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2018-06-20
Dnr: S/Gbg-2018-66

Report from the SMHI monitoring cruise with M/V Aura

Survey period: 2018-05-26 - 2018-06-01
Principal: Swedish Meteorological and Hydrological Institute (SMHI), Swedish Agency for Marine and Water Management (SwAM)
Cooperation partners: Finnish Environment Institute (SYKE), VG-Shipping

SUMMARY

During the cruise, which is part of the Swedish national marine monitoring programme, stations in the Skagerrak, the Kattegat, the Sound, the Baltic Proper were visited.

The warm and sunny weather in May, in combination with calm winds, had warmed the surface water, and the surface water temperature was above normal at all visited stations. High phytoplankton activity was found mainly at the stations in the Baltic Proper, indicating ongoing spring bloom. Large peaks of fluorescence were found at 10-20 meters depth.

In large areas of the Baltic Proper, oxygen concentration in the deep water was close to zero. Anoxic conditions, when hydrogen sulfide can form, were found in the Bornholm Basin and the Bay of Gdansk at about 90 meters depth, in Bight of Hanö at 77 meters, and in Western and Eastern Gotland Basin at about 70 and 140 meters depth respectively. Acute hypoxia (oxygen < 2ml/l) was found from about 70 meters depth at the stations in the Baltic Proper, but also at the bottom at about 45 meters depth in one of the stations in the Arkona Basin. Dissolved inorganic nitrogen was below detection level at the entire survey area, which is normal for the season. Concentration of phosphate was below normal in the Eastern, Western and Northern Gotland Basin. Silicate concentration in the surface was above normal levels in the southern part of the Eastern and Western Gotland Basin and in the Bay of Gdansk. The other investigated areas showed values normal for the season.

The next cruise is planned to start in the middle of July.

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RESULTS

The cruise was conducted aboard the Finnish vessel Aura, and it started in Gothenburg on the 26th of May and ended in Turku the 1th of June. The winds were mostly weak from the northeast to east. Air temperature varied mainly between 15 to 20 °C.

This report is based on data that have passed a first quality control. When data are published at the nation 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 a week after the cruise.

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

The Skagerrak

The surface water temperature was above normal for the season, and varied between 18-19 °C. The salinity was somewhat below normal in the surface, around 26 psu at the most offshore stations and 18.2-20.9 psu at the other stations. Thermocline and halocline coincided at all stations, and was found at 5-10 meters depth.

Nutrients in the surface water were almost depleted, which is normal for the season. Dissolved inorganic nitrogen, DIN (the sum of nitrate, nitrite and ammonia), was below detection level in the surface water. Concentration of dissolved inorganic phosphorus, DIP, showed normal levels. The surface concentration varied between 0.04-0.05 µmol/l. Silicate concentration was normal for the season in the surface water at all stations, and varied between 0.8 and 1.6 µmol/l, highest at the coastal stations.

Indications of phytoplankton bloom were found at the offshore stations, and distinct fluorescence peaks were found at about 20 meters depth. For more information on species composition see separate report "AlgAware" that will be available one to two weeks after completion of the expedition.

Oxygen saturation was above normal in the surface. In the deep water, the oxygen concentration was normal.

The Kattegat and the Sound

The surface water temperature was above normal for the season, and was measured to around 15 °C. The salinity was normal or below normal in the surface. In the Kattegat it varied from 15.8 to 21.4 psu, and in the Sound it was 7.5 psu. The halocline and the thermocline coincided at all stations, and the stratification was very clear at Fladen and W Landskrona.

The concentration of DIN in the surface water was below detection level, except at Fladen, where it was 0.04 µmol/l, and this is normal for the season. The concentration of DIP in the surface water of the Kattegat was between 0.04 and 0.09 µmol/l, and 0.24 µmol/l in the Sound. Silicate concentration was normal in the area, and varied between 1.4 and 3.3 µmol/l in the Kattegat, and was 8.2 µmol/l in the Sound.

Fluorescence measurements from the CTD showed peaks at about 15 meters at Anholt E, but no peaks were present at the other stations.

The deep water in the area was well oxygenated, which is normal for the season. The oxygen concentration near the bottom varied between 4.6 and 5.5 ml/l. For N14 and Anholt E the concentration was a somewhat below normal.

The Baltic Proper

The surface water temperature was above normal for the season, and varied between 10.5 and 14.9 °C. The surface salinity varied between 6.2 and 7.5 psu, which is normal for the season. A developed thermocline was found at several stations at 10-20 meters depth. And a more distinct stratification was found at 55 to 75 meters depth.

Nutrient concentration of DIN in the surface water was below detection level at all stations, and this is normal for the season. The surface concentration of DIP was normal in the Bornholm Basin, and at BY1, where it varied between 0.17 and 0.34 µmol/l. At the other stations in the area, the level was below normal, with concentration between 0.05 and 0.14 µmol/l.

The silicate concentration in the surface of the southern parts of the Eastern and Western Gotland Basin was above normal for the season, and normal in the other areas. Concentration varied between 7.6 and 16.8 µmol/l.

Large parts of the deep water in the Baltic Proper had oxygen concentration close to zero. Anoxic conditions, when hydrogen sulfide can form, were found close to the bottom in the Bornholm Basin, the Bight of Hanö and in the Bay of Gdansk. In the Eastern and Western Gotland Basin, anoxic conditions were found at 70 and 140 meters depth respectively. Acute hypoxia (oxygen < 2ml/l) was found in the whole area from 60-80 meters depth, but also at the bottom at about 45 meters depth at BY1 in the Arkona Basin.

Fluorescence measurements from the CTD showed distinct peaks at the thermocline at 10-20 meters depth.

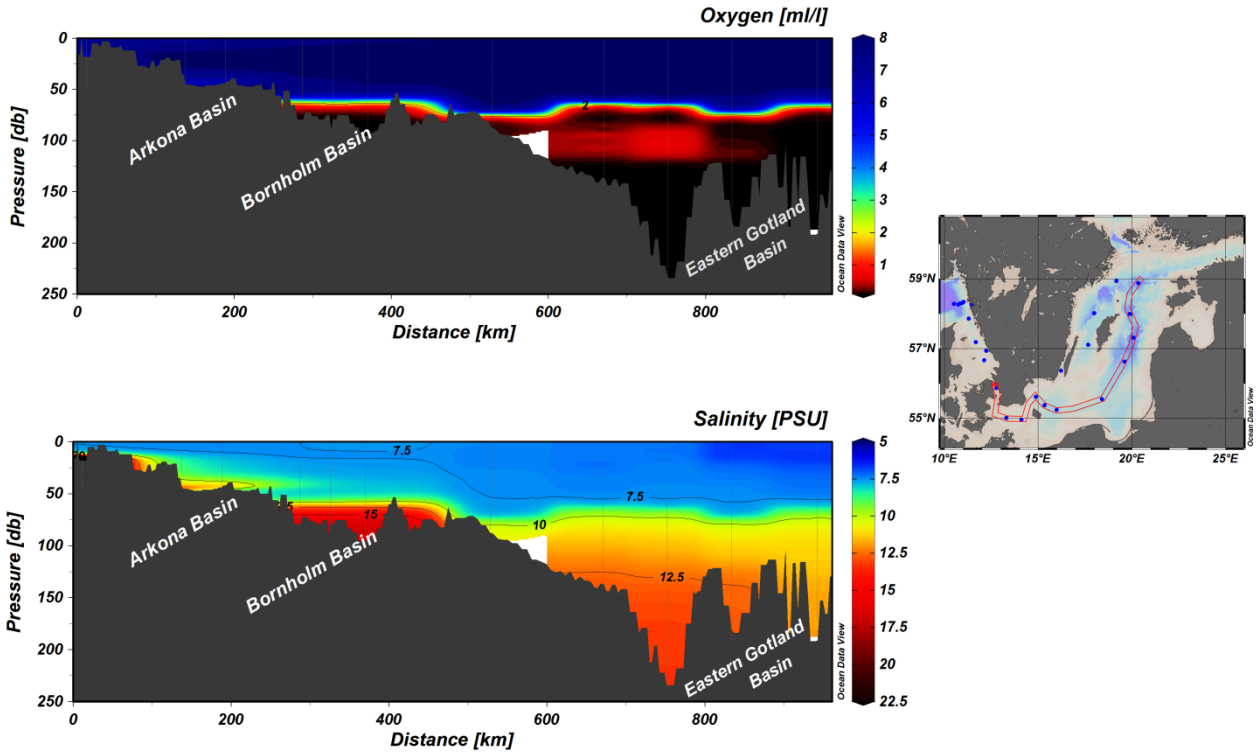

Figure 1. Transect showing dissolved oxygen and salinity from the Sound, through the Baltic Proper, to the Eastern Gotland Basin.

PARTICIPANTS

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Johan Kronsell	Chief Scientist	SMHI
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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

SMHI
Havs och Vatten myndigheten

TRACKCHART
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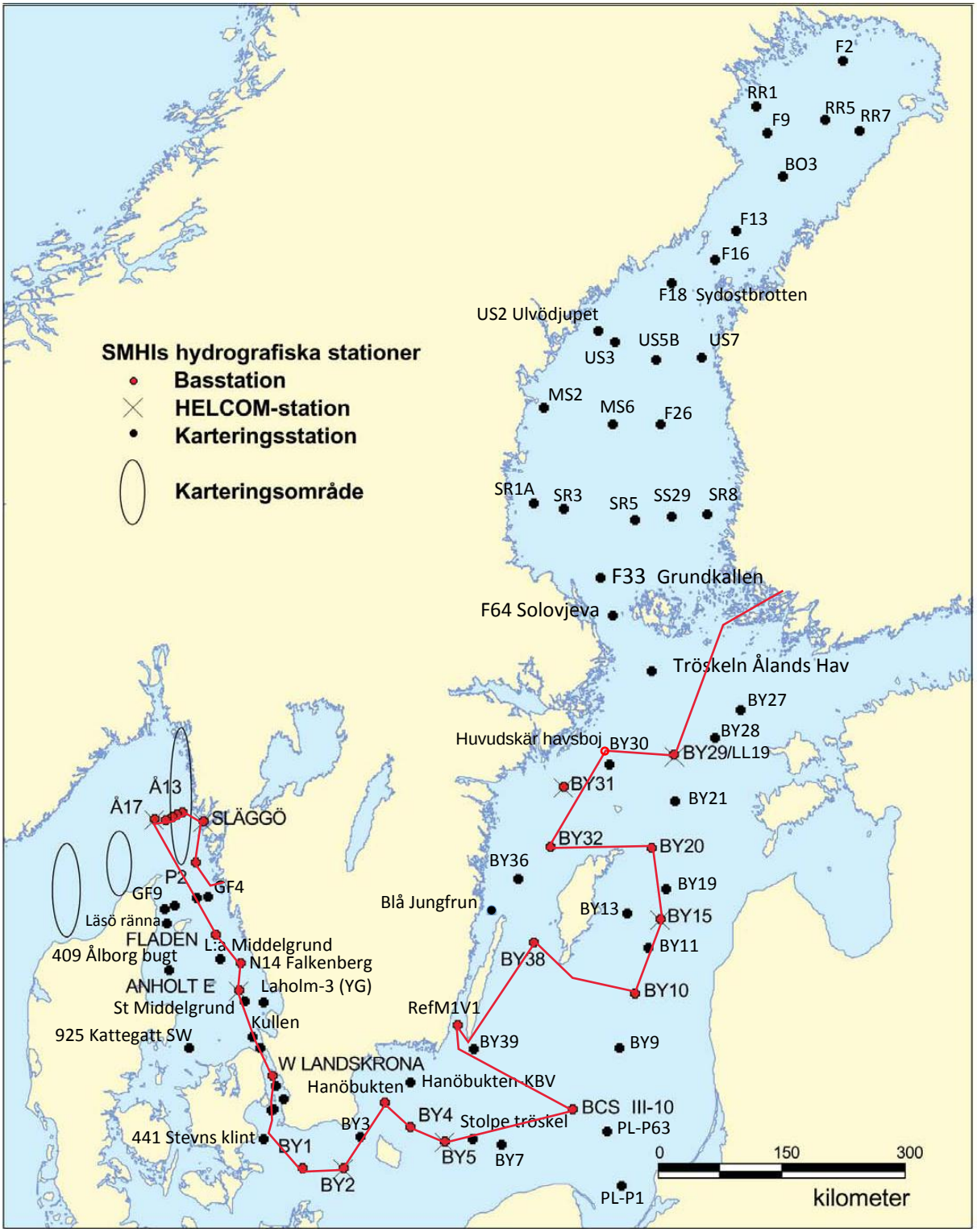
Date: 20180526-20180601
Series: 0026-0051



Ship: EB
Year: 2018

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	Wind vel	Air temp C	Air pres hPa	WCWI (Weath Cloud Waves Iceob)	CZPP (Chla Zoop Phytop Pp)	No de	No btl	Temp_btl	Temp_ctd	Salt_btl	Salt_ctd	Ph	Doxy_btl	Doxy_ctd	H2s	Phos	Ptot	Ntri	Ntra	Ntrz	Amon	Ntot	Alky	Sio3-si	Humus	Comnt_visit	Comnt_samp
0026	2	SKEX23	BAS...	P2	5752.00	01117.49	20180526	1650	92		31	4.7	23.8	1027	1120	----	10		x	x	x	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	-	-
0027	2	FIBG27	BAS...	SLÄGGÖ	5815.59	01126.15	20180526	2110	72		05	5.1	19.7	1027	9990	-x--	9		x	x	x	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	x	-
0028	2	SKEX14	BAS...	Å13	5820.41	01101.66	20180526	2345	96		09	6	18	1026	9990	----	10		x	x	x	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	x	x
0029	2	SKEX15	BAS...	Å14	5818.98	01056.57	20180527	0115	116		09	5.2	18.2	1027	9990	----	11		-	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
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0035	2	KAEX29	BAS...	ANHOLT E	5640.12	01206.69	20180527	2040	62		07	7	18.3	1026	9990	-x--	10		x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	-	-	-
0036	2	SOCX39	BAS...	W LANDSKRONA	5552.00	01244.92	20180528	0245	51		09	10	15.4	1024	1430	----	9		x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	-	x
0037	2	BPSA02	BAS...	BY1	5500.95	01318.07	20180528	0900	45	6	09	8	16.0	1024	1230	----	8		x	x	x	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	-	x
0038	2	BPSA03	BAS...	BY2 ARKONA	5458.27	01405.95	20180528	1250	46	6	09	10	19.7	1024	1330	-x--	8		x	x	x	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	-	x
0039	2	BPSH05	BAS...	HANÖBUKTEN	5537.04	01452.05	20180528	1750	78	6	07	10	15.1	1024	1130	----	11		x	x	x	x	x	x	x	x	x	-	x	x	x	x	-	x	x	-	-	-
0040	2	BPSB06	BAS...	BY4 CHRISTIANSÖ	5522.98	01520.05	20180528	2045	91		08	10	14.9	1023	1130	----	12		x	x	x	x	-	x	x	x	x	-	x	x	x	x	-	-	x	-	-	-
0041	2	BPSB07	BAS...	BY5 BORNHOLMSDJ	5515.00	01559.07	20180529	0010	89		10	8	15.2	1023	9990	-x--	12		x	x	x	x	x	x	x	-	x	-	x	x	x	x	-	x	x	-	x	x
0042	2	BPSE11	BAS...	BCS III-10	5533.31	01824.03	20180529	0840	89	6	12	3	22.1	1023	1120	----	12		x	x	x	x	-	x	x	x	x	-	x	x	x	-	-	-	x	-	x	-
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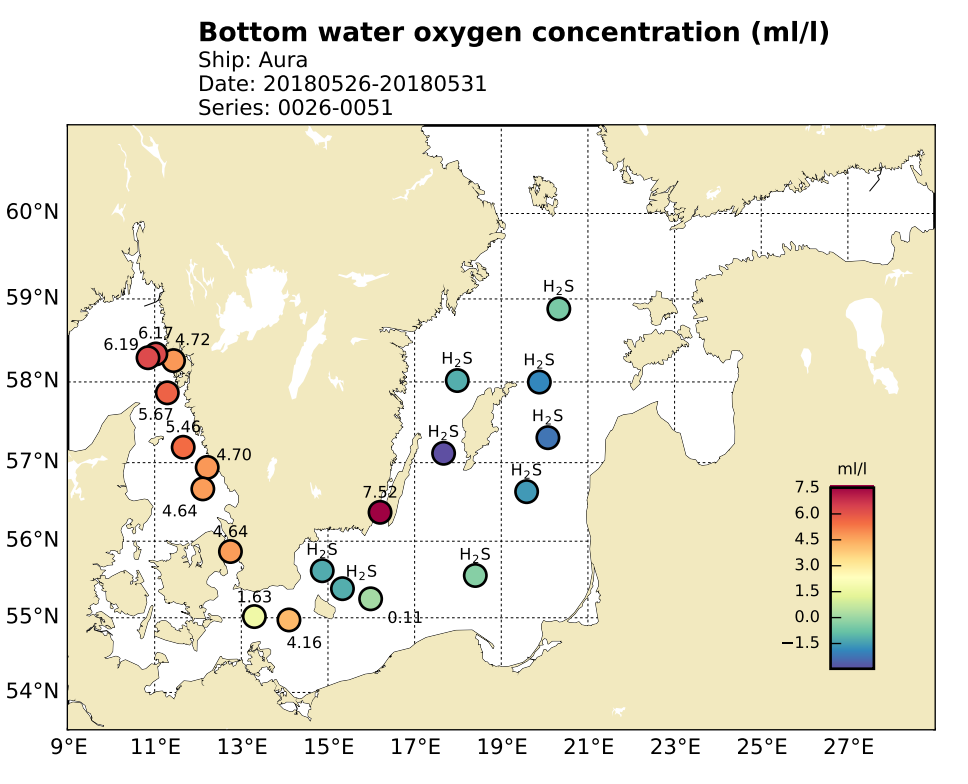
0048	2	BPEX26	BAS...	BY20 FÅRÖDJ	5759.90	01952.73	20180530	2150	195		01	10	13.3	1023	9990	----	17		x	x	-	x	-	x	x	x	x	-	x	x	x	x	-	-	x	-	x	-
0049	2	BPWX38	BAS...	BY32 NORRKÖPINGSDJ	5801.02	01759.08	20180531	0440	197	6.5	03	8	13.6	1025	0040	----	17		x	x	-	x	-	x	x	x	x	-	x	x	x	x	-	-	x	-	-	-
0050	2	BPNX00	EXT...	HUVUDSKÄR	5856.19	01909.42	20180531	1100	89		05	8	15.1	1028	0030	----	12		-	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
0051	2	BPNX35	BAS...	BY29 / LL19	5852.91	02019.68	20180531	1500	172	6	25	5.6	20.6	1027	0030	----	16		x	x	-	x	-	x	x	x	x	-	x	x	x	x	-	-	x	-	-	-


Bottom water oxygen concentration (ml/l)
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Date: 20180526-20180531
Series: 0026-0051
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58°N
57°N
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15°E
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19°E
21°E
23°E
25°E
27°E
6.19
6.17
4.72
5.67
5.46
4.70
4.64
4.64
7.52
1.63
4.16
0.11
H2S
ml/l
7.5
6.0
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1.5
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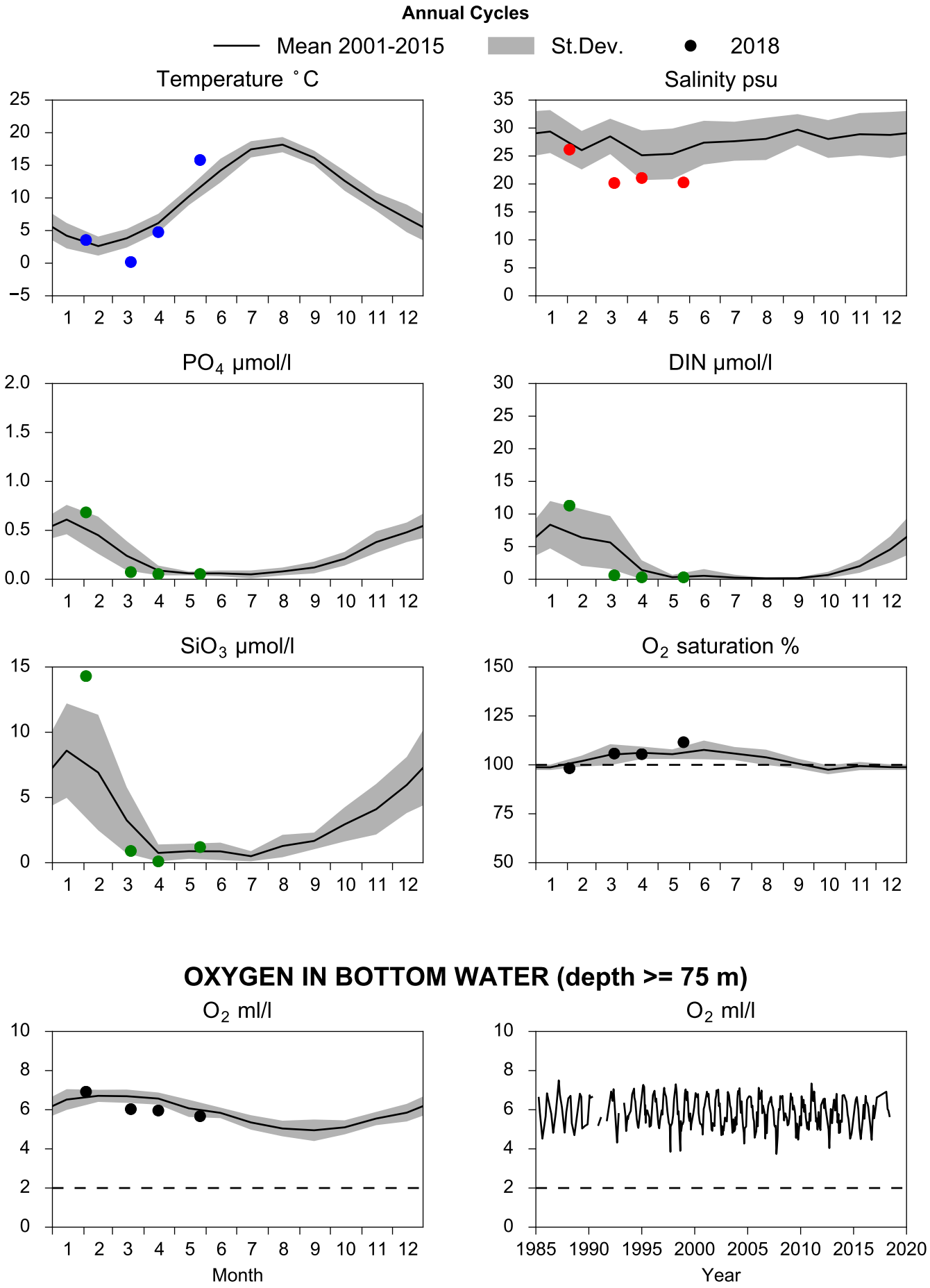
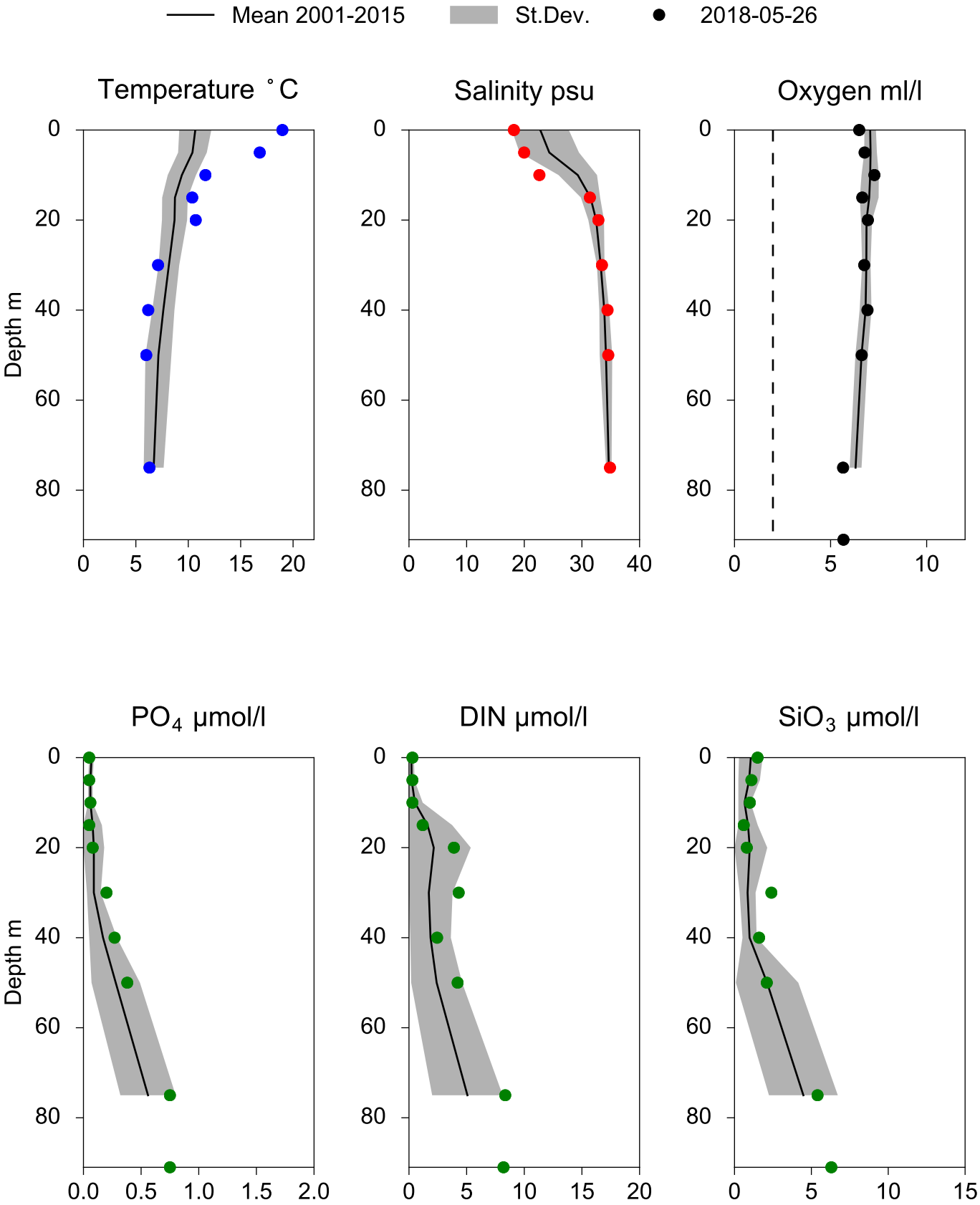
−1.5

STATION P2 SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 75 m)

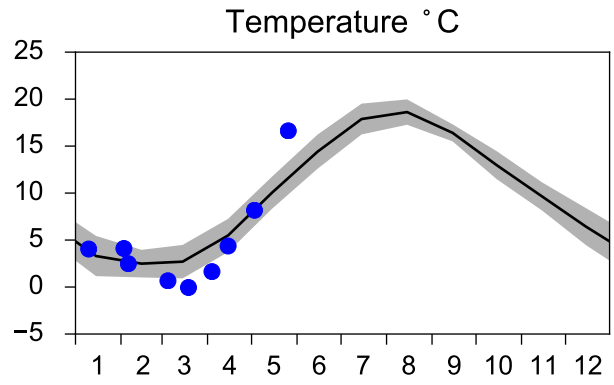
Vertical profiles P2
May

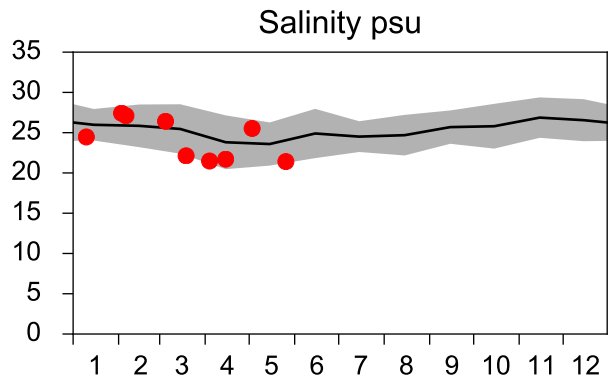


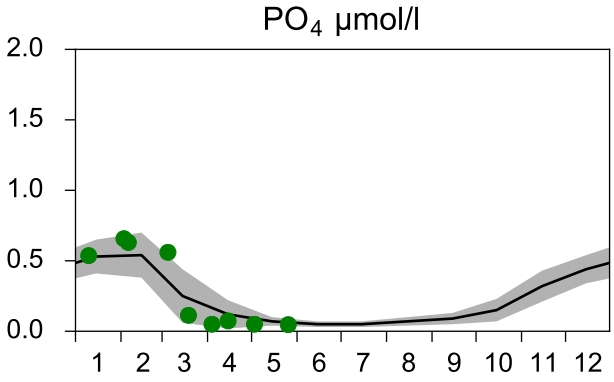
STATION SLÄGGÖ SURFACE WATER (0-10 m)

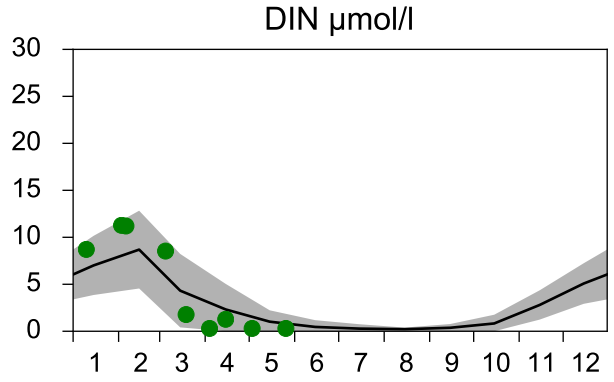
Annual Cycles

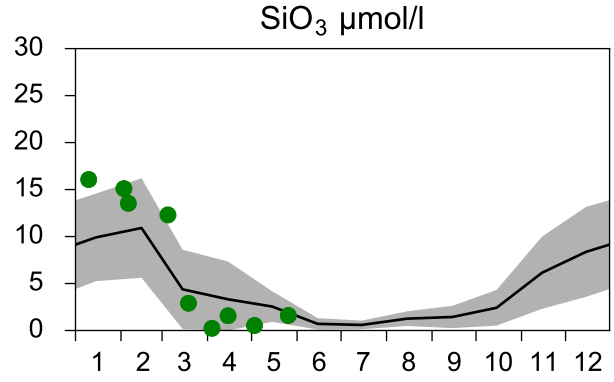
Mean 2001-2015 St.Dev. 2018

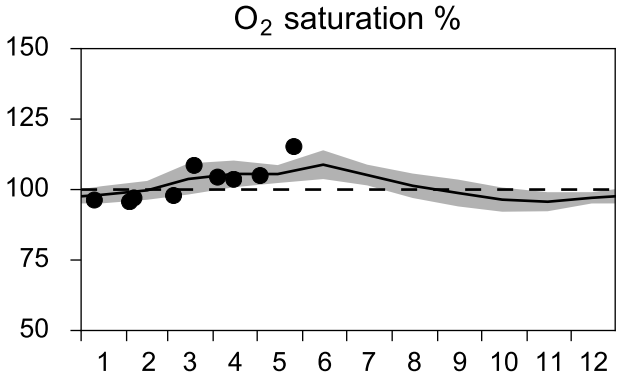




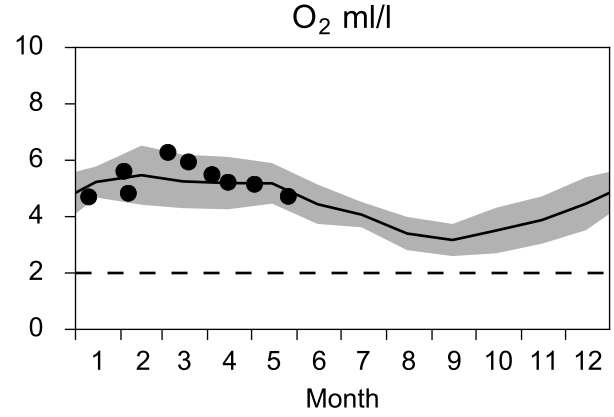


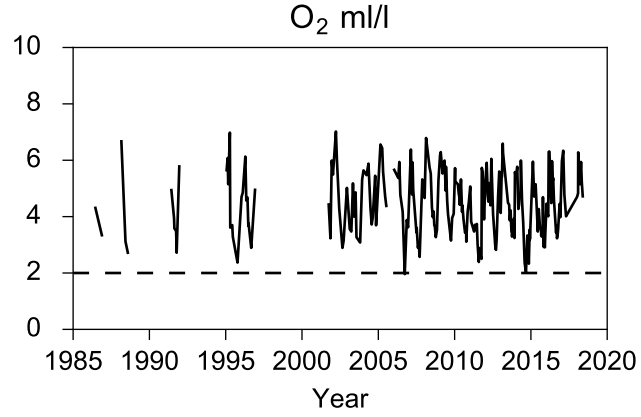




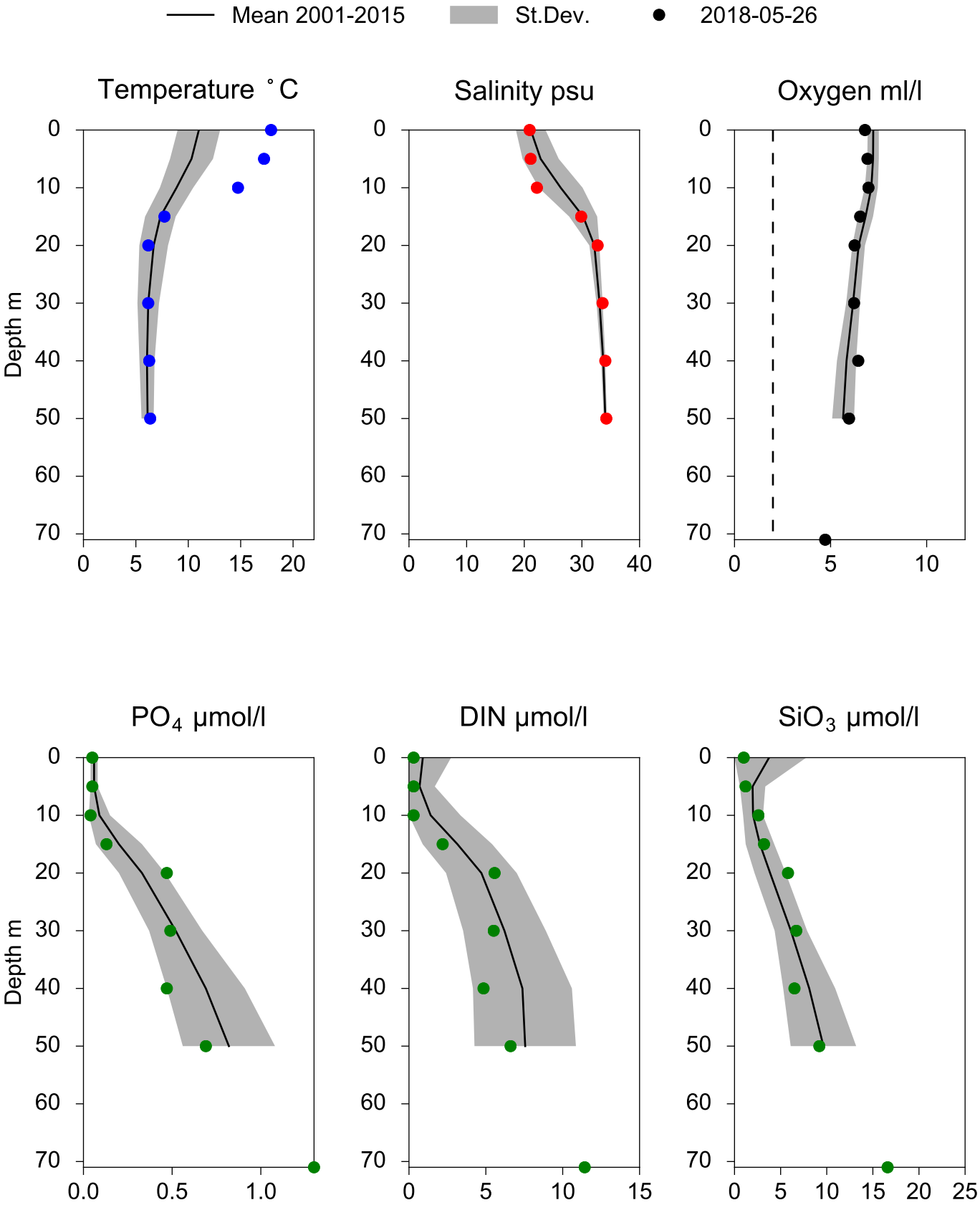


OXYGEN IN BOTTOM WATER (depth >= 64 m)



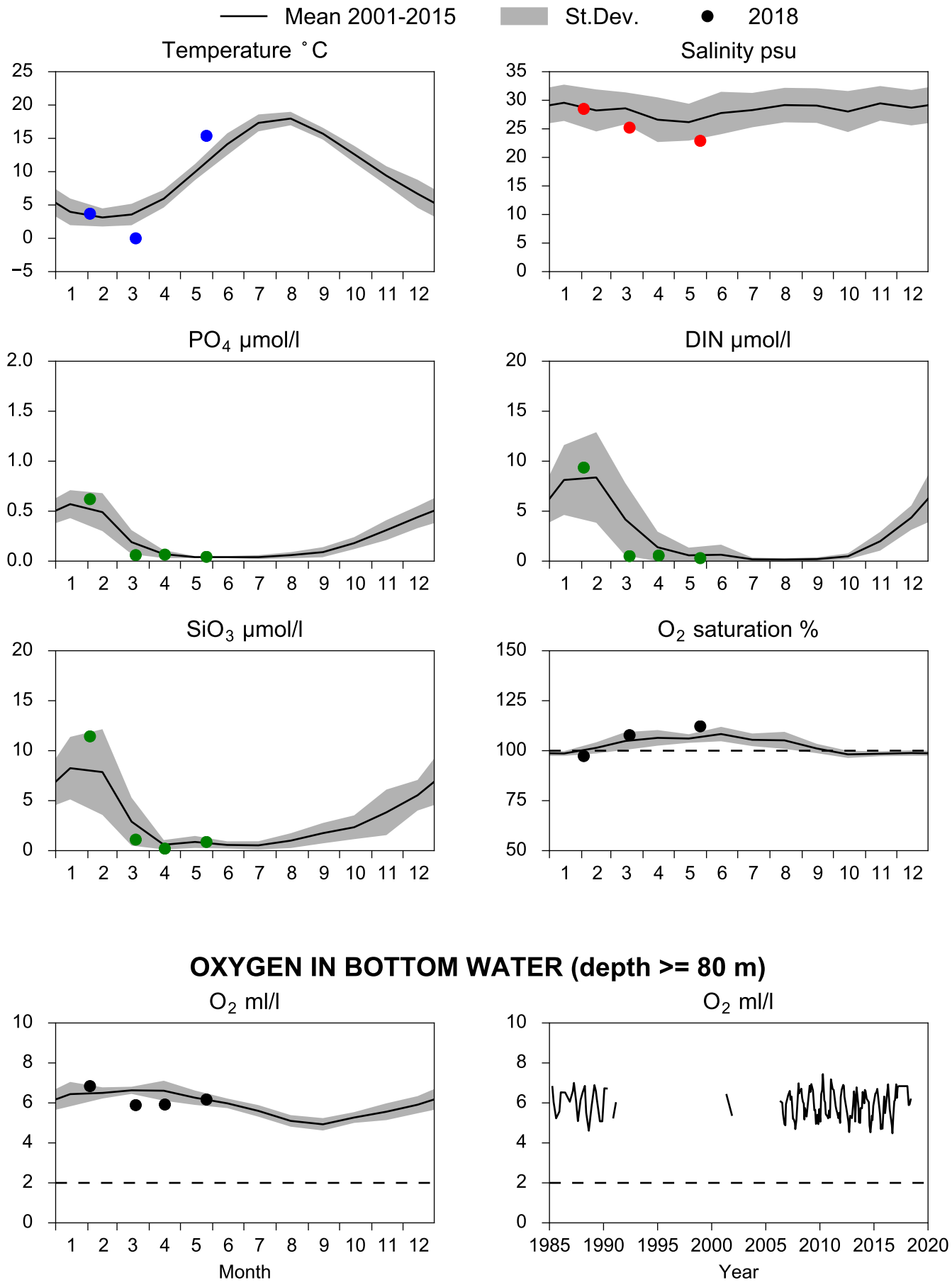


Vertical profiles SLÄGGÖ
May



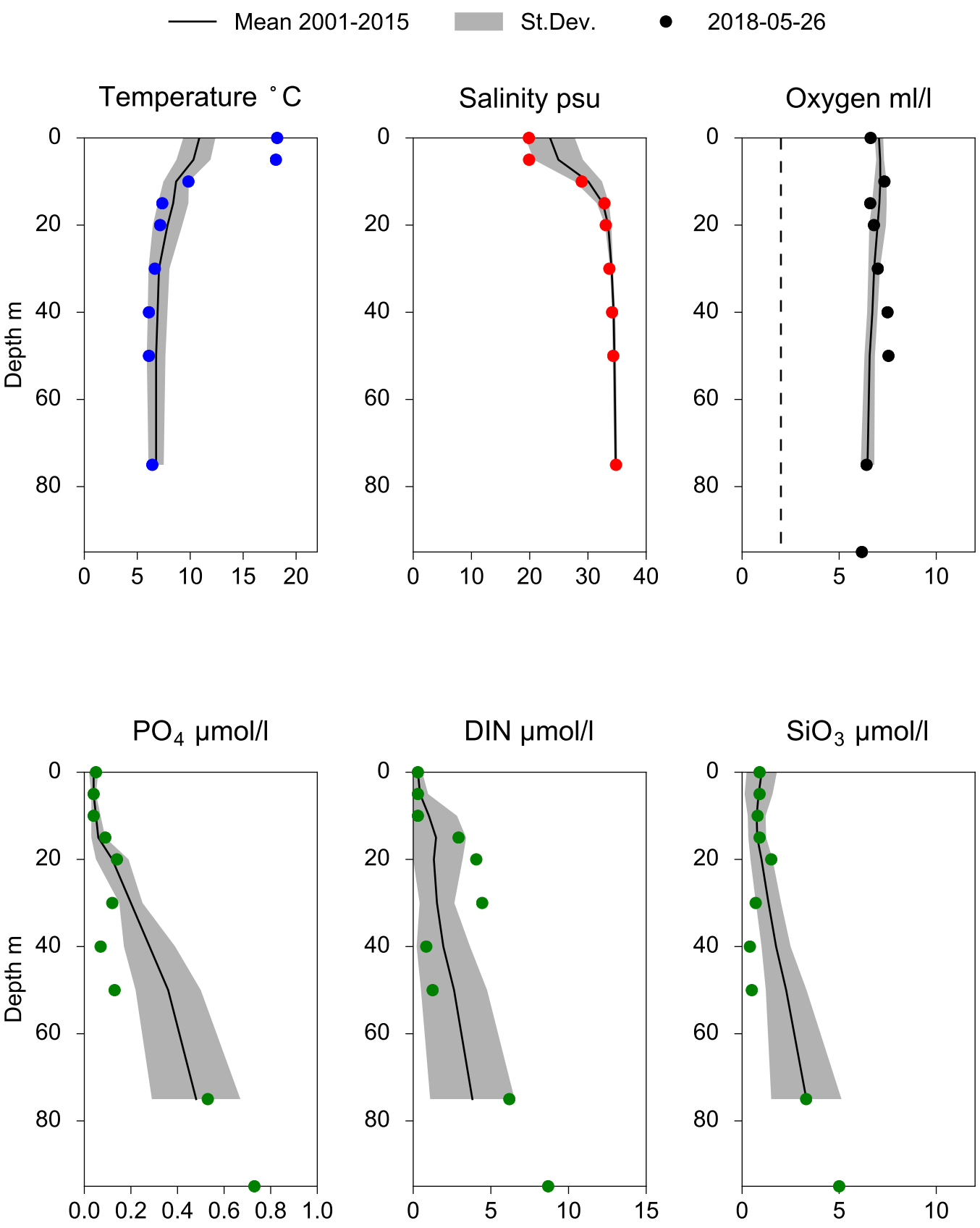
STATION Å13 SURFACE WATER (0-10 m)

Annual Cycles



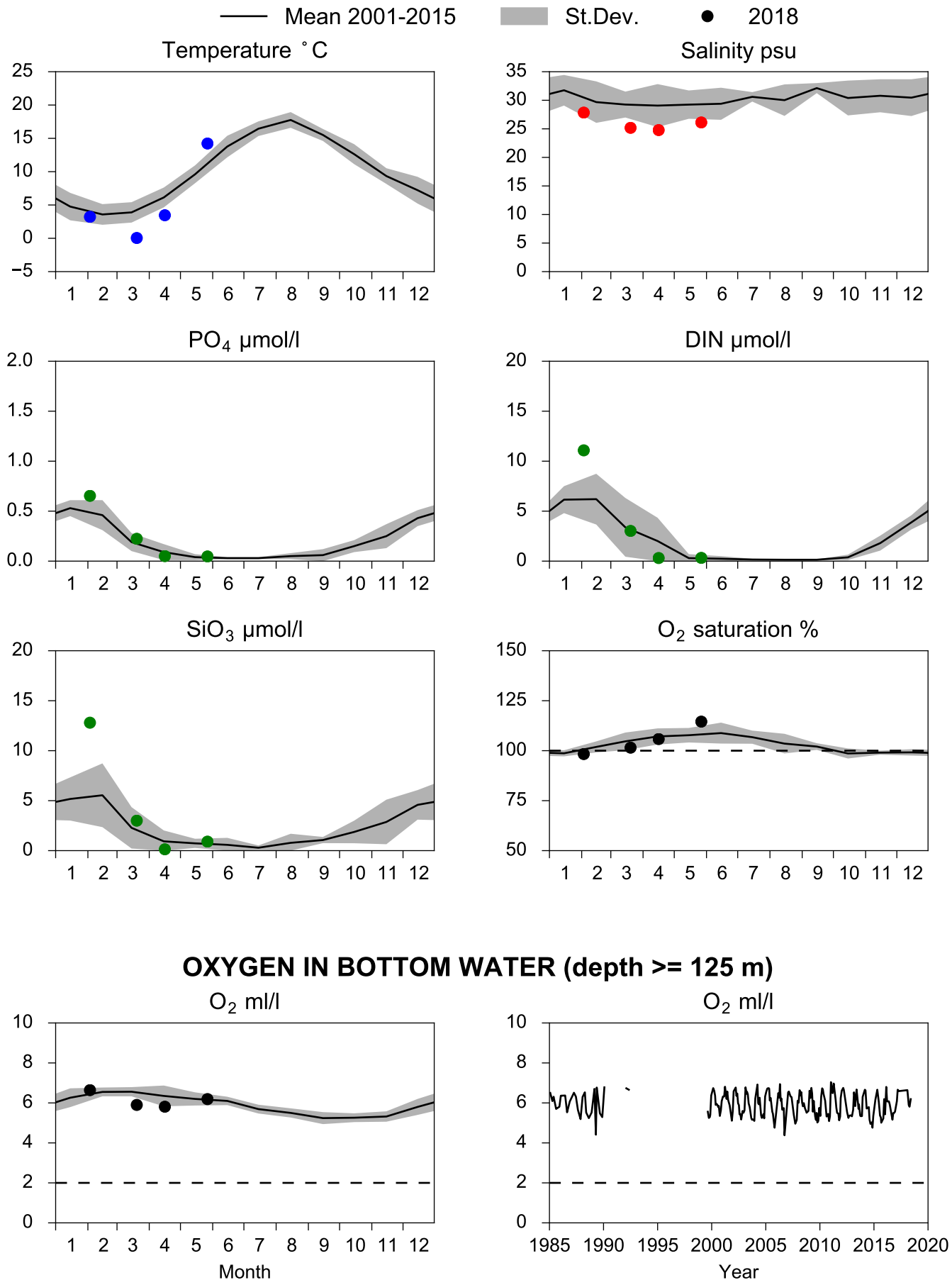
OXYGEN IN BOTTOM WATER (depth >= 80 m)

Vertical profiles Å13
May

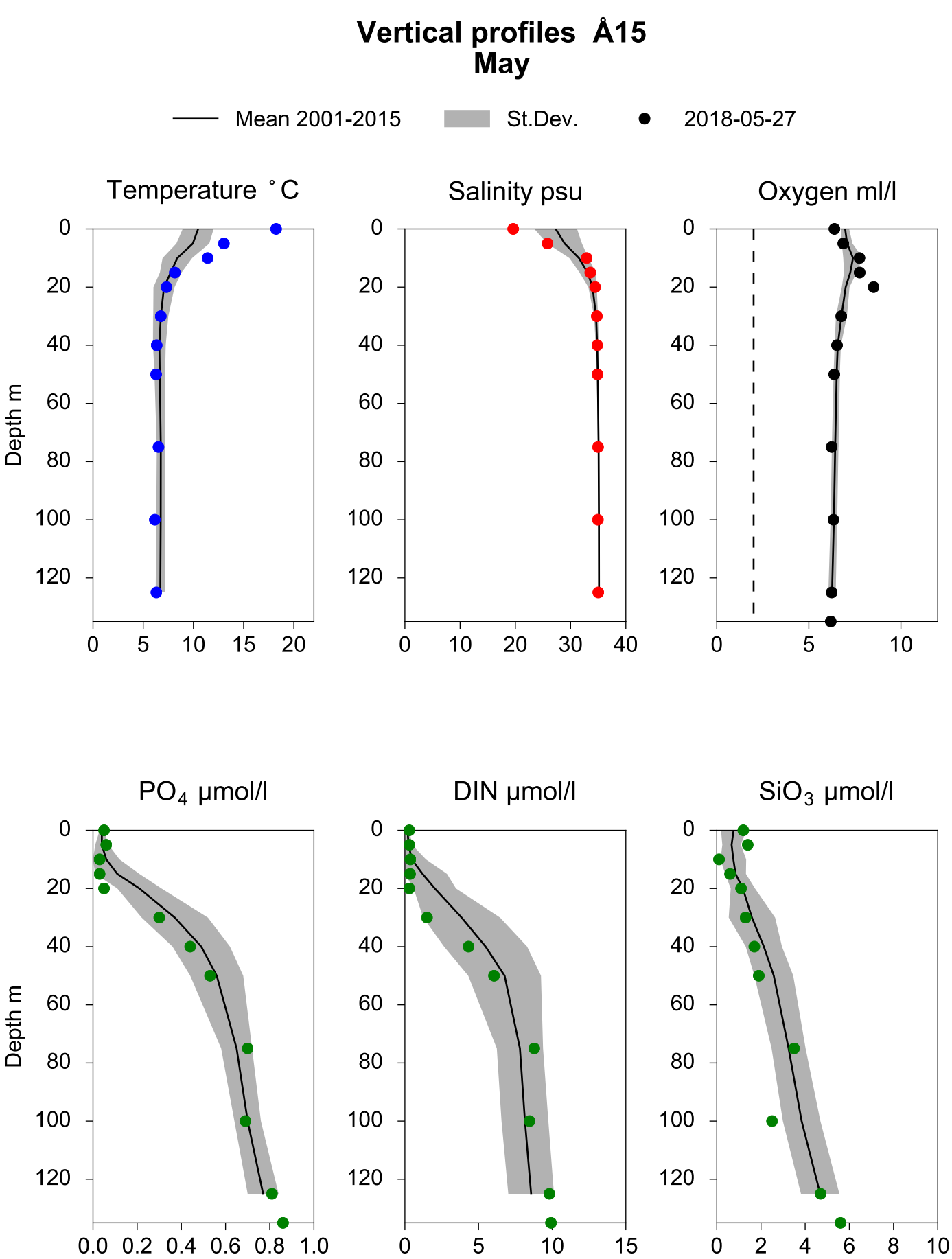


STATION Å15 SURFACE WATER (0-10 m)

Annual Cycles



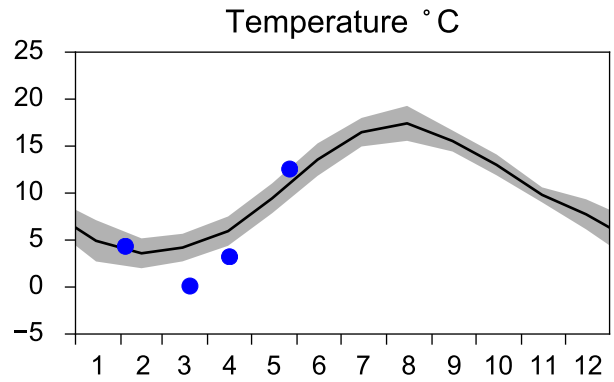
OXYGEN IN BOTTOM WATER (depth >= 125 m)

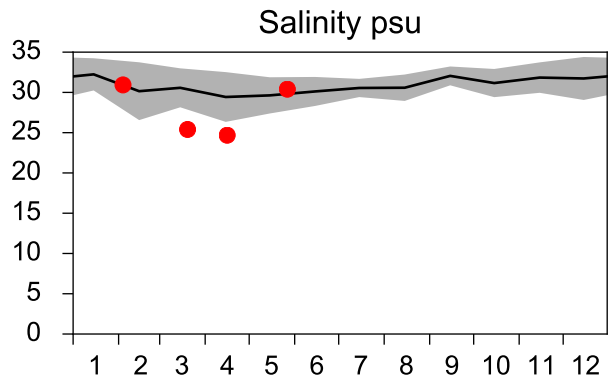

Vertical profiles Å15
May
Mean 2001-2015
St.Dev.
2018-05-27
Temperature ˚C
Salinity psu
Oxygen ml/l
Depth m
PO4 µmol/l
DIN µmol/l
SiO3 µmol/l

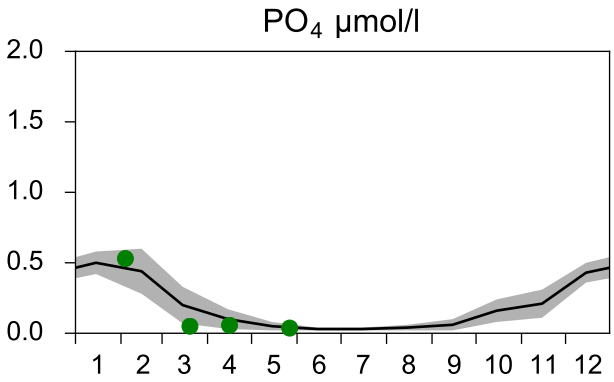
STATION Å17 SURFACE WATER (0-10 m)

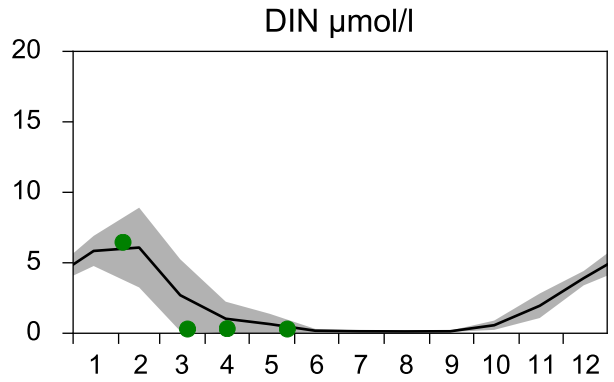
Annual Cycles

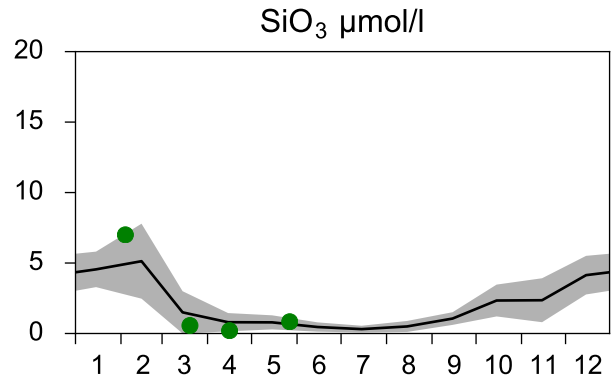
Mean 2001-2015 St.Dev. 2018

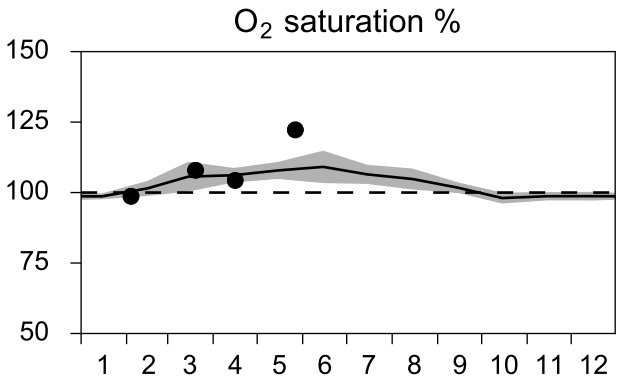




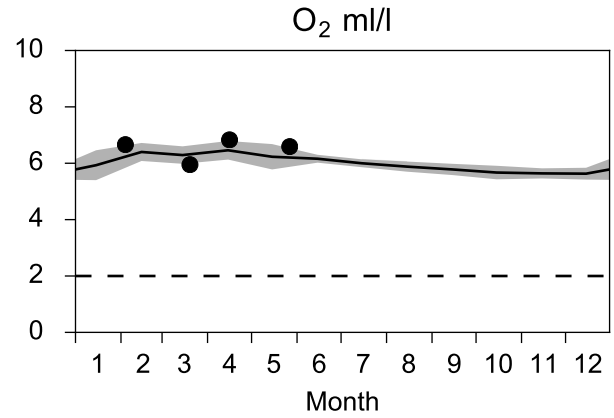


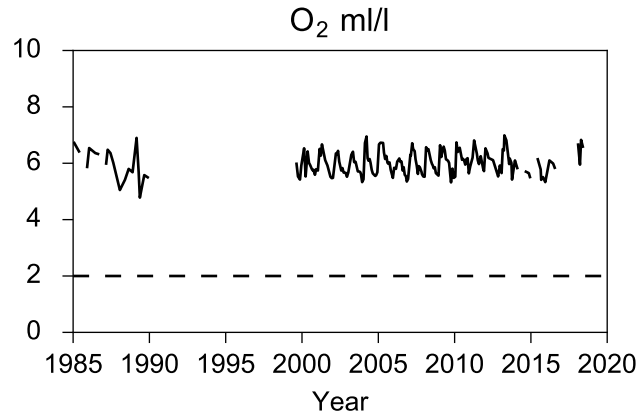




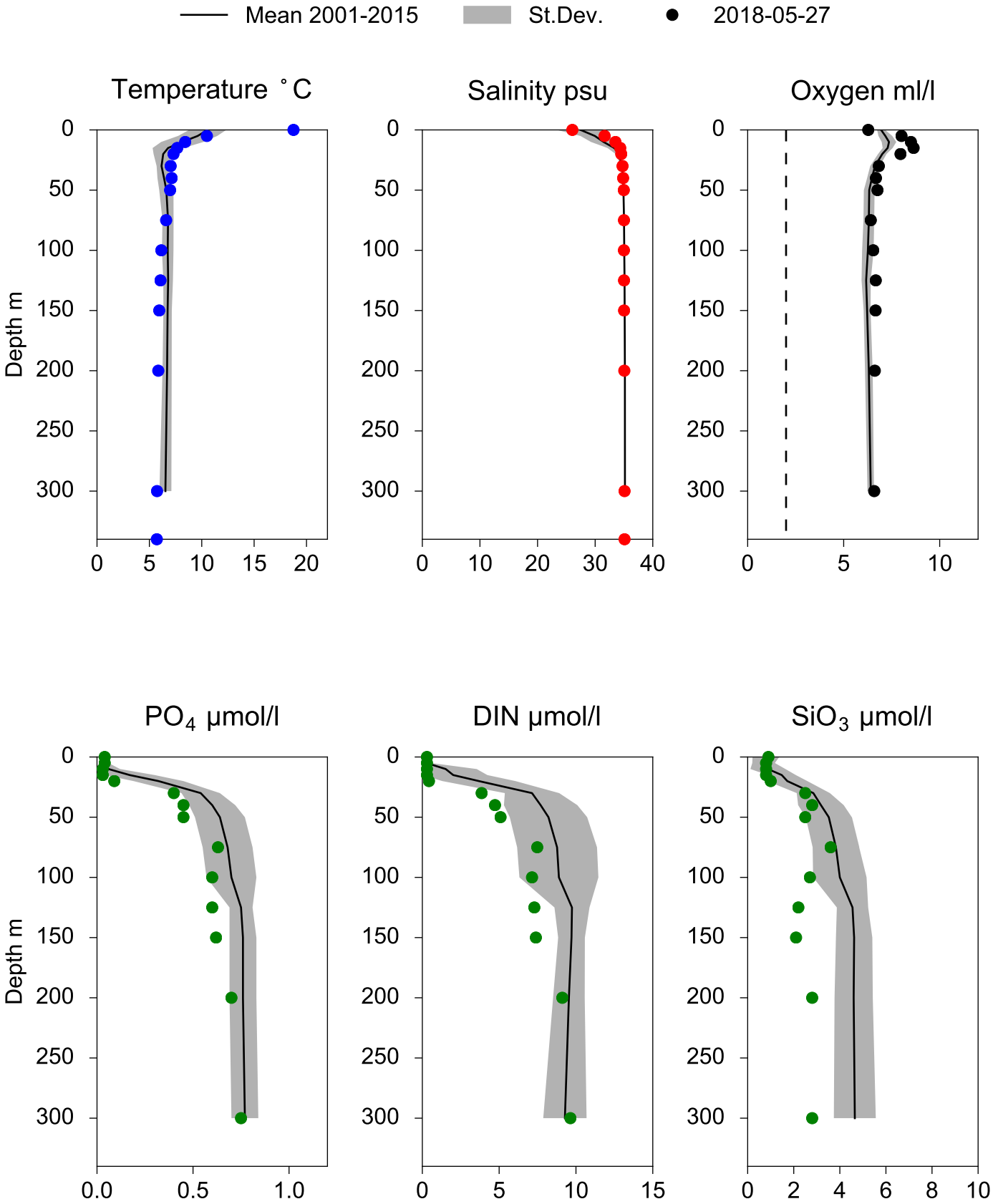


OXYGEN IN BOTTOM WATER (depth >= 300 m)

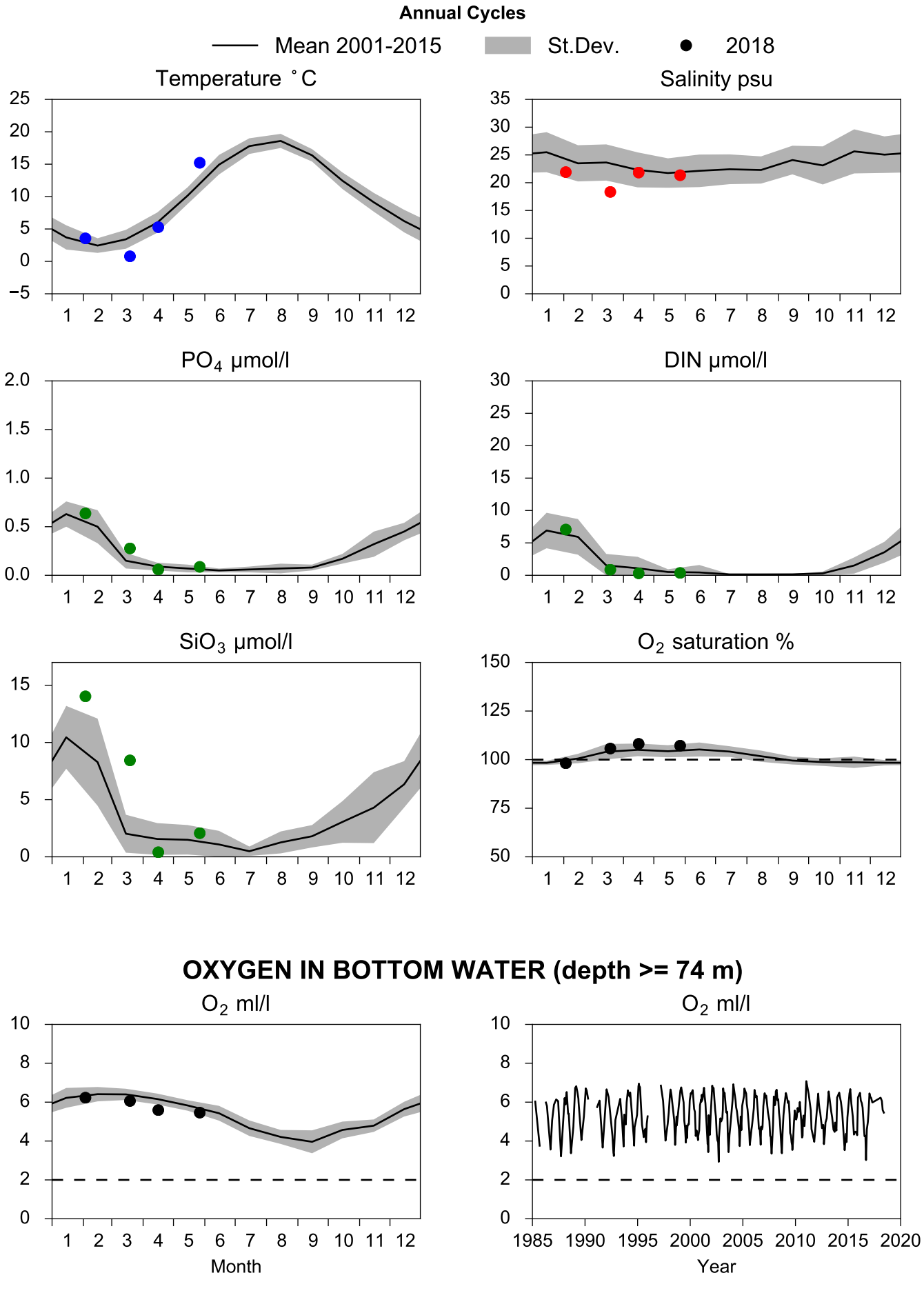




Vertical profiles Å17
May

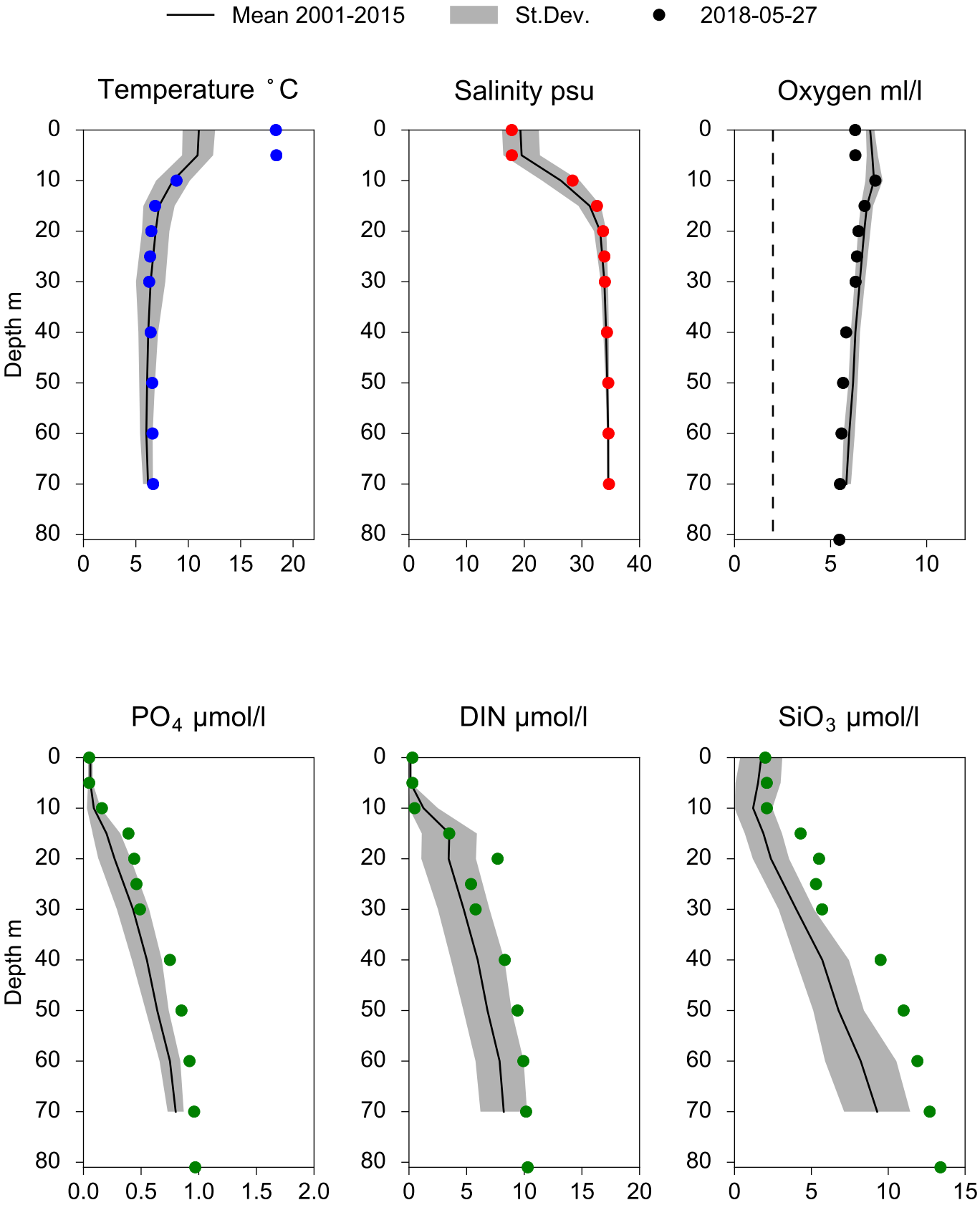


STATION FLADEN SURFACE WATER (0-10 m)



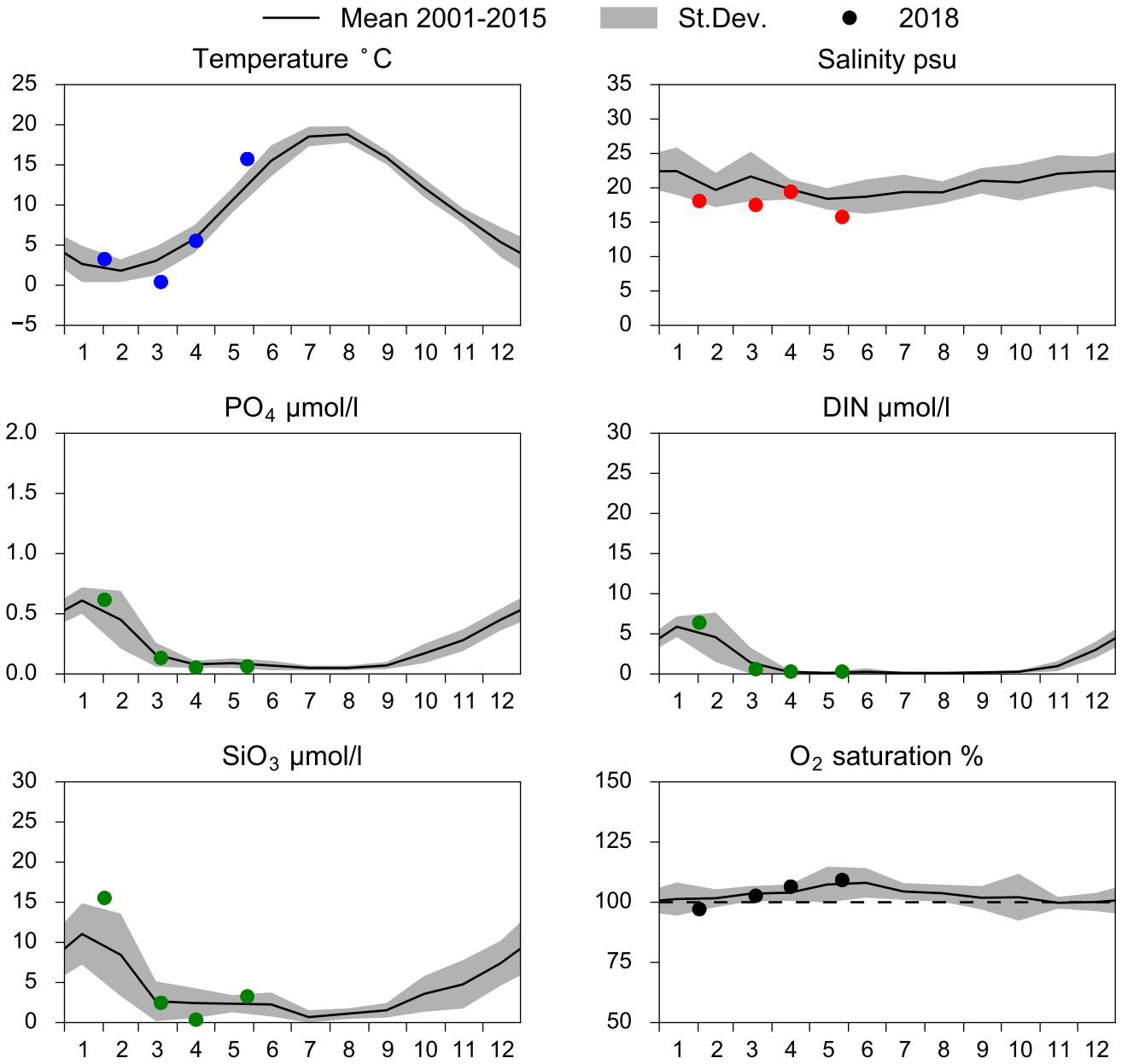
OXYGEN IN BOTTOM WATER (depth >= 74 m)

Vertical profiles FLADEN
May

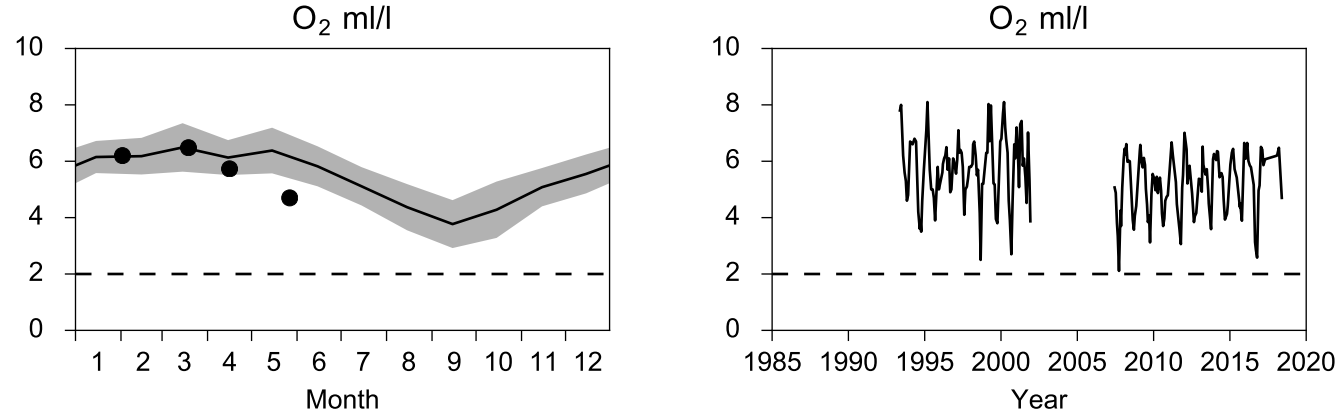


STATION N14 FALKENBERG SURFACE WATER (0-10 m)

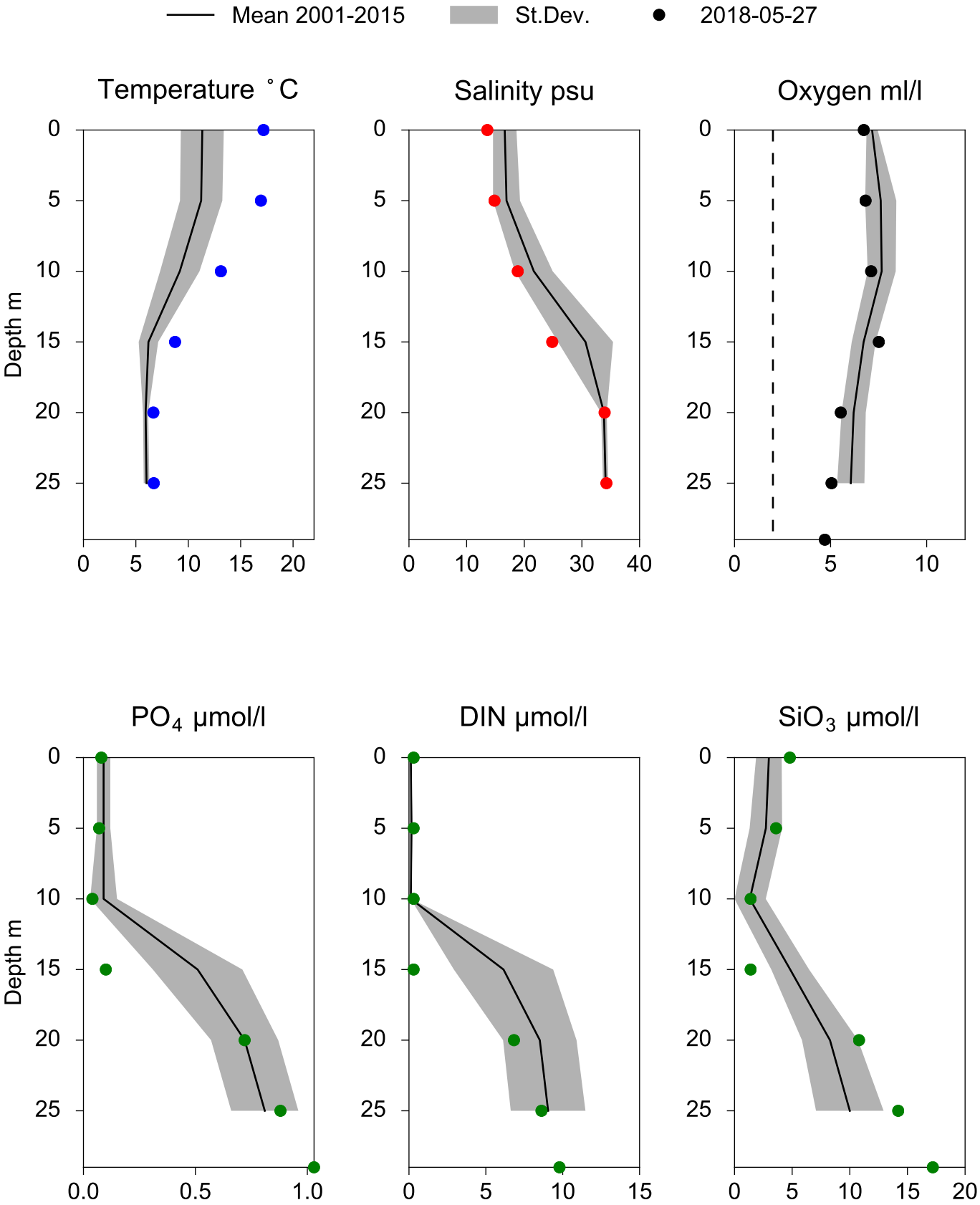
Annual Cycles



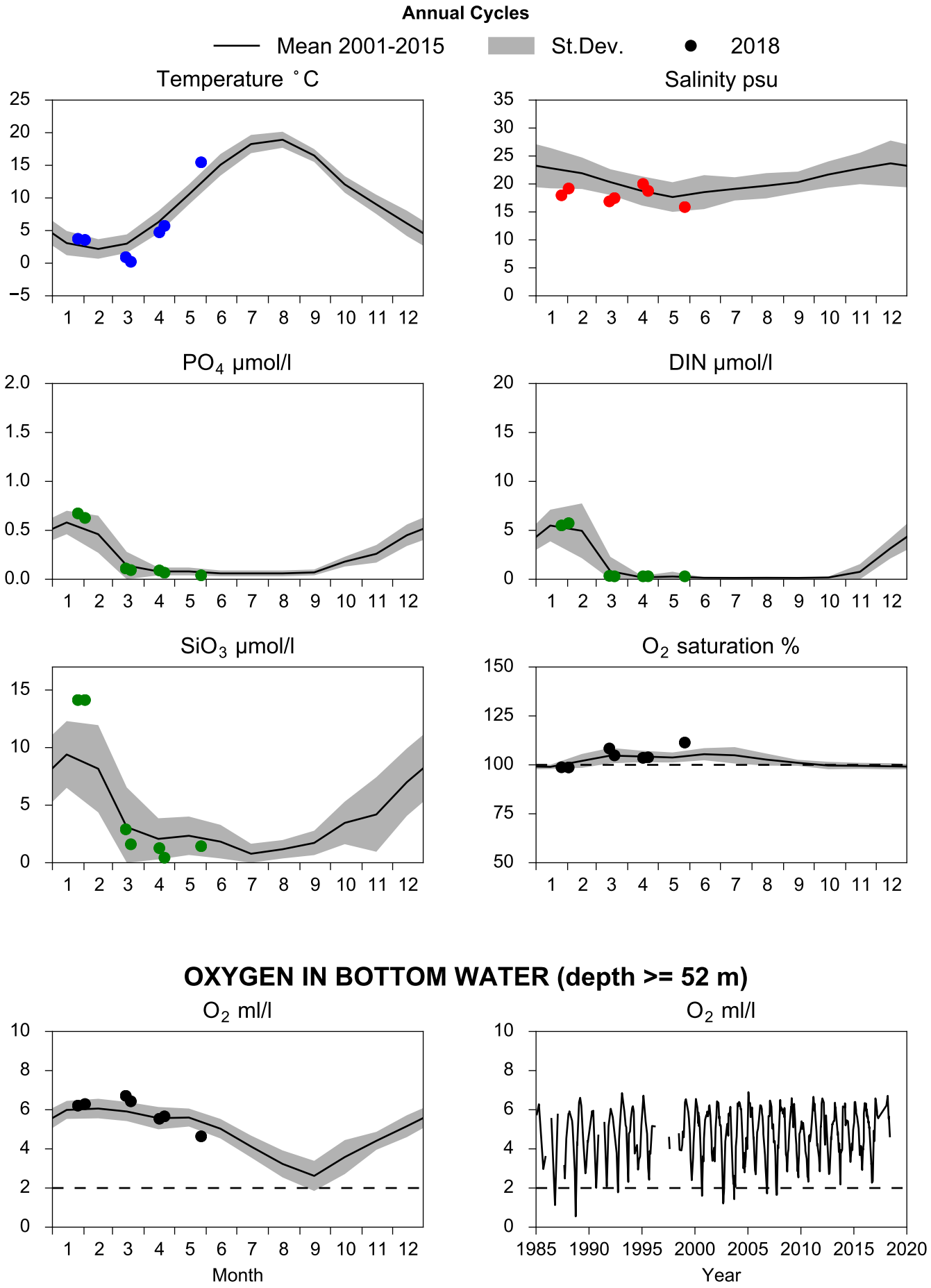
OXYGEN IN BOTTOM WATER (depth >= 25 m)



Vertical profiles N14 FALKENBERG
May

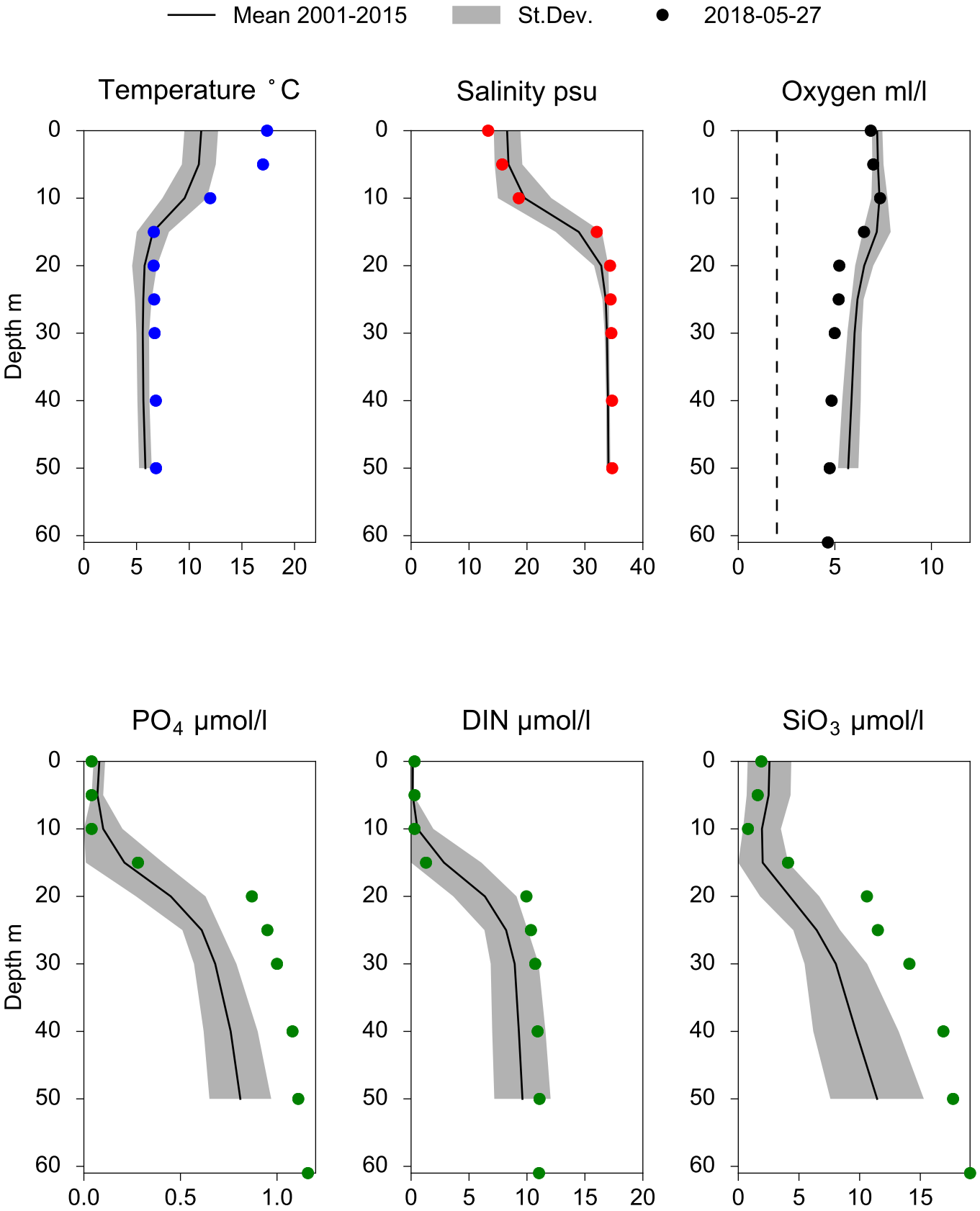


STATION ANHOLT E SURFACE WATER (0-10 m)

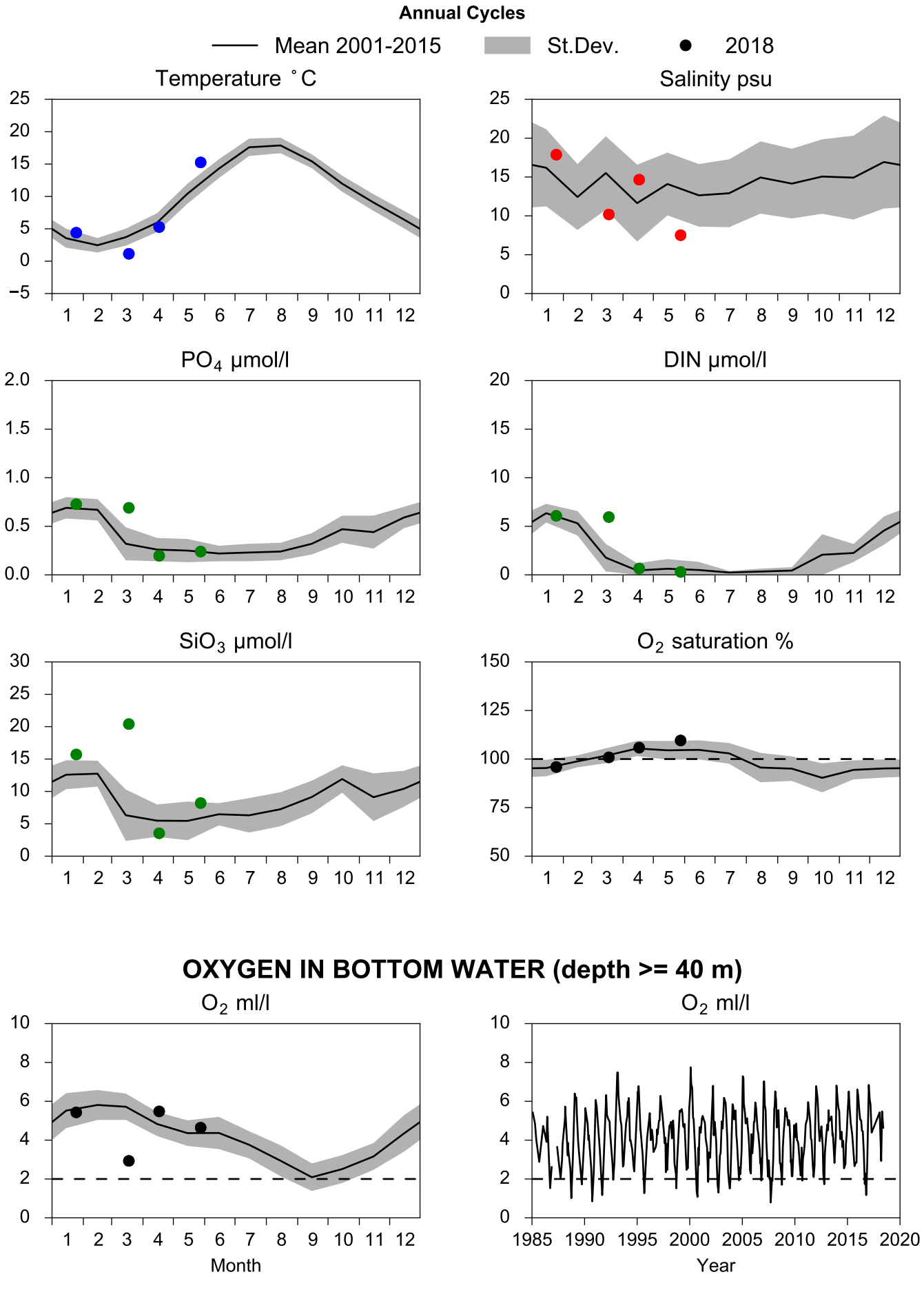


OXYGEN IN BOTTOM WATER (depth >= 52 m)

Vertical profiles ANHOLT E
May

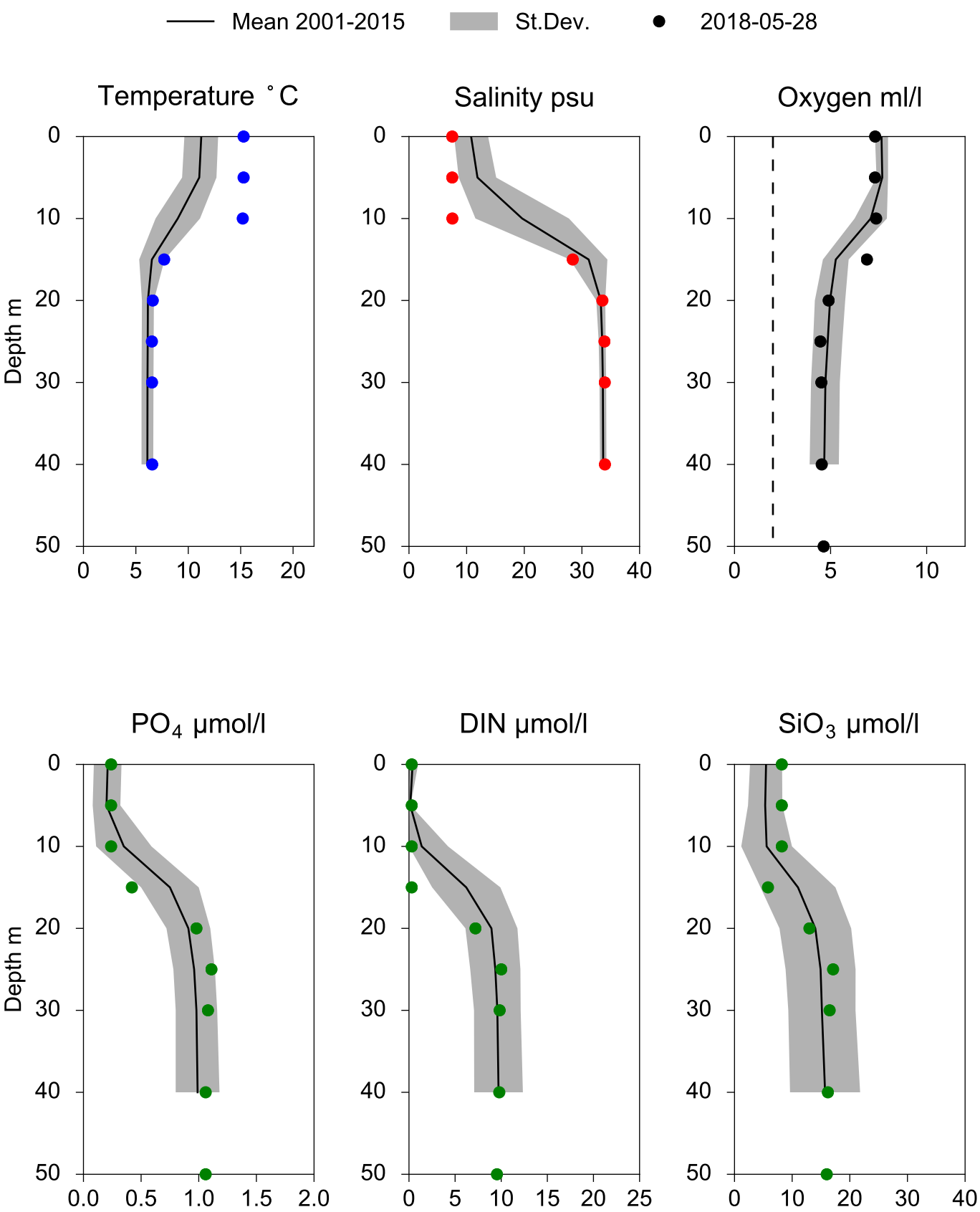


STATION W LANDSKRONA SURFACE WATER (0-10 m)

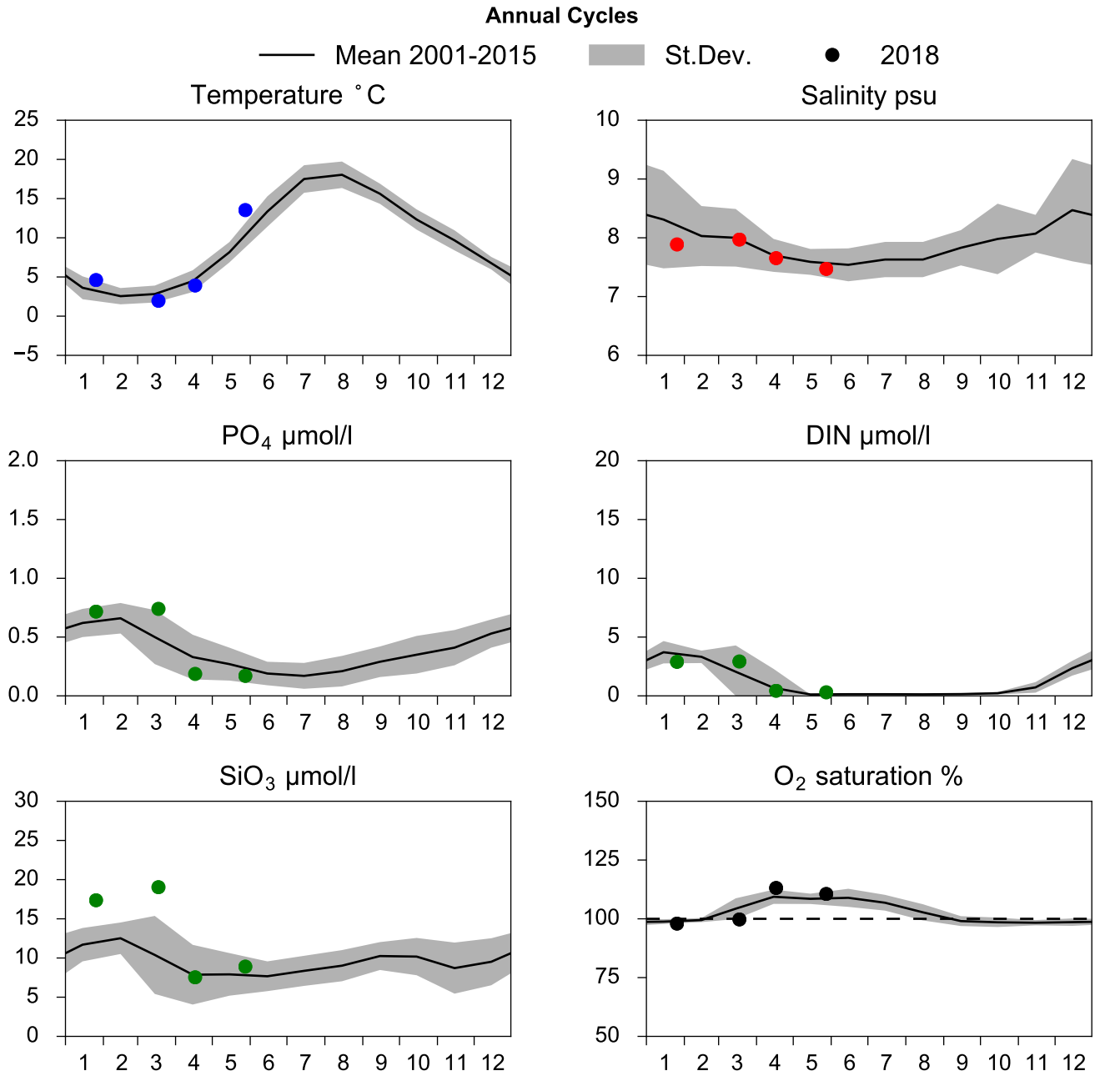


OXYGEN IN BOTTOM WATER (depth >= 40 m)

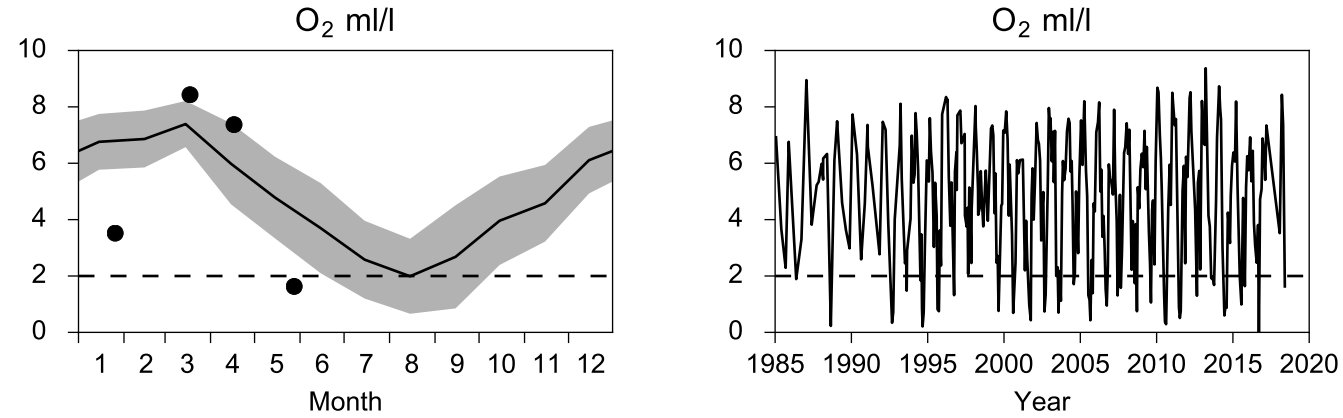
Vertical profiles W LANDSKRONA
May



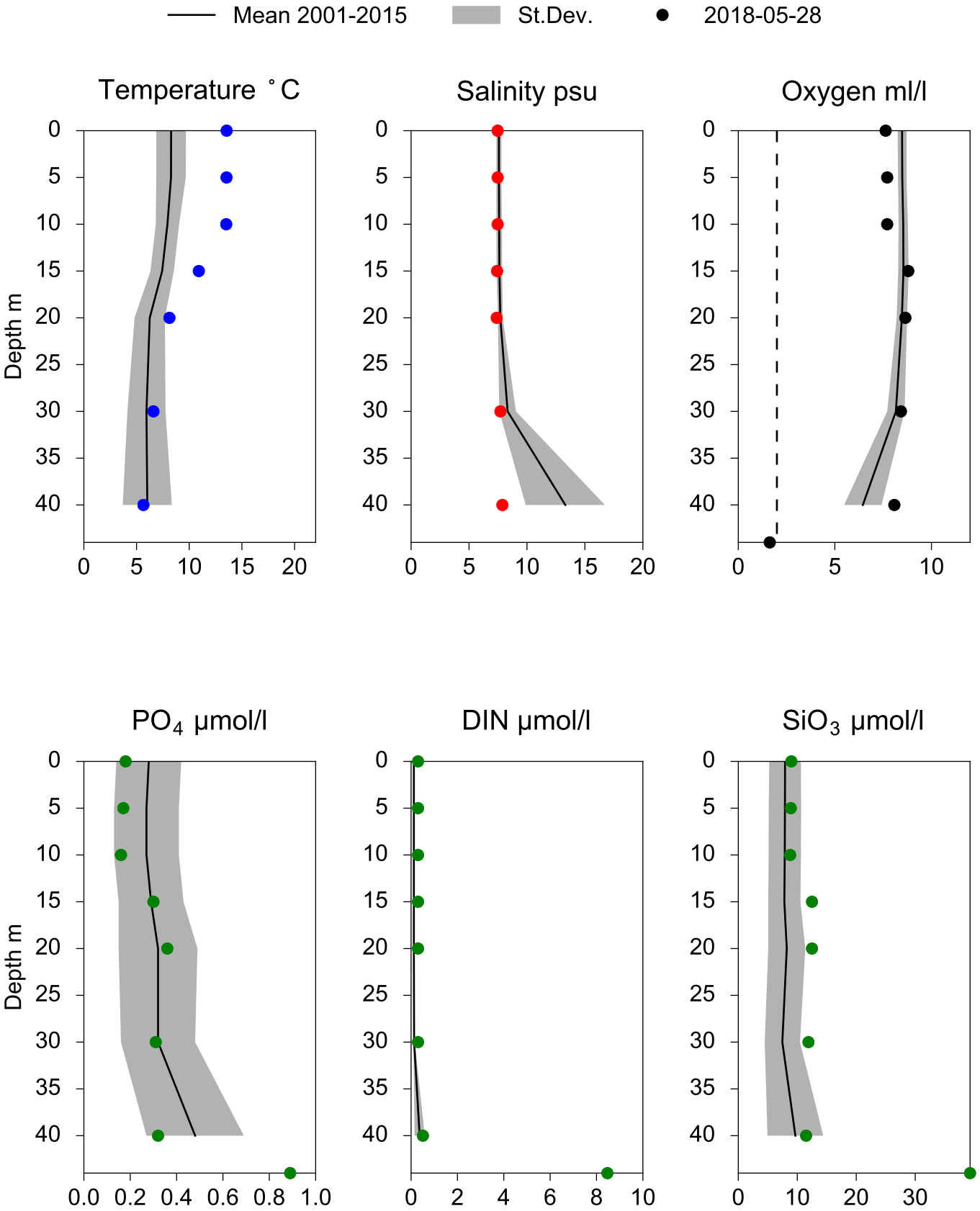
STATION BY1 SURFACE WATER (0-10 m)



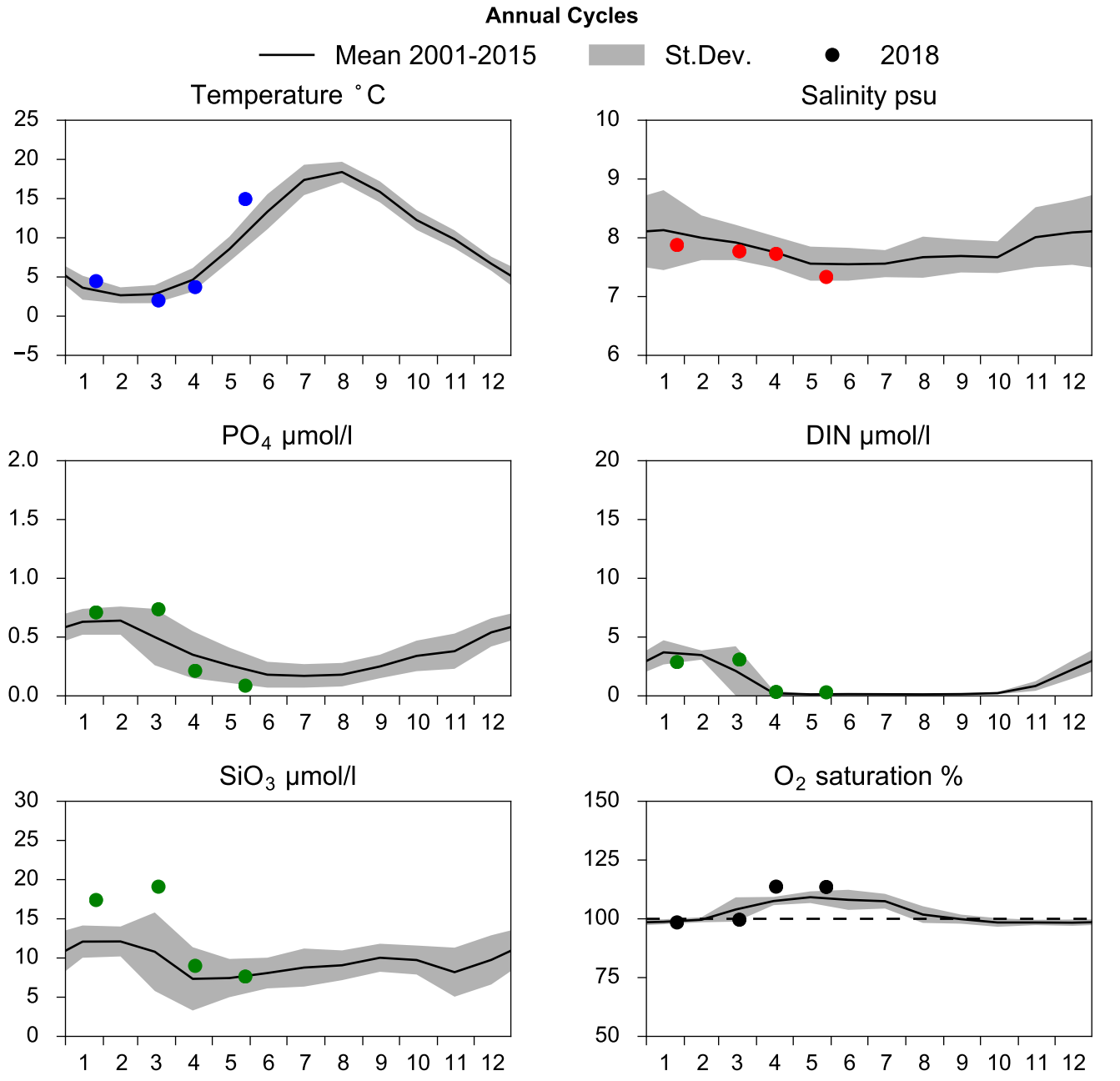
OXYGEN IN BOTTOM WATER (depth >= 40 m)



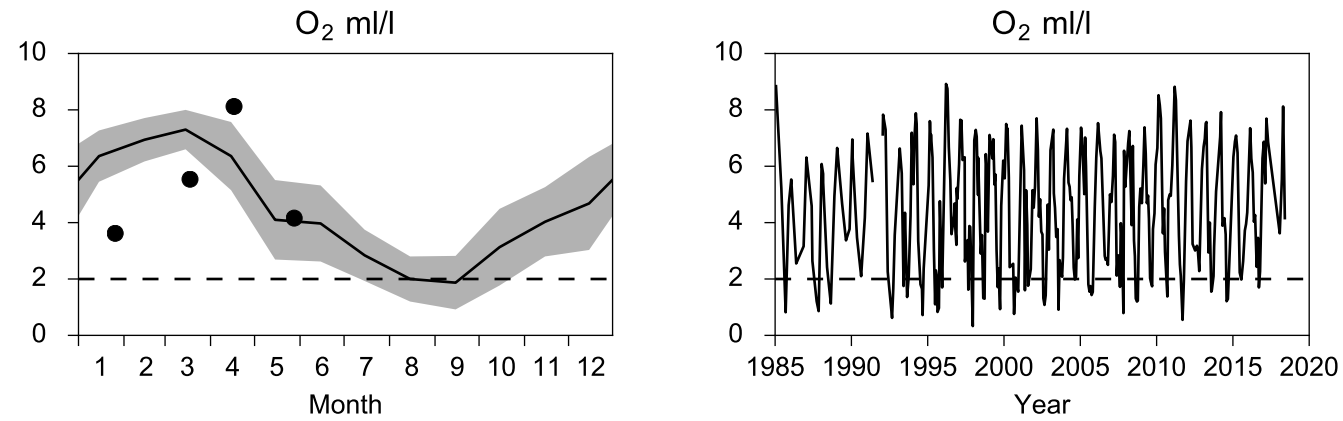
Vertical profiles BY1
May



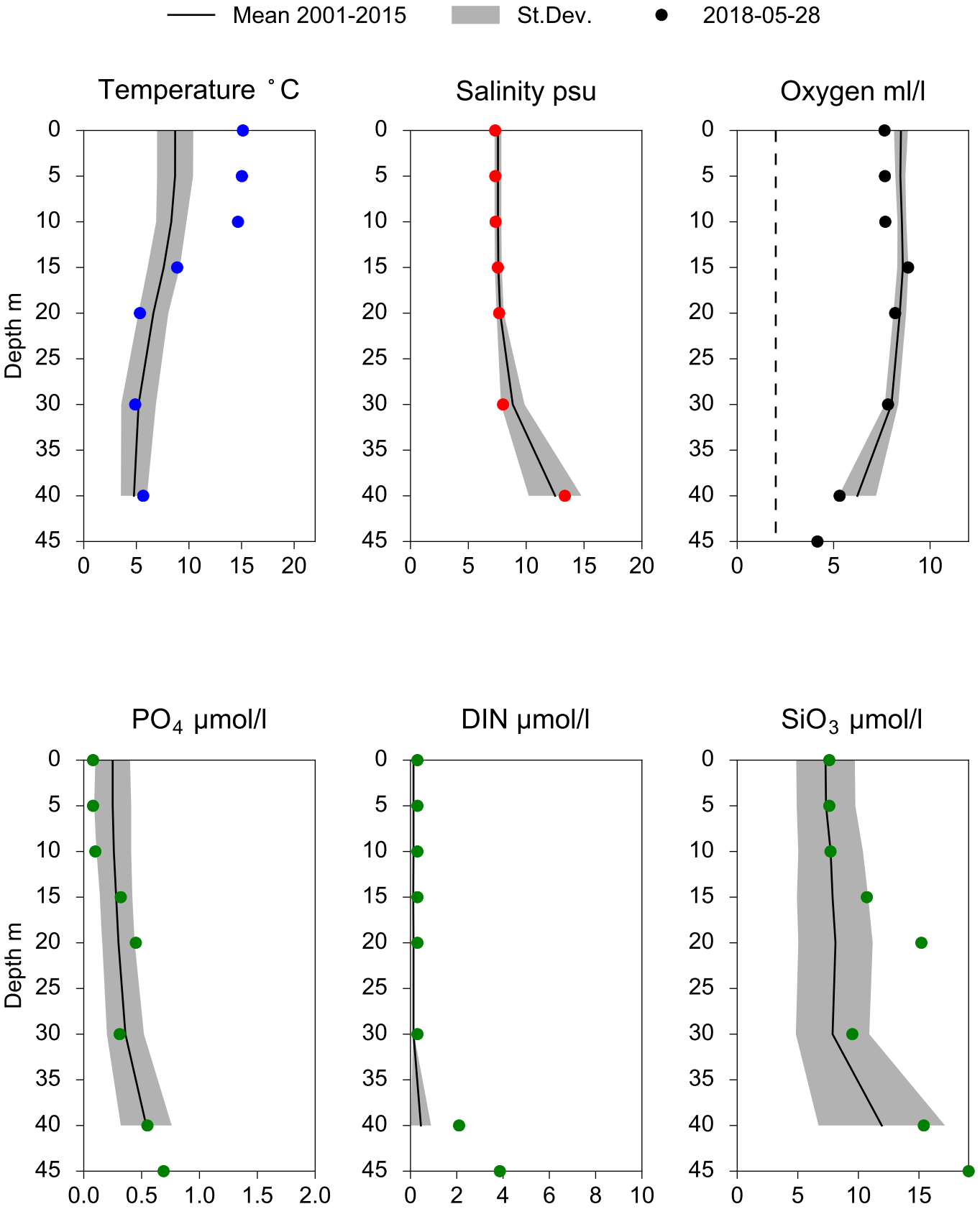
STATION BY2 ARKONA SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 40 m)



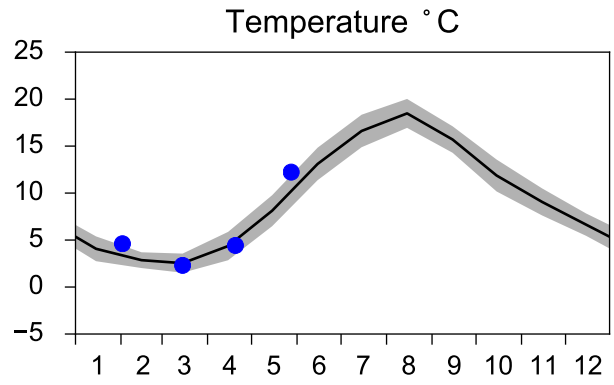
Vertical profiles BY2 ARKONA
May

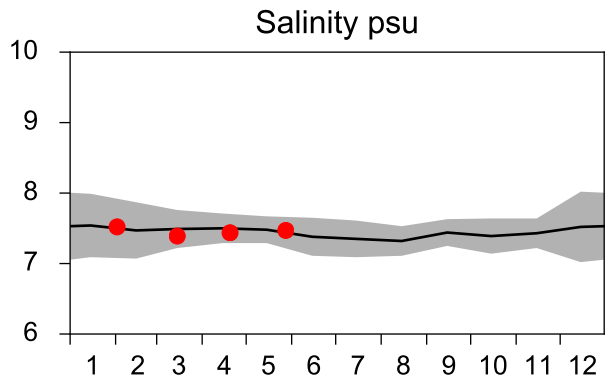


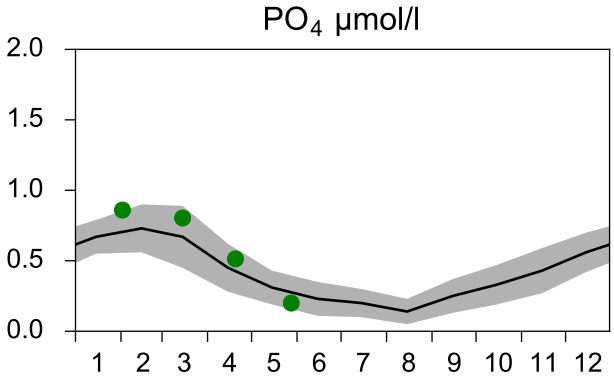
STATION HANÖBUKTEN SURFACE WATER (0-10 m)

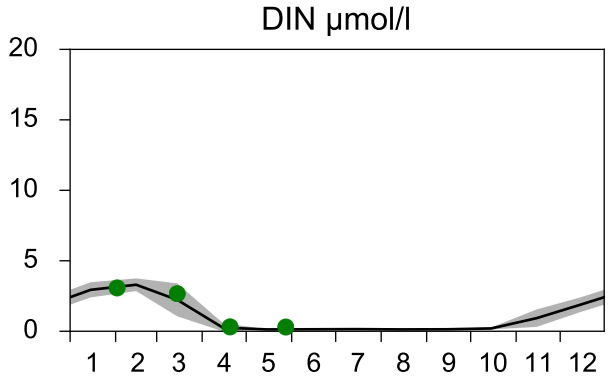
Annual Cycles

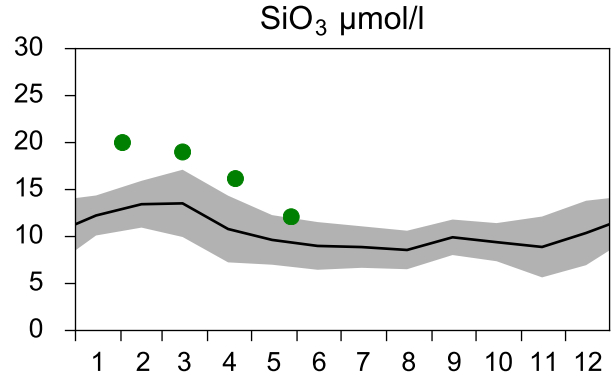
Mean 2001-2015 St.Dev. 2018

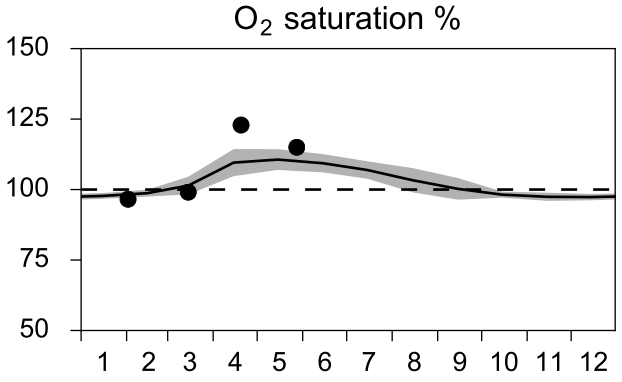




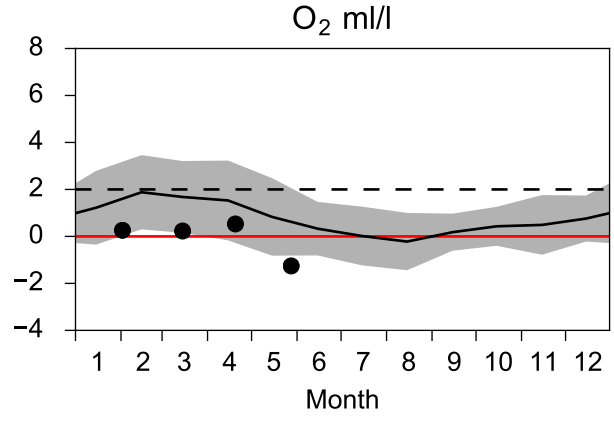


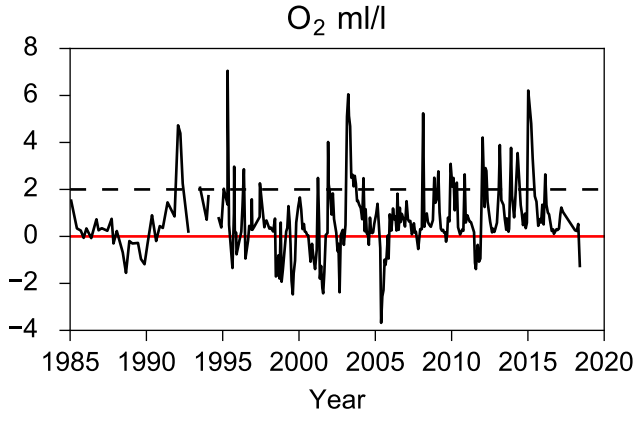




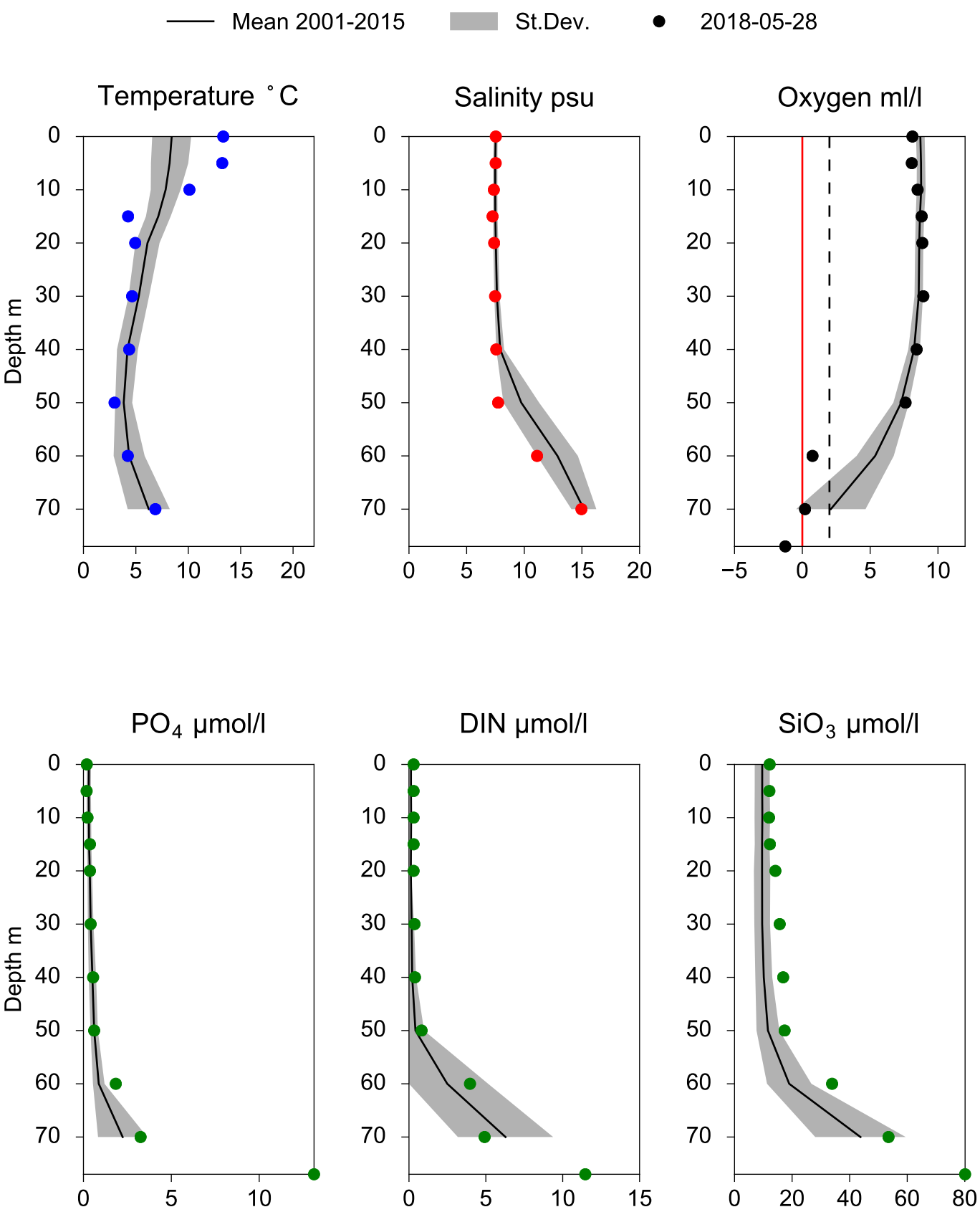


OXYGEN IN BOTTOM WATER (depth >= 70 m)





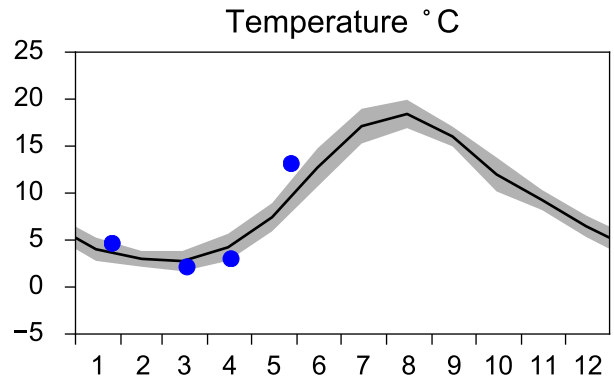
Vertical profiles HANÖBUKTEN
May

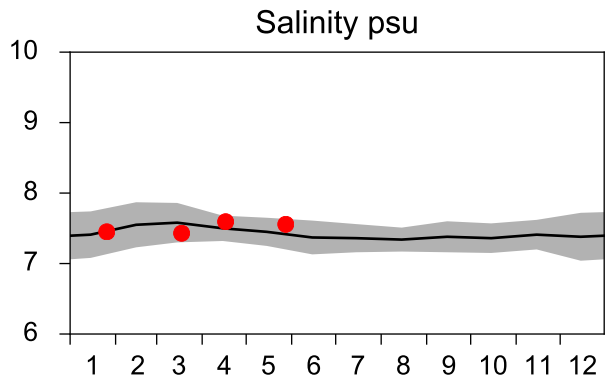


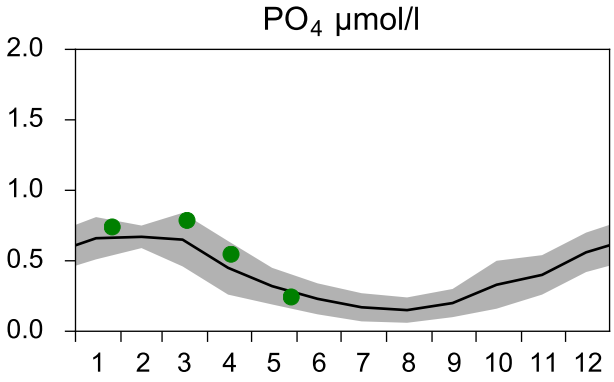
STATION BY4 CHRISTIANSÖ SURFACE WATER (0-10 m)

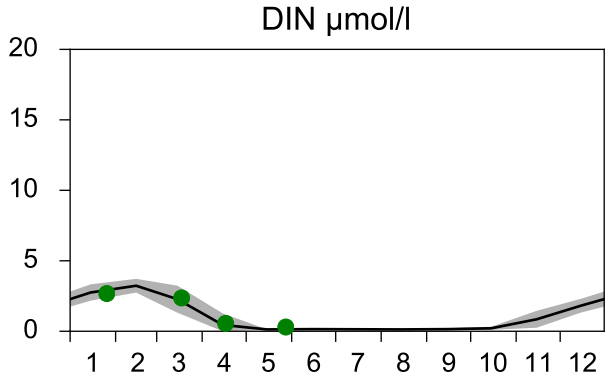
Annual Cycles

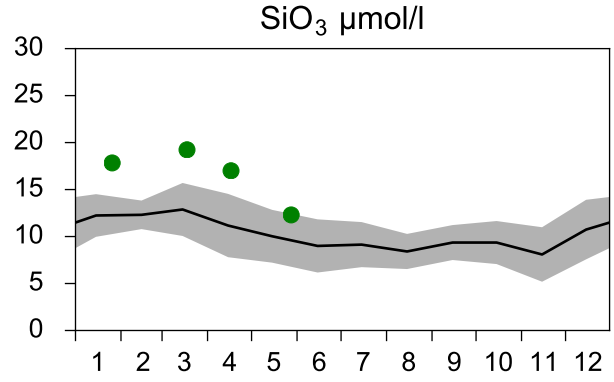
Mean 2001-2015 St.Dev. 2018

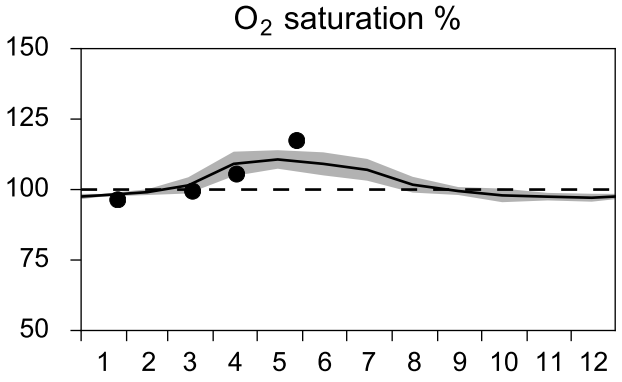




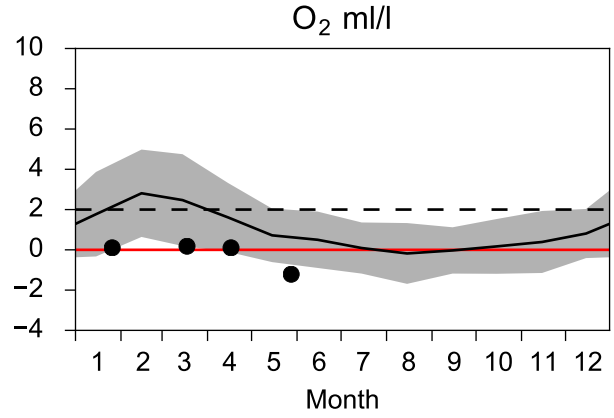


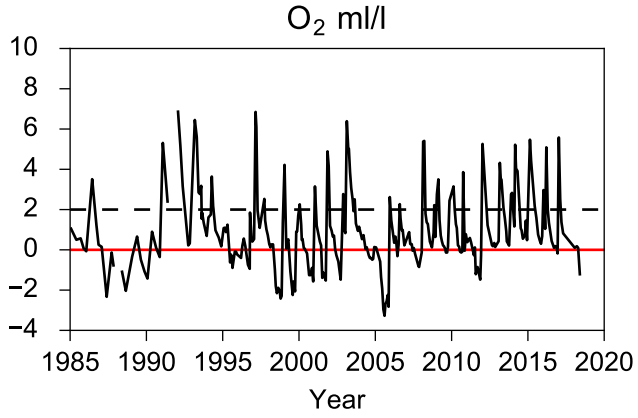




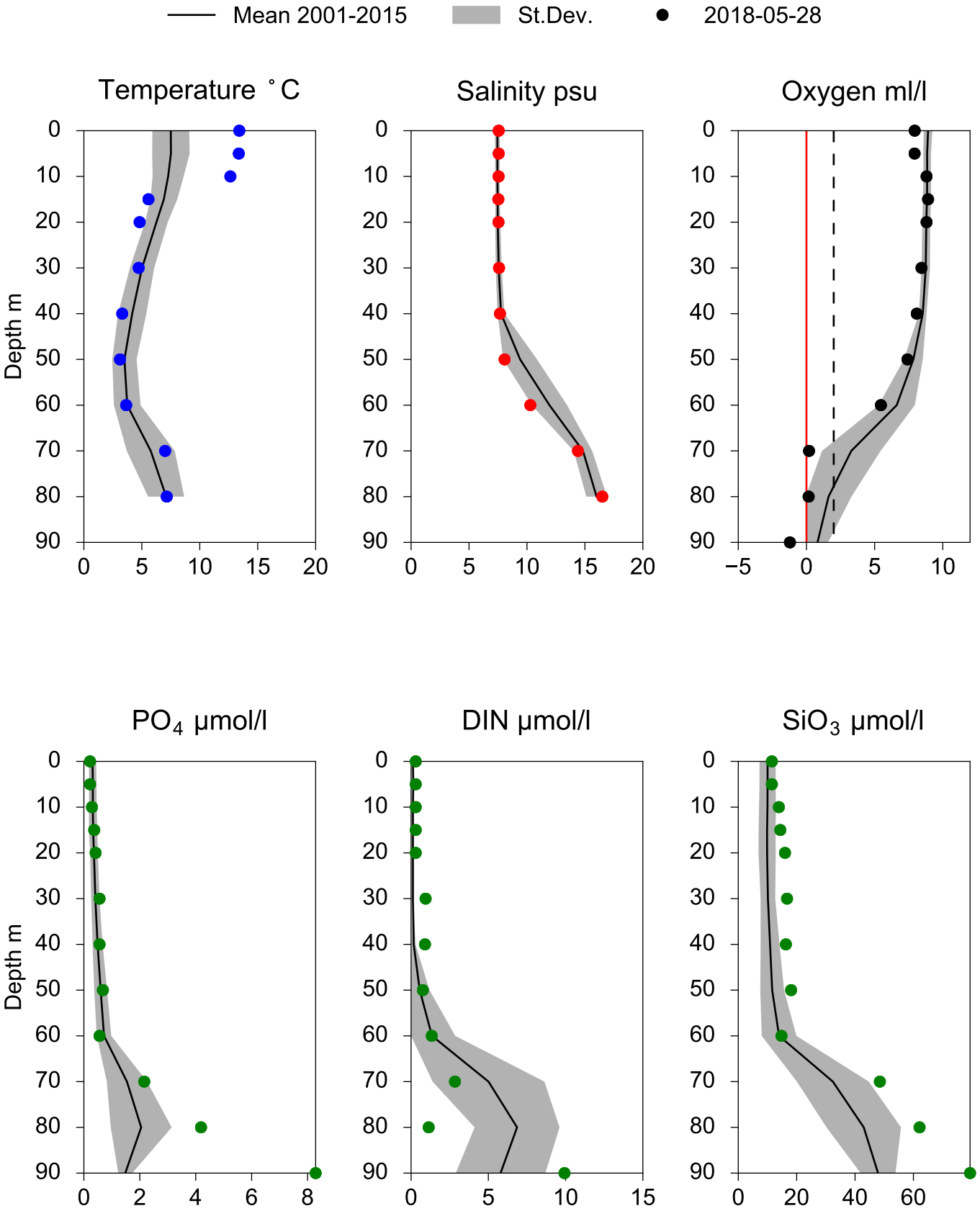


OXYGEN IN BOTTOM WATER (depth >= 80 m)

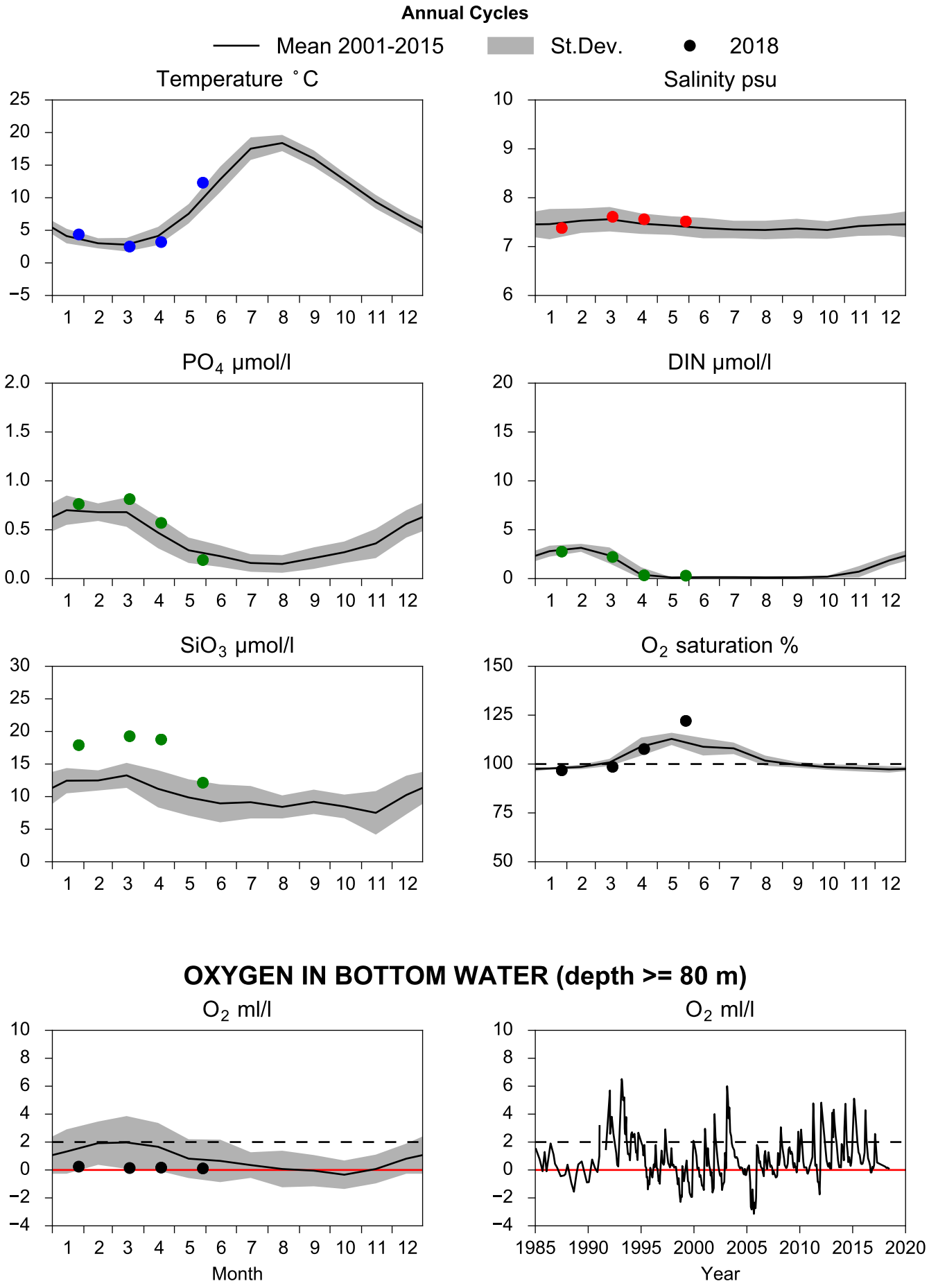




Vertical profiles BY4 CHRISTIANSÖ
May

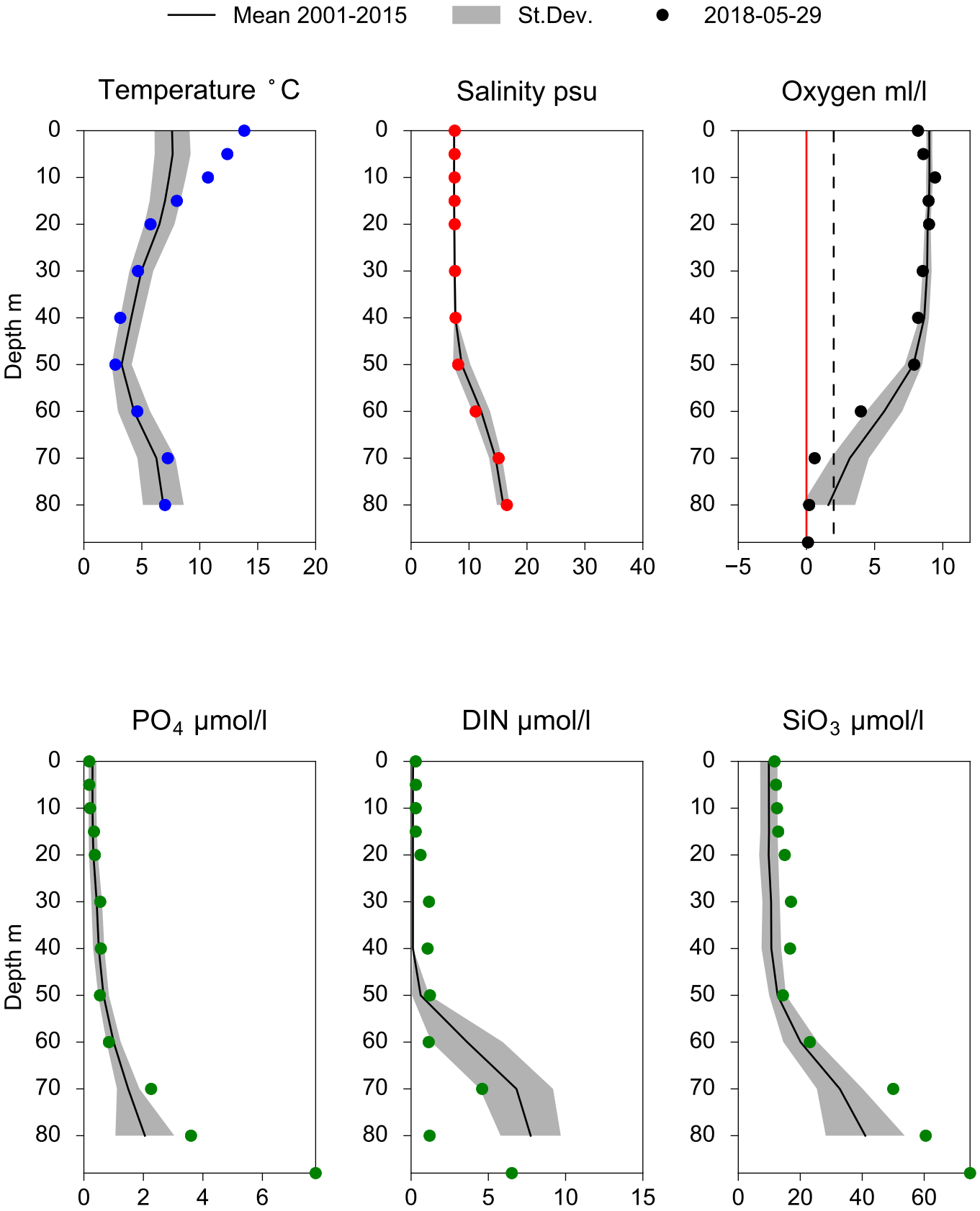


STATION BY5 BORNHOLMSDJ SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 80 m)

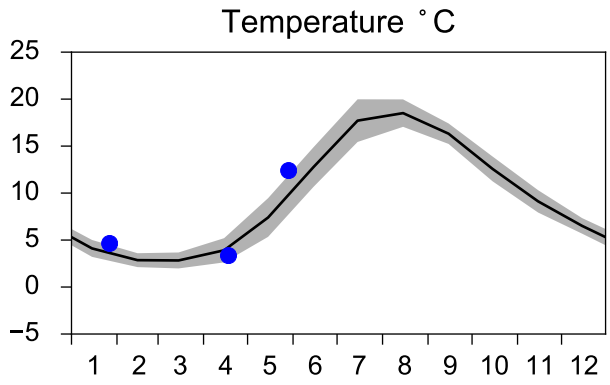
Vertical profiles BY5 BORNHOLMSDJ
May

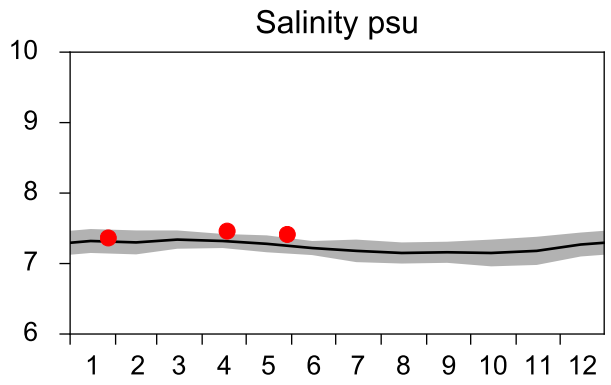


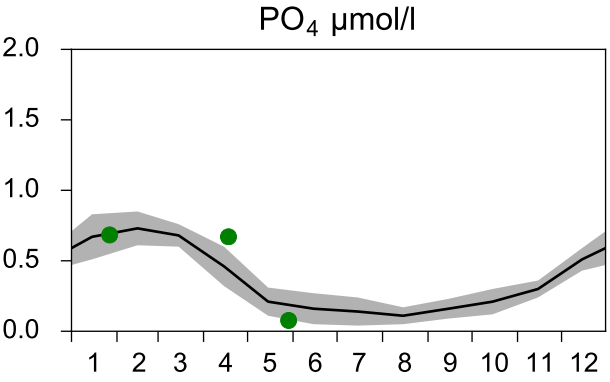
STATION BCS III-10 SURFACE WATER (0-10 m)

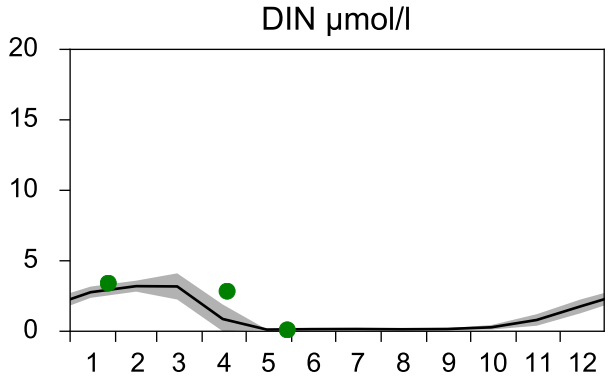
Annual Cycles

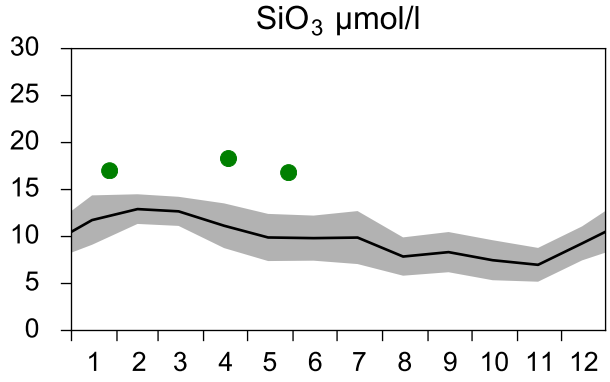
Mean 2001-2015 St.Dev. 2018

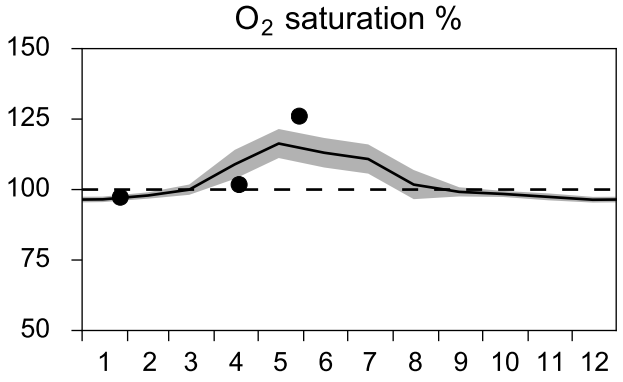




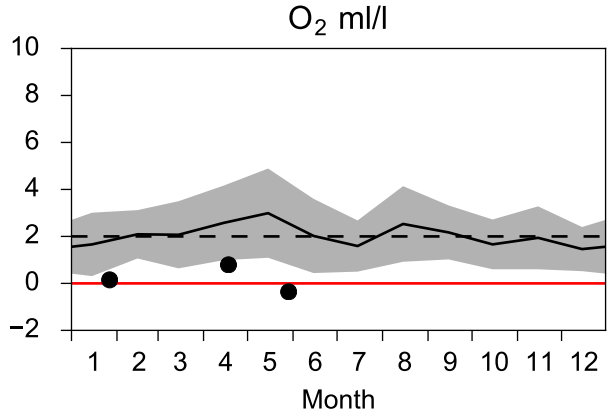


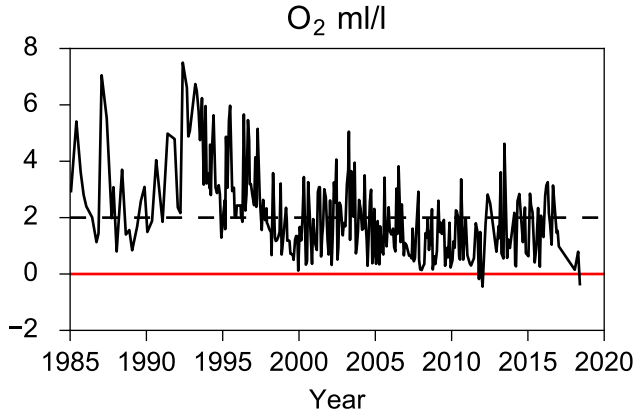




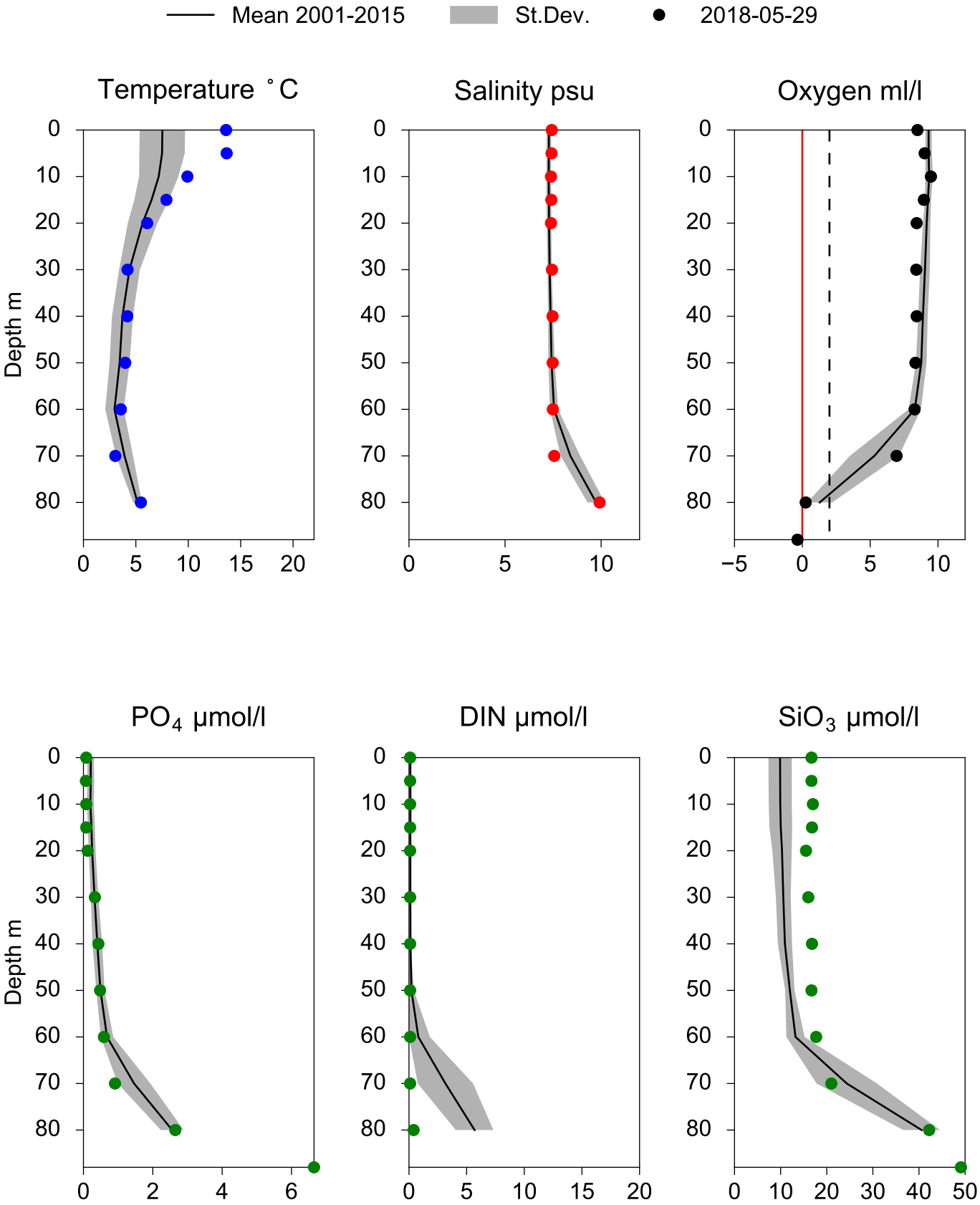


OXYGEN IN BOTTOM WATER (depth >= 80 m)

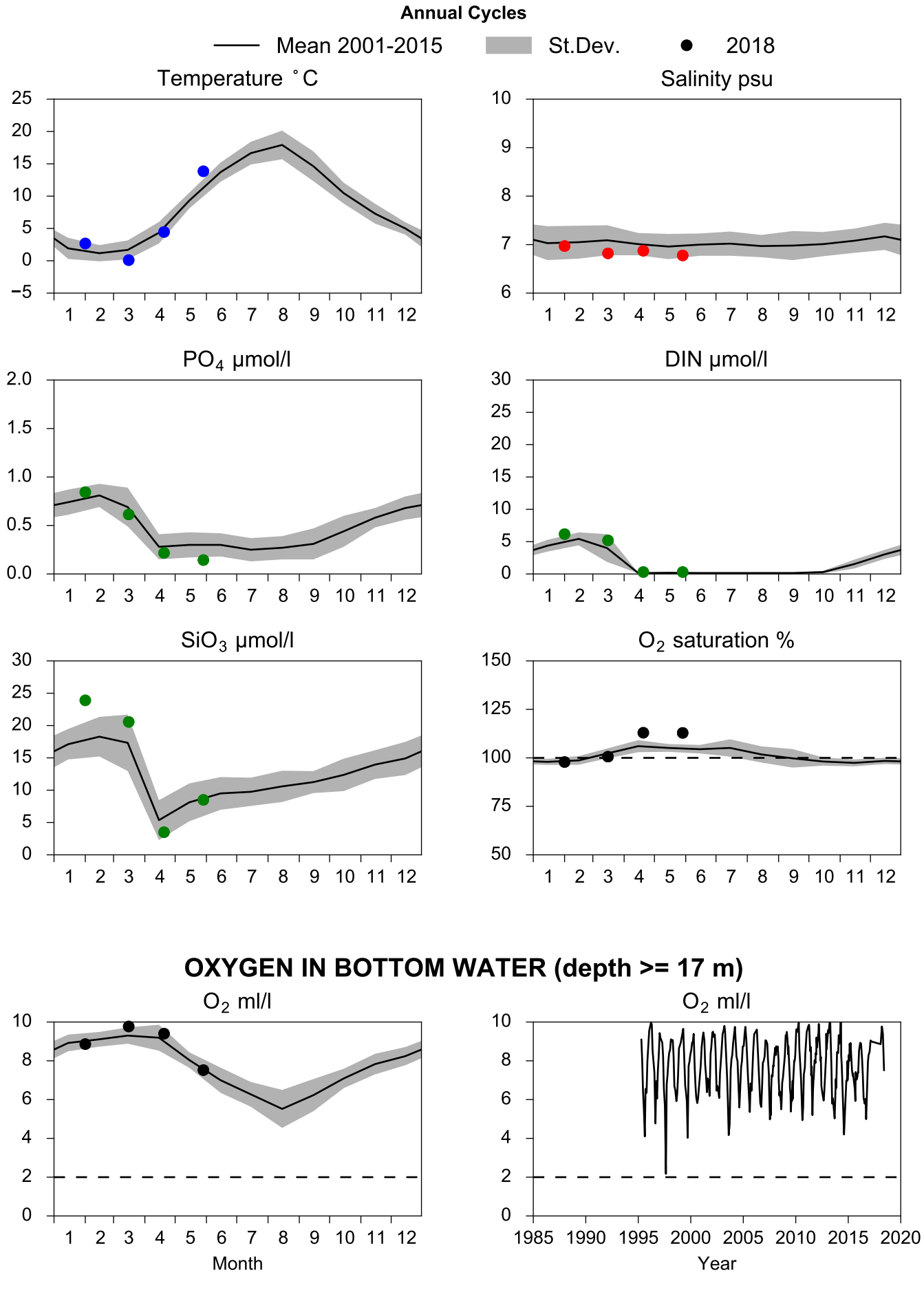




Vertical profiles BCS III-10
May

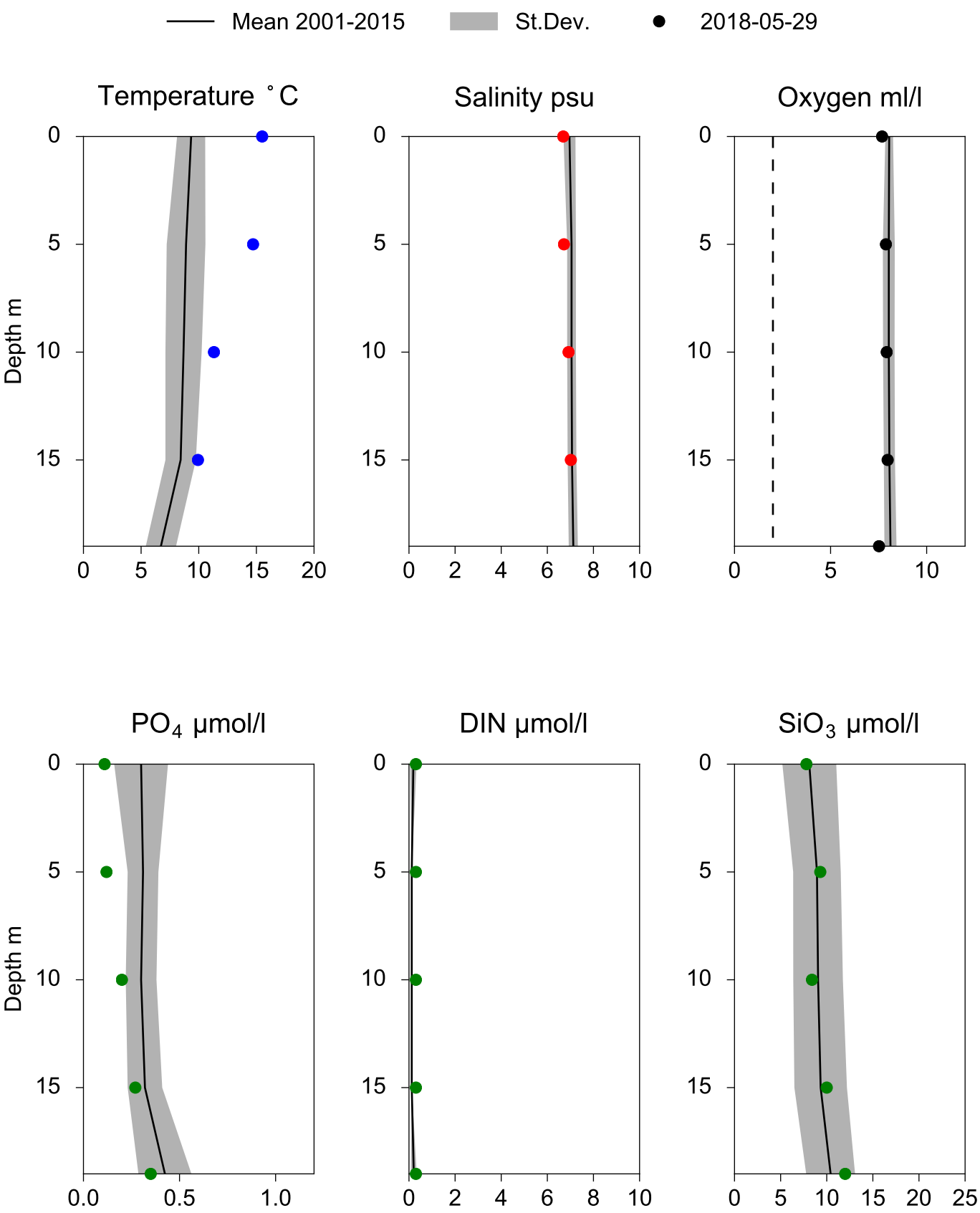


STATION REF M1V1 SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 17 m)

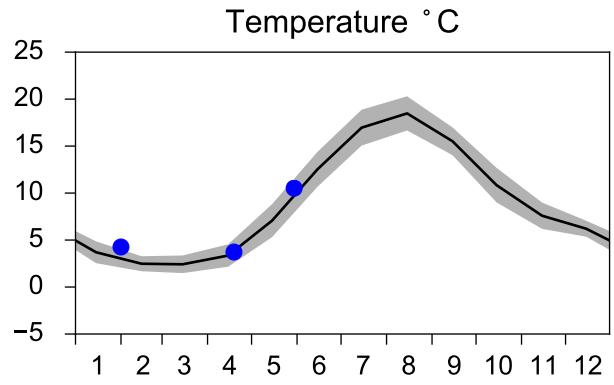
Vertical profiles REF M1V1
May

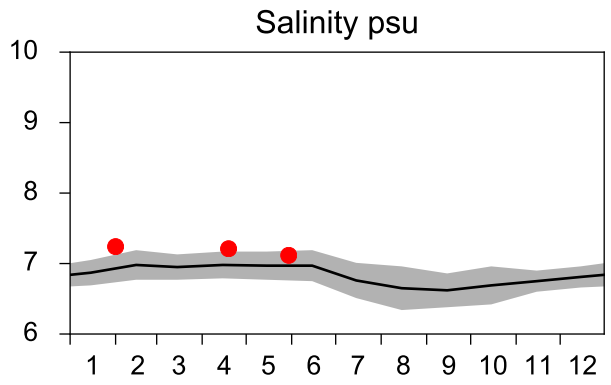


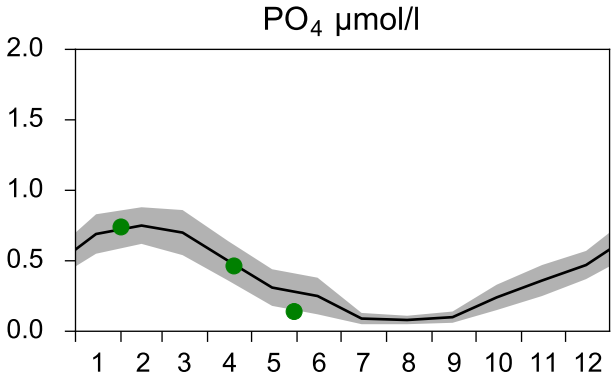
STATION BY38 KARLSÖDJ SURFACE WATER (0-10 m)

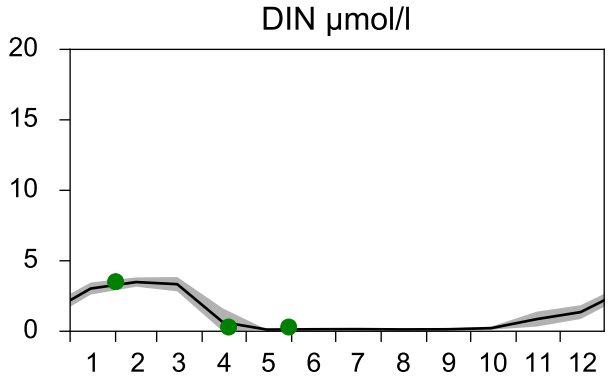
Annual Cycles

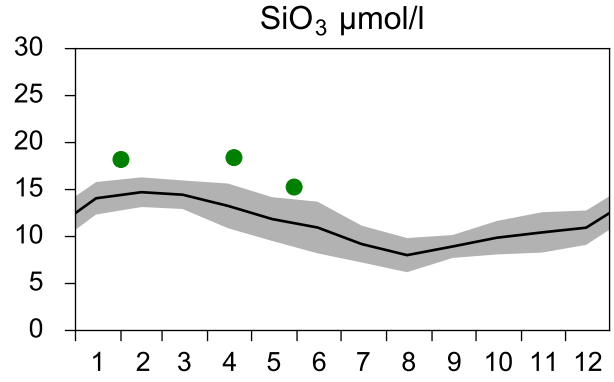
Mean 2001-2015 St.Dev. 2018

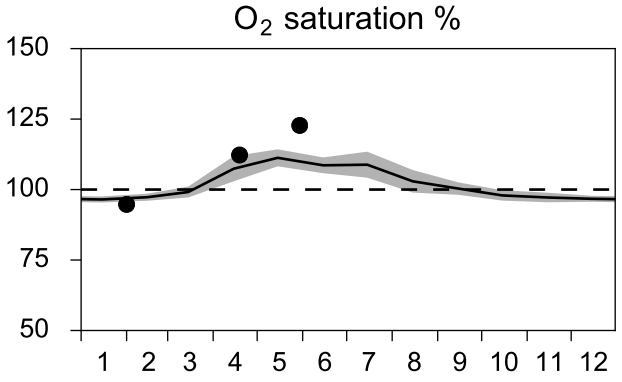




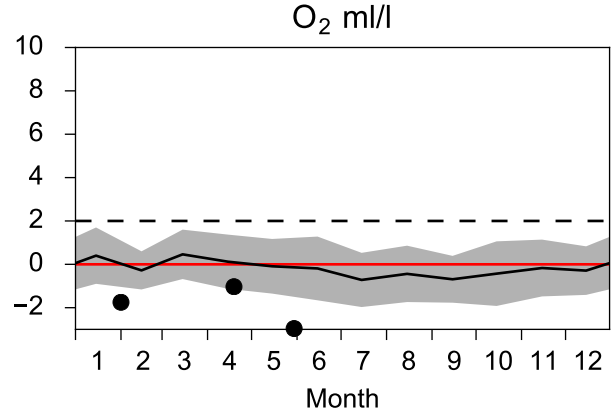


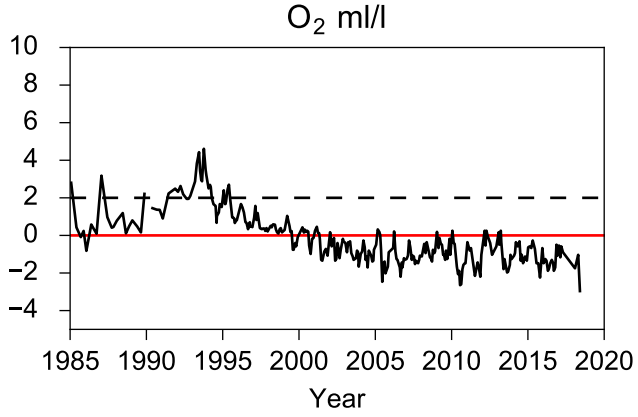




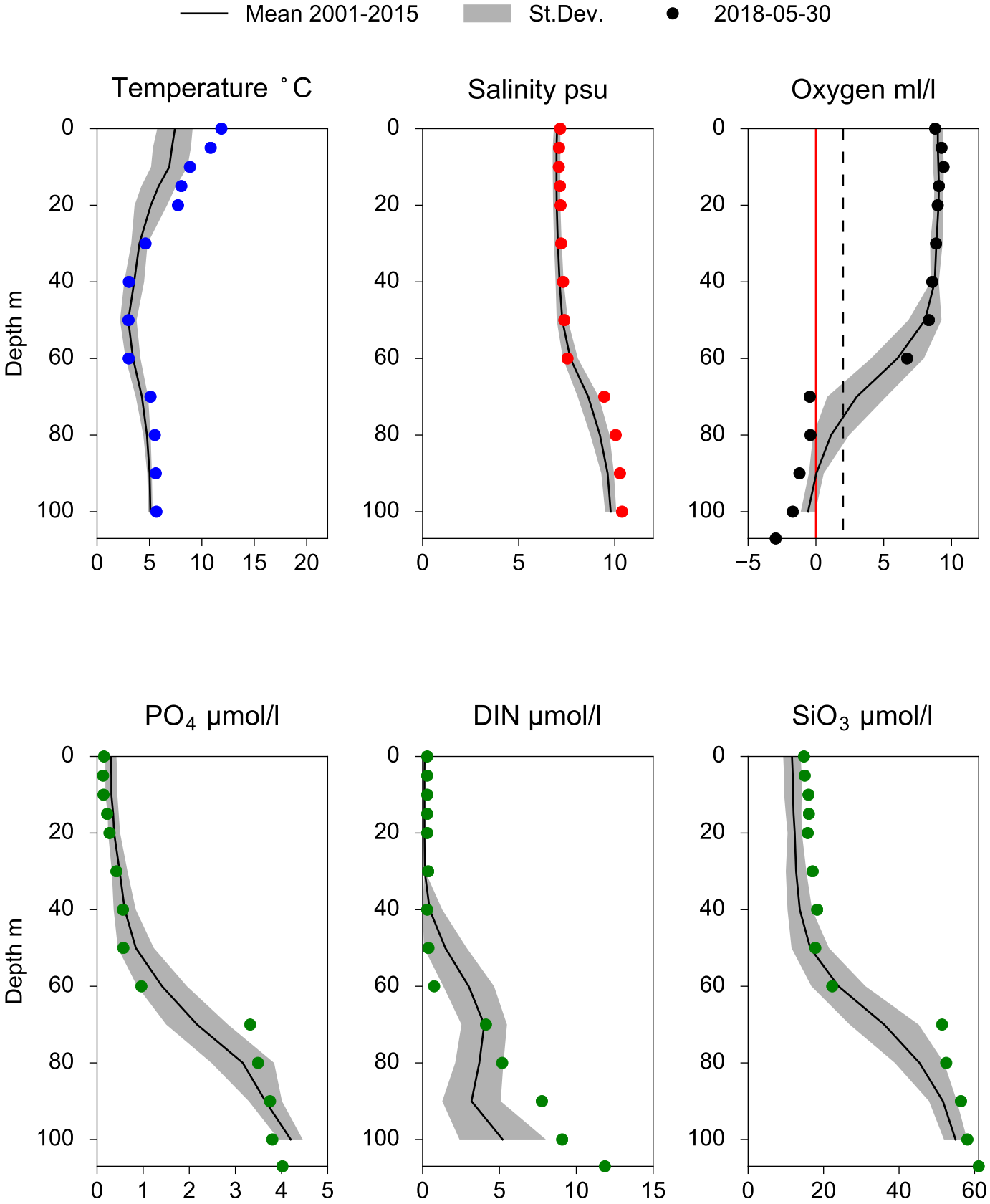


OXYGEN IN BOTTOM WATER (depth >= 100 m)

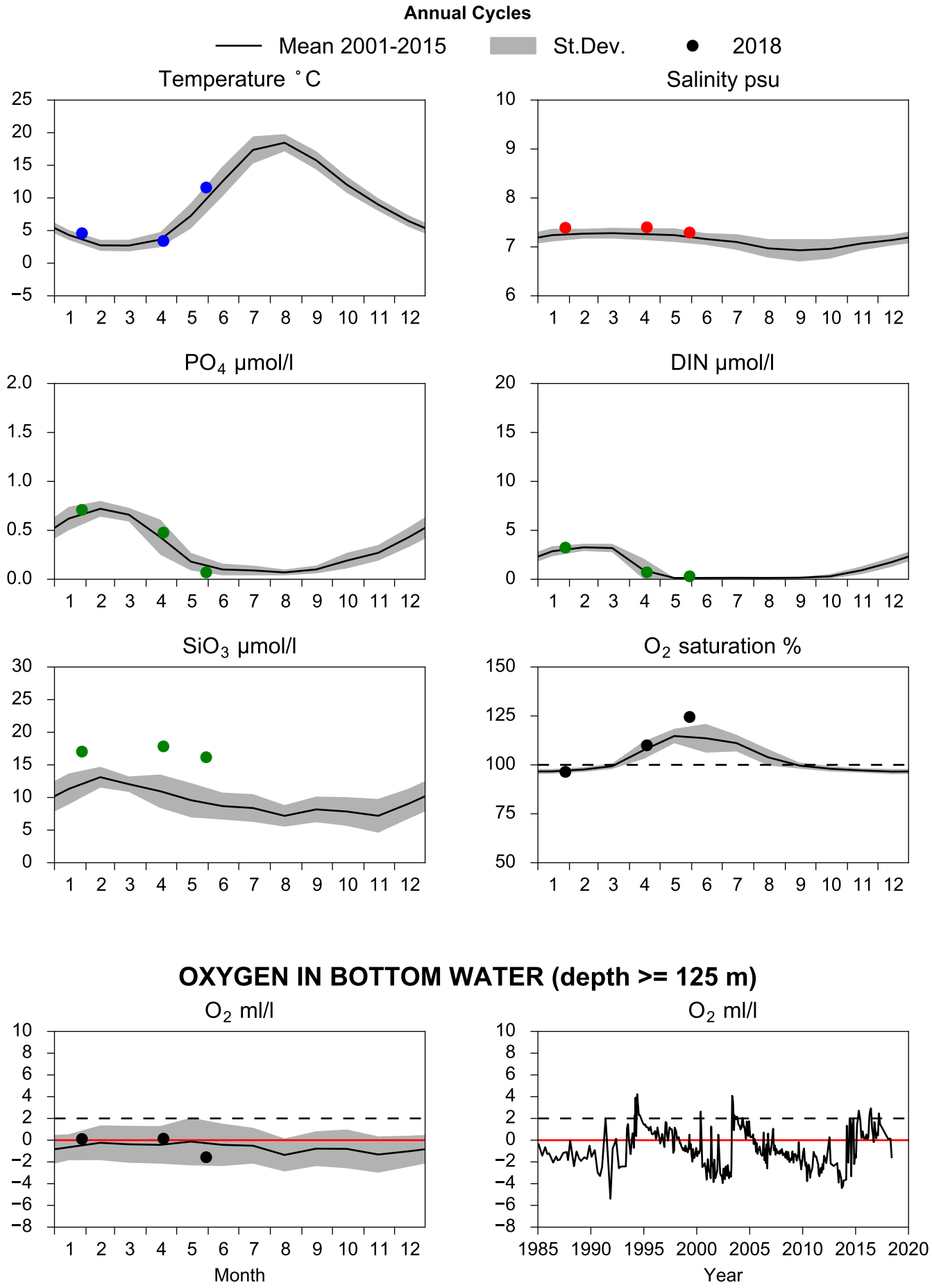




Vertical profiles BY38 KARLSÖDJ
May

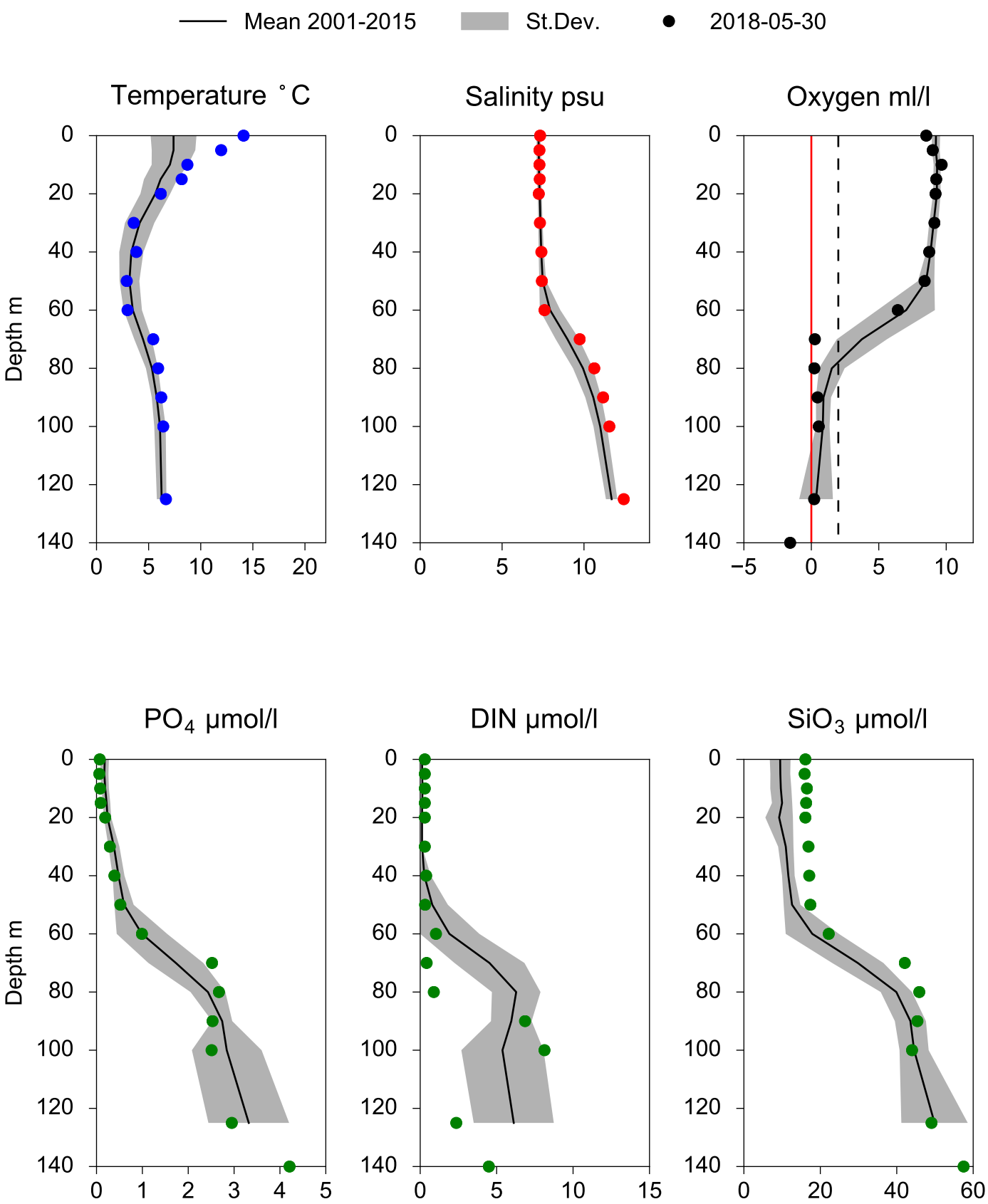


STATION BY10 SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 125 m)

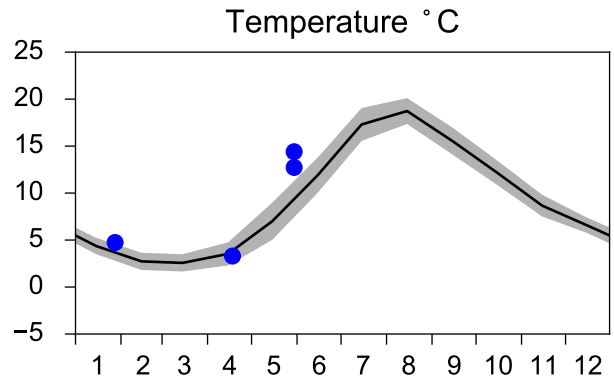
Vertical profiles BY10
May

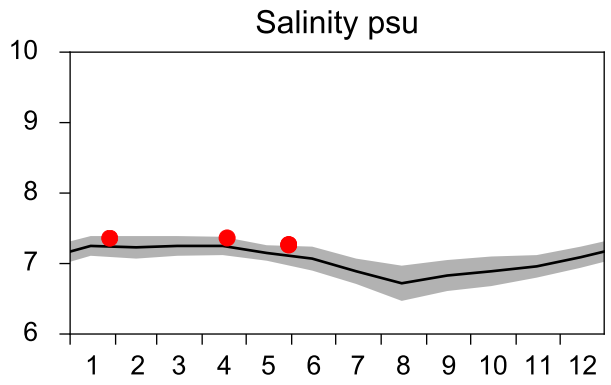


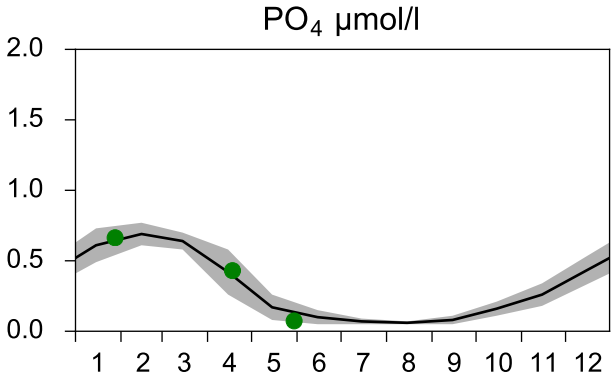
STATION BY15 GOTLANDSDJ SURFACE WATER (0-10 m)

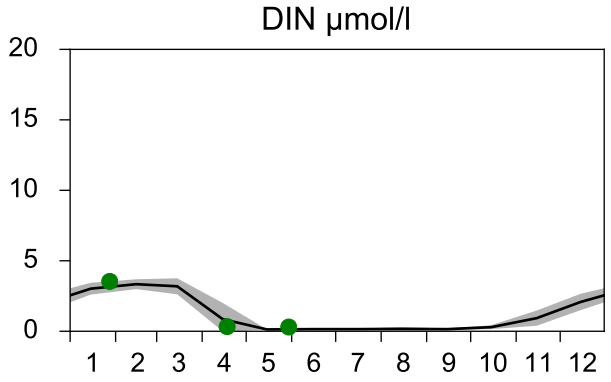
Annual Cycles

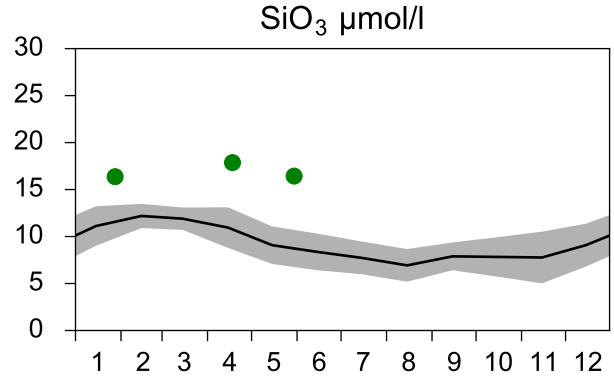
Mean 2001-2015 St.Dev. 2018

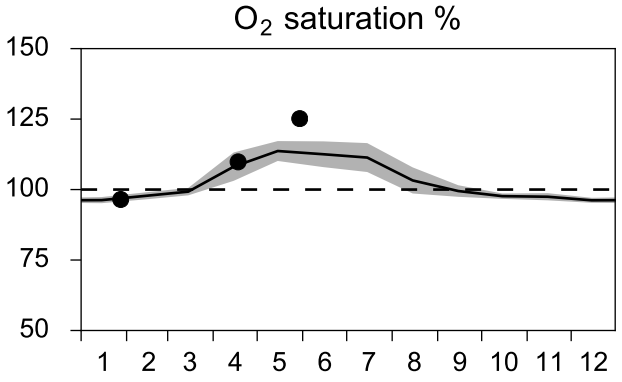




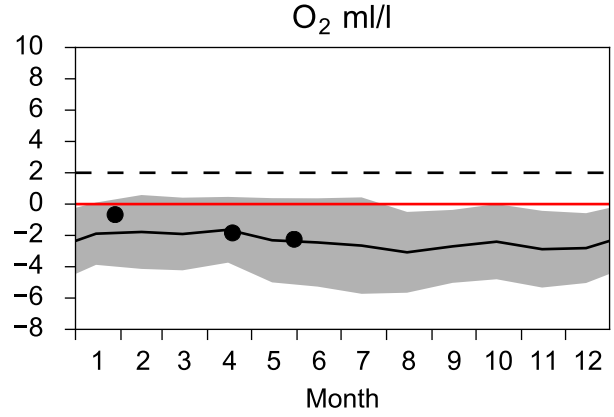


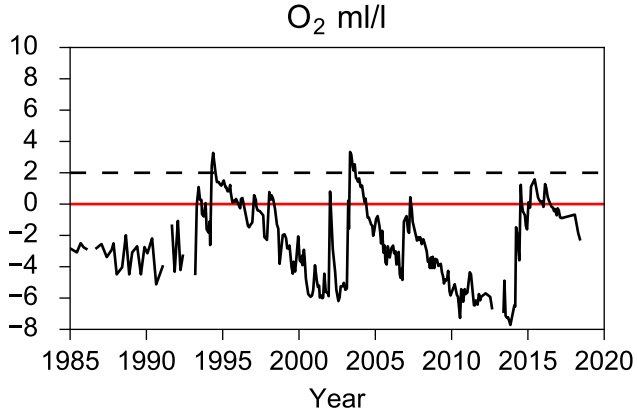




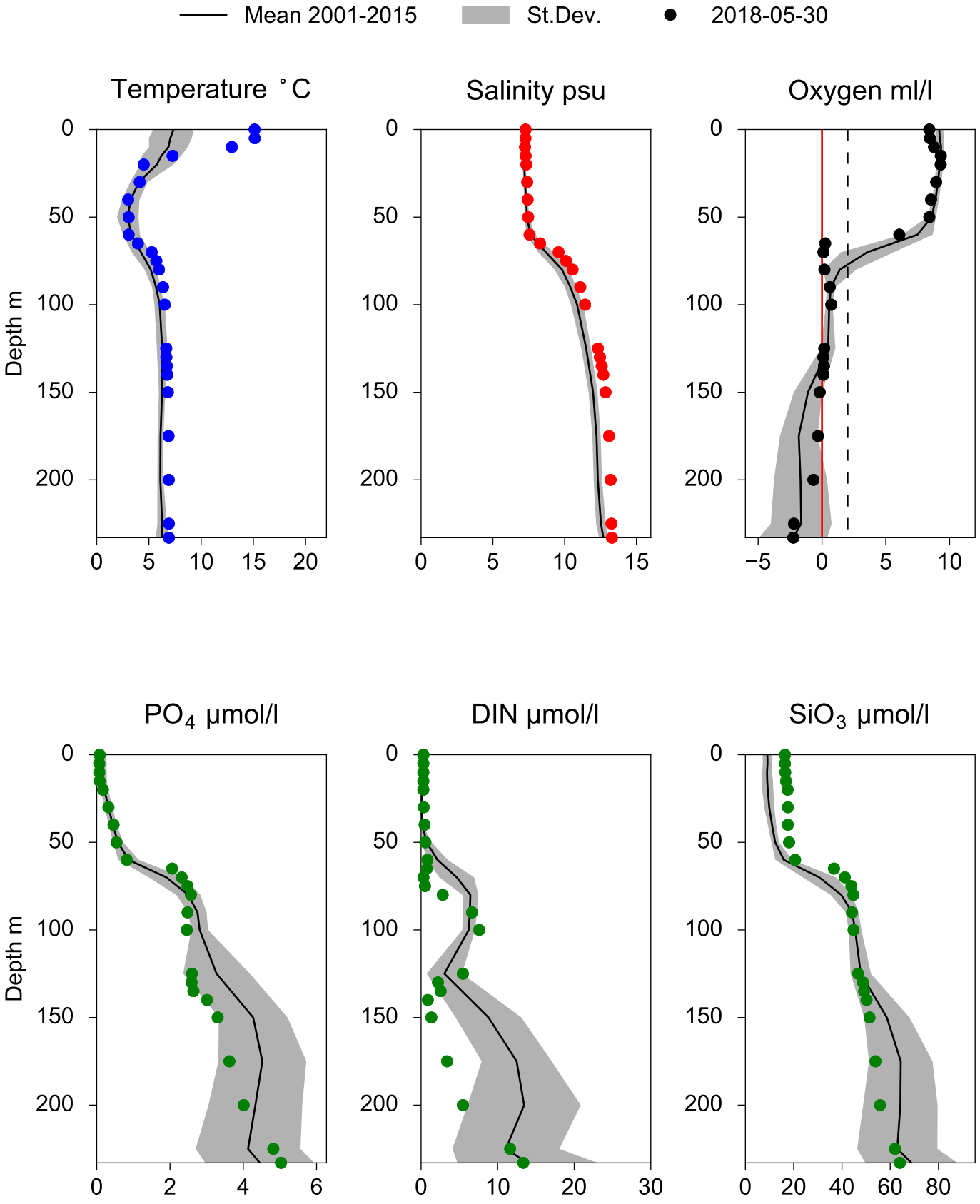


OXYGEN IN BOTTOM WATER (depth >= 225 m)





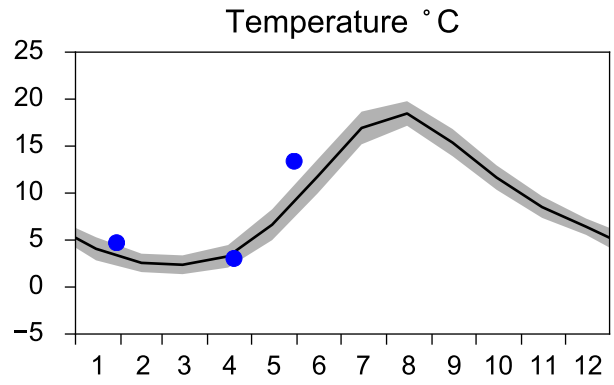
Vertical profiles BY15 GOTLANDSDJ
May

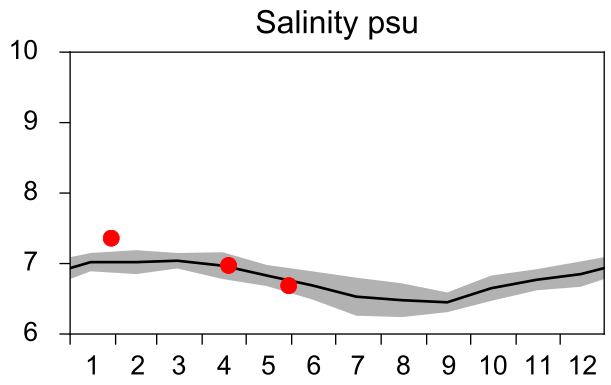


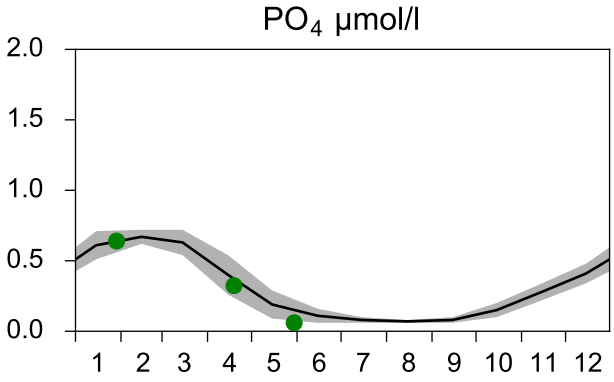
STATION BY20 FÅRÖDJ SURFACE WATER (0-10 m)

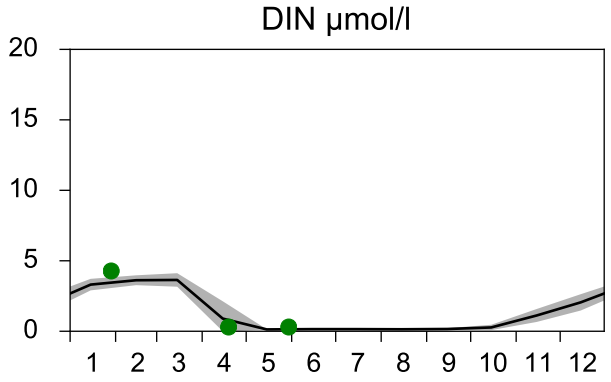
Annual Cycles

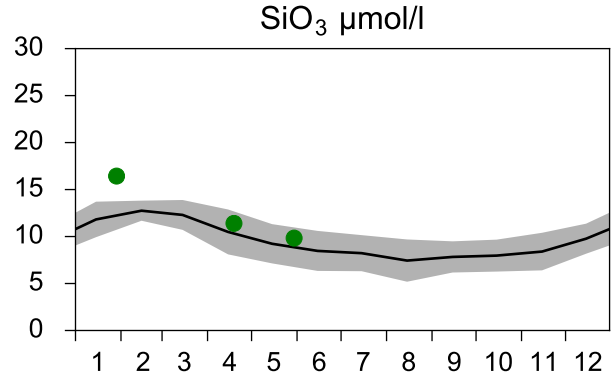
Mean 2001-2015 St.Dev. 2018

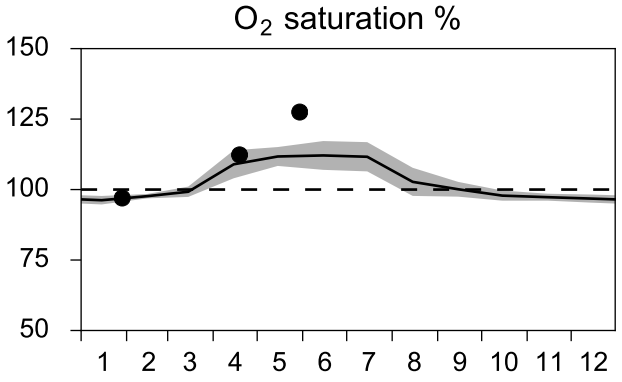




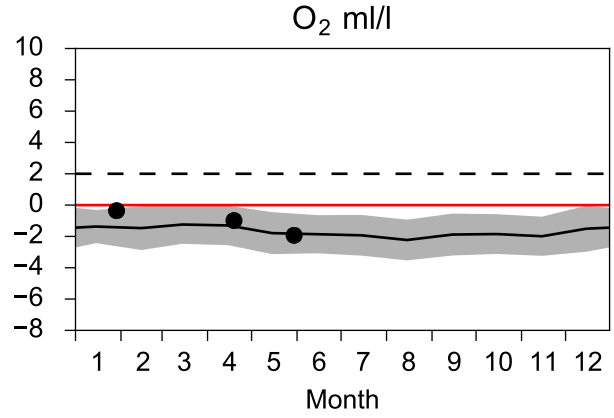


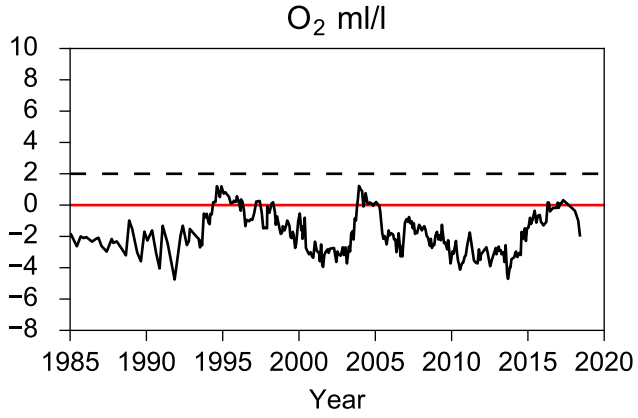




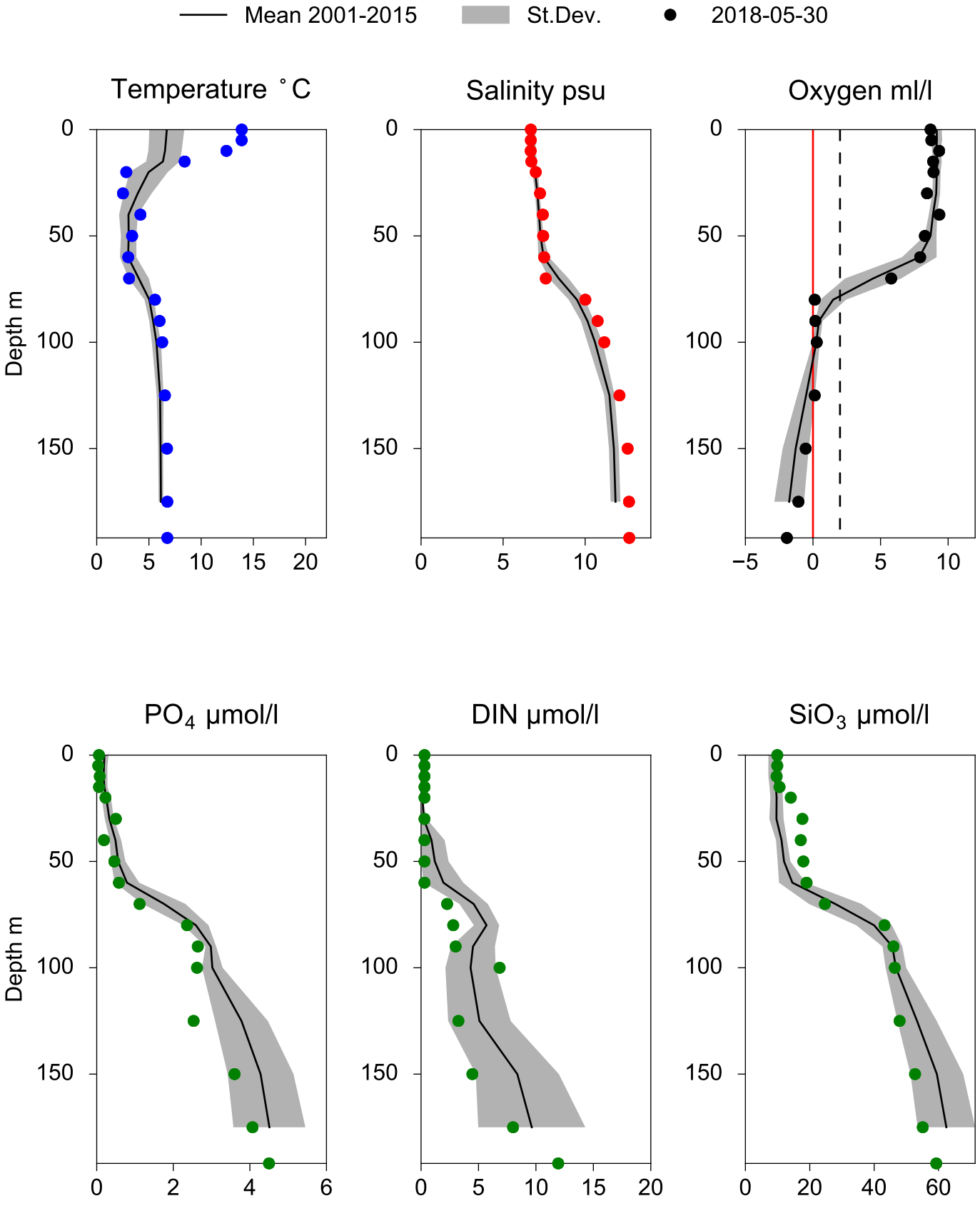


OXYGEN IN BOTTOM WATER (depth >= 175 m)

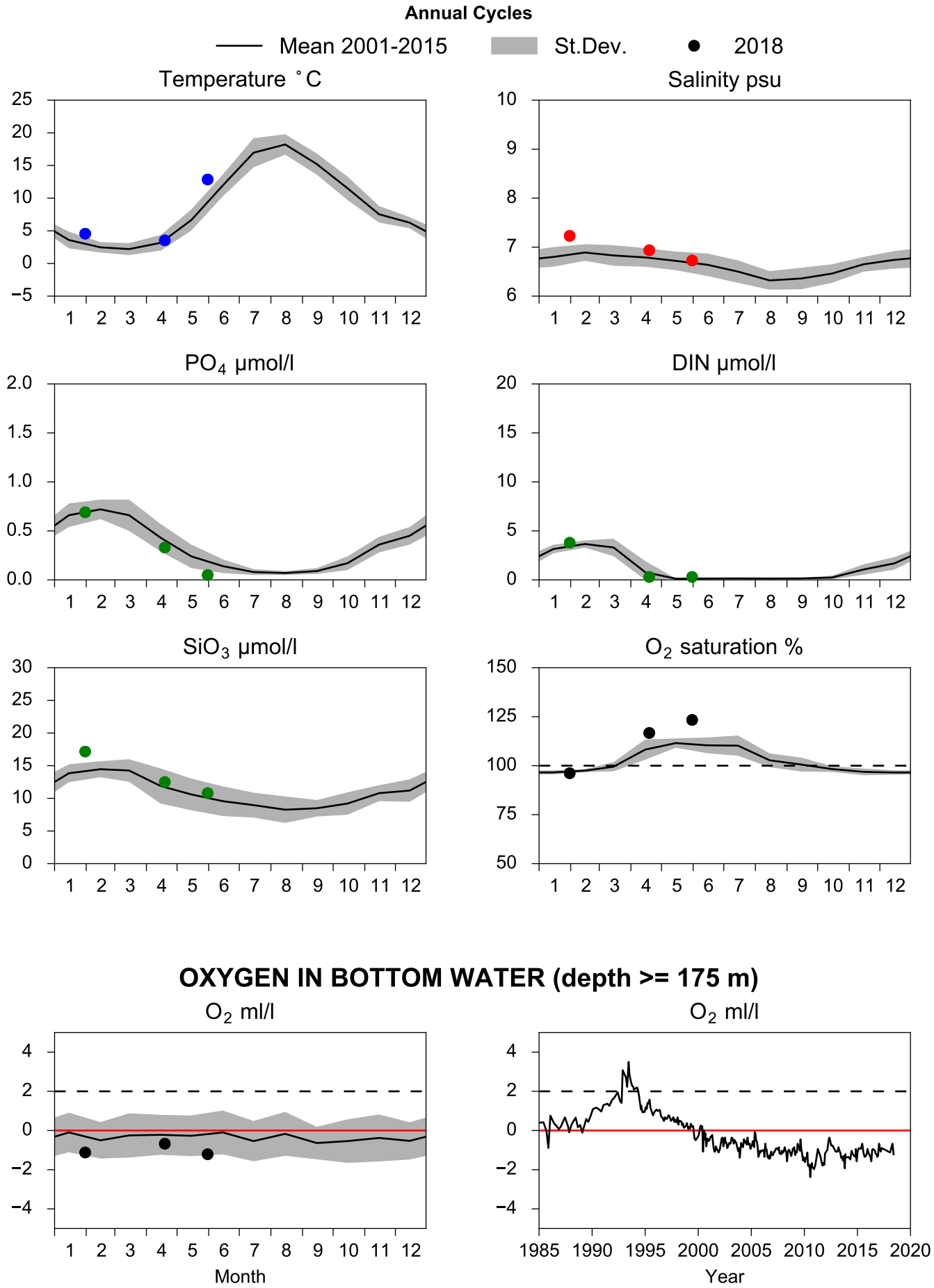




Vertical profiles BY20 FÅRÖDJ
May

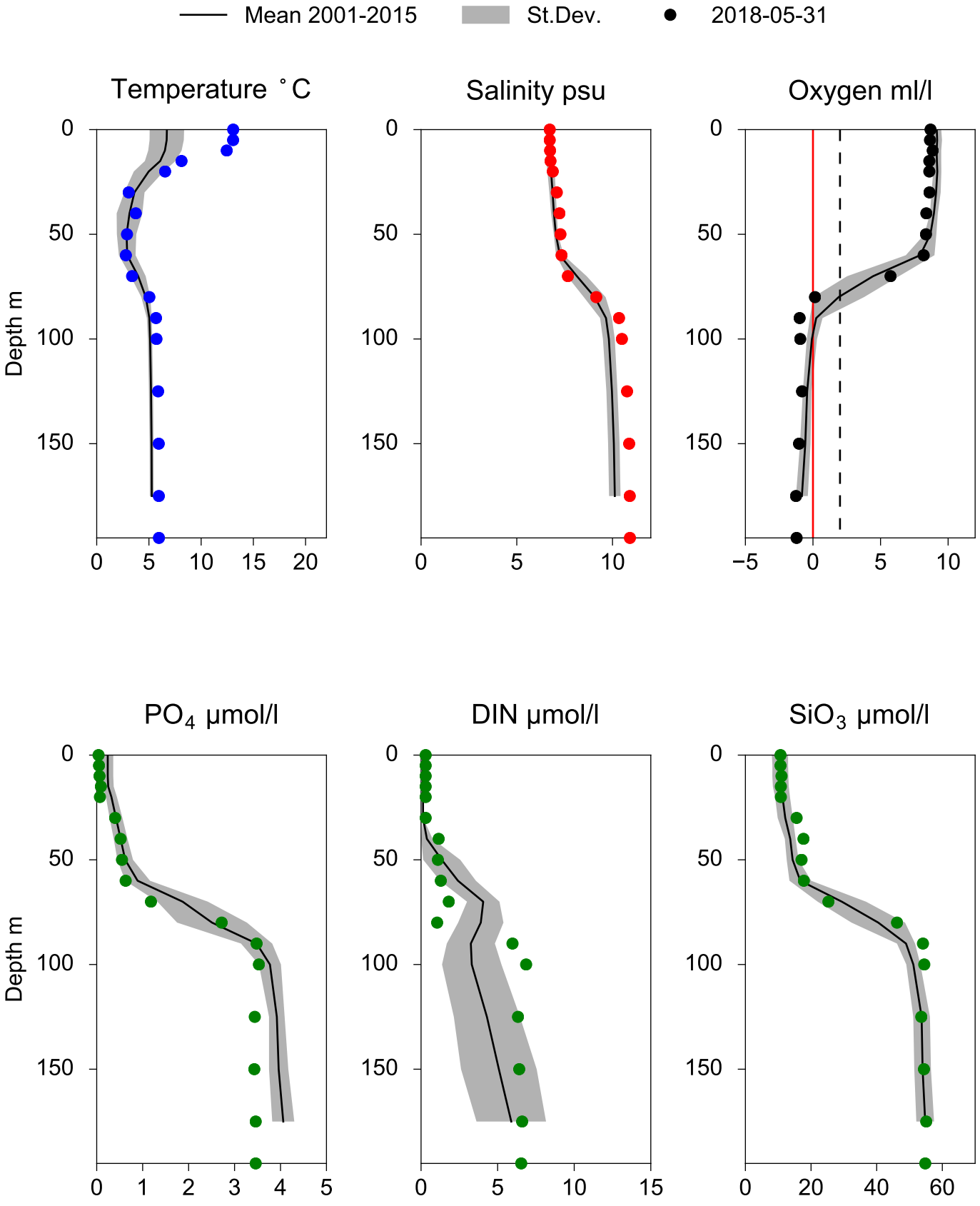


STATION BY32 NORRKÖPINGSDJ SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 175 m)

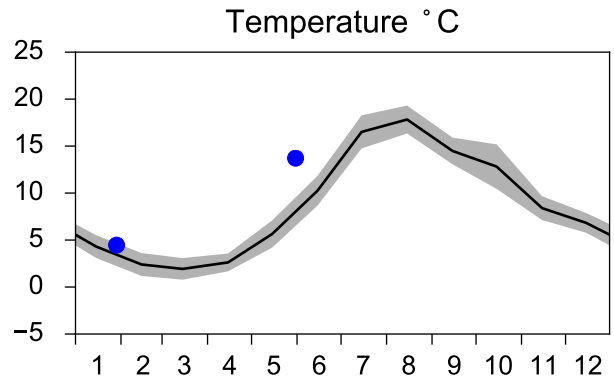
Vertical profiles BY32 NORRKÖPINGSDJ
May

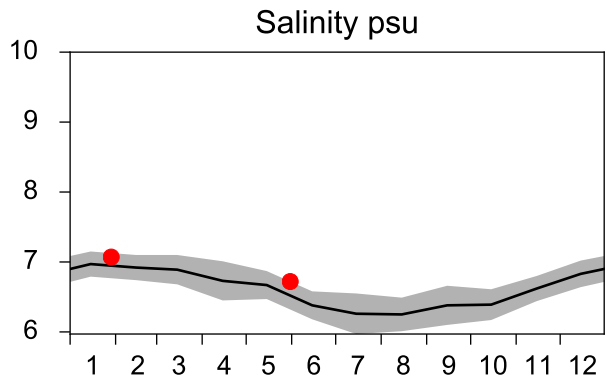


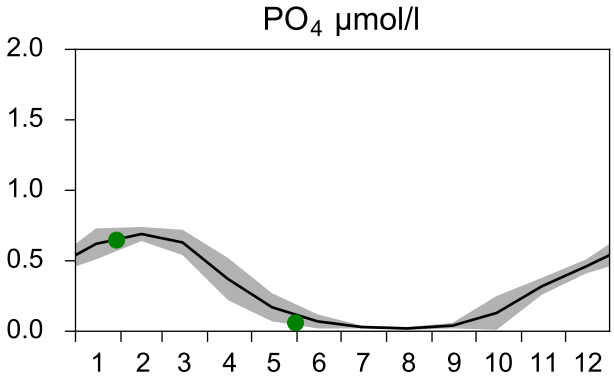
STATION BY29 / LL19 SURFACE WATER (0-10 m)

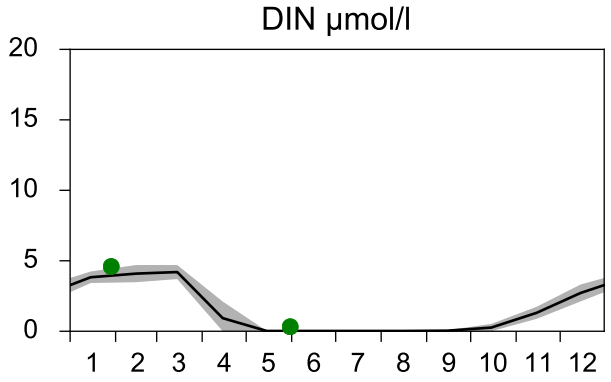
Annual Cycles

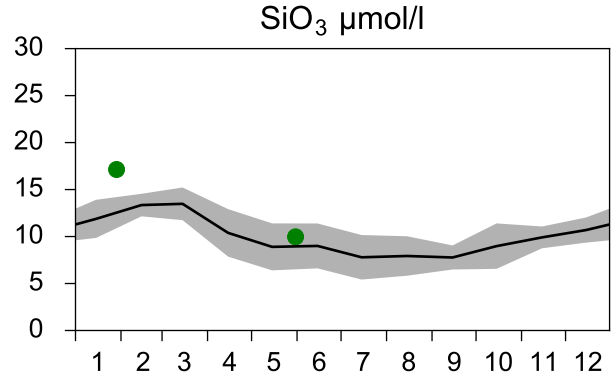
Mean 2001-2015 St.Dev. 2018

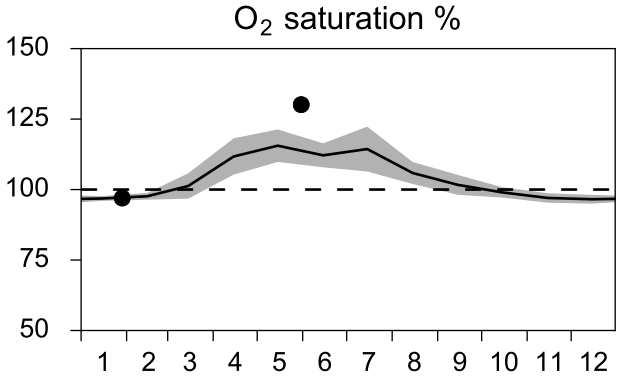




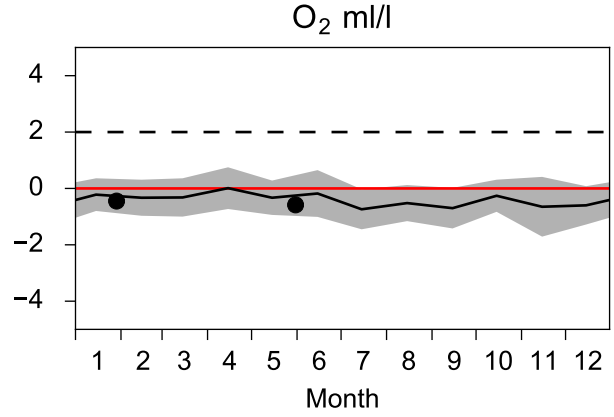


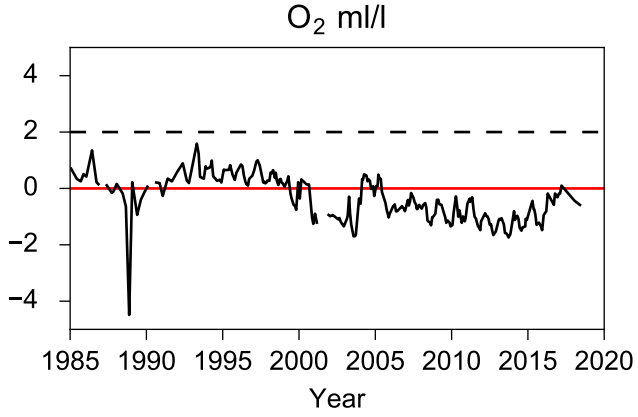






OXYGEN IN BOTTOM WATER (depth >= 150 m)





Vertical profiles BY29 / LL19
May