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Oceanographic Laboratory

2016-12-14
Dnr: S/Gbg-2016-143

Report from the SMHI monitoring cruise with R/V Aranda

Survey period: 2016-12-01 to 2016-12-14
Principal: The Swedish Meteorological and Hydrological Institute and the Swedish Agency for Marine and Water Management

SUMMARY

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

In large parts of the deep water in the Baltic Proper the oxygen concentrations were found to be around 0 ml/l, but no high concentrations of hydrogen sulphide was found. Though, in the Western Gotland Basin, hydrogen sulphide was found from depth exceeding 80 meters. Acute hypoxia, < 2 ml/l was found in all basins from 60-70 meters depths in the Baltic Proper.

In Skagerrak and Kattegat all nutrients were lower than normal in the whole upper part of the water column. The opposite was found in the Baltic Proper were all nutrients were elevated to concentrations over or much over normal levels for the season.

The surface water temperature was lower than normal in the Western, Northern and Eastern Gotland Basin and the surface salinity was higher than normal in the Eastern Gotland Basin. In remaining areas normal salinities and temperatures were found.

Next cruise is scheduled to start 7th of January. In addition to the normal sampling, the winter pool of nutrients will be surveyed in the Kattegat area.

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RESULTS

The cruise was performed aboard the Finnish research vessel Aranda and started in Helsinki on the 7th of December and ended in the same port on 14th of December. The winds during the cruise were mainly westerly with varying strength. During the beginning of the cruise, in the Gulf of Finland there were strong winds which declined in the Western Gotland Basin. Fresh to strong winds were also prevailing in Hanö Bight and in the Eastern Gotland Basin.

During the expedition extra zooplankton samples were taken on behalf of Umeå University for future analysis of mercury.

On behalf of the Swedish Agency for Marine and Water Management, photos and films were taken of the bottom at a number of sampling stations during the cruise. The photage will be used to describe the bottom nature type at the sampling stations.

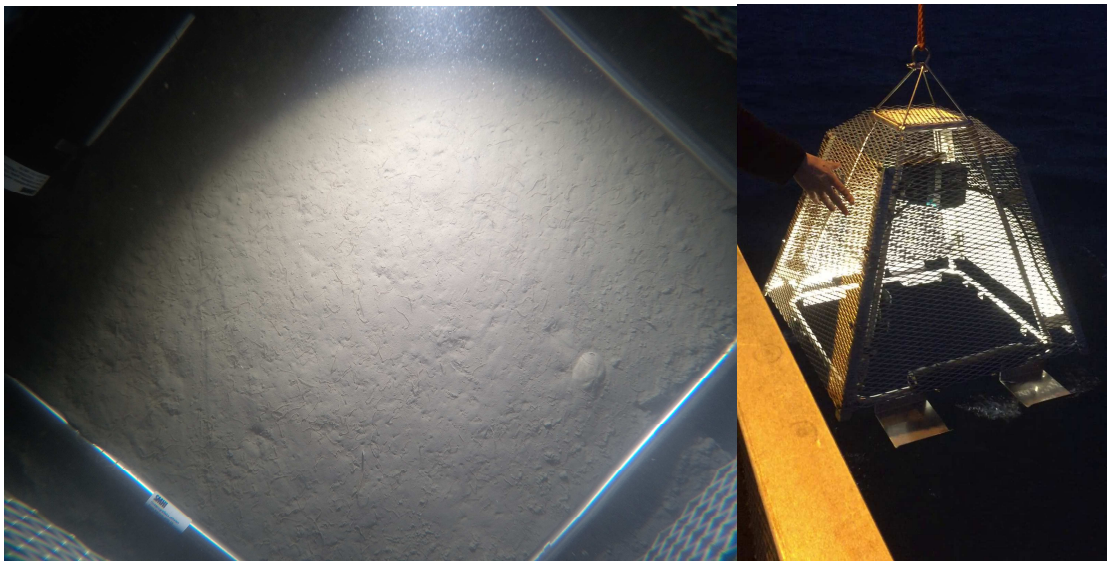

Figure 1. The drop-video rig is equipped with head lights and two Go-pro cameras that both takes pictures and films the bottom. The image is taken at the station P2 in Skagerrak.

This report is based on data that have passed a first quality control. When data are published at the SMHI data centre some values might have changed after further quality controls have been performed. Preliminary data from this cruise are published as soon as possible on the data centres webpage, normally within one or two weeks after a cruise.

Download data here: http://www.smhi.se/klimatdata/oceanografi/havsmiljodata

The Skagerrak

The temperature in the surface water was normal for the season and was found to be just over 7°C. The surface salinity varied from 31-33 psu, somewhat higher than normal near the coast and in the southern parts. In the remaining areas the salinities was found to be normal. The halocline and thermocline was well developed in the outer Skagerrak and coincided at 20 meters depth. In the eastern and southern parts the surface layer was well mixed down to 70-80 meters depth.

Generally, all nutrients showed concentrations lower than normal in the whole water column except from the coastal stations were the concentrations were found to be normal. The concentration of phosphate was about 0.3 µmol/l and inorganic nitrogen (nitrate+ nitrite+ammonia) varied from 3.1 to 3.4 µmol/l. Silicate concentrations varied from 1.7 – 2.0 µmol/l. At Släggö the concentrations were higher, phosphate 0.5 µmol/l, silicate 5.3 µmol/l and inorganic nitrogen 5.1 µmol/l.

The fluorescence from the CTD was low at all stations but some phytoplankton activity could be seen in the surface layer.

The bottom water was well oxygenated, even at the coastal station; Släggö.

The Kattegat and the Sound

The temperature of the surface water was normal for the season and varied between 5.9 – 6.7°C, lowest in the Sound and highest in the northern parts. Surface salinities was highly elevated in the whole areas and varied from 27 – 30 psu in Kattegat and around 23 psu in the Sound. The stratification was found at 5 to 25 meters depth.

The nutrients showed a similar situation as in Skagerrak, hence all nutrients showed concentrations lower or much lower than normal in the whole water column. The phosphate concentration was 0.2-0.3 µmol/l. The inorganic nitrogen had increased to 1.7 - 2.7 µmol/l, in the Kattegat and the Sound. Silicate varied around 1.1-2.2 µmol/l in Kattegat and 4.2 µmol/l in the Sound.

The deep water was well oxygenated in the whole Kattegat as well as in the Sound. The concentrations in the bottom water varied around 5 ml/l.

The fluorescence from the CTD indicated phytoplankton activity down to 20 meters depth in the whole area.

The Baltic Proper

The temperature in the surface water was lower than normal in the Western, Northern and Eastern Gotland Basin and varied between 5.7°C, in the northern parts to 7.7°C in southwest. The salinity was higher than normal in the surface water in the Eastern Gotland Basin but normal in the remaining areas. The surface salinity was lowest in the Western Gotland Basin with 6.8 psu and highest in Arkona Basin with 8 psu. The halocline and thermocline was found at 40-55 meters depth. In the Arkona basin the stratification was weakly developed and was found shallower at 20-25 meters depths.

The phosphate concentrations were elevated in the whole investigated area with the exception of the Arkona- and Bornholm Basin where normal conditions prevailed. The concentrations varied between 0.5 and 0.7 µmol/l. The concentrations of inorganic nitrogen was also highly elevated and varied from 2.4 to 4.3 µmol/l. Silicate concentrations continued to be highly elevated in the whole area and varied between 12 - 18 µmol/l.

In large parts of the Baltic Proper deep water, oxygen concentration near 0 ml/l was found, but no high concentrations of hydrogen sulphide was noted. The only exception was the Western Gotland Basin where hydrogen sulphide still was found at high concentrations from 80 meters depth. In the Eastern Gotland Basin (BY15) anoxic conditions was found at the bottom (235 meters) but north of that station at the Fårö deep (BY20) no hydrogen sulphide was found but the concentration of oxygen was close to 0 ml/l. Acute hypoxia, < 2ml/l, was found in all basins at depths exceeding 60-70 meters depth.

The fluorescence measurements from the CTD showed low phytoplankton activity in the whole investigated area.

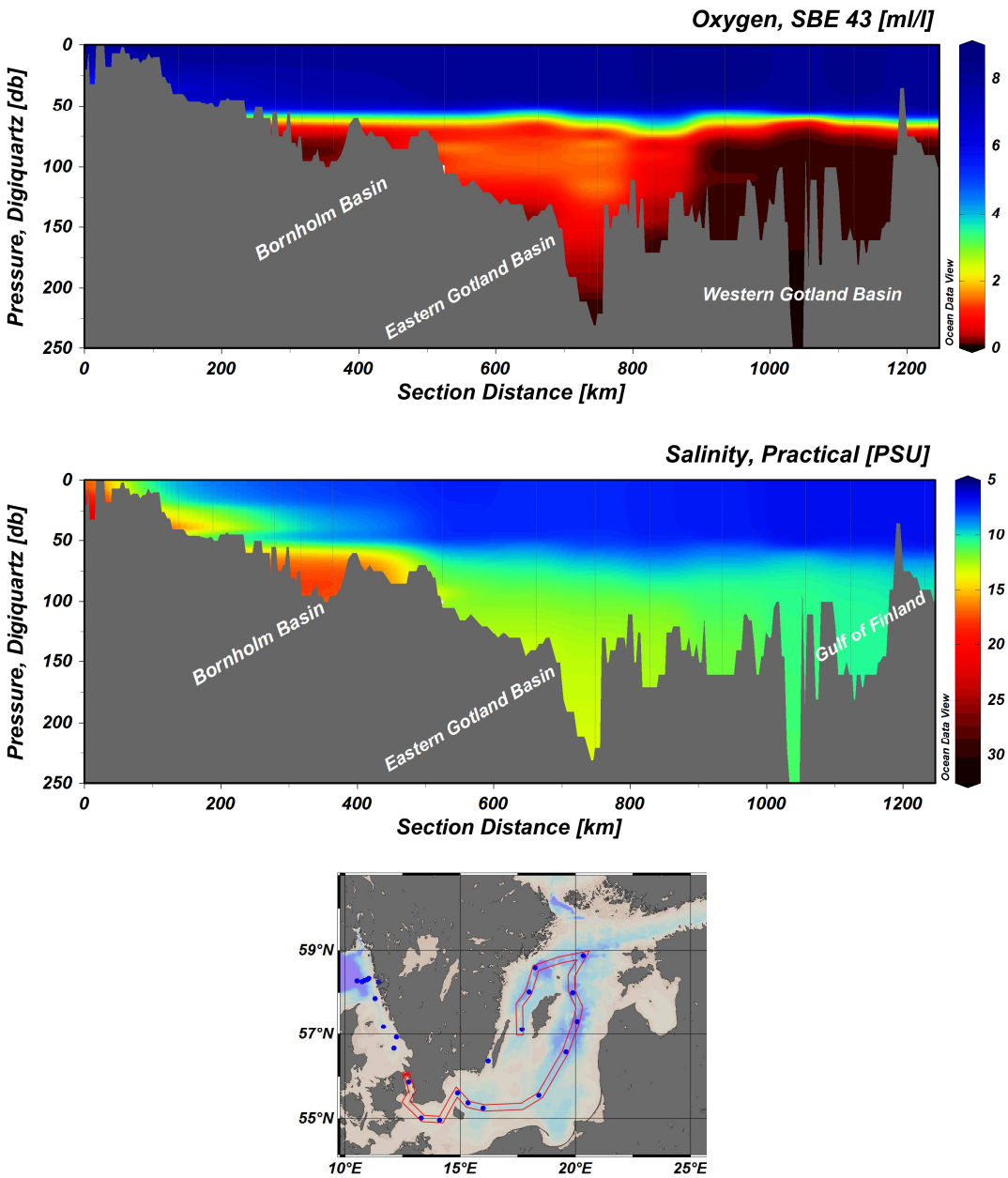

Figure 2. Transect showing oxygen and salinity through the Baltic Proper, from the Sound to the Eastern and Western Gotland Basin.

SMHI

PARTICIPANTS

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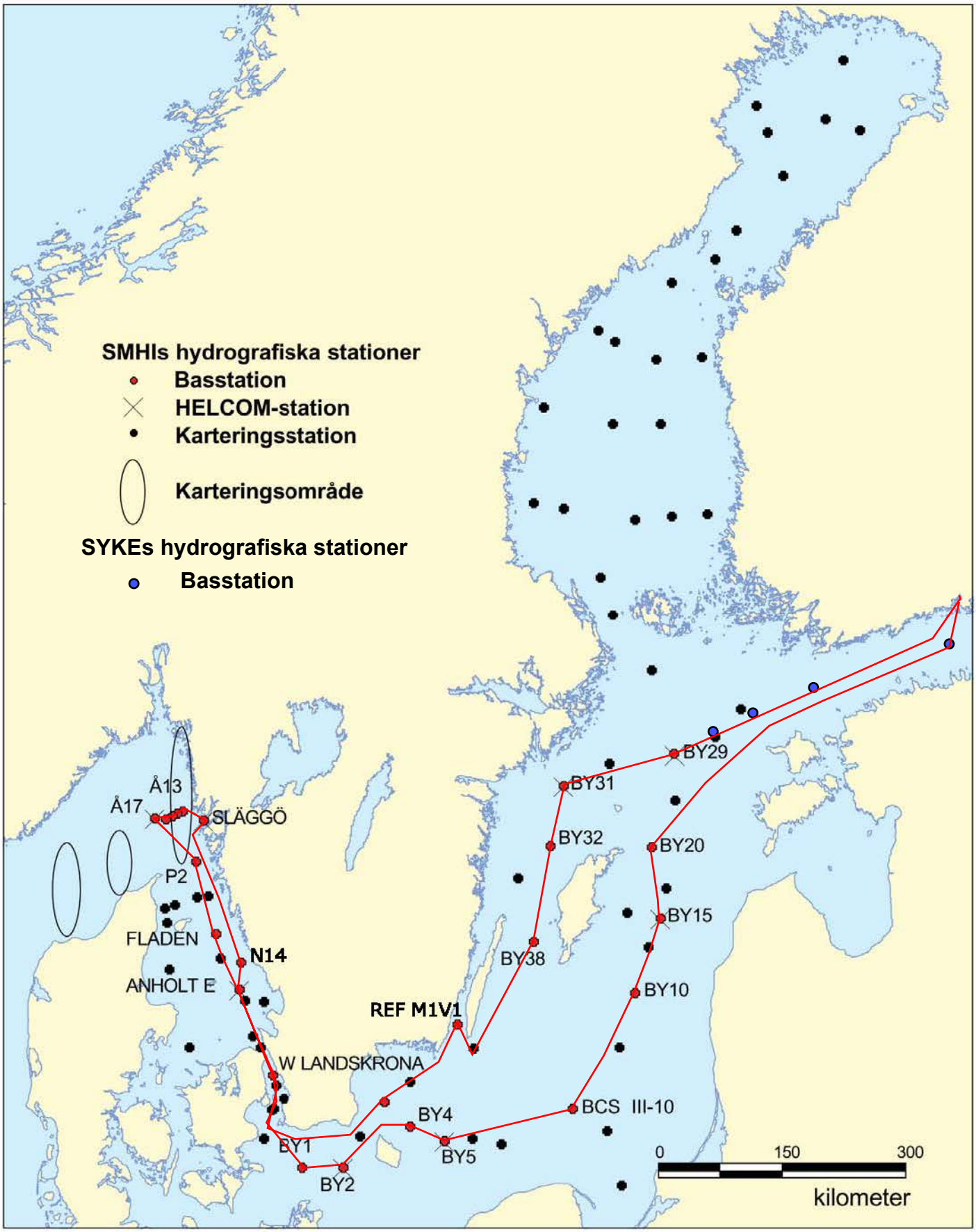
APPENDICES

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


SMHIs hydrografiska stationer
Basstation
HELCOM-station
Karteringsstation
Karteringsområde
SYKEs hydrografiska stationer
Basstation
Å13
Å17
SLÄGGÖ
P2
FLADEN
N14
ANHOLT E
REF M1V1
W LANDSKRONA
BY1
BY2
BY4
BY5
BY38
BY32
BY31
BY29
BY20
BY15
BY10
BCS III-10
0
150
300
kilometer

Date: 2016-12-14
Time: 23:17

Ship: AR
Year: 2016, 2026

Ser no	Cru no	Stat code	Proj	Stat name	Lat	Lon	Start date yyyymmdd	Start time hhmm	Bottom depth m	Secchi depth m	Wind di ve	Air temp C	Air pres hPa	WCWI elac aove tueo hdsb	BSHP imop gas le nl e tn e t	No de	T e m p b t l	T e m p b t d	S a m p l c t l	S a m p l b t d	P h o s p h a t	D o x y l	D o x y b t l	H o 2 s	P h o s p h a t	P o r t i n g	N i t r i t e	N i t r a z o n e	N i t r a t e	A m m o n i a	N i t r o g e n	A s k o r b i n s i	S u m 3 - s i	H u m u s	C l o r i d e	D e p t h	P o s i t i o n	T e m p e r a t u r e	P h e n o l n i n	L i g n i n	Y e l l o w	A e r a t i o n	U r e a	C o n d u c t i v i t y	C o m m e n t
0602	20	BPNX35	BAS	BY29/LL19	5852.91	02019.66	20161208	0230	175		28	11.5	5	1001	9990	-xx-	16	x	x	-	x	-	x	x	x	-	x	x	x	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
0603	20	BPNX37	BAS	BY31 LANDSORTSDJ	5836.62	01814.18	20161208	1020	445	8	28	11	8	997	2740	2xx-	23	x	x	-	x	x	x	x	x	-	x	x	x	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
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0605	20	BPWX45	BAS	BY38 KARLSÖDJ	5707.02	01740.12	20161208	2310	110		27	11	7	1008	9990	-xx-	14	x	x	-	x	-	x	x	x	-	x	x	x	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
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0611	20	KAEX29	BAS	ANHOLT E	5640.11	01206.68	20161210	1250	62		27	10	7	1009	2840	-xx-	10	x	x	-	x	-	x	x	-	x	-	x	x	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	x
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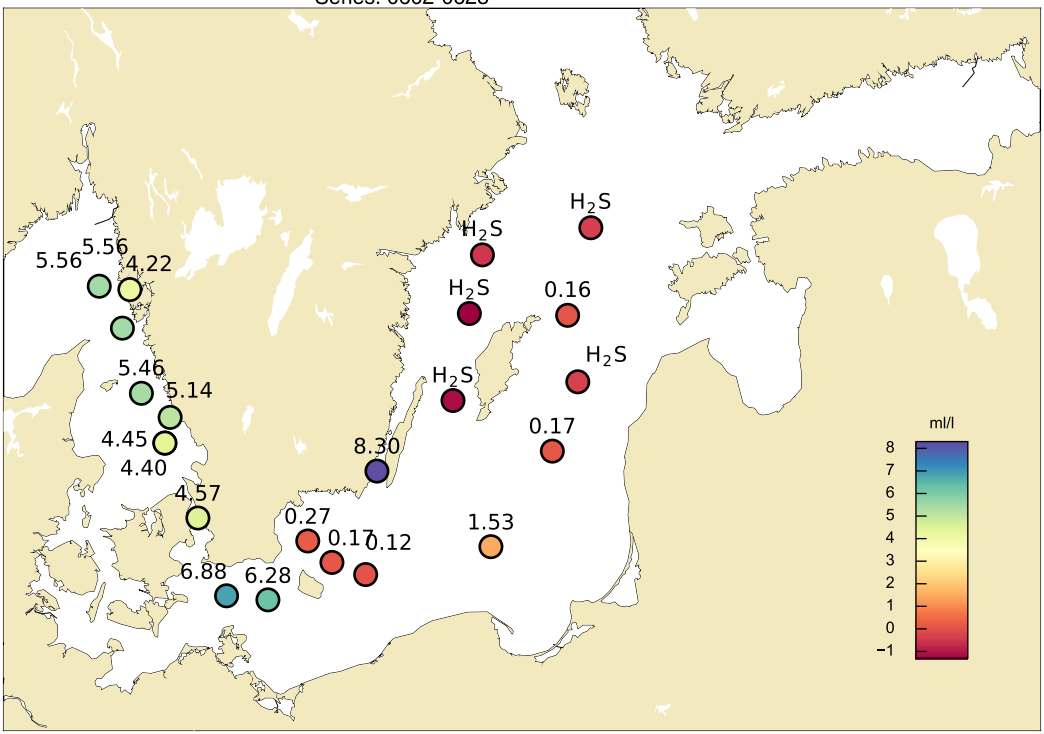
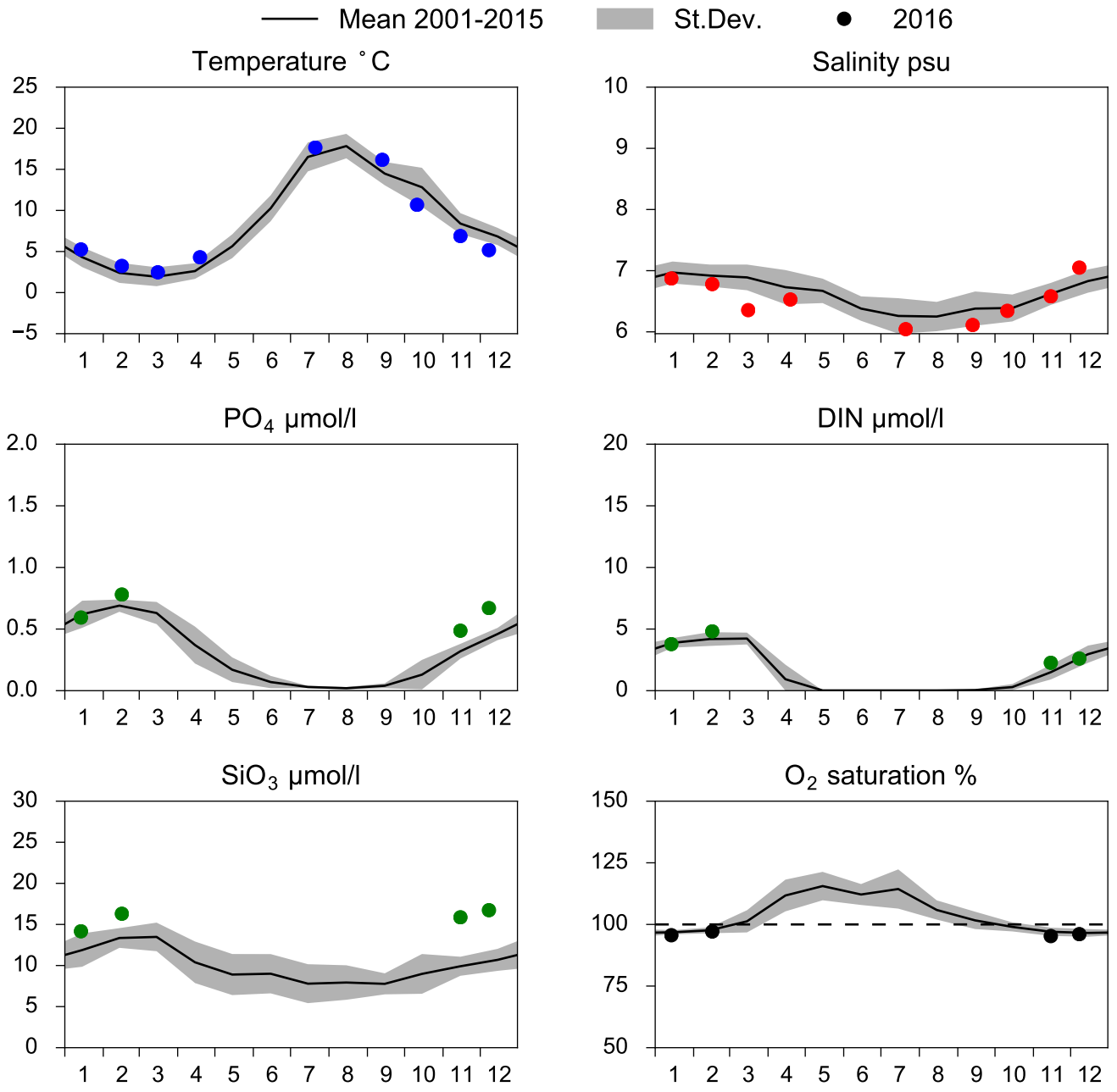
Ship: Aranda
Date: 20161207-20161214
Series: 0602-0628

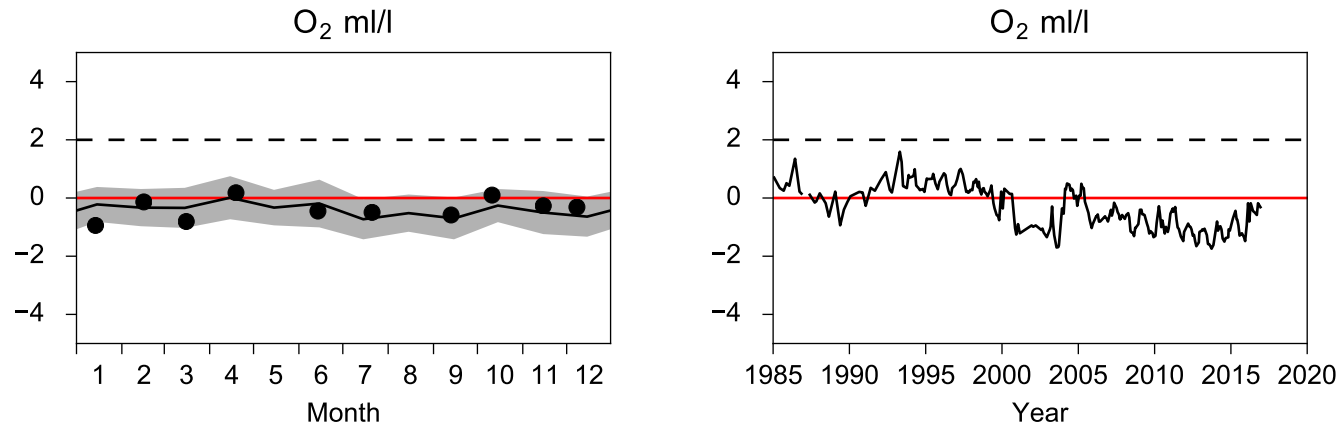


STATION BY29 / LL19 SURFACE WATER (0-10m)

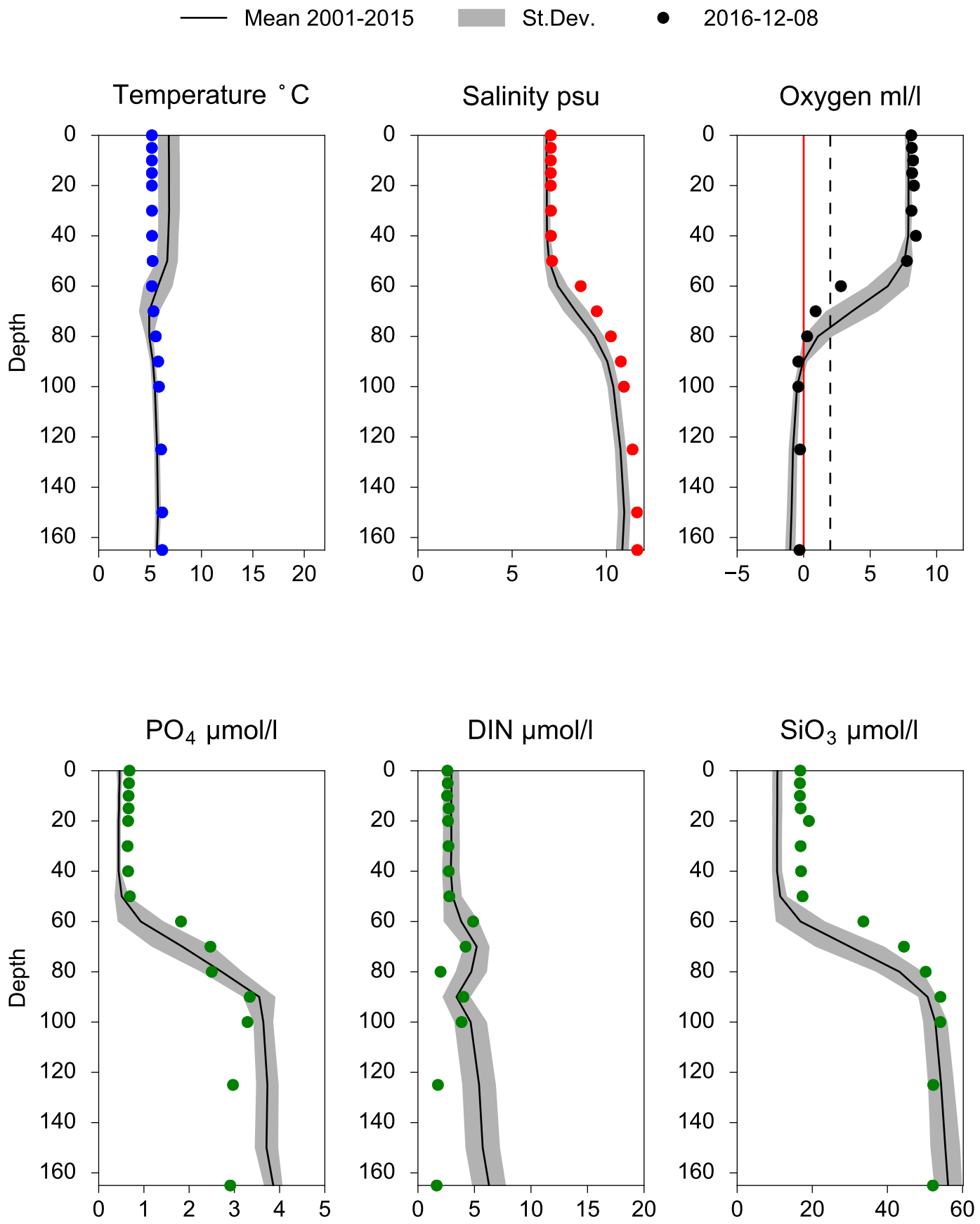
Annual Cycles



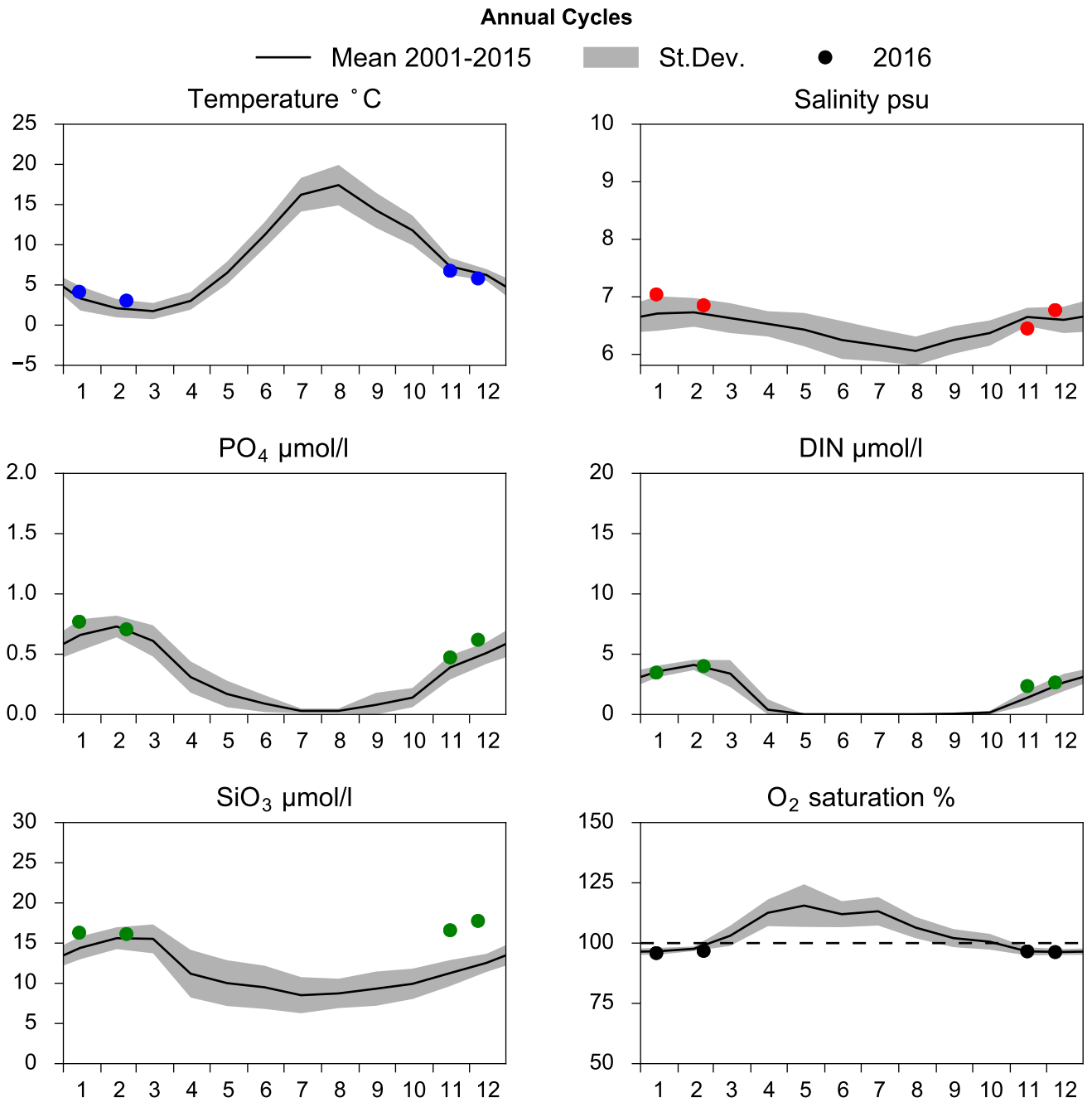
OXYGEN IN BOTTOM WATER (depth >= 150 m)



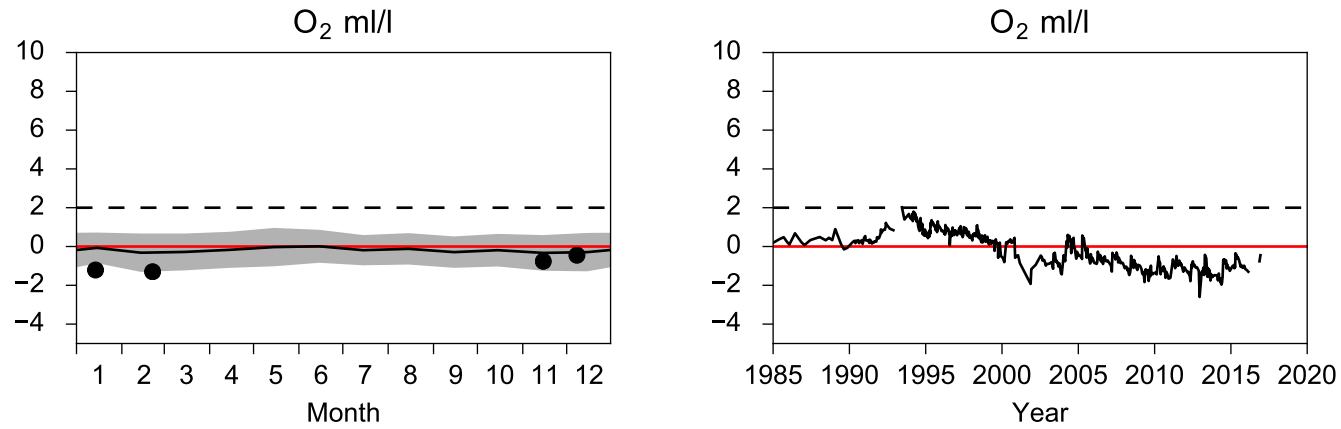
Vertical profiles BY29 / LL19
December



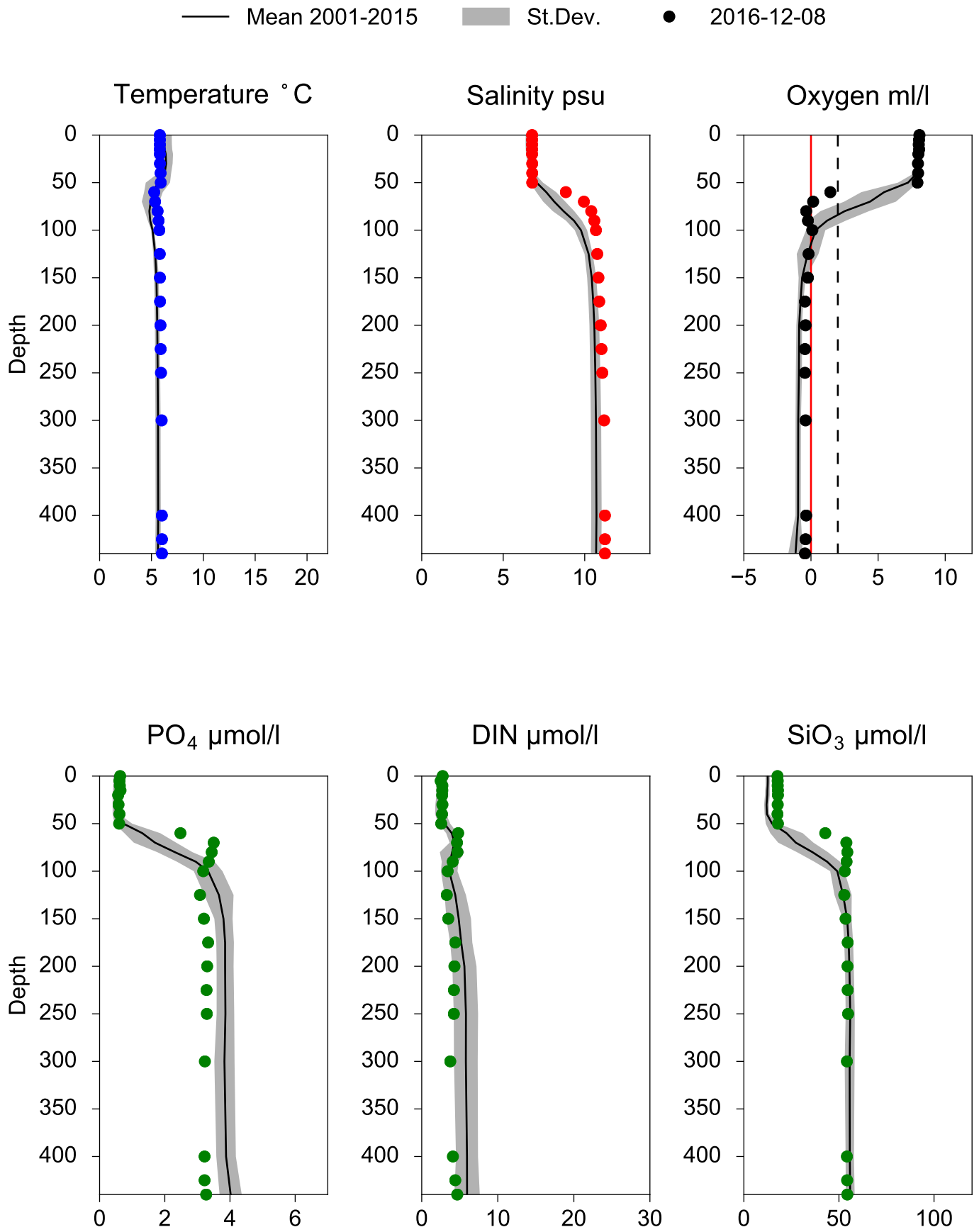
STATION BY31 LANDSORTSDJ SURFACE WATER (0-10m)



OXYGEN IN BOTTOM WATER (depth >= 425 m)



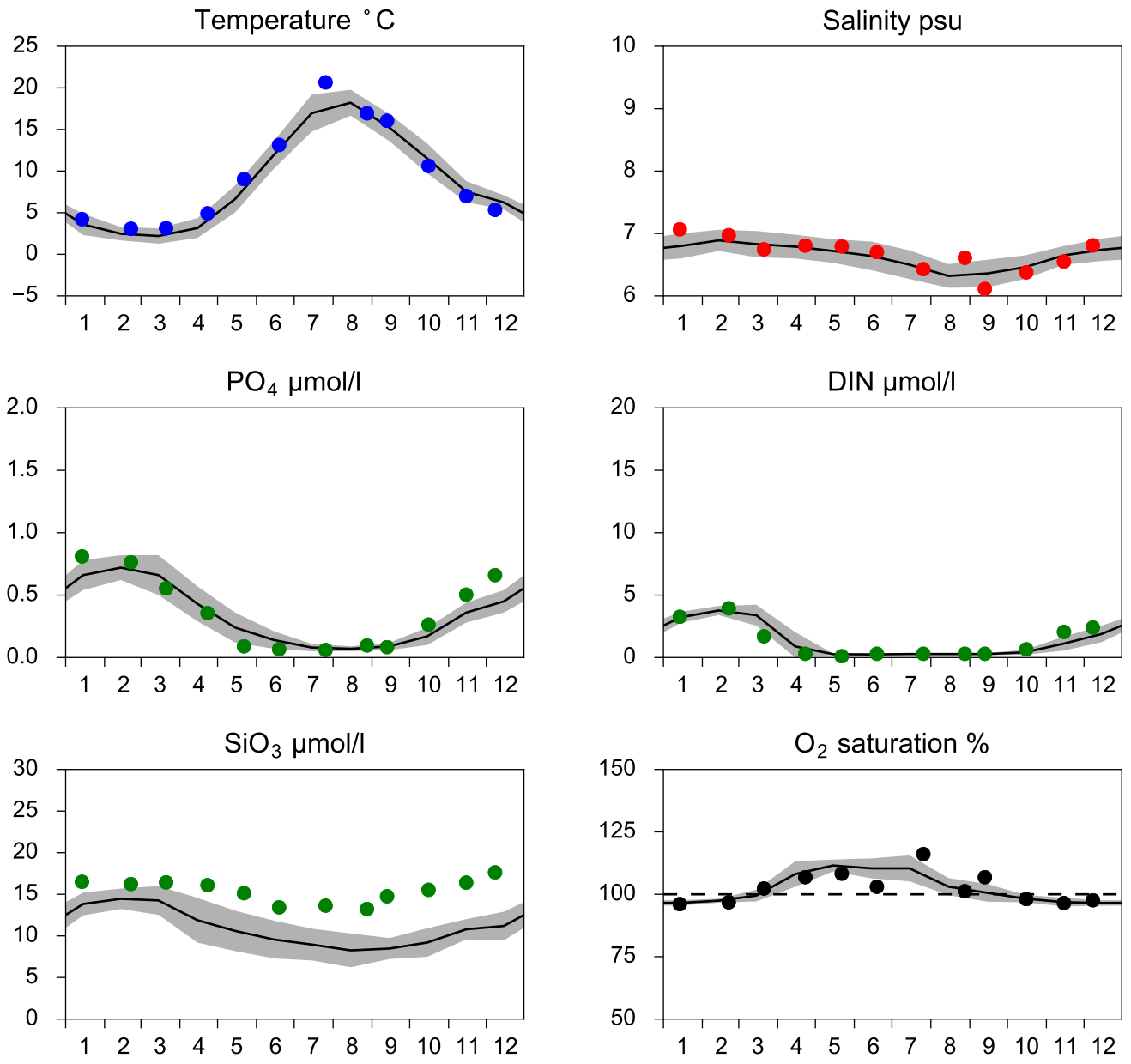
Vertical profiles BY31 LANDSORTSDJ
December



STATION BY32 NORRKÖPINGSDJ SURFACE WATER (0-10m)

Annual Cycles

Mean 2001-2015 | St.Dev. | 2016



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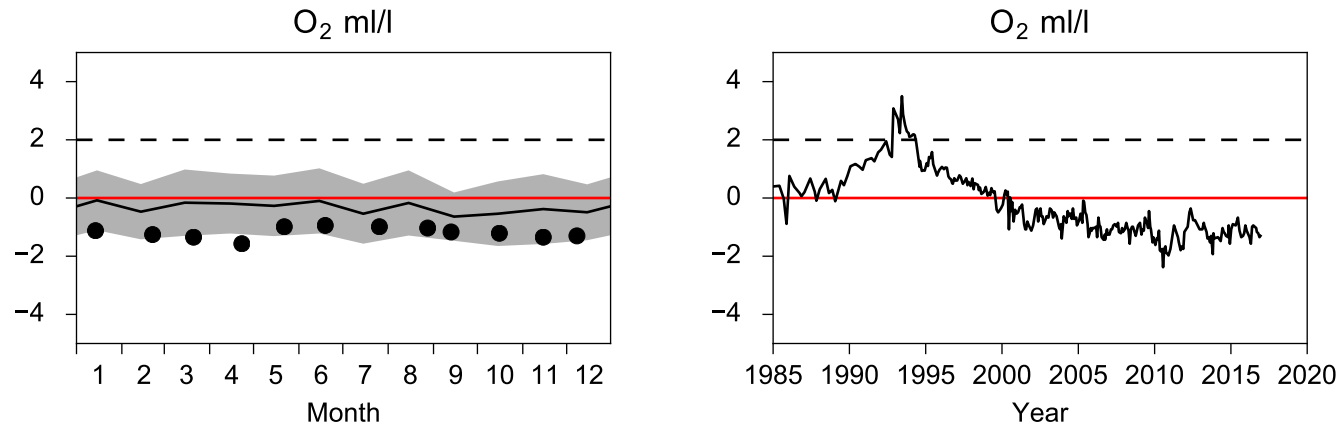
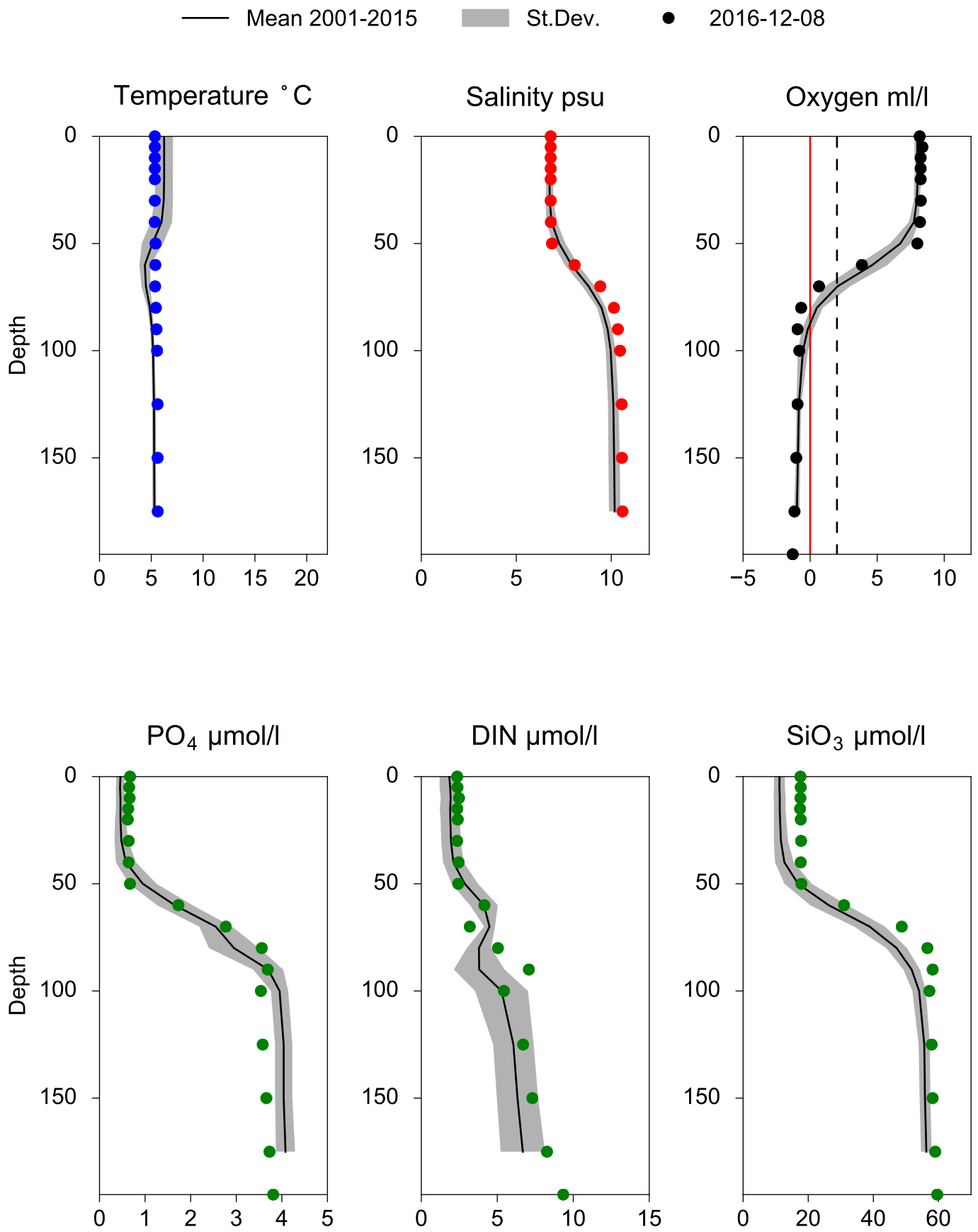


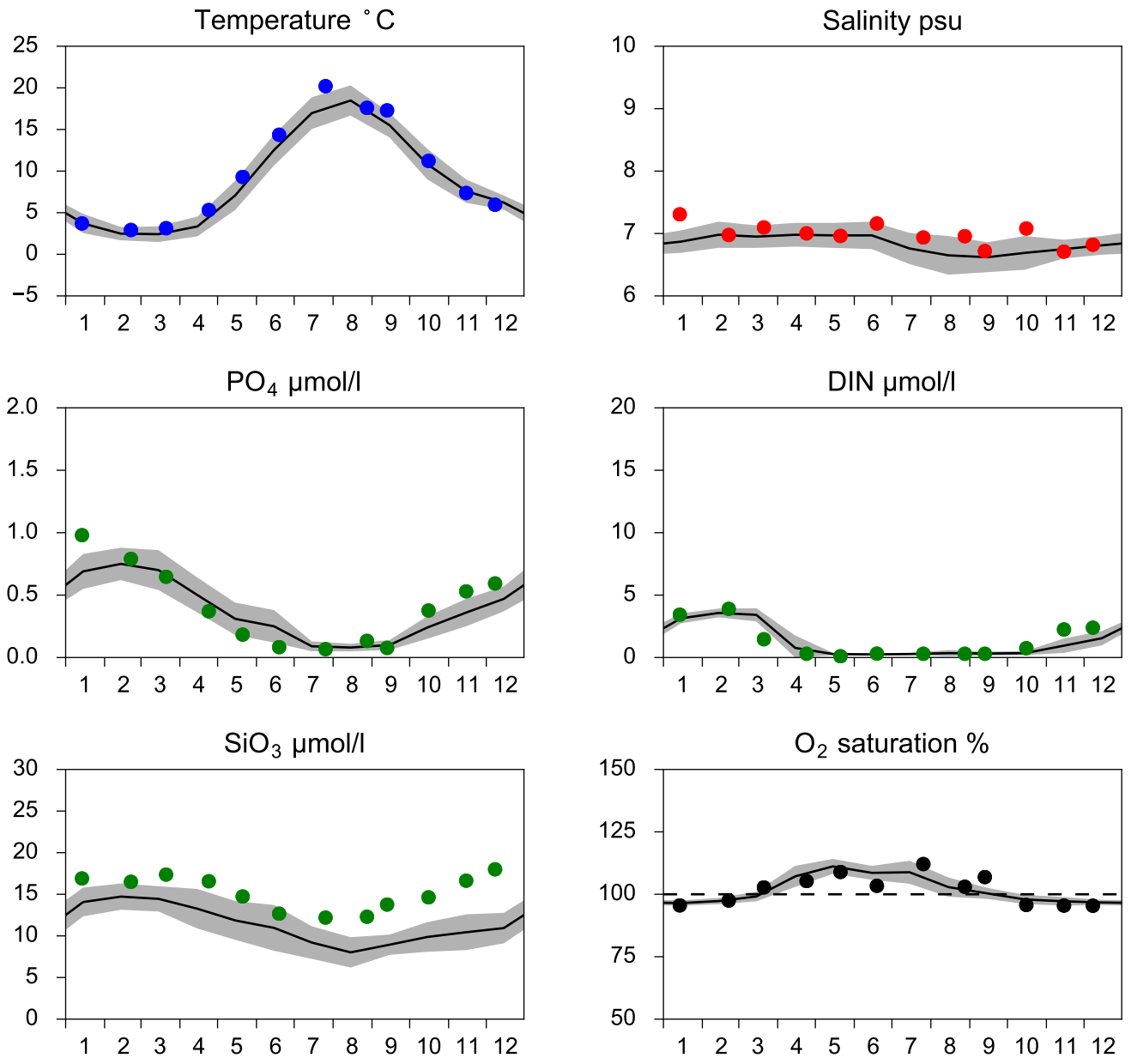
Vertical profiles BY32 NORRKÖPINGSDJ
December



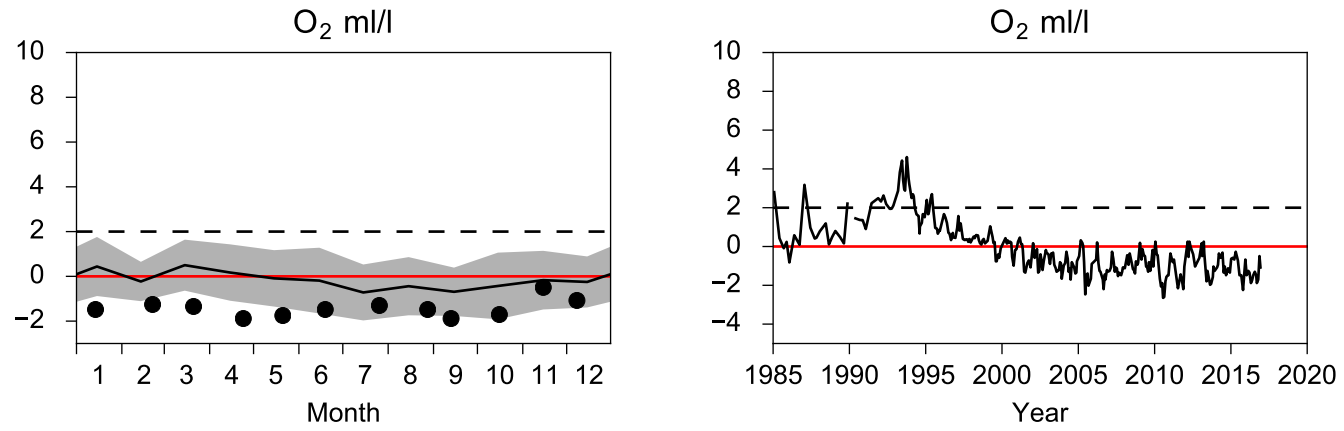
STATION BY38 KARLSÖDJ SURFACE WATER (0-10m)

Annual Cycles

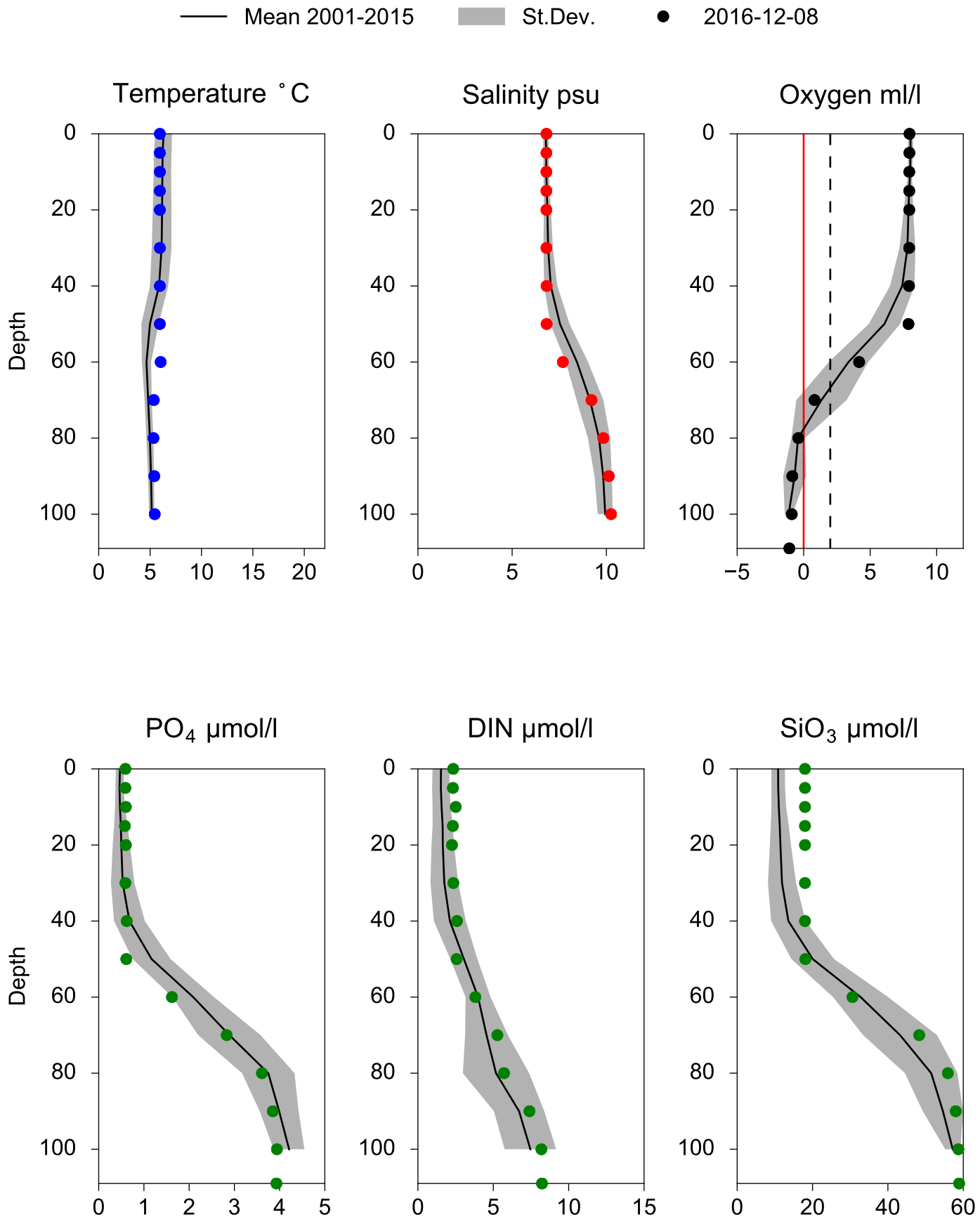
Mean 2001-2015 | St.Dev. | 2016



OXYGEN IN BOTTOM WATER (depth >= 100 m)



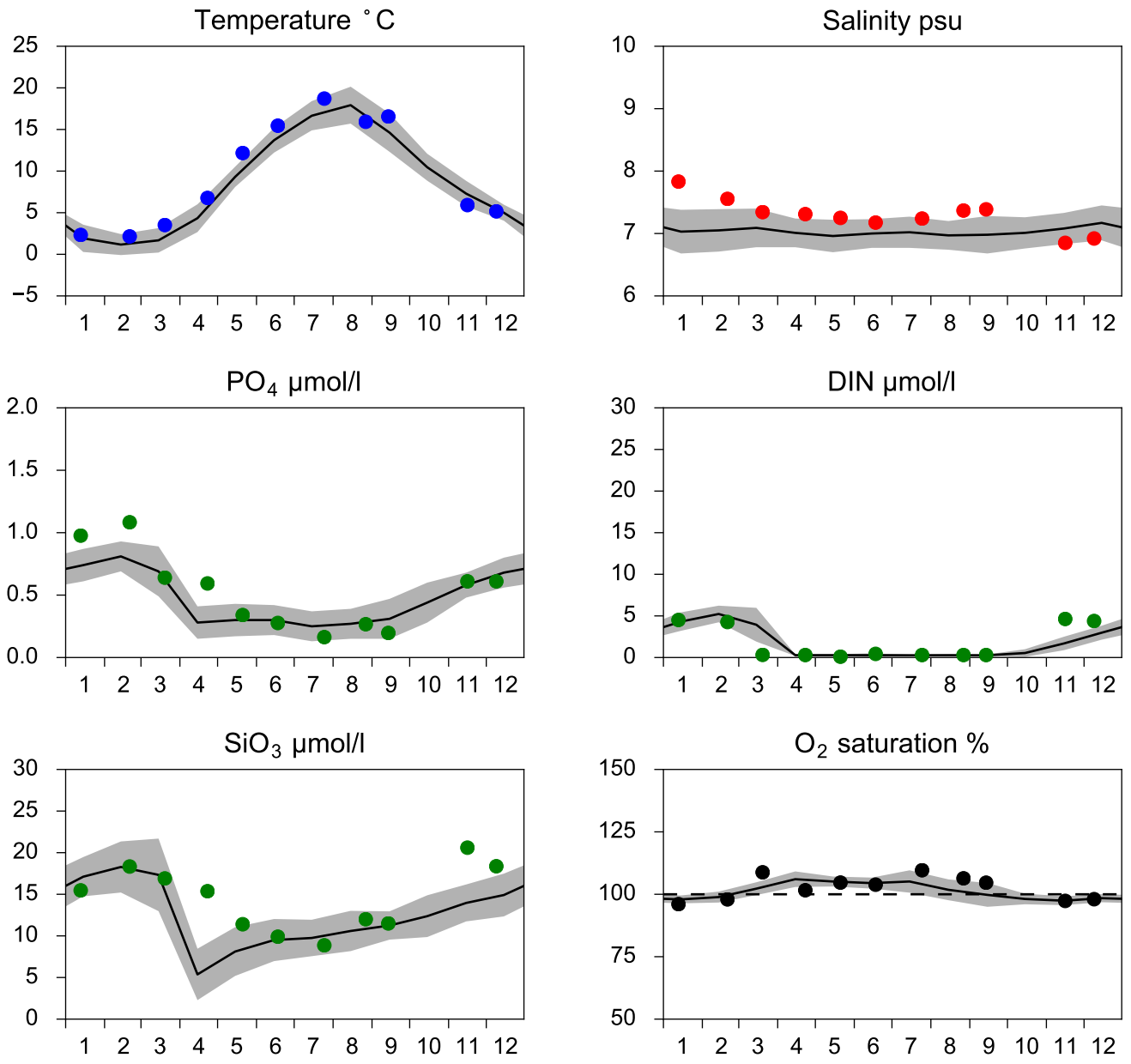
Vertical profiles BY38 KARLSÖDJ
December



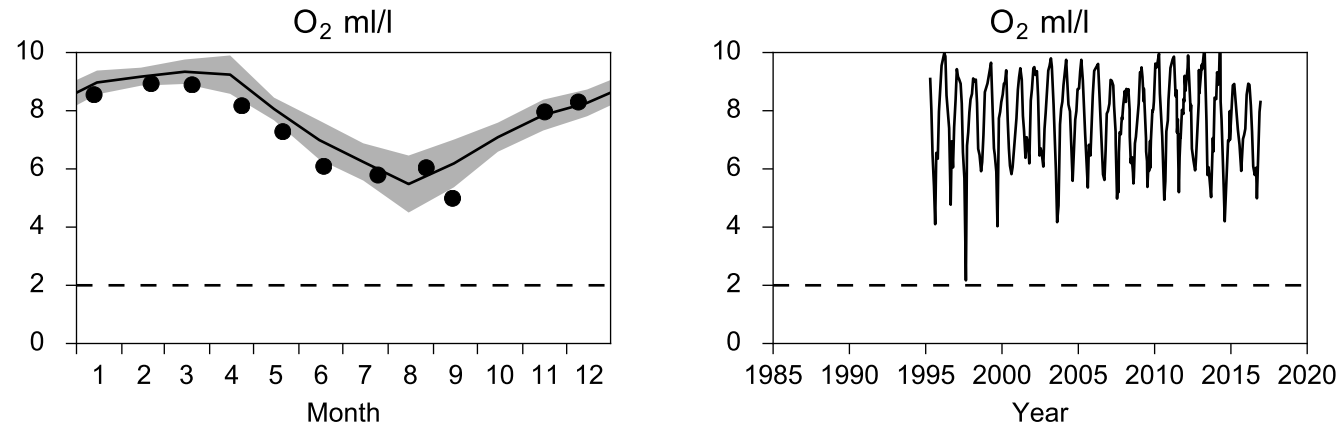
STATION REF M1V1 SURFACE WATER (0-10m)

Annual Cycles

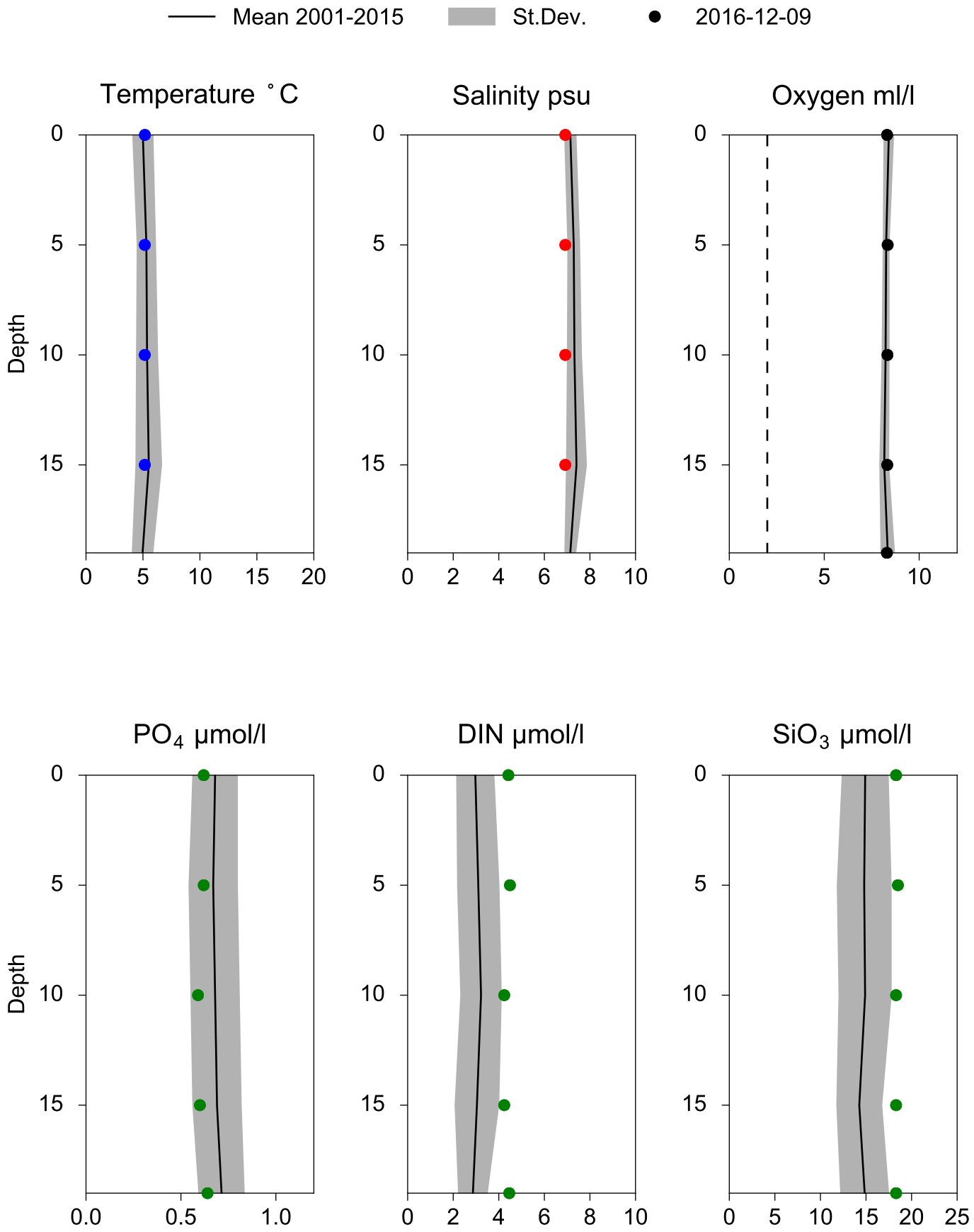
Mean 2001-2015 | St.Dev. | 2016



OXYGEN IN BOTTOM WATER (depth >= 17 m)

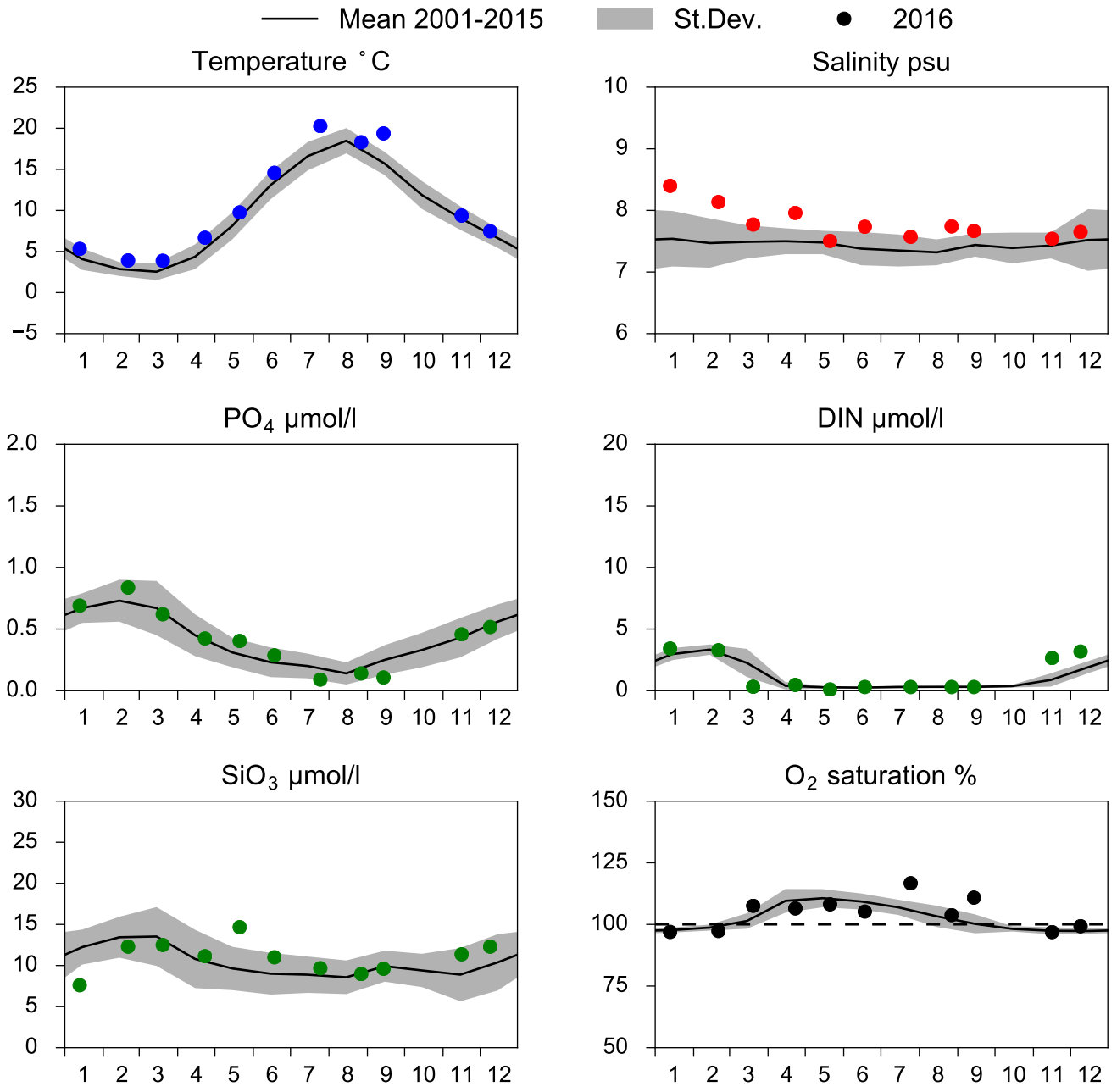


Vertical profiles REF M1V1
December

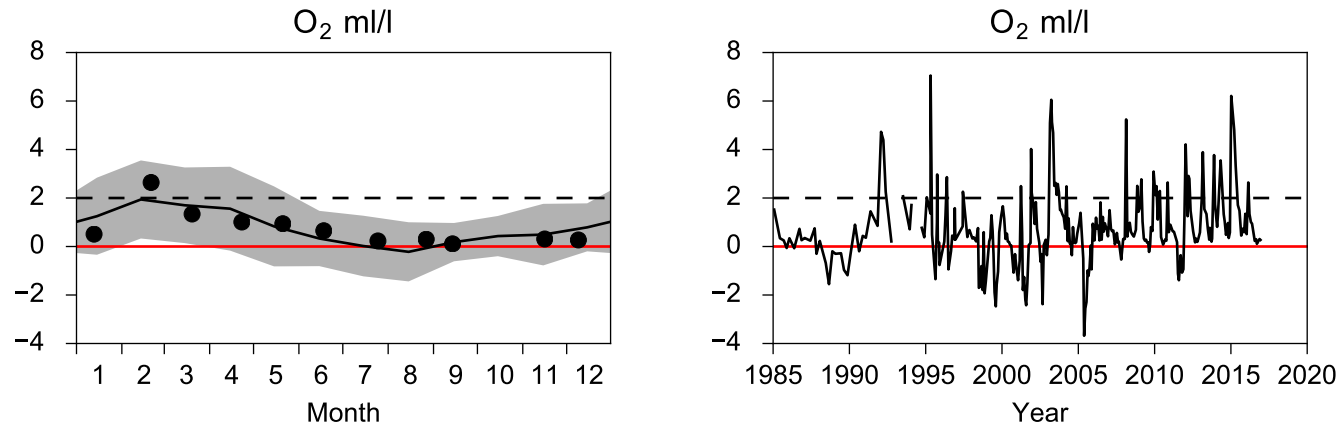


STATION HANÖBUKTEN SURFACE WATER (0-10m)

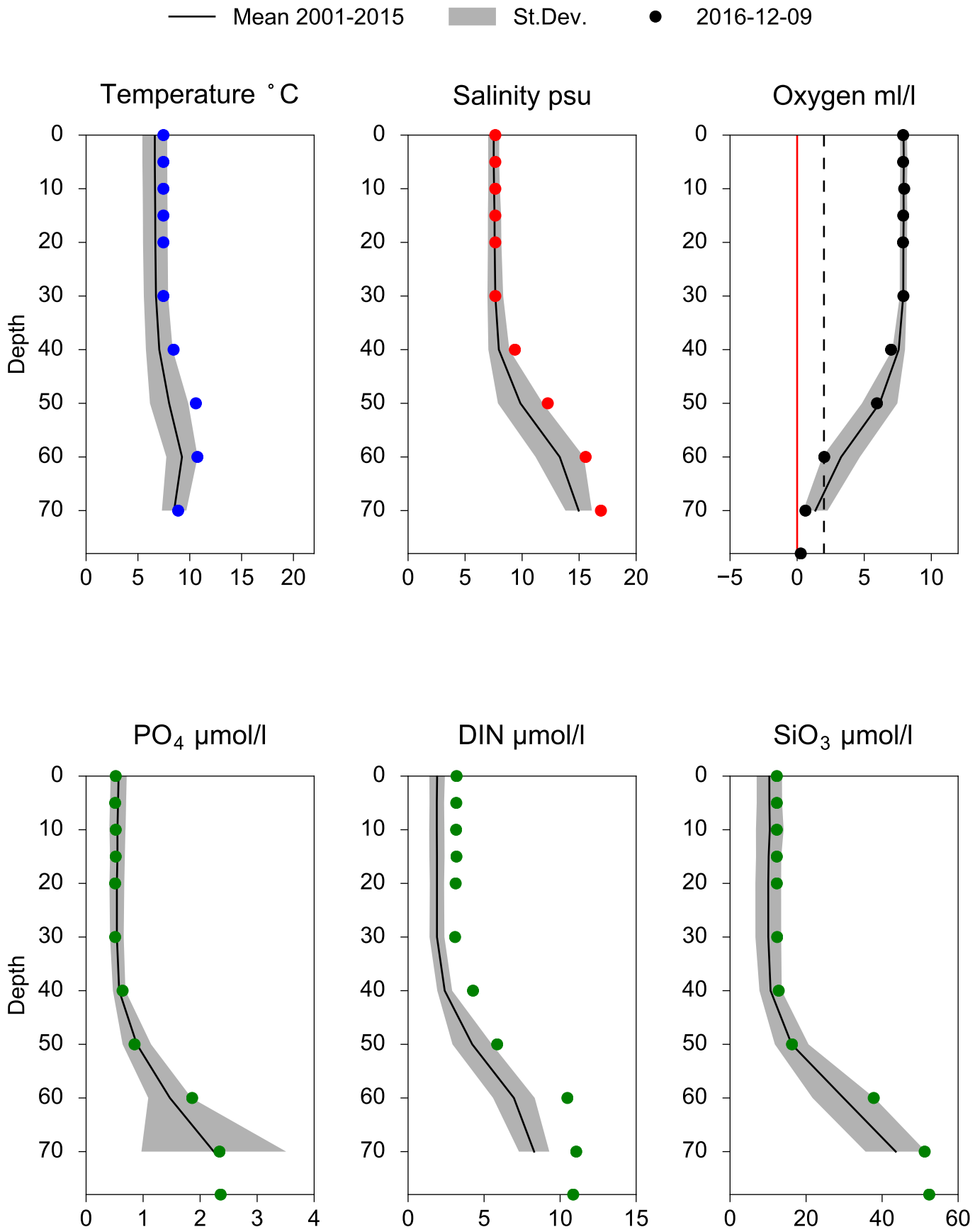
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 70 m)



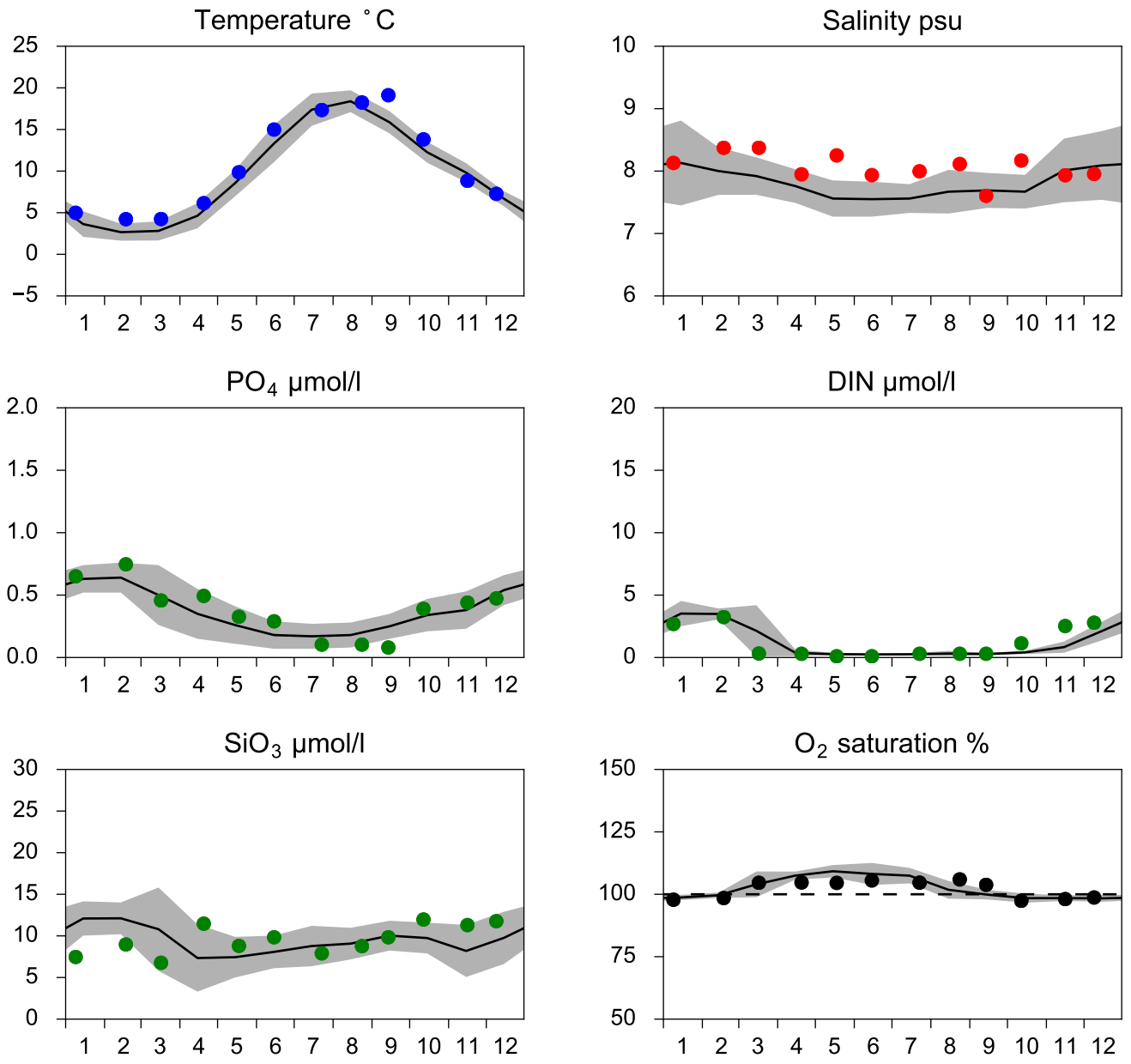
Vertical profiles HANÖBUKTEN
December



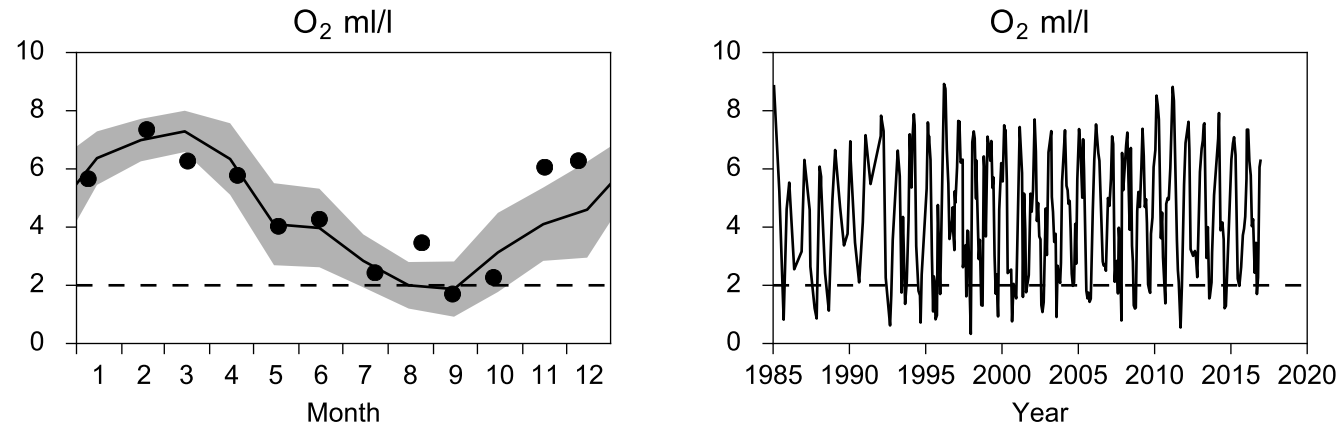
STATION BY2 ARKONA SURFACE WATER (0-10m)

Annual Cycles

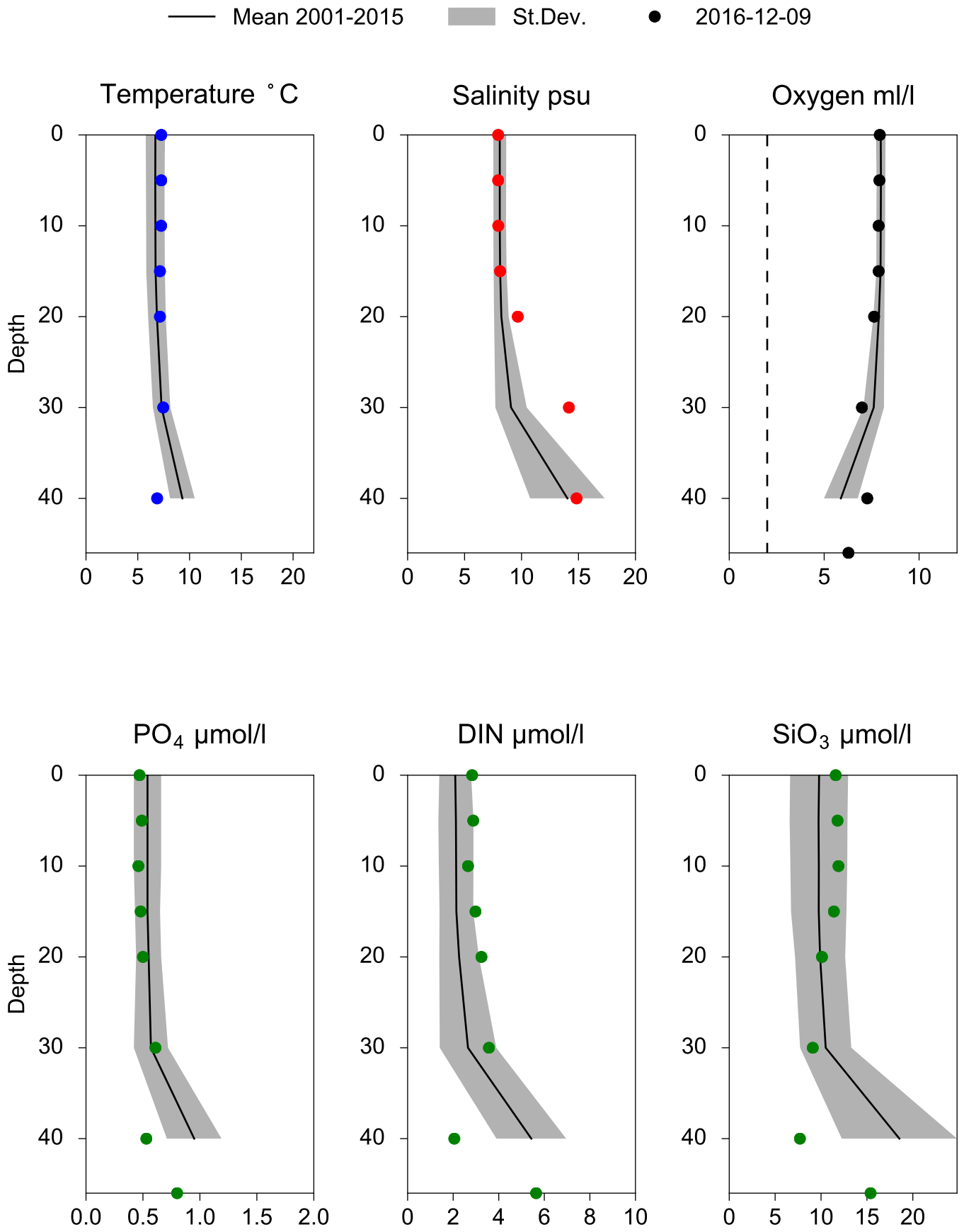
Mean 2001-2015 | St.Dev. | 2016



OXYGEN IN BOTTOM WATER (depth >= 40 m)

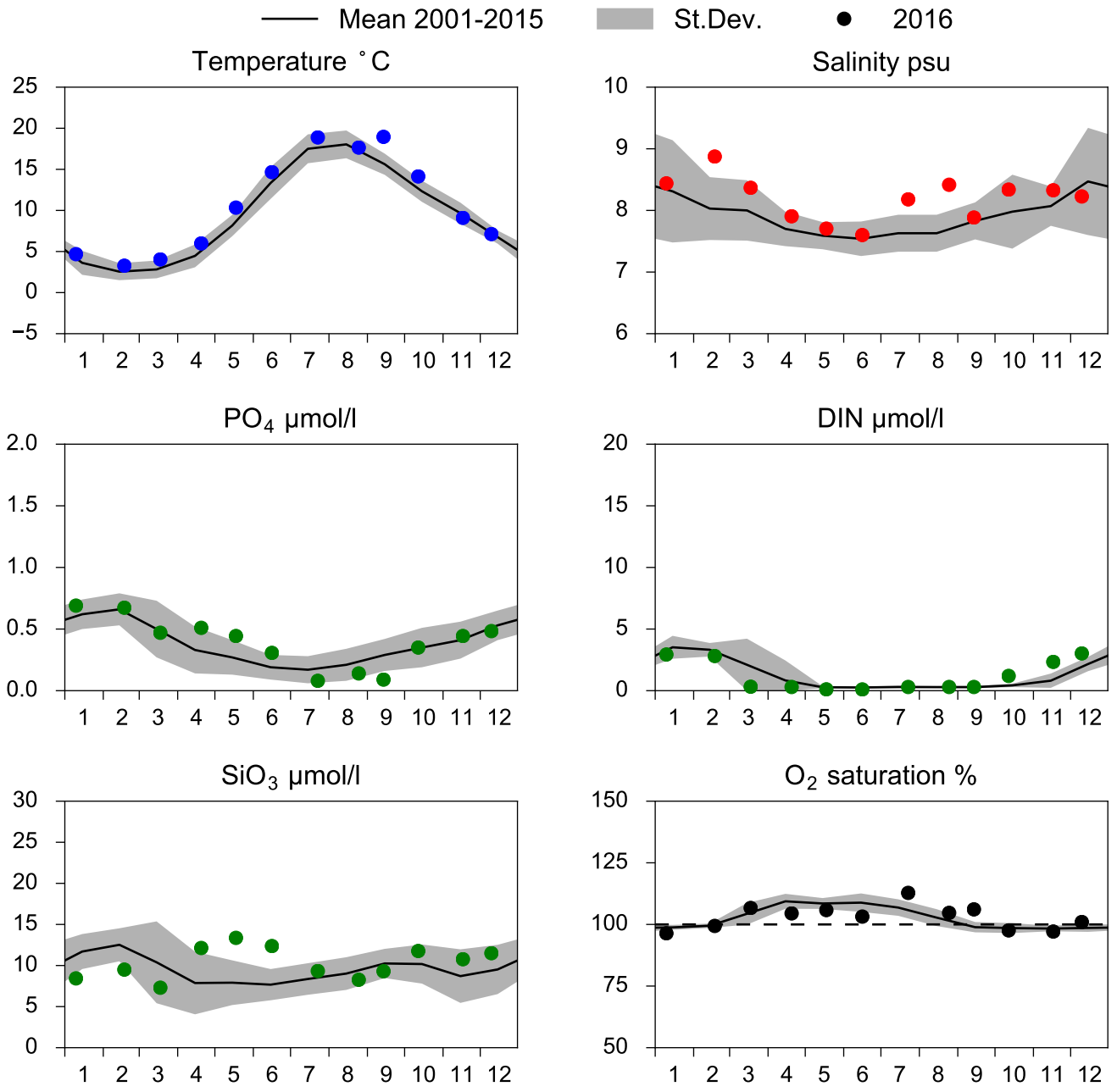


Vertical profiles BY2 ARKONA
December

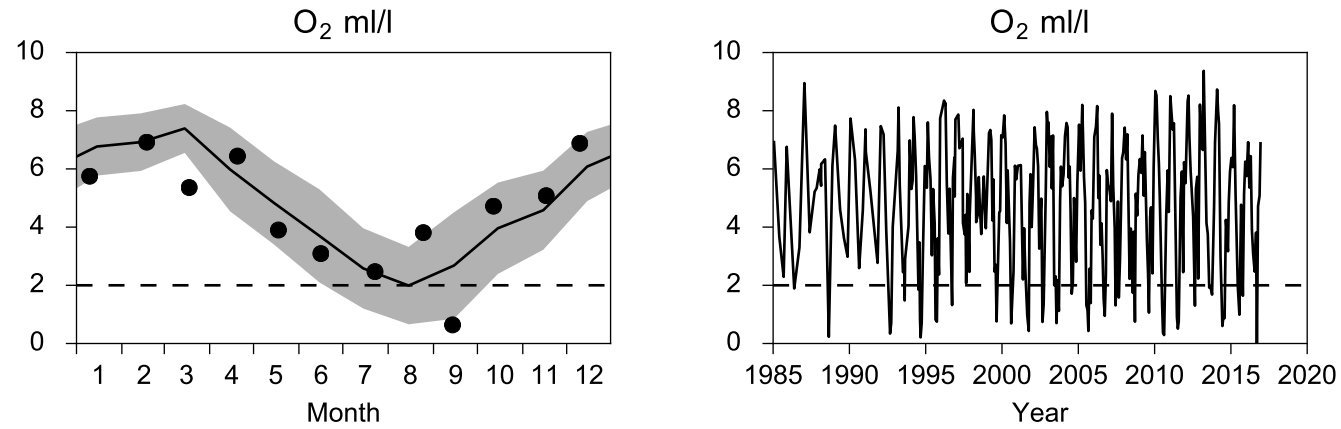


STATION BY1 SURFACE WATER (0-10m)

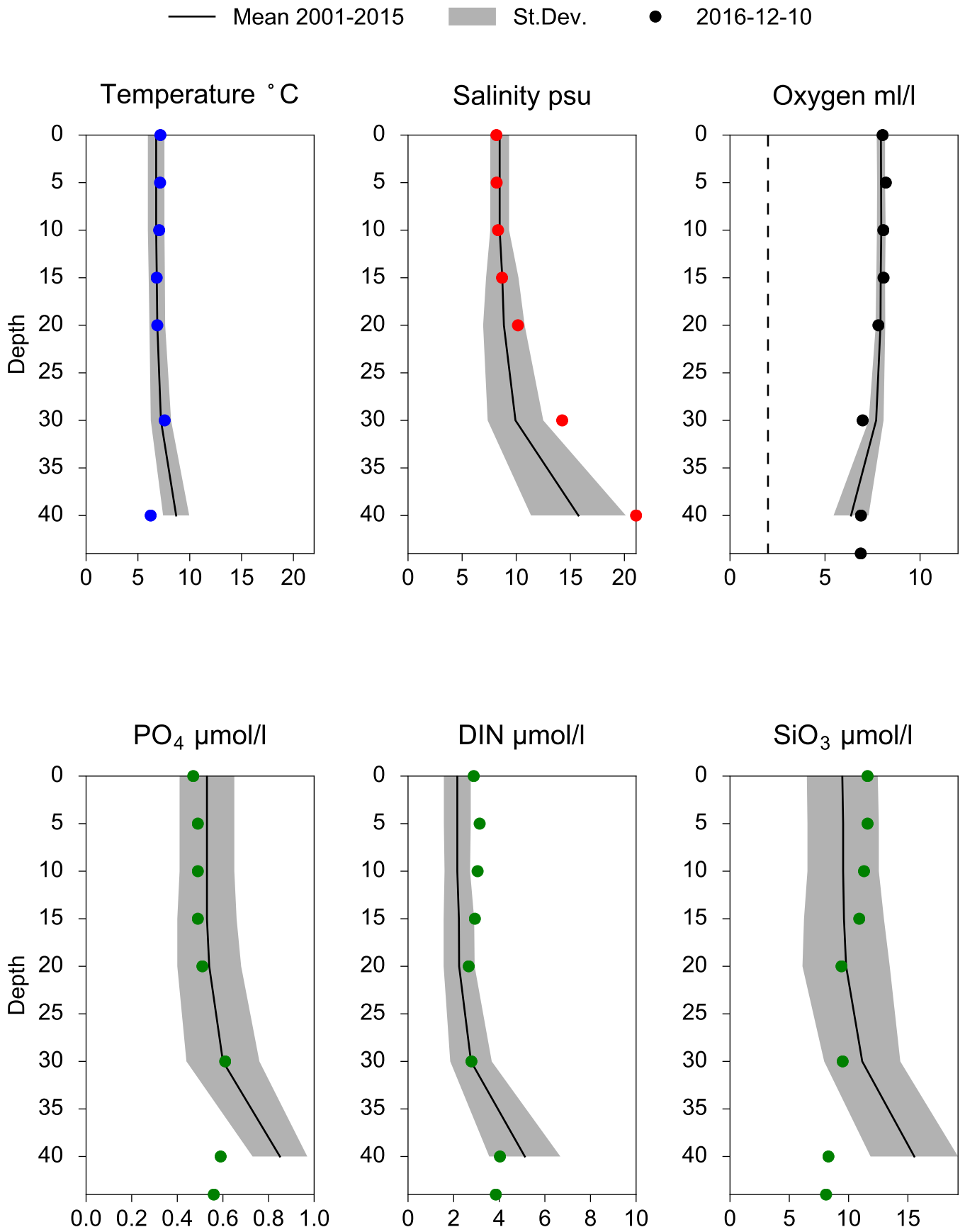
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 40 m)



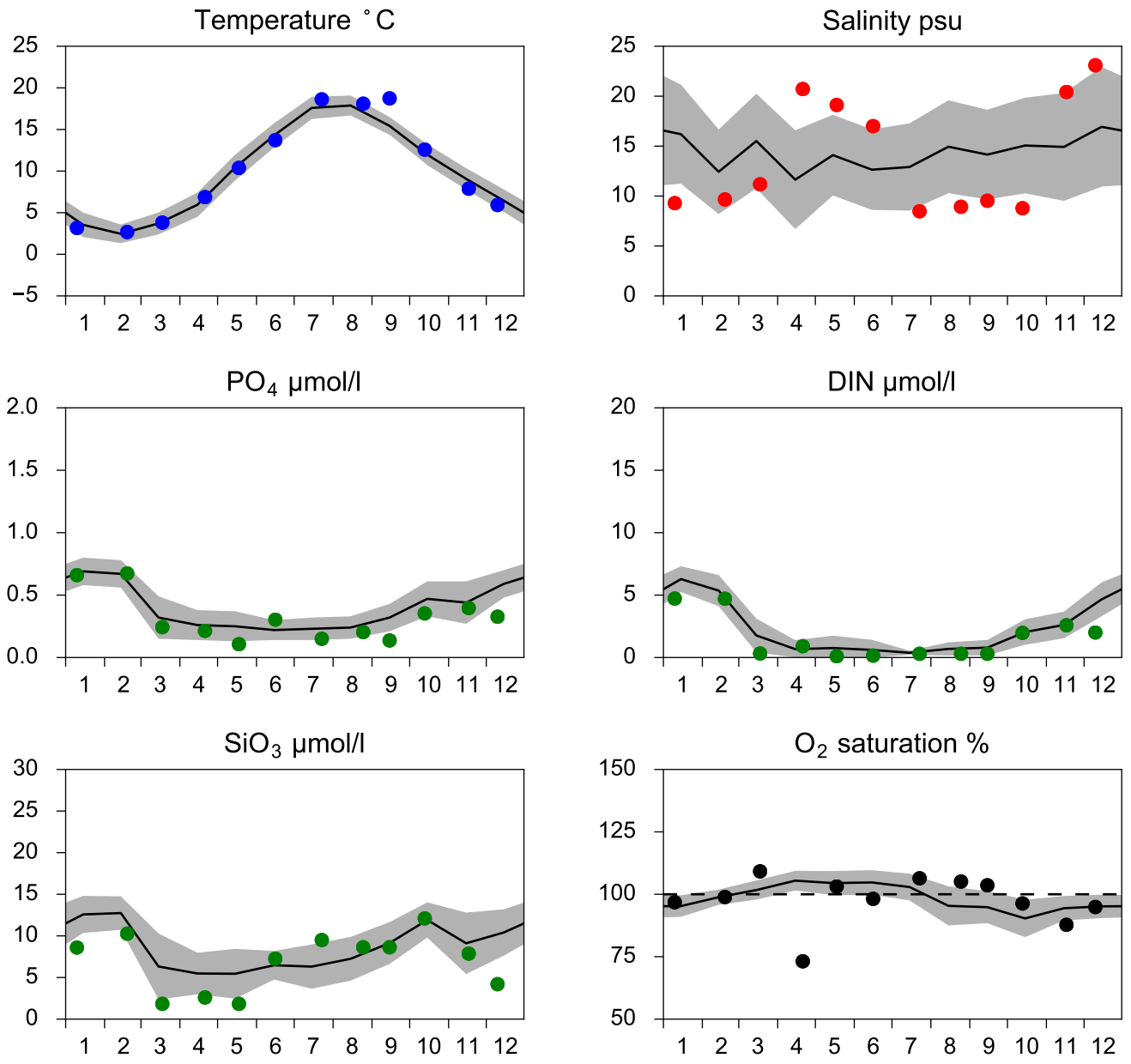
Vertical profiles BY1
December



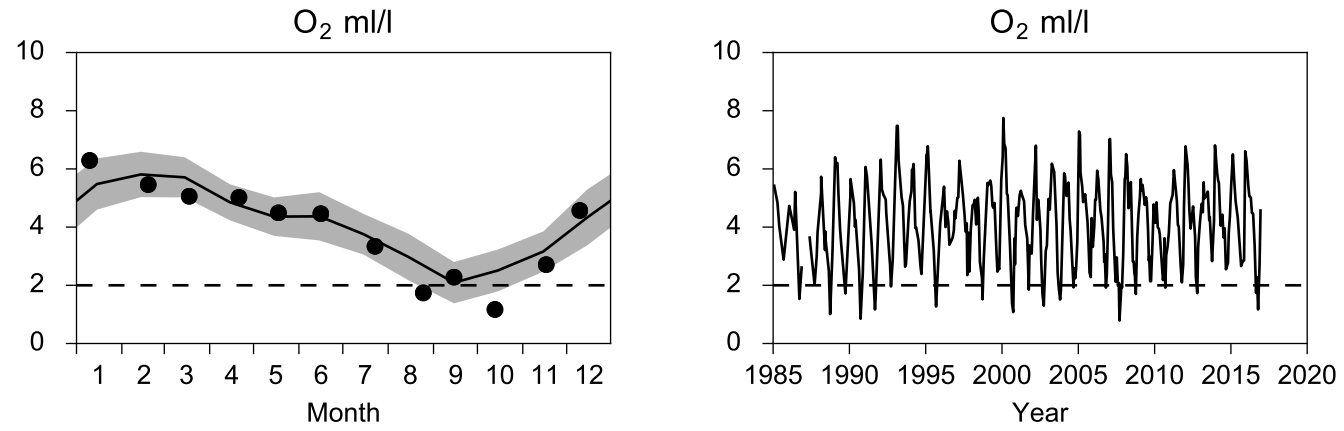
STATION W LANDSKRONA SURFACE WATER (0-10m)

Annual Cycles

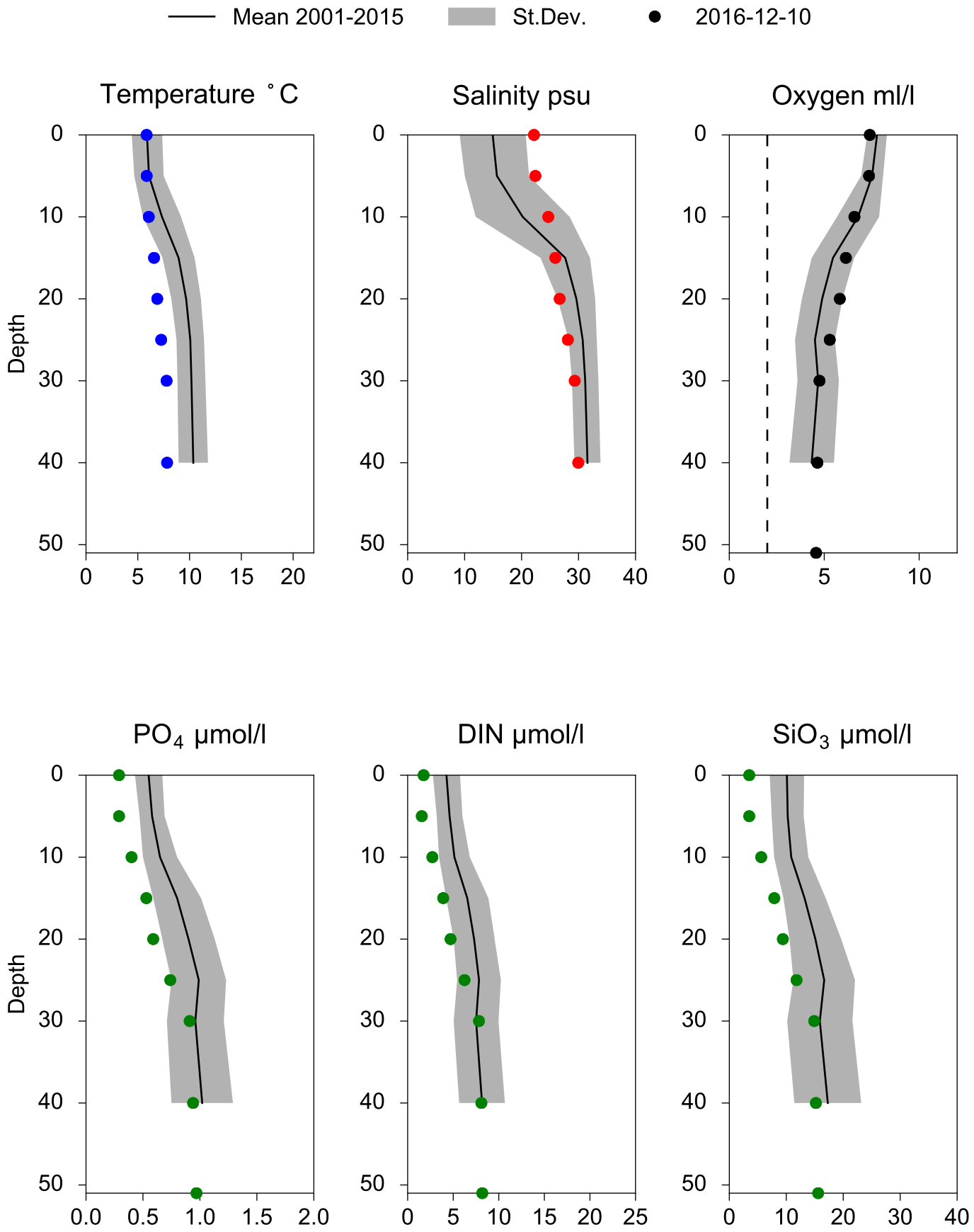
Mean 2001-2015 | St.Dev. | 2016



OXYGEN IN BOTTOM WATER (depth >= 40 m)



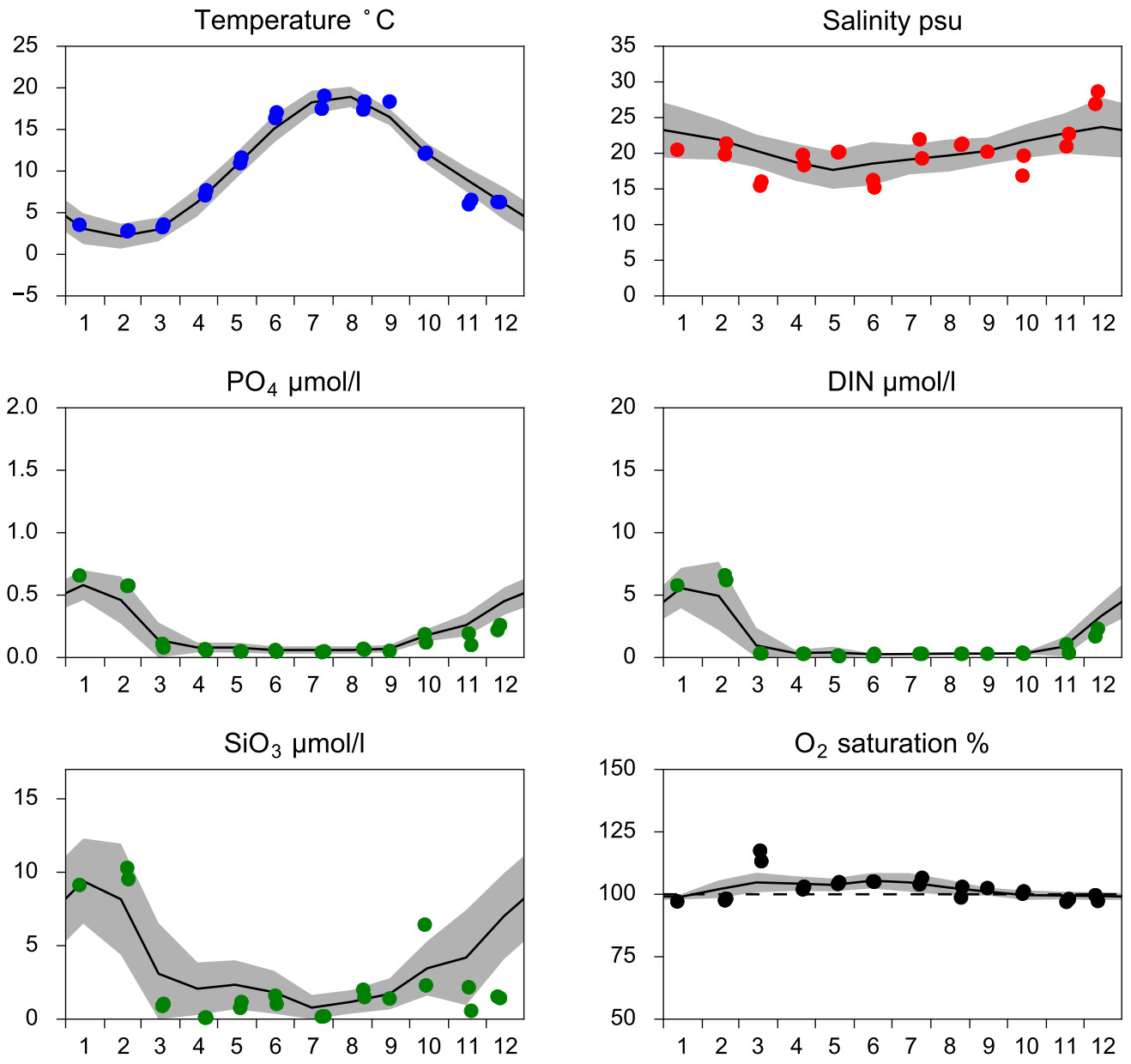
Vertical profiles W LANDSKRONA
December



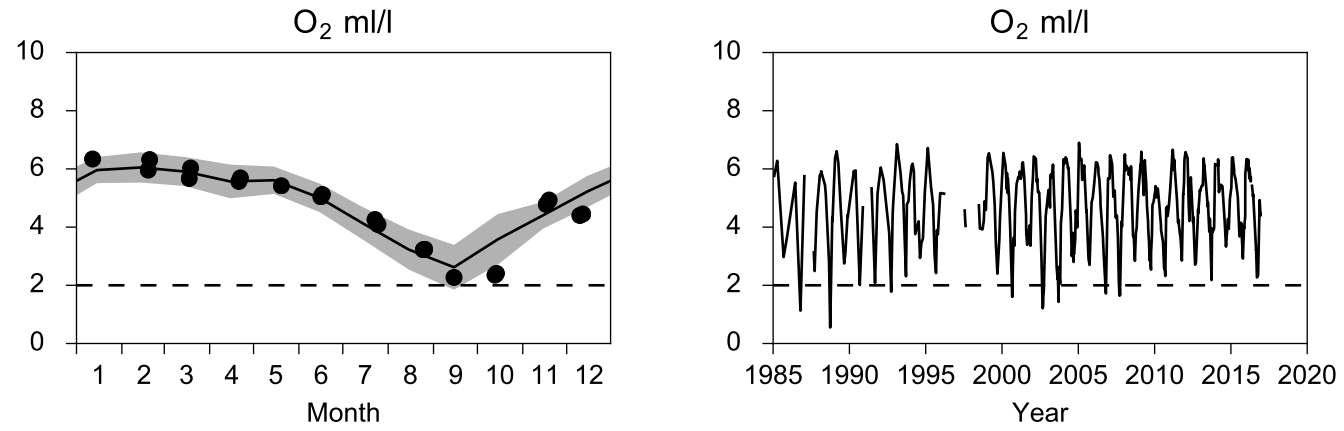
STATION ANHOLT E SURFACE WATER (0-10m)

Annual Cycles

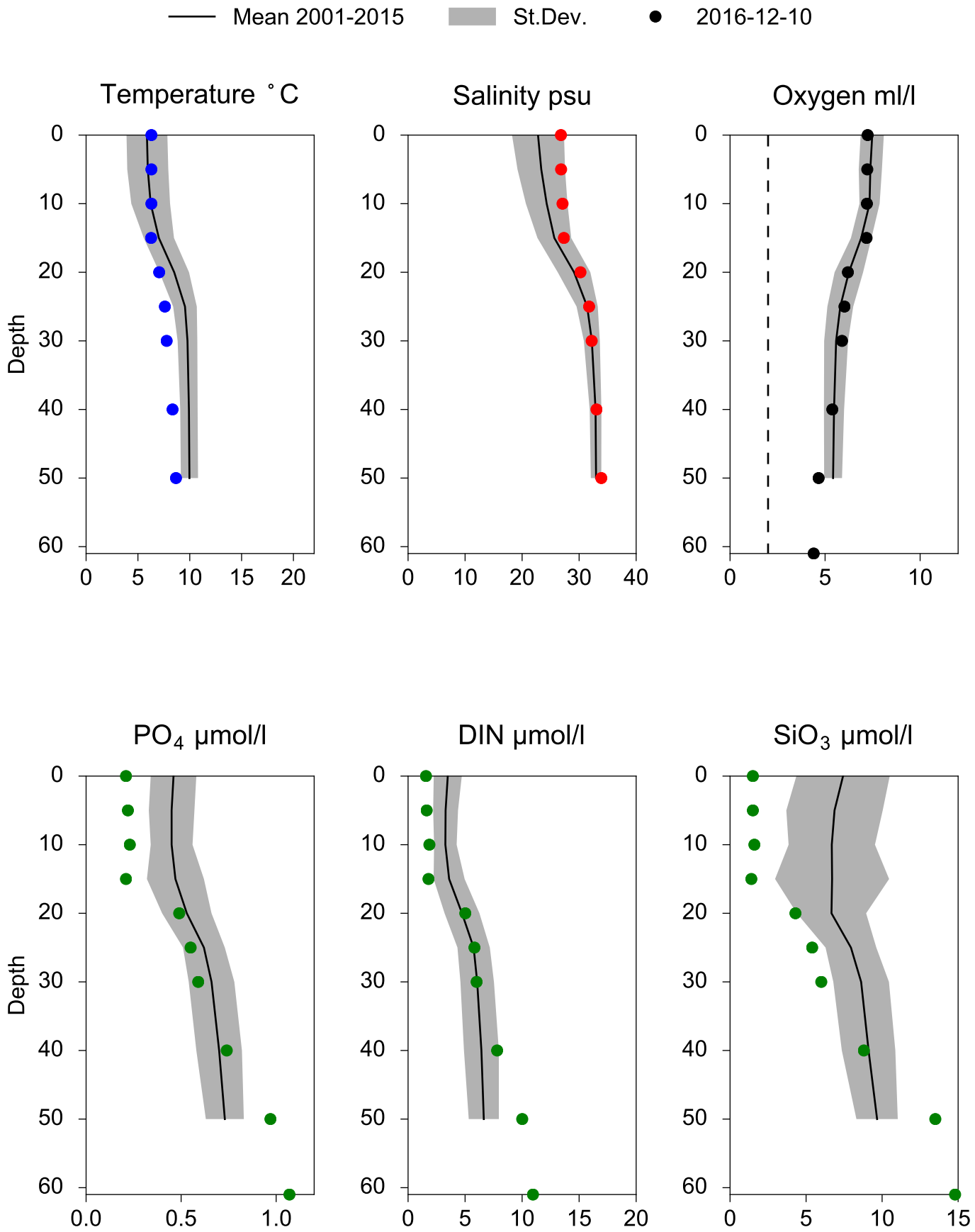
Mean 2001-2015 | St.Dev. | 2016



OXYGEN IN BOTTOM WATER (depth >= 52 m)



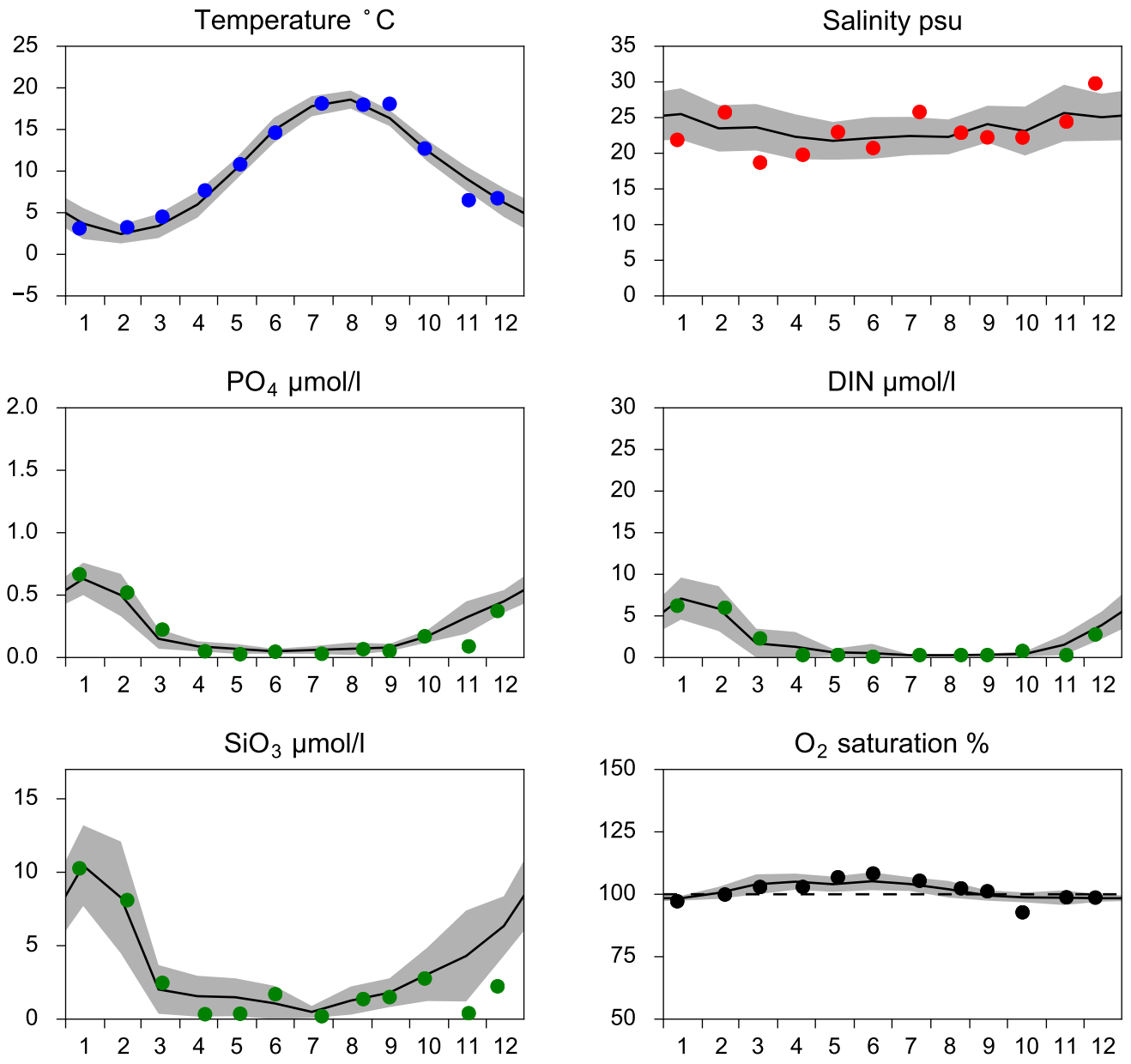
Vertical profiles ANHOLT E
December



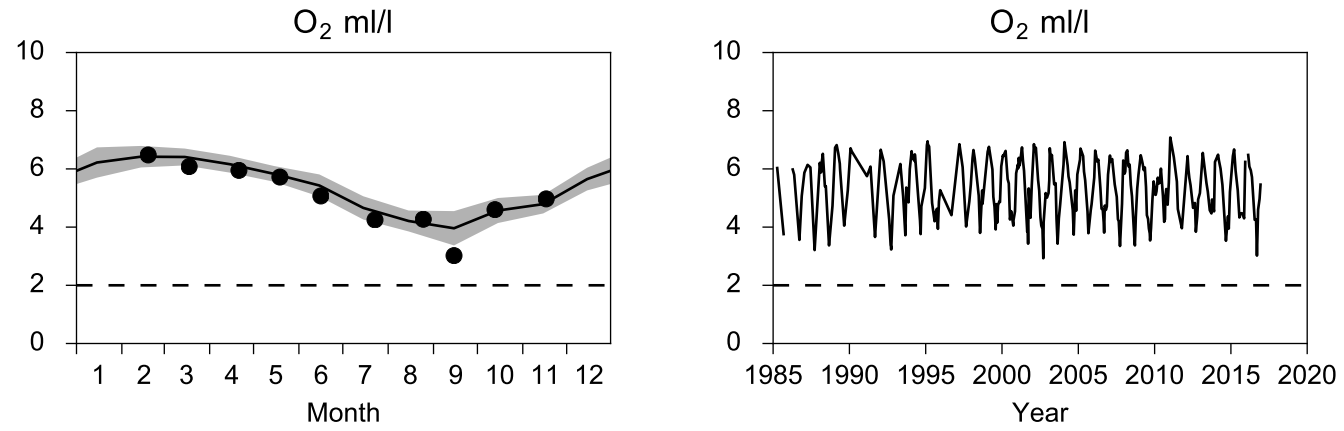
STATION FLADEN SURFACE WATER (0-10m)

Annual Cycles

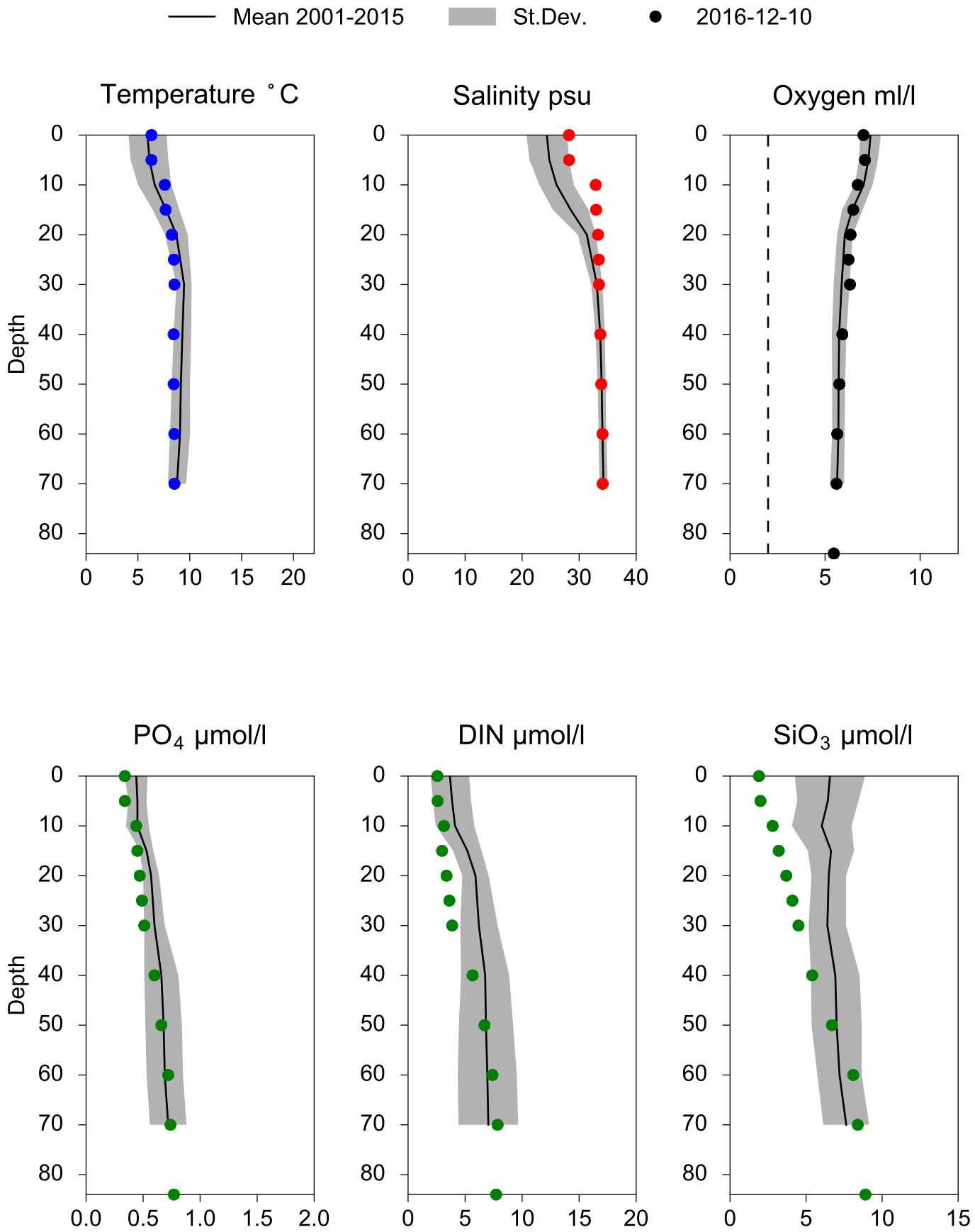
Mean 2001-2015 | St.Dev. | 2016



OXYGEN IN BOTTOM WATER (depth >= 74 m)

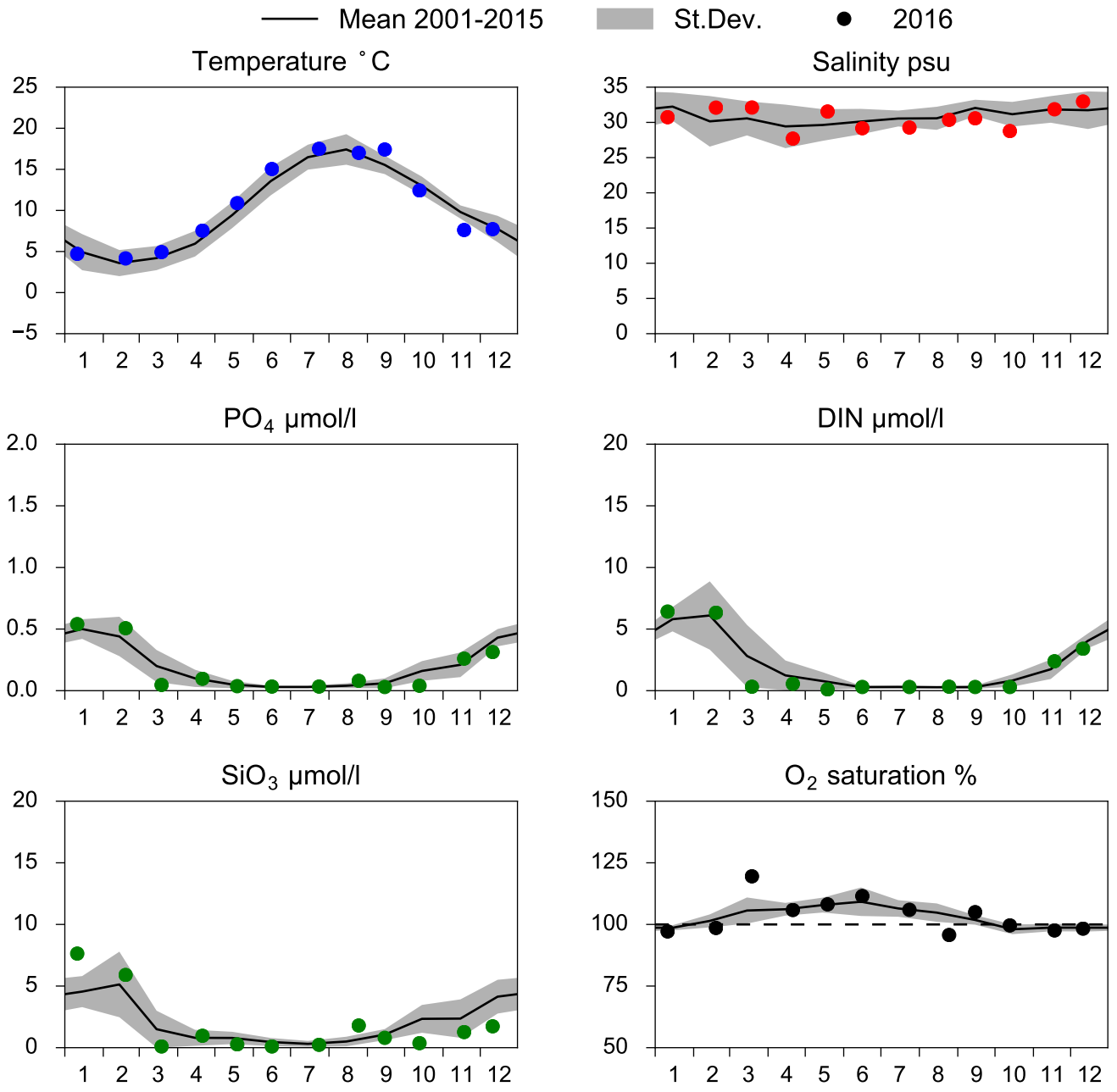


Vertical profiles FLADEN
December

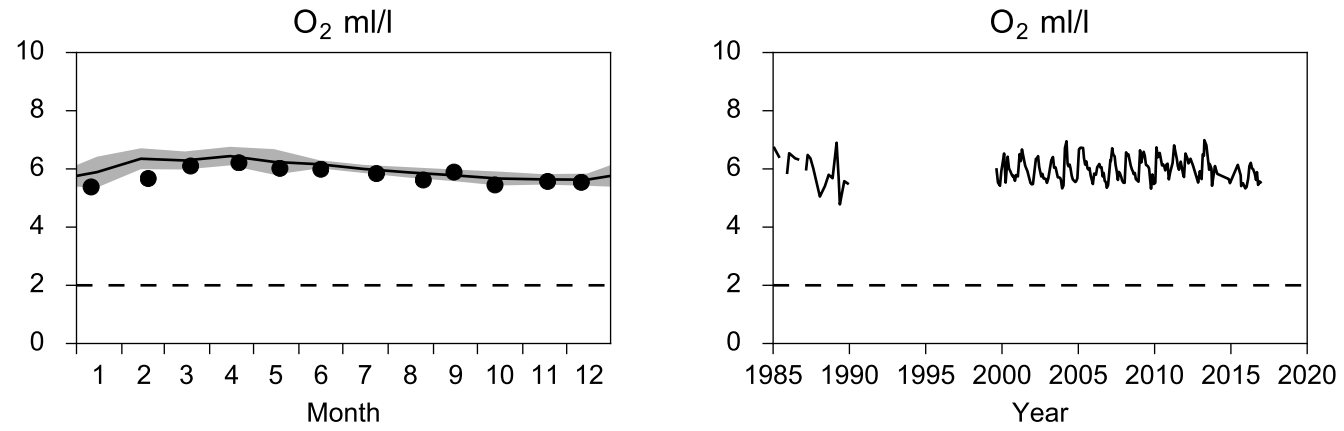


STATION Å17 SURFACE WATER (0-10m)

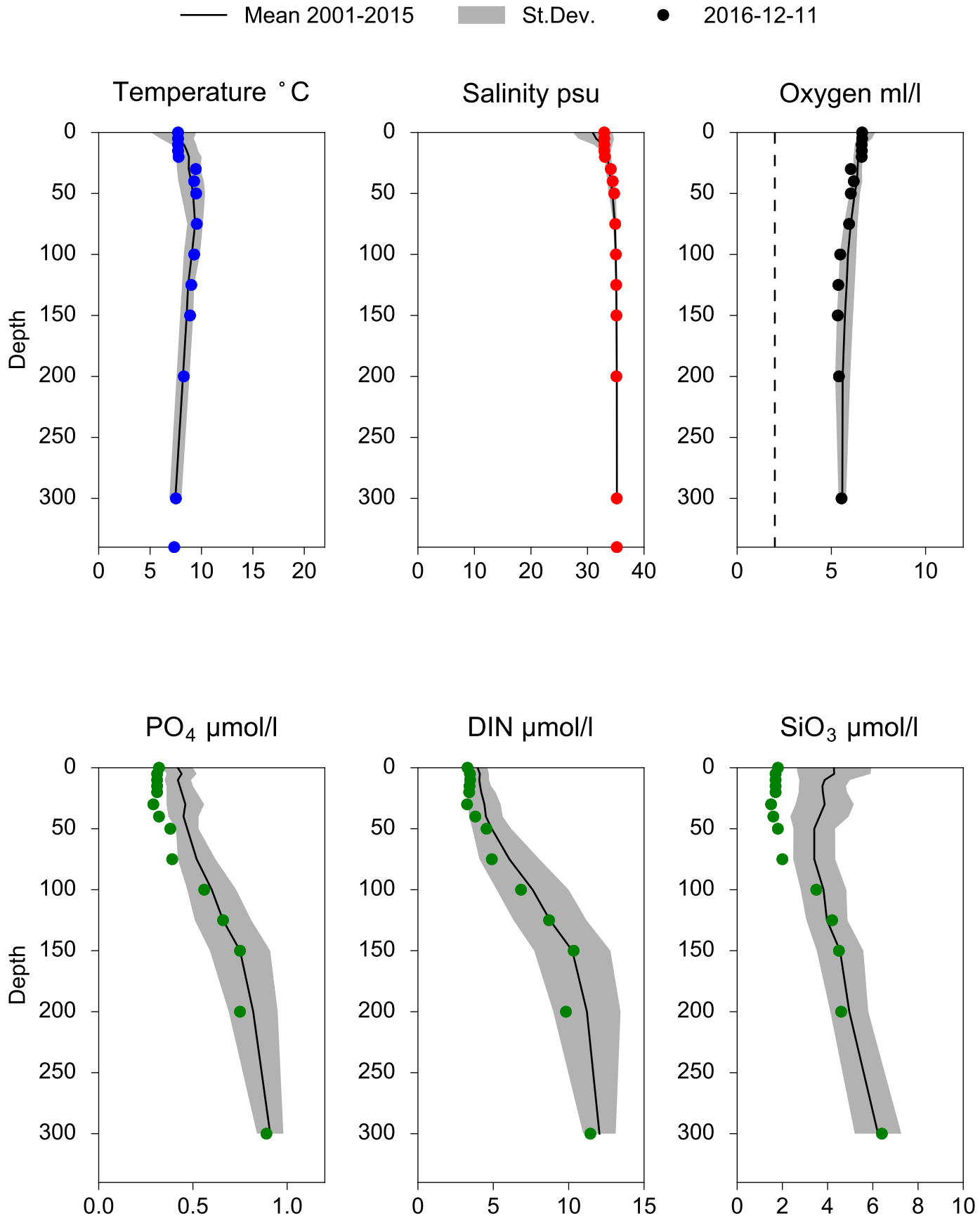
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 300 m)

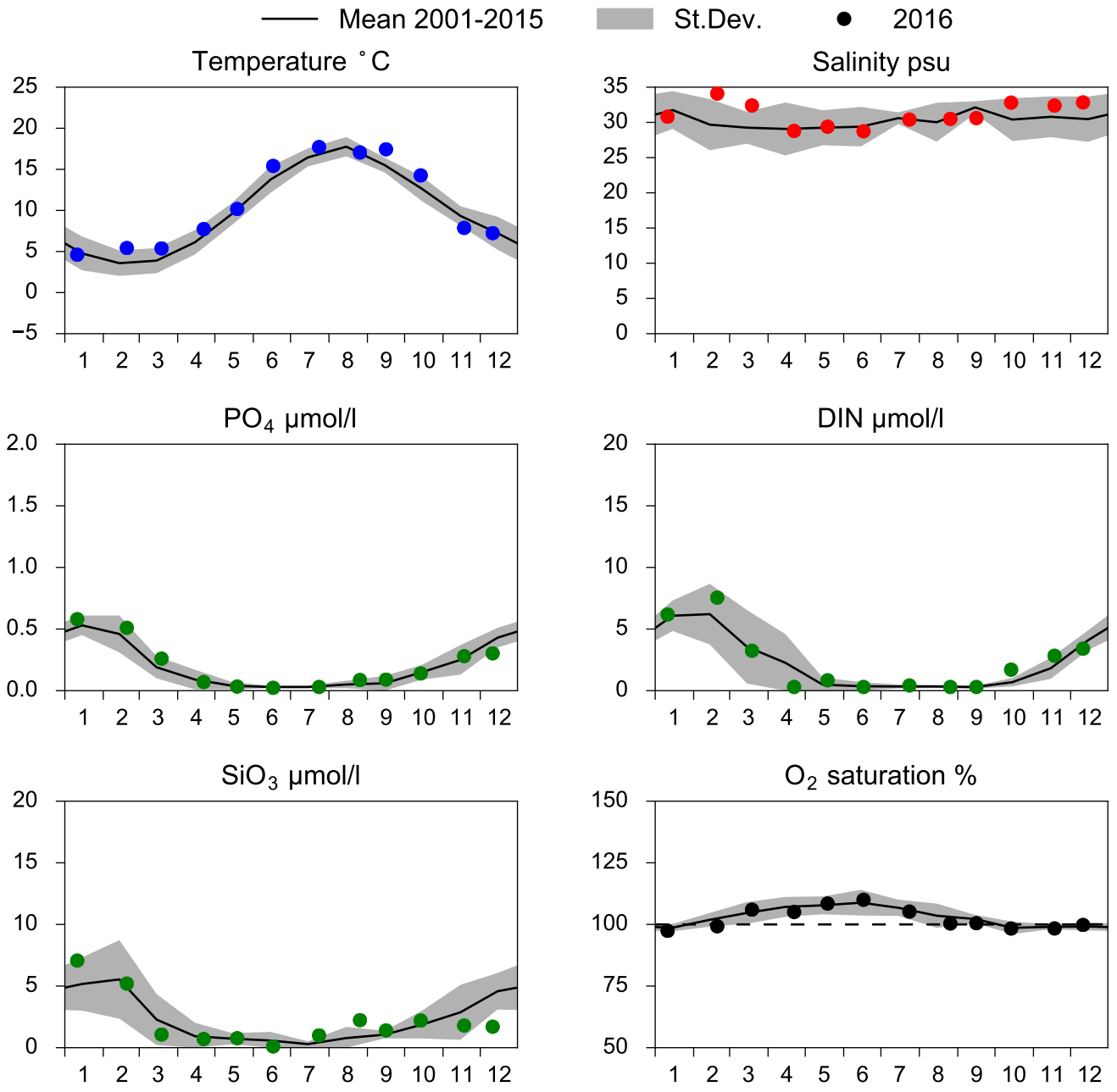


Vertical profiles Å17
December

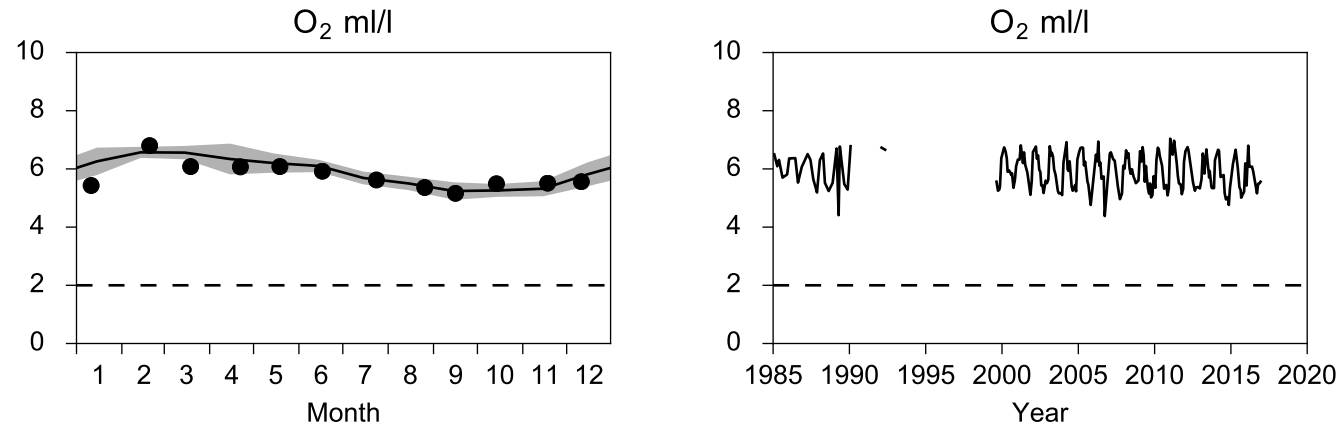


STATION Å15 SURFACE WATER (0-10m)

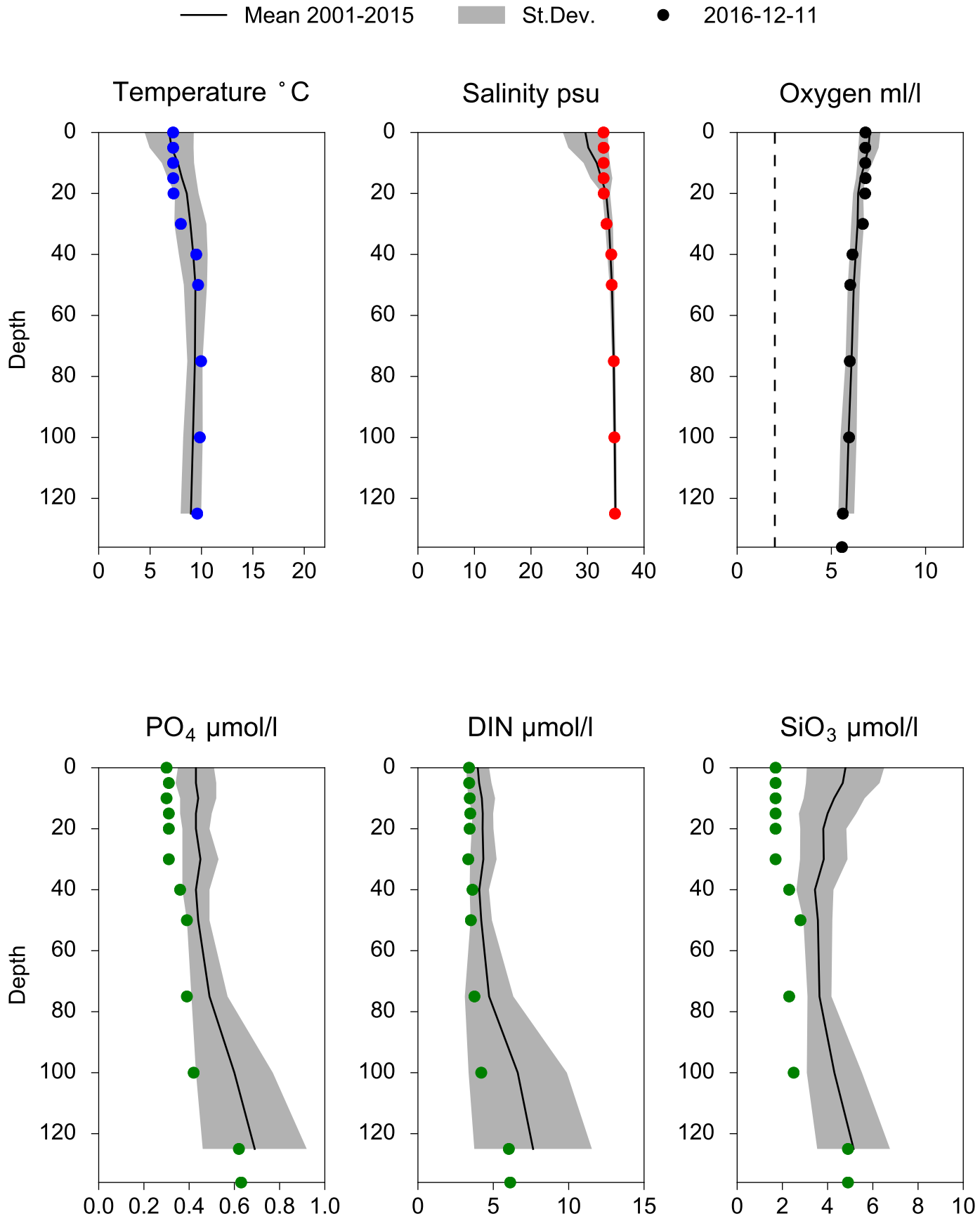
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 125 m)

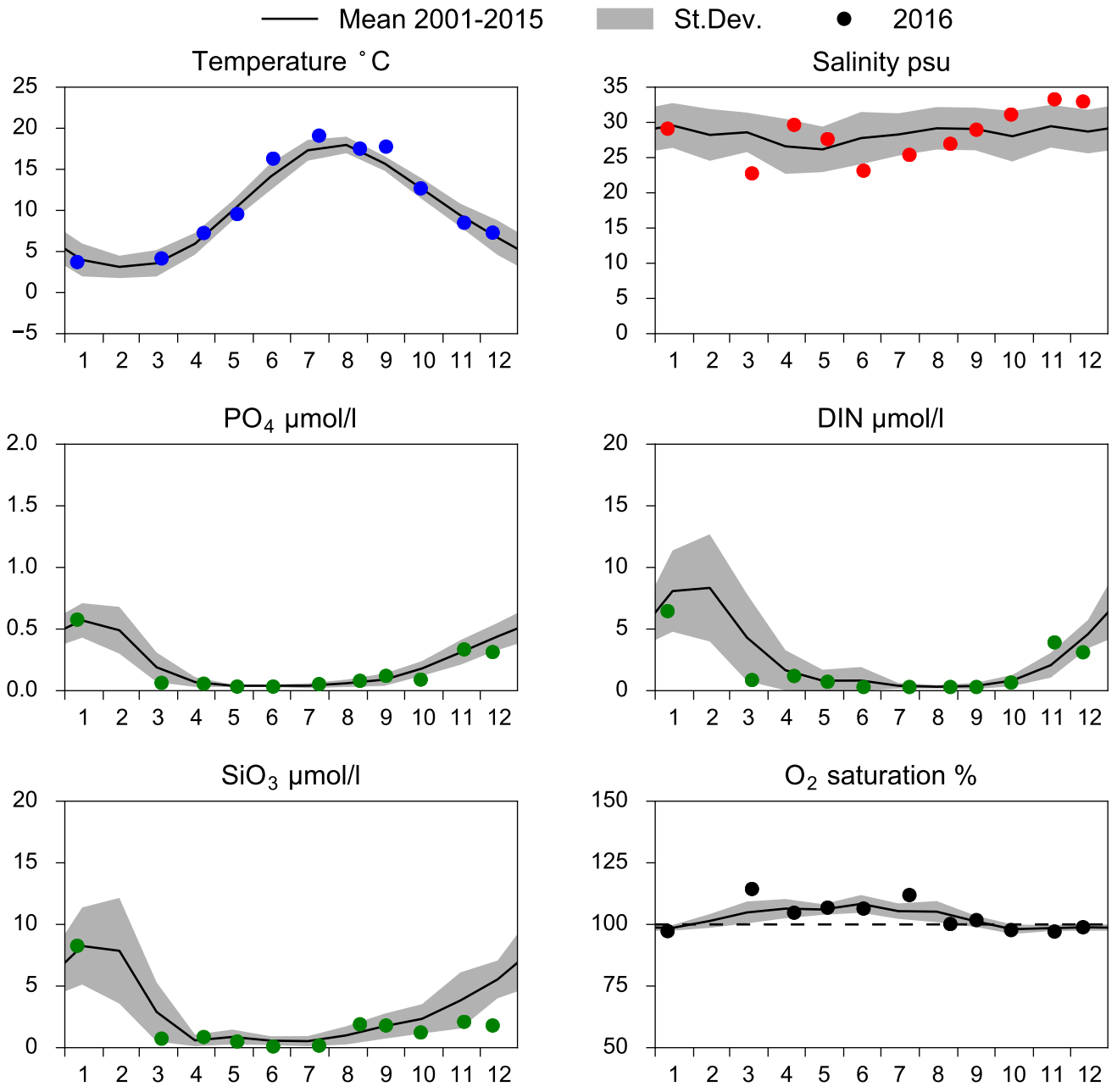


Vertical profiles Å15
December

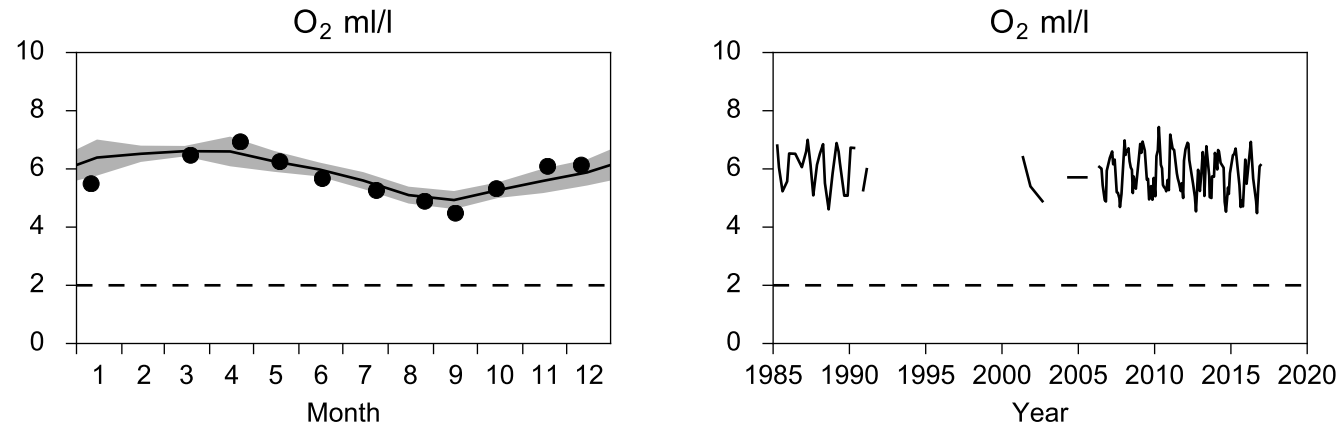


STATION Å13 SURFACE WATER (0-10m)

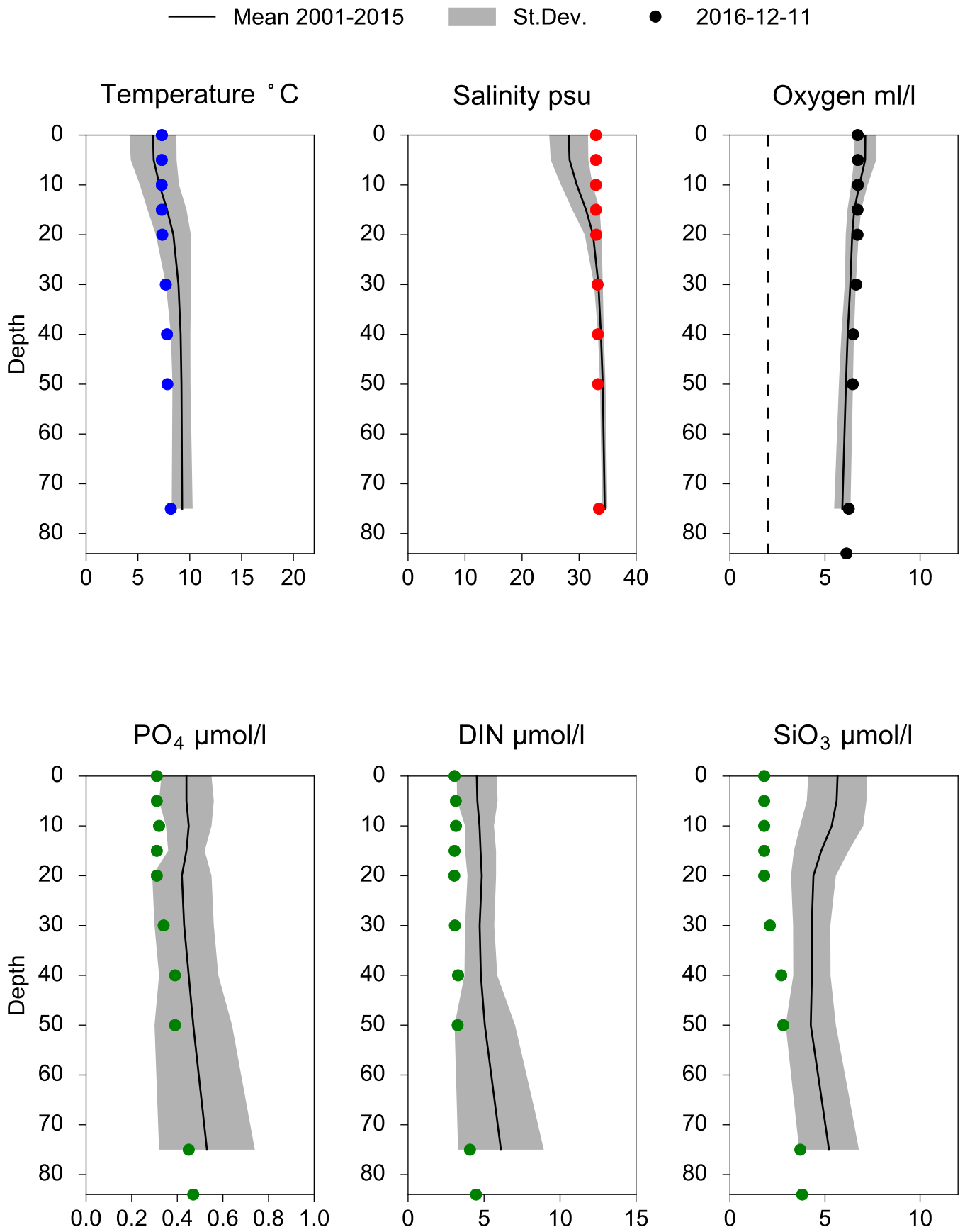
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 82 m)



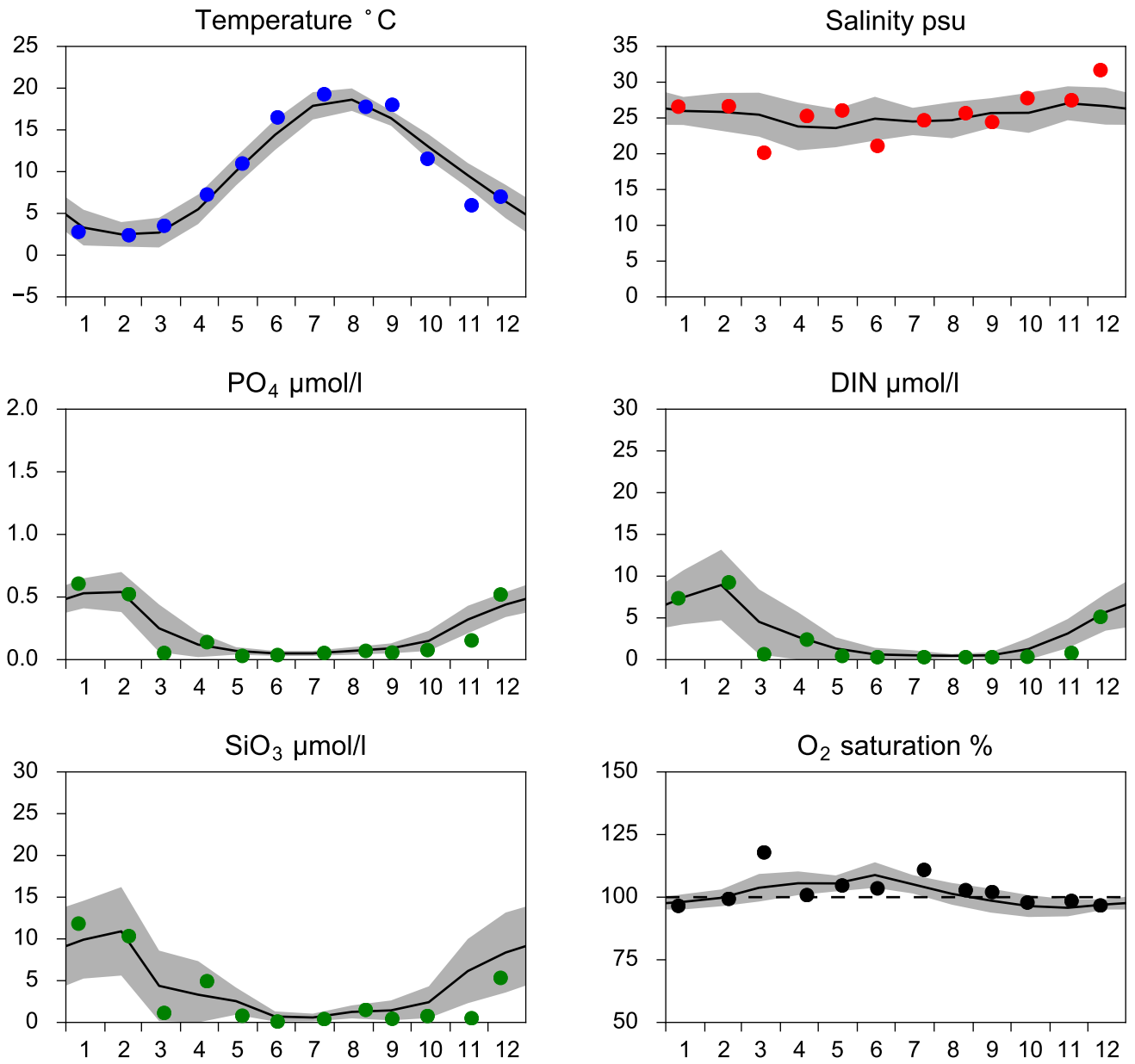
Vertical profiles Å13
December



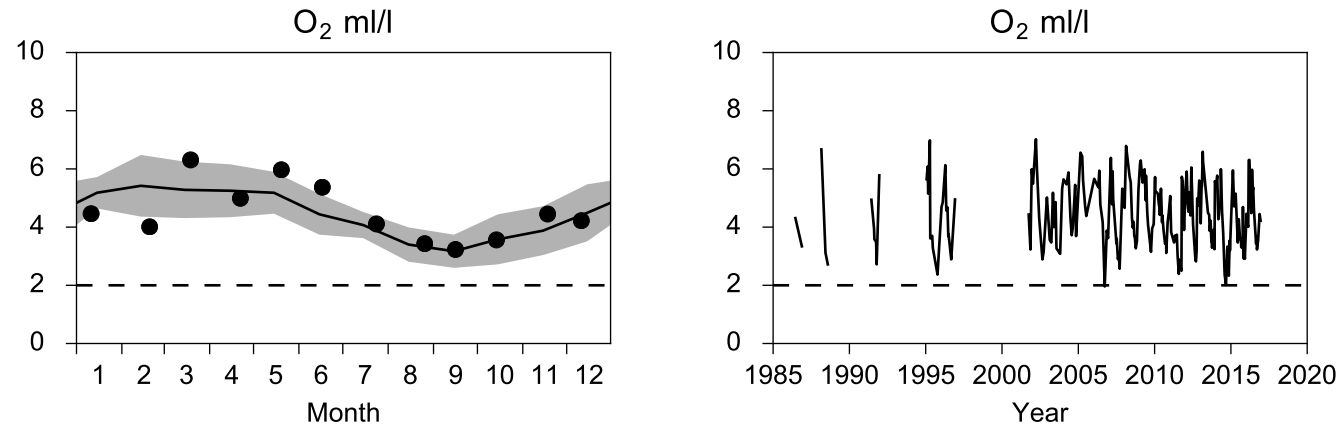
STATION SLÄGGÖ SURFACE WATER (0-10m)

Annual Cycles

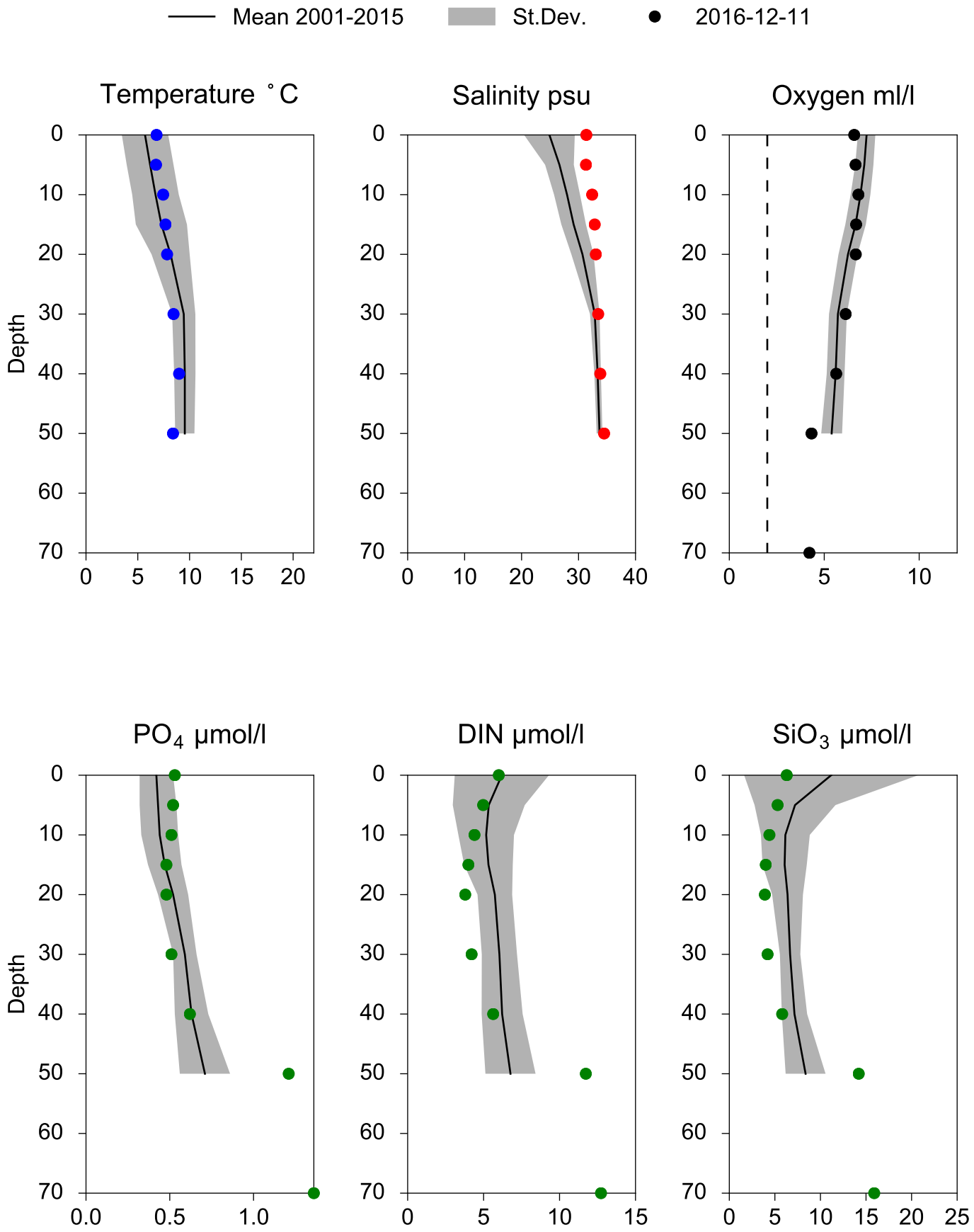
Mean 2001-2015 | St.Dev. | 2016



OXYGEN IN BOTTOM WATER (depth >= 64 m)



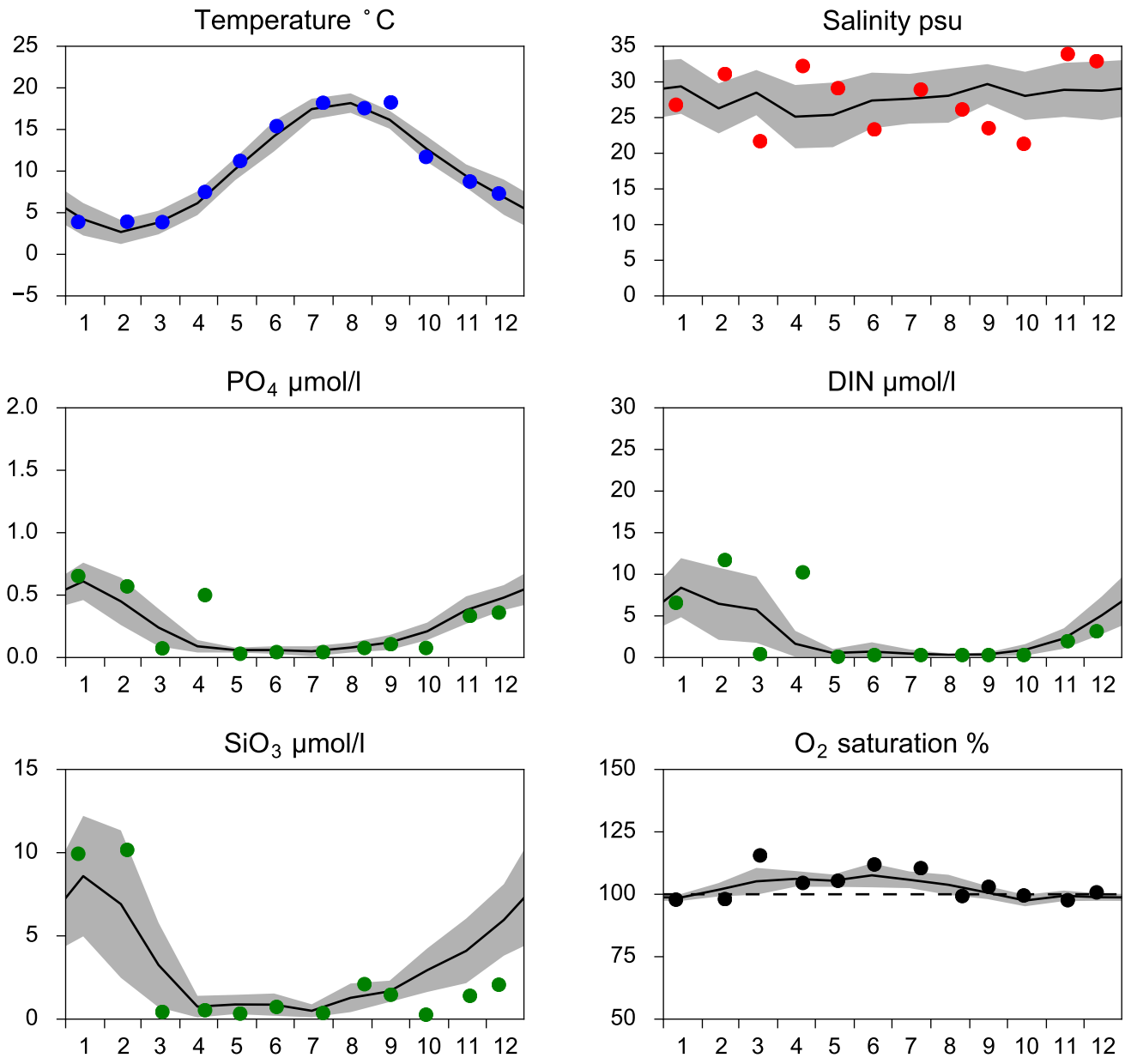
Vertical profiles SLÄGGÖ
December



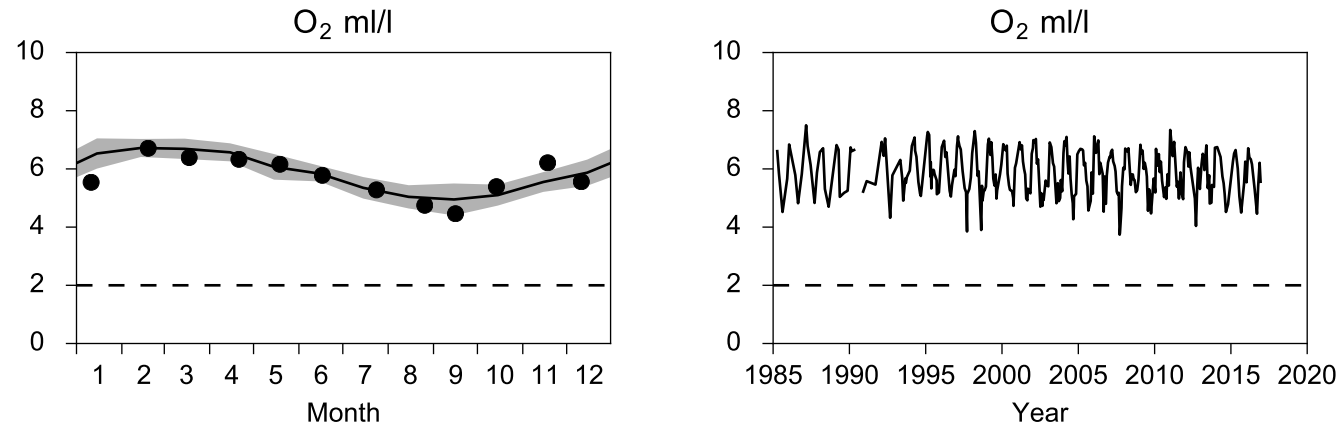
STATION P2 SURFACE WATER (0-10m)

Annual Cycles

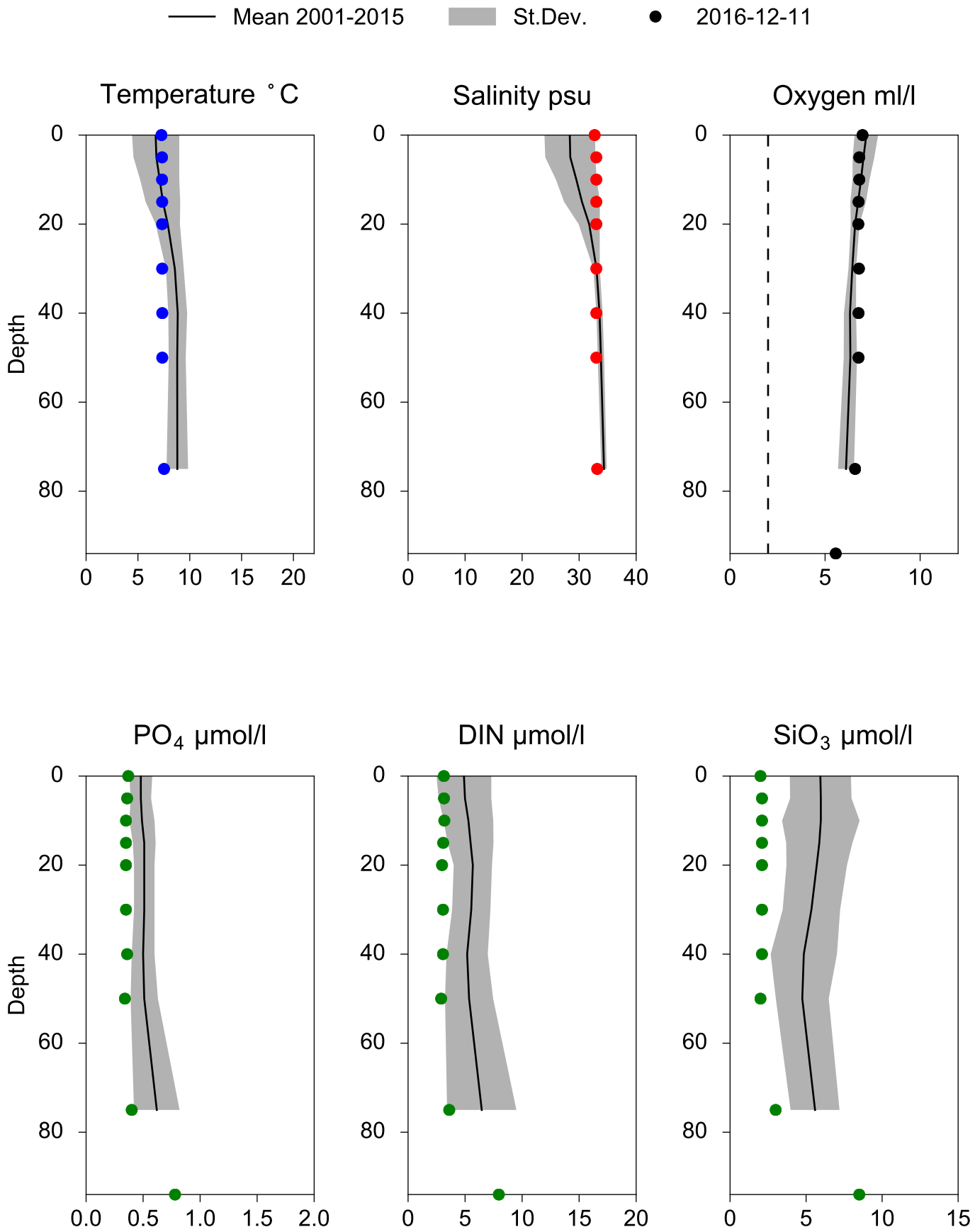
Mean 2001-2015 | St.Dev. | 2016



OXYGEN IN BOTTOM WATER (depth >= 75 m)



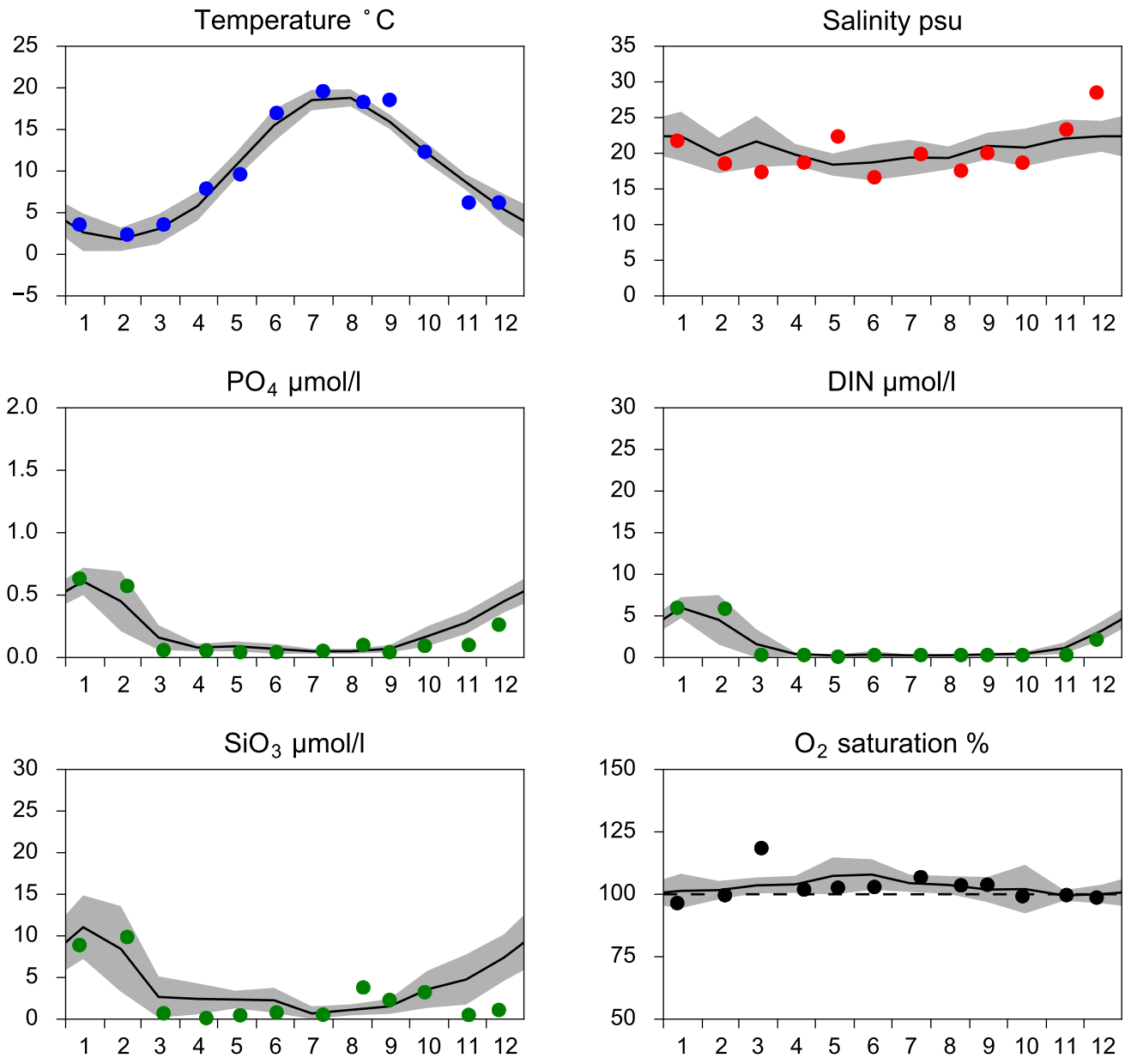
Vertical profiles P2
December



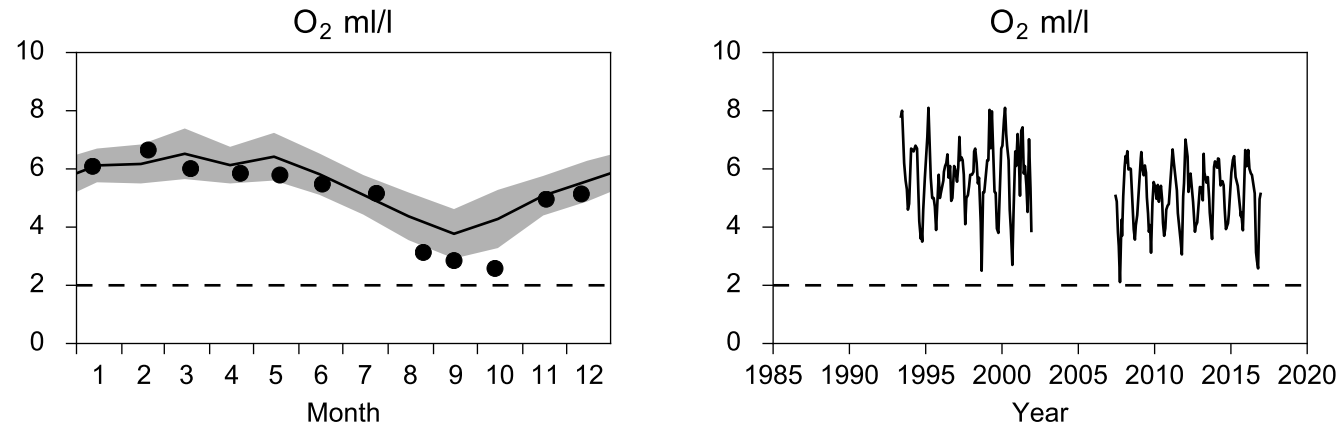
STATION N14 FALKENBERG SURFACE WATER (0-10m)

Annual Cycles

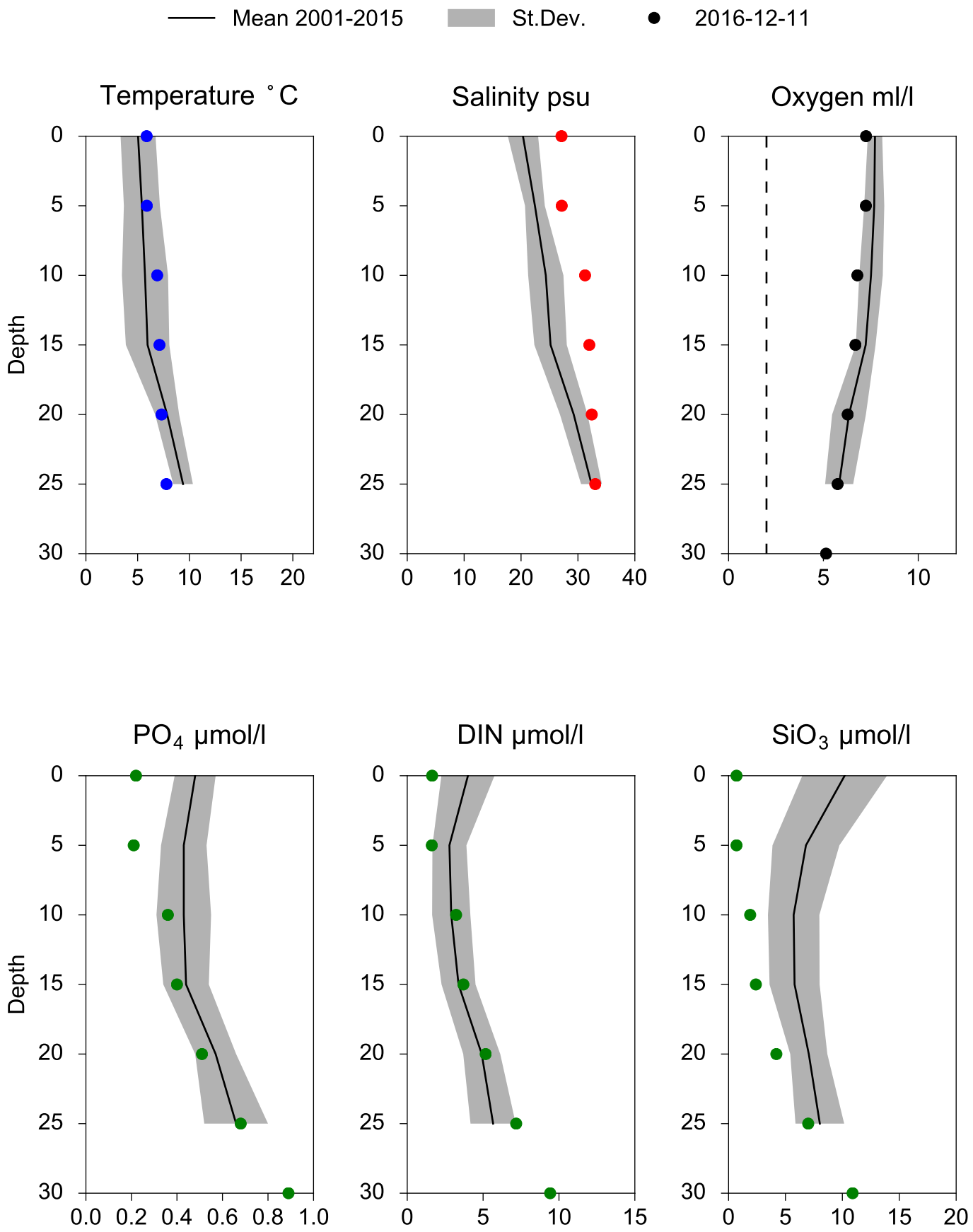
Mean 2001-2015 | St.Dev. | 2016



OXYGEN IN BOTTOM WATER (depth >= 25 m)



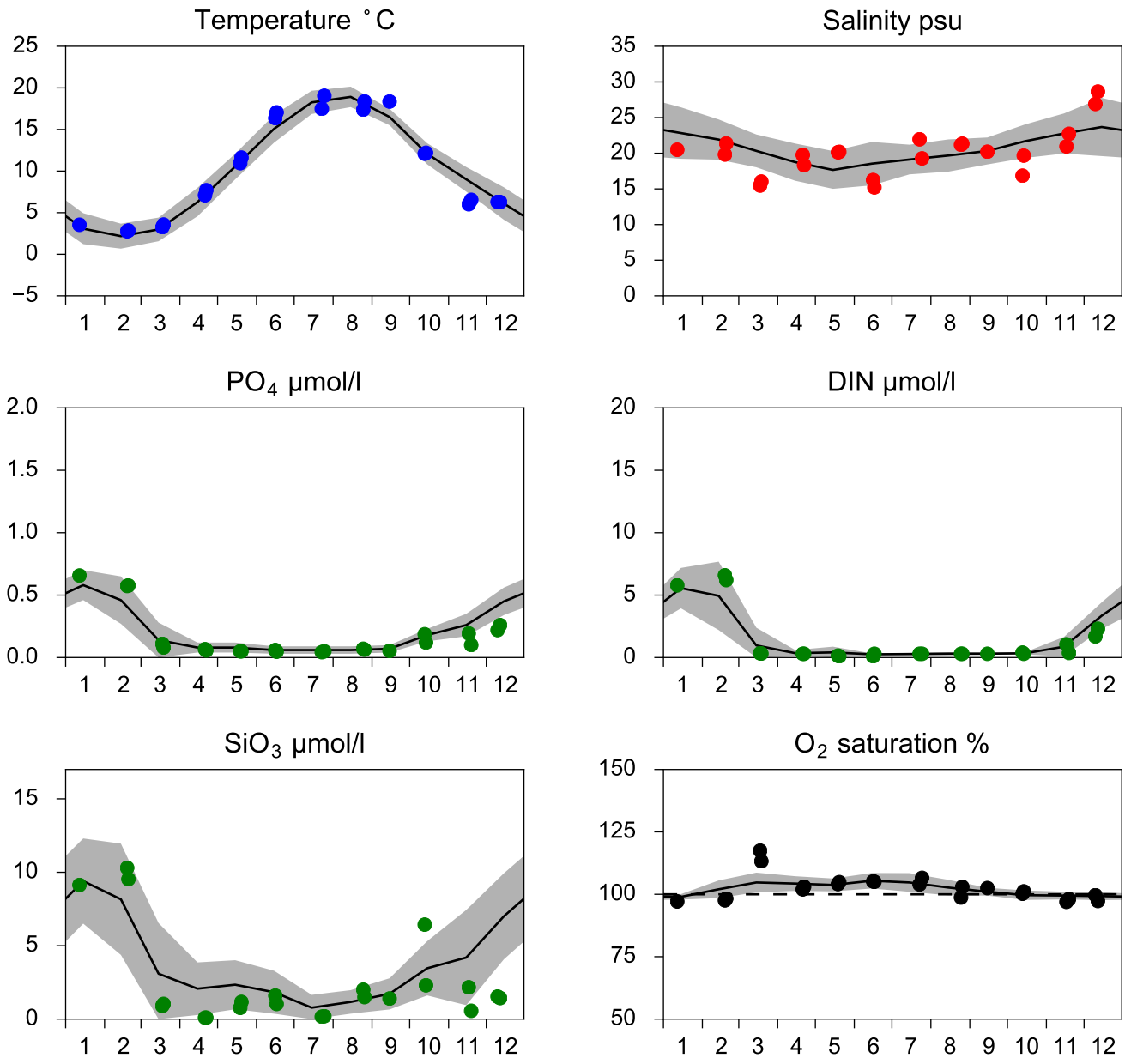
Vertical profiles N14 FALKENBERG
December



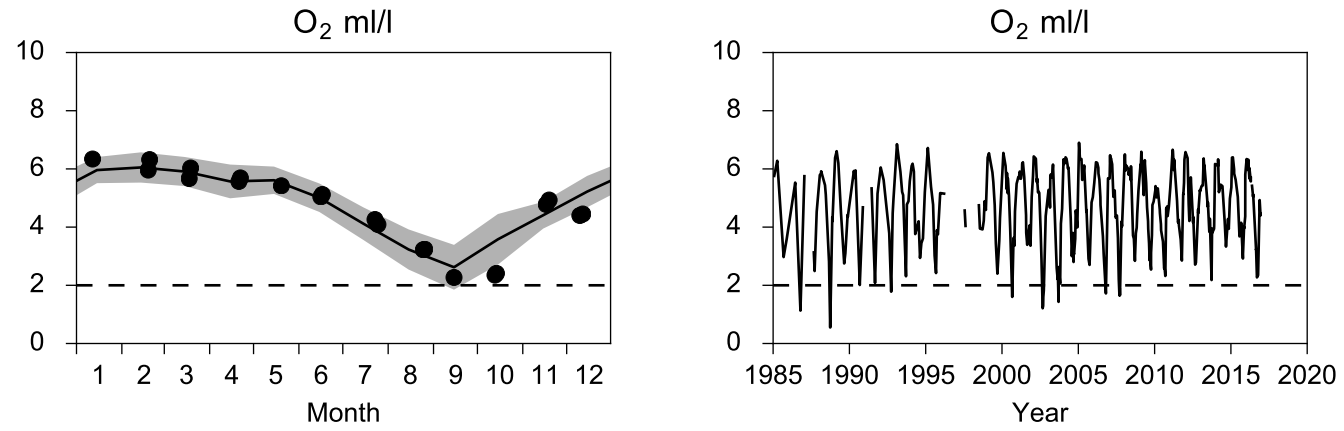
STATION ANHOLT E SURFACE WATER (0-10m)

Annual Cycles

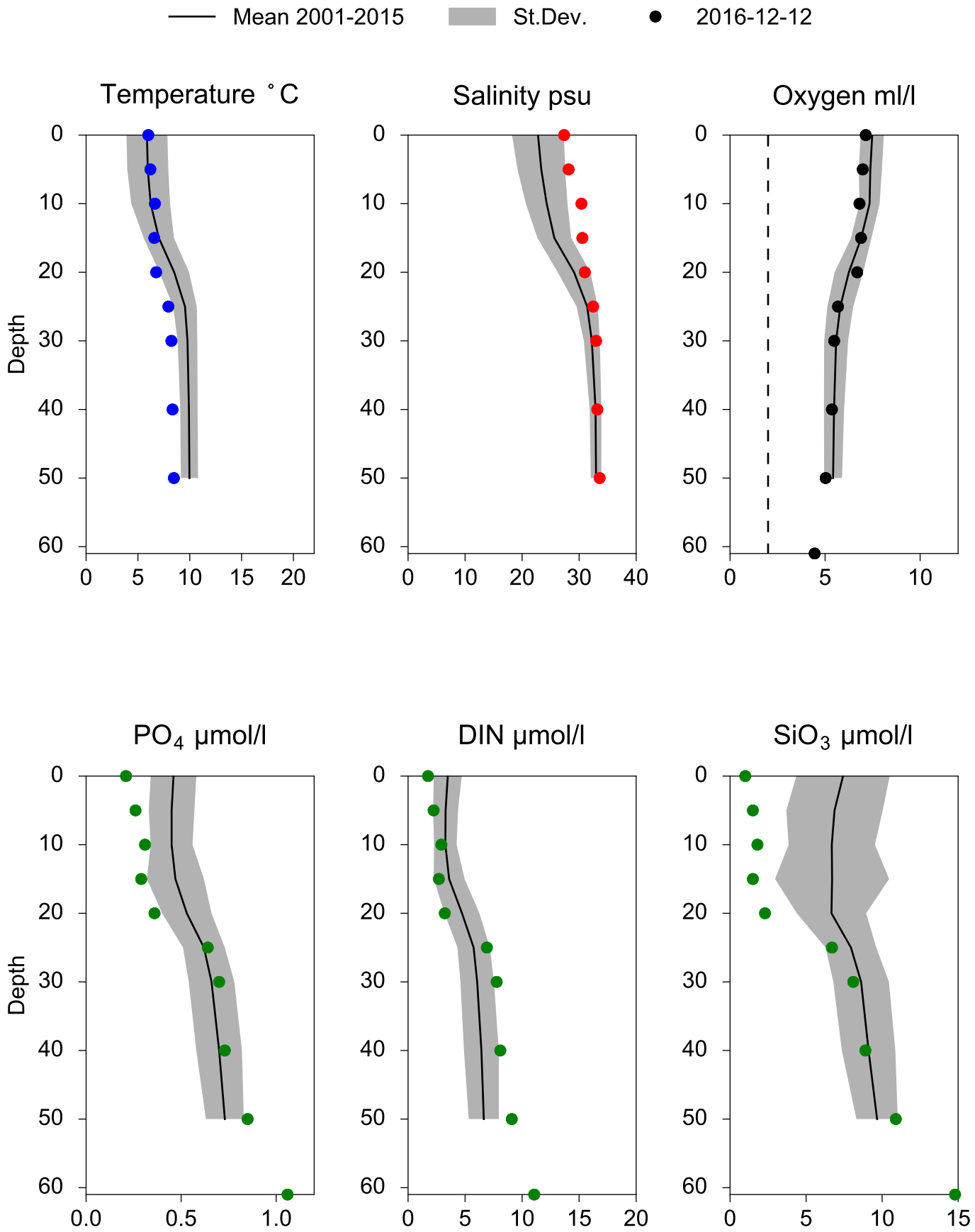
Mean 2001-2015 | St.Dev. | 2016



OXYGEN IN BOTTOM WATER (depth >= 52 m)

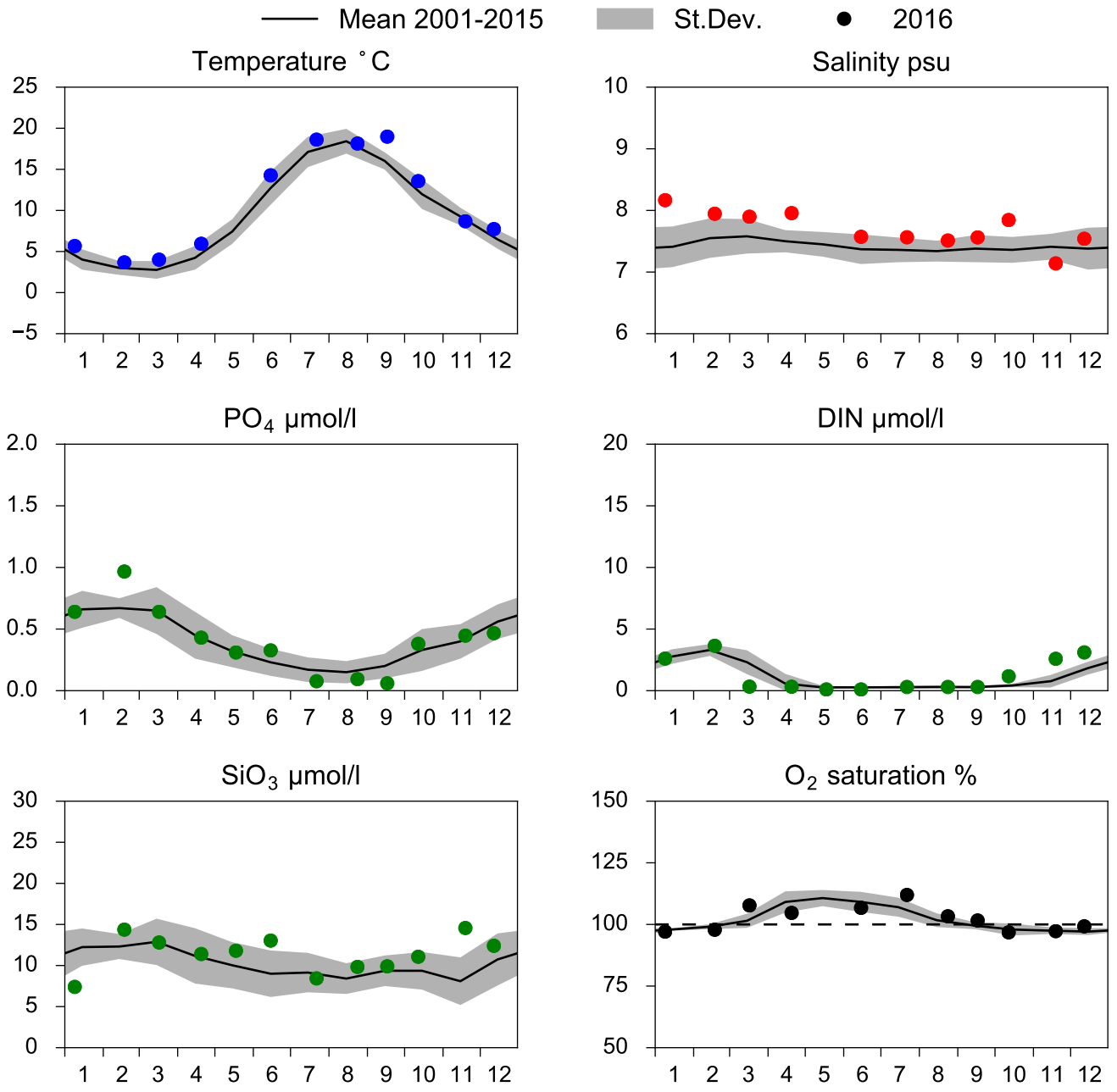


Vertical profiles ANHOLT E
December

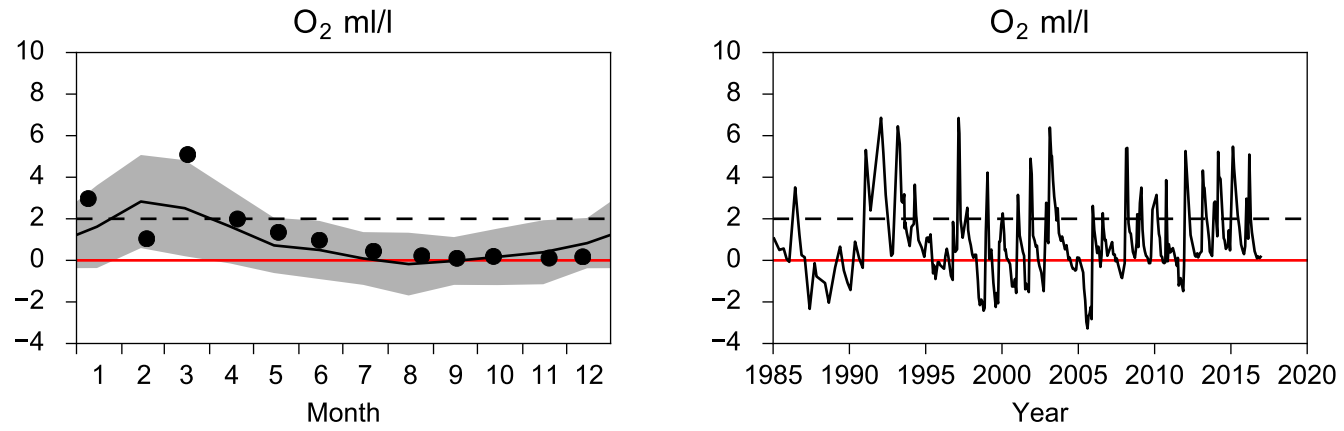


STATION BY4 CHRISTIANSÖ SURFACE WATER (0-10m)

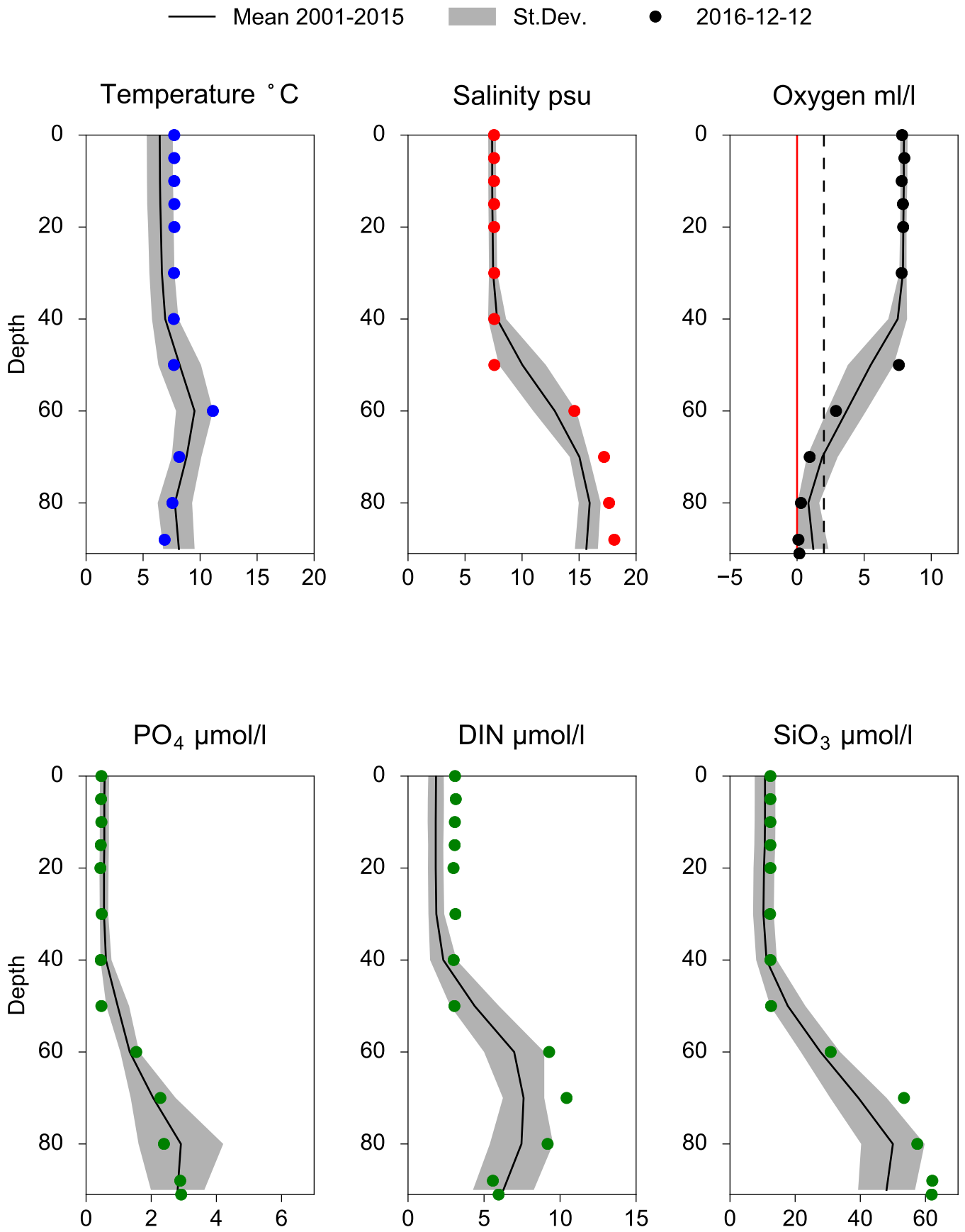
Annual Cycles



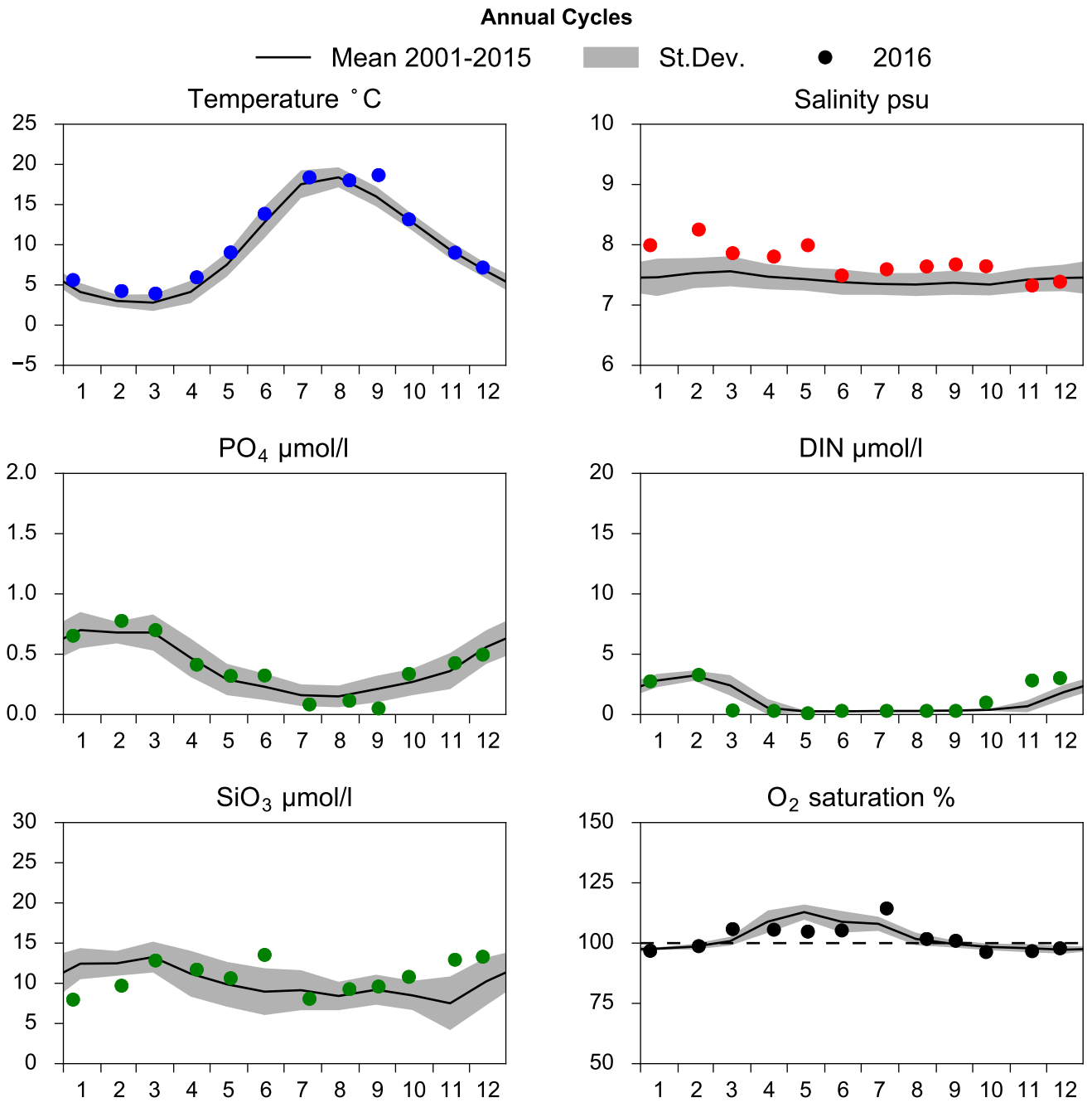
OXYGEN IN BOTTOM WATER (depth >= 80 m)



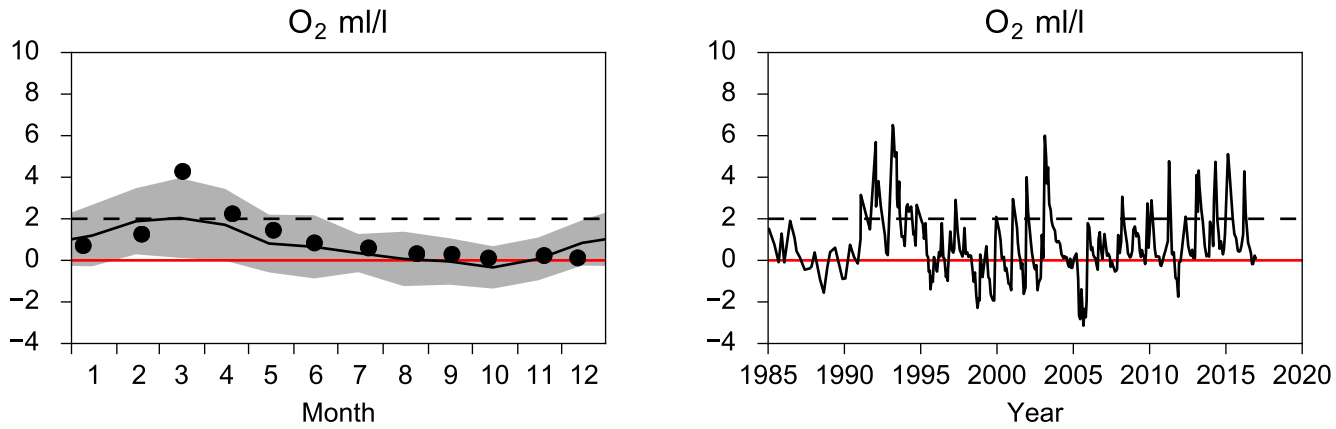
Vertical profiles BY4 CHRISTIANSÖ
December



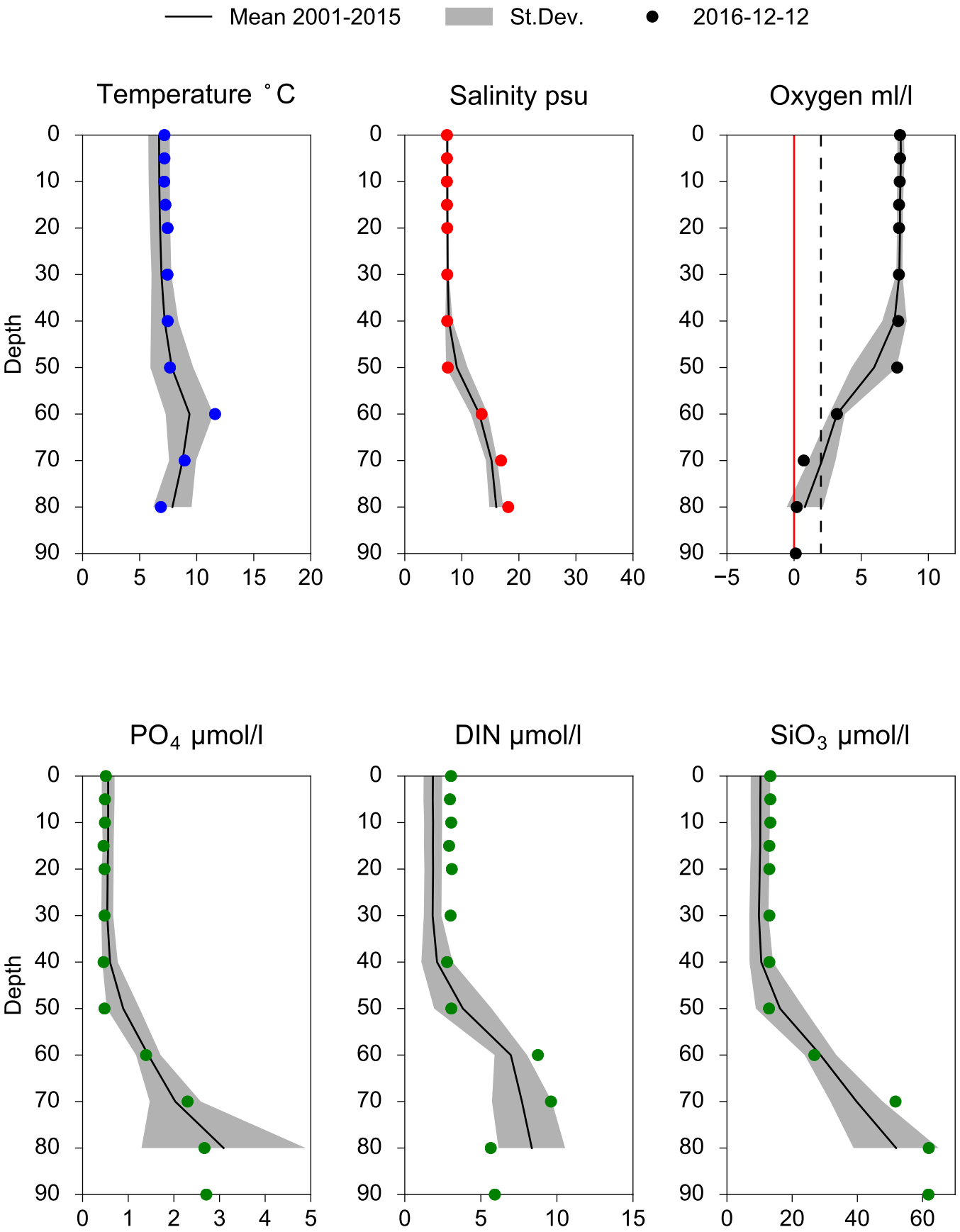
STATION BY5 BORNHOLMSDJ SURFACE WATER (0-10m)



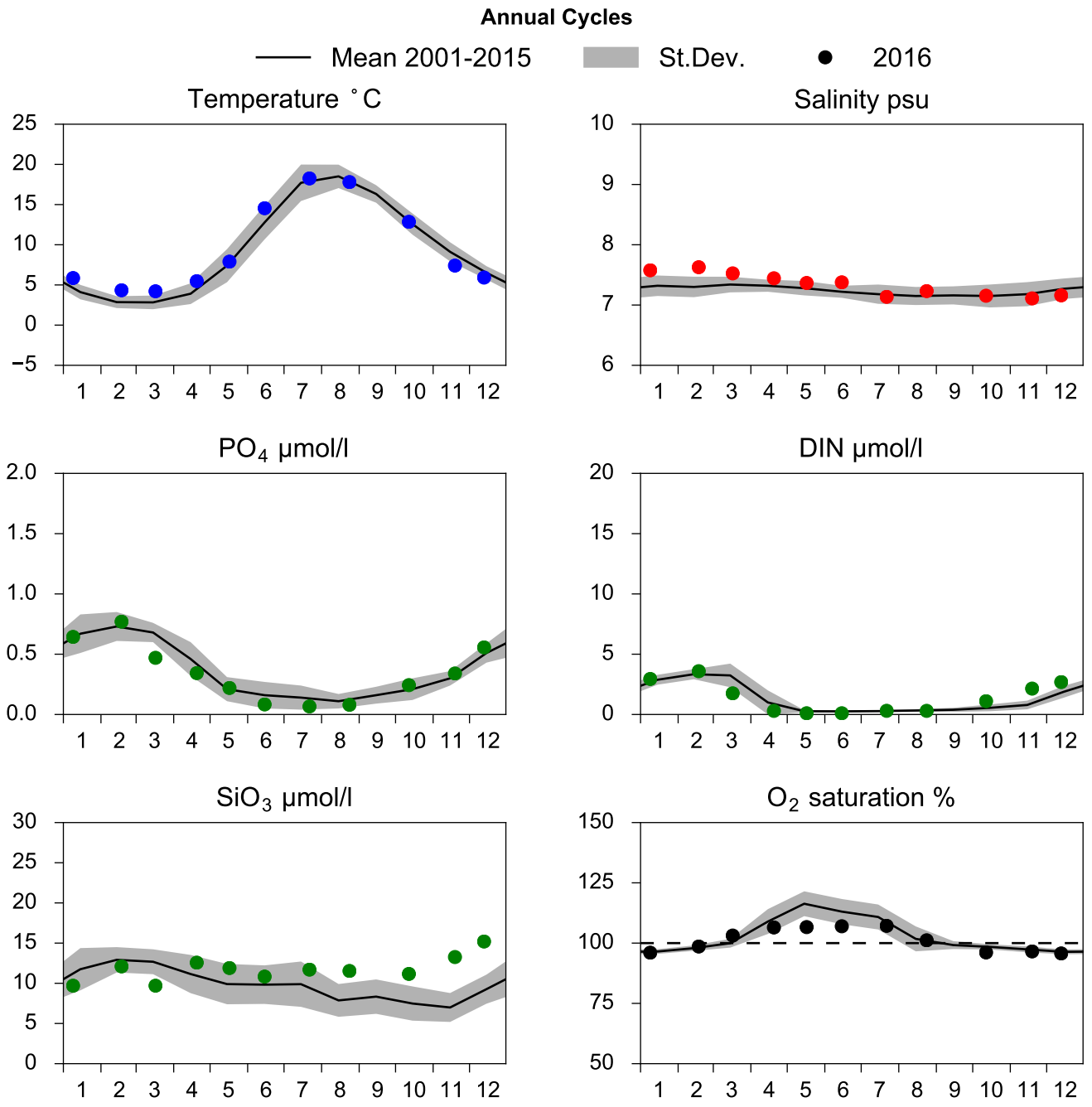
OXYGEN IN BOTTOM WATER (depth >= 80 m)



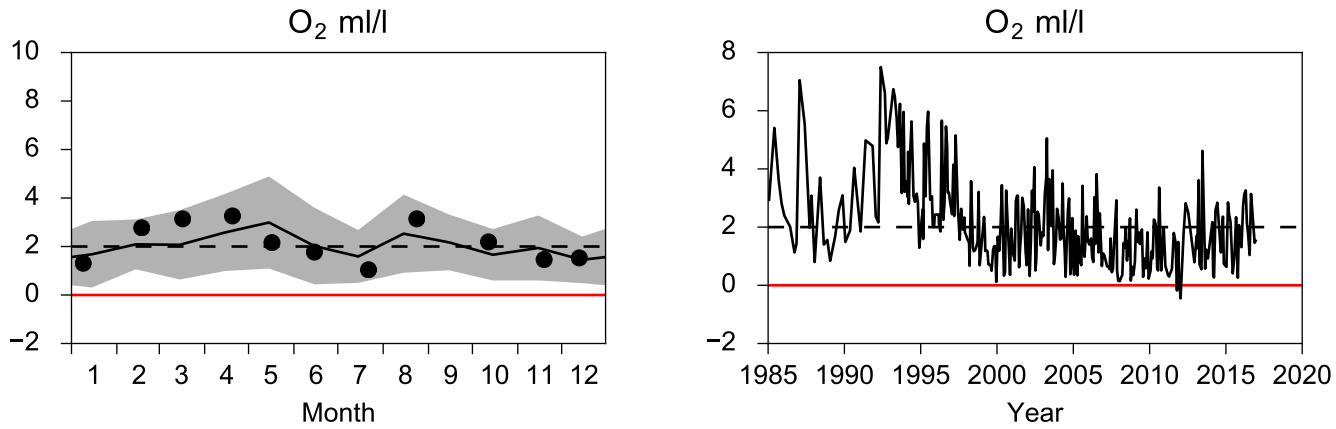
Vertical profiles BY5 BORNHOLMSDJ
December



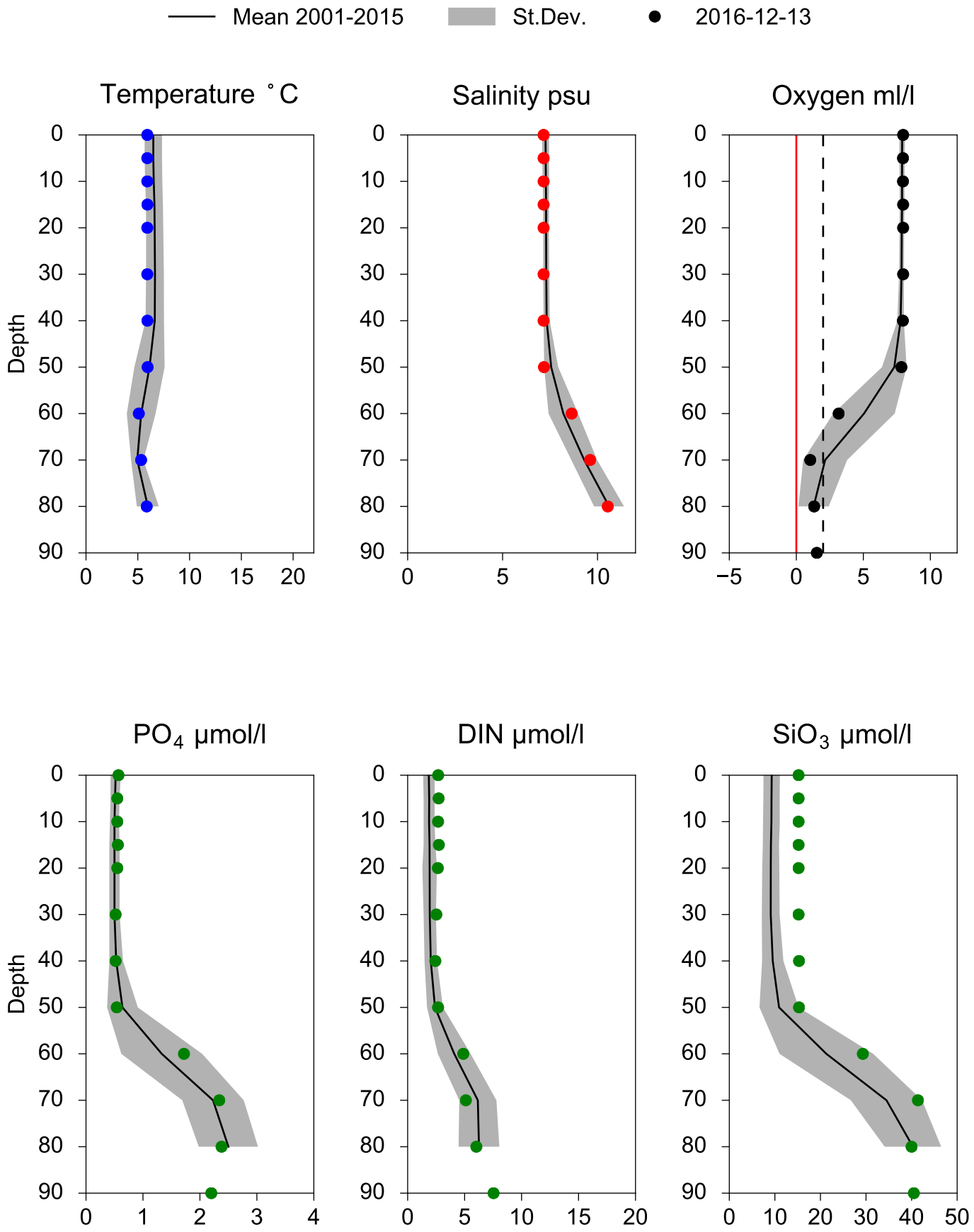
STATION BCS III-10 SURFACE WATER (0-10m)



OXYGEN IN BOTTOM WATER (depth >= 80 m)



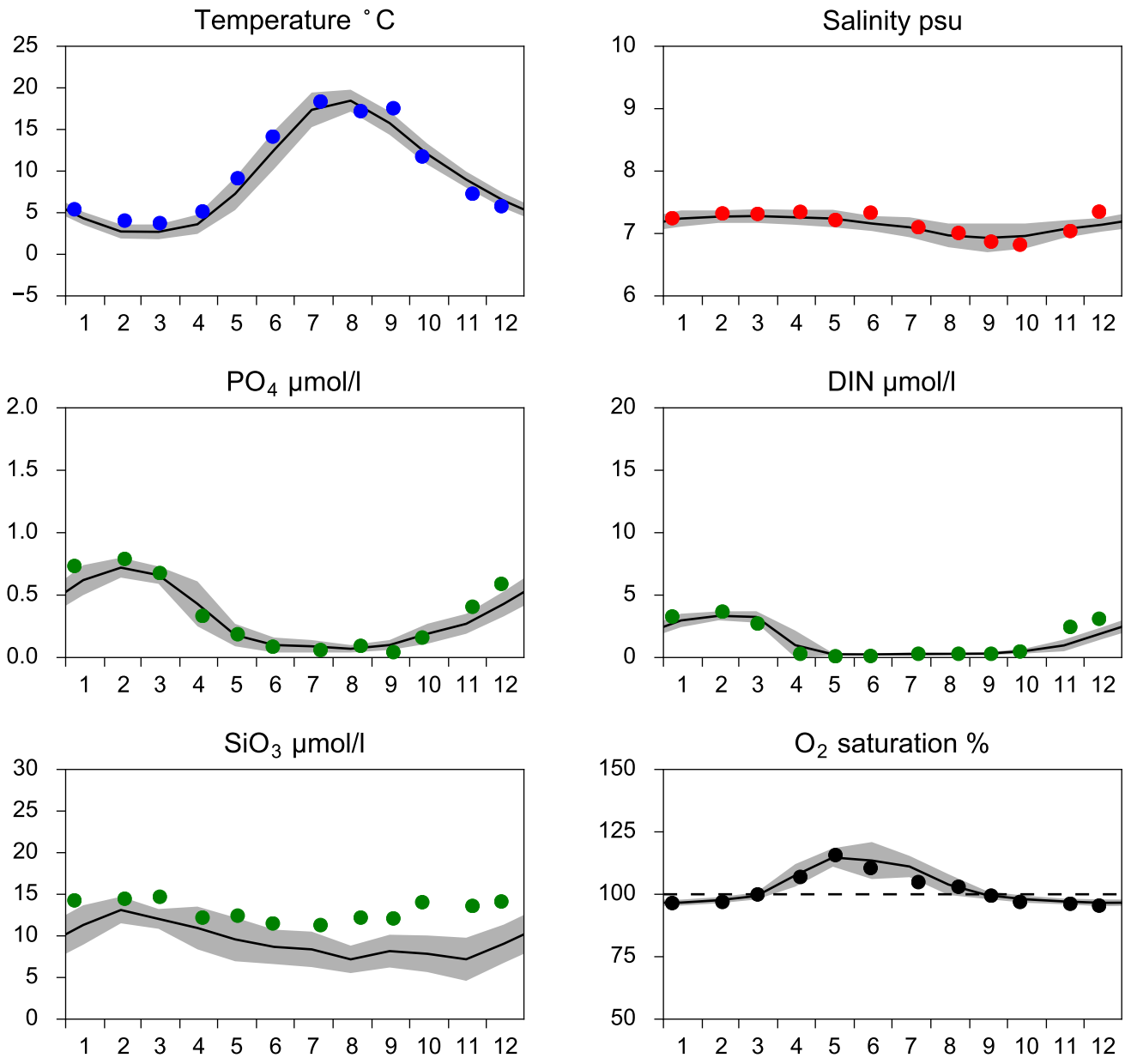
Vertical profiles BCS III-10
December



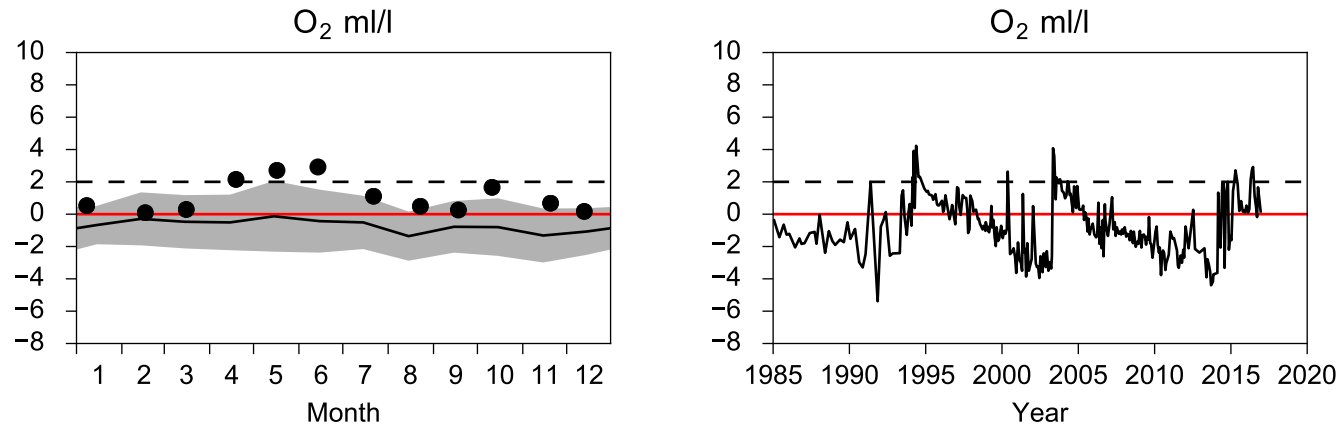
STATION BY10 SURFACE WATER (0-10m)

Annual Cycles

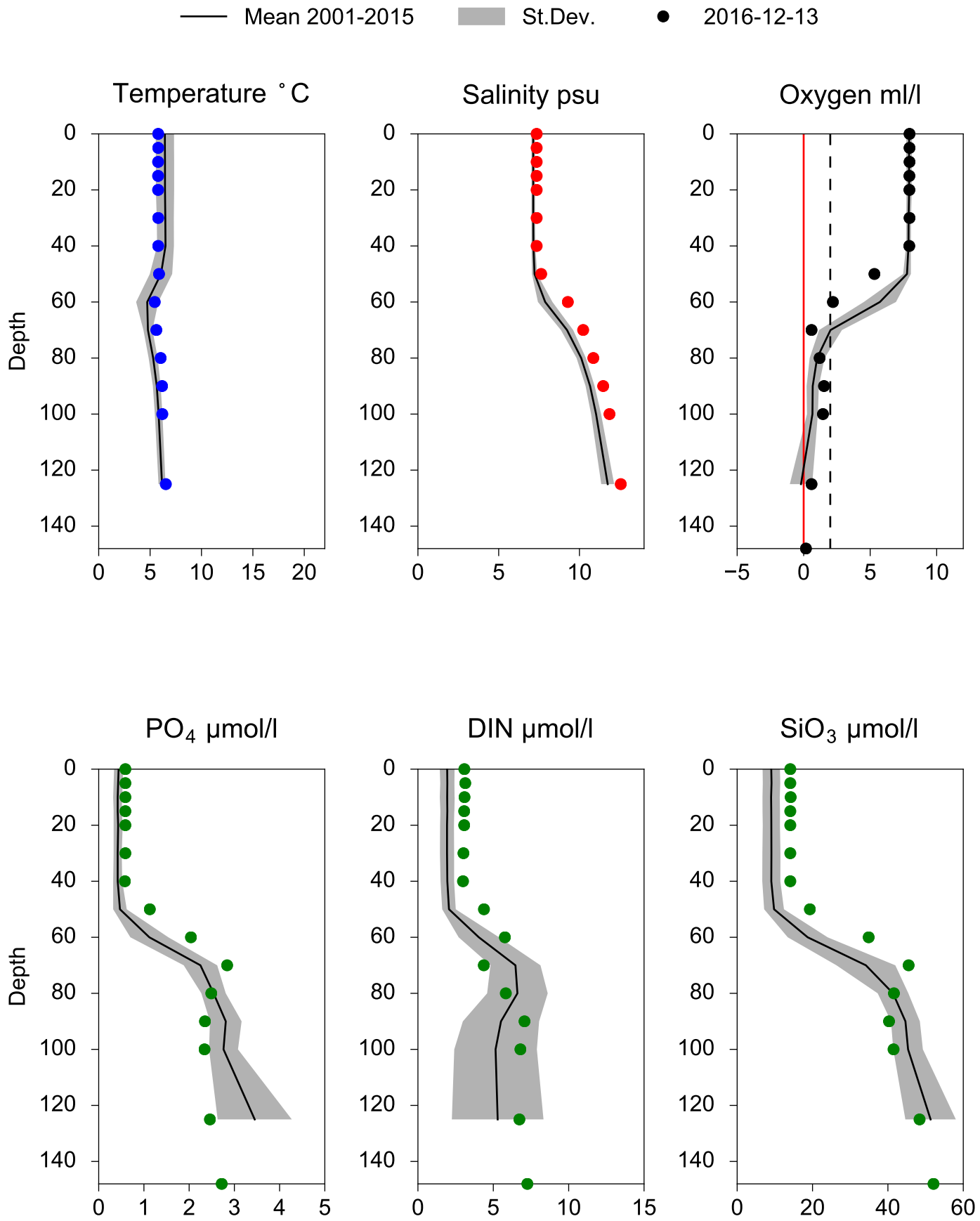
Mean 2001-2015 | St.Dev. | 2016



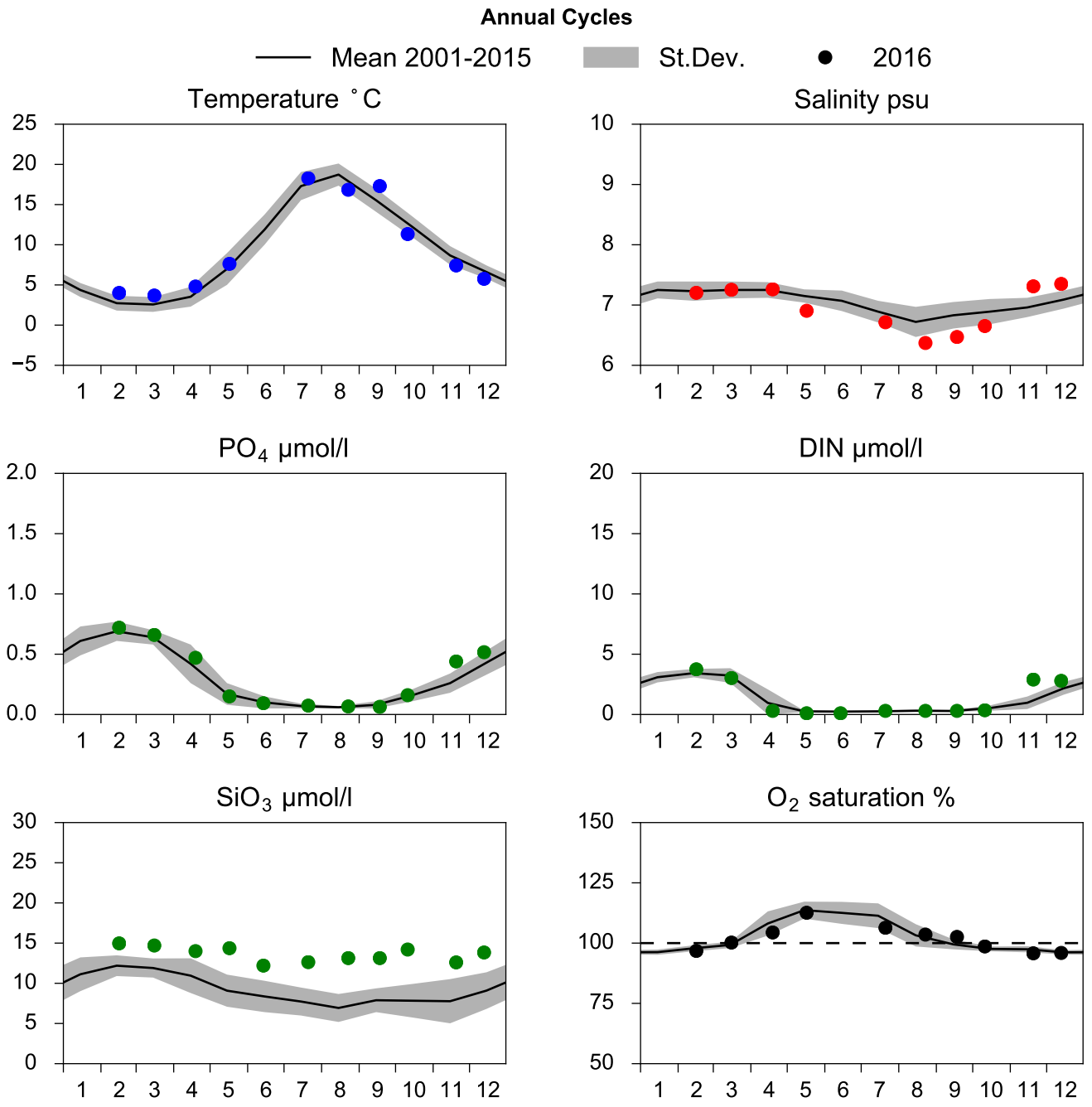
OXYGEN IN BOTTOM WATER (depth >= 125 m)



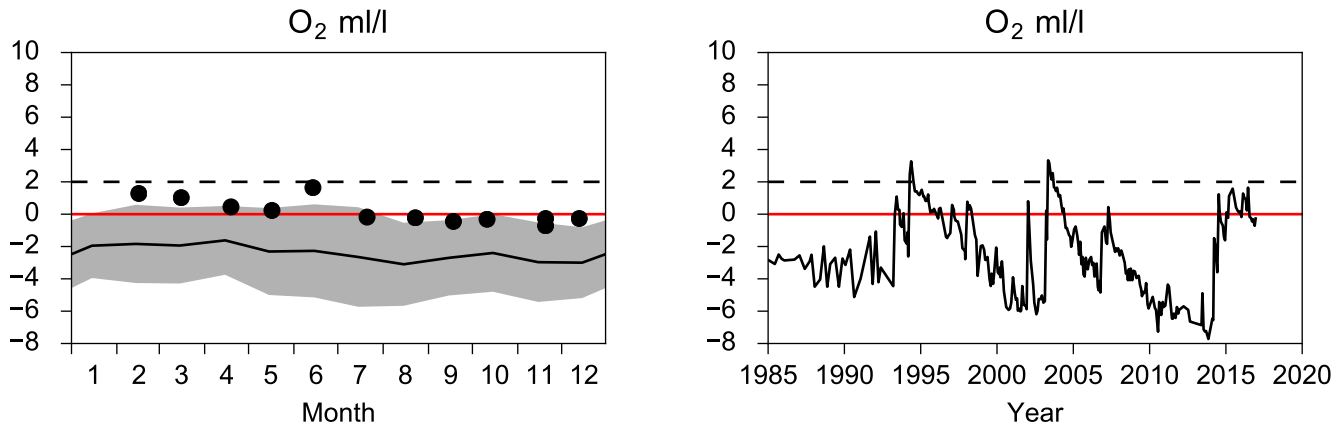
Vertical profiles BY10
December



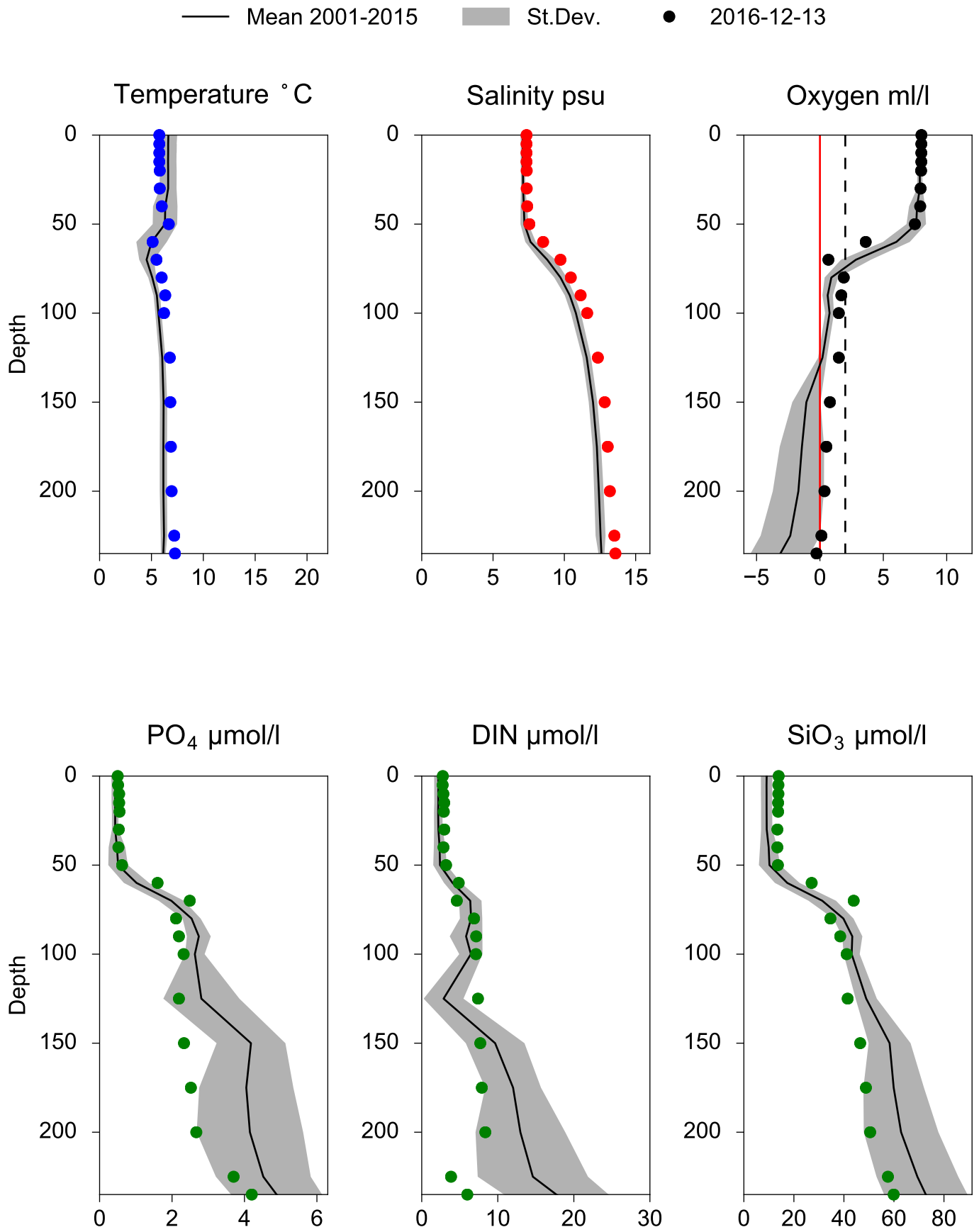
STATION BY15 GOTLANDSDJ SURFACE WATER (0-10m)



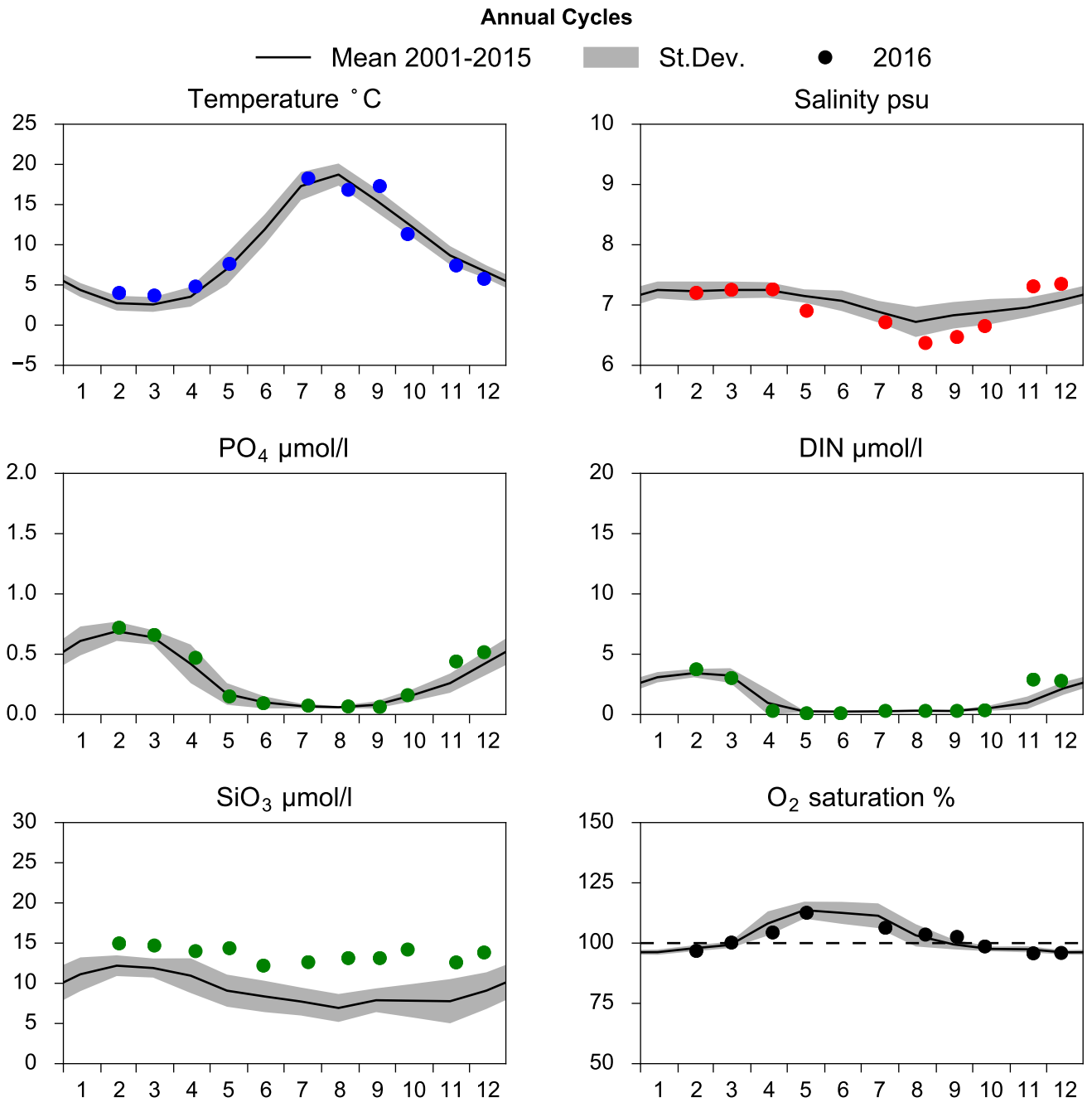
OXYGEN IN BOTTOM WATER (depth >= 225 m)



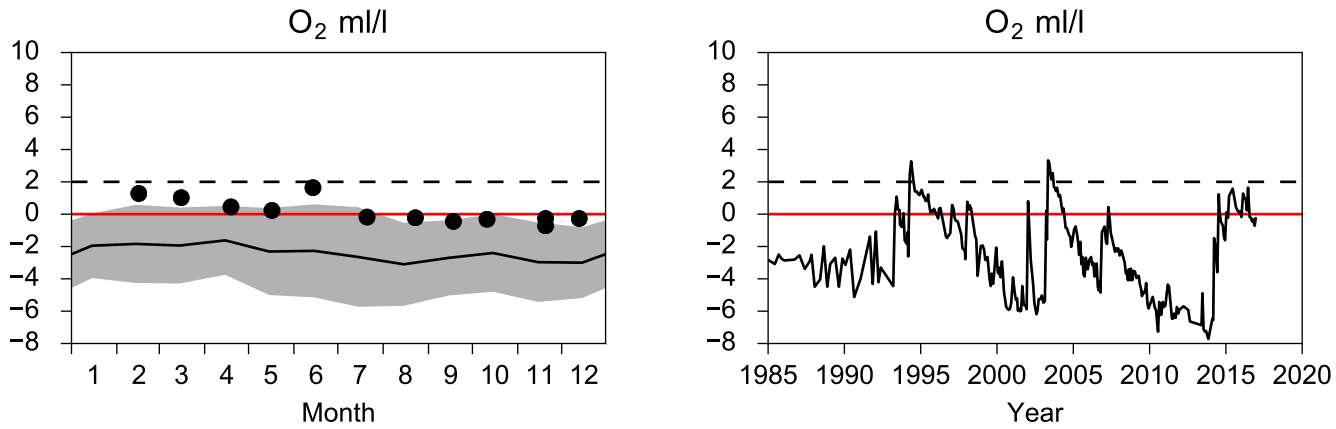
Vertical profiles BY15 GOTLANDSDJ
December



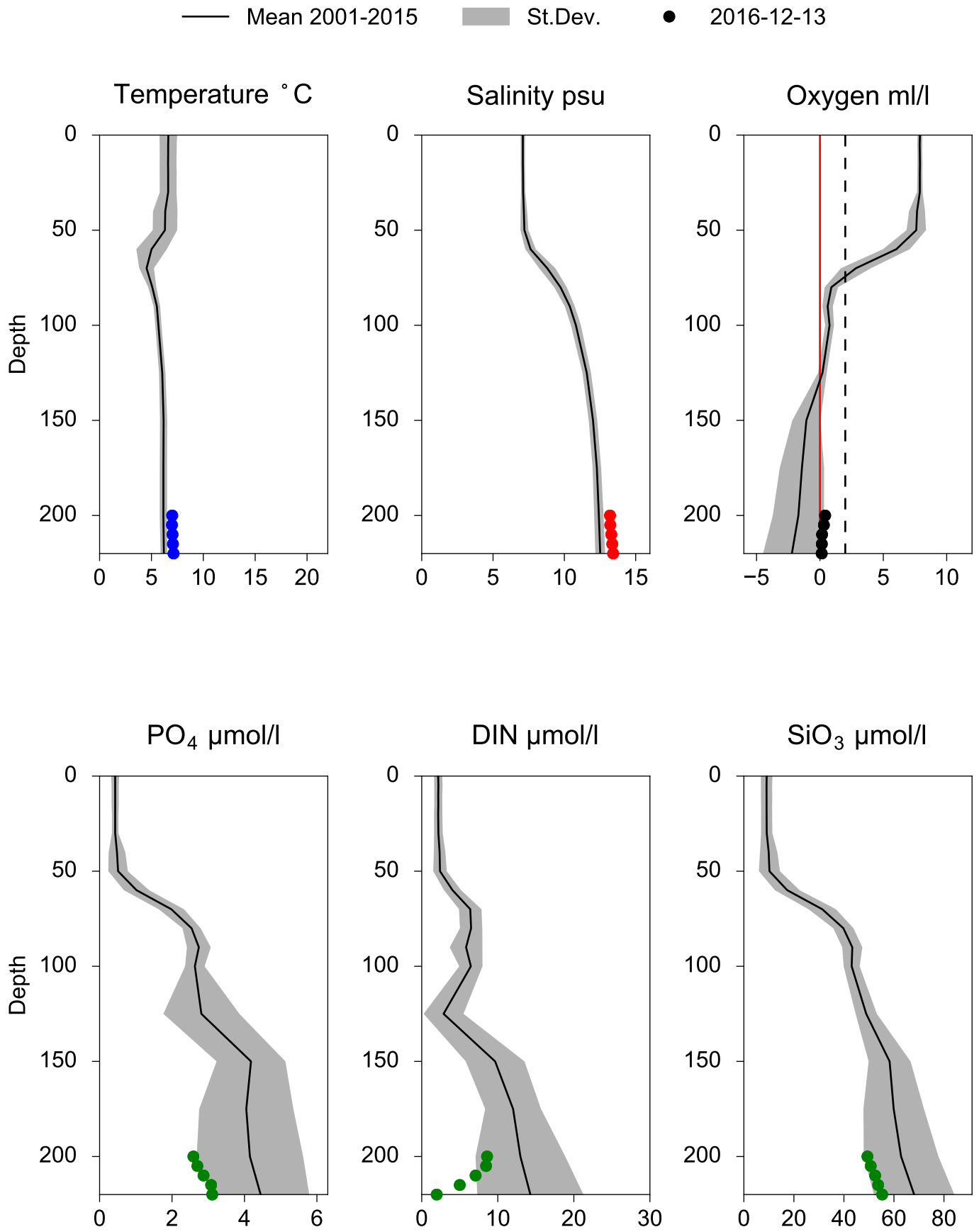
STATION BY15 GOTLANDSDJ SURFACE WATER (0-10m)



OXYGEN IN BOTTOM WATER (depth >= 225 m)



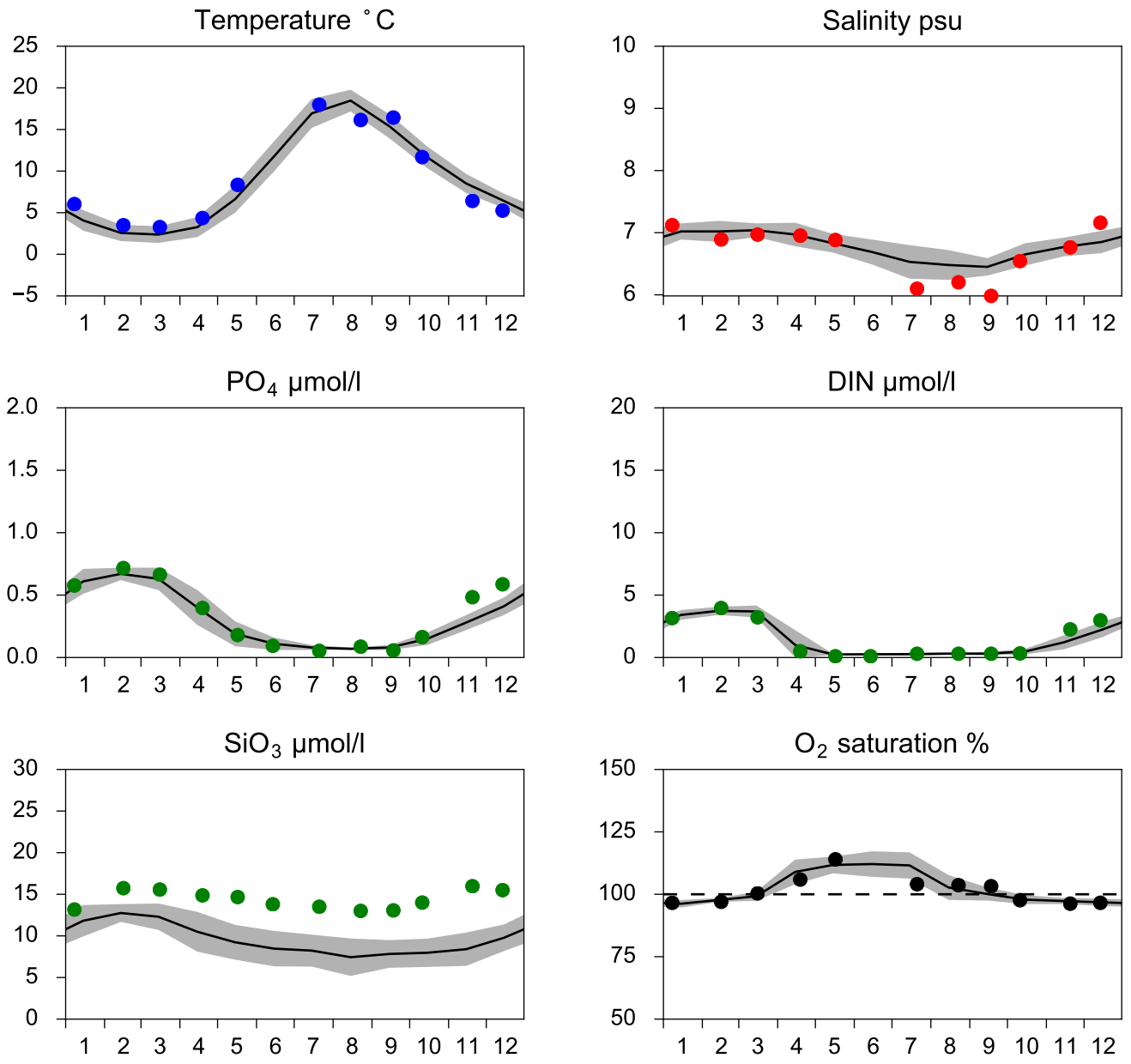
Vertical profiles BY15 GOTLANDSDJ
December



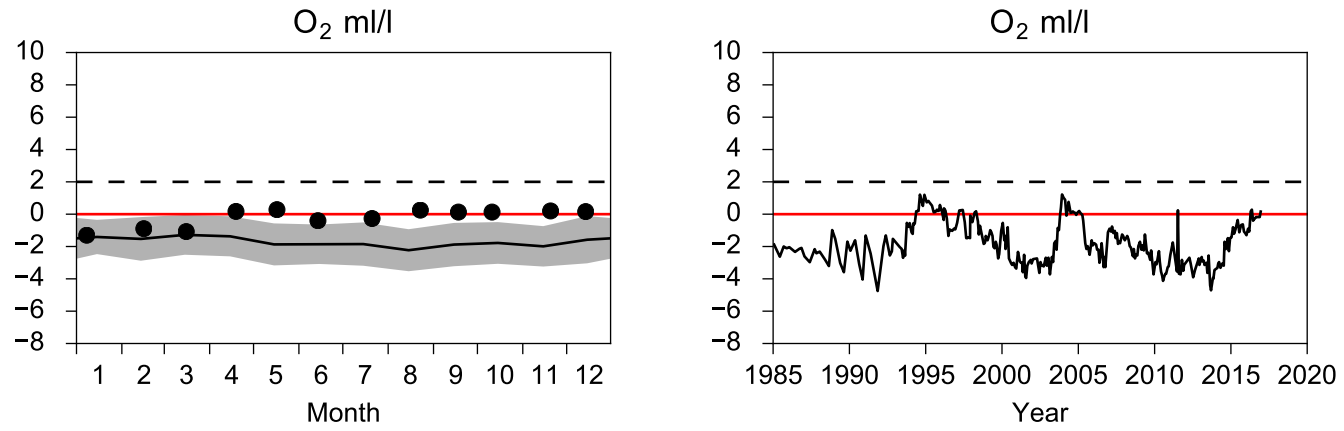
STATION BY20 FÅRÖDJ SURFACE WATER (0-10m)

Annual Cycles

Mean 2001-2015 | St.Dev. | 2016



OXYGEN IN BOTTOM WATER (depth >= 175 m)



Vertical profiles BY20 FÅRÖDJ
December