

Report from SMHI marine monitoring cruise with M/V Aura



Survey period: 2017-10-10 - 2017-10-16
Principal: Swedish Meteorological and Hydrological Institute (SMHI),
Swedish Agency for Marine and Water Management (SwAM).
Cooperation partners: Finnish Environment Institute (SYKE) & VG-shipping

SUMMARY

The October cruise, which is part of the Swedish national marine monitoring programme, covered the Skagerrak, the Kattegat, the Sound and the southern Baltic Proper.

The stations in the Western and Eastern Gotland Basin could not be sampled due to delay caused by hard weather and technical problems with a winch. Totally six stations had to be cancelled.

In the Sound acute hypoxia was found directly below the stratification at 15 meters depth down to the bottom. Acute hypoxia was also found in Hanö Bight and the Bornholm Basin from depth exceeding 65 meters. Oxygen concentrations near zero were found from 75-80 meters depth. In the Arkona Basin the oxygen situation had improved since the last cruise in September, the whole water column was again well oxygenated.

The nutrients DIN and DIP were generally depleted in the surface water which is normal at this time of year. Surface concentrations of silicate were still highly elevated in the whole southern parts of the Baltic Proper.

Next monitoring cruise is scheduled to start in mid November.

RESULTS

The October cruise was conducted aboard the Finnish vessel Aura and started in Gothenburg on the 10th of October and ended in the same port on the 16th. The winds in Skagerrak were fresh and increased to gale force in Kattegat. Due to strong winds and technical problems with the hydrographic winch a harbour visit was conducted to the port of Helsingborg. The winch could not be repaired but the weather improved and the cruise could be continued. However, the stations in the western and eastern Gotland basin could not be visited due to the delay. Totally six stations could not be sampled.

During the expedition net samples of jelly fish was taken in order to evaluate a new monitoring method. The samples were photographed and the images will later be analyzed.

This report is based on data that have passed a first quality control. When data are published at the national oceanographic data centre some values might have changed after further quality controls have been performed. Data from this cruise will be published as soon as possible on the data center's webpage, normally within one or two weeks after the cruise.

Download data here: <http://www.smhi.se/klimatdata/oceanografi/havsmiljodata> (only available in Swedish)

The Skagerrak

The surface water temperature in the Skagerrak was generally somewhat above normal for the season and varied between 12.4 and 14.7°C. The salinity was still above normal and varied between 28 and 35. The halocline in outer Skagerrak was weakly developed but closer to the coast more pronounced and found between 5 and 20 meters depth. In the outer Skagerrak the thermocline was situated at 70-80 meters depth while at the coast the cooling of the sea surface had started and the thermocline was found close to the surface between 5-20 meters depth.

Concentrations of nutrients in the surface water hade increased since the last cruise in September. The level of dissolved inorganic nitrogen, (sum on nitrate, nitrite and ammonia) ranged from below the detection limit to 0.67 µmol/l, which is normal for the season, while high concentrations, 2.3 µmol/l was noted at Släggö, situated near the coast. The concentrations of phosphate varied between 0.09 and 0.34 µmol/l, lower than normal in the outer Skagerrak while slightly above normal closer to the coast. The silicate concentrations ranged between 0.8 and 3.2 µmol/l and showed similar spatial variations as phosphate.

The oxygen situation at all stations and depths was normal, except for Släggö were the oxygen concentration was higher than normal in the deep water.

Generally, the fluorescence measured by the CTD showed certain but low phytoplankton activity from the surface down to 20 meters depth. No fluorescence maxima were found.

The Kattegat and the Sound

The water temperature in the surface was normal for the season and varied between 12.8 and 13.4°C, highest in the northern parts and lowest in the Sound. The surface salinity was elevated above normal at Fladen and in the Sound. At the remaining stations the salinity varied between 20 and 23. The stratification was found at 15-20 meters depth.

Surface concentrations of nutrients were generally normal for the season in the entire Kattegat and the Sound except for lower concentrations than normal of phosphate in the Sound and silicate at Fladen. The phosphate concentrations were found to be around 0.2 µmol/l and silicate 0.7-3.9 µmol/l. Inorganic nitrogen was found to be depleted at all stations.

The oxygen concentrations in the Kattegat deep water was normal for the season except for the Sound where acute hypoxia (<2ml/l) was noted already below the stratification at about 15 meters depth and down to the bottom.

The fluorescence measured by the CTD generally showed some phytoplankton activity from the surface and down to the stratification at 15 meters depth.

The Hanö Bight, Arkona- and Bornholm Basin

Due to delay caused by hard weather and technical problems with a winch the Eastern and Western Gotland Basin could not be visited. Totally six stations could not be sampled. However, there is an ongoing Swedish fishery cruise performed onboard R/V Dana in these areas with SMHI personnel onboard. Four of the stations that not could be sampled will be sampled by Dana.

The surface temperature in the investigated area was normal for the season and varied between 11.4 and 12.4 °C. The salinity was also normal, 6.9-8.0, lowest close to the coast and highest in the western parts. A pronounced thermocline was found at 30-40 meters depth and the halocline was found deeper at 60-70 meters depth.

Available nutrients in the surface layer showed normal concentrations for the season except for silicate that continues to be elevated much higher than normal. Inorganic nitrogen was depleted with concentrations below the detections limit. Phosphate varied between 0.33-0.43 µmol/l and silicate was found vary around 15 µmol/l.

Acute hypoxia (<2ml/l oxygen) was also found in Hanö Bight and the Bornholm Basin from depth exceeding 65 meters. Oxygen concentrations near zero were found from 75-80 meters depth. In the Arkona Basin the oxygen situation had improved since the last cruise in September, the whole water column was again well oxygenated.

Fluorescence measurements with the CTD showed low phytoplankton activity in the surface layer.

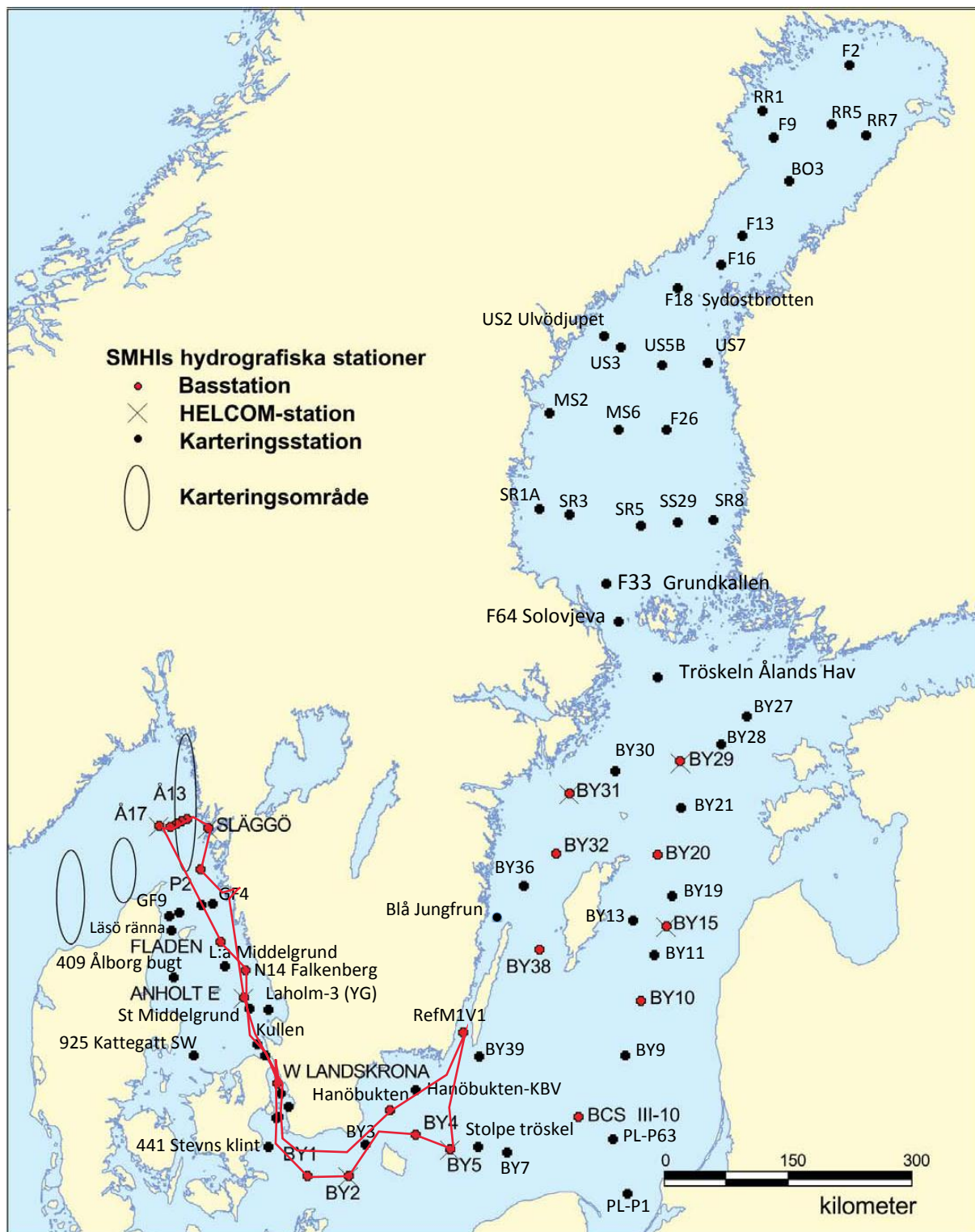
PARTICIPANTS

Name		From
Martin Hansson	Chief Scientist	SMHI
Karin Wesslander		SMHI
Johanna Linders		SMHI
Lena Viktorsson		SMHI
Johan Kronsell		SMHI
Kristin Andreasson		SMHI

APPENDICES

- Track chart
- Table over stations, sampled parameters and number of sampling depths
- Map showing bottom oxygen concentrations
- Vertical profiles for regular monitoring stations
- Monthly average surface water plots for regular monitoring stations

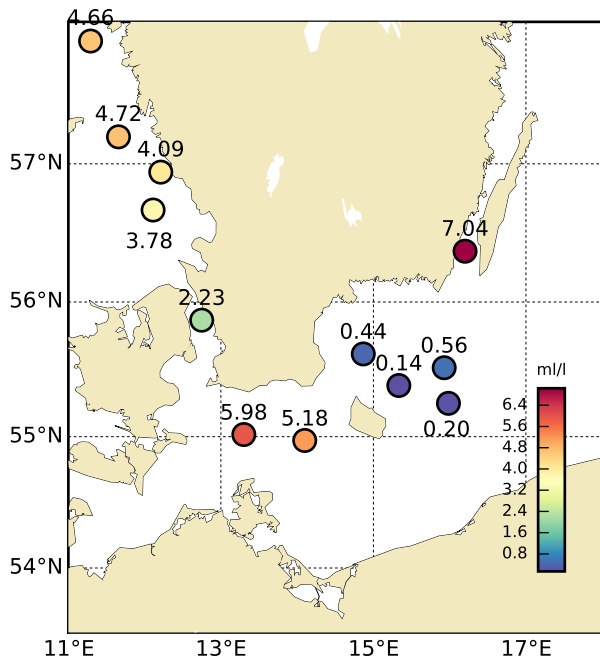




Date: 2017-10-16
Time: 08:19

Ship: 07
Year: 2017

Ser no	Cru no	Stat code	Proj	Stat name	Lat	Lon	Start date yyyymmdd	Start time hhmm	Bottom depth m	Secchi depth m	Wind dir vel	Air temp C	Air pres hPa	WCWI elac	CZPP hohp	No de	No btl	T e	T e	S a	P h	D o	D o	H 2	P h	P t	N t	N t	N t	N t	A z	N t	A z	S t	H t	C t		
																		m	m	l	l	x	x	s	o	r	r	r	r	o	k	o	k	m	m	n		
																		p	p	t	t	y	y	s	t	i	a	z	n	t	y	3	u	n	n	n		
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STATION P2 SURFACE WATER (0-10 m)

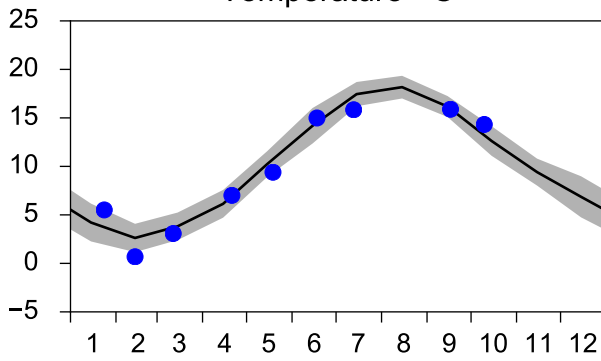
Annual Cycles

— Mean 2001-2015

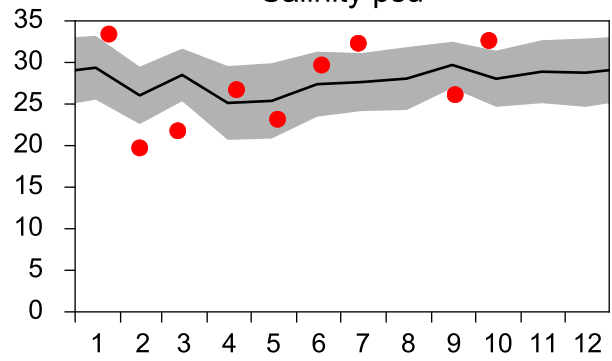
■ St.Dev.

● 2017

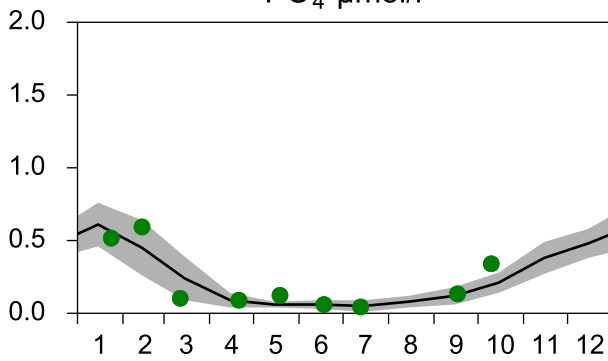
Temperature °C



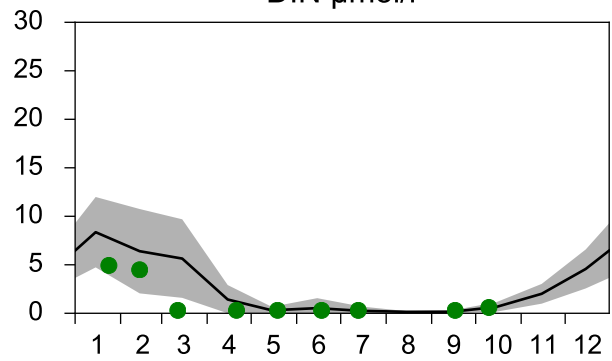
Salinity psu



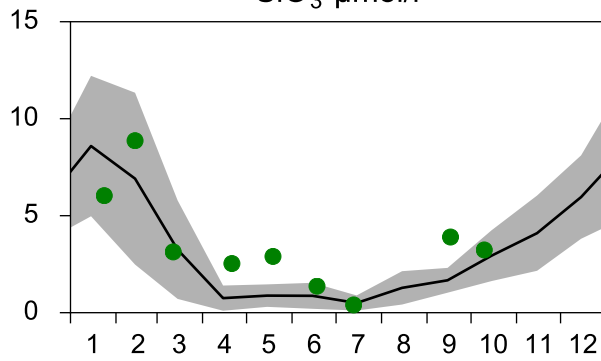
PO₄ μmol/l



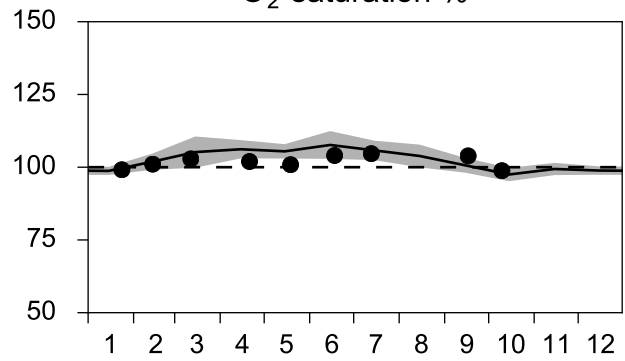
DIN μmol/l



SiO₃ μmol/l

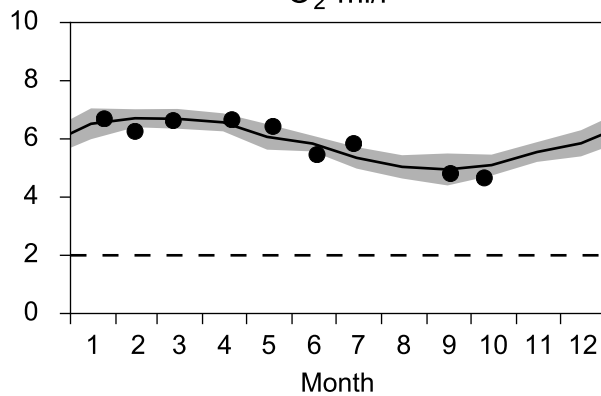


O₂ saturation %

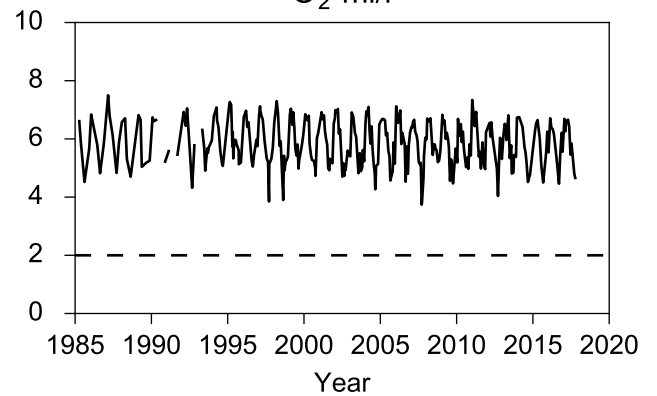


OXYGEN IN BOTTOM WATER (depth >= 75 m)

O₂ ml/l

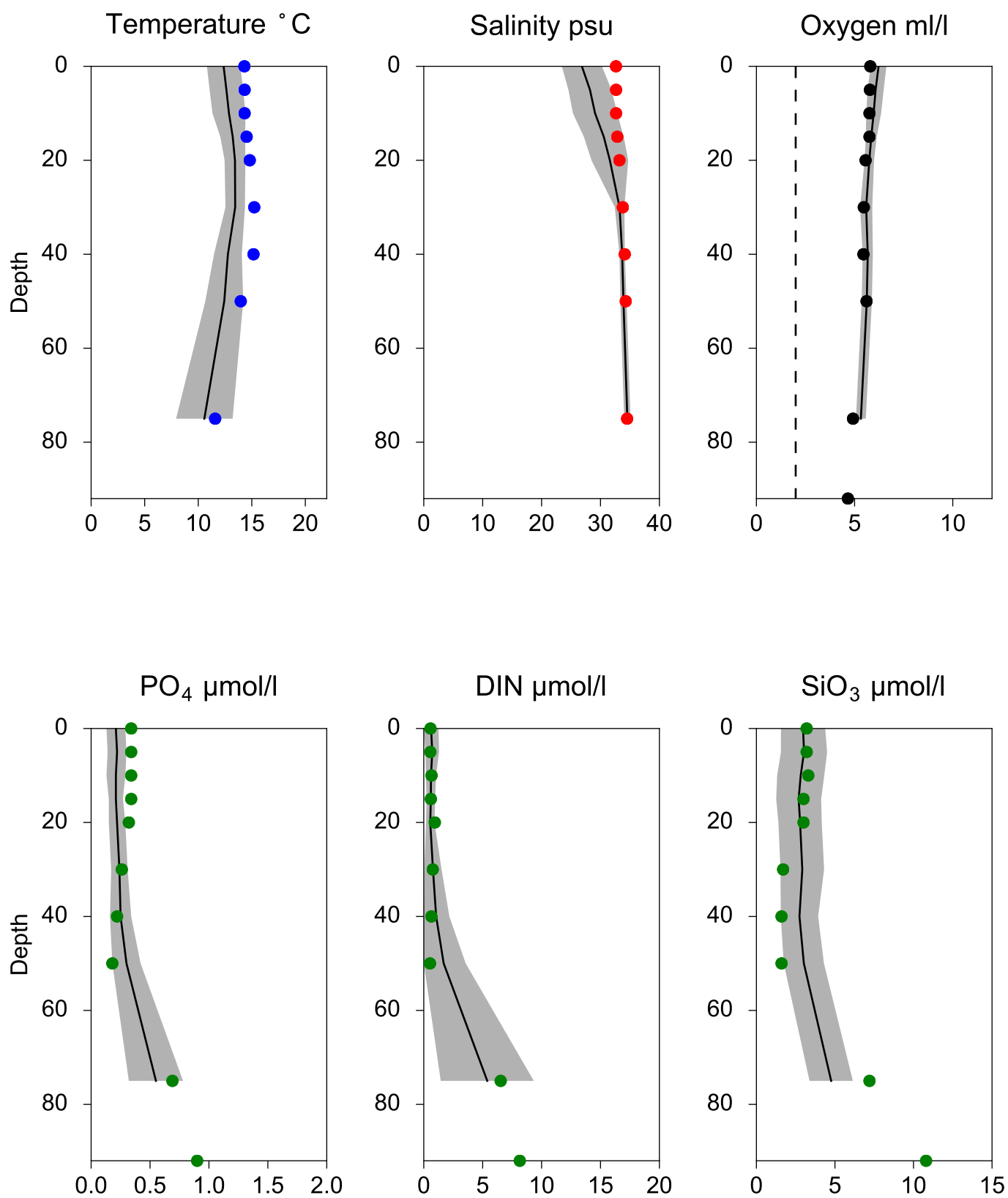


O₂ ml/l



Vertical profiles P2 October

— Mean 2001-2015 St.Dev. • 2017-10-10



STATION SLÄGGÖ SURFACE WATER (0-10 m)

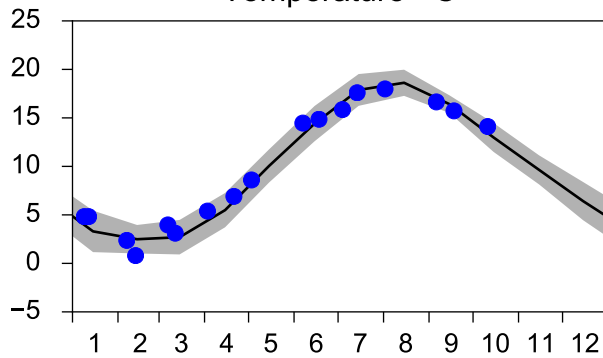
Annual Cycles

— Mean 2001-2015

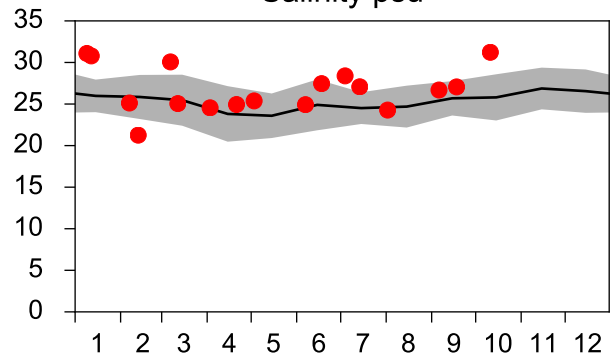
■ St.Dev.

● 2017

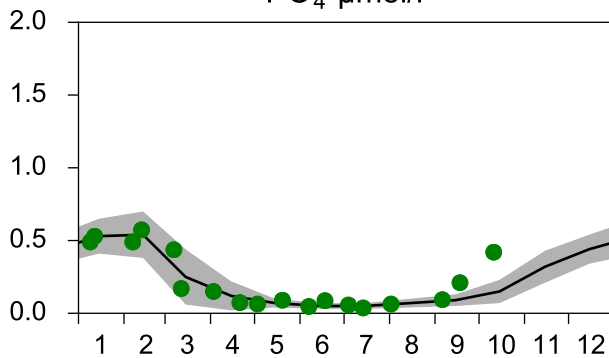
Temperature °C



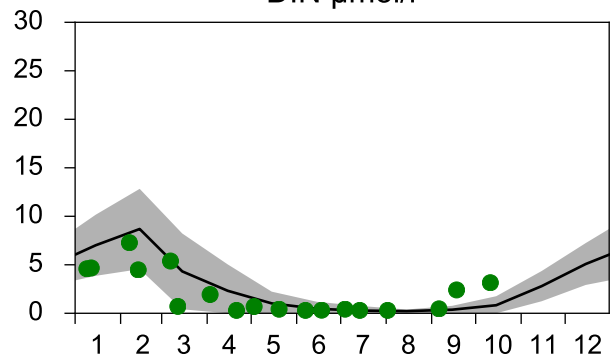
Salinity psu



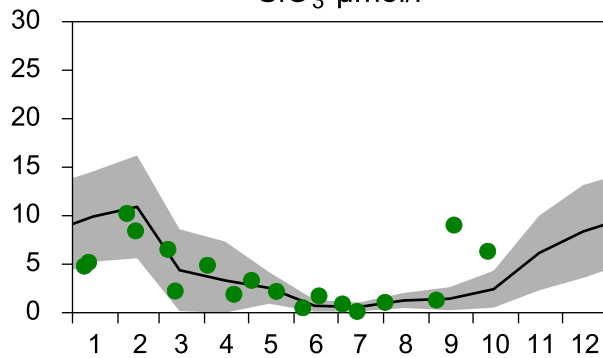
PO₄ µmol/l



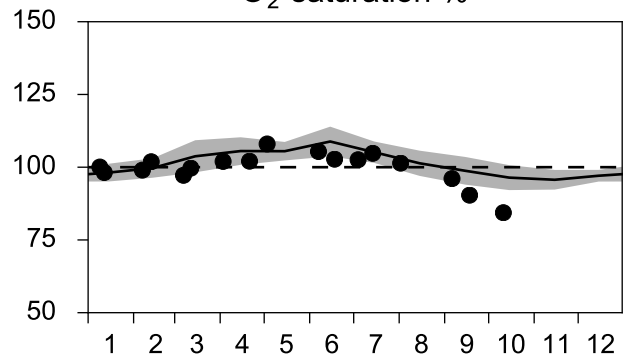
DIN µmol/l



SiO₃ µmol/l

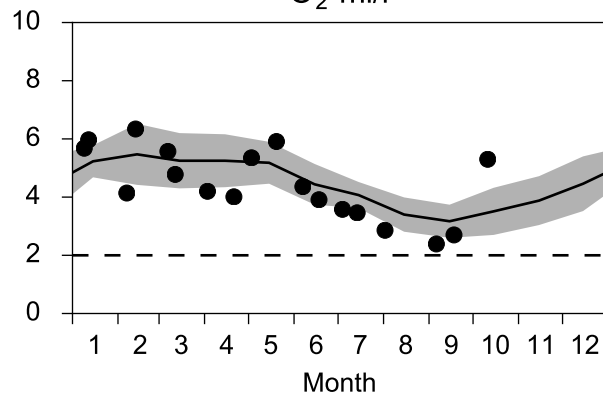


O₂ saturation %

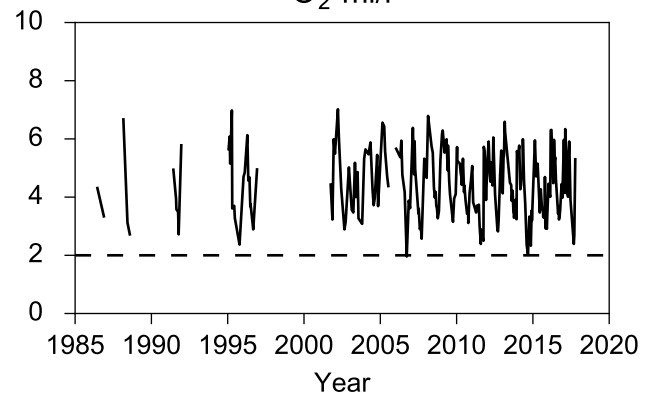


OXYGEN IN BOTTOM WATER (depth >= 64 m)

O₂ ml/l



O₂ ml/l

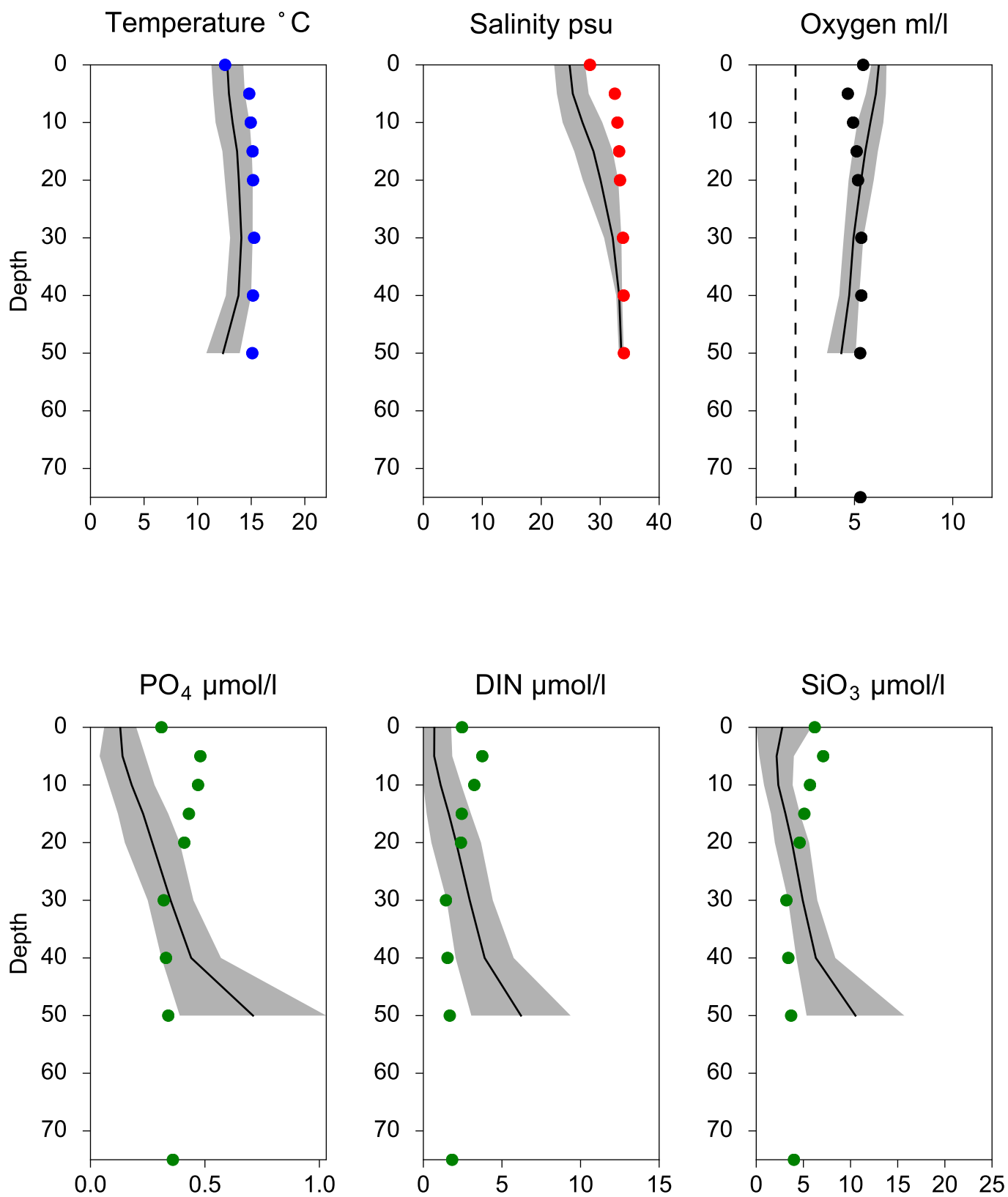


Vertical profiles SLÄGGÖ October

— Mean 2001-2015

■ St.Dev.

● 2017-10-11



STATION Å13 SURFACE WATER (0-10 m)

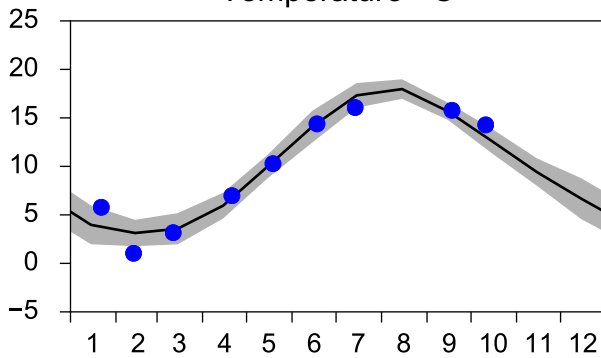
Annual Cycles

— Mean 2001-2015

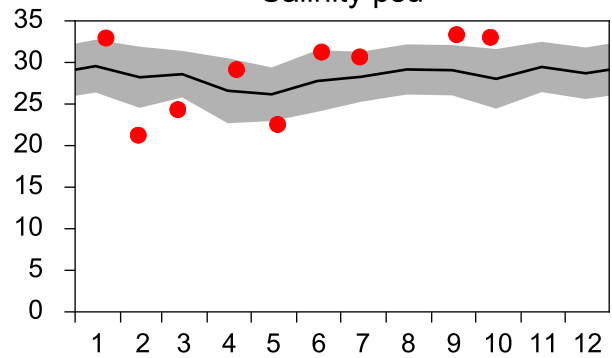
■ St.Dev.

● 2017

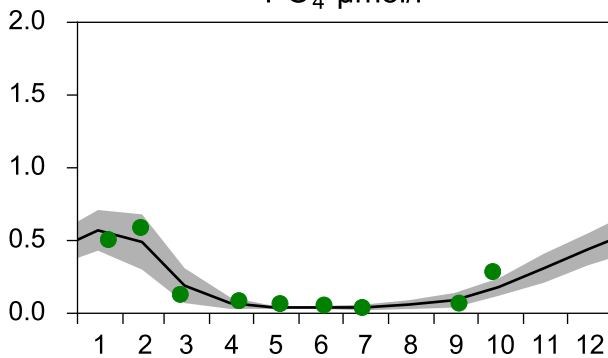
Temperature °C



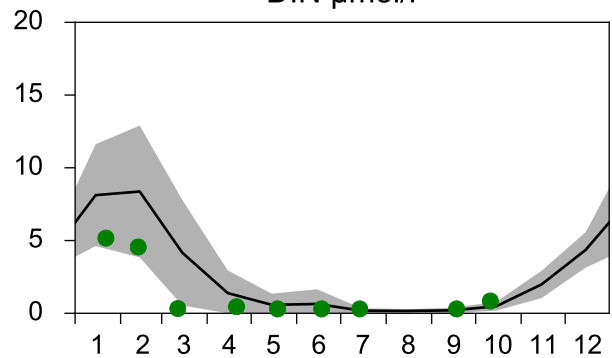
Salinity psu



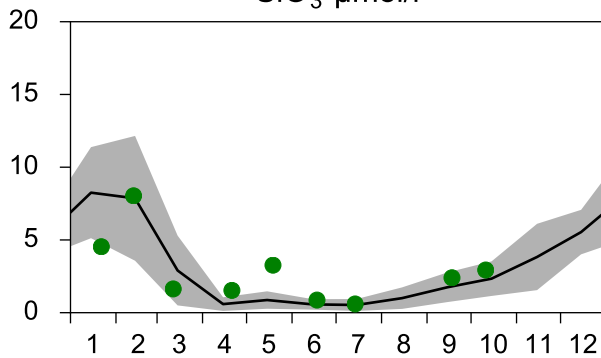
PO₄ µmol/l



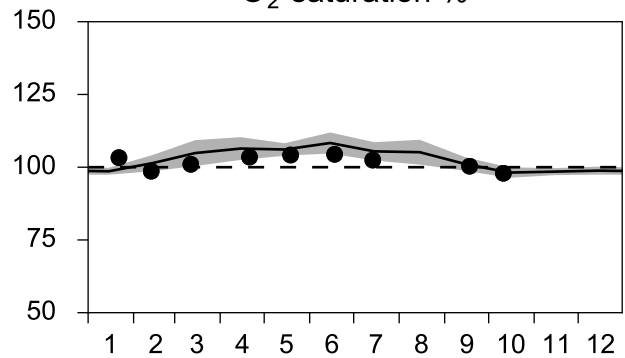
DIN µmol/l



SiO₃ µmol/l

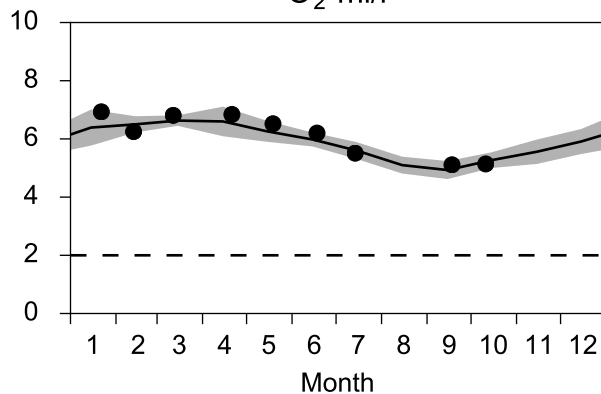


O₂ saturation %

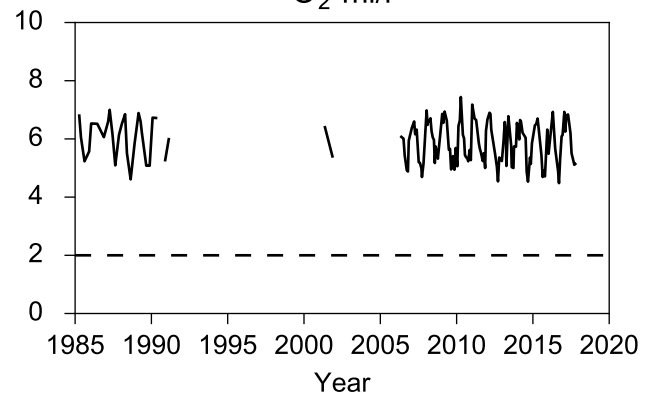


OXYGEN IN BOTTOM WATER (depth >= 80 m)

O₂ ml/l

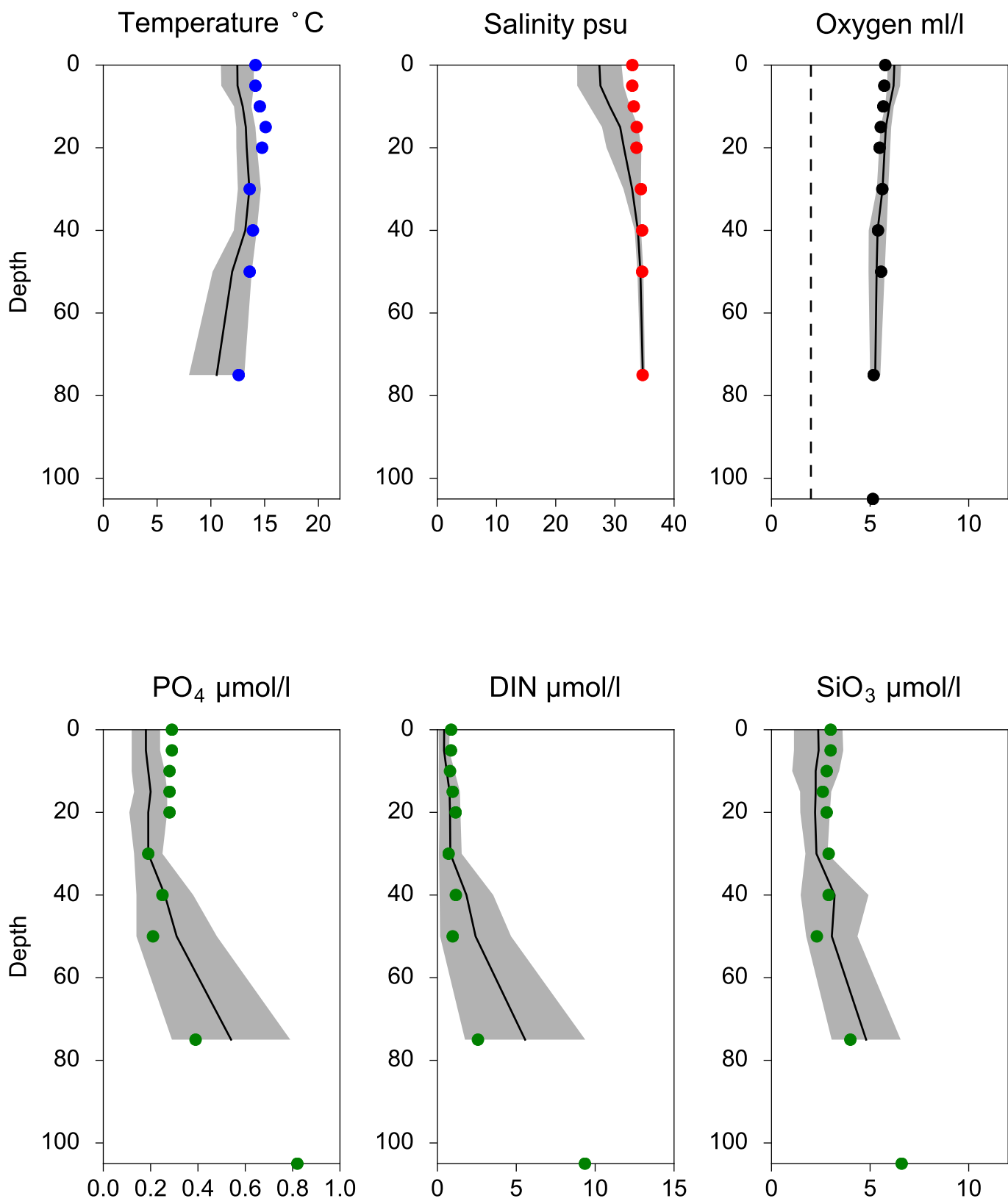


O₂ ml/l



Vertical profiles Å13 October

— Mean 2001-2015 St.Dev. • 2017-10-11



STATION Å15 SURFACE WATER (0-10 m)

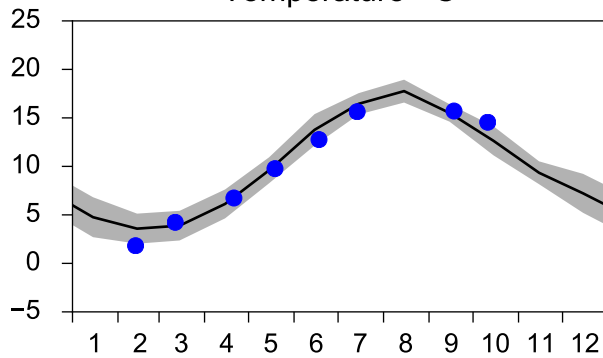
Annual Cycles

— Mean 2001-2015

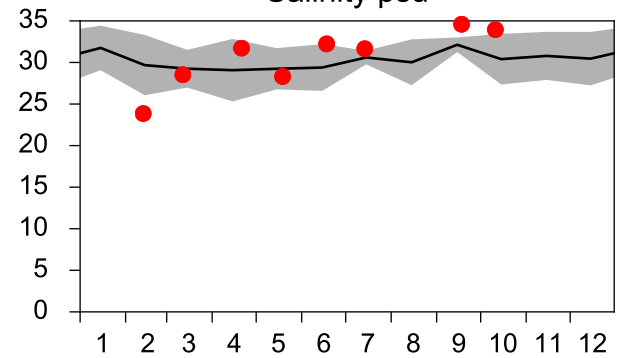
■ St.Dev.

● 2017

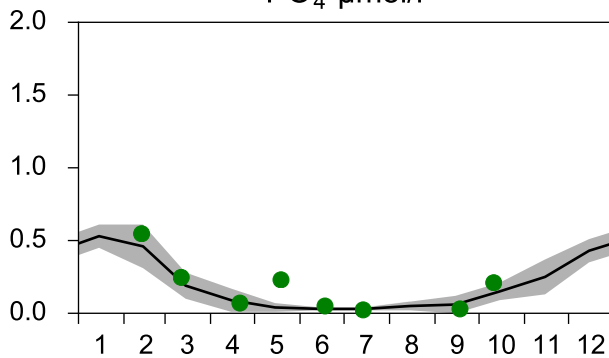
Temperature °C



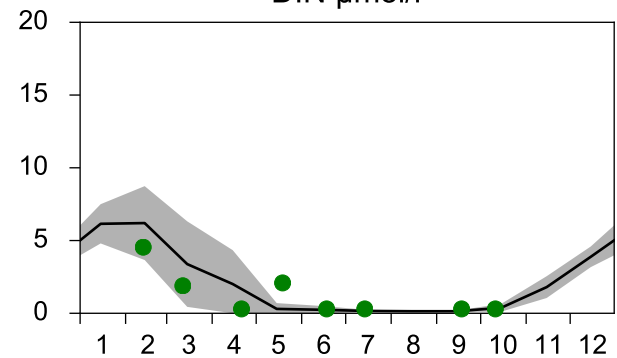
Salinity psu



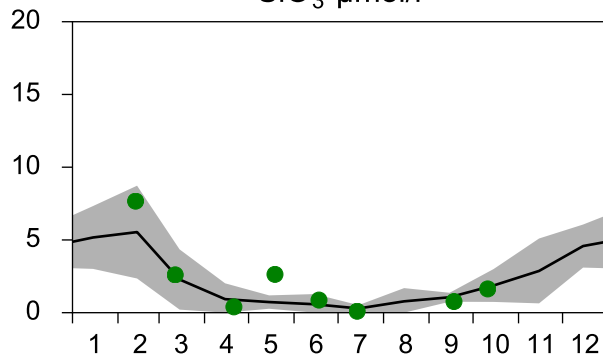
PO₄ μmol/l



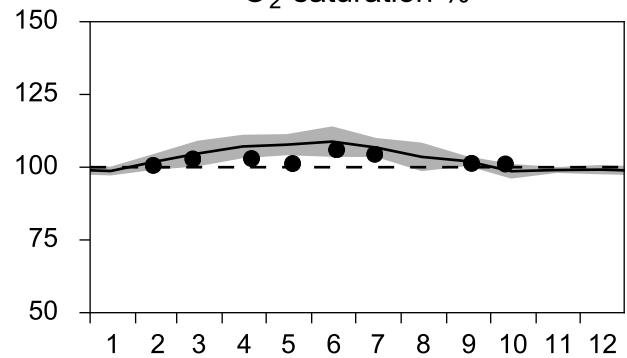
DIN μmol/l



SiO₃ μmol/l

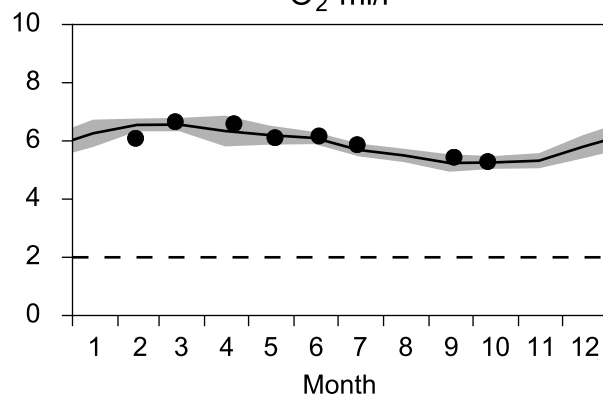


O₂ saturation %

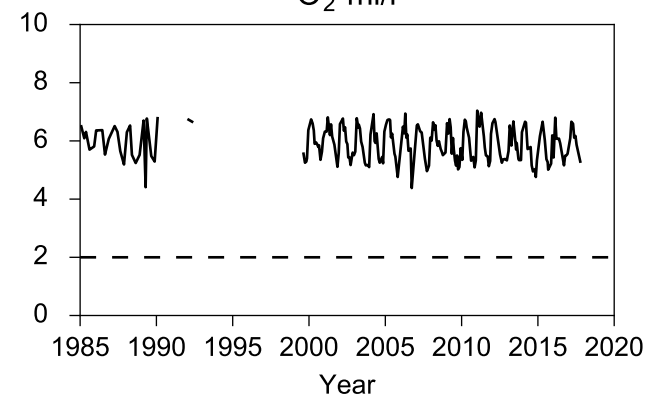


OXYGEN IN BOTTOM WATER (depth >= 125 m)

O₂ ml/l

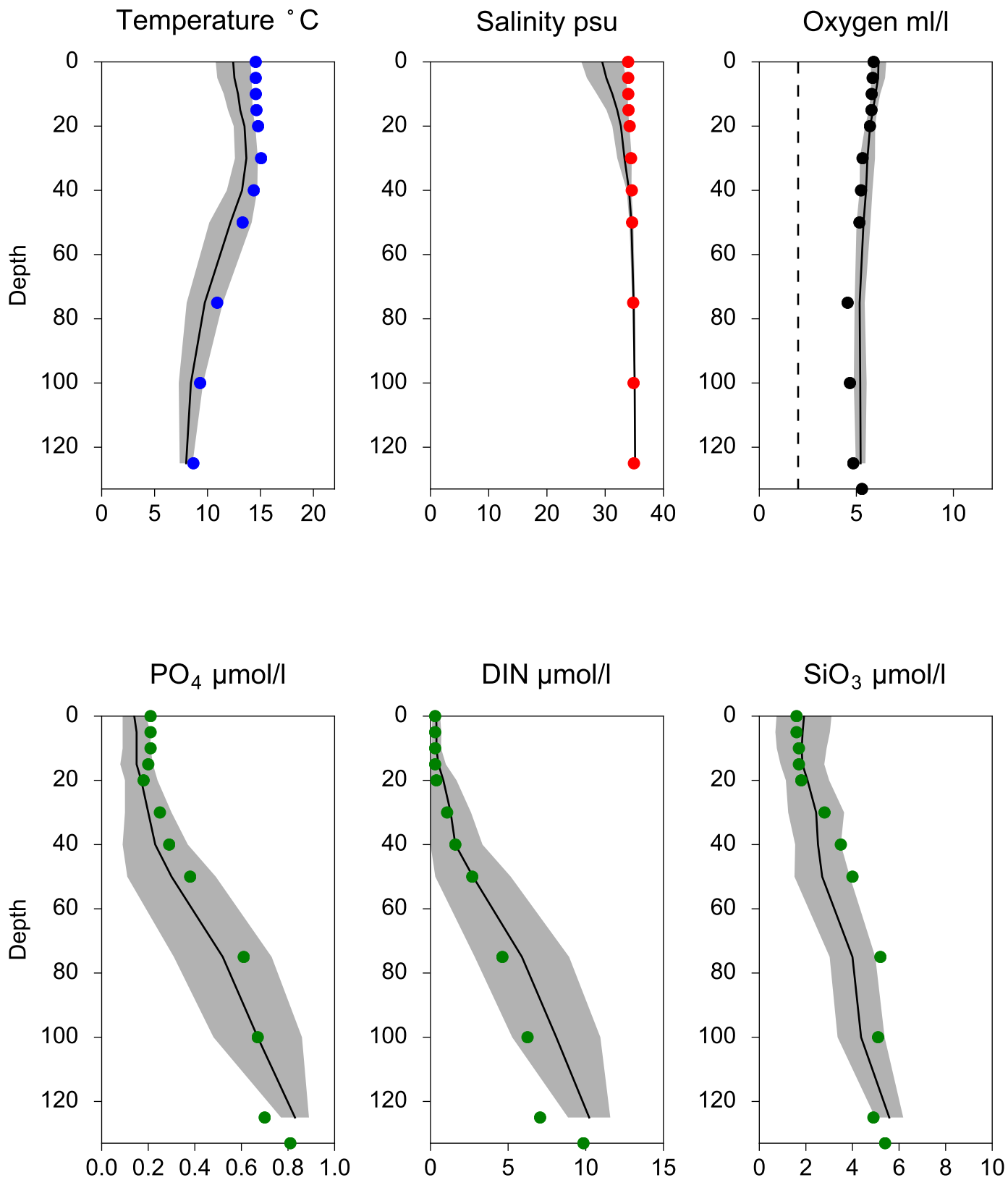


O₂ ml/l



Vertical profiles Å15 October

— Mean 2001-2015 St.Dev. • 2017-10-11



STATION Å17 SURFACE WATER (0-10 m)

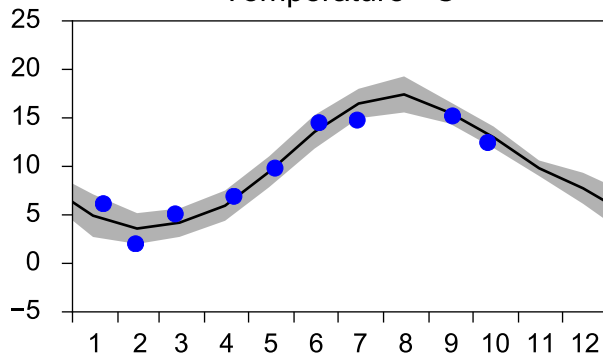
Annual Cycles

— Mean 2001-2015

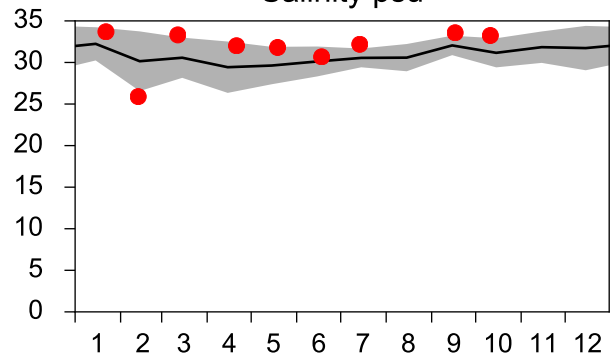
■ St.Dev.

● 2017

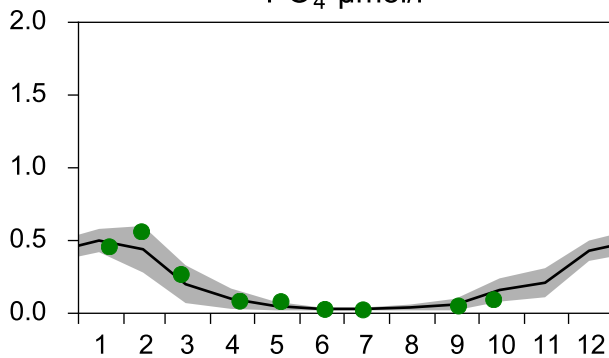
Temperature °C



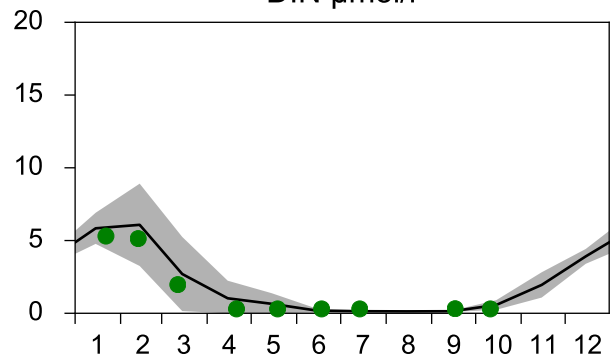
Salinity psu



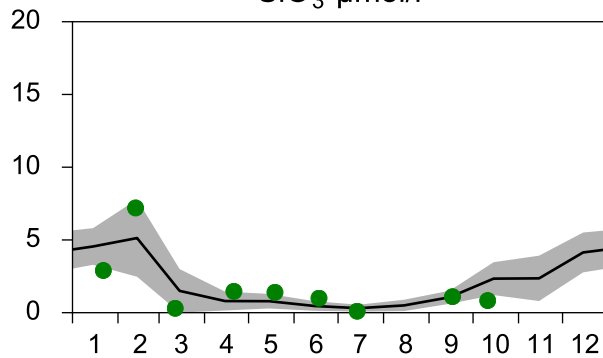
PO₄ μmol/l



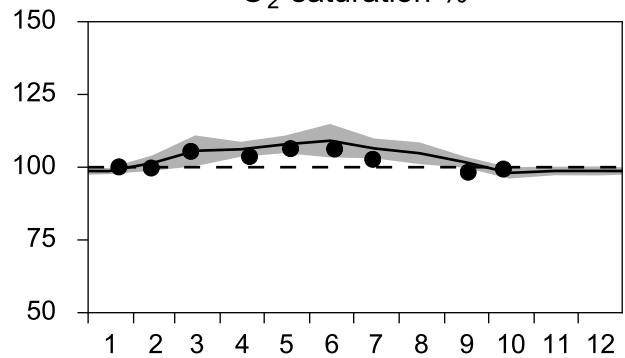
DIN μmol/l



SiO₃ μmol/l

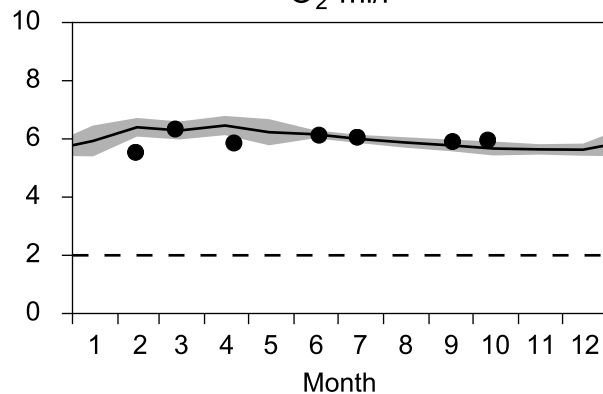


O₂ saturation %

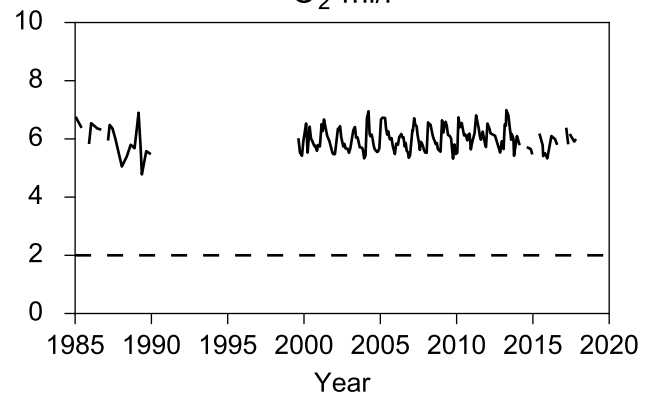


OXYGEN IN BOTTOM WATER (depth >= 300 m)

O₂ ml/l

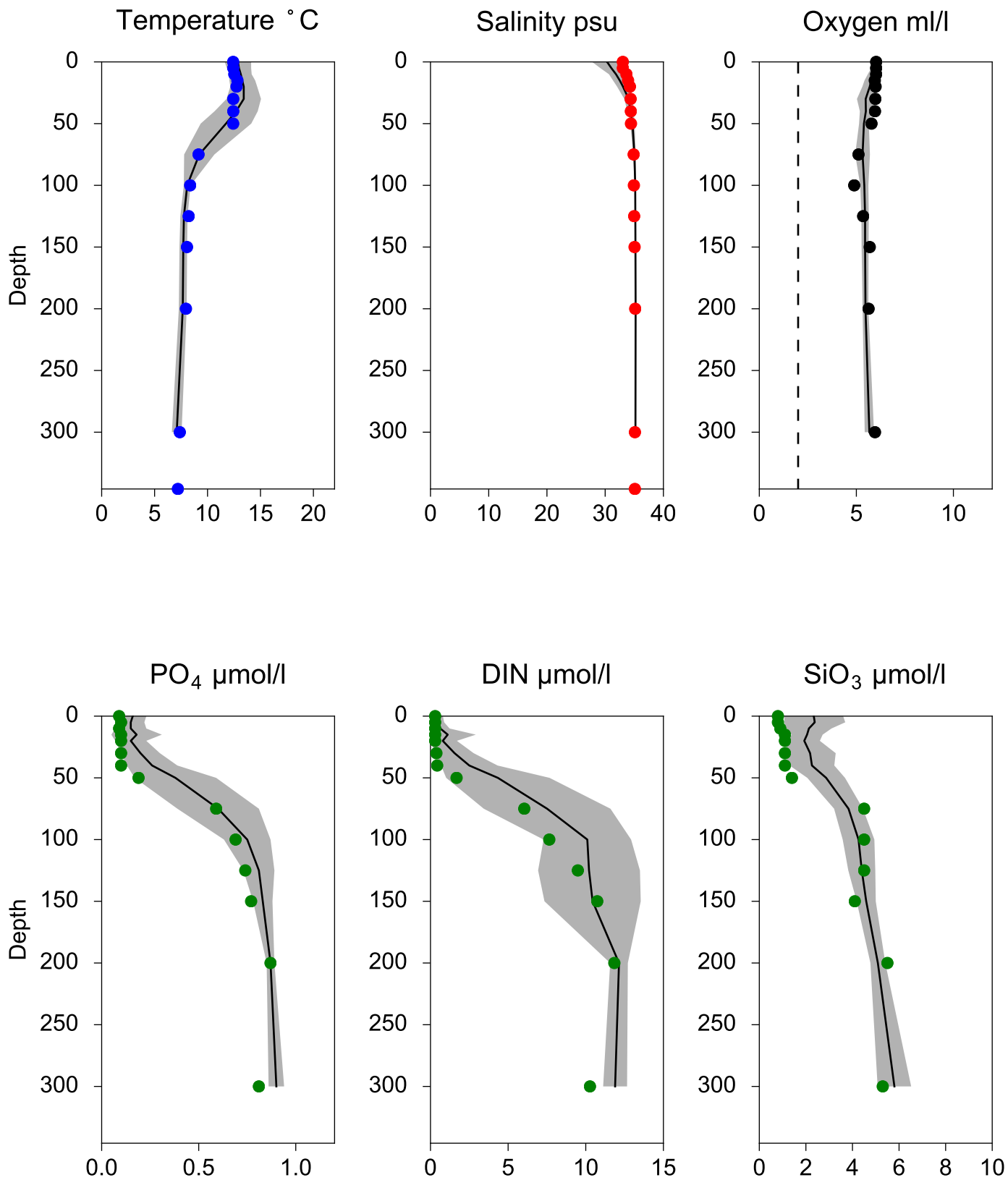


O₂ ml/l



Vertical profiles Å17 October

— Mean 2001-2015 St.Dev. • 2017-10-11



STATION FLADEN SURFACE WATER (0-10 m)

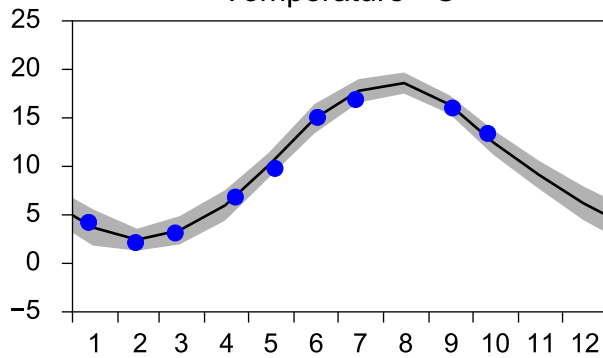
Annual Cycles

— Mean 2001-2015

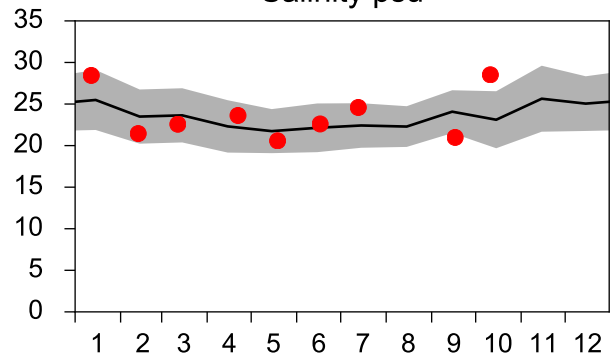
■ St.Dev.

● 2017

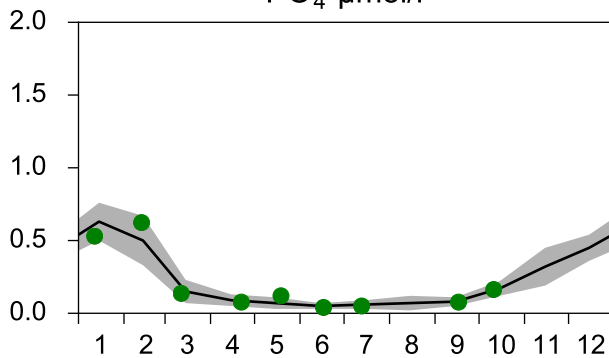
Temperature °C



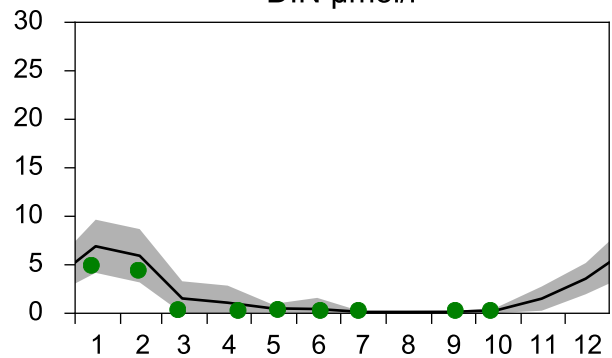
Salinity psu



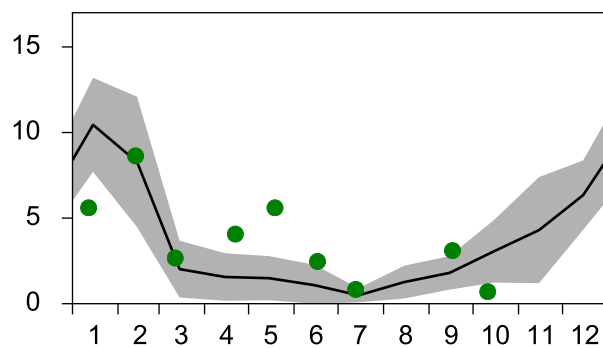
PO₄ µmol/l



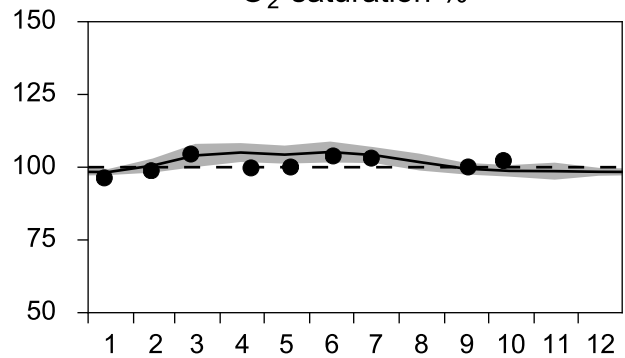
DIN µmol/l



SiO₃ µmol/l

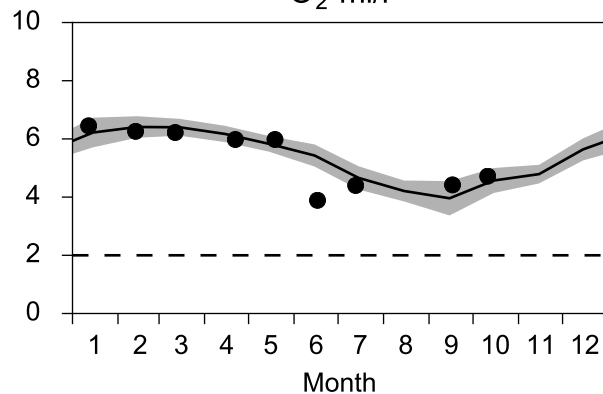


O₂ saturation %

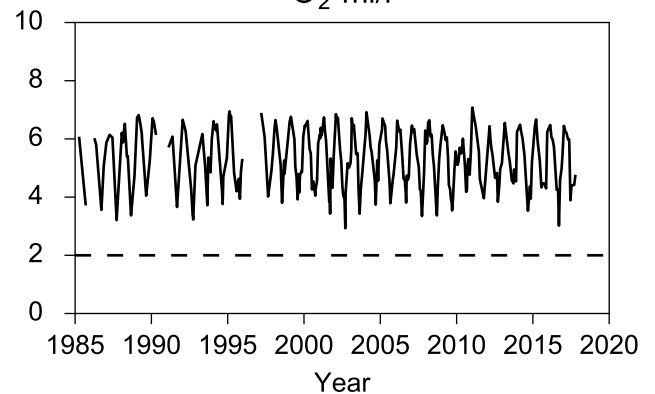


OXYGEN IN BOTTOM WATER (depth >= 74 m)

O₂ ml/l

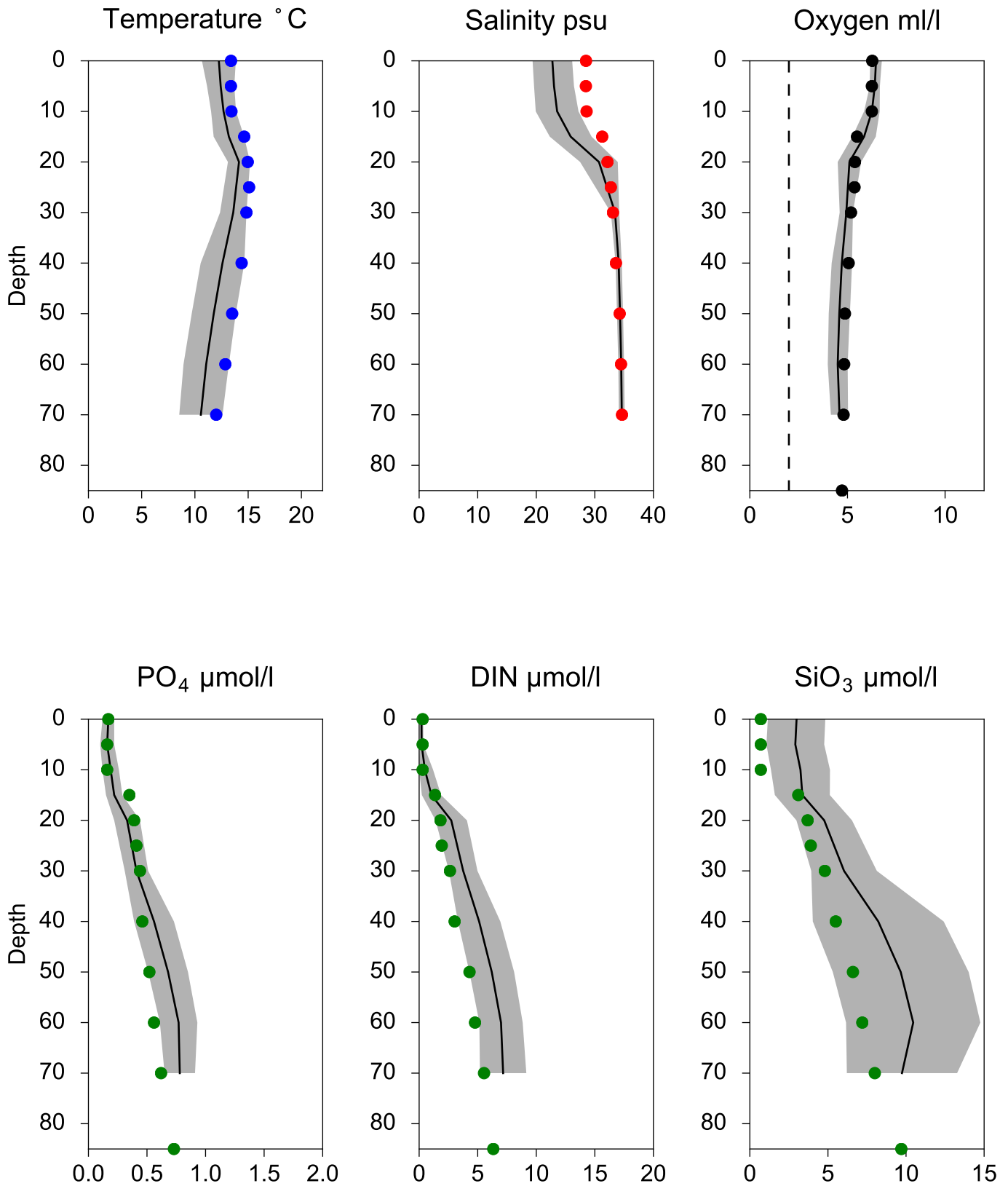


O₂ ml/l



Vertical profiles FLADEN October

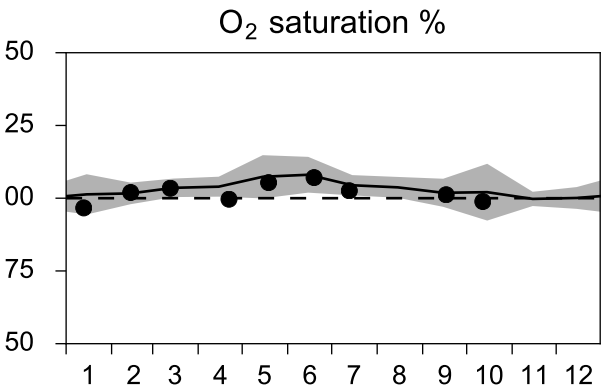
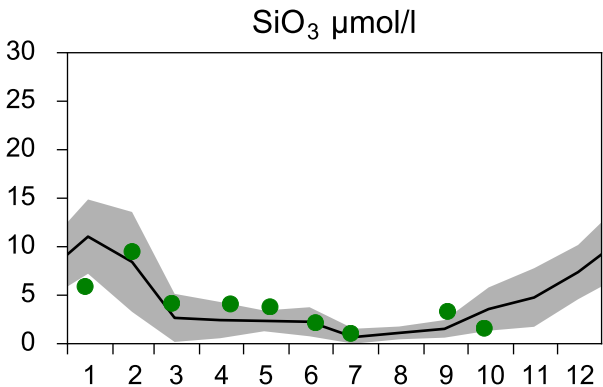
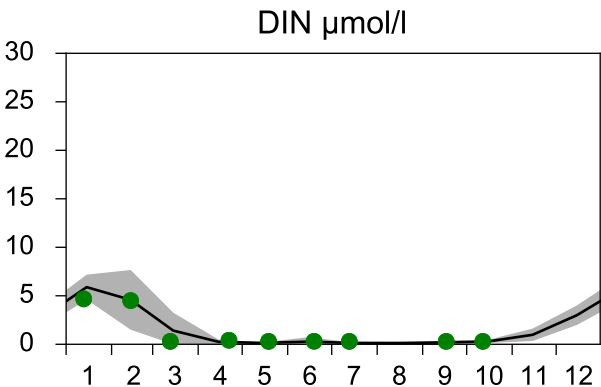
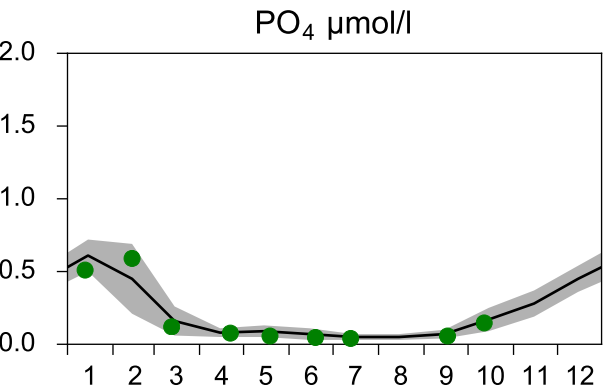
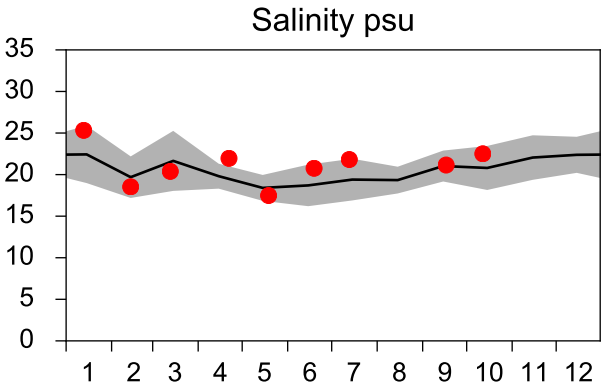
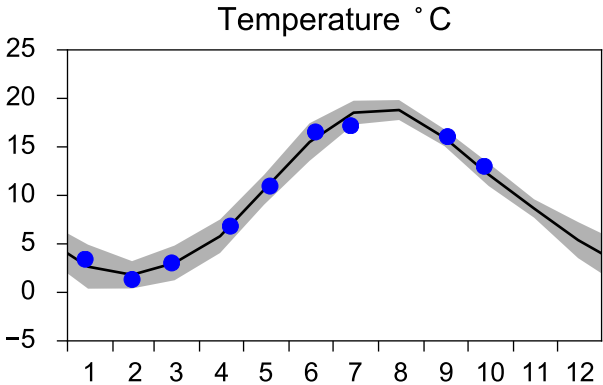
— Mean 2001-2015 St.Dev. • 2017-10-11



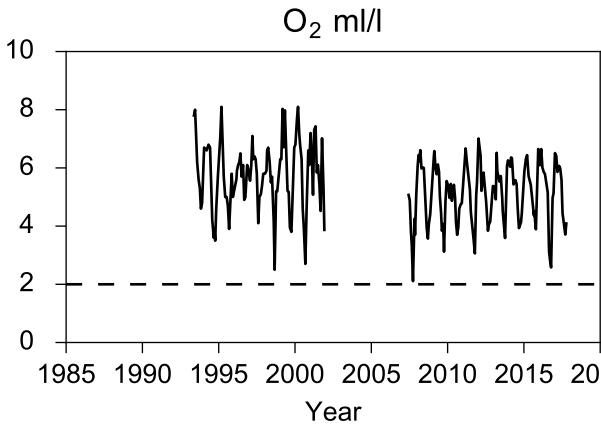
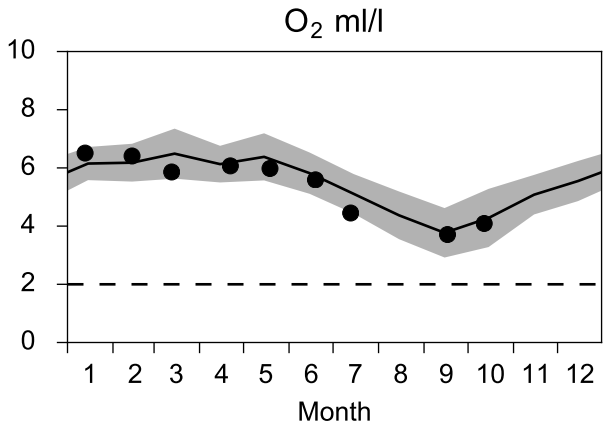
STATION N14 FALKENBERG SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. • 2017

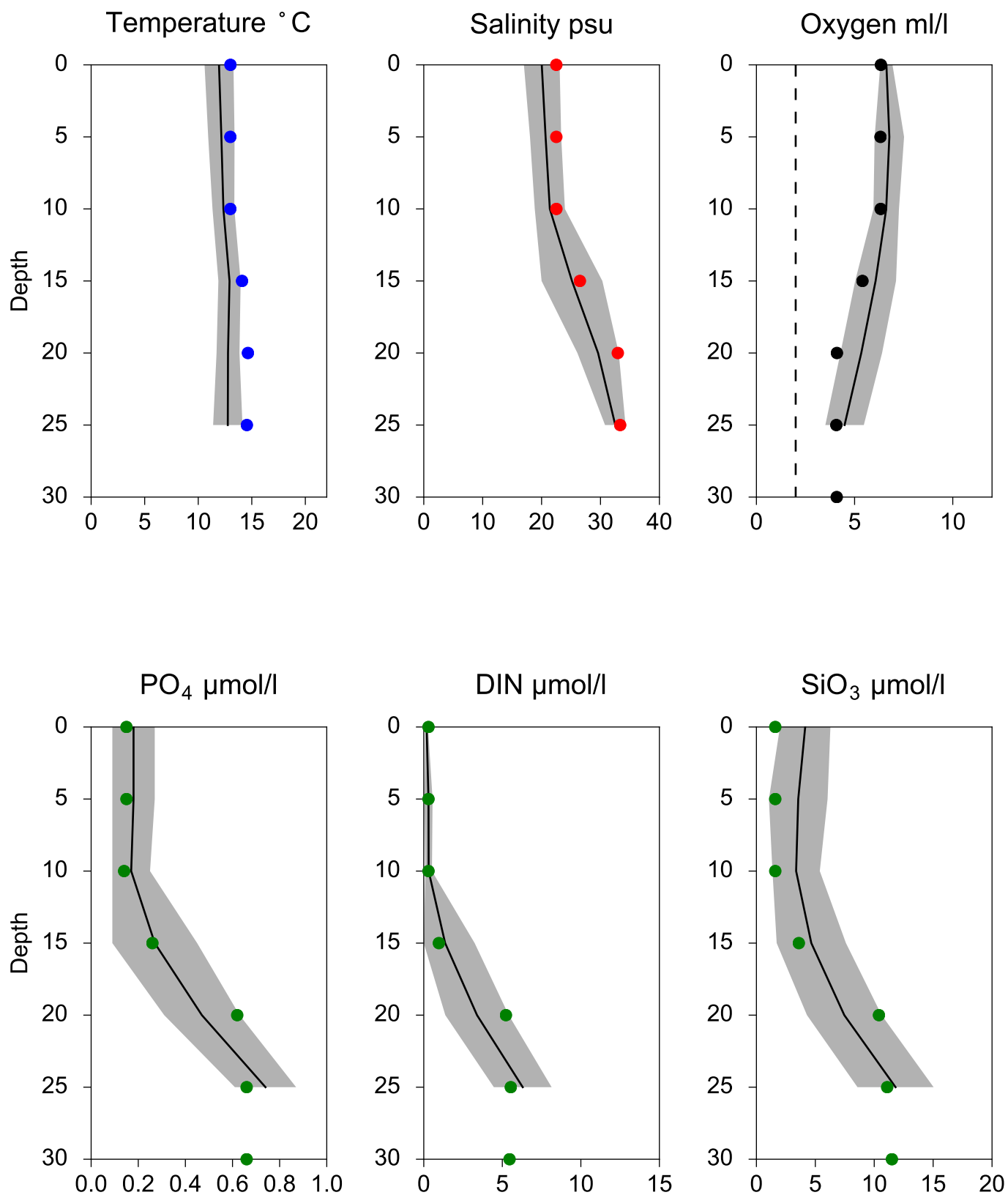


OXYGEN IN BOTTOM WATER (depth >= 25 m)



Vertical profiles N14 FALKENBERG October

— Mean 2001-2015 St.Dev. • 2017-10-12



STATION ANHOLT E SURFACE WATER (0-10 m)

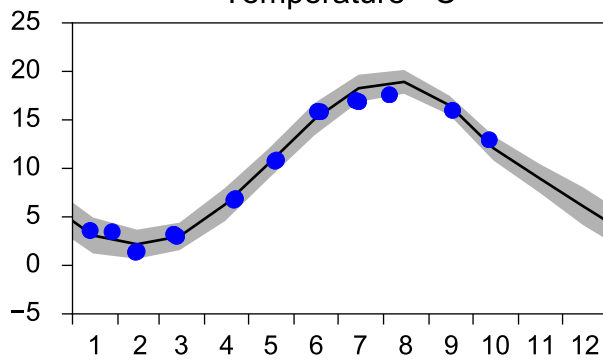
Annual Cycles

— Mean 2001-2015

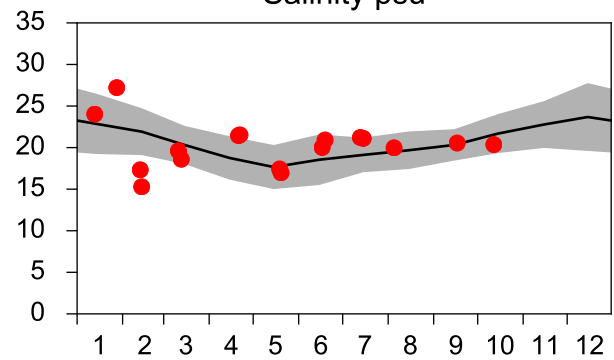
■ St.Dev.

● 2017

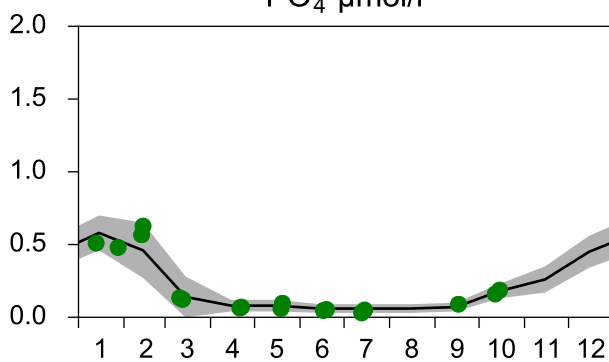
Temperature °C



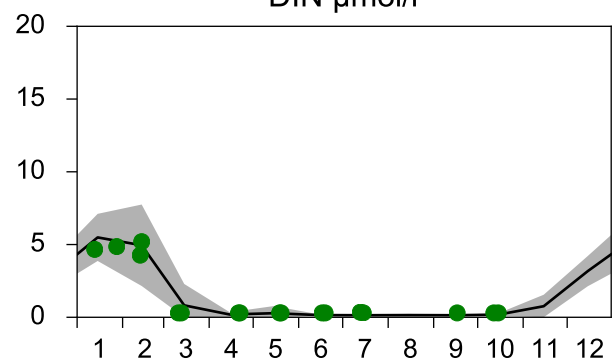
Salinity psu



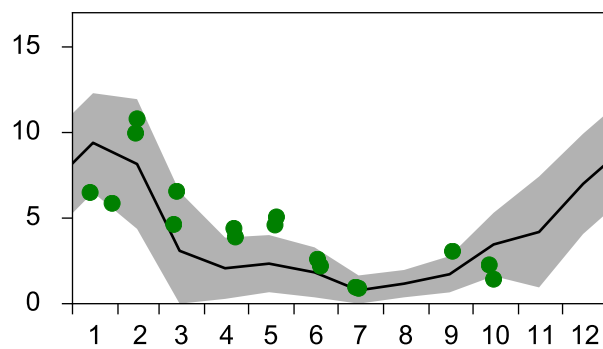
PO₄ µmol/l



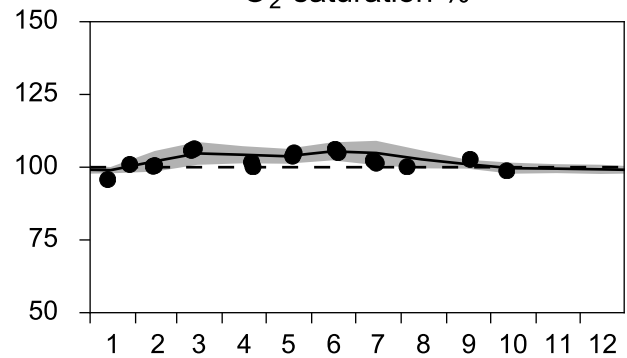
DIN µmol/l



SiO₃ µmol/l

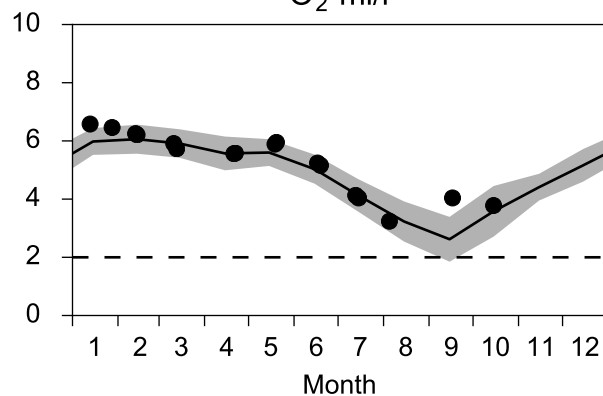


O₂ saturation %

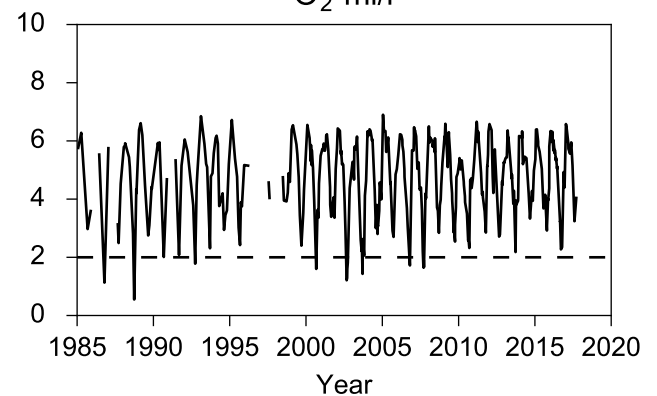


OXYGEN IN BOTTOM WATER (depth >= 52 m)

O₂ ml/l

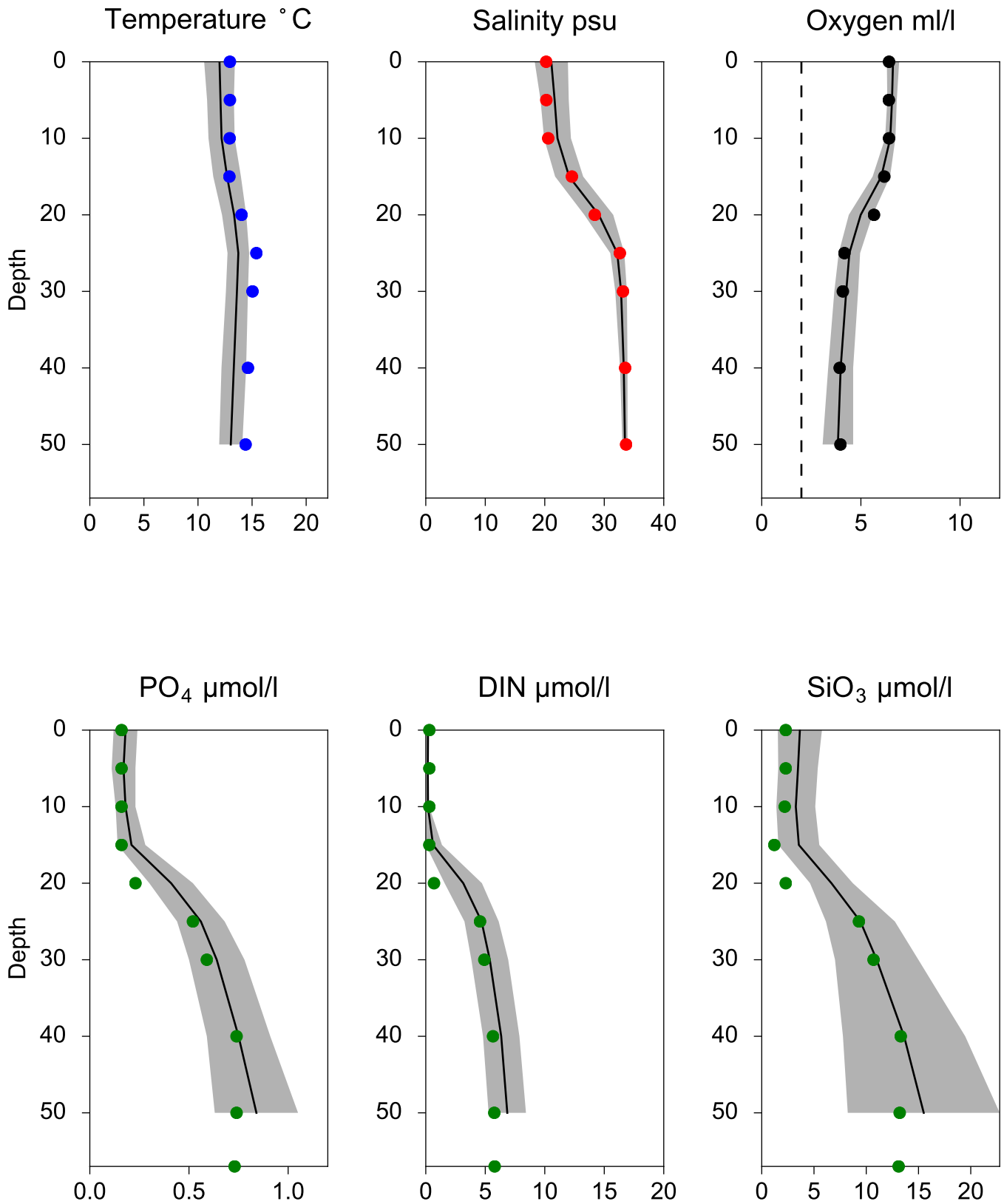


O₂ ml/l



Vertical profiles ANHOLT E October

— Mean 2001-2015 St.Dev. • 2017-10-12



STATION W LANDSKRONA SURFACE WATER (0-10 m)

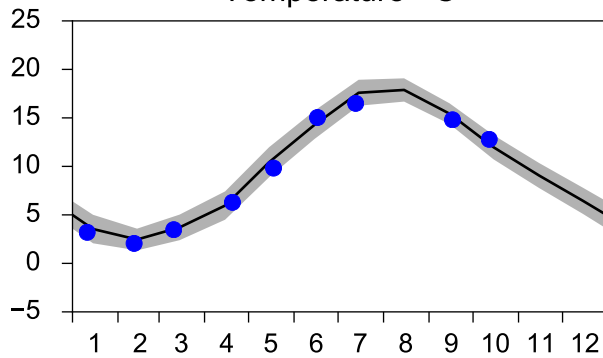
Annual Cycles

— Mean 2001-2015

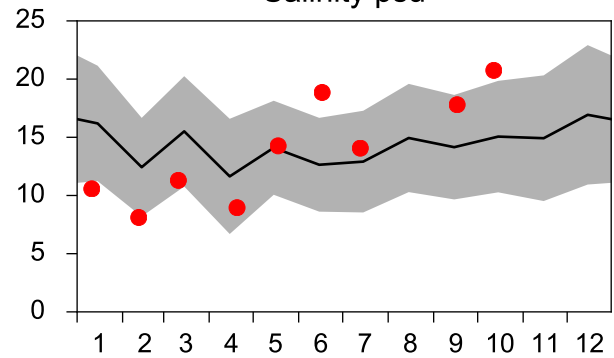
■ St.Dev.

● 2017

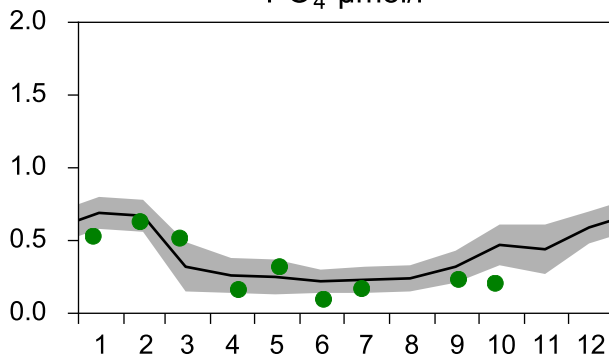
Temperature °C



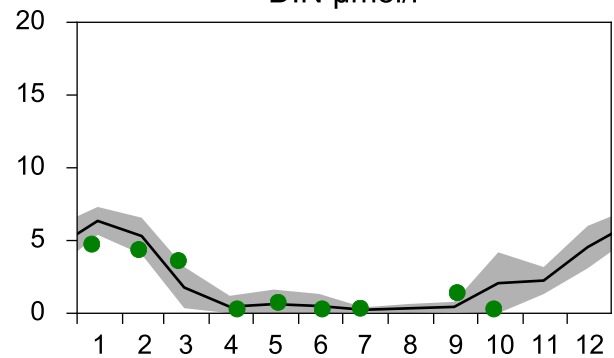
Salinity psu



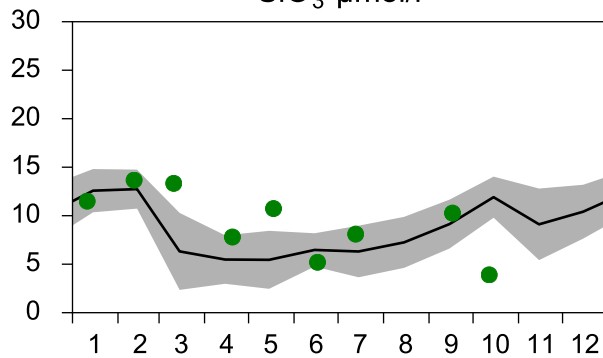
PO₄ µmol/l



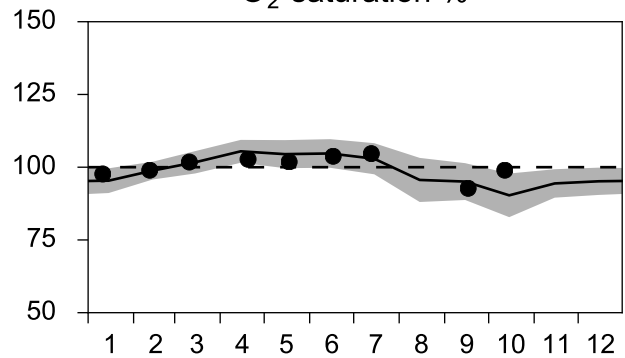
DIN µmol/l



SiO₃ µmol/l

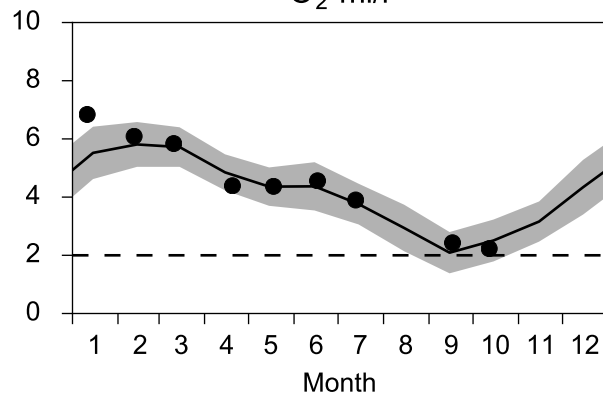


O₂ saturation %

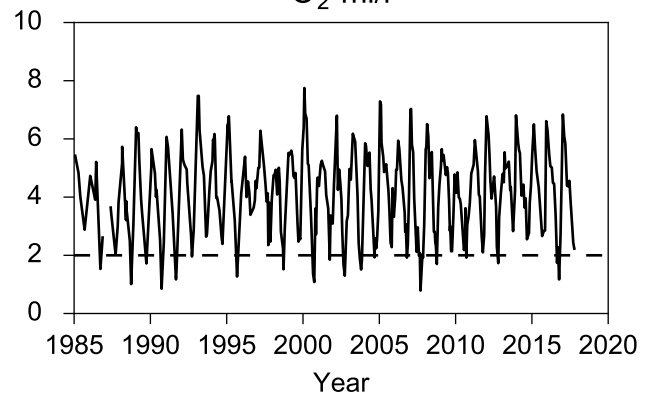


OXYGEN IN BOTTOM WATER (depth >= 40 m)

O₂ ml/l

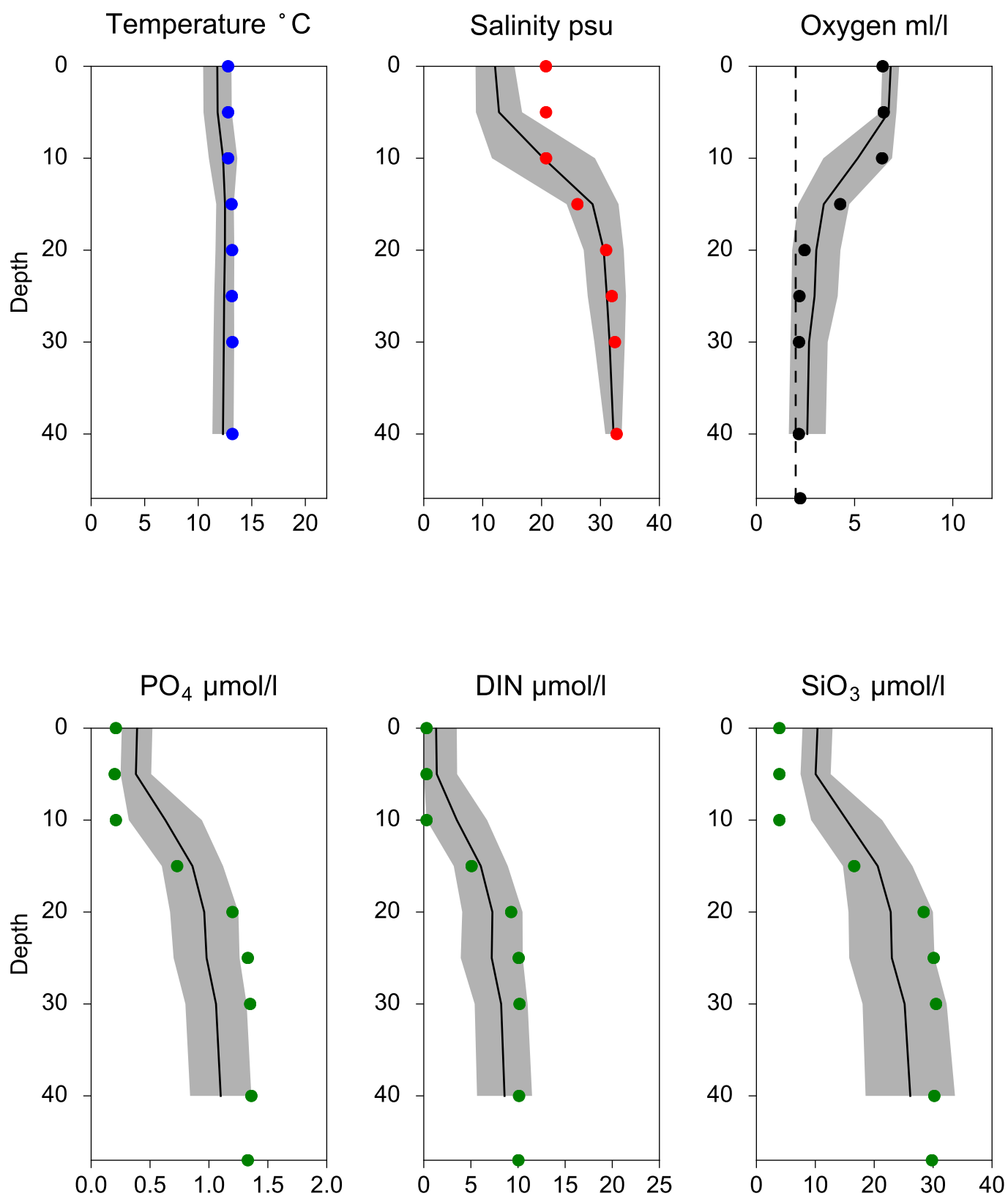


O₂ ml/l



Vertical profiles W LANDSKRONA October

— Mean 2001-2015 St.Dev. • 2017-10-12



STATION BY1 SURFACE WATER (0-10 m)

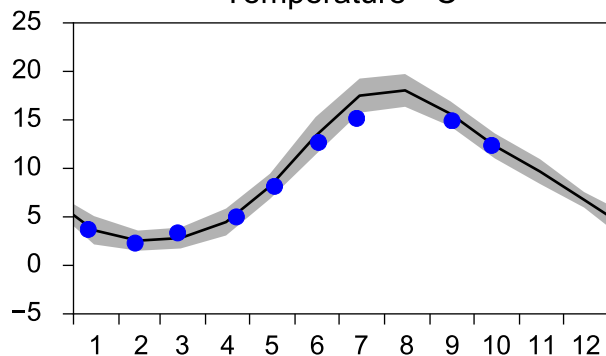
Annual Cycles

— Mean 2001-2015

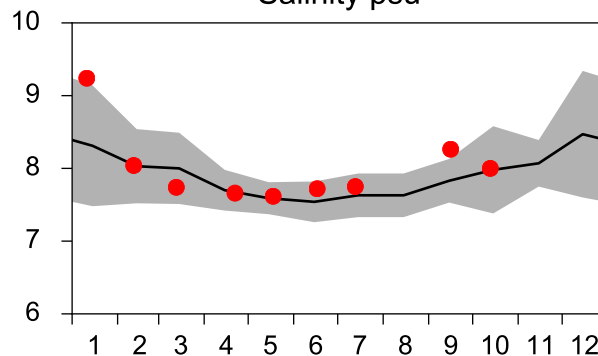
■ St.Dev.

● 2017

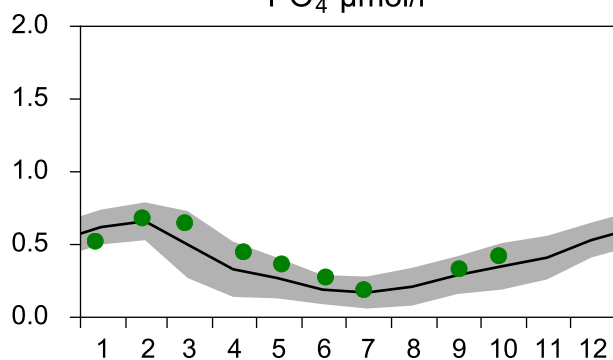
Temperature °C



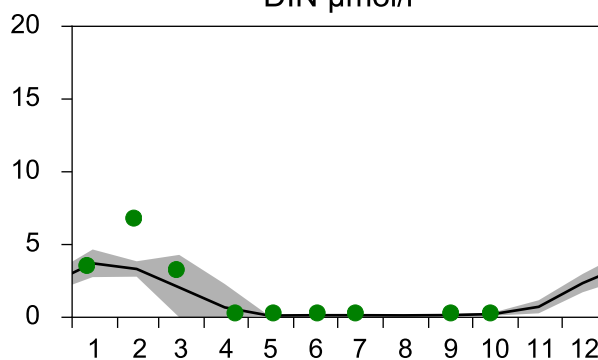
Salinity psu



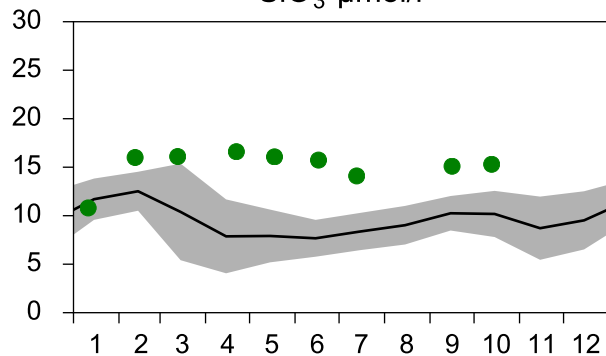
PO₄ µmol/l



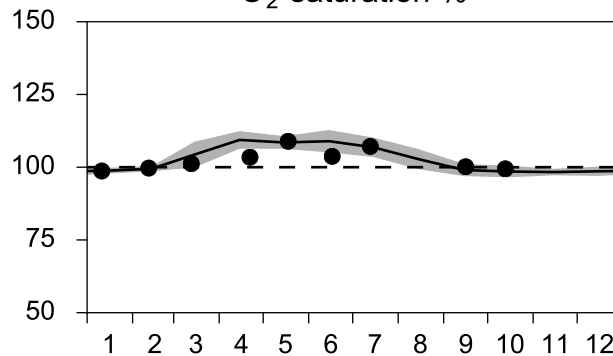
DIN µmol/l



SiO₃ µmol/l

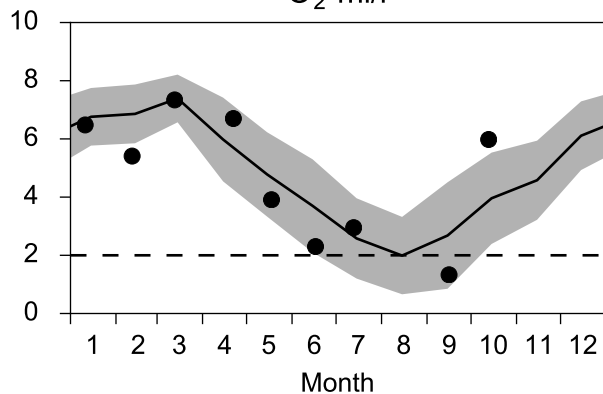


O₂ saturation %

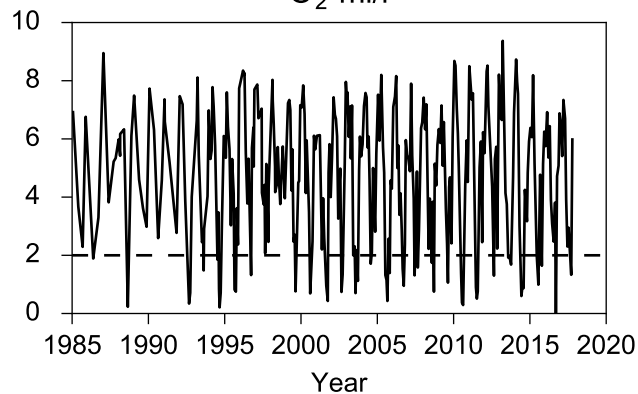


OXYGEN IN BOTTOM WATER (depth >= 40 m)

O₂ ml/l

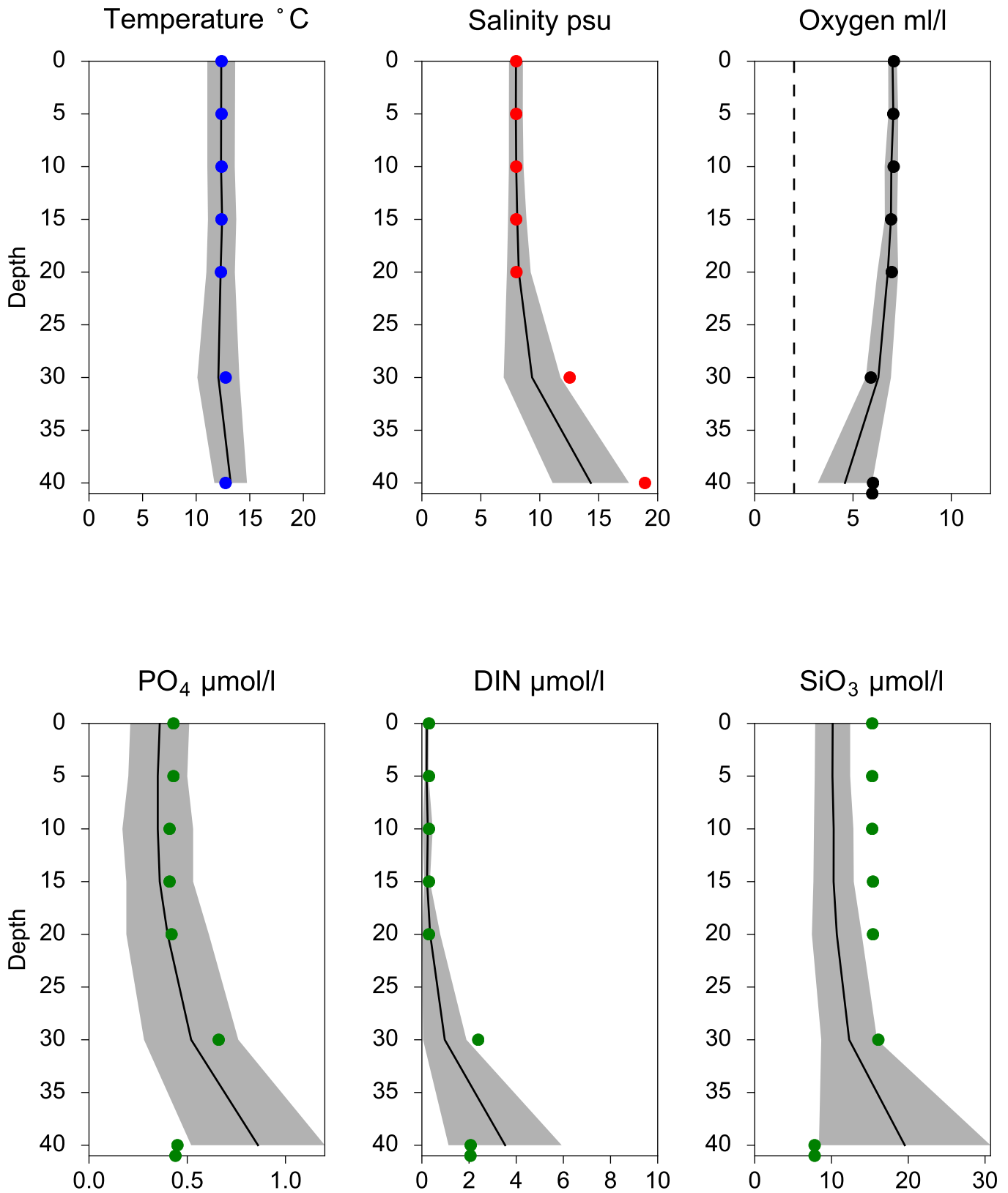


O₂ ml/l



Vertical profiles BY1 October

— Mean 2001-2015 St.Dev. • 2017-10-13



STATION BY2 ARKONA SURFACE WATER (0-10 m)

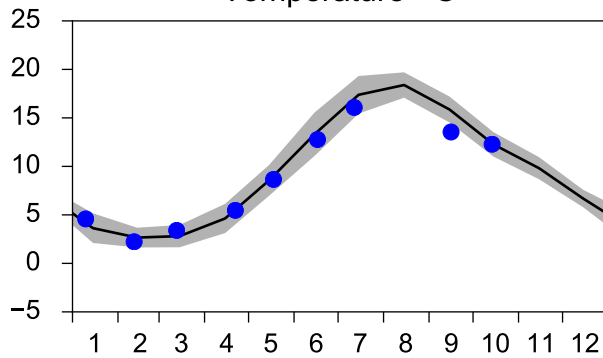
Annual Cycles

— Mean 2001-2015

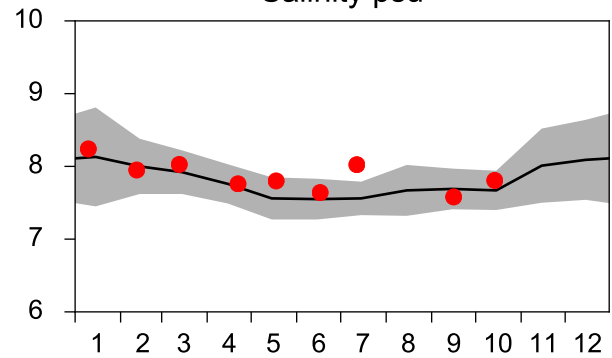
■ St.Dev.

● 2017

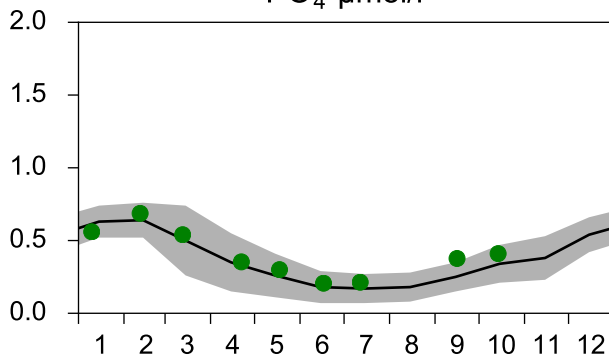
Temperature °C



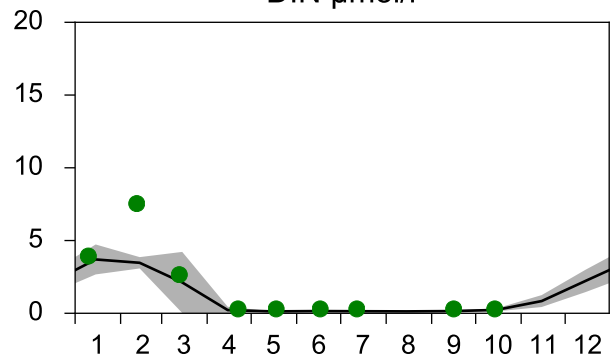
Salinity psu



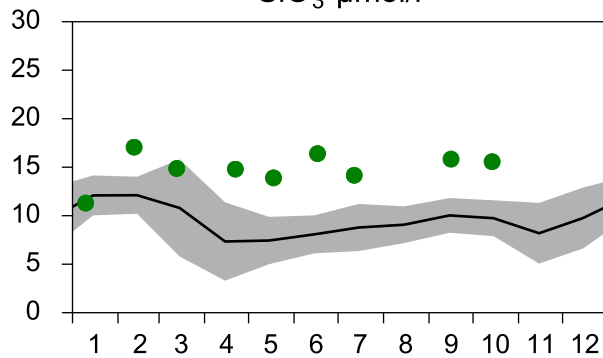
PO₄ µmol/l



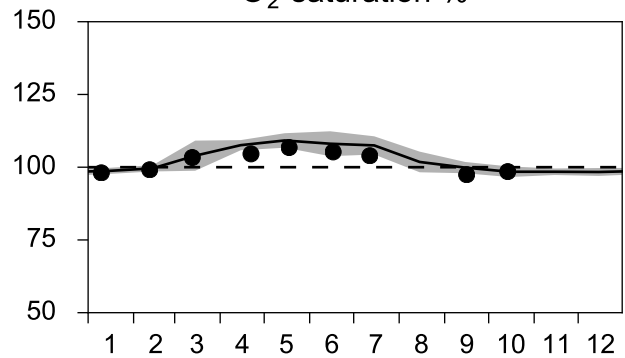
DIN µmol/l



SiO₃ µmol/l

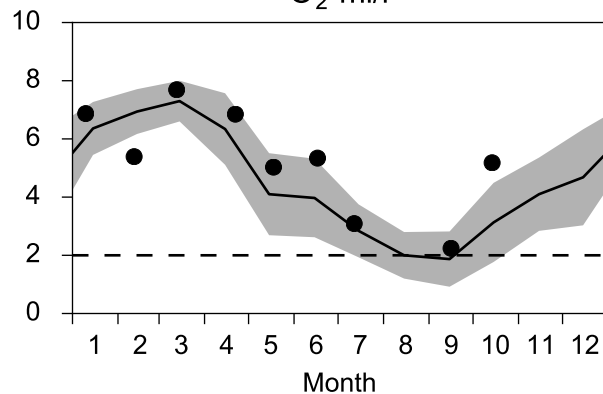


O₂ saturation %

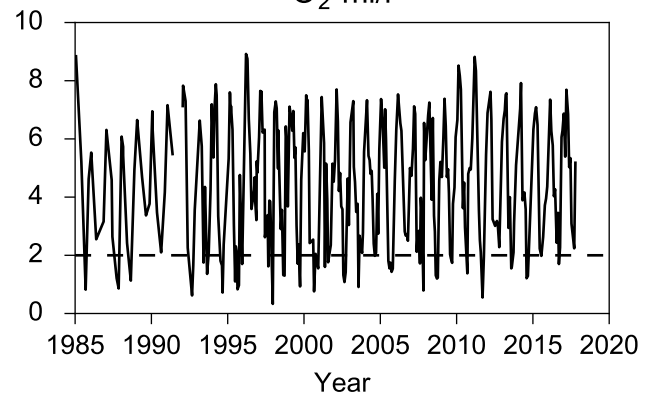


OXYGEN IN BOTTOM WATER (depth >= 40 m)

O₂ ml/l

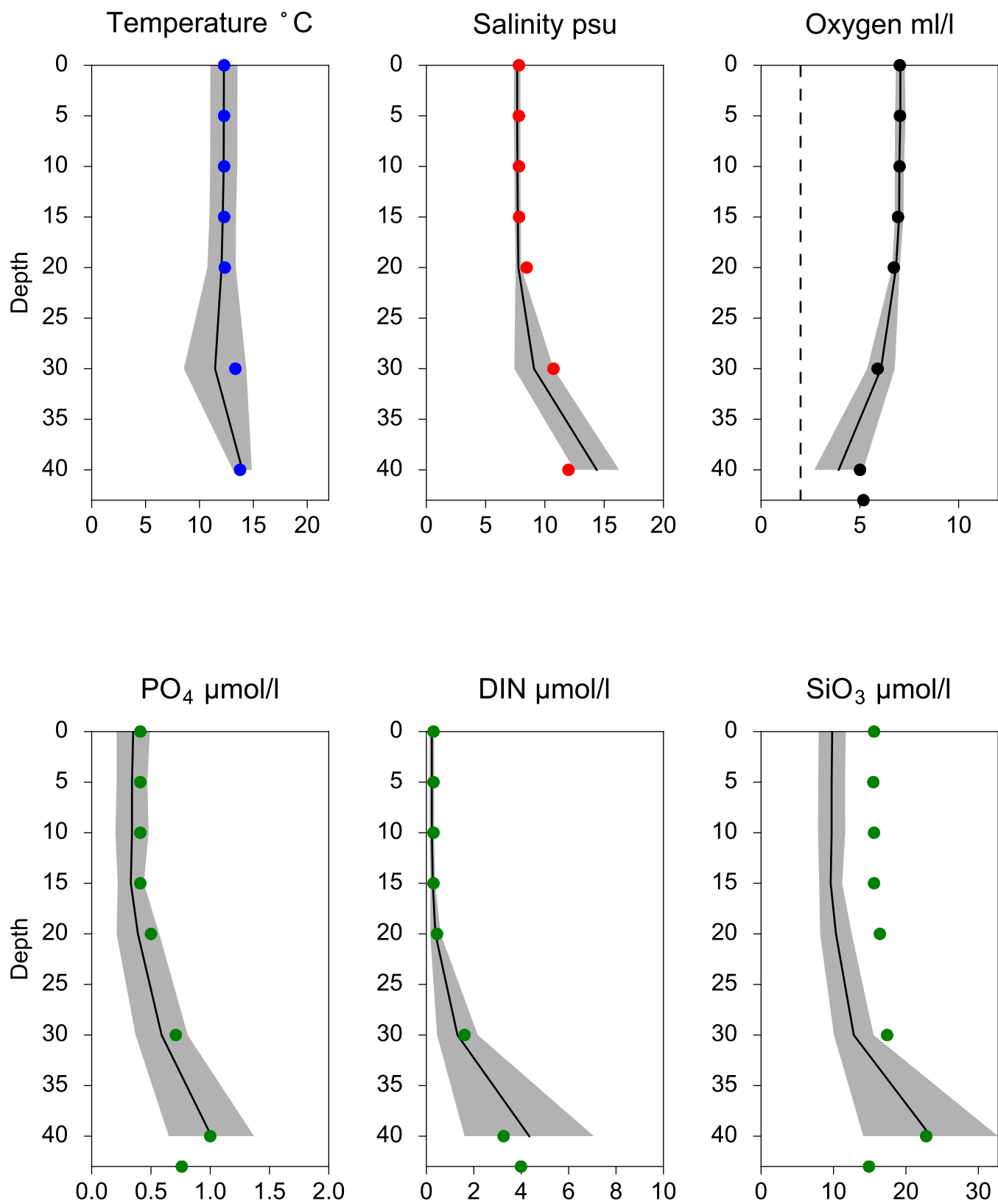


O₂ ml/l



Vertical profiles BY2 ARKONA October

— Mean 2001-2015 ■ St.Dev. ● 2017-10-14



STATION BY4 CHRISTIANSÖ SURFACE WATER (0-10 m)

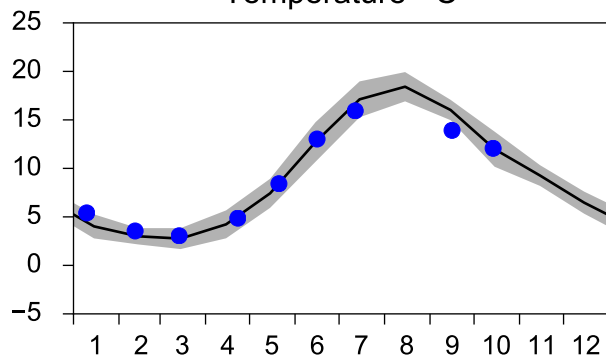
Annual Cycles

— Mean 2001-2015

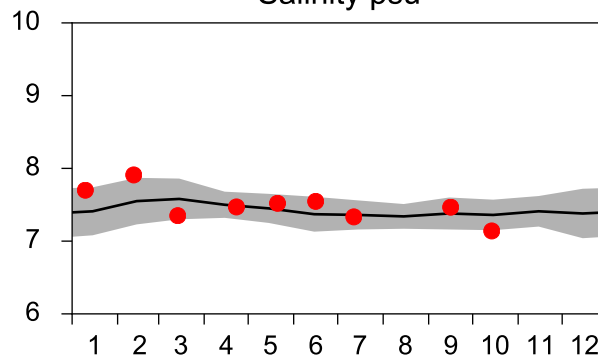
■ St.Dev.

● 2017

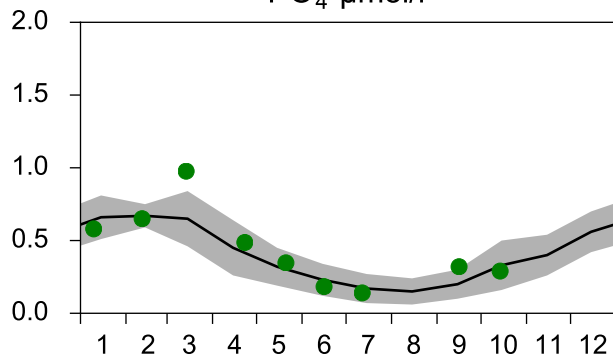
Temperature °C



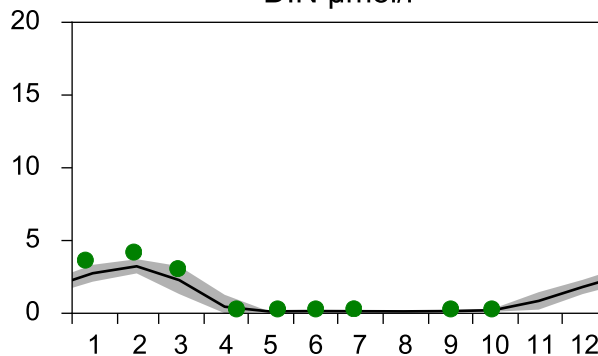
Salinity psu



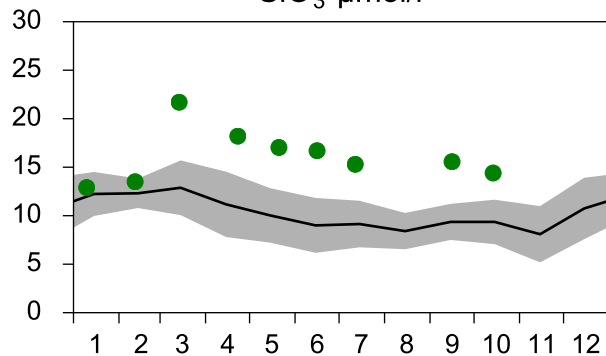
PO₄ µmol/l



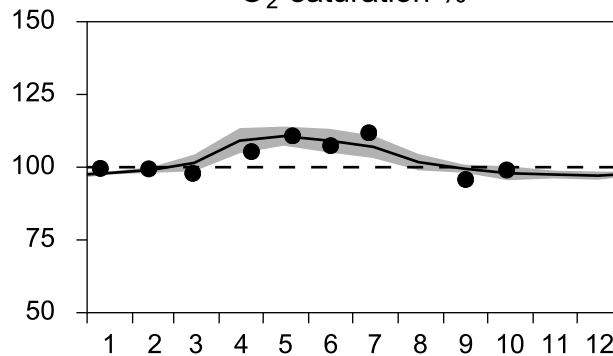
DIN µmol/l



SiO₃ µmol/l

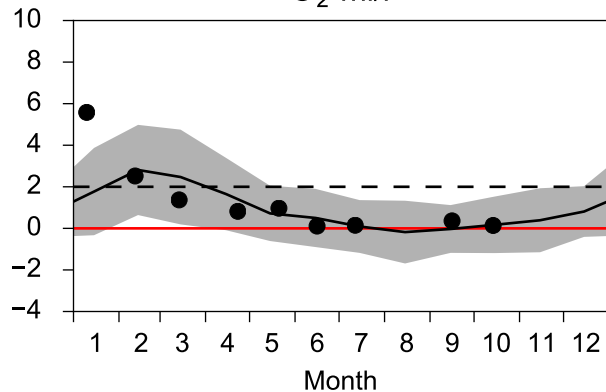


O₂ saturation %

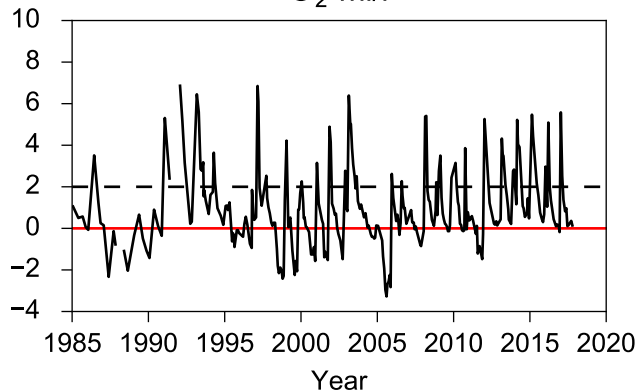


OXYGEN IN BOTTOM WATER (depth >= 80 m)

O₂ ml/l

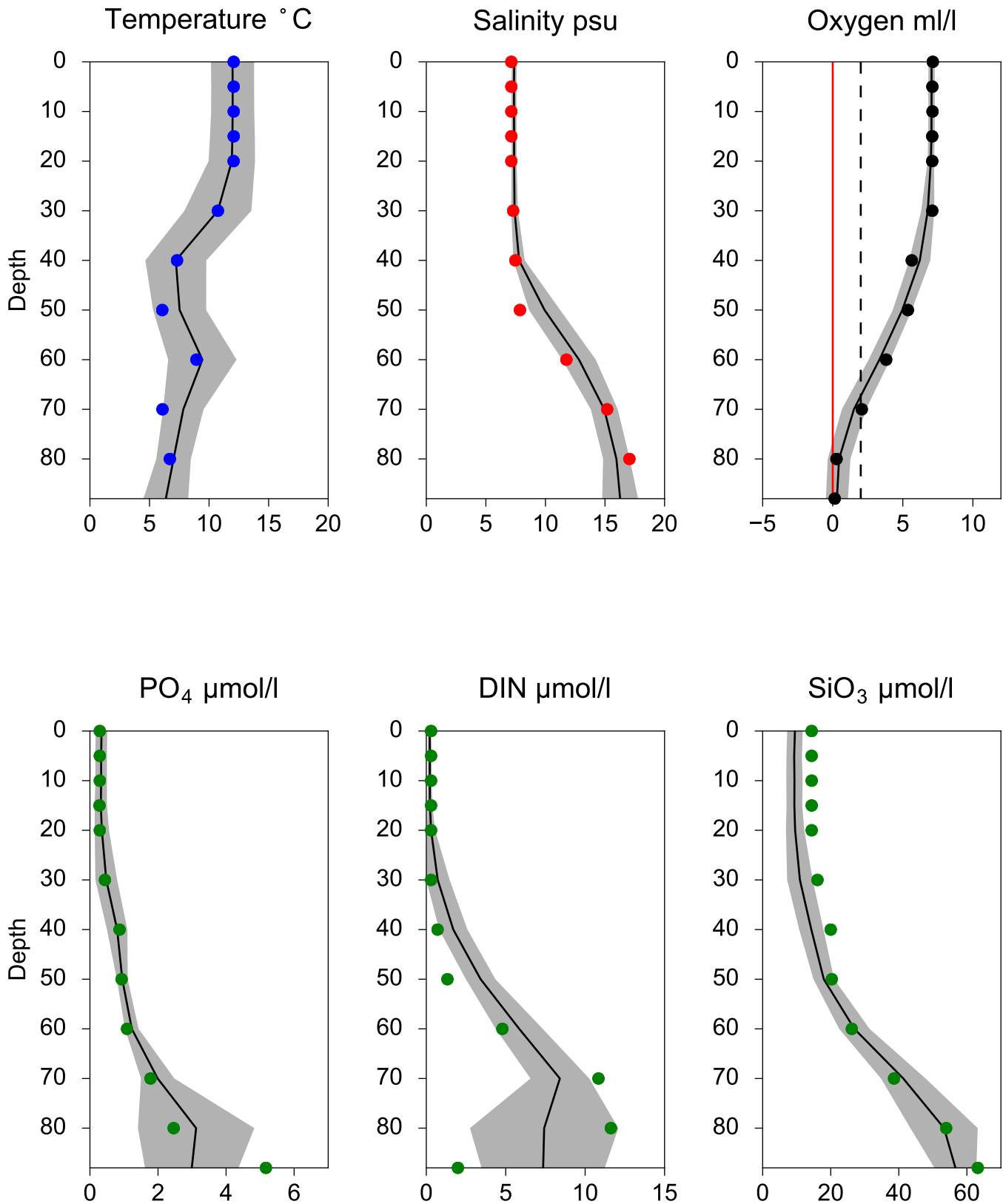


O₂ ml/l



Vertical profiles BY4 CHRISTIANSÖ October

— Mean 2001-2015 ■ St.Dev. ● 2017-10-14



STATION BY5 BORNHOLMSDJ SURFACE WATER (0-10 m)

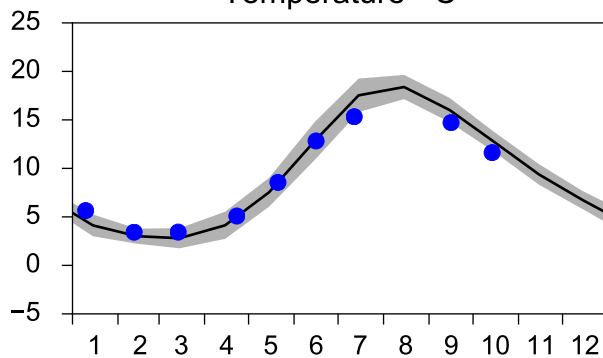
Annual Cycles

— Mean 2001-2015

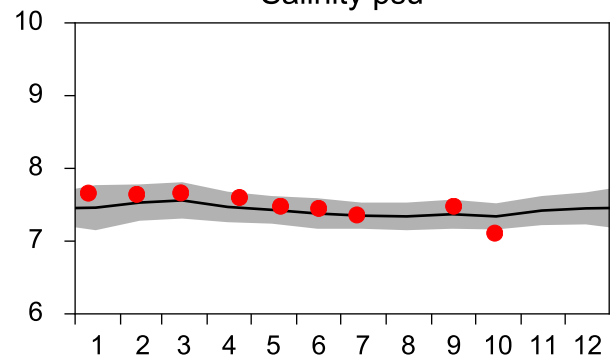
■ St.Dev.

● 2017

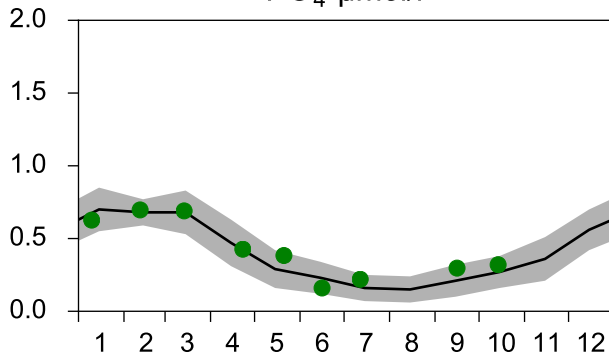
Temperature °C



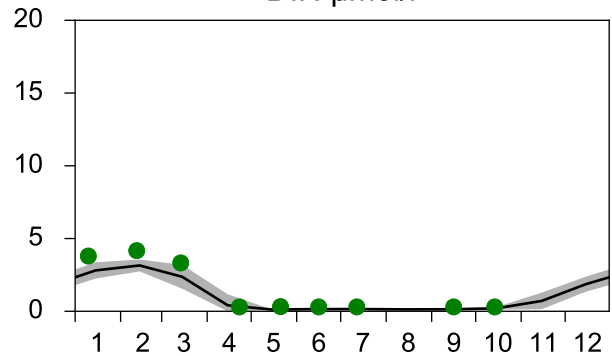
Salinity psu



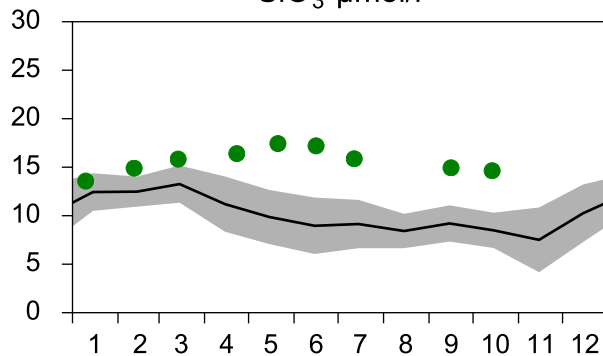
PO₄ μmol/l



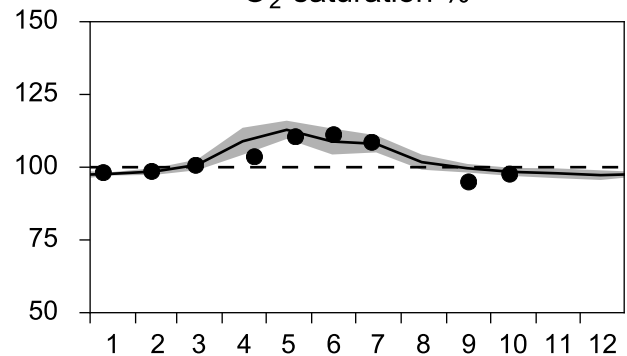
DIN μmol/l



SiO₃ μmol/l

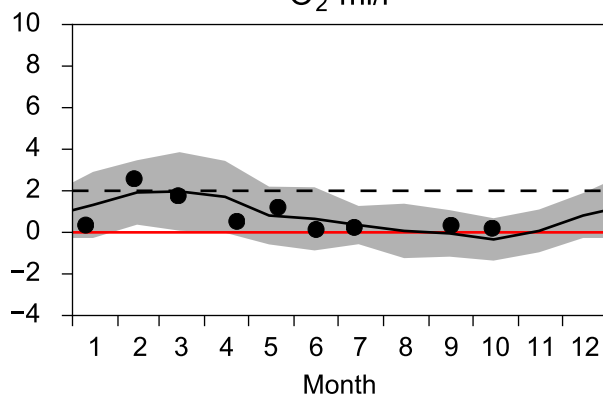


O₂ saturation %

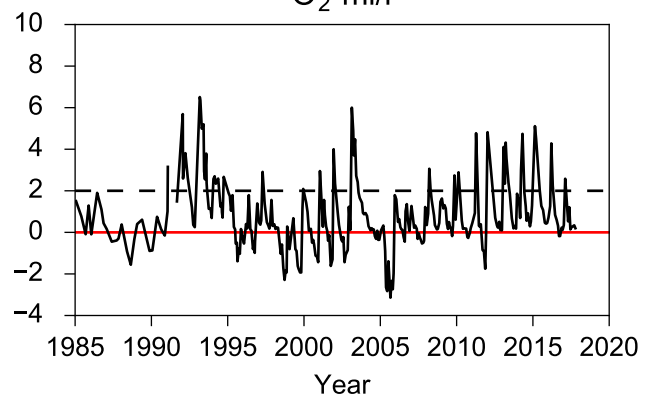


OXYGEN IN BOTTOM WATER (depth >= 80 m)

O₂ ml/l

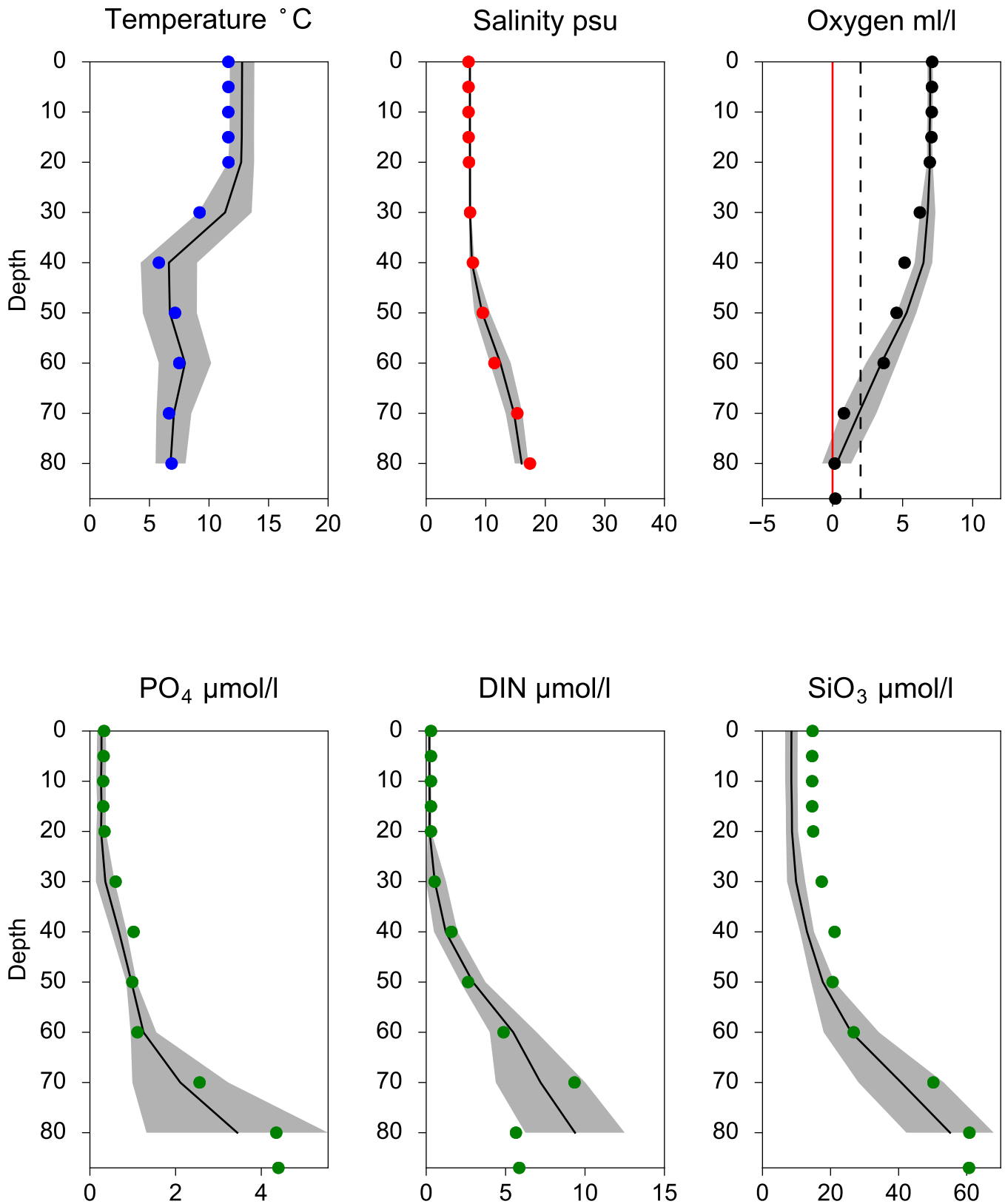


O₂ ml/l



Vertical profiles BY5 BORNHOLMSDJ October

— Mean 2001-2015 ■ St.Dev. ● 2017-10-14



STATION REF M1V1 SURFACE WATER (0-10 m)

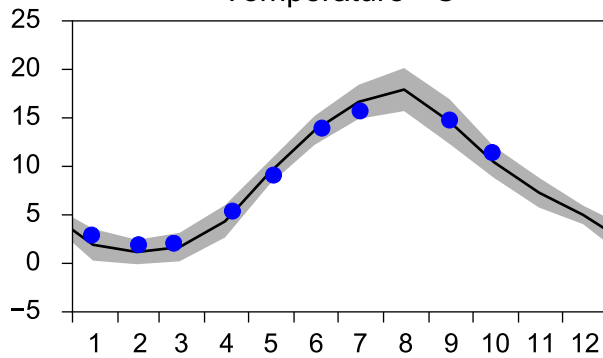
Annual Cycles

— Mean 2001-2015

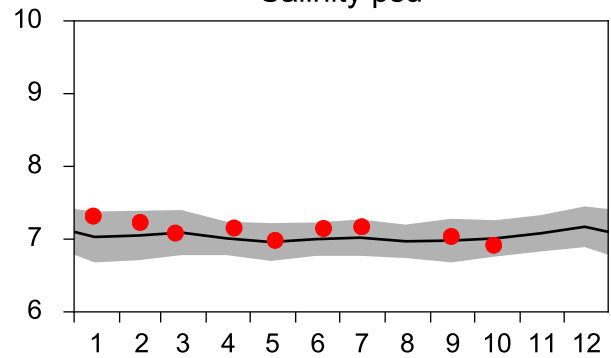
■ St.Dev.

● 2017

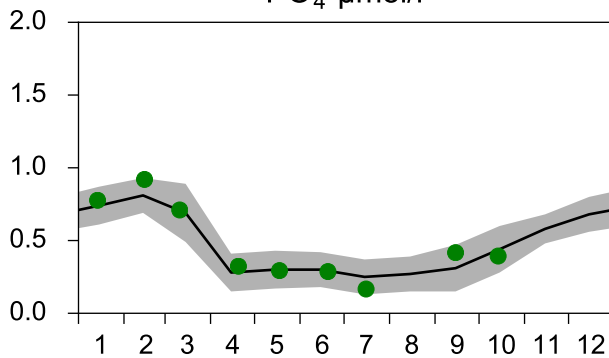
Temperature °C



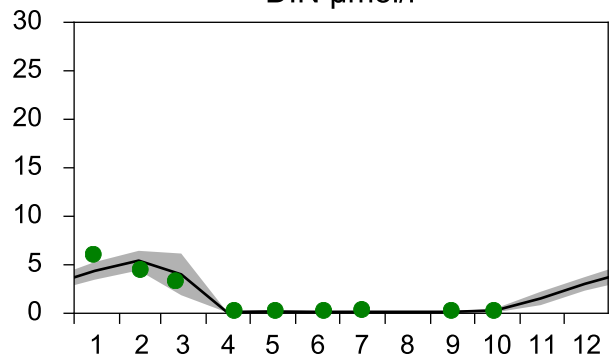
Salinity psu



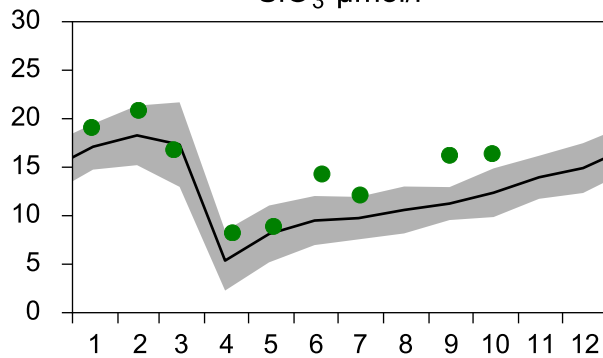
PO₄ µmol/l



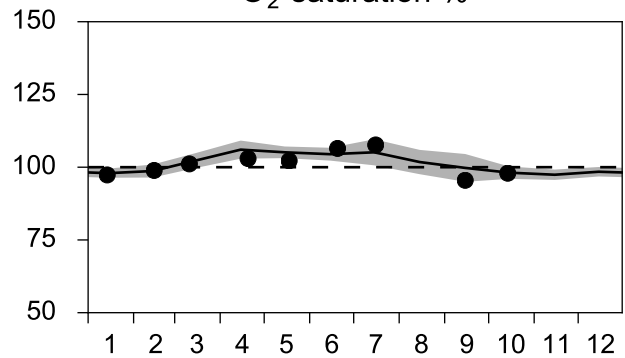
DIN µmol/l



SiO₃ µmol/l

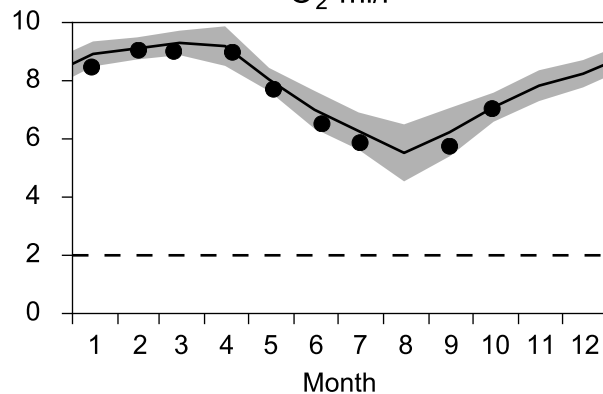


O₂ saturation %

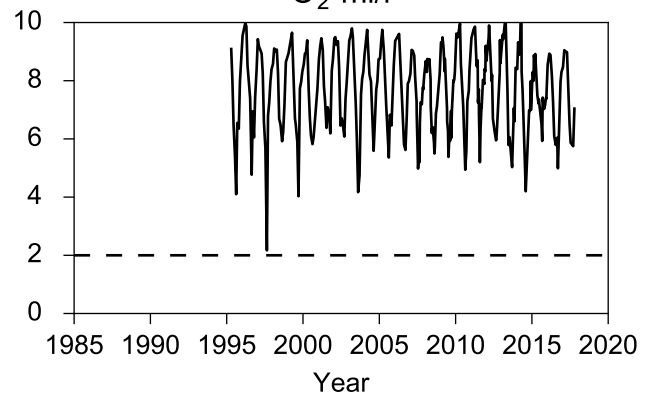


OXYGEN IN BOTTOM WATER (depth >= 17 m)

O₂ ml/l

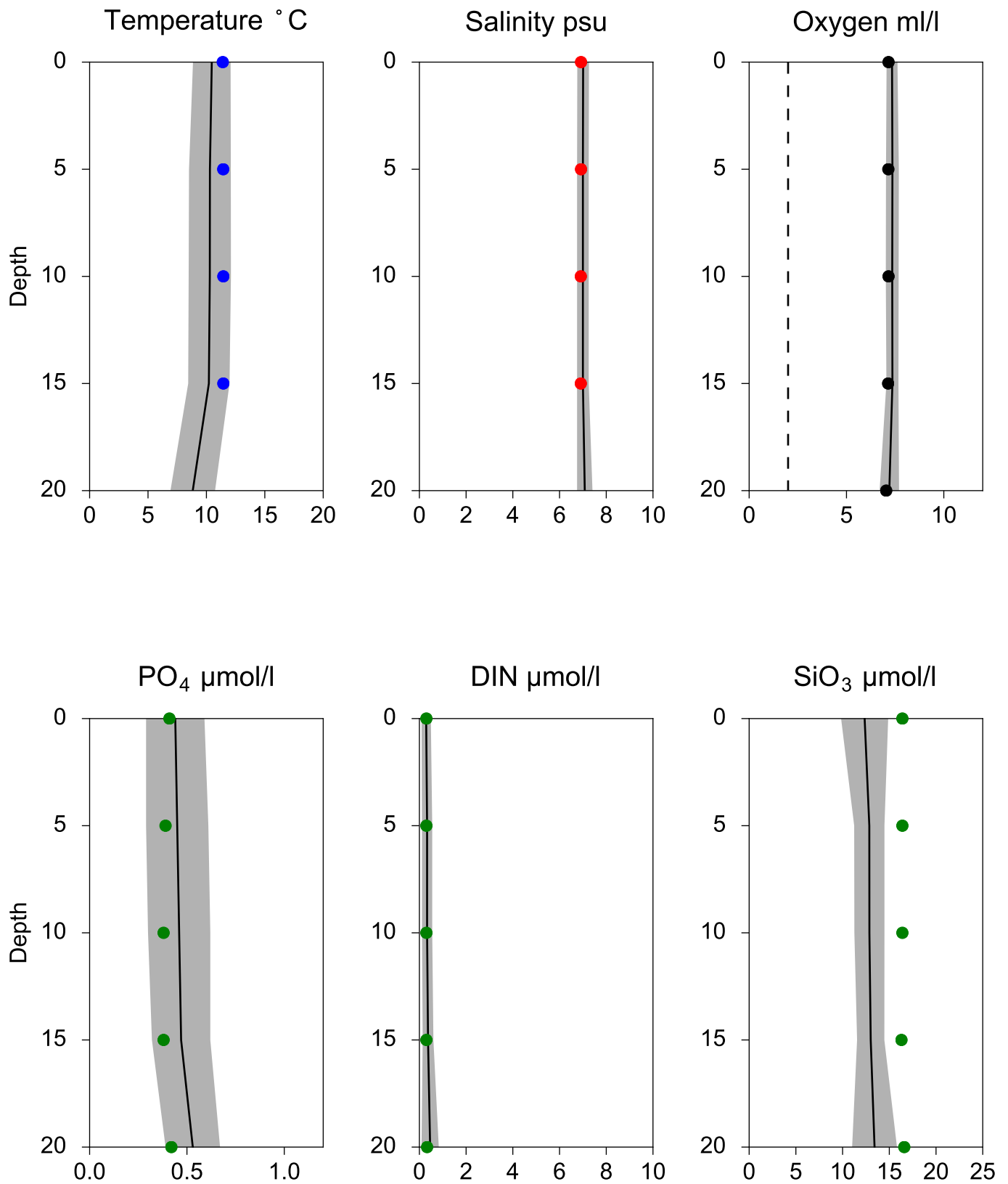


O₂ ml/l



Vertical profiles REF M1V1 October

— Mean 2001-2015 ■ St.Dev. ● 2017-10-14



STATION HANÖBUKTEN SURFACE WATER (0-10 m)

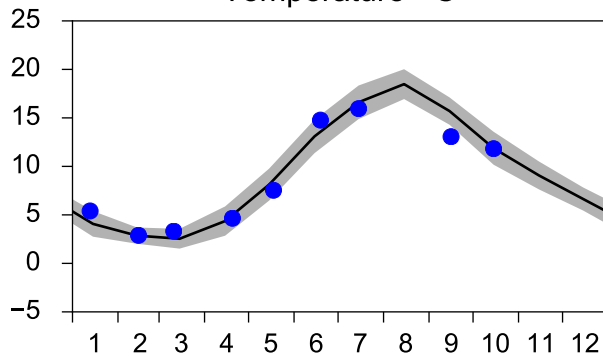
Annual Cycles

— Mean 2001-2015

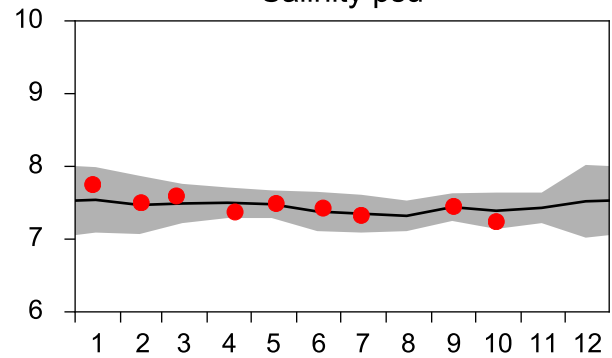
■ St.Dev.

● 2017

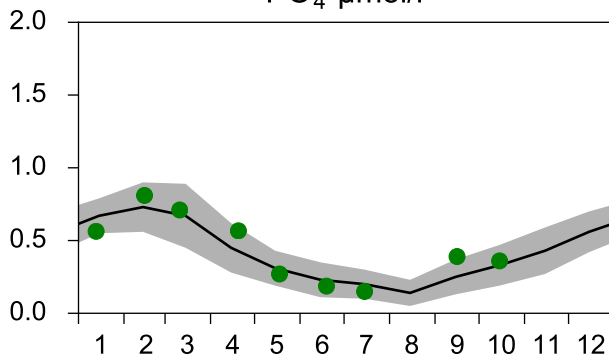
Temperature °C



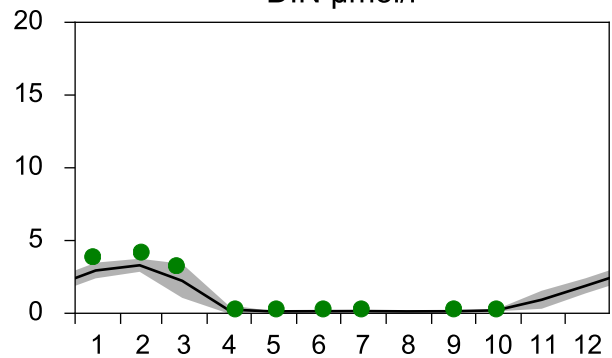
Salinity psu



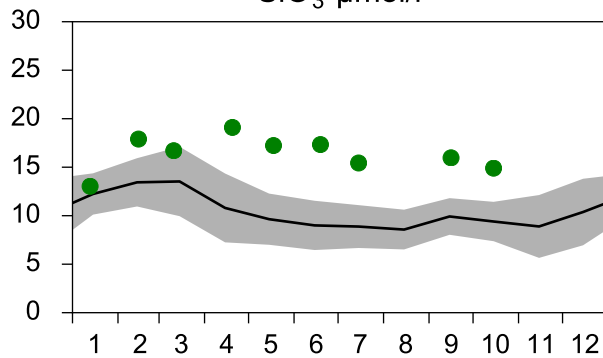
PO₄ µmol/l



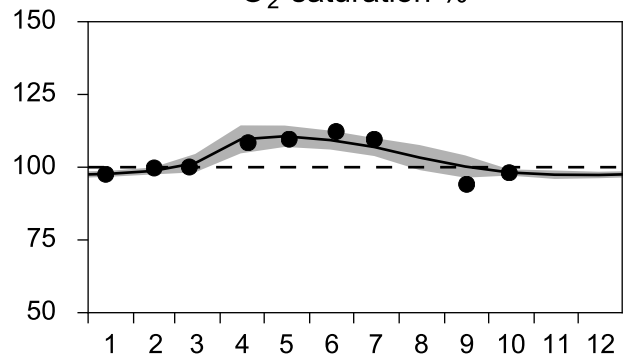
DIN µmol/l



SiO₃ µmol/l

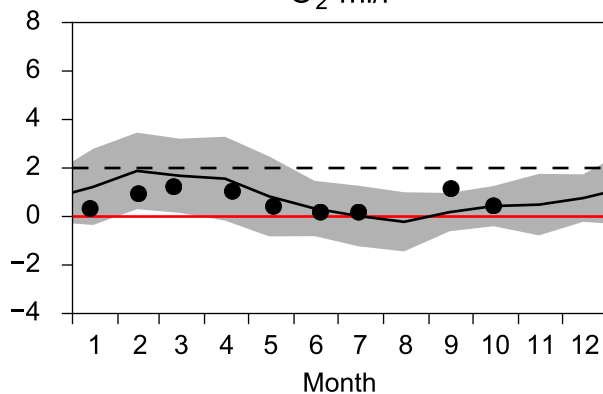


O₂ saturation %

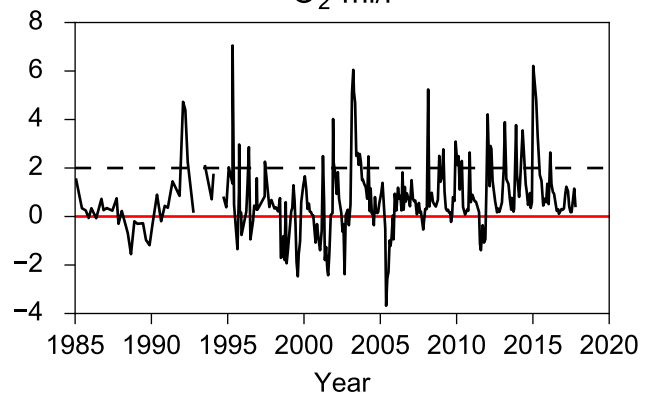


OXYGEN IN BOTTOM WATER (depth >= 70 m)

O₂ ml/l

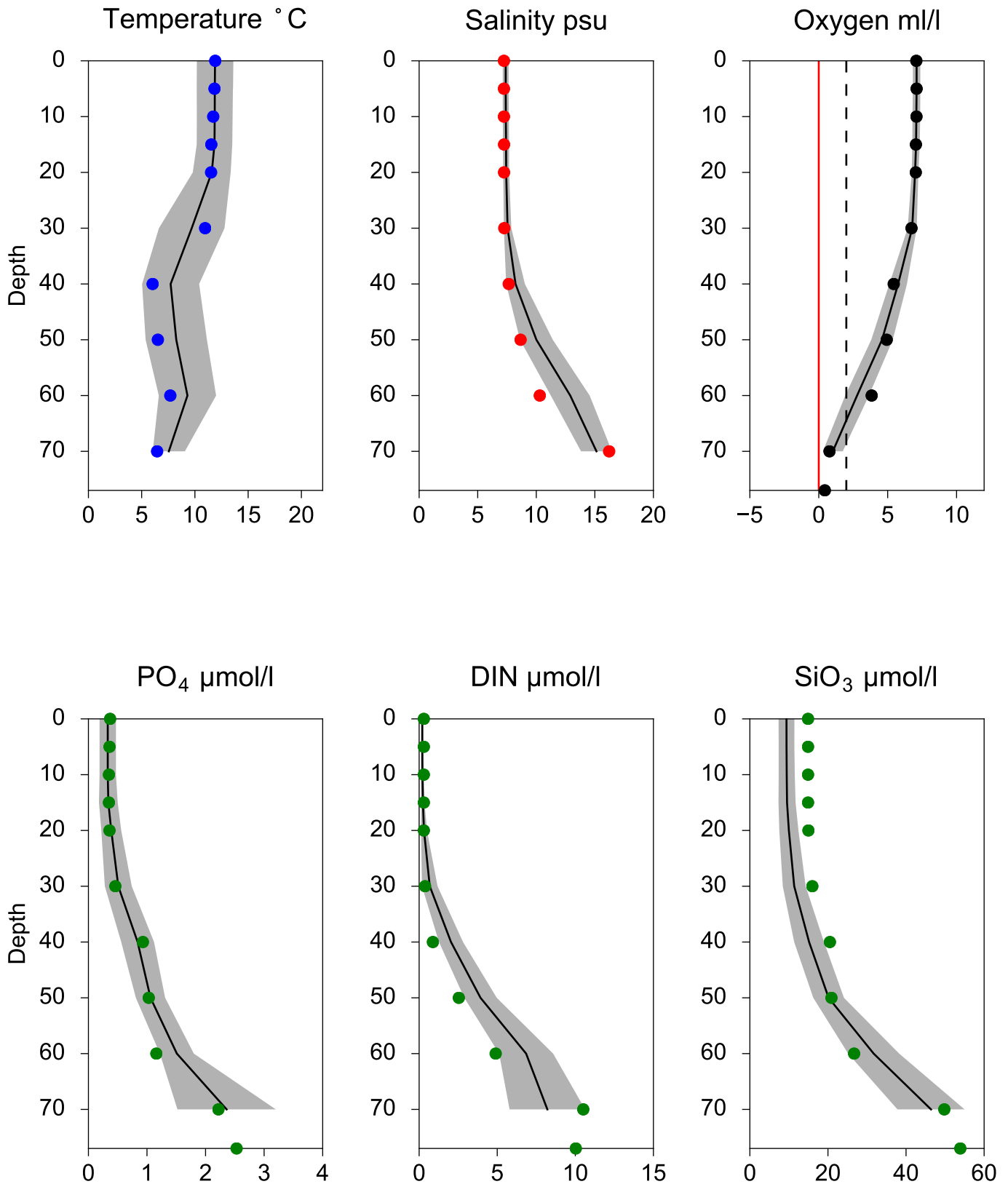


O₂ ml/l



Vertical profiles HANÖBUKTEN October

— Mean 2001-2015 St.Dev. • 2017-10-15



STATION ANHOLT E SURFACE WATER (0-10 m)

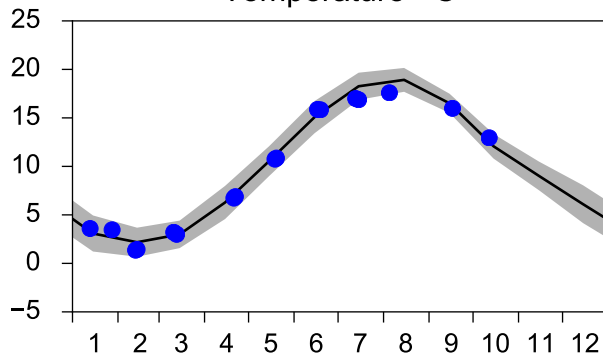
Annual Cycles

— Mean 2001-2015

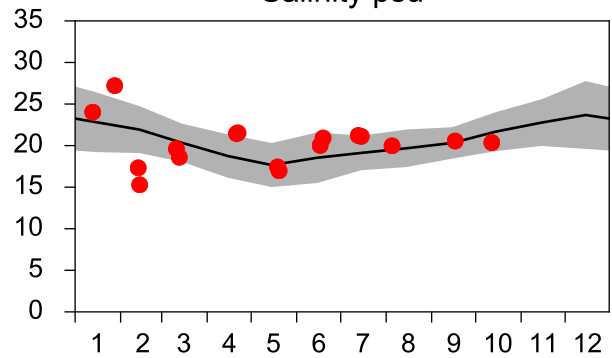
■ St.Dev.

● 2017

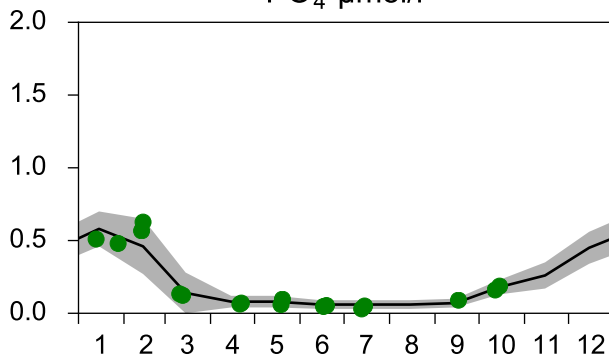
Temperature °C



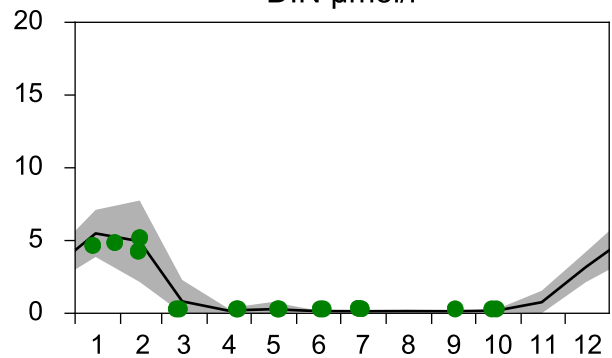
Salinity psu



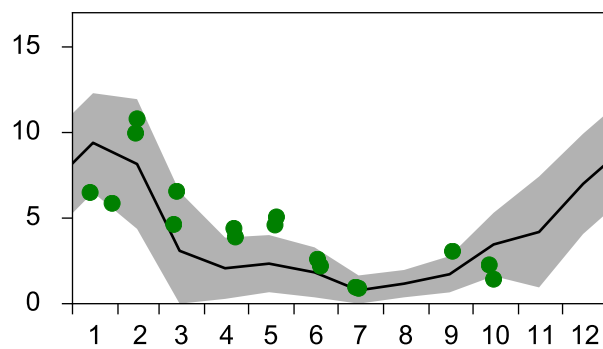
PO₄ µmol/l



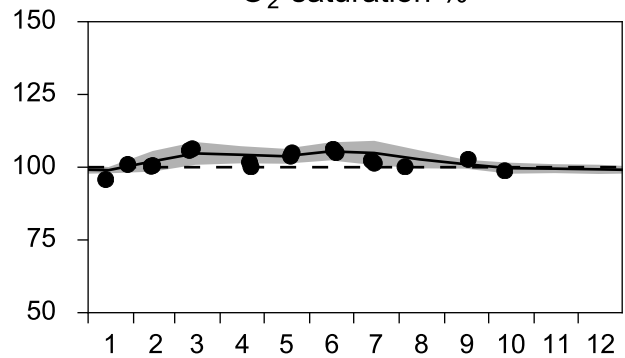
DIN µmol/l



SiO₃ µmol/l

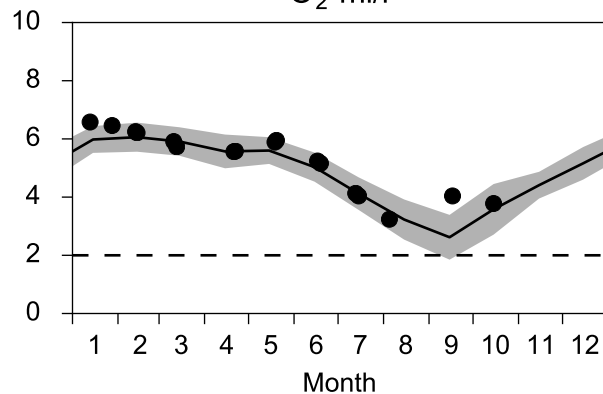


O₂ saturation %

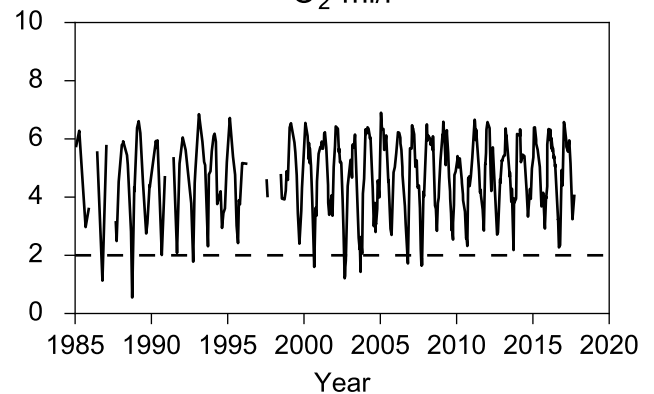


OXYGEN IN BOTTOM WATER (depth >= 52 m)

O₂ ml/l



O₂ ml/l



Vertical profiles ANHOLT E October

— Mean 2001-2015 ■ St.Dev. ● 2017-10-15

