

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



Photo: Örjan Bäck, SMHI

Area with surface accumulation of cyanobacteria west of Bornholm.

<b>Survey period:</b>	2023-09-15 – 2023-09-21
<b>Principals:</b>	Swedish Meteorological and Hydrological Institute (SMHI), Swedish Agency for Marine and Water Management (SwAM)
<b>Cooperation partners:</b>	Swedish University of Agricultural Sciences (SLU), Swedish Maritime Administration (SMA)

## SUMMARY

The Skagerrak, the Kattegat, Öresund and the Baltic Proper were visited during this cruise, which is part of the national marine monitoring programme of Sweden.

The warm weather in September had caused the water temperature in the surface water to rise since August in all areas except in the Western Gotland Basin, where the temperature had dropped by around 1 degree. The temperature varied between 16.5 to 18.5 °C, in the Western Gotland basin from 14 to 16 °C.

The nutrient concentrations in the surface water were generally low in all areas, which is normal for the season, slightly higher phosphate levels occurred in the Western Gotland basin. In the deep water there were higher levels but within the normal range, however, higher concentrations of nutrients were observed in the deep water in the Eastern Gotland basin, also higher than normal levels of phosphate were found at the bottom in the southern Kattegat and in Öresund.

In the Arkona Basin, west of Bornholm, there was acute oxygen deficiency ( $O_2 < 2$  ml/l) closest to the bottom with concentrations between 0 and 1 ml/l, likewise the oxygen concentration at the bottom in Hanö Bay was close to 0 ml/l. In the Bornholm basin, east of Bornholm, it was completely oxygen-free at the bottom and instead concentrations of hydrogen sulphide were measured. In the Gotland basins, the oxygen ran out at a depth of around 70 to 80 metres. At the majority of stations in the Gotland basins, there are now record high levels of hydrogen sulphide closest to the bottom.

SMHI's next cruise with R/V Svea is planned to start the 19th of October, starting in Kalmar and ending in Lysekil.

## RESULTS

The expedition was carried out with R/V Svea and started in Gothenburg on September 15th and ended in Kalmar on September 21st. The winds during the expedition were strong from about the south. The air temperature varied between 15 and 20 °C.

One of Svea's ADCPs (current measurement) and the Ferrybox (continuous measurements at a depth of 4 meters) were running during the expedition. We could also use the MVP (Moving Vessel Profiler) on this trip after a few months of technical problems.

Several tasks in addition to our regular environmental monitoring took place during this expedition:

During the first day, several representatives from SWEDAC were there to inspect our accredited measurement operations.

Sampling of the gelatinous zooplankton (jellyfish) for evaluation was done in collaboration with an expert from the University of Gothenburg.

A bottom measurement system at P22 outside Kullen was salvaged and a new one deployed, this on behalf of the County Administrative Board.

A profiling float was recovered in the East Gotland basin for the FMI (Finnish Meteorological Institute) at the same time a new one was deployed.

The wave buoy at Knolls Grund was salvaged and a newly serviced buoy was deployed. Sveas ena ADCP (strömmätning) och Ferryboxen (kontinuerliga mätningar på 4 meters djup) var igång under expeditionen. Även MVPn (Moving Vessel Profiler) kunde användas på denna resa efter några månaders uppehåll på grund av tekniska problem.

Technical problems with the CTD<sup>1</sup> at the end of the cruise meant that station BY31 was only sampled down to 200 meters. The stations after that, BY32 and BY38, could not be sampled with the CTD rosette, but a smaller CTD (SBE19) was used there and water samplers were hung on wire, hence a slightly reduced number of sampling depths.

This report is based on data that has undergone an initial quality control and is compared to monthly means from the period 1991 - 2020. When additional quality control has been performed, certain values may change. Values in the report have been rounded and by that can differ a bit from values published in the data base. Data from this cruise are published as soon as possible on the data host's website, this usually takes place within a week after the cruise has ended. Some analyses are made after the cruise and are published later.

Data can be downloaded here:

<https://www.smhi.se/en/services/open-data/national-archive-for-oceanographic-data/download-data-1.153150>

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<sup>1</sup> CTD is a profiling measurement instrument which stands for Conductivity, Temperature and Depth. SMHI's CTD is also equipped with sensors that measure dissolved oxygen and fluorescence among other things.

## **The Skagerrak**

The temperature in the surface water was around 16 - 17 °C, warmest closest to the coast. The temperature decreased from 20 meters and down. The surface salinity varied from 24 psu at the coastal station Släggö in the fjord Gullmarn to about 32 psu offshore, decreasing to the south. At the stations at the far end of the Å transect, the surface salinity was above normal. A stratification in salinity (halocline) was observed at around 10 meters at all stations.

All nutrient concentrations in the surface water were low, which is normal for the season when nutrients are consumed during algal blooms. Slightly increasing concentrations of silicate and phosphate were measured closest to the coast. Beneath the stratification, the concentration of nutrients increases, at a depth of around 30 meters, concentrations slightly higher than the average for the season were measured at the Å stations. Abnormally high levels of ammonium were measured in the surface water of Å15, these values are under further review when this report is written.

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

The chlorophyll fluorescence, which is a measure of plankton density measured from the CTD probe, showed higher levels down to 15 meters at Släggö, otherwise low values were measured.

## **The Kattegat and Öresund**

The temperature in surface layer in the Kattegat and Öresund was higher than normal for the month at all stations, above 18 °C. On the other hand, the salinity was lower than normal in the surface, but only slightly lower, about 20 psu in the Kattegatt and about 10 psu in the Öresund. A strong halocline was observed between 10 and 20 meters at all stations, also a weak stratification in temperature (thermocline) could be noted at the same depth.

All nutrient concentrations in the surface were low, which is normal for the season. The levels of silicate in the surface were slightly lower than normal, but high values of silicate were measured near the bottom, especially at the southernmost stations Anholt E and at W Landskrona in Öresund. Also the phosphate levels closest to the bottom at these stations were higher than the seasonal average.

The oxygen levels were normal for the season, somewhat low near the bottom at Anholt E; 2.1 ml/l. Values just over 2 ml/l were also measured closest to the bottom in Öresund.

The chlorophyll fluorescence showed some plankton activity in the surface water, highest around 10 - 15 meters.

## **The Baltic Proper**

Calm and warm weather in September meant warmer than normal surface water in large parts of the Baltic Proper, between 17 to 18 °C. Only in the Western Gotland basin normal surface water temperatures for the season were measured, around 14 to 16 °C. Temperatures just above normal were also measured in the bottom water everywhere except in the Arkona Basin farthest to the west



The salinity in the surface varied from 6.3 psu at BY31 in the northwest to barely 8 psu in the Arkona basin, normal levels except in the northeast where values were slightly higher than normal.

Two stratifications could be observed in the Baltic Proper. A thermocline closest to the surface starting from around 20 meters caused by the warmer surface water, strongest in the Eastern and Western Gotland basins. Deeper down is the permanent halocline in the Baltic Proper, shallowest in the Arkona Basin where it starts from about 30 meters, in Hanö Bay and the Bornholm Basin from about 50 meters. In the Eastern Gotland Basin, the halocline was observed from about 60 meters, at BY10 already at 50 meters which is unusual. In the Western Gotland Basin, the halocline started around 50 meters.

The concentration of phosphate in the surface water was low, which is normal for the season, however values slightly higher than normal were measured in the Western Gotland Basin, at most up to 0.2  $\mu\text{mol/l}$ . The levels of dissolved inorganic nitrogen (DIN) were very low, below the detection limit of the analysis at most visited stations in the Baltic Proper, which is normal for the season when the nitrogen is consumed by phytoplankton. A few stations with deviant values occurred; at stations BY15, BY29 and BY38, higher levels of nitrogen, in the form of ammonium, up to 0.4  $\mu\text{mol/l}$  were measured. Ammonium normally occurs only in higher concentrations in the oxygen-free part of the water mass. It is possible that the upwelling that occurred during the storm Hans mixed up ammonium in the water column, but these values must be considered uncertain until extended quality control is performed. The concentrations of silicate were at normal levels above the halocline.

The concentrations of nutrients increase below the halocline, primarily nitrogen and phosphate, silicate for shell-forming organisms, this is normal throughout the year. Especially in the Eastern Gotland Basin, concentrations of nutrients were observed that were higher than normal in the deep water, in other areas mostly normal to slightly above normal concentrations were present.

In the Arkona Basin there was acute oxygen deficiency ( $\text{O}_2 < 2 \text{ ml/l}$ ) closest to the bottom with concentrations between 0 and 1 ml/l, likewise the oxygen concentration at the bottom in Hanö Bay was close to 0 ml/l. In the Bornholm basin, there was acute oxygen deficiency from 70 meters and closest to the bottom, hydrogen sulphide was measured, which is only formed when there is a total lack of oxygen. In the Gotland basins, the oxygen ran out at a depth of around 70 to 80 meters, at BY10 it was almost oxygen-free already at a depth of 60 meters. At the majority of stations in the Gotland basins, there are now record high levels of hydrogen sulphide closest to the bottom.

The fluorescence measurement from the CTD probe showed some plankton presence in the surface water above the thermocline at all stations.

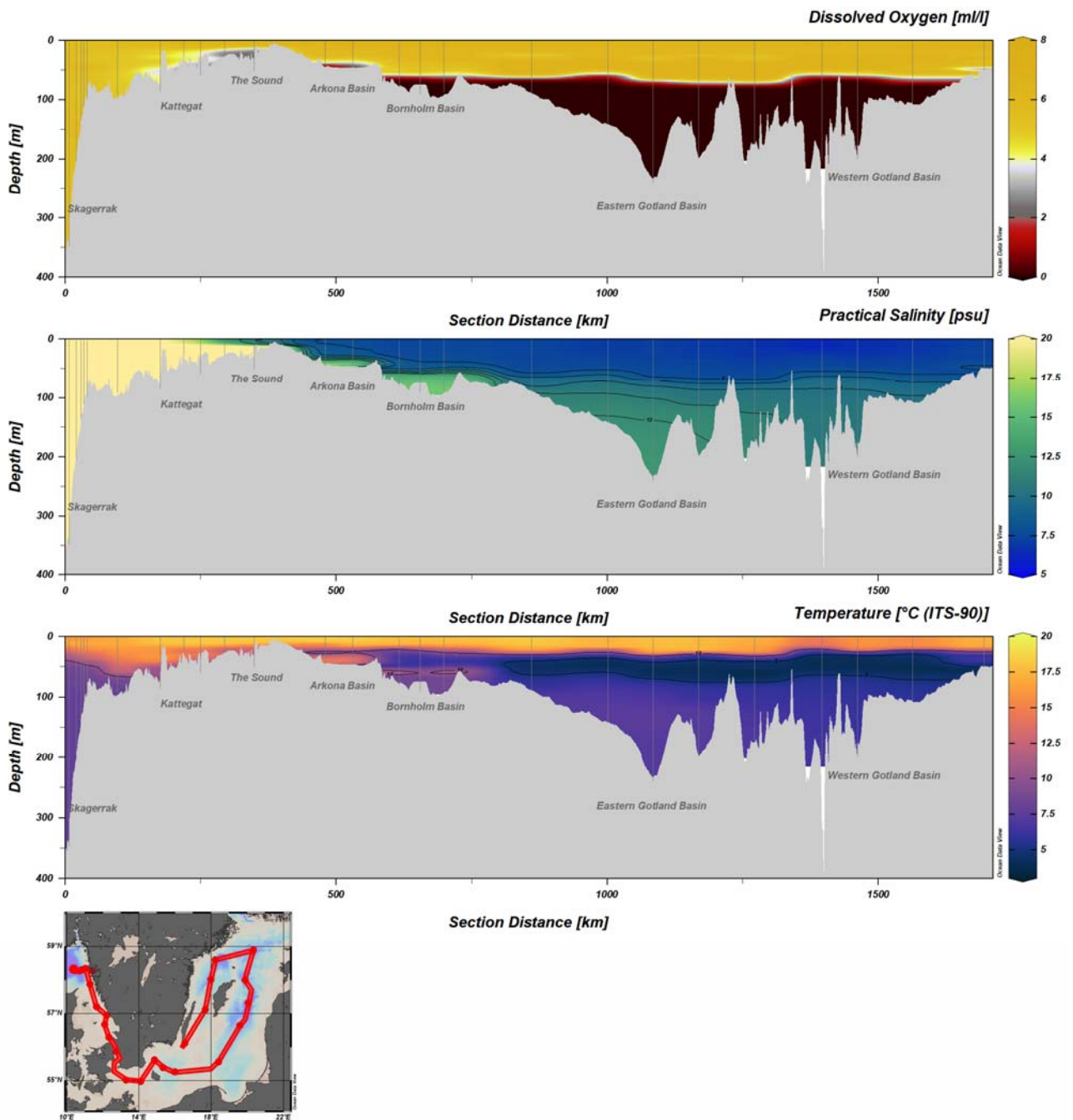


Figure 1. Transect showing CTD measurements of dissolved oxygen concentration, salinity and temperature from the Skagerrak, through the Kattegat and Öresund, further into the Baltic Proper, also shown in the map (bottom).

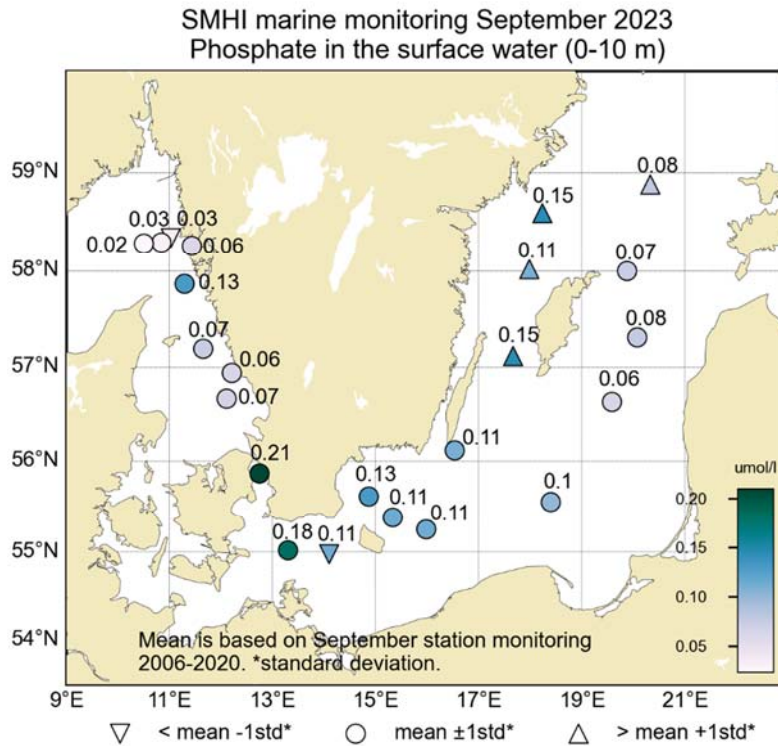


Figure 2. Concentration ( $\mu\text{mol/l}$ ) of phosphate in the surface water (0-10m). Mean is based on data from the month within each basin during the years 1991 – 2020.

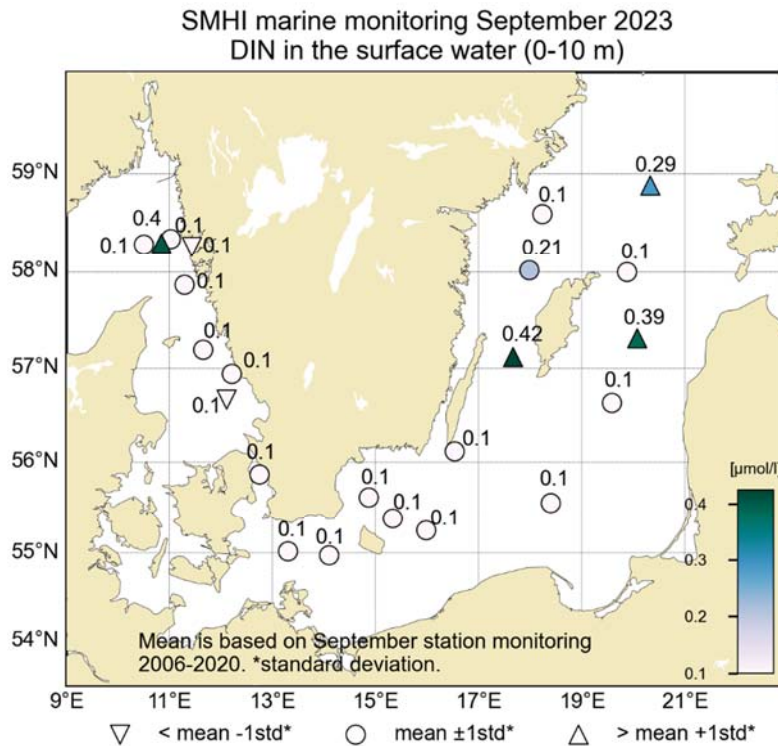


Figure 3. Concentration ( $\mu\text{mol/l}$ ) of dissolved inorganic nitrogen (DIN) in the surface water (0-10m). Mean is based on data from the month within each basin during the years 1991 – 2020.

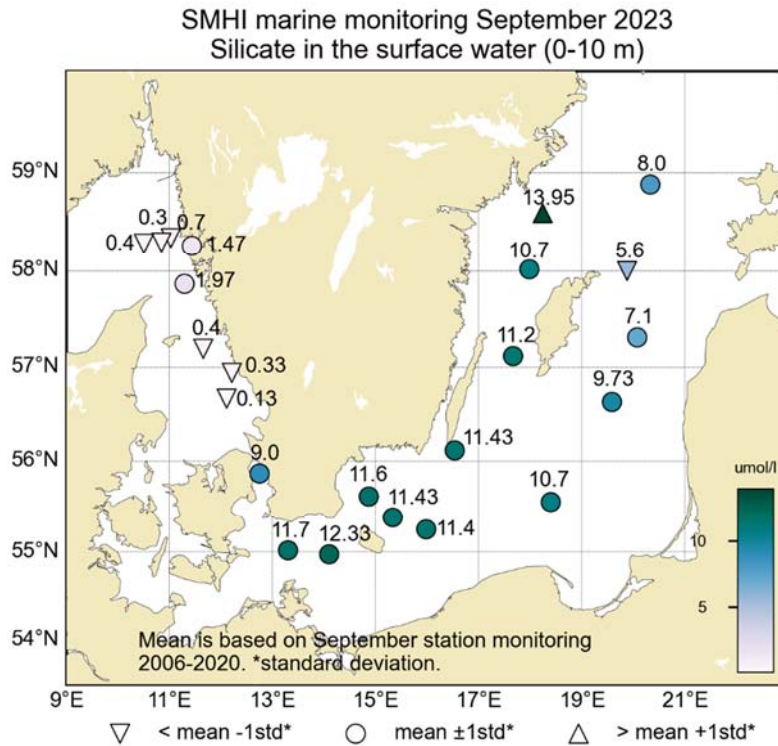


Figure 4. Concentration ( $\mu\text{mol/l}$ ) of silicate in the surface water (0-10m). Mean is based on data from the month within each basin during the years 1991 – 2020.

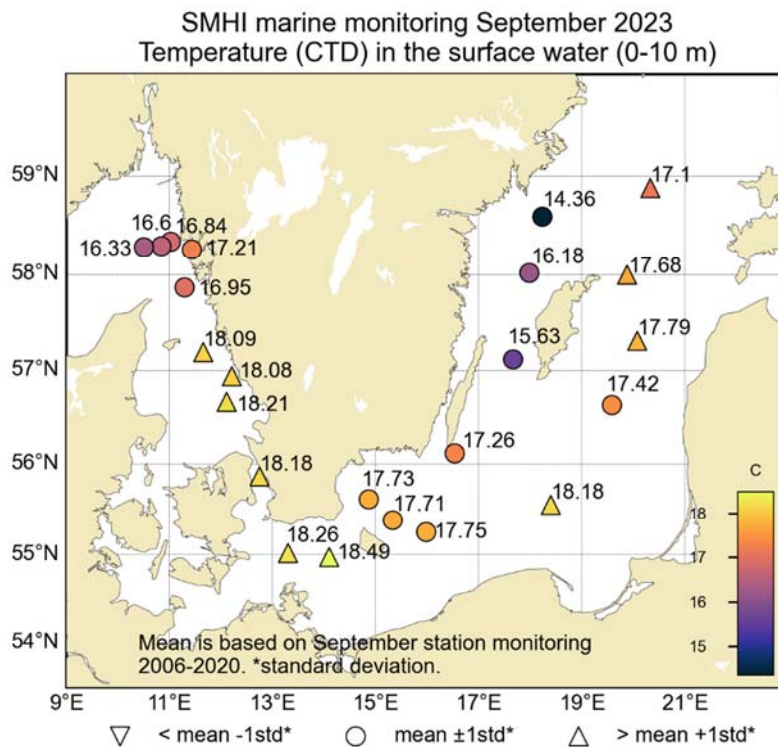


Figure 5. Temperature in the surface water (0-10m). Mean is based on data from the month within each basin during the years 1991 – 2020.

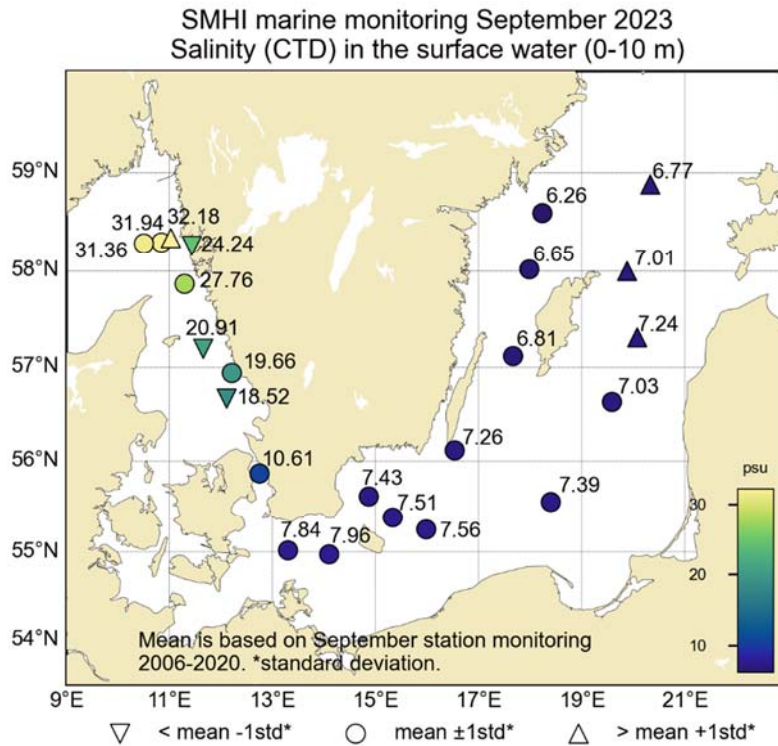


Figure 6. Salinity in the surface water (0-10m). Mean is based on data from the month within each basin during the years 1991 – 2020.

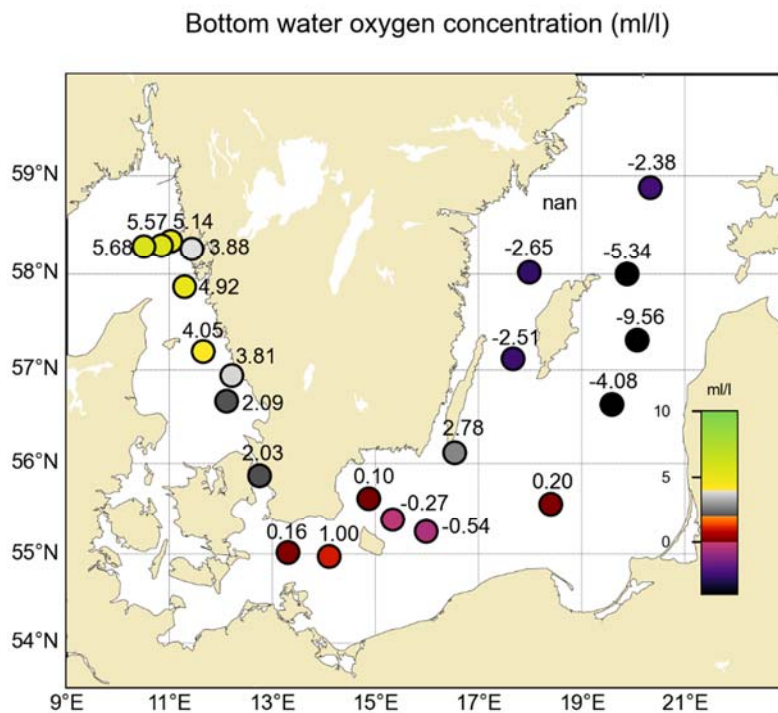


Figure 7. Dissolved oxygen concentration in the bottom water, approximately 1 meter above the seabed. Note that the values have not been compared to statistics in the same way as in figures 2–6, that’s why only circles are shown. Presence of hydrogen sulphide is shown as negative oxygen.



## PARTICIPANTS

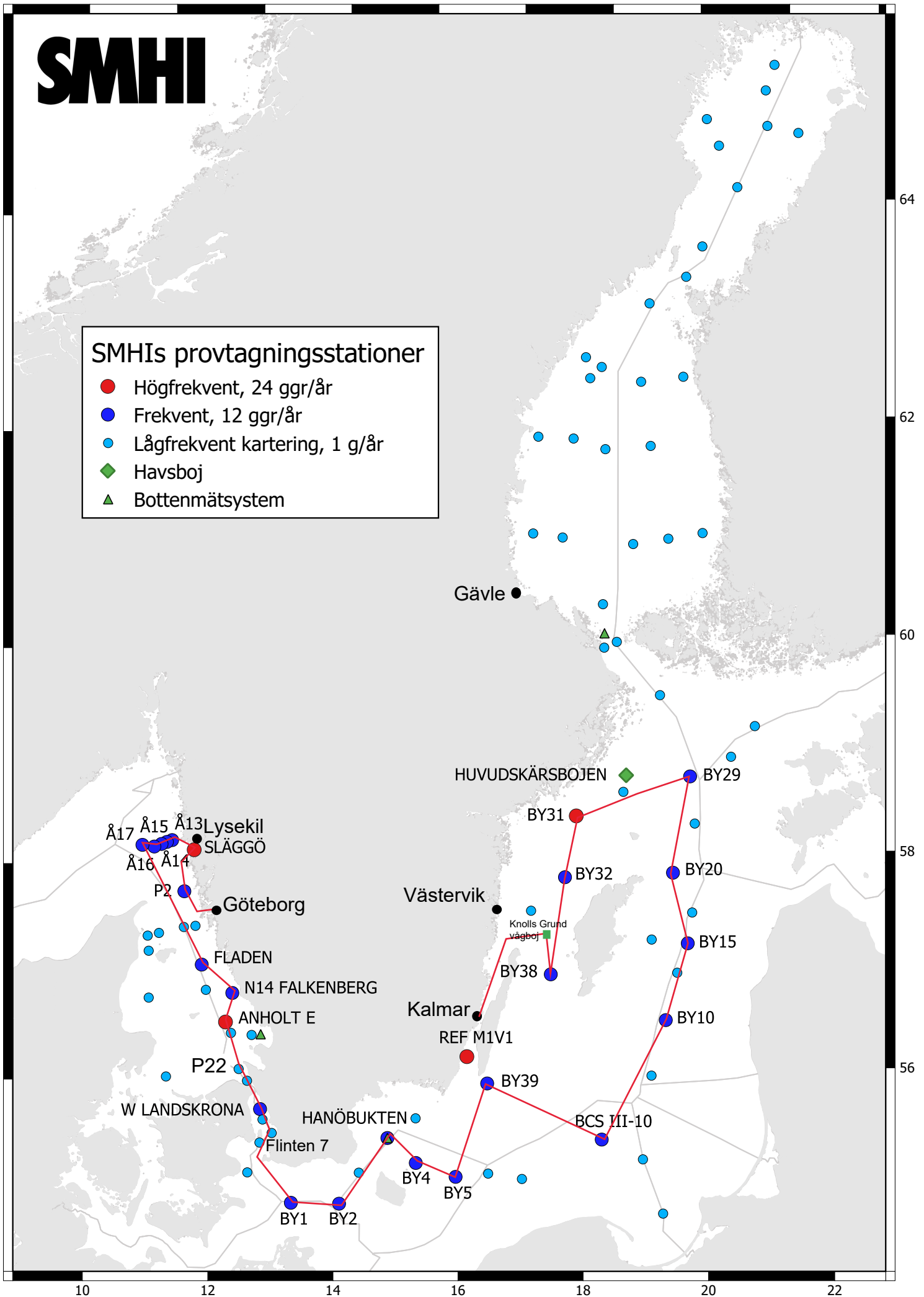
<b>Namn</b>	<b>Roll</b>	<b>Från</b>
Örjan Bäck	Chief Scientist, Oceanographer	SMHI
Sara Johansson	Quality Manager, Chemist	SMHI
Madeleine Nilsson	Marine Chemist	SMHI
Lena Viktorsson	Oceanographer	SMHI
Daniel Bergman-Sjöstrand	Marine Technician	SMHI
Kristoffer Johansson Dale	Marine Technician	SMHI

## APPENDICES

- Track chart
- Table over stations, analyzed parameters and number of sampling depths
- Map of dissolved oxygen in the bottom water
- Vertical profiles for regular monitoring stations
- Monthly average surface water plots for regular monitoring stations

## SMHIs provtagningsstationer

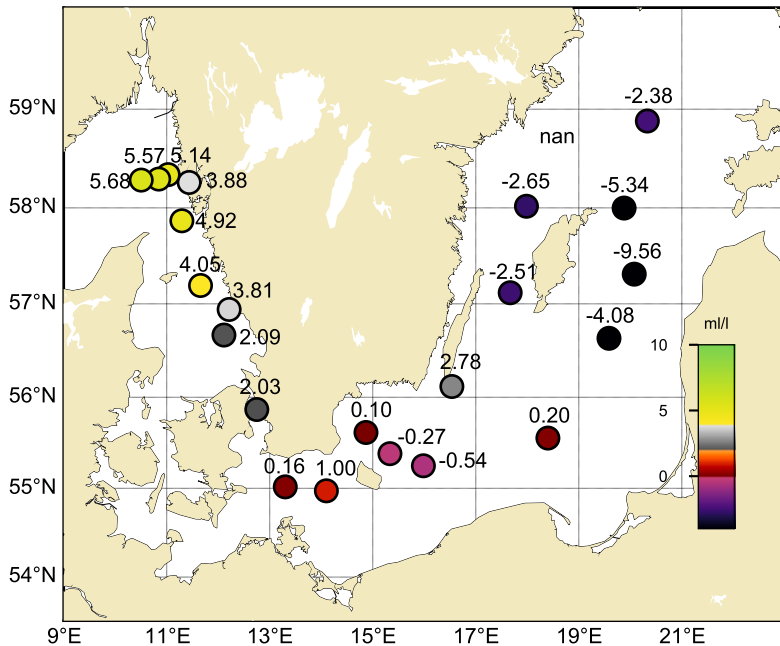
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- Frekvent, 12 ggr/år
- Lågfrekvent kartering, 1 g/år
- ◆ Havsboj
- ▲ Bottenmätsystem







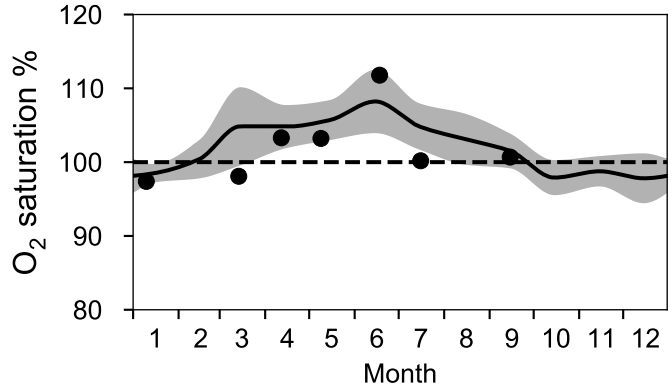
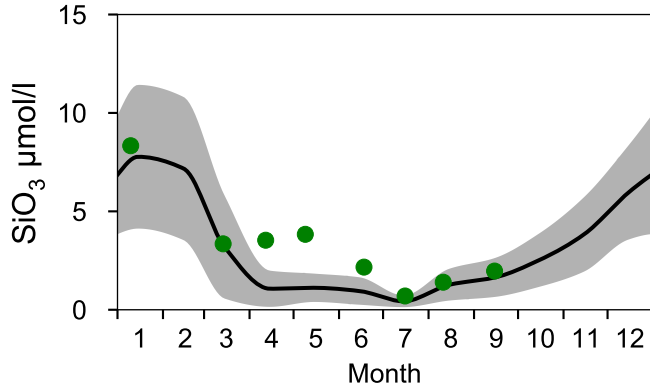
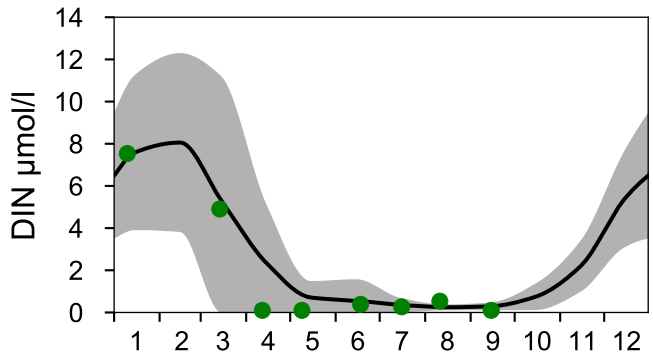
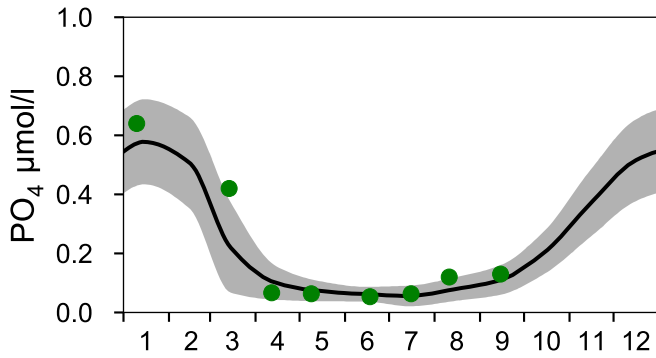
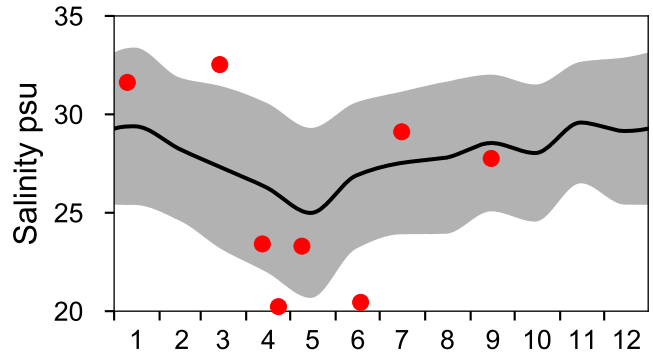
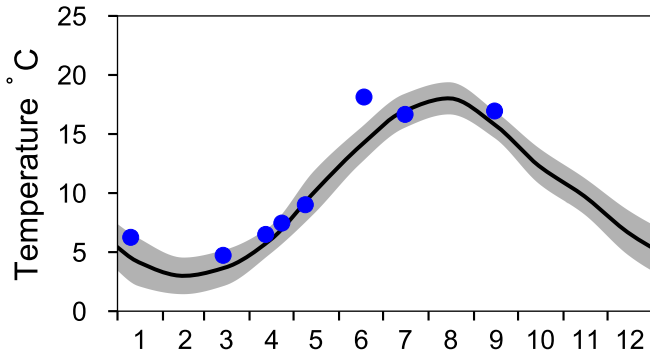
# Bottom water oxygen concentration (ml/l)



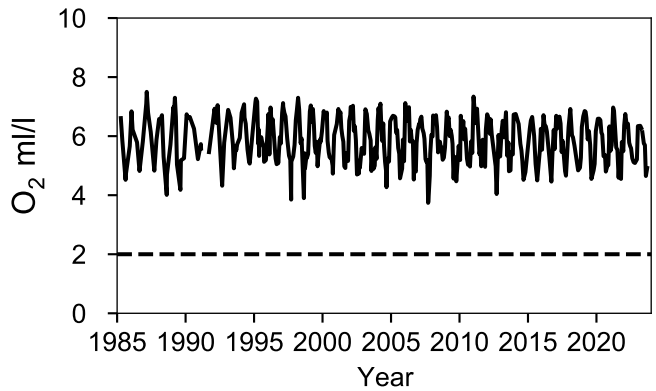
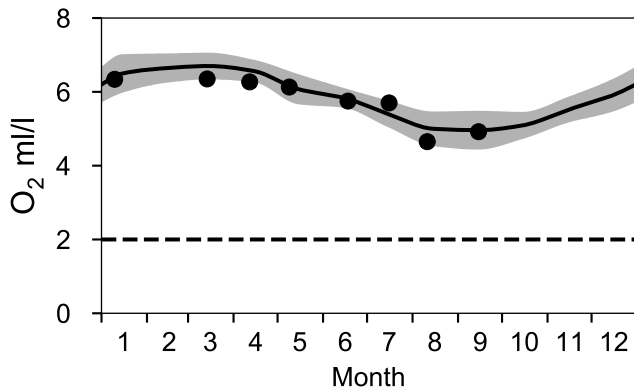
# STATION P2 SURFACE WATER (0-10 m)

Annual Cycles

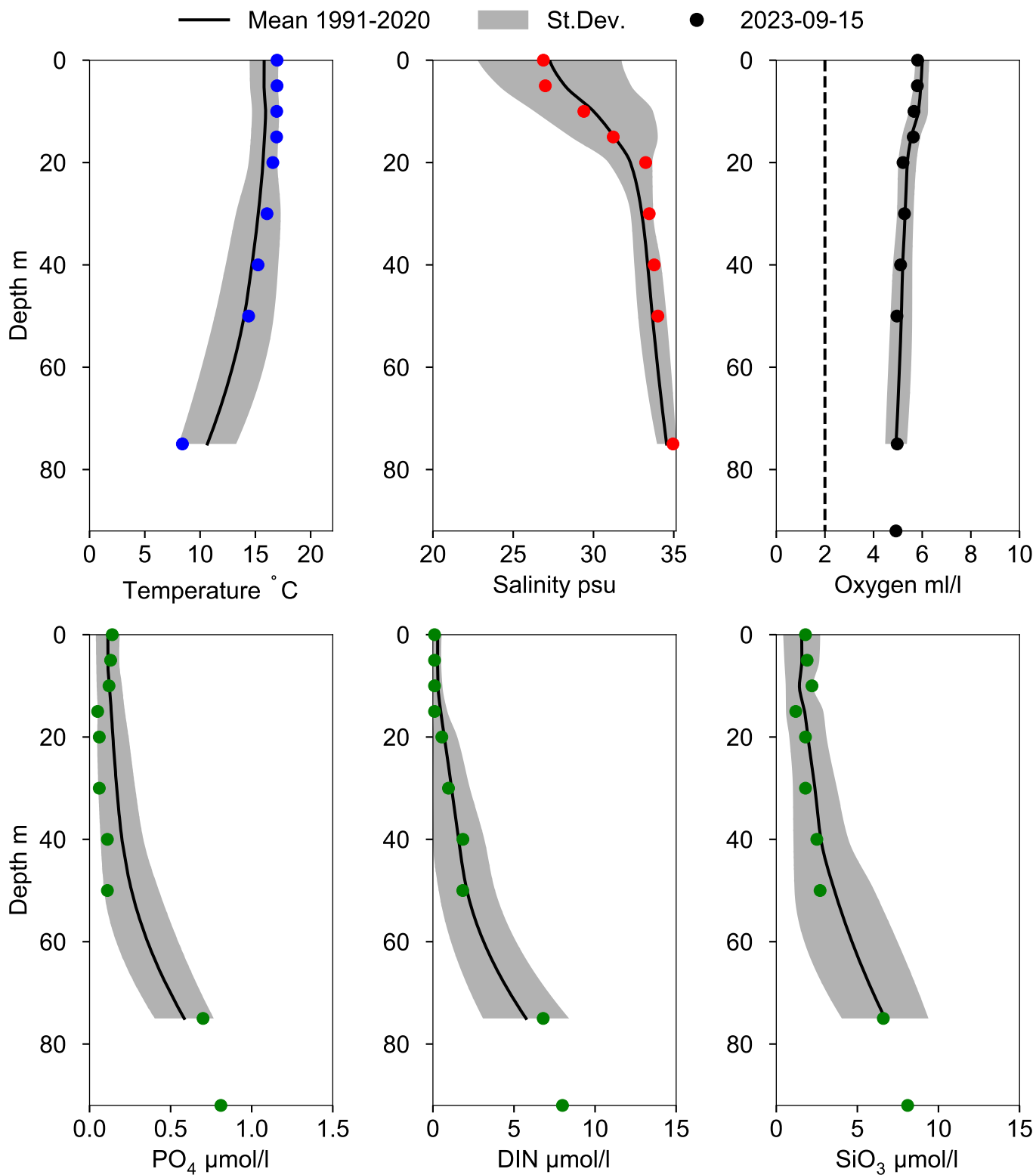
— Mean 1991-2020    St.Dev.    ● 2023



## OXYGEN IN BOTTOM WATER (depth >= 75 m)



# Vertical profiles P2 September



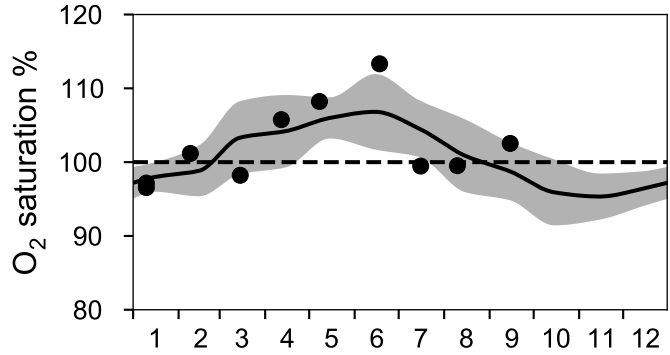
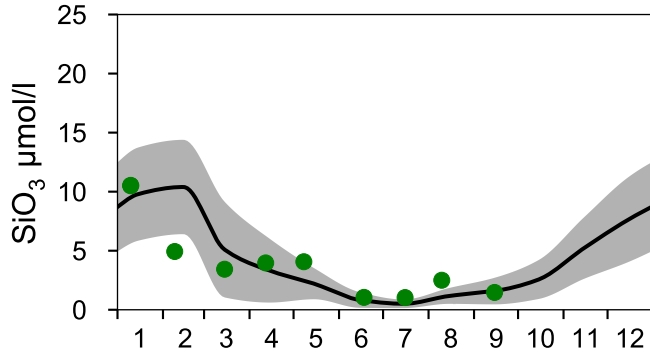
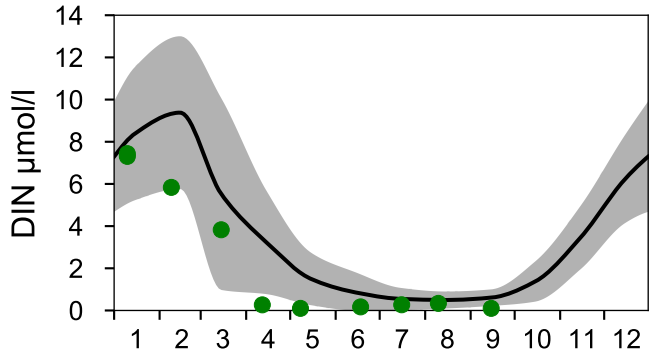
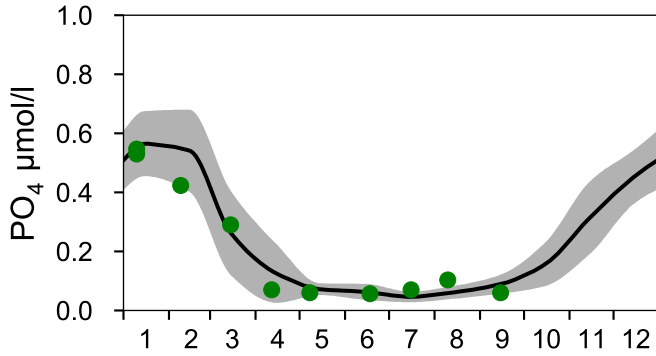
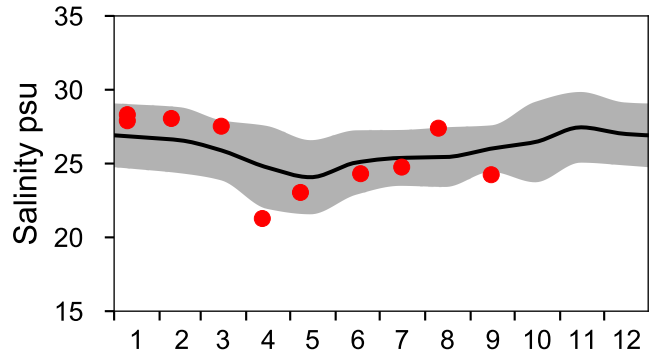
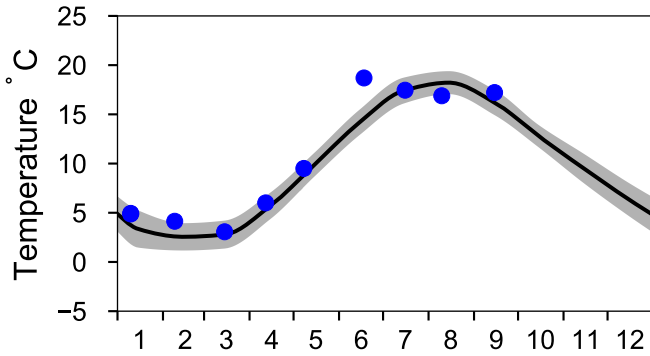
# STATION SLÄGGÖ SURFACE WATER (0-10 m)

Annual Cycles

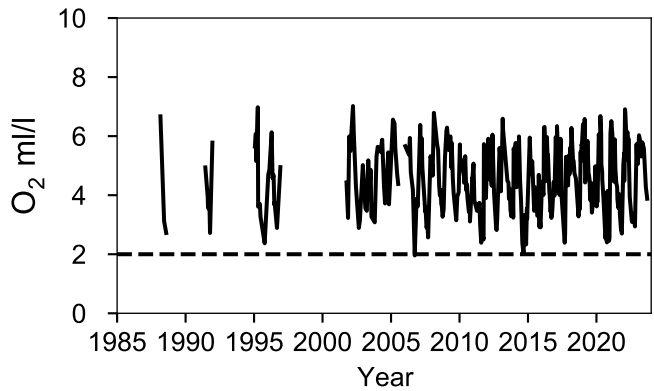
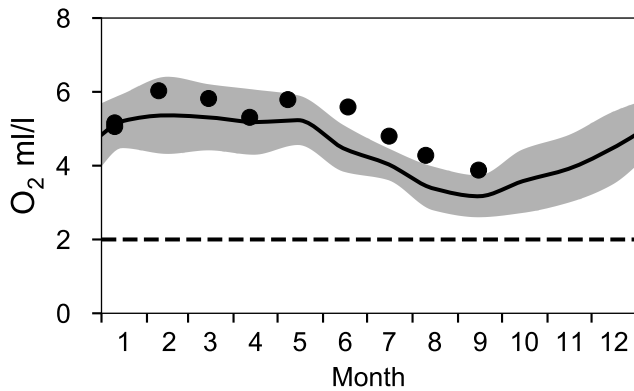
— Mean 1991-2020

■ St.Dev.

● 2023

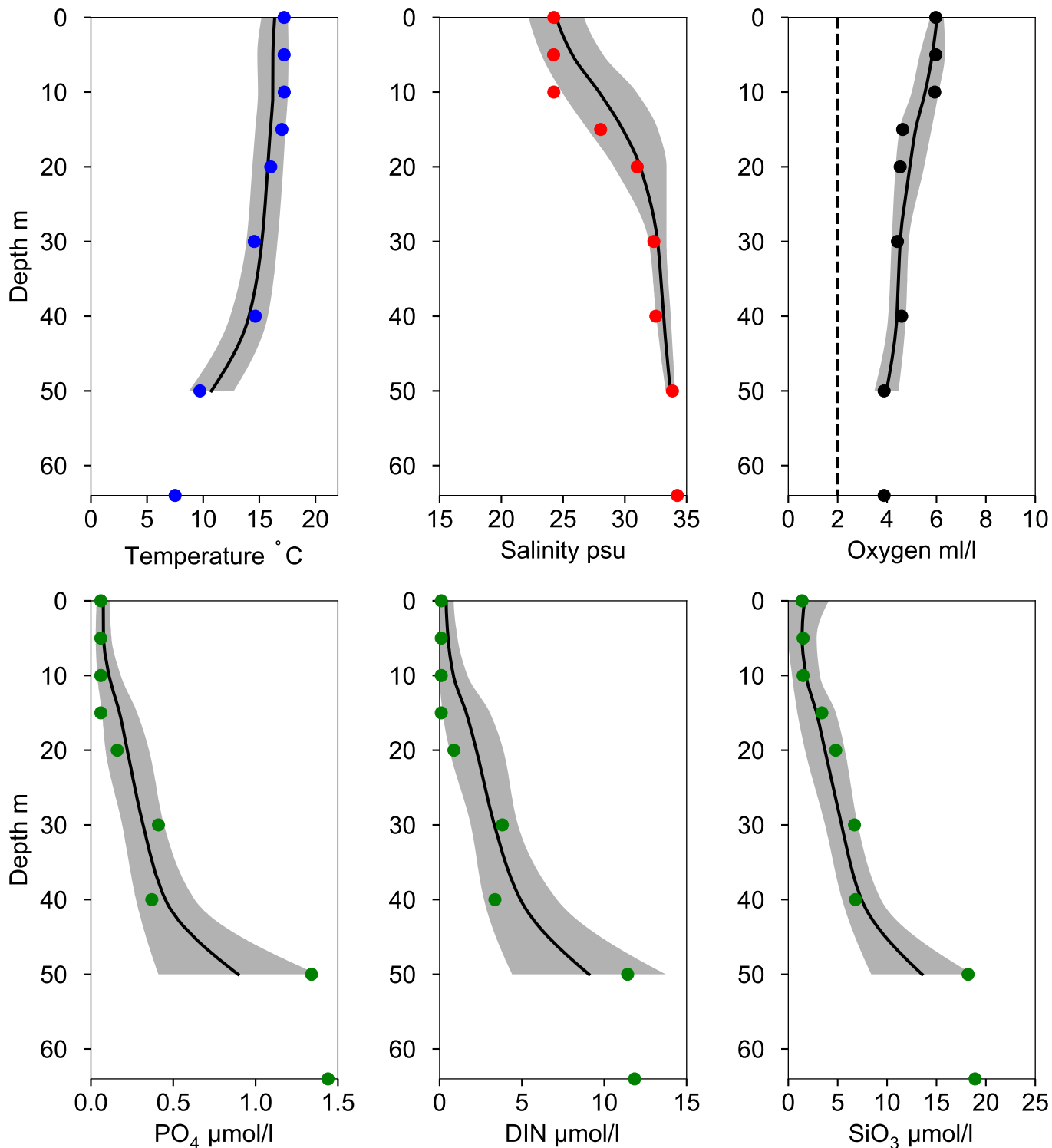


## OXYGEN IN BOTTOM WATER (depth >= 64 m)



# Vertical profiles SLÄGGÖ September

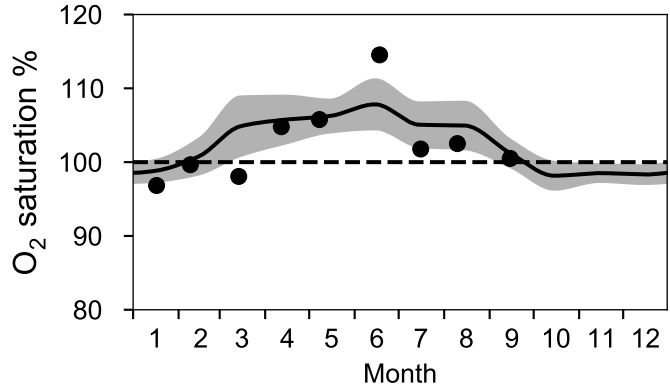
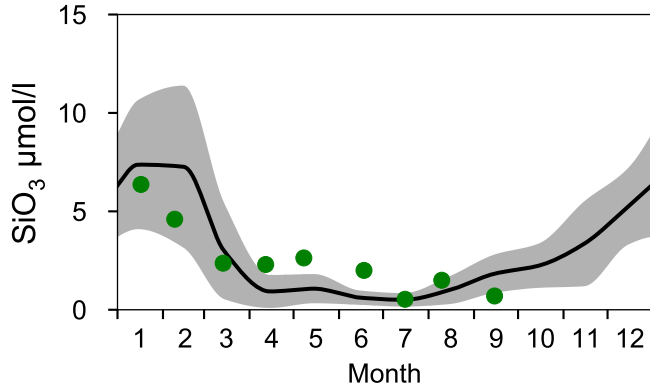
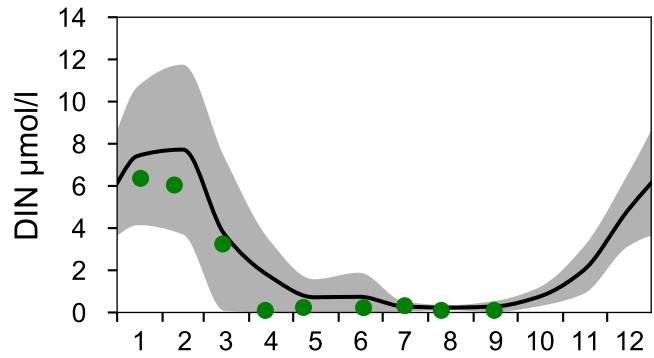
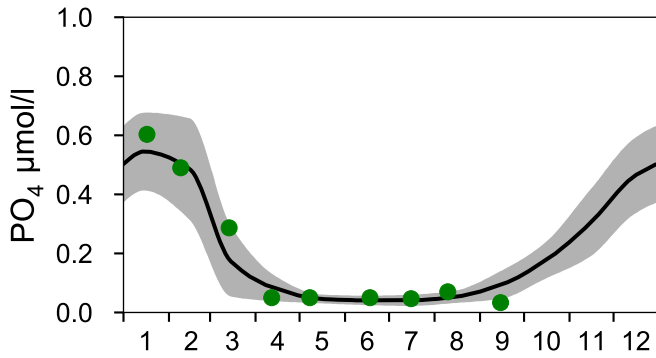
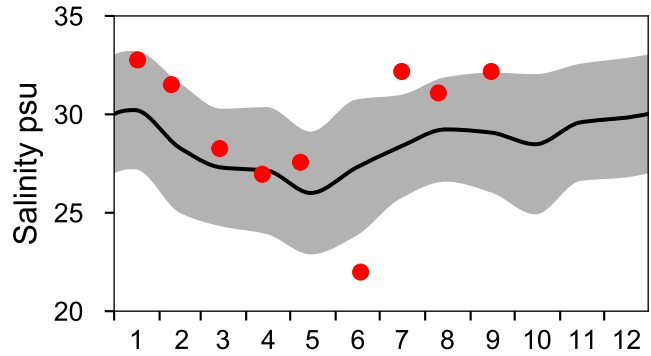
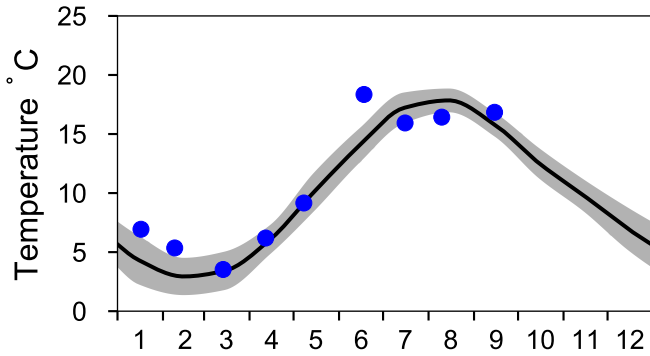
— Mean 1991-2020    St.Dev.    ● 2023-09-15



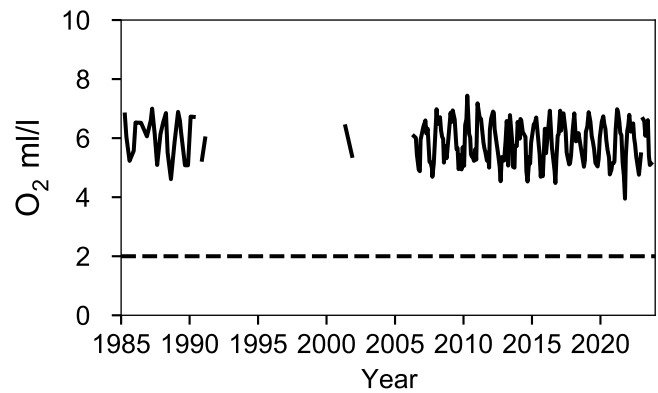
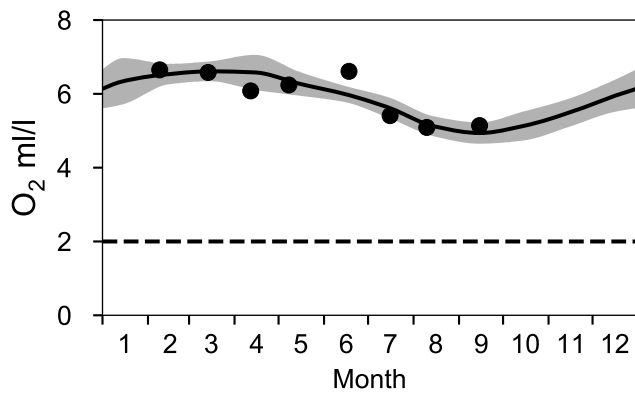
# STATION Å13 SURFACE WATER (0-10 m)

Annual Cycles

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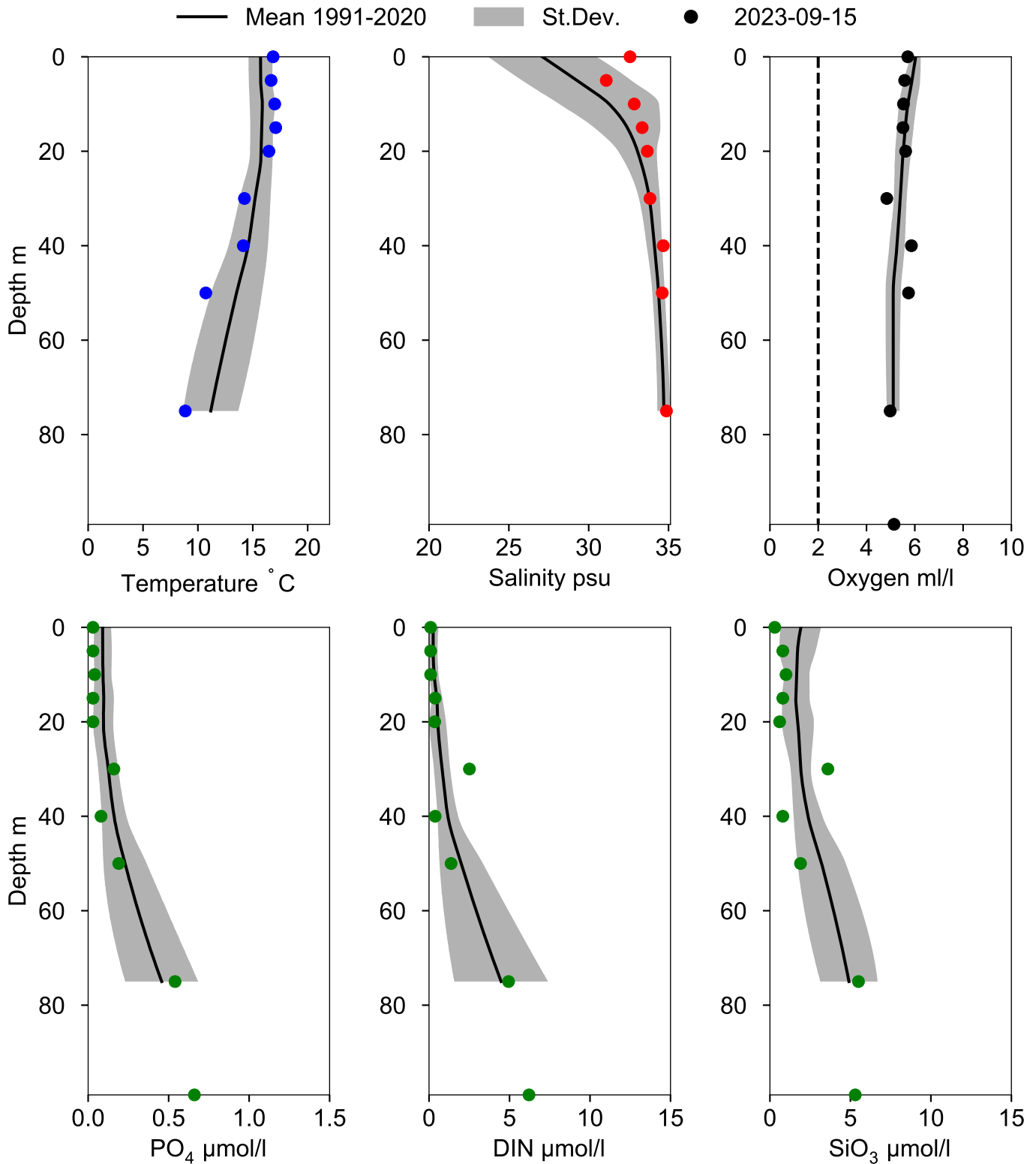


## OXYGEN IN BOTTOM WATER (depth >= 82 m)





# Vertical profiles A13 September



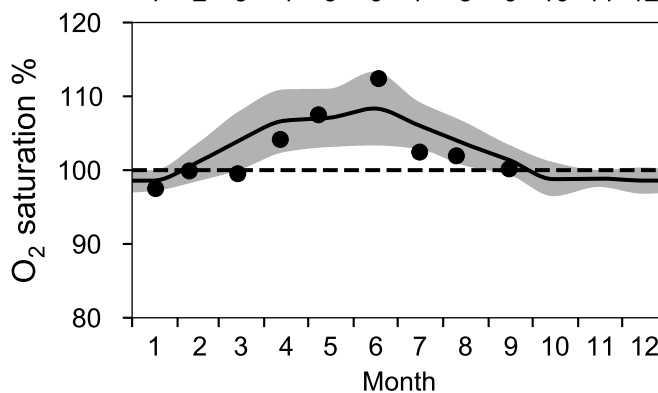
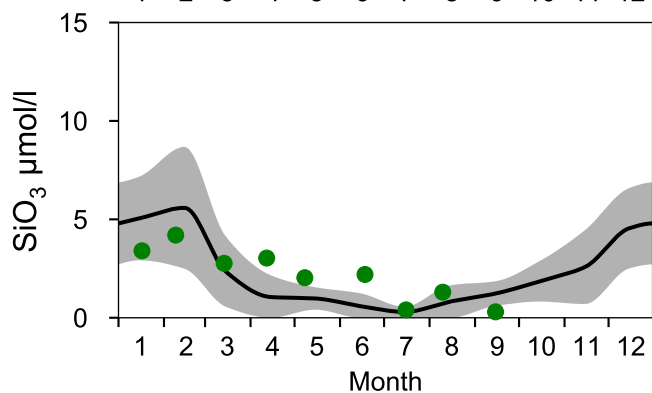
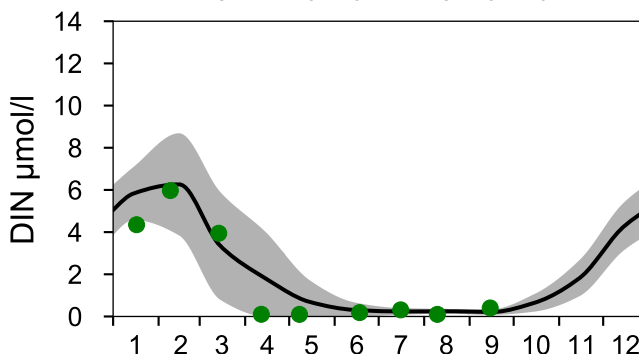
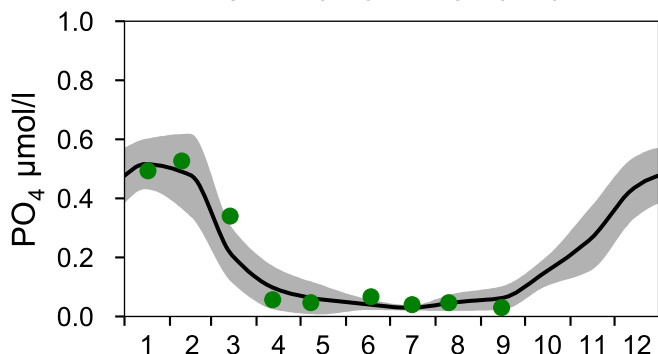
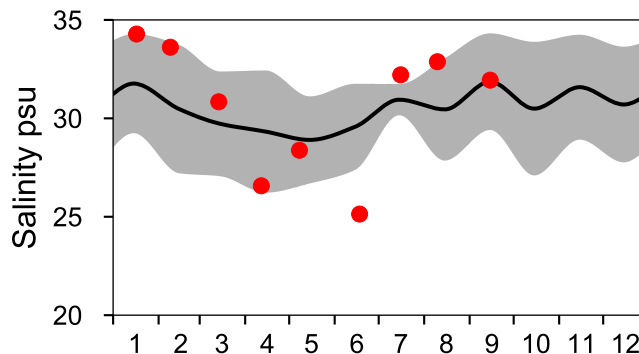
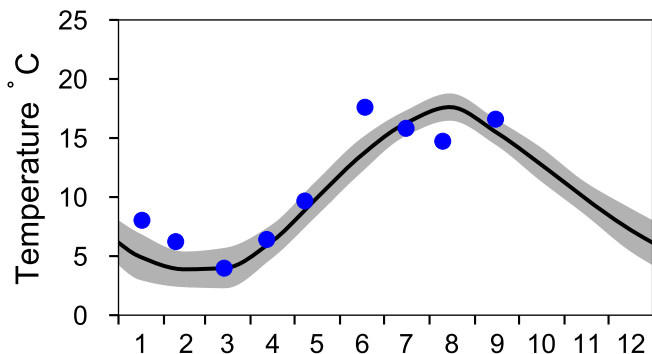
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Annual Cycles

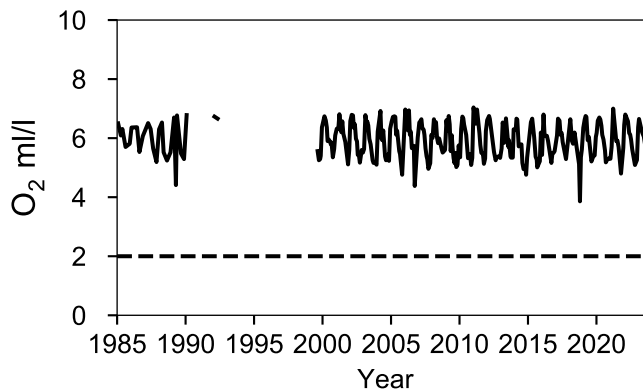
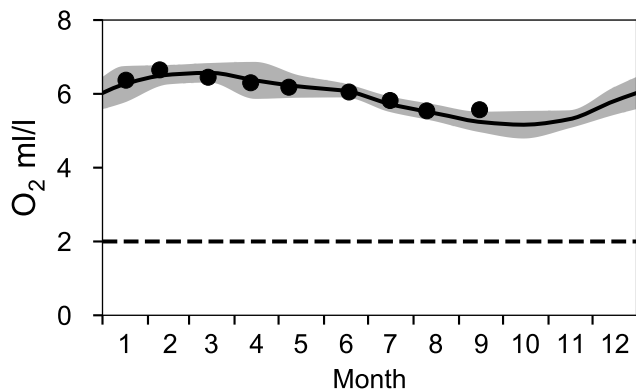
— Mean 1991-2020

■ St.Dev.

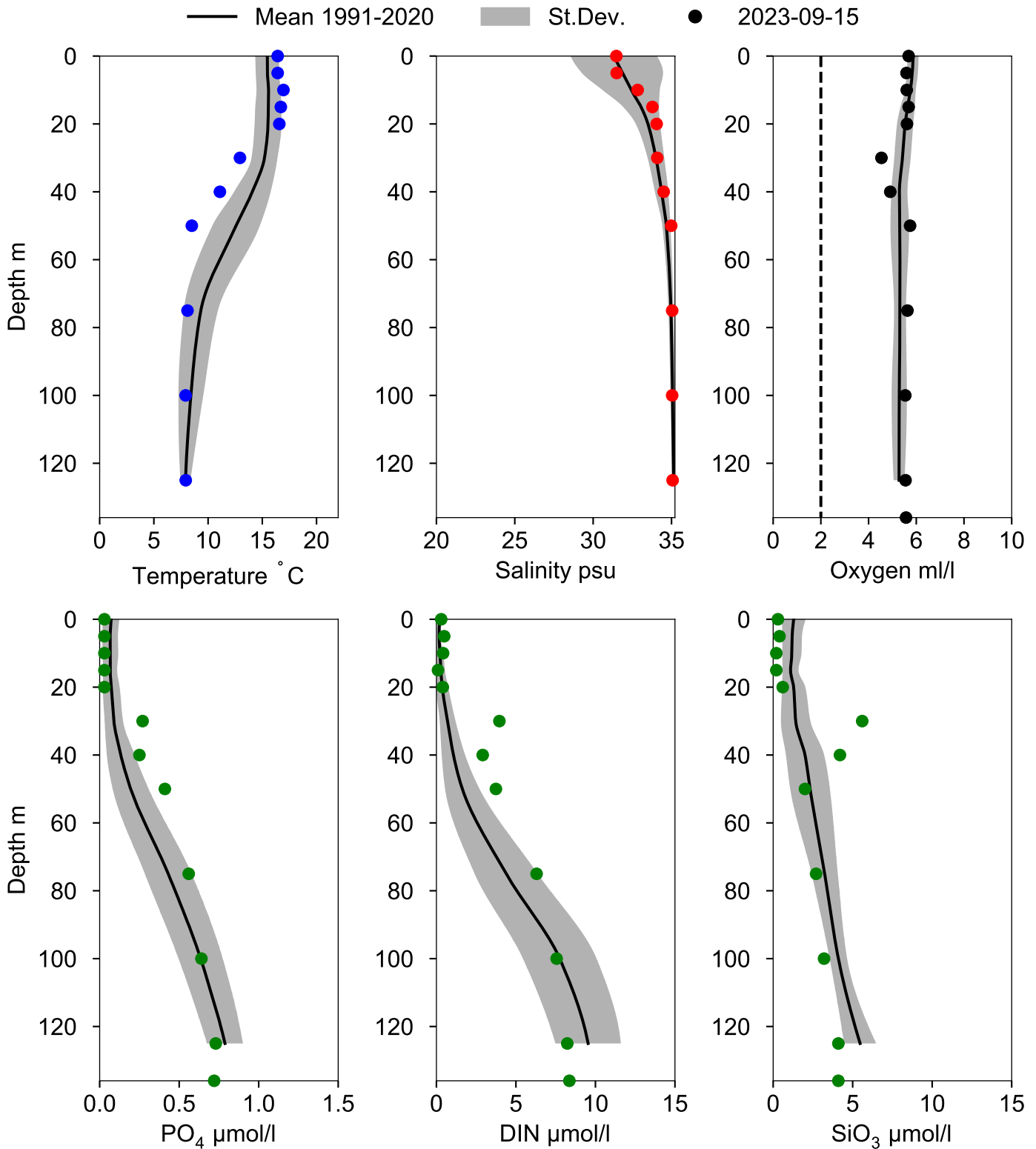
● 2023



## OXYGEN IN BOTTOM WATER (depth >= 125 m)



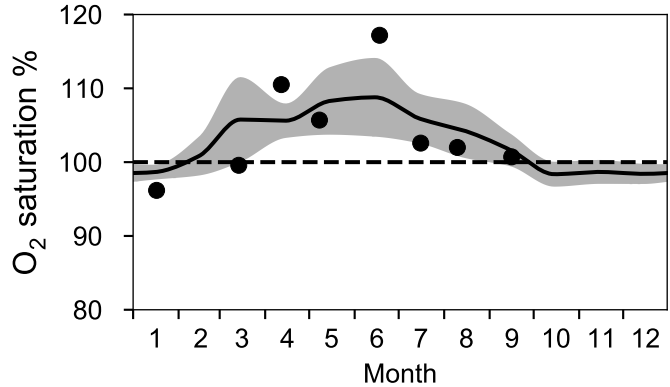
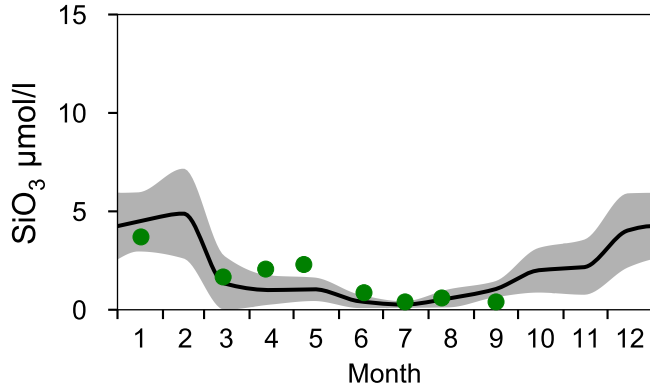
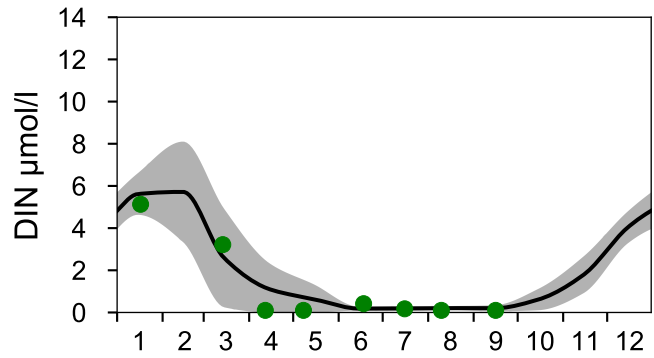
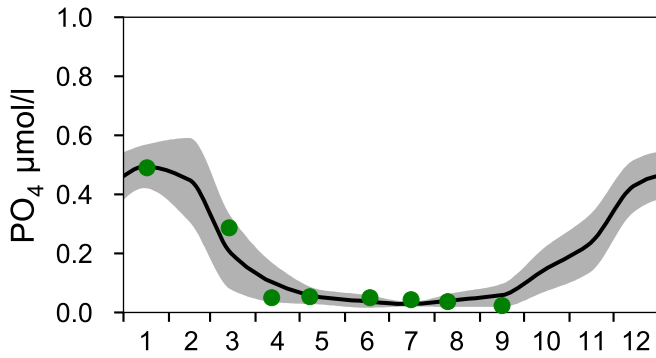
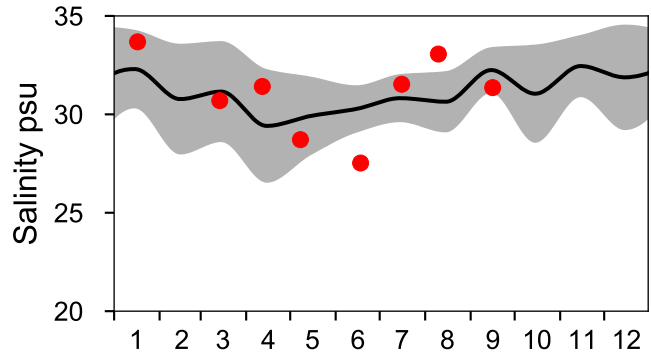
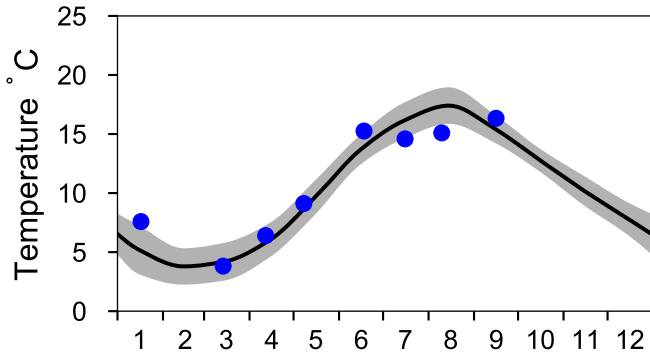
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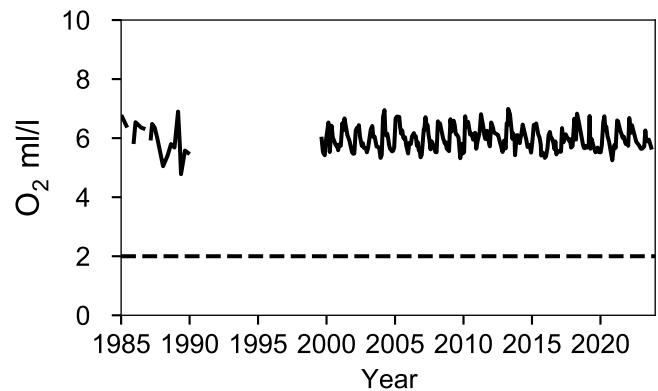
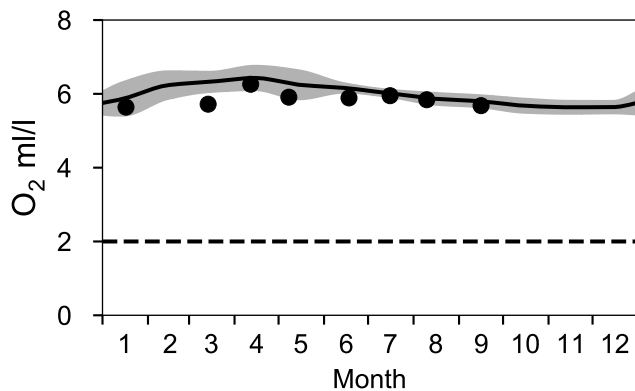
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Annual Cycles

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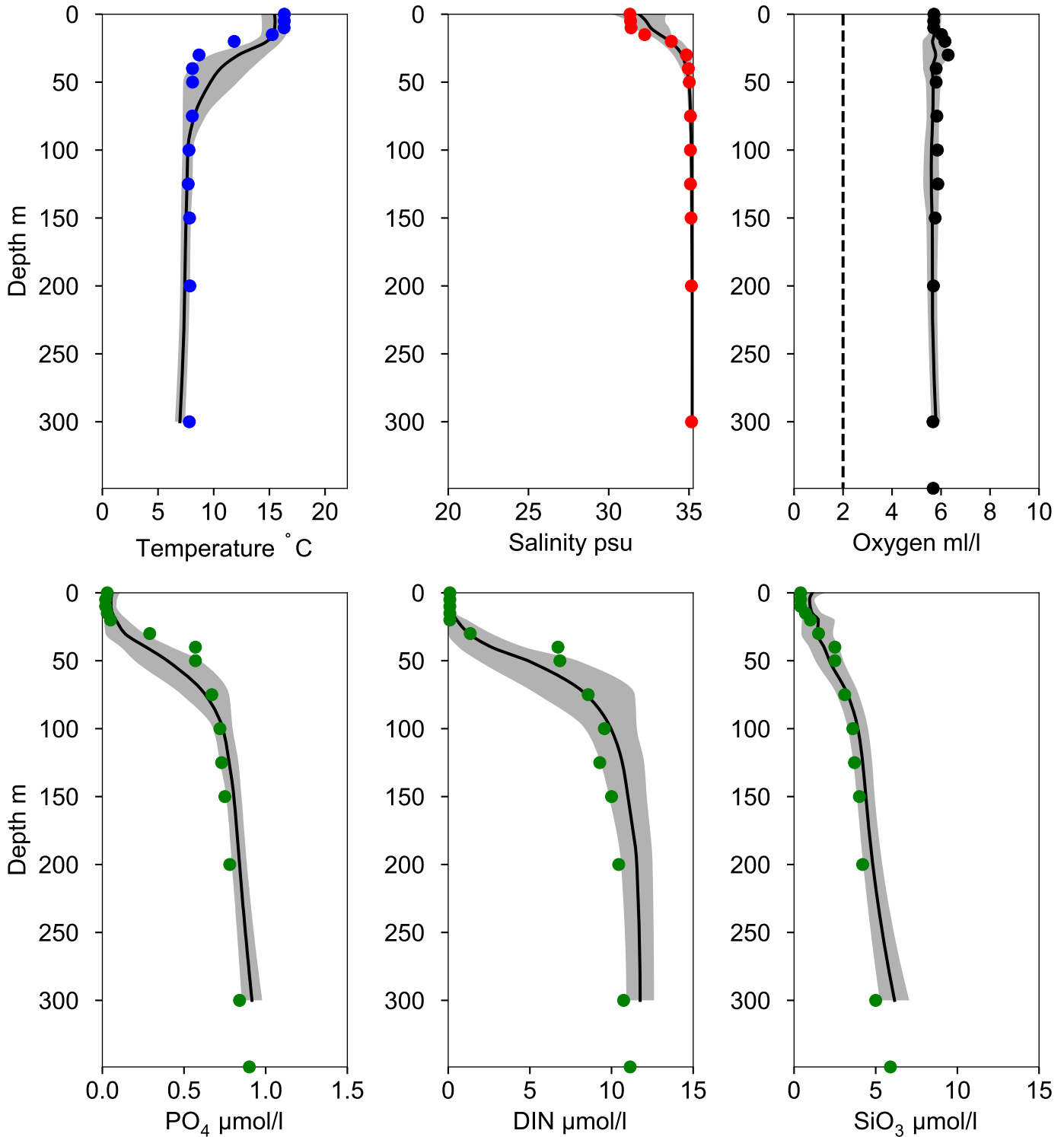


## OXYGEN IN BOTTOM WATER (depth >= 300 m)



# Vertical profiles Å17 September

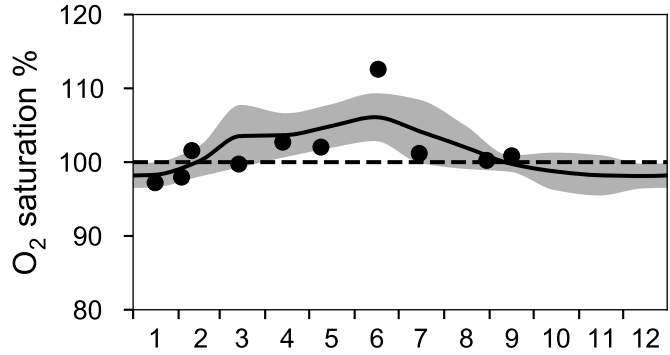
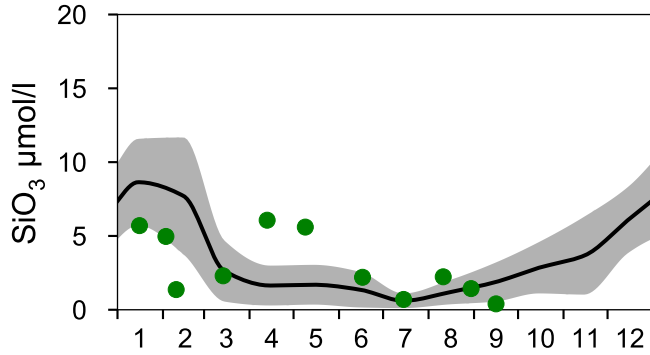
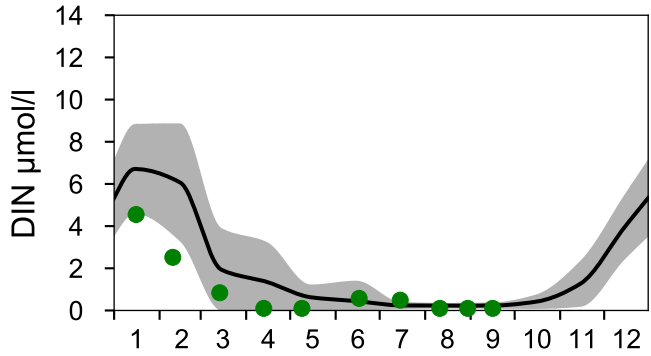
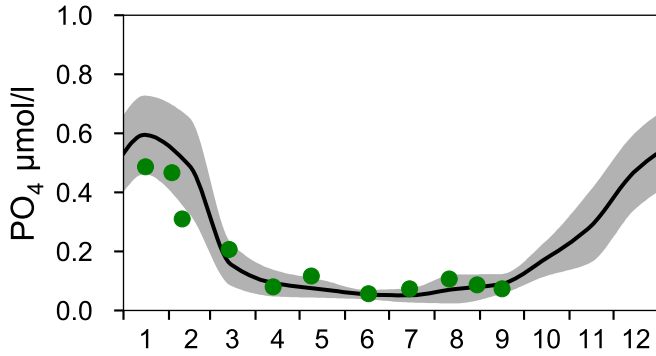
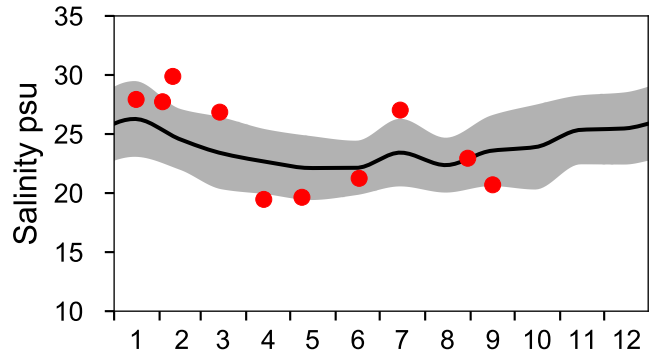
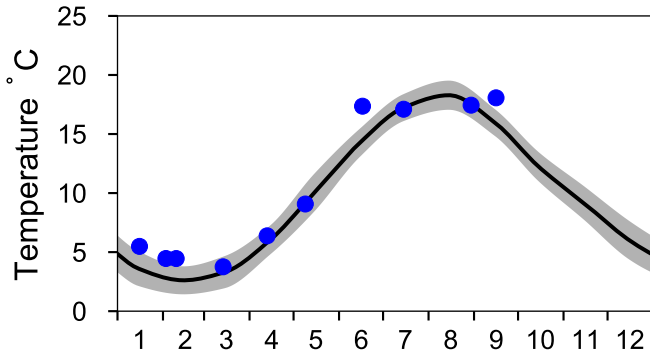
— Mean 1991-2020    St.Dev.    ● 2023-09-16



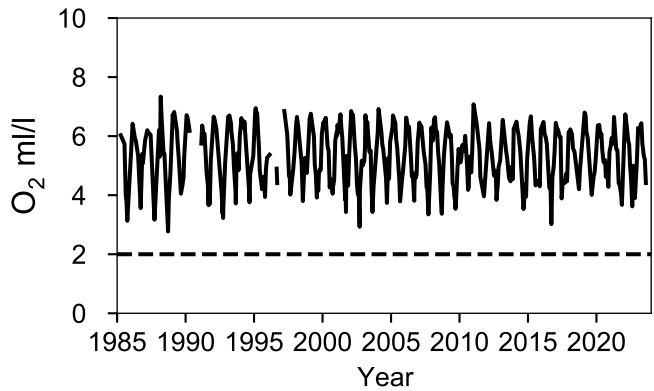
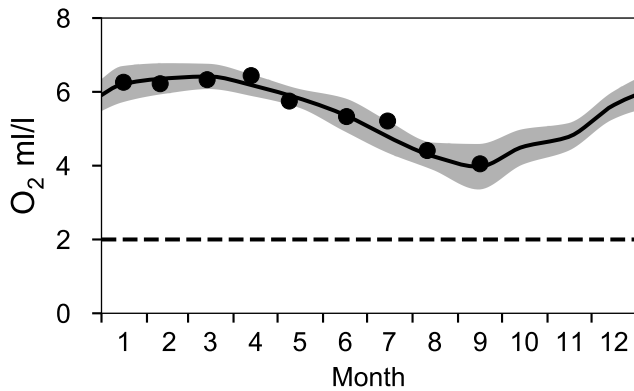
# STATION FLADEN SURFACE WATER (0-10 m)

Annual Cycles

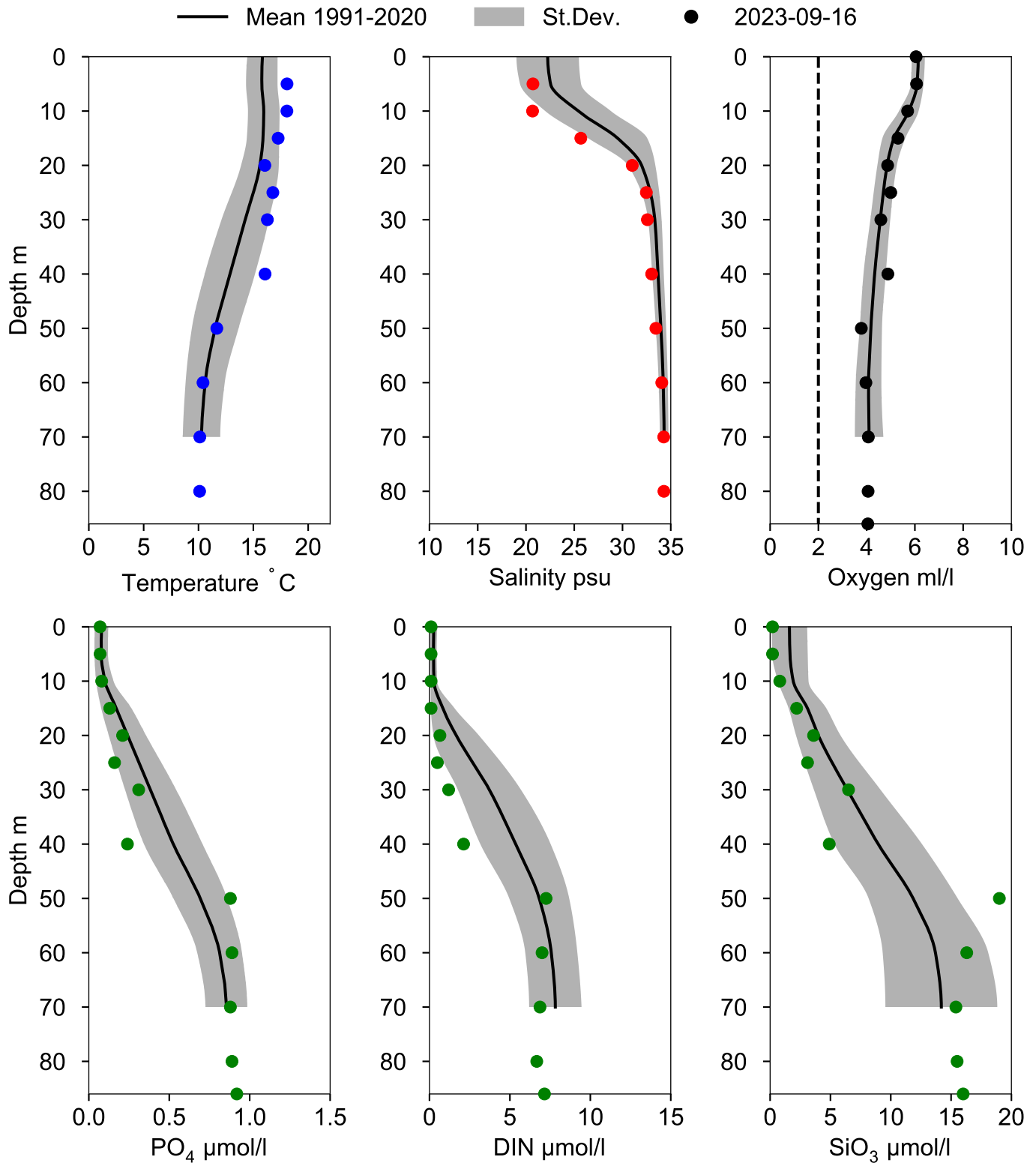
— Mean 1991-2020    St.Dev.    ● 2023



## OXYGEN IN BOTTOM WATER (depth >= 74 m)



# Vertical profiles FLADEN September

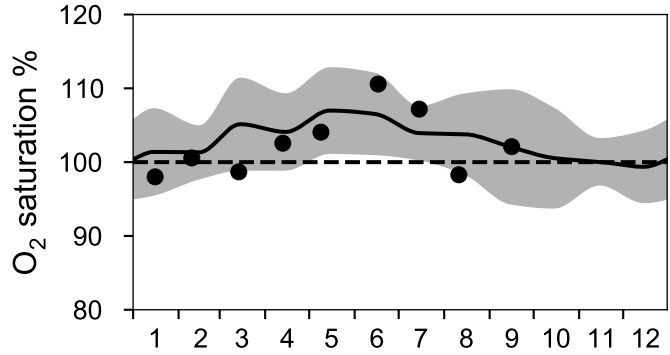
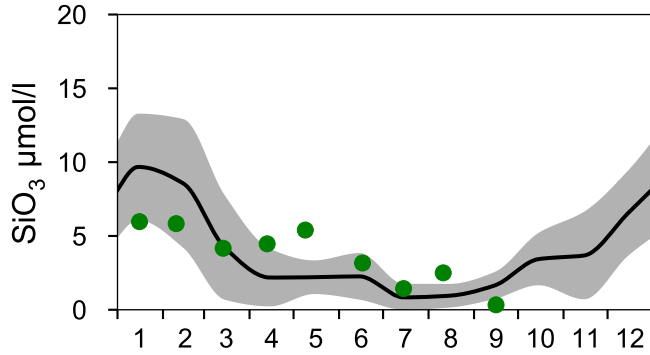
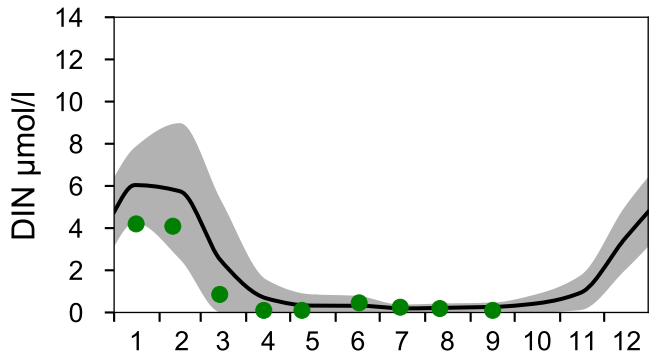
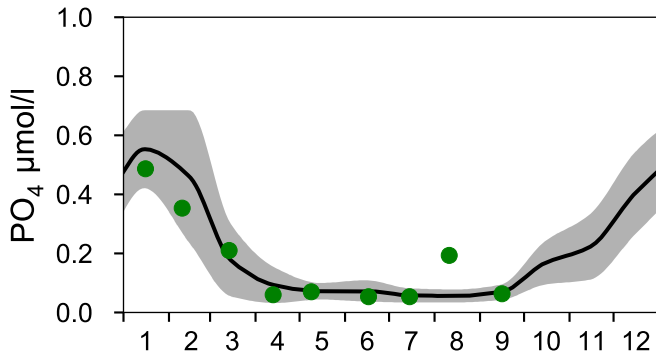
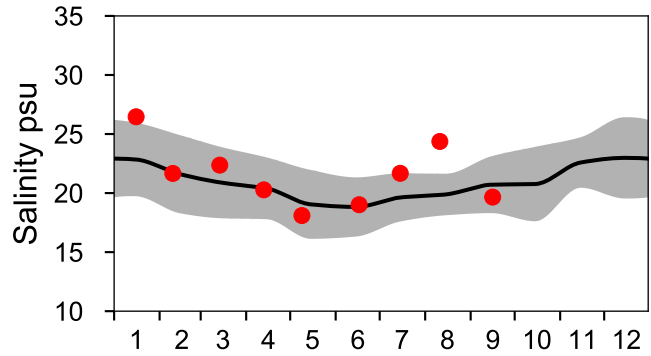
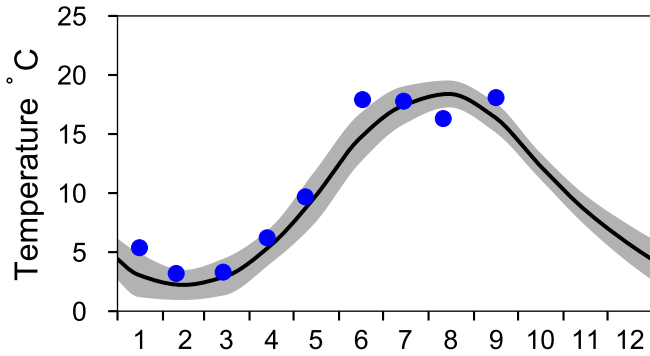




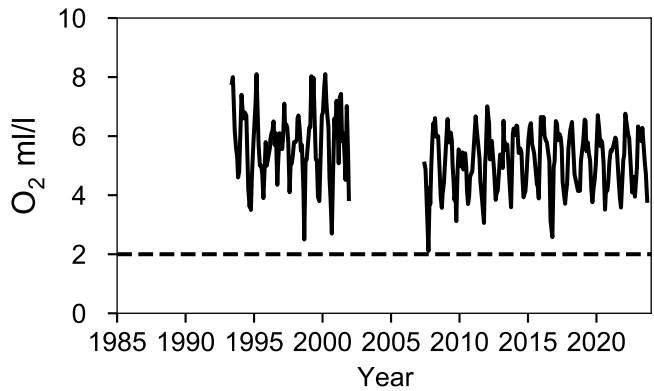
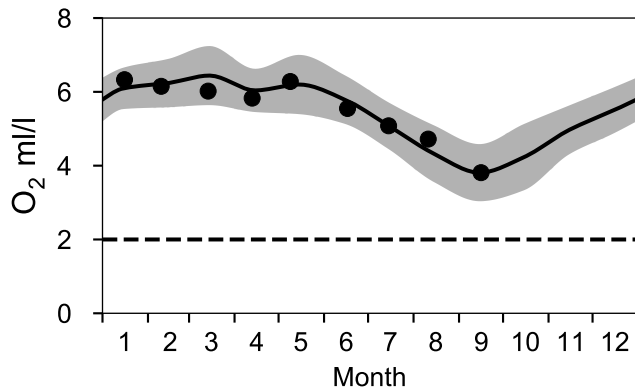
# STATION N14 FALKENBERG SURFACE WATER (0-10 m)

Annual Cycles

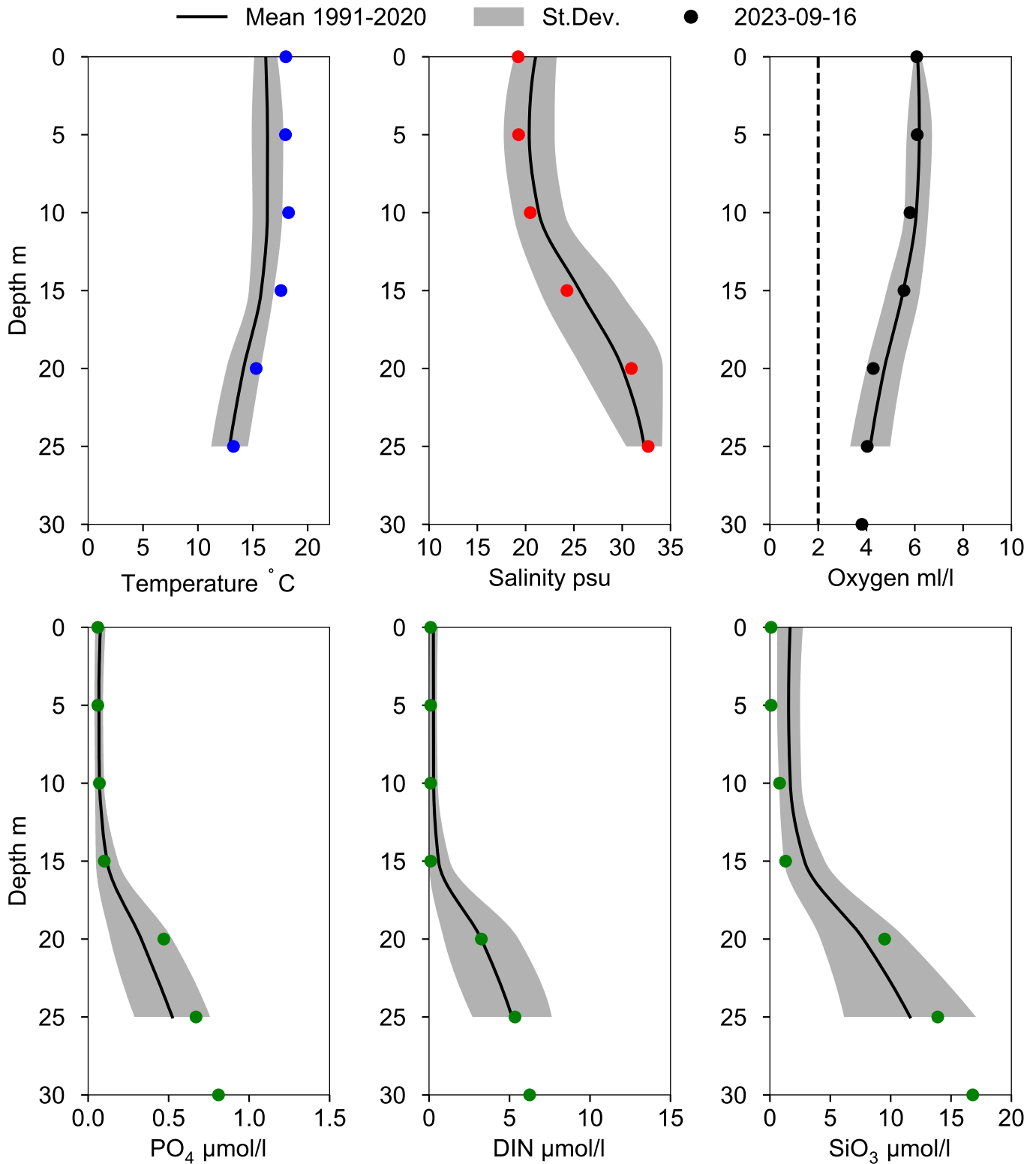
— Mean 1991-2020    St.Dev.    ● 2023



## OXYGEN IN BOTTOM WATER (depth >= 25 m)



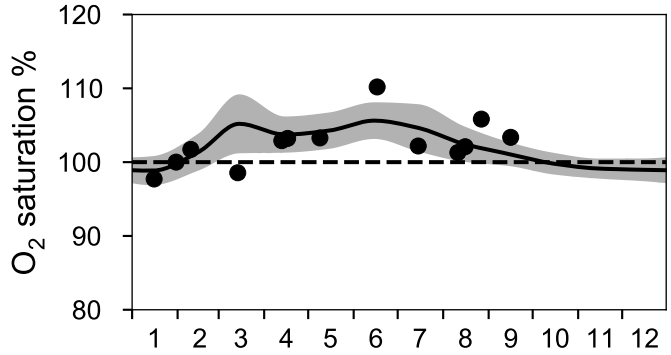
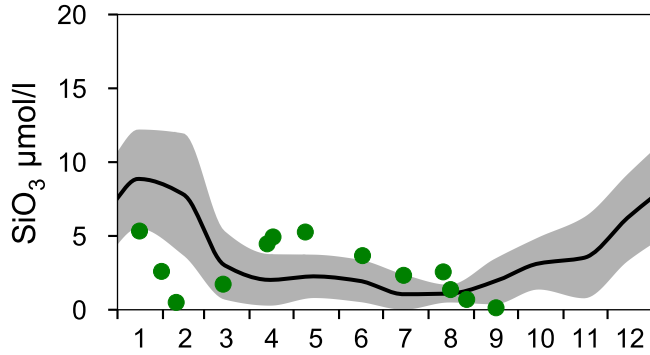
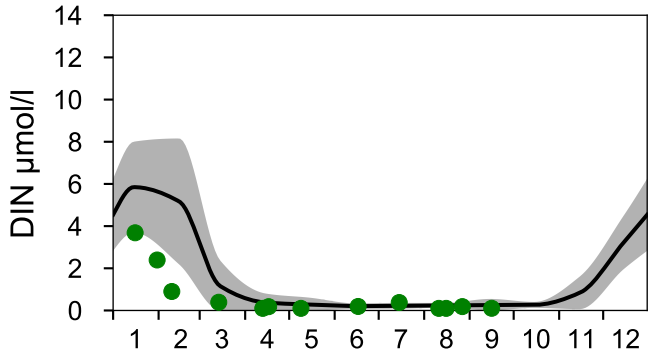
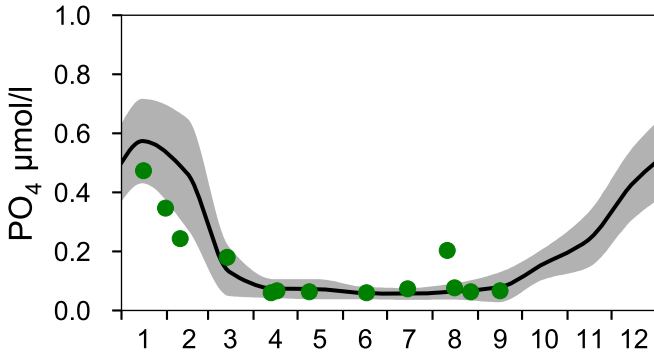
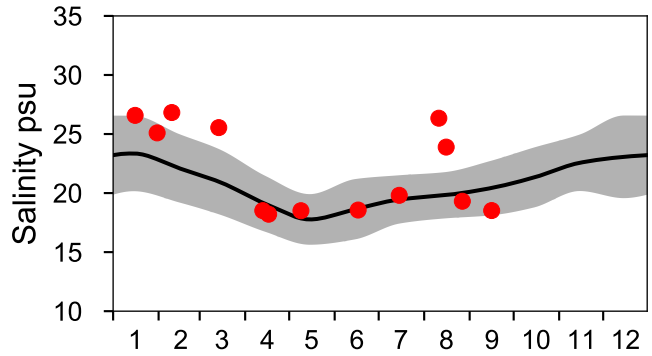
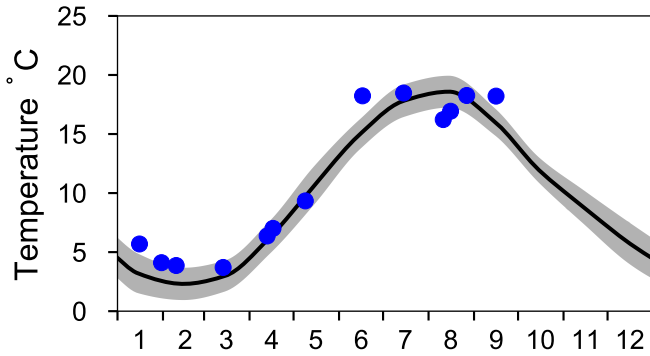
# Vertical profiles N14 FALKENBERG September



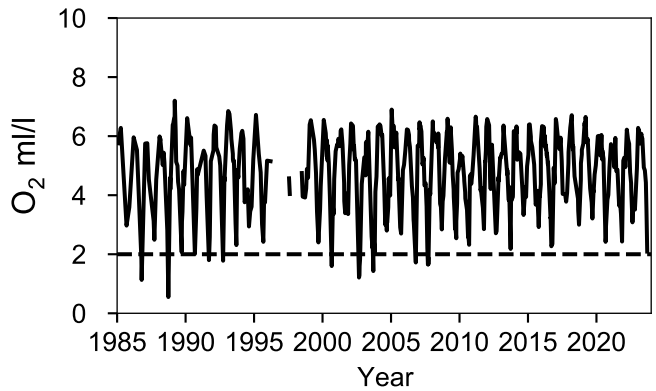
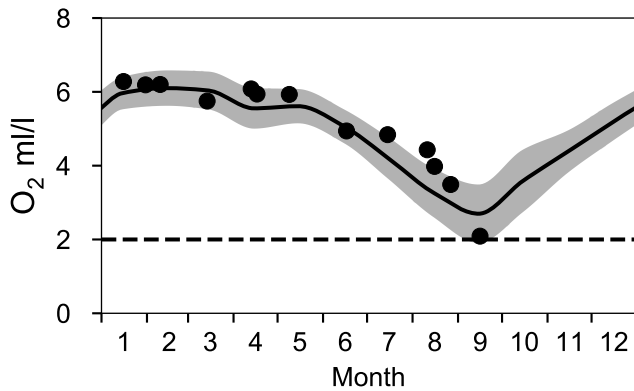
# STATION ANHOLT E SURFACE WATER (0-10 m)

Annual Cycles

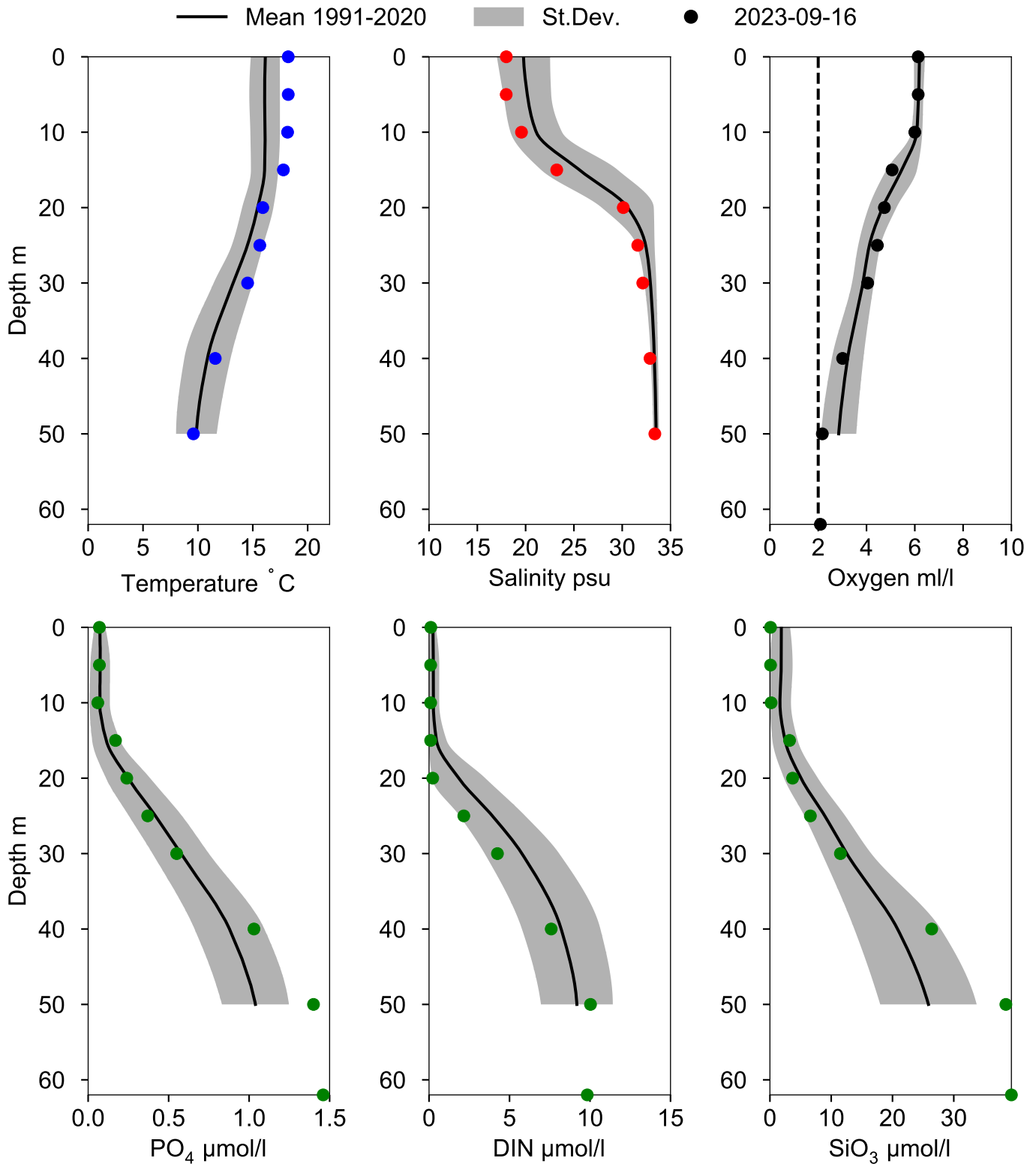
— Mean 1991-2020    St.Dev.    ● 2023



## OXYGEN IN BOTTOM WATER (depth >= 52 m)



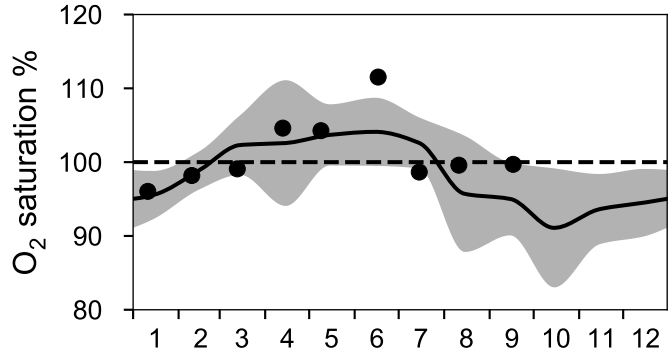
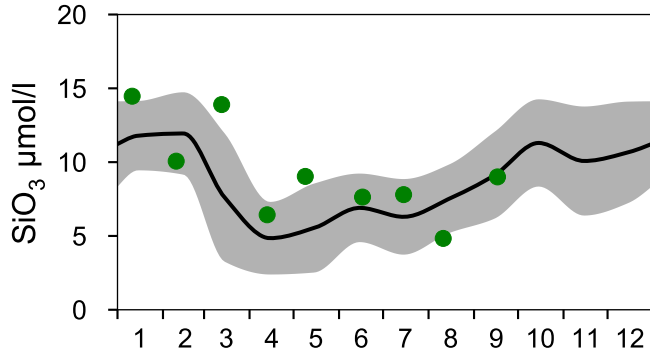
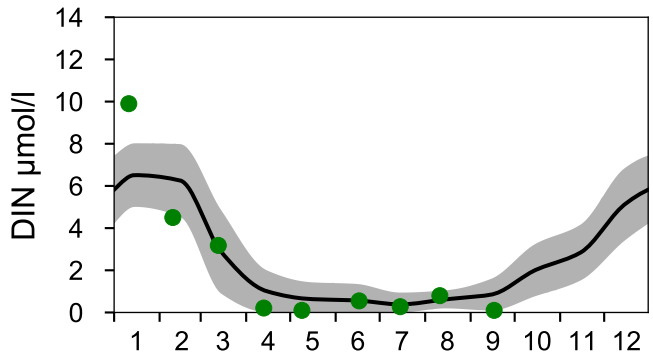
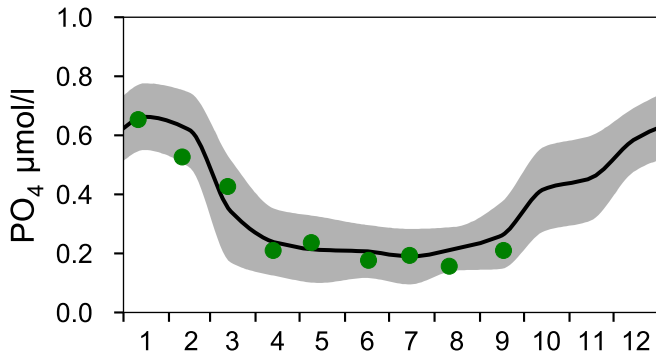
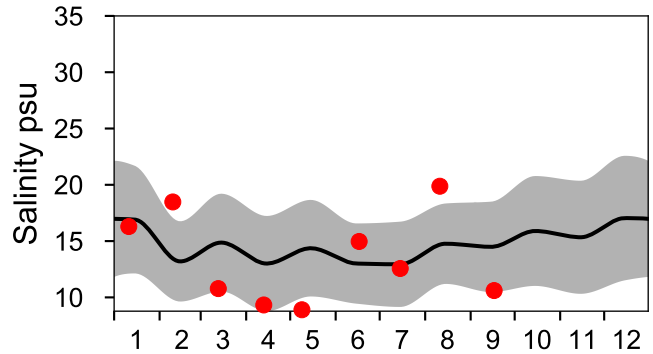
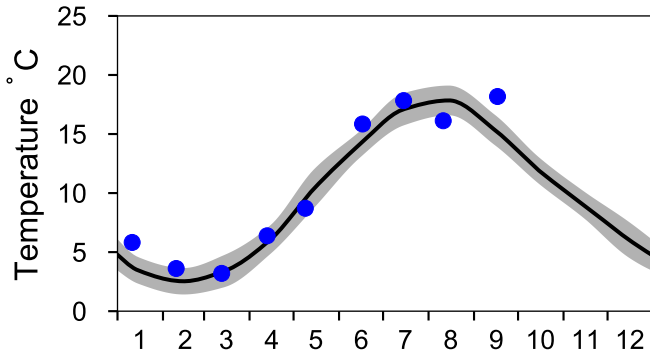
# Vertical profiles ANHOLT E September



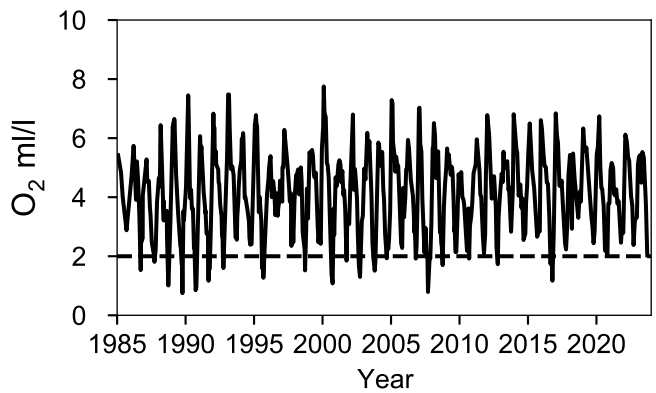
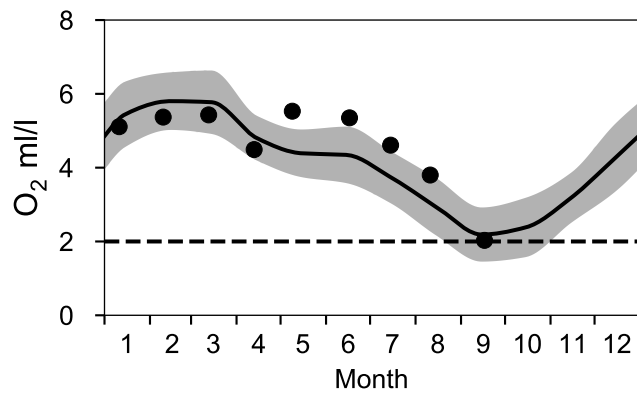
# STATION W LANDSKRONA SURFACE WATER (0-10 m)

Annual Cycles

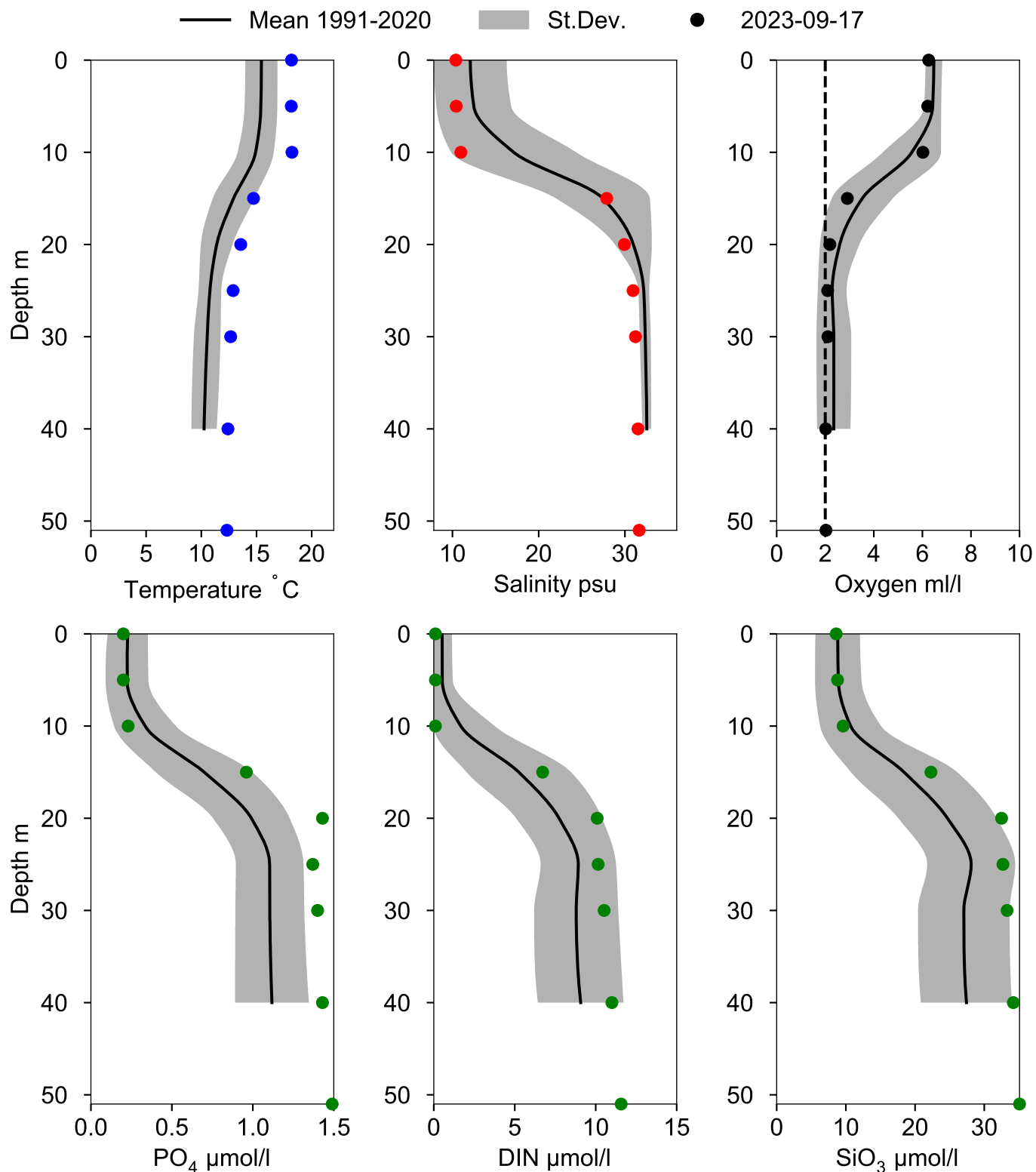
— Mean 1991-2020    St.Dev.    ● 2023



## OXYGEN IN BOTTOM WATER (depth >= 40 m)



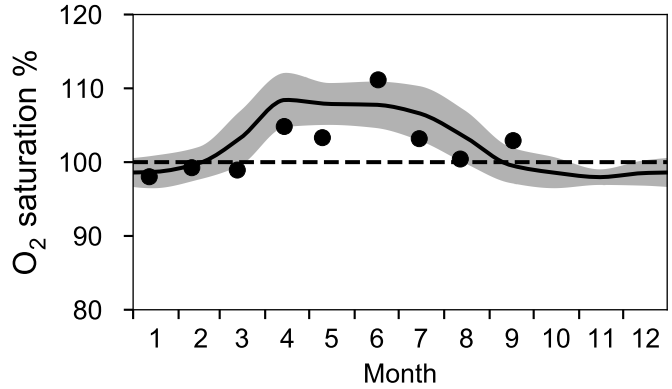
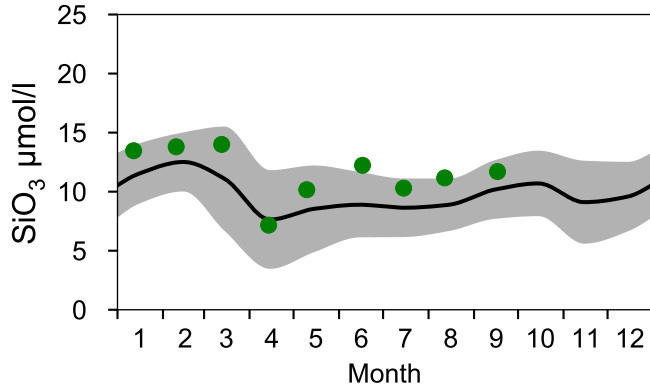
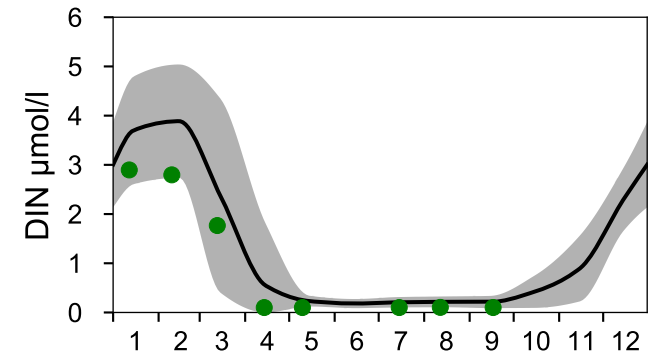
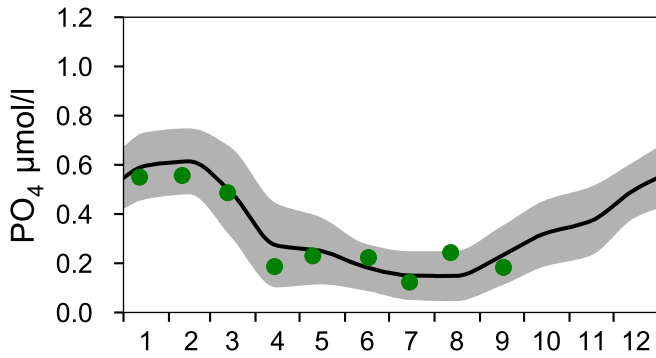
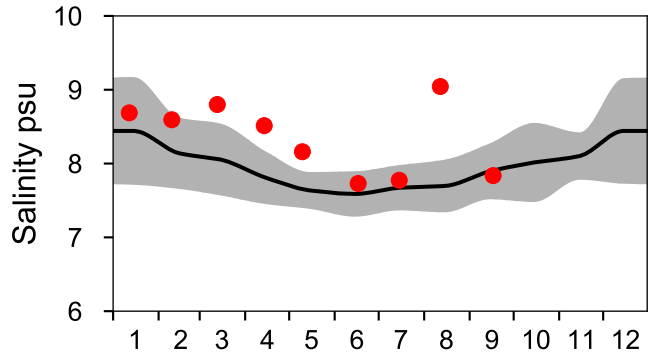
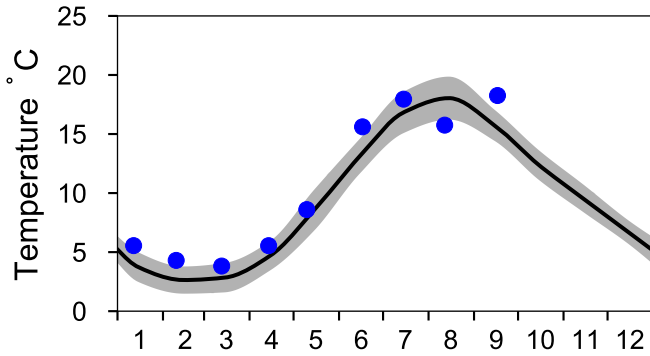
# Vertical profiles W LANDSKRONA September



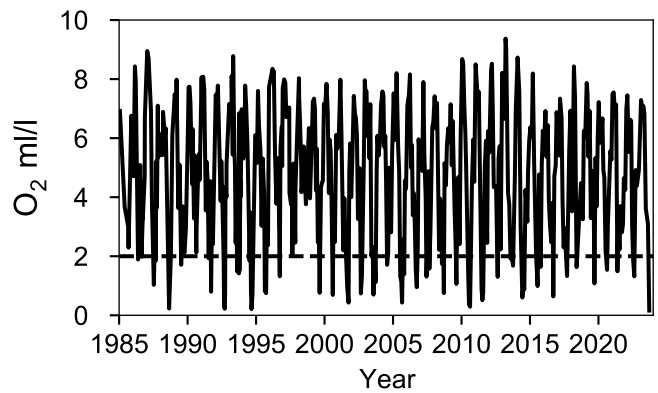
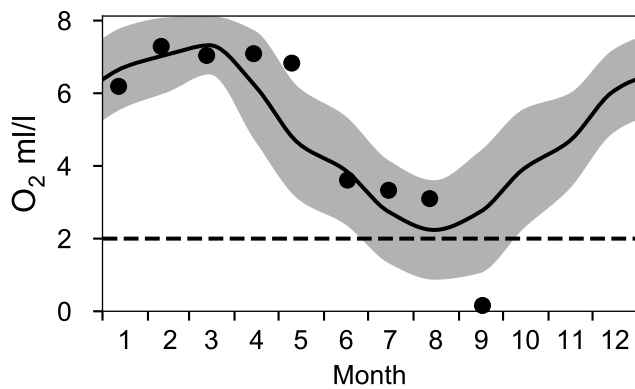
# STATION BY1 SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020    St.Dev.    ● 2023

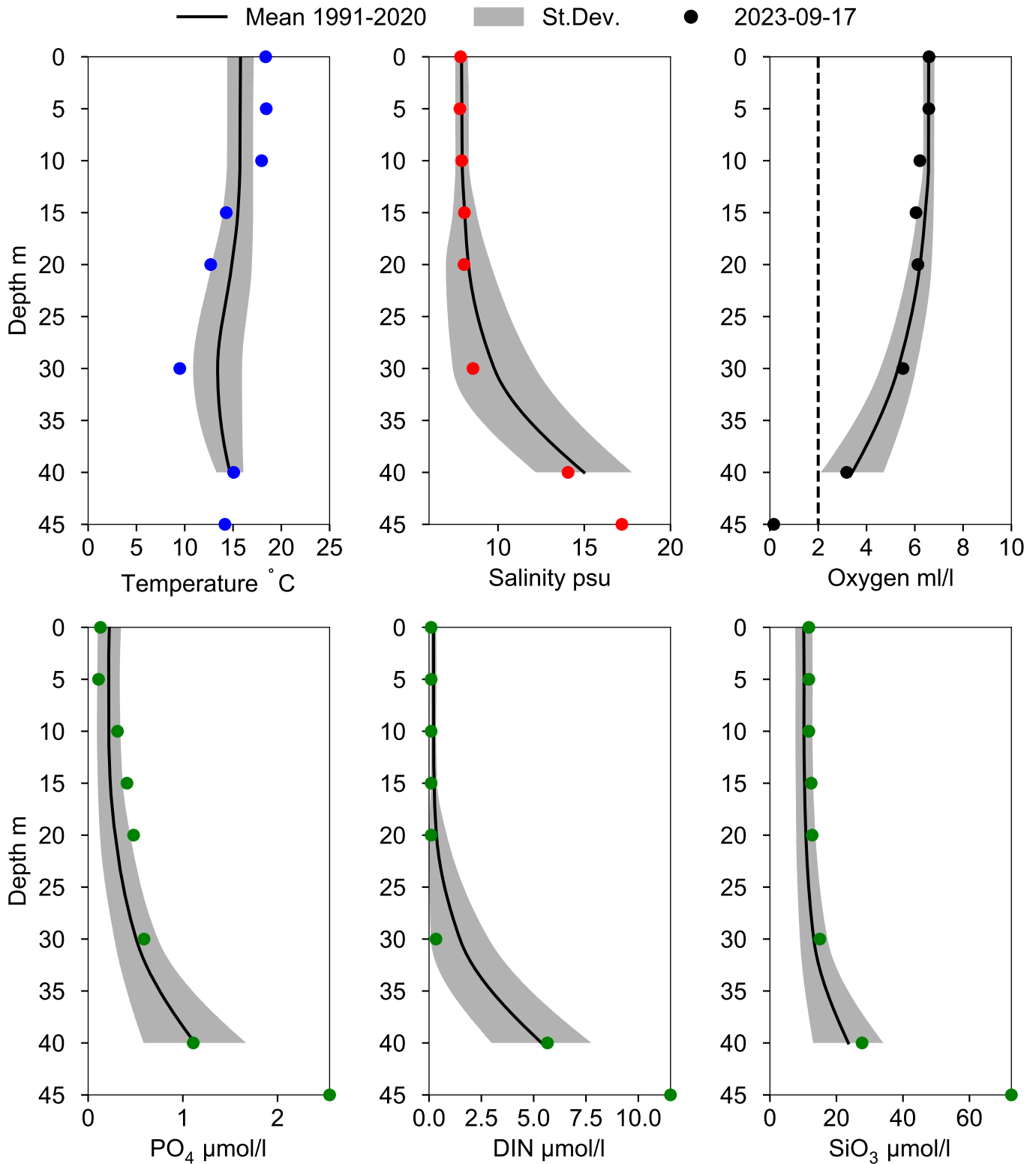


## OXYGEN IN BOTTOM WATER (depth >= 39 m)





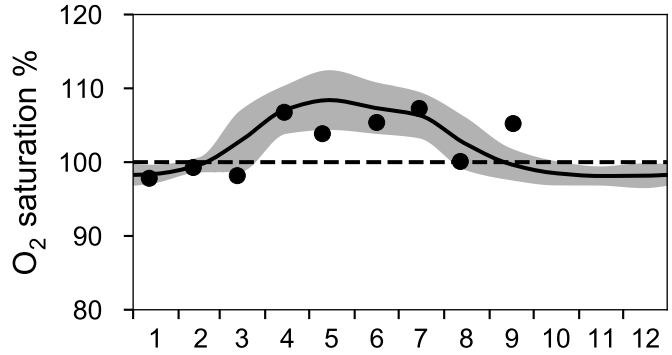
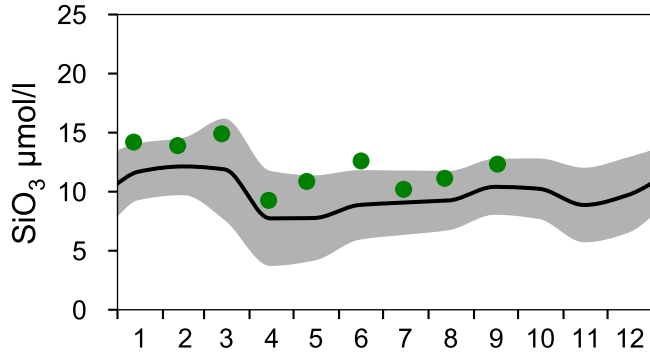
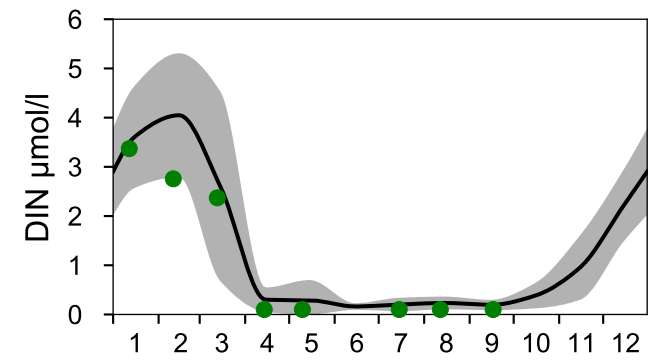
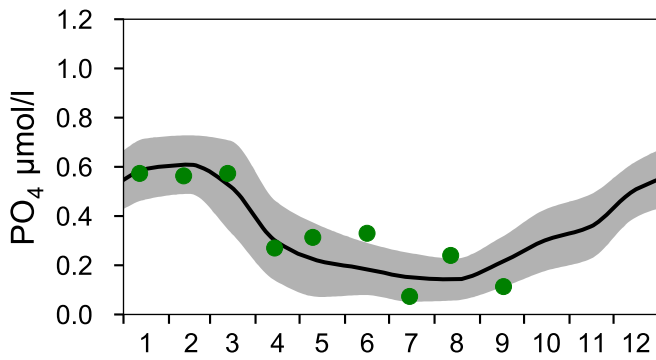
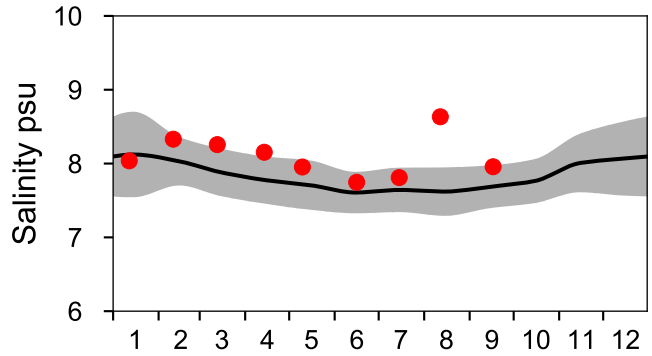
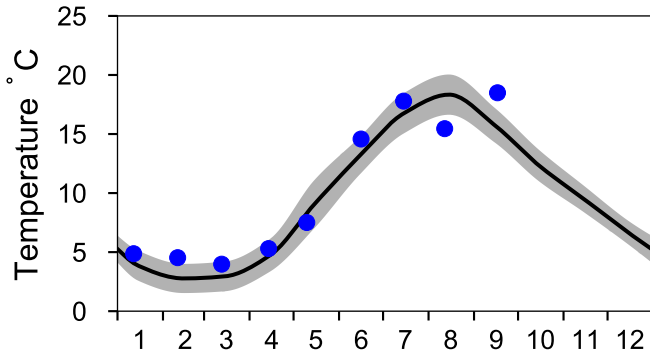
# Vertical profiles BY1 September



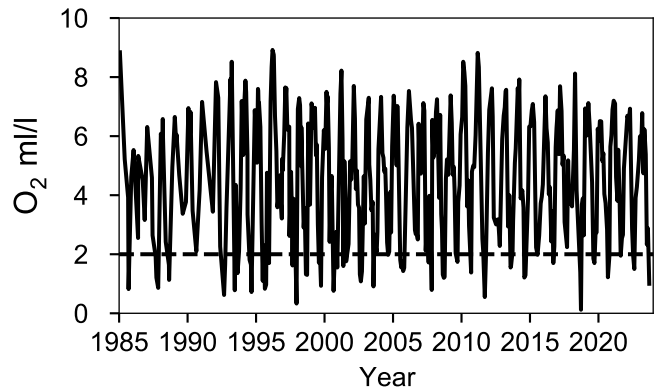
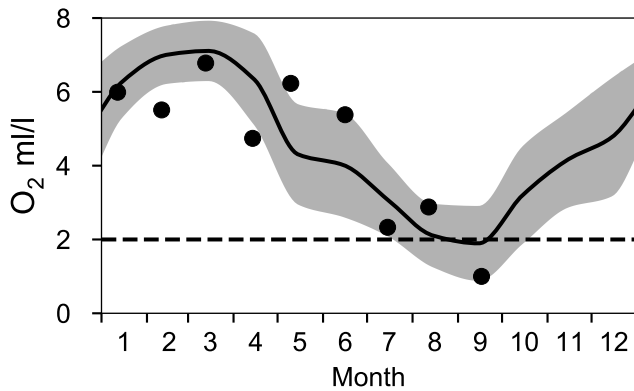
# STATION BY2 ARKONA SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020    St.Dev.    ● 2023

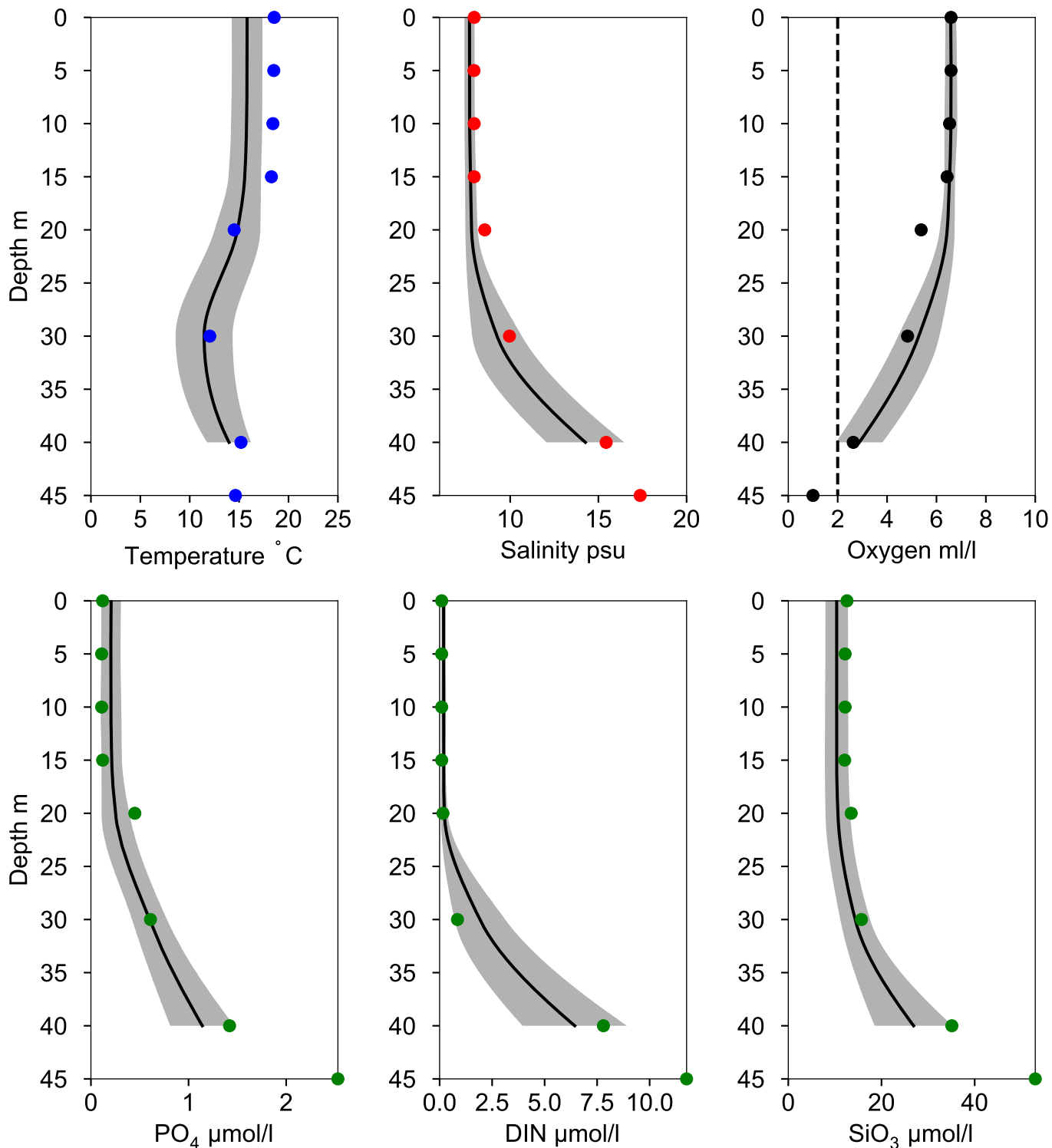


## OXYGEN IN BOTTOM WATER (depth >= 40 m)



# Vertical profiles BY2 ARKONA September

— Mean 1919-2020    ■ St.Dev.    ● 2023-09-17



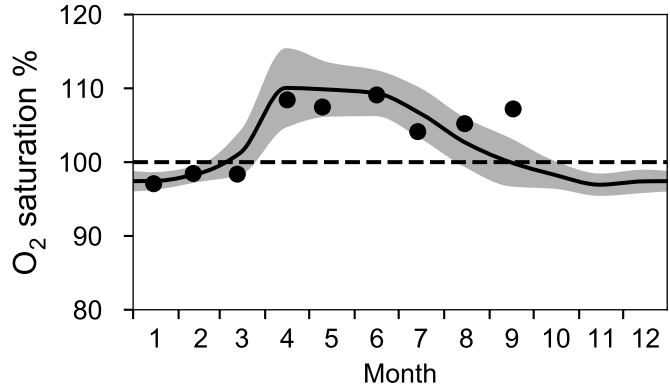
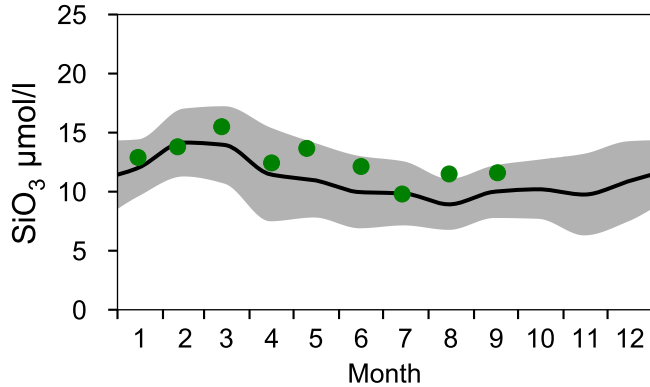
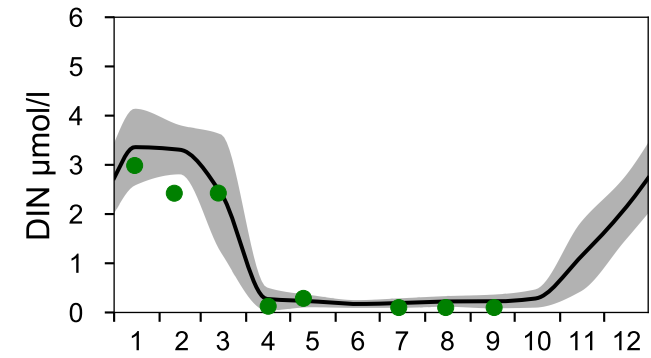
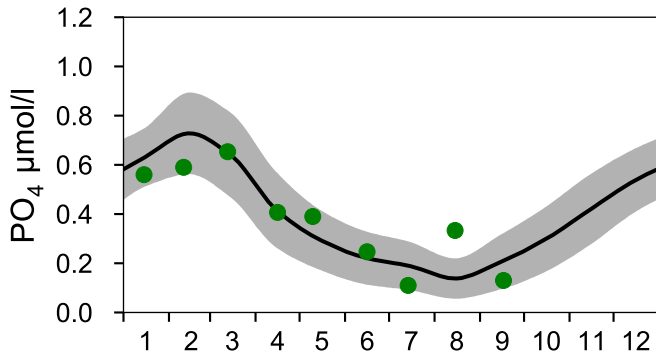
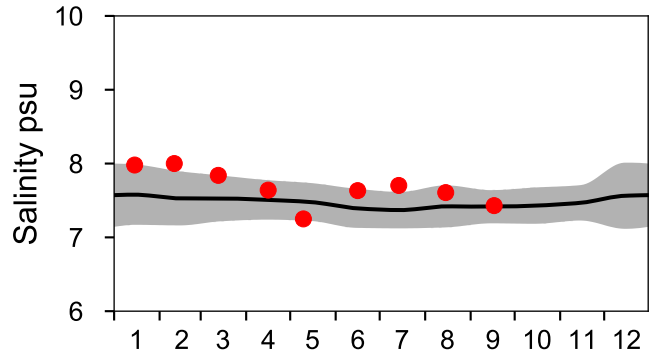
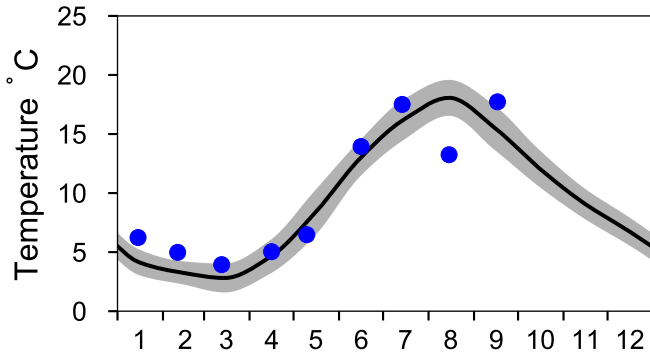
# STATION HANÖBUKTEN SURFACE WATER (0-10 m)

Annual Cycles

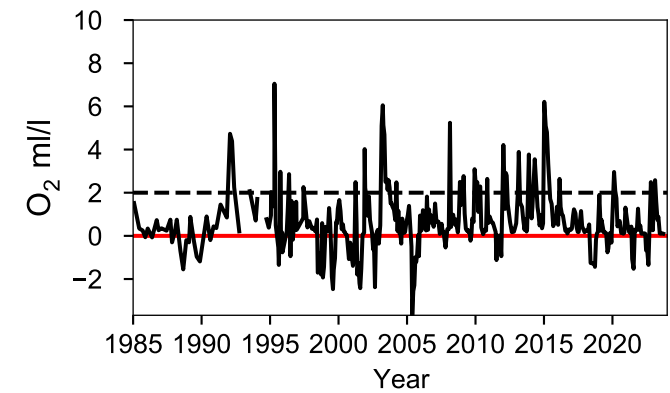
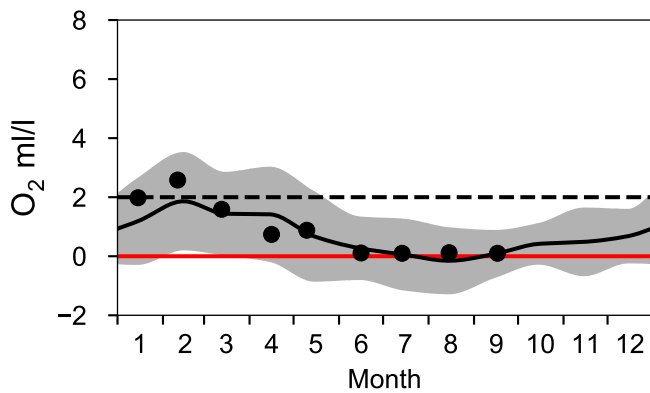
— Mean 1991-2020

■ St.Dev.

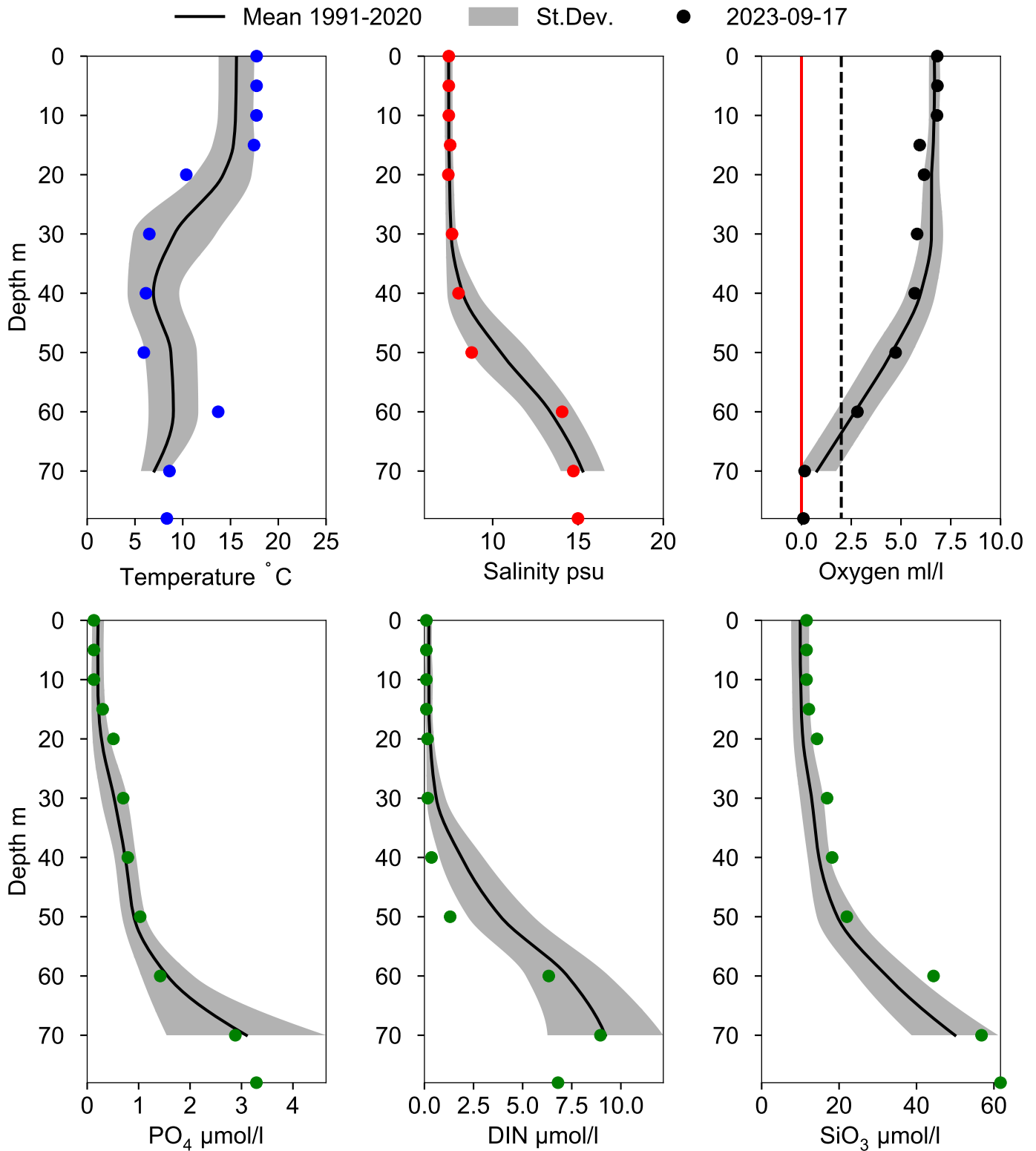
● 2023



## OXYGEN IN BOTTOM WATER (depth >= 70 m)



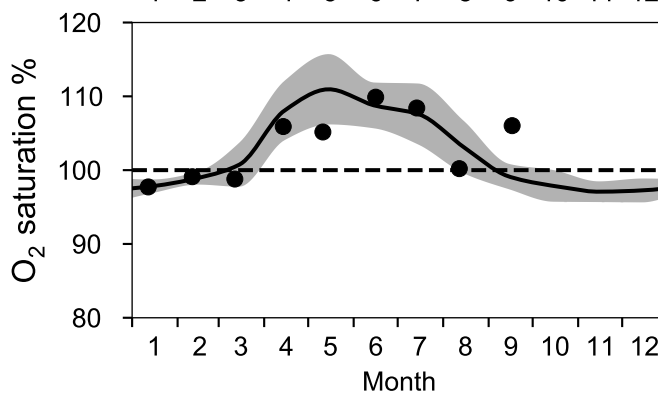
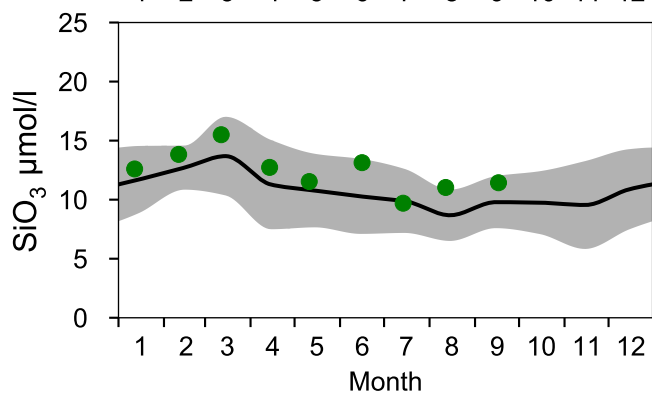
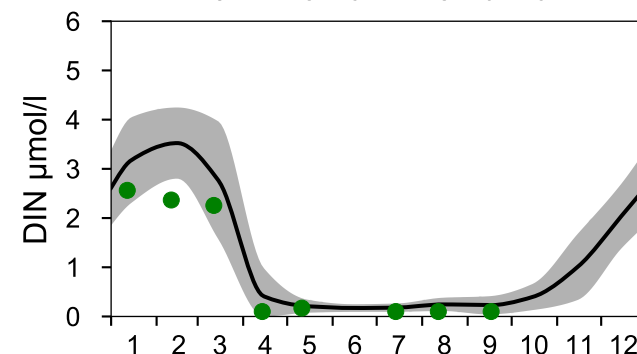
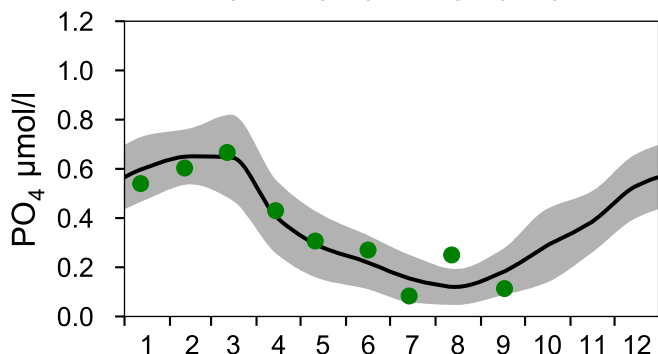
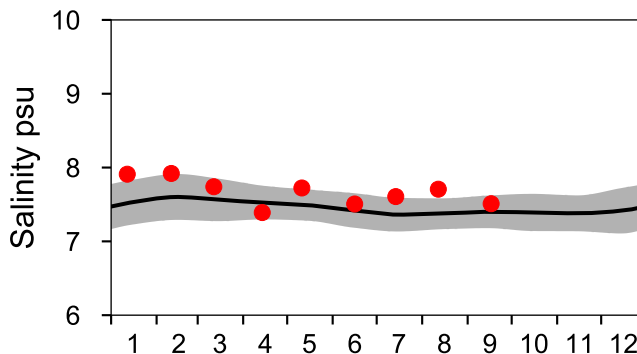
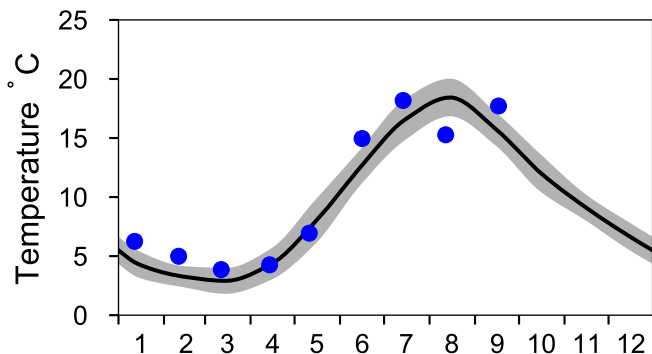
# Vertical profiles HANÖBUKTEN September



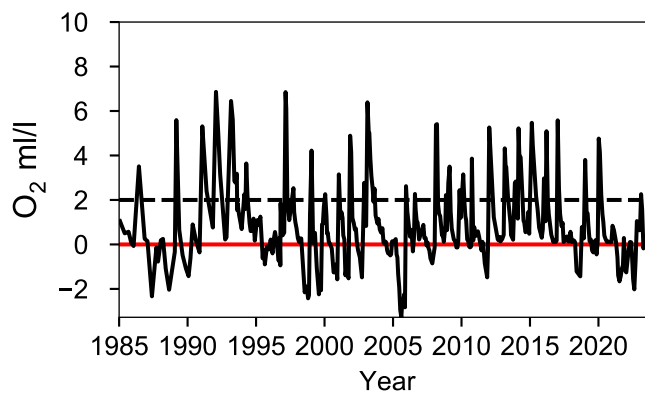
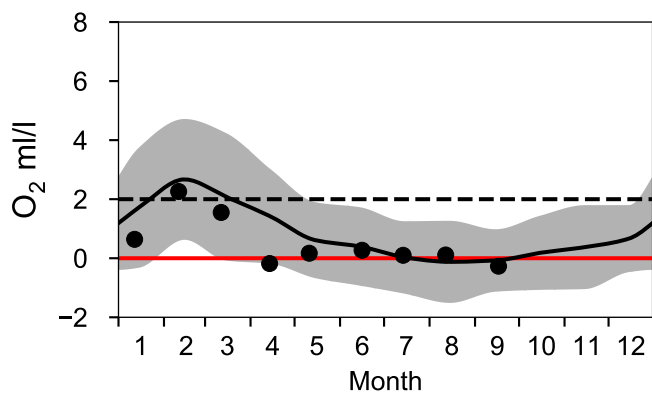
# STATION BY4 CHRISTIANSÖ SURFACE WATER (0-10 m)

Annual Cycles

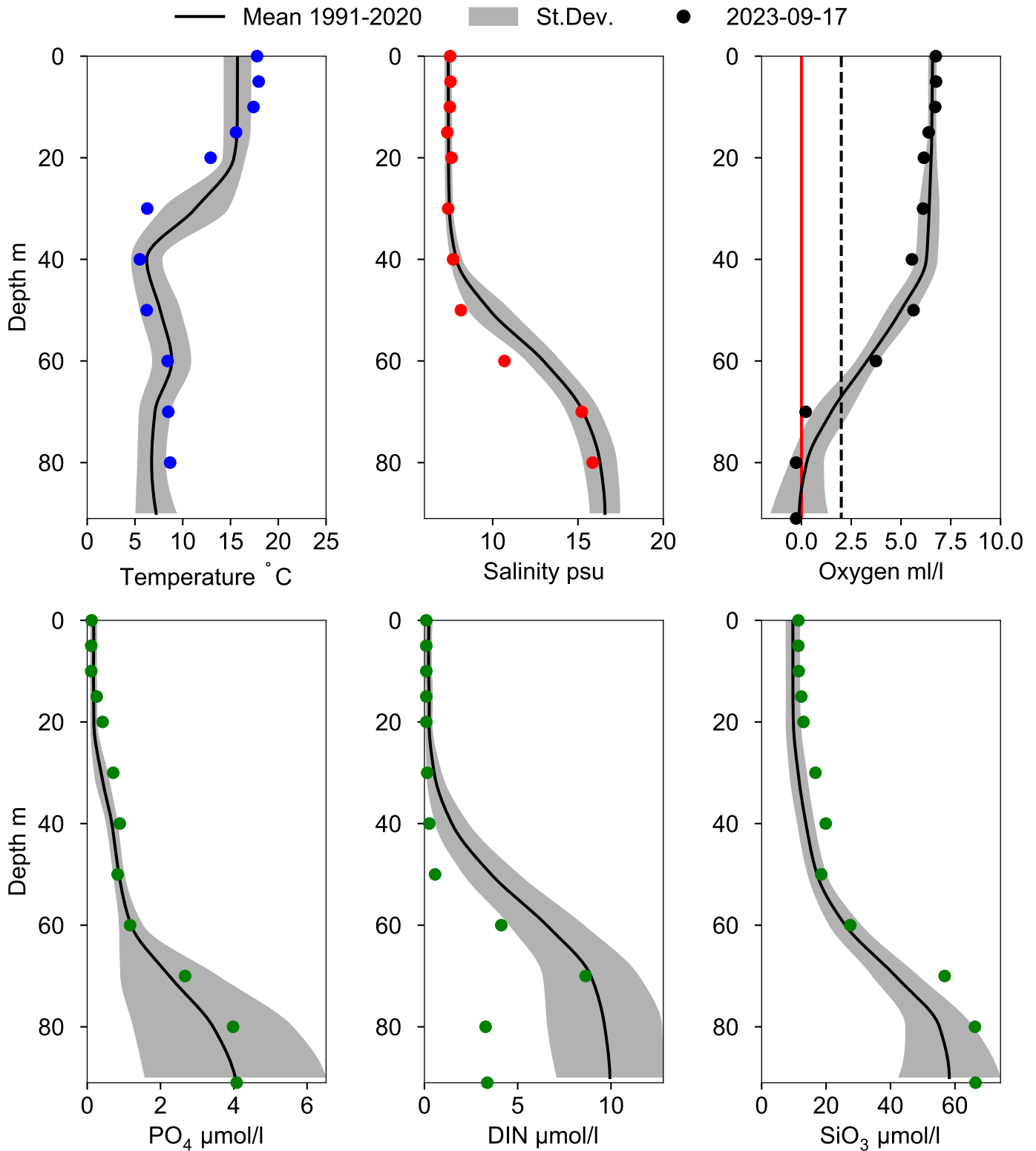
— Mean 1991-2020    St.Dev.    ● 2023



## OXYGEN IN BOTTOM WATER (depth >= 80 m)



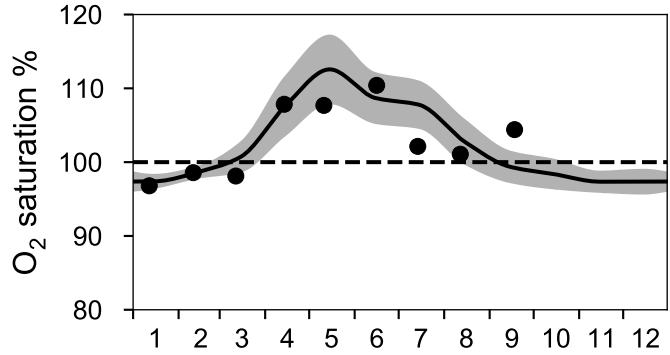
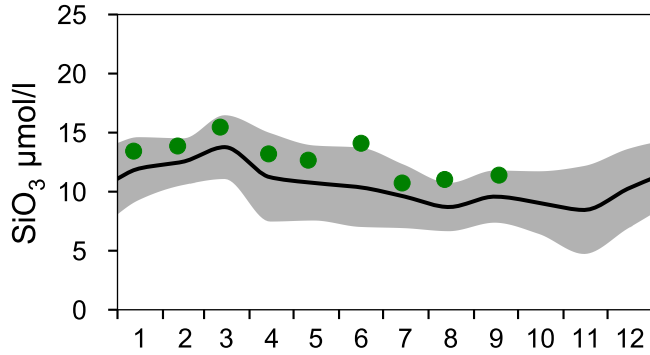
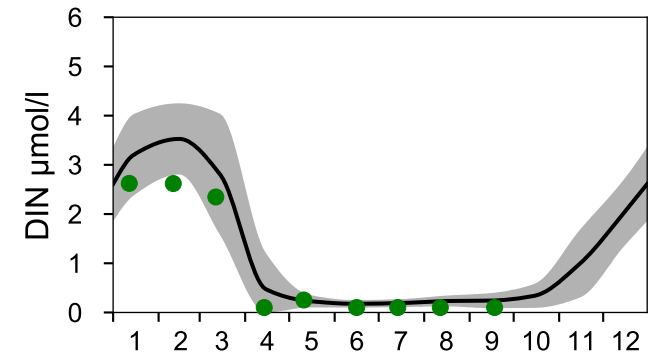
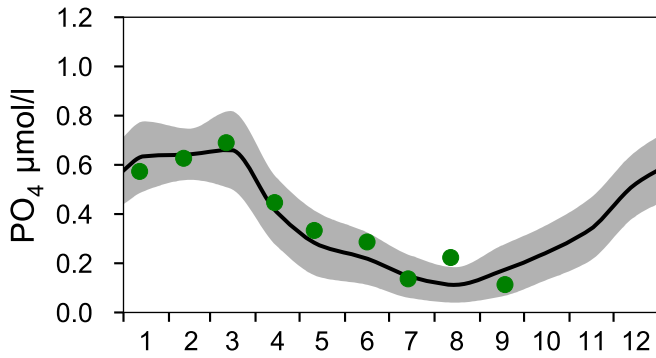
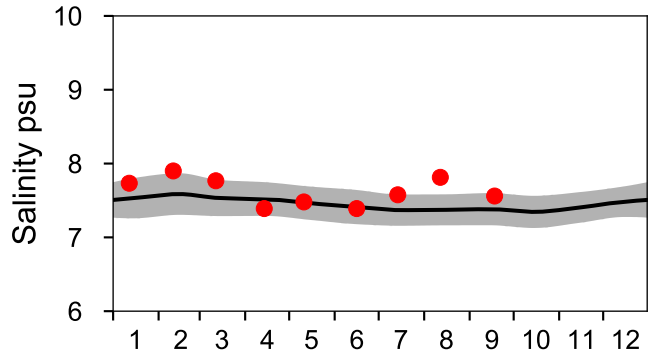
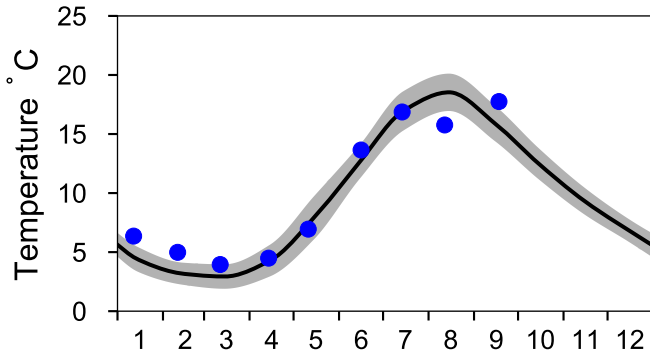
# Vertical profiles BY4 CHRISTIANSÖ September



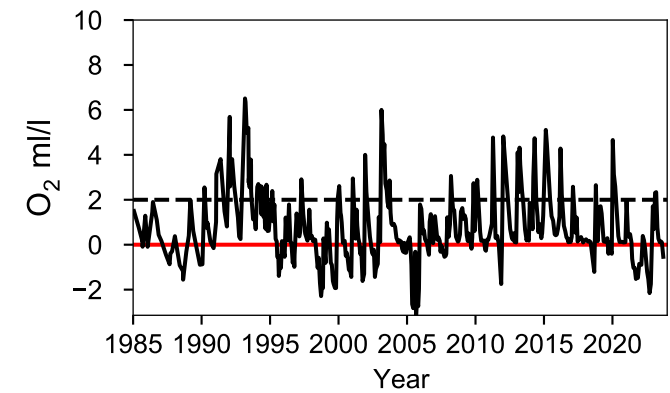
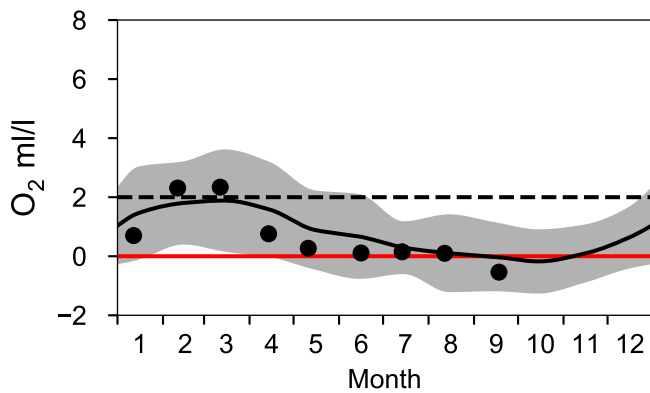
# STATION BY5 BORNHOLMSDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020    St.Dev.    ● 2023

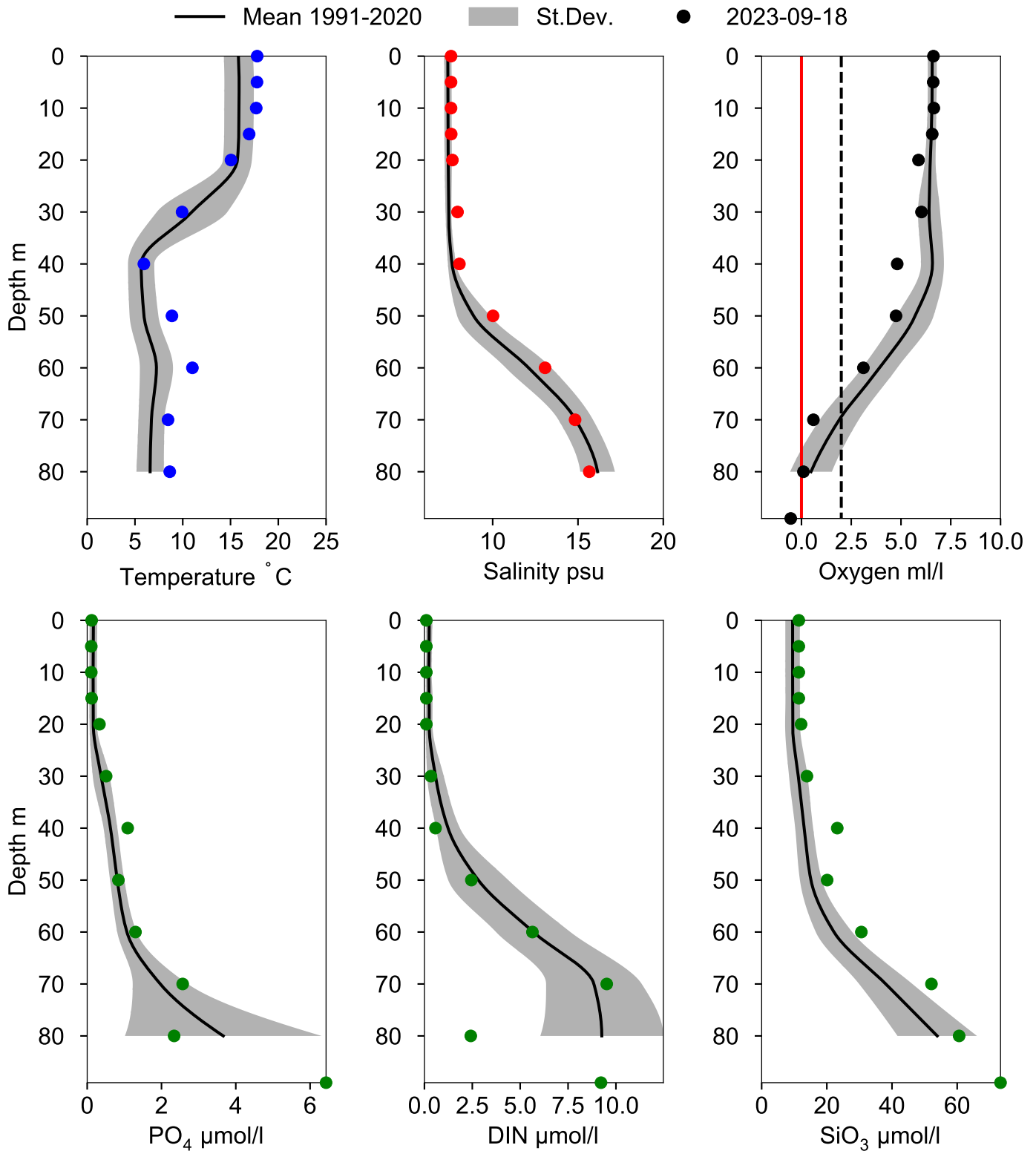


## OXYGEN IN BOTTOM WATER (depth >= 80 m)





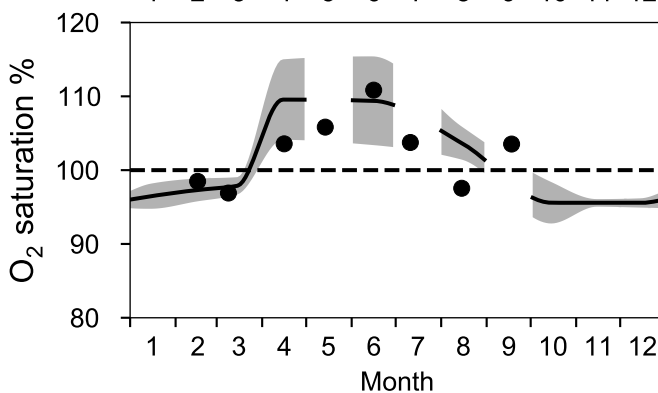
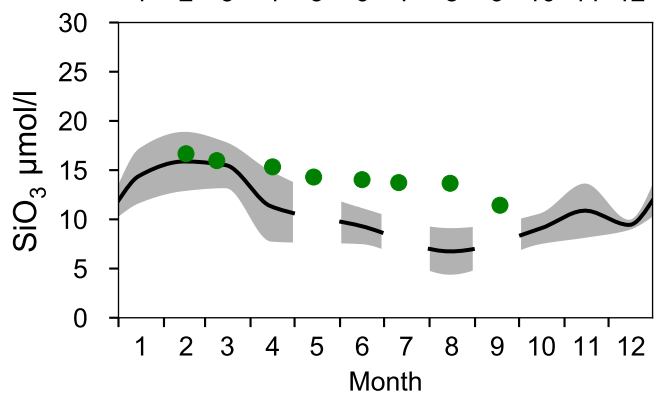
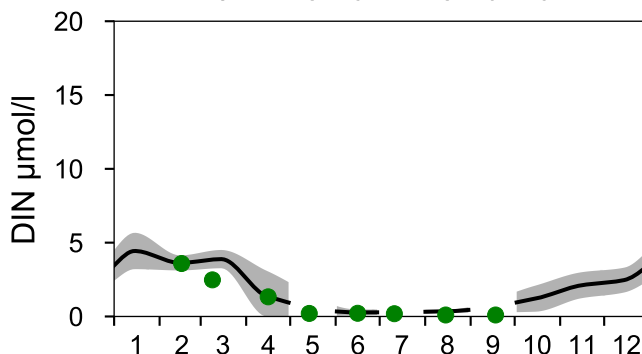
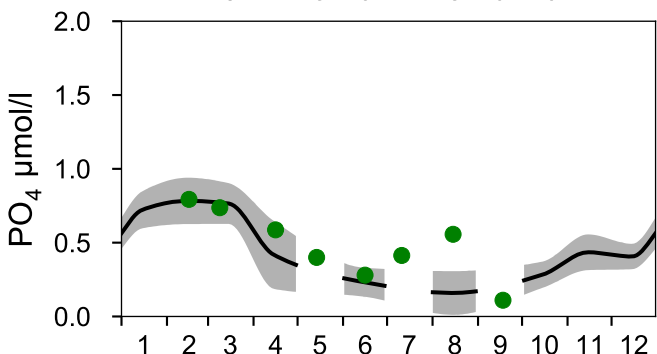
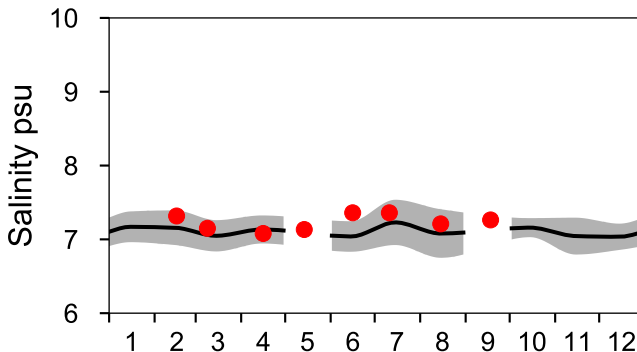
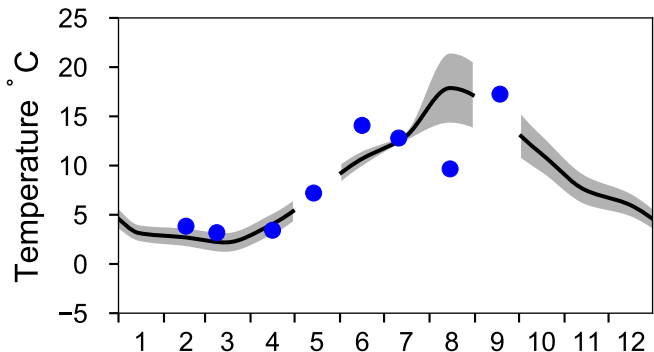
# Vertical profiles BY5 BORNHOLMSDJ September



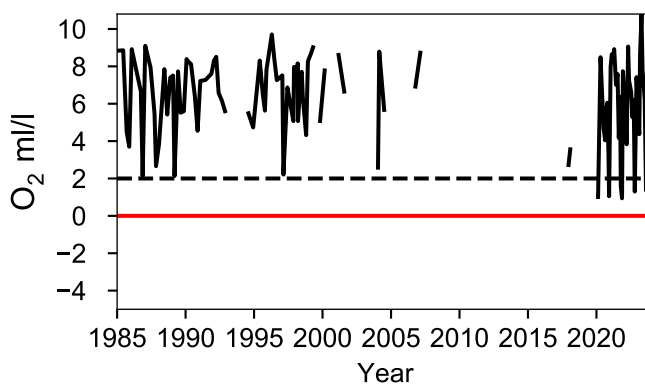
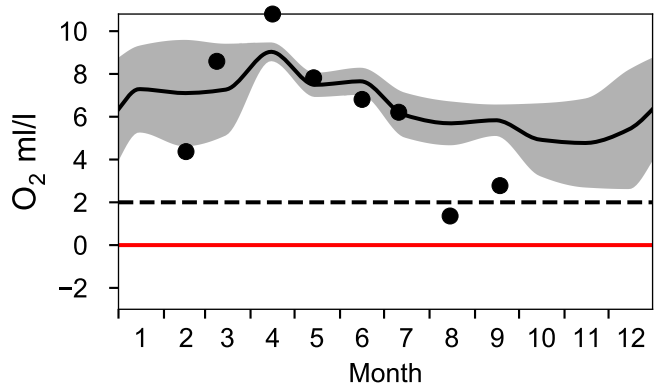
# STATION BY39 ÖLANDS S UDDE SURFACE WATER (0-10 m)

Annual Cycles

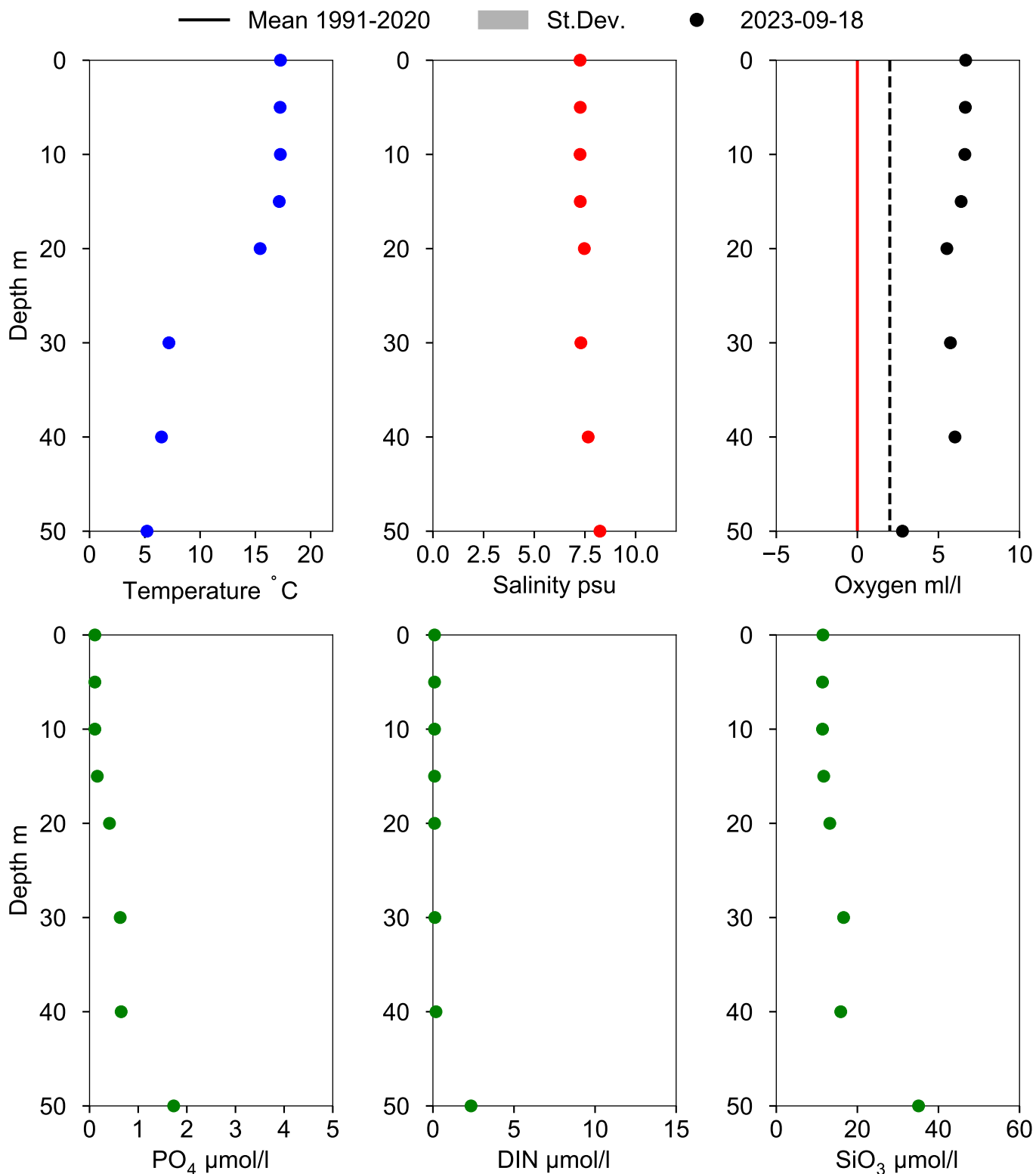
— Mean 1991-2020    St.Dev.    ● 2023



## OXYGEN IN BOTTOM WATER (depth >= 40 m)



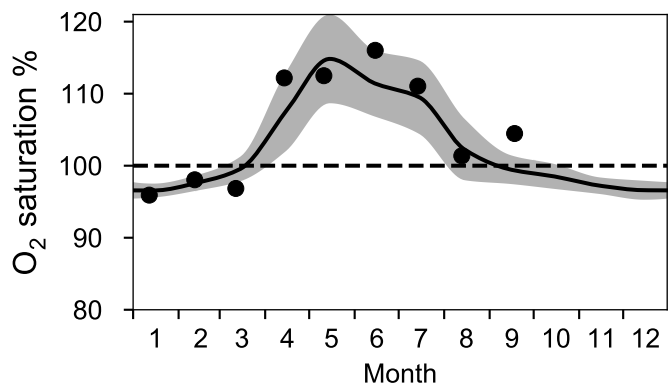
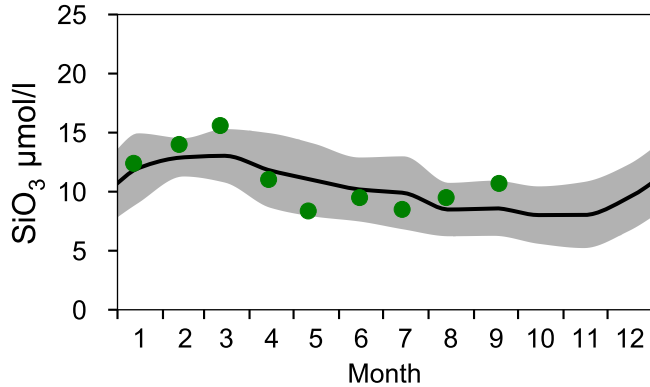
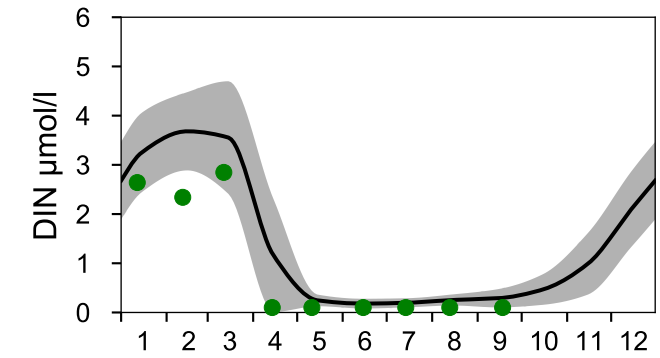
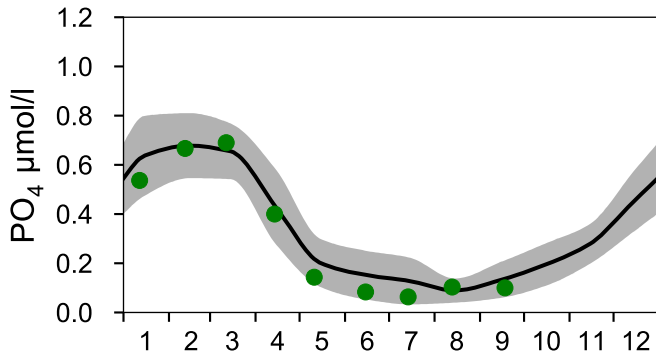
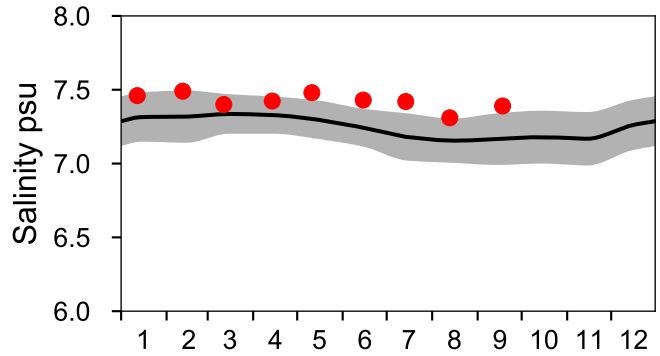
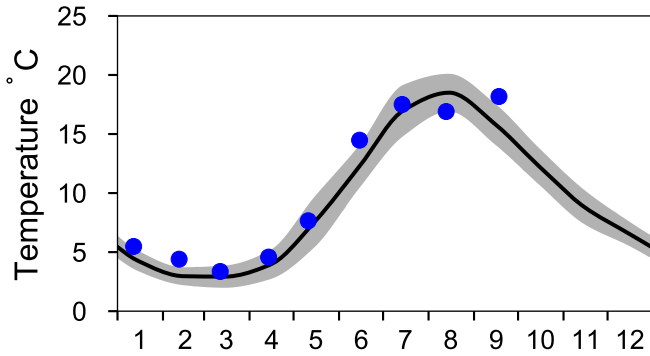
# Vertical profiles BY39 ÖLANDS S UDDE September



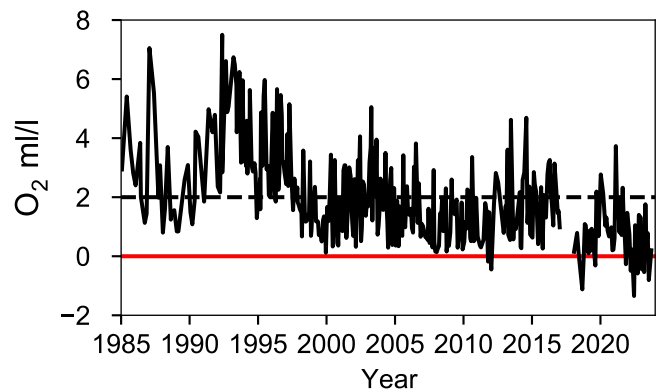
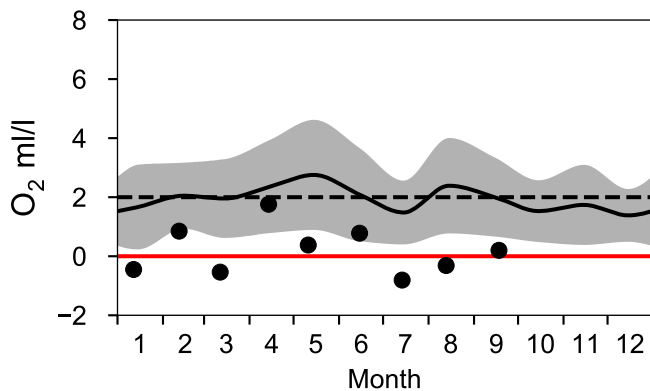
# STATION BCS III-10 SURFACE WATER (0-10 m)

Annual Cycles

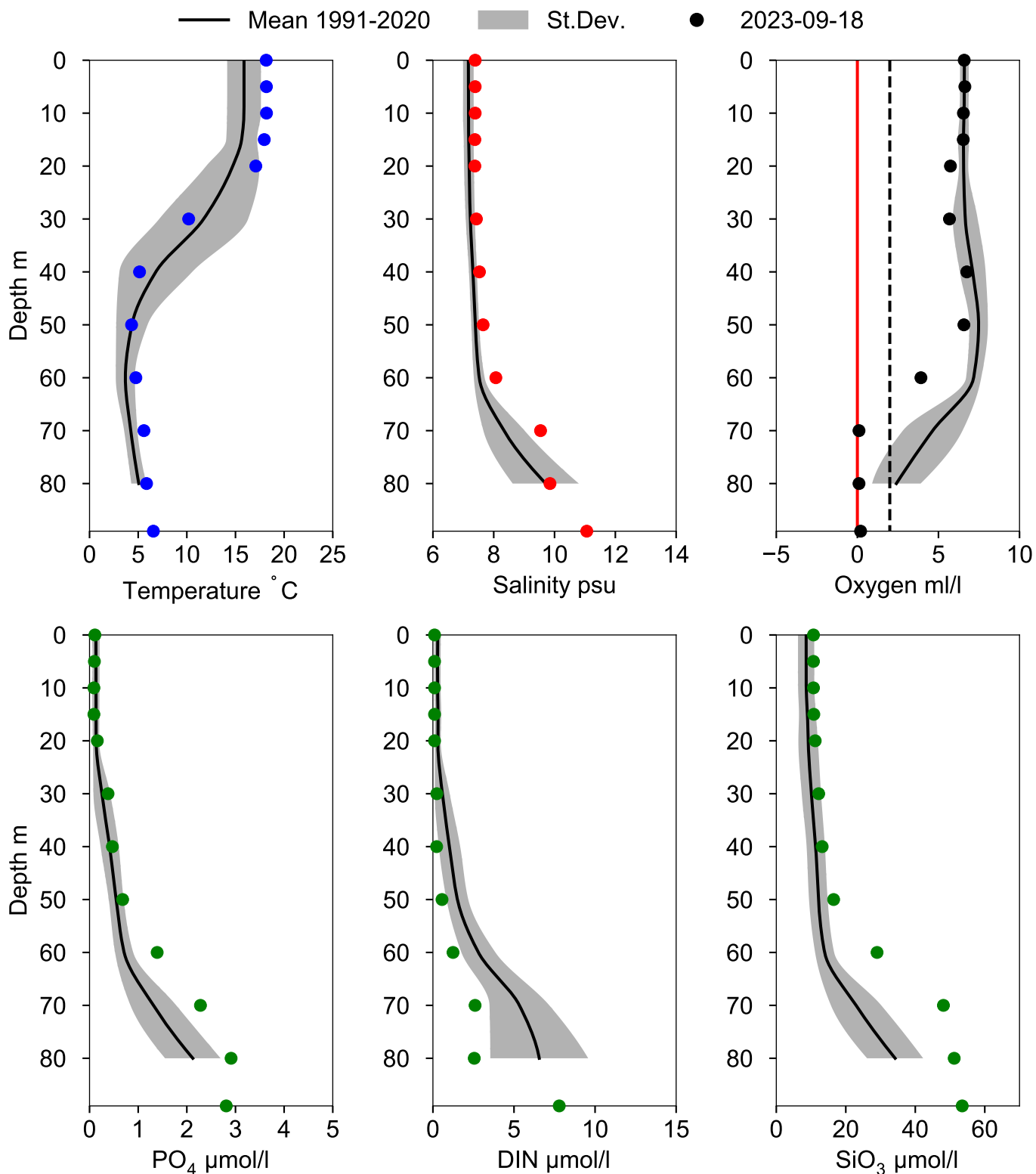
— Mean 1991-2020    St.Dev.    ● 2023



## OXYGEN IN BOTTOM WATER (depth >= 80 m)



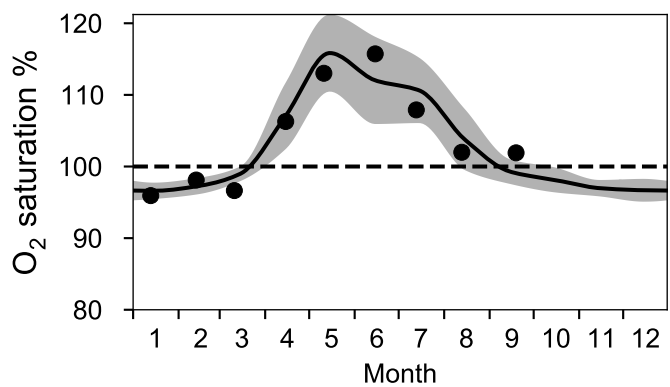
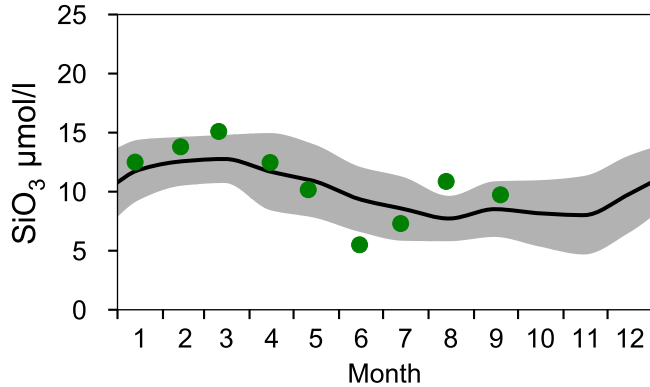
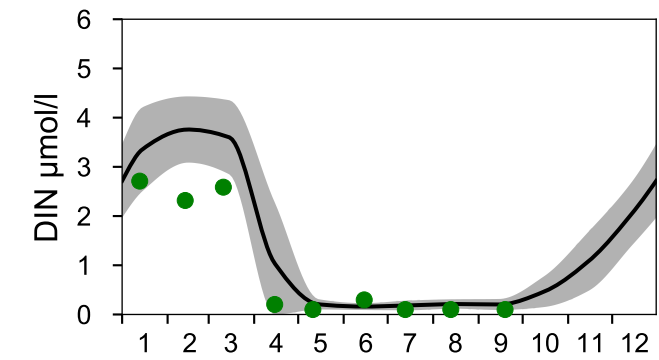
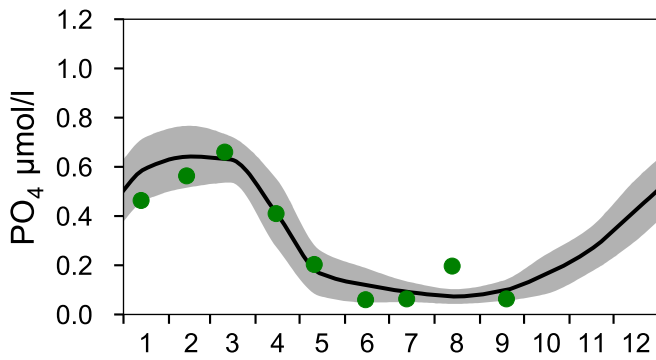
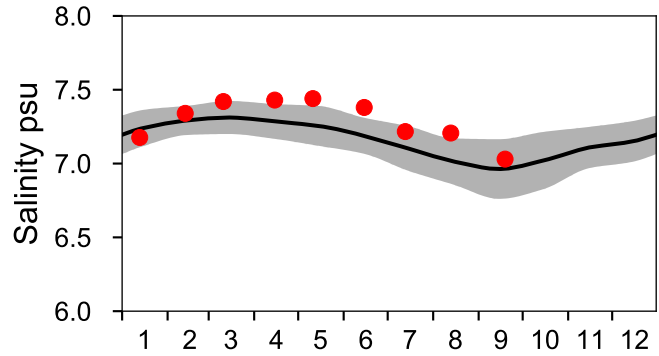
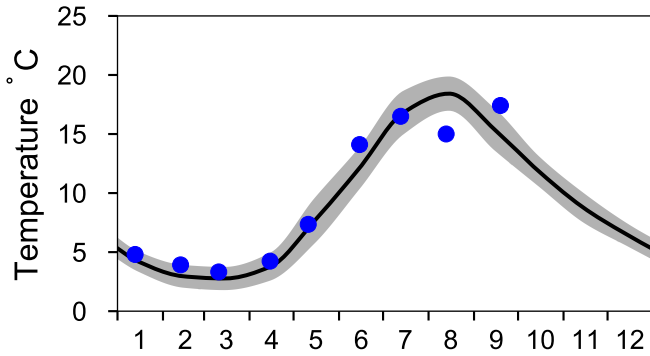
# Vertical profiles BCS III-10 September



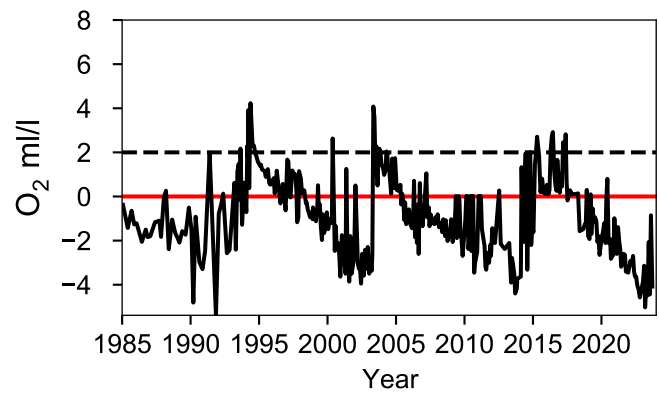
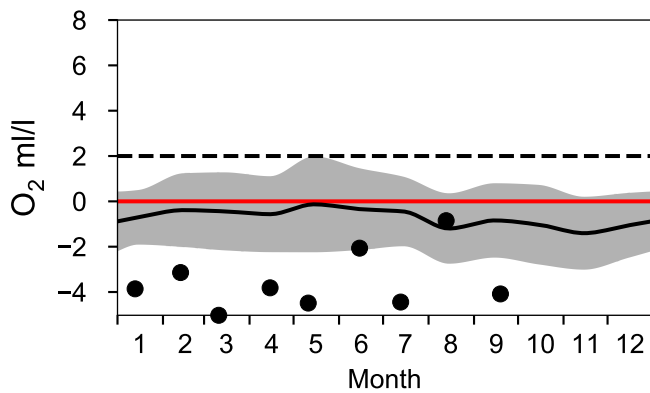
# STATION BY10 SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020    St.Dev.    ● 2023

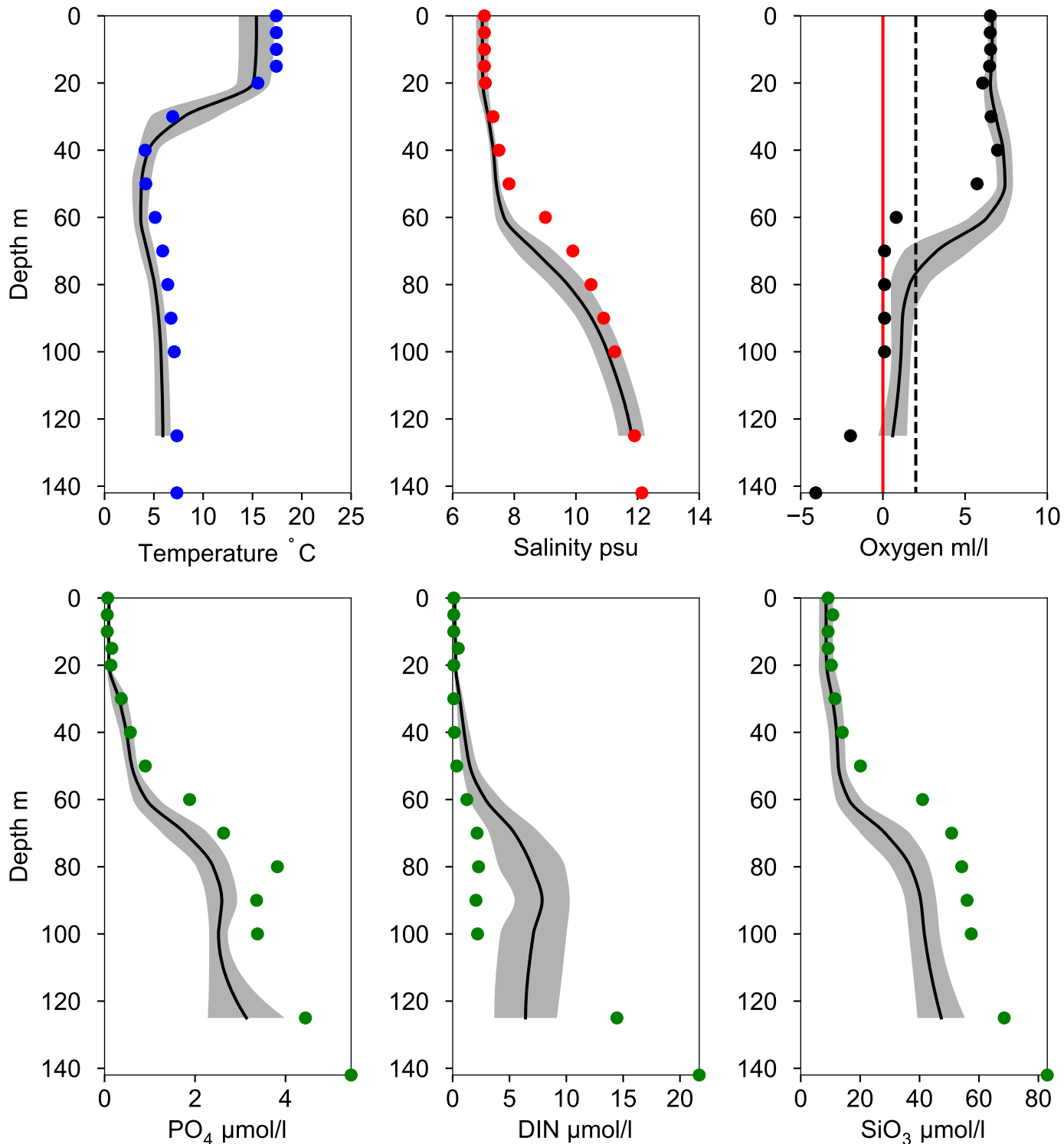


## OXYGEN IN BOTTOM WATER (depth >= 125 m)



# Vertical profiles BY10 September

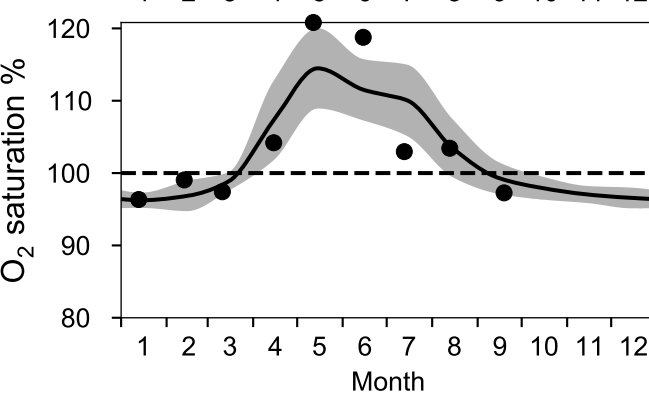
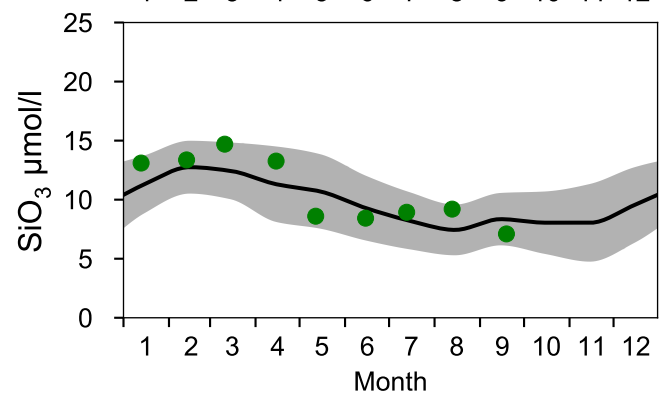
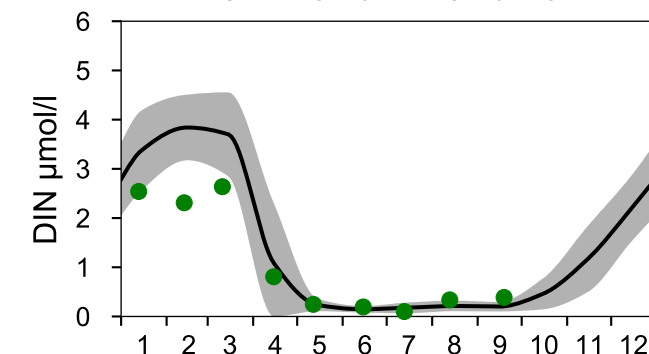
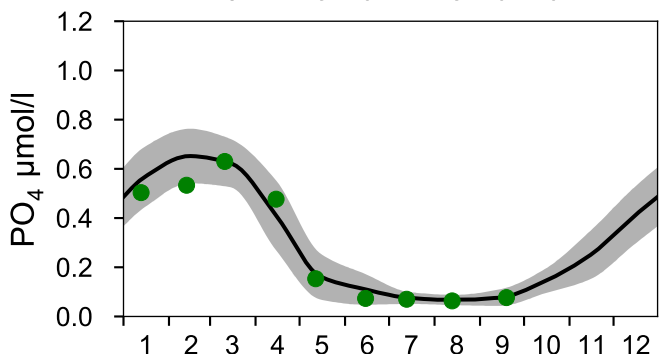
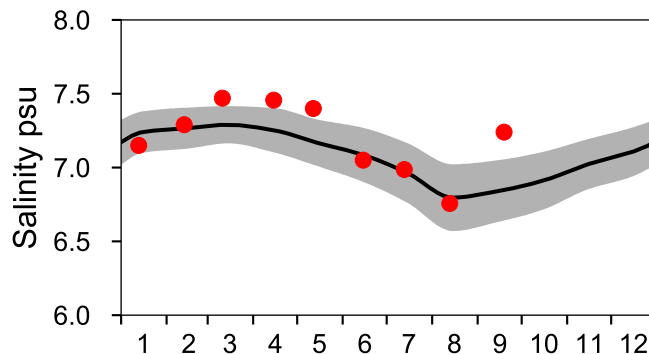
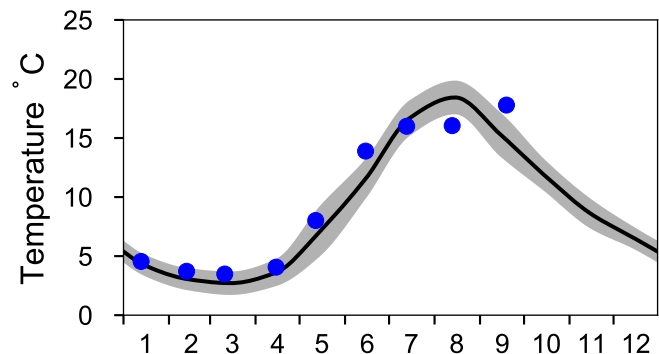
— Mean 1991-2020    St.Dev.    ● 2023-09-19



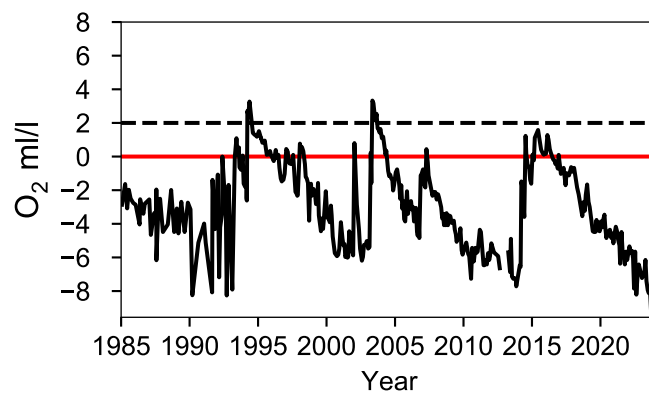
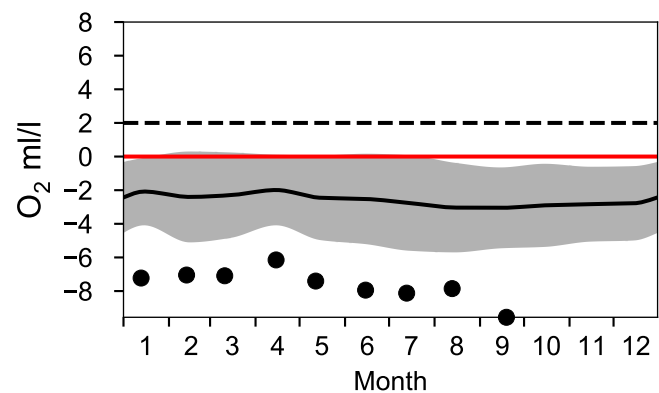
# STATION BY15 GOTLANDSDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020    St.Dev.    ● 2023

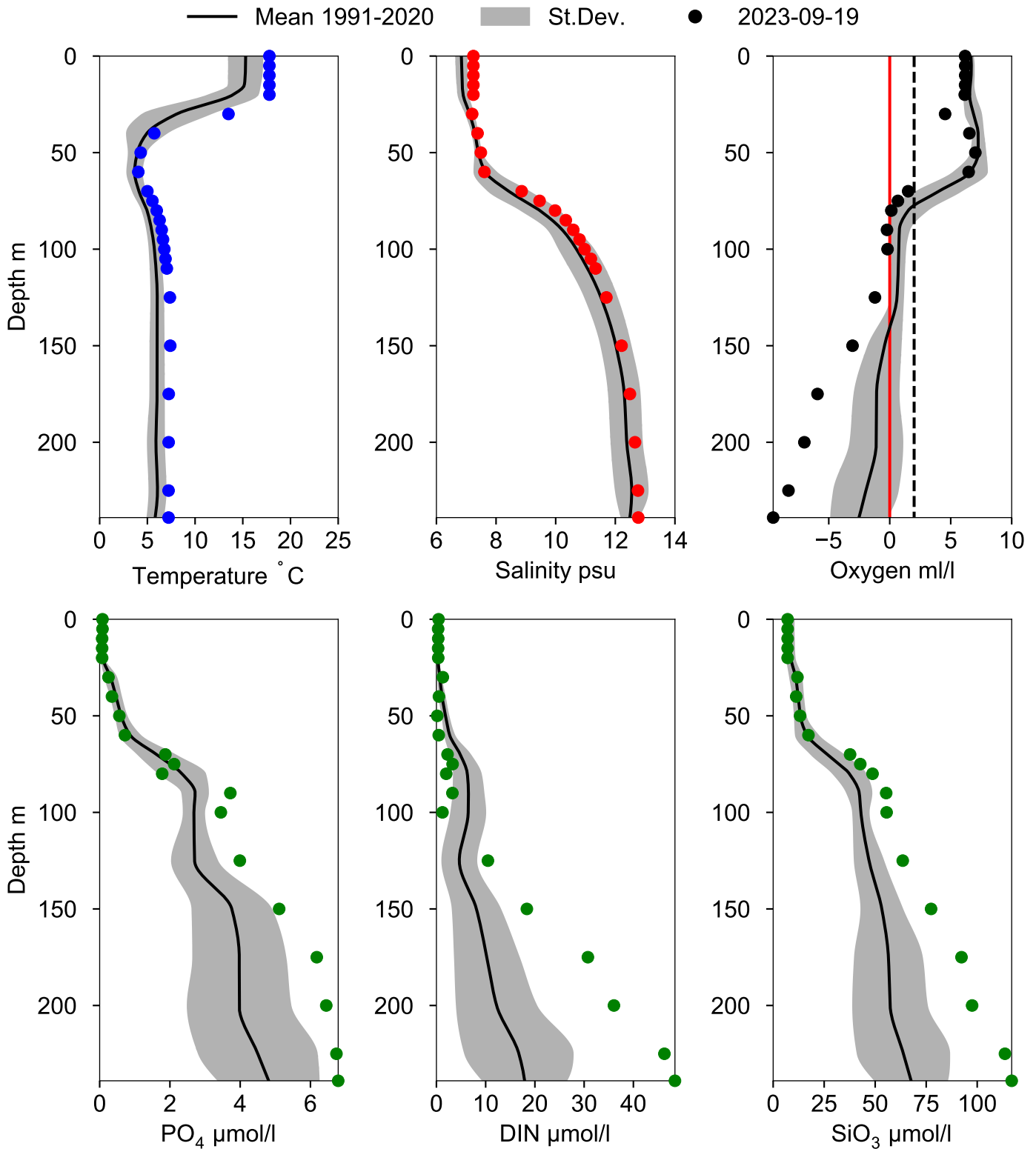


## OXYGEN IN BOTTOM WATER (depth >= 225 m)





# Vertical profiles BY15 GOTLANDSDJ September



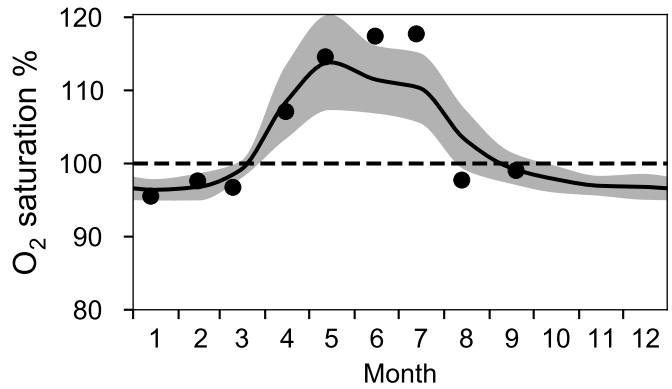
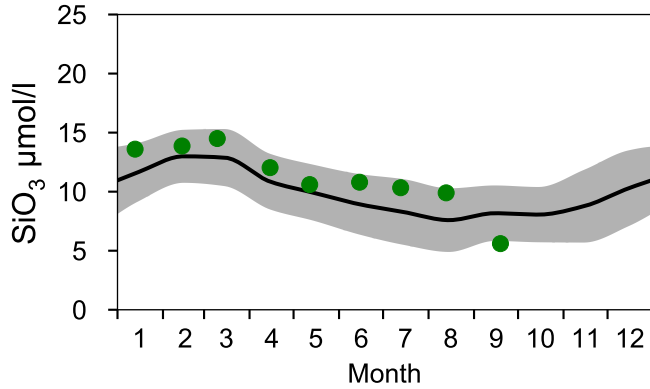
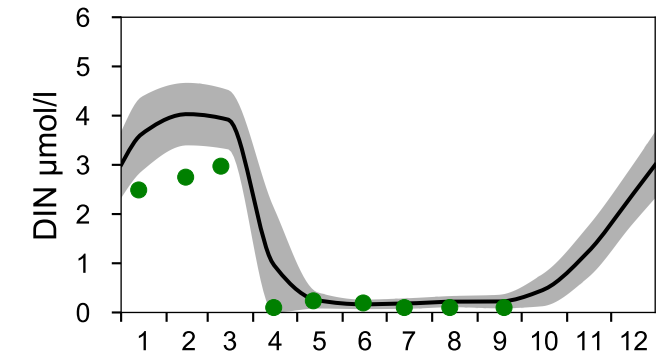
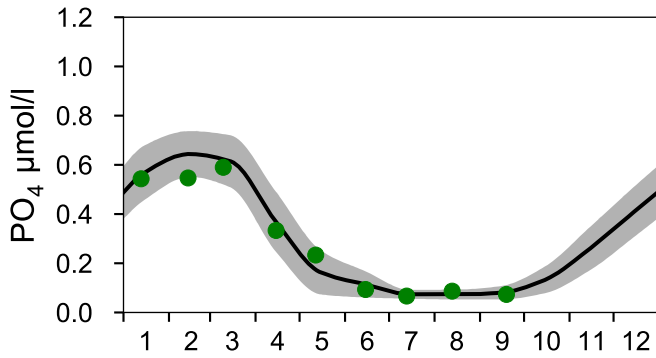
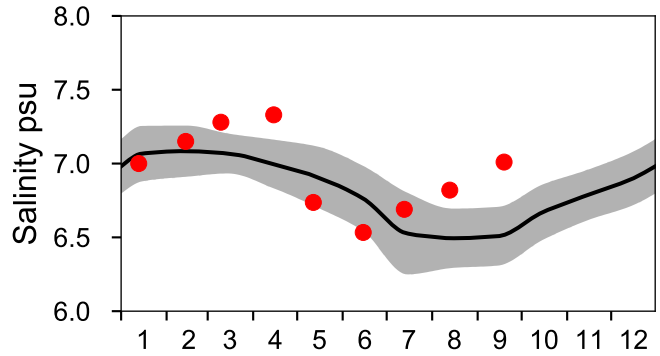
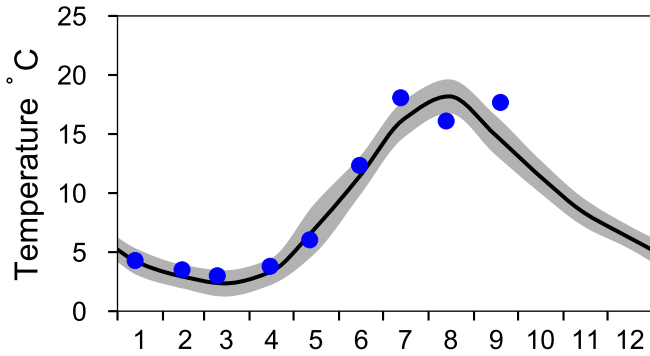
# STATION BY20 FÄRÖDJ SURFACE WATER (0-10 m)

Annual Cycles

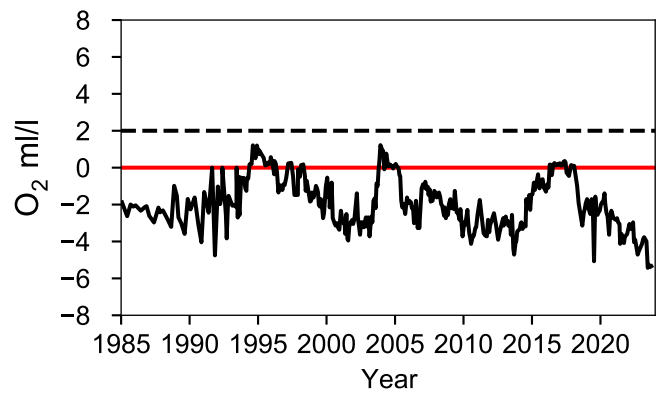
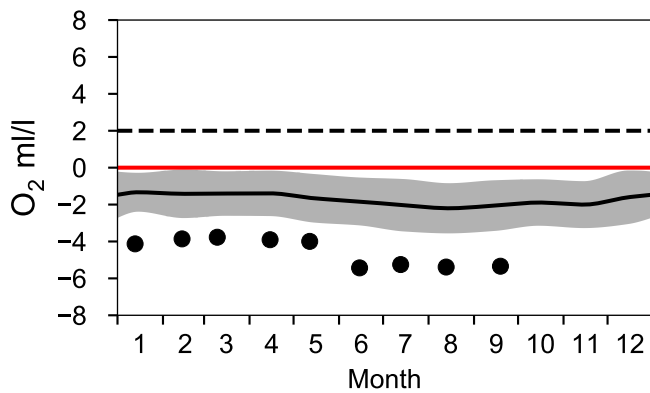
— Mean 1991-2020

■ St.Dev.

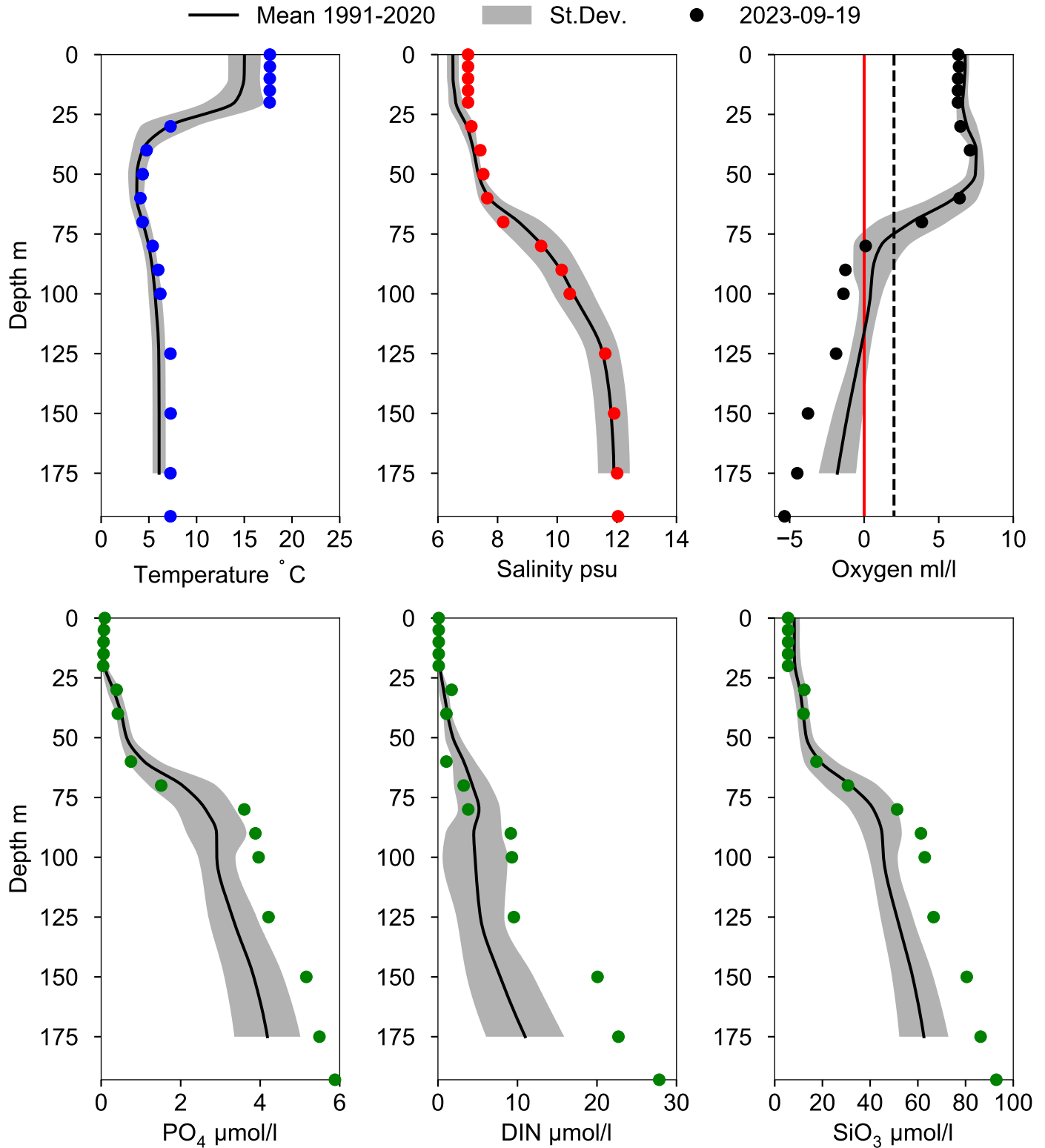
● 2023



## OXYGEN IN BOTTOM WATER (depth >= 175 m)



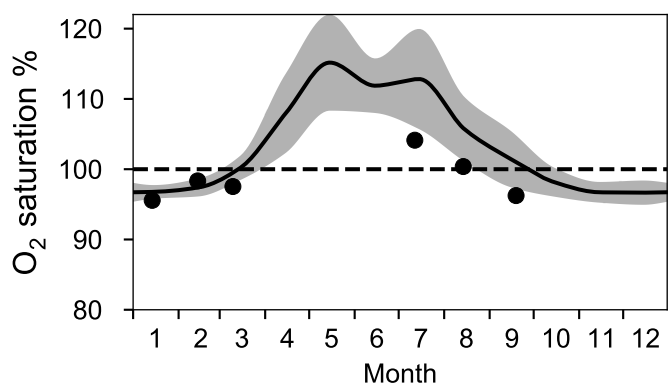
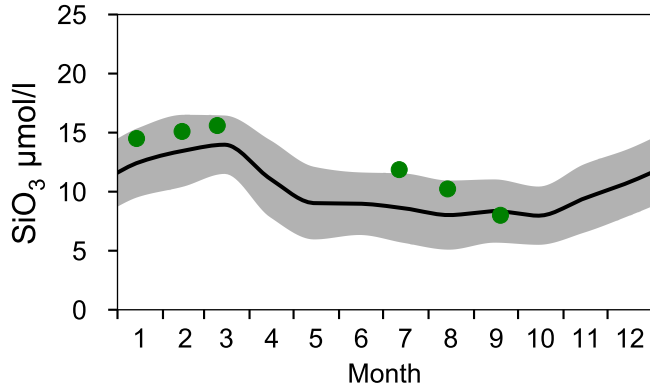
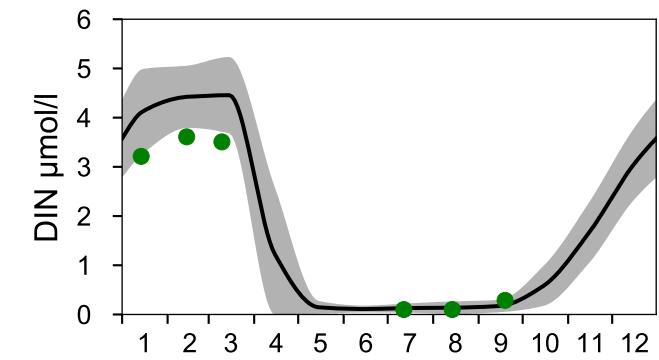
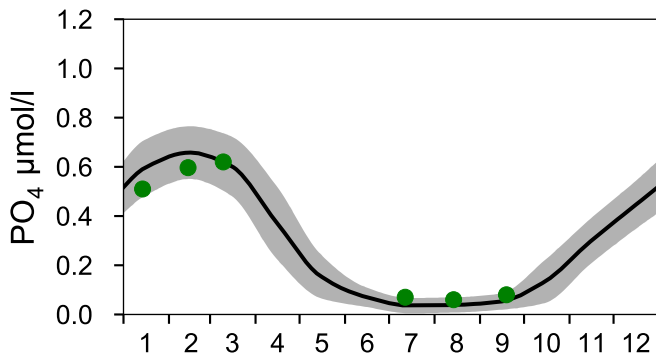
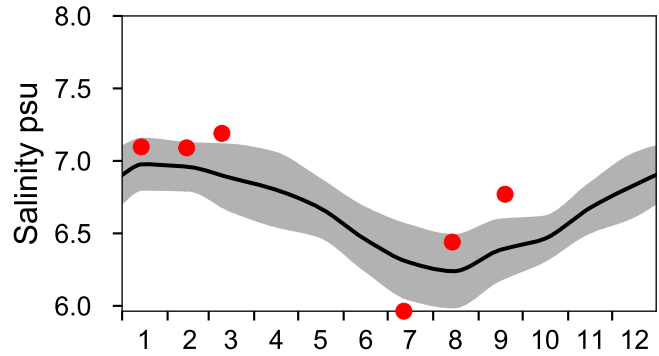
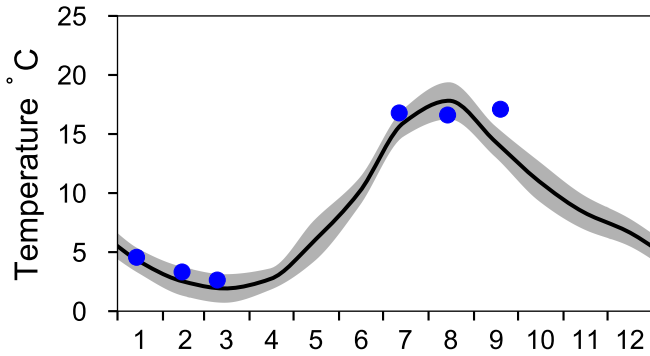
# Vertical profiles BY20 FÄRÖDJ September



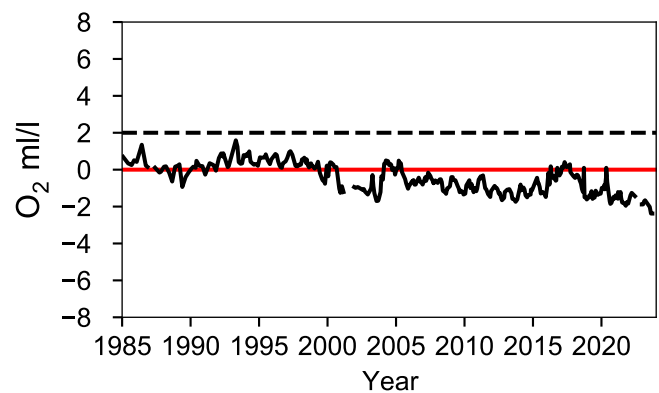
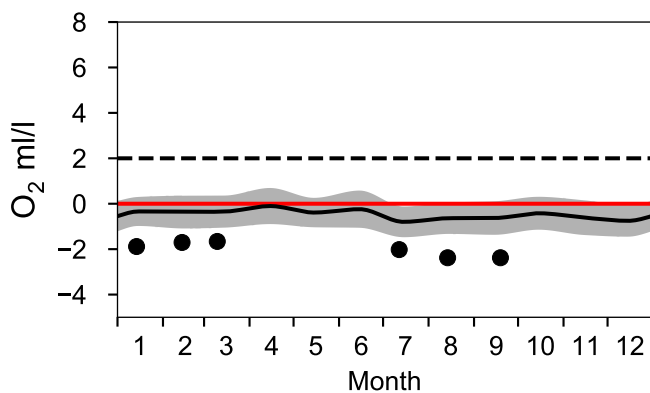
# STATION BY29 / LL19 SURFACE WATER (0-10 m)

Annual Cycles

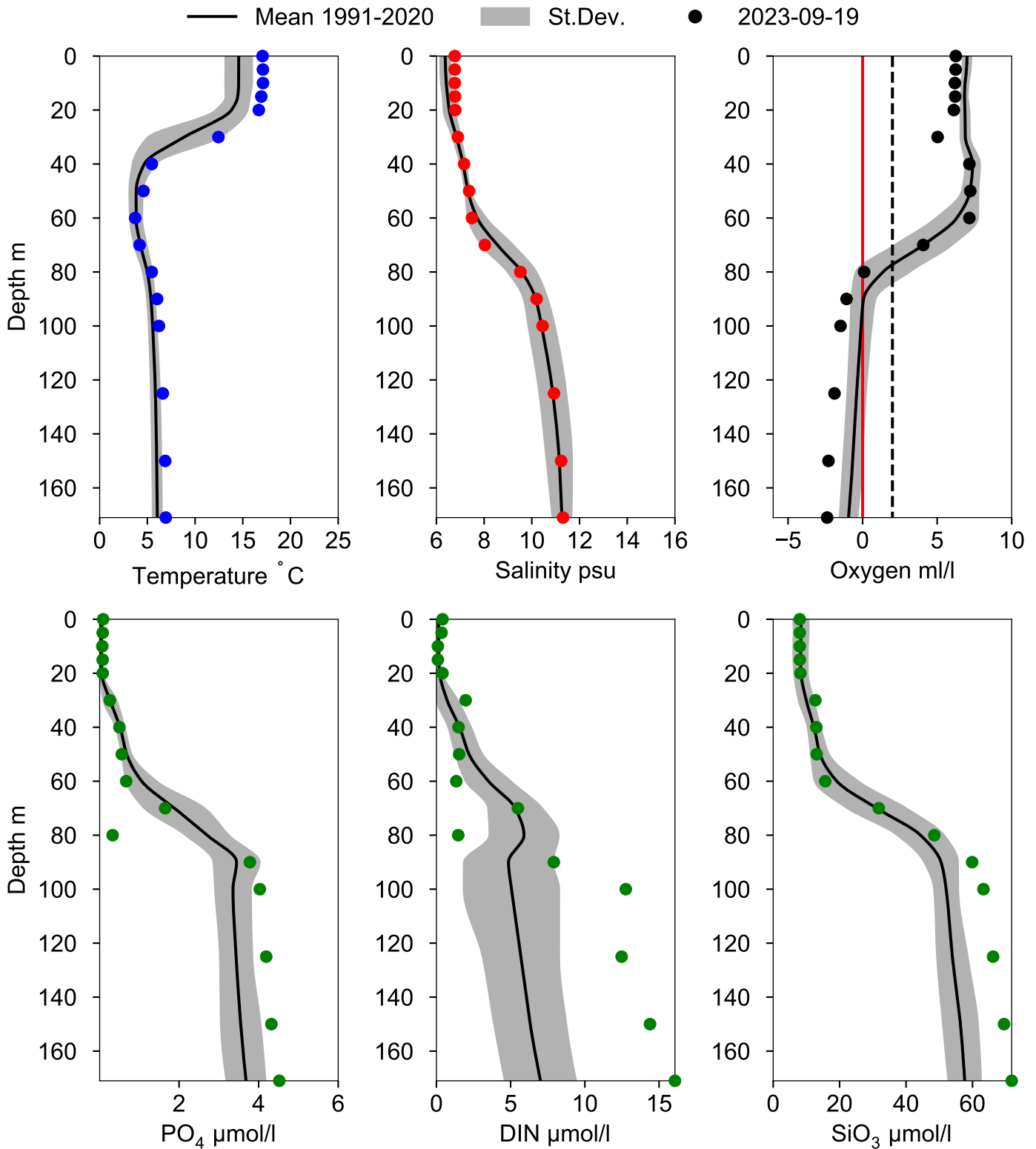
— Mean 1991-2020    St.Dev.    ● 2023



## OXYGEN IN BOTTOM WATER (depth >= 150 m)



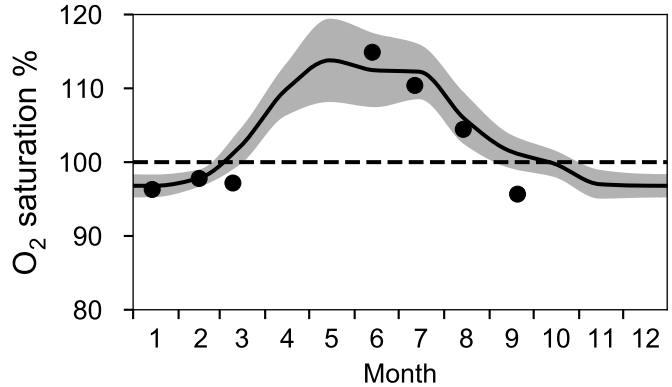
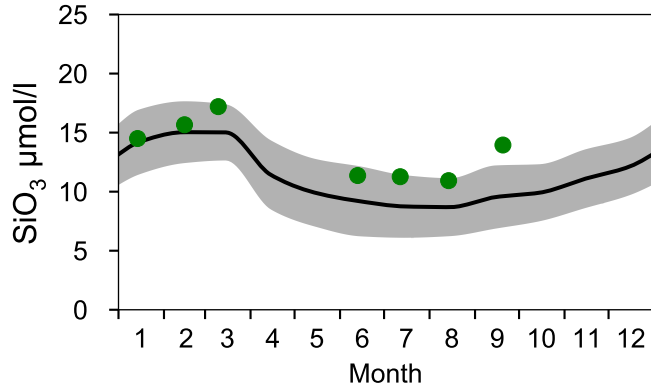
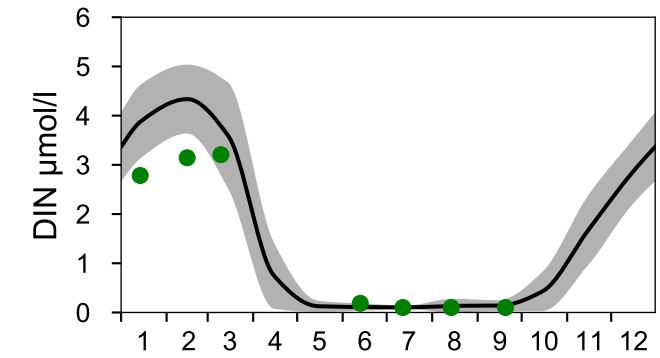
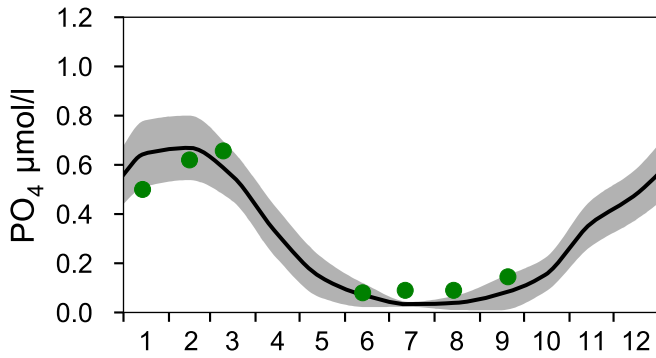
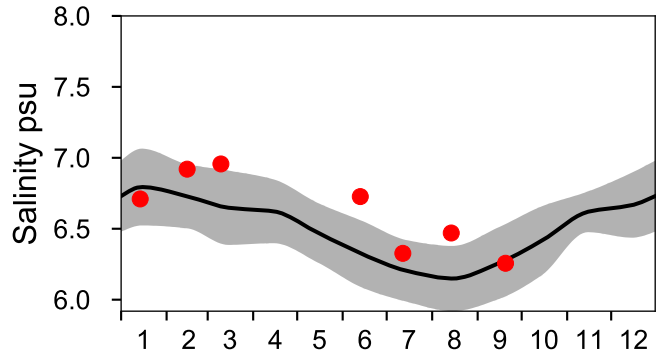
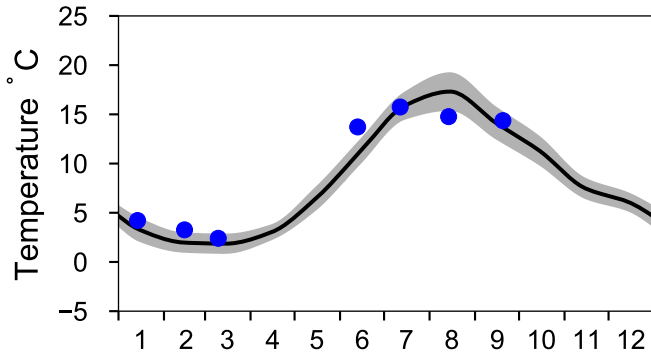
# Vertical profiles BY29 / LL19 September



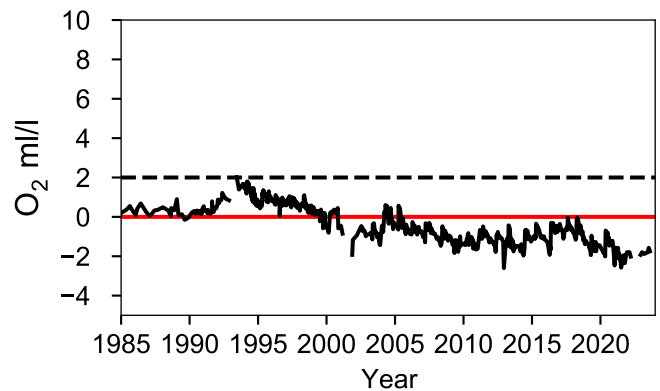
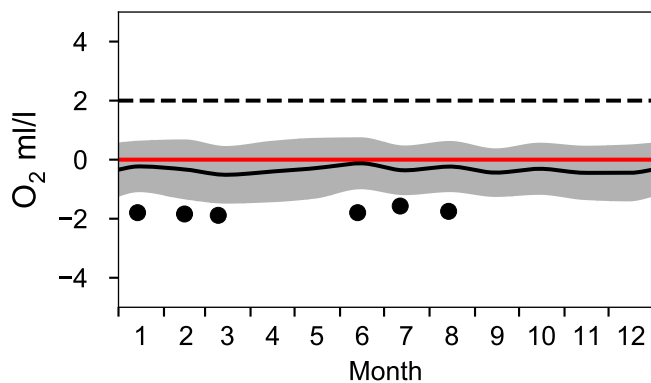
# STATION BY31 LANDSORTSDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020    St.Dev.    ● 2023

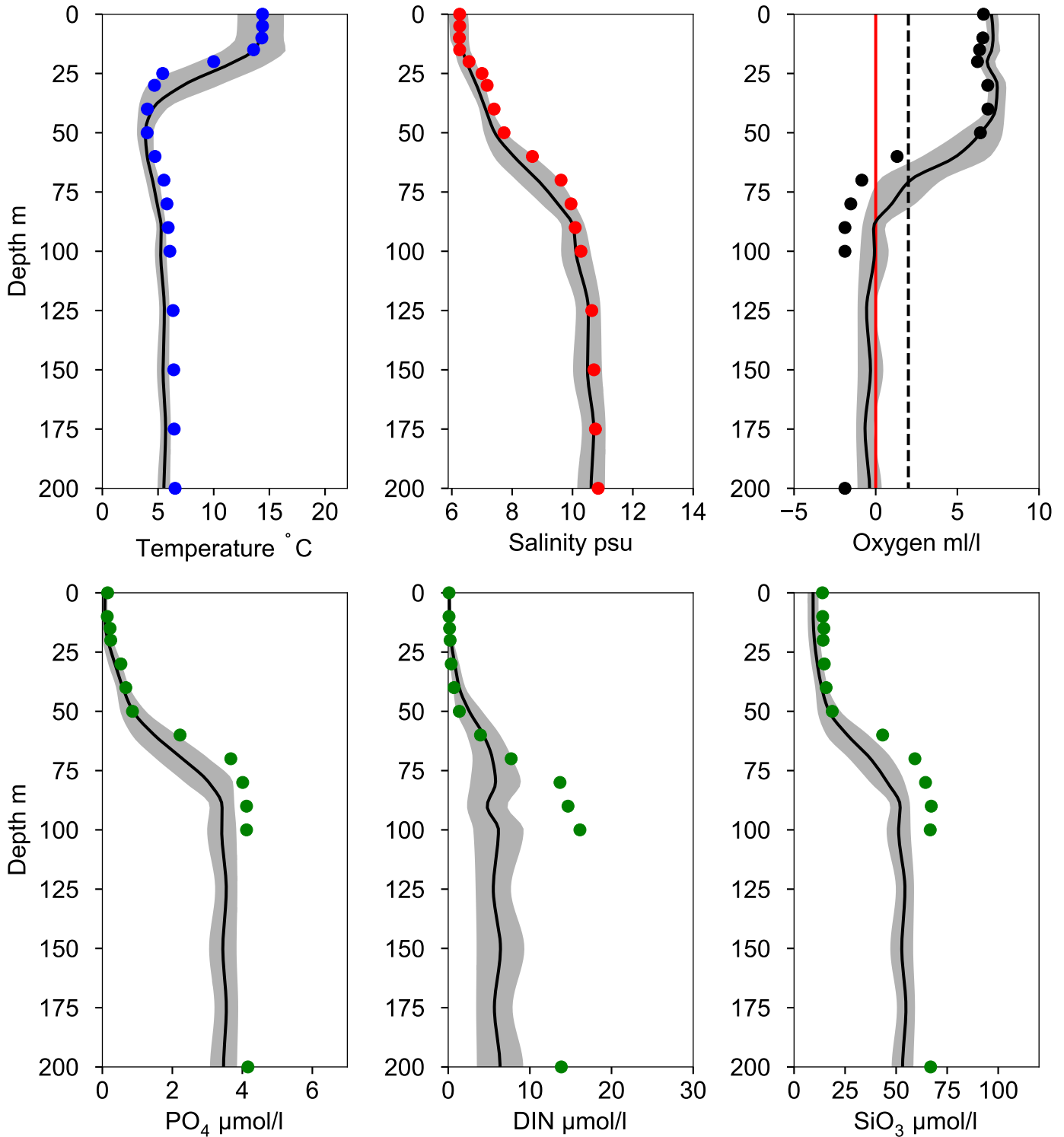


## OXYGEN IN BOTTOM WATER (depth >= 419 m)



# Vertical profiles BY31 LANDSORTSDJ September

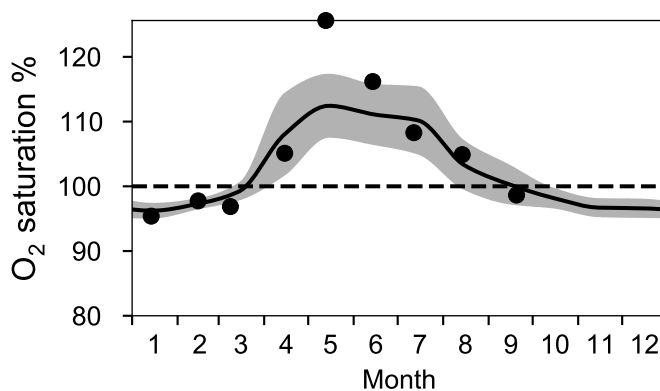
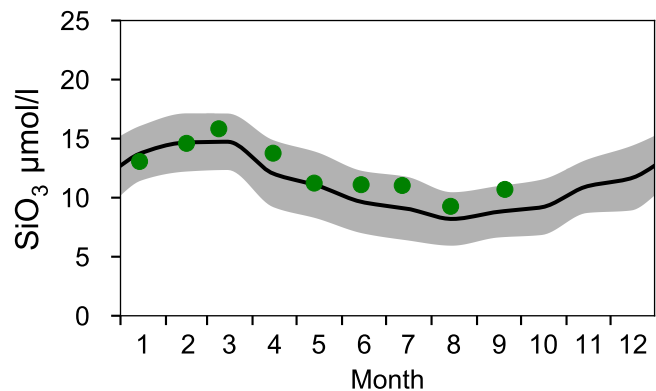
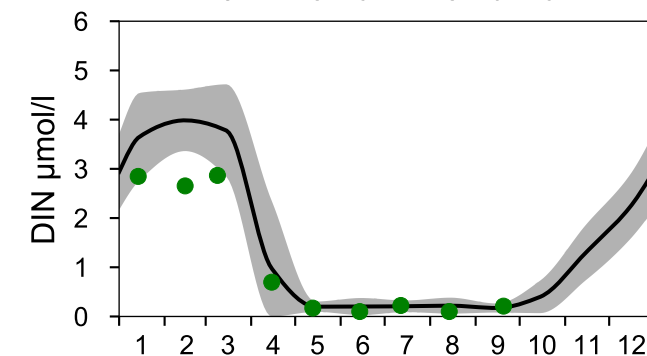
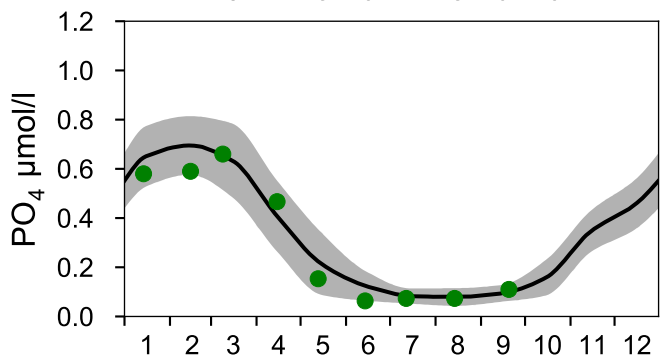
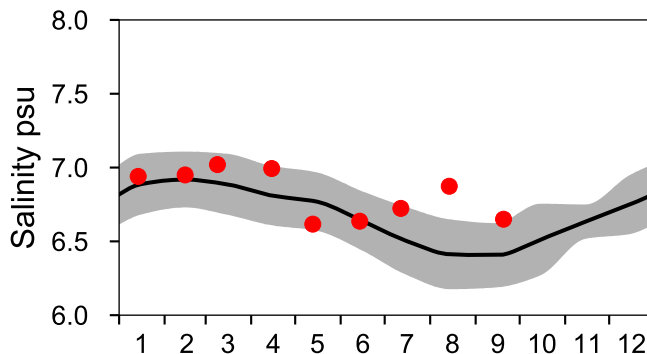
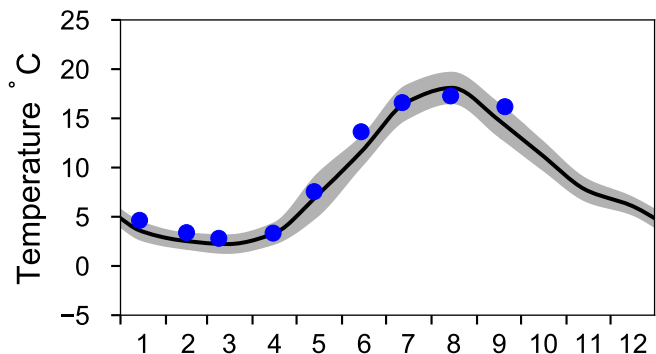
— Mean 1991-2020    St.Dev.    ● 2023-09-20



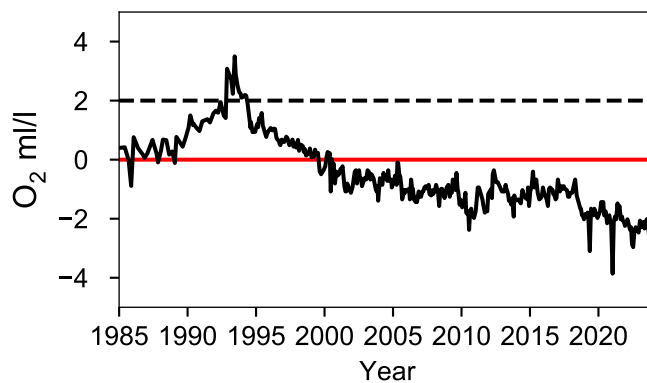
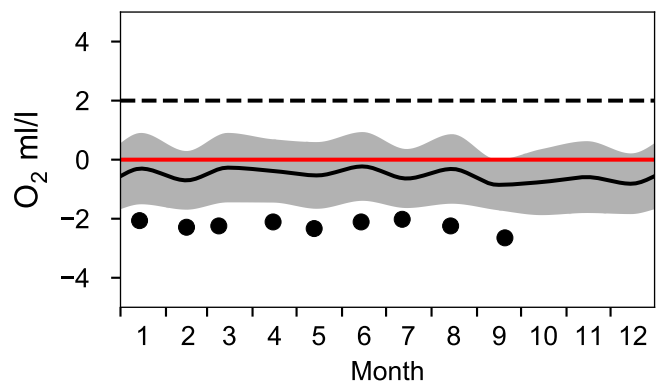
# STATION BY32 NORRKÖPINGSDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020    St.Dev.    ● 2023



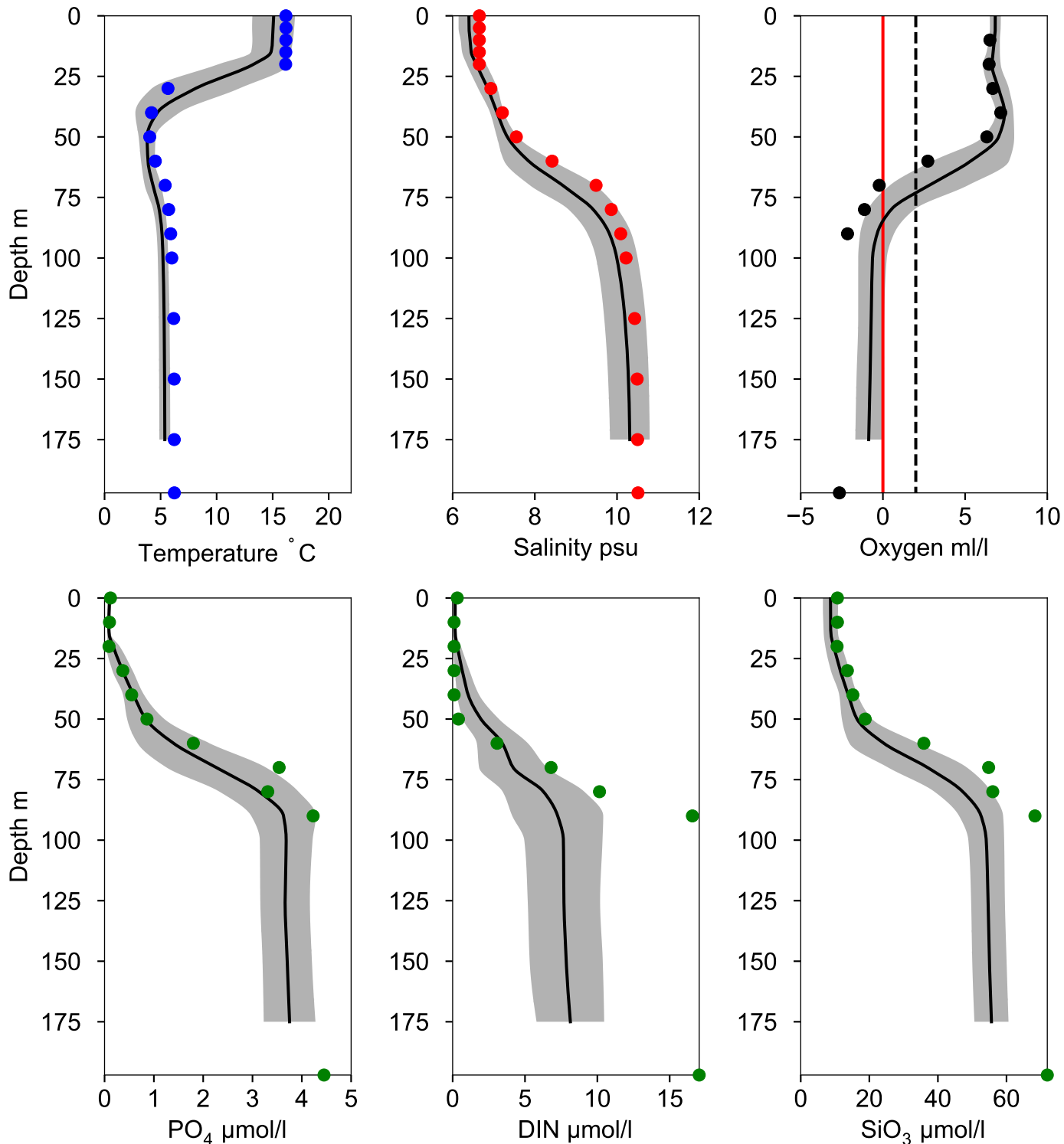
## OXYGEN IN BOTTOM WATER (depth >= 175 m)





# Vertical profiles BY32 NORRKÖPINGSDJ September

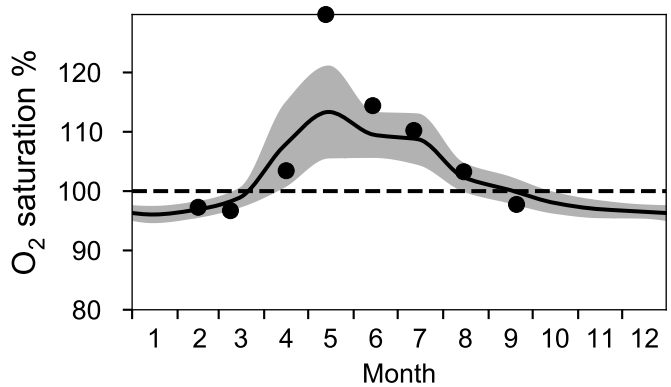
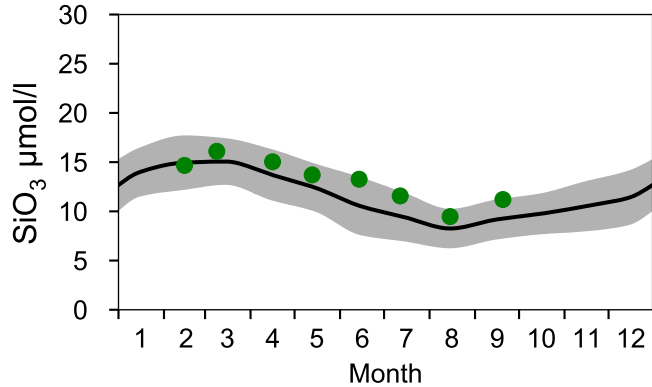
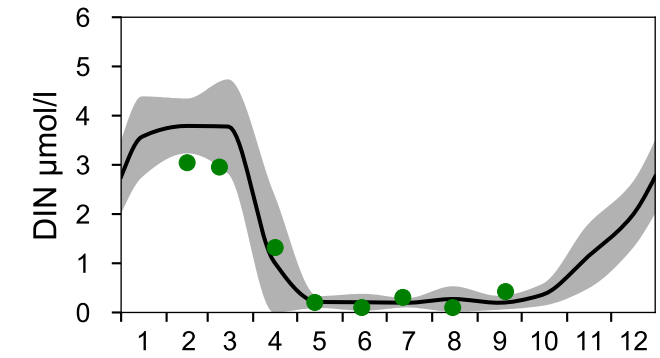
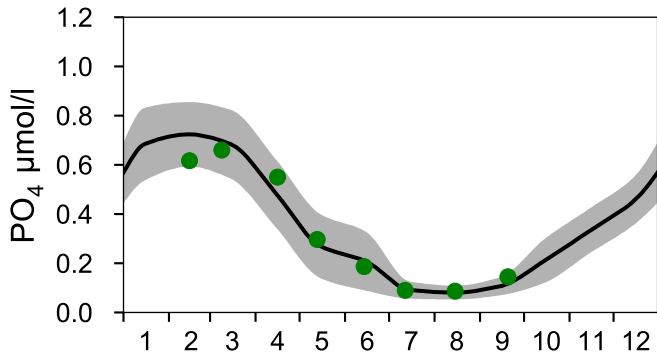
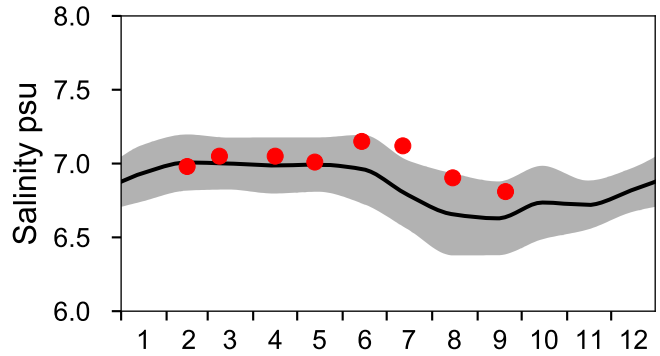
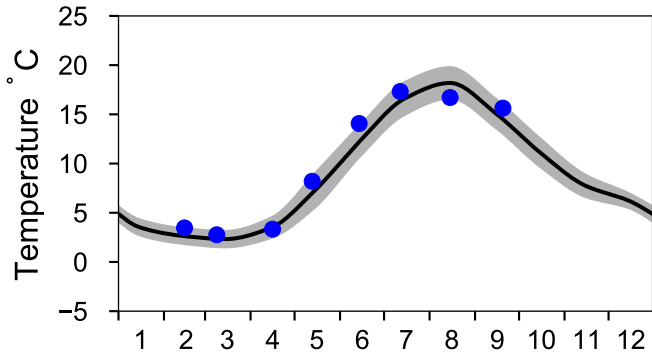
— Mean 1991-2020    ■ St.Dev.    ● 2023-09-20



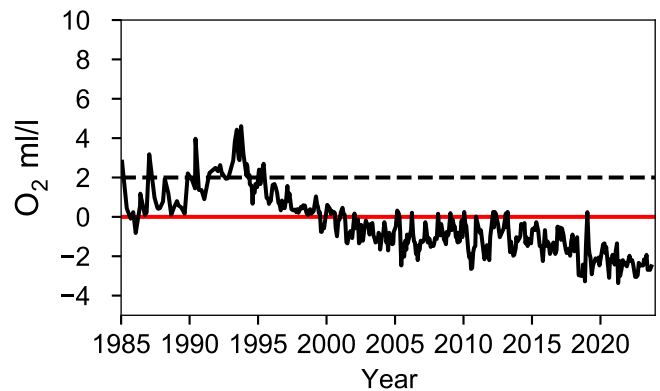
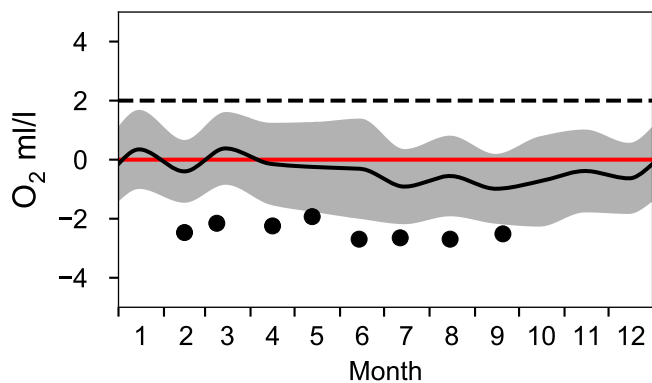
# STATION BY38 KARLSÖDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020    St.Dev.    ● 2023



## OXYGEN IN BOTTOM WATER (depth >= 100 m)



# Vertical profiles BY38 KARLSÖDJ September

— Mean 1991-2020    St.Dev.    ● 2023-09-20

