

## Rapport från SMHIs utsjöexpedition med R/V Aranda



**Expeditionens varaktighet:** 2014-12-06 - 2014-12-14  
**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.

Temperaturen i ytvattnet låg fortsatt över det normala, dock ej lika markant som under novemberexpeditionen. Närsalterna i ytvattnet uppvisade för årstiden i stort sett normala värden, förutom silikat i egentliga Östersjön. I Bornholmsbassängen och Hanöbukten förekom akut syrebrist (<2 ml/l) från djup överstigande 70 meter. I östra Gotlandsbassängen förekom helt syrefria förhållanden från djup överstigande 125 meter (vid BY20 redan från 90 m) och akut syrebrist från 70 -80 meters djup. I västra Gotlandsbassängen är syresituationen fortfarande allvarlig då akut syrebrist redan förekom från djup överstigande 70 meter och svavelväte från 80-90 meters djup.

Nästa ordinarie expedition är planerad till vecka 2 i januari 2015.

## PRELIMINÄRA RESULTAT

Expeditionen genomfördes ombord det finska forskningsfartyget Aranda och startade i Åbo den 6:e december och avslutades i Helsingfors den 14:e. Vindarna under expedition var i huvudsak friska till hårda mellan 15 och 20 m/s kring i huvudsak från sydväst. Lufttemperaturen varierade mellan 5-6°C.

Under expeditionen pågick ett inflöde till Östersjön. Genom Öresund strömmade ca 40 km<sup>3</sup> in i Östersjön under det att expeditionen pågick.

### Skagerrak

Temperaturen i ytlagret hade, från föregående mättillfälle med rekordhöga temperaturer, nu sjunkit till för årstiden normala värden ca 7°C. Dock förekom fortfarande ett stort temperaturöverskott på djup mellan 20 och 50 meter. På 30 meters djup uppmättes temperaturer på drygt 12°C, vilket är ca 3 grader högre än normalt. Salthalten i ytlagret var lägre än normalt, ca 25 psu. Vid stationen P2 i sydost var dock både temperatur och salthalt högre än normalt och vattnet homogent från ytan ned till ett djup på 70 meter. Salthalten låg här på 32.5 psu och temperaturen på 8.9°C.

Fosfat samt oorganiskt kväve (nitrit + nitrat) uppvisade halter typiska för årstiden medan koncentrationerna av silikat låg över det normala. Fosfathalterna låg på 0.45 µmol/l, nitrit + nitrat på ca 3.3 µmol/l, medan silikatkoncentrationerna låg i intervallet 6.5 – 7 µmol/l.

Fluorescensmätningar visade på viss planktonaktivitet, i ytlagret.

Det lägsta syrevärdet i bottenvattnet, 3.2 ml/l, uppmättes vid stationen Släggö, i Gullmarfjordens mynning, vilket dock är en höjning med ca 1 ml/l från föregående mättillfälle i november.

### Kattegatt och Öresund

I detta område låg ytvattentemperaturen fortfarande över det normala, med värden kring 7°C mot normala 5. Termoklin och haloklin återfanns båda på djup mellan 15 och 20 meter. Salthalten i Kattegatts ytvatten var normal ca 23 psu, medan den i Öresund lågt högt över det normala, 22 psu. Halterna av fosfat och oorganiskt kväve uppvisade värden typiska för årstiden, medan silikatkoncentrationerna var högre än normalt. Fosfat låg kring 0.5 µmol/l, oorganiskt kväve ca. 3.5 µmol/l, medan silikalthalterna låg i intervallet 7 – 10.6 µmol/l.

Fluorescensmätningar visade på viss planktonaktivitet, i ytlagret.

De lägsta syrehalterna i bottenvattnet uppmättes vid W Landskrona i Öresund, 4.36 ml/l.

### Egentliga Östersjön

Vattentemperaturen i ytlagret låg fortfarande över det normala i hela området, varierande mellan 6.6 och 8.9°C. Salthalten i ytvattnet var normal i större delen av området, mellan 6.5 och 8.6 psu. I östra Gotlandsbassängen, vid BY15 var ytsalthalten fortsatt lägre än normalt ca 6.8 psu. Haloklinen återfanns på omkring 60 till 80 meters djup i norra, västra och östra Gotlandsbassängerna, medan den låg grundare i de södra delarna, på djup mellan 30 och 60 meter.

Närsalterna uppvisade i stort sett normala halter för årstiden i ytlagret, fosfathalterna låg i intervallet 0.44 – 0.56 µmol/l, medan halterna av oorganiskt kväve (nitrit + nitrat) varierade från 1.24 till 2.63 µmol/l. Silikat uppvisade något förhöjda halter i de norra och centrala delarna, medan koncentrationerna i de södra delarna var lägre än normalt. Halterna varierade mellan 6.3 och 14.6 µmol/l.

Fluorescensmätningar visade att planktonaktiviteten var låg i hela området.

# SMHI

Under expeditionen pågick ett inflöde till Östersjön. Mellan den 2:e och 15:e december strömmade det in totalt 40 km<sup>3</sup> genom Öresund. Effekterna av detta inflöde syntes dock endast vid stationerna i Arkonabassängen där syrehalten i bottenvattnet var hög, 6-7 ml/l. Akut syrebrist förekom i Bornholmsbassängen och Hanöbukten från 70 meters djup.

I de centrala delarna av östra Gotlandsbassängen noterades akut syrebrist från 70 - 80 meters djup och svavelväte i djup överstigande 125 meter, Vid stationen BY20, i norra delen, förekom svavelväte redan på 90 meters djup. I västra Gotlandsbassängen var syresituationen allvarlig då akut syrebrist förekom från djup överstigande 70-80 meter och svavelväte från 80-90 meters djup.

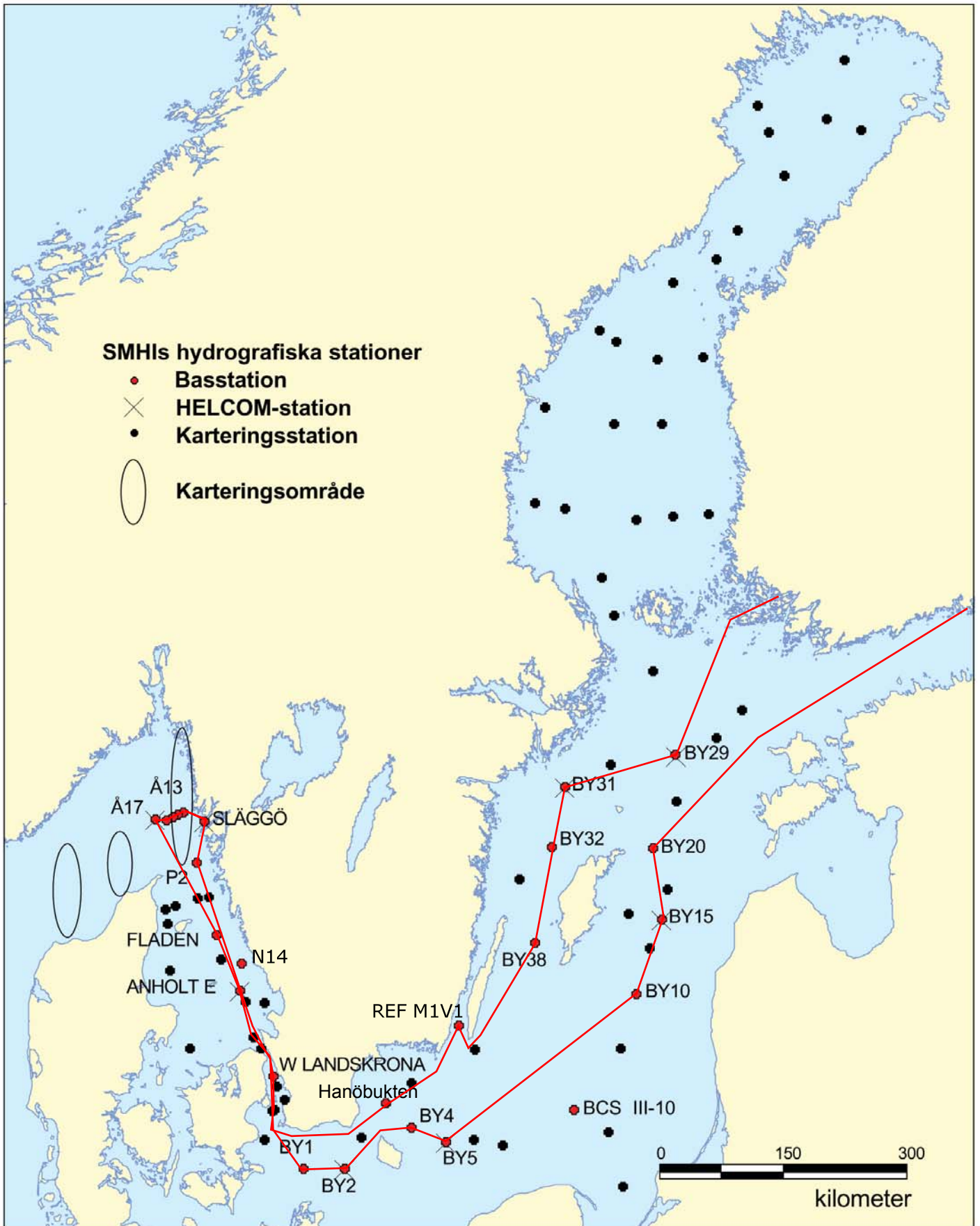
## DELTAGARE

<b>Namn</b>		<b>Från</b>
Lars Andersson	Expeditionsledare	SMHI
Örjan Bäck (Lysekil-Helsingfors)		SMHI
Daniel Bergman-Sjöstrand		SMHI
Martin Hansson (Åbo-Lysekil)		SMHI
Johan Håkansson		SMHI
Sari Sipilä		SMHI
Ilkka Lastumäki		SYKE

## 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: 20141206-201413  
Series: 0772-0797



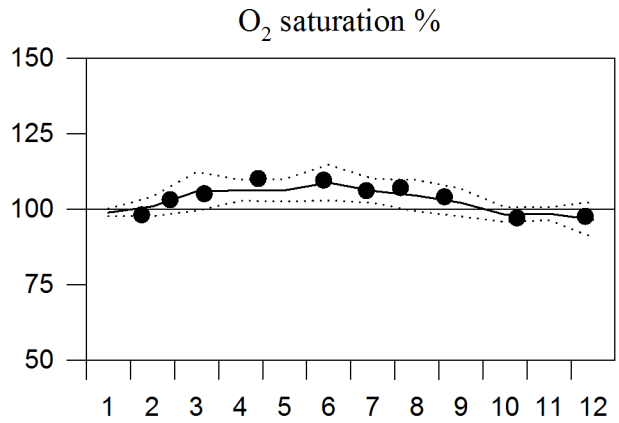
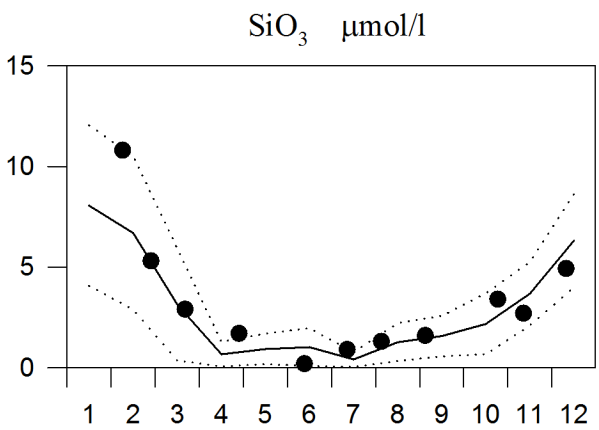
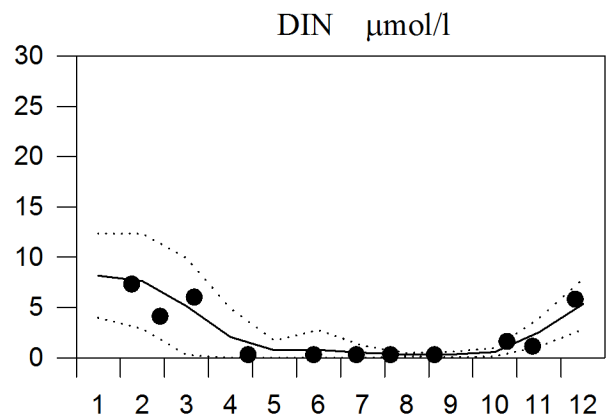
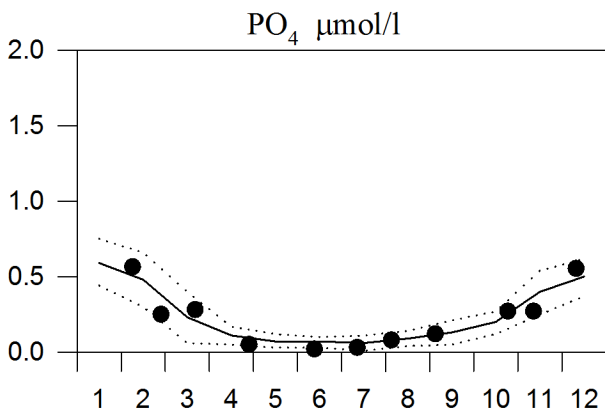
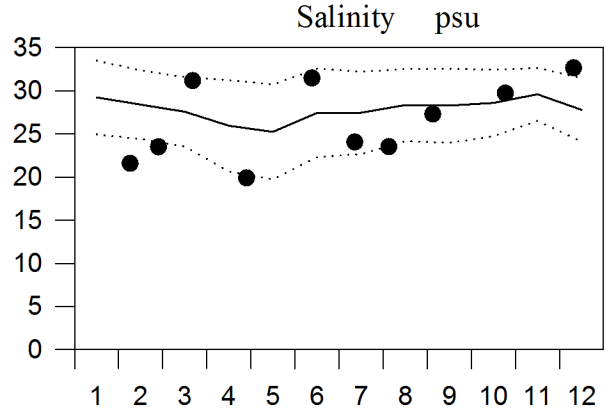
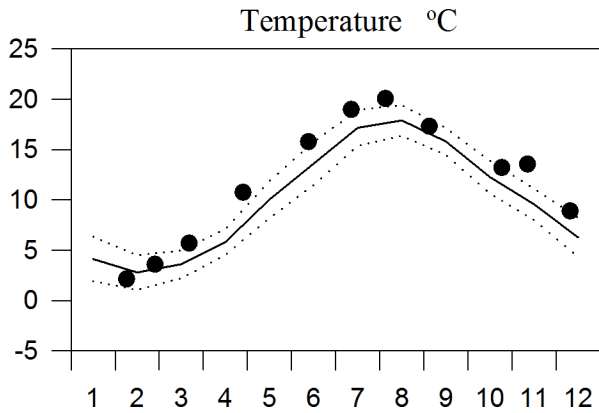




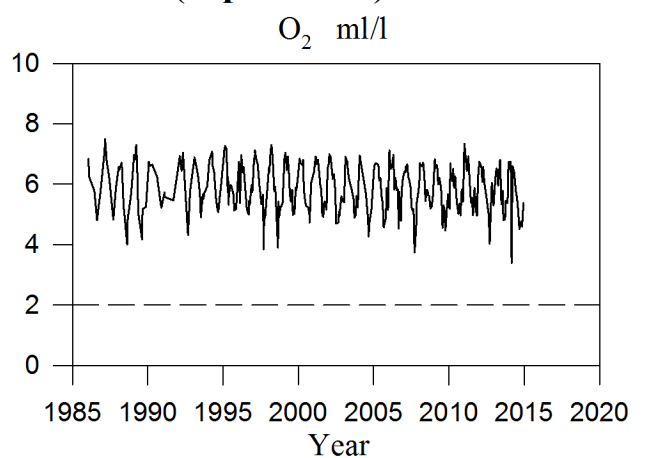
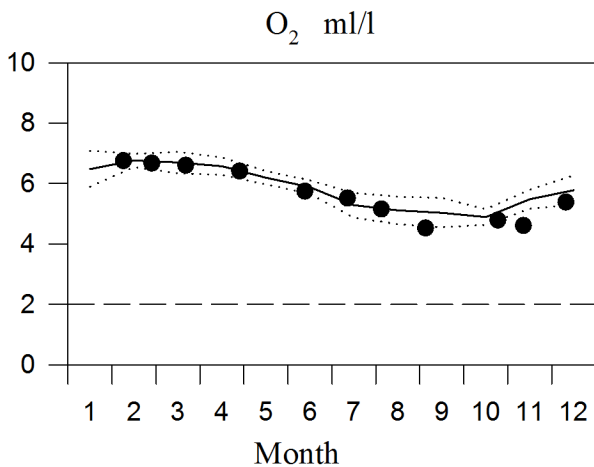
# STATION P2 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

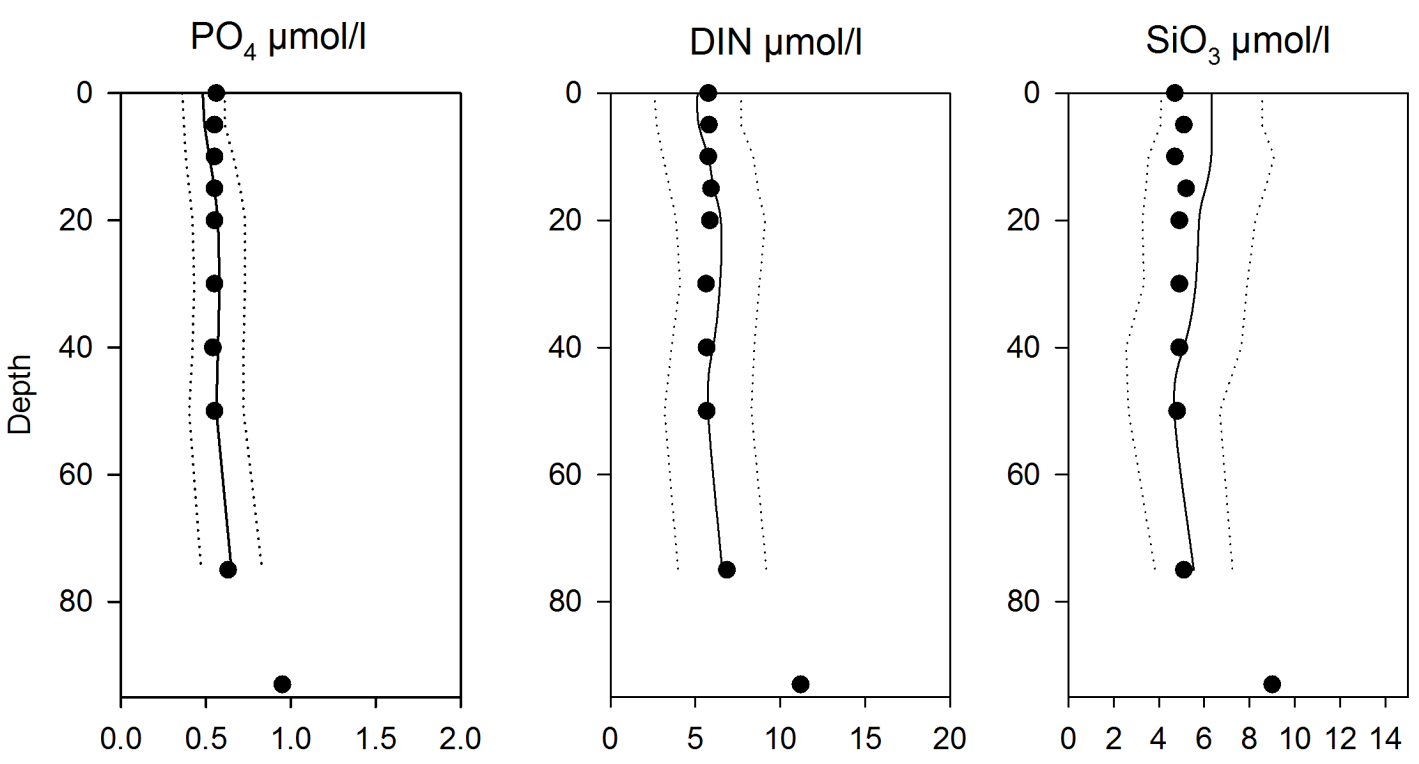
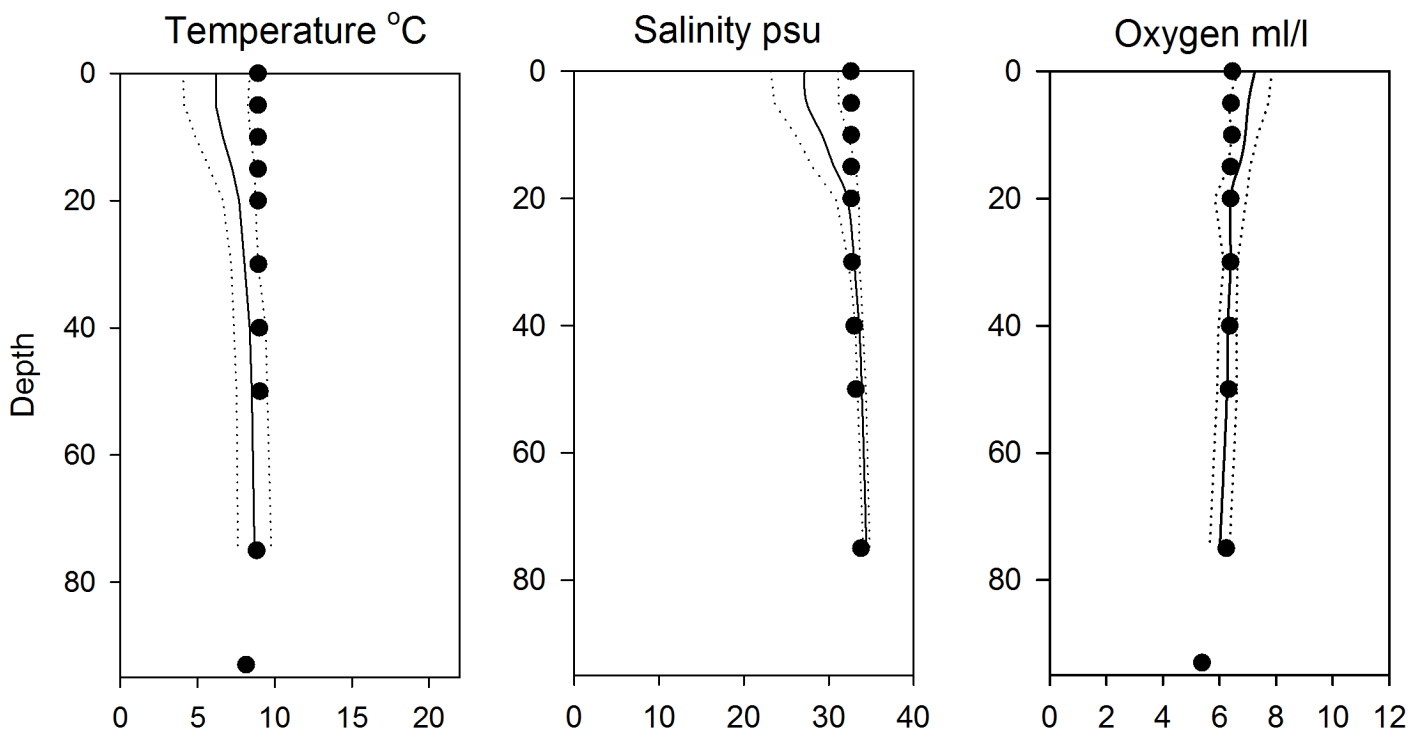


## OXYGEN IN BOTTOM WATER (depth >75m)



# Vertical profiles P2 December

— Mean 1996-2010      ..... St.Dev.      ● 2014

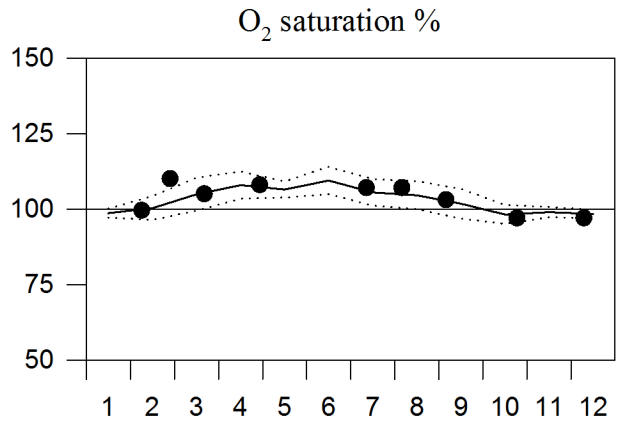
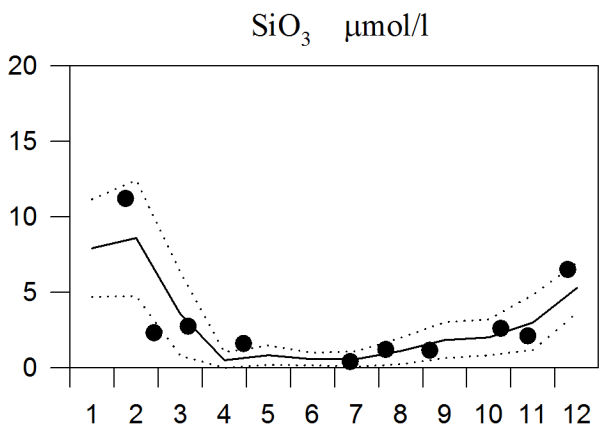
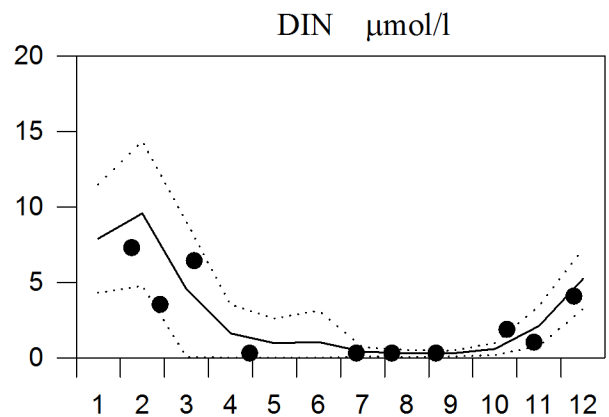
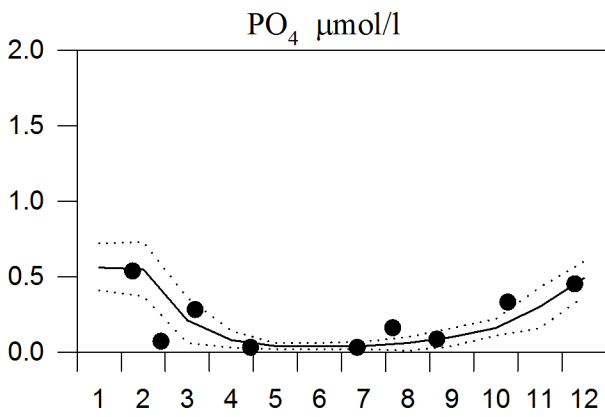
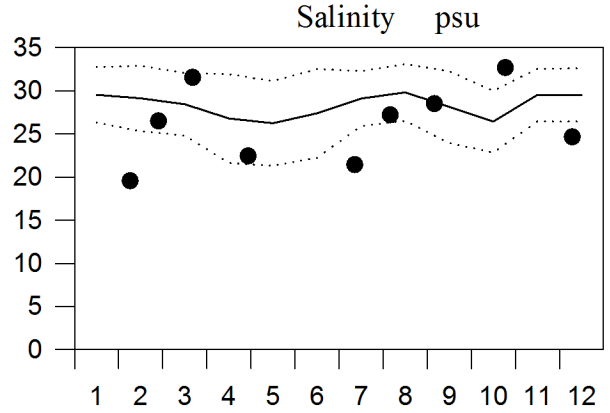
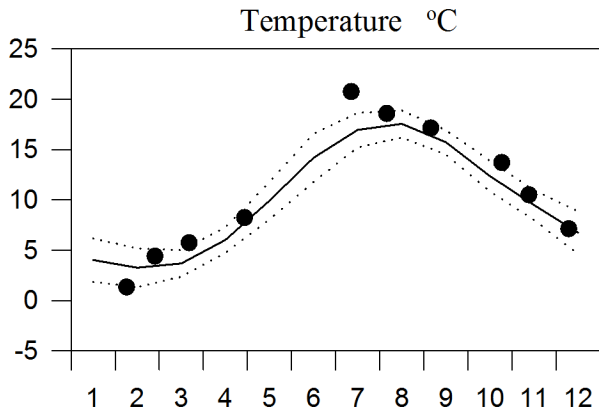




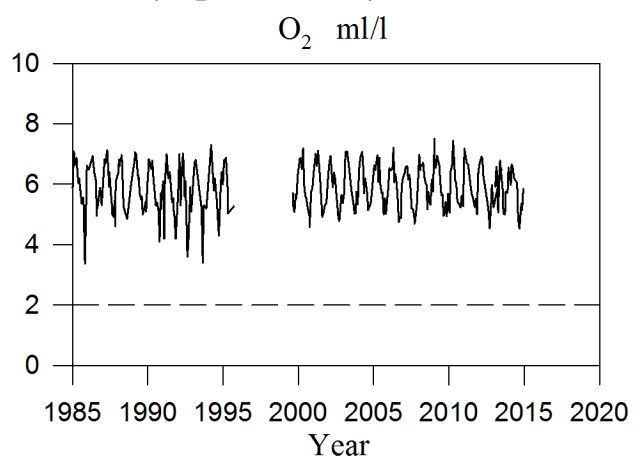
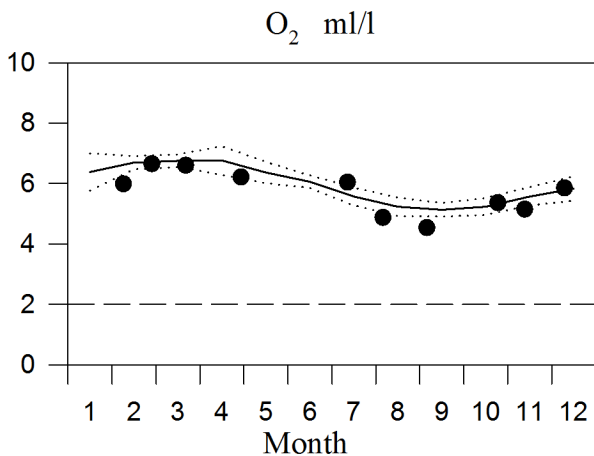
# STATION Å13 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

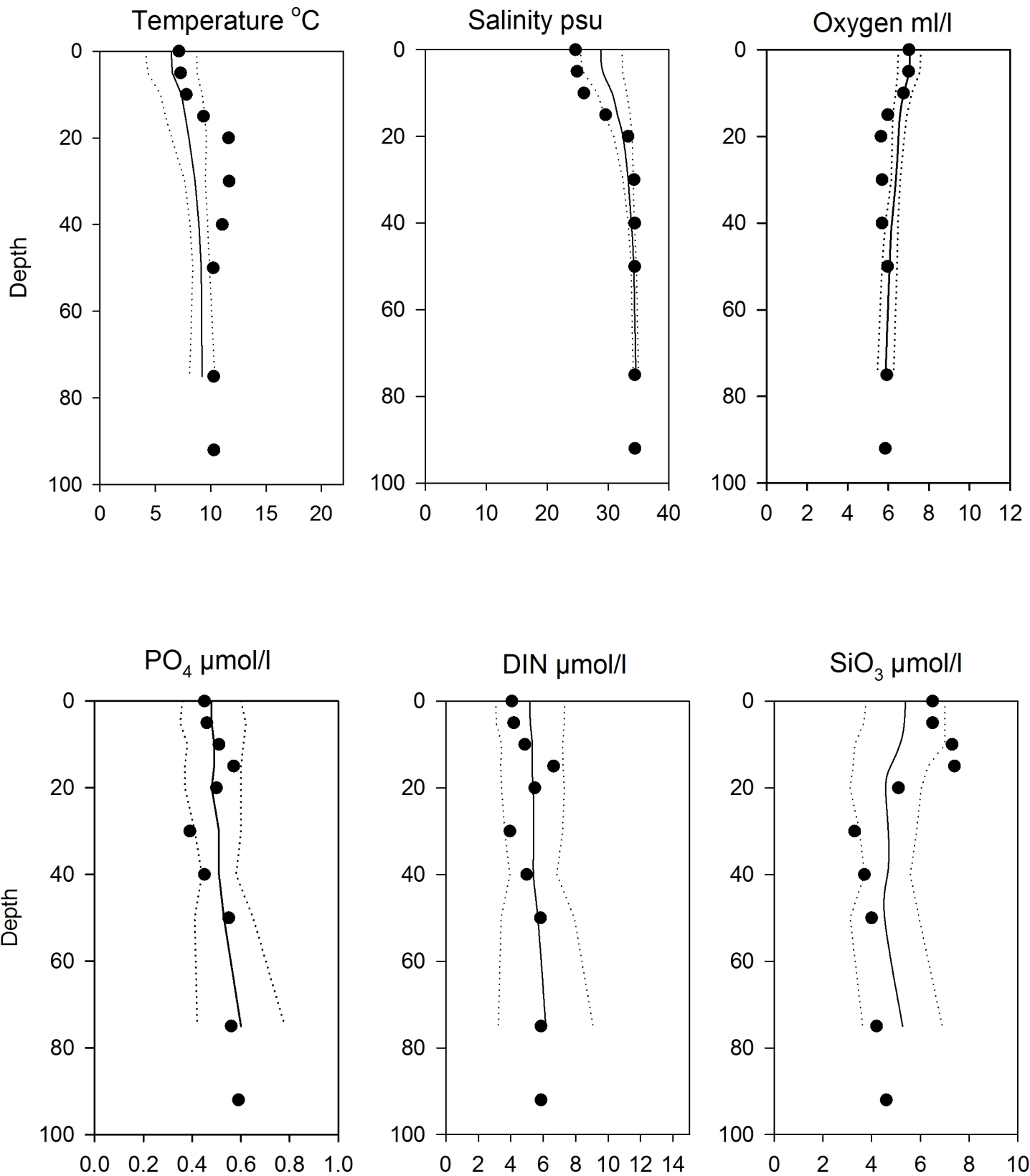


## OXYGEN IN BOTTOM WATER (depth >=75m)



# Vertical profiles Å13 December

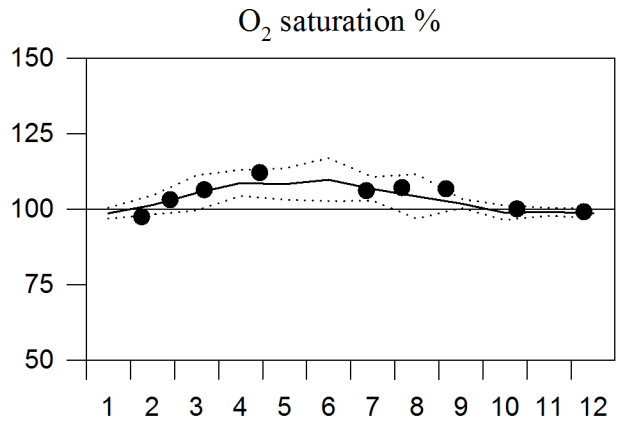
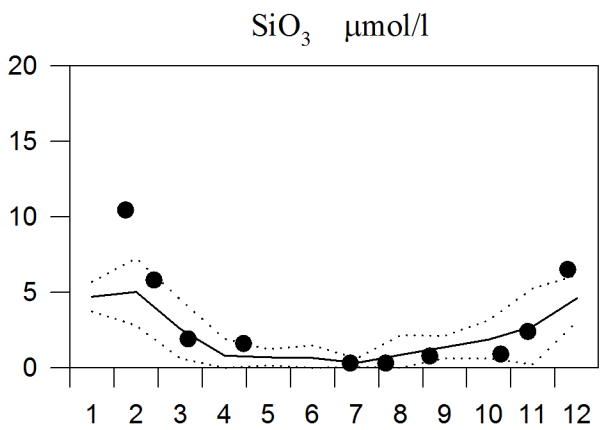
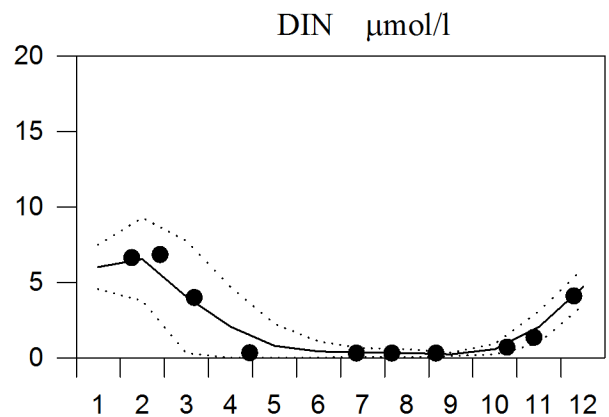
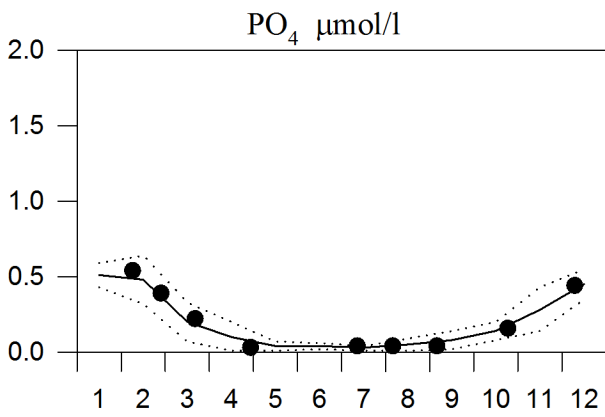
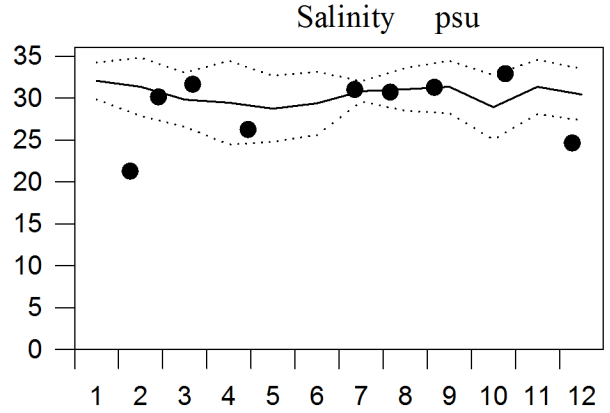
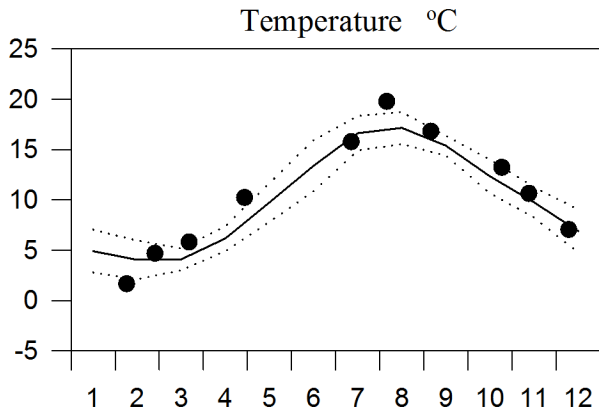
— Mean 1996-2010      ..... St.Dev.      ● 2014



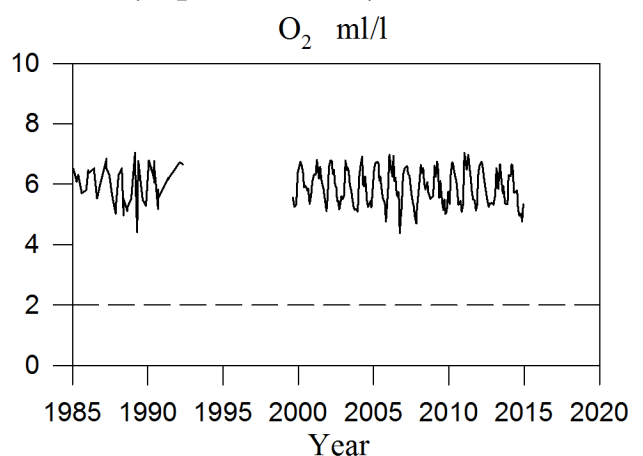
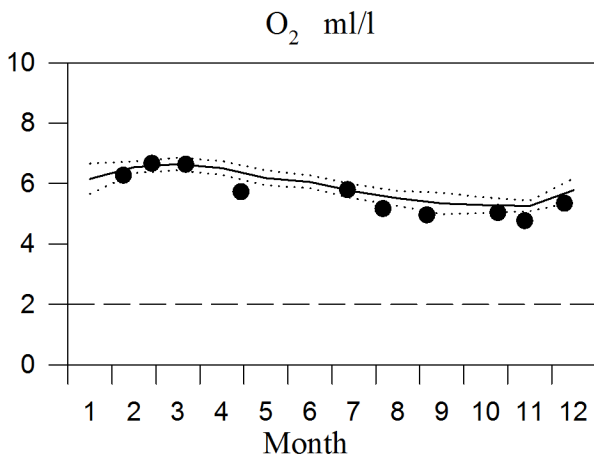
# STATION Å15 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

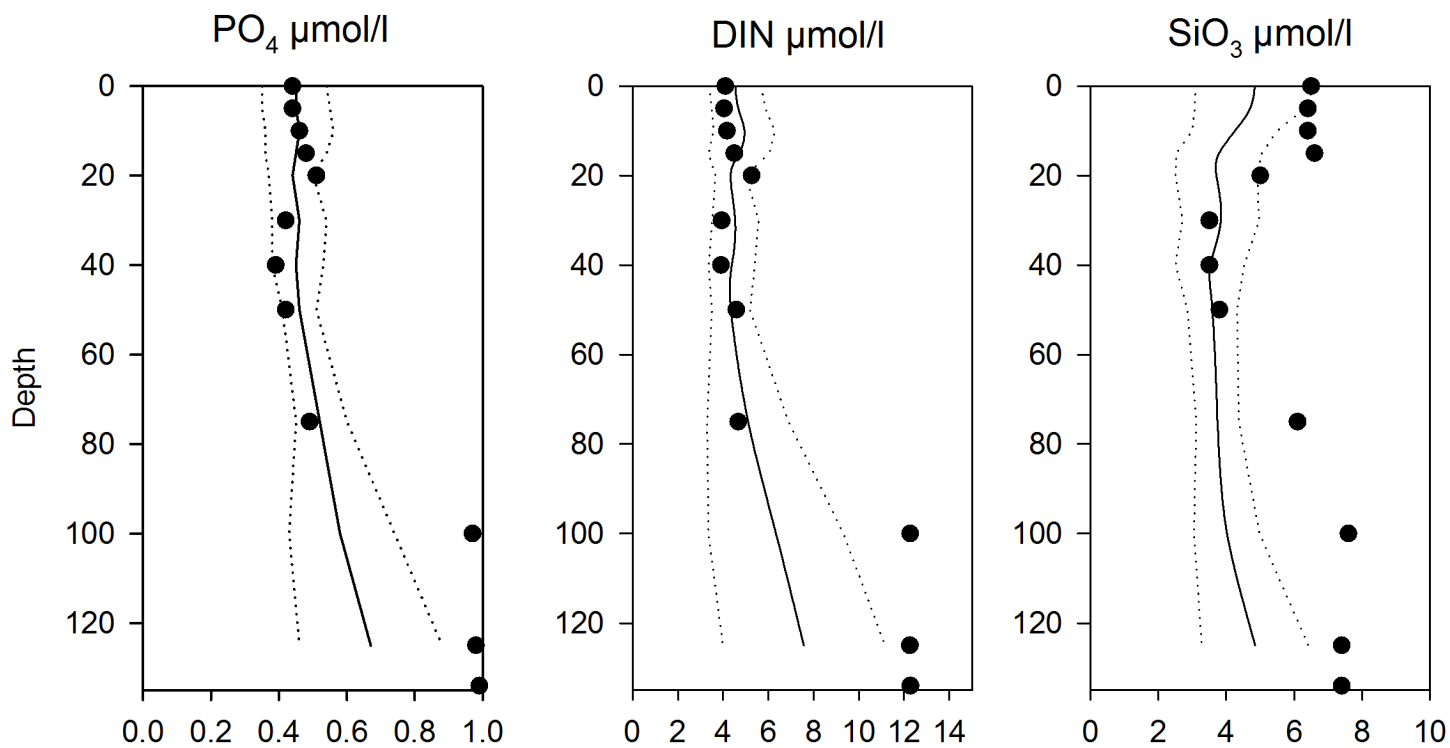
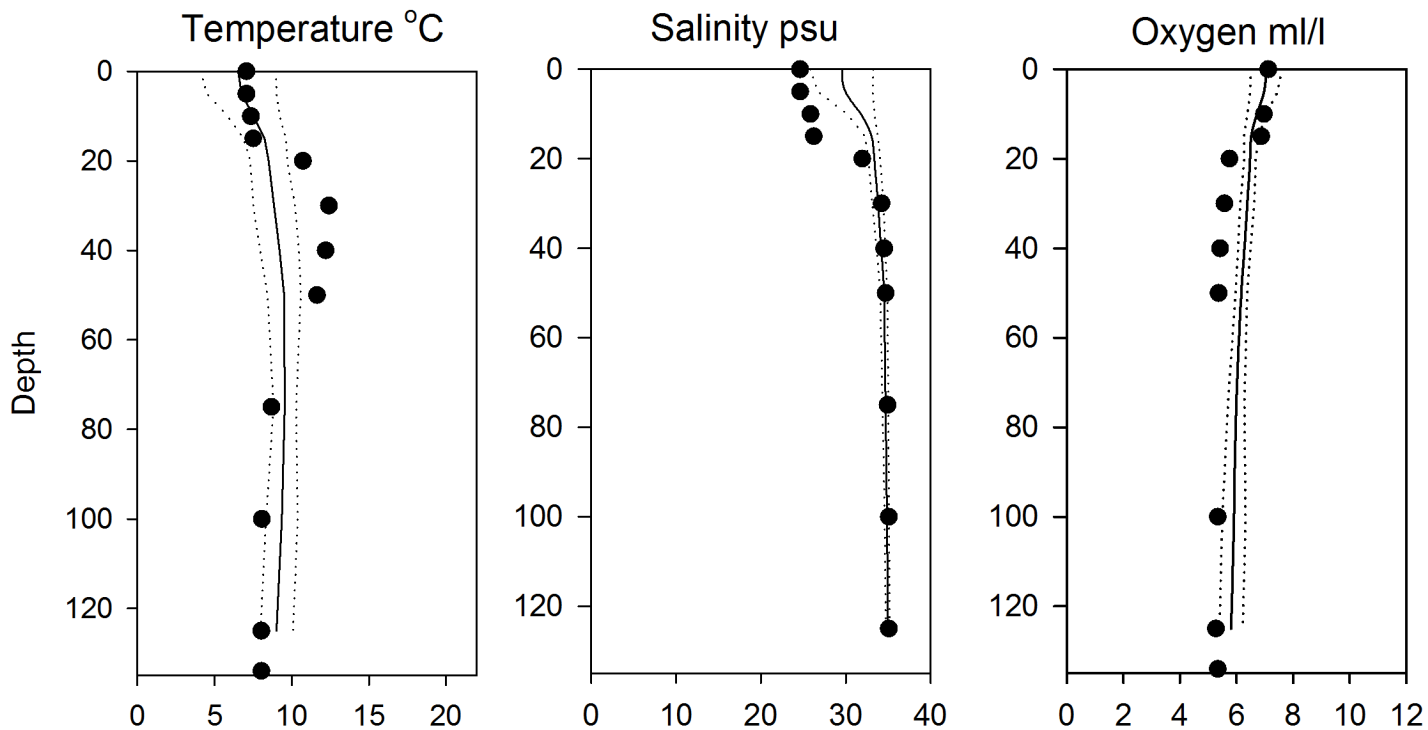


## OXYGEN IN BOTTOM WATER (depth >=125m)



# Vertical profiles Å15 December

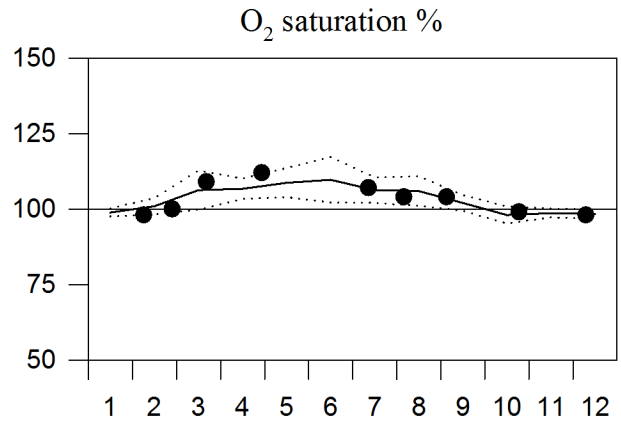
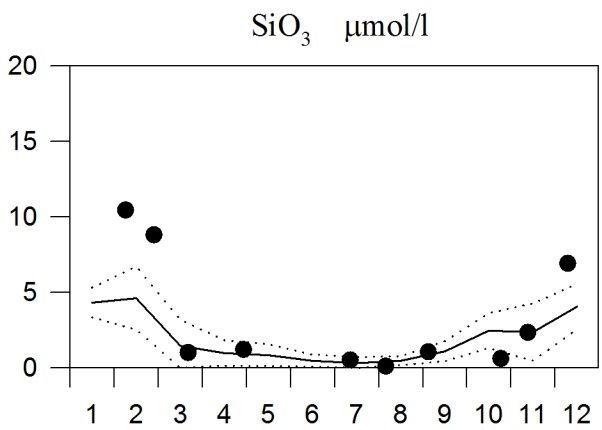
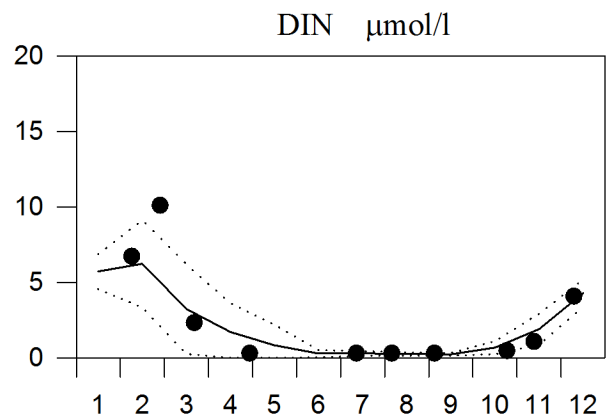
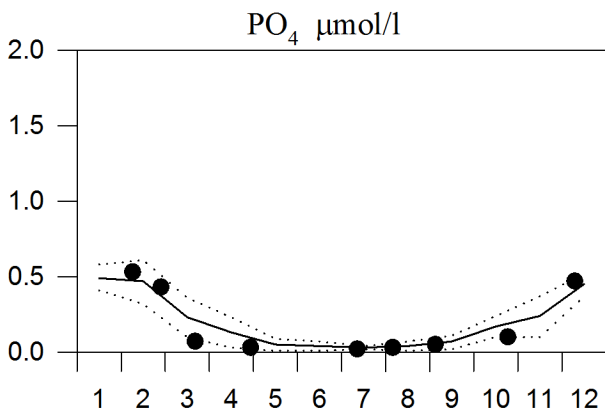
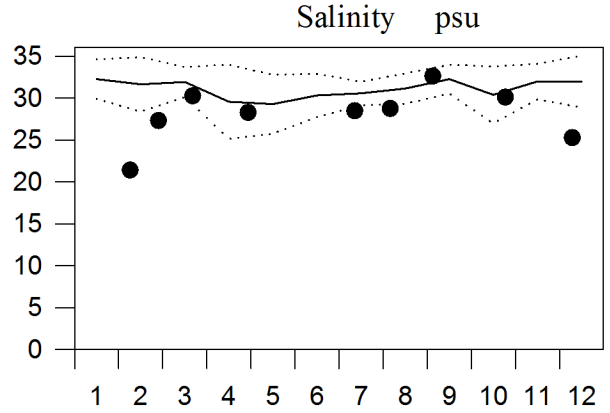
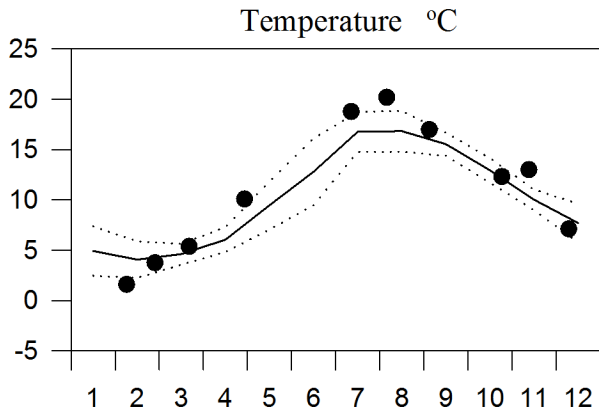
— Mean 1996-2010      ..... St.Dev.      ● 2014



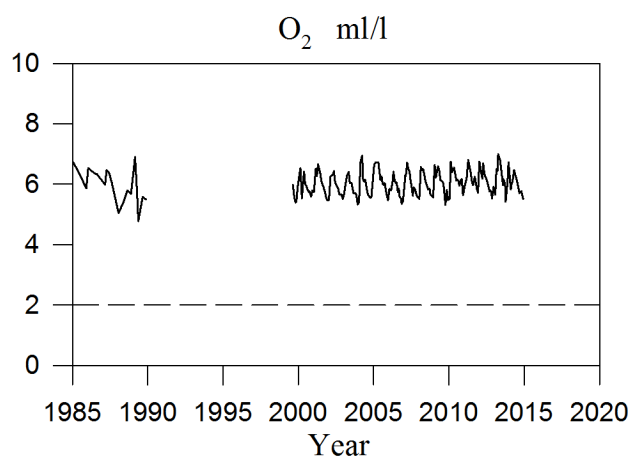
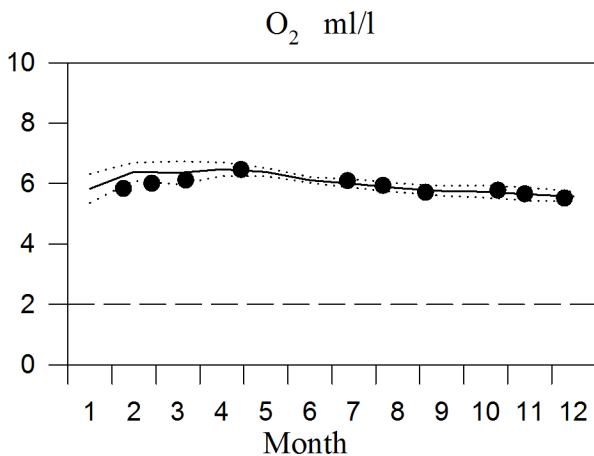
# STATION Å17 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ····· St.Dev.      ● 2014

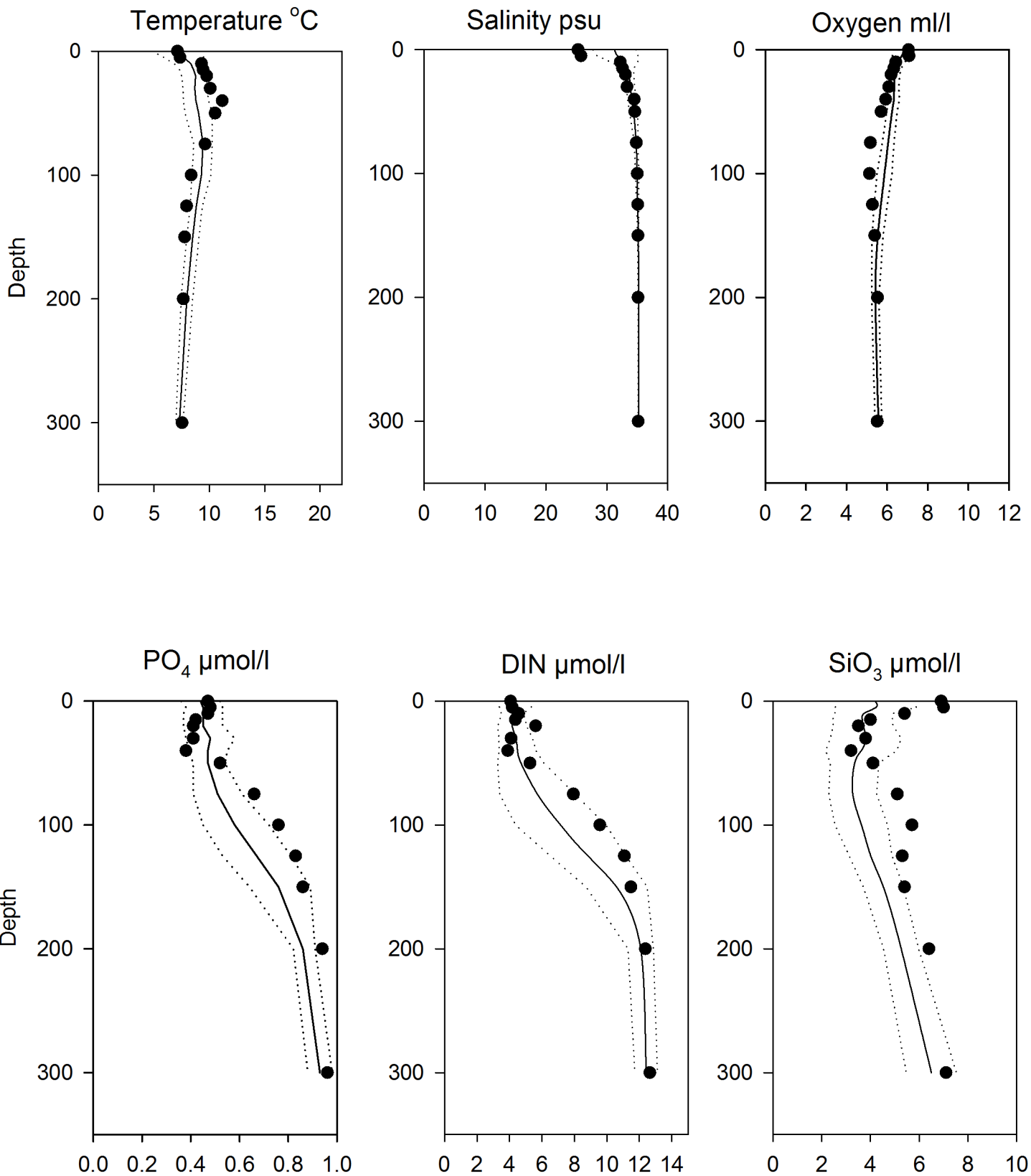


## OXYGEN IN BOTTOM WATER (depth = 300m)



# Vertical profiles Å17 December

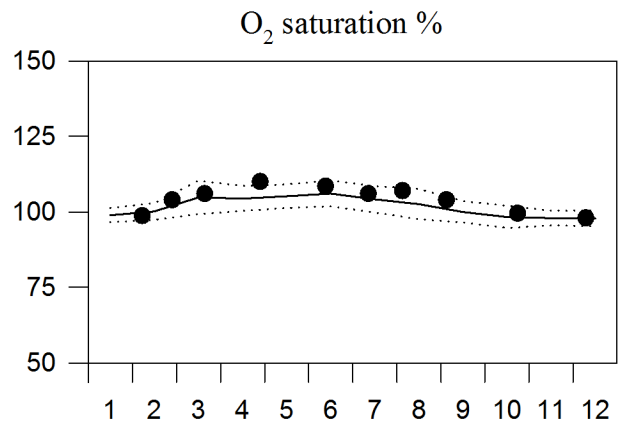
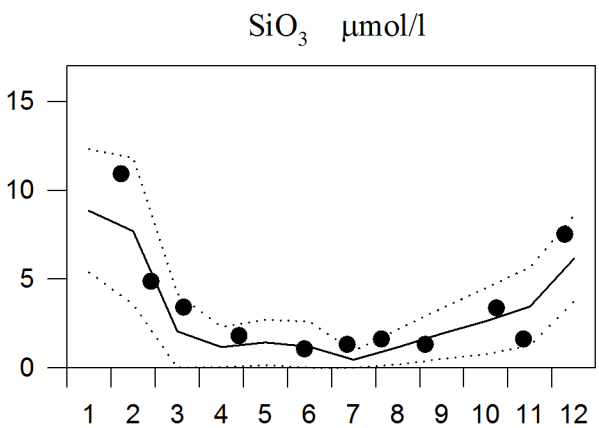
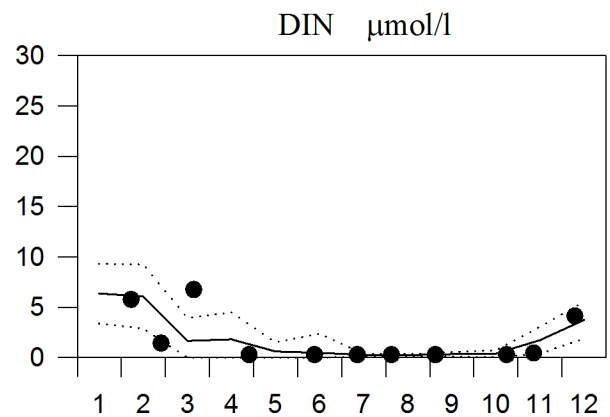
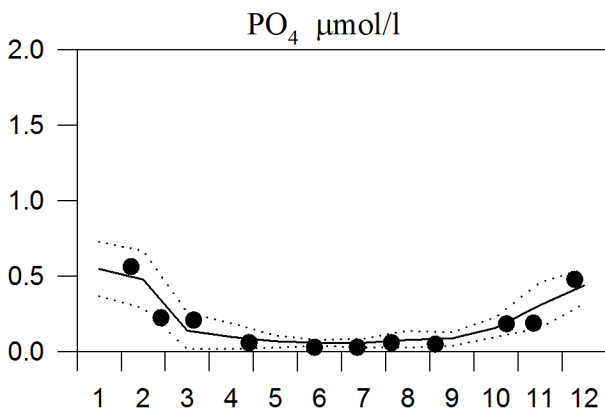
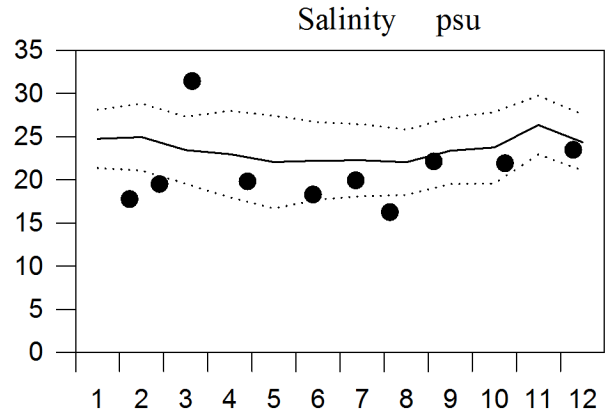
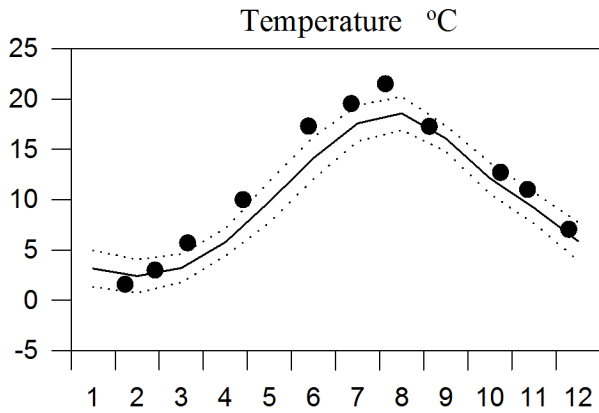
— Mean 1996-2010      ..... St.Dev.      ● 2014



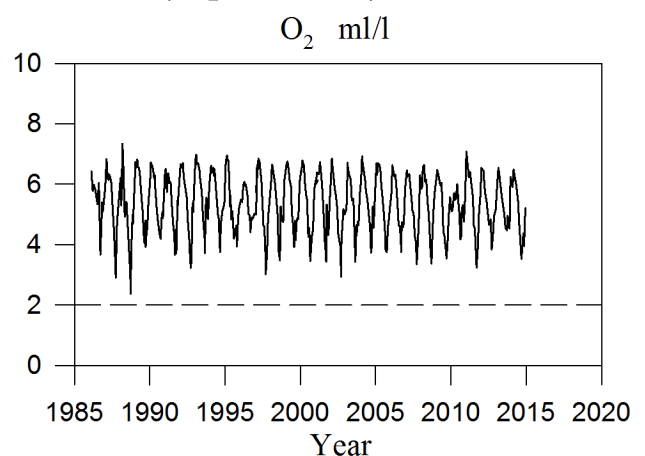
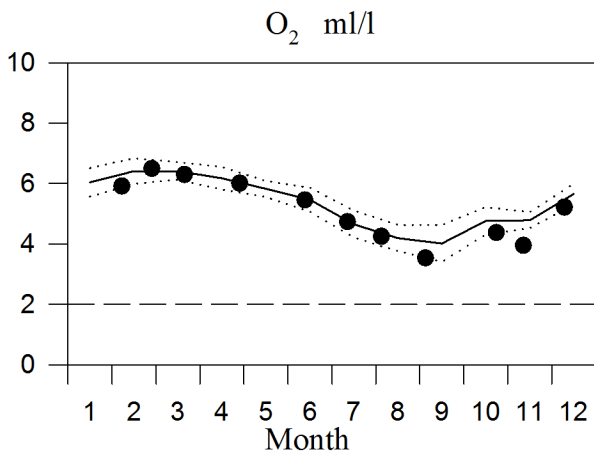
# STATION FLADEN SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

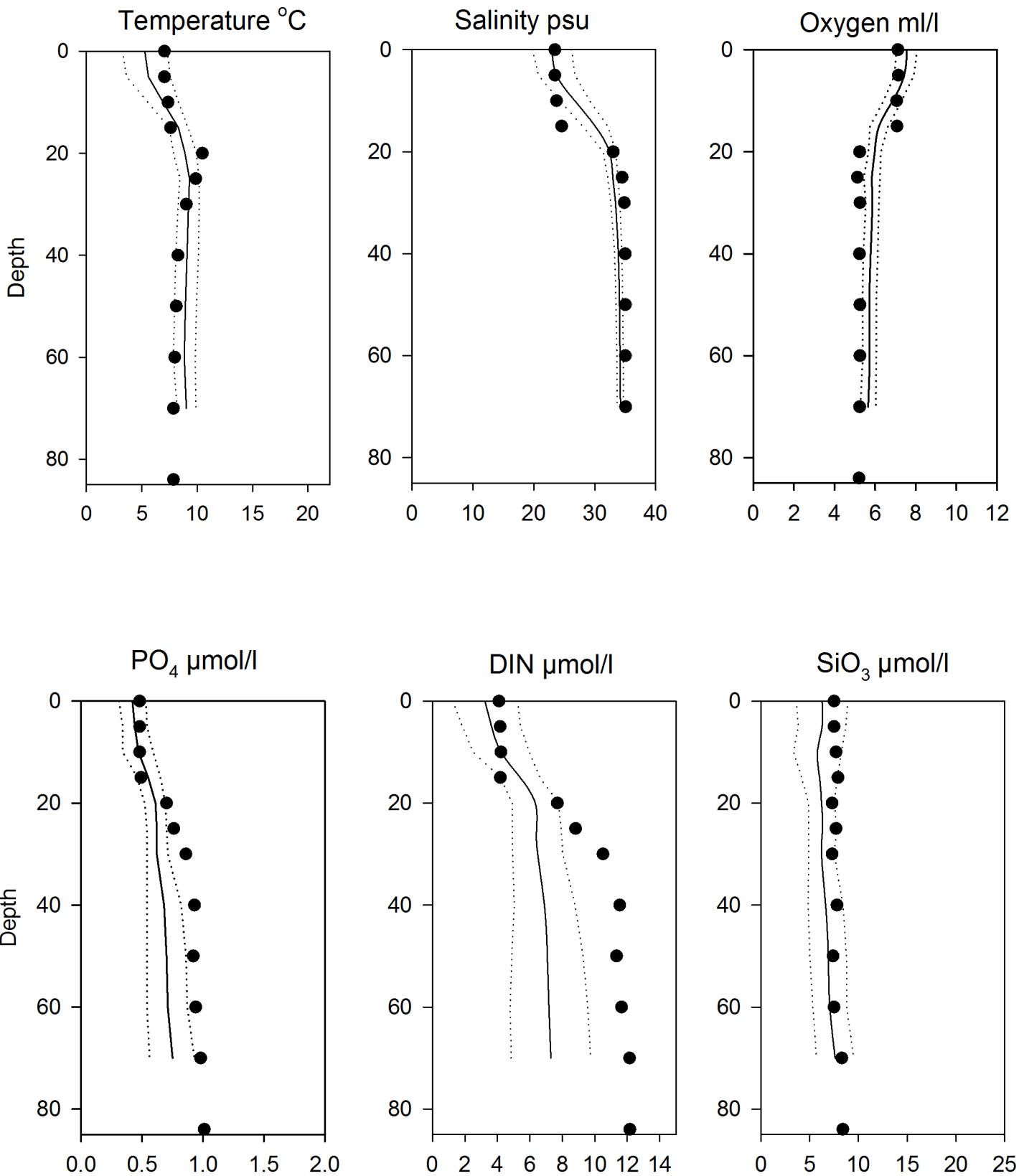


## OXYGEN IN BOTTOM WATER (depth > 70m)



# Vertical profiles Fladen December

— Mean 1996-2010      ..... St.Dev.      ● 2014

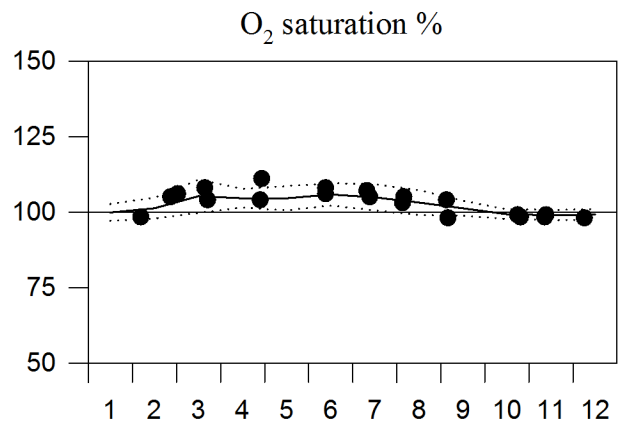
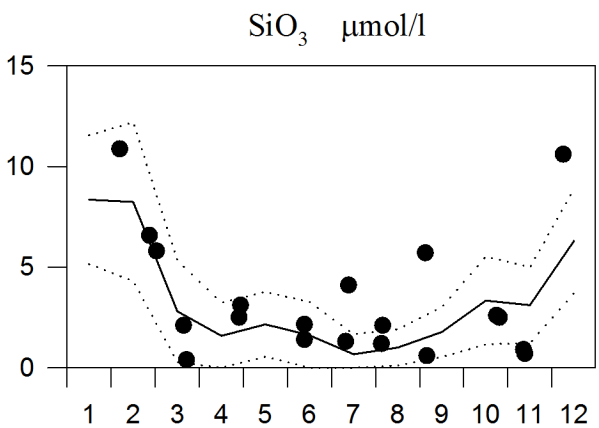
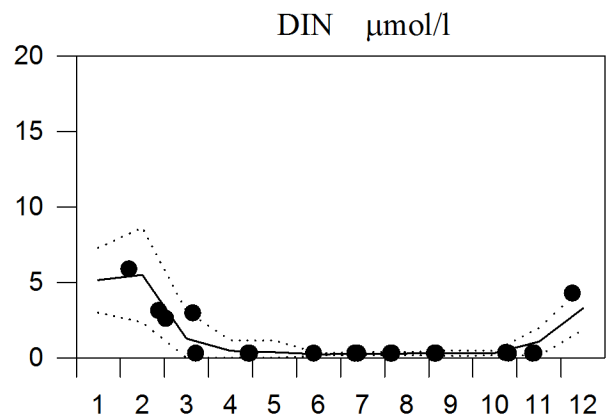
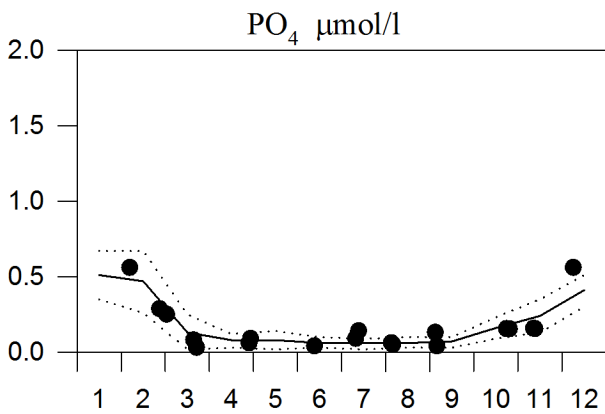
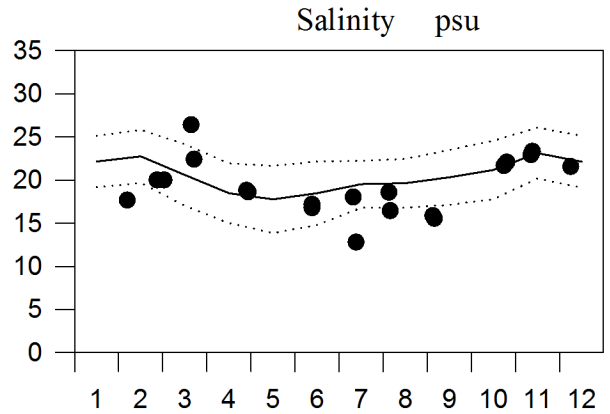
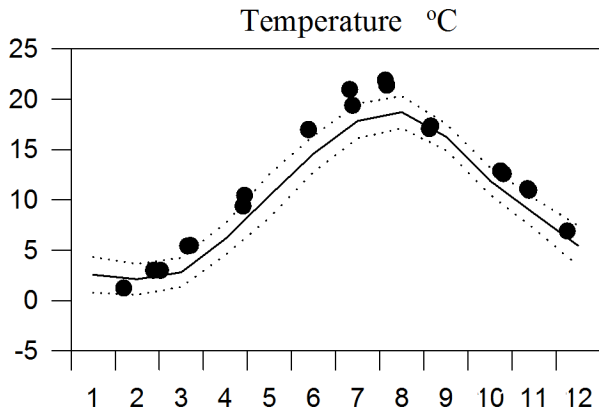




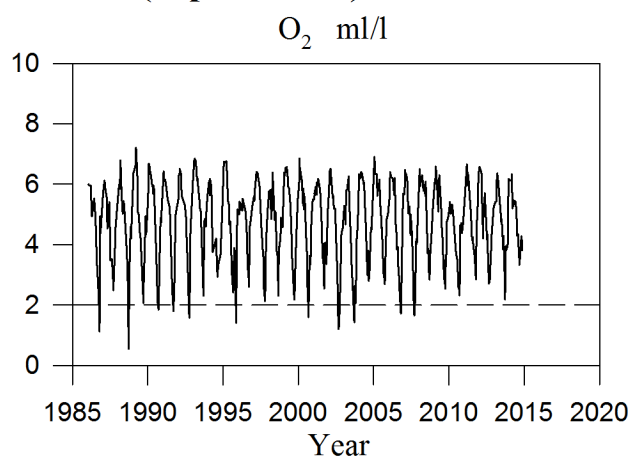
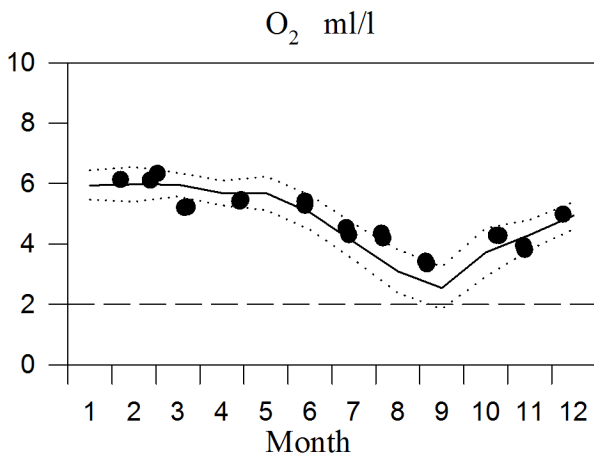
# STATION ANHOLT E SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

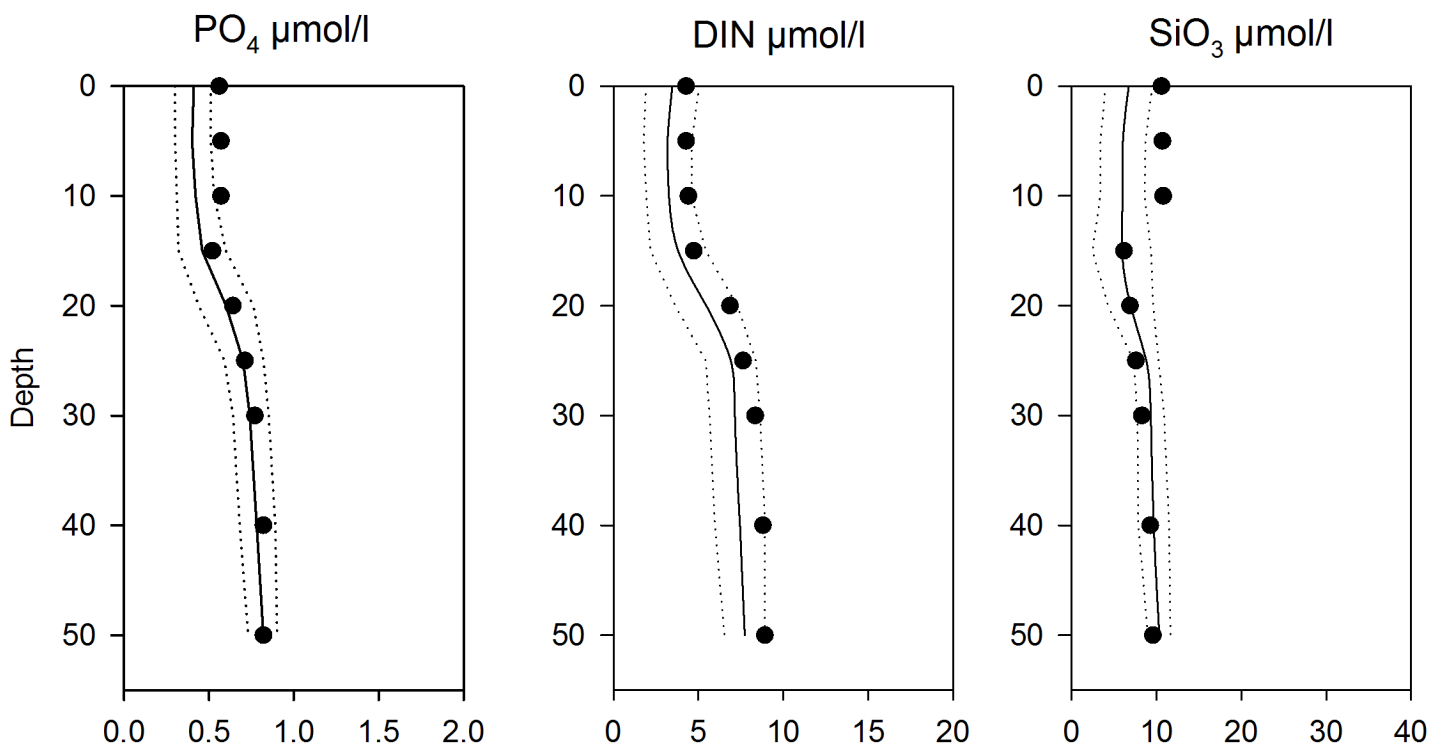
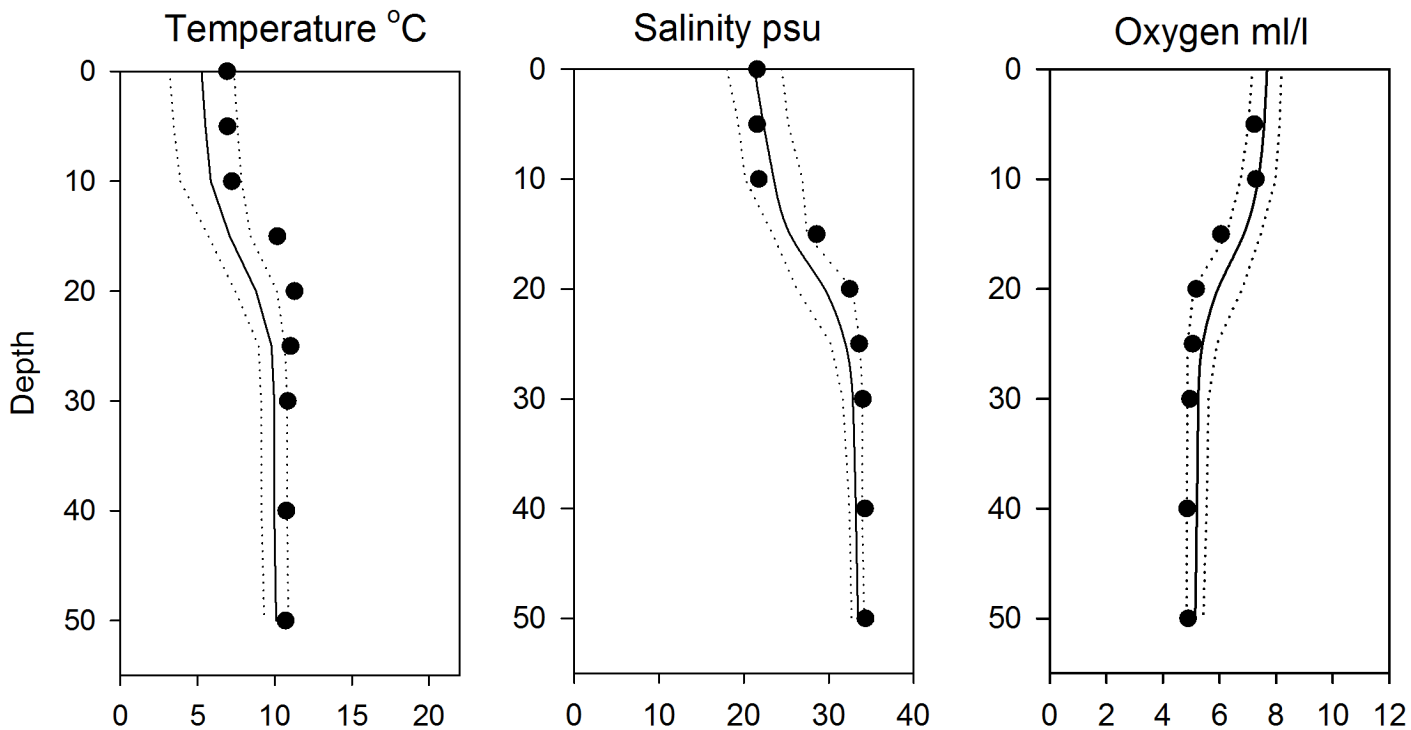


## OXYGEN IN BOTTOM WATER (depth > 50m)



# Vertical profiles Anholt E December

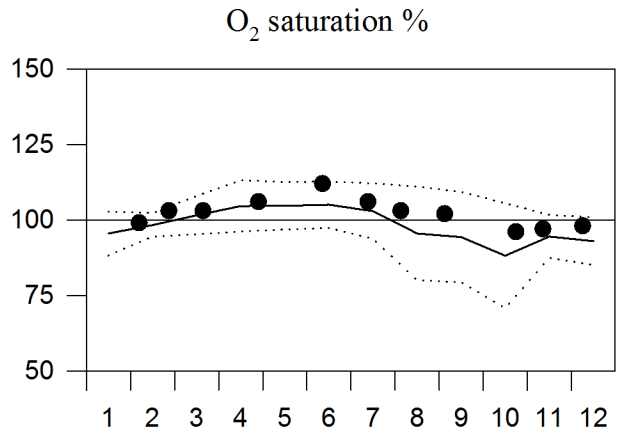
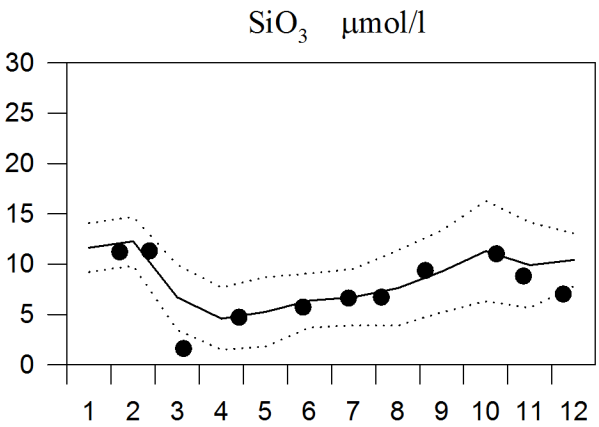
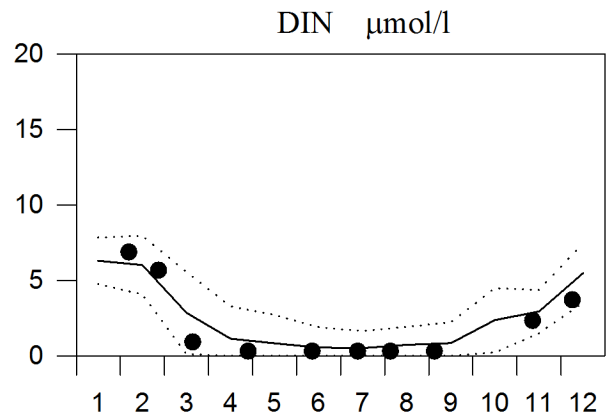
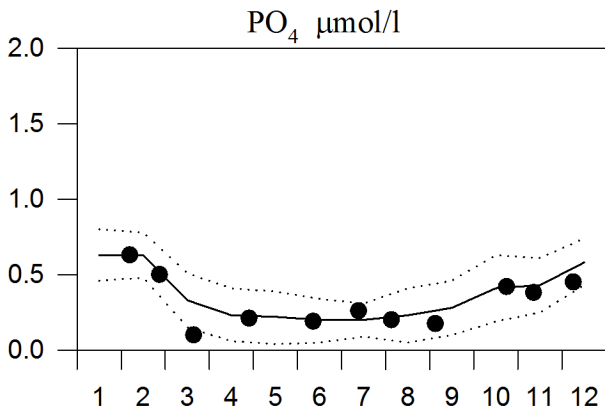
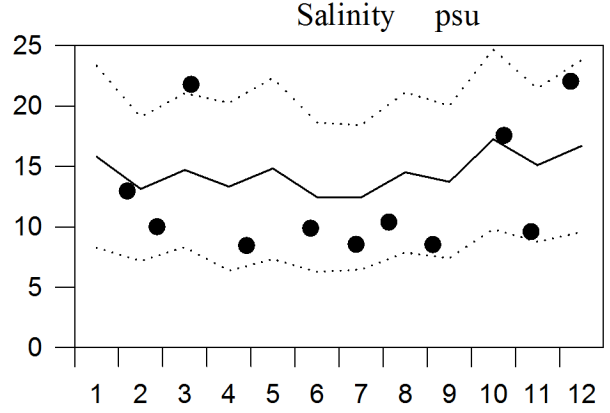
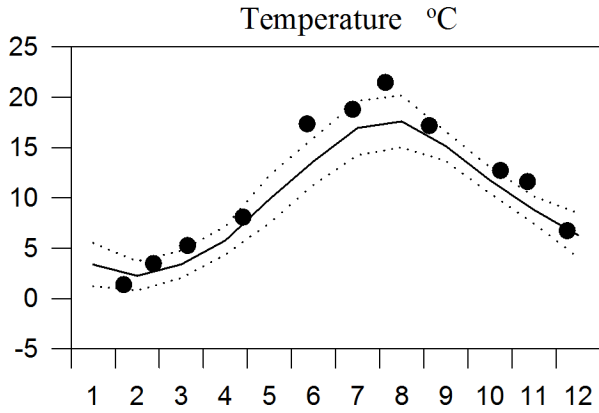
— Mean 1996-2010      ..... St.Dev.      ● 2014



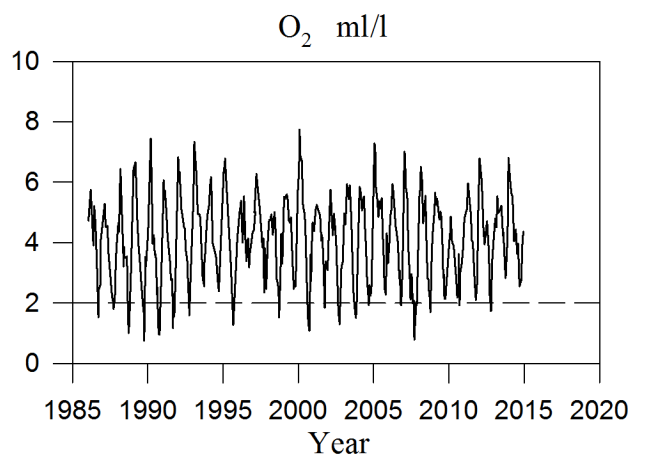
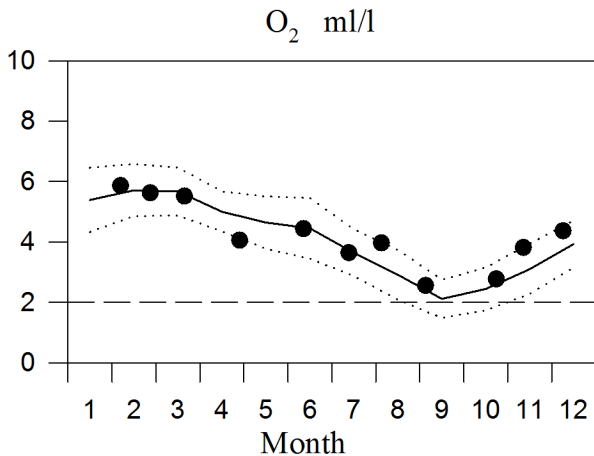
# STATION W LANDSKRONA SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

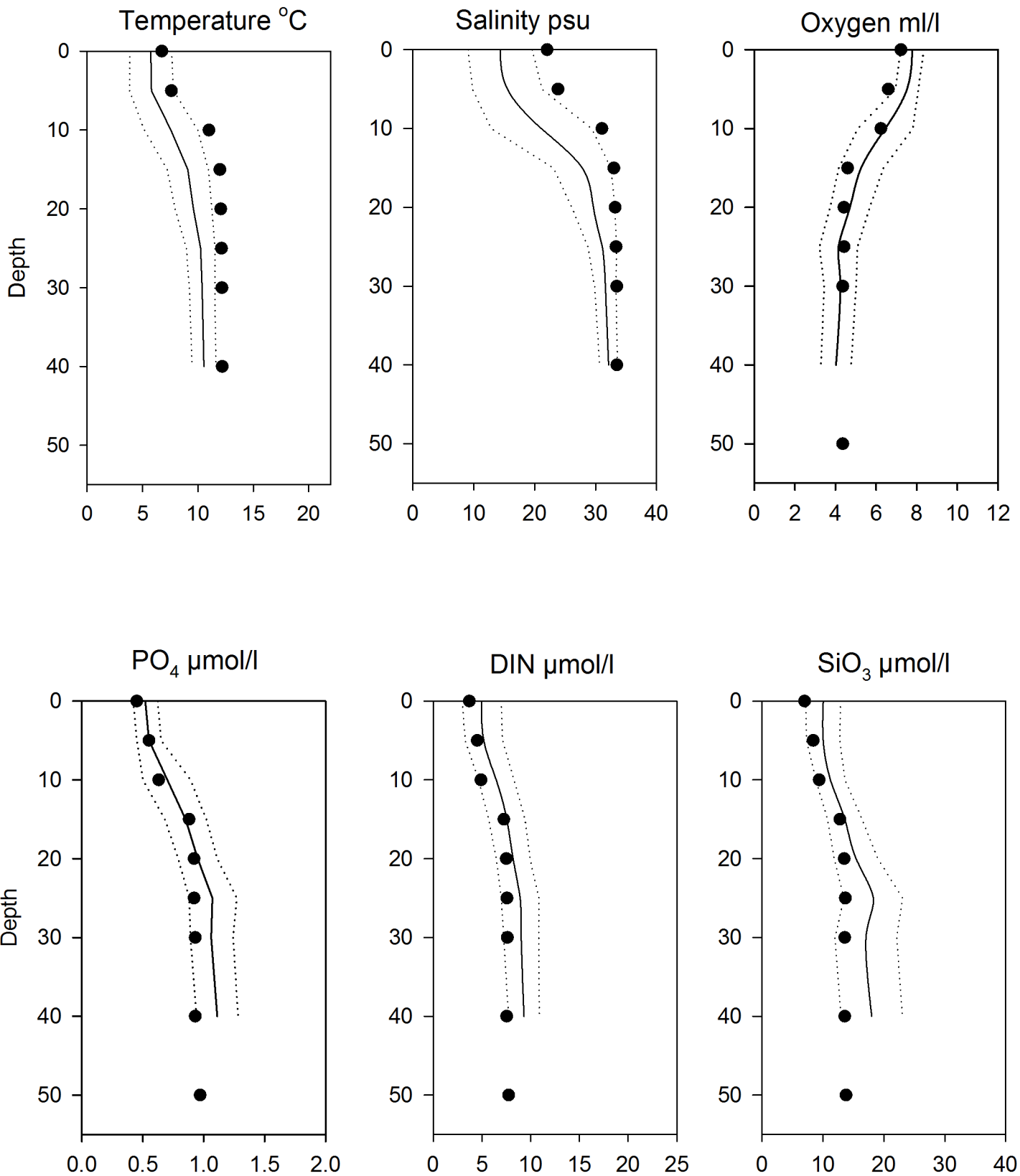


## OXYGEN IN BOTTOM WATER (depth >40m)



# Vertical profiles W Landskrona December

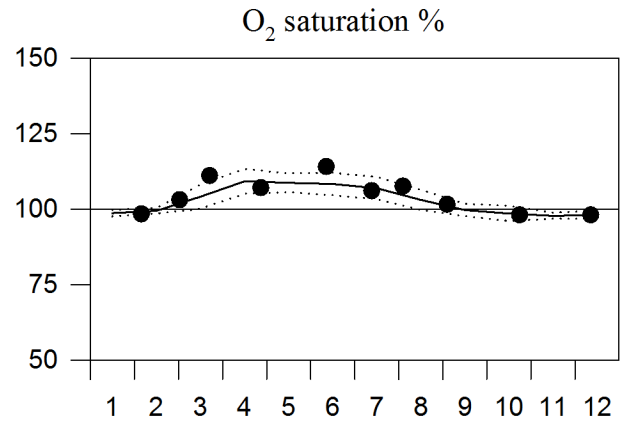
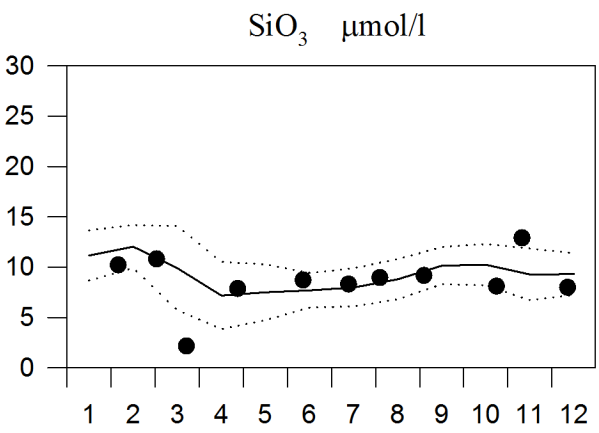
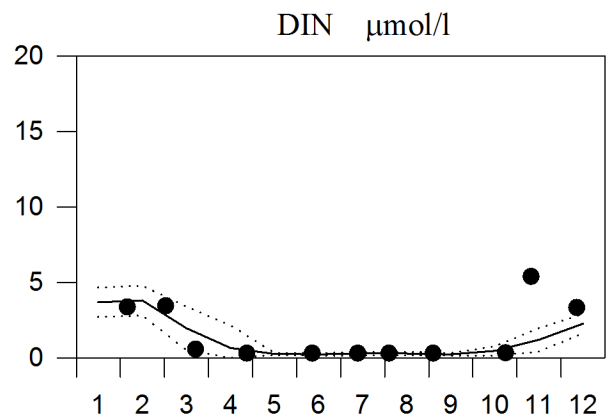
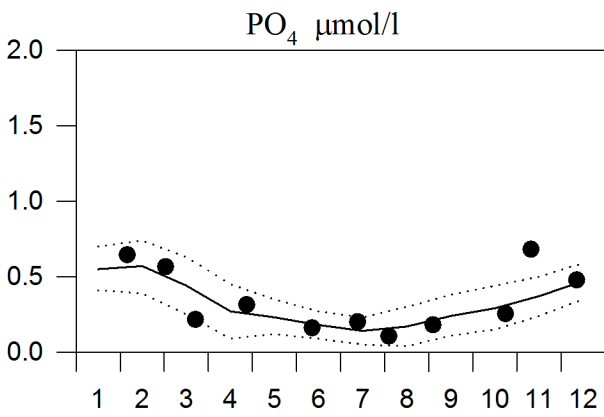
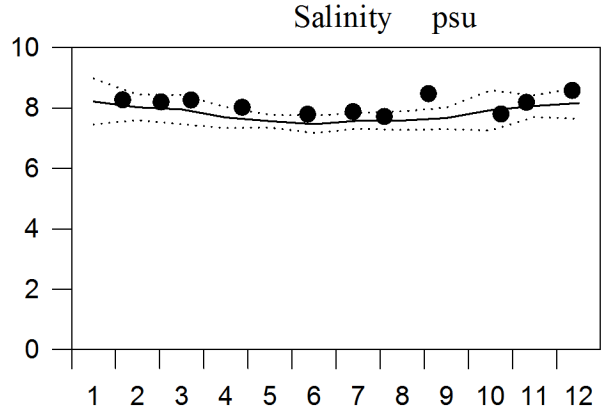
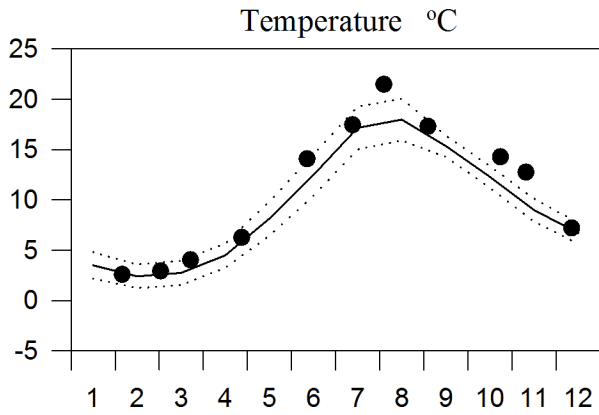
— Mean 1996-2010      ..... St.Dev.      ● 2014



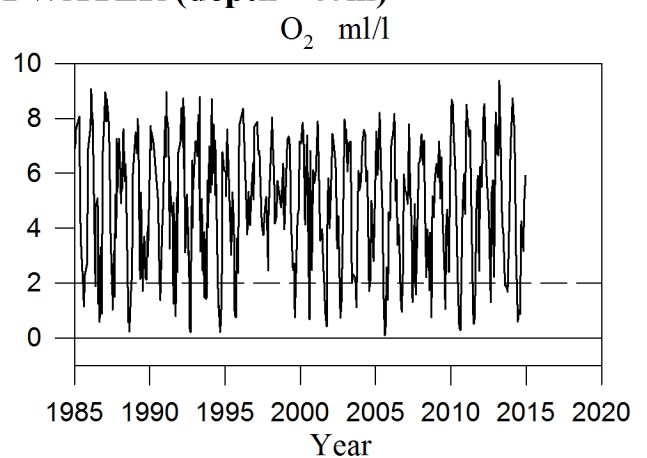
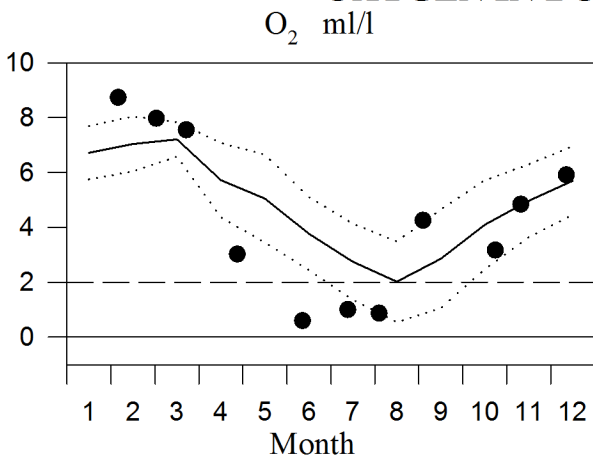
# STATION BY1 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ····· St.Dev.      ● 2014

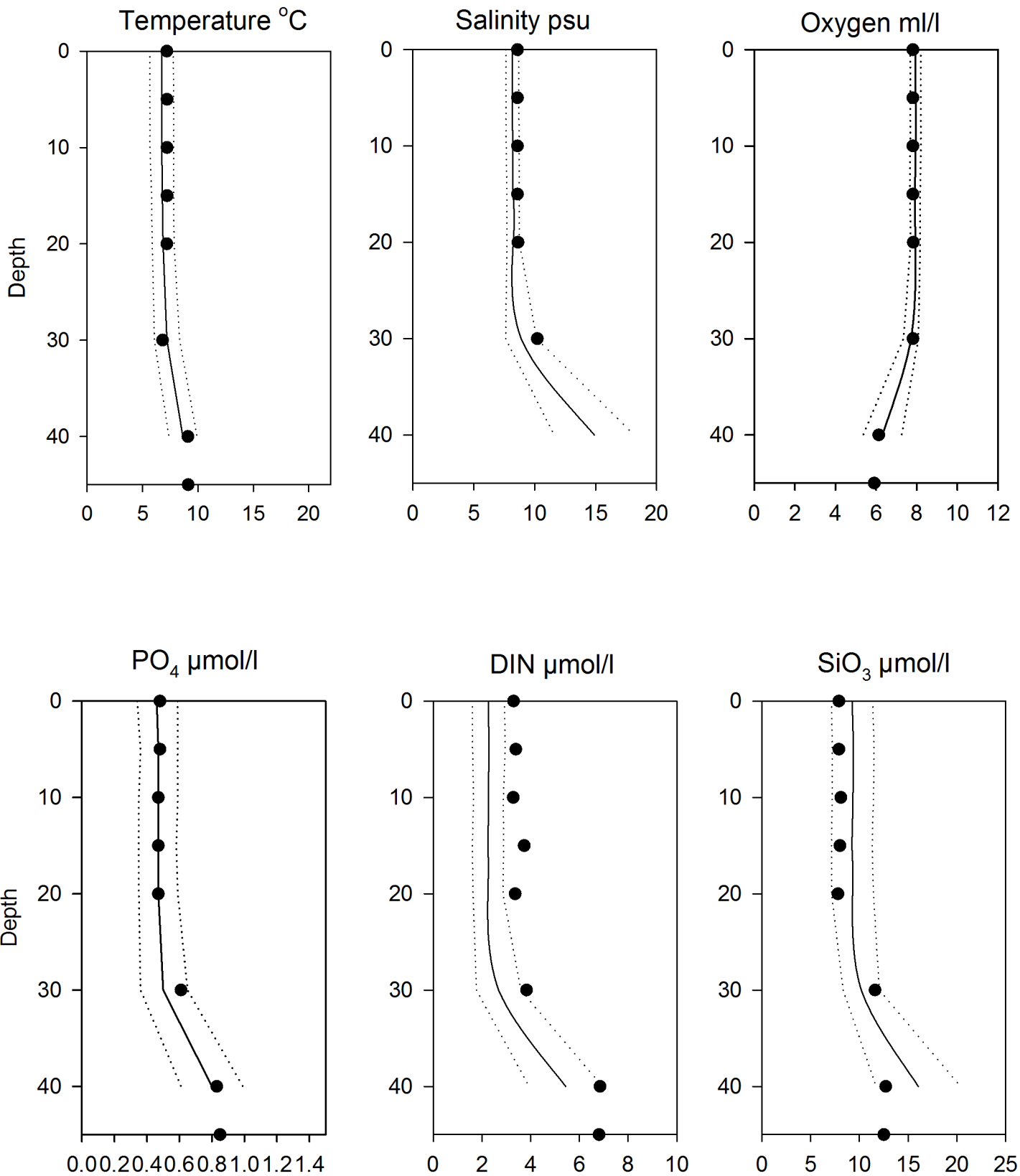


## OXYGEN IN BOTTOM WATER (depth >40m)



# Vertical profiles BY1 December

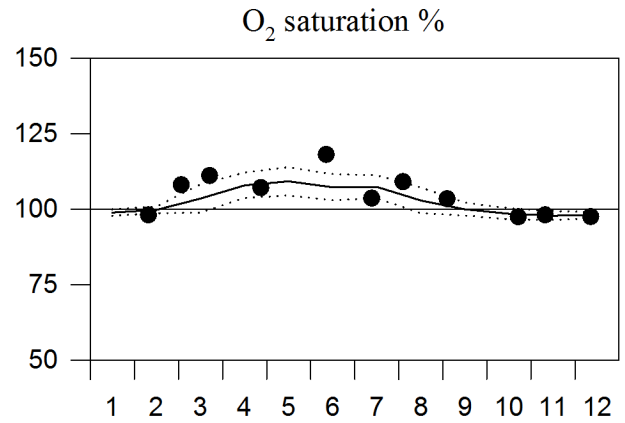
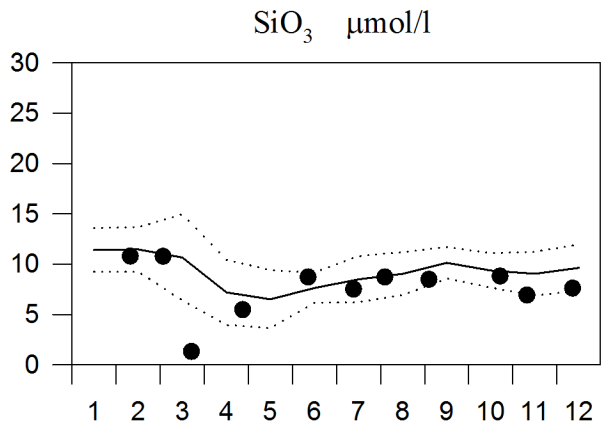
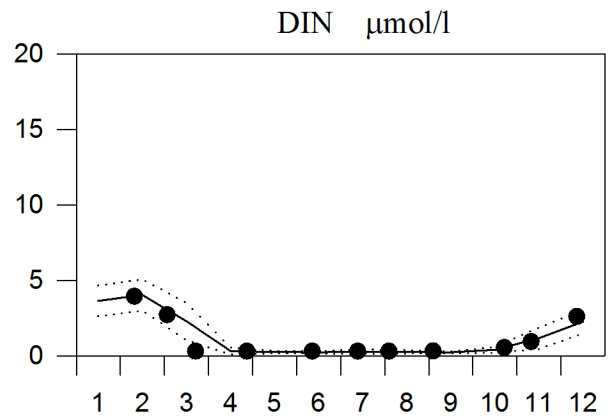
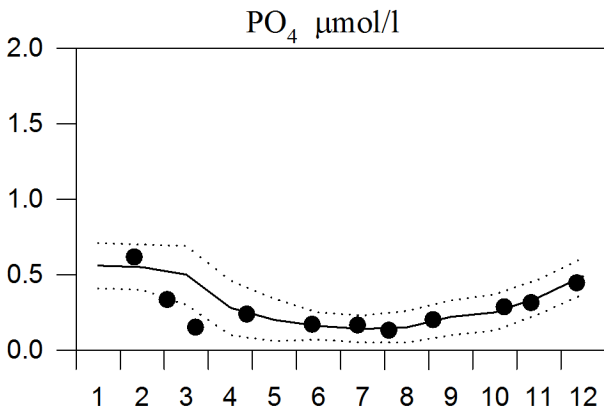
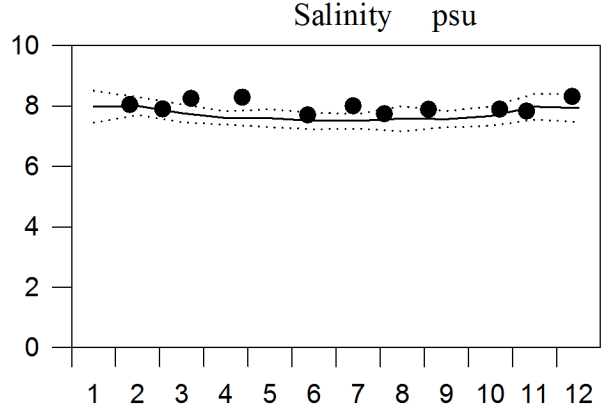
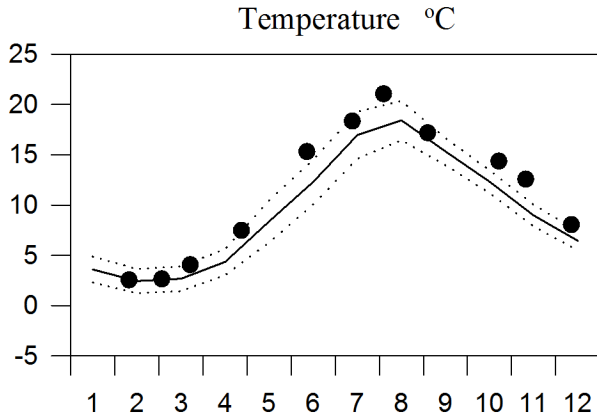
— Mean 1996-2010      ..... St.Dev.      ● 2014



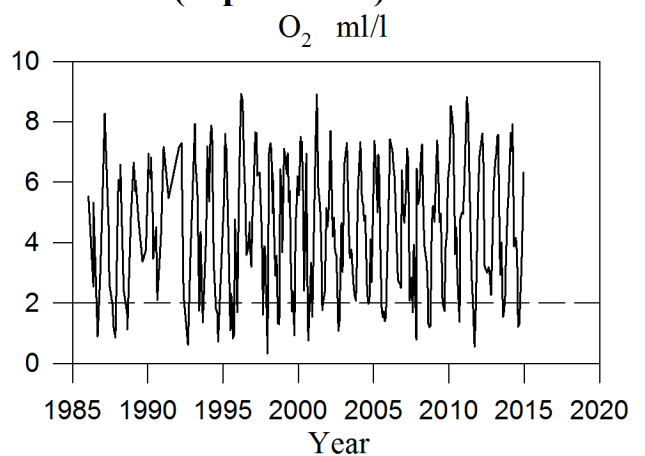
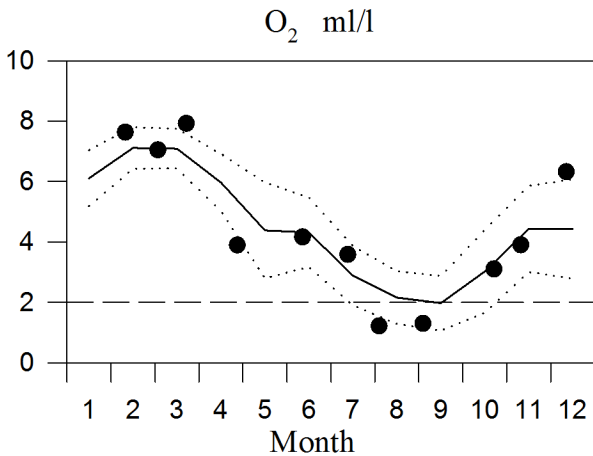
# STATION BY2 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

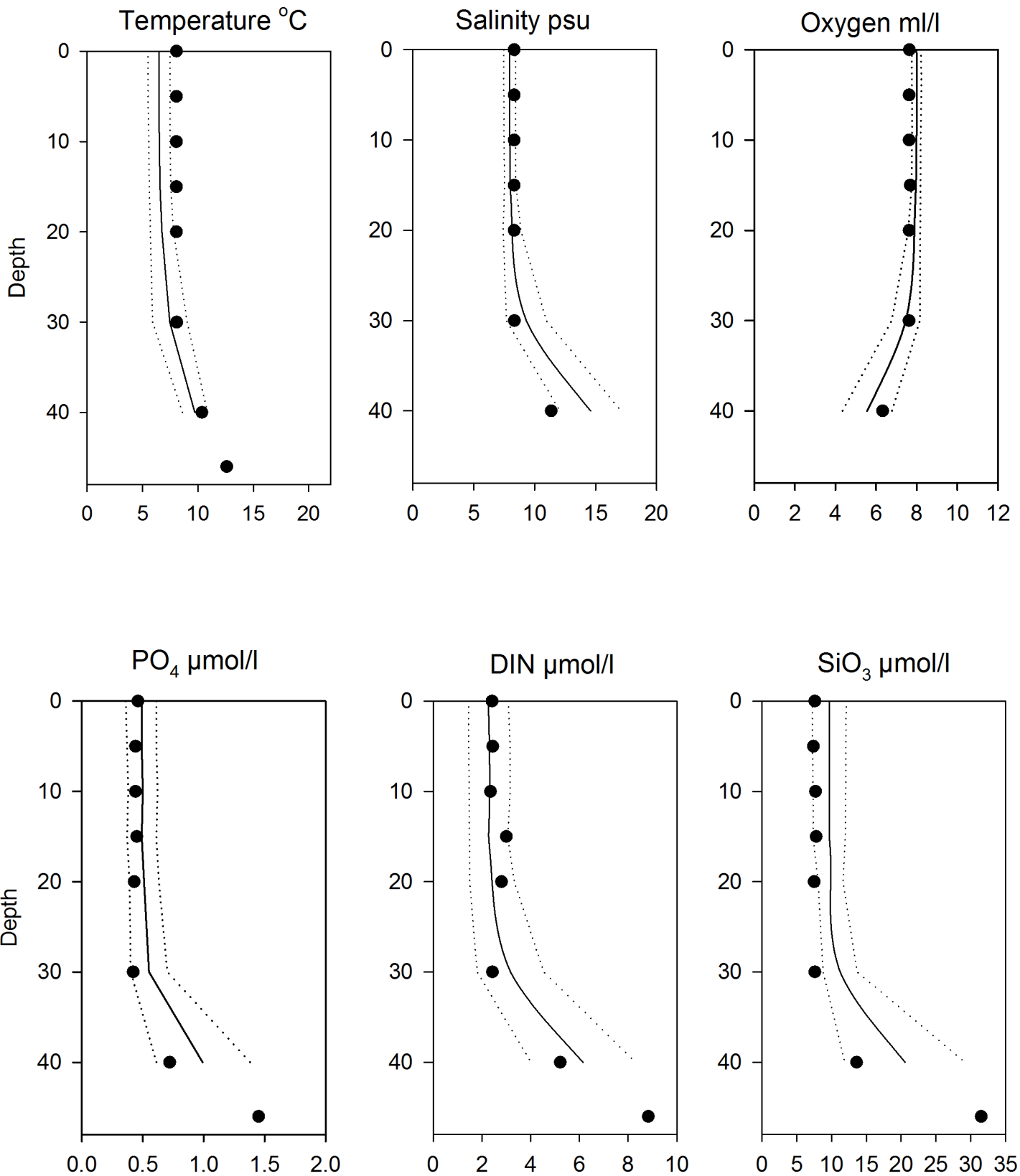


## OXYGEN IN BOTTOM WATER (depth >40m)



# Vertical profiles BY2 December

— Mean 1996-2010      ····· St.Dev.      ● 2014

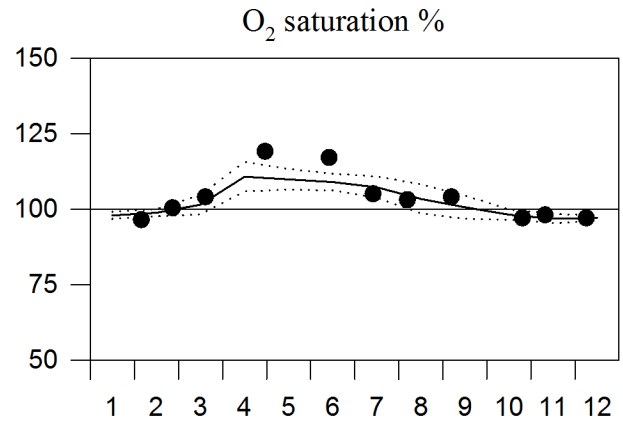
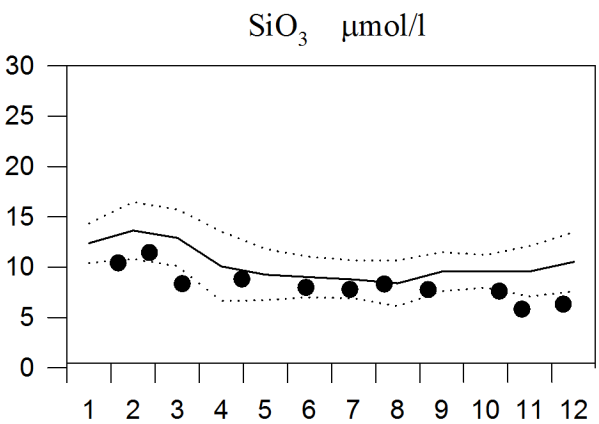
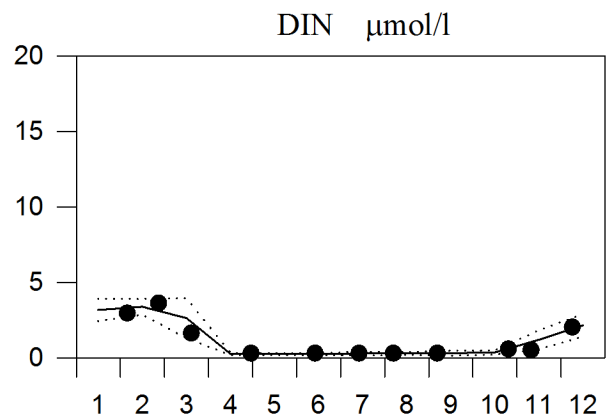
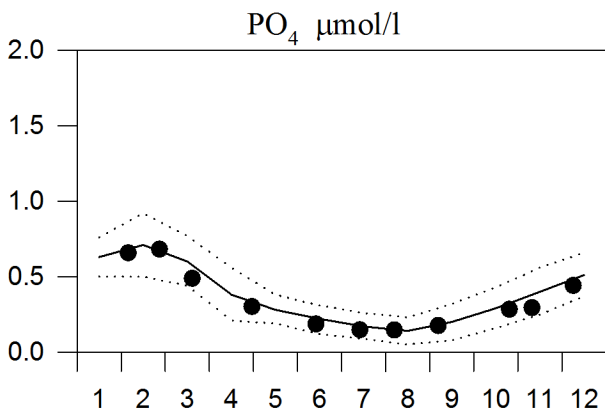
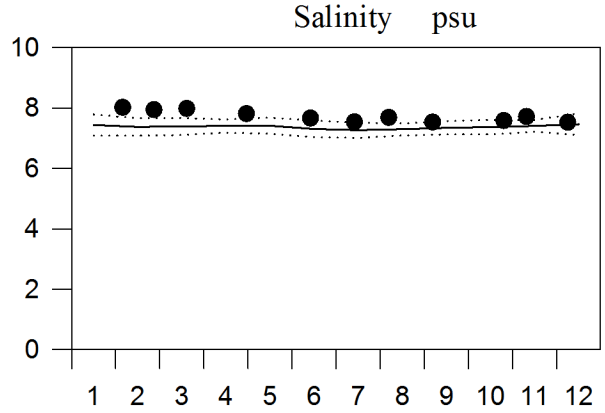
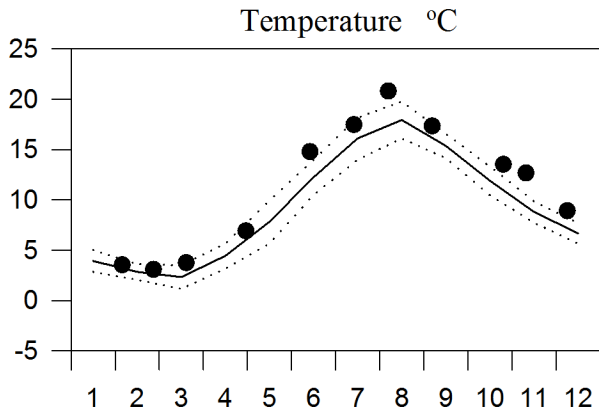




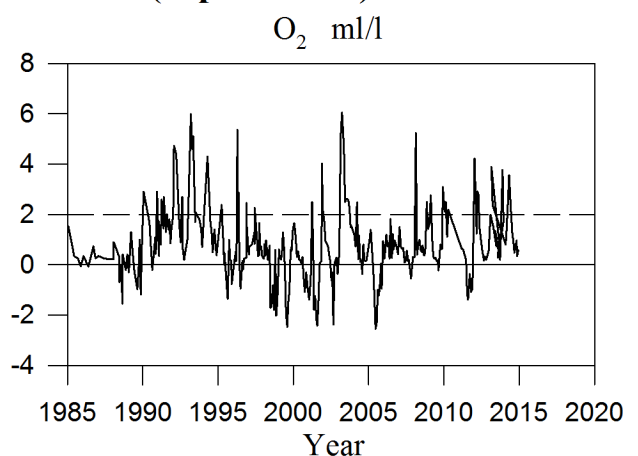
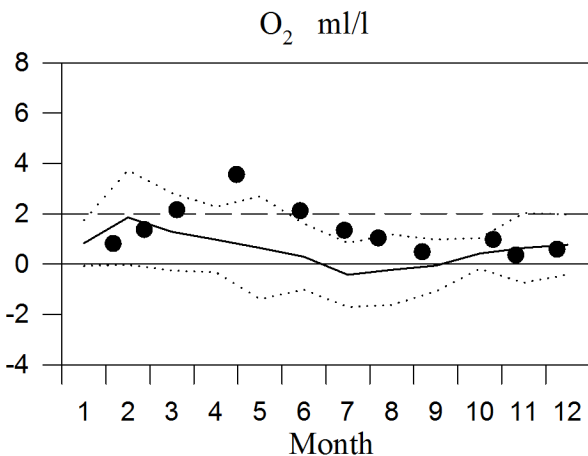
# STATION HANÖBUKTEN SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

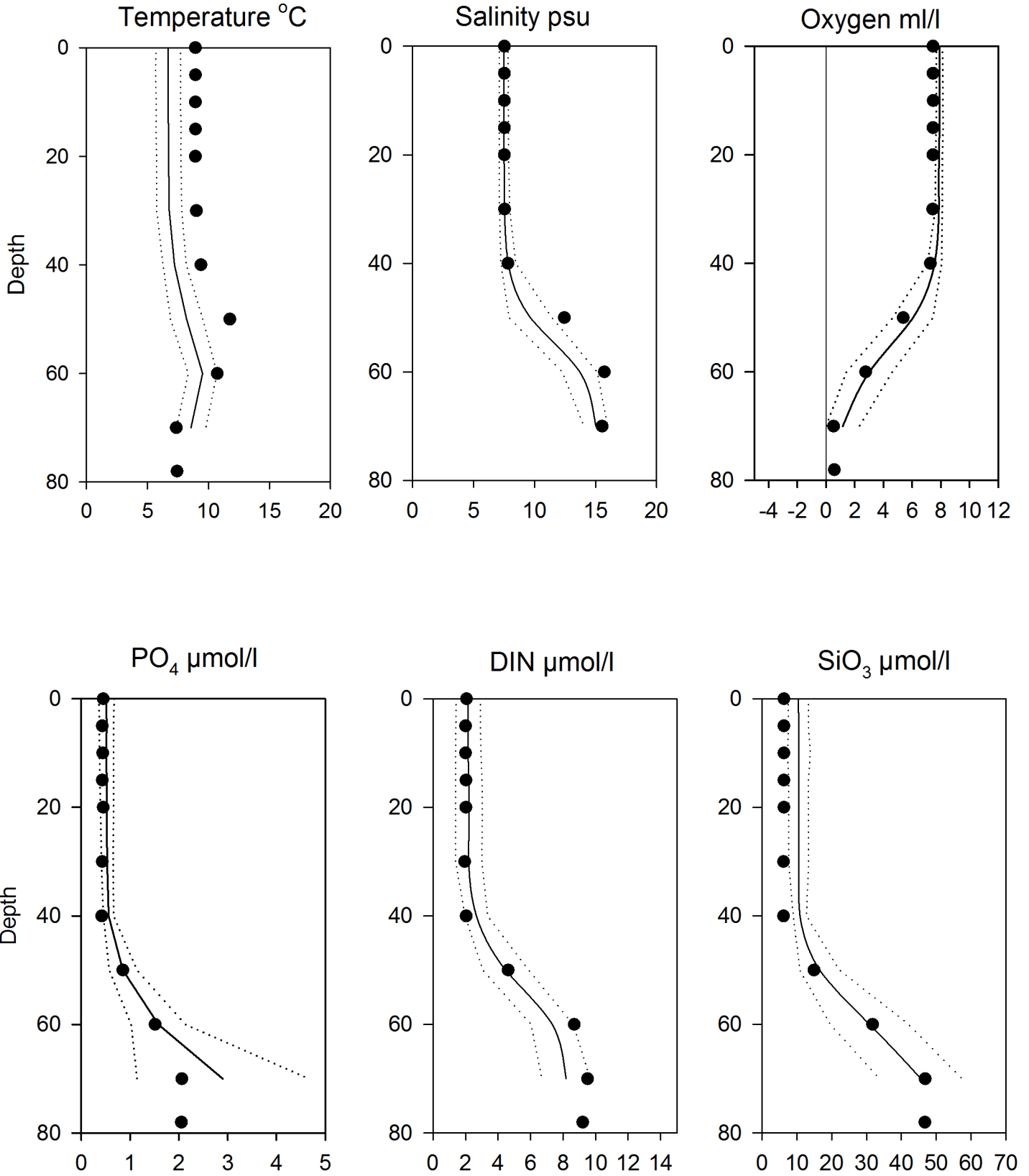


## OXYGEN IN BOTTOM WATER (depth > 70m)



# Vertical profiles Hanöbukten December

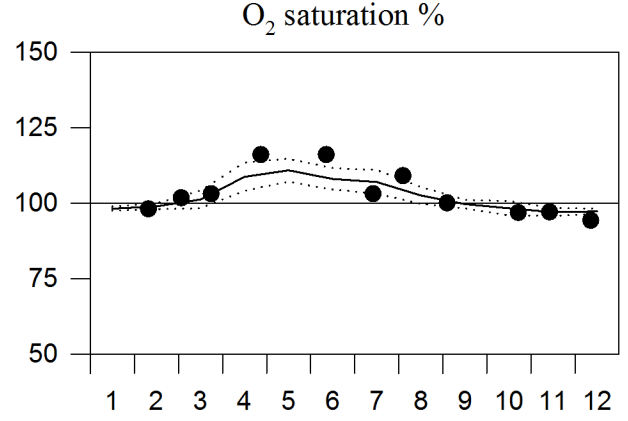
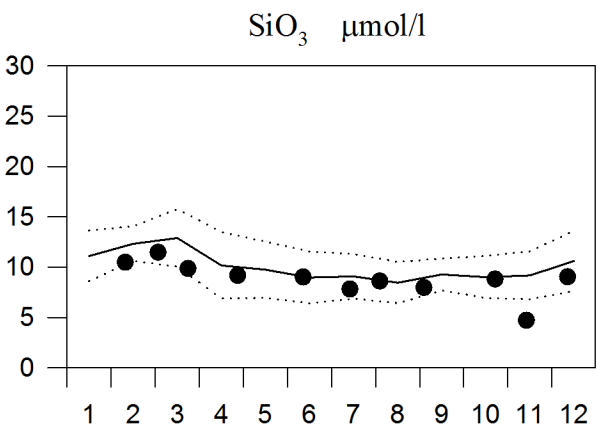
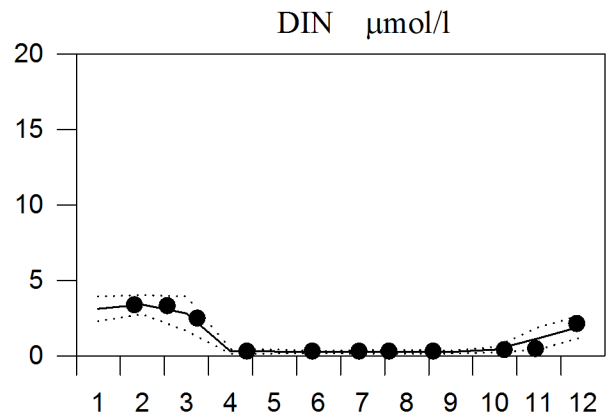
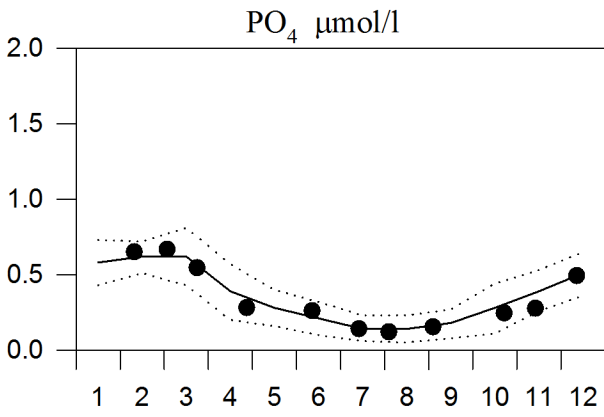
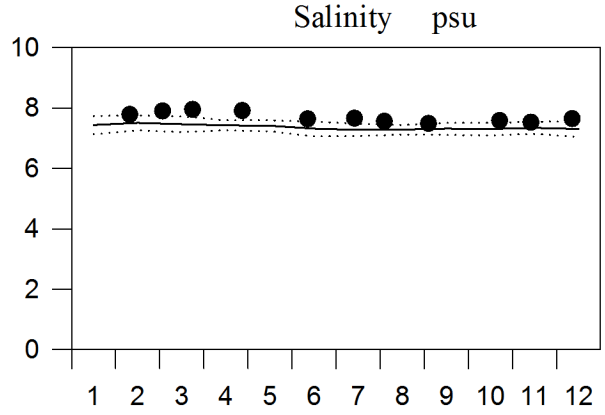
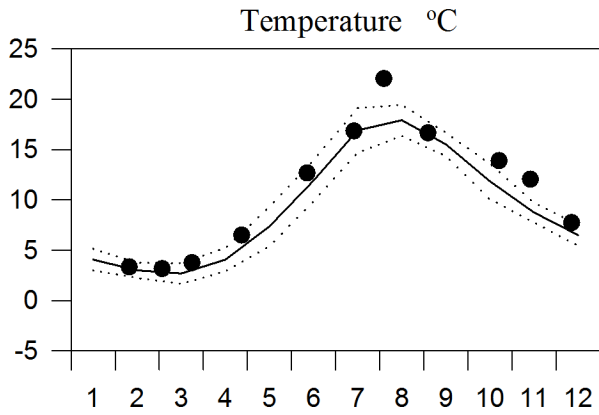
— Mean 1996-2010      ····· St.Dev.      ● 2014



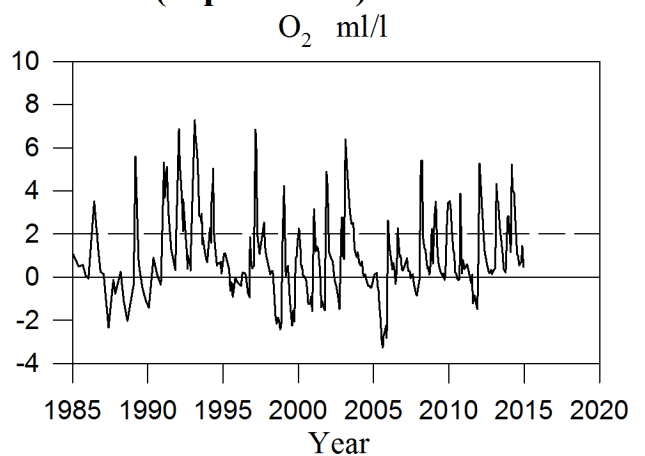
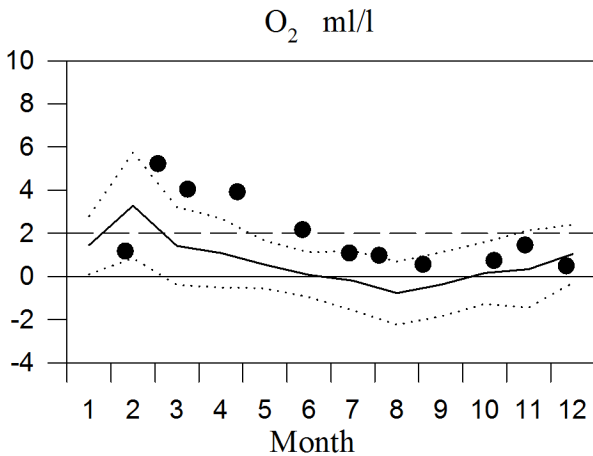
# STATION BY4 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ····· St.Dev.      ● 2014

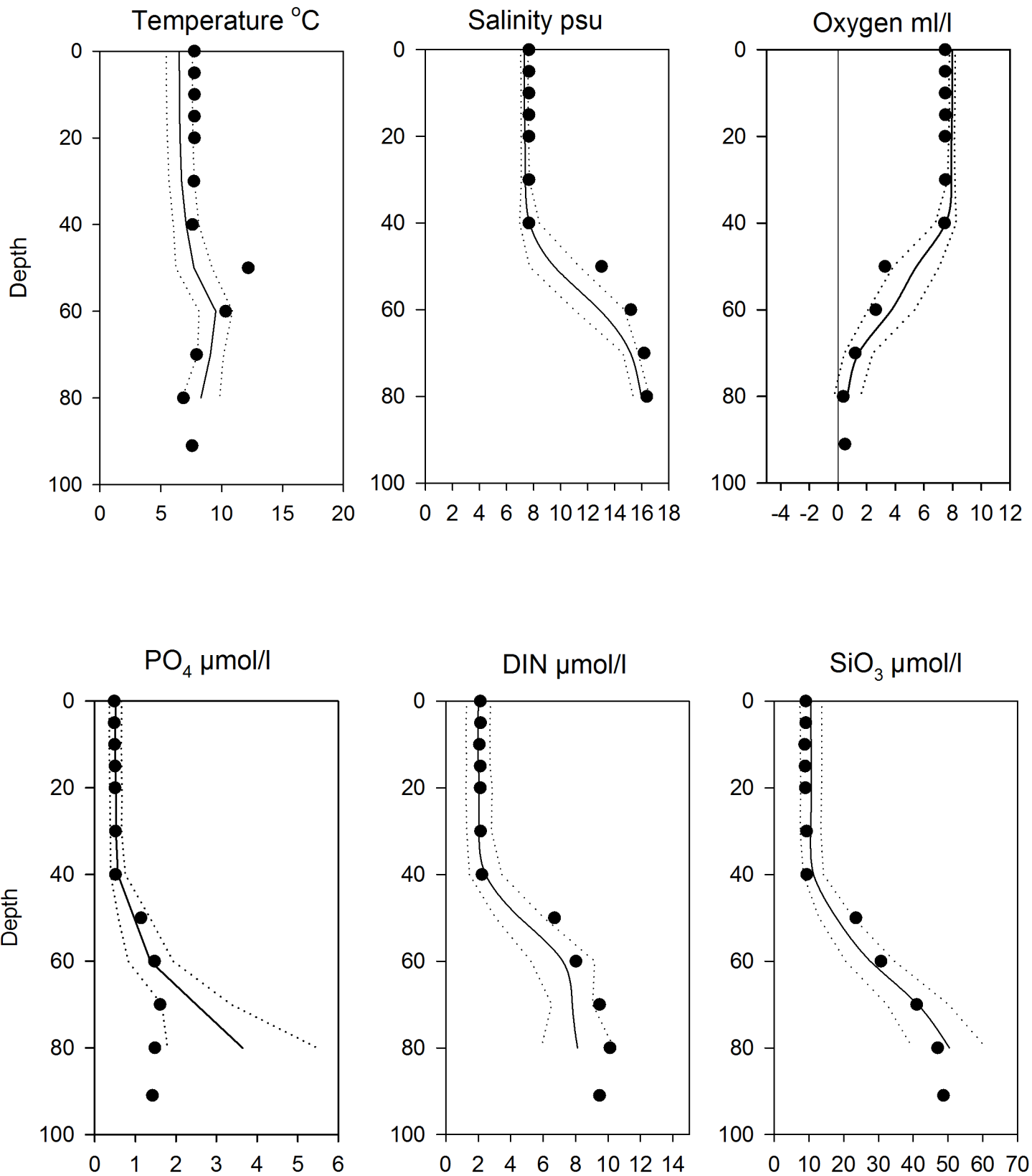


## OXYGEN IN BOTTOM WATER (depth >80m)



# Vertical profiles BY4 December

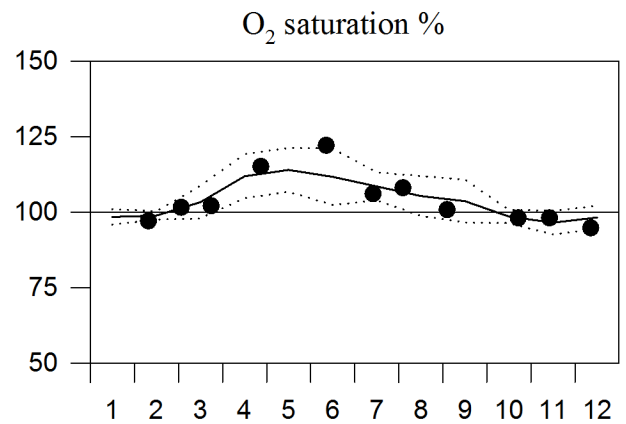
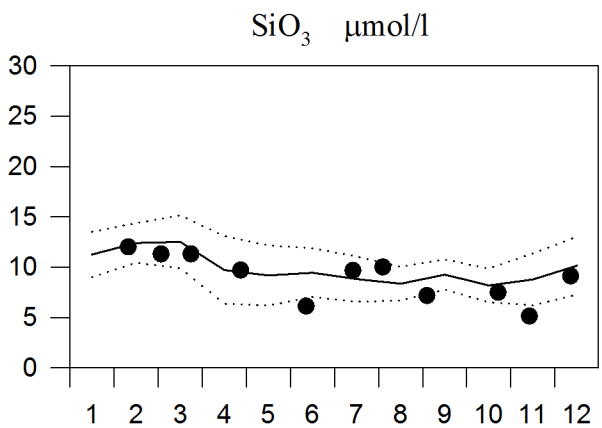
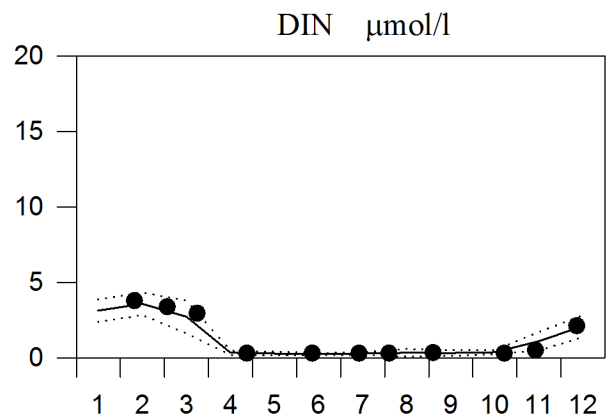
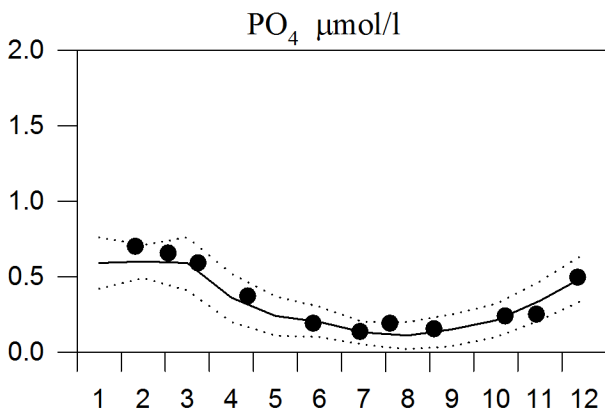
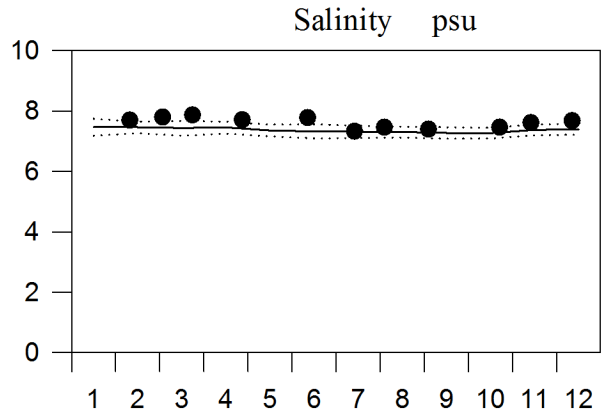
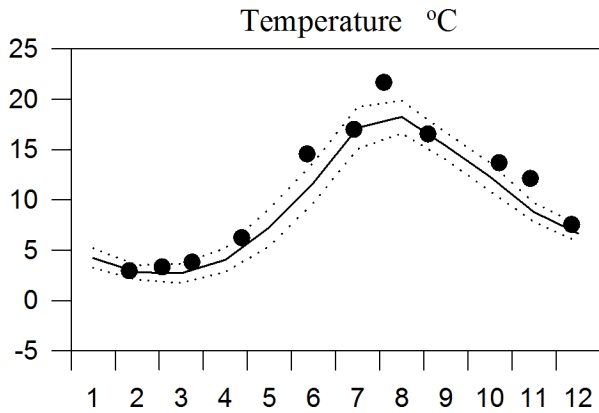
— Mean 1996-2010      ····· St.Dev.      ● 2014



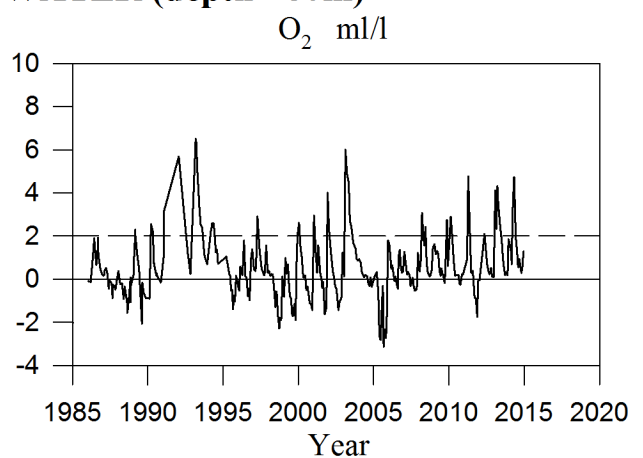
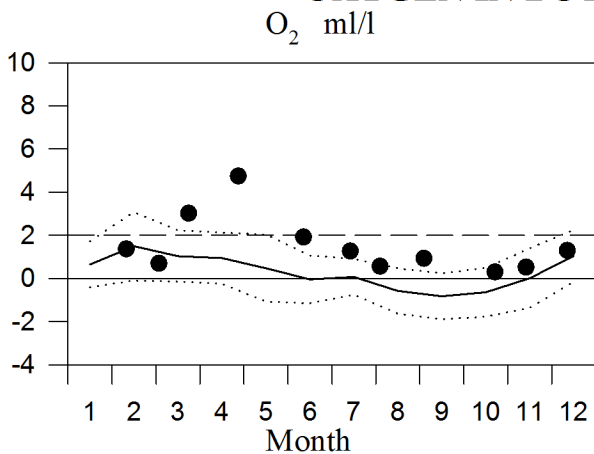
# STATION BY5 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

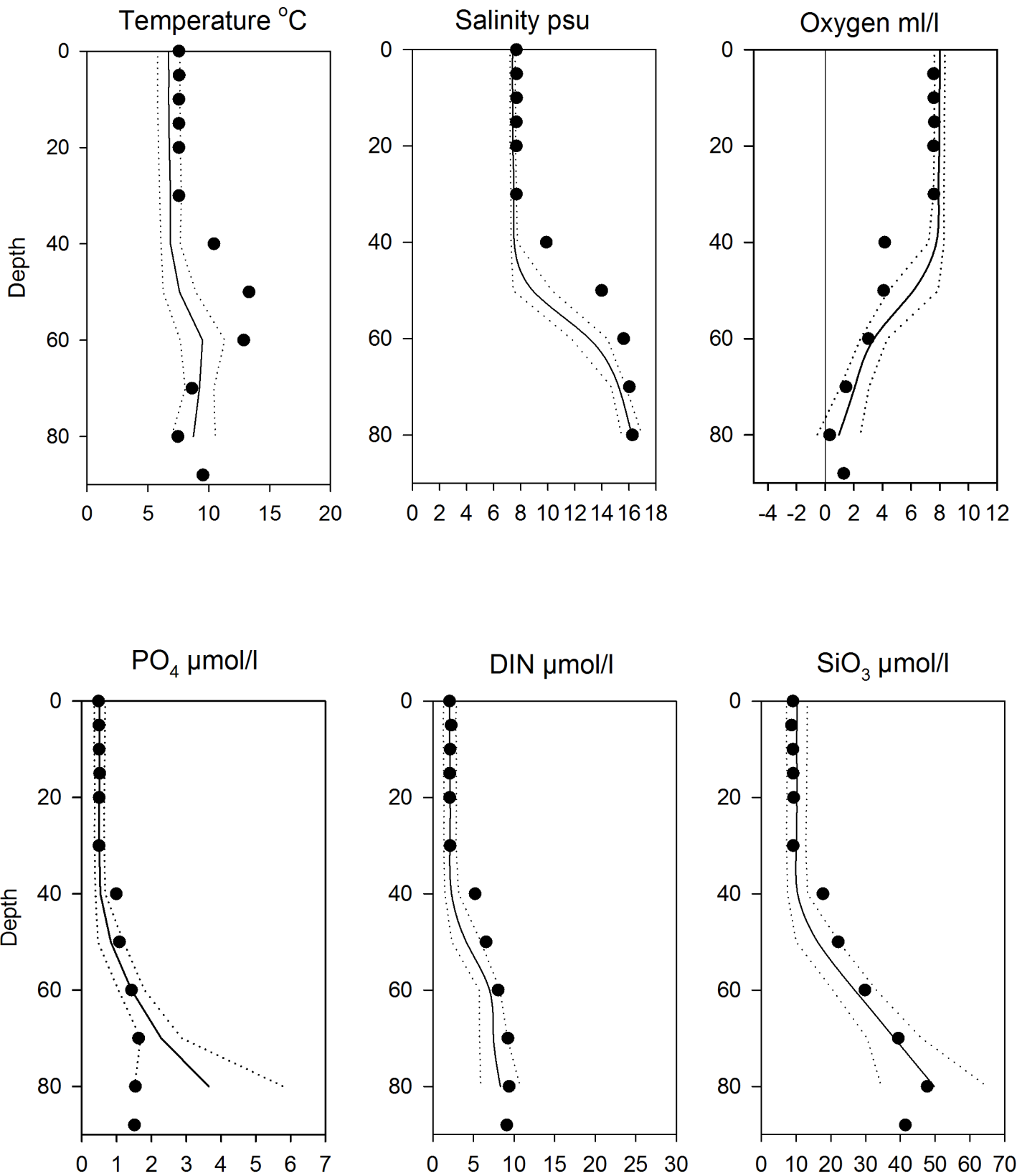


## OXYGEN IN BOTTOM WATER (depth >80m)



# Vertical profiles BY5 December

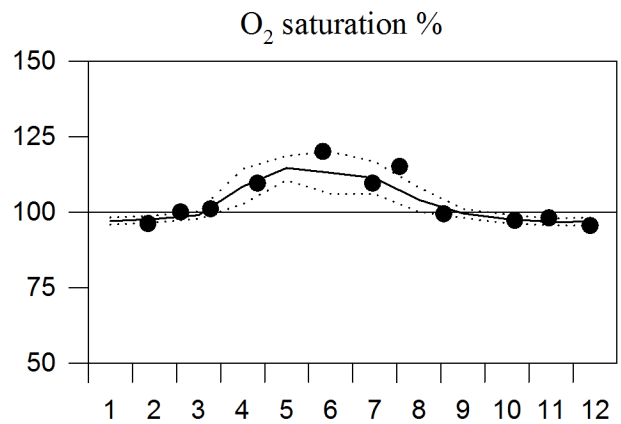
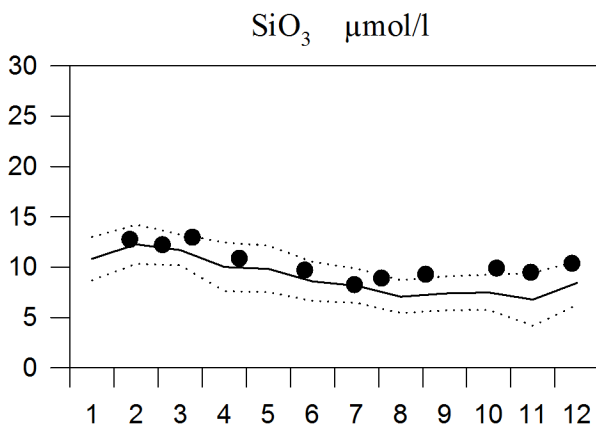
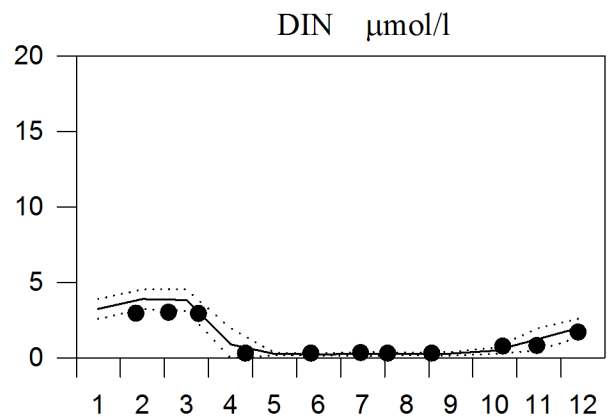
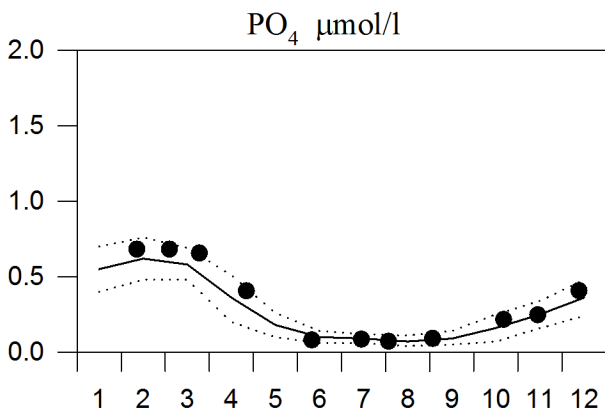
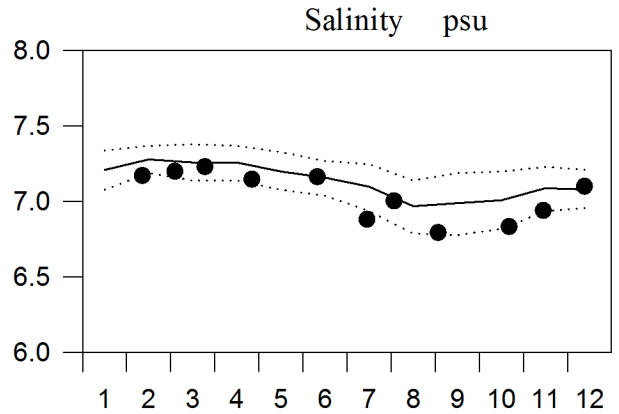
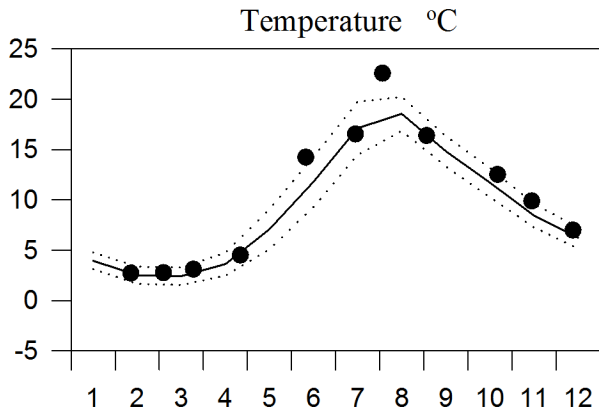
— Mean 1996-2010      ····· St.Dev.      ● 2014



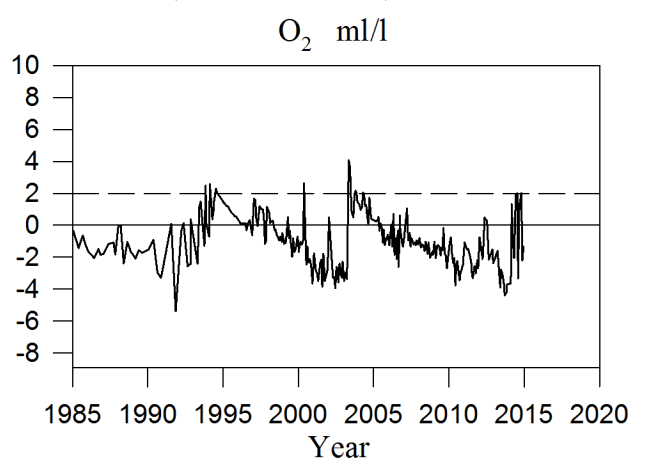
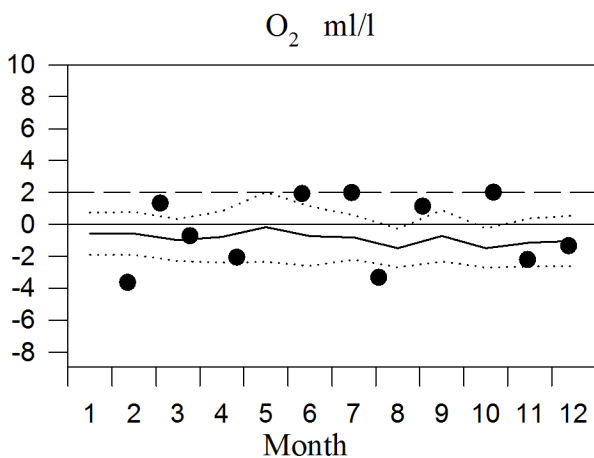
# STATION BY10 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ····· St.Dev.      ● 2014

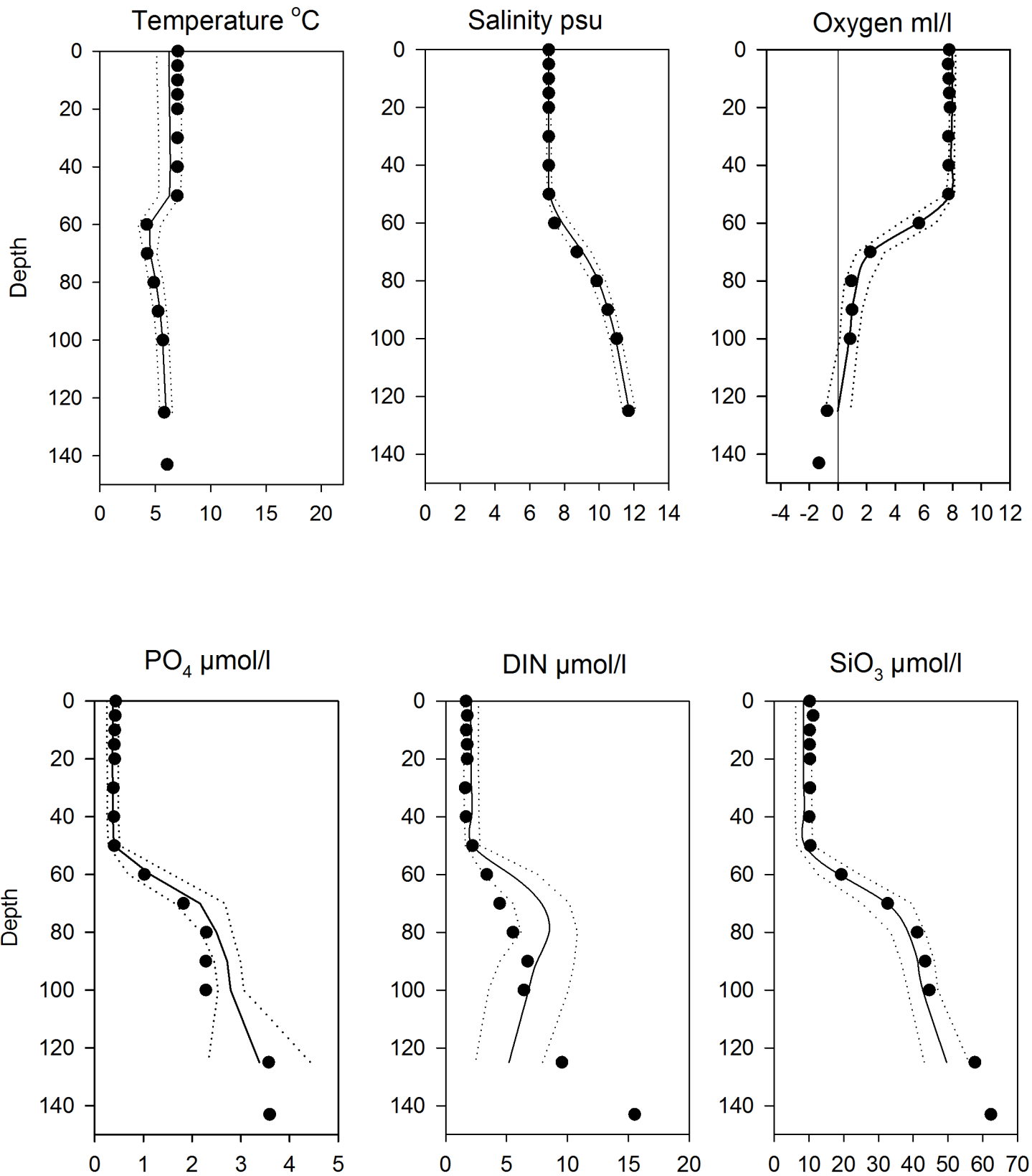


## OXYGEN IN BOTTOM WATER (depth >125m)



# Vertical profiles BY10 December

— Mean 1996-2010      ····· St.Dev.      ● 2014

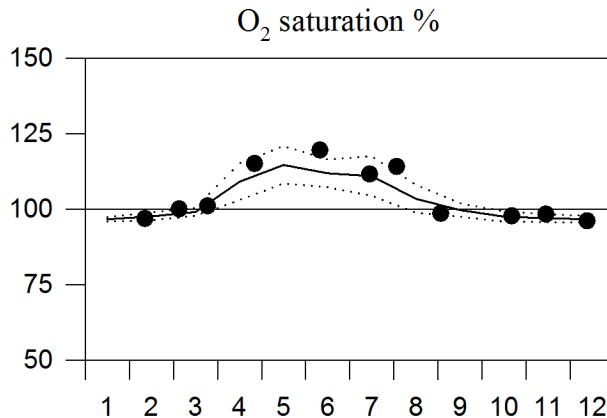
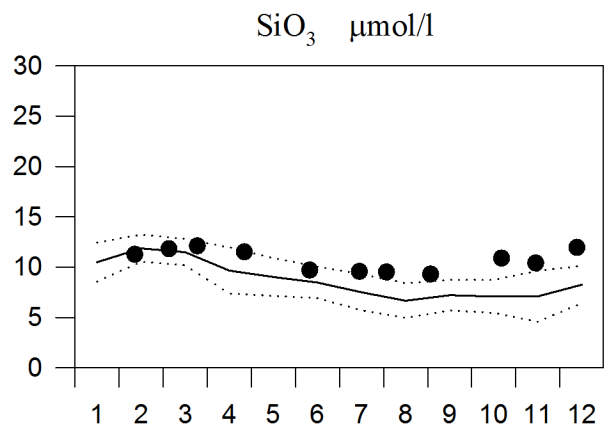
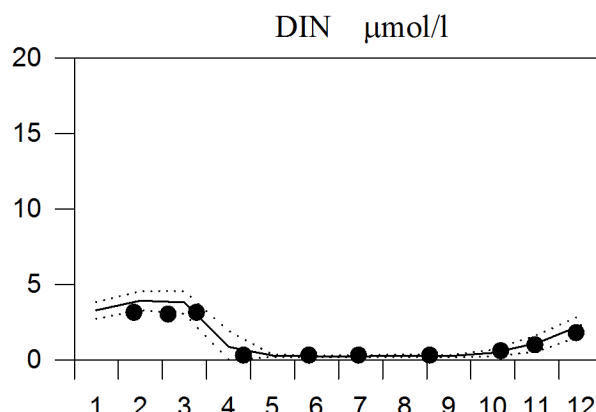
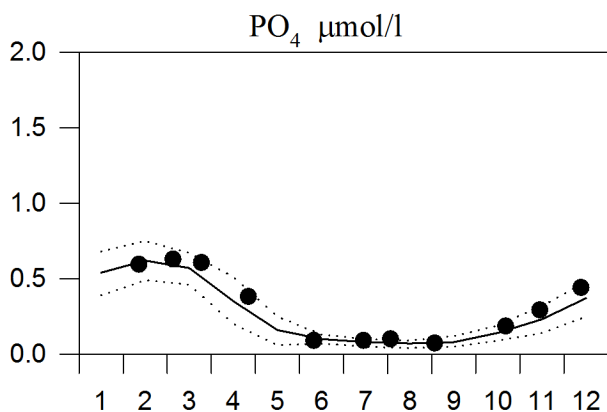
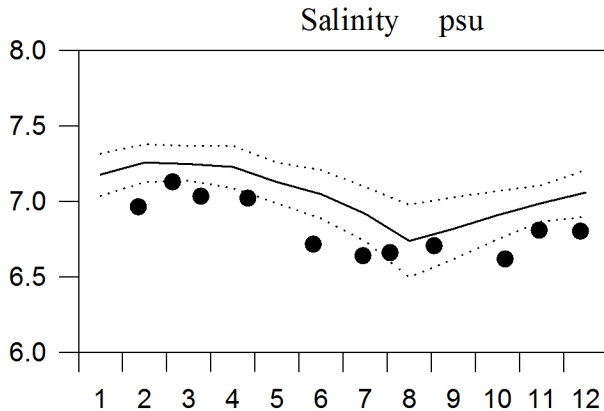
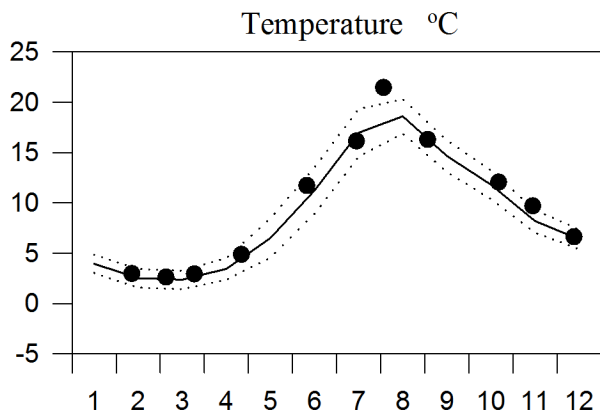




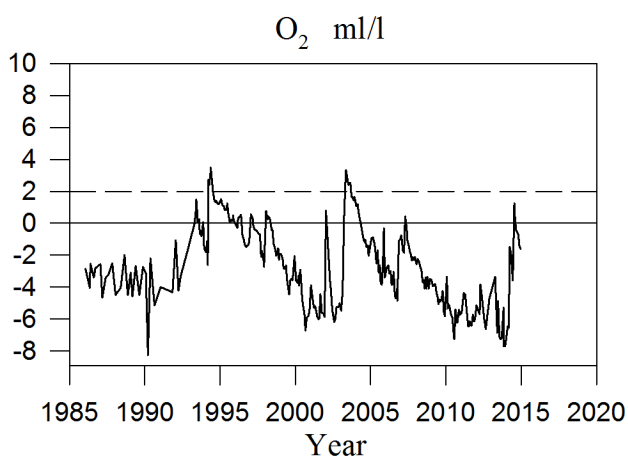
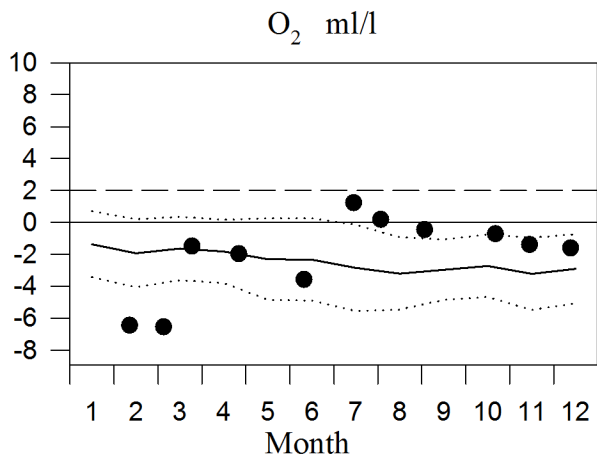
# STATION BY15 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

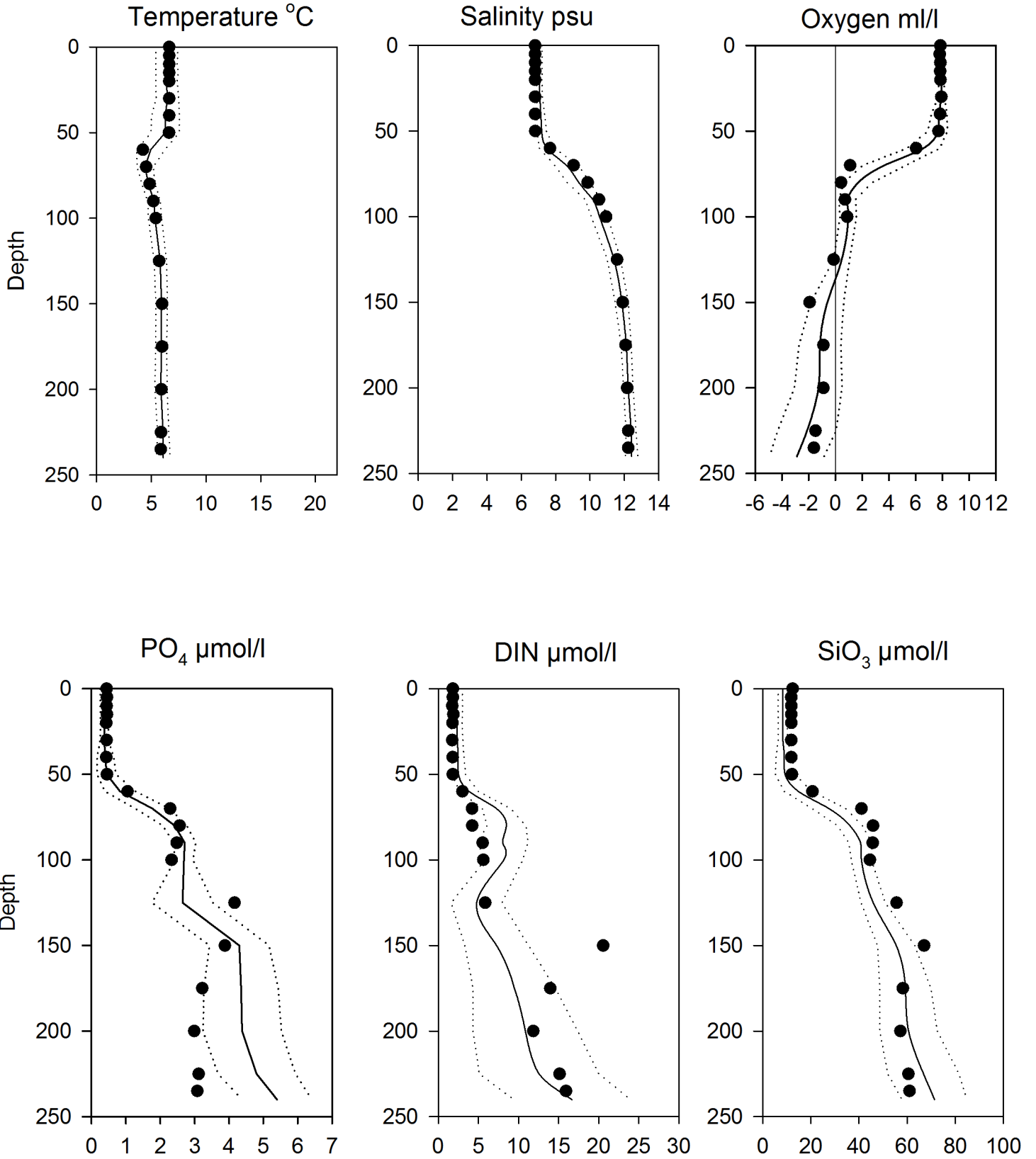


## OXYGEN IN BOTTOM WATER (depth >225m)



# Vertical profiles BY15 December

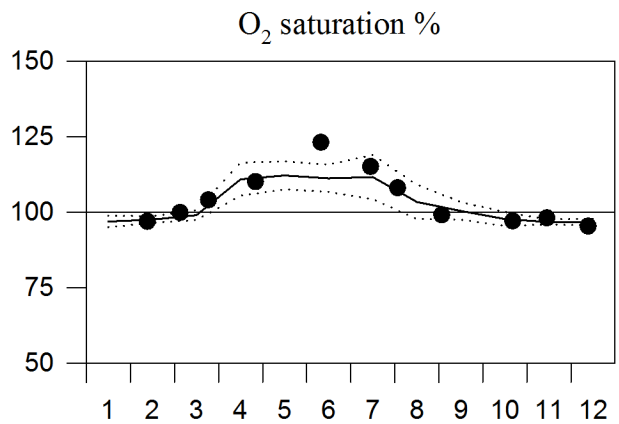
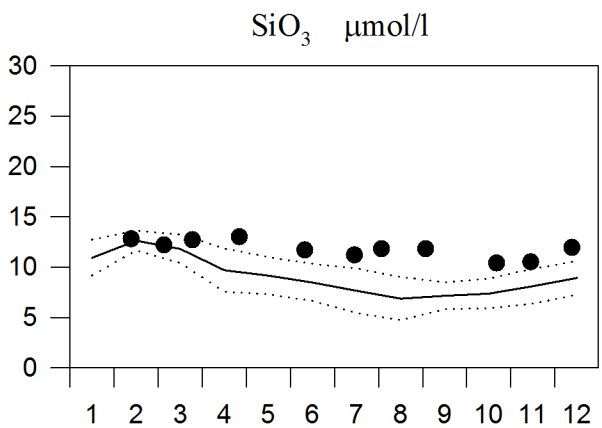
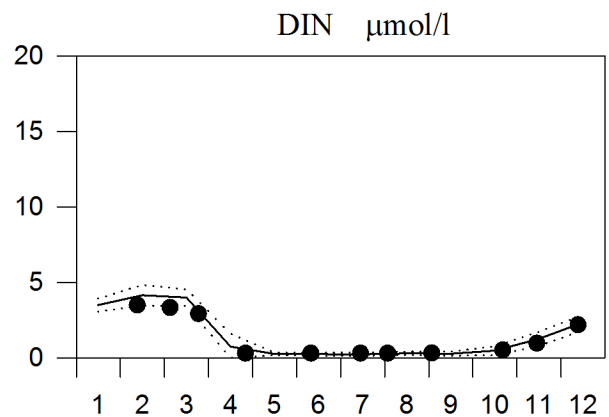
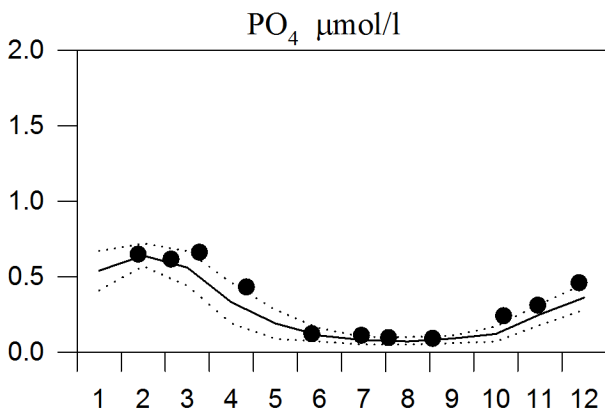
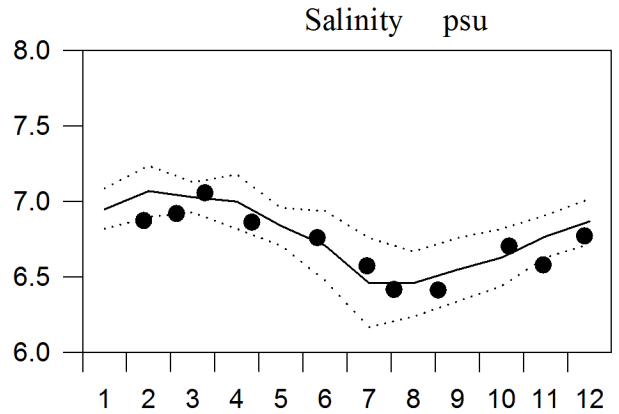
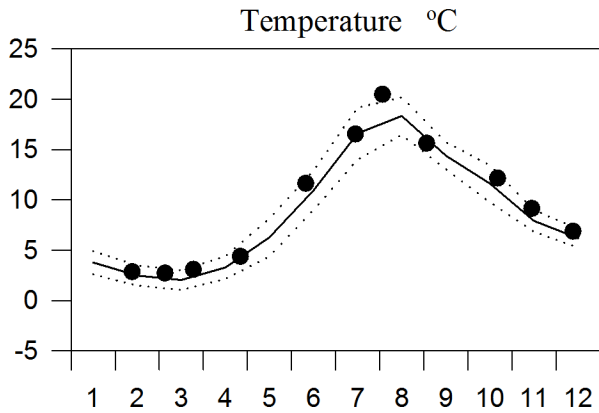
— Mean 1996-2010      ····· St.Dev.      ● 2014



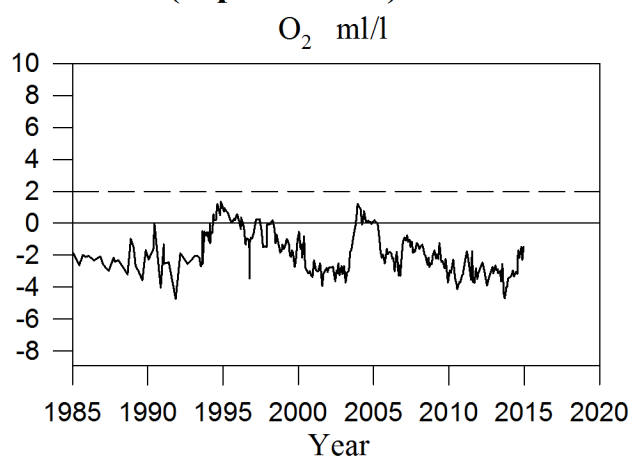
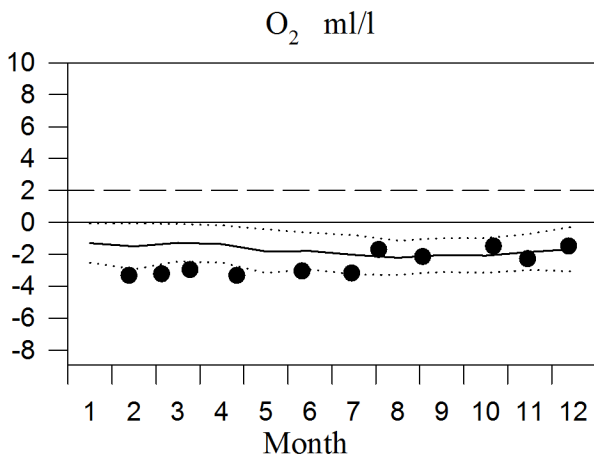
# STATION BY20 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

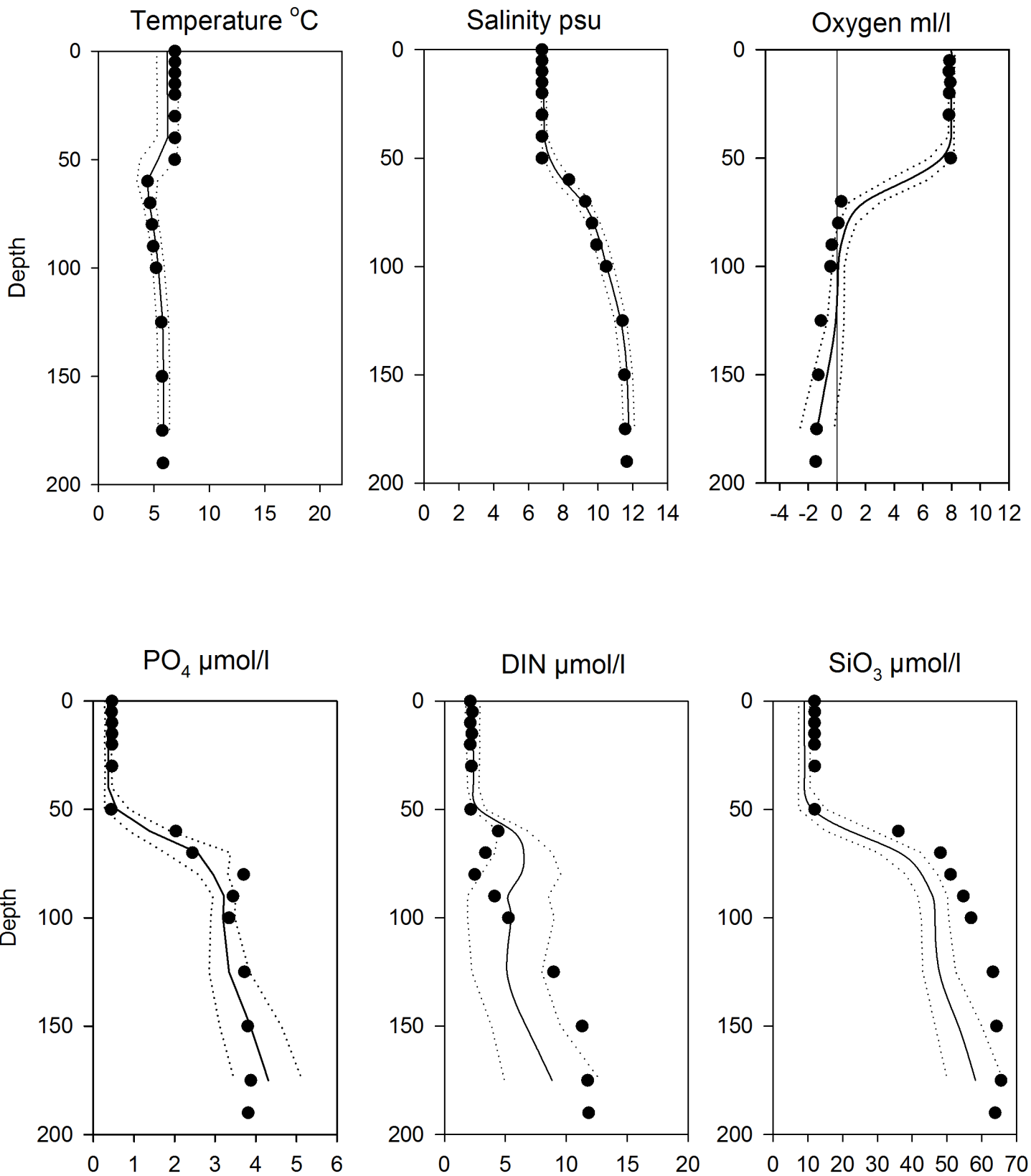


## OXYGEN IN BOTTOM WATER (depth >175m)



# Vertical profiles BY20 December

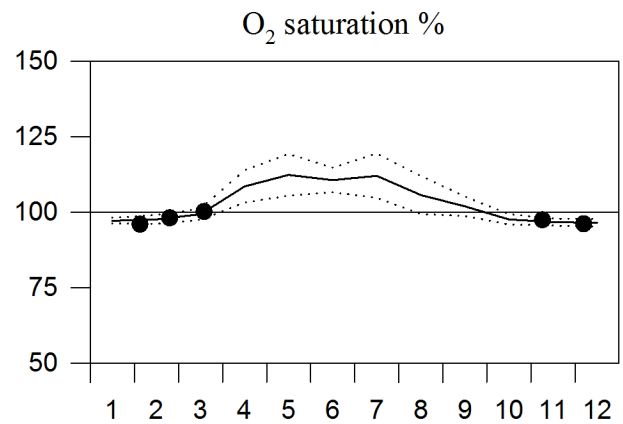
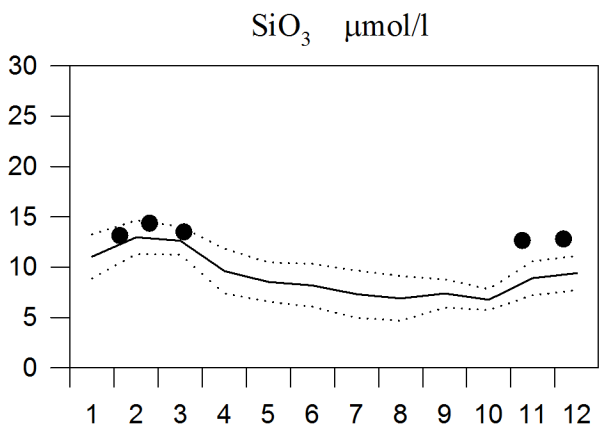
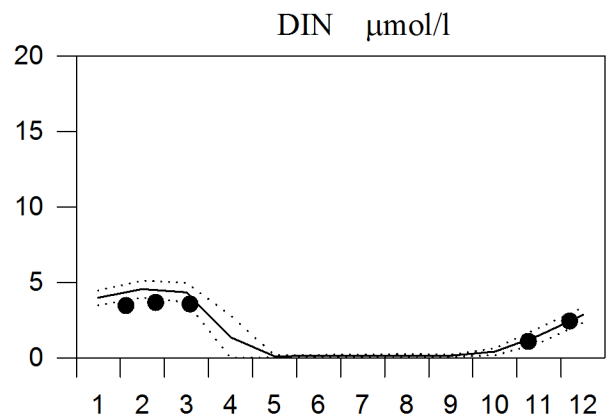
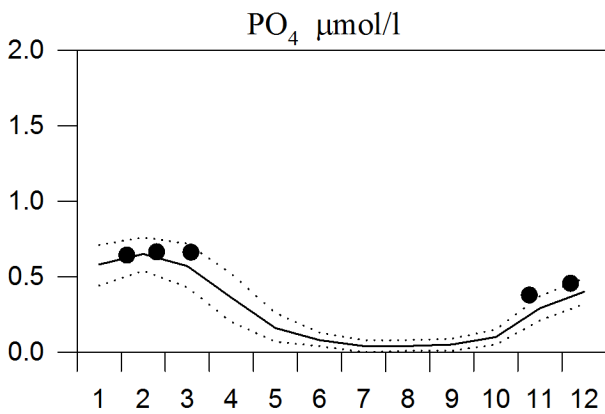
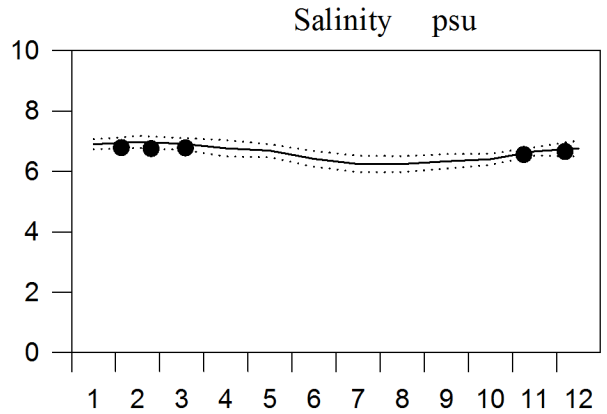
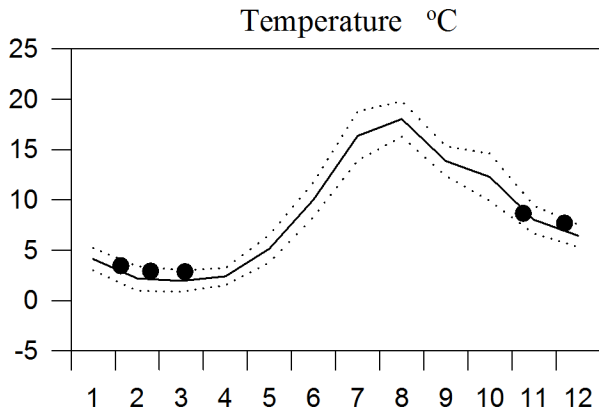
— Mean 1996-2010      ····· St.Dev.      ● 2014



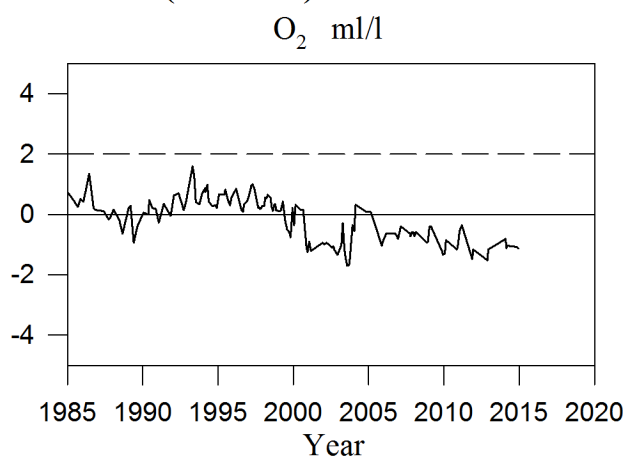
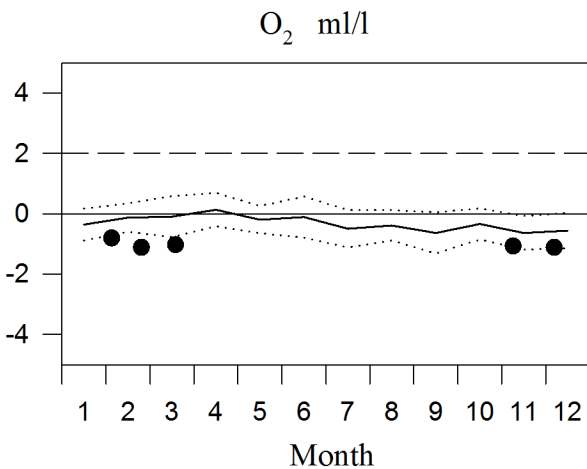
# STATION BY29 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

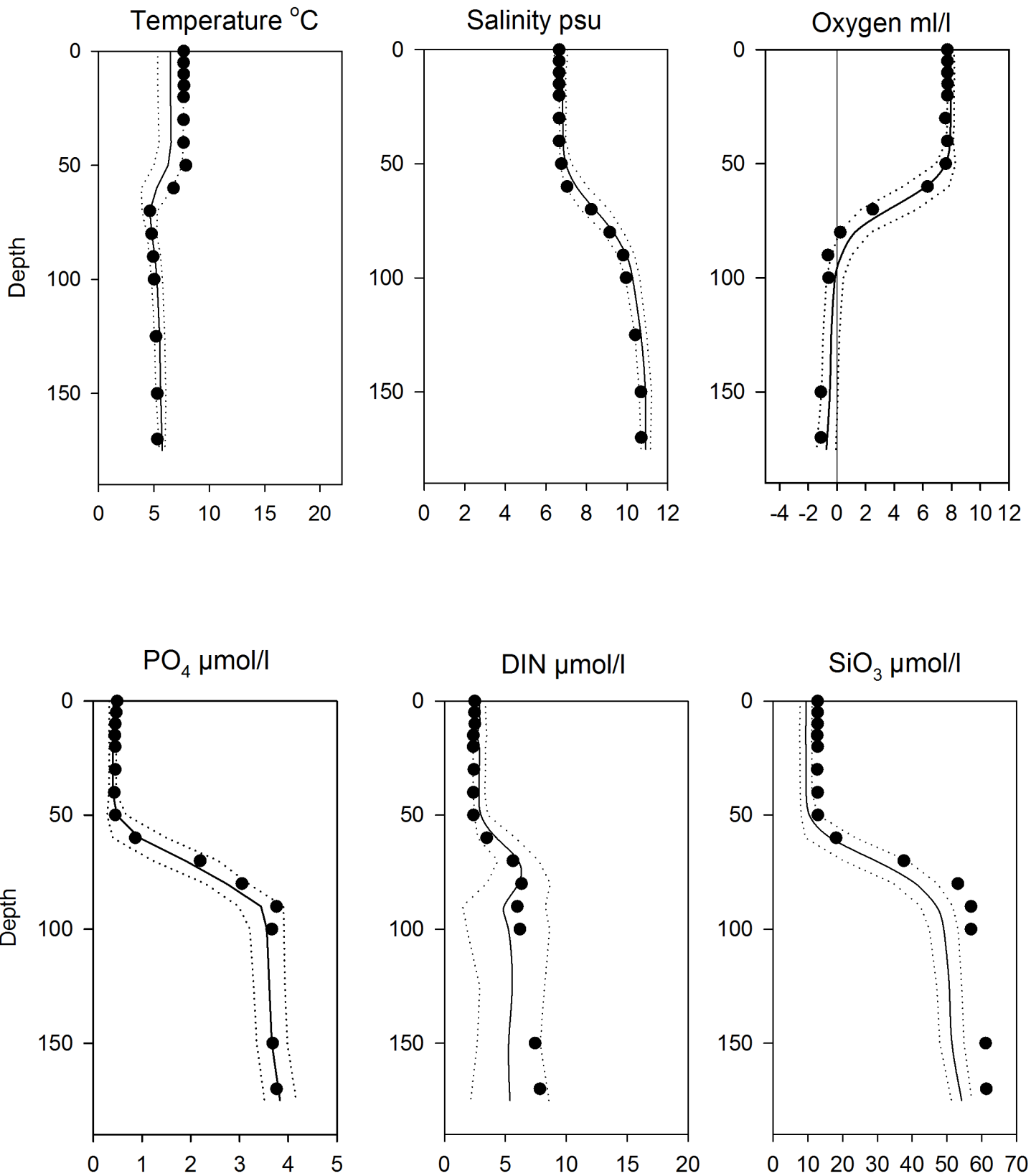


## OXYGEN IN BOTTOM WATER (>=150m)



# Vertical profiles BY29 December

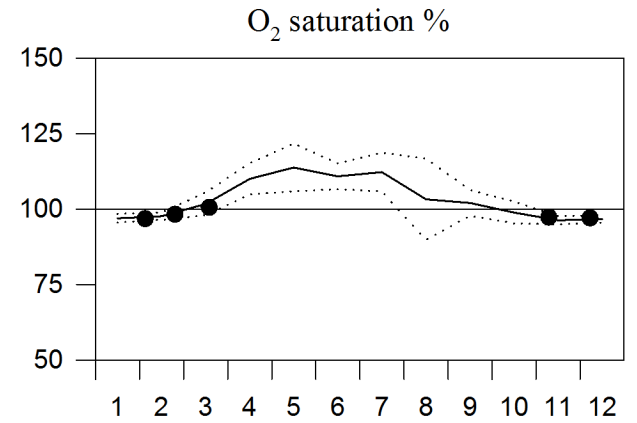
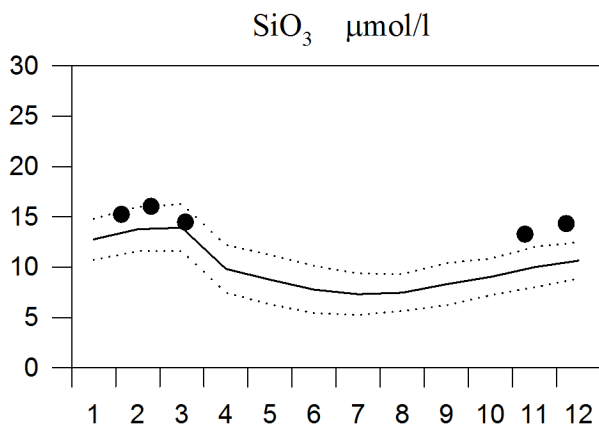
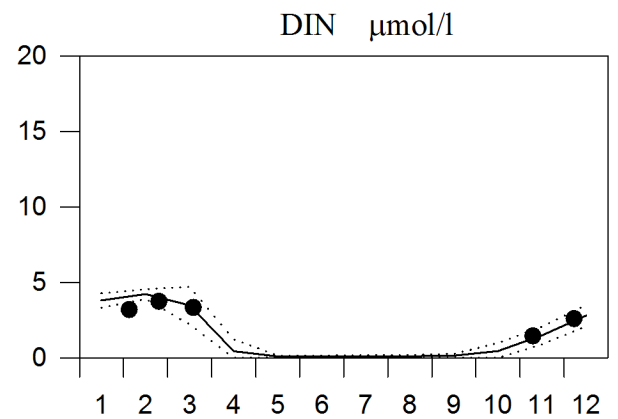
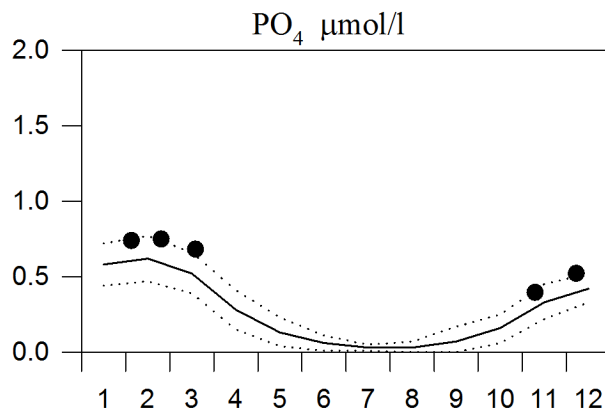
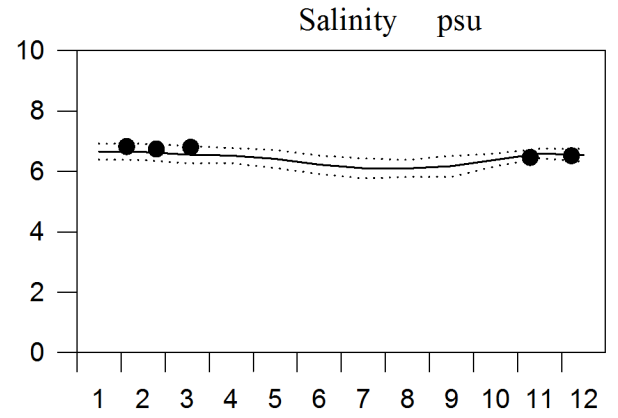
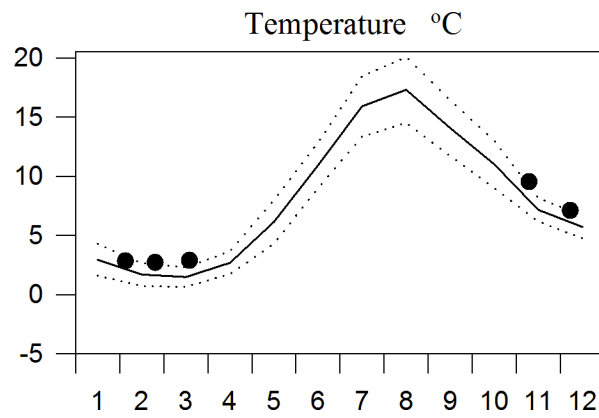
— Mean 1996-2010      ····· St.Dev.      ● 2014



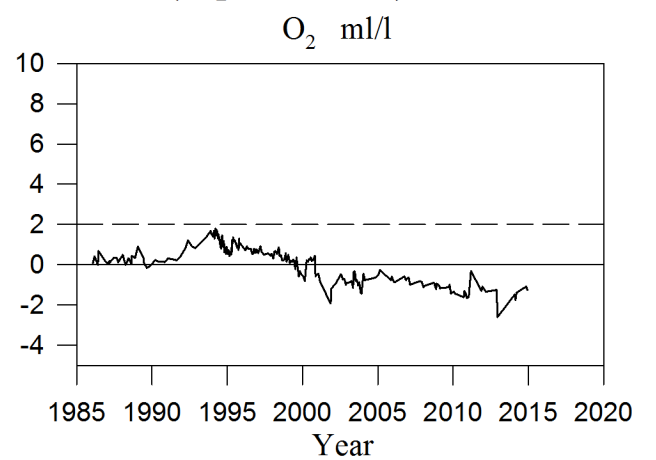
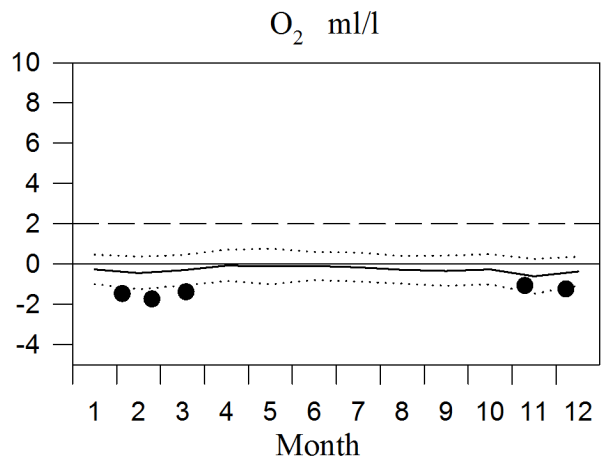
# STATION BY31 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

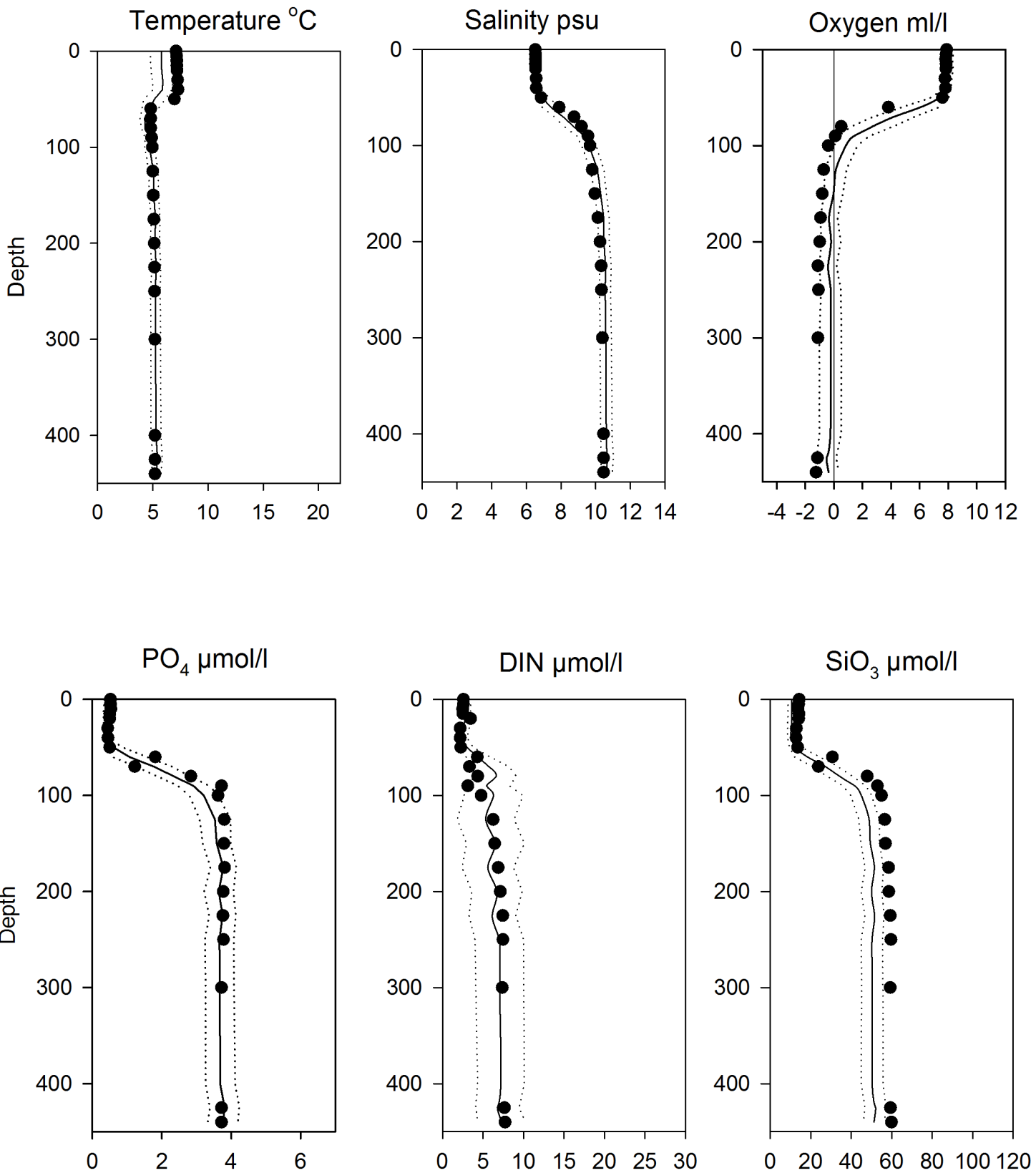


## OXYGEN IN BOTTOM WATER (depth = 440m)



# Vertical profiles BY31 December

— Mean 1996-2010      ····· St.Dev.      ● 2014

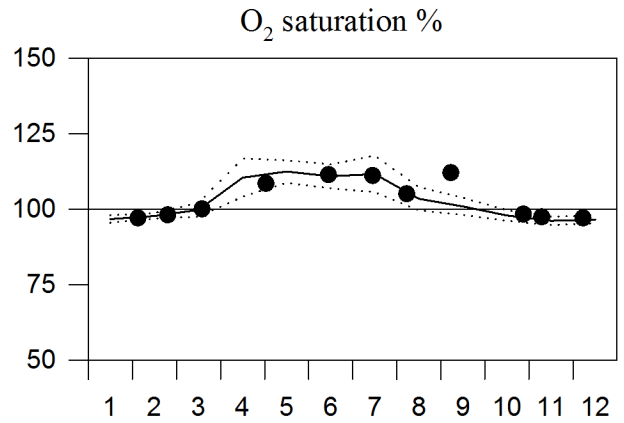
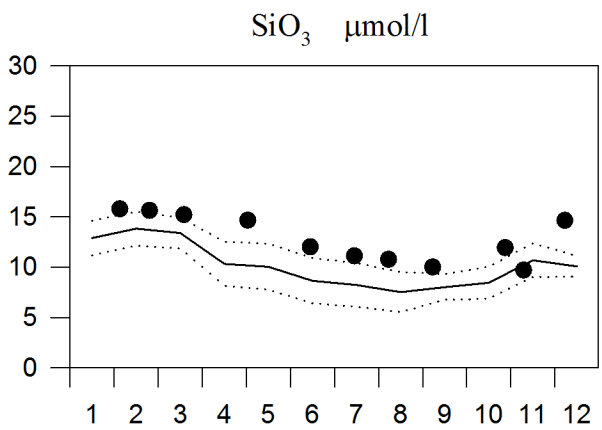
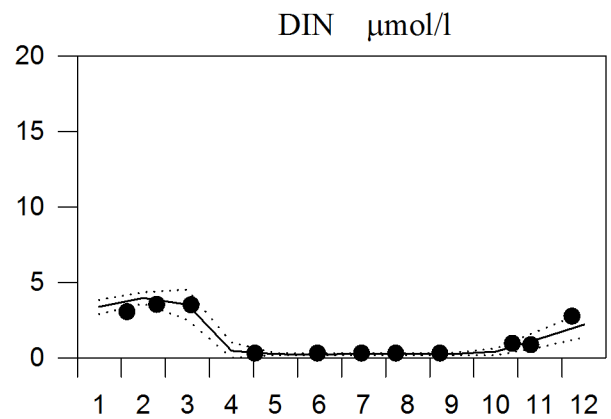
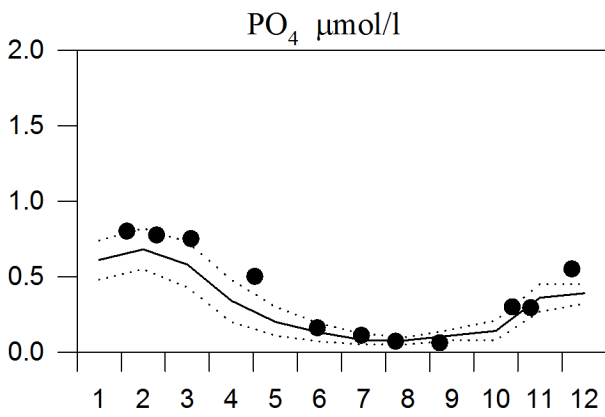
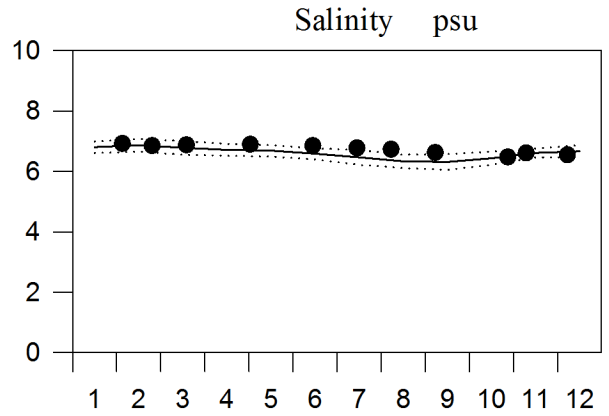
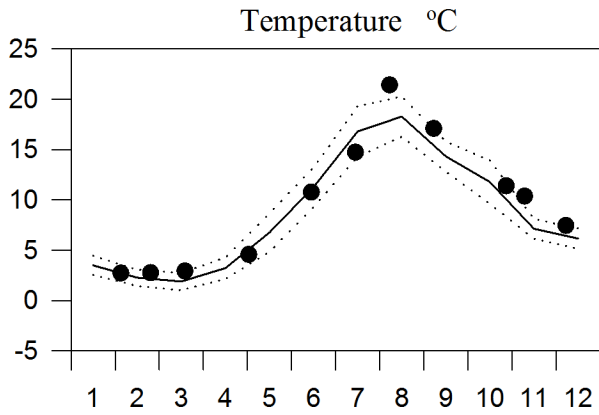




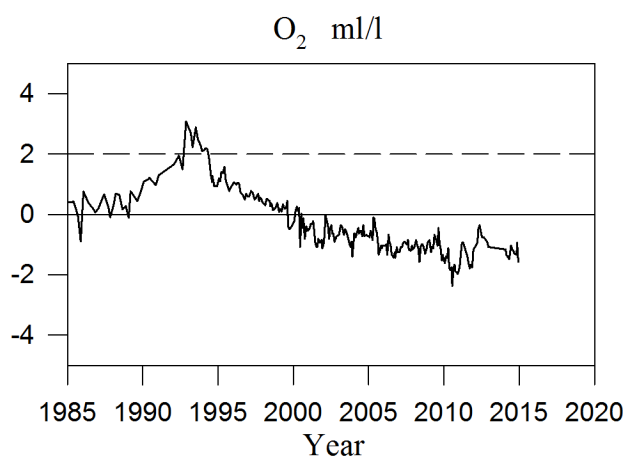
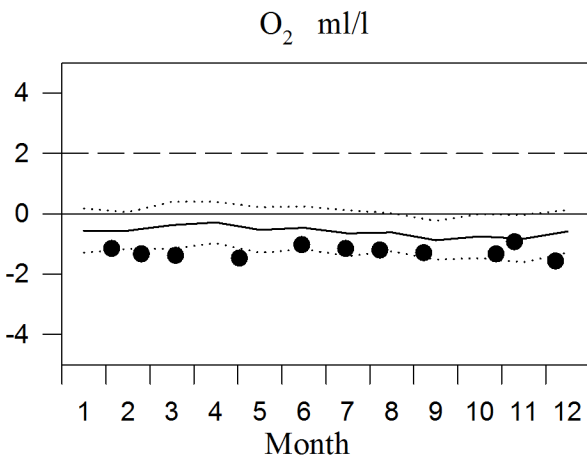
# STATION BY32 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

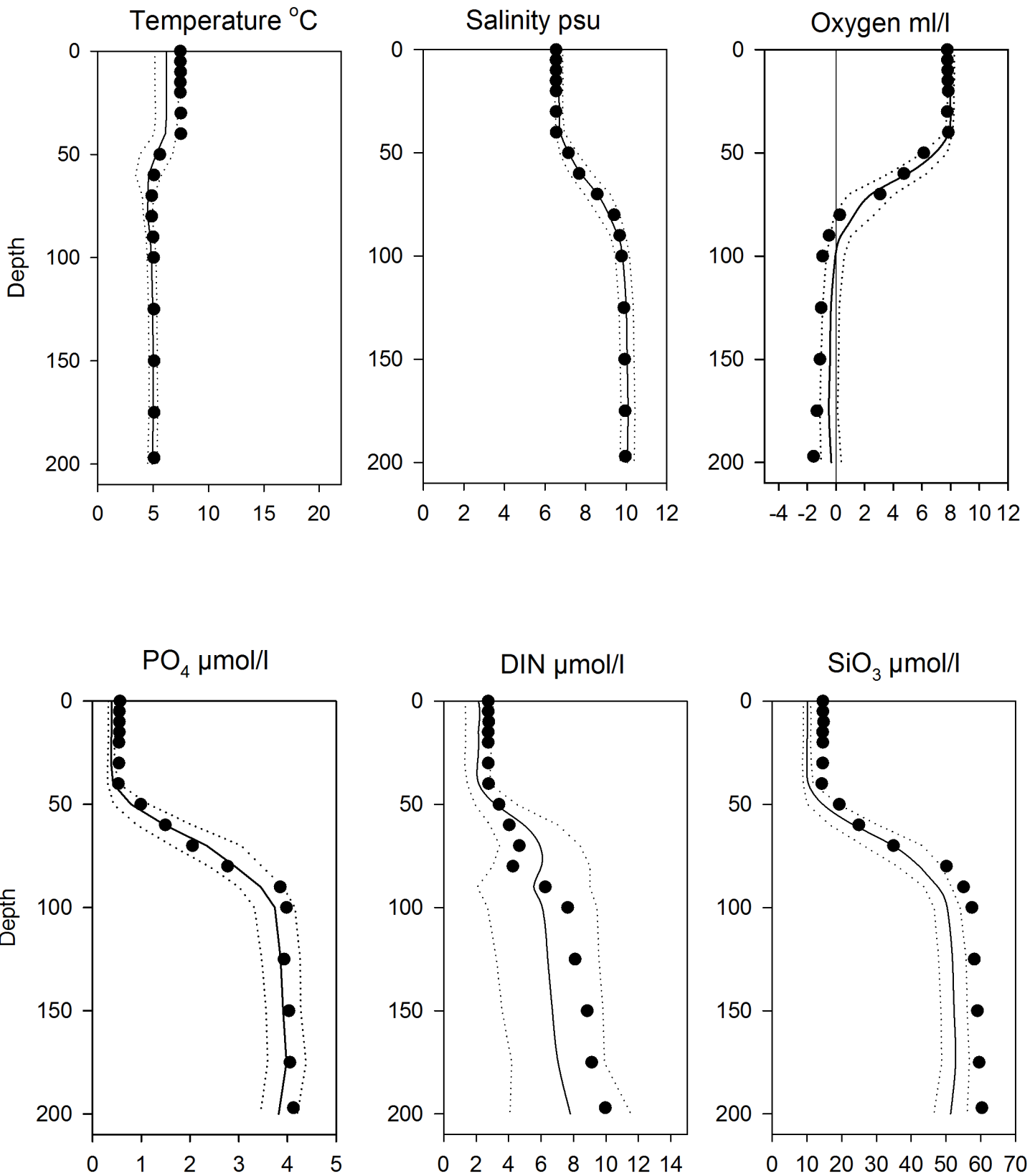


## OXYGEN IN BOTTOM WATER (depth > 175m)



# Vertical profiles BY32 December

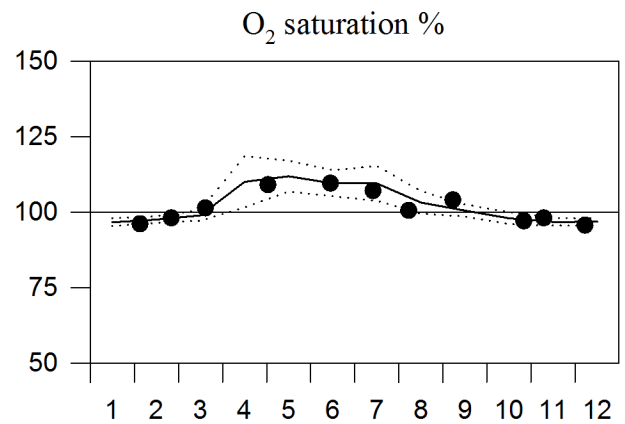
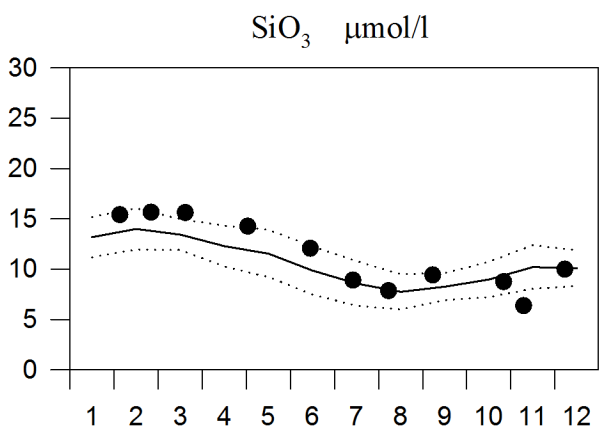
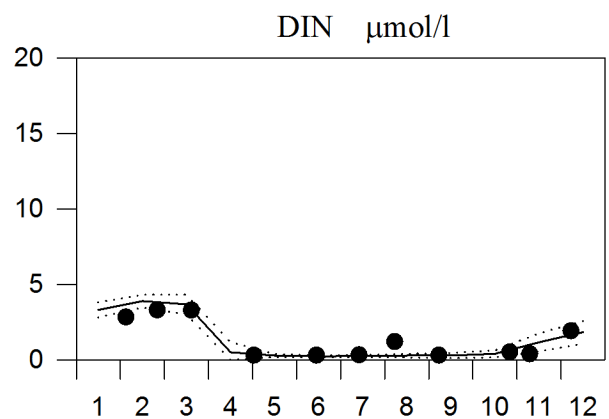
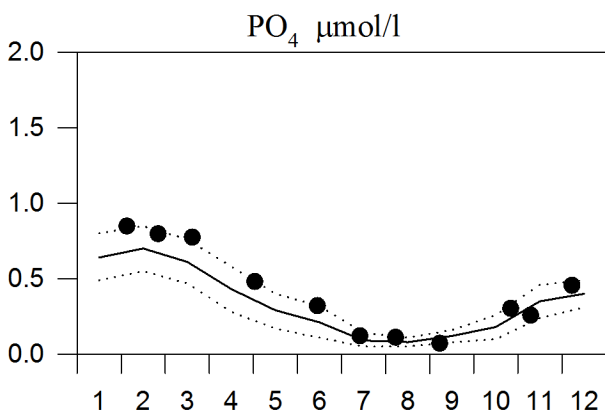
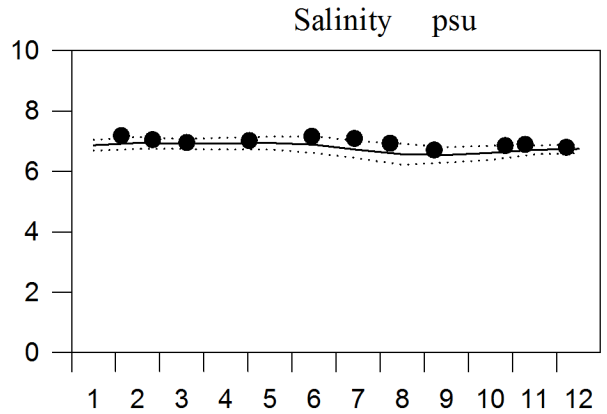
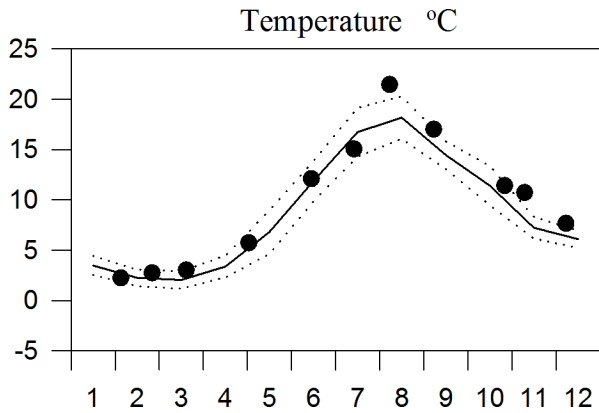
— Mean 1996-2010      ····· St.Dev.      ● 2014



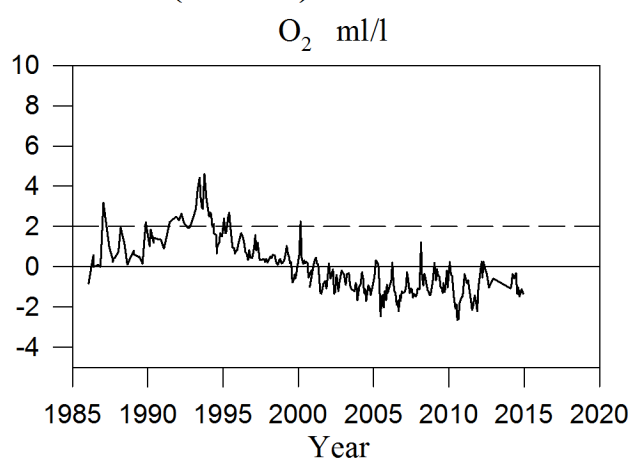
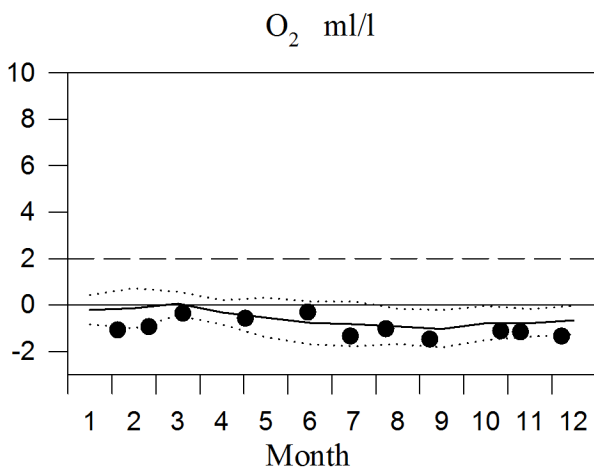
# STATION BY38 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

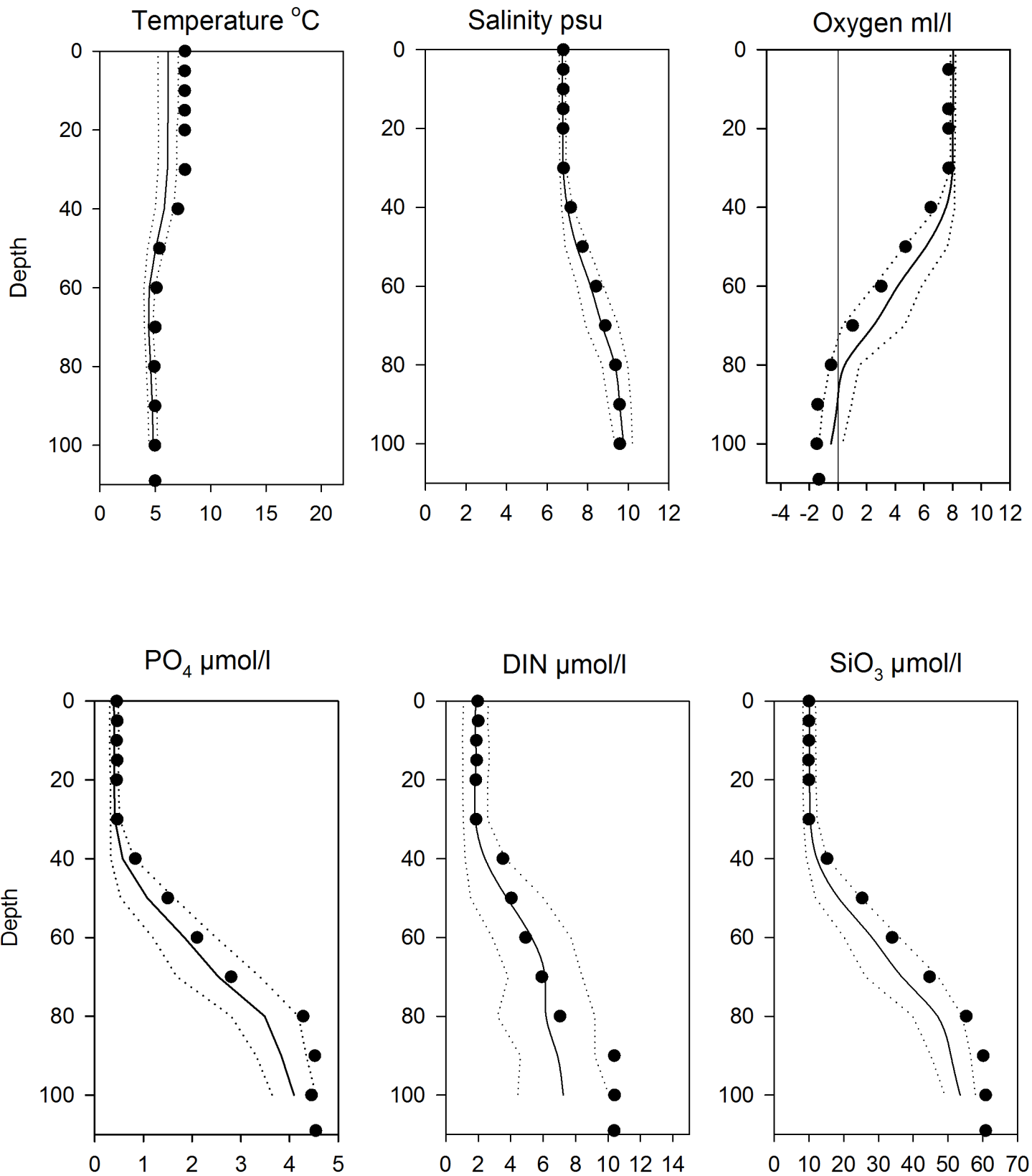


## OXYGEN IN BOTTOM WATER (> 100m)



# Vertical profiles BY38 December

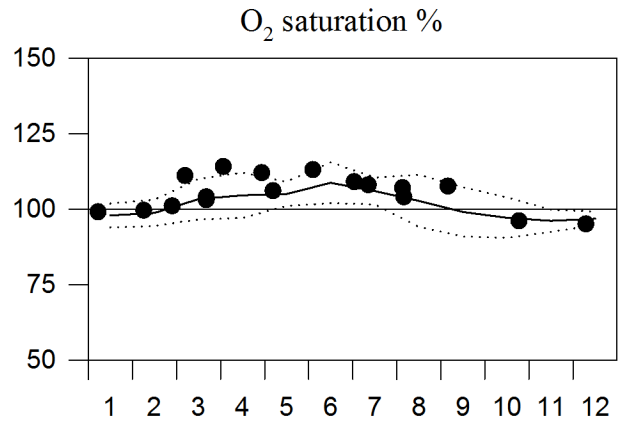
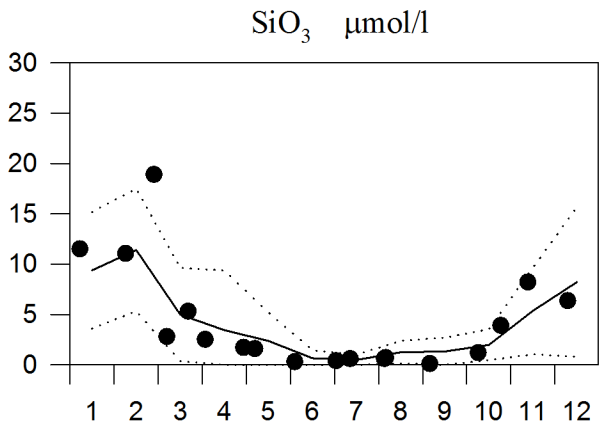
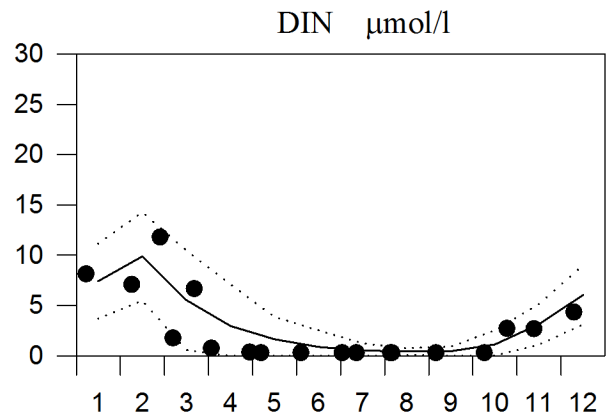
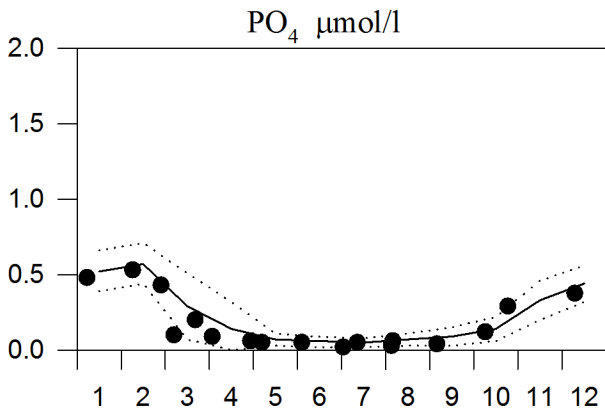
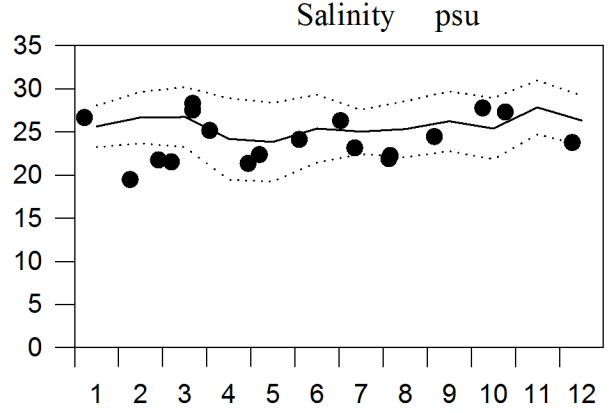
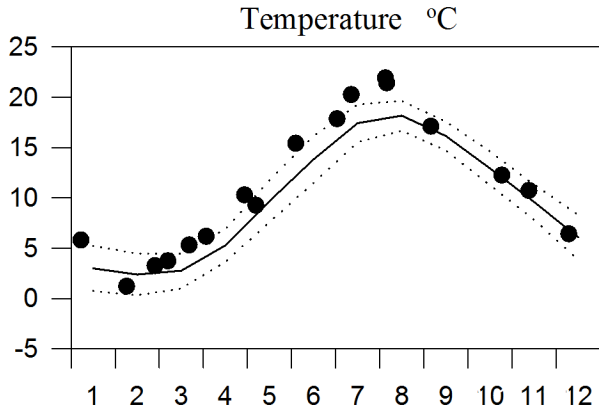
— Mean 1996-2010      ····· St.Dev.      ● 2014



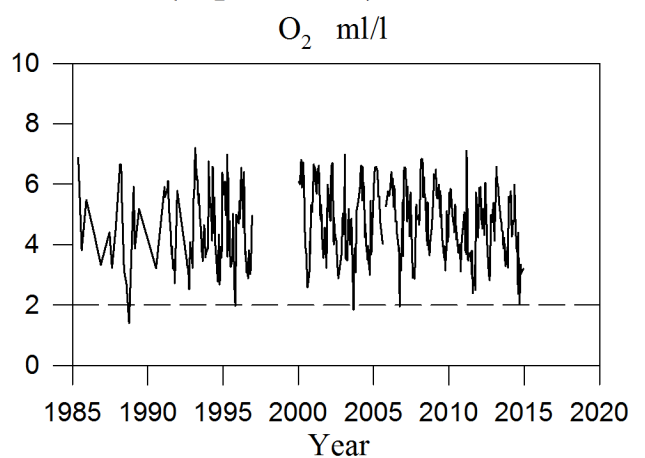
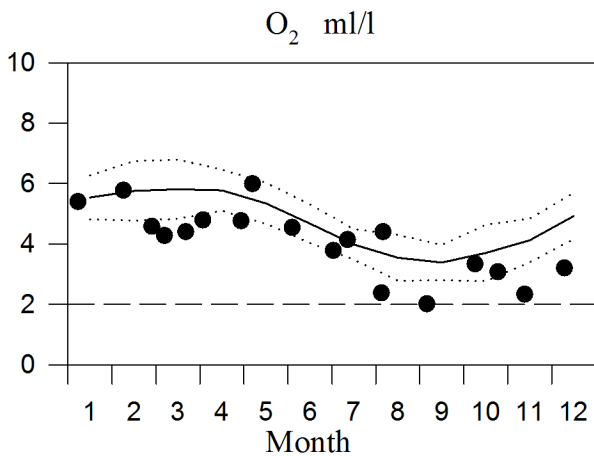
# STATION SLÄGGÖ SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ..... St.Dev.      ● 2014

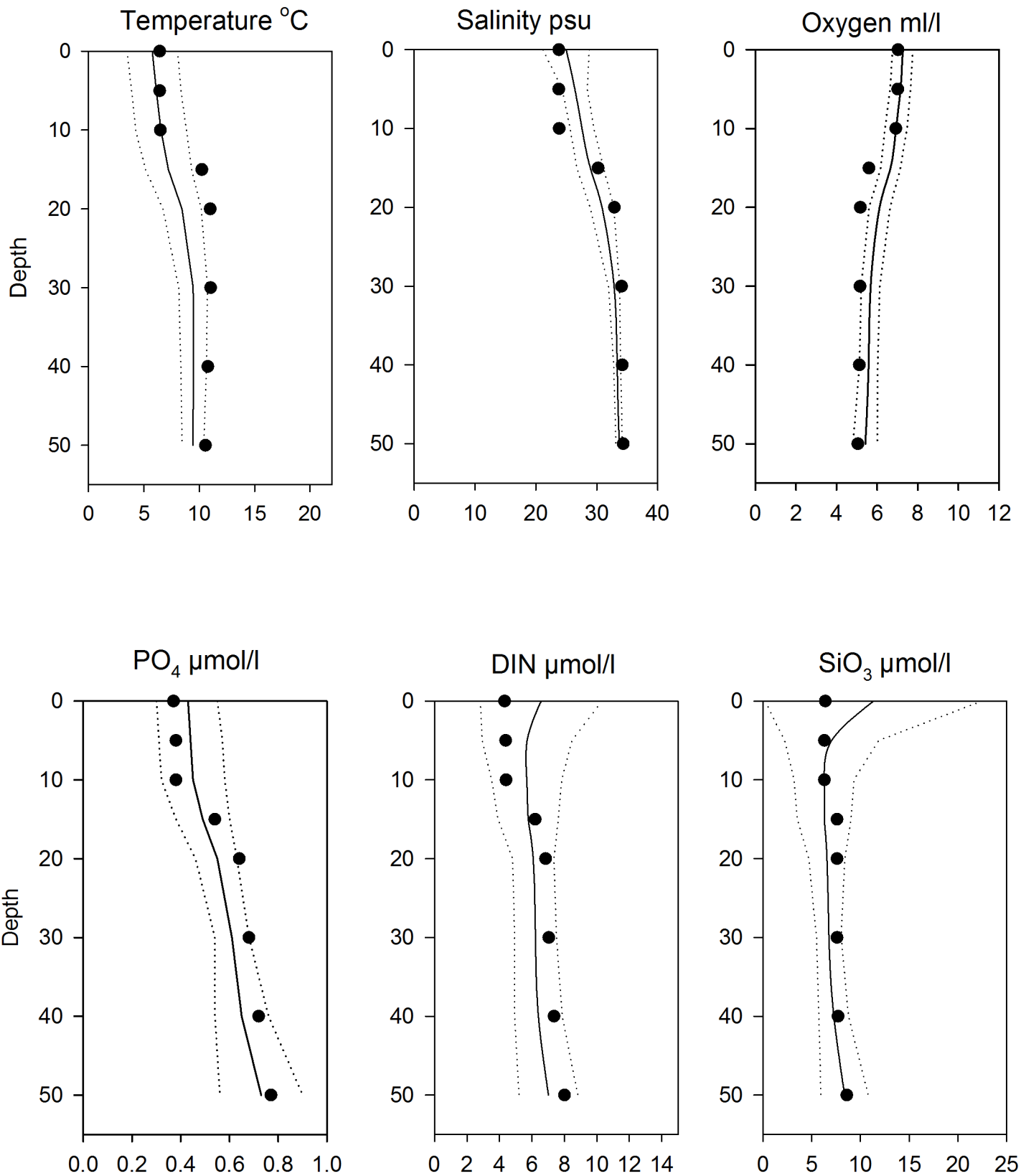


## OXYGEN IN BOTTOM WATER (depth >50m)



# Vertical profiles Släggö December

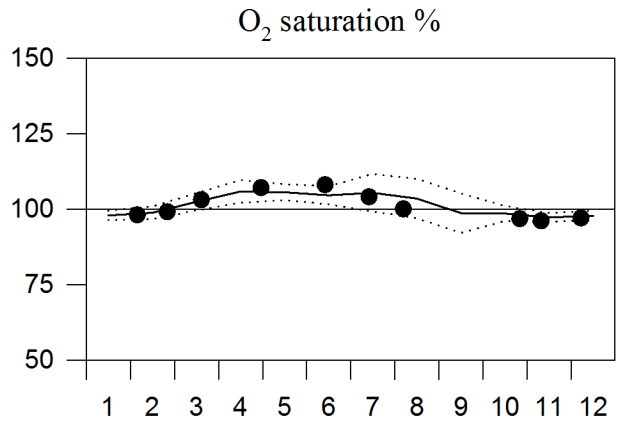
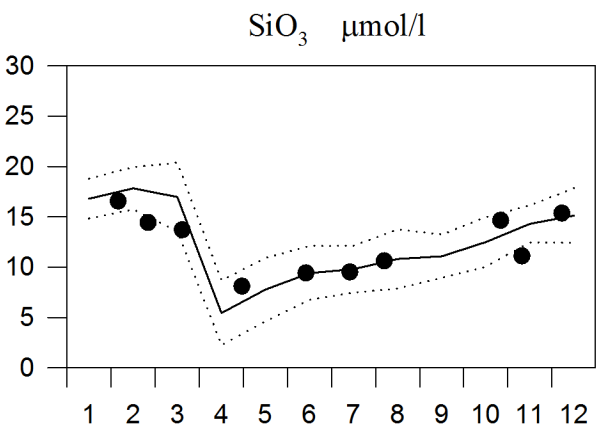
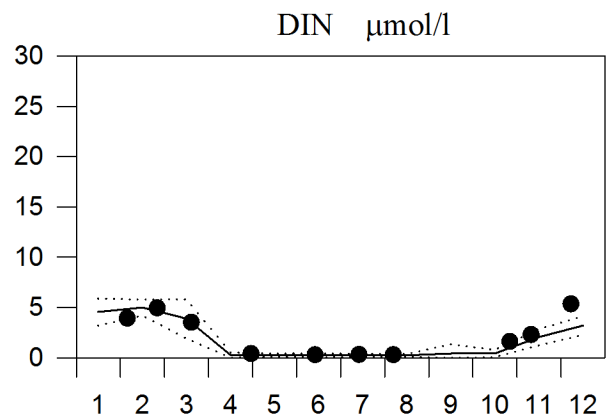
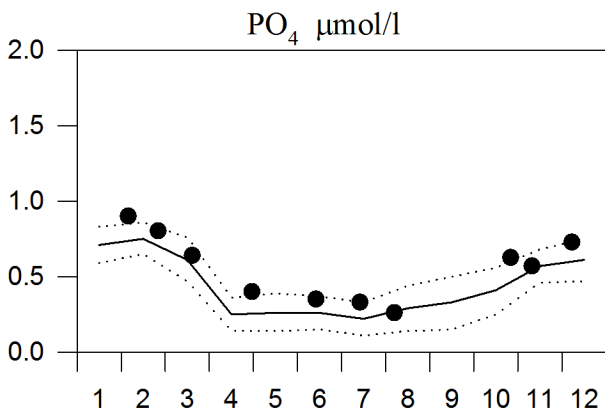
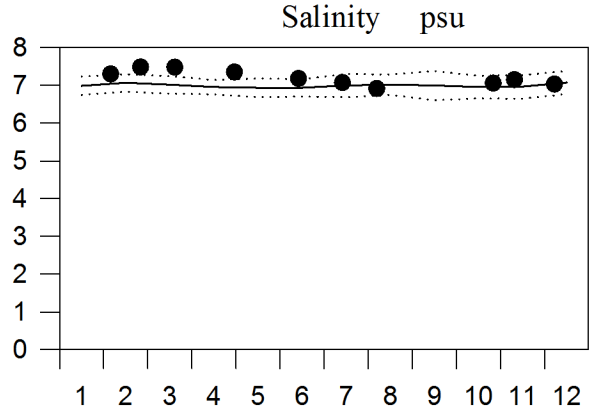
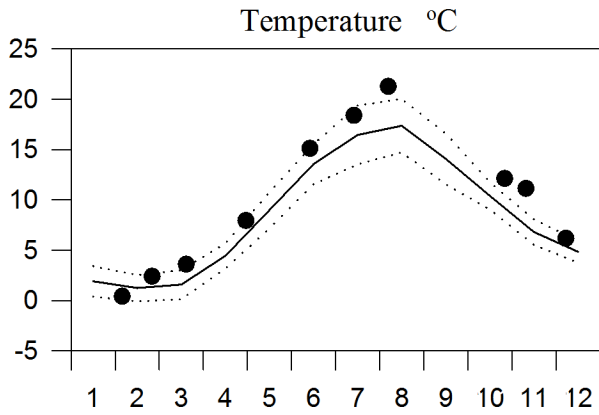
— Mean 1996-2010      ..... St.Dev.      ● 2014



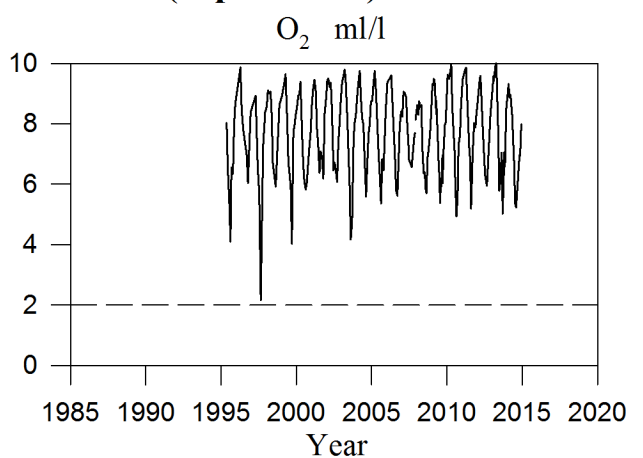
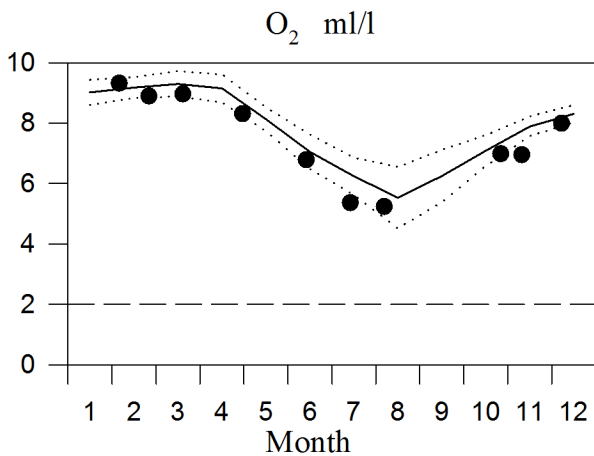
# STATION REF M1V1 SURFACE WATER

## Annual Cycles

— Mean 1996-2010      ····· St.Dev.      ● 2014



## OXYGEN IN BOTTOM WATER (depth >15m)



# Vertical profiles Ref M1V1 December

— Mean 1996-2010      ····· St.Dev.      ● 2014

