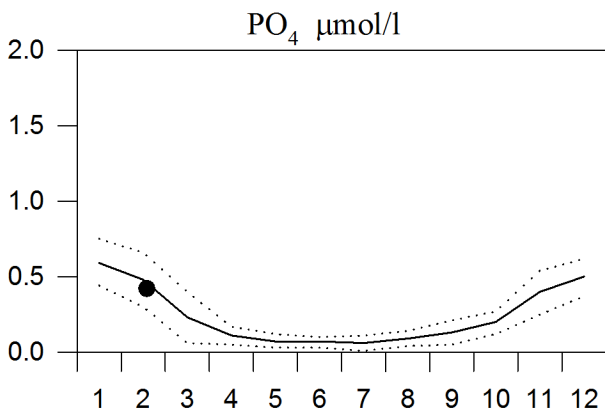
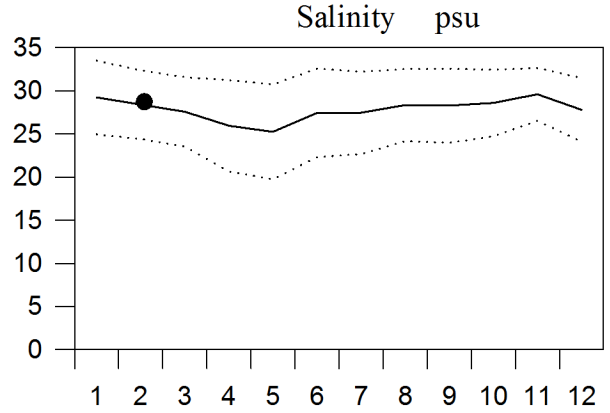
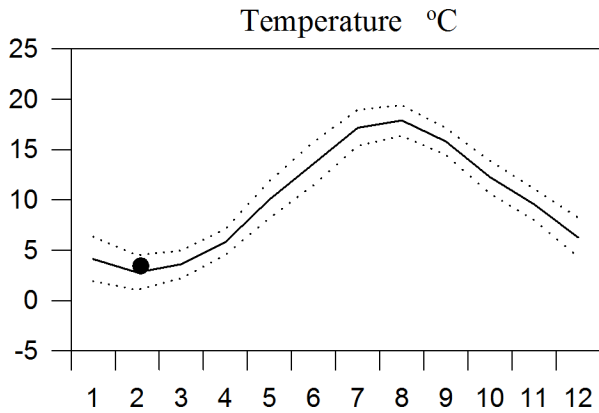
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Ship : Aranda
Date : 20150215-20150221
Series : 0100-0144



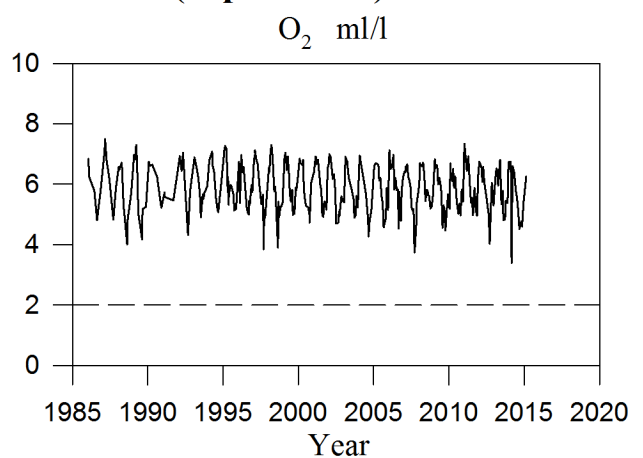
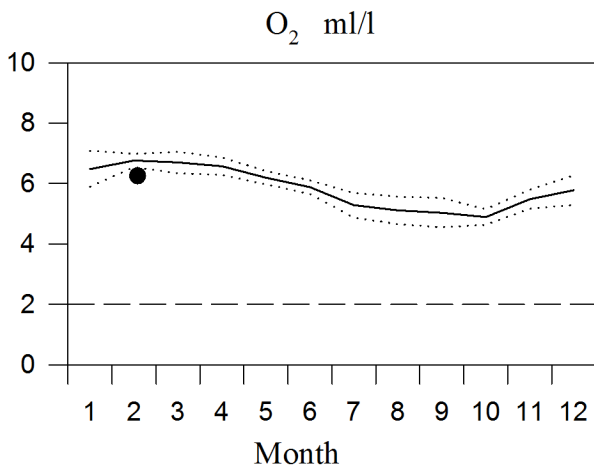
STATION P2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

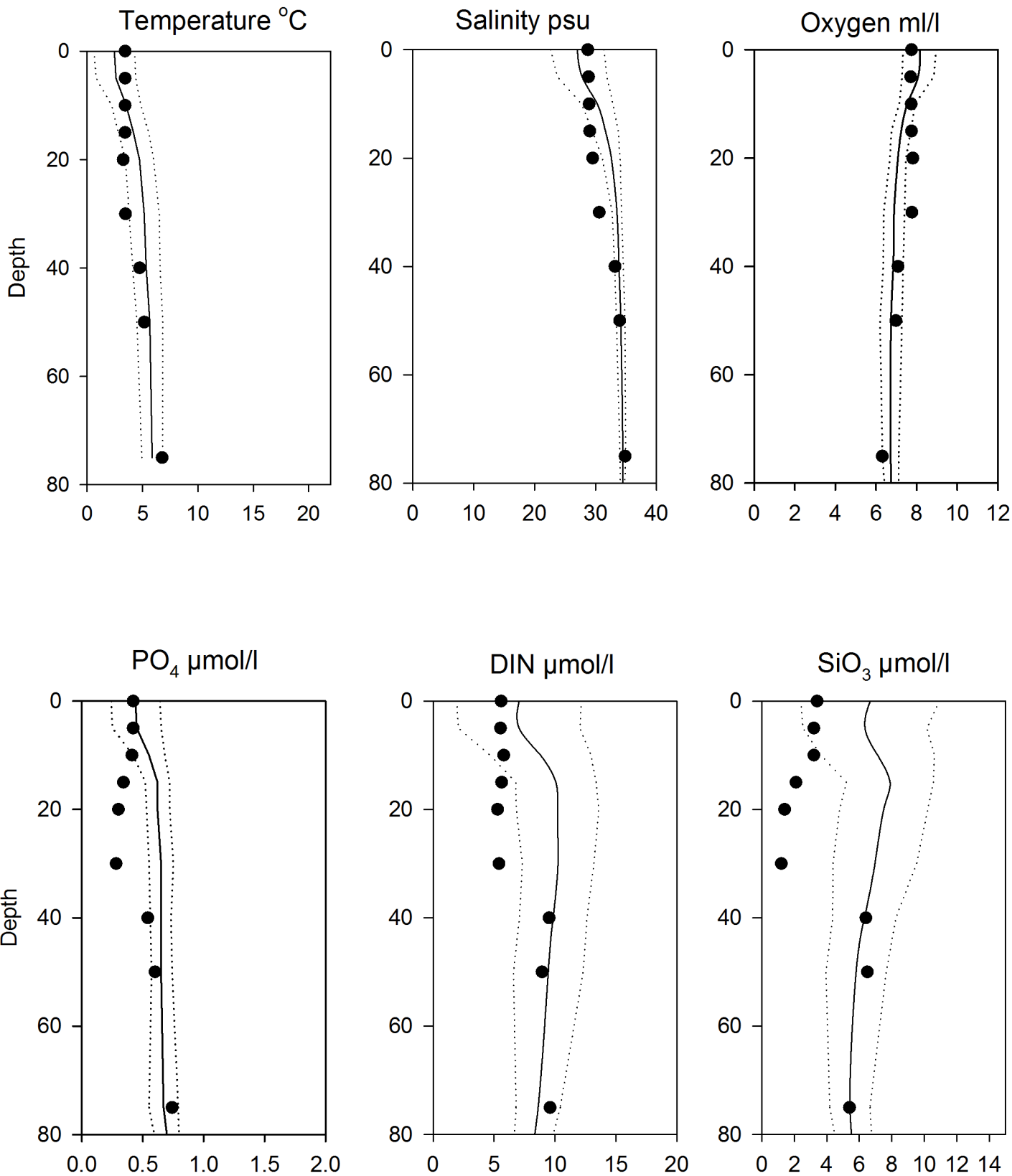


OXYGEN IN BOTTOM WATER (depth >75m)



Vertical profiles P2 February

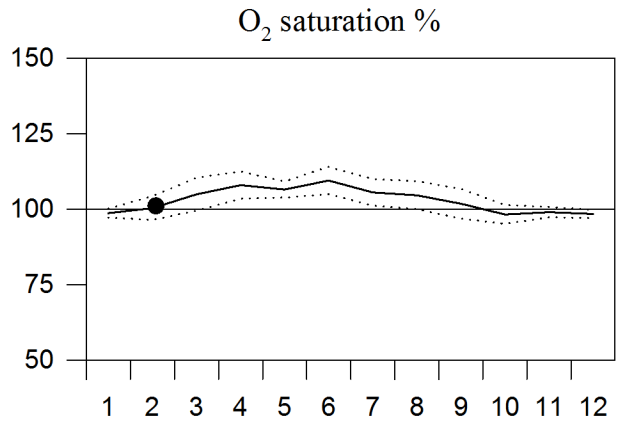
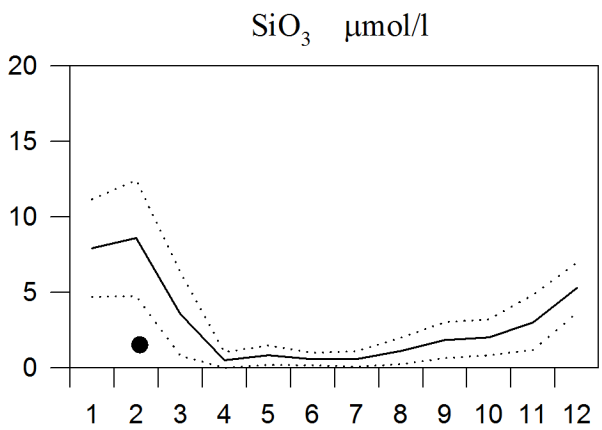
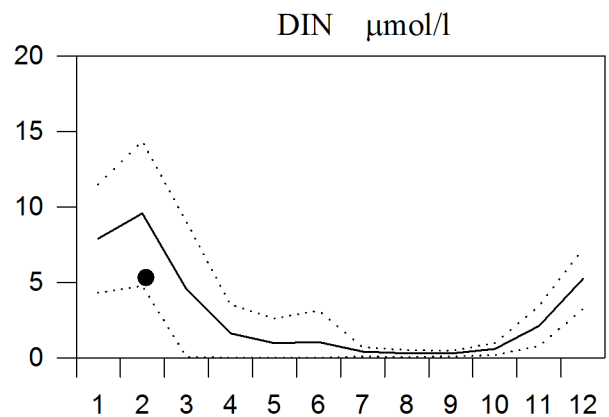
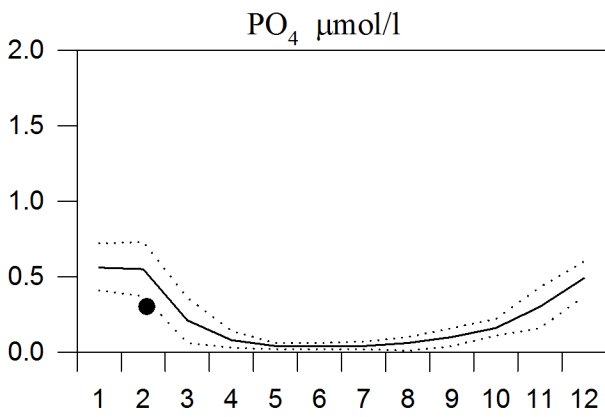
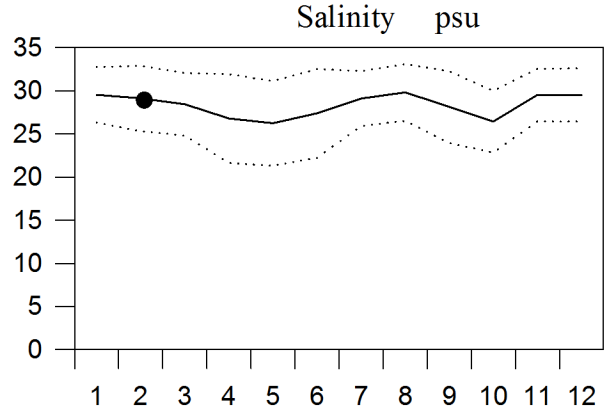
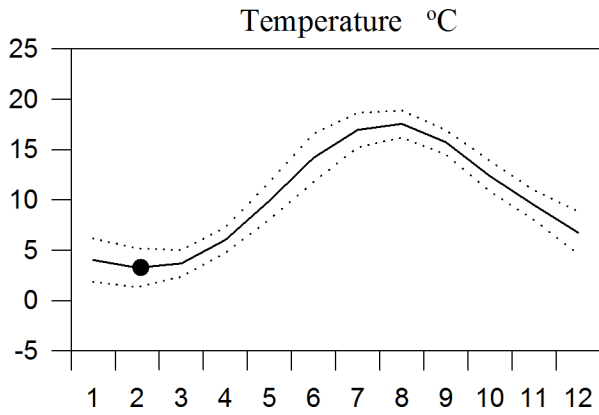
— Mean 1996-2010 St.Dev. ● 2015



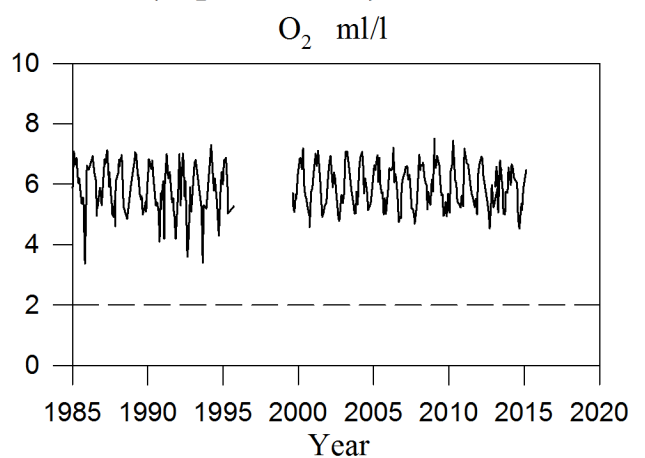
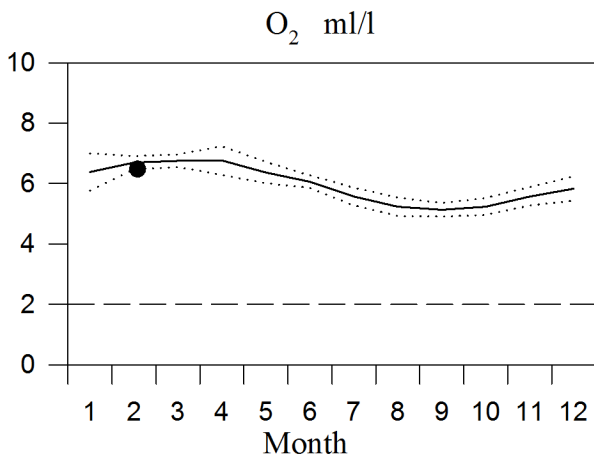
STATION Å13 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

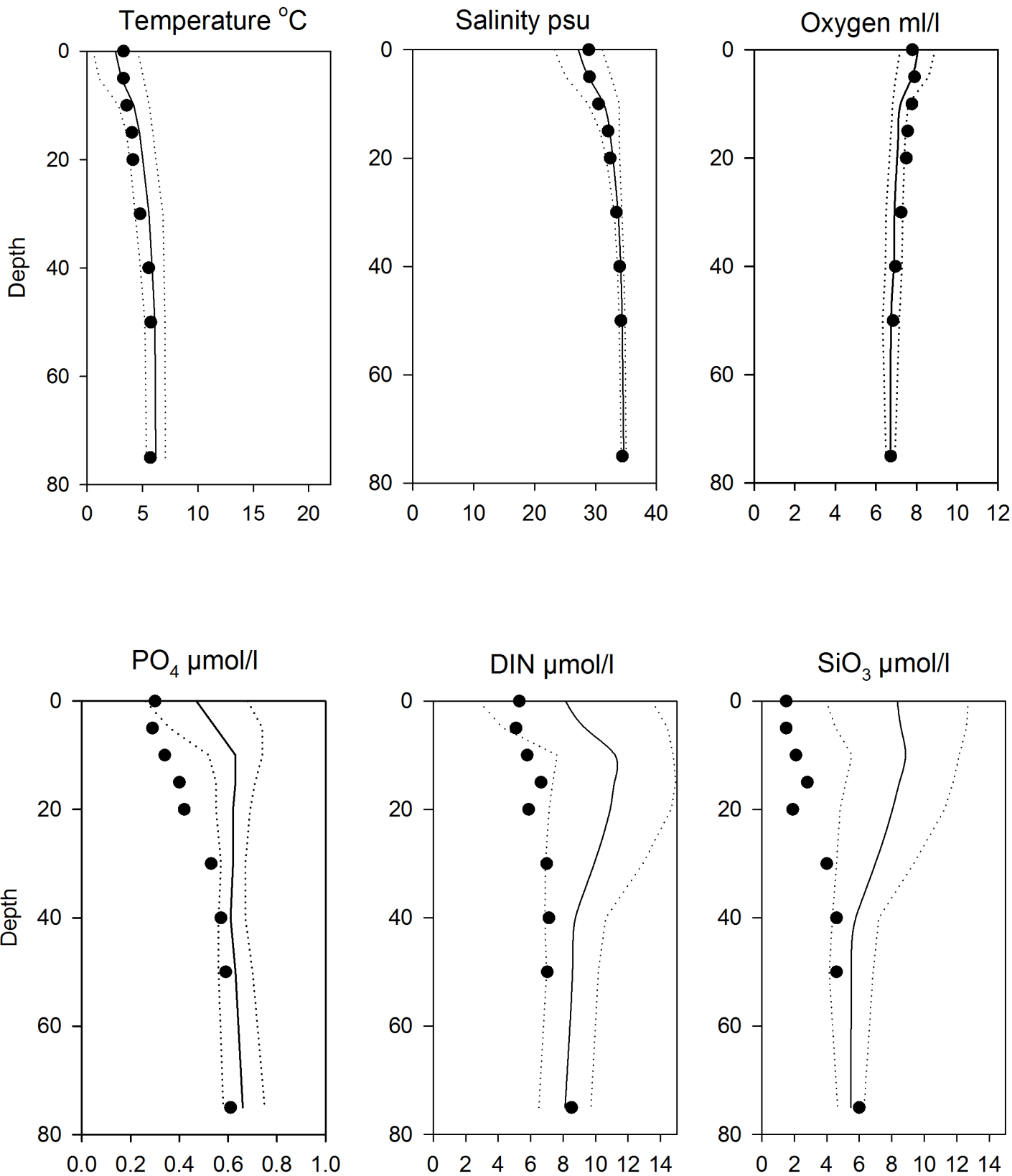


OXYGEN IN BOTTOM WATER (depth >=75m)



Vertical profiles Å13 February

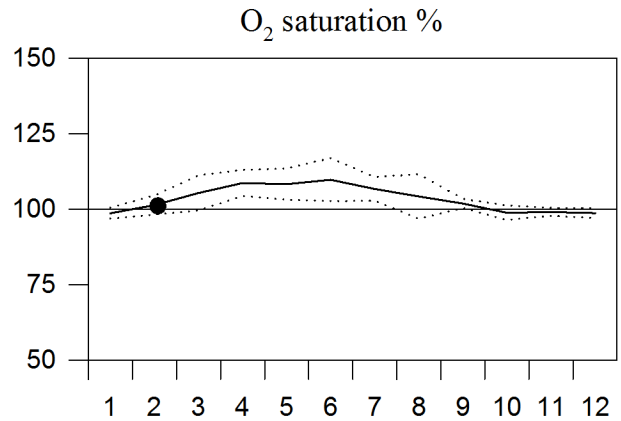
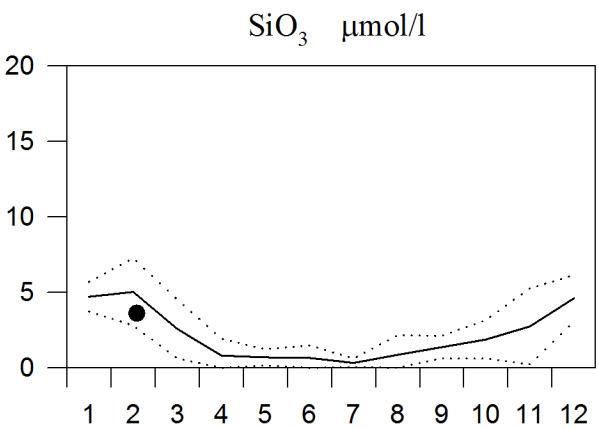
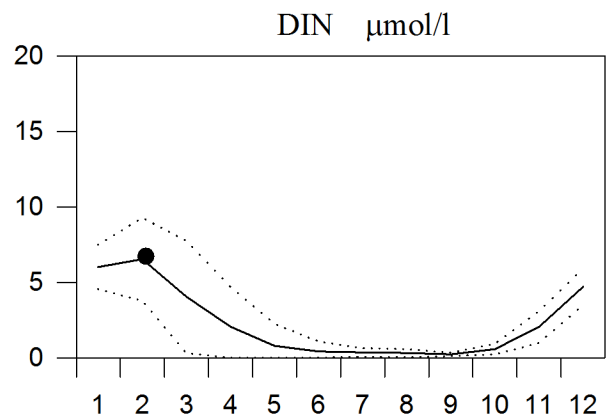
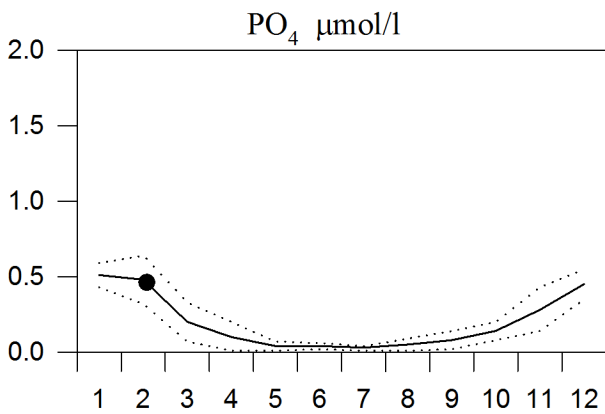
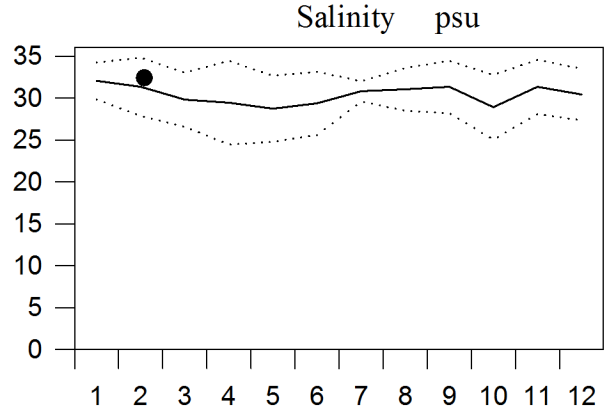
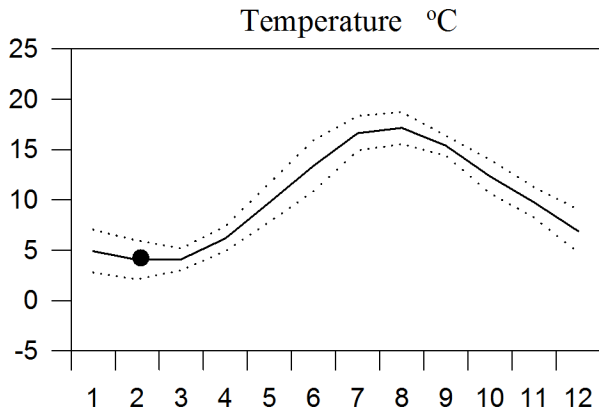
— Mean 1996-2010 St.Dev. ● 2015



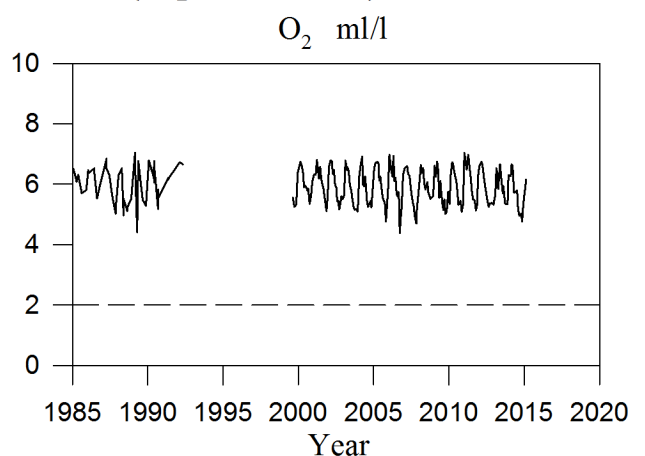
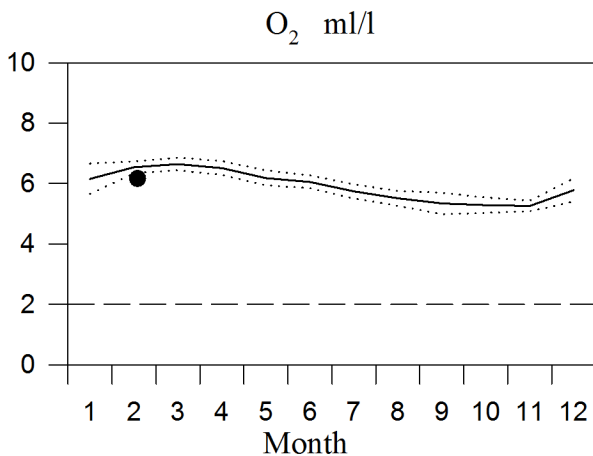
STATION Å15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

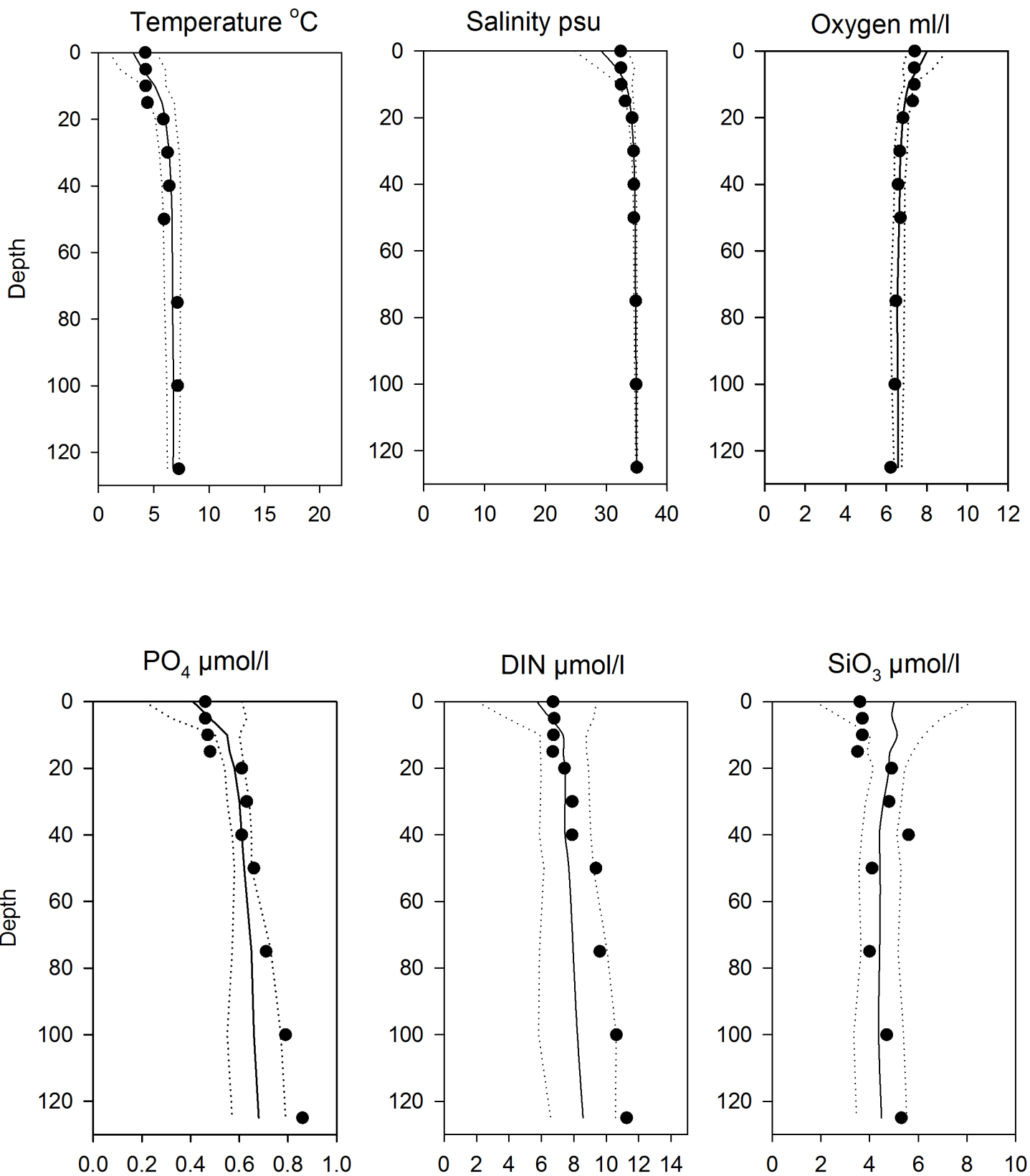


OXYGEN IN BOTTOM WATER (depth >=125m)



Vertical profiles Å15 February

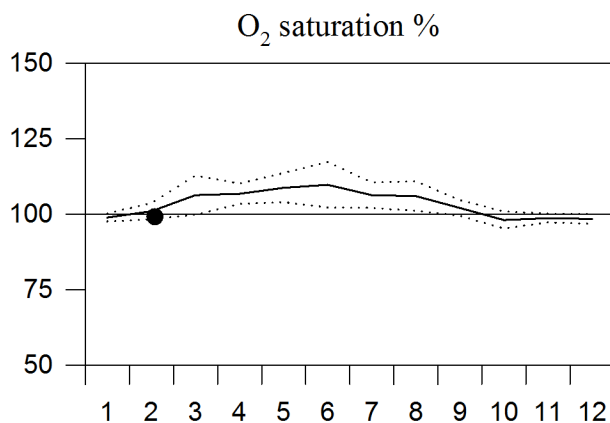
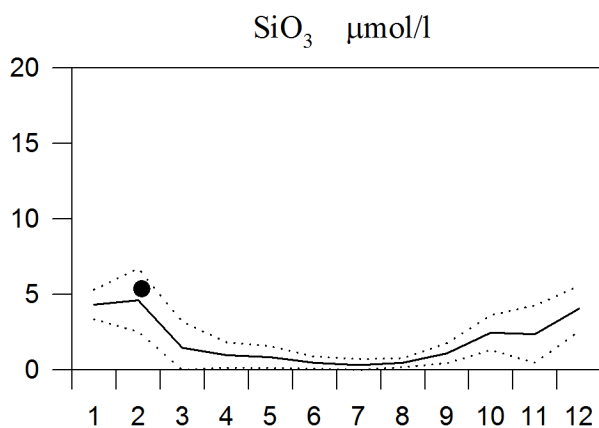
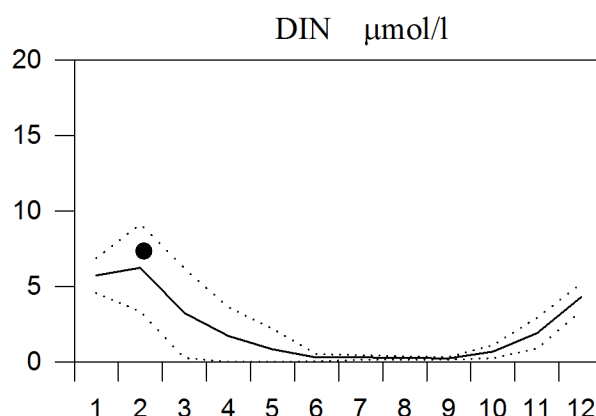
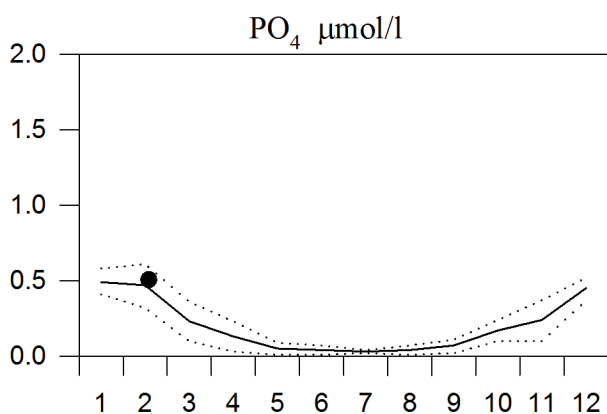
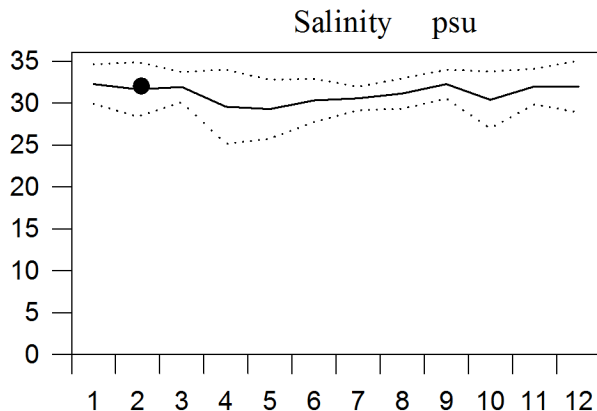
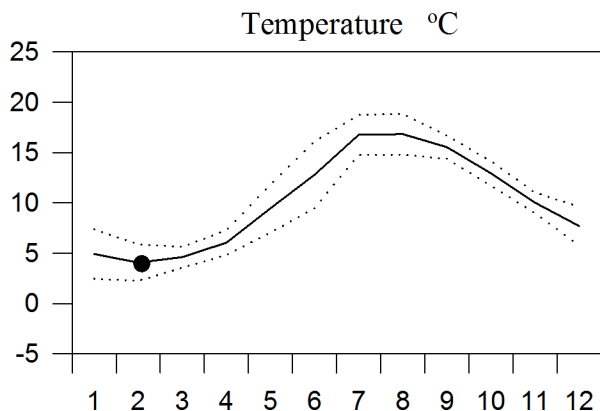
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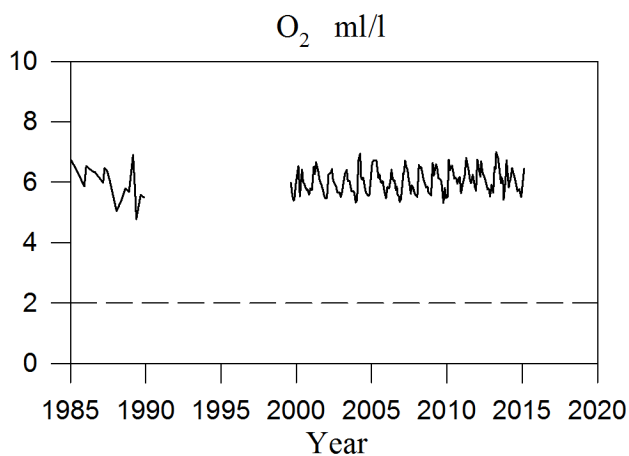
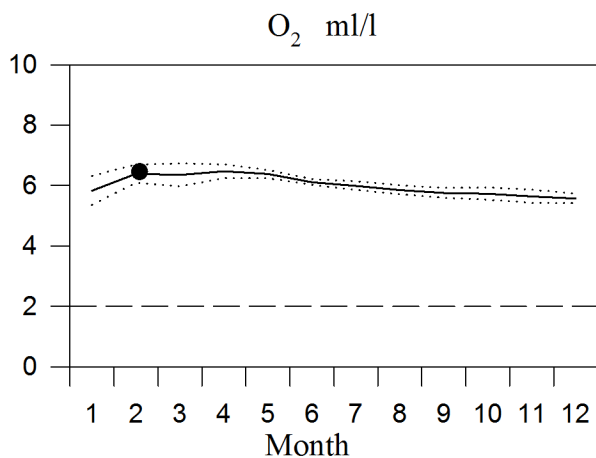
STATION Å17 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

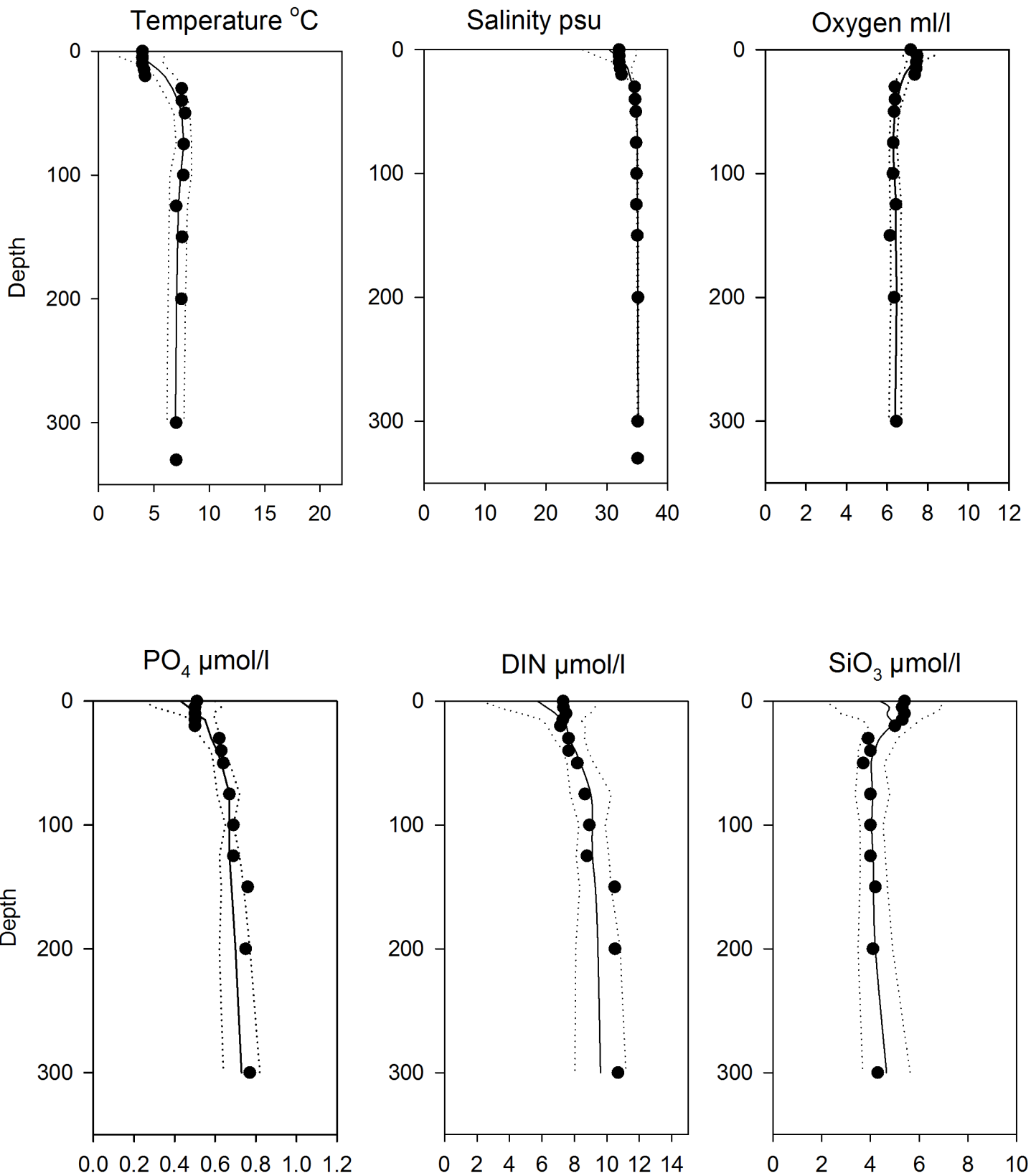


OXYGEN IN BOTTOM WATER (depth = 300m)



Vertical profiles Å17 February

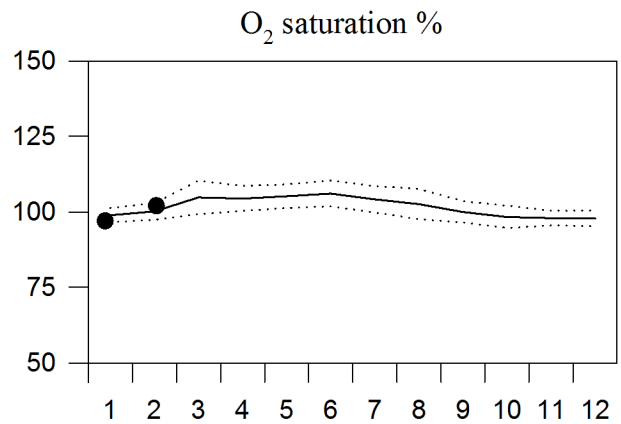
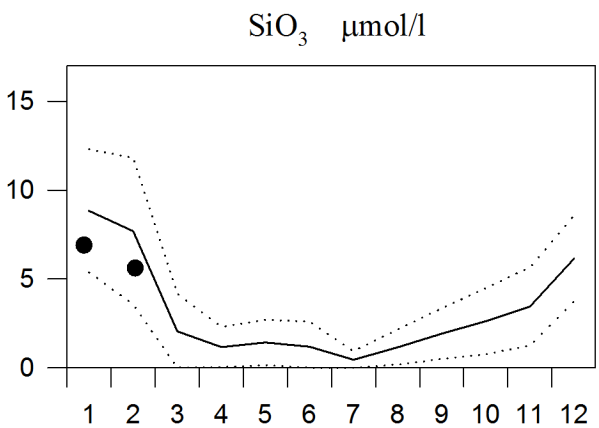
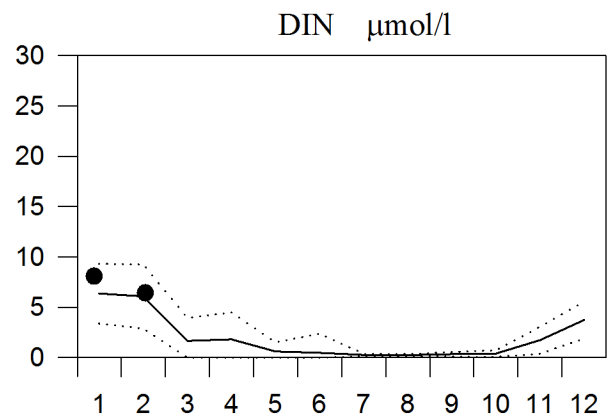
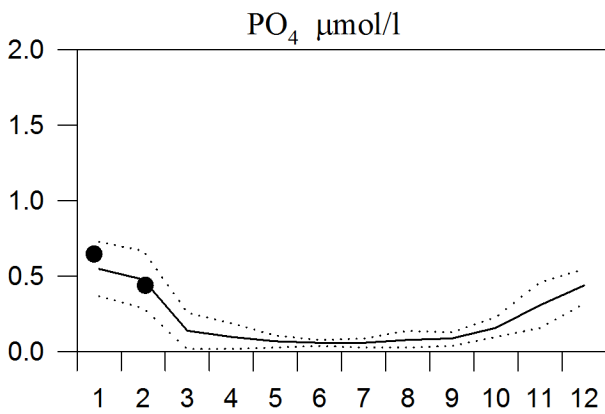
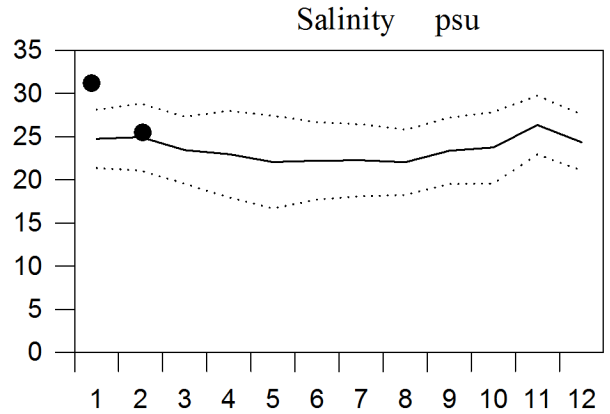
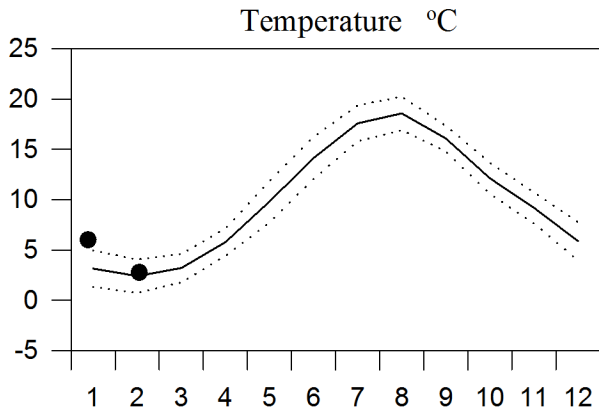
— Mean 1996-2010 St.Dev. ● 2015



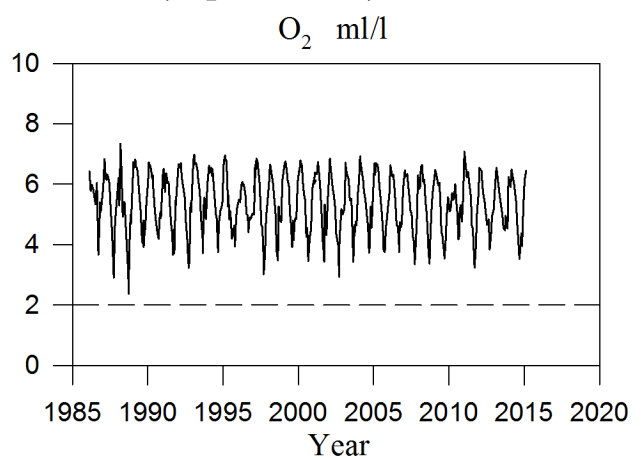
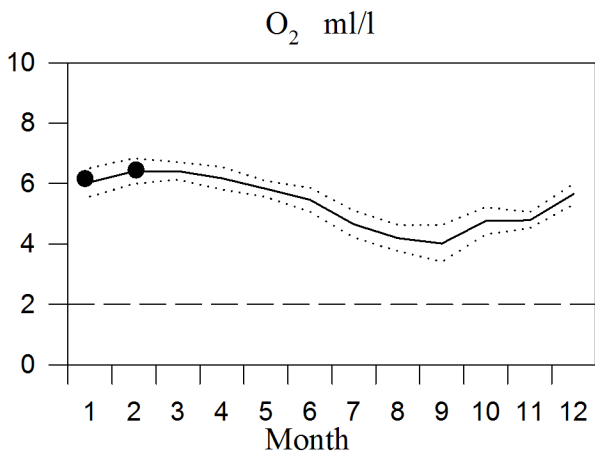
STATION FLADEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

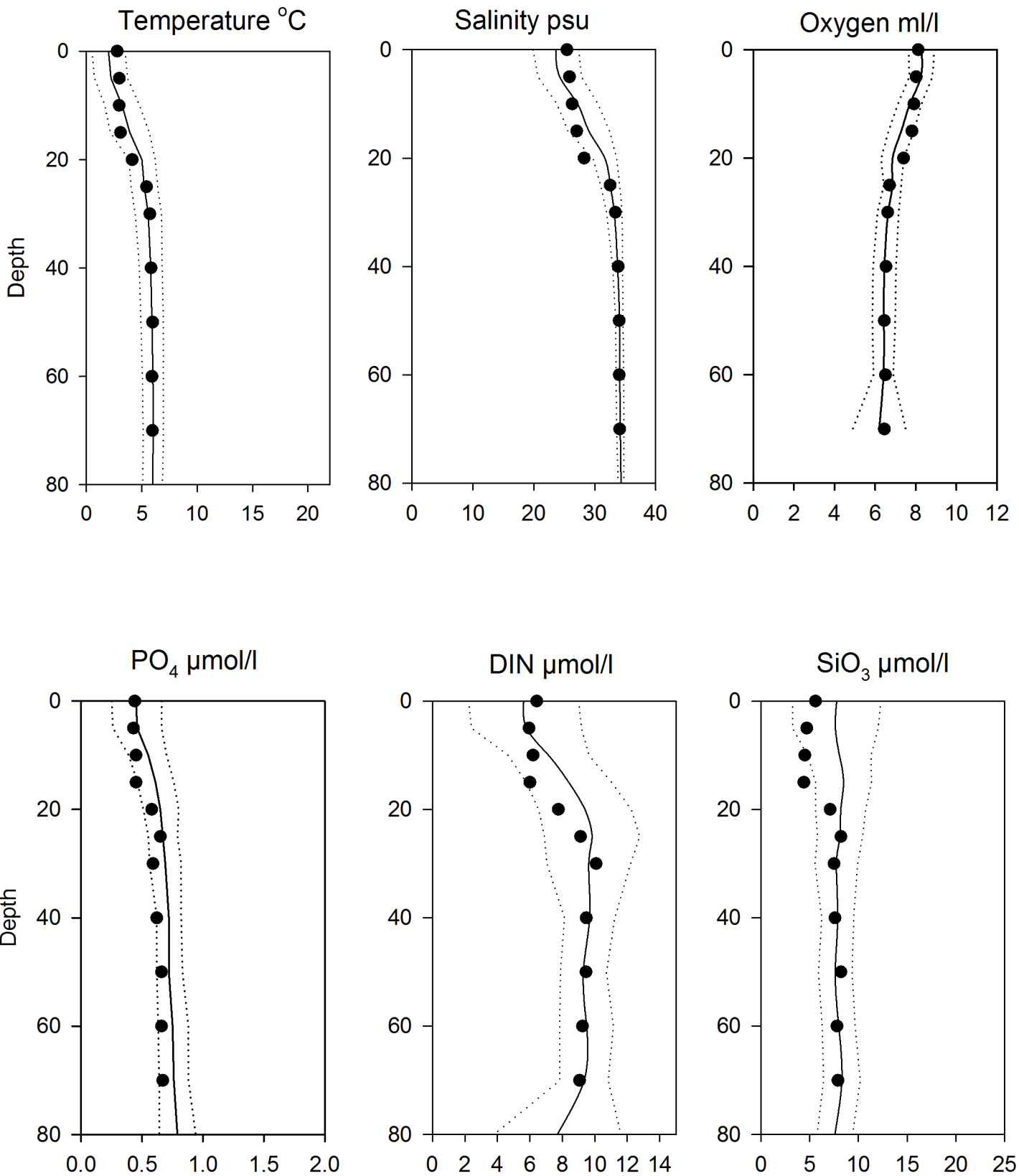


OXYGEN IN BOTTOM WATER (depth > 70m)



Vertical profiles Fladen February

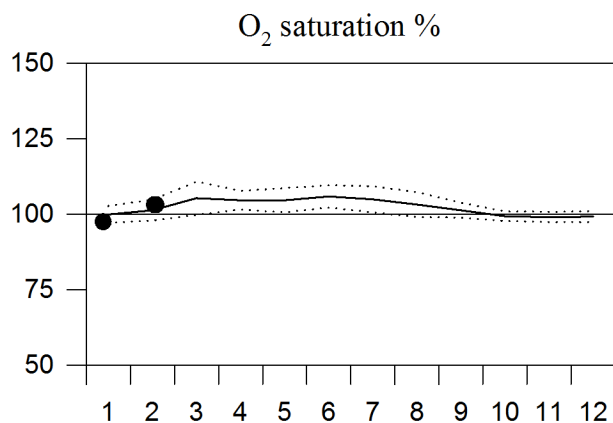
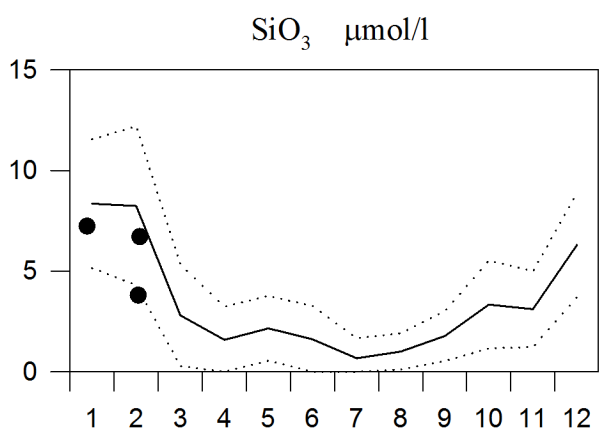
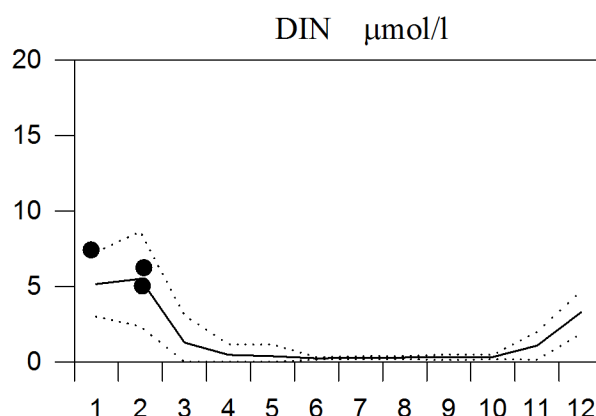
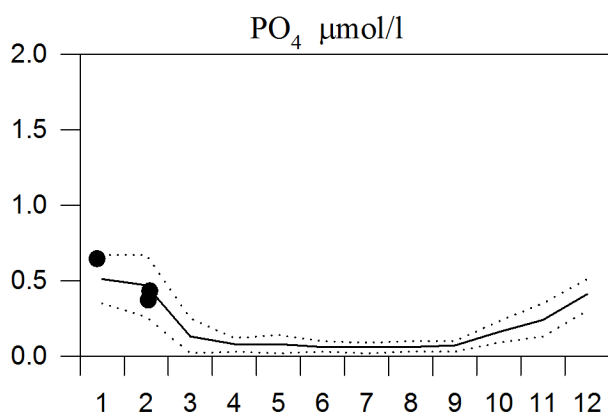
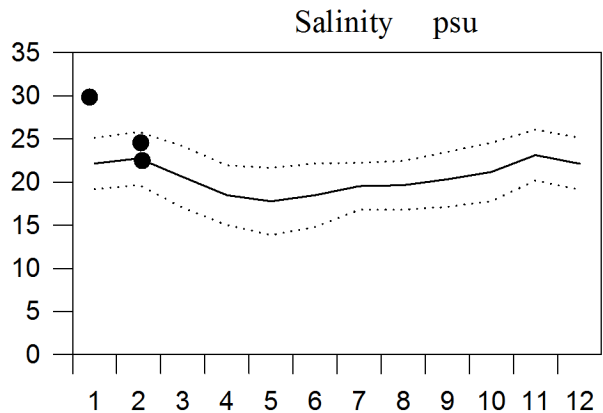
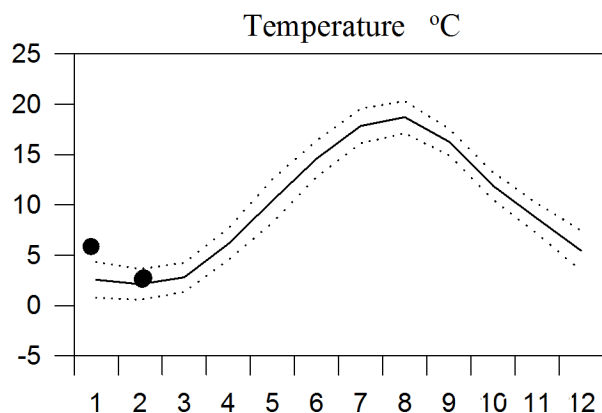
— Mean 1996-2010 St.Dev. ● 2015



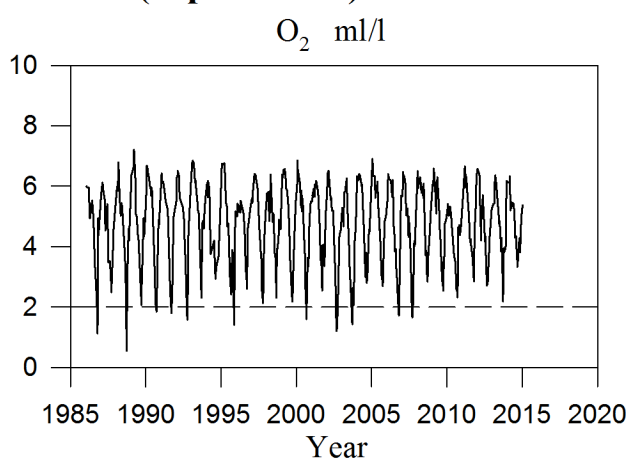
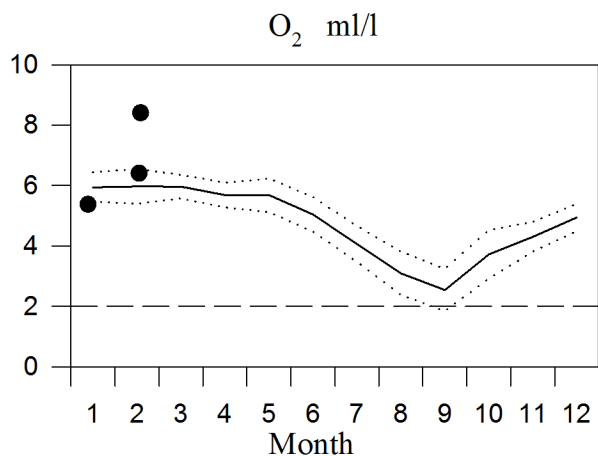
STATION ANHOLT E SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015



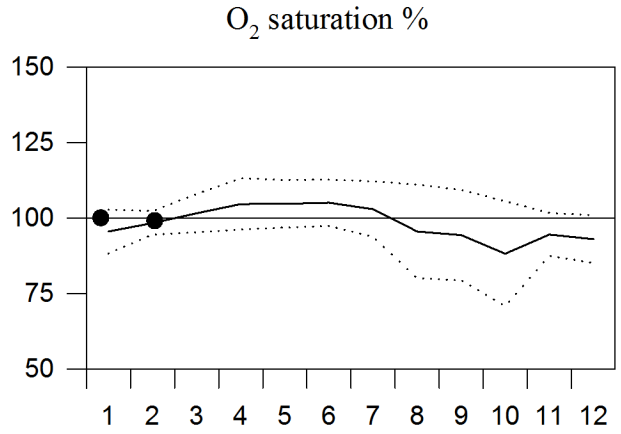
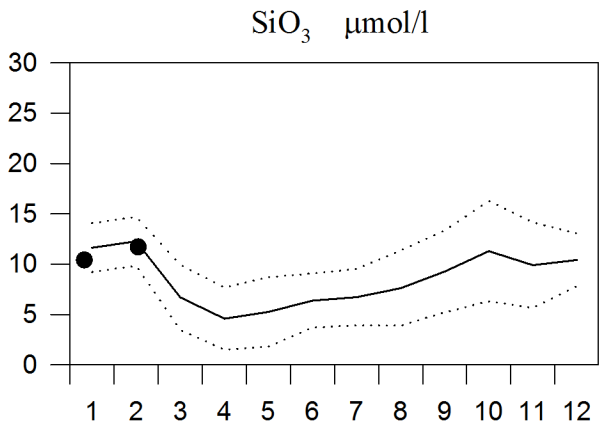
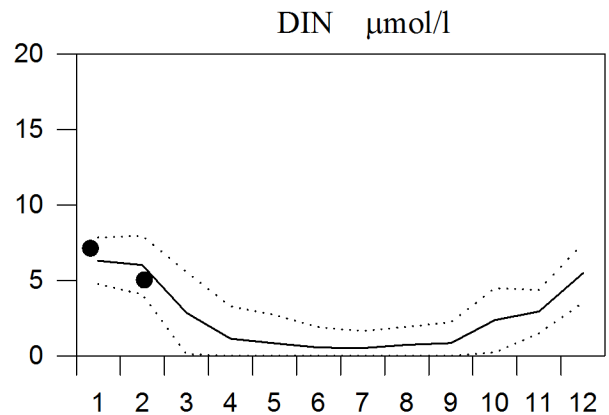
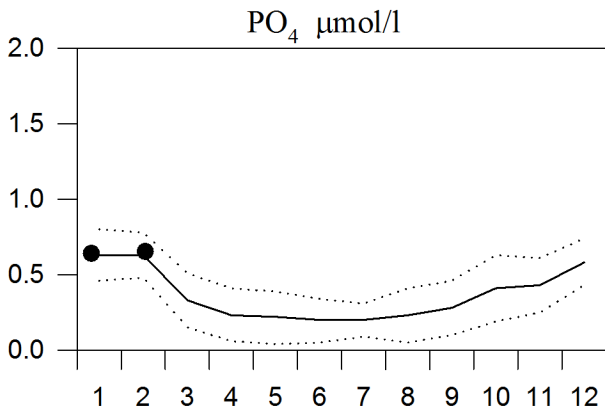
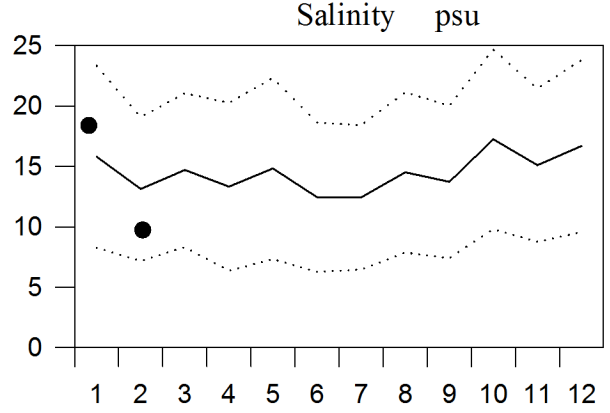
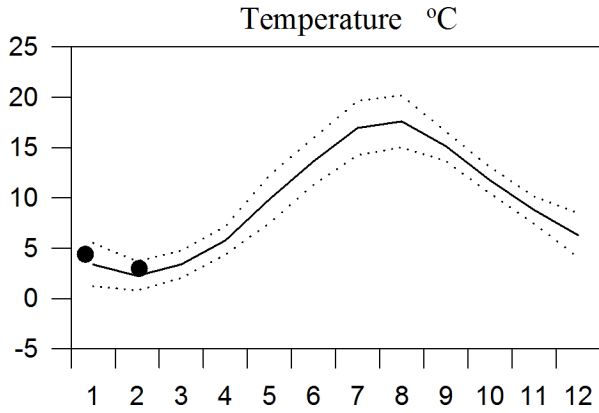
OXYGEN IN BOTTOM WATER (depth > 50m)



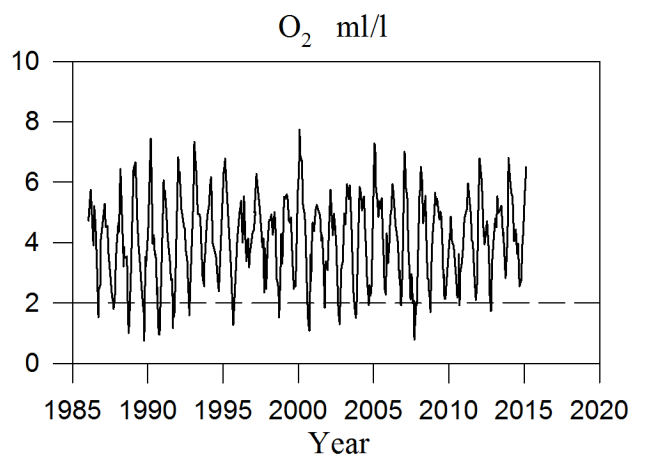
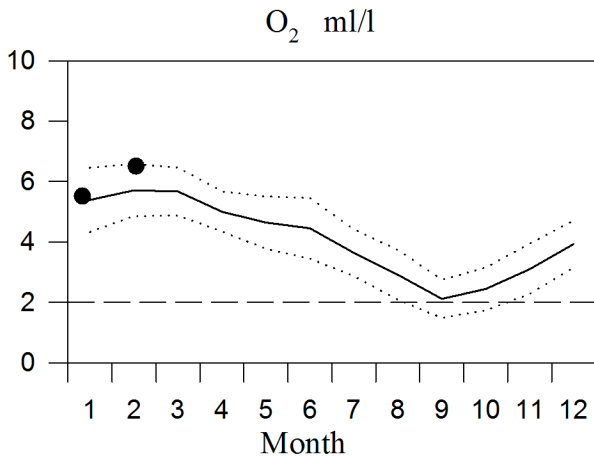
STATION W LANDSKRONA SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

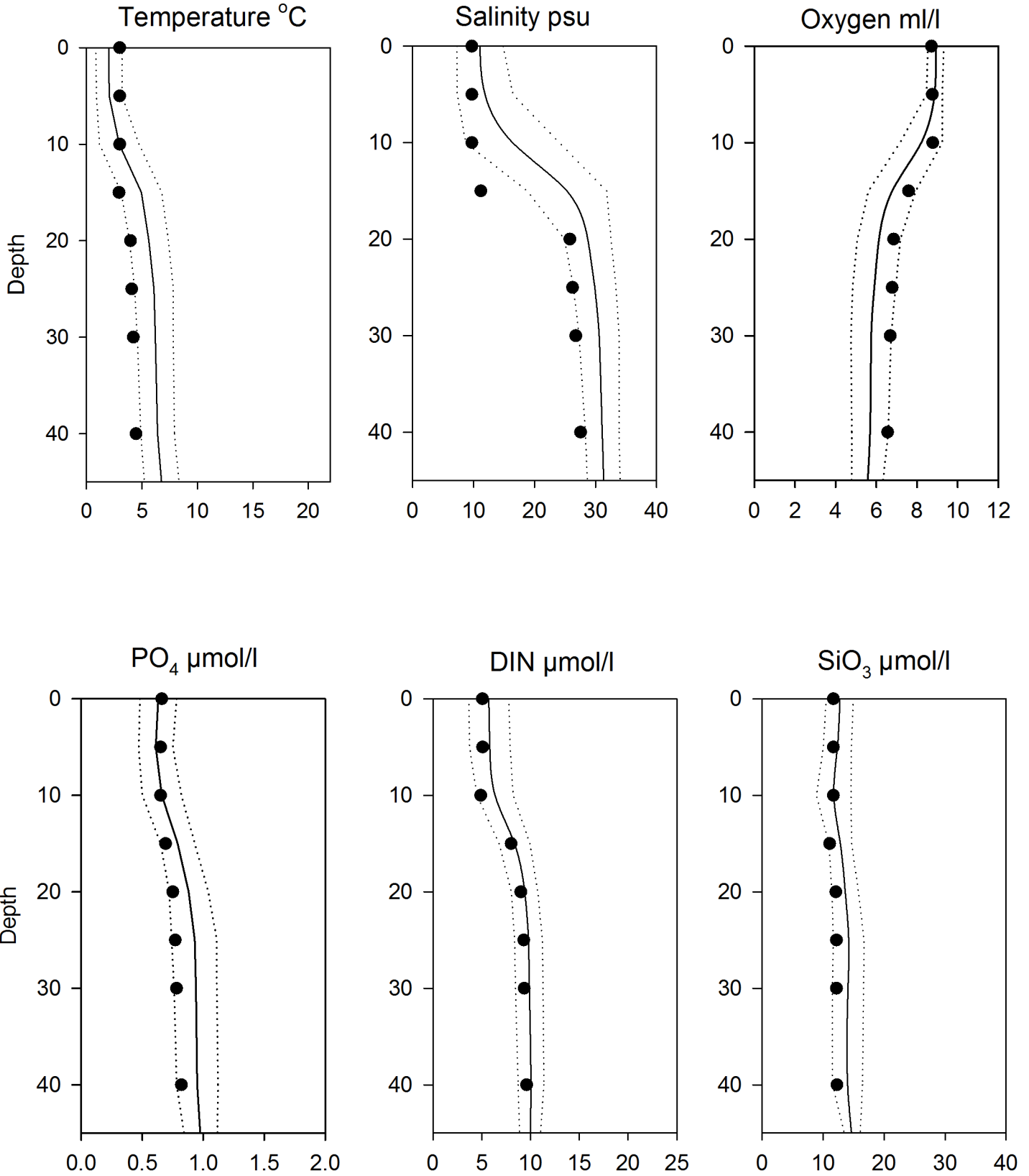


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles W Landskrona Febuary

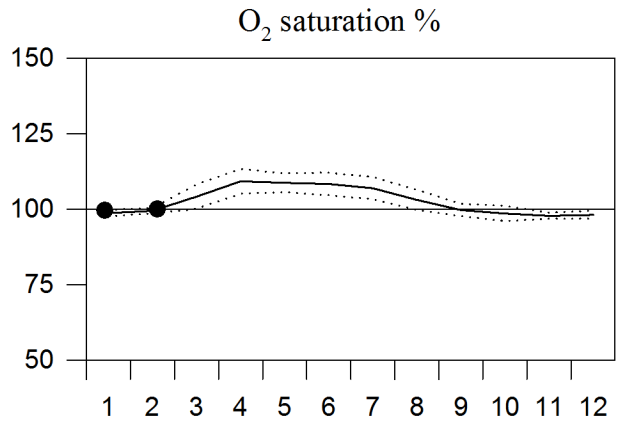
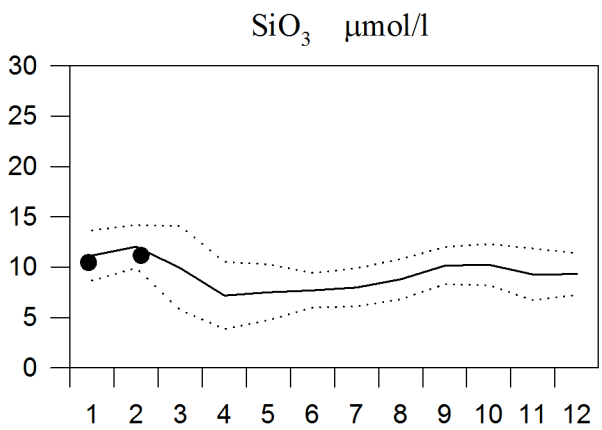
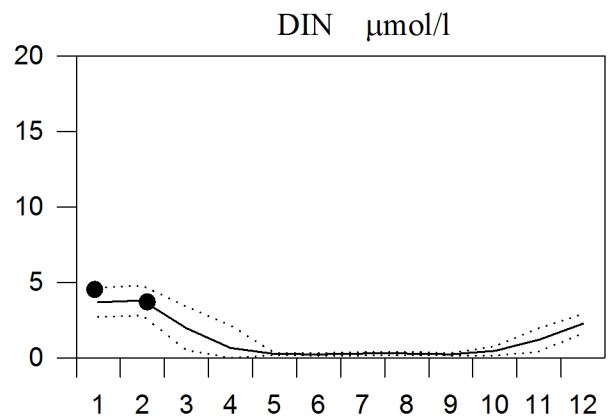
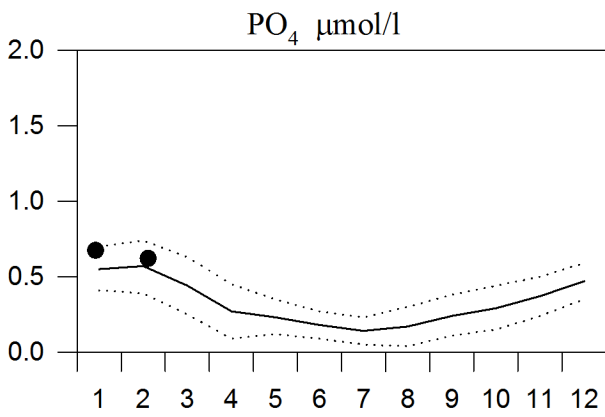
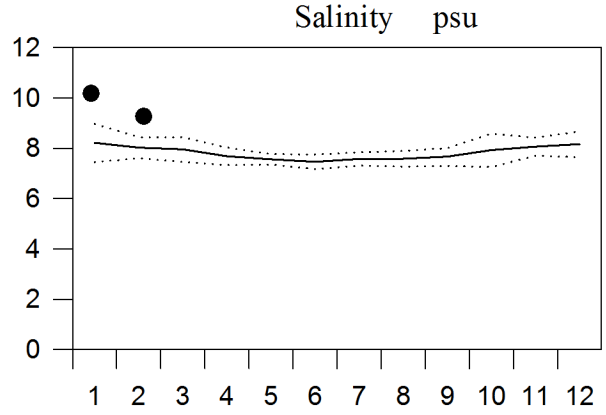
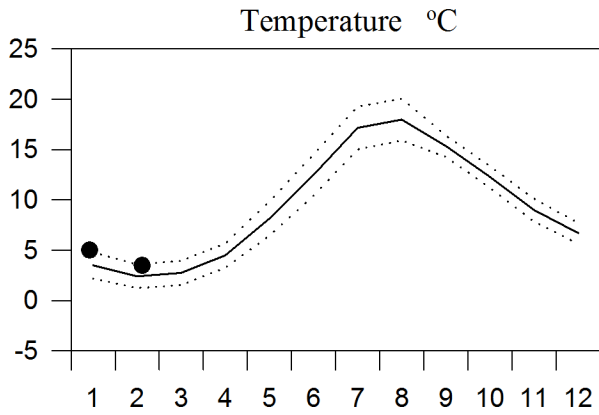
— Mean 1996-2010 St.Dev. ● 2015



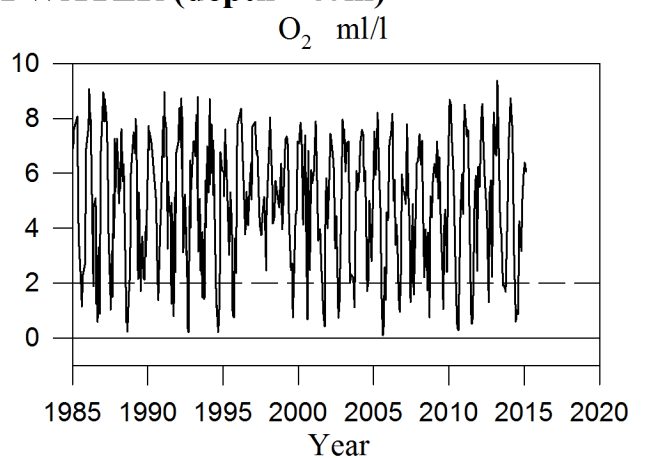
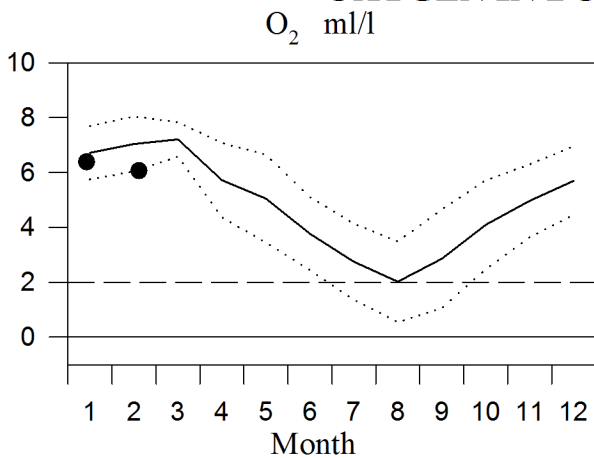
STATION BY1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

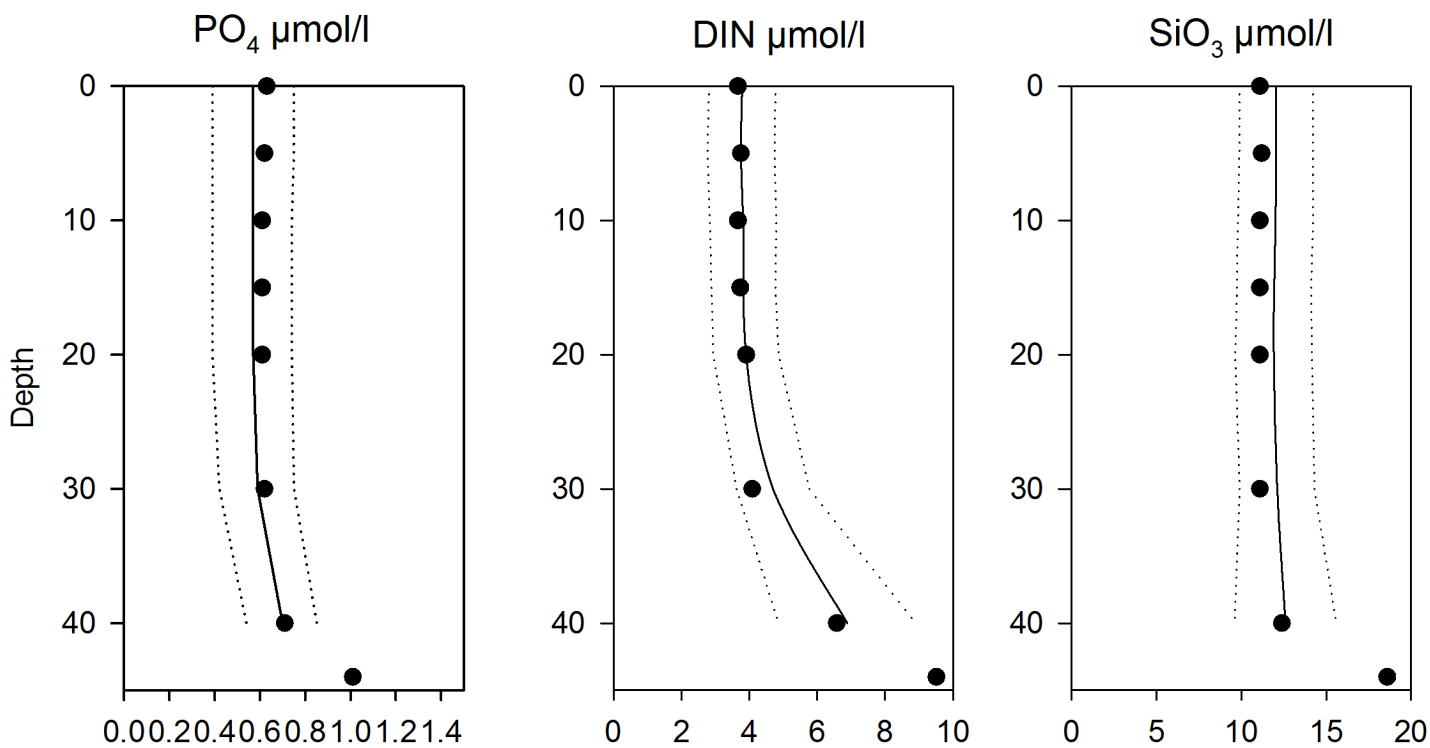
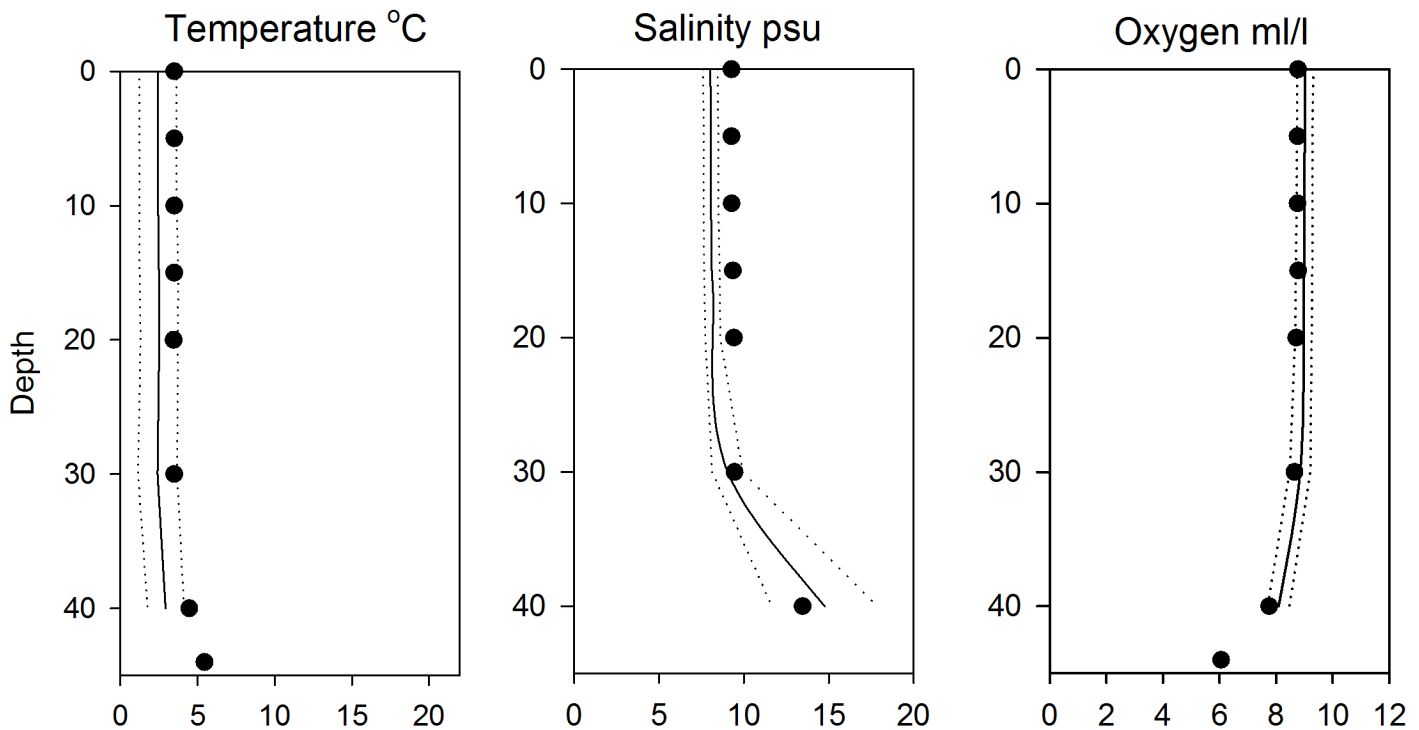


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY1 February

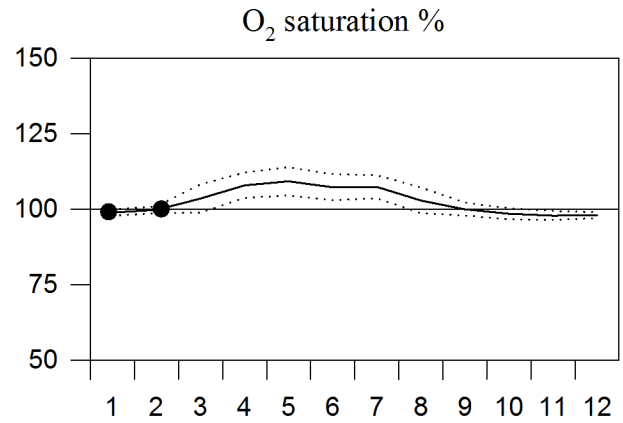
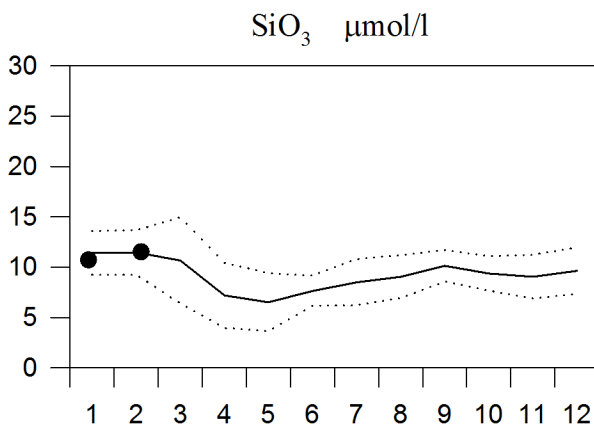
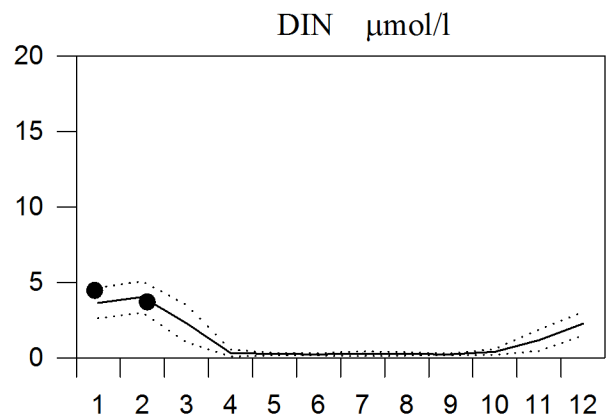
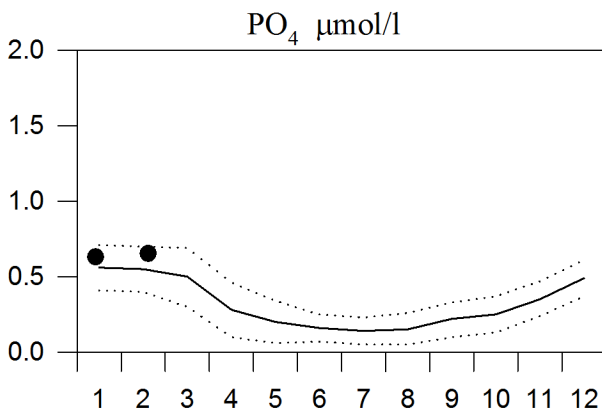
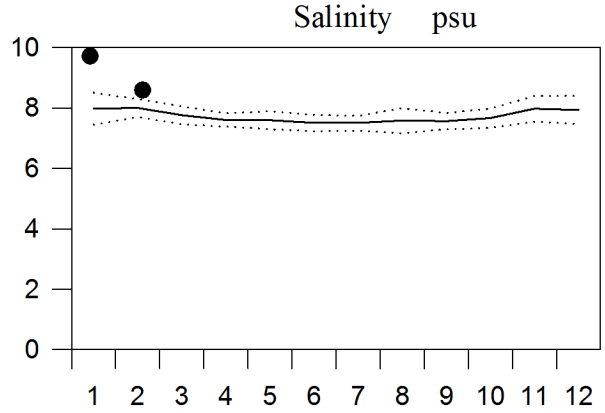
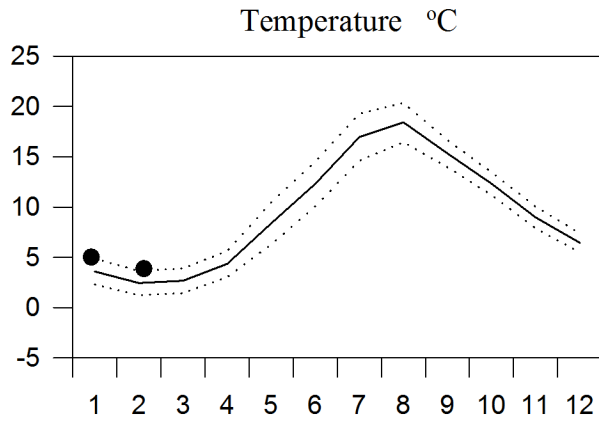
— Mean 1996-2010 ····· St.Dev. ● 2015



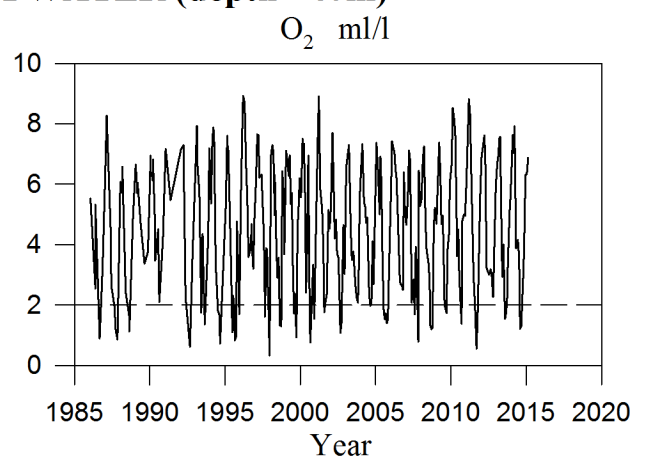
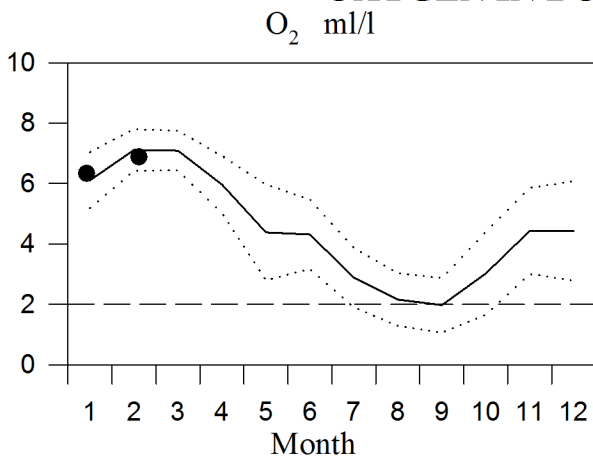
STATION BY2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

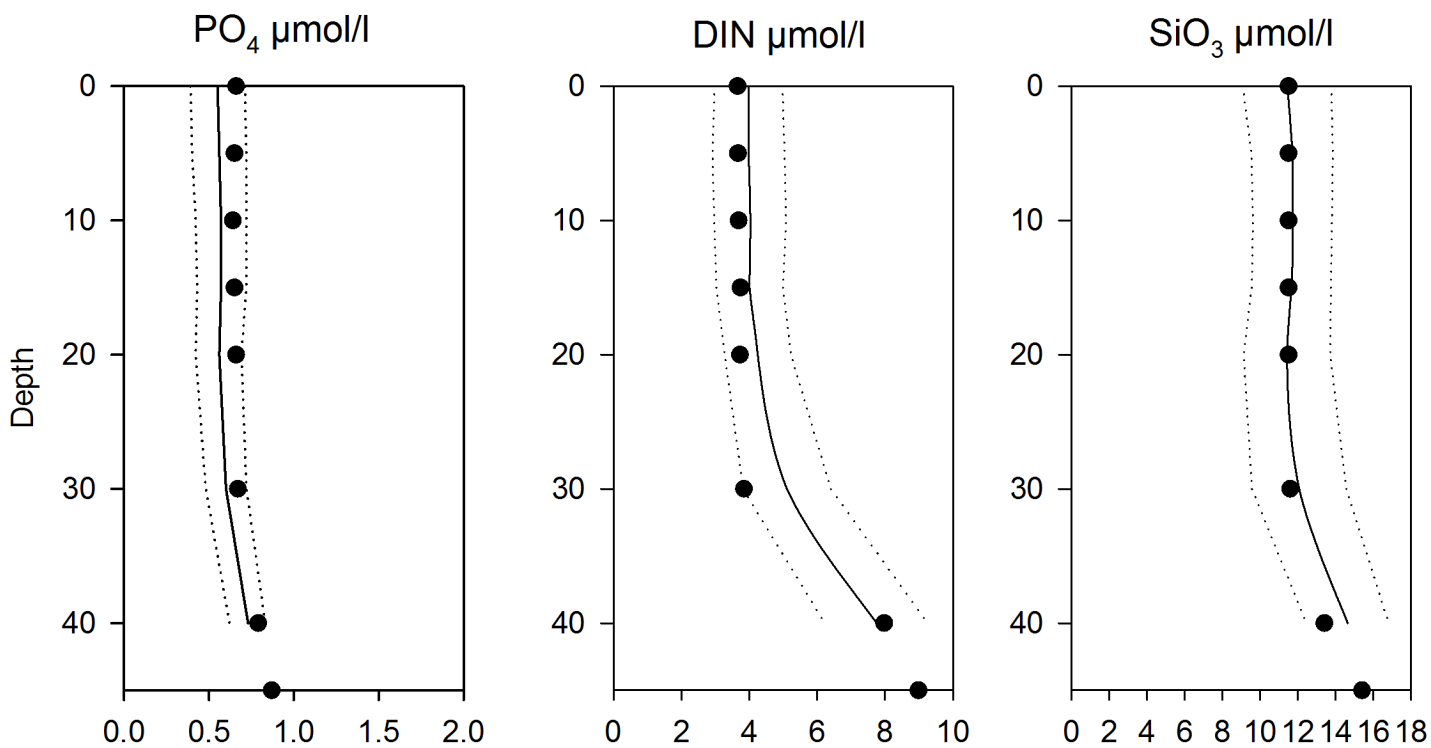
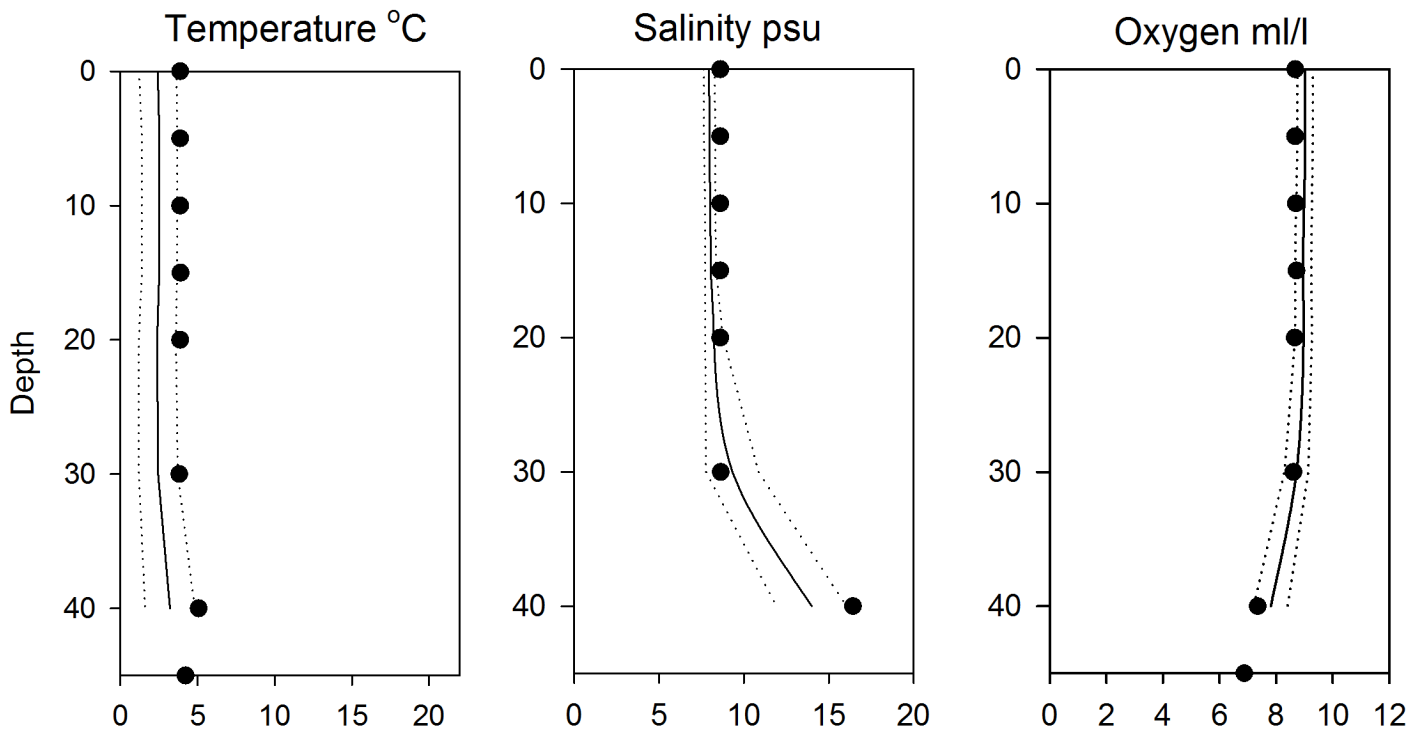


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY2 February

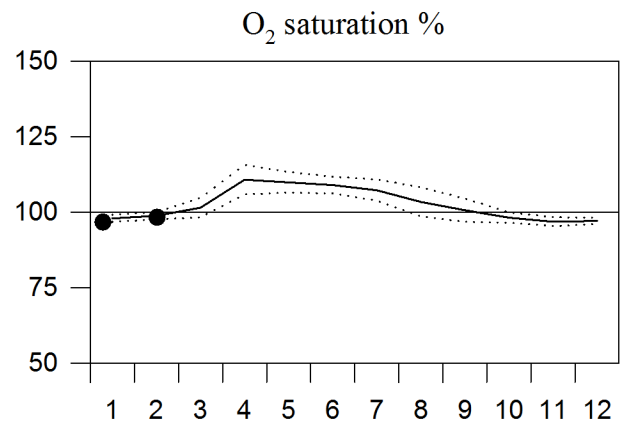
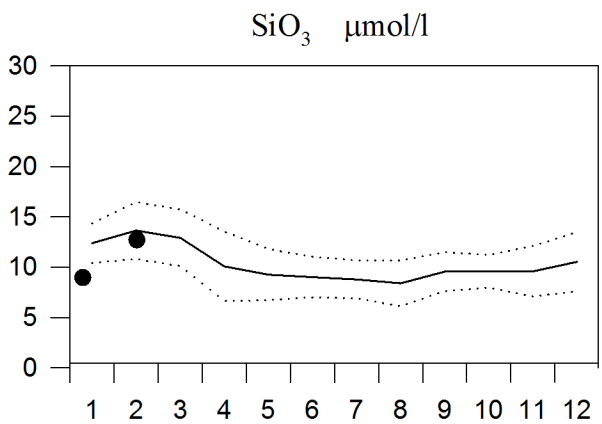
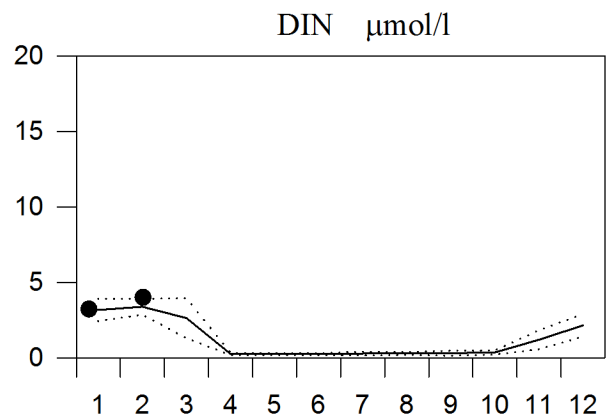
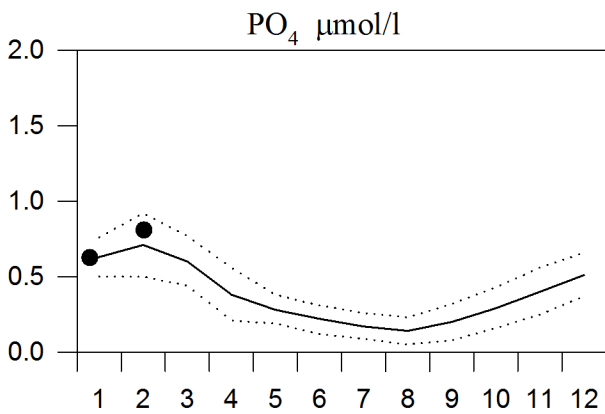
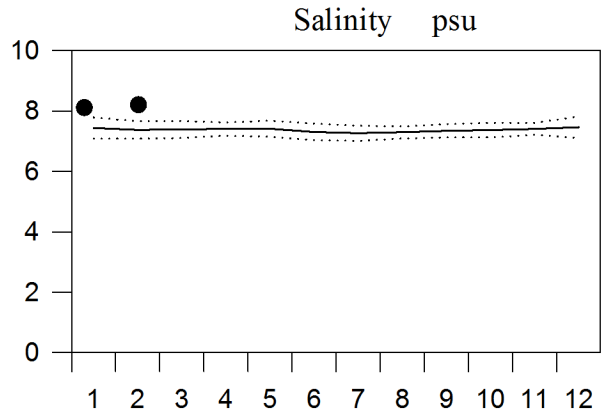
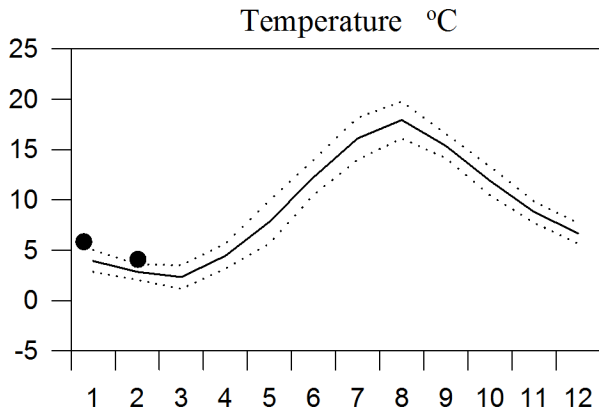
— Mean 1996-2010 ····· St.Dev. ● 2015



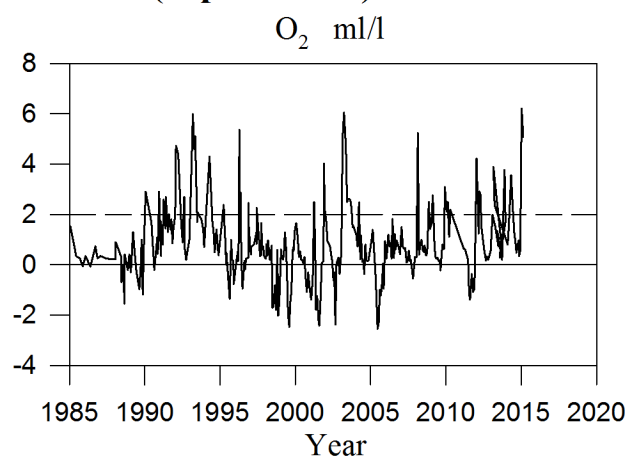
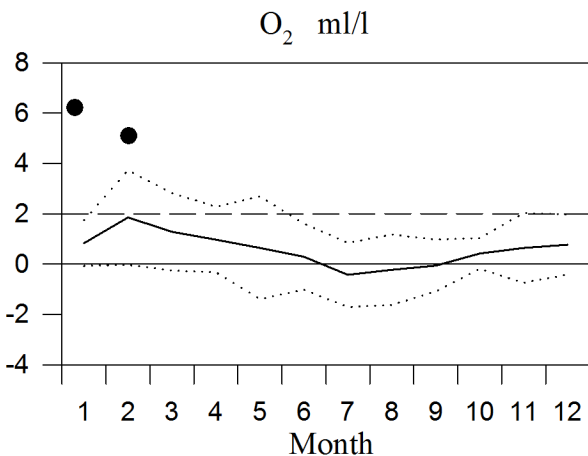
STATION HANÖBUKTEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

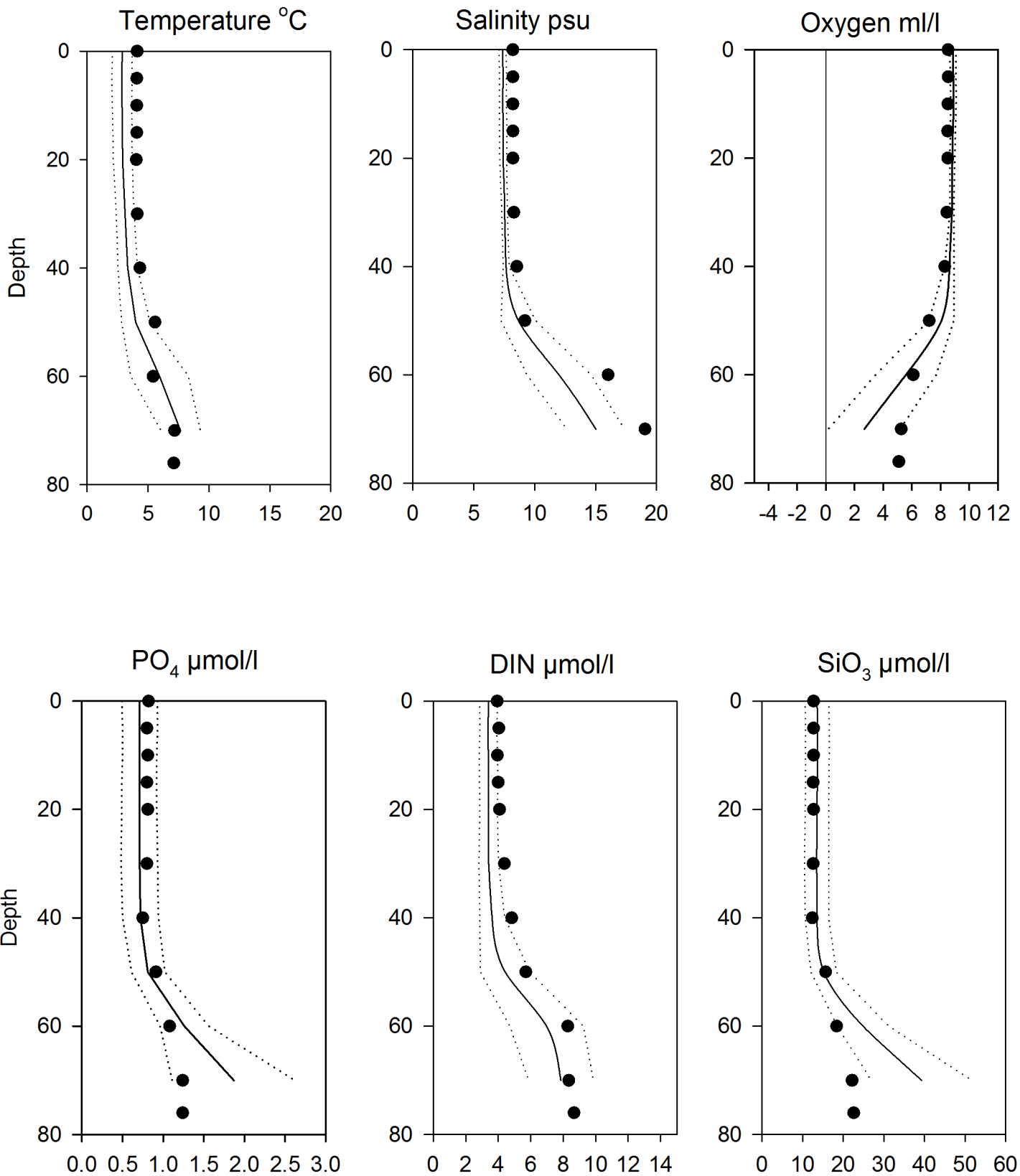


OXYGEN IN BOTTOM WATER (depth > 70m)



Vertical profiles Hanöbukten February

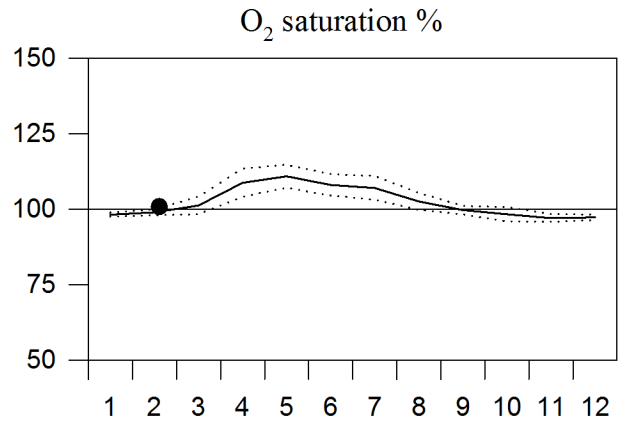
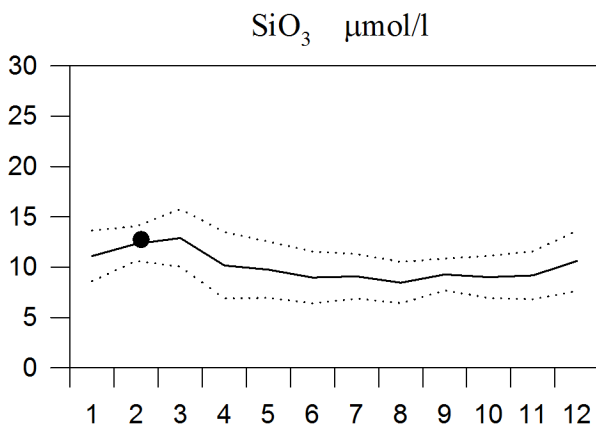
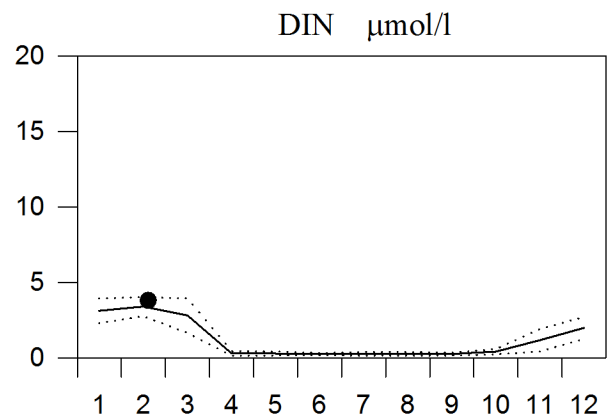
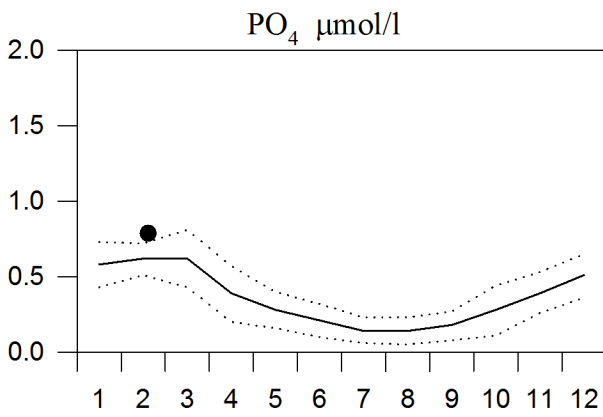
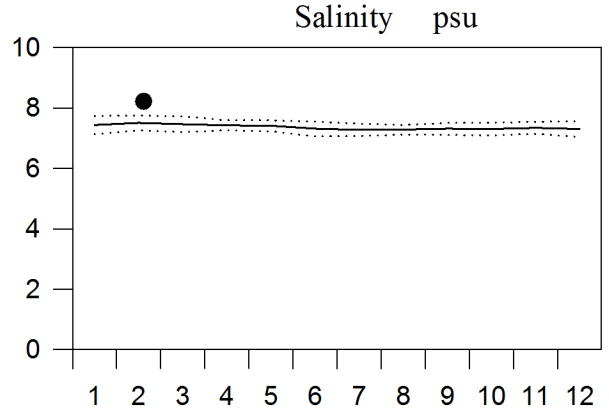
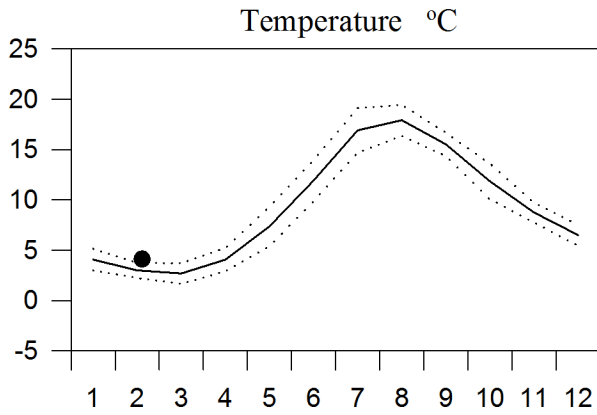
— Mean 1996-2010 ····· St.Dev. ● 2015



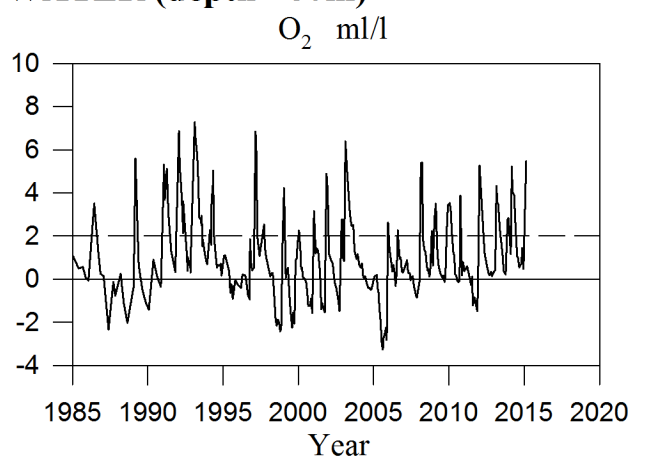
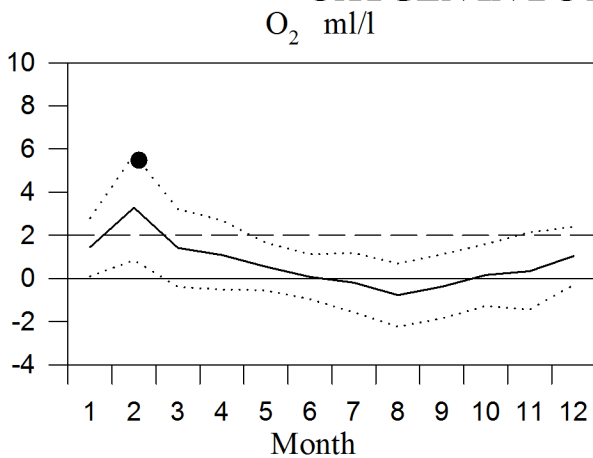
STATION BY4 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

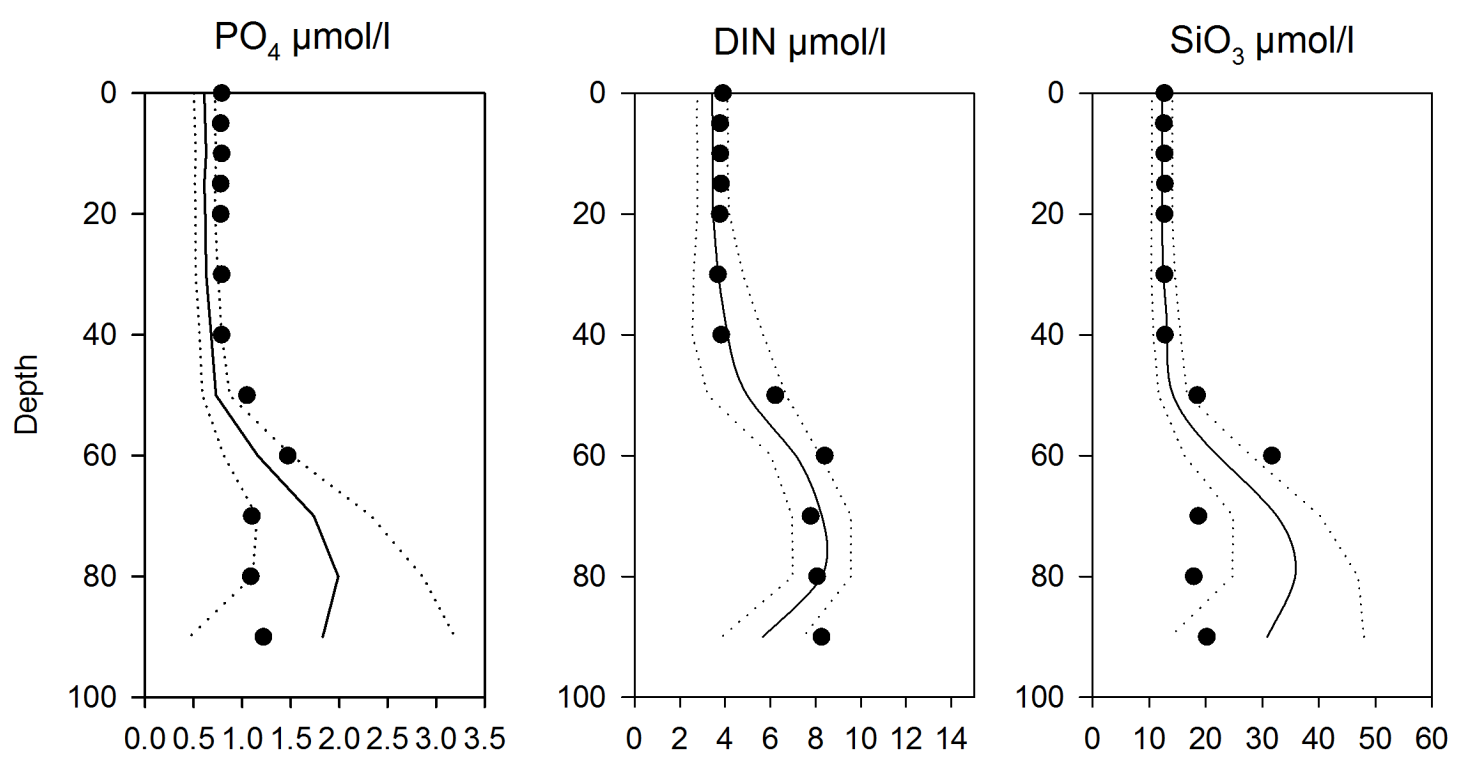
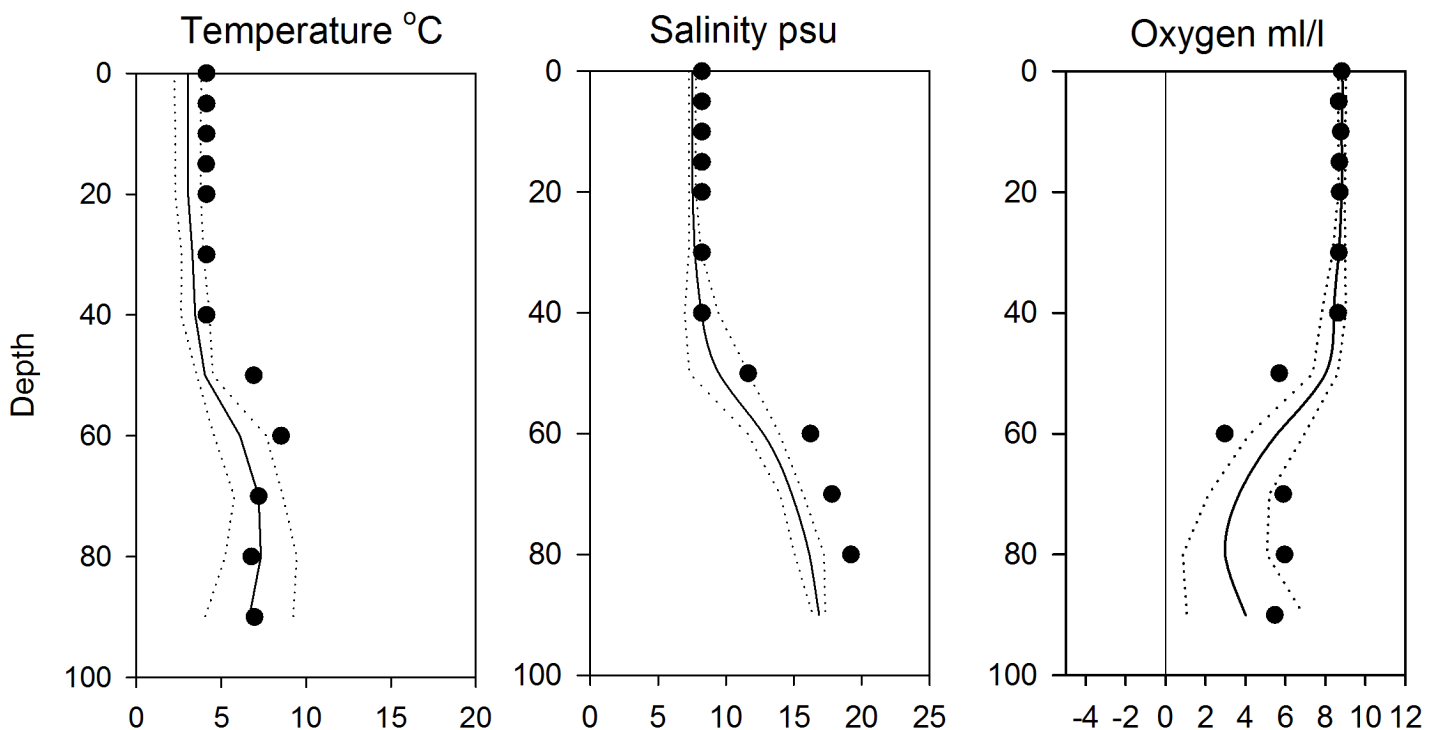


OXYGEN IN BOTTOM WATER (depth >80m)



Vertical profiles BY4 February

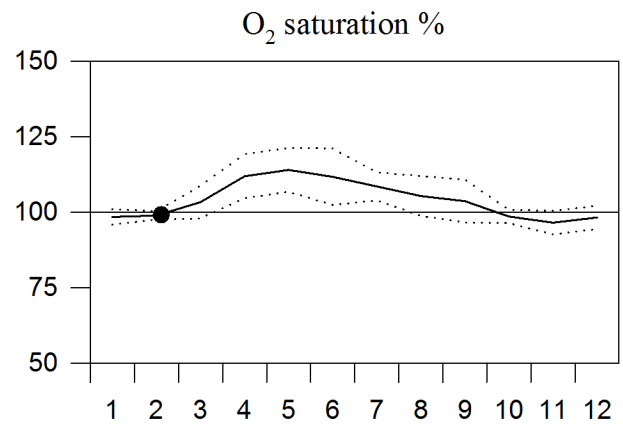
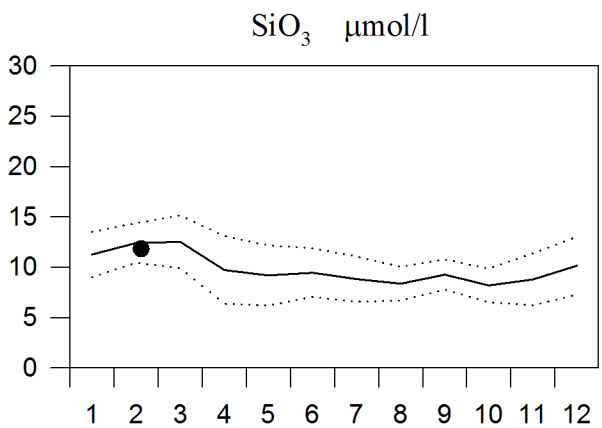
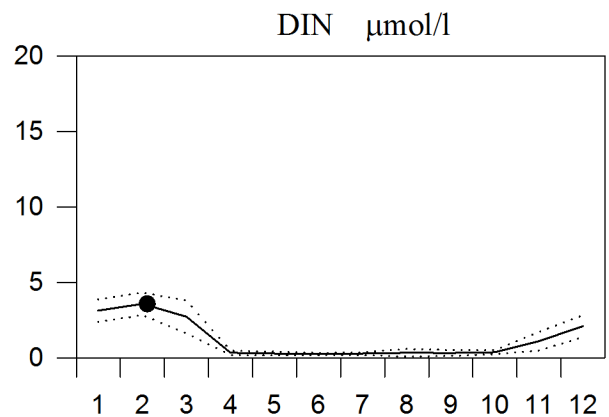
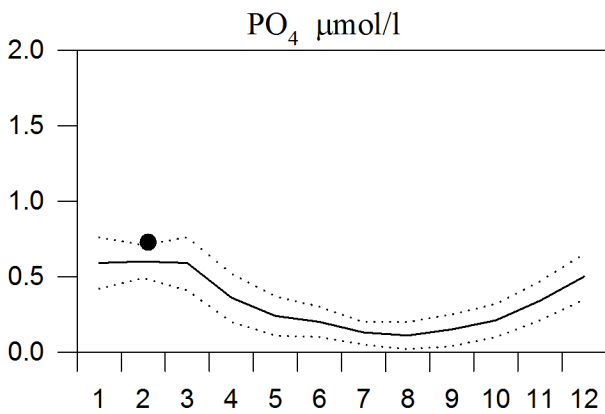
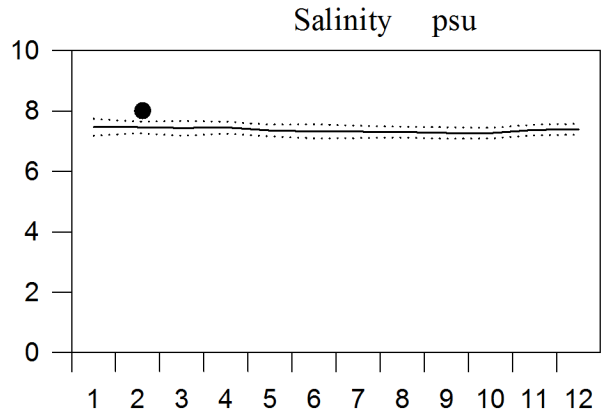
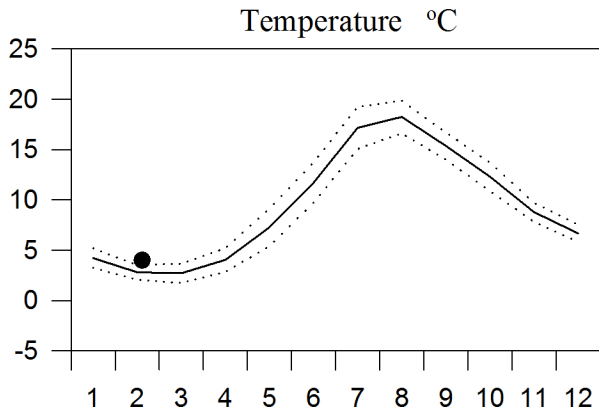
— Mean 1996-2010 ····· St.Dev. ● 2015



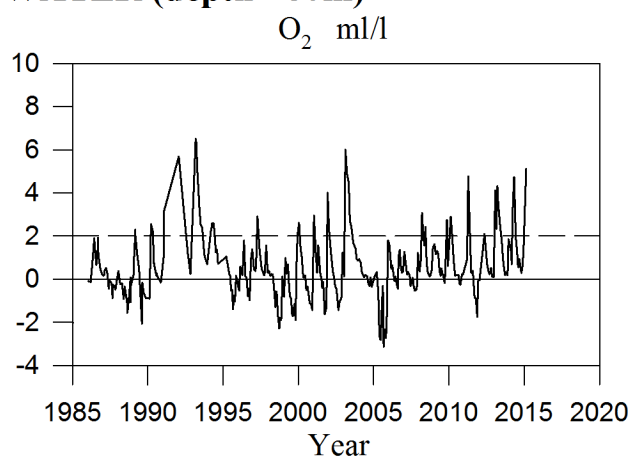
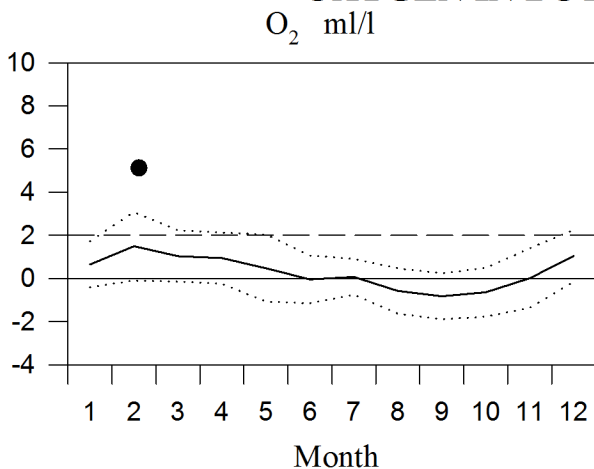
STATION BY5 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

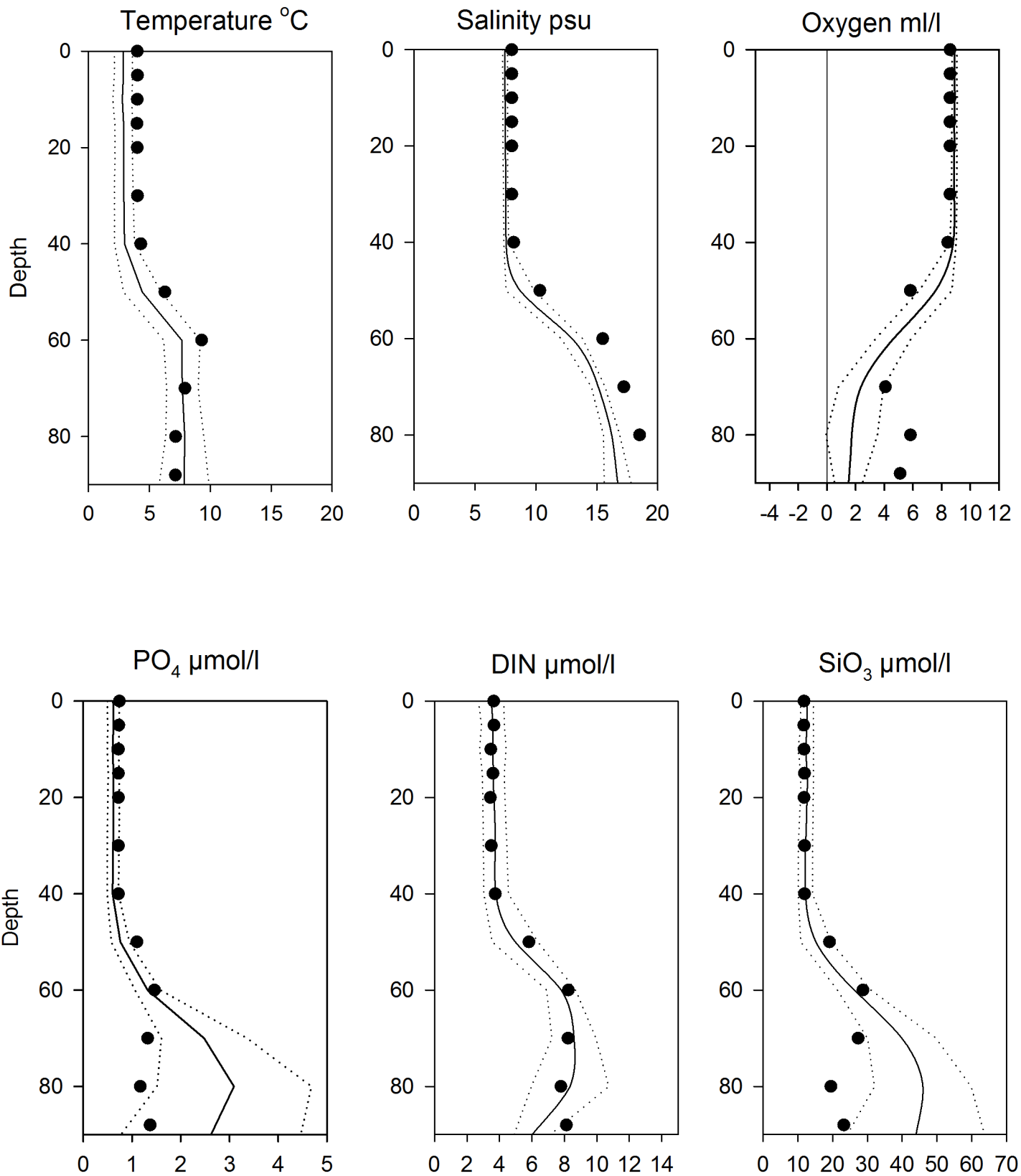


OXYGEN IN BOTTOM WATER (depth >80m)



Vertical profiles BY5 February

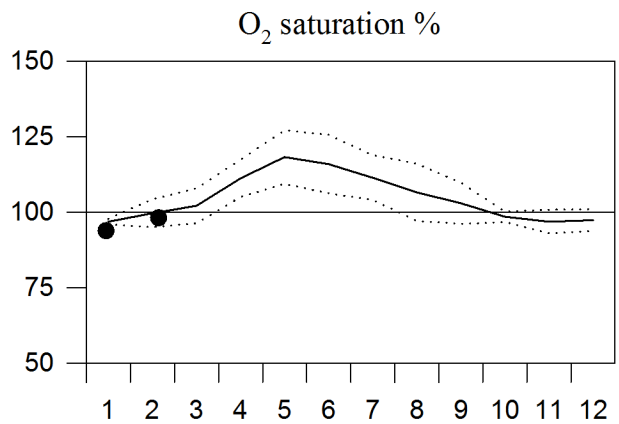
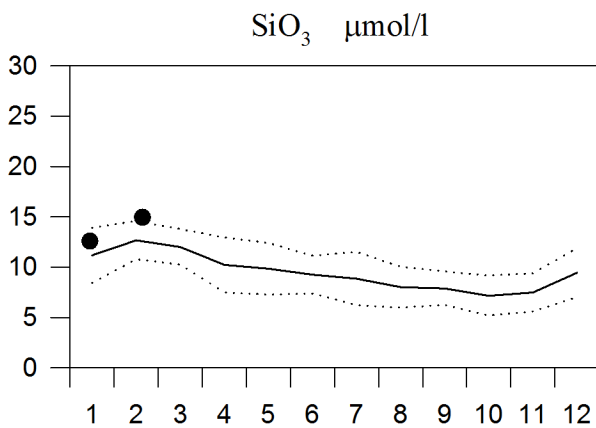
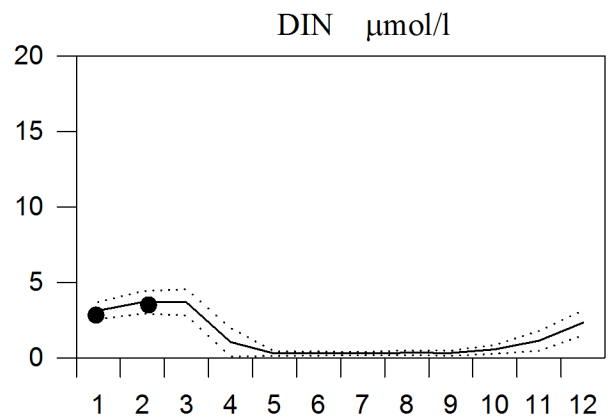
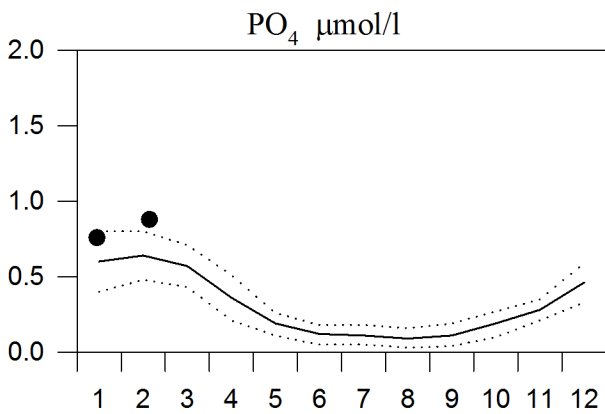
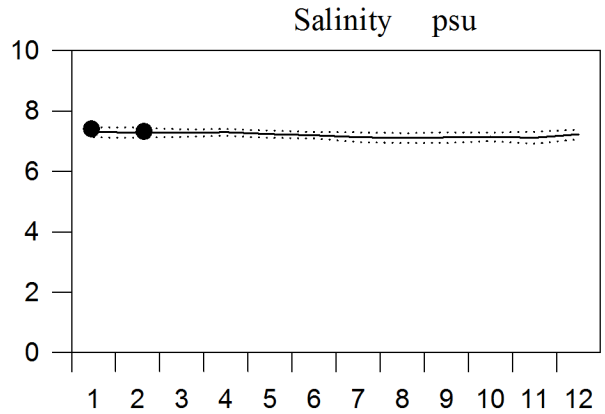
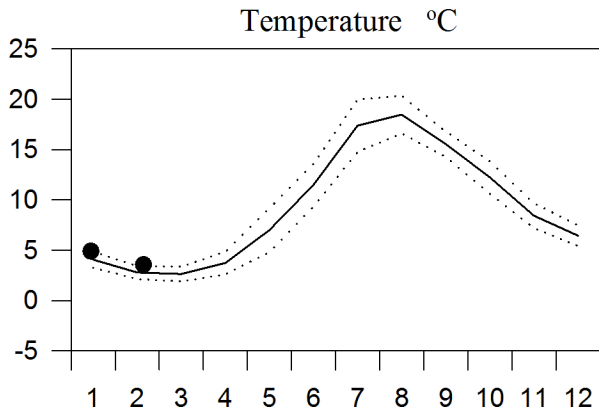
— Mean 1996-2010 ····· St.Dev. ● 2015



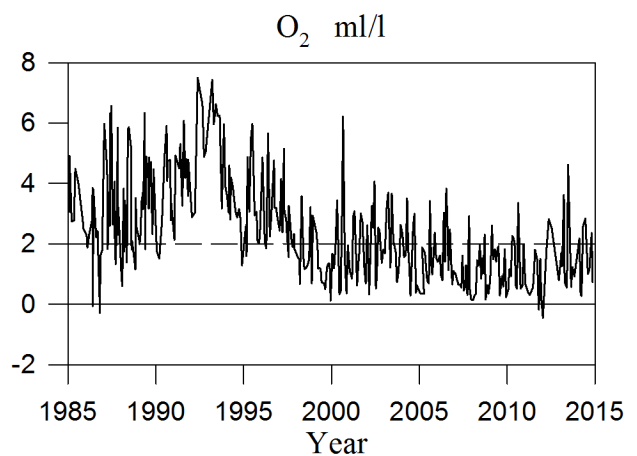
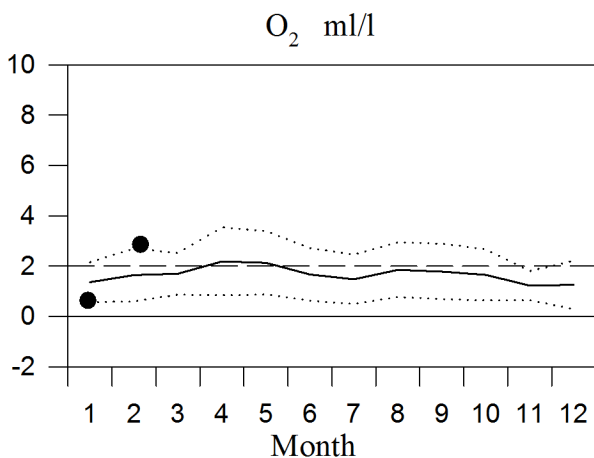
STATION BCS III-10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

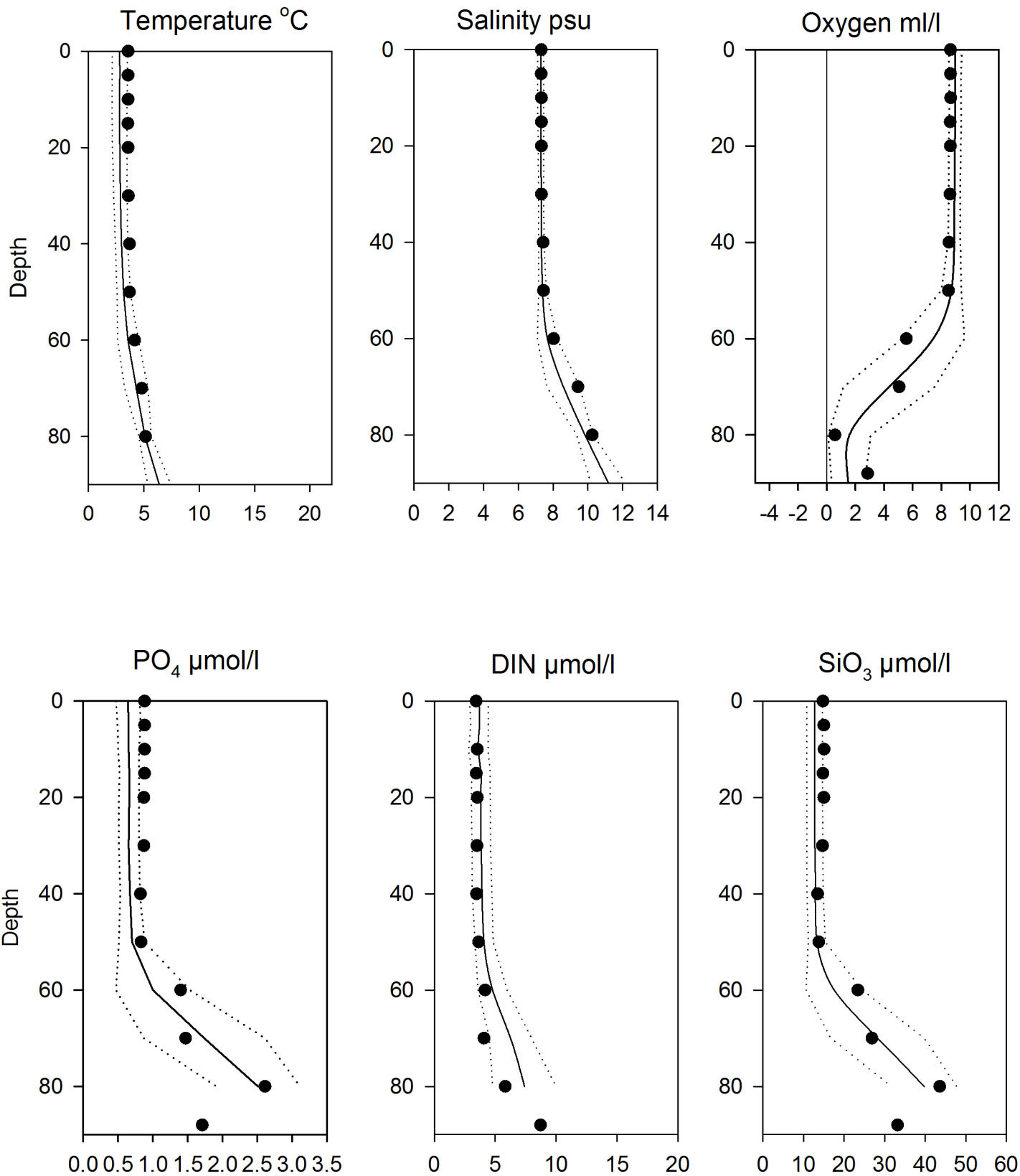


OXYGEN IN BOTTOM WATER (depth > 80m)



Vertical profiles BCS III-10 February

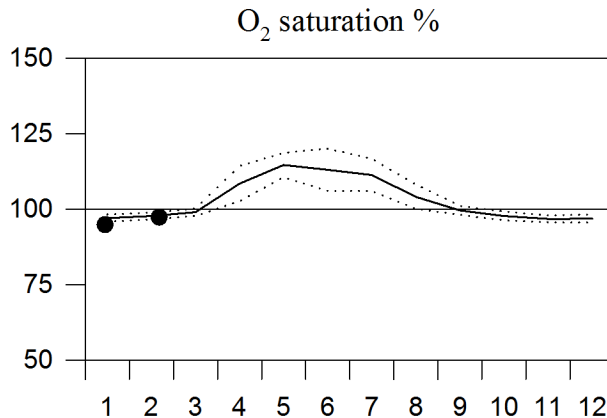
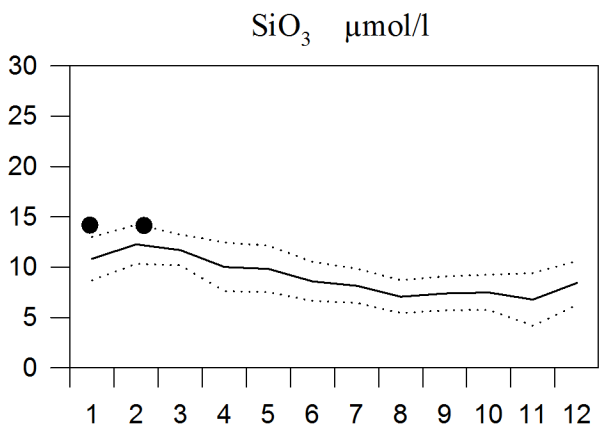
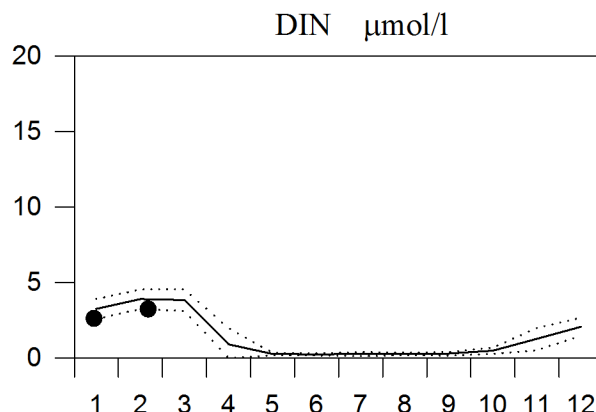
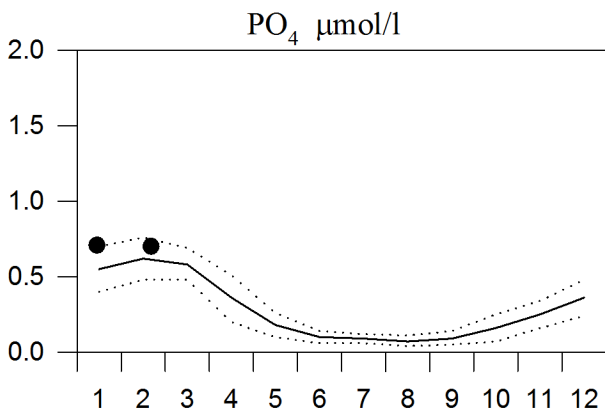
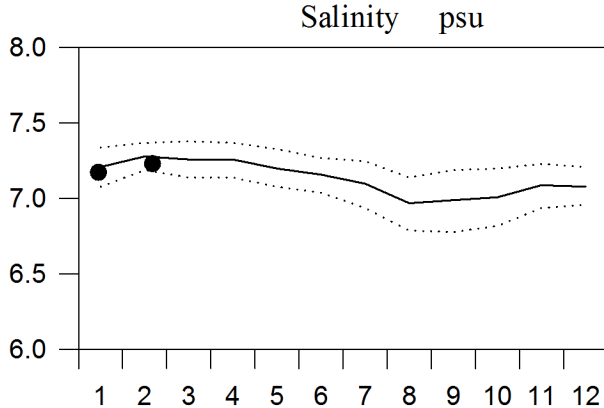
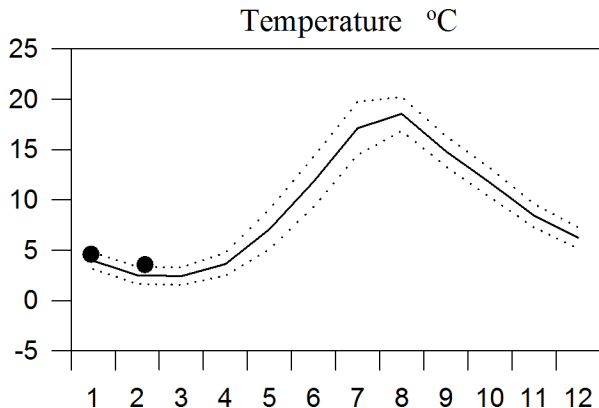
— Mean 1996-2010 St.Dev. ● 2015



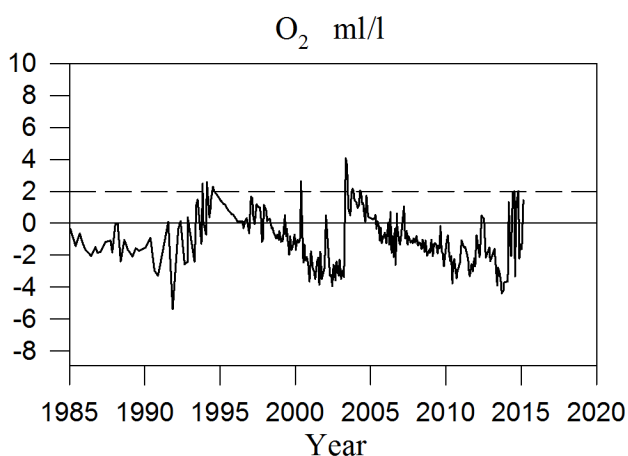
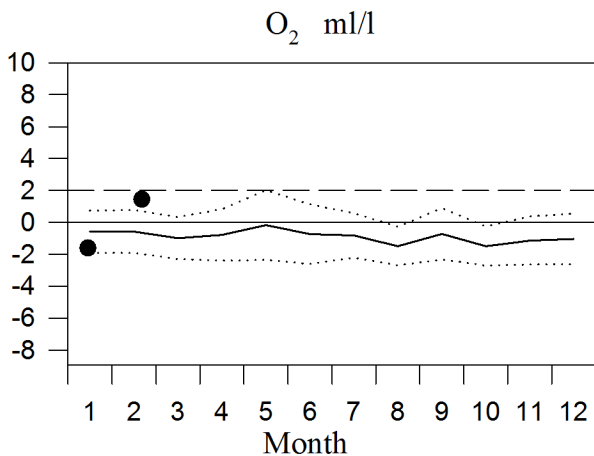
STATION BY10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

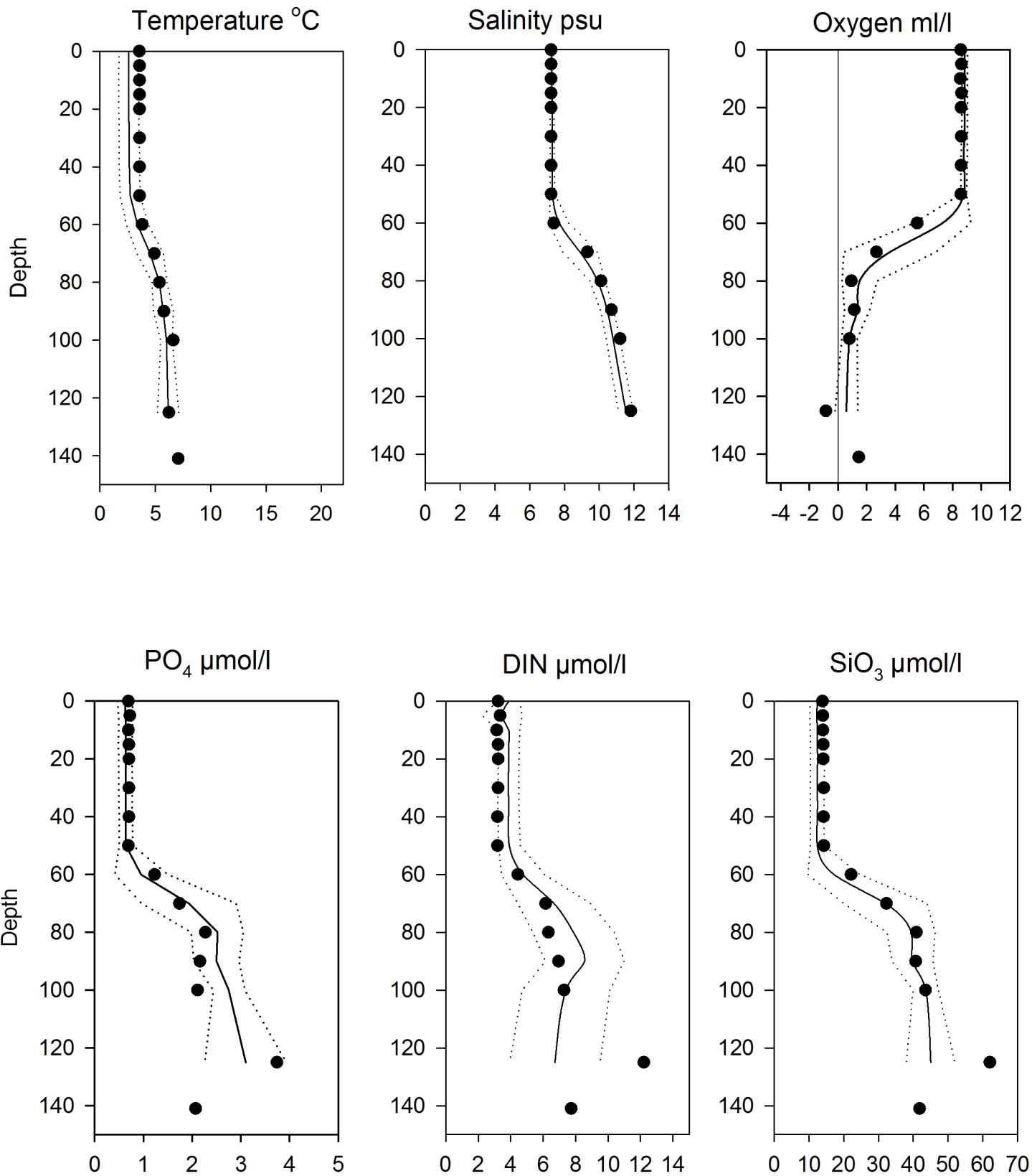


OXYGEN IN BOTTOM WATER (depth >125m)



Vertical profiles BY10 February

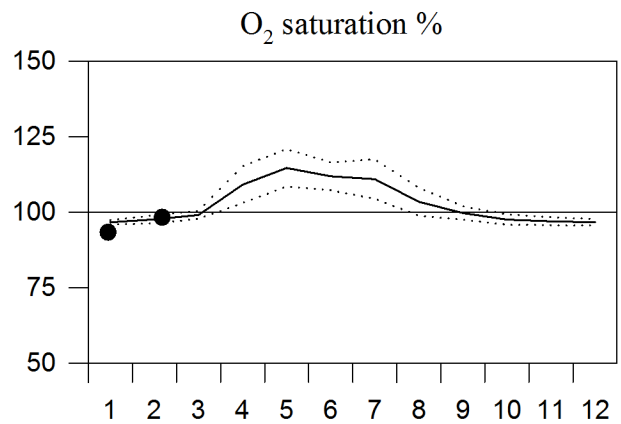
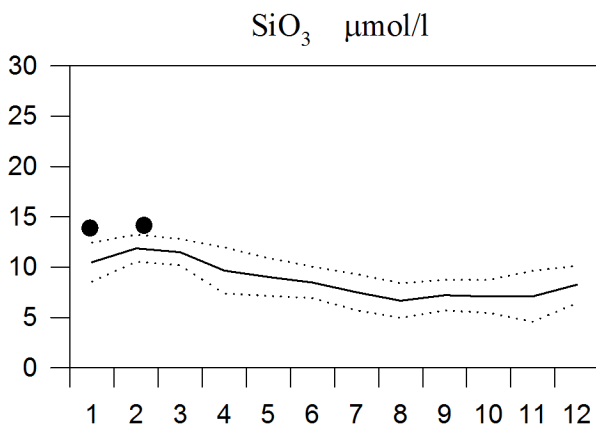
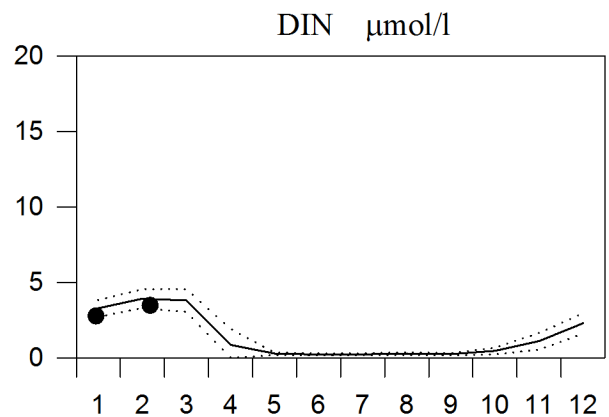
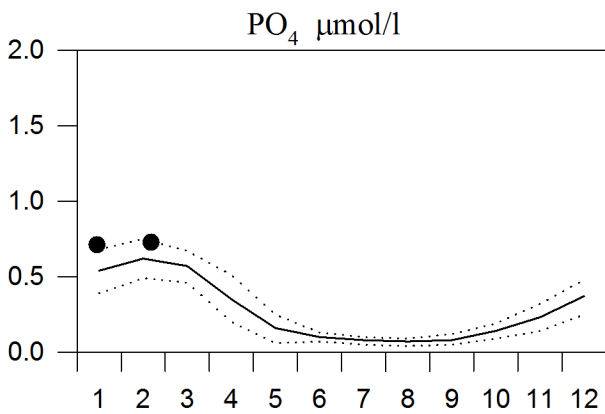
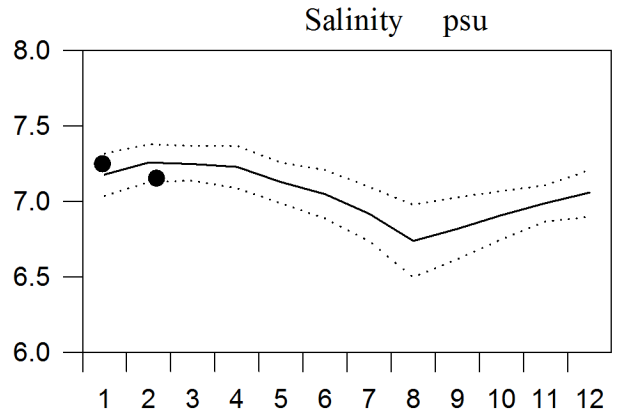
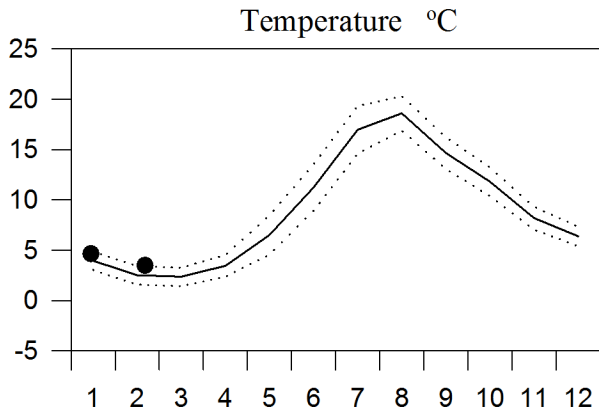
— Mean 1996-2010 ····· St.Dev. ● 2015



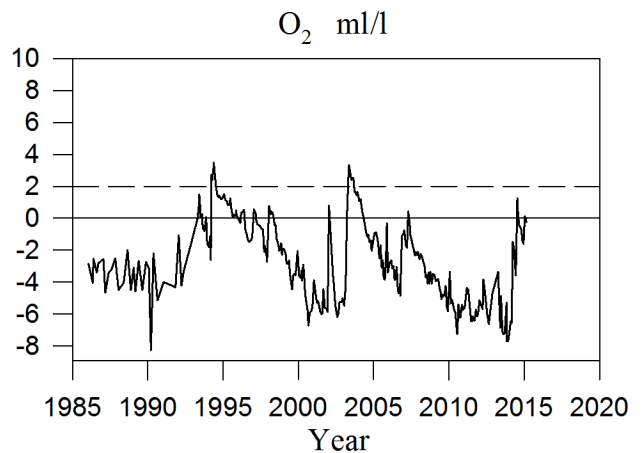
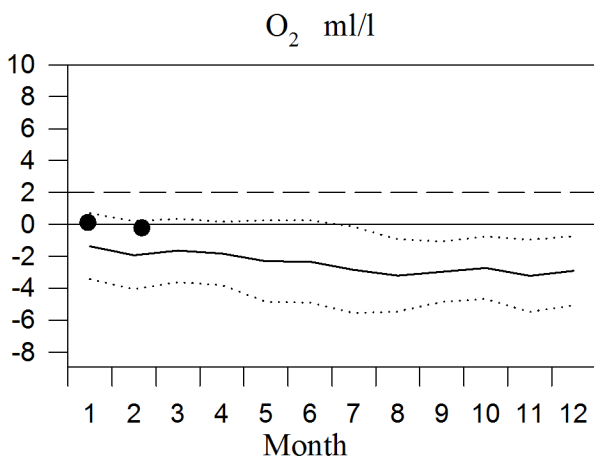
STATION BY15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

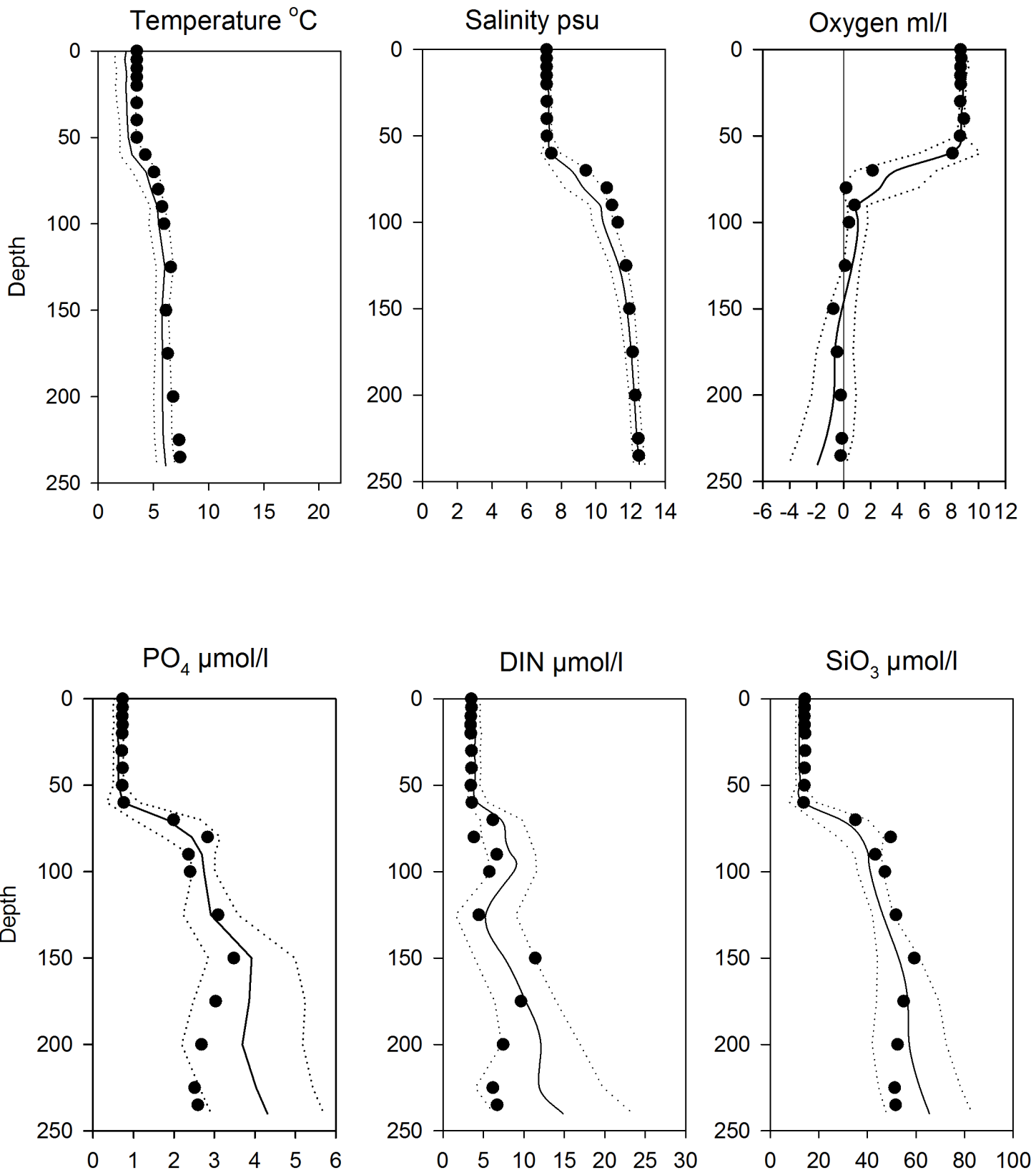


OXYGEN IN BOTTOM WATER (depth >225m)



Vertical profiles BY15 February

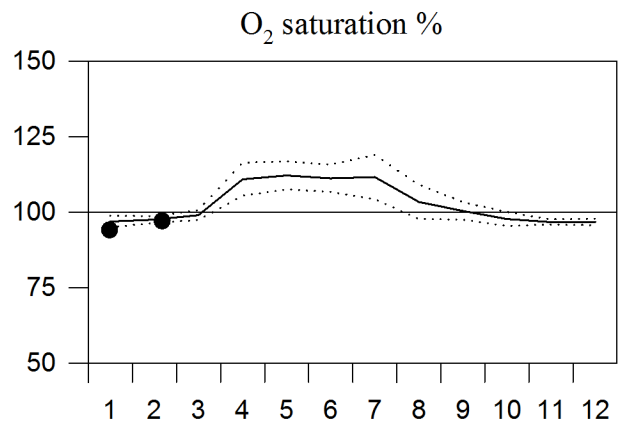
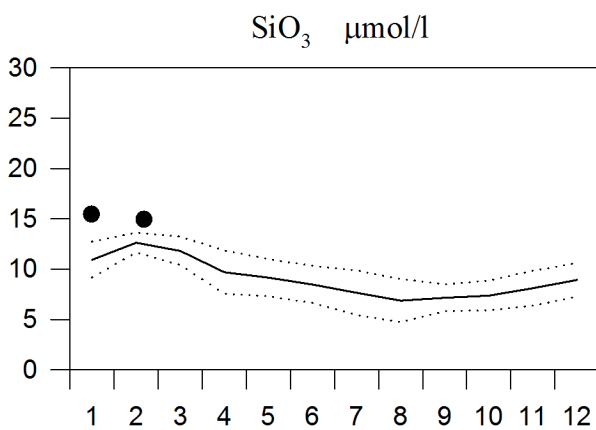
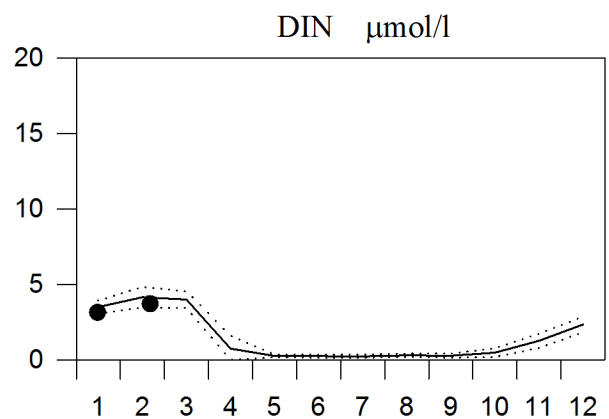
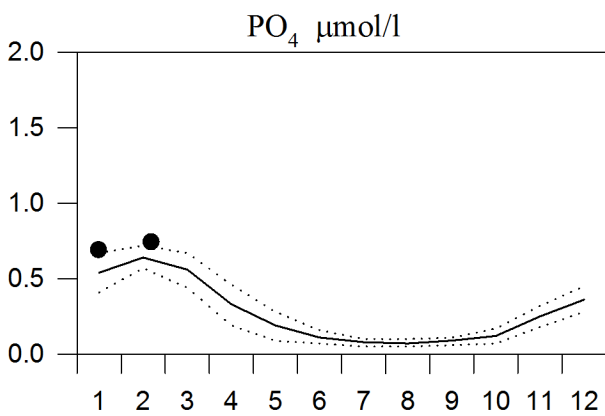
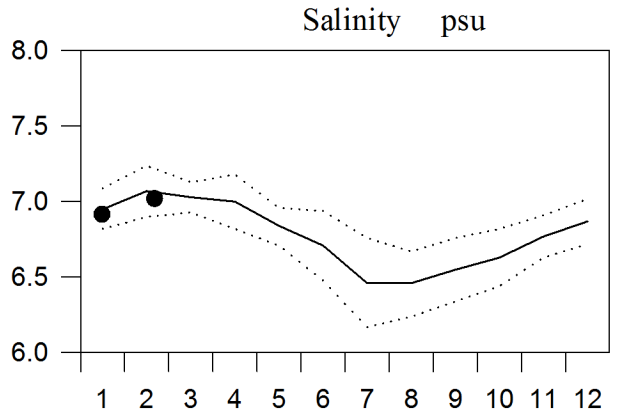
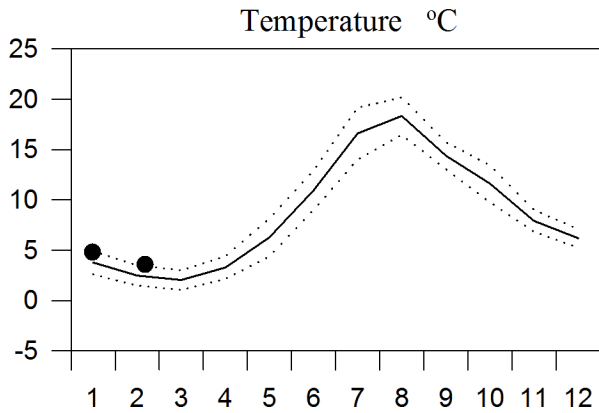
— Mean 1996-2010 ····· St.Dev. ● 2015



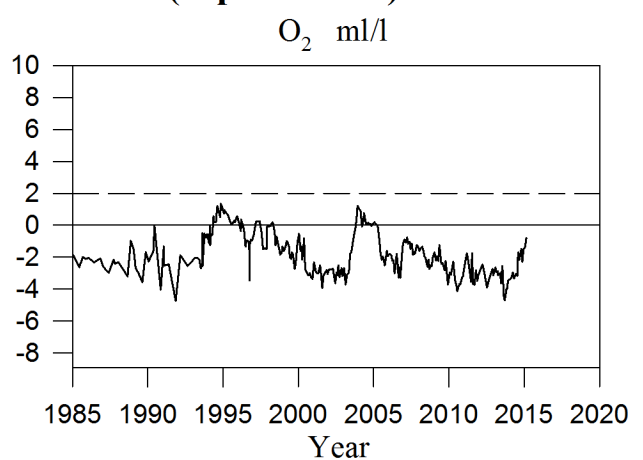
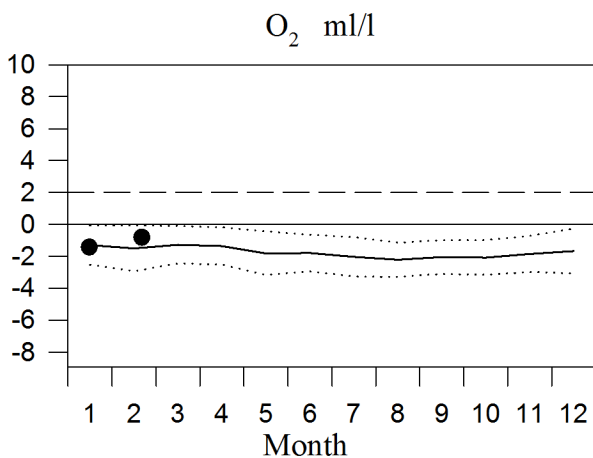
STATION BY20 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

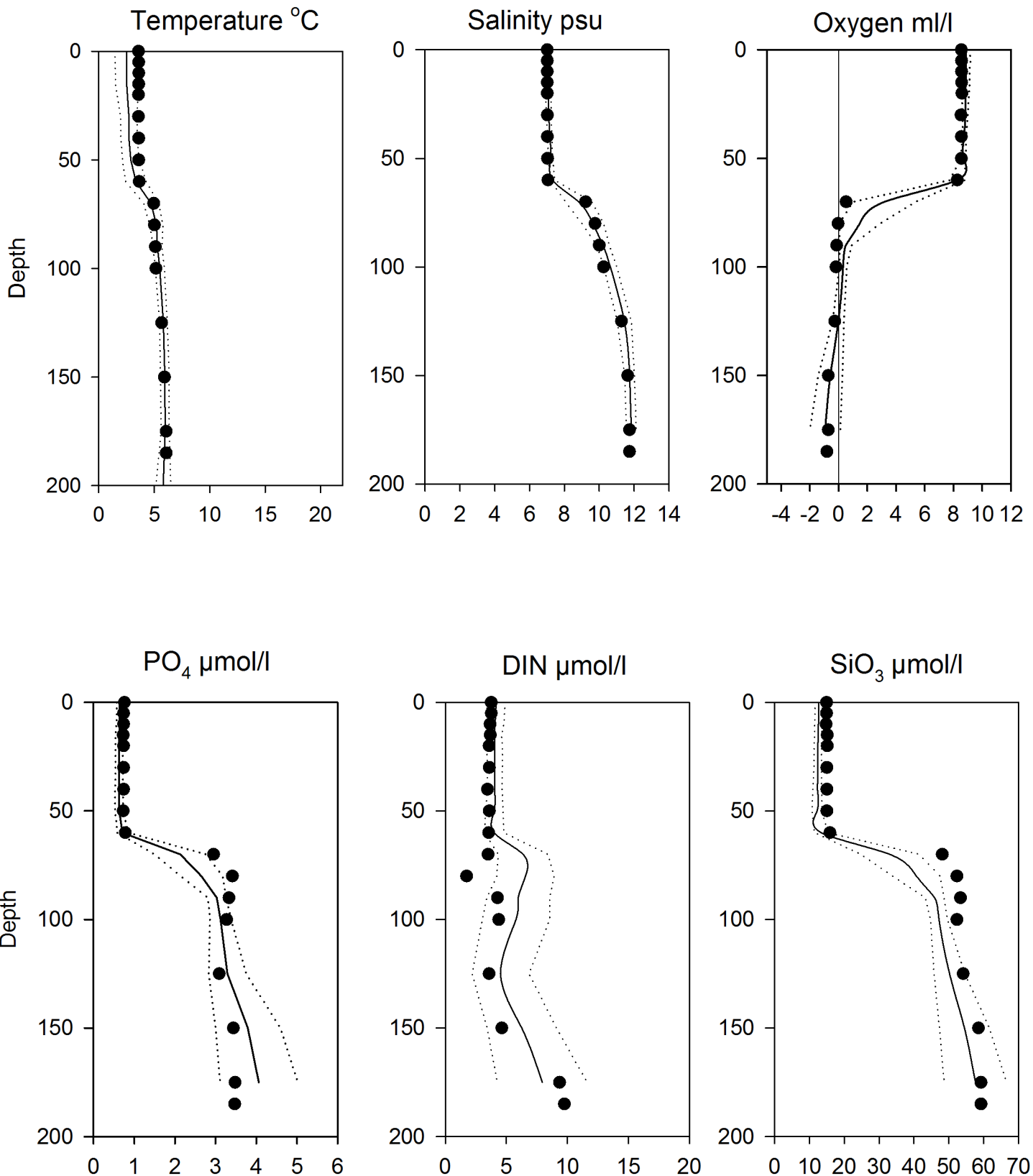


OXYGEN IN BOTTOM WATER (depth >175m)



Vertical profiles BY20 February

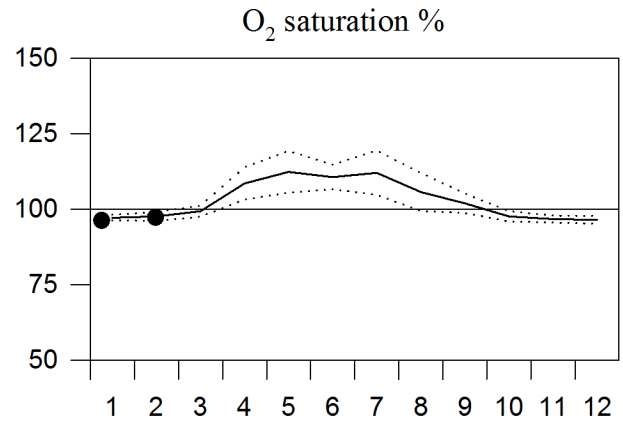
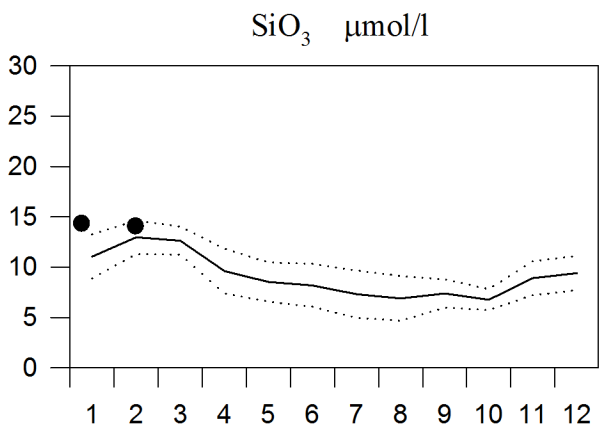
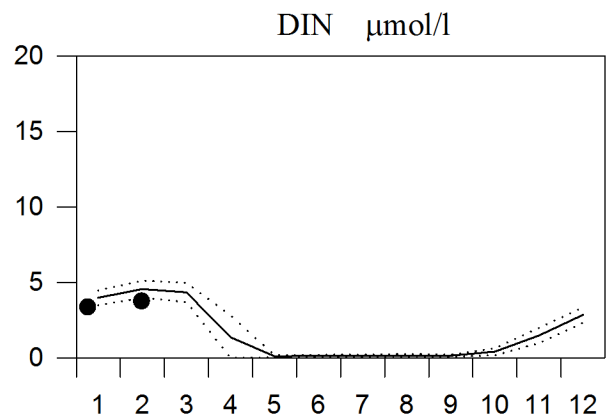
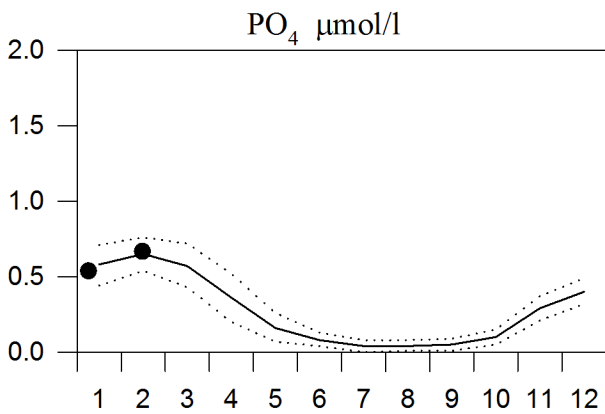
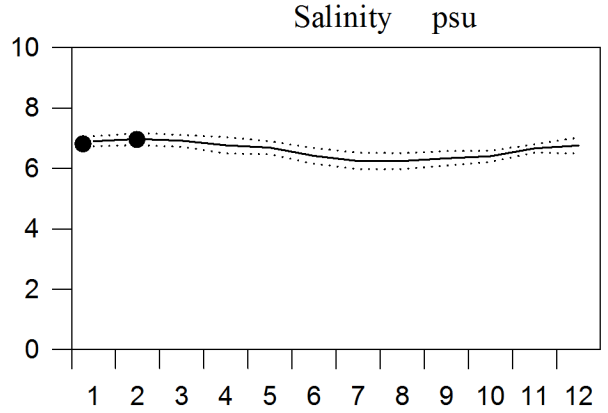
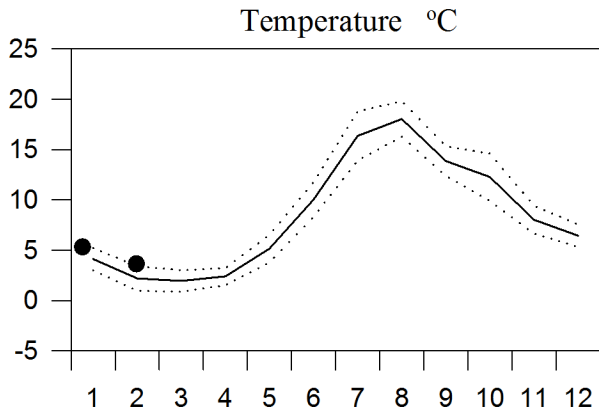
— Mean 1996-2010 ····· St.Dev. ● 2015



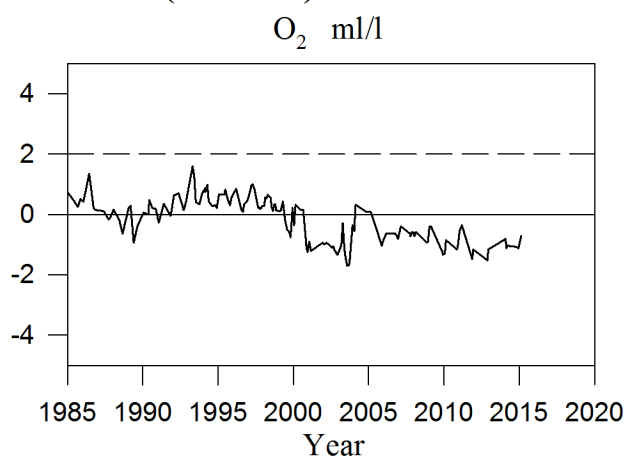
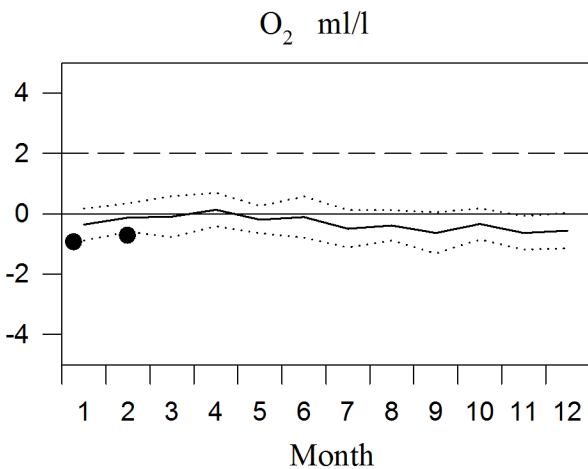
STATION BY29 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

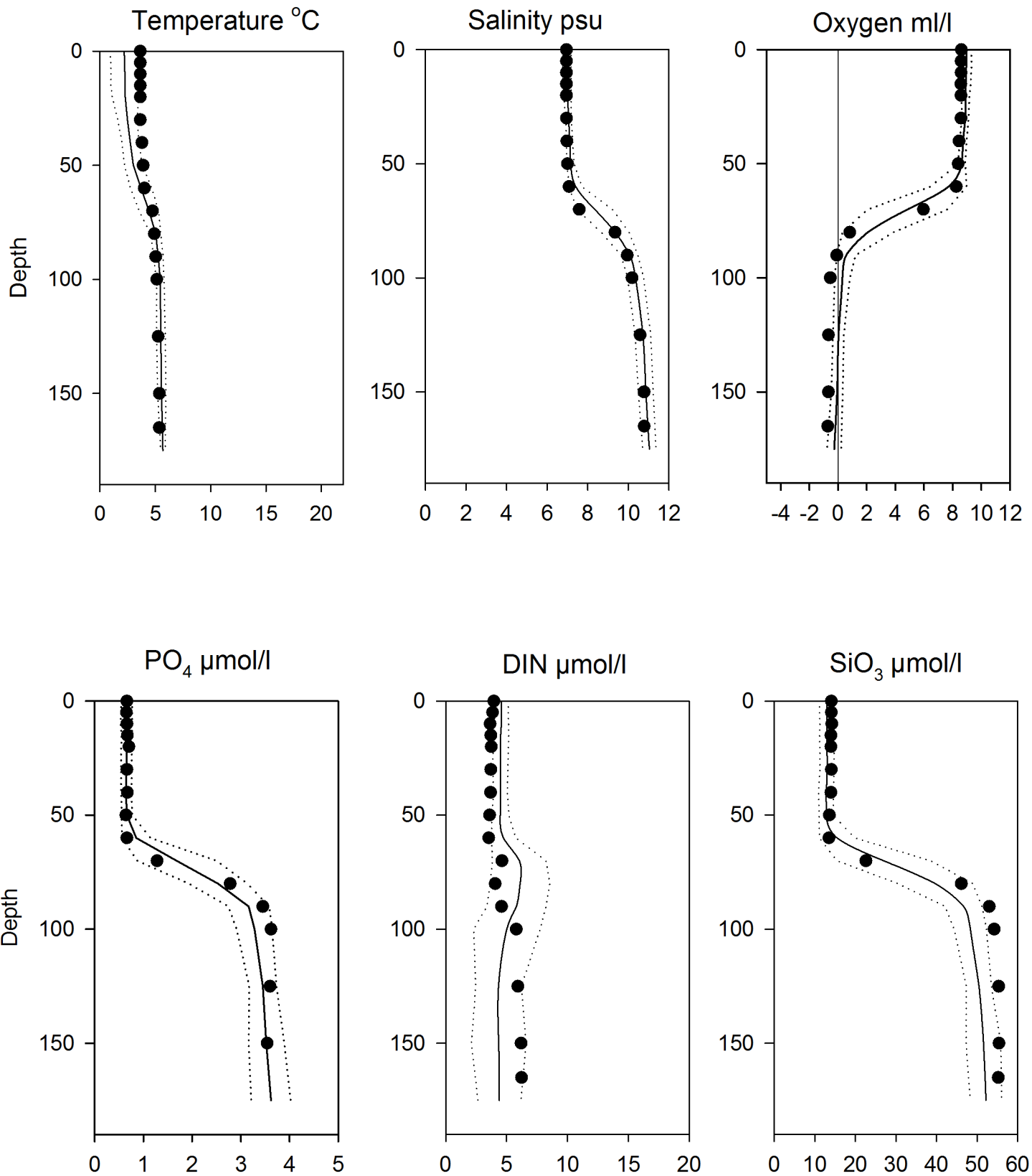


OXYGEN IN BOTTOM WATER (>=150m)



Vertical profiles BY29 February

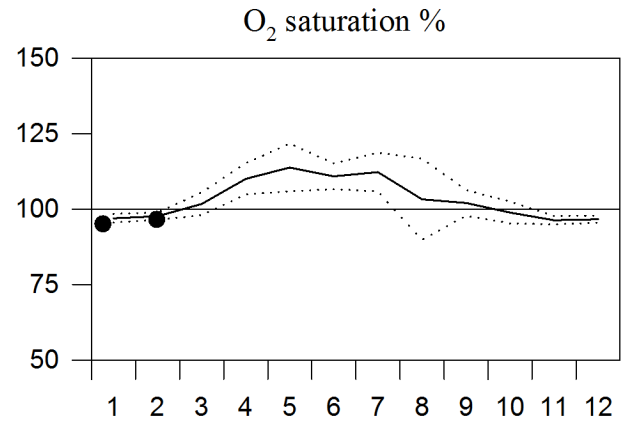
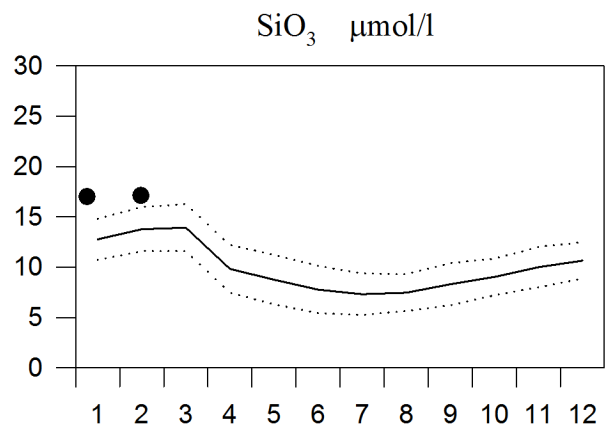
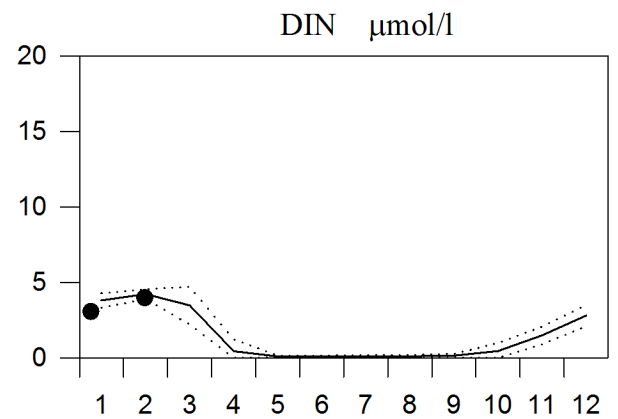
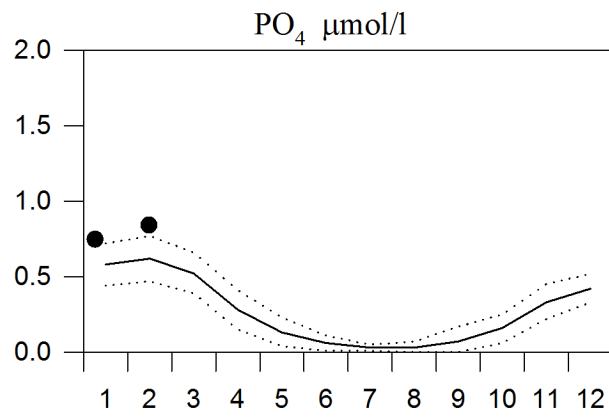
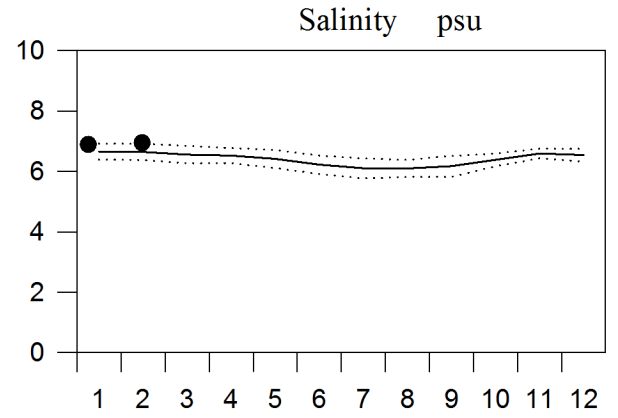
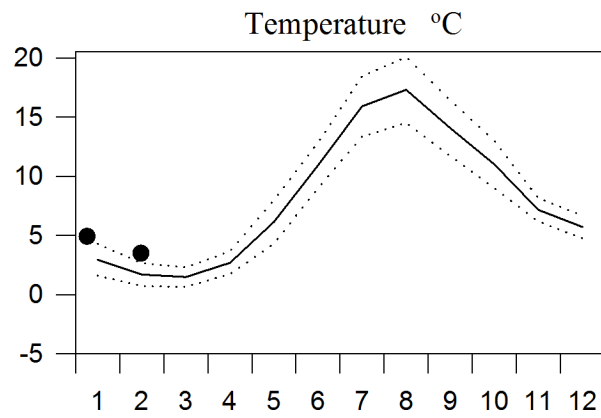
— Mean 1996-2010 ····· St.Dev. ● 2015



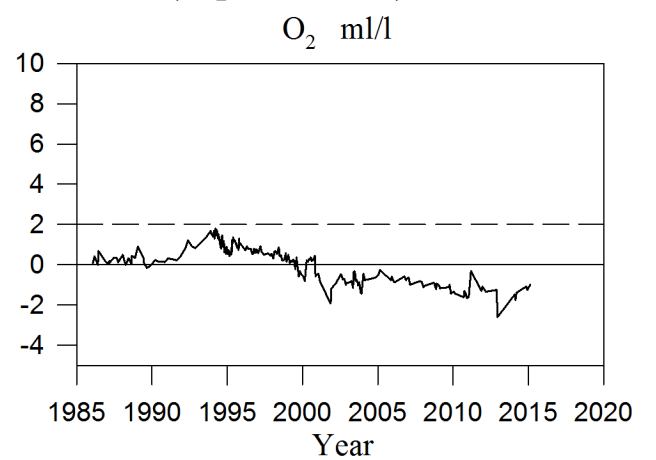
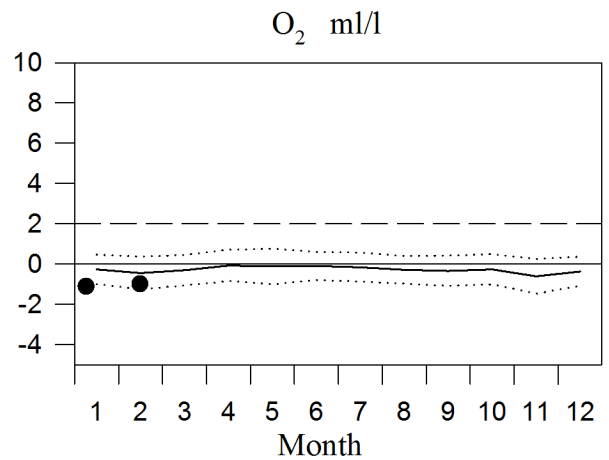
STATION BY31 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

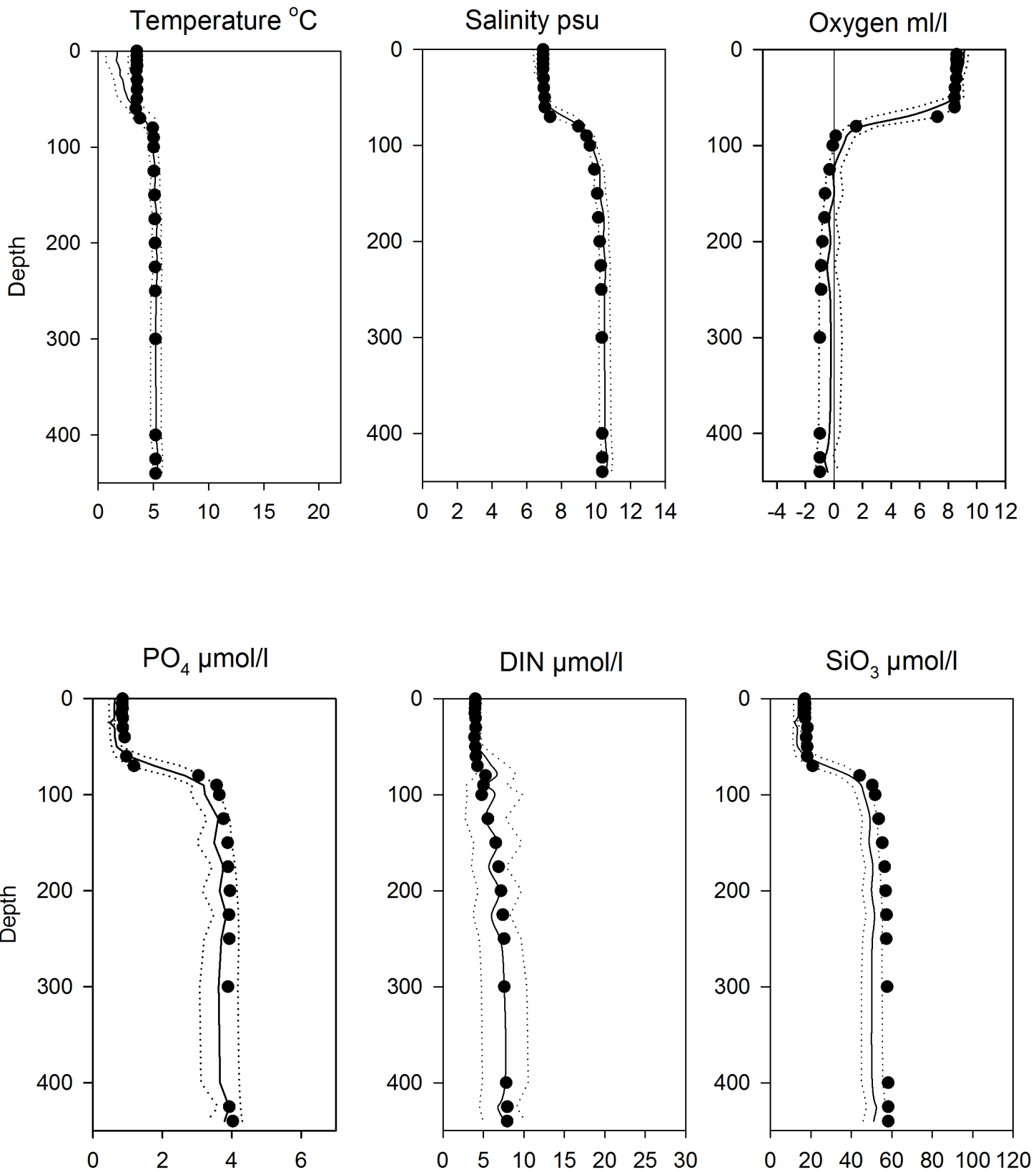


OXYGEN IN BOTTOM WATER (depth = 440m)



Vertical profiles BY31 February

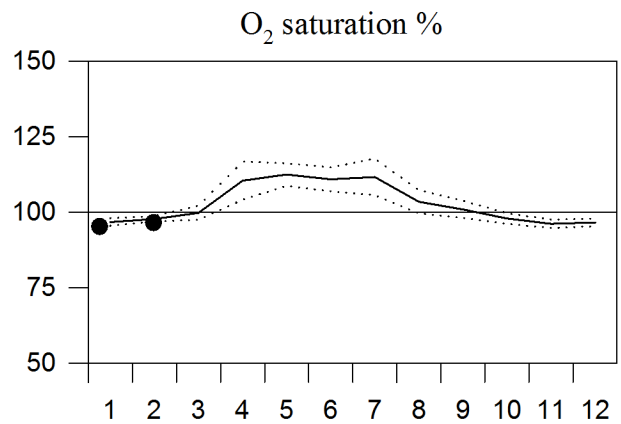
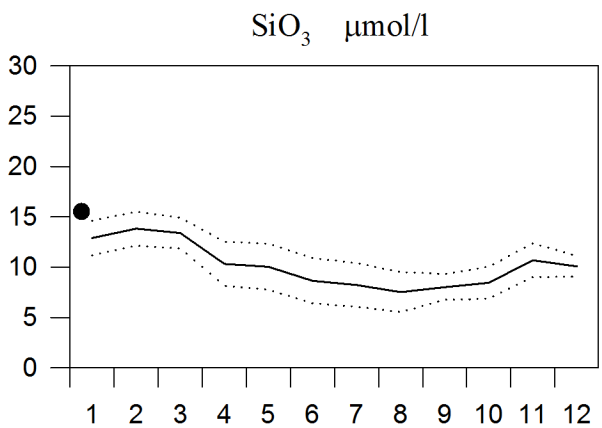
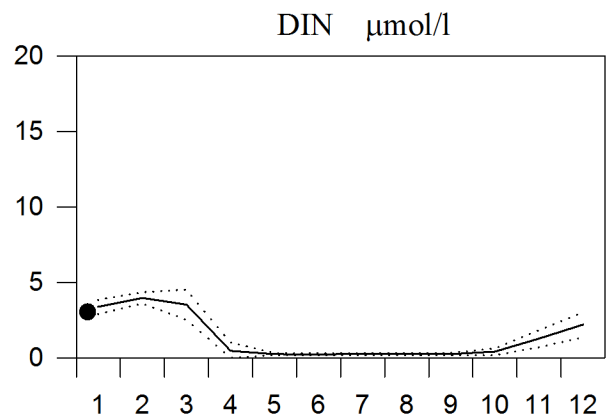
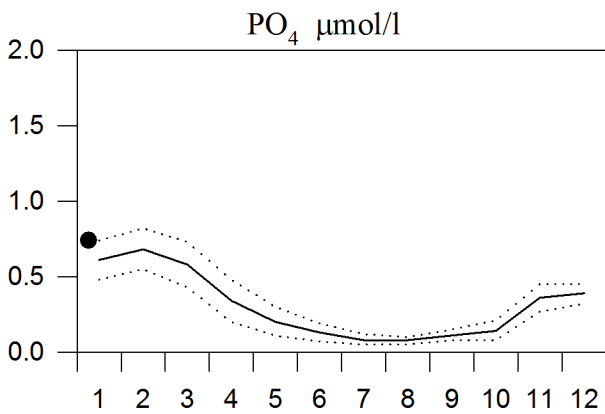
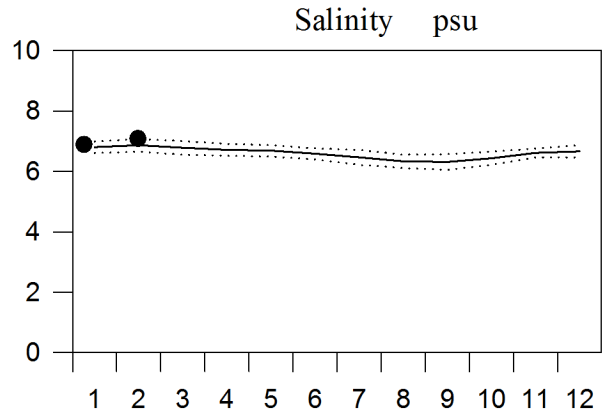
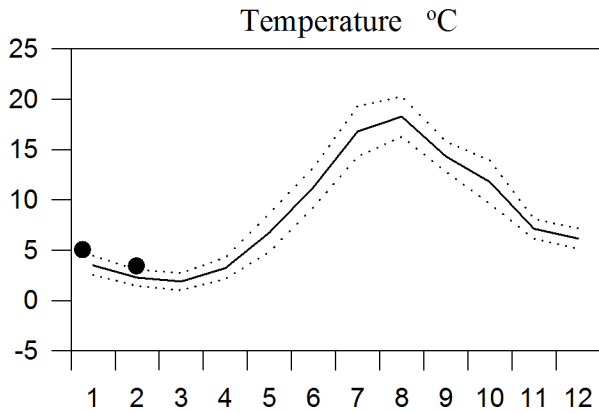
— Mean 1996-2010 ····· St.Dev. ● 2015



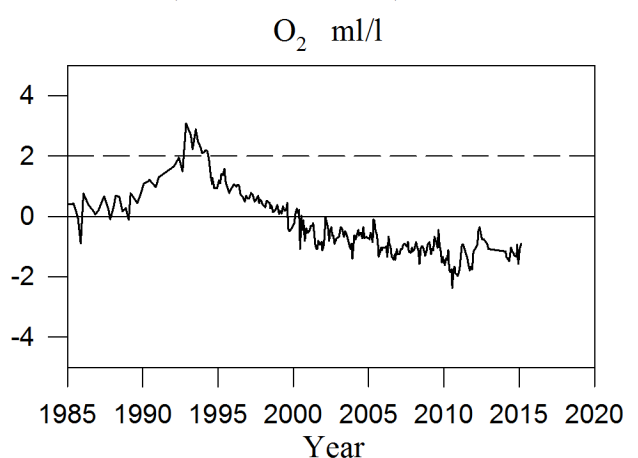
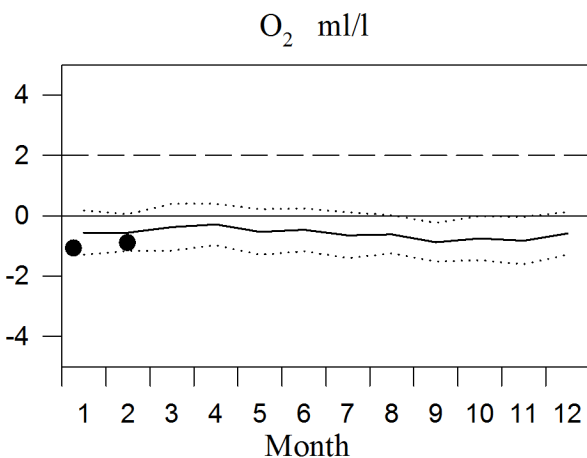
STATION BY32 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

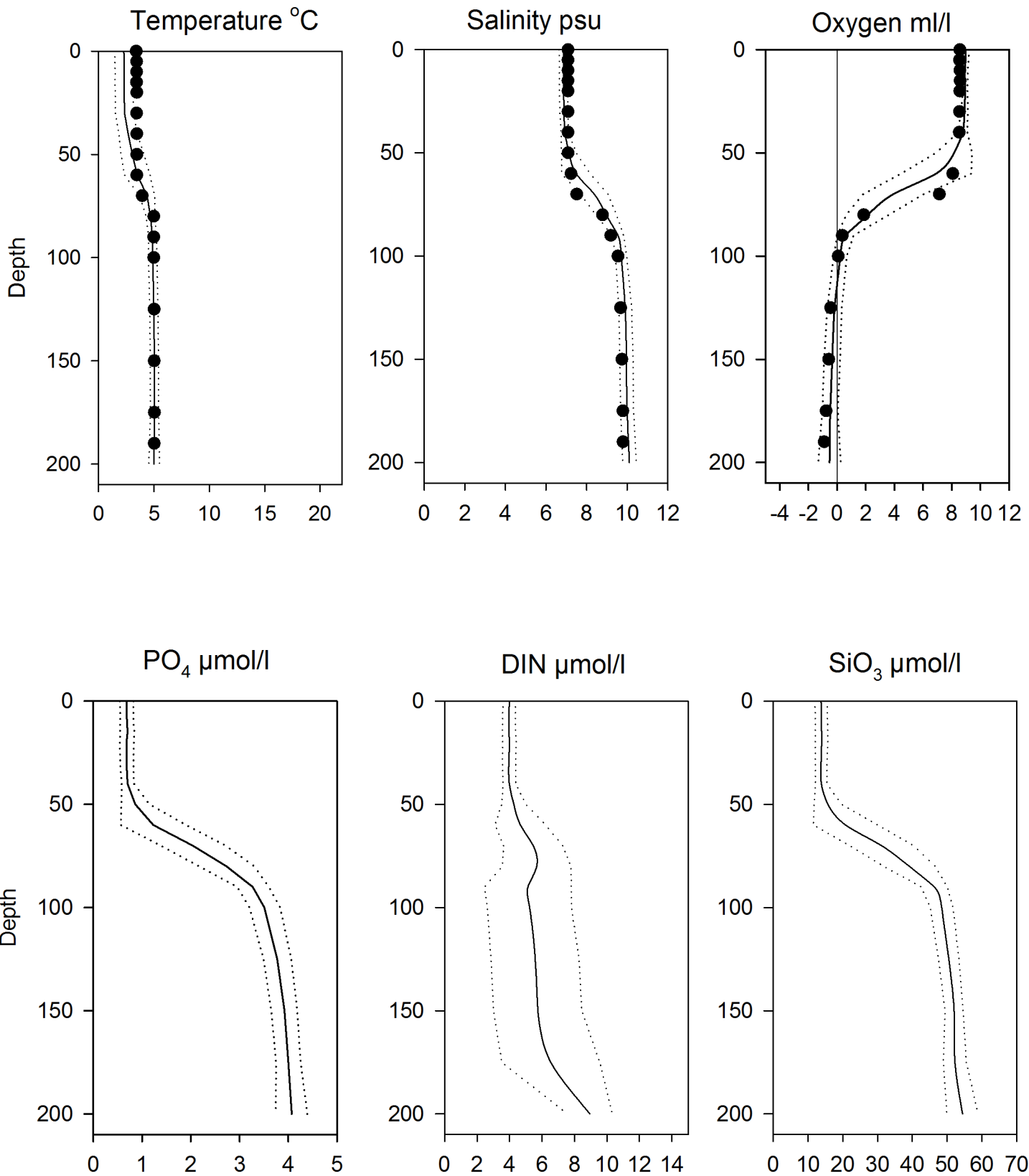


OXYGEN IN BOTTOM WATER (depth > 175m)



Vertical profiles BY32 February

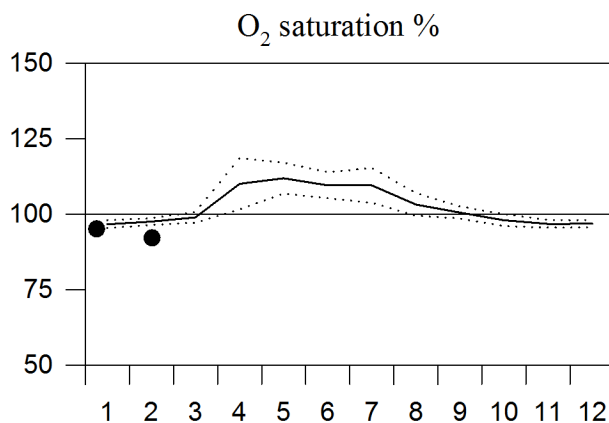
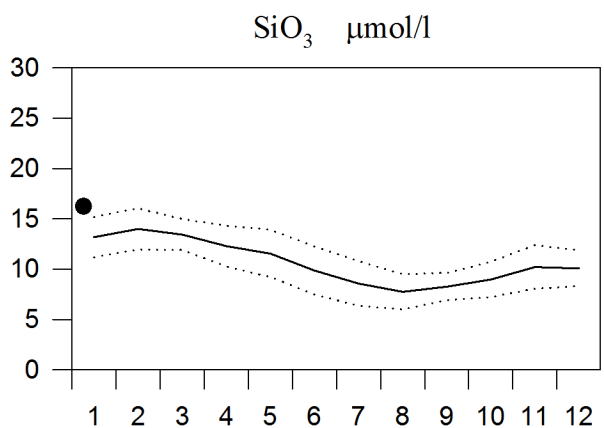
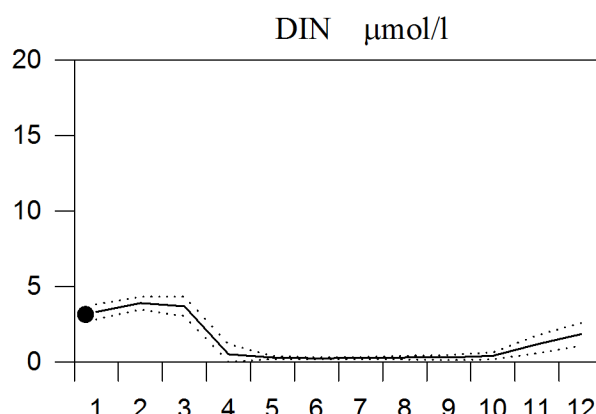
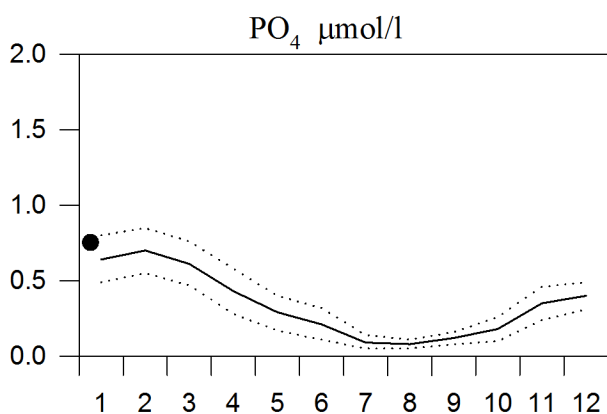
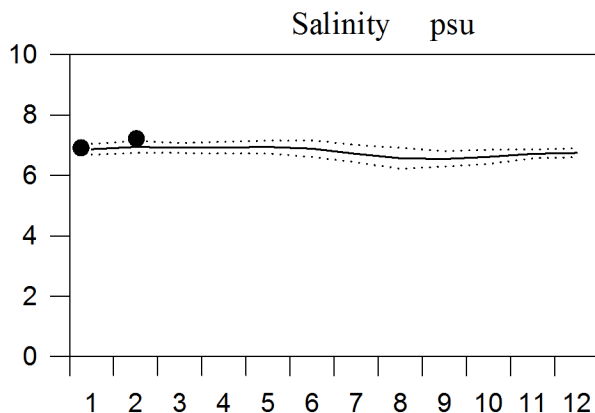
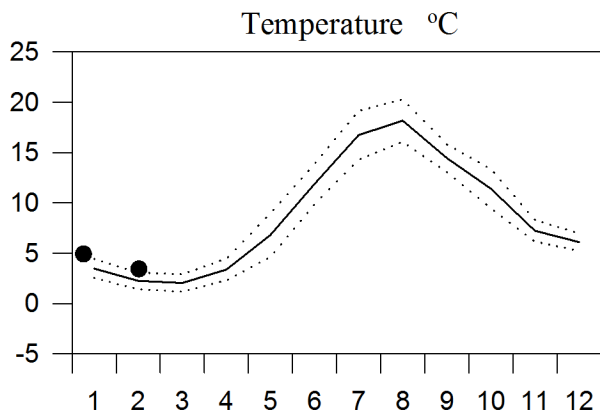
— Mean 1996-2010 ····· St.Dev. ● 2015



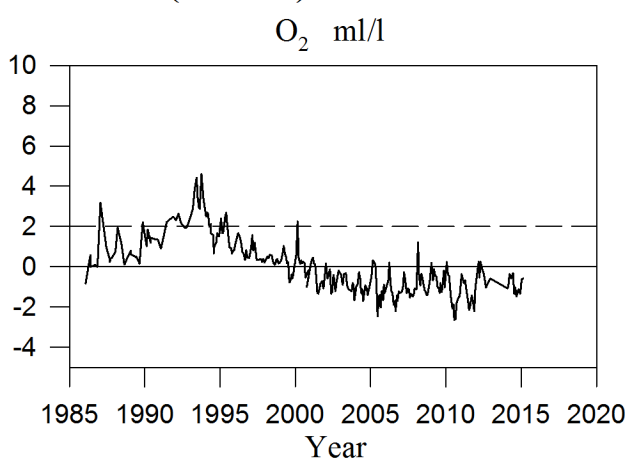
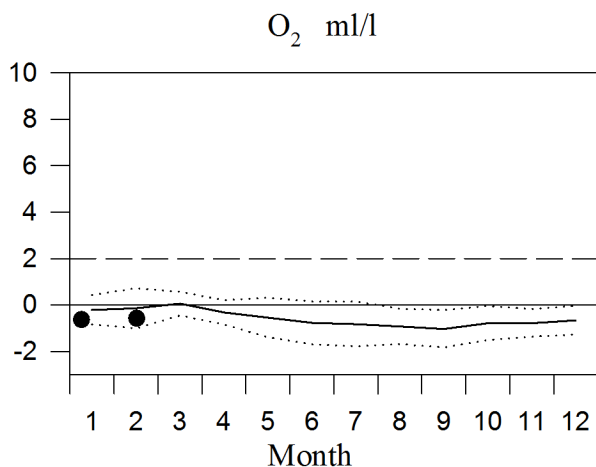
STATION BY38 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

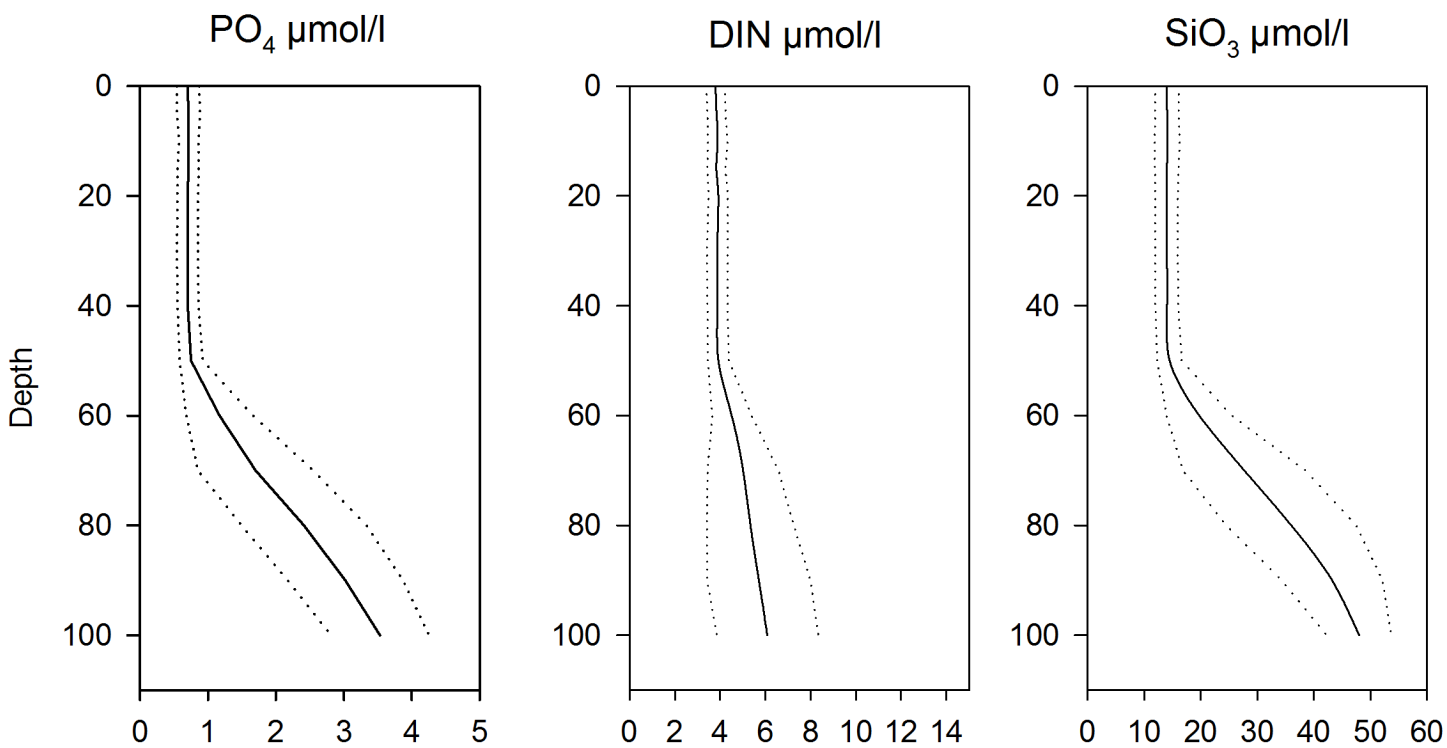
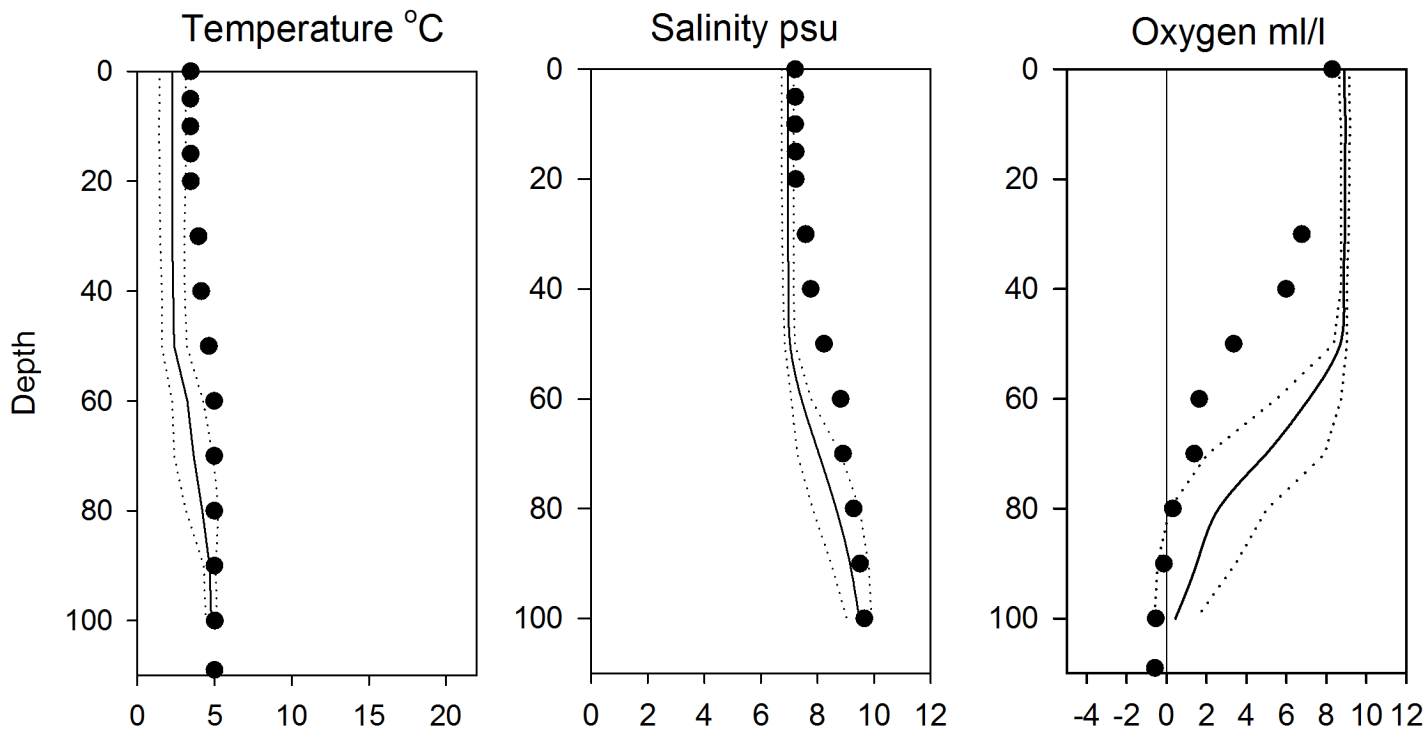


OXYGEN IN BOTTOM WATER (> 100m)



Vertical profiles BY38 February

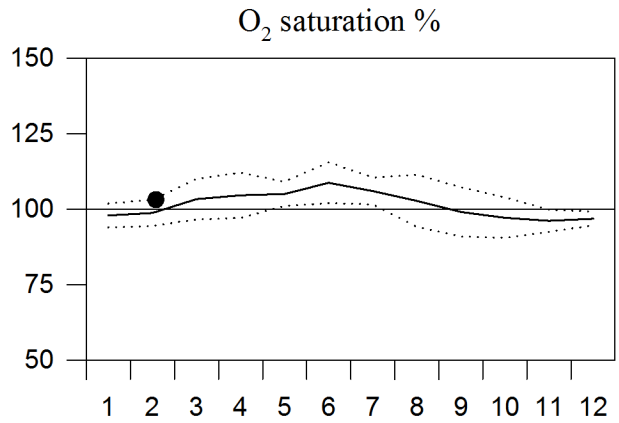
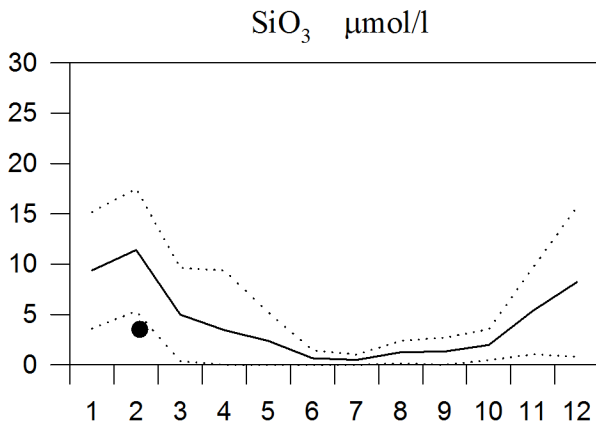
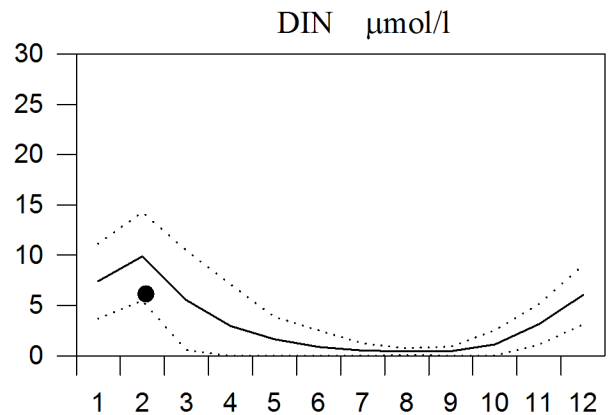
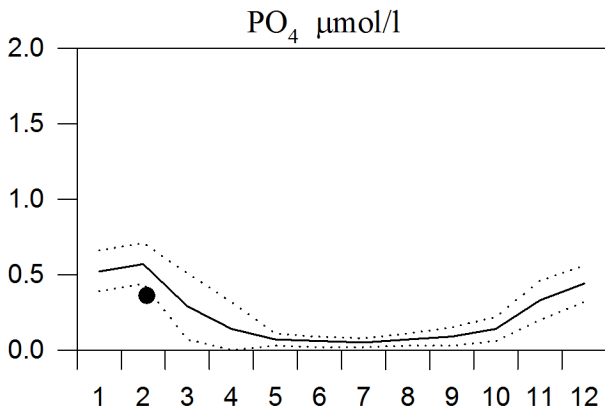
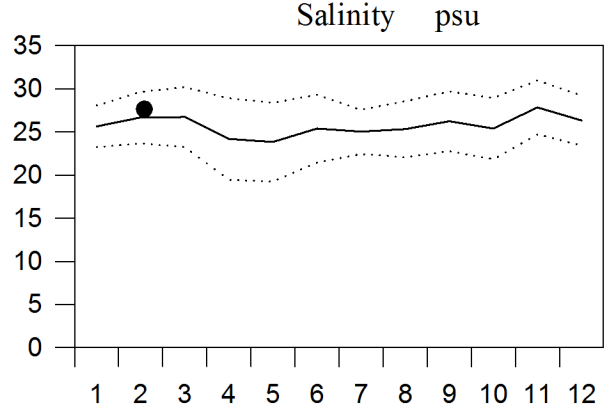
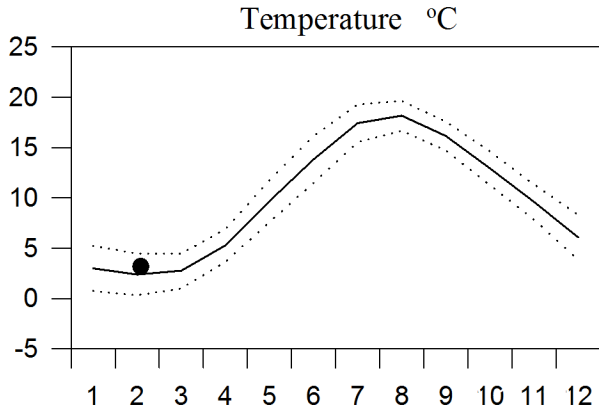
— Mean 1996-2010 ····· St.Dev. ● 2015



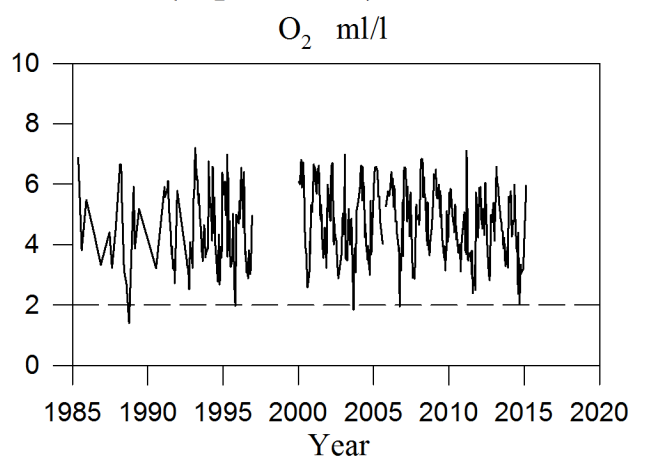
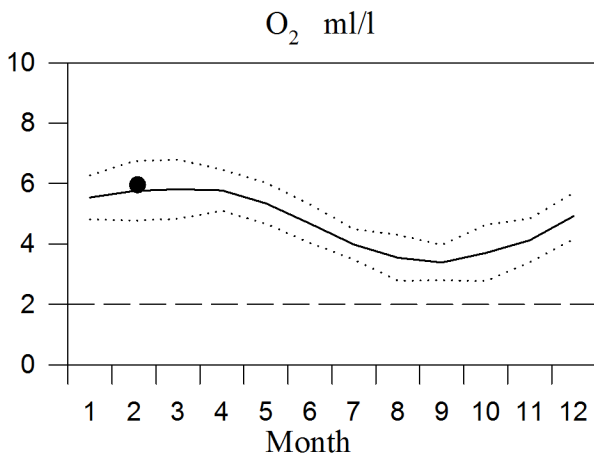
STATION SLÄGGÖ SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015

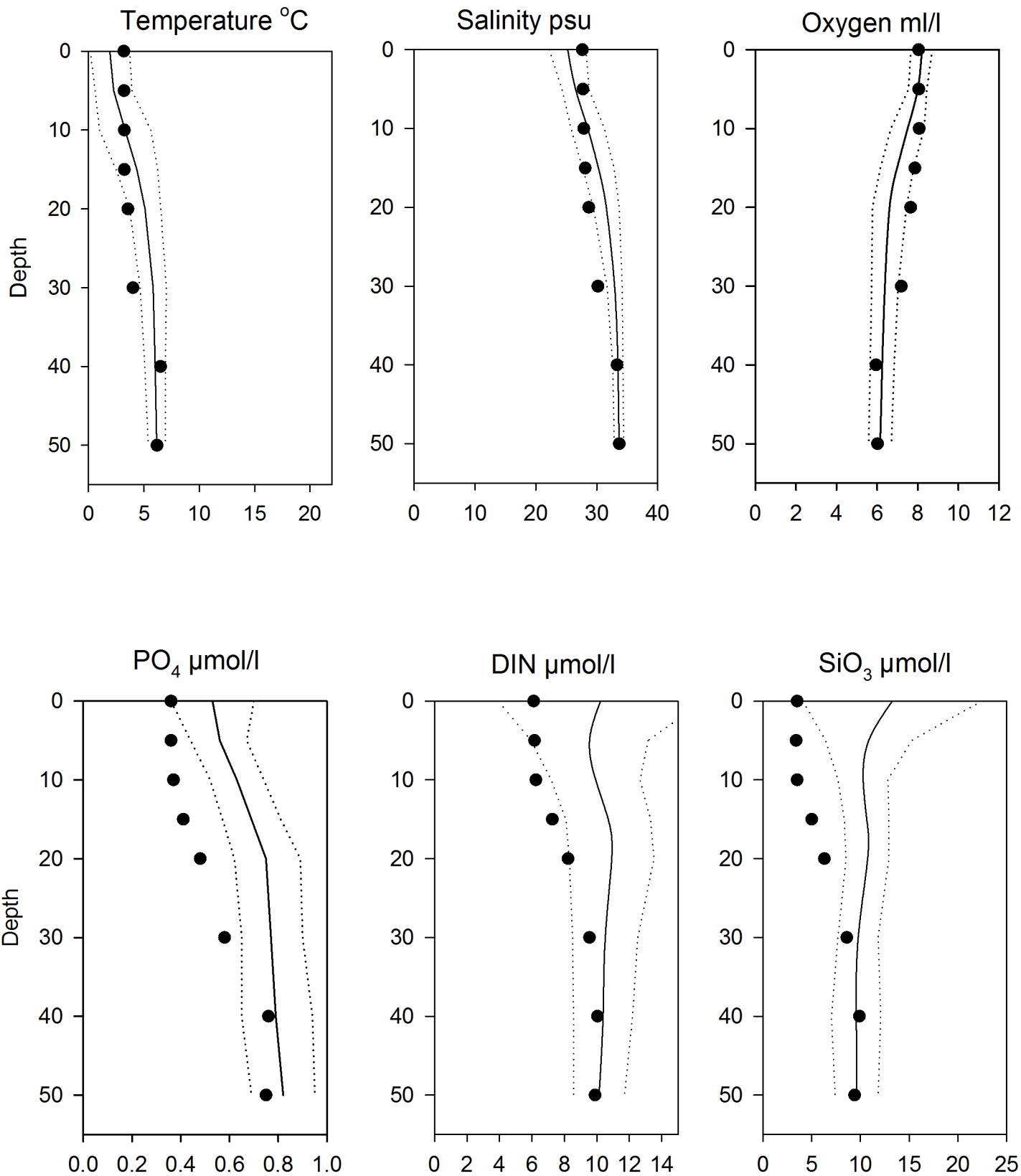


OXYGEN IN BOTTOM WATER (depth >50m)



Vertical profiles Släggö February

— Mean 1996-2010 St.Dev. ● 2015



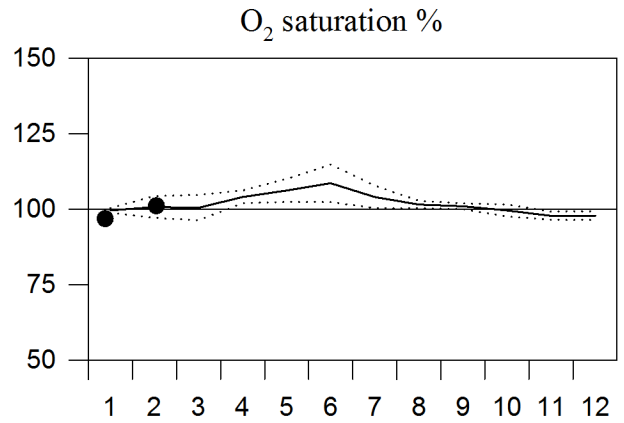
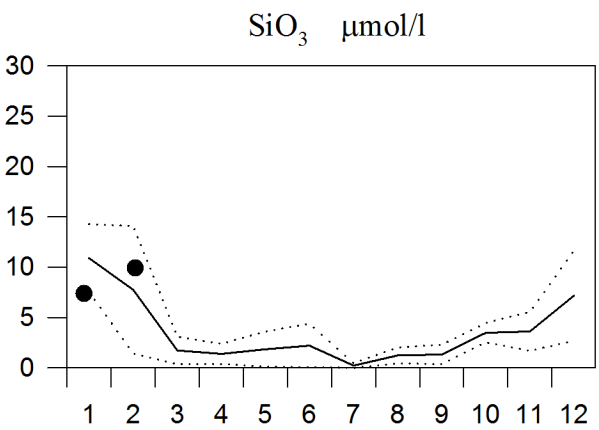
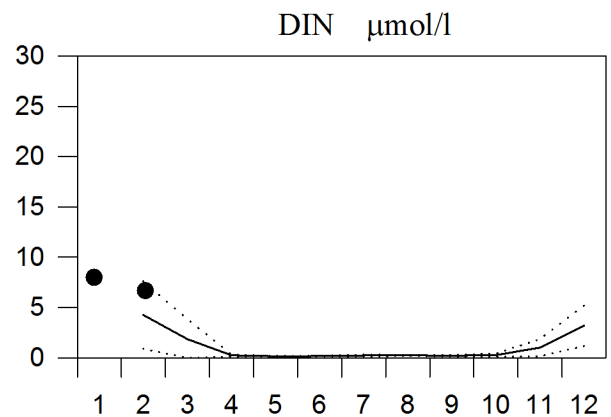
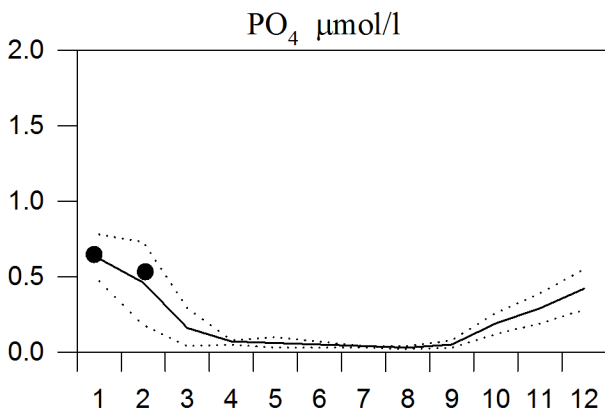
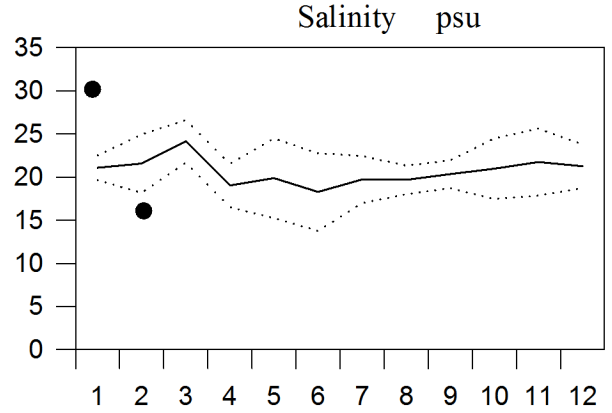
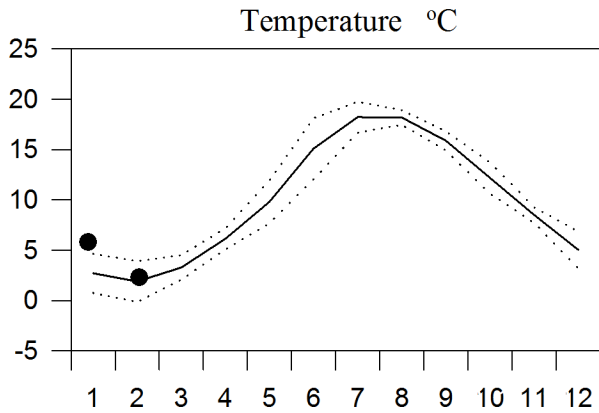
STATION N14 Falkenberg SURFACE WATER

Annual Cycles

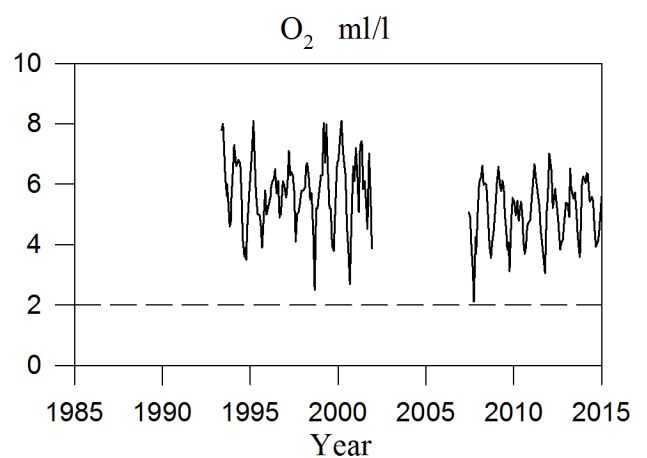
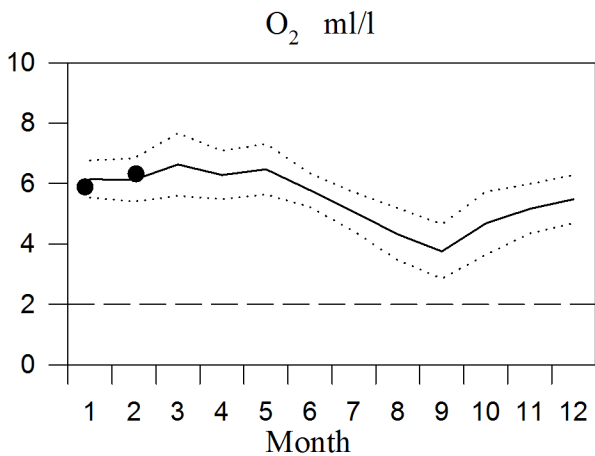
— Mean 2007-2010

..... St.Dev.

● 2015

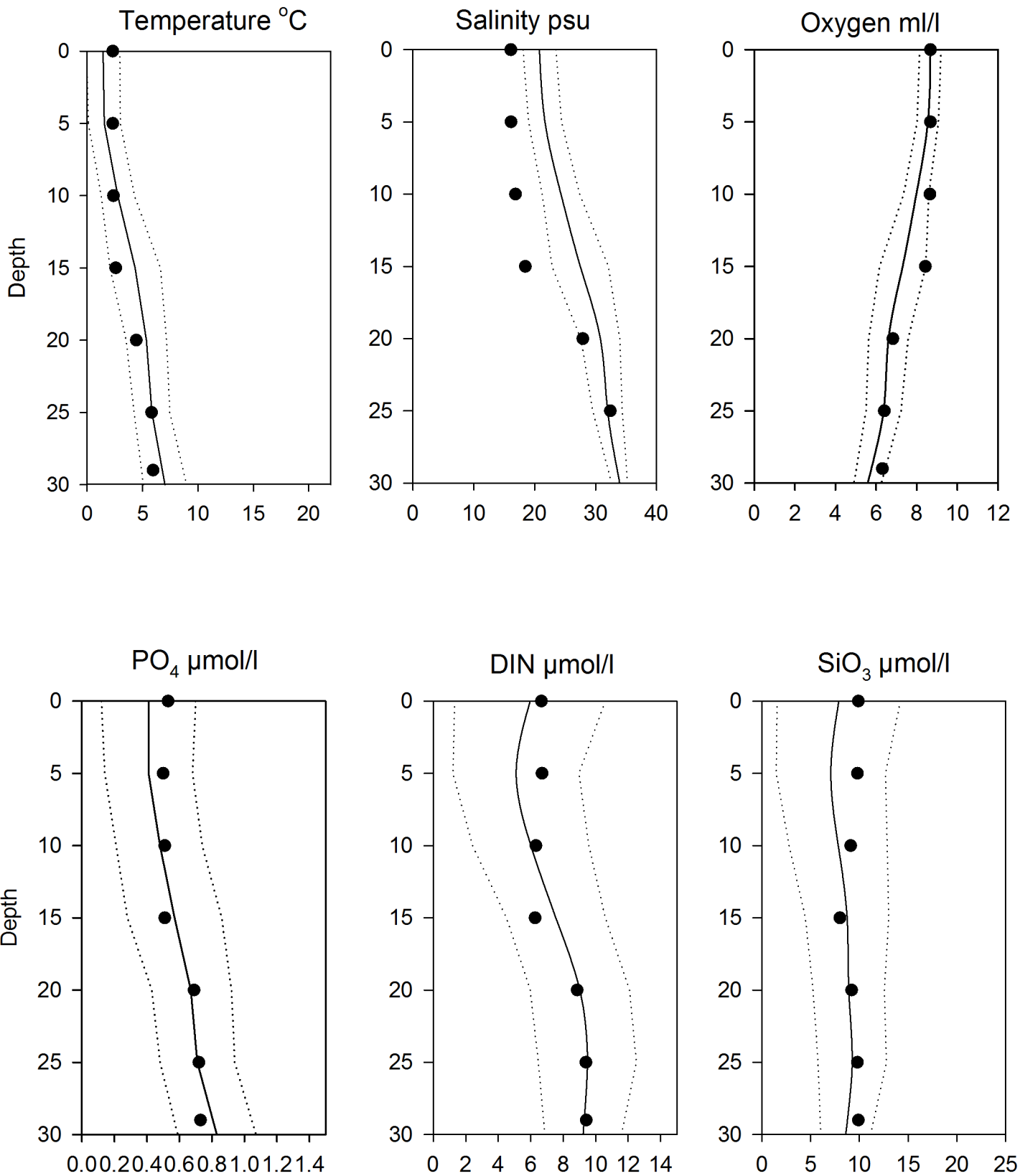


OXYGEN IN BOTTOM WATER (depth > 25m)



Vertical profiles N14 Falkenberg February

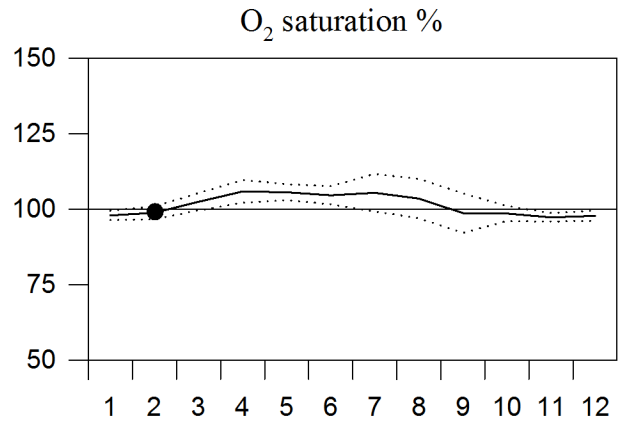
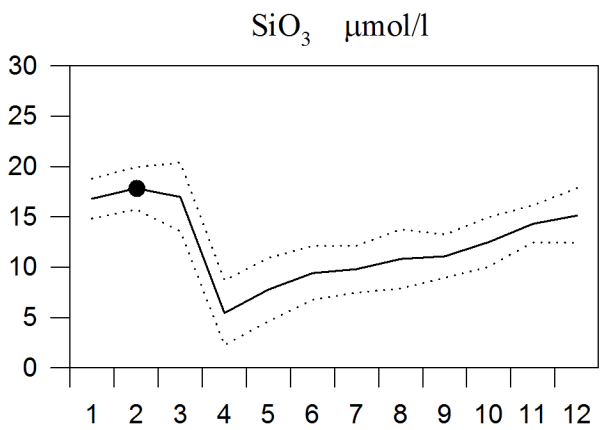
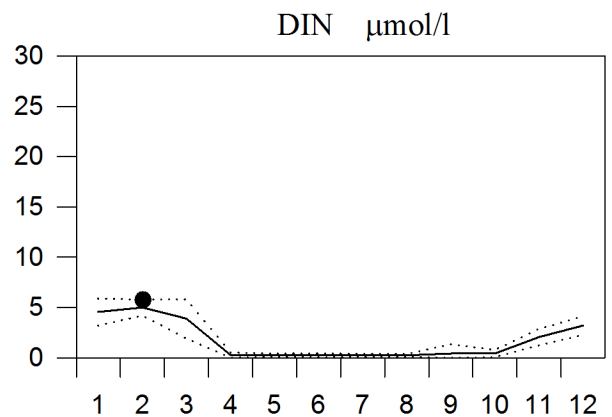
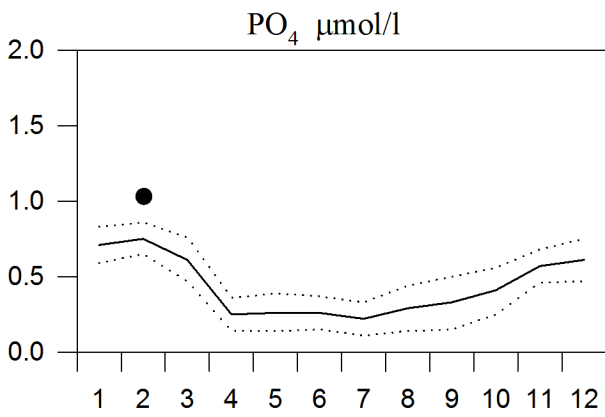
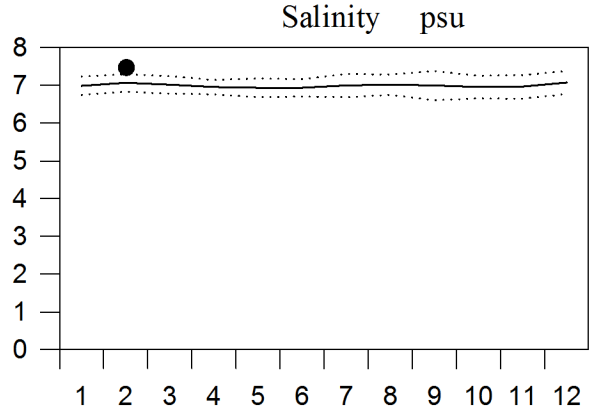
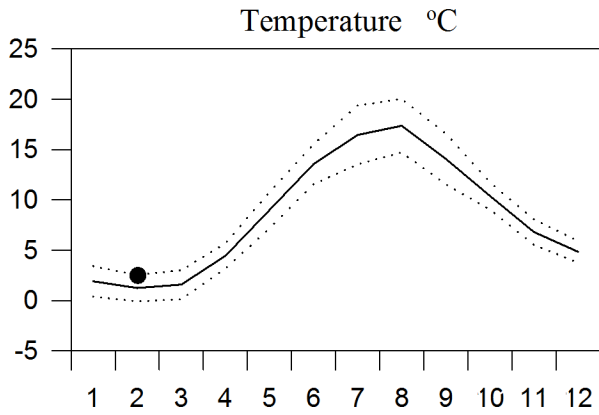
— Mean 1996-2010 St.Dev. ● 2015



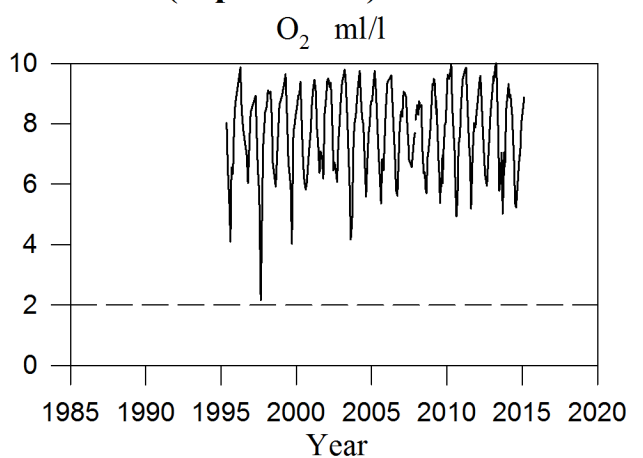
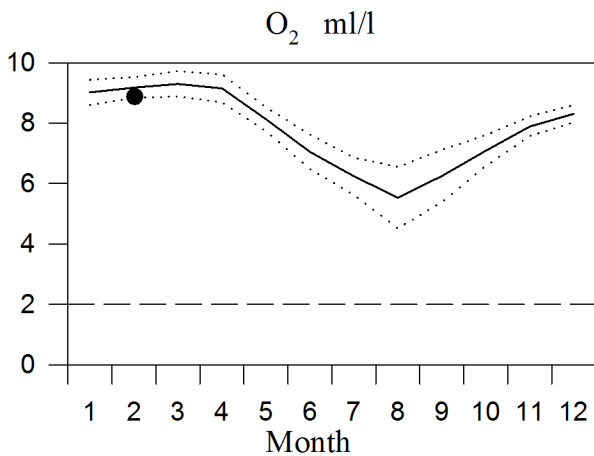
STATION REF M1V1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2015



OXYGEN IN BOTTOM WATER (depth >15m)



Vertical profiles Ref M1V1 February

— Mean 1996-2010 St.Dev. ● 2015

