

Rapport från SMHIs utsjöexpedition med R/V Aranda



Expeditionens varaktighet: 2014-07-10 - 2014-07-14
Undersökningsområde: Skagerrak, Kattegatt och egentliga Östersjön
Uppdragsgivare: SMHI samt Havs- och Vattenmyndigheten

SAMMANFATTNING

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

Ytvattentemperaturen låg över det normala i de flesta av de besökta områdena, med undantag för västra delen av egentliga Östersjön där temperaturen var lägre än normalt. Närsalterna i ytvattnet uppvisade, för årstiden normala värden vid de flesta besökta provtagningsstationerna.

Syreförhållandena i Hanöbukten och Bornholmsbassängen har försämrats och är nu under gränsen för akut syrebrist. I den sydöstra delen av egentliga Östersjön syntes spår efter ett tidigare inflöde och BY15 var syresatt vid botten vilket inte skett sedan april 2007. Helt syrefria förhållanden återfanns, i Östersjön, från 90-125 meters djup och akut syrebrist från ca 80 meters djup.

Inga ytansamlingar av cyanobakterier syntes i det undersökta området, men analysen visade stora mängder i vattnet. En utförligare algrapport återfinns på:

<http://www.smhi.se/publikationer/algrapport-nummer-5-2014-1.38049>

Nästa ordinarie expedition är planerad till vecka 32. 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 Falkenberg den 10:e juli och avslutades i Nynäshamn den 14:e. På grund av tillstånd vid fel datum kunde inte polskt vatten besökas.

Vindarna under expeditionen var svaga till måttliga, med varierande riktning. Lufttemperaturen varierade mellan 15 och 23°C.

Skagerrak

Ytvattentemperaturerna var normala till strax över normala för årstiden, och varierade mellan 15,8 och 20,8°C. Salthalten i ytlagret varierade mellan 21,4 och 31,0 psu, vilket är normalt till lägre än normalt. Termoklin och haloklin låg båda på mellan 10 och 30 meters djup.

Samtliga närsalter i ytlagret hade normala koncentrationer för årstiden. Fosfat varierade mellan 0,02 och 0,05 µmol/l och silikat mellan 0,3 och 0,9 µmol/l, medan nitrit + nitrat låg under detektionsgränsen, < 0,10 µmol/l.

Fluorescensmaxima låg runt 30 meters djup i området.

Kattegatt och Öresund

Även i detta område var ytvattentemperaturen över det normala, runt 19°C. Ytsalthalten var normal till under normal och varierade mellan 12,8 och 19,9 psu i Kattegatt, medan den i Öresund låg på 8,5 psu. Termoklin och haloklin sammanföll och låg på 10 till 15 meters djup i hela området.

Halterna av näringsämnen i ytvattnet låg inom det normala för årstiden, utom vid Anholt E där silikathalten hade ökat till över normalt vid det andra besöket. I Kattegatt låg fosfathalterna mellan 0,03 och 0,14 µmol/l, medan den i Öresund låg på 0,26 µmol/l. Silikathalten i Kattegatt varierade mellan 1,1 och 4,1 µmol/l och låg i Öresund på 6,6 µmol/l. Halten av nitrit + nitrat låg under detektionsgränsen i hela området.

Fluorescensmaxima återfanns på 17 meter vid Fladen och W Landskrona och på 30 meters djup vid Anholt E.

Det lägsta syrevärdet i Kattegatts djupvatten återfanns vid Anholt E i södra Kattegatt, 4,3 ml/l. I Öresund uppmättes som lägst 3,6 ml/l.

Egentliga Östersjön

Ytvattentemperaturerna varierade från normala till något över normala värden i de södra och östra delarna (16,2 till 18,3°C) medan temperaturer något under det normala (ca 15°C) uppmättes i den västra delen. Salthalten låg mellan 6,6 och 8,0 psu, normal till något över normal i de flesta områden. Vid stationen BY15 och nu även BY10 i östra Gotlandsbassängen var salthalten lägre än normalt. Vid BY15 har salthalten varit lägre än normalt sedan sommaren 2013. Haloklinen återfanns på omkring 70 till 80 meters djup i norra, västra och östra Gotlandsbassängerna, medan den låg grundare i de södra delarna, på djup mellan 50 och 60 meter. En termoklin återfanns på djup mellan 15 och 30 meter.

Samtliga närsalter, i ytlagret, uppvisade i stort sett normala värden för årstiden, utom i norra och östra delarna där silikathalterna var förhöjda. Fosfathalterna låg i intervallet 0,09–0,20 µmol/l och silikathalterna mellan 7,5 och 11,2 µmol/l. Oorganiskt kväve (nitrit + nitrat) låg nära eller under detektionsgränsen i hela det undersökta området.

I Arkonabassängens bottenvatten hade syreförhållandena förbättrats något sedan förra mätningen vid stationen BY1 (1,00 ml/l) medan de vid stationen BY2 fortfarande var relativt goda (3,58 ml/l). Syrevärdena i Bornholmsbassängen och Hanöbukten hade nu sjunkit till under gränsen för akut



syrebrist (< 2 ml/l). Under februari och mars förekom inflöden genom Öresund på totalt ca 35 km³. Detta syresatta vatten observerades nu vid BY15, i form av syre vid botten, vilket inte har skett sedan april 2007. Vid stationerna BY10 och BY15 förekom svavelväte intermediärt på djup från 125 till 200 meter. Helt syrefria förhållanden återfanns generellt från 90 - 125 meters djup och akut syrebrist från ca 80 meter.

Inga ytansamlingar av cyanobakterier syntes på grund av vågor och vind, men analyser visade att det var gott om cyanobakterier i vattnet som med högsta sannolikhet kommer bilda nya ytansamlingar när vädret åter är stilla.

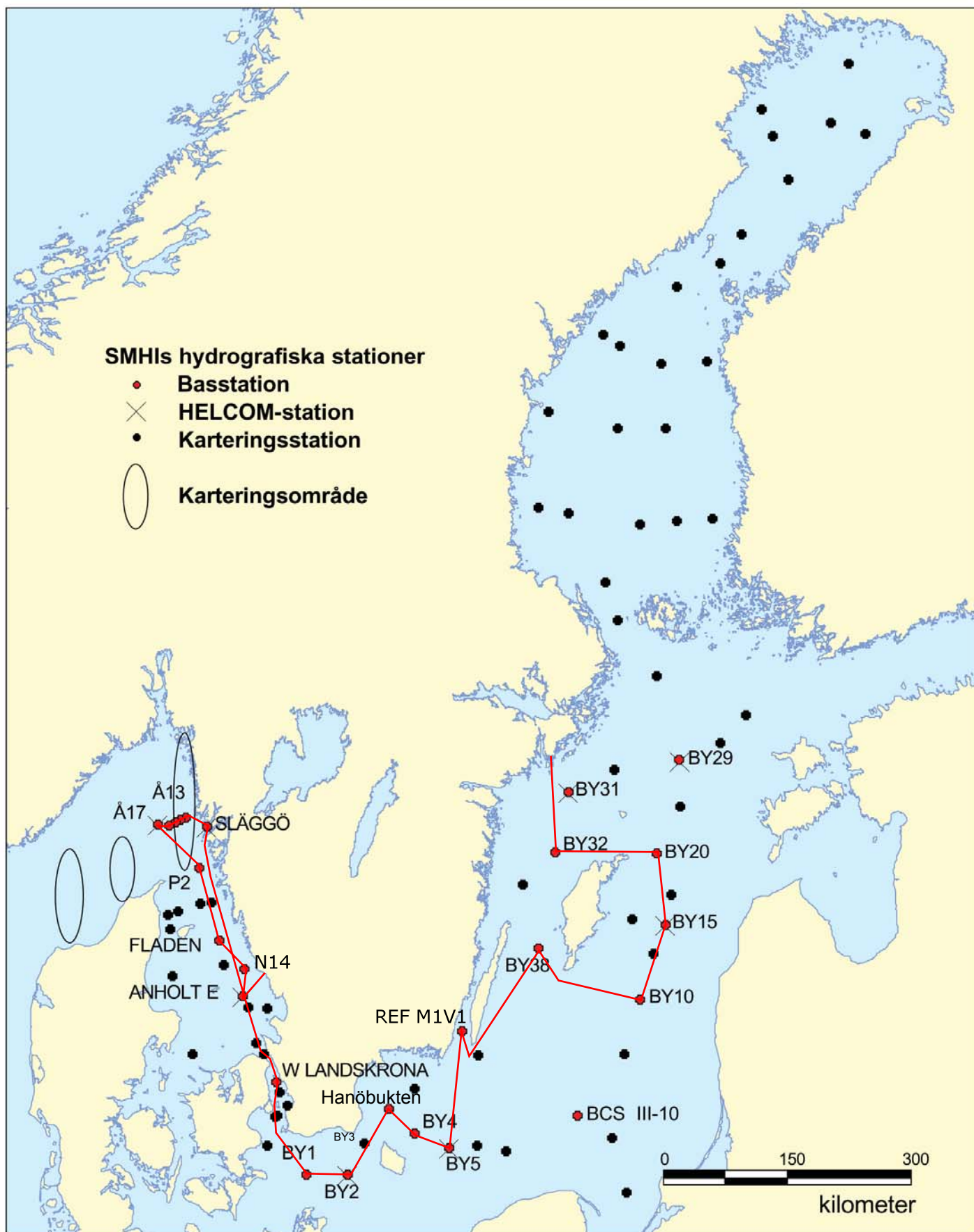
DELTAGARE

Namn		Från
Anna-Kerstin Thell	Expeditionsledare	SMHI
Kristin Andreasson		SMHI
Daniel Bergman-Sjöstrand		SMHI
Sara Johansson		SMHI
Vivi Månsson		SMHI
Ann-Turi Skjevik		SMHI
Yue Hu		KTH

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: 20140710-20140714
Series: 0450-0471



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Date: 2014-07-16
Time: 11:02
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Ser no	Stat code	P r o j	Station-----	Lat-----	Lon-----	Date yyyymmdd	Time hhmm utc	Bottom depth m	Secchi depth m	Wind di ve	Air temp C	Air pres hPa	WCSI elec t aoae hd	C PPCPZT Hrhhoo Cilyooa PrP l	No de	T e a h m l y g n	P O H P T N N N T A S H L P P T C x 2 o o o o h o l i u i O O O y S 4 t 2 3 4 t 2 3 4 P P N N N N k a 3 u n c m m
0450	KAEX29BAS		ANHOLT E	N5640.0	E1207.0	20140710	2205	62		09 6	22.4	1016	9990	x --x----	9	x x x x -	- x x x x x x x x x - - - - x
0451	KANX50BAS		N14 FALKENBERG	N5656.40	E1212.70	20140711	0020	31		07 5	21.0	1017	9990	x -xxxx--	7	x x x x -	- x x x x x x x x x - - - - x
0452	KANX25BAS		FLADEN	N5711.5	E1140	20140711	0350	85	7	10 6	20	1017	1230	x --x----	12	x x - x -	- x x x x x x x x x - - - - x
0453	SKEX23BAS	P2		N5752	E1118	20140711	0825	93	8	05 2	19.3	1019	1120	x --x----	10	x x - x -	- x x x x x x x x x - - - - -
0454	SKEX18BAS	Å17		N5816.5	E1030.8	20140711	1150	350	11	06 3	21.2	1019	1220	x --xxx--	14	x x x x -	- x x x x x x x x x - - - - x
0455	SKEX16BAS	Å15		N5817.7	E1051	20140711	1410	136	10	06 3	23.6	1018	1220	x --x----	12	x x - x -	- x x x x x x x x x - - - - x
0456	SKEX14BAS	Å13		N5820.2	E1102	20140711	1545	109		09 8	22.9	1018	1230	x --x----	10	x x - x -	- x x x x x x x x x - - - - -
0457	FIBG27BAS	SLÄGGÖ		N5815.5	E1126.0	20140711	1805	77		06 8	22.2	1017	1320	x -xxxx--	9	x x x x -	- x x x x x x x x x - - - - x
0458	KAEX29BAS		ANHOLT E	N5640.0	E1207.0	20140712	0415	64	9	10 6	16.1	1016	1230	x -xxxx--	10	x x x x -	- x x x x x x x x x - - - - x
0459	SOCX39BAS	W LANDSKRONA		N5552.0	E1245.0	20140712	1015	52	8	34 2	18.3	1011	2720	x --x----	9	x x - x -	- x x x x x x x x x - - - - x
0460	BPSA02BAS	BY1		N5500	E1318	20140712	1610	46		35 3	16.5	1011	6730	x --x----	8	x x - x -	- x x x x x x x x x - - - - x
0461	BPSA03BAS	BY2	ARKONA	N5500	E1405	20140712	1910	47		03 10	15.3	1010	6840	x --xxxx--	8	x x - x -	- x x x x x x x x x - - - - x
0462	BPSH05BAS	HANÖBKUTEN		N5537	E1452	20140713	0030	80		08 2	16.3	1005	5990	x --x----	11	x x - x -	- x x x x x x x x x - - - - x
0463	BPSB06BAS	BY4	CHRISTIANSÖ	N5523	E1520	20140713	0310	92		25 3	15.6	1004	5840	x --x----	12	x x - x -	- x x x x x x x x x - - - - x
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0470	BPEX26BAS	BY20	FÄRÖDJ	N5800	E1953	20140714	1450	196	4	20 7	16.7	1010	1330	x --x----	17	x x - x x	- x x x x x x x x x - - - - x
0471	BPWX38BAS	BY32	NORRKÖPINGSDJ	N5801	E1759	20140714	2045	201		10 7	15	1006	6990	x --x----	17	x x - x x	- x x x x x x x x x - - - - -

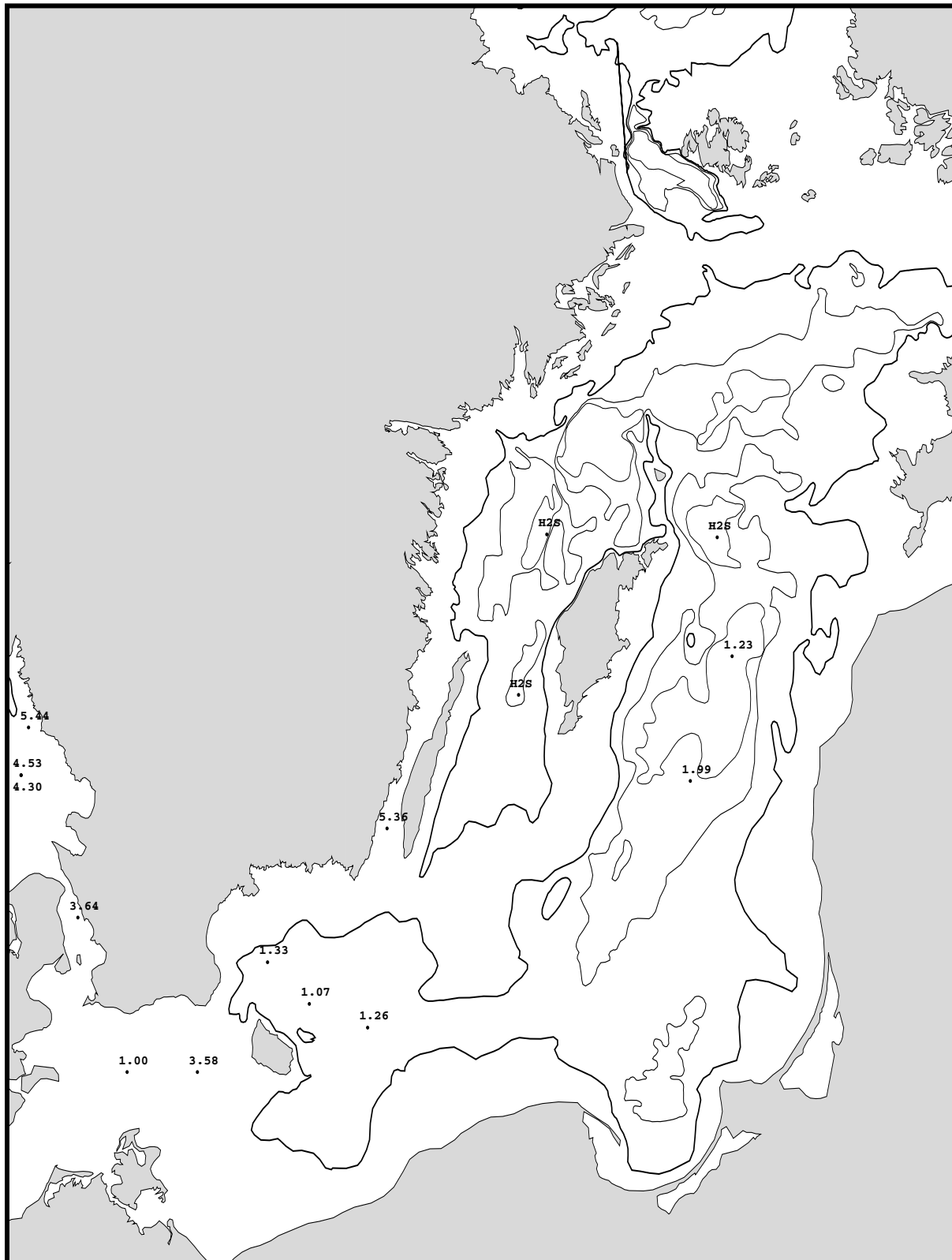
Bottom water oxygen concentration (ml/l)

Country: Finland

Ship : Aranda

Date : 20140710-20140714

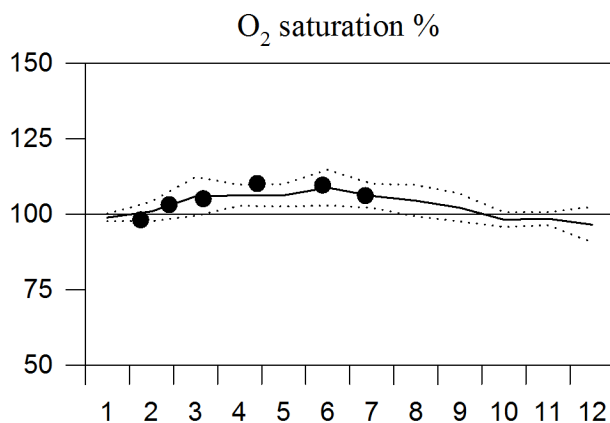
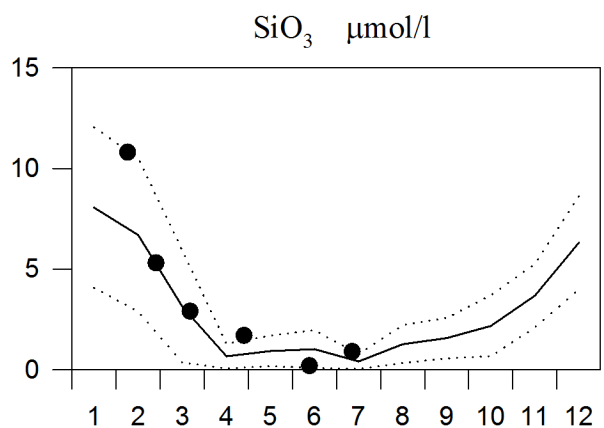
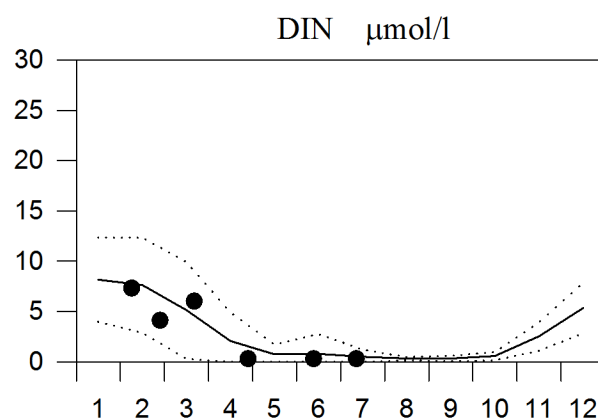
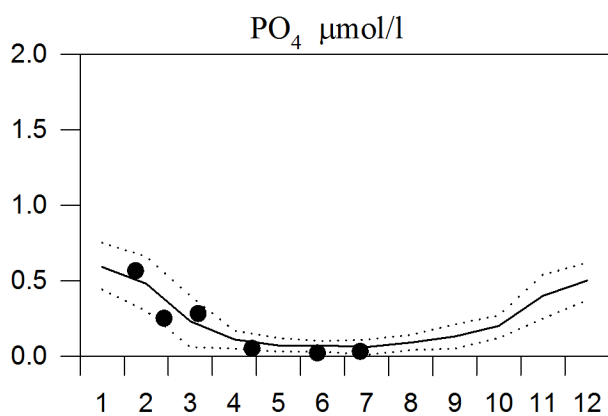
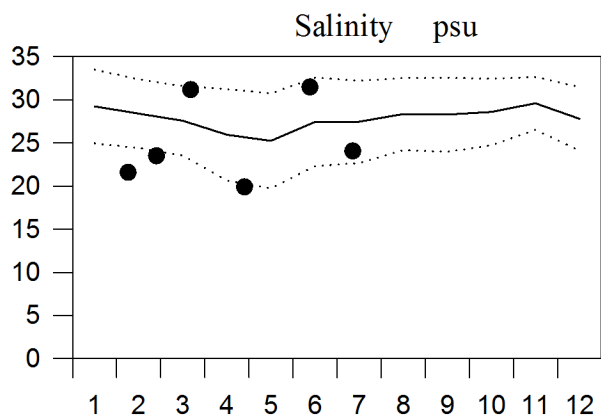
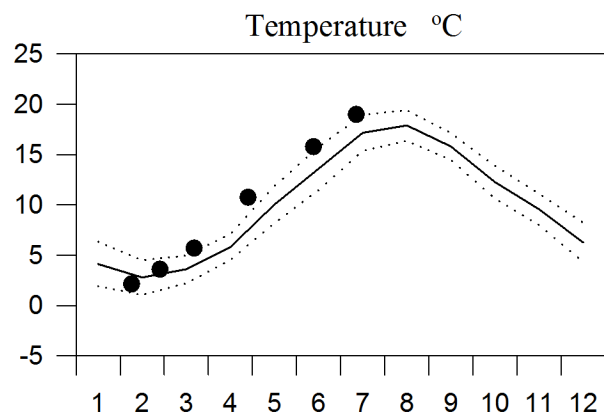
Series : 0450-0471



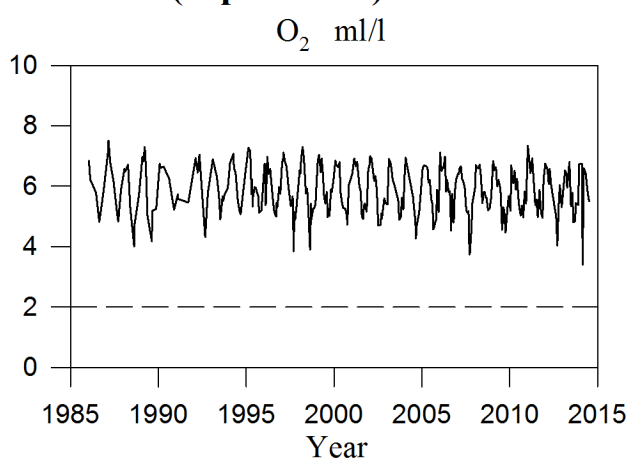
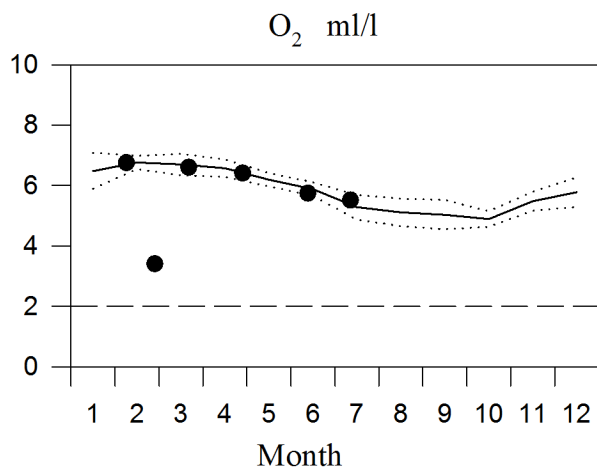
STATION P2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

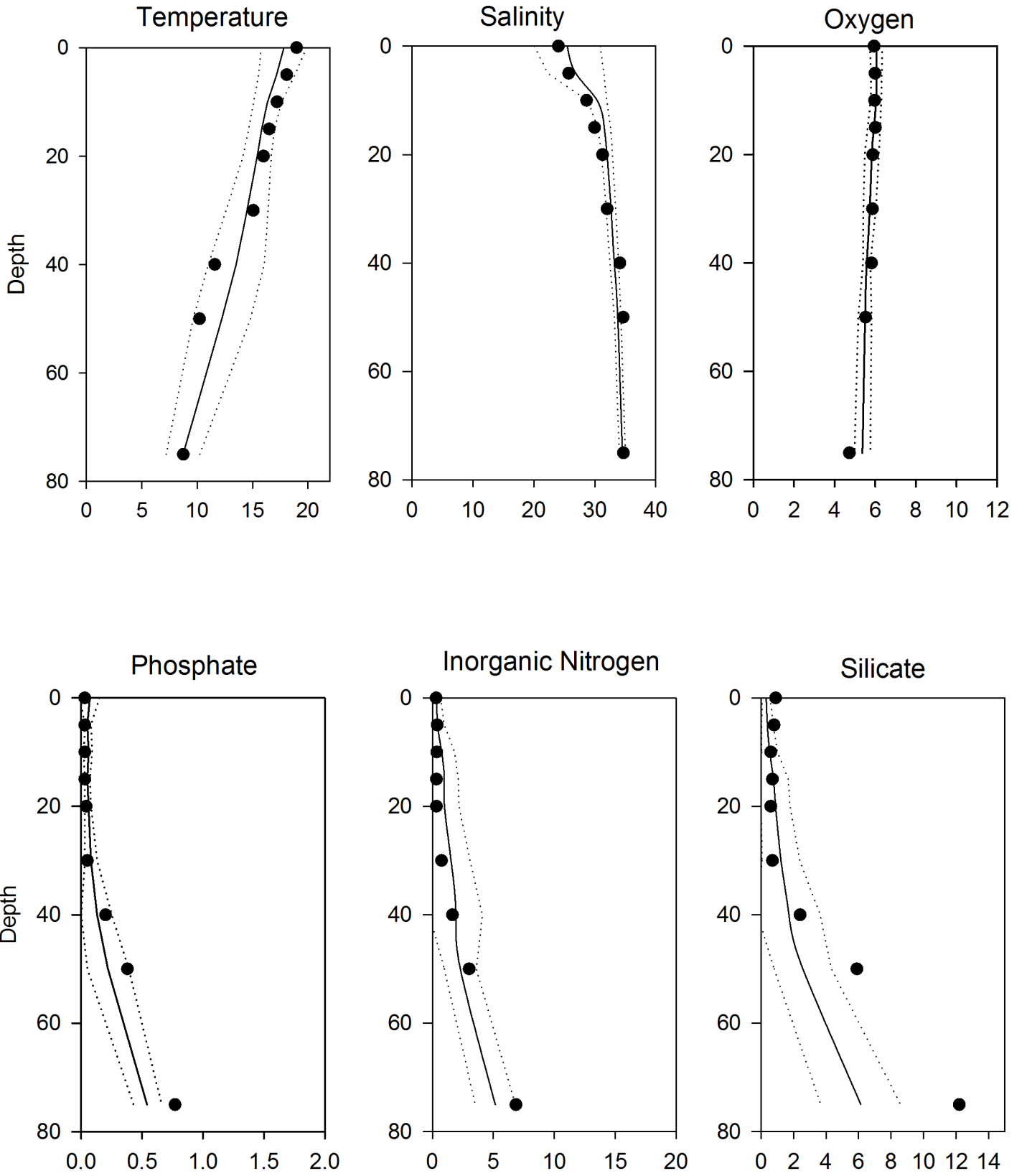


OXYGEN IN BOTTOM WATER (depth >75m)



Vertical profiles P2 July

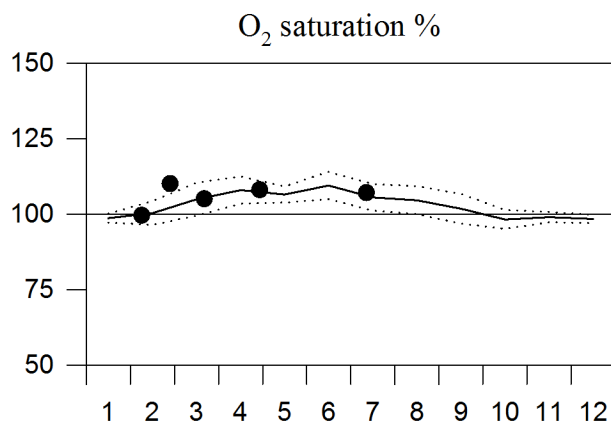
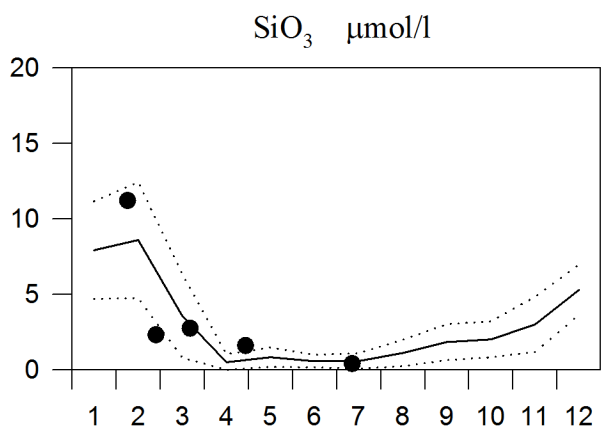
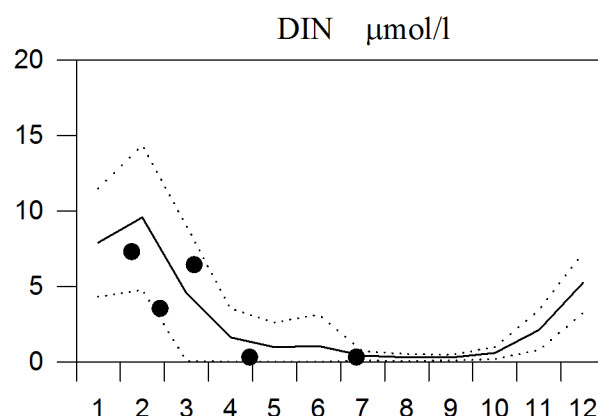
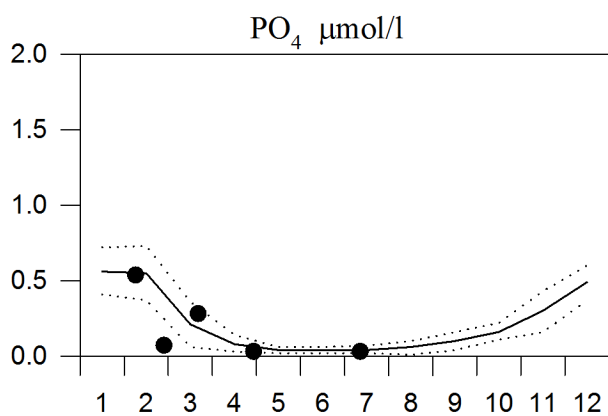
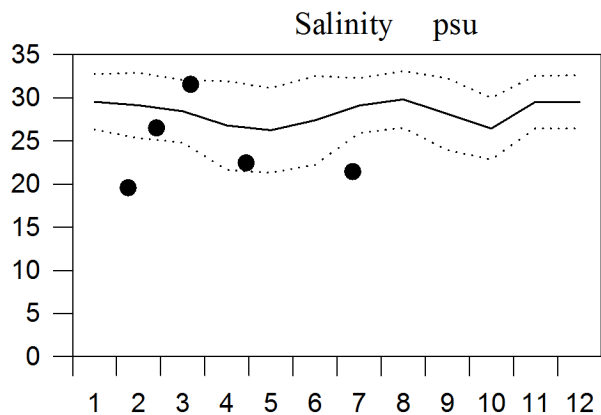
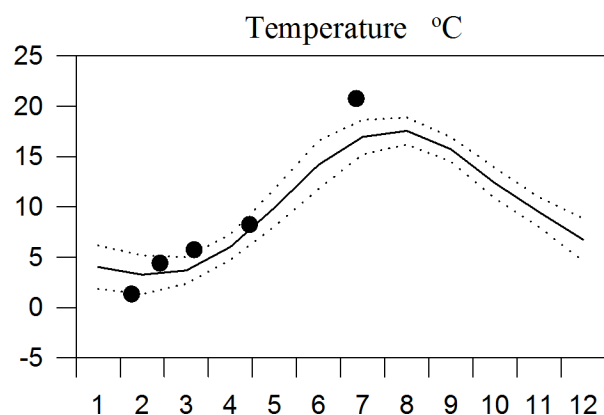
— Mean 1996-2010 St.Dev. ● 2014



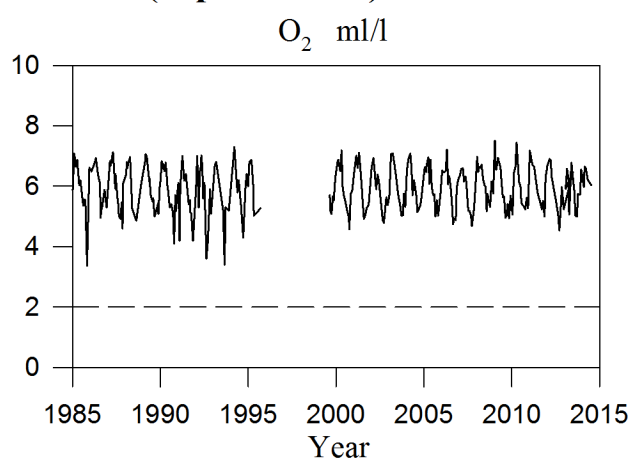
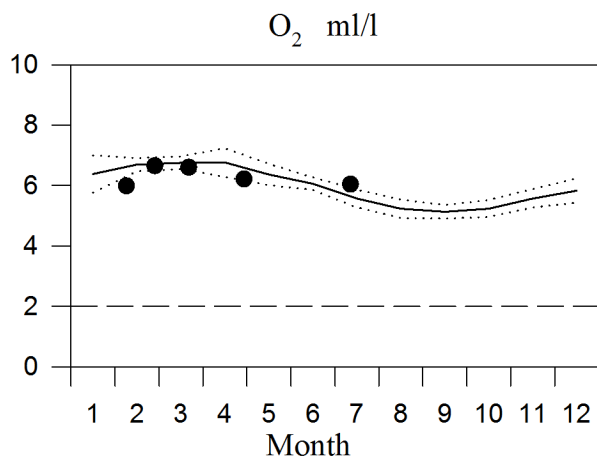
STATION Å13 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

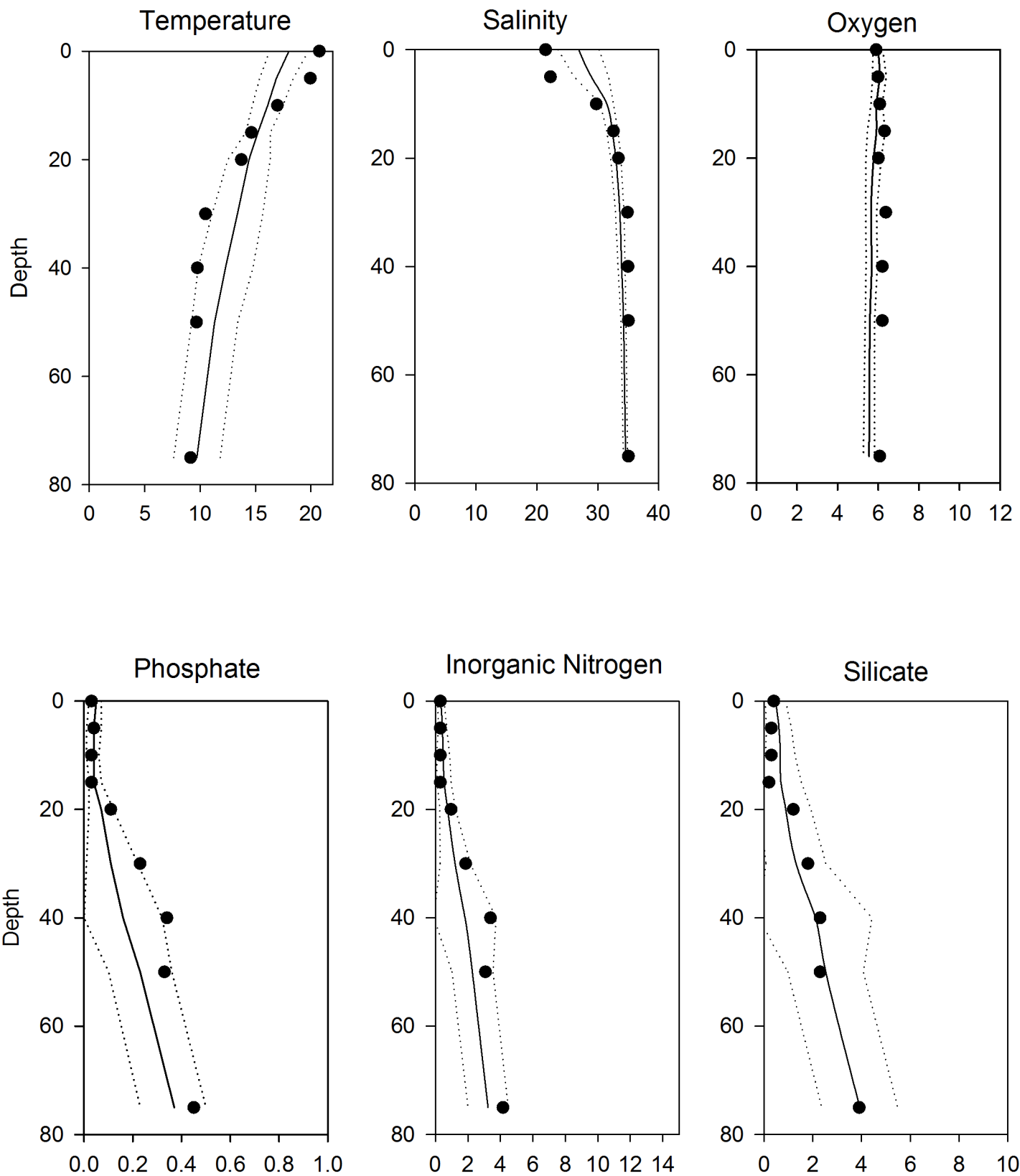


OXYGEN IN BOTTOM WATER (depth >=75m)



Vertical profiles Å13 July

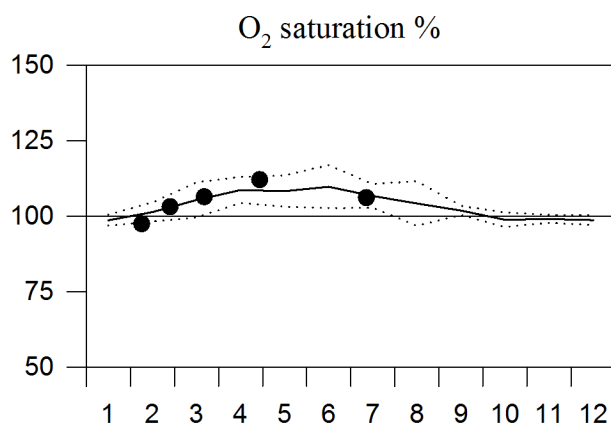
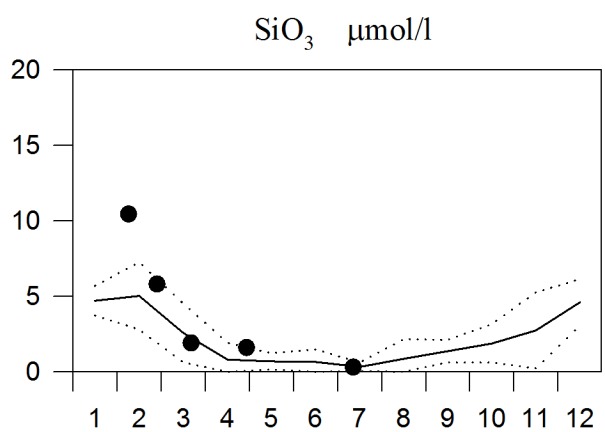
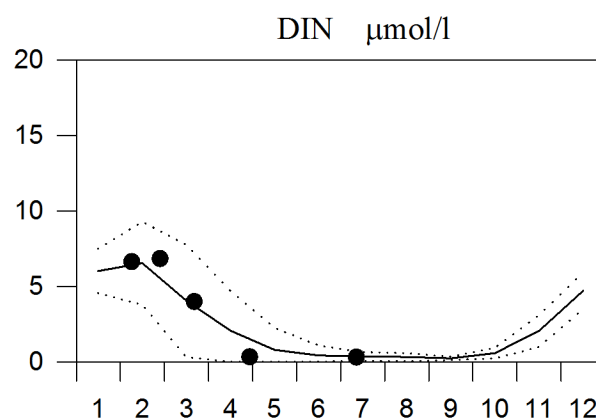
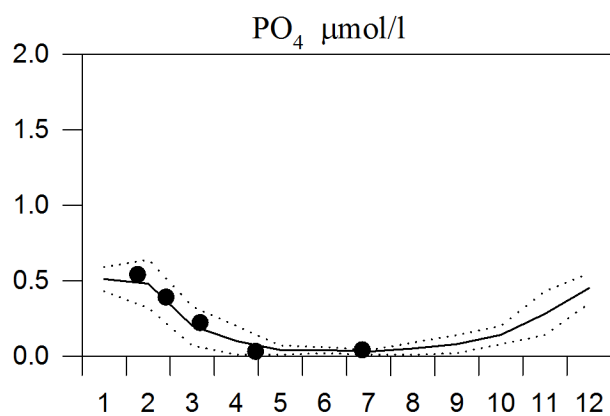
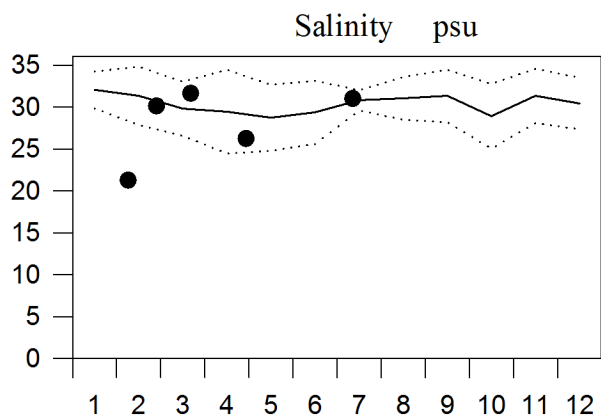
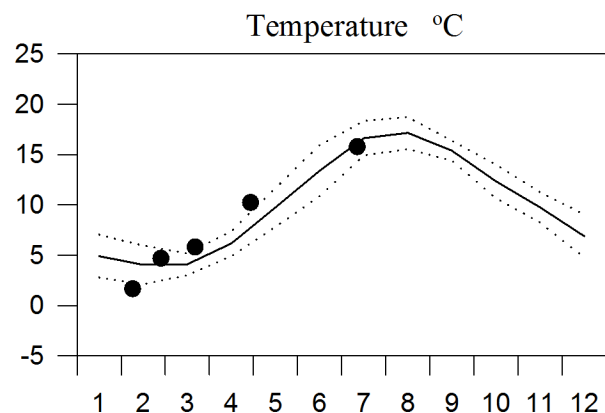
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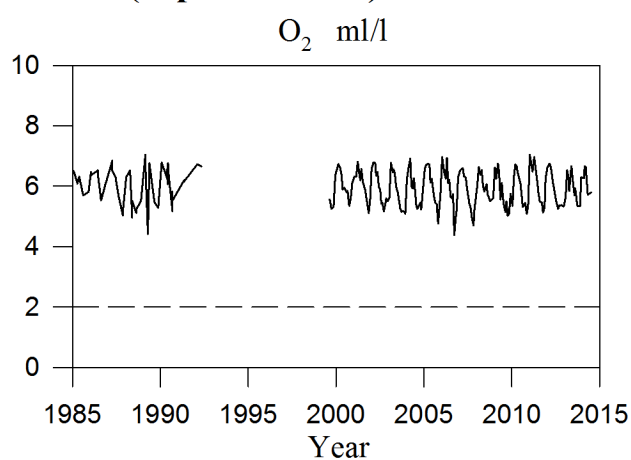
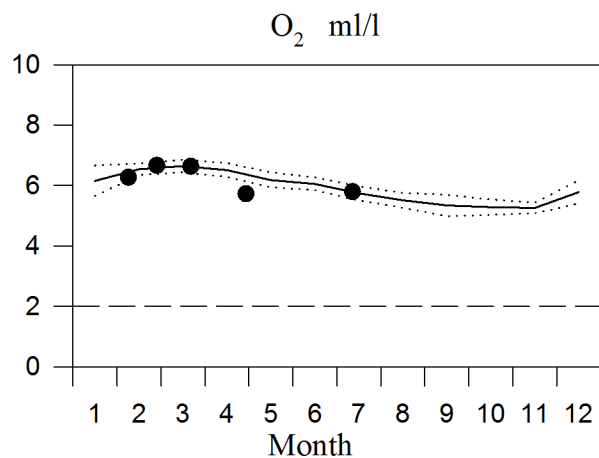
STATION Å15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



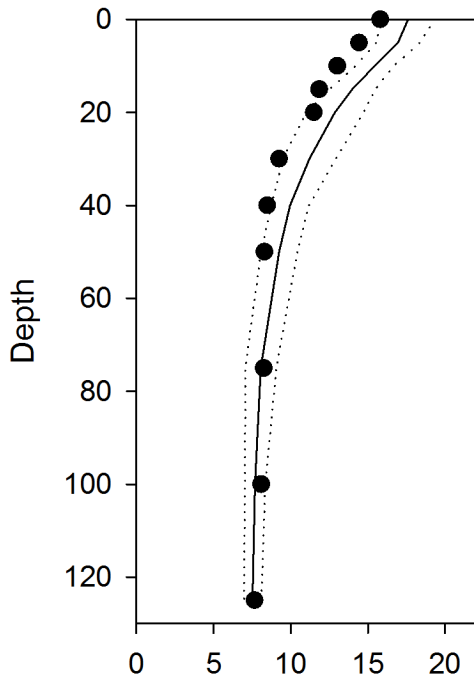
OXYGEN IN BOTTOM WATER (depth >=125m)



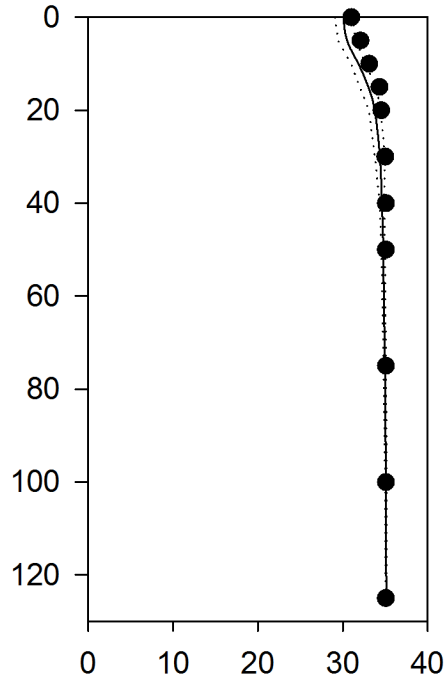
Vertical profiles Å15 July

— Mean 1996-2010 St.Dev. ● 2014

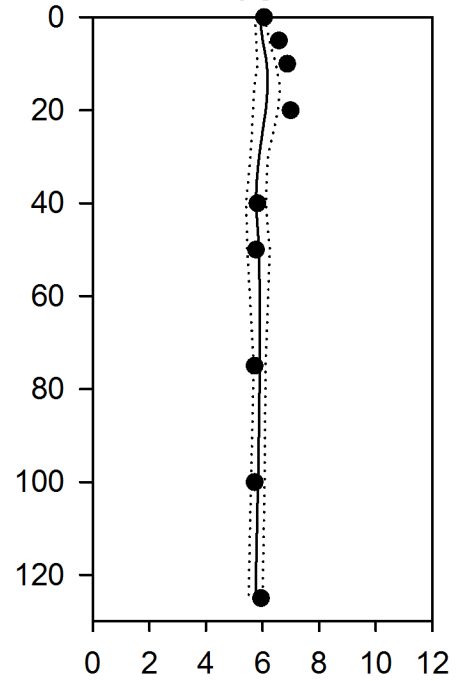
Temperature



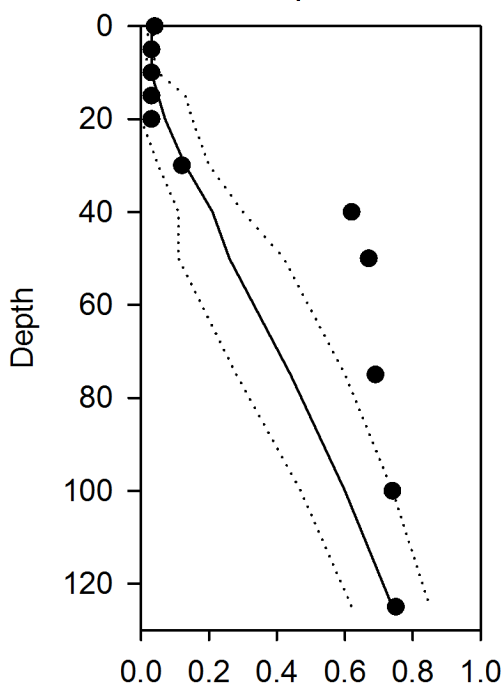
Salinity



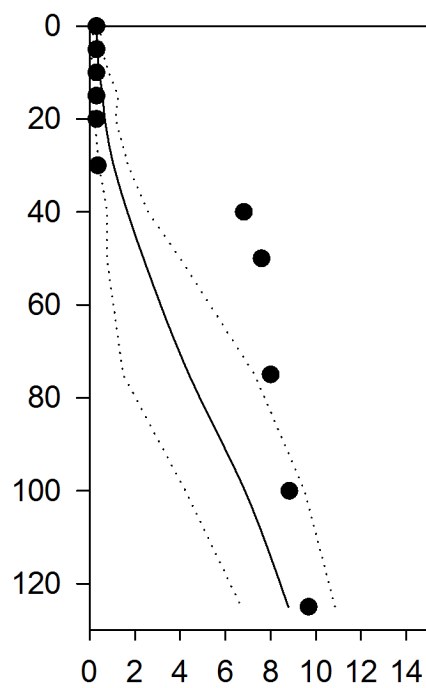
Oxygen



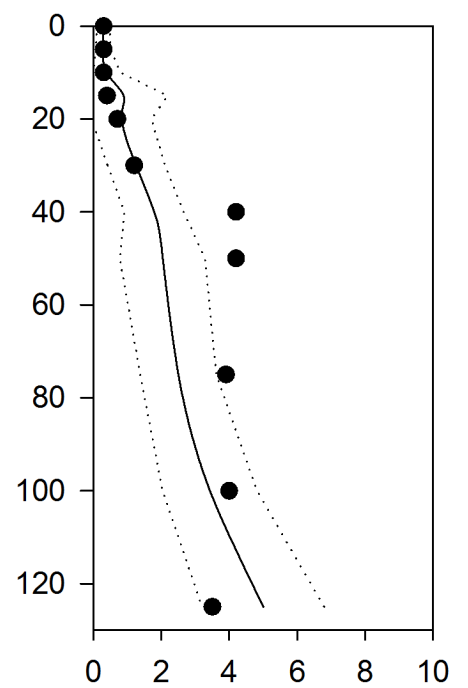
Phosphate



Inorganic Nitrogen



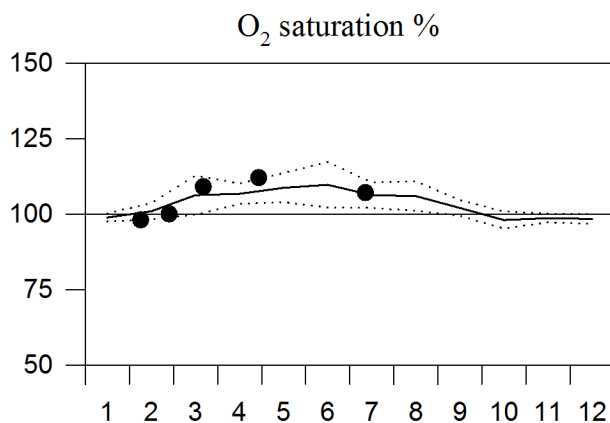
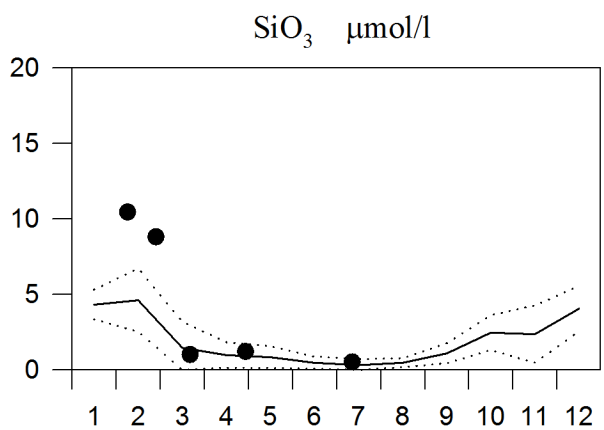
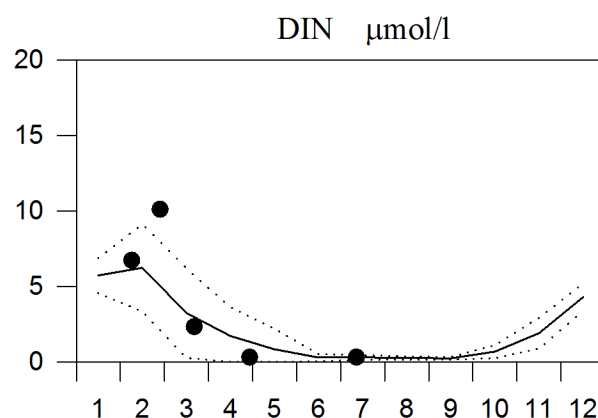
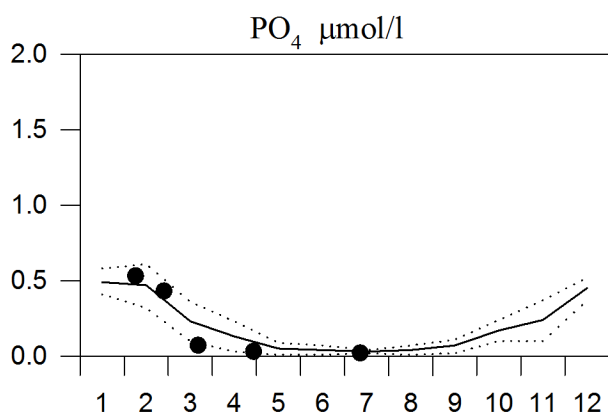
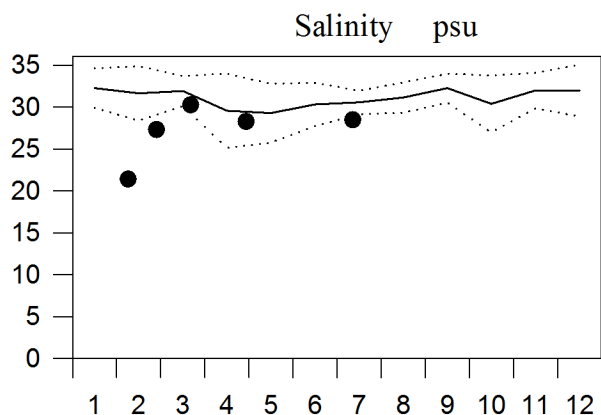
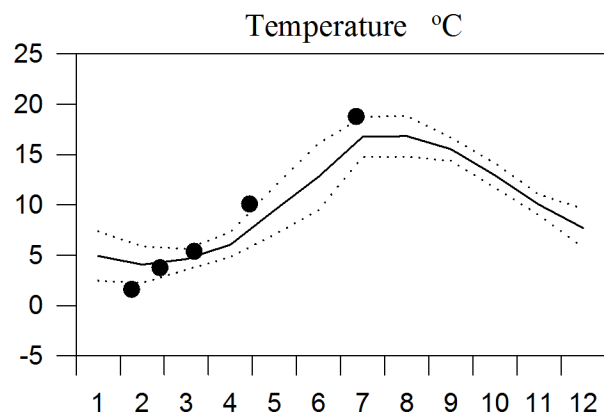
Silicate



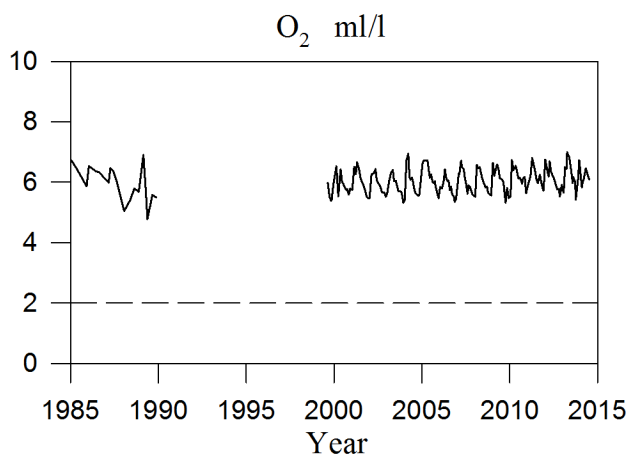
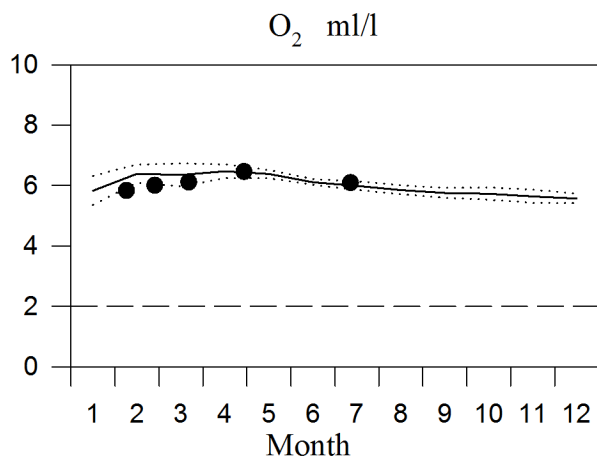
STATION Å17 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



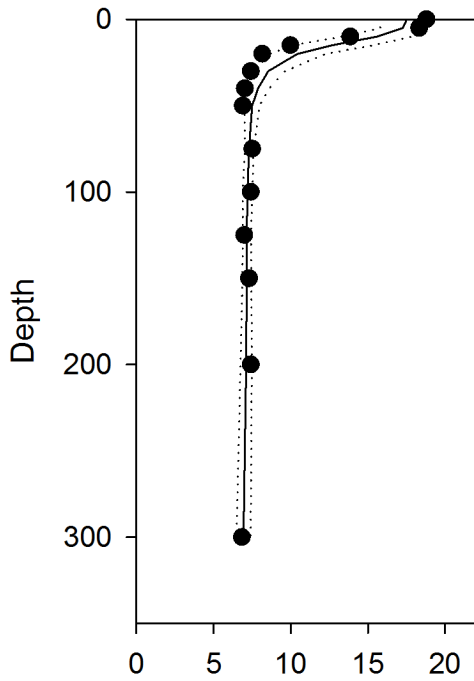
OXYGEN IN BOTTOM WATER (depth = 300m)



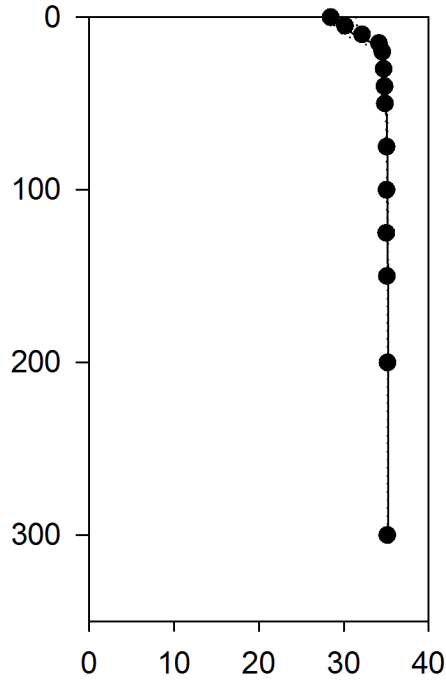
Vertical profiles Å17 July

— Mean 1996-2010 St.Dev. ● 2014

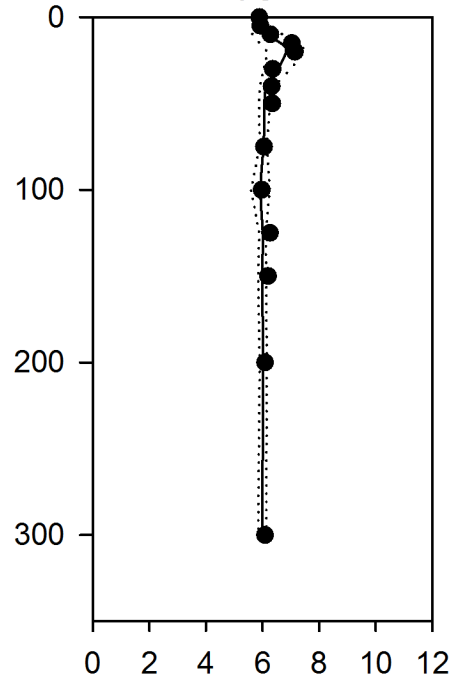
Temperature



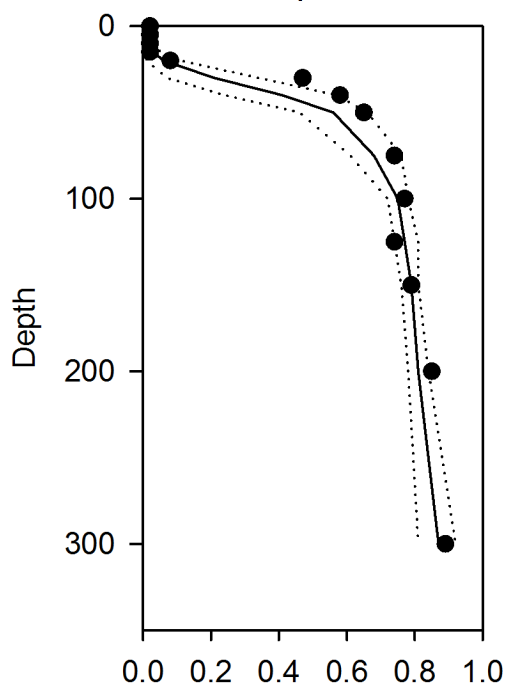
Salinity



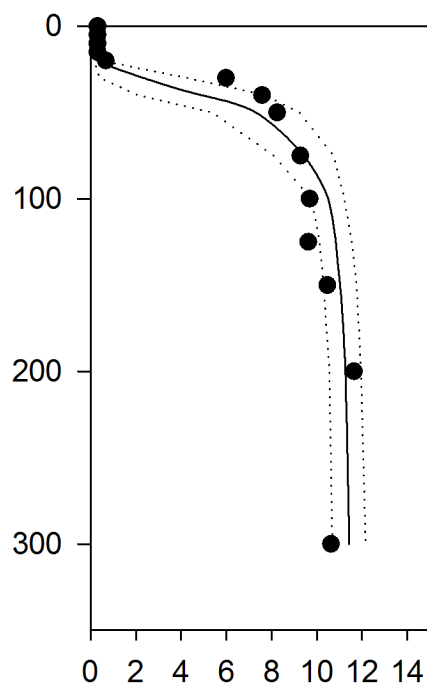
Oxygen



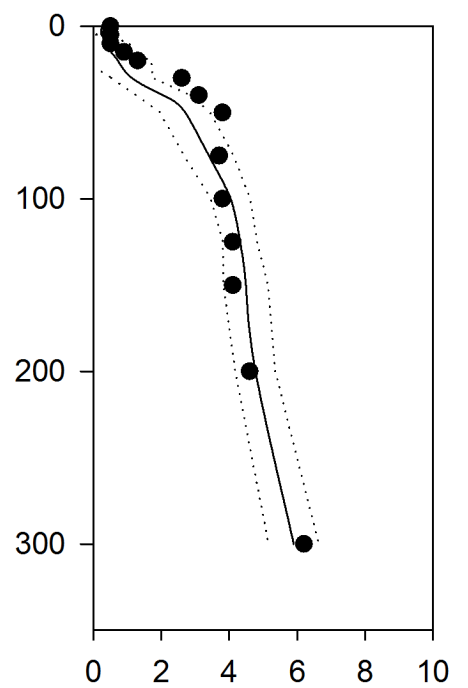
Phosphate



Inorganic Nitrogen



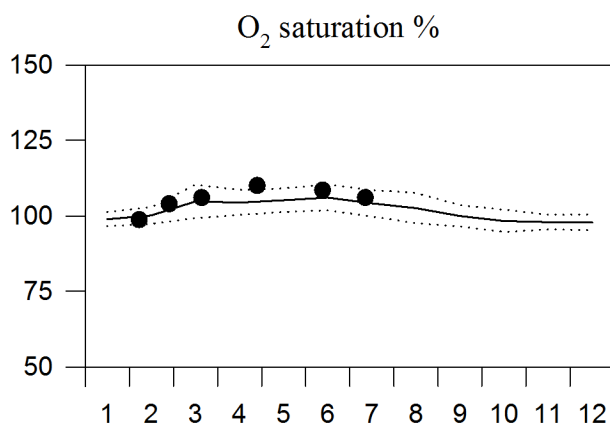
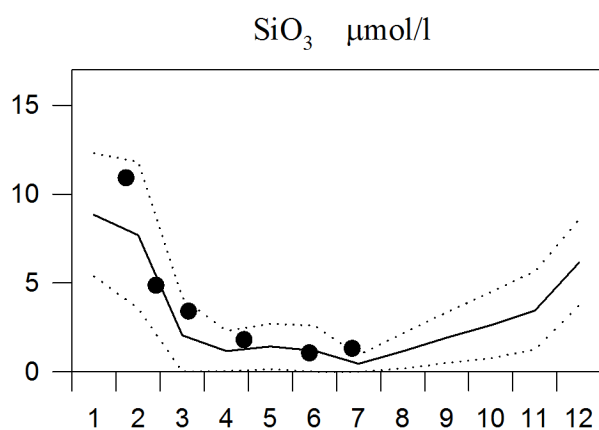
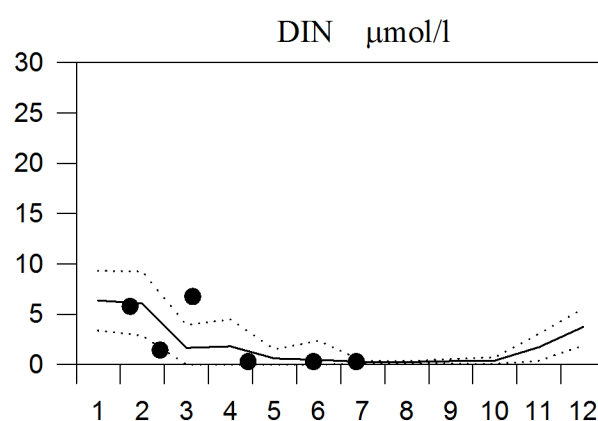
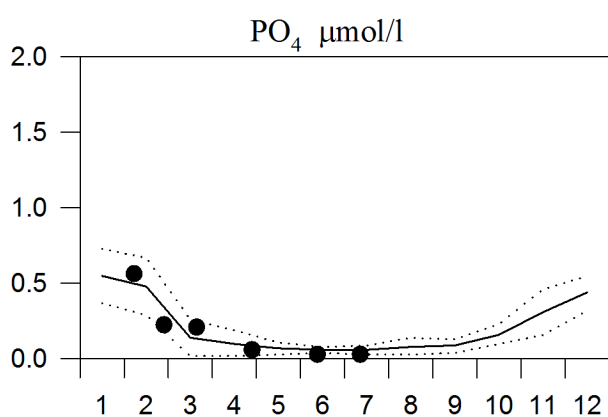
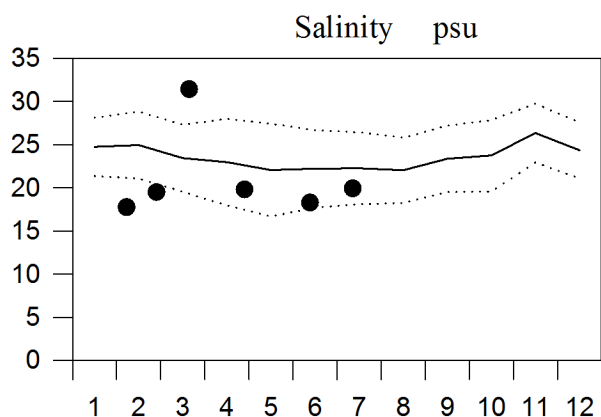
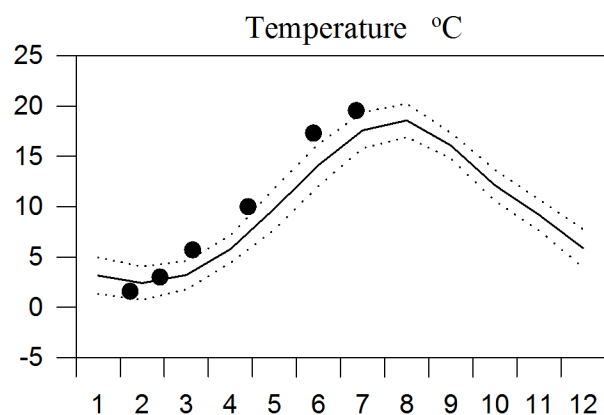
Silicate



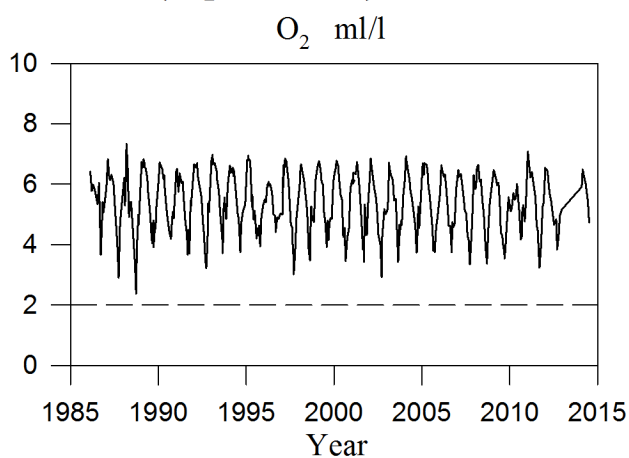
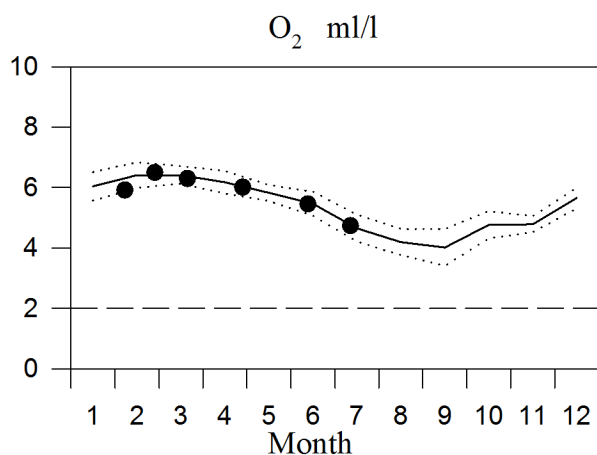
STATION FLADEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

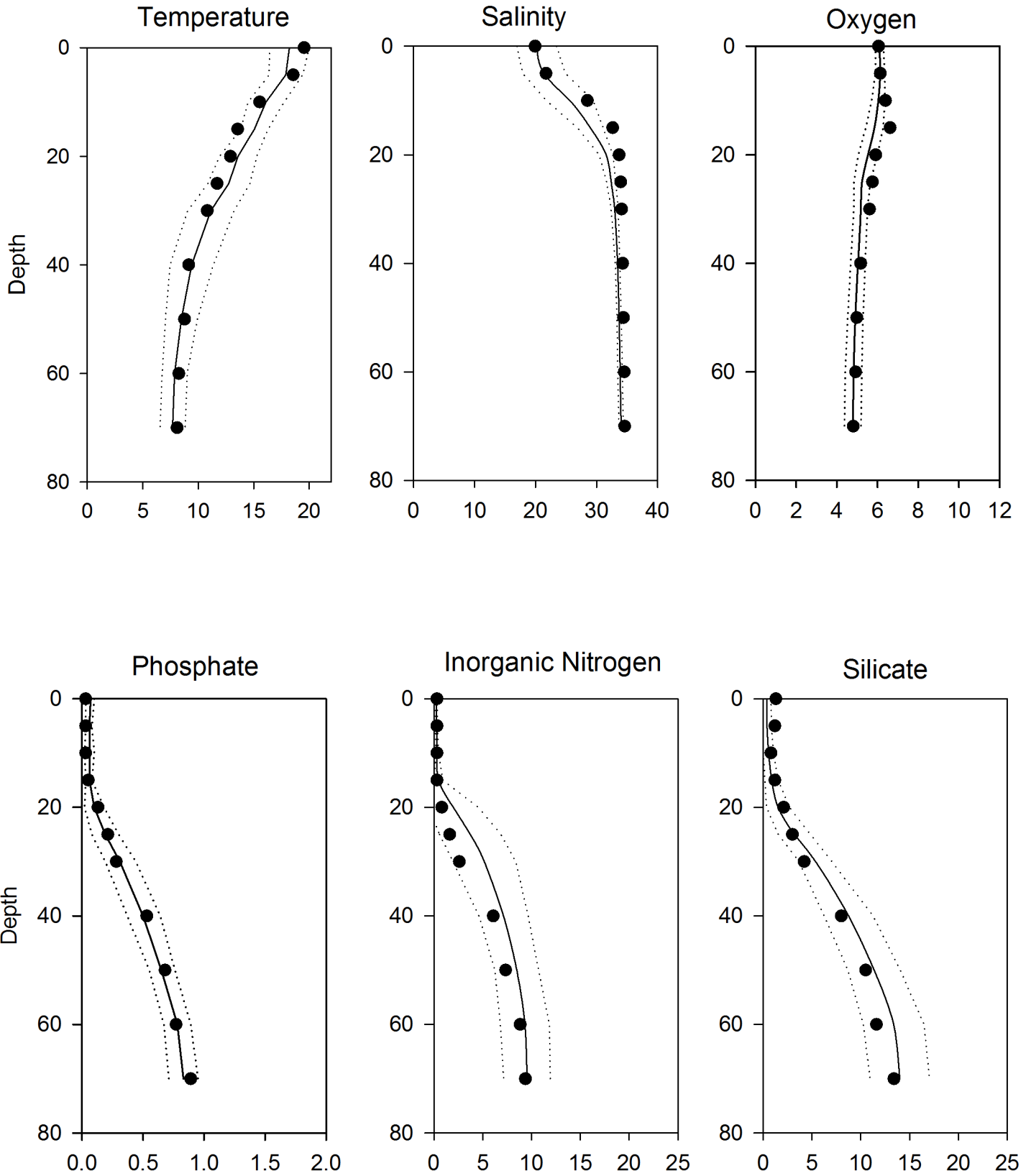


OXYGEN IN BOTTOM WATER (depth > 70m)



Vertical profiles Fladen July

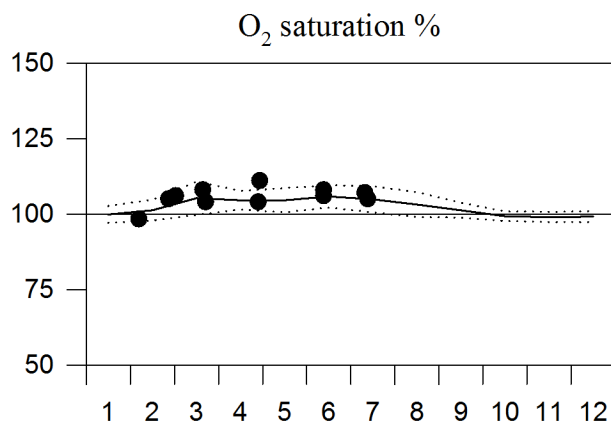
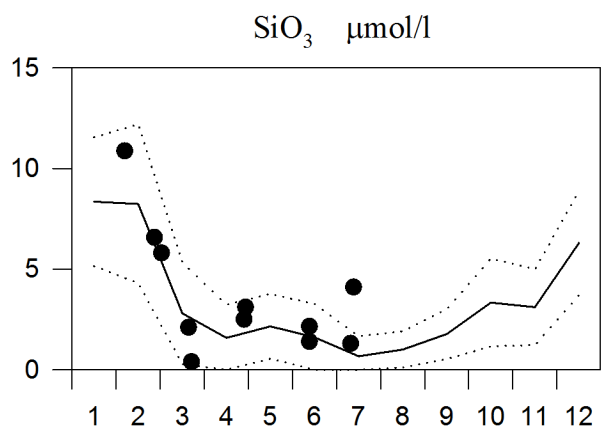
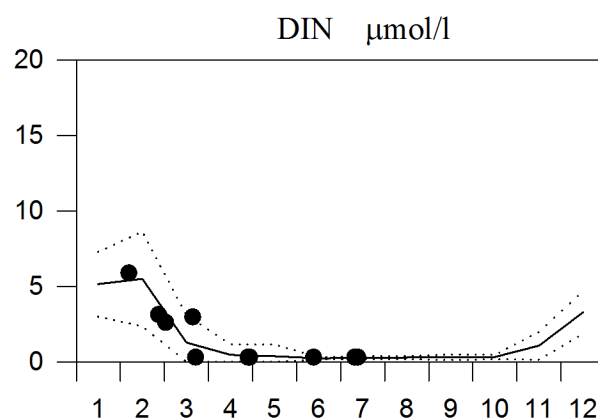
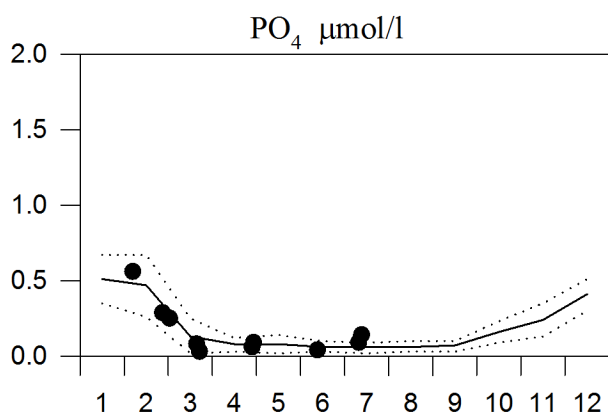
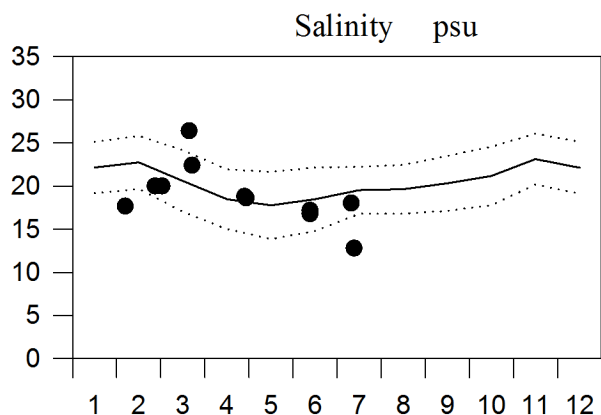
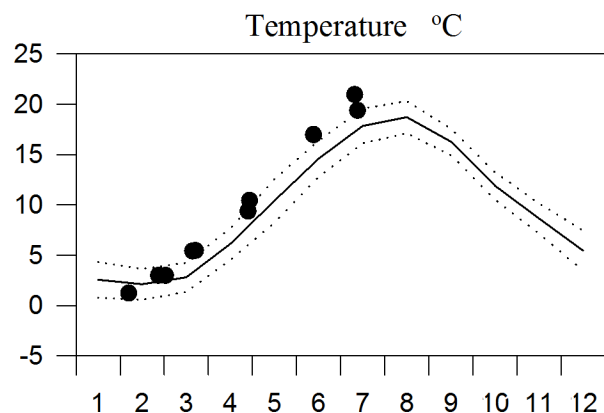
— Mean 1996-2010 St.Dev. ● 2014



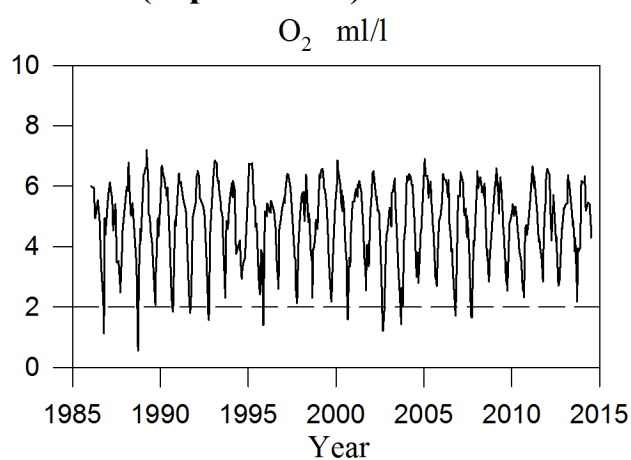
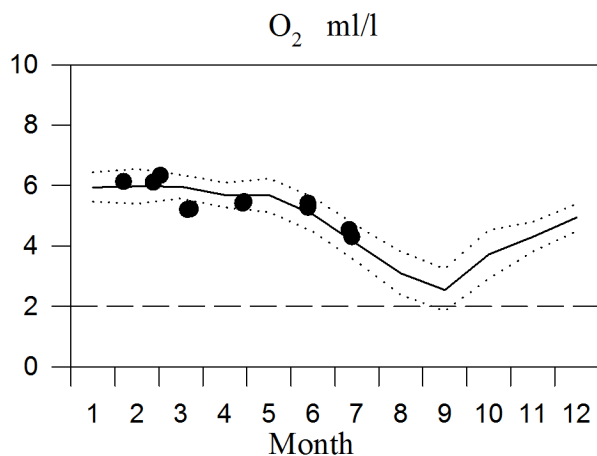
STATION ANHOLT E SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

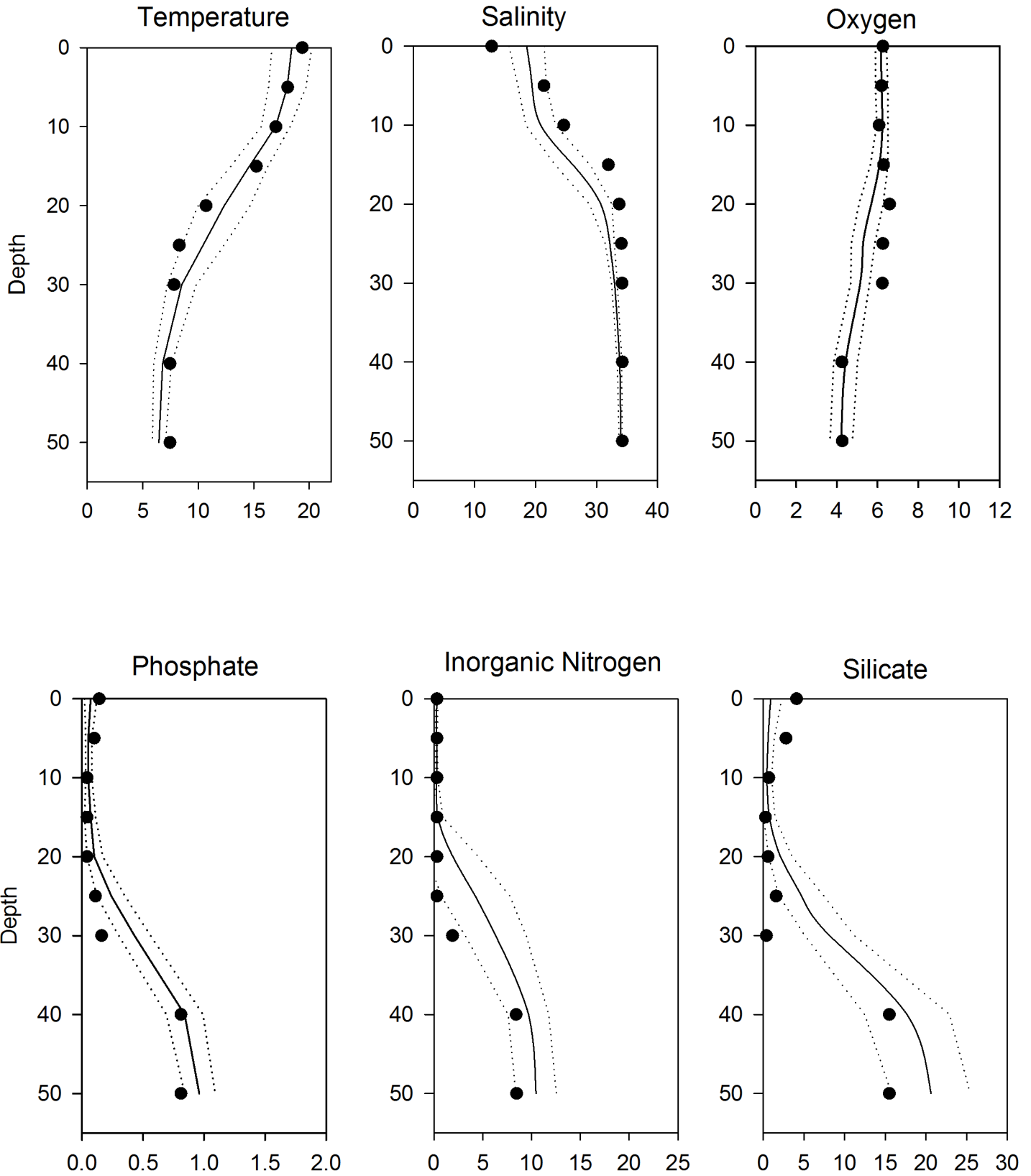


OXYGEN IN BOTTOM WATER (depth > 50m)



Vertical profiles Anholt E July

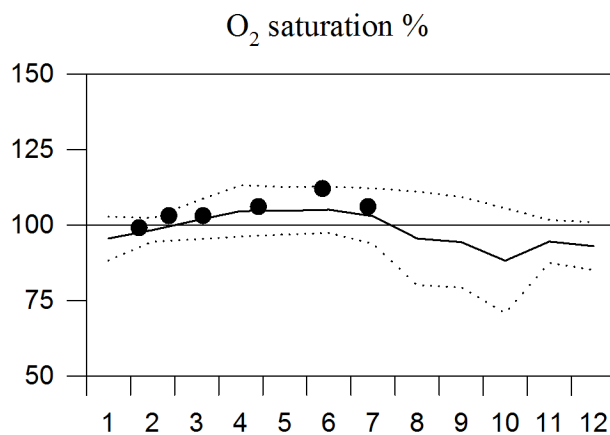
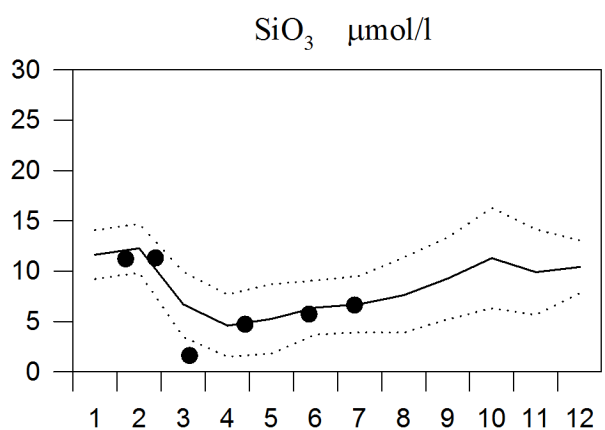
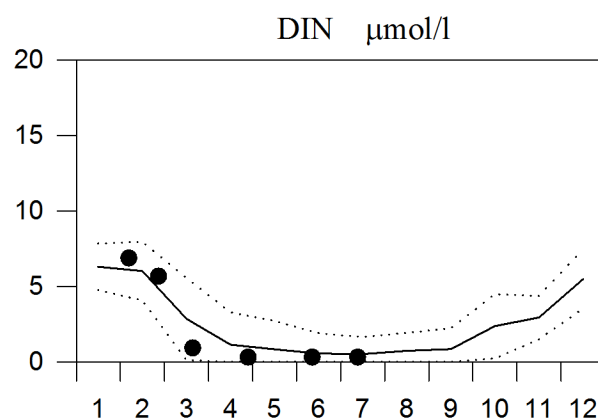
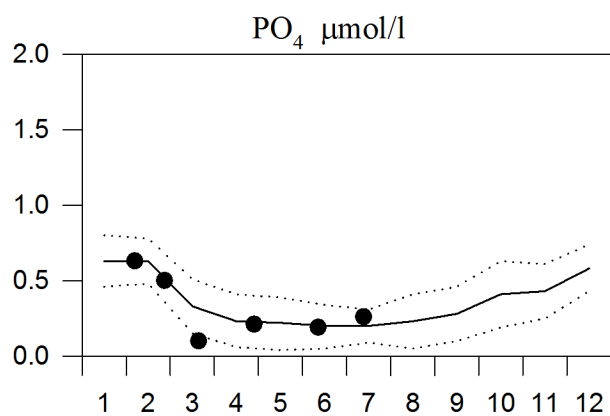
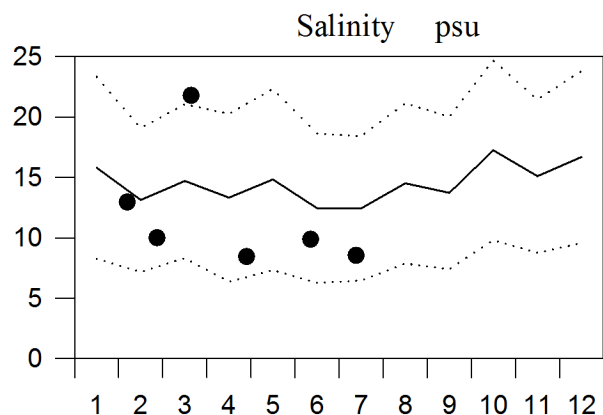
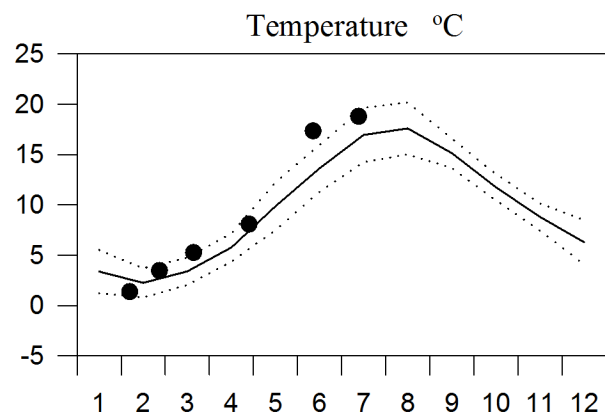
— Mean 1996-2010 St.Dev. ● 2014



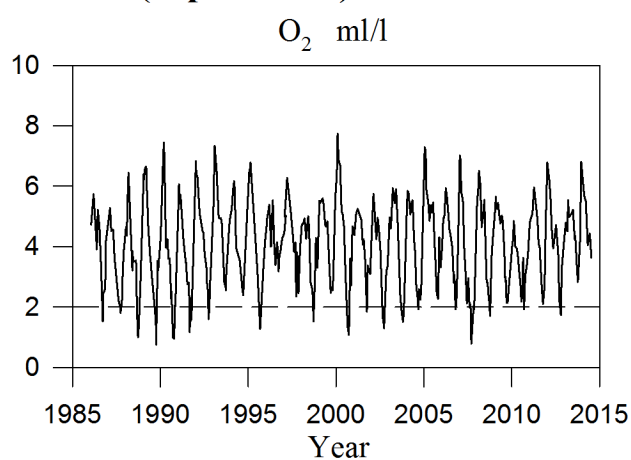
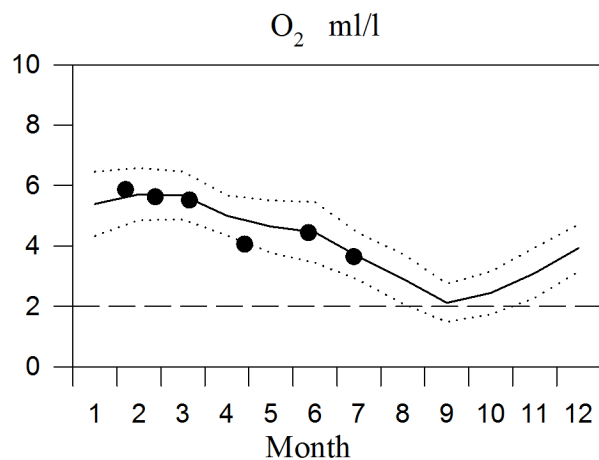
STATION W LANDSKRONA SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

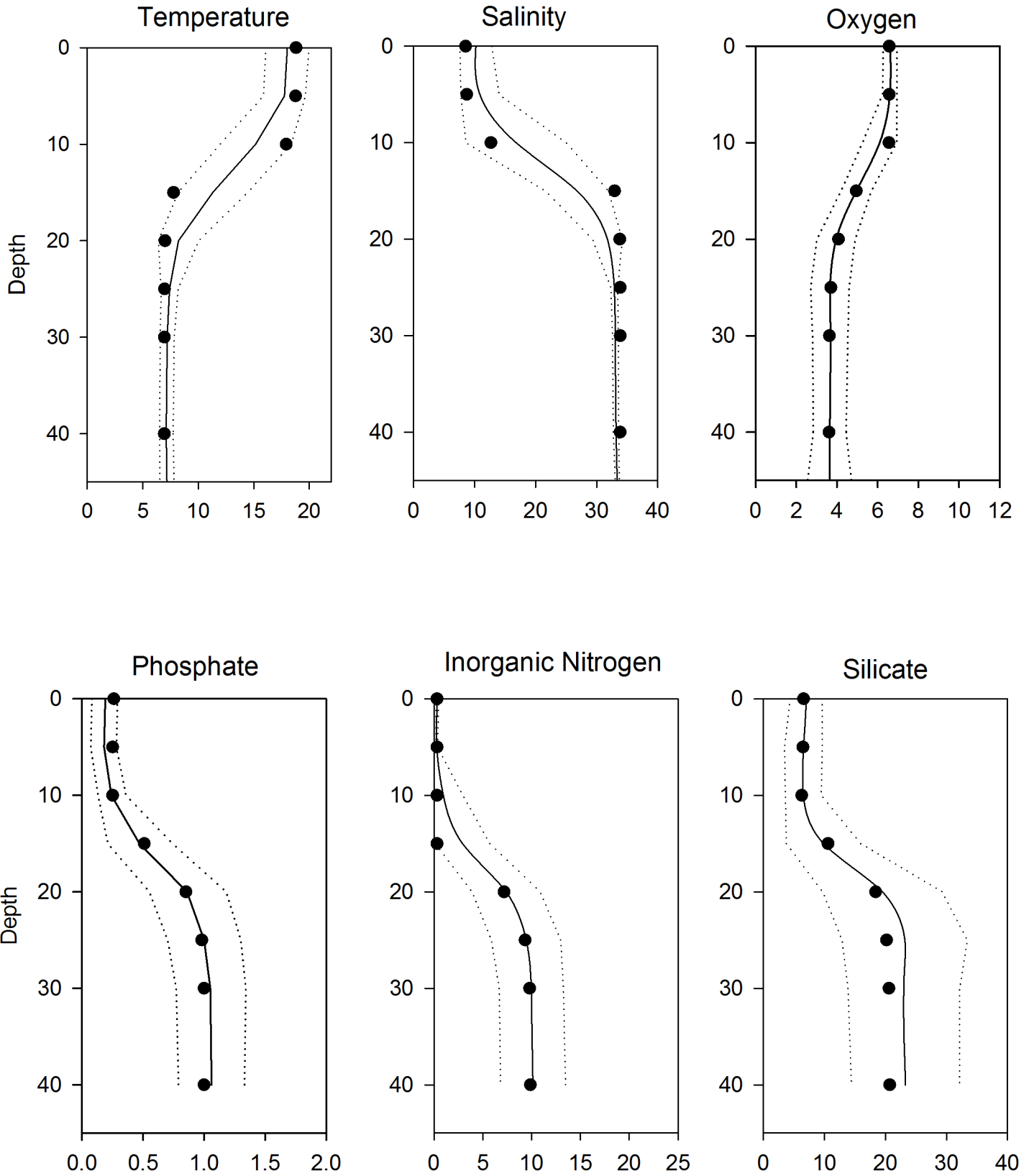


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles W Landskrona July

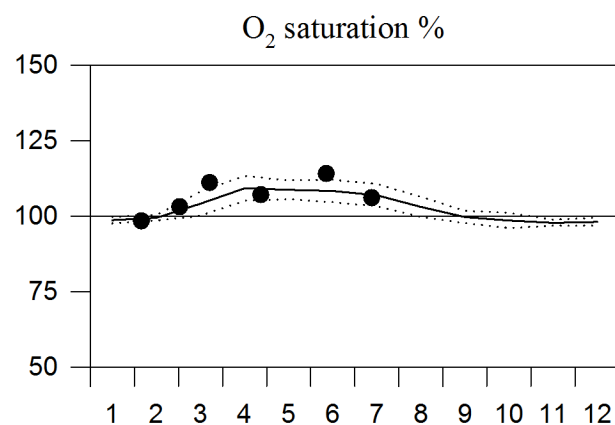
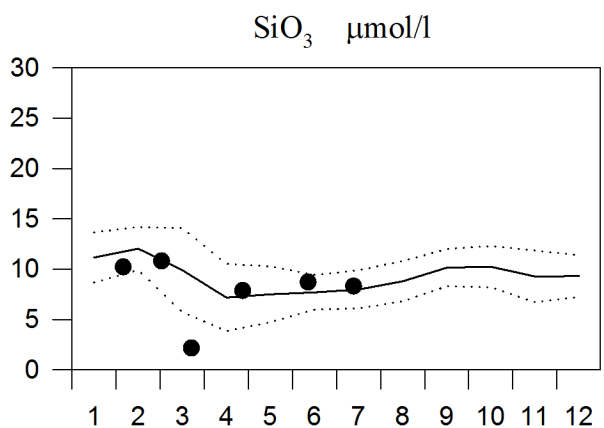
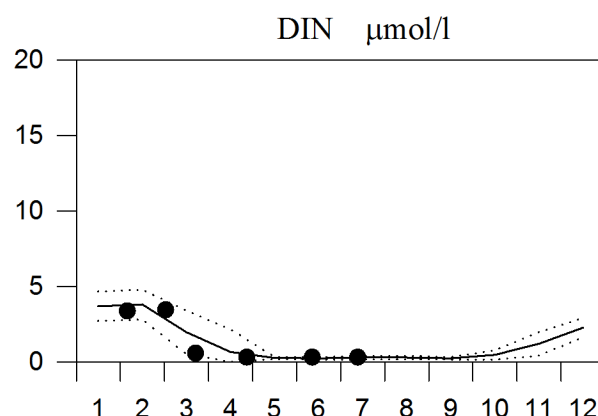
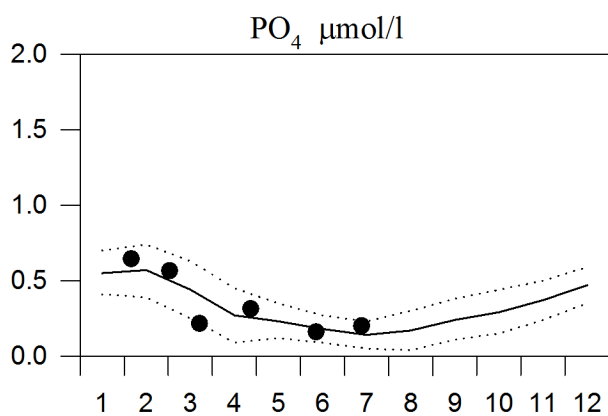
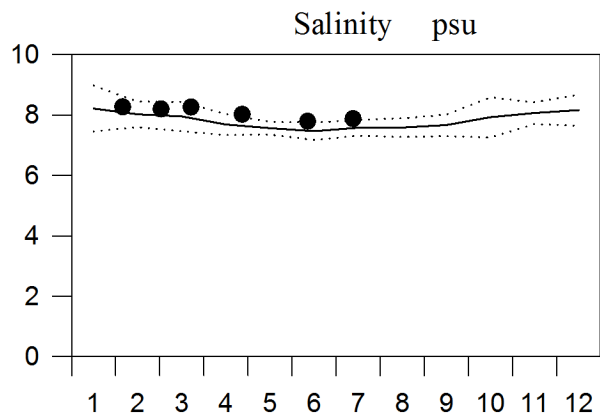
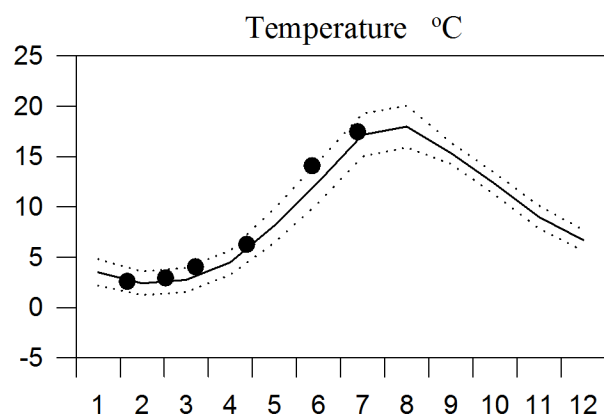
— Mean 1996-2010 St.Dev. ● 2014



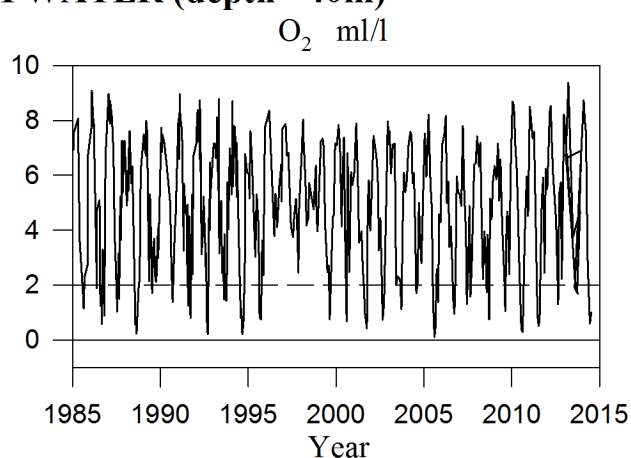
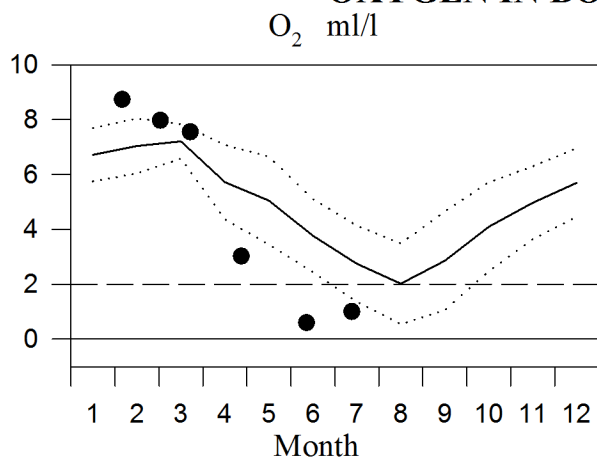
STATION BY1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

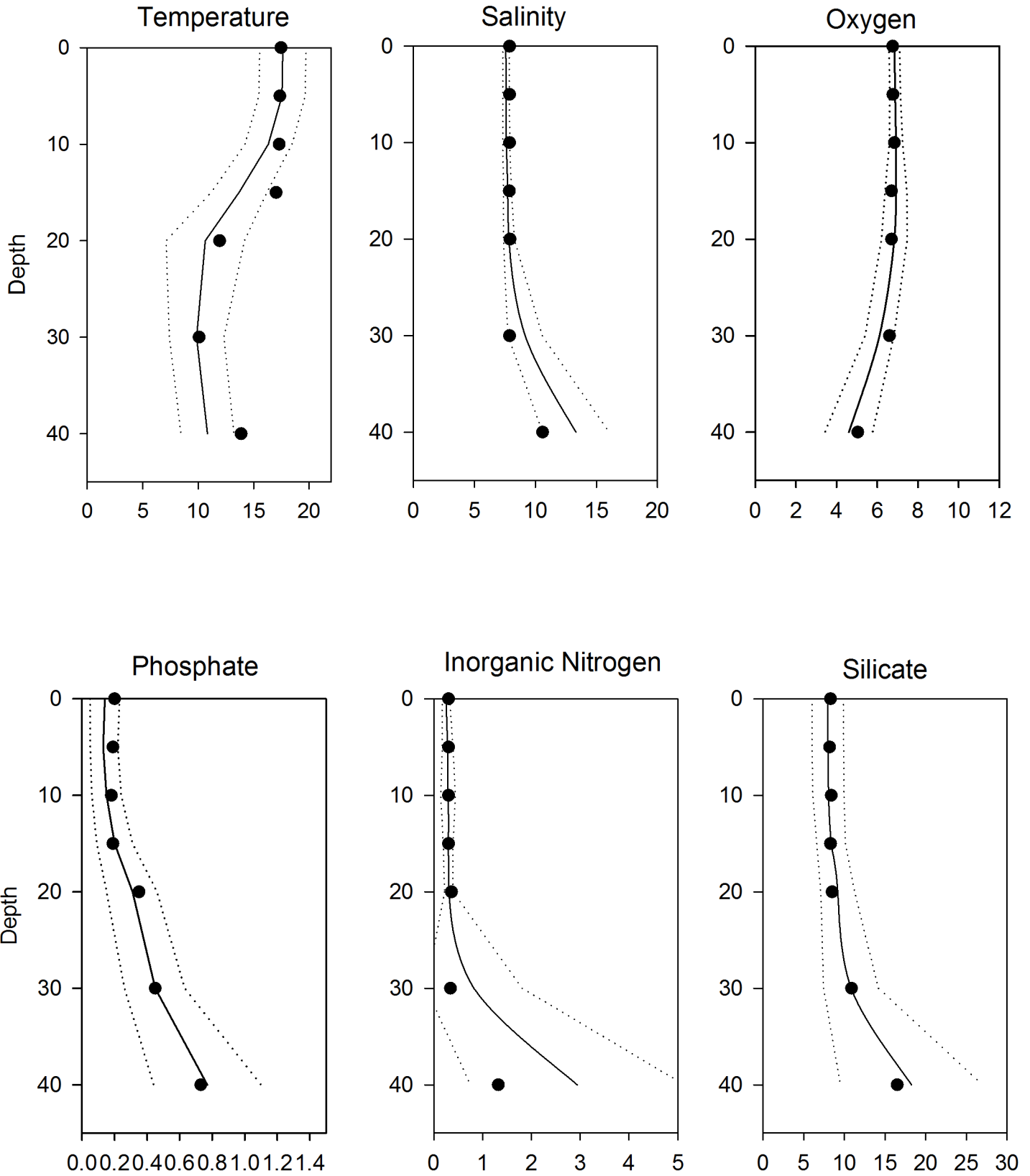


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY1 July

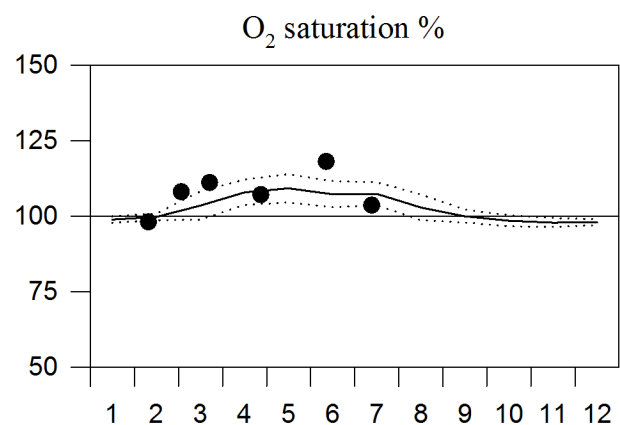
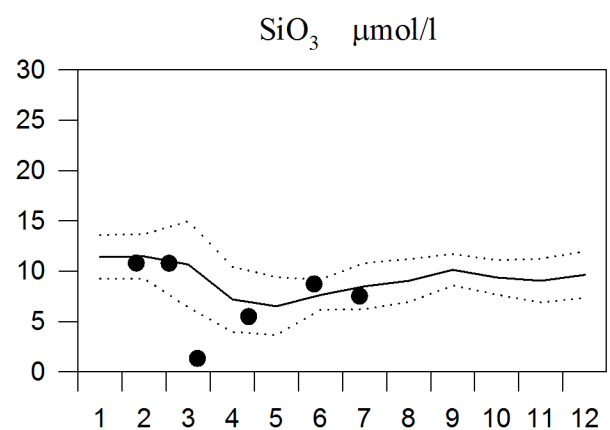
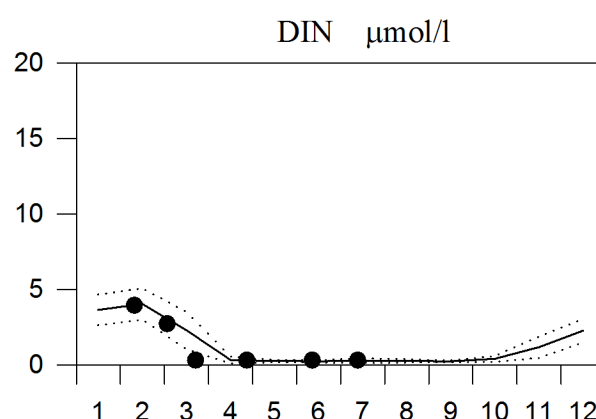
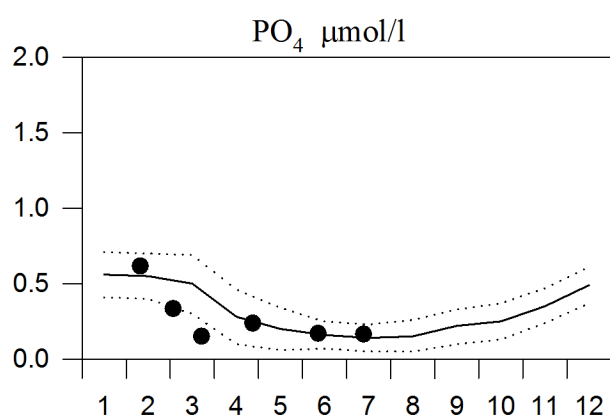
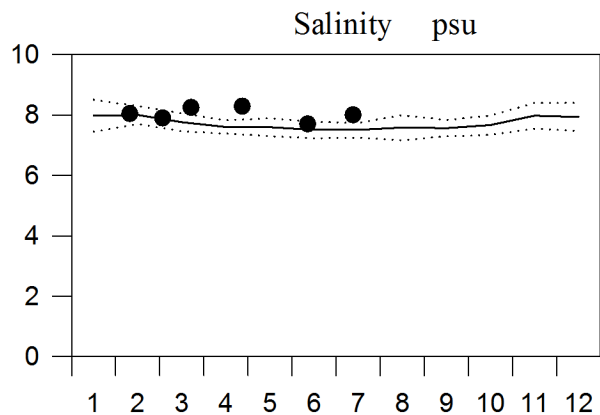
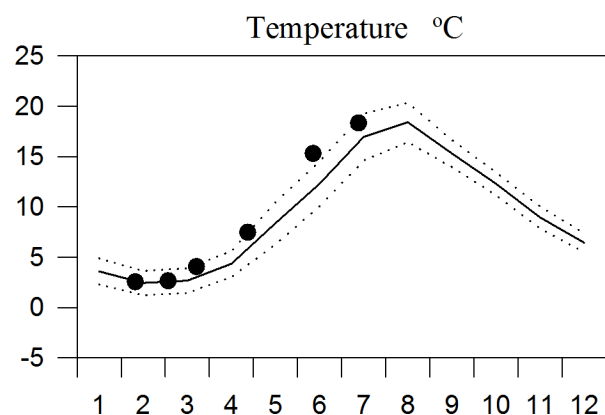
— Mean 1996-2010 St.Dev. ● 2014



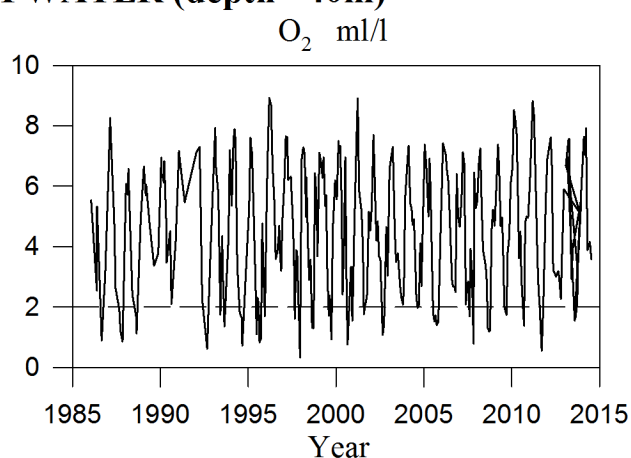
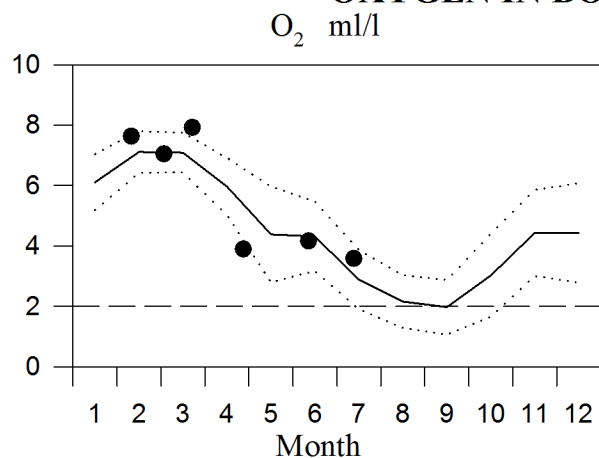
STATION BY2 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

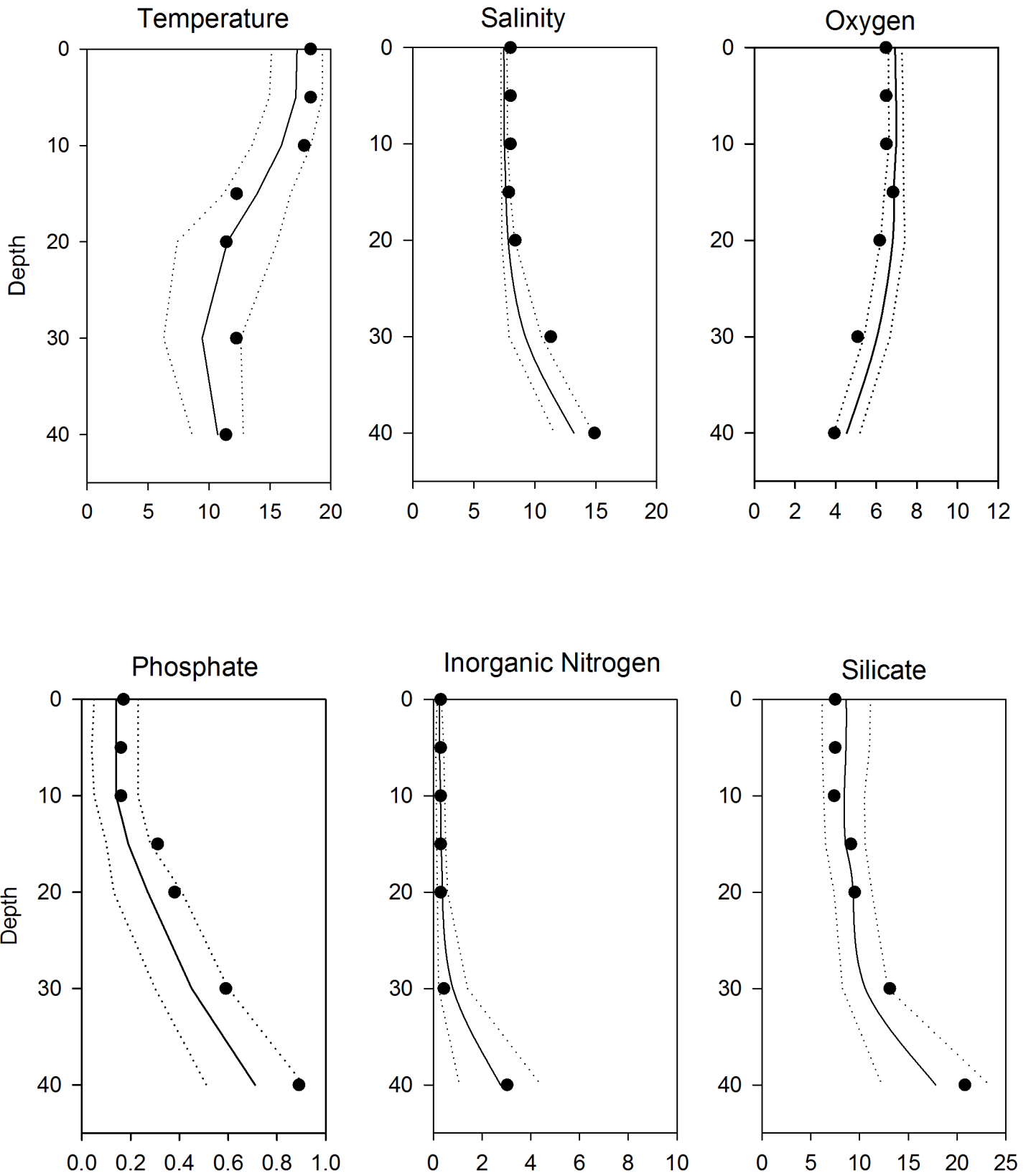


OXYGEN IN BOTTOM WATER (depth >40m)



Vertical profiles BY2 July

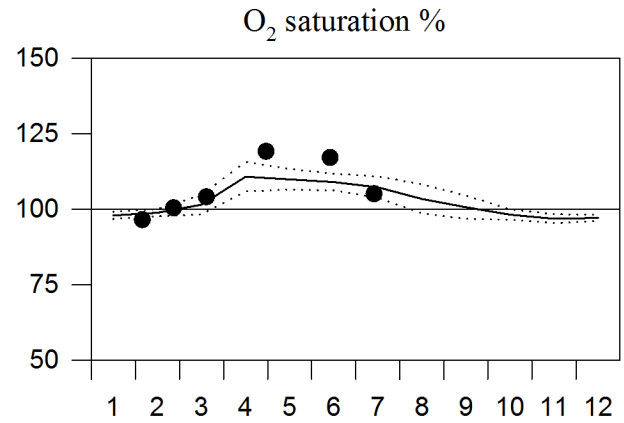
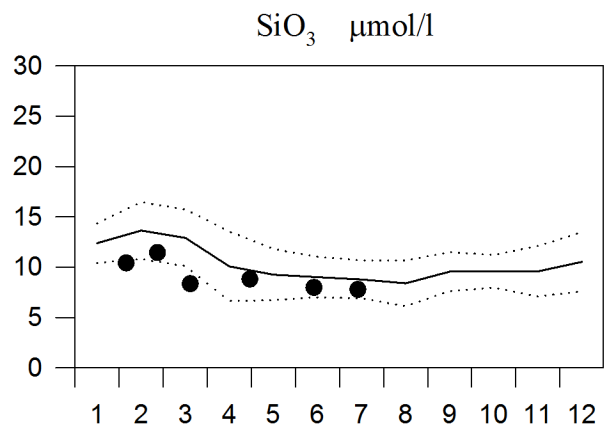
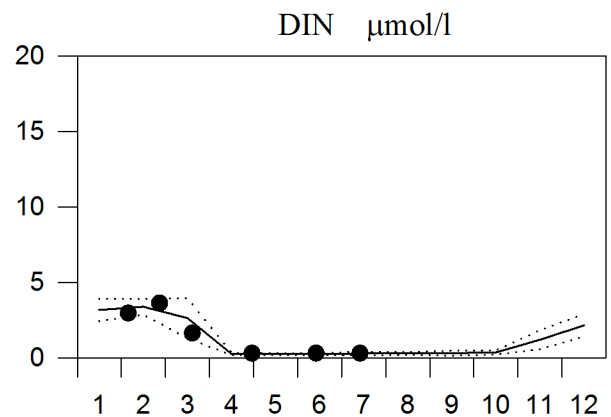
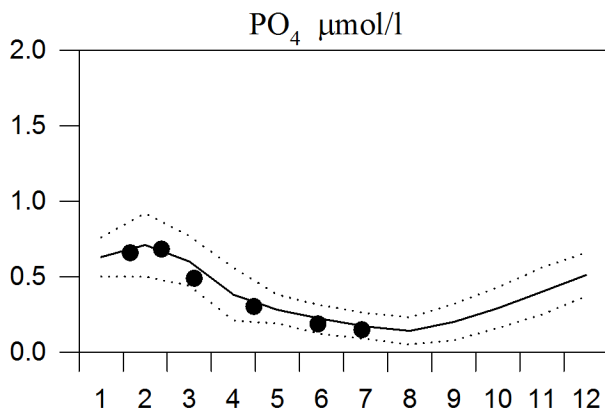
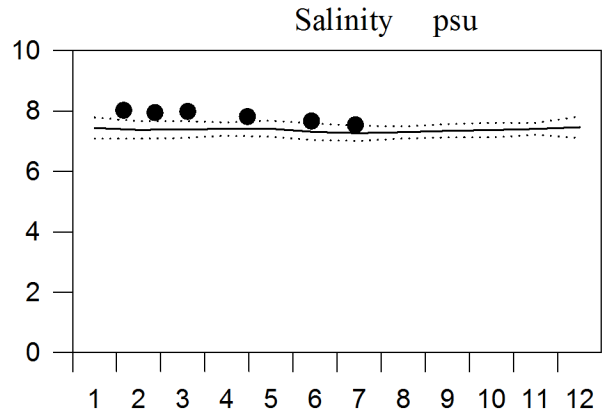
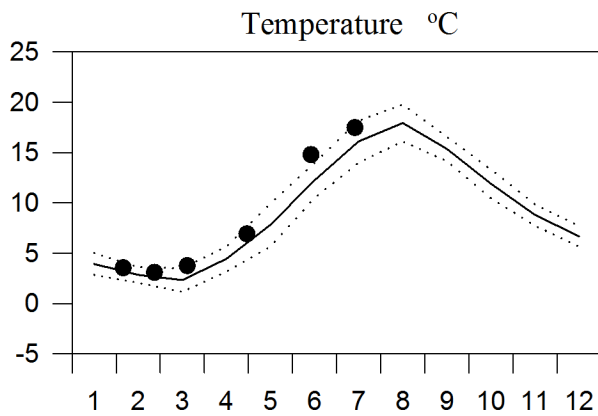
— Mean 1996-2010 St.Dev. ● 2014



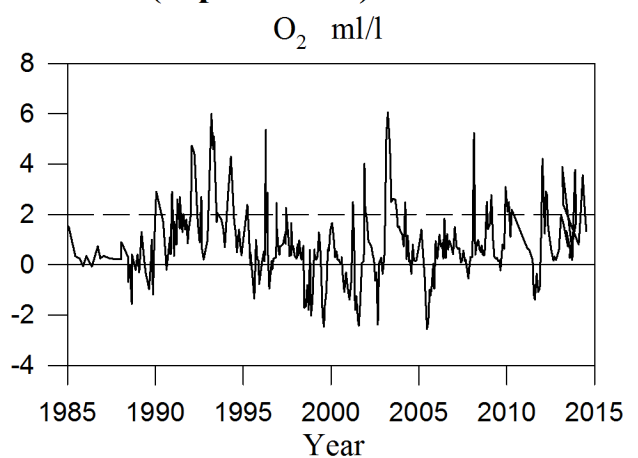
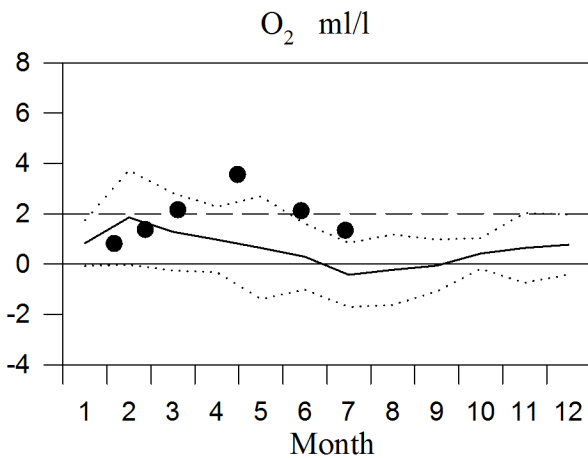
STATION HANÖBUKTEN SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

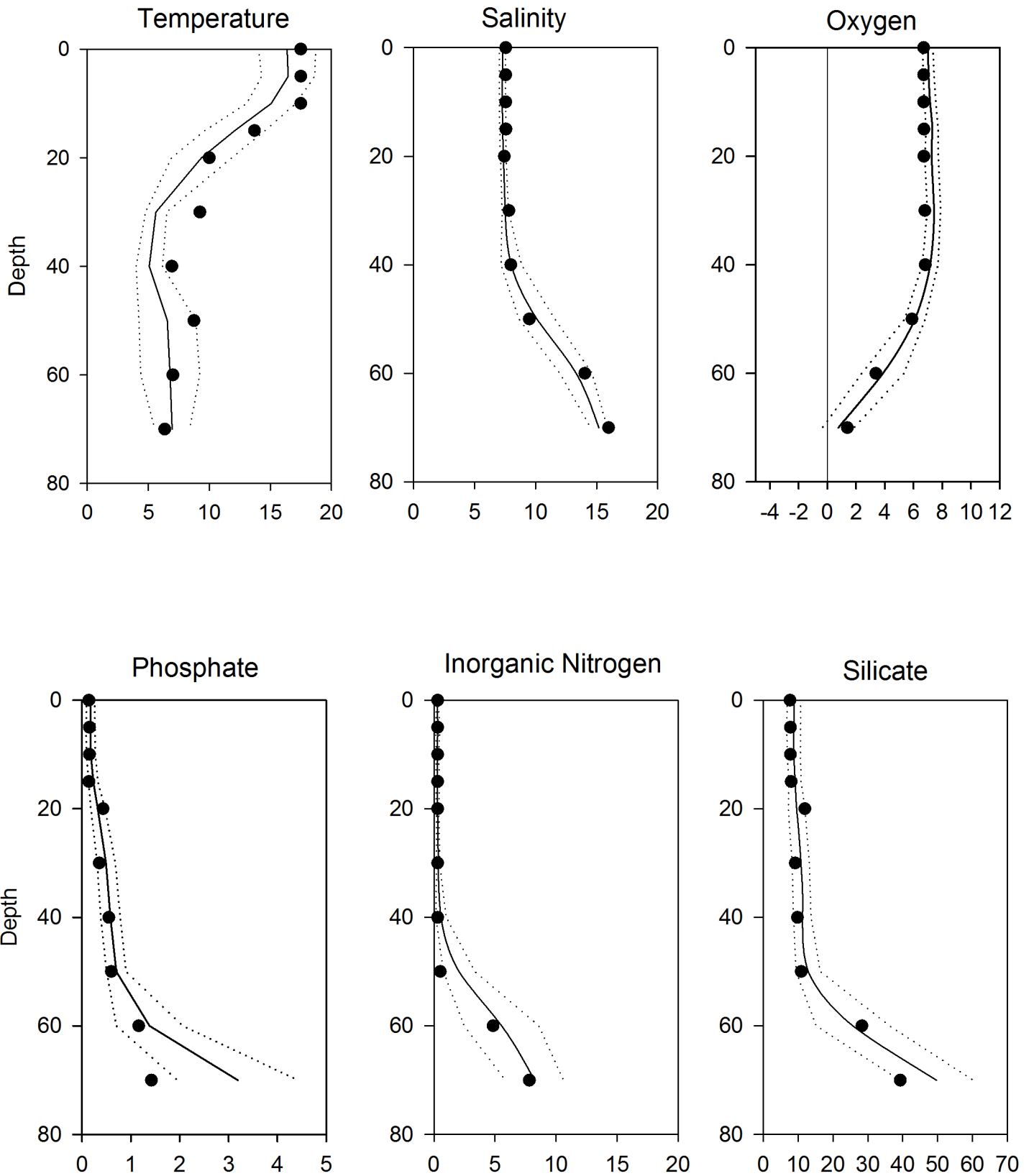


OXYGEN IN BOTTOM WATER (depth > 70m)



Vertical profiles Hanöbukten July

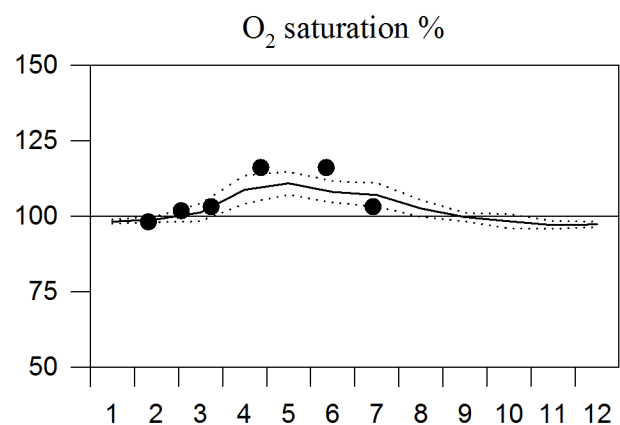
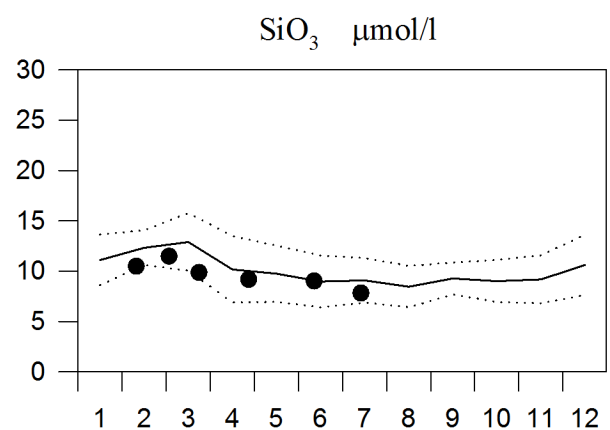
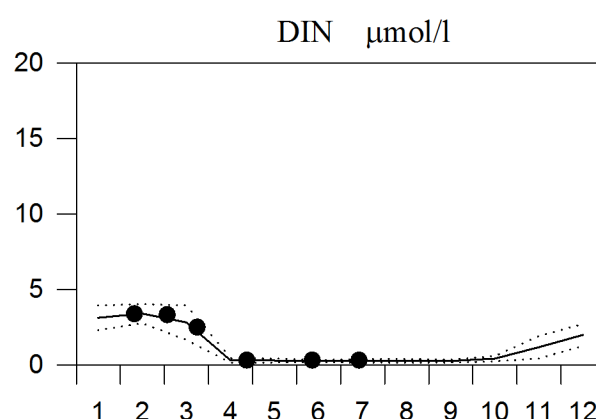
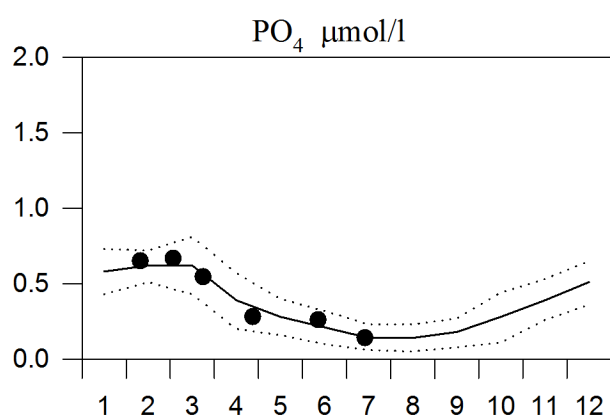
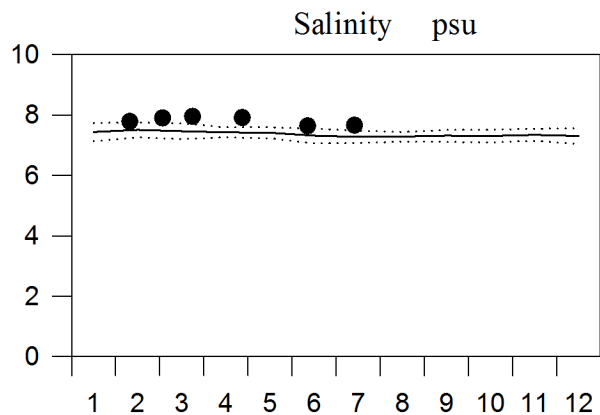
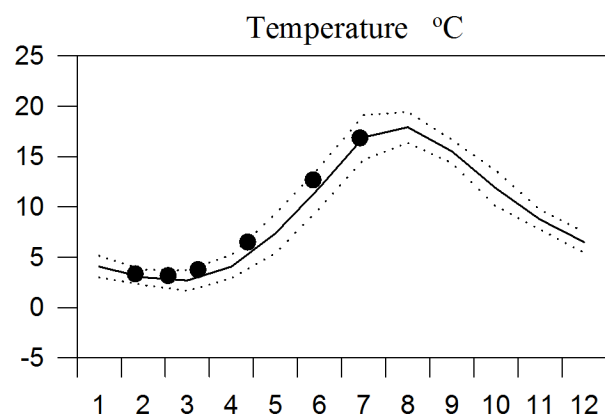
— Mean 1996-2010 St.Dev. ● 2014



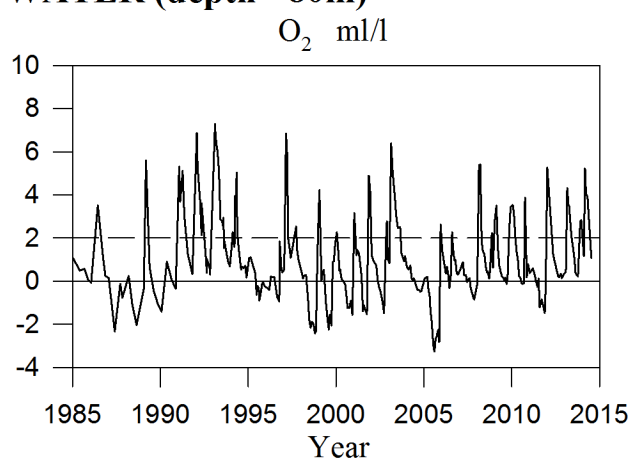
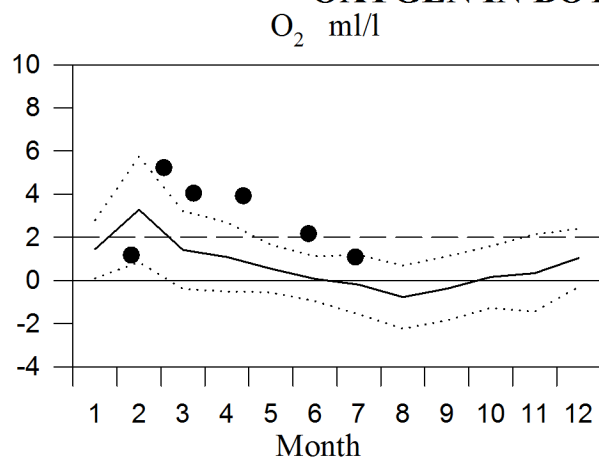
STATION BY4 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



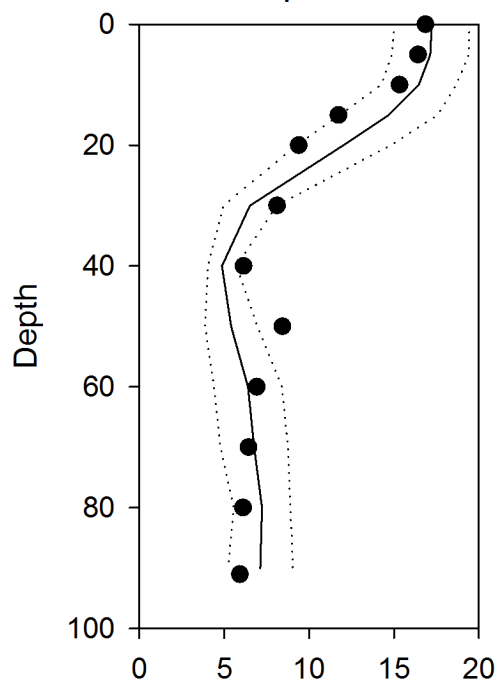
OXYGEN IN BOTTOM WATER (depth >80m)



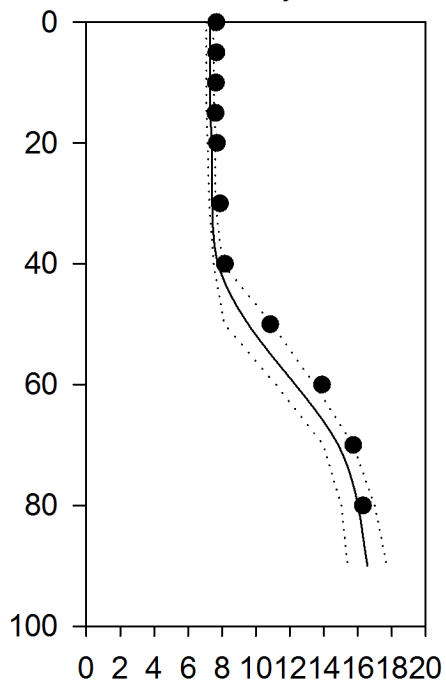
Vertical profiles BY4 July

— Mean 1996-2010 St.Dev. ● 2014

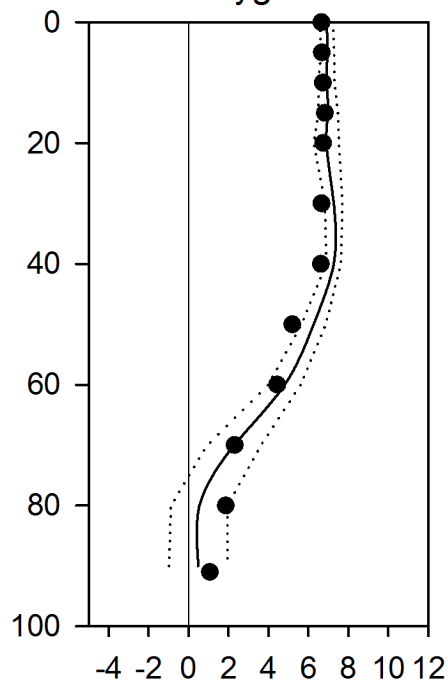
Temperature



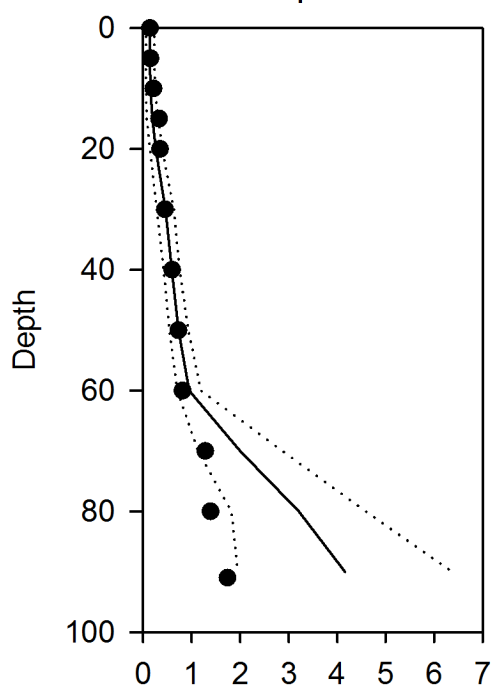
Salinity



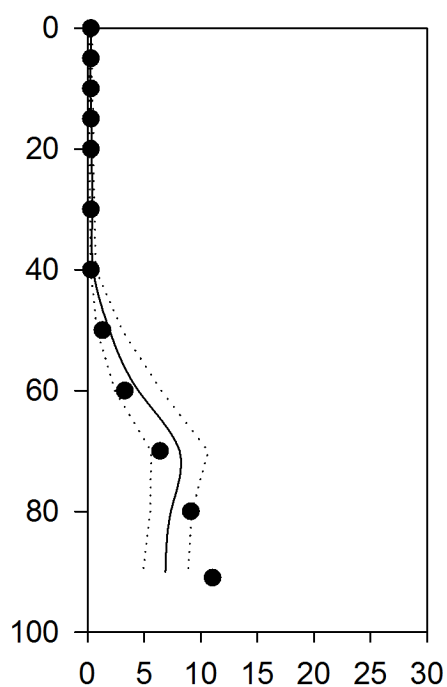
Oxygen



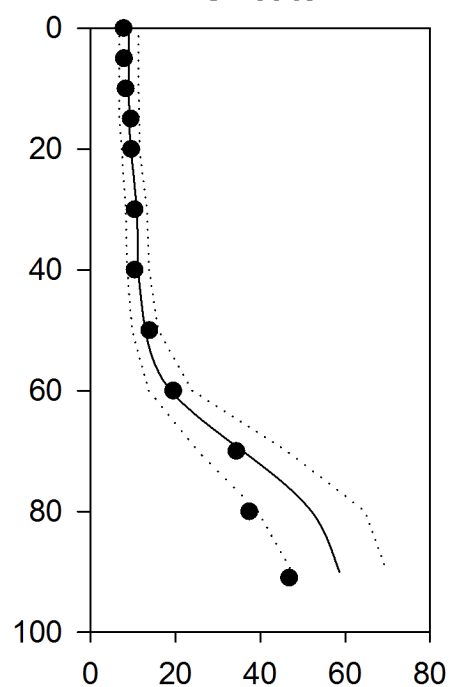
Phosphate



Inorganic Nitrogen



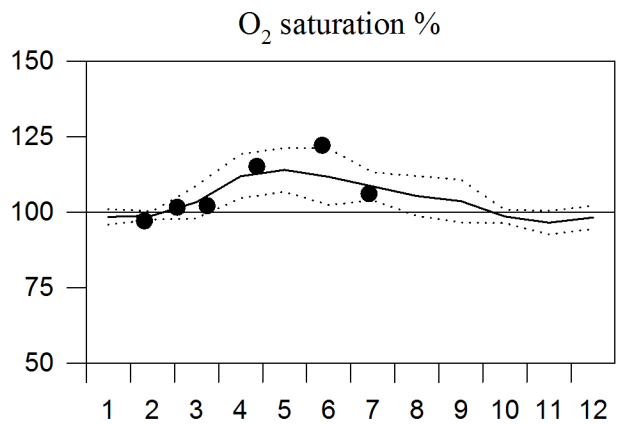
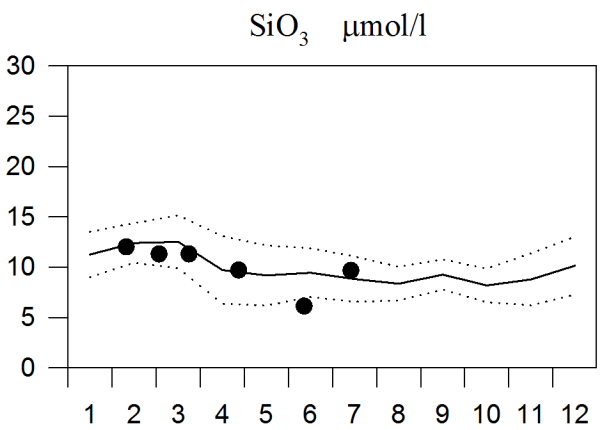
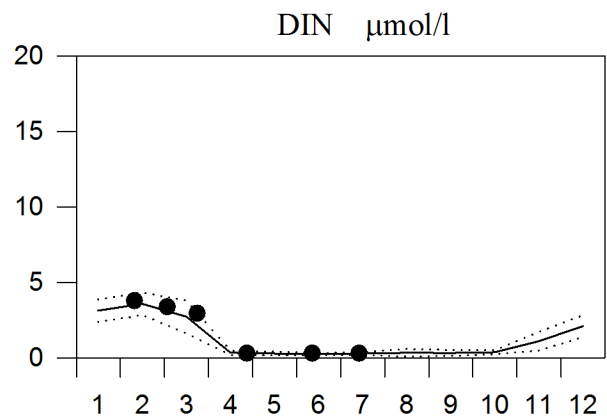
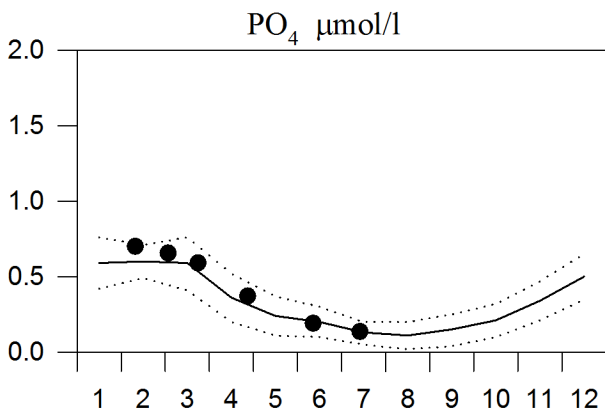
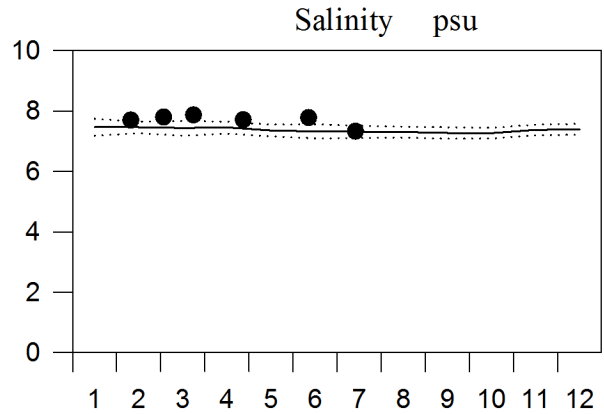
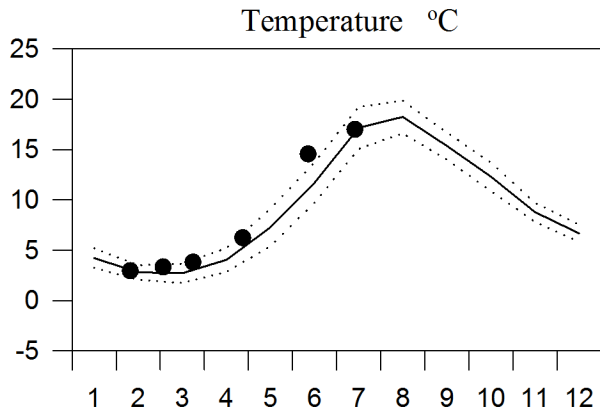
Silicate



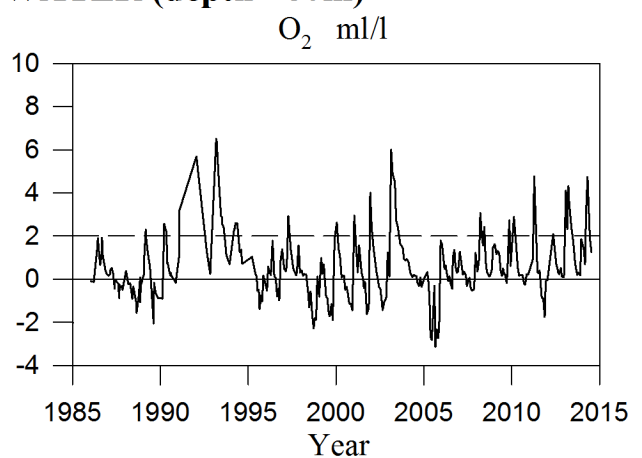
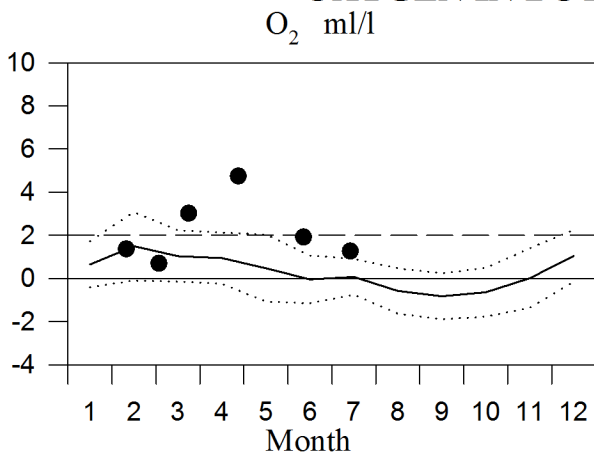
STATION BY5 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

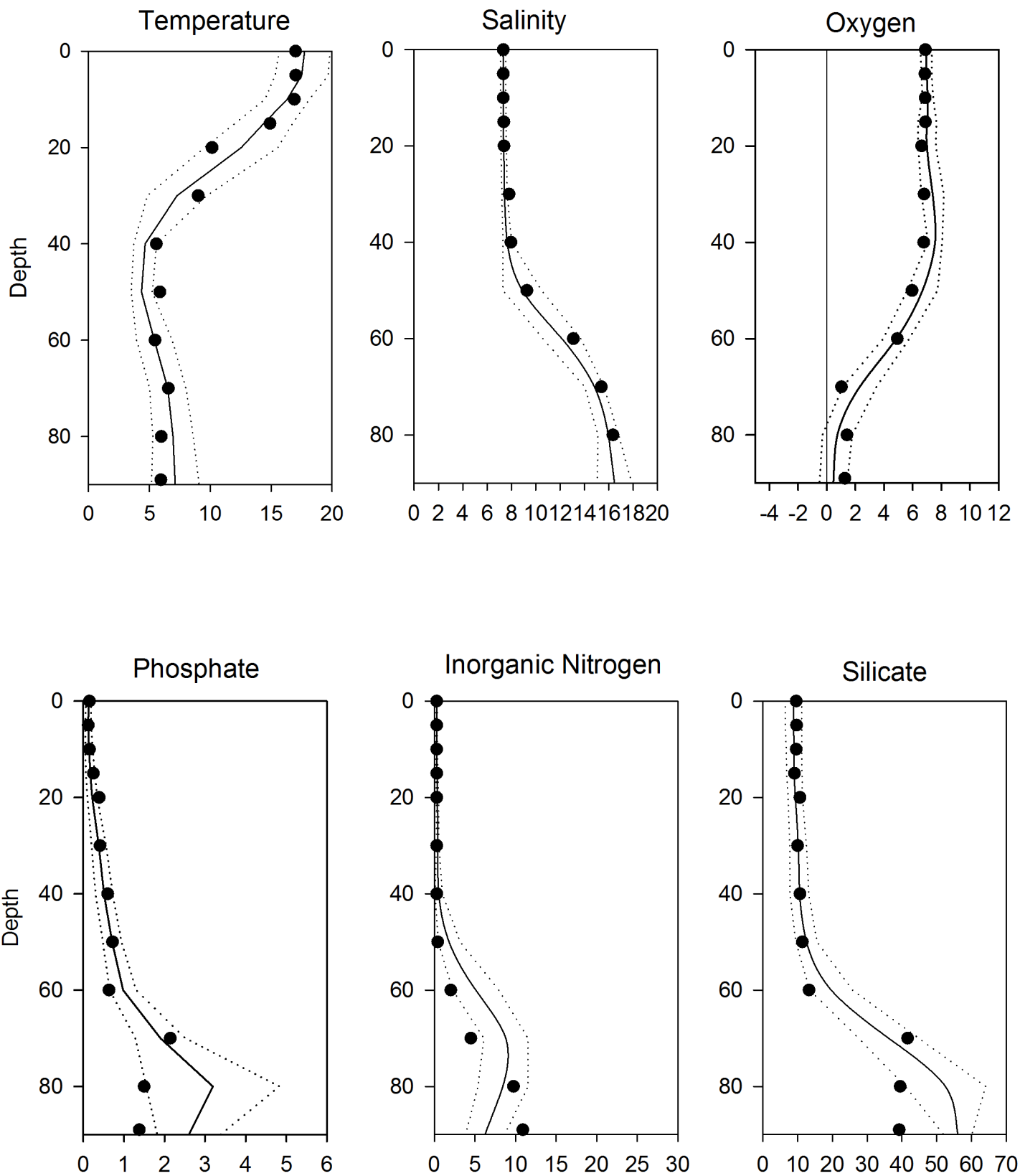


OXYGEN IN BOTTOM WATER (depth >80m)



Vertical profiles BY5 July

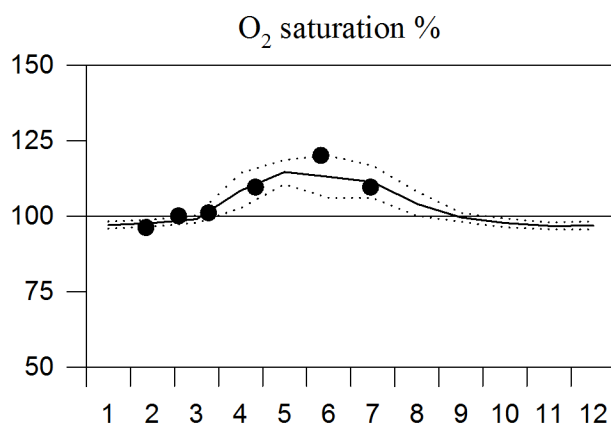
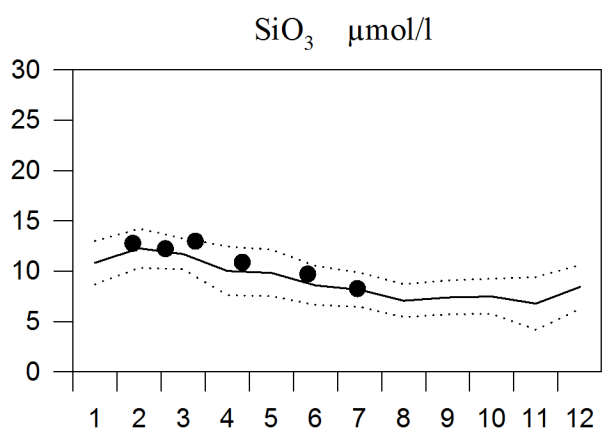
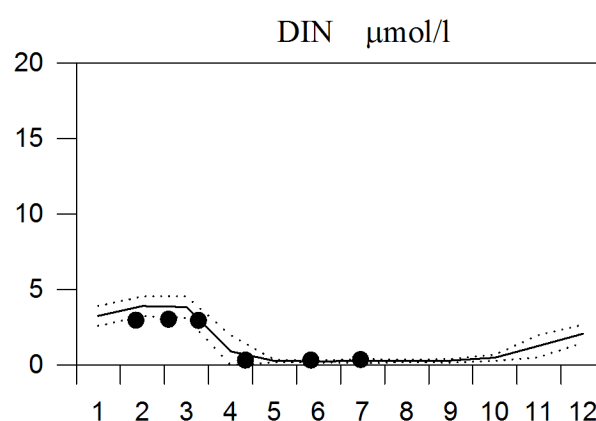
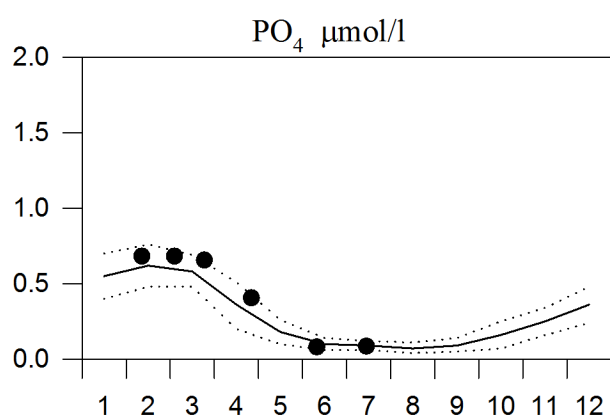
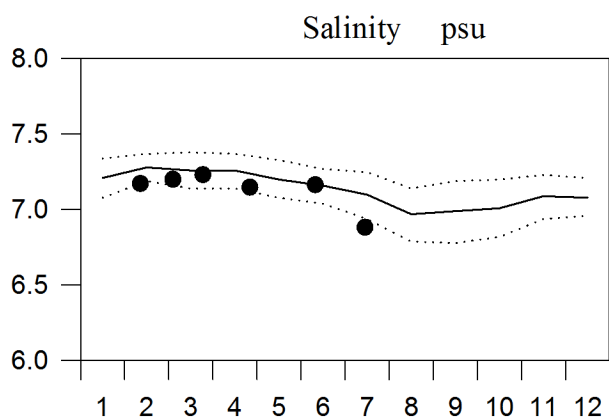
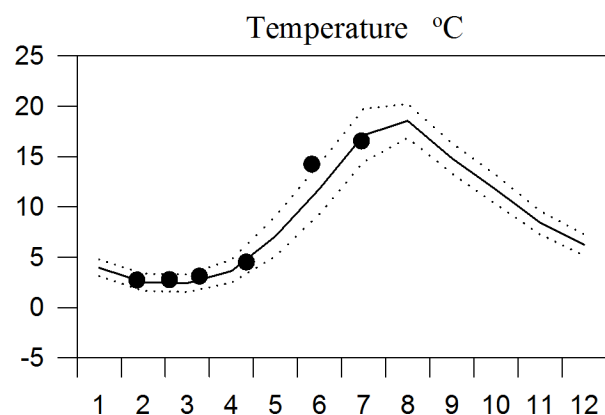
— Mean 1996-2010 St.Dev. ● 2014



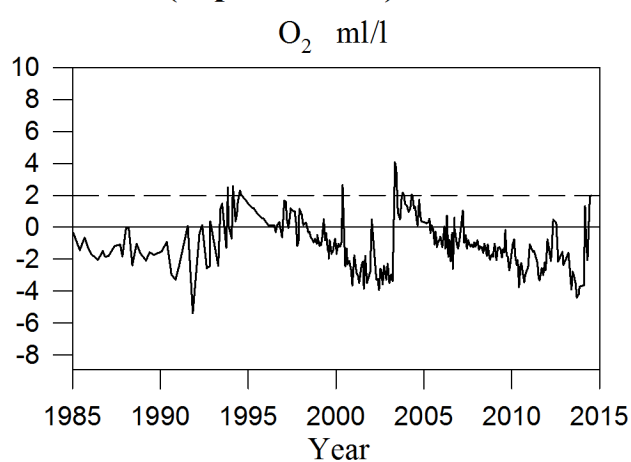
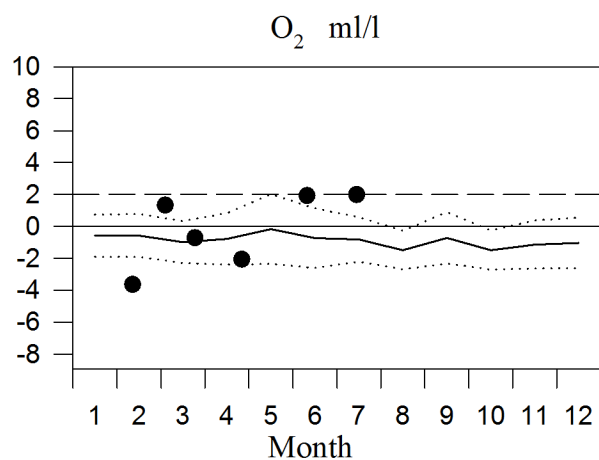
STATION BY10 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

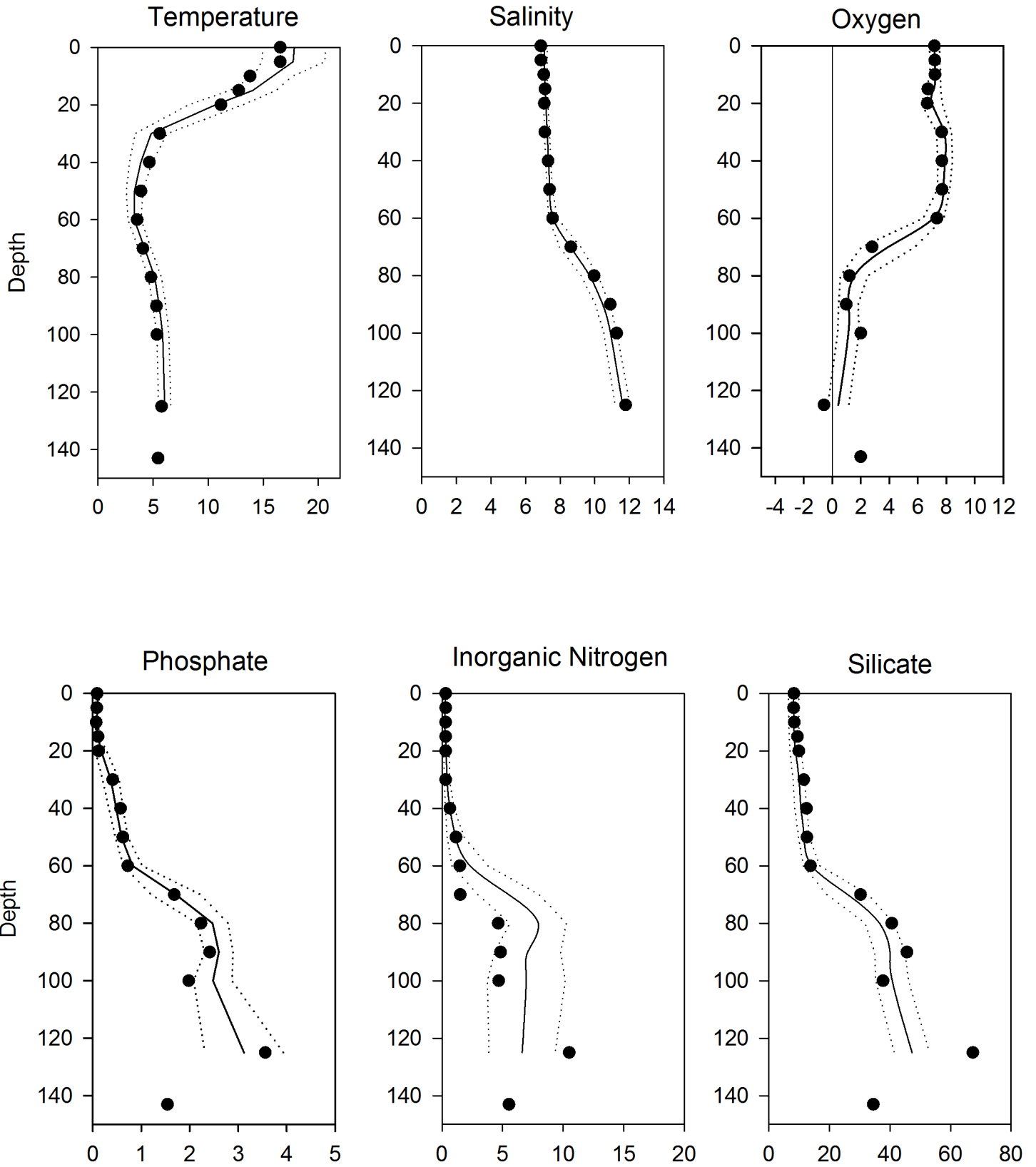


OXYGEN IN BOTTOM WATER (depth >125m)



Vertical profiles BY10 July

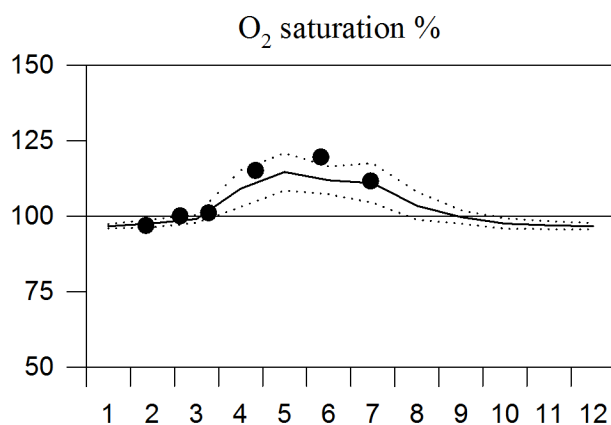
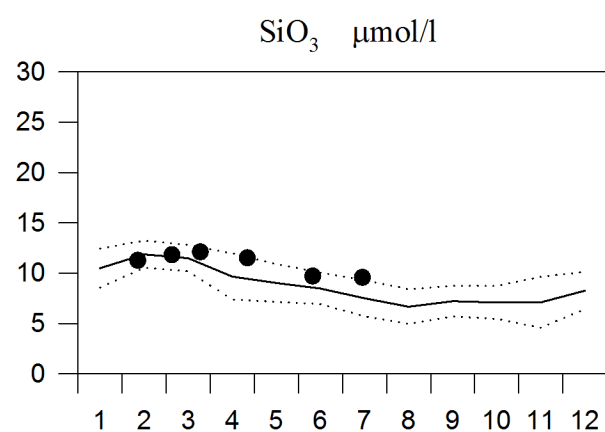
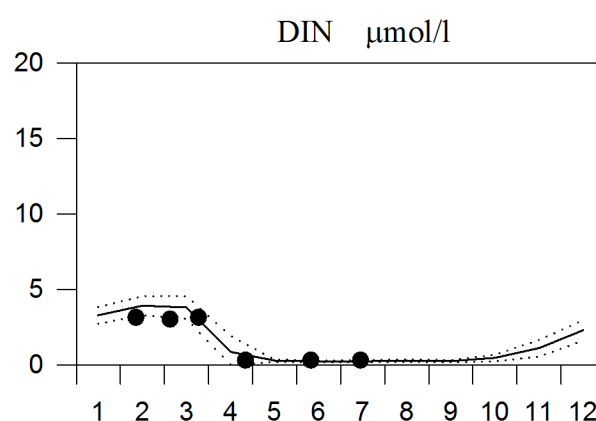
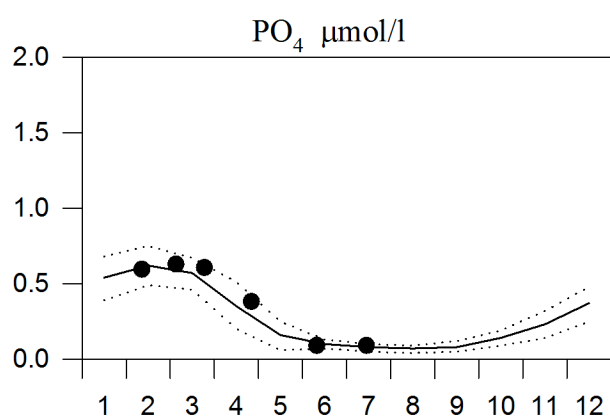
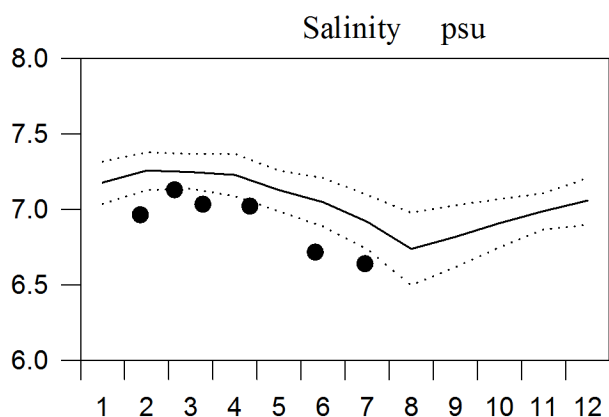
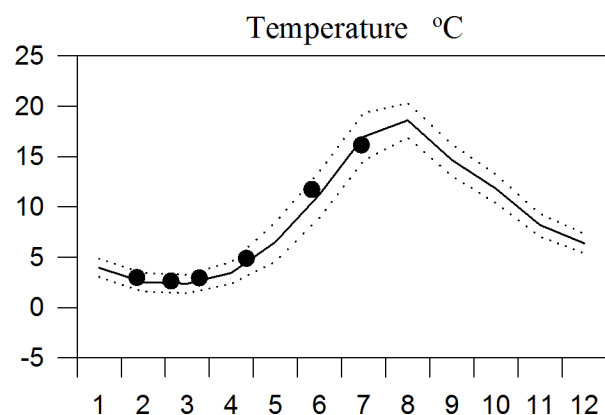
— Mean 1996-2010 St.Dev. ● 2014



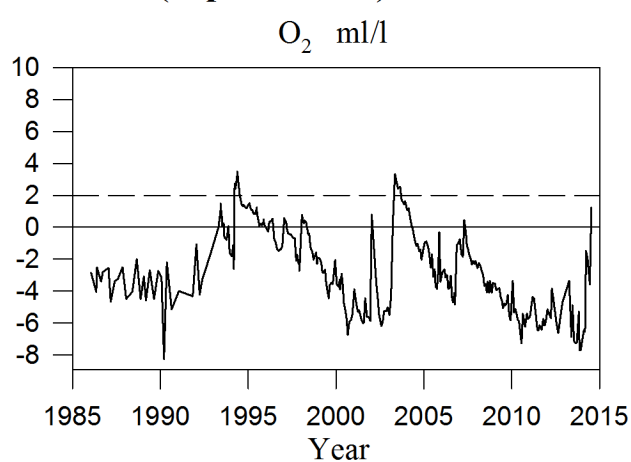
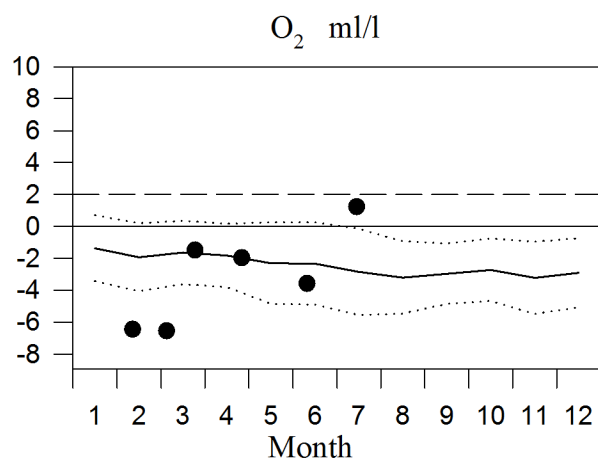
STATION BY15 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



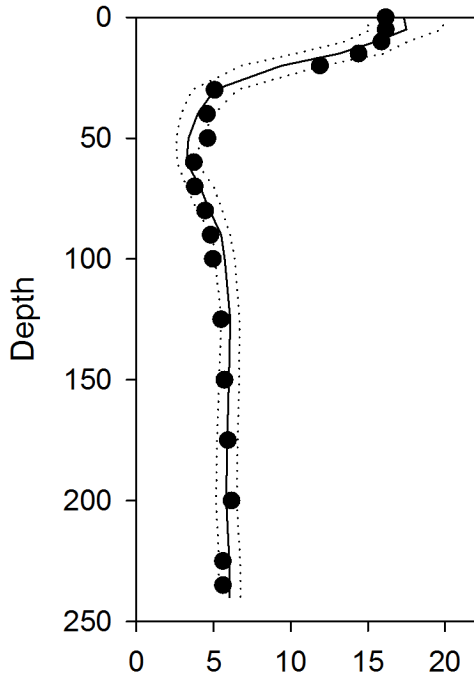
OXYGEN IN BOTTOM WATER (depth >225m)



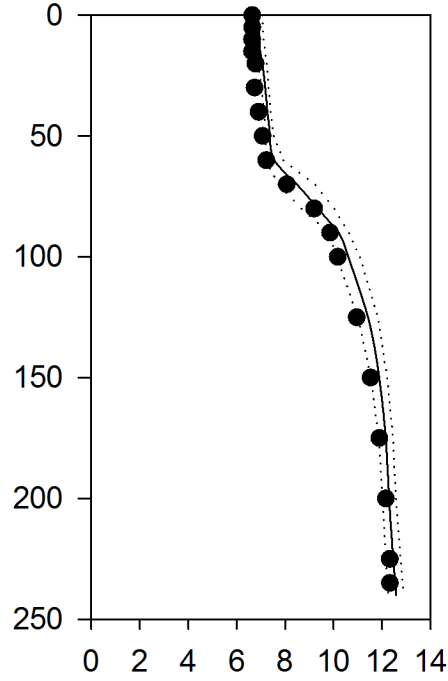
Vertical profiles BY15 July

— Mean 1996-2010 St.Dev. ● 2014

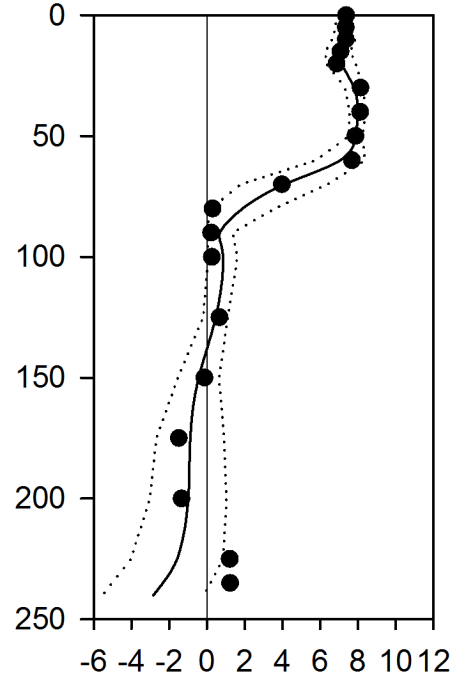
Temperature



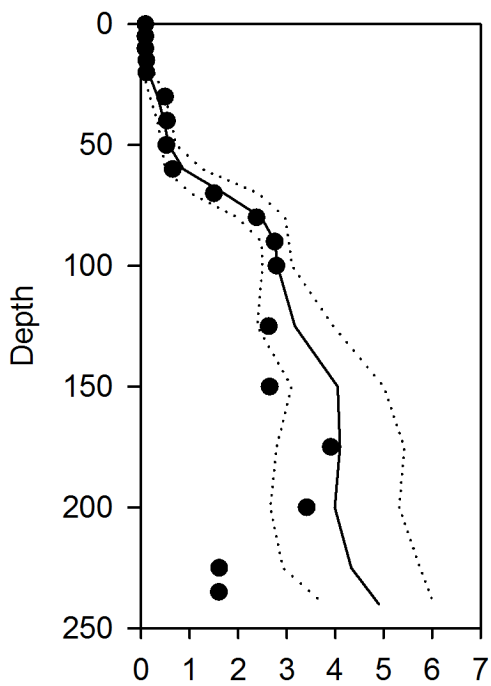
Salinity



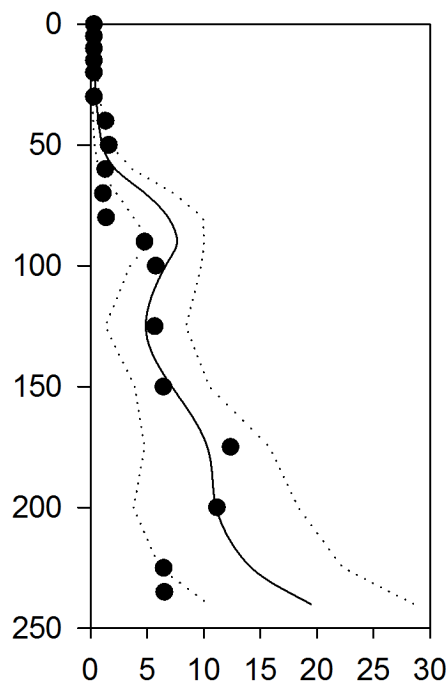
Oxygen



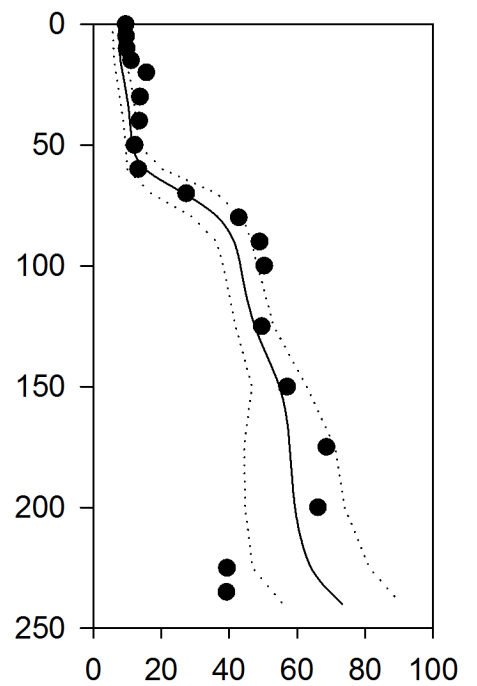
Phosphate



Inorganic Nitrogen



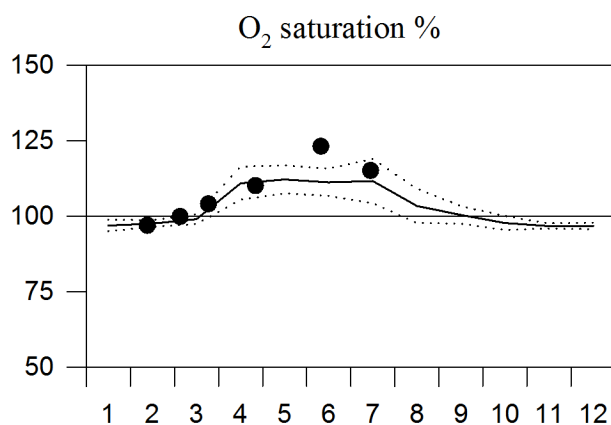
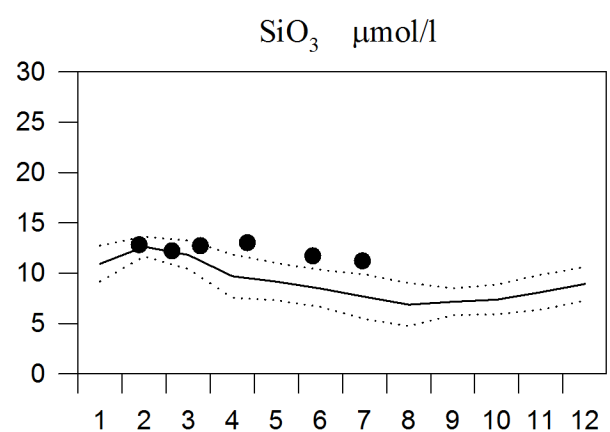
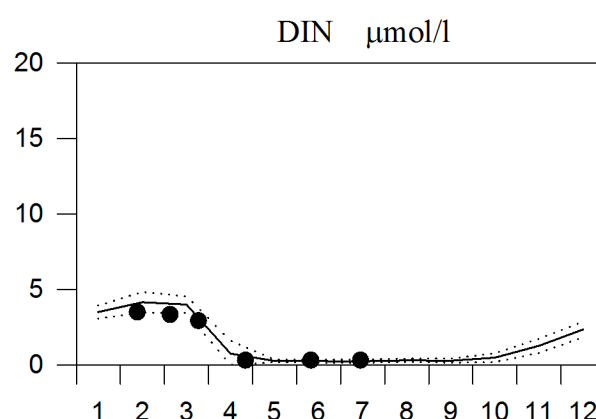
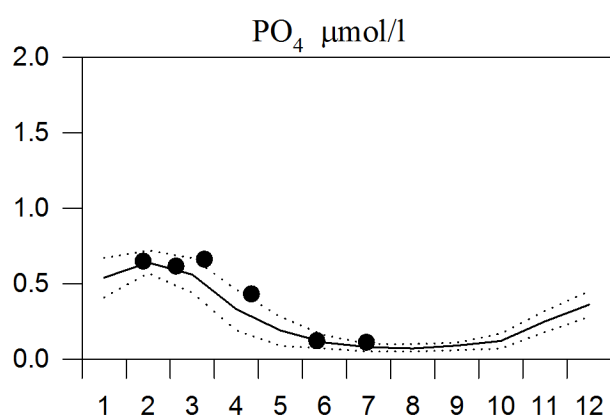
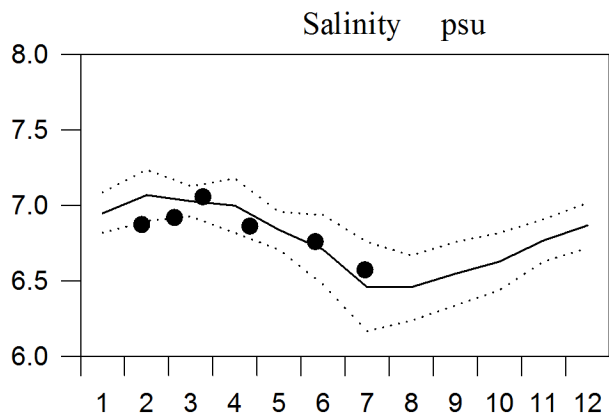
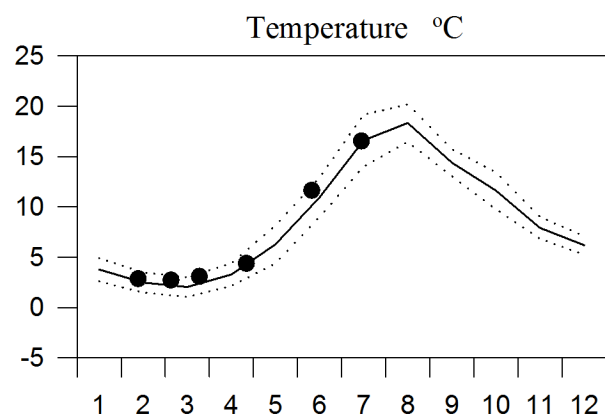
Silicate



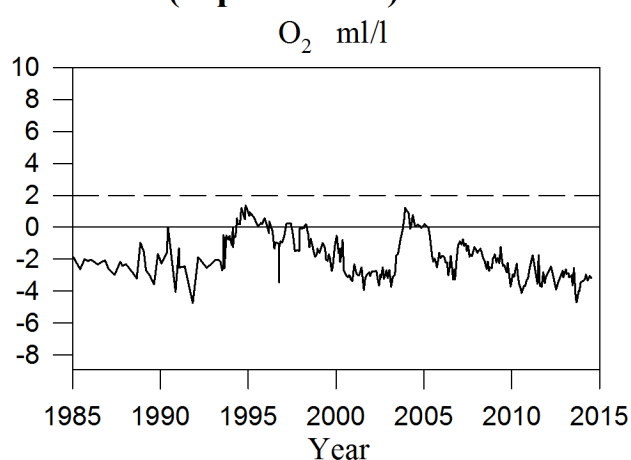
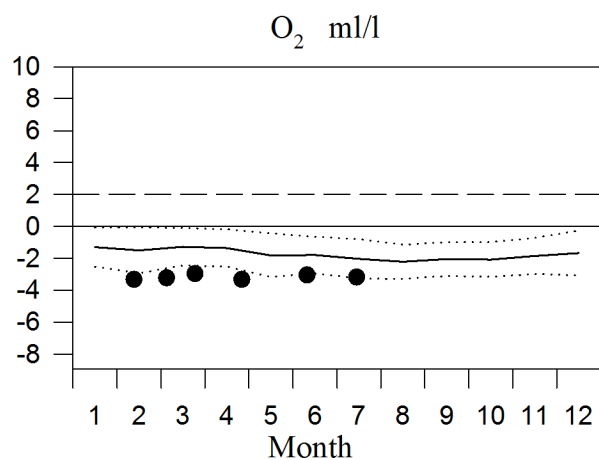
STATION BY20 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

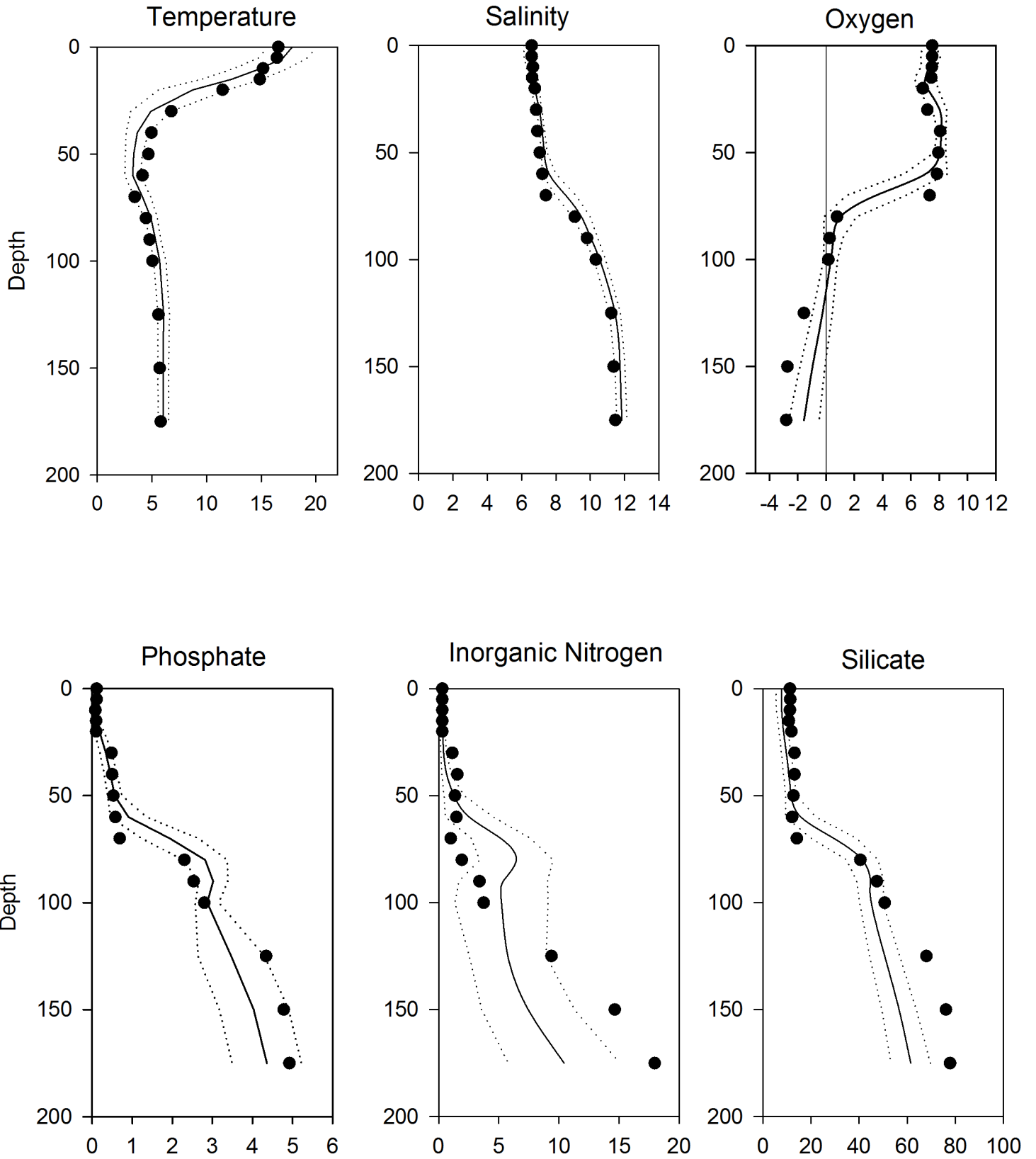


OXYGEN IN BOTTOM WATER (depth >175m)



Vertical profiles BY20 July

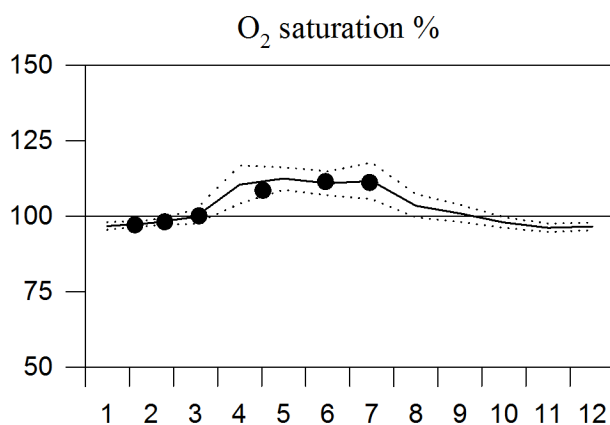
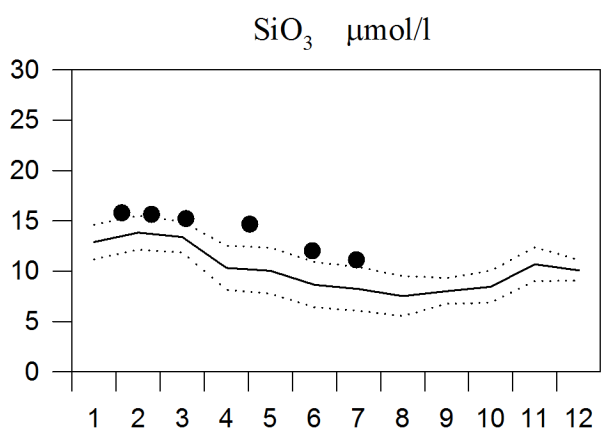
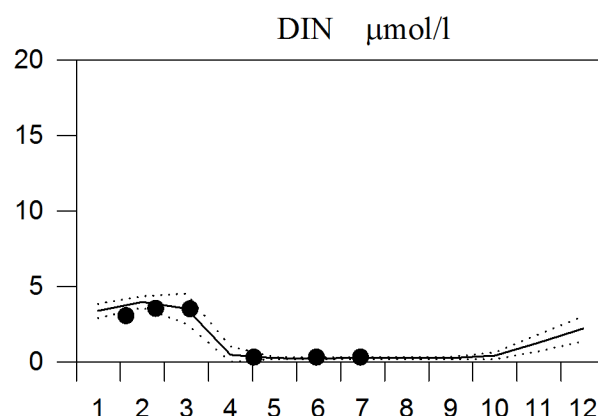
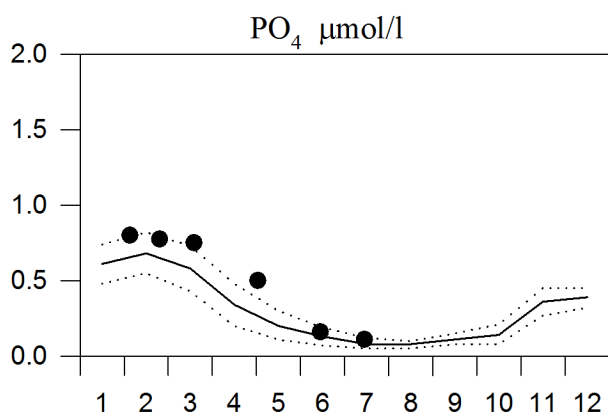
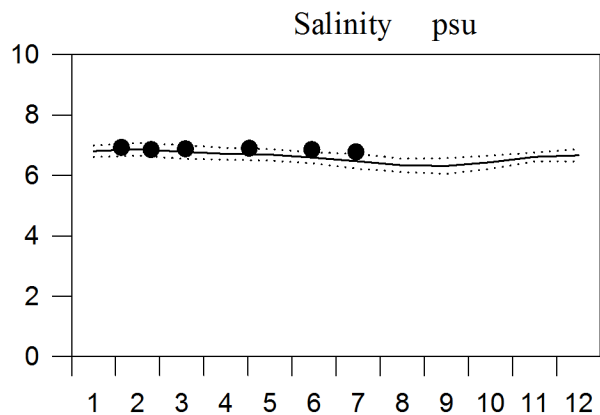
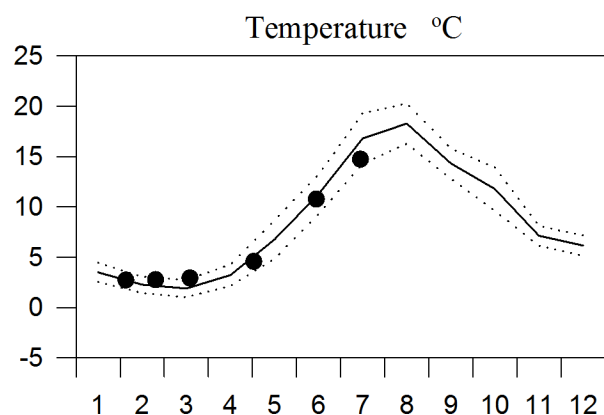
— Mean 1996-2010 St.Dev. ● 2014



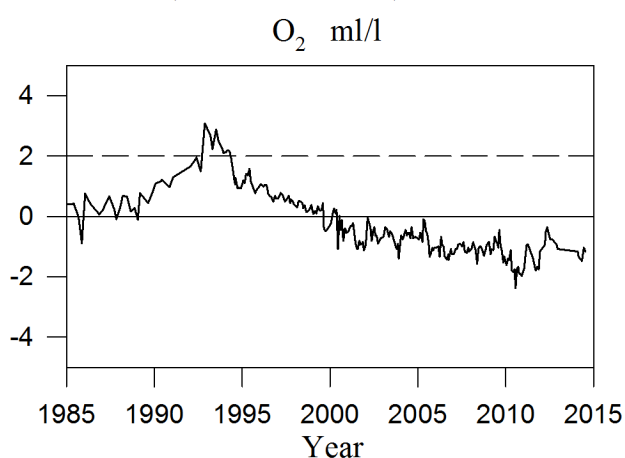
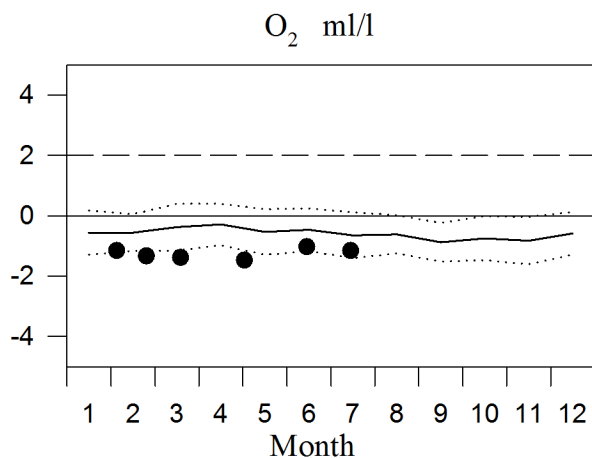
STATION BY32 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



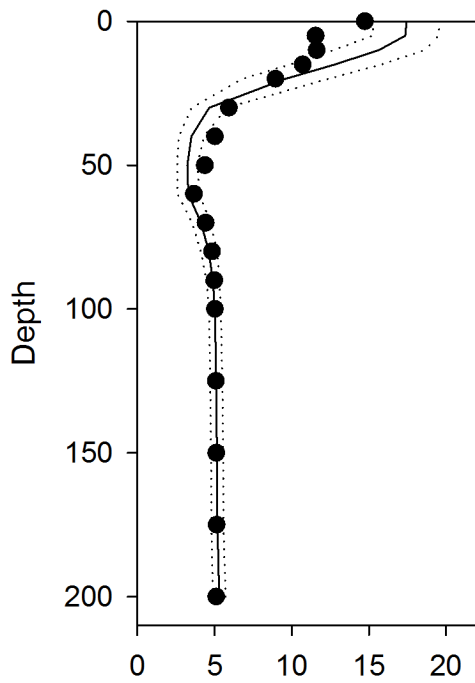
OXYGEN IN BOTTOM WATER (depth > 175m)



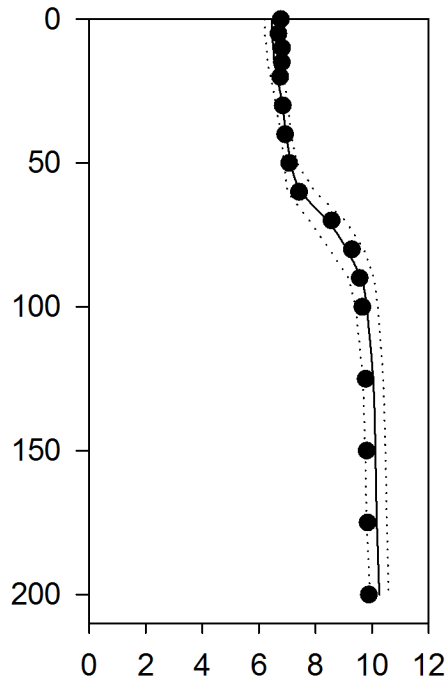
Vertical profiles BY32 July

— Mean 1996-2010 St.Dev. ● 2014

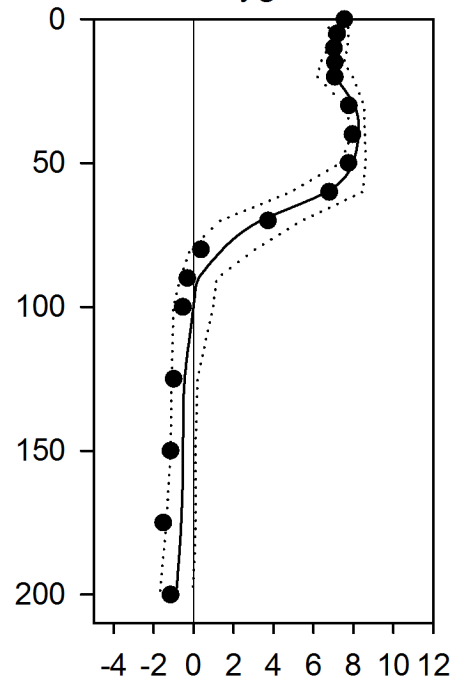
Temperature



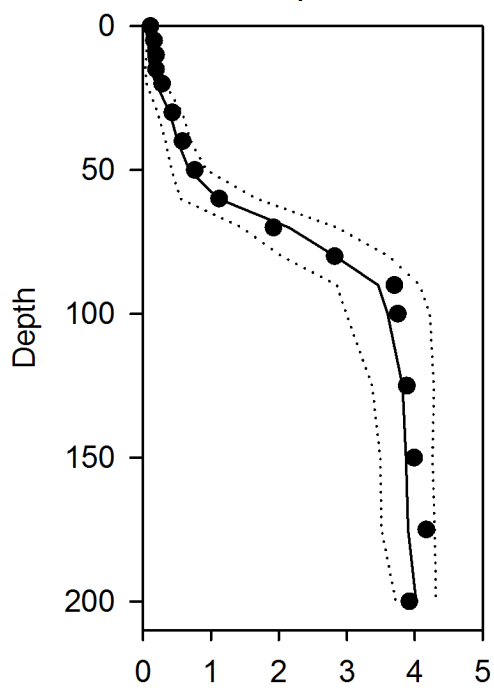
Salinity



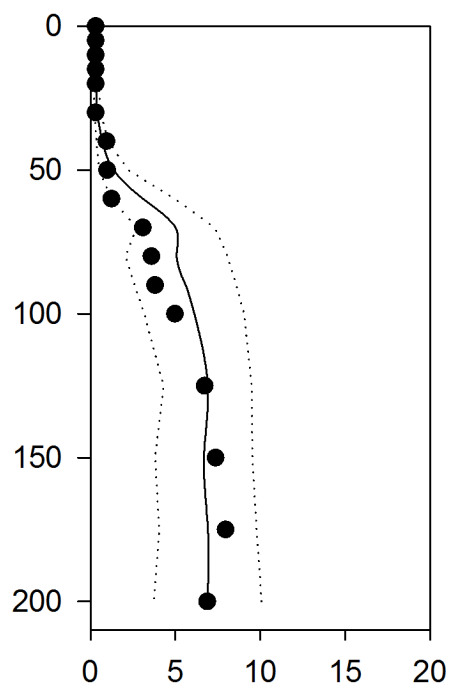
Oxygen



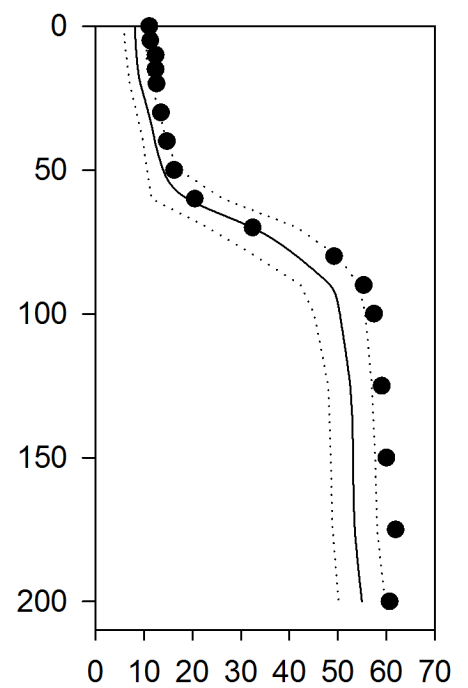
Phosphate



Inorganic Nitrogen



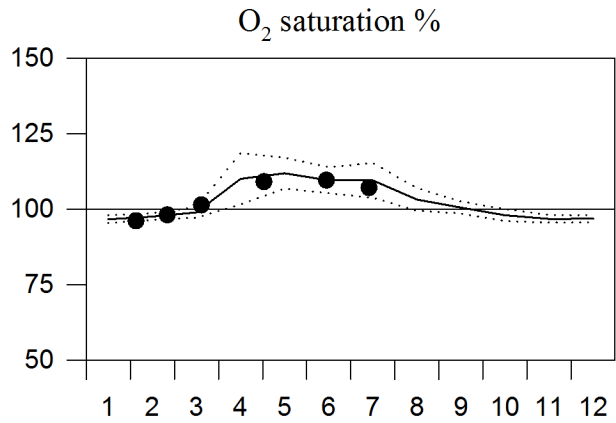
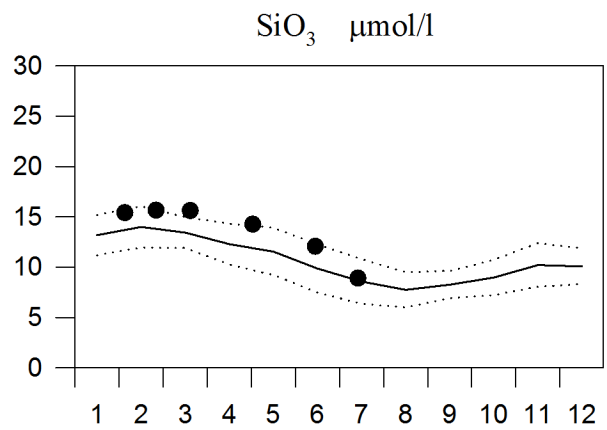
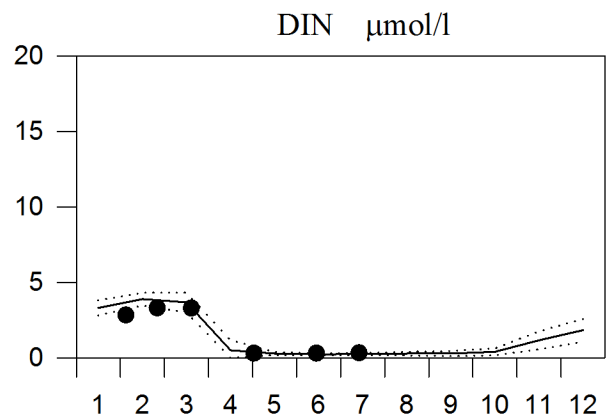
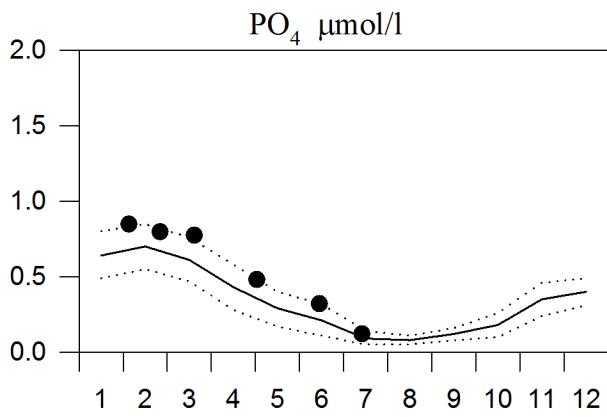
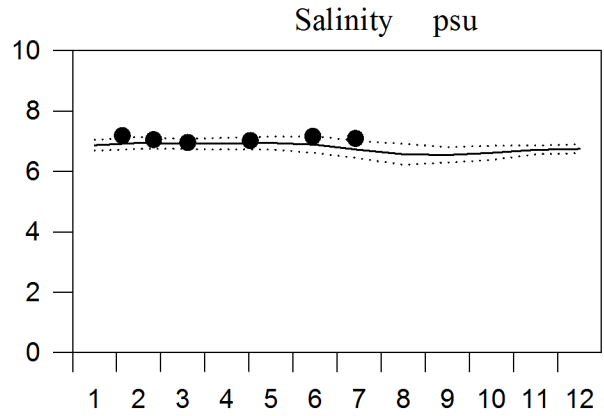
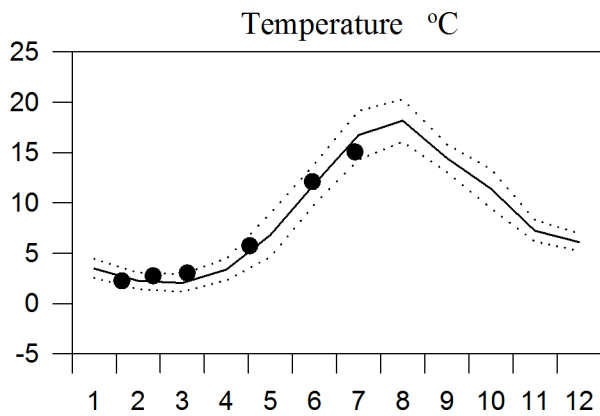
Silicate



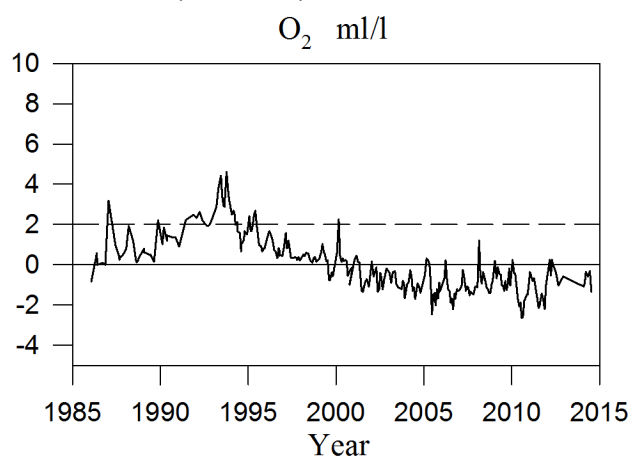
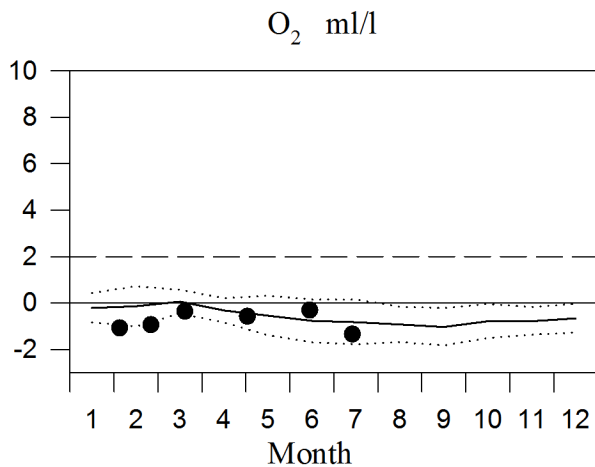
STATION BY38 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

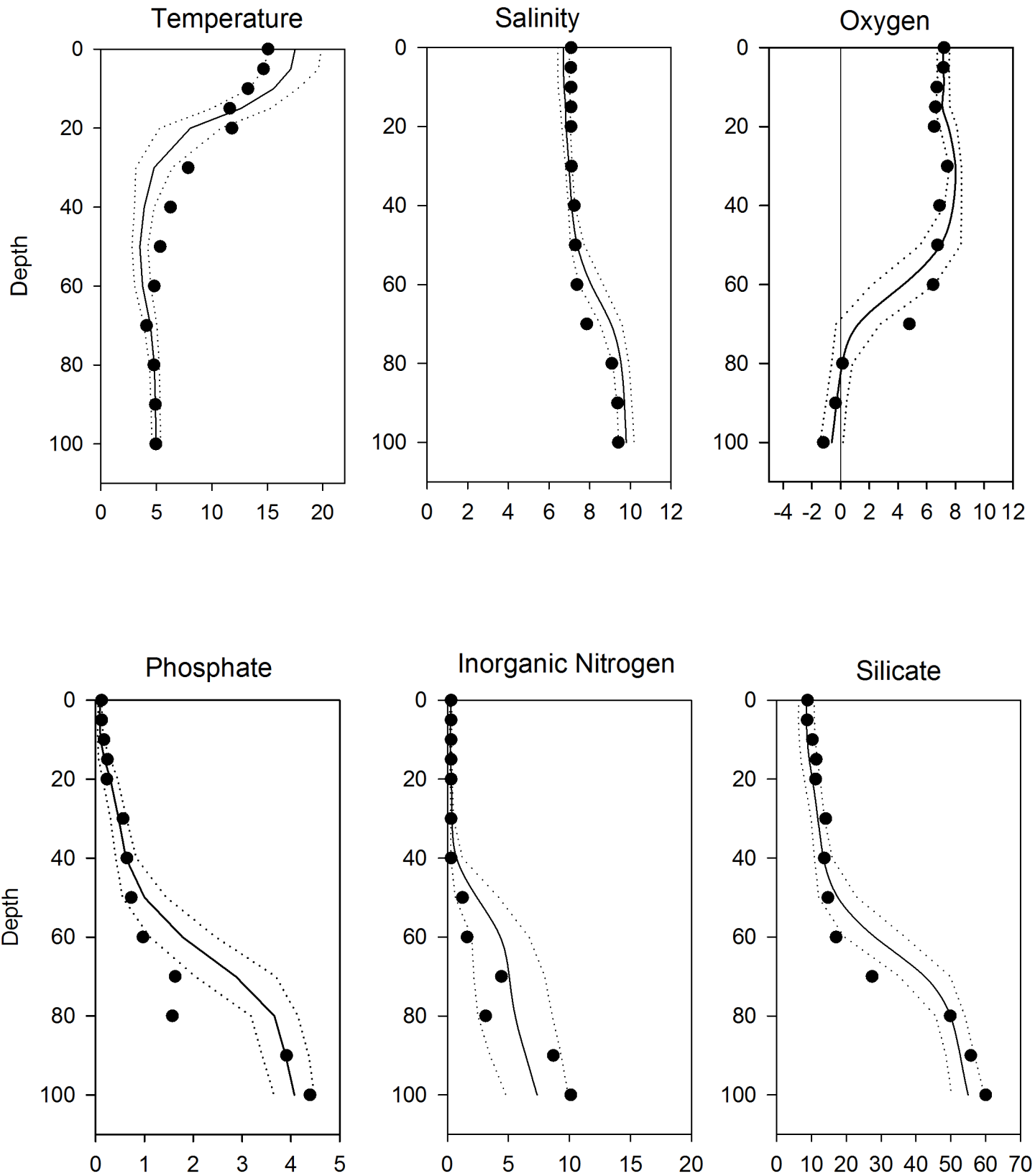


OXYGEN IN BOTTOM WATER (> 100m)



Vertical profiles BY38 July

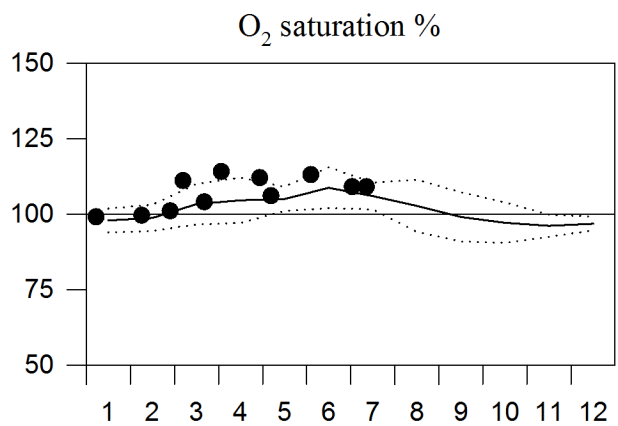
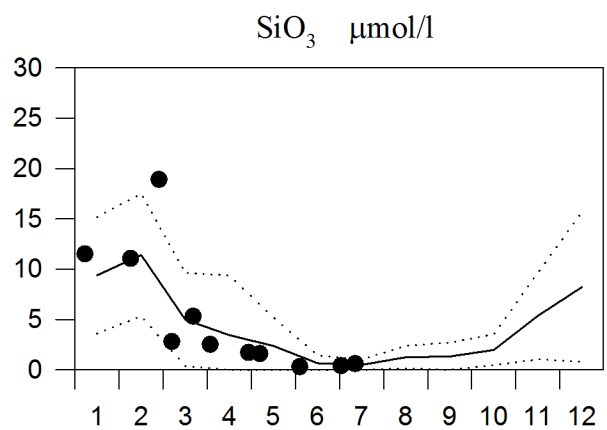
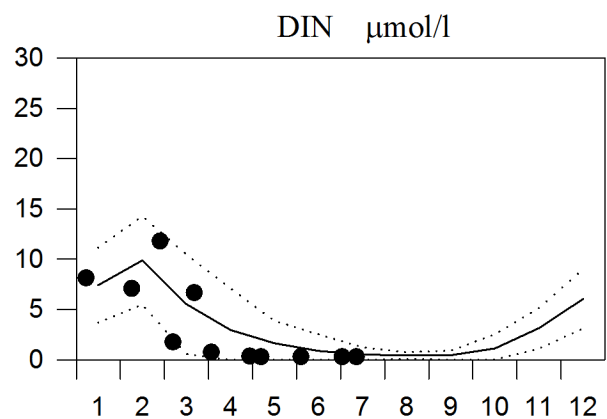
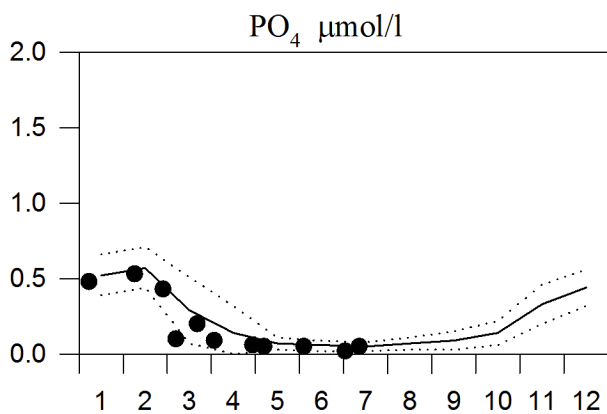
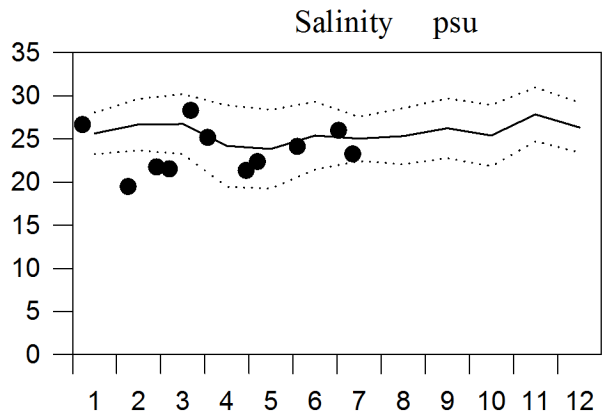
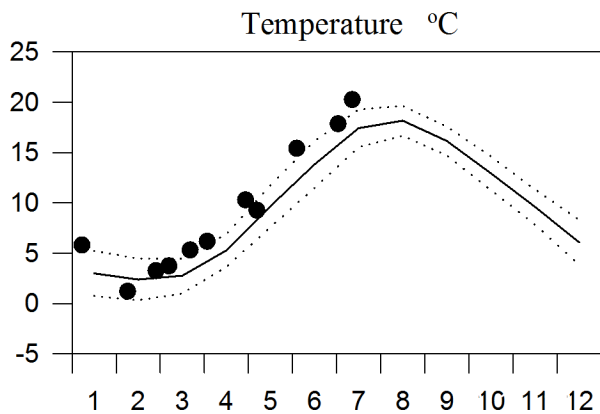
— Mean 1996-2010 St.Dev. ● 2014



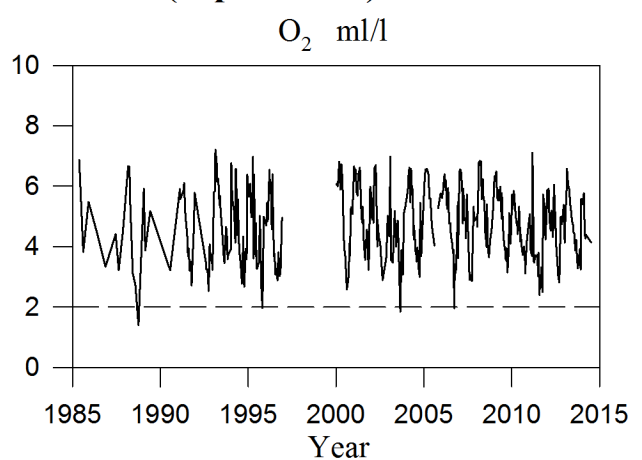
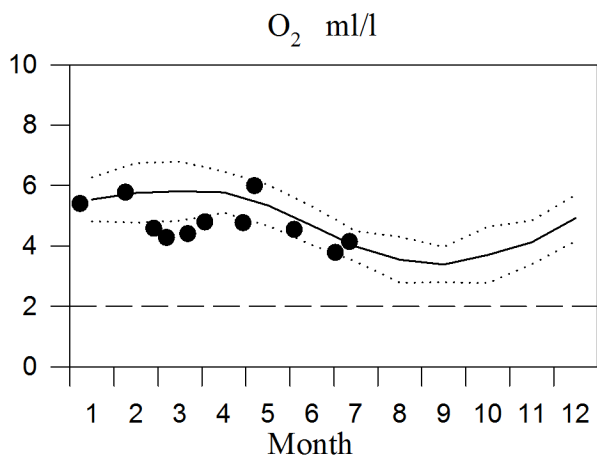
STATION SLÄGGÖ SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014

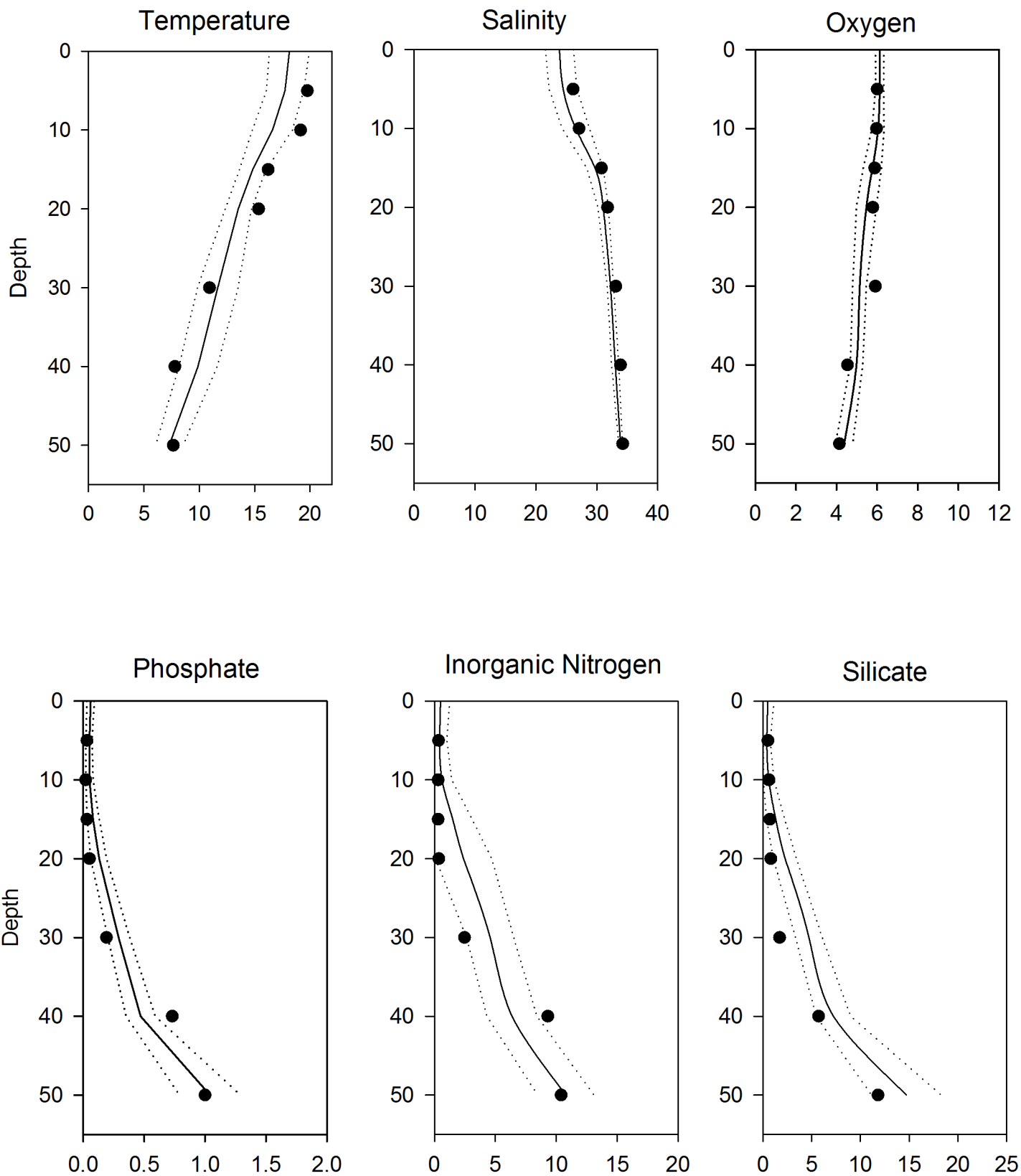


OXYGEN IN BOTTOM WATER (depth >50m)



Vertical profiles Släggö July

— Mean 1996-2010 St.Dev. ● 2014



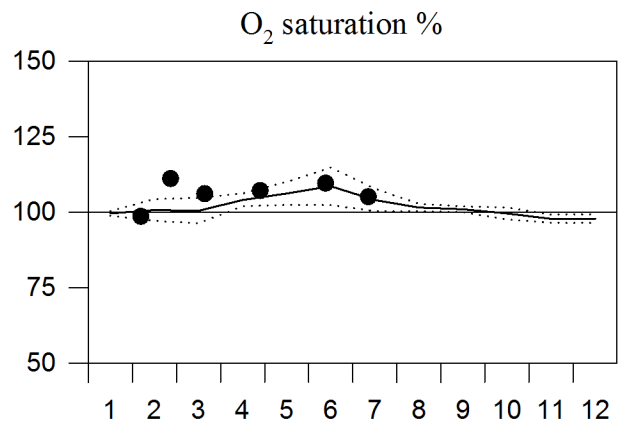
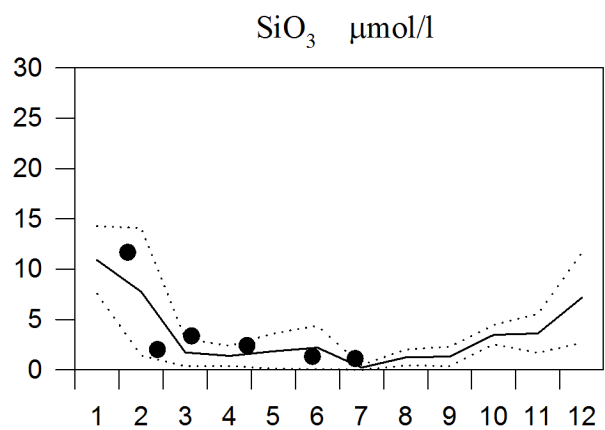
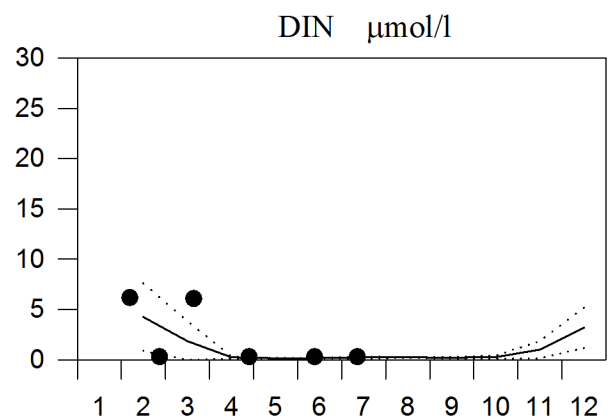
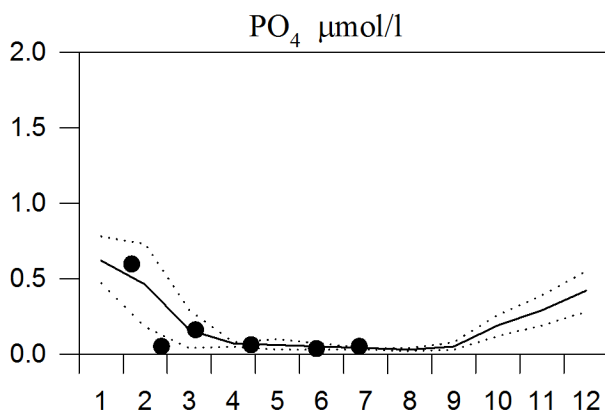
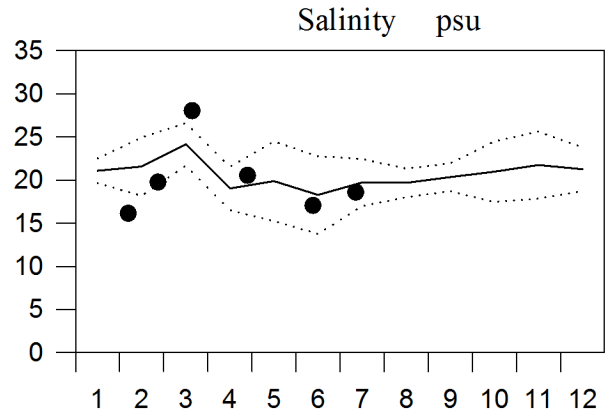
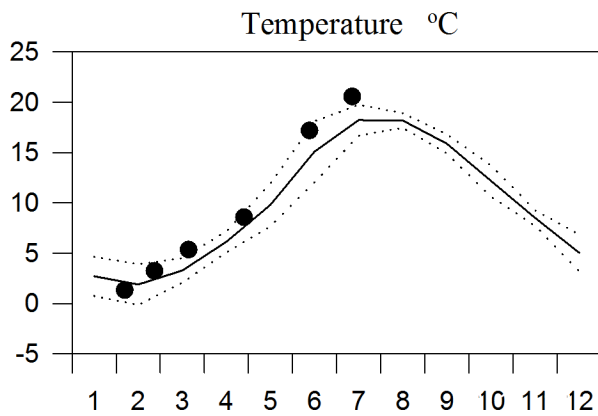
STATION N14 Falkenberg SURFACE WATER

Annual Cycles

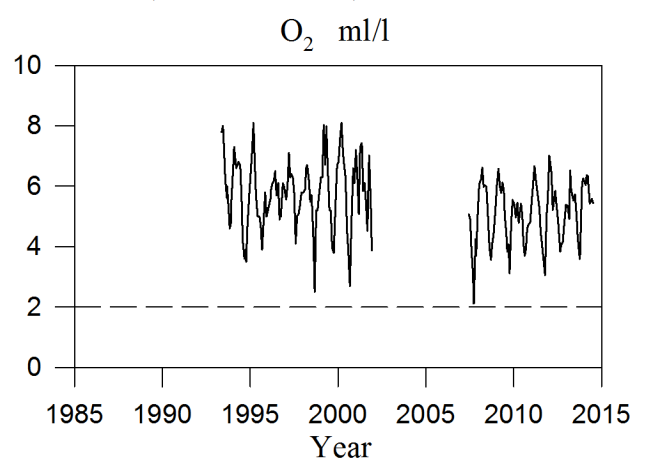
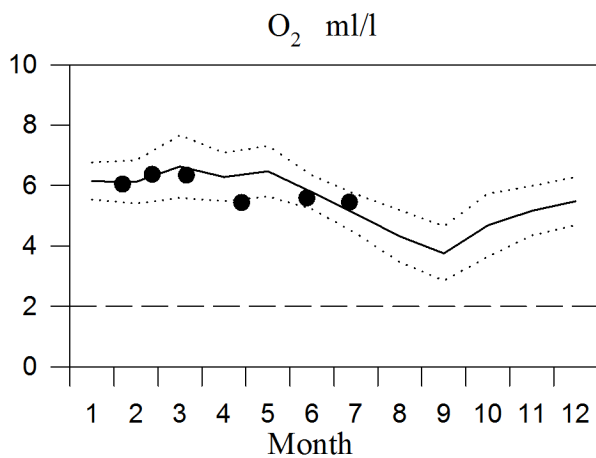
— Mean 2007-2010

..... St.Dev.

● 2014

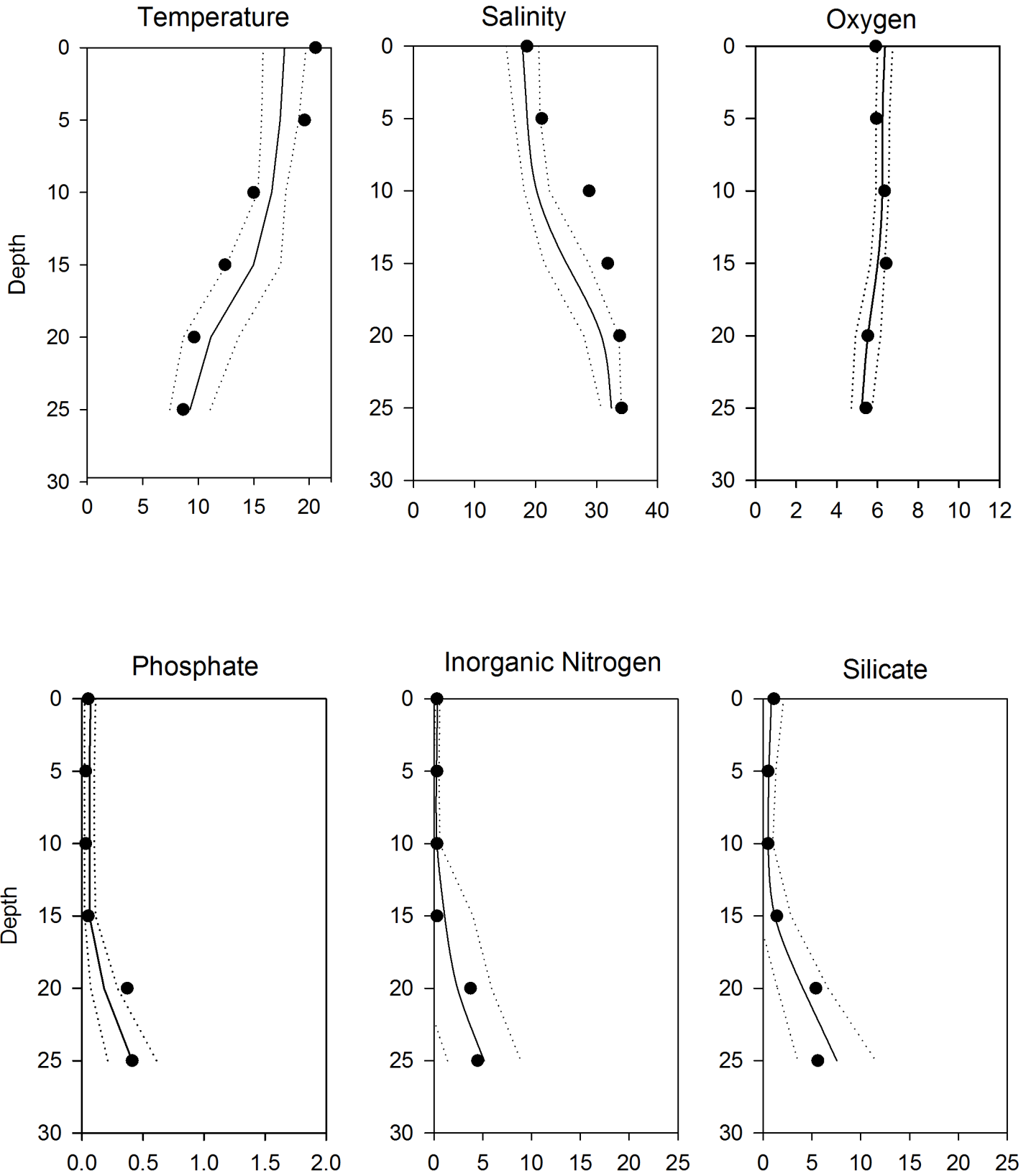


OXYGEN IN BOTTOM WATER (depth > 25m)



Vertical profiles N14 Falkenberg July

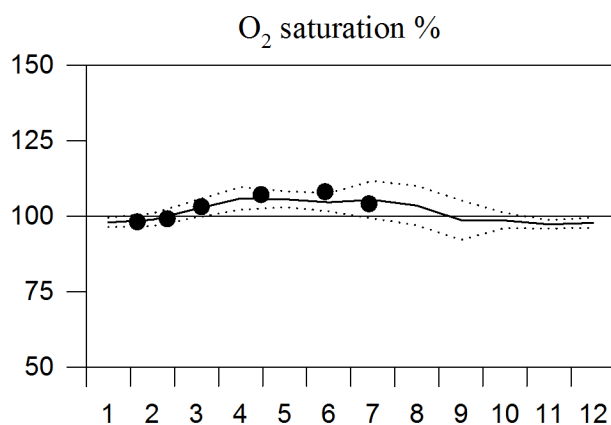
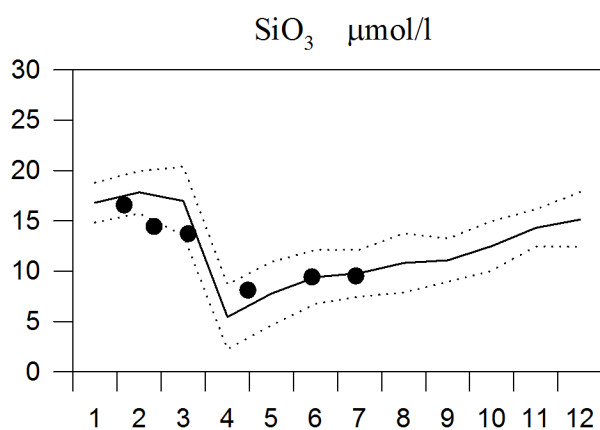
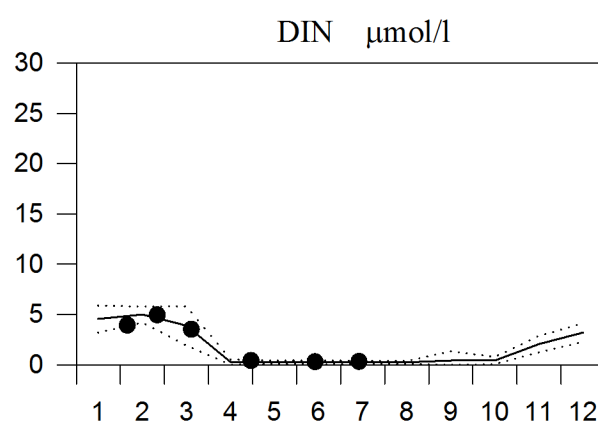
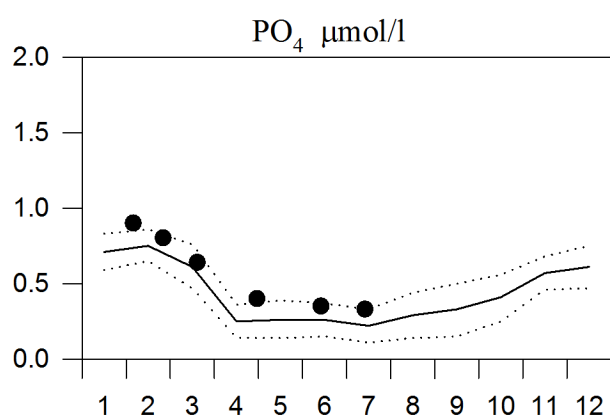
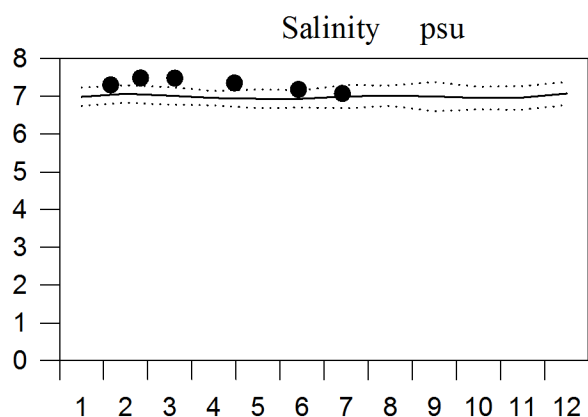
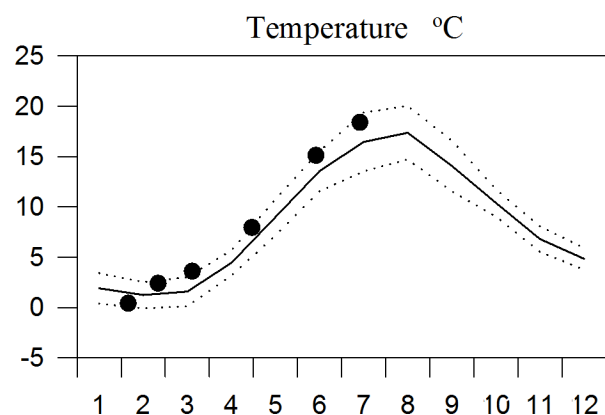
— Mean 1996-2010 St.Dev. ● 2014



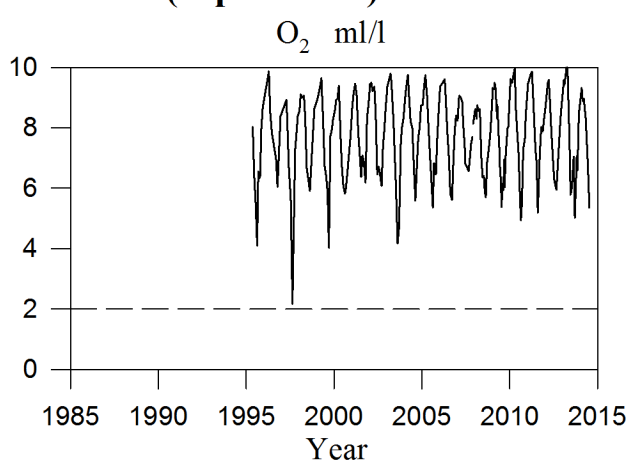
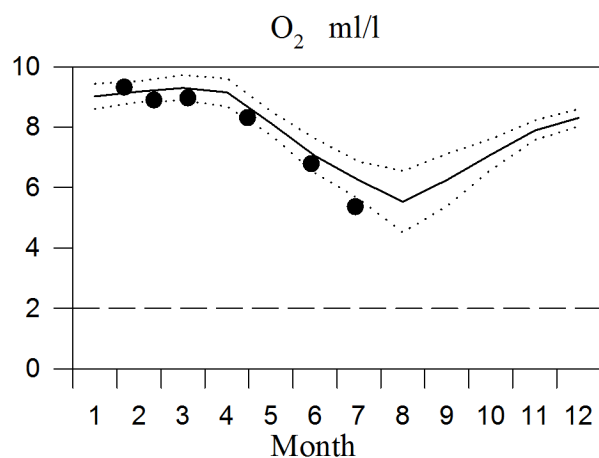
STATION REF M1V1 SURFACE WATER

Annual Cycles

— Mean 1996-2010 St.Dev. ● 2014



OXYGEN IN BOTTOM WATER (depth >15m)



Vertical profiles Ref M1V1 July

— Mean 1996-2010 St.Dev. ● 2014

