

Rapport från SMHI:s utsjöexpedition med R/V Aranda



Expeditionens varaktighet: 2014-03-17 - 2014-03-24
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, på de flesta platserna, normala för årstiden. I egentliga Östersjön, utom Arkonabassängen, var halterna av fosfat och silikat högre än normalt. Syreförhållandena i Hanöbukten och Bornholmsbassängen hade förbättrats sedan förra mätningen och låg över gränsen för akut syrebrist. Även i Gotlandsdjupet sågs en viss förbättring genom minskad svavelvätehalt. I västra, norra delen av östra och norra Gotlandsbassängen sågs ingen förbättring av syresituationen. Helt syrefria förhållanden, återfanns från 100-125 meters djup och akut syrebrist från 70-90 meters djup. Vårblomningen pågick för fullt i västra Skagerrak och i södra Östersjön.

Nästa ordinarie expedition är planerad till vecka 17. Då kommer egentliga Östersjön, Skagerrak och Kattegatt att besökas.

PRELIMINÄRA RESULTAT

Expeditionen, vilken var den första i egen regi med det finska forskningsfartyget Aranda, startade i Helsingfors den 17:e mars och avslutades i Nynäshamn den 24:e mars. Ett uppehåll gjordes i Lysekil för att ta ombord kompletterande utrustning samt för att ta iland prover. Vindarna var svaga i början och slutet av expeditionen och friska i mitten, riktningen varierade. Lufttemperaturen varierade från -1 till +9°C.

Skagerrak

Temperaturen i ytlagret var normal för årstiden och varierade mellan 5,3 och 5,7°C. Salthalten varierade från normalt till något högre än normalt, från 27,5 psu närmast kusten till 31,2 psu i södra Skagerrak. Haloklinen och termoklinen var svagt utvecklade i hela området utom i den västra delen där den var starkt utvecklad och återfanns på djup mellan 10-70 meter.

Närsalthalterna i ytvattnet uppvisade normala halter för årstiden. Fosfathalterna varierade från 0,07 till 0,28 $\mu\text{mol/l}$, silikat mellan 1,0 och 5,3 $\mu\text{mol/l}$, medan oorganiskt kväve hade koncentrationer från 2,1 till 6,5 $\mu\text{mol/l}$.

Fluorescensmätningar visade att det pågick algblooming i västra delen av området.

Kattegatt och Öresund

Ytvattentemperaturen var något förhöjd i området och varierande mellan 5,3 och 5,7°C. Salthalten i Kattegatts ytvatten var över det normala, 22,4 till 31,4 psu, i Öresund 21,8 psu. Termoklin och haloklin sammanföll på djup mellan 15 och 25 meter och var svagt utvecklade.

Näringsämnen i Kattegatts ytvatten varierade från normalt till under och över det normala för årstiden. Fosfatkoncentrationerna, under det normala i Öresund, låg mellan 0,03 och 0,21 $\mu\text{mol/l}$. Halterna av nitrit + nitrat, över det normala i norra delen, varierade från under detektionsgränsen <0,10 $\mu\text{mol/l}$ till 6,3 $\mu\text{mol/l}$, medan silikat hade koncentrationer mellan 0,4 och 3,3 $\mu\text{mol/l}$, under det normala i Öresund.

Enligt fluorescensmätningarna är vårbloomingen över för den här gången.

Syreförhållandena i djupvattnet var goda, det lägsta värdet i Kattegatt uppmättes vid Anholt E, 5,2 ml/l. I Öresund uppmättes som lägst 5,5 ml/l.

Egentliga Östersjön

Ytvattentemperaturen var normal för årstiden och varierade mellan 2,8 och 4,0°C. I egentliga Östersjön var ytlagret välblandat, termoklin och haloklin sammanföll och återfanns på omkring 50 - 80 meters djup i norra, västra och östra Gotlandsbassängen, på 50 meters djup i Bornholmsbassängen och på 30 meters djup i Arkonabassängen.

Halterna av fosfat och silikat var något högre än normalt i hela området utom i Arkonabassängen, där de var lägre än normalt. Fosfathalterna låg mellan 0,15–0,77 $\mu\text{mol/l}$ och silikalthalterna mellan 1,3 och 15,6 $\mu\text{mol/l}$. Koncentrationen av nitrit + nitrat var normal i alla områden, förutom i Arkonabassängen där halterna var lägre än normal och varierade mellan <0,10 och 3,4 $\mu\text{mol/l}$.

I Arkonabassängens bottenvatten är syreförhållandena fortfarande goda. Syresituationen i Bornholmsbassängen och Hanöbukten har förbättrats sedan förra mättillfället och låg över gränsen för akut syrebrist (< 2 ml/l).

Vid BCSIII-10 hade halterna försämrats ytterligare och i bottenvattnet uppmättes endast 0,27 ml/l. Norr om BCS III-10 vid Gotladsdjupet märktes ett tidigare inflöde av genom att



svavelvätekoncentration i bottevattnet hade minskat. I västra, norra delen av östra samt norra Gotlandsbassängerna sågs ingen förbättring av syresituationen. Helt syrefria förhållanden återfanns från 100 - 125 meters djup och akut syrebrist från 70 - 90 meters djup. I Arkona, Bornholmsbassängen samt i Hanöbukten var blomningen i full gång, med kraftigt förhöjd fluorescens. I övrigt var planktonaktiviteten, baserat på fluorescensmätningar låg.

DELTAGARE

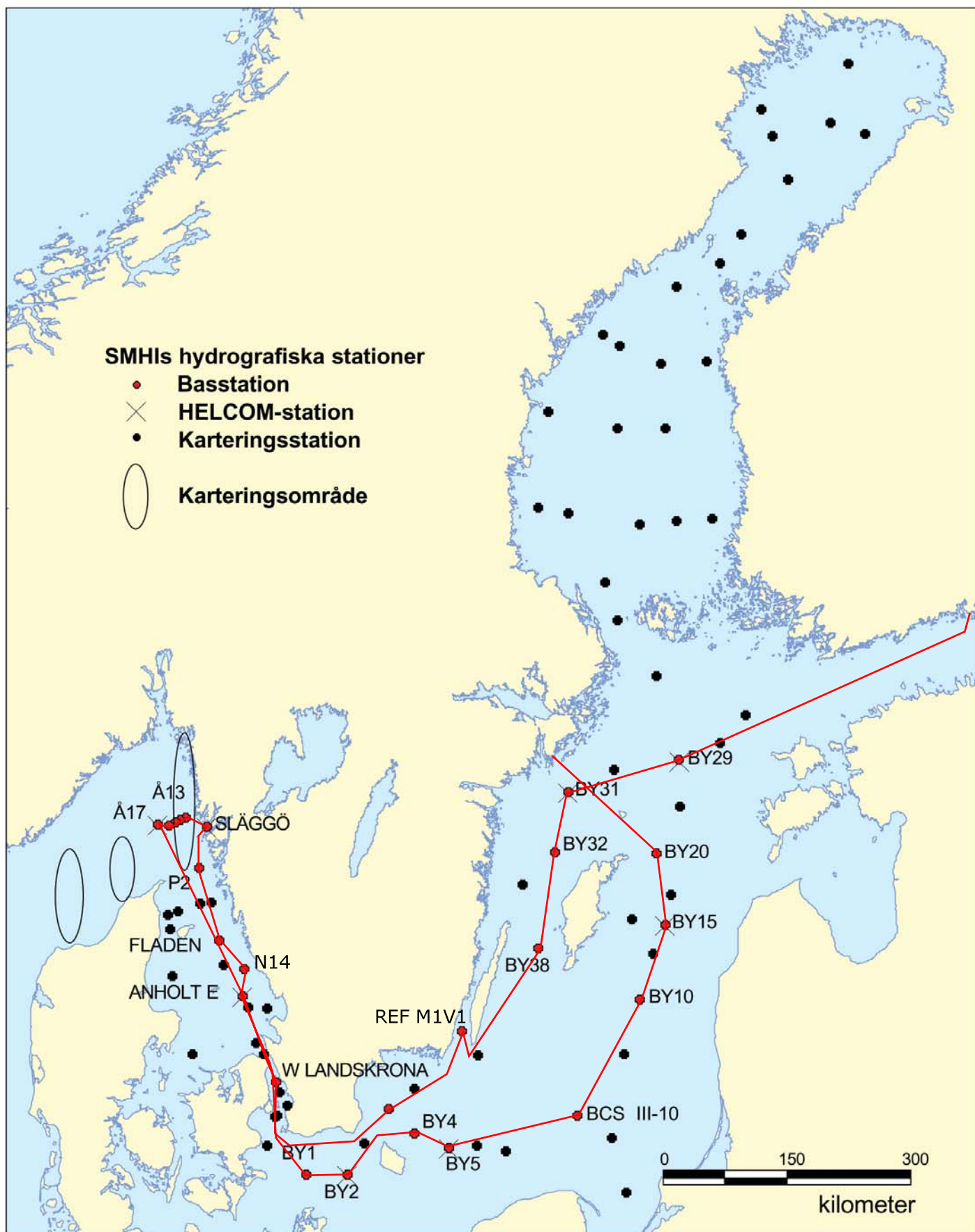
Namn		Från
Anna-Kerstin Thell	Expeditionsledare	SMHI
Daniel Bergman-Sjöstrand		SMHI
Vivi Månsson		SMHI
Sari Sipilä		SMHI
Jan Szaron		SMHI

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

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 t	PPCPZT Hrhhoo Cilyyoo motPBw PrP l	No de	T e a m l y g	S o h x 2 P S	P O o o 2 P N	H 2 o o 0 P N	P T o o 3 P N	N N t t 3 P N	N N t t 3 P N	A S h o l i t k o m g n a 3 u n l s i	S H u i o l u n c 3 m	L P O O N C C m	P T O O C C m							
0146	GFXX00EXT		CTD-TEST FINSKA VIKEN	N5949.88	E2420.90	20140317	1340	50		08 9	-1.4	992	1230	x		10	-	-	-	-	-	-	-	-	-	-	-	x						
0147	BPNX35BAS	BY29		N5853	E2019	20140318	0310	174		28 5	2.0	999	9999	x	--x----	16	x	x	-	x	x	x	x	x	x	-	x	-	-	x				
0148	BPNX37BAS	BY31	LANDSORTSDJ	N5835	E1814	20140318	1115	451	10	20 8	2.9	998	2830	x	-xxxx--	23	x	x	x	x	x	x	x	x	x	x	-	-	-	x				
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0151	BPWK01BAS	REF M1V1		N5622.25	E1612.1	20140319	1035	21	5	24 10	6.4	1003	2830	x	-xxxx--	5	x	x	x	-	x	x	x	x	x	x	-	-	-	-	x			
0152	BPSH05BAS		HANÖBUKTEN	N5537	E1452	20140319	1920	80		24 12	5.8	1004	9990	x	-x-----	11	x	x	-	x	x	x	x	x	x	-	x	-	-	-	x			
0153	SOCX39BAS	W	LANDSKRONA	N5552.0	E1245.0	20140320	0900	52	5	22 8	7.6	1009	1630	x	-x-----	9	x	x	-	x	x	x	x	x	x	-	x	-	-	-	-			
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0157	SKEX23BAS	P2		N5752	E1118	20140321	0240	95		23 11	7.0	991	9990	x	-x-----	10	x	x	-	x	x	x	x	x	x	-	x	-	-	-	-	-	-	
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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 t	C PPCPZT	No de	T S a l	P h x	O 2	H 2 S	P 4	T S	N N	N N	N T	A S	S H	L i u	P m	P T	C O			
0173	BPEX26BAS	BY20	FÅRÖDJ	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

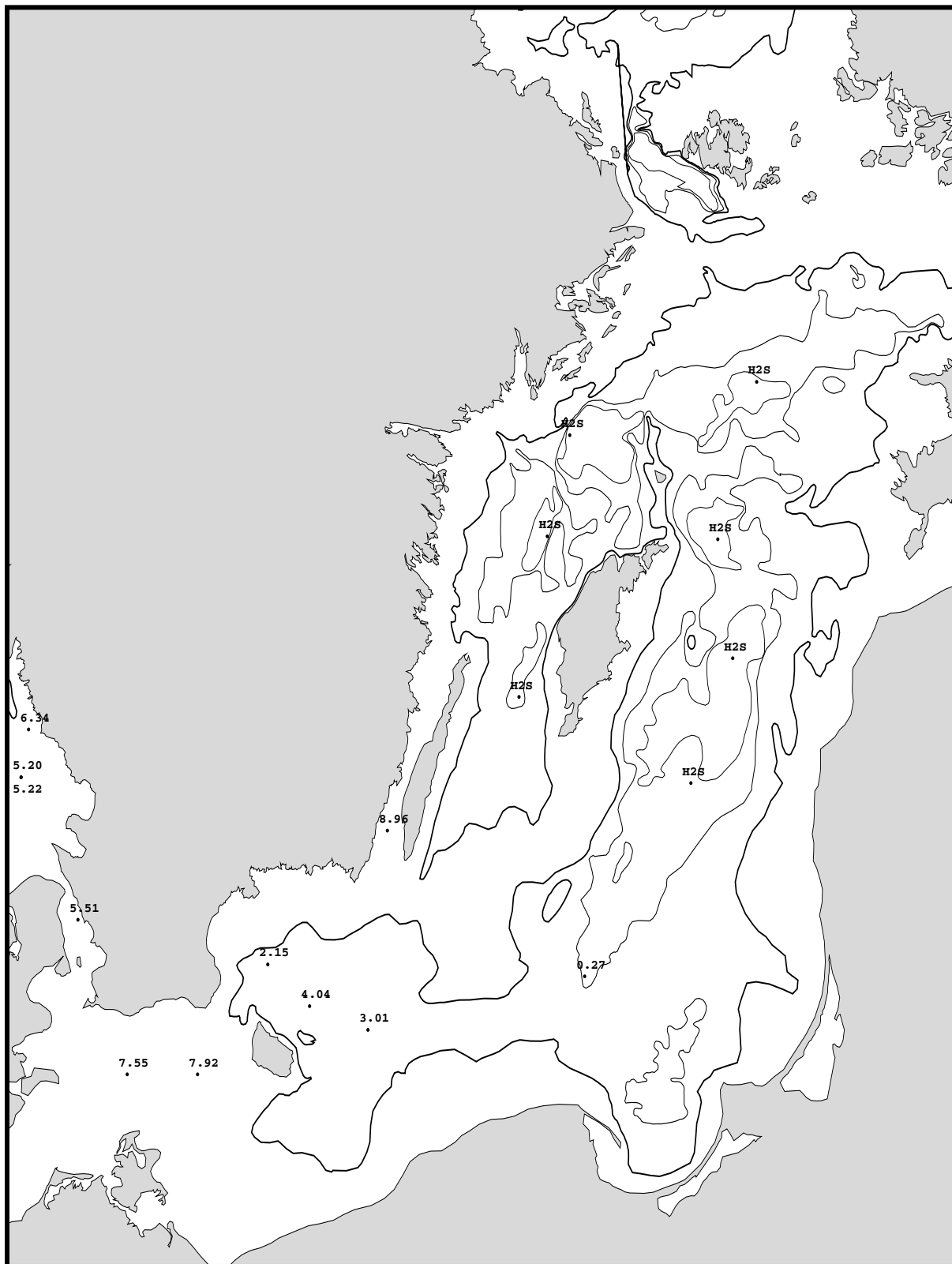
Bottom water oxygen concentration (ml/l)

Country: Finland

Ship : Aranda

Date : 20140317-20140324

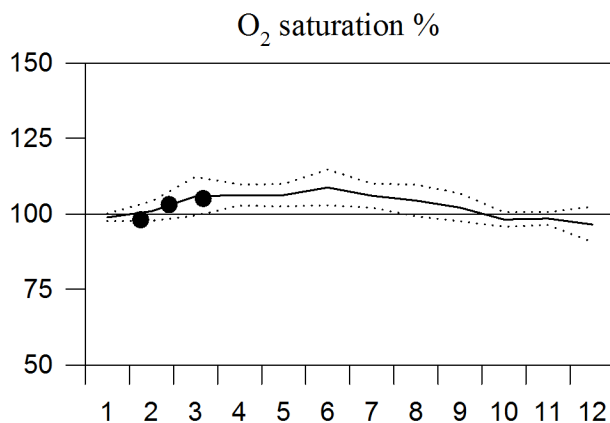
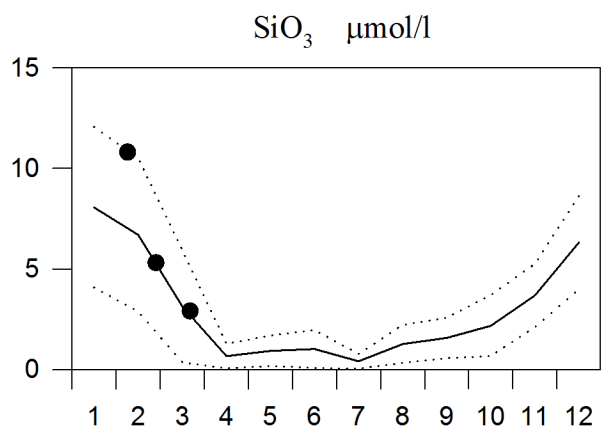
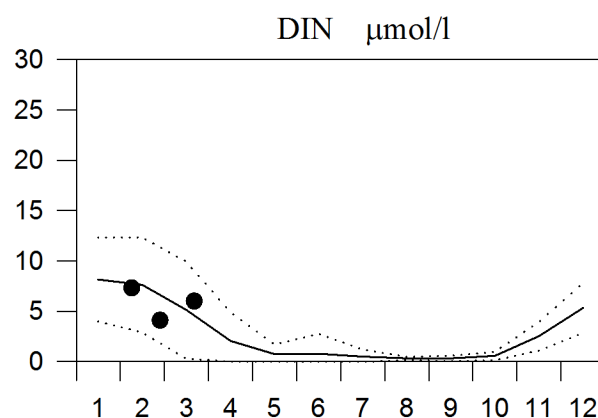
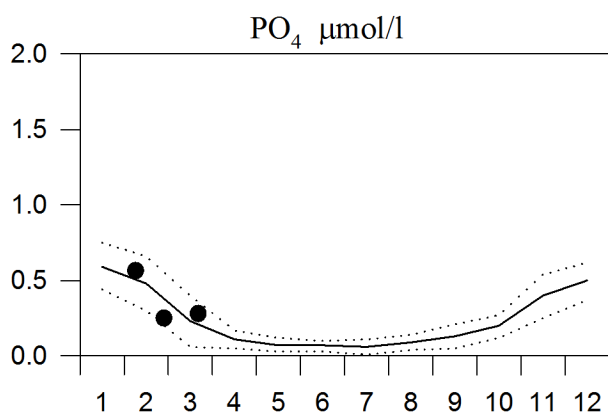
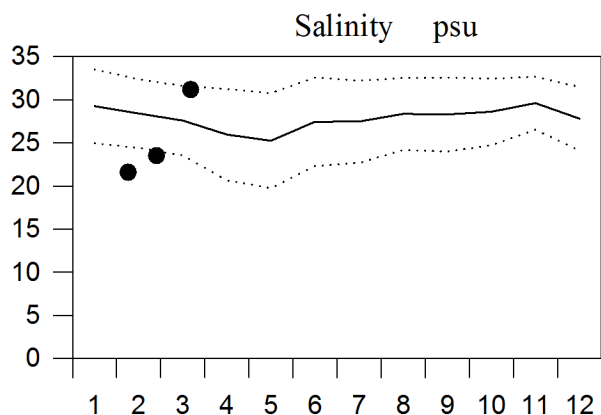
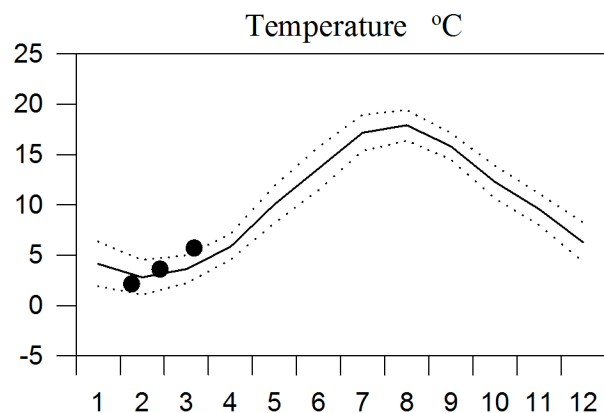
Series : 0146-0173



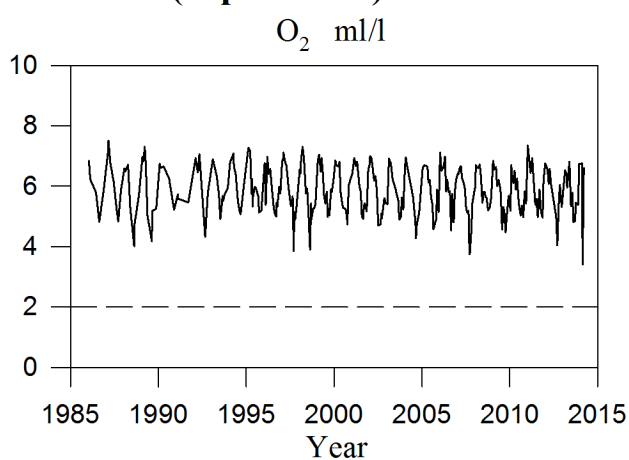
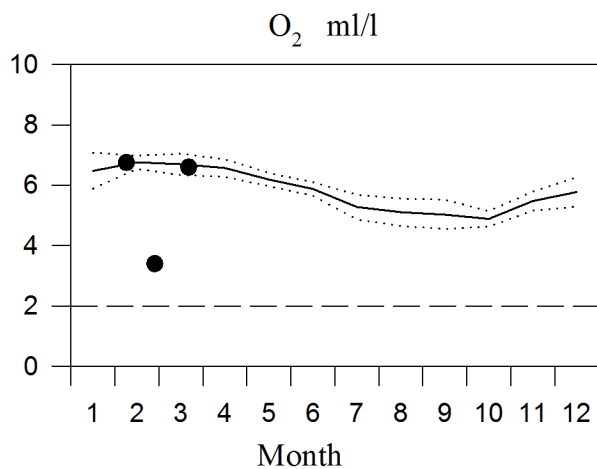
STATION P2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



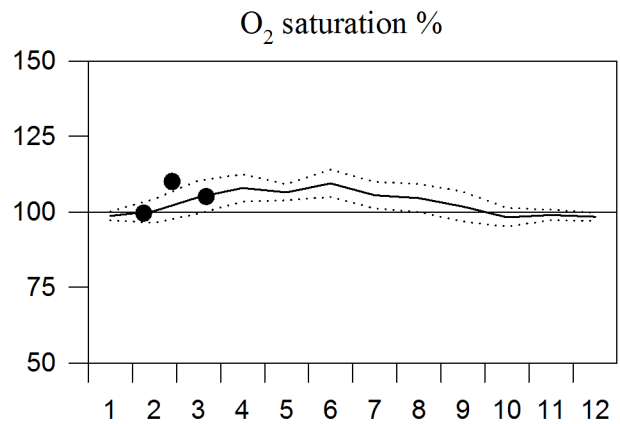
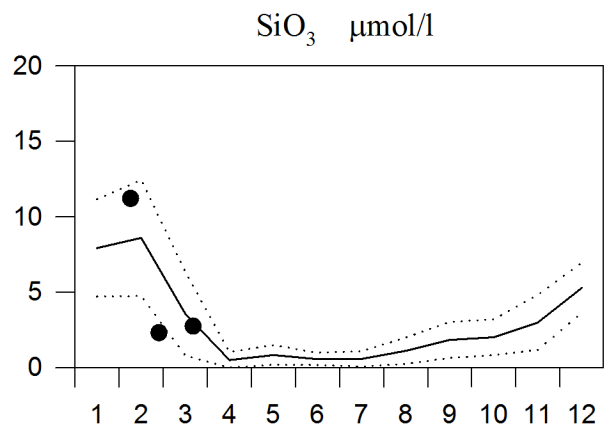
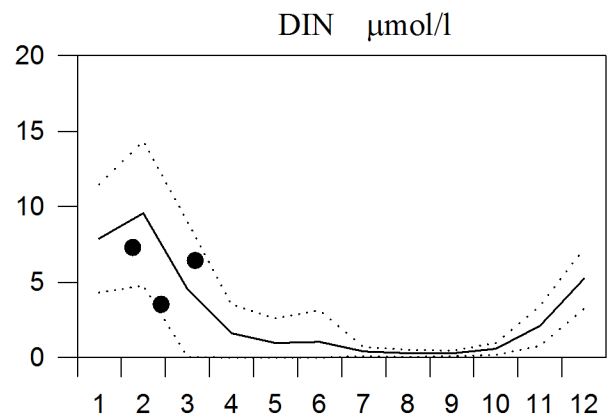
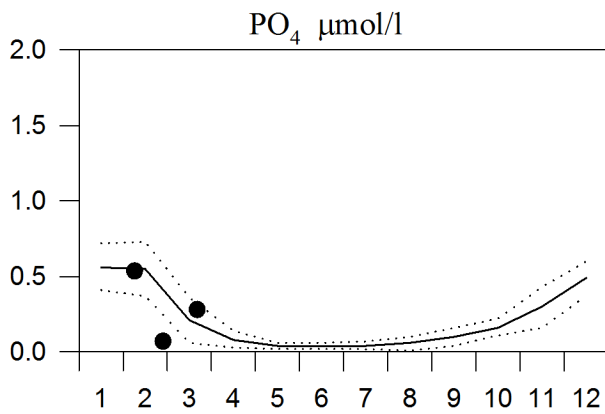
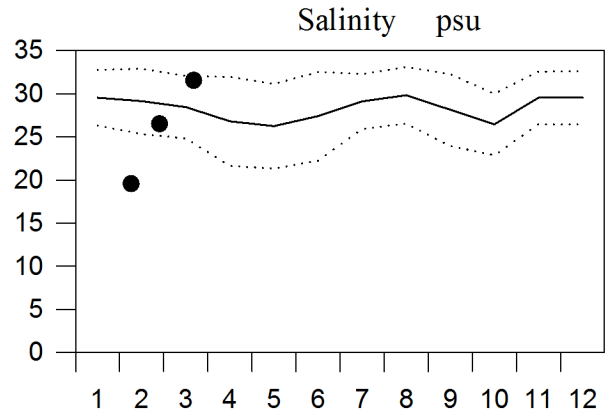
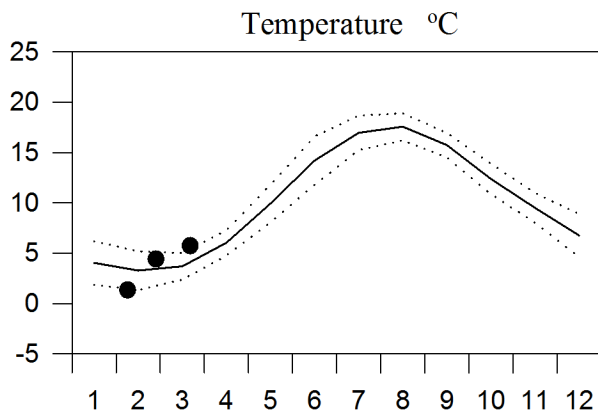
OXYGEN IN BOTTOM WATER (depth >75m)



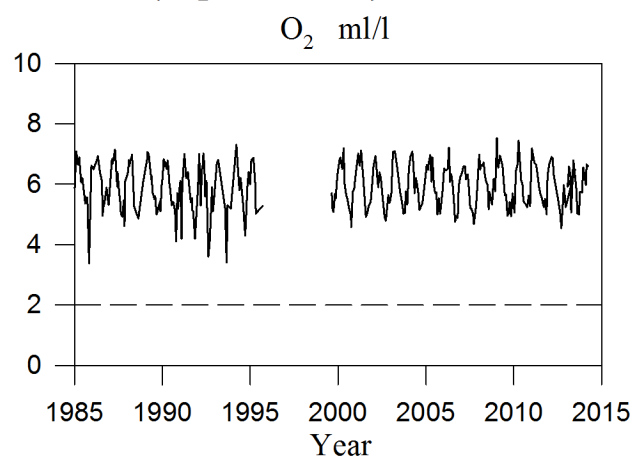
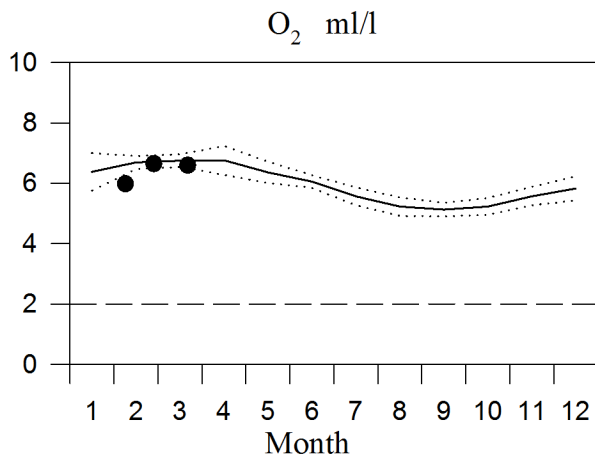
STATION Å13 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



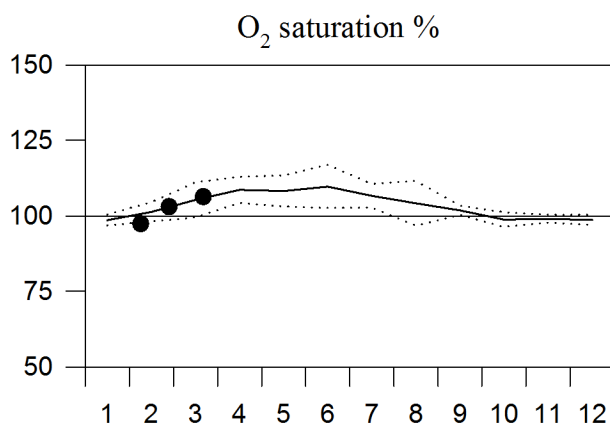
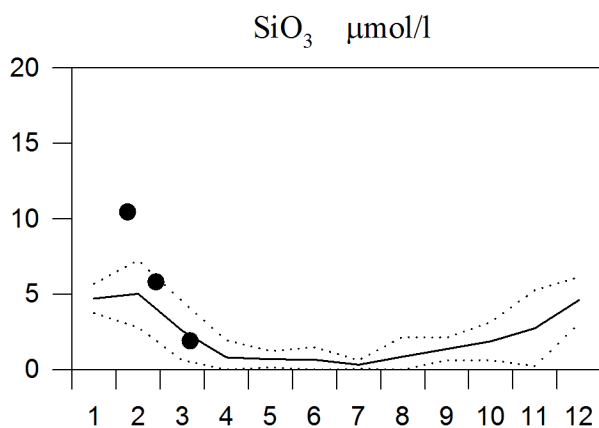
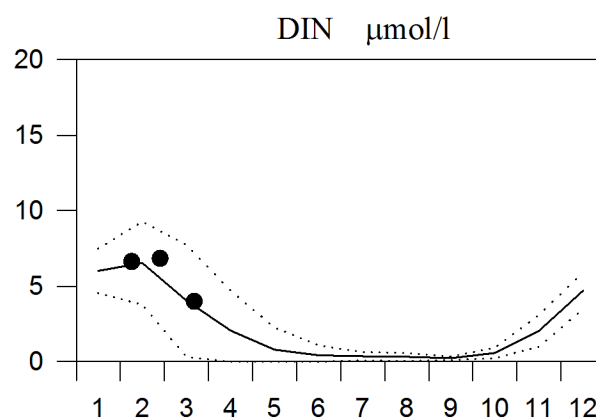
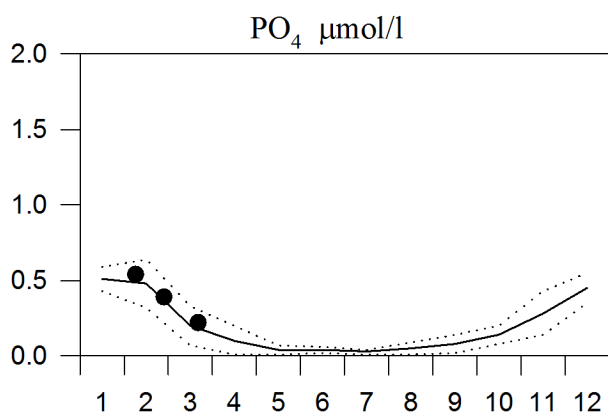
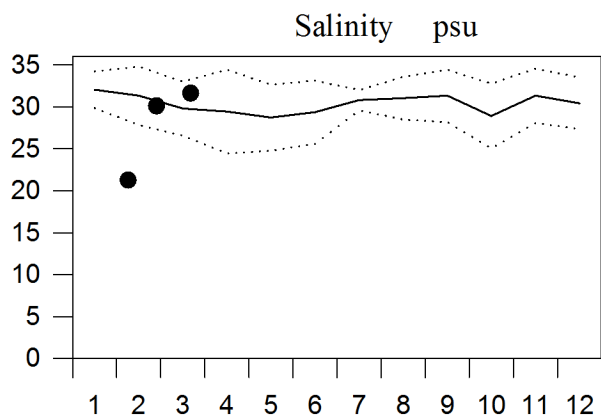
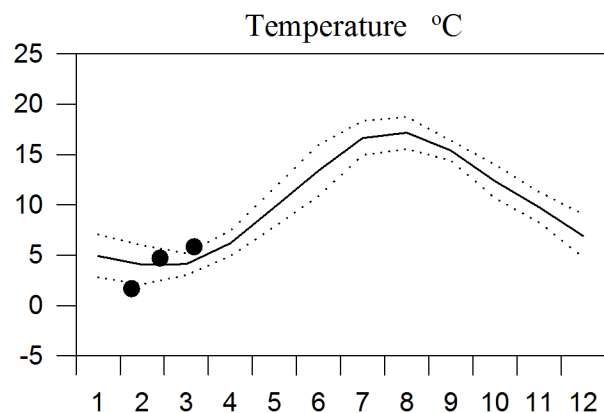
OXYGEN IN BOTTOM WATER (depth >=75m)



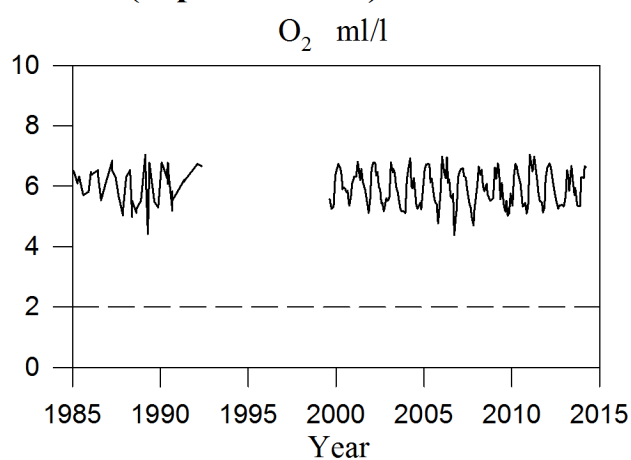
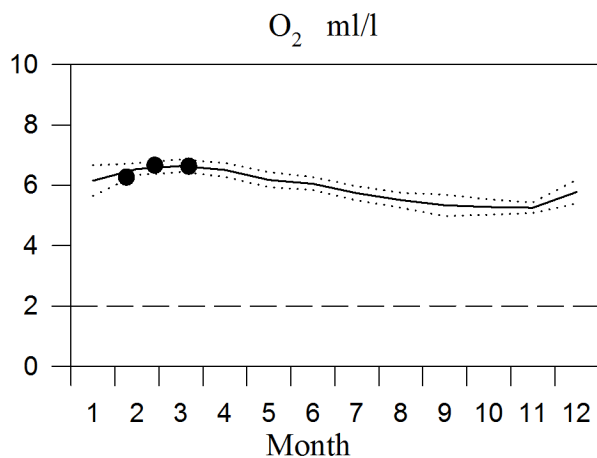
STATION Å15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



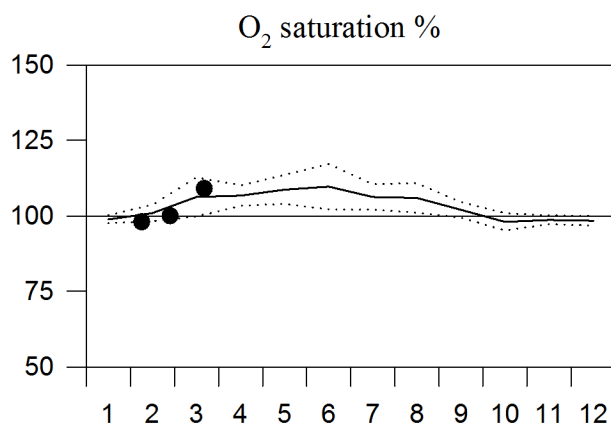
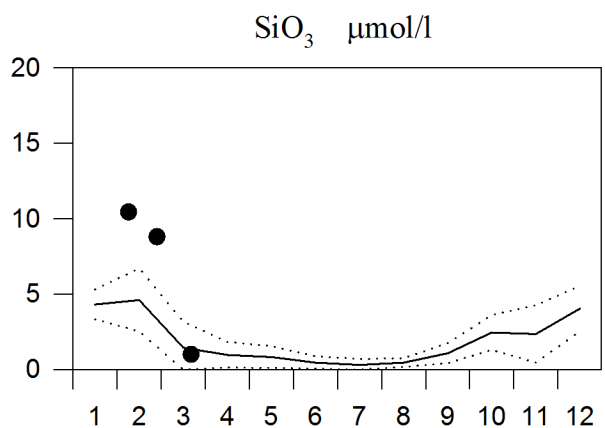
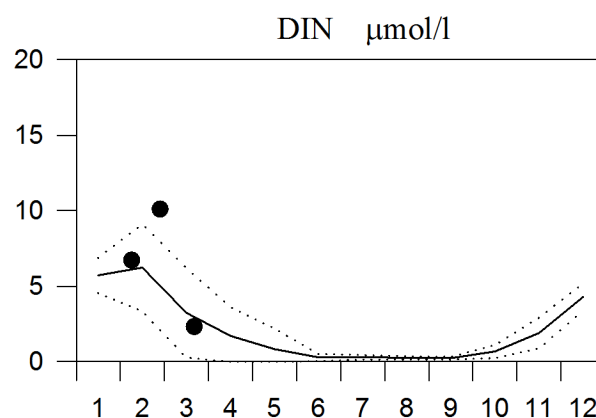
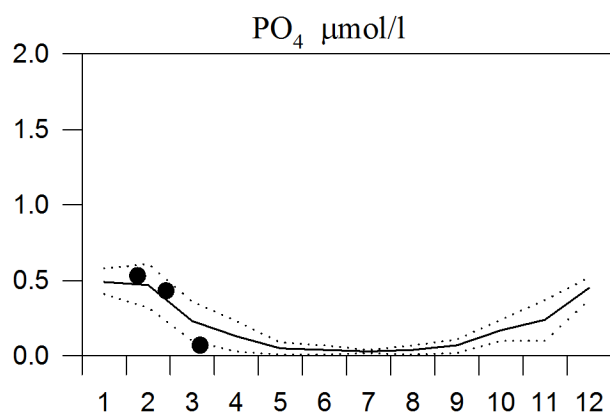
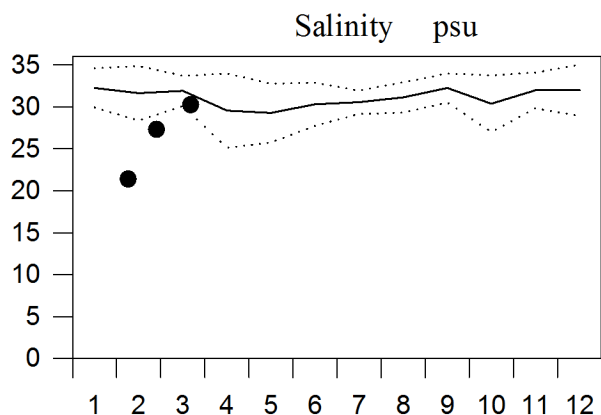
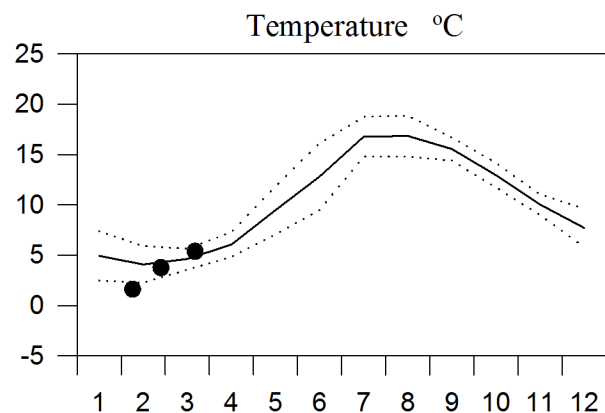
OXYGEN IN BOTTOM WATER (depth >=125m)



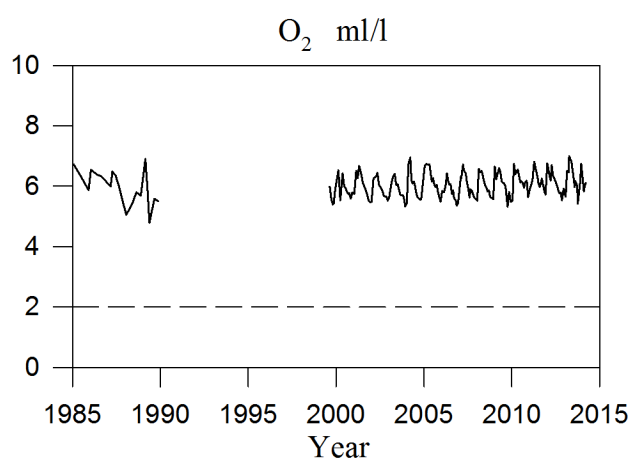
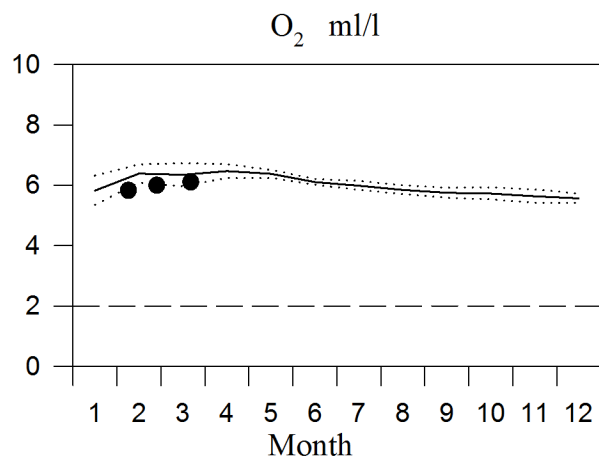
STATION Å17 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



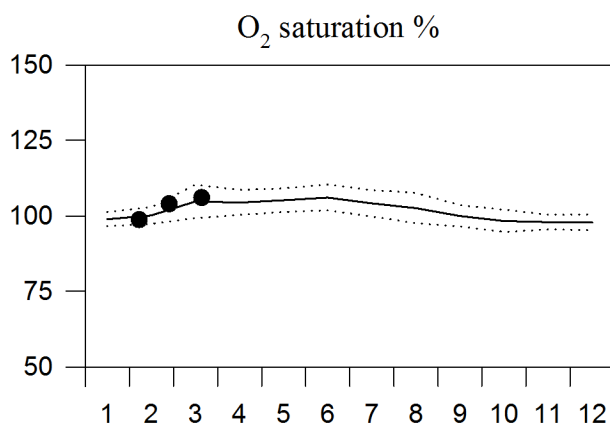
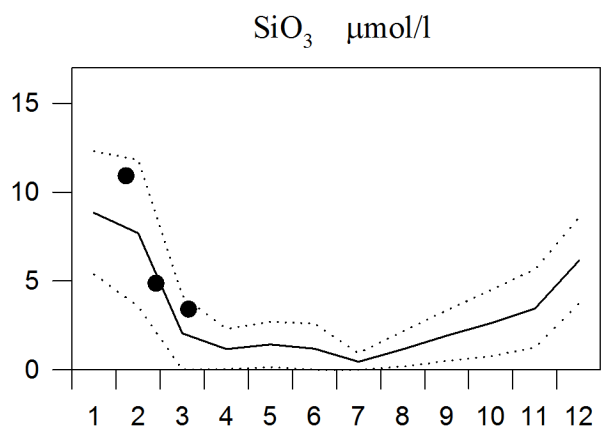
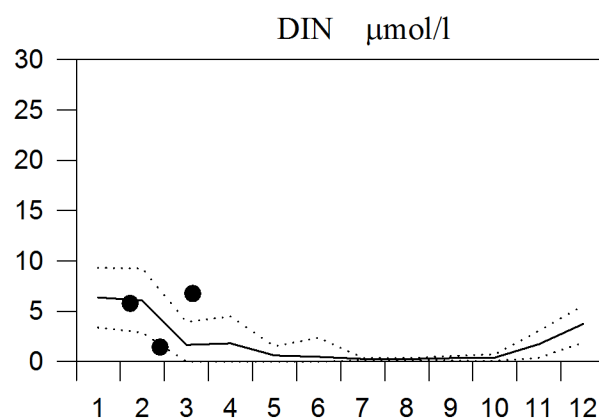
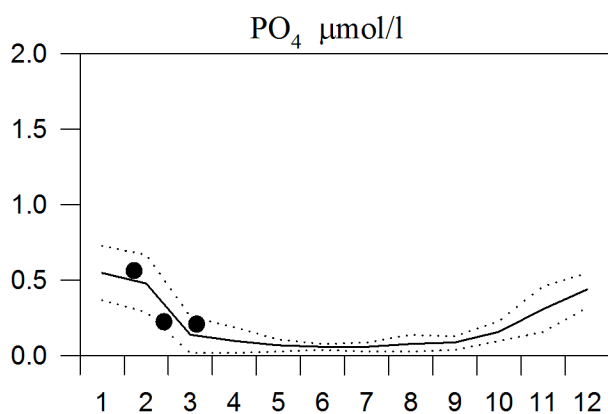
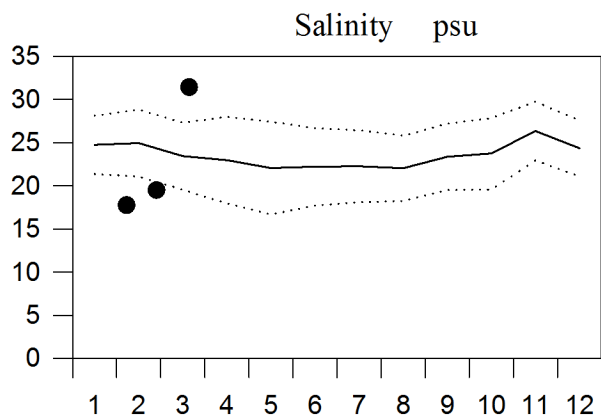
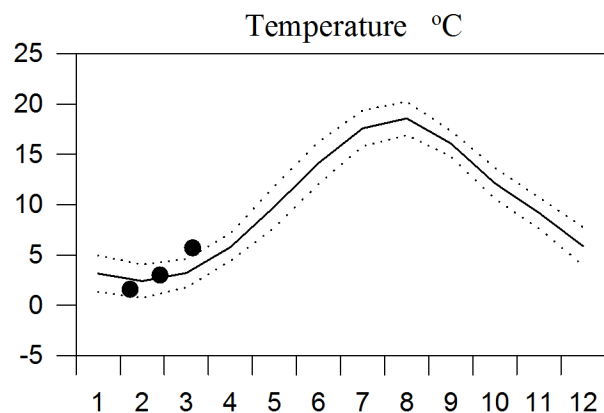
OXYGEN IN BOTTOM WATER (depth = 300m)



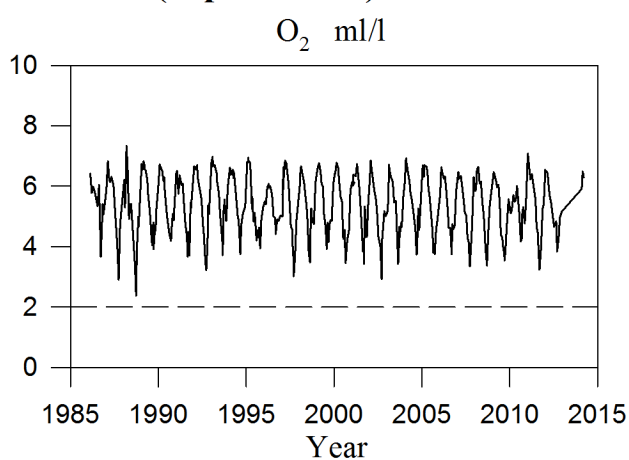
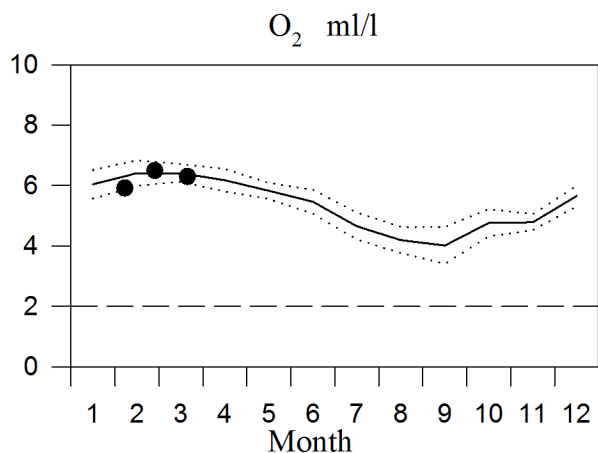
STATION FLADEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



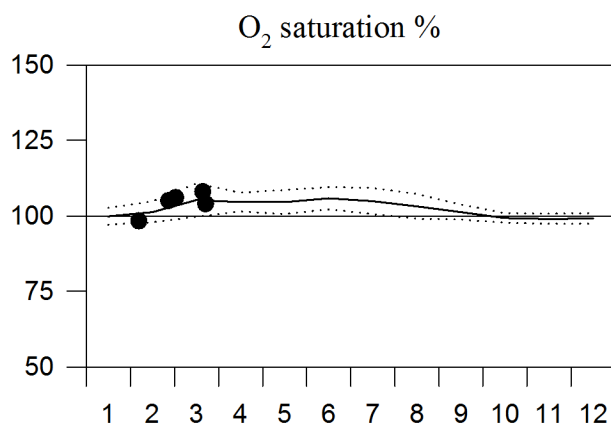
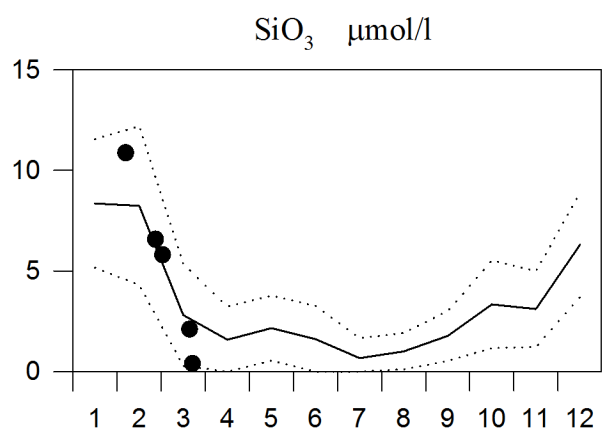
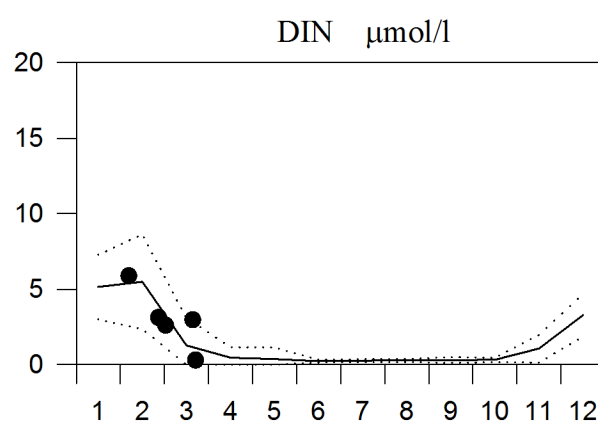
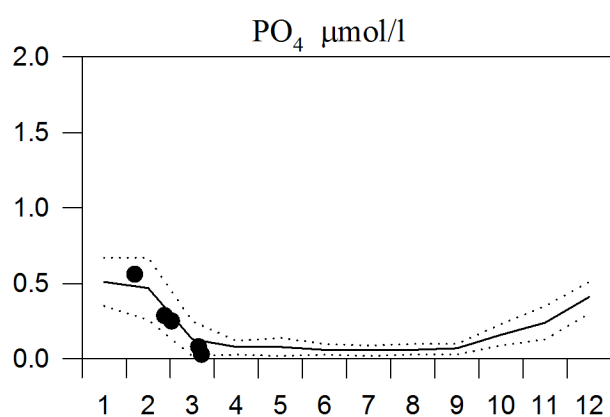
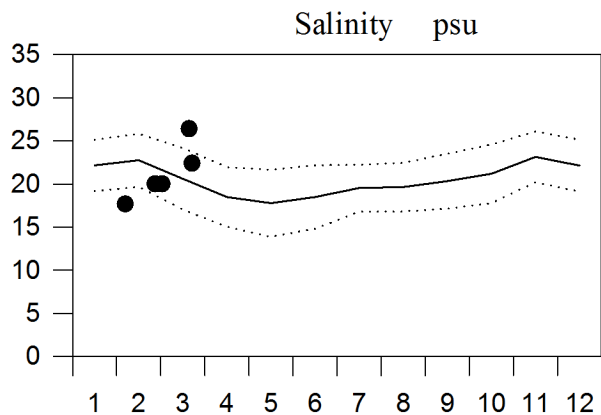
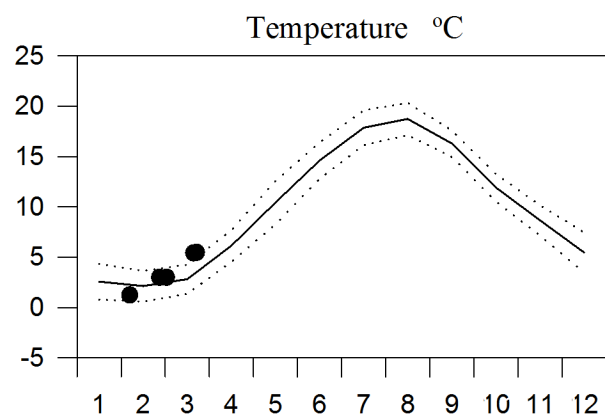
OXYGEN IN BOTTOM WATER (depth > 70m)



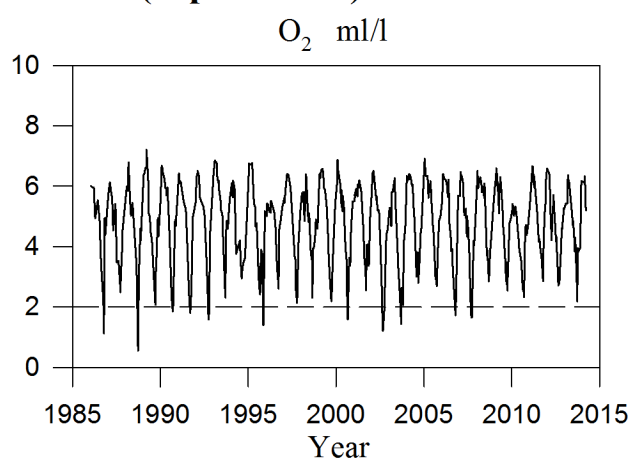
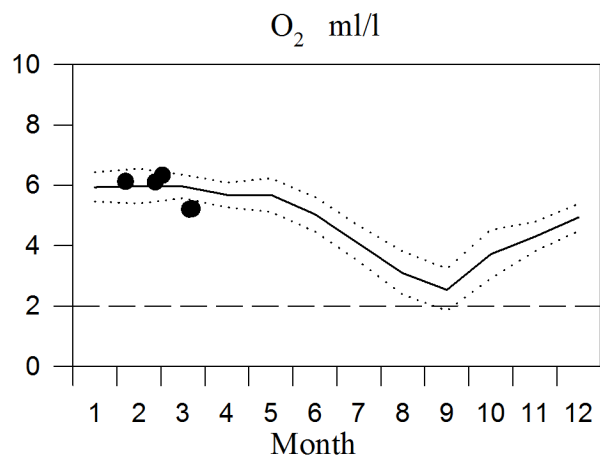
STATION ANHOLT E SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



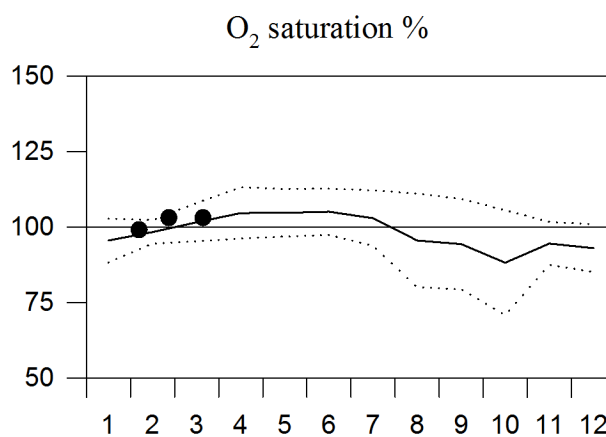
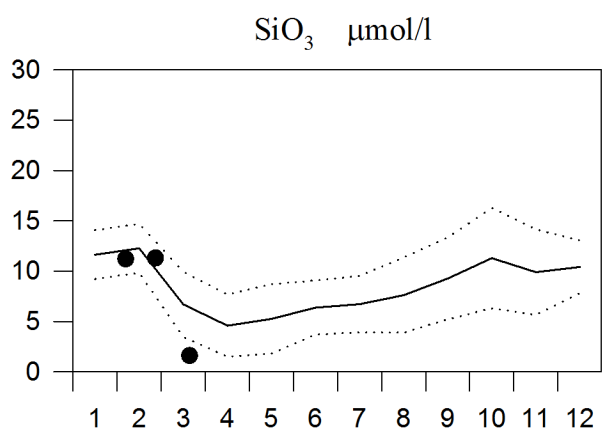
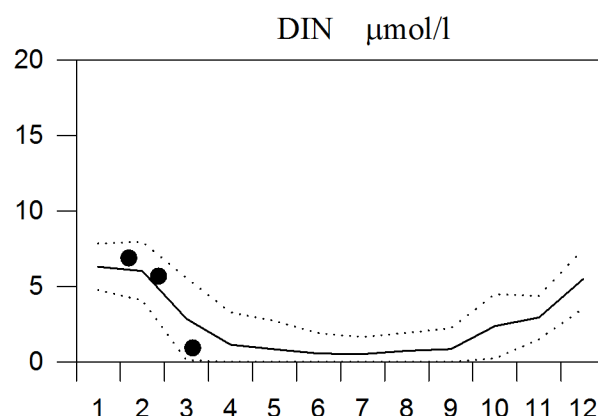
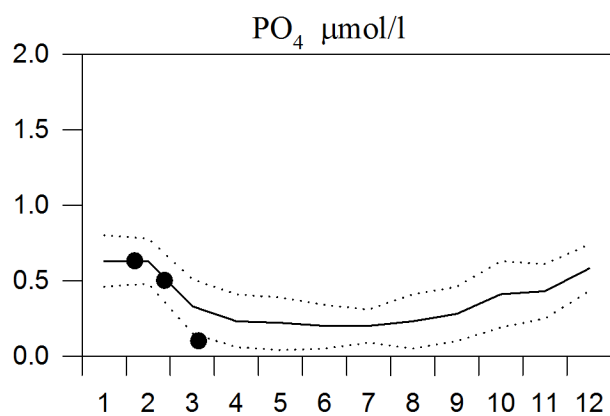
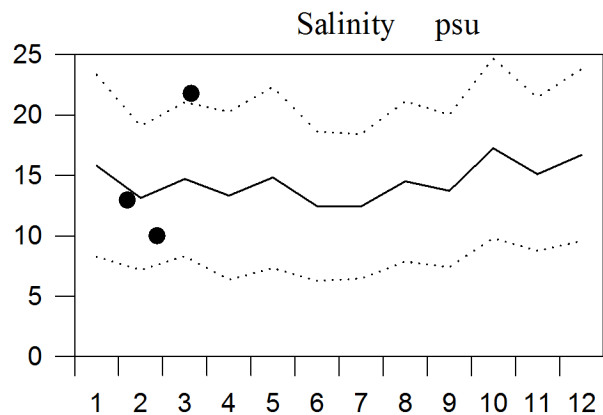
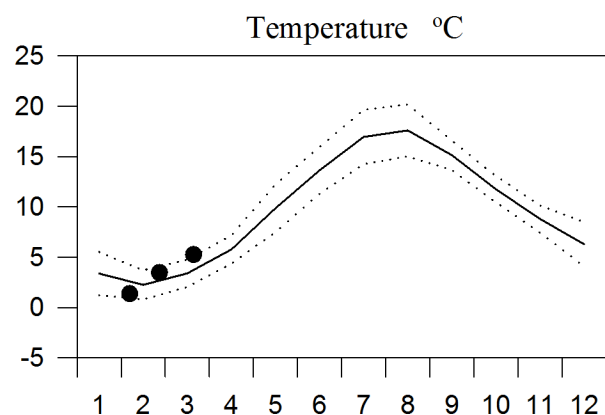
OXYGEN IN BOTTOM WATER (depth > 50m)



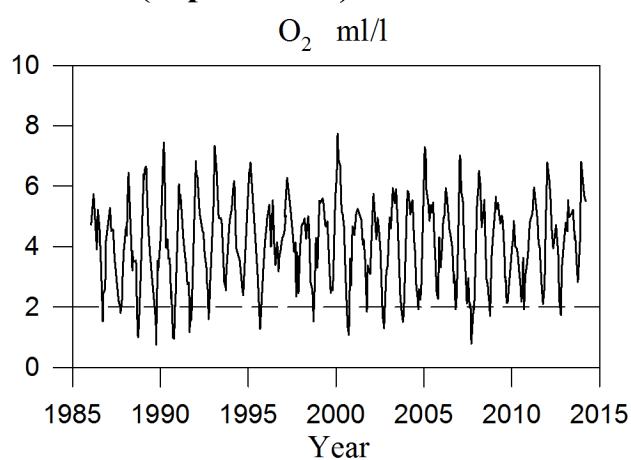
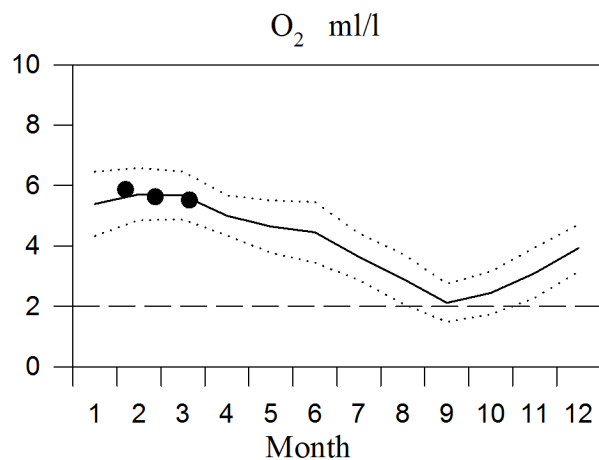
STATION W LANDSKRONA SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



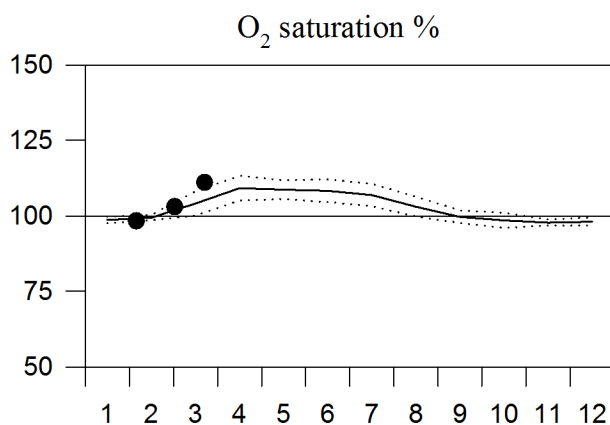
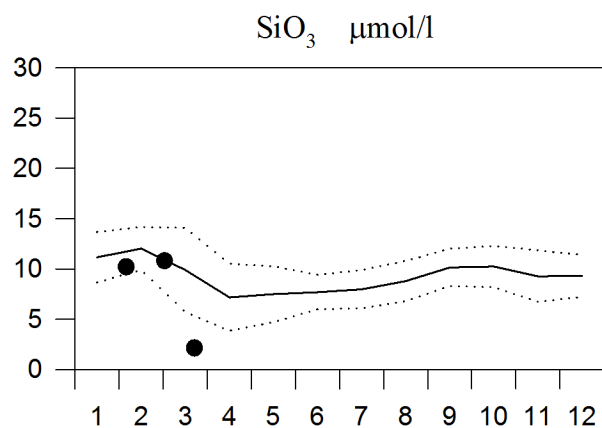
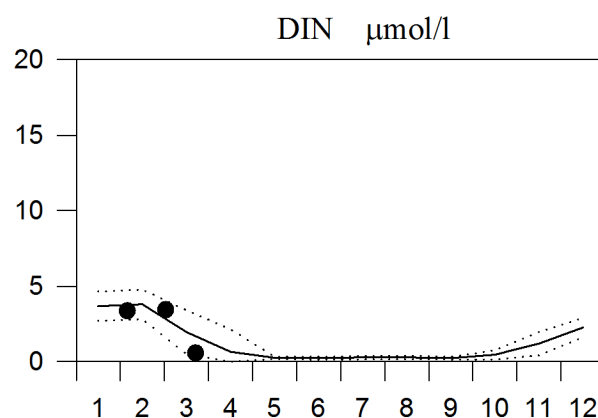
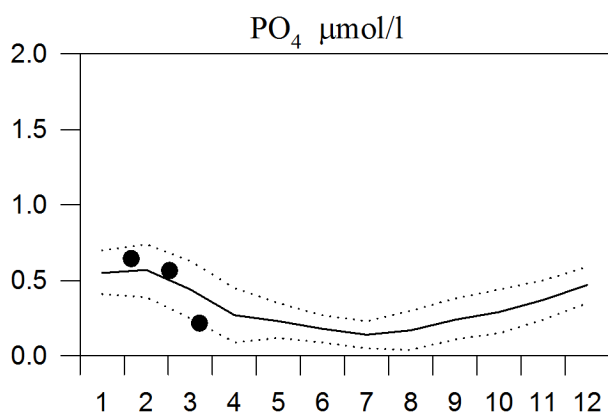
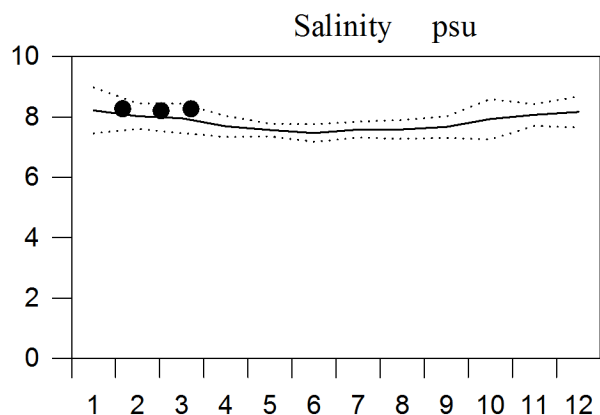
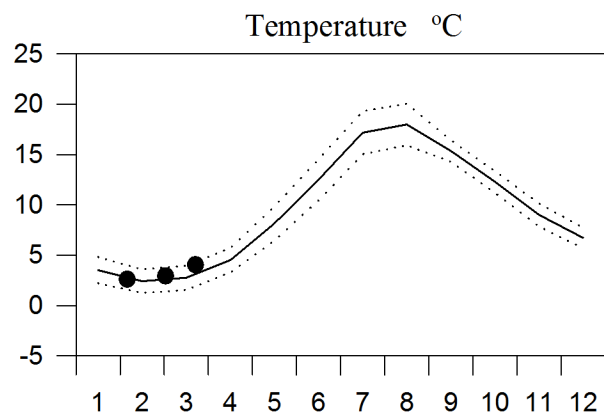
OXYGEN IN BOTTOM WATER (depth >40m)



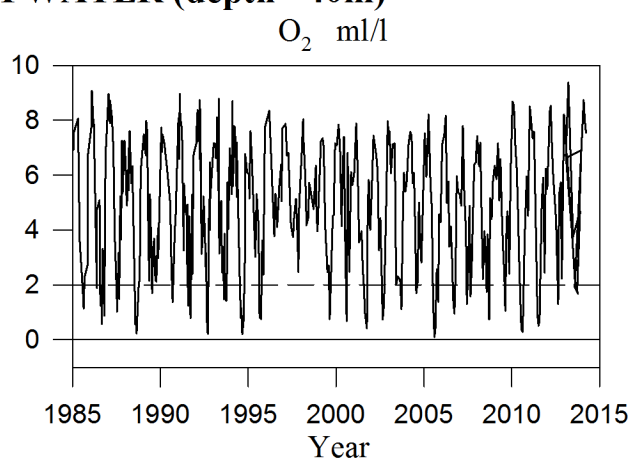
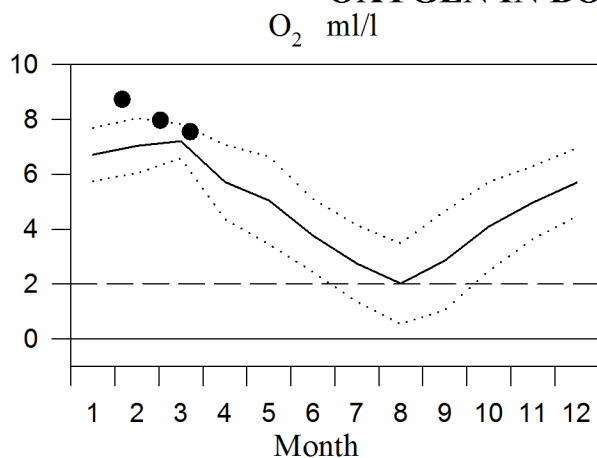
STATION BY1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



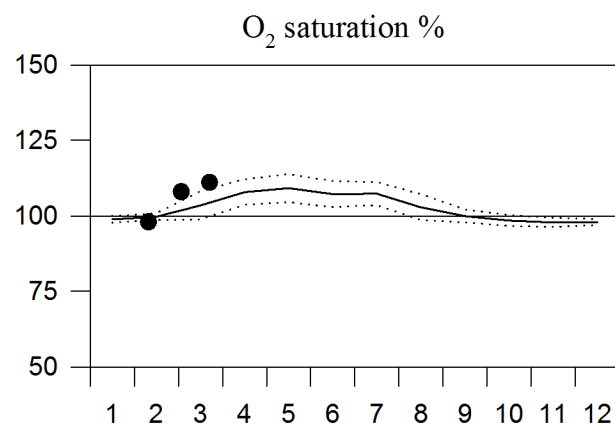
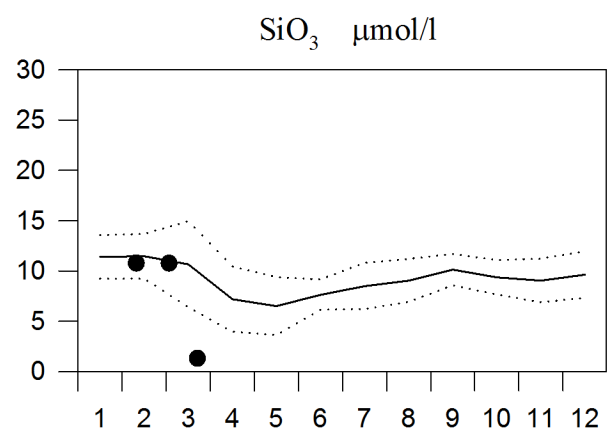
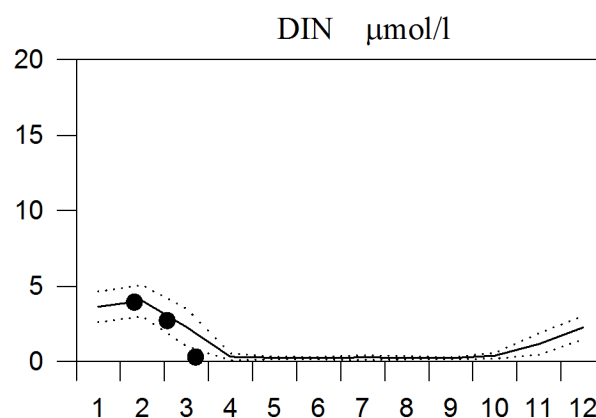
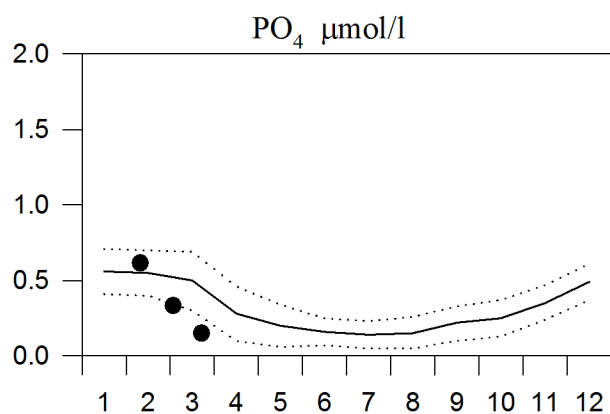
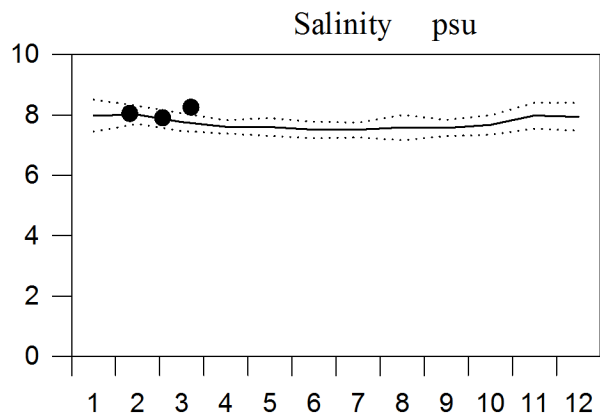
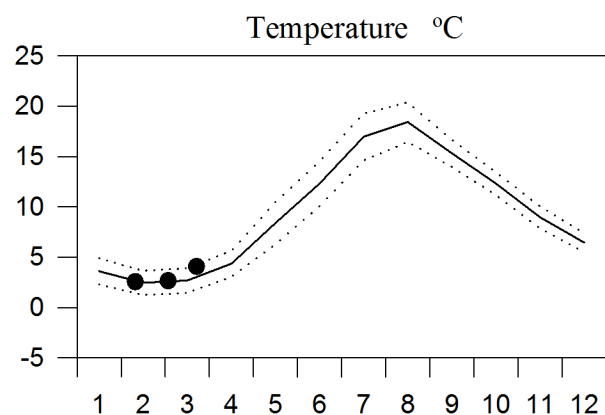
OXYGEN IN BOTTOM WATER (depth >40m)



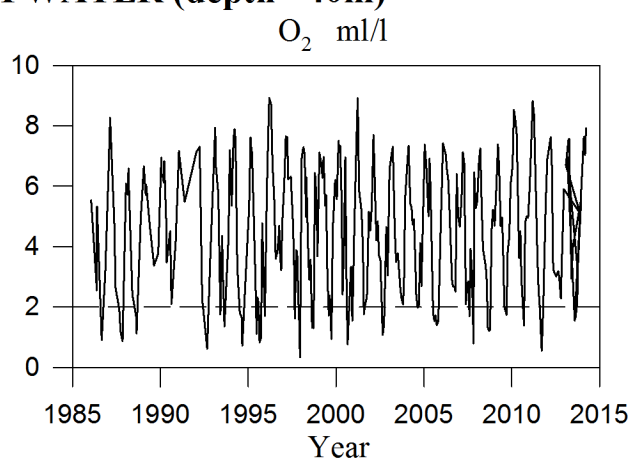
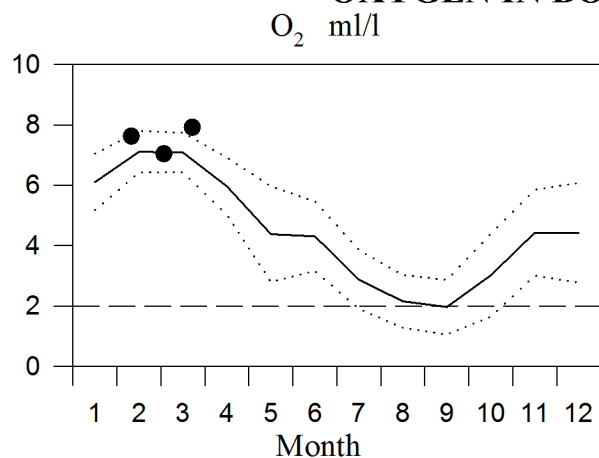
STATION BY2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



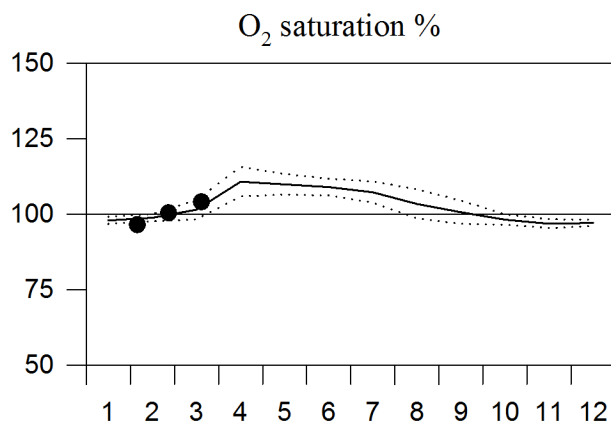
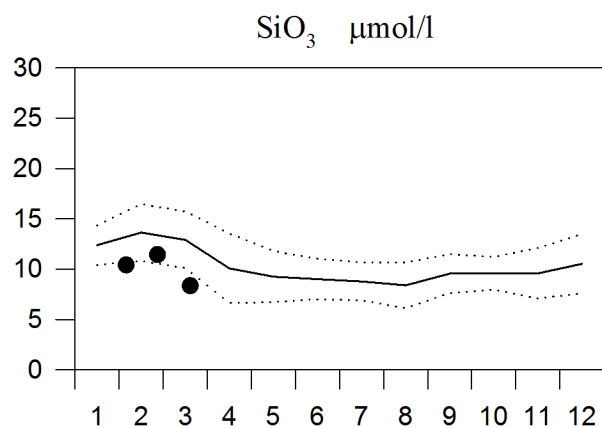
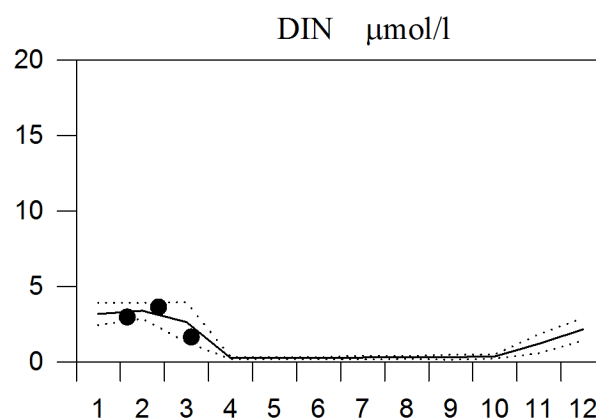
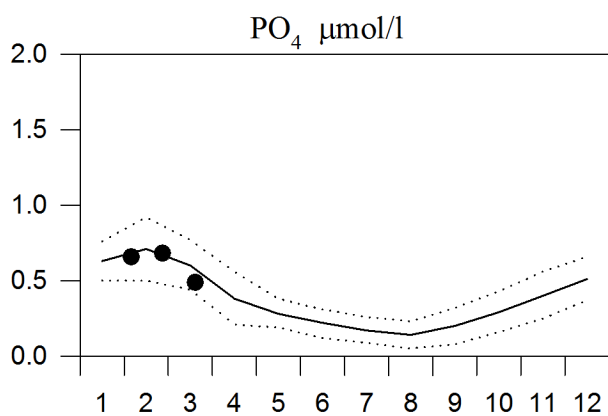
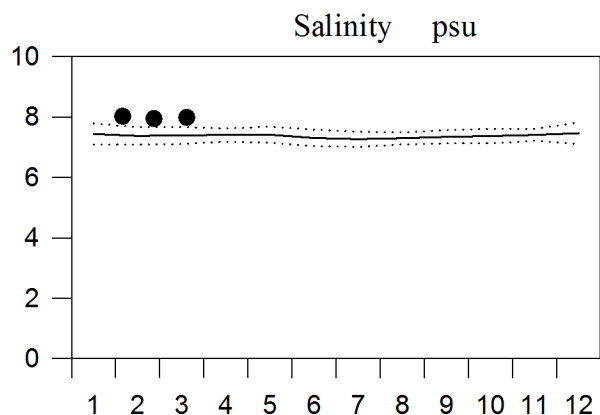
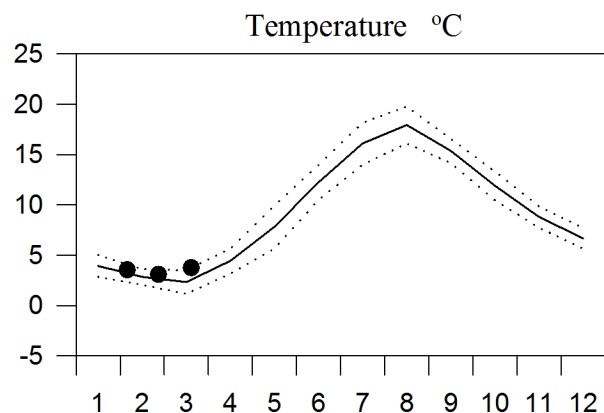
OXYGEN IN BOTTOM WATER (depth >40m)



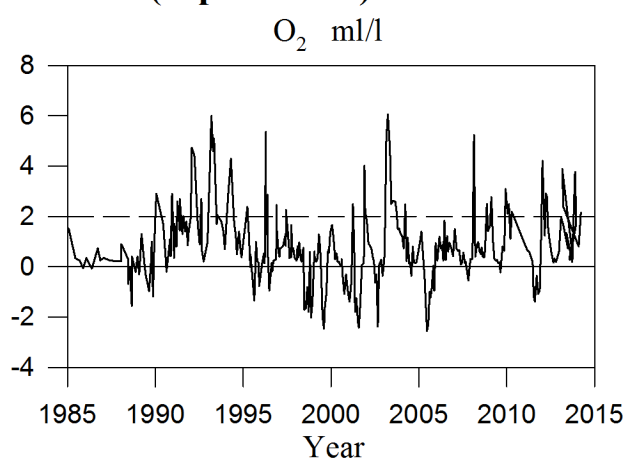
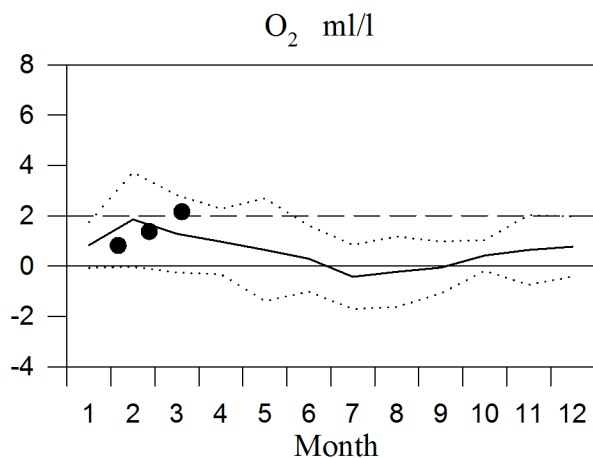
STATION HANÖBUKTEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



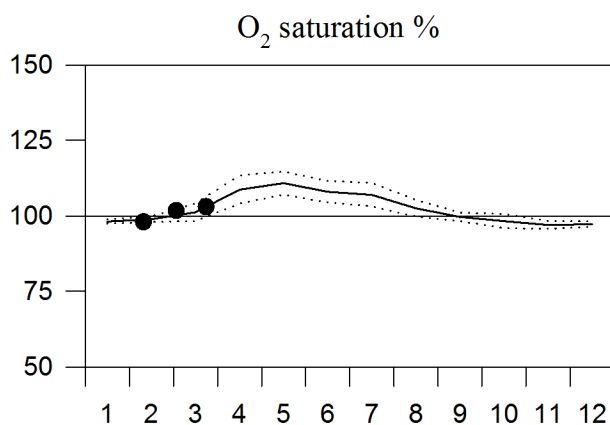
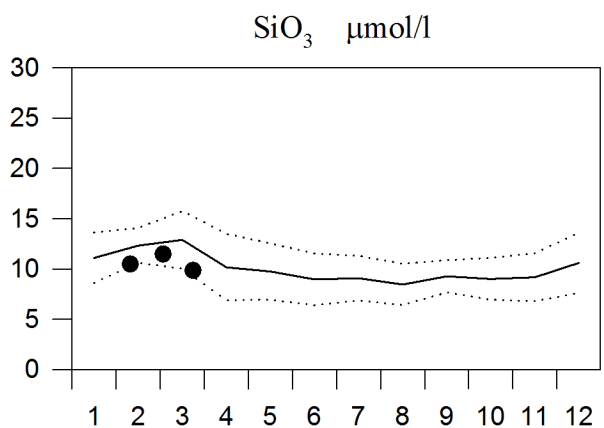
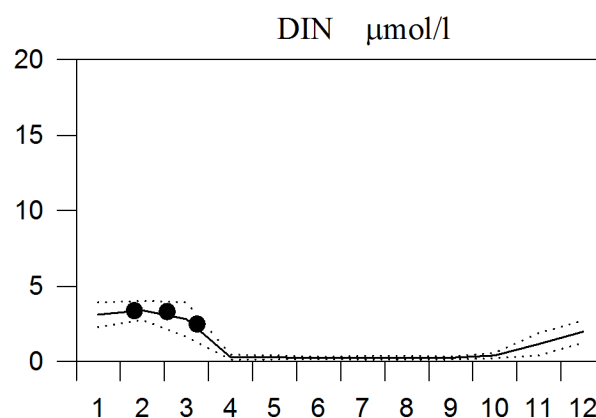
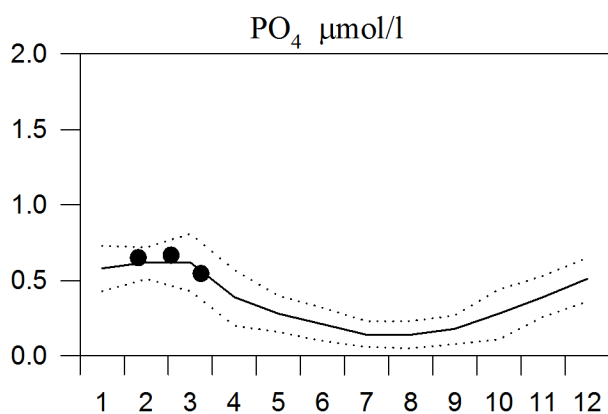
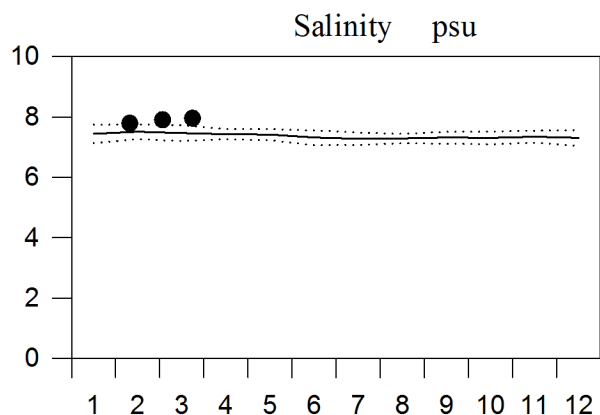
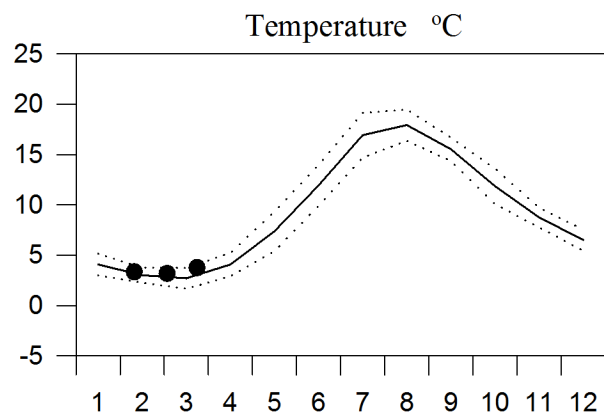
OXYGEN IN BOTTOM WATER (depth > 70m)



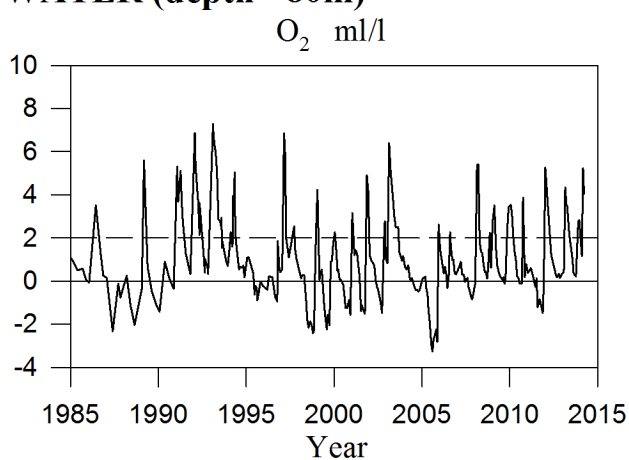
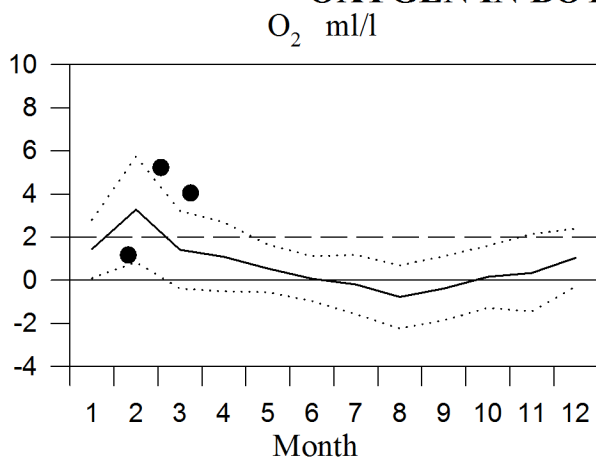
STATION BY4 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



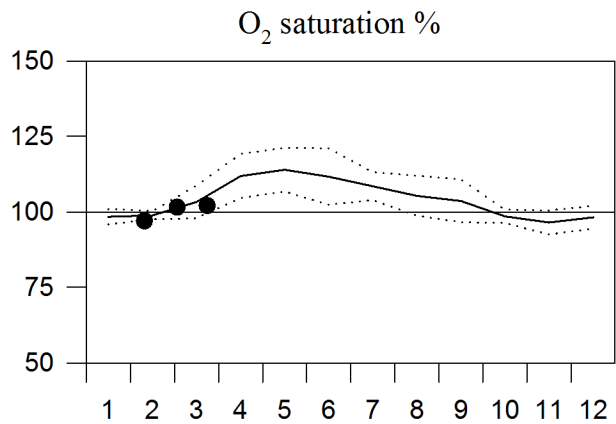
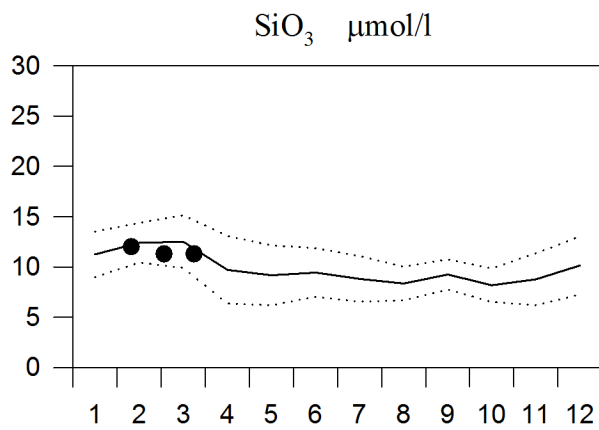
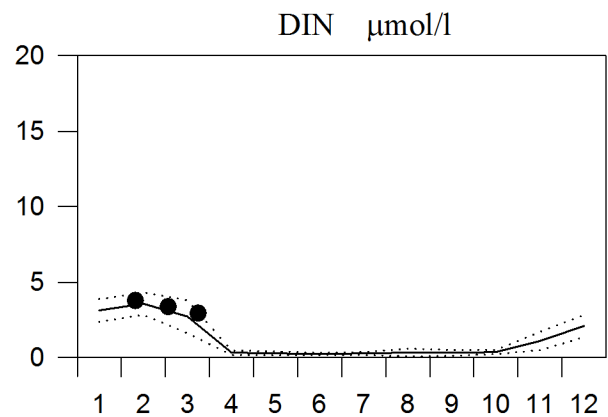
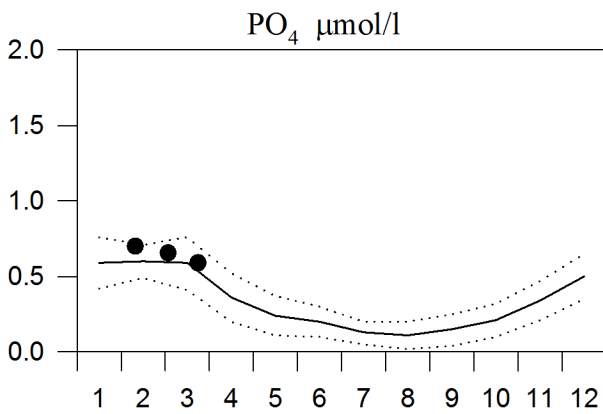
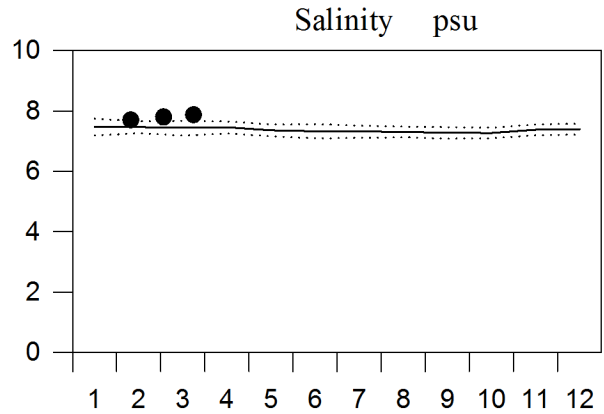
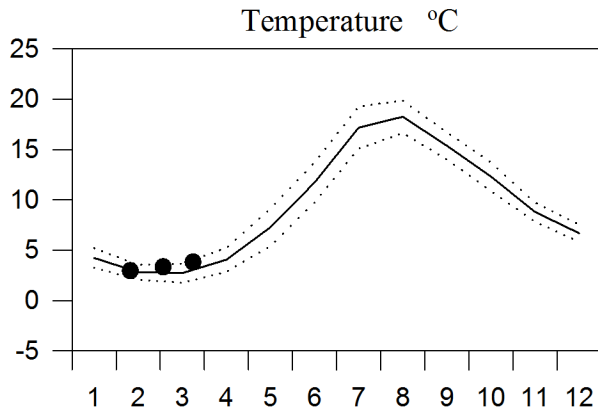
OXYGEN IN BOTTOM WATER (depth >80m)



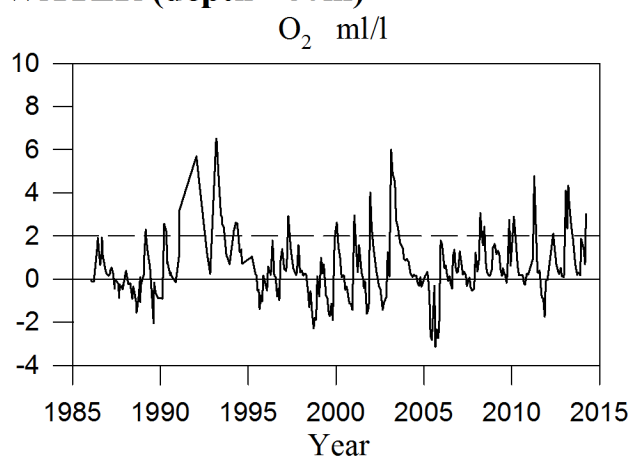
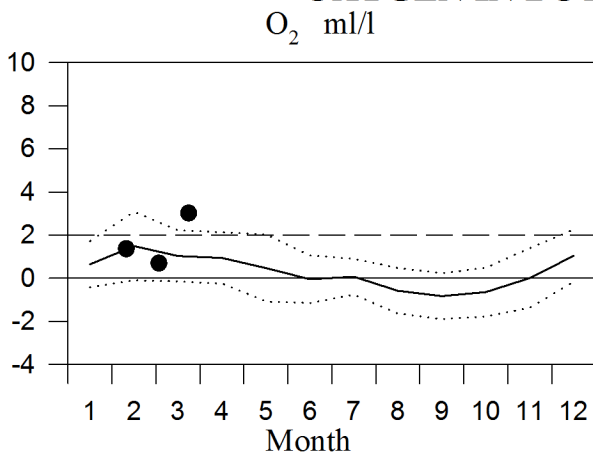
STATION BY5 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



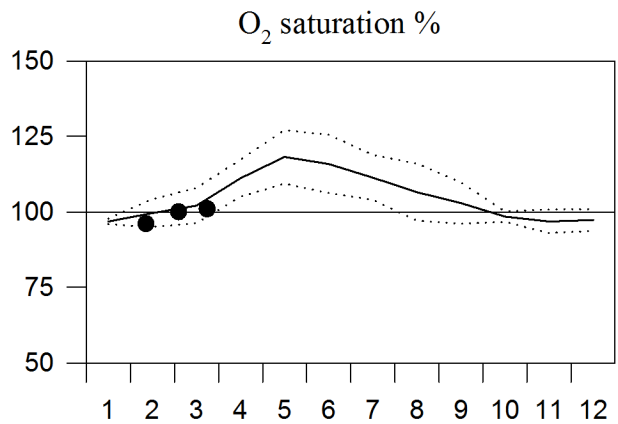
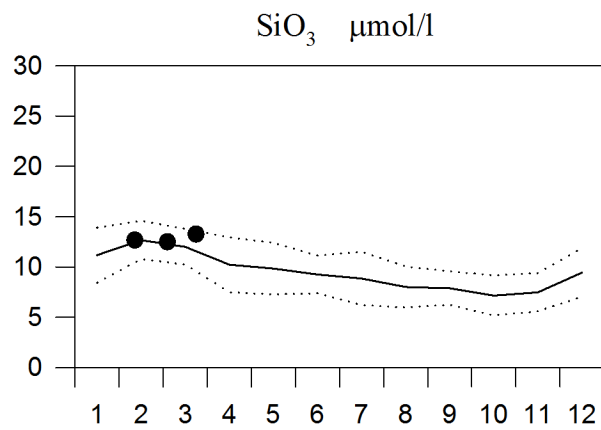
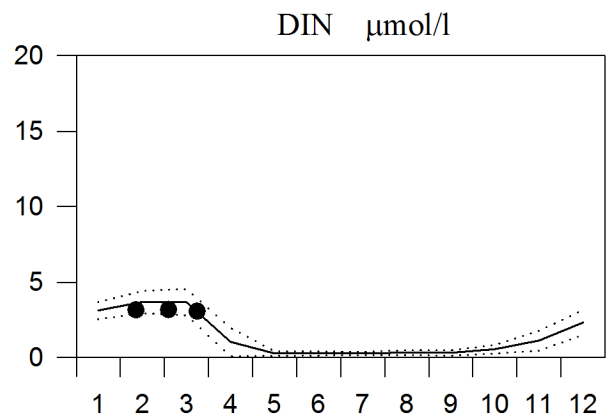
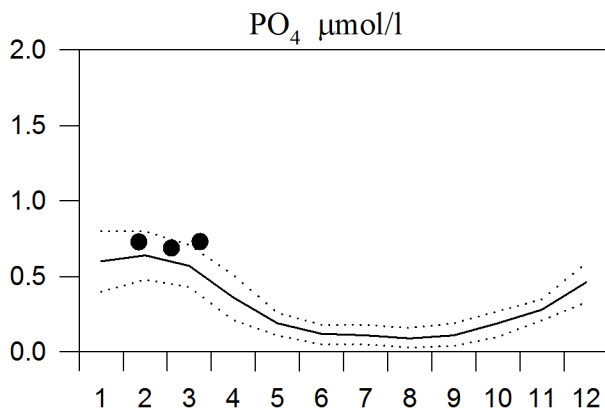
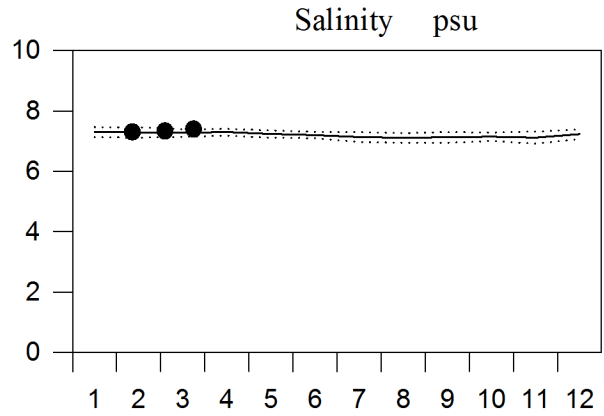
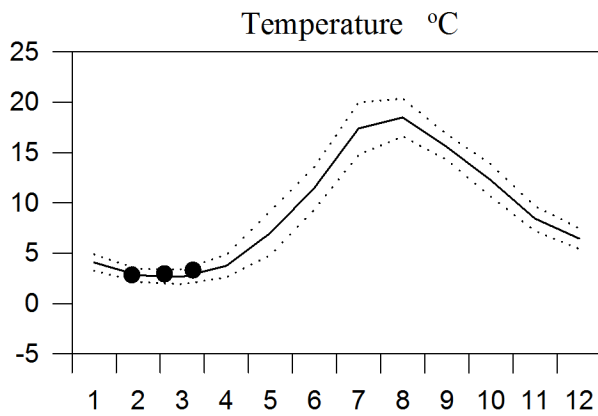
OXYGEN IN BOTTOM WATER (depth >80m)



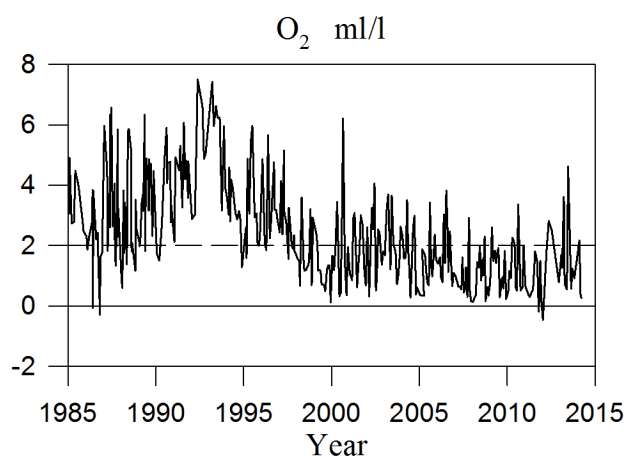
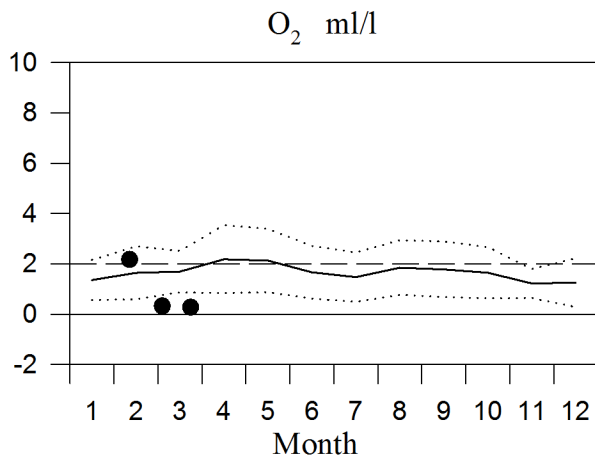
STATION BCS III-10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



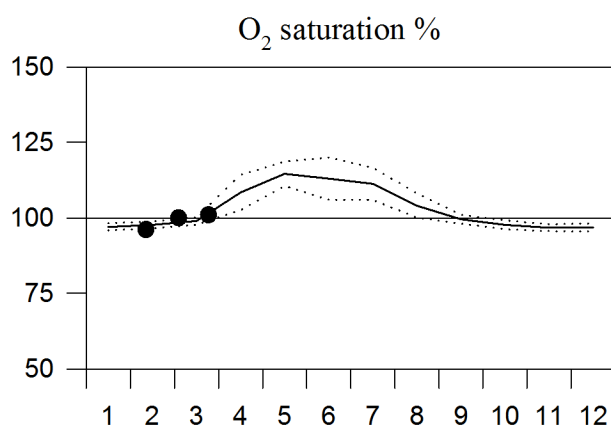
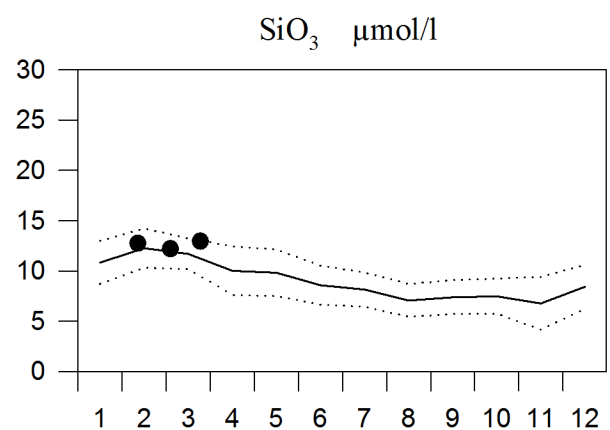
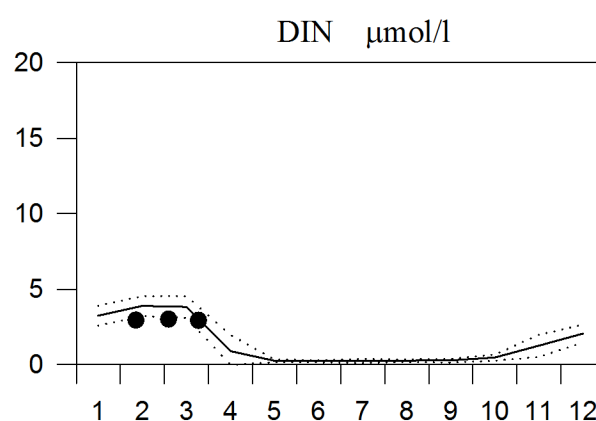
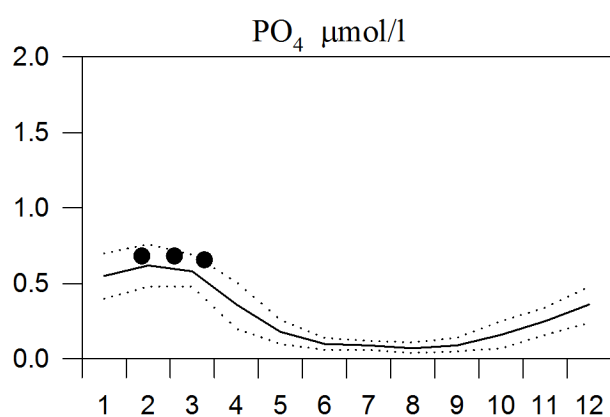
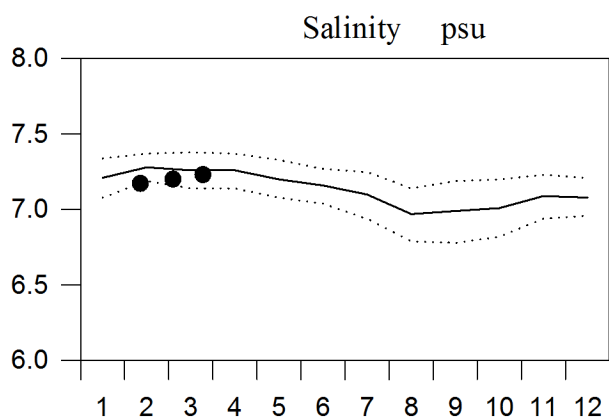
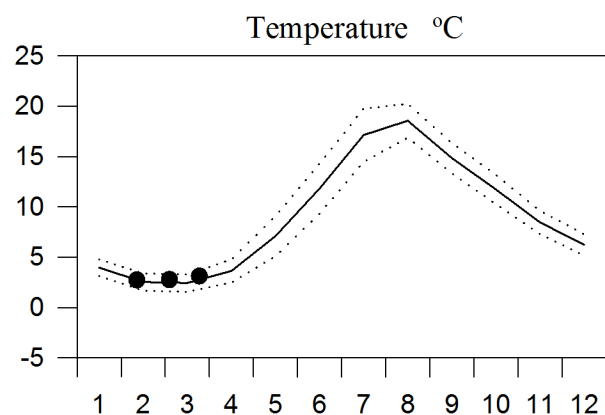
OXYGEN IN BOTTOM WATER (depth > 80m)



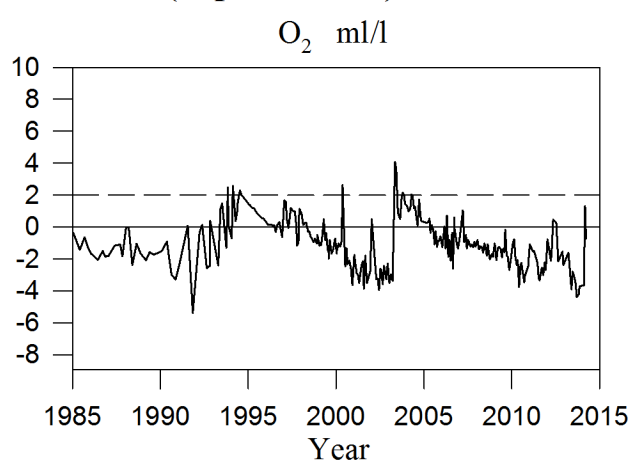
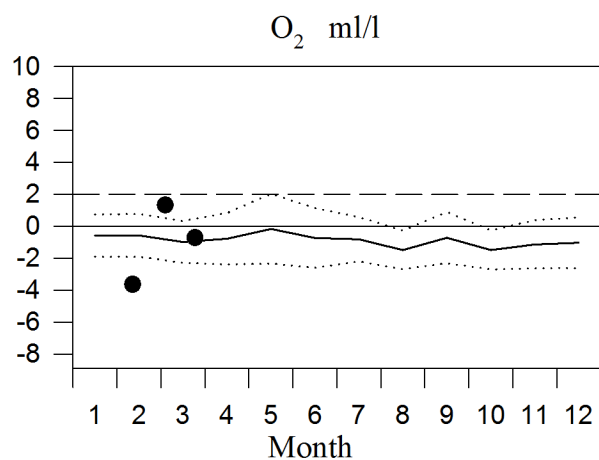
STATION BY10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



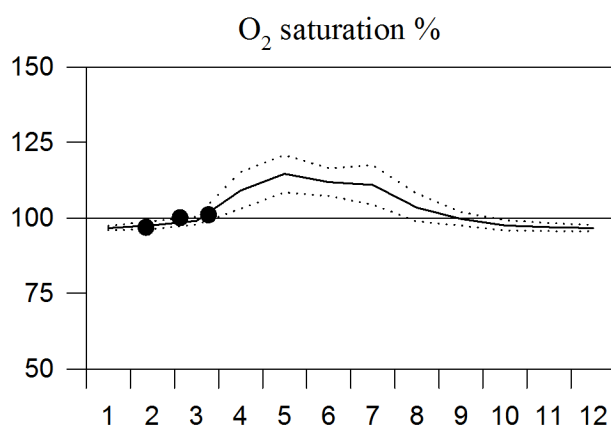
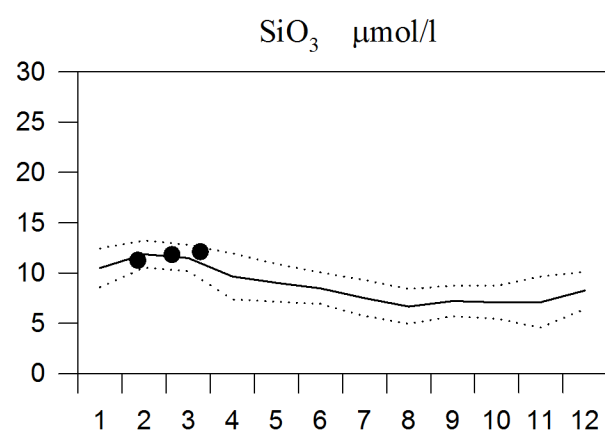
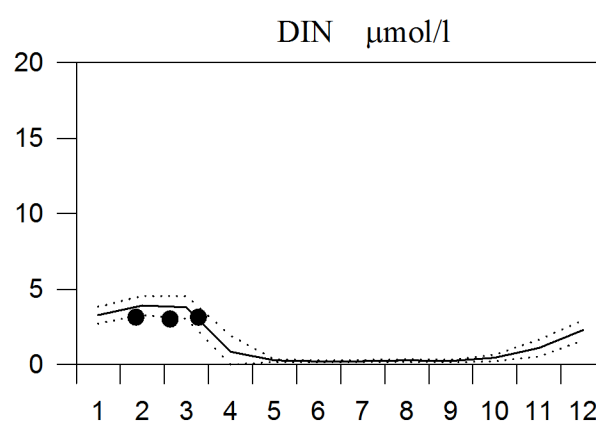
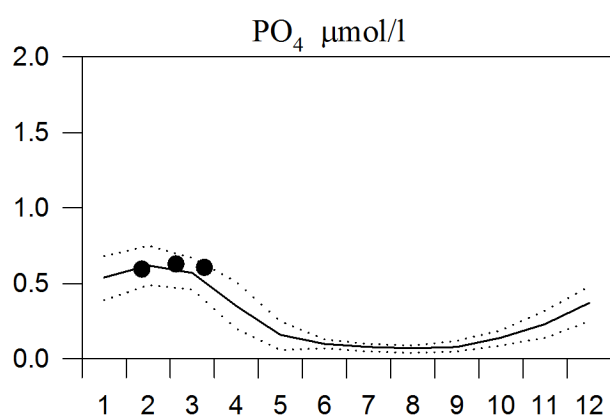
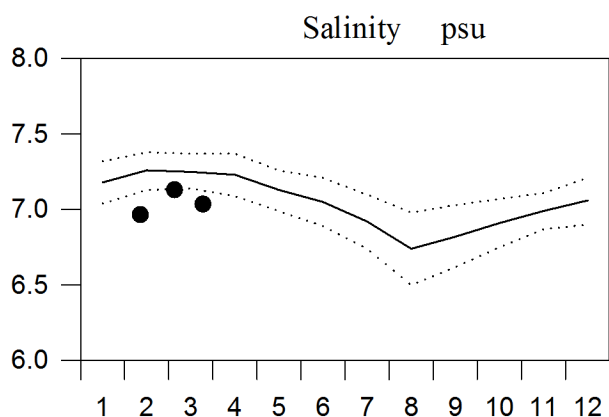
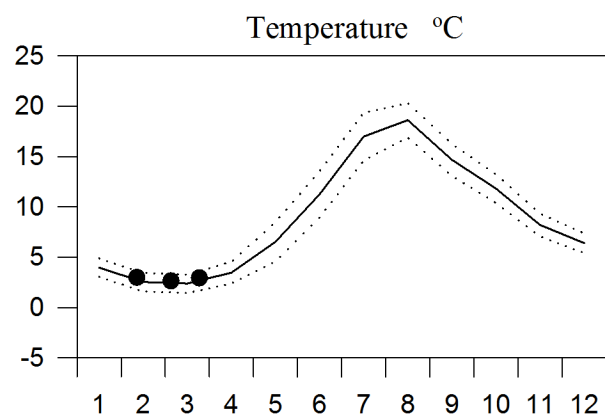
OXYGEN IN BOTTOM WATER (depth >125m)



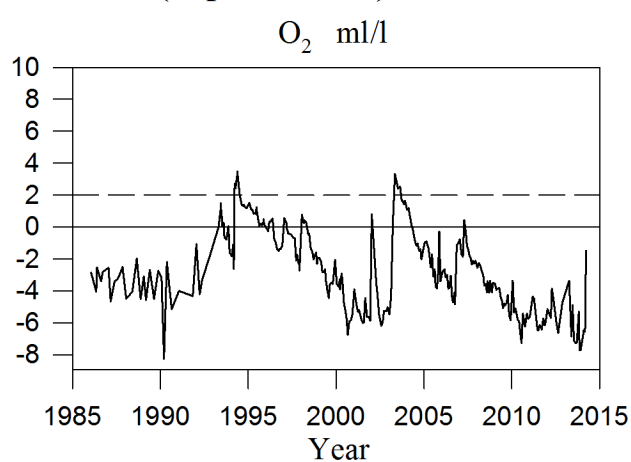
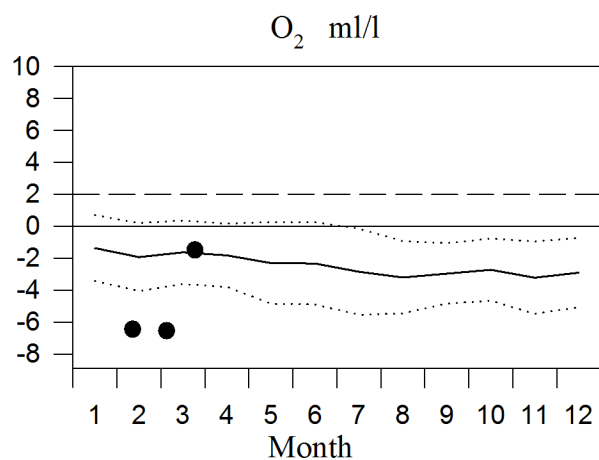
STATION BY15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



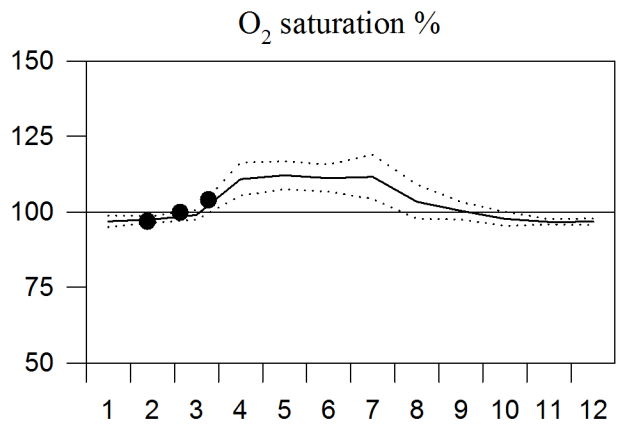
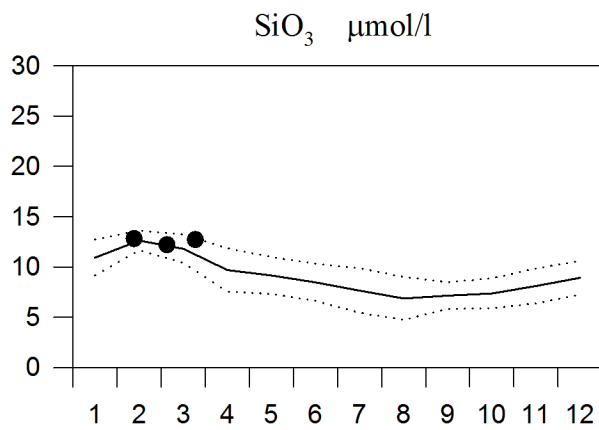
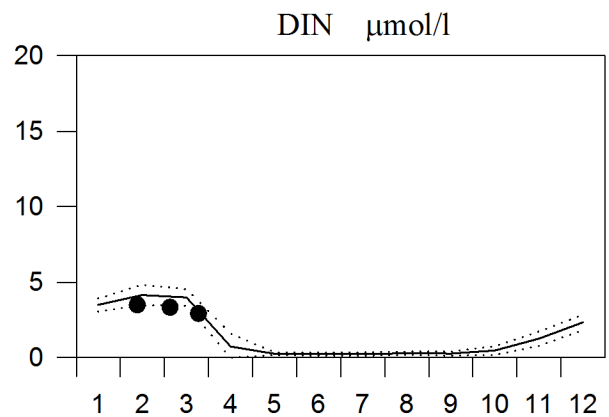
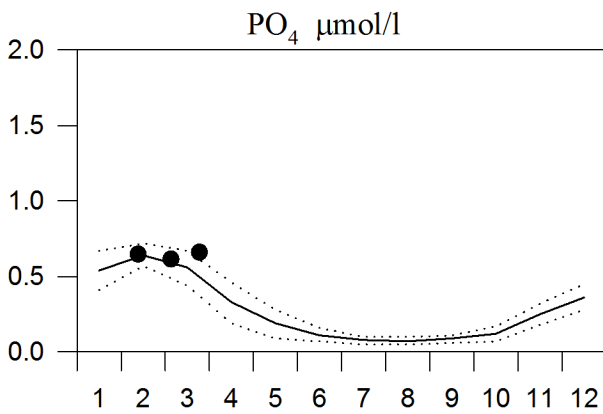
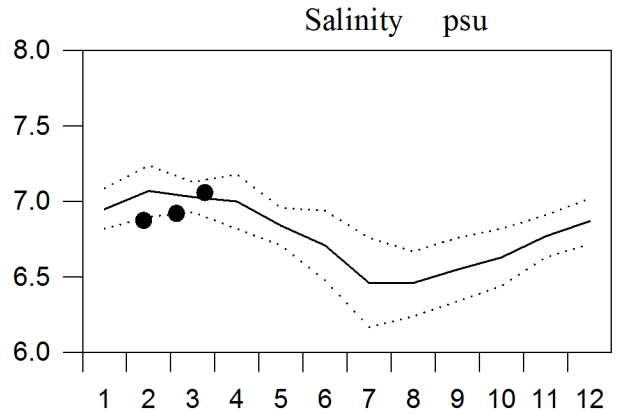
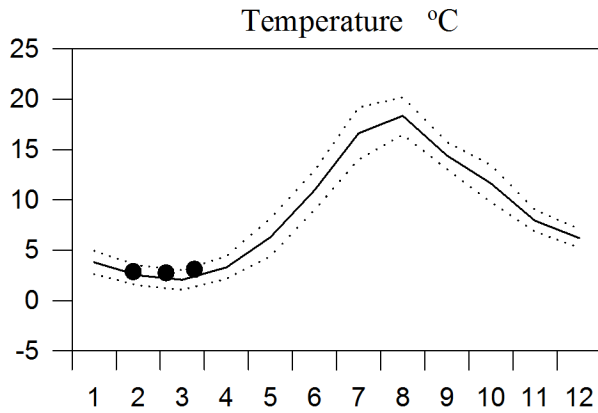
OXYGEN IN BOTTOM WATER (depth >225m)



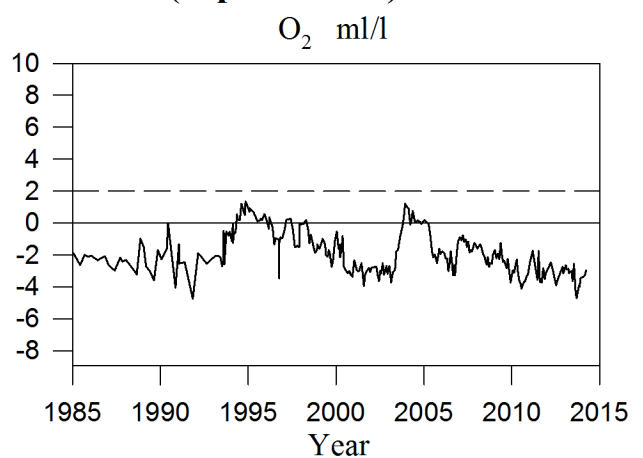
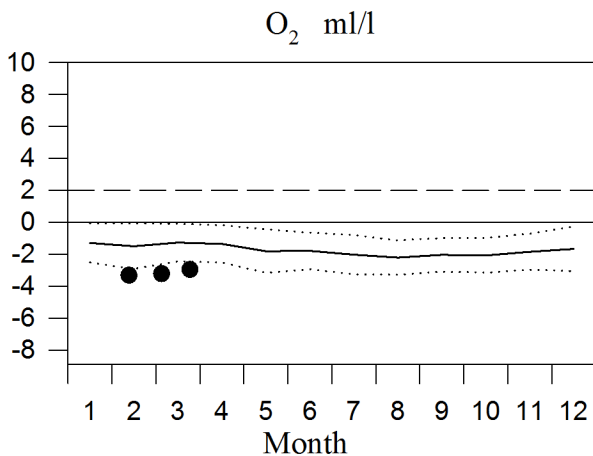
STATION BY20 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



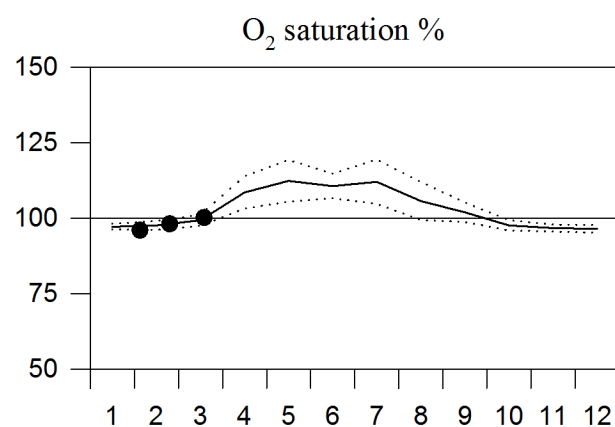
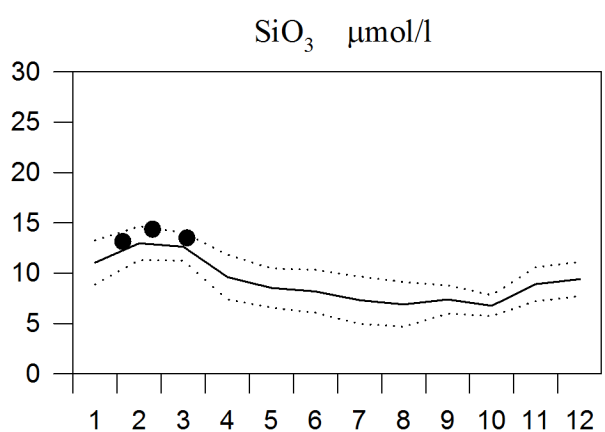
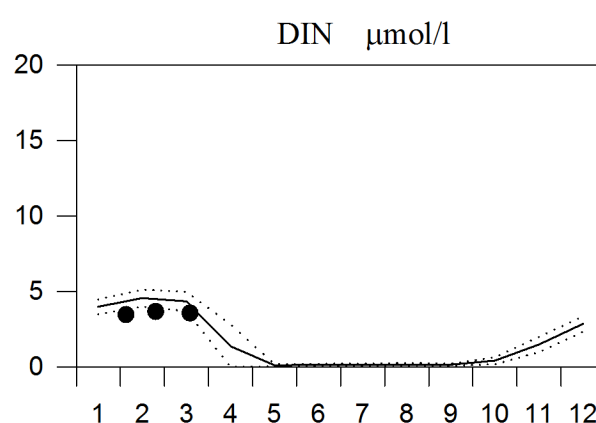
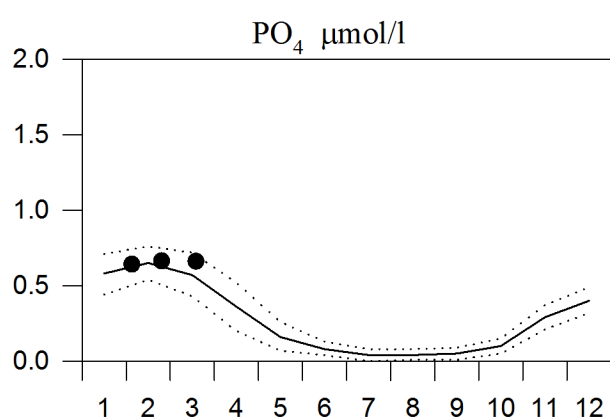
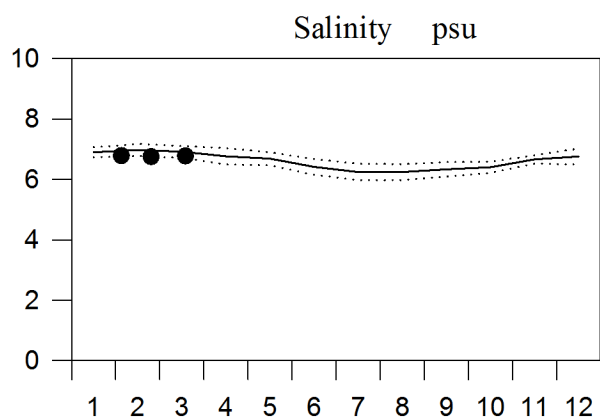
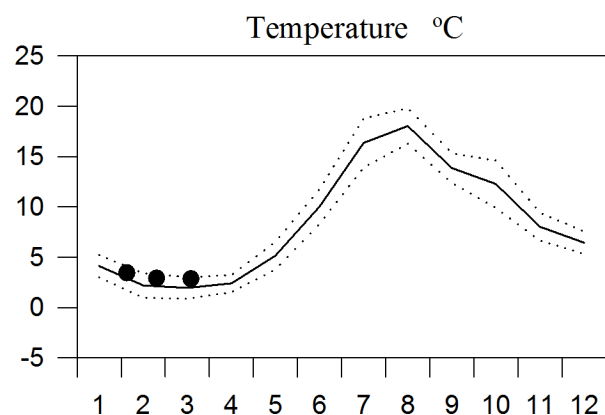
OXYGEN IN BOTTOM WATER (depth >175m)



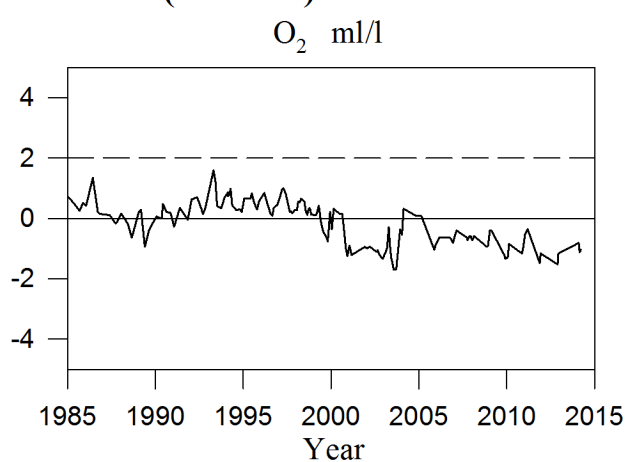
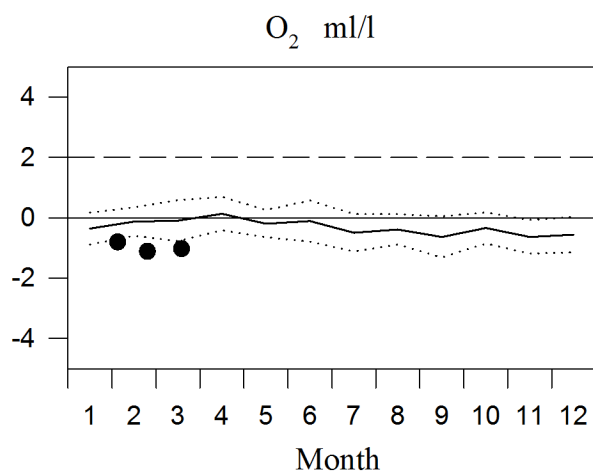
STATION BY29 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



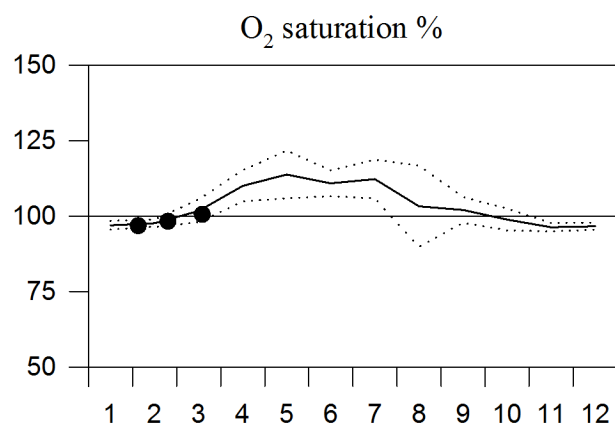
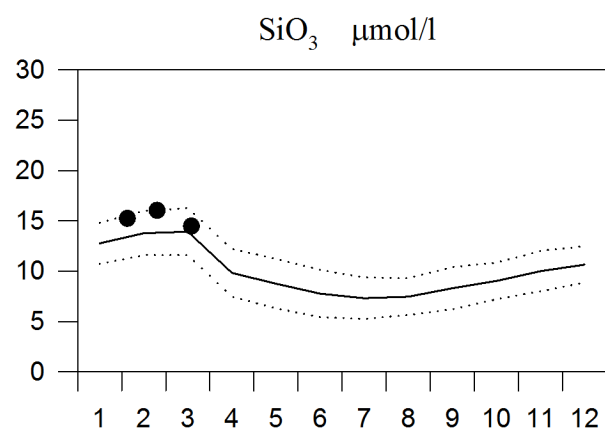
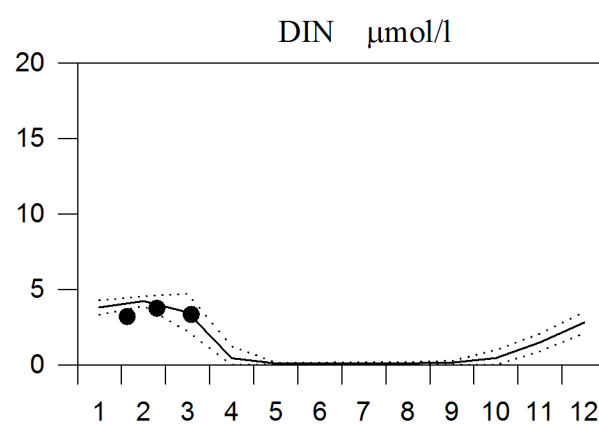
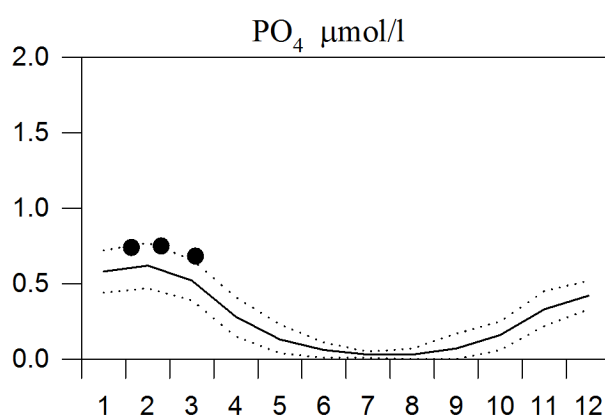
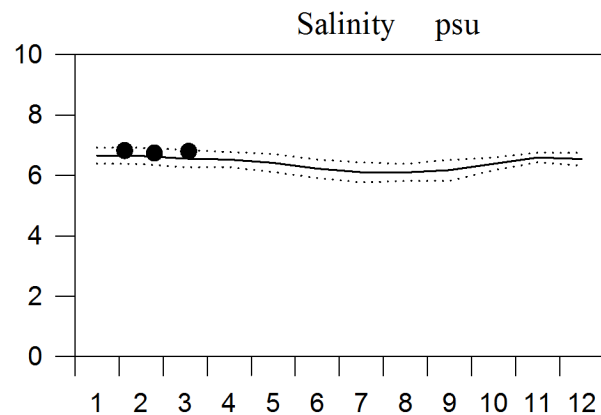
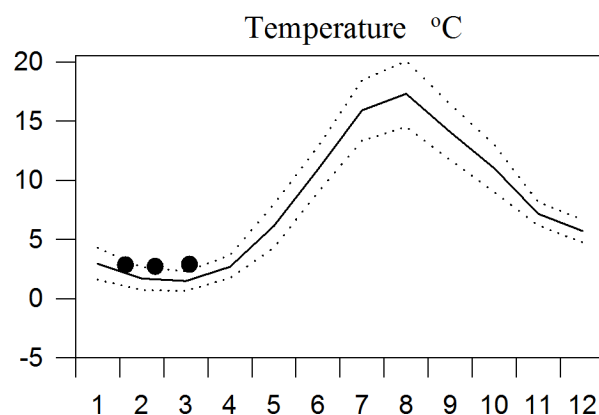
OXYGEN IN BOTTOM WATER (>=150m)



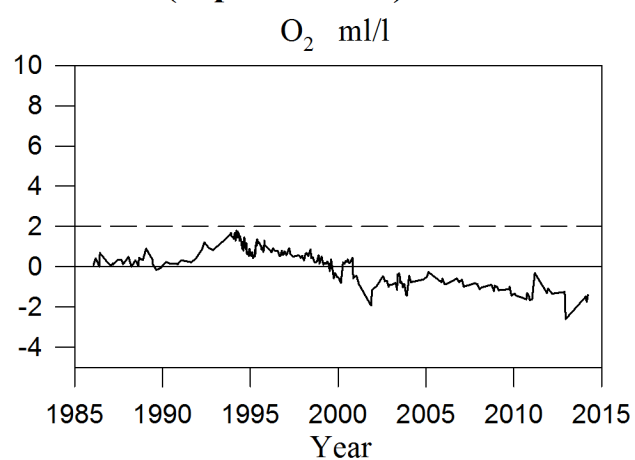
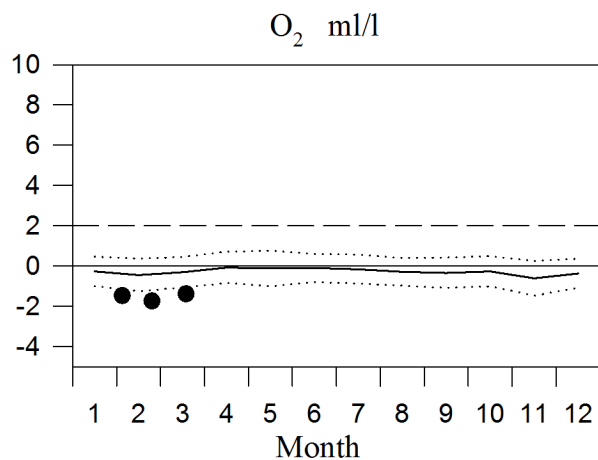
STATION BY31 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



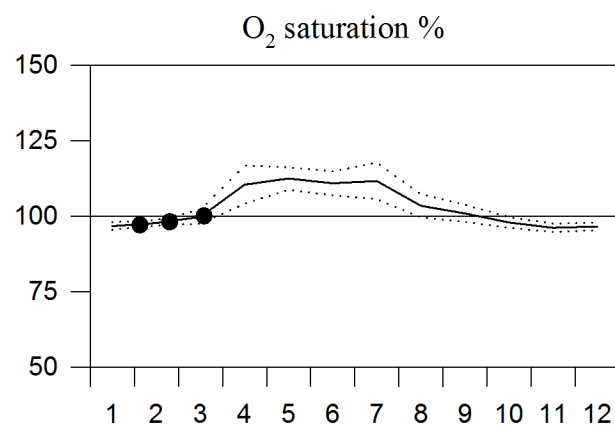
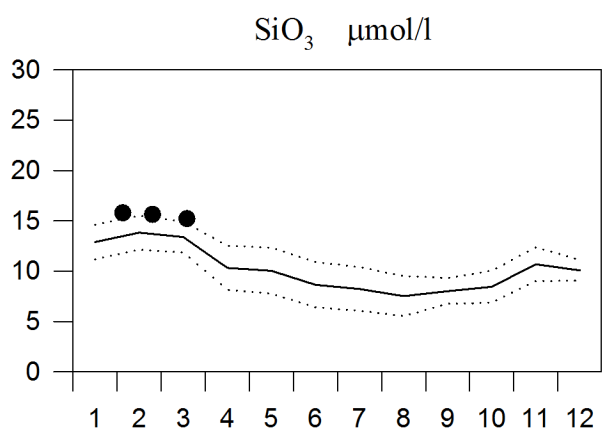
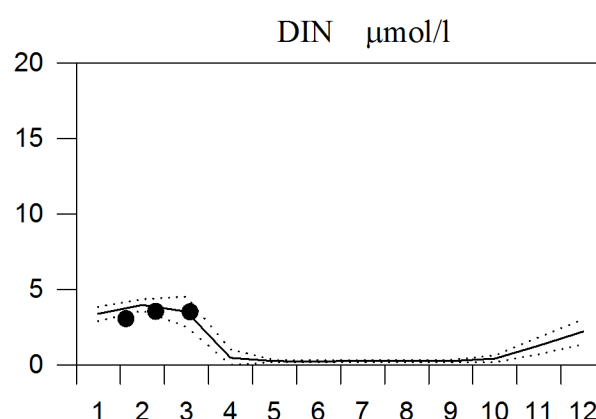
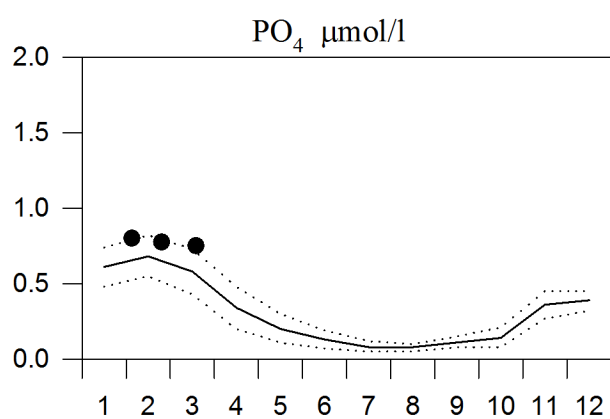
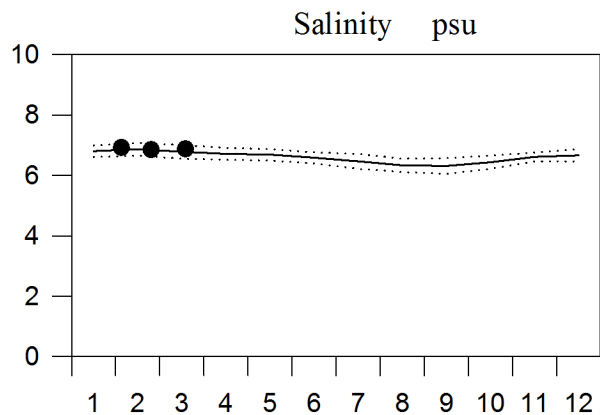
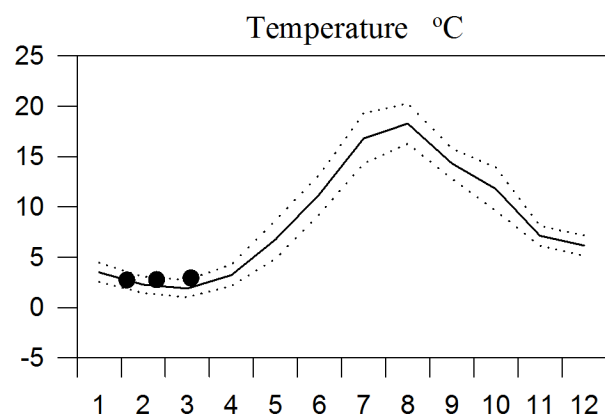
OXYGEN IN BOTTOM WATER (depth = 440m)



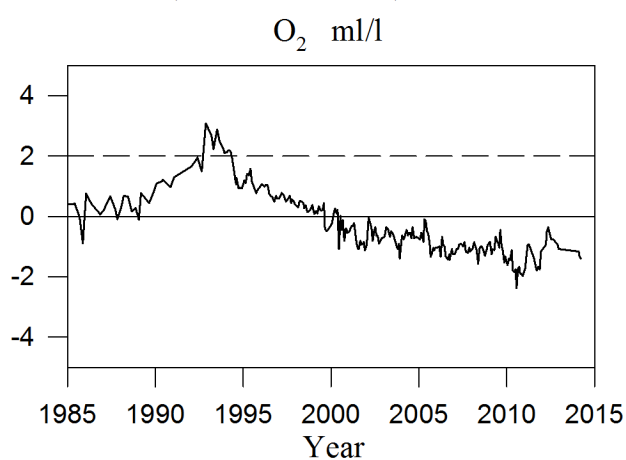
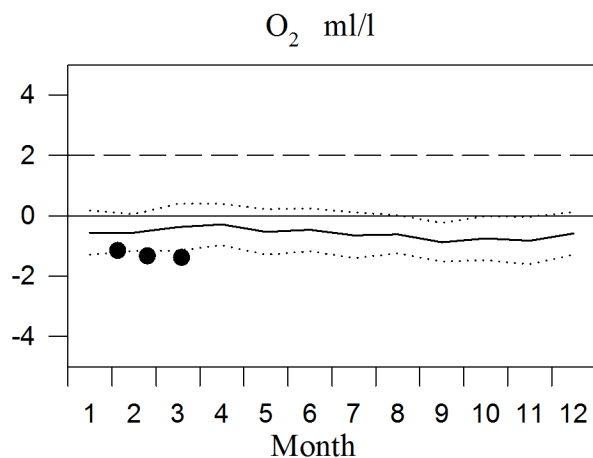
STATION BY32 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



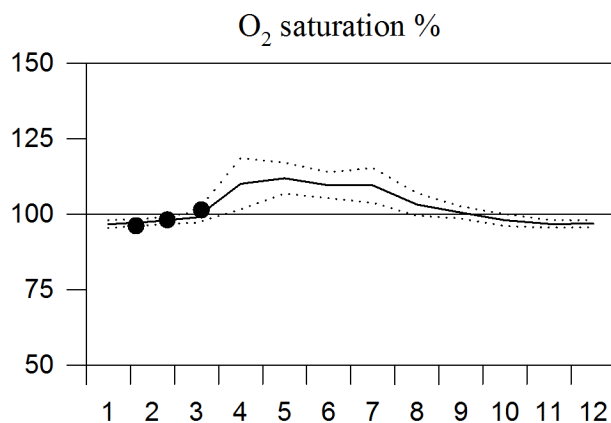
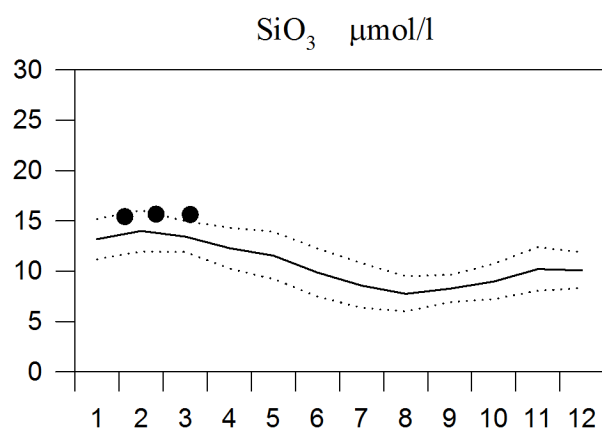
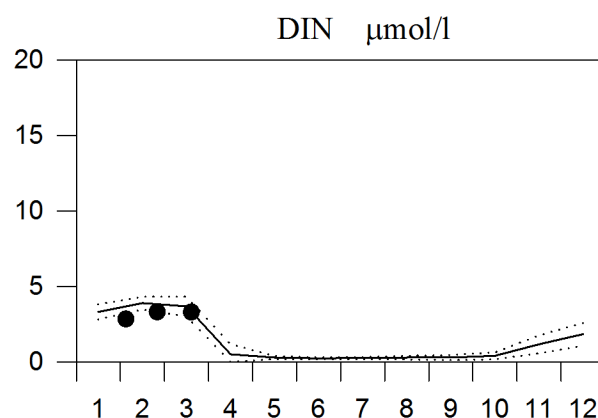
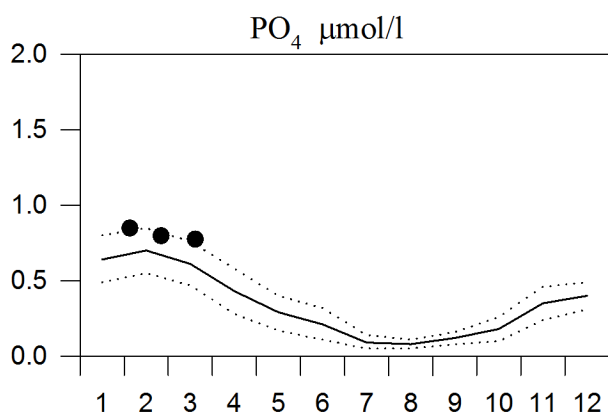
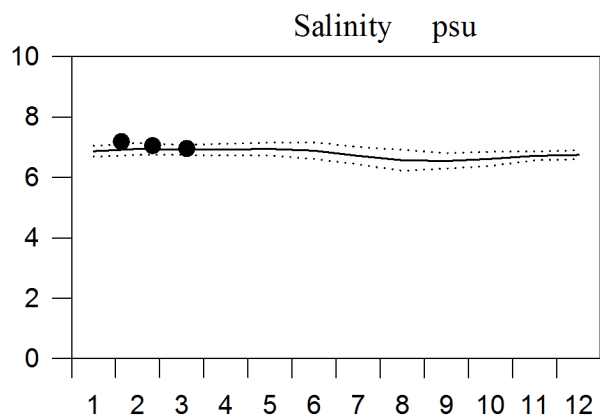
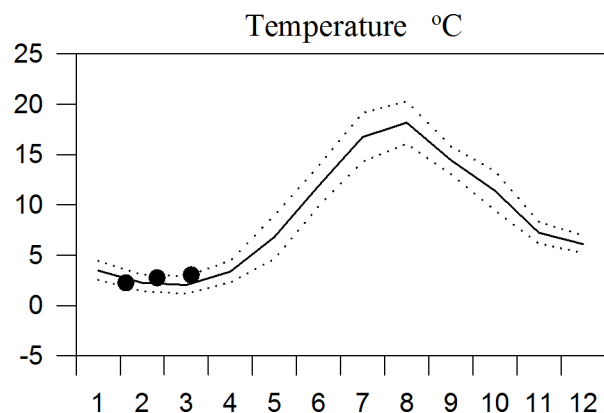
OXYGEN IN BOTTOM WATER (depth > 175m)



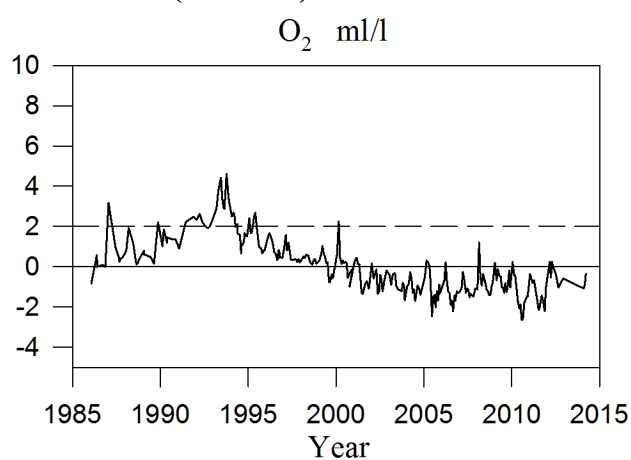
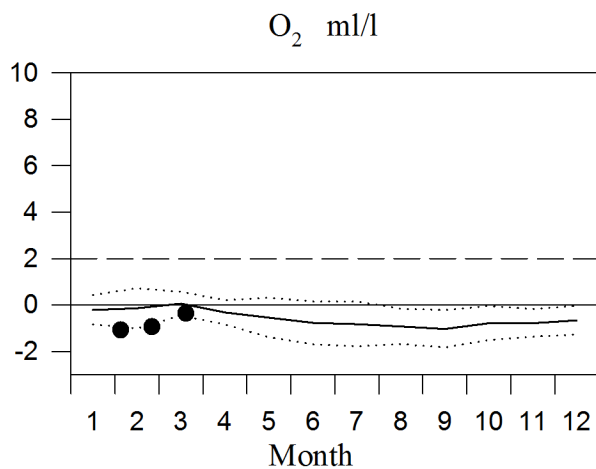
STATION BY38 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



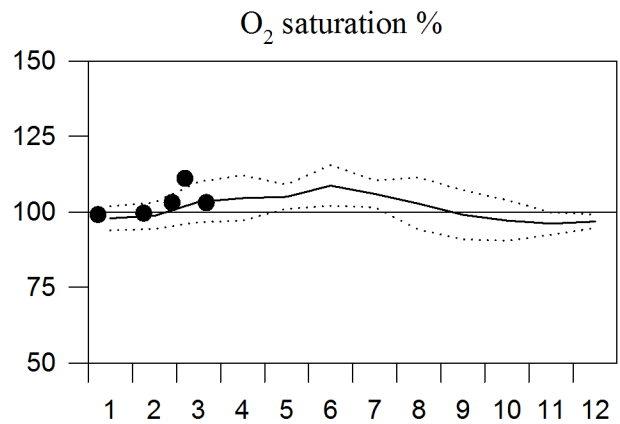
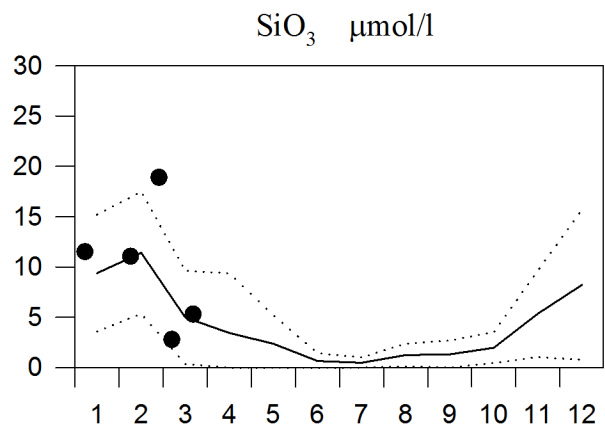
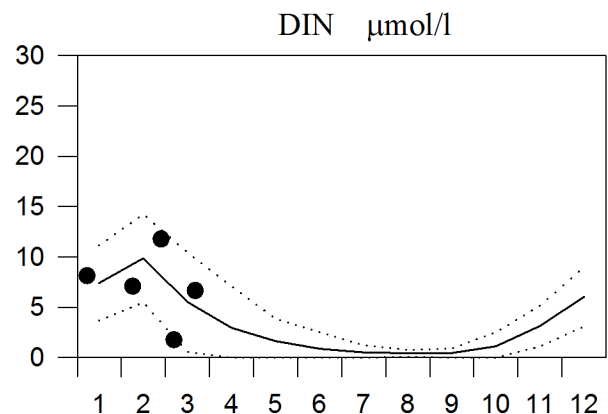
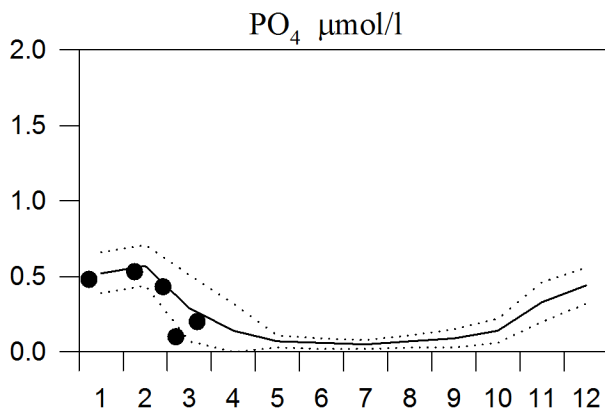
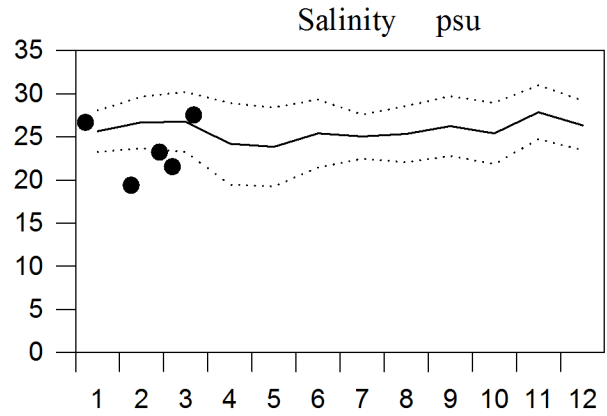
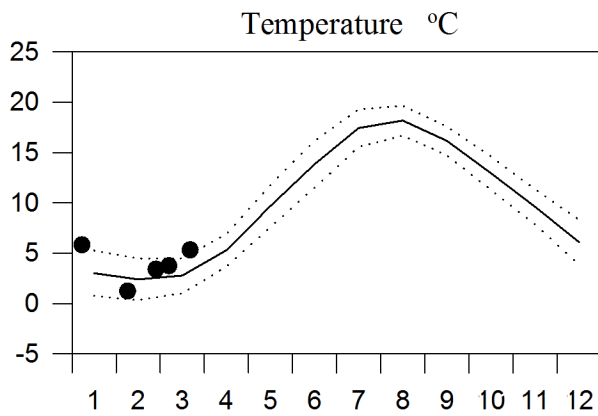
OXYGEN IN BOTTOM WATER (> 100m)



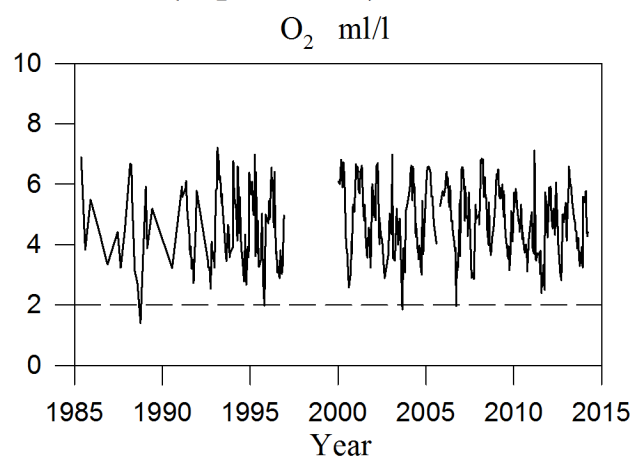
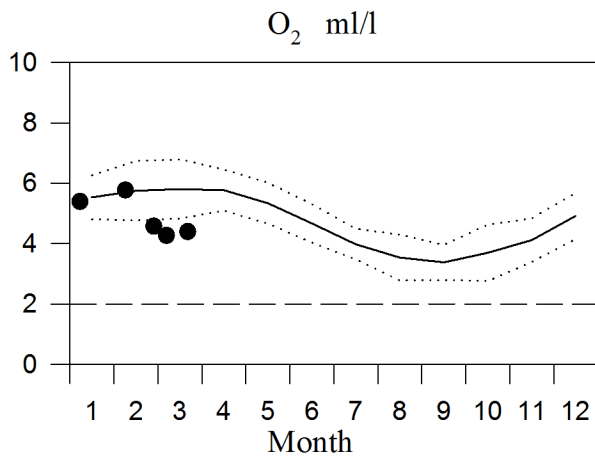
STATION SLÄGGÖ SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



OXYGEN IN BOTTOM WATER (depth >50m)



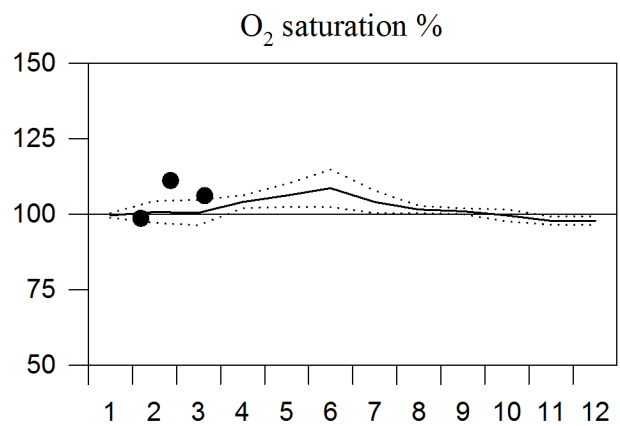
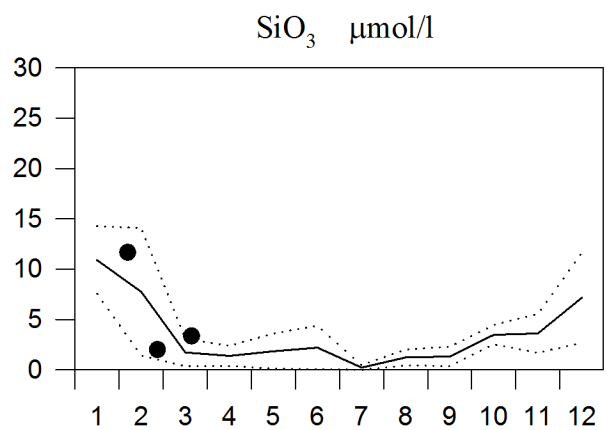
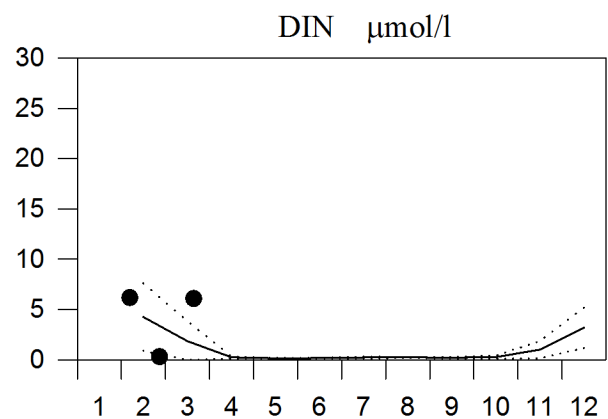
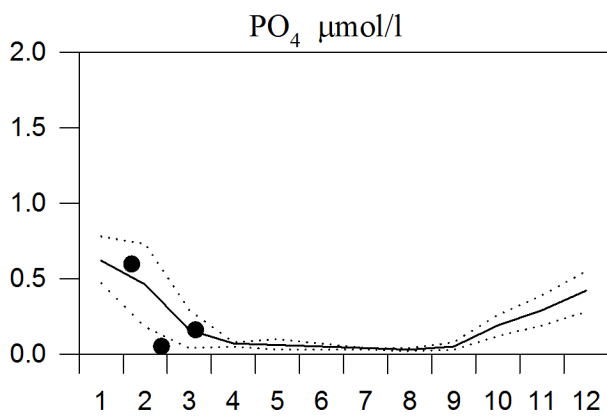
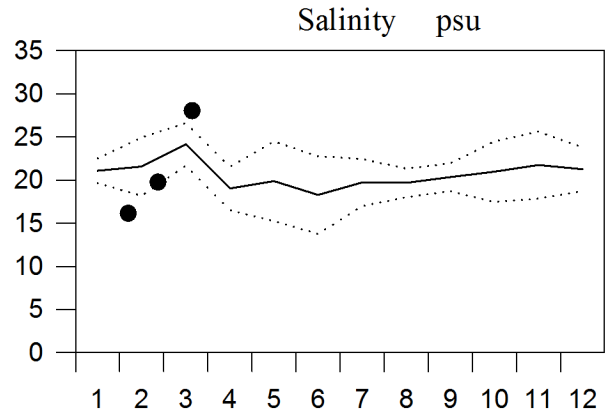
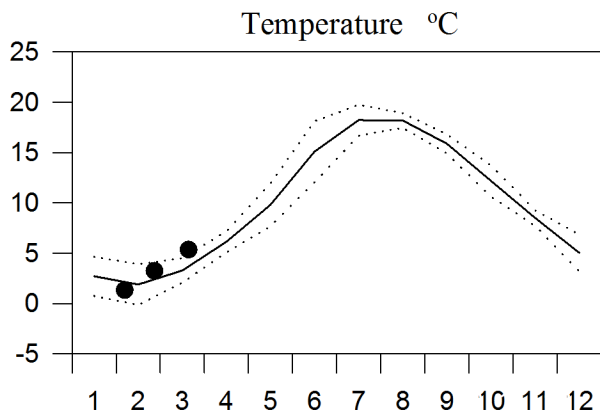
STATION N14 Falkenberg SURFACE WATER

Annual Cycles

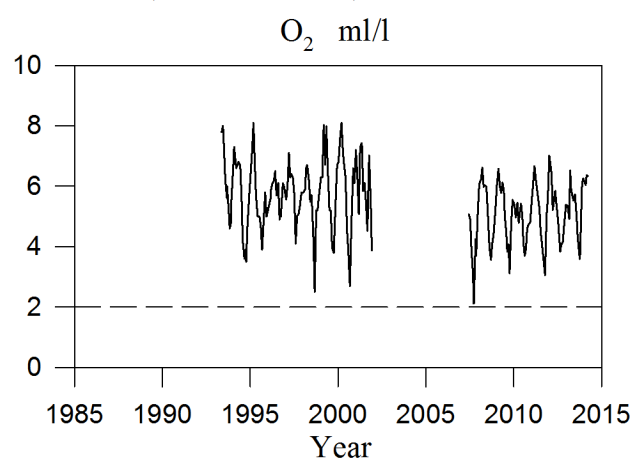
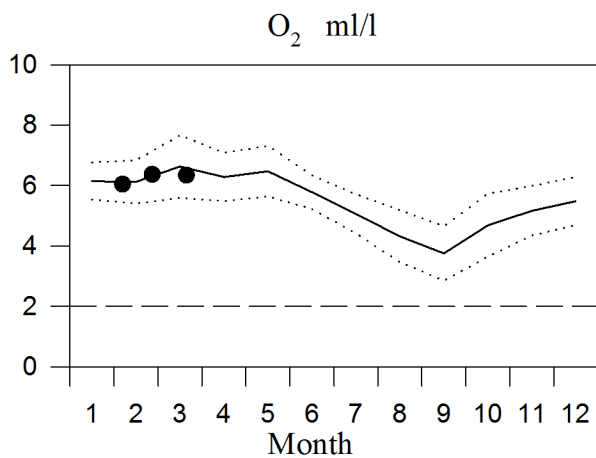
— Mean 2007-2010

..... St.Dev.

● 2014



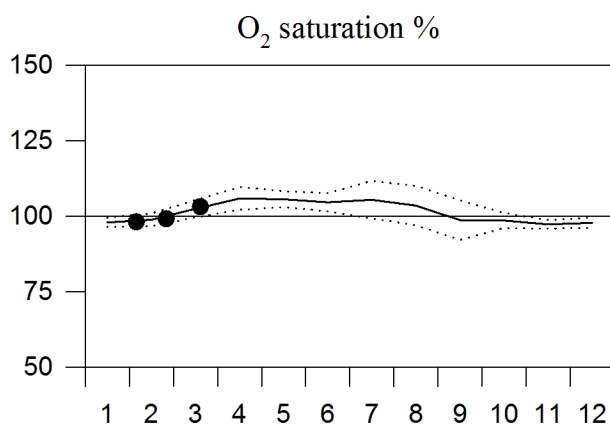
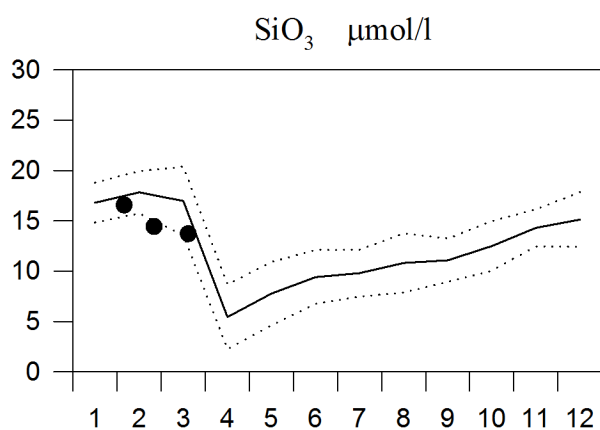
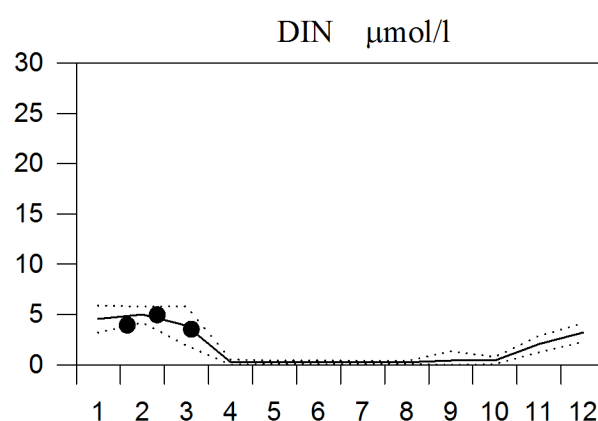
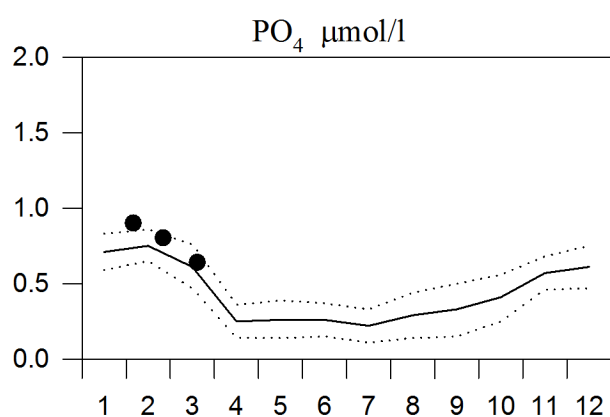
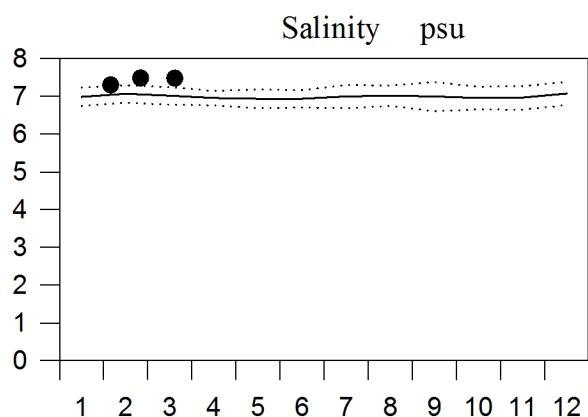
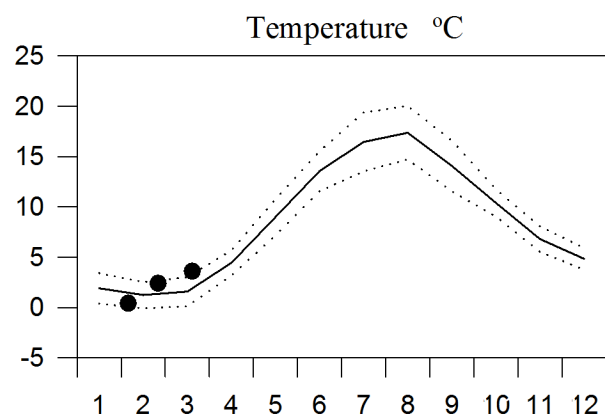
OXYGEN IN BOTTOM WATER (depth > 25m)



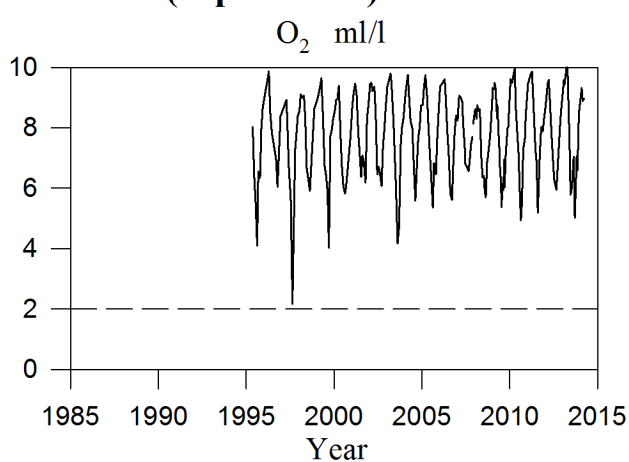
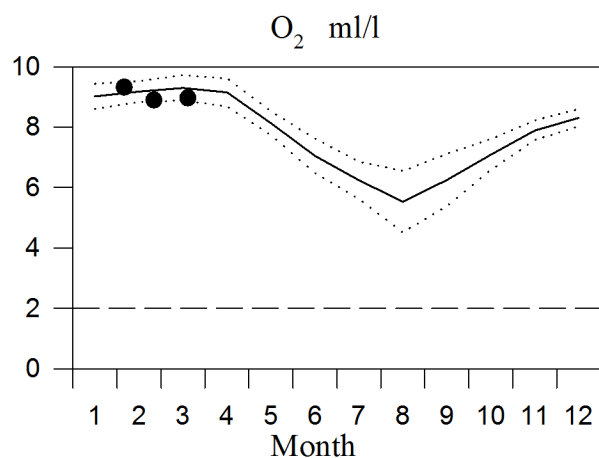
STATION REF M1V1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

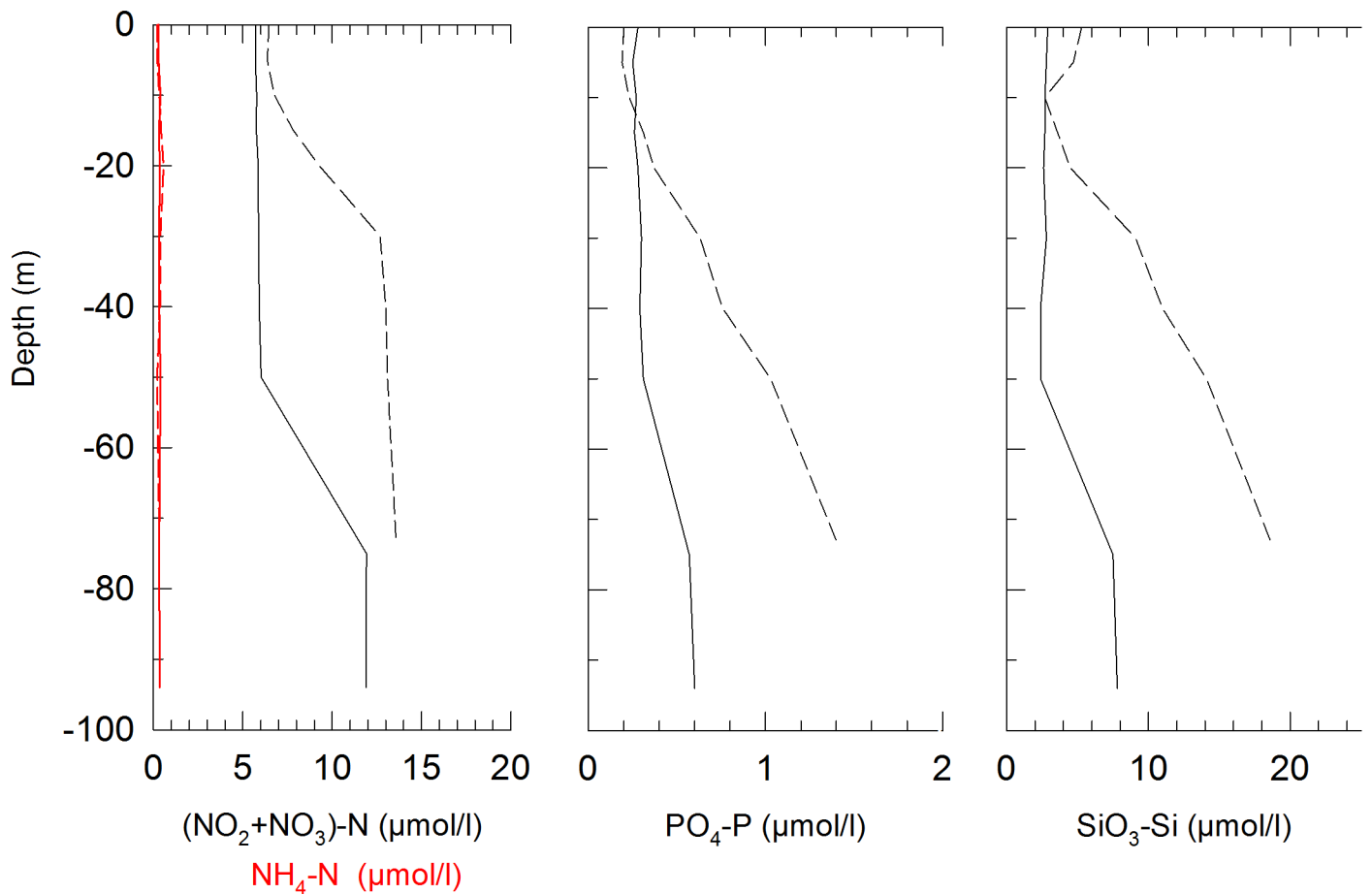
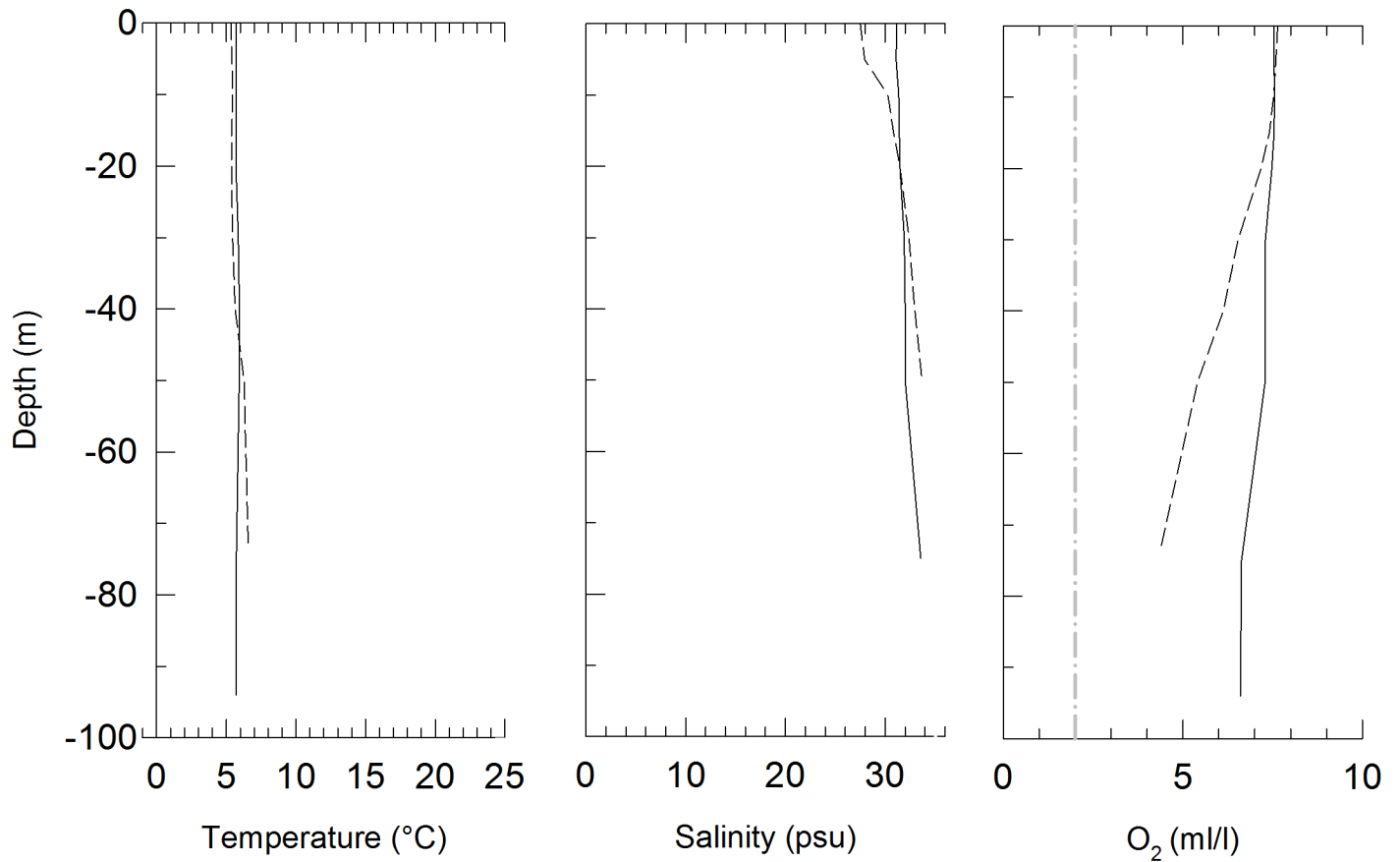


OXYGEN IN BOTTOM WATER (depth >15m)



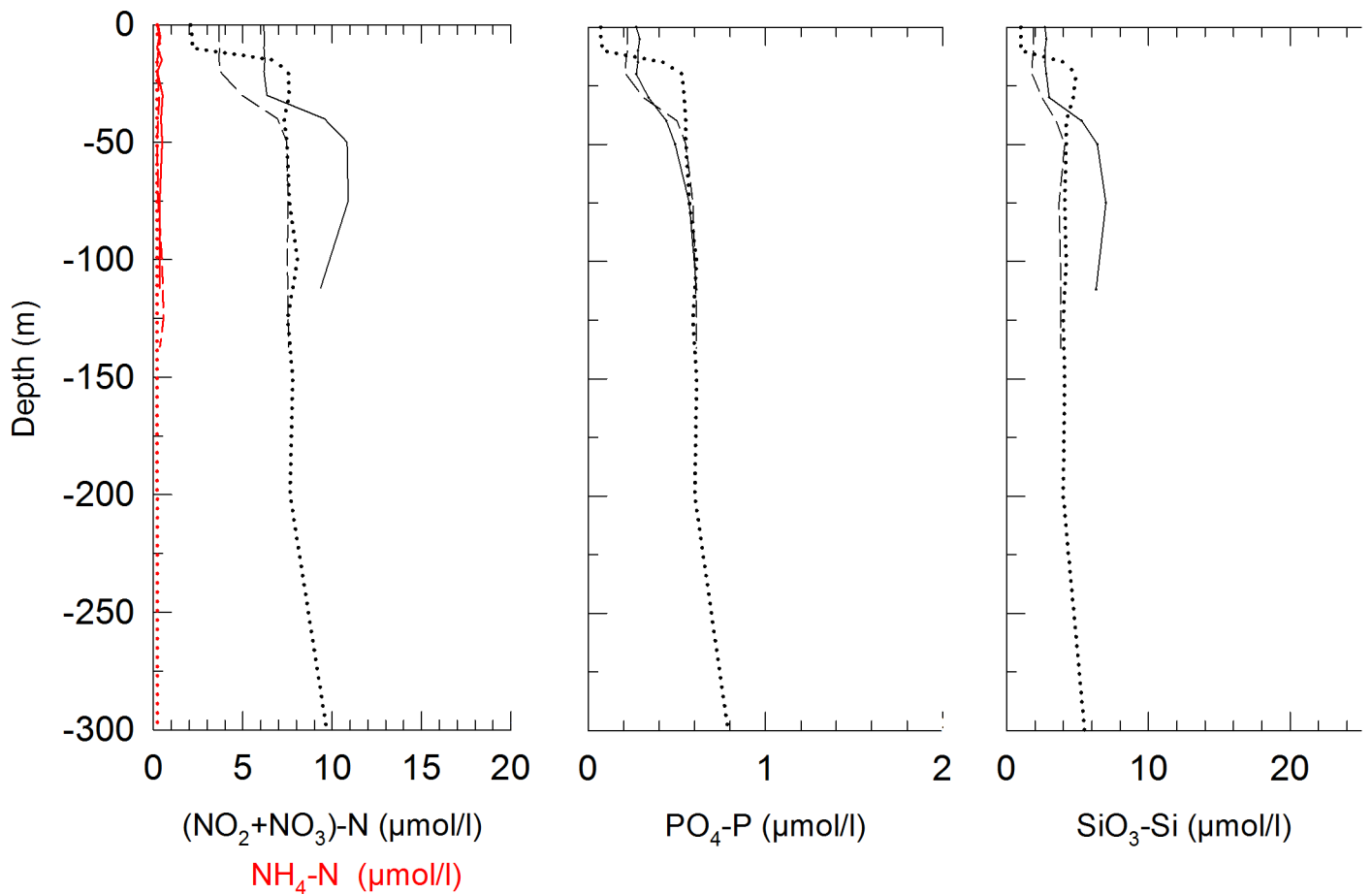
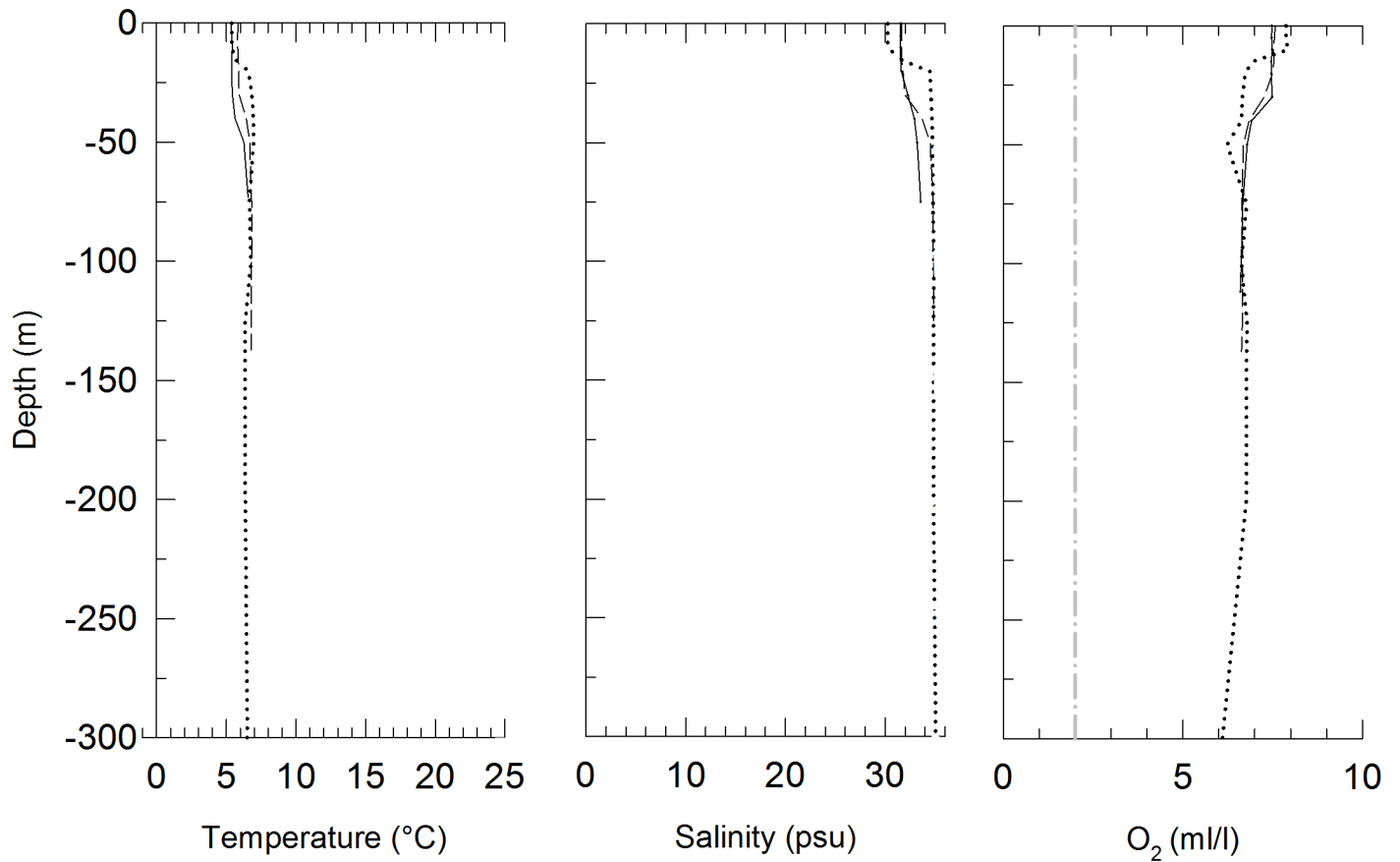
SKAGERRAK Coast 2014-03-21

—— P2 - - - - Släggö

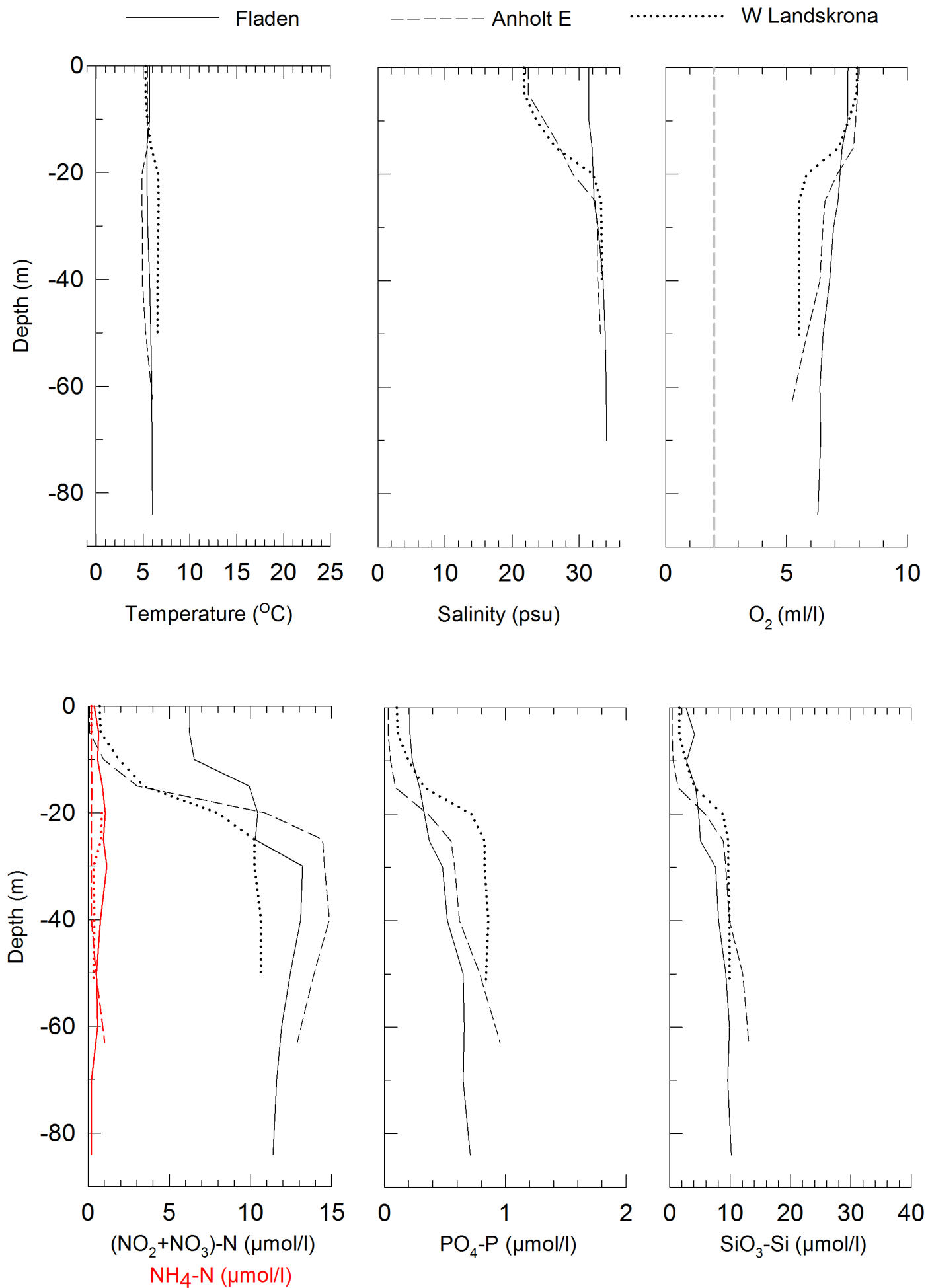


SKAGERRAK Å-Section 2014-03-21

—— Å13 - - - - - Å15 Å17

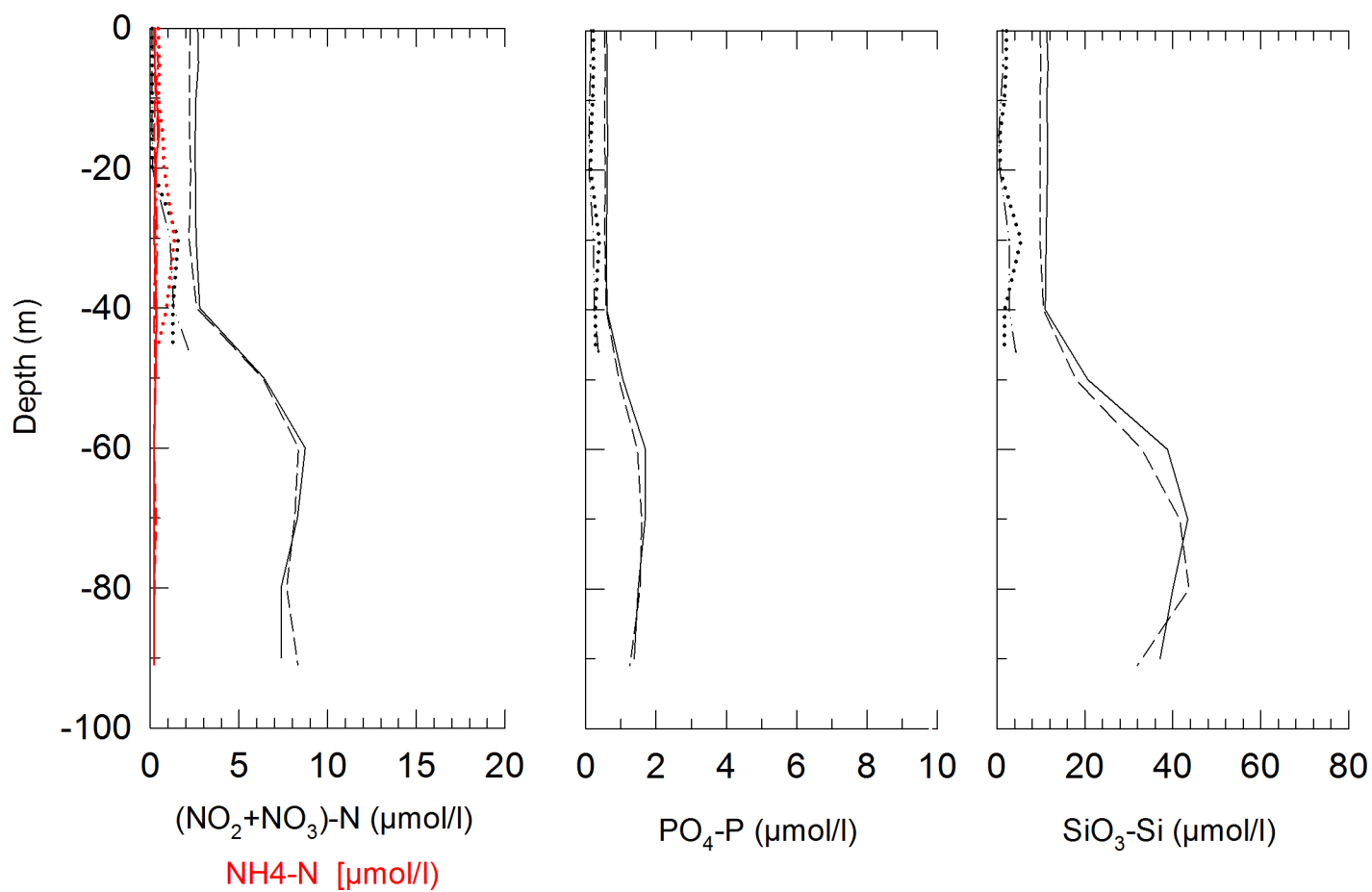
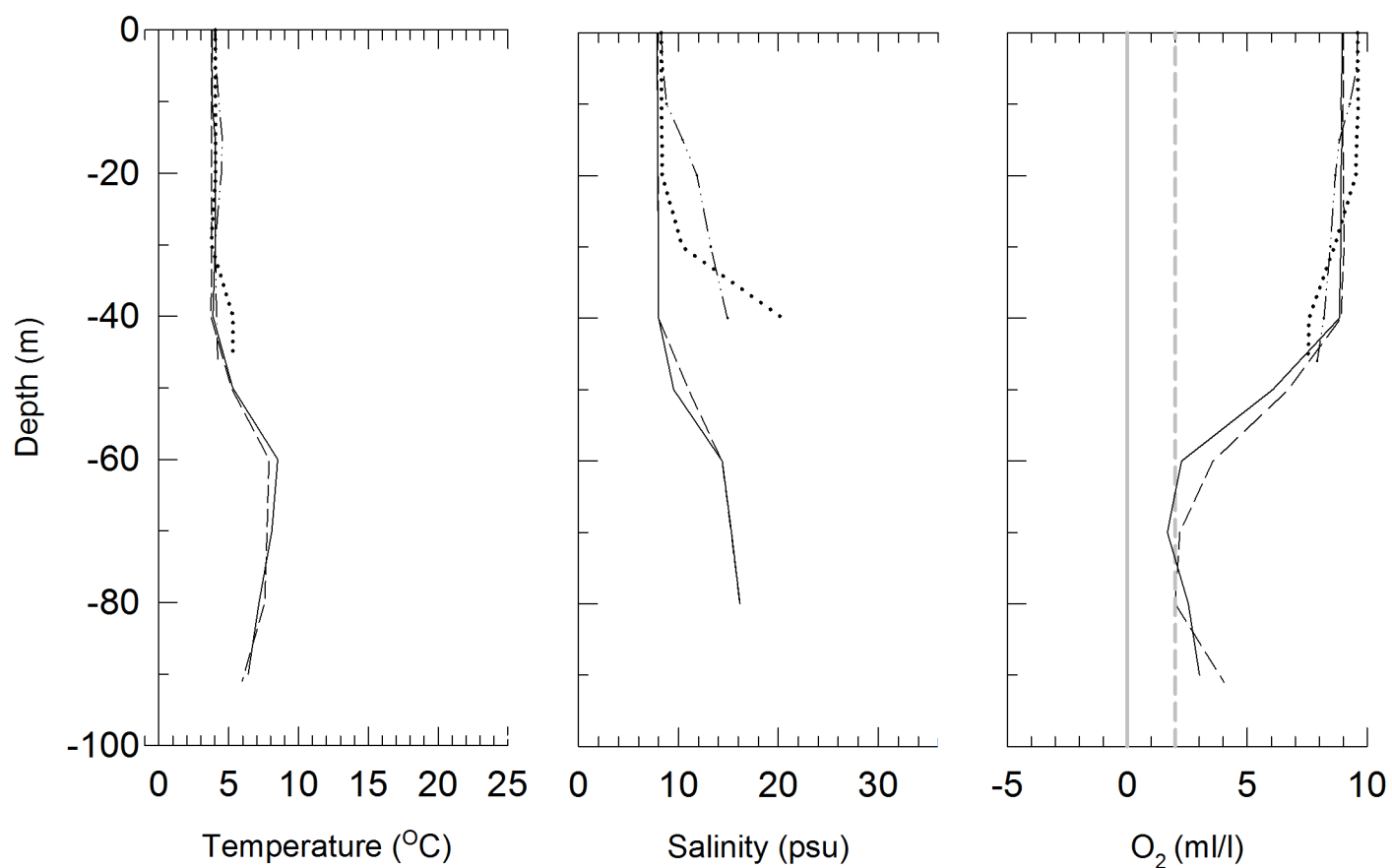


KATTEGAT and THE SOUND 2014-03-20/22



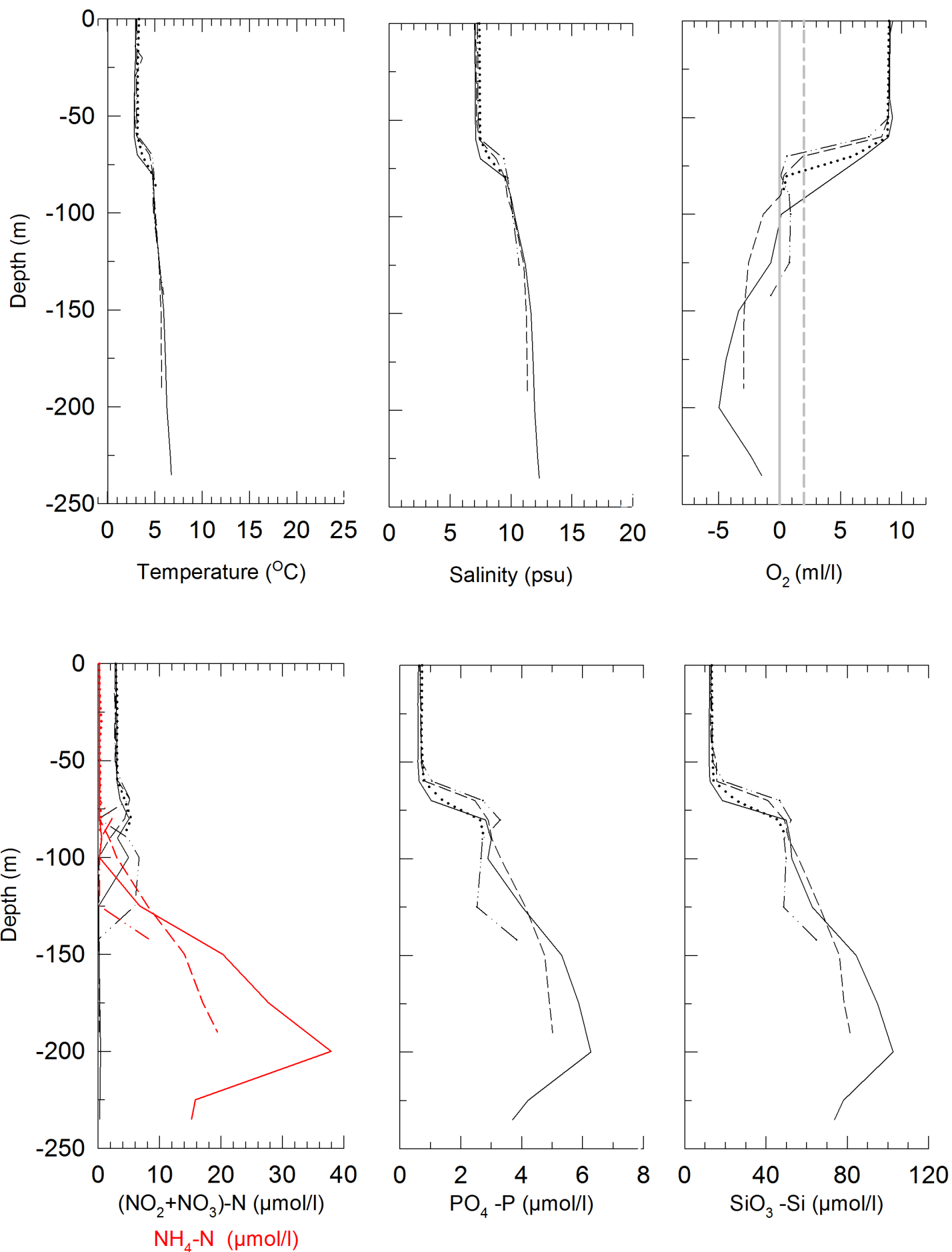
SOUTHERN BALTIC 2014-03-22/23

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



EASTERN BALTIC 2014-03-23/24

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



WESTERN BALTIC 2014-03-18/19

———— BY32 - - - - - BY38

