Cruise Report
July, R/V Svea
Swedish National Marine Monitoring Program

Survey period: 2020-07-07 - 2020-07-13
Survey area: Skagerrak, Kattegat, the Sound and the Baltic Proper
Principal: 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)

SUMMARY

During the cruise, which is part of the Swedish pelagial monitoring program, the Skagerrak, the Kattegat, the Sound and the Baltic Proper were visited.

The surface water temperature varied between 12.5-17.3 °C, which is lower than normal for the season. The salinity in the surface in the Baltic Proper was above normal at all stations visited.

Dissolved inorganic nitrogen in the surface water was below detection limit from the surface to 20-40 m at most every visited station, which is normal for the season. Phosphate levels were normal for the season in all sea areas. The silicate levels were above normal in the Baltic Proper except in the Western Gotland Basin and at BY20 Fårö Depth were the levels were normal. In the Kattegat the silicate levels were normal to below normal and in the Skagerrak measured normal levels.

The oxygen situation in the Baltic Sea continues to be severe. Completely oxygen-free conditions, when toxic hydrogen sulphide is formed, were found in the Western Gotland Basin from 80 meters deep and in the Eastern Gotland Basin from 125 meters deep. Acute oxygen deficiency (<2 ml/l) was found from 60-75 meters depth throughout the area. At BY1 in Arkona the oxygen level has decreased to the limit for acute oxygen deficiency, 2ml/l. The oxygen situation was good in the Skagerrak and Kattegat.

SMHI's next expedition is scheduled for 16-22 August with R/V Svea.

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RESULTS

The cruise was performed onboard R/V Svea and started in Lysekil on the 7th of July and ended in Göteborg on the 13th of July. The winds were strong during the first 24 hours and decreased to moderate the rest of the cruise and directions from mainly south west to west. The air temperature varied between 12.2 and 17.3°C.

A bottom system that measures temperature, salinity, oxygen and current was deployed at station Hanö Bight.

The wave buoy at Knolls ground were changed.

Samples were also taken from water and plankton samples for measuring selenium for EAWAG in Switzerland (Swiss Federal Institute of Aquatic Science and Technology). Samples from the surface were taken for Uppsala University.

During the expedition, phytoplankton samples were analysed on board by the phytoplankton expert Marie Johansen, the results are presented in the Algaware report for July;
https://www.smhi.se/publikationer/publikationer/algrapporter .
Daily algae monitoring via satellite is performed by SMHI during the summer and is available at
http://www.smhi.se/vadret/hav-och-kust/algsituationen .

This report is based on data that has undergone an initial quality control. After further quality controls, certain values or quality flags may have changed. Data from this cruise is published as soon as possible on the data host's website, normally this is done within a week after the cruise is completed. Some analyzes are done after the cruise and will be published later.

Data and cruise reports can be downloaded here:
https://www.smhi.se/en/theme/marine-environment-2-885

The Skagerrak

The surface water temperature varied between 12.5 and 17.3°C which were lower than normal for the season. It was warmest near the coast. Deeper in the water column, the temperature was also normal or slightly above normal. The salinity in the surface water was between 23-32 psu and was higher than normal at all stations except at Släggö where it was lower. The stratification was developed and the thermocline and the halocline coincided at a depth of 15-70 meters.

The concentration of nutrients was low from the surface to 20 m. In the surface water, 0-10 m, normal levels were noted at all stations and the phosphate levels varied between 0.04-0.07 µmol/l, the silicate levels varied between 0.1 µmol/l in offshore Skagerrak to 0.3 µmol/l near the coast. The content of dissolved inorganic nitrogen (DIN) was below detection limit (<0.1 µmol/l) at all stations except at P2 were the level was 0.7 µmol/l. In the deep water the concentrations of nutrients were normal to lower than normal.

The oxygen situation was good at all stations in the Skagerrak, with values normal for the season. The lowest concentration was noted at Släggö, 3.9 ml/l.

Plankton activity, measured by CTD fluorescence, was noted at nearly all stations about 20-30 meters depth.

The Kattegat and the Sound

The surface water temperature was lower than normal for the season and varied between 15.6-16.3°C. The salinity in the surface water was slightly higher than normal and varied between 18 and 26 psu, lowest in the Sound and highest in the northern Kattegat. Thermocline and halocline coincided and were found at a depth of 17-23 meters. In the deep water, below the stratification, the salinity was normal and the temperature was generally normal or slightly above normal.

Dissolved inorganic nitrogen and phosphate were consumed down to stratification which is normal for the season. Phosphate levels in the surface water varied between 0.05-0.06 µmol/l. The content of dissolved inorganic nitrogen was below detection limit (<0.1 µmol/l) at all stations. The silicate concentrations were lower or much lower than normal at all stations and varied between 0.1-0.3 µmol/l. The nutrient levels in the deep water were normal to lower than normal for the season.

At all the stations visited, the oxygen content in the bottom water was good. In Kattegat the bottom water oxygen concentration ranged from 4.9 to 5.2 ml/l and in the Sound it was 3.7 ml/l.

Fluorescence measurements from the CTD indicated low plankton activity from the surface down to a depth of 20 meters. A fluorescence peak was noted at Anholt E at about 20 meters.

The Baltic Proper

The surface water temperature, 0-10 m, was slightly lower than normal throughout the entire Baltic Proper and varied between 13.5-16.2°C. The salinity in the surface water was still above normal at all stations visited, and varied between 6.7 and 8.2 psu. The halocline was found at about 60-70 meters depth in the Eastern and Western Gotland Basin. In the Bornholm Basin, Hanö Bight and in Arkona it was found about 40 meters depth. The thermocline was found in the whole area at 20-30 meters depth.

The levels of phosphate in the surface water were normal in the whole area and varied between 0.07–0.28 µmol/l. Dissolved inorganic nitrogen was detected from below the detection limit (<0.10 µmol/l) in almost the whole area to 0.5 µmol/l at the stations in the north. The silicate content in the surface water was above normal throughout the entire Baltic Proper, except in the Western Gotland Basin and at BY20 Fårö Depth where it was normal. The levels varied between 9.1-16.9 µmol/l.

The oxygen situation in the Baltic Sea continues to be severe. Completely oxygen-free conditions, when toxic hydrogen sulphide is formed, were found in the Western Gotland Basin from 80 meters deep and in the Eastern Gotland Basin from 125 meters deep. Acute oxygen deficiency (<2 ml/l) was found from 60-75 meters depth throughout the area. At BY1 in Arkona the oxygen level has decreased to the limit for acute oxygen deficiency, 2ml/l.

The inflow that occurred in November/December 2019 was still visible at the southeastern Baltic Proper. Oxygen levels just below 1.0 ml/l were observed close to the bottom at BCSIII-10 and at intermediate depth, 80-120 meters, at BY10. The inflow was weakly visible at between 115 and 120 meters depth at BY15

Plankton activity, estimated from the chlorophyll fluorescence on the CTD probe, occurred throughout the investigated area.

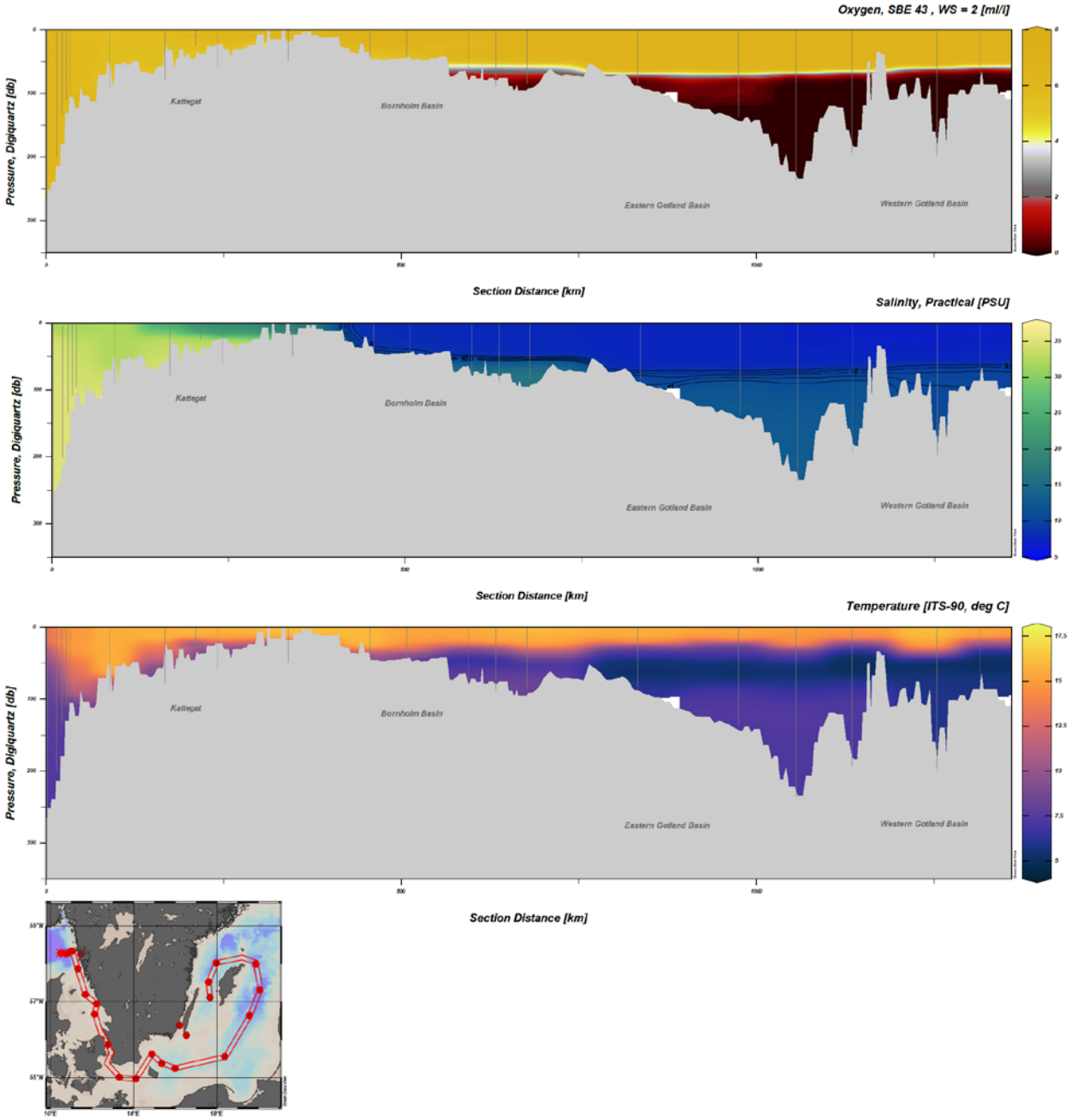

Figure 1. Transect showing dissolved oxygen, salinity and temperature from the Skagerrak, Kattegat, the Sound, through the Baltic Proper, to the Western Gotland Basin.

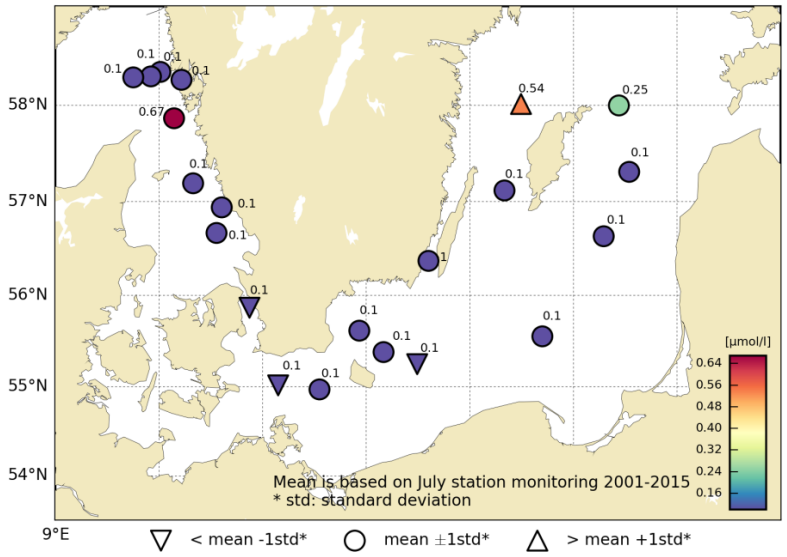

Figure 2: Concentration of dissolved inorganic nitrogen in the surface water (0-10m).

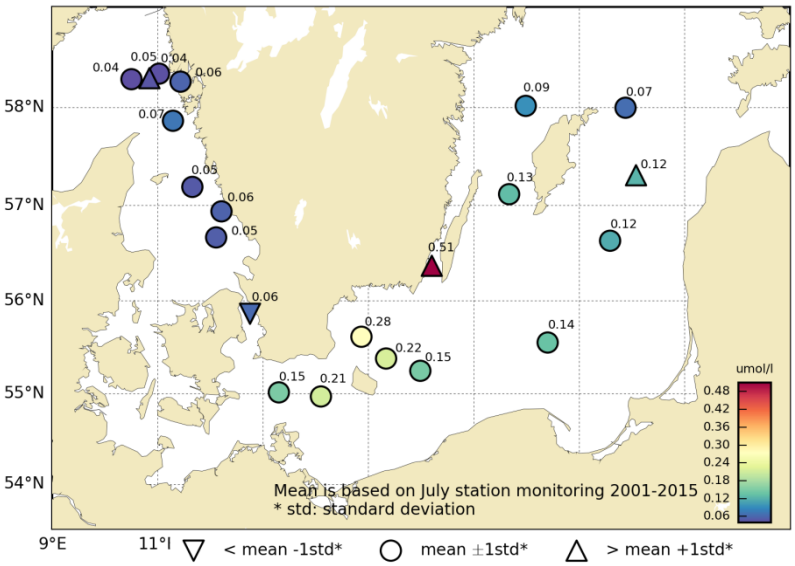

Figure 3: Concentration of phosphate in the surface water (0-10m).

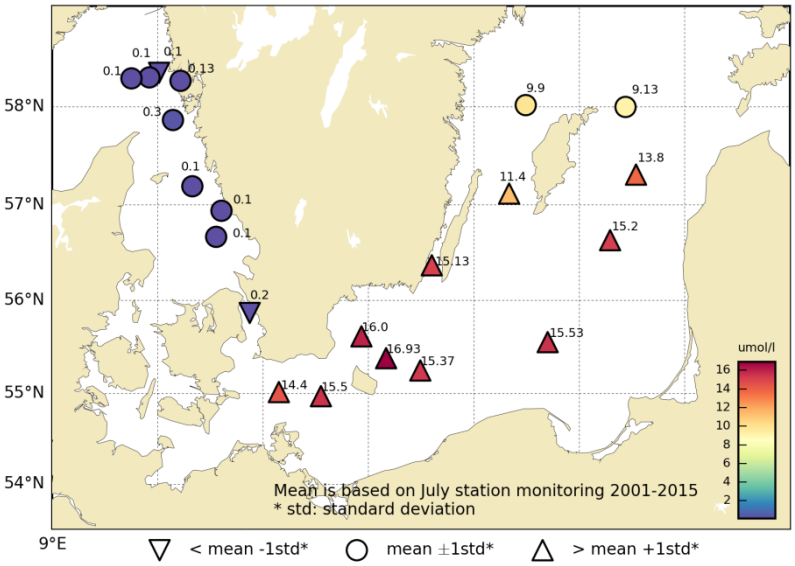

Figure 4: Concentration of silicate in the surface water (0-10m).

PARTICIPANTS

Name		Leg	From
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APPENDICES

- Track chart
- Table over stations, sampled parameters and number of sampling depths
- Map showing bottom oxygen concentrations and surface salinity, temperature and nutrient 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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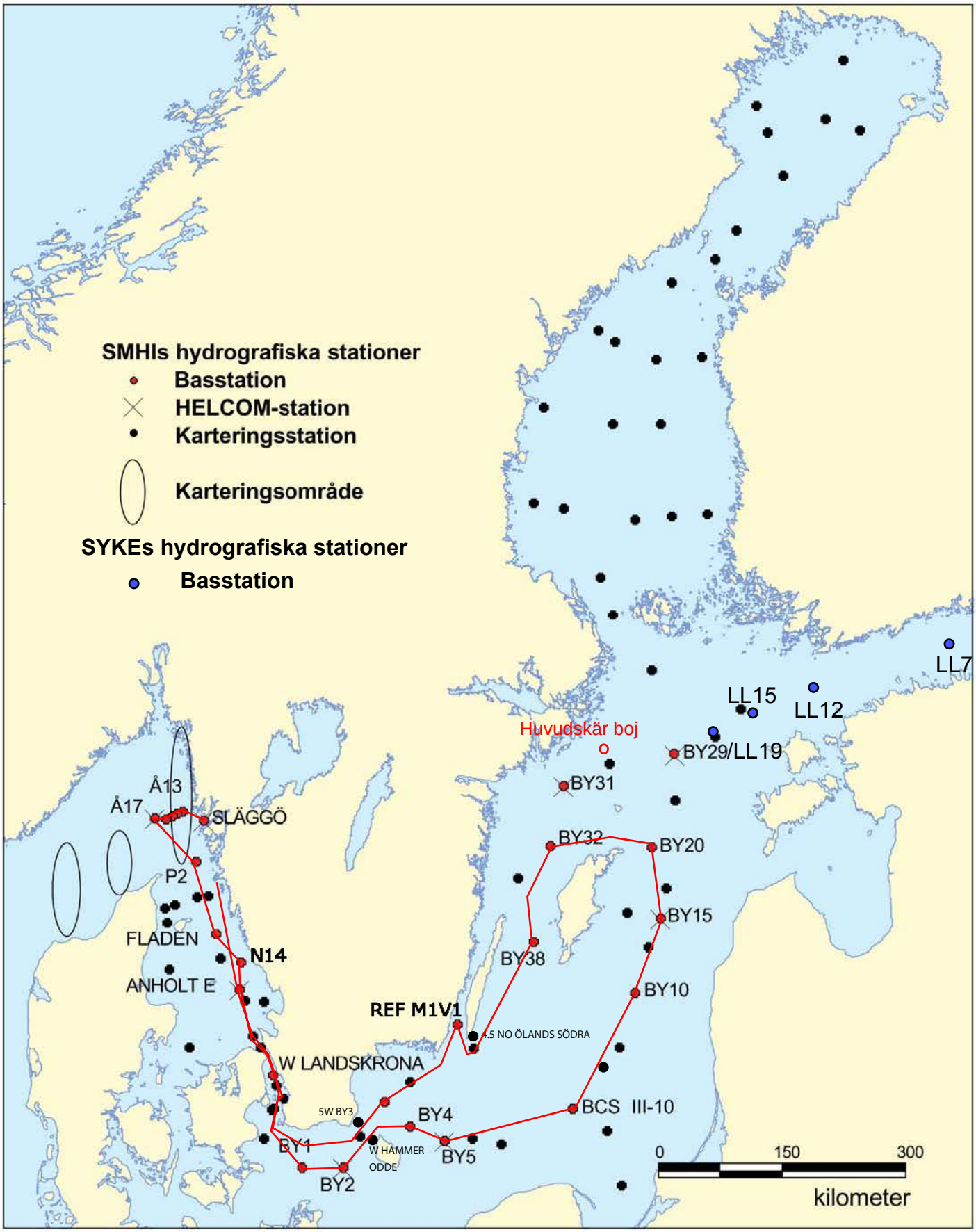
Ship: R/V SVEA
Date: 20200707-20200713
Series: 0469-0494



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Time: 22:47

Ship: SE
Year: 2020

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
0469	14	FIBG27	BAS...	SLÄGGÖ	5815.58	01126.09	20200707	1015	74	7	22	14	13.4	1004	1420	xxx-	9	9	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-
0470	14	SKEX14	BAS...	Å13	5820.39	01101.68	20200707	1400	90		22	12	12.4	1003	1150	x---	10	10	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-
0471	14	SKEX15	BAS...	Å14	5818.99	01056.54	20200707	1540	110		22	12	13.1	1003	1250	----	11	0	-	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
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0473	14	SKEX17	BAS...	Å16	5816.03	01043.45	20200707	1845	202		21	8	13.2	1002	1640	----	14	0	-	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
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0476	14	KANX25	BAS...	FLADEN	5711.53	01139.58	20200708	0640	84		25	9	12.7	1005	1240	x---	12	12	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	x	-
0477	14	KANX50	BAS...	N14 FALKENBERG	5656.37	01212.72	20200708	1150	30	6	24	7	13.5	1007	2430	xxx-	7	7	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	-	x	-
0478	14	KAEX29	BAS...	ANHOLT E	5640.12	01206.64	20200708	1250	62	6	26	9	14.2	1008	1230	xxxx	10	10	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x
0479	14	BPSA02	BAS...	BY1	5500.94	01318.04	20200709	0210	47		27	6	13.8	1012	1530	x---	8	8	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-
0480	14	BPSA03	BAS...	BY2 ARKONA	5458.27	01405.93	20200709	0640	47	7	24	4	14.0	1013	1120	xxx-	8	8	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	x	-	-
0481	14	BPSB06	BAS...	BY4 CHRISTIANSÖ	5522.97	01520.10	20200709	1300	94	7	20	1	17.3	1012	1420	x---	12	12	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-
0482	14	BPSB07	BAS...	BY5 BORNHOLMSDJ	5515	01559.05	20200709	1620	91	6	22	2	14.8	1010	6820	xxxx	12	12	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
0483	14	BPSE11	BAS...	BCS III-10	5533.32	01824.01	20200710	0140	90		08	4	14.9	1006	9920	x---	12	12	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	-	x	x	-	-
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0488	14	BPWX00	EXT...	VÅGBOJ KNOLLS GRUND	5731.08	01736.47	20200711	0830	85		25	7	13.3	1009	1330	----	12	0	-	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	x	-
0489	14	BPWX45	BAS...	BY38 KARLSÖDJ	5707.03	01740.14	20200711	1140	114	6	23	2	15.0	1012	0020	x---	14	14	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	-	x	x	-	-
0490	14	BPSE49	BAS...	BY39 ÖLANDS S UDDE	5606.97	01632.15	20200711	1920	50		22	8	14.6	1016	1130	----	8	1	x	x	x	x	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-
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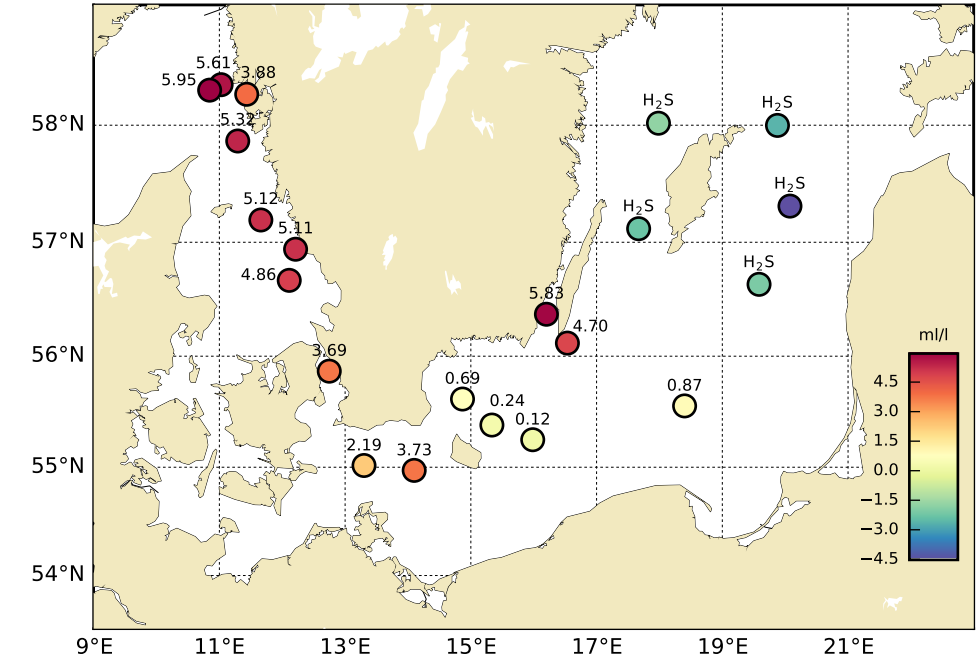
0492	14	BPSH05	BAS...	HANÖBUKTEN	5537.03	01452.04	20200712	0730	80	8	24	9	14.0	1020	1130	x---	11	11	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	x	-
0493	14	SOCX39	BAS...	W LANDSKRONA	5551.99	01244.87	20200712	2050	50		26	8	15.0	1021	9999	x---	9	9	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-
0494	14	KAEX29	BAS...	ANHOLT E	5640.11	01206.66	20200713	0325	62		26	8	13.3	1019	2830	x-xx	10	10	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x	-

Bottom water oxygen concentration (ml/l)

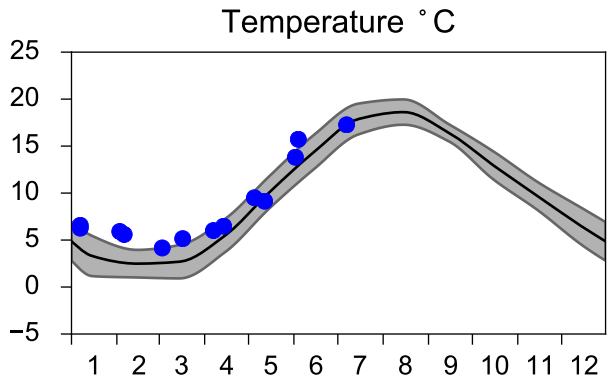
Ship: R/V Svea
Date: 20200707-20200713
Series: 0469-0494

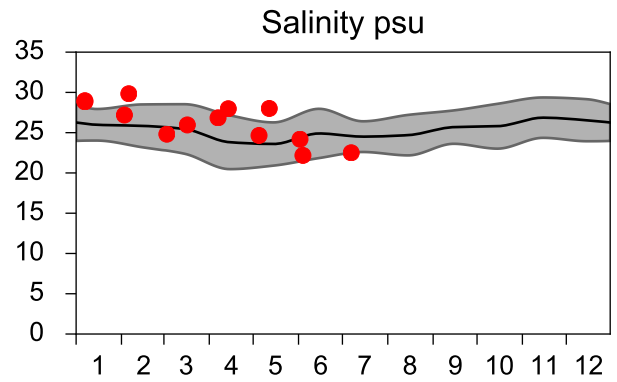


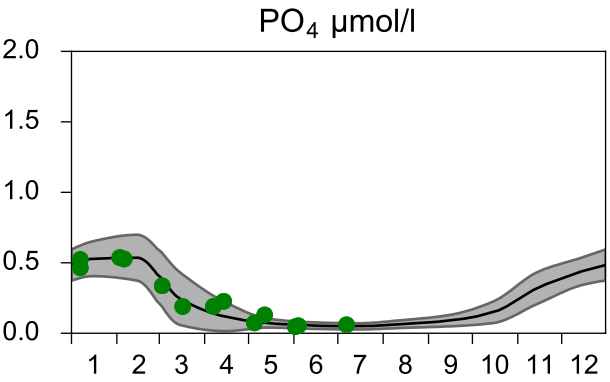
STATION SLÄGGÖ SURFACE WATER (0-10 m)

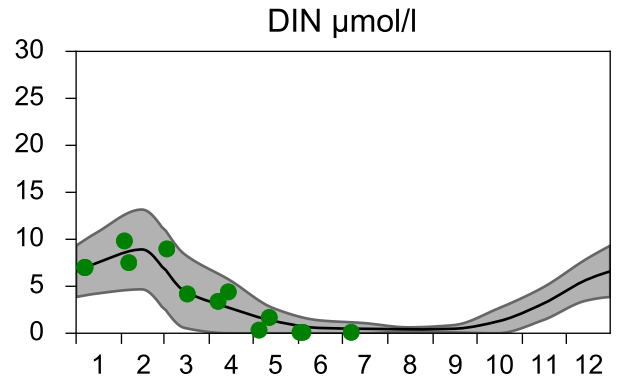
Annual Cycles

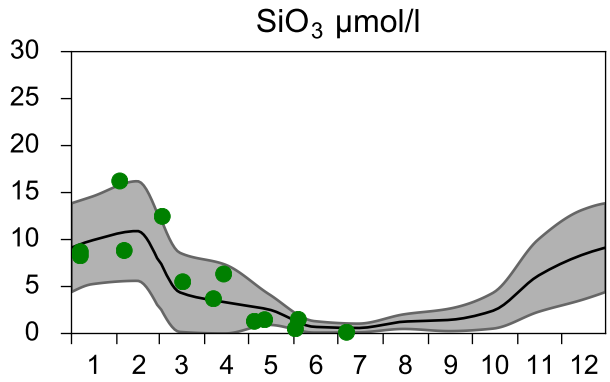
Mean 2001-2015 St.Dev. 2020

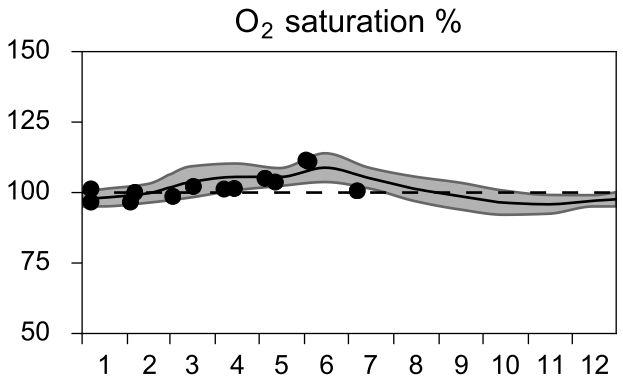




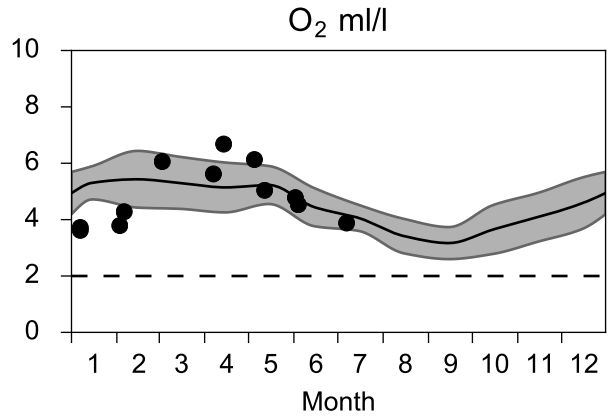


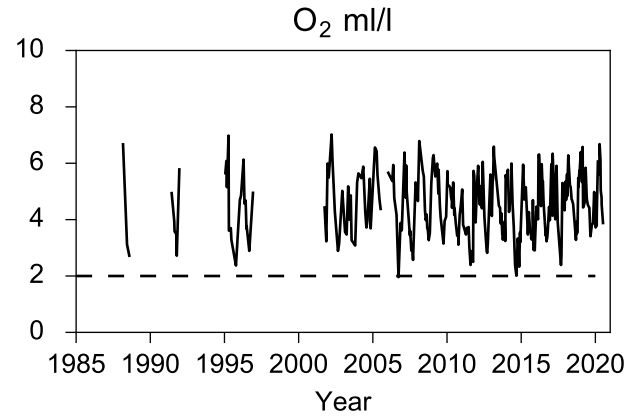




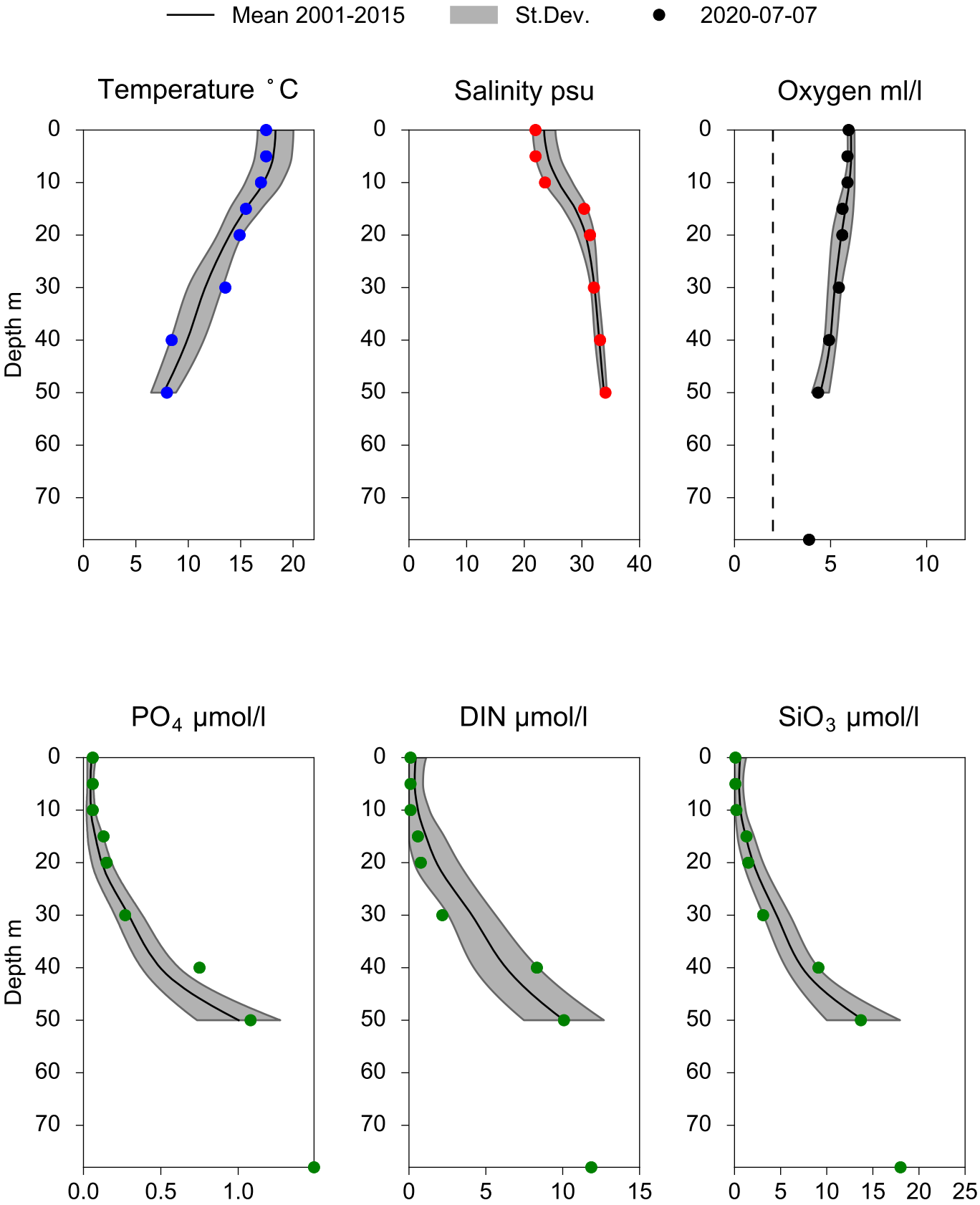


OXYGEN IN BOTTOM WATER (depth >= 64 m)





Vertical profiles SLÄGGÖ
July



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Annual Cycles

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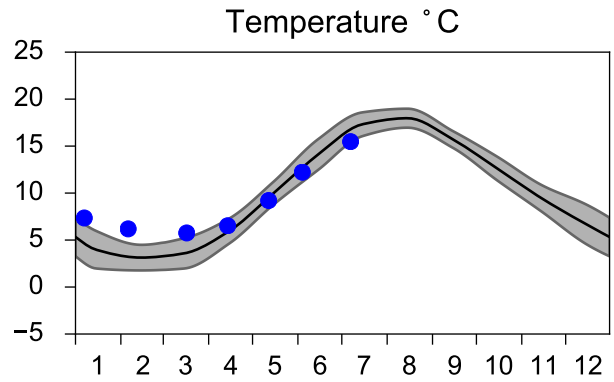
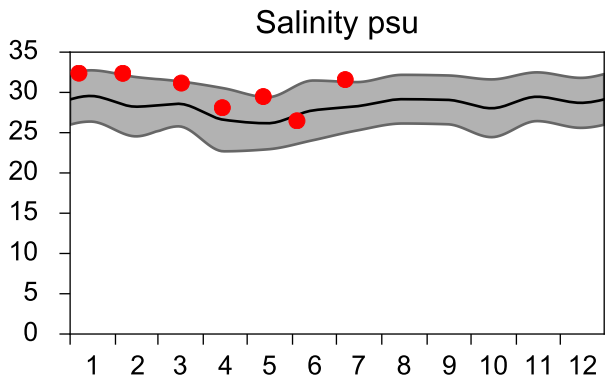
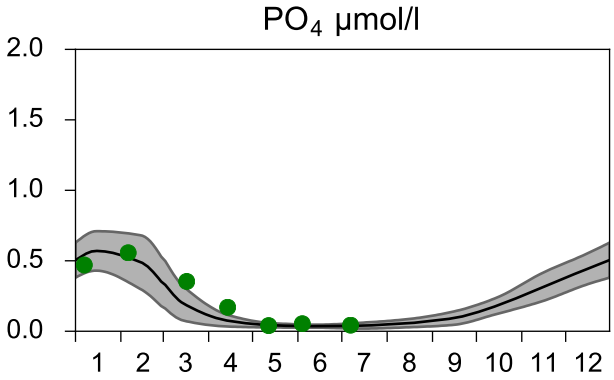
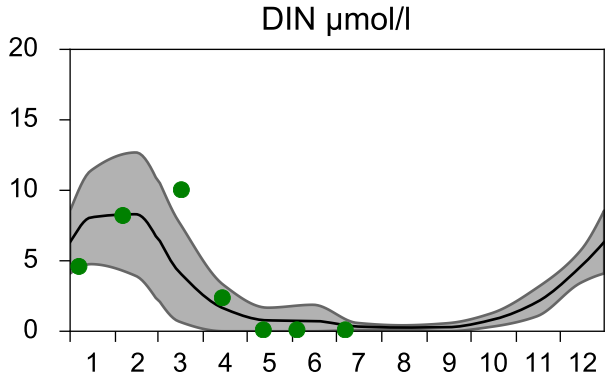
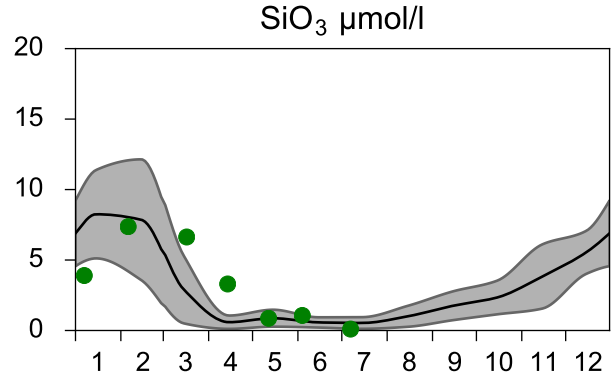
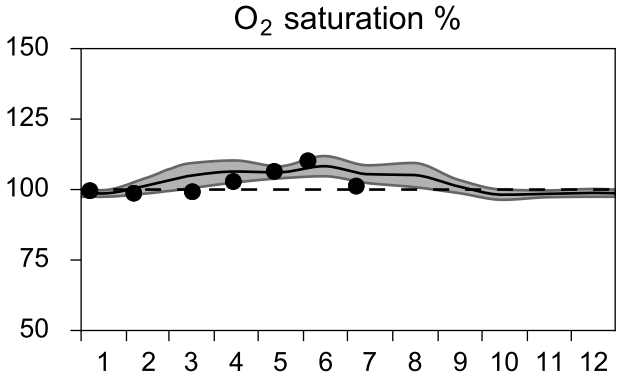




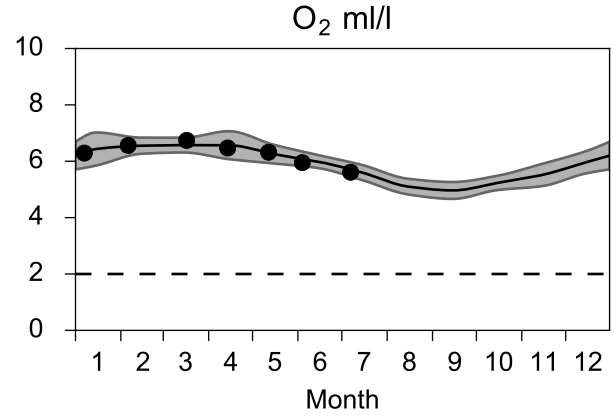


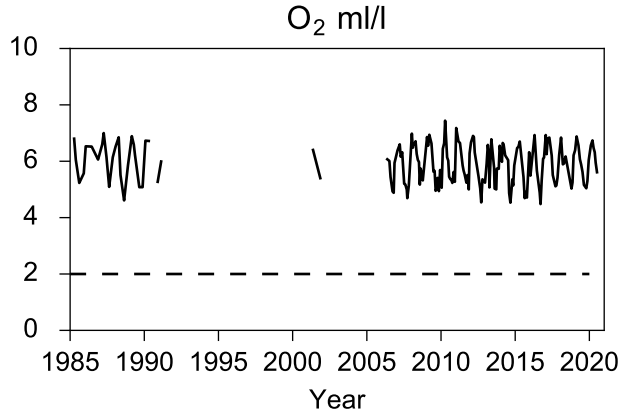




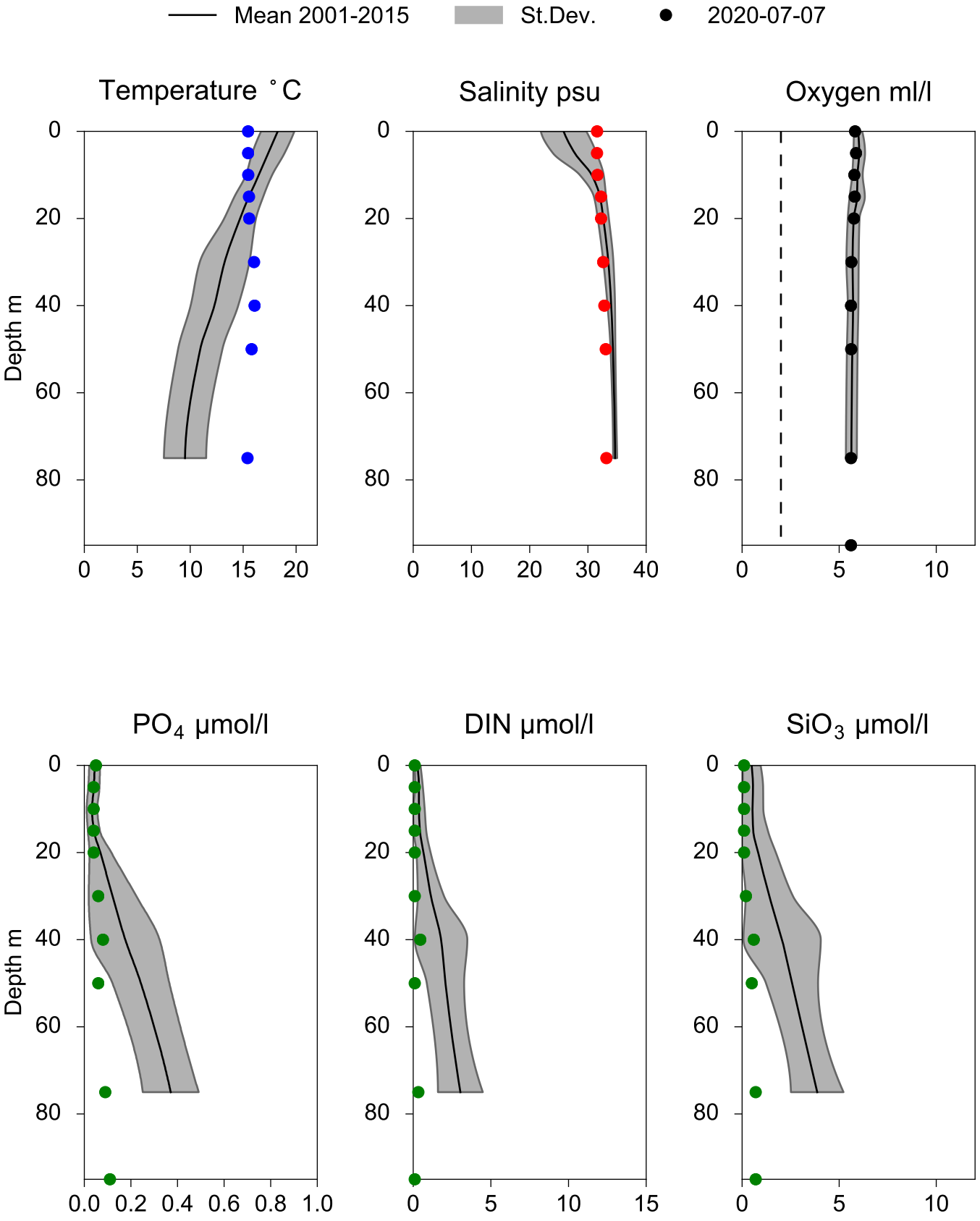


OXYGEN IN BOTTOM WATER (depth >= 80 m)



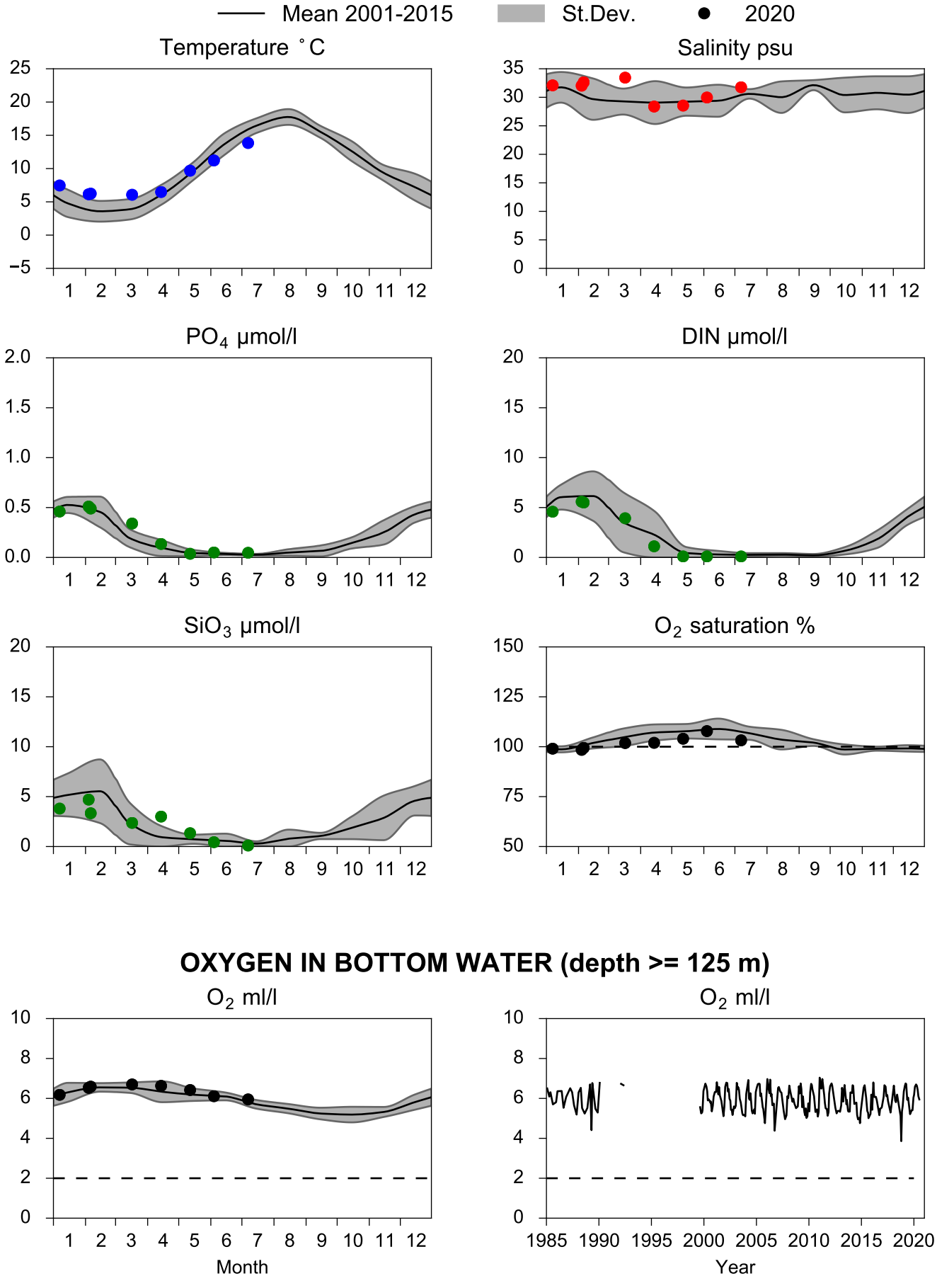


Vertical profiles Å13
July



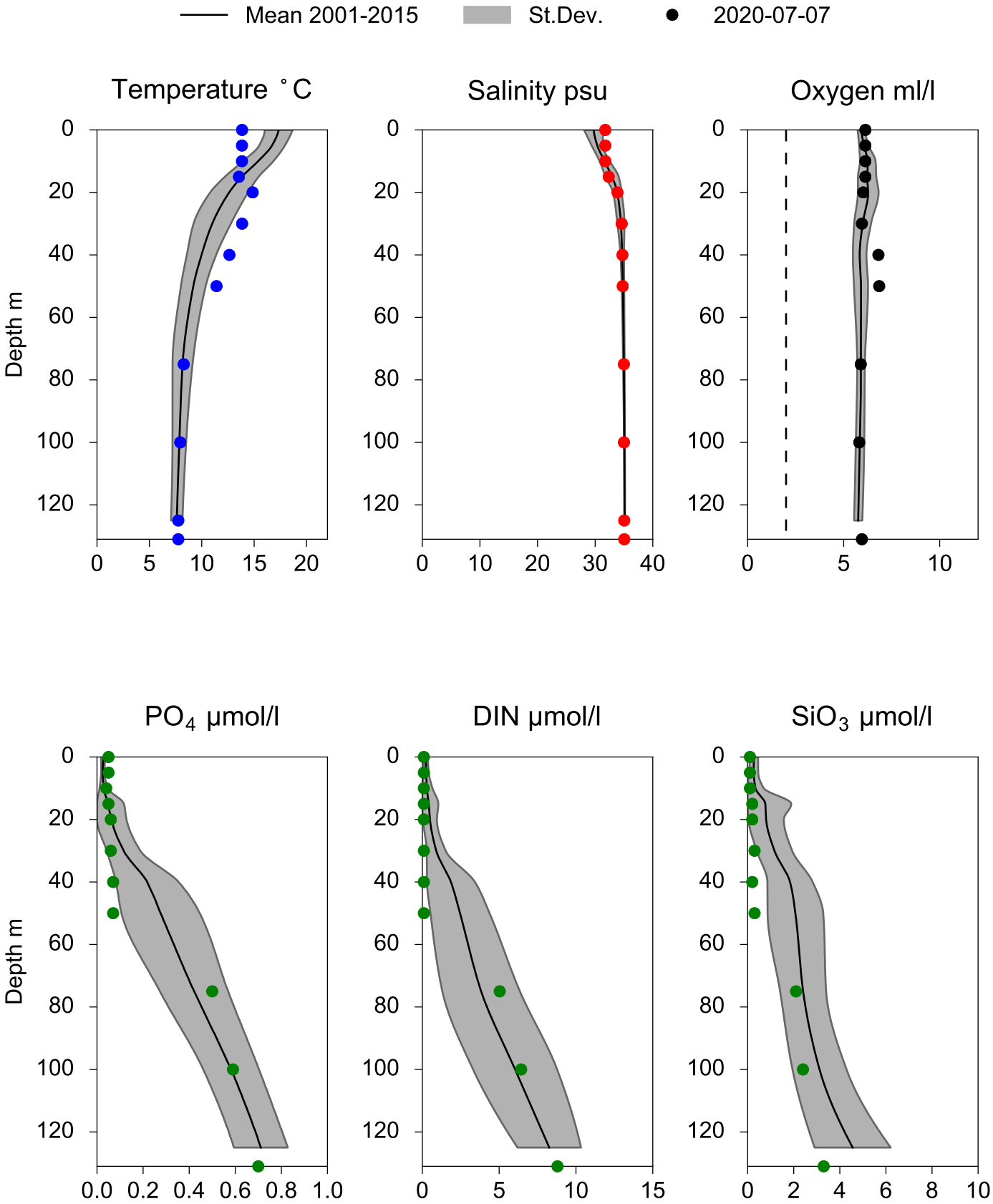
STATION Å15 SURFACE WATER (0-10 m)

Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 125 m)

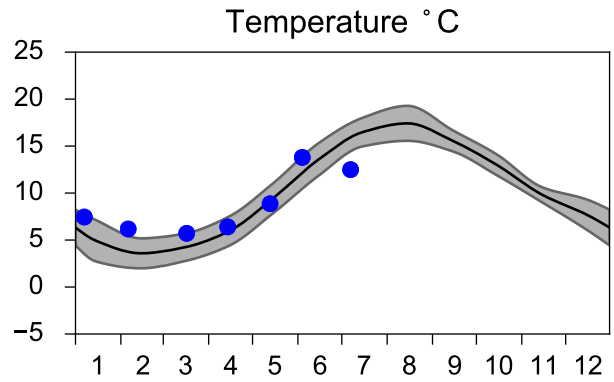
Vertical profiles Å15
July

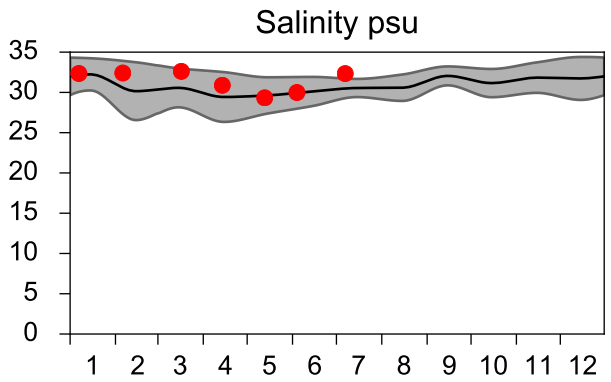


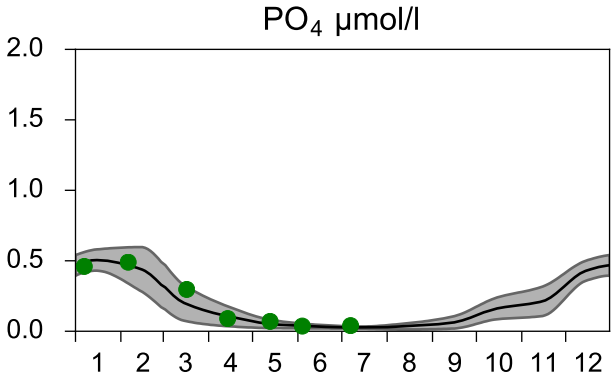
STATION Å17 SURFACE WATER (0-10 m)

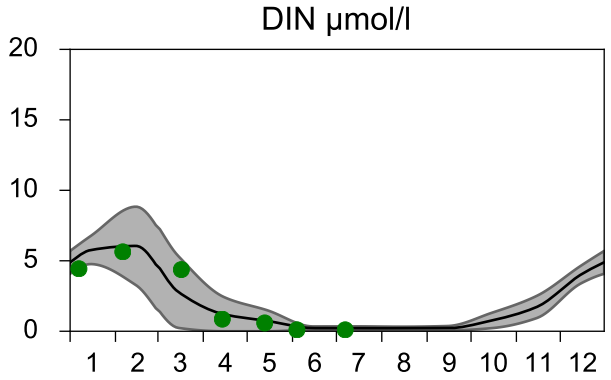
Annual Cycles

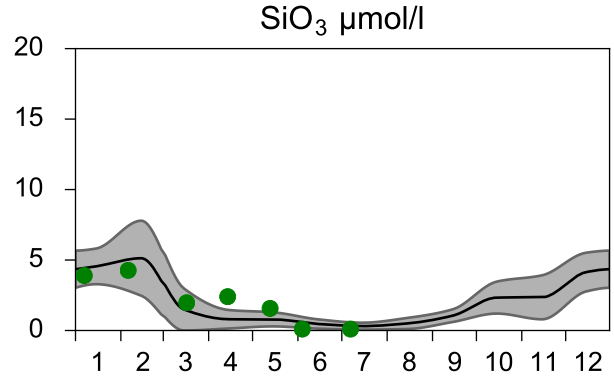
Mean 2001-2015 St.Dev. 2020

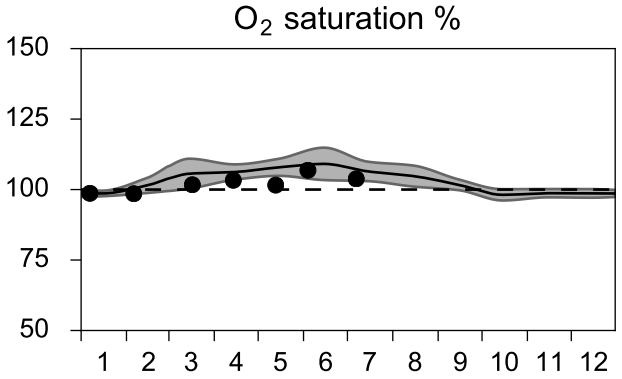




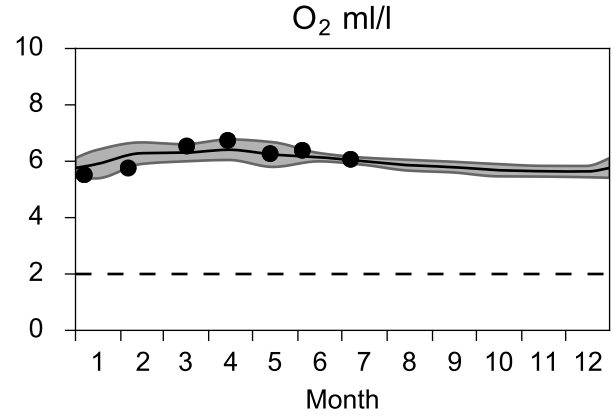


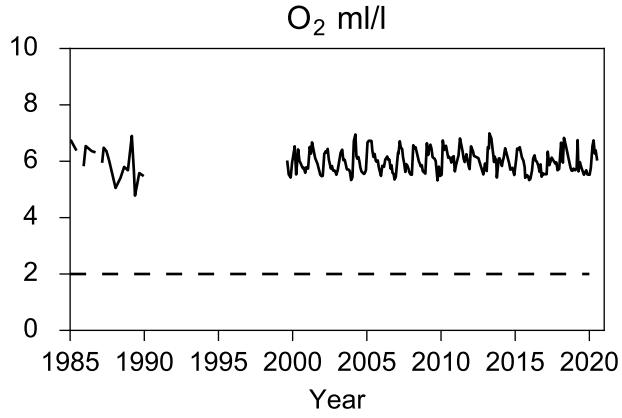




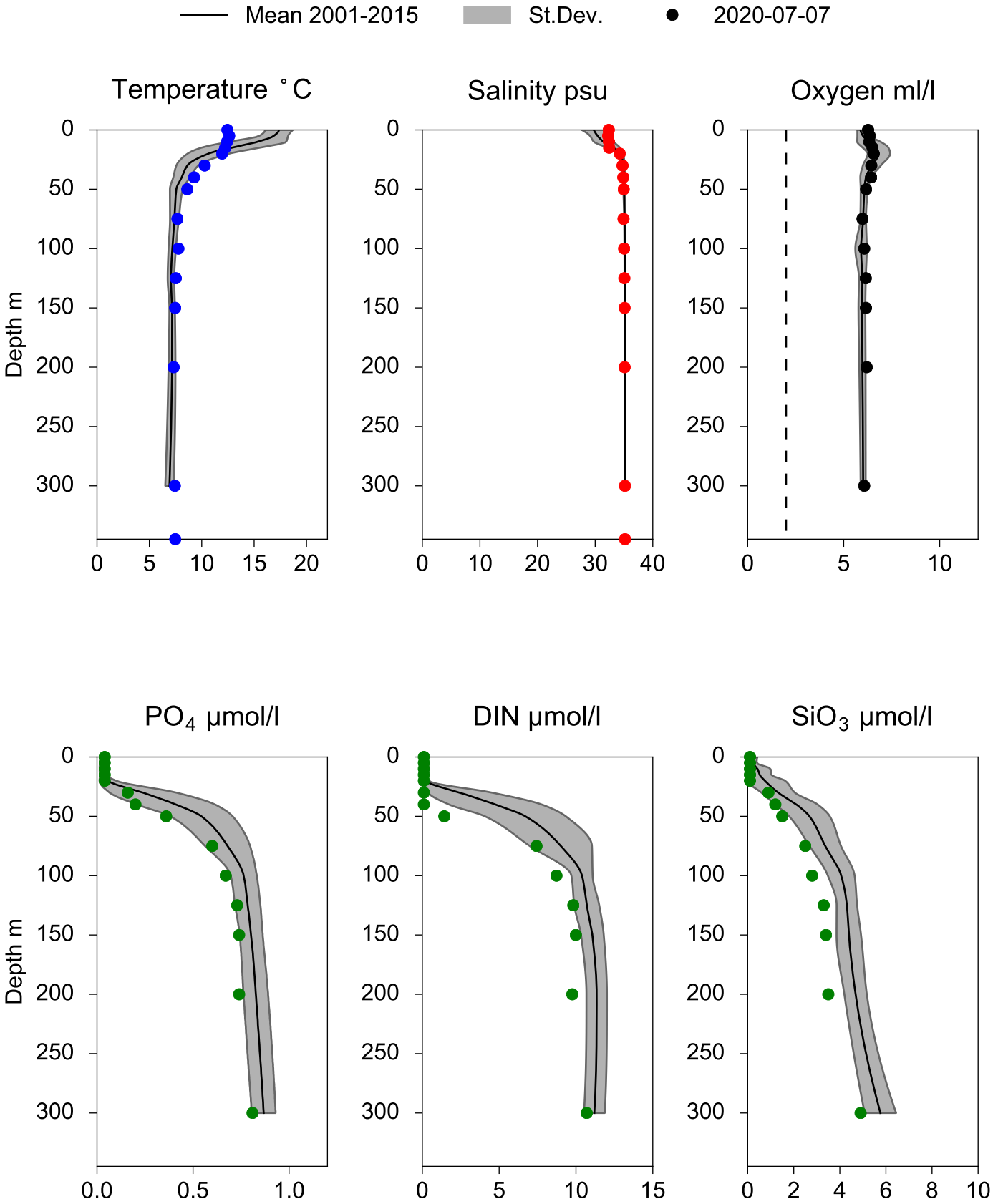


OXYGEN IN BOTTOM WATER (depth >= 300 m)





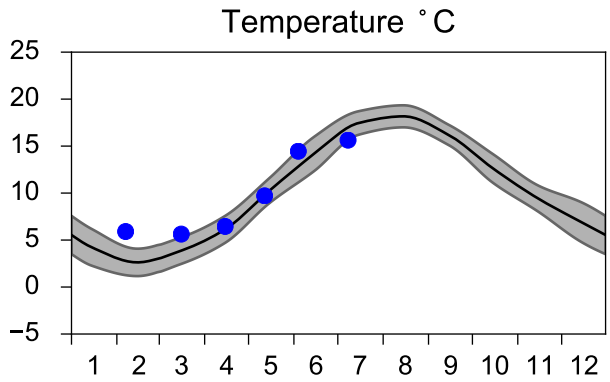
Vertical profiles Å17
July

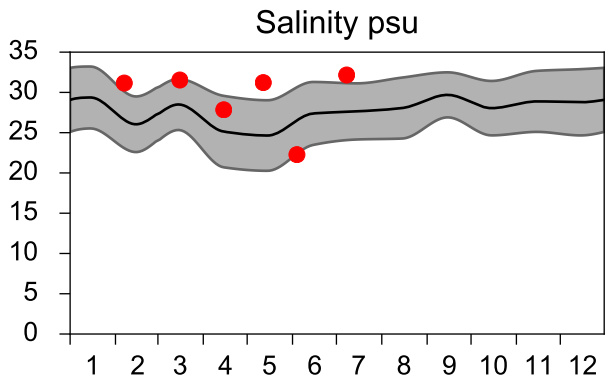


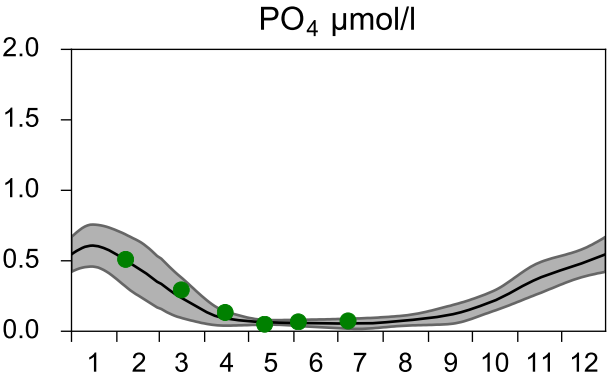
STATION P2 SURFACE WATER (0-10 m)

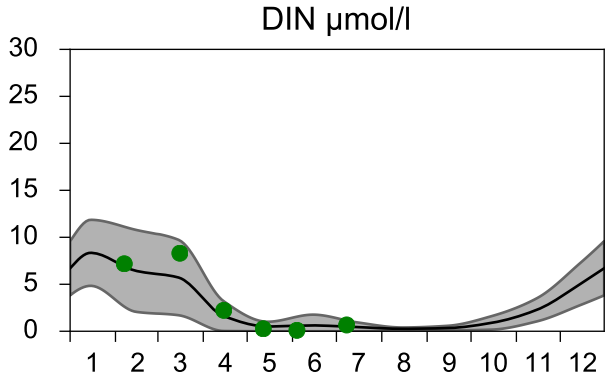
Annual Cycles

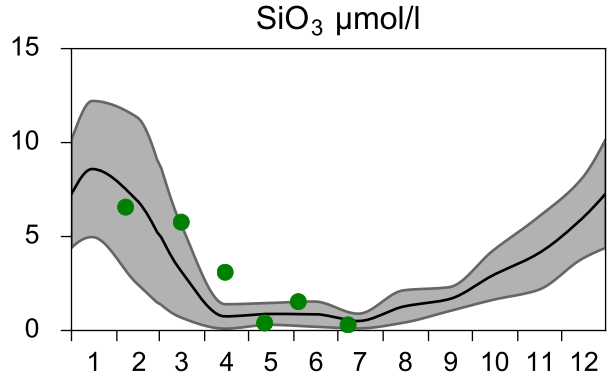
Mean 2001-2015 St.Dev. 2020

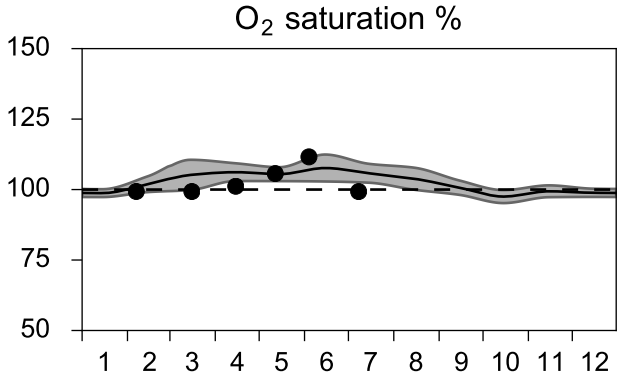




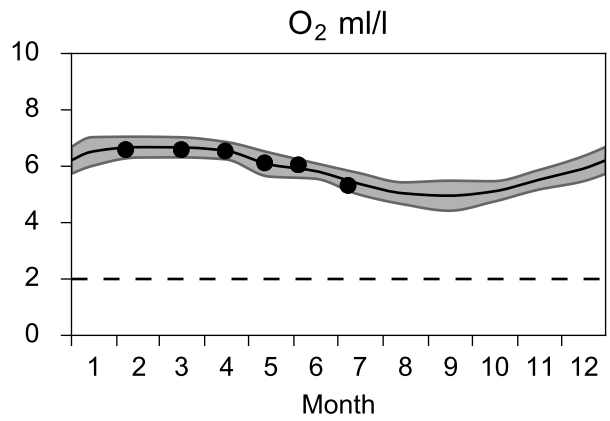


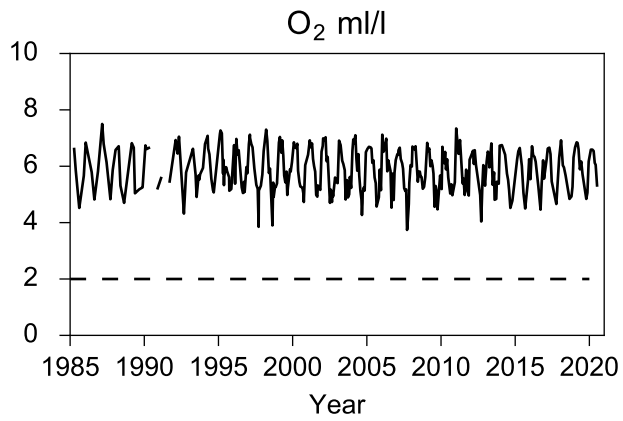




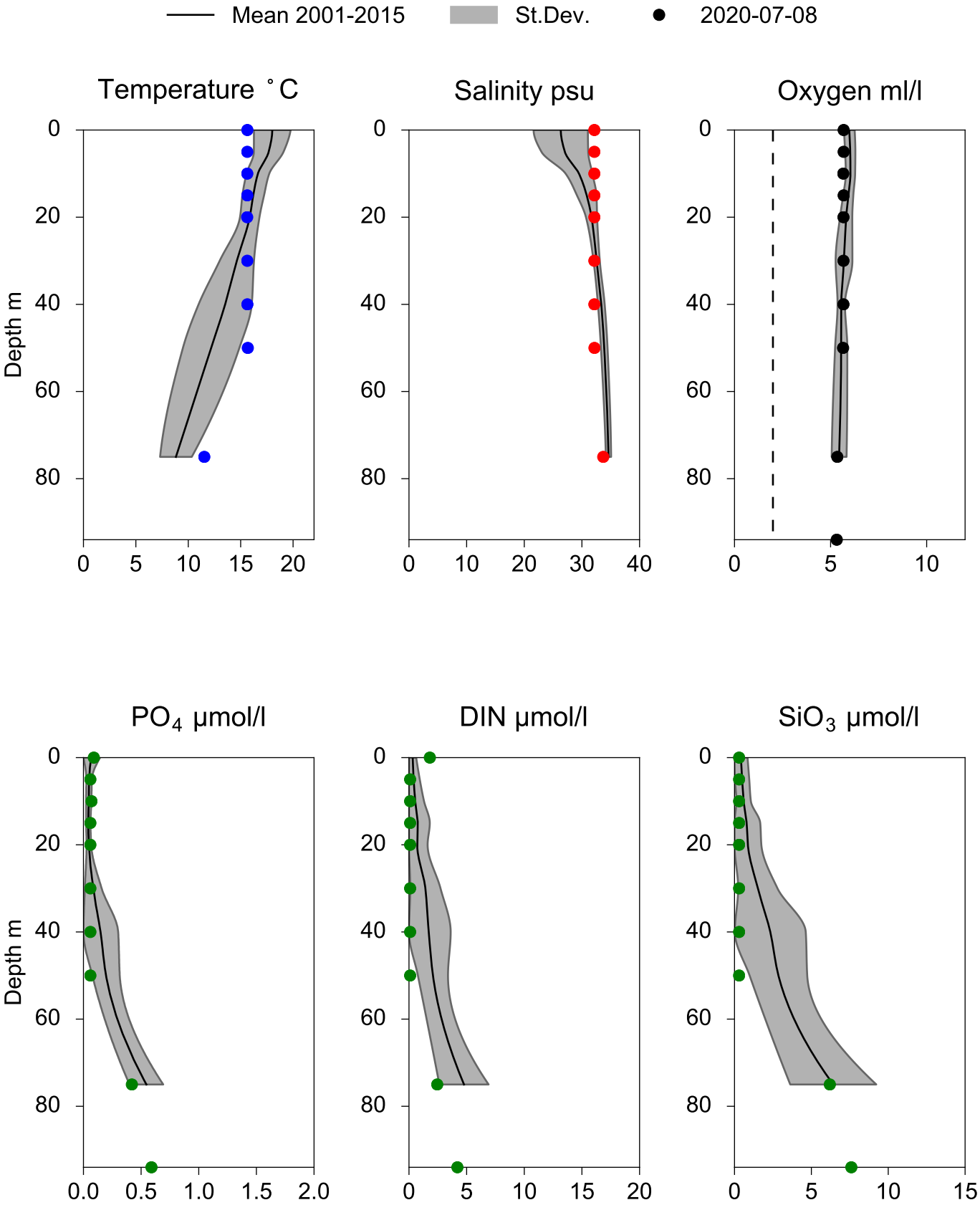


OXYGEN IN BOTTOM WATER (depth >= 75 m)

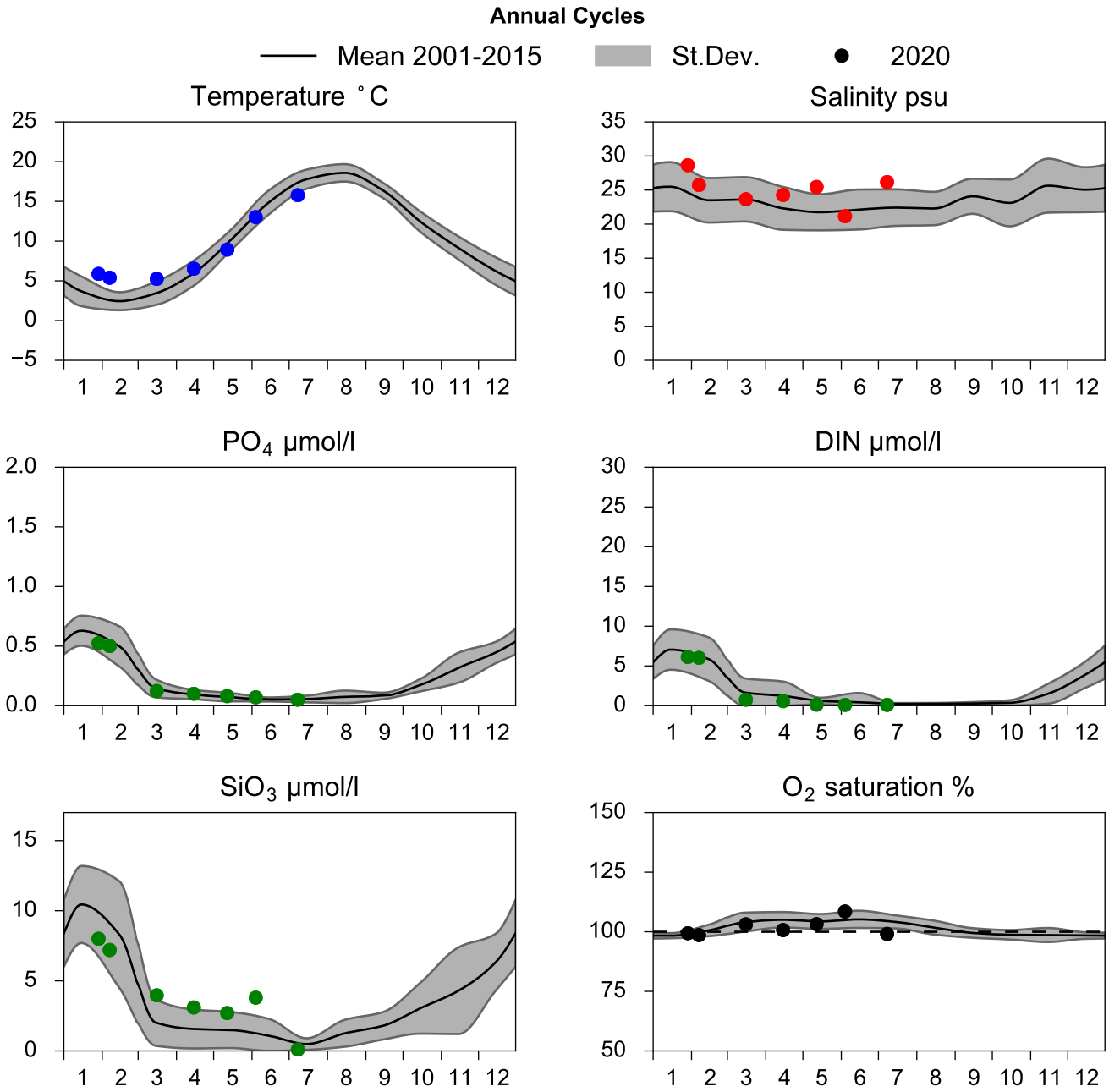




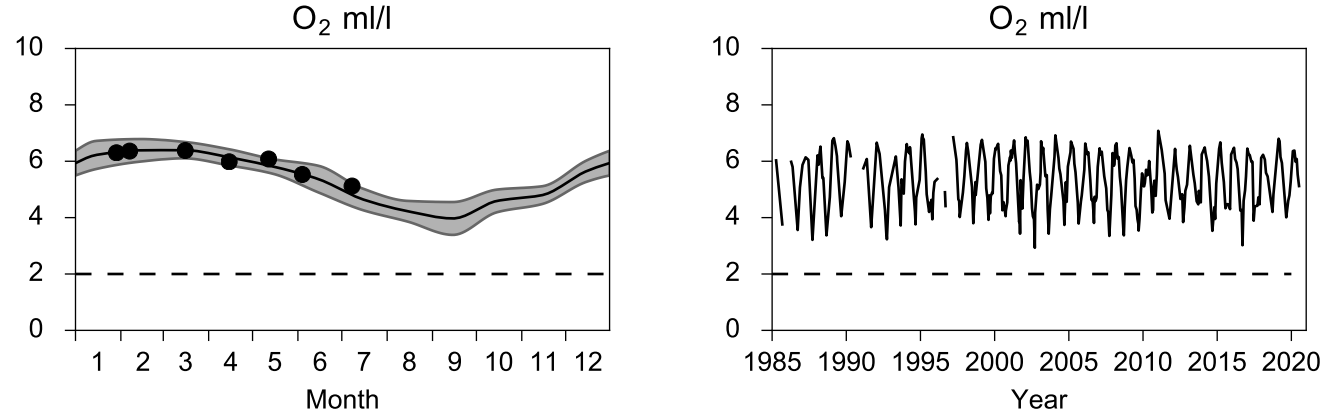
Vertical profiles P2
July



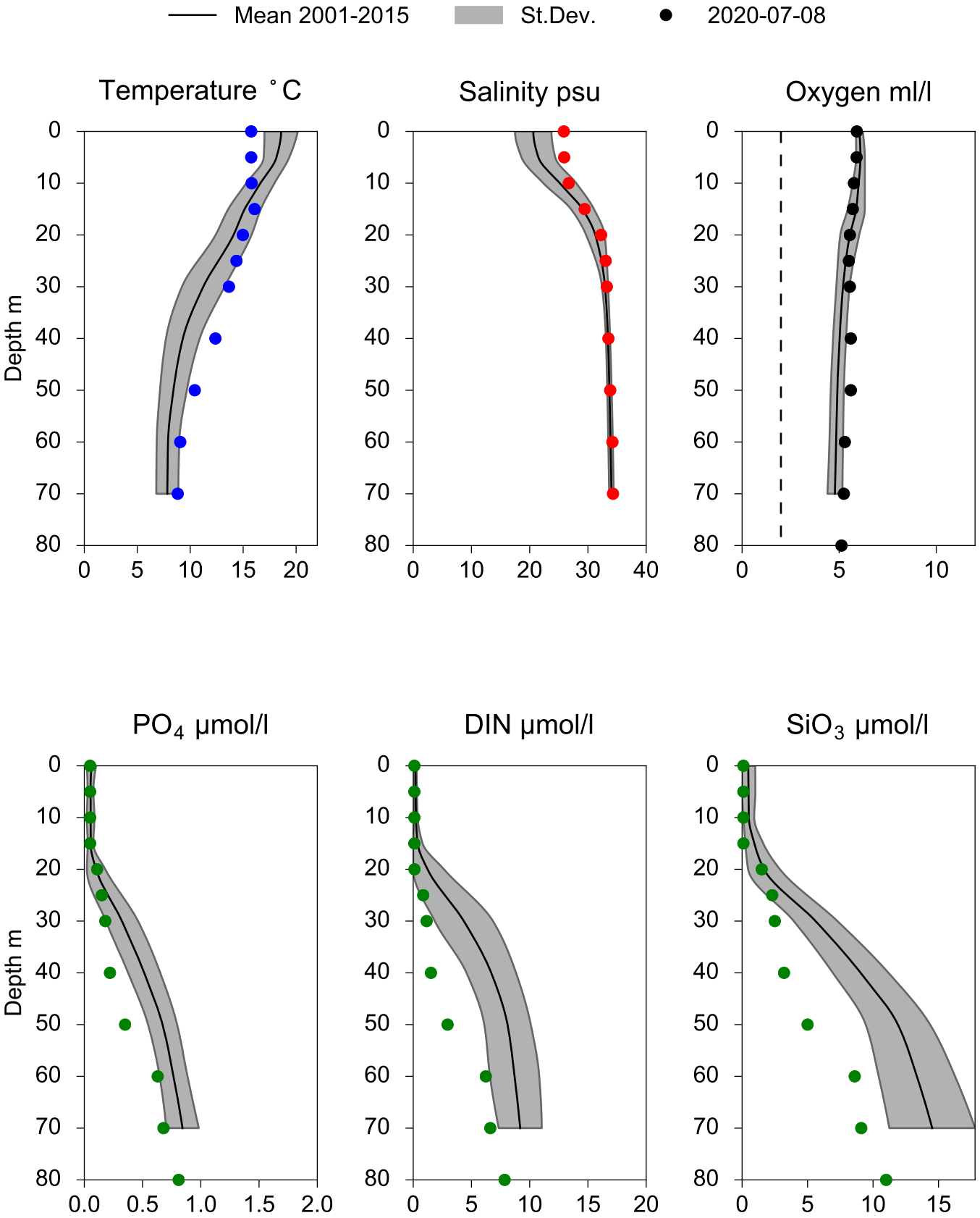
STATION FLADEN SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 74 m)

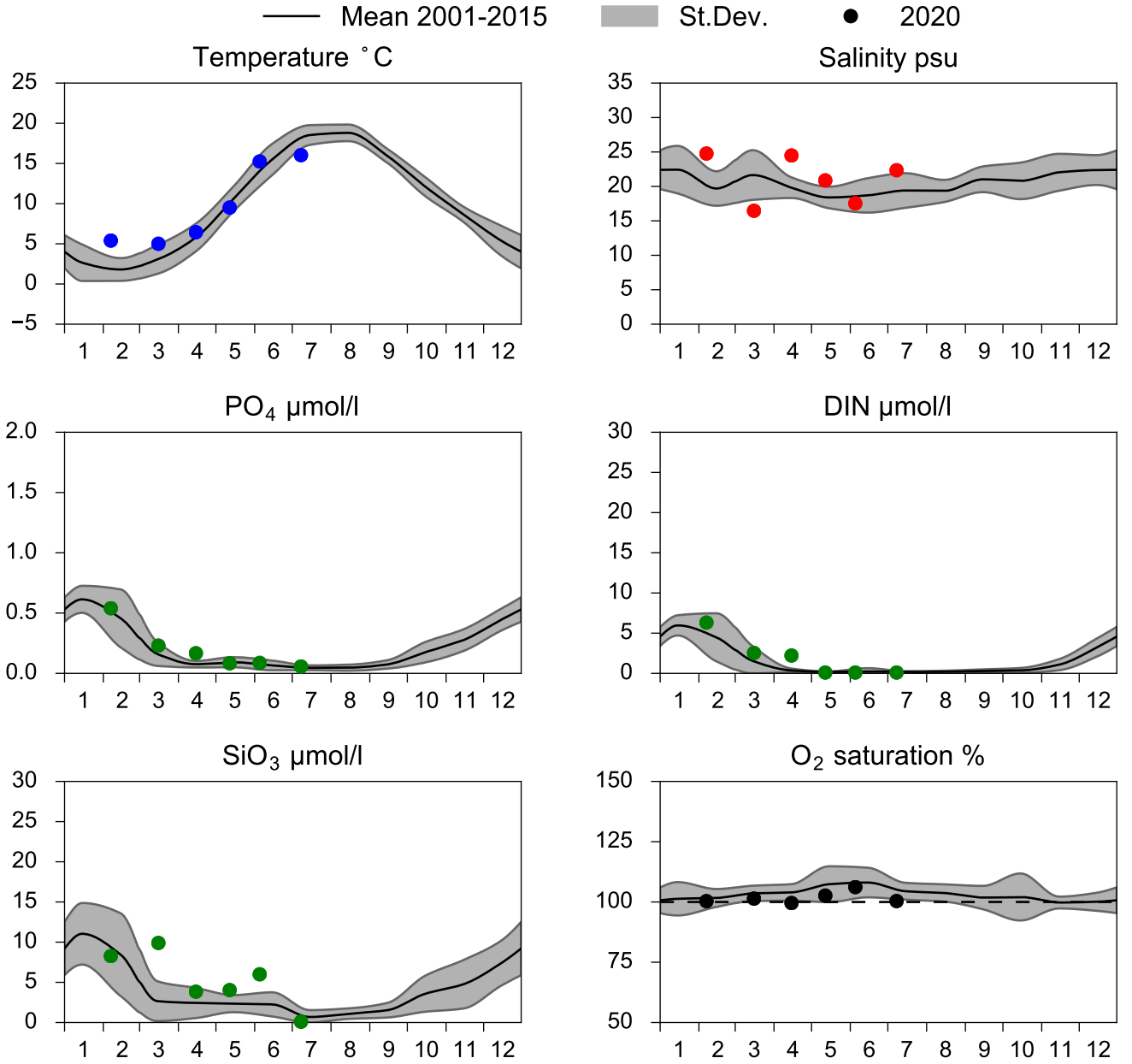


Vertical profiles FLADEN
July

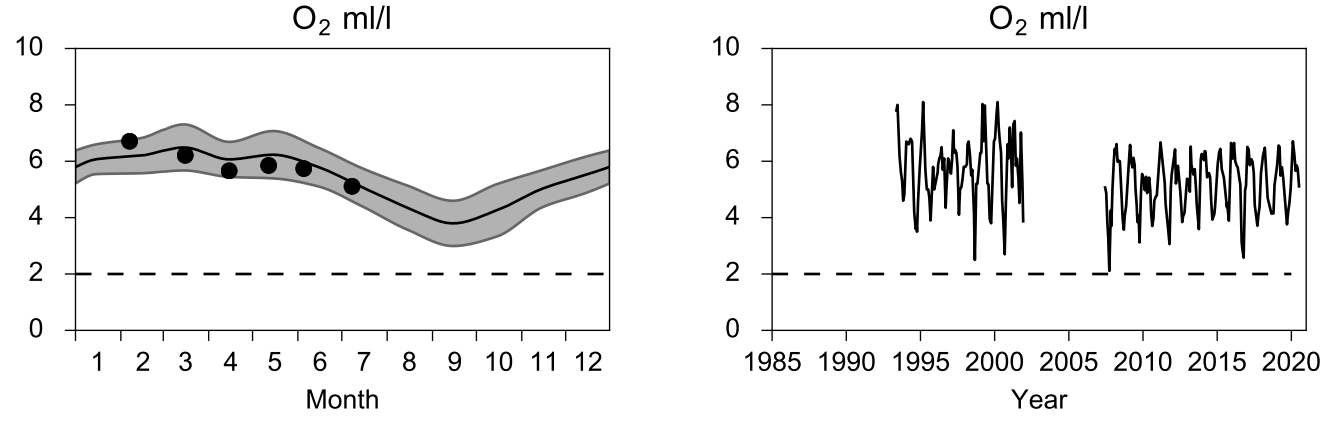


STATION N14 FALKENBERG SURFACE WATER (0-10 m)

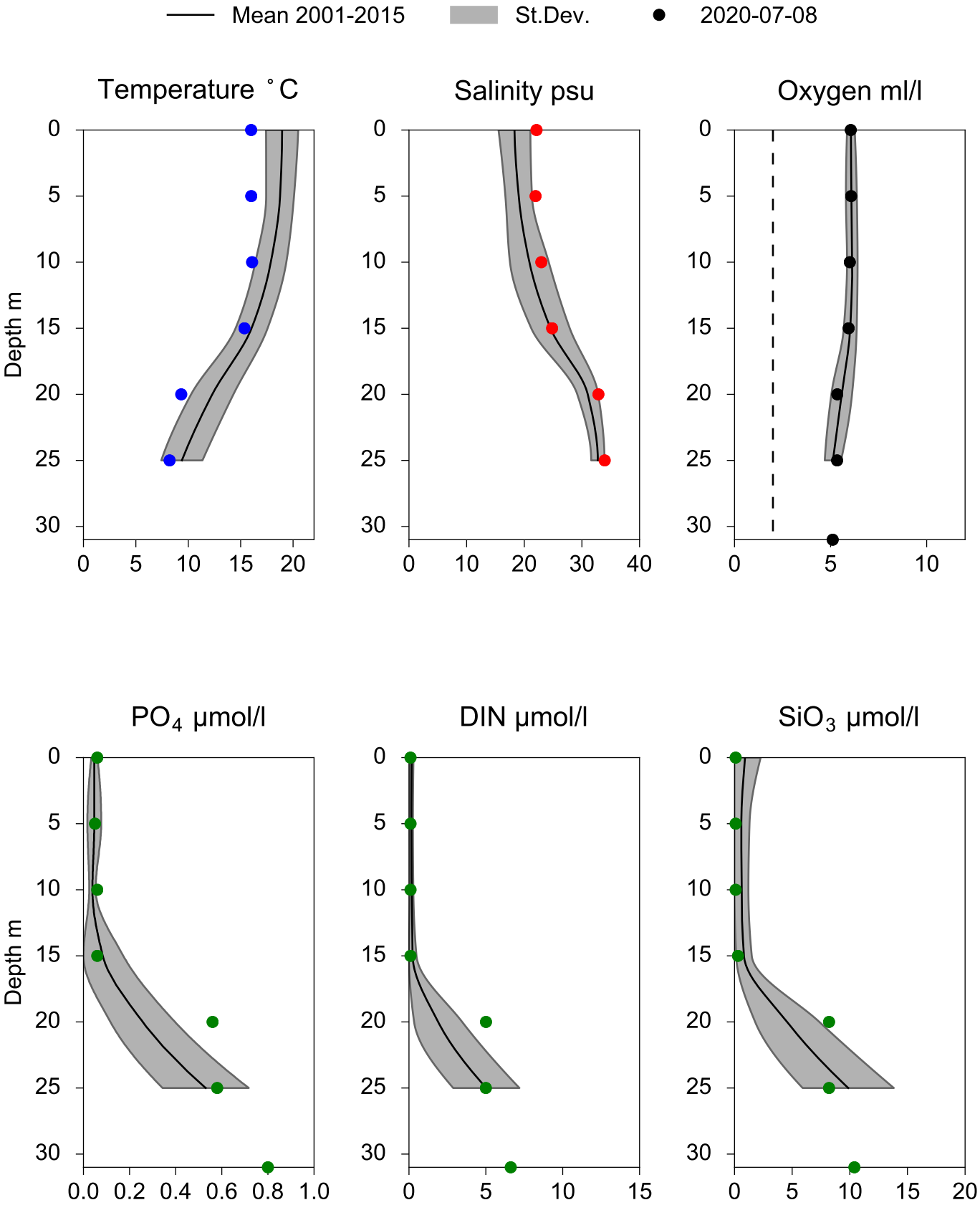
Annual Cycles



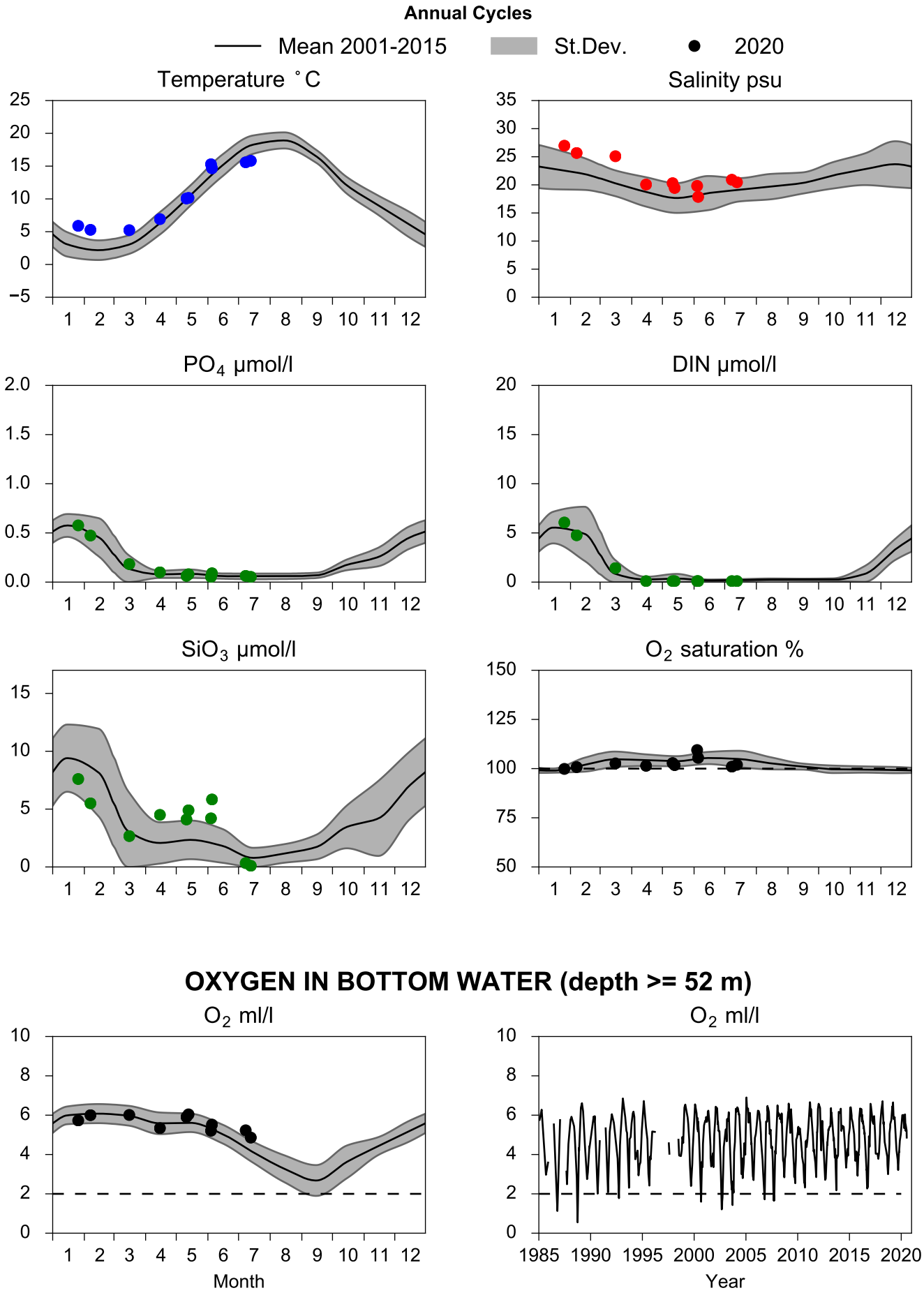
OXYGEN IN BOTTOM WATER (depth >= 20 m)



Vertical profiles N14 FALKENBERG
July

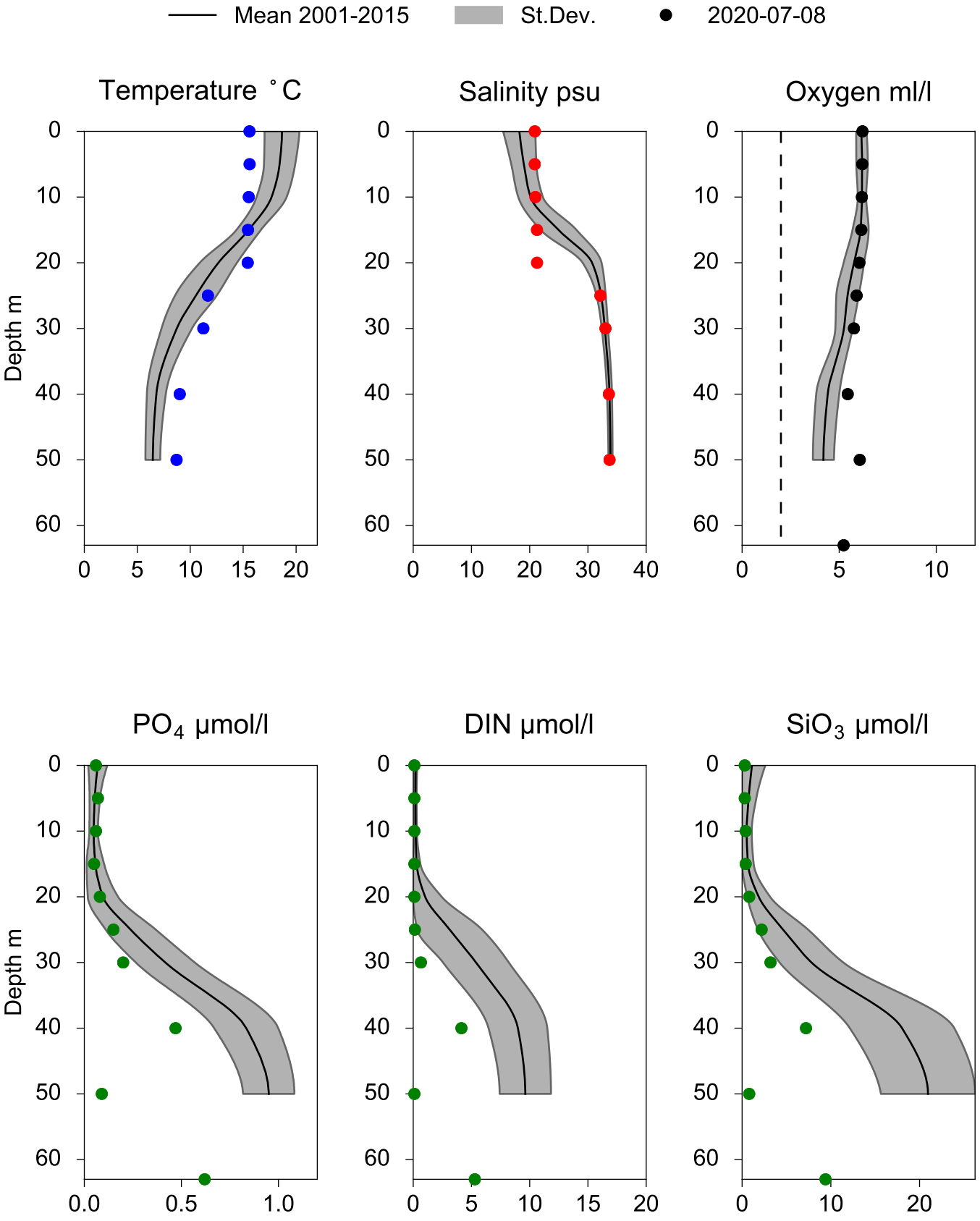


STATION ANHOLT E SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 52 m)

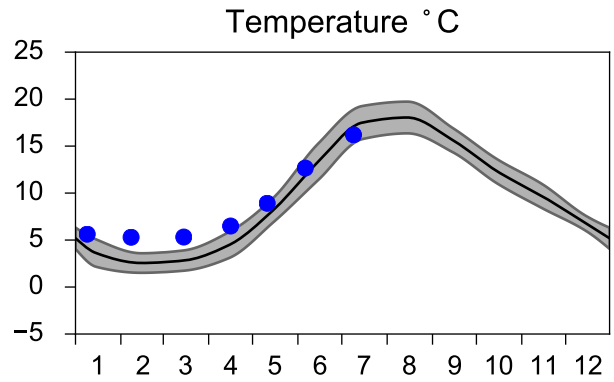
Vertical profiles ANHOLT E
July

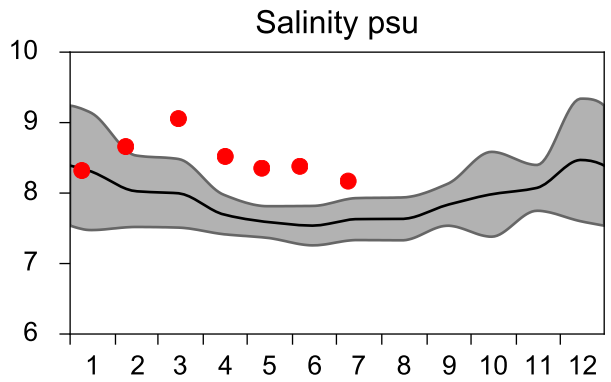


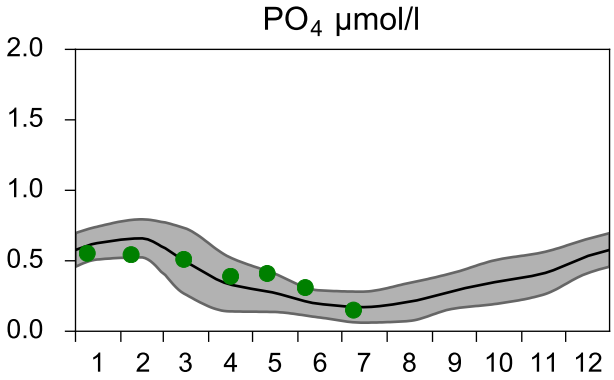
STATION BY1 SURFACE WATER (0-10 m)

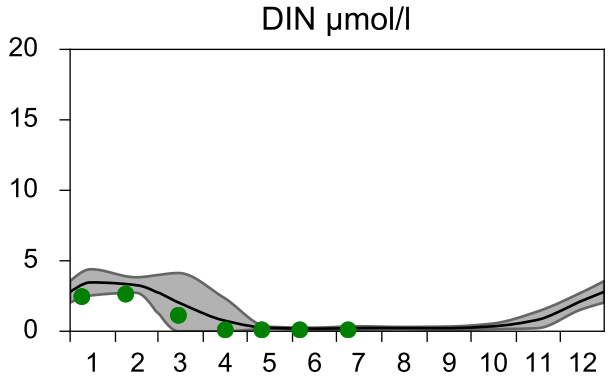
Annual Cycles

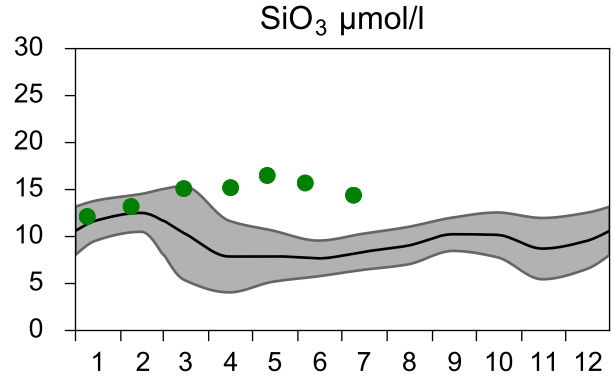
Mean 2001-2015 St.Dev. 2020

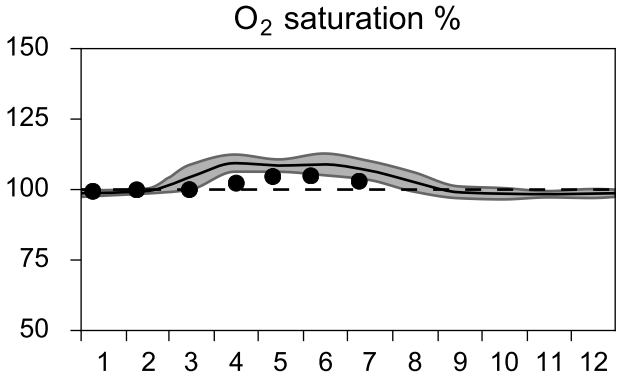




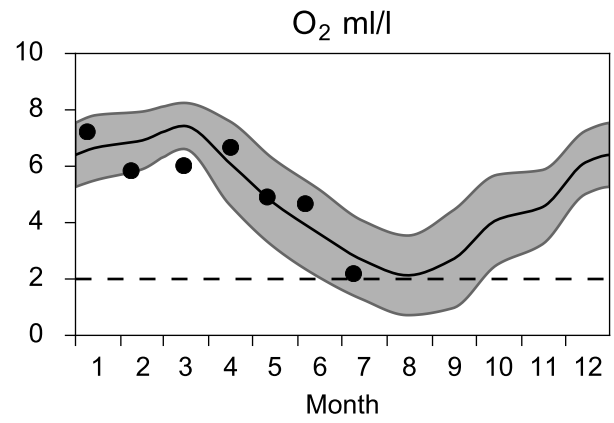


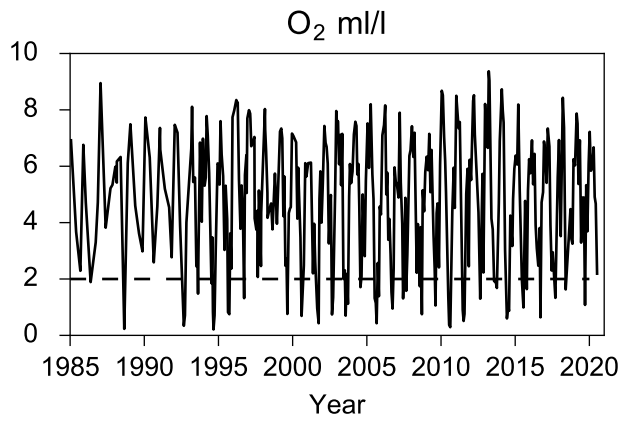




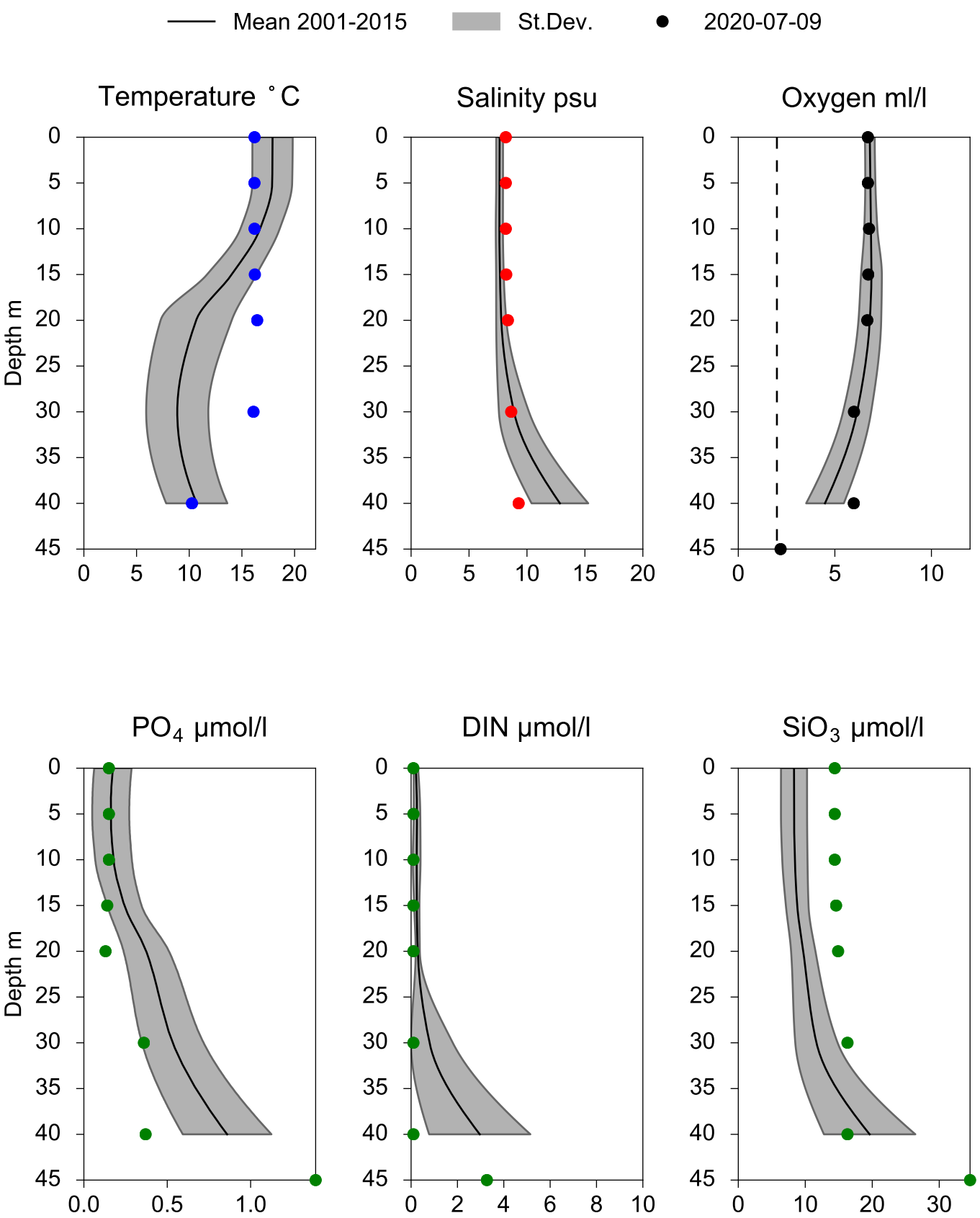


OXYGEN IN BOTTOM WATER (depth >= 40 m)

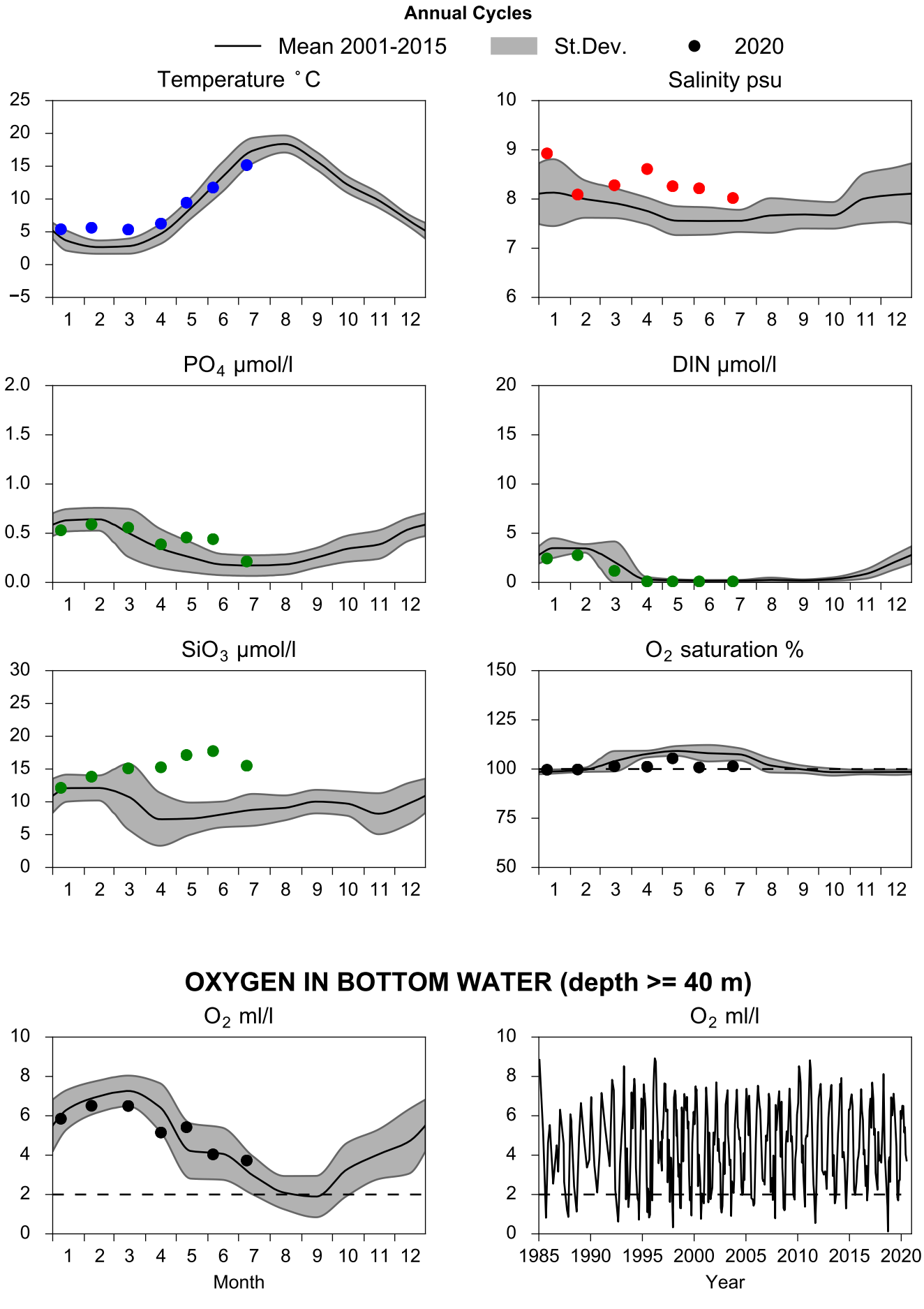




Vertical profiles BY1
July

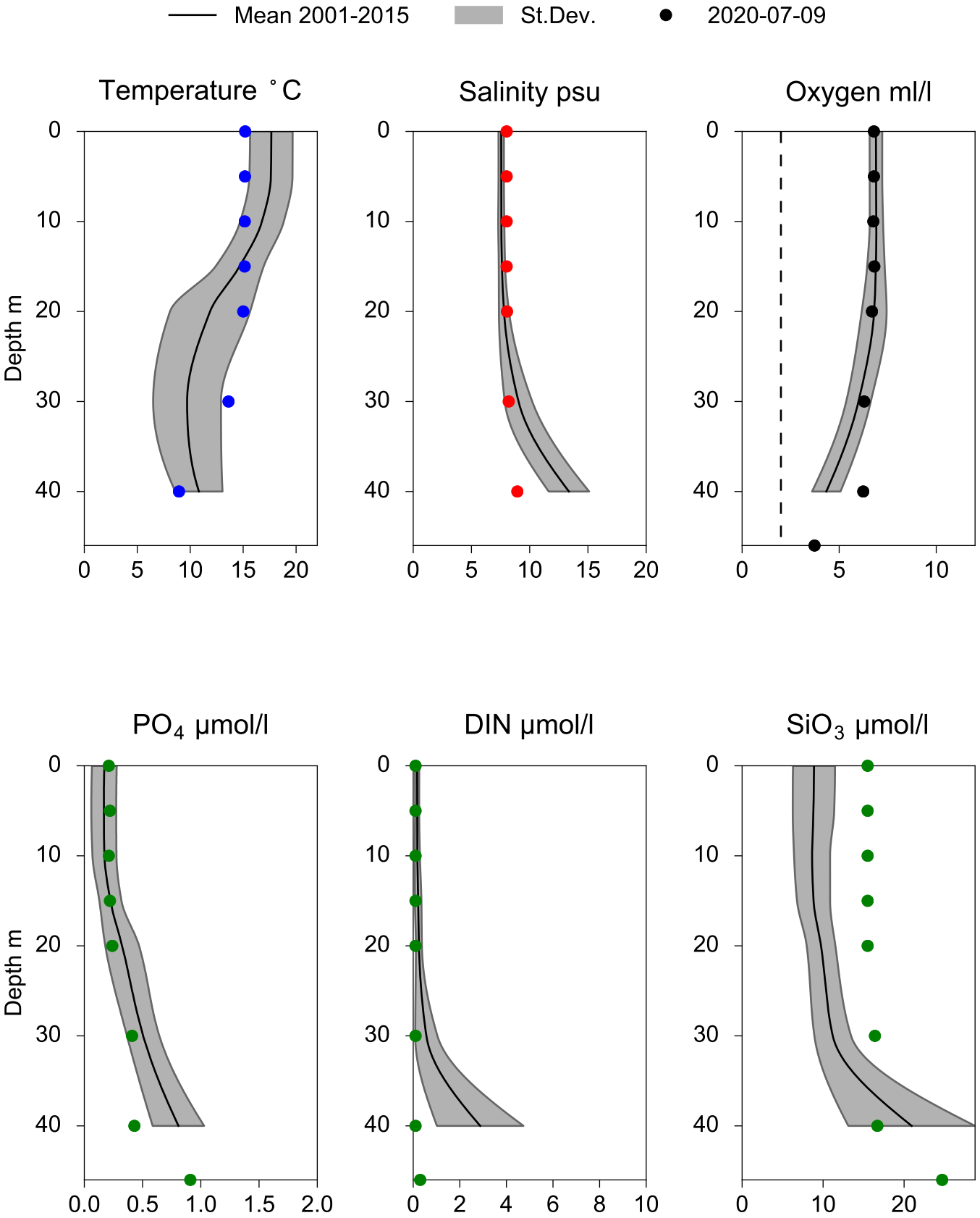


STATION BY2 ARKONA SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 40 m)

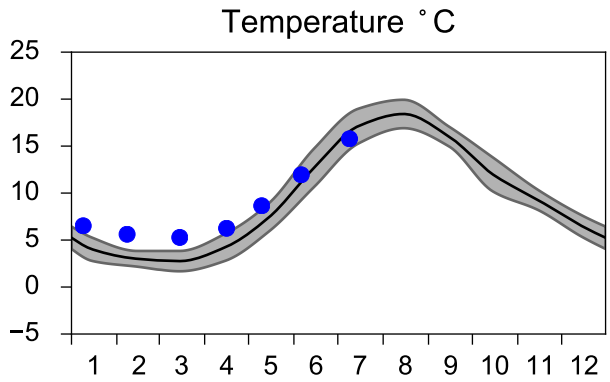
Vertical profiles BY2 ARKONA
July

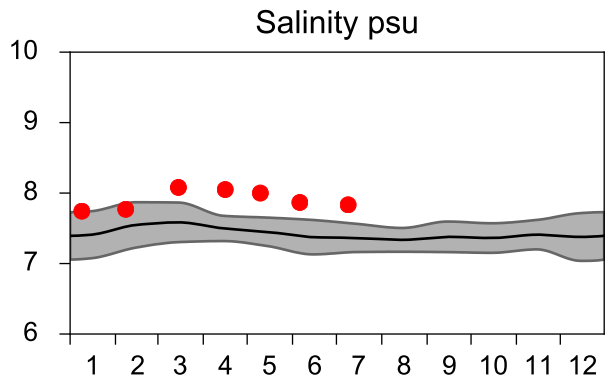


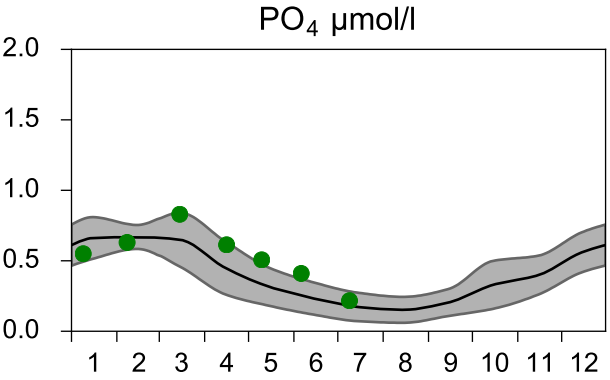
STATION BY4 CHRISTIANSÖ SURFACE WATER (0-10 m)

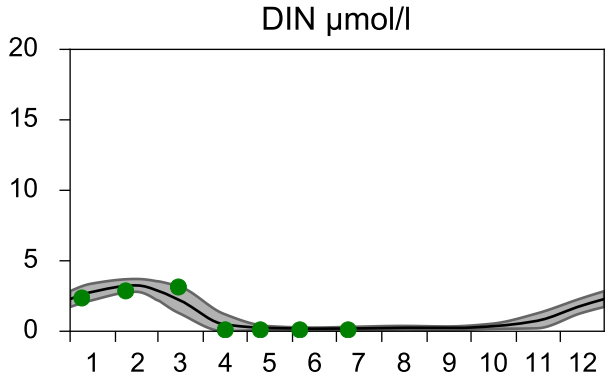
Annual Cycles

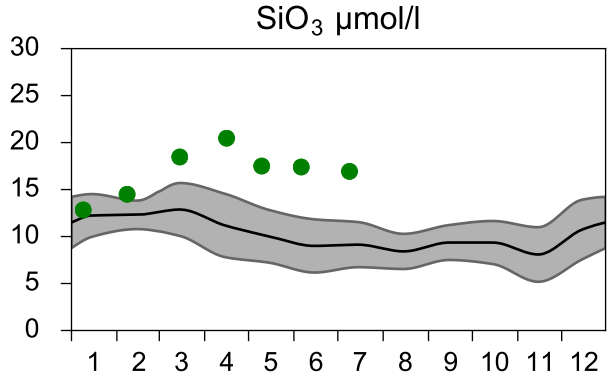
Mean 2001-2015 St.Dev. 2020

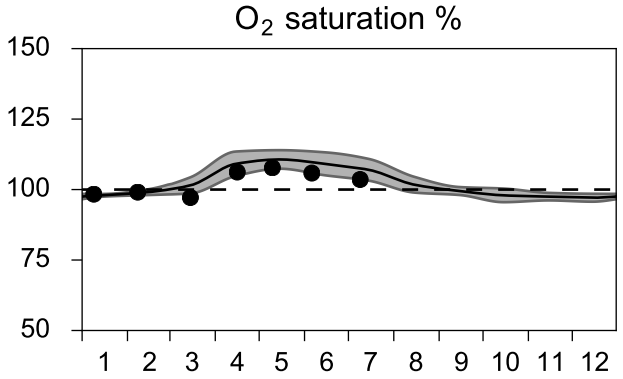




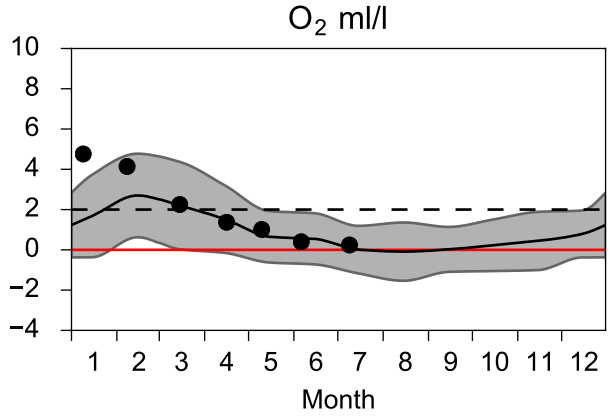


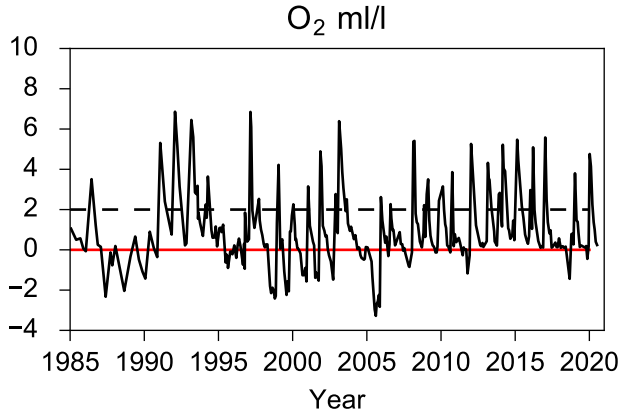




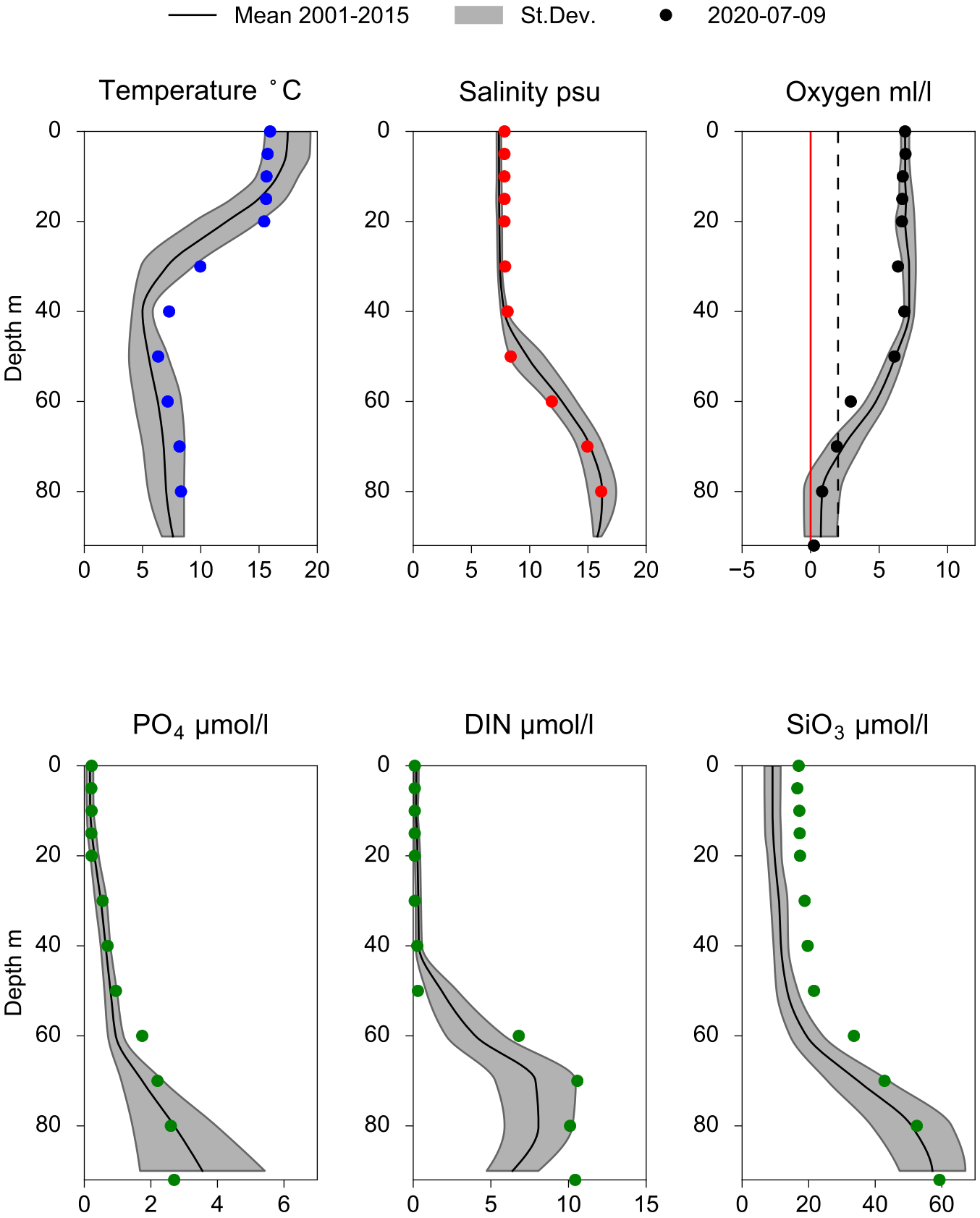


OXYGEN IN BOTTOM WATER (depth >= 80 m)

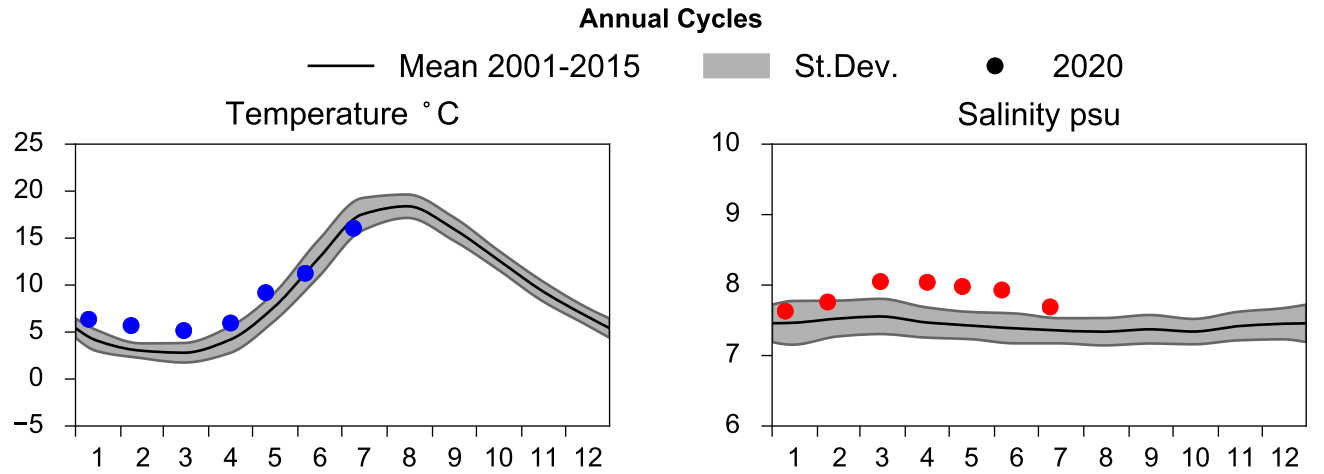




Vertical profiles BY4 CHRISTIANSÖ
July



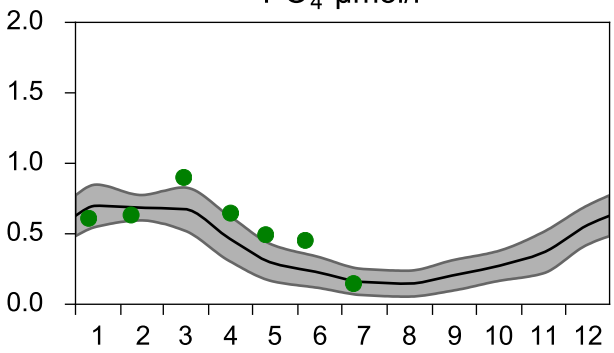
STATION BY5 BORNHOLMSDJ SURFACE WATER (0-10 m)



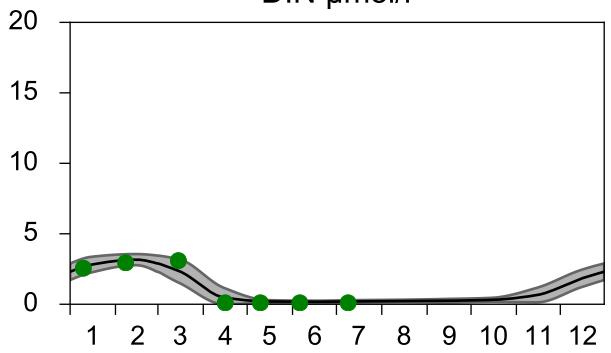
Temperature ˚C

Salinity psu

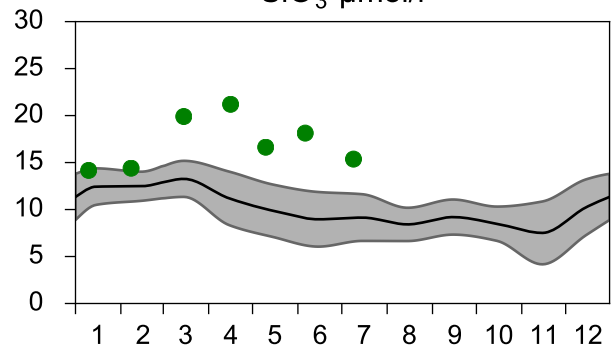
PO_4 µmol/l



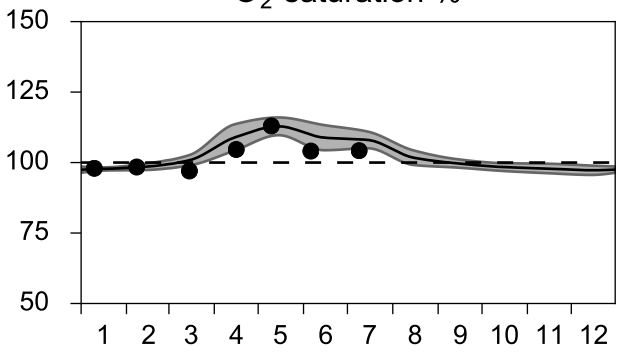
DIN µmol/l



SiO_3 µmol/l

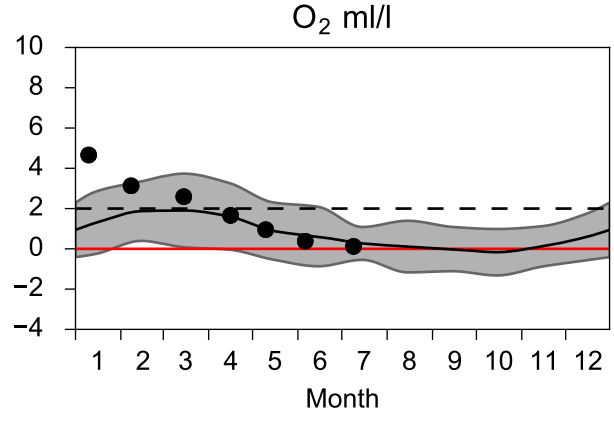


O_2 saturation %

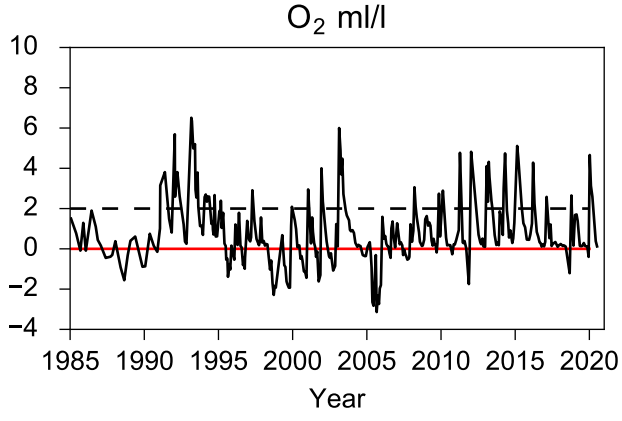


OXYGEN IN BOTTOM WATER (depth >= 80 m)

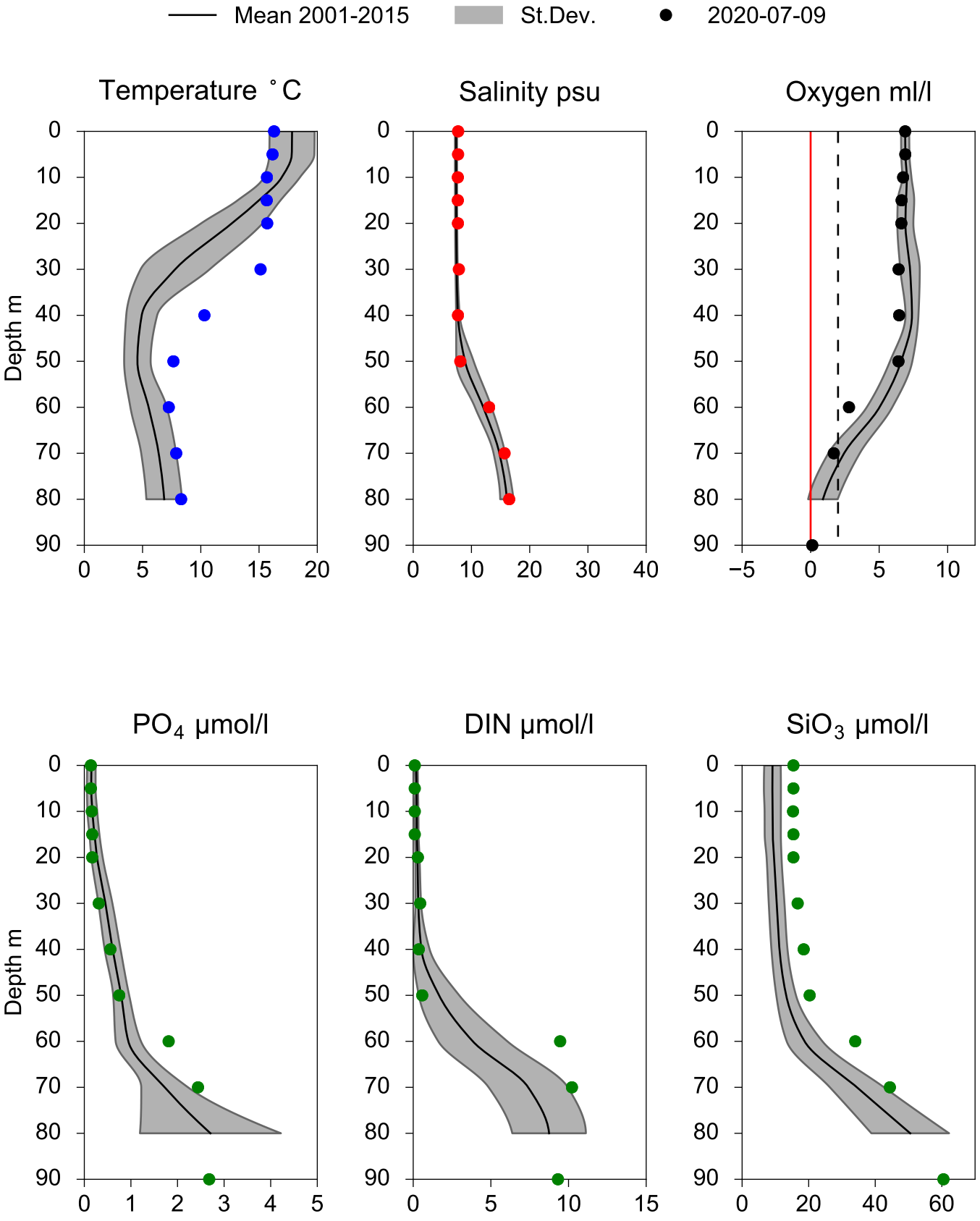
O_2 ml/l



O_2 ml/l



Vertical profiles BY5 BORNHOLMSDJ
July

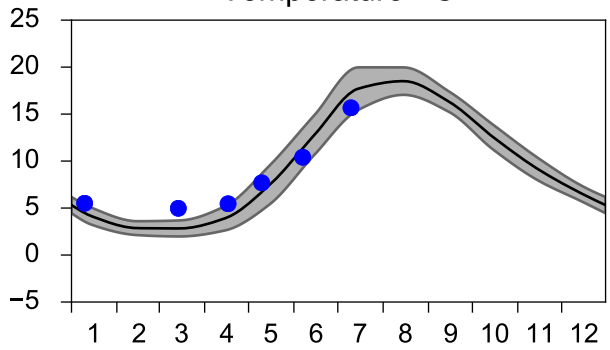


STATION BCS III-10 SURFACE WATER (0-10 m)

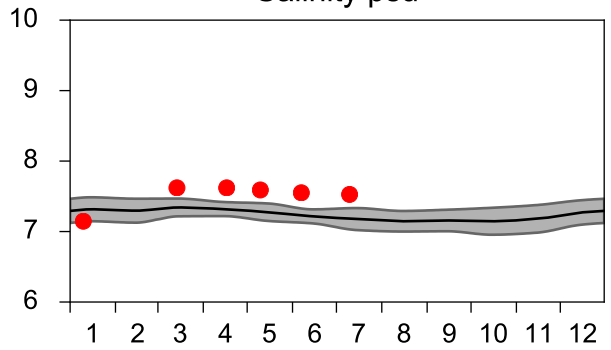
Annual Cycles

Mean 2001-2015 St.Dev. 2020

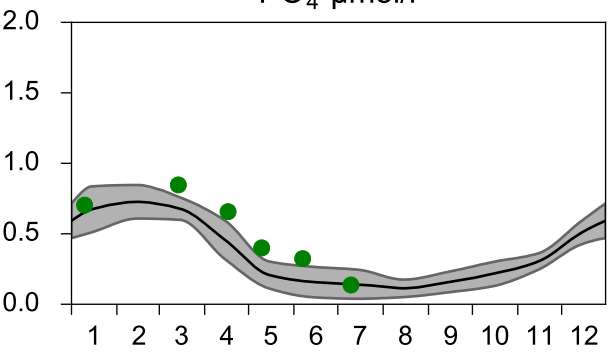
Temperature ˚C



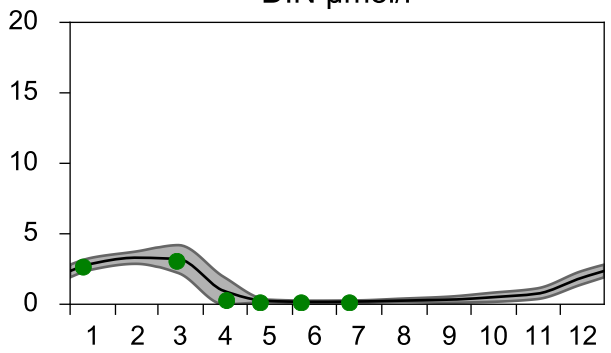
Salinity psu



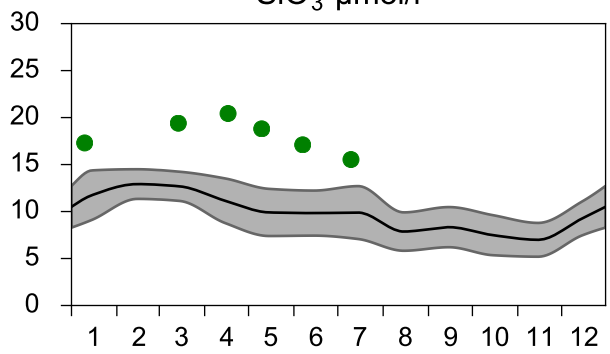
PO_4 µmol/l



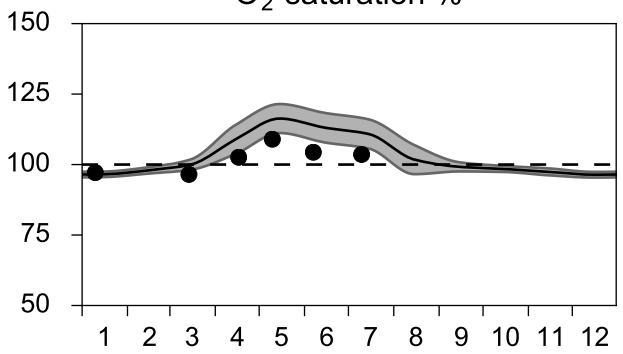
DIN µmol/l



SiO_3 µmol/l

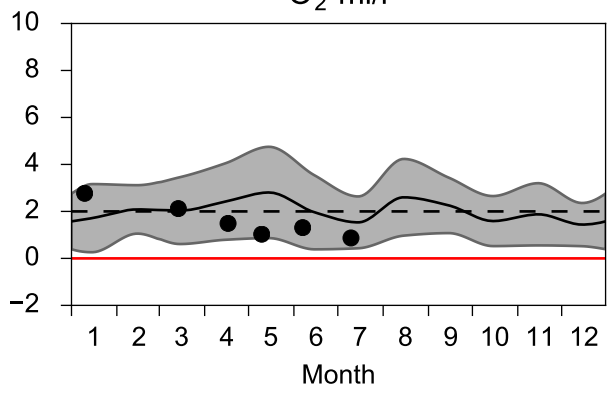


O_2 saturation %

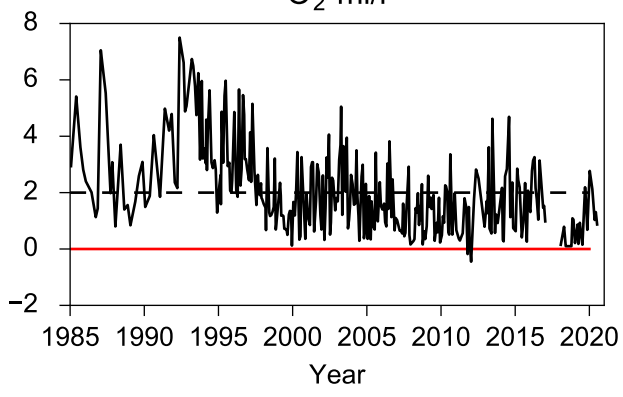


OXYGEN IN BOTTOM WATER (depth >= 80 m)

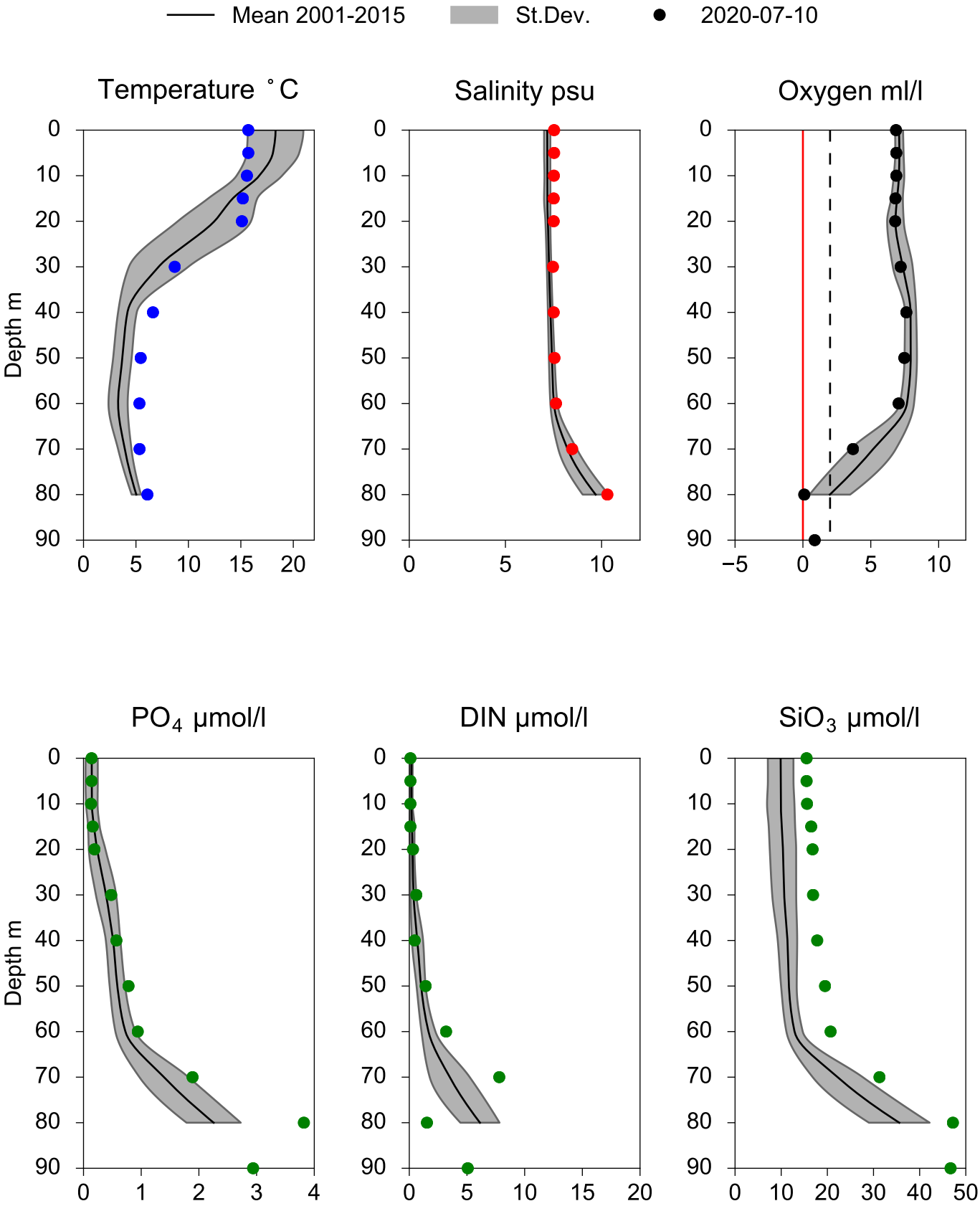
O_2 ml/l



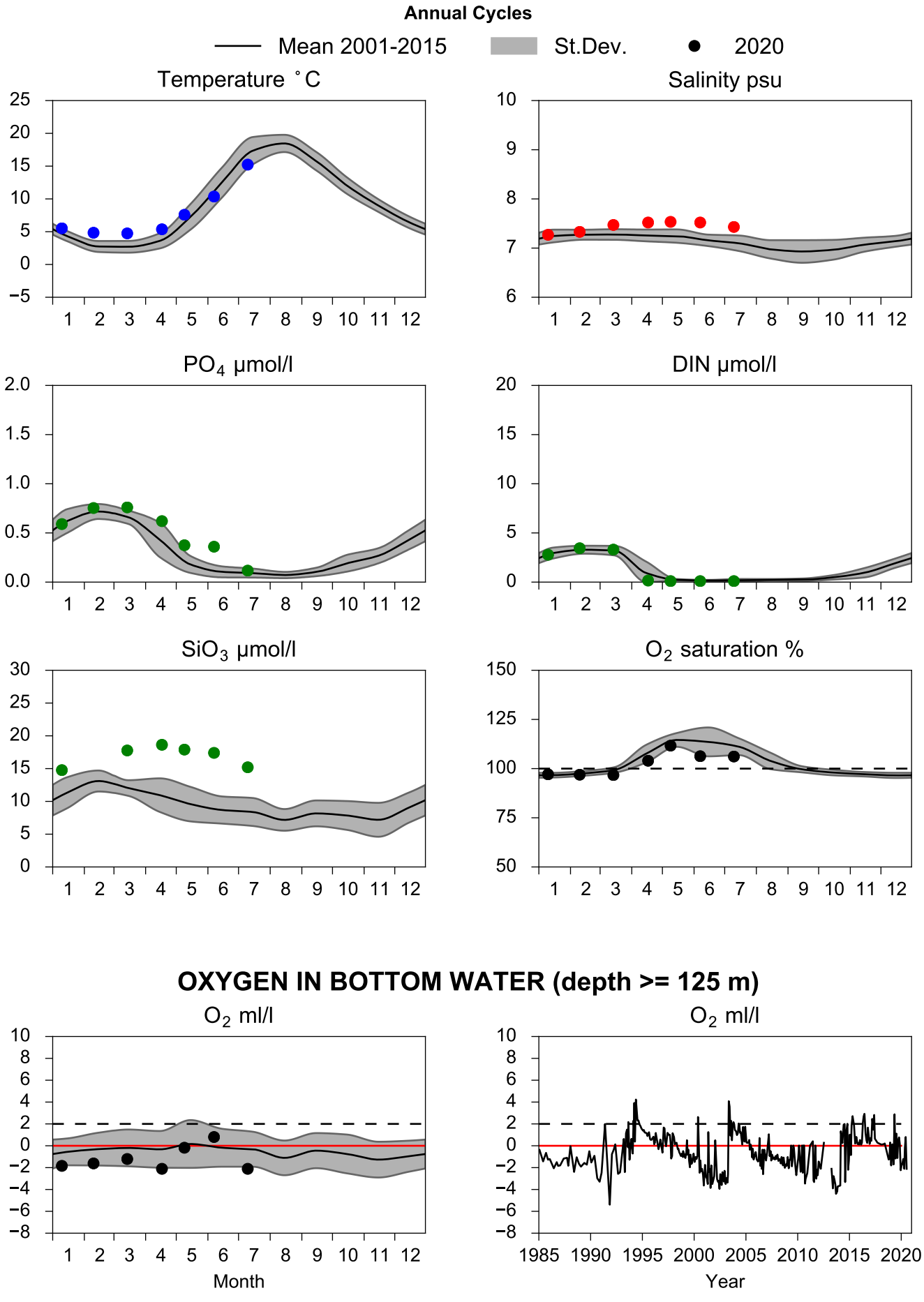
O_2 ml/l



Vertical profiles BCS III-10
July

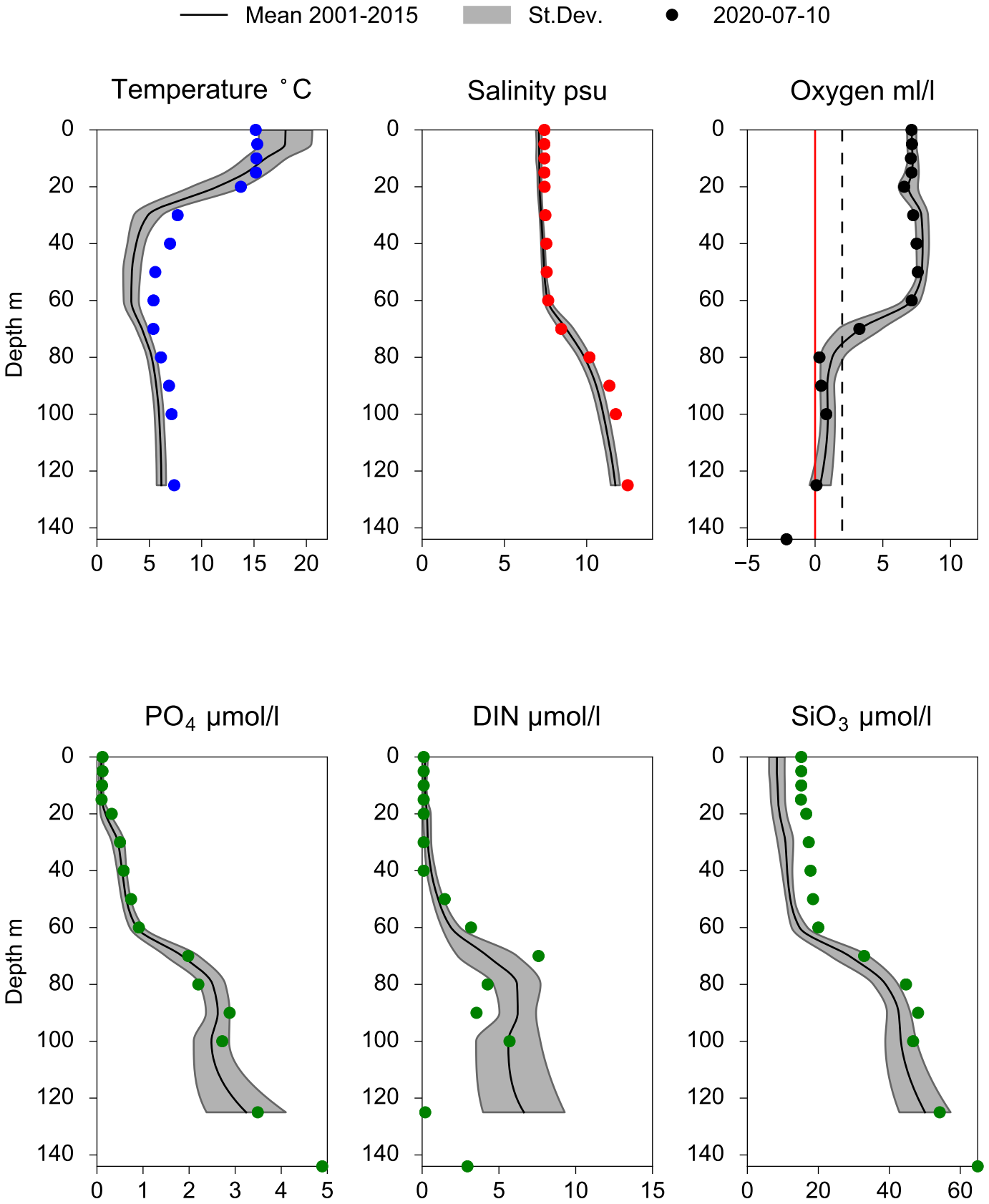


STATION BY10 SURFACE WATER (0-10 m)

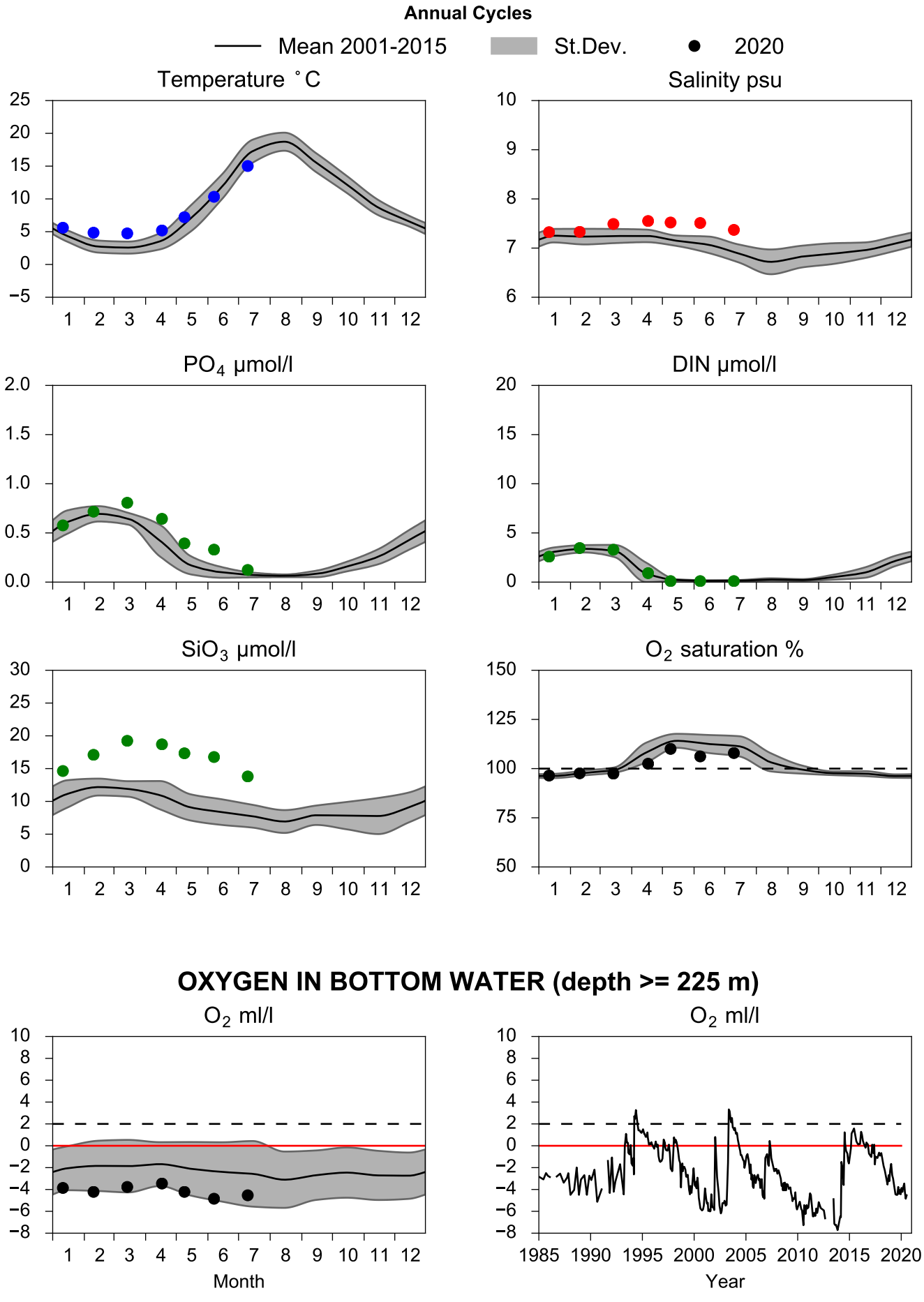


OXYGEN IN BOTTOM WATER (depth >= 125 m)

Vertical profiles BY10
July

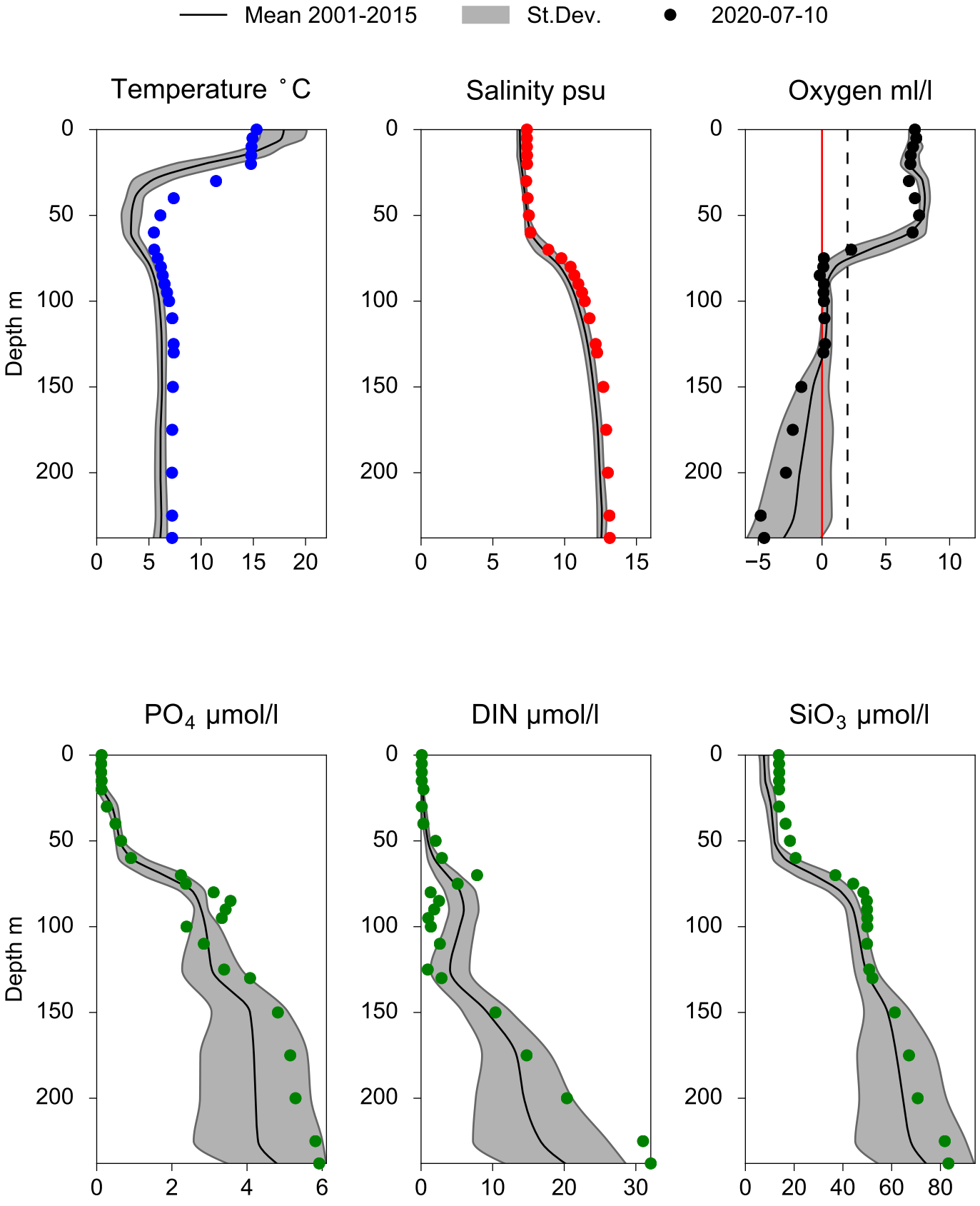


STATION BY15 GOTLANDSDJ SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 225 m)

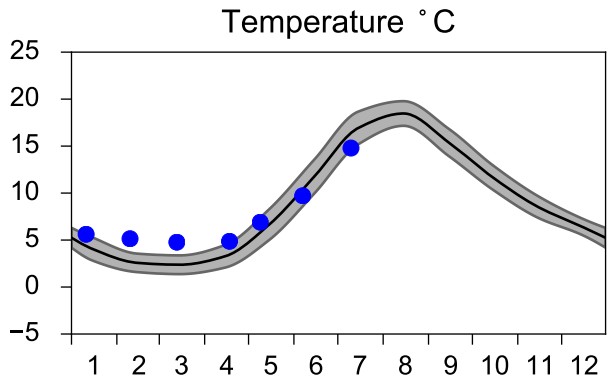
Vertical profiles BY15 GOTLANDSDJ
July

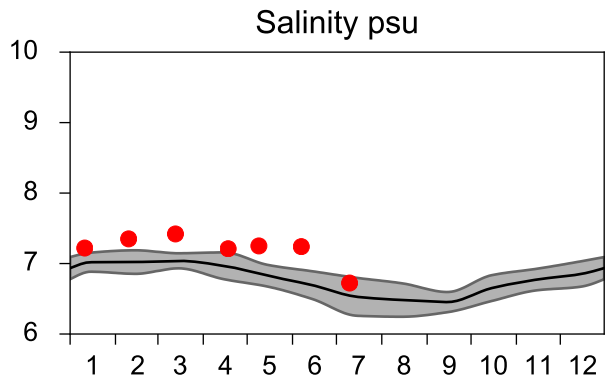


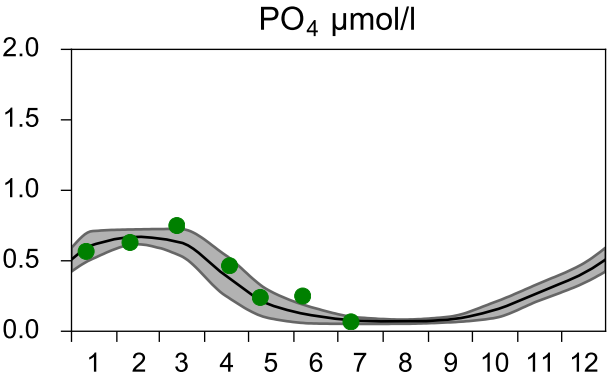
STATION BY20 FÅRÖDJ SURFACE WATER (0-10 m)

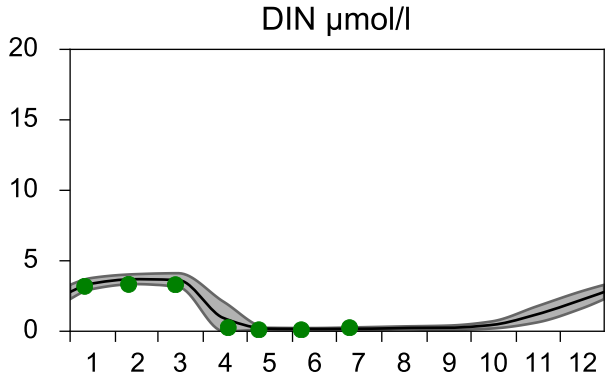
Annual Cycles

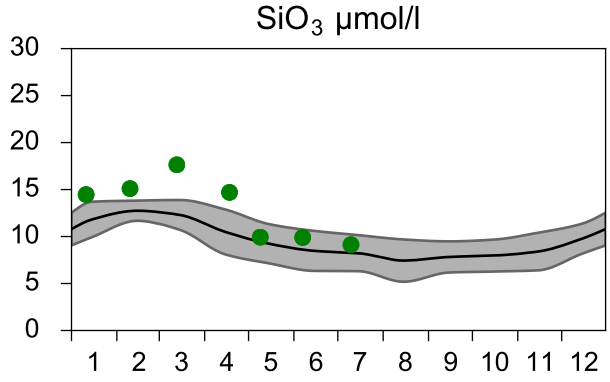
Mean 2001-2015 St.Dev. 2020

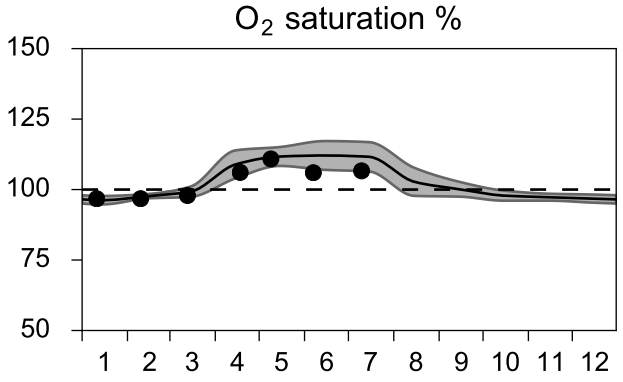




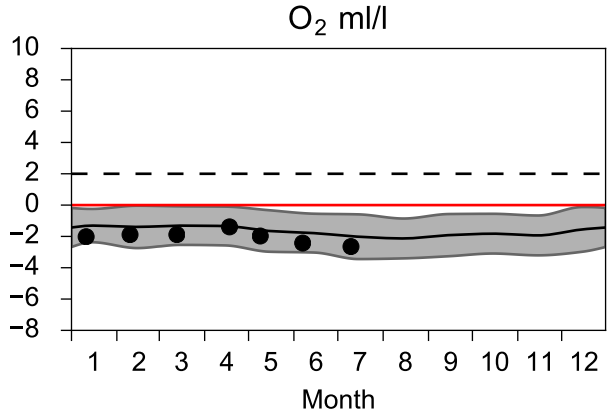


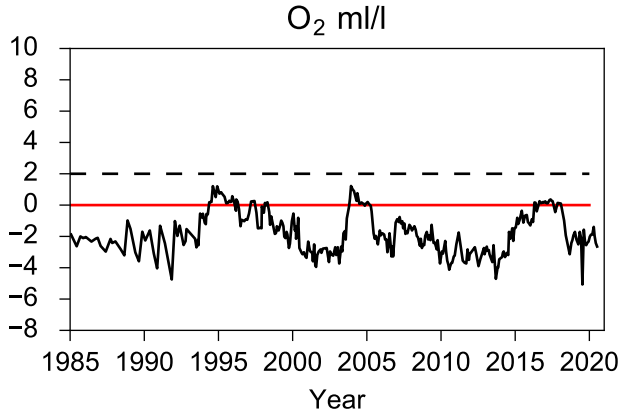




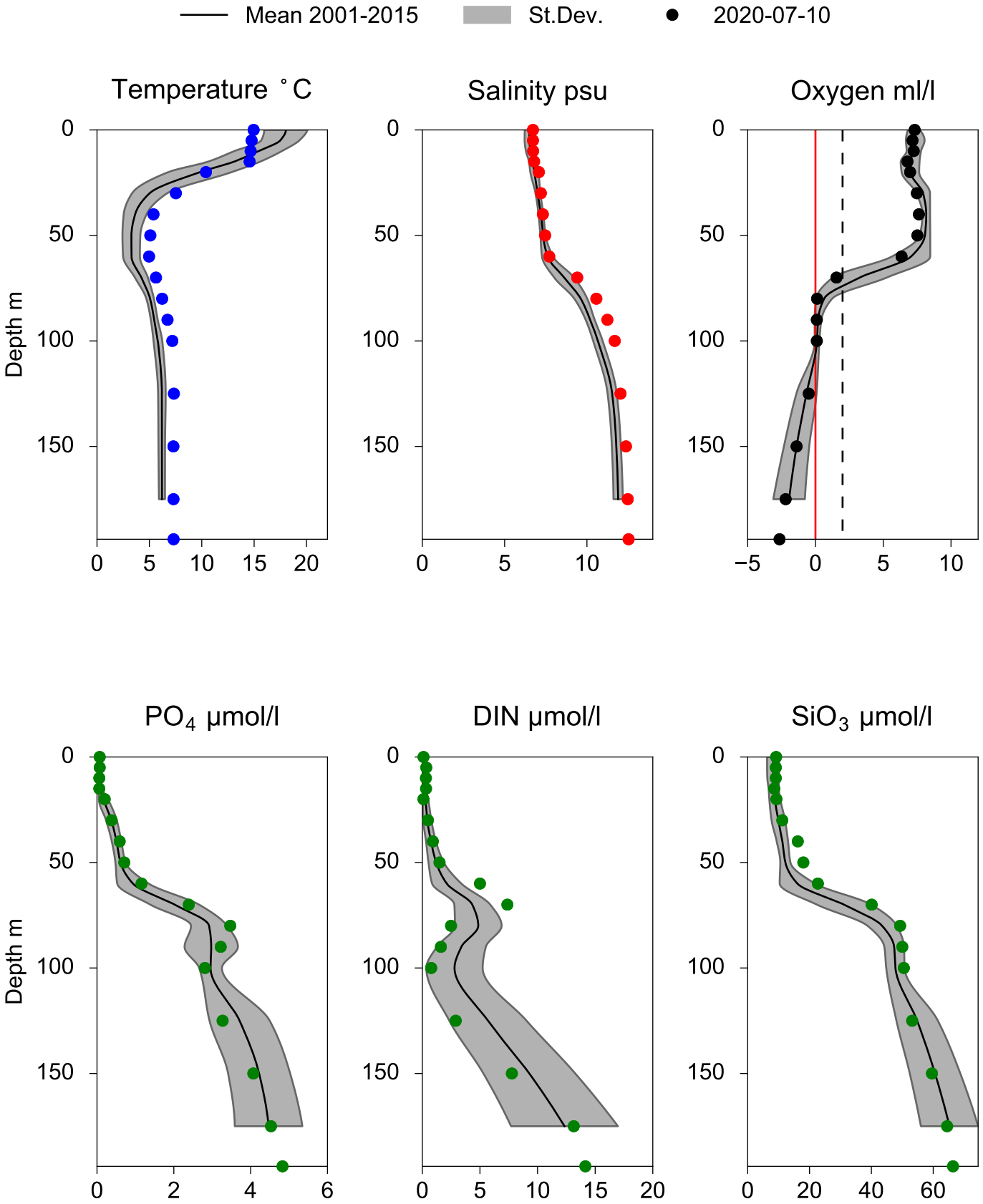


OXYGEN IN BOTTOM WATER (depth >= 175 m)

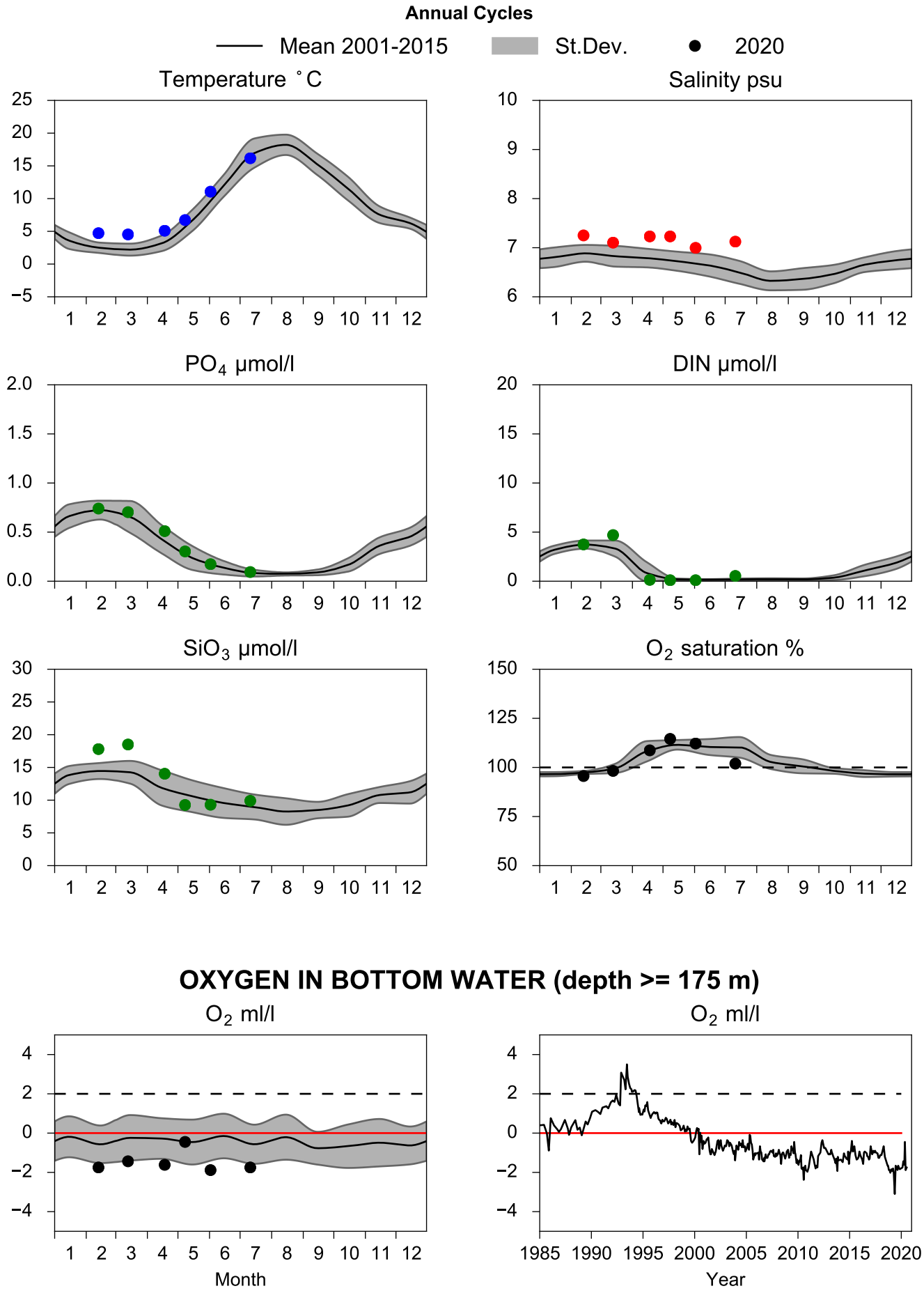




Vertical profiles BY20 FÅRÖDJ
July

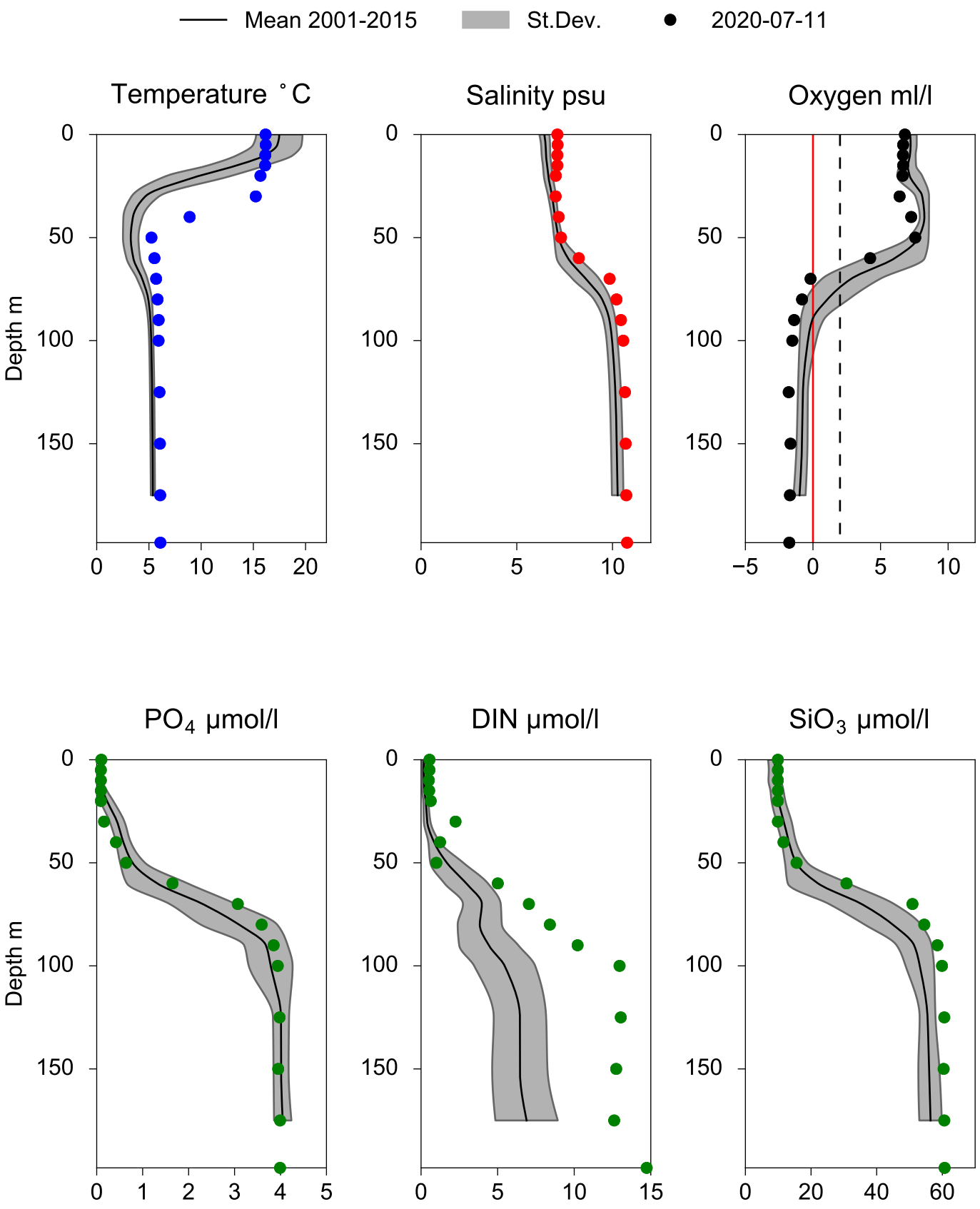


STATION BY32 NORRKÖPINGSDJ SURFACE WATER (0-10 m)

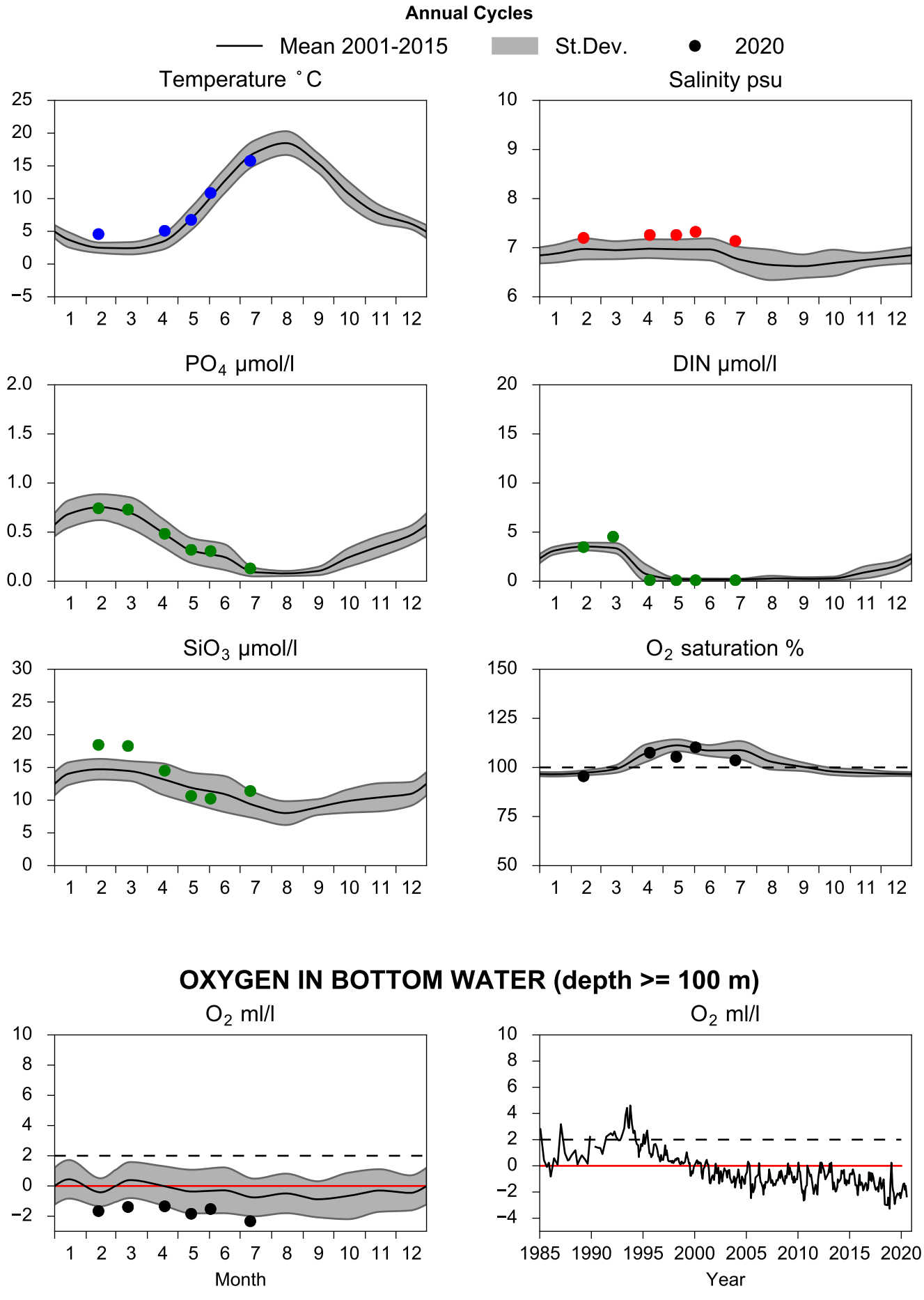


OXYGEN IN BOTTOM WATER (depth >= 175 m)

Vertical profiles BY32 NORRKÖPINGSDJ
July

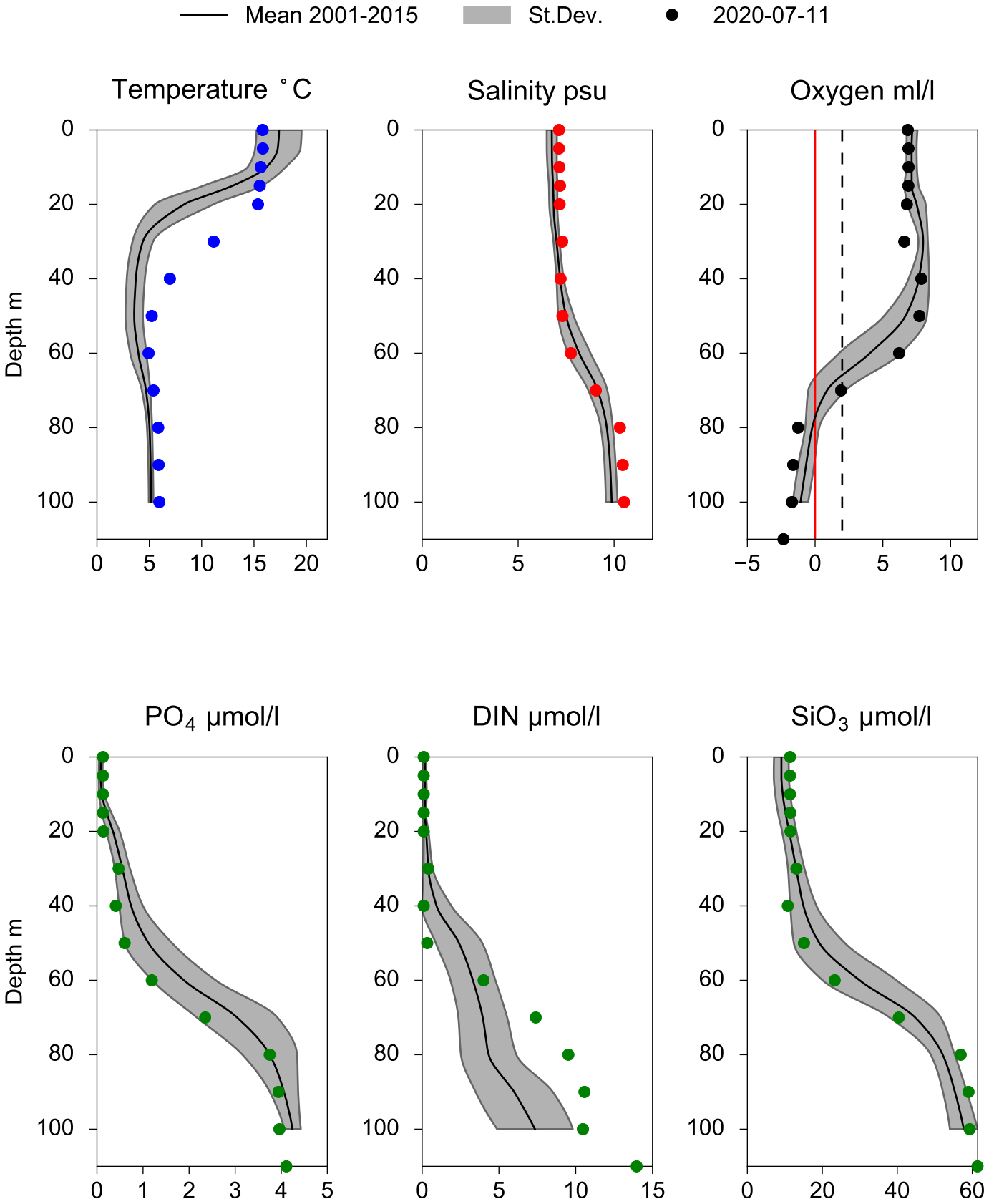


STATION BY38 KARLSÖDJ SURFACE WATER (0-10 m)

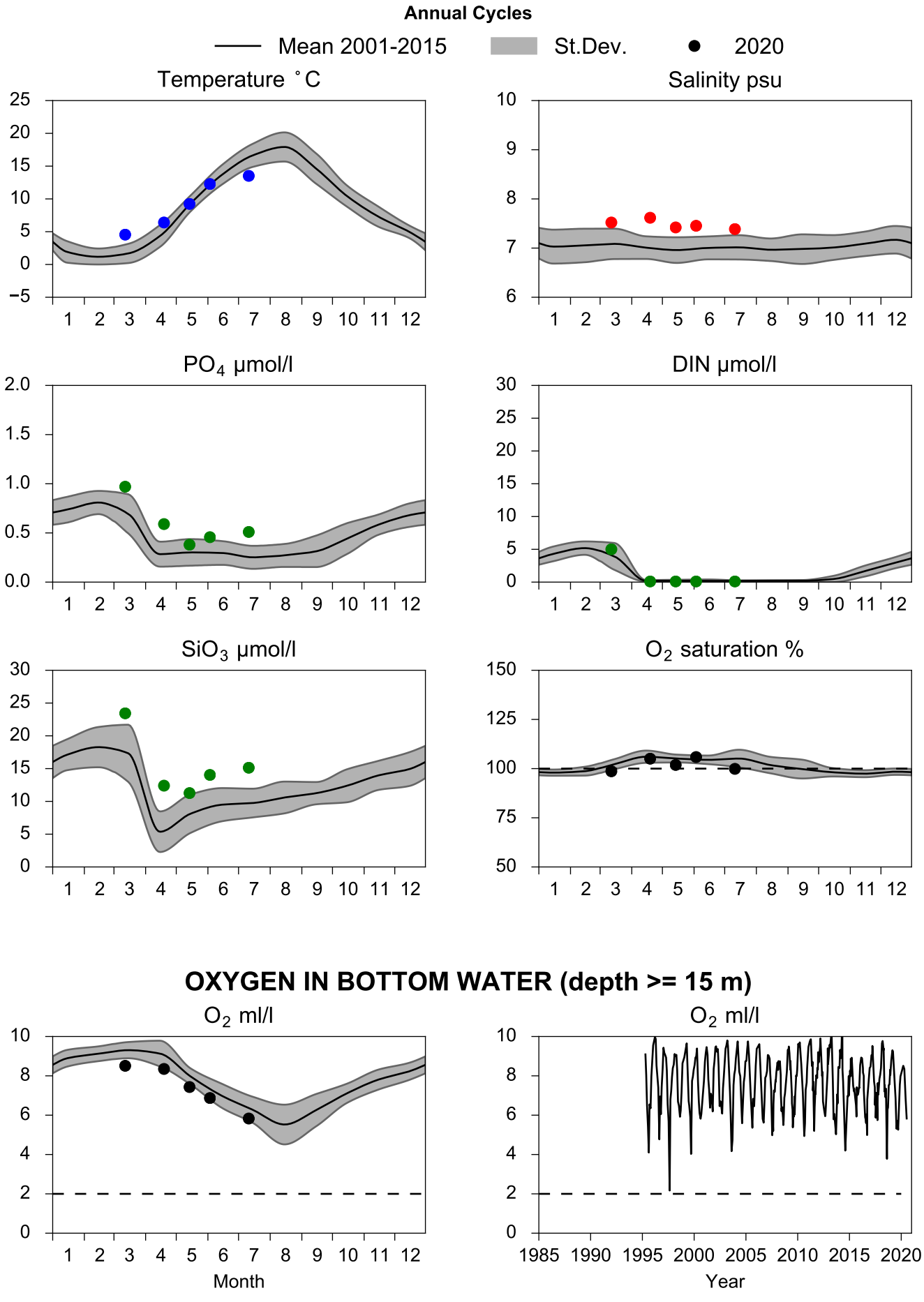


OXYGEN IN BOTTOM WATER (depth >= 100 m)

Vertical profiles BY38 KARLSÖDJ
July

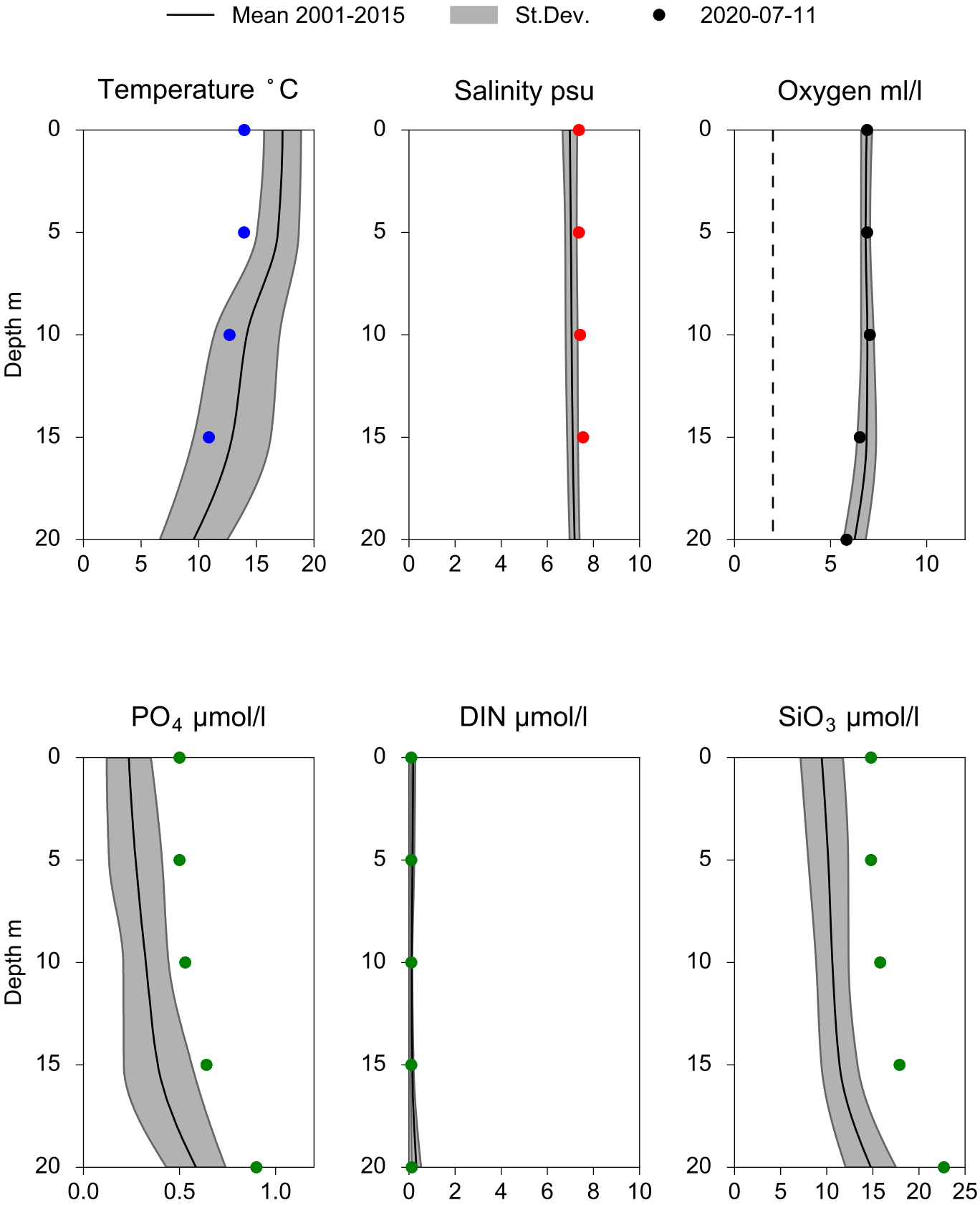


STATION REF M1V1 SURFACE WATER (0-10 m)



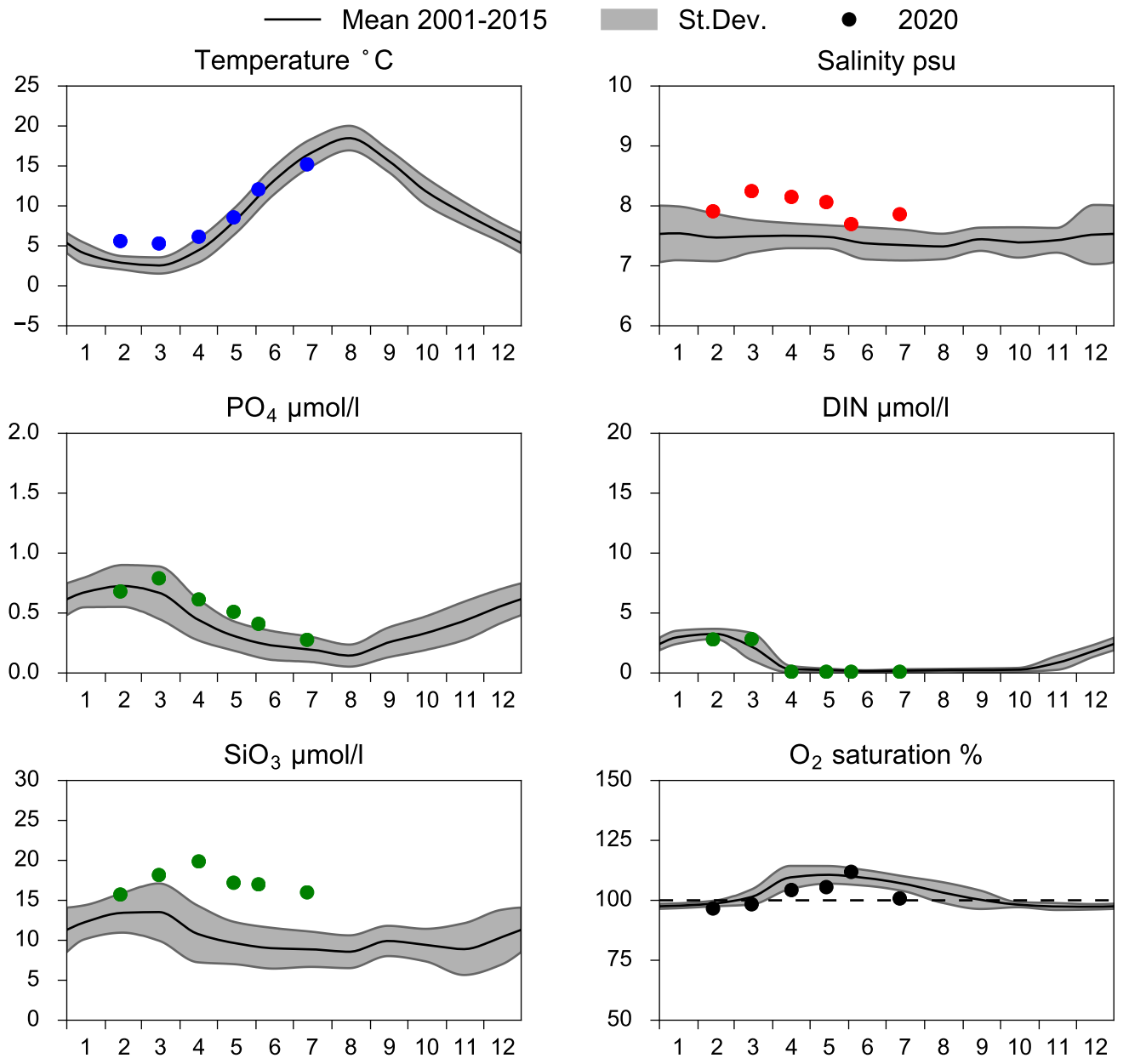
OXYGEN IN BOTTOM WATER (depth >= 15 m)

Vertical profiles REF M1V1
July

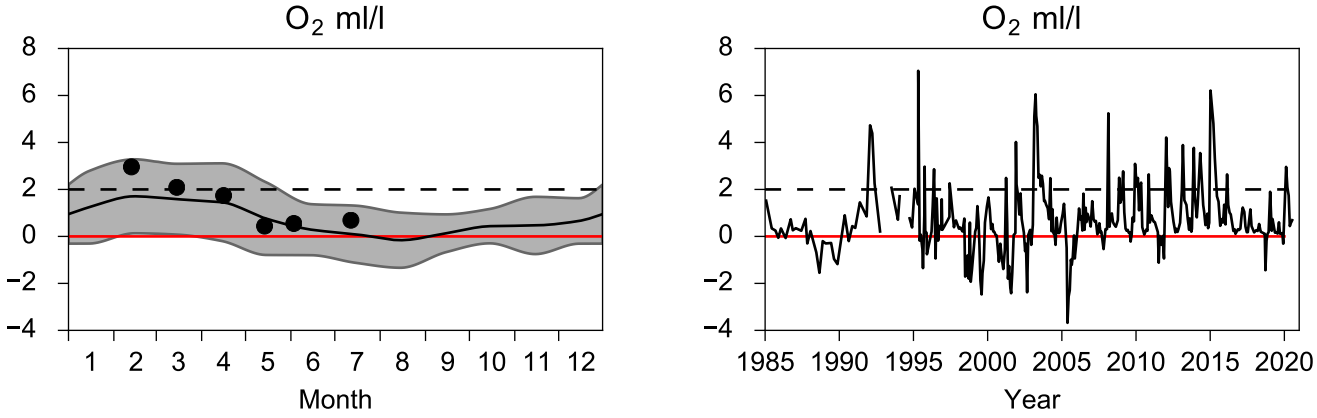


STATION HANÖBUKTEN SURFACE WATER (0-10 m)

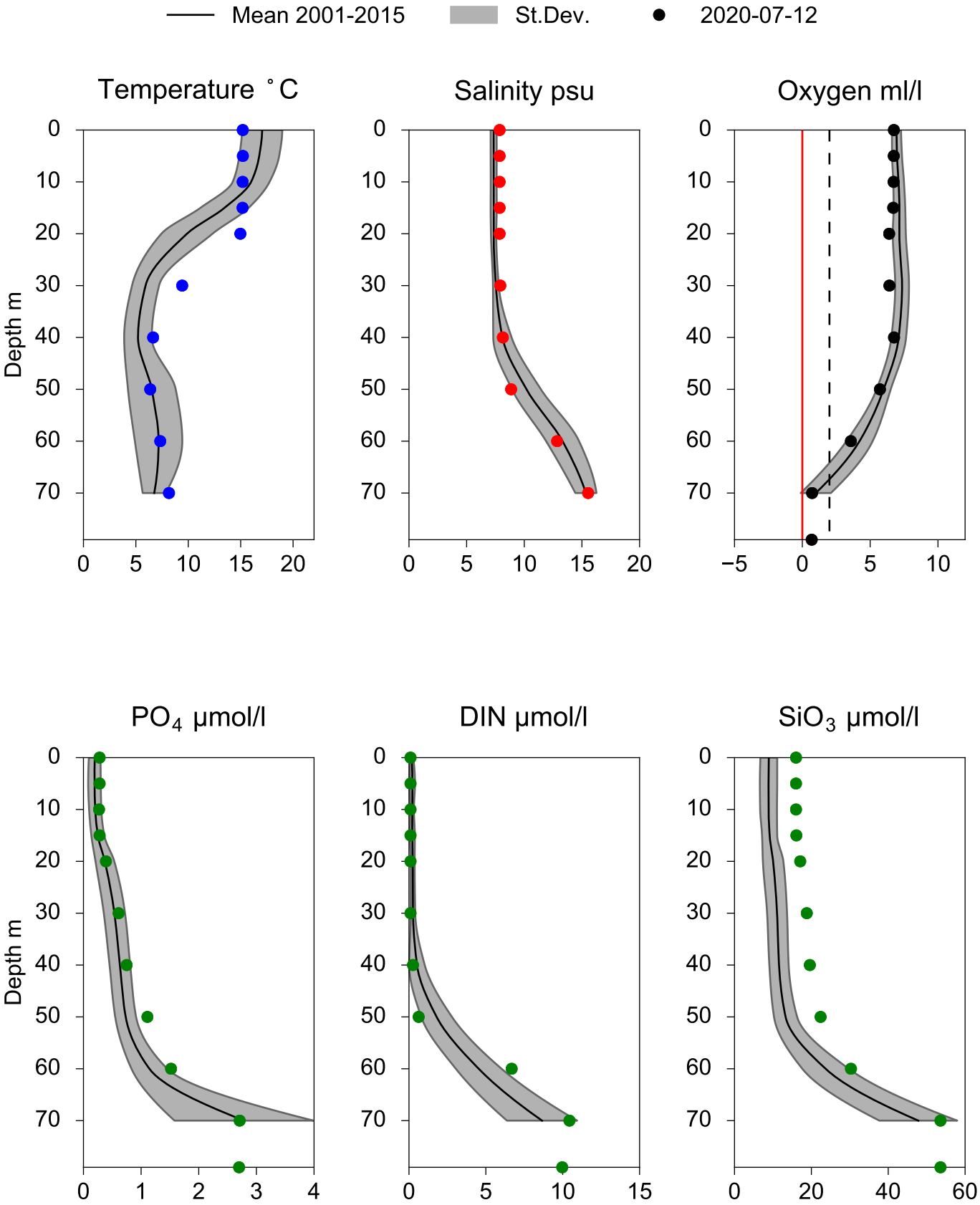
Annual Cycles



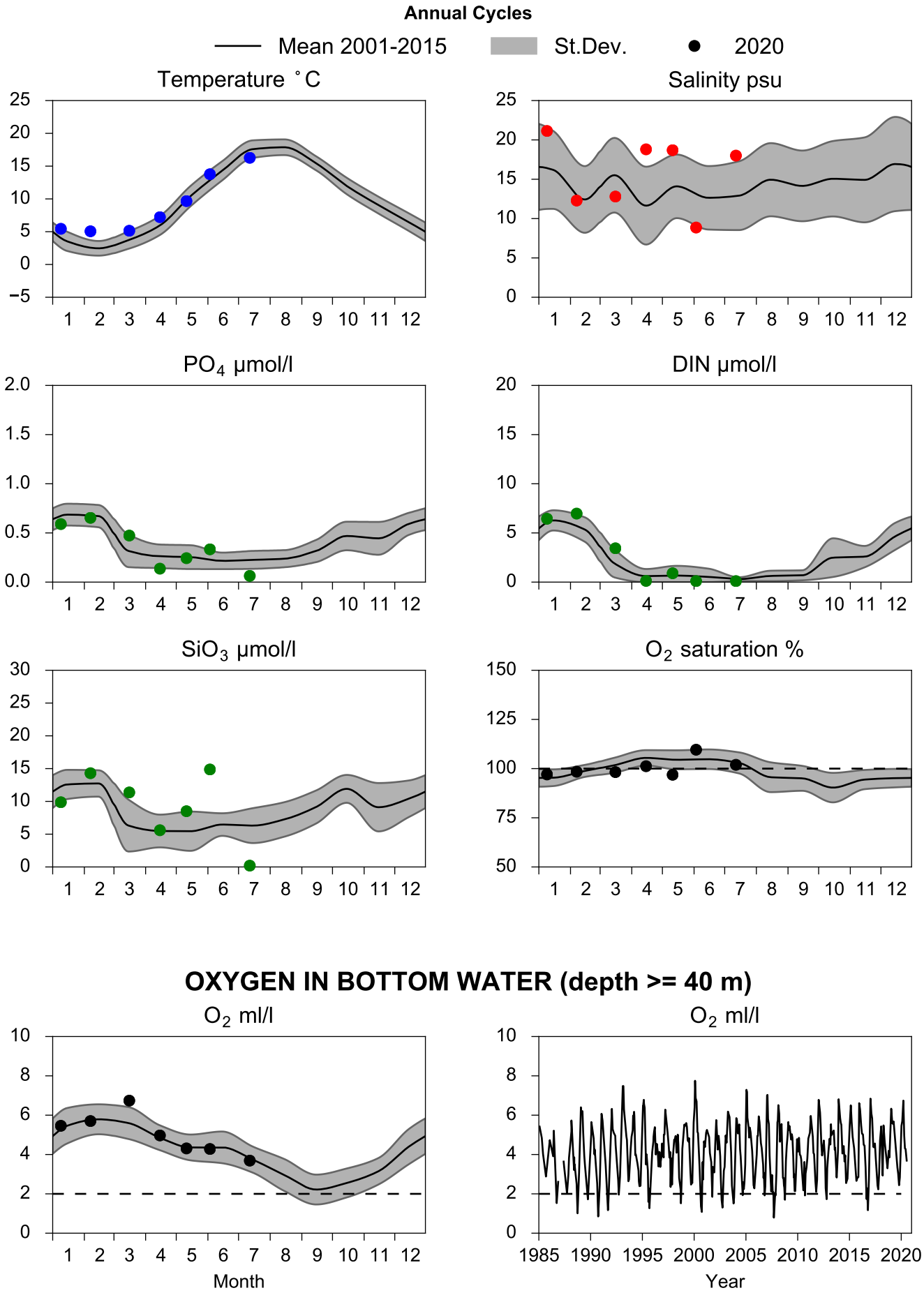
OXYGEN IN BOTTOM WATER (depth >= 70 m)



Vertical profiles HANÖBUKTEN
July

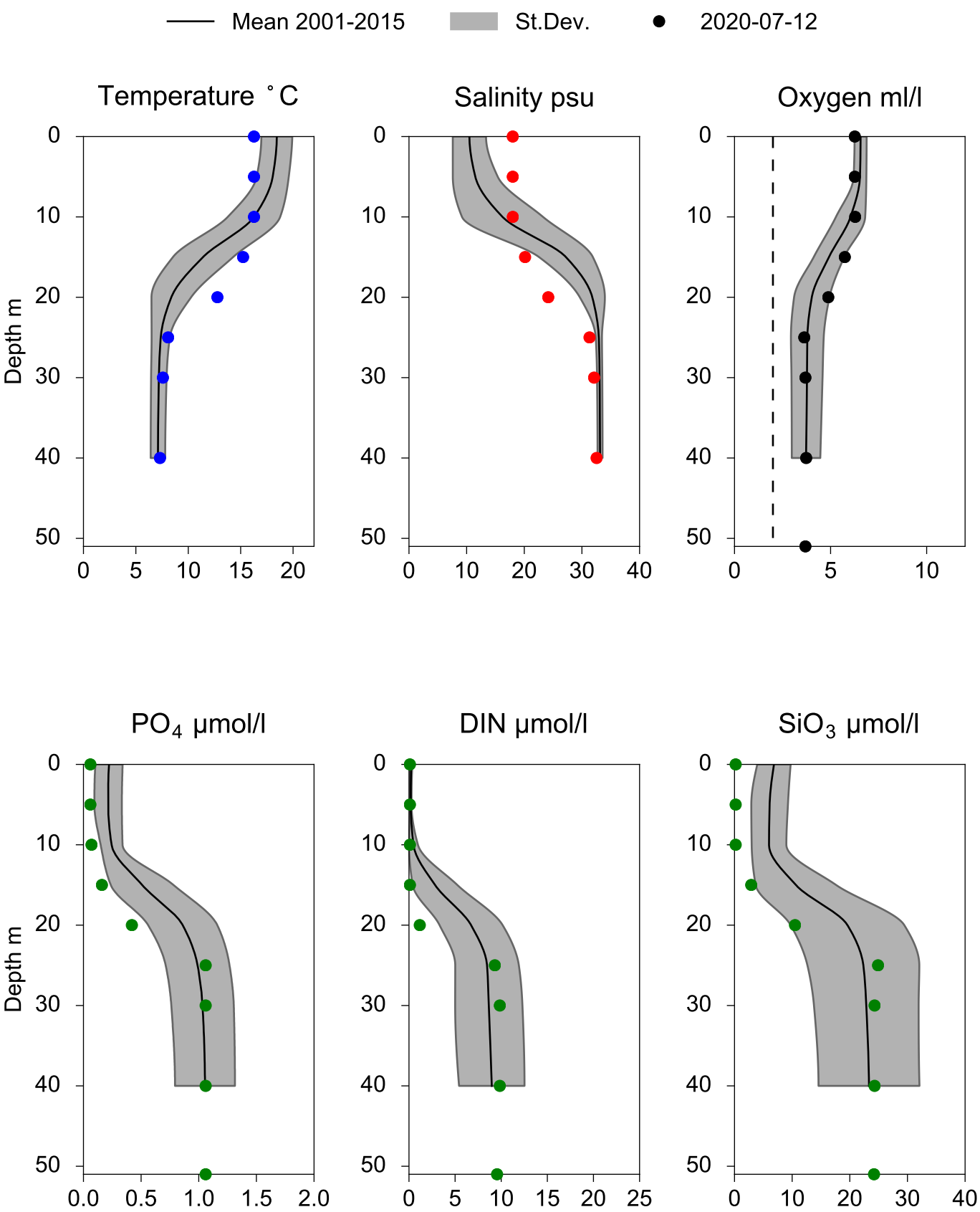


STATION W LANDSKRONA SURFACE WATER (0-10 m)

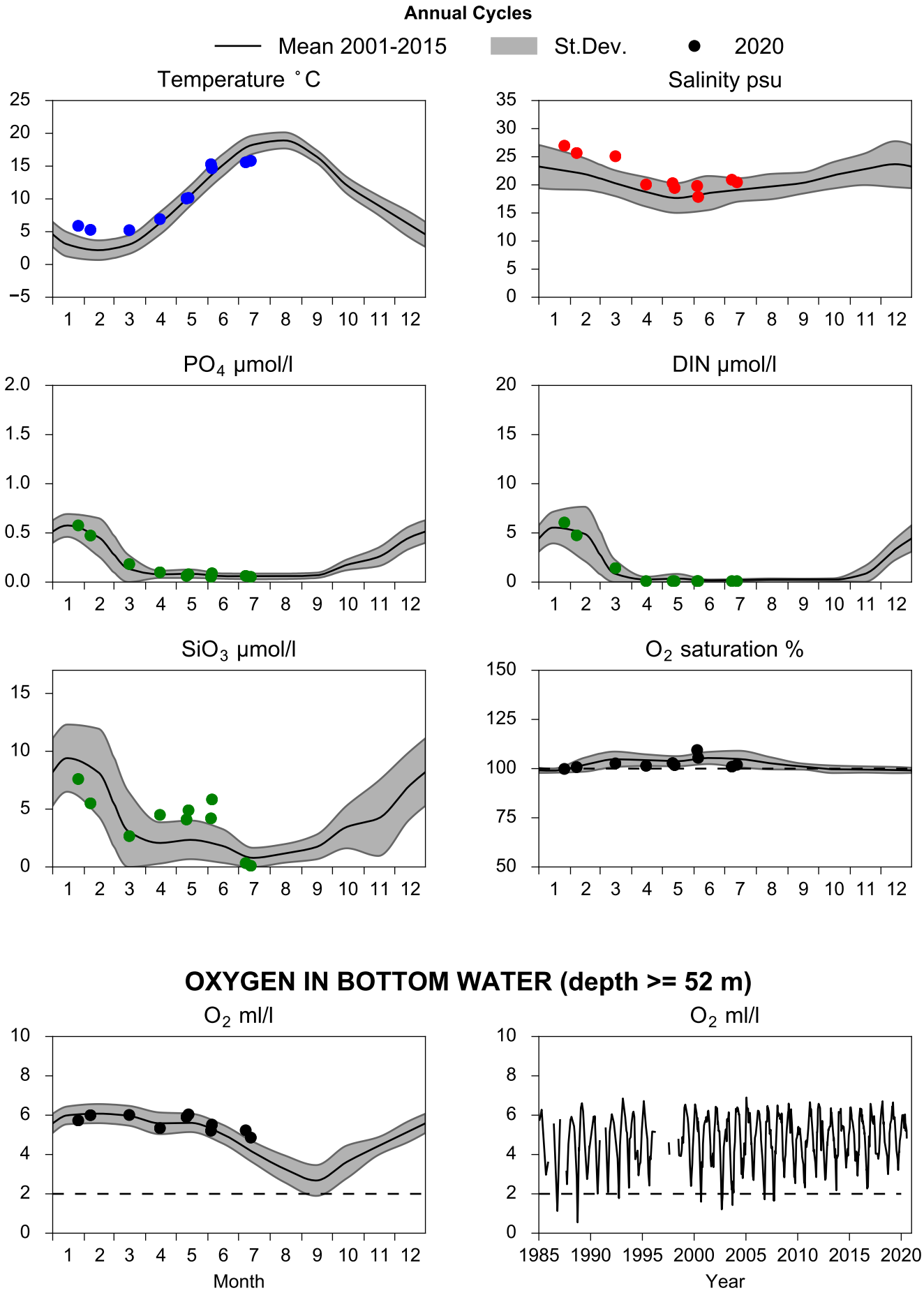


OXYGEN IN BOTTOM WATER (depth >= 40 m)

Vertical profiles W LANDSKRONA
July



STATION ANHOLT E SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 52 m)

Vertical profiles ANHOLT E
July