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Report from SMHI's marine monitoring cruise with R/V Svea

Photo: Örjan Bäck, SMHI.
Alongside the German research vessel Elisabeth Mann Borgese at the station BY15 east of Gotland.

Survey period: 2021-11-08 to 2021-11-15

Principals: Swedish Meteorological and Hydrological Institute (SMHI), Swedish Agency for Marine and Water Management (SwAM)

Cooperation partners: Swedish University of Agricultural Sciences (SLU), Swedish Maritime Administration (SMA)

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Summary

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

The water in the Skagerrak was well mixed which resulted in weak stratification and higher salinity in the surface water. Temperatures higher than normal for the month where observed at several places in the Skagerrak and at some places in the Kattegat. The water in the Baltic Proper was well mixed down to 30 - 45 metres, shallowest mixed layer depth was found in the southwest in the Arkona Basin. Below the mixed layer there was a thermocline with decreasing temperature and a small increase in salinity, the salinity then increased more at the permanent halocline at around 60 - 80 metres. The temperature and the salinity in the deep water in the basins around Gotland were somewhat higher than normal.

The nutrient concentrations were generally at low levels in the upper parts of the water body in all areas. Concentrations increase below the halocline, low to normal values where observed on the west coast. In the Baltic Proper low to normal values of DIP where found below the halocline and with ammonium missing (due to technical issues with the instrument) DIN haven't been possible to evaluate, DIN concentrations far over monthly mean was observed in October.

The oxygen situation was good in the Skagerrak, an improvement since October which probably depends on the mixing of the water column which was seen in temperature and salinity. In the Kattegat the oxygen concentrations were lower than normal below the halocline which was located at 20 metres. At Anholt E the oxygen concentration was just over 2 ml/l at the bottom which is close to the limit of acute hypoxia (<2 ml/l).

The oxygen conditions were still very poor in large parts of the Baltic Proper. At BY15 in the Eastern Gotland Basin, BCSIII-10 in the southeast, as well as in the Eastern, Northern and Western Gotland Basins, hydrogen sulphide concentrations were found much over of which is normal, several stations are now closing in on record high values of hydrogen sulphide. A small increase in oxygen concentrations in the bottom water could be seen in the Arkona Basin, the Bight of Hanö and at BY4 in the Bornholm Basin which led to that the oxygen levels there where on normal values for the month and somewhat higher than what was observed in October.

Plankton activity measured by fluorescence from the CTD was generally low in all areas. No peaks in chlorophyll fluorescence were noted. The fluorescence was low and evenly distributed throughout the well mixed surface layer, then rapidly decreasing below the thermocline.

SMHIs next regular monitoring cruise with R/V Svea is planned to 7th to 18th December, starting in Kalmar and ending in Lysekil. During the December cruise mapping of nutrients will be made in the Bothnian Sea and the Bothnian Bay. This year in addition a coordination and intercalibration with Umeå University which are responsible for the regular national monitoring the year around in the Gulf of Bothnia.

Results

The cruise was carried out on board the Swedish research vessel R/V Svea and started in Lysekil the 8th of November and ended in the same port the 15th of November.

Initial winds from east that turned to blow from south and increased in strength lead to cancelling of several zooplankton nets since this sampling method is sensitive to strong winds. The zooplankton sampling at Å17 was also cancelled but due to strong currents. The strong wind continued in the Baltic Proper, primarily from southwest then turning to west. Just in time for the buoy recovery at Huvudskär the wind calmed down and after waiting a couple of hours for even weaker winds the buoy recovery went very smooth.

A part of the instrument used to analyse ammonia, NH_4, didn't work properly which resulted in that no ammonia analyses at all could be performed during the November cruise. The malfunctioning instrument part was replaced shortly after the cruise and the analysis is expected to work again during the December cruise.

Water samples for selenium analysis was taken at five stations for EAWAG in Switzerland. Extra phytoplankton samples were also taken at three station on the west coast for Uppsala University.

At the station in the Bight of Hanö there have been a bottom rig with sensors to continuously measure temperature, salinity, oxygen and currents. During the last cruise in October the rig was planned to be recovered but the attempts failed, several dragging attempts were made. In November new dragging attempts were made with no success.

Transects with Svea's MVP (Moving Vessel Profiler) which are used to measure temperature, salinity and oxygen profiles during transit, were made at parts of the Å-transect after a few initial technical issues. After the cable to the MVP was reterminated and the brake was tightened the Stolpe trench (also called the Slupsk Channel) transect and the BY10-BY15 transect could be sampled. After those transects it was established that the brake was too worn out to safely use the MVP and it needs service before sampling during transit can once again be resumed. Stationary profiles were also taken at different fall speed at Å17 and BY15 for comparison against the CTD.

Both the Ferrybox (continuous measurements at a depth of 4 metres) and Svea's both ADCPs (current measurement) were running during the cruise.

This report is based on data that has undergone an initial quality control. When additional quality review has been performed certain values may change. Data from the cruise is published as soon as possible on the National Oceanographic Data Centre's – SMHI's website. This usually takes place within one to two weeks after the cruise has ended. Some analyses are made after the cruise and are published later.

Data download at SHARKweb: https://sharkweb.smhi.se/hamta-data/

The Skagerrak

The water in the Skagerrak was generally well mixed, cooling to some extent could be seen at the most coastal near stations with temperature at around 10 °C as lowest in the surface at Släggö. Further from the coast, temperatures at around 12 °C were measured which is warmer than usual. At Å13, Å15 and P2 the water was warmer than normal for November in the entire profile from the surface to the bottom. At Å17 the water was warmer than normal down to around 100 metres, from 125 metres down to 340 metres the temperature was normal for the season.

The mixing of the water body resulted in weaker stratification, neither salinity stratification, halocline, nor temperature stratification, thermocline, could be seen at Å15, Å16, Å17 or P2, at least not any clear ones. At Å17 the temperature decreased gradually from around 13 °C at 75 metres down to barely 8 °C at 125 metres, a significant decrease in temperature but over a large depth interval, which means that the density changes slowly with the depth and hence there is no strong stratification. The salinity was at these stations somewhat higher than normal closest to the surface, 32 - 34 psu, and at normal levels deeper down, at Å15 somewhat lower than normal from 40 metres and down to the bottom.

At Å13 there was a halocline at 12 metres where the salinity increased from 29 psu to 32 psu at 14 metres, cooling of the water of about 1 °C could be seen above the halocline. At Släggö both the temperature and salinity increased quickly from the surface down to 6 metres, after that the salinity increased slower with depth. At around 52 metres there was a weak stratification with an increase in salinity and a decrease in temperature.

The concentrations of nutrients in the form of dissolved inorganic nitrogen, DIN[1], were lower than normal for the season in the entire water column at the Å-stations Å13, Å15 and Å17. At P2 the concentrations were normal from the surface down to 20 metres, thereafter lower than normal down to the bottom. Concentrations below 1 µmol/l were observed down to 100 metres. At the coastal station Släggö, which is located in Gullmarsfjorden, normal values for the season were observed, somewhat higher in the surface, at 50 metres and closest to the bottom. Phosphate, dissolved inorganic phosphorous or DIP[2], were also on normal levels at Släggö but with somewhat higher values at 50 metres and at the bottom. Phosphate concentrations were generally at normal levels at the rest of the stations in the Skagerrak with somewhat deviating low values from 75 metres and below at Å15 and at Å17 between 75 - 200 metres.

The silicate concentrations, which is used by diatoms to form shells, were at normal levels at the Å-stations, 2 - 5 µmol/l, usually increasing with depth. At P2 the concentrations were somewhat higher in the surface and somewhat lower than normal deeper down below 30 metres. At Släggö values at the surface and closest to the bottom stood out with values over 20 µmol/l.

The oxygen conditions in the Skagerrak were good with values over 5 ml/l, up to 6 ml/l, closest to the bottom. At the coastal station Släggö, where low oxygen concentrations occur in the bottom water, the oxygen concentration decreased rapidly around 50 metres and at the bottom only 2.7 ml/l was measured. This is just above the limit for acute hypoxia which is used when the concentration falls below 2 ml/l.

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[1] Dissolved inorganic nitrogen, abbreviated DIN, the sum of nitrate, nitrite and ammonium.

[2] Dissolved inorganic phosphorus, abbreviated DIP, only in the form of phosphate.

Chlorophyll fluorescence measurements with the CTD[3] showed low plankton activity. At Å13 and Släggö the fluorescence was somewhat higher in the surface layer. The secchi disk depth at Släggö was low, only 3 metres was measured.

The Kattegat and the Sound

The temperature was at normal levels in the surface or possibly slightly above, just over 10 °C in the entire Kattegat and the Sound. Below 20 metres depth the temperature increased, up to 13 °C in the Kattegat and 11.5 °C in the Sound. A halocline was observed in the Kattegat at around 20 metres, and in the Sound a strong one between 15 and 20 metres. The salinity above the halocline varied between 24 - 26 psu in the Kattegat and it was just below 14 psu in the Sound. The salinity increased below the halocline, up to 32 - 34 psu at every station, all values were within the normal range for the season.

The nutrient concentrations were lower then normal above the halocline in the Kattegat, both for nitrogen and phosphorus. In the Sound at the station W Landskrona low nitrogen values were measured while the phosphate concentrations were normal at around 0.4 µmol/l. The nutrient concentrations normally increase below the halocline, measurements indicated normal values for the area except from 30 metres and below at Anholt E where somewhat higher concentrations of phosphate were found, up to 1.36 µmol/l at the bottom. Silicate concentrations were at normal levels above the halocline but deviated in the deeper waters at Fladen and Anholt E, with values around 19 µmol/l at Fladen and up towards 30 µmol/l at Anholt E.

Oxygen concentrations below the halocline at Fladen and Anholt E were lower than normal. At Fladen, the oxygen concentration decreased to below 4 ml/l closest to the bottom, this is the level where the first signs of oxygen deficiency can be seen. At Anholt E the concentrations approached 2 ml/l, which is the limit for acute oxygen hypoxia. In the Sound below the halocline the oxygen concentrations were around 4 ml/l, which is low but within normal for the station and season.

Chlorophyll fluorescence measurements with the CTD showed low plankton activity above the halocline with no clear peaks.

The Baltic Proper

The water in the Baltic Proper was well mixed down to 30 - 45 metres, shallowest mixed layer depth was found in the southwest in the Arkona Basin. The station BY39, at the south point of Öland, deviated with slowly increasing salinity and decreasing temperature already from 17 metres and down. Below the well mixed upper layer there was a thermocline with decreasing temperature and a weak increase in salinity, the salinity then increased more at the permanent halocline at around 60 - 80 metres. In the Arkona basin there was no clear thermocline; instead the temperature was rather stable in the whole profile and the halocline was present around 30 - 40 metres. The temperature in the upper layer was around 9 - 11 °C and the salinity ranged from barely 7 psu west of Gotland up to just over 8 psu in the southwest in the Arkona Basin. The temperature in the deep water in the basins around Gotland were somewhat higher than normal and varied from 6 to just over 7 °C. The salinity in the Gotland Basins were also somewhat higher than normal both in the

[3] CTD is a profiling instrument which stands for Conductivity, Temperature and Depth. SMHI's CTD is also equipped with sensors that measure oxygen and fluorescence among others.

surface and bottom waters, similar observations of higher values in the deep water around Gotland were made in October as well.

The nutrient concentrations in the form of DIN, dissolved inorganic nitrogen, were low in the mixed upper layer, around the lower limit for what is normal for the season. This was true in particular for the stations around Gotland, at the stations around Bornholm more normal concentrations were observed. Values varied between 0.1 - 0.9 µmol/l. Since ammonium, NH_4, is missing for the entire cruise it's not possible to evaluate the nutrient situation in the deep water in the Baltic Proper. The deep water is anoxic and in such conditions ammonium stands for the major part of DIN.

The concentration of DIP, dissolved inorganic phosphorus in the form phosphate, was somewhat higher than normal close to the bottom in the Bornholm Basin; 6 - 8 µmol/l. At the northernmost stations BY20 - BY38 values lower than normal were noted in the mixed upper layer, between 0.15 - 0.25 µmol/l. At the other stations the concentrations were at normal levels.

The silicate concentrations were somewhat higher than normal in the southwest around Bornholm, at most over 80 µmol/l closest to the bottom at BY5 and around 13 µmol/l in the surface. Normal values were measured above the halocline around Gotland and somewhat elevated values below the halocline, here also with a top just over 80 µmol/l at the bottom at BY15.

The oxygen situation was still very serious in large parts of the Baltic Proper. At BY5 in the eastern part of the Bornholm Basin, at BCSIII-10 in southeast, and in the Eastern, Northern and Western Gotland Basins hydrogen sulphide[4] values higher than normal were observed, several stations are closing in on record levels of hydrogen sulphide concentrations. Some oxygenation of the bottom water was noted in the Arkona Basin, Bight of Hanö and at BY4 in the Bornholm Basin which made the oxygen concentrations there to be at normal levels and somewhat higher than in October. The oxygen concentration was between 4.6 - 4.9 ml/l at the bottom in the Arkona Basin, 0.3 ml/l at BY4 and 1.3 ml/l in the Bight of Hanö. However, the oxygen concentration just above the bottom, at 70 metres, in the Bight of Hanö was at only 0.2 ml/l and at 80 metres at BY4 hydrogen sulphide was observed. Likely only a small amount of heavy oxygenated water has entered the Bight of Hanö and the western part of the Bornholm Basin and lifted or pushed away the older bottom water. The future monthly monitoring will show if there will be a continued improvement or if it's just a small inflow with limited effect. At the rest of the stations, from BY5 to BY38, which are located in a wide arc counter clockwise around Gotland, hydrogen sulphide or oxygen concentrations close to zero were observed from 70 or 80 metres depth and below. At BY10 and BY15 there was a small area between about 80 to 100 metres where the oxygen concentration was close to zero but with no hydrogen sulphide present.

The plankton activity measured with fluorescence from the CTD was low in the entire area. No peaks in chlorophyll fluorescence were observed. The fluorescence was evenly spread in the entire mixed upper layer and then decreased rapidly below the thermocline.

More information about the algal situation can be read in the Algaware report for October: https://www.smhi.se/publikationer/publikationer/algrapporter

[4] Hydrogen sulphide, H_2S, forms in oxygen free conditions.

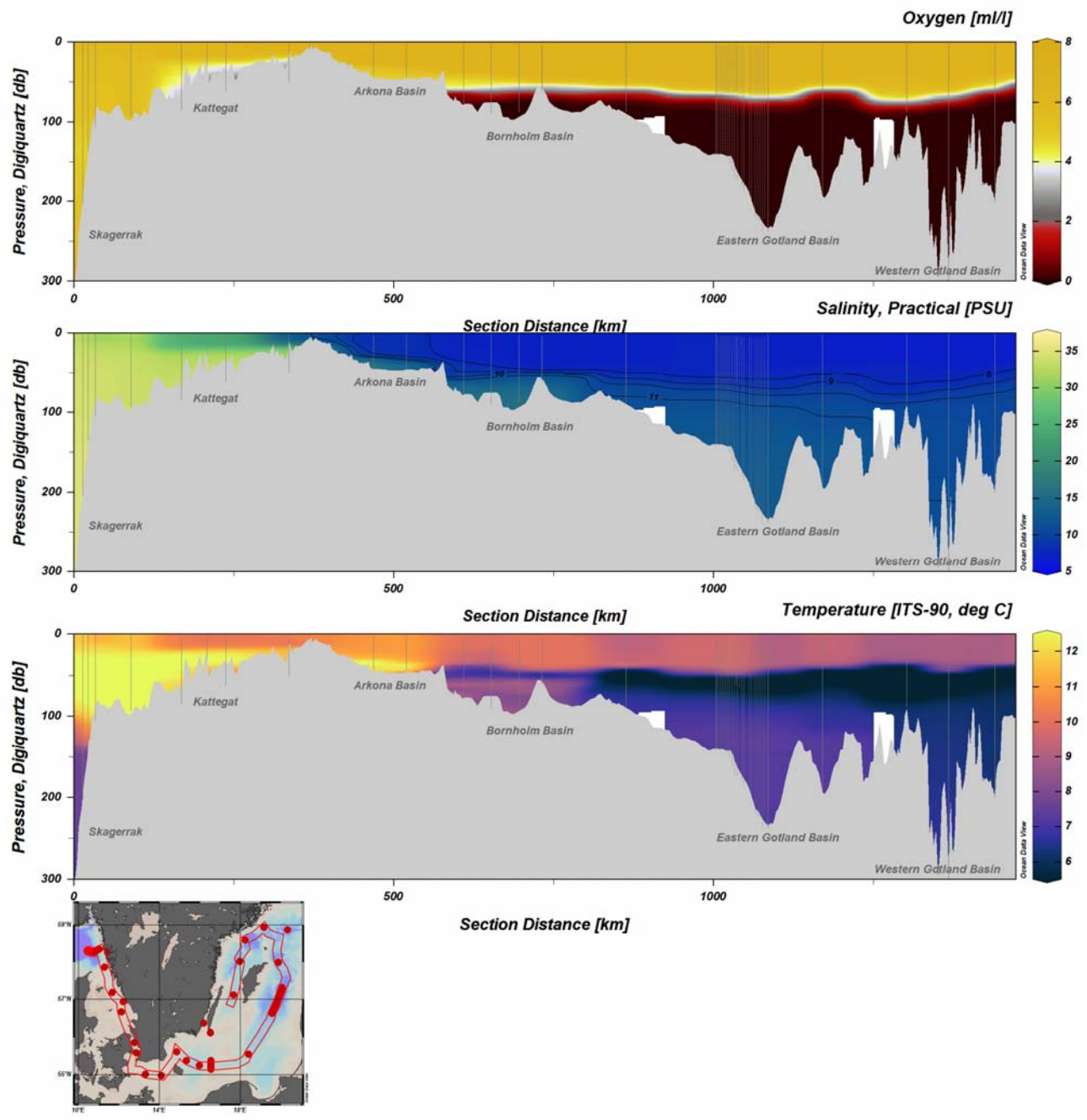

Figure 1. Transect showing oxygen concentration, salinity and temperature from measurements with the CTD and some MVP, from the Skagerrak via the Kattegat and the Sound to the Eastern Gotland Basin and further into the Western Gotland Basin.

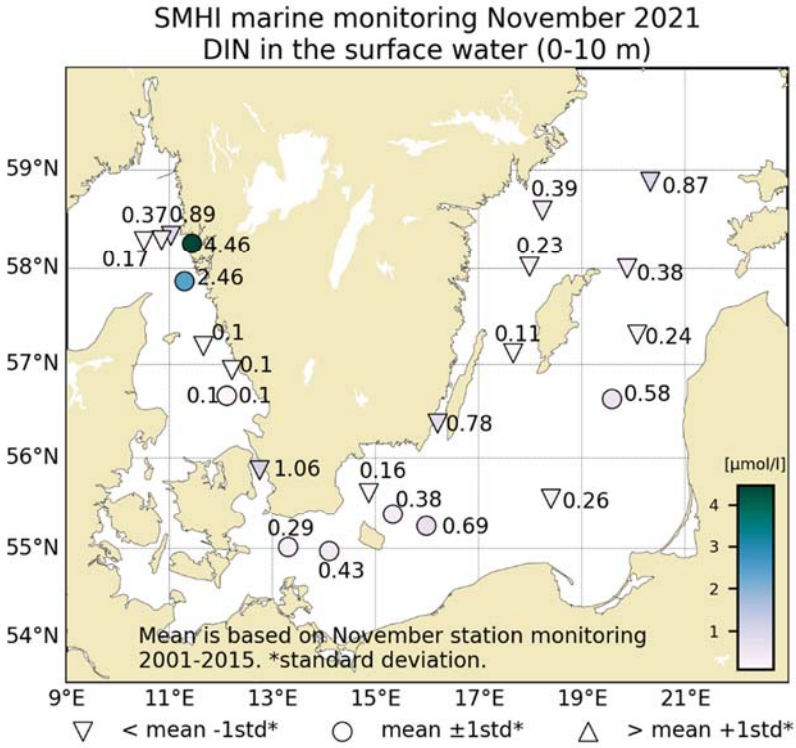

Figure 2. Concentration of dissolved inorganic nitrogen in the surface water (0-10m).

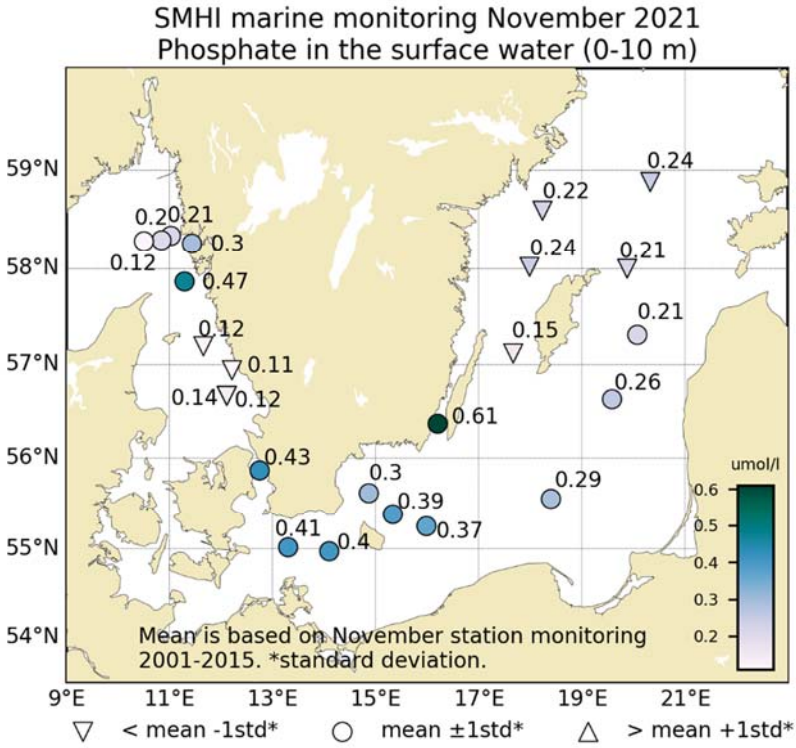

Figure 3. Concentration of phosphate in the surface water (0-10m).

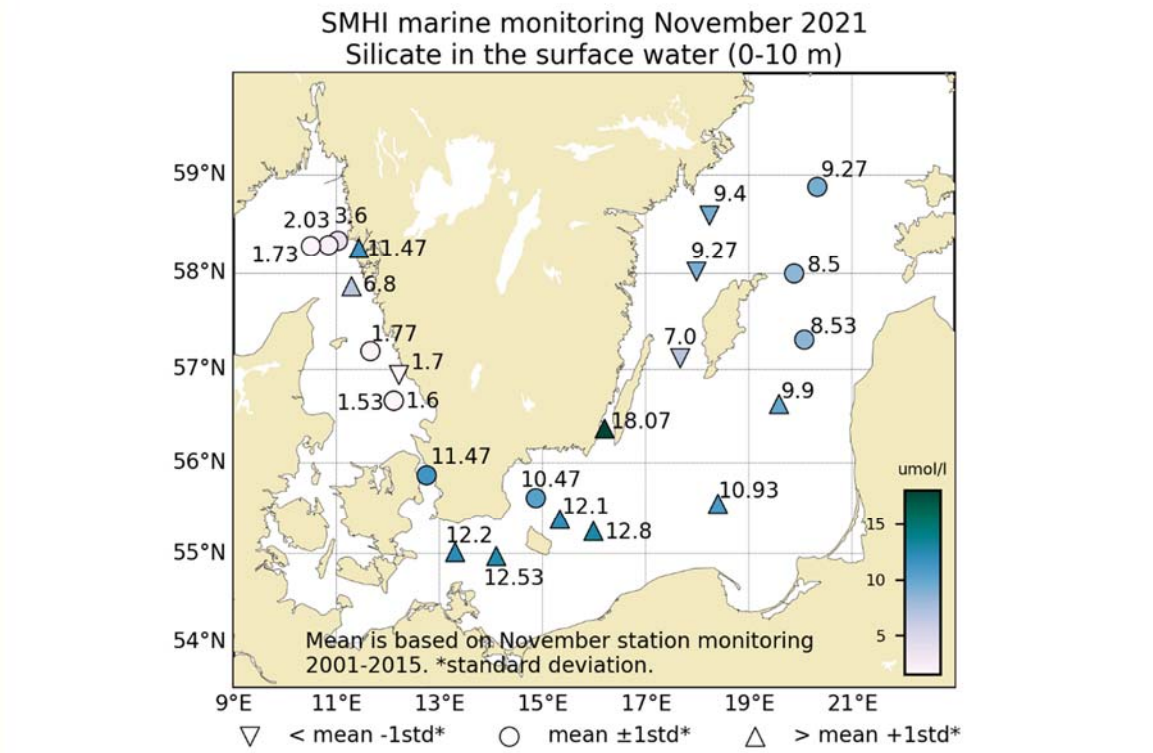

Figure 4. Concentration of silicate in the surface water (0-10m).

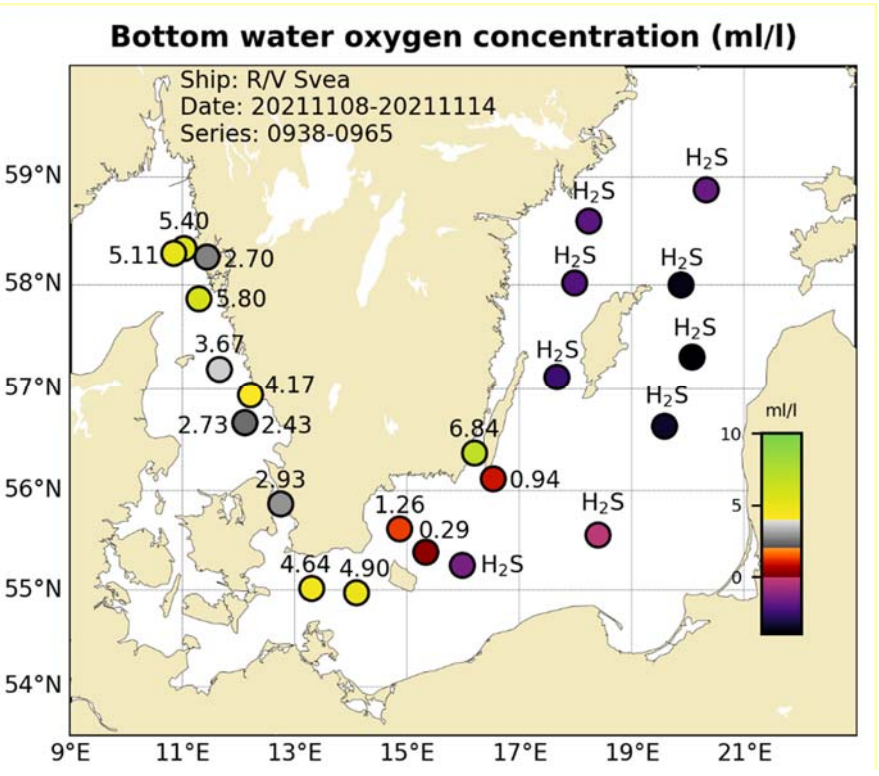

Figure 5. Oxygen concentration in the bottom water.

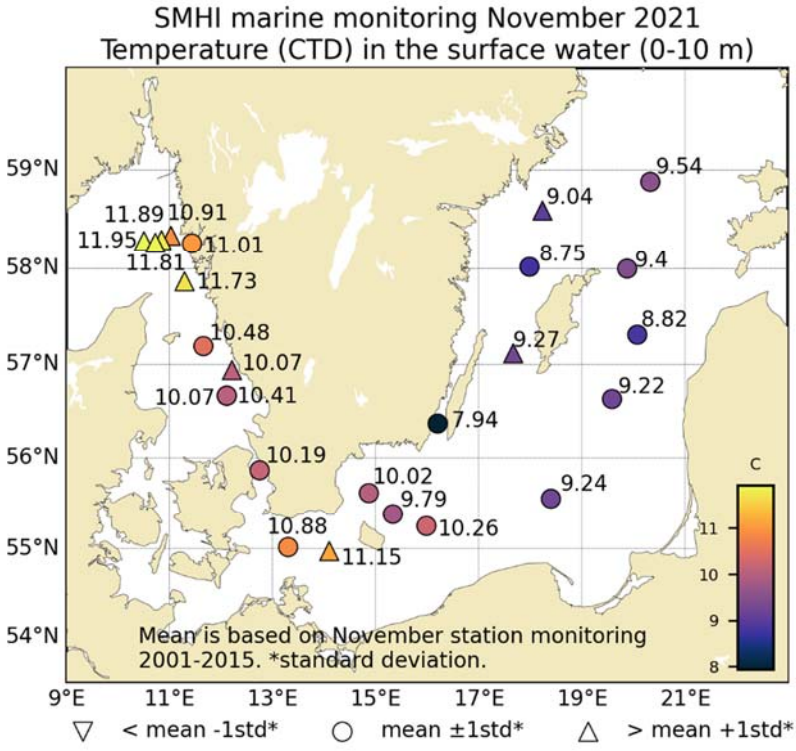

Figure 6. Temperature in the surface water (0-10m).

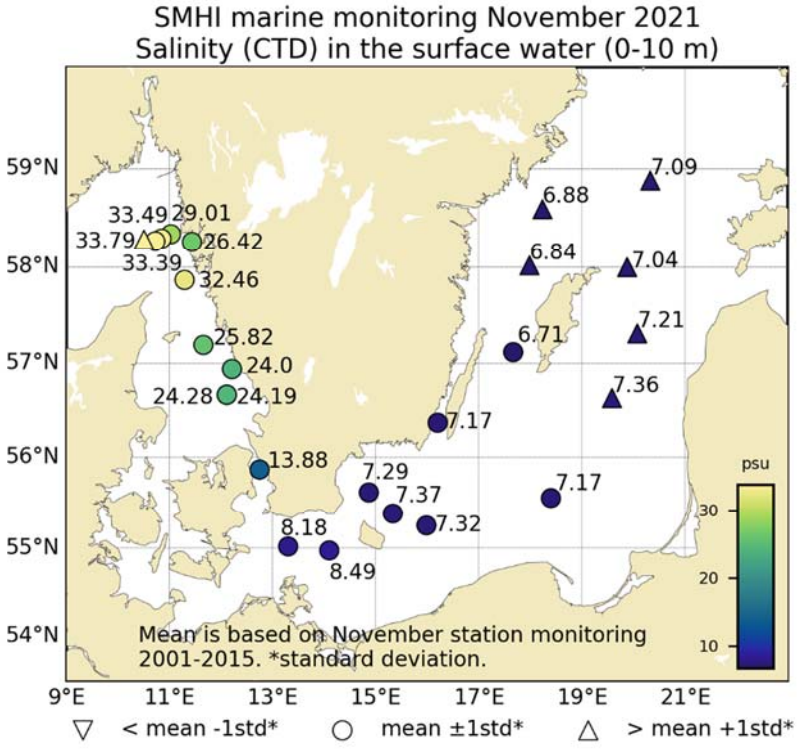

Figure 7. Salinity in the surface water (0-10m).

PARTICIPANTS

Name	Role	Institute
Örjan Bäck	Chief scientist	SMHI
Kristin Andreasson	Quality manager	SMHI
Johan Kronsell		SMHI
Madeleine Nilsson		SMHI
Sara Johansson		SMHI
Erik Udehn	Technician buoy recovery	SMHI
Raul Salas	Technician buoy recovery	SMHI

APPENDICES

- Track chart
- Table over 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
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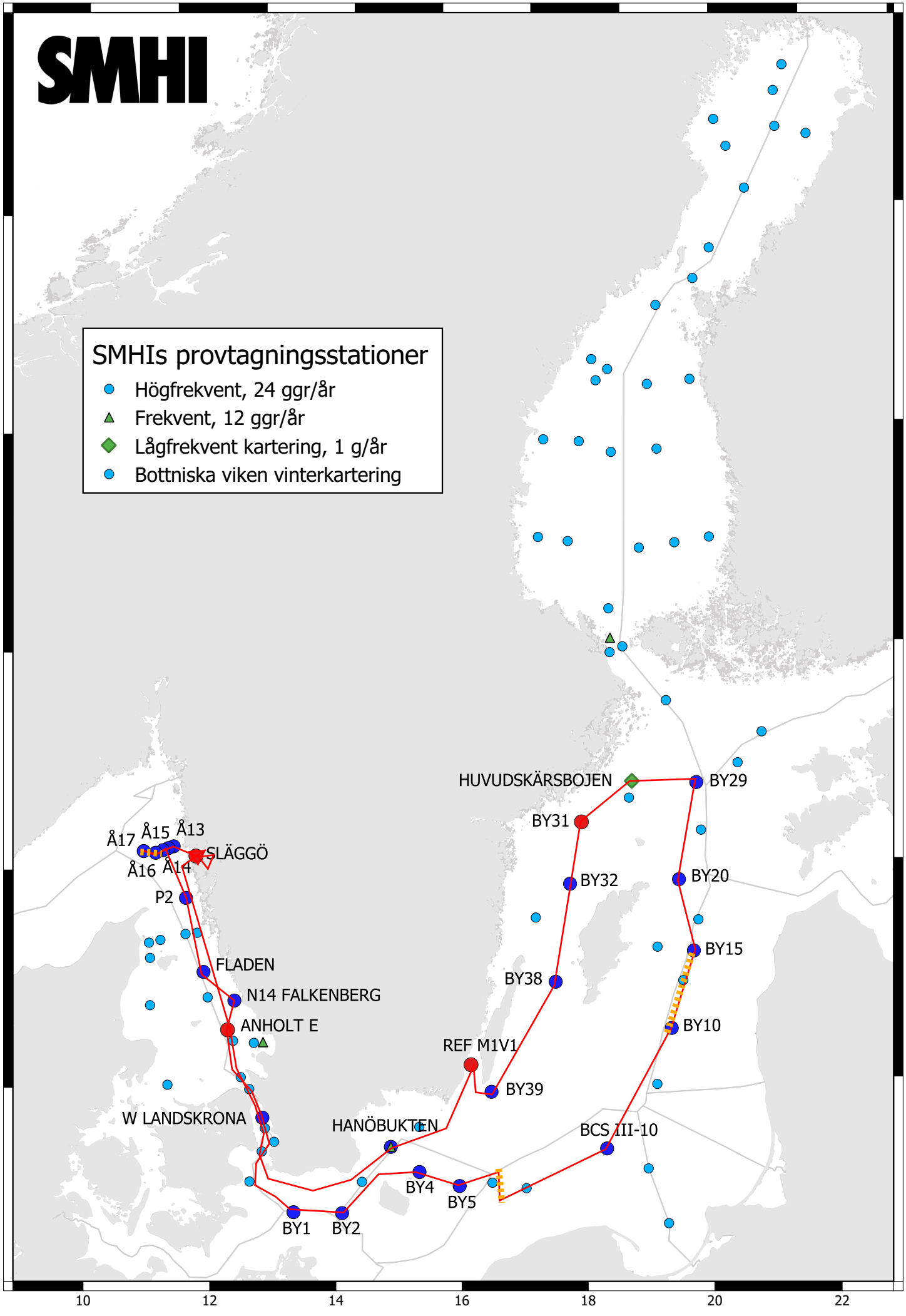
SMHI
SMHIs provtagningsstationer
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Frekvent, 12 ggr/år
Lågfrekvent kartering, 1 g/år
Bottniska viken vinterkartering
HUVUDSKÄRSBOJEN
BY29
BY31
BY32
BY20
BY15
BY38
BY10
REF M1V1
BY39
BCS III-10
HANÖBUKTEN
BY4
BY5
BY1
BY2
W LANDSKRONA
ANHOLT E
N14 FALKENBERG
FLADEN
P2
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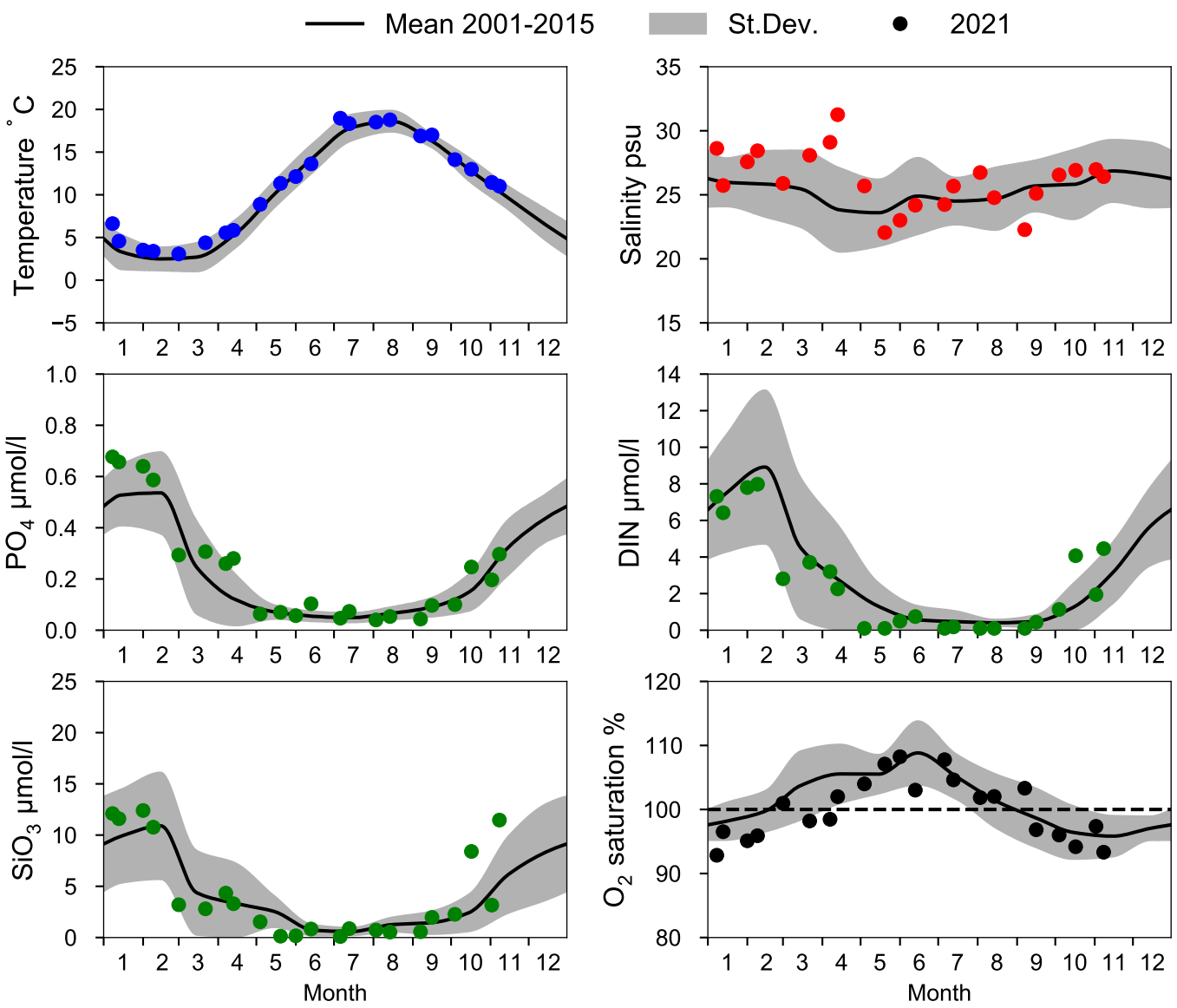
Date: 2021-12-06
Time: 11:13

Ship: SE
Year: 2021

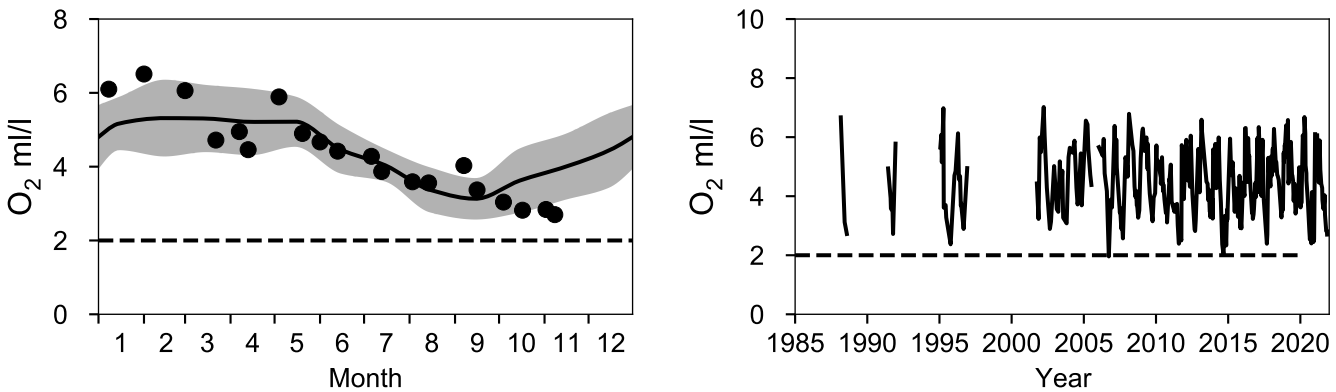
Ser no	Cru no	Stat code	Proj	Stat name	Lat	Lon	Start date yyyymmdd	Start time hhmm	Bottom depth m	Secchi depth m	Wind dir	Wind vel	Air temp C	Air pres hPa	WCWI	CZPP	No de	No btl	Temp_btl	Temp_ctd	Salt_btl	Salt_ctd	Ph	Doxy_btl	Doxy_ctd	H2s	Phos	Ptot	Ntri	Ntra	Ntrz	Amon	Ntot	Alky	Sio3-si	Humus	Comnt_visit	Comnt_samp
0938	21	FIBG27	BAS...	SLÄGGÖ	5815.59	01126.14	20211108	0740	74	3	09	6	3.3	1015	1220	xxx-	9	9	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	x	x
0939	21	SKEX14	BAS...	Å13	5820.37	01101.67	20211108	1050	90	8	09	6	4.3	1018	1730	x---	10	10	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	x	x
0940	21	SKEX16	BAS...	Å15	5817.65	01050.70	20211108	1300	135		11	6	4.8	1019	2730	x---	12	12	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	x	-
0941	21	SKEX18	BAS...	Å17	5817.06	01030.27	20211108	1520	340		12	5.6	5.8	1019	1620	x-x-	15	14	x	x	-	x	x	x	x	-	x	x	x	x	x	x	x	x	x	-	x	-
0942	21	SKEX17	BAS...	Å16	5816.03	01043.45	20211108	1740	202		13	6.4	5.3	1020	9999	----	13	0	-	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
0943	21	SKEX23	BAS...	P2	5752.00	01117.52	20211108	2120	93		15	7.4	4.7	1022	9999	x---	10	10	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	x	-
0944	21	KANX25	BAS...	FLADEN	5711.57	01139.45	20211109	0240	84		17	8	6.7	1021	9990	x---	13	13	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	x	-
0945	21	KANX50	BAS...	N14 FALKENBERG	5656.40	01212.71	20211109	0800	30		16	11	7.0	1020	2840	x-x-	7	7	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	-	x	-
0946	21	KAEX29	BAS...	ANHOLT E	5640.10	01206.66	20211109	0830	62	9	18	10.5	8.8	1019	2840	x-xx	10	10	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x	-
0947	21	SOCX39	BAS...	W LANDSKRONA	5552.00	01244.91	20211109	1420	50	8	16	9	10.4	1021	2820	x---	9	9	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	x	-
0948	21	SOSX00	EXT...	FLINTEN-7	5535.42	01250.78	20211109	1700	8		22	9	10.6	1021	9990	----	3	0	-	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	x	-
0949	21	BPSA02	BAS...	BY1	5500.94	01318.08	20211109	2230	47		22	10	10.1	1023	9990	x---	8	8	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	x	-
0950	21	BPSA03	BAS...	BY2 ARKONA	5458.27	01405.95	20211110	0140	47		22	9.1	10.0	1022	9999	x-x-	8	8	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	x	x	-
0951	21	BPSB06	BAS...	BY4 CHRISTIANSÖ	5522.99	01520.01	20211110	0730	94	7	22	8	9.5	1020	1340	x---	12	12	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	-	x	-	x	-
0952	21	BPSB07	BAS...	BY5 BORNHOLMSDJ	5515.02	01559.07	20211110	1100	91	9	22	9	9.1	1021	1440	xxxx	12	12	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
0953	21	BPSE11	BAS...	BCS III-10	5533.31	01824.02	20211110	2240	90		25	6.3	8.9	1019	9999	x---	12	12	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	-	x	x	x	-
0954	21	BPEX13	BAS...	BY10	5638.01	01935.09	20211111	0630	147		24	5	8.1	1016	4830	x---	15	15	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	-	x	-	-	-
0955	21	BPEX21	BAS...	BY15 GOTLANDSDJ	5718.72	02004.55	20211111	1200	249	9	24	10.6	8.8	1012	1330	x-xx	24	24	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-
0956	21	BPEX26	BAS...	BY20 FÅRÖDJ	5759.88	01952.73	20211111	1810	203		26	18	9.6	1007	9990	x---	17	17	x	x	-	x	-	x	x	x	x	x	x	x	x	x	x	-	x	-	-	-
0957	21	BPNX35	BAS...	BY29 / LL19	5852.90	02019.67	20211112	0220	178		30	12.5	8.1	1007	9999	x---	16	16	x	x	-	x	-	x	x	x	x	x	x	x	x	x	x	-	x	-	x	-
0958	21	BPNX00	EXT...	HUVUDSKÄR	5856.11	01909.49	20211112	0735	91		31	9	6.7	1013	0040	----	12		x	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	x	-
0959	21	BPNX37	BAS...	BY31 LANDSORTSDJ	5835.62	01814.18	20211112	1420	459	9	27	4.5	7.0	1016	1120	xxxx	23	23	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-
0960	21	BPWX38	BAS...	BY32 NORRKÖPINGSDJ	5801.01	01759.09	20211112	2010	205		08	2.6	7.6	1017	9999	x---	17	17	x	x	-	x	-	x	x	x	x	x	x	x	x	x	x	-	x	-	x	-
0961	21	BPWX45	BAS...	BY38 KARLSÖDJ	5707.02	01740.09	20211113	0255	114		14	4	8.2	1017	9990	x---	14	14	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	-	x	x	x	-
0962	21	BPSE49	BAS...	BY39 ÖLANDS S UDDE	5606.97	01632.13	20211113	1030	50		14	7.1	7.7	1016	2830	x---	8	8	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	x	-
0963	21	BPWK01	BAS...	REF M1V1	5622.24	01612.12	20211113	1345	21	7	11	6.7	7.7	1015	2820	xxx-	5	5	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	-	x	-
0964	21	BPSH05	BAS...	HANÖBUKTEN	5537.04	01452.04	20211113	2030	80		09	4	8.4	1017	9990	x---	11	11	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	x	-
0965	21	KAEX29	BAS...	ANHOLT E	5640.12	01206.67	20211114	1440	62		08	6.2	8.1	1029	2820	xxx-	10	10	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x	-

STATION SLÄGGÖ SURFACE WATER (0-10 m)

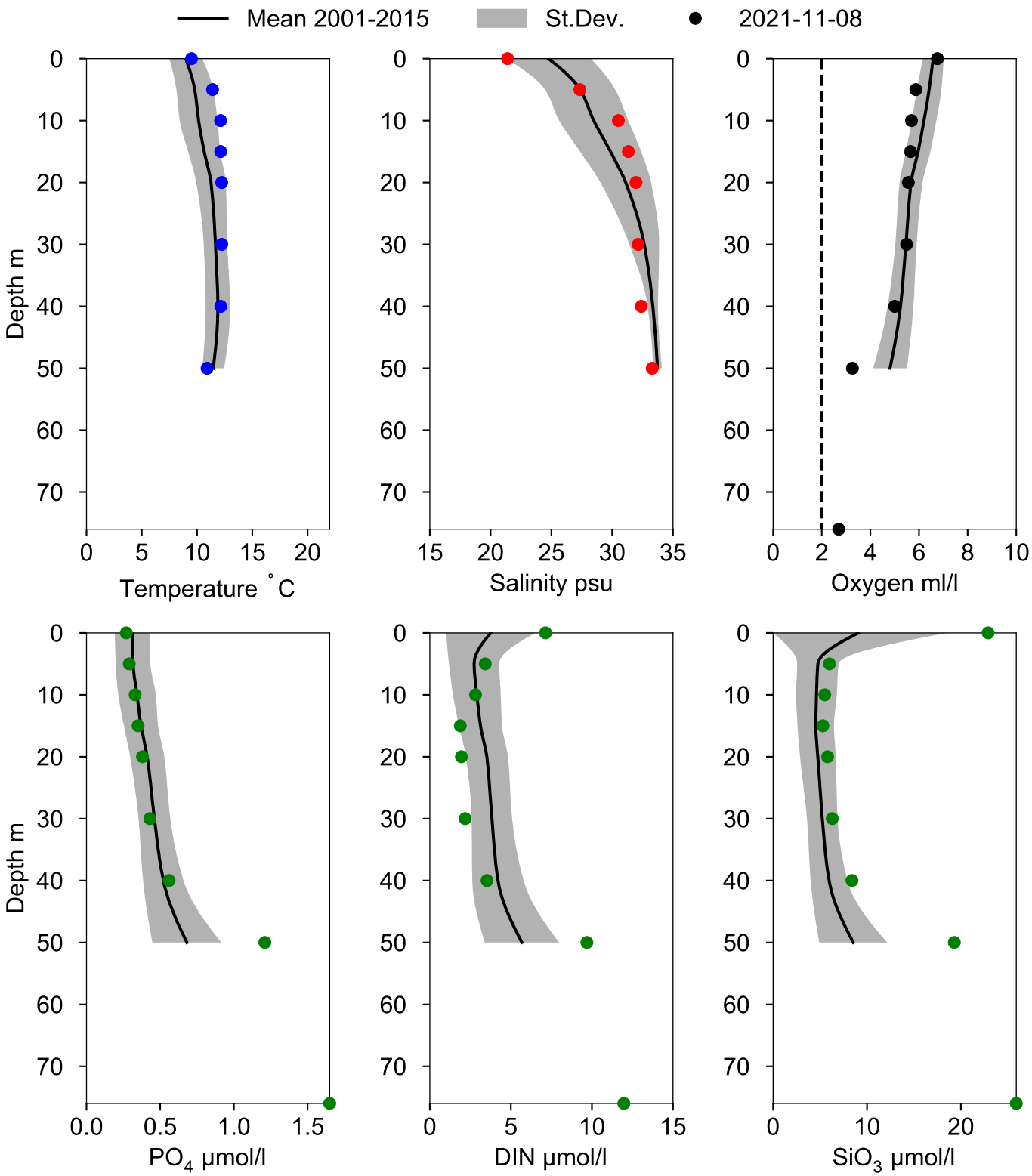
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 64 m)

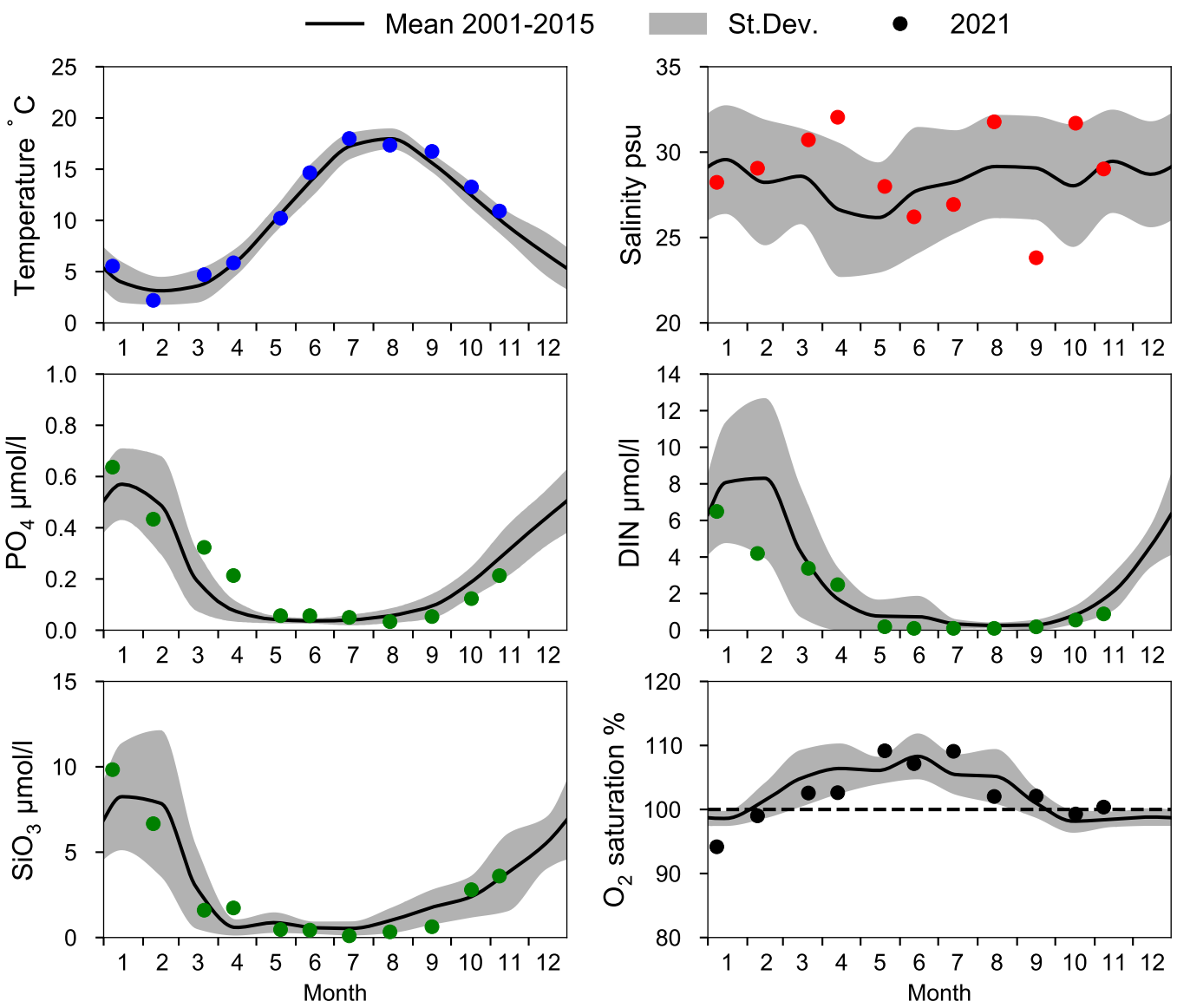


Vertical profiles SLÄGGÖ
November

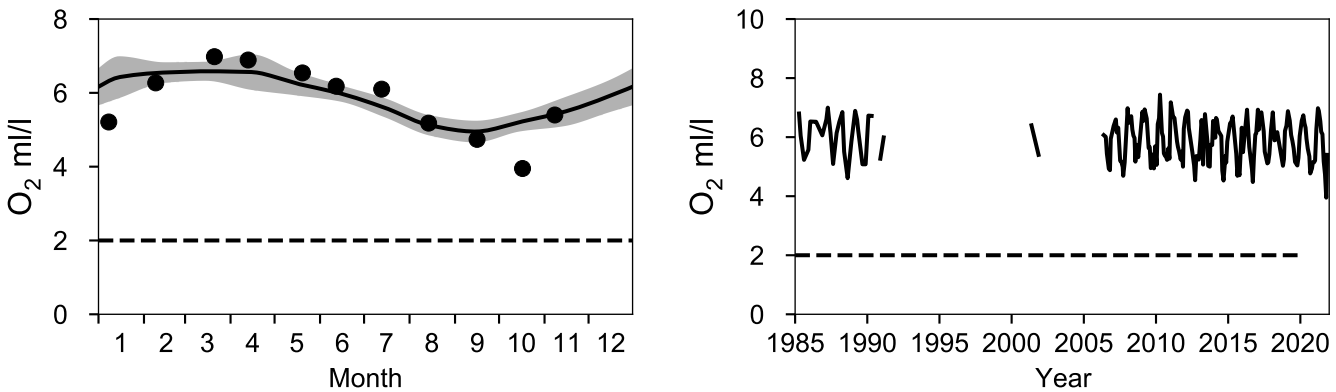


STATION Å13 SURFACE WATER (0-10 m)

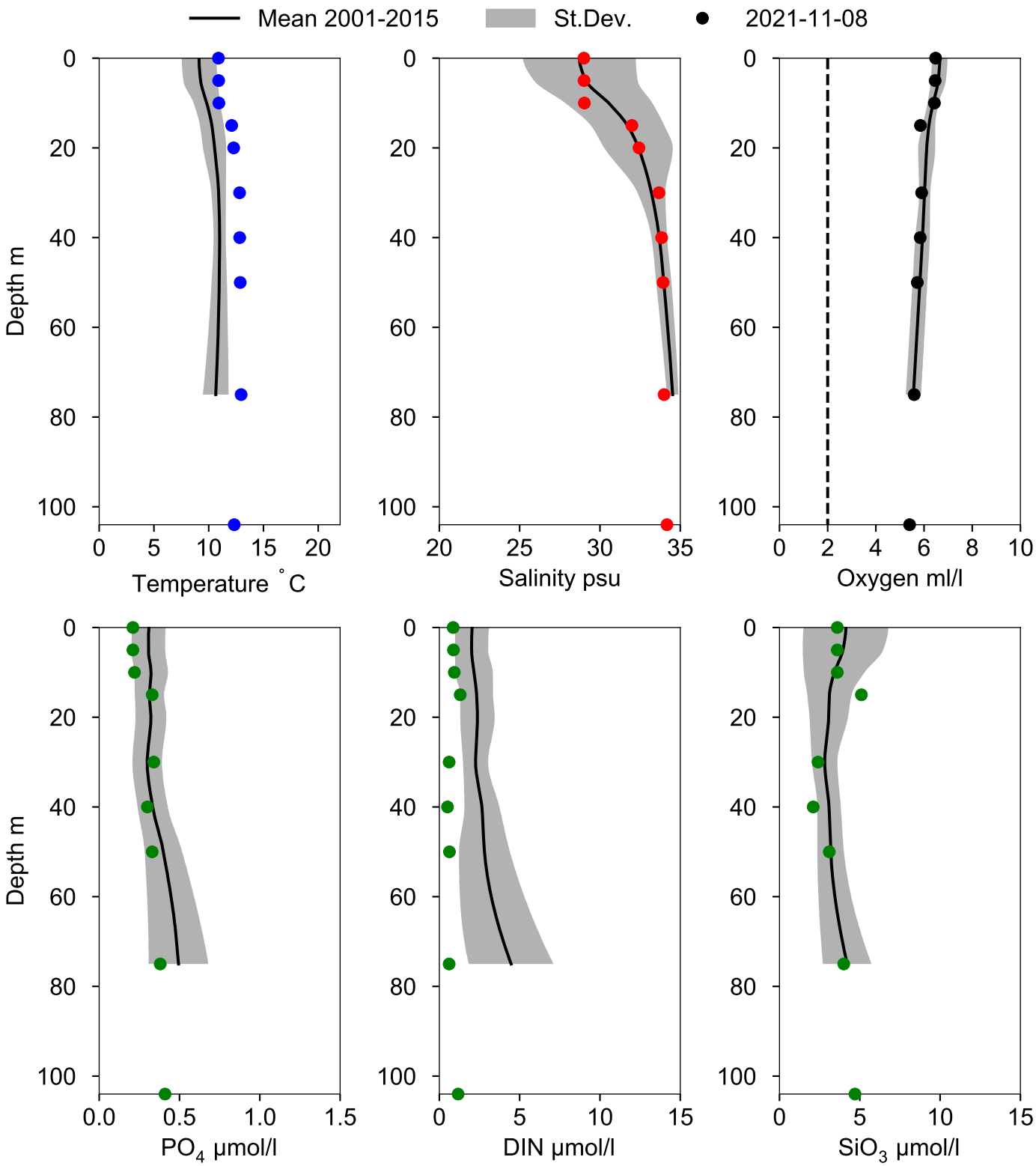
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 82 m)

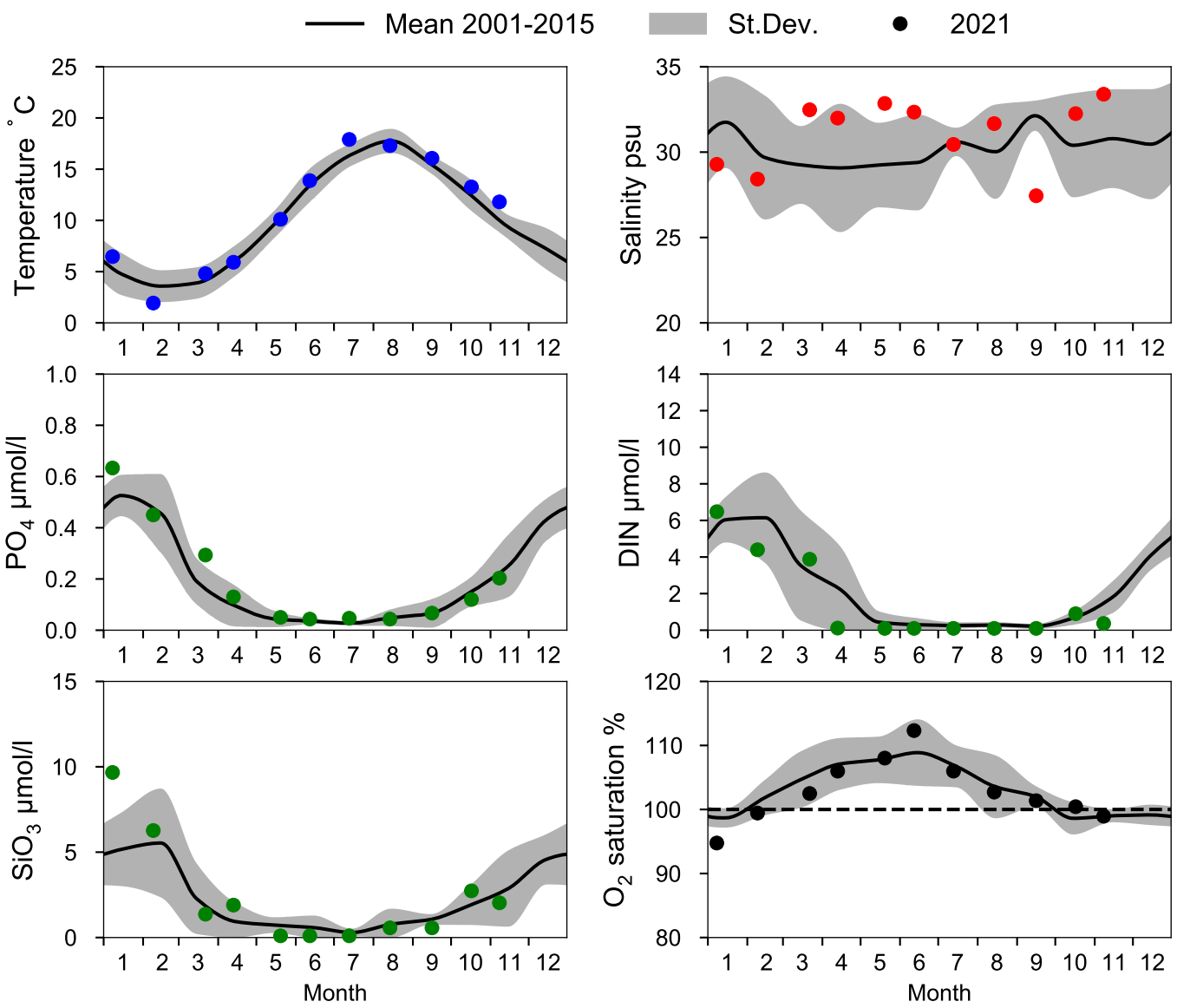


Vertical profiles Å13
November

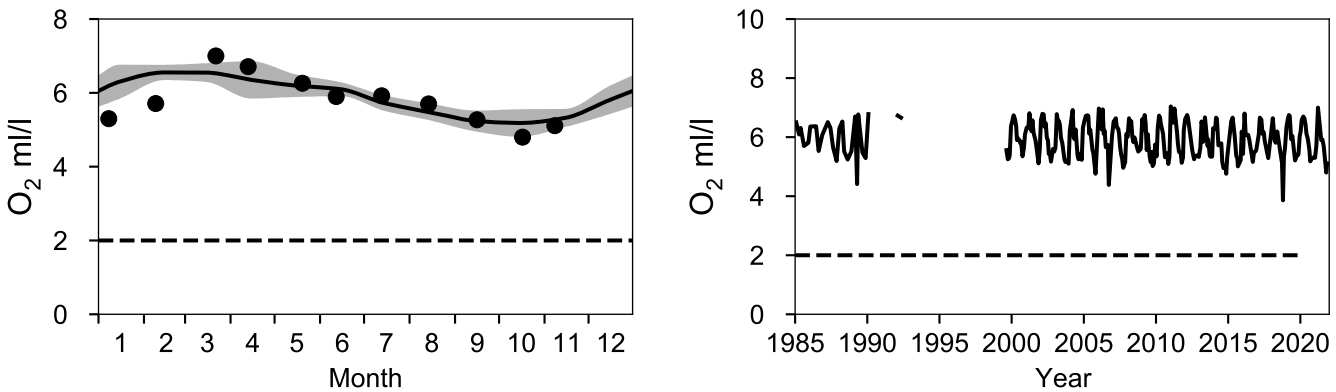


STATION Å15 SURFACE WATER (0-10 m)

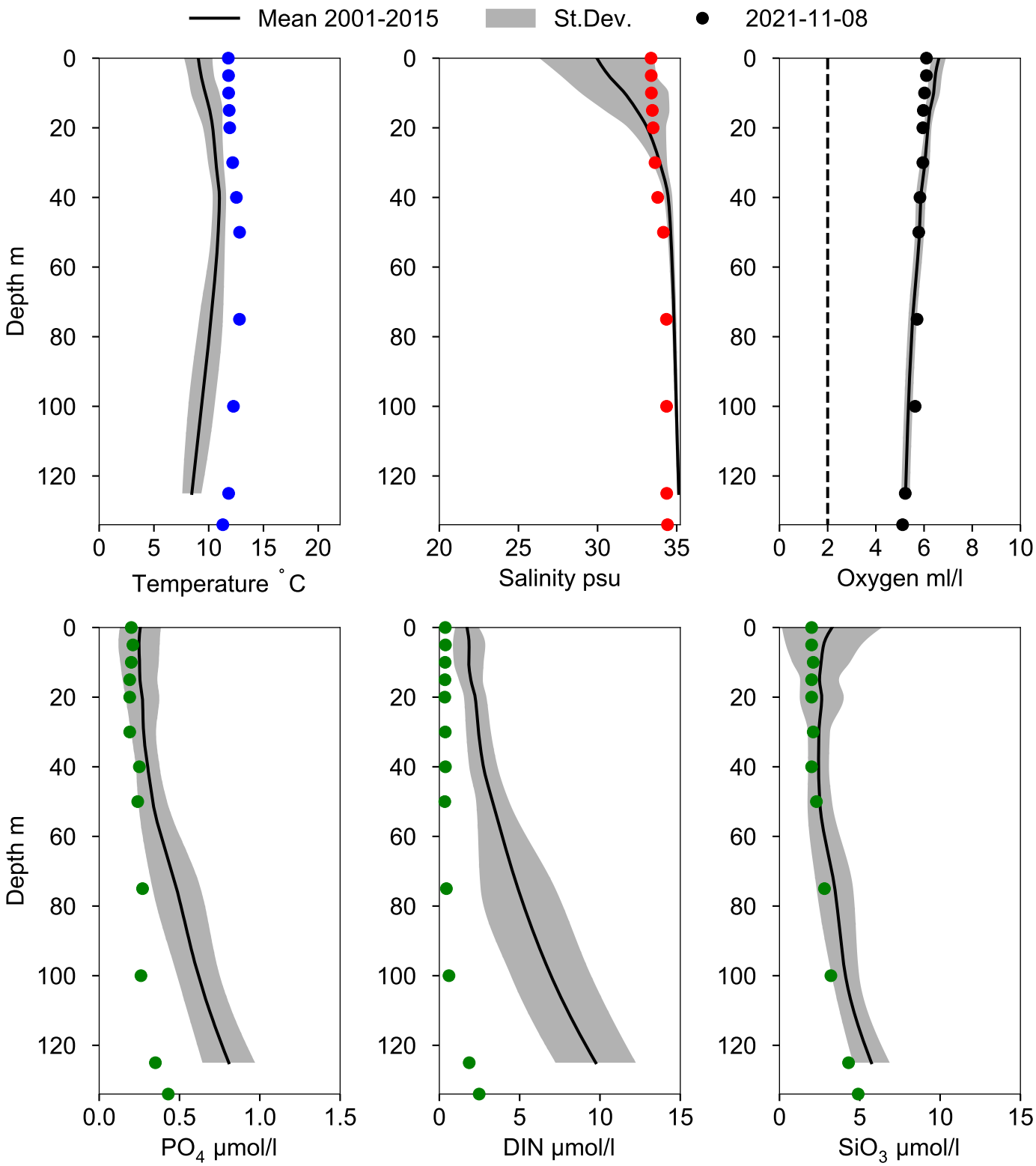
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 125 m)

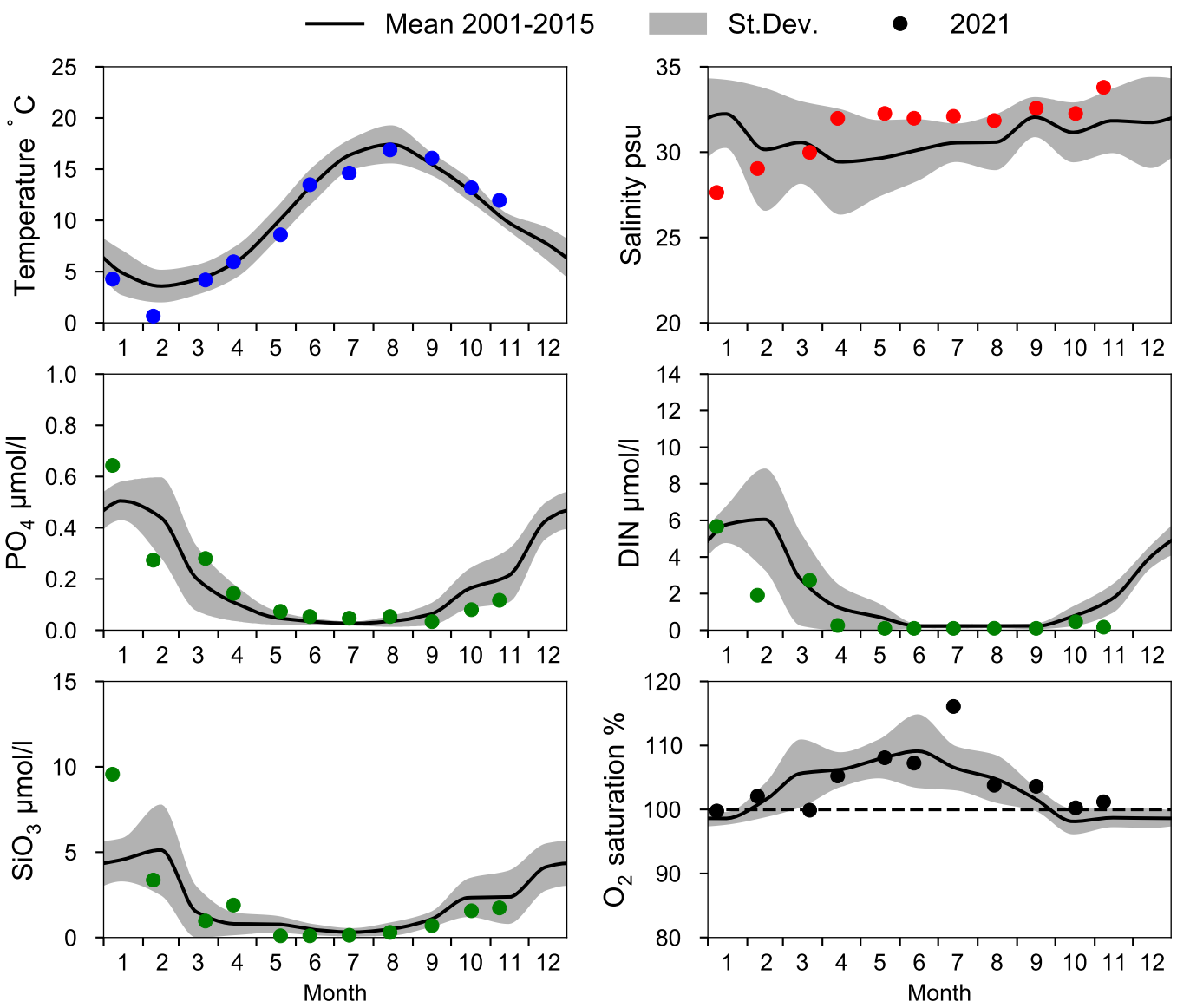


Vertical profiles Å15
November

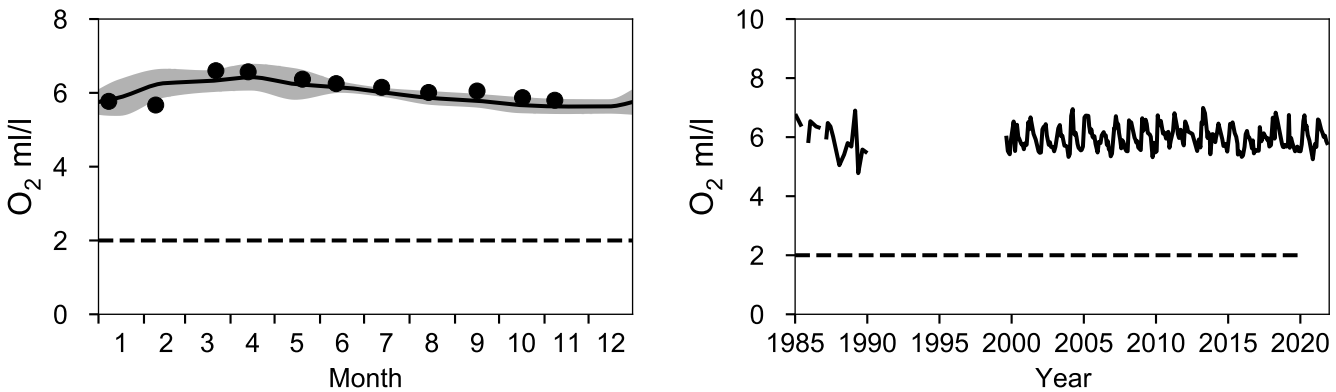


STATION Å17 SURFACE WATER (0-10 m)

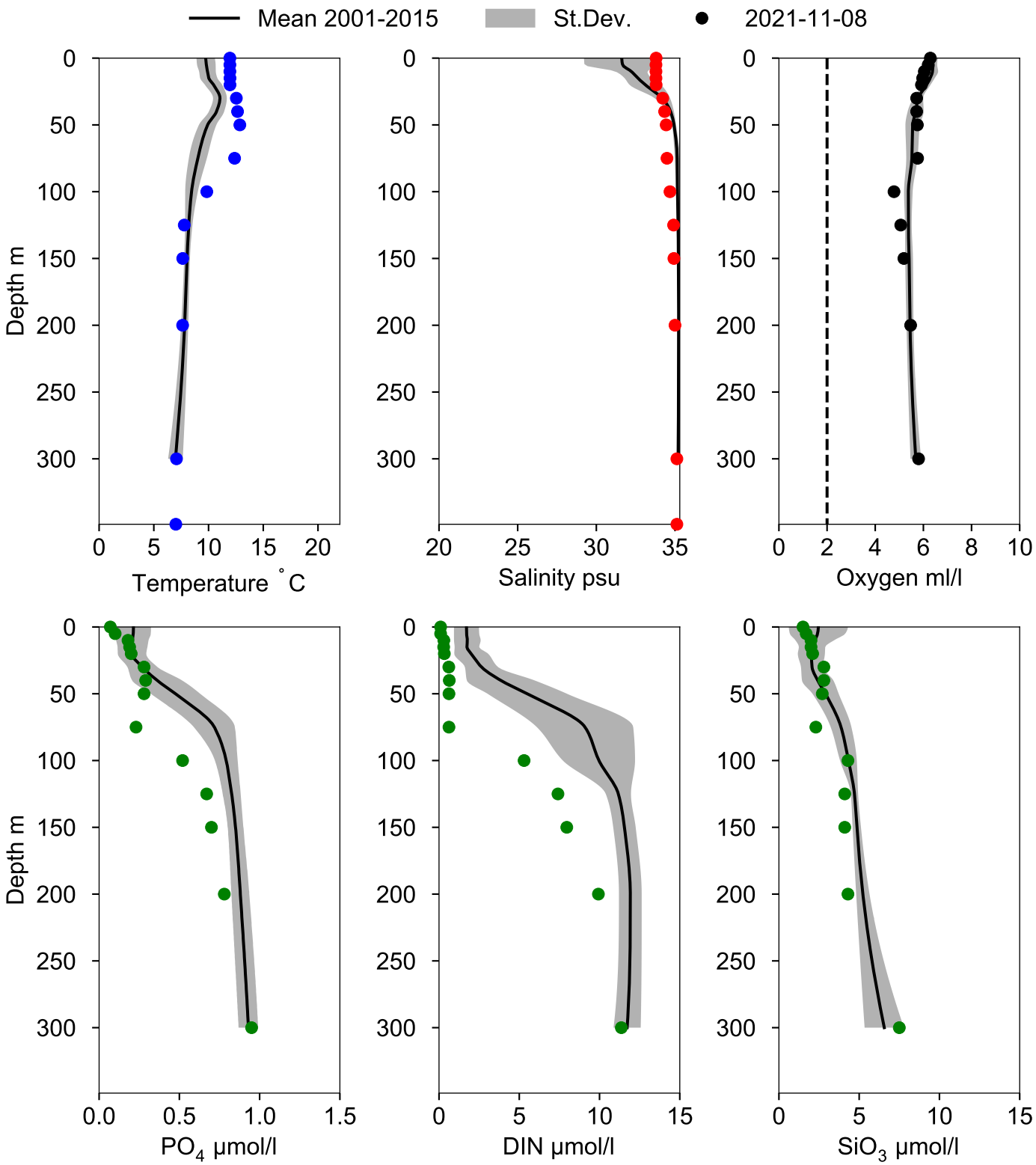
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 300 m)

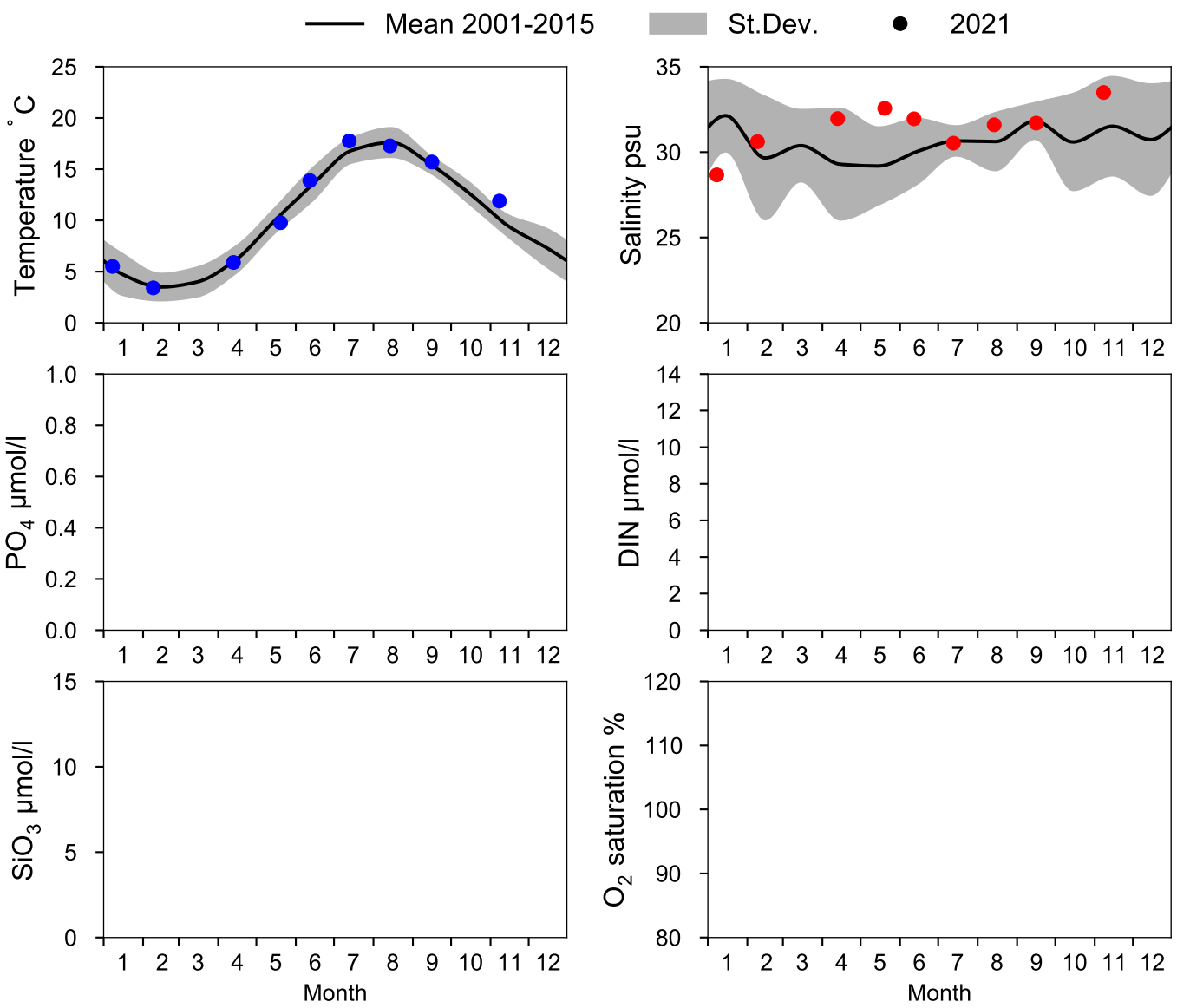


Vertical profiles Å17
November

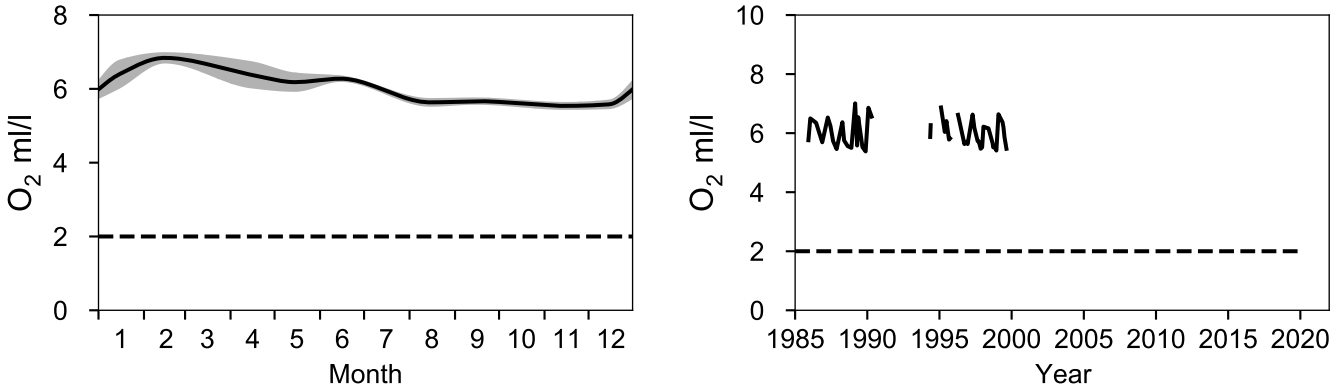


STATION Å16 SURFACE WATER (0-10 m)

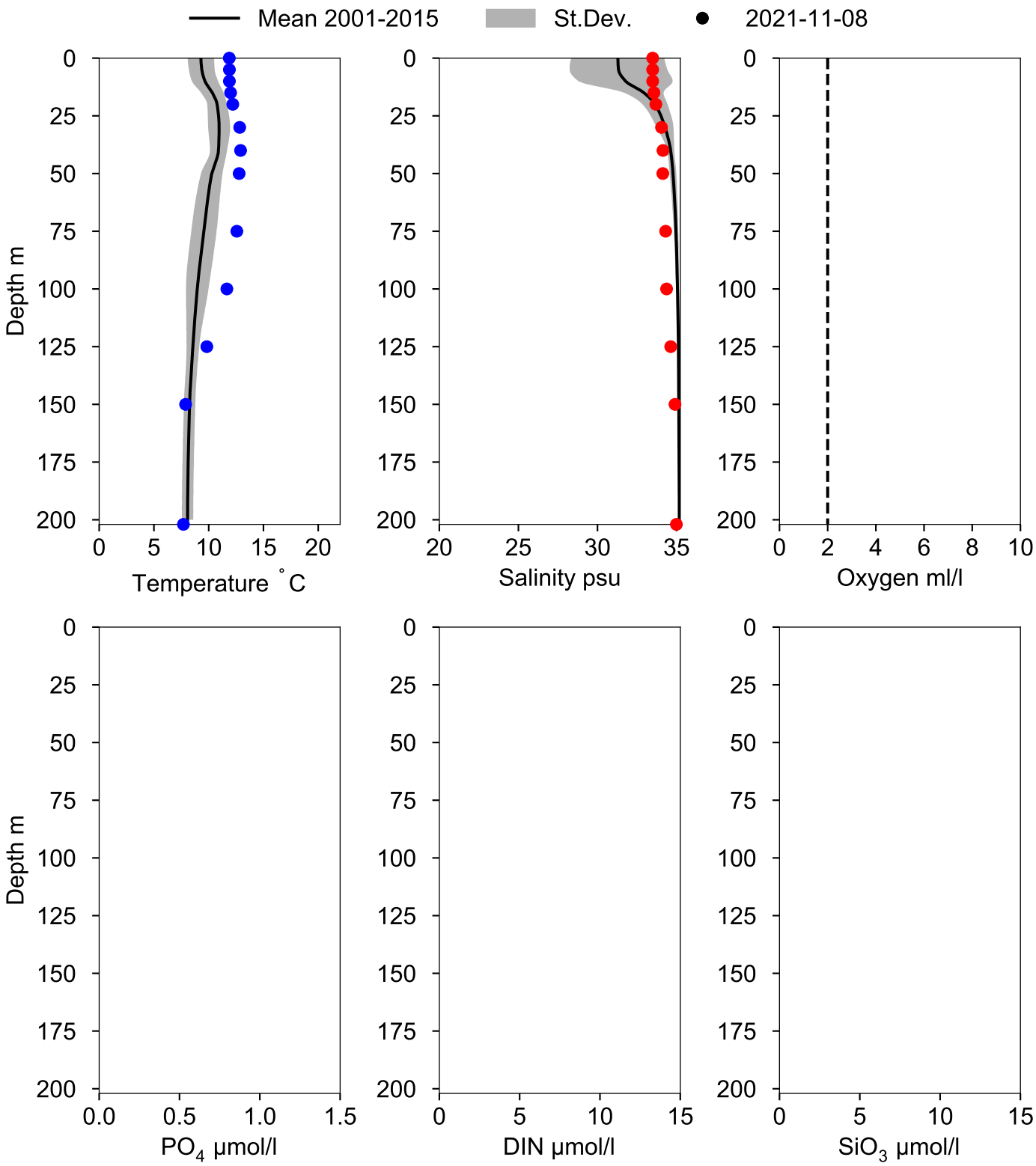
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 193 m)

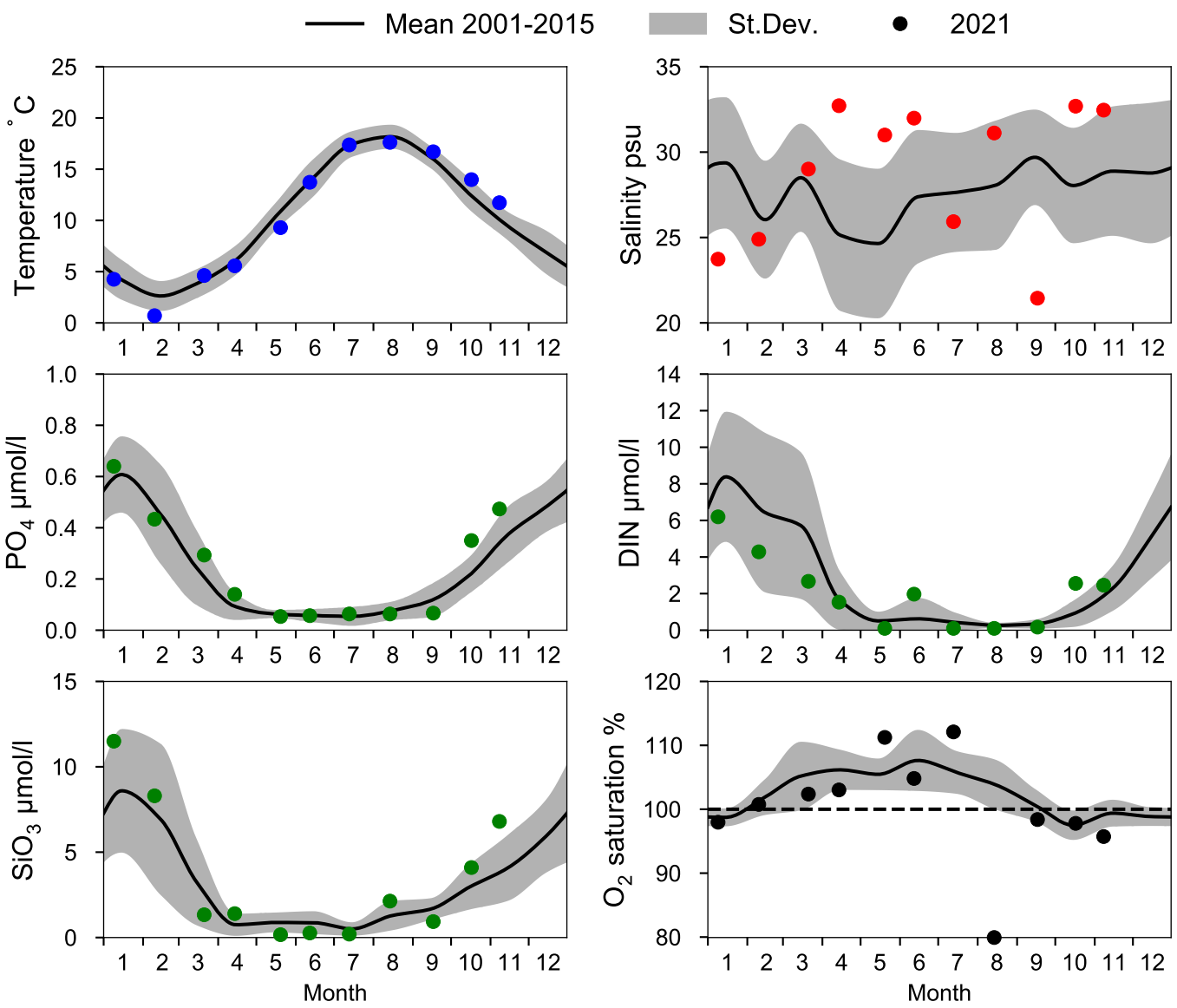


Vertical profiles Å16
November

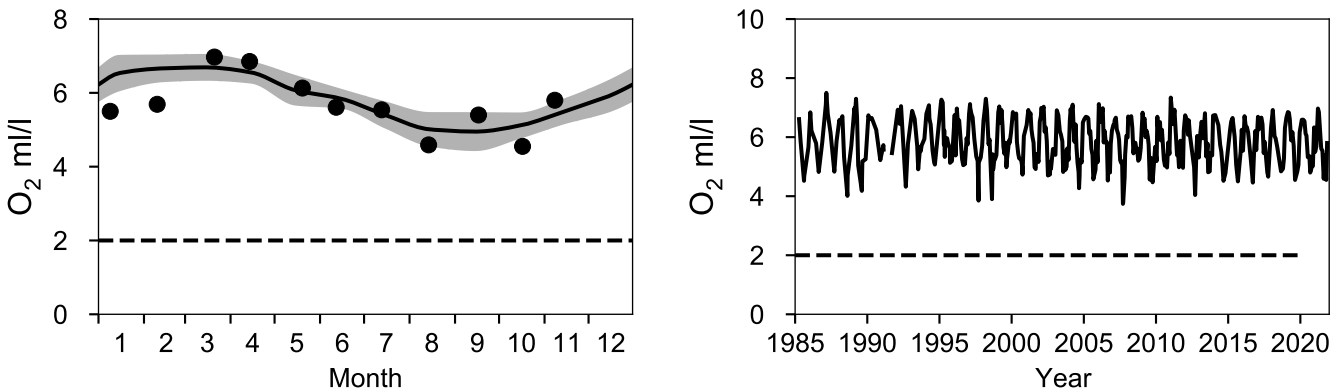


STATION P2 SURFACE WATER (0-10 m)

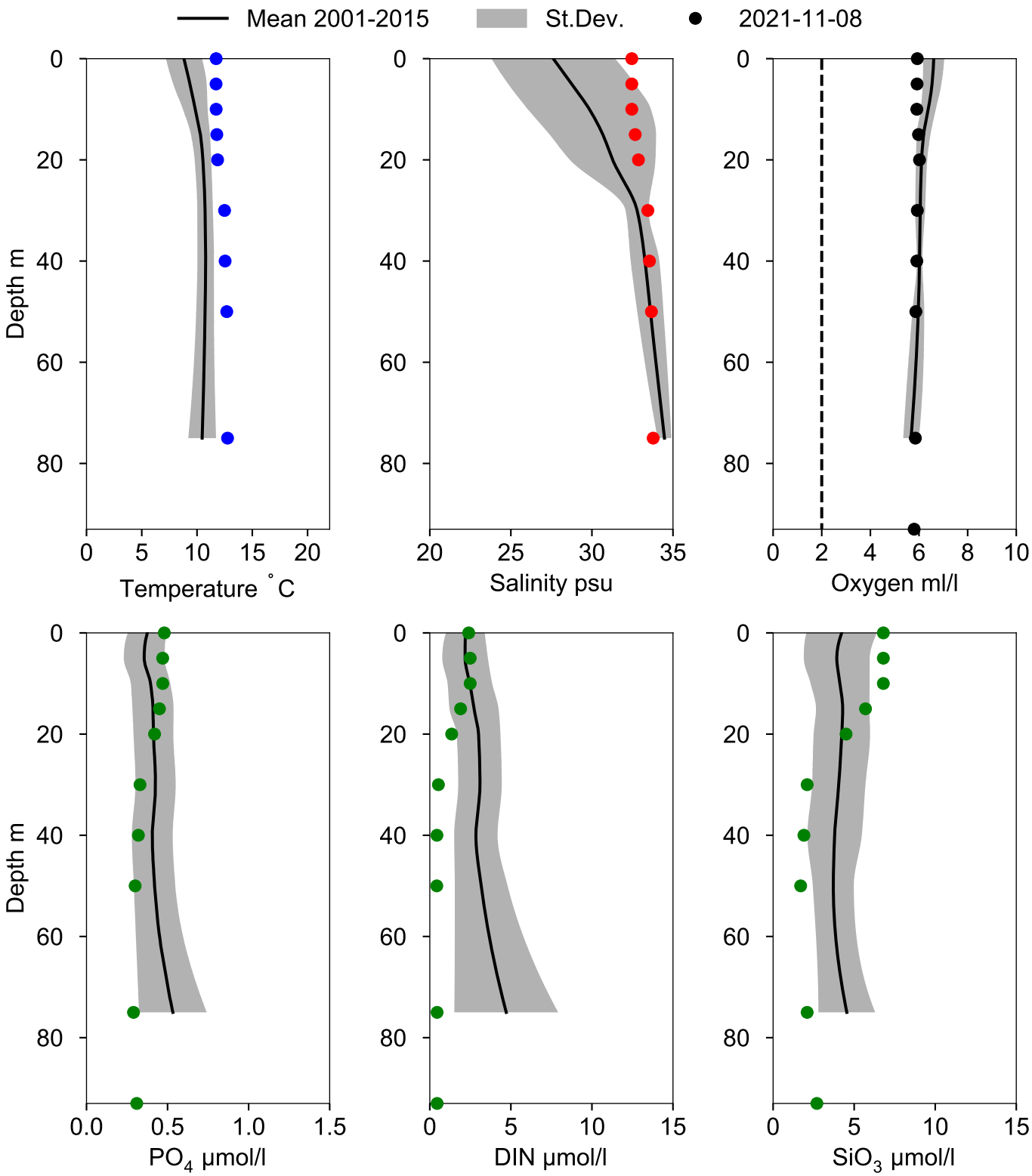
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 75 m)

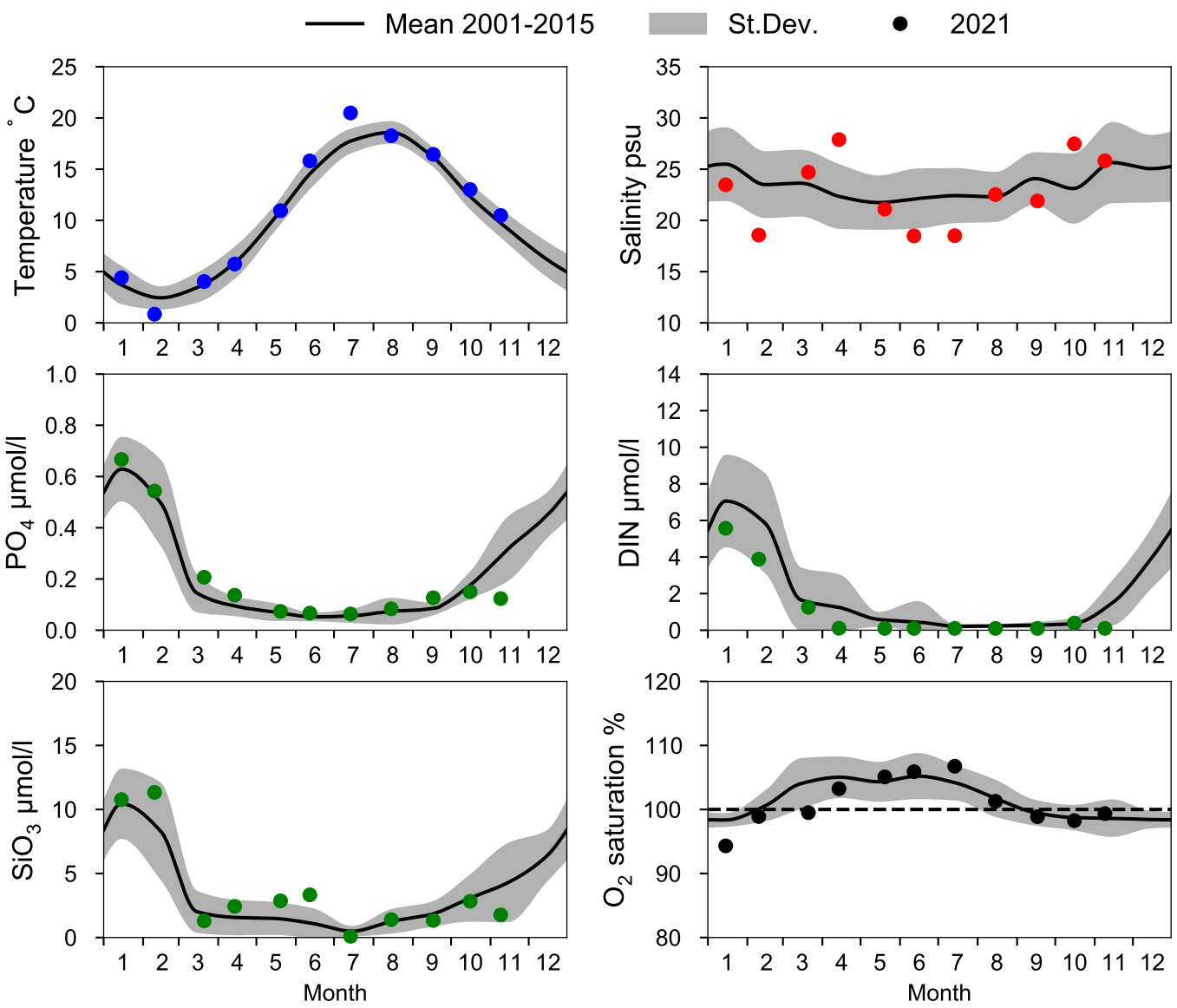


Vertical profiles P2
November

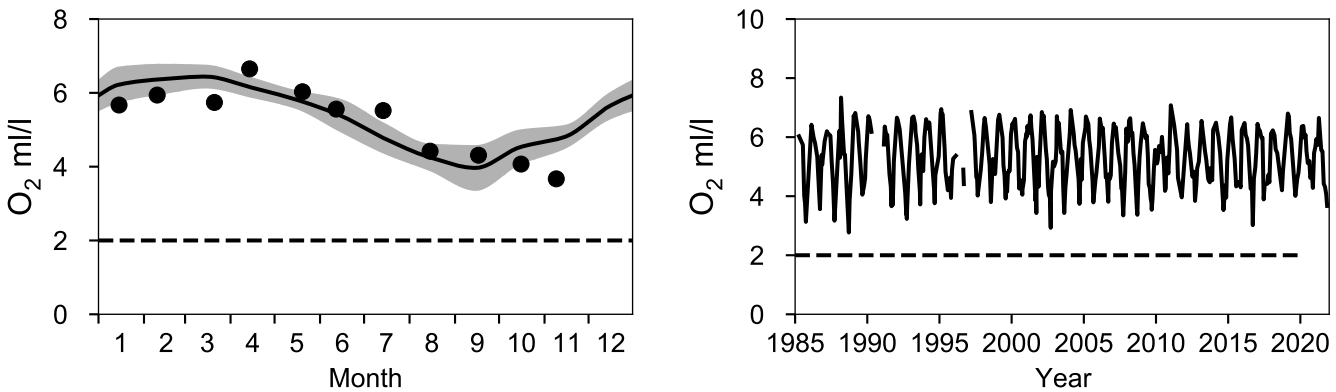


STATION FLADEN SURFACE WATER (0-10 m)

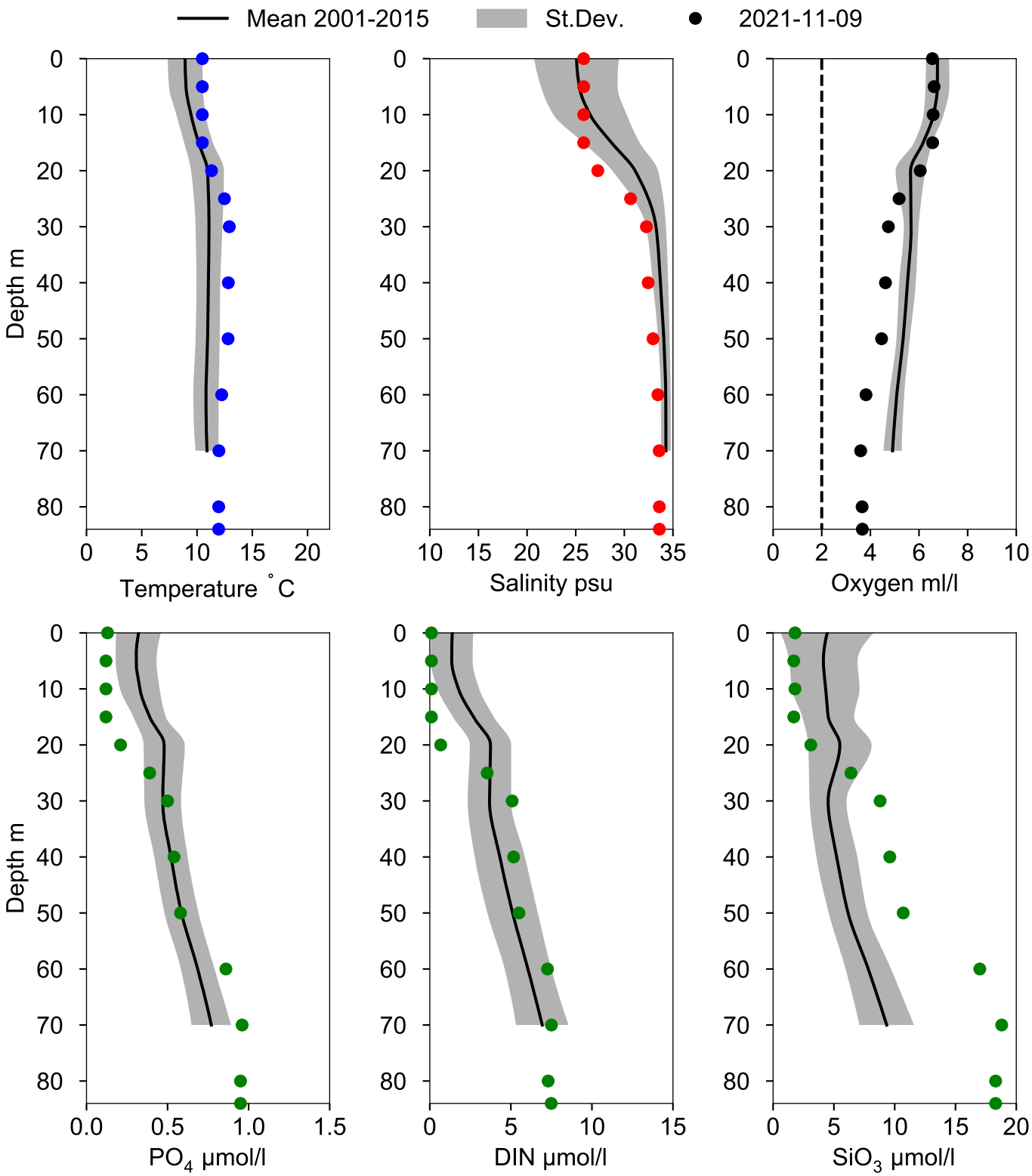
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 74 m)

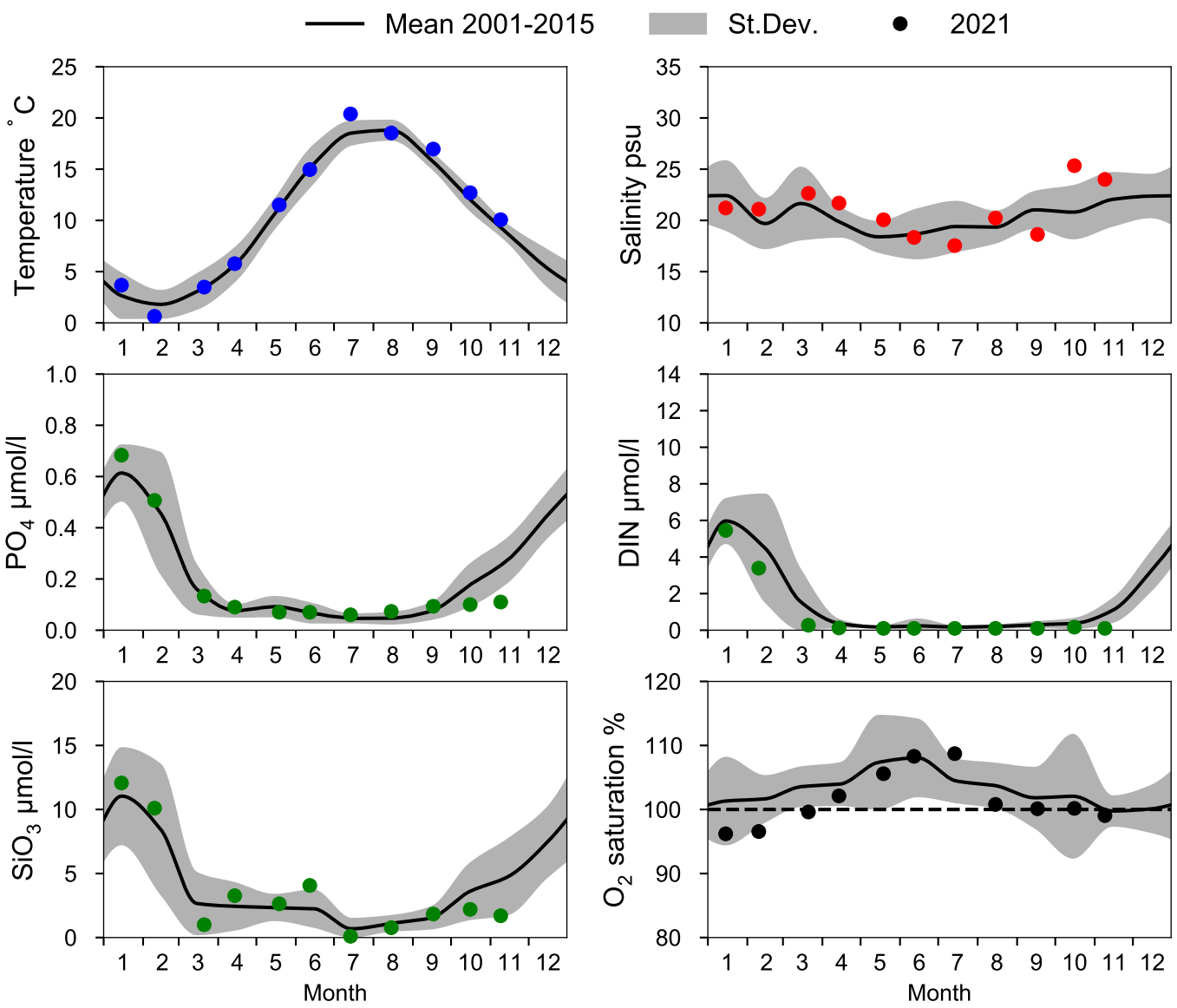


Vertical profiles FLADEN
November

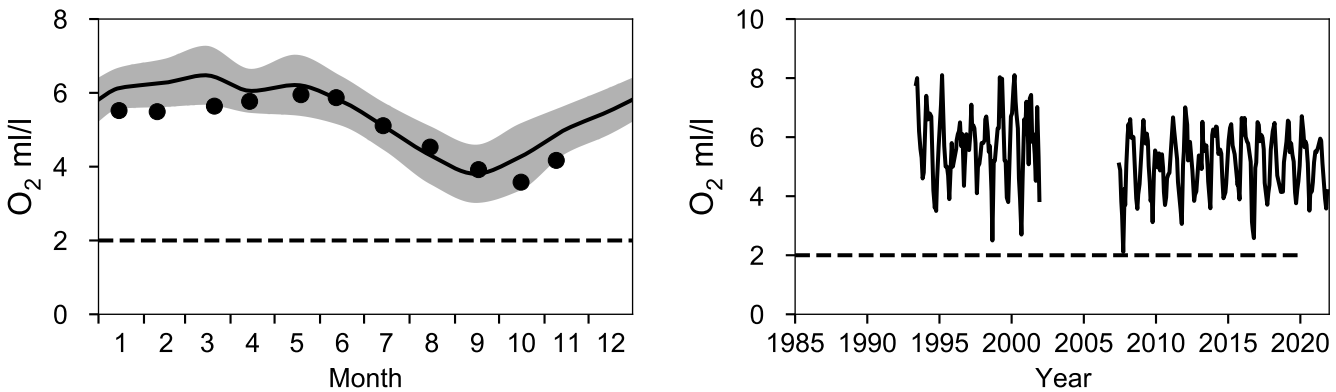


STATION N14 FALKENBERG SURFACE WATER (0-10 m)

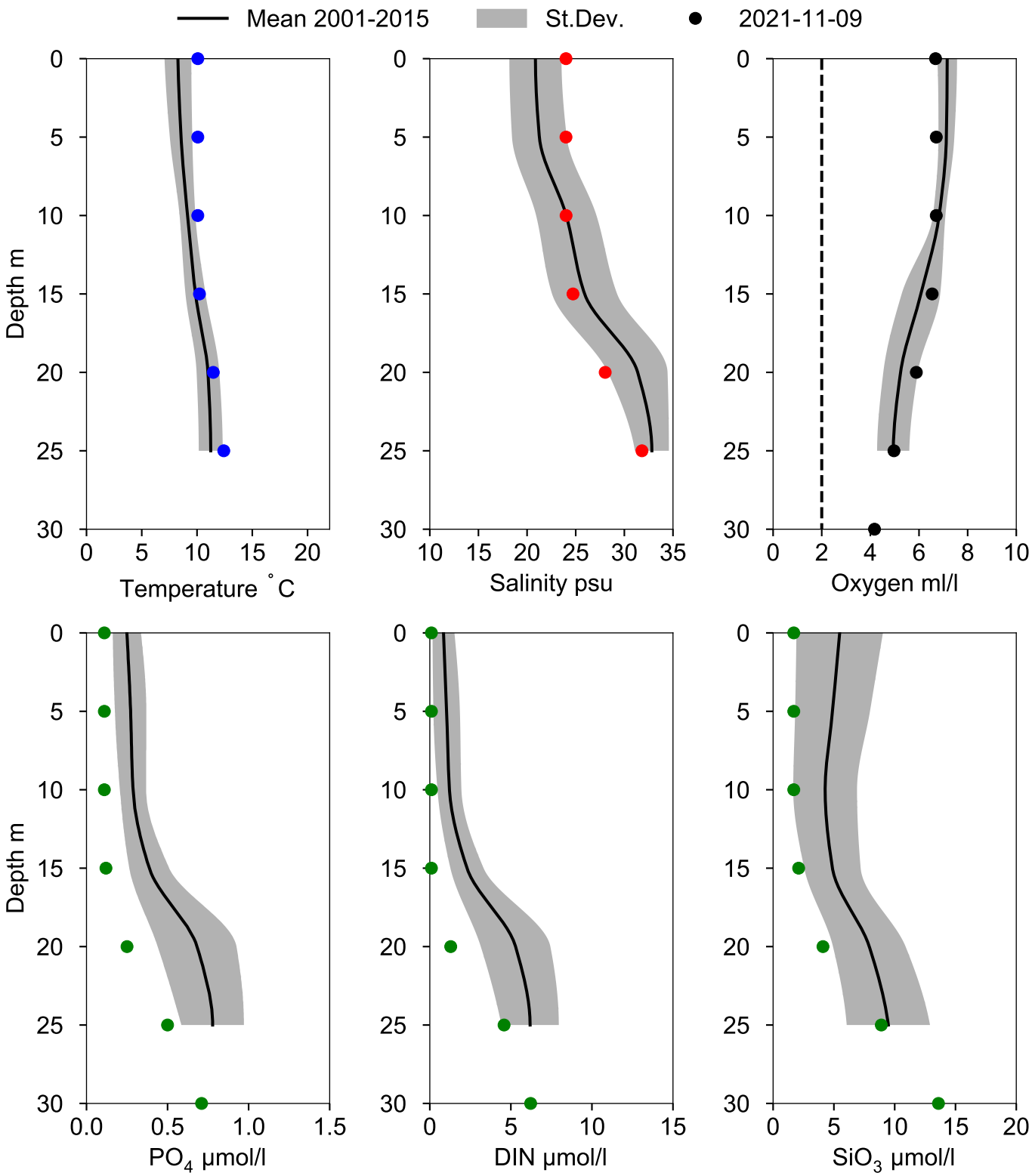
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 25 m)

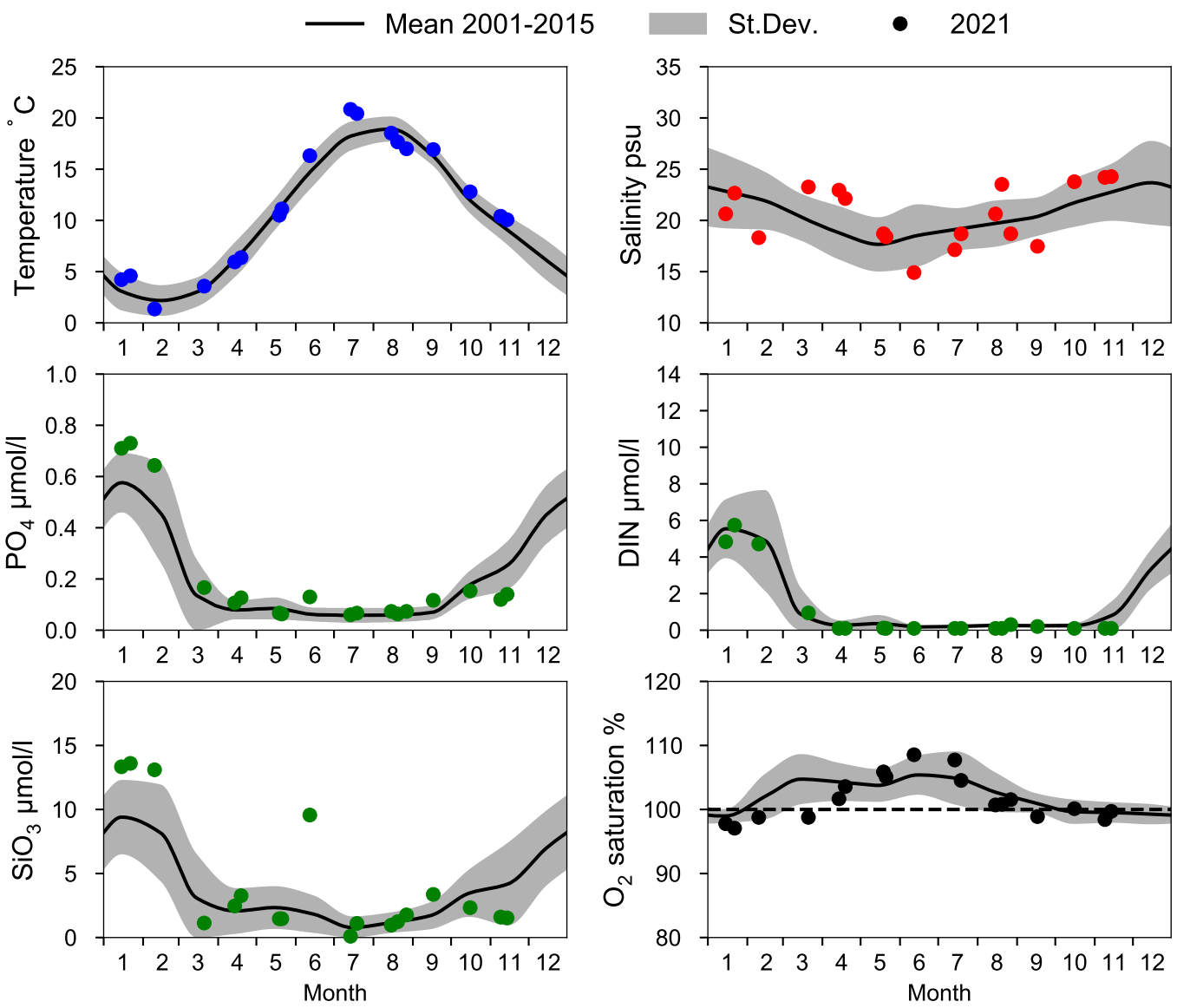


Vertical profiles N14 FALKENBERG
November

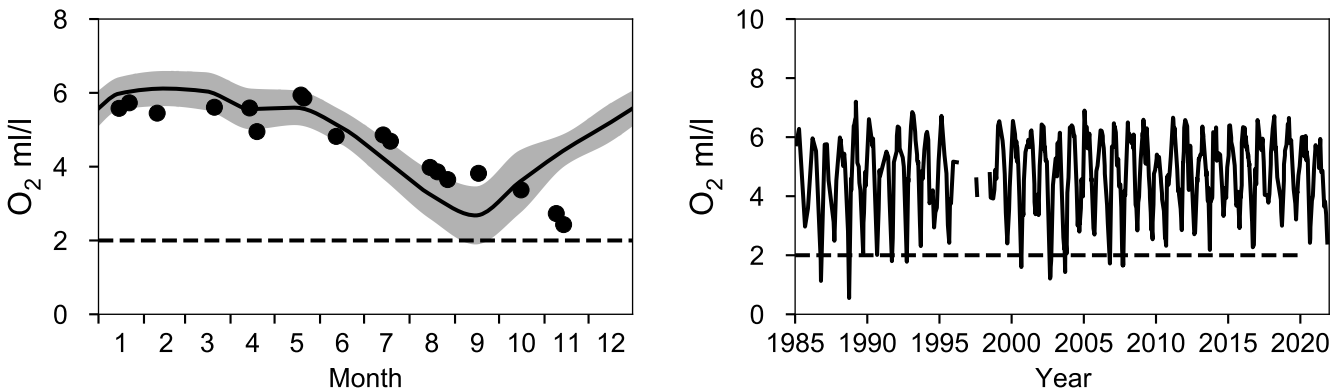


STATION ANHOLT E SURFACE WATER (0-10 m)

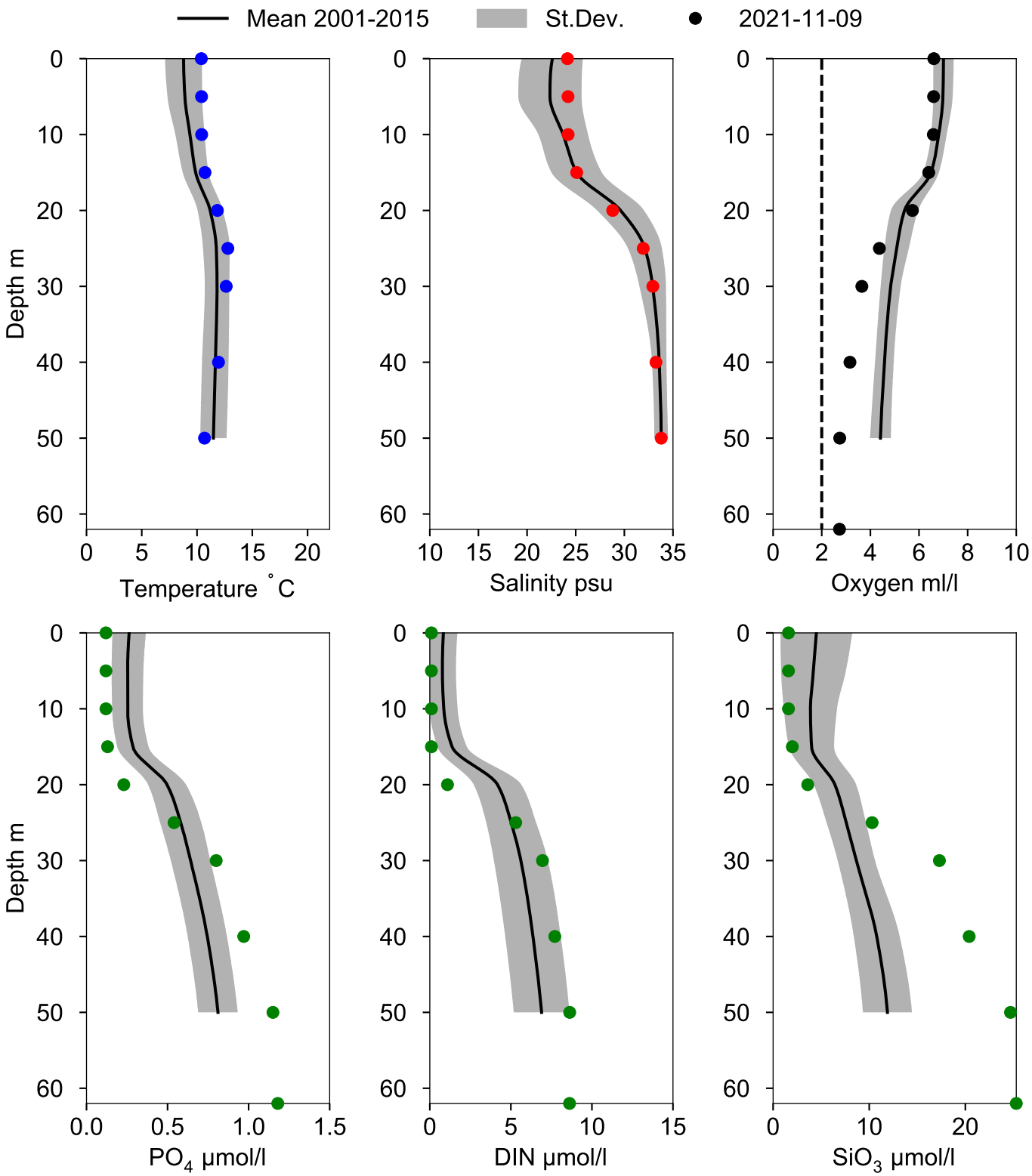
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 52 m)

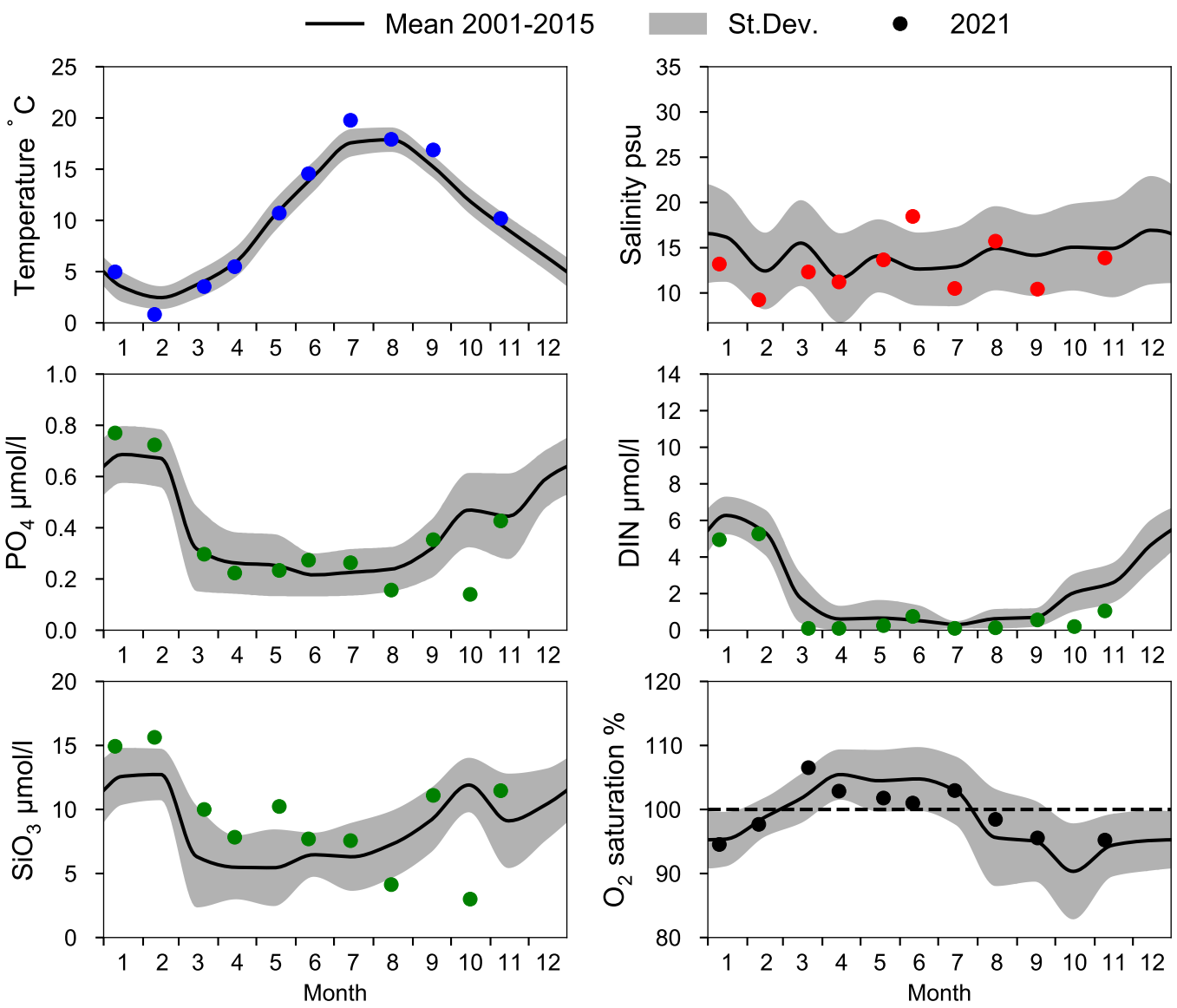


Vertical profiles ANHOLT E
November

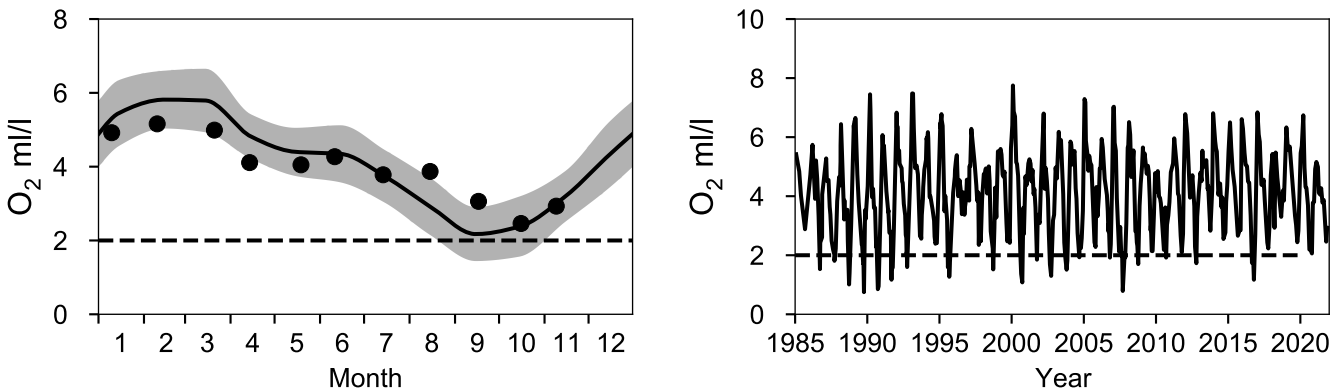


STATION W LANDSKRONA SURFACE WATER (0-10 m)

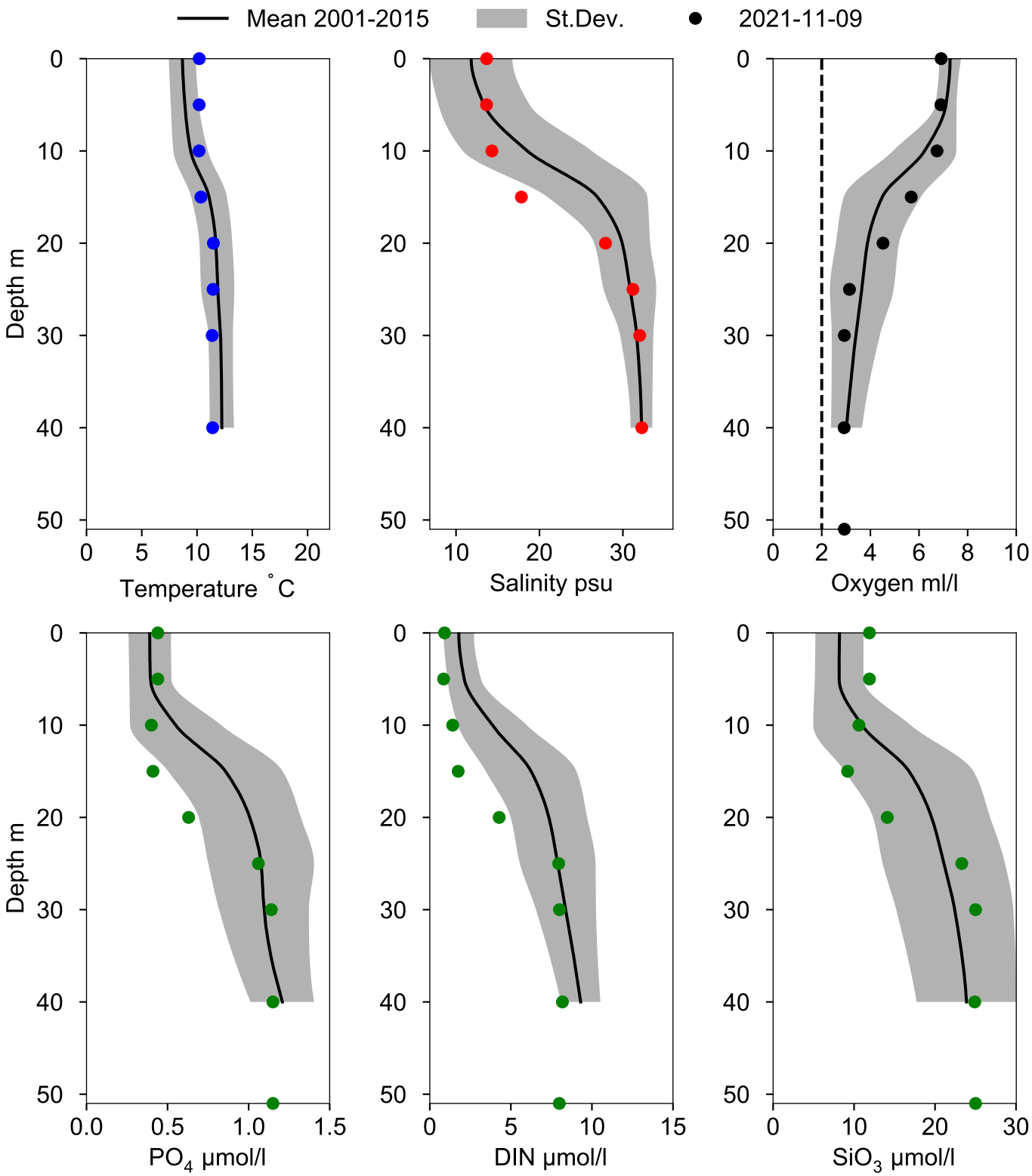
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 40 m)

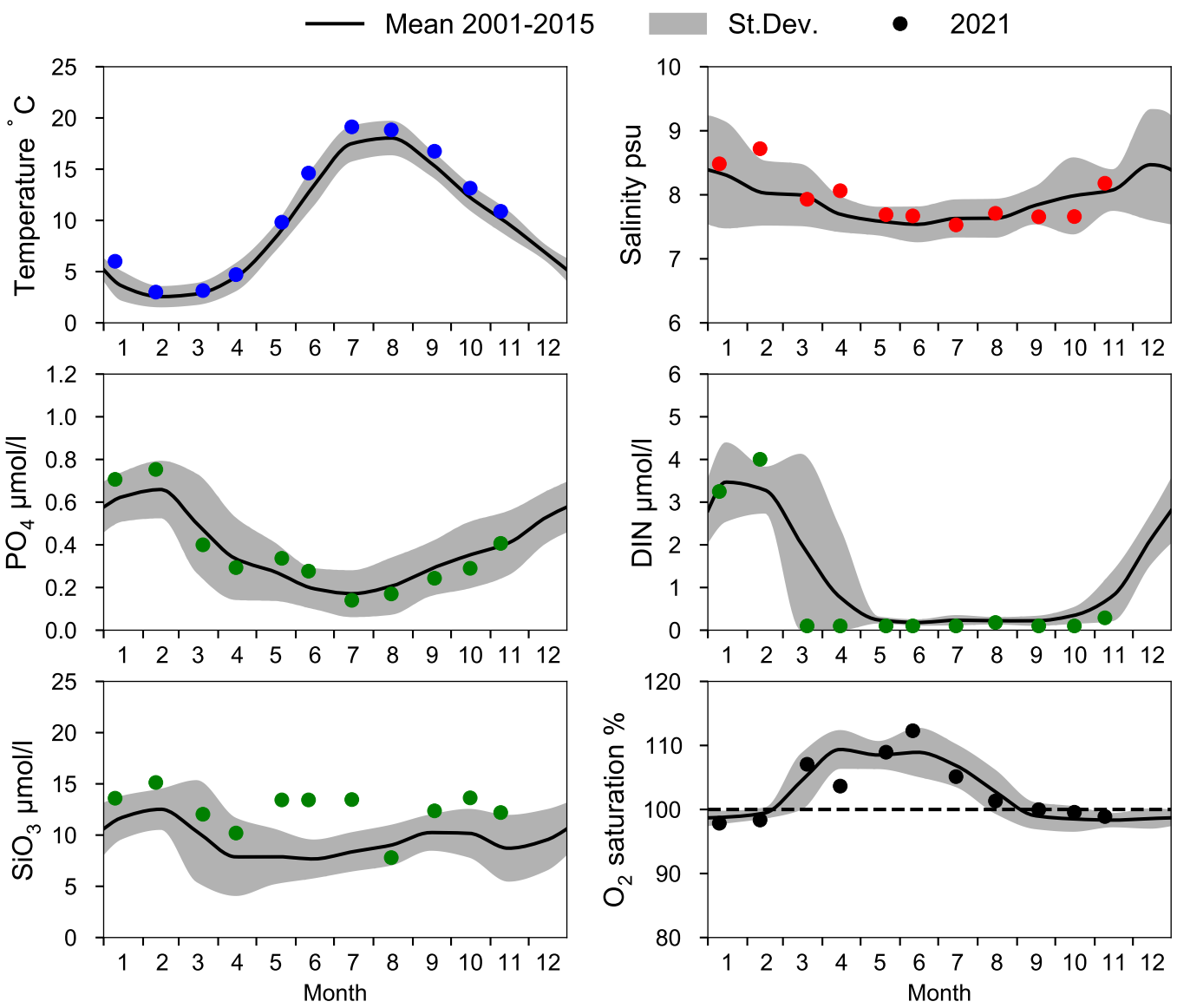


Vertical profiles W LANDSKRONA
November

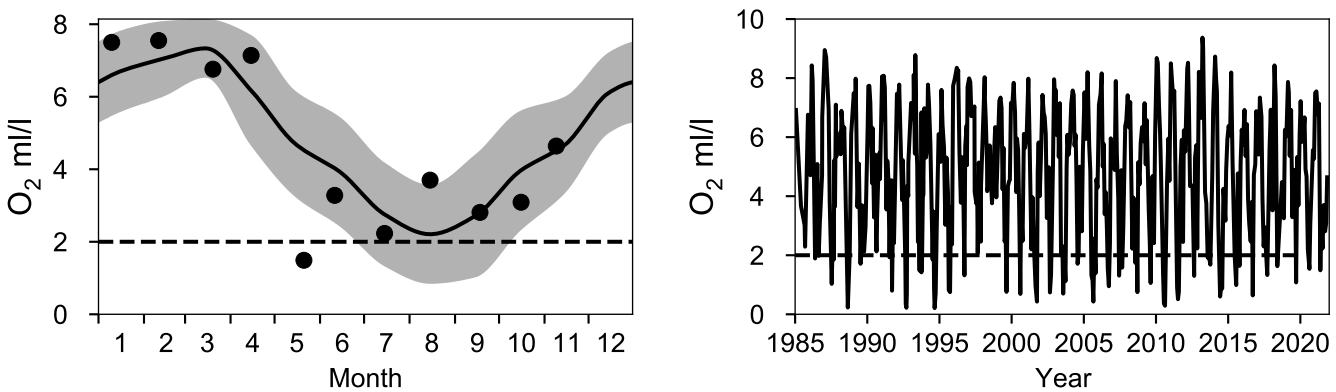


STATION BY1 SURFACE WATER (0-10 m)

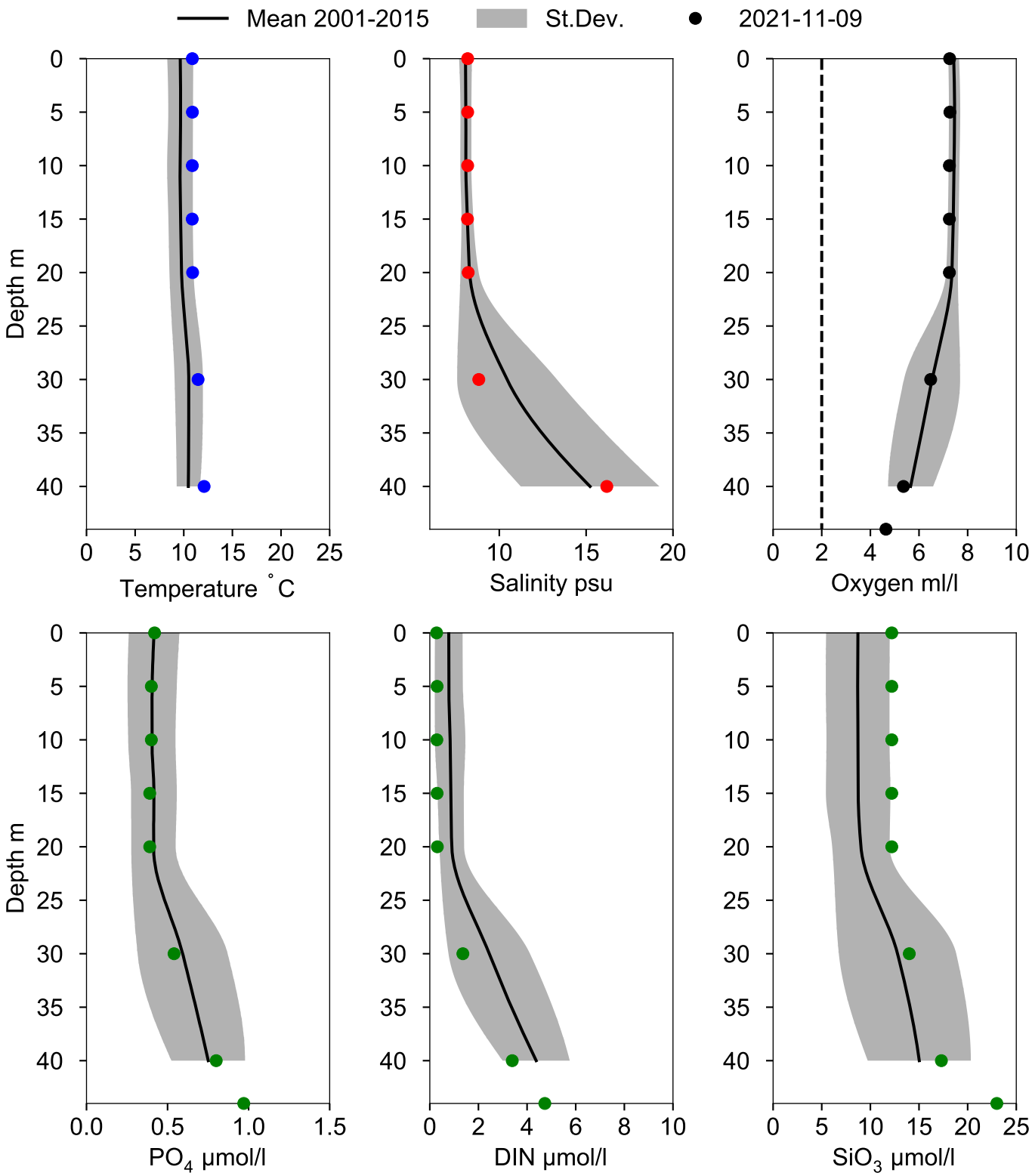
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 39 m)

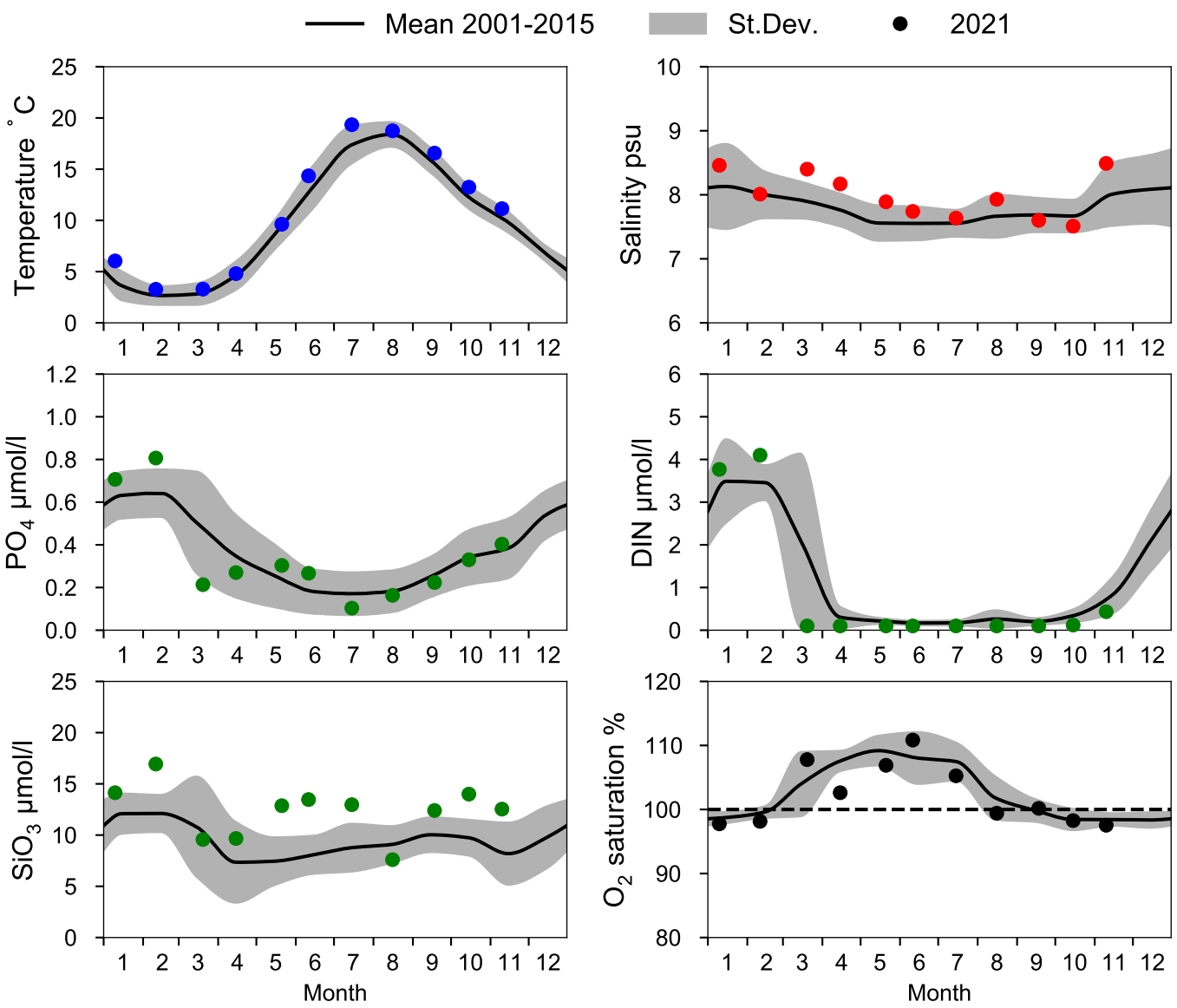


Vertical profiles BY1
November

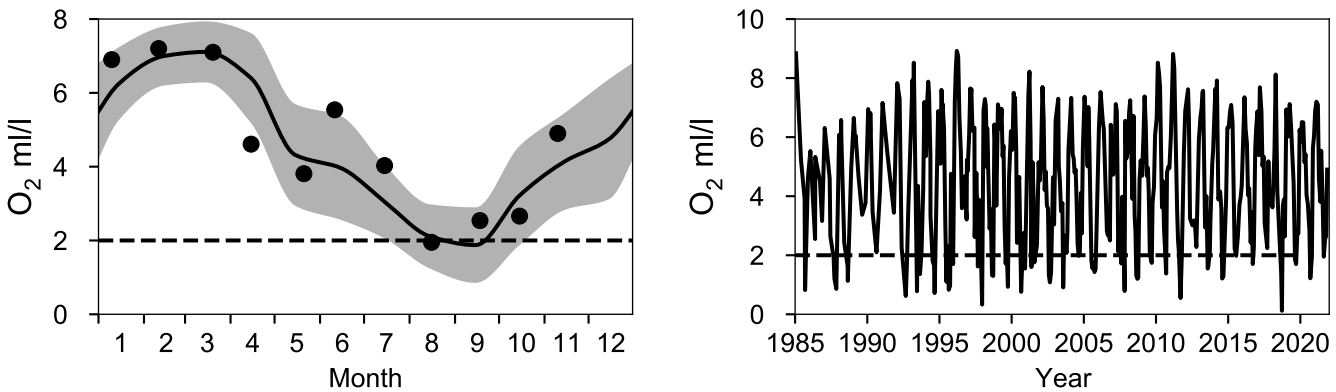


STATION BY2 ARKONA SURFACE WATER (0-10 m)

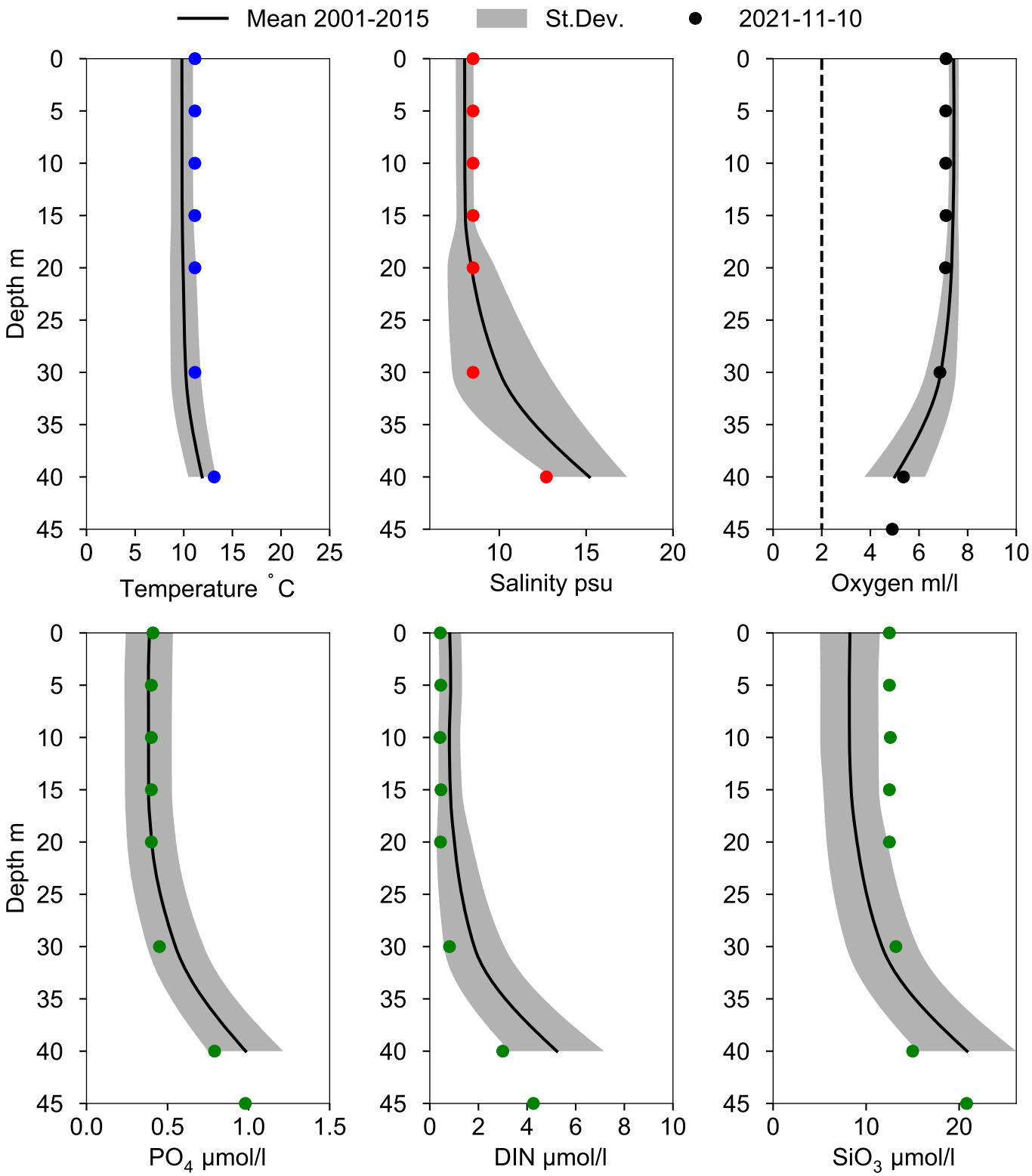
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 40 m)

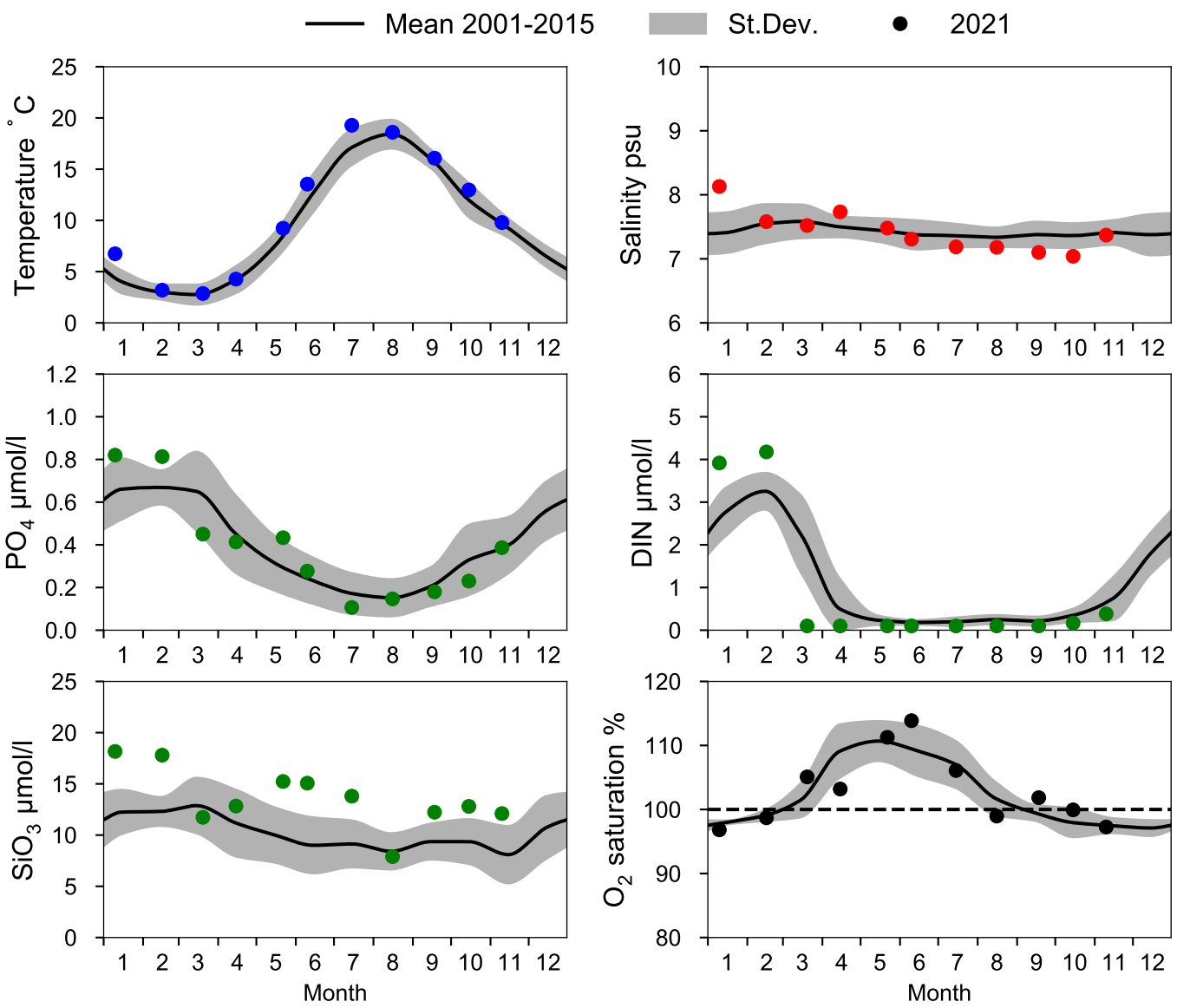


Vertical profiles BY2 ARKONA
November

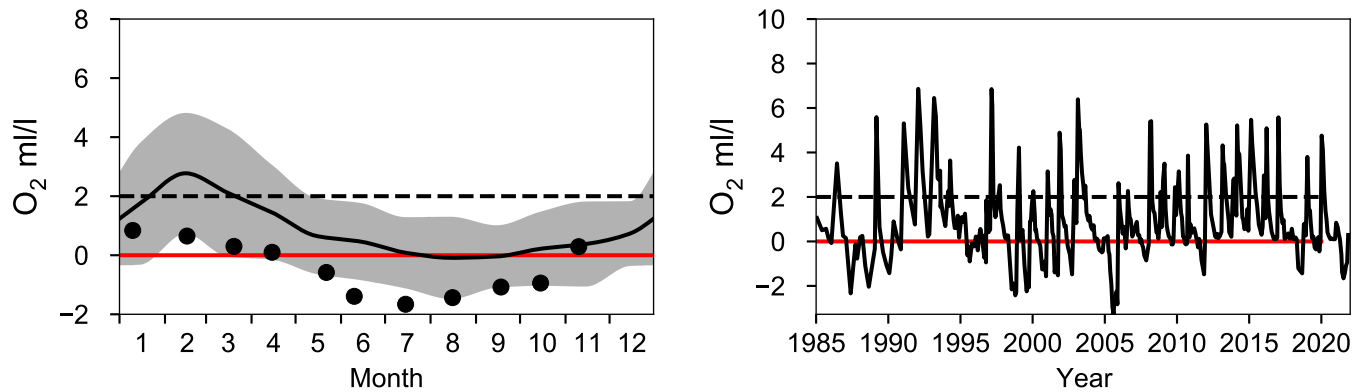


STATION BY4 CHRISTIANSÖ SURFACE WATER (0-10 m)

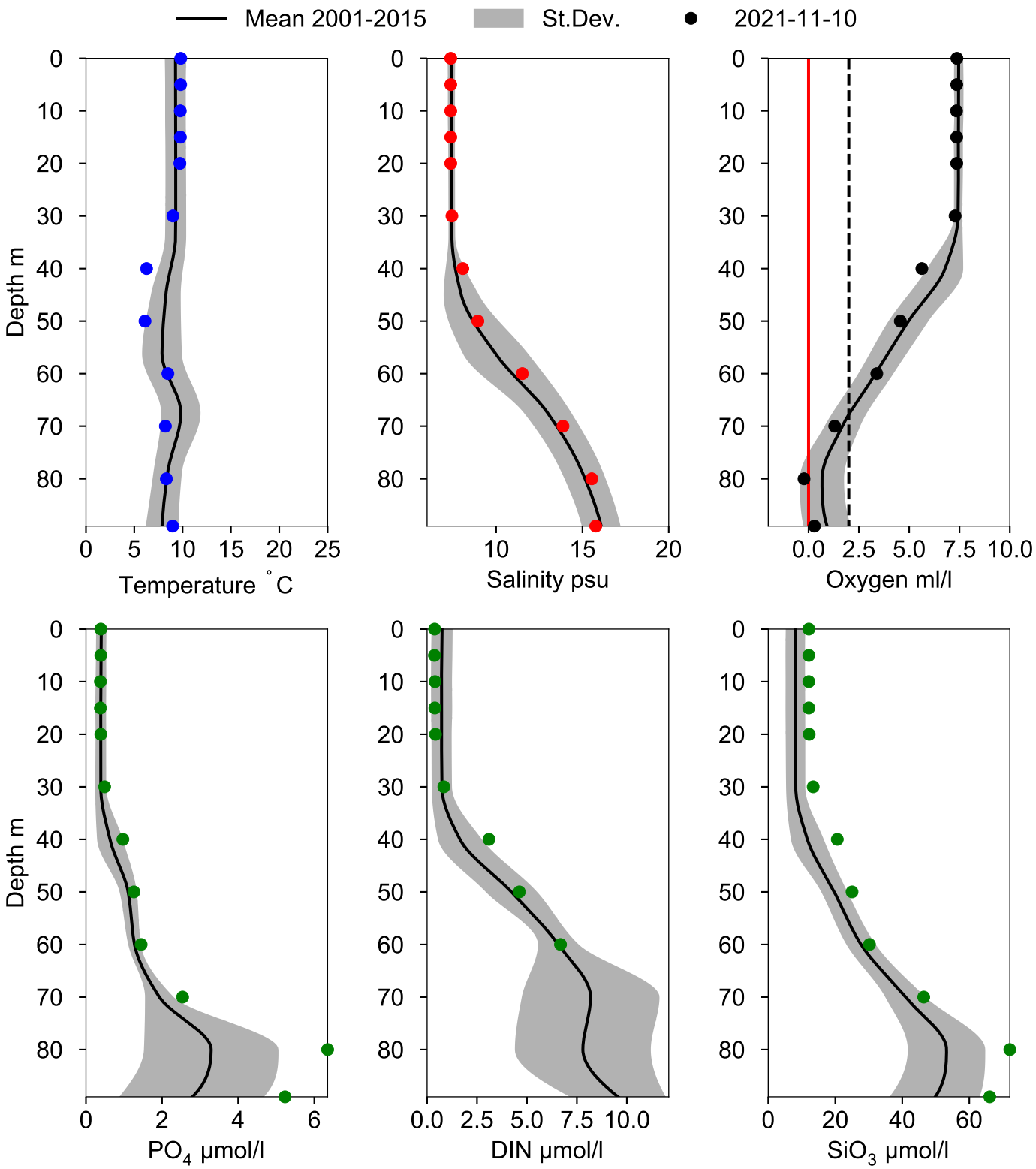
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 80 m)

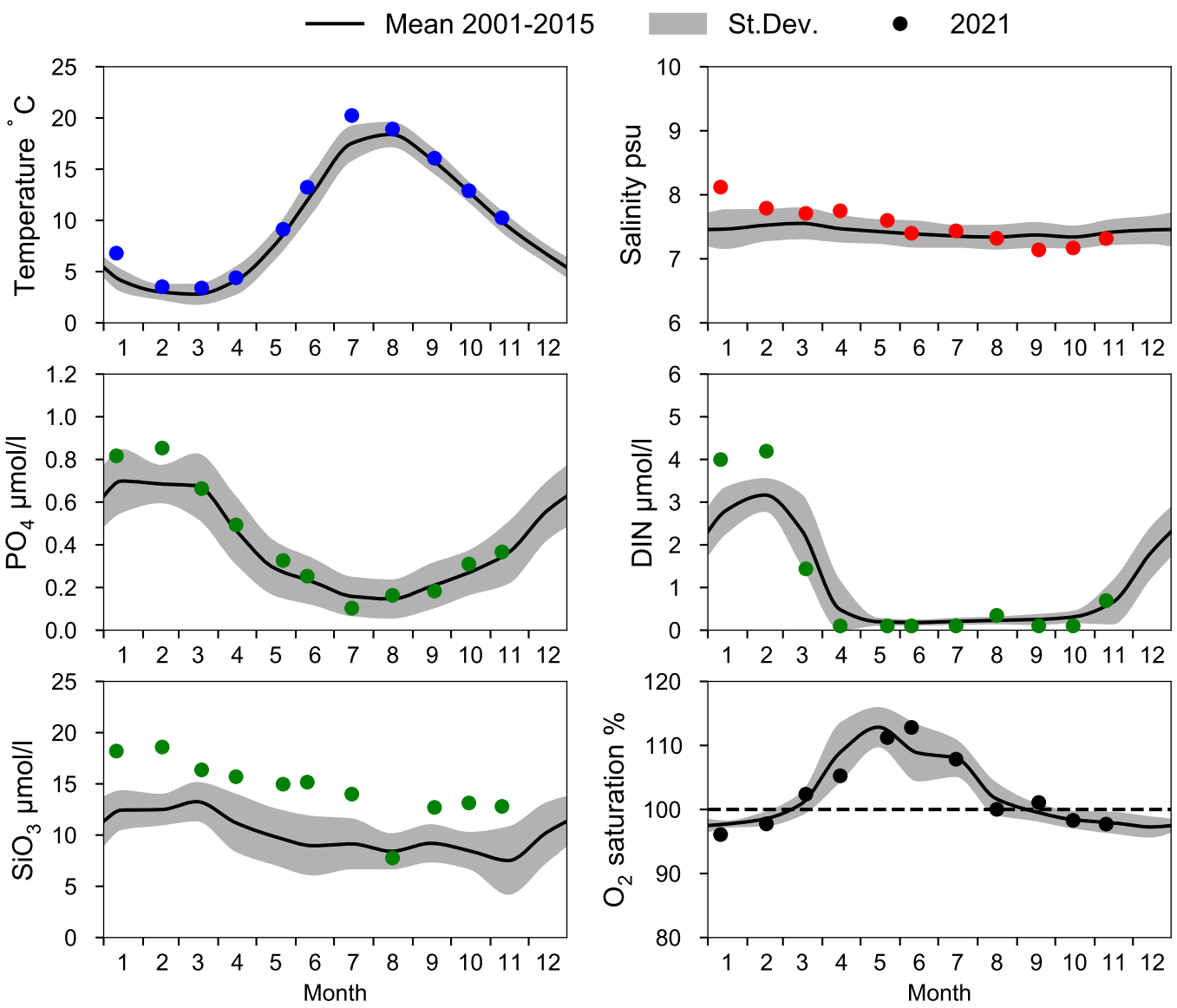


Vertical profiles BY4 CHRISTIANSÖ
November

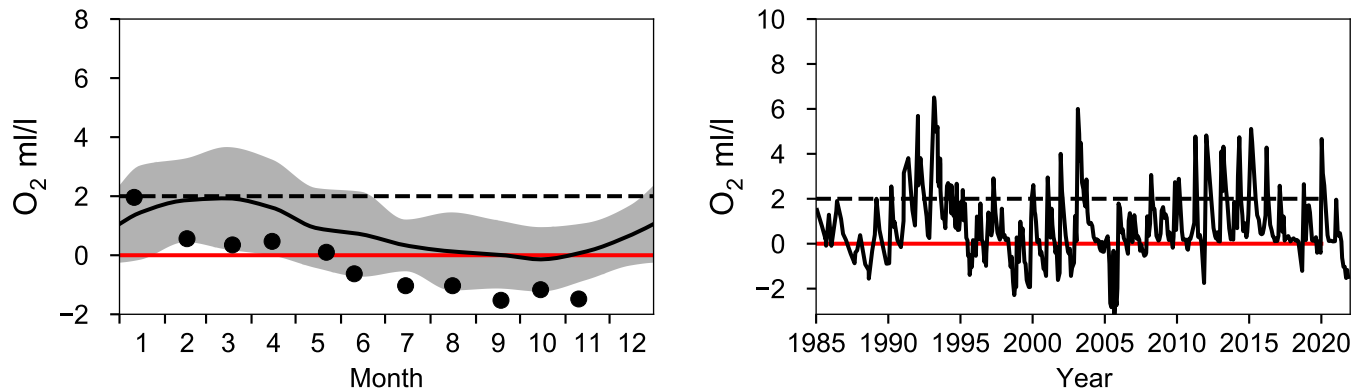


STATION BY5 BORNHOLMSDJ SURFACE WATER (0-10 m)

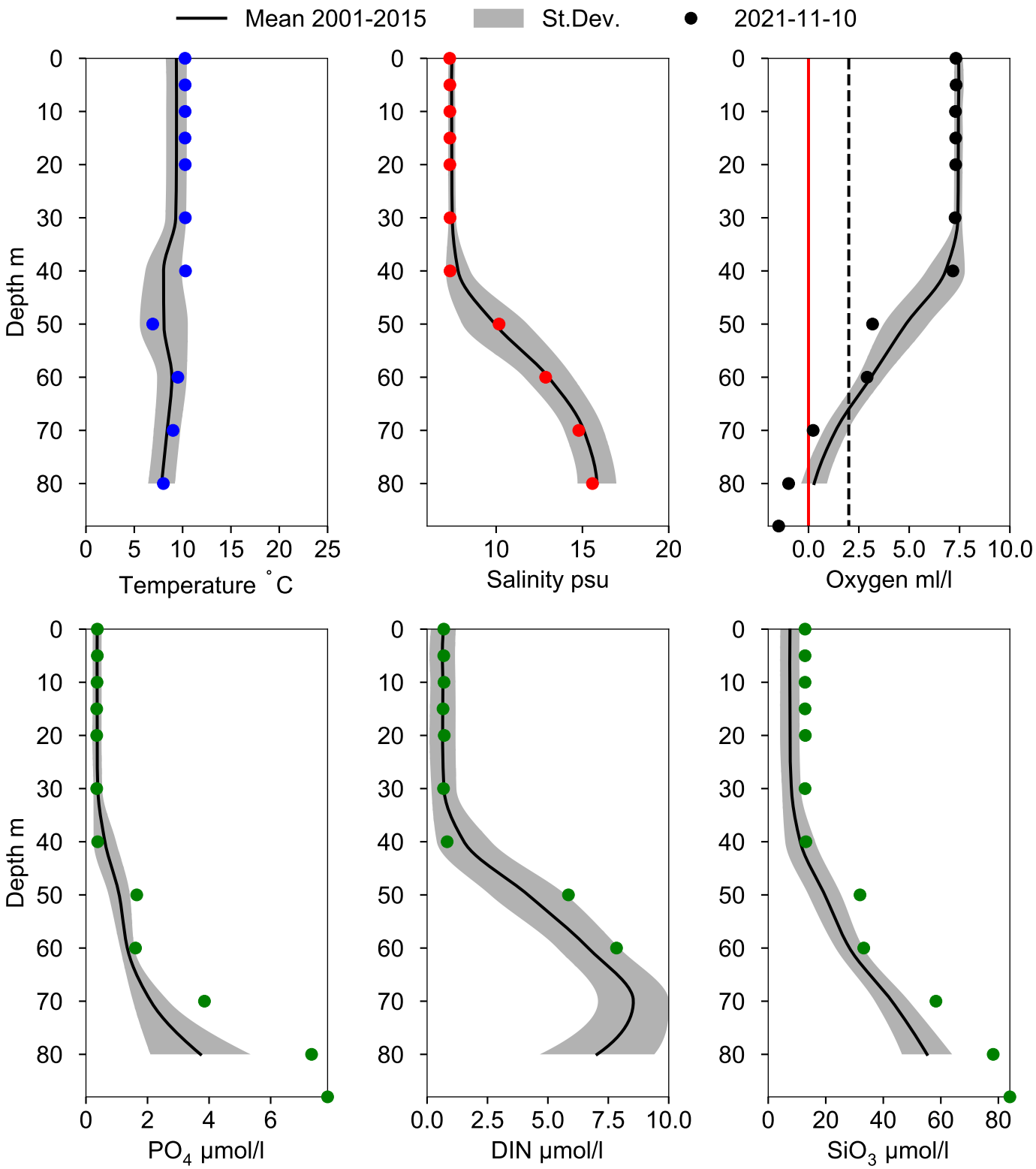
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 80 m)

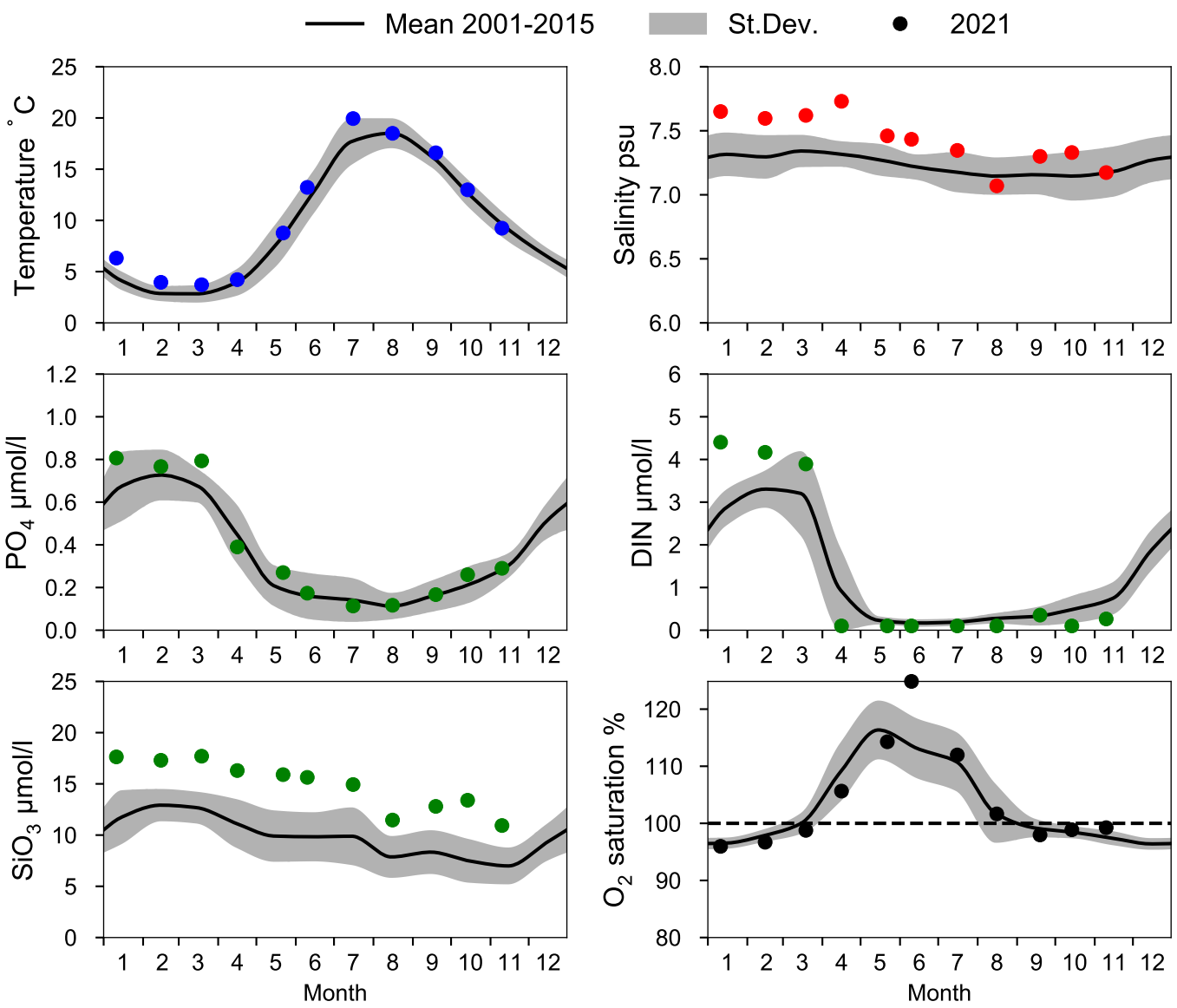


Vertical profiles BY5 BORNHOLMSDJ
November

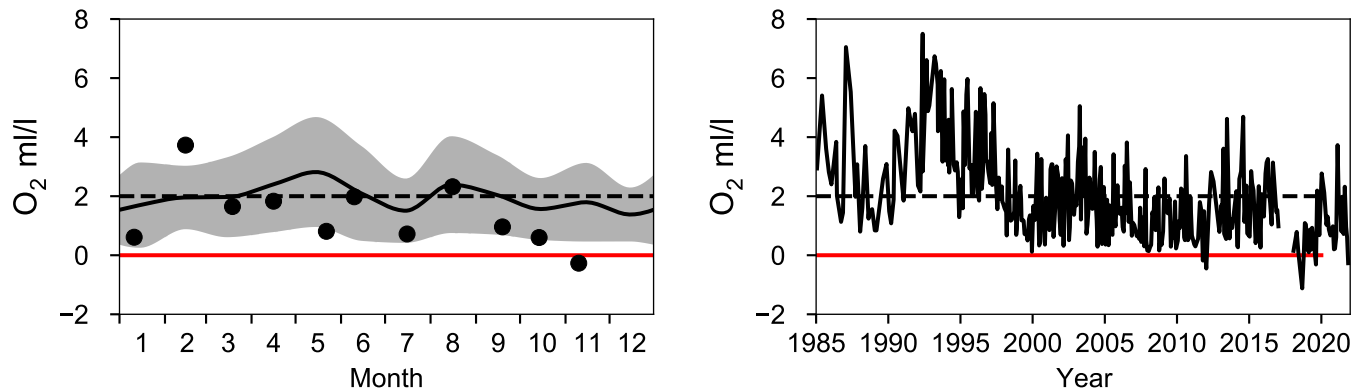


STATION BCS III-10 SURFACE WATER (0-10 m)

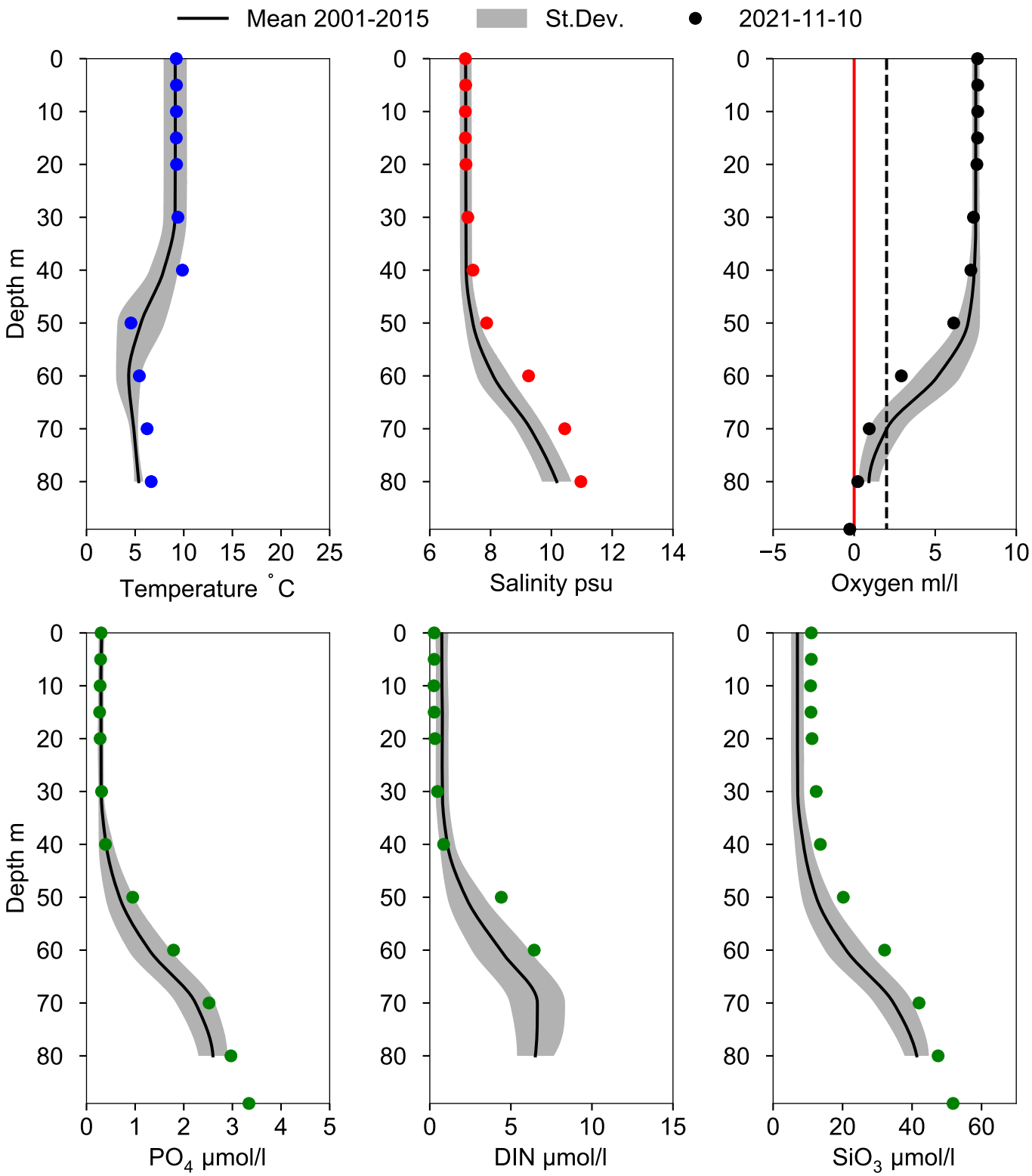
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 80 m)

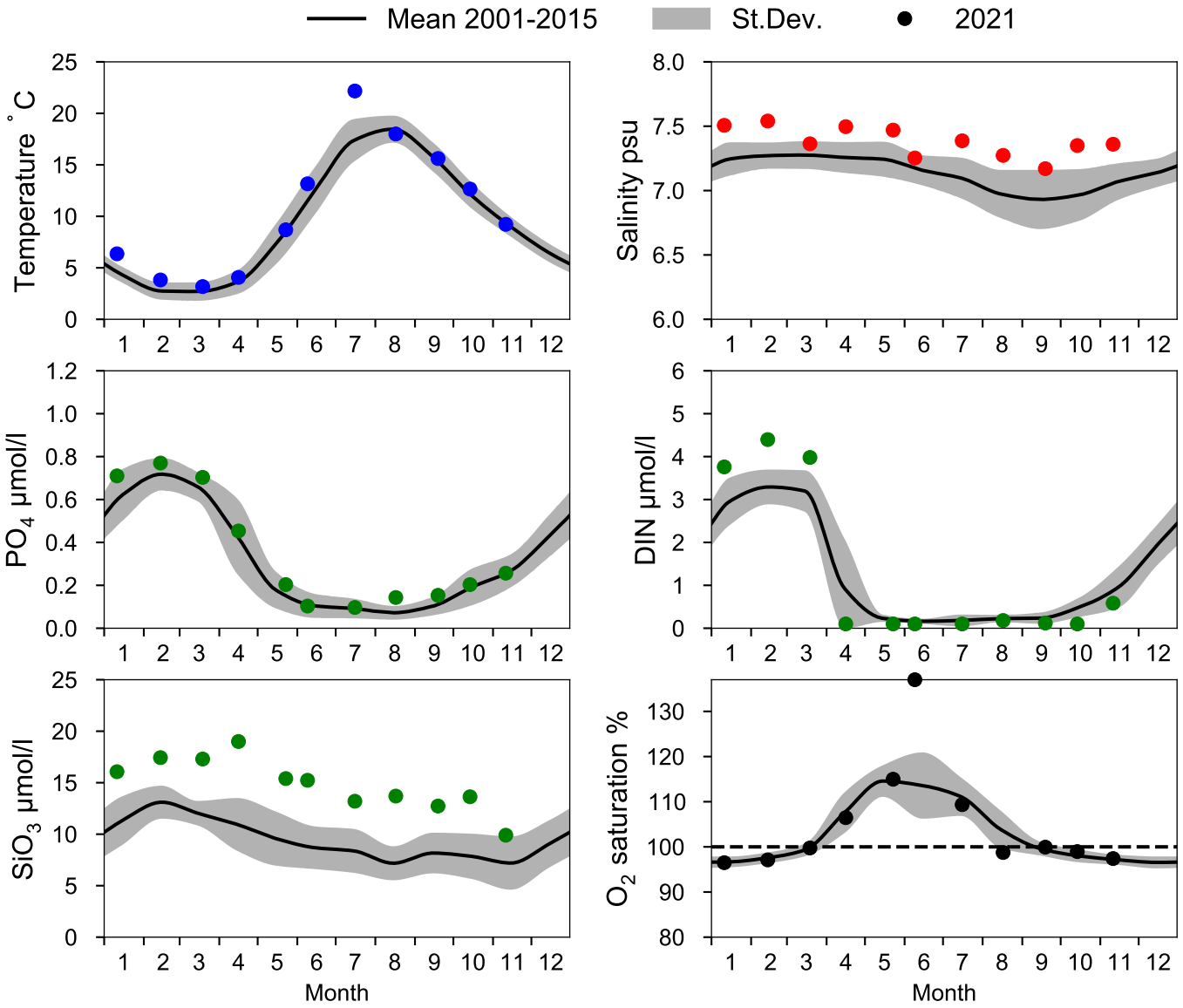


Vertical profiles BCS III-10
November

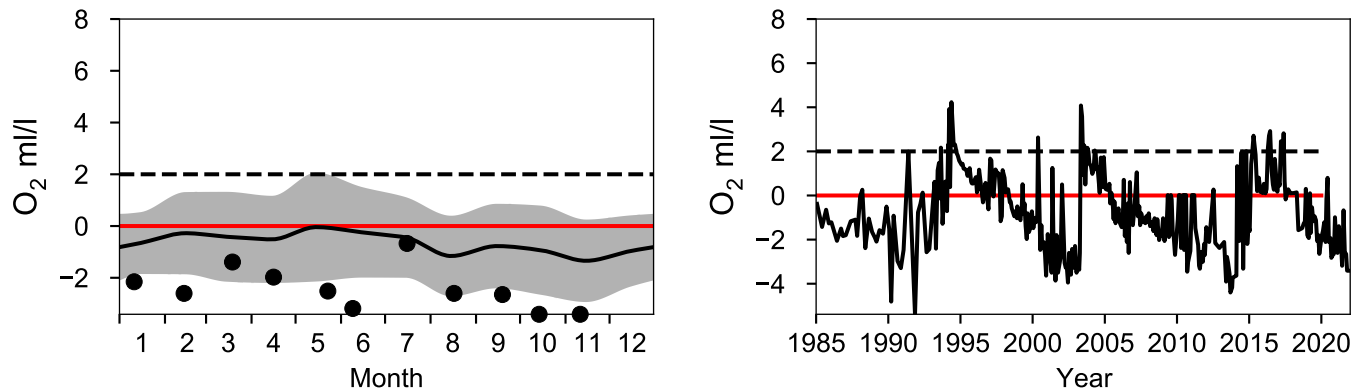


STATION BY10 SURFACE WATER (0-10 m)

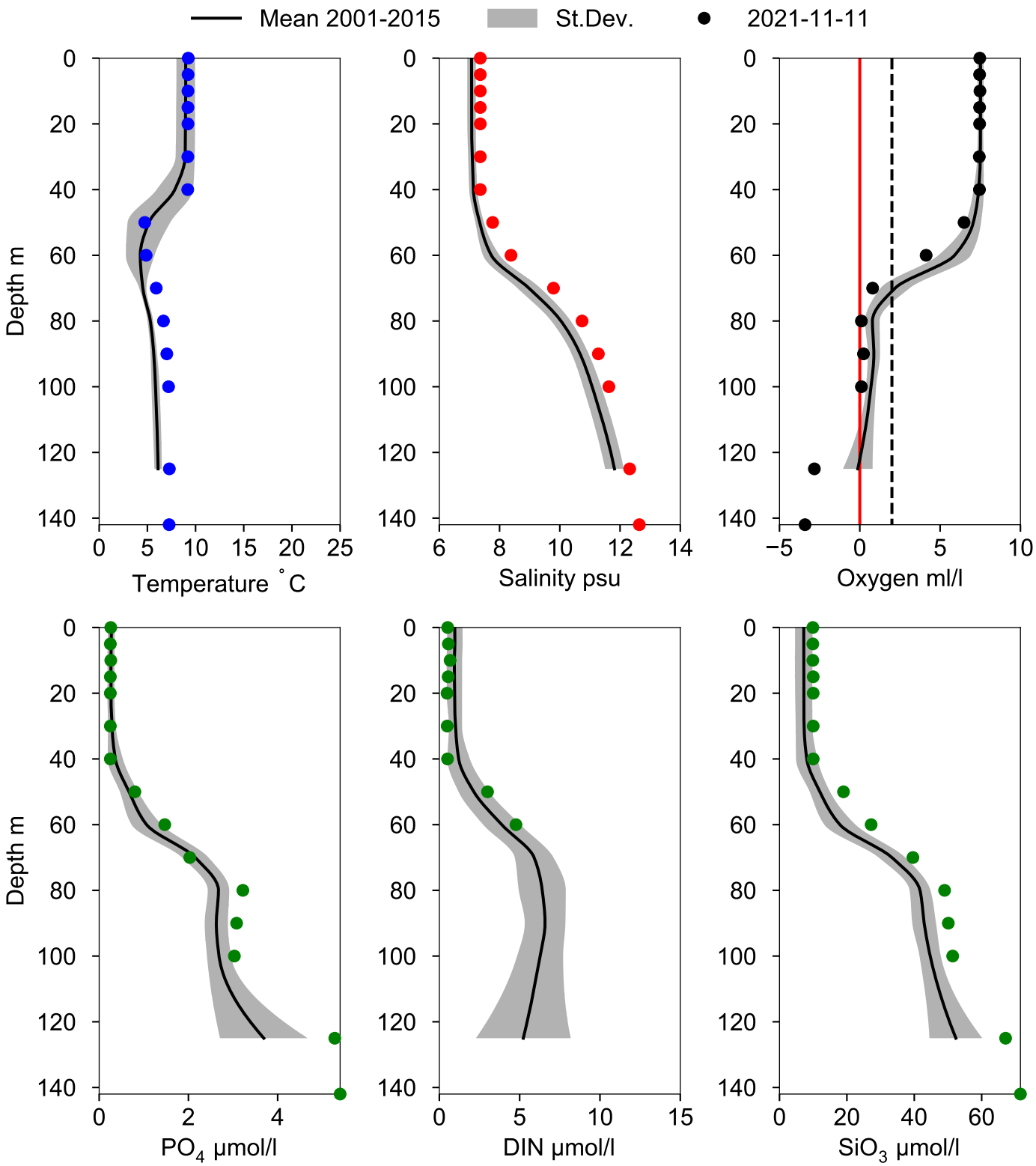
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 125 m)

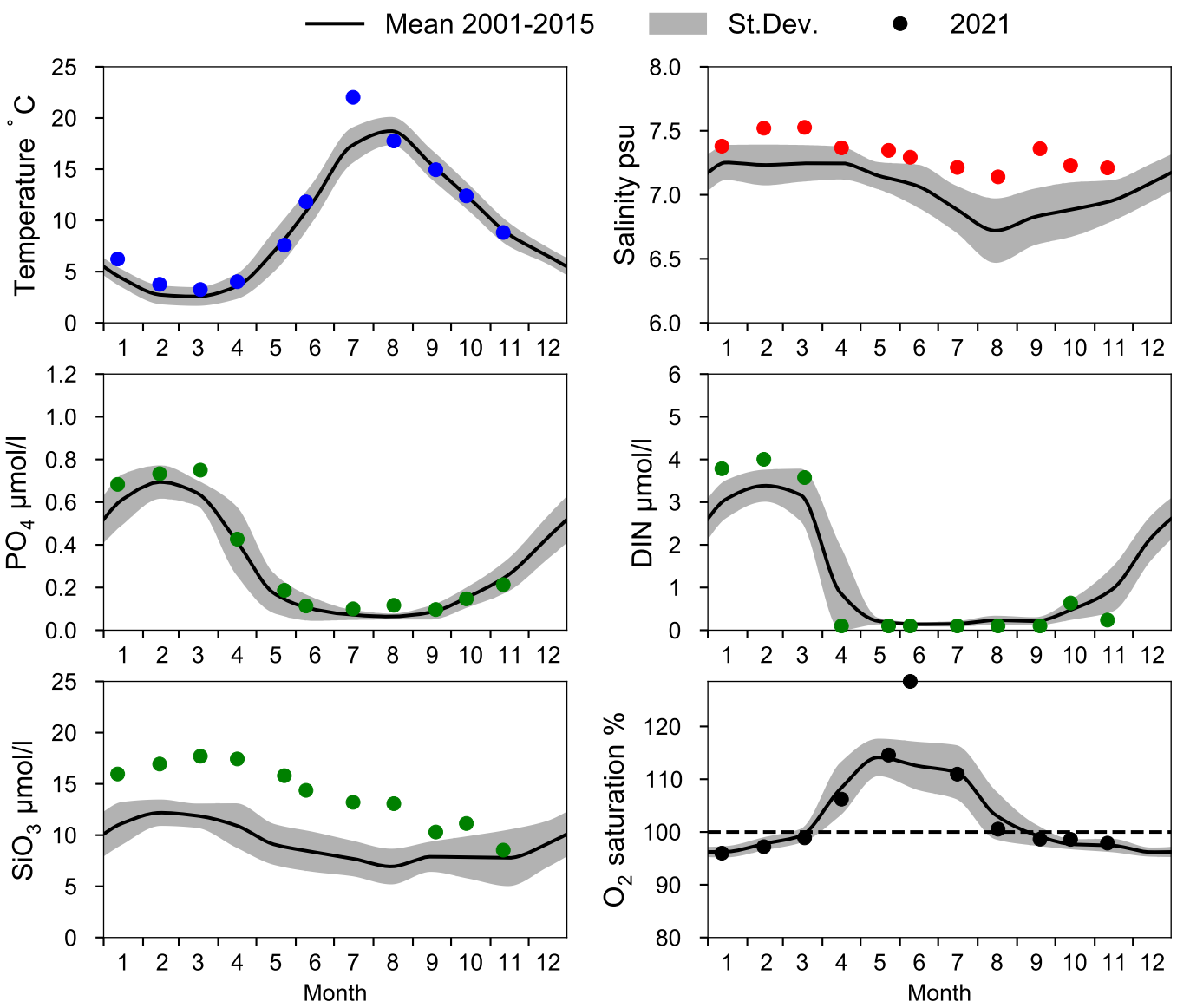


Vertical profiles BY10
November

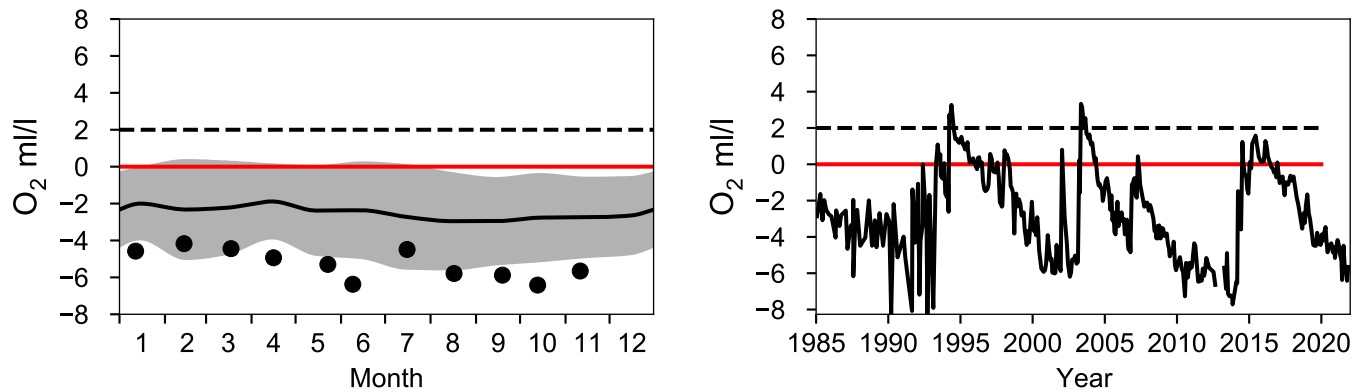


STATION BY15 GOTLANDSDJ SURFACE WATER (0-10 m)

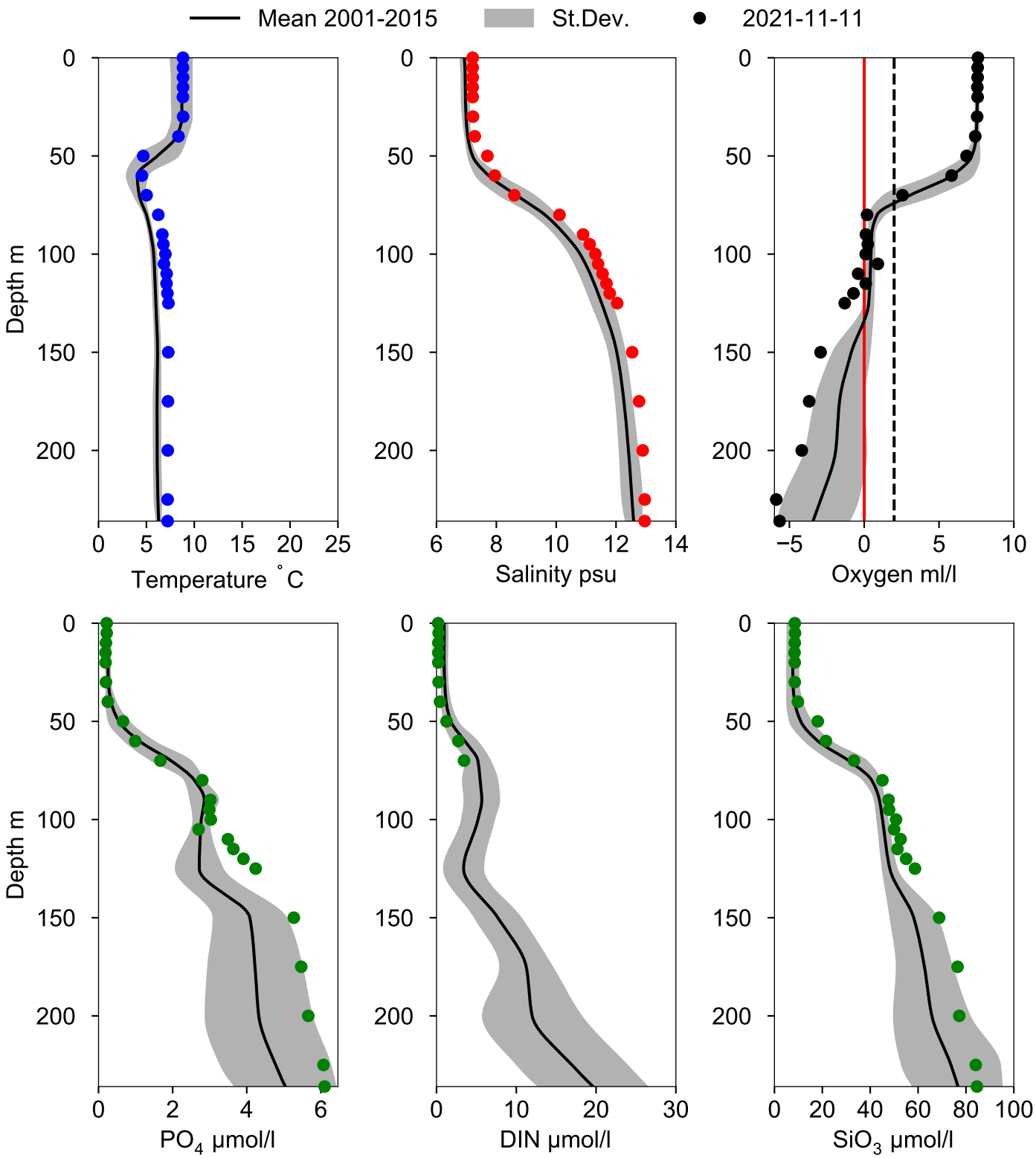
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 225 m)

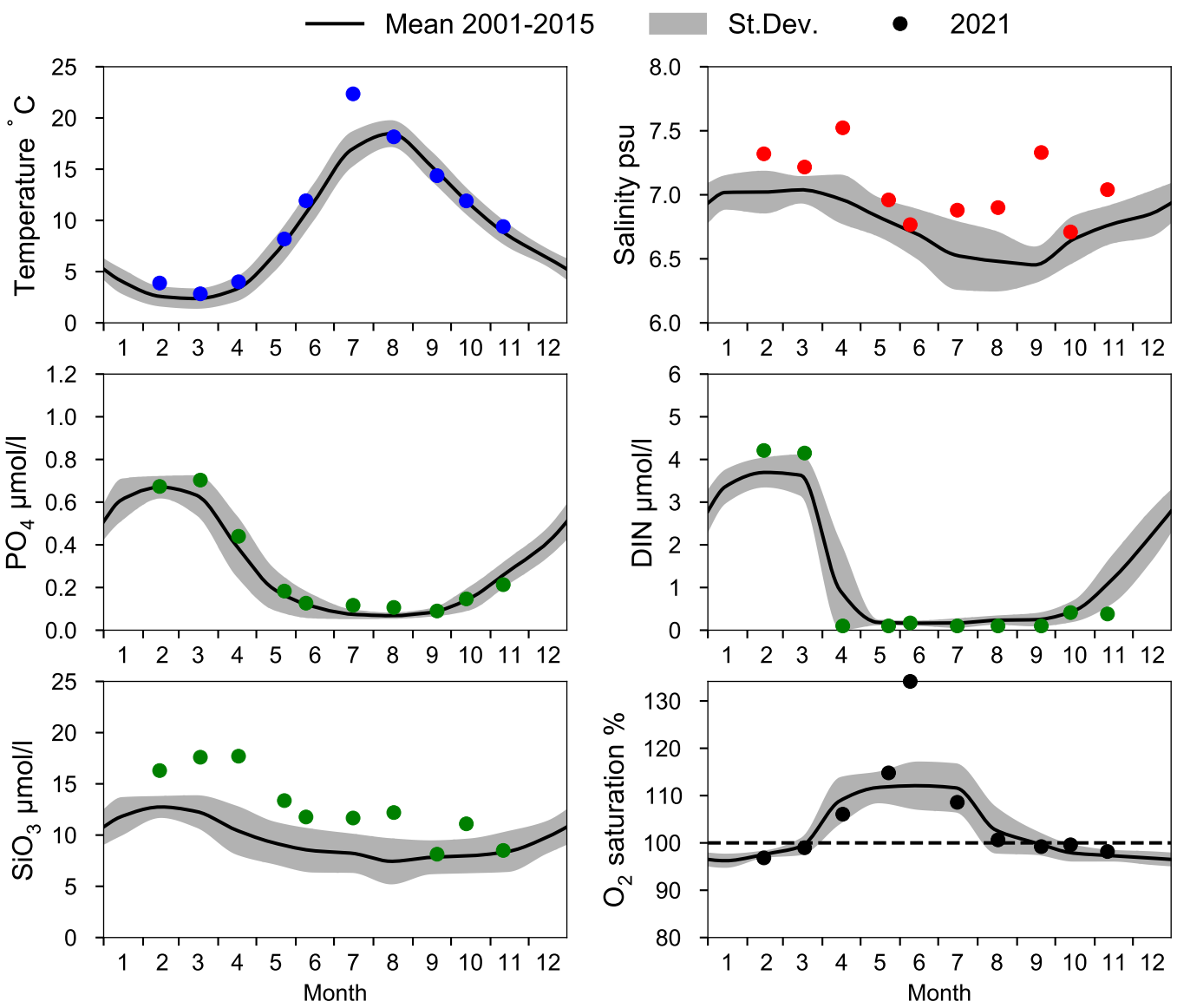


Vertical profiles BY15 GOTLANDSDJ
November

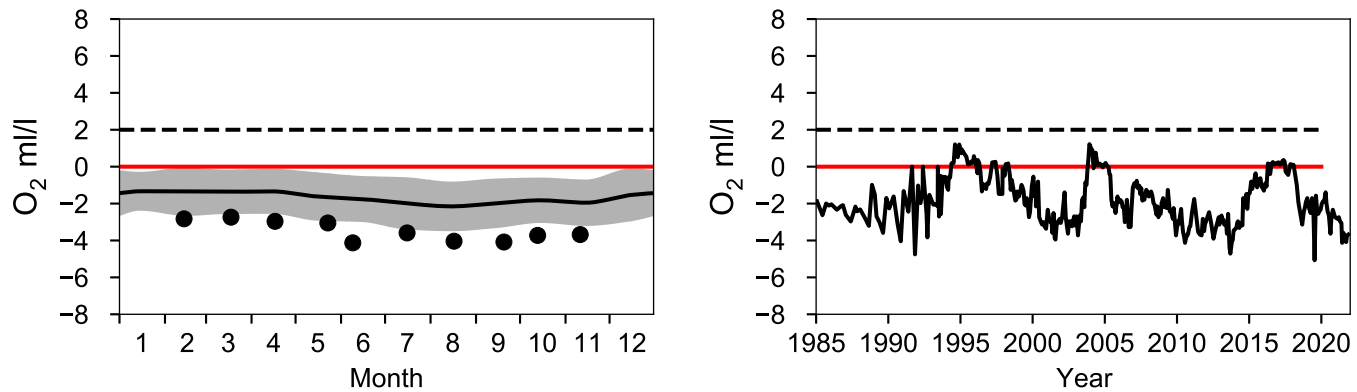


STATION BY20 FÅRÖDJ SURFACE WATER (0-10 m)

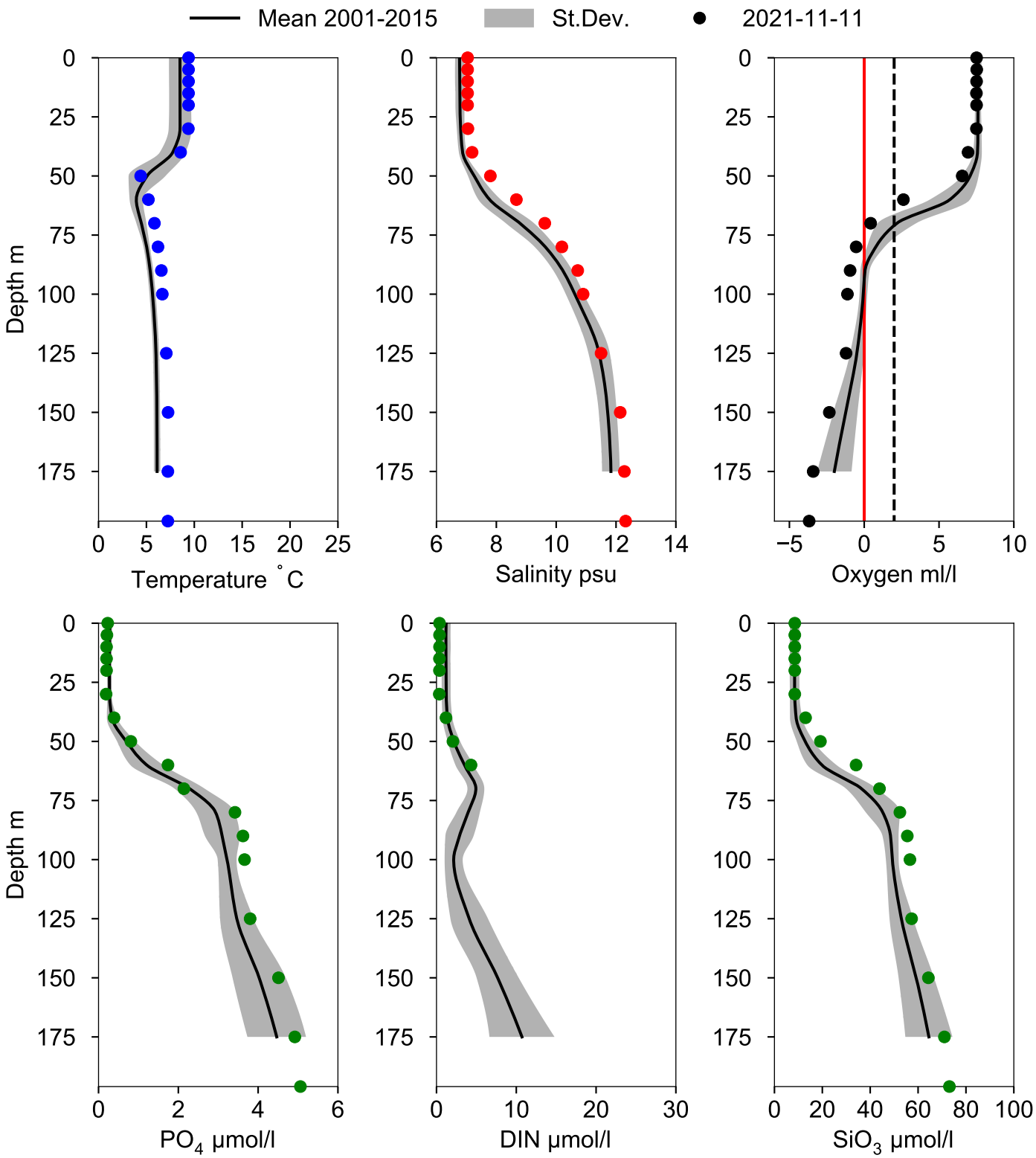
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 175 m)

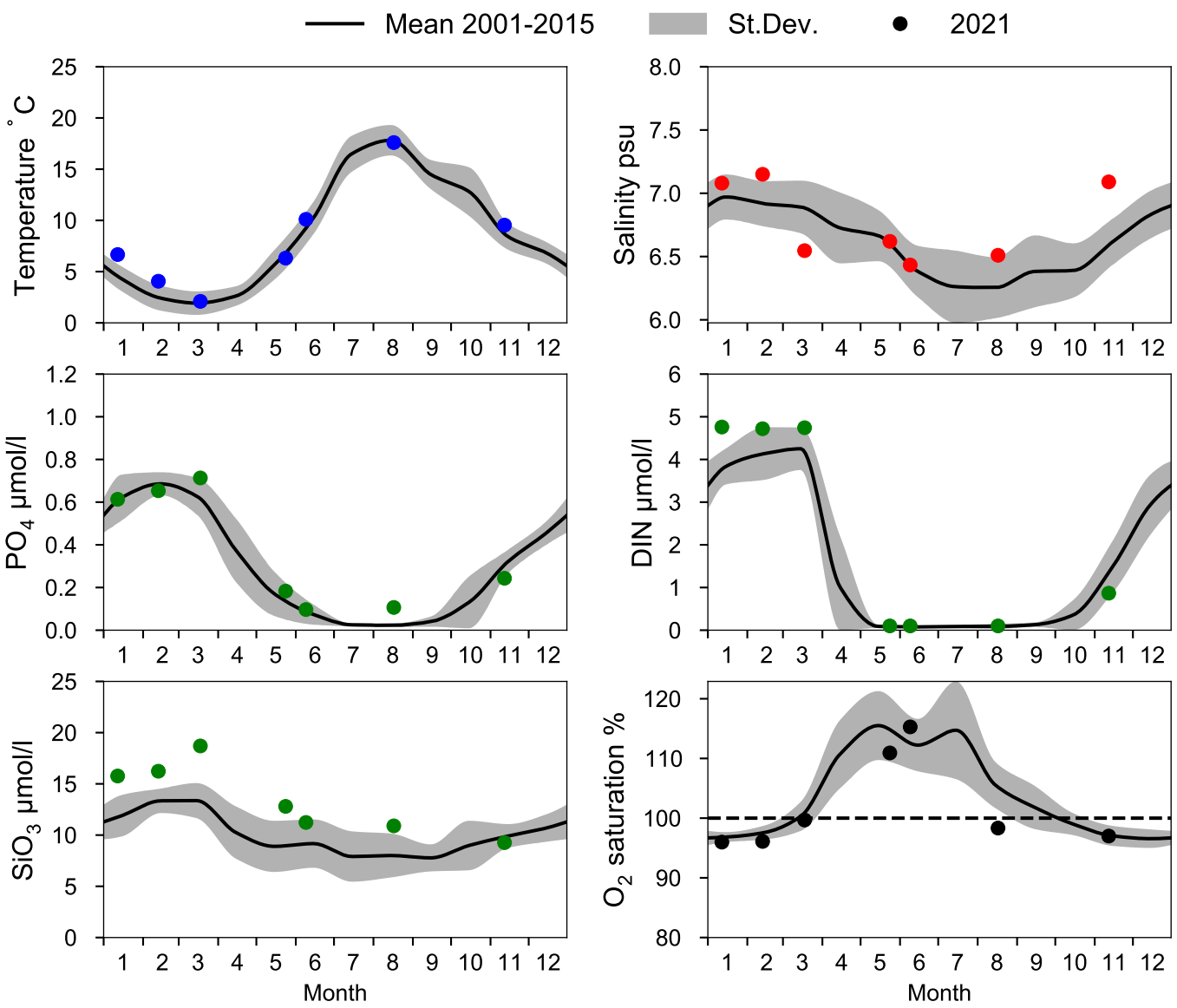


Vertical profiles BY20 FÅRÖDJ
November

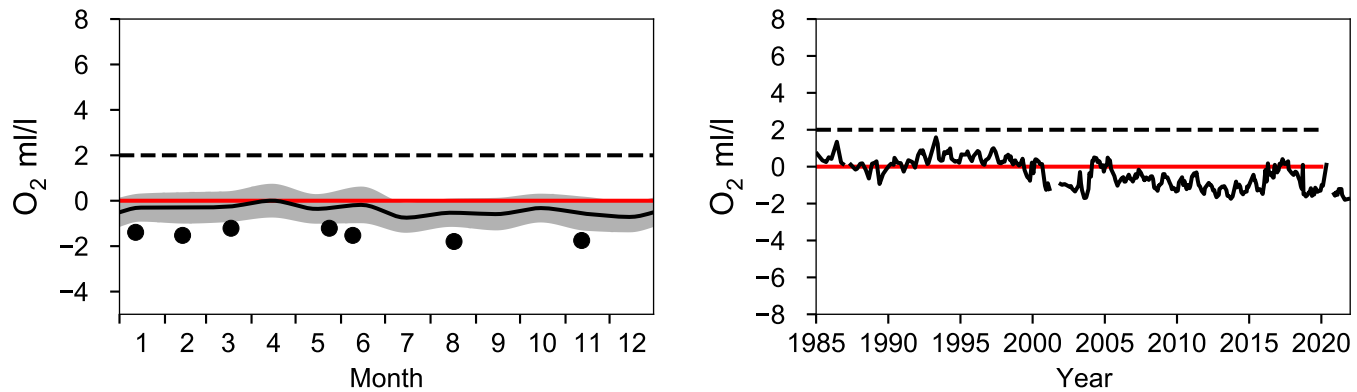


STATION BY29 / LL19 SURFACE WATER (0-10 m)

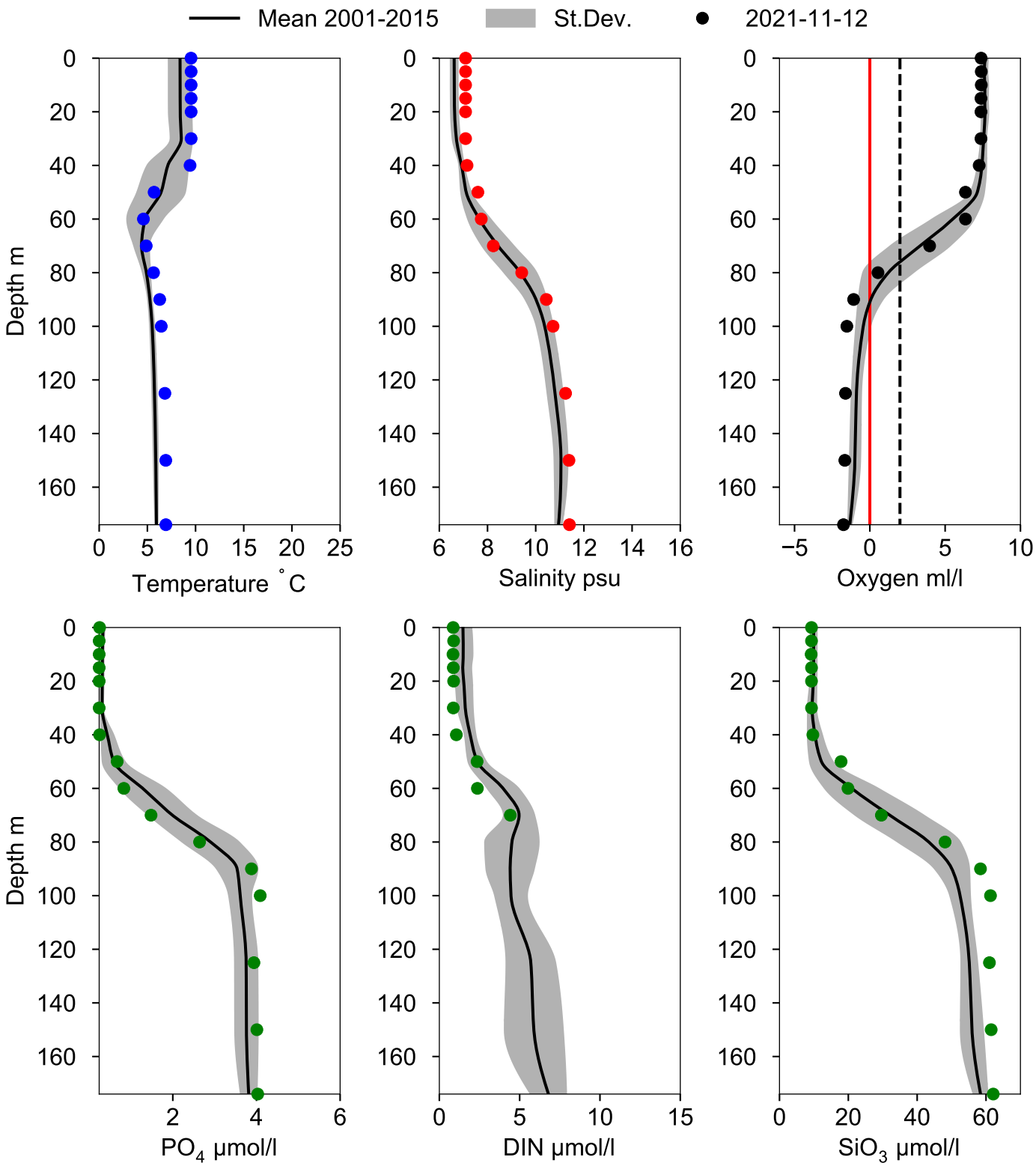
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 150 m)

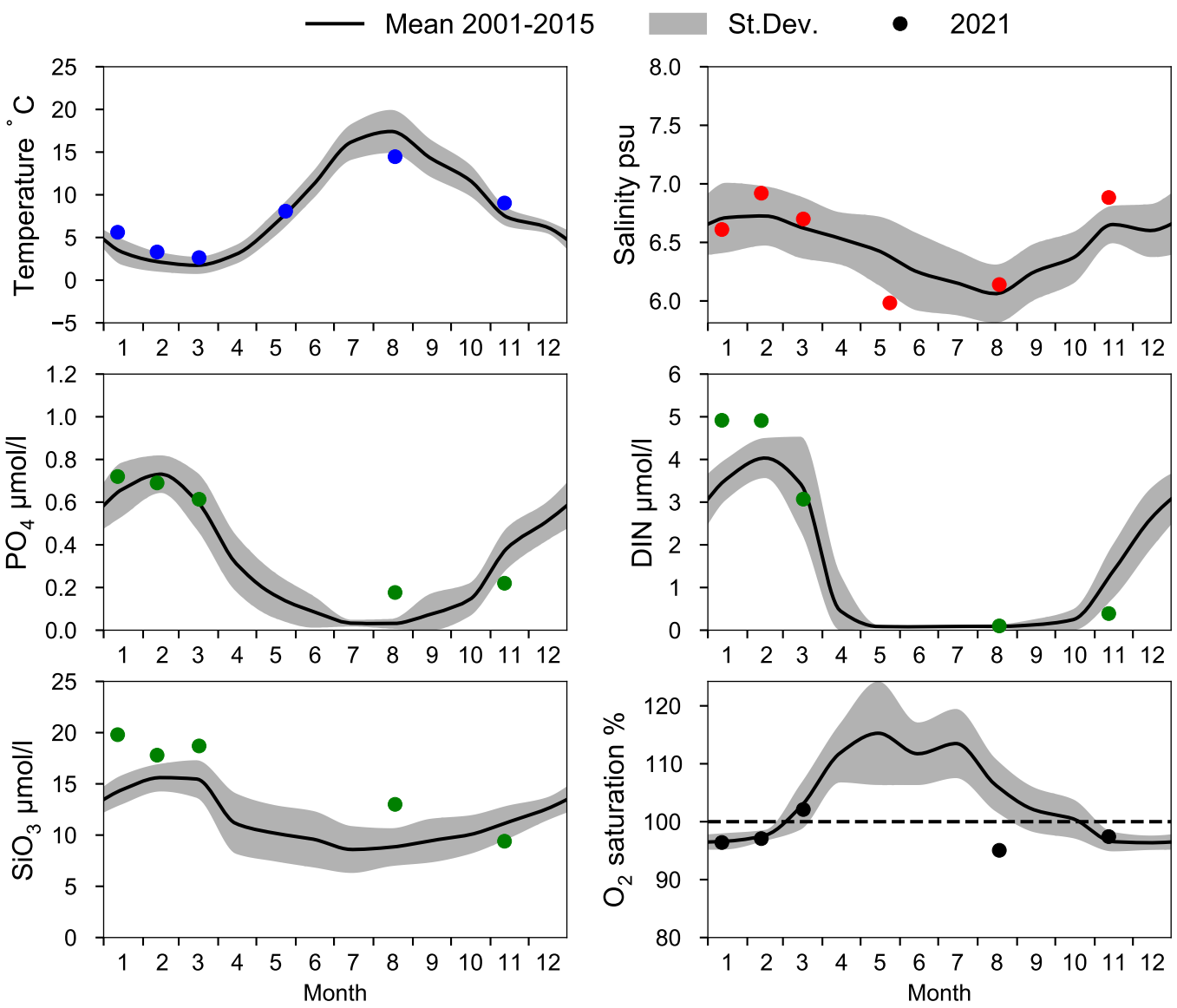


Vertical profiles BY29 / LL19
November

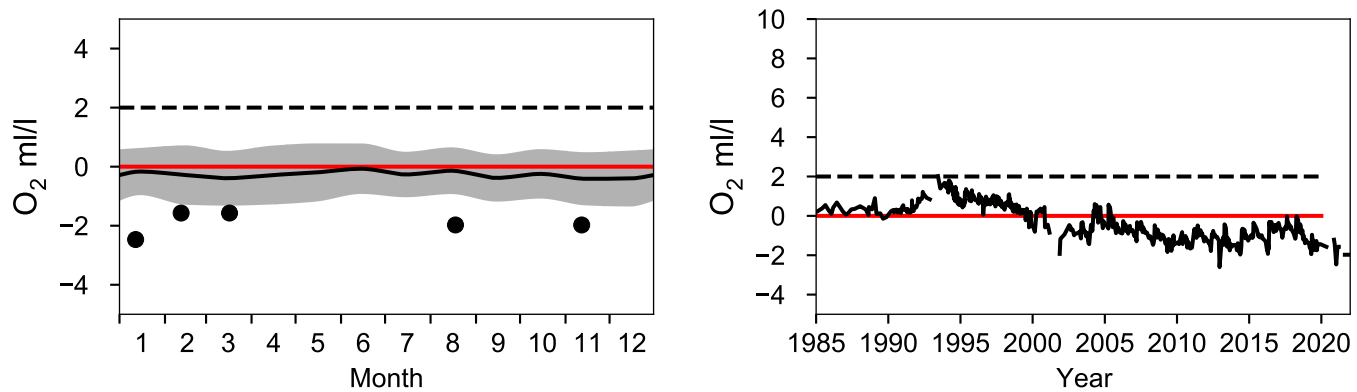


STATION BY31 LANDSORTSDJ SURFACE WATER (0-10 m)

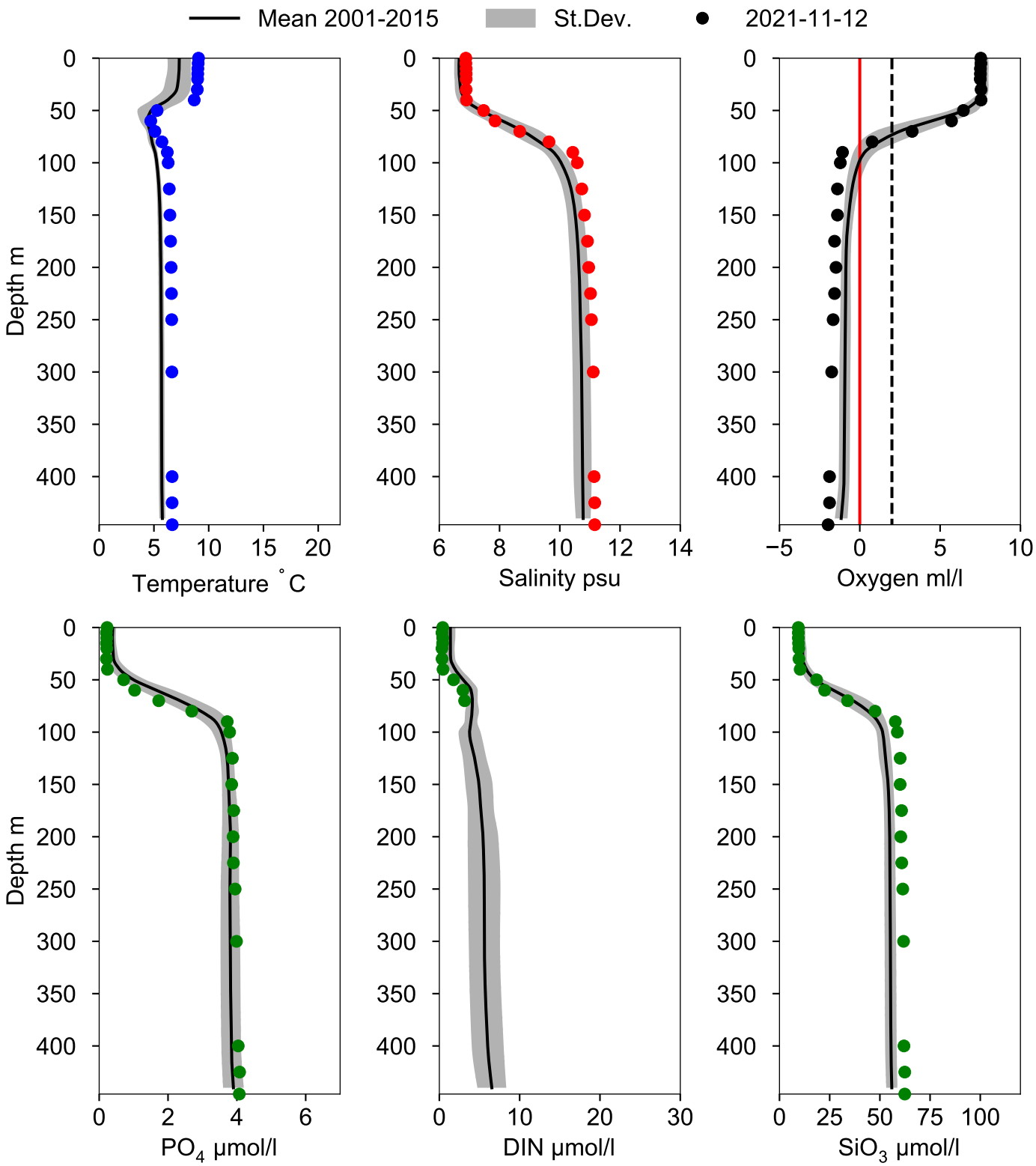
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 419 m)

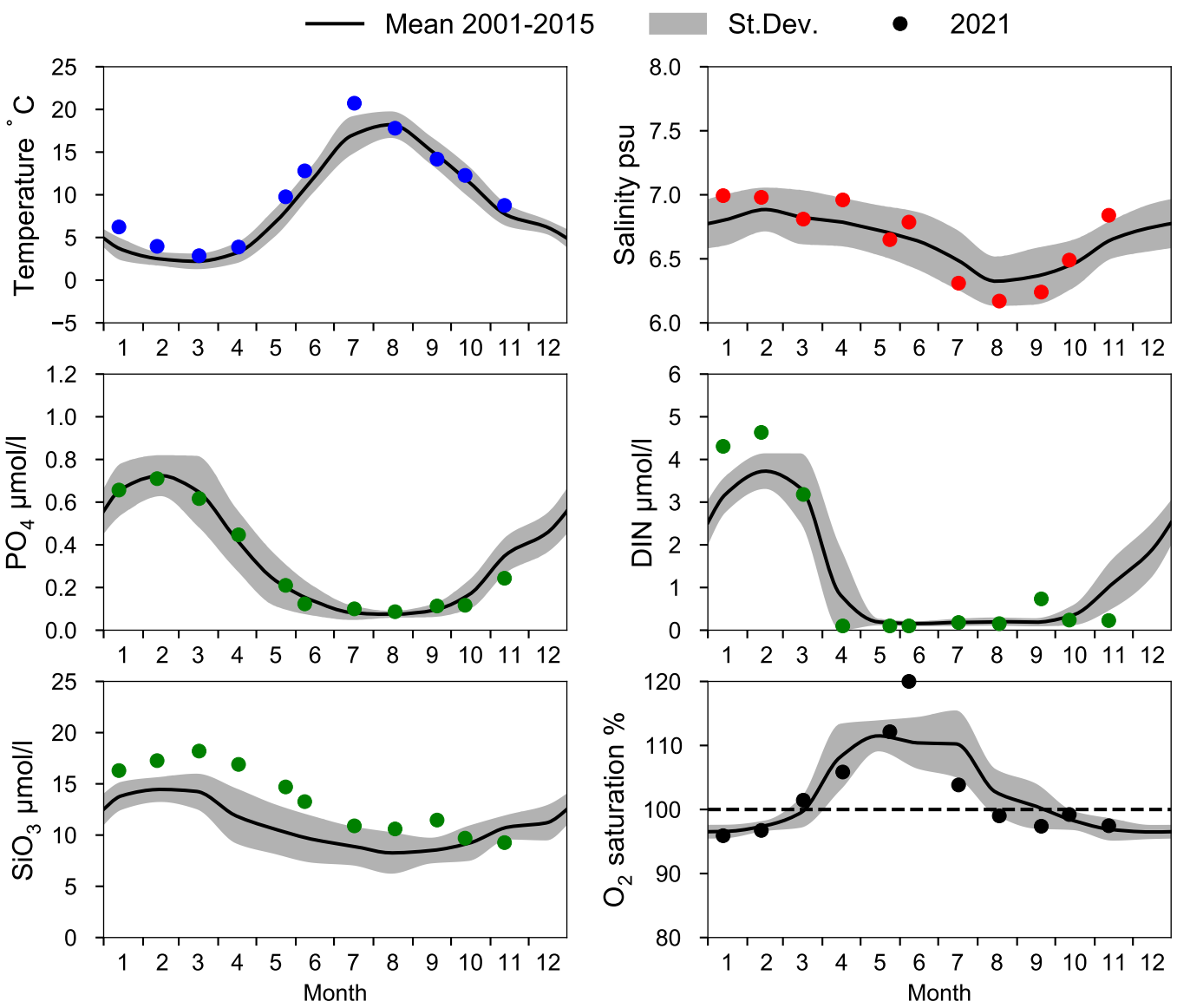


Vertical profiles BY31 LANDSORTSDJ
November

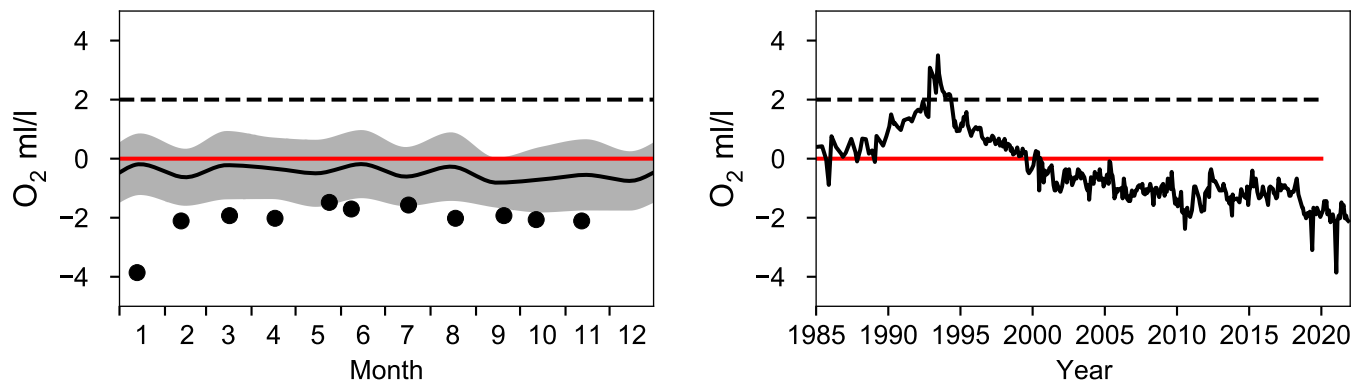


STATION BY32 NORRKÖPINGSDJ SURFACE WATER (0-10 m)

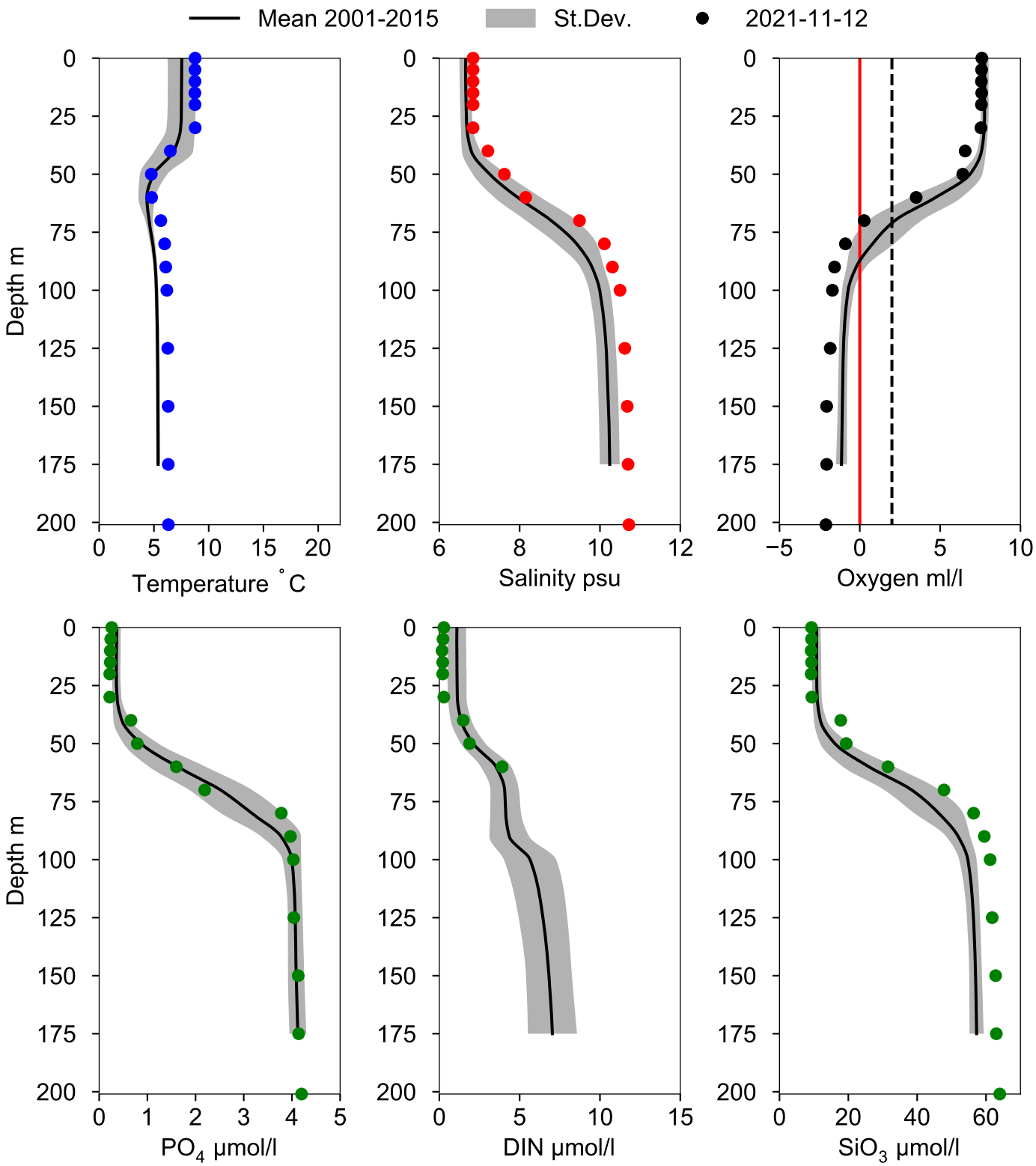
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 175 m)

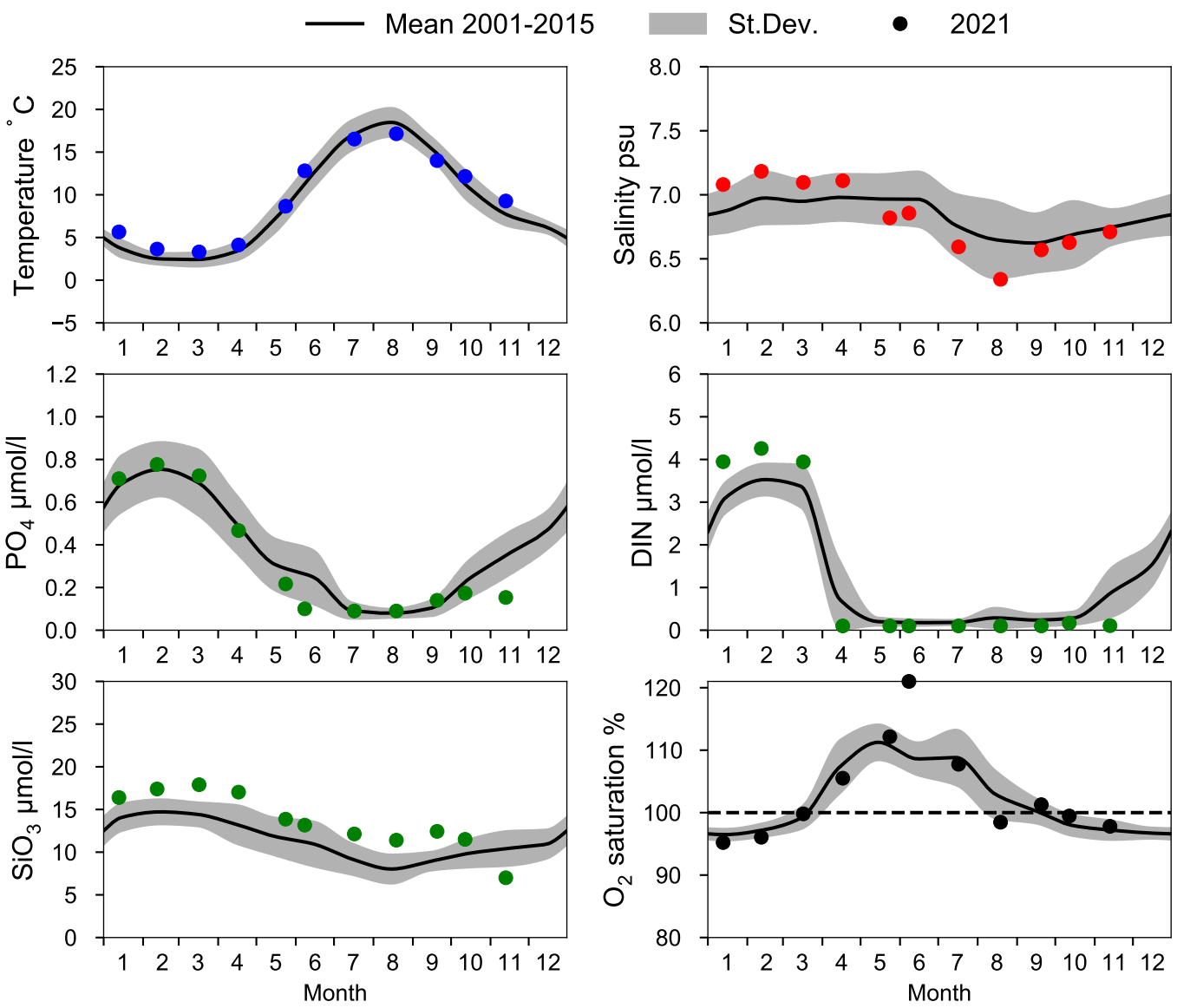


Vertical profiles BY32 NORRKÖPINGSDJ
November

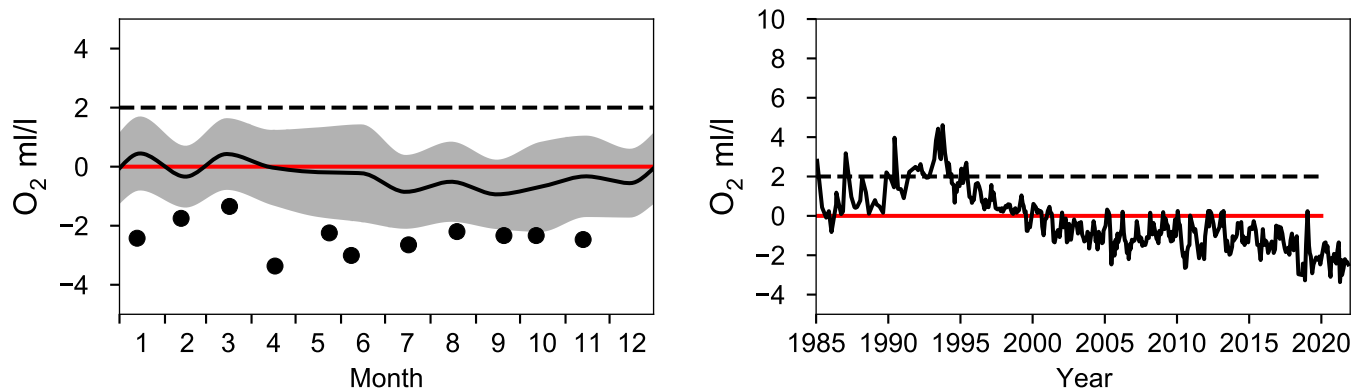


STATION BY38 KARLSÖDJ SURFACE WATER (0-10 m)

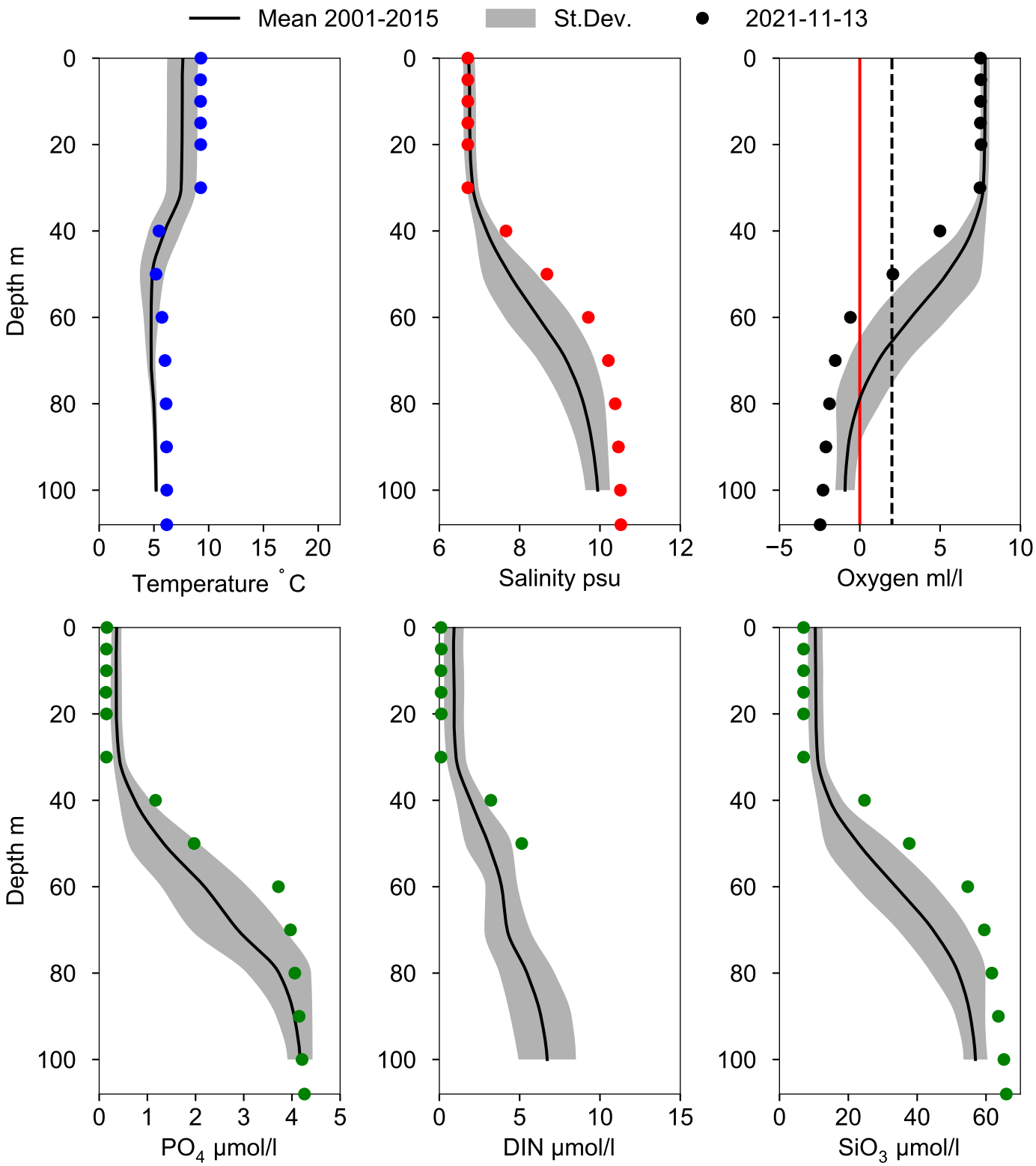
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 100 m)



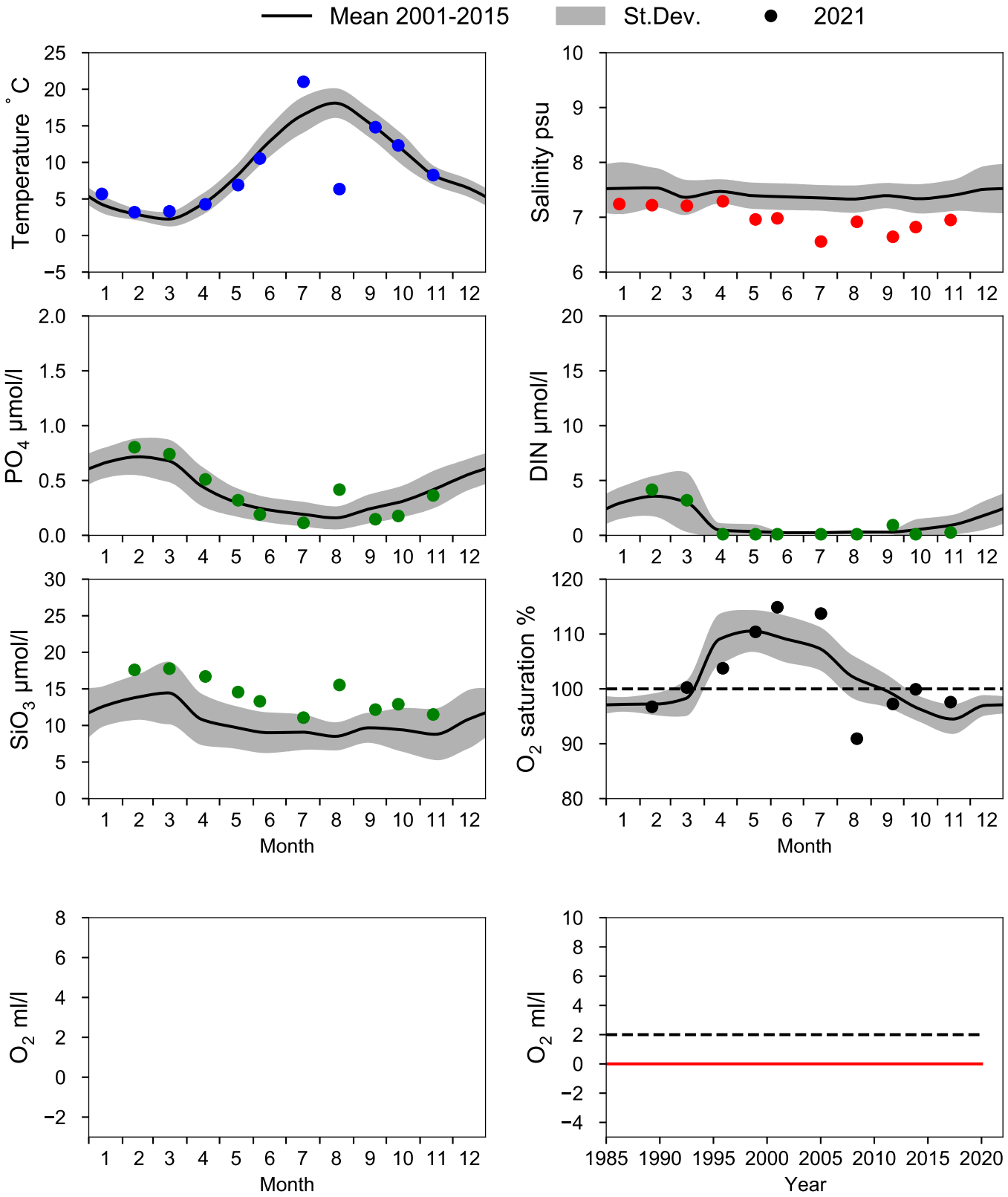
Vertical profiles BY38 KARLSÖDJ
November



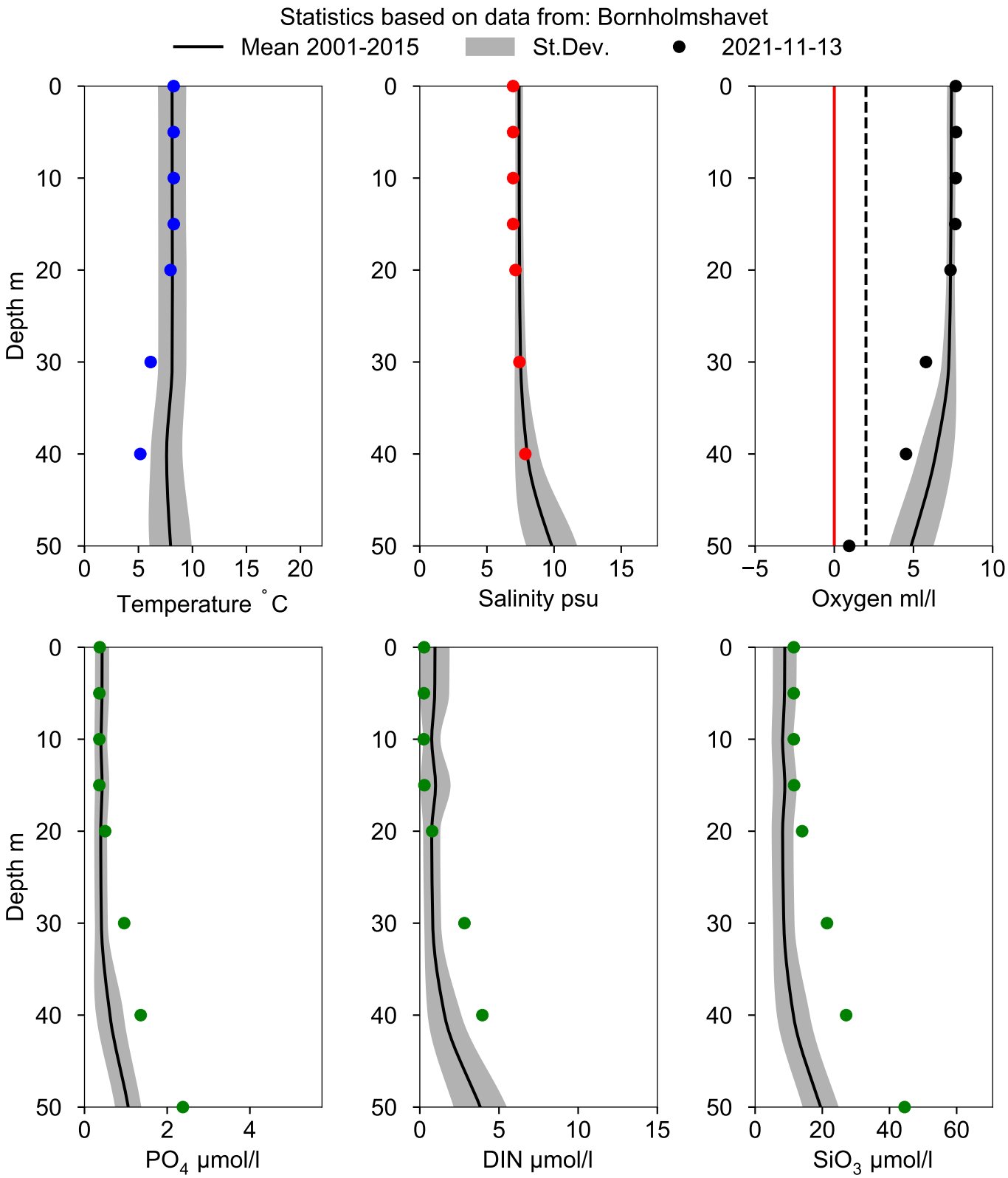
STATION BY39 ÖLANDS S UDDE SURFACE WATER (0-10 m)

Annual Cycles

Statistics based on data from: Bornholmshavet

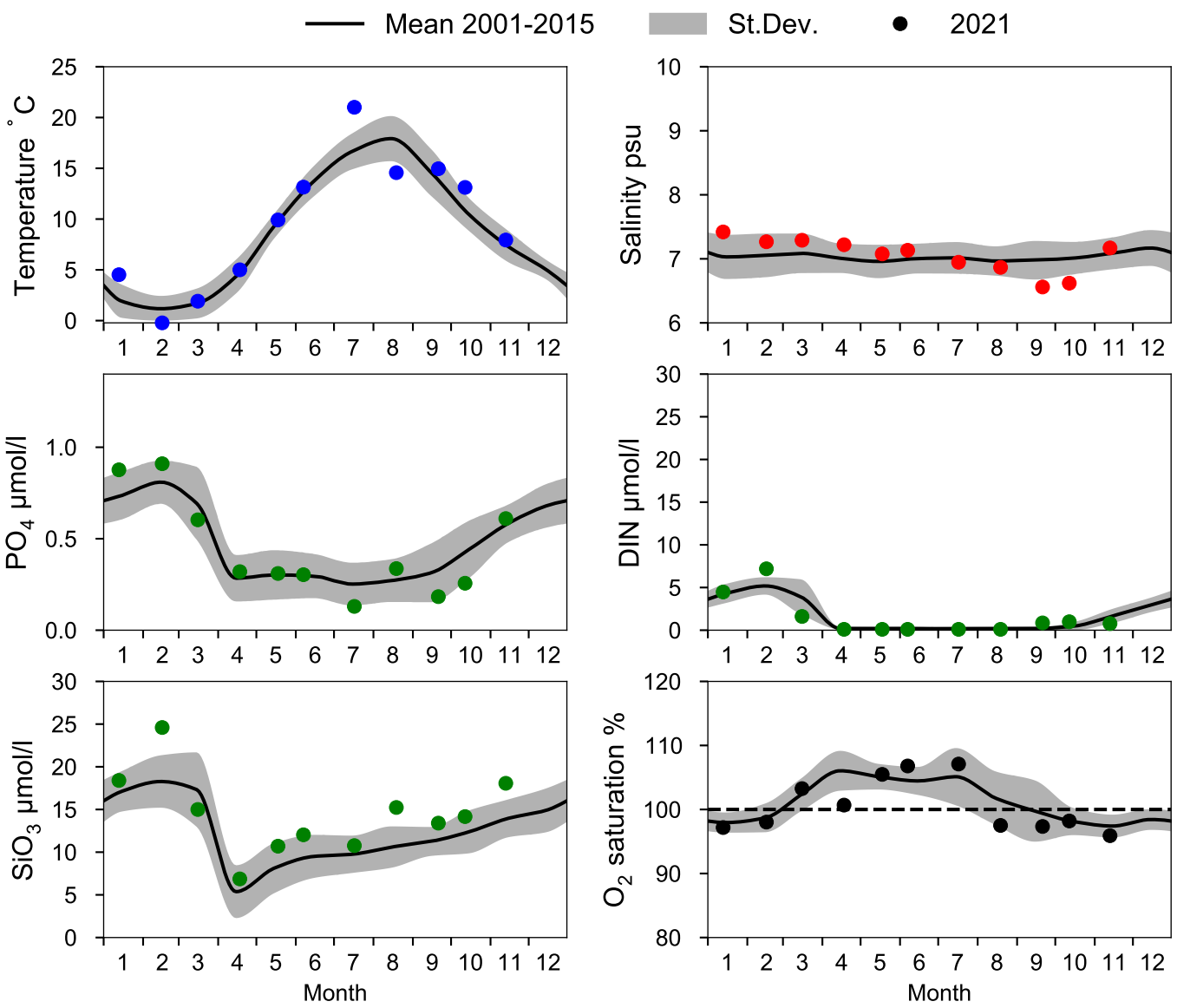


Vertical profiles BY39 ÖLANDS S UDDE
November

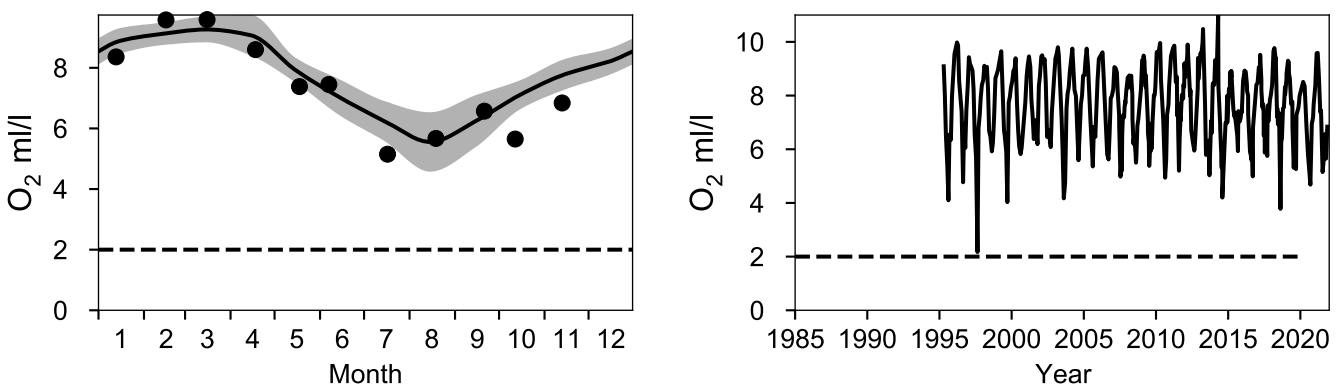


STATION REF M1V1 SURFACE WATER (0-10 m)

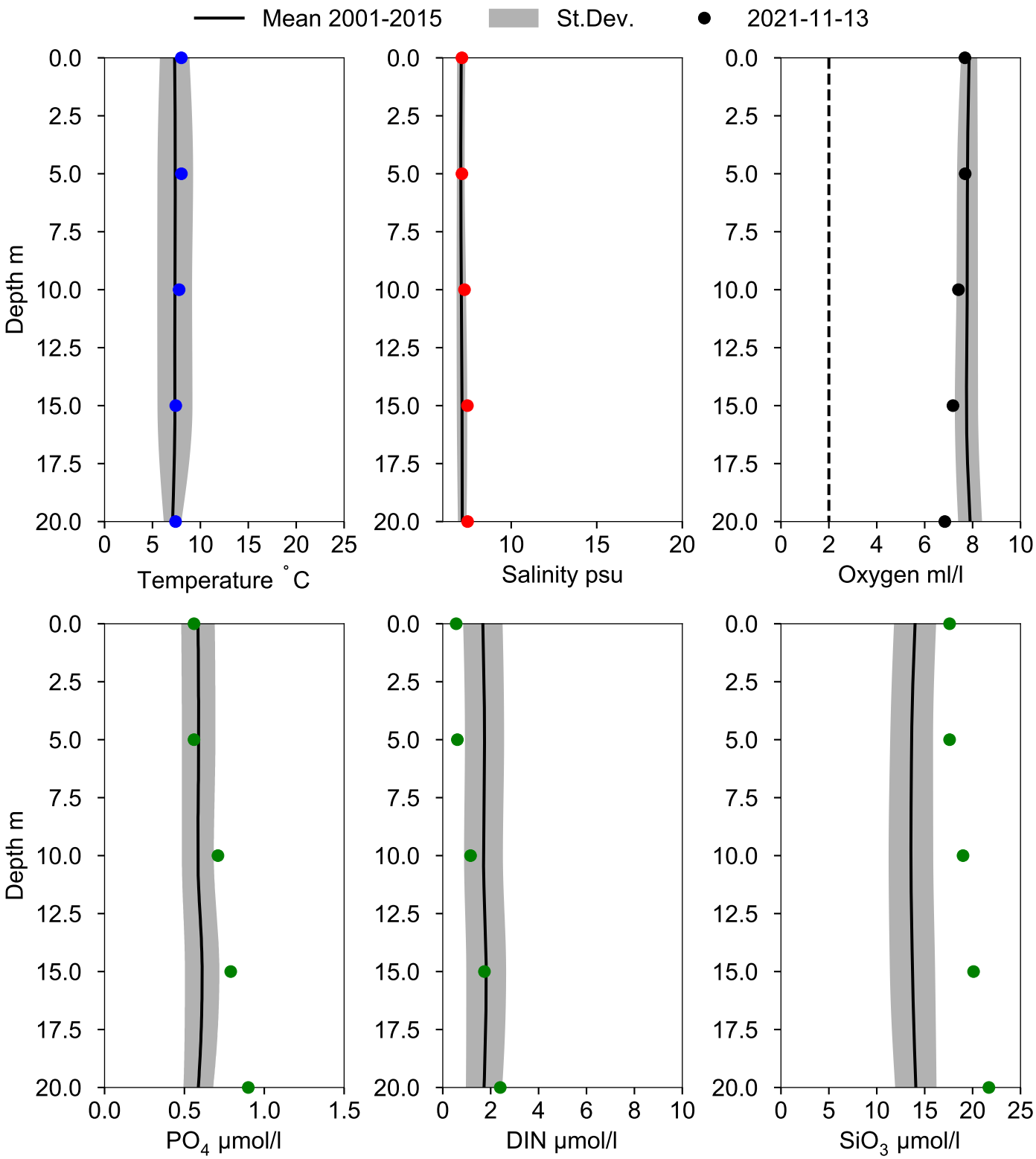
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 15 m)

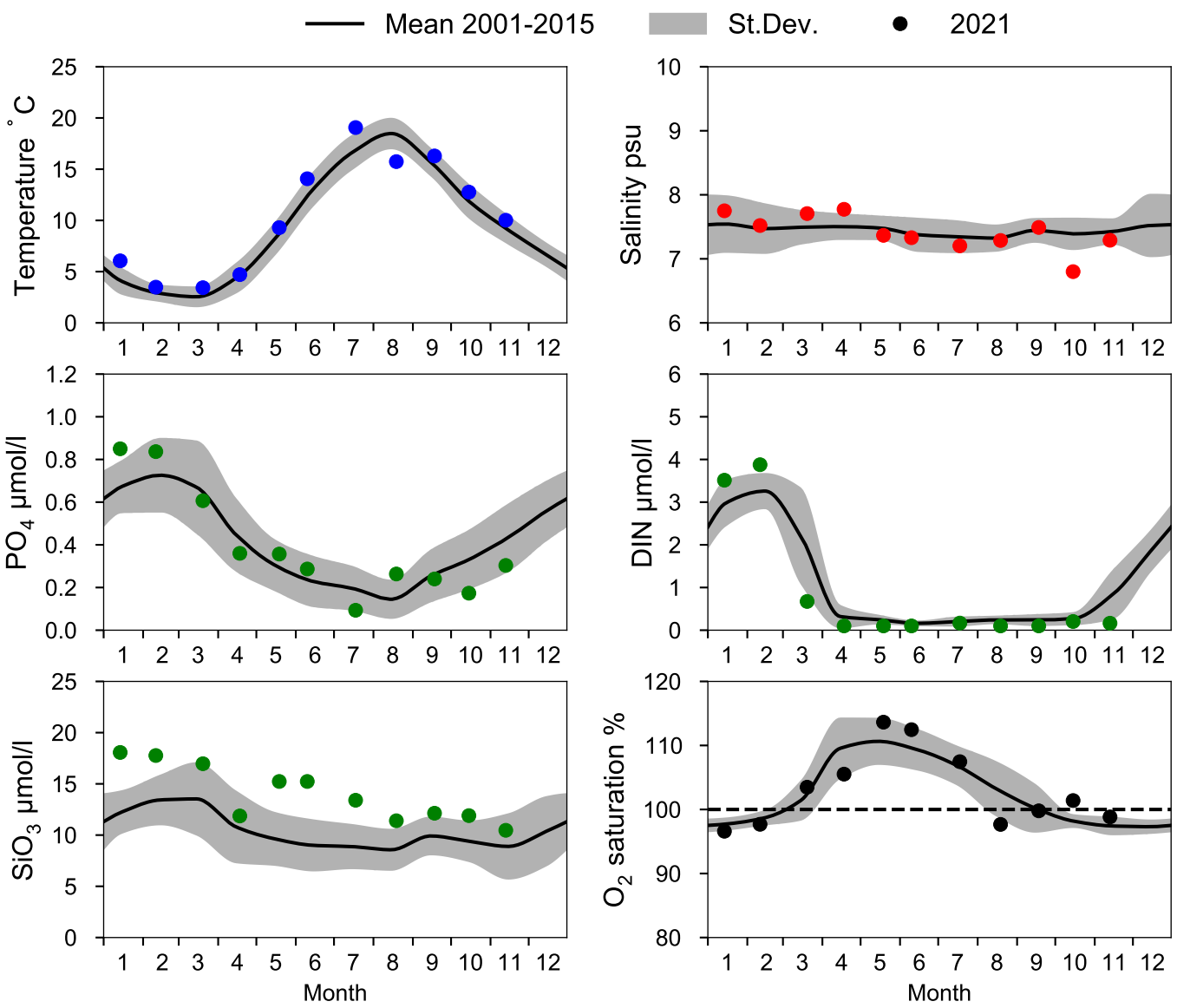


Vertical profiles REF M1V1
November

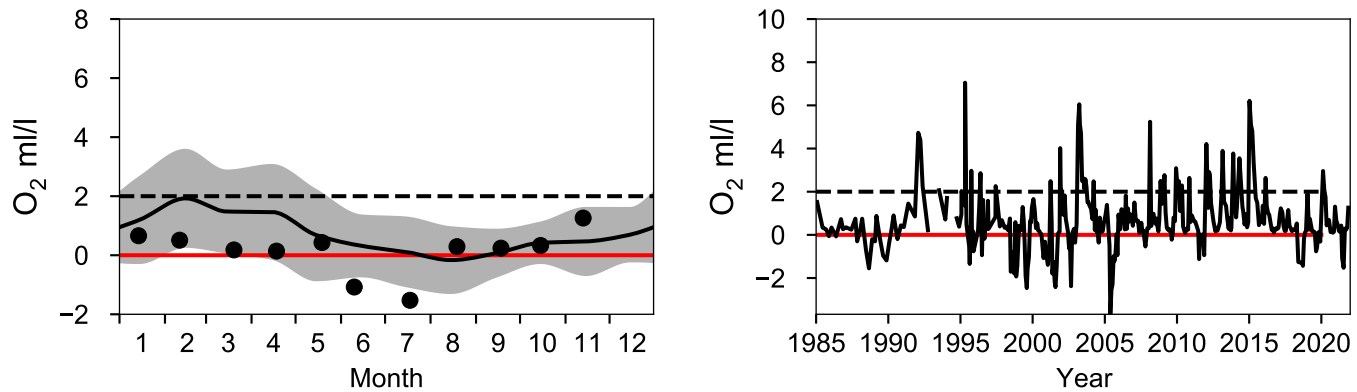


STATION HANÖBUKTEN SURFACE WATER (0-10 m)

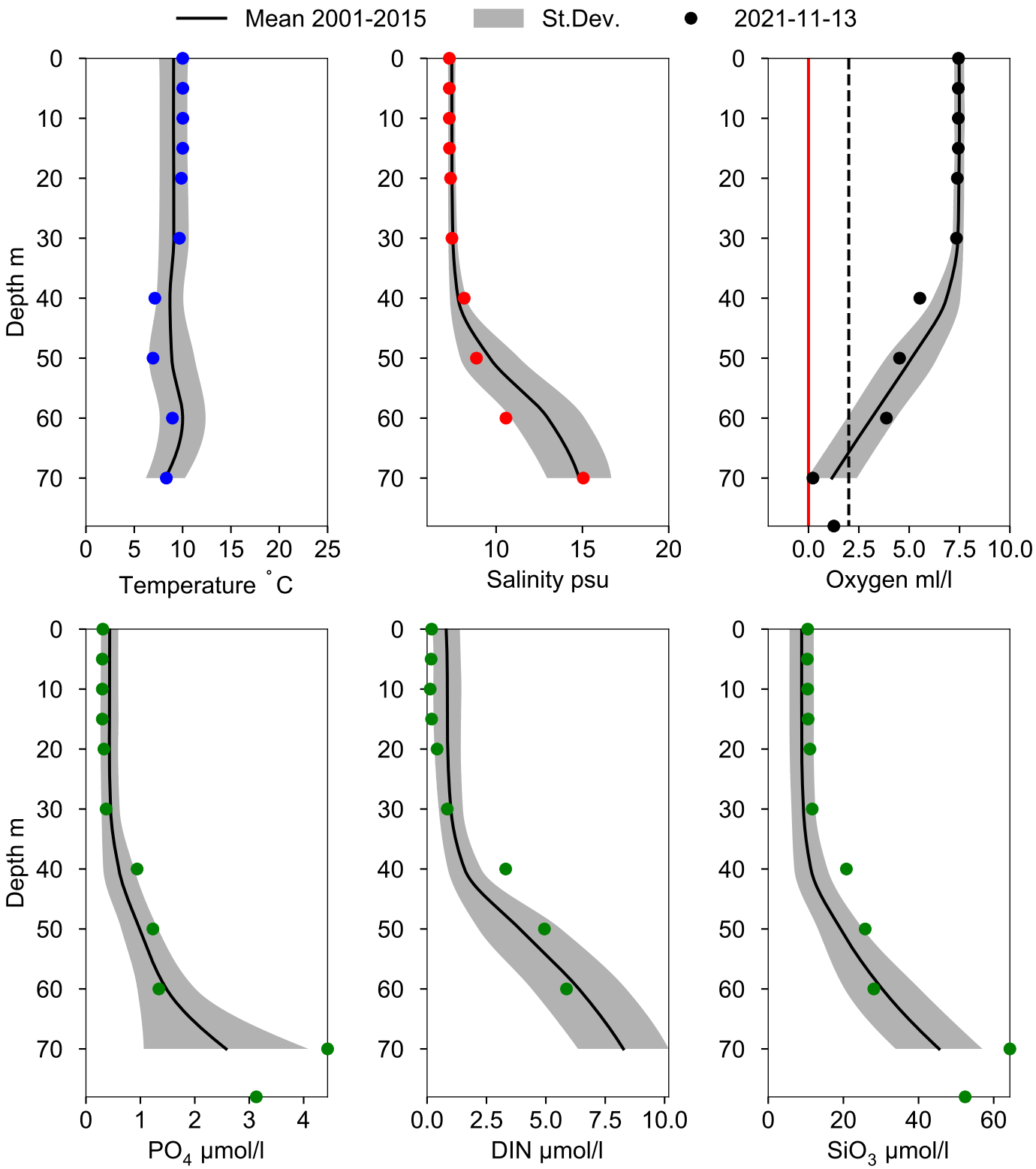
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 70 m)

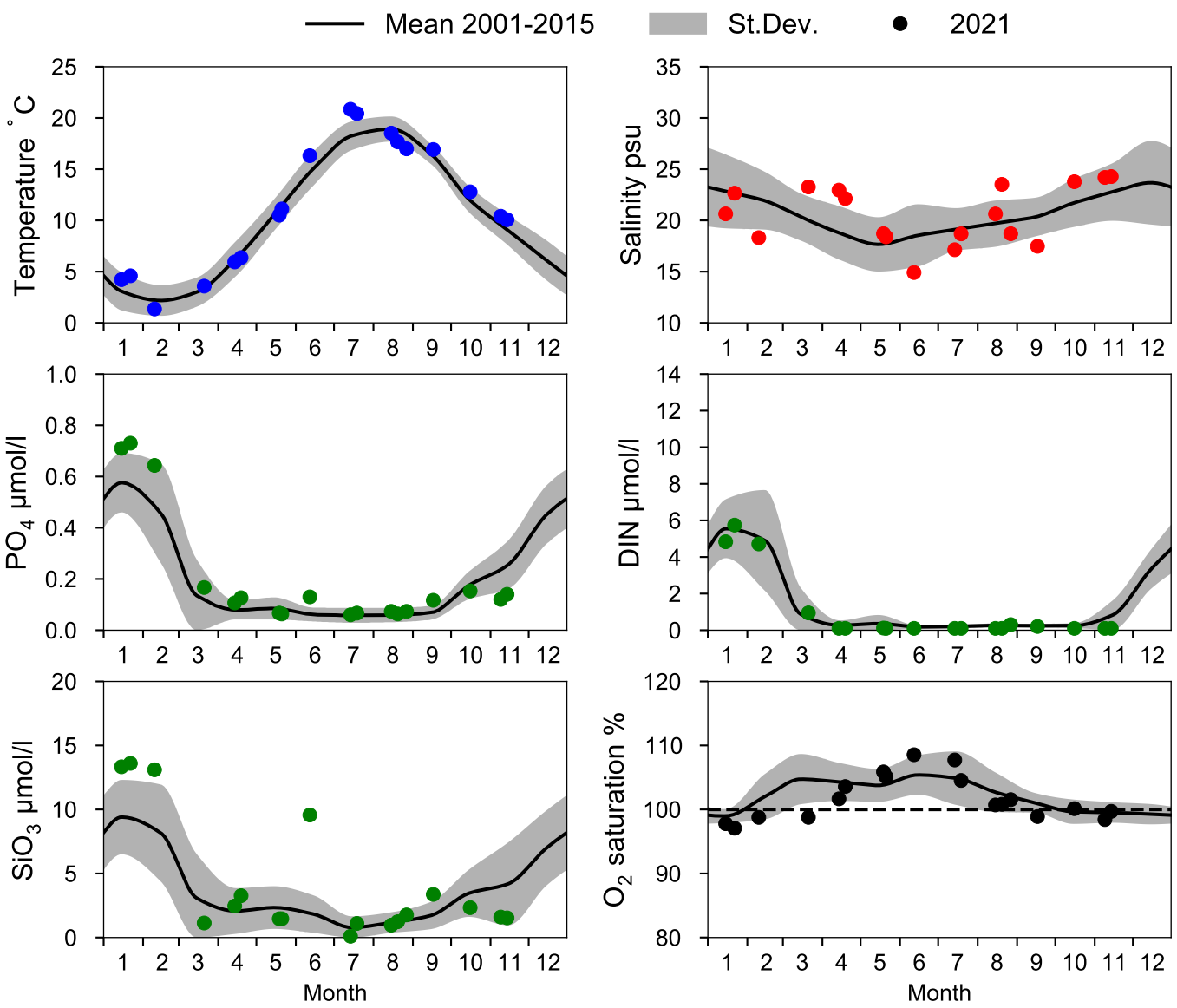


Vertical profiles HANÖBUKTEN
November

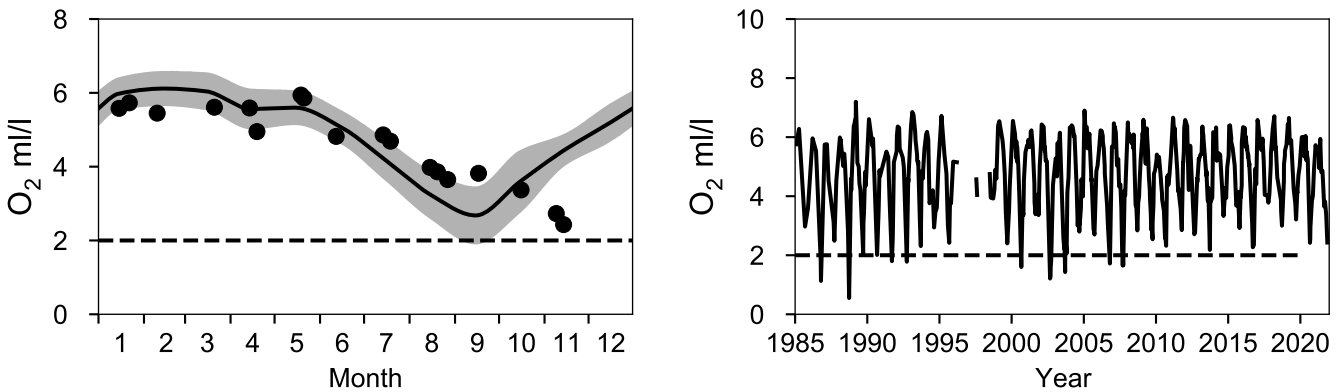


STATION ANHOLT E SURFACE WATER (0-10 m)

Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 52 m)



Vertical profiles ANHOLT E
November