

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



Photo: Ola Kalén, SMHI

Survey period: 2023-05-08 - 2023-05-14

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)
Stockholm University (SU)

Summary

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

The expedition was a collaboration with Stockholm University, and in addition to SMHI's regular sampling, bottom sediment grabs were made at several positions distributed in four major areas, see the route map.

Concentration of nutrients in the form of dissolved inorganic phosphorus (phosphate) and dissolved inorganic nitrogen in the surface water were, with few exceptions, normal in visited sea areas. For silicon in the form of silicate, levels in the Baltic Proper were normal, while in the Skagerrak, the Kattegat and the Sound levels were above or slightly above normal. In the deep water, it is mainly the deeper stations in the Baltic Proper, for example BY15 and BY32, that have very high levels of nutrients in the form of dissolved inorganic nitrogen and silicate.

The oxygen situation in the Skagerrak, the Kattegat and the Sound, as well as the Arkona Basin, was good. In the other basins in the Baltic Proper, acute oxygen deficiency (<2 ml/l) was measured at a depth of 70 meters. At BY32 in the Western Gotland Basin, hydrogen sulfide was found at a depth of 70 meters, and in the Eastern Gotland Basin, hydrogen sulfide was present at a depth of 90 meters. At several stations, levels of hydrogen sulfide were above normal.

SMHI's next cruise with R/V Svea is planned for 13th to 19th of June, starting in Stockholm and ending in Lysekil.

Results

The cruise was carried out on board R/V Svea and started in Lysekil the 8th of May and ended in Kalmar the 14th of May.

The expedition started with weak winds, but in the Kattegat and the Arkona Basin there was a fresh breeze. The wind direction was predominantly southeast. The air temperature stayed between 9–13 °C.

Four scientists and two students from Stockholm University (SU) did sediment grabs and sampled water at several stations located in four larger areas. This was part of their regular monitoring of benthic fauna. In previous years SU has had its own expedition, but this year we were able to carry out a joint expedition. During the expedition, intercalibration of hydrogen sulfide was made between SU and SMHI at BY15 and BY32.

Svea's instruments for continuous measurements of surface water and current, Ferrybox and ADCP (Acoustic Doppler Current Profiler) were in operation throughout the expedition. Due to a previous incident of the MVP (Moving Vessel Profiler), no measurement with it could be carried out during the expedition.

During the expedition, the wire to the small winch broke. This happened at BY15 during ongoing sampling of zooplankton. The equipment was lost and sampling of zooplankton at BY15 and BY39 was cancelled.

Extra phytoplankton from the surface water was sampled at the stations Släggö, Å17 and Anholt E for Uppsala University and Stockholm University.

This report is based on data that has 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 centre's webpage, normally within a week after the cruise. Some analyses are done after the expedition and will be published later. Data can be downloaded here: <https://www.smhi.se/en/services/open-data/national-archive-for-oceanographic-data/download-data-1.153150>

The Skagerrak

The temperature in Skagerrak's surface water (0–10 m) had increased by about 3 °C since the previous expedition and now varied between 9–10 °C, which is normal for the season. The salinity in the surface water along the Å-section was 28–29 psu, at P2 further south it was a little lower; around 23 psu. Släggö, which is closer to the coast, also had a salinity of 23 psu. For all stations, these were normal values. The thermocline and halocline coincided and were found between 5–30 meters deep.

Concentrations of nutrients in the surface water in the form of dissolved inorganic nitrogen (DIN) were very low at all stations. Levels of phosphate in the form of dissolved inorganic phosphorus (DIP) were also low, which is normal for the time of year. Concentration of silicate in the surface water was above normal at all stations and varied between 2.0–2.3 $\mu\text{mol/l}$ along the Å-section. At P2 and Släggö, higher concentrations were measured, 3.8 and 4.1 $\mu\text{mol/l}$, respectively. In the deep water, overall normal levels of nutrients were observed, but slightly increased concentration of silicate were found at Å15 and P2.

Chlorophyll fluorescence measurements from the CTD, which is a measure of phytoplankton activity, indicated an activity peak at a depth of 10–20 meters, which was especially clear at both Å17 and Å16, where the highest levels were found. The Secchi depth varied between 6–7 meters.

The oxygen conditions in Skagerrak's bottom water were good, with 5.9–6.2 ml/l at the open sea stations and 5.8 ml/l at Släggö. These were normal concentrations for the season at all stations.

The Kattegat and the Sound

The temperature in the surface water in the Kattegat was normal for the season and slightly below normal in the Sound. The temperature had increased by roughly 2 °C since last expedition and was now around 9 °C in the Kattegat, slightly lower in the Sound. The salinity of the surface water was normal for the season in the Kattegat with 18.1–19.6 psu and below normal in the Sound with 8.9 psu. At all stations there were a distinct halocline and thermocline at a depth of 10–20 metres.

Levels of nutrients in the form of DIN were low in the surface water at all stations, which is normal for the season. The concentration of dissolved inorganic phosphorus was slightly above normal at Fladen, normal at the other stations, it varied between 0.06–0.12 $\mu\text{mol/l}$ in the Kattegat and was 0.24 $\mu\text{mol/l}$ in the Sound. The silicate content was above normal at all stations, with values around 5.5 $\mu\text{mol/l}$ in the Kattegat and 9 $\mu\text{mol/l}$ in the Sound. In the deep water there were generally normal levels of both silicate and dissolved inorganic phosphorus, but in general slightly below normal concentrations of dissolved inorganic nitrogen.

Measurements of chlorophyll fluorescence showed increased activity that coincided with the stratification at all stations. This was very distinct at Fladen and Anholt E. The Secchi depth was between 6–9 metres.

The oxygen situation in the bottom water of the Kattegat and the Sound was good, with levels between 5.5–6.3 ml/l.

The Baltic Proper

The temperature in the surface water was normal for the season at all stations visited and it varied generally between 6–8 °C, slightly warmer at BY1 in the western part of the Arkona Basin. Compared to the previous expedition, this was a warming of the surface water of 3–4 °C for most stations. Surface water salinity was slightly above normal at several stations. The salinity varied between 7–8 psu, with the exception of the two northernmost stations where it was slightly lower, and at BY1 where the salinity was slightly higher.

A well-mixed surface layer with a uniform temperature was found at all stations. The surface layer was at most stations 10–20 meters deep, and below temperatures decreased. The more permanent thermocline and halocline was found at a depth of 50–70 meters in the Hanö Bay and the Bornholm Basin. In the Arkona Basin, there was a stratification at about 40 meters deep, which is only 5–6 meters above the bottom. In the deeper basins, the permanent stratification was found at a depth of 60–80 meters. The salinity in deep water were normal, while the temperature was slightly above normal at several stations.

Nutrients in the surface water in the form of DIN were normal at most stations. The concentrations varied between 0.1–0.3 µmol/l, with the highest values measured in the Hanö Bay. For dissolved inorganic phosphorus, the concentrations in the surface water were normal at all stations and varied between 0.15–0.40 µmol/l. For silicate, levels were normal at all stations, and varied from 8.6 to 14.3 µmol/l. In the deep water of the Eastern and Western Gotland Basins, nutrients were in many cases above normal, for example at BY15 where the levels of DIN and DIP were above normal from a depth of 175 meters, and silicate above normal already from a depth of 70 meters. At BY32, levels of silicate and DIN, were above or well above normal in the deep water. In the other basins, more normal levels of nutrients in the deep water.

The oxygen situation in the bottom water of the Baltic Proper was very bad. Good oxygen conditions in the bottom water were found only in the Arkona Basin. In the Hanö Bay, the Bornholm Basin and at BCSIII-10 in the south-eastern Baltic Proper, there was an acute oxygen deficiency (<2 ml/l) from a depth of 70 meters and in the bottom water the oxygen concentrations were only 0.2–0.9 ml/l. For BCSIII-10 this was below normal, but for the Hanö Bay and the Bornholm Basin it was within normal levels. In the Eastern Gotland Basin, acute oxygen deficiency was measured from a depth of 70 meters and completely oxygen-free conditions with hydrogen sulfide was found from a depth of 90 meters. At BY32 in the northern part of the Western Gotland Basin, the oxygen content at a depth of 60 meters was only 2.6 ml/l, and already at 70 meters hydrogen sulfide was measured. For BY38, hydrogen sulfide was measured at a depth of 80 meters. For both basins, the hydrogen sulfide content in the bottom water was higher than normal, which seen in the diagrams for oxygen content in the bottom water where hydrogen sulfide is shown as negative oxygen values.

At the northern stations high levels of chlorophyll fluorescence were measured and at BY32 there was a strong peak at a depth of about 5 meters. The oxygen concentration in the surface water was above 10 ml/l, which indicates high plankton activity. At the stations in the south, there were more uniform levels of chlorophyll fluorescence in the surface water.

The Secchi depth was measured at 3 stations; in the southern basins 6–7 meters and at BY15 in the Easter Gotland Basin 13 meters.

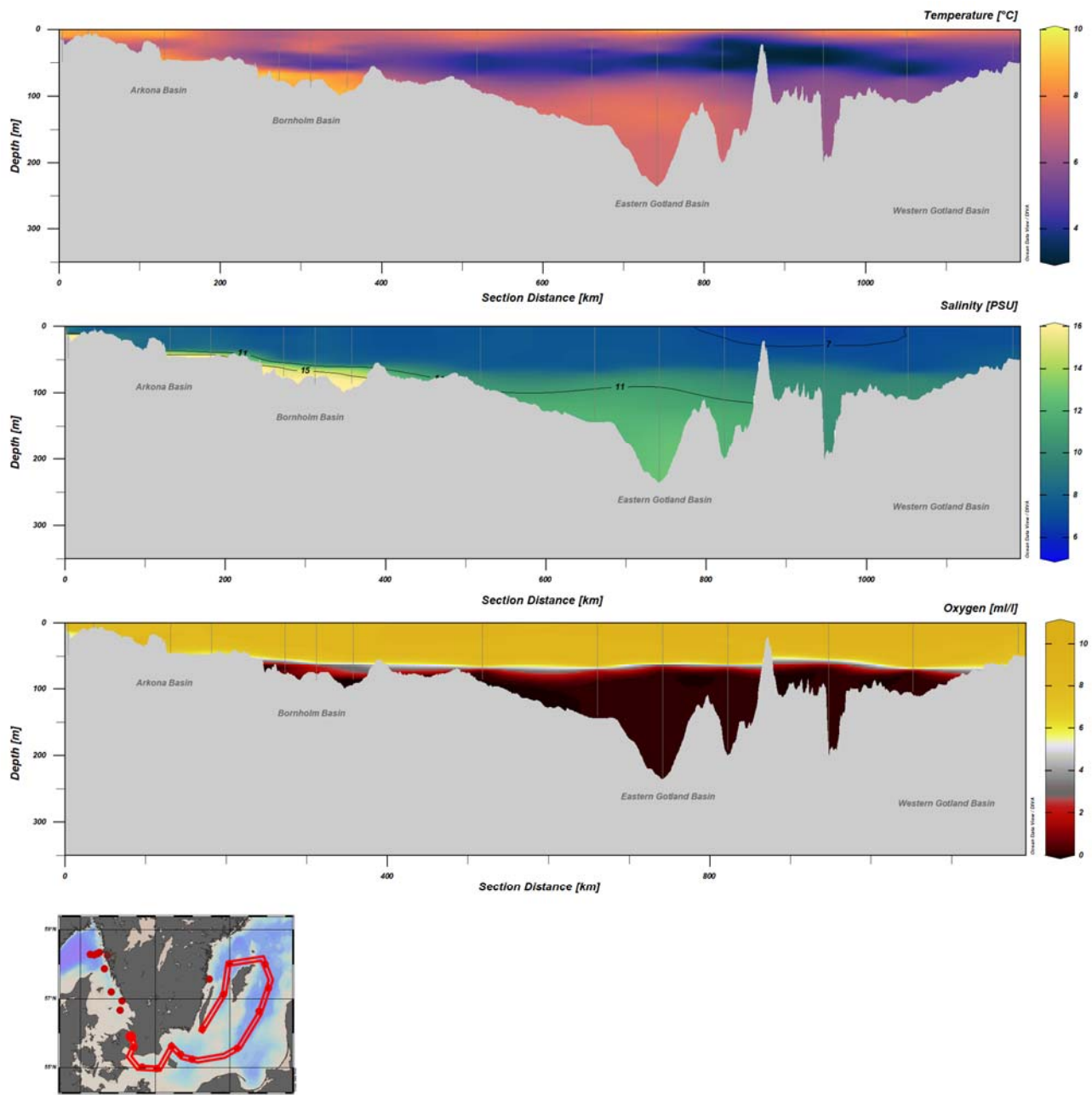


Figure 1. Transect showing CTD measurements of temperature, salinity and dissolved oxygen from the Sound through the Eastern Gotland Basin into the Western Gotland Basin. Figure created in Ocean Data View with DIVA-interpolation.

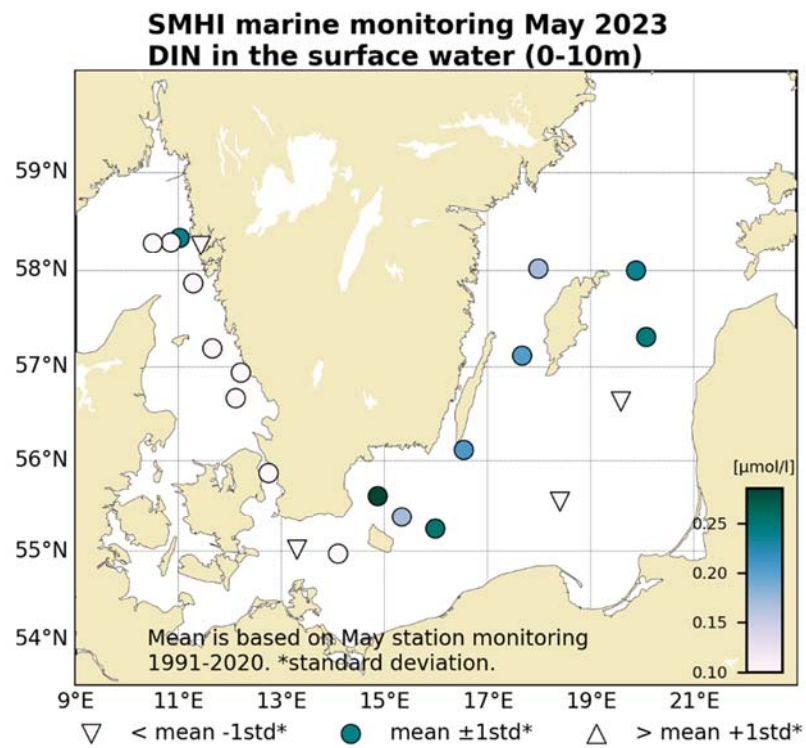


Figure 2. Concentration of dissolved inorganic nitrogen in the surface water (0-10 m).

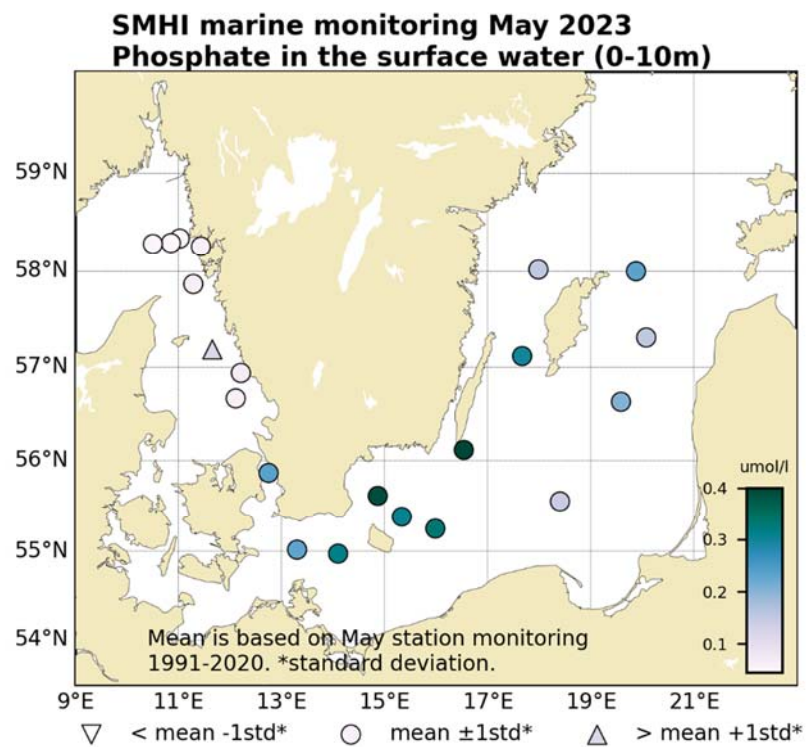


Figure 3. Concentration of phosphate in the surface water (0-10 m).

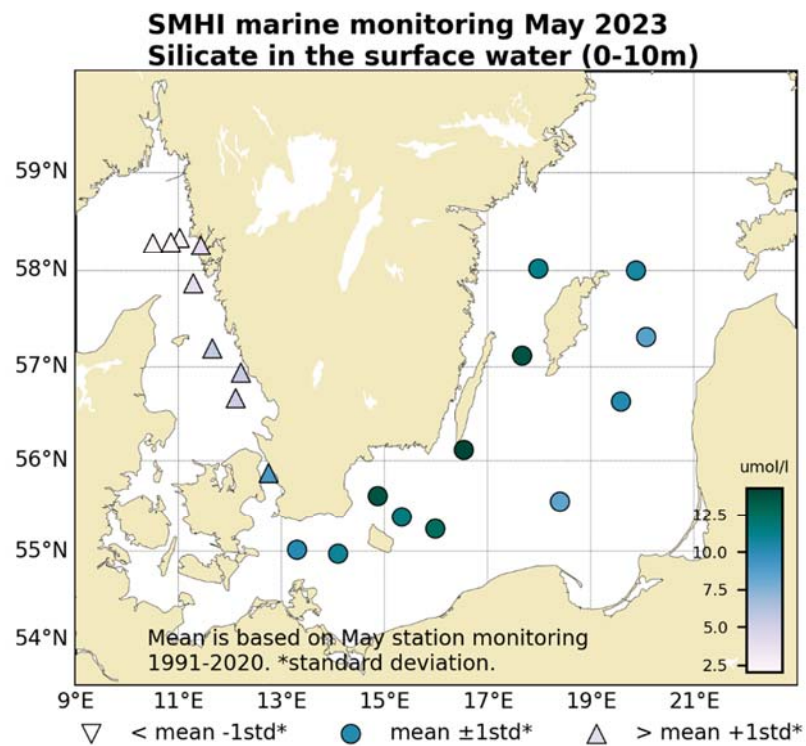


Figure 4. Concentration of silicate in the surface water (0-10m).

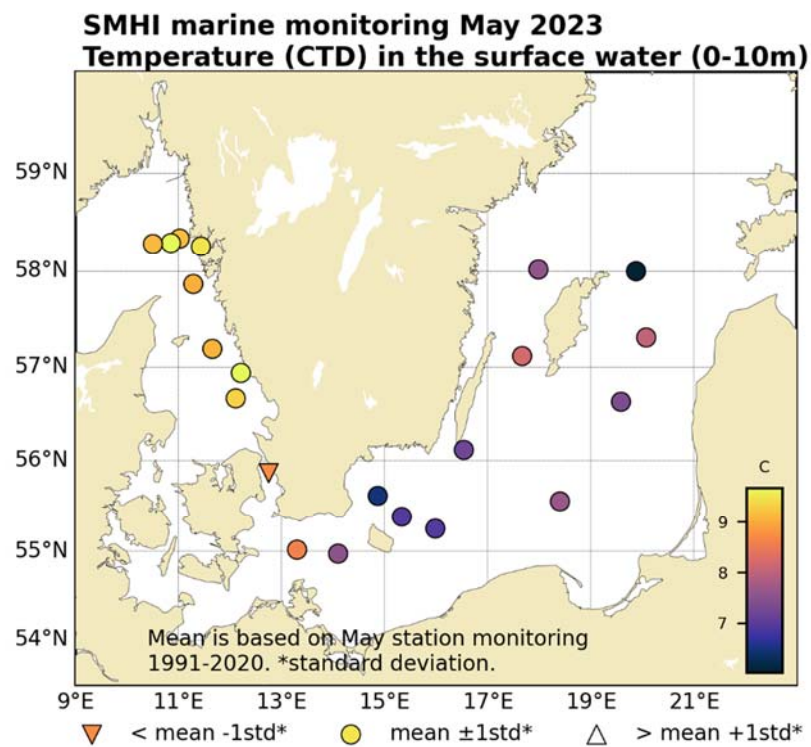


Figure 5. Temperature in the surface water (0-10m).

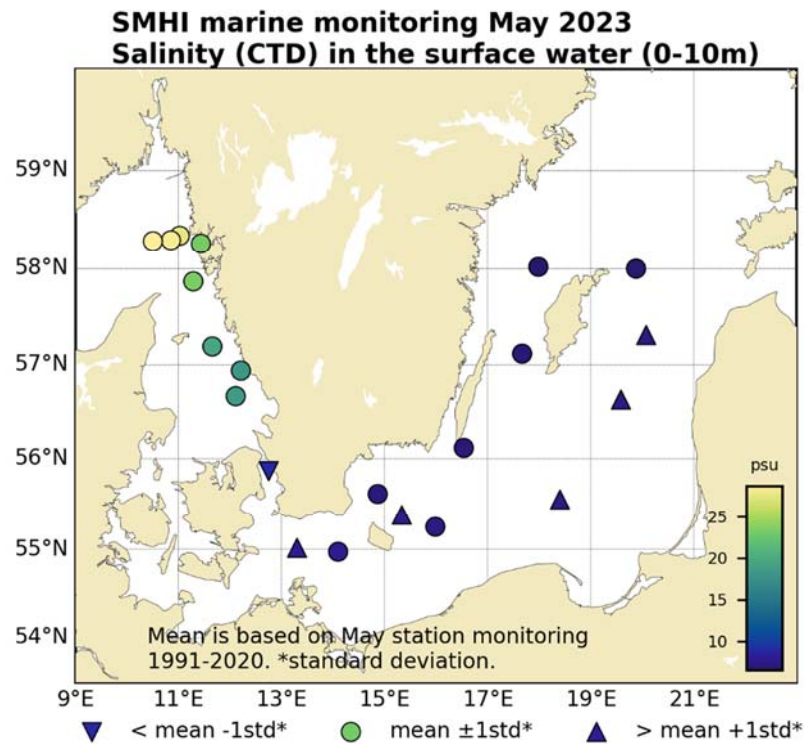


Figure 6. Salinity in the surface water (0-10m).

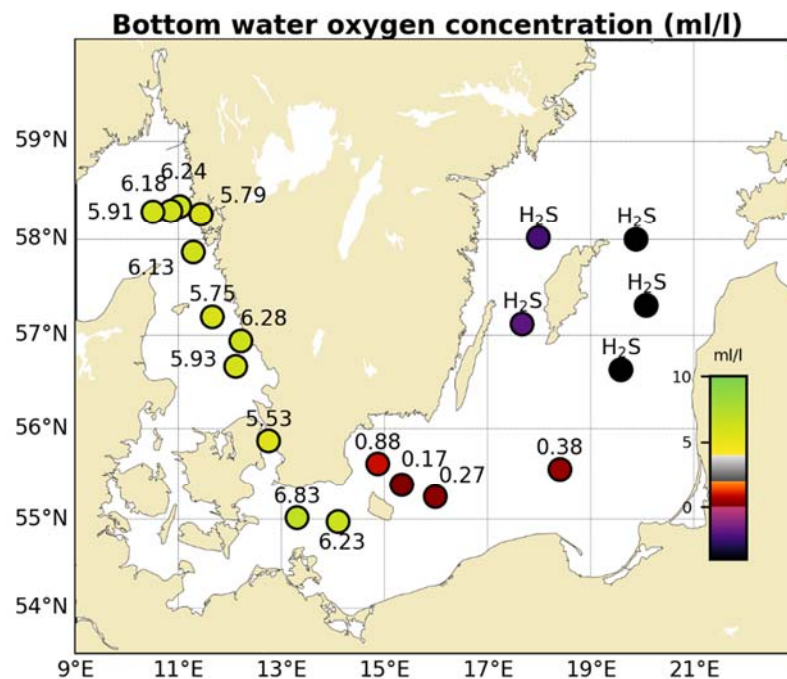


Figure 7. Oxygen concentration in the bottom water, about 1 m above the bottom. Note that the value is not compared to statistics in the same way as Figures 2–6 and therefore only circles are shown in the graph.

PARTICIPANTS

Name	Role	Institute
Johan Kronsell	Chief Scientist, oceanographer	SMHI
Martin Hansson	Oceanographer	SMHI
Sara Johansson	Quality controller, chemist	SMHI
Sari Sipilä	Chemist	SMHI
Anna-Kerstin Thell	Chemist	SMHI
Marika Huldt	Chief Scientist, research engineer	SU
Malin Dahlgren	Research engineer	SU
Jesper Ström	Research engineer	SU
Markus Olsson	Research assistant	SU
Klara Freed	Bachelor's student	SU
Nathalie Lundström	Bachelor's student	SU

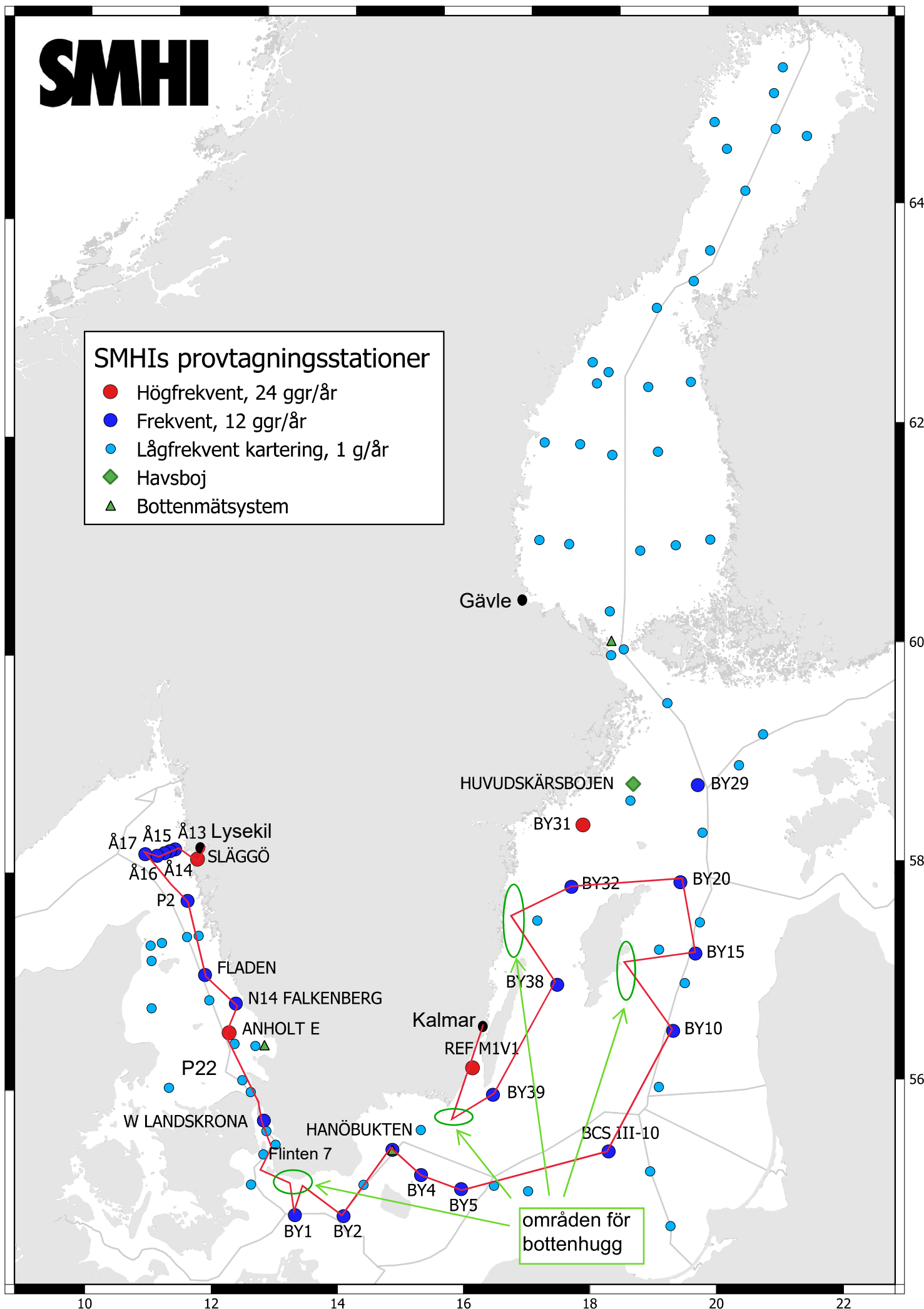
APPENDICES

- Track chart
- Table over stations, sampled parameters and number of sampling depths
- Vertical profiles for regular monitoring stations
- Annual average surface water plots for regular monitoring stations, and oxygen development in the bottom water.



SMHIs provtagningsstationer

- Högfrekvent, 24 ggr/år
- Frekvent, 12 ggr/år
- Lågfrekvent kartering, 1 g/år
- ◆ Havsboj
- ▲ Bottenmätsystem



64

62

60

58

56

10

12

14

16

18

20

22

Date: 2023-06-09
Time: 10:31

Ship: 77SE
Year: 2023

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 vel	Air temp C	Air pres hPa	WCWI elac aoe	CZPP ho hp loy	No No de btl	T T S S P D D H P P N N N A N A S H C C e e a a h o o 2 h t t t t m t l i u o o m m l l x x s o o r r r r o o k o m m m p p t t y y s t i a z n t y 3 u n n - - - - - - - - - - - - - - - - - - - b c b c b c b c s _ _ t t t t t t i v s l d l d l d i a s m i p t
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0443	09	SKEX16	BAS...	Å15	5817.71	01051.21	20230508	1550	134	6	15 7	11.1	1028	2530	x---	12	x x x x - x x - x - x x x x - - x - x -
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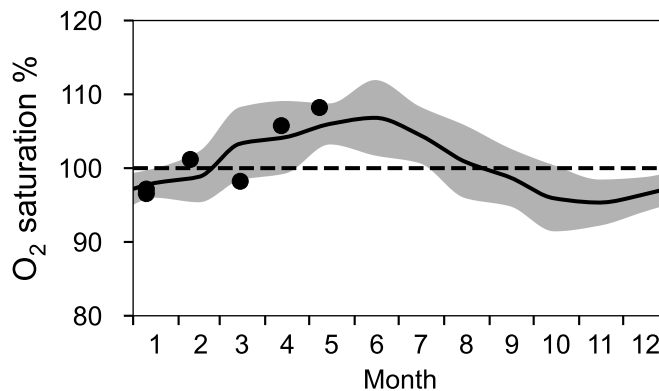
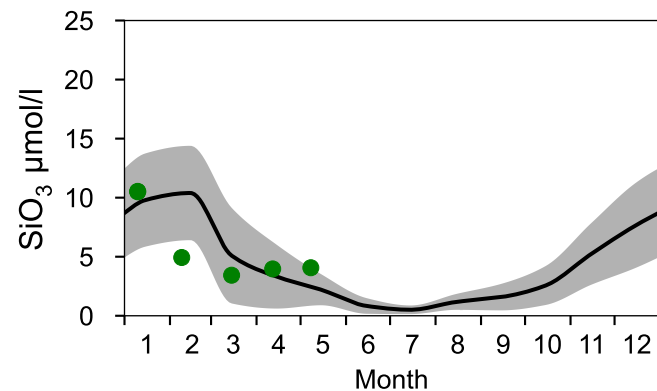
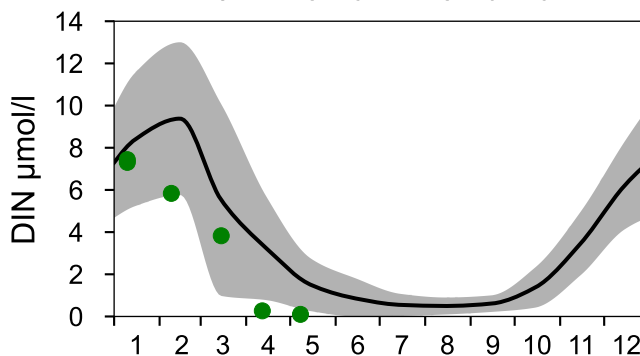
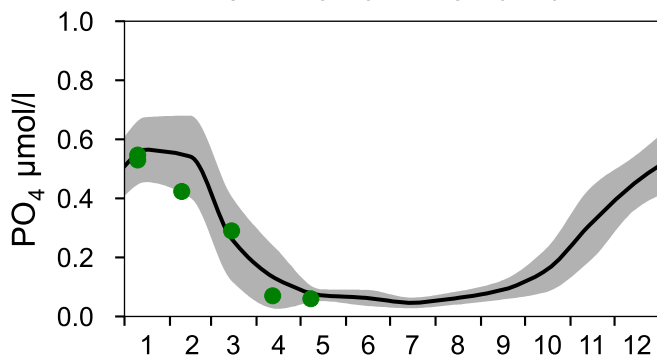
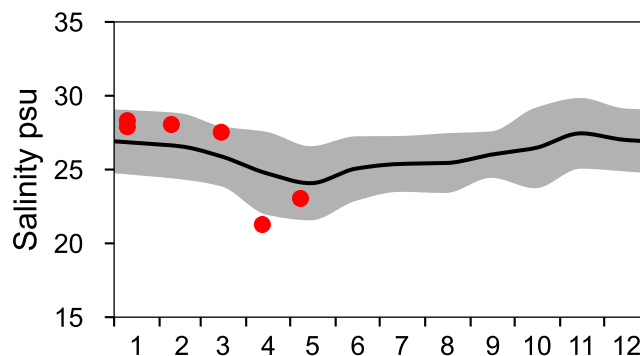
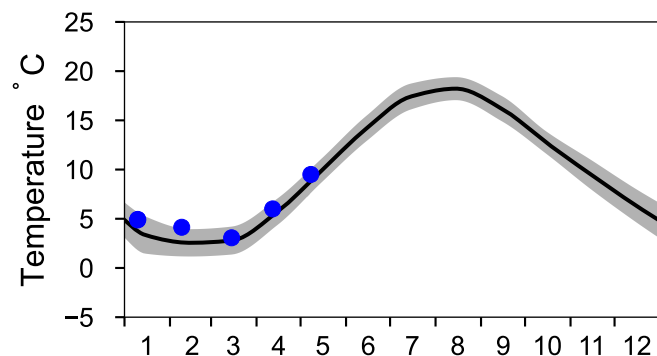
STATION SLÄGGÖ SURFACE WATER (0-10 m)

Annual Cycles

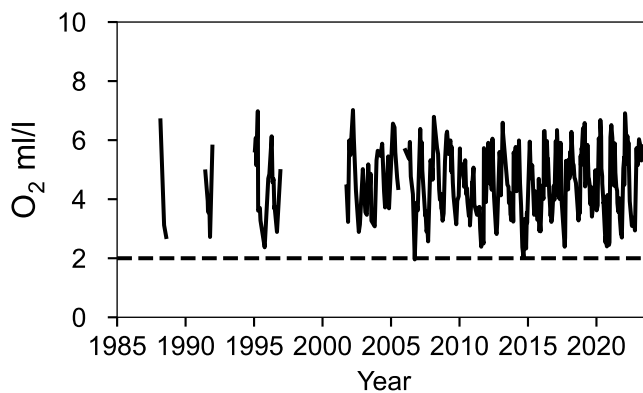
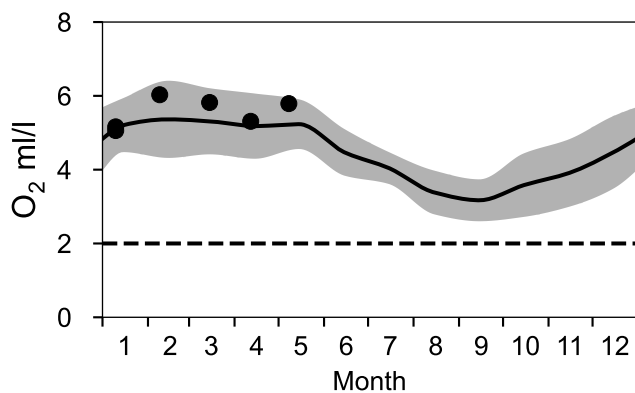
— Mean 1991-2020

■ St.Dev.

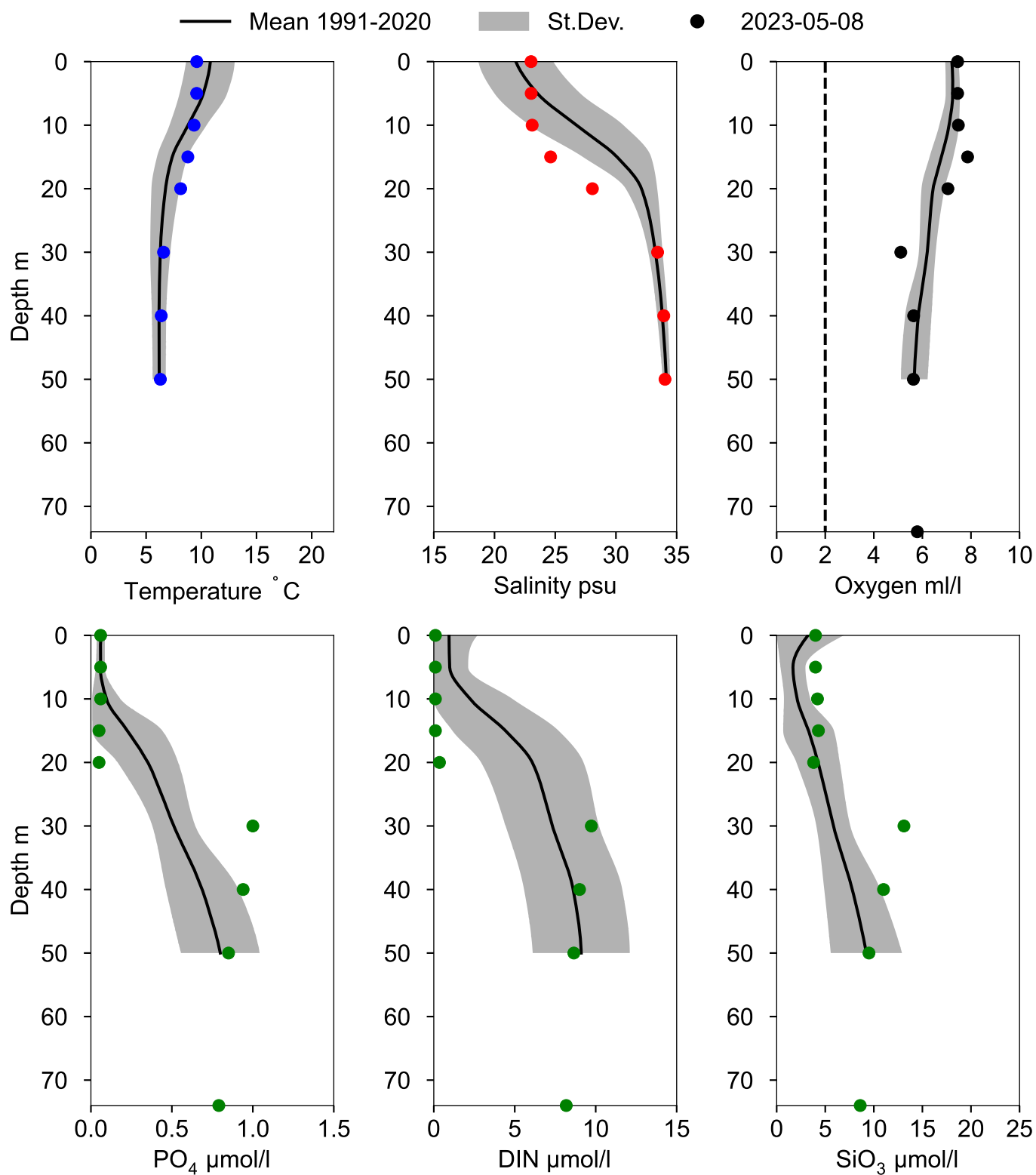
● 2023



OXYGEN IN BOTTOM WATER (depth >= 64 m)



Vertical profiles SLÄGGÖ May



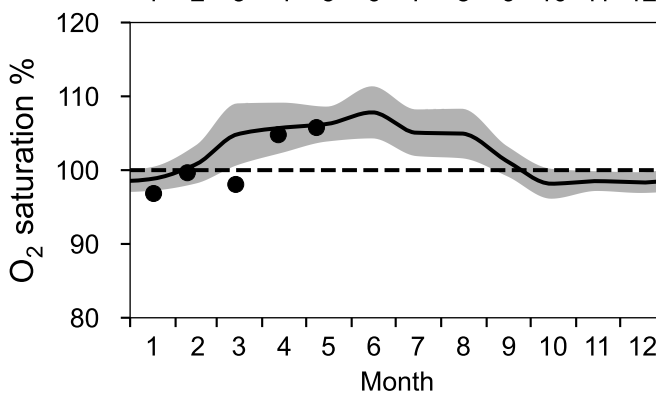
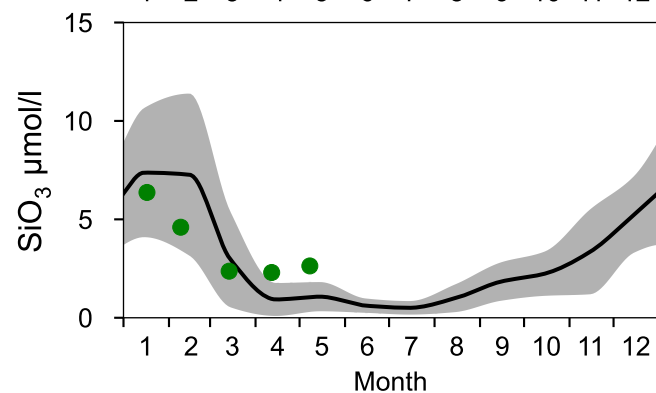
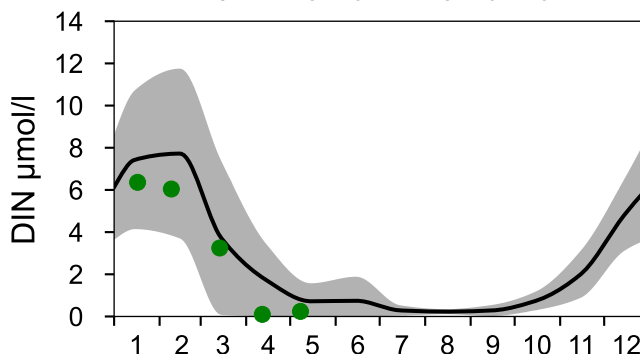
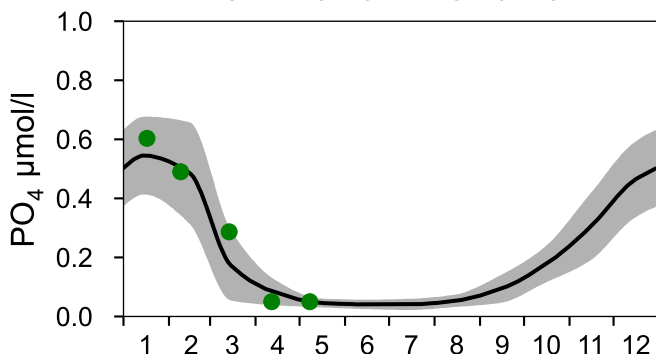
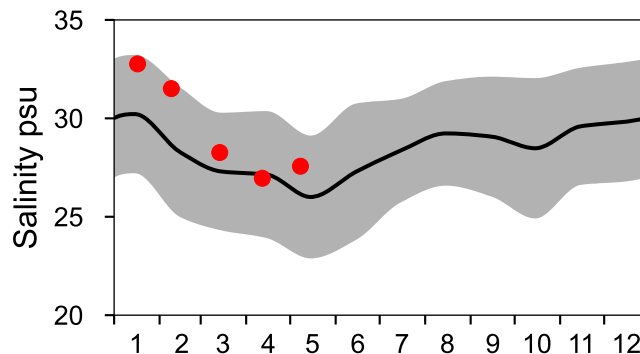
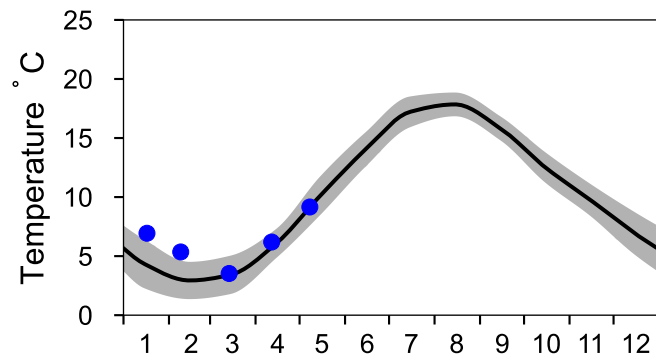
STATION Å13 SURFACE WATER (0-10 m)

Annual Cycles

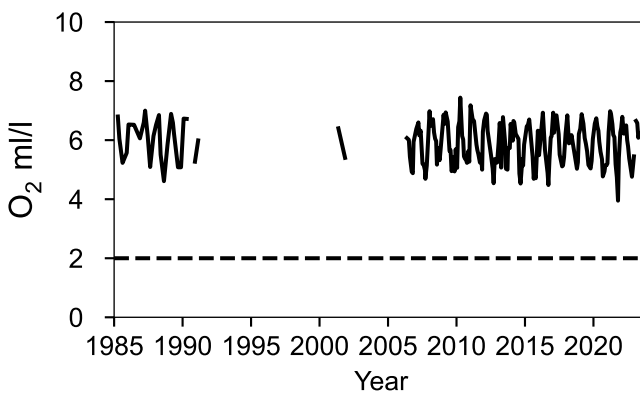
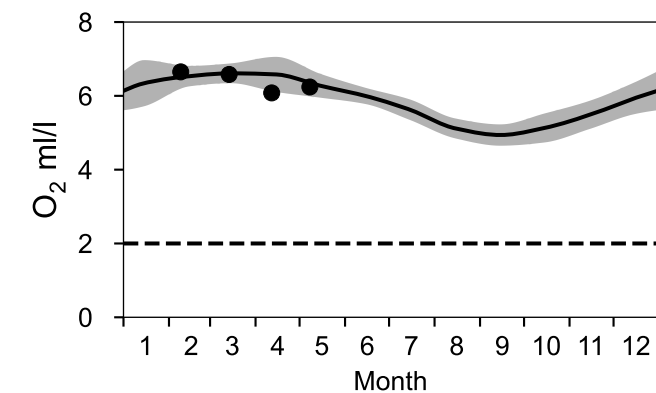
— Mean 1991-2020

■ St.Dev.

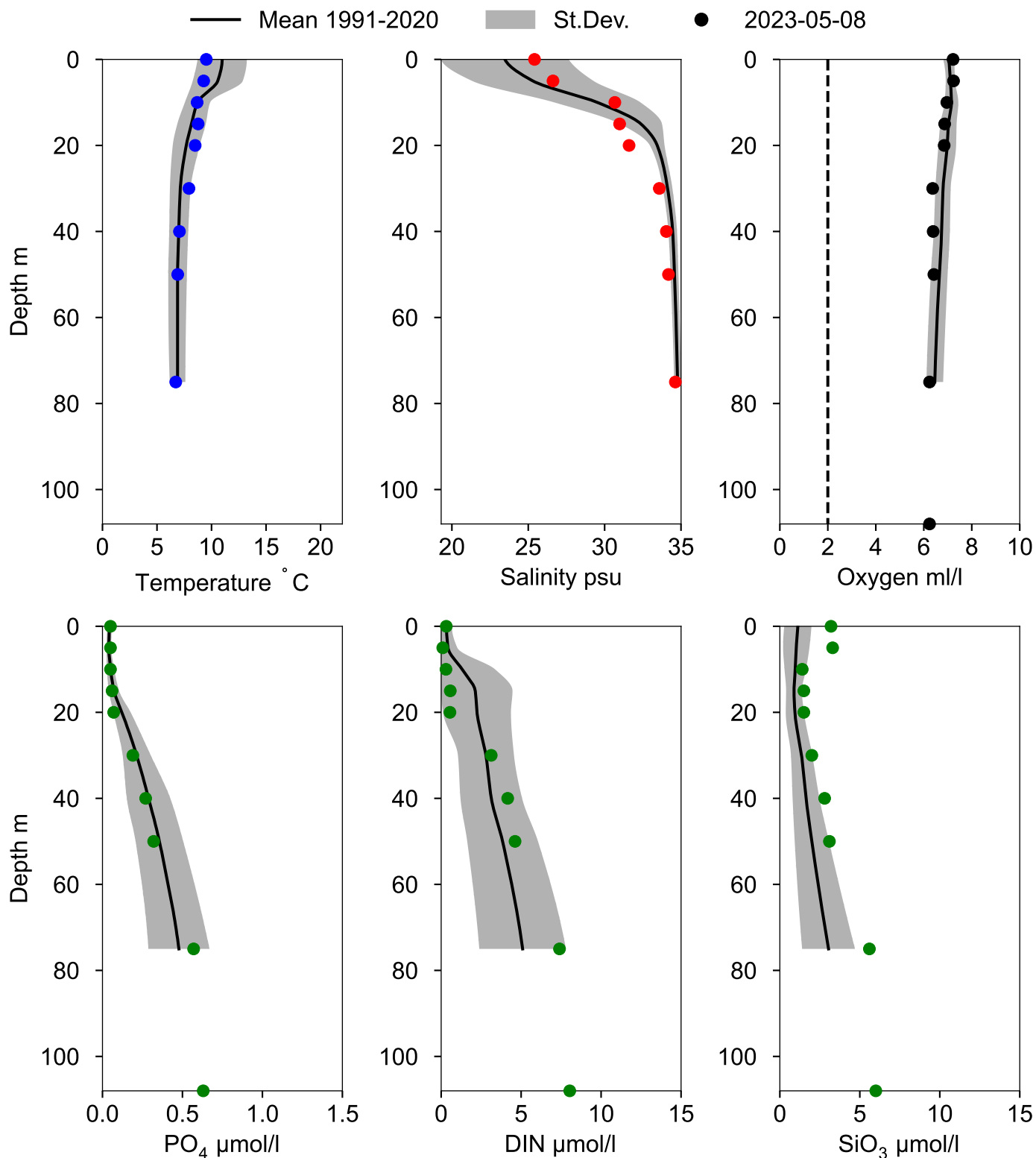
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OXOGEN IN BOTTOM WATER (depth >= 82 m)



Vertical profiles Å13 May



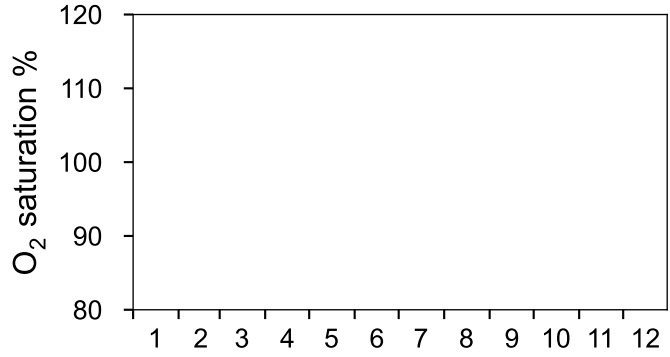
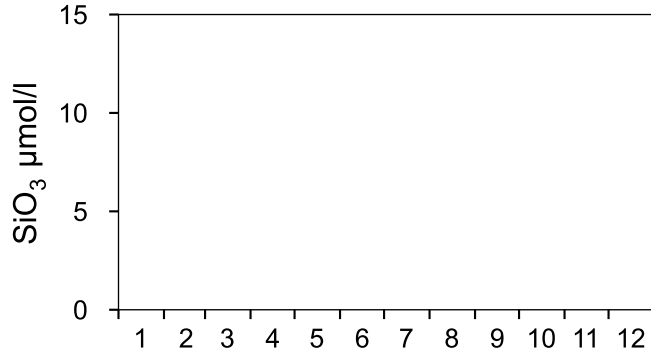
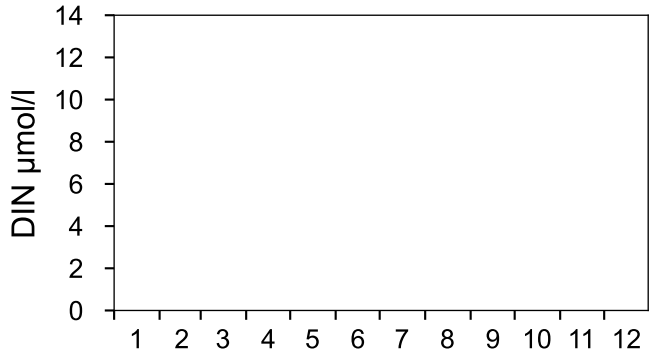
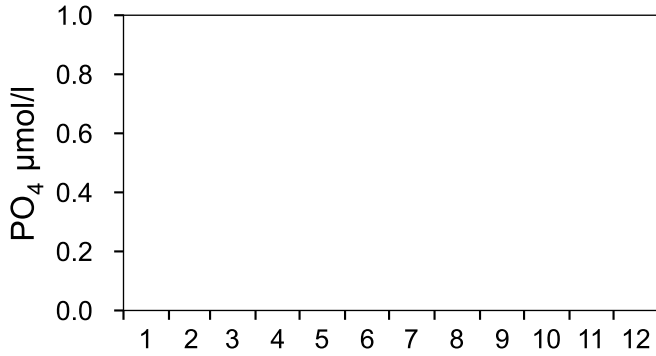
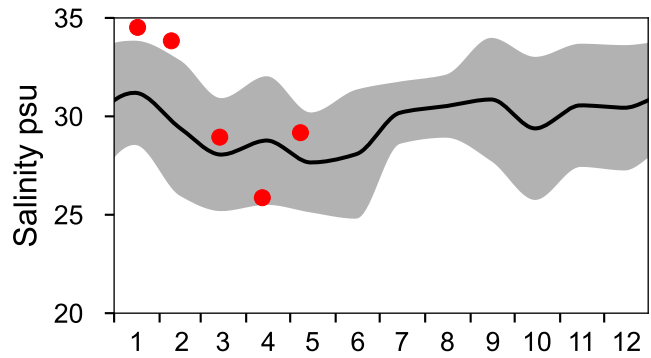
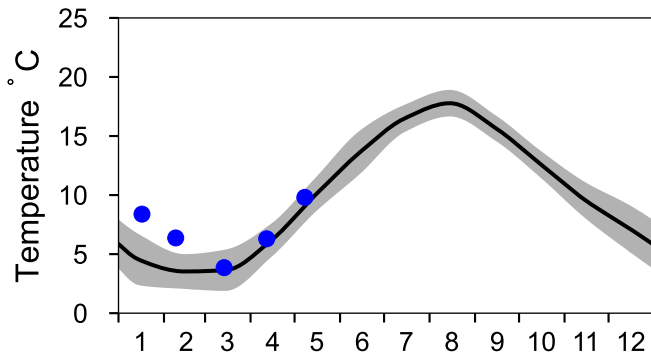
STATION Å14 SURFACE WATER (0-10 m)

Annual Cycles

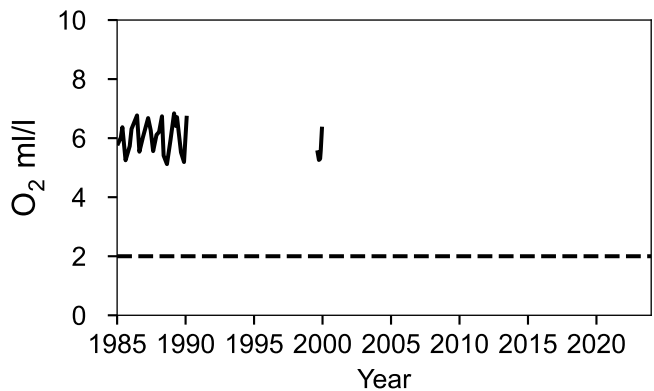
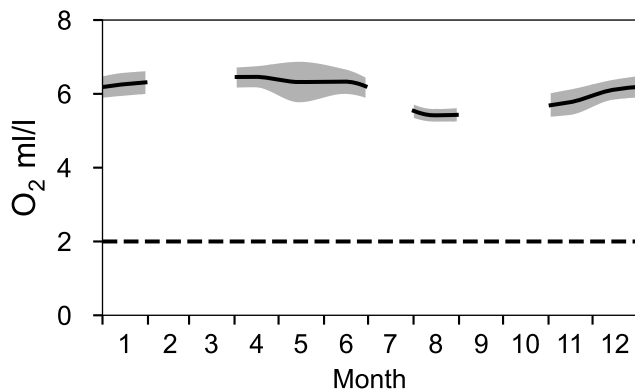
— Mean 1991-2020

■ St.Dev.

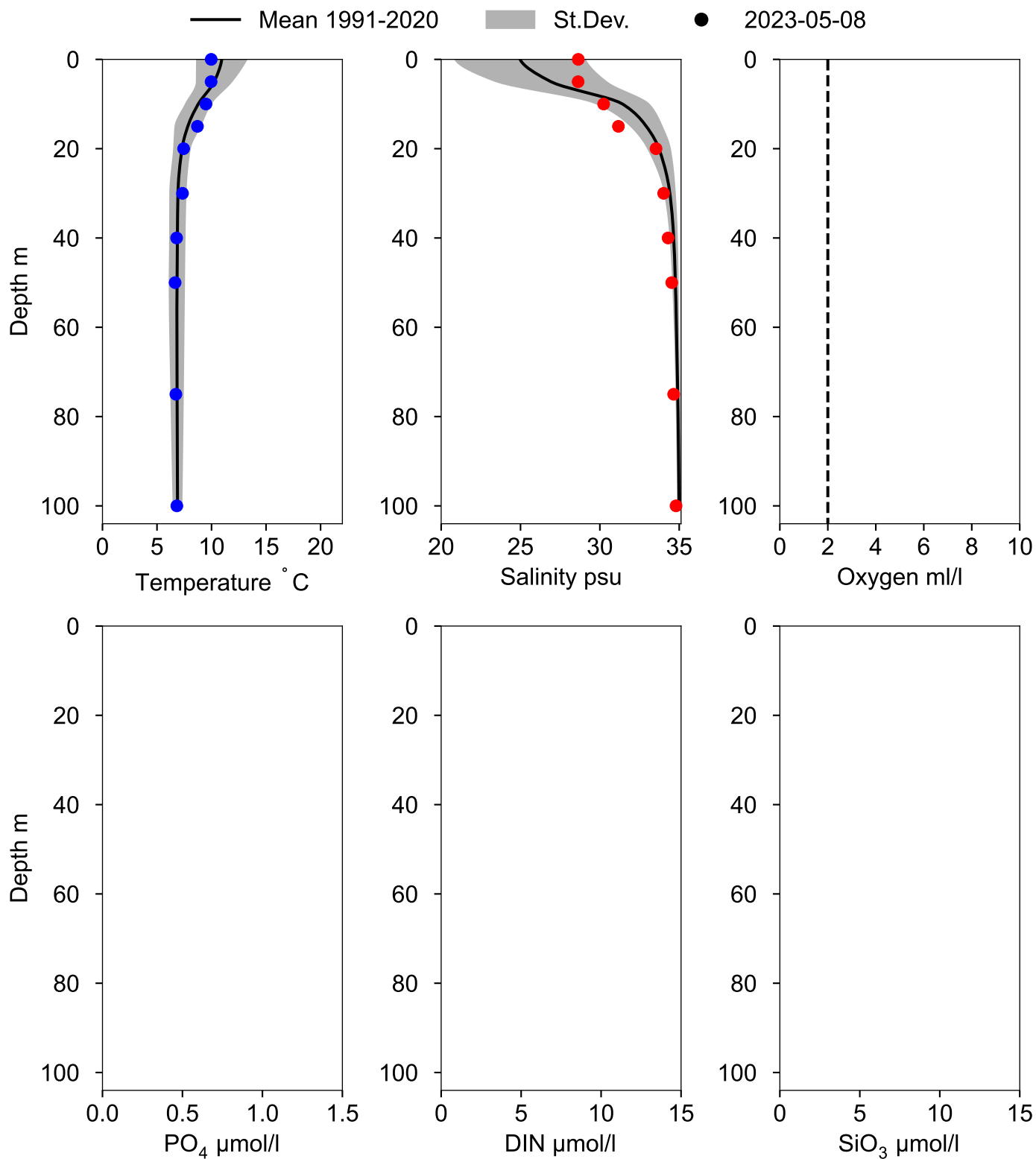
● 2023



OXYGEN IN BOTTOM WATER (depth >= 100 m)



Vertical profiles A14 May



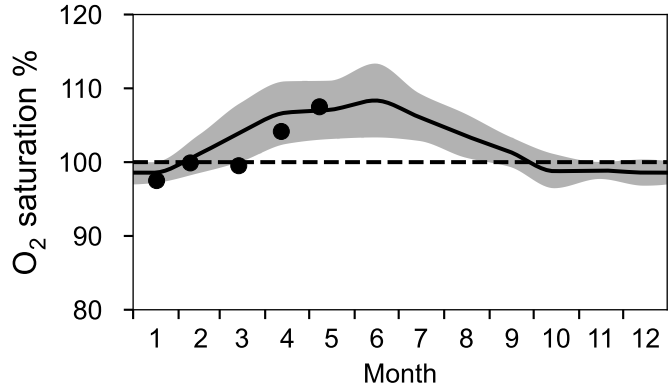
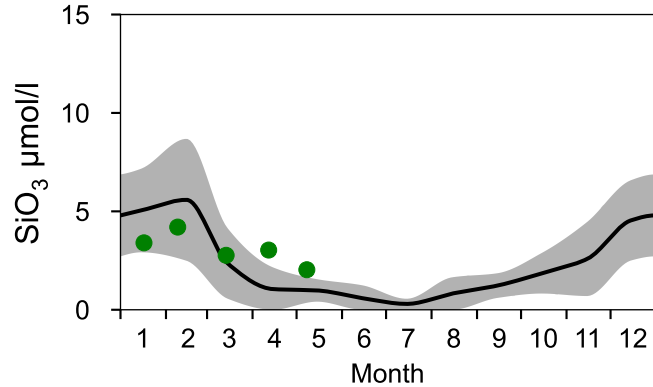
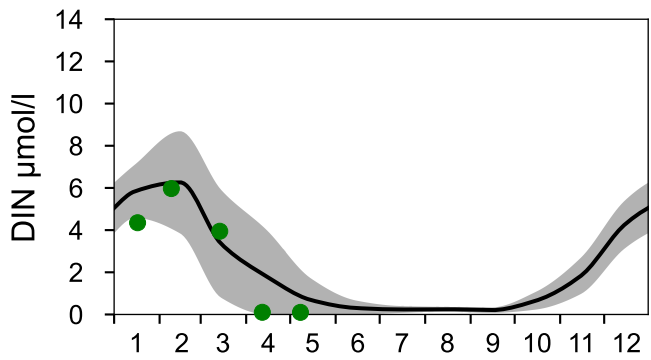
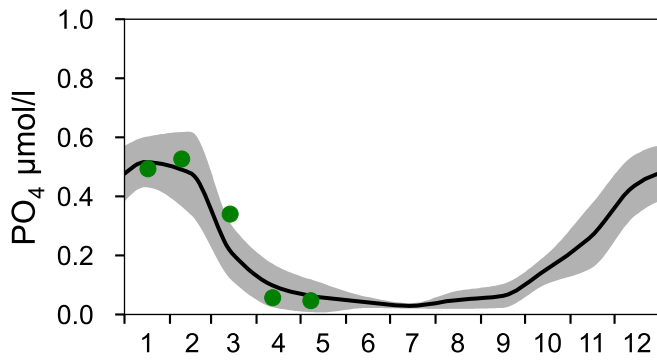
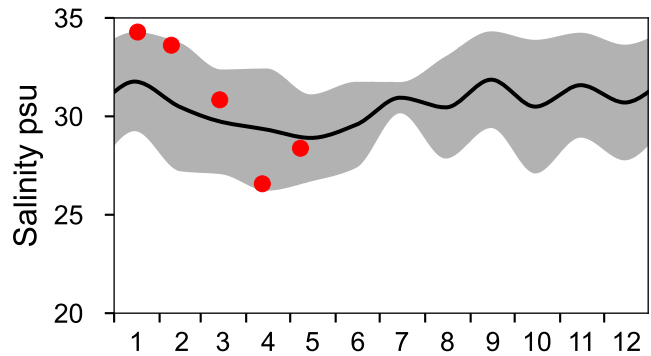
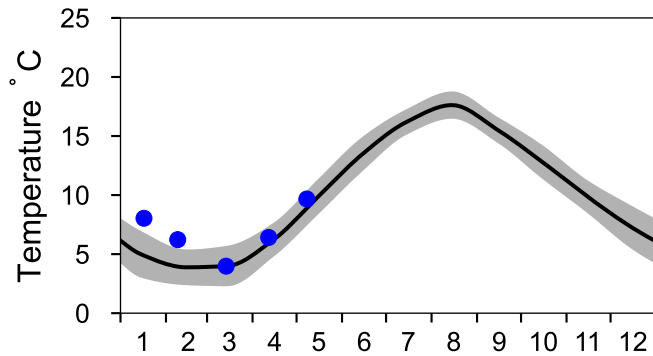
STATION Å15 SURFACE WATER (0-10 m)

Annual Cycles

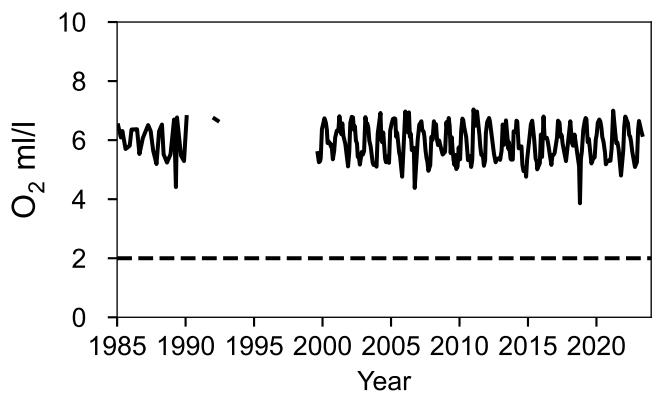
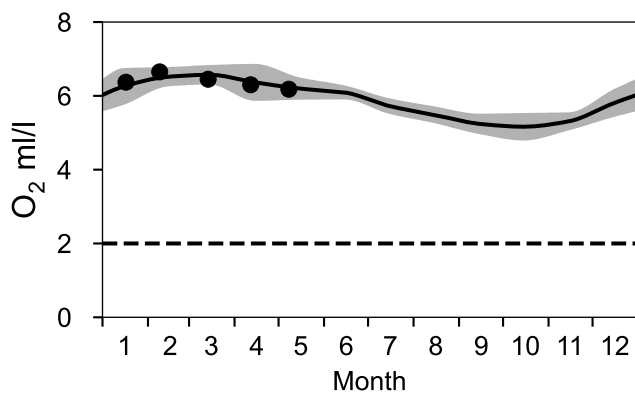
— Mean 1991-2020

■ St.Dev.

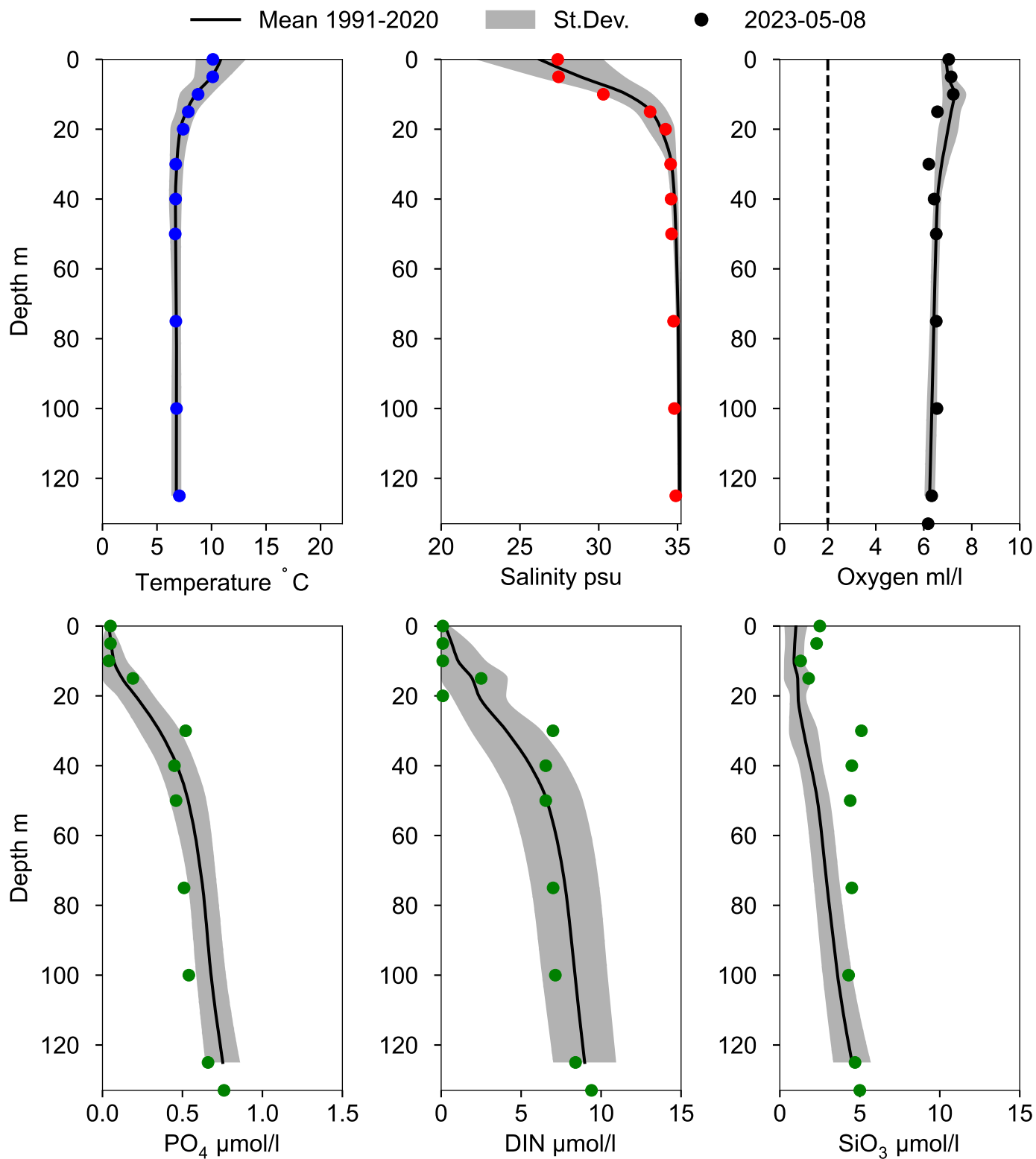
● 2023



OXYGEN IN BOTTOM WATER (depth >= 125 m)



Vertical profiles A15 May



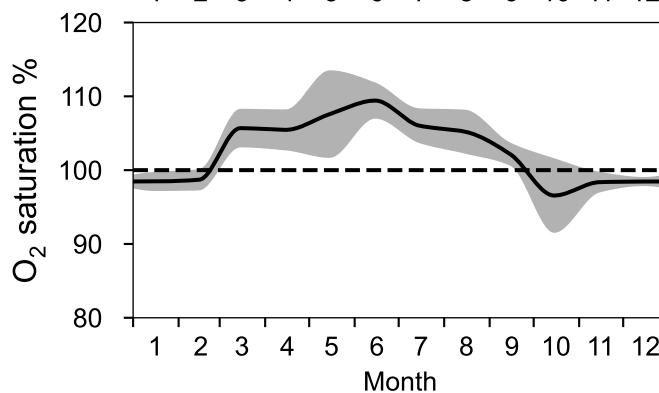
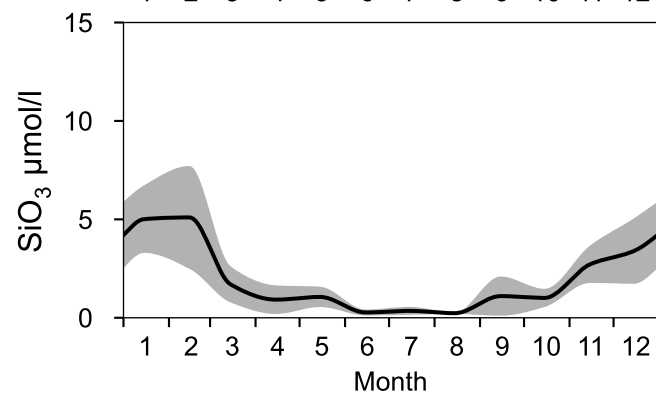
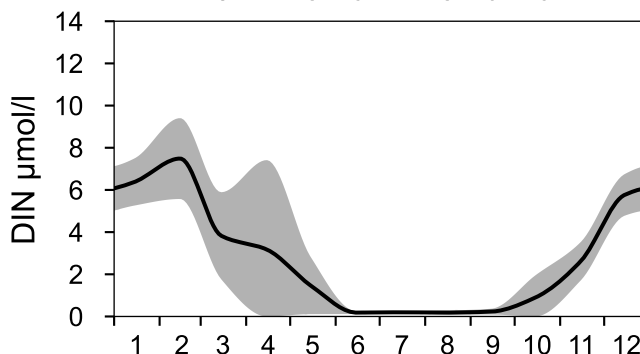
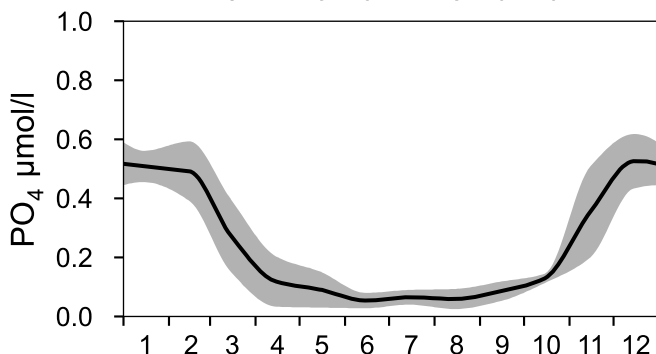
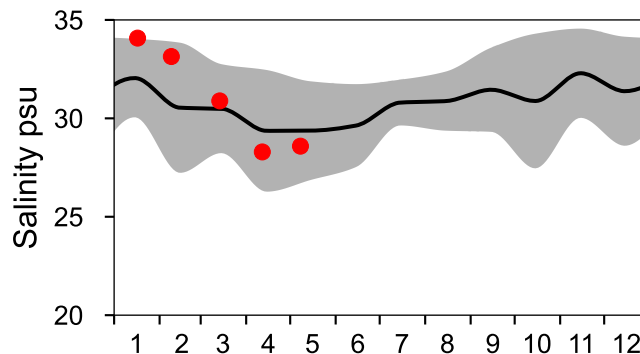
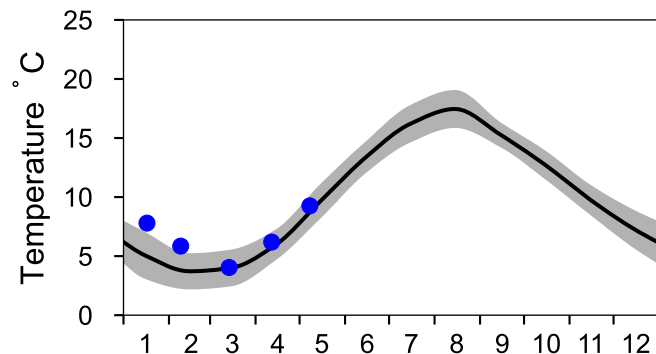
STATION Å16 SURFACE WATER (0-10 m)

Annual Cycles

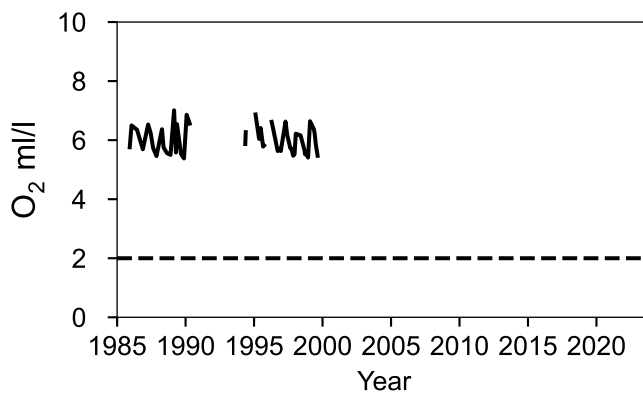
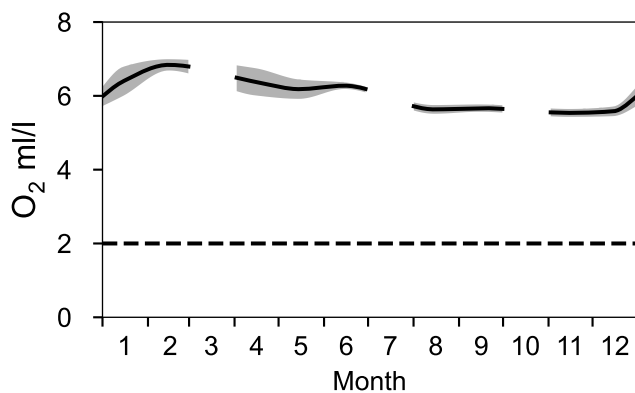
— Mean 1991-2020

■ St.Dev.

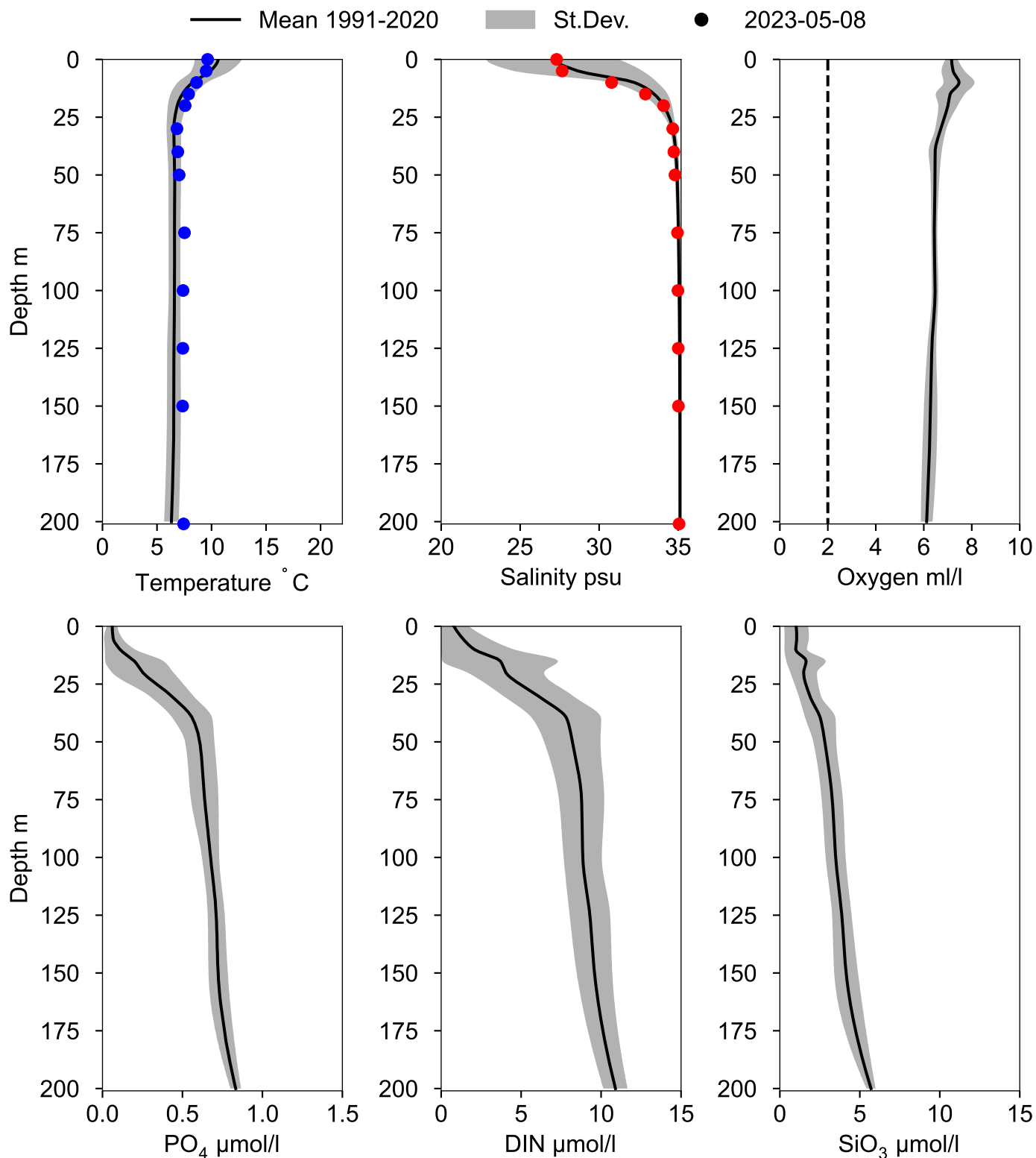
● 2023



OXYGEN IN BOTTOM WATER (depth >= 193 m)



Vertical profiles A16 May



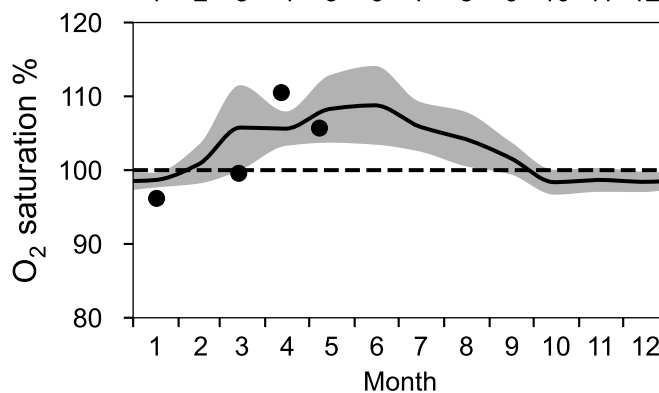
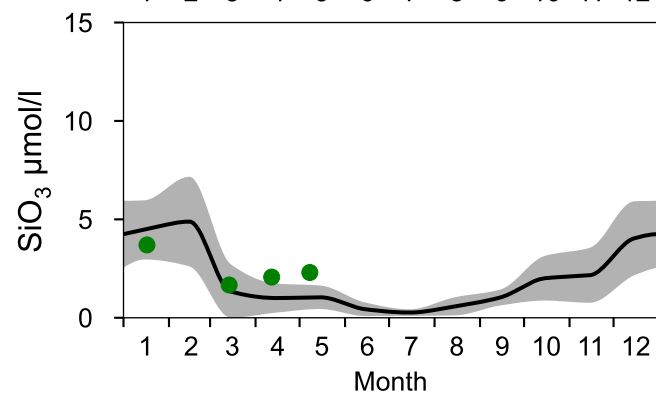
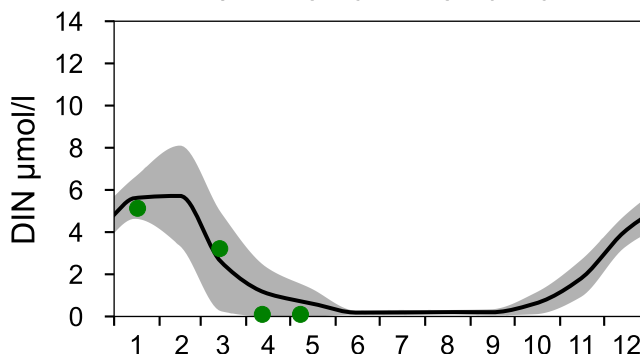
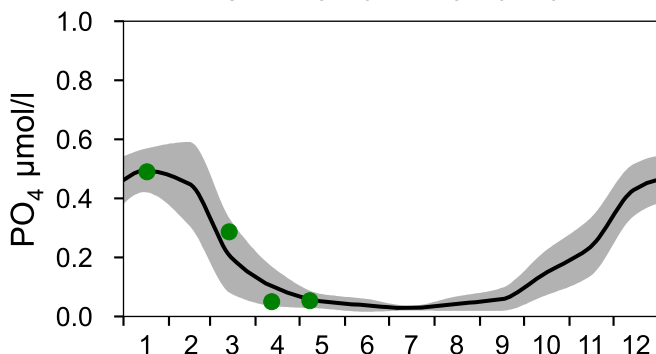
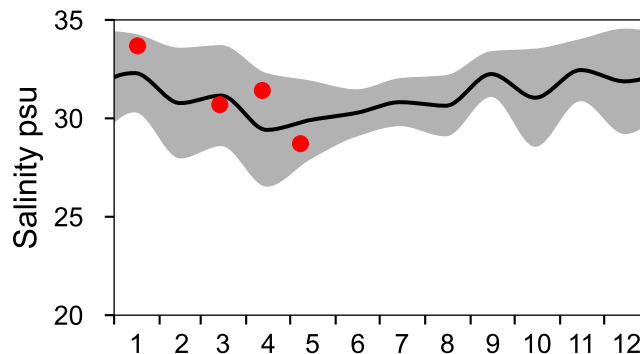
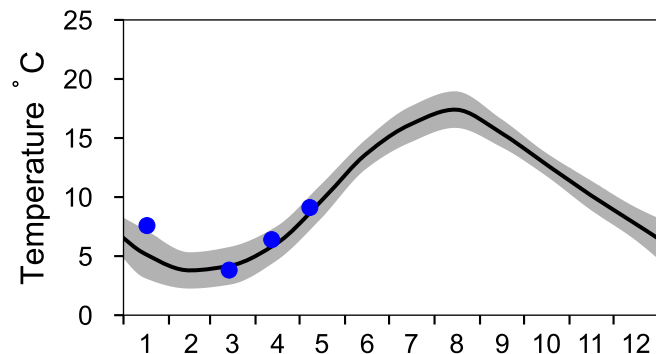
STATION Å17 SURFACE WATER (0-10 m)

Annual Cycles

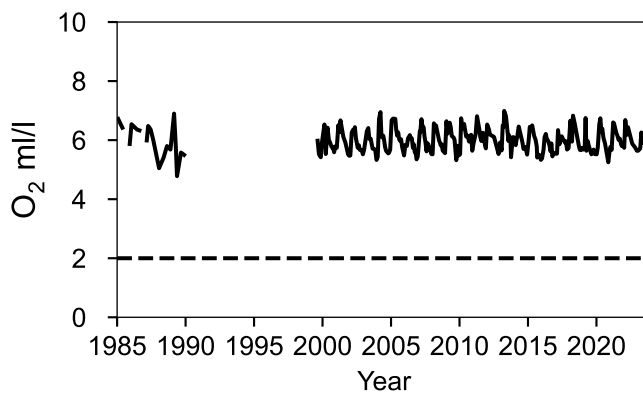
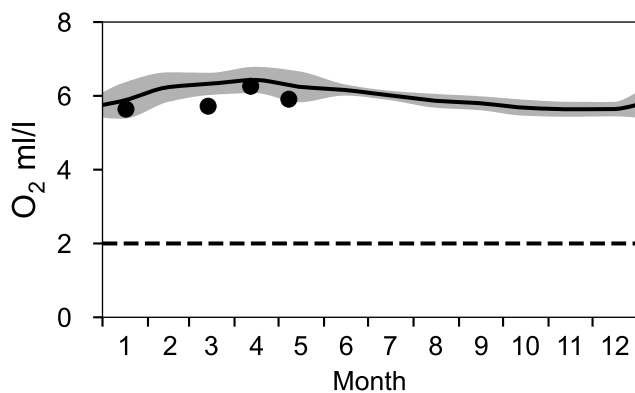
— Mean 1991-2020

■ St.Dev.

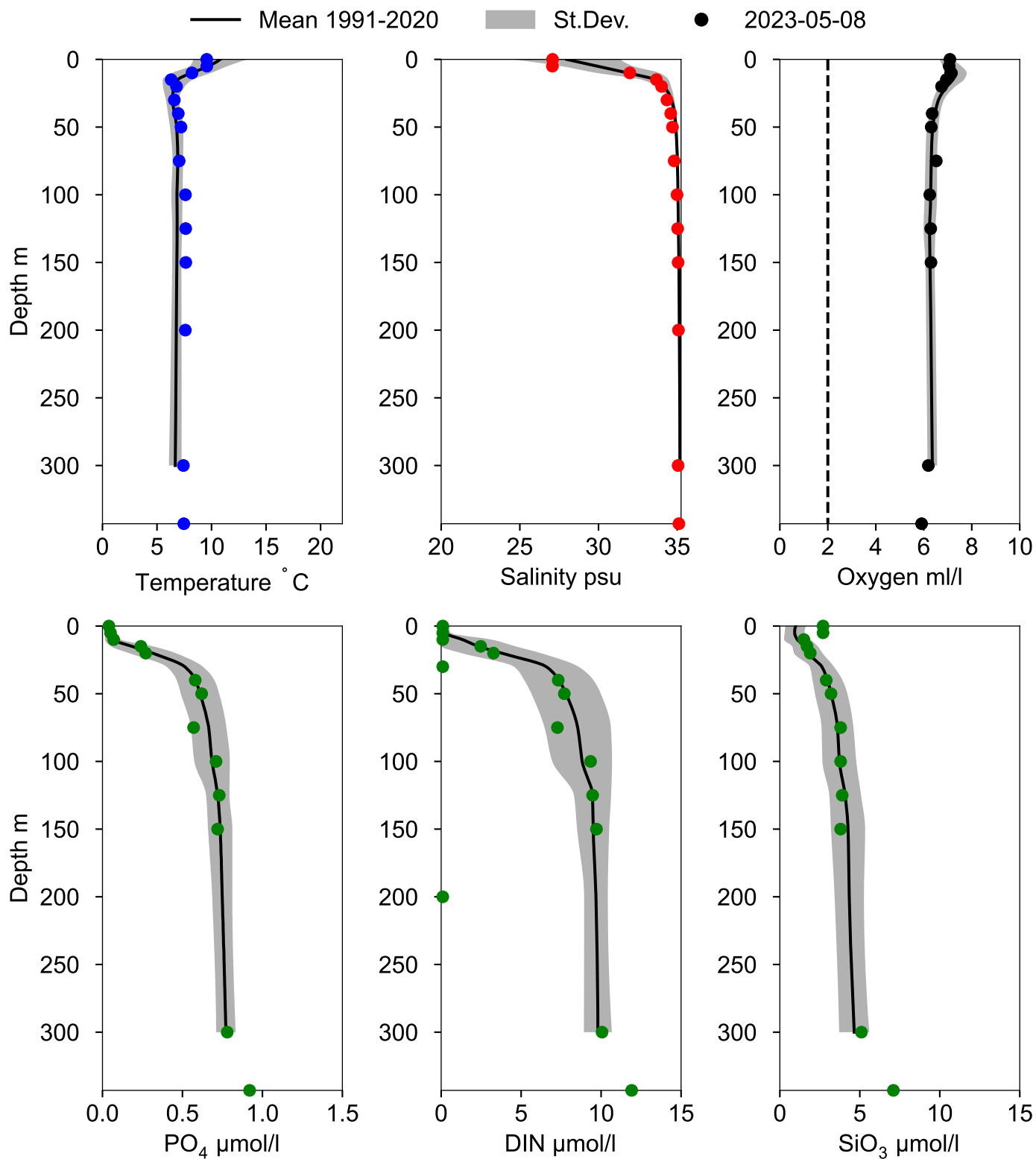
● 2023



OXYGEN IN BOTTOM WATER (depth >= 300 m)



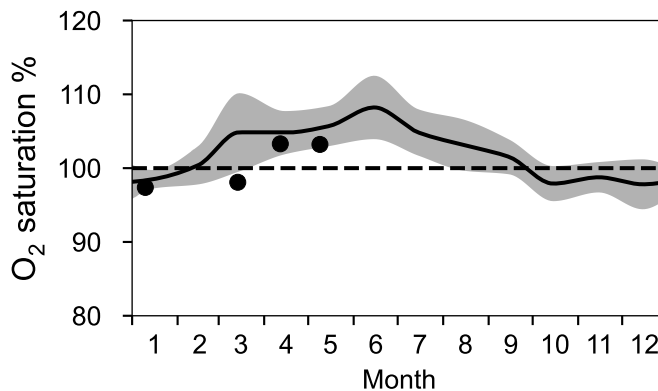
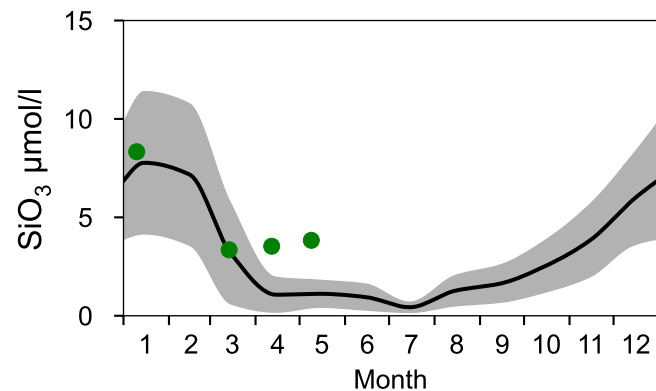
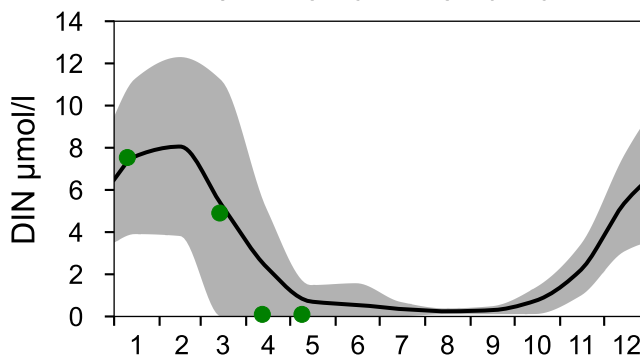
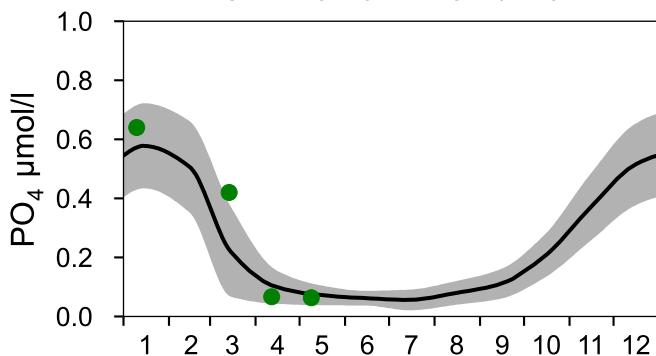
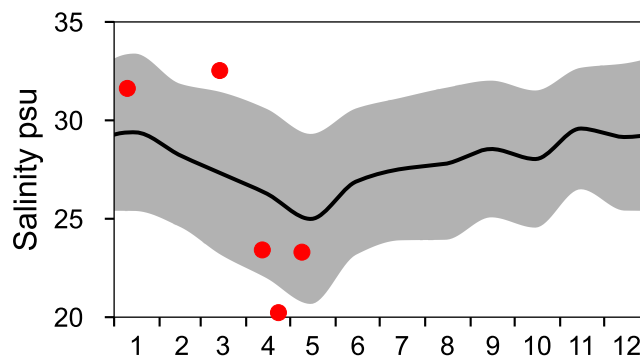
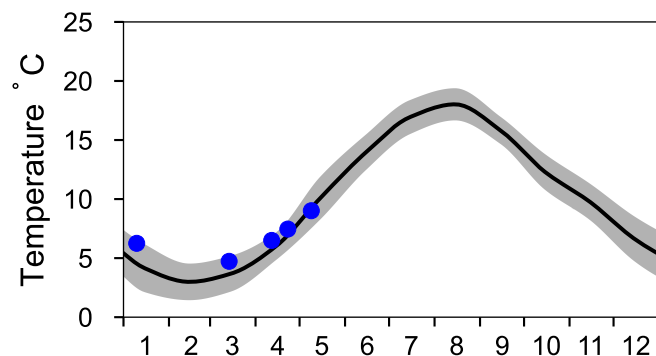
Vertical profiles A17 May



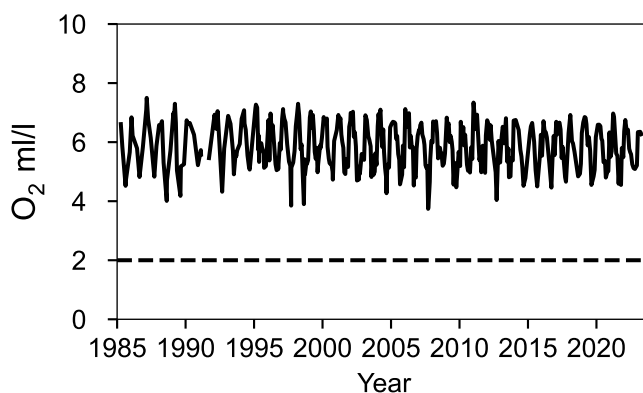
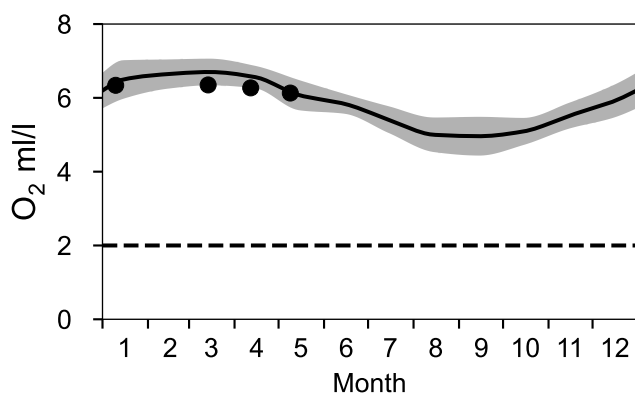
STATION P2 SURFACE WATER (0-10 m)

Annual Cycles

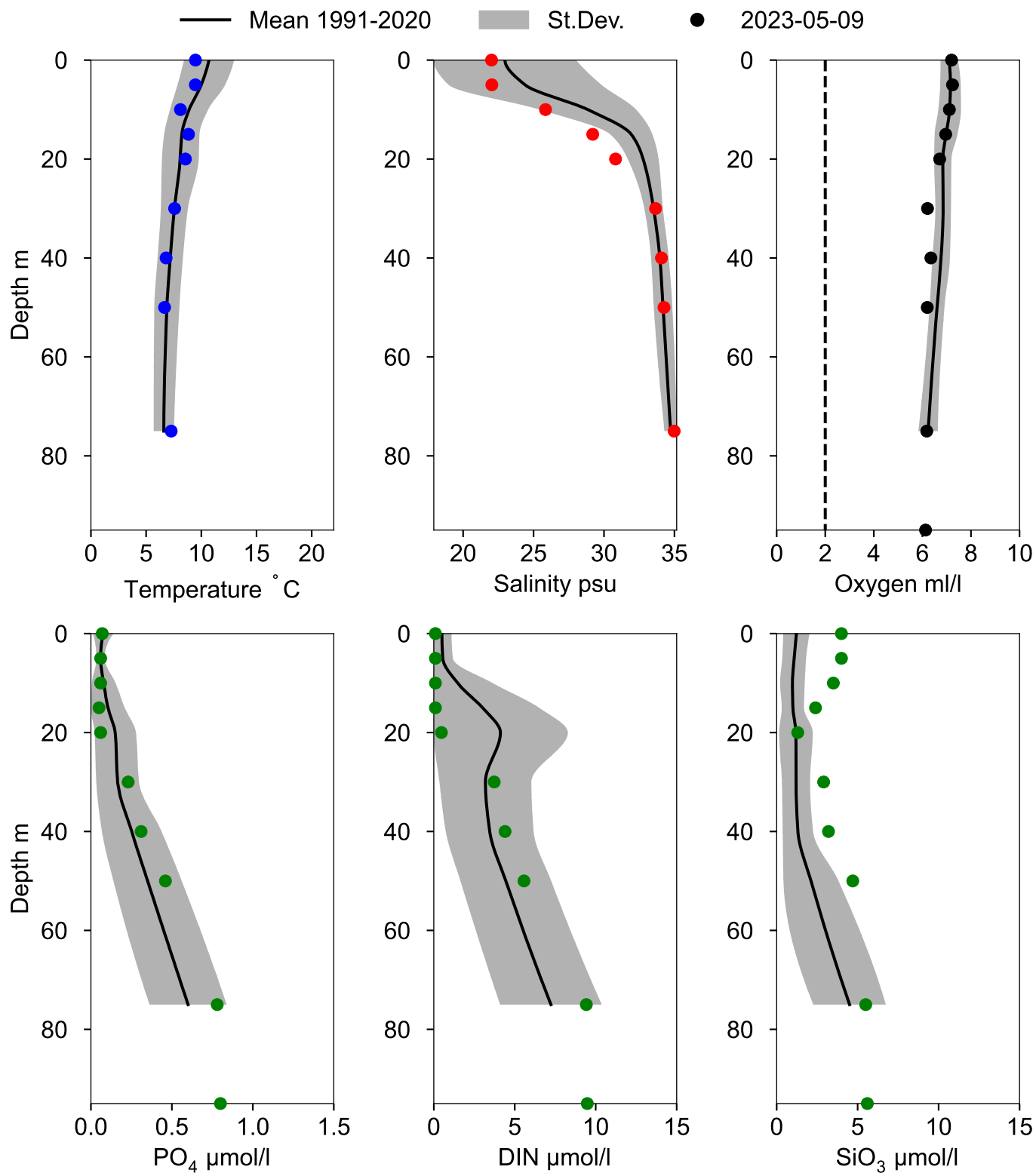
— Mean 1991-2020 St.Dev. ● 2023



OXYGEN IN BOTTOM WATER (depth >= 75 m)



Vertical profiles P2 May



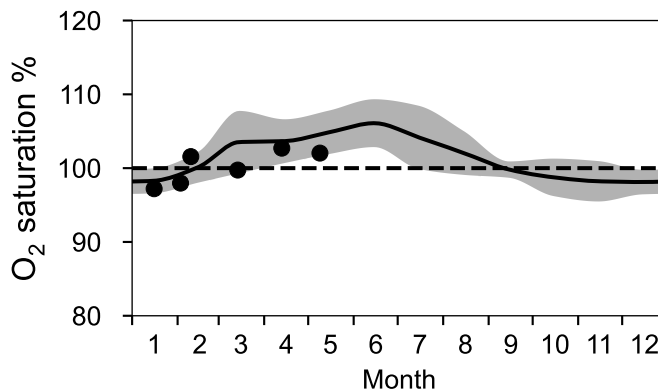
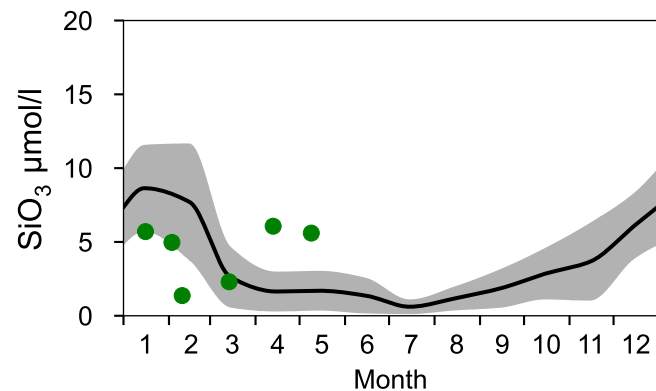
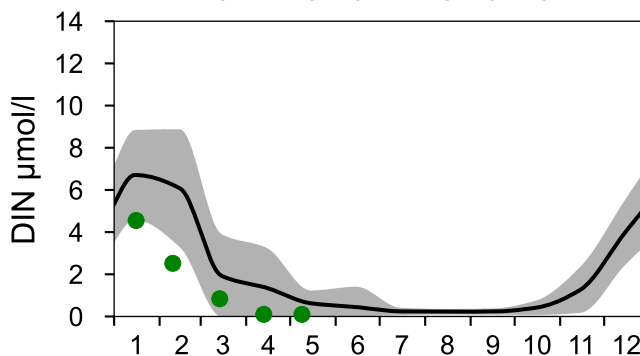
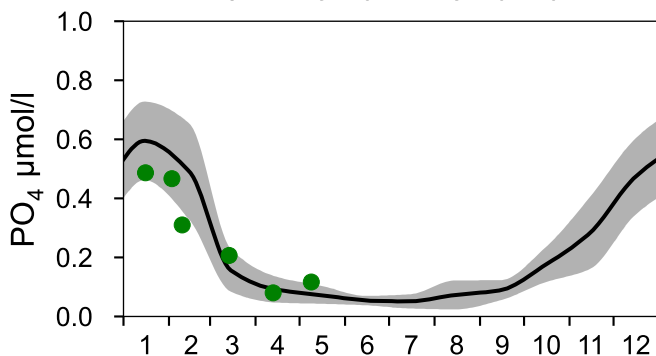
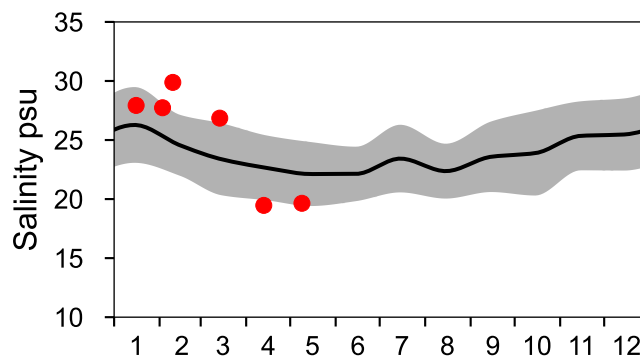
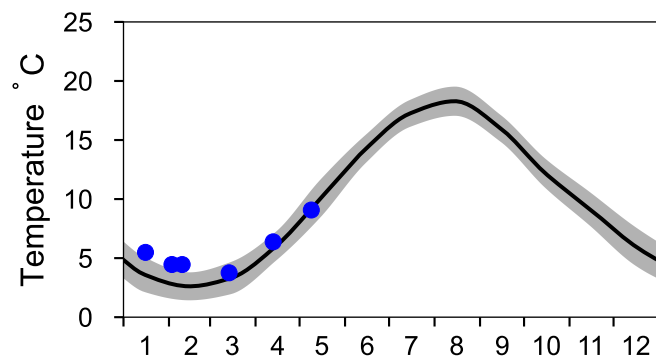
STATION FLADEN SURFACE WATER (0-10 m)

Annual Cycles

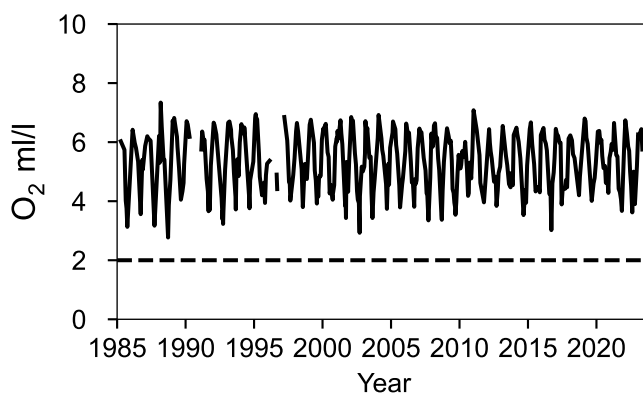
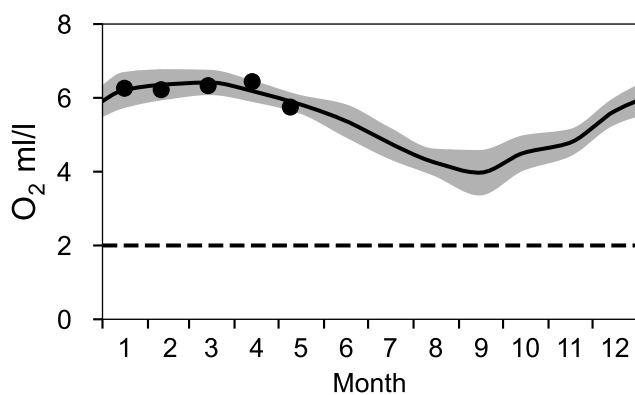
— Mean 1991-2020

■ St.Dev.

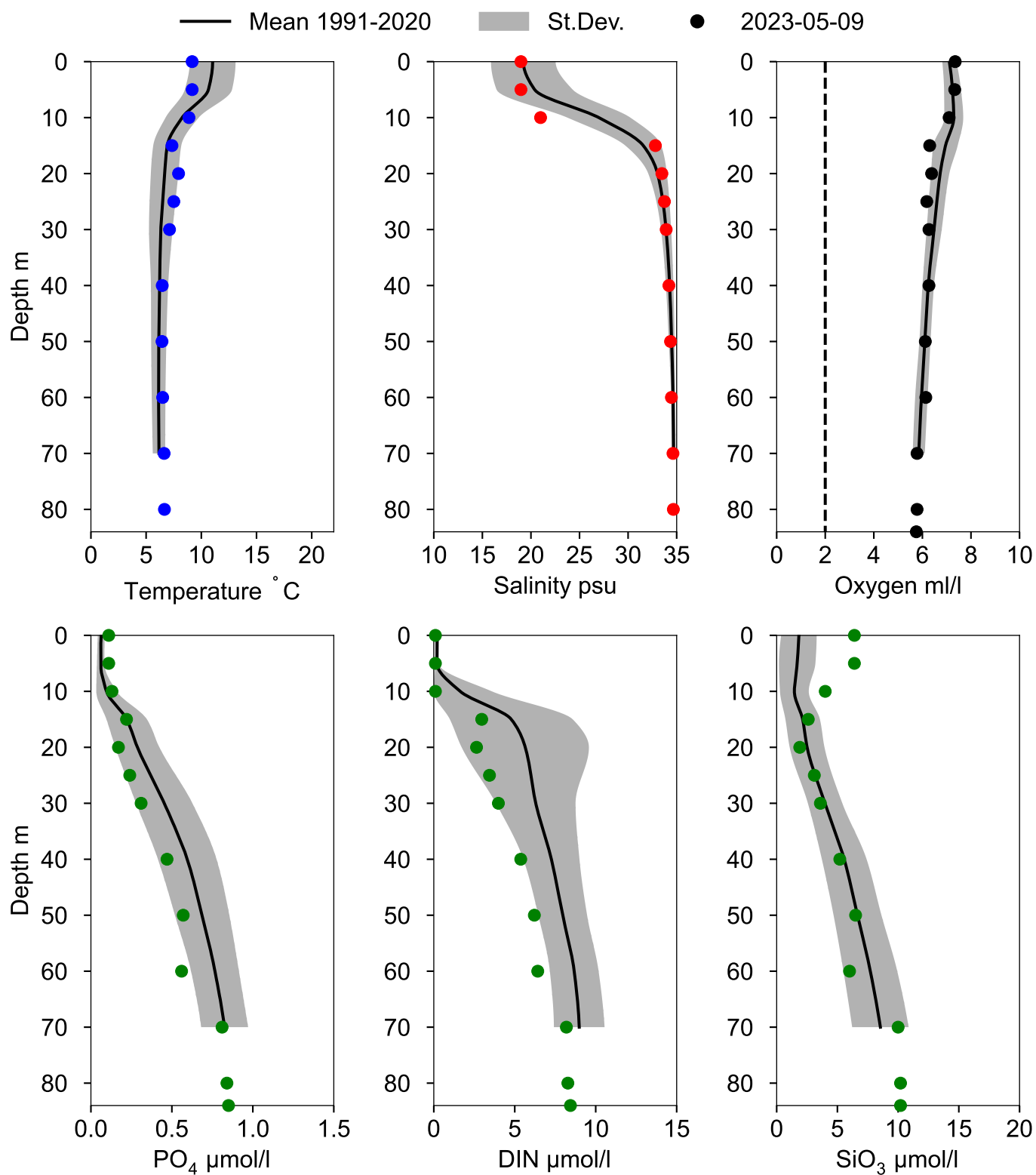
● 2023



OXYGEN IN BOTTOM WATER (depth >= 74 m)



Vertical profiles FLADEN May



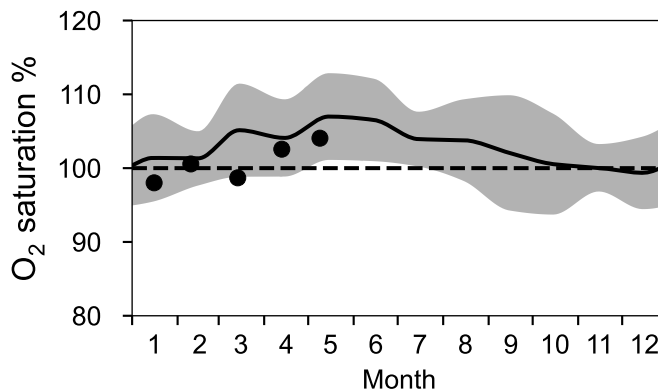
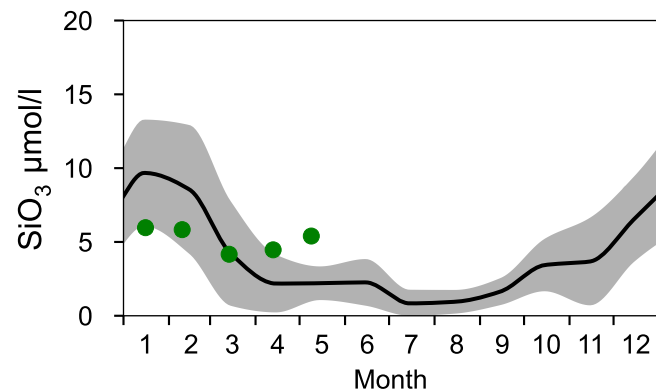
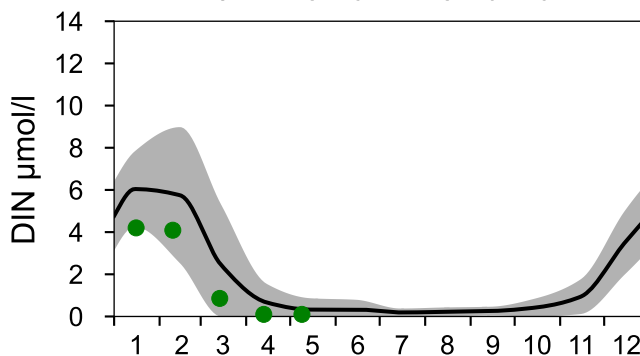
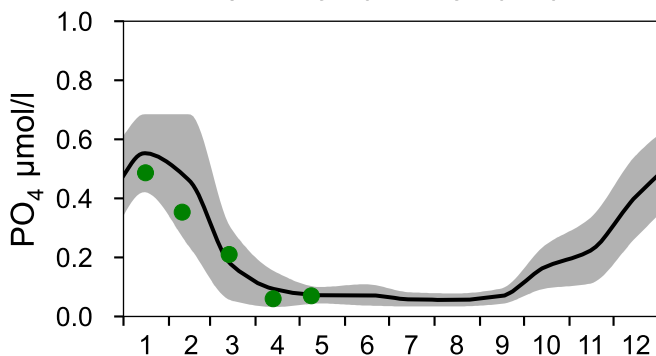
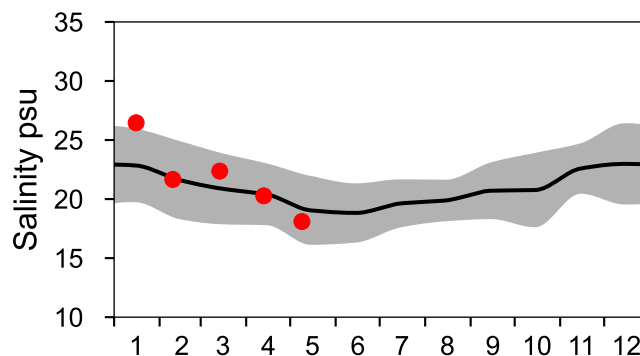
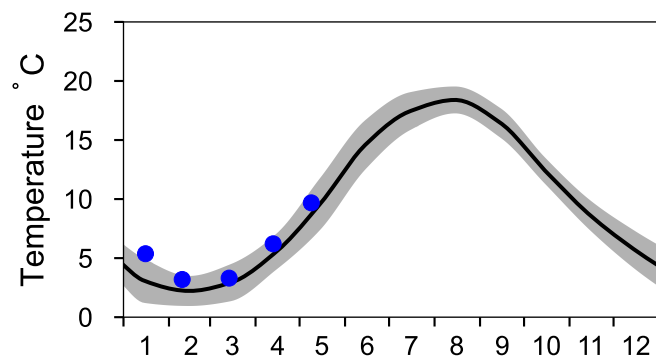
STATION N14 FALKENBERG SURFACE WATER (0-10 m)

Annual Cycles

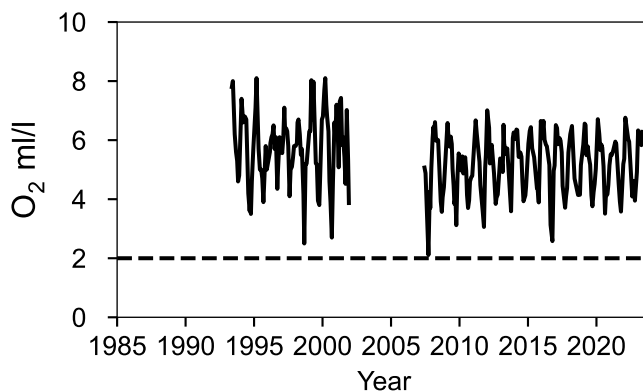
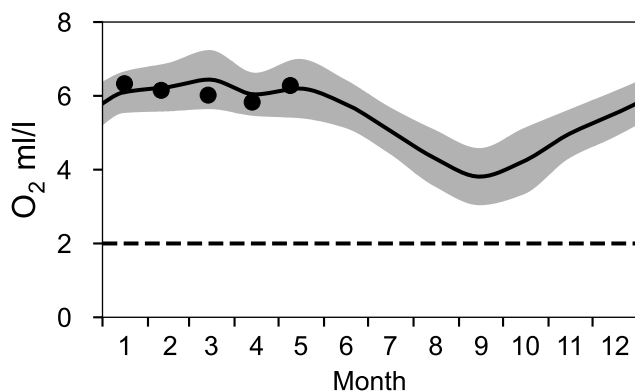
— Mean 1991-2020

■ St.Dev.

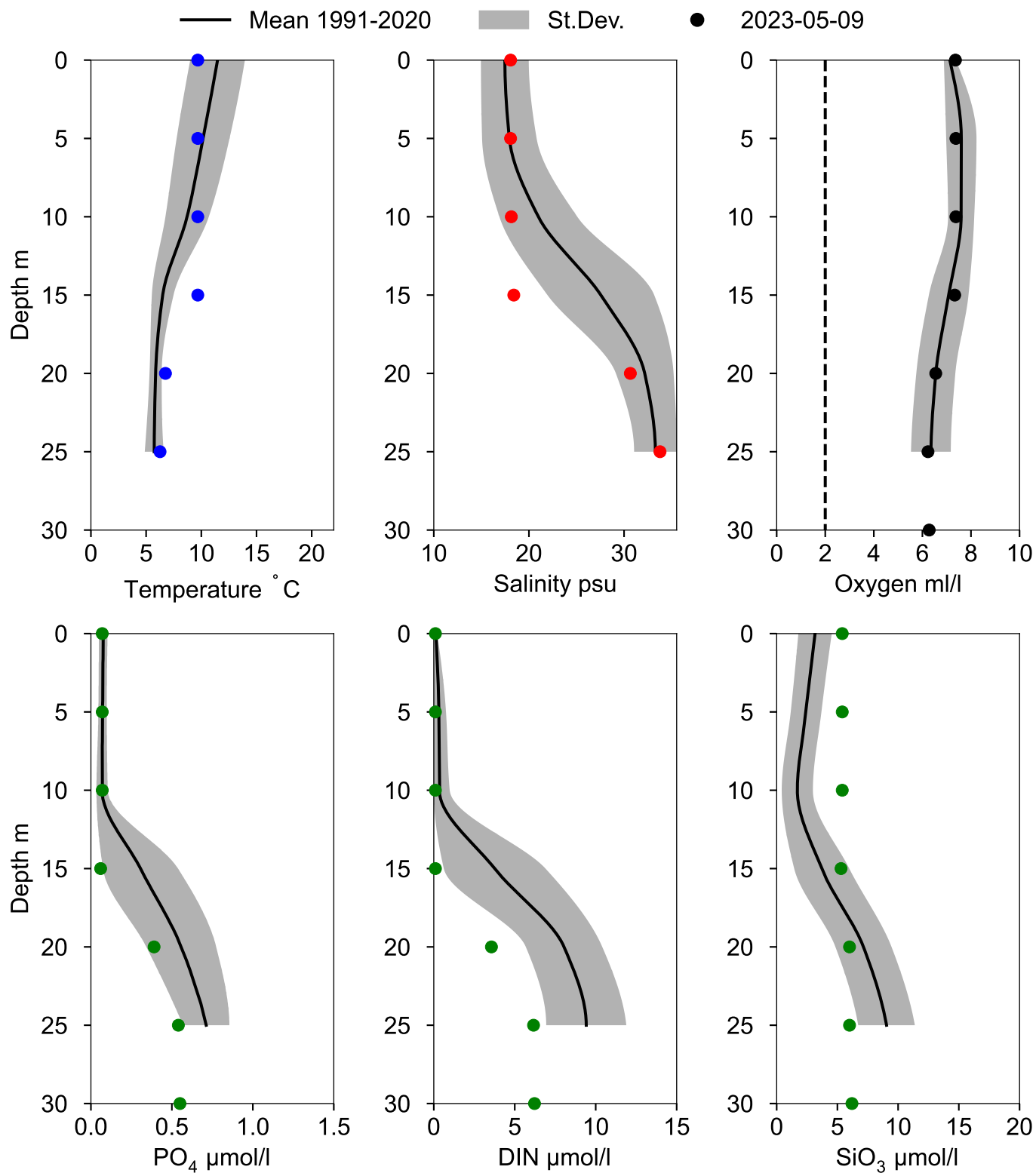
● 2023



OXYGEN IN BOTTOM WATER (depth >= 25 m)



Vertical profiles N14 FALKENBERG May



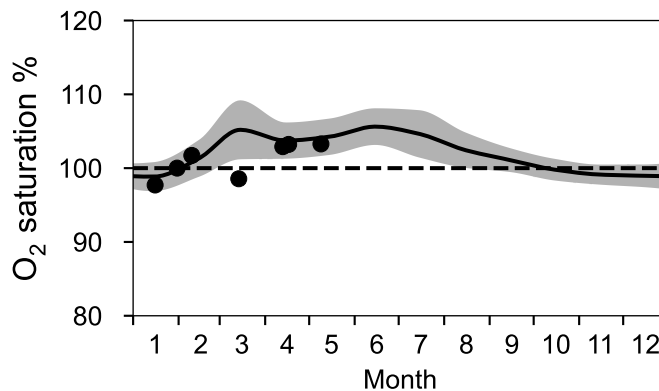
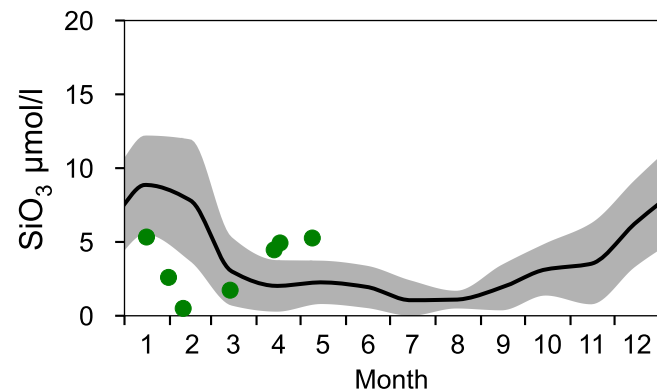
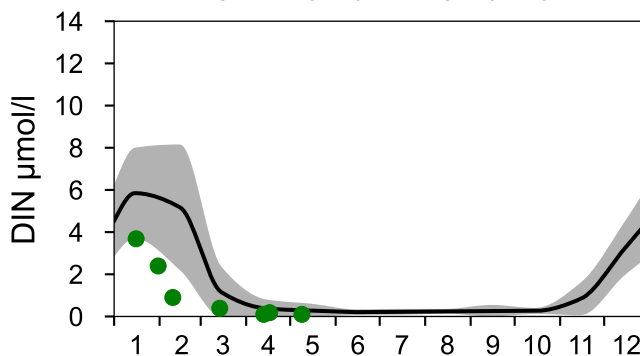
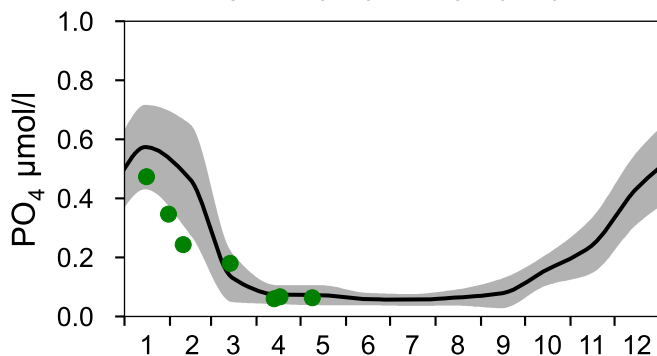
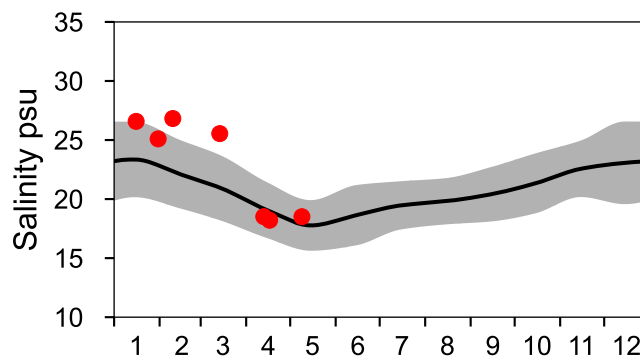
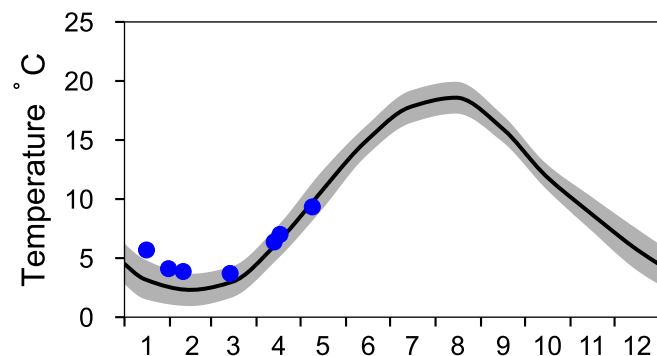
STATION ANHOLT E SURFACE WATER (0-10 m)

Annual Cycles

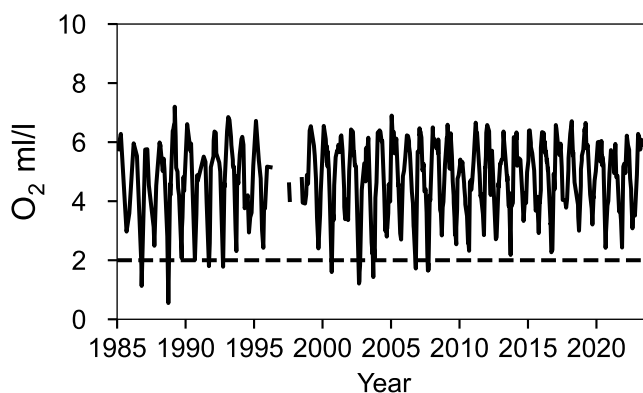
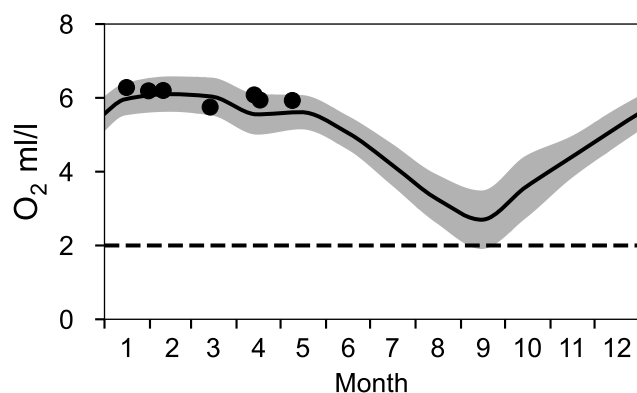
— Mean 1991-2020

■ St.Dev.

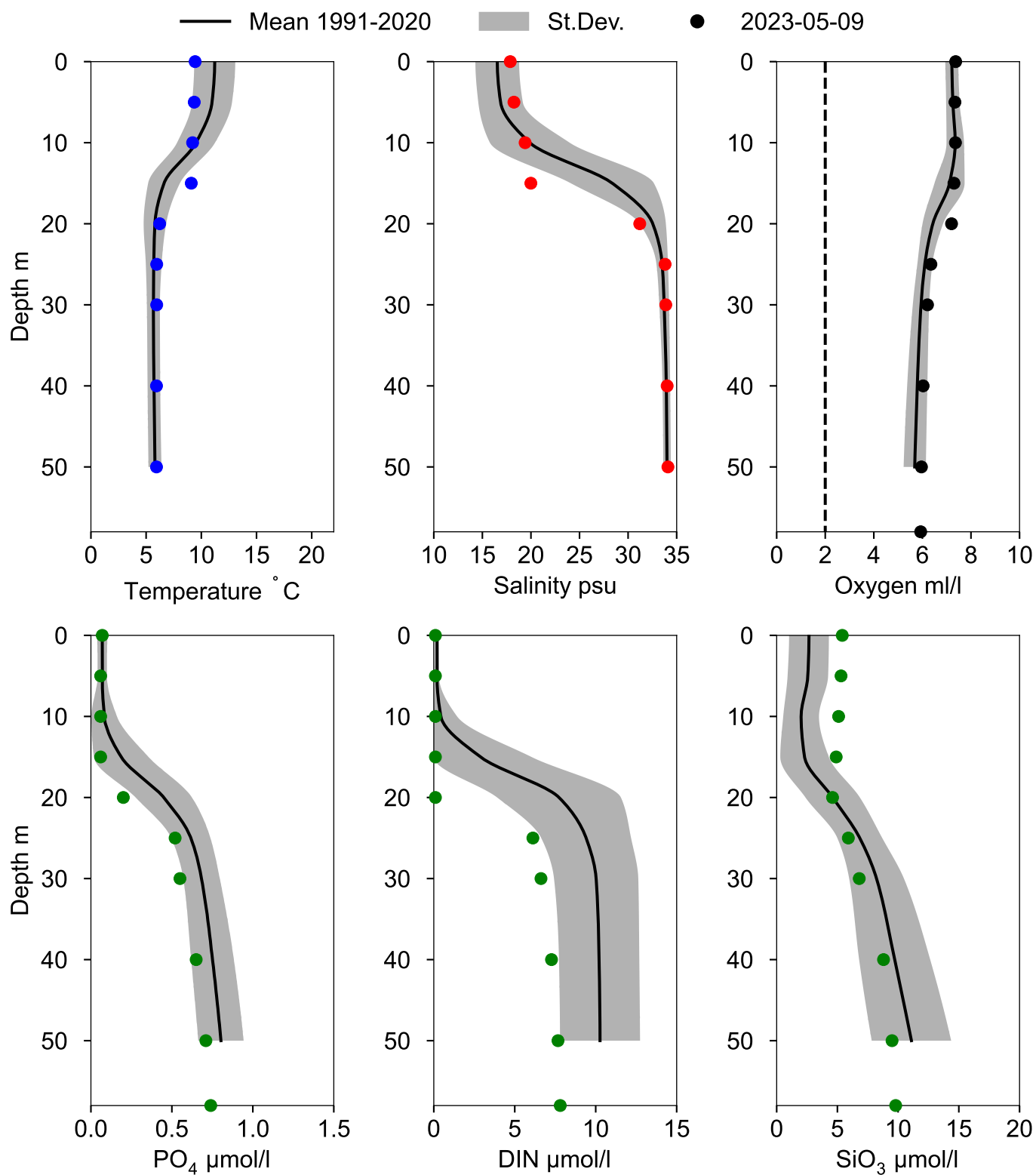
● 2023



OXOGEN IN BOTTOM WATER (depth >= 52 m)



Vertical profiles ANHOLT E May



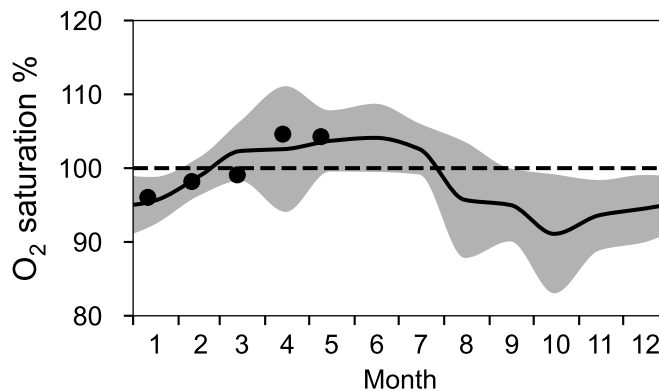
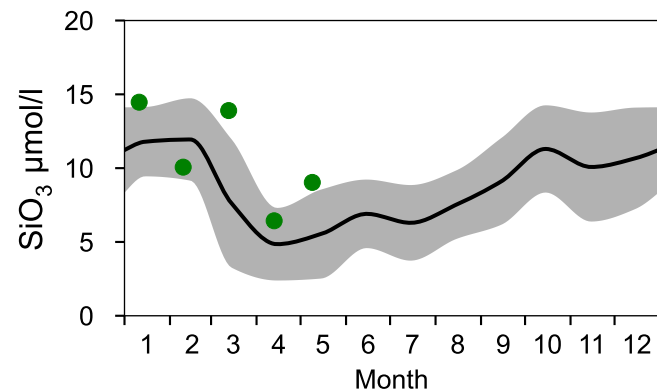
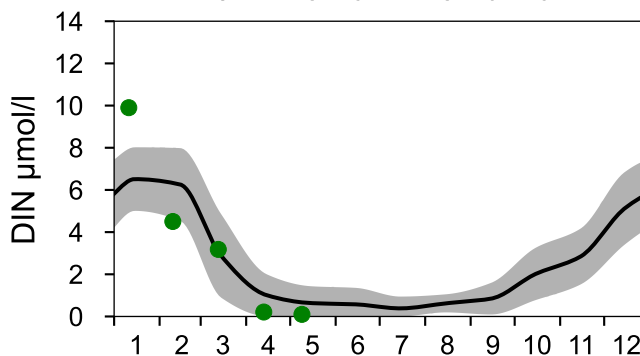
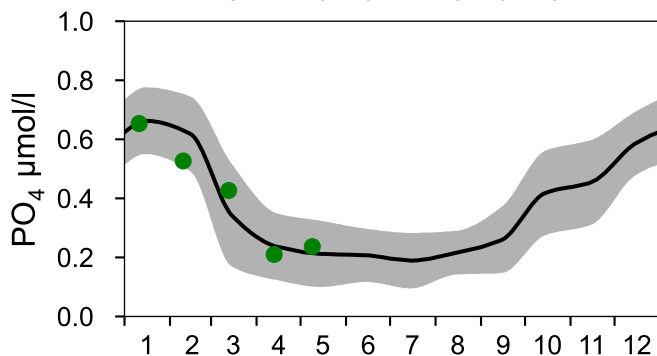
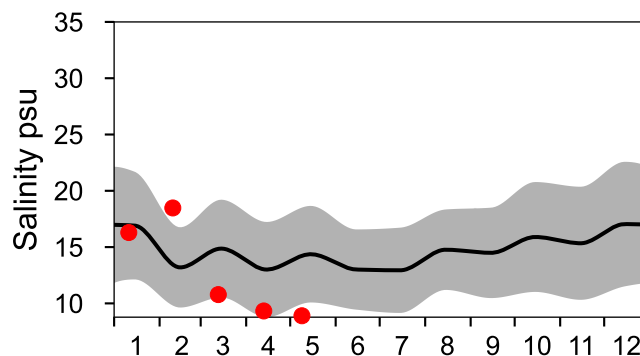
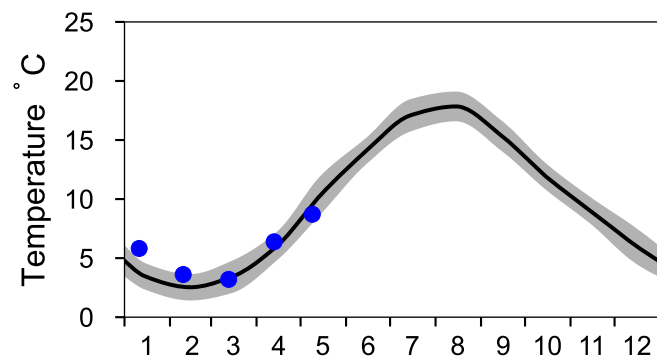
STATION W LANDSKRONA SURFACE WATER (0-10 m)

Annual Cycles

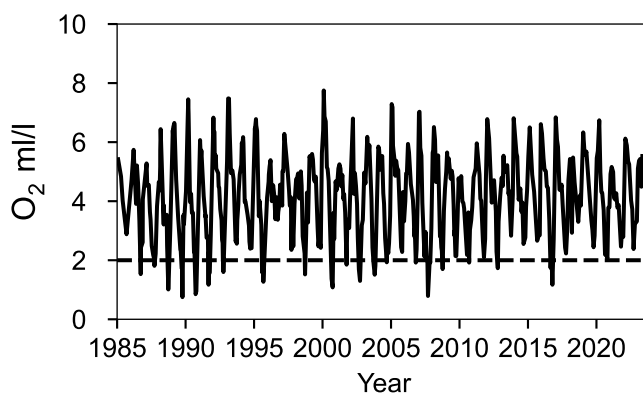
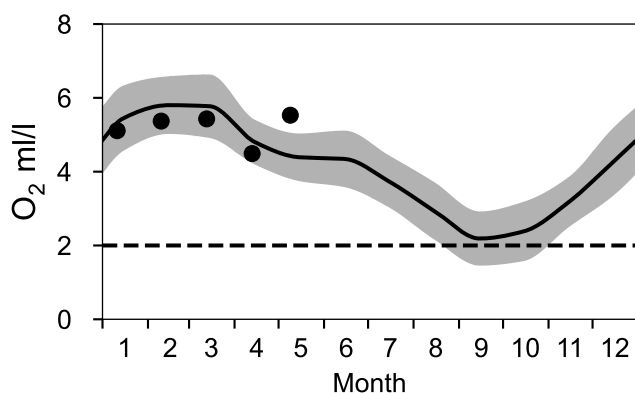
— Mean 1991-2020

■ St.Dev.

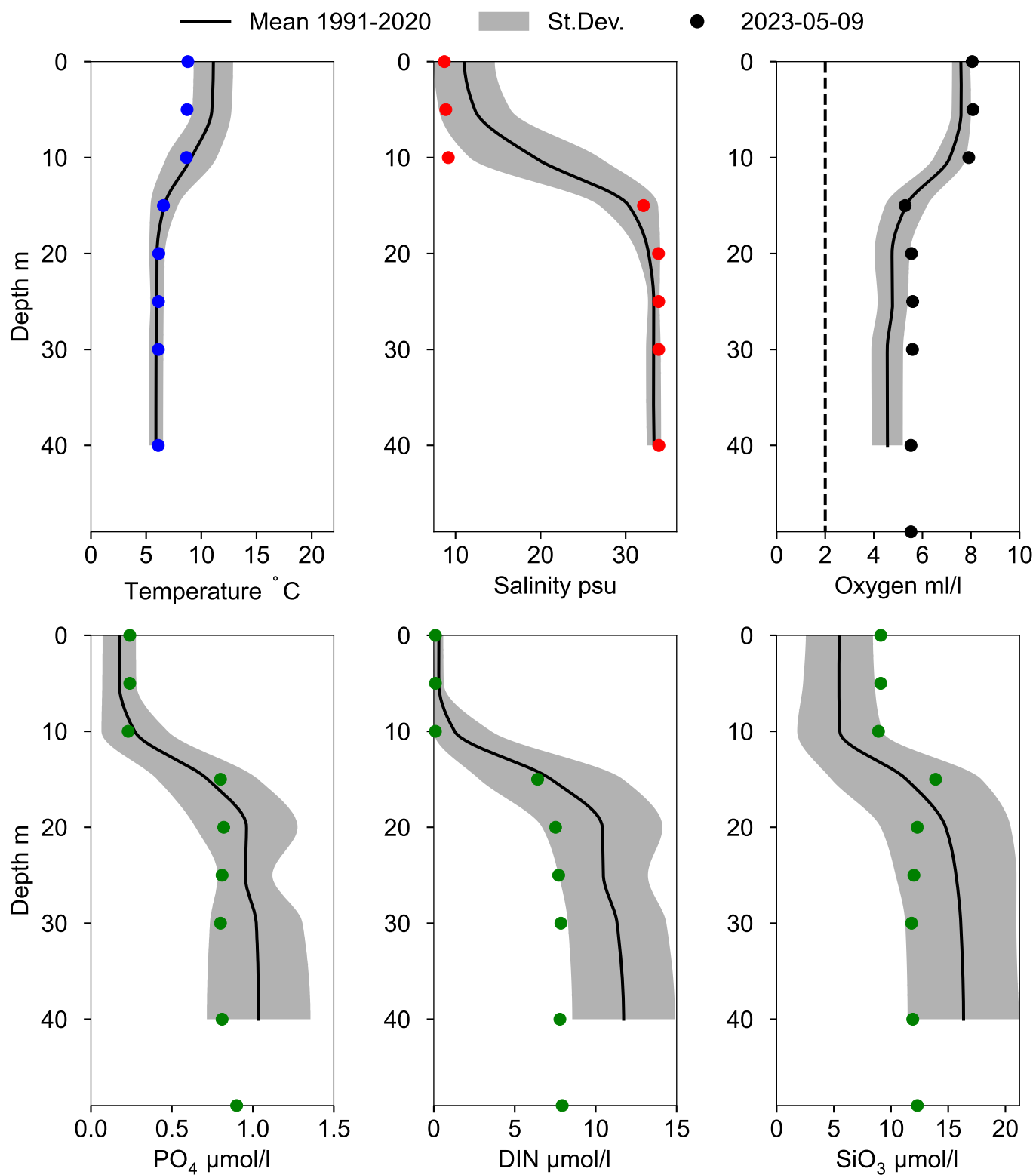
● 2023



OXYGEN IN BOTTOM WATER (depth >= 40 m)



Vertical profiles W LANDSKRONA May



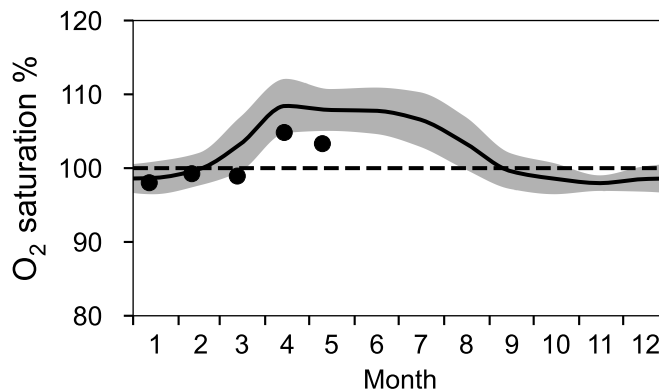
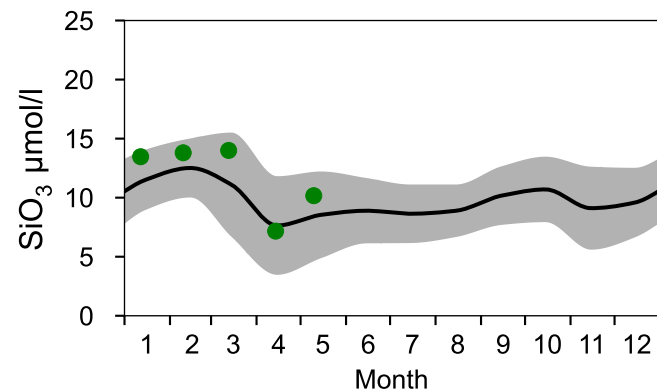
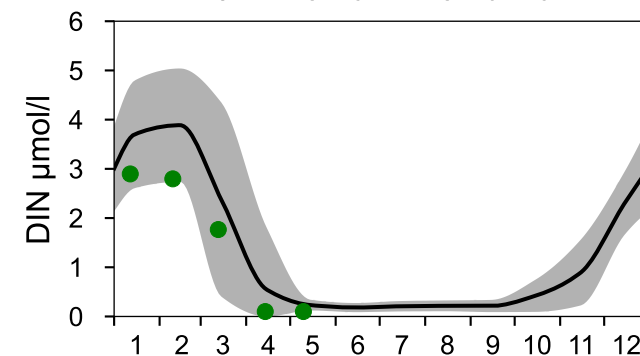
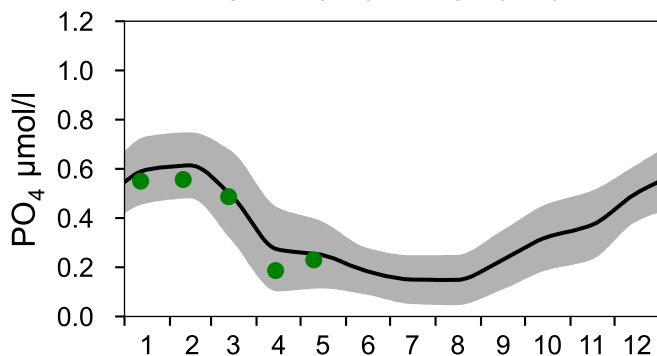
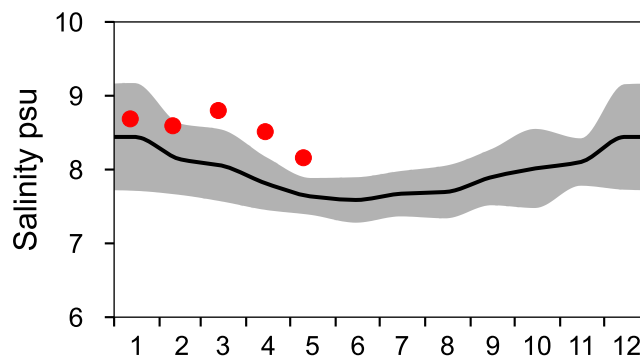
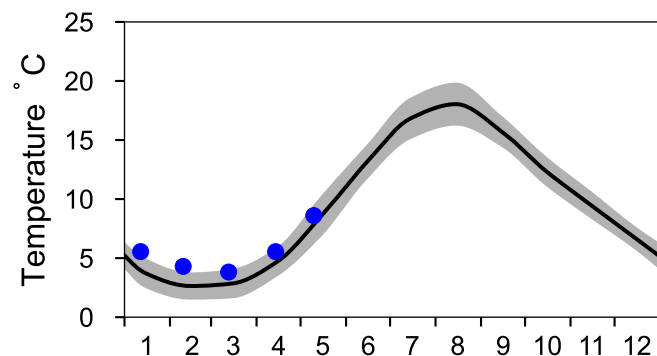
STATION BY1 SURFACE WATER (0-10 m)

Annual Cycles

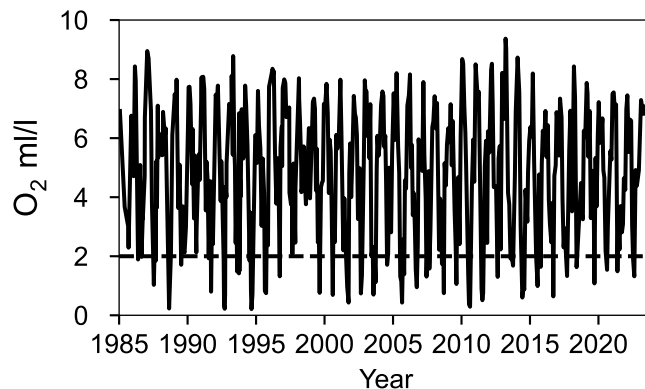
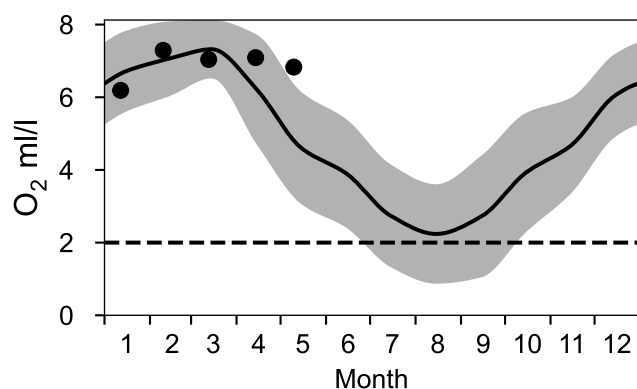
— Mean 1991-2020

■ St.Dev.

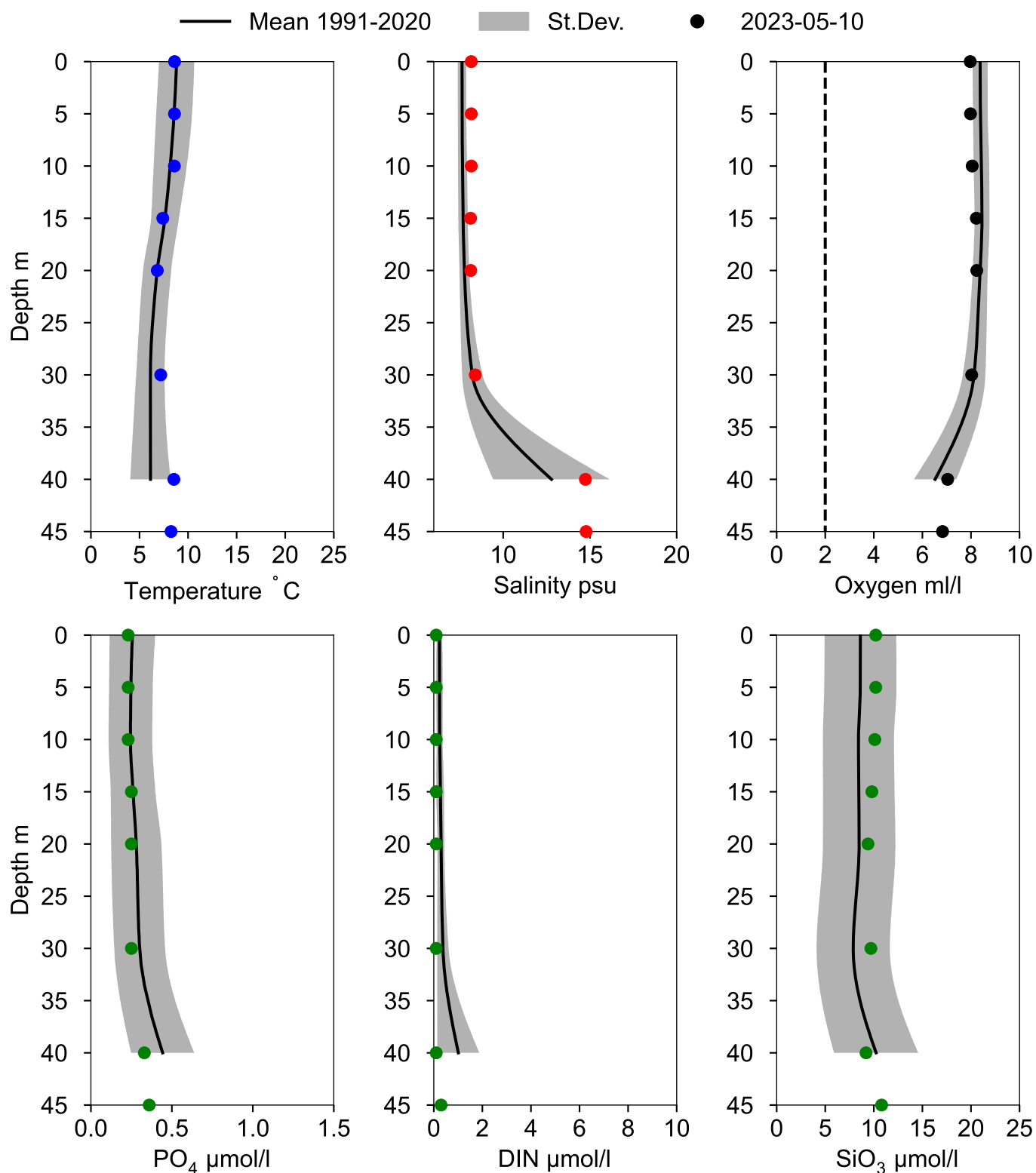
● 2023



OXYGEN IN BOTTOM WATER (depth >= 39 m)



Vertical profiles BY1 May



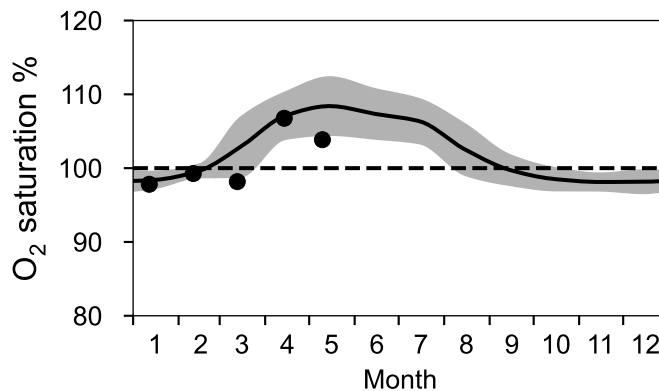
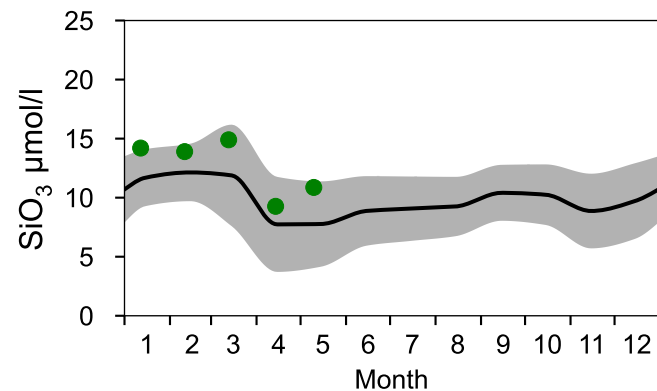
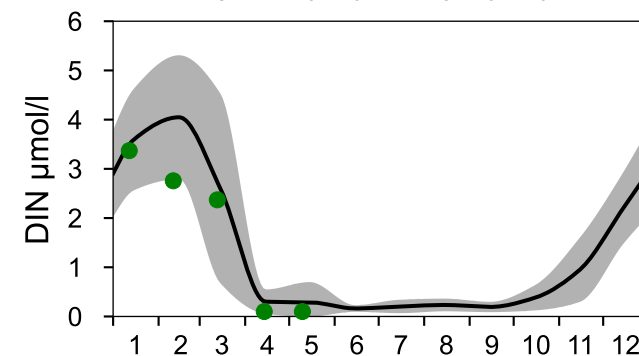
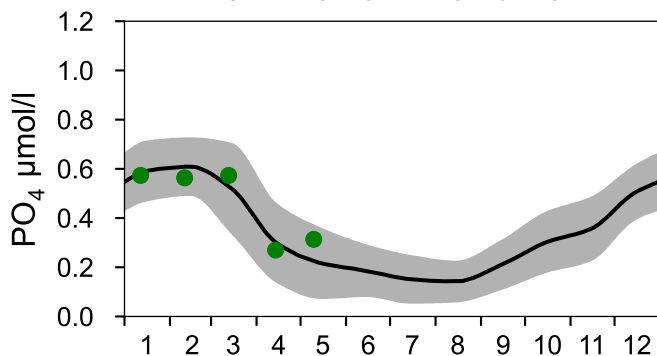
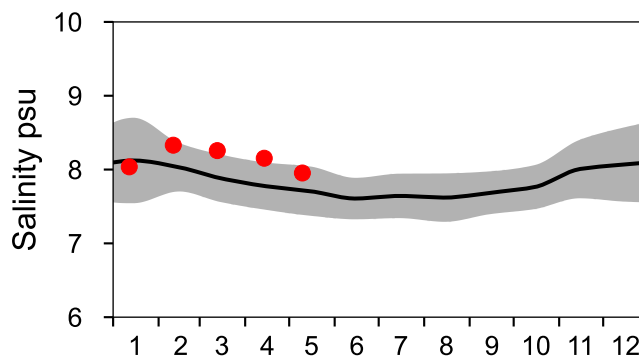
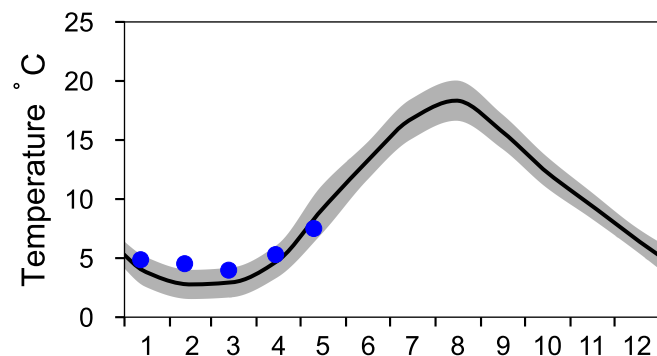
STATION BY2 ARKONA SURFACE WATER (0-10 m)

Annual Cycles

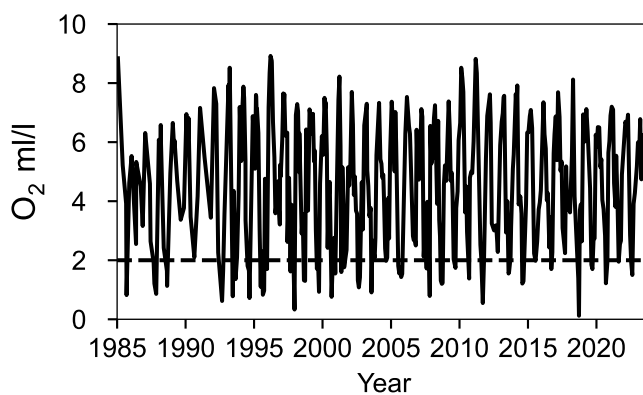
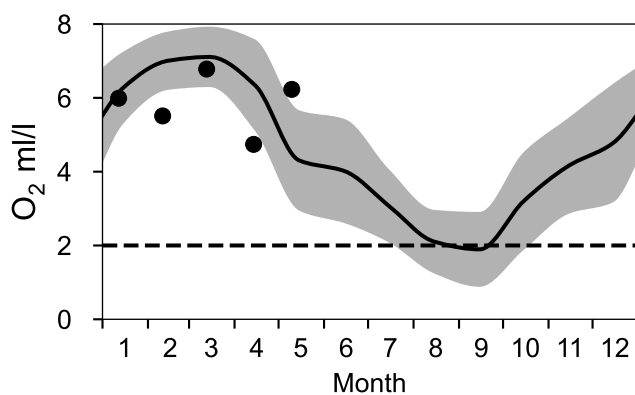
— Mean 1991-2020

■ St.Dev.

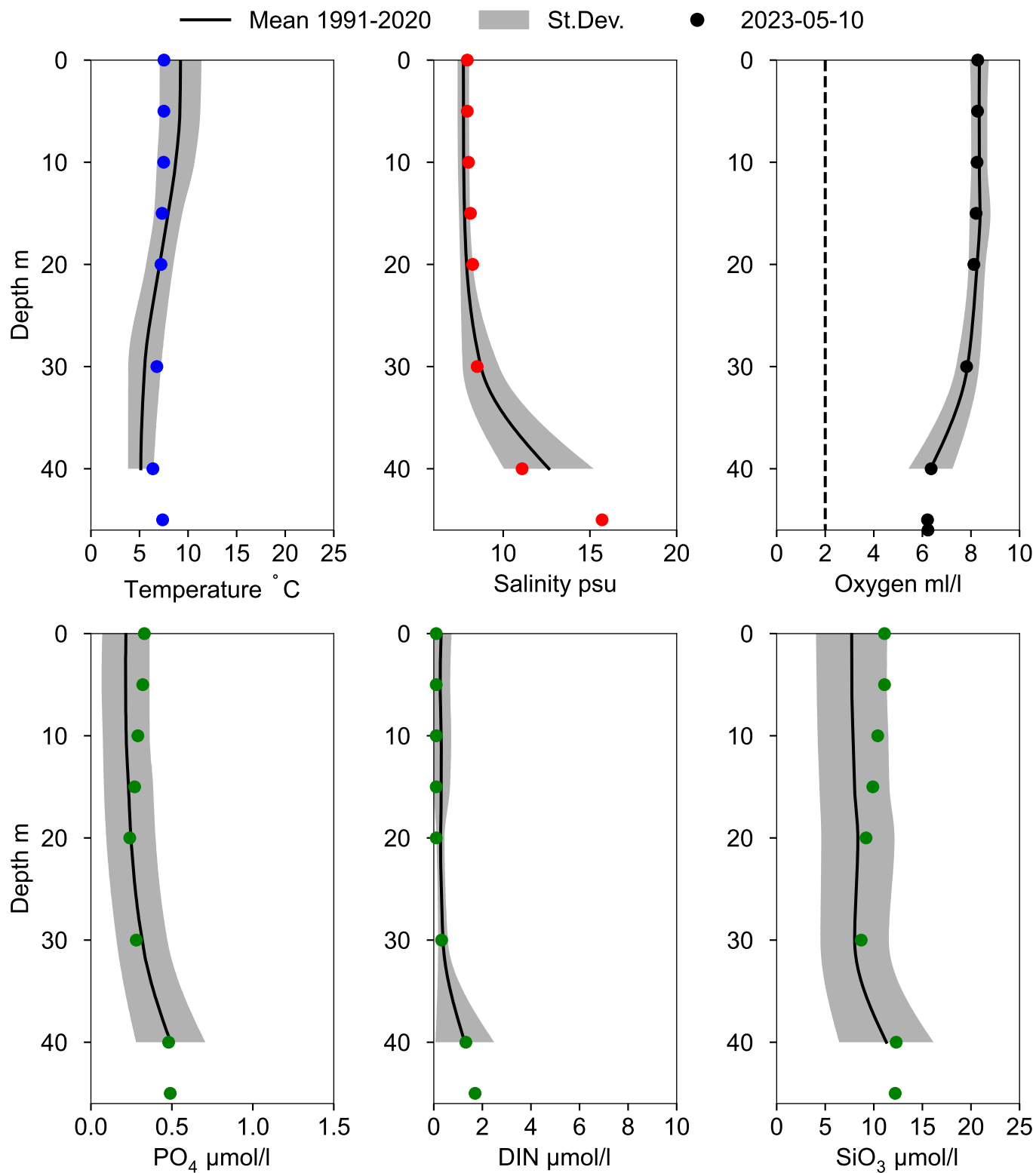
● 2023



OXYGEN IN BOTTOM WATER (depth >= 40 m)



Vertical profiles BY2 ARKONA May



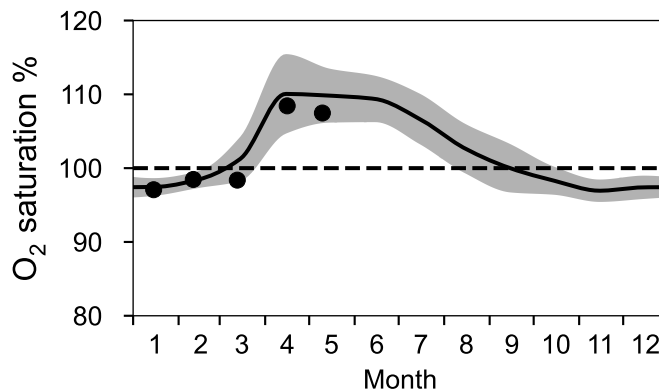
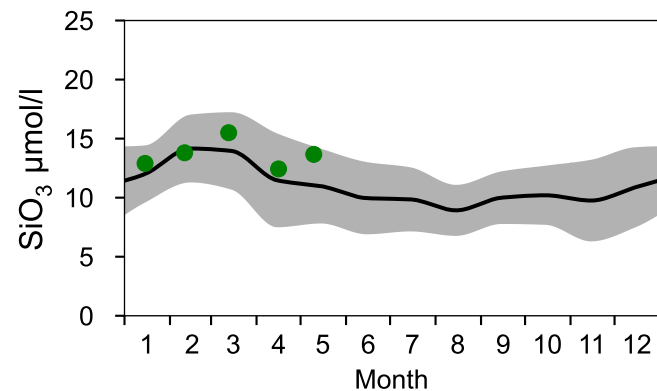
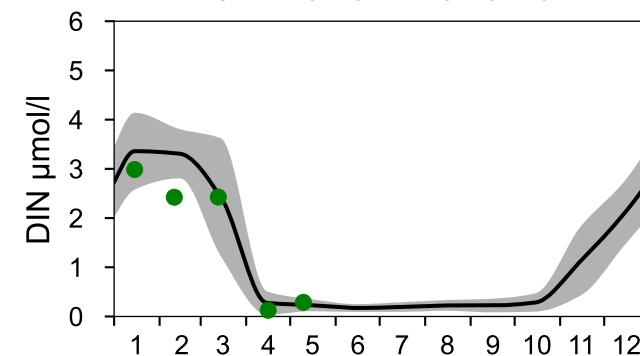
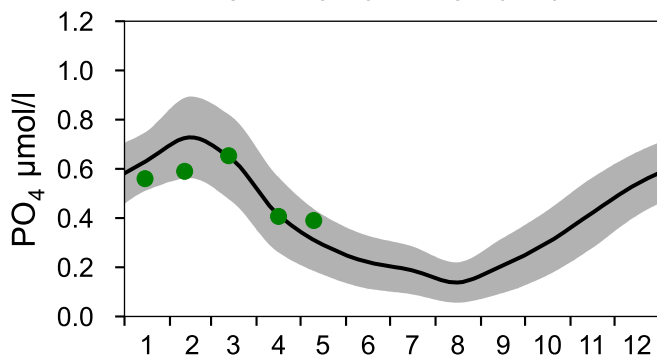
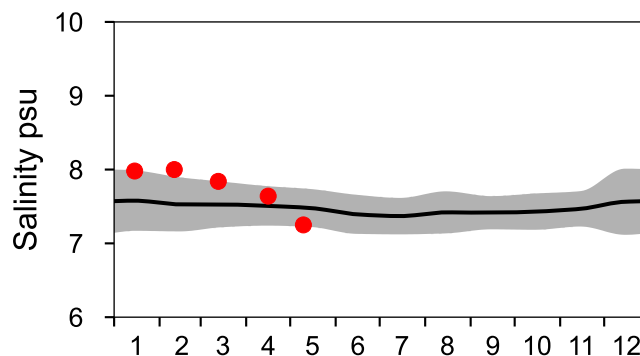
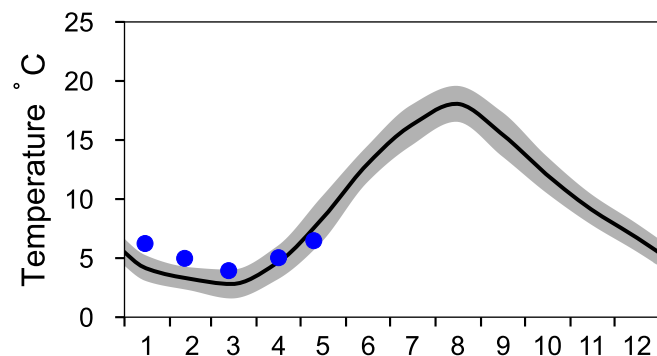
STATION HANÖBUKTEN SURFACE WATER (0-10 m)

Annual Cycles

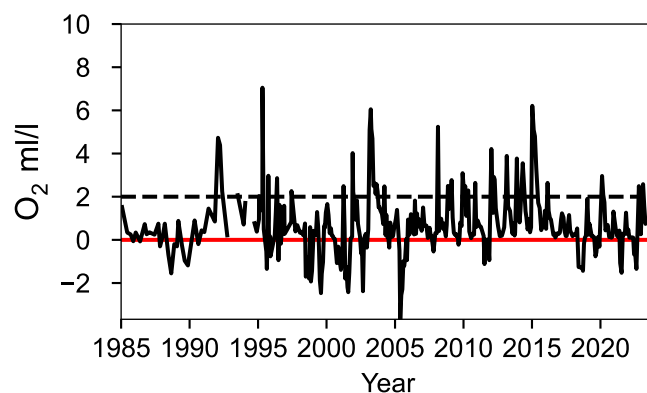
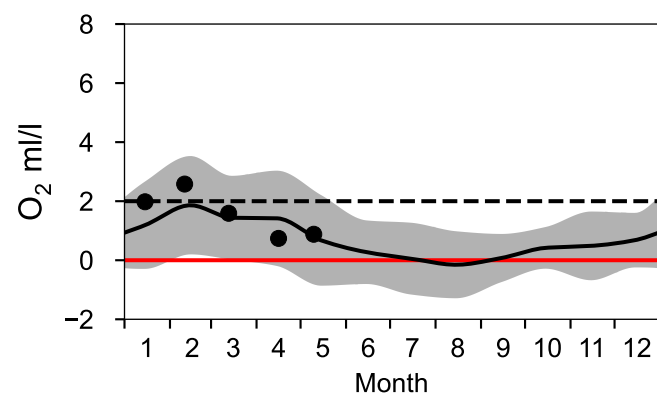
— Mean 1991-2020

■ St.Dev.

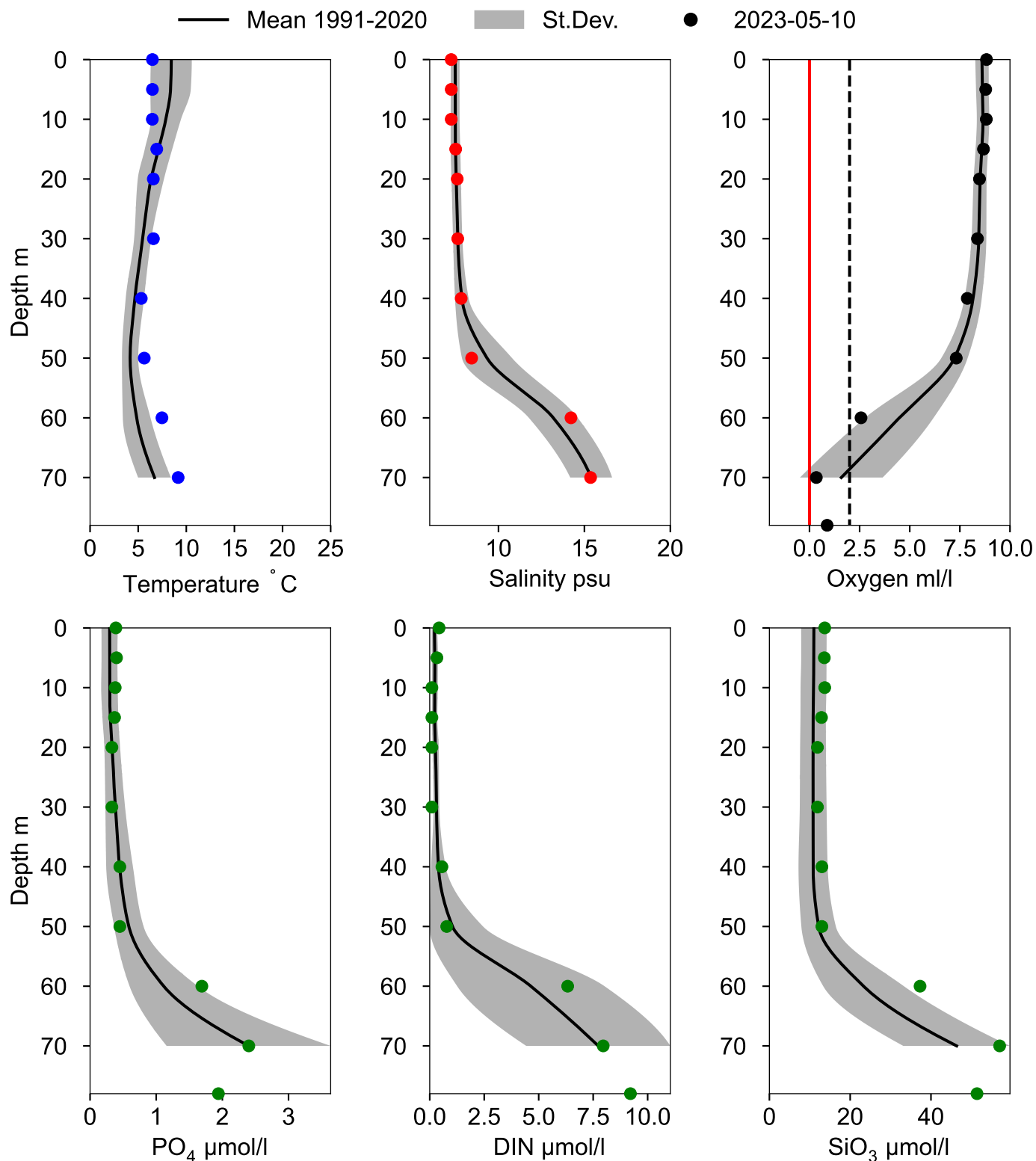
● 2023



OXYGEN IN BOTTOM WATER (depth >= 70 m)



Vertical profiles HANÖBUKTEN May



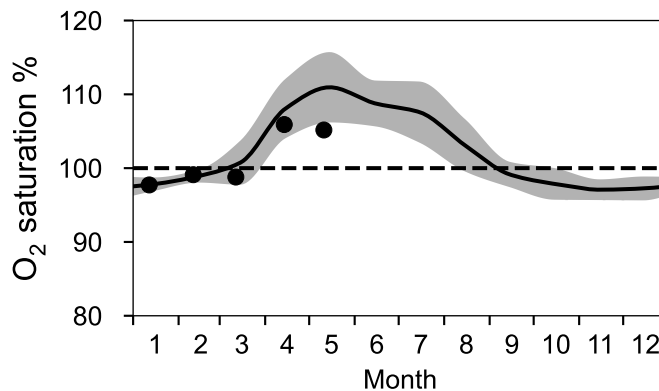
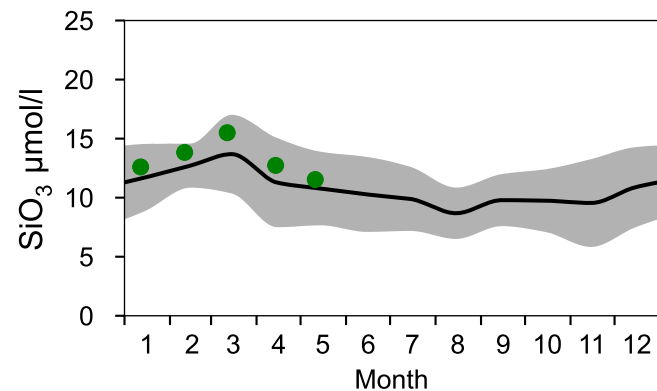
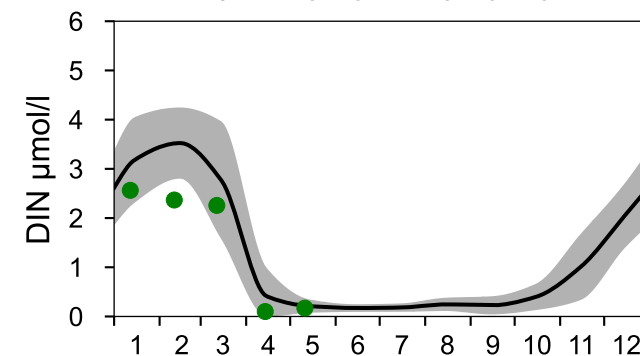
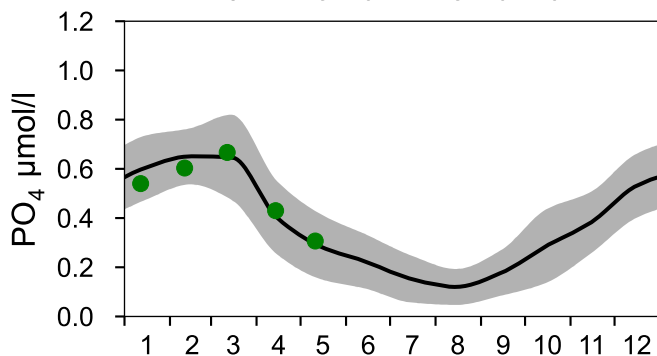
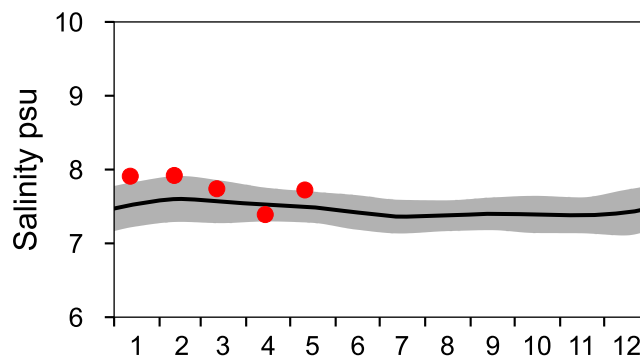
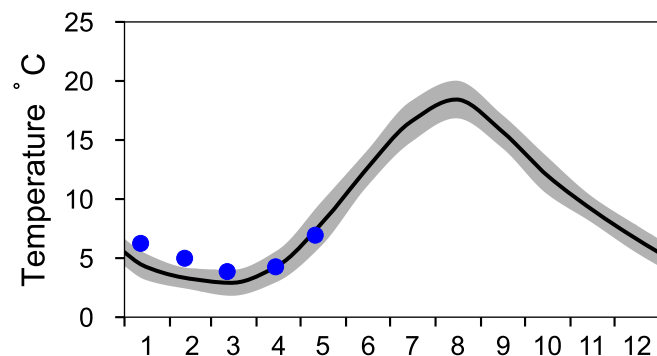
STATION BY4 CHRISTIANSÖ SURFACE WATER (0-10 m)

Annual Cycles

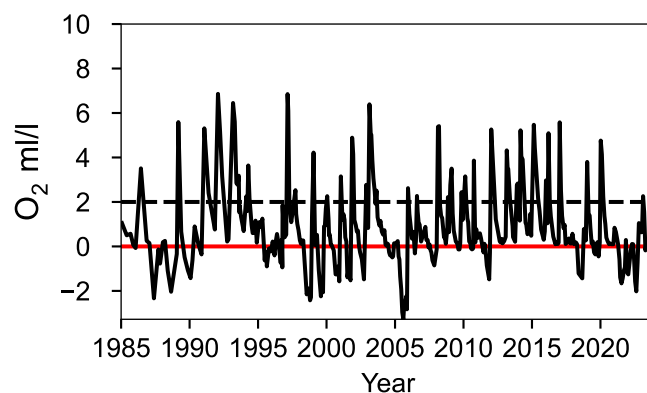
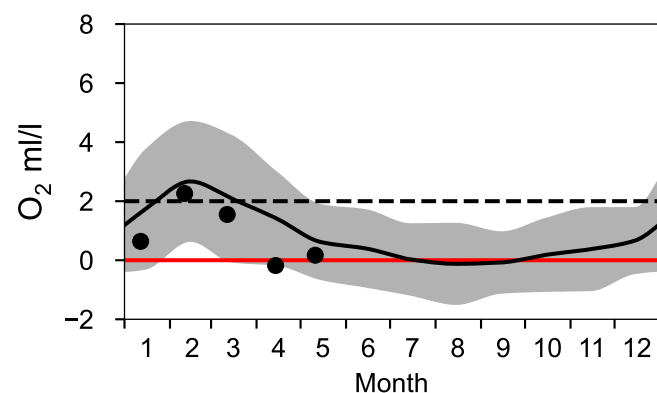
— Mean 1991-2020

■ St.Dev.

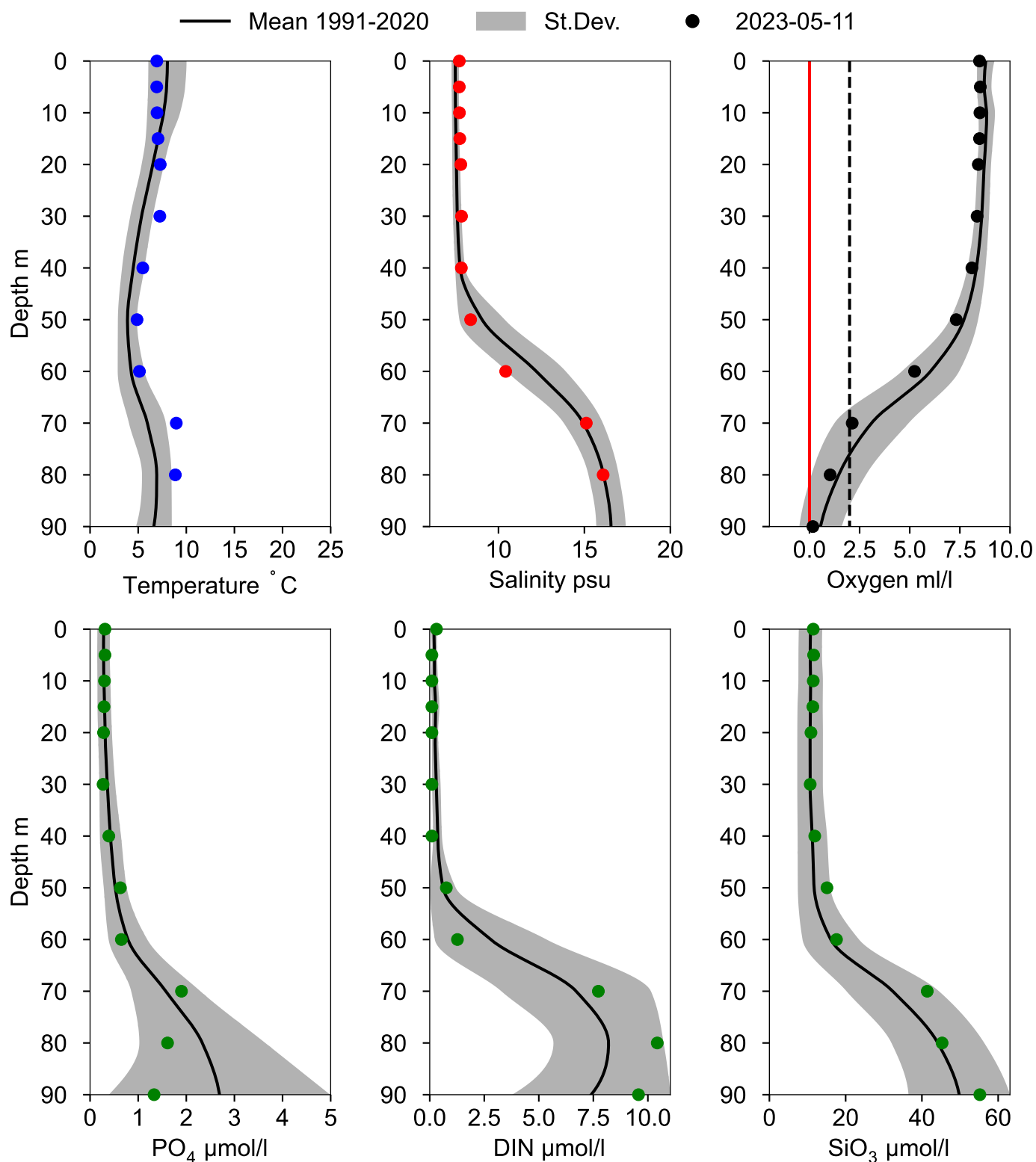
● 2023



OXYGEN IN BOTTOM WATER (depth >= 80 m)



Vertical profiles BY4 CHRISTIANSÖ May



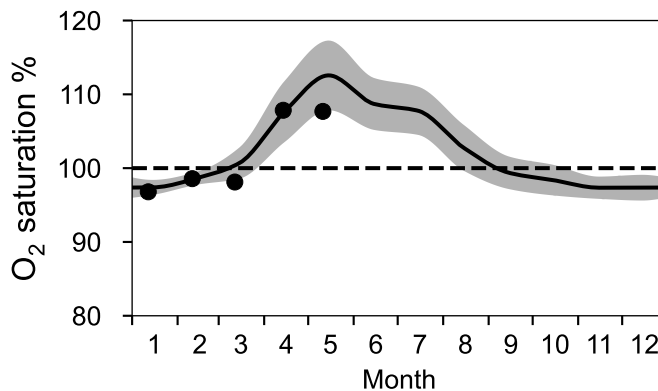
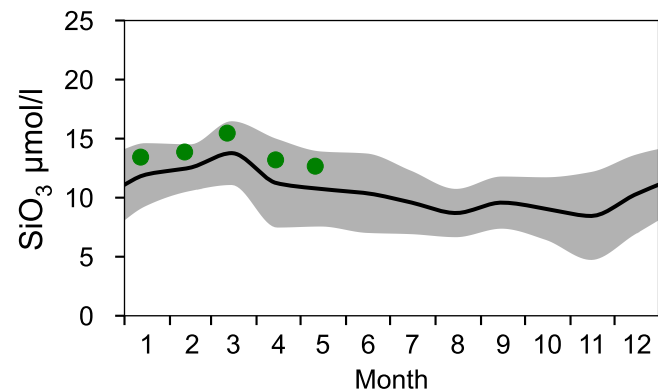
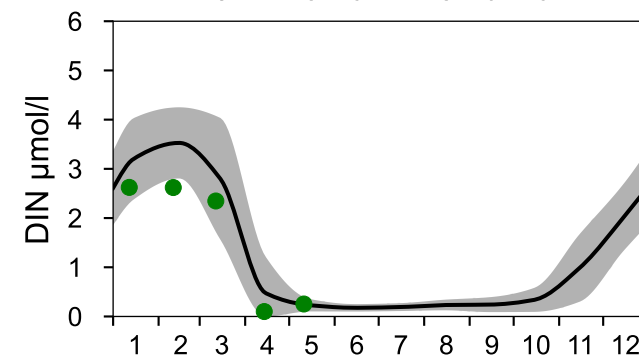
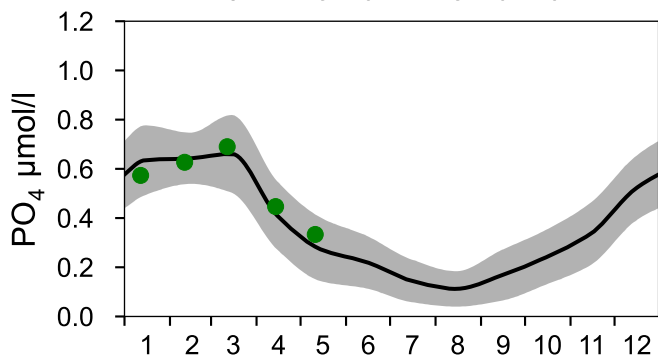
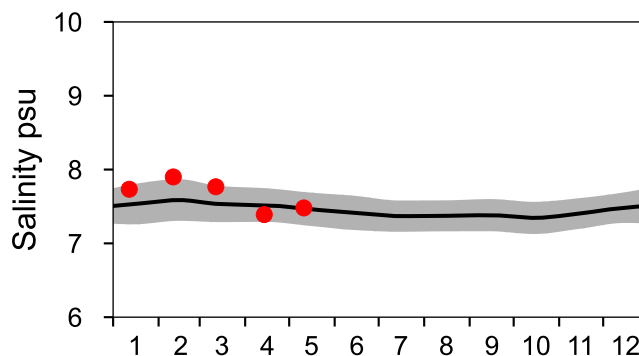
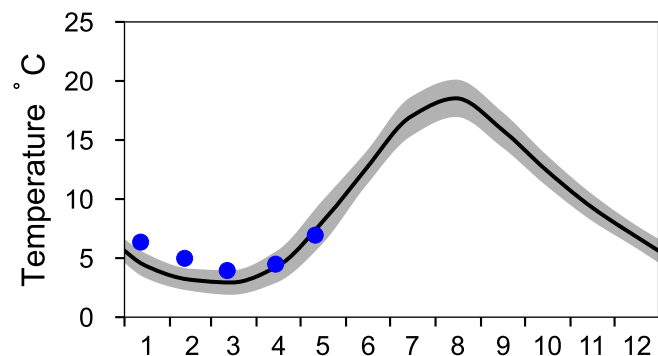
STATION BY5 BORNHOLMSDJ SURFACE WATER (0-10 m)

Annual Cycles

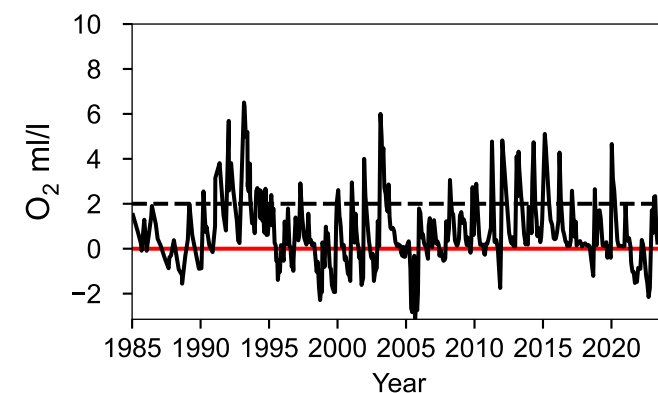
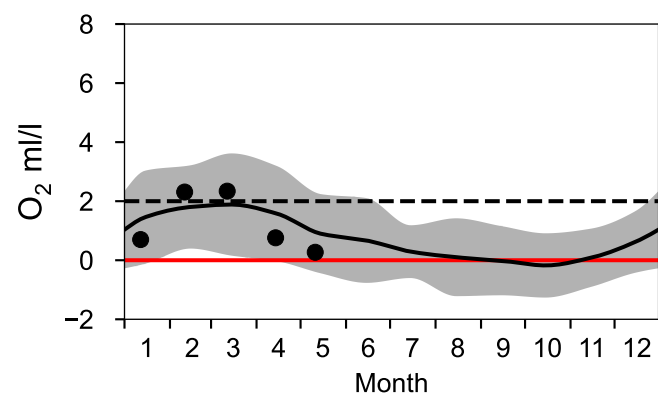
— Mean 1991-2020

■ St.Dev.

● 2023

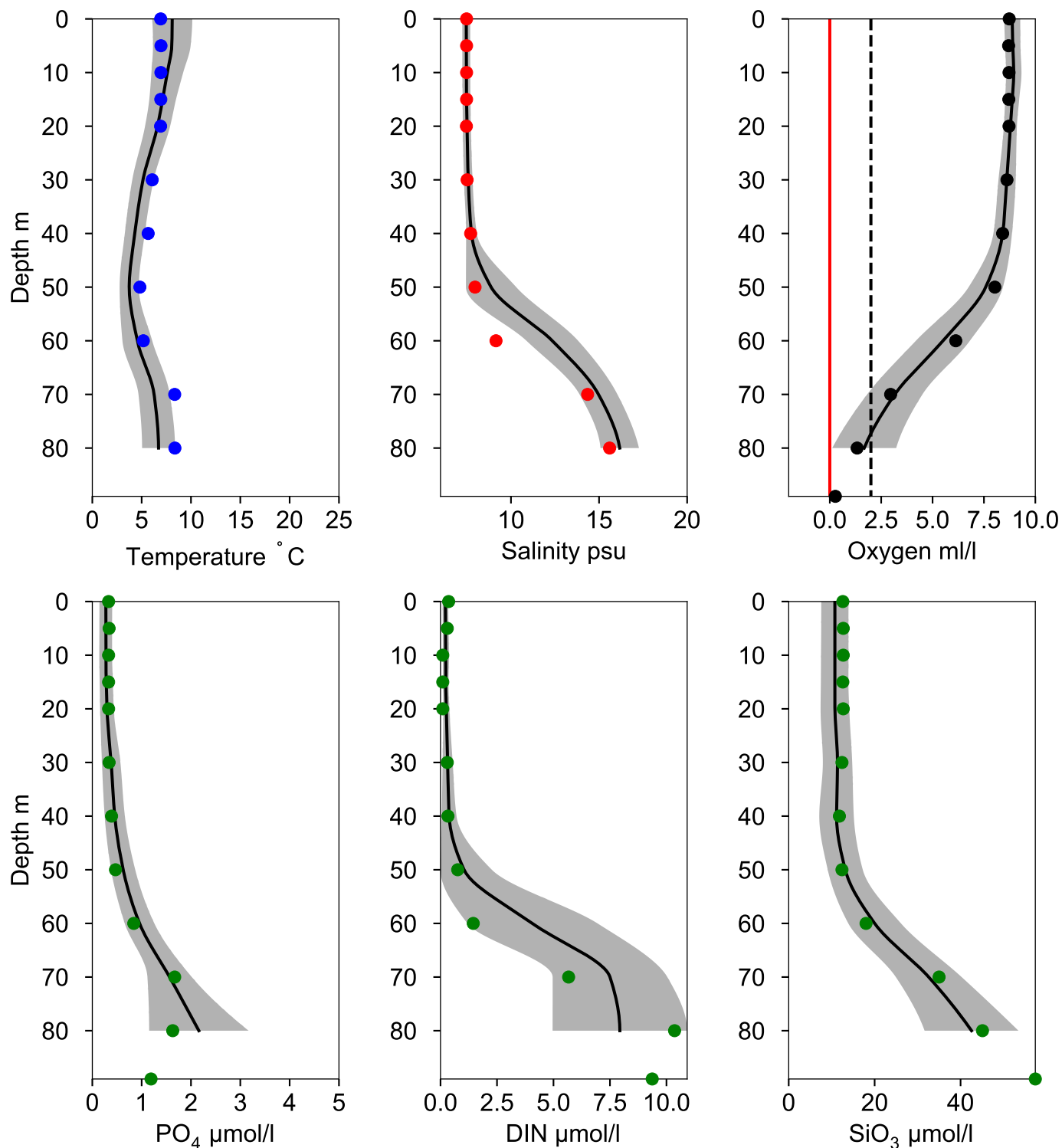


OXYGEN IN BOTTOM WATER (depth >= 80 m)



Vertical profiles BY5 BORNHOLMSDJ May

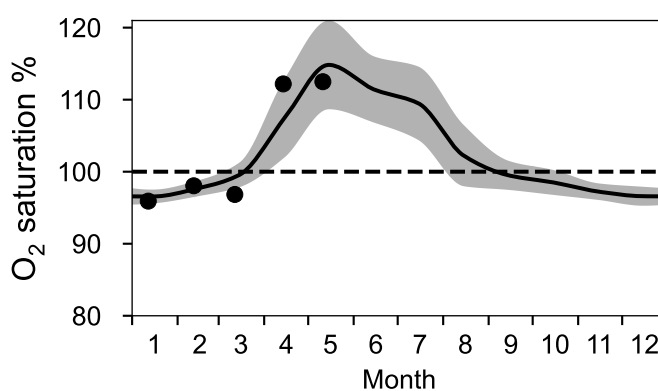
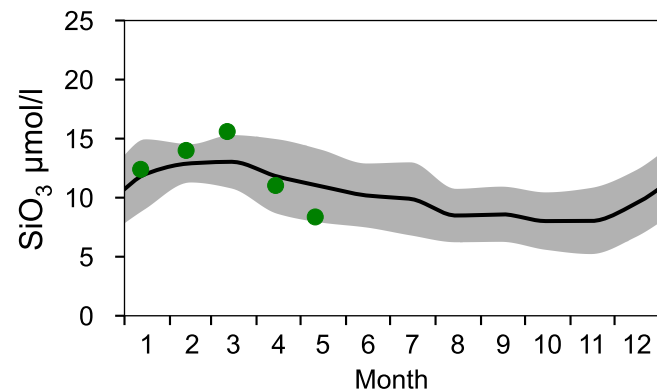
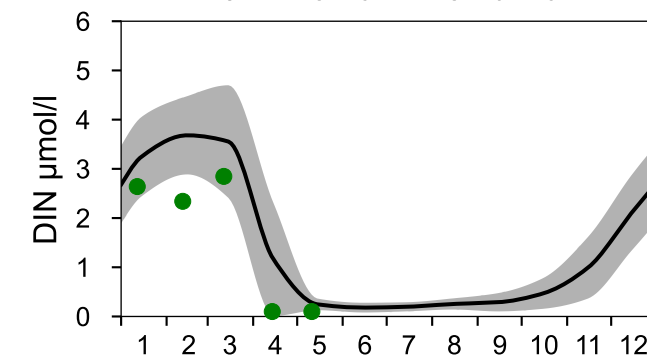
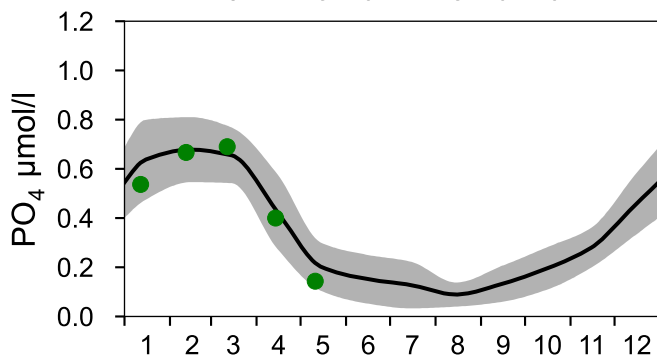
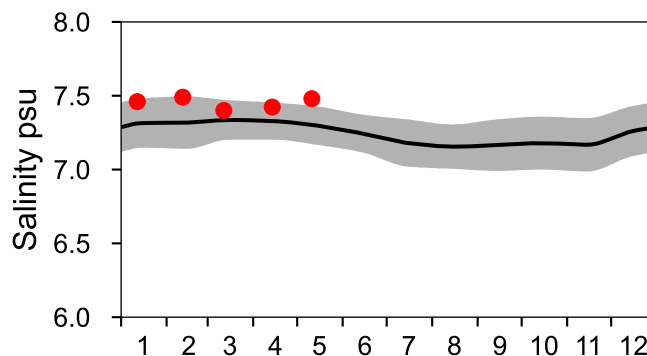
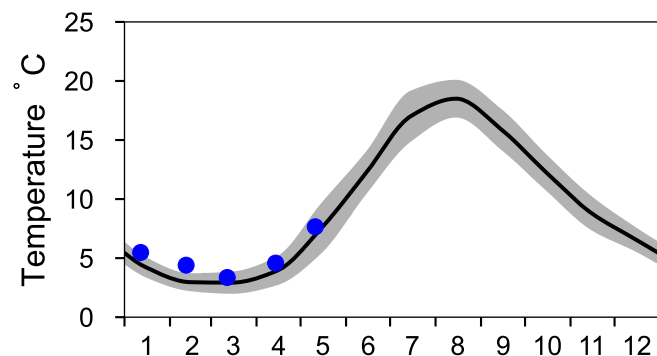
— Mean 1991-2020 St.Dev. ● 2023-05-11



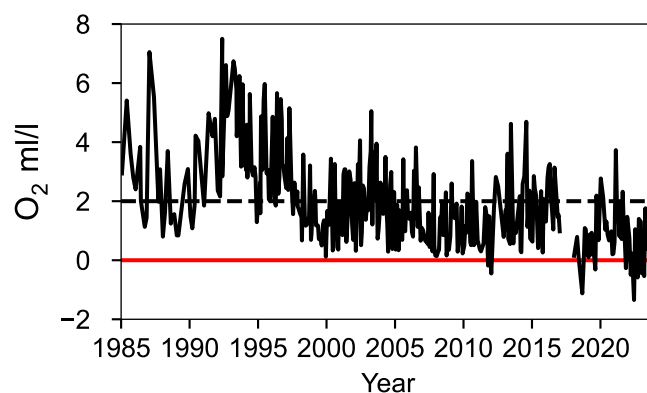
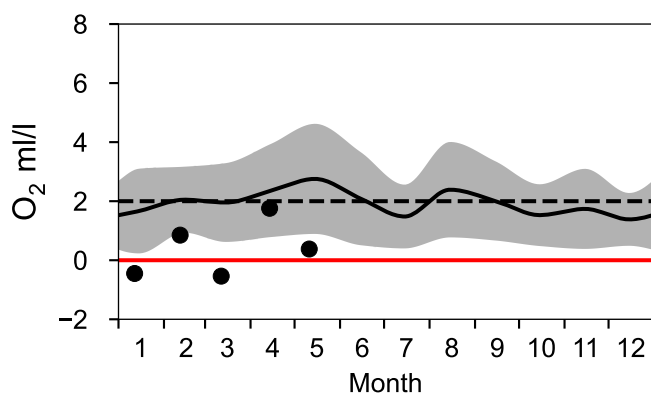
STATION BCS III-10 SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023

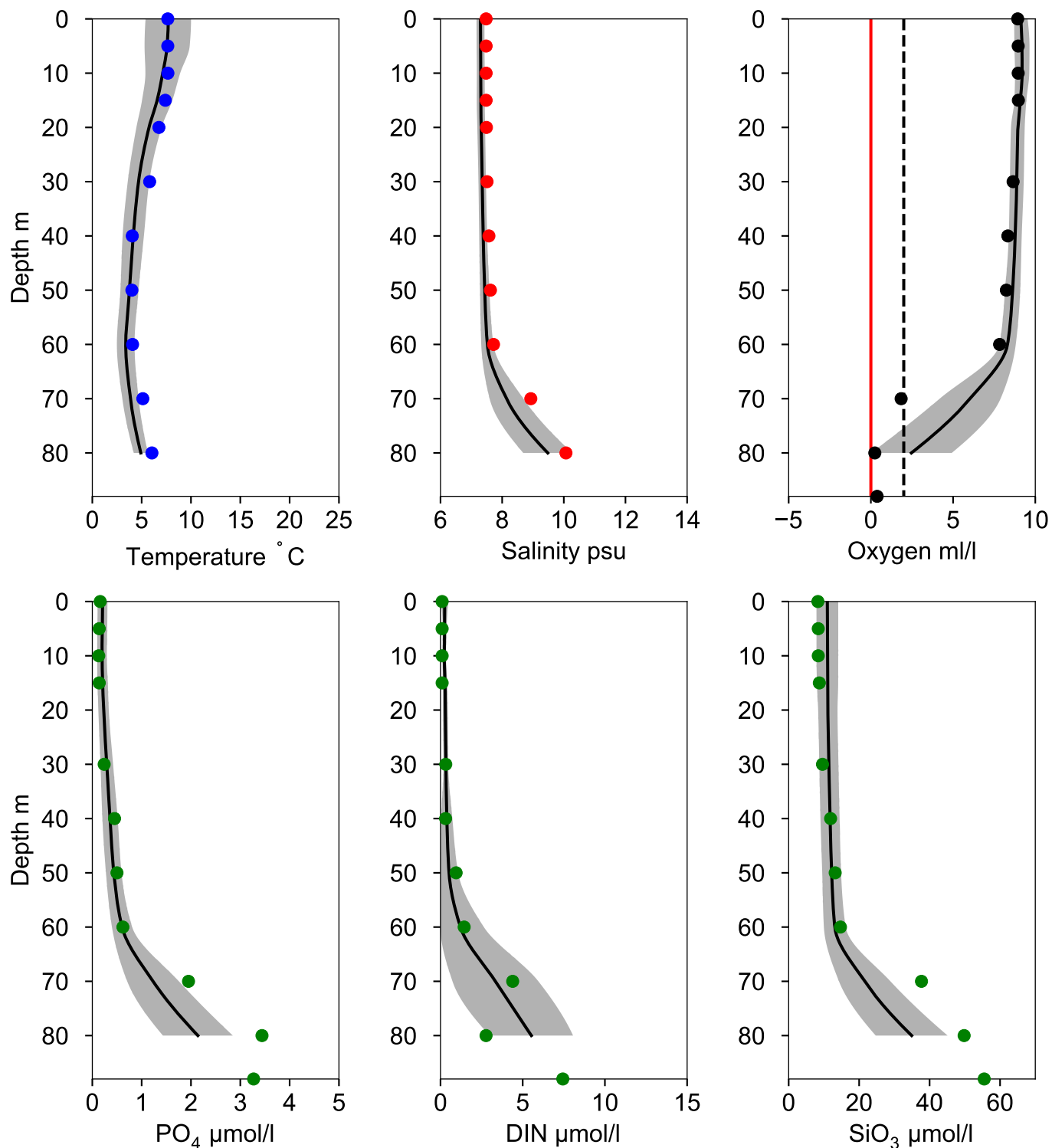


OXYGEN IN BOTTOM WATER (depth >= 80 m)



Vertical profiles BCS III-10 May

— Mean 1991-2020 St.Dev. ● 2023-05-11



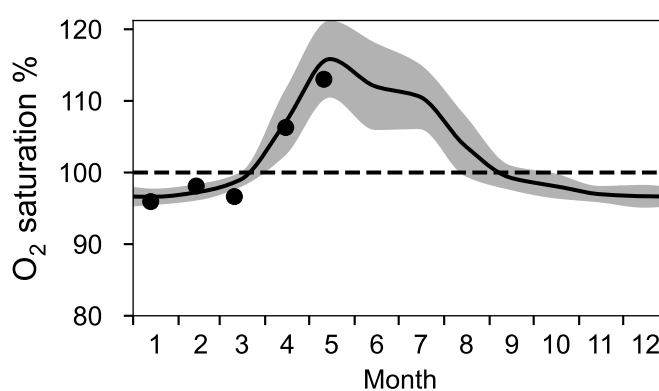
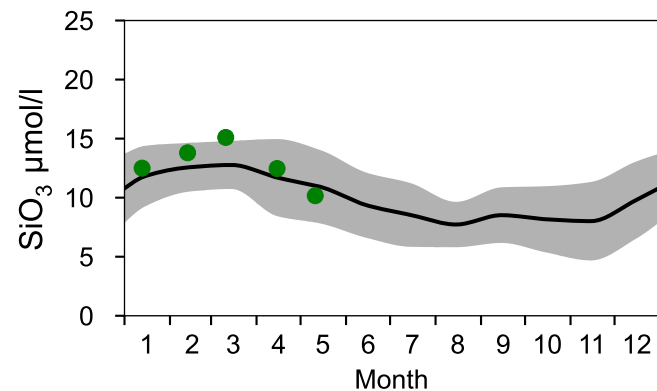
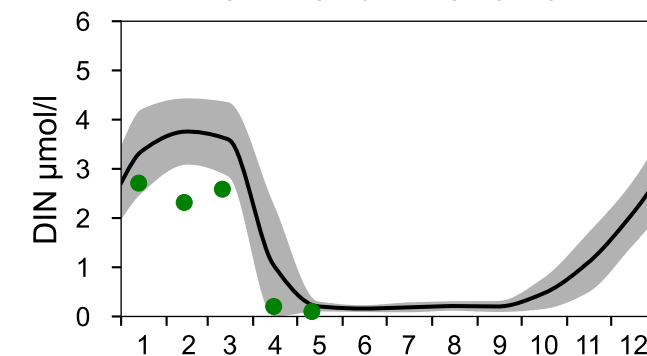
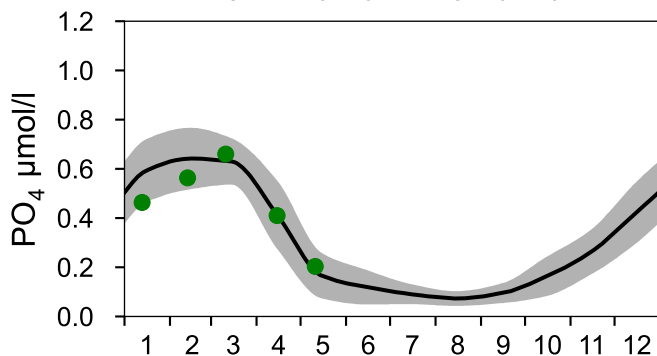
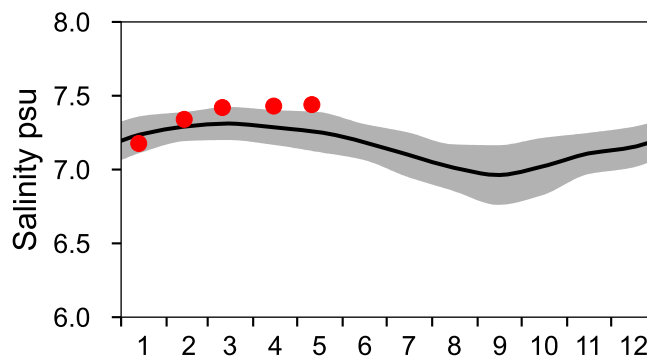
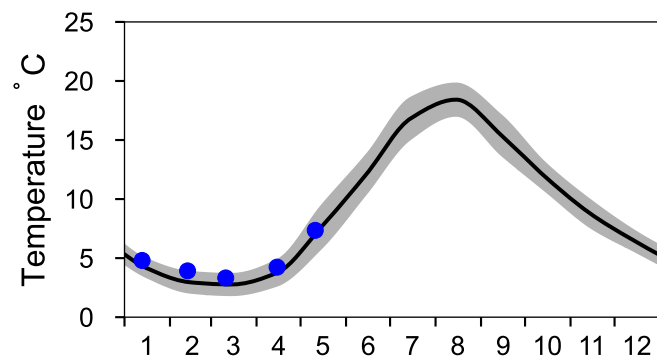
STATION BY10 SURFACE WATER (0-10 m)

Annual Cycles

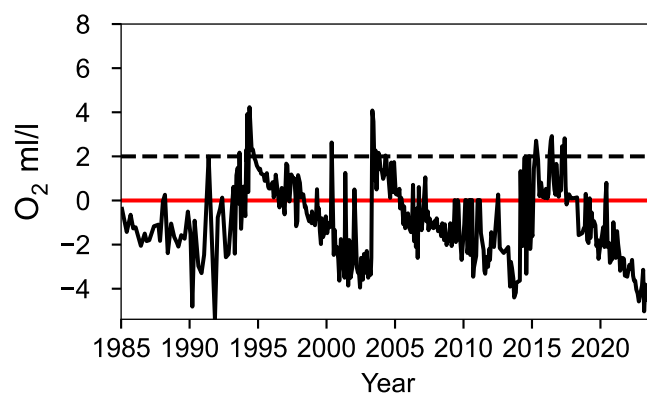
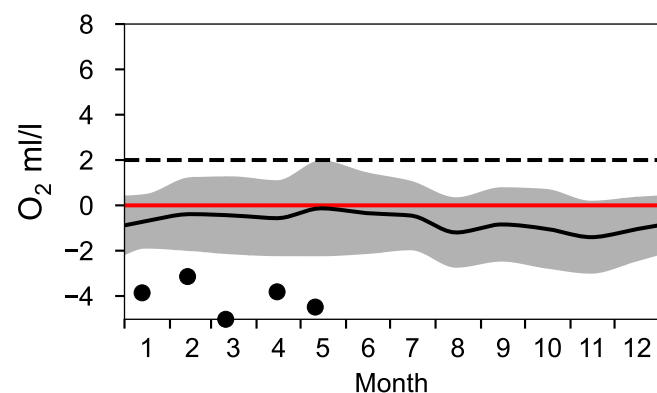
— Mean 1991-2020

■ St.Dev.

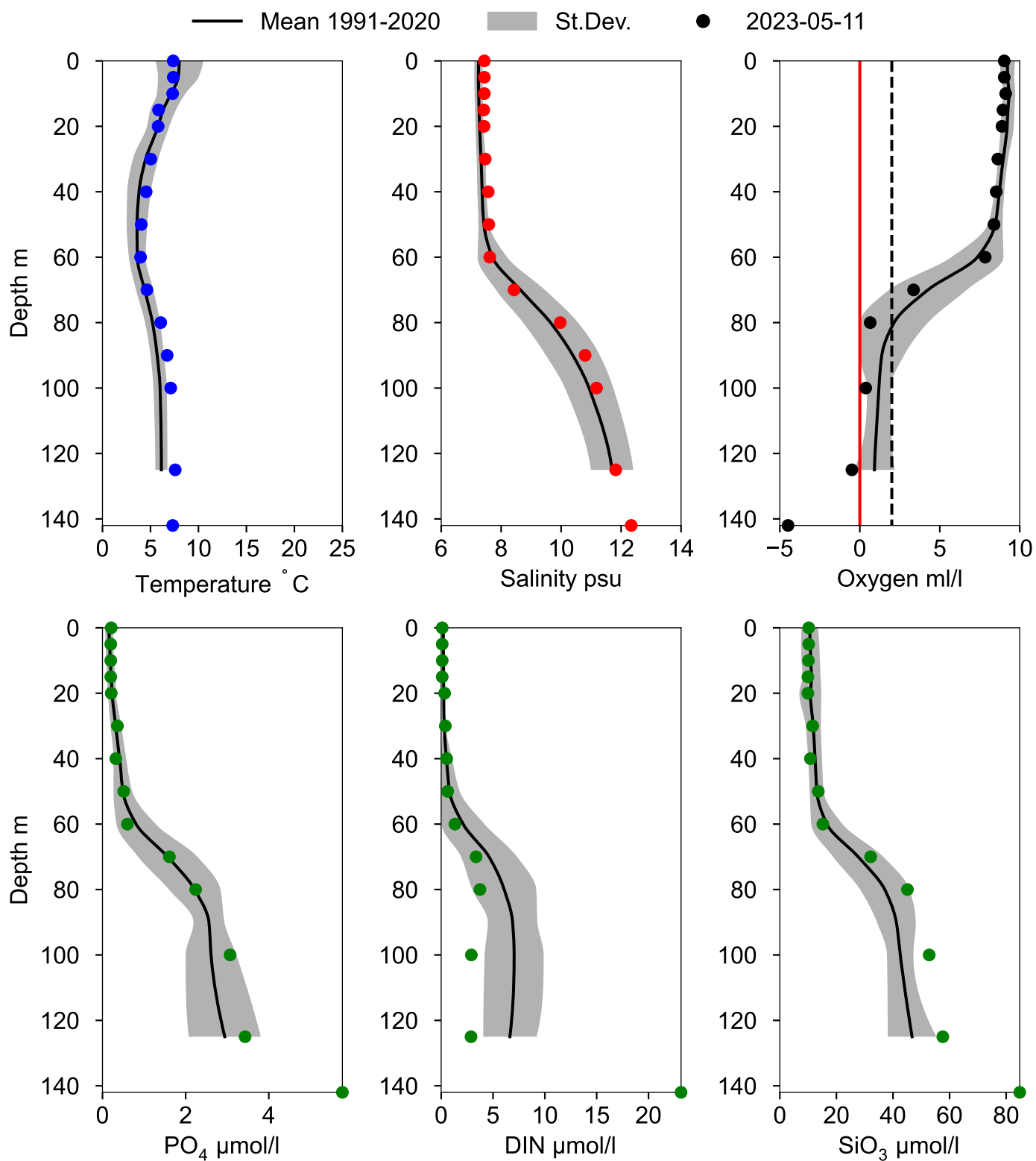
● 2023



OXYGEN IN BOTTOM WATER (depth >= 125 m)



Vertical profiles BY10 May



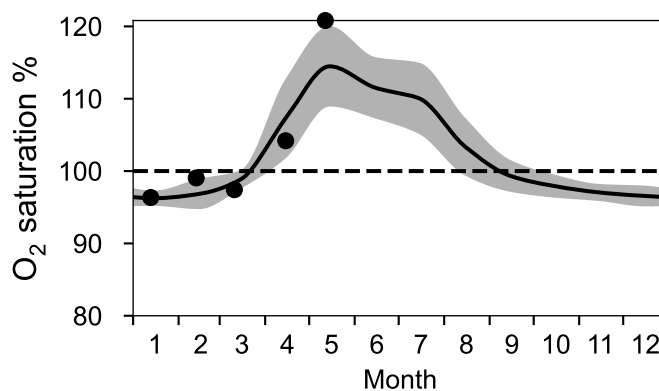
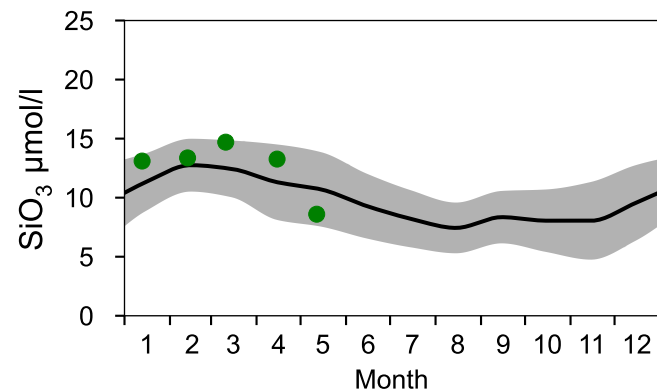
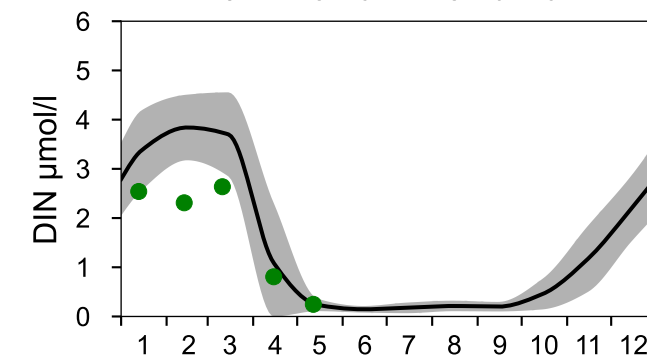
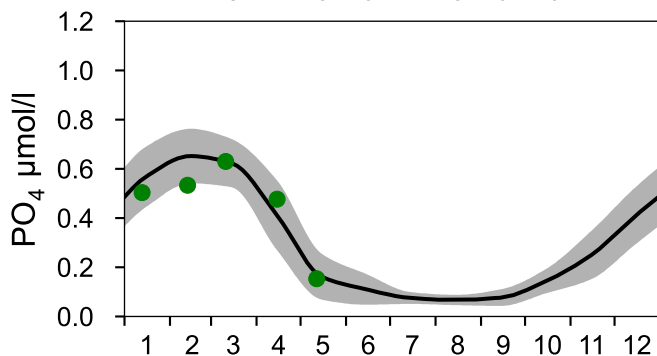
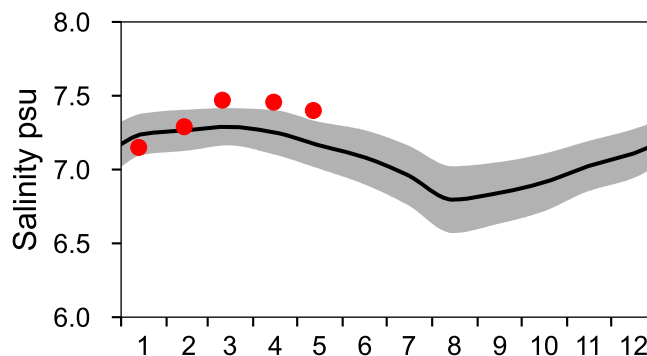
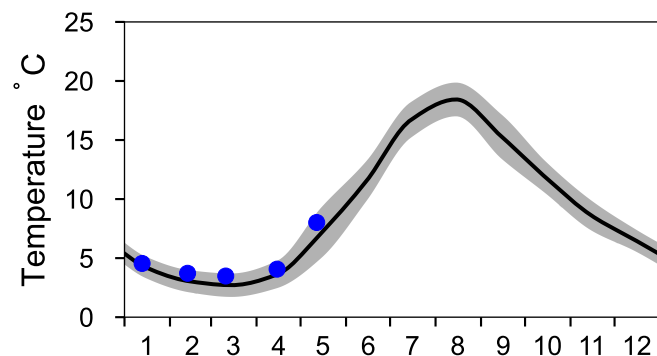
STATION BY15 GOTLANDSDJ SURFACE WATER (0-10 m)

Annual Cycles

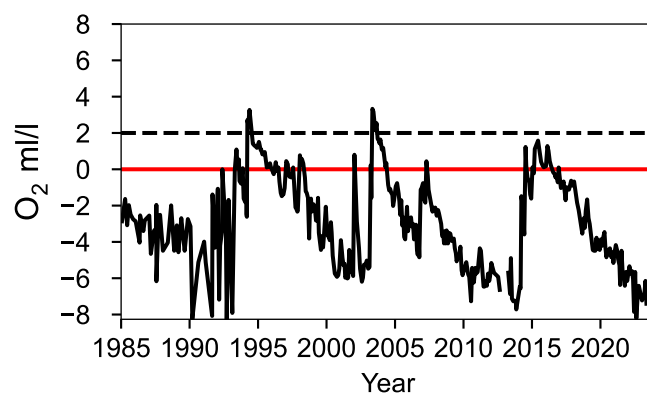
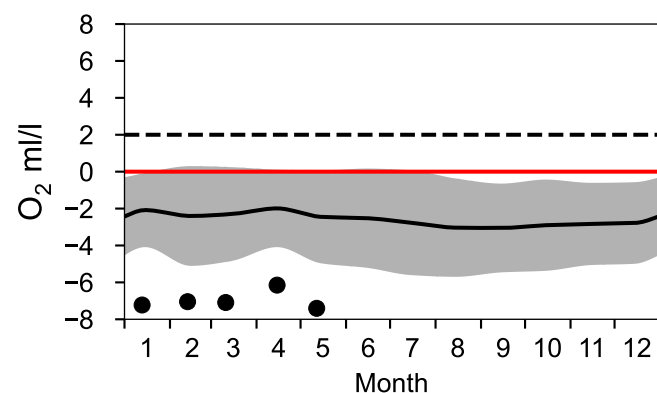
— Mean 1991-2020

■ St.Dev.

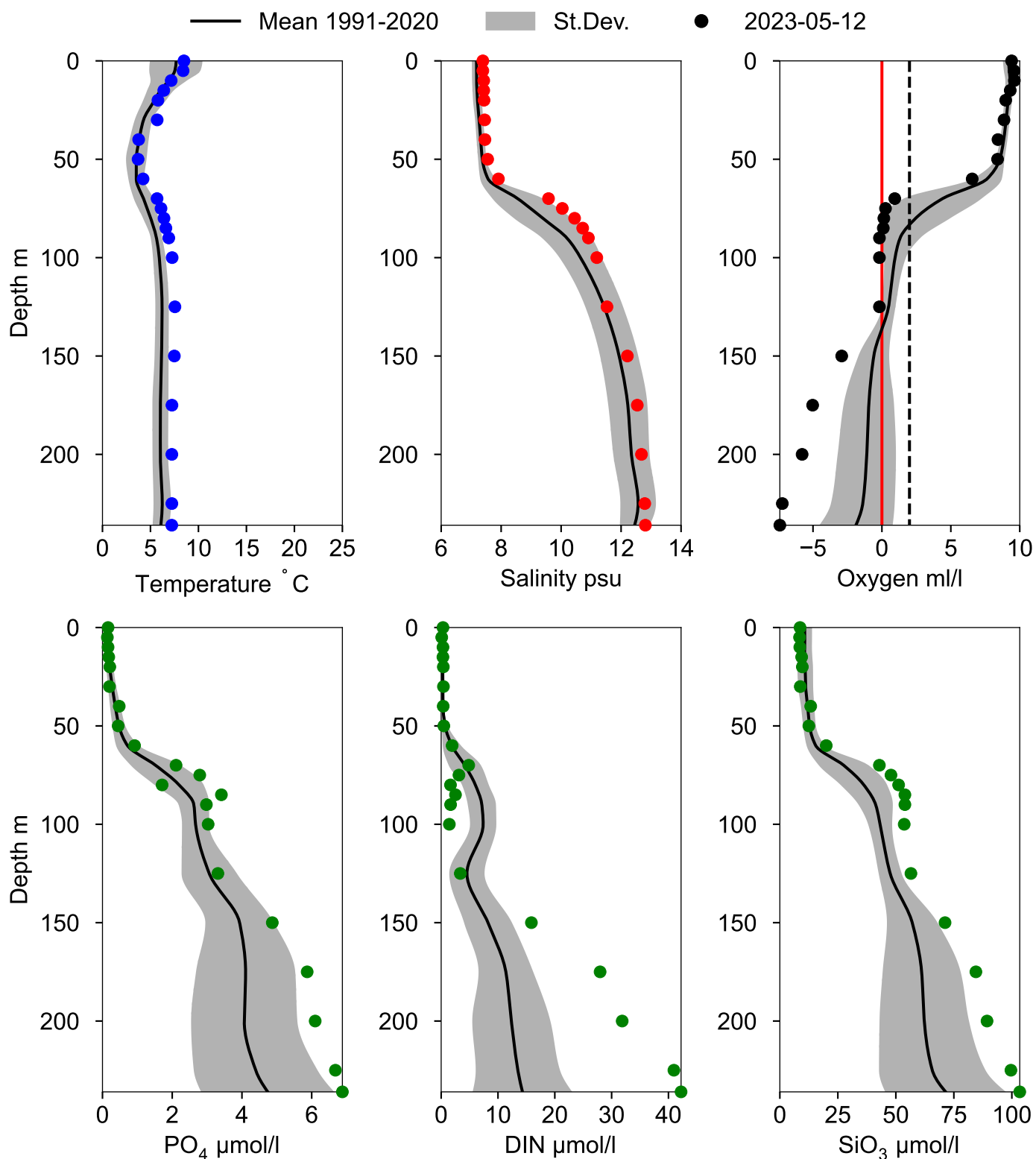
● 2023



OXYGEN IN BOTTOM WATER (depth >= 225 m)



Vertical profiles BY15 GOTLANDSDJ May



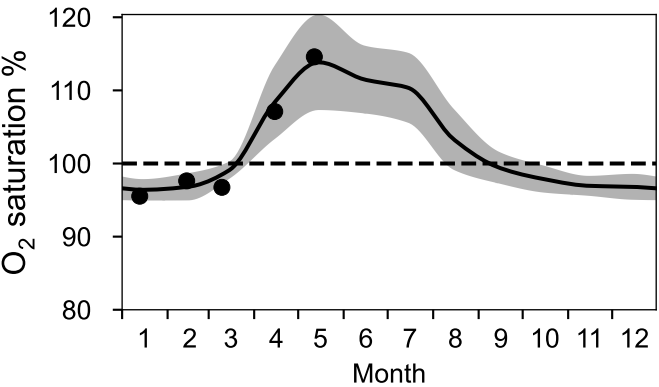
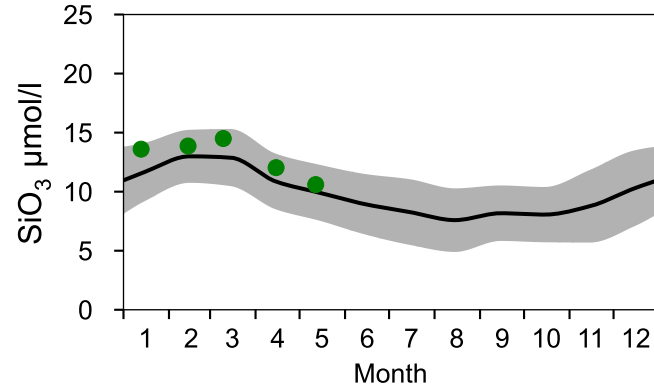
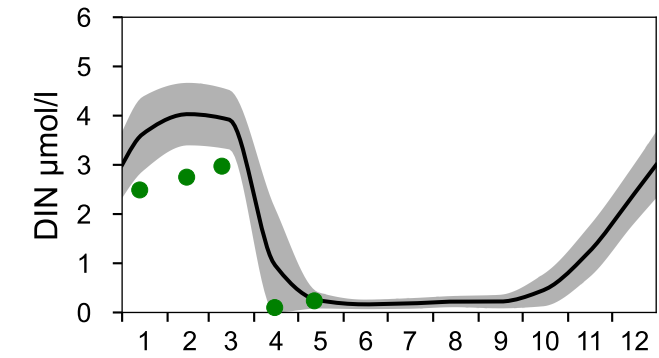
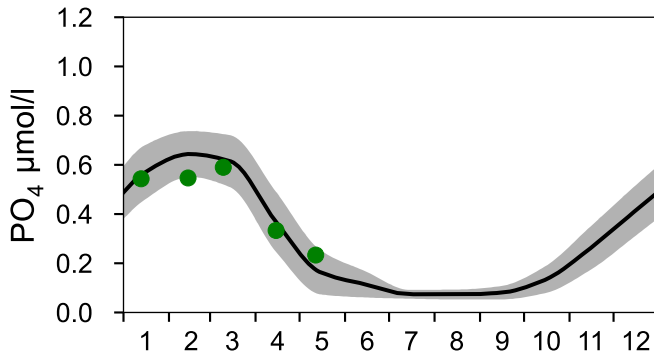
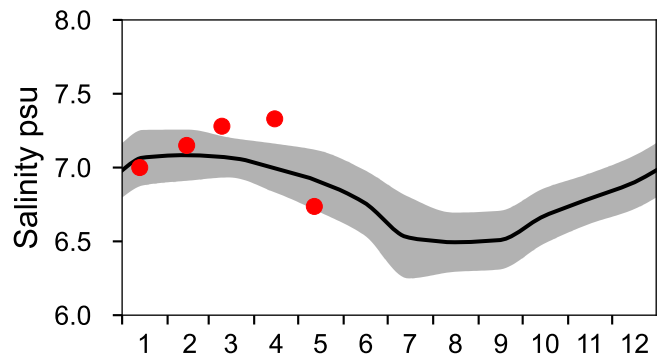
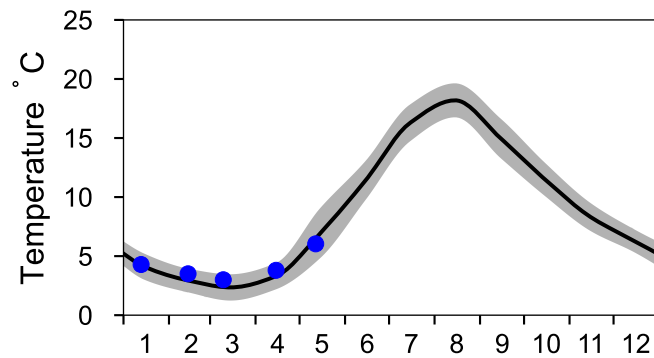
STATION BY20 FÄRÖDJ SURFACE WATER (0-10 m)

Annual Cycles

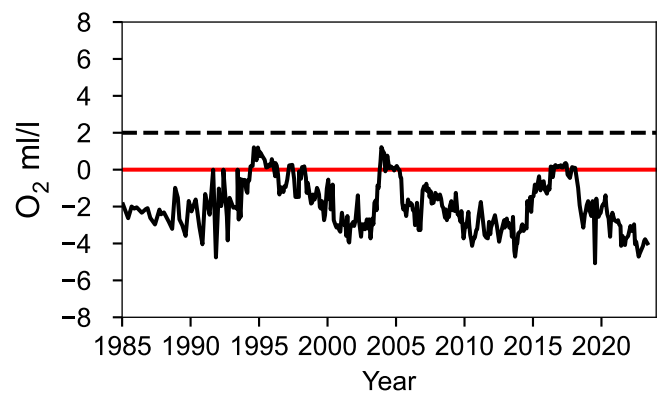
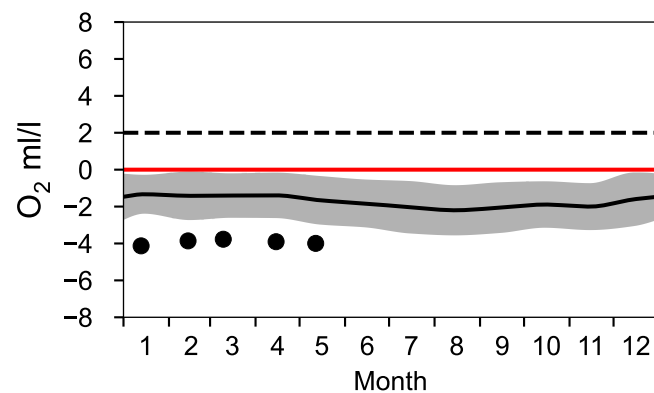
— Mean 1991-2020

■ St.Dev.

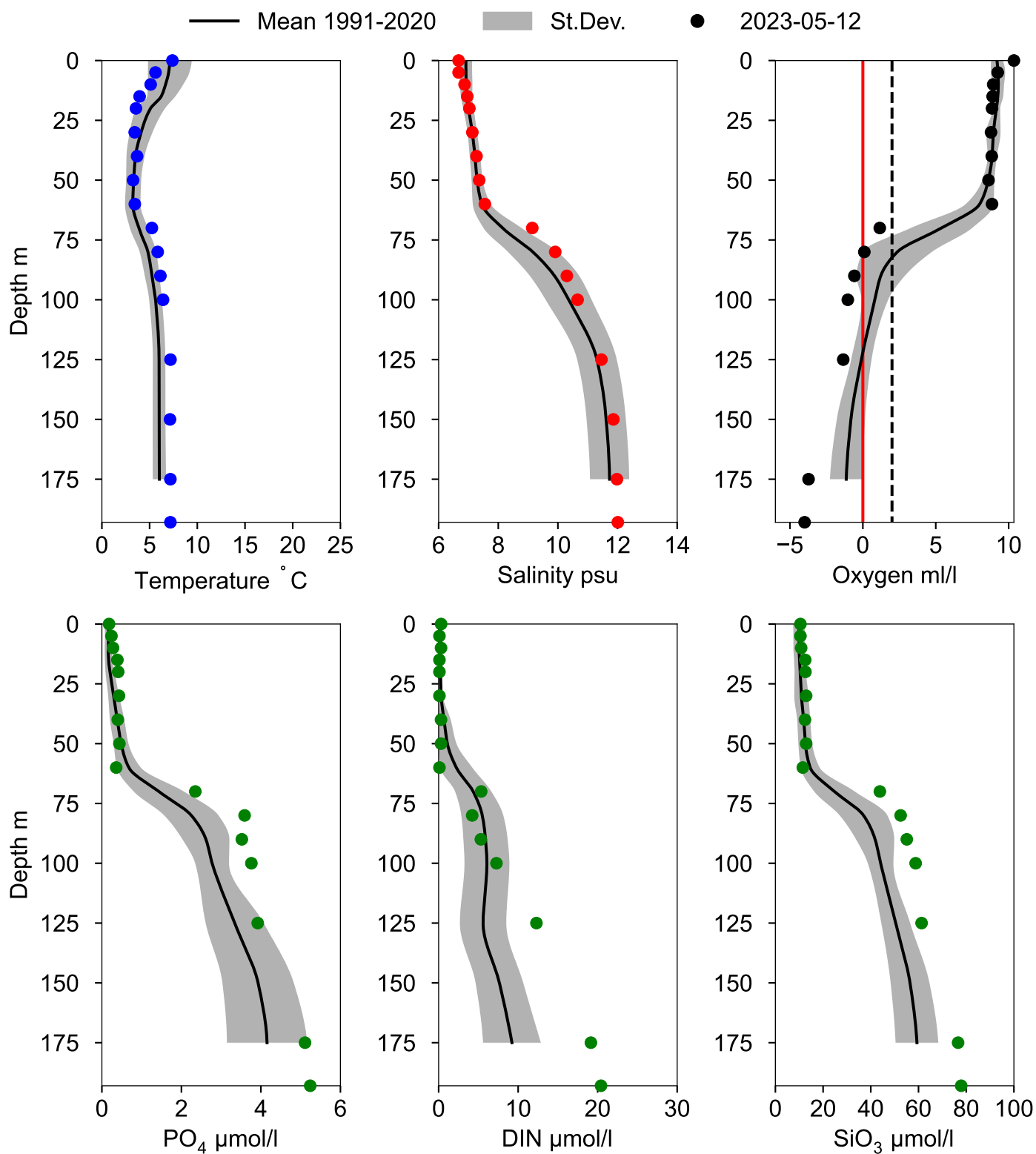
● 2023



OXYGEN IN BOTTOM WATER (depth >= 175 m)



Vertical profiles BY20 FÅRÖDJ May



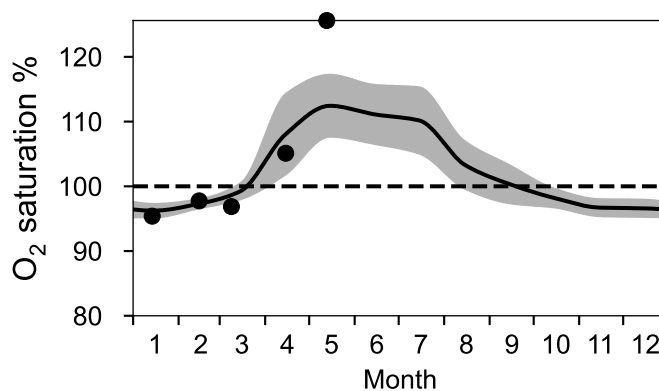
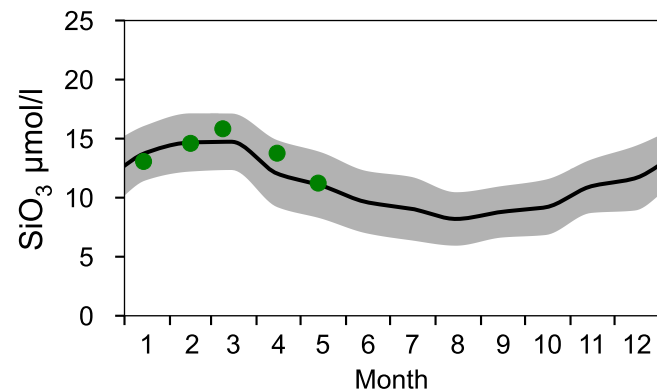
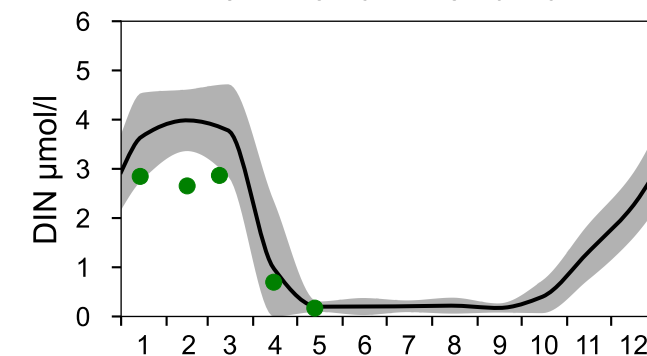
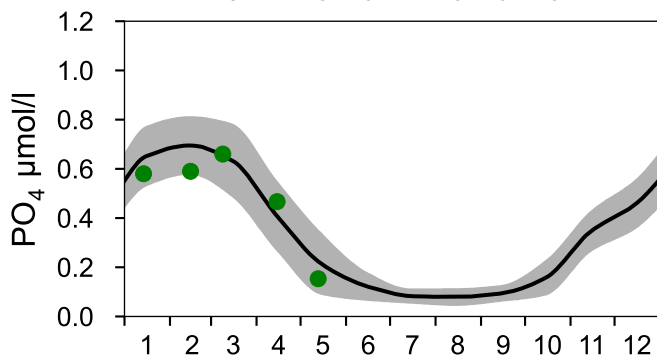
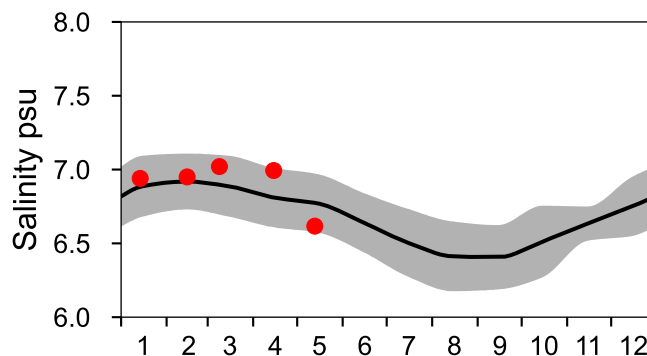
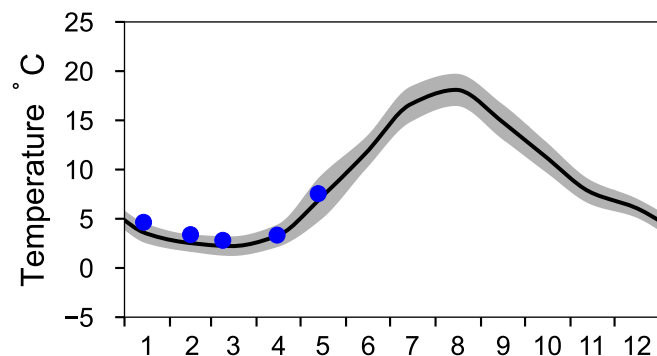
STATION BY32 NORRKÖPINGSDJ SURFACE WATER (0-10 m)

Annual Cycles

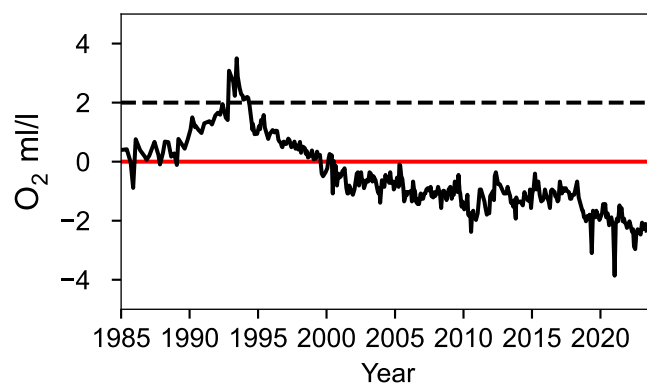
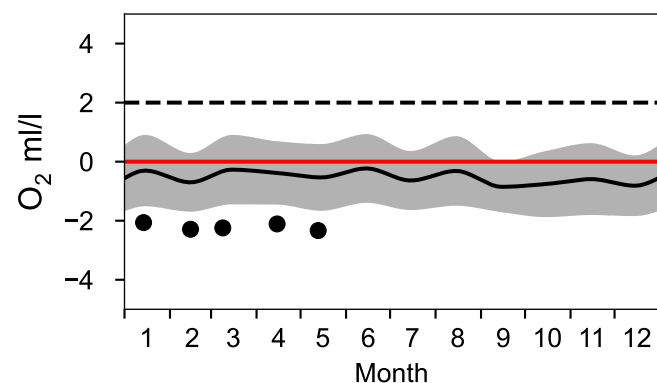
— Mean 1991-2020

■ St.Dev.

● 2023



OXYGEN IN BOTTOM WATER (depth >= 175 m)

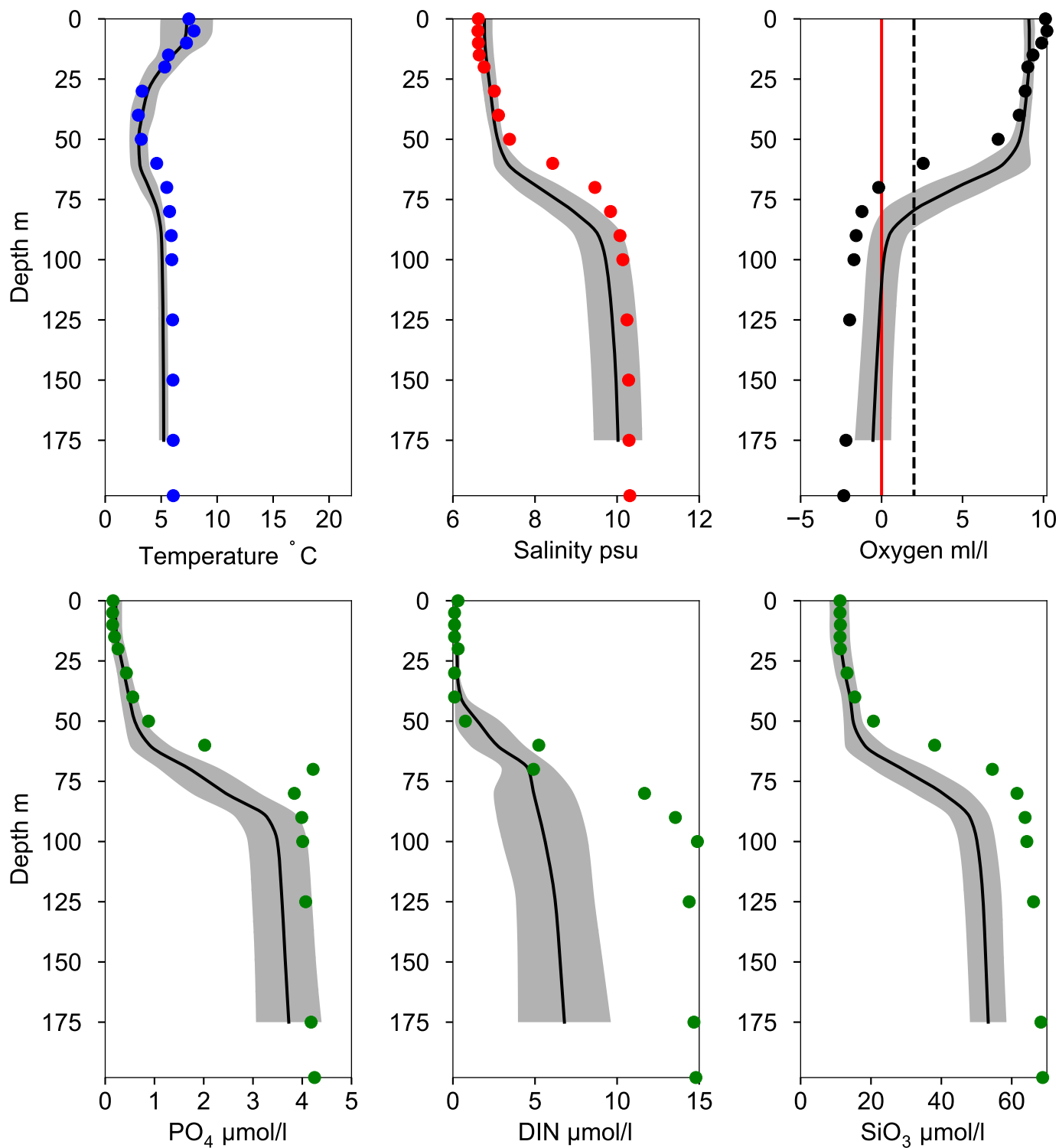


Vertical profiles BY32 NORRKÖPINGSDJ May

— Mean 1991-2020

■ St.Dev.

● 2023-05-13



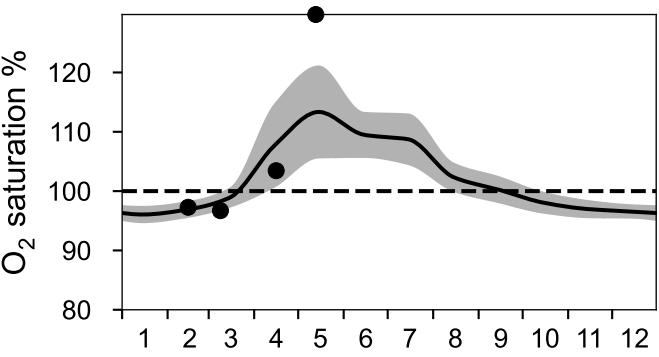
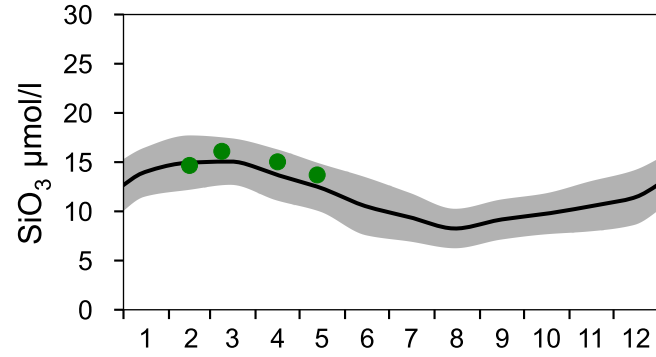
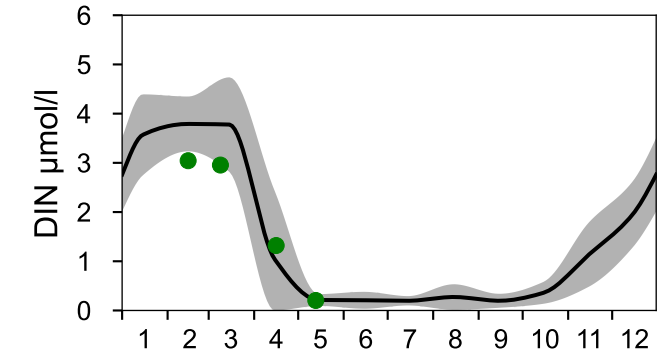
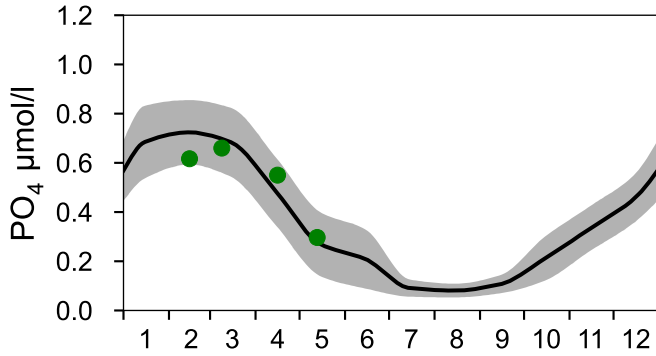
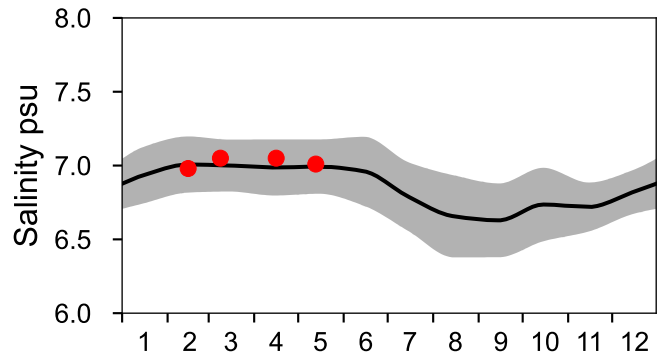
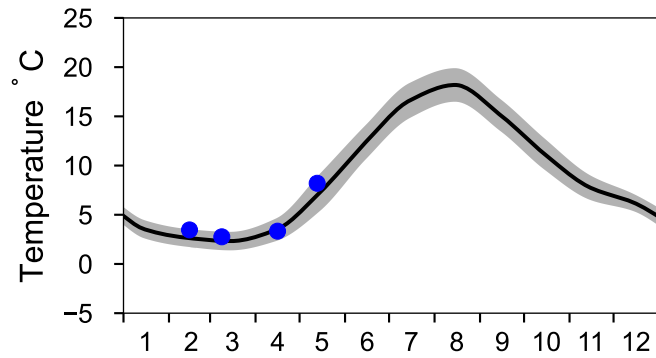
STATION BY38 KARLSÖDJ SURFACE WATER (0-10 m)

Annual Cycles

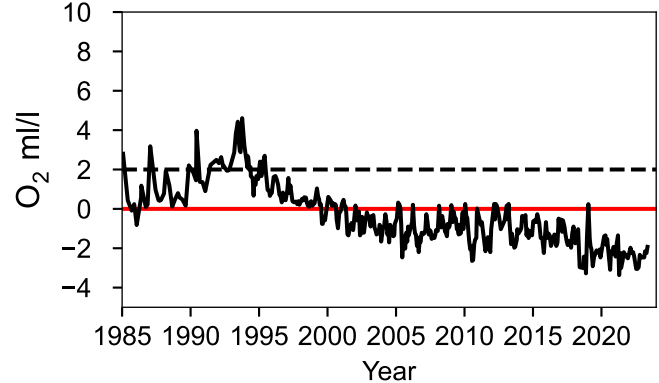
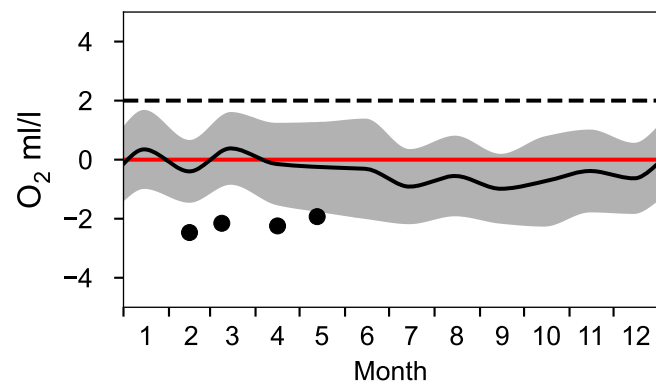
— Mean 1991-2020

■ St.Dev.

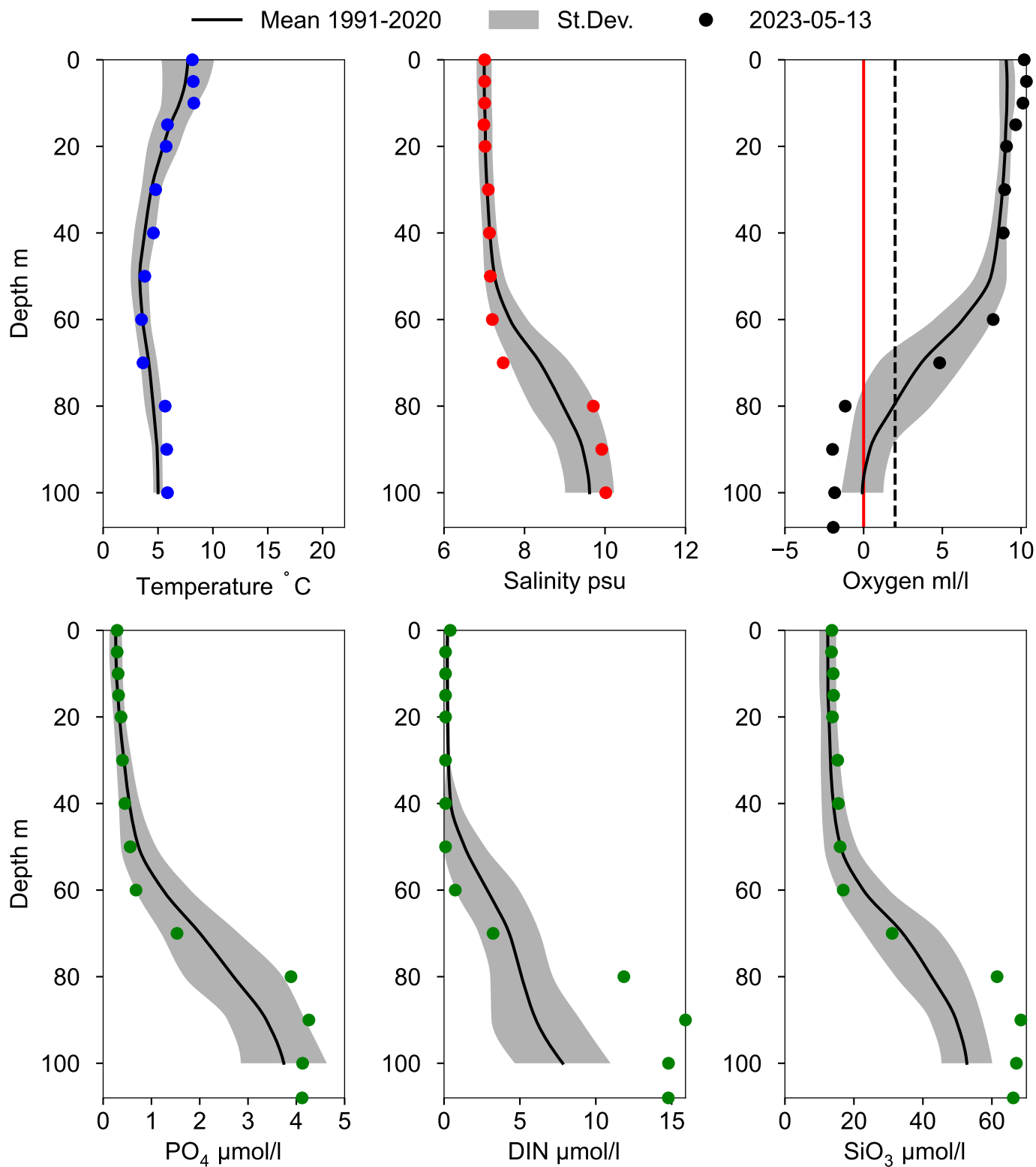
● 2023



OXYGEN IN BOTTOM WATER (depth >= 100 m)



Vertical profiles BY38 KARLSÖDJ May



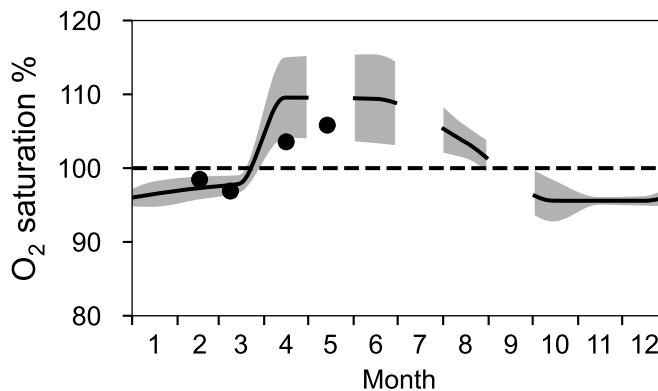
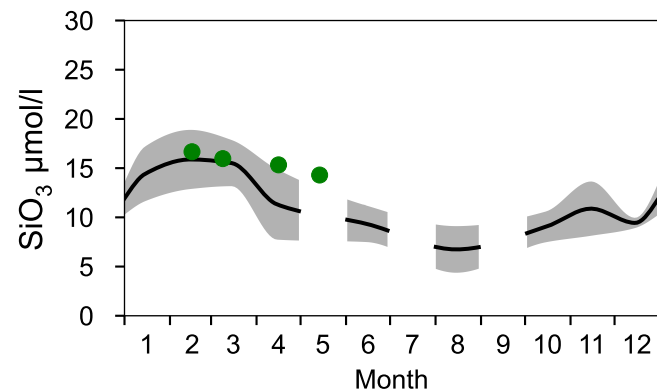
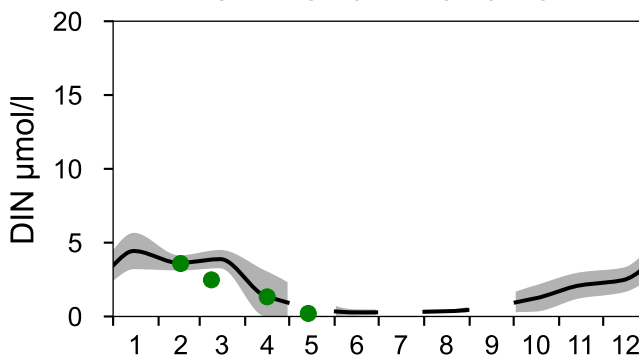
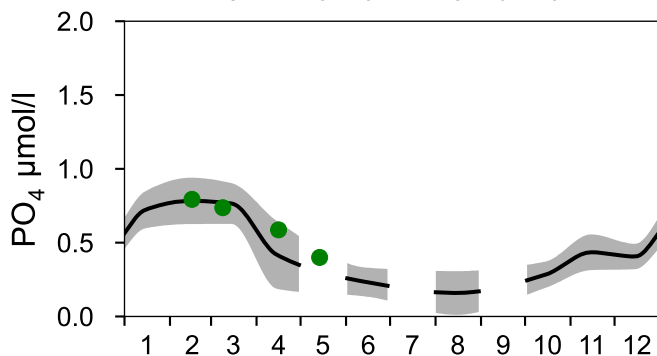
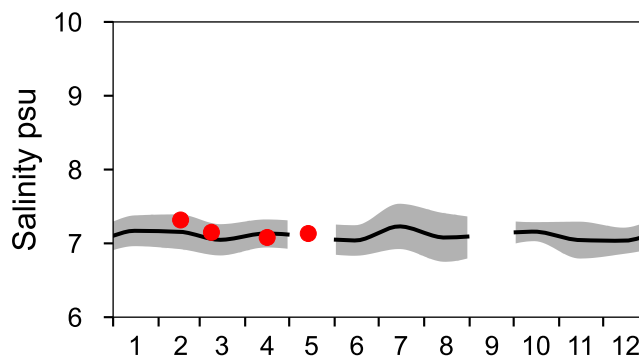
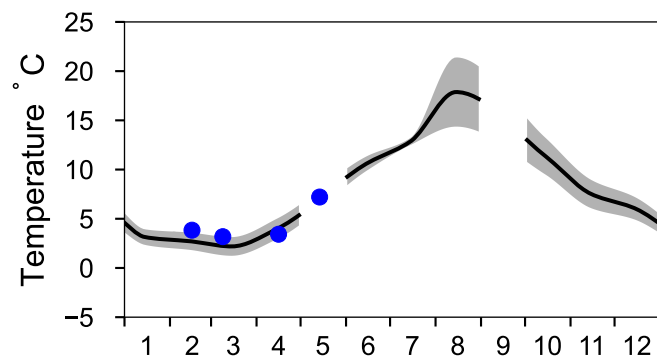
STATION BY39 ÖLANDS S UDDE SURFACE WATER (0-10 m)

Annual Cycles

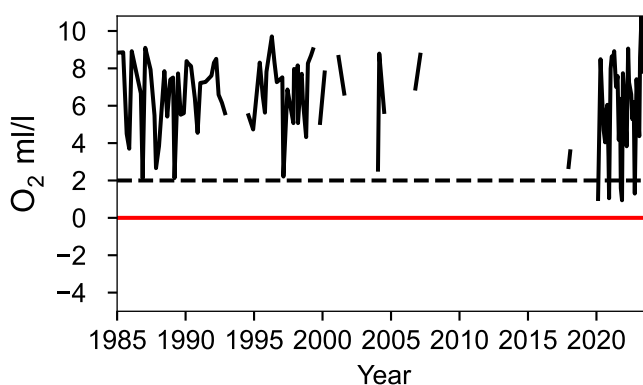
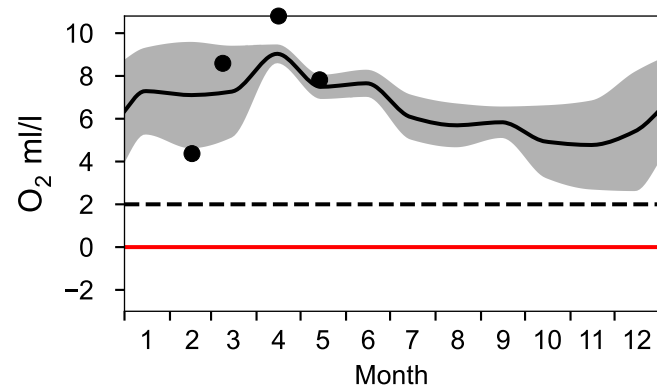
— Mean 1991-2020

■ St.Dev.

● 2023



OXYGEN IN BOTTOM WATER (depth >= 40 m)



Vertical profiles BY39 ÖLANDS S UDDE
May

