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Report from the SMHI monitoring cruise with R/V Aranda

Survey period: 2019-04-05 – 2019-04-12
Principal: Swedish Meteorological and Hydrological Institute (SMHI), Swedish Agency for Marine and Water Management (SwAM)
Cooperation partners: Finnish Environment Institute (SYKE)

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SUMMARY

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

The sea surface temperature was between 2.9–6.5 ºC, coldest in the northern parts of the Baltic Proper and warmest in Skagerrak and Kattegat. The sea surface salinity was as highest 30.5 in the open Skagerrak and as lowest 6.8 in the Baltic Proper and the salinity was above normal at some stations in the Baltic Proper. In Skagerrak, the halocline was observed between 10–20 meters and in Kattegat between 5–15 meters. In the Baltic Proper, the halocline started at 30 meters in the Arkona Basin and at 65 meters in the Eastern Gotland Basin.

The dissolved inorganic nitrogen in the surface layer was consumed at almost all stations, which is normal for April. There were very small amounts of phosphate in the Skagerrak and Kattegat surface layer (<0.1 µmol/l) but in the Baltic Proper there were plenty of phosphate left in the surface (0.5 µmol/l). The concentration of silicate was above normal in the surface layer in Skagerrak, Kattegat and most of the Baltic Proper. Normal levels of silicate were only found in the Arkona and Bornholm Basins. It was generally low fluorescence (plankton activity) in Skagerrak and Kattegat but higher in the Baltic Proper.

Acute oxygen deficiency (<2 ml/l) was found from 65–75 meters depth in the Baltic Proper. Hydrogen sulphide was observed in the Eastern, Western and Northern Gotland Basin. Anoxic conditions, when hydrogen sulphide forms, were observed in the Eastern Gotland Basin from 130 meters in the Gotland Deep (BY15) and from 90 meters in the Fårö Deep (BY20). In the Western and Northern Gotland Basin anoxic condition was observed from 80–90 meters. The deep water in the Arkona Basin, Skagerrak and Kattegat was well oxygenated.

The analyzed plankton samples are presented in the separate algae report "AlgAware".

Next regular cruise is scheduled to 9th – 16th May.

RESULTS

The expedition was conducted aboard the Finnish research vessel Aranda and started in Nynäshamn on 5th April and ended in Helsinki on the morning of the 12th April. The winds were mostly moderate apart from open sea in Skagerrak where it was strong winds. The expedition started with westerly winds and ended with more northerly winds. The air temperature varied between 4–7 °C and the weather was mostly clear.

During the expedition additional sampling was performed for analysis of DNA-barcoding for the project "*DNA-metabarcoding of marine phytoplankton*" supported by the Swedish Agency for Marine and Water Management (SwAM). The project covers all national marine monitoring stations in the open sea where plankton sampling is done.

Two guest scientists from Uppsala University, Leonie Esters and Lucia Gutiérrez-Loza, joined the cruise to put out an ADCP and to make service on a system for carbon dioxide measurements at Östergarnsholm outside Gotland.

At some stations, water samples and plankton samples were taken to measure selenium at EAWAG in Switzerland (Swiss Federal Institute of Aquatic Science and Technology), we also took some extra samples of plankton for Åbo Akademi who measures DNA.

In total 26 stations were visited and an overview of the stations and which parameters were measured are summarized in the Appendix.

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 centre's webpage, normally within a week after the cruise.

Data can be downloaded here: http://www.smhi.se/klimatdata/oceanografi/havsmiljodata (only available in Swedish)

Skagerrak

Temperature and salinity in the surface layer (0-10 m) was normal in the Skagerrak, the temperature was about 6.5 ºC and the salinity varied from 23.2 psu (P2) to 30.5 psu (open Skagerrak). The halocline was observed between 10 and 20 meters and it was a bit sharper in the open Skagerrak. Close to the coast a second halocline was present at 50 meters. The salinity below the halocline was about 34.5 psu. Even though the surface layer had begun to warm up there were no greater variations in the vertical temperature.

The spring bloom had consumed most of the nutrients in the surface layer and there were very low concentrations of dissolved inorganic nitrogen (DIN) and phosphate, which is normal for his time of year. The concentration of DIN was at the detection limit (0.3 µmol/l) and phosphate varied between 0.03 and 0.05 µmol/l. However, the concentrations of silicate were above normal and it varied from 1.5 µmol/l at open sea to 3.8 µmol/l closer to the coast. It was generally more nutrients below the halocline than in the surface layer. The concentrations of silicate close to coast did not follow this pattern when it was more silicate in the surface than below halocline.

The oxygen concentrations were normal except at Å17 (300 meters) where somewhat lower oxygen concentrations coincided with somewhat higher concentrations of nutrients, which could be explained by mineralization processes. The fluorescence in the surface layer was low but there were peaks in the halocline layer between 10 and 50 meters.

Kattegat and the Sound

The surface temperature in the Kattegat was similar to the surface layer in Skagerrak, i.e. 6.5 ºC and in the Sound it was a bit colder (6.2 ºC). The salinity of the surface layer was within the normal range and decreased from 21.8 psu at Fladen to 8.5 psu in the Sound. The halocline in the Kattegat was between 5–15 meters and below it the salinity was around 33 psu and the temperature was 5–5.6 ºC. At Anholt E there was also a temperature stratification around 5 meters, because of a slightly warmer water layer under the surface layer. In the Sound, there was a strong halocline around 14–20 meters.

In the Kattegat it was for the season normal and low concentrations of DIN and phosphate in the surface water (0–10 m). The levels of phosphate varied between 0.09–0.15 µmol/l and DIN varied between 0.3–1.2 µmol/l. The concentration of silicate was higher than normal in the Kattegat surface water and varied between 4.4–5.2 µmol/l. The Sound surface water was more nutritious than the Kattegat which is normal; phosphate 0.3 µmol/l, DIN 0.45 µmol/l and silicate 8.2 µmol/l. Below the stratification, in both the Kattegat and the Sound, the concentrations of all nutrients were higher than in the surface water and the levels were within normal ranges.

The oxygen conditions in the bottom water were good and the lowest observation was 5.49 ml/l at Fladen. In the middle Kattegat, there were high fluorescence peaks around 5–10 meters, which indicates plankton activity.

Baltic Proper

Warming of the surface layer (0–10 m) had started in the Baltic Proper and the temperature varied within normal values, from 5.9 ºC in the Arkona Basin to 2.9 ºC in the Western Gotland Basin. The salinity of the surface layer was 6.8–8.0 and at some stations (RefM1V1, BCS III-10, BY15 and BY29) it was slightly saltier than normal. The highest salinity was in the Arkona Basin and the lowest was in the Western Gotland Basin.

In the Arkona and Bornholm Basins, the halocline began around 30–45 meters. In the Eastern Gotland Basin, the halocline was at its deepest and it started there around 65 meters. In the Western and Northern Gotland Basin, the halocline started around 50 meters. The water was well mixed down to the halocline except in the Western Gotland Basin where there was a slightly warmer water layer just above the halocline. Both temperature and salinity were slightly higher than normal below the halocline in the Eastern, Western and Northern Gotland Basin. At BY15, the temperature in the deep water was 7 ºC and the salinity was 13 psu.

DIN was consumed down to 30 meters in most of the Baltic Proper, which is normal for the season. At some stations in the Eastern and Northern Gotland Basin, however, there was still some DIN in the surface water. The concentration of DIN (0–10 m) varied between the detection limit of 0.3 µmol/l to a maximum of 1.7 µmol/l in the Northern Gotland Basin. The concentration of phosphate (0–10 m) varied between 0.23–0.58 µmol/l with lowest levels in the Arkona Basin and highest levels in the Northern Gotland Basin where they also were slightly above normal. Otherwise, the

phosphate levels were within the normal range in the surface. The concentration of silicate (0–10 m) was between 7.2 µmol/l in the Arkona Basin to 18.4 µmol/l in the Western Gotland Basin. In the Eastern, Northern and Western Gotland Basin, the levels of silicate in the surface layer were above normal. Below the halocline there were generally normal concentrations of silicate and phosphate. In the Western Gotland Basin, there were higher concentrations of DIN (as ammonium) than normal in the deep water. In the Eastern Gotland Basin there was a layer with lower DIN concentrations around 80–100 meters where it was also very low concentrations of oxygen.

In the Bornholm Basin and the Hanö Bay, acute oxygen deficiency (<2ml/l) occurred from 65–70 meters depth and the lowest observation of oxygen was measured to 0.51 ml/l in the Bight of Hanö. In the other basins there were acute oxygen deficiency from 65–75 meters depth. Hydrogen sulphide was measured in the Eastern, Western and Northern Gotland Basin. In the Eastern Gotland Basin, it was completely oxygen-free (when hydrogen sulphide is formed) from 130 meters in the Gotland Deep (BY15) and from 90 meters in the Fårö Deep (BY20). In the Western and Northern Gotland Basin, it was completely oxygen-free from 80–90 meters. In the Arkona Basin, the bottom water was well oxygenated.

There was generally high fluorescence throughout the Baltic Proper, which indicates that the spring bloom was ongoing.

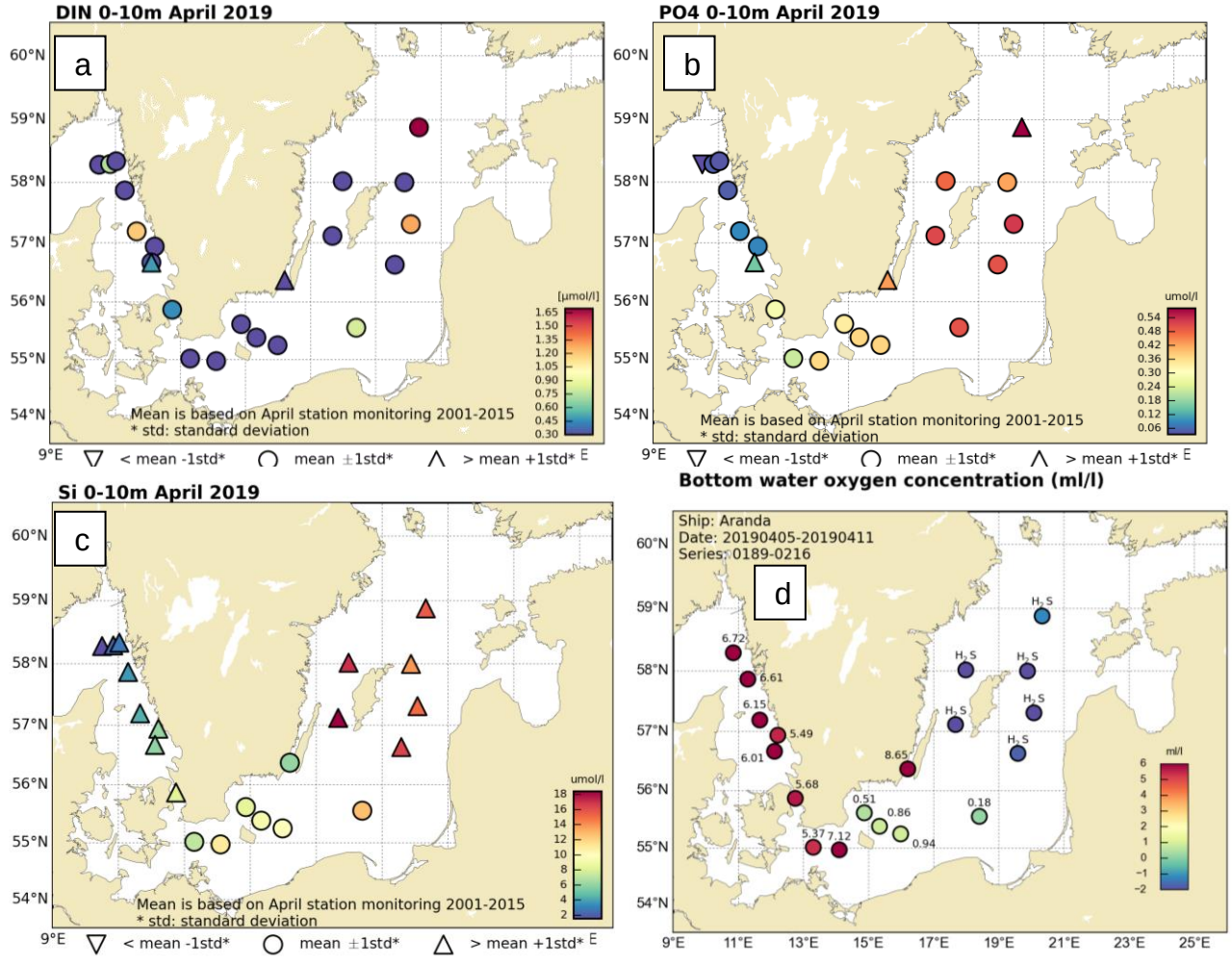

Figure 1. The concentration of DIN (a), phosphate (b) and silicate (c) in the surface layer 0–10 meter. (d) shows the oxygen condition in the bottom water, H2S means hydrogen sulphide.

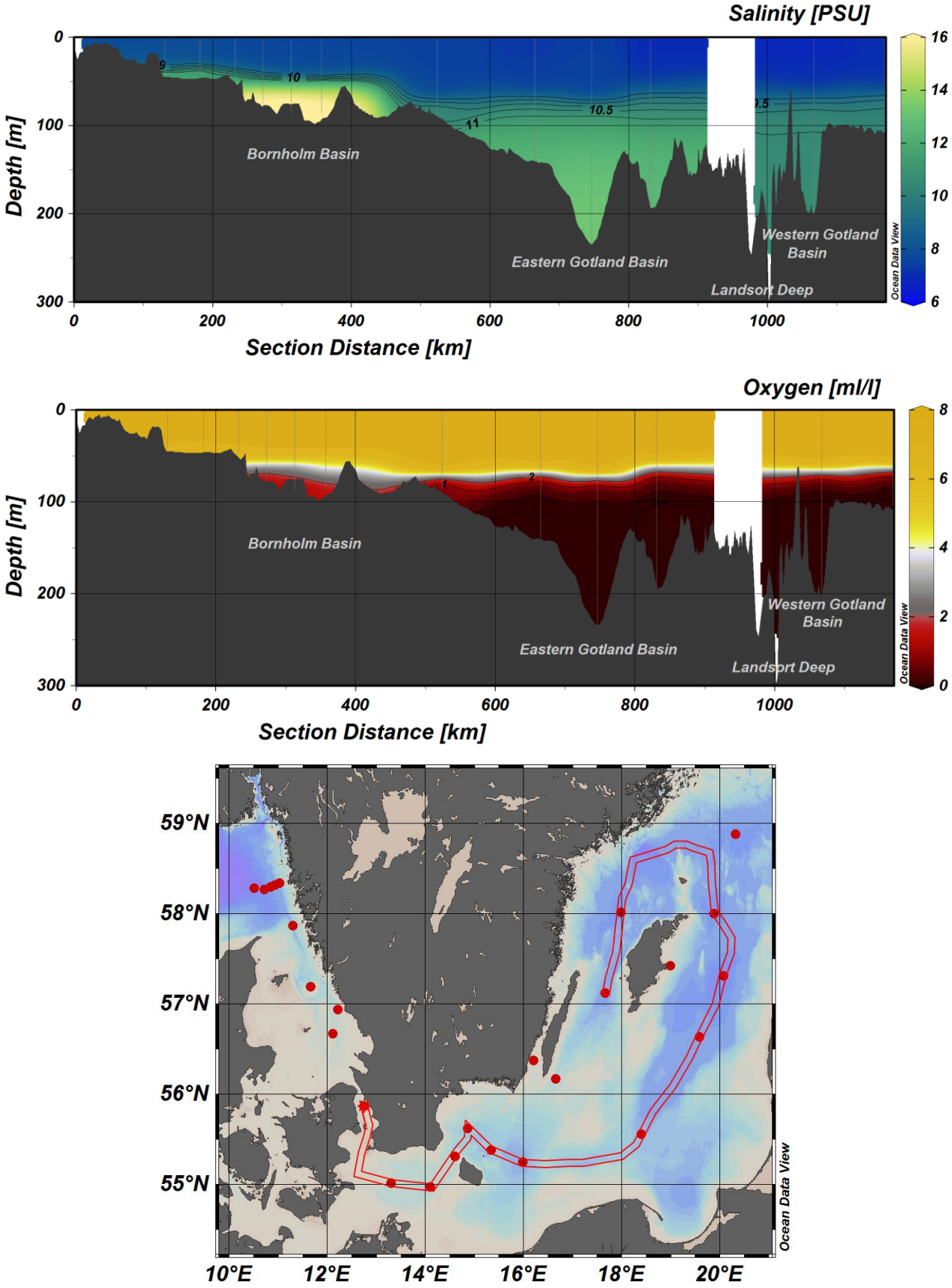

Figure 2. Transect showing salinity and dissolved oxygen from the Sound, through the Baltic Proper, to the Western Gotland Basin.

Participants

Name	Leg	Responsibility	Institute
Johan Kronsell		Chief scientist	SMHI
Lars Anderson			SMHI
Johan Håkansson		Quality manager	SMHI
Sara Johansson			SMHI
Ola Kalén			SMHI
Anna-Kerstin Thell			SMHI
Leonie Esters	Nynäsh-Gbg	Guest scientist	Uppsala University
Lucia Gutiérrez-Loza	Nynäsh-Gbg	Guest scientist	Uppsala University

Appendix

- Track chart
- Table of stations, sampled parameters and number of sampling depths
- 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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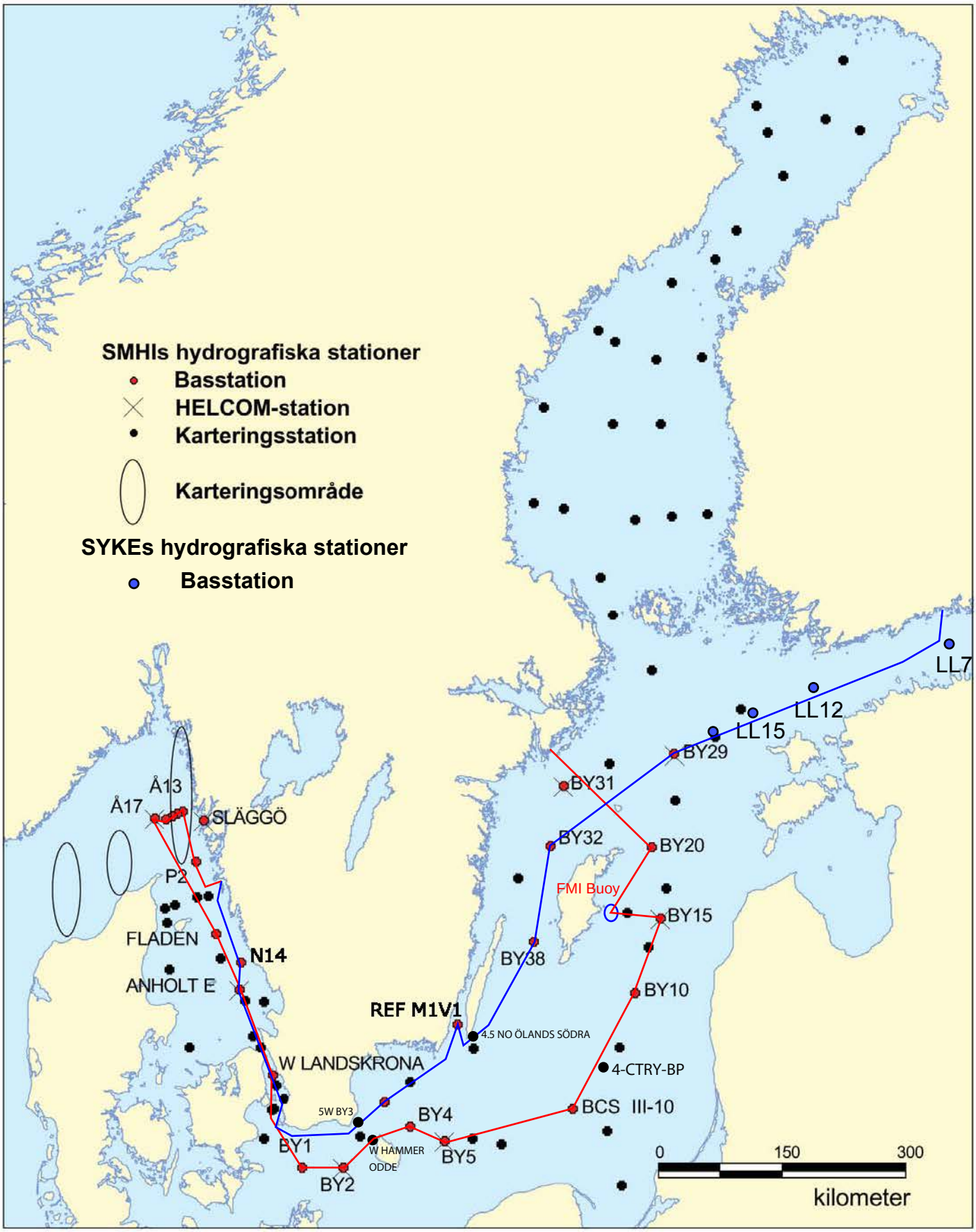
Ship: R/V Aranda
Date: 20190405-20190412
Series: 0189-0216



Date: 2019-04-12
Time: 10:35

Ship: AR
Year: 2019

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
0189	6	BPEX26	BAS...	BY20 FÅRÖDJ	5759.88	01952.72	20190405	2300	194		12	9	5.7	1016	9990	x---	17		x	x	-	x	-	x	x	x	x	-	x	x	x	x	-	-	x	-	-	-
0190	6	BPEX00	EXT...	ÖSTERGARNSHOLM	5725.42	01859.57	20190406	0430	20		11	9	5.0	1015	0030	----	5		-	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
0191	6	BPEX21	BAS...	BY15 GOTLANDSDJ	5718.73	02004.57	20190406	0800	239	12	10	9	5.0	1016	0030	xxxx	24		x	x	-	x	x	x	x	x	x	-	x	x	x	x	-	-	x	-	x	-
0192	6	BPEX21	BAS...	BY15 GOTLANDSDJ	5718.73	02004.57	20190406	0940	239	12	09	8	5.4	1016	0030	----	19		-	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
0193	6	BPEX13	BAS...	BY10	5638.01	01935.07	20190406	1410	145	9	10	7	7.0	1012	1120	x---	15		x	x	x	x	-	x	x	x	x	-	x	x	x	x	-	-	x	-	x	-
0194	6	BPSE11	BAS...	BCS III-10	5533.32	01824.00	20190406	2120	90		08	7	6.7	1010	9990	x-x-	12		x	x	x	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	x	-
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0196	6	BPSB06	BAS...	BY4 CHRISTIANSÖ	5522.99	01520.03	20190407	0840	93	10	09	4	5.3	1007	0020	x---	12		x	x	x	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	-	-
0197	6	BPSA05	EXT...	W HAMMER ODDE	5518.54	01435.93	20190407	1130	51		02	6	4.7	1007	0020	----	8		x	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
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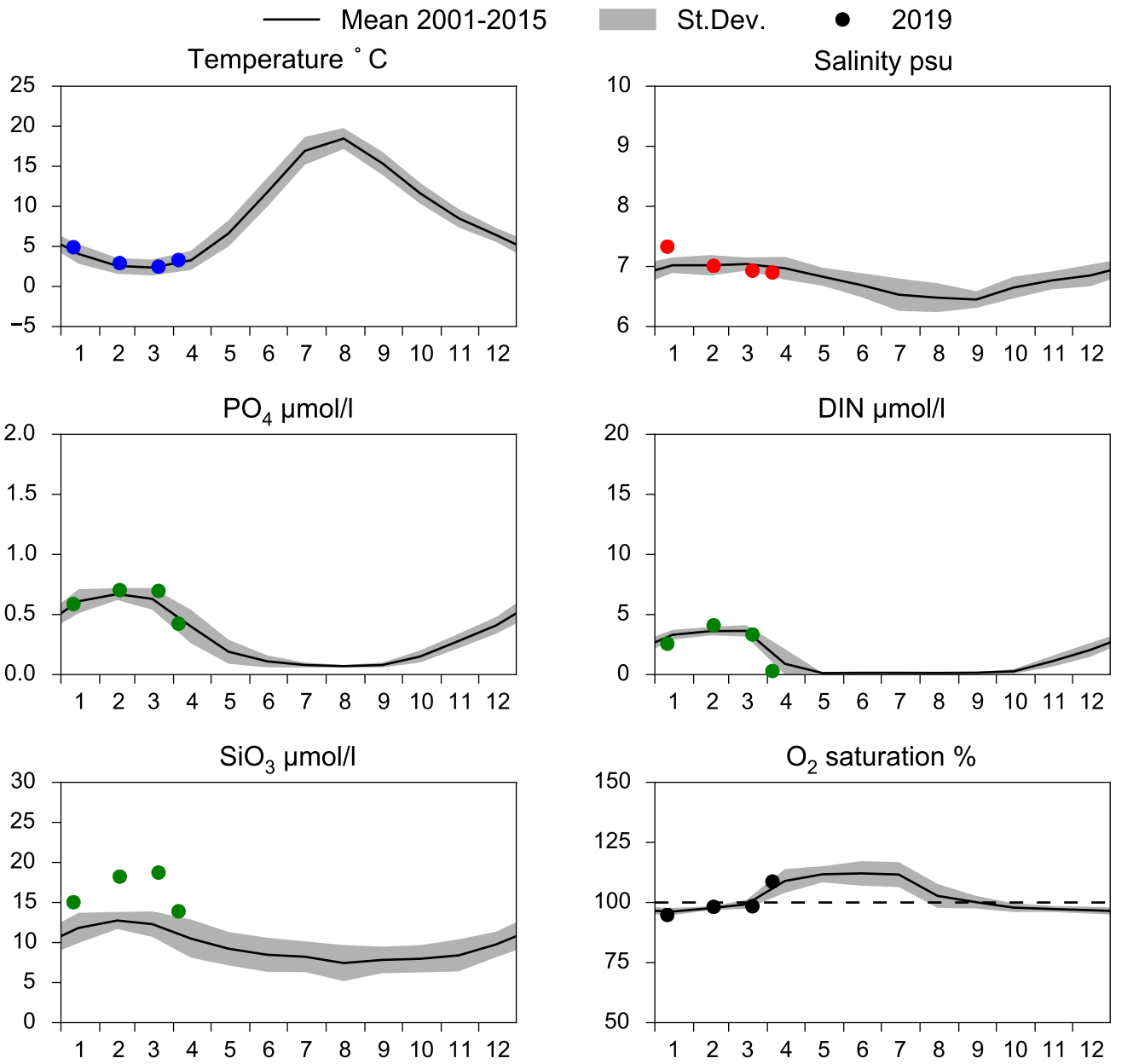
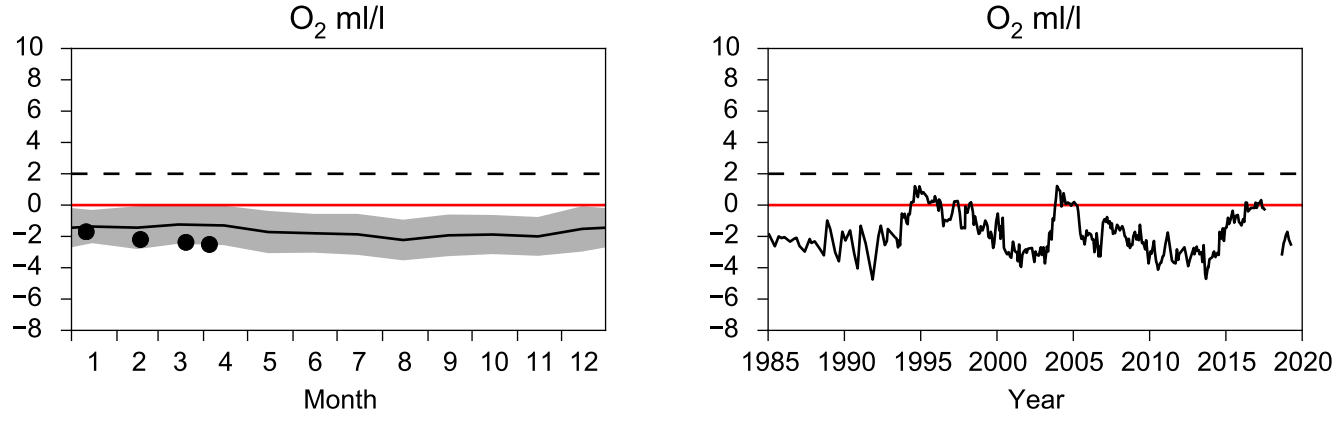
0200	6	SOCX39	BAS...	W LANDSKRONA	5551.99	01244.89	20190408	0001	52		03	5	7.2	1008	9990	x---	9		x	x	x	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	-	-
0201	6	KAEX29	BAS...	ANHOLT E	5640.14	01206.62	20190408	0530	57		04	11.7	4.7	1011	0030	x-xx	10		x	x	x	x	x	x	x	-	x	-	x	x	x	x	-	-	x	-	x	x
0202	6	KANX50	BAS...	N14 FALKENBERG	5656.39	01212.71	20190408	0800	31	4	01	6.3	5.6	1012	0030	xxx-	7		x	x	x	x	x	x	x	-	x	-	x	x	x	x	-	-	x	-	x	-
0203	6	KANX25	BAS...	FLADEN	5711.55	01139.45	20190408	1100	86	8	34	9	5.7	1004	1130	x---	12		x	x	x	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	x	-
0204	6	SKEX18	BAS...	Å17	5817.05	01030.24	20190408	1815	342		01	11	7.1	1016	1130	xxx-	15		x	x	-	x	x	x	x	-	x	-	x	x	x	x	-	-	x	-	x	-
0205	6	SKEX17	BAS...	Å16	5816.02	01043.38	20190408	2000	198		02	15	6.5	1017	9990	----	14		-	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
0206	6	SKEX16	BAS...	Å15	5817.67	01050.66	20190408	2055	137		02	13	6.0	1017	9990	x---	12		x	x	x	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	-	-
0207	6	SKEX15	BAS...	Å14	5818.94	01056.47	20190408	2200	109		03	14	4.5	1016	9990	----	11		-	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
0208	6	SKEX14	BAS...	Å13	5820.36	01101.66	20190408	2300	107		02	12	3.8	1019	9990	x---	10		x	x	x	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	-	-
0209	6	SKEX23	BAS...	P2	5752.00	01117.49	20190409	0230	94		02	12	1.6	1018	9930	x---	10		x	x	x	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	-	-
0210	6	KAEX29	BAS...	ANHOLT E	5640.24	01206.51	20190409	1105	61	8	34	5	3.9	1015	1130	x-xx	10		x	x	x	x	x	x	x	-	x	-	x	x	x	x	-	-	x	-	x	-
0211	6	BPSH05	BAS...	HANÖBUKTEN	5537.03	01452.02	20190410	0220	80		22	6	3.9	1015	9990	x---	11		x	x	x	x	-	x	x	-	x	-	x	x	x	x	-	-	x	-	-	x
0212	6	BPWK01	BAS...	REF M1V1	5622.24	01612.10	20190410	0930	21	10	35	6.6	5.0	1008	2830	xxx-	5		x	x	x	x	x	x	x	-	x	-	x	x	x	x	-	-	x	-	-	-
0213	6	BPSE50	EXT...	4.5 NO ÖLANDS SÖDRA	5610	01639.00	20190410	1215	54		01	9	1.1	1018	7840	----	9		-	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
0214	6	BPWX45	BAS...	BY38 KARLSÖDJ	5707.02	01740.11	20190410	1830	110		03	10		1020	7830	x-x-	14		x	x	x	x	-	x	x	x	x	-	x	x	x	x	-	-	x	-	x	-
0215	6	BPWX38	BAS...	BY32 NORRKÖPINGSDJ	5801.00	01759.06	20190411	0000	202		03	8		1023	9940	x---	17		x	x	-	x	-	x	x	x	x	-	x	x	x	x	-	-	x	-	-	-
0216	6	BPNX35	BAS...	BY29 / LL19	5852.91	02019.66	20190411	0900	176	9	02	8	1.1	1022	1330	x-x-	16		x	x	-	x	-	x	x	x	x	-	x	x	x	x	-	-	x	-	x	-

STATION BY20 FÅRÖDJ SURFACE WATER (0-10 m)

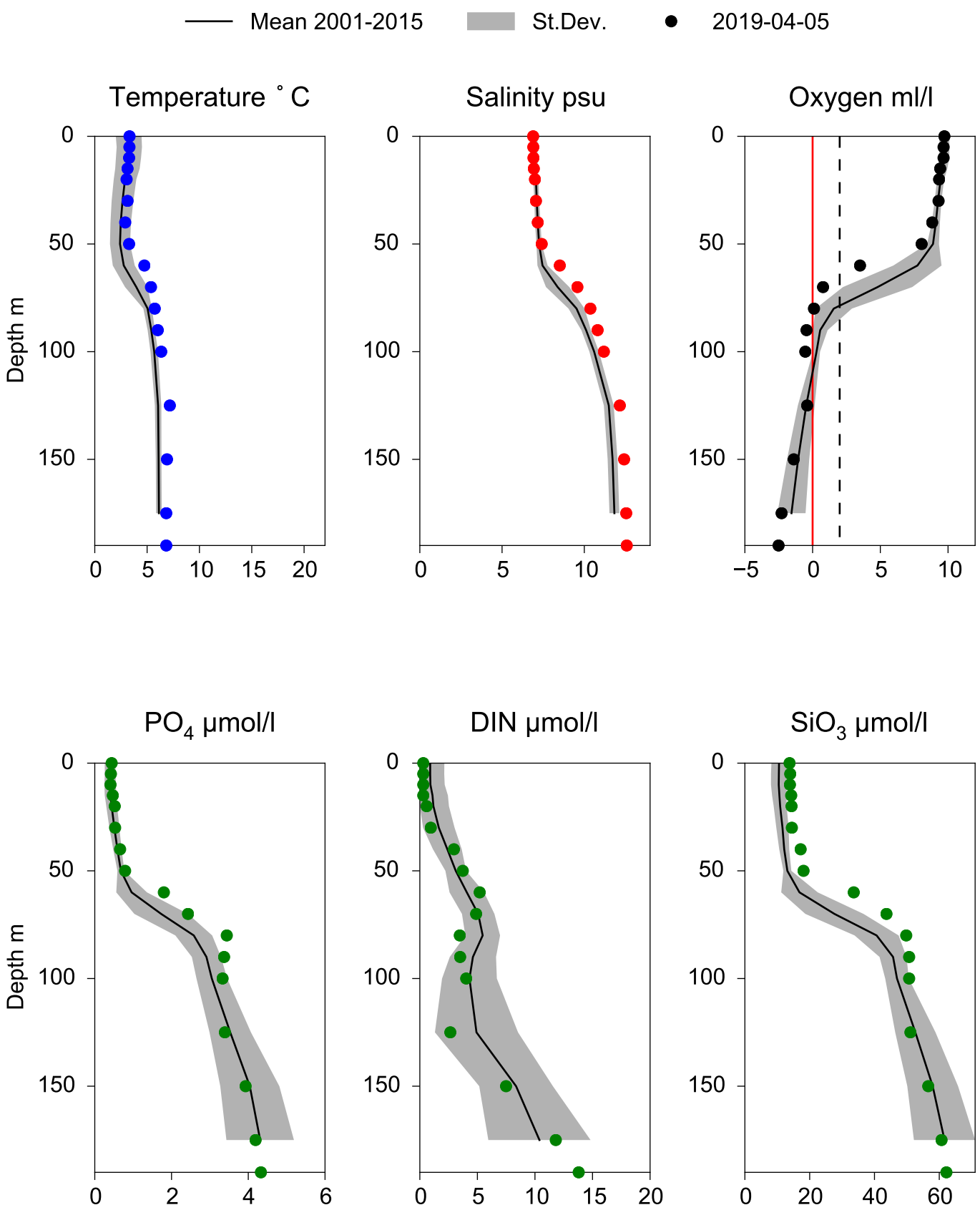
Annual Cycles



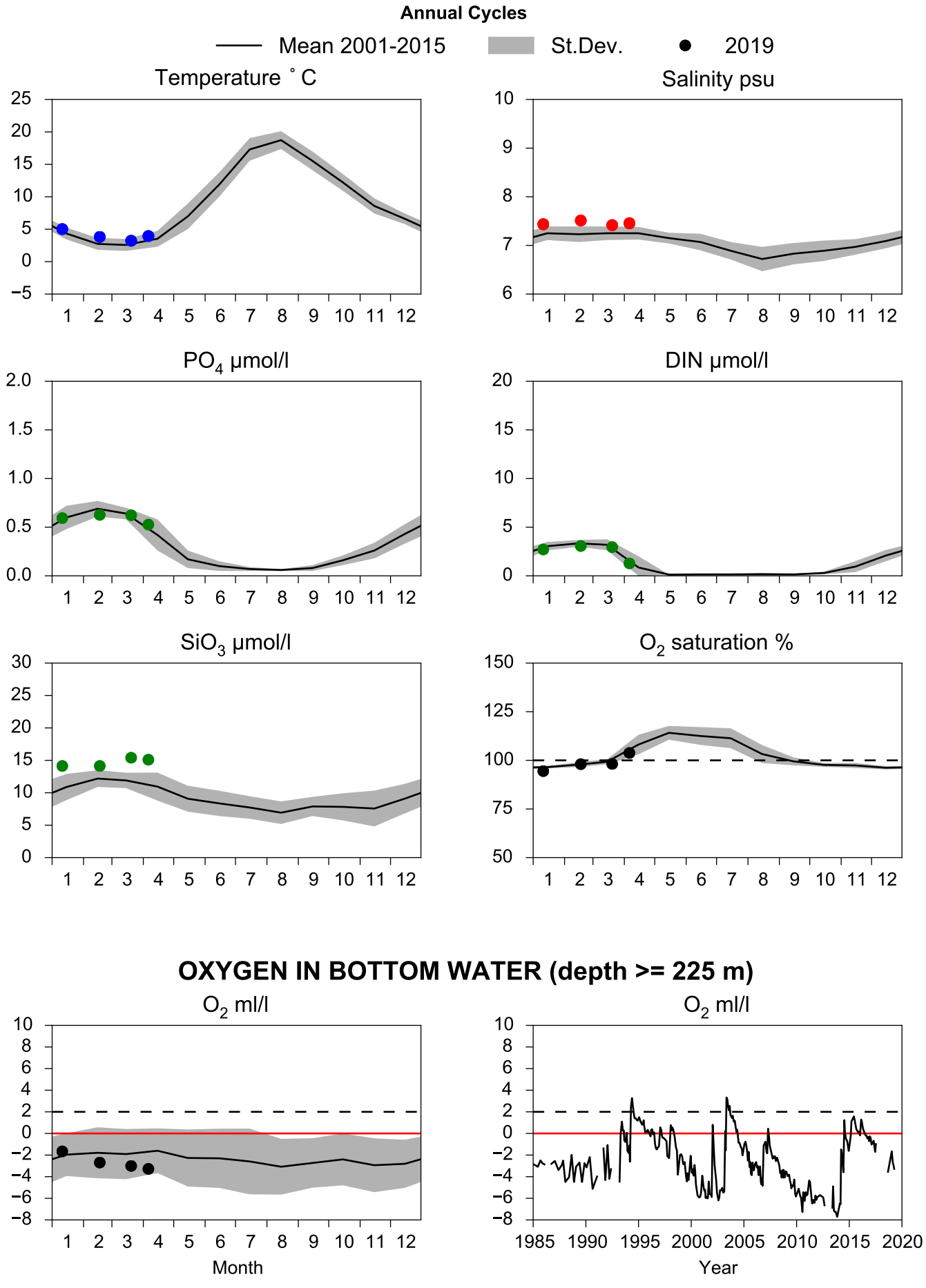
OXYGEN IN BOTTOM WATER (depth >= 175 m)



Vertical profiles BY20 FÅRÖDJ
April

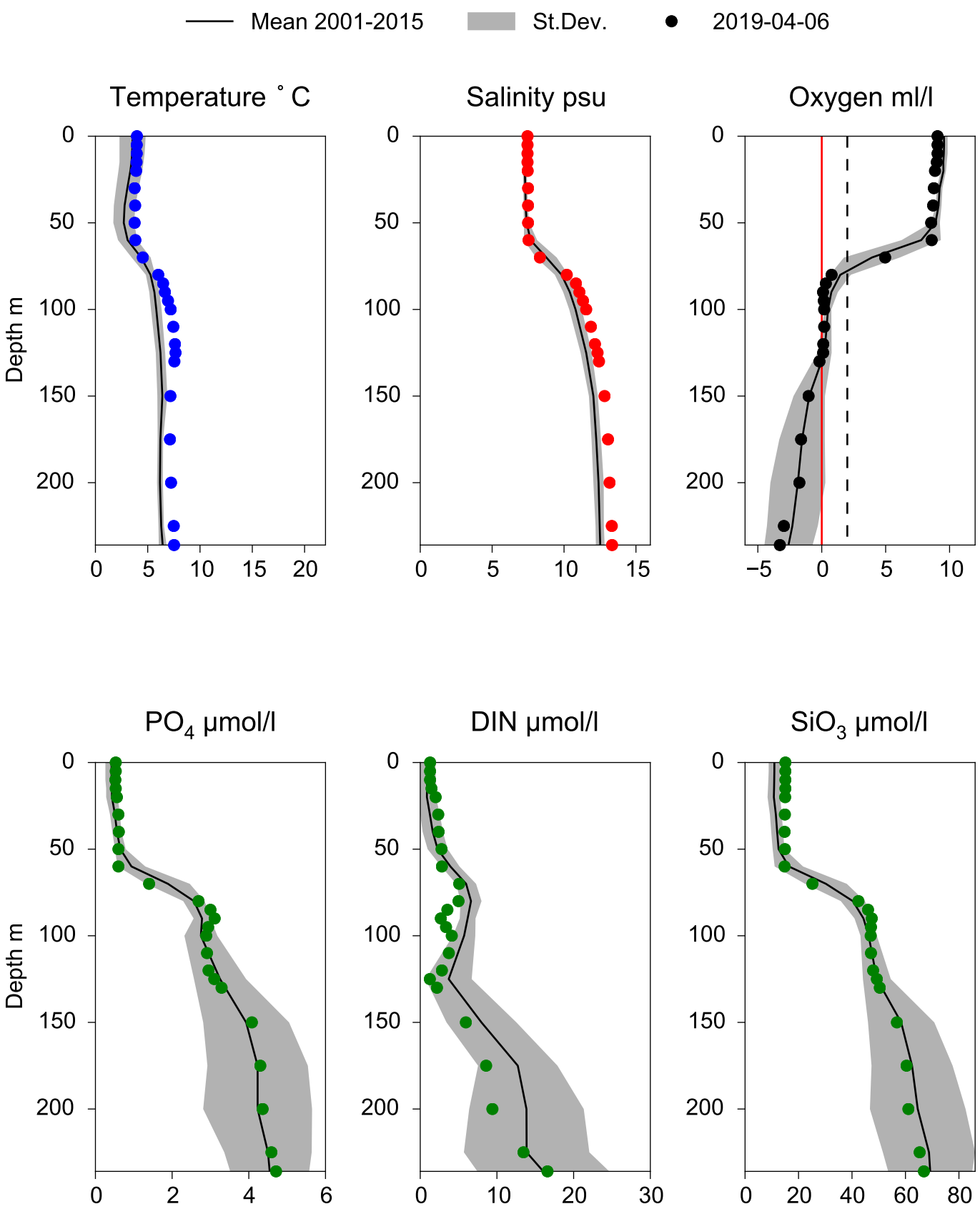


STATION BY15 GOTLANDSDJ SURFACE WATER (0-10 m)

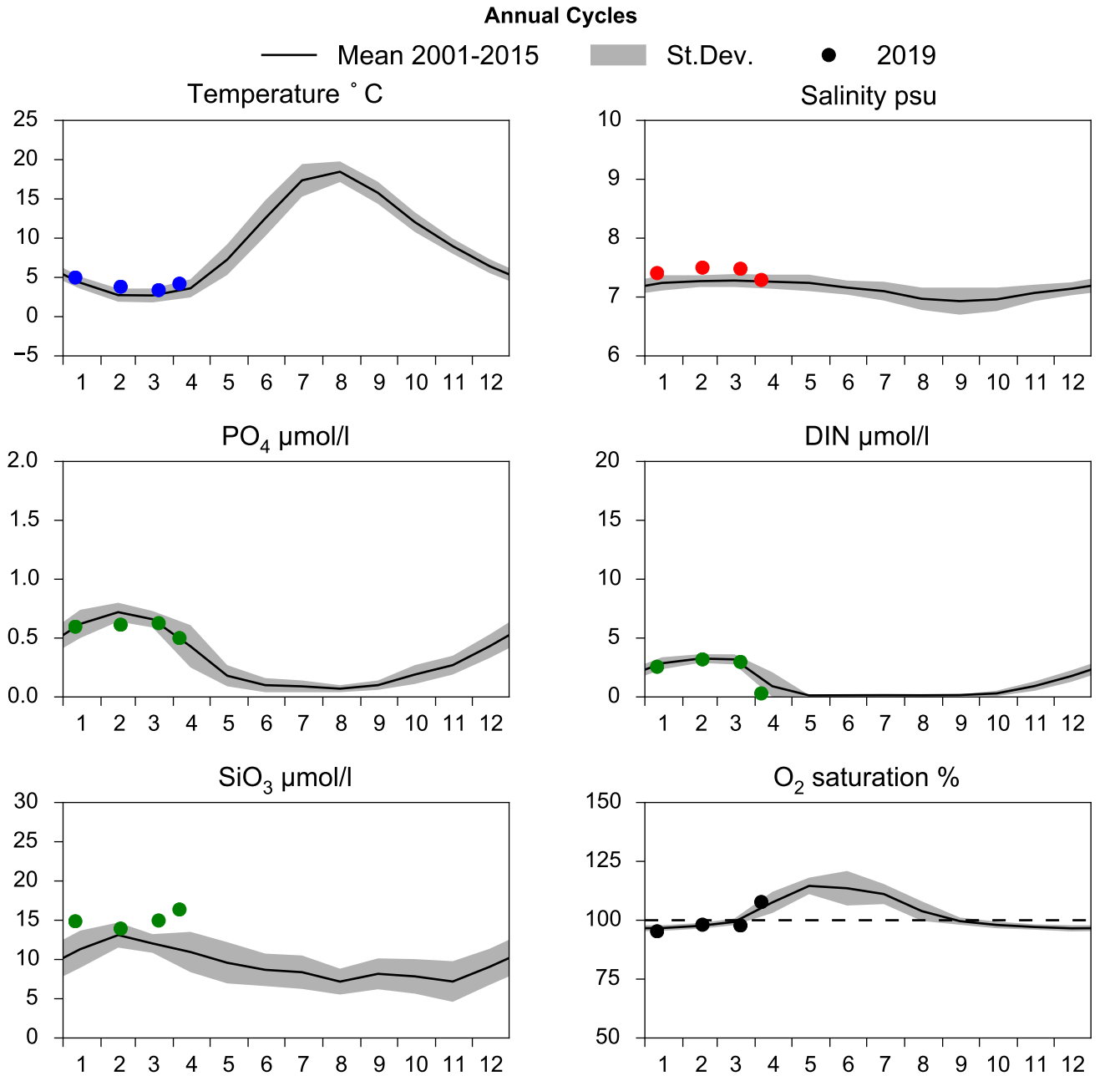


OXYGEN IN BOTTOM WATER (depth >= 225 m)

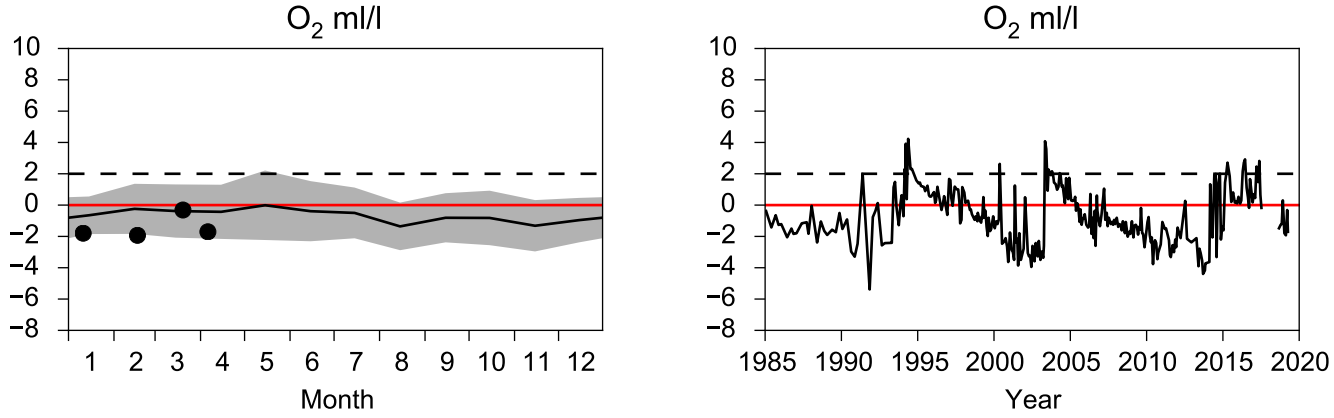
Vertical profiles BY15 GOTLANDSDJ
April



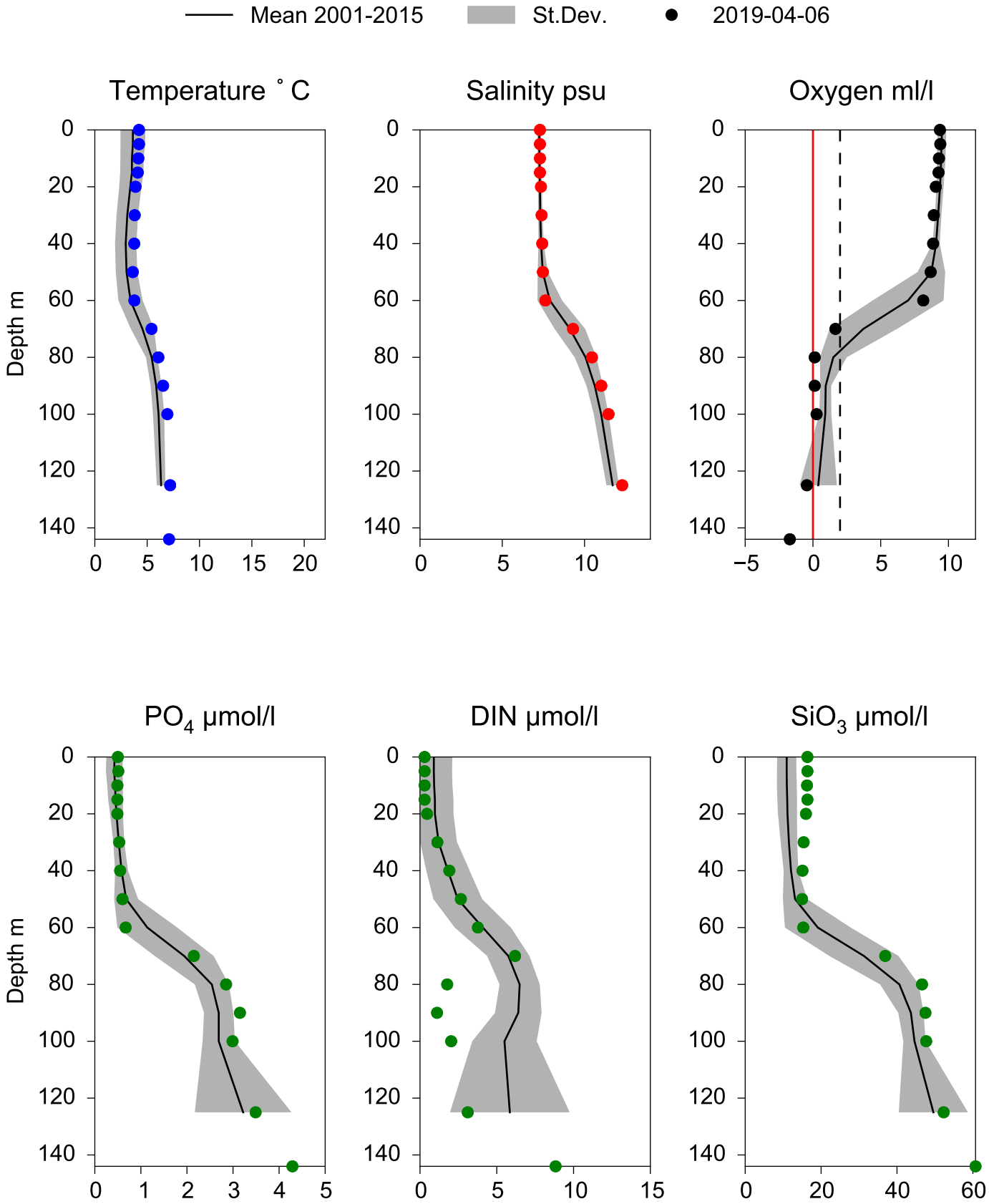
STATION BY10 SURFACE WATER (0-10 m)



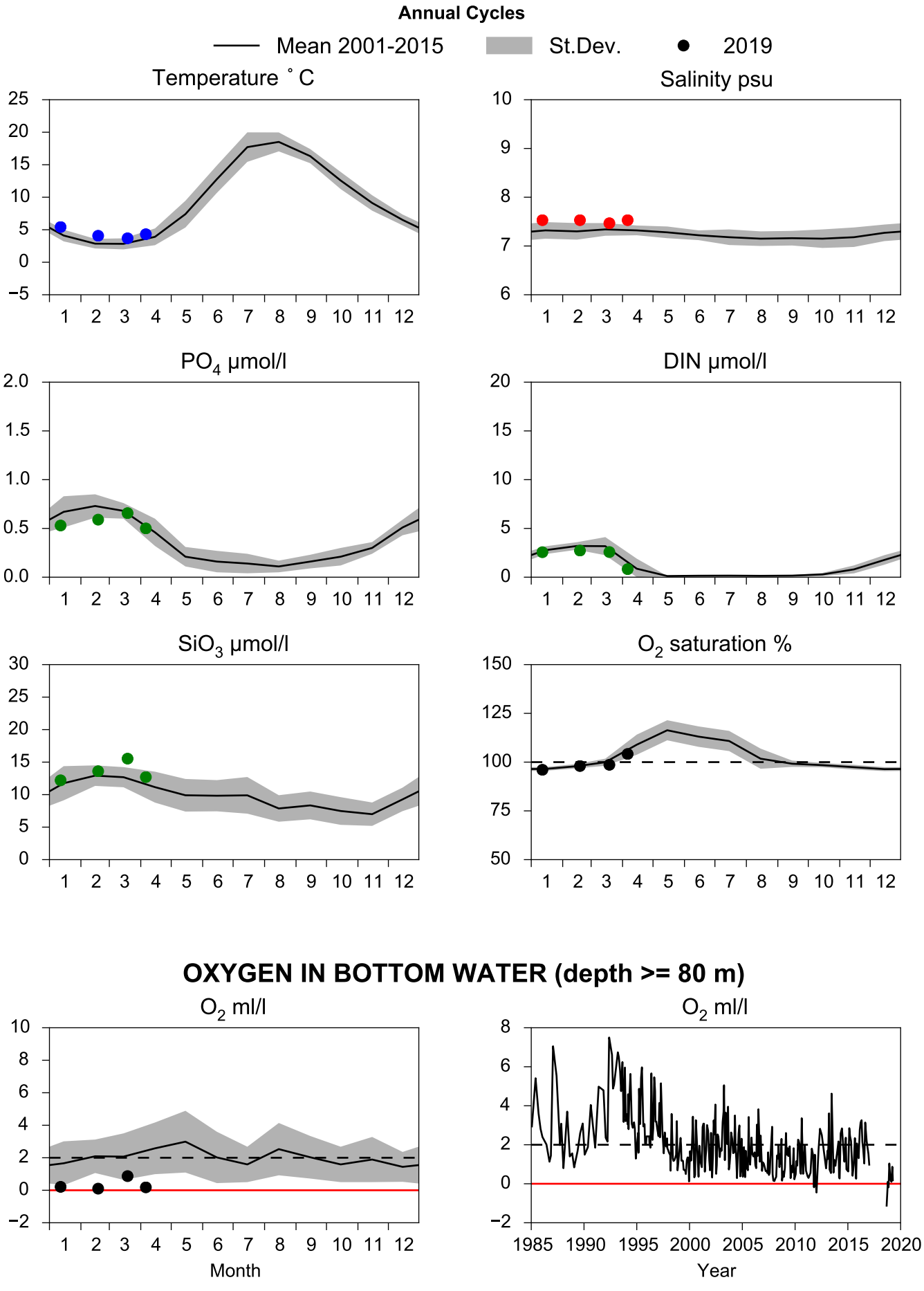
OXYGEN IN BOTTOM WATER (depth >= 125 m)



Vertical profiles BY10
April

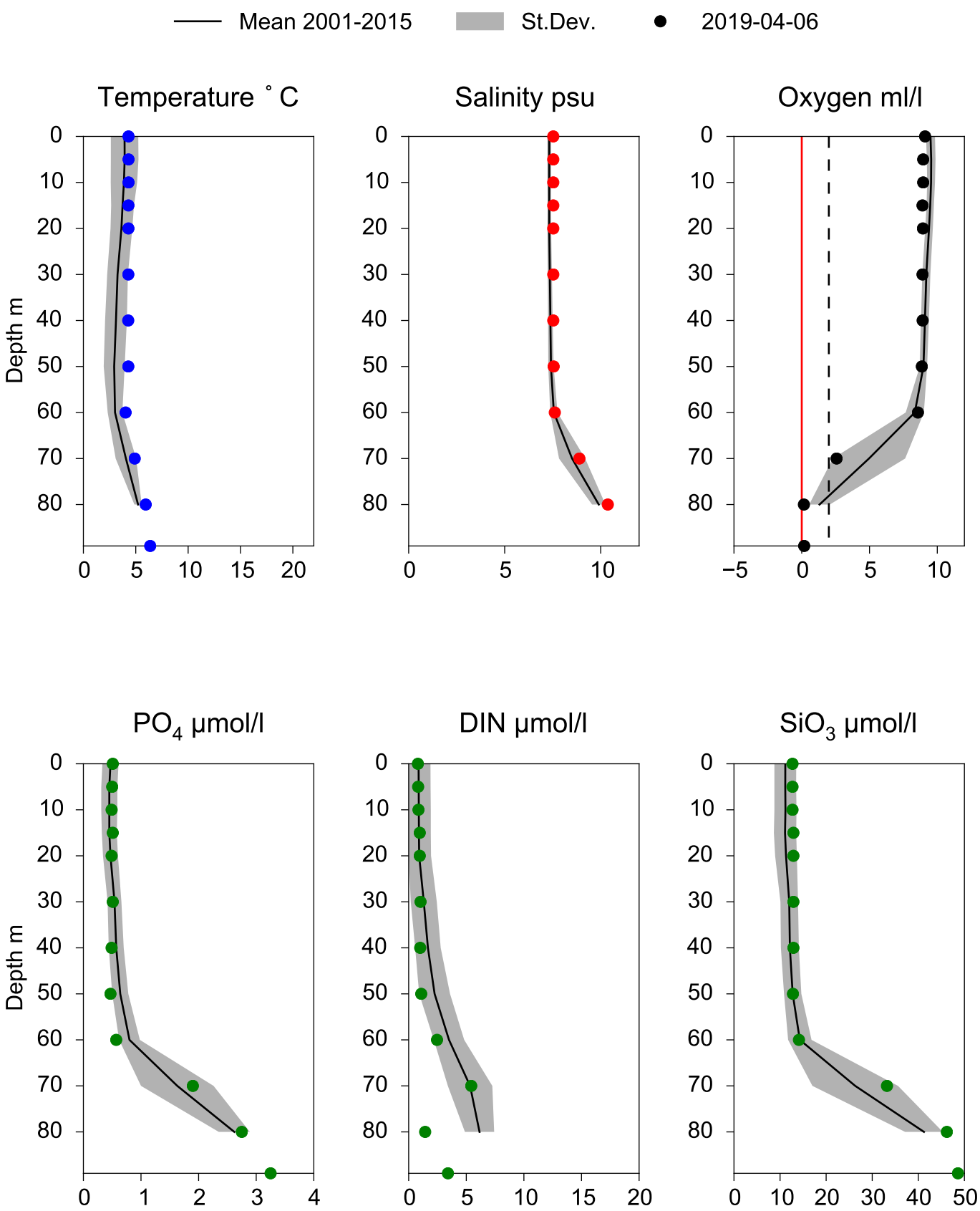


STATION BCS III-10 SURFACE WATER (0-10 m)

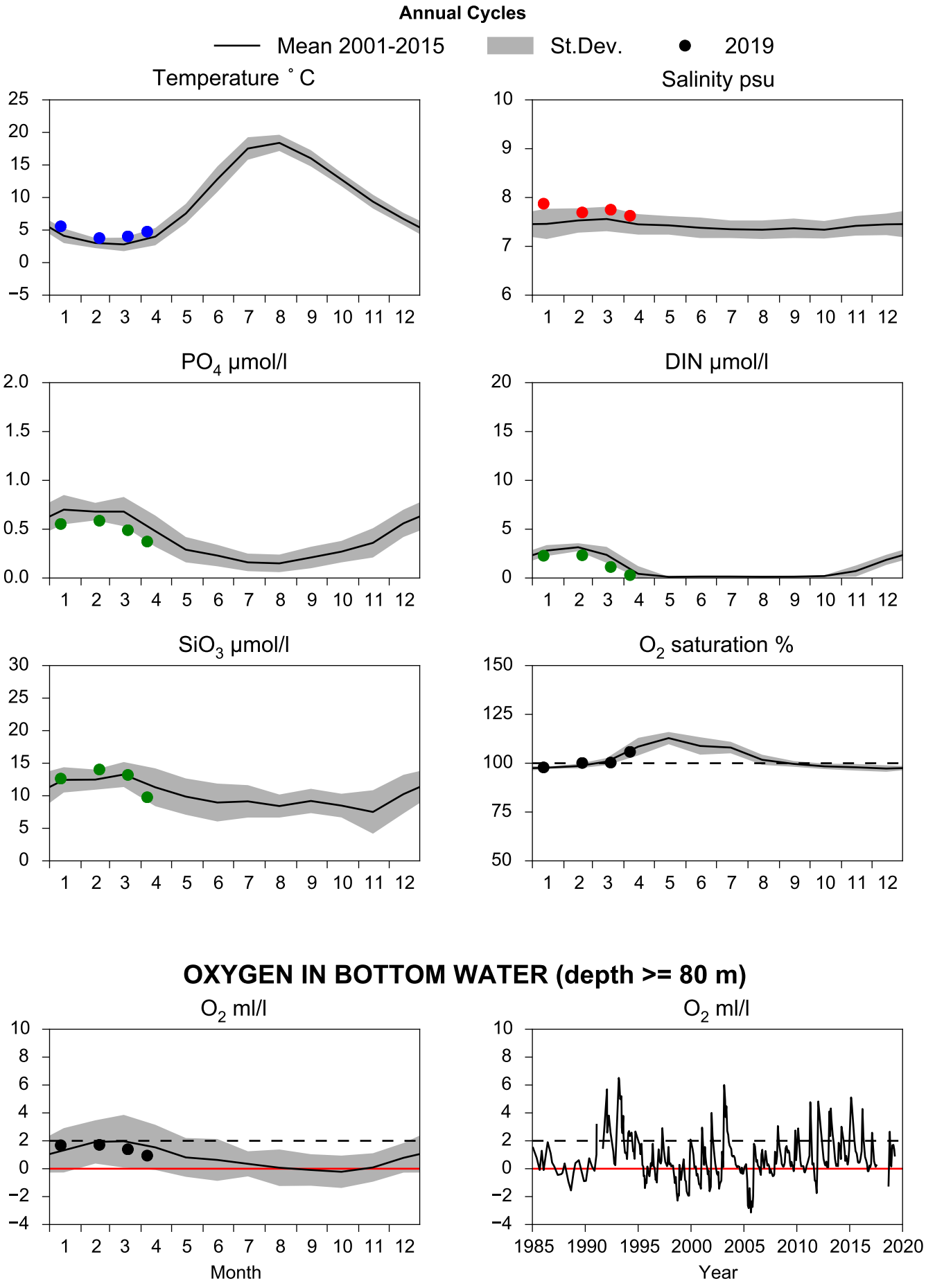


OXYGEN IN BOTTOM WATER (depth >= 80 m)

Vertical profiles BCS III-10
April

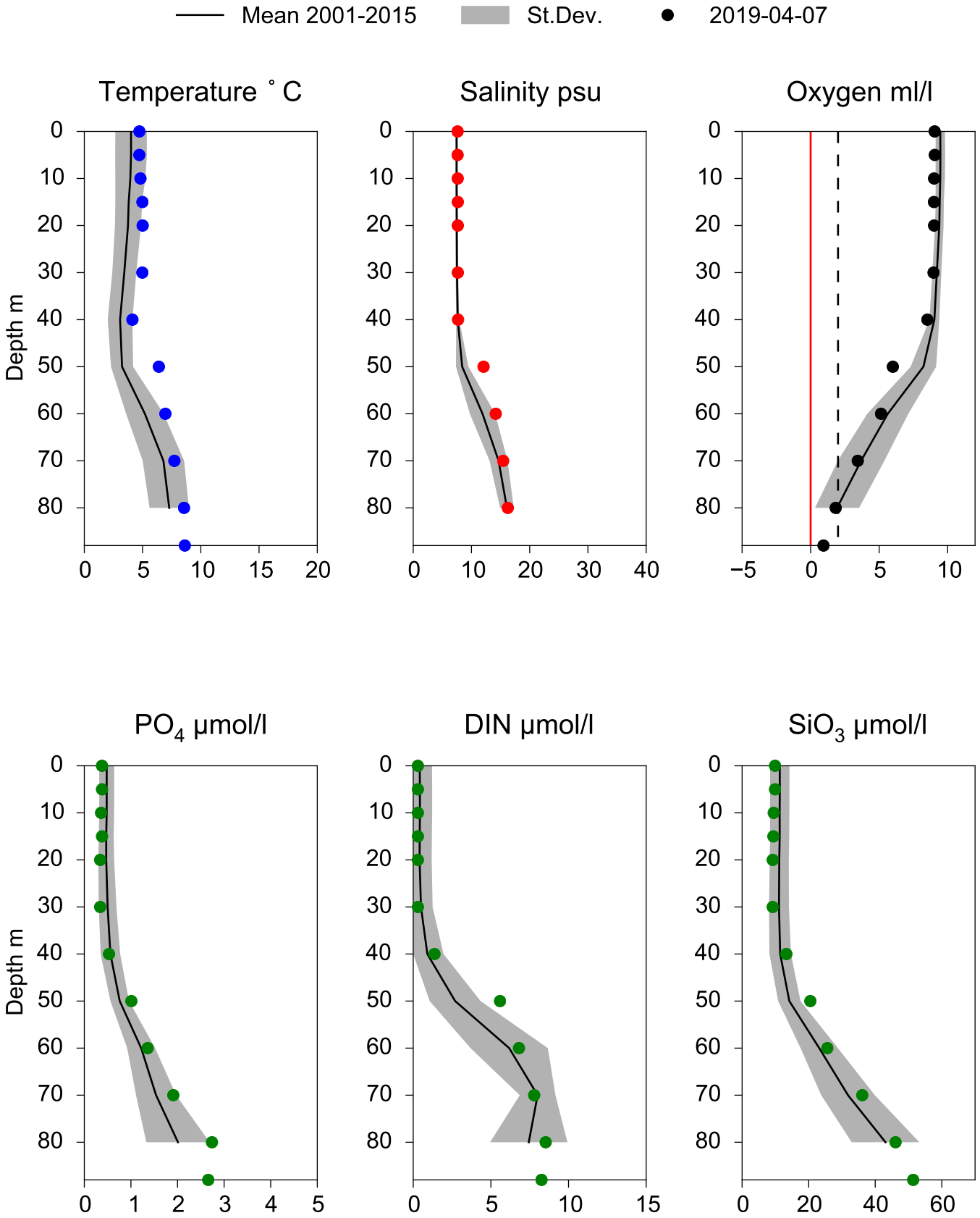


STATION BY5 BORNHOLMSDJ SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 80 m)

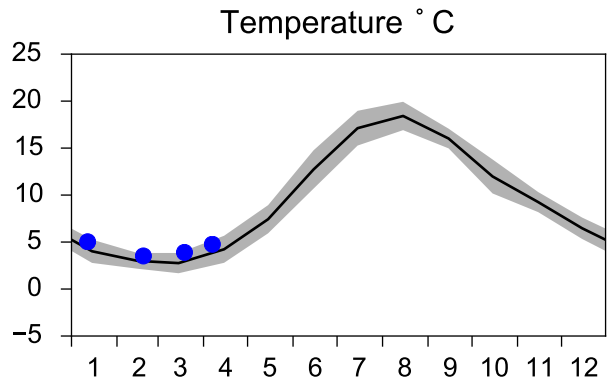
Vertical profiles BY5 BORNHOLMSDJ
April

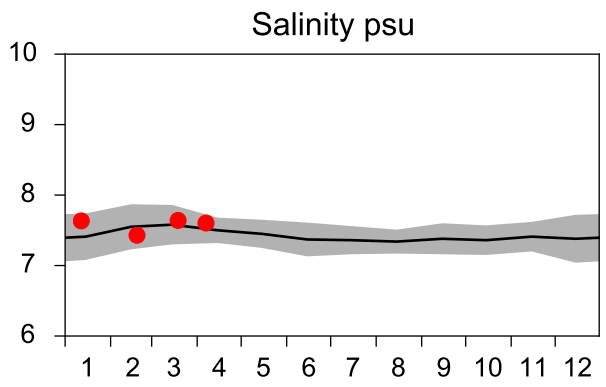


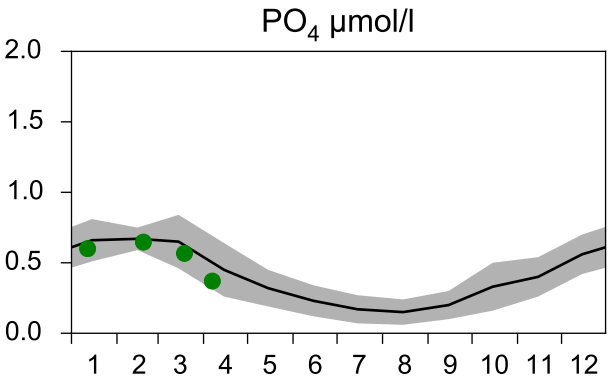
STATION BY4 CHRISTIANSÖ SURFACE WATER (0-10 m)

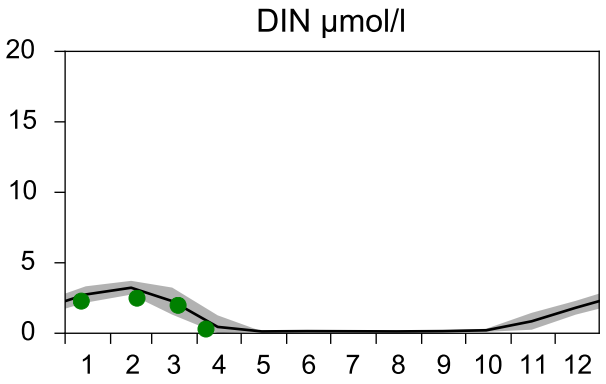
Annual Cycles

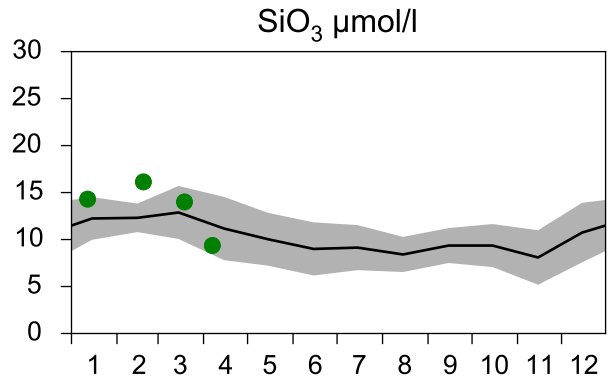
Mean 2001-2015 St.Dev. 2019

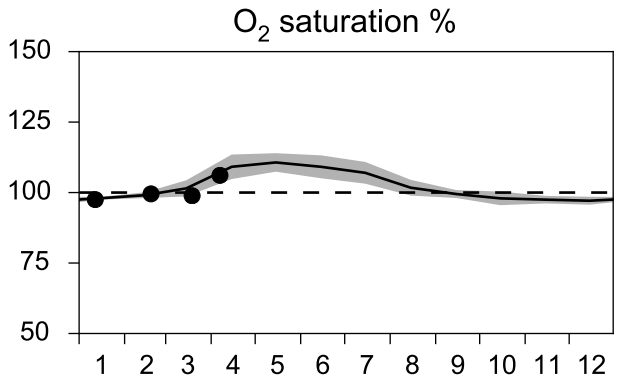




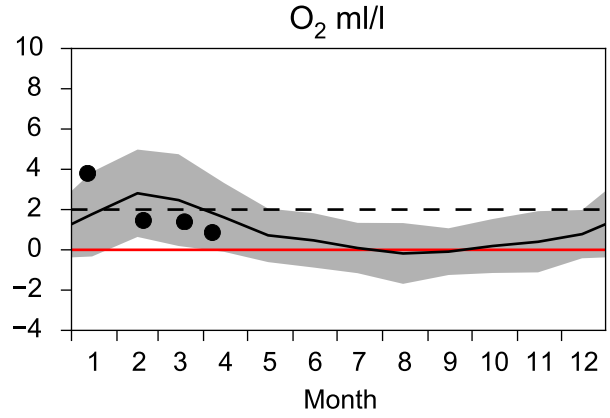


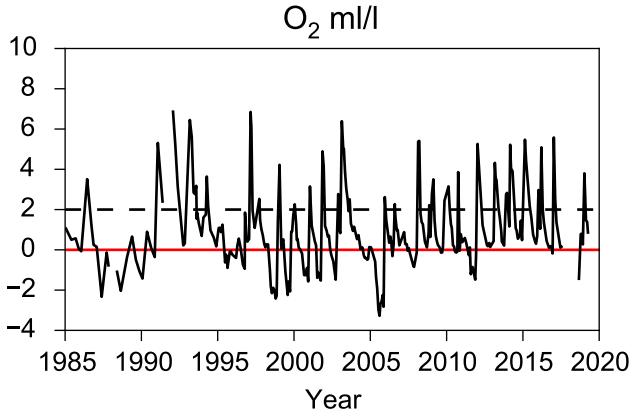




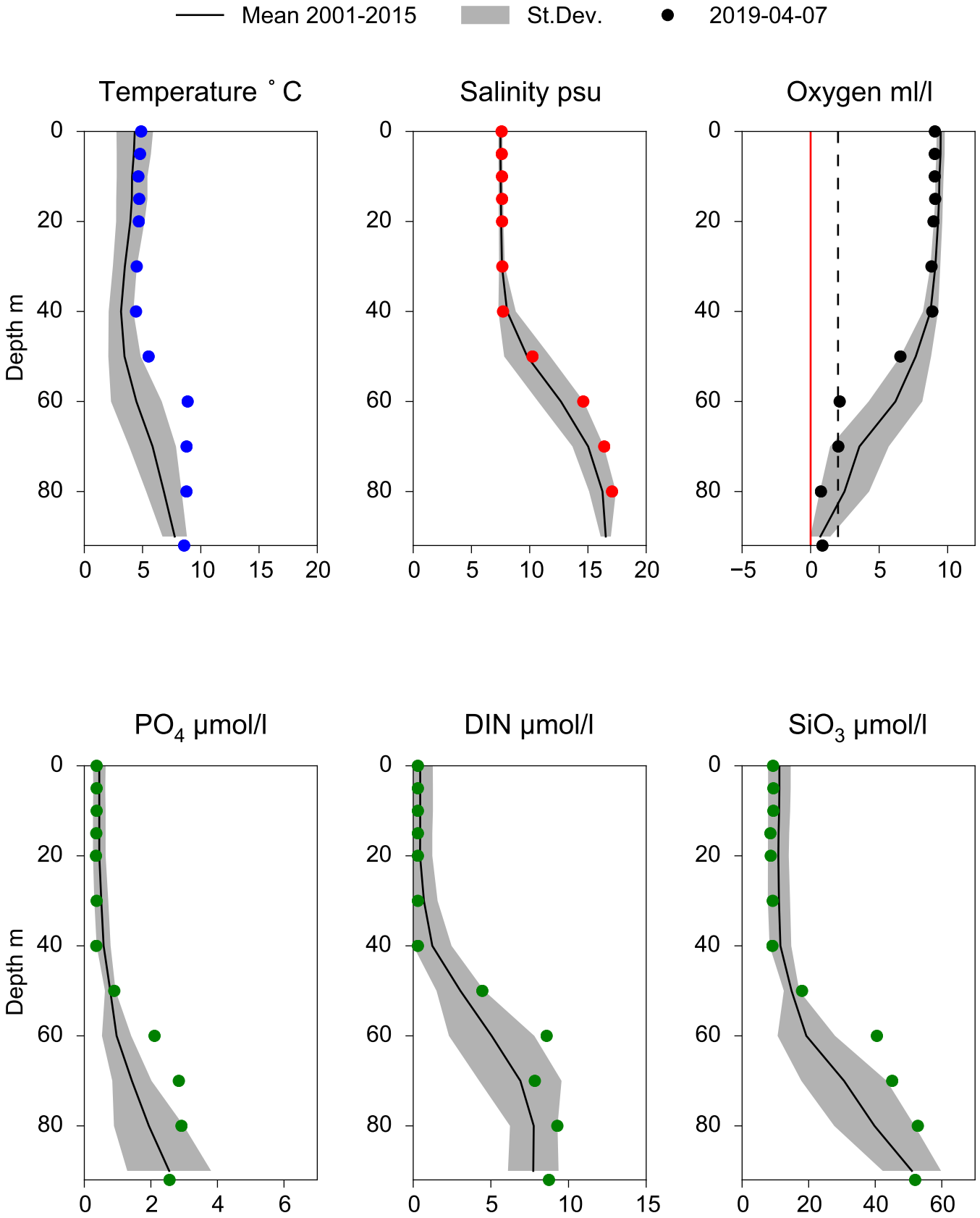


OXYGEN IN BOTTOM WATER (depth >= 80 m)

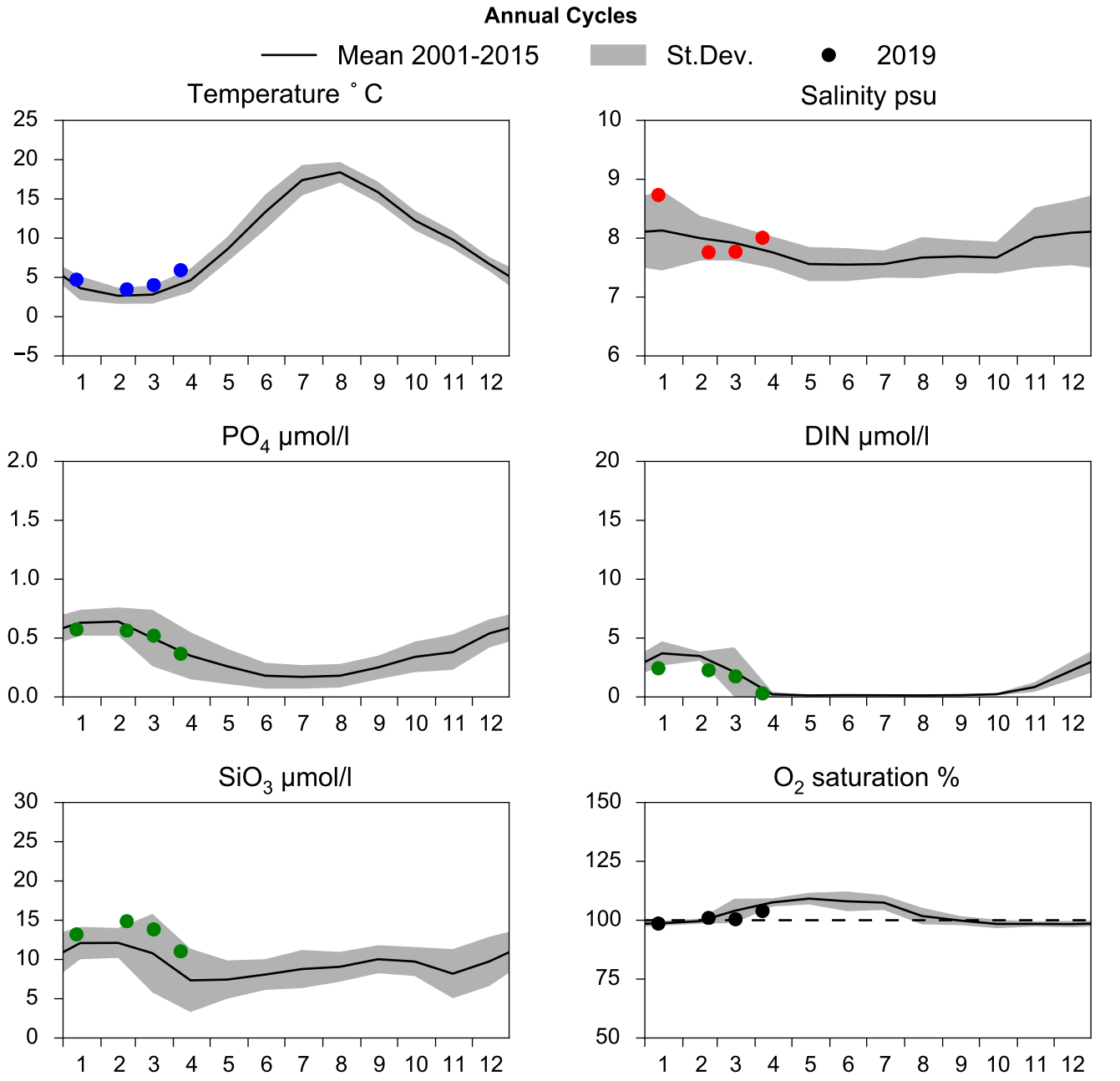




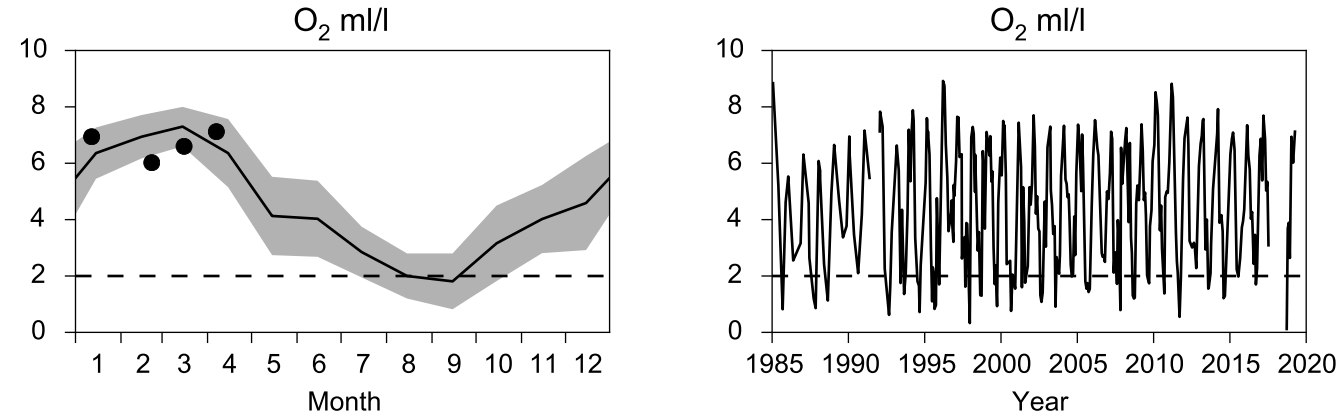
Vertical profiles BY4 CHRISTIANSÖ
April



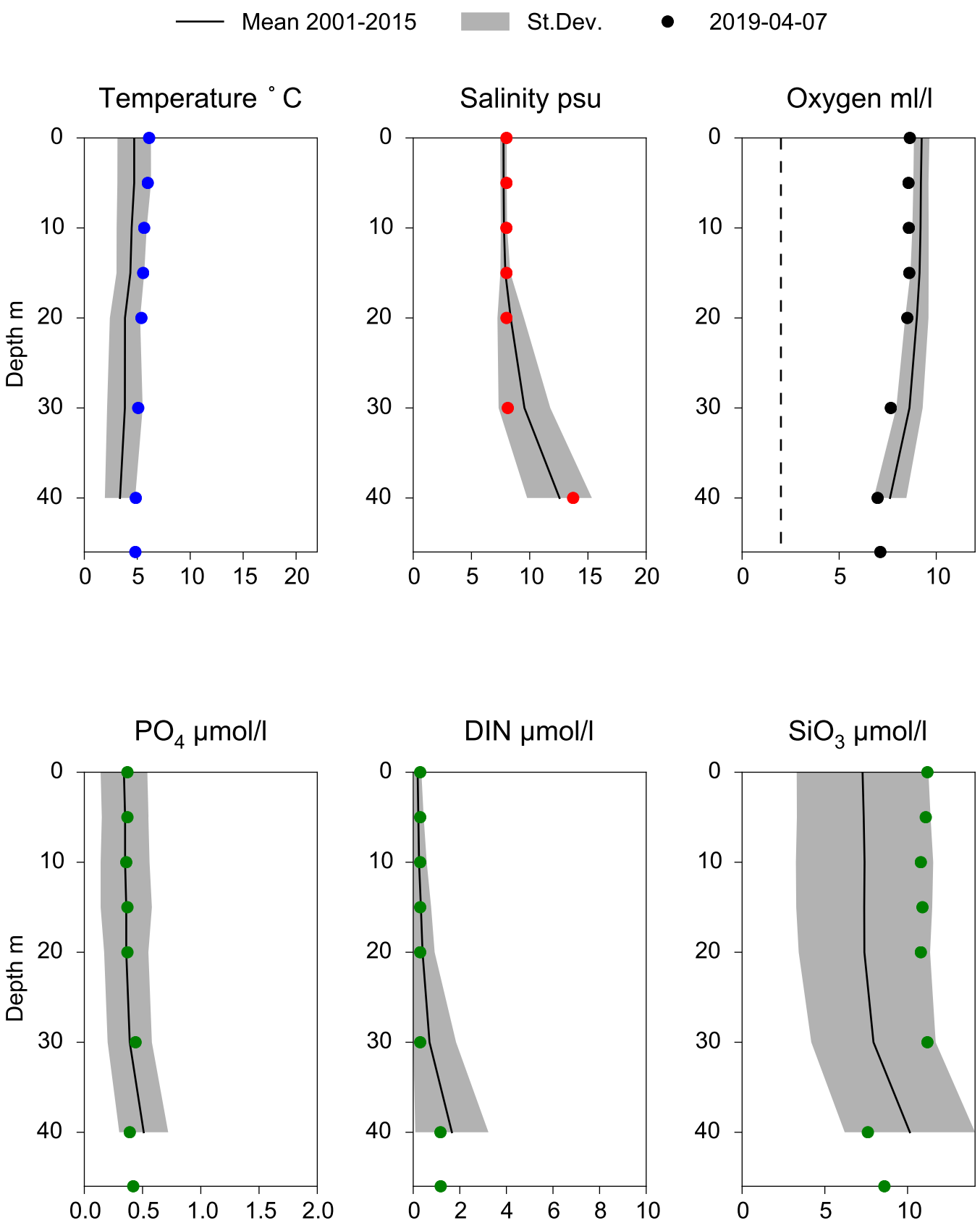
STATION BY2 ARKONA SURFACE WATER (0-10 m)



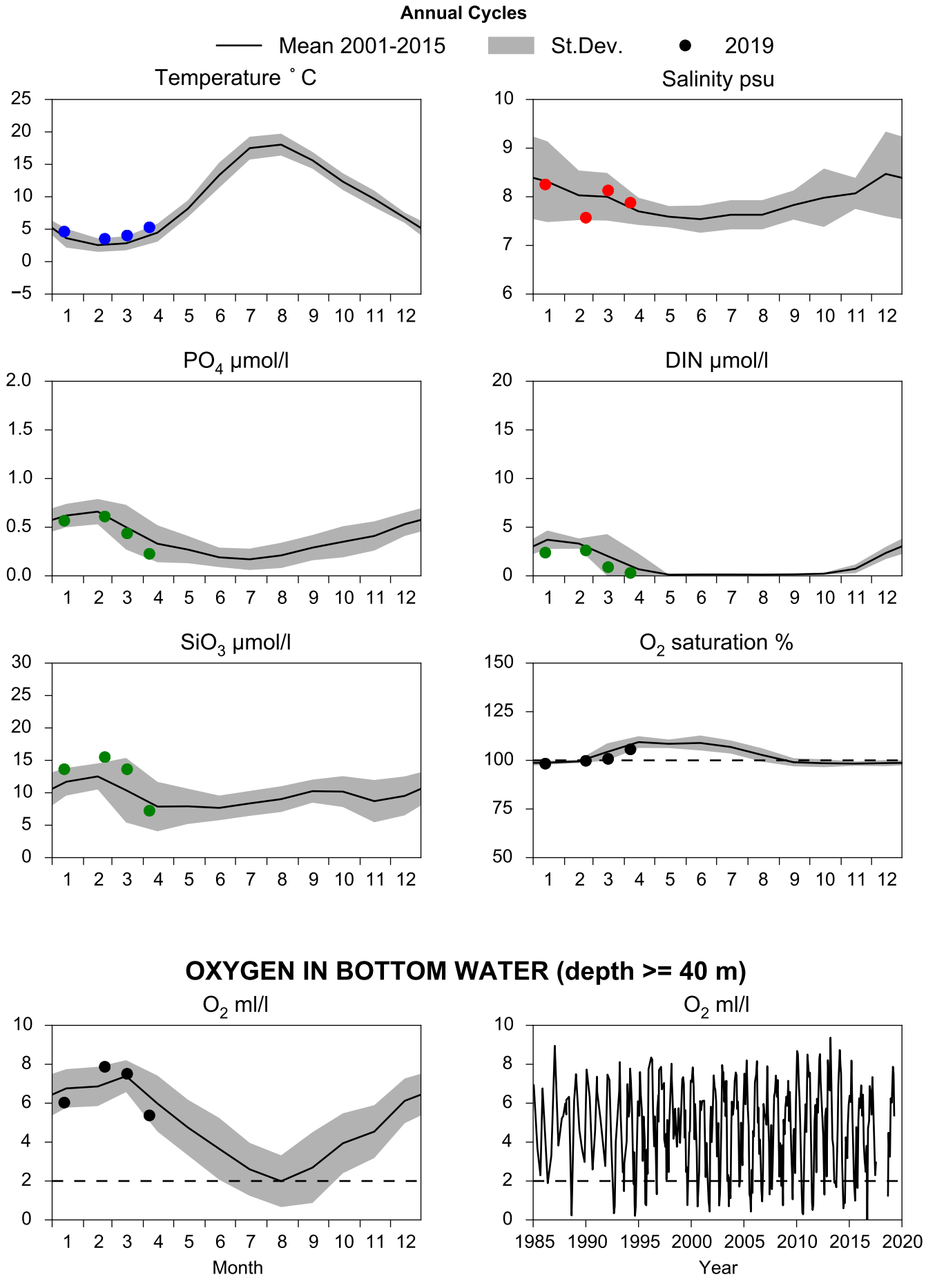
OXYGEN IN BOTTOM WATER (depth >= 40 m)



Vertical profiles BY2 ARKONA
April

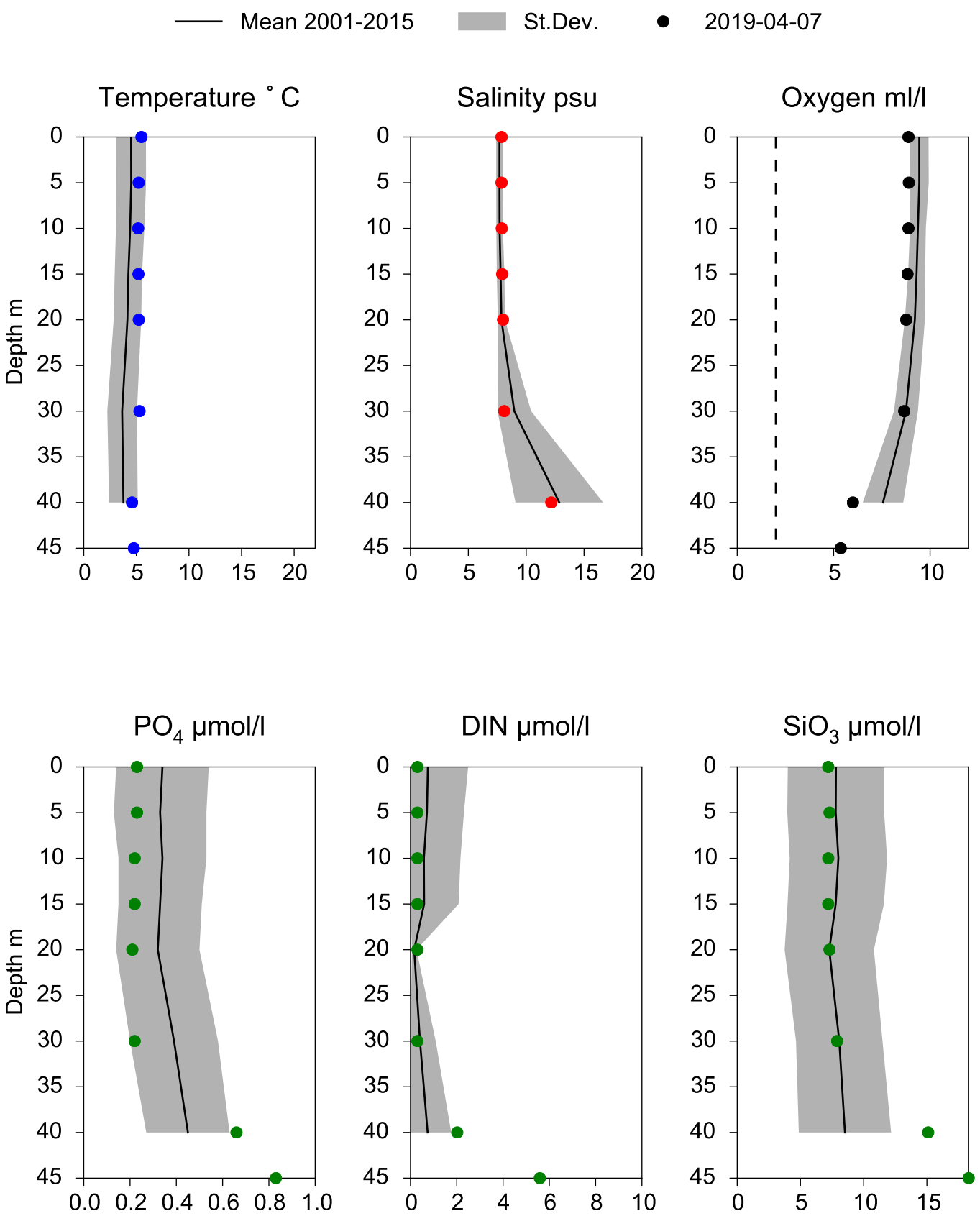


STATION BY1 SURFACE WATER (0-10 m)

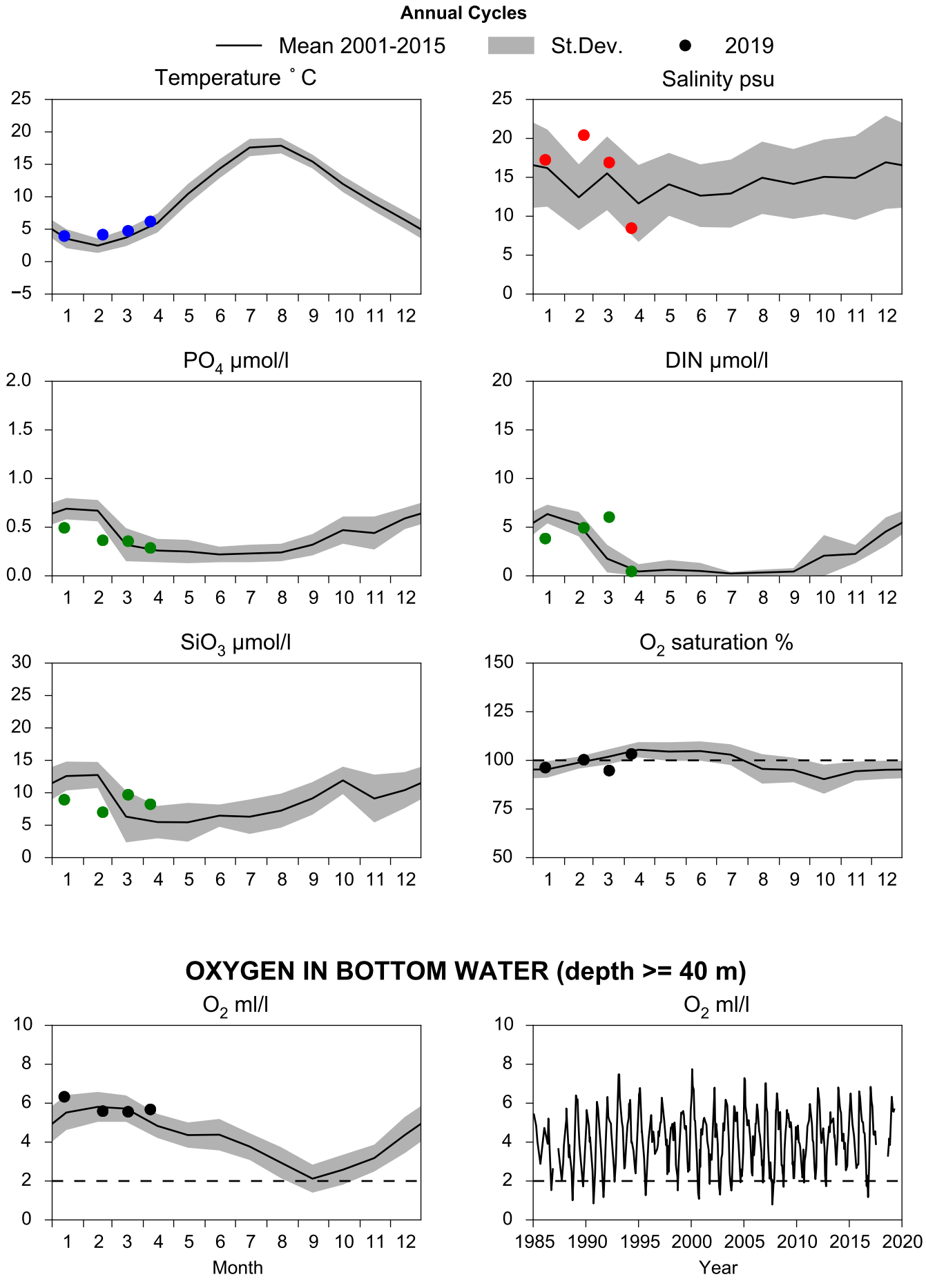


OXYGEN IN BOTTOM WATER (depth >= 40 m)

Vertical profiles BY1
April

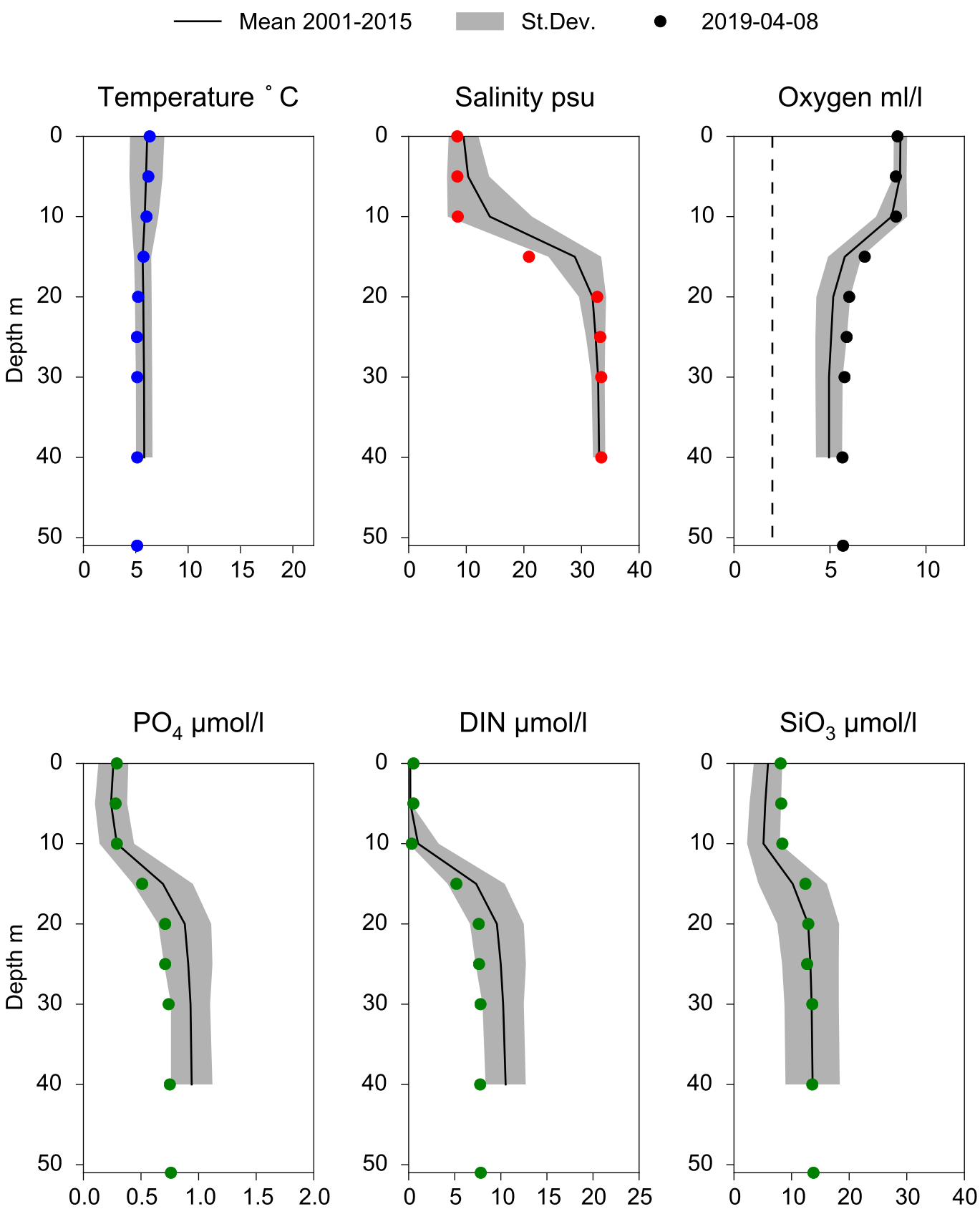


STATION W LANDSKRONA SURFACE WATER (0-10 m)

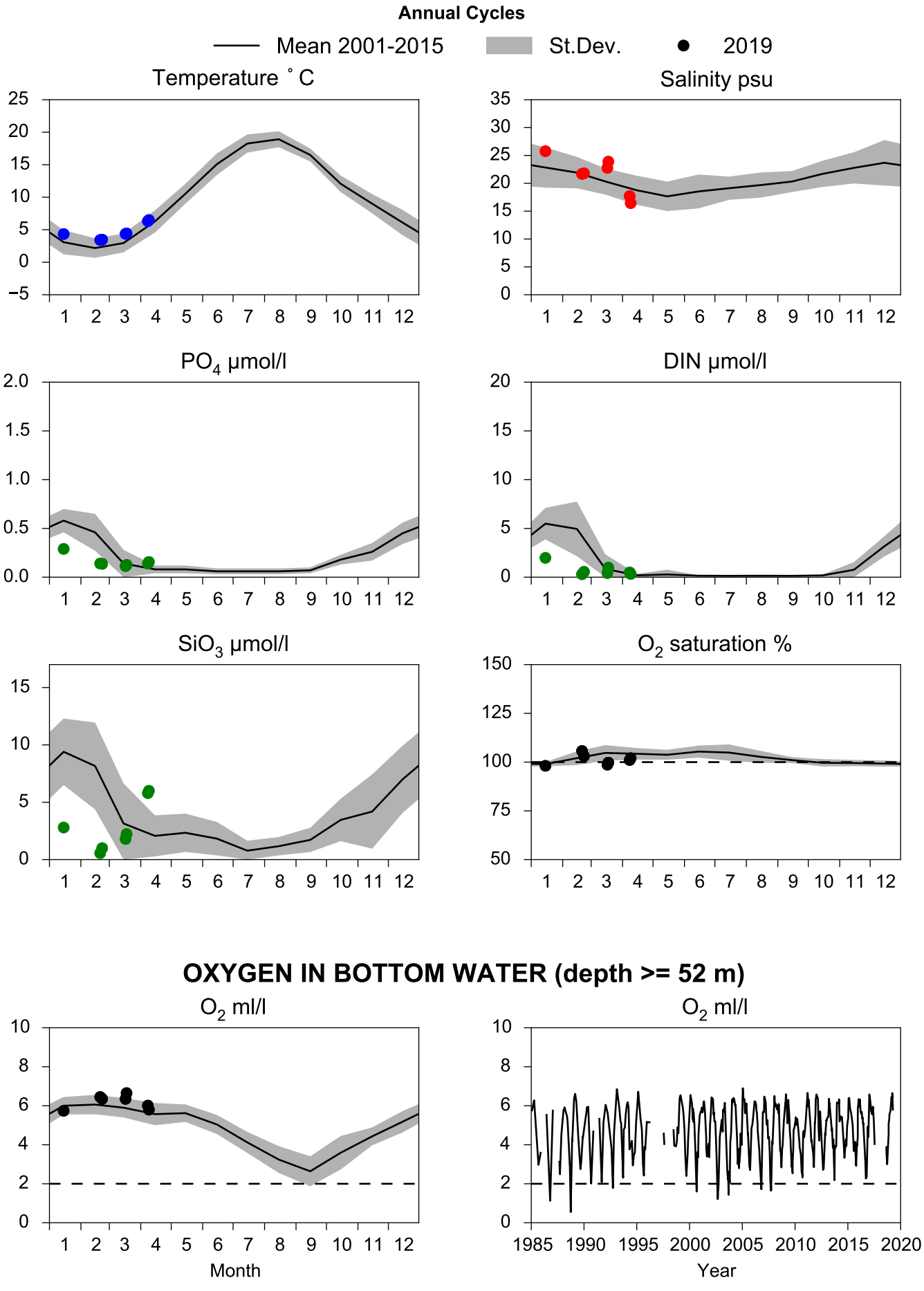


OXYGEN IN BOTTOM WATER (depth >= 40 m)

Vertical profiles W LANDSKRONA
April

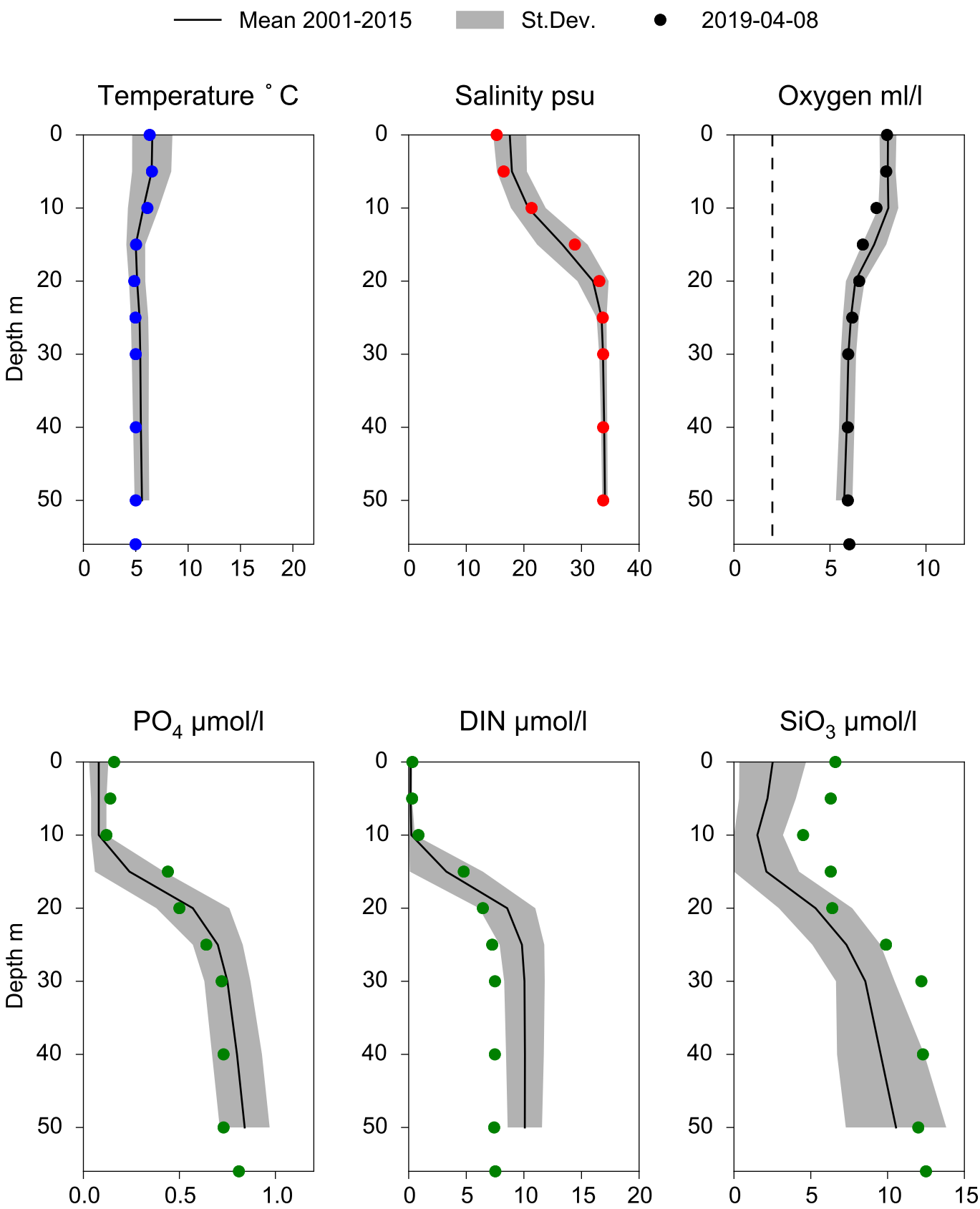


STATION ANHOLT E SURFACE WATER (0-10 m)



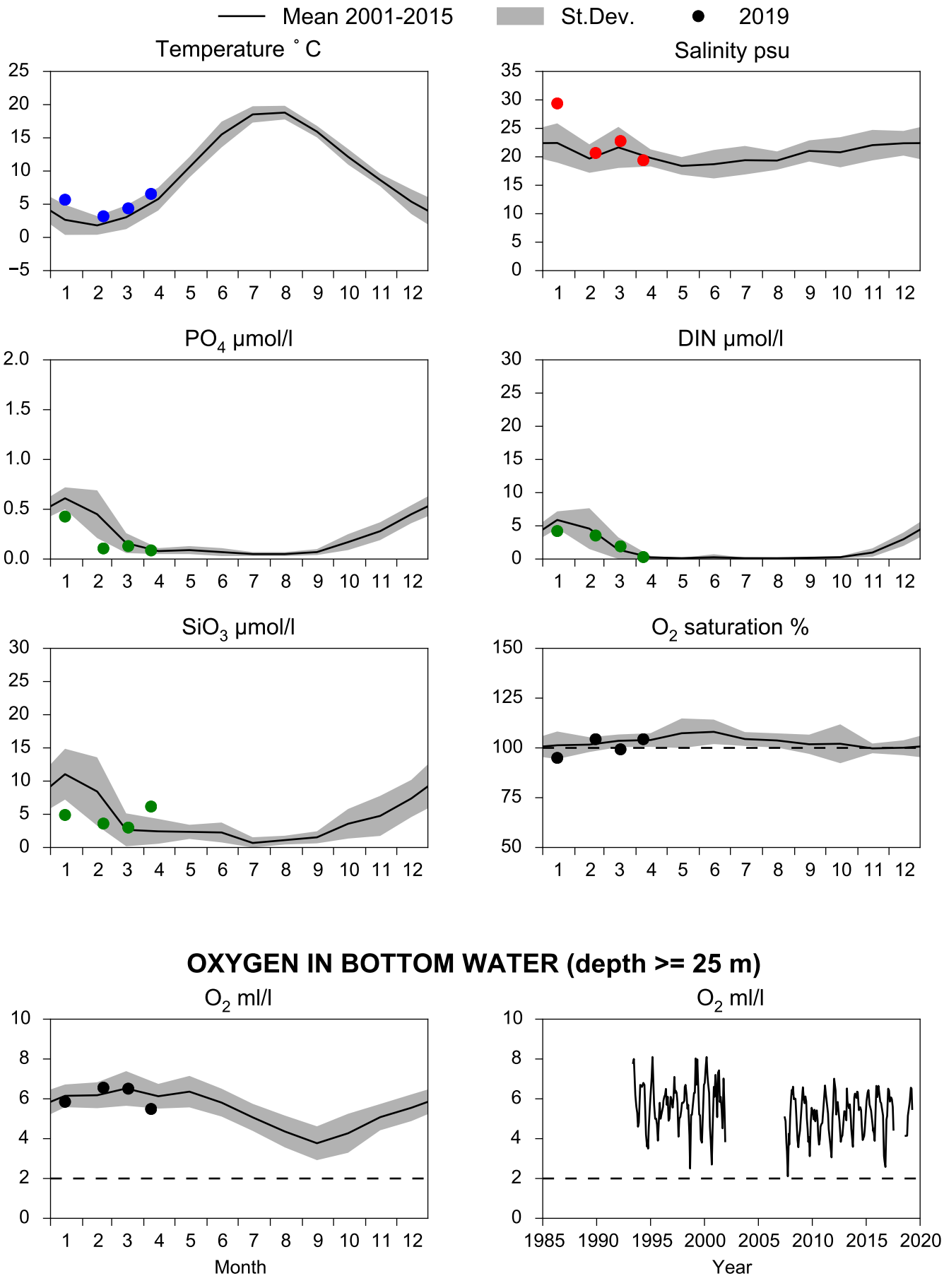
OXYGEN IN BOTTOM WATER (depth >= 52 m)

Vertical profiles ANHOLT E
April



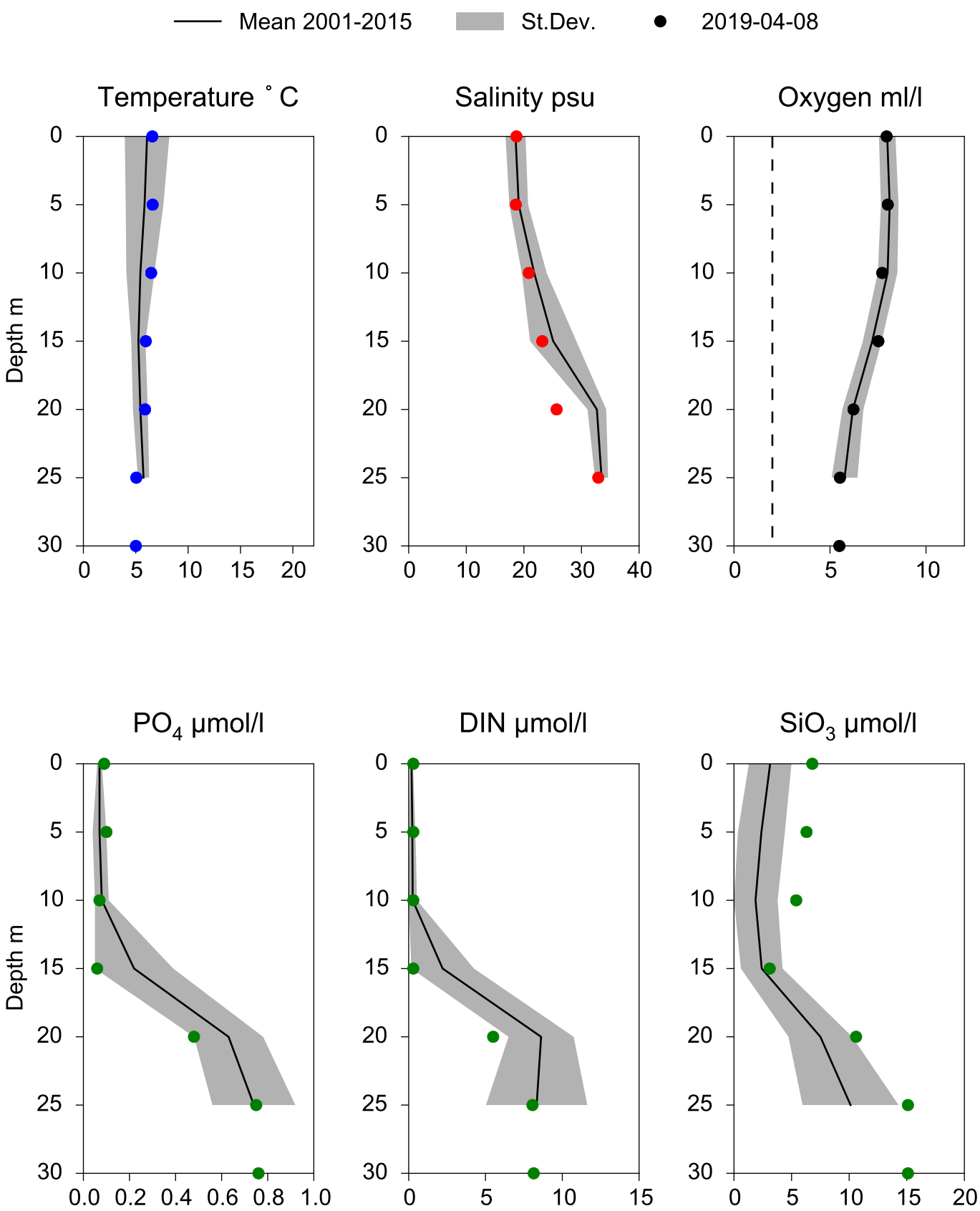
STATION N14 FALKENBERG SURFACE WATER (0-10 m)

Annual Cycles

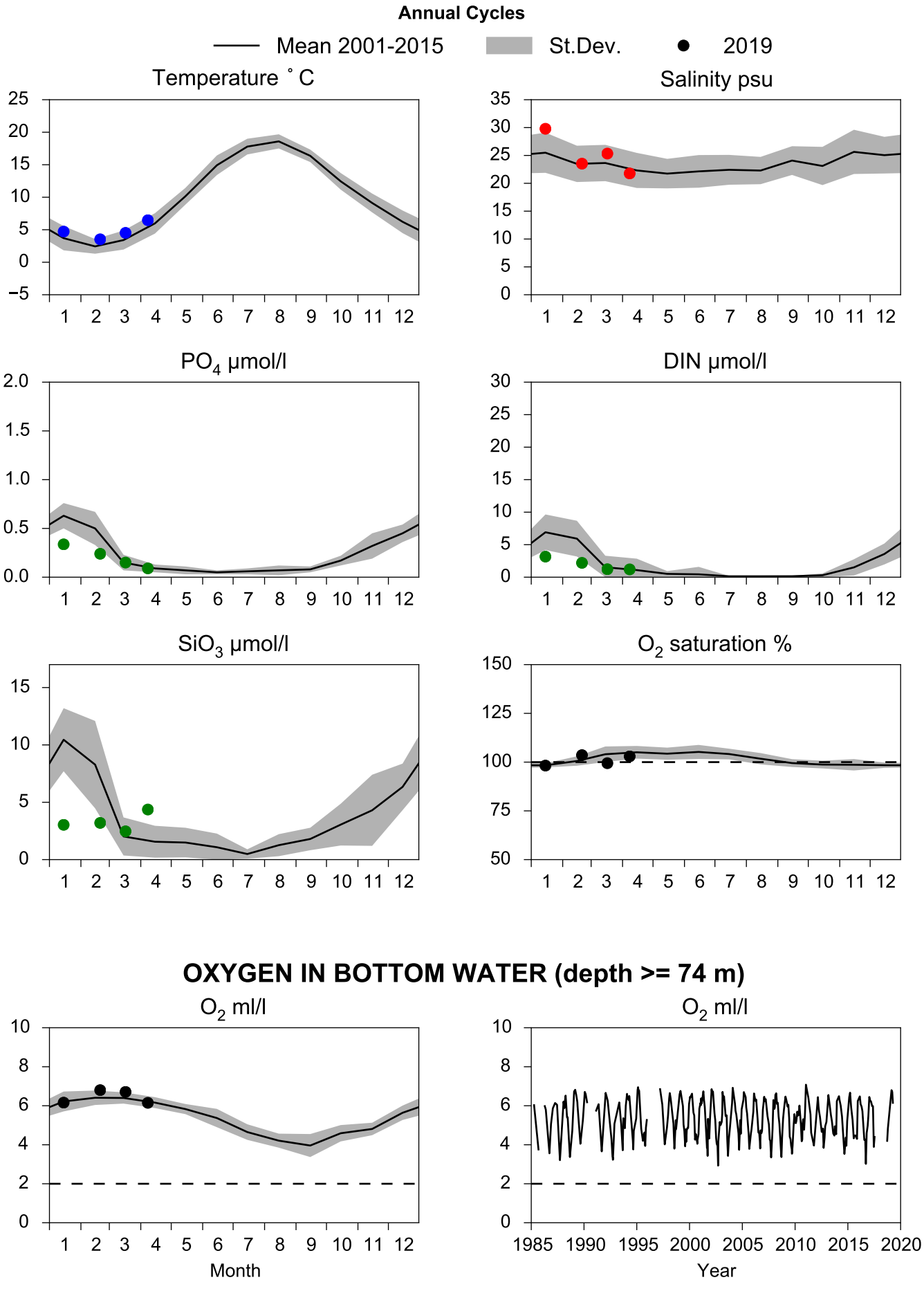


OXYGEN IN BOTTOM WATER (depth >= 25 m)

Vertical profiles N14 FALKENBERG
April

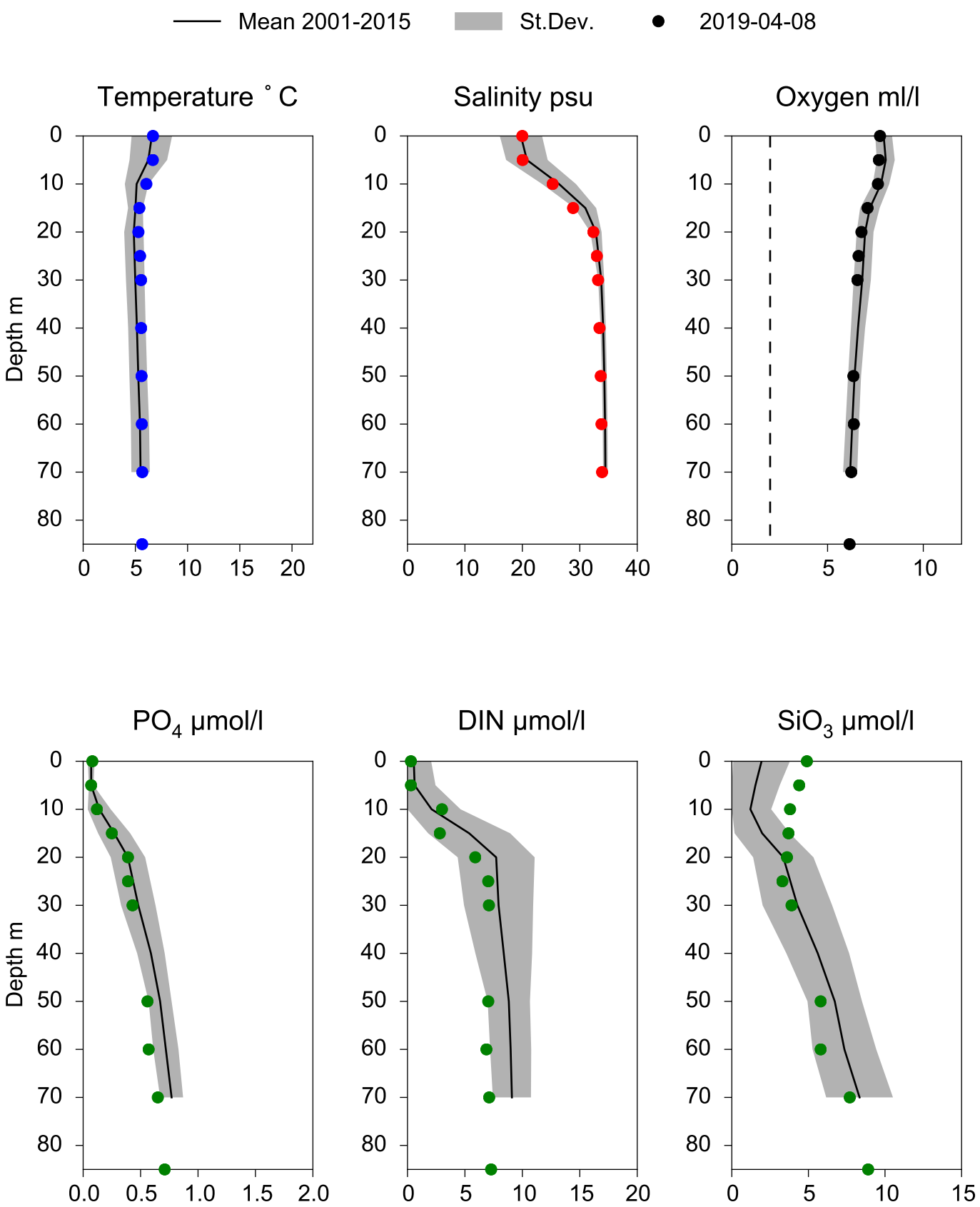


STATION FLADEN SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 74 m)

Vertical profiles FLADEN
April

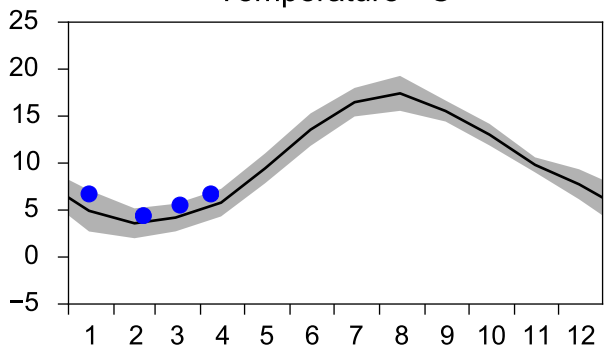


STATION Å17 SURFACE WATER (0-10 m)

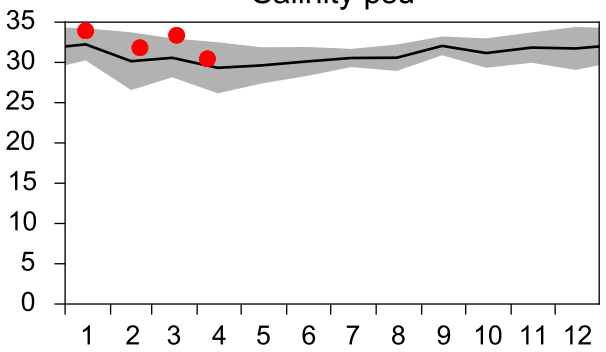
Annual Cycles

Mean 2001-2015 St.Dev. 2019

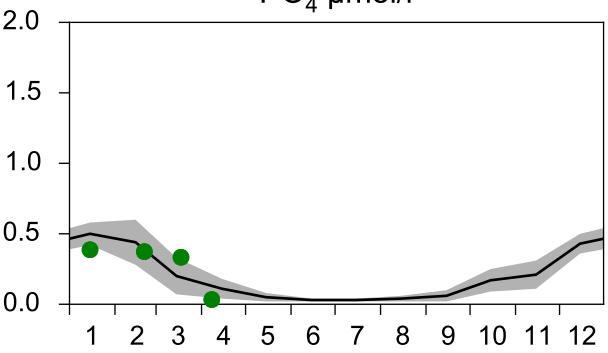
Temperature ˚C



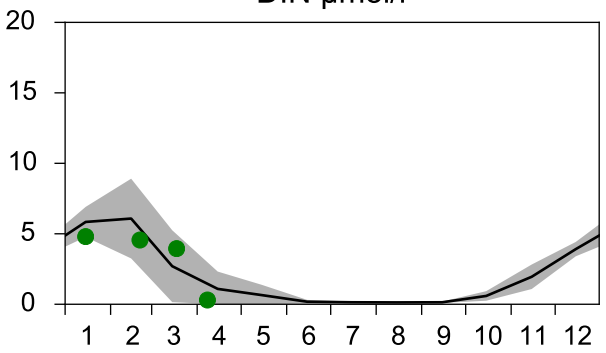
Salinity psu



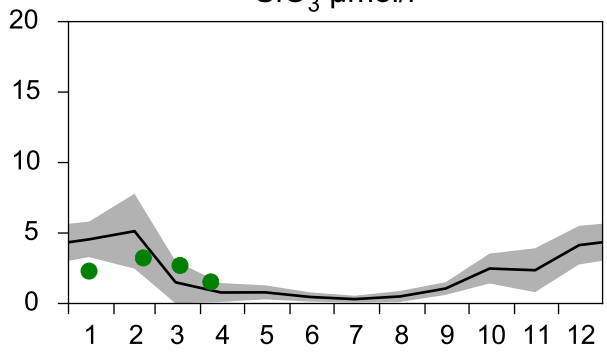
PO_4 µmol/l



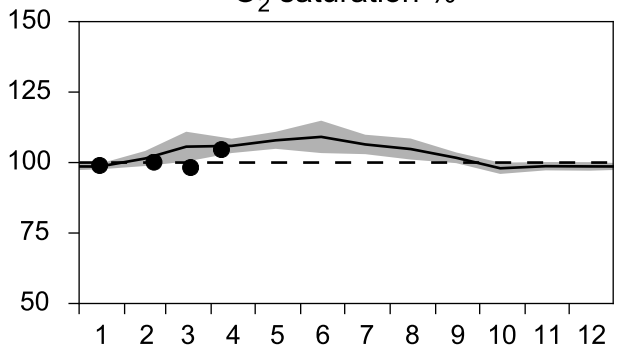
DIN µmol/l



SiO_3 µmol/l

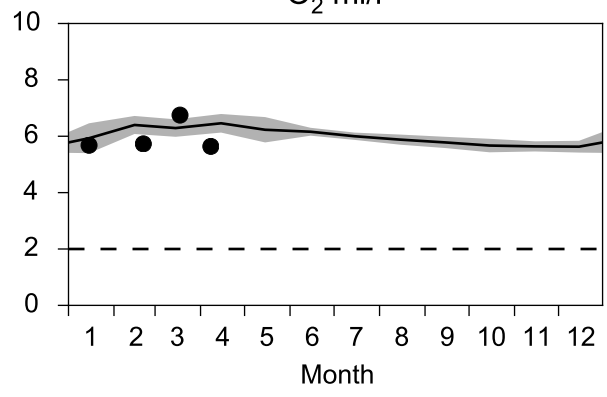


O_2 saturation %

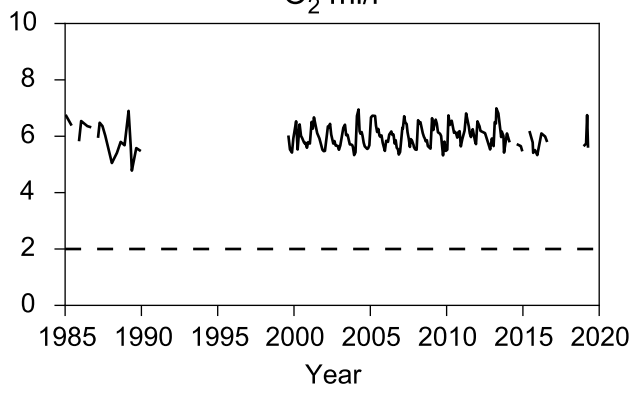


OXYGEN IN BOTTOM WATER (depth >= 300 m)

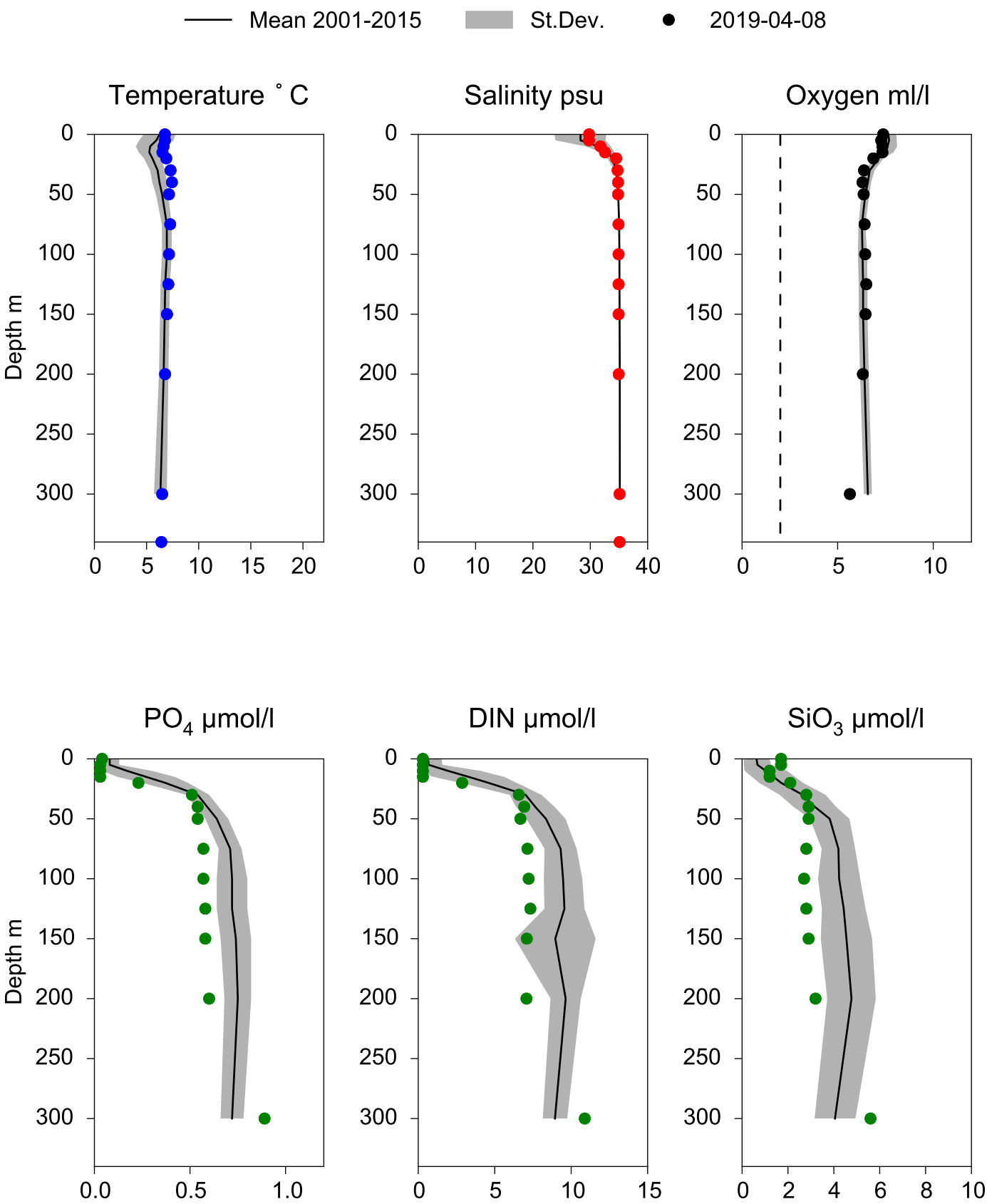
O_2 ml/l



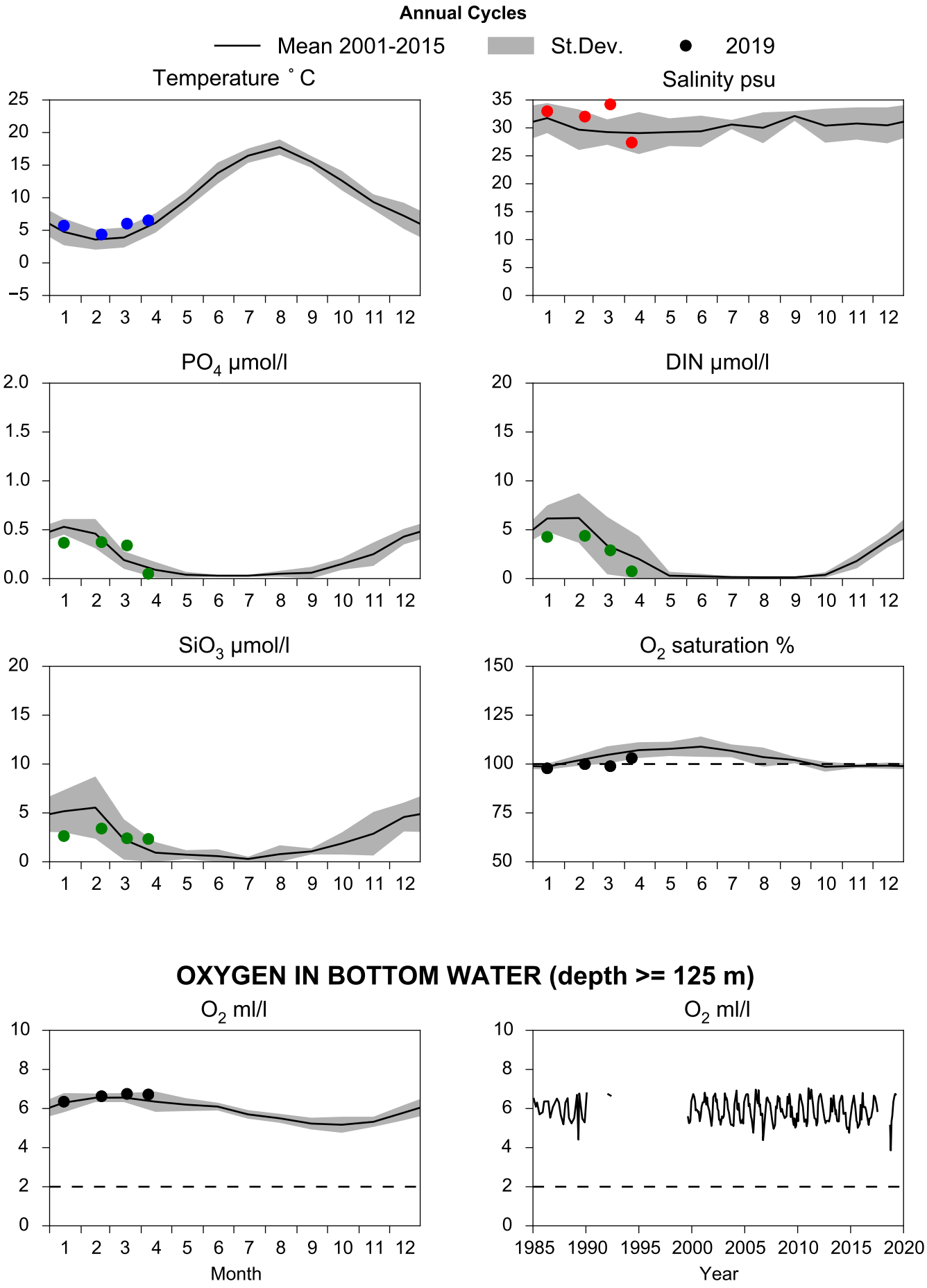
O_2 ml/l



Vertical profiles Å17
April

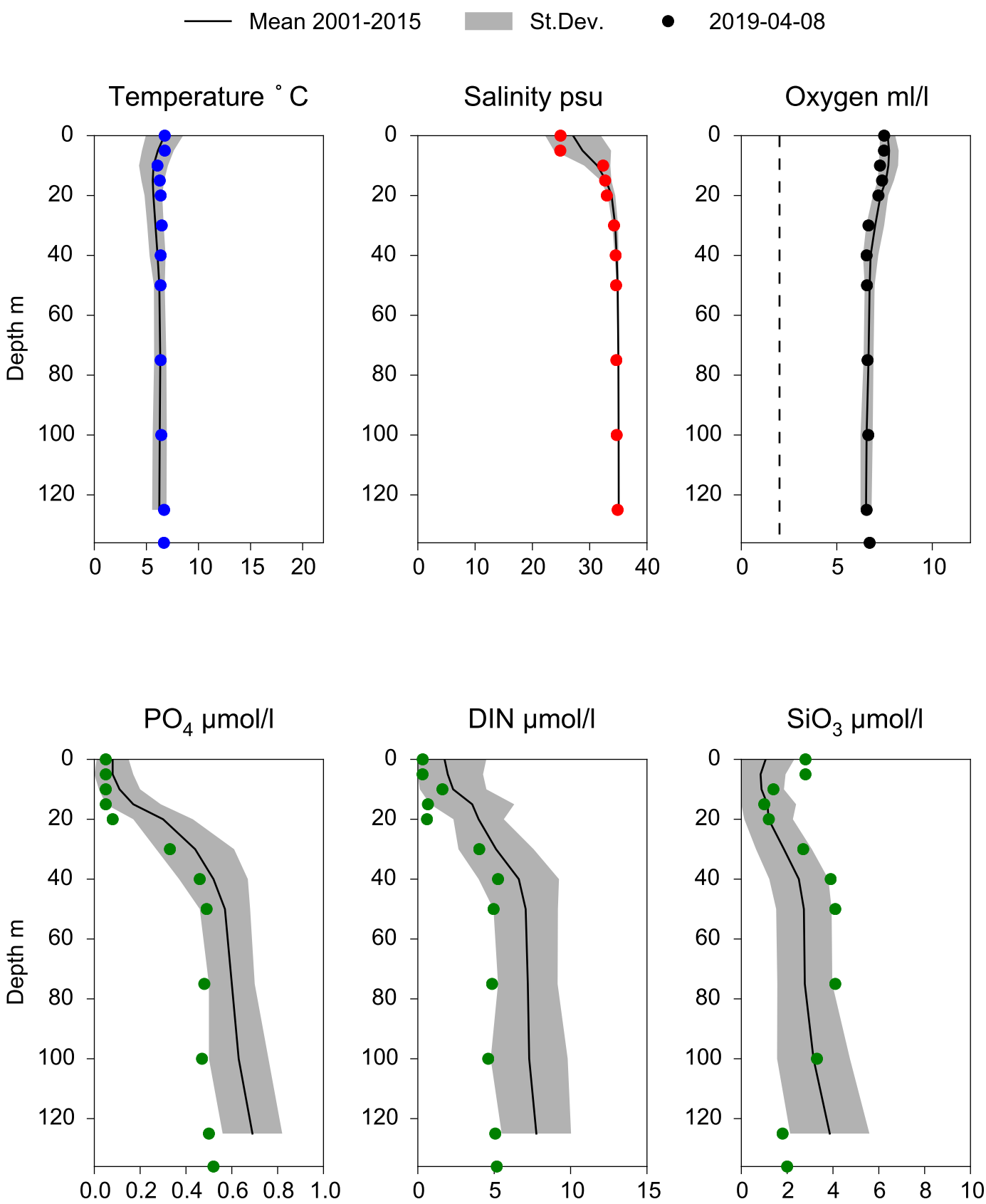


STATION Å15 SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 125 m)

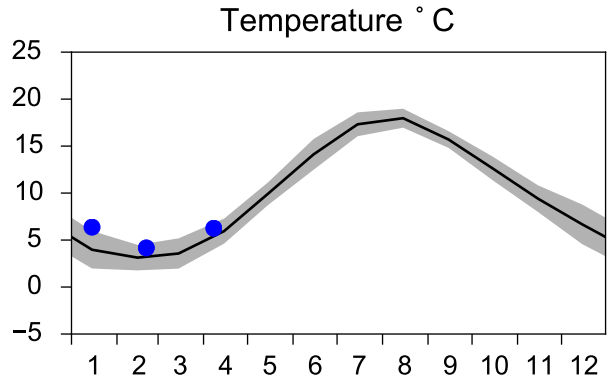
Vertical profiles Å15
April

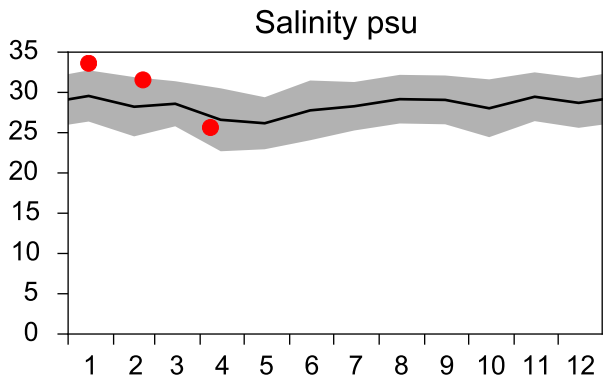


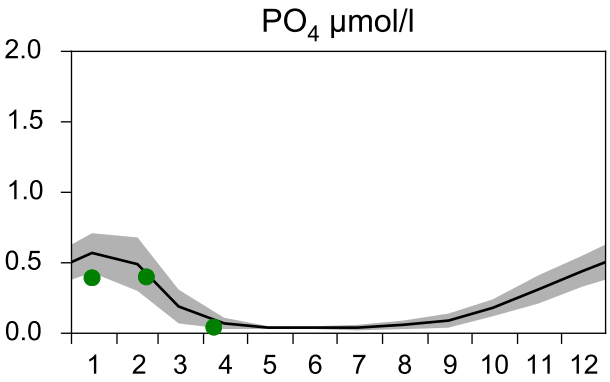
STATION Å13 SURFACE WATER (0-10 m)

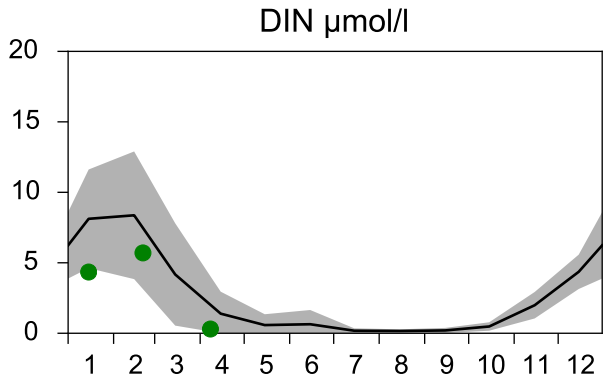
Annual Cycles

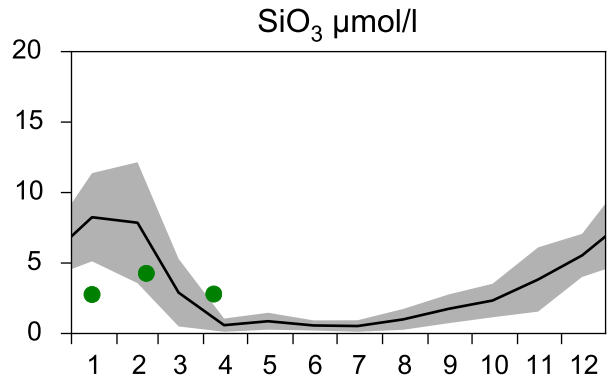
Mean 2001-2015 St.Dev. 2019

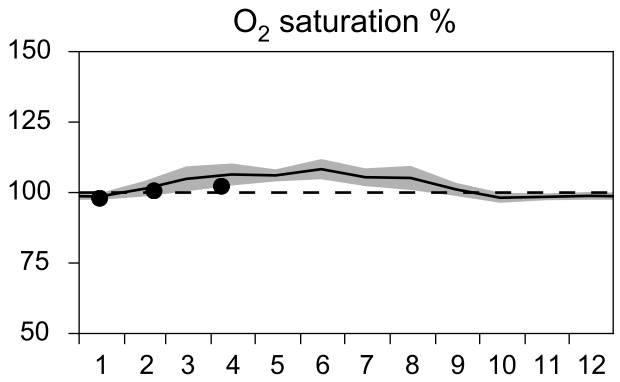




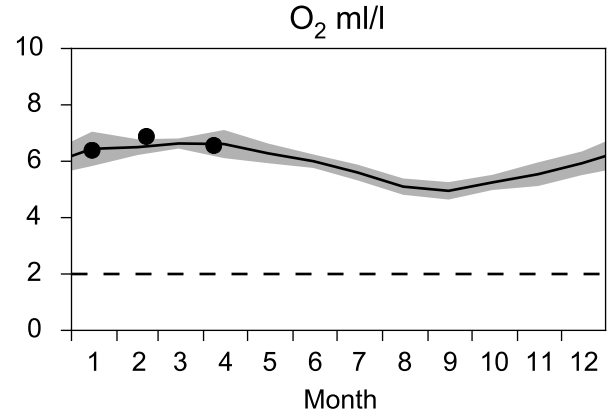


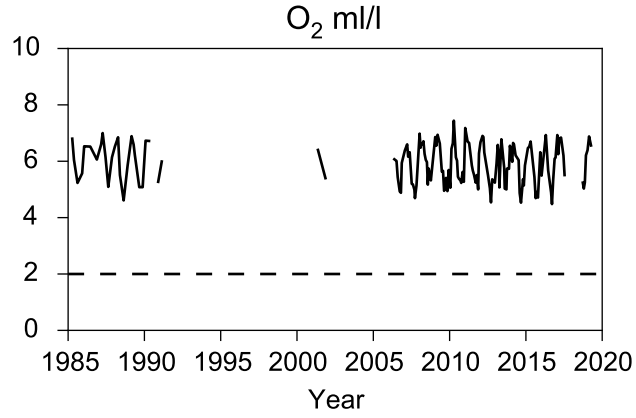




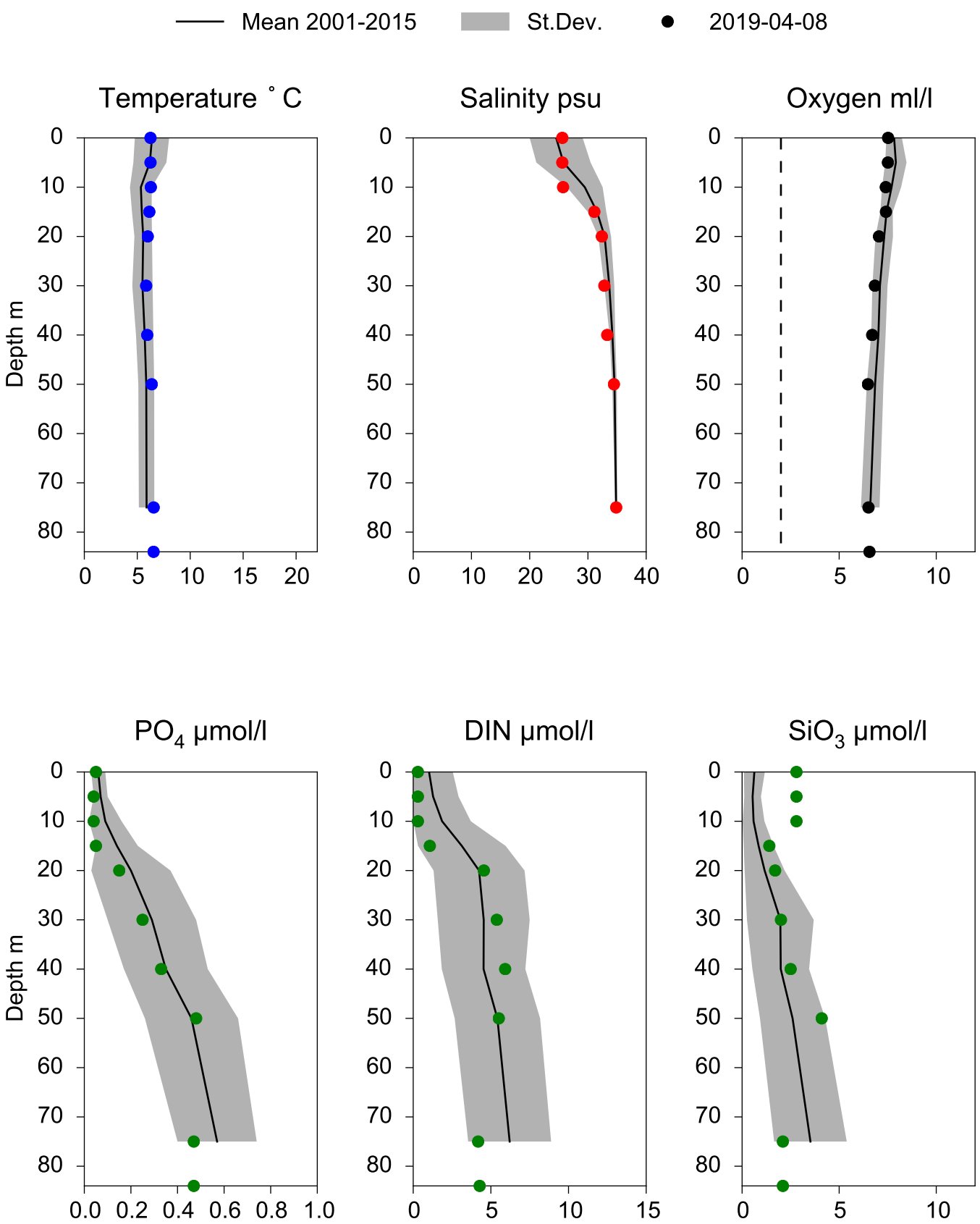


OXYGEN IN BOTTOM WATER (depth >= 80 m)





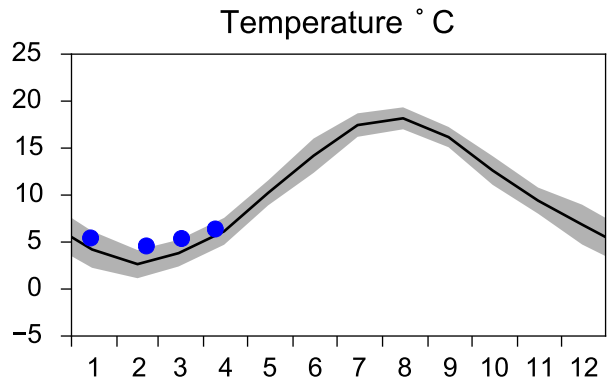
Vertical profiles Å13
April

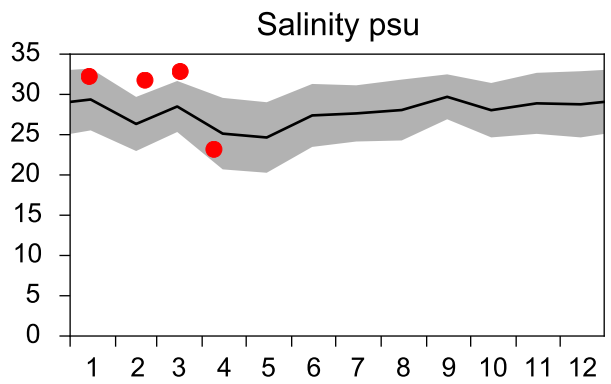


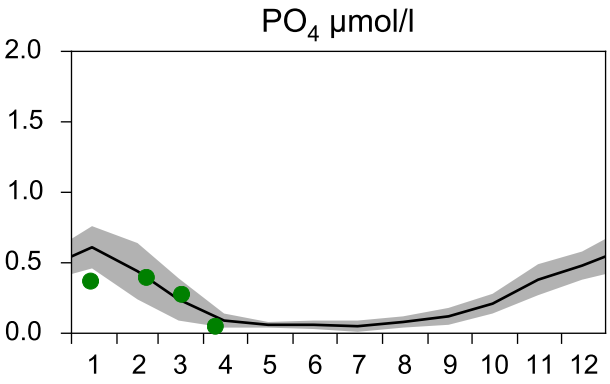
STATION P2 SURFACE WATER (0-10 m)

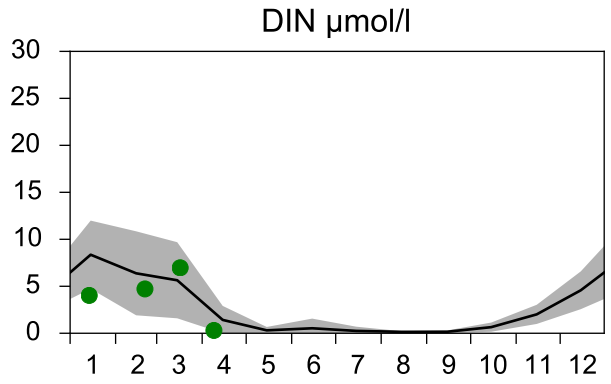
Annual Cycles

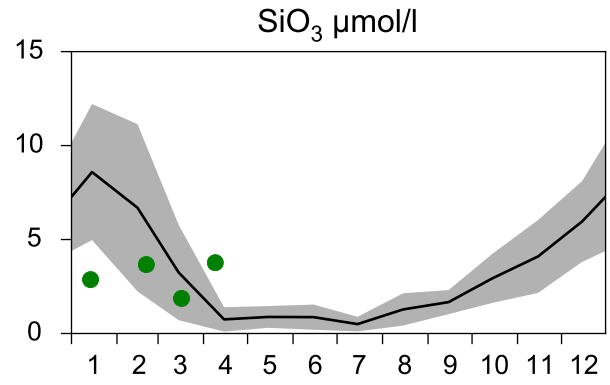
Mean 2001-2015 St.Dev. 2019

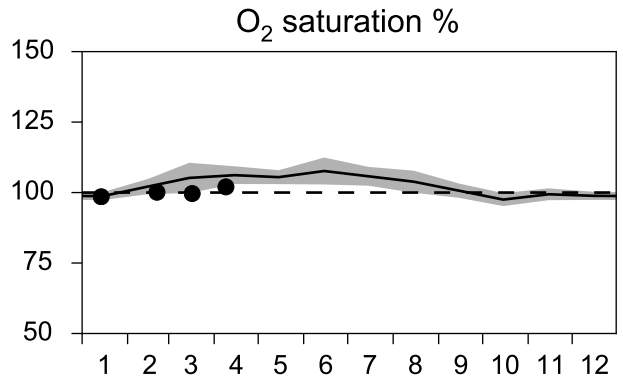




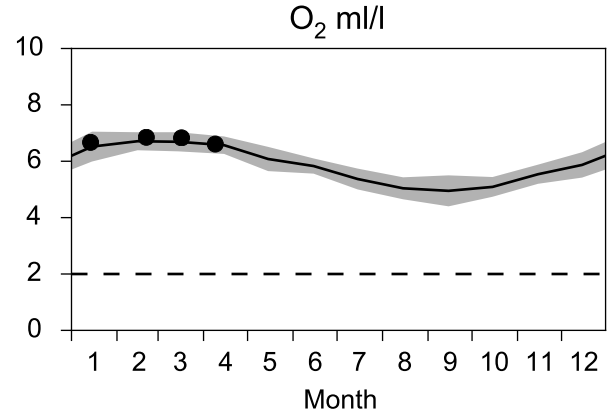


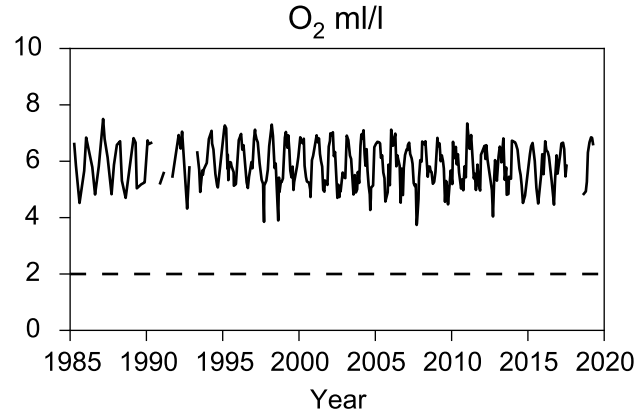




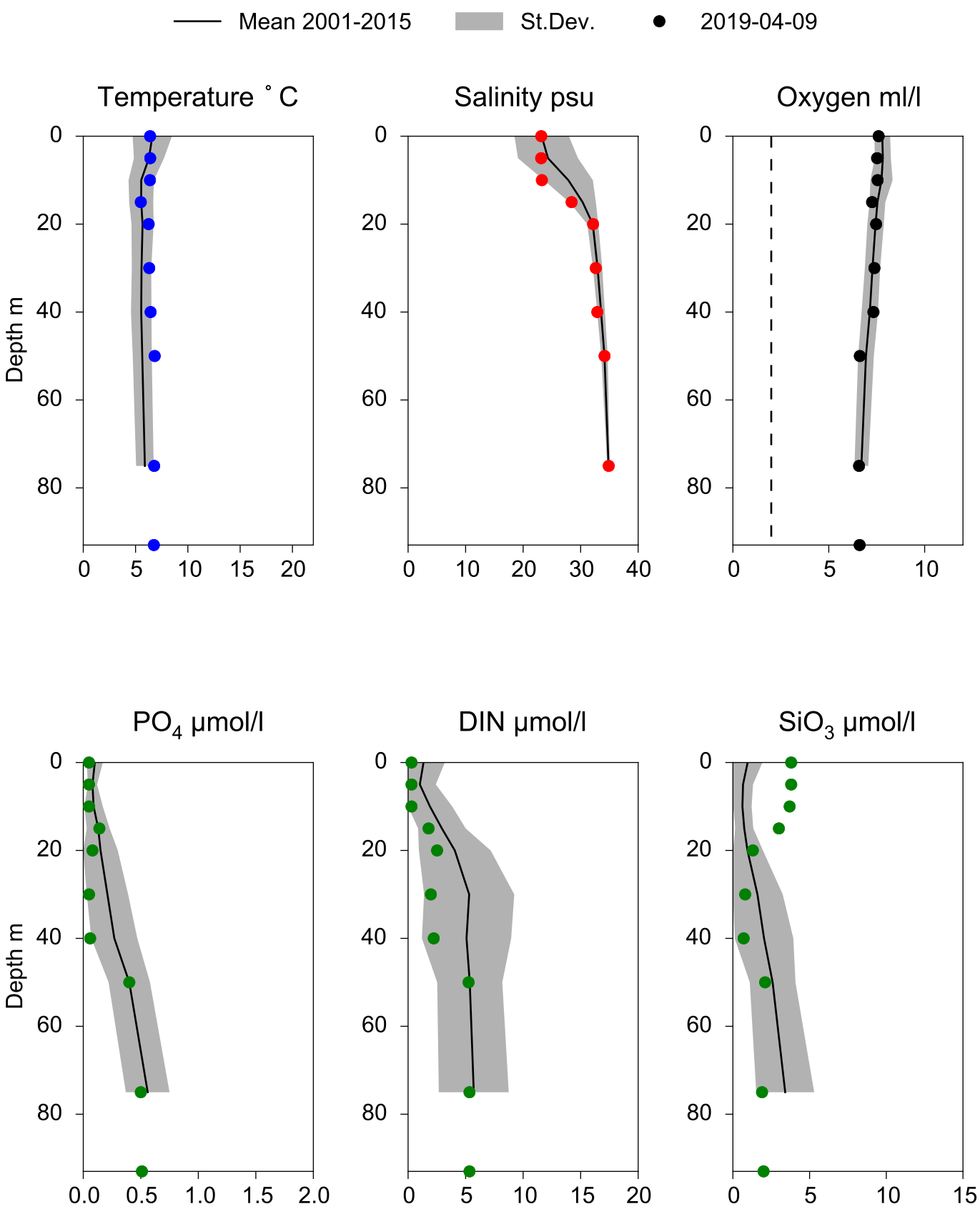


OXYGEN IN BOTTOM WATER (depth >= 75 m)

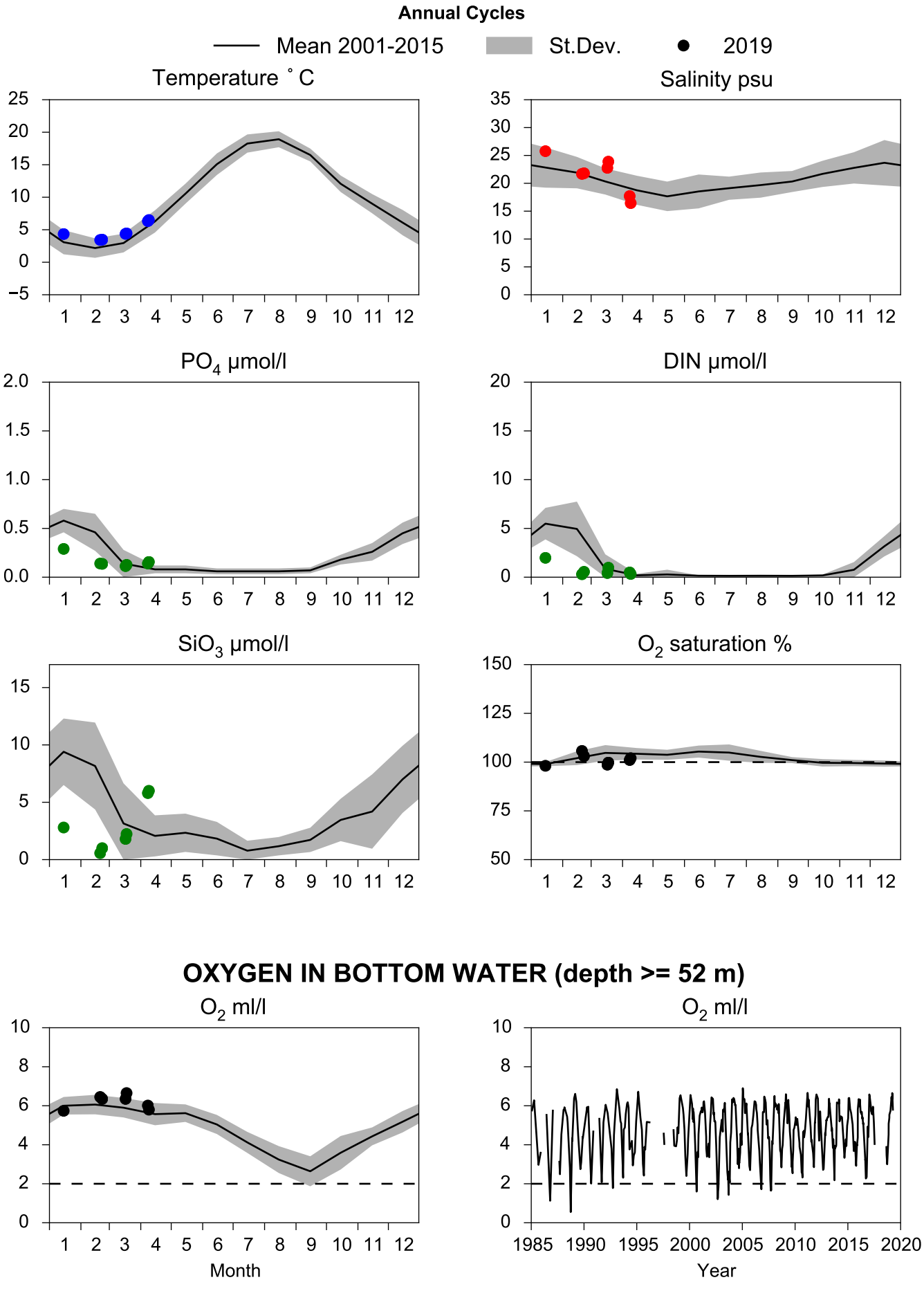




Vertical profiles P2
April

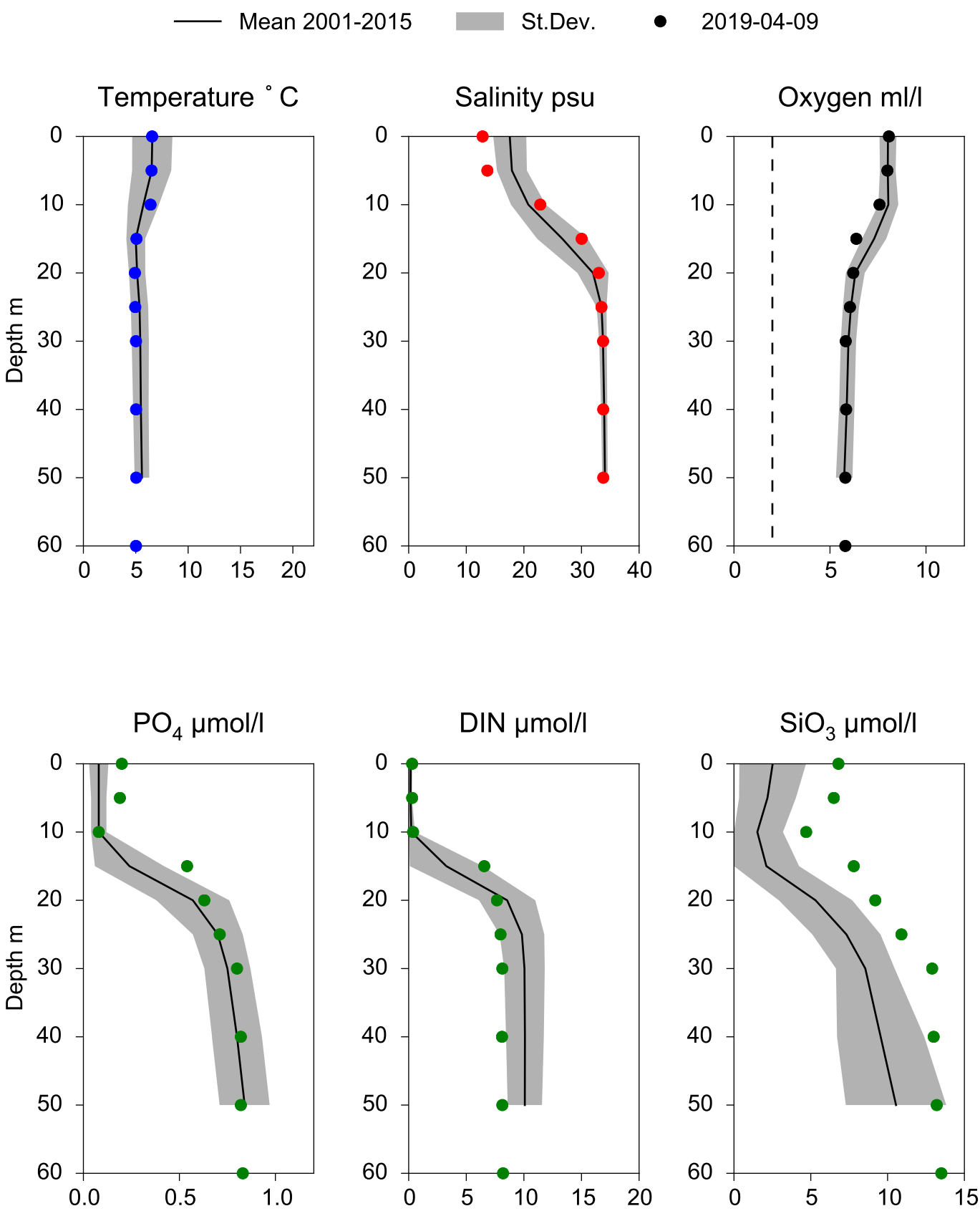


STATION ANHOLT E SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 52 m)

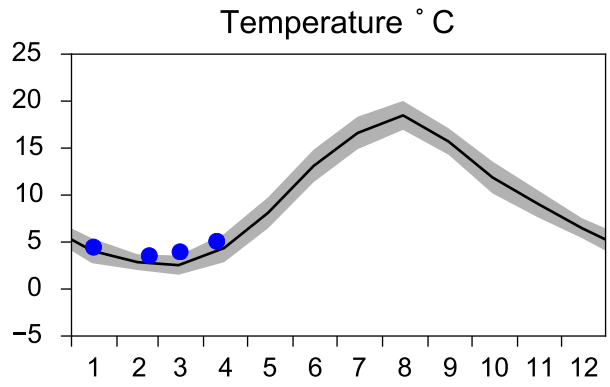
Vertical profiles ANHOLT E
April

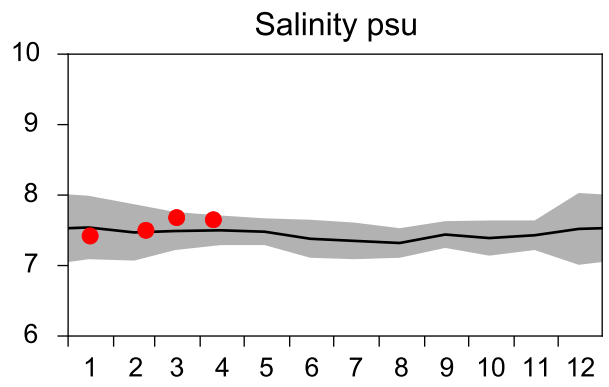


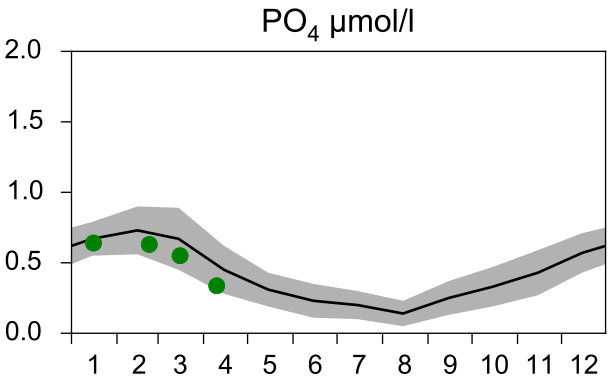
STATION HANÖBUKTEN SURFACE WATER (0-10 m)

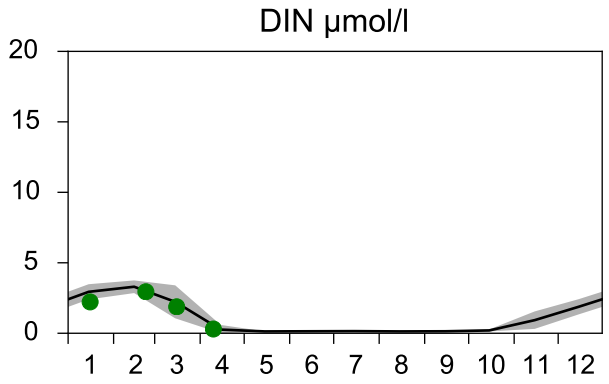
Annual Cycles

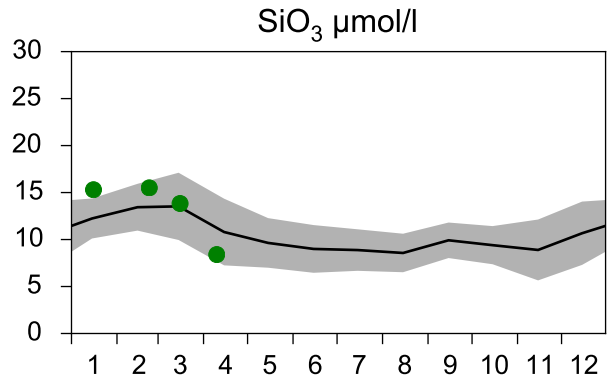
Mean 2001-2015 St.Dev. 2019

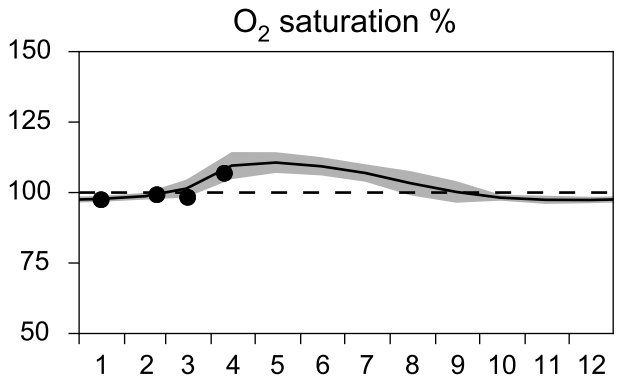




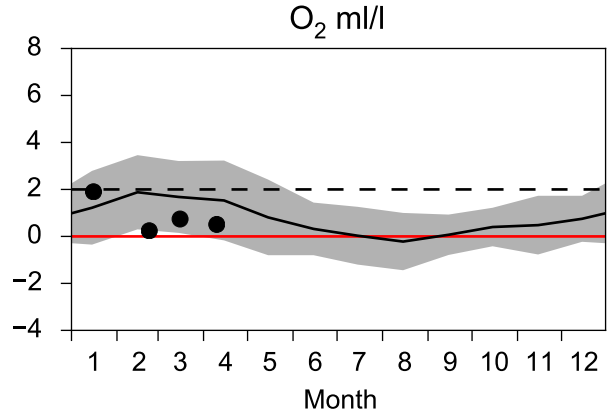


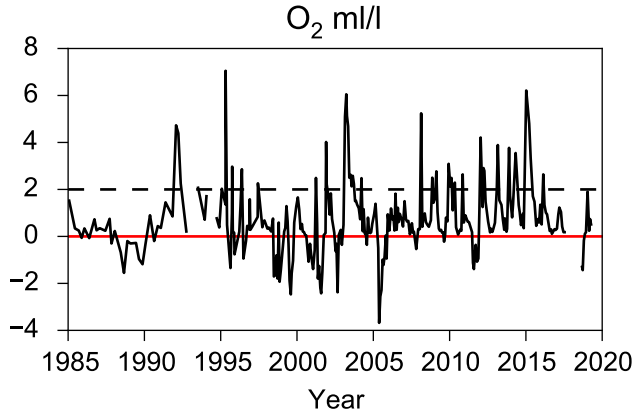




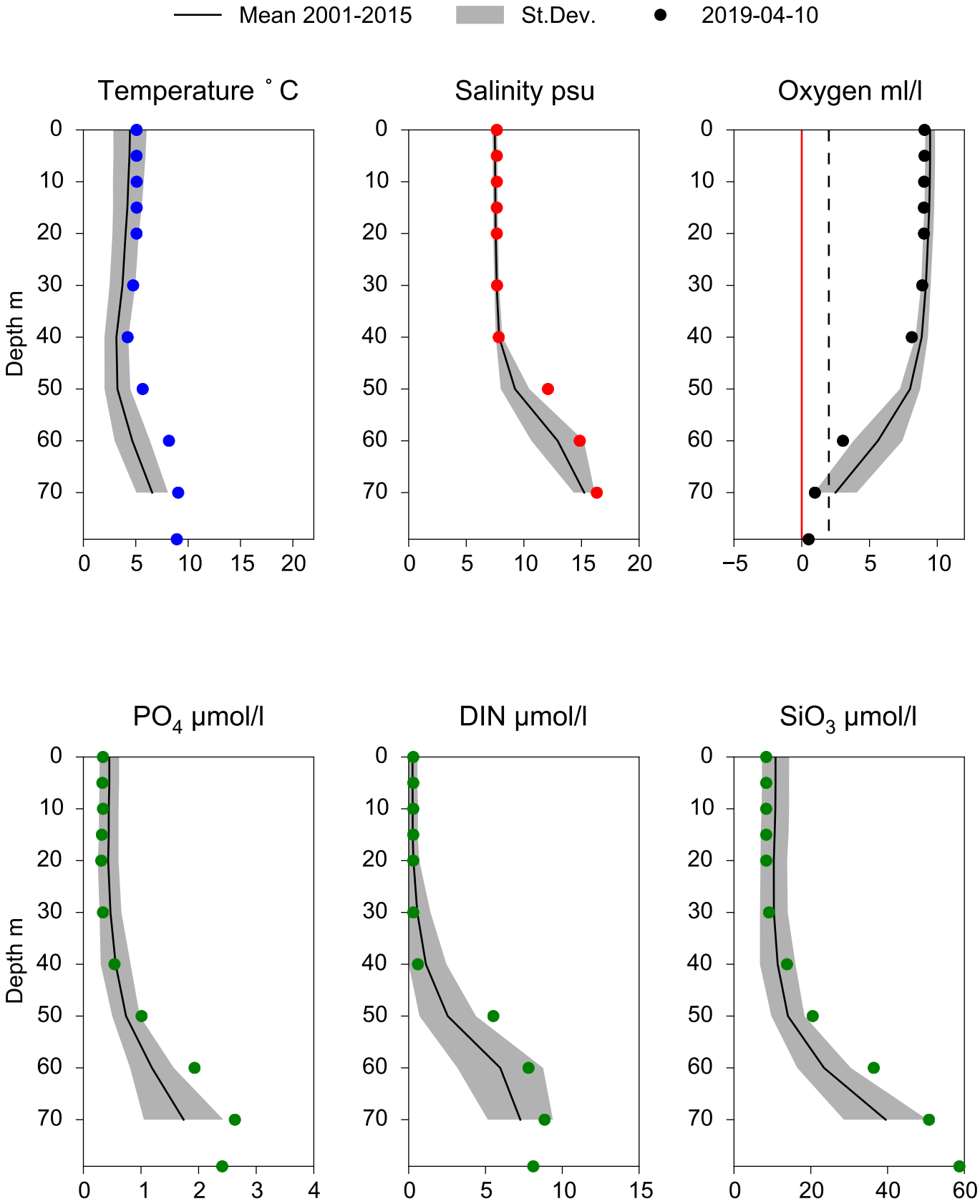


OXYGEN IN BOTTOM WATER (depth >= 70 m)

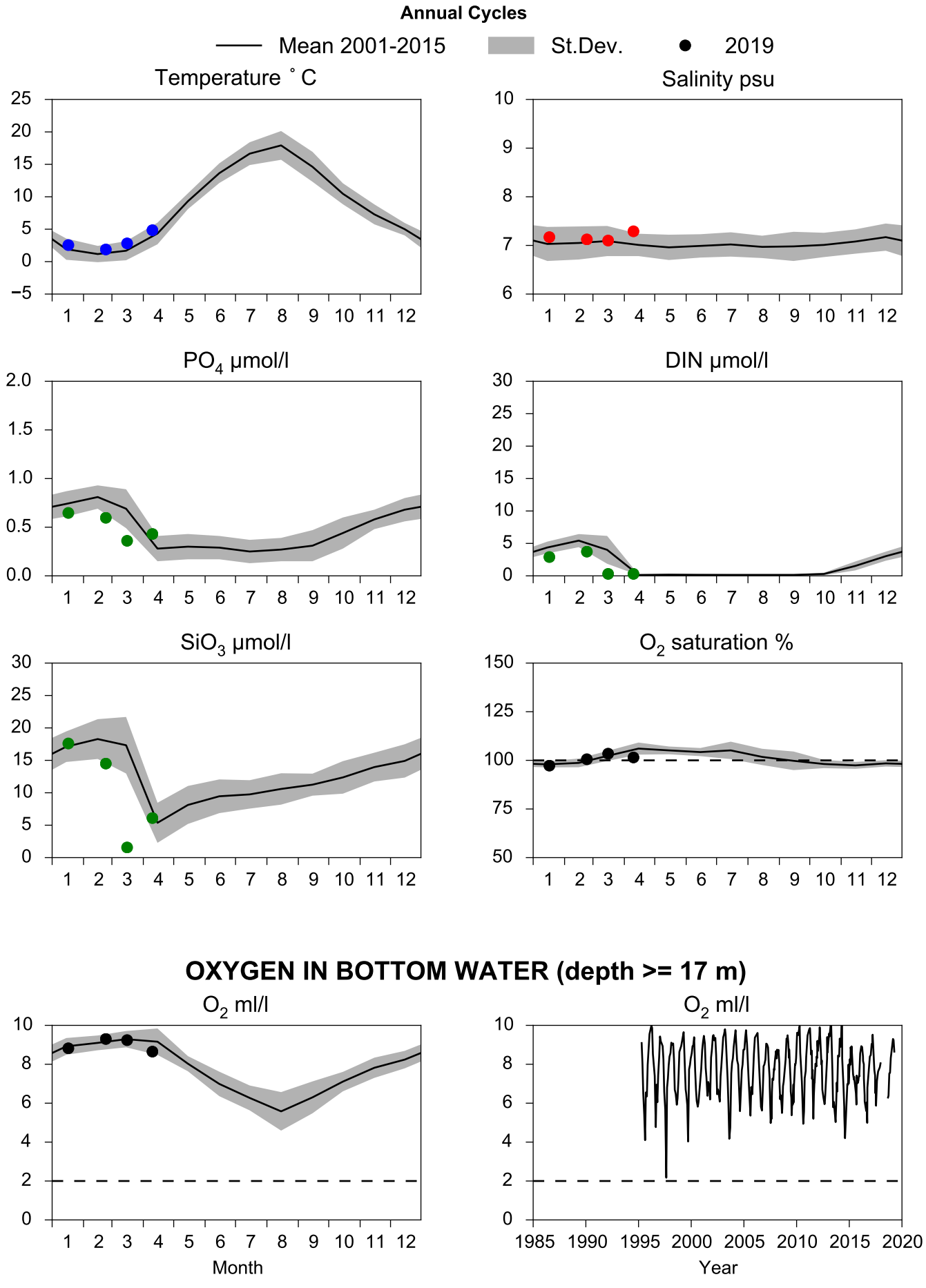




Vertical profiles HANÖBUKTEN
April

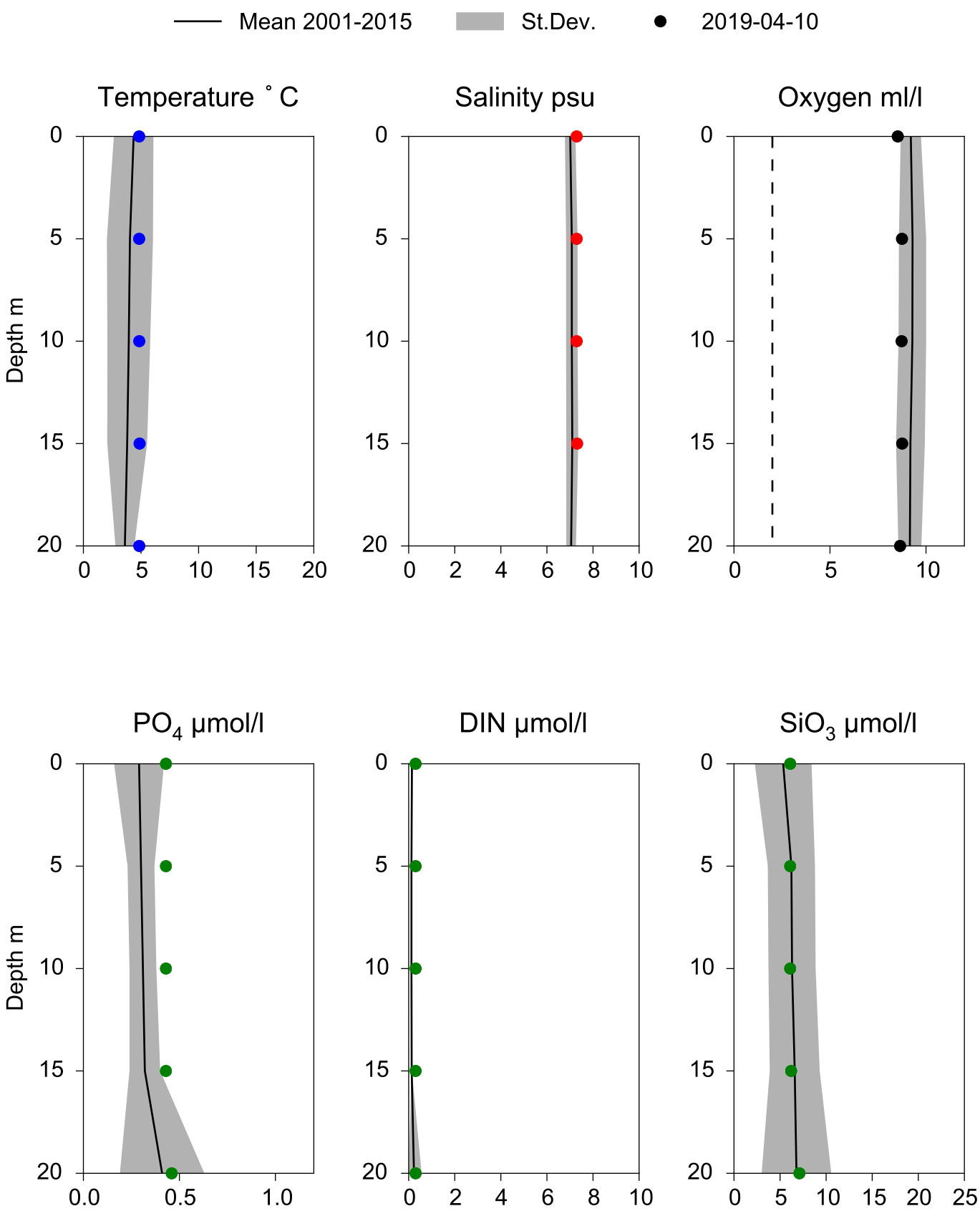


STATION REF M1V1 SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 17 m)

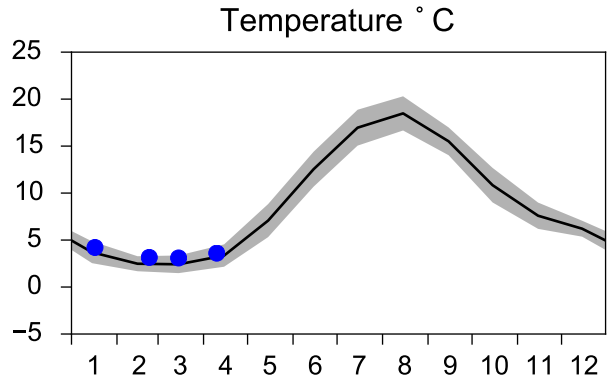
Vertical profiles REF M1V1
April

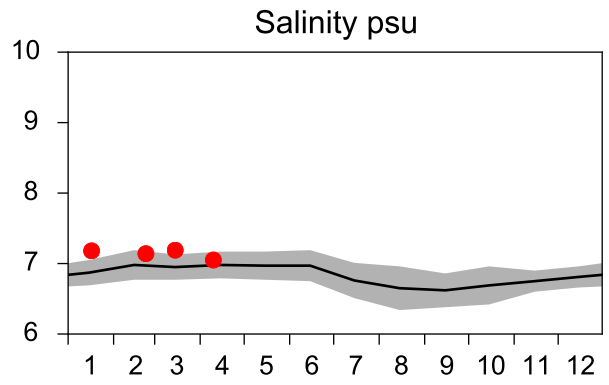


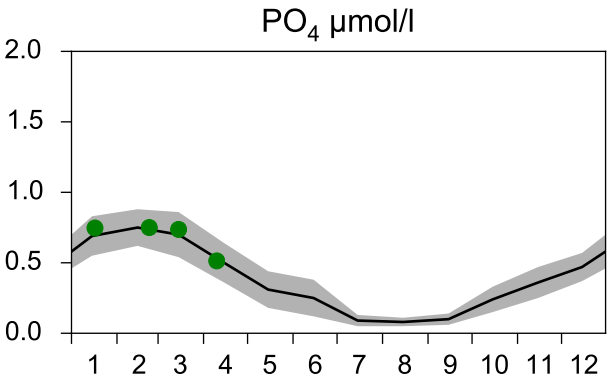
STATION BY38 KARLSÖDJ SURFACE WATER (0-10 m)

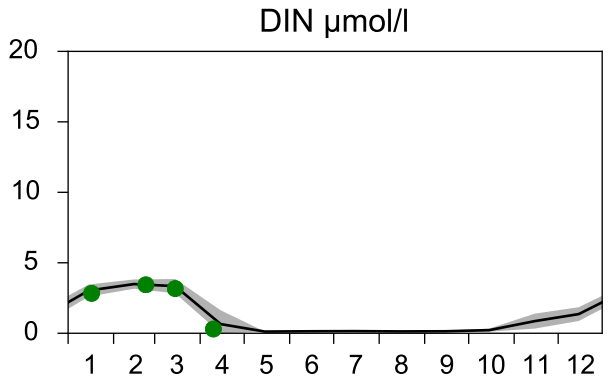
Annual Cycles

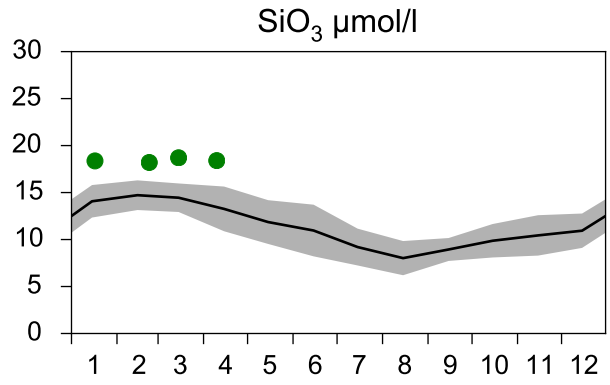
Mean 2001-2015 St.Dev. 2019

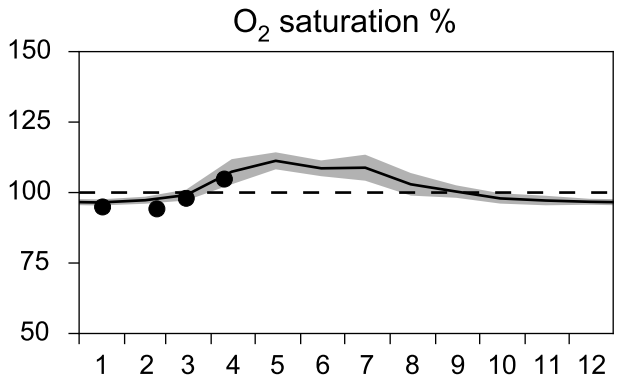




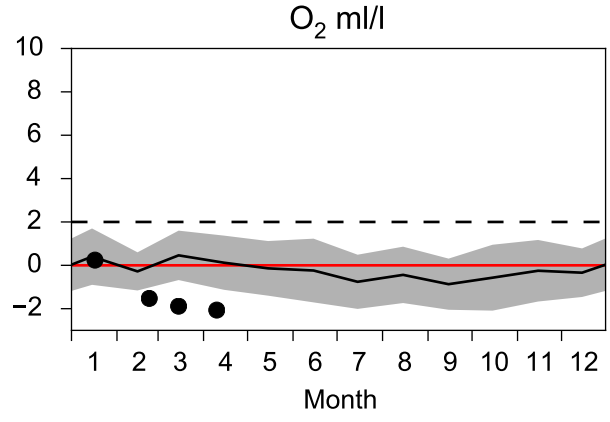


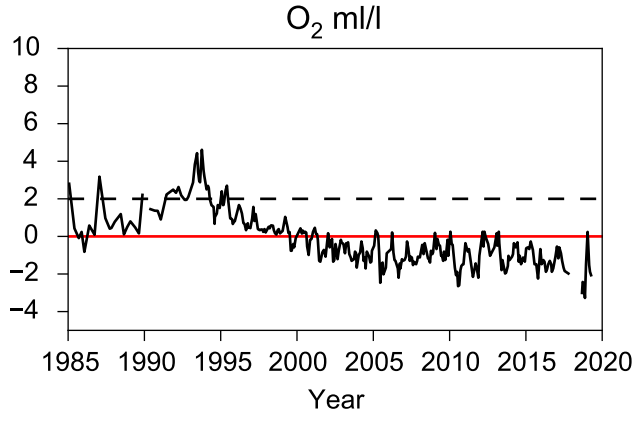




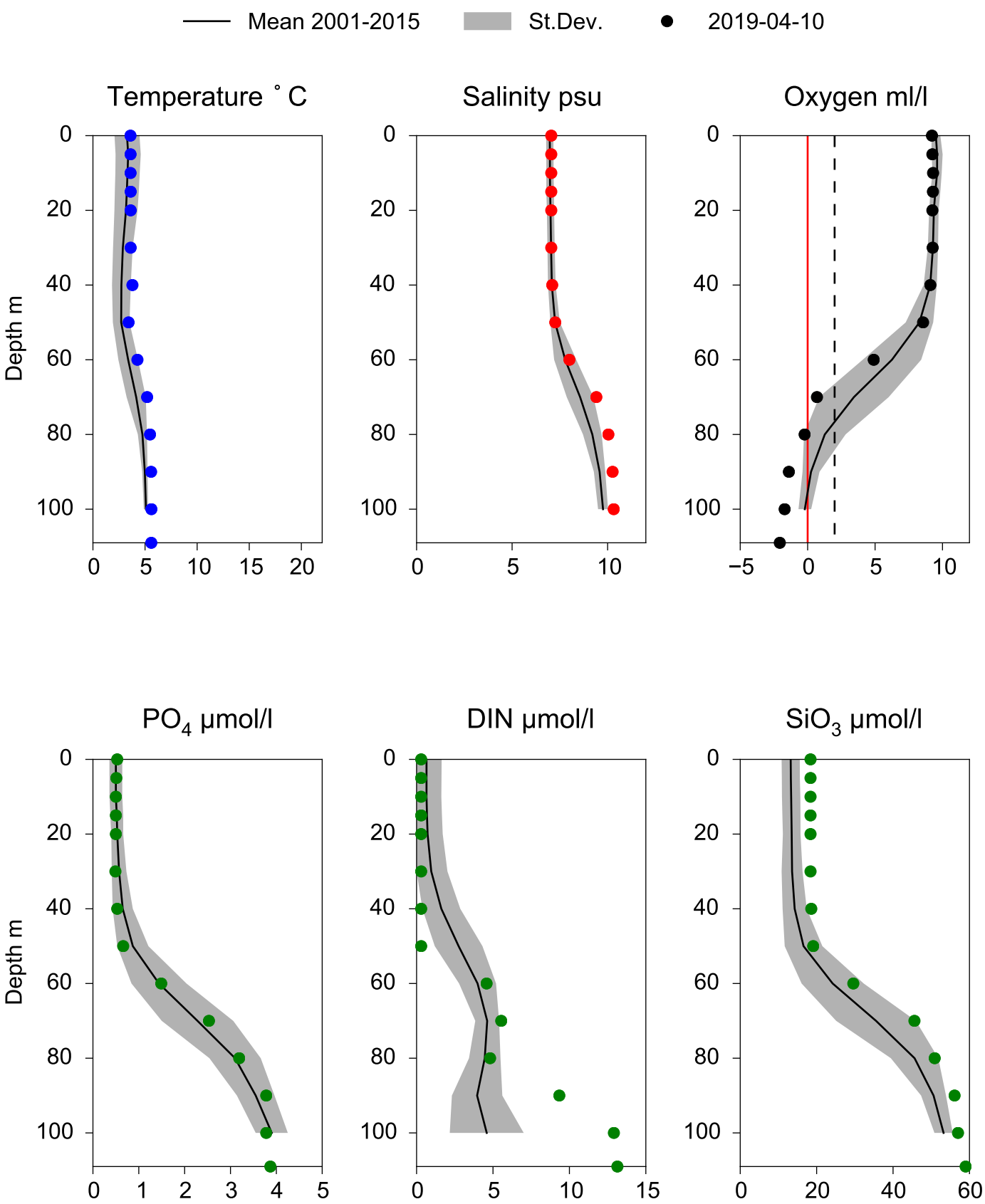


OXYGEN IN BOTTOM WATER (depth >= 100 m)





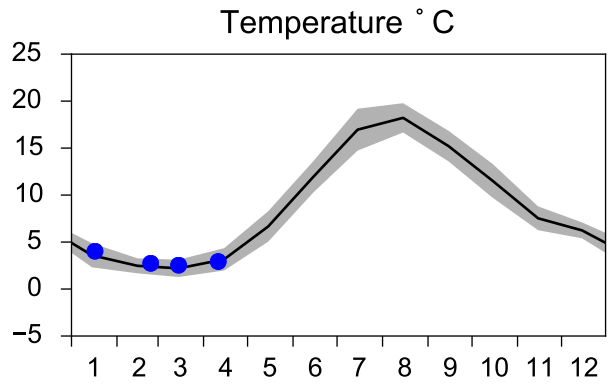
Vertical profiles BY38 KARLSÖDJ
April

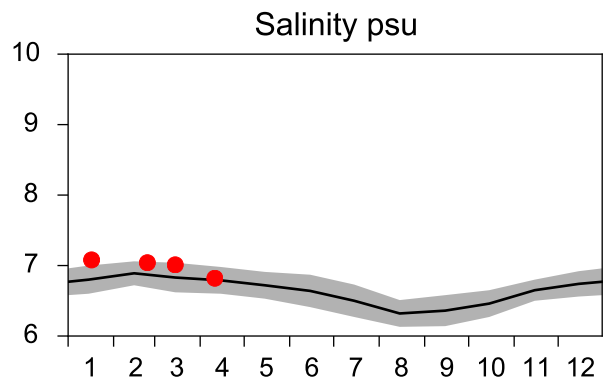


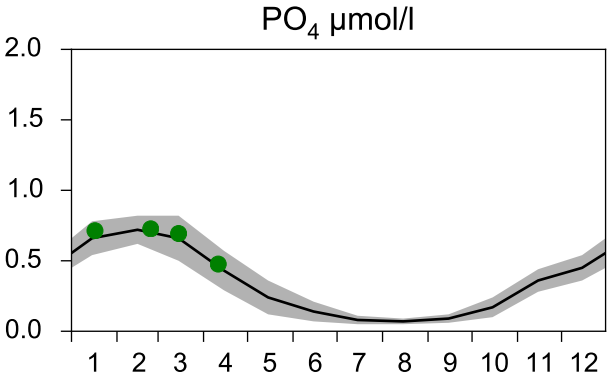
STATION BY32 NORRKÖPINGSDJ SURFACE WATER (0-10 m)

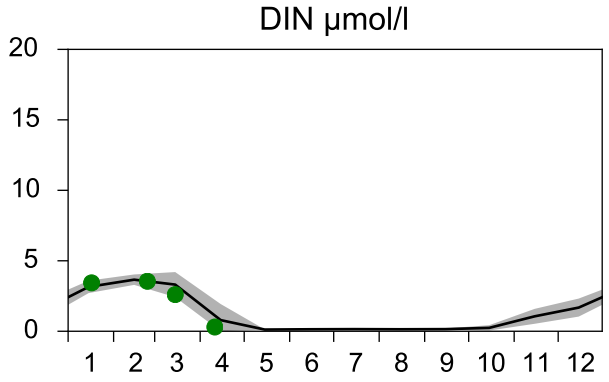
Annual Cycles

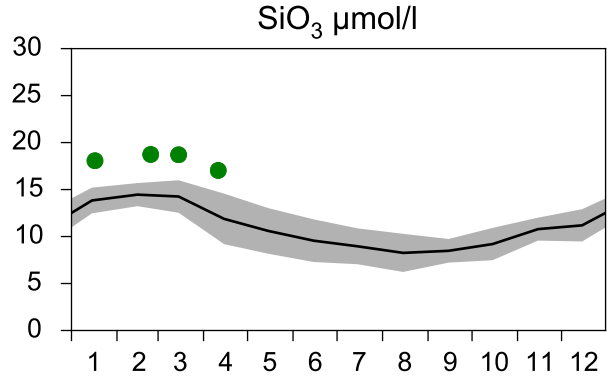
Mean 2001-2015 St.Dev. 2019

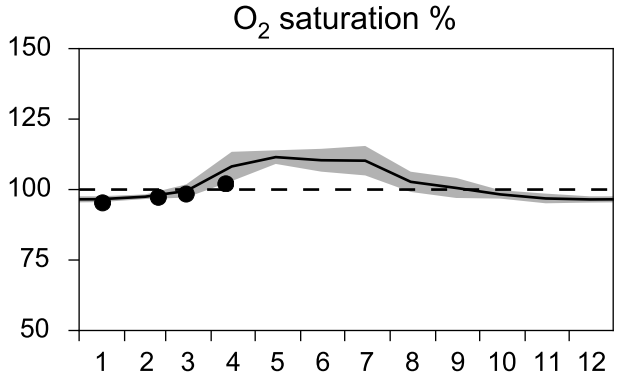




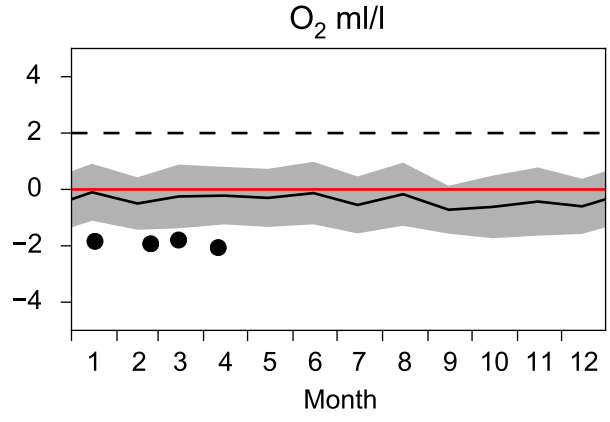


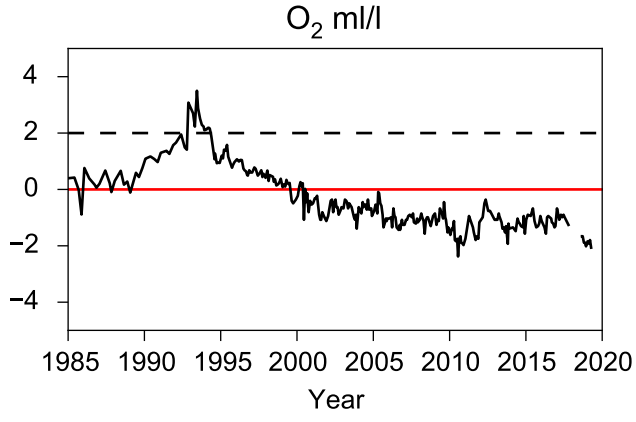




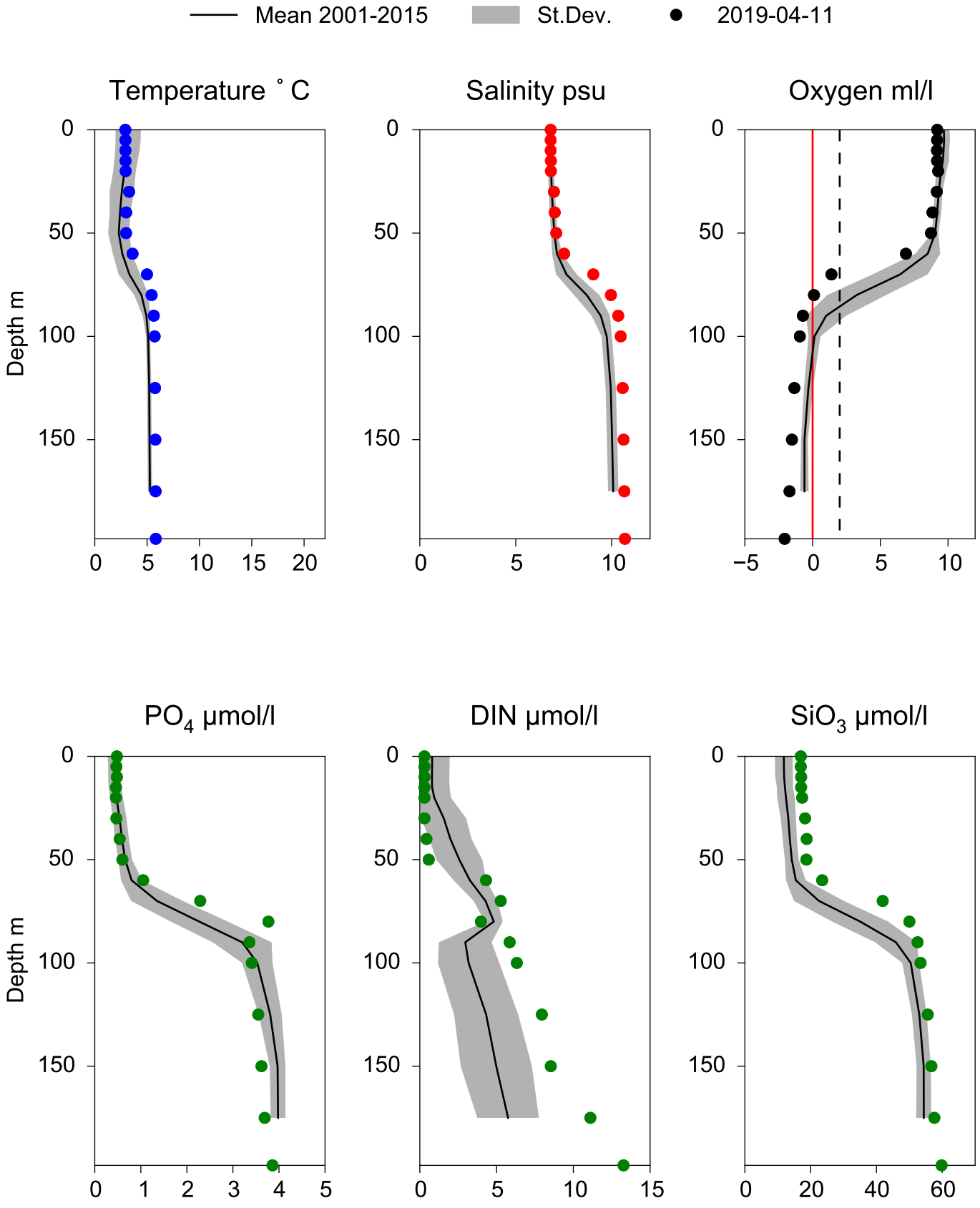


OXYGEN IN BOTTOM WATER (depth >= 175 m)

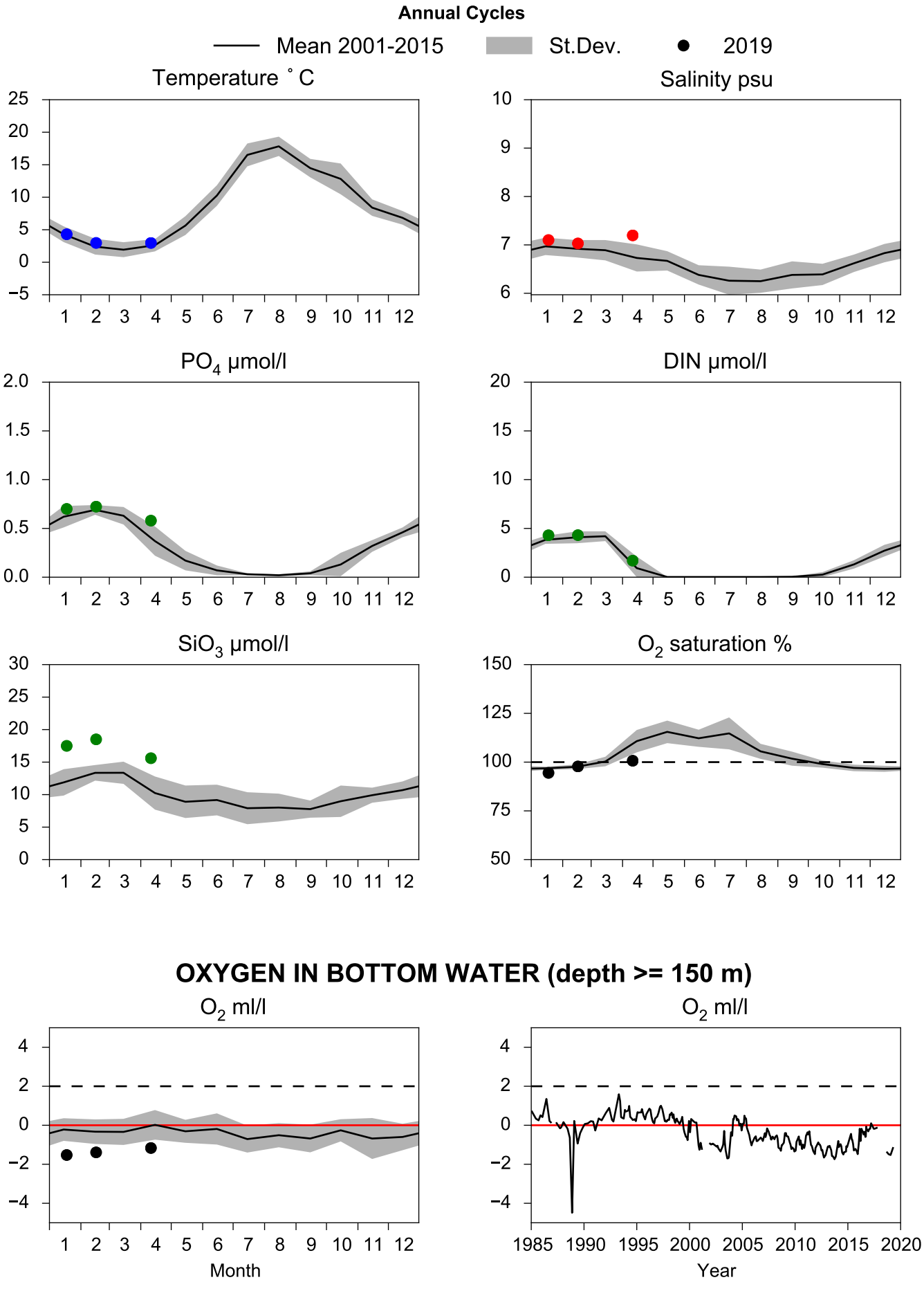




Vertical profiles BY32 NORRKÖPINGSDJ
April



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



OXYGEN IN BOTTOM WATER (depth >= 150 m)

Vertical profiles BY29 / LL19
April