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Oceanografiska Laboratoriet

2015-06-18
Dnr: S/Gbg-2015-89

Rapport från SMHIs utsjöexpedition med R/V Aranda

Expeditionens varaktighet: 2015-06-11 - 2015-06-18
Undersökningsområde: Skagerrak, Kattegatt, Öresund och egentliga Östersjön
Uppdragsgivare: SMHI samt Havs- och Vattenmyndigheten

SAMMANFATTNING

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

Vattentemperaturen i ytlagret var i huvudsak normal för årstiden. I Västerhavet var nu vårblomningen över och närsalterna uppvisade låga koncentrationer. Oorganiskt kväve var under detektionsgränsen medan det var små mängder fosfat kvar. I Östersjön rådde måttlig planktonaktivitet. Oorganiskt kväve var under detektionsgränsen och fosfat- samt silikathalten var högre än normalt.
Effekterna av inflödet under december 2014 hade nu spridit sig till den nordöstra delen av östra Gotlandsbassängen. Bottenvattnet i Bornholmsbassängen och Hanöbukten var fortfarande syresatta men koncentrationen av syre var lägre än vid förra mättillfället. I västra Gotlandsbassängen var syresituationen dock fortfarande allvarlig då akut syrebrist förekom från djup överstigande 60 - 70 meter och svavelväte från ca 90 meters djup.

Nästa ordinarie expedition är planerad till vecka 30 i juli 2015.

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PRELIMINÄRA RESULTAT

Expeditionen genomfördes ombord det finska forskningsfartyget Aranda och startade i Helsingfors den 11:e juni och avslutades i samma hamn den 18:e.
Vindarna under expeditionen var i huvudsak svaga till måttliga. I delar av Kattegatt och Skagerrak rådde dock kulingstyrka. Lufttemperaturen varierade mellan 10.1 och 16.2°C.

Skagerrak

Salthalten i ytlagret uppvisade små variationer kring 30 psu. Ytvattentemperaturen var normal för årstiden och låg mellan 12.4 och 13.2 °C. Haloklinen och termoklinen återfanns på omkring 10-20 meters djup.
Närsalterna i ytvattnet var nu i stort sett förbrukade i utsjön medan de var något högre vid kusten. Fosfatkoncentrationerna i utsjöns ytvatten låg i intervallet 0.02 och 0.04 µmol/l, nitrit + nitrat var kring 0.1 µmol/l, medan halterna av silikat varierade mellan 0.3 och 1.8 µmol/l. Vid kusten var motsvarande halter 0.07 för fosfat, 1.05 för nitrit + nitrat och 4.9 µmol/l för silikat.
Fluorescensmätningar visade låg biologisk aktivitet förutom nära haloklinen där det var något högre fluorescens. Den blomning av kiselager som pågick under förra expeditionen var nu över.

Kattegatt och Öresund

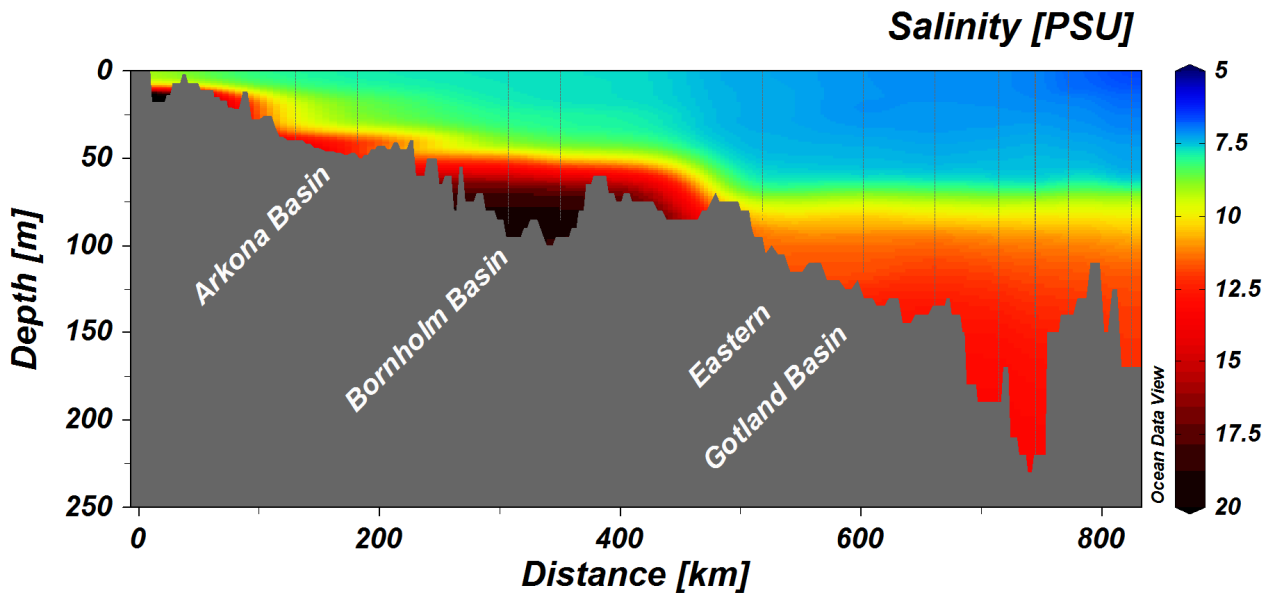
Temperaturen i ytvattnet var normal för årstiden och varierade mellan 14.8 °C i söder och 13.2 °C i norr. I Kattegatt var ytsalthalten normal, mellan 20.4 - 22.1 psu. I Öresund var salthalten dock något lägre än normalt, omkring 9 psu. Haloklin och termoklin återfanns på 15 till 20 meters djup.
Halterna av näringsämnen i ytvattnet var normala för årstiden förutom när det gällde silikat som uppvisade halter högre än normalt. Vårblomningen i ytan var över medan det fortfarande uppmättes högre fluorescensvärden i anslutning till haloklinen. Fosfatkoncentrationerna var 0.04 µmol/l i hela Kattegatt, silikat låg i intervallet 1.8 i norr till 2.9 µmol/l i söder. I Öresund var mosvarande värden 0.24 för fosfat och 6.8 µmol/l för silikat. Oorganiskt kväve låg under detektionsgränsen i hela området ner till 15 meter.
De lägsta syrehalterna i bottenvattnet uppmättes vid Anholt E i Kattegatt, 5.04 ml/l samt vid W Landskrona i Öresund, 4.32 ml/l.

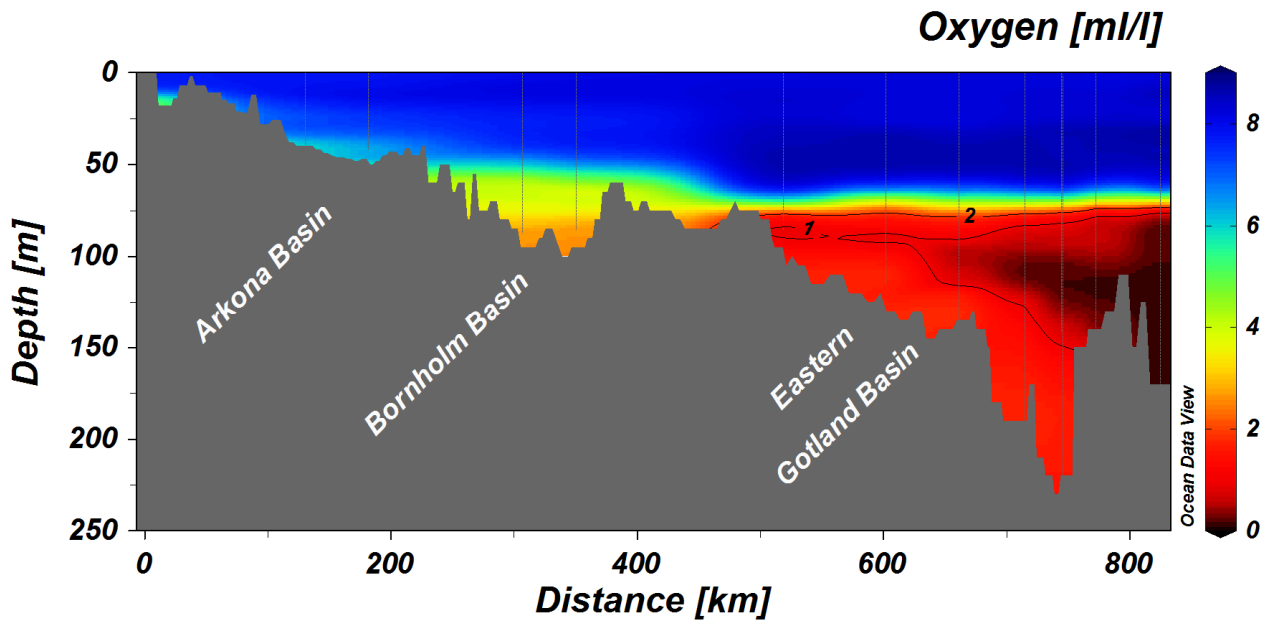
Egentliga Östersjön

Temperaturen i ytskiktet var normal för årstiden och varierade från 11.1°C till 14.5°C. Ytsalthalten var något över det normala i sydvästra Östersjön och något under det normala i nordöstra delarna. Den varierade mellan 6.5 psu i nordost till 8.0 psu i sydväst. Haloklinen återfanns på 60 till 80 meters djup i västra och östra Gotlandsbassängerna, medan den blev allt grundare i de södra delarna. I Arkonabassängen återfanns den på 30-40 m djup.
Fosfat- och silikathalterna var fortfarande över det normala och varierade mellan 0.23 - 0.53 µmol/l och 8.6 - 17 µmol/l respektive med de högsta koncentrationerna i den sydöstra delen samt i södra delen av västra Gotlandsbassängen. Oorganiskt kväve var helt uttömt ner till 20 meter i hela Egentliga Östersjön.
Fluorescensmätningarna visade på måttlig planktonaktivitet i hela området.

Det stora inflöde till Östersjön vilket ägde rum under december 2014 hade nu nått ytterligare längre norrut i östra Gotlandsbassängen och syntes nu mellan Fårödjupet (BY20) och Gotlandsdjupet (BY15) som ett tunt lager vid botten.

I norra delen av Östra Gotlandsbassängen (BY20) syntes effekter av inflödet, dels i haloklinen samt i att halterna av svavelväte, på djup överstigande 110 meter hade sjunkit något.
Vid Gotlandsdjupet förekom akut syrebrist vid djup överstigande 70 meter. Svavelväte förekom intermediärt men endast kring 115 meters djup. Djupvattnet var nu helt syresatt under detta lager men den maximala koncentrationen av syrgas hade minskat med ca 1 ml/l, från 2.61 ml/l till 1.63 ml/l, sedan föregående mättillfälle i april. Salthalten i bottenvattnet hade minskat något medan den ökat i det intermediära vattnet kring 100-150 meter. I den sydligaste delen av östra Gotlandsbassängen rådde akut syrebrist från 75 meters djup och syrehalten i bottenvattnet hade minskat från 2.2 ml/l vid föregående mätning till 0.4 ml/l. I Bornholmsbassängen samt i Hanöbukten förekom ingen syrebrist i bottenvattnet men syrgashalterna hade även här minskat sedan förra mättillfället, här med ca 1.5 ml/l. I Arkonabassängen hade också syrehalterna i bottenvattnet sjunkit från 5-6 ml/l vid förra besöket till koncentrationer kring endast 2 ml/l.
I Västra Gotlandsbassängen var syresituationen fortsatt allvarlig. Helt syrefria förhållanden återfanns från 80-90 meter och akut syrebrist (< 2ml/l) från 60-70 meter.





SMHI

DELTAGARE

Namn			Från
Karin Wesslander		Expeditionsledare	SMHI
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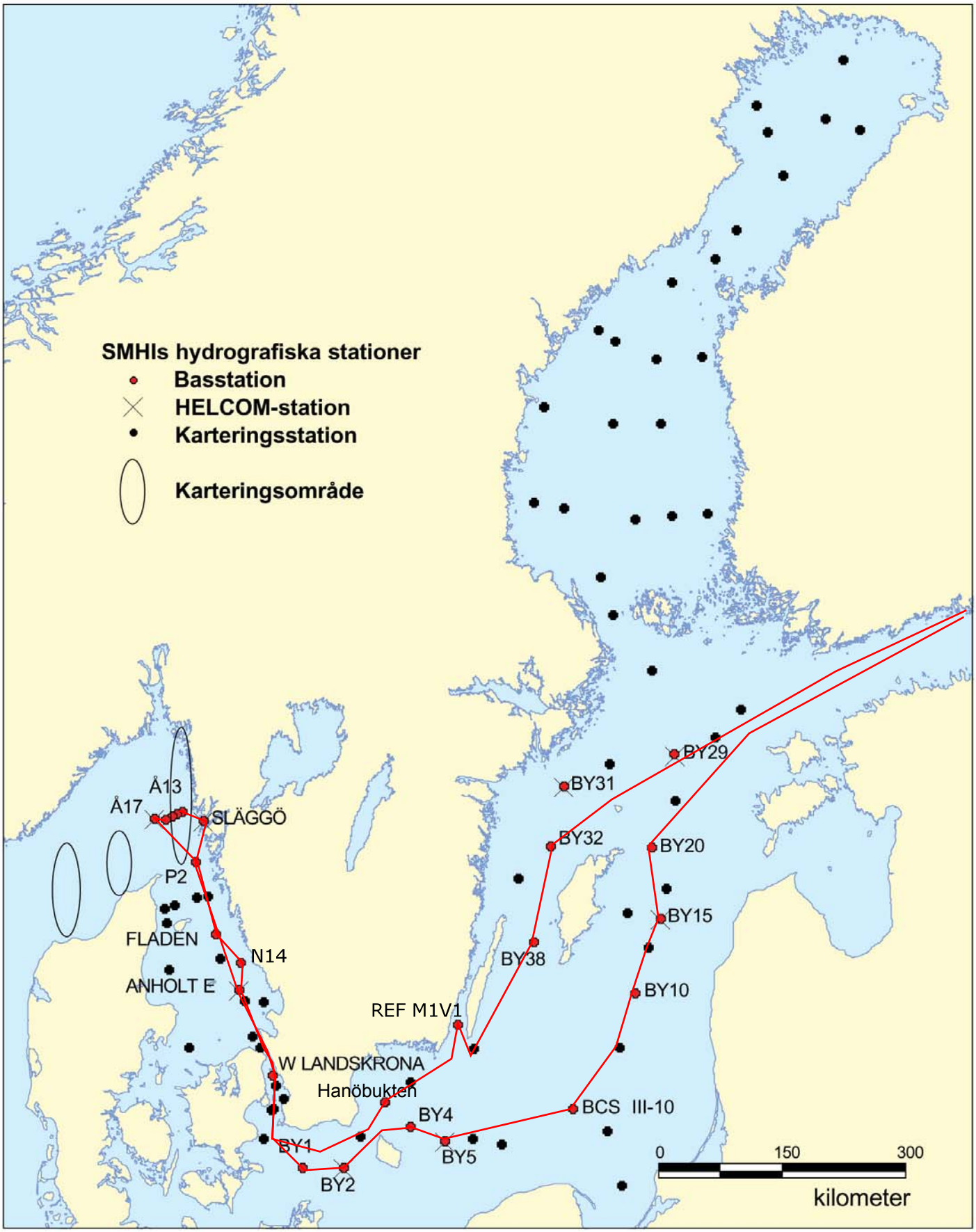
Johan Håkansson			SMHI
Johan Kronsell	(Helsingfors-Lysekil)		SMHI
Daniel Simonsson			SMHI
Sari Sipilä			SMHI
Anna-Kerstin Thell	(Lysekil-Helsingfors)		SMHI

BILAGOR

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

TRACKCHART
Country: Sweden
Ship: R/V ARANDA
Date: 20150611-20150618
Series: 0325-0351



SMHI ***** Hydrographic series Ship: 01-Aranda ****** Date: 2015-06-17
Ocean enh ***** series Year: 2015 ****** Time: 16:42

Ser no	Stat code	Proj	Station----------	Lat-----	Lon-----	Date yyyymmdd	Time hhmm utc	Bottom depth m	Secchi depth m	Wind dir	Wind ve	Air temp C	Air pres hPa	WCSI elec aoae tu hd	Ct	PPCPZZT Hrhhoor Cilyooa motPBw PrP l	No de	Temp	Salin	Ph	Oxyg	H2S	Phos	Tot P	Nitr2	Nitr3	Nitr4	Total N	Alk	SiO3	Humus	Light	PON	POC	TOC	Comm
0325	BPEX26BAS		BY20 FÅRÖDJ	N5800	E1953	20150612	0905	193	6	22	4	12.3	1013	1130	x	--x----	17	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-	-	-	x
0326	BPEX25EXT		BY19	N5737	E2010	20150612	1210	158		20	9	12.0	1014	1130	x	-------	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0327	BPEX21BAS		BY15 GOTLANDSDJ	N5720	E2003	20150612	1410	238	6	20	9	10.7	1014	4930	x	-xxxx--	19	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-	-
0328	BPEX21EXT		BY15 GOTLANDSDJ	N5720	E2003	20150612	1550	238	6	20	9	10.1	1013	4930	x	-------	5	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-
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0332	BPSE11BAS		BCS III-10	N5533.3	E1824	20150613	0500	88	6	29	2	13.7	1009	0010	x	--x----	12	x	x	-	x	-	x	x	x	x	x	-	x	-	-	-	-	-	x
0333	BPSB07BAS		BY5 BORNHOLMSDJ	N5515	E1559	20150613	1245	91	8	19	4	15.8	1009	1120	x	-xxxx--	12	x	x	x	-	x	x	x	x	x	x	x	x	x	-	-	-	-	x
0334	BPSB06BAS		BY4 CHRISTIANSÖ	N5523	E1520	20150613	1615	92	8	16	7	16.2	1006	1420	x	-------	12	x	x	-	x	-	x	x	x	x	x	-	x	-	-	-	-	-	-
0335	BPSA03BAS		BY2 ARKONA	N5500	E1405	20150613	2205	47		26	8	15.9	1004	6990	x	--xxx--	8	x	x	-	x	-	x	x	x	x	x	-	x	x	-	-	-	-	-
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0349	BPSE00EXT		4.5NE ÖLANDS SÖDRA	N5610.06	E1659	20150616	2140	58		28	7	12.7	1018	9990	x	-------	9	x	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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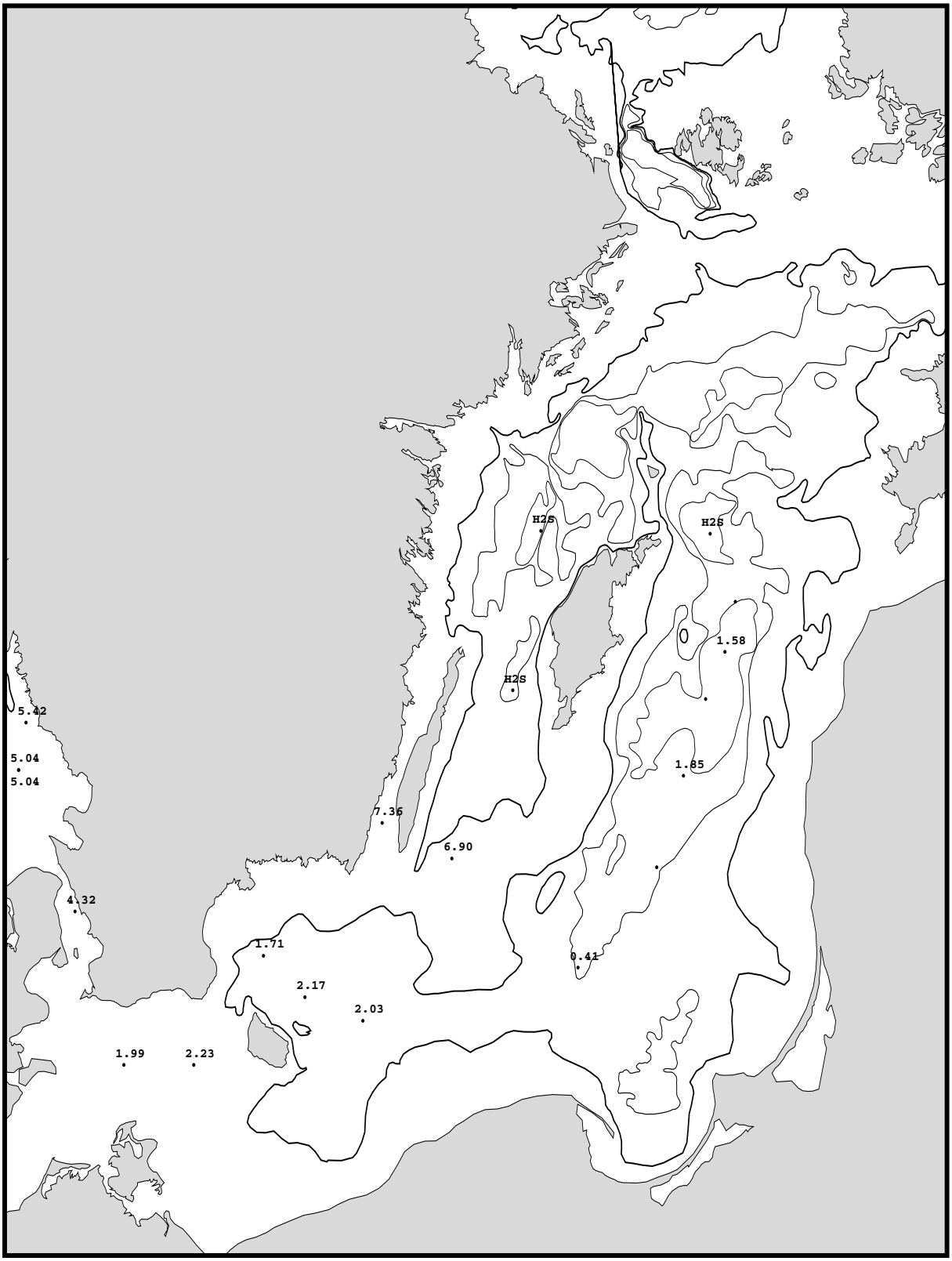
0351	BPWX38BAS		BY32 NORRKÖPINGSDJ	N5801	E1759	20150617	0920	200	8	19	5	12.2	1015	1530	x	--x----	17	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-	-	-	-

Bottom water oxygen concentration (ml/l)

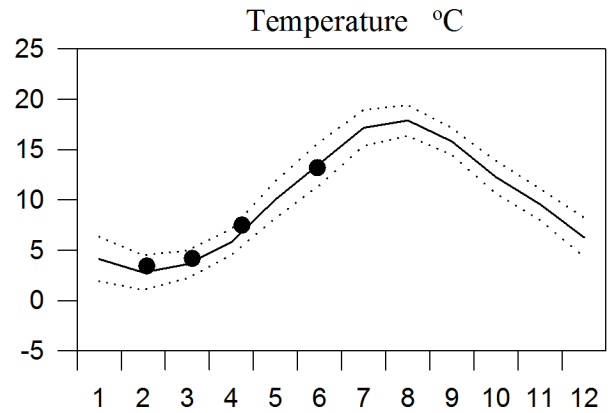
Country: Finland
Ship : Aranda
Date : 20150612-20150617
Series : 0325-0351

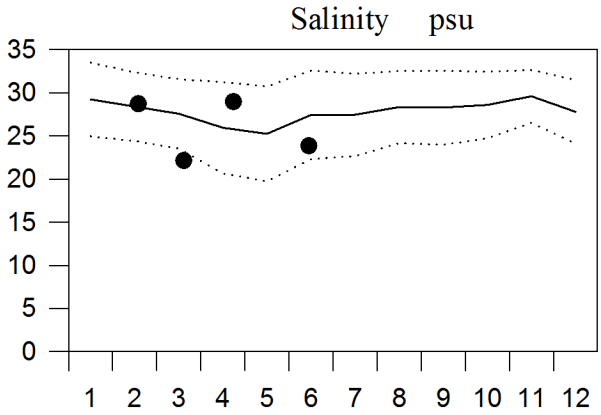


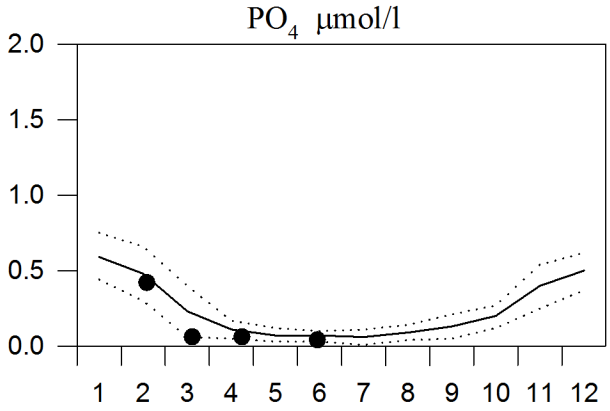
STATION P2 SURFACE WATER

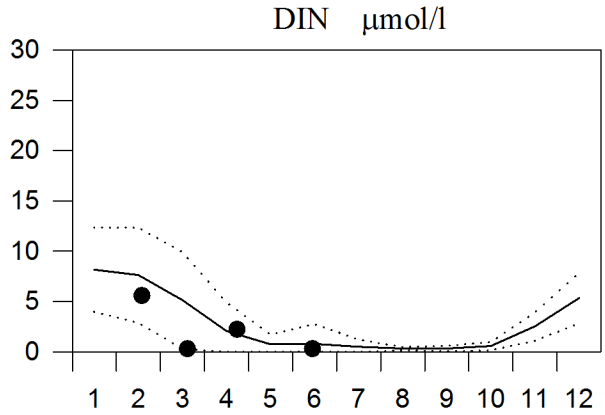
Annual Cycles

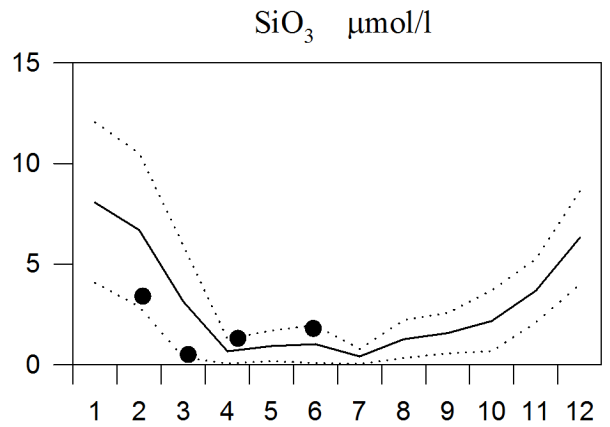
Mean 1996-2010 St.Dev. 2015

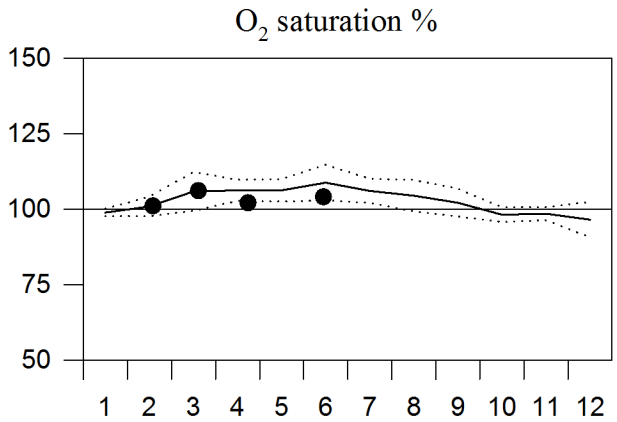




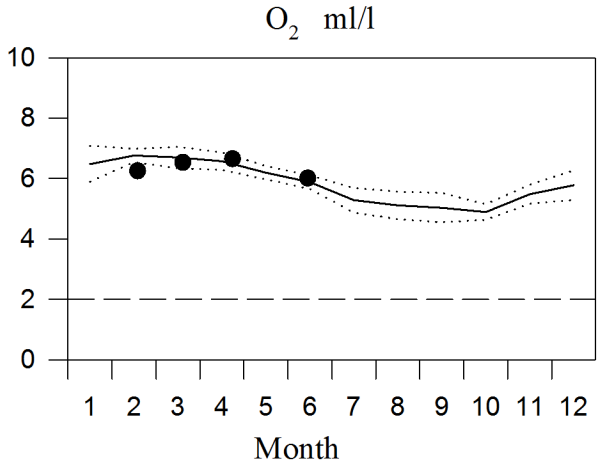


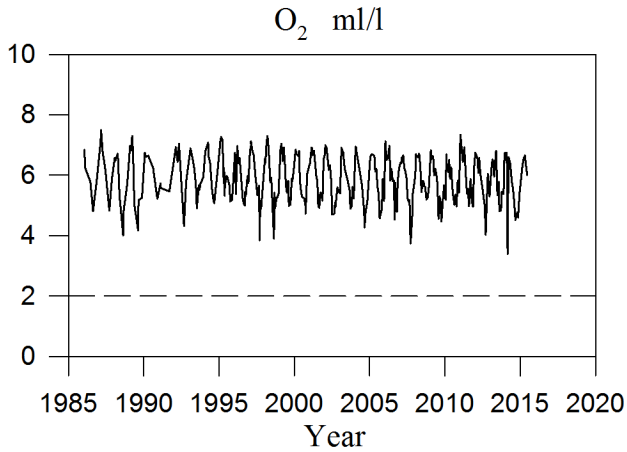




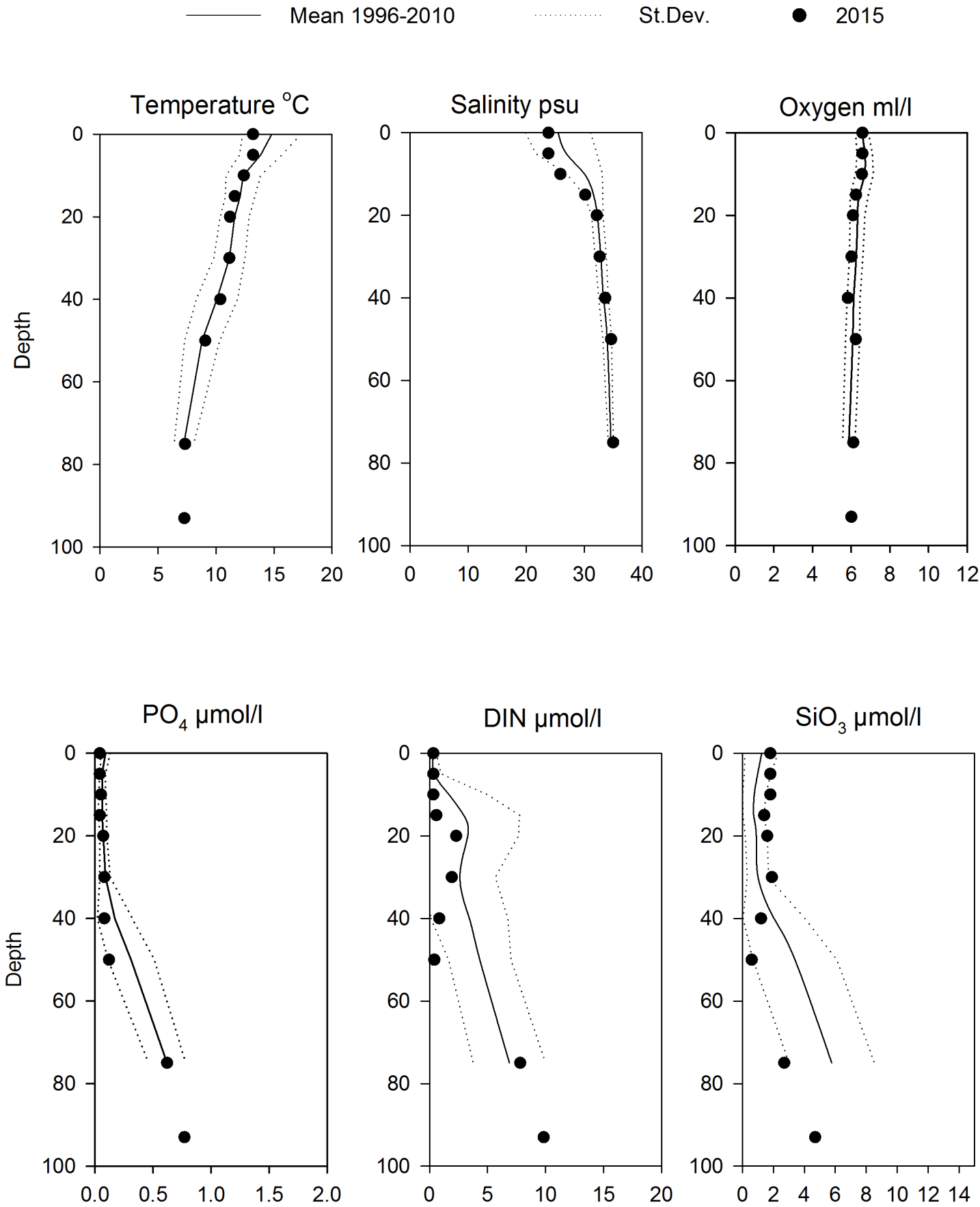


OXYGEN IN BOTTOM WATER (depth >75m)





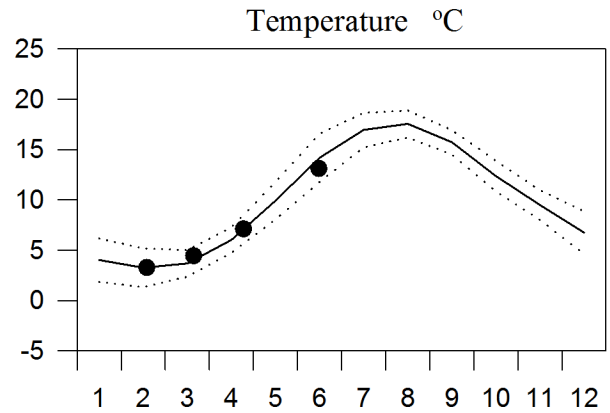
Vertical profiles P2 June

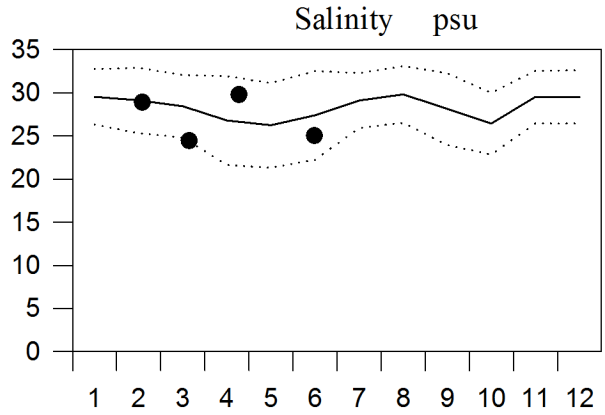


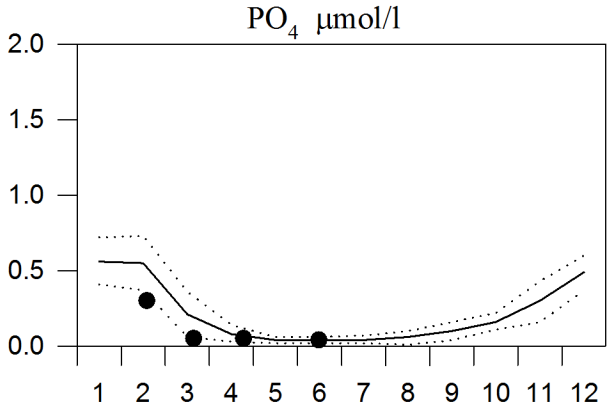
STATION Å13 SURFACE WATER

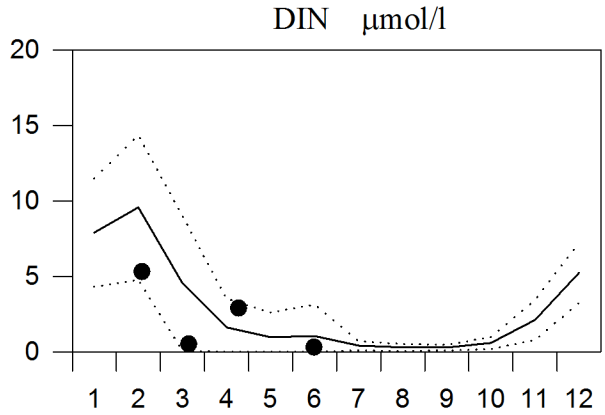
Annual Cycles

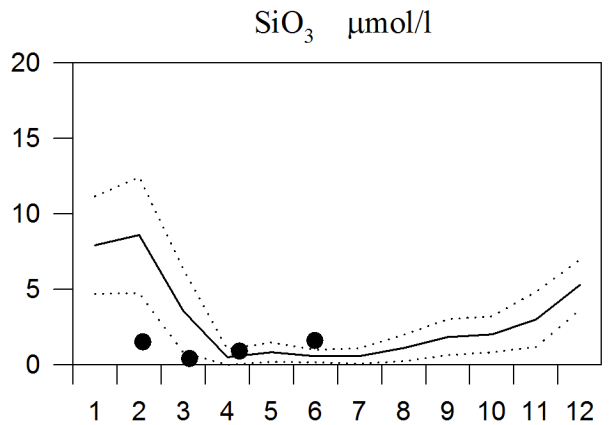
Mean 1996-2010 St.Dev. 2015

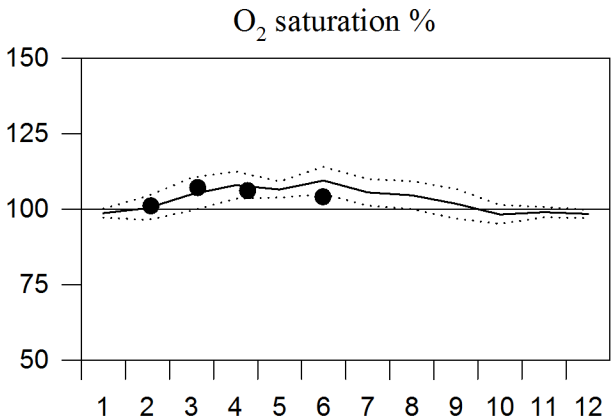




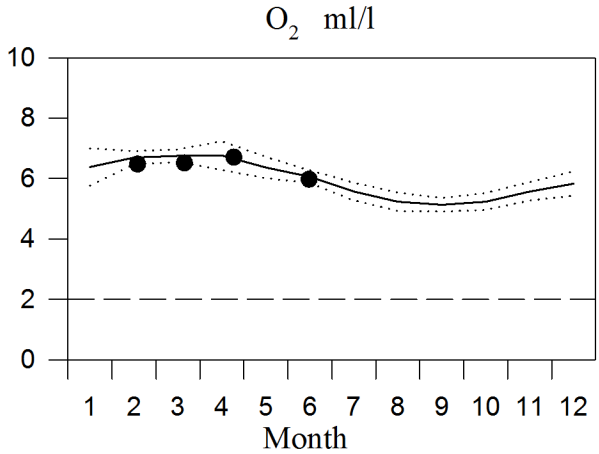


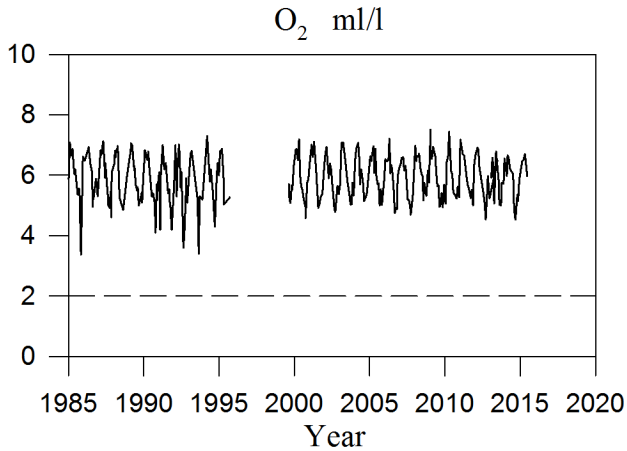




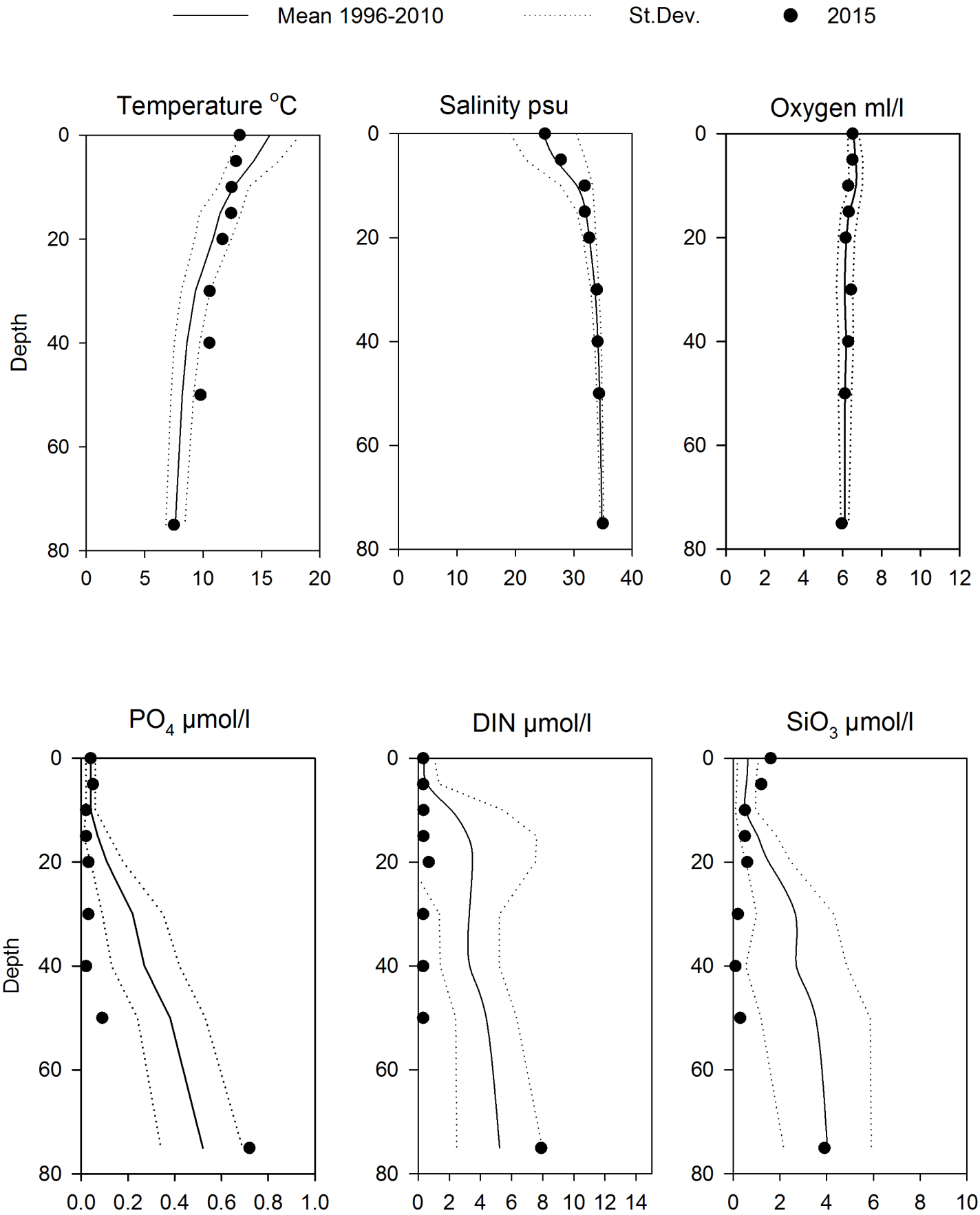


OXYGEN IN BOTTOM WATER (depth >=75m)



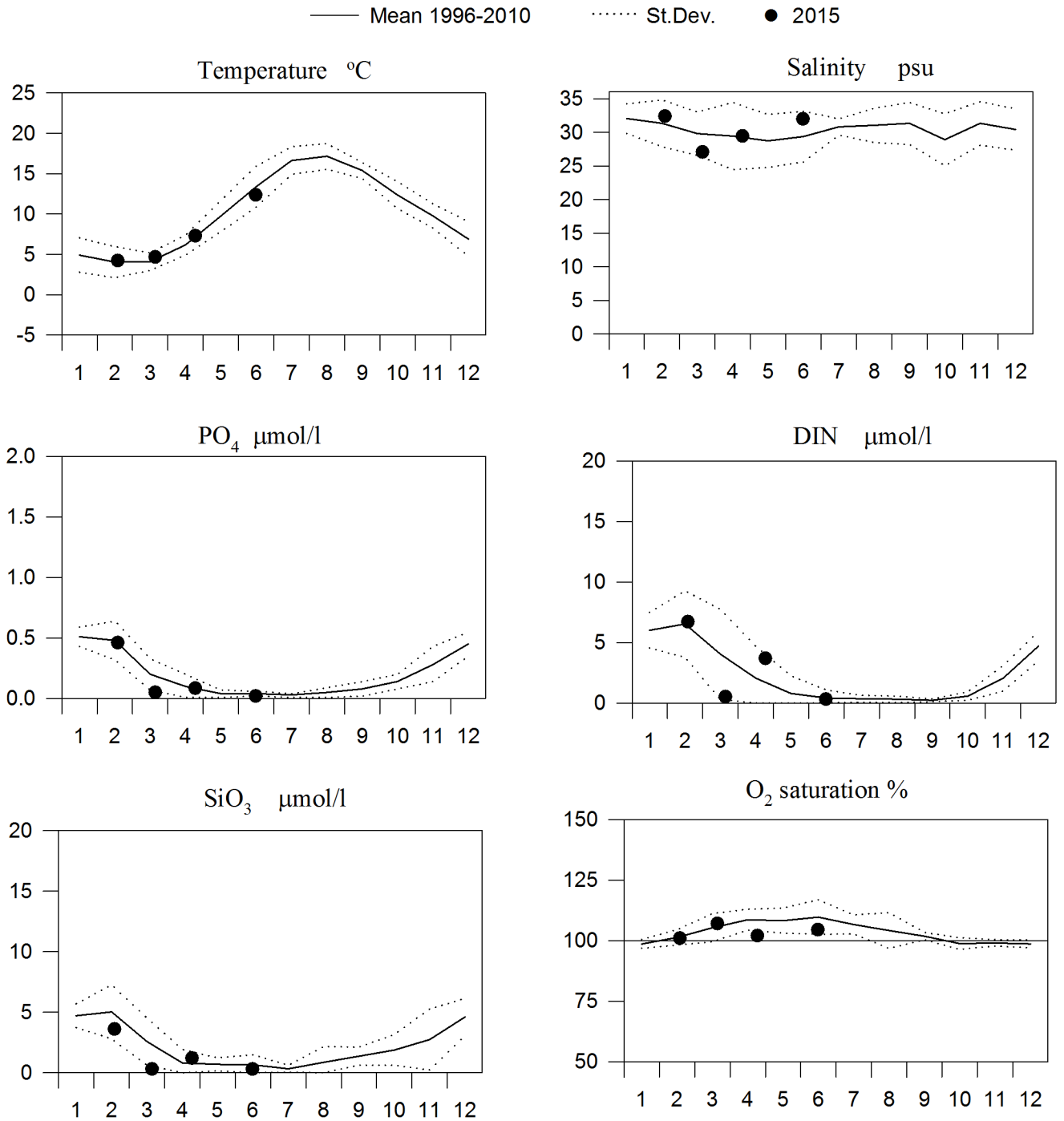


Vertical profiles Å13 June

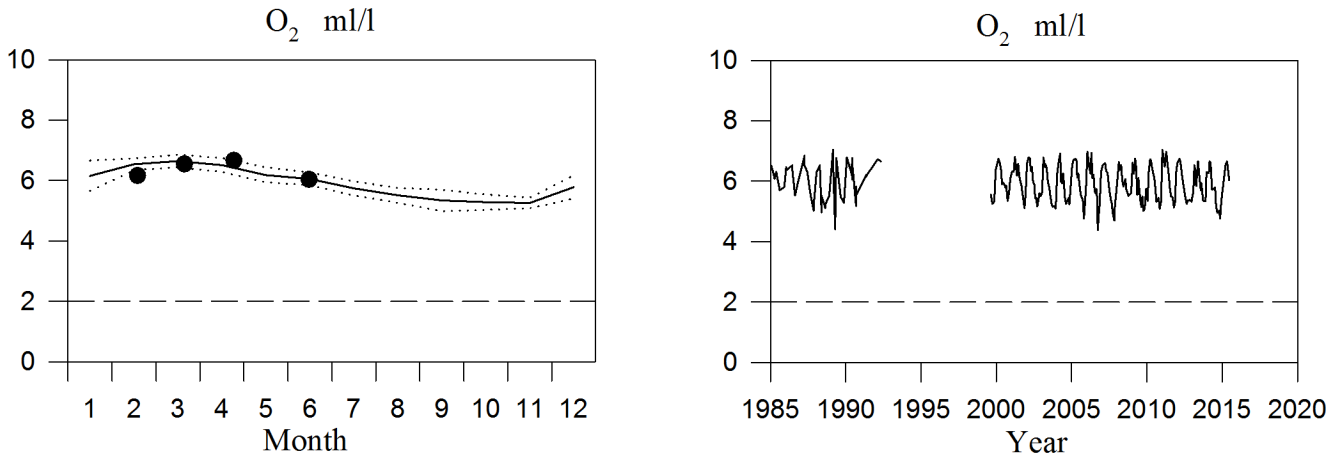


STATION Å15 SURFACE WATER

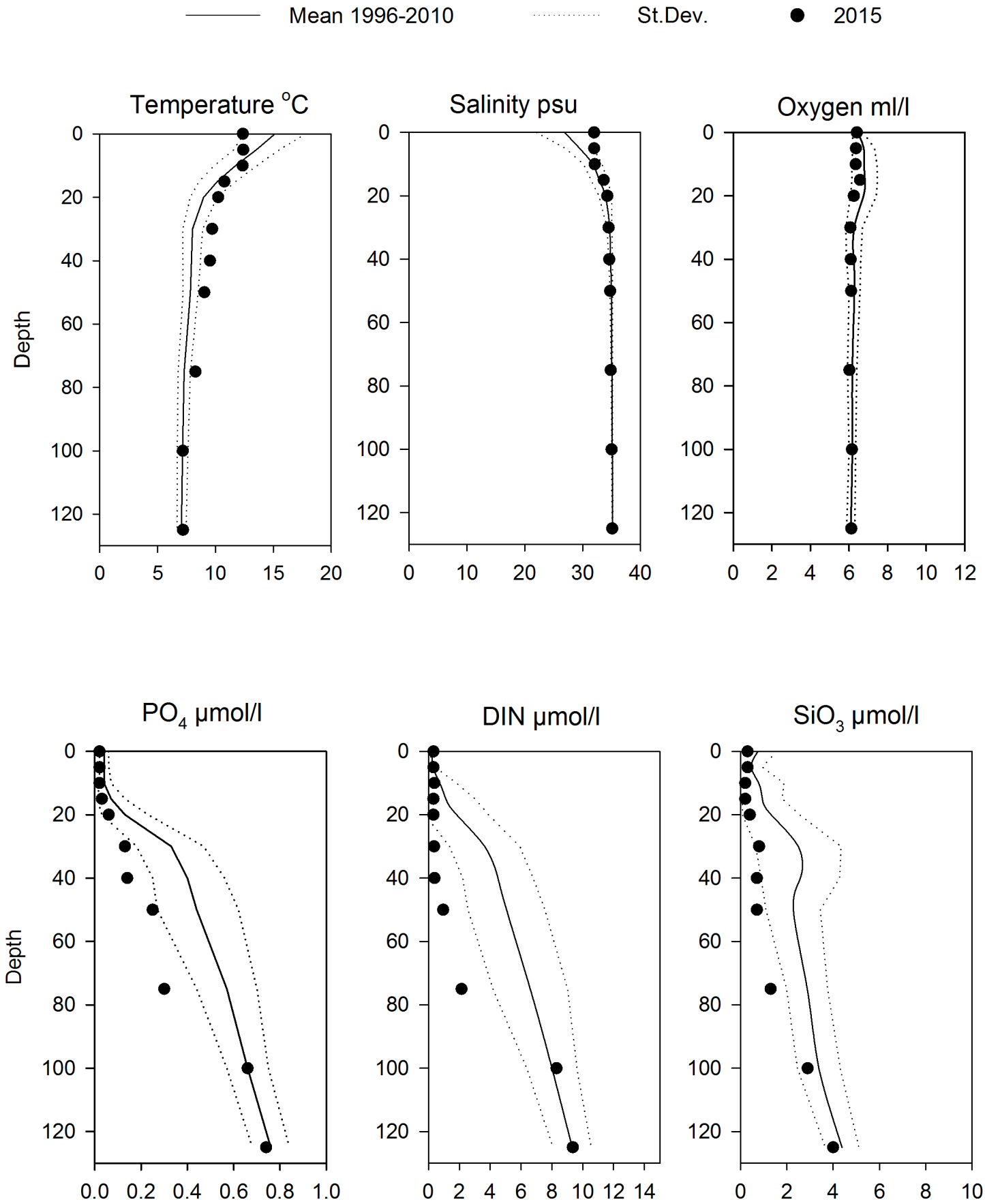
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >=125m)

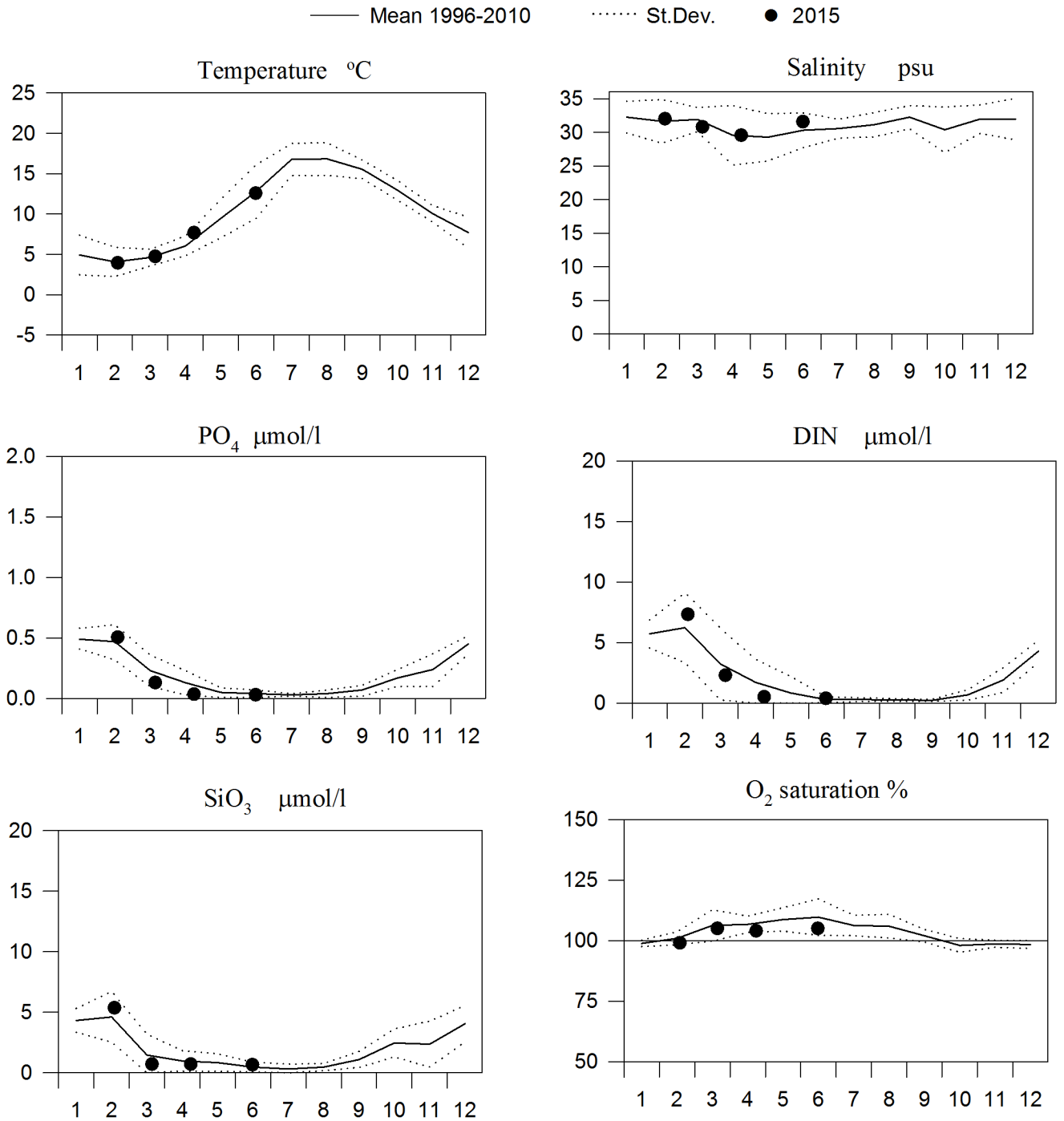


Vertical profiles Å15 June

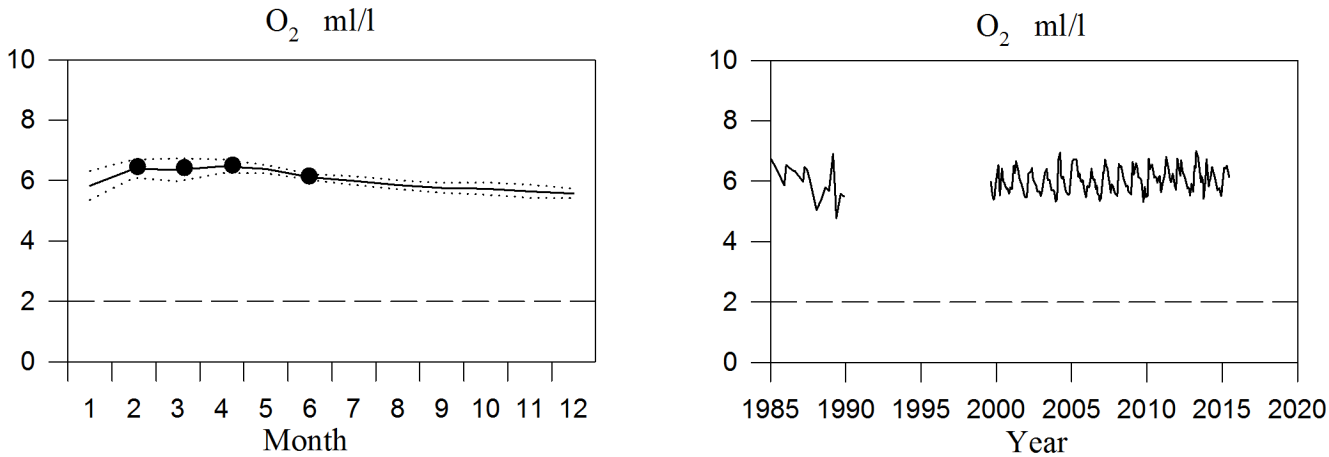


STATION Å17 SURFACE WATER

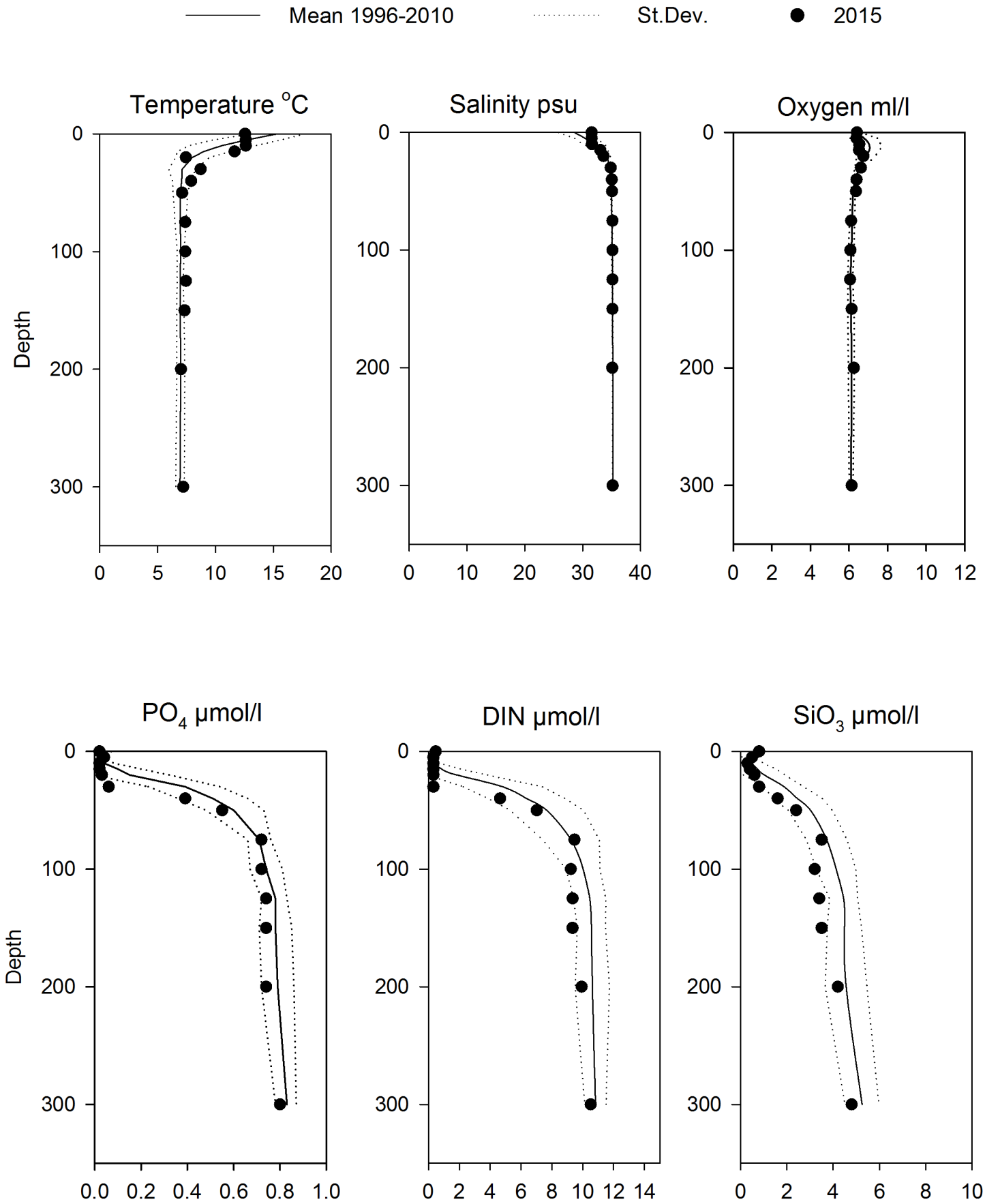
Annual Cycles



OXYGEN IN BOTTOM WATER (depth = 300m)



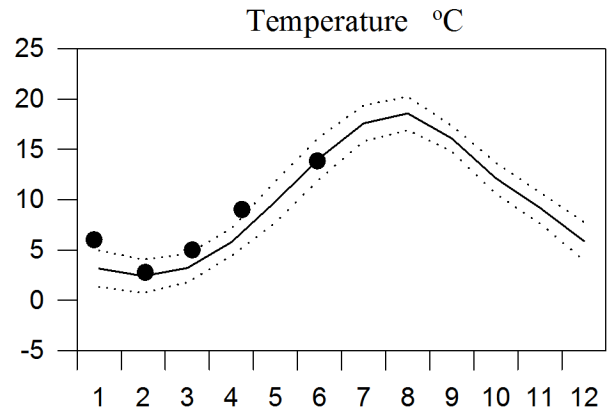
Vertical profiles Å17 June

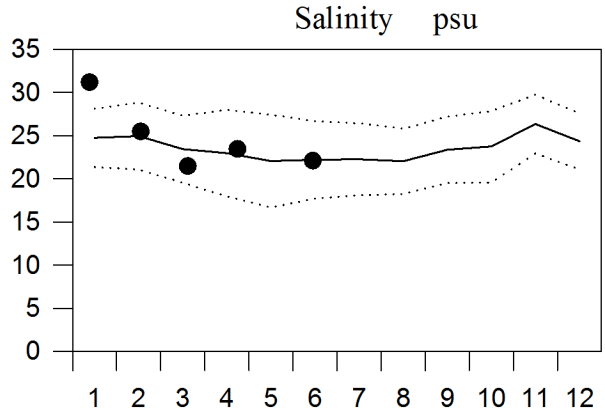


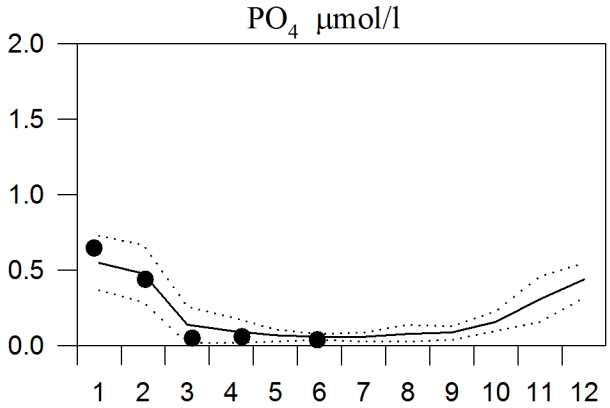
STATION FLADEN SURFACE WATER

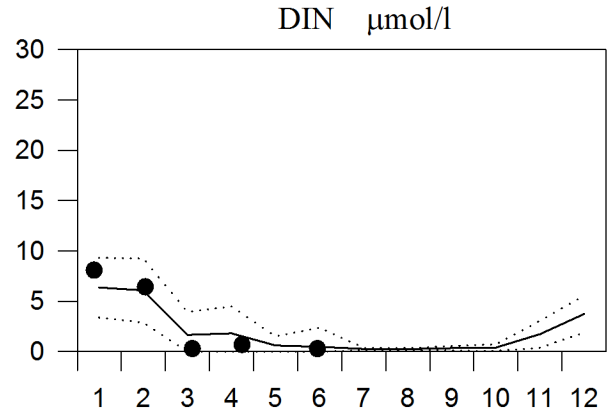
Annual Cycles

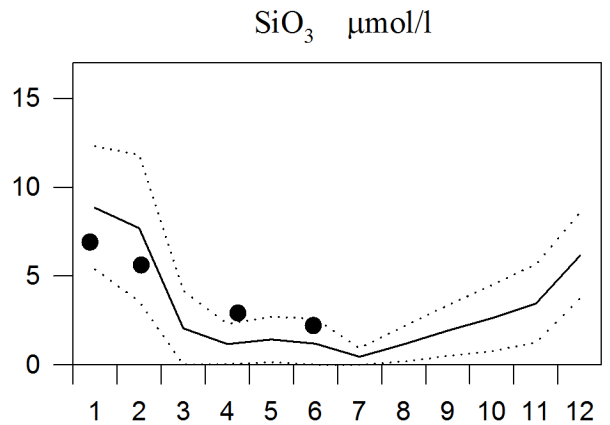
Mean 1996-2010 ····· St.Dev. ● 2015

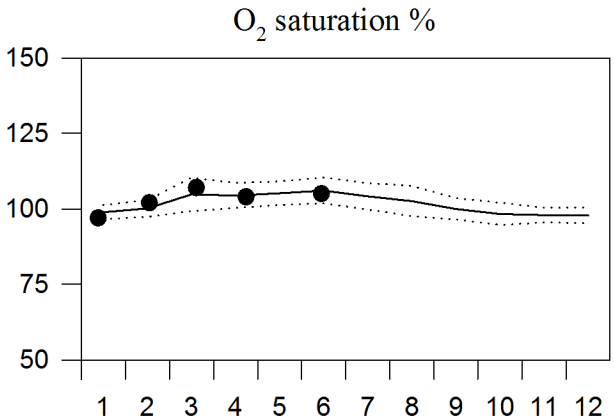




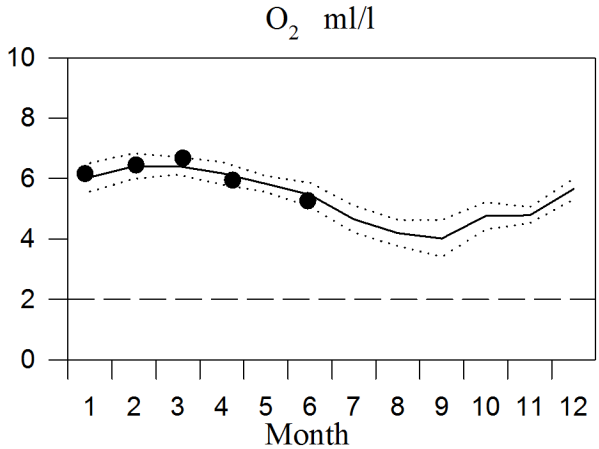


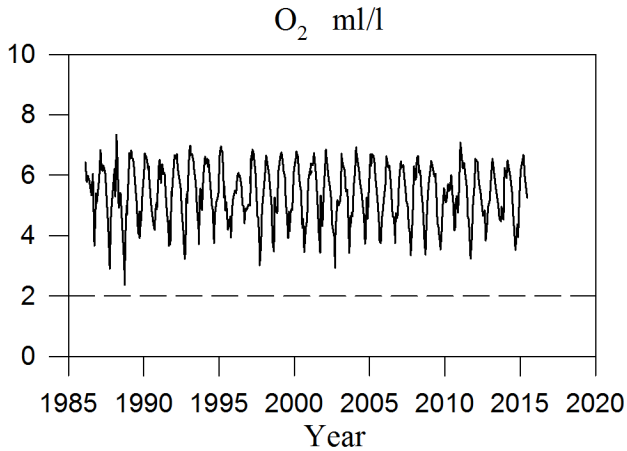




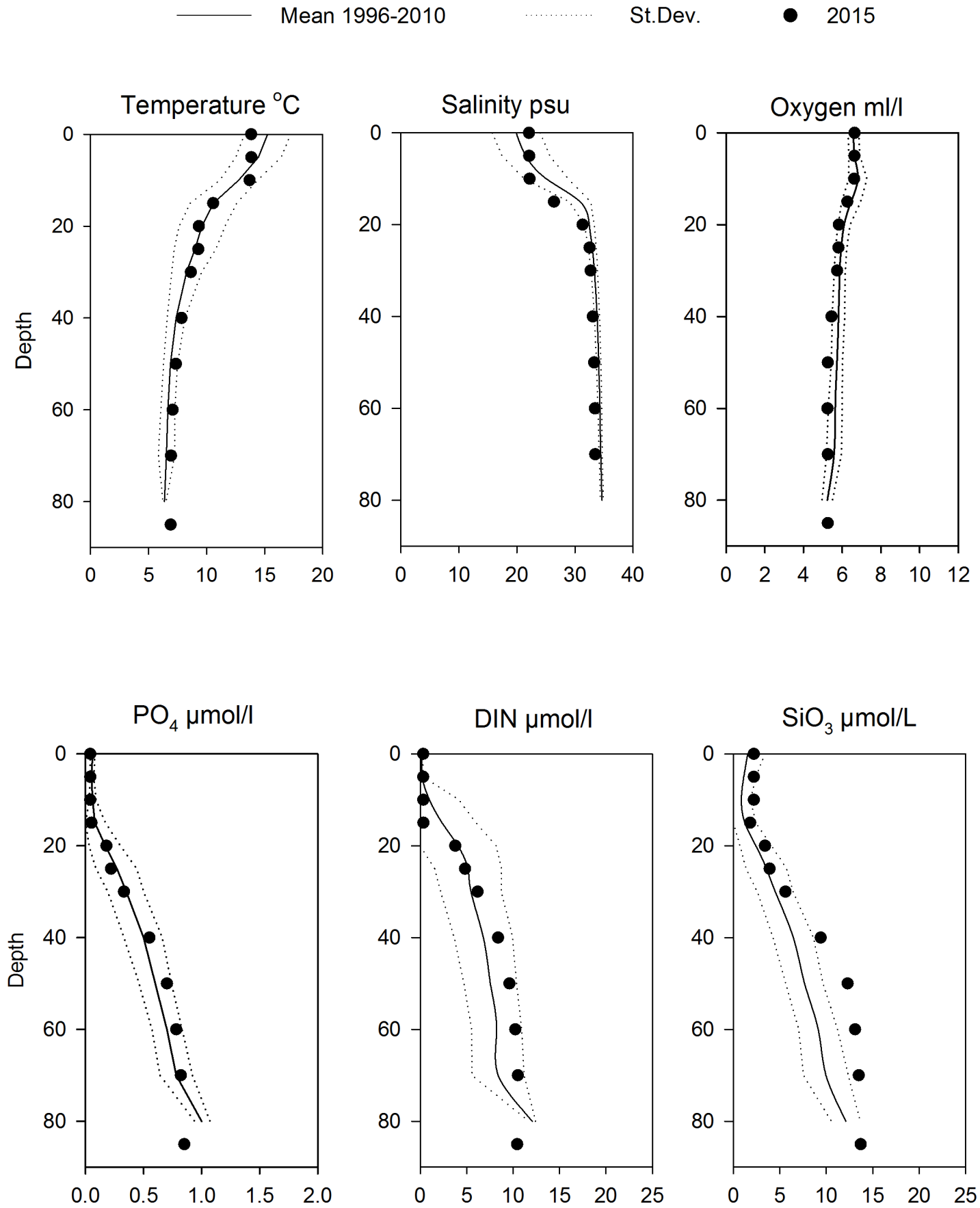


OXYGEN IN BOTTOM WATER (depth > 70m)





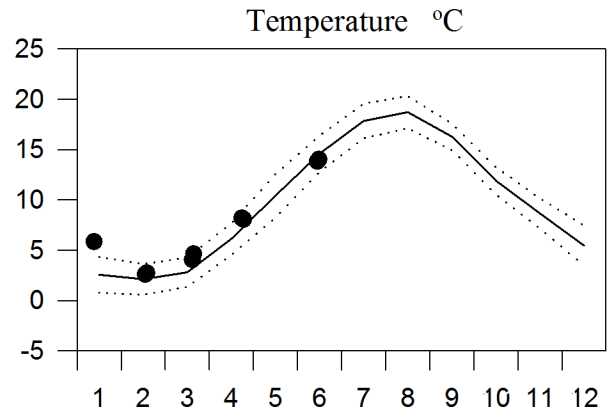
Vertical profiles Fladen June

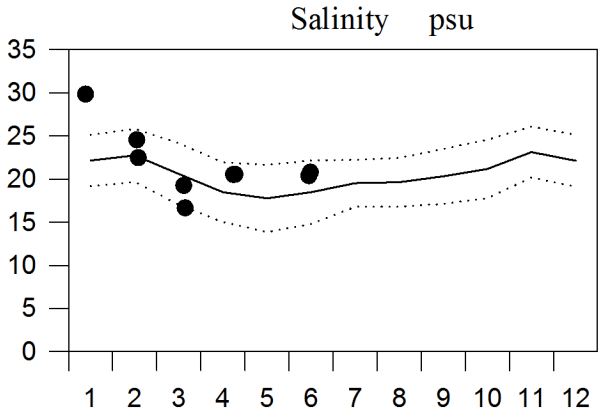


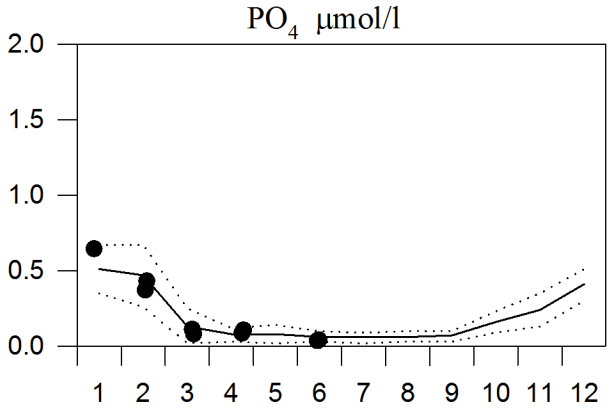
STATION ANHOLT E SURFACE WATER

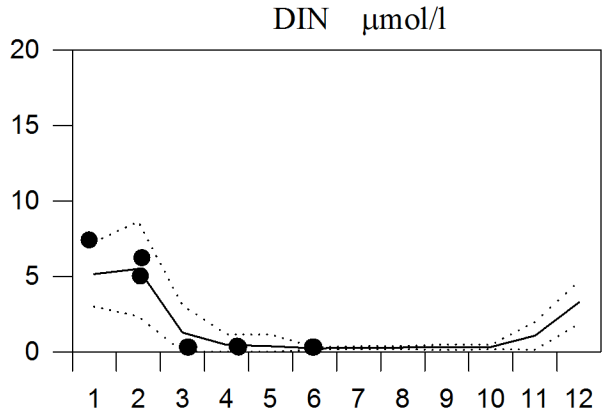
Annual Cycles

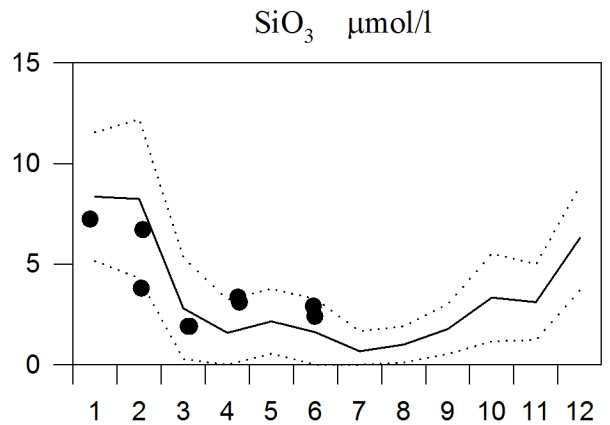
Mean 1996-2010 St.Dev. 2015

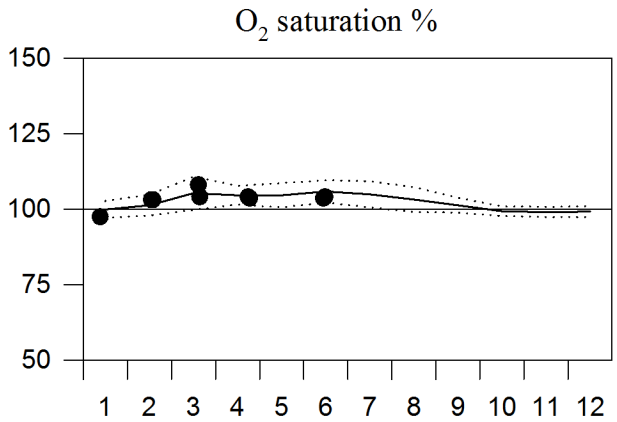




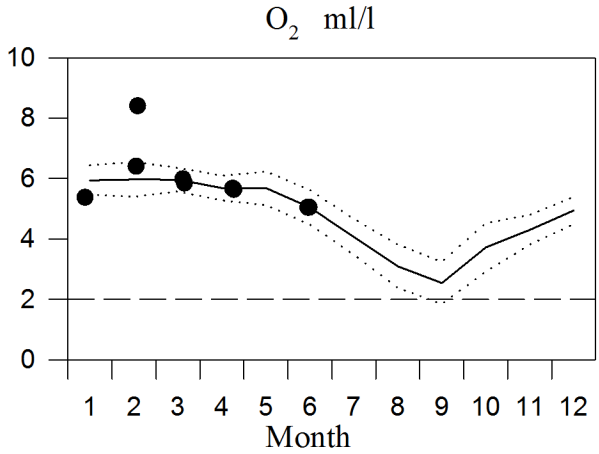


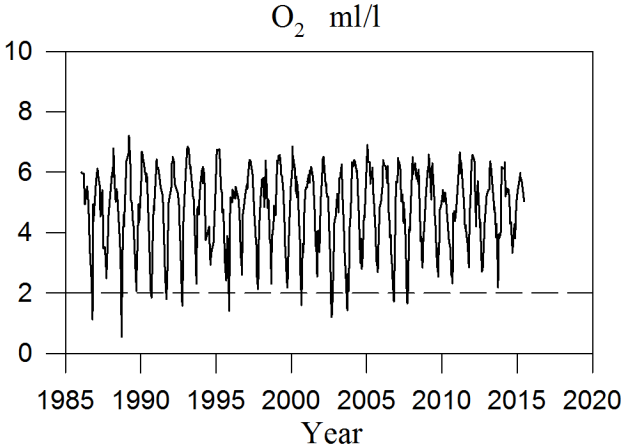




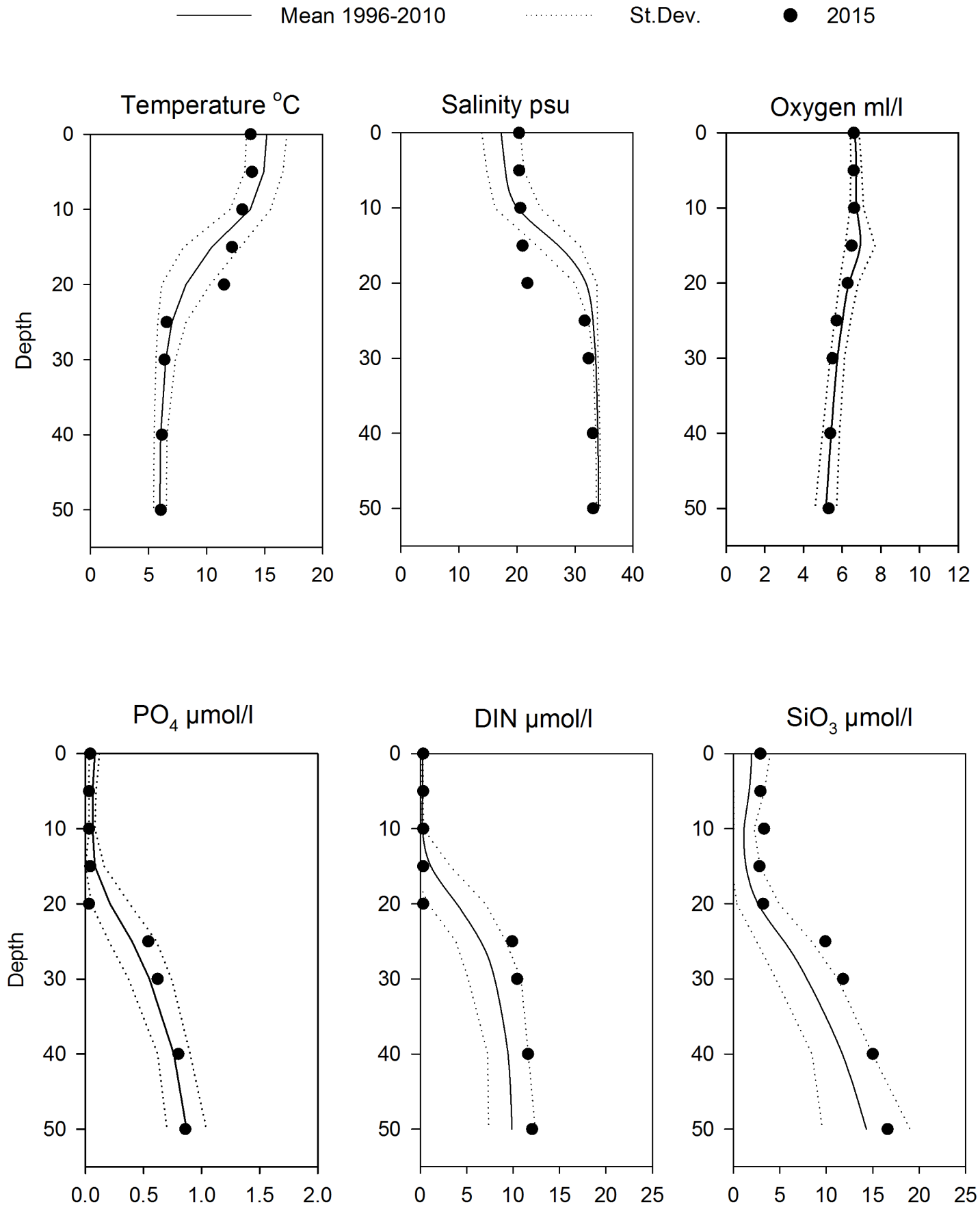


OXYGEN IN BOTTOM WATER (depth > 50m)





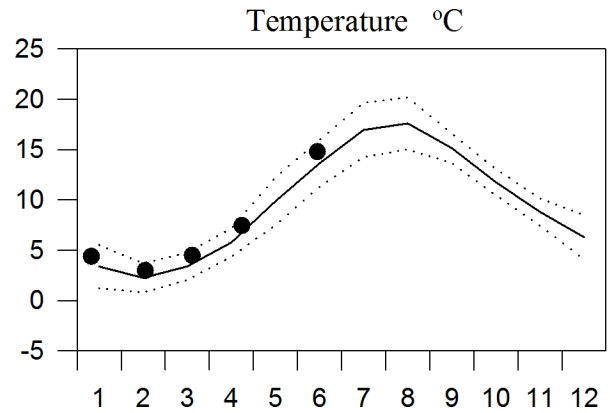
Vertical profiles Anholt E June

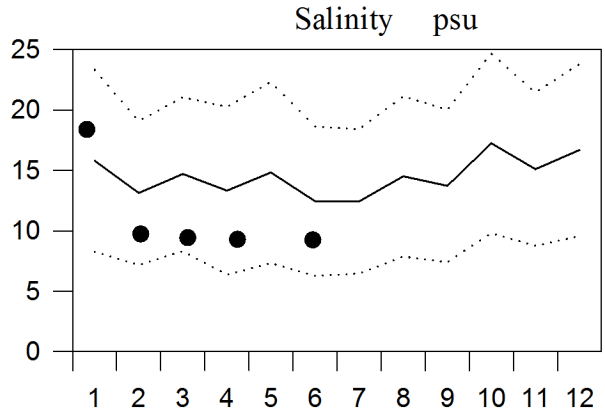


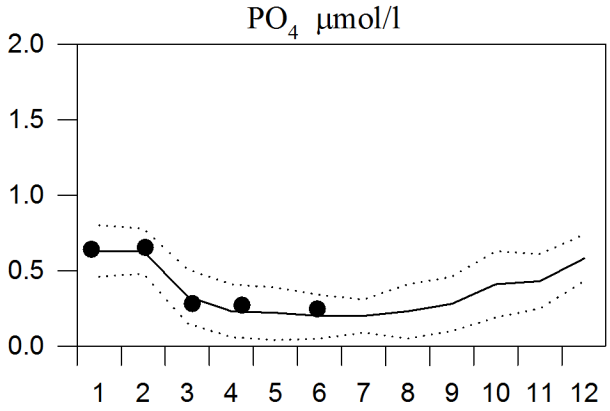
STATION W LANDSKRONA SURFACE WATER

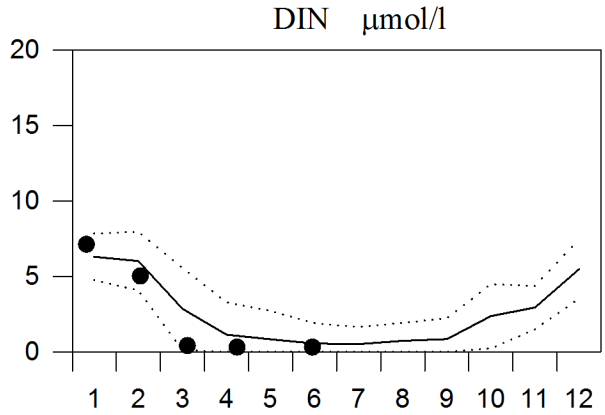
Annual Cycles

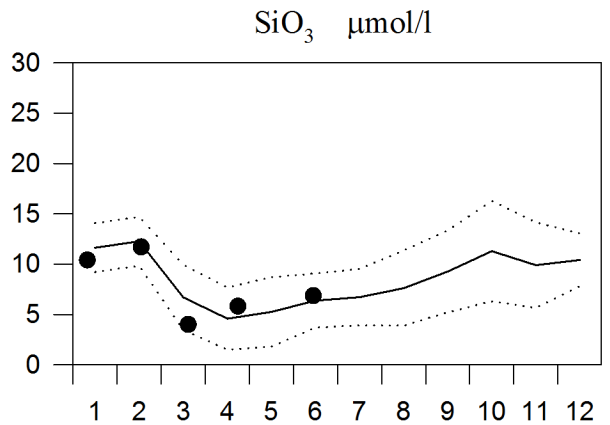
Mean 1996-2010 St.Dev. 2015

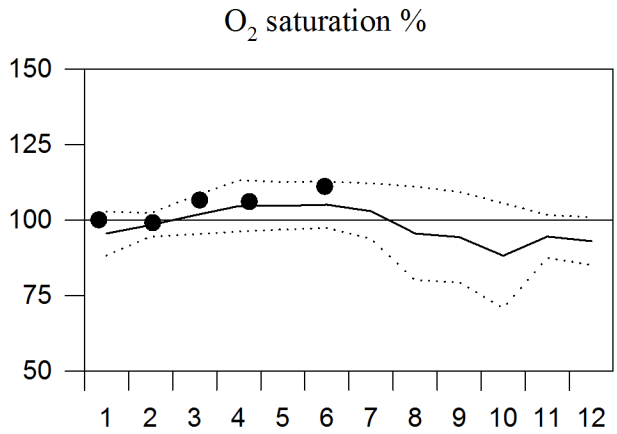




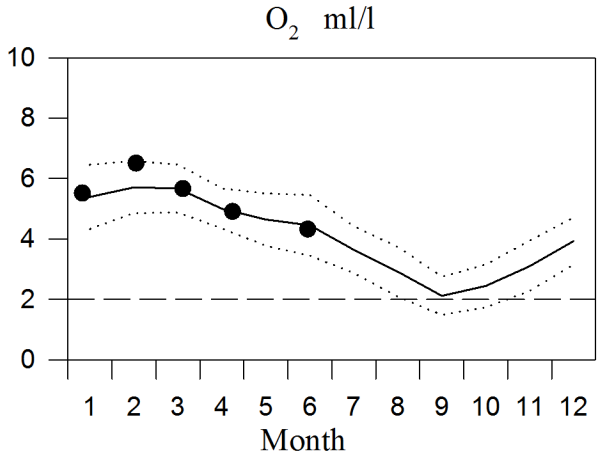


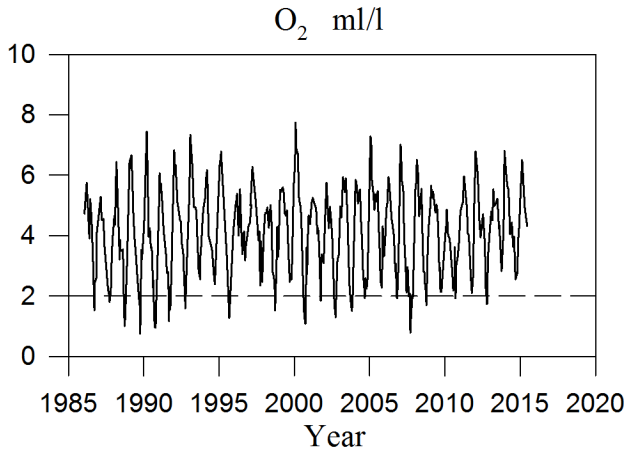




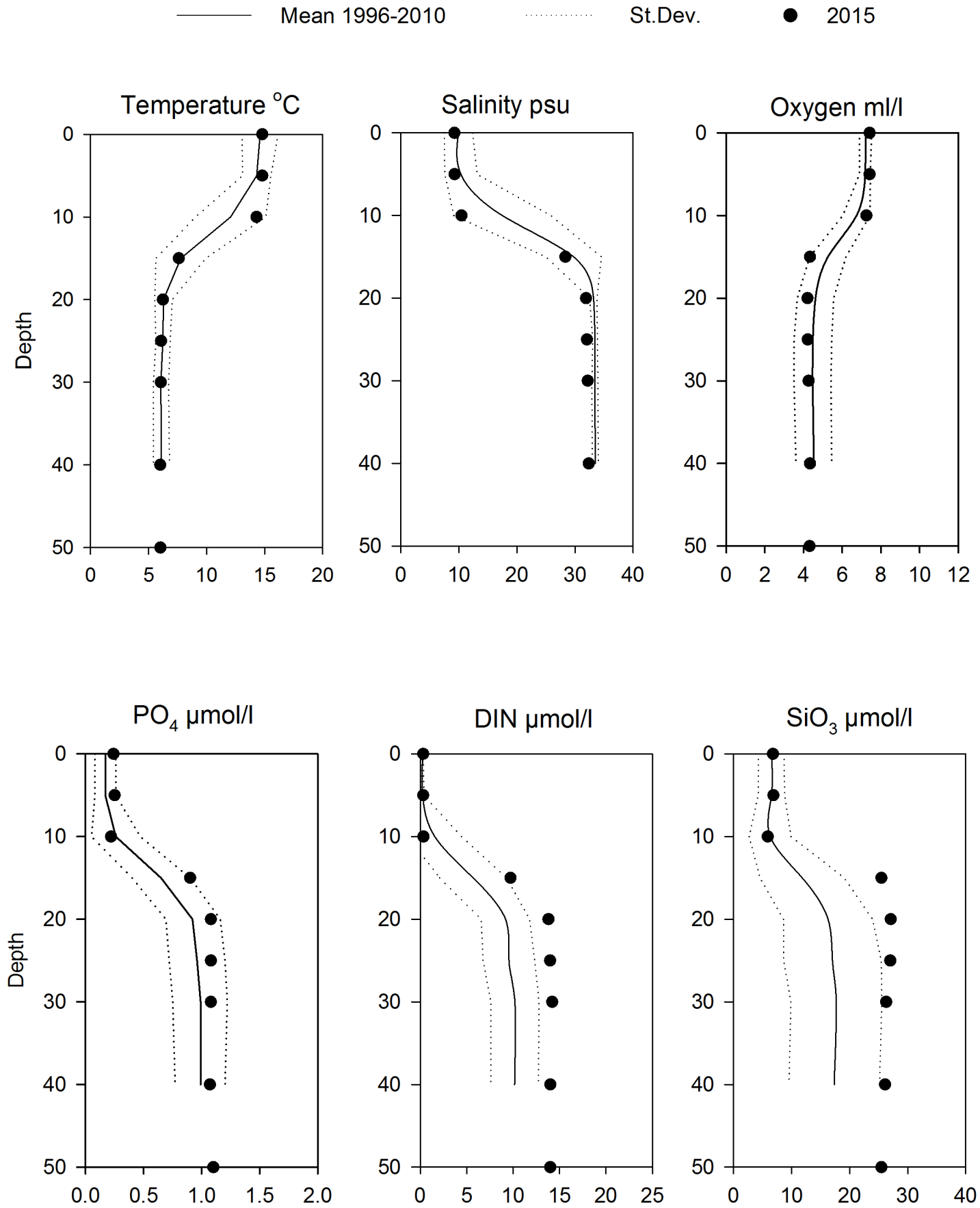


OXYGEN IN BOTTOM WATER (depth >40m)





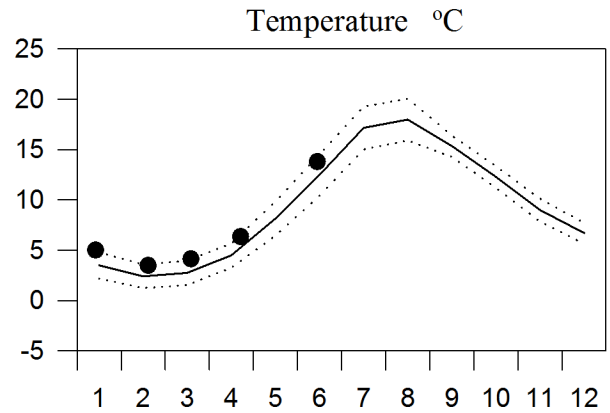
Vertical profiles W Landskrona June

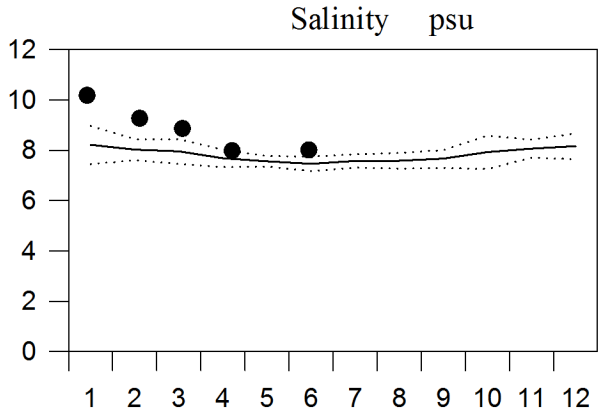


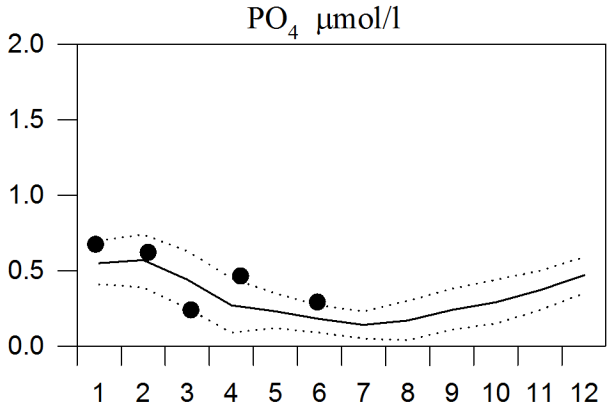
STATION BY1 SURFACE WATER

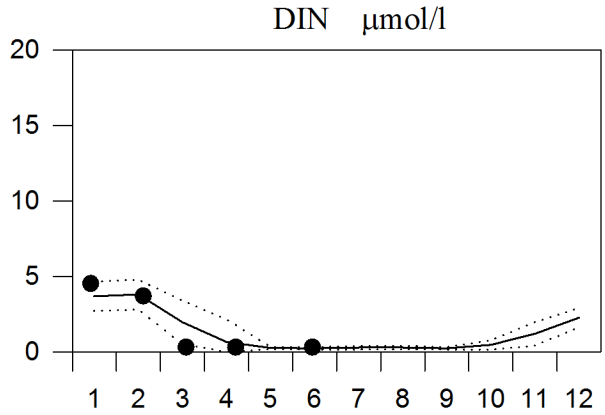
Annual Cycles

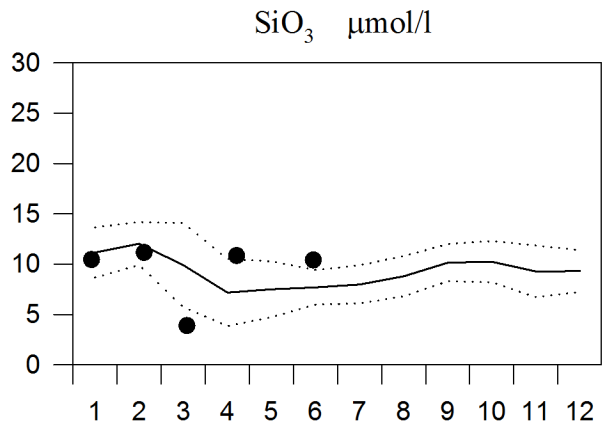
Mean 1996-2010 St.Dev. 2015

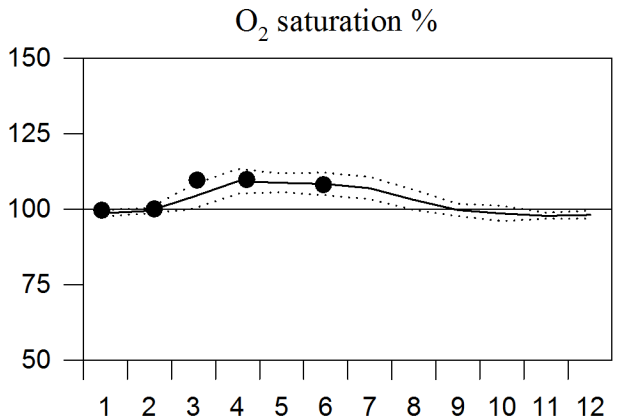




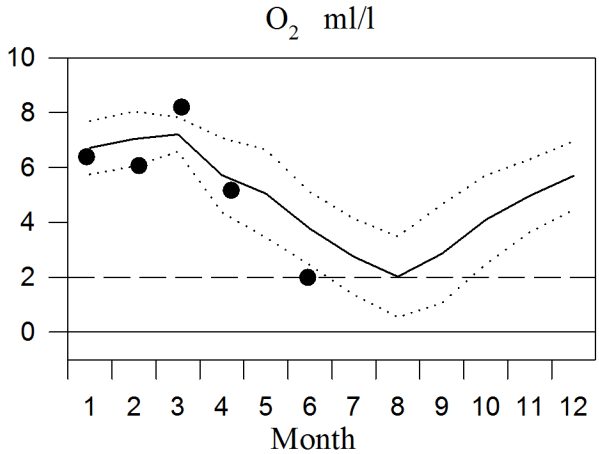


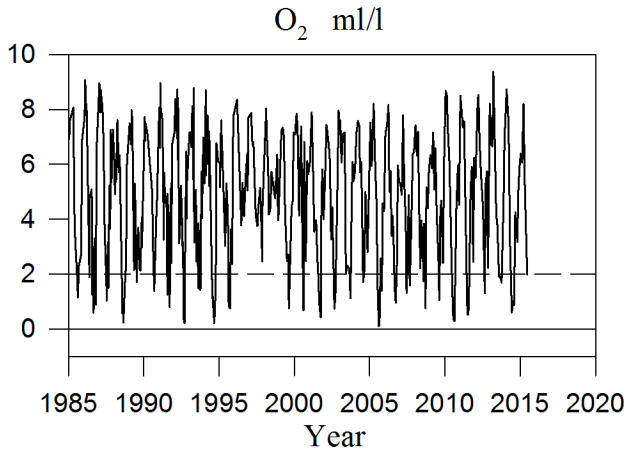




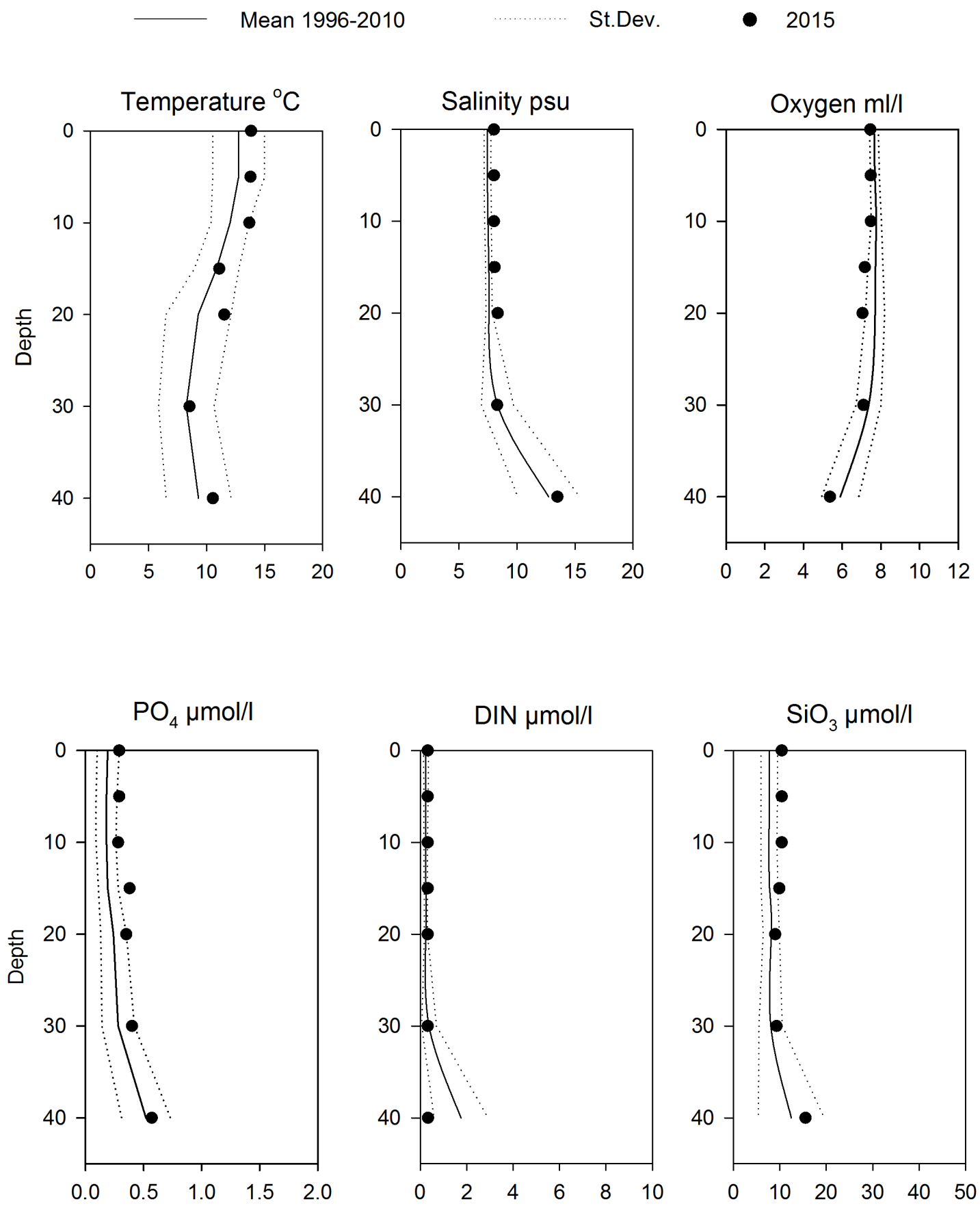


OXYGEN IN BOTTOM WATER (depth >40m)





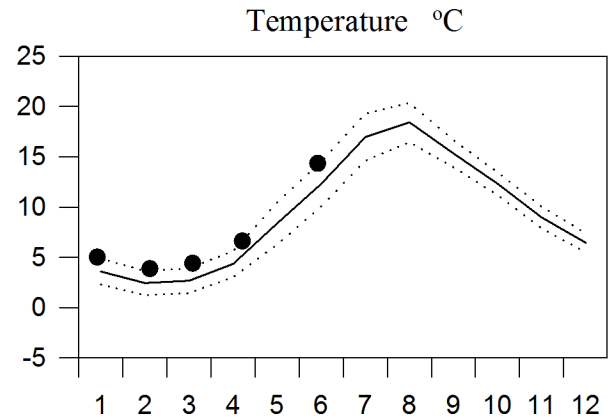
Vertical profiles BY1 June

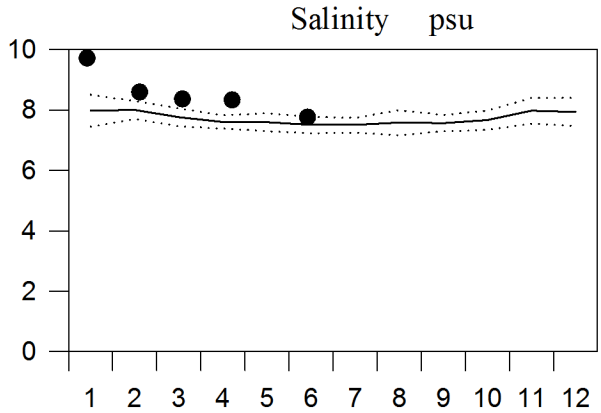


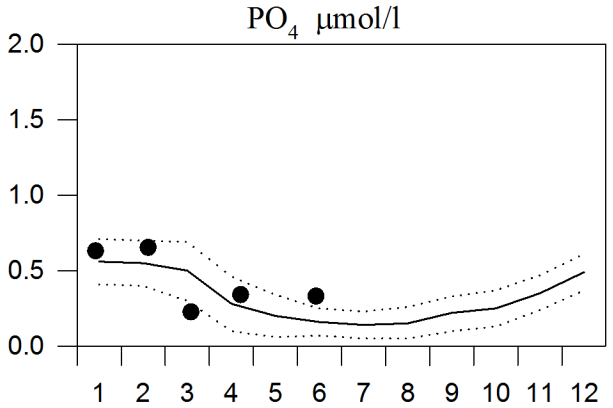
STATION BY2 SURFACE WATER

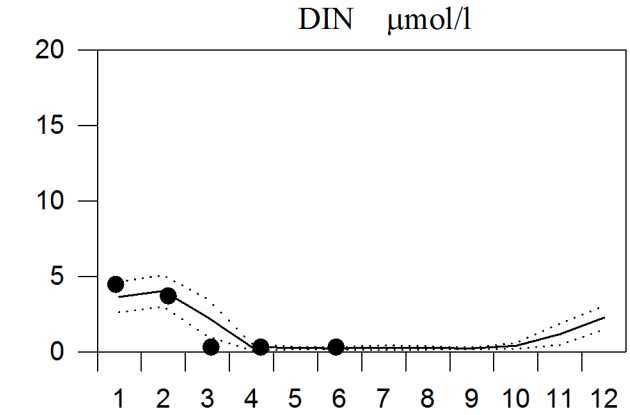
Annual Cycles

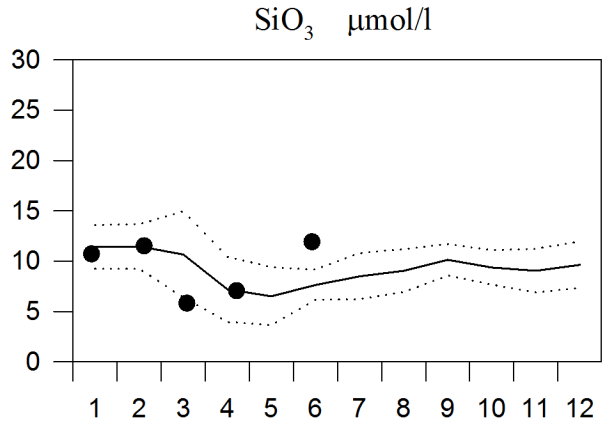
Mean 1996-2010 St.Dev. 2015

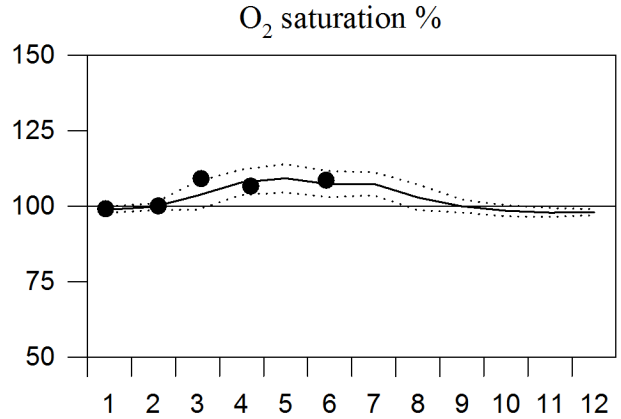




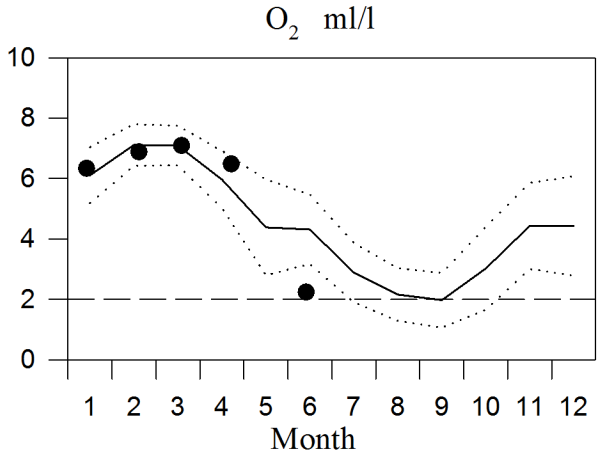


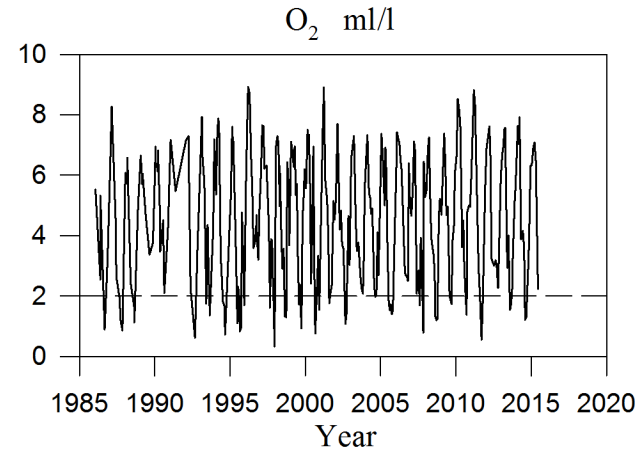




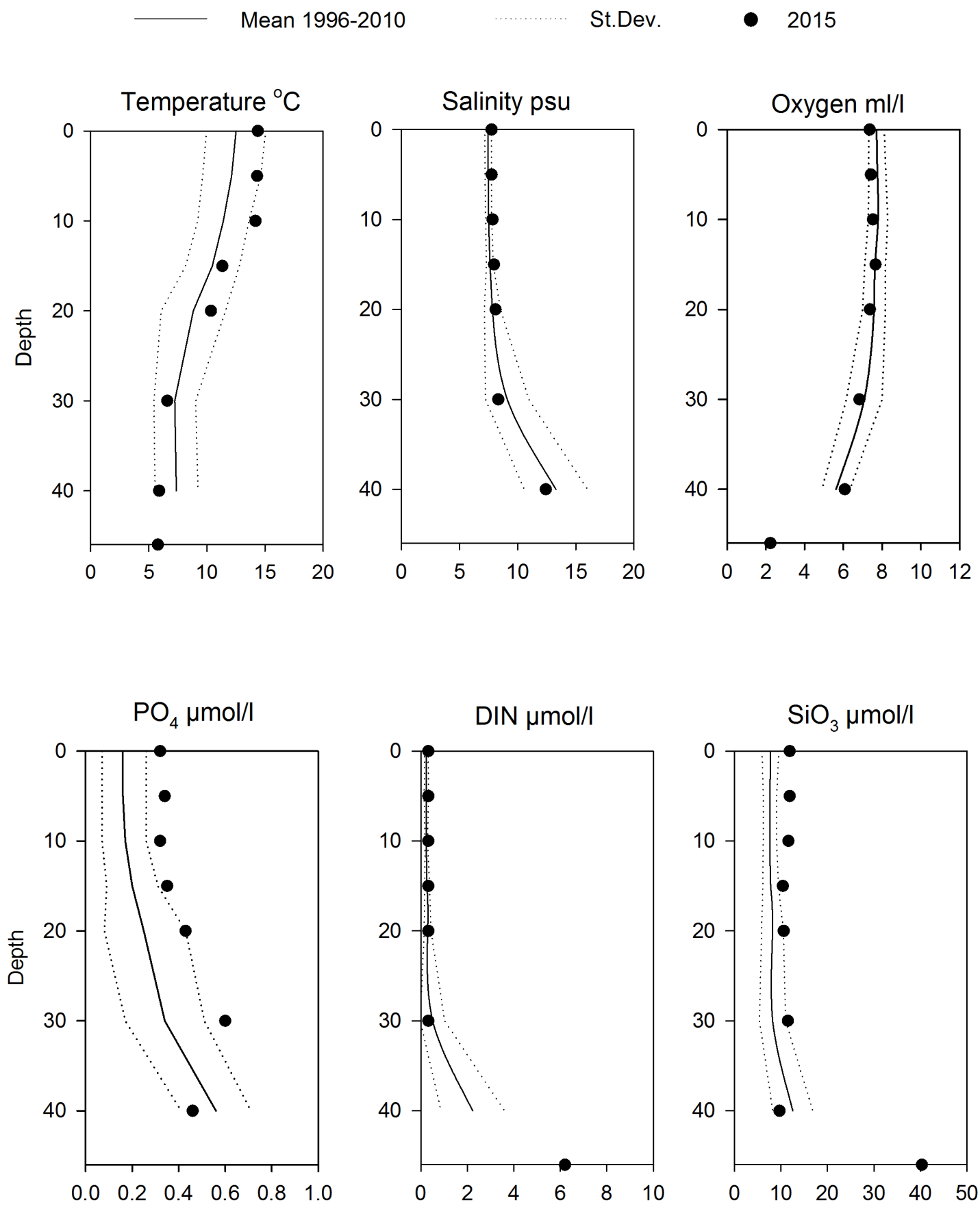


OXYGEN IN BOTTOM WATER (depth >40m)





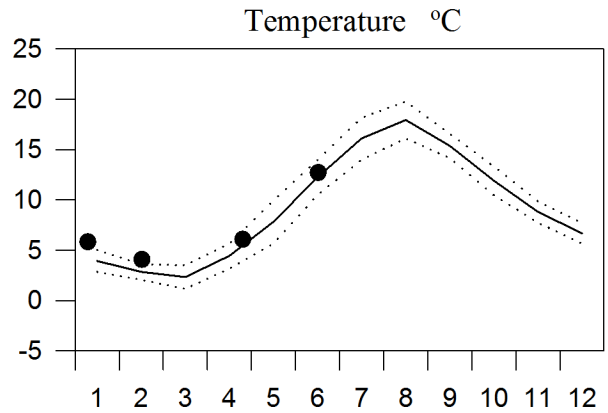
Vertical profiles BY2 June

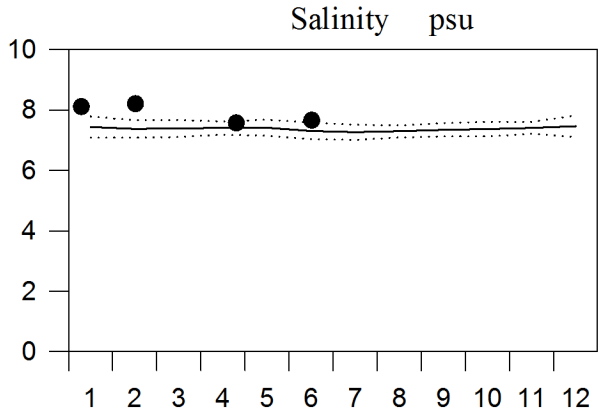


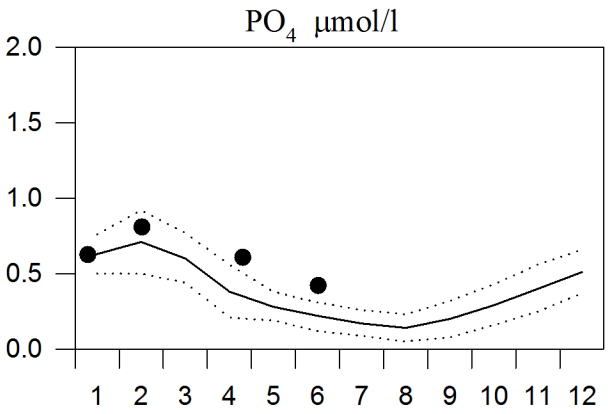
STATION HANÖBUKTEN SURFACE WATER

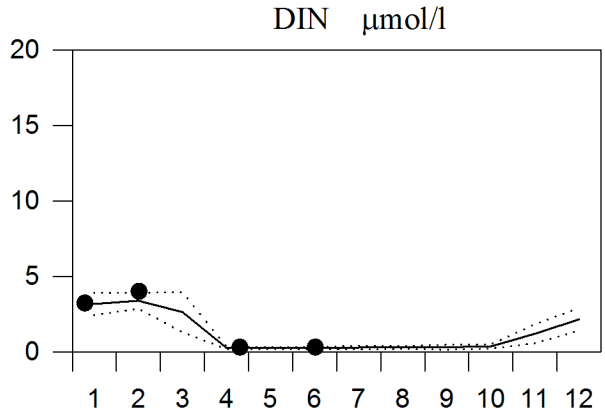
Annual Cycles

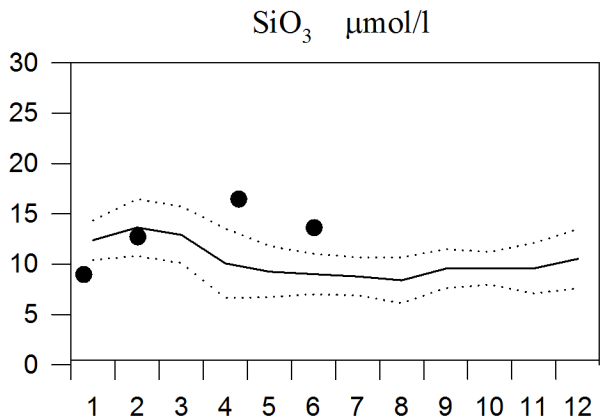
Mean 1996-2010 St.Dev. 2015

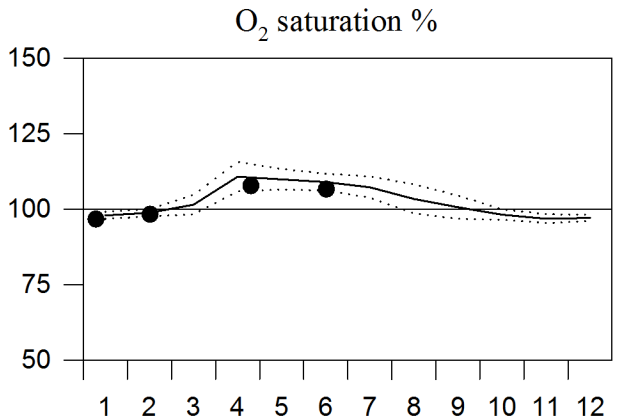




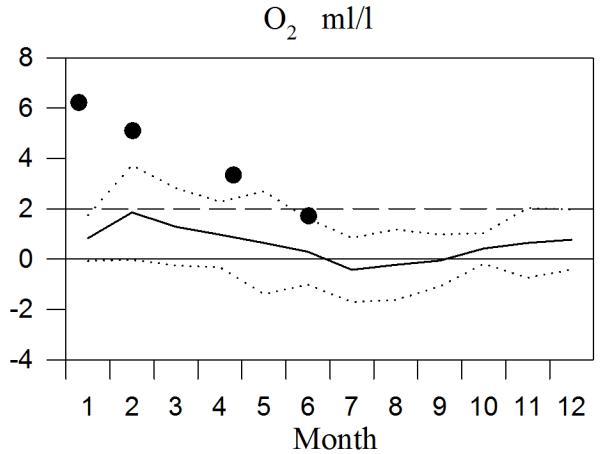


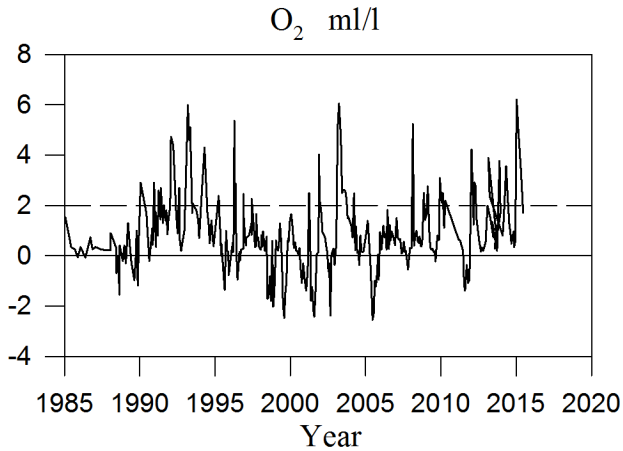




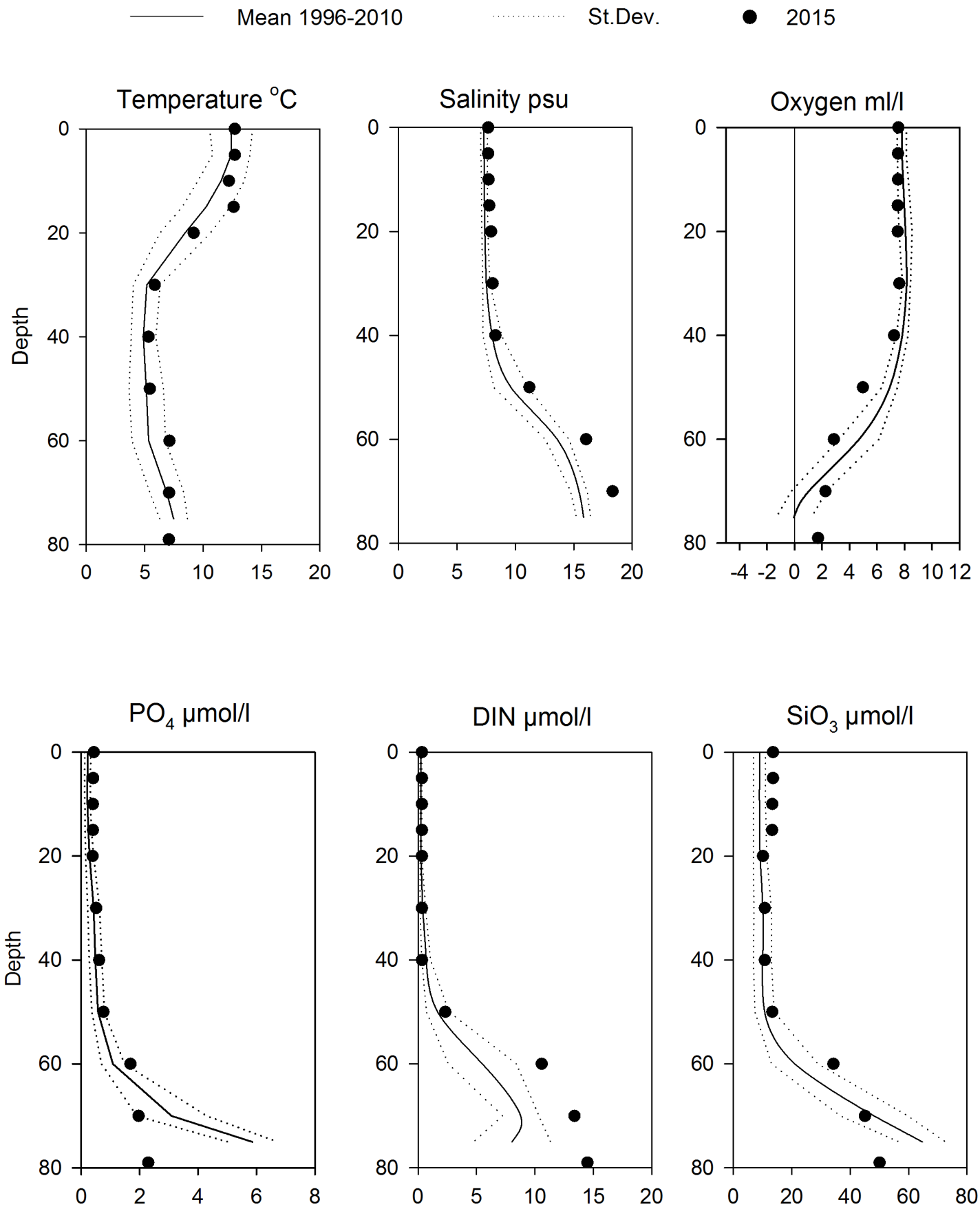


OXYGEN IN BOTTOM WATER (depth > 70m)



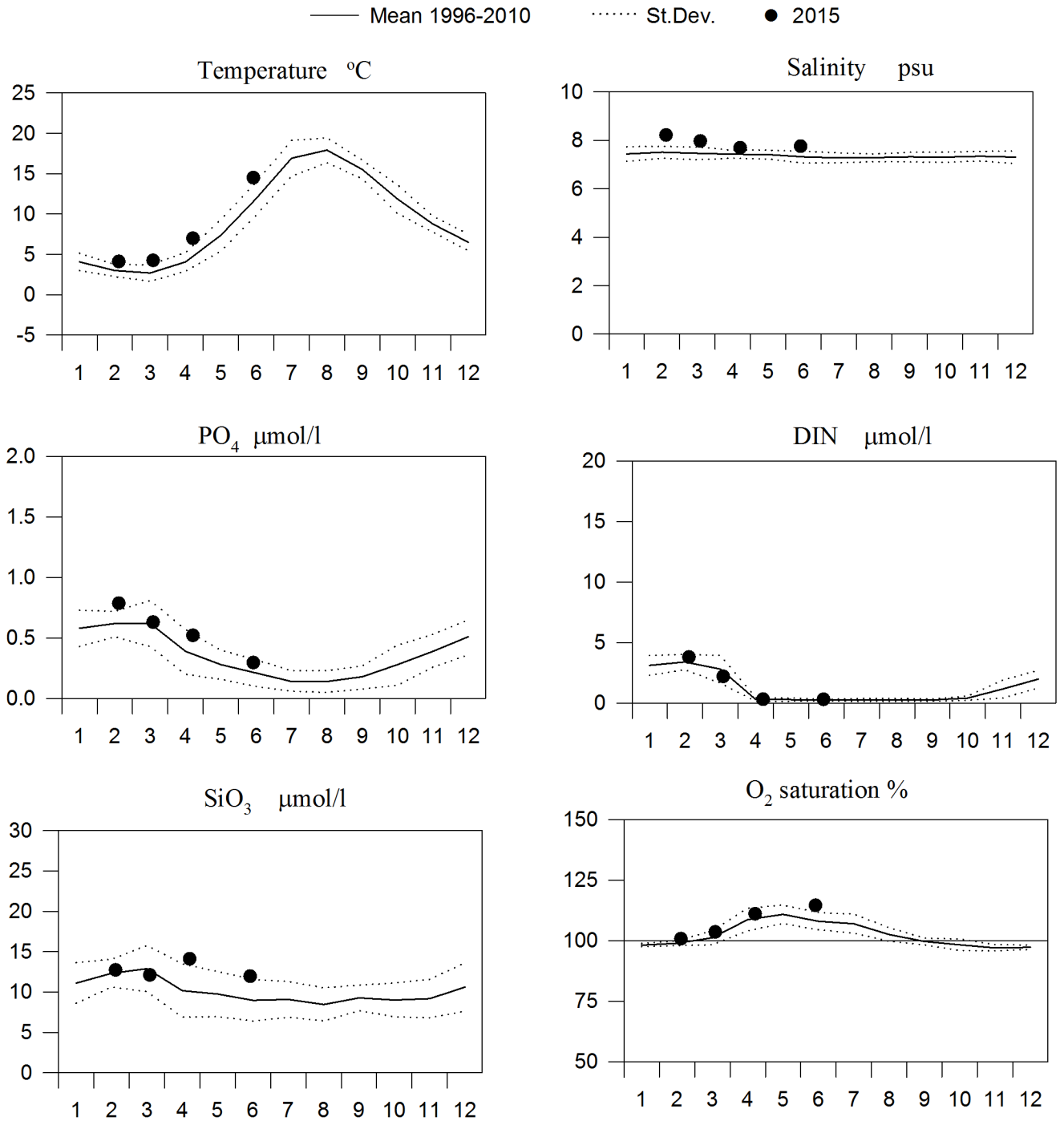


Vertical profiles Hanöbukten June

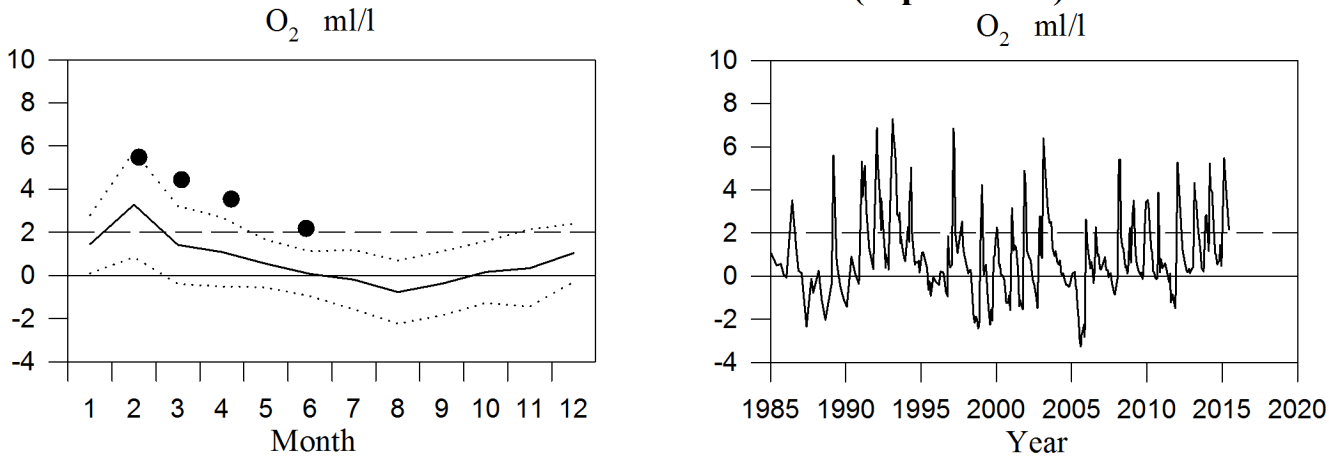


STATION BY4 SURFACE WATER

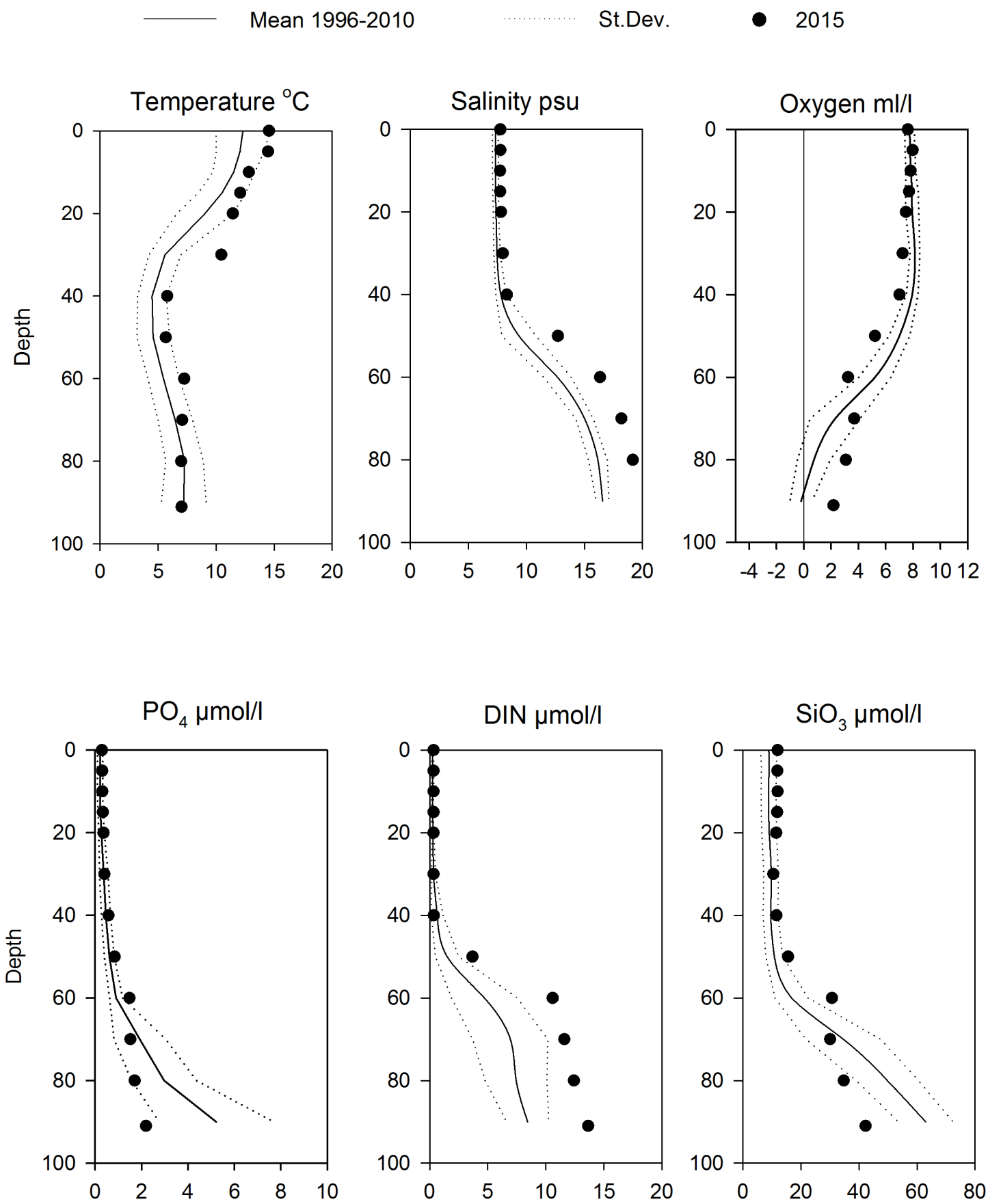
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >80m)

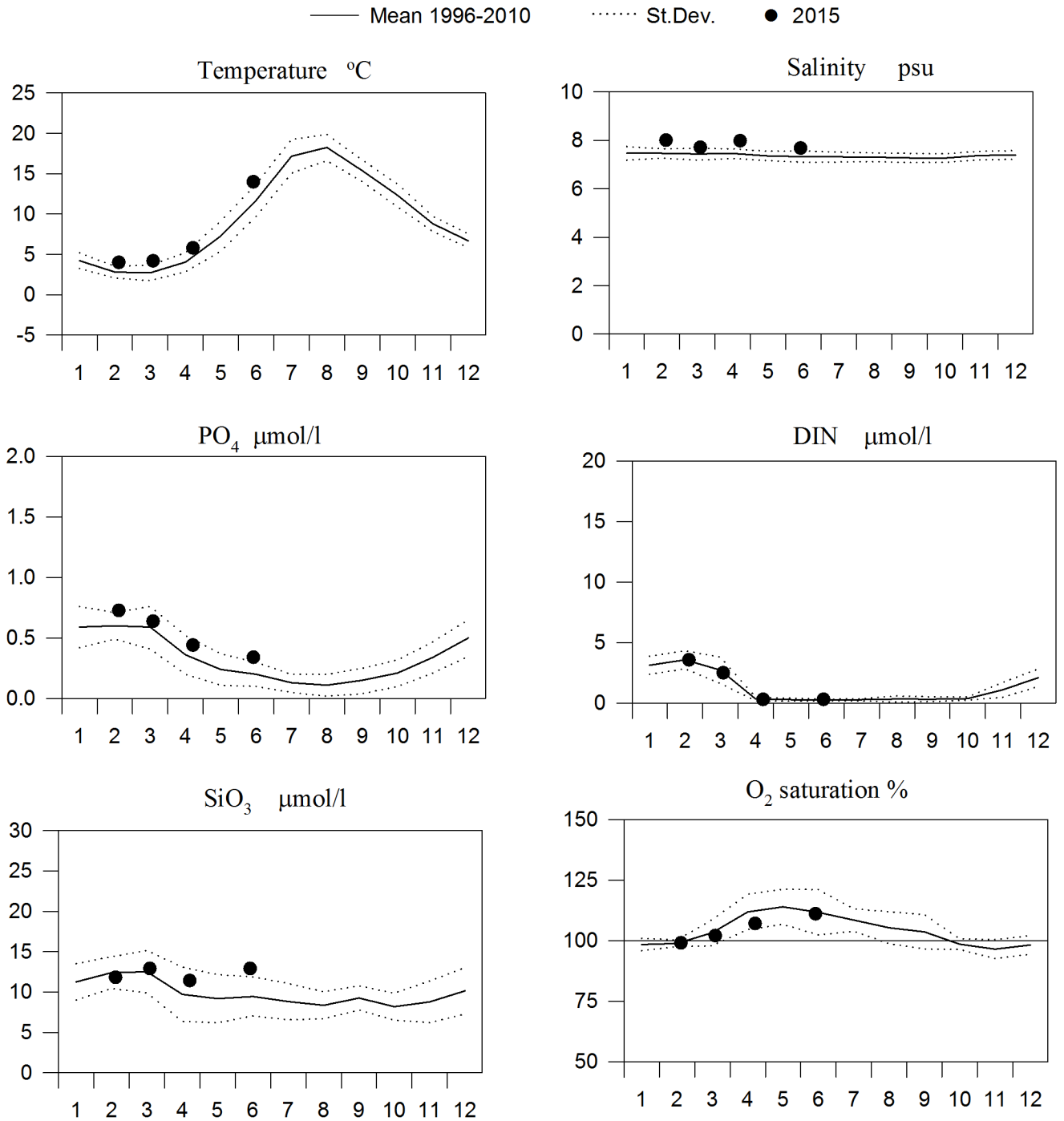


Vertical profiles BY4 June

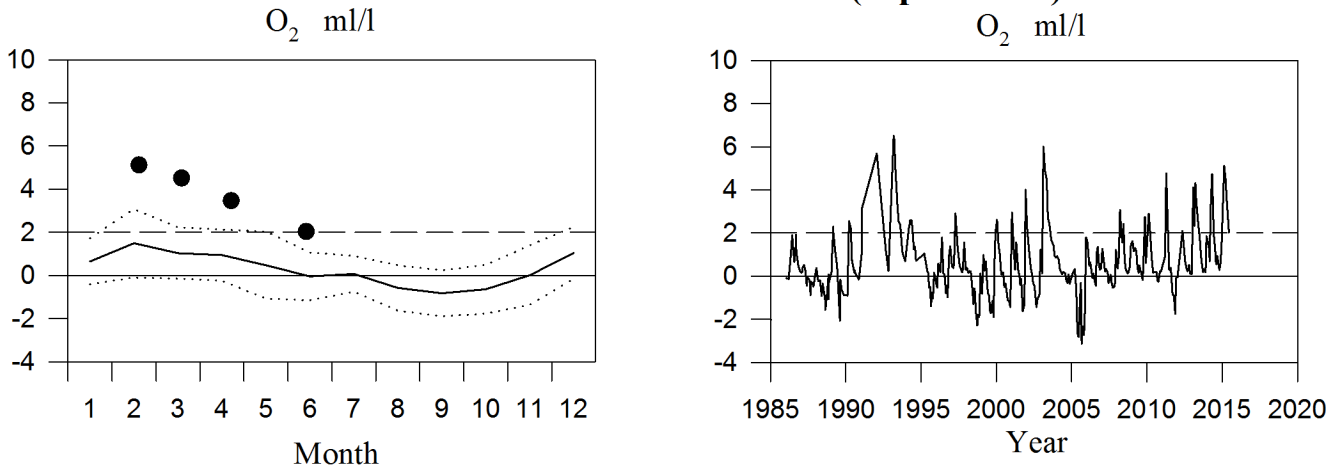


STATION BY5 SURFACE WATER

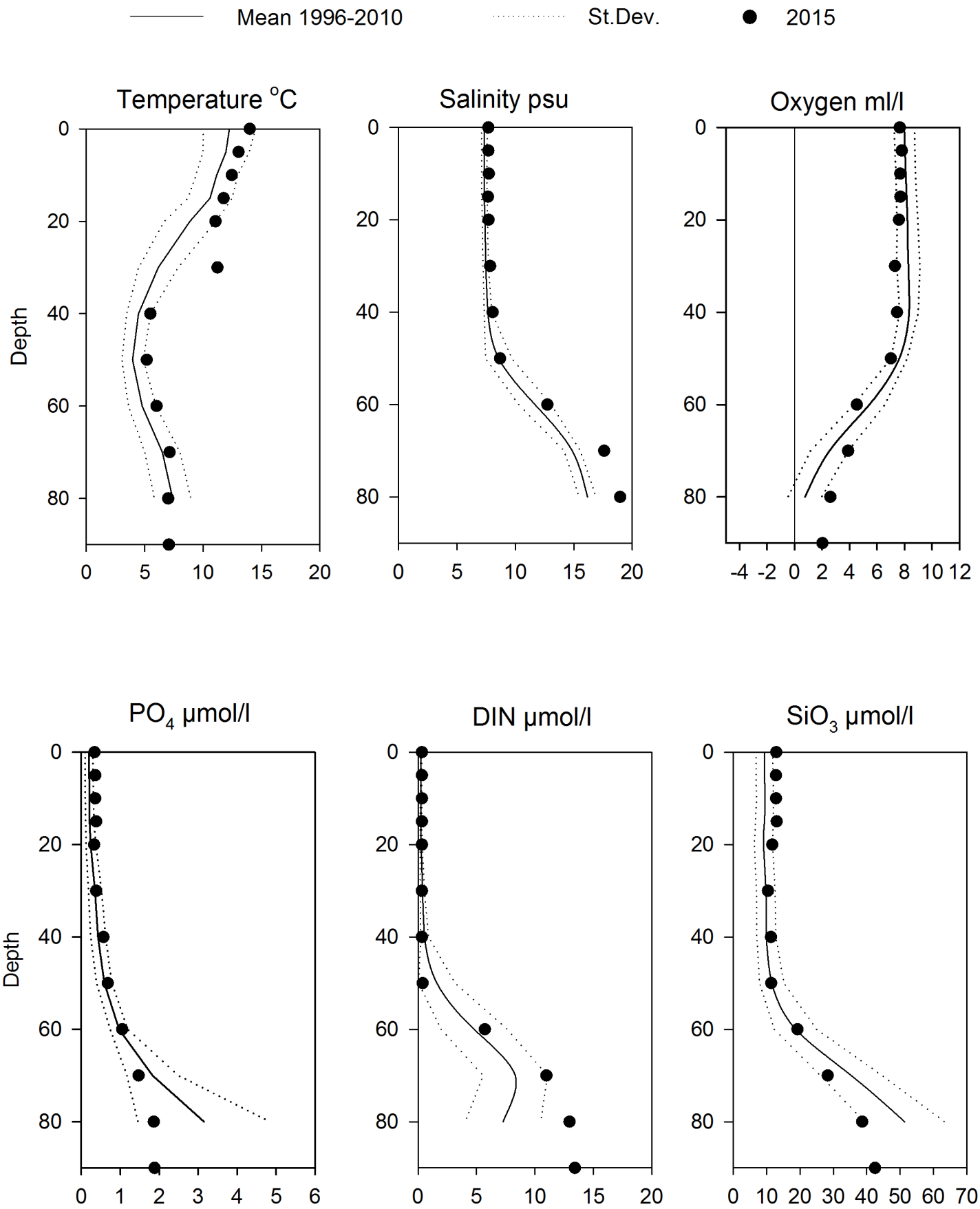
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >80m)

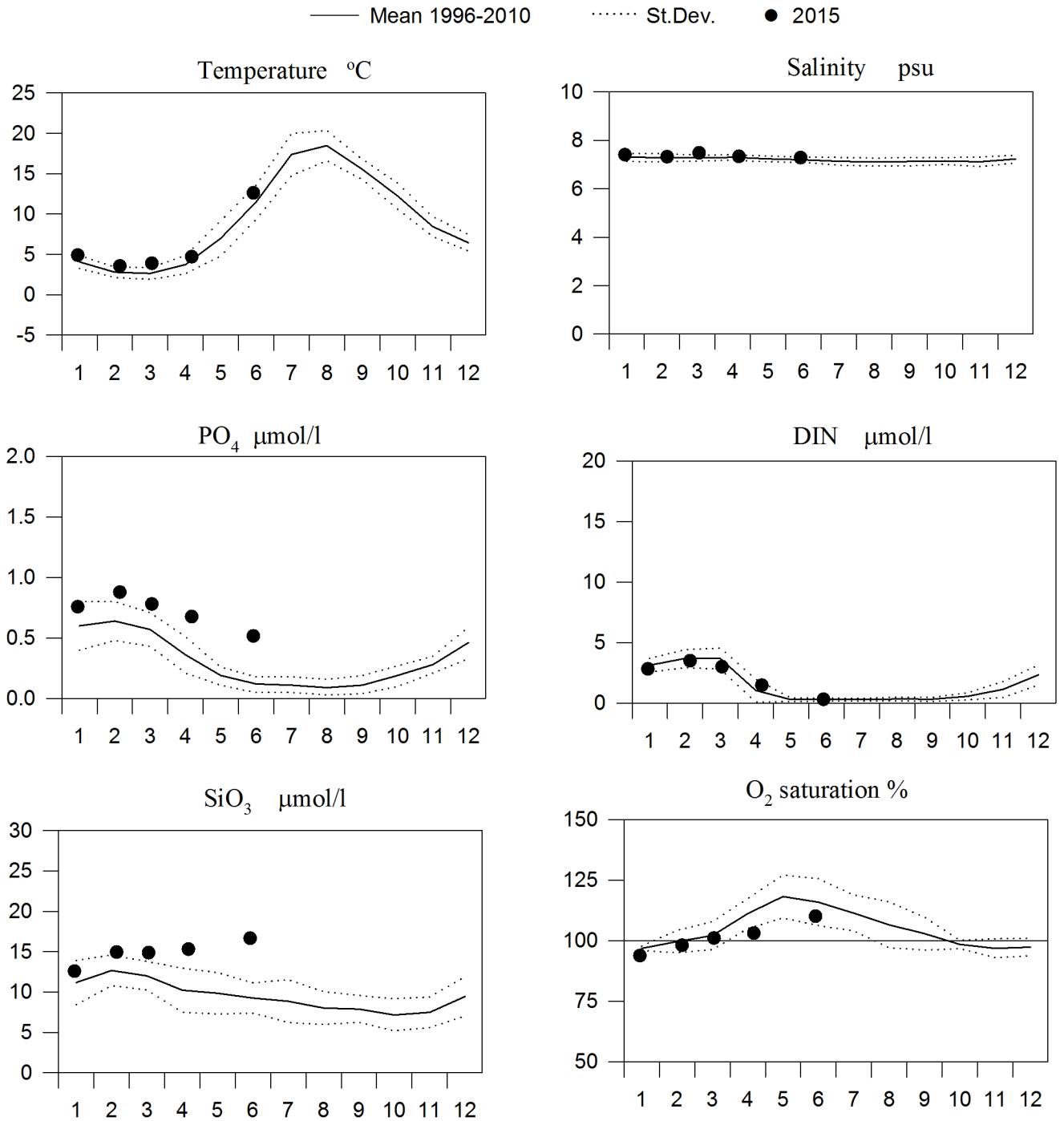


Vertical profiles BY5 June

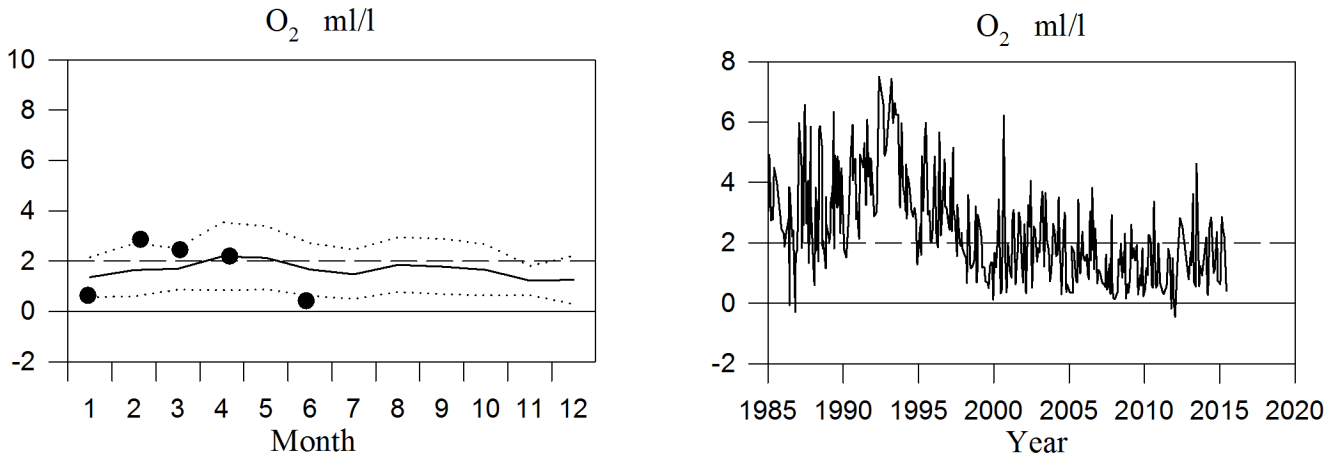


STATION BCS III-10 SURFACE WATER

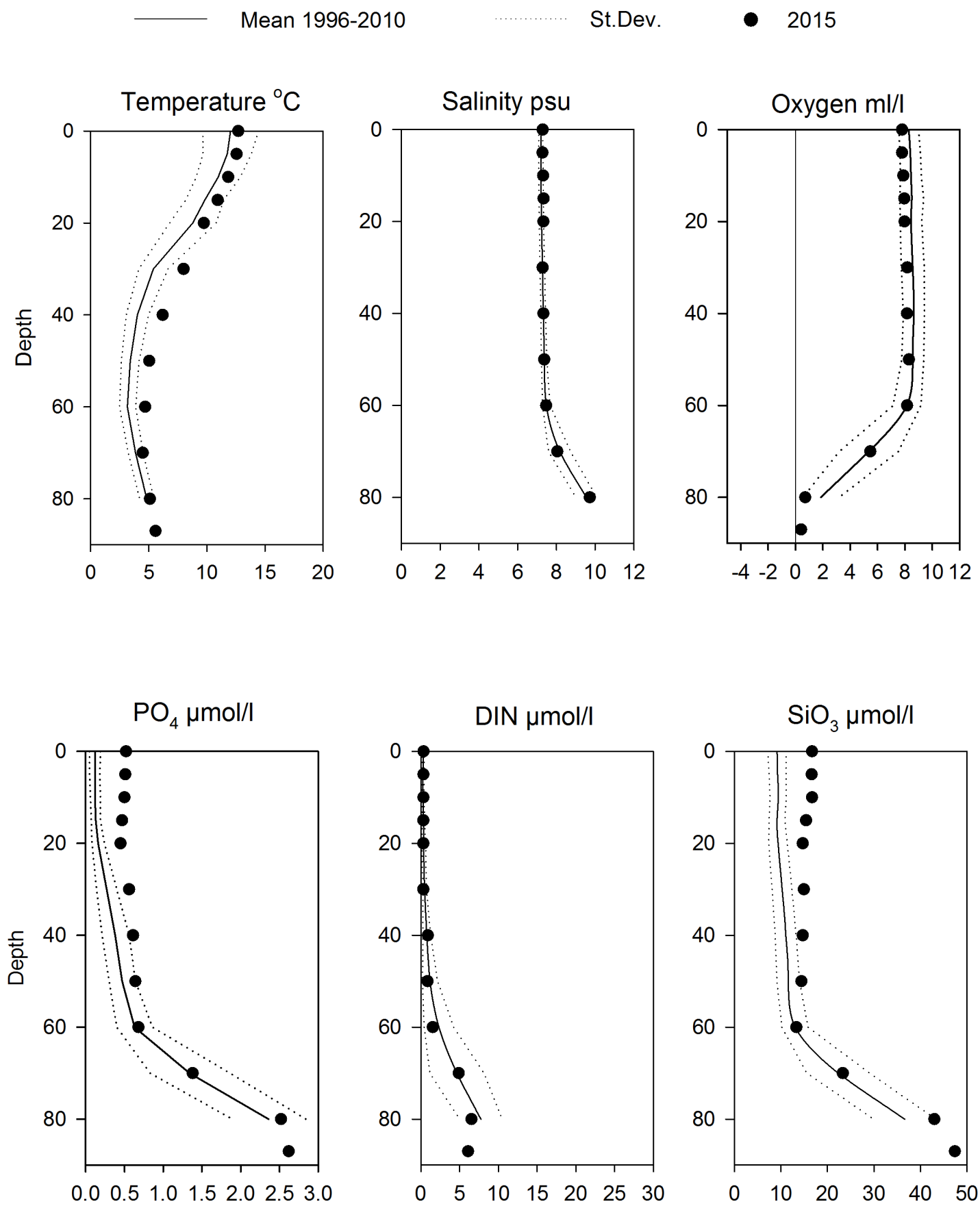
Annual Cycles



OXYGEN IN BOTTOM WATER (depth > 80m)



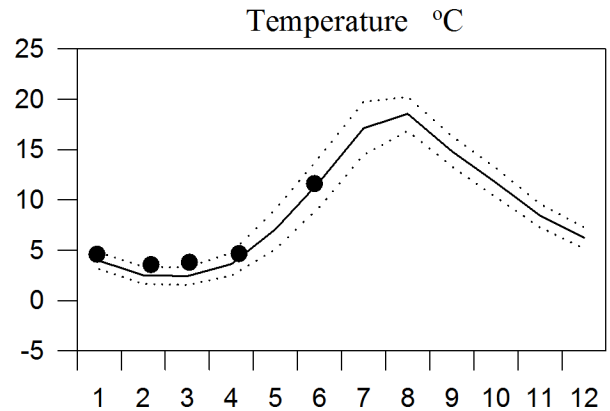
Vertical profiles BCS III-10 June

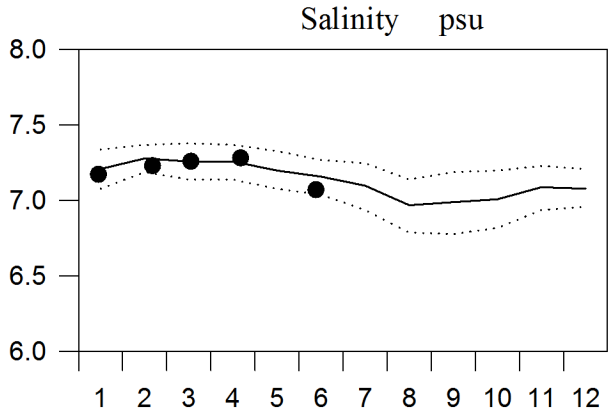


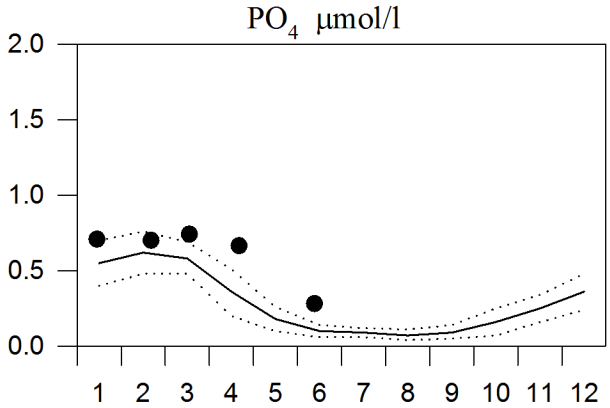
STATION BY10 SURFACE WATER

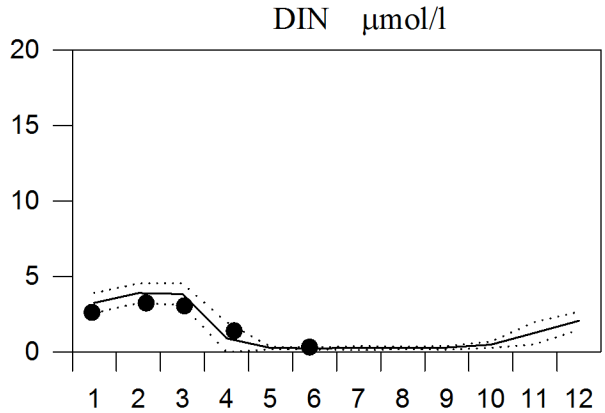
Annual Cycles

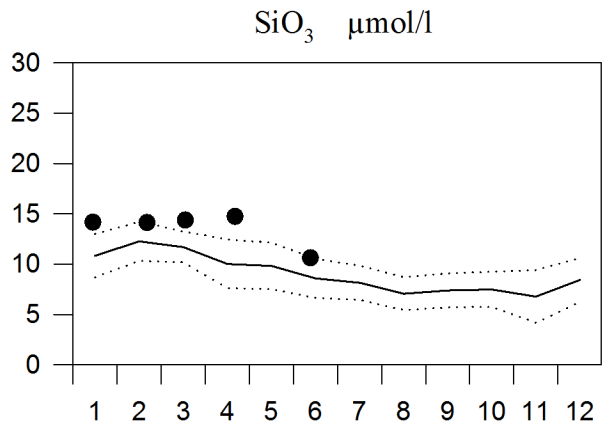
Mean 1996-2010 St.Dev. 2015

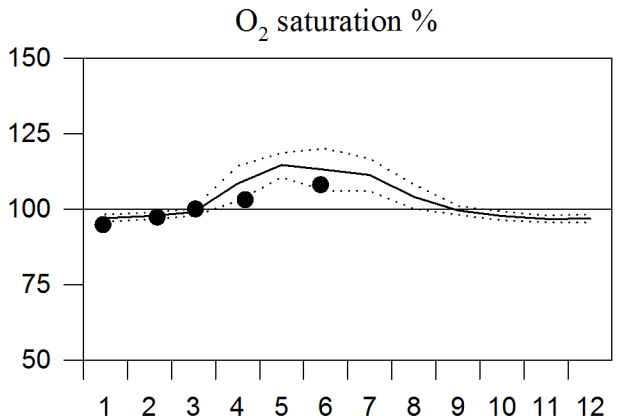




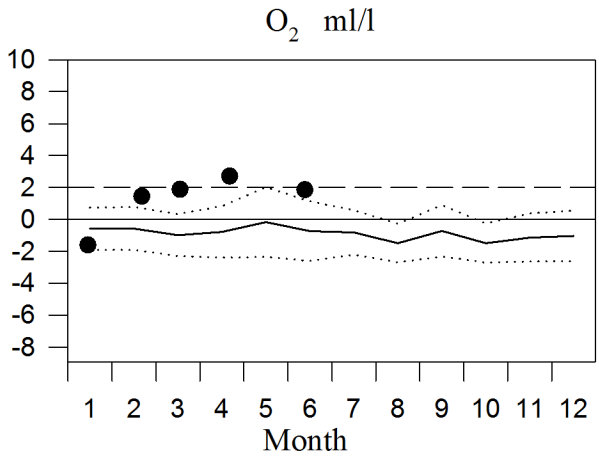


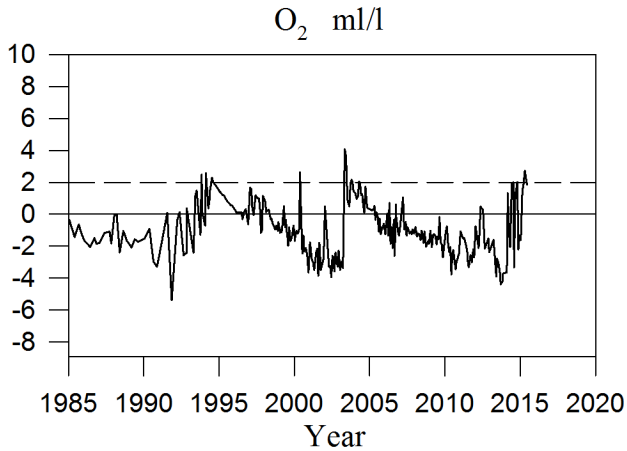




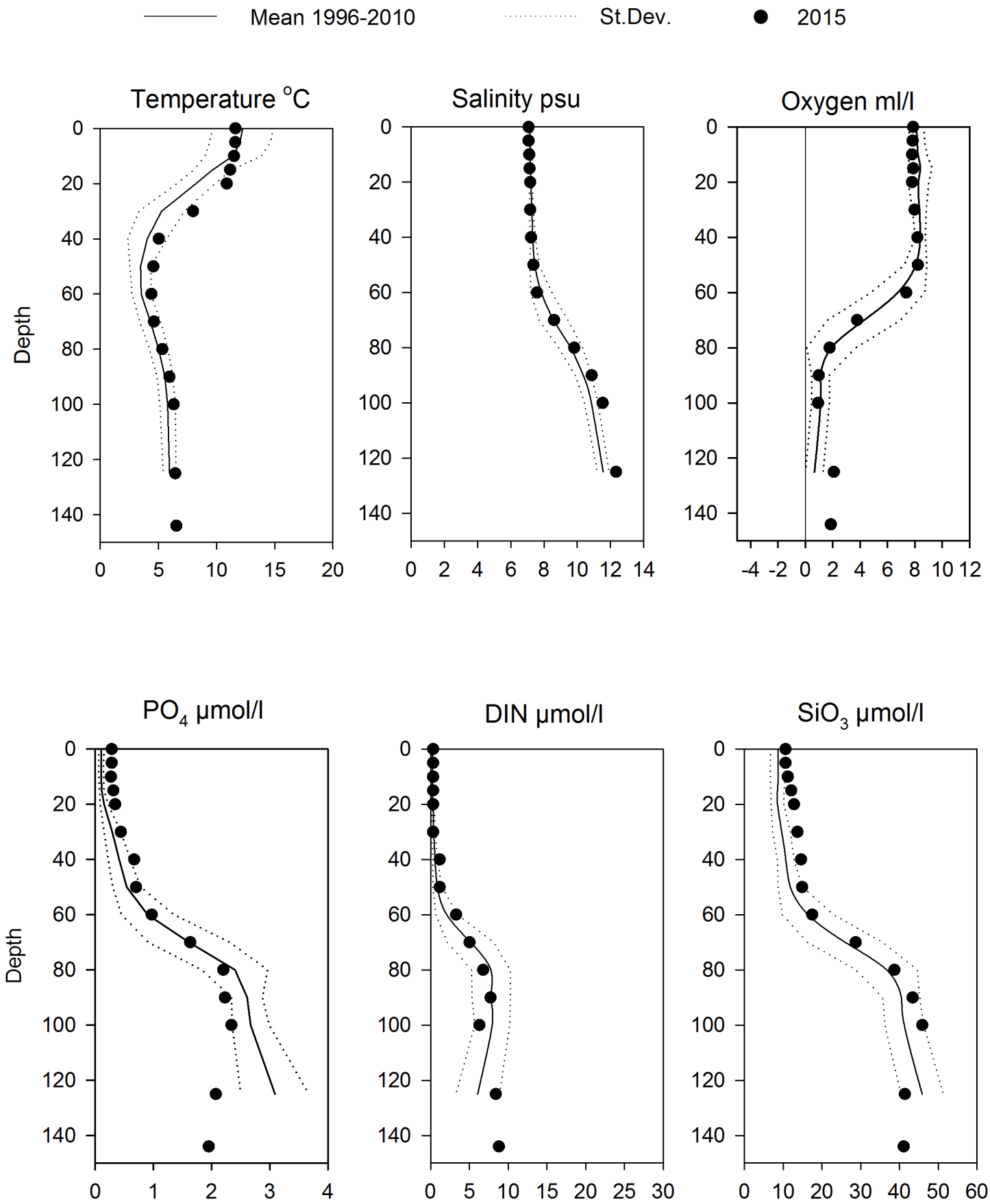


OXYGEN IN BOTTOM WATER (depth >125m)





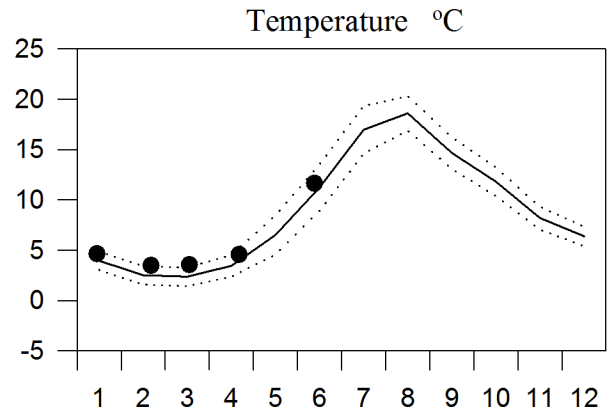
Vertical profiles BY10 June

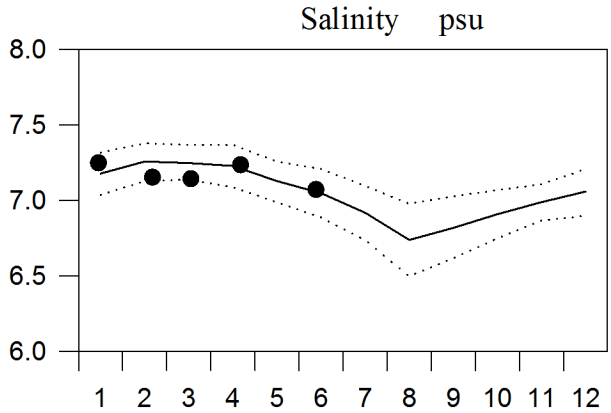


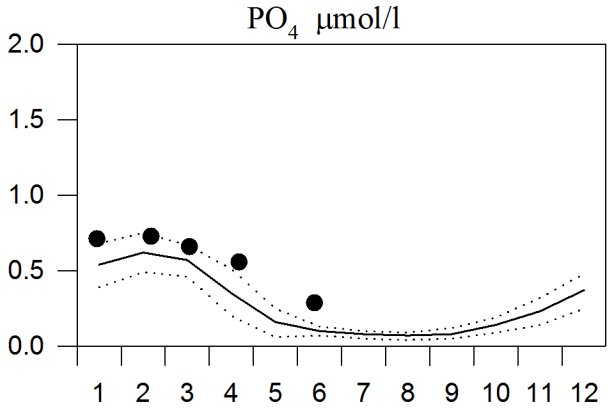
STATION BY15 SURFACE WATER

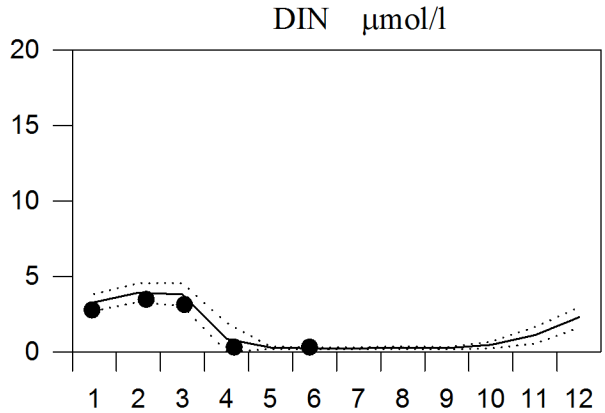
Annual Cycles

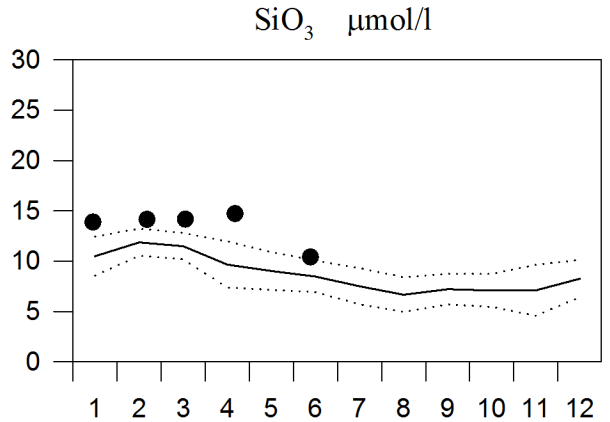
Mean 1996-2010 St.Dev. 2015

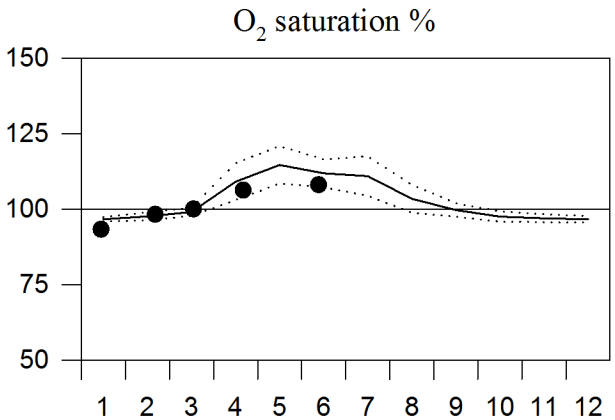




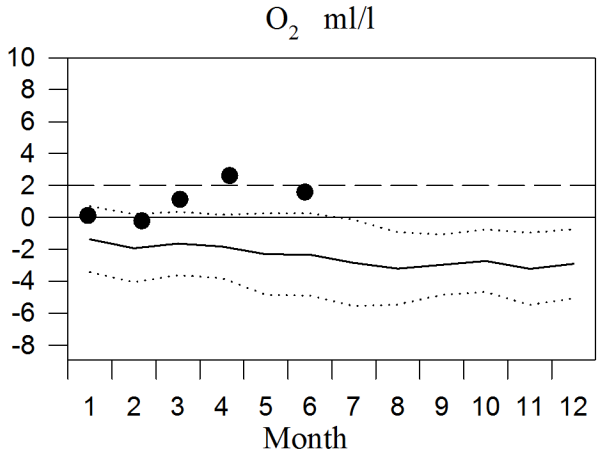


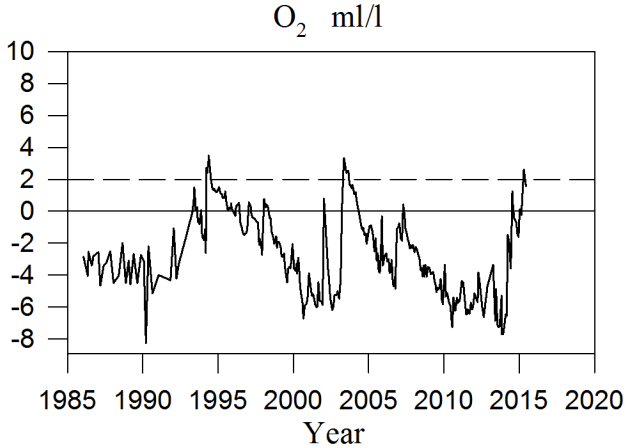




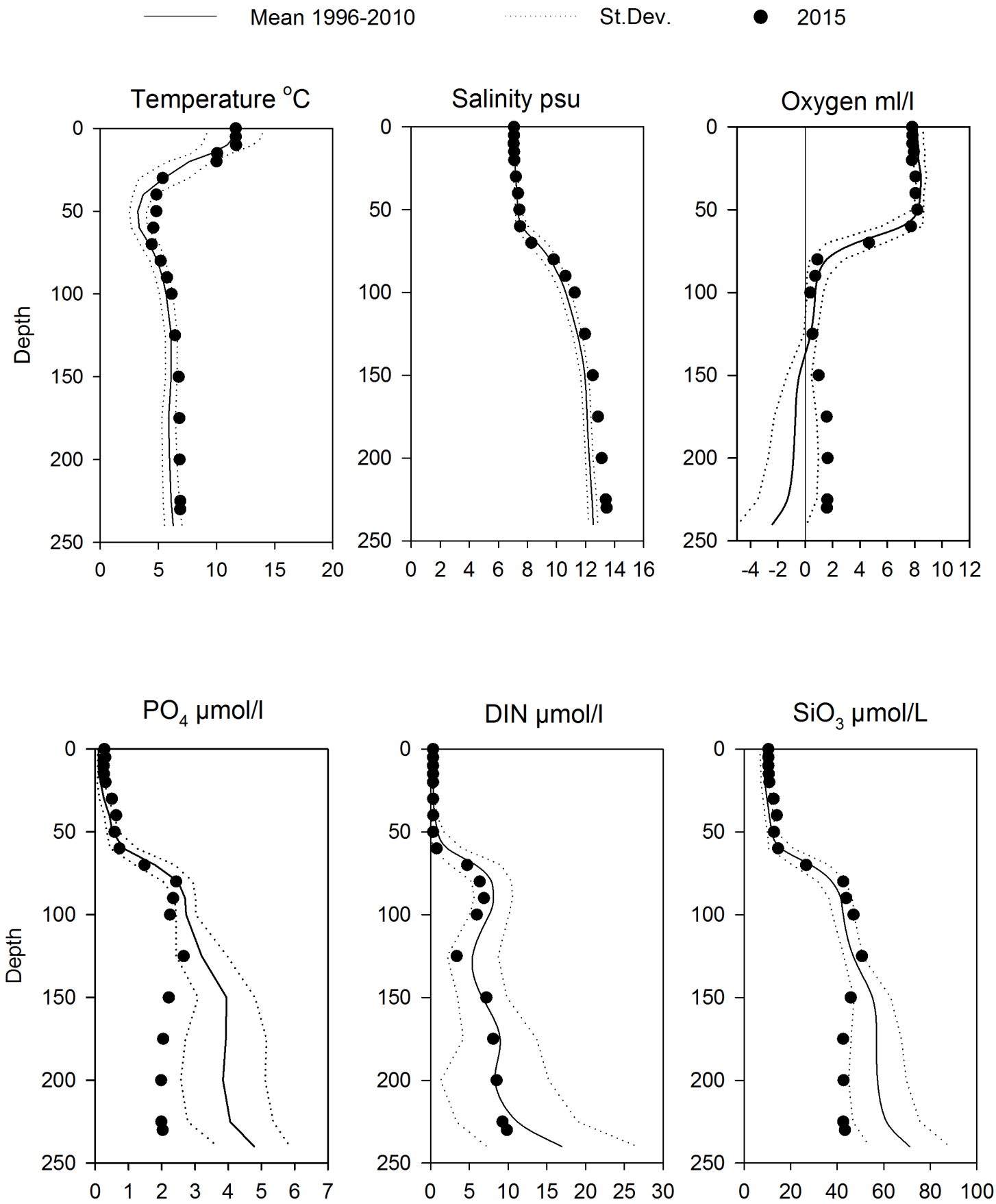


OXYGEN IN BOTTOM WATER (depth >225m)





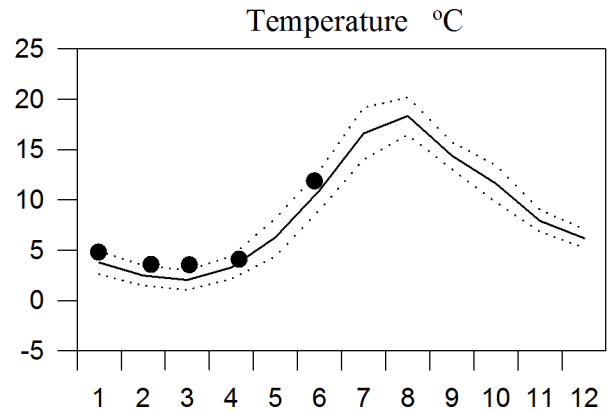
Vertical profiles BY15 June

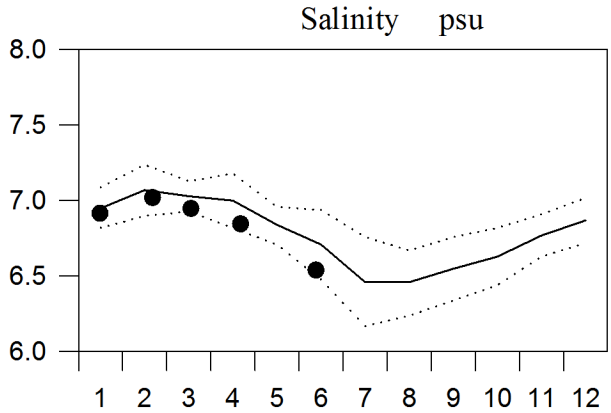


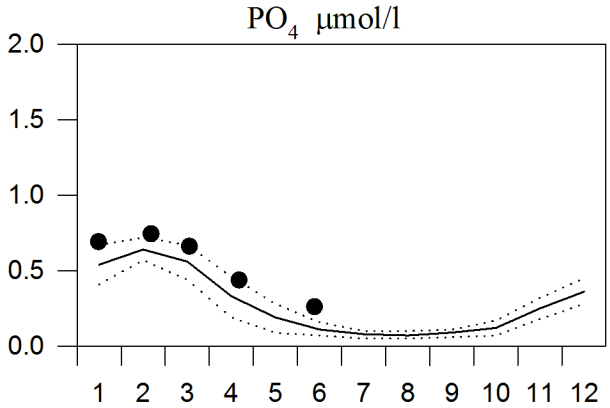
STATION BY20 SURFACE WATER

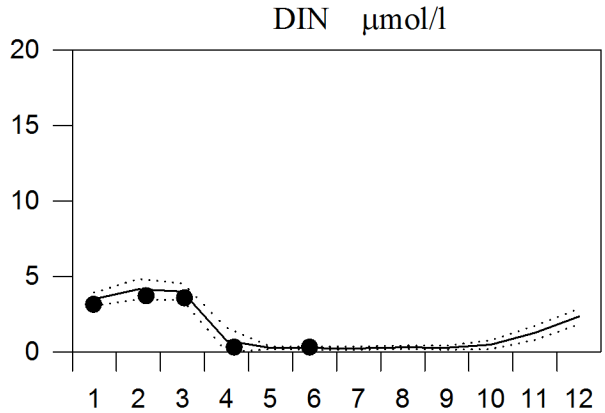
Annual Cycles

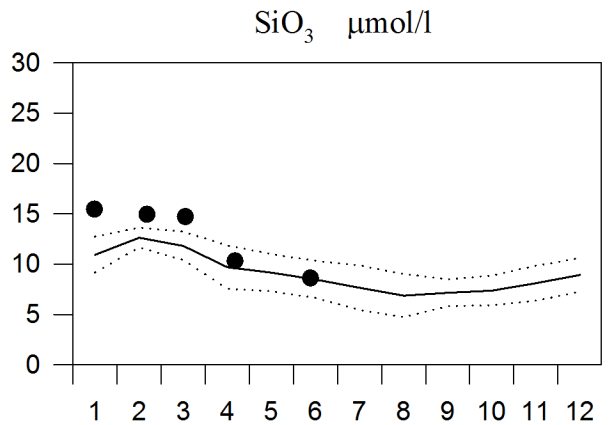
Mean 1996-2010 St.Dev. 2015

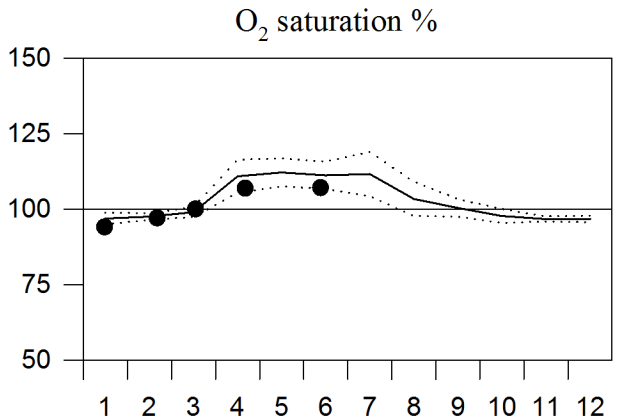




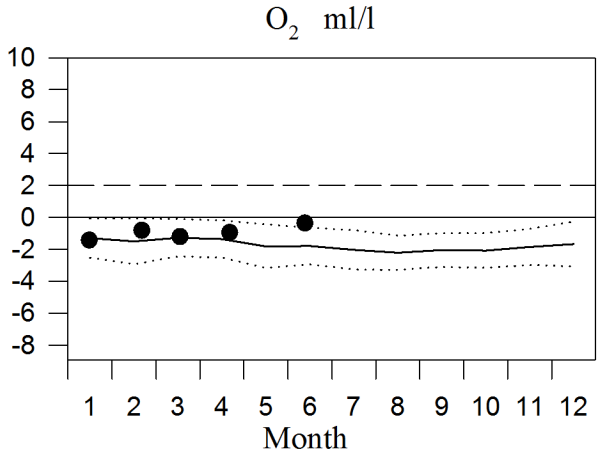


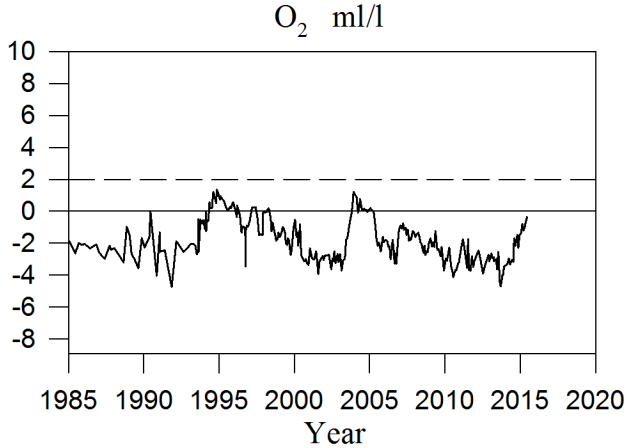




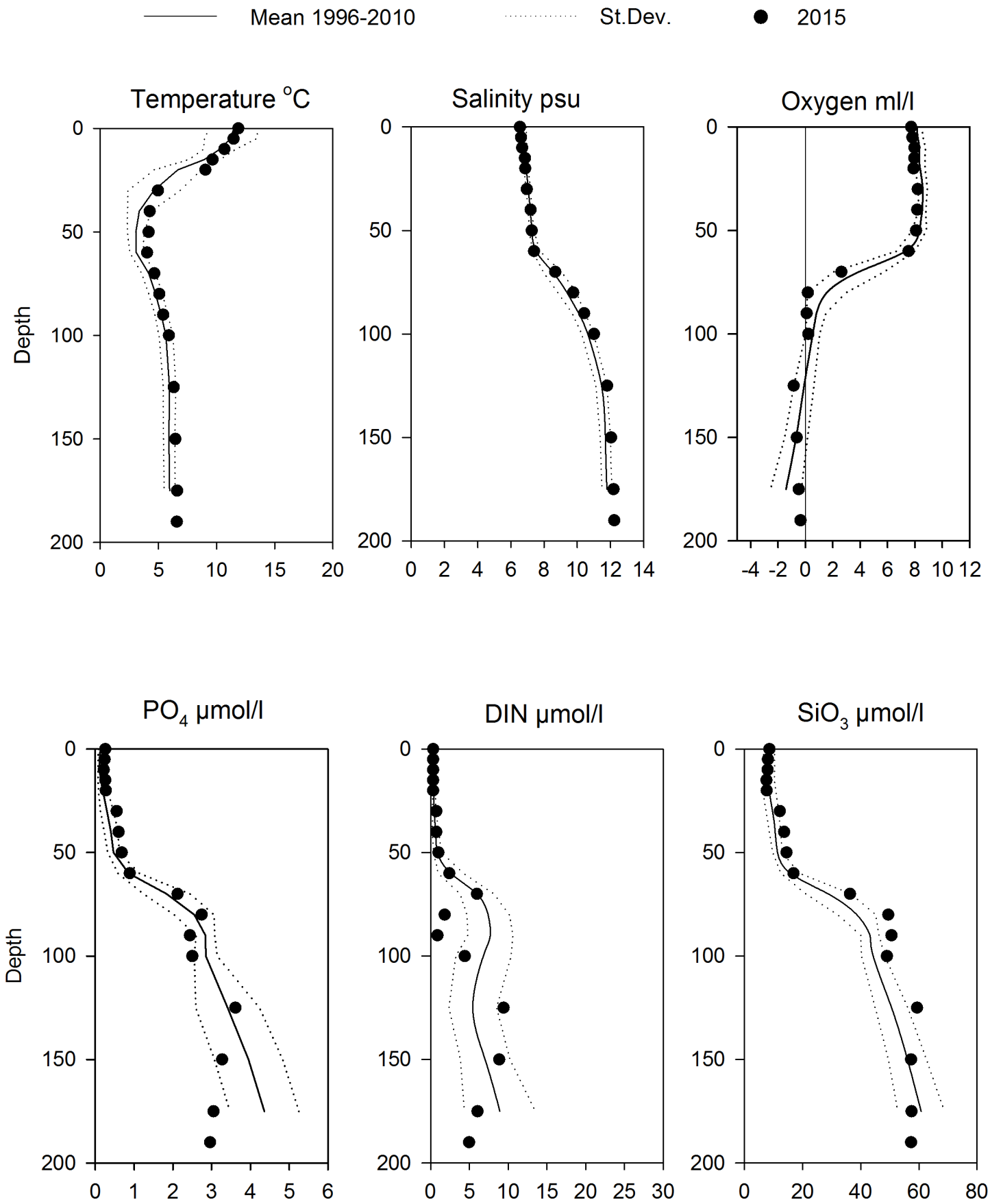


OXYGEN IN BOTTOM WATER (depth >175m)





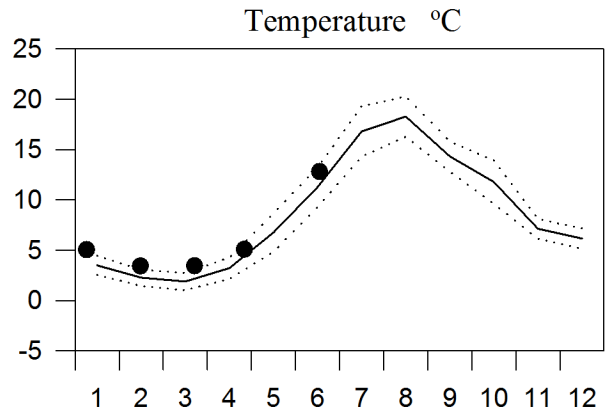
Vertical profiles BY20 June

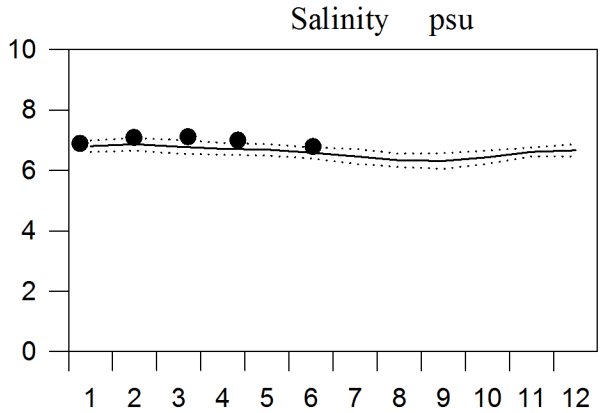


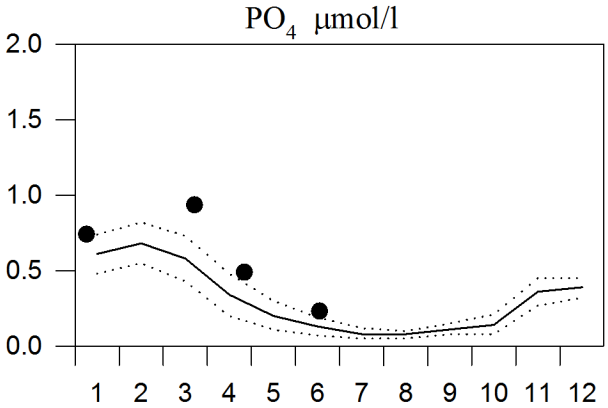
STATION BY32 SURFACE WATER

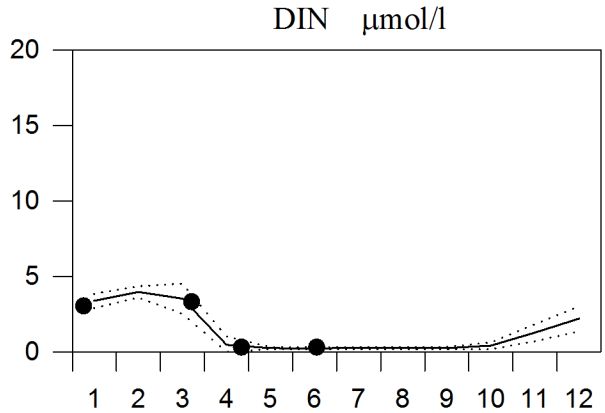
Annual Cycles

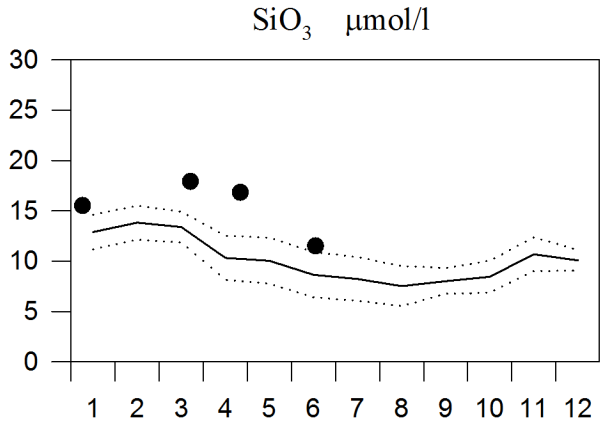
Mean 1996-2010 St.Dev. 2015

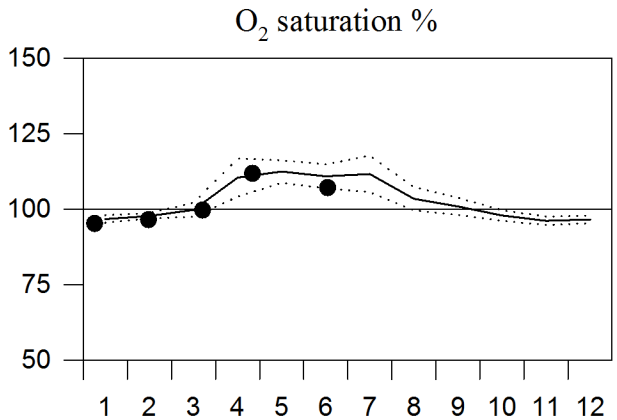




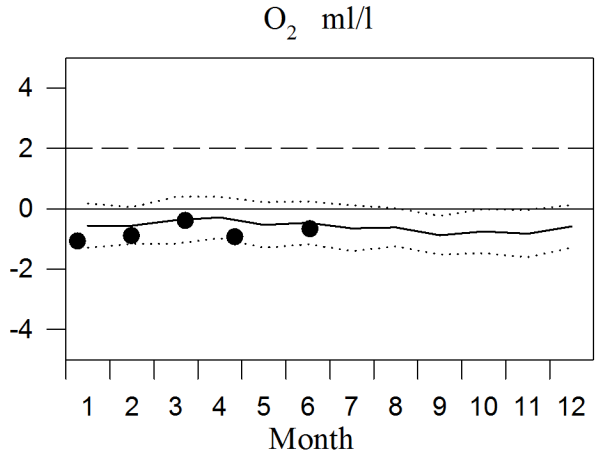


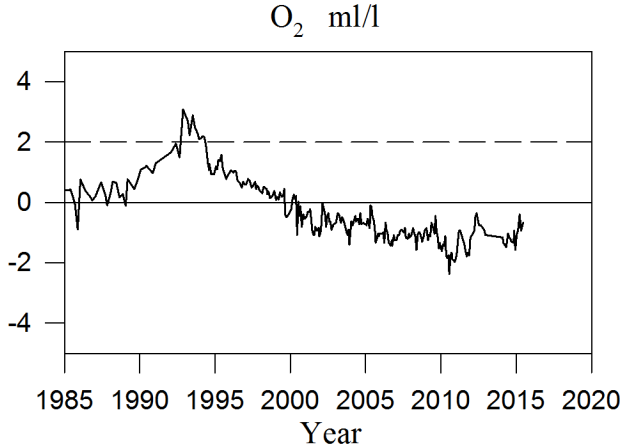




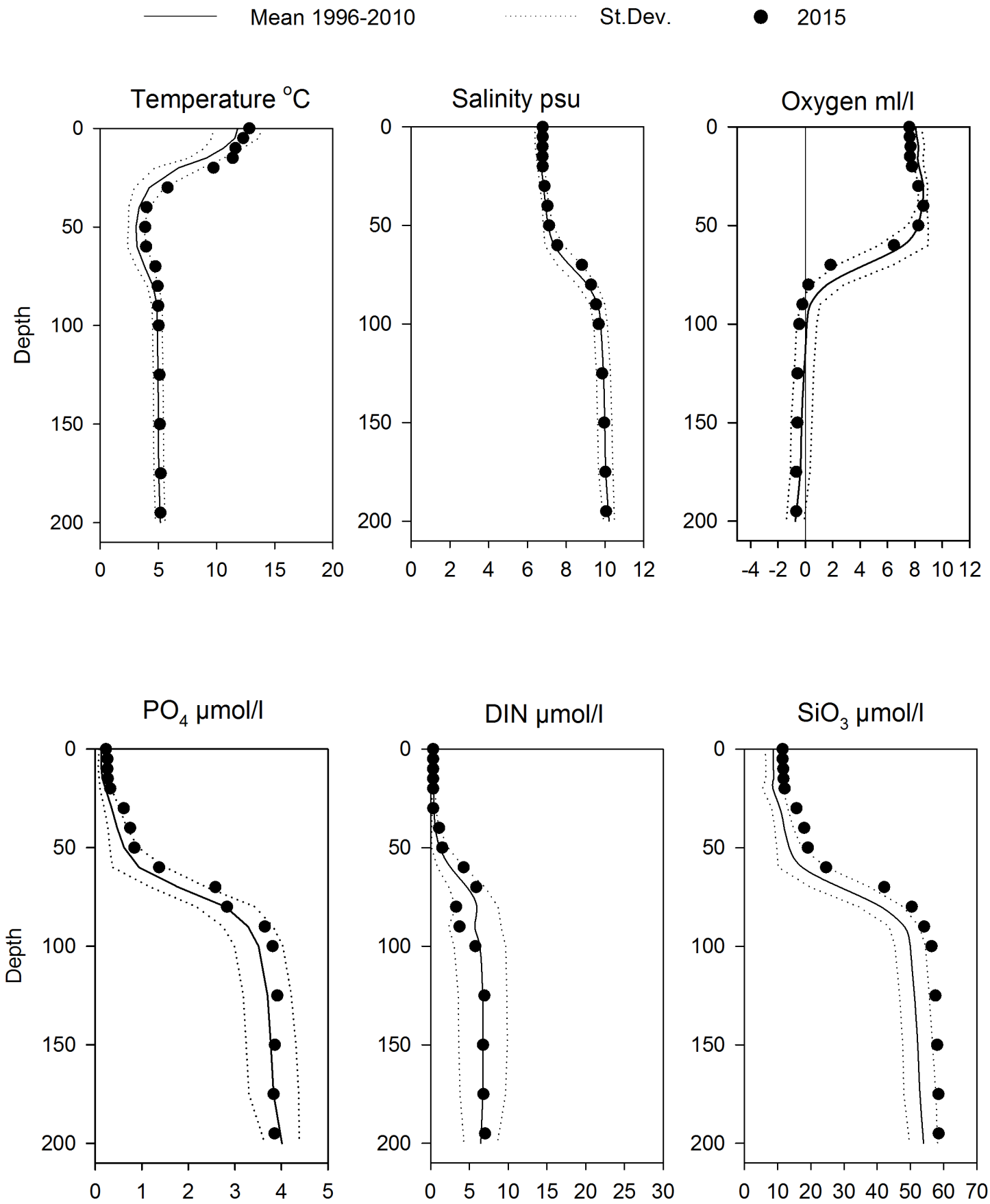


OXYGEN IN BOTTOM WATER (depth > 175m)





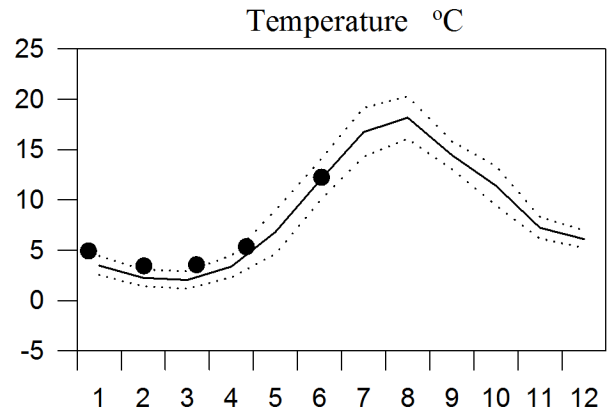
Vertical profiles BY32 June

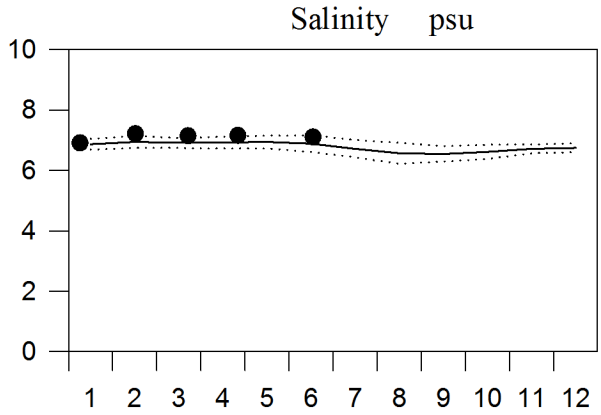


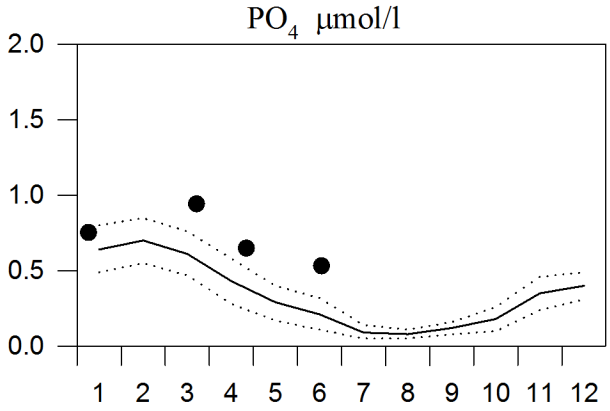
STATION BY38 SURFACE WATER

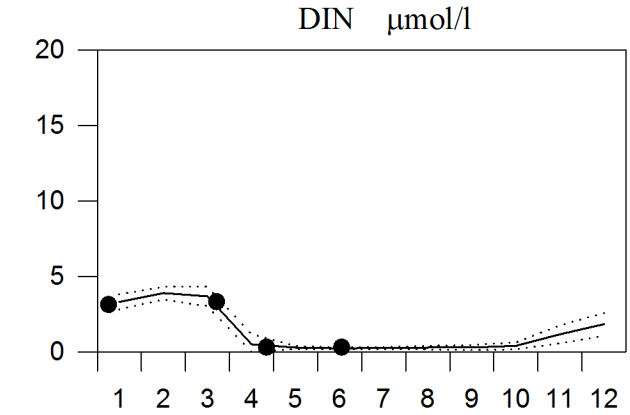
Annual Cycles

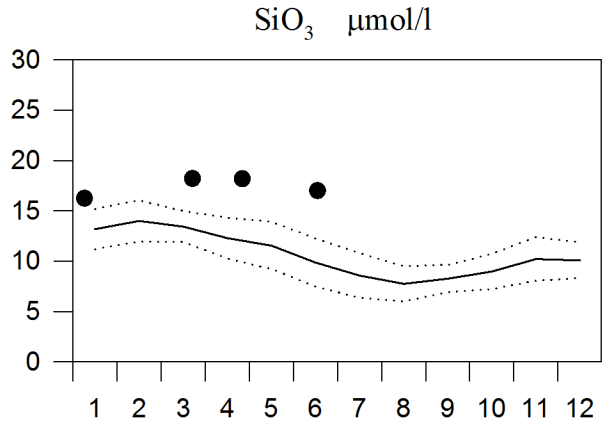
Mean 1996-2010 St.Dev. 2015

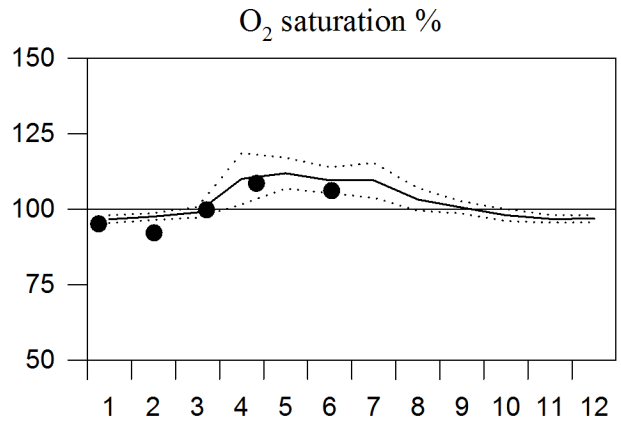




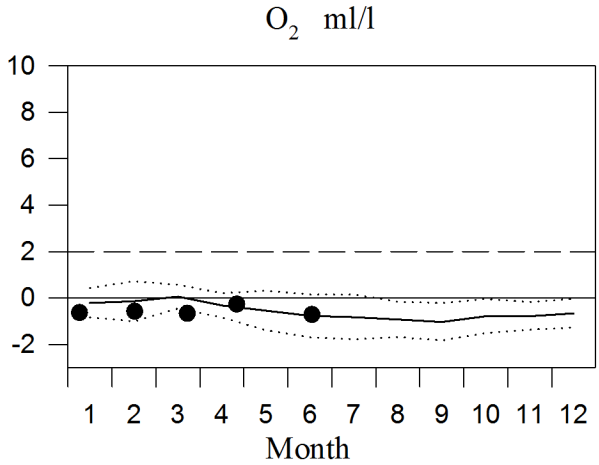


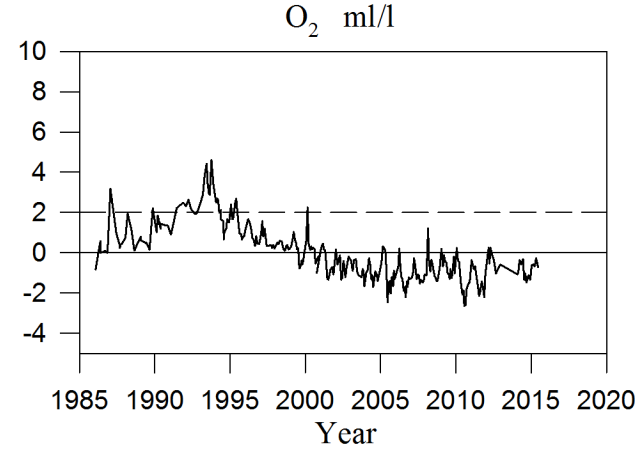




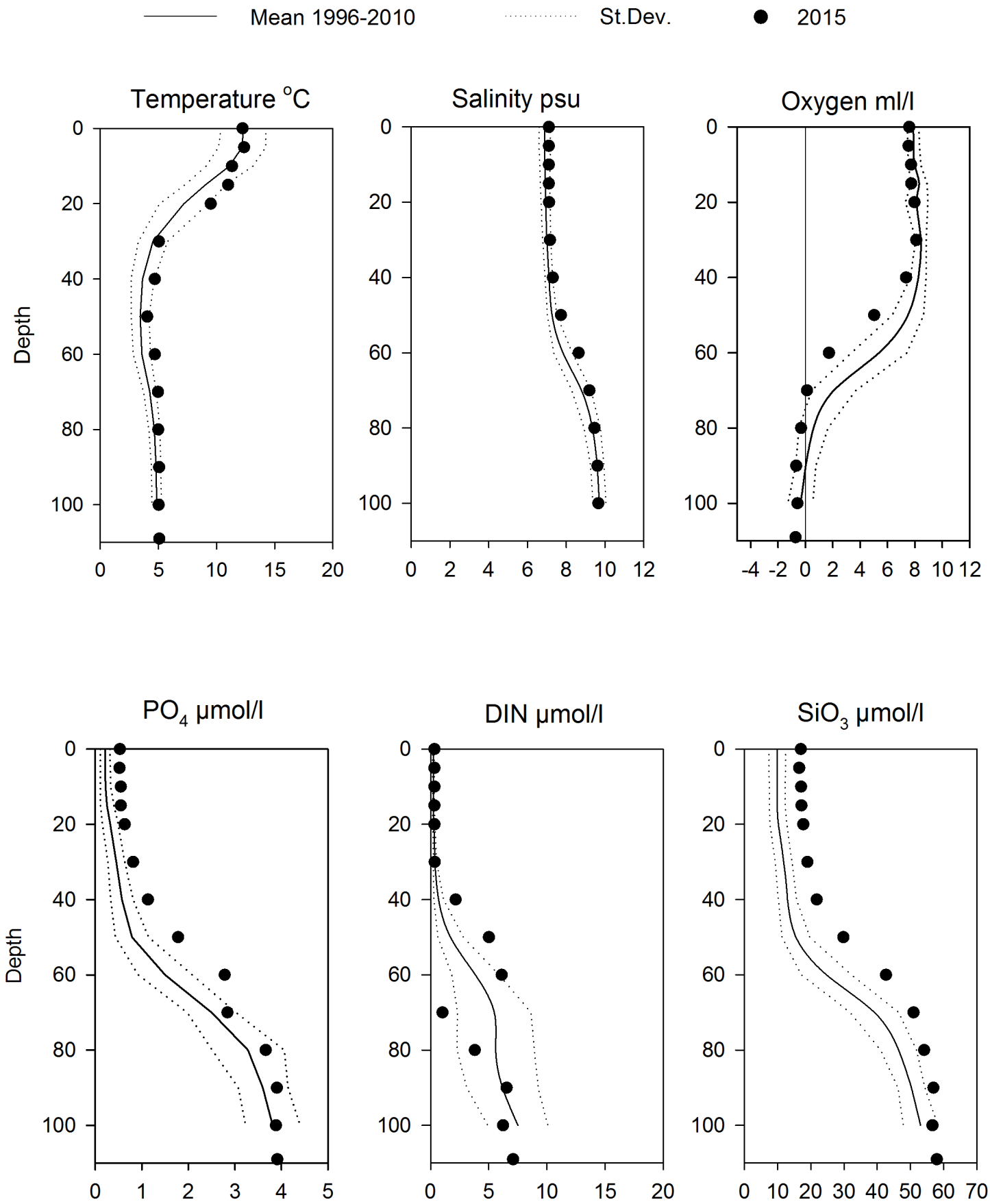


OXYGEN IN BOTTOM WATER (> 100m)





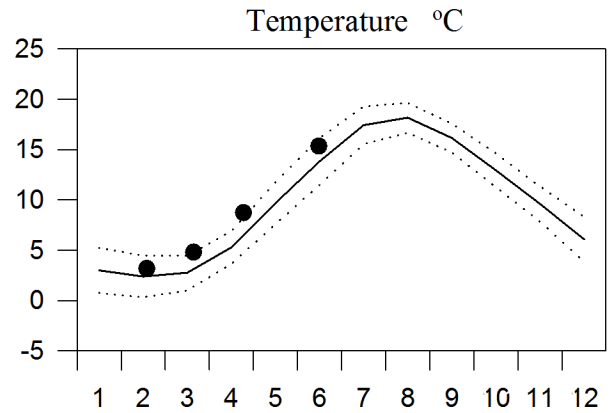
Vertical profiles BY38 June

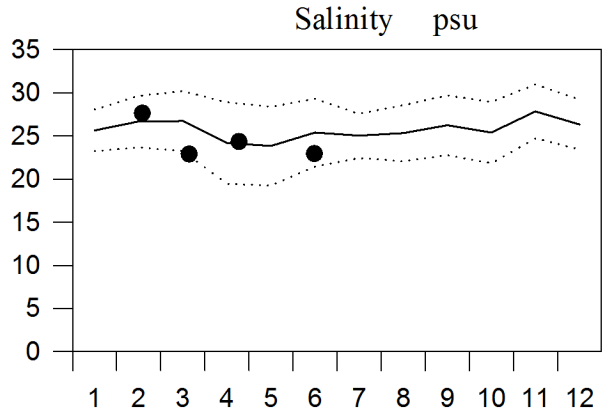


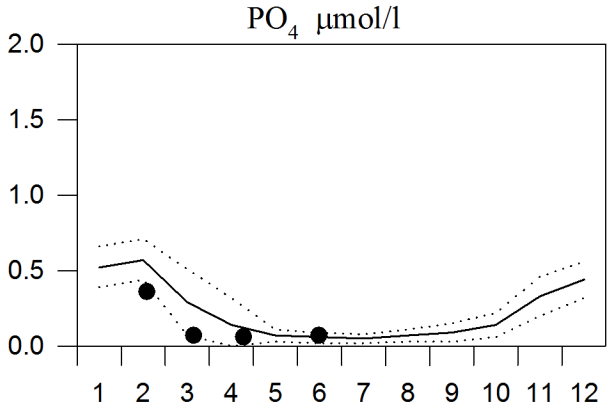
STATION SLÄGGÖ SURFACE WATER

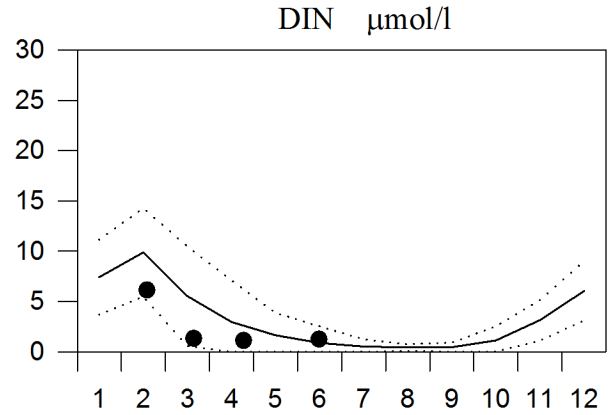
Annual Cycles

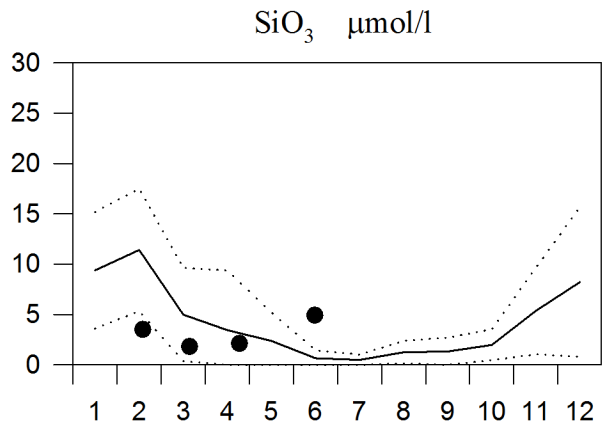
Mean 1996-2010 St.Dev. 2015

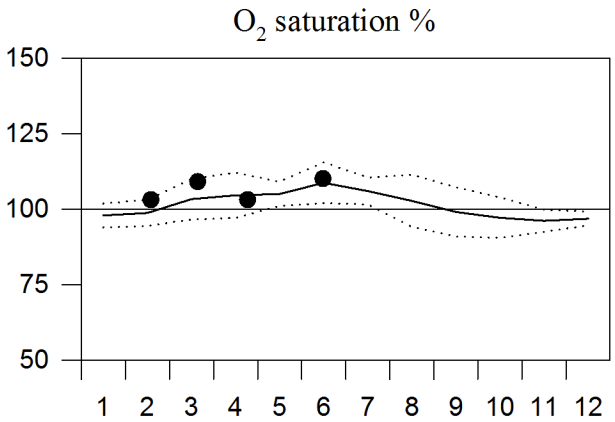




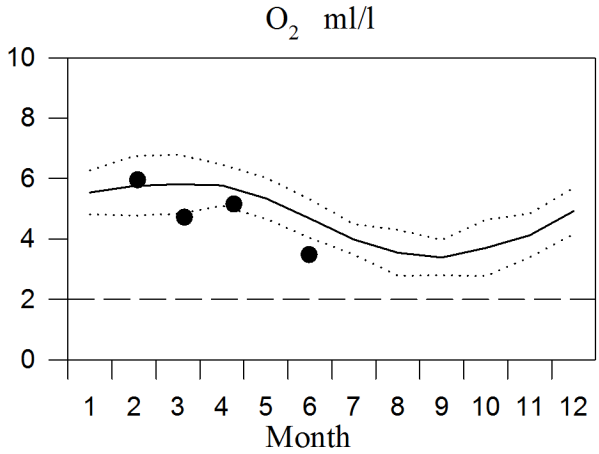


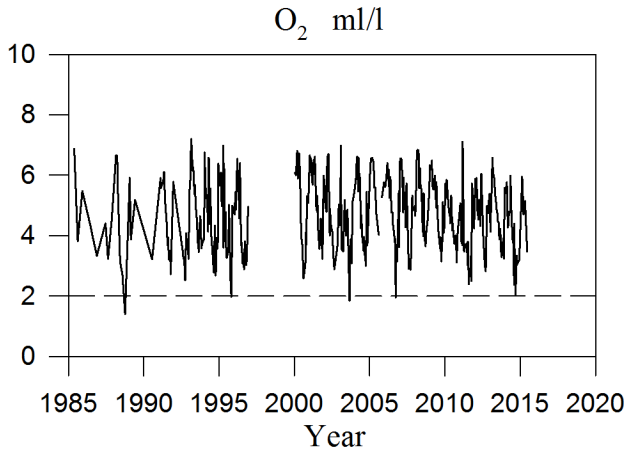




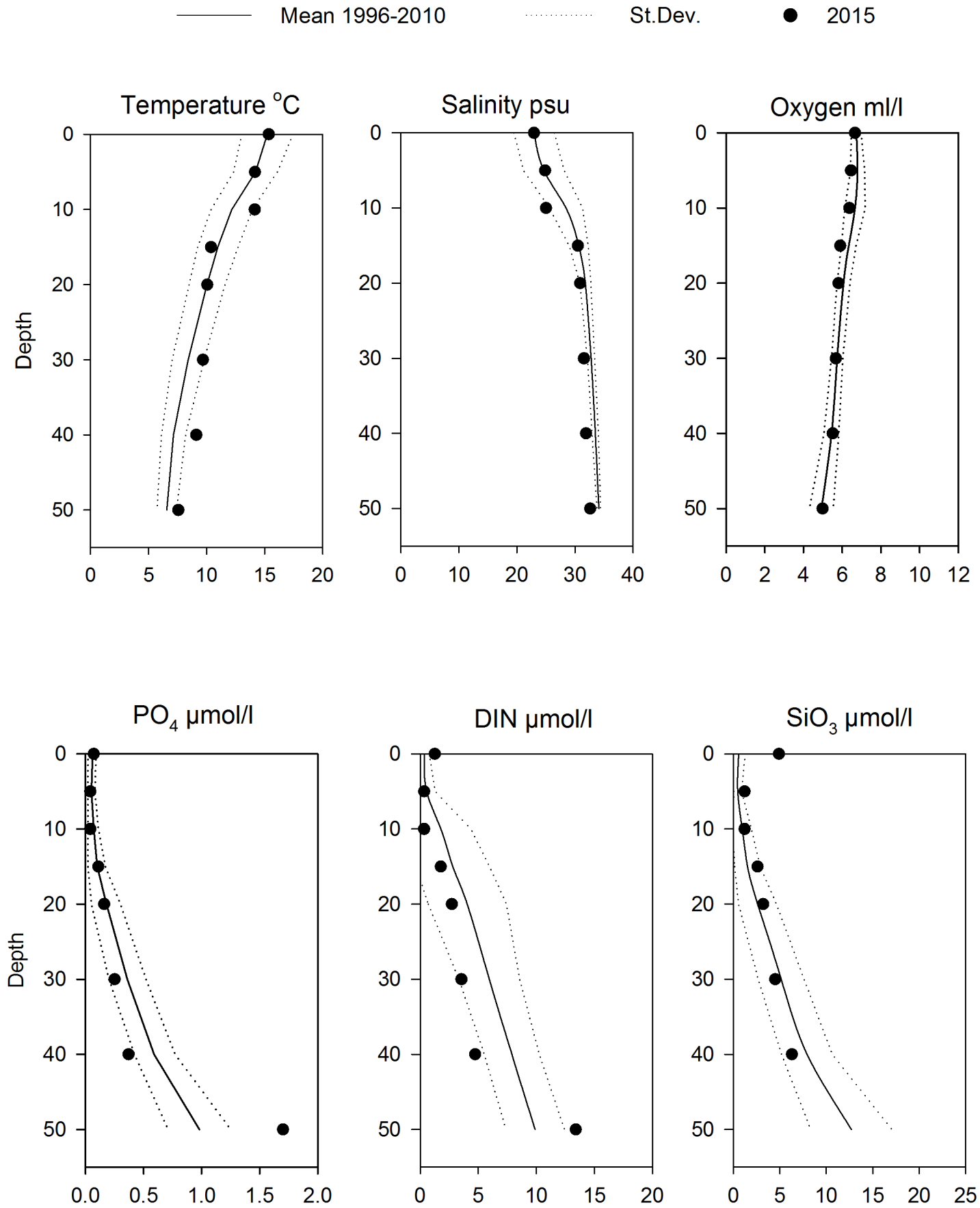


OXYGEN IN BOTTOM WATER (depth >50m)





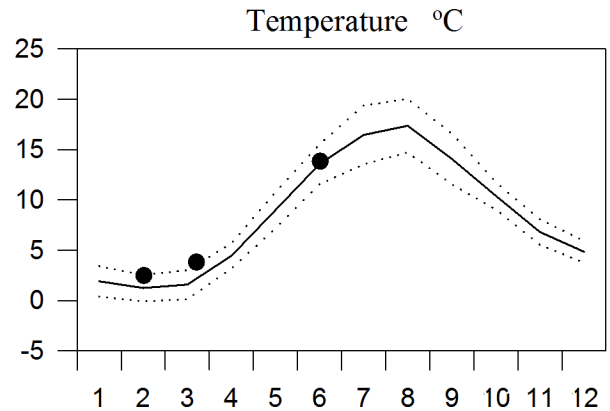
Vertical profiles Släggö June

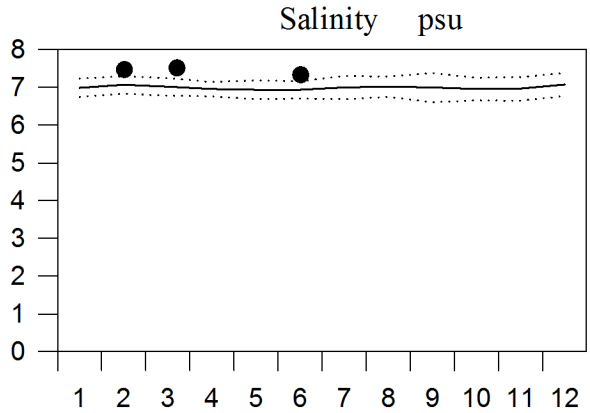


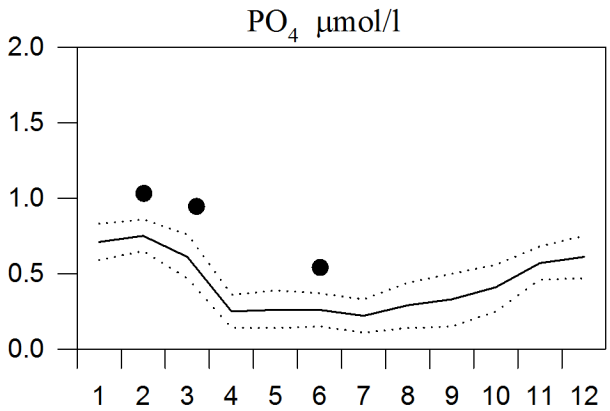
STATION REF M1V1 SURFACE WATER

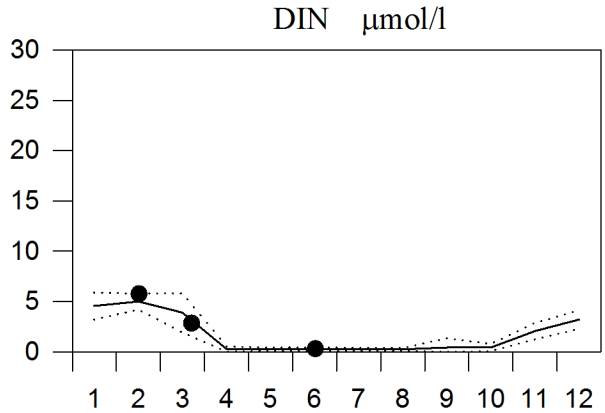
Annual Cycles

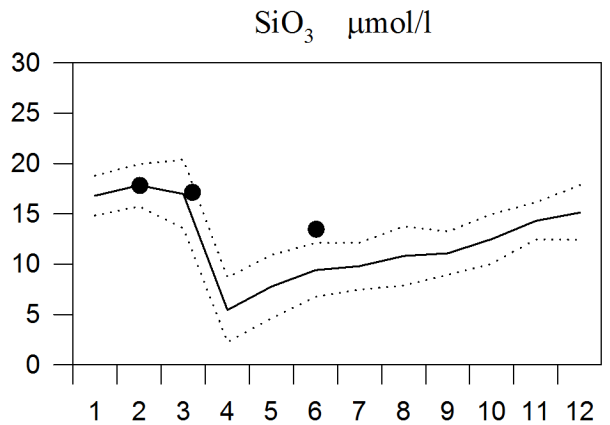
Mean 1996-2010 St.Dev. 2015

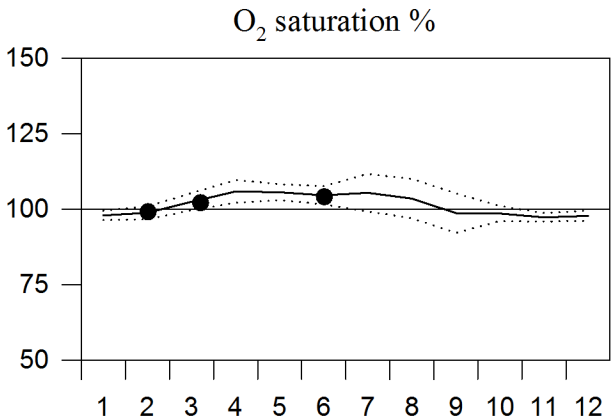




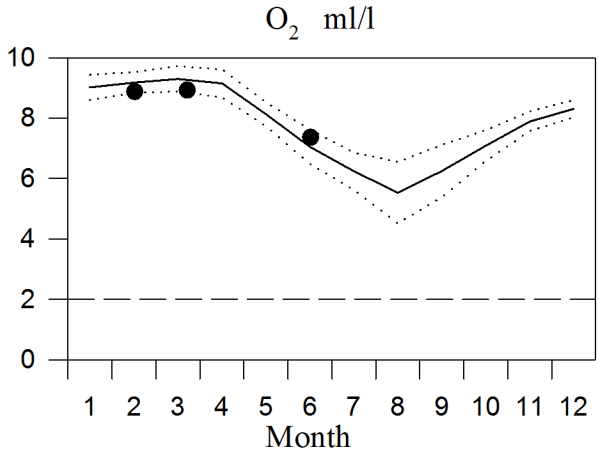


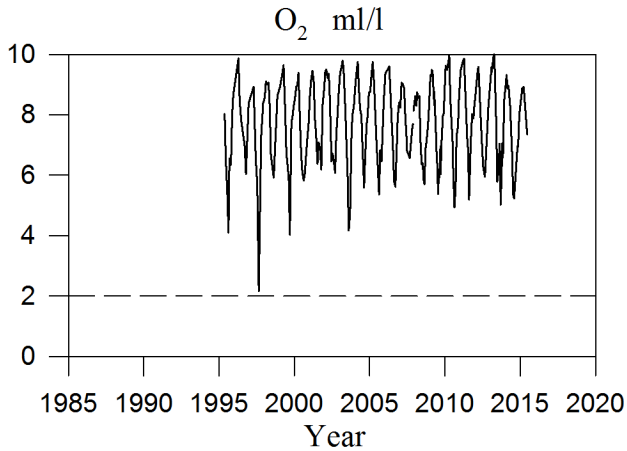
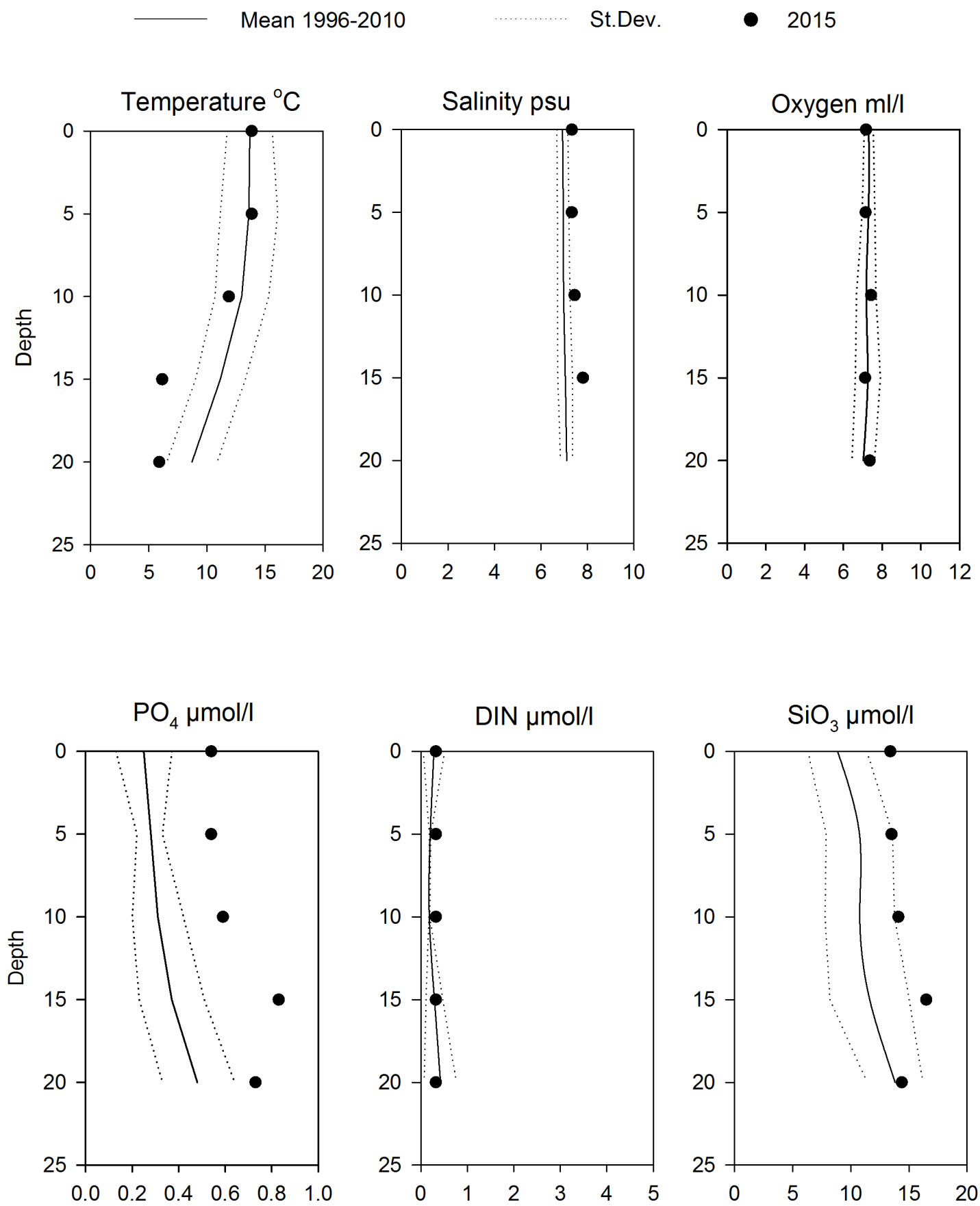






OXYGEN IN BOTTOM WATER (depth >15m)





Vertical profiles Ref M1V1 June