

Rapport från SMHIs utsjöexpedition med R/V Aranda



Expeditionens varaktighet: 2014-04-25 - 2014-05-01
Undersökningsområde: Skagerrak, Kattegatt och egentliga Östersjön
Uppdragsgivare: SMHI samt Havs- och Vattenmyndigheten

SAMMANFATTNING

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

I både Skagerrak och Kattegatt var närsalterna i ytvattnet i allmänhet lägre än normalt för årstiden. I egentliga Östersjön, utom Arkonabassängen, var halterna av fosfat och silikat något högre än normalt. Syreförhållandena i Hanöbukten och Bornholmsbassängen var alltså goda och låg över gränsen för akut syrebrist. Även vid station BCSIII-10 märktes en förbättring av syresituationen, dock inte i resten av Östersjön. Helt syrefria förhållanden återfanns från 90-125 meters djup och akut syrebrist från 65-75 meters djup, något djupare i den västra delen. I Skagerrak och Kattegatt återfanns en hög fluorescenssignal på cirka 15 meters djup, där pyknoklinen befann sig.

Nästa ordinarie expedition är planerad till vecka 24. Då kommer egentliga Östersjön, Skagerrak och Kattegatt att besökas.

PRELIMINÄRA RESULTAT

Expeditionen, som var en för SMHI ordinarie övervakningstur med det finska forskningsfartyget Aranda, startade i Helsingfors den 25:e april och avslutades i Nynäshamn den 1:a maj. Ett kort uppehåll gjordes i Lysekil för att ta ombord kompletterande utrustning samt för att sätta iland prover. Vindarna var mycket svaga och med varierande riktning under största delen av expeditionen, även om det friskade i något under det sista dygnet, med nordliga vindar på upp mot 20 m/s. Lufttemperaturen varierade mellan 4 och 13°C.

Skagerrak

Temperaturen i ytlagret var något hög för årstiden och varierade mellan 9,2 och 10,7°C. Salthalten låg i allmänhet i den lägre delen av normalspannet, från 19,9 PSU i söder till 28,3 PSU i den västra delen av det undersökta området. Haloklinen och termoklinen var relativt väl utvecklade i hela området och återfanns på djup mellan 10-20 meter.

Närsalterna i ytvattnet uppvisade halter som var relativt låga för årstiden, mer karakteristiska för sommaren, undantaget silikat som låg på normala värden. Fosfathalterna varierade från 0,03 till 0,06 $\mu\text{mol/l}$, silikat mellan 1,2 och 1,7 $\mu\text{mol/l}$, medan oorganiskt kväve låg under detektionsgränsen på 0,1 $\mu\text{mol/l}$.

Fluorescensmätningar visade en stark signal på cirka 15 meters djup (vid pyknoklinen) i hela området.

Kattegatt och Öresund

Ytvattentemperaturen var möjligen något förhöjd i området och varierade mellan 8,1 och 10,8°C. Salthalten i Kattegatts ytvatten var något låg, men inom det normala, 8,4 PSU i Öresund till 20,5 PSU i östra delen av området. Termoklin och haloklin var väl utvecklade och sammanföll på djup mellan 10 och 20 meter.

Näringsämnen i Kattegatts ytvatten låg inom det normala för årstiden. Fosfatkoncentrationerna var normala och låg mellan 0,06 och 0,21 $\mu\text{mol/l}$. Halterna av nitrit + nitrat låg under detektionsgränsen, vilket är normalt för årstiden, medan silikat hade koncentrationer mellan 1,8 och 4,7 $\mu\text{mol/l}$, också inom det normala.

Fluorescensmätningar visade en stark signal på cirka 10-15 meters djup (vid pyknoklinen) i hela området.

Syreförhållandena i djupvattnet uppvisade värden i den lägre delen av det för årstiden normala intervallet. Det lägsta värdet i Kattegatt uppmättes vid Anholt E, 5,4 ml/l. I Öresund uppmättes som lägst 4,5 ml/l.

Egentliga Östersjön

Ytvattentemperaturen var normal för årstiden och varierade mellan cirka 4,5 i norr och 6,5°C i sydväst. I egentliga Östersjön var ytlagret välblandat, termoklin och haloklin sammanföll och återfanns på omkring 60 meters djup i norra, västra och östra Gotlandsbassängen, med en termoklin på väg att utvecklas på cirka 40 meters djup. I Bornholmsbassängen var termoklinen svagare och återfanns på omkring 30-40 meters djup och på knappt 20 meters djup i Arkonabassängen.

Halterna av fosfat och silikat låg i den högre delen av det normala intervallet i hela Östersjön, utom i Arkonabassängen, där de snarare var något lägre än normalt. Fosfathalterna låg mellan 0,25–0,50



$\mu\text{mol/l}$ och silikathalterna mellan 5,4 och 14,5 $\mu\text{mol/l}$. Oorganiskt kväve (nitrit + nitrat) var förbrukat i ytvattnet och låg under detektionsgränsen i hela det undersökta området.

I Arkonabassängens bottenvatten var syreförhållandena försämrade, men ej kritiska, och låg något under det normala. Syresituationen i Bornholmsbassängen och Hanöbukten var alltså relativt god och låg klart över gränsen för akut syrebrist ($< 2 \text{ ml/l}$).

Vid BCSIII-10 hade syresituationen förbättrats jämfört med tidigare i år, och i bottenvattnet uppmättes halter strax över gränsen för akut syrebrist. Den effekt av ett tidigare inflöde som märktes i form av minskade koncentrationer av svavelväte i bottenvattnet i östra Östersjön hade nu avklingat, och halterna tenderade att öka igen. Helt syrefria förhållanden återfanns från 90 - 125 meters djup och akut syrebrist från 65 - 75 meters djup, något djupare i västra Östersjön. Planktonaktiviteten, baserad på fluorescensmätningar, var låg i hela det undersökta området.

DELTAGARE

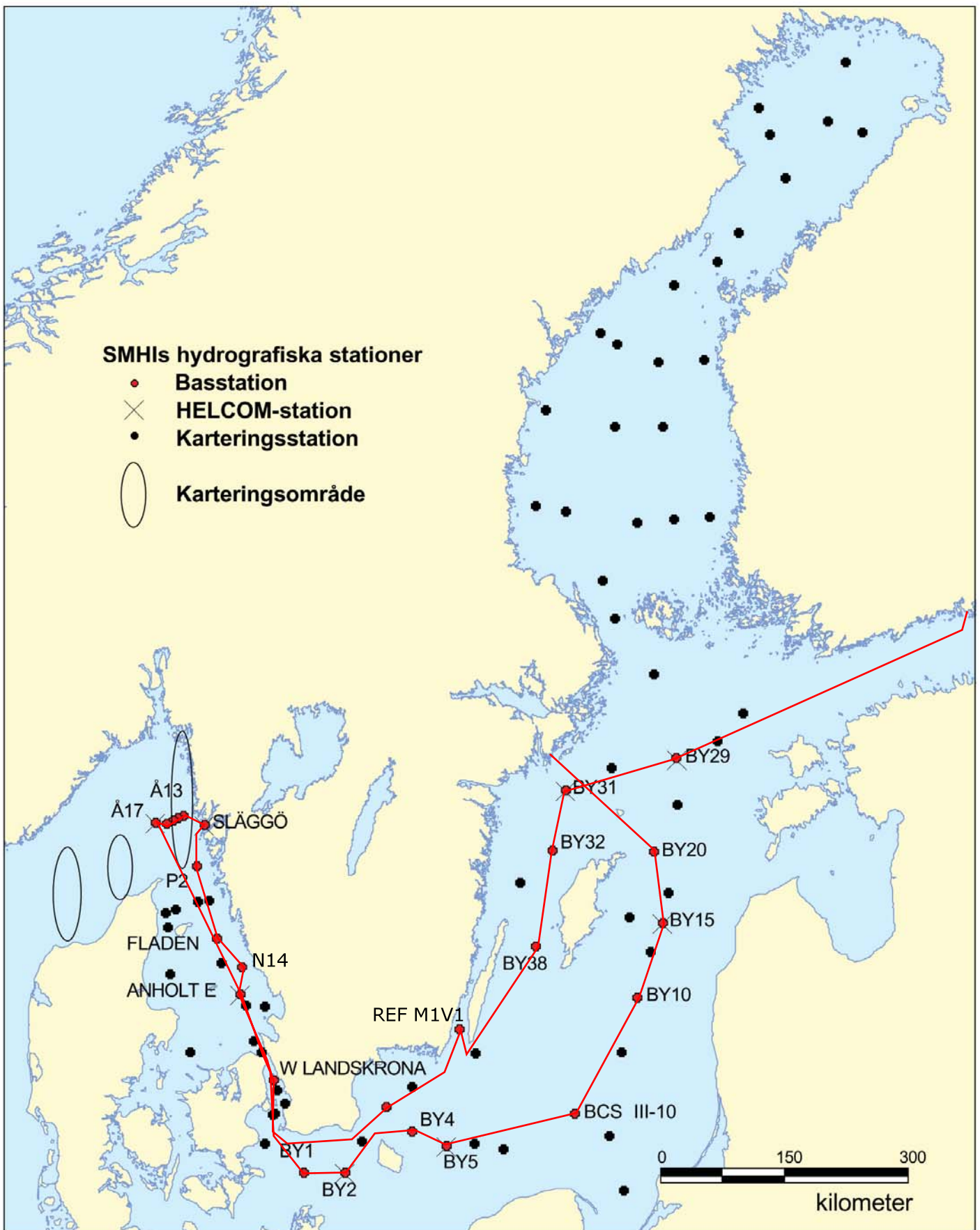
Namn		Från
Anna-Kerstin Thell	Expeditionsledare	SMHI
Sara Johansson		SMHI
Mikael Krysell		SMHI
Vivi Månsson		SMHI
Sari Sipilä		SMHI
Martin Nilsson (29/4-1/5)	Praktikant	SMHI

BILAGOR

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

TRACKCHART

Country: Sweden
 Ship: R/V ARANDA
 Date: 20140317-20140324
 Series: 0146-0173



Date: 2014-03-26
Time: 17:32

[illegible]

SMHI
Ocean enh

Hydrographic
series

Ship: 01-Aranda
Year: 2014

Date: 2014-03-26
Time: 17:32

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 tu hd	C C C C C	PPCPZZT Hrhh Cilyooa motPBw PrP l	No de	T e	S a	P h	O x	H 2	P o	T o	N o	N o	N o	T h	A o	S l	H i	L u	P i	P o	T o	C o	
0173	BPEX26BAS	BY20	FÄRÖDJ	N5800	E1953	20140324	1245	197	11	01 3	3.1	1008	1420	x	--x----	17	x	x	-	x	x	x	x	x	x	x	x	x	-	x	-	-	-	-	-	x

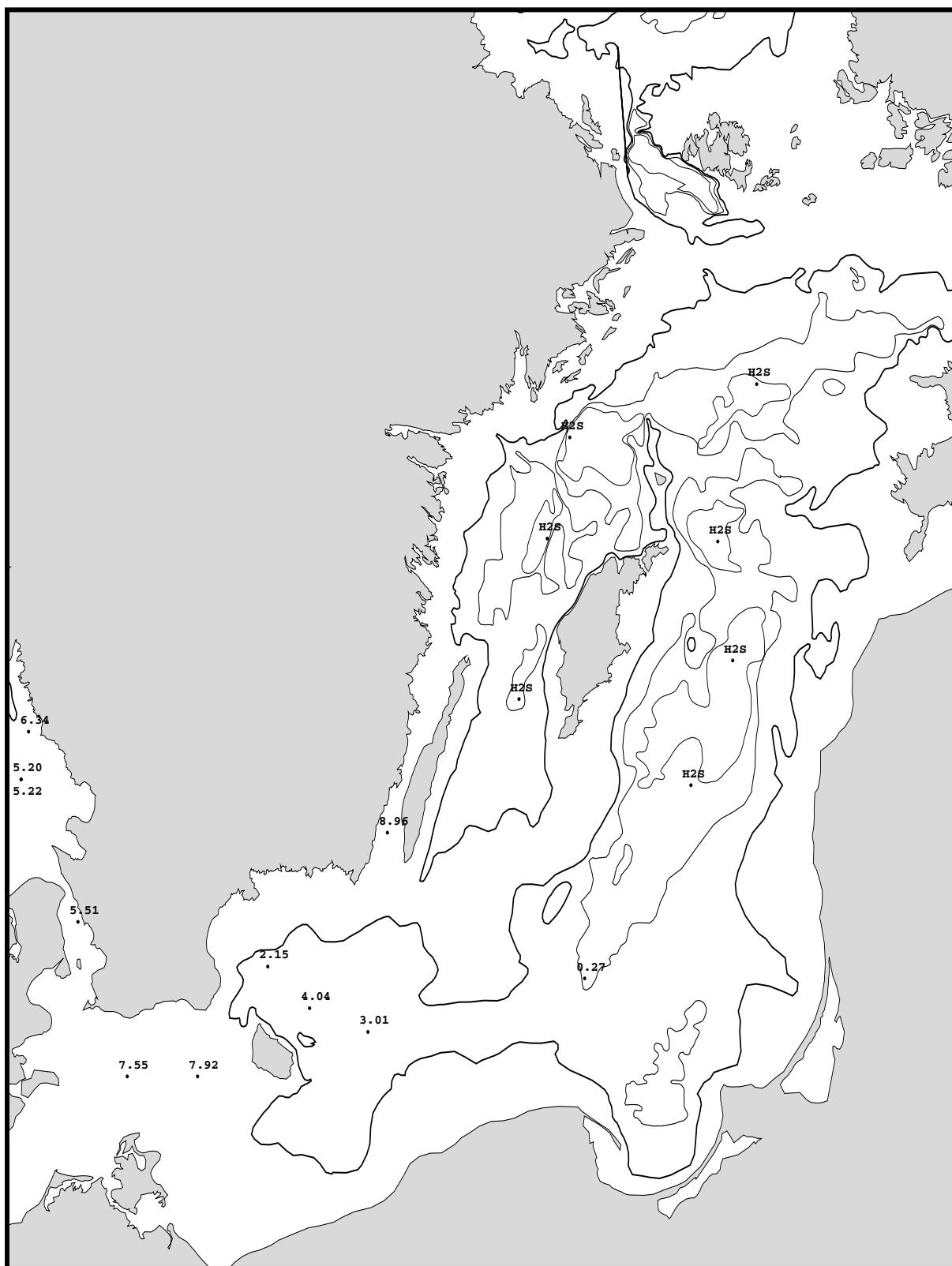
Bottom water oxygen concentration (ml/l)

Country: Finland

Ship : Aranda

Date : 20140317-20140324

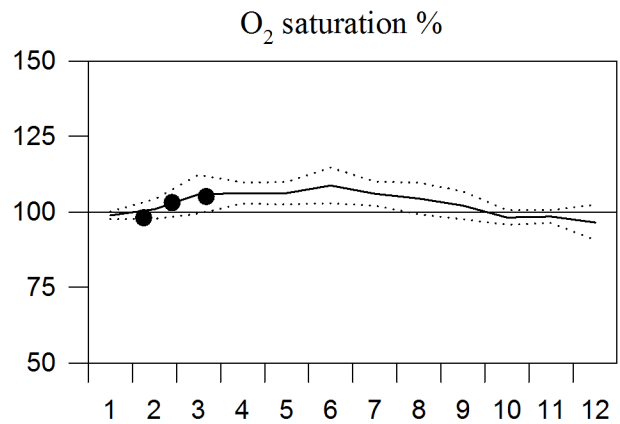
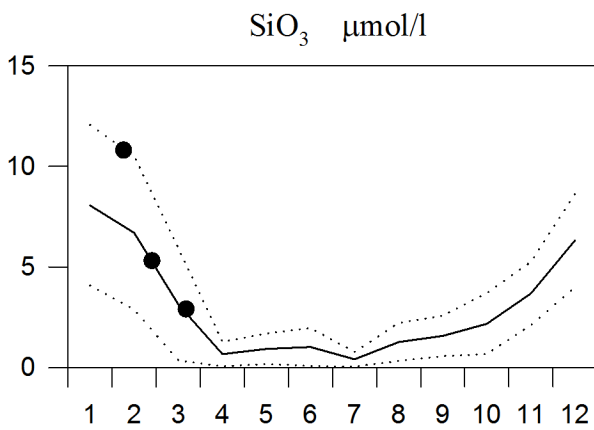
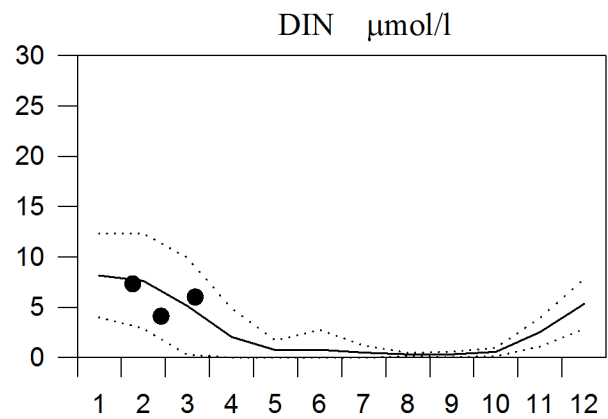
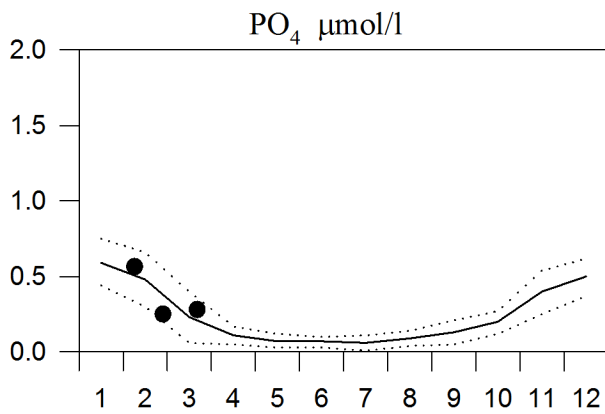
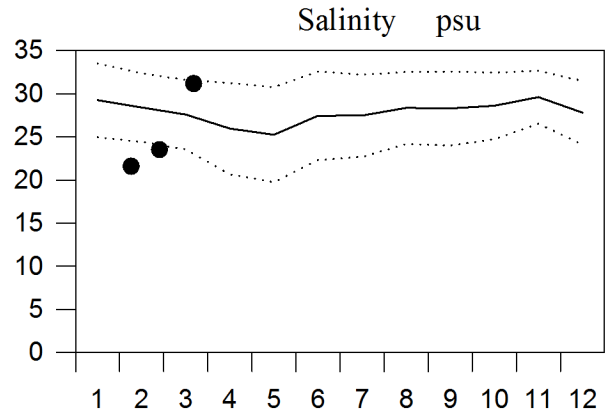
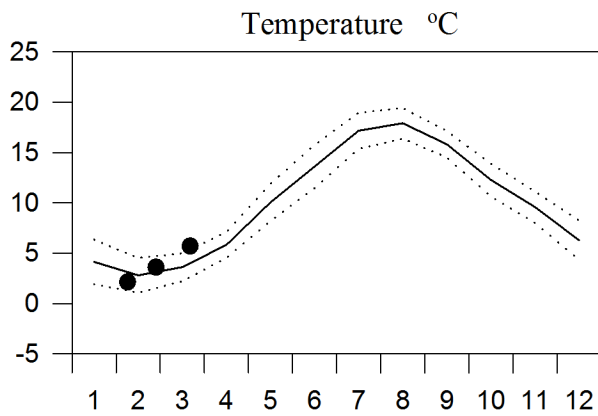
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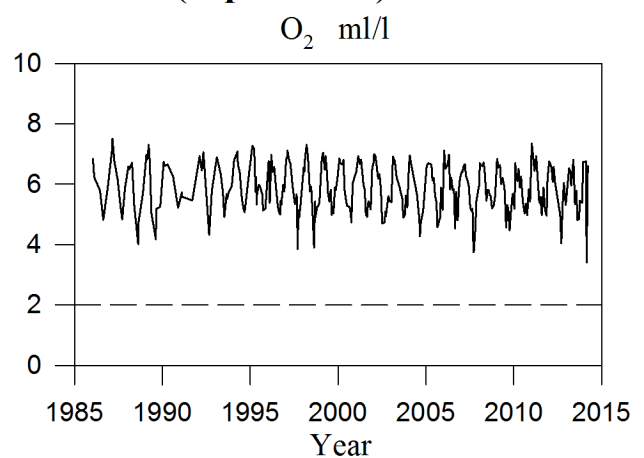
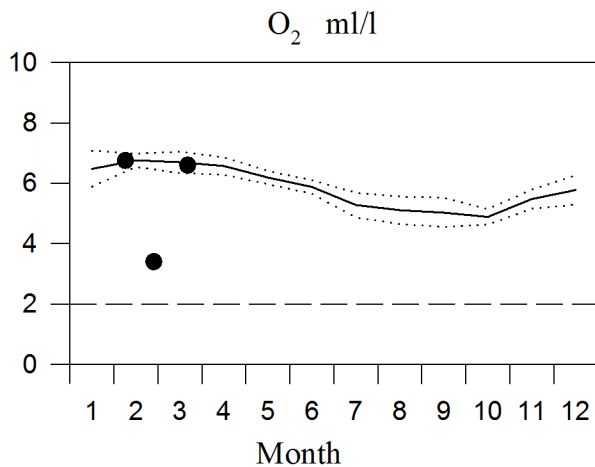
STATION P2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



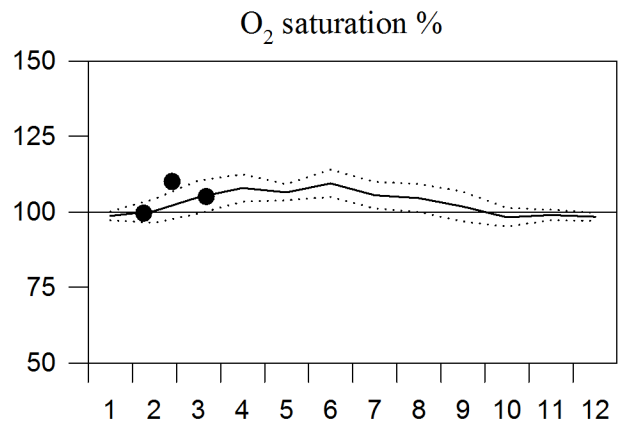
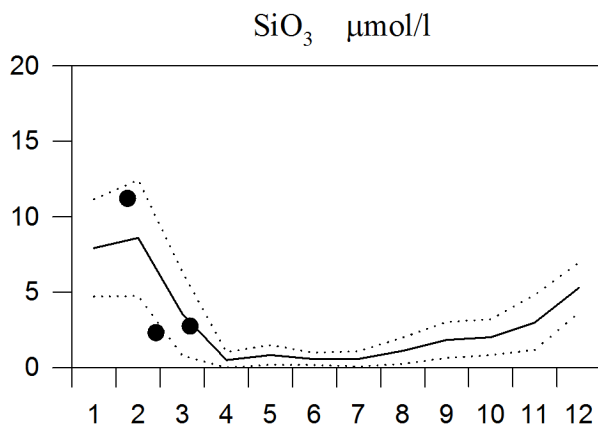
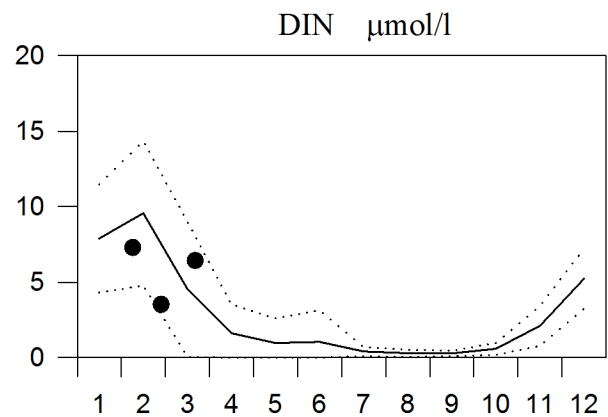
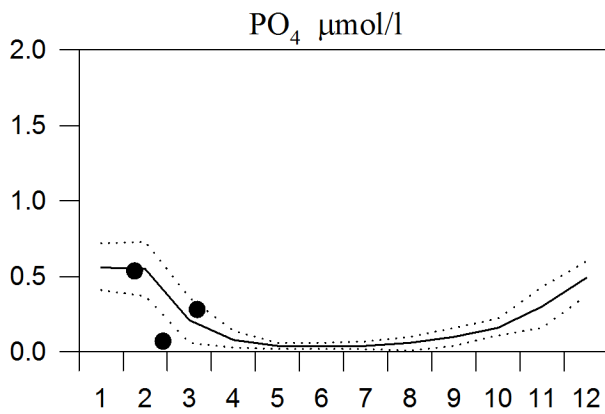
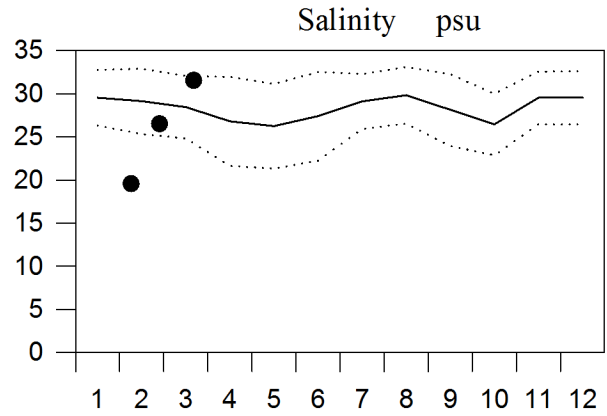
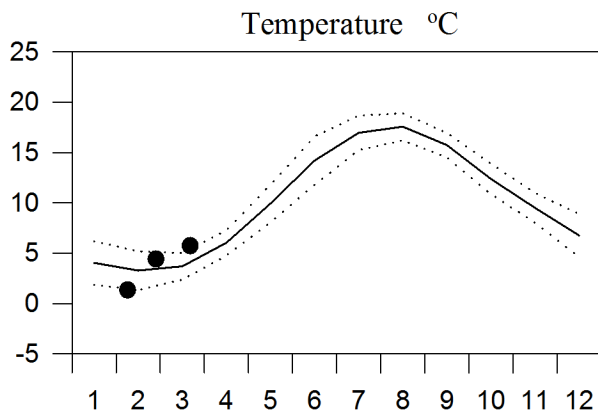
OXYGEN IN BOTTOM WATER (depth >75m)



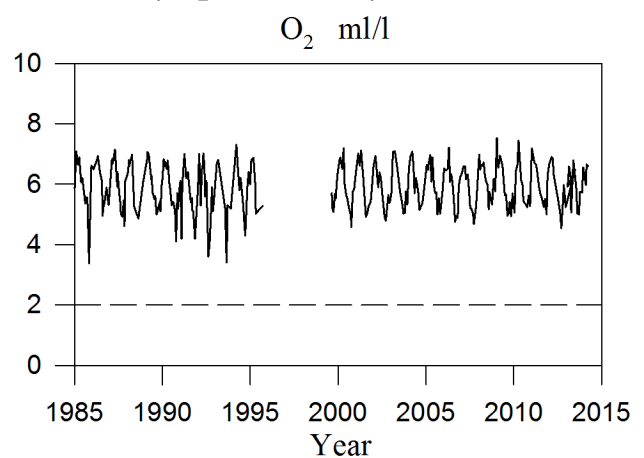
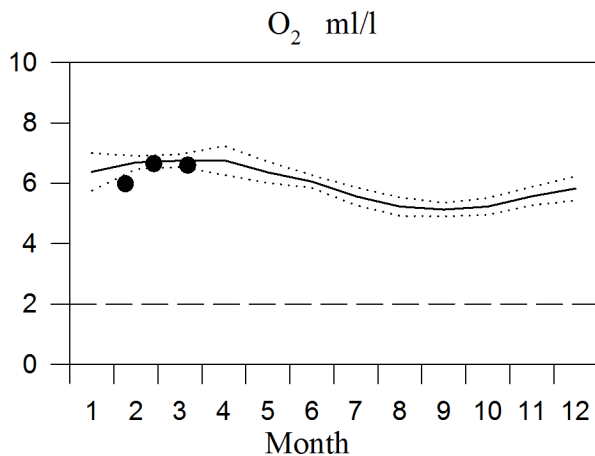
STATION Å13 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



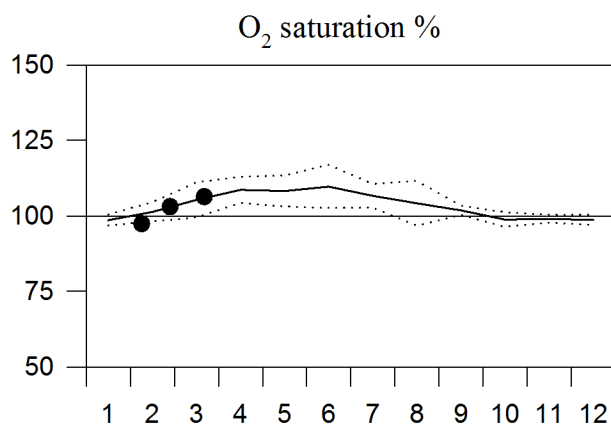
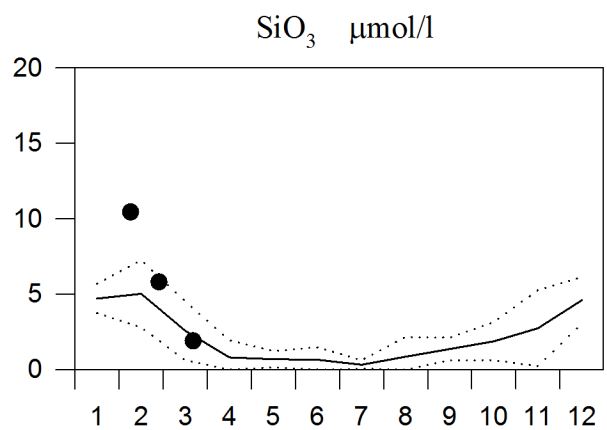
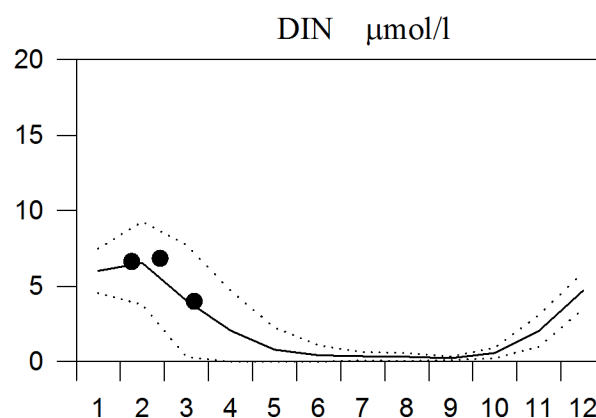
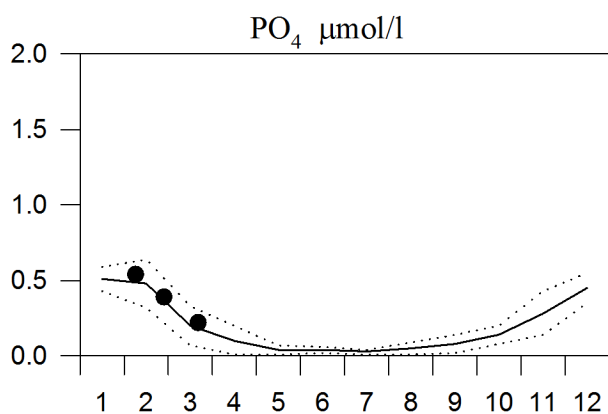
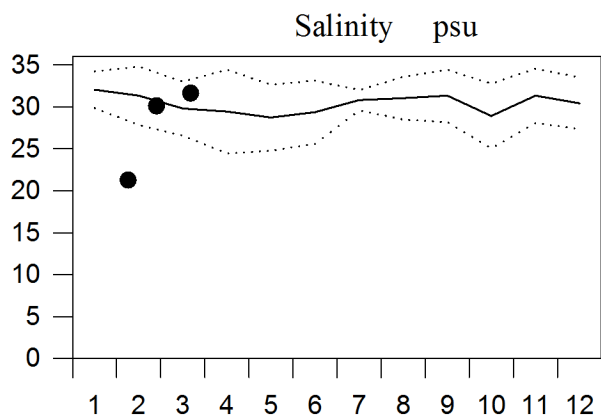
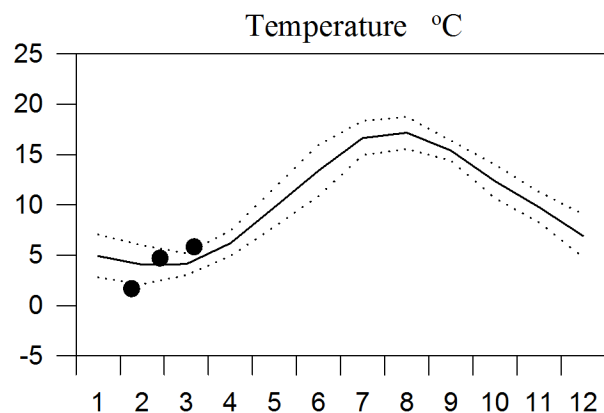
OXYGEN IN BOTTOM WATER (depth >=75m)



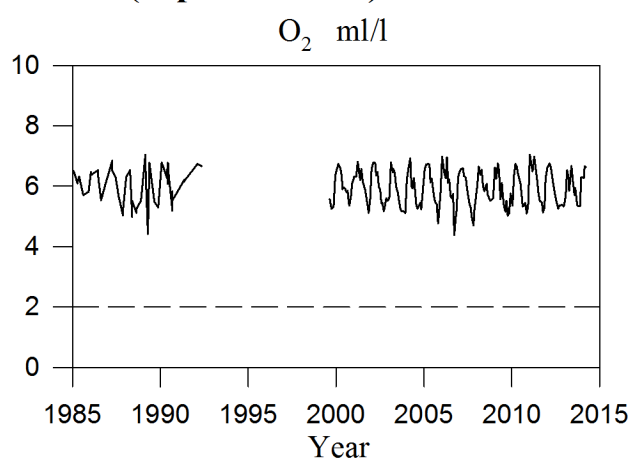
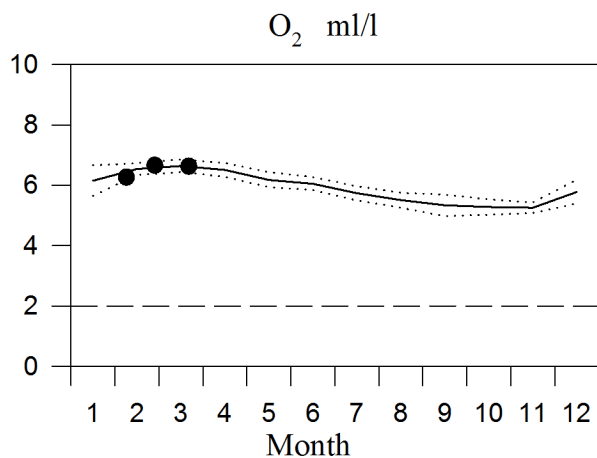
STATION Å15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



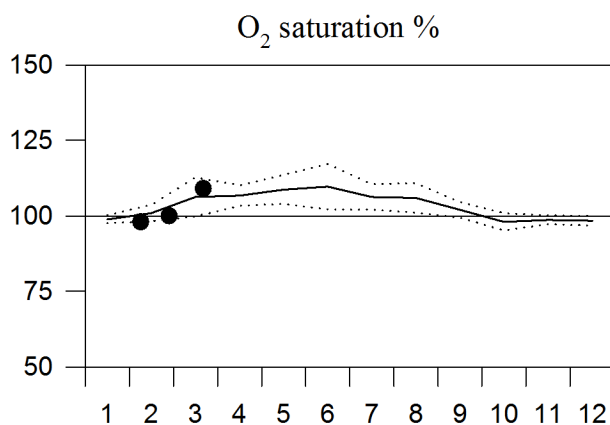
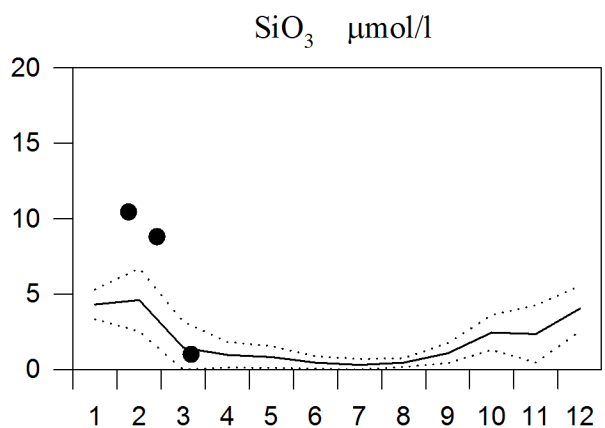
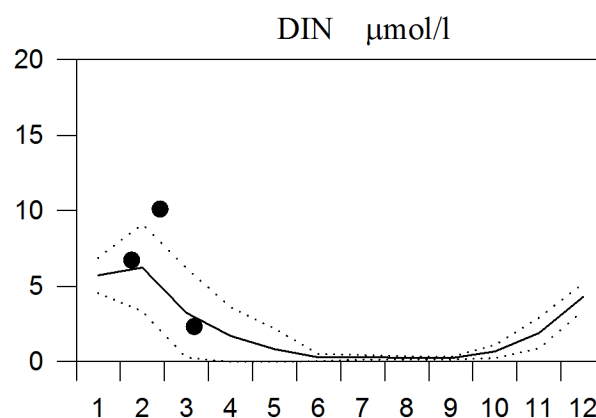
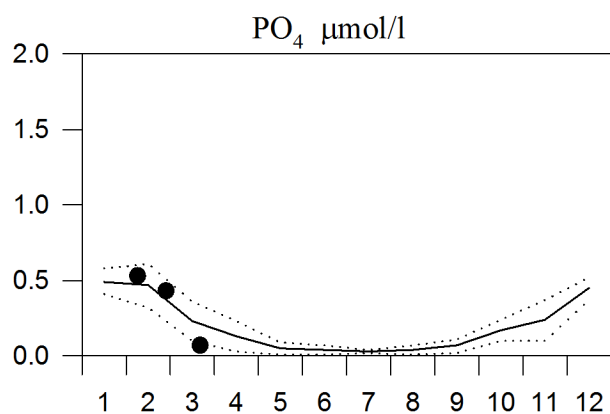
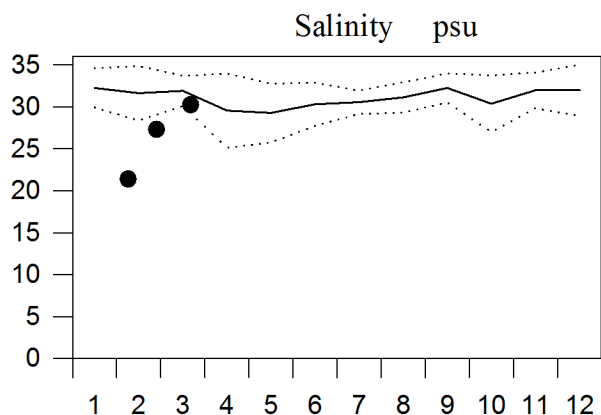
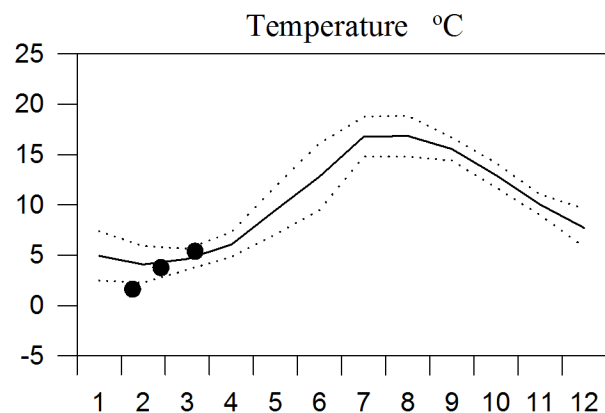
OXYGEN IN BOTTOM WATER (depth >=125m)



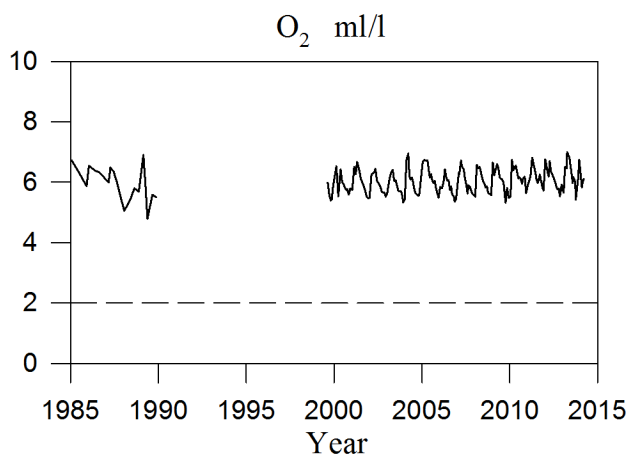
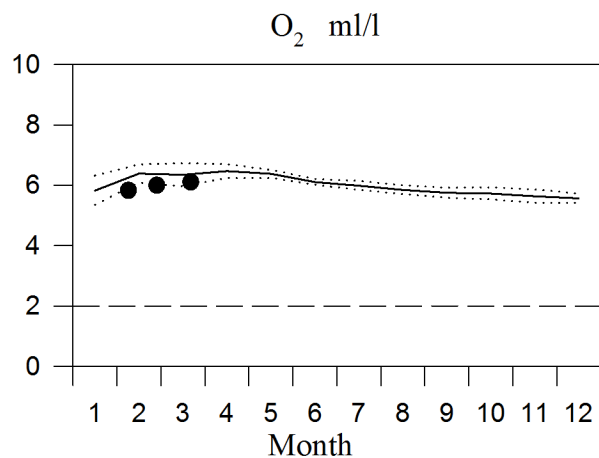
STATION Å17 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



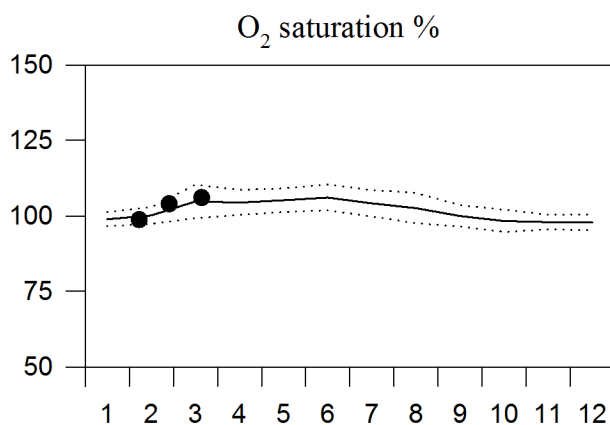
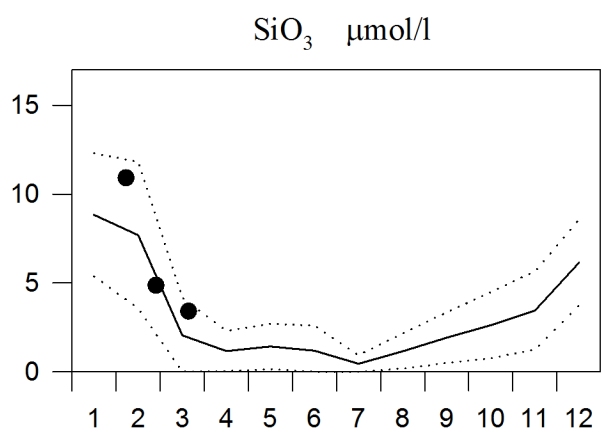
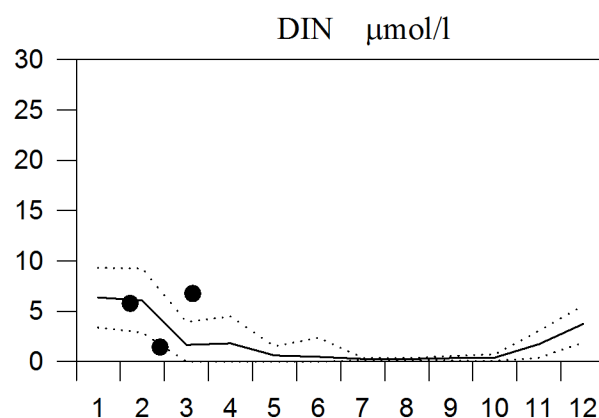
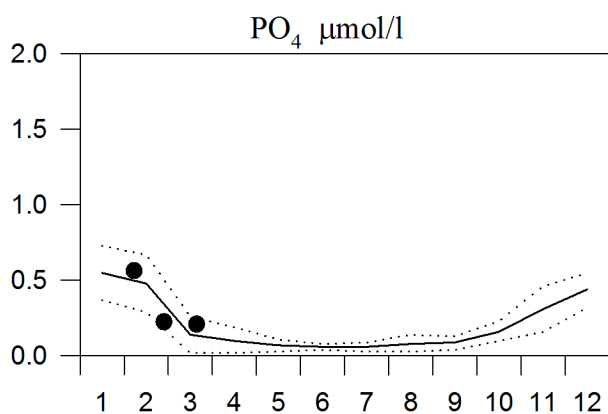
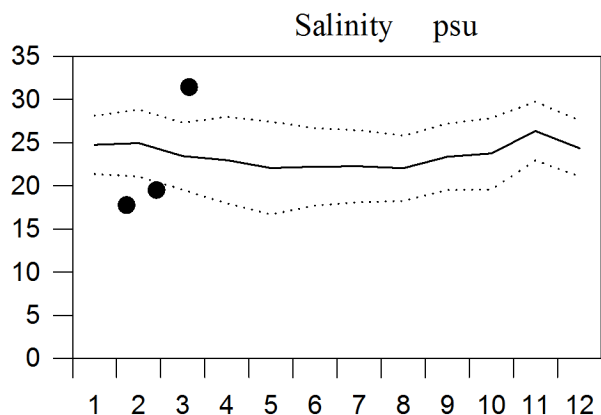
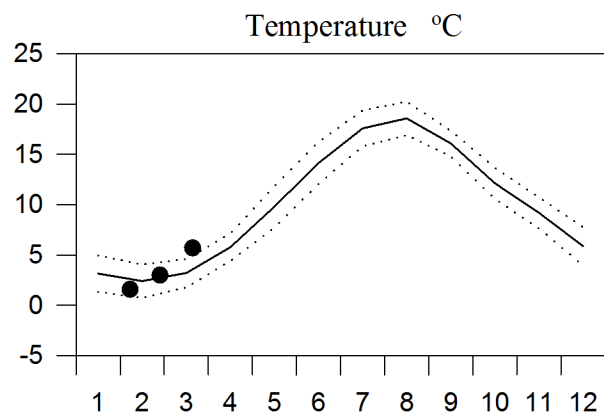
OXYGEN IN BOTTOM WATER (depth = 300m)



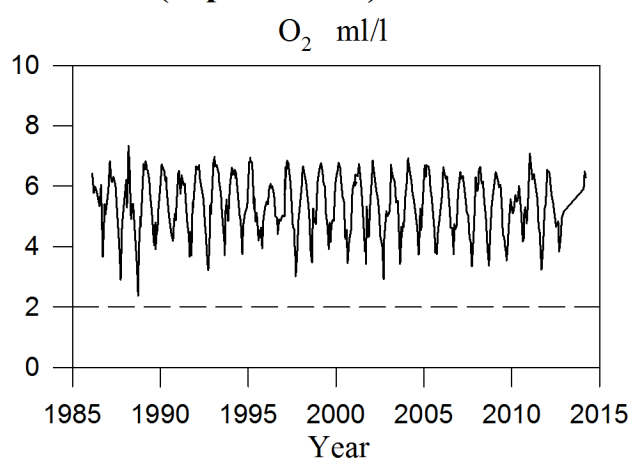
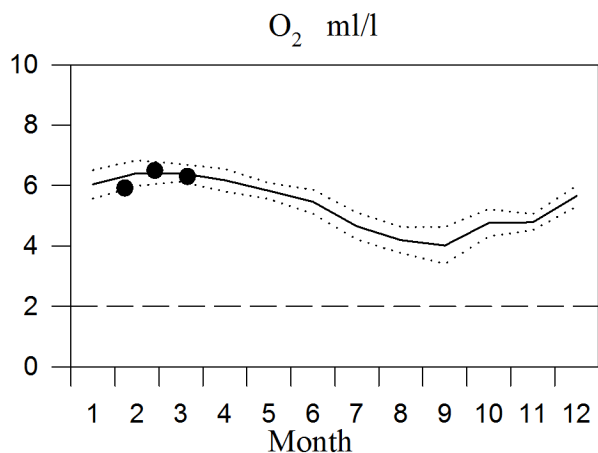
STATION FLADEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



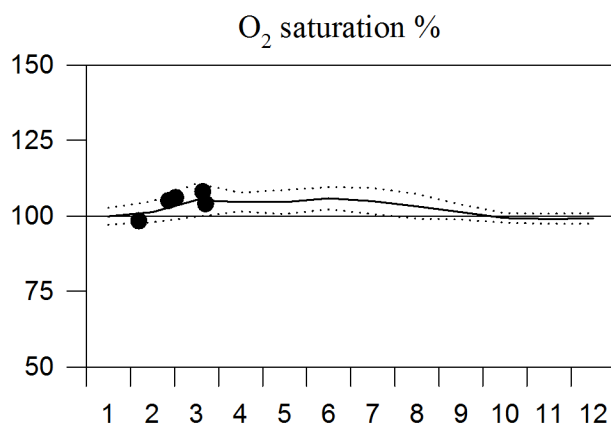
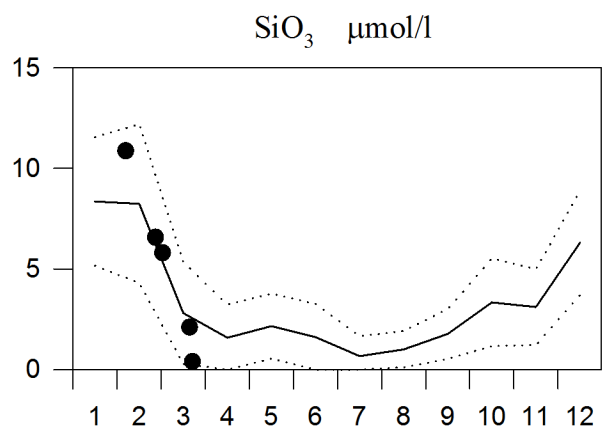
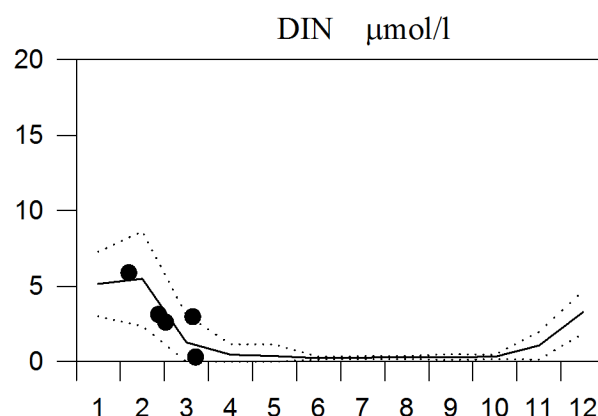
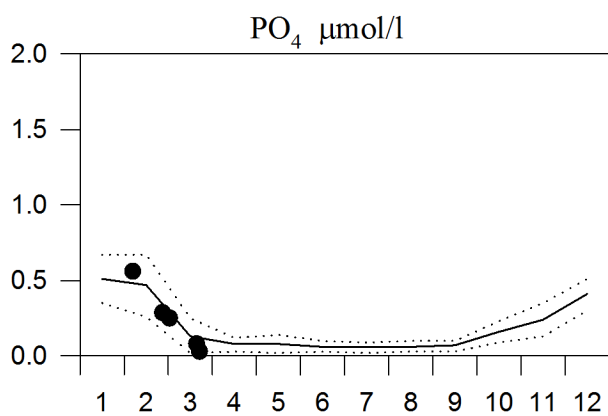
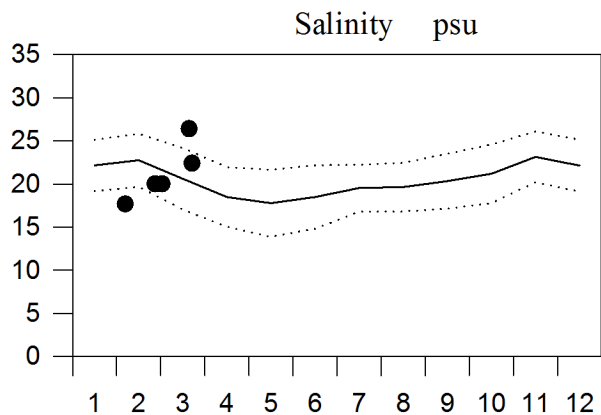
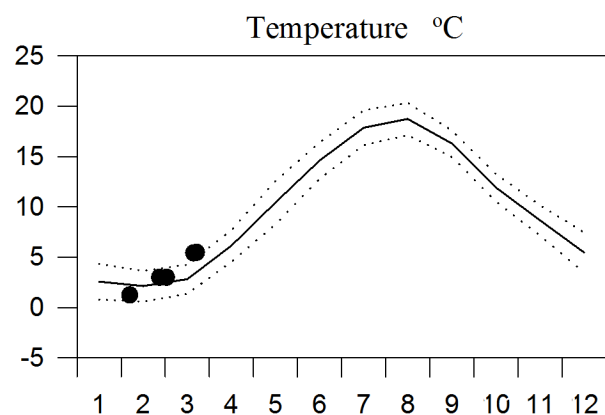
OXYGEN IN BOTTOM WATER (depth > 70m)



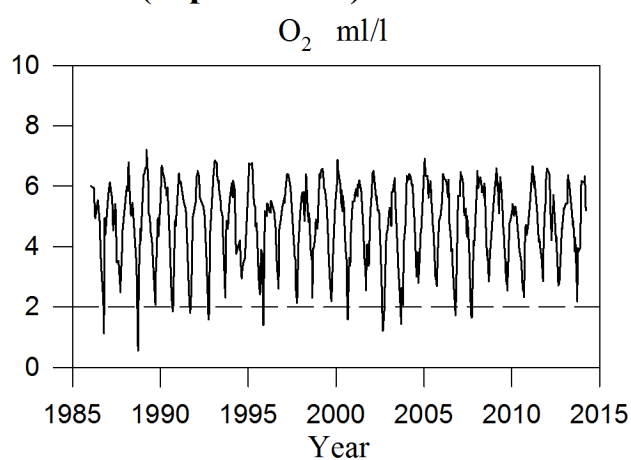
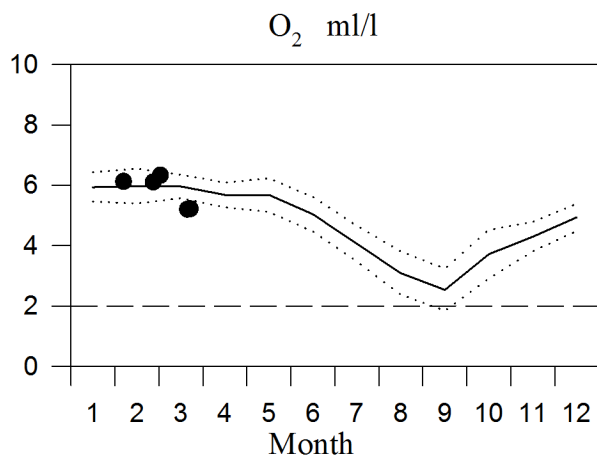
STATION ANHOLT E SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



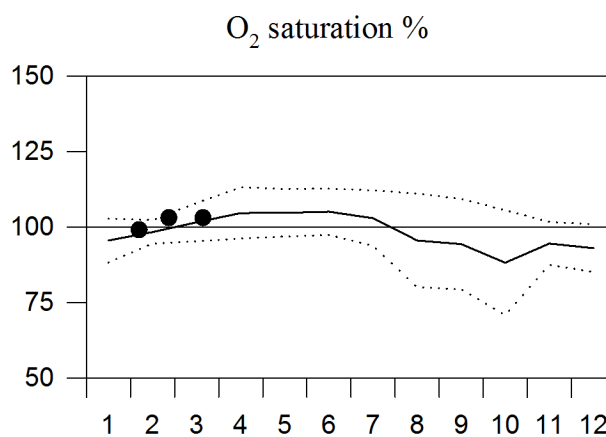
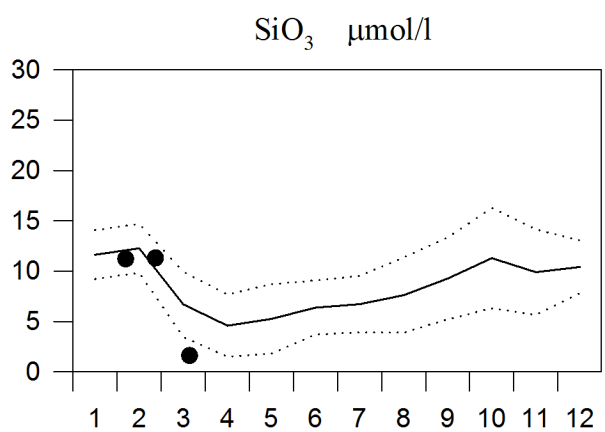
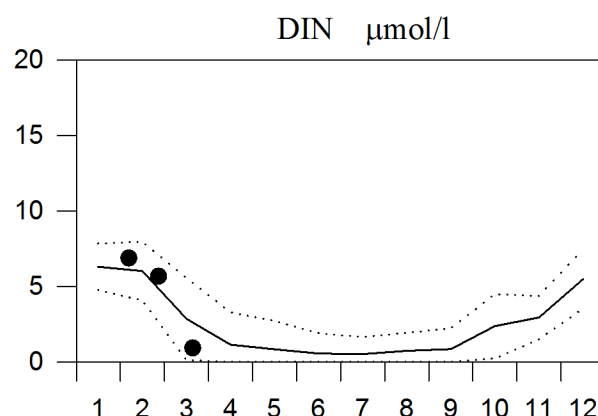
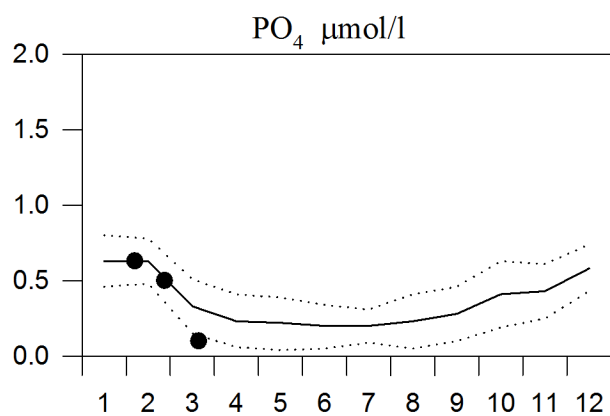
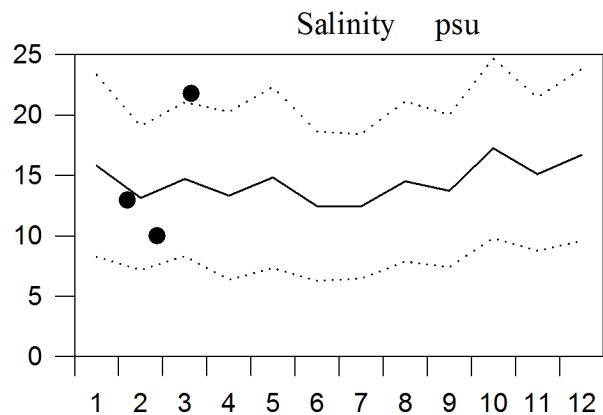
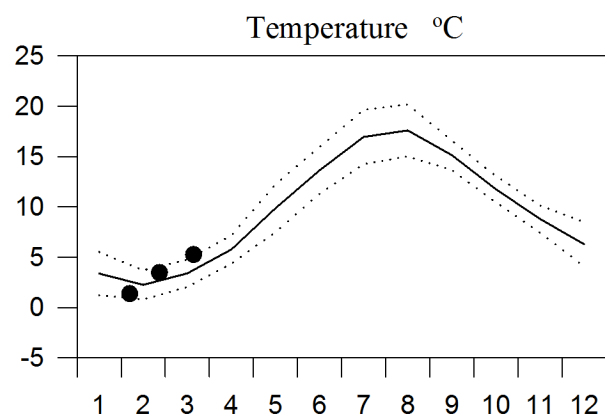
OXYGEN IN BOTTOM WATER (depth > 50m)



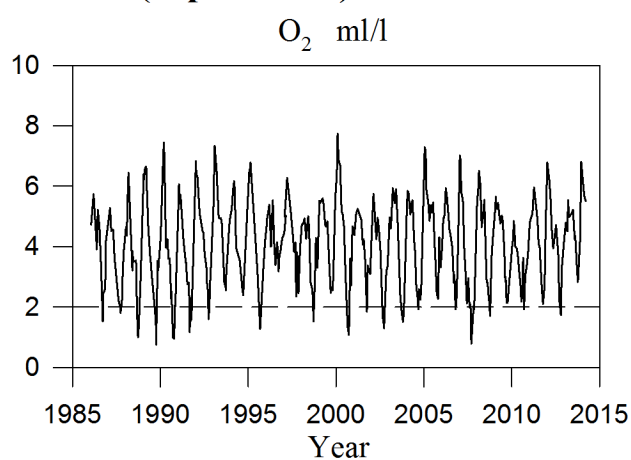
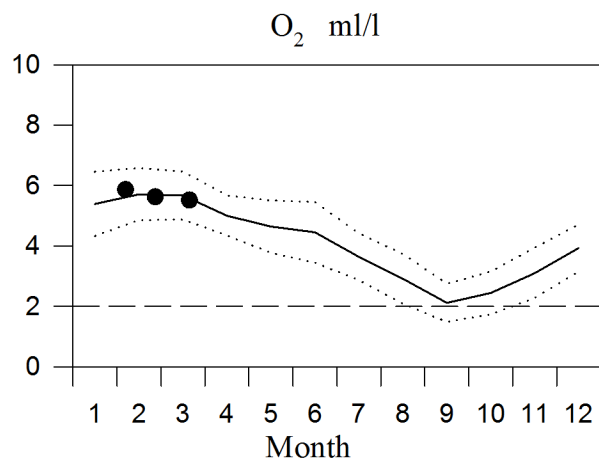
STATION W LANDSKRONA SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



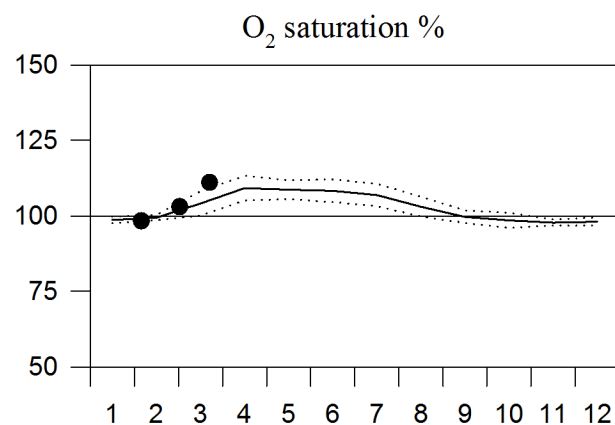
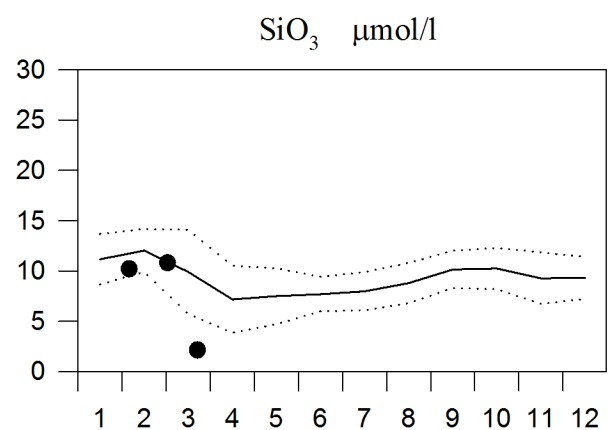
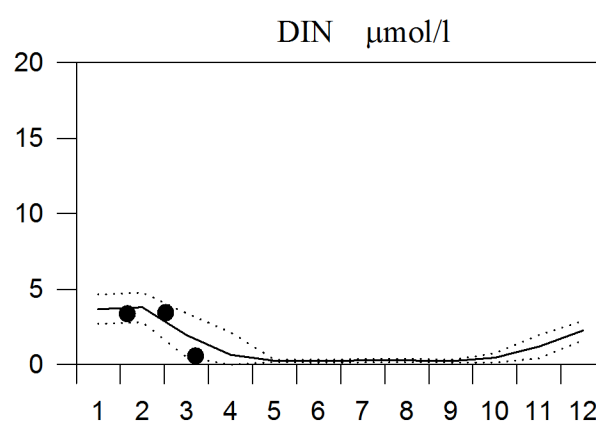
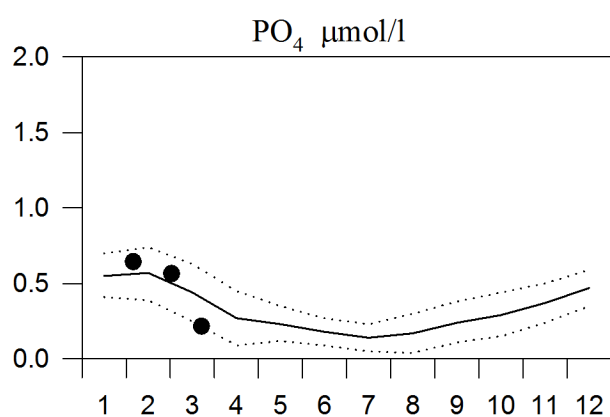
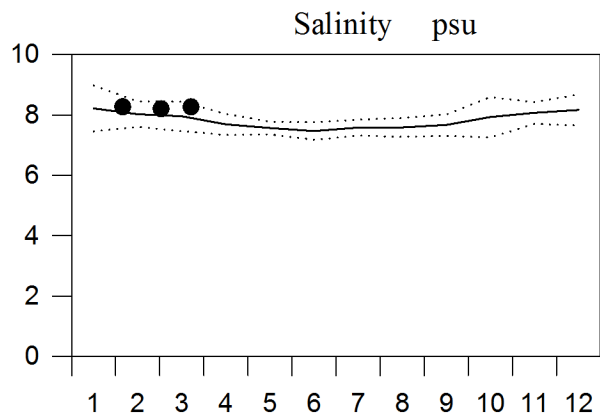
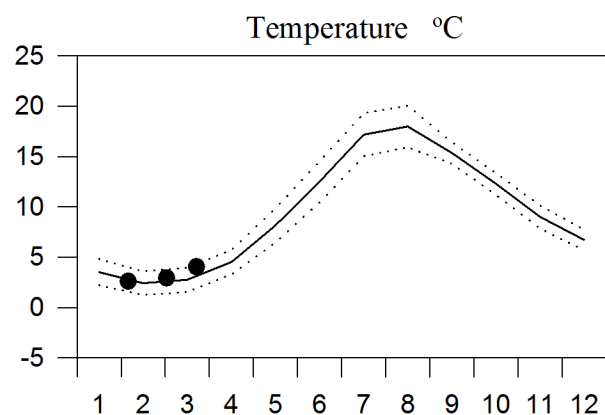
OXYGEN IN BOTTOM WATER (depth >40m)



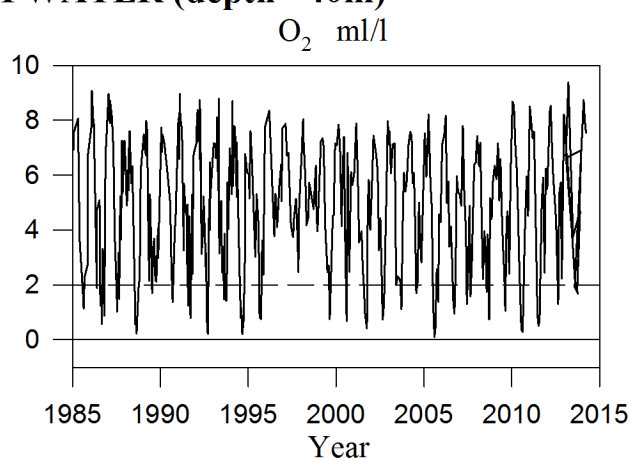
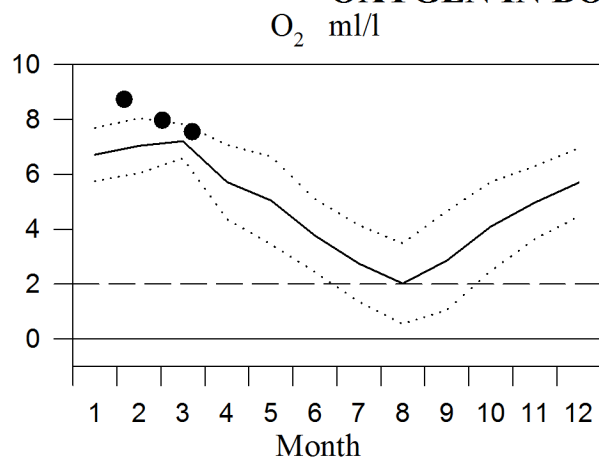
STATION BY1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



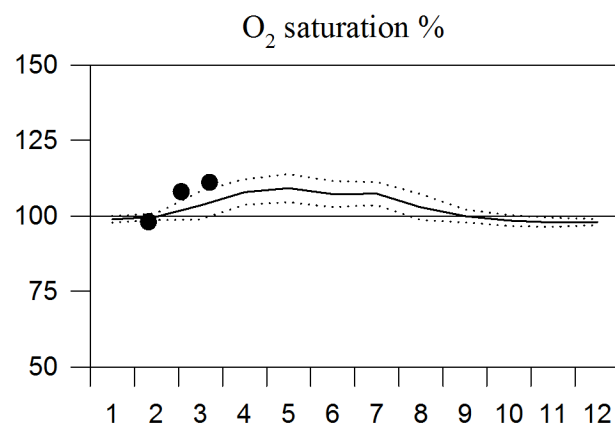
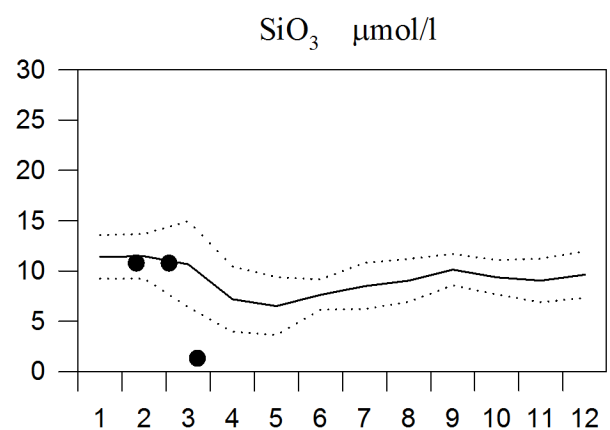
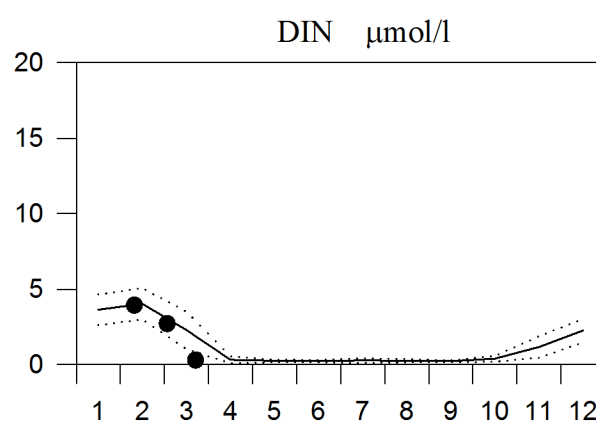
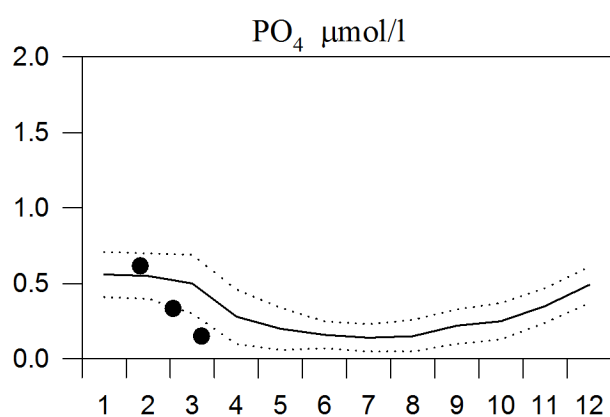
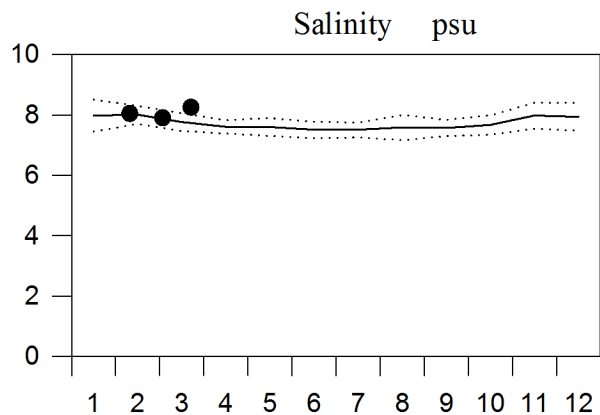
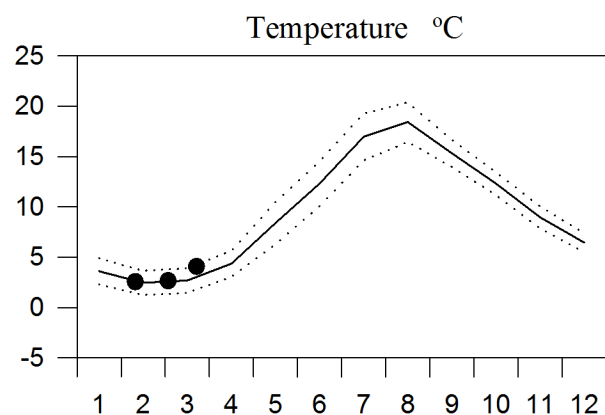
OXYGEN IN BOTTOM WATER (depth >40m)



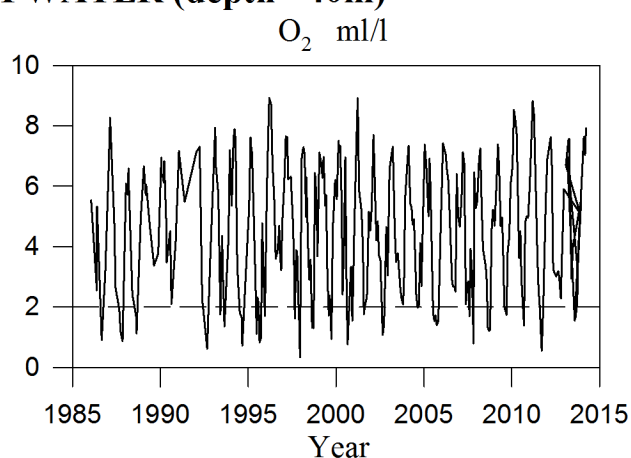
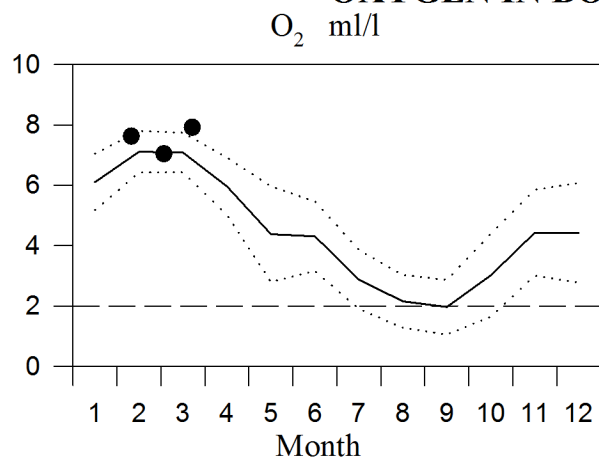
STATION BY2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



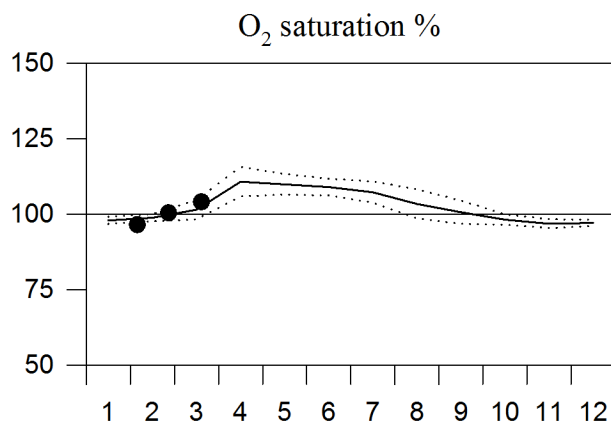
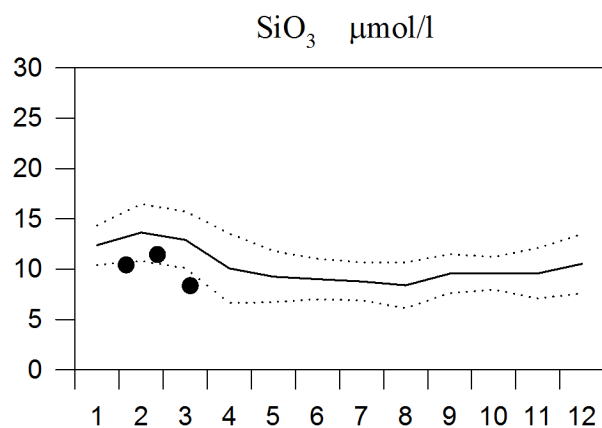
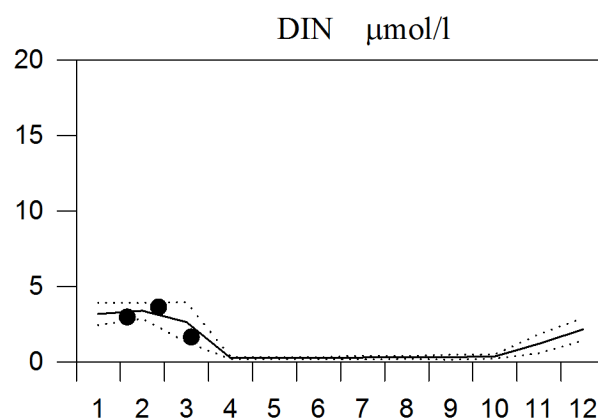
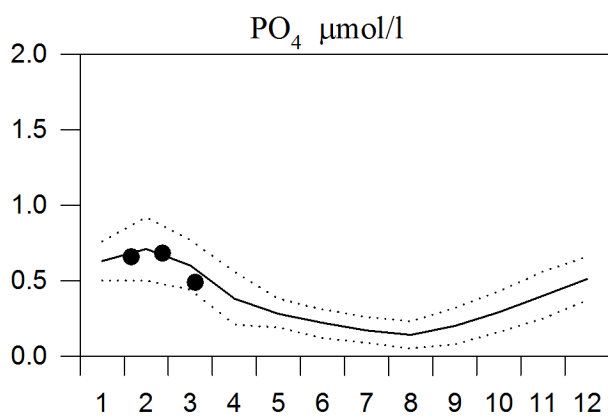
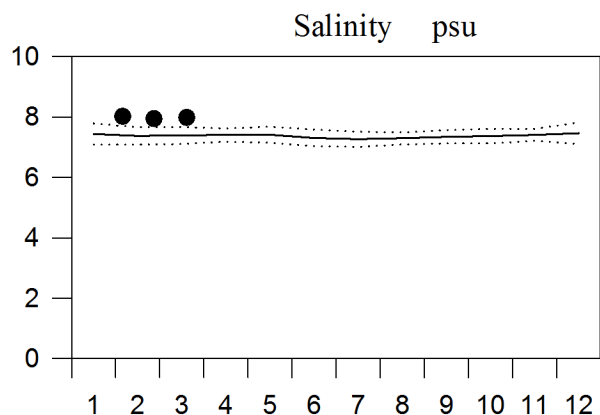
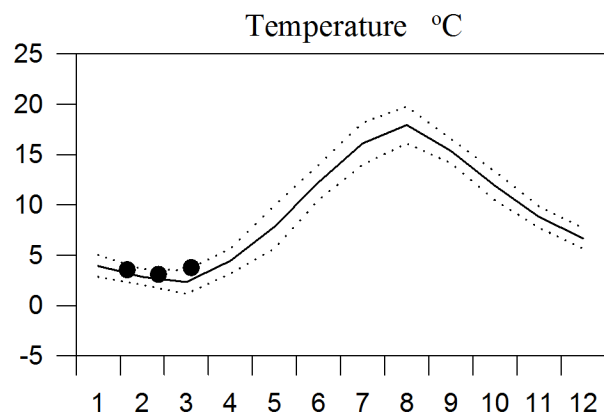
OXYGEN IN BOTTOM WATER (depth >40m)



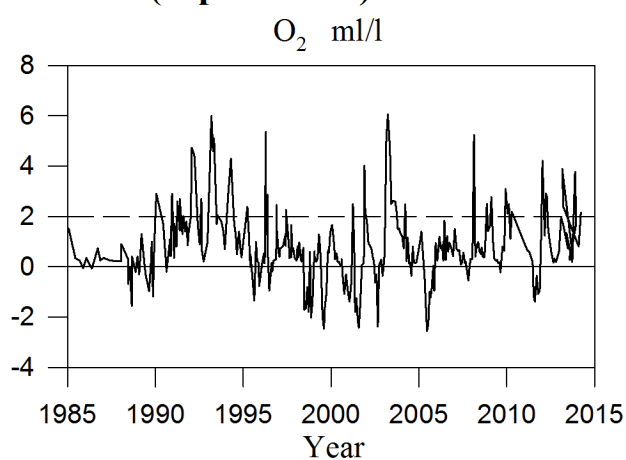
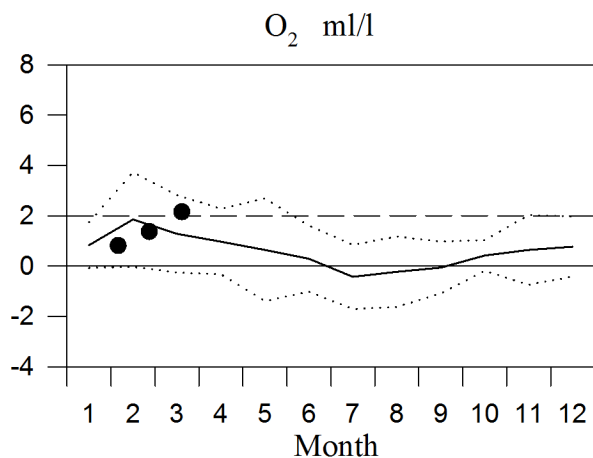
STATION HANÖBUKTEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



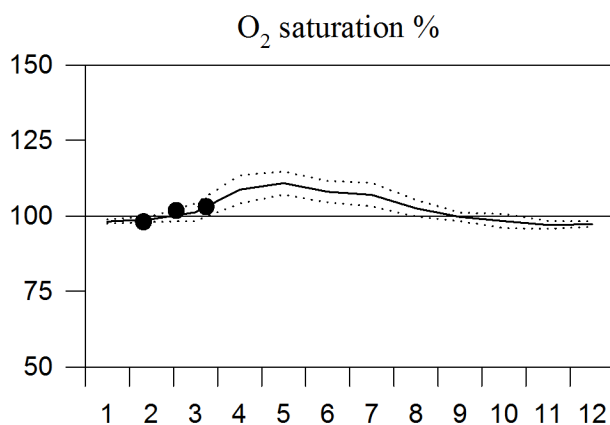
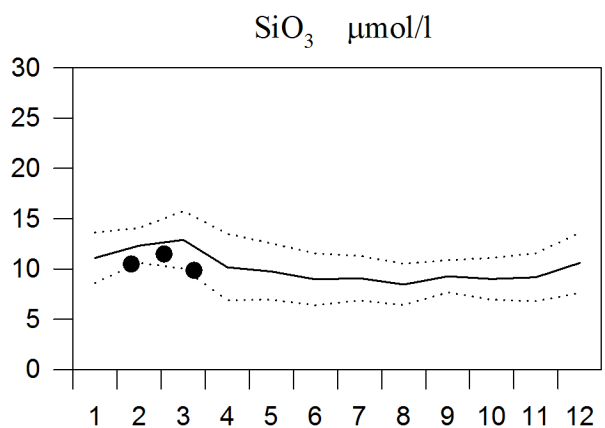
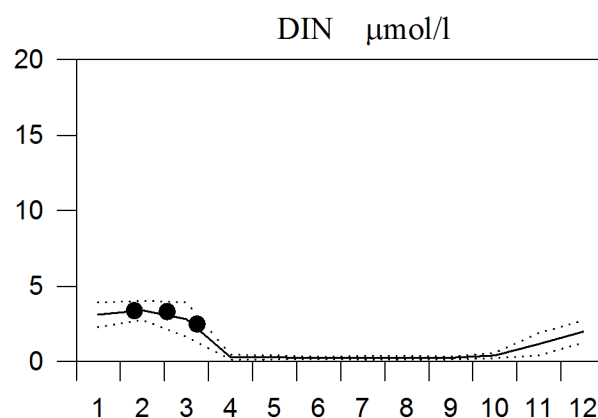
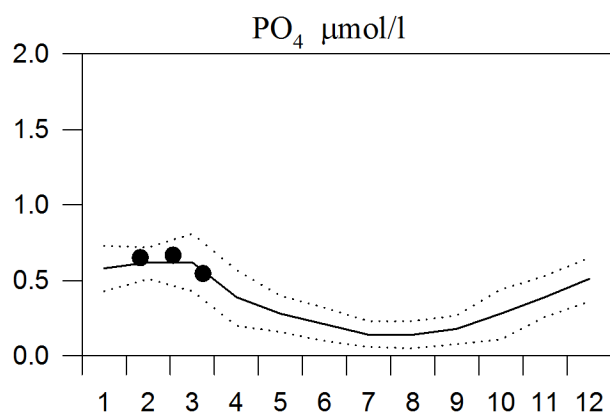
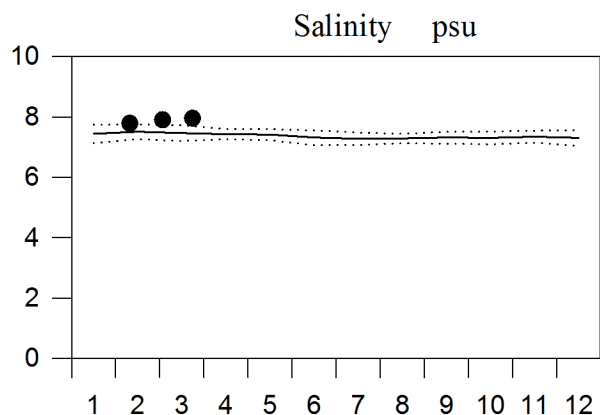
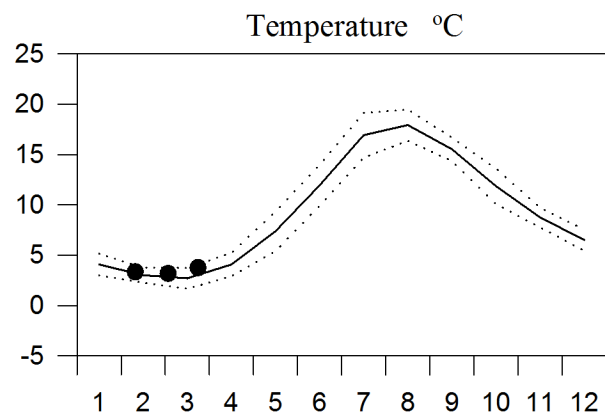
OXYGEN IN BOTTOM WATER (depth > 70m)



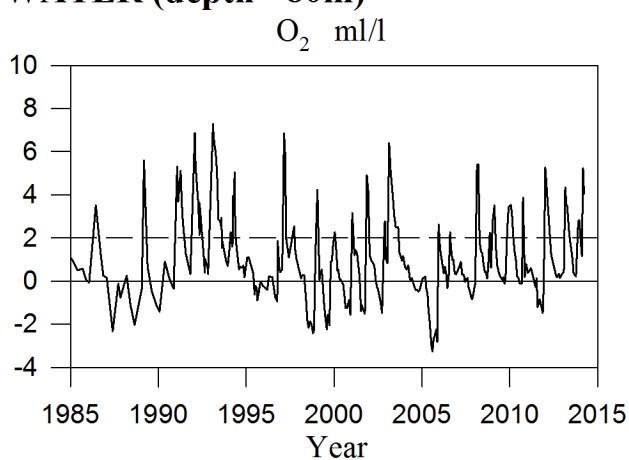
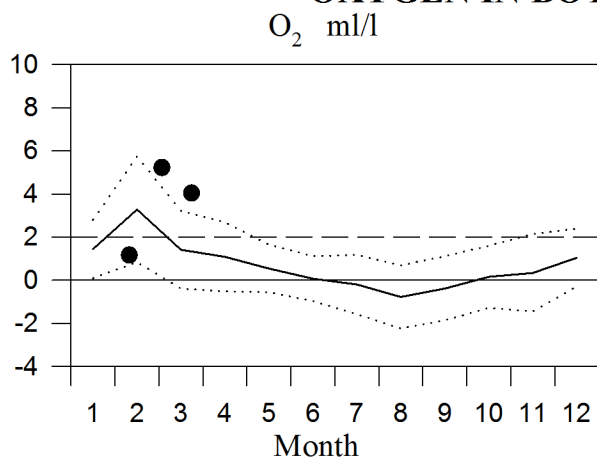
STATION BY4 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



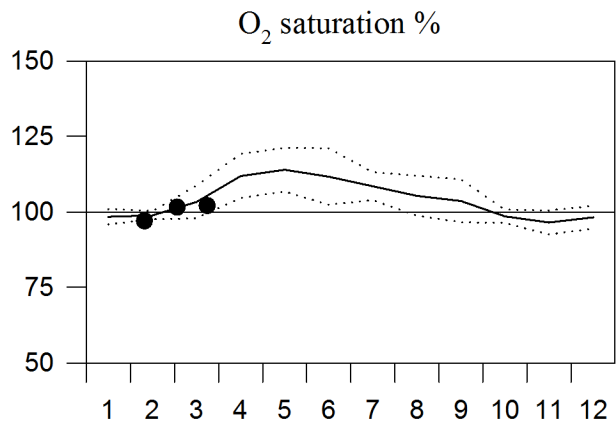
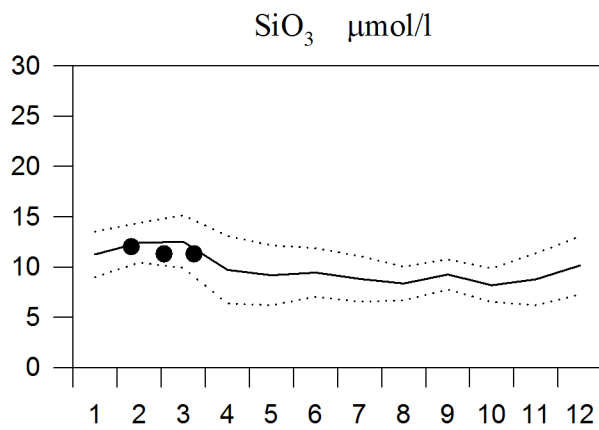
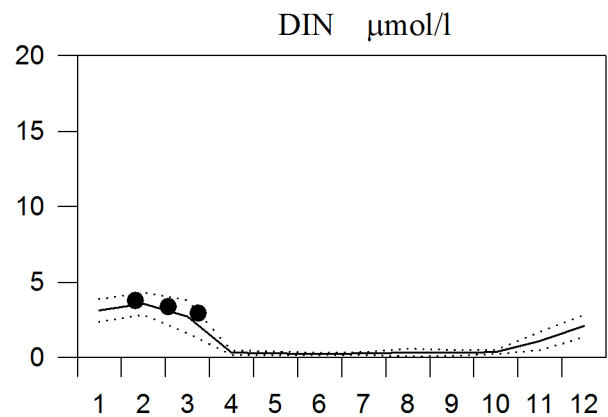
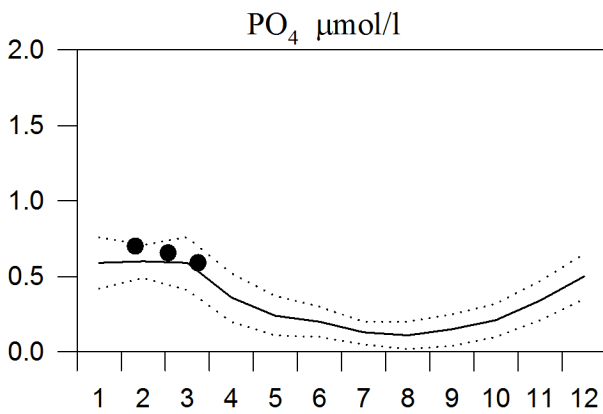
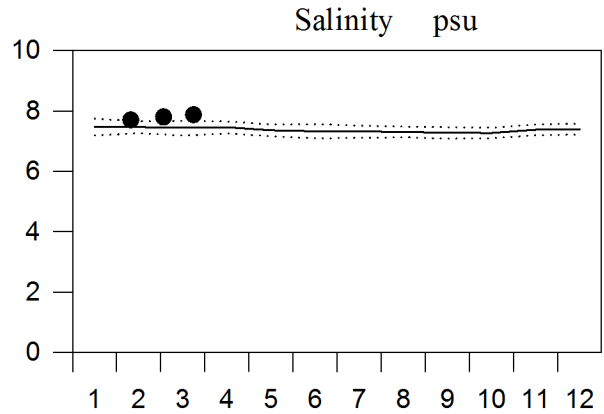
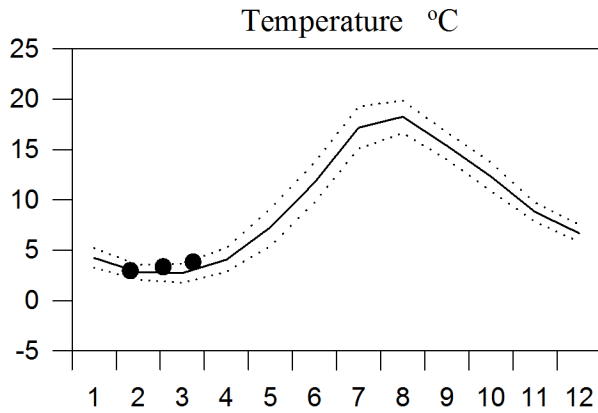
OXYGEN IN BOTTOM WATER (depth >80m)



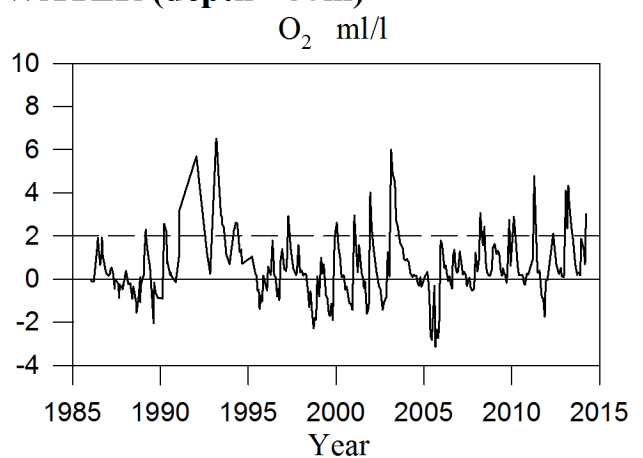
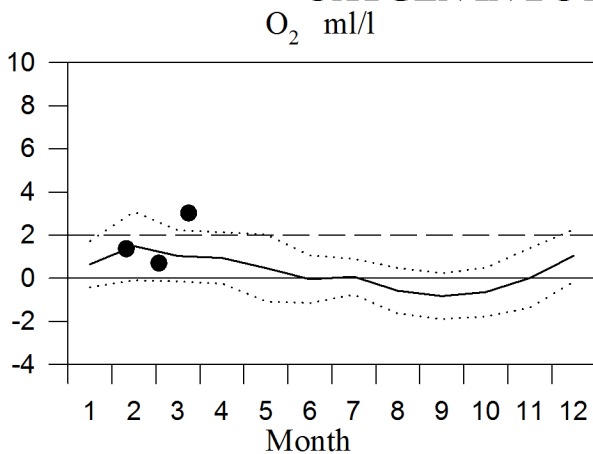
STATION BY5 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



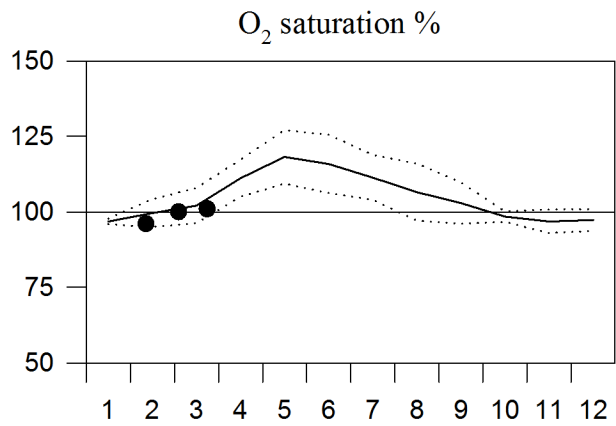
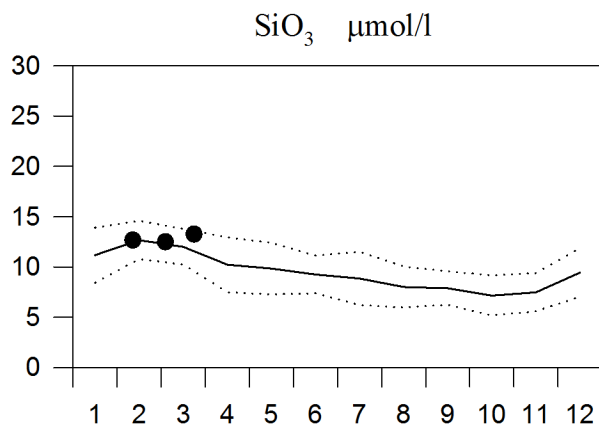
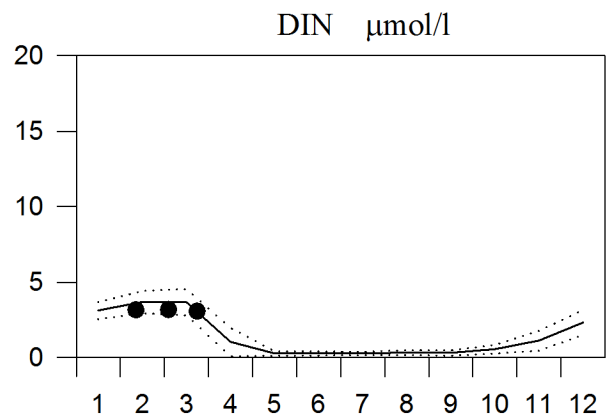
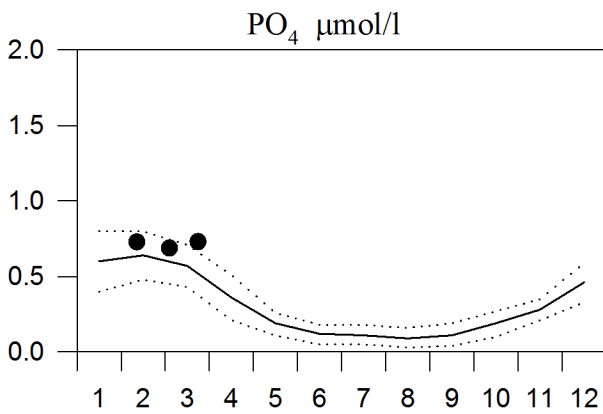
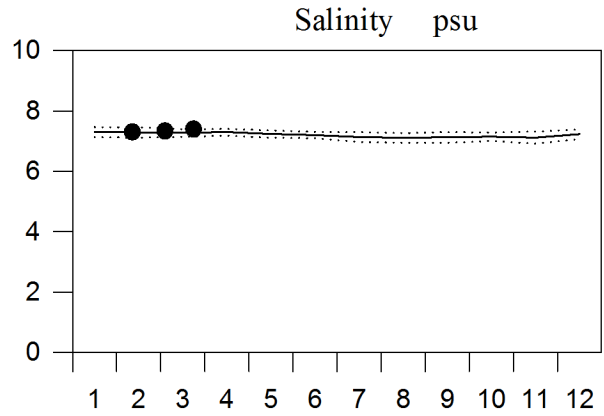
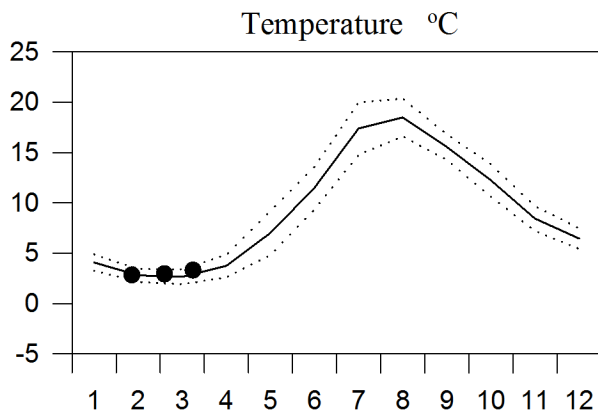
OXYGEN IN BOTTOM WATER (depth >80m)



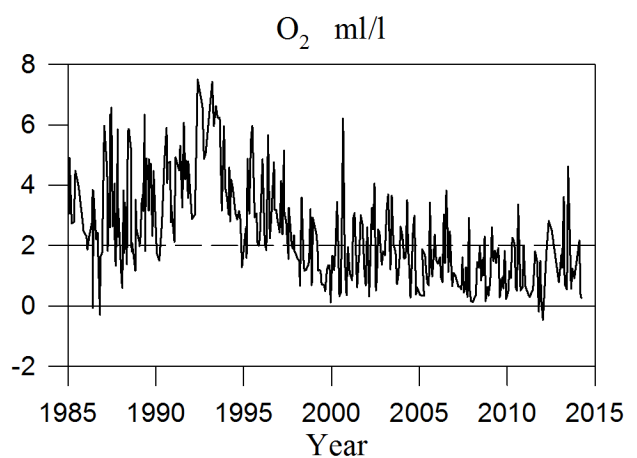
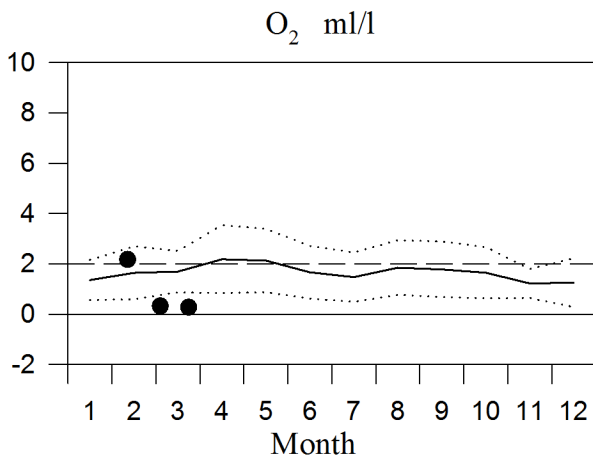
STATION BCS III-10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



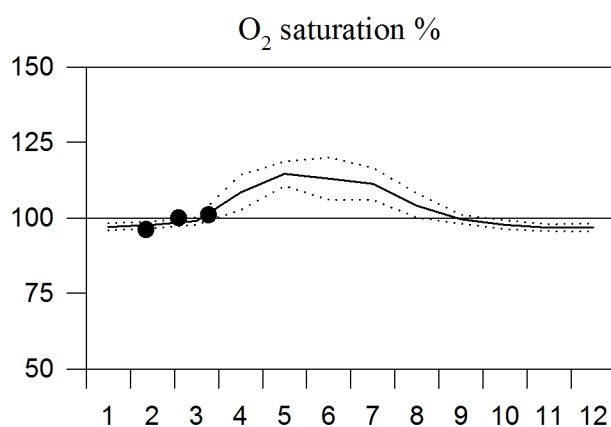
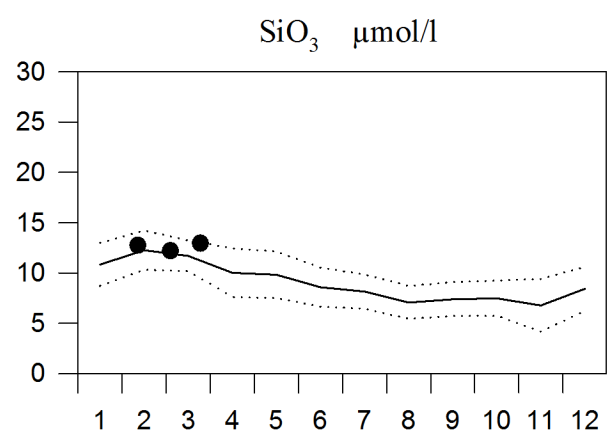
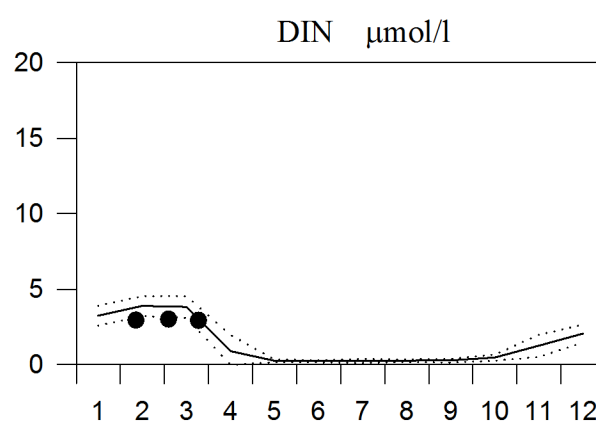
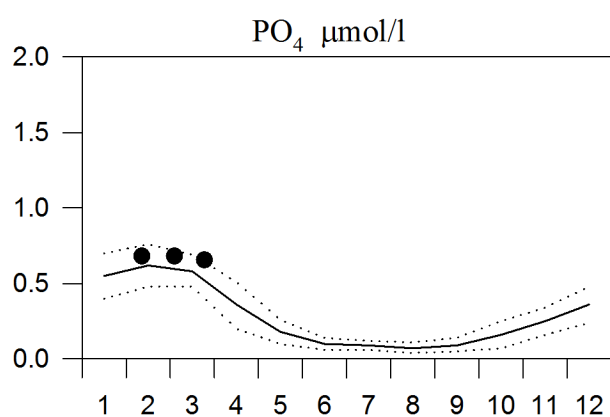
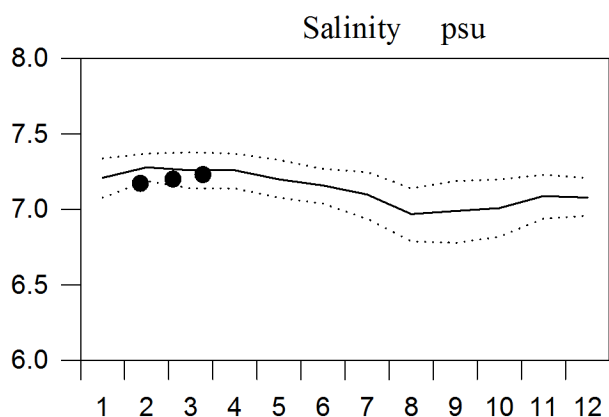
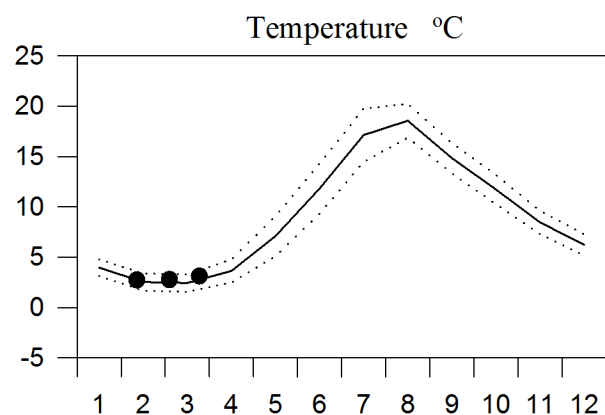
OXYGEN IN BOTTOM WATER (depth > 80m)



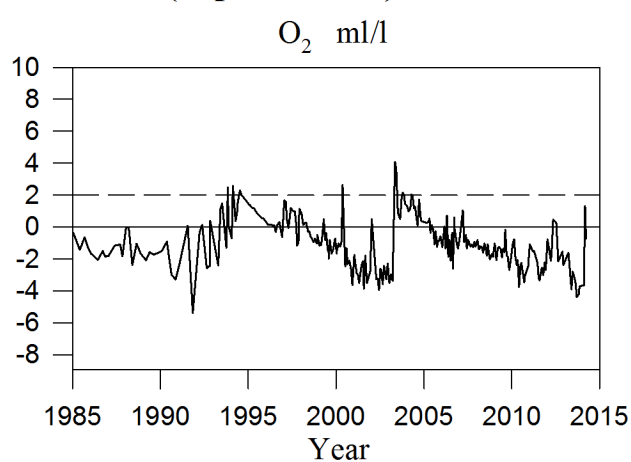
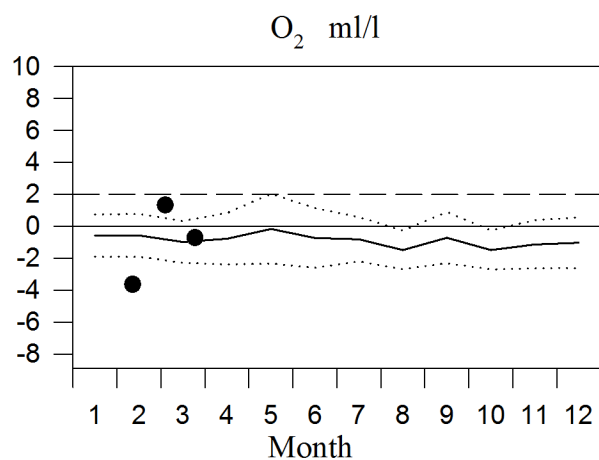
STATION BY10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



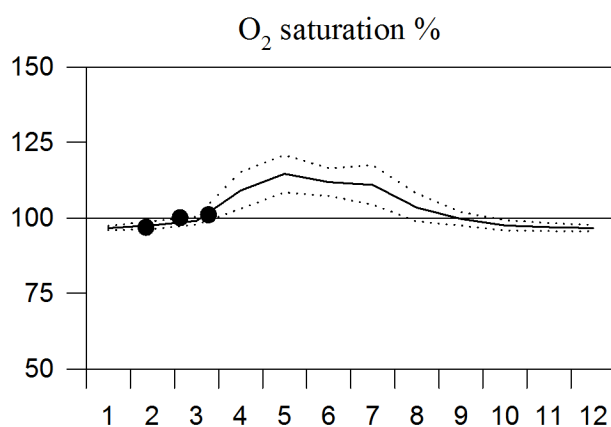
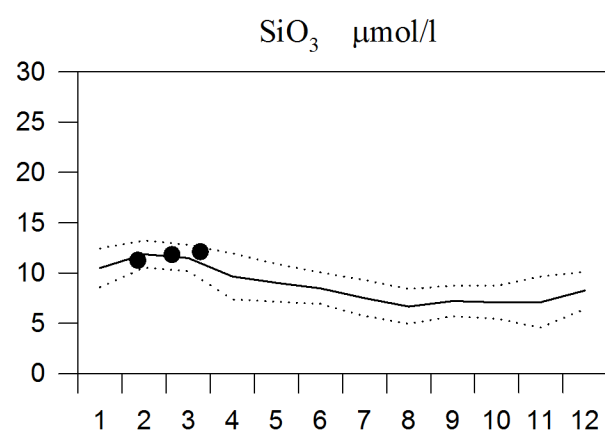
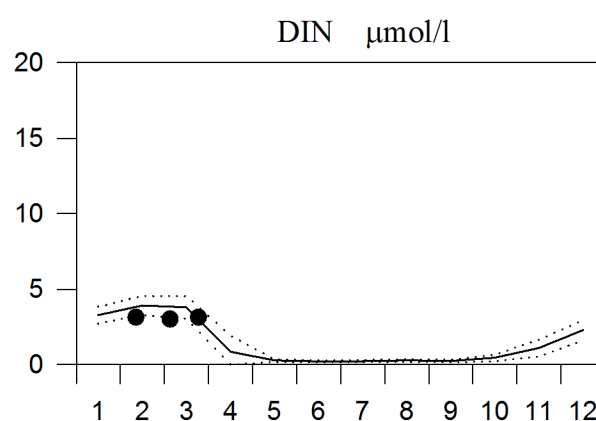
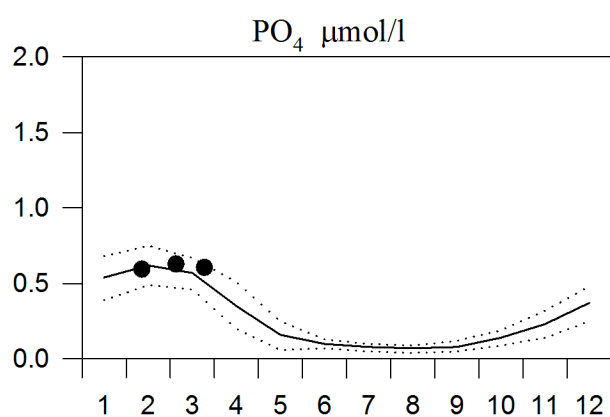
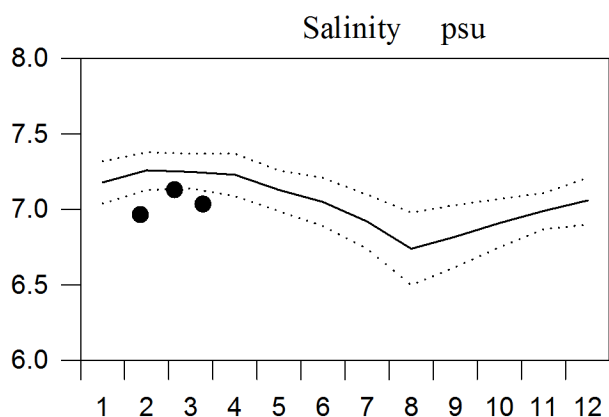
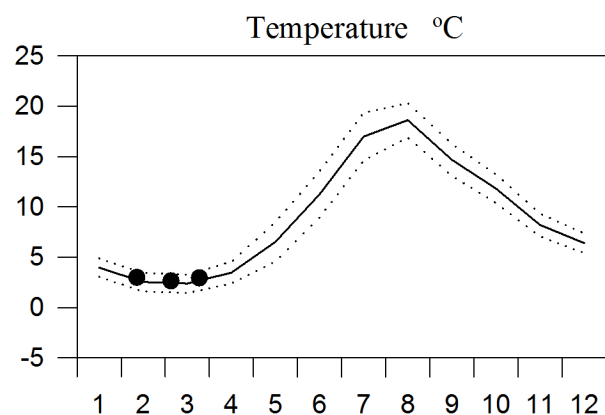
OXYGEN IN BOTTOM WATER (depth >125m)



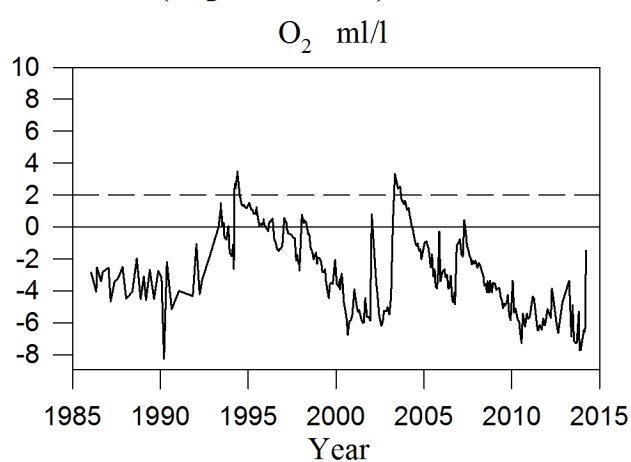
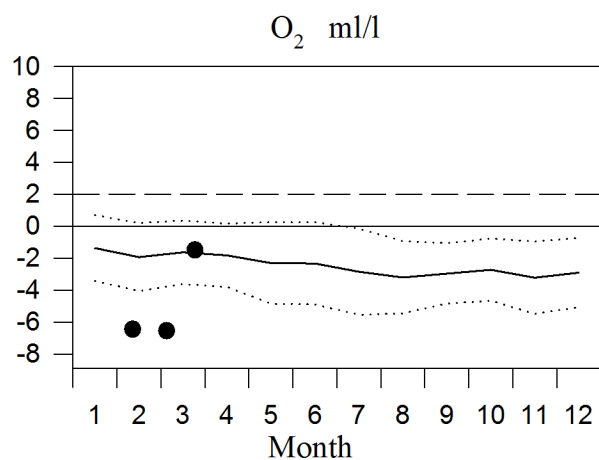
STATION BY15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



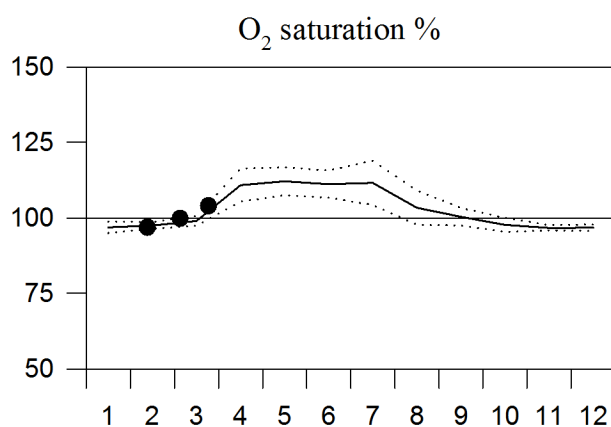
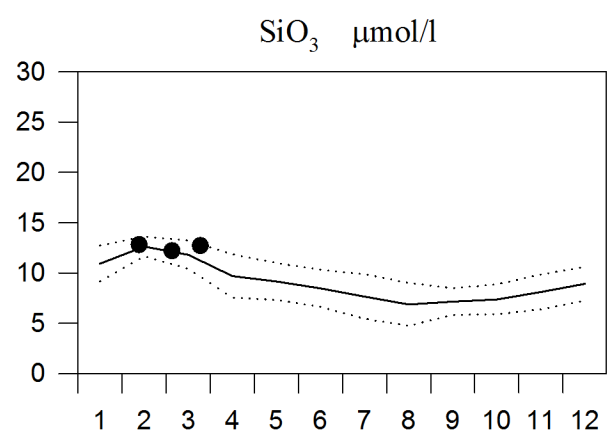
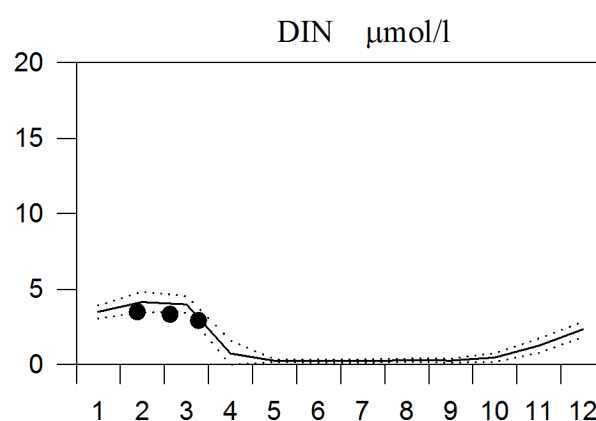
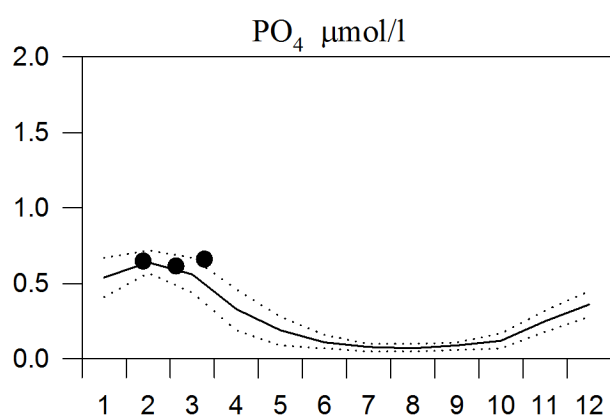
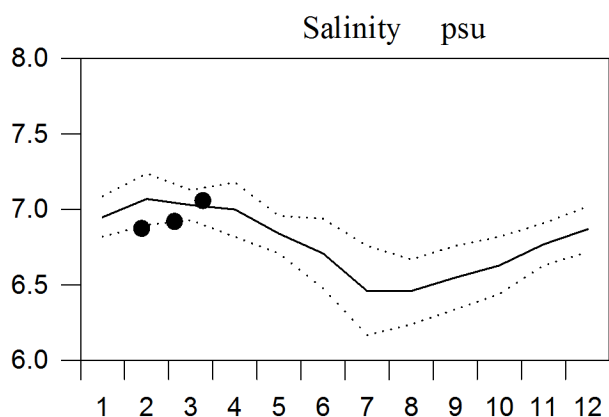
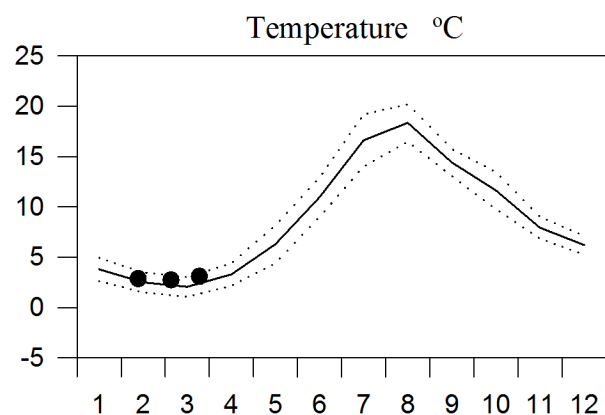
OXYGEN IN BOTTOM WATER (depth >225m)



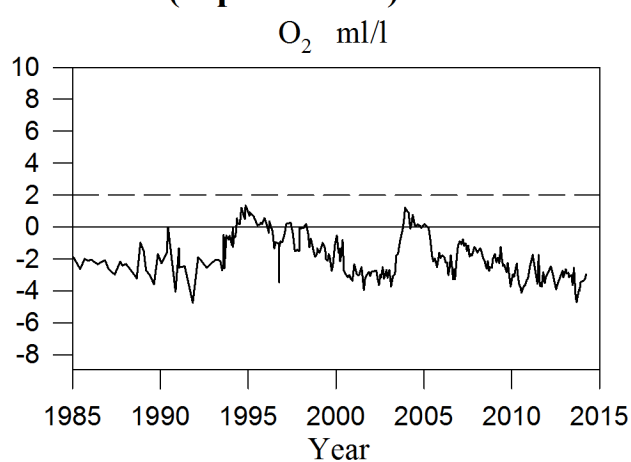
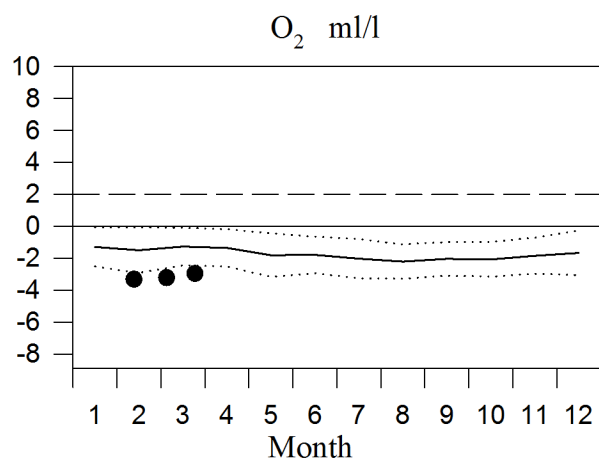
STATION BY20 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



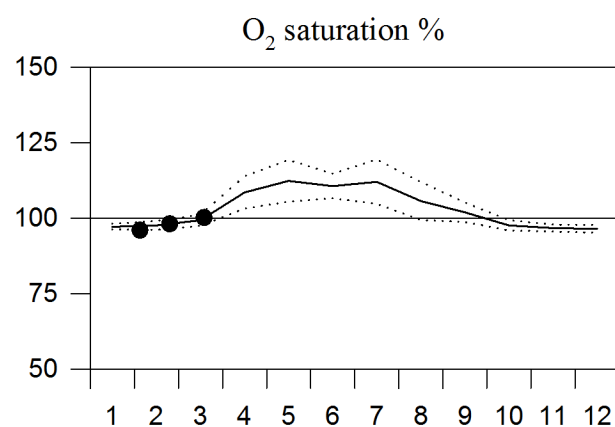
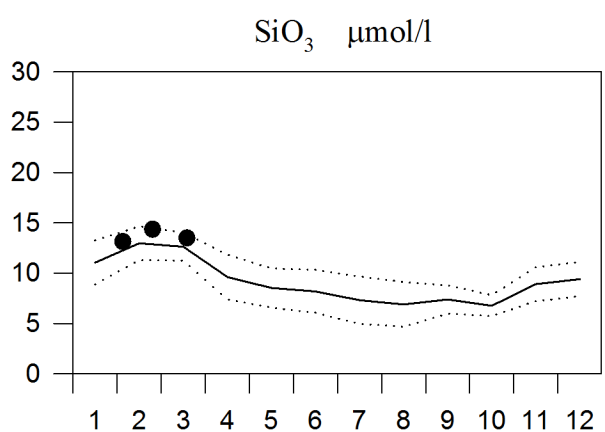
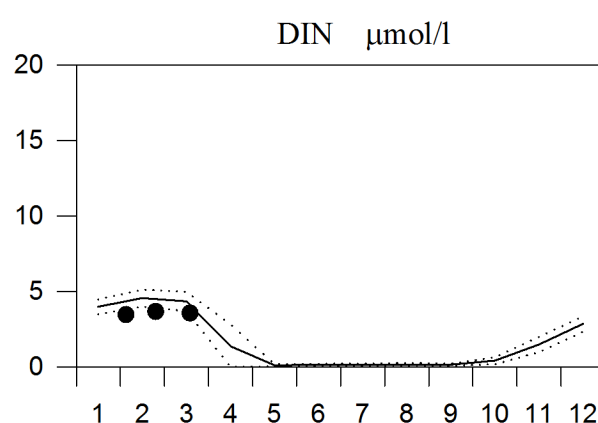
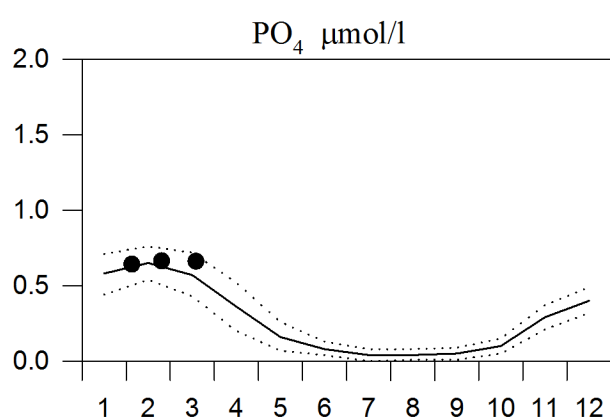
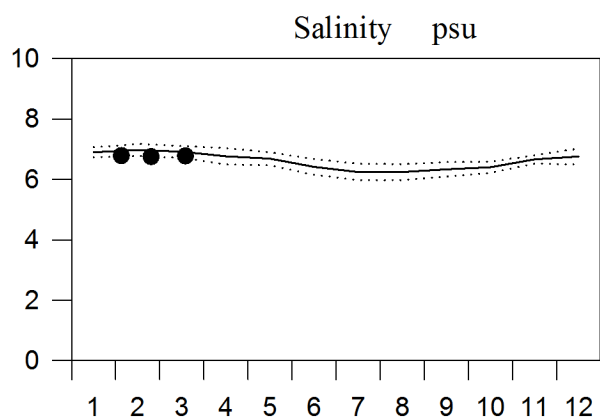
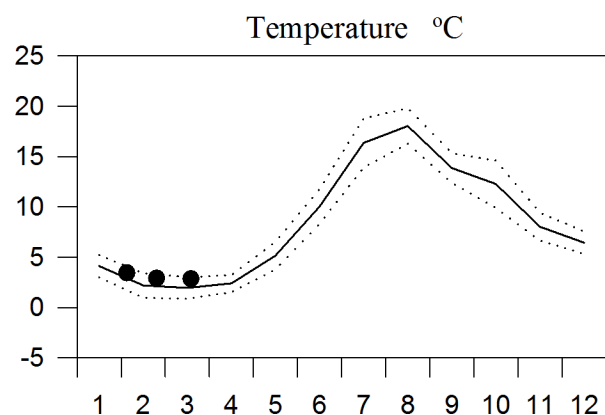
OXYGEN IN BOTTOM WATER (depth >175m)



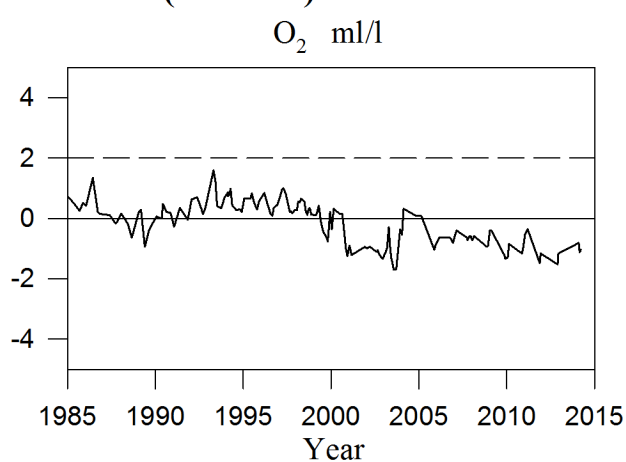
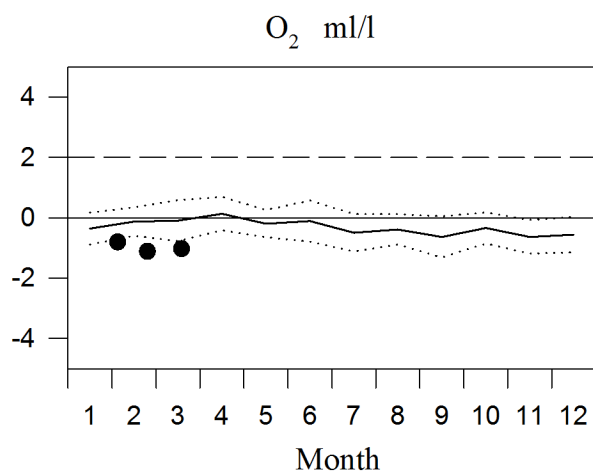
STATION BY29 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



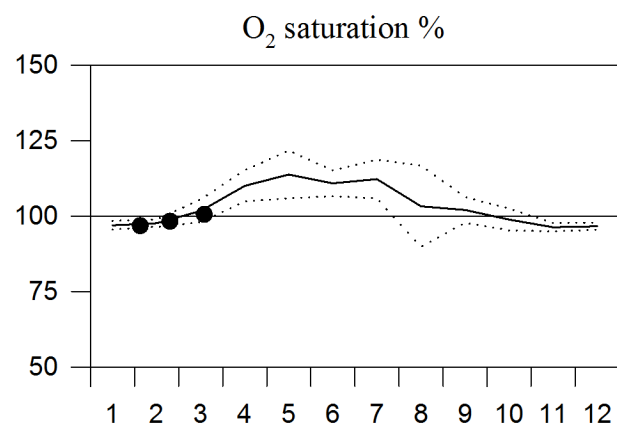
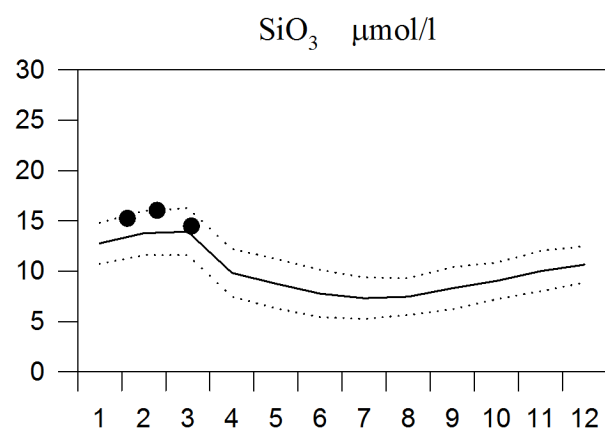
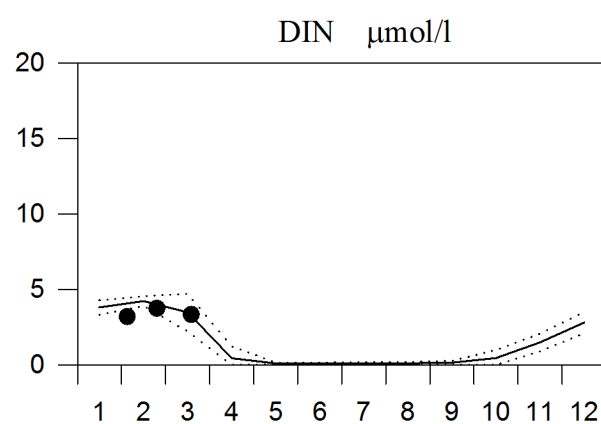
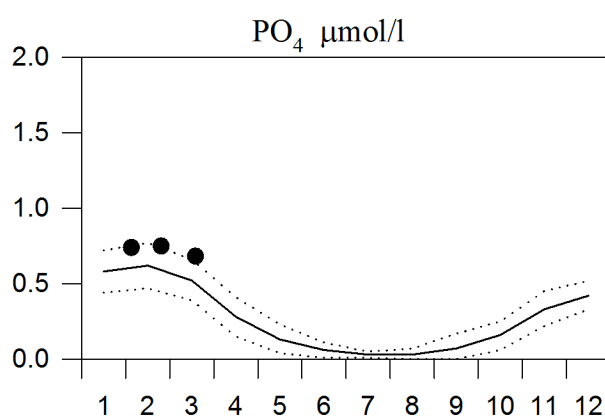
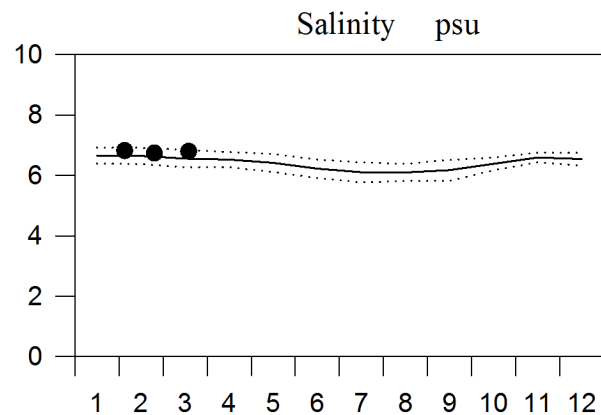
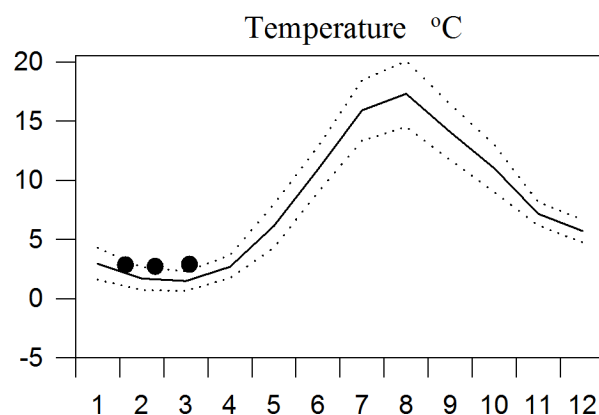
OXYGEN IN BOTTOM WATER (>=150m)



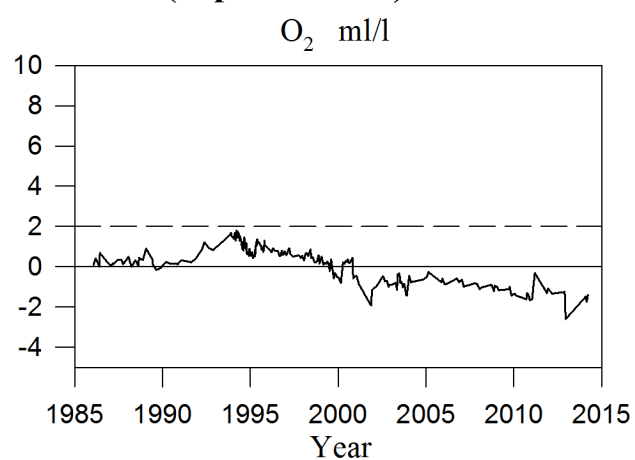
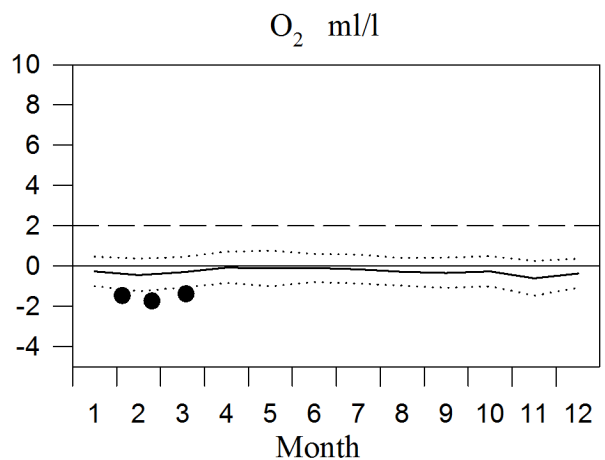
STATION BY31 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



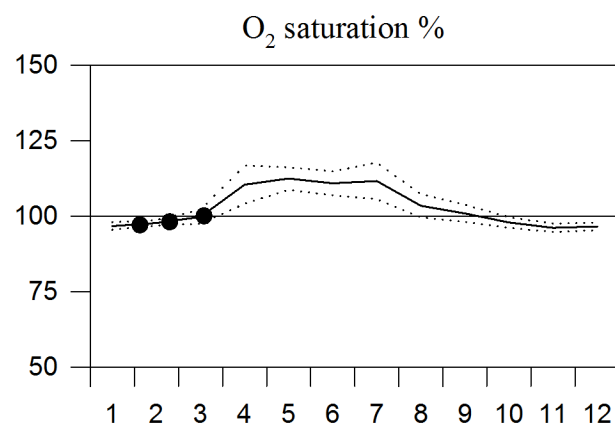
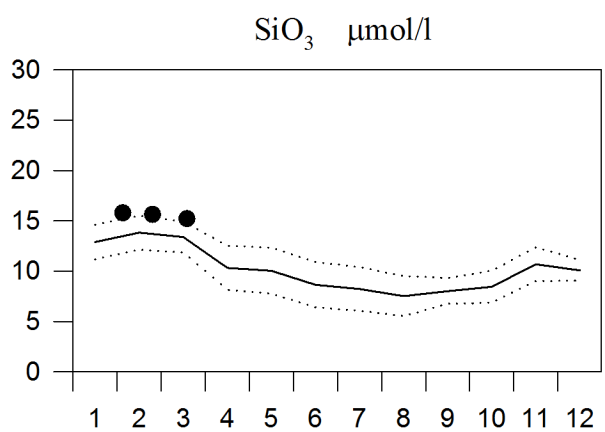
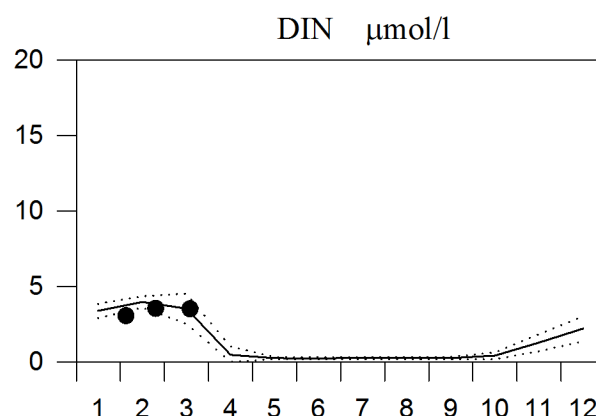
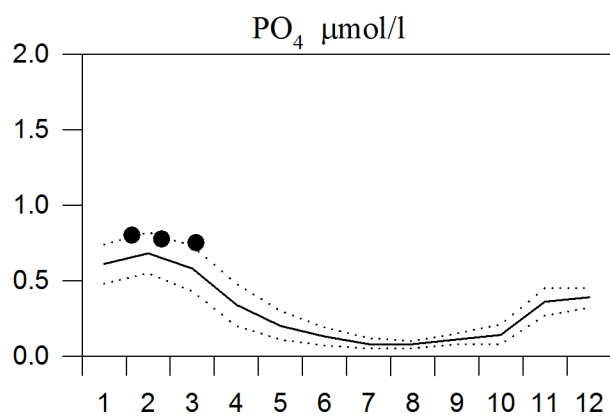
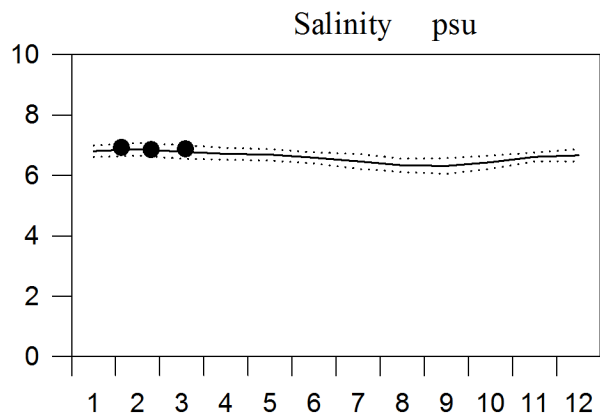
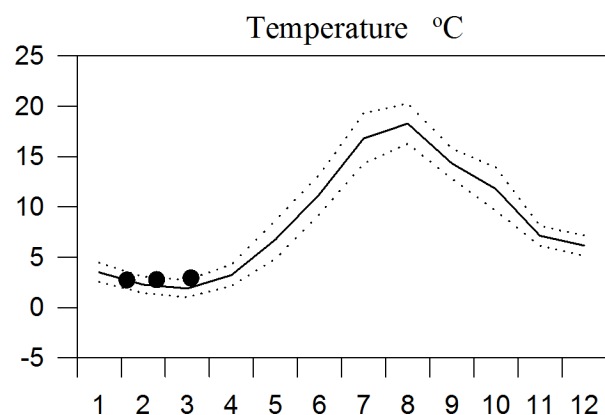
OXYGEN IN BOTTOM WATER (depth = 440m)



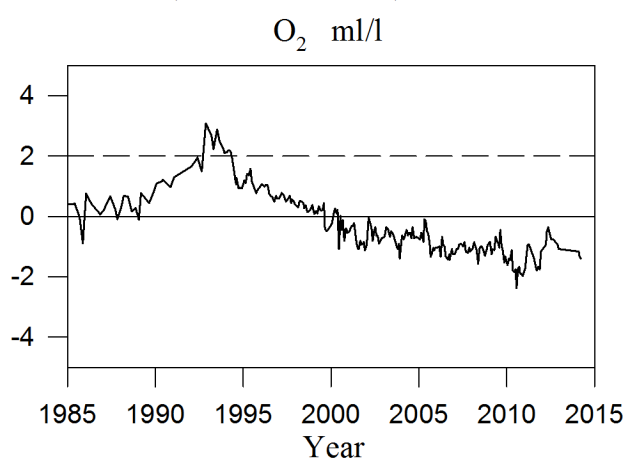
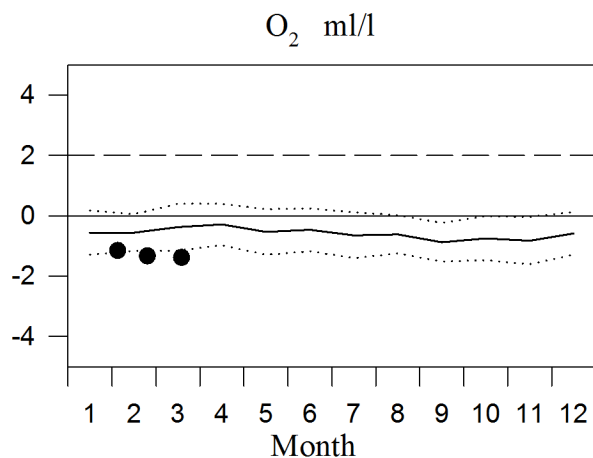
STATION BY32 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



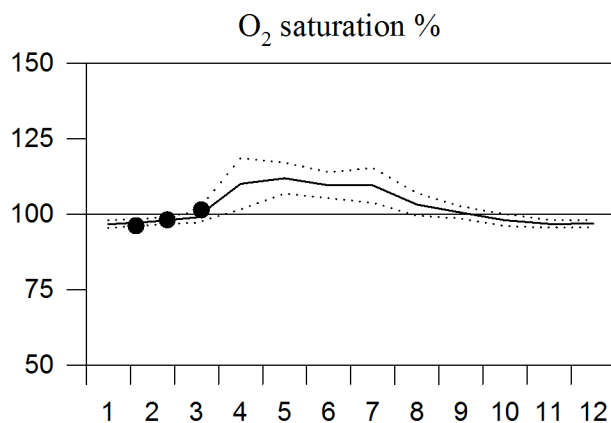
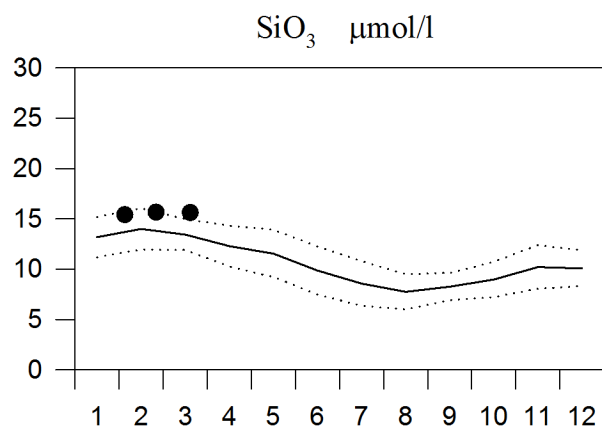
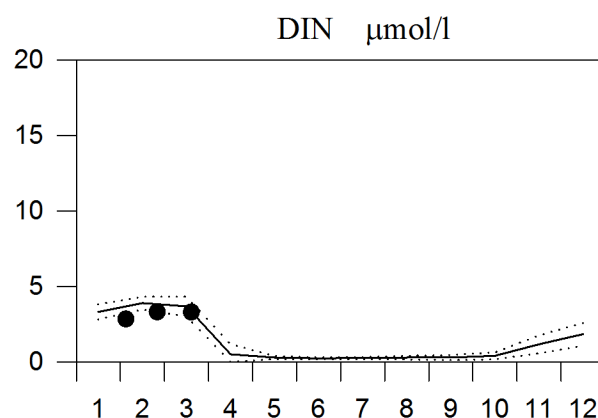
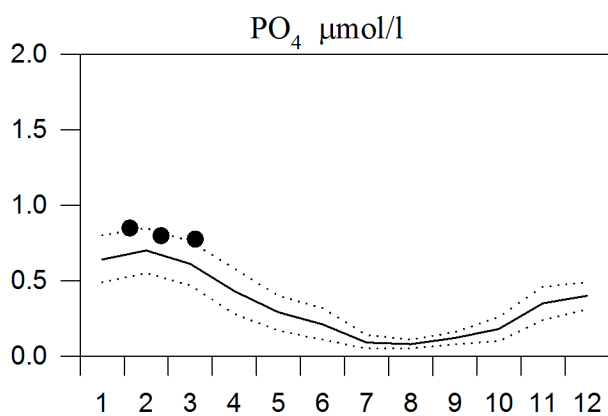
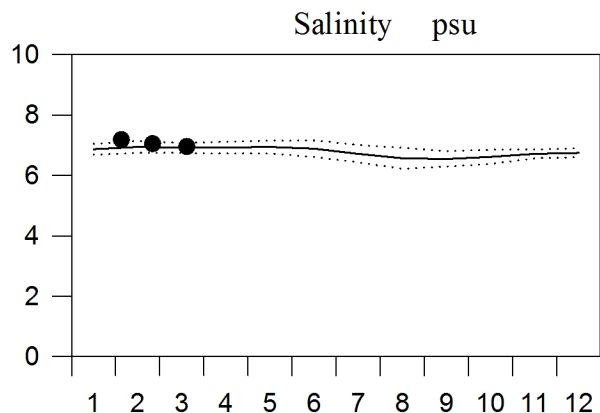
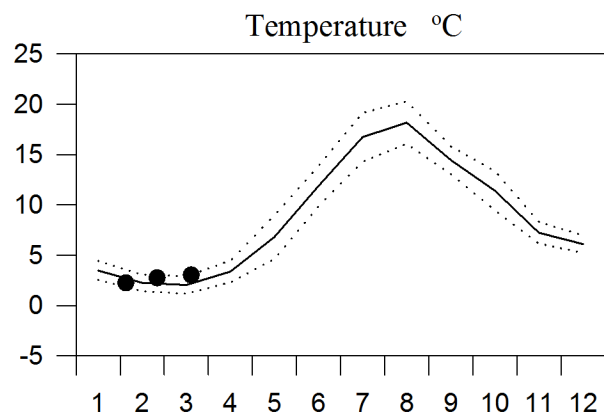
OXYGEN IN BOTTOM WATER (depth > 175m)



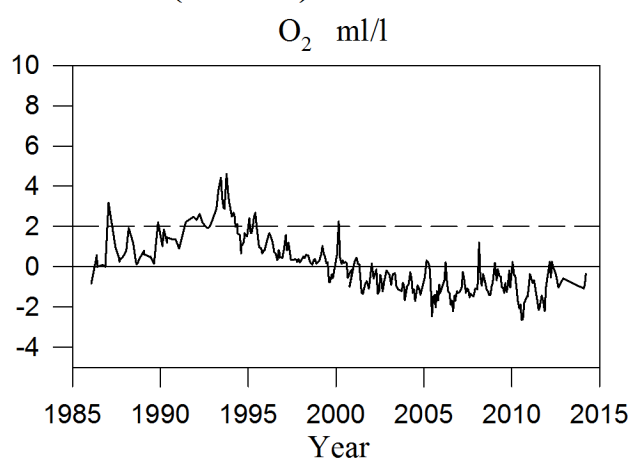
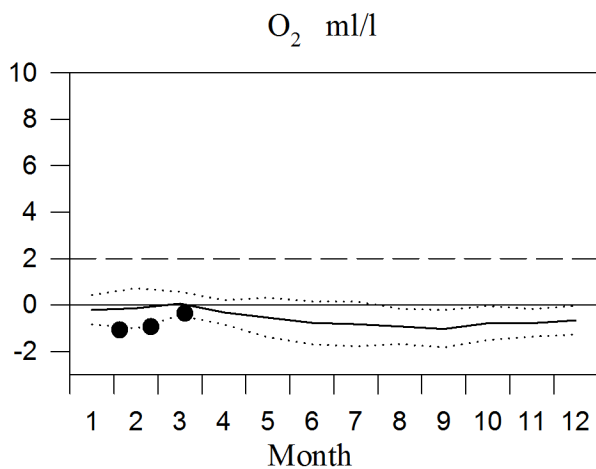
STATION BY38 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



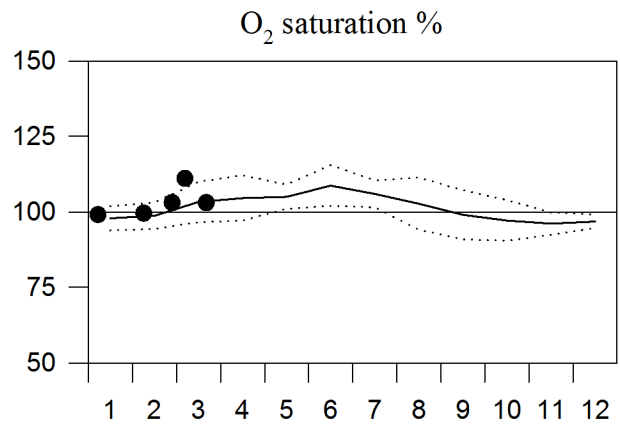
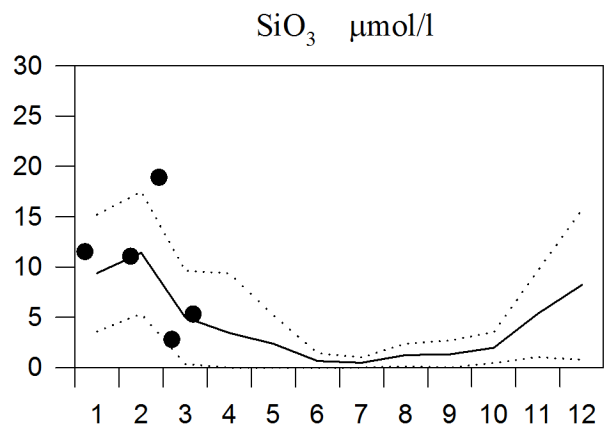
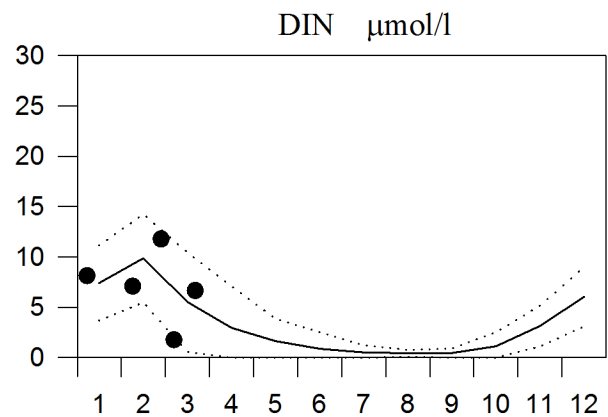
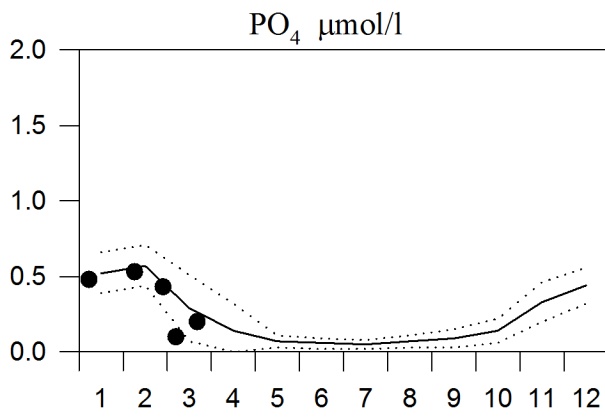
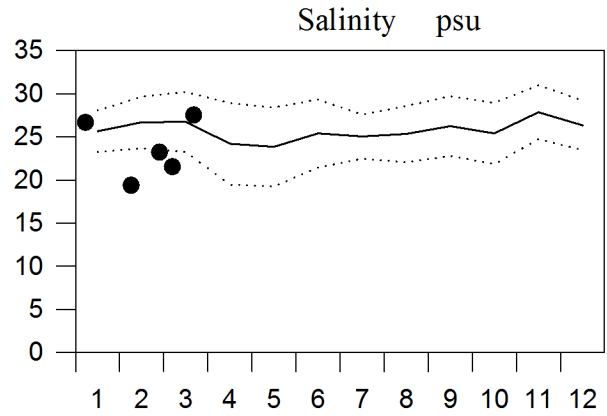
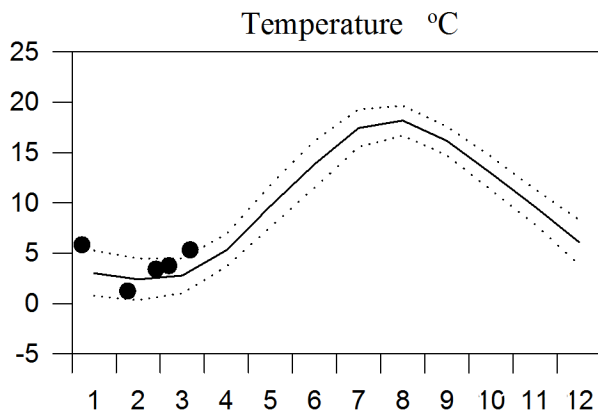
OXYGEN IN BOTTOM WATER (> 100m)



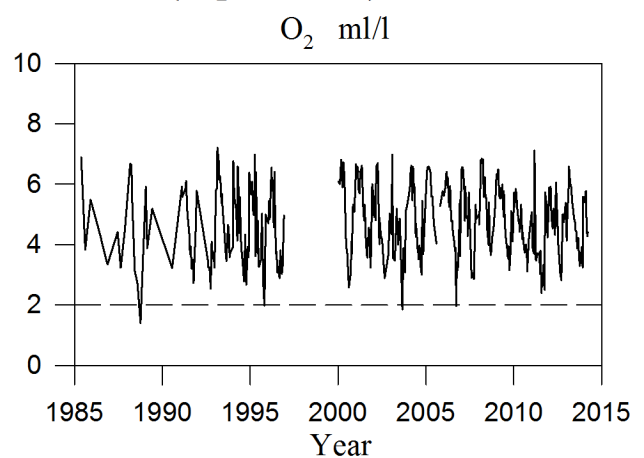
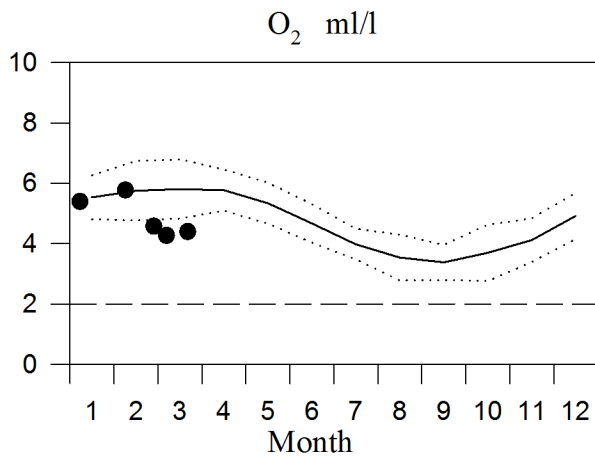
STATION SLÄGGÖ SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



OXYGEN IN BOTTOM WATER (depth >50m)



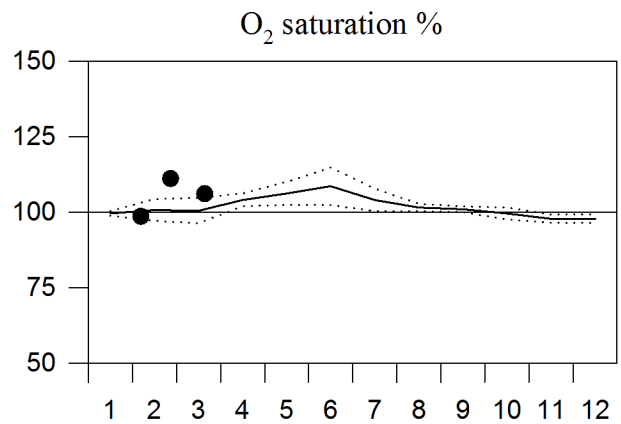
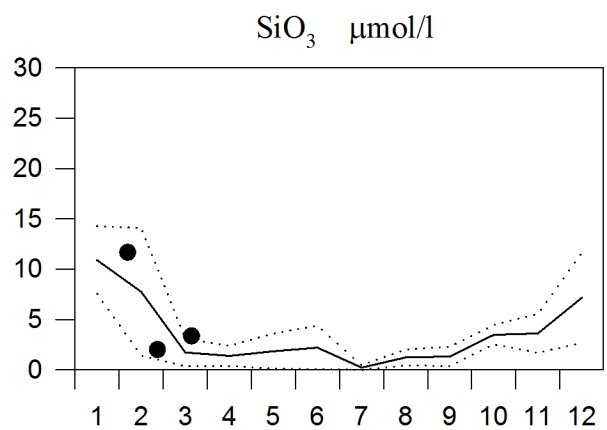
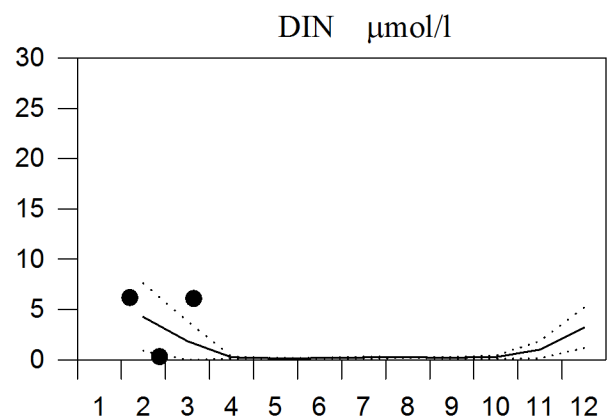
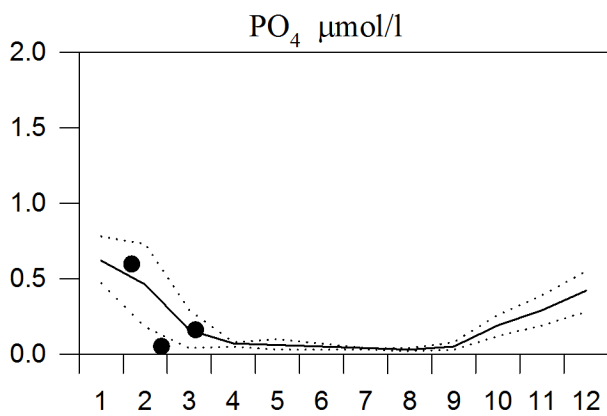
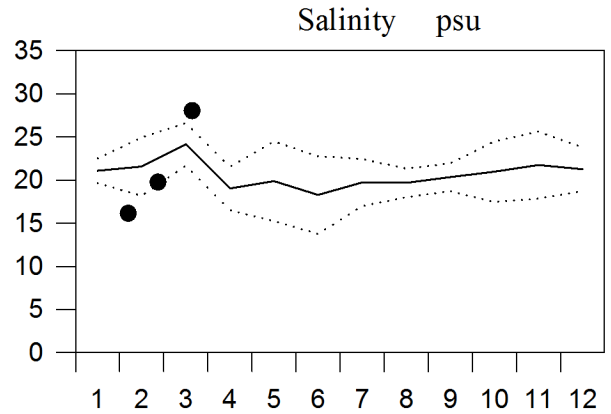
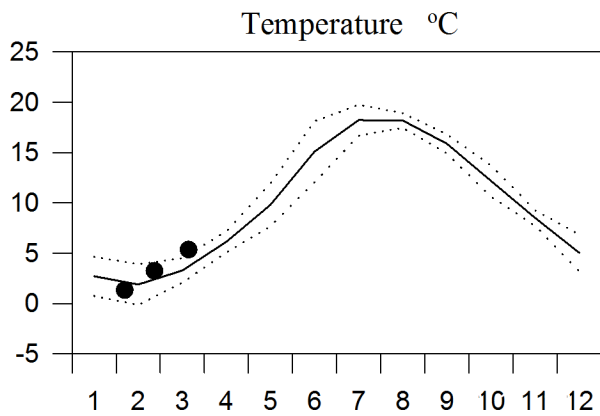
STATION N14 Falkenberg SURFACE WATER

Annual Cycles

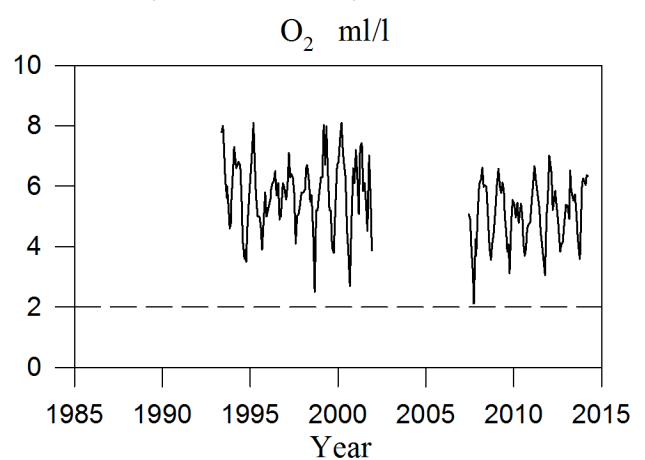
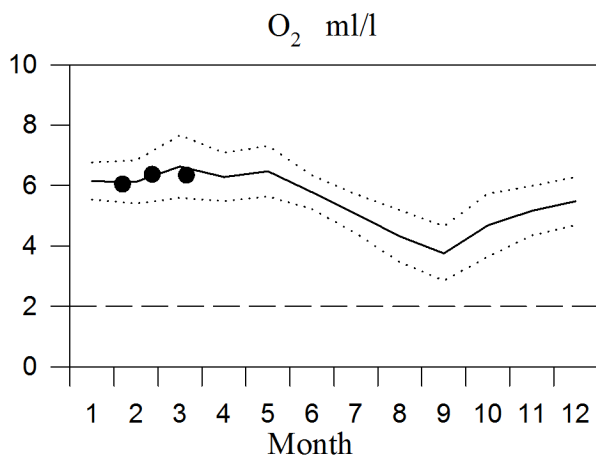
— Mean 2007-2010

..... St.Dev.

● 2014



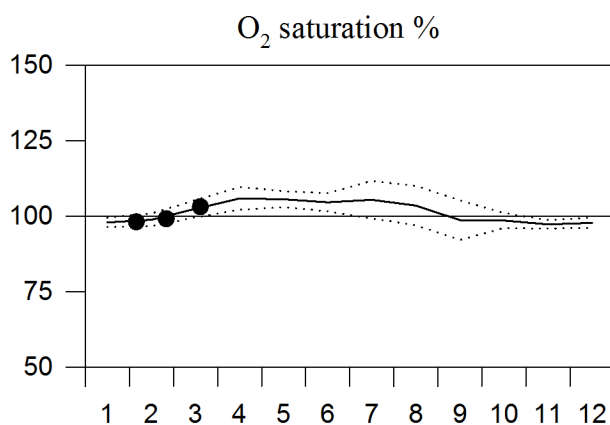
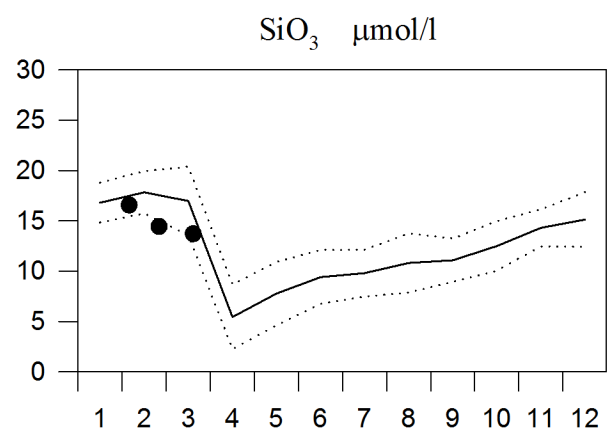
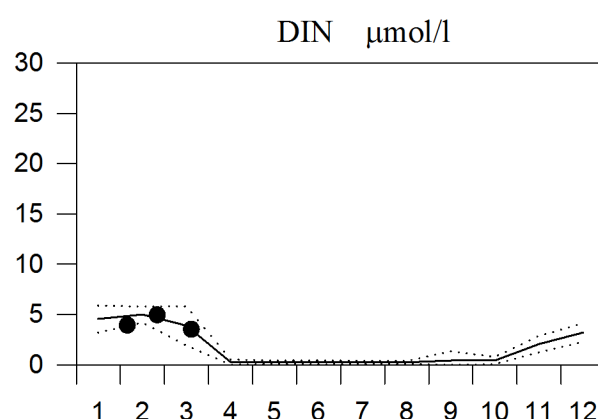
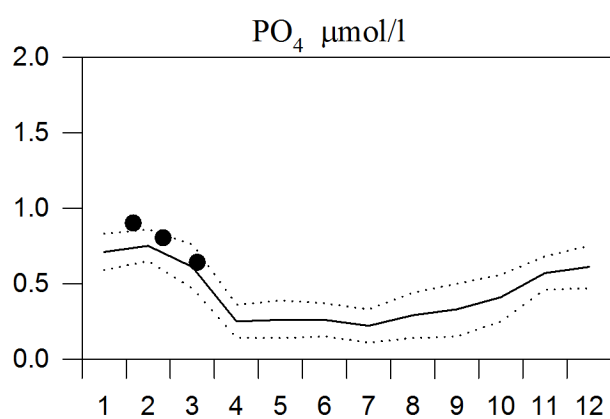
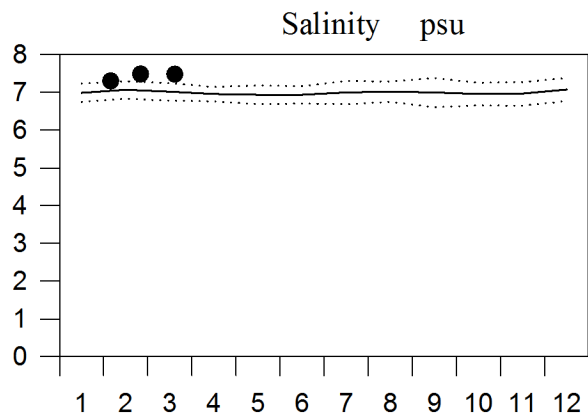
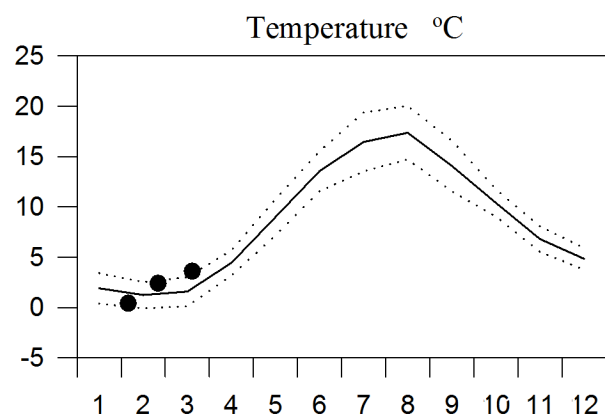
OXYGEN IN BOTTOM WATER (depth > 25m)



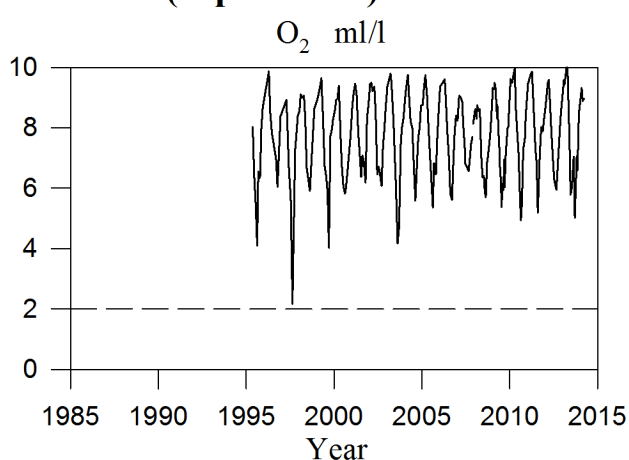
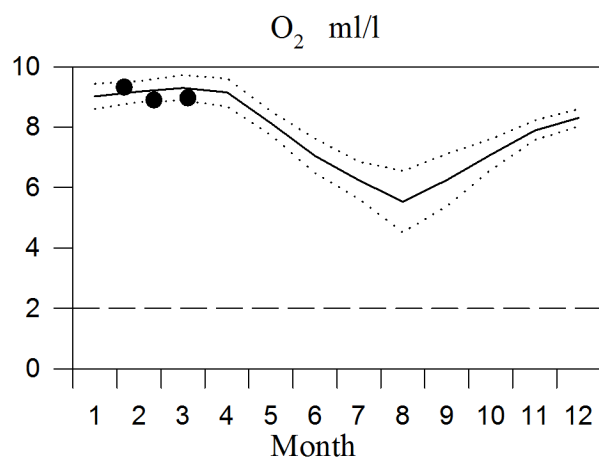
STATION REF M1V1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

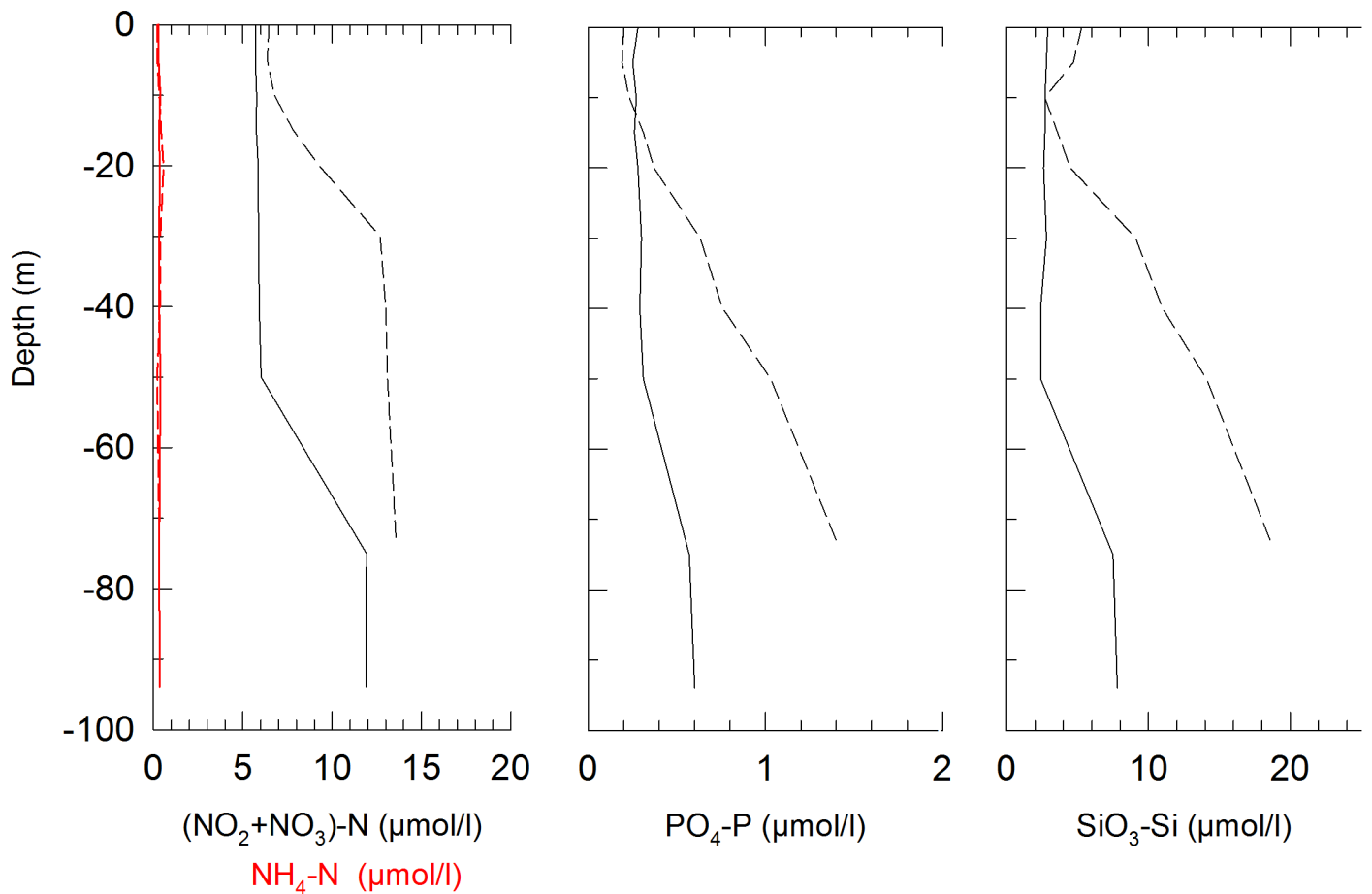
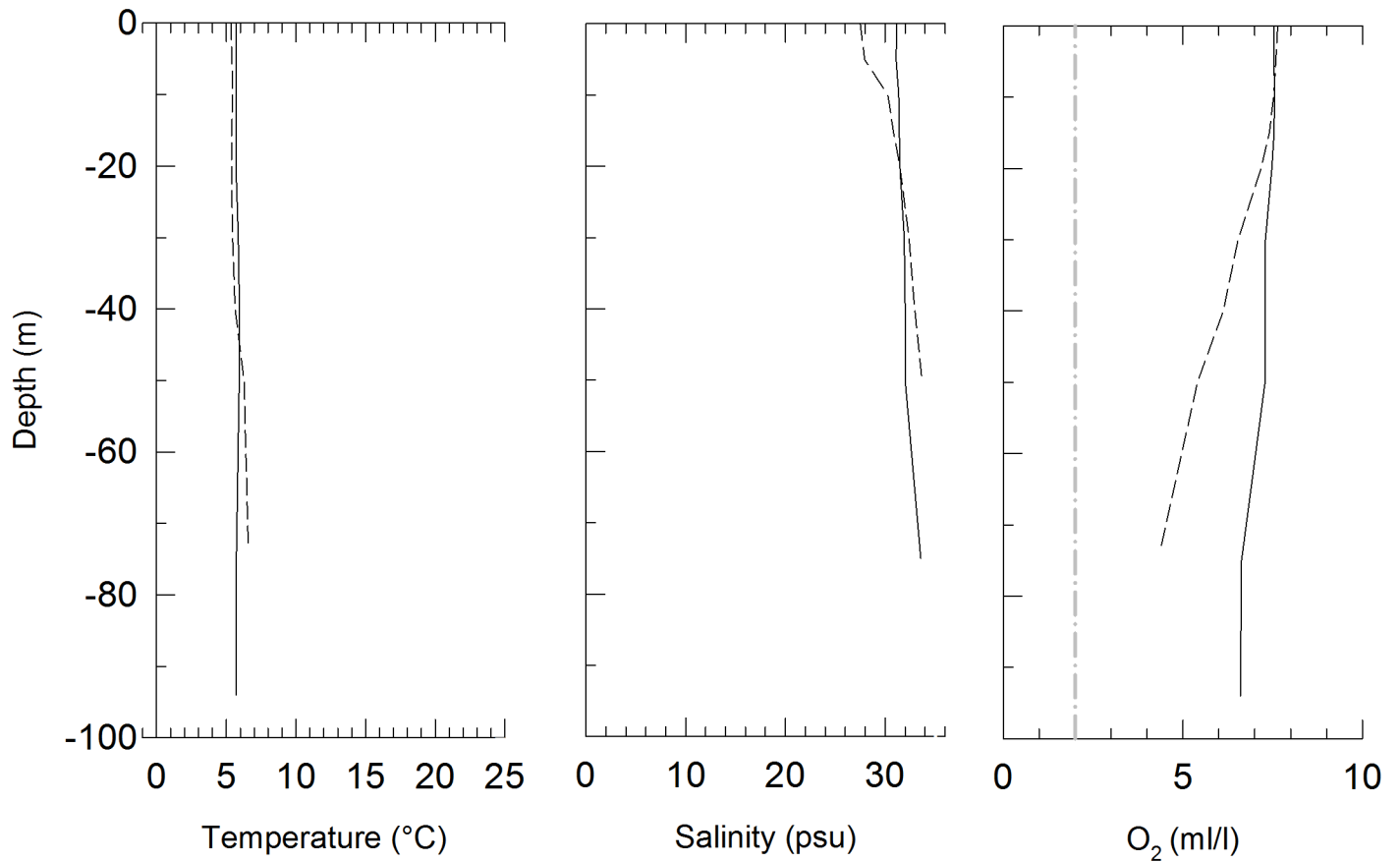


OXYGEN IN BOTTOM WATER (depth >15m)



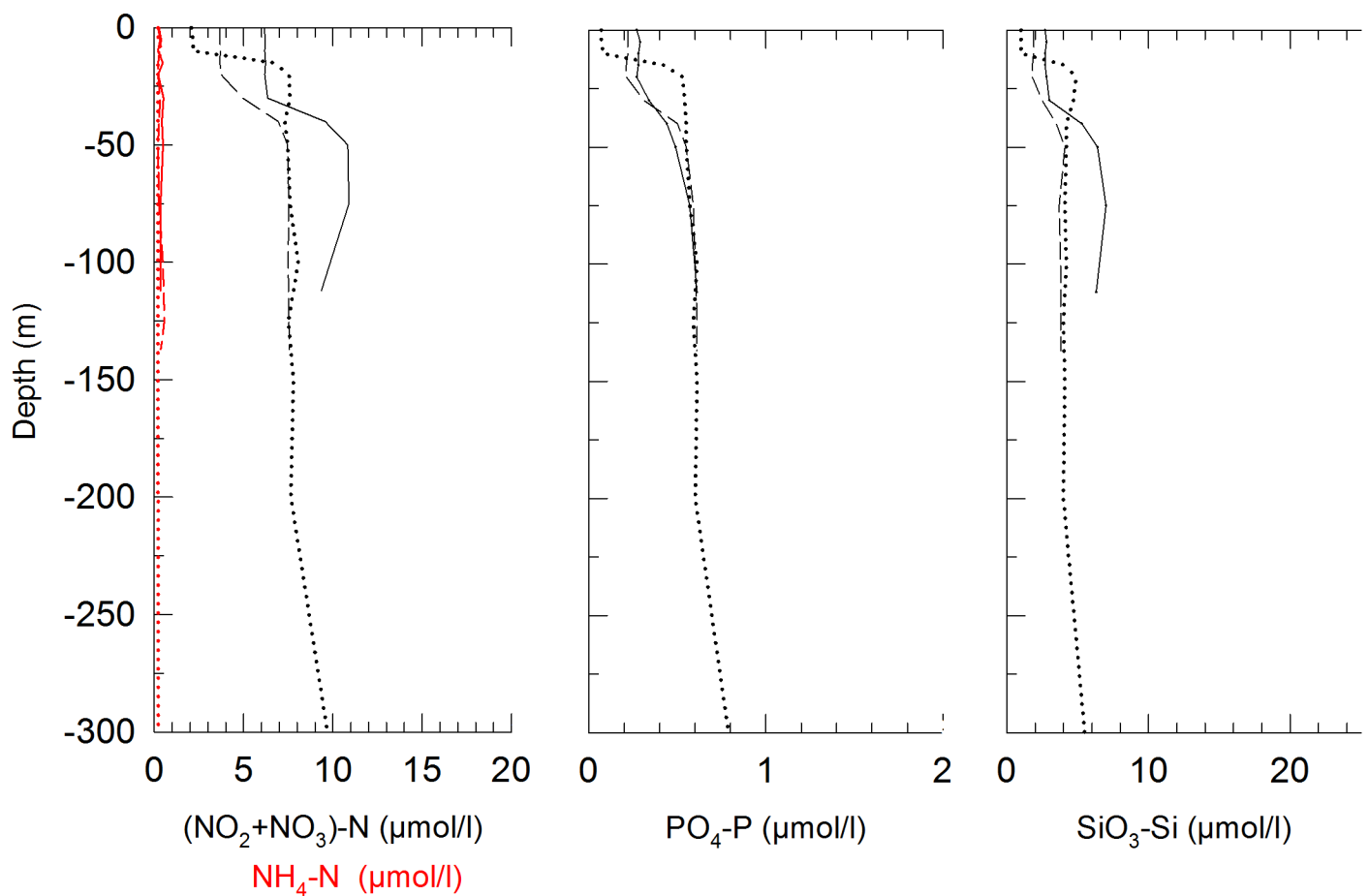
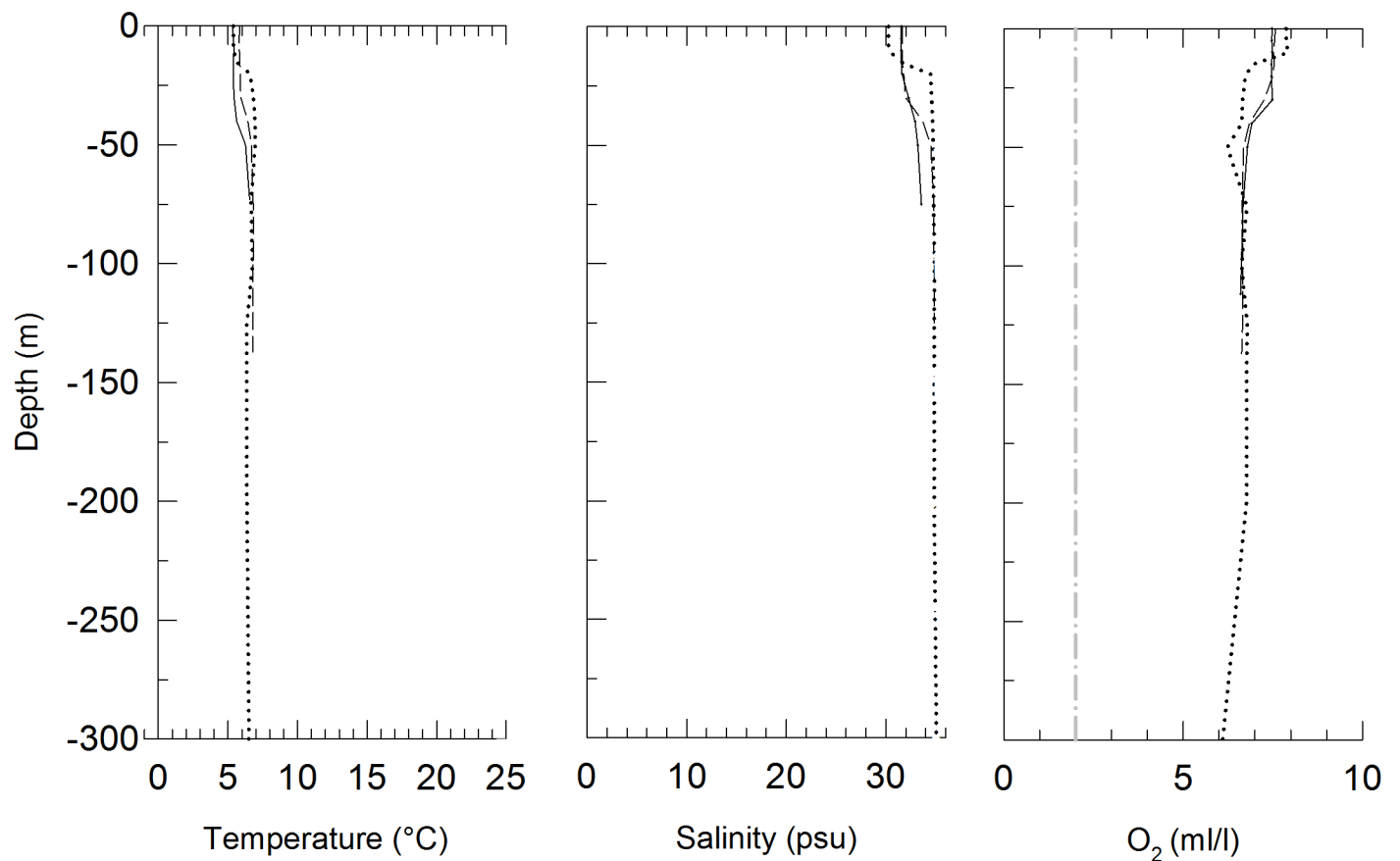
SKAGERRAK Coast 2014-03-21

—— P2 - - - - Släggö

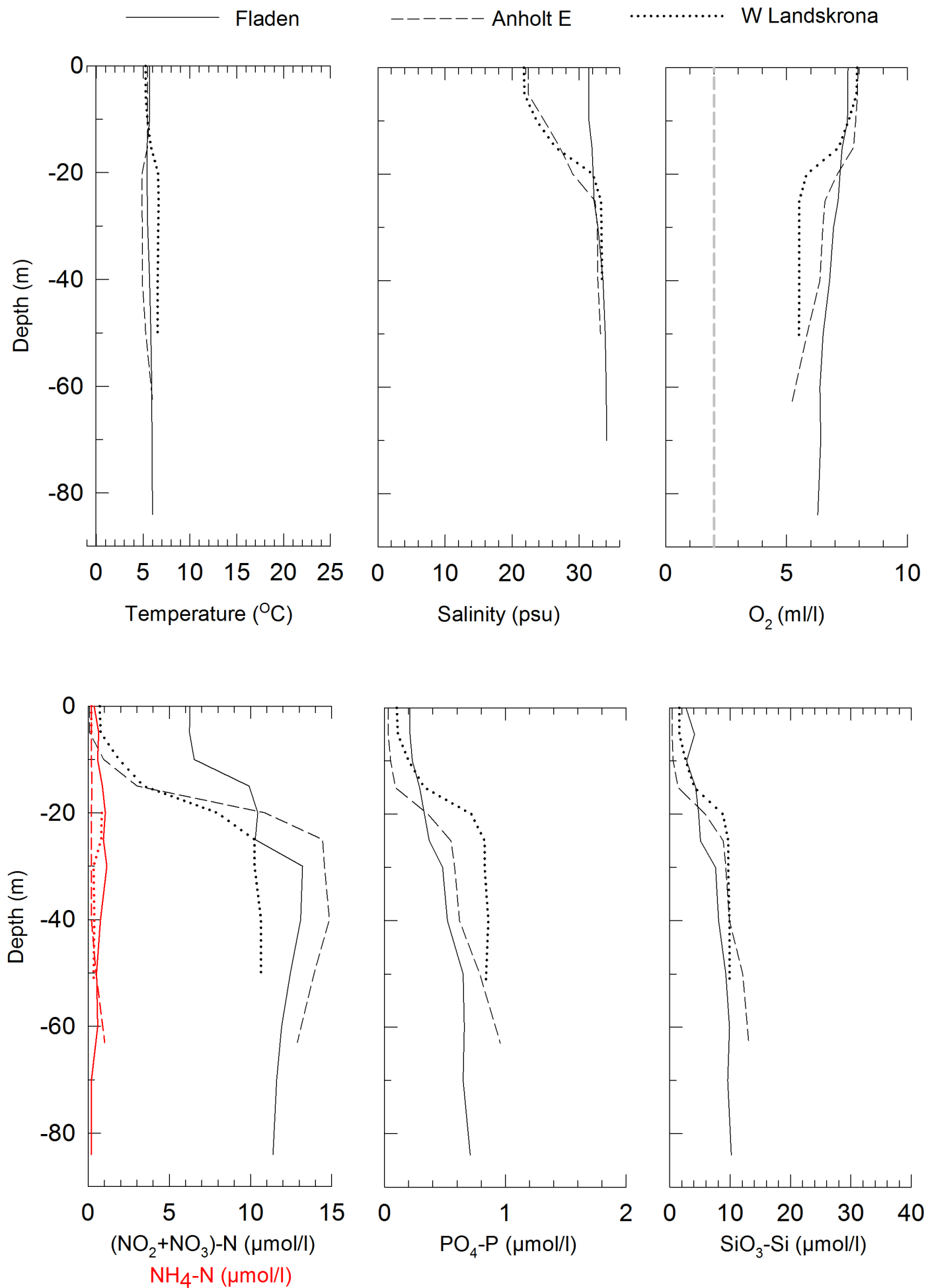


SKAGERRAK Å-Section 2014-03-21

—— Å13 - - - - - Å15 Å17

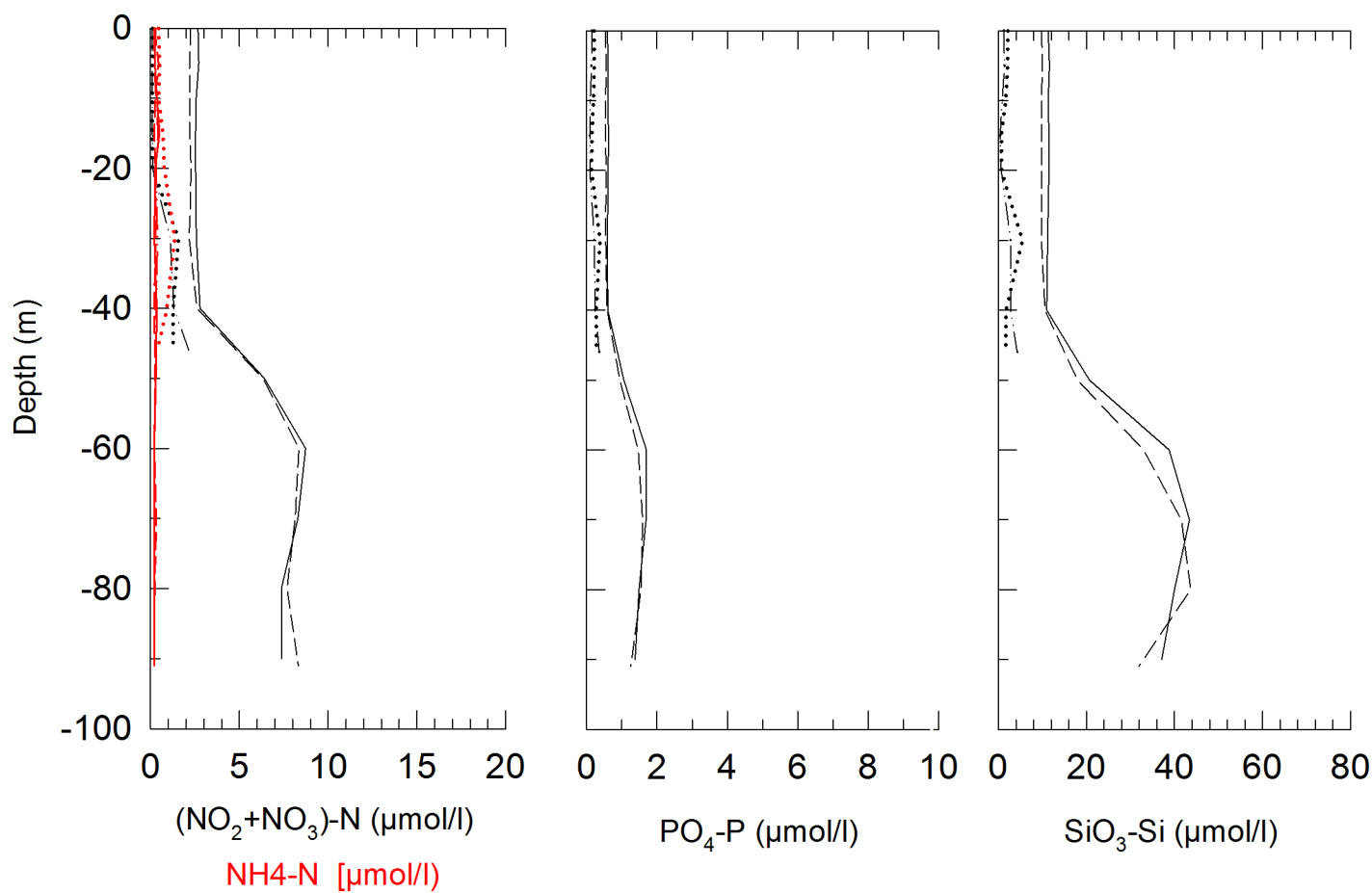
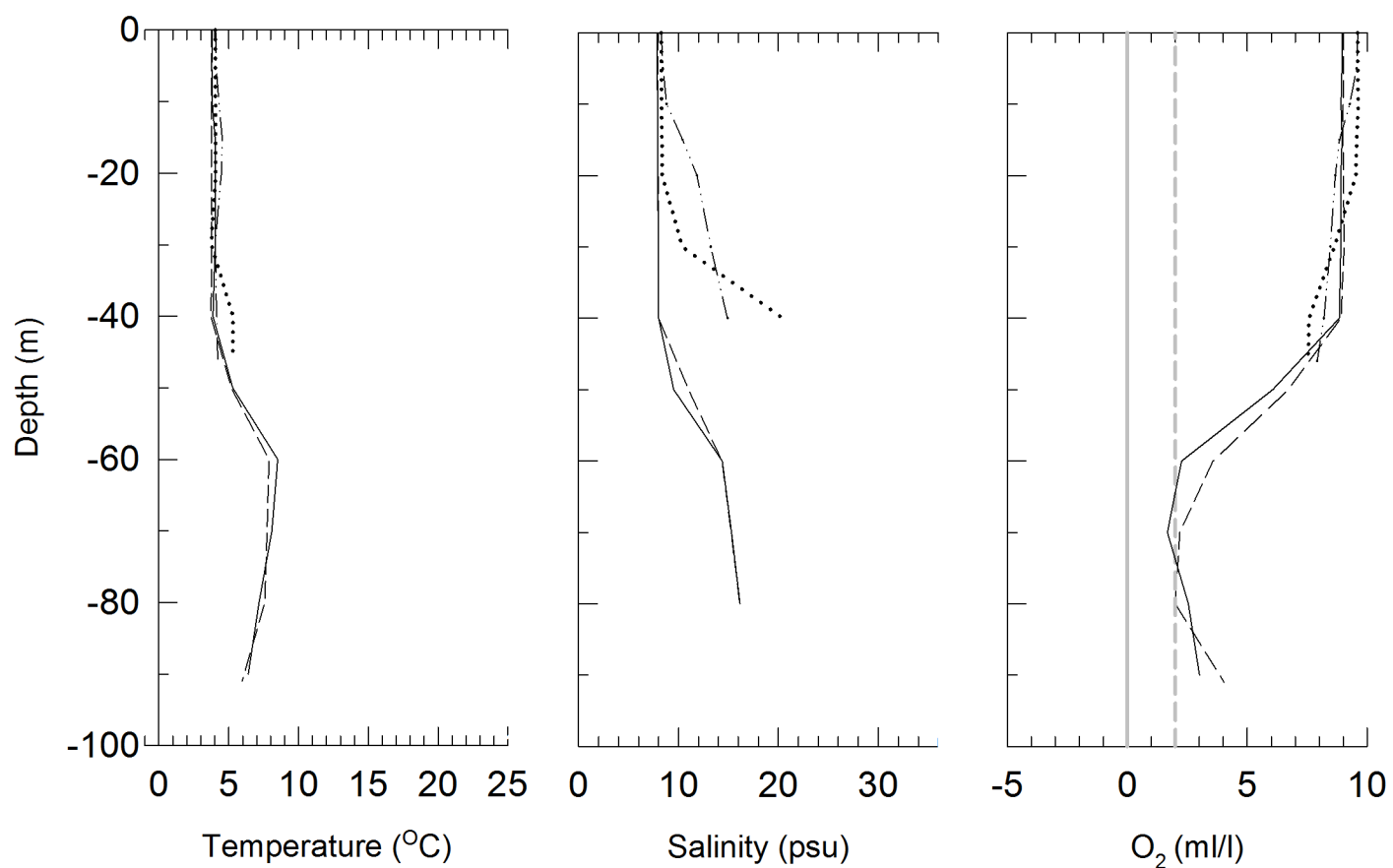


KATTEGAT and THE SOUND 2014-03-20/22



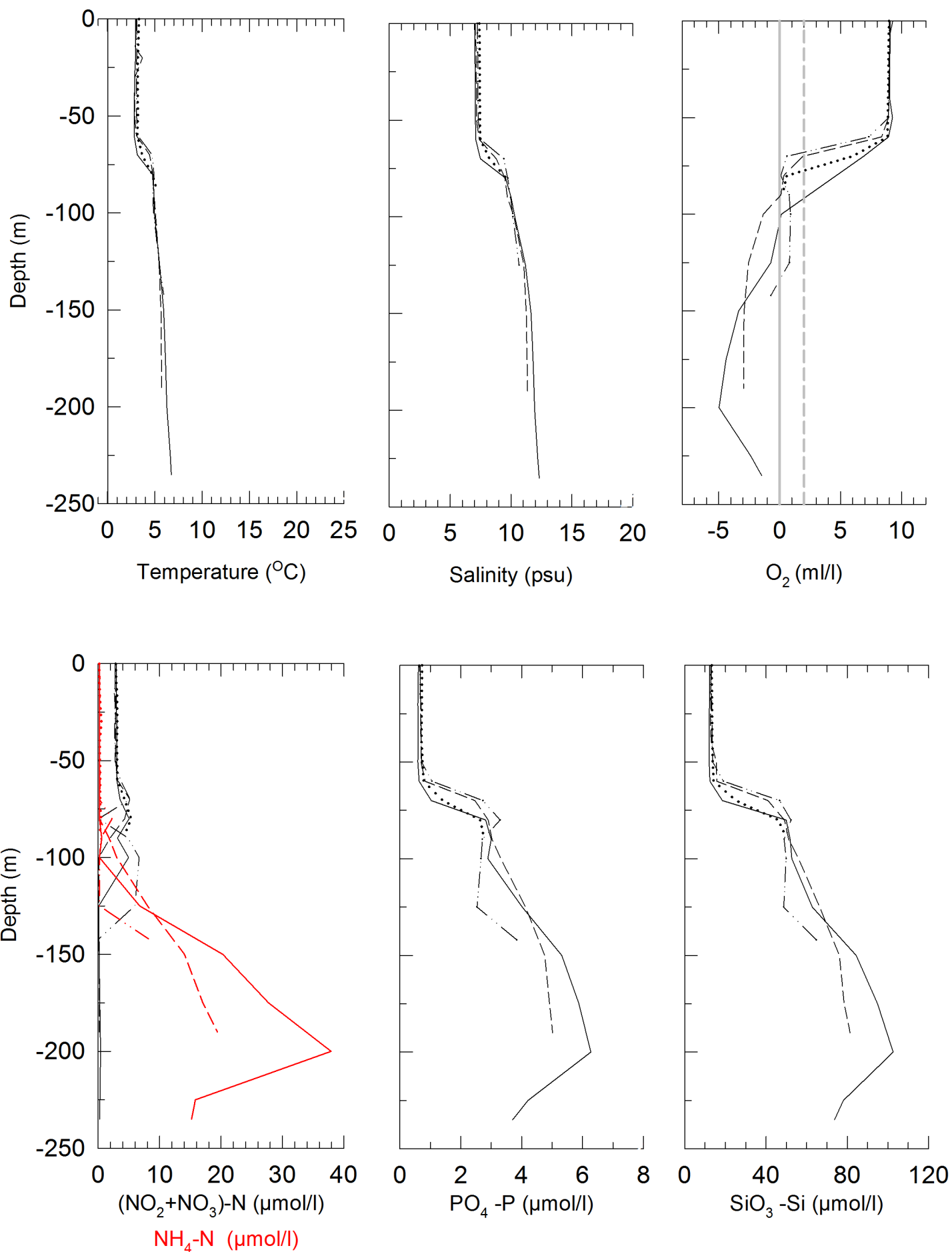
SOUTHERN BALTIC 2014-03-22/23

— BY5 - - - BY4 - · - · - BY2 ····· BY1



EASTERN BALTIC 2014-03-23/24

— — — BY20 — BY15 - - - BY10 BCS III-10



WESTERN BALTIC 2014-03-18/19

———— BY32 - - - - - BY38

