Karin Wesslander

Swedish Meteorological and Hydrological Institute
Oceanographic Laboratory

2020-01-17
Dnr: S/Gbg-2020-1

SMHI monitoring cruise with R/V Svea
January

Survey period: 2020-01-07 – 2020-01-14
Principal: Swedish Meteorological and Hydrological Institute (SMHI), Swedish Agency for Marine and Water Management (SwAM).
Cooperation partners: Swedish University of Agricultural Sciences (SLU)

Address:
Sven Källfelts Gata 15
426 71 Västra Frölunda

Telephone:
+46-11-495 80 00

E-mail:
Karin.wesslander@smhi.se
WWW:
http://www.smhi.se/

SUMMARY

During the expedition, which is part of the Swedish national marine monitoring programme, the Skagerak, the Kattegat, the Sound and the Baltic Proper was visited. Extra stations were visited in the Kattegat and the Sound to map the spatial distribution of nutrients. Because of technical problems on the ship, the cruise was cancelled when it reached the Northern Gotland Basin and as a consequence, the Western Gotland Basin and the east part of Kattegat could not be monitored.

The surface temperature in January was above normal at all stations and varied between 7.5°C in the Skagerak and 5.4°C in the Baltic Proper. At the west coast, the pycnocline was observed at 15 – 20 meters and in the Baltic Proper the surface water was well mixed down to 25 – 70 meters, shallowest in the Arkona Basin and deepest in the Northern Gotland Basin.

The levels of nutrients in the surface water (0-10 m) had increased since last month. The concentration of phosphate was normal at all stations and the dissolved inorganic nitrogen was below normal in the off shore Skagerak as well as parts of the Baltic Proper. Concentrations of silicate were lower than normal in the Kattegat and the Sound and above normal in the Eastern Gotland Basin.

The oxygen condition in the Arkona Basin was normal and without oxygen deficit. The Bornholm Basin was anoxic in December and hypoxia was noted at the bottom, but now in January the bottom concentration of oxygen had increased to 4.7 ml/l, probably as a consequence of the inflow in December. In the Eastern- and Northern Gotland Basin anoxia was noted from 60 – 70 meters. In the southern part of the Eastern Gotland Basin, at BCS III-10, the concentration of oxygen was 2.8 ml/l at the bottom, which is also probably because of the inflow in December. At the station BY15, it was low oxygen levels, about 0.5 ml/l, from 70 to 150 meters and below 150 meters hydrogen sulphide was present. At the more northern station BY20, hypoxia was noted already from 80 meters.

The next regular expedition is scheduled to begin the 6th February. During the February cruise, the spatial distribution of nutrients will be mapped in the Baltic Proper.

Front page: R/V Svea in the Gulf of Bothnia, photo by colleagues on-board KBV181 from Umeå Marine Sciences Centre during the cruise in December 2019.

RESULT

The expedition was made with the Swedish research vessel Svea and started in Lysekil on January 7th 2020 and ended in the same harbour on January 14th. Weather was grey and it was mainly moderate to fresh winds, from south – south west. In the Skagerak, the wind increased to 18 m/s, while it was calmer in the southern parts of the Baltic Proper. During the expedition, the spatial distribution of nutrients was mapped in the Kattegat and the Sound. Because of technical problems on the ship, the cruise was cancelled when it reached the Northern Gotland Basin and as a consequence, the Western Gotland Basin and the east part of Kattegat could not be monitored.

Normally, no biological samples have been analyzed at the time of writing this report, but eventually there will be an algae report for the current month where more information on phytoplankton is available: https://www.smhi.se/publikationer/publikationer/algrapporter

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 at the data center'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).

The Skagerak

The temperature in the surface water (0-10 m) varied from 6.3°C at the coast to 7.5°C at the off shore Skagerak, which is about one degree colder than in December. At all stations in the Skagerak, the surface temperature was above normal. The sea surface salinity varied about 32 in the off shore and about 29 at the coast where it also was higher than normal. The thermocline at the coast was observed at about 15 meters and in the off shore parts the thermocline and halocline coincided at 25 meters.

The concentrations of nutrients in the Skagerak surface water varied for phosphate around 0.46 µmol/l, dissolved inorganic nitrogen 4.5 – 7.0 µmol/l and silicate 3.9 – 8.7 µmol/l, which is an increase since December. The highest levels were observed at the coast. The levels of phosphate and silicate were normal for the season while the levels of dissolved inorganic nitrogen were below normal in the off shore. In the deep water at stations Å13 and Å15, the levels of nutrients were below normal.

Oxygen concentrations in the bottom water were below normal at the coastal station Släggö, 3.7 ml/l. The chlorophyll fluorescence was low at all stations.

The Kattegat and the Sound

The temperature in the surface water (0-10 m) was above normal and varied between 5.5 – 6.5°C. The salinity in the surface water varied with 25 – 31 in Kattegat, which is normal, and in the Sound the surface salinity was 21, which is also normal. In the Kattegat, the surface layer was well mixed to 15 – 20 meters where the thermocline and halocline coincided. The stratification in the Sound was less pronounced and the increase of temperature and salinity was continuous from the surface towards the bottom.

The surface levels of phosphate (0.55 – 0.66 µmol/l) and dissolved inorganic nitrogen (5.85 – 8.75 µmol/l) were normal for the season while the levels of silicate (6.3 – 11.0 µmol/l) were below normal.

The oxygen condition was good in the bottom water and the lowest observation was 5.9 ml/l in the Kattegat and 5.5 ml/l in the Sound.

The chlorophyll fluorescence was low except from at the station Läsö Ränna where it was a peak in the surface.

Only the western part of Kattegat could be monitored during this cruise.

The Baltic Proper

The sea surface temperature was warmer than normal for the season and varied between 5.4 – 6.5°C. The sea surface salinity (7.2 – 8.9) varied between being normal and slightly above normal in mainly the northern part (BY20 and BY29). The deep water in the Eastern- and the Northern Gotland Basin was both warmer and had higher salinity than normal. The halocline was observed at depths between 25 and 70 meters, shallowest in the Arkona Basin and deepest in the Northern Gotland Basin.

The oxygen condition in the Arkona Basin was normal and without oxygen deficit. The Bornholm Basin was anoxic in December and hypoxia was noted at the bottom, but now in January the bottom concentration of oxygen had increased to 4.7 ml/l, probably as a consequence of the inflow in December. In the Eastern- and Northern Gotland Basin anoxia was noted from 60 – 70 meters. In the southern part of the Eastern Gotland Basin, at BCS III-10, the concentration of oxygen was 2.8 ml/l at the bottom which is also probably because of the inflow in December. At the station BY15, it was low oxygen levels, about 0.5 ml/l, from 70 to 150 meters and below 150 meters hydrogen sulphide was present. At the more northern station BY20, hypoxia was noted already from 80 meters. The expedition had to be cancelled in the Northern Gotland Basin and station BY29 was only partially sampled, therefor we do not know from what depth hypoxia starts but it was observed at the bottom.

The surface concentrations (0-10 m) had increased since last cruise. The levels of phosphate were normal at all stations and varied between 0.51 – 0.7 µmol/l. The dissolved inorganic nitrogen (2.4 – 3.5 µmol/l) was at normal concentrations apart from the Arkona Basin and at BY15 where it was lower than normal. The levels of silicate were above normal in the Eastern Gotland Basin and varied between 12.1 – 17.1 µmol/l. Generally, concentrations of nutrients increase with depth. The concentration of phosphate and silicate in the deep water in the Bornholm basin was lower than usual probably because of the inflow in December.

The chlorophyll fluorescence was low except from the station Läsö Ränna where it was a peak in the surface.

The Western Gotland Basin could not be monitored during this cruise.

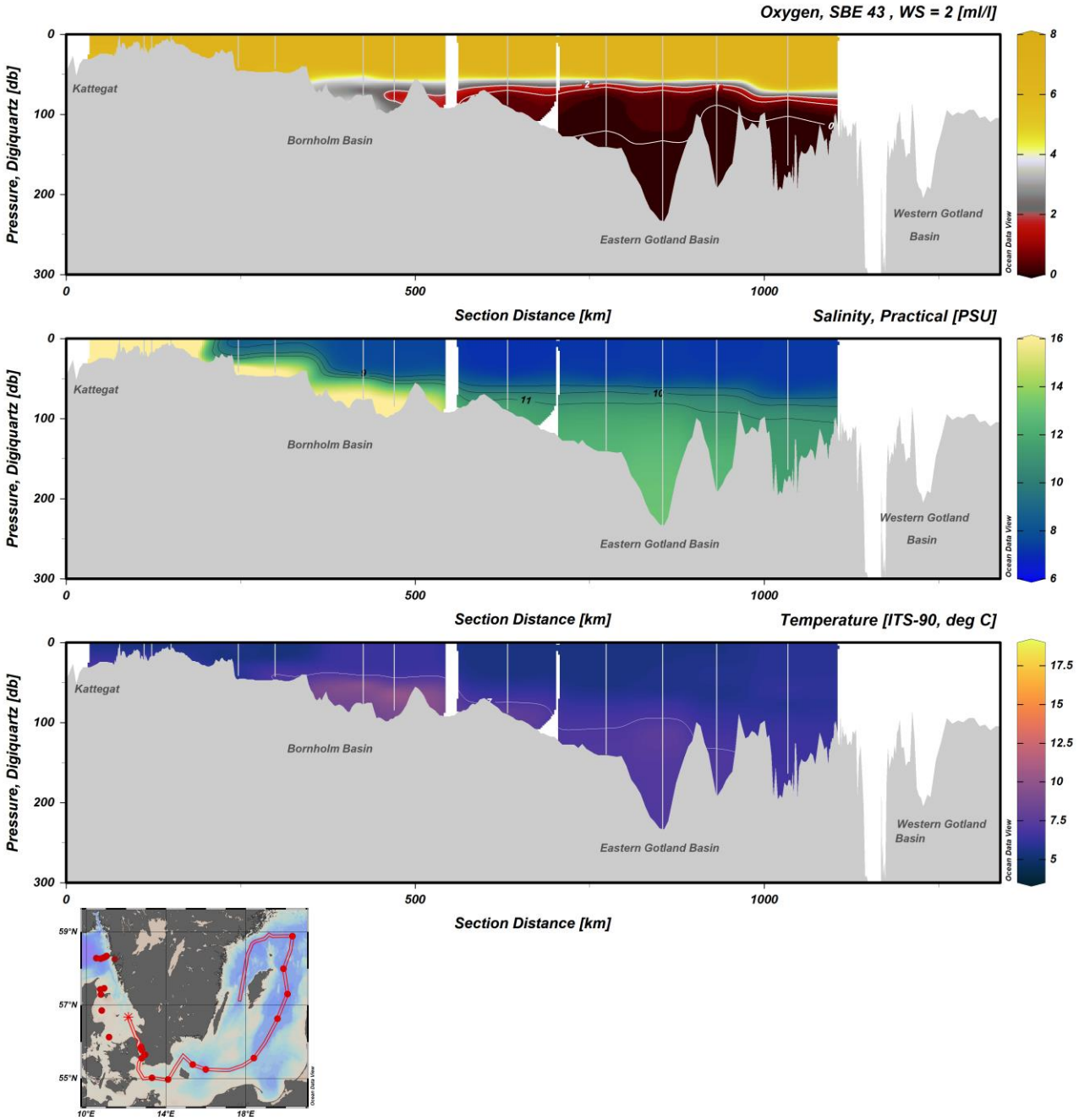

Figure 1. Transect showing dissolved oxygen, salinity and temperature from the Sound, through the Baltic Proper, to the Western Gotland Basin. Grey lines mark the positions that the plots are based on and below is a map showing these positions.

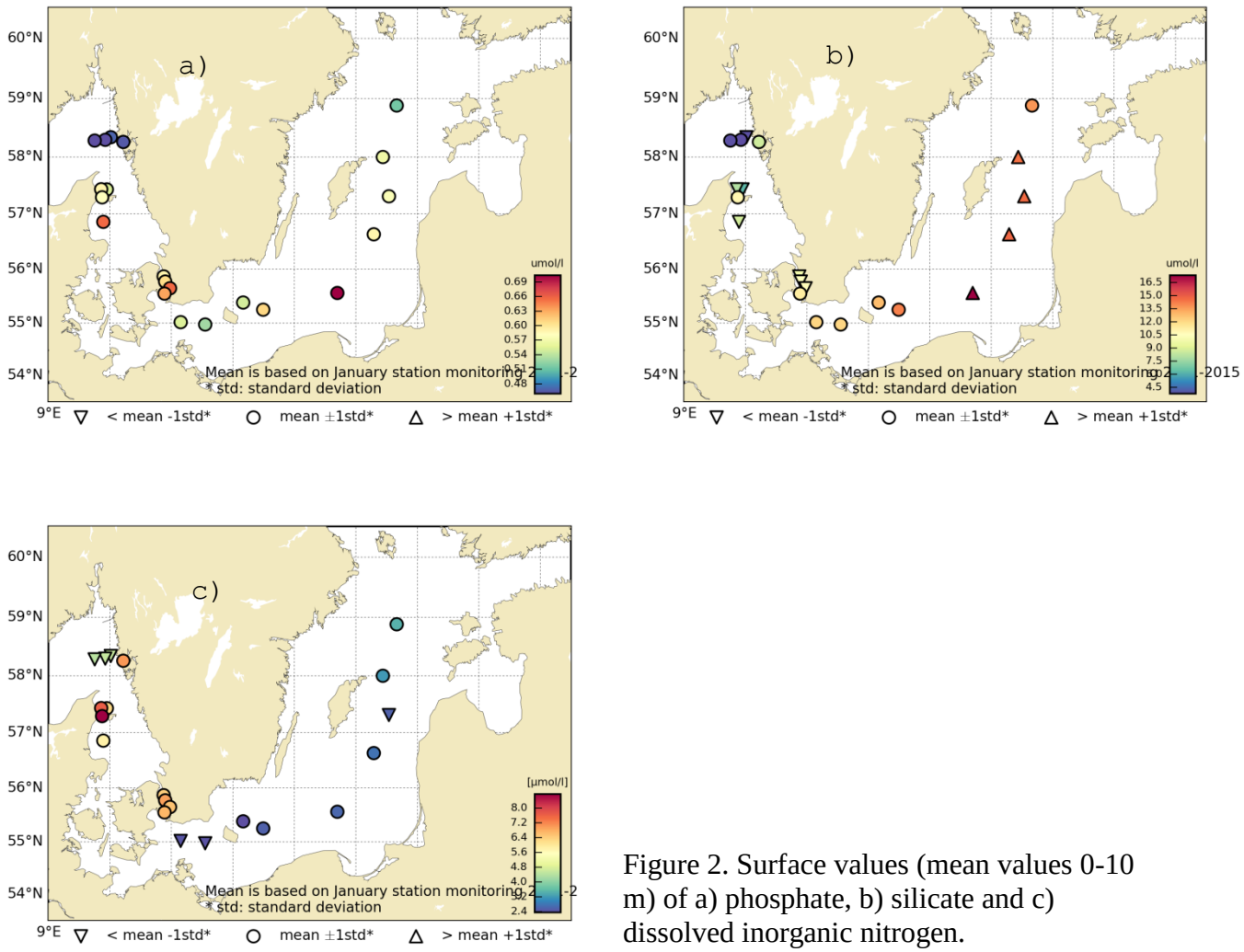

Figure 2. Surface values (mean values 0-10 m) of a) phosphate, b) silicate and c) dissolved inorganic nitrogen.

Address:
Sven Källfelts Gata 15
426 71 Västra Frölunda

Telephone:
+46-11-495 80 00

E-mail:
Karin.wesslander@smhi.se
WWW:
http://www.smhi.se/

Participants

Name	Role	Section	From
Johan Kronsell	Chief Scientist		SMHI
Sari Sipilä			SMHI
Kristin Andreasson			SMHI
Daniel Bergman Sjöstrand			SMHI
Johan Håkansson			SMHI
Ann-Turi Skjevik			

APPENDICES

- Track chart
- Table over stations, sampled parameters and number of sampling depths
- Map of bottom water oxygen/hydrogen sulphide concentration
- Vertical profiles for regular monitoring stations
- Monthly average surface water plots for regular monitoring stations

SMHI
Havs och Vatten myndigheten

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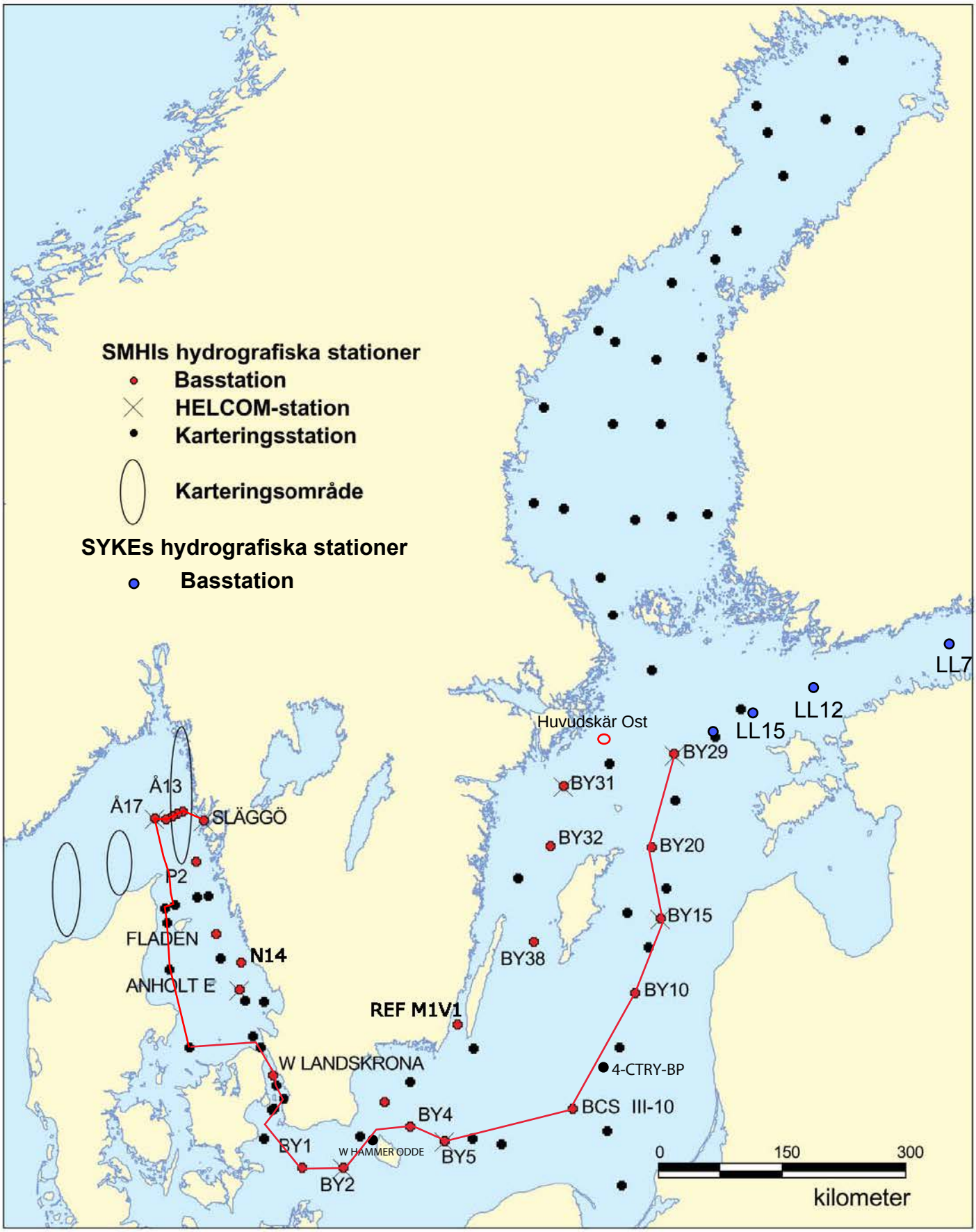
Series: 0001-0024



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Year: 2020

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0002	1	SKEX14	BAS...	Å13	5820.53	01101.71	20200107	1600	120		18	14	7.3	1010	9990	x---	10	10	x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	-	-
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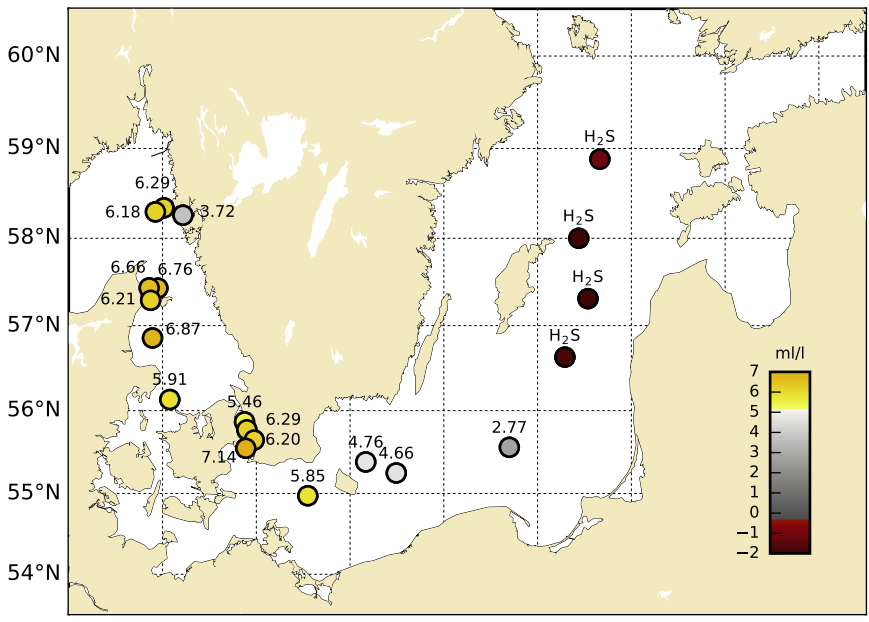
Bottom water oxygen concentration (ml/l)
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15°E
17°E
19°E
21°E
23°E
25°E
6.29
6.18
3.72
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6.76
6.21
6.87
5.91
5.46
6.29
6.20
7.14
5.85
4.76
4.66
2.77
H2S
H2S
H2S
H2S
ml/l
7
6
5
4
3
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1
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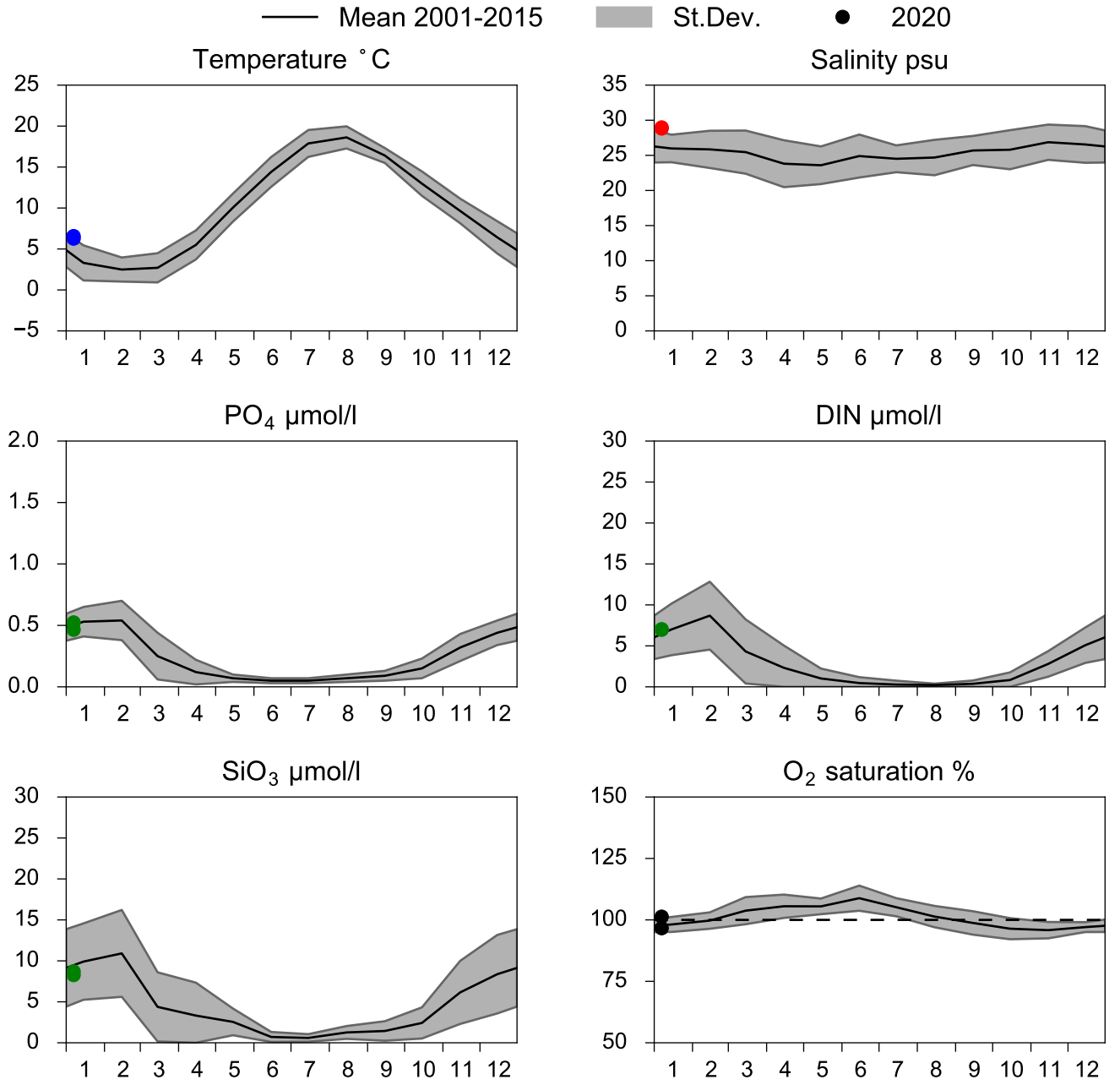
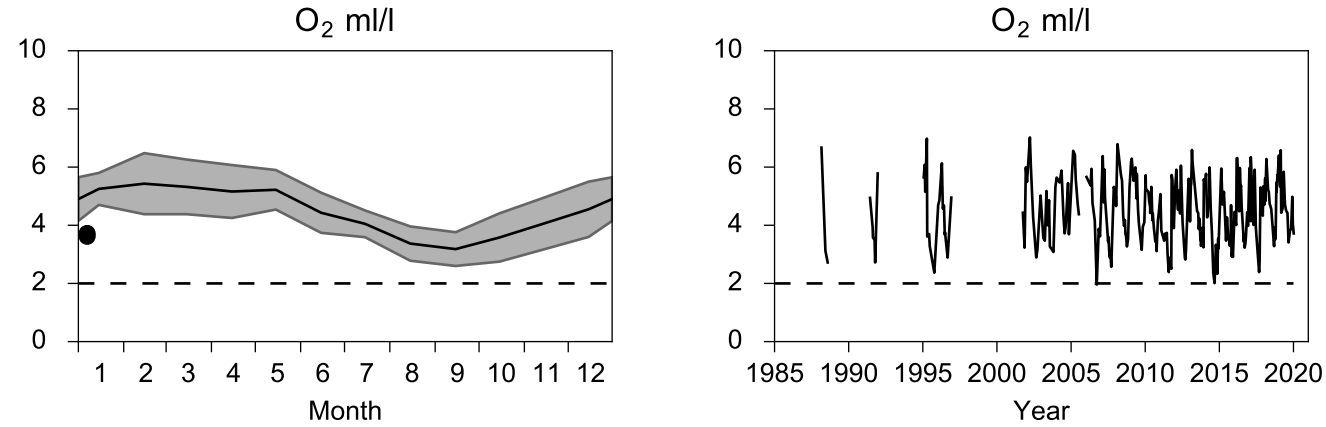
−1
−2

STATION SLÄGGÖ SURFACE WATER (0-10 m)

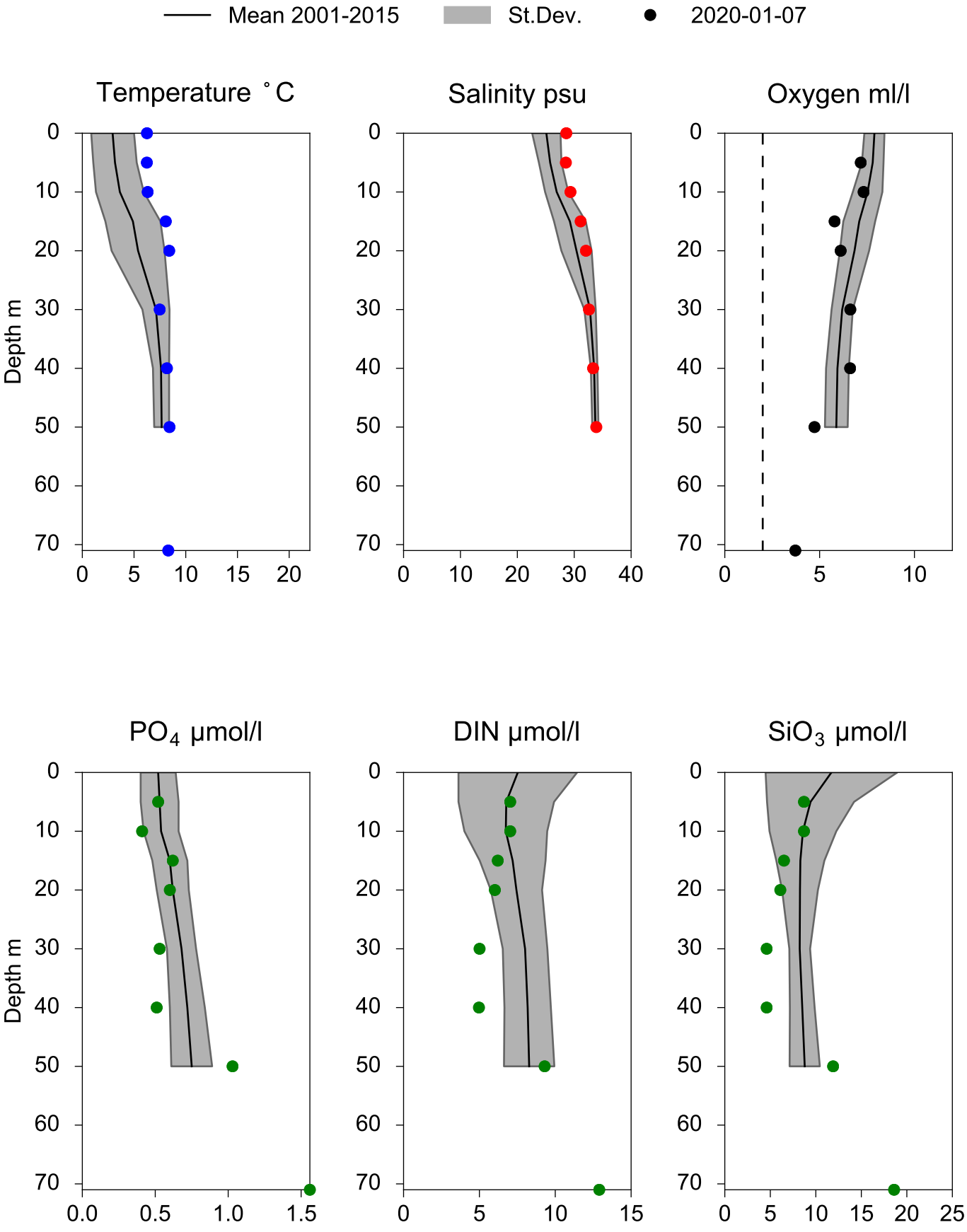
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 64 m)



Vertical profiles SLÄGGÖ
January

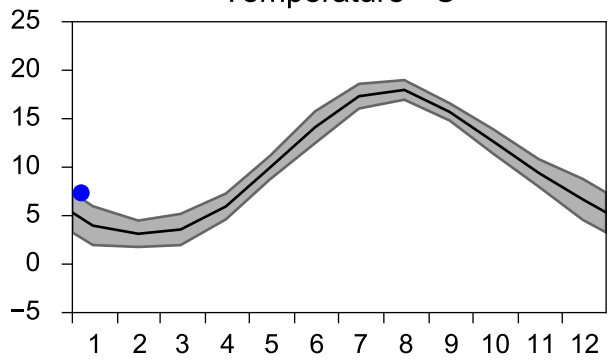


STATION Å13 SURFACE WATER (0-10 m)

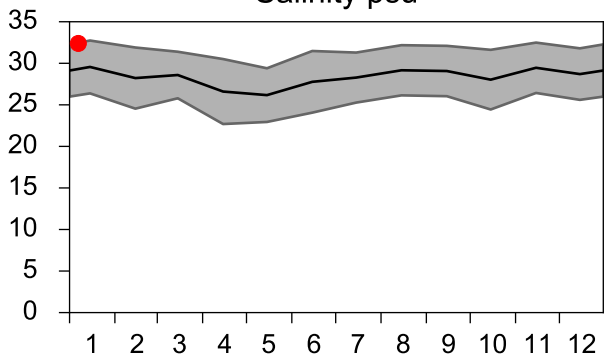
Annual Cycles

Mean 2001-2015 St.Dev. 2020

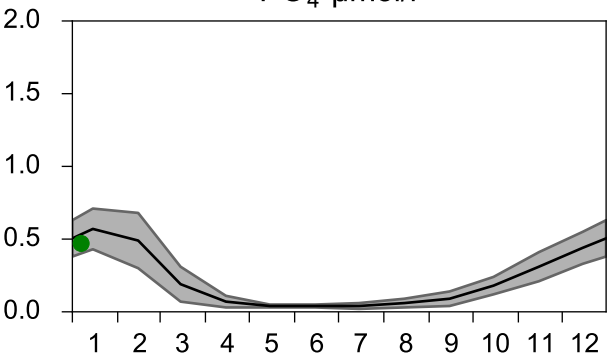
Temperature ˚C



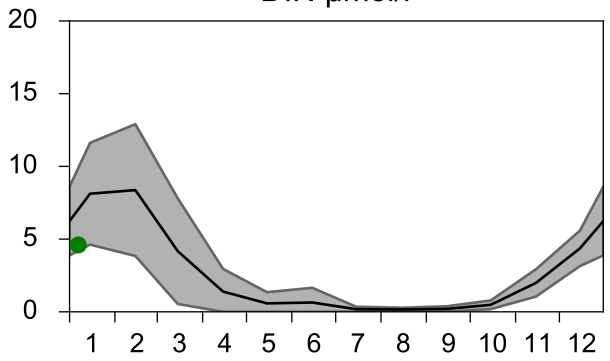
Salinity psu



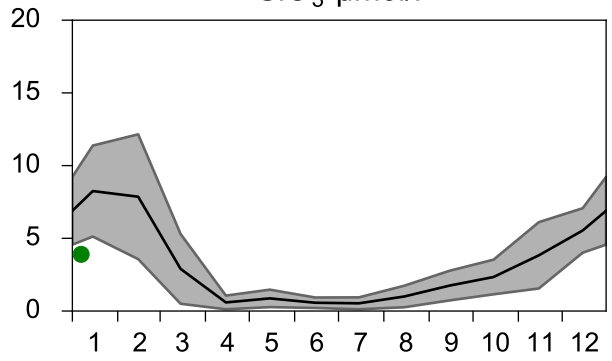
PO_4 µmol/l



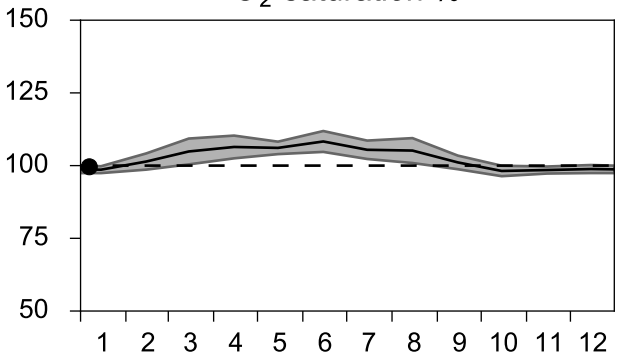
DIN µmol/l



SiO_3 µmol/l



O_2 saturation %



OXYGEN IN BOTTOM WATER (depth >= 80 m)

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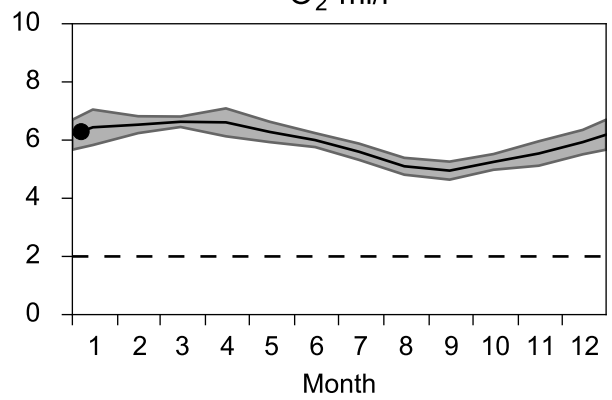
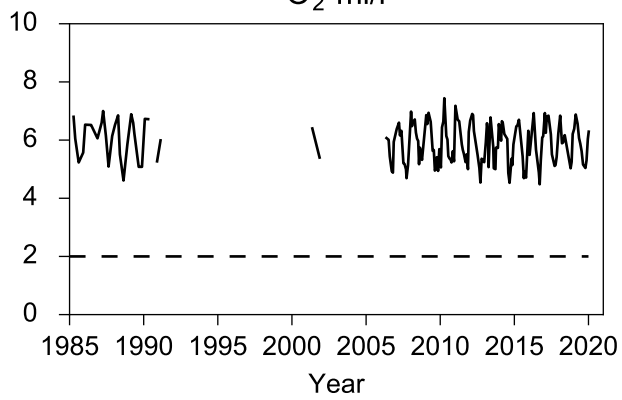
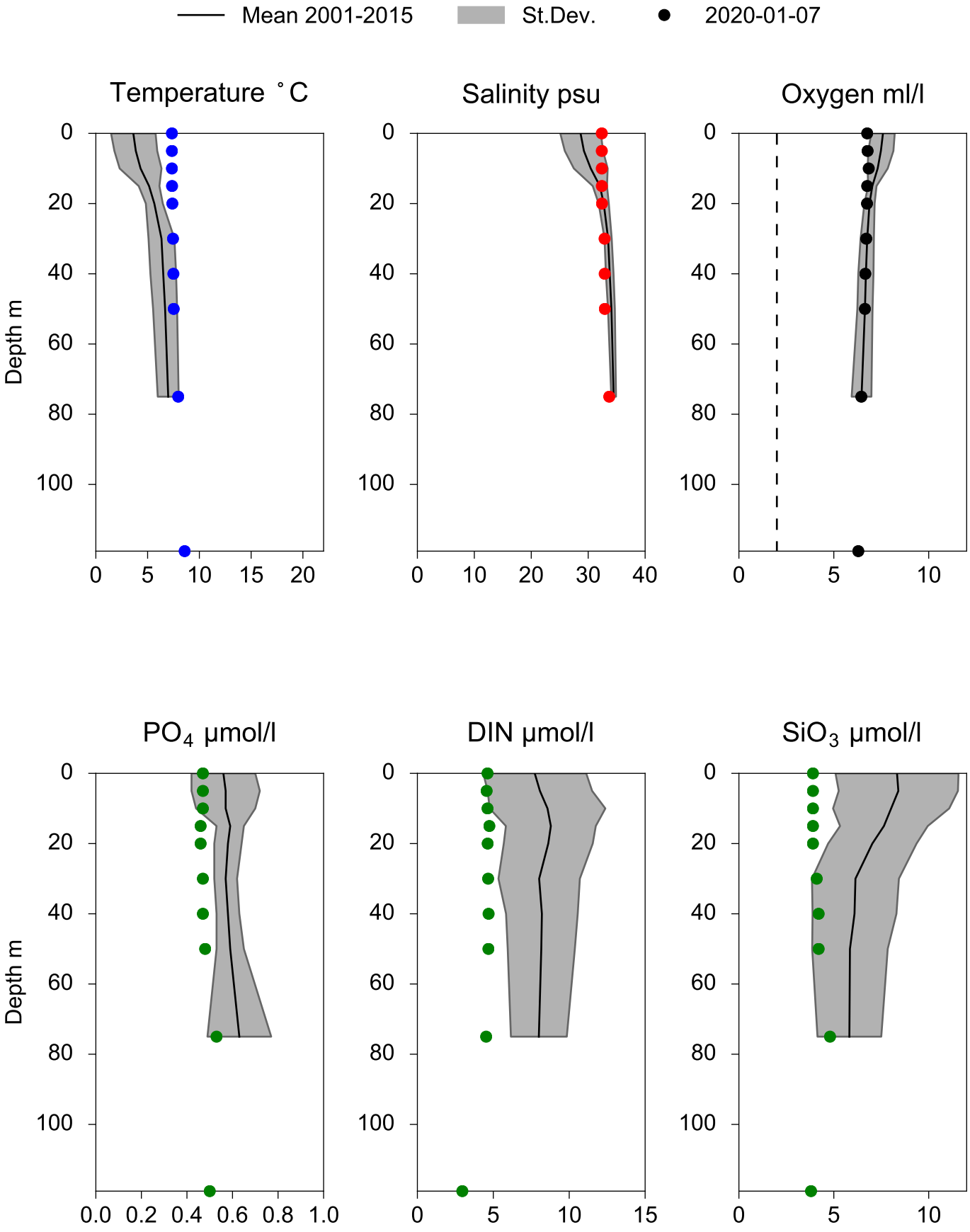


O_2 ml/l



Vertical profiles Å13
January

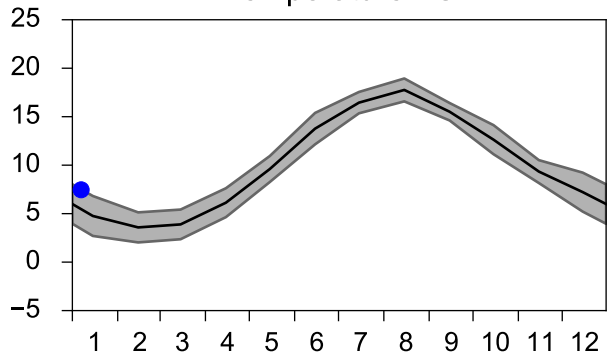


STATION Å15 SURFACE WATER (0-10 m)

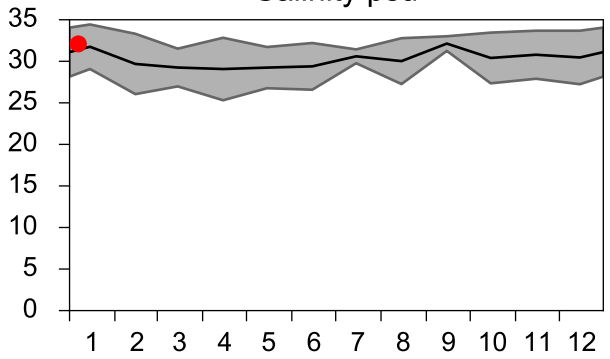
Annual Cycles

Mean 2001-2015 St.Dev. 2020

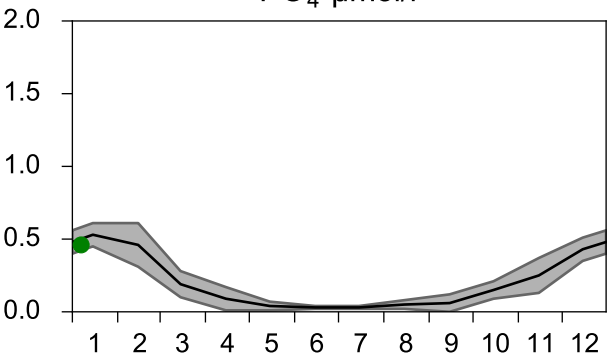
Temperature ˚C



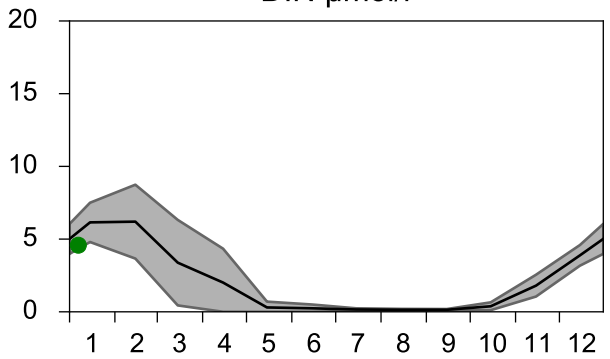
Salinity psu



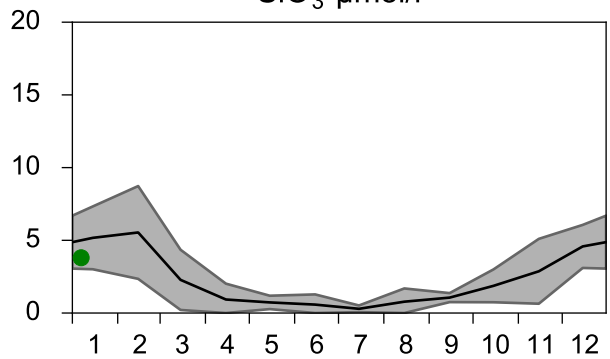
PO_4 µmol/l



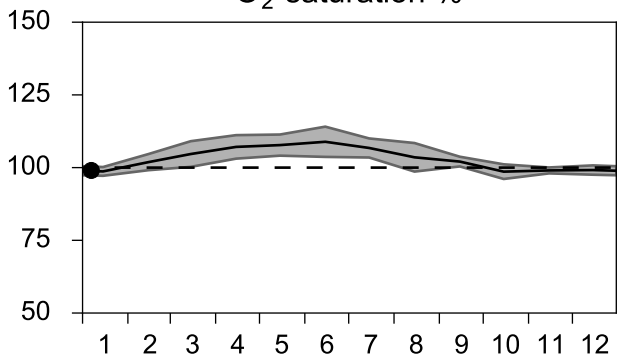
DIN µmol/l



SiO_3 µmol/l

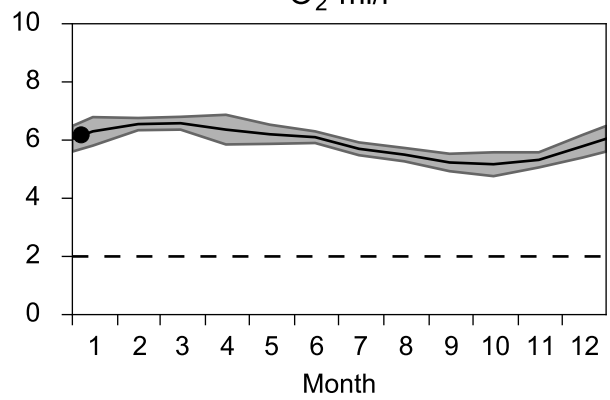


O_2 saturation %

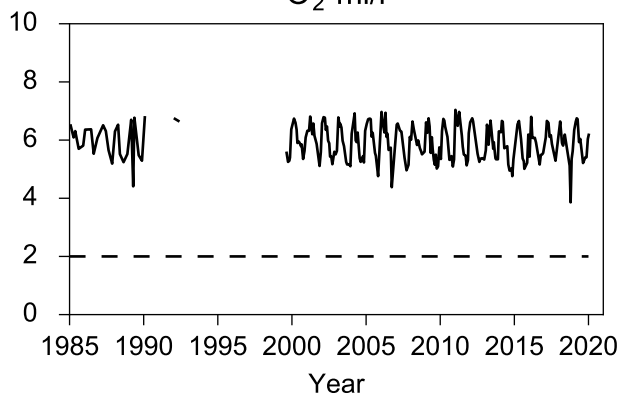


OXYGEN IN BOTTOM WATER (depth >= 125 m)

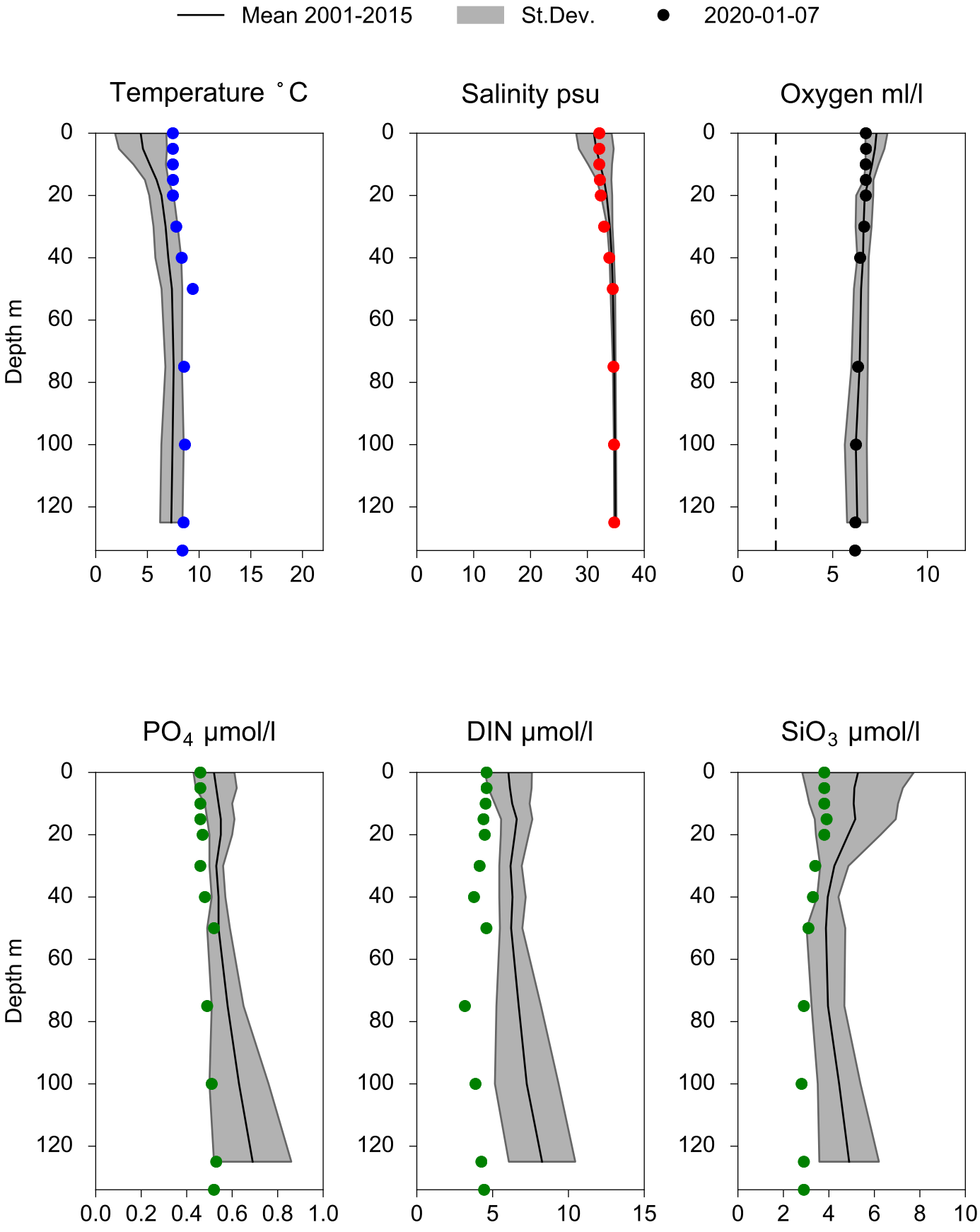
O_2 ml/l



O_2 ml/l



Vertical profiles Å15
January

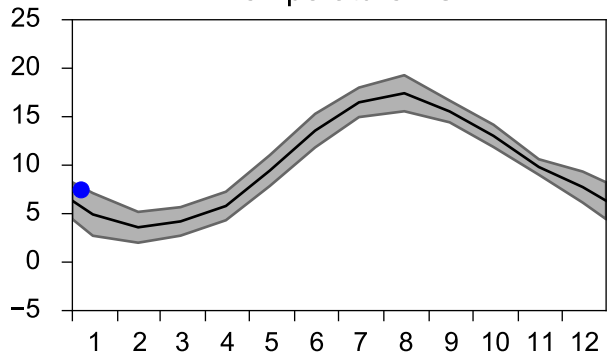


STATION Å17 SURFACE WATER (0-10 m)

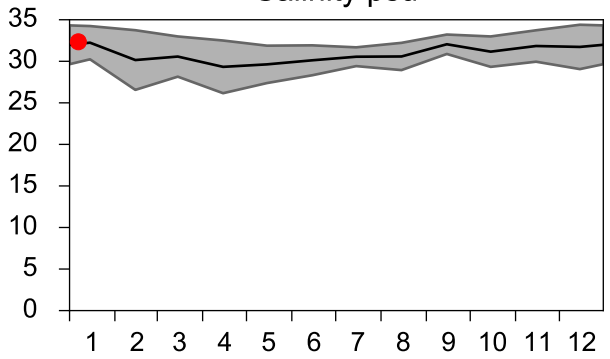
Annual Cycles

Mean 2001-2015 St.Dev. 2020

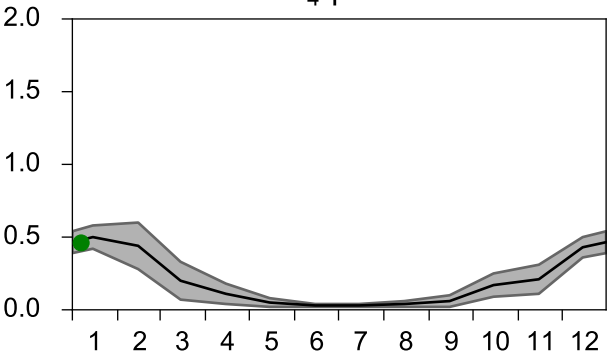
Temperature ˚C



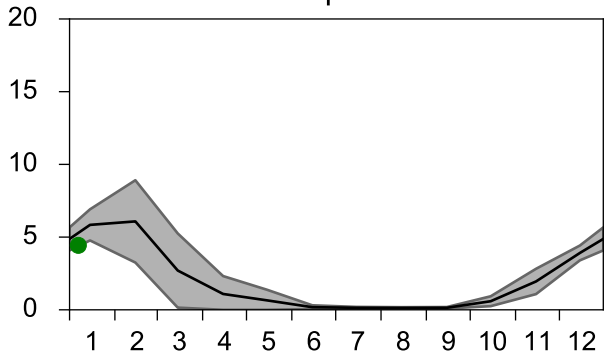
Salinity psu



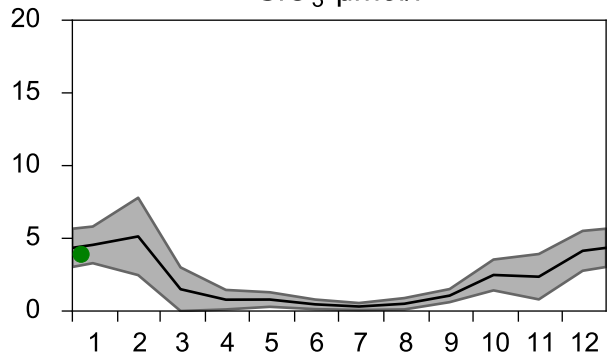
PO_4 µmol/l



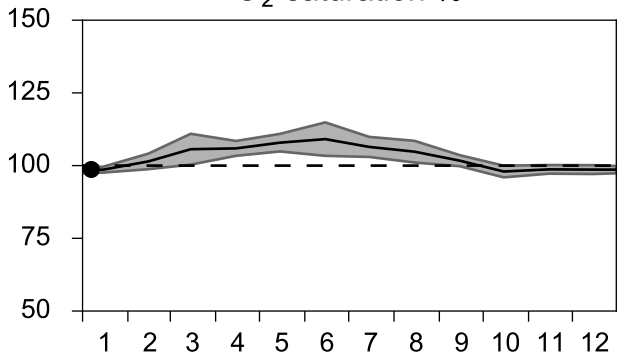
DIN µmol/l



SiO_3 µmol/l

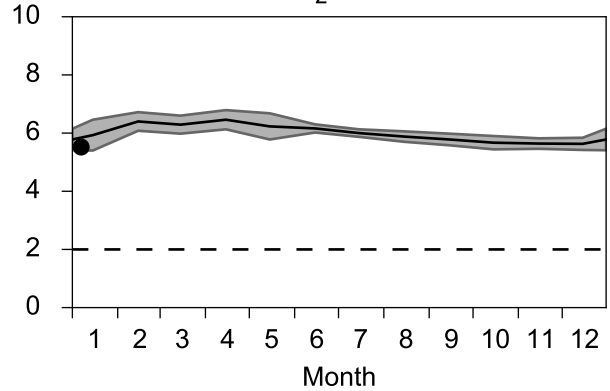


O_2 saturation %

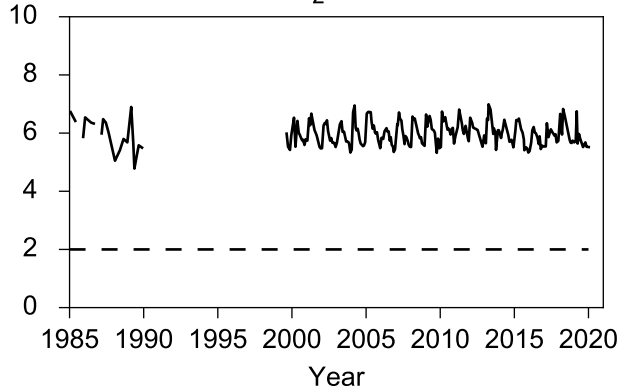


OXYGEN IN BOTTOM WATER (depth >= 300 m)

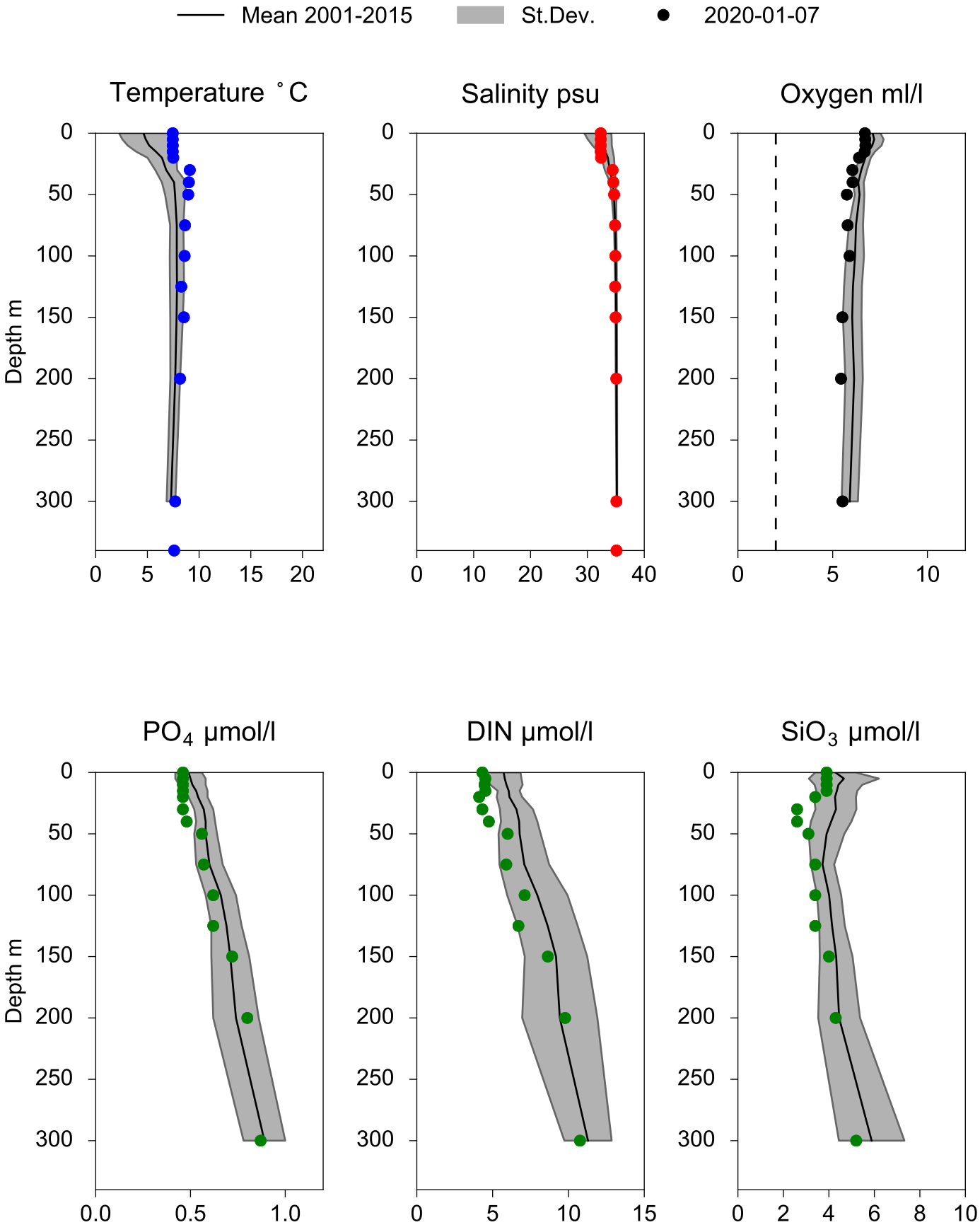
O_2 ml/l



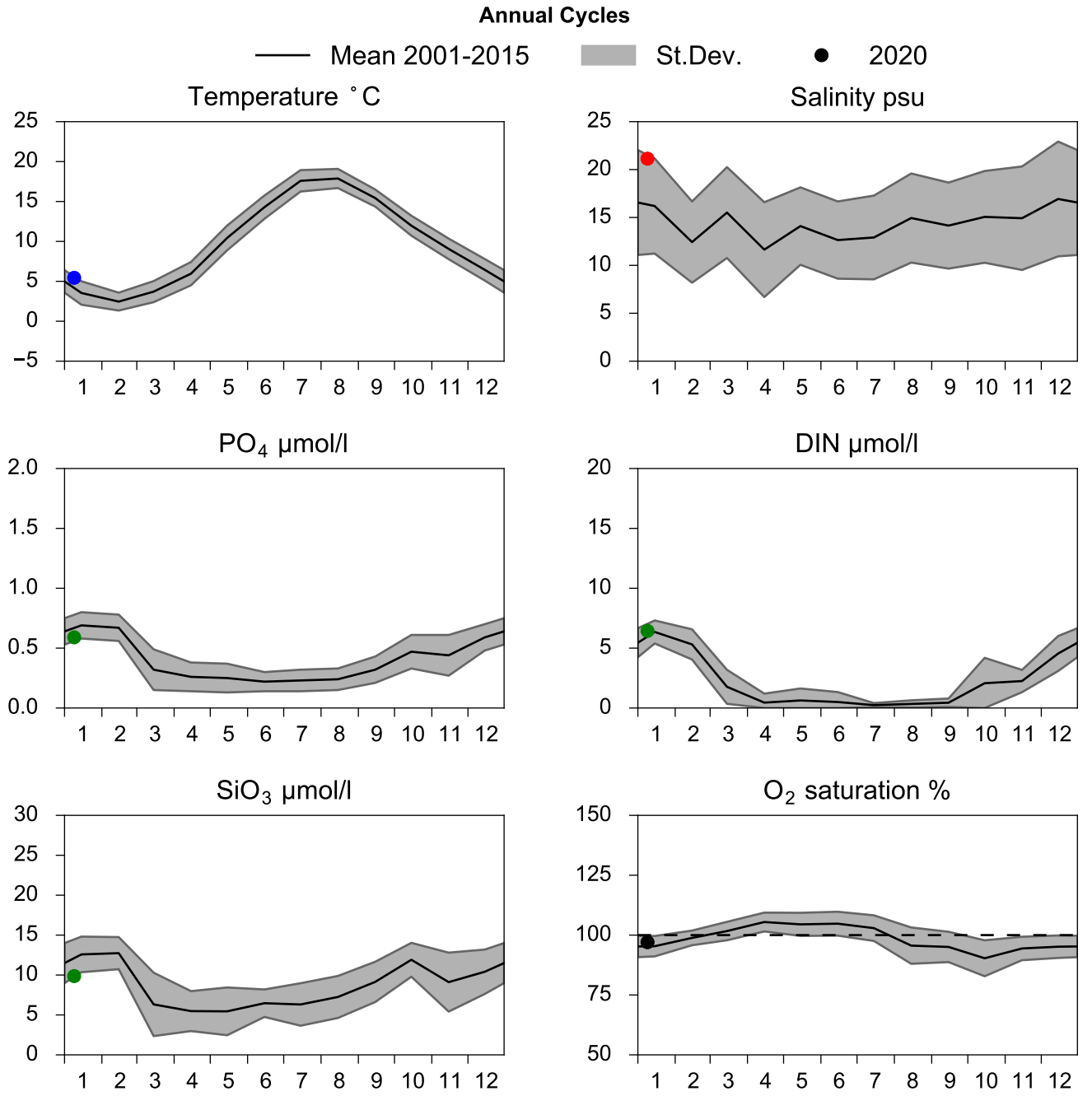
O_2 ml/l



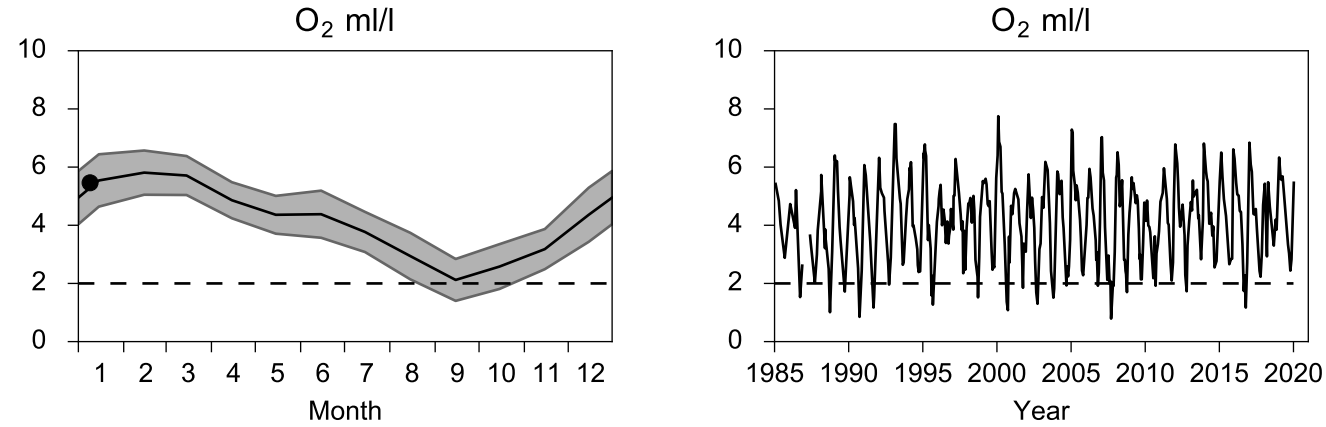
Vertical profiles Å17
January



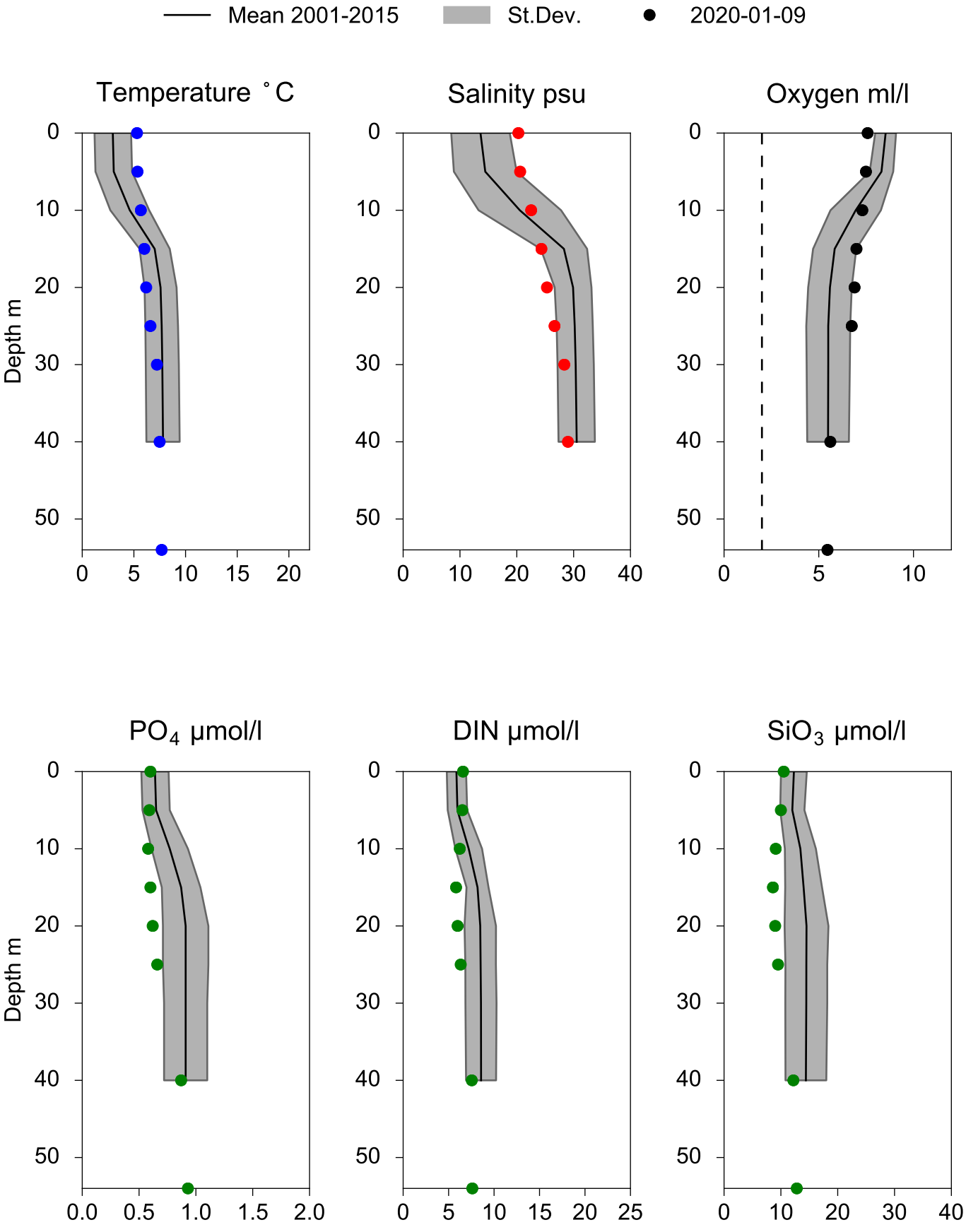
STATION W LANDSKRONA SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 40 m)

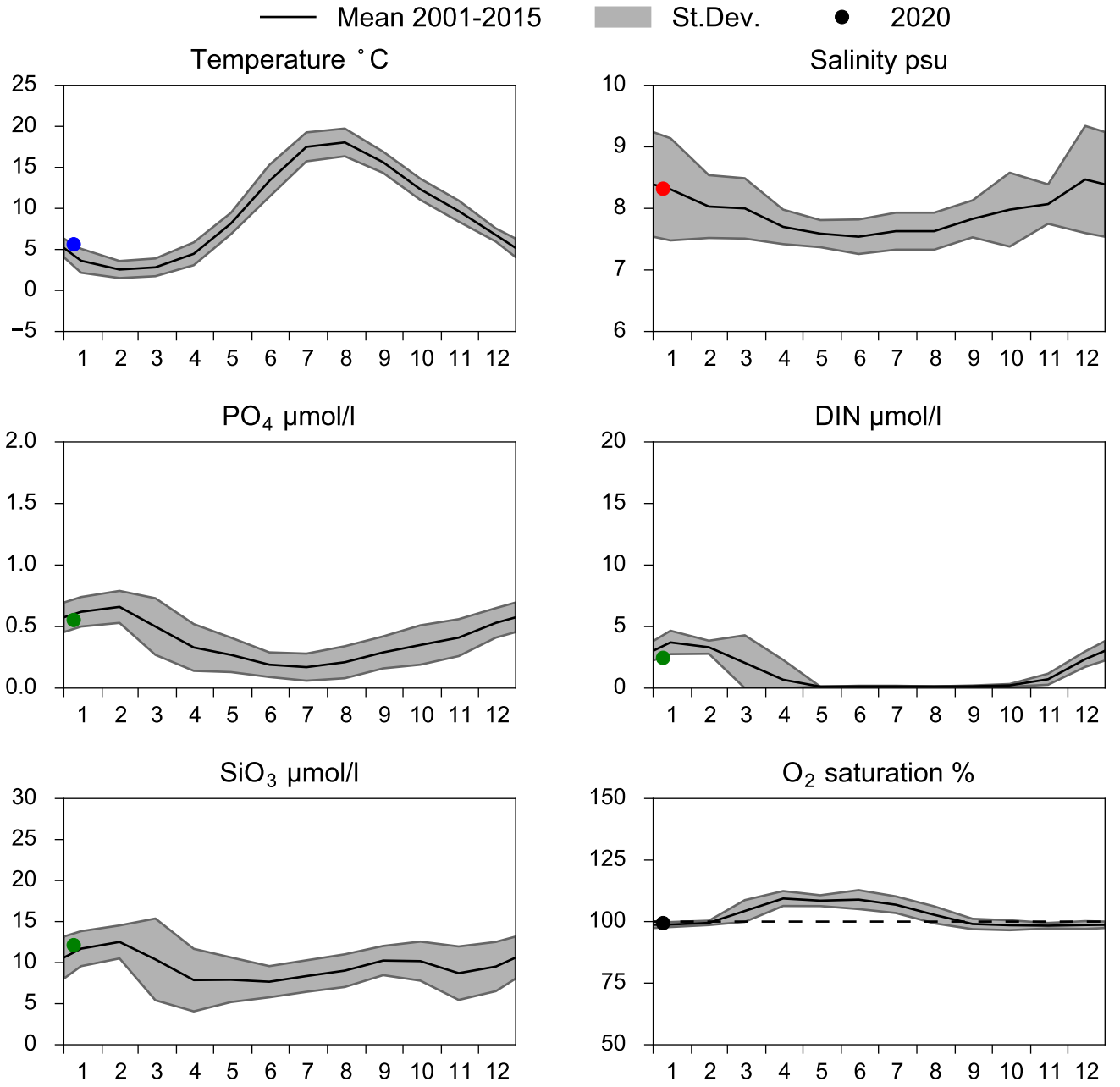


Vertical profiles W LANDSKRONA
January

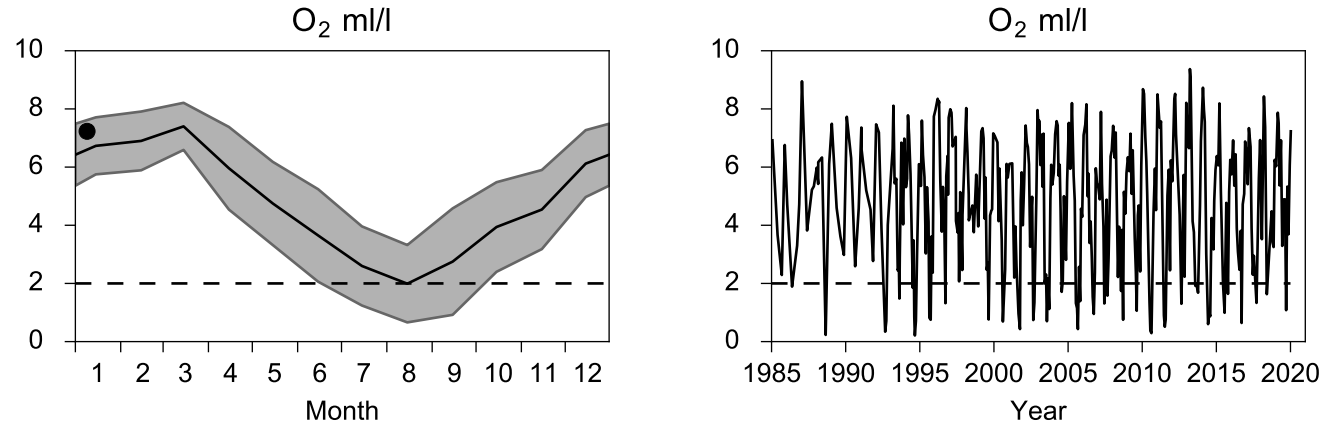


STATION BY1 SURFACE WATER (0-10 m)

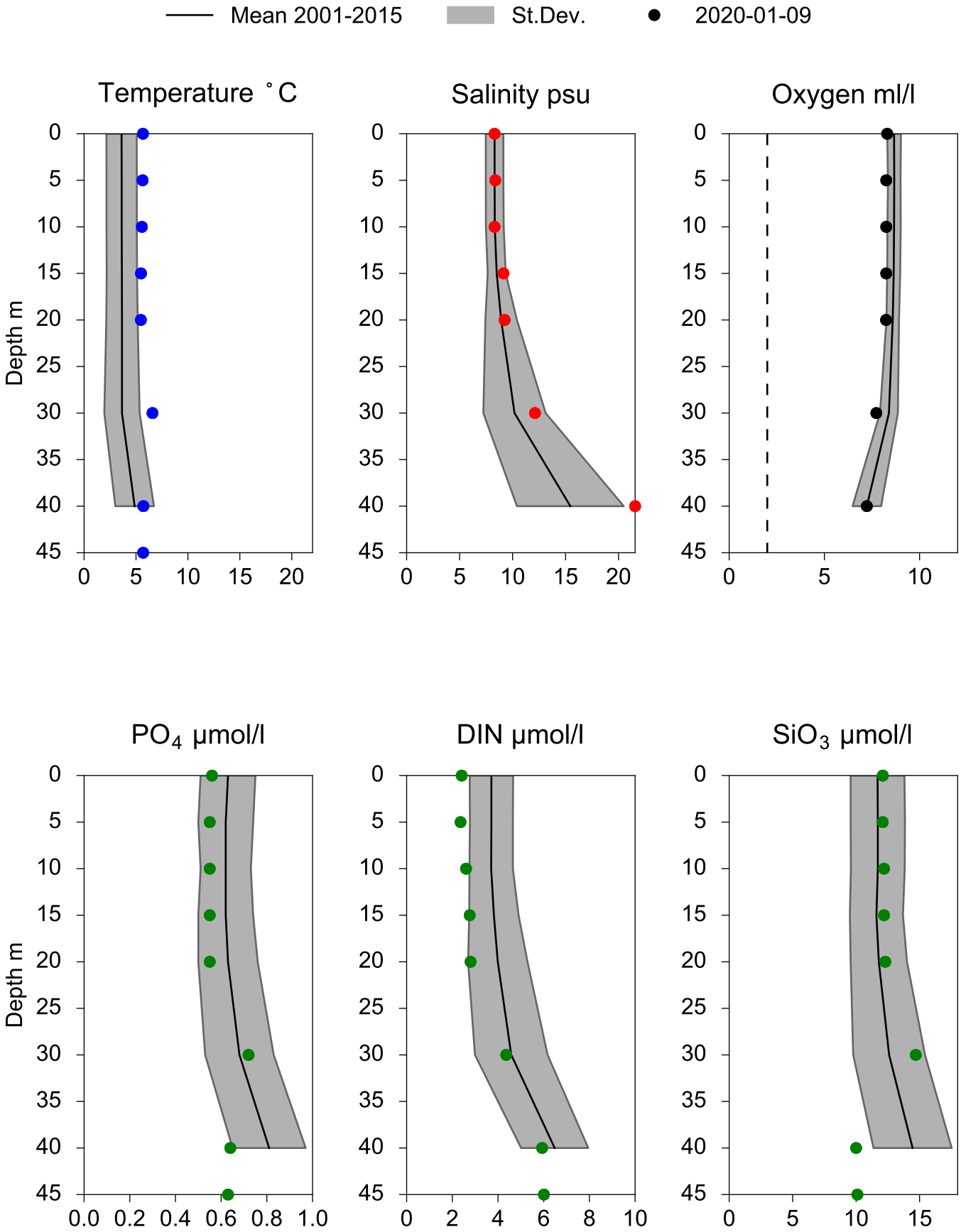
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 40 m)



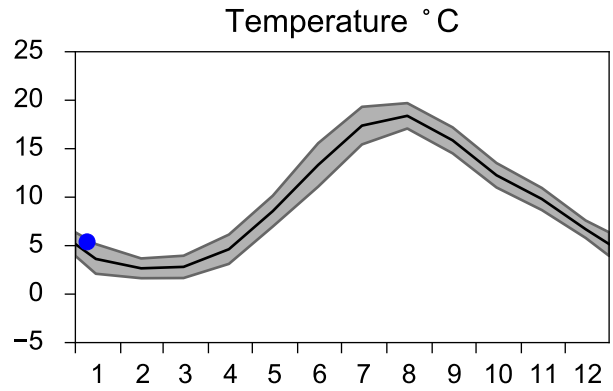
Vertical profiles BY1
January

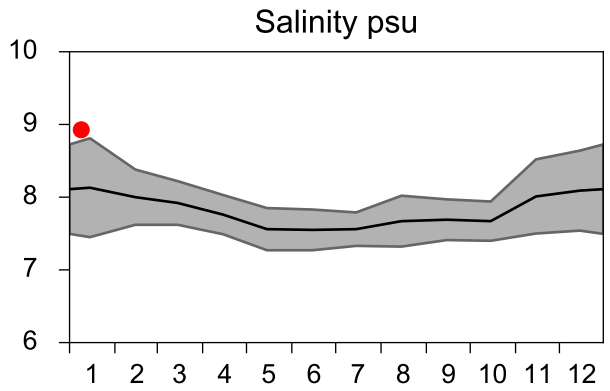


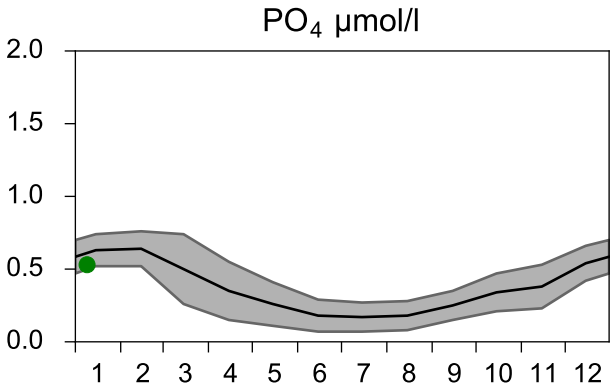
STATION BY2 ARKONA SURFACE WATER (0-10 m)

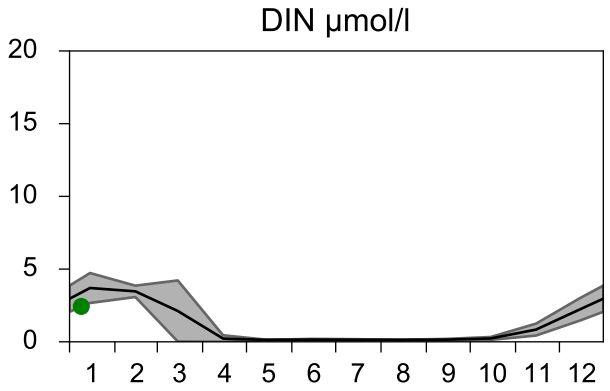
Annual Cycles

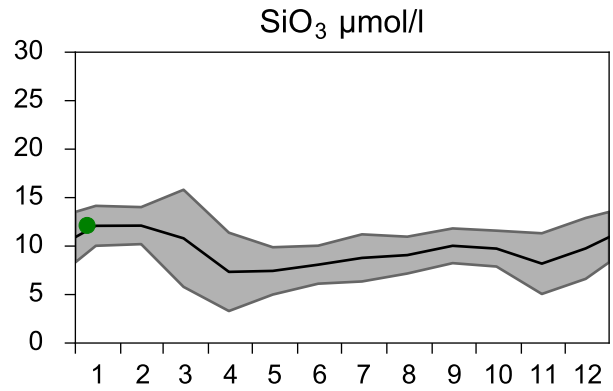
Mean 2001-2015 St.Dev. 2020

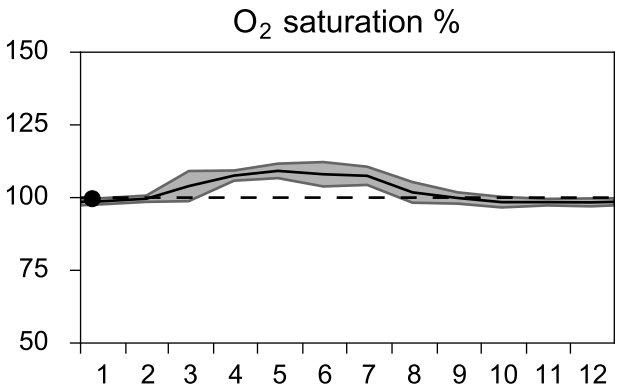




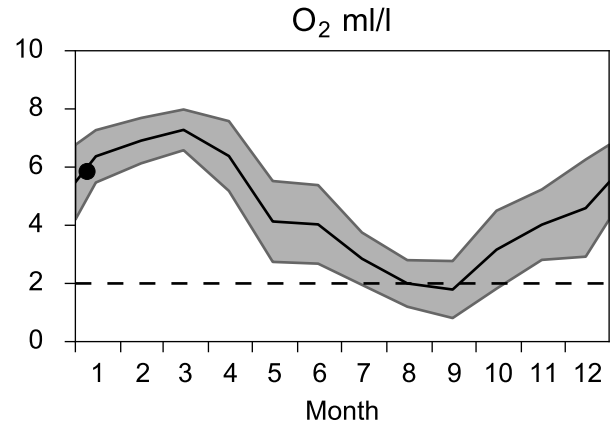


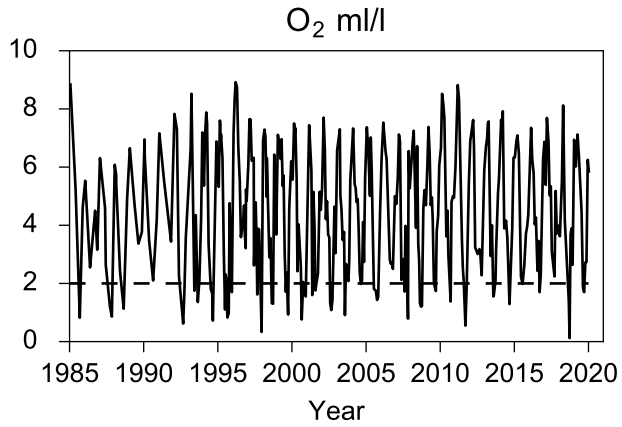




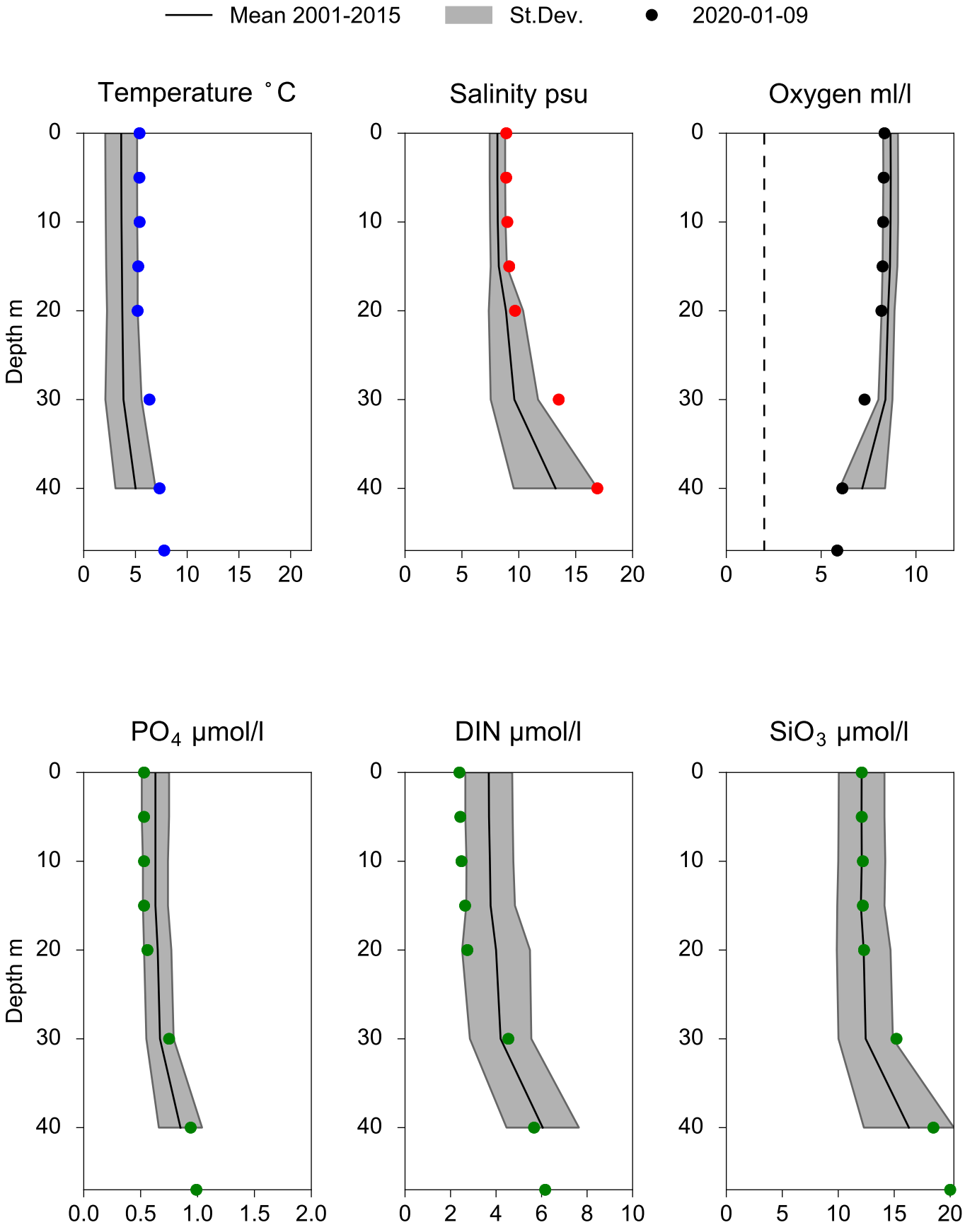


OXYGEN IN BOTTOM WATER (depth >= 40 m)

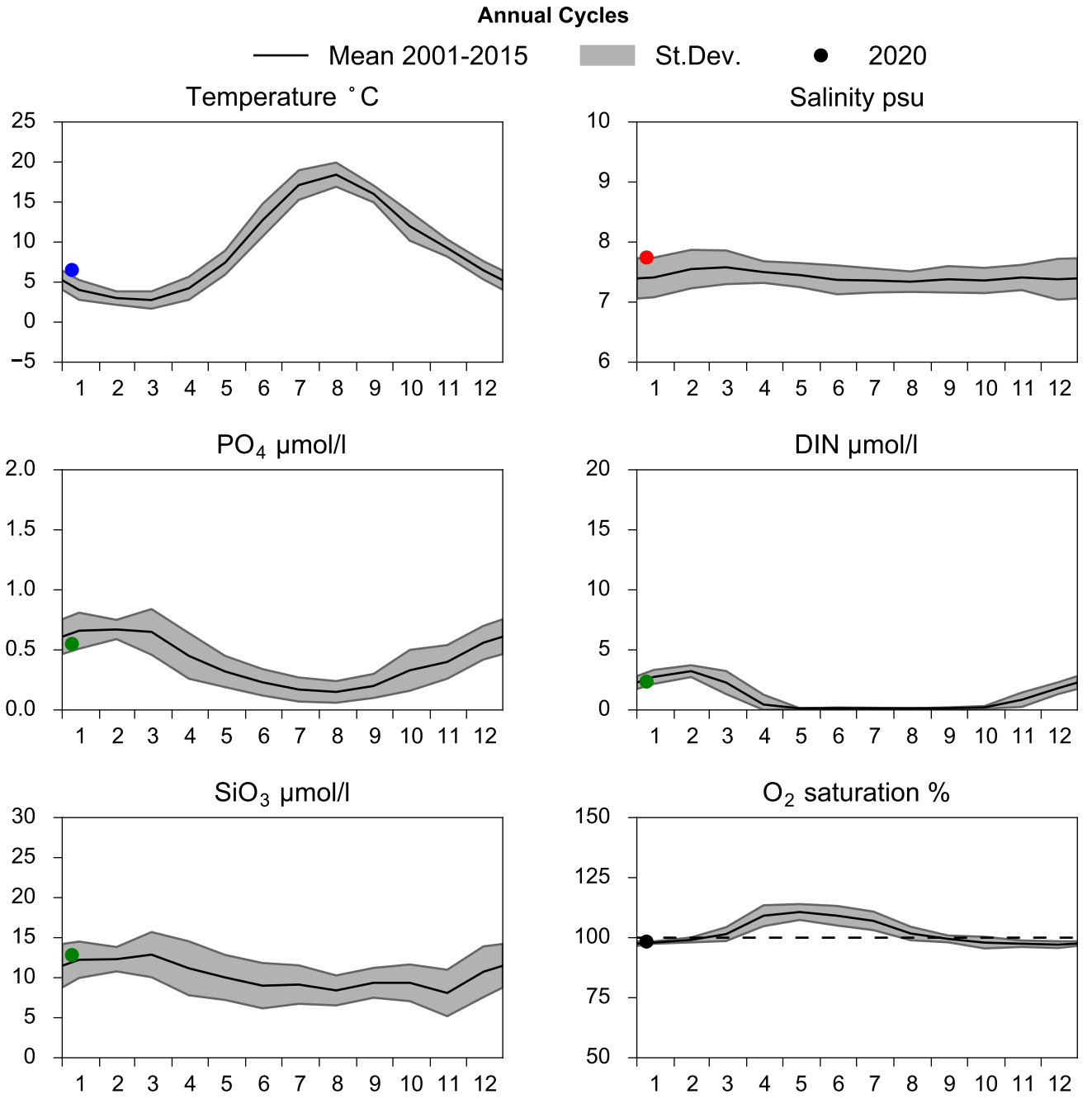




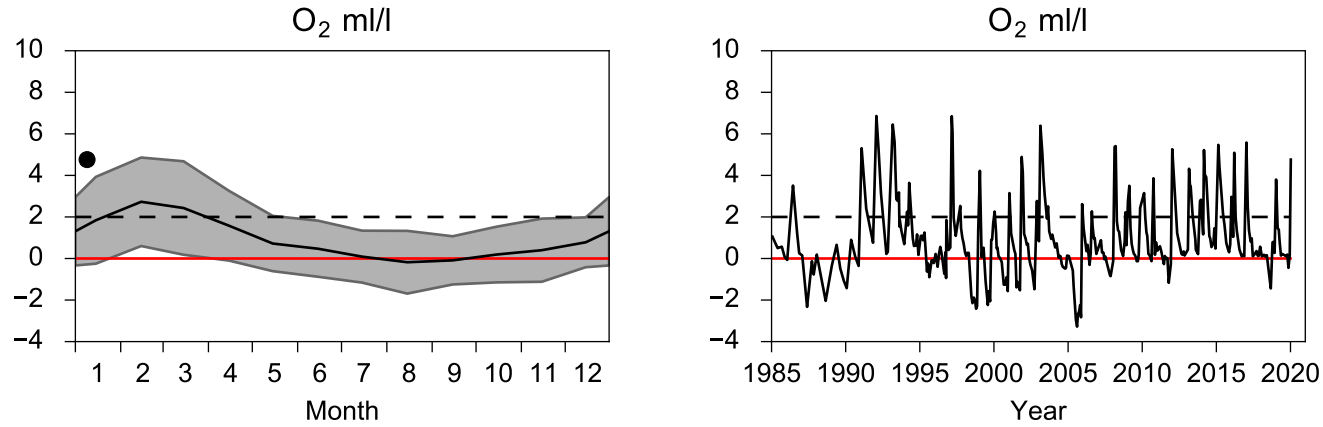
Vertical profiles BY2 ARKONA
January



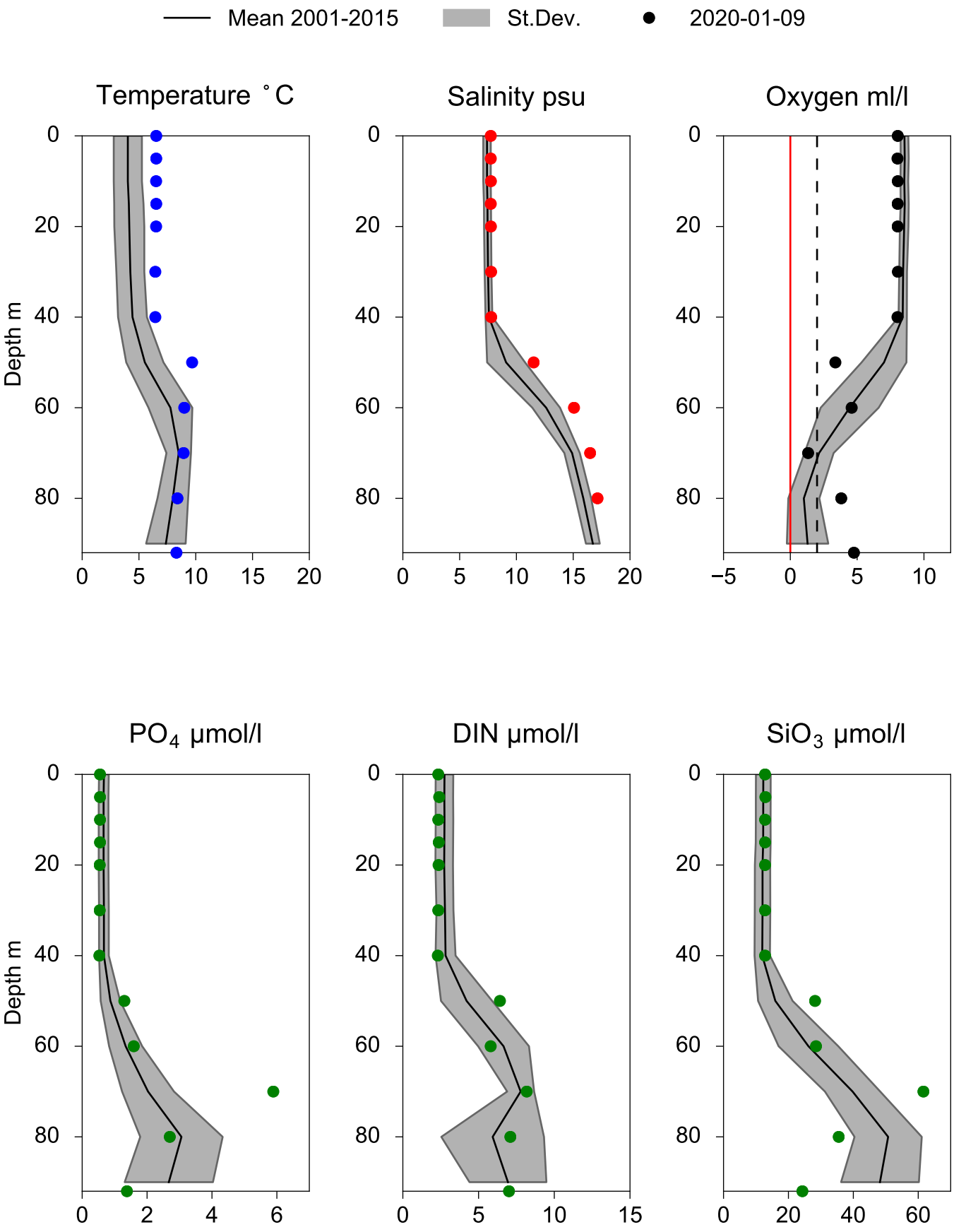
STATION BY4 CHRISTIANSÖ SURFACE WATER (0-10 m)



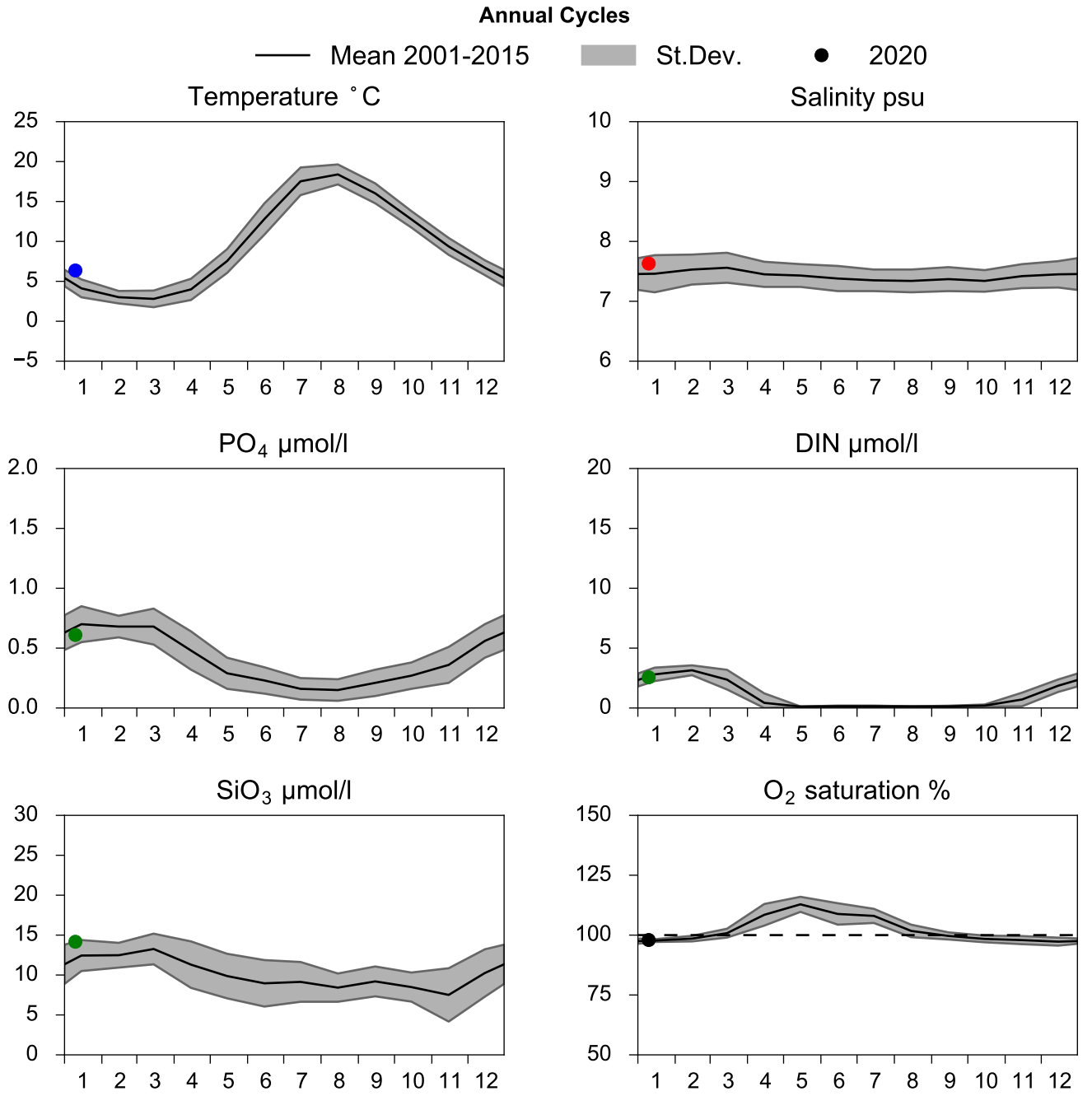
OXYGEN IN BOTTOM WATER (depth >= 80 m)



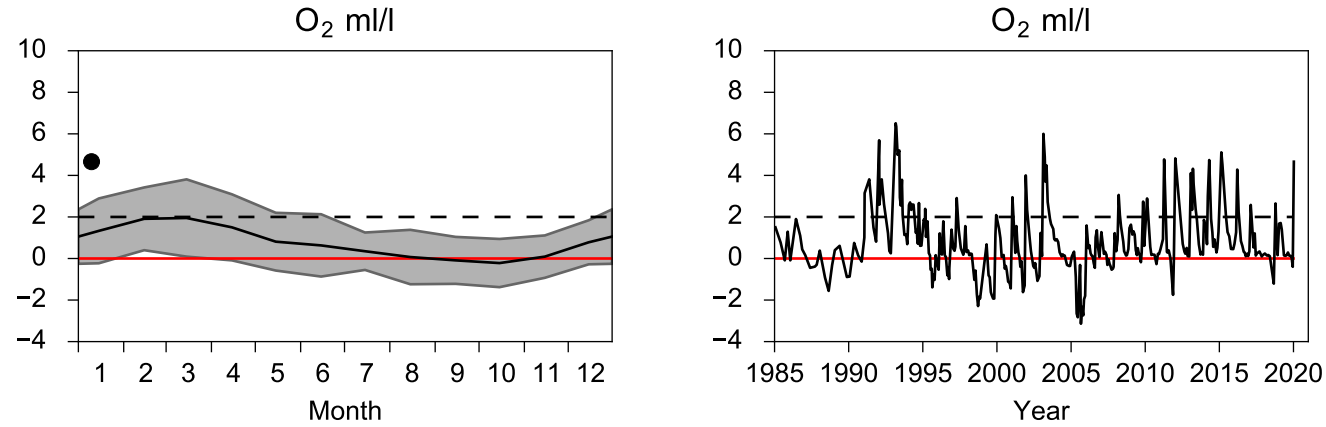
Vertical profiles BY4 CHRISTIANSÖ
January



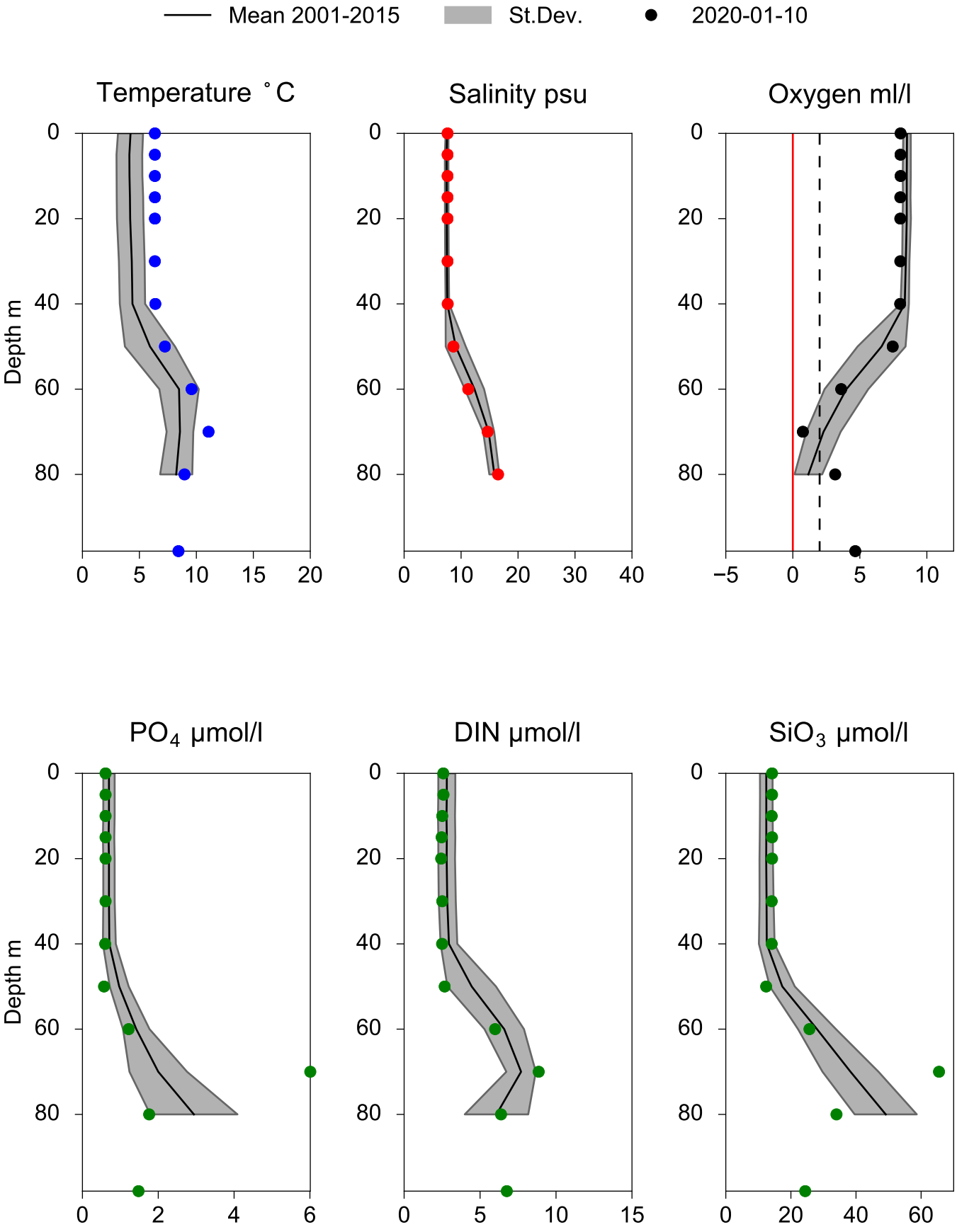
STATION BY5 BORNHOLMSDJ SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 80 m)



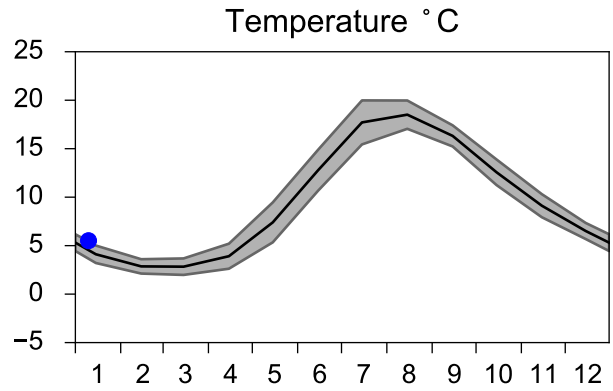
Vertical profiles BY5 BORNHOLMSDJ
January

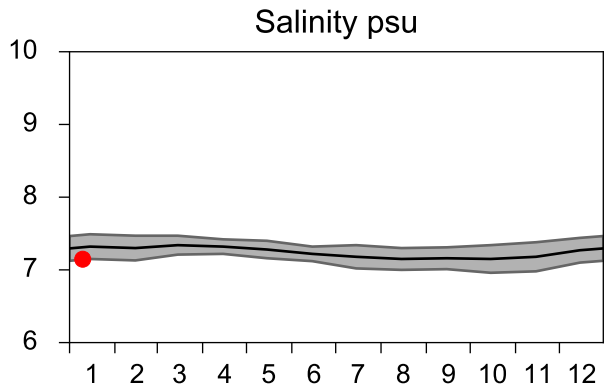


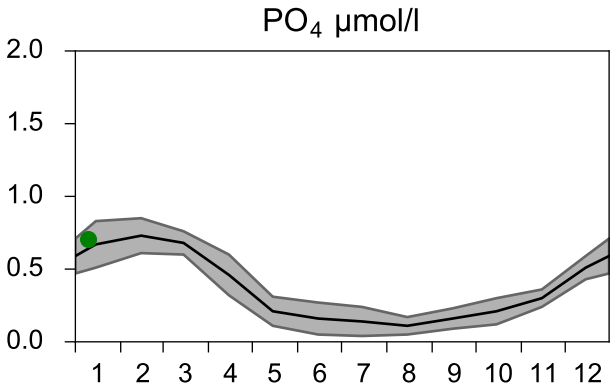
STATION BCS III-10 SURFACE WATER (0-10 m)

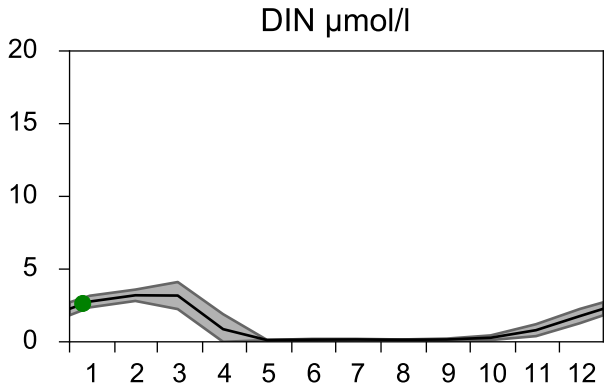
Annual Cycles

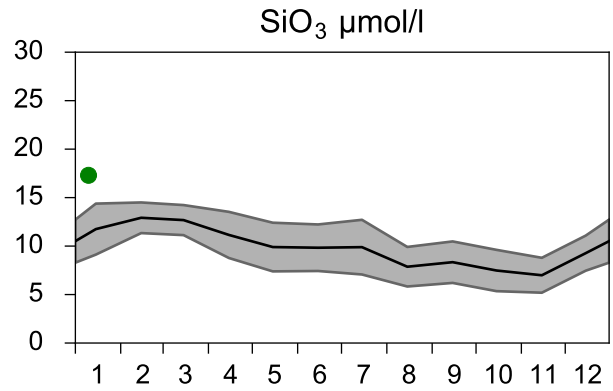
Mean 2001-2015 St.Dev. 2020

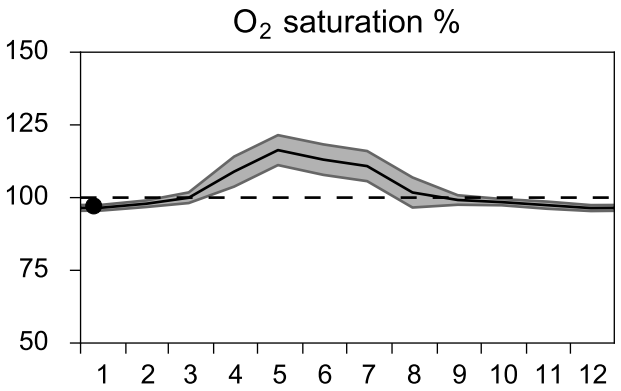




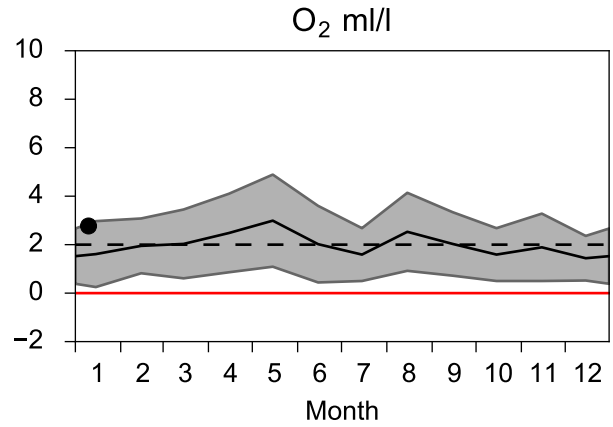


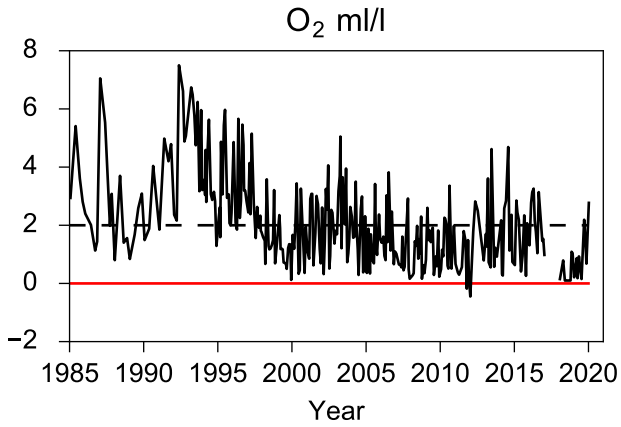




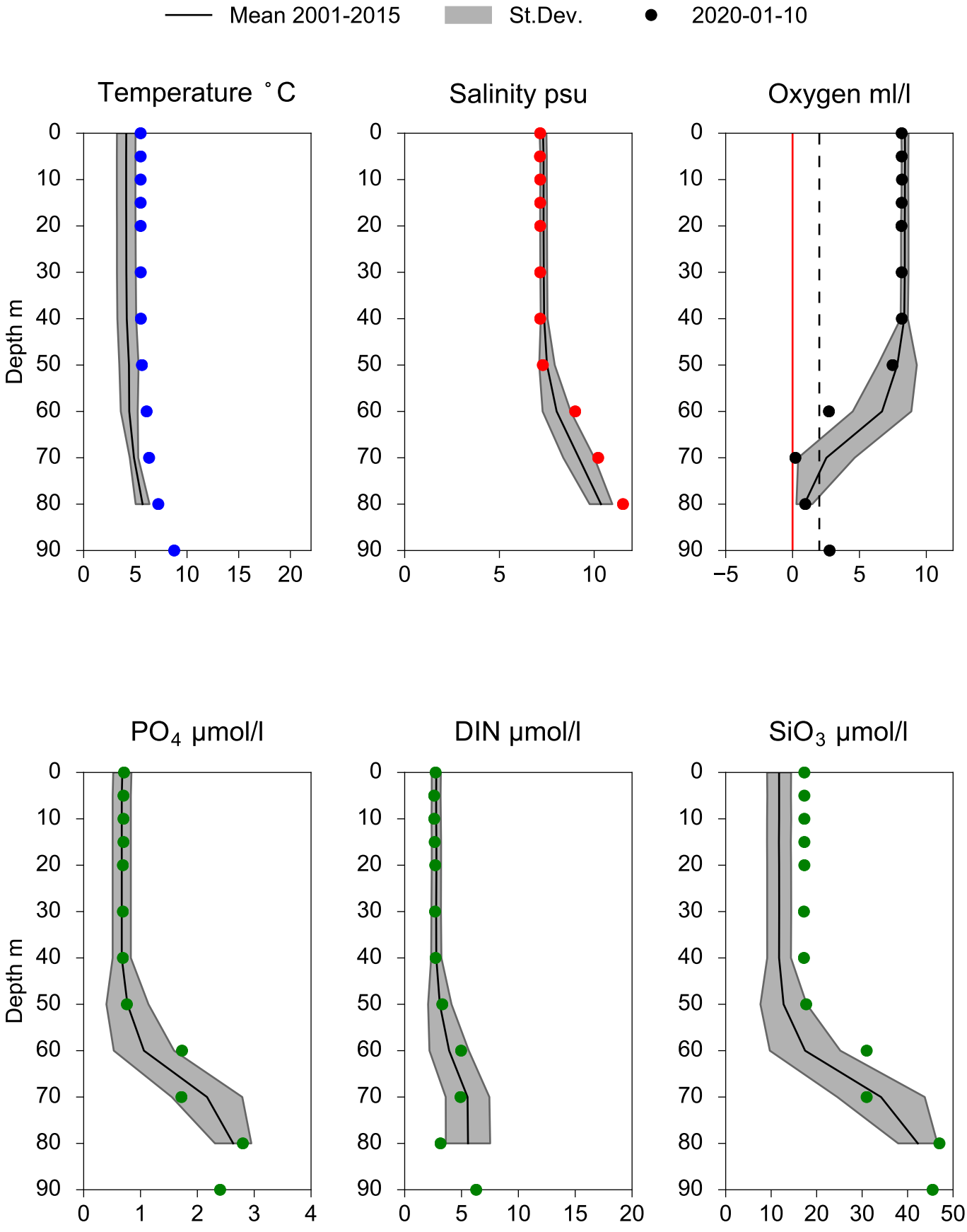


OXYGEN IN BOTTOM WATER (depth >= 80 m)

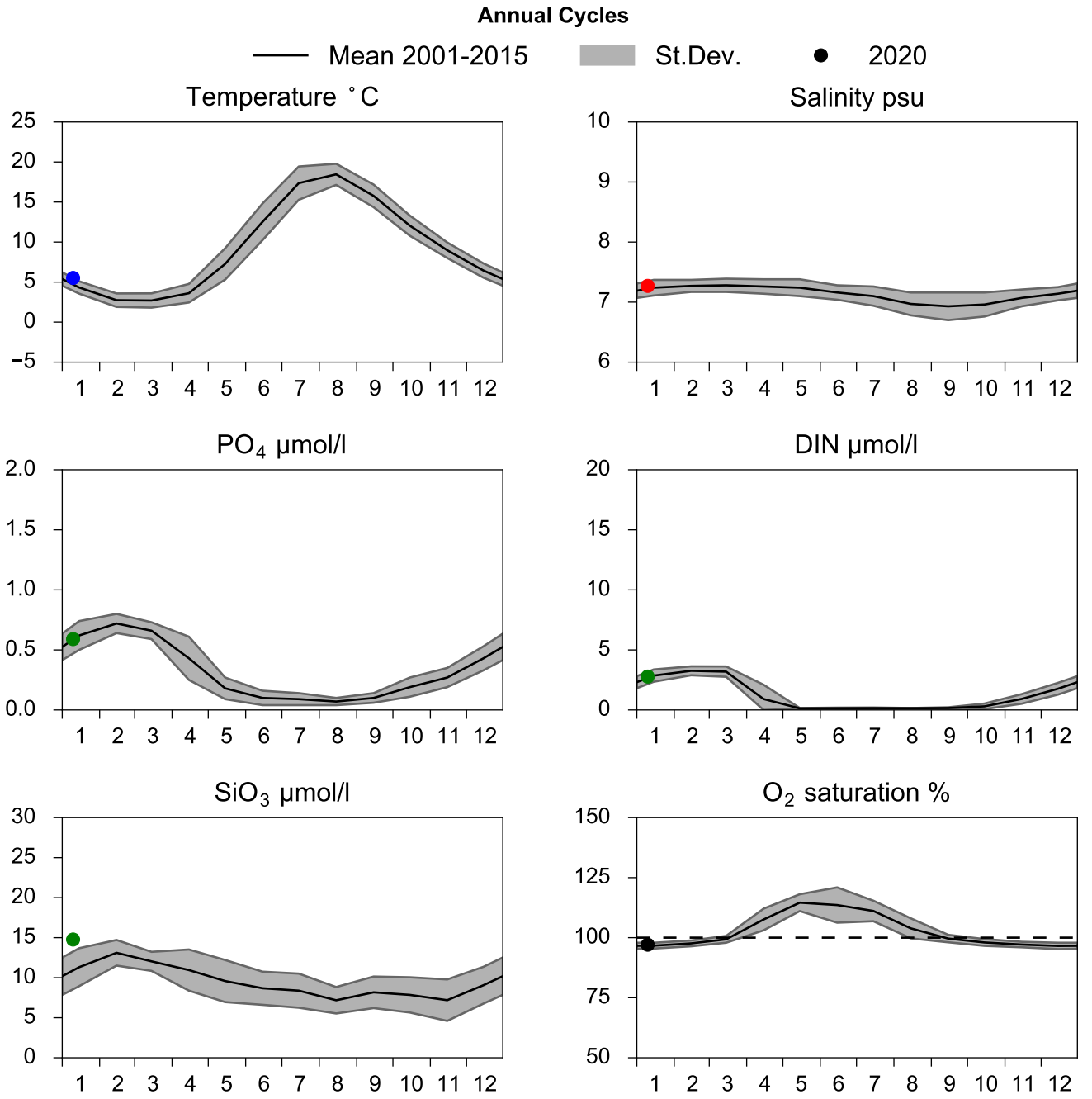




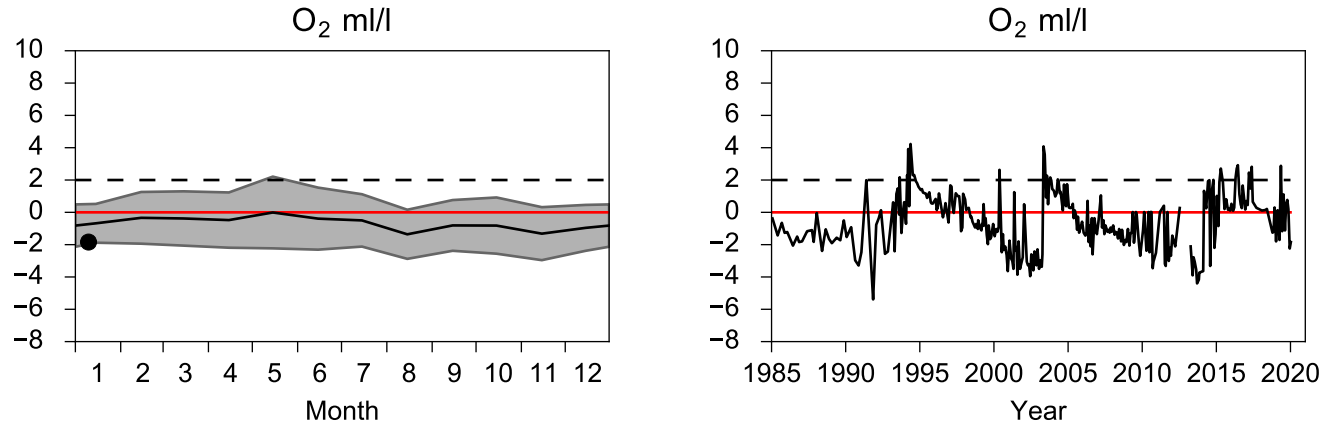
Vertical profiles BCS III-10
January



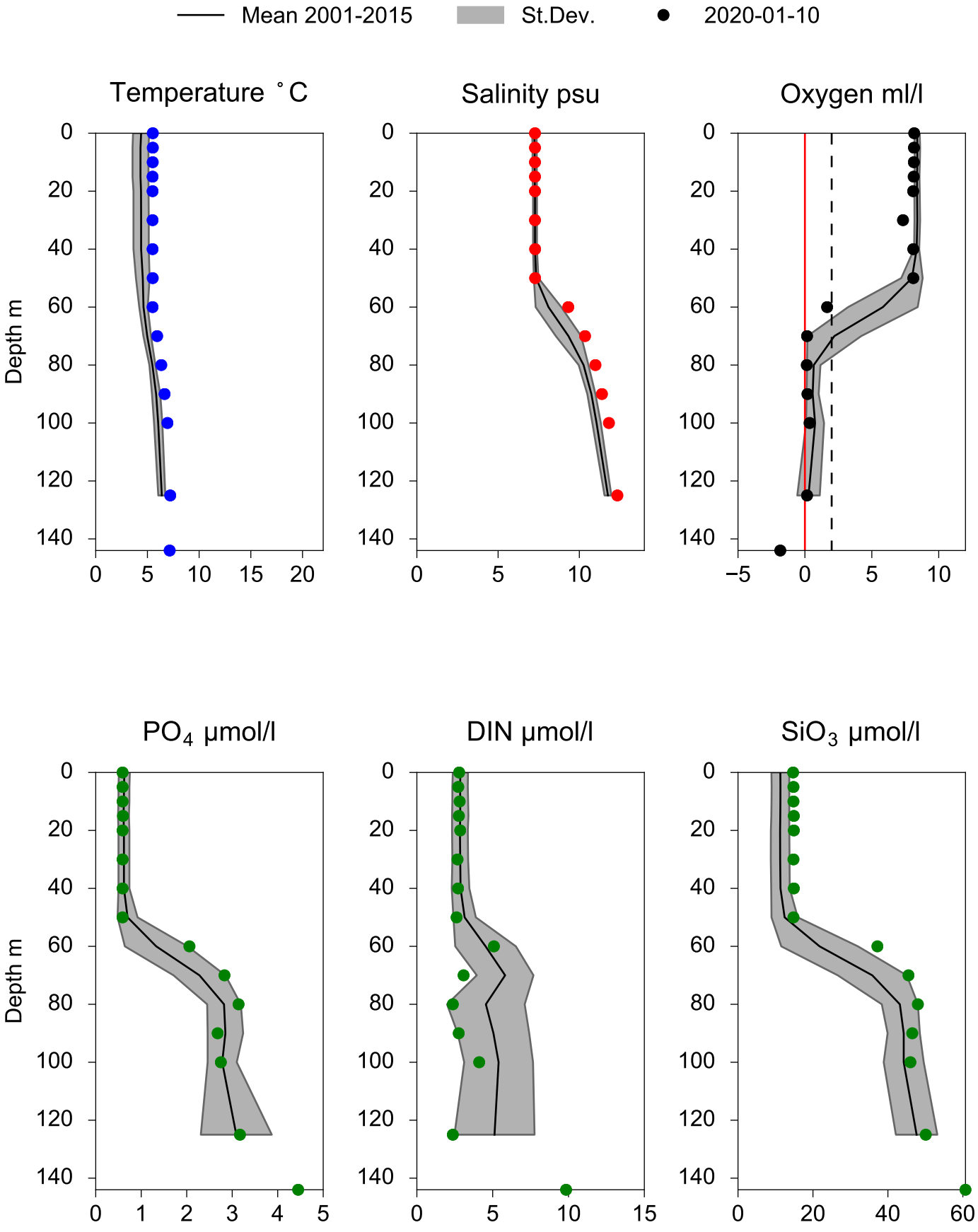
STATION BY10 SURFACE WATER (0-10 m)



OXYGEN IN BOTTOM WATER (depth >= 125 m)



Vertical profiles BY10
January

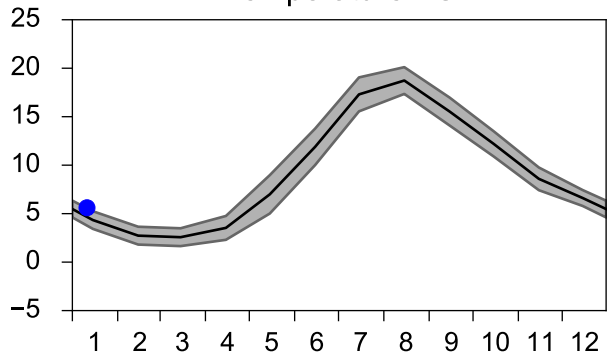


STATION BY15 GOTLANDSDJ SURFACE WATER (0-10 m)

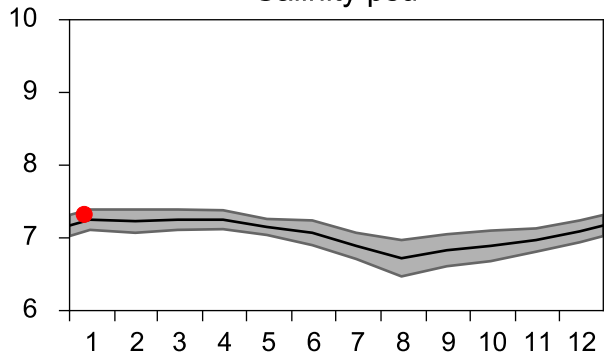
Annual Cycles

Mean 2001-2015 St.Dev. 2020

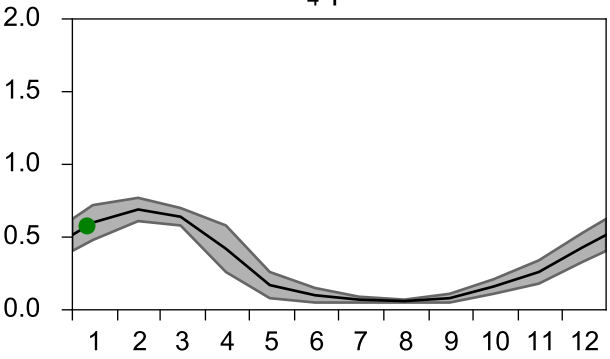
Temperature ˚C



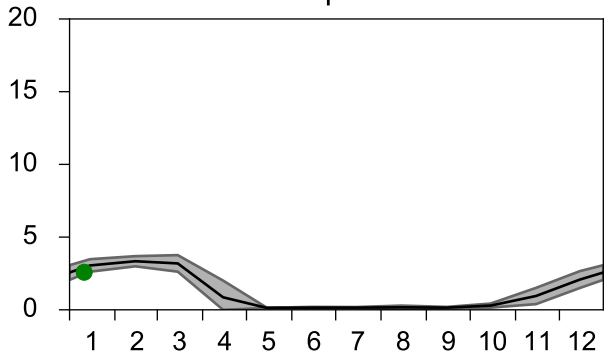
Salinity psu



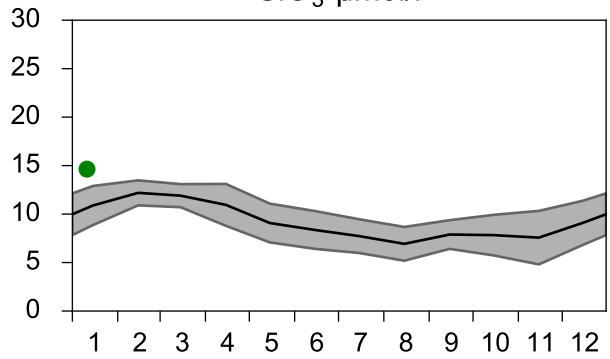
PO_4 µmol/l



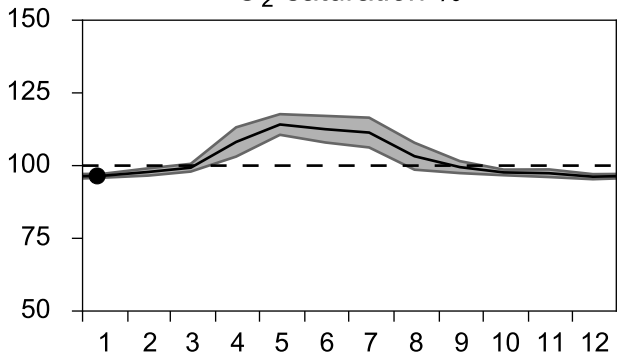
DIN µmol/l



SiO_3 µmol/l

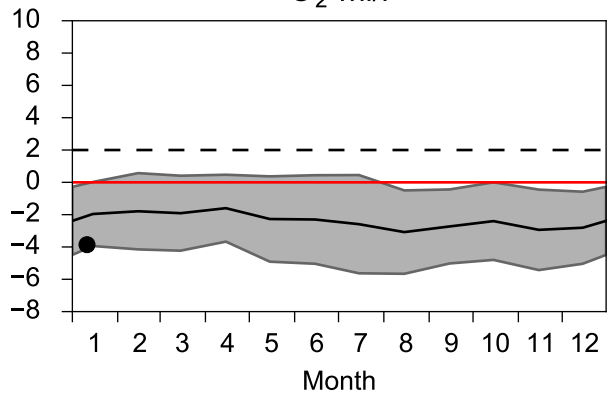


O_2 saturation %

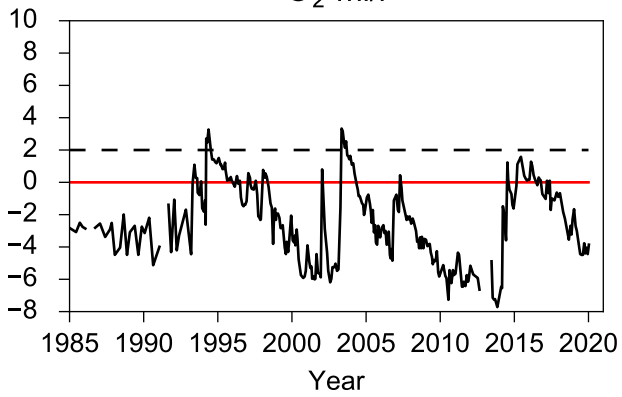


OXYGEN IN BOTTOM WATER (depth >= 225 m)

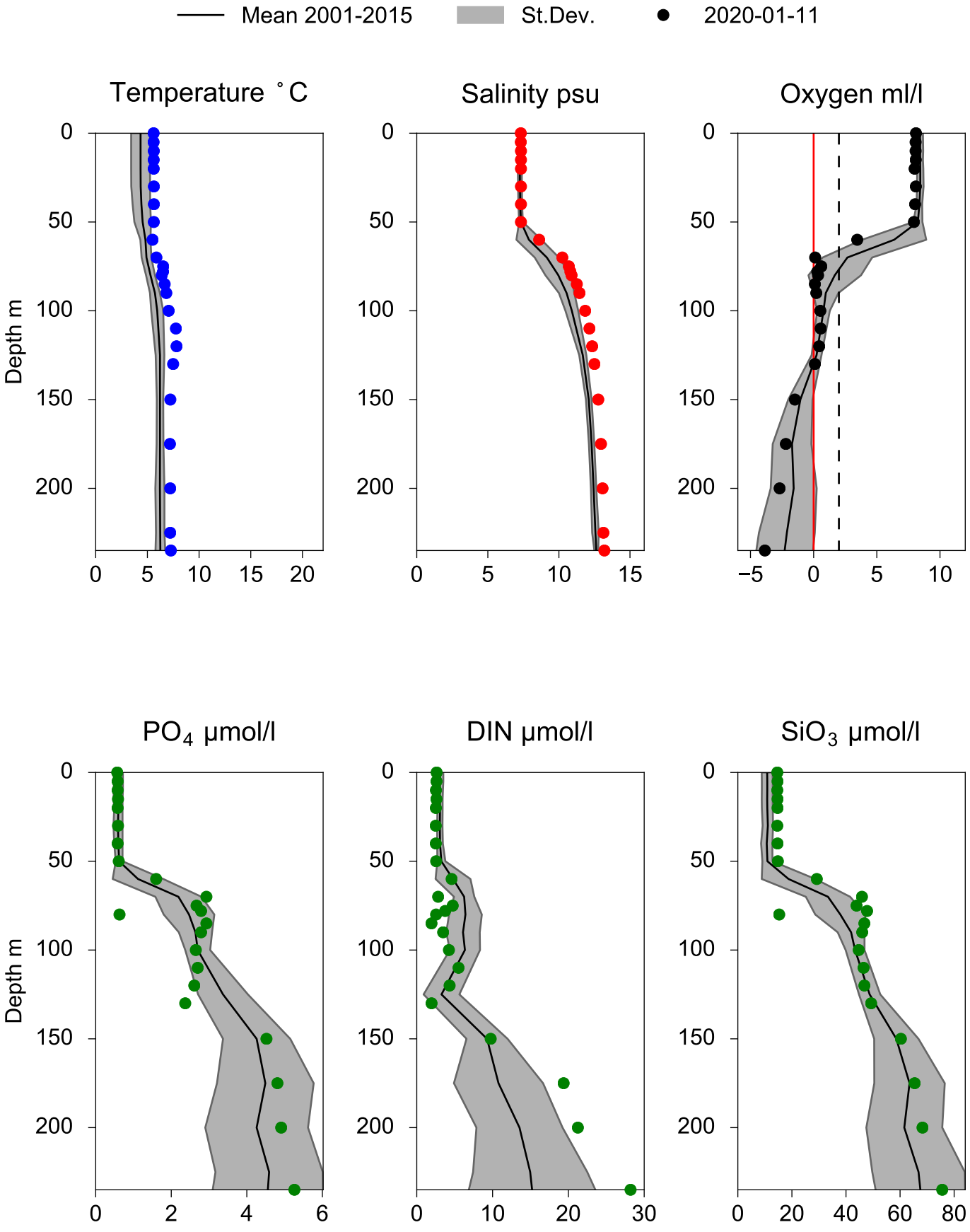
O_2 ml/l



O_2 ml/l



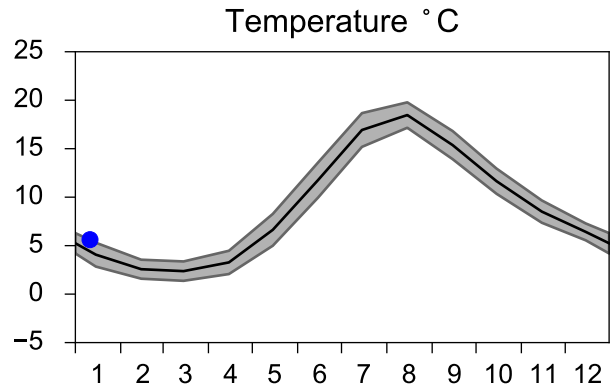
Vertical profiles BY15 GOTLANDSDJ
January

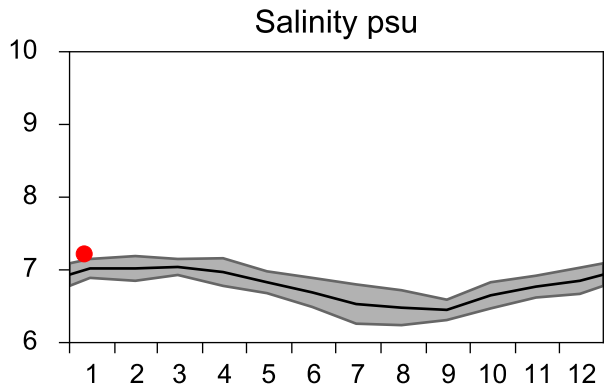


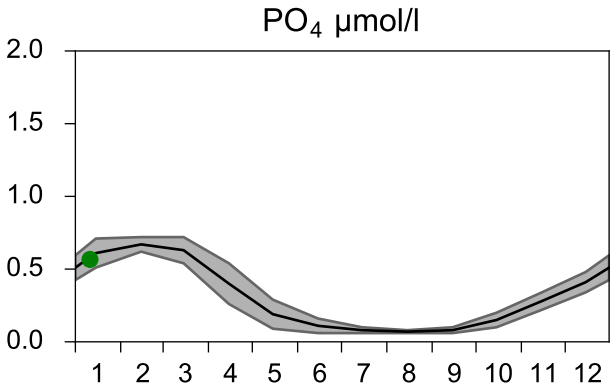
STATION BY20 FÅRÖDJ SURFACE WATER (0-10 m)

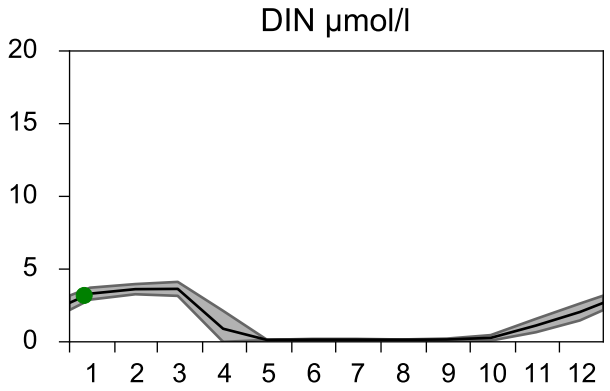
Annual Cycles

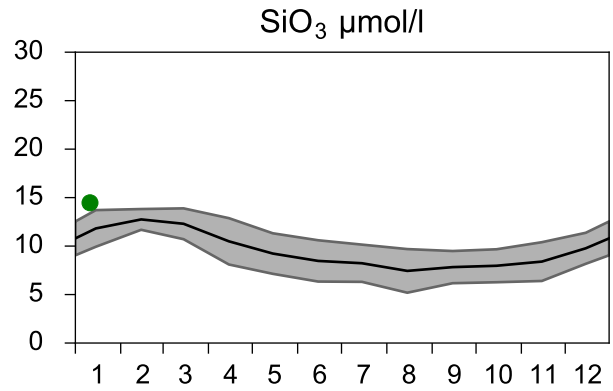
Mean 2001-2015 St.Dev. 2020

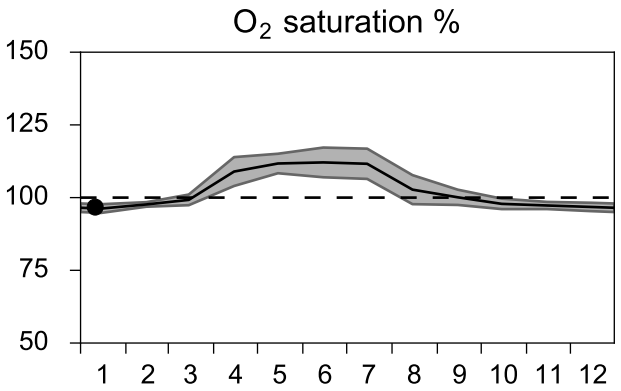




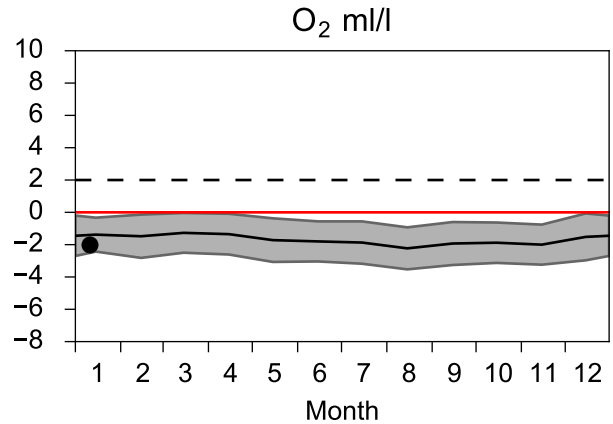


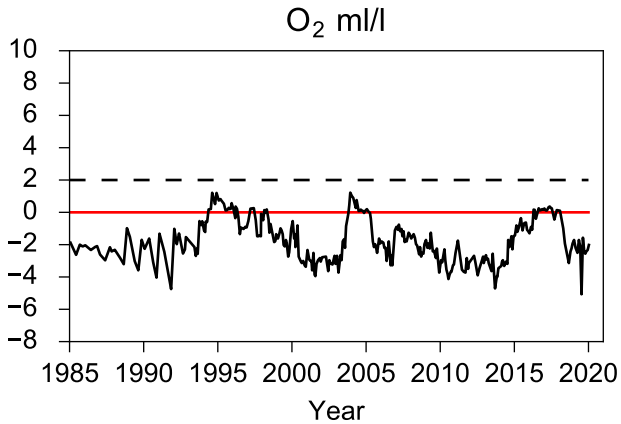




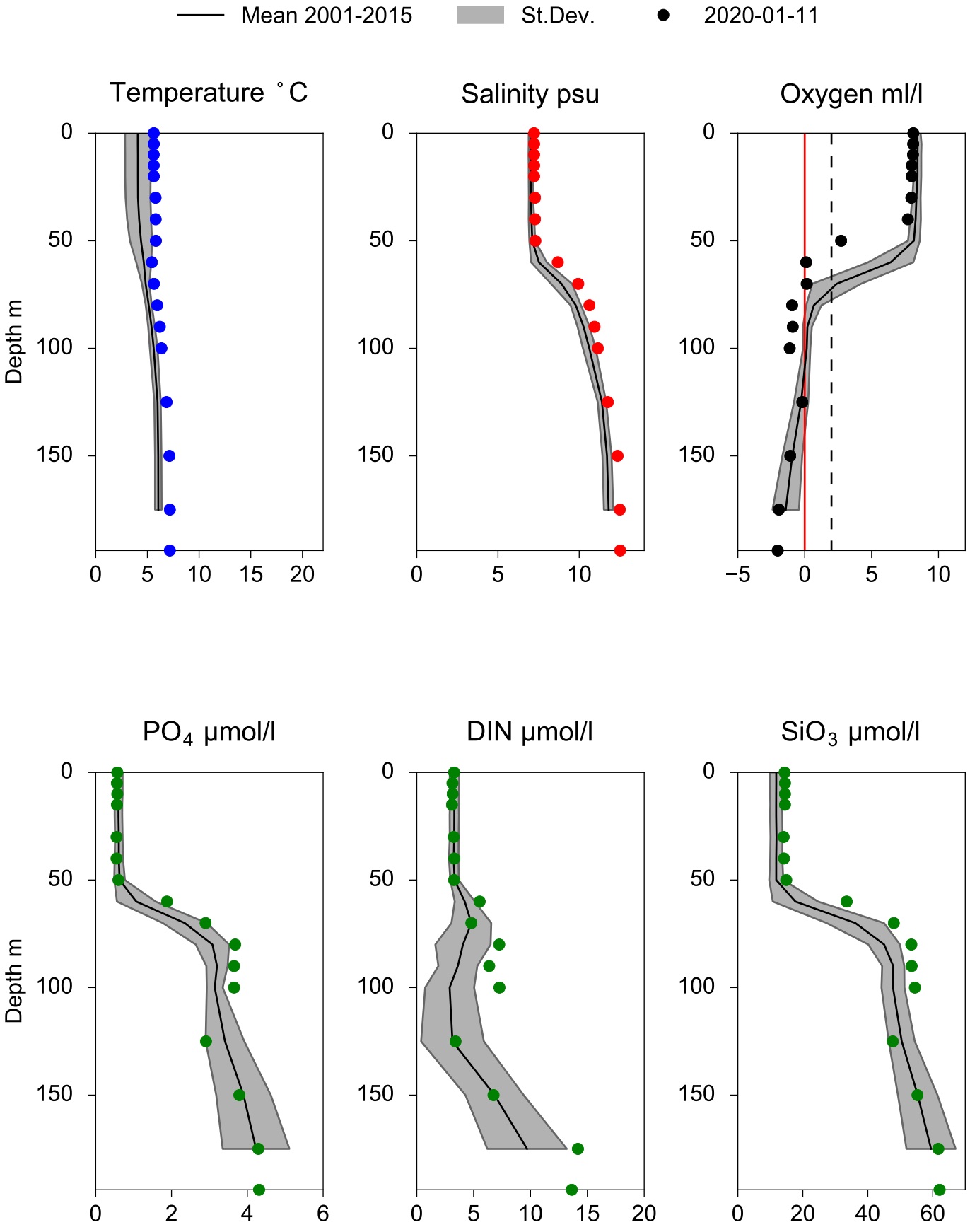


OXYGEN IN BOTTOM WATER (depth >= 175 m)





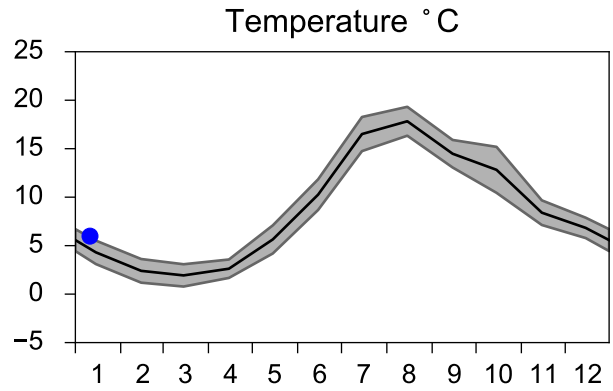
Vertical profiles BY20 FÅRÖDJ
January

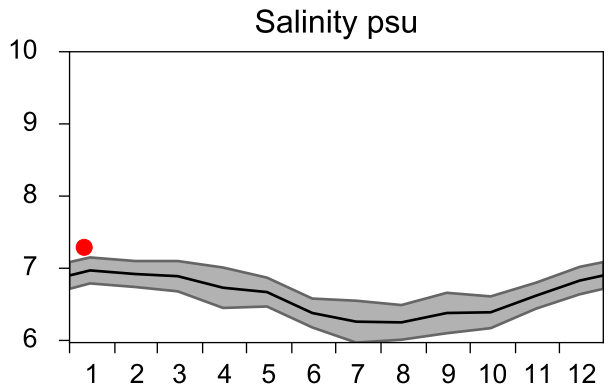


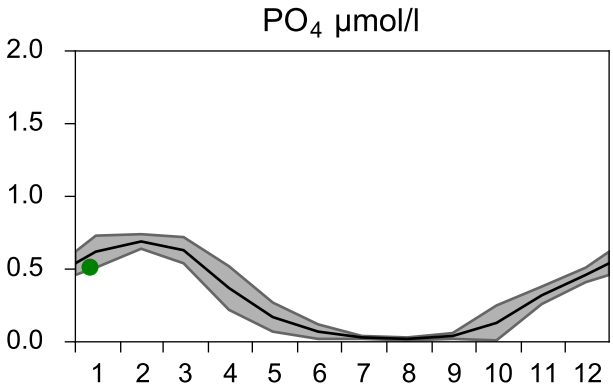
STATION BY29 / LL19 SURFACE WATER (0-10 m)

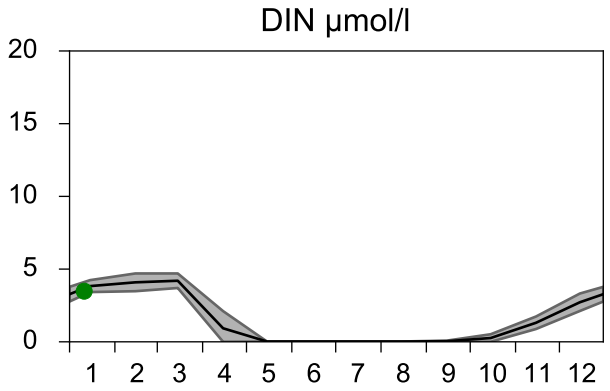
Annual Cycles

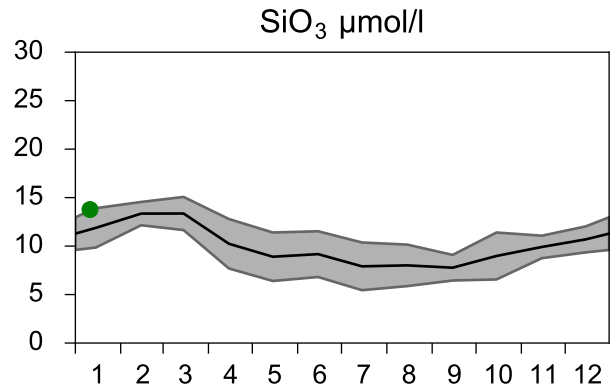
Mean 2001-2015 St.Dev. 2020

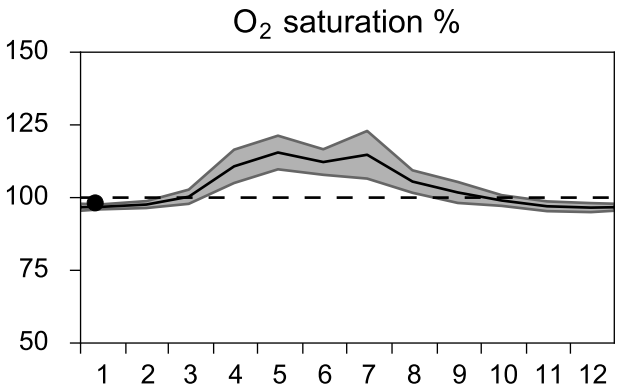




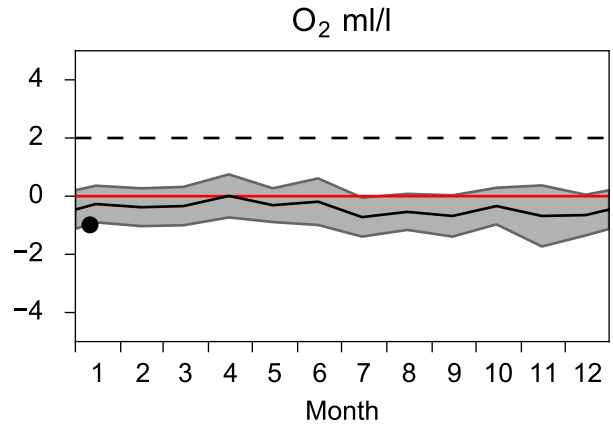


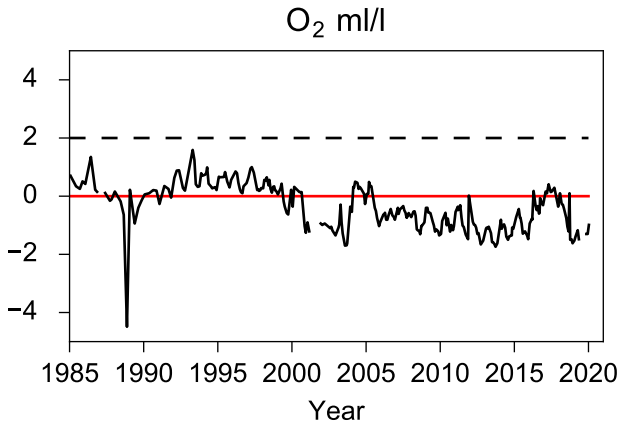






OXYGEN IN BOTTOM WATER (depth >= 150 m)





Vertical profiles BY29 / LL19
January