

Report from SMHI's joint monitoring cruise with UMF on board R/V Svea

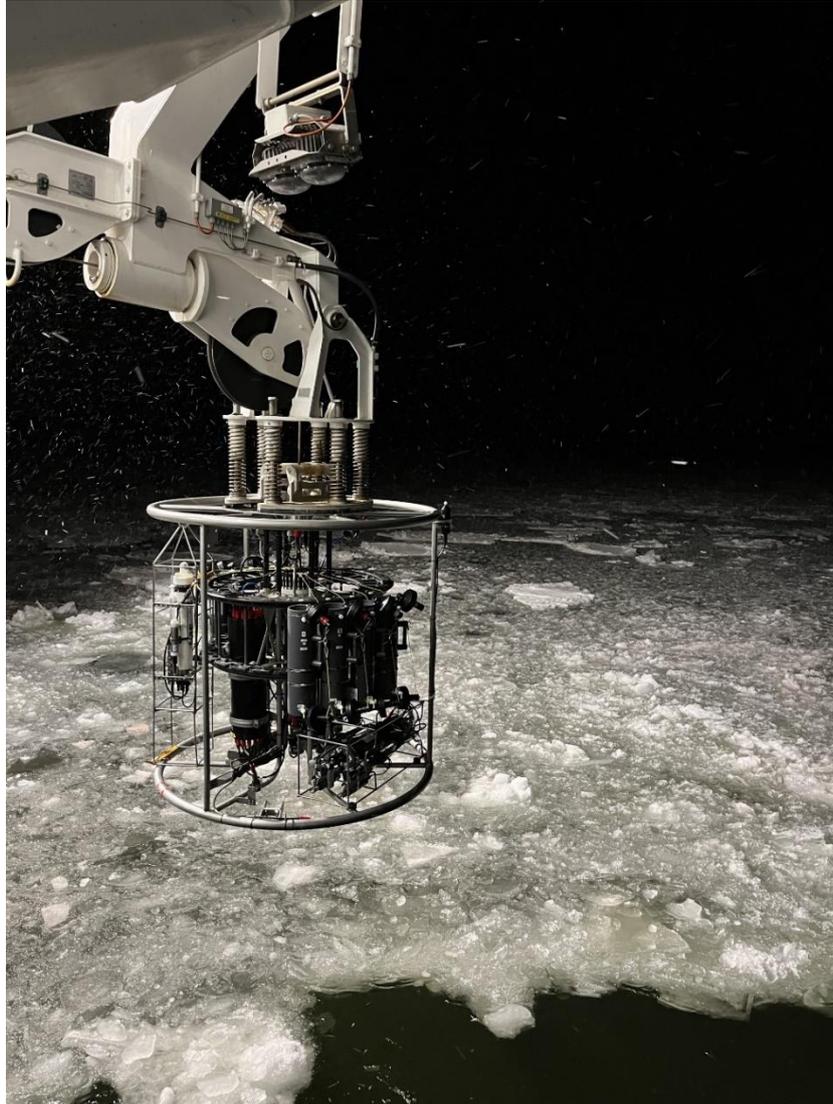


Photo: Sampling in Örefjärden, Madeleine Nilsson, SMHI

Survey period: 2023-12-05 till 2023-12-16

Principal: Swedish Meteorological and Hydrological Institute (SMHI),
Umeå Marine Sciences Centre (UMF),
Swedish Agency for Marine and Water Management (SwAM)

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

SUMMARY

During the expedition, as part of the Swedish pelagic monitoring program, the Skagerrak, the Kattegat, the Sound, the Baltic Proper, and the Bothnian Bay were visited. In the Bothnian Bay, SMHI and Umeå Marine Research Centre (UMF) conducted joint mapping, including nutrients.

The surface water temperature had continued to decline in December and was lower than normal in many areas.

Normally, the concentrations of dissolved inorganic nutrients increase during winter, but in December, the concentrations of both phosphate and dissolved inorganic nitrogen had decreased at several stations in Skagerrak. However, in Kattegat, the concentrations of inorganic nutrients had increased since November, which is normal. In the Baltic Proper, the concentration of nutrients in the surface layer had increased since November. The levels were within the normal range for the season, except in the Northern Baltic Proper where the levels were above normal.

The levels of dissolved inorganic nitrogen in the surface waters of the Åland Sea were at normal levels. In the Bothnian Sea, the levels were slightly higher than normal in the north-west and at some stations in the south-east. The levels increased with depth, and at these stations, levels above normal were also noted in the bottom water. In the central Bothnian Sea, the levels were higher than normal and around the normal range.

Phosphate levels in surface waters were higher than normal at all stations except coastal stations along the Swedish coast. Phosphate levels increased with depth, and the levels were well above normal in deep waters at some stations. Silicate levels were above normal at the majority of stations in the Bothnian Sea. Here too, the levels increased with depth, and at many stations, levels above normal were noted in deep waters.

In the Bothnian Bay, the concentration of dissolved inorganic nitrogen was around normal. In deep waters, nitrogen levels increased and showed both lower and higher levels than normal. Phosphate levels in surface waters were very low, which is normal for the season, except in the southern Bothnian Bay where levels were higher than normal. Levels increased with depth, and higher-than-normal levels were found in deep waters. Silicate levels in surface waters are naturally high due to the large runoff into the Bothnian Bay. Levels above normal were noted, and in the deep waters, the levels increased further, also exceeding normal levels.

The oxygen situation was good at all stations in Skagerrak and Kattegat; no oxygen deficiency was noted. In the Sound, oxygen deficiency was measured near the bottom.

In the main basins of the Baltic Proper, oxygen-free conditions occurred from 60 to 80 meters, which coincided with measured levels of hydrogen sulphide. Similar conditions could be observed in the Bornholm Basin and in the Hanö Bay. The oxygen situation in the bottom waters of the Arkona Basin were good.

The oxygen levels in the bottom water of the Bothnian Sea varied around 5,5 ml/l in the deeper areas and slightly higher in the bottom water of the shallower regions. Oxygen deficiency was observed in Gaviksfjärden. No oxygen deficiency was noted in the Bothnian Bay or Northern Quark, which is normal.

SMHI's next regular expedition with R/V Svea is scheduled for January 11th to 17th, starting in Gothenburg and terminating in Lysekil.

RESULT

The expedition was carried out on board the R/V Svea, starting in Kalmar on December 5th and concluding in Lysekil on December 16th. In the Bothnian Bay, a joint sampling expedition was conducted with colleagues from Umeå Marine Research Centre (UMF) as part of the streamlining and coordination of the Swedish Meteorological and Hydrological Institute (SMHI) and UMF's contributions to the national marine environmental monitoring program.

In a joint effort, the annual winter mapping of nutrients in the Bothnian Bay was conducted. SMHI's personnel performed CTD (Conductivity, Temperature, Depth), water, and net sampling, as well as some analyses, while UMF's personnel carried out all analyses of nutrients and biological parameters. New for this year was the sampling of Örefjärden and the national station NB1/B3. In the Bothnian Sea, two stations, US2 and SR1A, were cancelled to adhere to the schedule. UMF's personnel and equipment were picked up and dropped off in Gävle after the sampling. SMHI also changed personnel after the Bothnian Bay was visited.

During the second part of the expedition, from Gävle to Lysekil, the Baltic Proper, the Kattegatt and the Skagerrak were visited. Due to several SMHI personnel falling ill towards the end of the cruise, one station (N14) was cancelled, along with sampling and analysed depths restricted in the Skagerrak.

In the Bothnian Bay, an instrument was placed at Falkens Grund to measure ice thickness, ice movements and currents in the area.

At three stations on the West coast, additional water sampling for phytoplankton samples was conducted for Stockholm University.

Svea's instrument for measuring profiles underway, MVP, was operating during day time at all stations. In the Bothnian Sea and the Bothnian Bay, measurements were interrupted as the instruments are sensitive to frost. Measurements resumed in the Baltic Proper when there was no longer a risk of ice formation. Unfortunately, the instrument itself was lost during a transect in the Kattegat. Since the instrument has a transponder, it will be recovered in early 2024.

The Ferrybox system ran continuously during the full cruise. Tests of the automatic sampling system were conducted throughout the expedition. Samples were regularly taken for the analysis of nutrients, total nitrogen and phosphorus, and chlorophyll.

This report is based on data that has undergone 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 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>

Skagerrak

The temperature in the surface water had significantly decreased since November and was now around 2–7 °C down to about 20 m. At the coastal station Släggö, the surface water temperature was lower, about 2 degrees. The surface water temperature was below normal for the month, except at station Å17, which also showed the highest surface water temperature at 6.8 degrees. At all stations except Å15, there was a relatively well-mixed surface layer down to about 20 m. At Å15, salinity and temperature increased continuously from the surface down to about 20 m. At around 40 m, there was slightly warmer water left from the summer, and below 50 m, the temperature dropped again to about 8 degrees. The surface salinity indicated that Å15 was situated between the fresher Baltic Sea water along the coast and the saltier water from the North Sea found at Å17. The surface water salinity was below normal at the other stations.

Normally, the concentration of dissolved inorganic nutrients increases during winter, but in December, the concentrations of both phosphate and dissolved inorganic nitrogen had decreased at all stations except Å15 and Å17. At the westernmost station Å17, the levels were above normal, while they were well below normal at the most coastal station Släggö.

The oxygen situation was good at all stations in the Skagerrak, with normal values for the season, with concentrations between 5.4–5.6 ml/l.

Chlorophyll fluorescence is a measure of plankton activity measured with a sensor mounted on the CTD¹. No strong chlorophyll fluorescence peaks were recorded, but some activity was noted at all stations in the mixed surface layer down to the depth of the thermocline.

Kattegatt and the Sound

Similar to the Skagerrak, the surface water temperature had significantly decreased since November and was now around 3–5 °C, with the warmest temperatures found in the Sound. At the two stations sampled in the Kattegatt, the surface water temperature was below normal. In the Sound, the water was well-mixed down to 5 m, and in this layer, the salinity was 8 psu, and the temperature was 4 degrees, which was lower than normal. Below the pycnocline at 10 m, both temperature and salinity increased, and here the salinity was above normal, about 34 psu. In the Kattegatt, stratification occurred between 5–10 m, also with temperatures below normal in the well-mixed surface layer. Just like in November, there was a layer of warmer water beneath the surface layer, at 11 degrees, around 25 m.

The concentration of inorganic nutrients had increased since November, which is normal. The concentrations of phosphate and dissolved inorganic nitrogen (DIN) were normal, while the concentration of silicate was above normal at the Anholt station and in the Sound. In the Sound, all nutrients were above normal below 5 m.

Oxygen levels in the bottom water of the Kattegat were normal for the season. In the Kattegatt, all values were above 4 ml/l (the limit for oxygen deficiency), and in the Sound, they were just below, at 3.7 ml/l.

¹ The CTD is a profiling measuring instrument and stands for Conductivity, Temperature, Depth. SMHI's CTD is also equipped with sensors that measure oxygen and fluorescence, among other parameters.

Similar to the Skagerrak, some plankton activity was noted in the upper layer down to the thermocline from the chlorophyll fluorescence sensor.

The Baltic Proper

The temperature in the surface layer had decreased since November and varied between 5–6 degrees. At two stations, it was below normal (BY4 and BY31), while at the remaining stations, it was within the normal range. The salinity in the surface layer ranged from 6.4–8.1 psu, from the Arkona Basin to the Northern Baltic Proper. At all stations, there was a well-mixed surface layer with cold water, but the depth of the thermocline varied significantly. It was only 10 m deep at stations BY31 (Landsort Deep) and BCS-III 10, but it extended to 50 m at stations BY15 and BY10 in the Eastern Gotland Basin. Beneath the well-mixed surface layer, there were layers with higher temperatures down to about 50 m depth. The halocline was situated between 60-70 m depth.

In the Northern Baltic Proper and Eastern Baltic Proper, the water was well-mixed down to approximately 50 meters. Below that, there was an intermediate layer of older, colder water extending down to about 70 meters, with the exception of BY20 where an intermediate water layer was also found at 50 meters, but it was somewhat warmer than normal. In the Bornholm Basin, there was a well-mixed water column down to 50 meters, beneath which there was a warmer water layer at around 9 degrees extending down to the bottom. This phenomenon could also be observed in the eastern Arkona Basin at BY2 Arkona at around 40 meters.

The concentration of nutrients had increased in the surface layer since November. The levels were within the normal range for the season, except in the Northern Baltic Proper where the concentrations were higher than normal. The concentrations ranged between 1.6 – 4.6 $\mu\text{mol/l}$. A similar trend was observed for the concentration of phosphate, where levels had increased since November, and the Northern Baltic Proper had concentrations higher than normal for the season. Phosphate concentrations varied between 0.5 – 0.7 $\mu\text{mol/l}$. The concentration of silicate had also increased since November, with the Arkona Basin and Bornholm Basin standing out with levels above normal in the surface layer, while concentrations at other stations were within the normal range for the season. Silicate levels ranged between 11.5 – 18.3 $\mu\text{mol/l}$. At the station Tröskeln Ålands Hav, higher than normal concentrations were noted for all sampled nutrients.

In the Bornholm Basin and the Baltic Proper, the concentration of all nutrients was higher than normal below the halocline towards the bottom. The increase in the nutrient levels was observed from approximately 60 to 70 meter throughout the area. This coincided with the depletion of oxygen in the water column, i.e. when the oxygen concentration is zero and toxic hydrogen sulphide is formed. From the Bornholm Basin to the Northern Baltic Proper, oxygen-free conditions prevailed in the bottom waters. Hydrogen sulphide was also measured in these areas. Oxygen-free conditions were noted in the Eastern Gotland Basin at depths exceeding 70 meters, and from 70 to 80 meters in the Western Gotland Basin. In the Northern Baltic Proper, oxygen-free conditions prevailed from around 60 meters.

In the Arkona Basin, the oxygen situation in the bottom water was good, with concentrations ranging between 5,8 – 7,3 ml/l.

Fluorescence measurements from the CTD indicated plankton activity in the surface layer above the thermocline at all stations, while very low values were measured beneath the thermocline. No significant peaks in chlorophyll fluorescence were observed.

More information about the algal situation can be found in the Algalware-report for December: <https://www.smhi.se/publikationer/publikationer/algrapporter> (Only available in Swedish).

The Bothnian Sea and the Åland Sea

In the western part of the Bothnian Sea, the surface water temperature was lower than normal for the season, ranging between 0.2 – 2.6 degrees. In other areas, the temperature was slightly lower to normal for the season, between 2.9 – 3.6 degrees. Generally, no distinct temperature stratification was observed at the visited stations.

The salinity in the surface water was mostly normal for the season, but lower levels were noted along the Swedish coast, while higher levels than normal were observed near the Finnish coast in the southeastern parts. Surface salinity varied between 4.6 and 5.6 psu. Similar to the temperature, no clear salinity stratification was observed, with slightly increasing salinities towards the bottom, where salinities ranged between 6 - 7 psu in the bottom water.

Concentrations of dissolved inorganic nitrogen in the surface water in the Åland Sea were around 2.9 – 3.0 $\mu\text{mol/l}$, which is normal. In the Bothnian Sea, concentrations were slightly higher than normal in the northwestern parts and at some stations in the southeastern part, ranging between 2.9 – 5.8 $\mu\text{mol/l}$. Concentrations increased with depth, and higher-than-normal levels were also noted in the bottom water at these stations. In the central Bothnian Sea, concentrations were higher than normal and around normal.

Phosphate concentrations in the surface water were higher than normal at all stations, except for nearshore stations along the Swedish coast. Concentrations varied between 0.3 - 0.5 $\mu\text{mol/l}$ throughout the area. Phosphate concentrations increased with depth, and in the deep water, concentrations were much higher than normal at some stations. Silicate concentrations were above normal at the majority of stations in the Bothnian Sea. Surface concentrations varied between 18.8 – 39.4 $\mu\text{mol/l}$. Similar to nitrogen, silicate concentrations increased with depth, and at many stations, concentrations above normal were noted in the deep water.

Oxygen concentrations in the bottom water varied around 5.5 ml/l in the deeper areas of the Bothnian Sea and slightly higher in the bottom water in shallower areas, ranging from 7-9 ml/l. In Gaviksfjärden, oxygen deficiency was noted with 3.7 ml/l, indicating that oxygen deficiency (<4 ml/l) was measured in the bottom water.

Plankton activity, assessed from chlorophyll fluorescence measured with the CTD probe, was low throughout the surveyed area. No visibility depth was measured due to darkness or rough seas, and turbidity measured with the CTD's turbidity meter indicated high particle concentrations in the deeper parts of the Bothnian Sea. This could also be observed in real-time video footage from the camera mounted on the CTD rosette.

The Bothnian Bay and Northern Quark

The stratification in the Bothnian Bay and Northern Quark is weaker than in the Bay of Bothnia, but a weak temperature stratification was found at around a depth between 20-50 meters. Generally, a well-mixed water mass was observed during the expedition in the Bothnian Bay.

The surface water temperature ranged from lower than normal to normal for the season, between -0.7 to 3.3 degrees Celsius, with the coastal station F16 standing out with a surface water temperature below 0 degrees. The surface salinity was normal, varying between 2.9 to 5.6 practical salinity units (psu). The salinity in the deep water was within the normal range.

The concentration of dissolved inorganic nitrogen was around normal levels, ranging between 4.1 to 6.0 $\mu\text{mol/l}$. In deep water, nitrogen concentration increased and exhibited some variation, with both normal levels and concentrations lower or higher than normal. Phosphate levels in surface water were very low, which is typical for the season, except for the southern Bothnian Bay where the levels were higher than normal. Phosphate concentrations increased with depth, and in the deep waters, higher levels than normal were observed. The silicate content in surface water is naturally high due to significant runoff into the Bothnian Bay. Levels above normal were noted, varying around 40 $\mu\text{mol/l}$. In deep water, concentrations further increased, and again, the levels were higher than normal.

No oxygen deficiency was observed in the Bothnian Bay or Northern Quark, which is normal. Oxygen levels in the bottom water were above 7 ml/l at all stations.

The plankton activity, assessed from chlorophyll fluorescence measured with a CTD probe, was low throughout the surveyed area. No visibility depth was measured due to darkness or high waves, preventing reliable measurements. Turbidity measured with the CTD's turbidity meter indicated lower particle concentrations in the deeper parts of the Bothnian Bay compared to the Bothnian Sea.

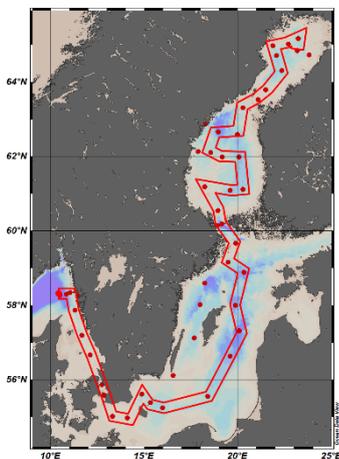
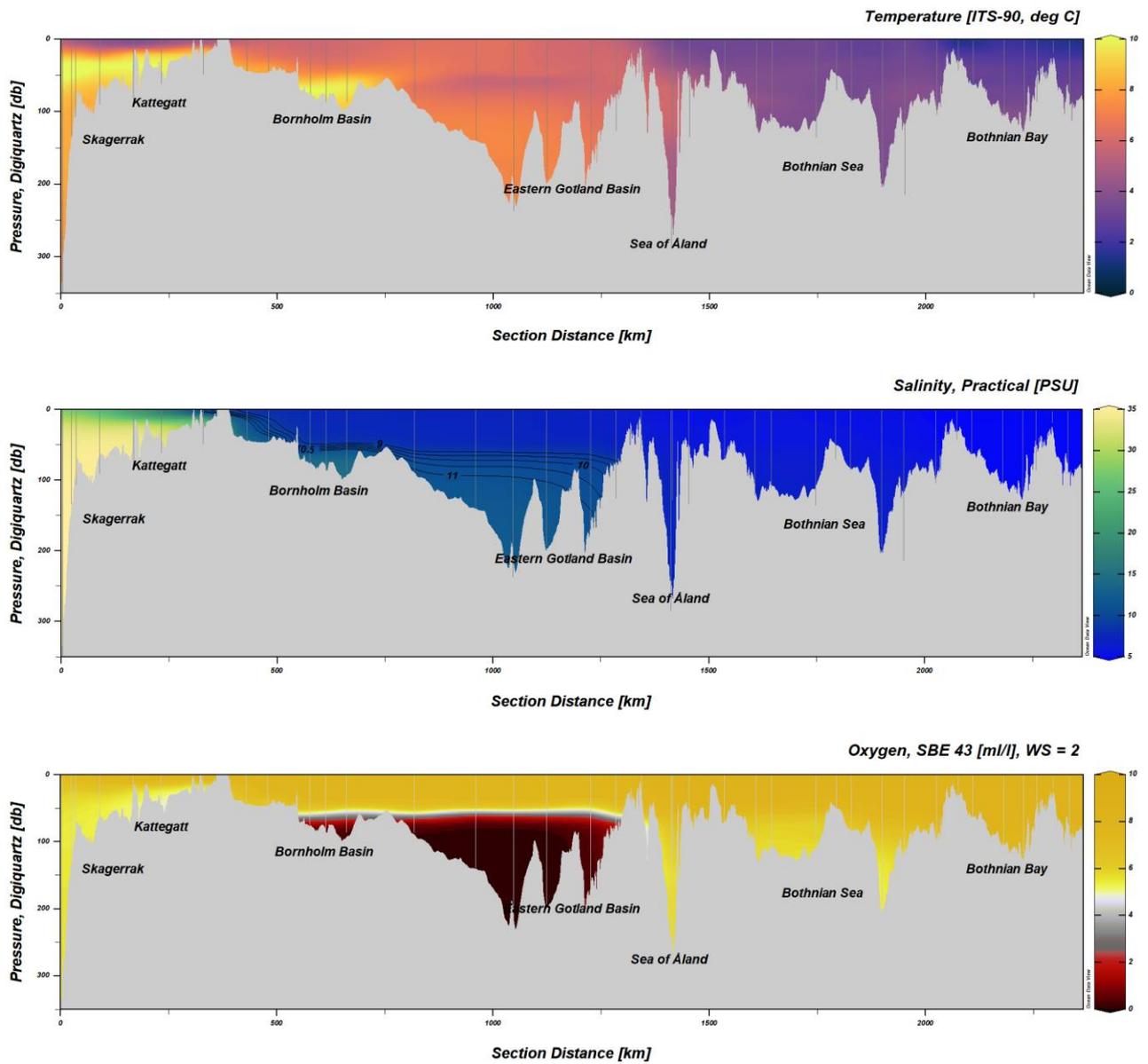
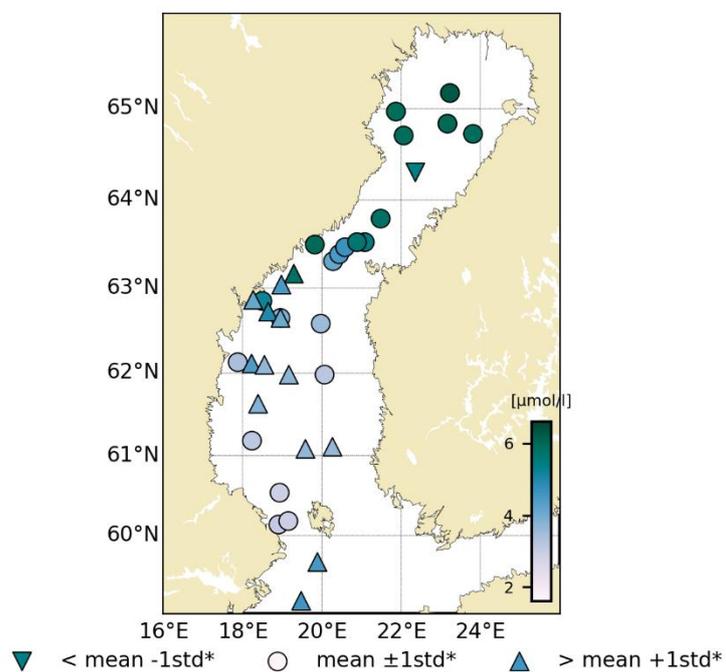
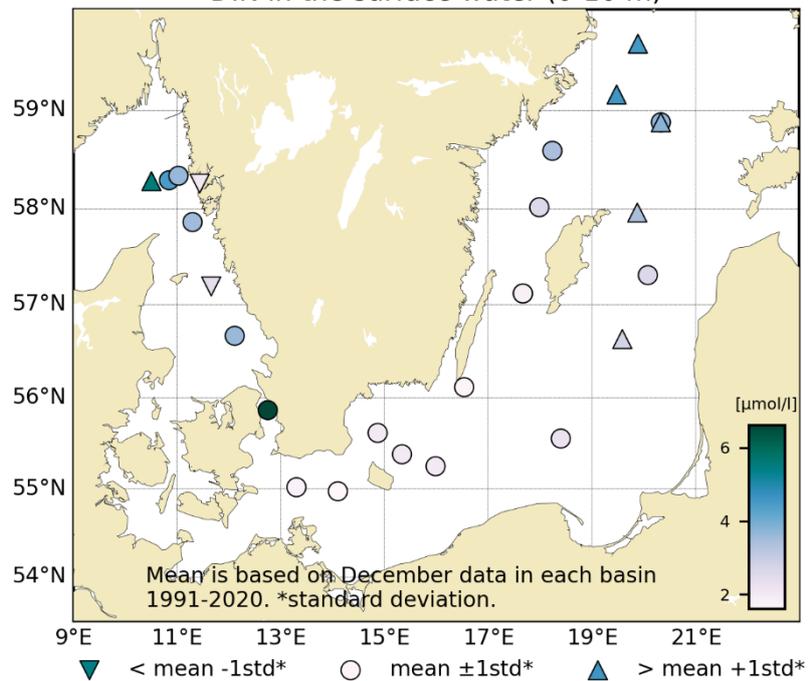


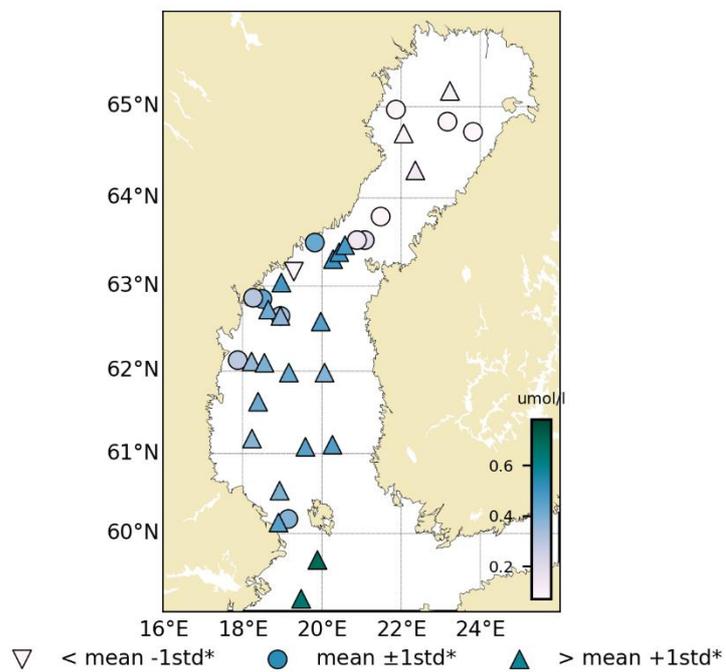
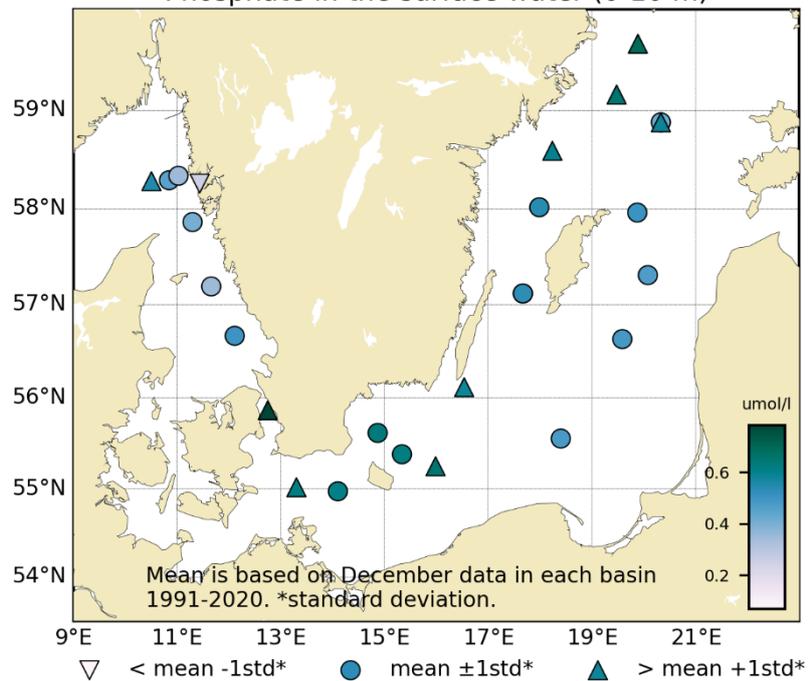
Figure 1. Transect showing oxygen concentration, salinity and temperature measured with CTD, stretching from Skagerrak, Kattegat, the Sound, the Baltic Proper, through the Eastern Gotland Basin and up to the Bothnian Bay.

SMHI marine monitoring December 2023
DIN in the surface water (0-10 m)



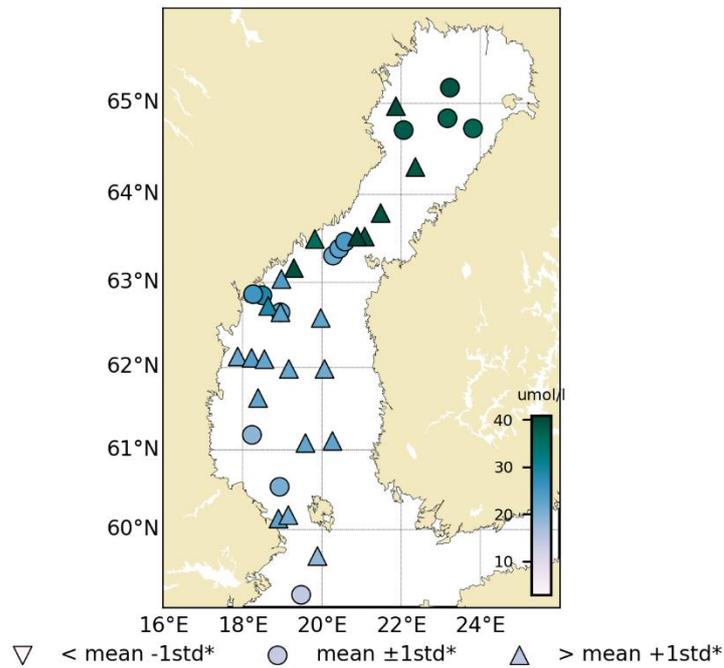
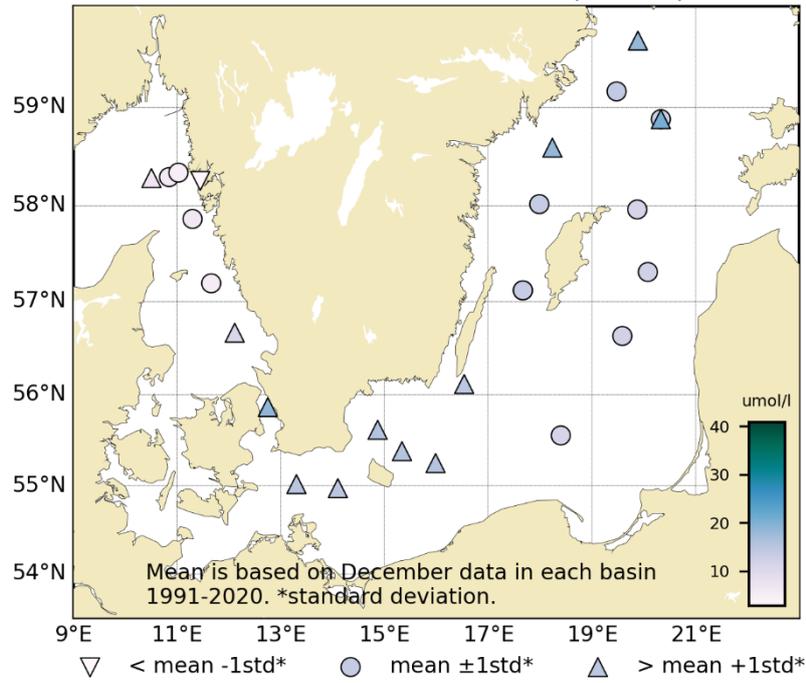
Figur 2. Koncentrationen ($\mu\text{mol/l}$) av oorganiskt kväve i ytvattnet (0-10m).

SMHI marine monitoring December 2023
Phosphate in the surface water (0-10 m)

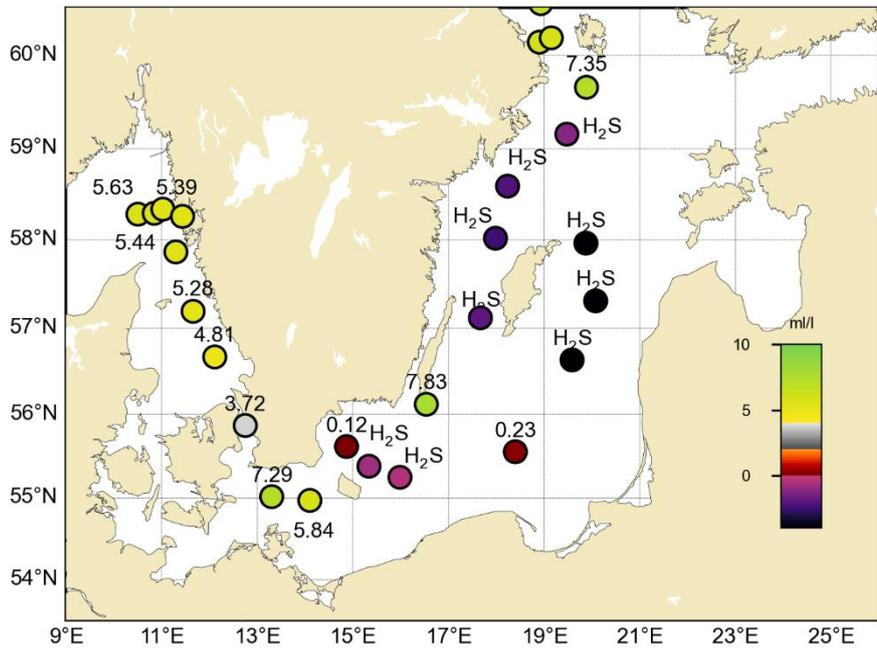
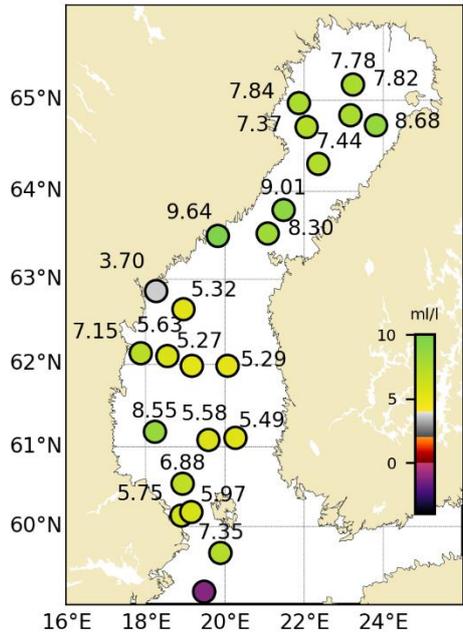


Figur 3. Koncentrationen ($\mu\text{mol/l}$) av fosfat i ytvattnet (0-10m).

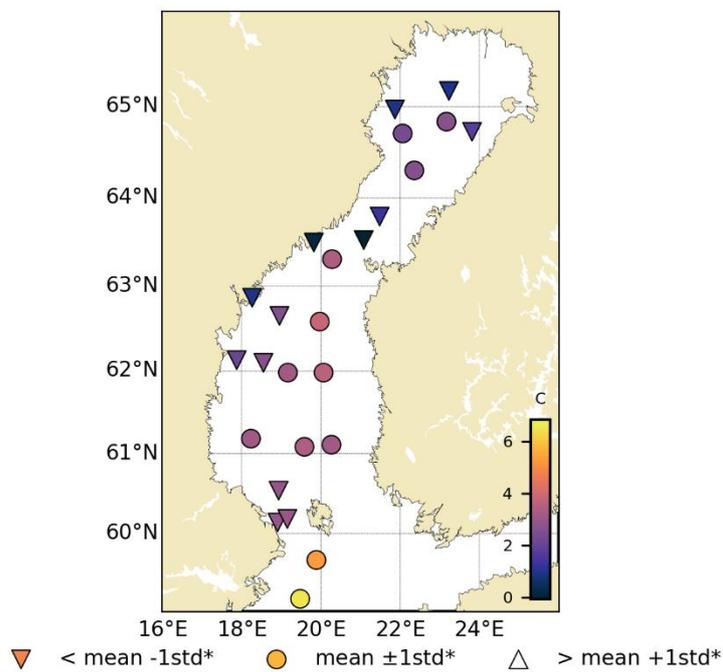
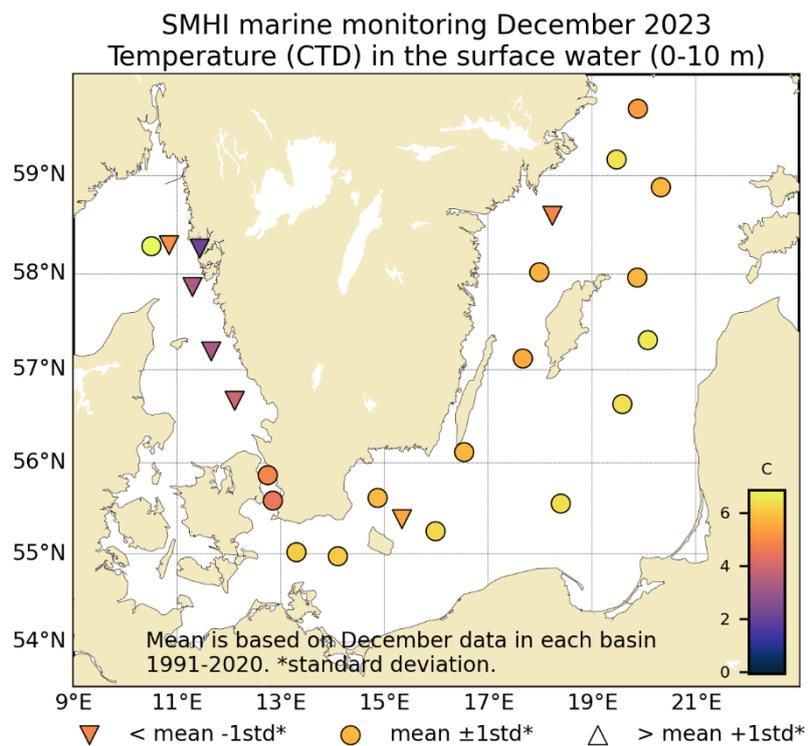
SMHI marine monitoring December 2023
Silicate in the surface water (0-10 m)



Figur 4. Koncentrationen ($\mu\text{mol/l}$) av silikat i ytvattnet (0-10m).

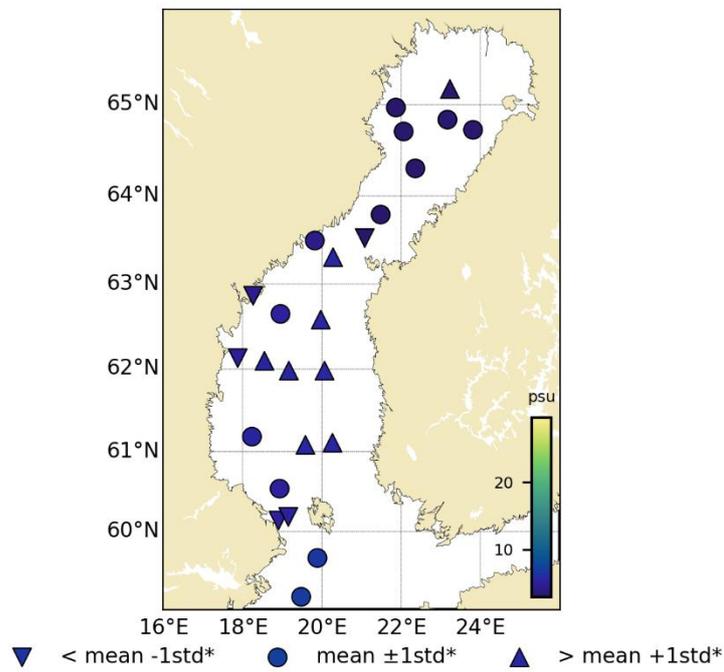
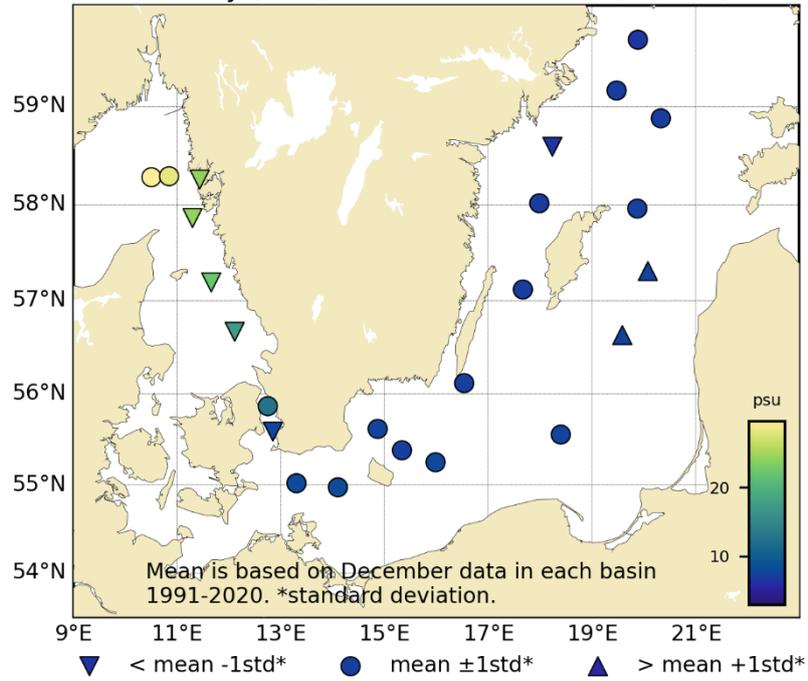


Figur 5. Syrekonsentrationen (ml/l) i bottenvattnet.



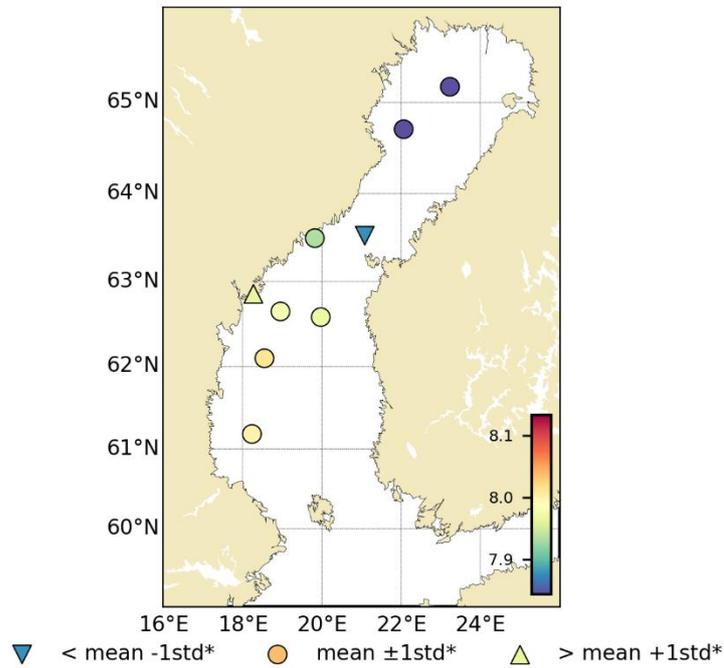
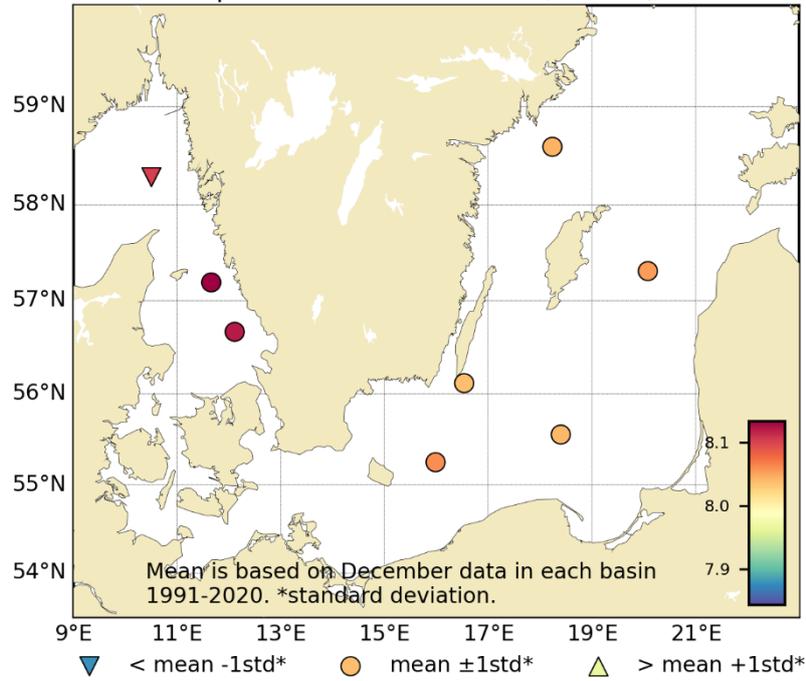
Figur 6. Temperaturen i ytvattnet (0-10m).

SMHI marine monitoring December 2023
Salinity (CTD) in the surface water (0-10 m)



Figur 7. Salthalten i ytvattnet (0-10m).

SMHI marine monitoring December 2023
pH in the surface water (0-10 m)



Figur 8. pH i ytvattnet (0-10m).

DELTAGARE

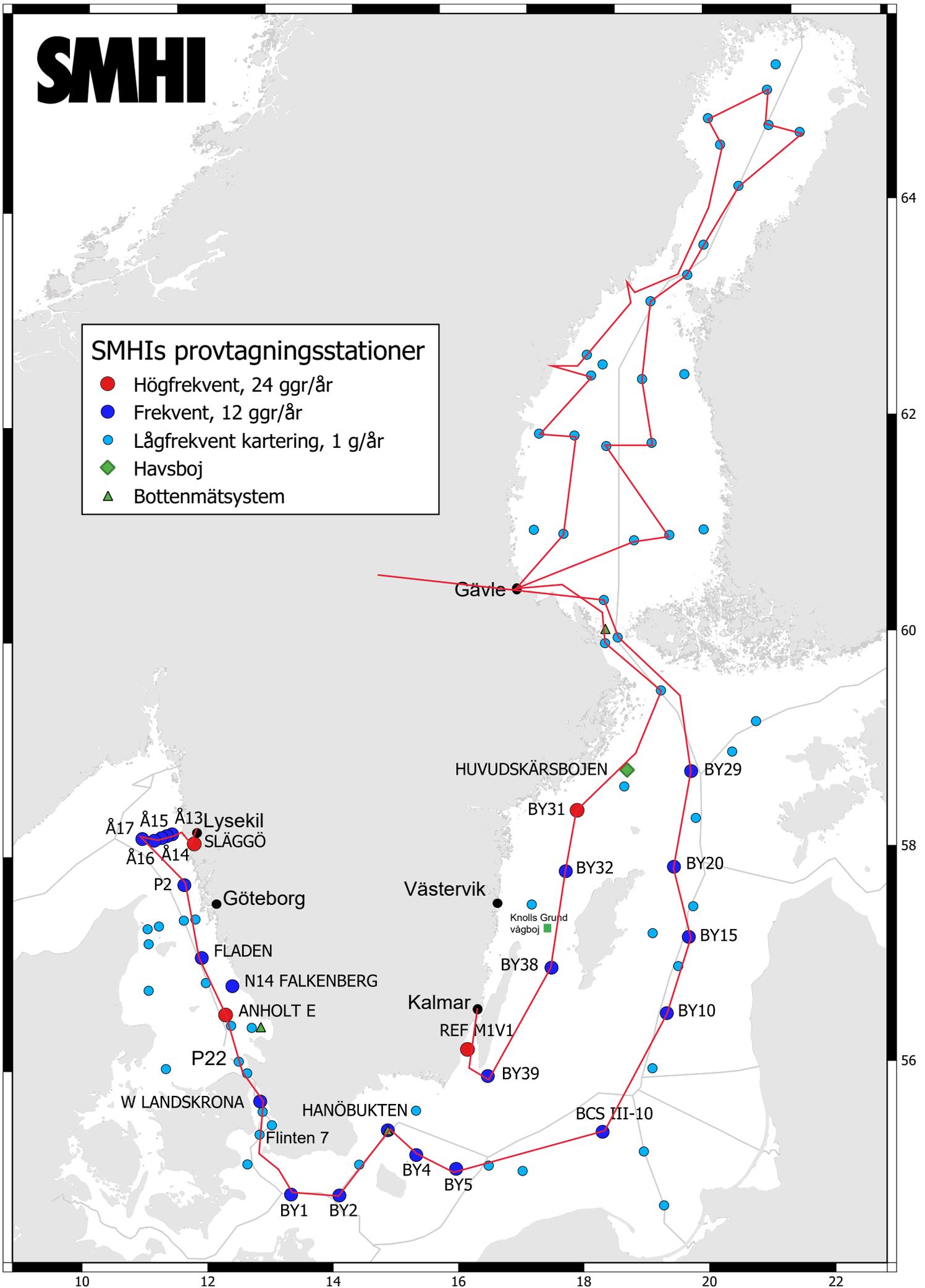
Name	Role	From
Martin Hansson	Cruise leader, leg one, Oceanographer	SMHI
Örjan Bäck	Oceanographer	SMHI
Madeleine Nilsson	Marine chemist	SMHI
Helena Björnberg	Marine chemist	SMHI
Monica Linder	Chemist	SMHI
Daniel Bergman Sjöstrand	Marine technician	SMHI
Joakim Ahlgren	Chemist	UMF
Martina Jeuthe	Chemist	UMF
Siv Huseby	Marin biologist	UMF
Lena Viktorsson	Cruise leader leg two, Oceanographer	SMHI
Sari Sipilä	Chemist	SMHI
Ann-Turi Skjevik	Marin biologist	SMHI
Johanna Linders	Oceanographer	SMHI
Johan Håkansson	Chemist	SMHI

APPENDICES

- Track chart
- Table over stations, analysed parameters and number of sampling depths
- Monthly average surface water plots for regular monitoring stations
- Vertical profiles for regular monitoring stations

SMHIs provtagningsstationer

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



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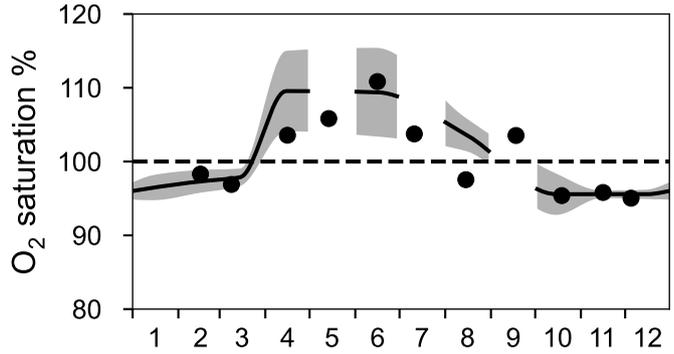
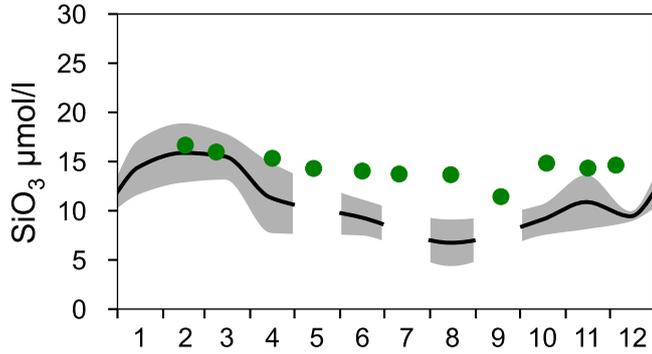
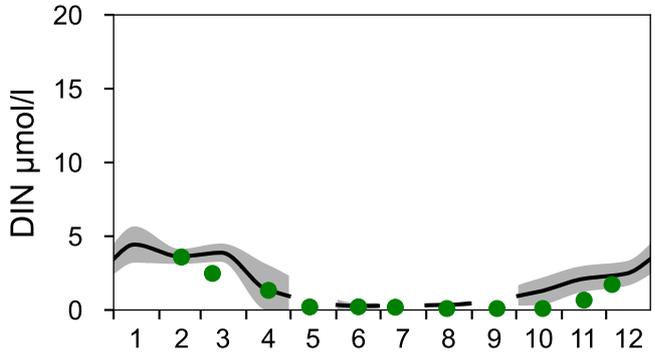
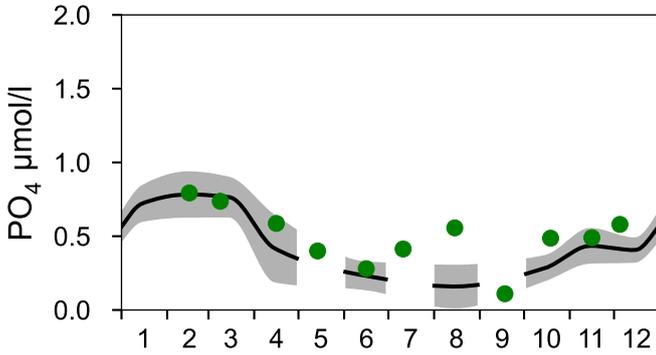
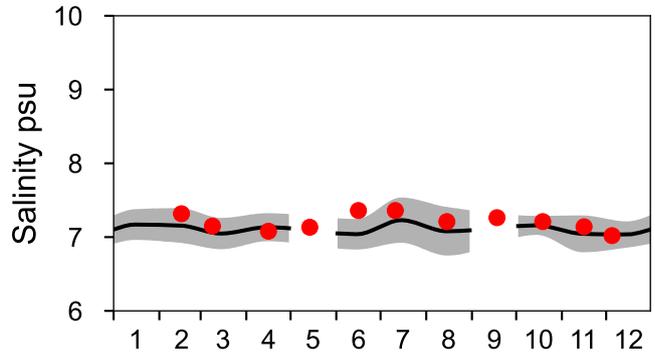
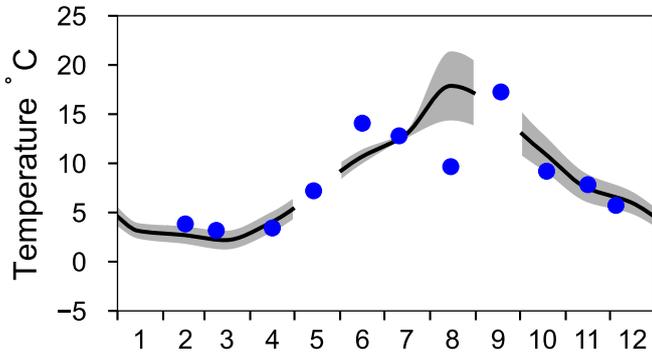
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0988	21	BPNX00	EXT...	10E ALMAGRUNDET	5909.56	01928.50	20231206	1105	133		31	2	-2.5	1025	2720	----	15		-	x	-	x	-	x	x	x	-	x	x	x	-	x	x	x	-	x	x	-	x	x						
5082	21	BPNX00	EXT...	FERRYBOX	5922.28	01953.67	20231206	1220	50								1																													
0989	21	GBAX01	BAS...	TRÖSKELN ÅLANDS HAV	5939.7	01953.13	20231206	1445	60		1	3.9	-0.1	1025	9999	----	9		-	x	-	x	-	x	-	x	x	x	-	x	x	x	-	x	x	-	x	x								
0990	21	BPST08	BAS...	U19 NORRA RANDEN	6008.34	01854.14	20231206	1932	131		30	4.5	-5.1	1027	9999	----	15		-	x	-	x	-	x	-	x	x	x	-	x	x	x	-	x	x											
5083	21	GBSX00	EXT...	FERRYBOX	6052.71	01831.63	20231207	1203	50								1																													
0991	21	GBSX07	BAS...	SR5 / C4	6105.03	01934.99	20231207	1515	124		12	10.5	-0.2	1029	9999	----	14		-	x	-	x	-	x	-	x	x	x	-	x	x	x	-	x	x											
0992	21	GBSX06	BAS...	SS29	6106.58	02015.93	20231207	1815	114		14	10	-1.3	1029	9999	----	14		-	x	-	x	-	x	-	x	x	x	-	x	x	x	-	x	x											
0993	21	GBSX22	BAS...	F26 / C15	6159.01	02003.99	20231207	2340	138		99	8.8	-1.4	1028	9999	----	15		-	x	-	x	-	x	-	x	x	x	-	x	x	x	-	x	x											
0994	21	GBSX17	BAS...	MS6	6159.00	01909.88	20231208	0301	73		14	12.9	-0.3	1027	9990	----	10		-	x	-	x	-	x	-	x	x	x	-	x	x	x	-	x	x											
0995	21	GBSX26	BAS...	US5B / C1	6235.19	01958.24	20231208	0750	218		15	13.2	-1.3	1029	2840	----	17		-	x	-	x	-	x	-	x	x	x	-	x	x	x	-	x	x											

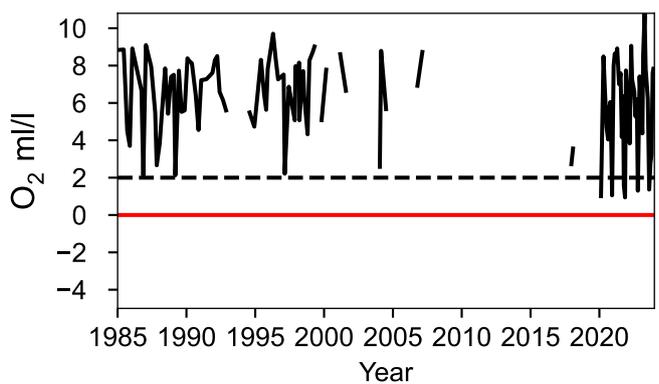
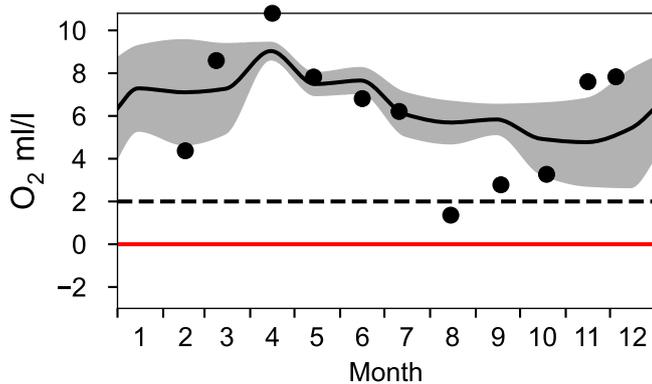
STATION BY39 ÖLANDS S UDDE SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023

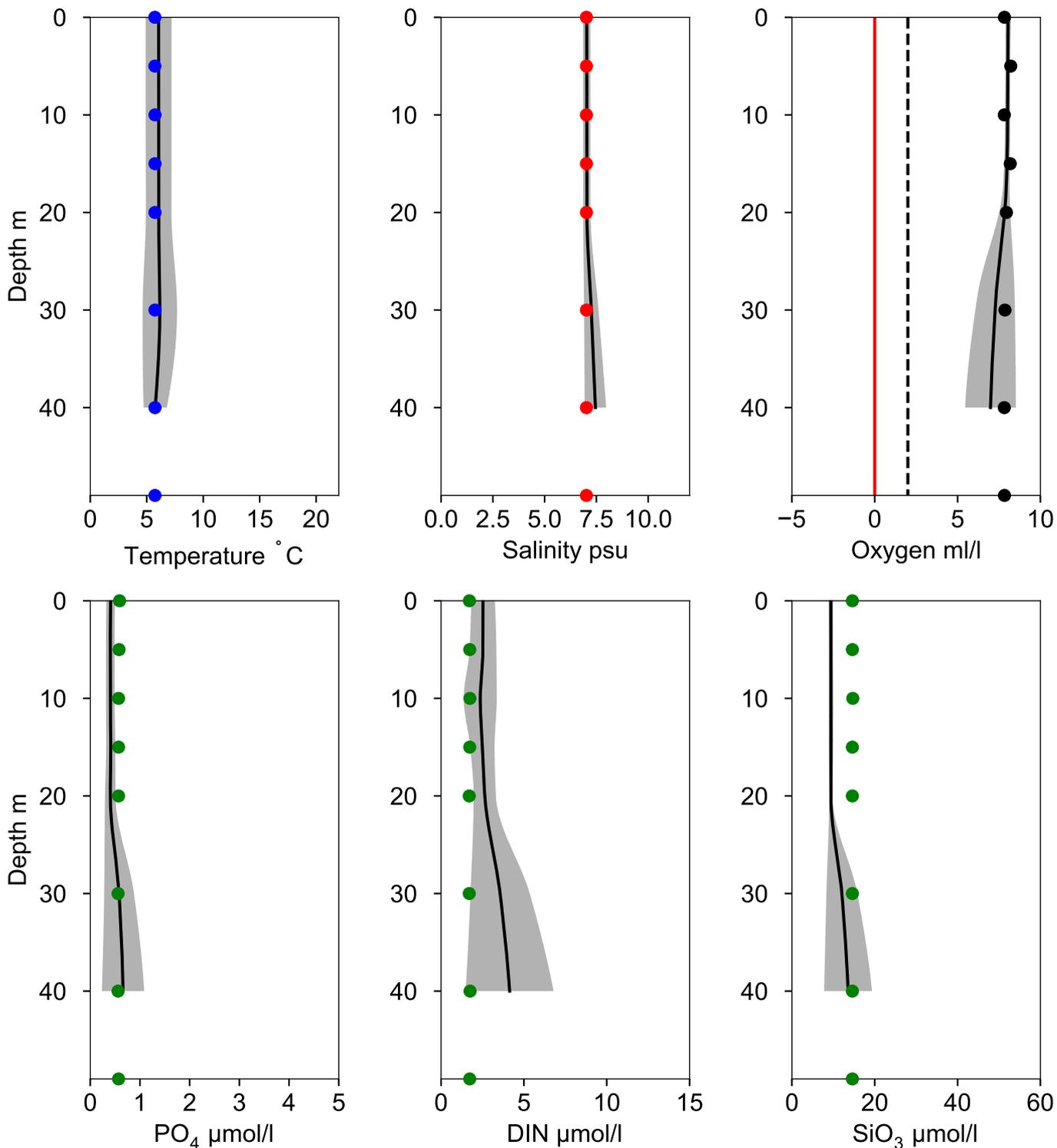


OXYGEN IN BOTTOM WATER (depth >= 40 m)



Vertical profiles BY39 ÖLANDS S UDDE December

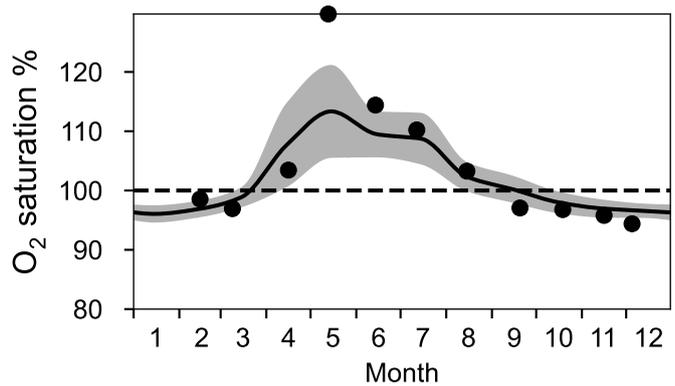
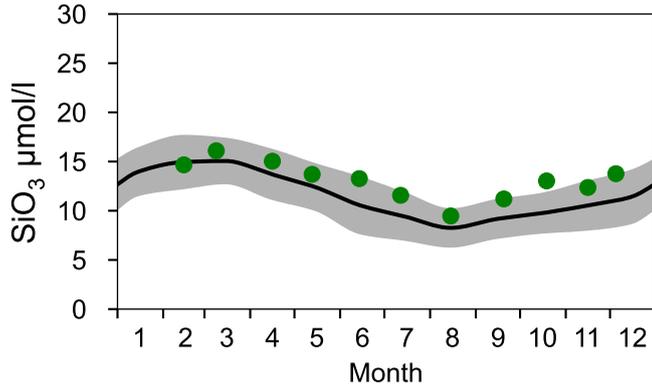
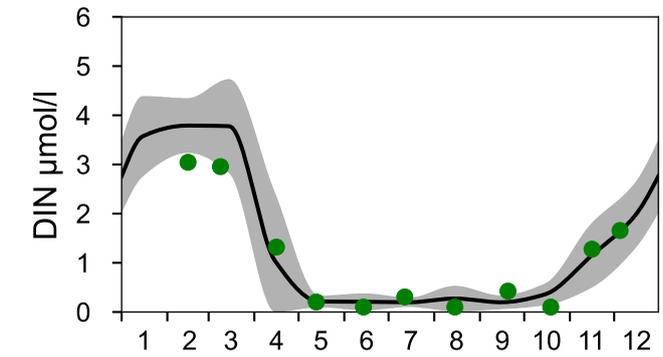
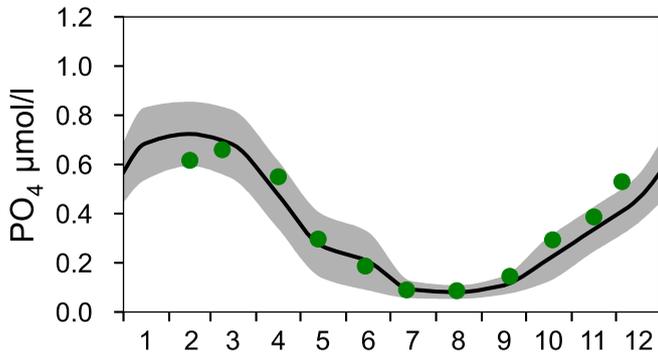
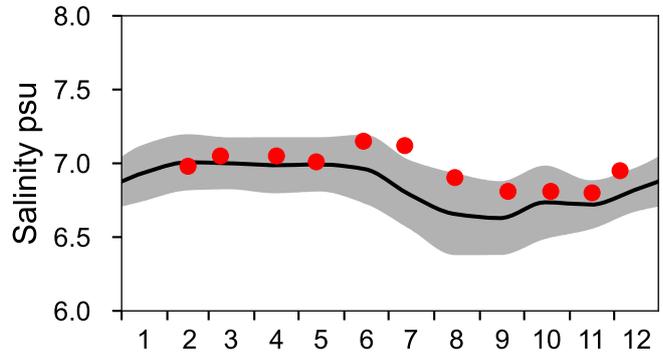
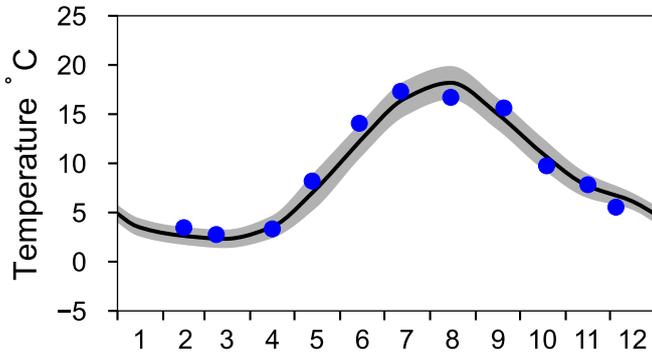
— Mean 1991-2020 St.Dev. ● 2023-12-05



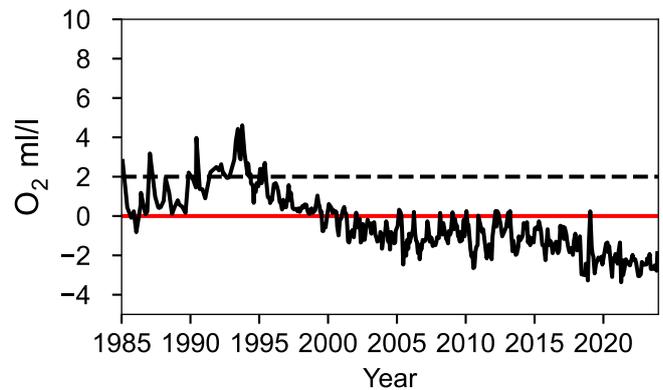
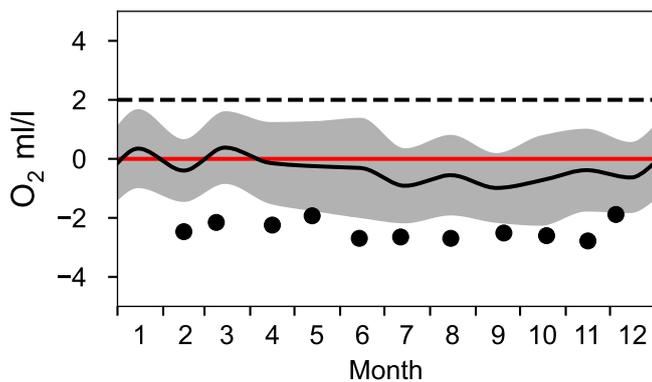
STATION BY38 KARLSÖDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023

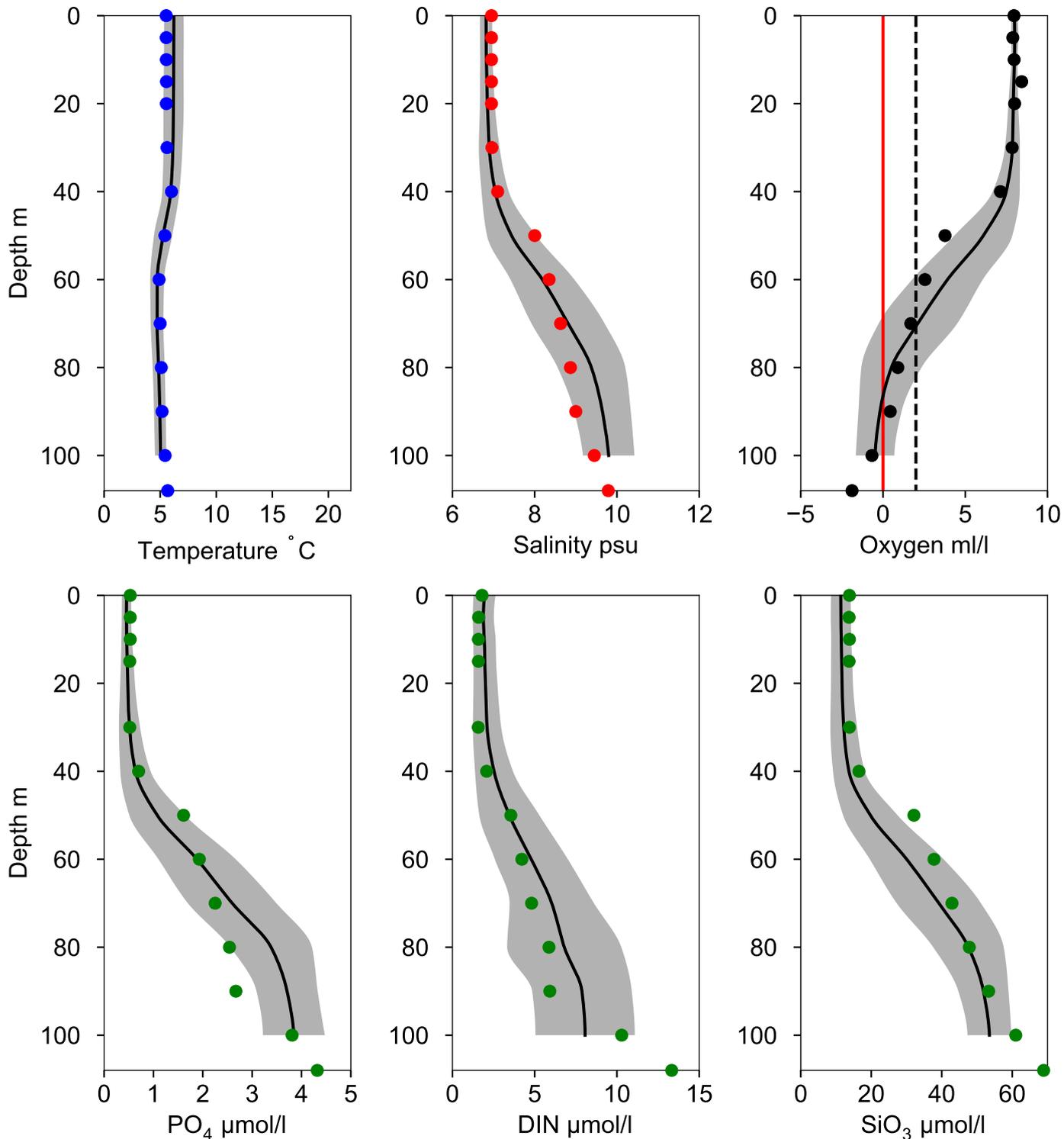


OXYGEN IN BOTTOM WATER (depth >= 100 m)



Vertical profiles BY38 KARLSÖDJ December

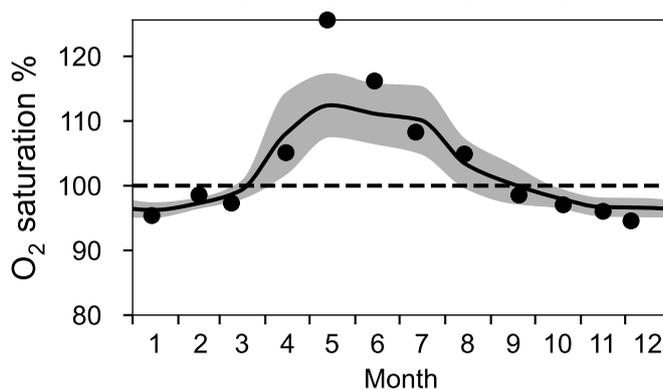
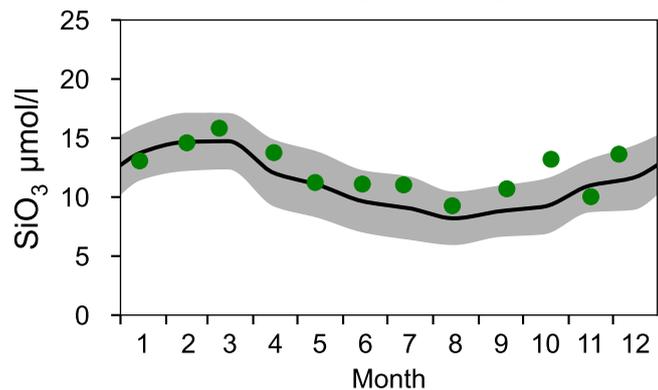
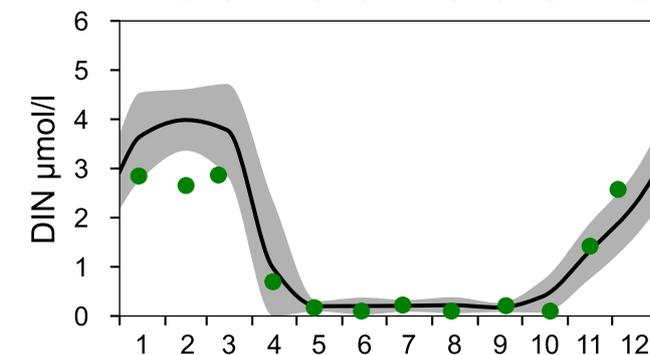
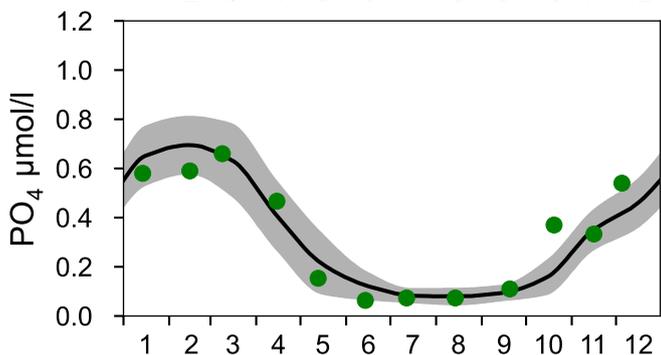
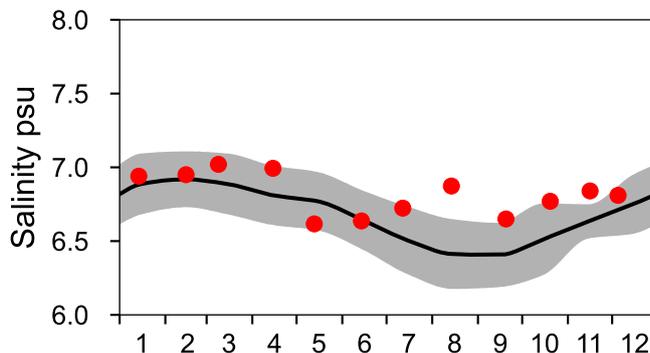
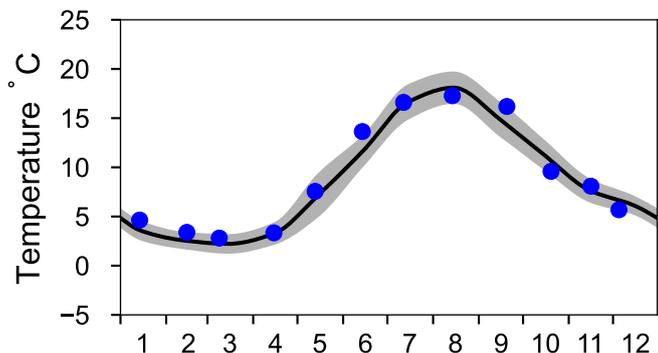
— Mean 1991-2020 ■ St.Dev. ● 2023-12-05



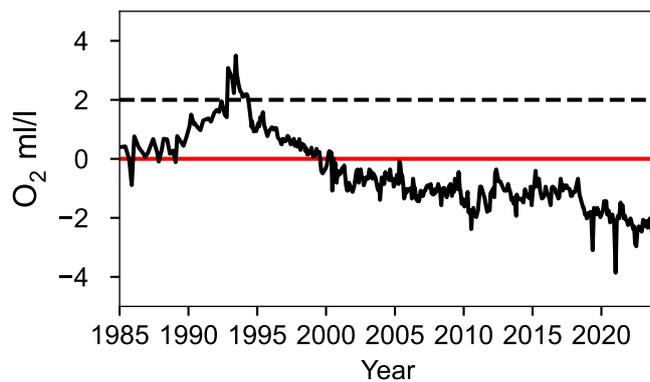
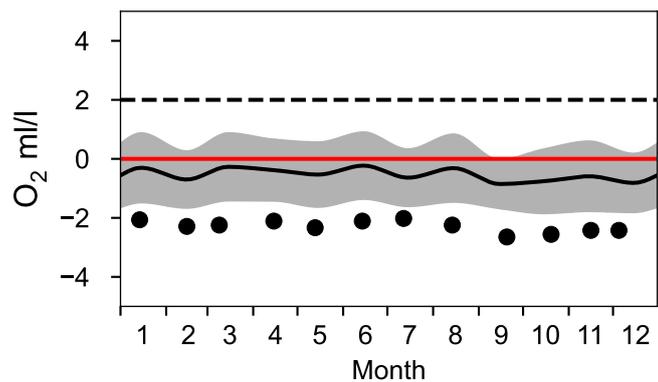
STATION BY32 NORRKÖPINGSDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023

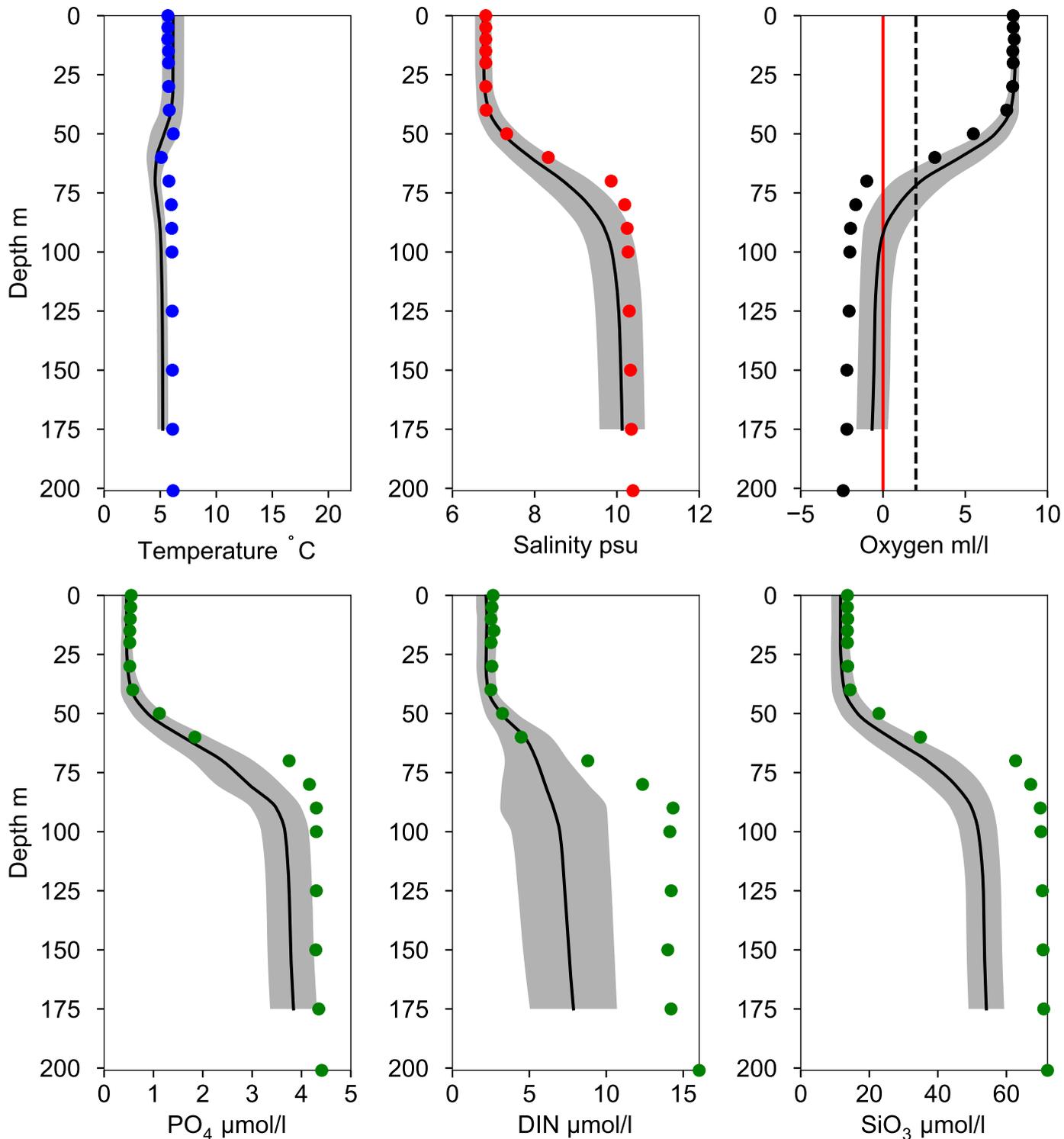


OXYGEN IN BOTTOM WATER (depth >= 175 m)



Vertical profiles BY32 NORRKÖPINGSDJ December

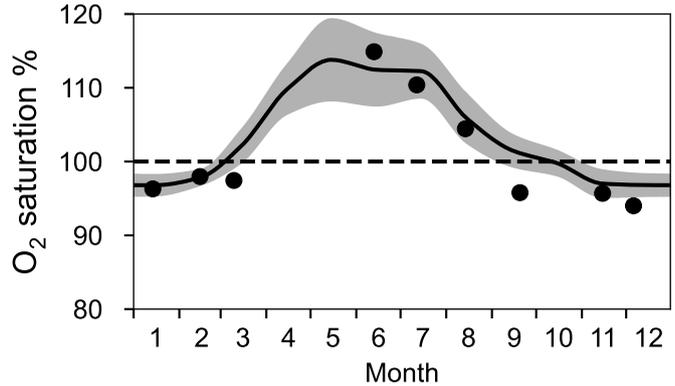
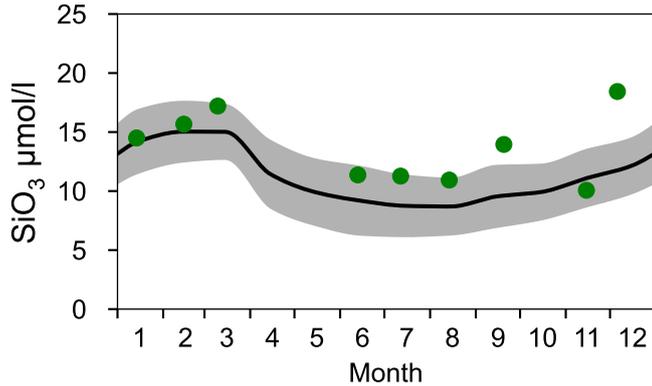
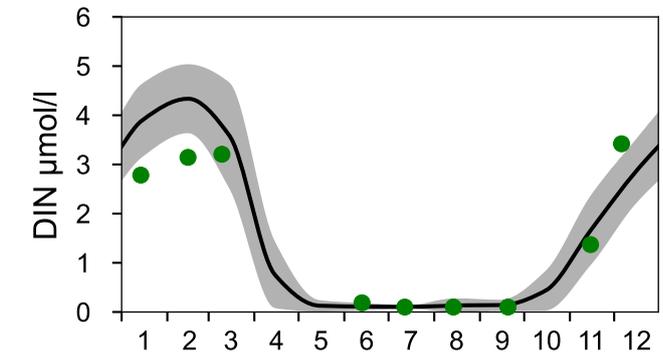
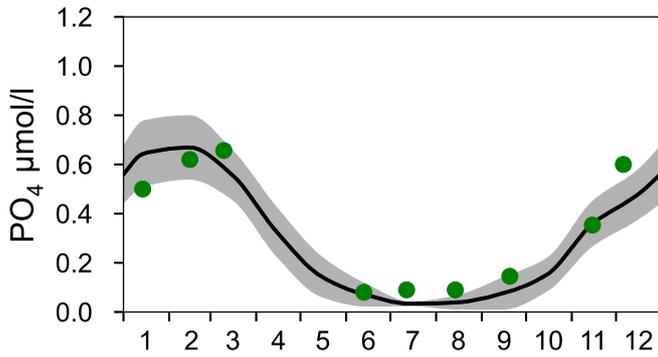
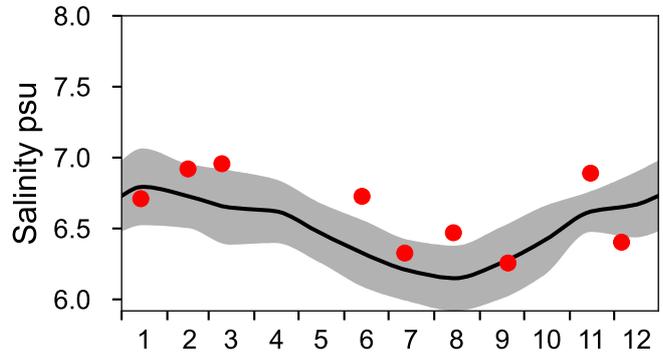
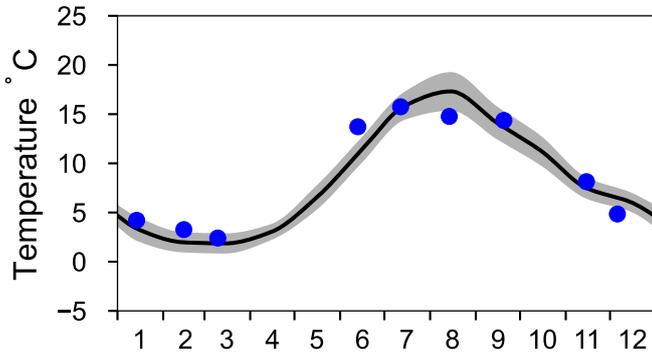
— Mean 1991-2020 ■ St.Dev. ● 2023-12-05



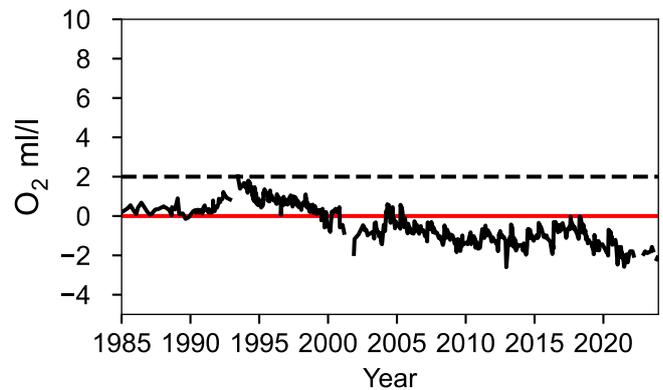
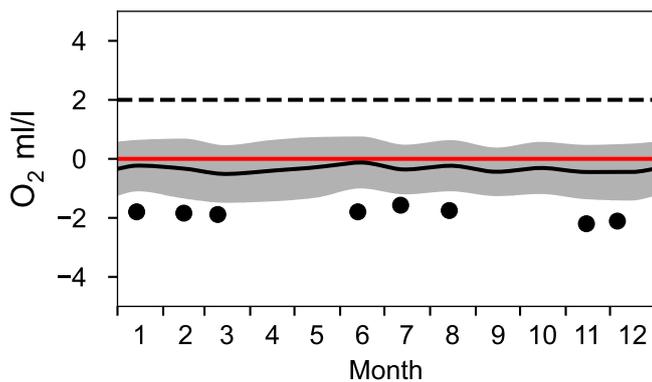
STATION BY31 LANDSORTSDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023

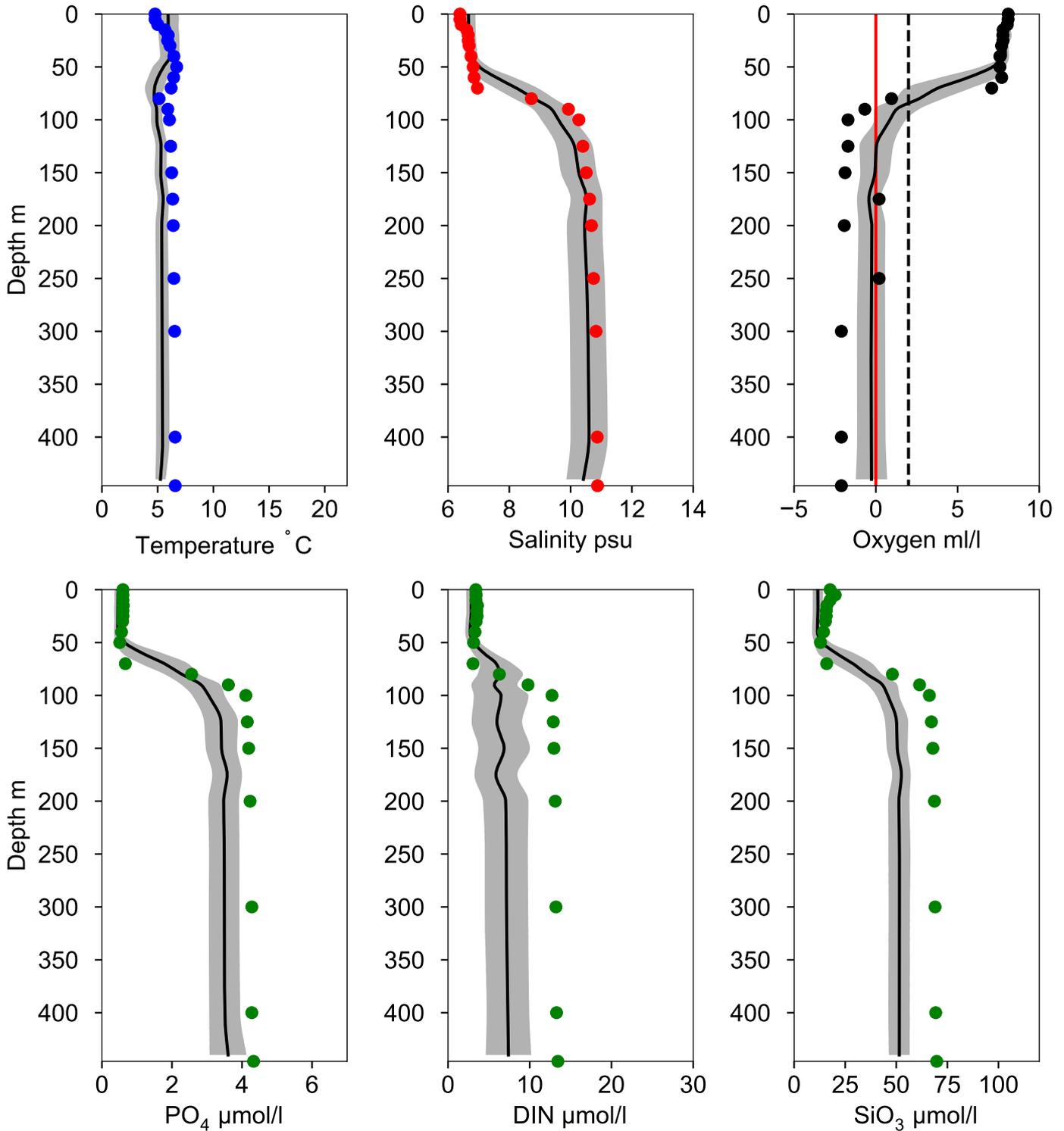


OXYGEN IN BOTTOM WATER (depth >= 419 m)



Vertical profiles BY31 LANDSORTSDJ December

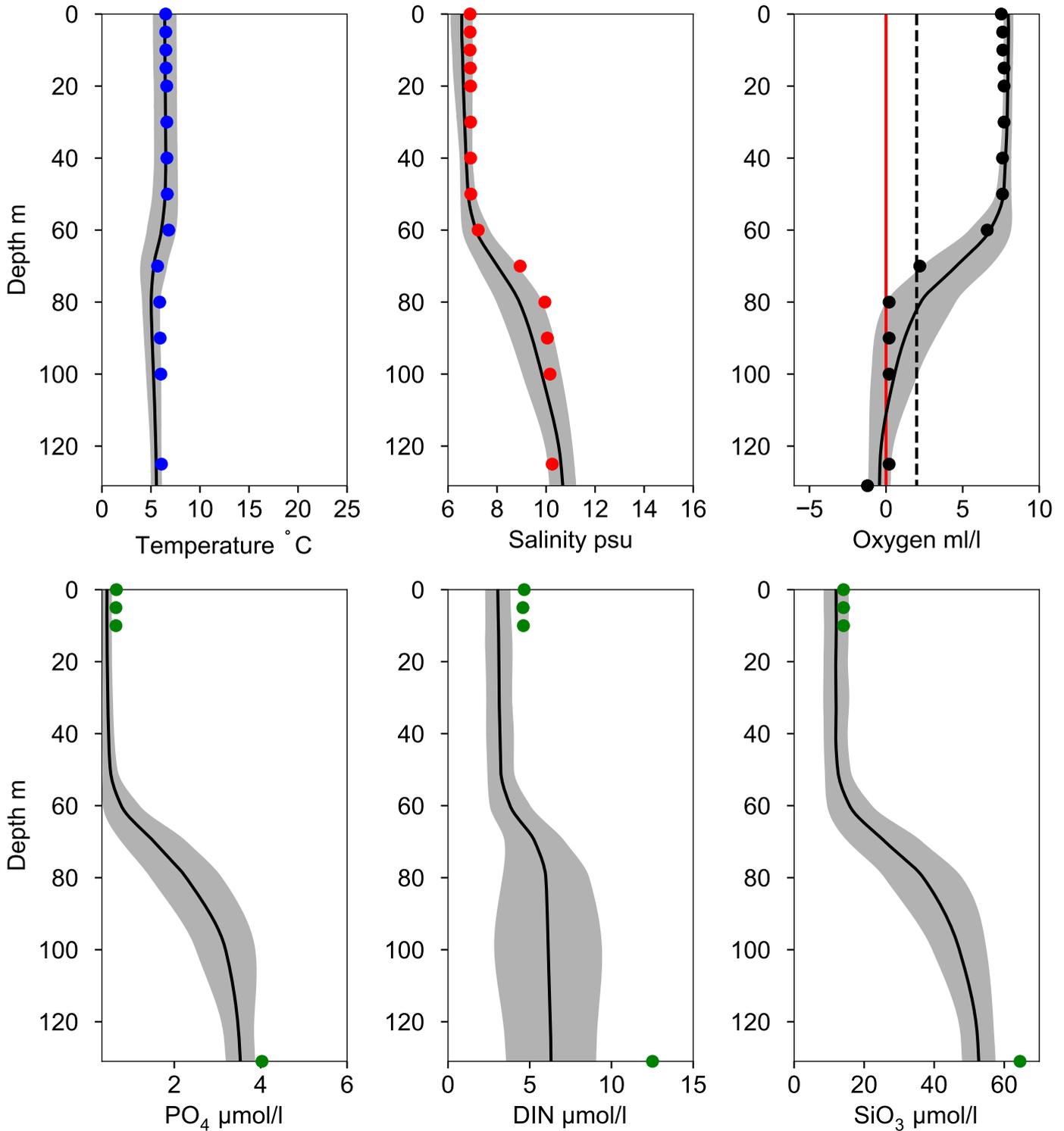
— Mean 1991-2020 ■ St.Dev. ● 2023-12-06



Vertical profiles 10E ALMAGRUNDET December

Statistics based on data from: Norra Egentliga Östersjön

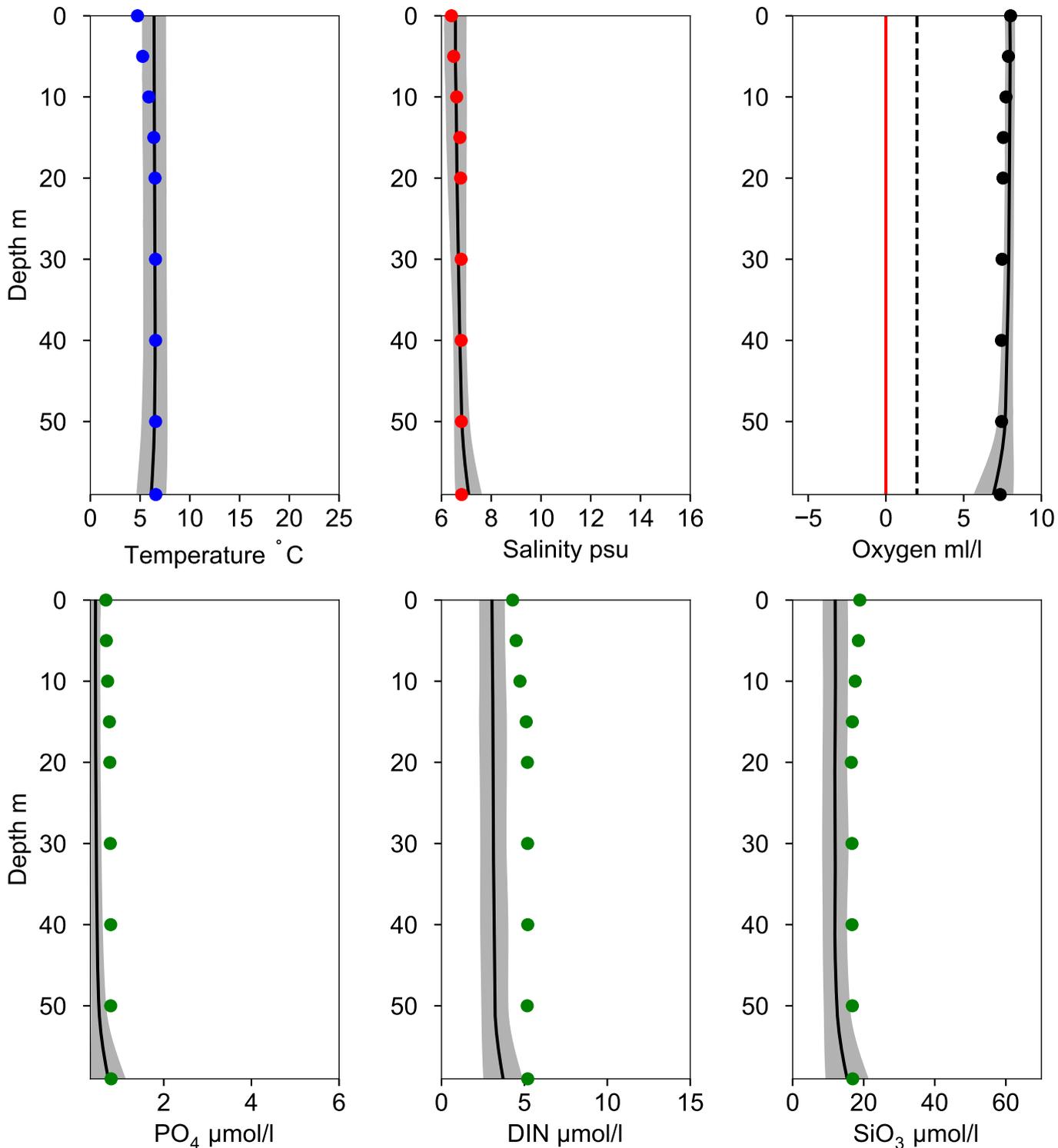
— Mean 1991-2020 St.Dev. ● 2023-12-06



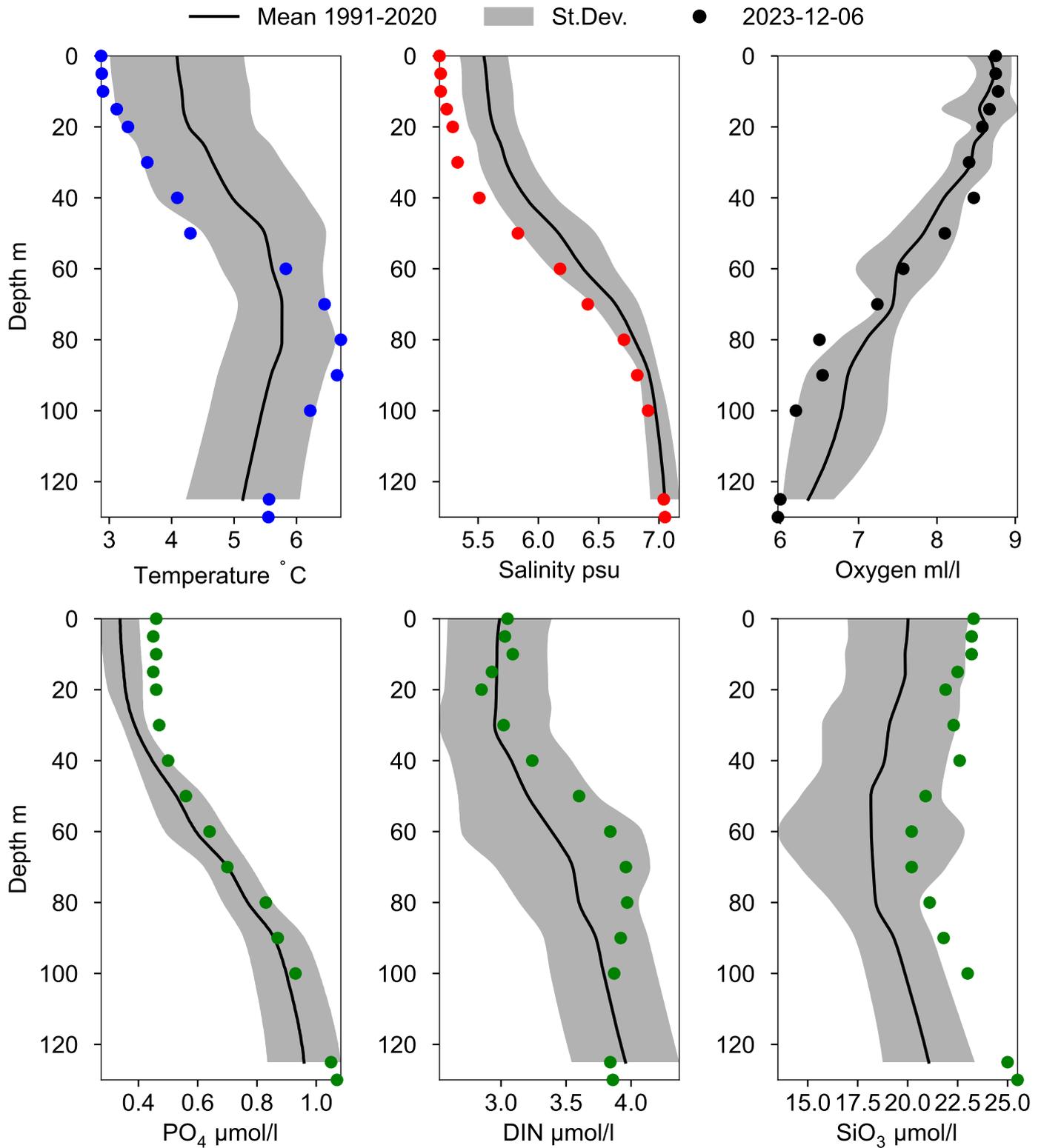
Vertical profiles TRÖSKELN ÅLANDS HAV December

Statistics based on data from: Norra Egentliga Östersjön

— Mean 1991-2020 St.Dev. ● 2023-12-06



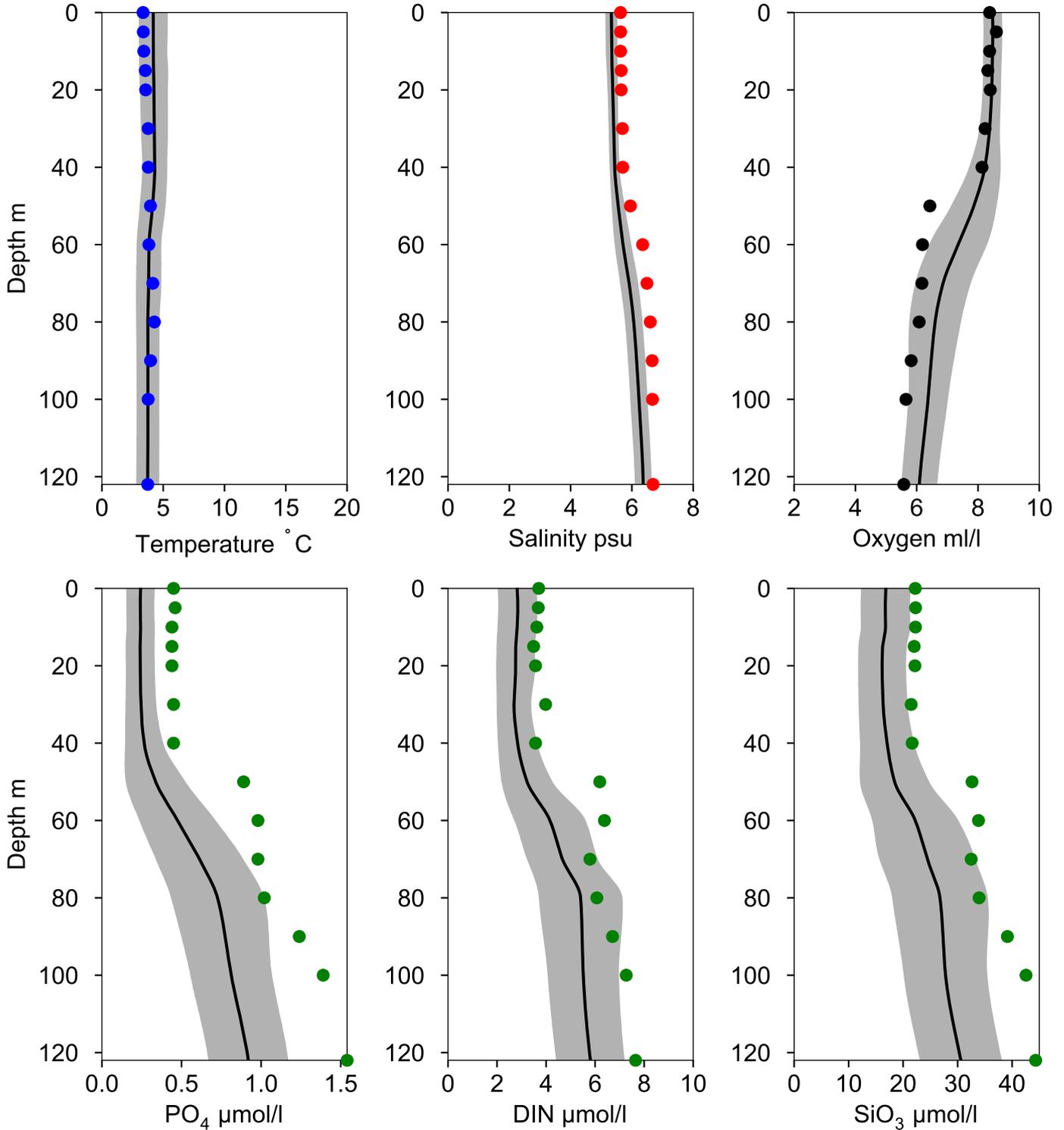
Vertical profiles U19 NORRA RANDEN December



Vertical profiles SR5/LL4 December

Statistics based on data from: Bottenhavet

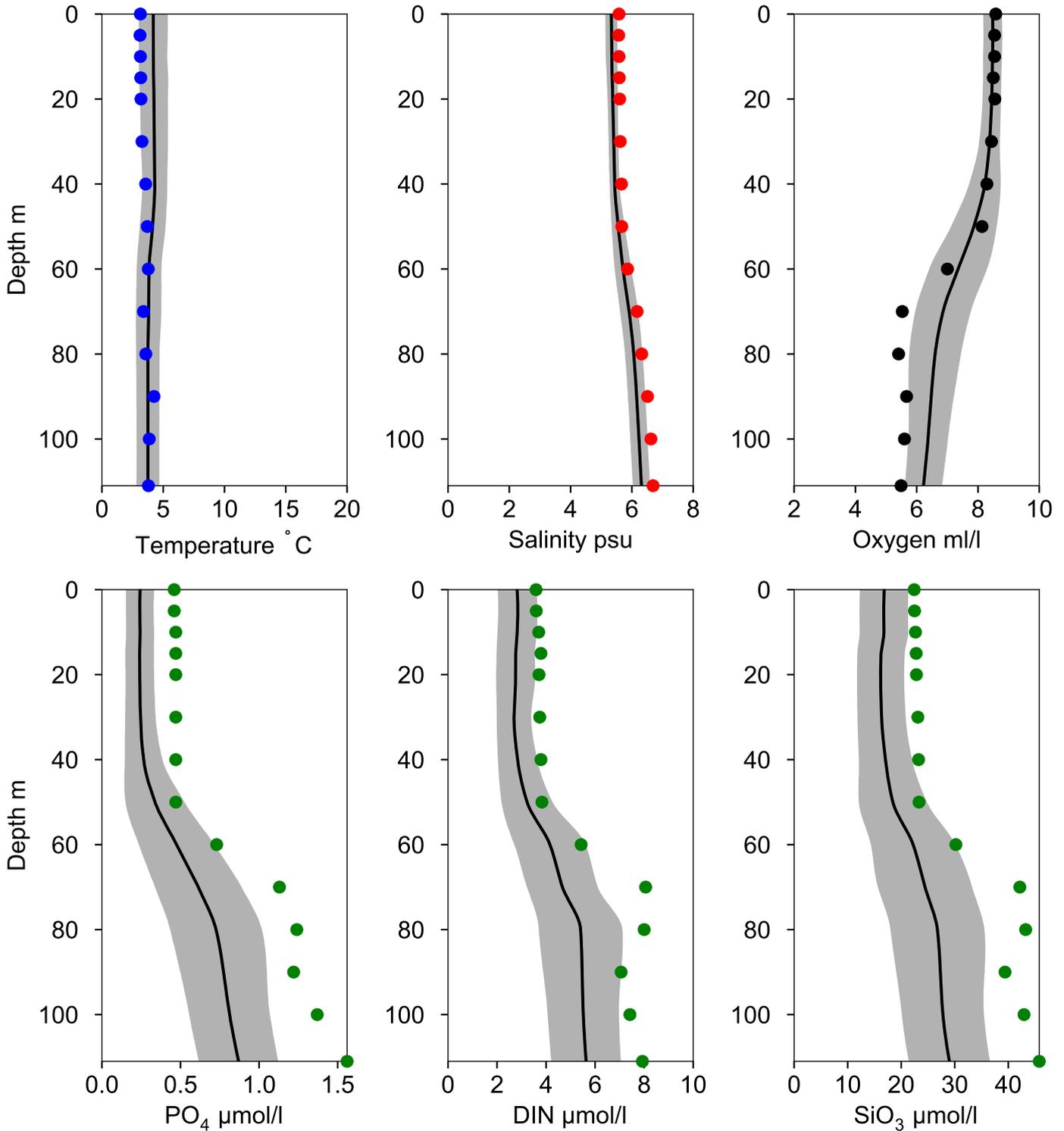
— Mean 1991-2020 St.Dev. ● 2023-12-07



Vertical profiles SS29 December

Statistics based on data from: Bottenhavet

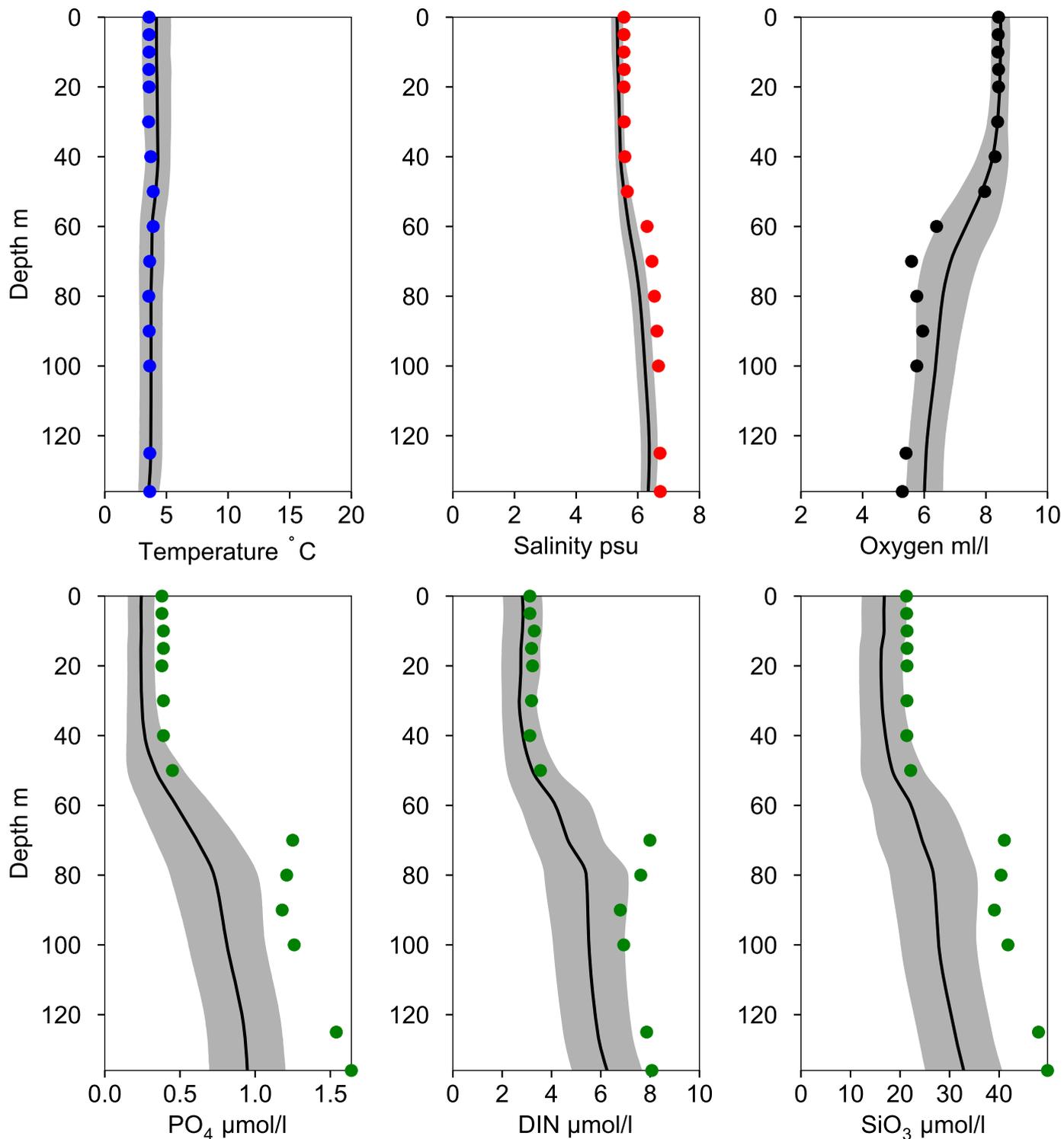
— Mean 1991-2020 ■ St.Dev. ● 2023-12-07



Vertical profiles F26 / C15 December

Statistics based on data from: Bottenhavet

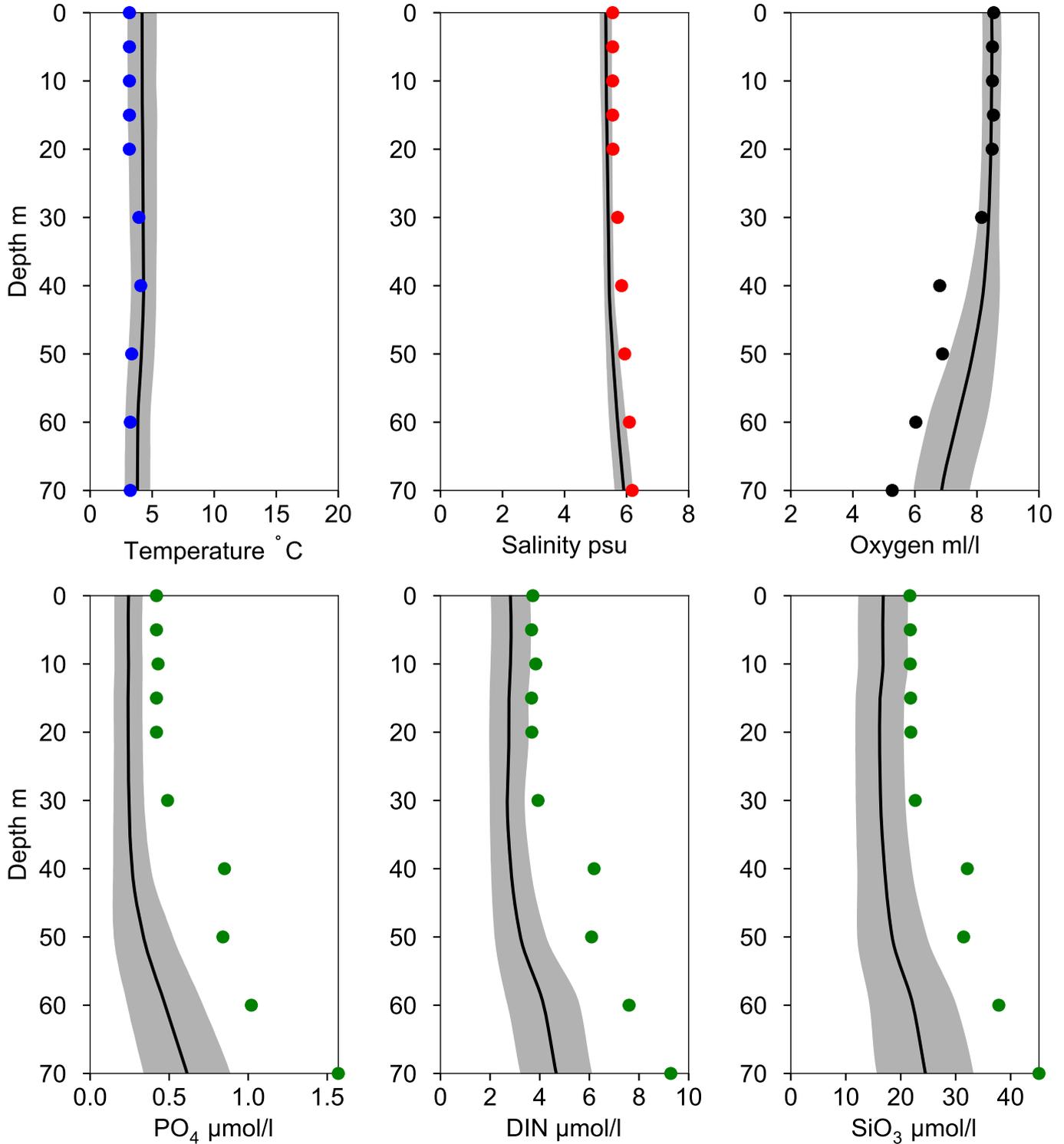
— Mean 1991-2020 ■ St.Dev. ● 2023-12-07



Vertical profiles MS6 December

Statistics based on data from: Bottenhavet

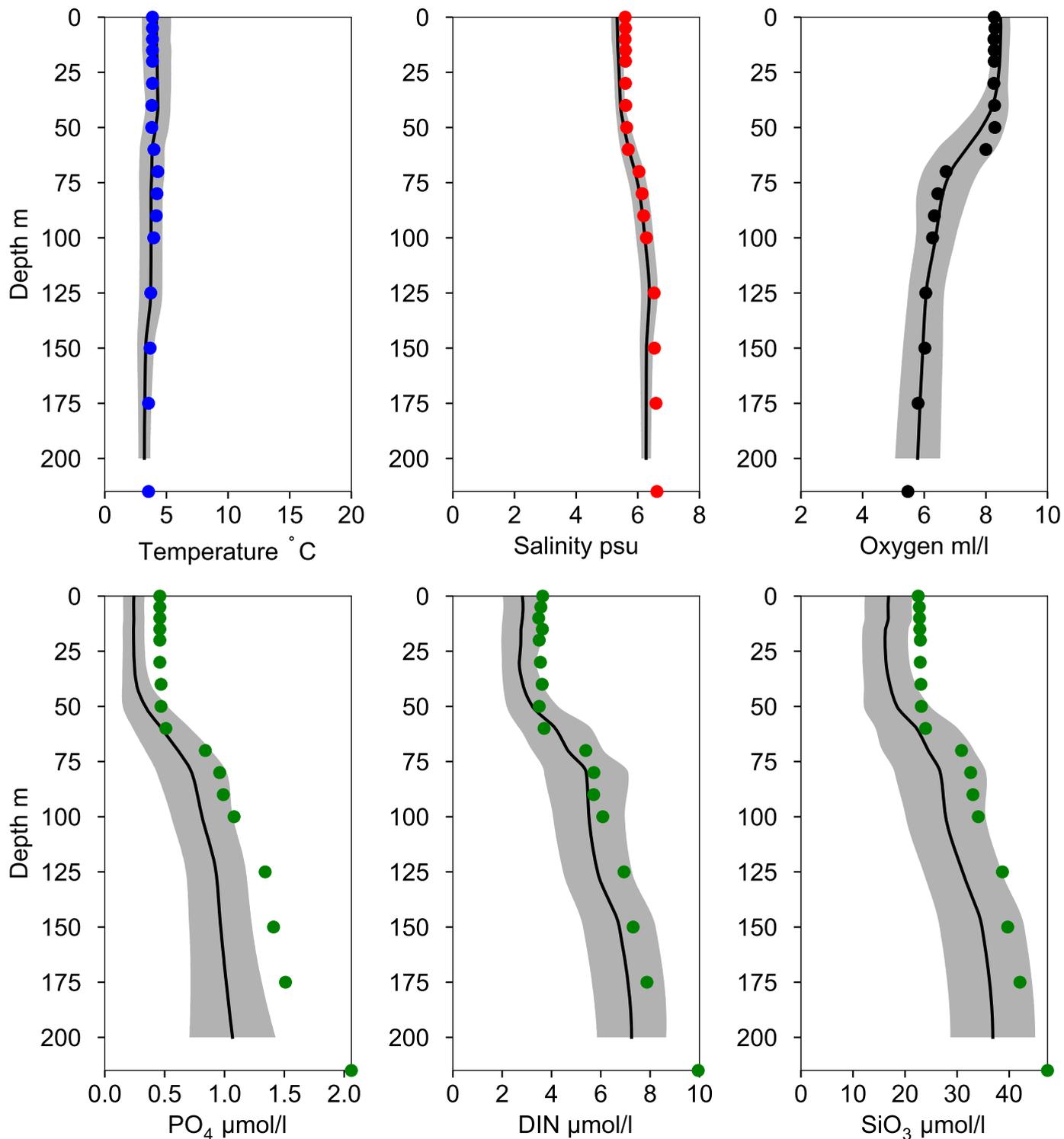
— Mean 1991-2020 St.Dev. ● 2023-12-08



Vertical profiles US5B / C1 December

Statistics based on data from: Bottenhavet

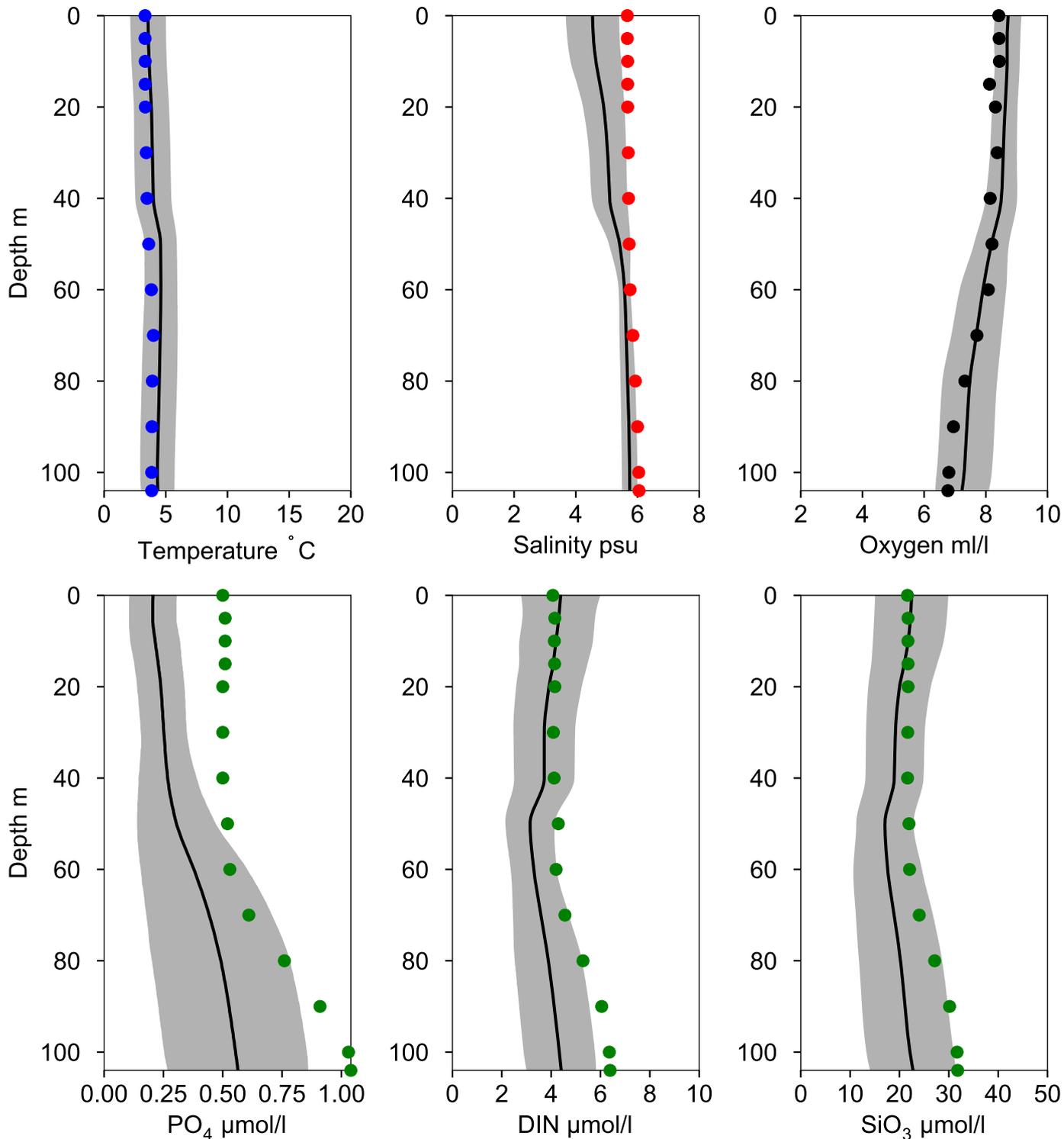
— Mean 1991-2020 ■ St.Dev. ● 2023-12-08



Vertical profiles F18 SYDOSTBROTEN December

Statistics based on data from: Norra Kvarken

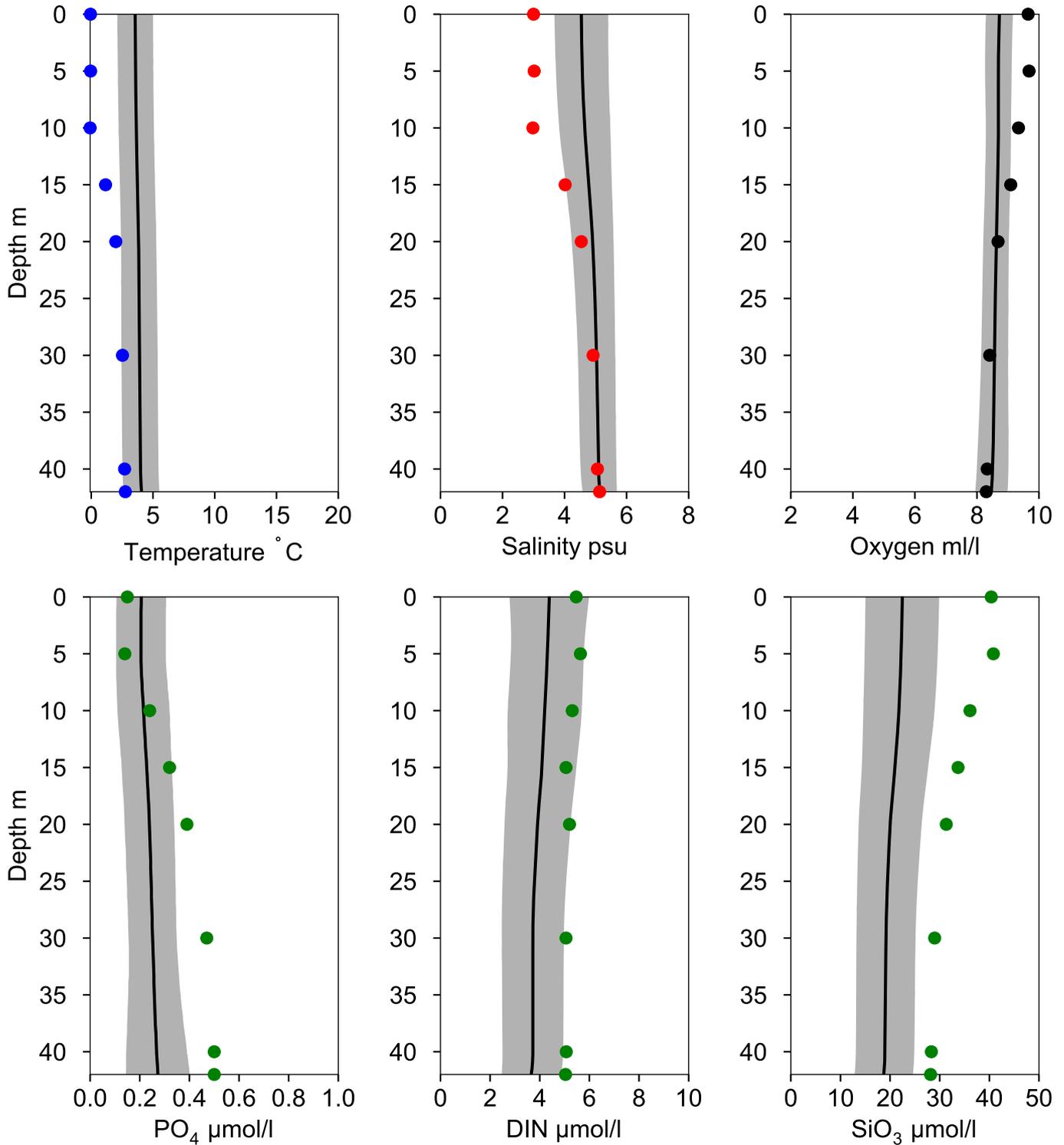
— Mean 1991-2020 ■ St.Dev. ● 2023-12-08



Vertical profiles F16 December

Statistics based on data from: Norra Kvarken

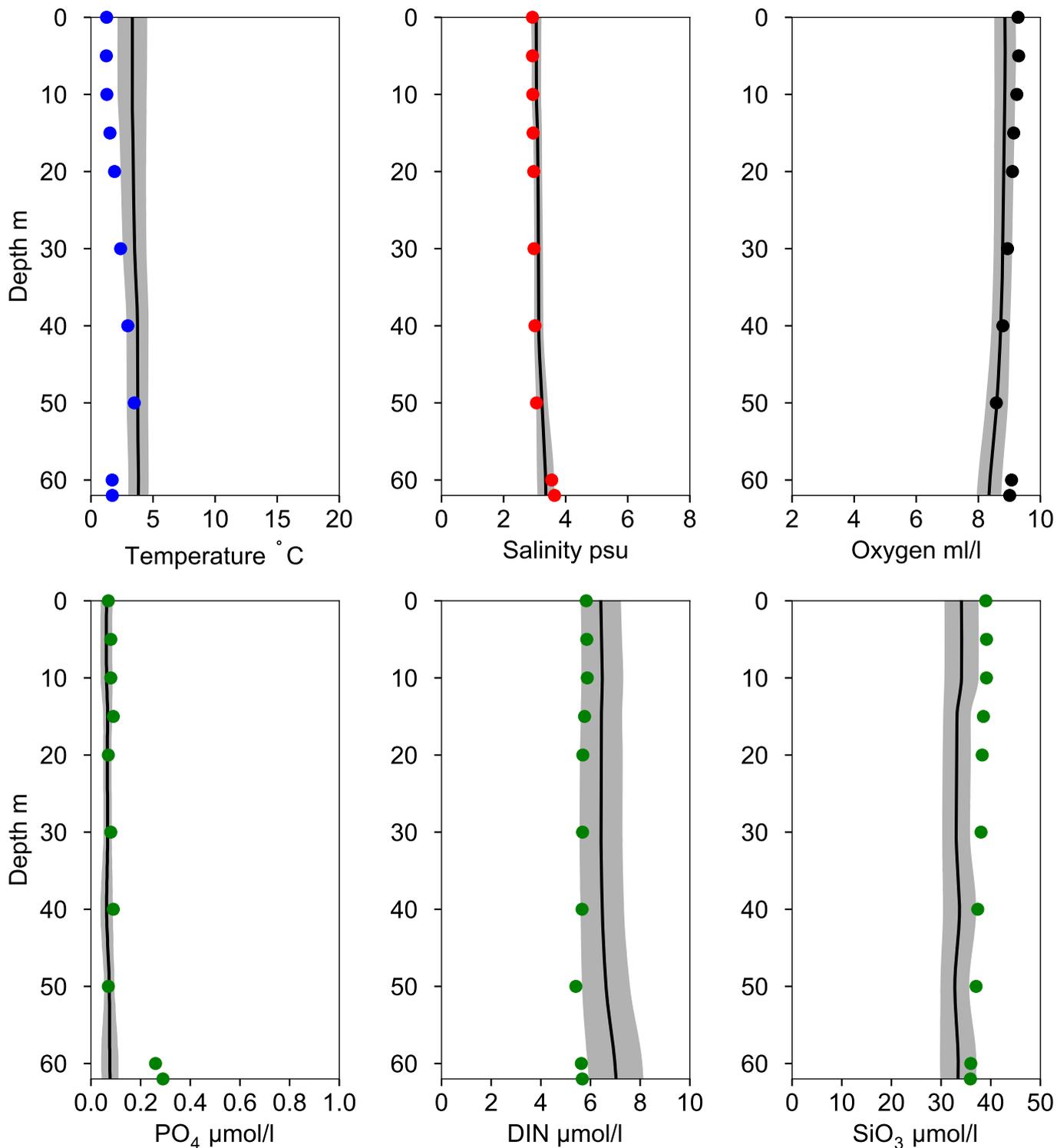
— Mean 1991-2020 ■ St.Dev. ● 2023-12-08



Vertical profiles F13/A19 December

Statistics based on data from: Bottenviken

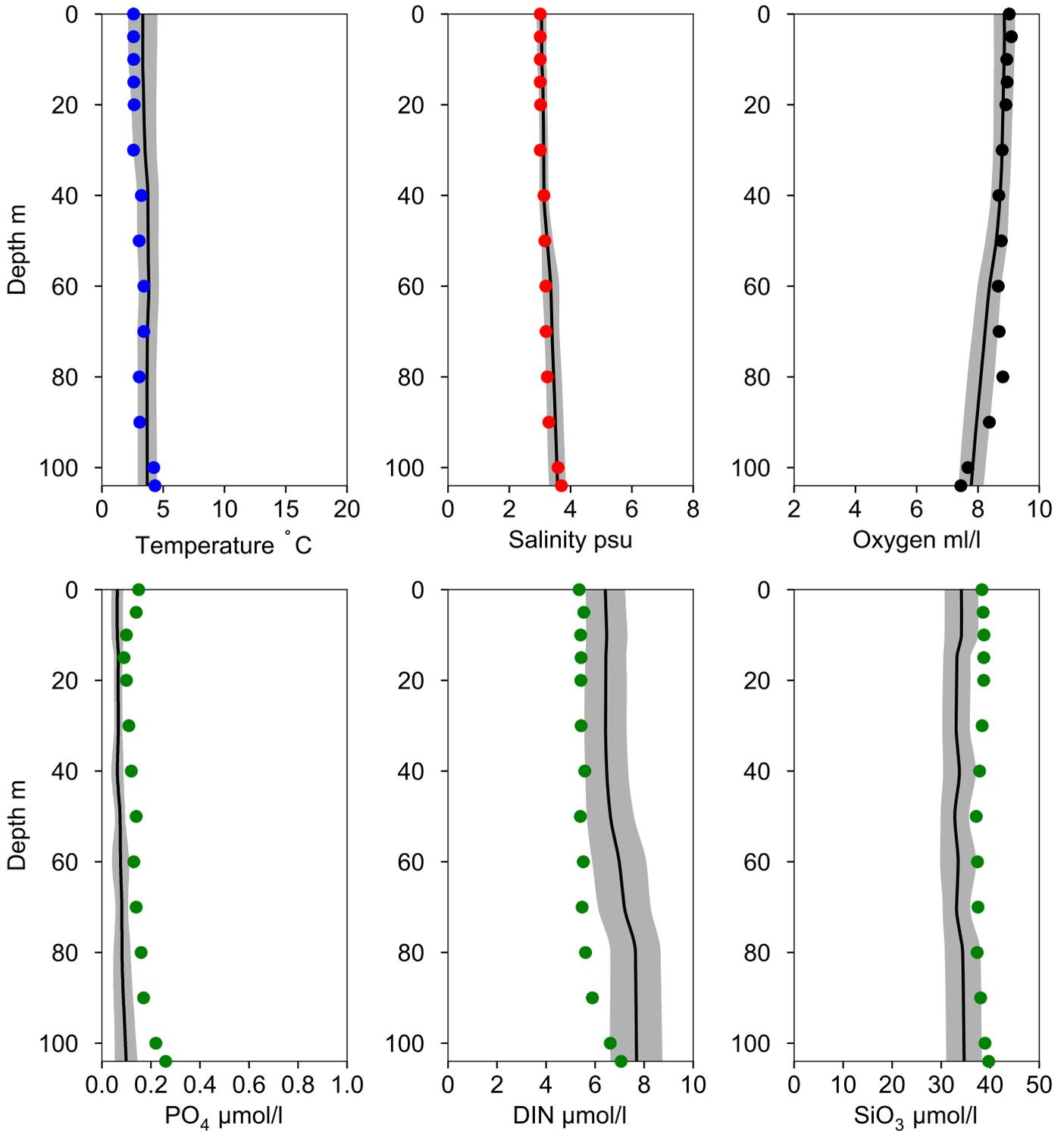
— Mean 1991-2020 ■ St.Dev. ● 2023-12-08



Vertical profiles BO3 / A3 December

Statistics based on data from: Bottenviken

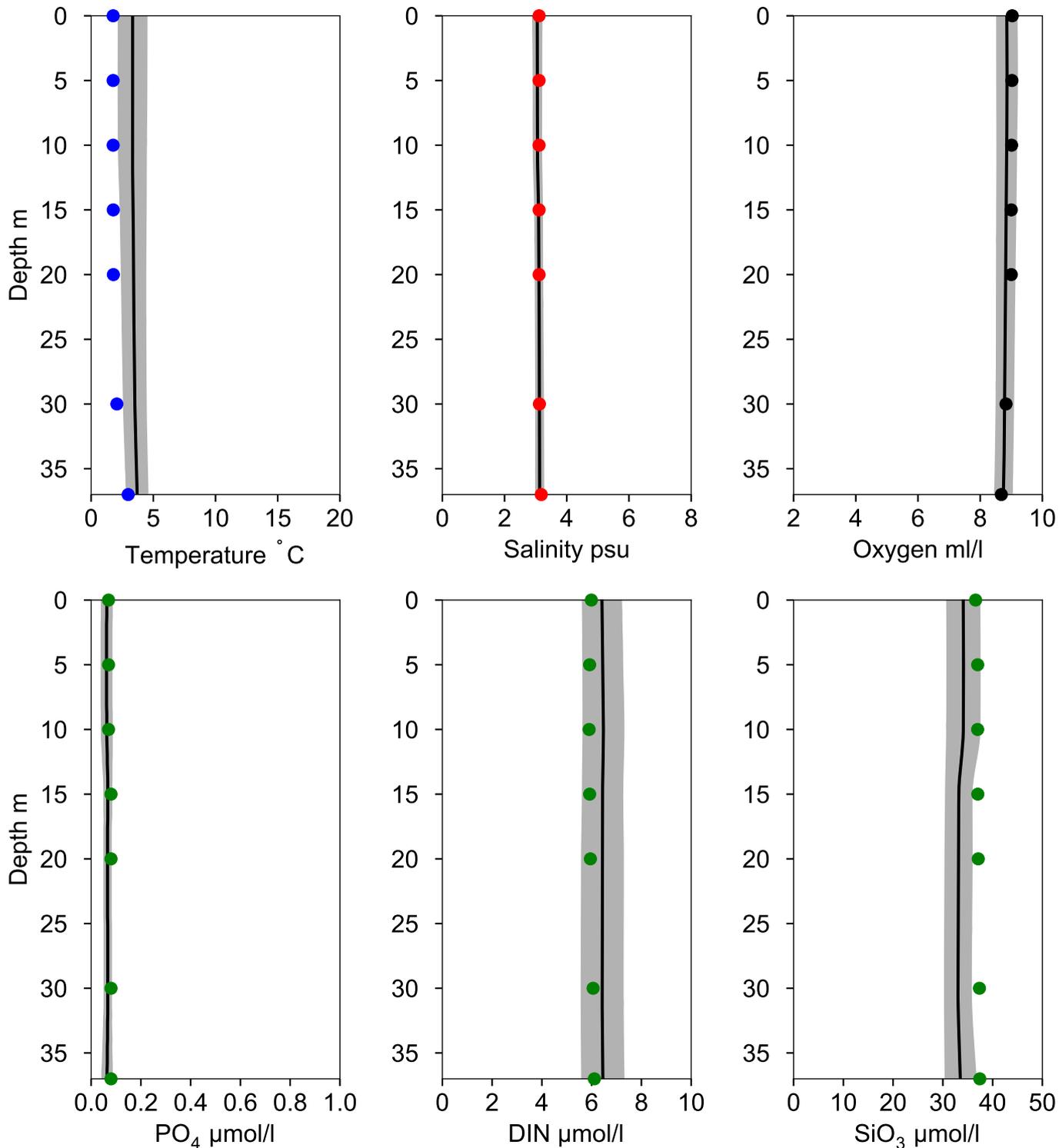
— Mean 1991-2020 ■ St.Dev. ● 2023-12-08



Vertical profiles RR7 December

Statistics based on data from: Bottenviken

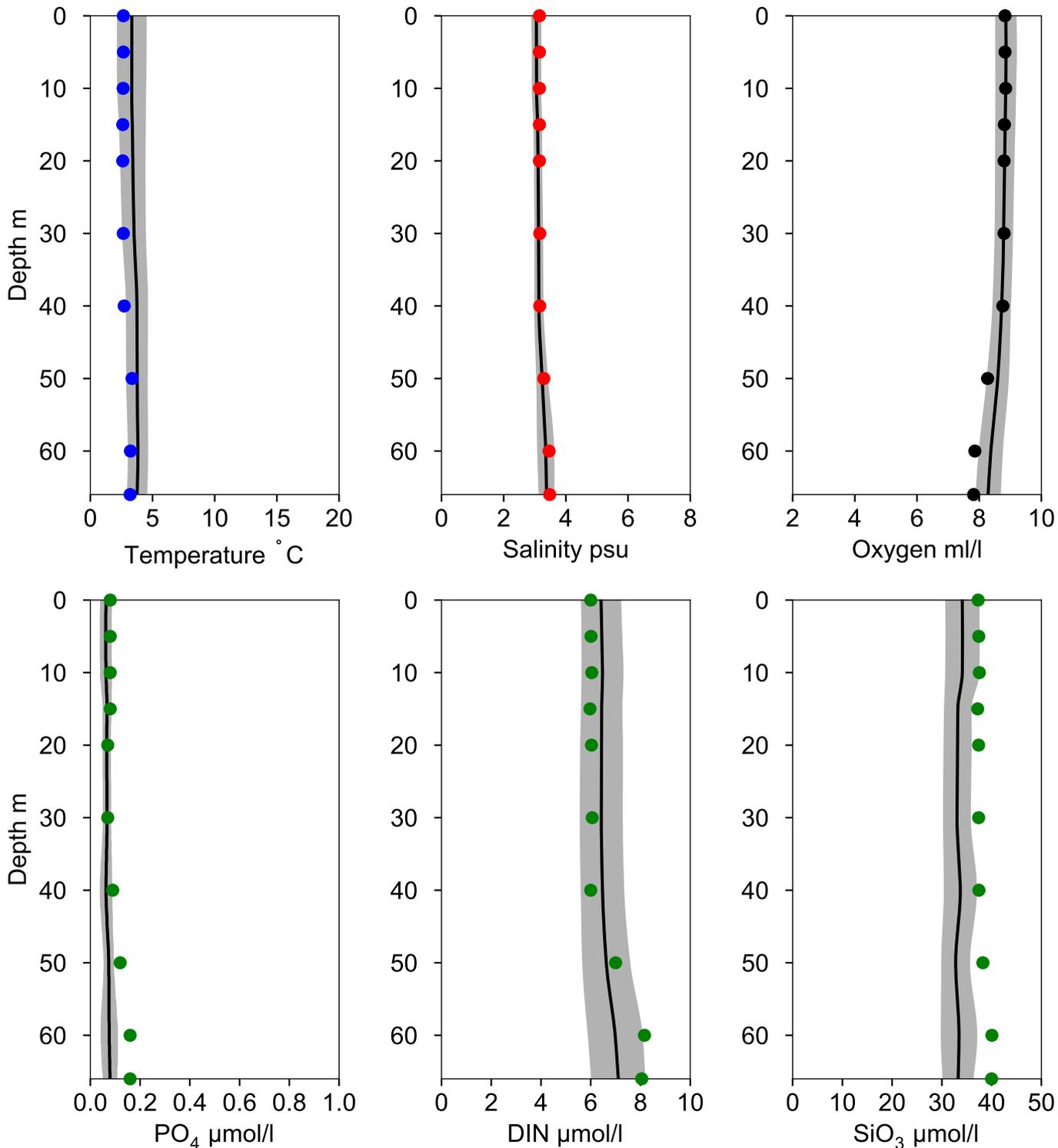
— Mean 1991-2020 ■ St.Dev. ● 2023-12-09



Vertical profiles RR5 December

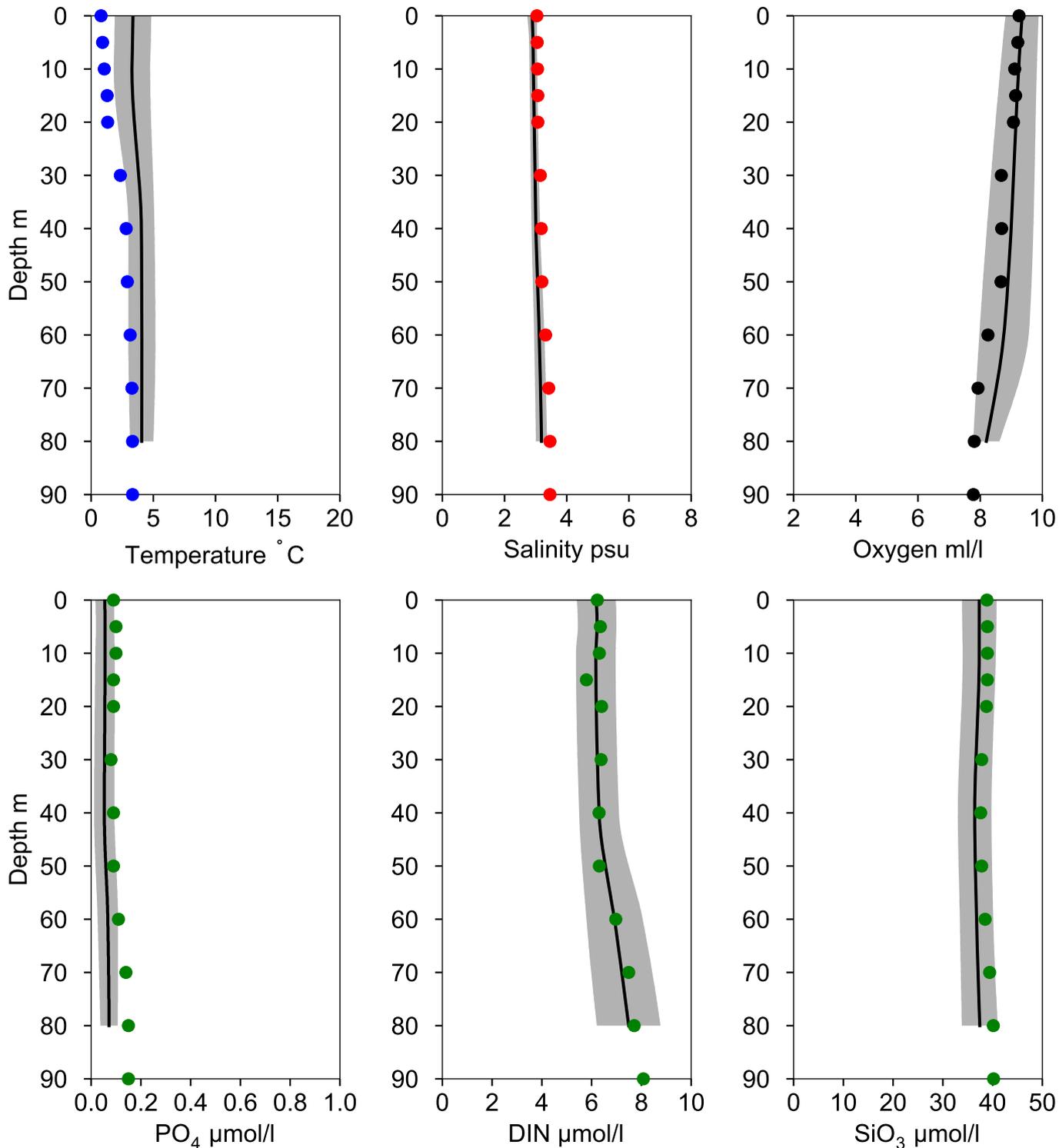
Statistics based on data from: Bottenviken

— Mean 1991-2020 ■ St.Dev. ● 2023-12-09



Vertical profiles F3 / A5 December

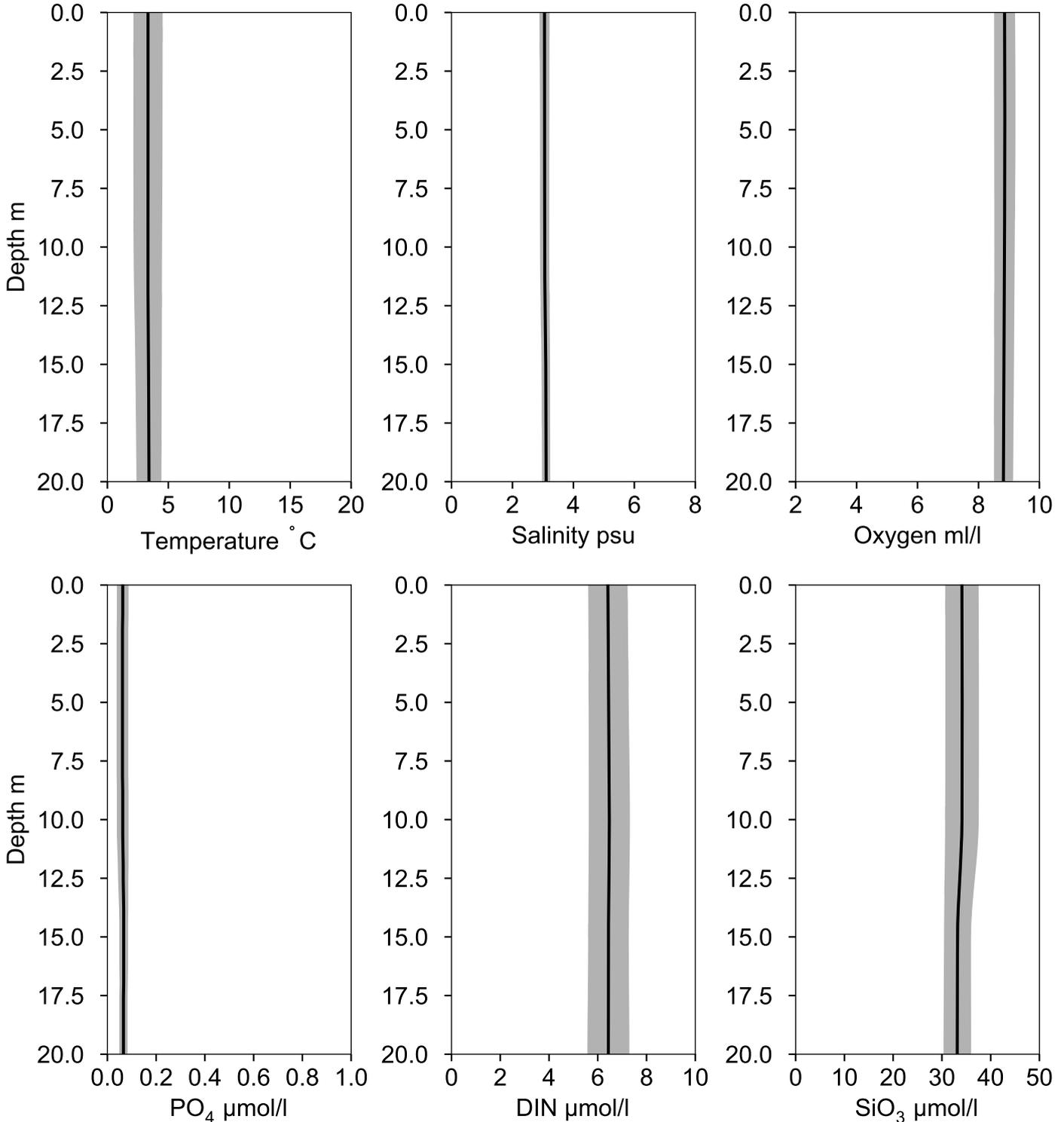
— Mean 1991-2020 ■ St.Dev. ● 2023-12-09



Vertical profiles FALKENS GRUND December

Statistics based on data from: Bottenviken

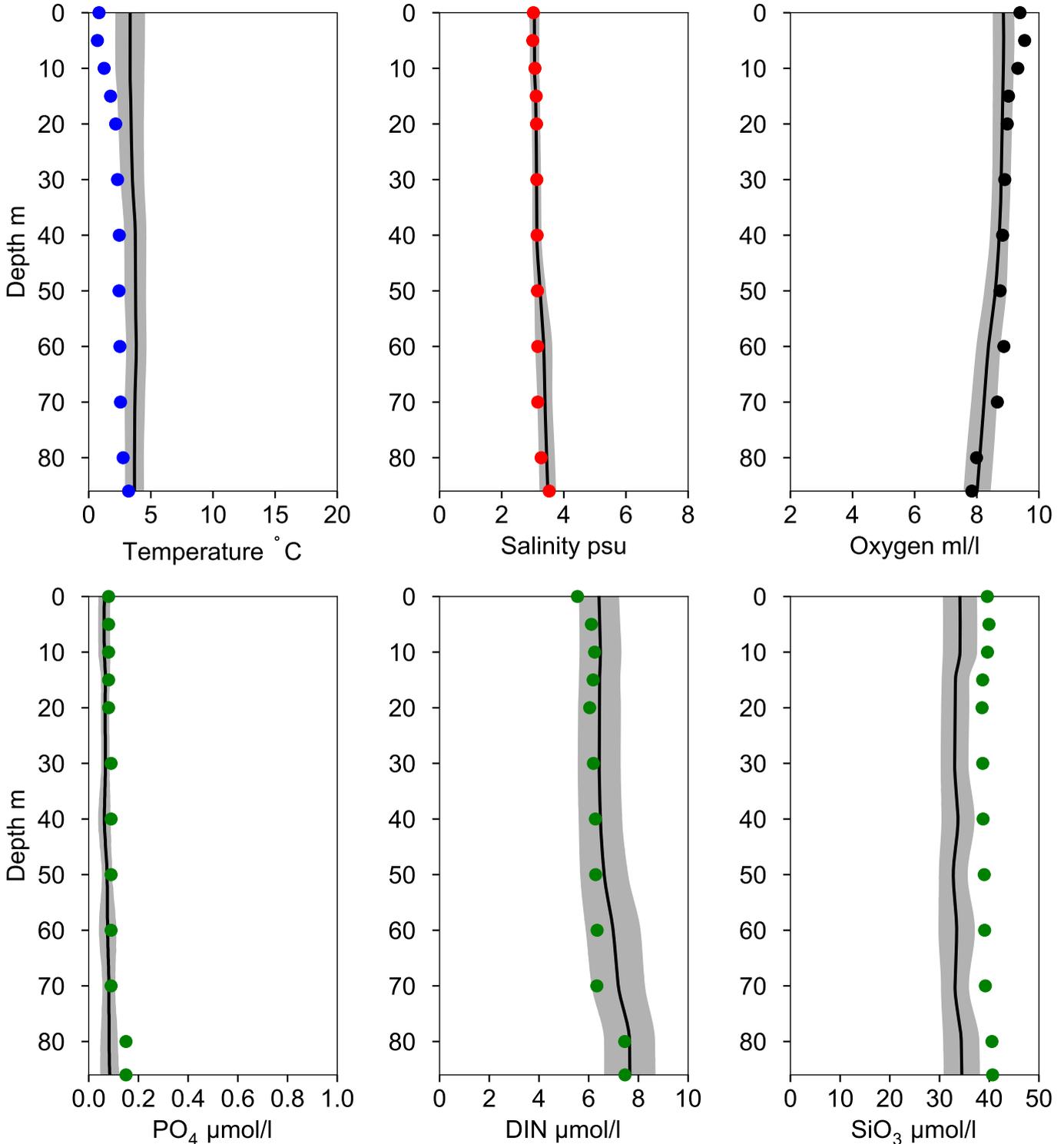
— Mean 1991-2020 ■ St.Dev. ● 2023-12-09



Vertical profiles RR1/A8 December

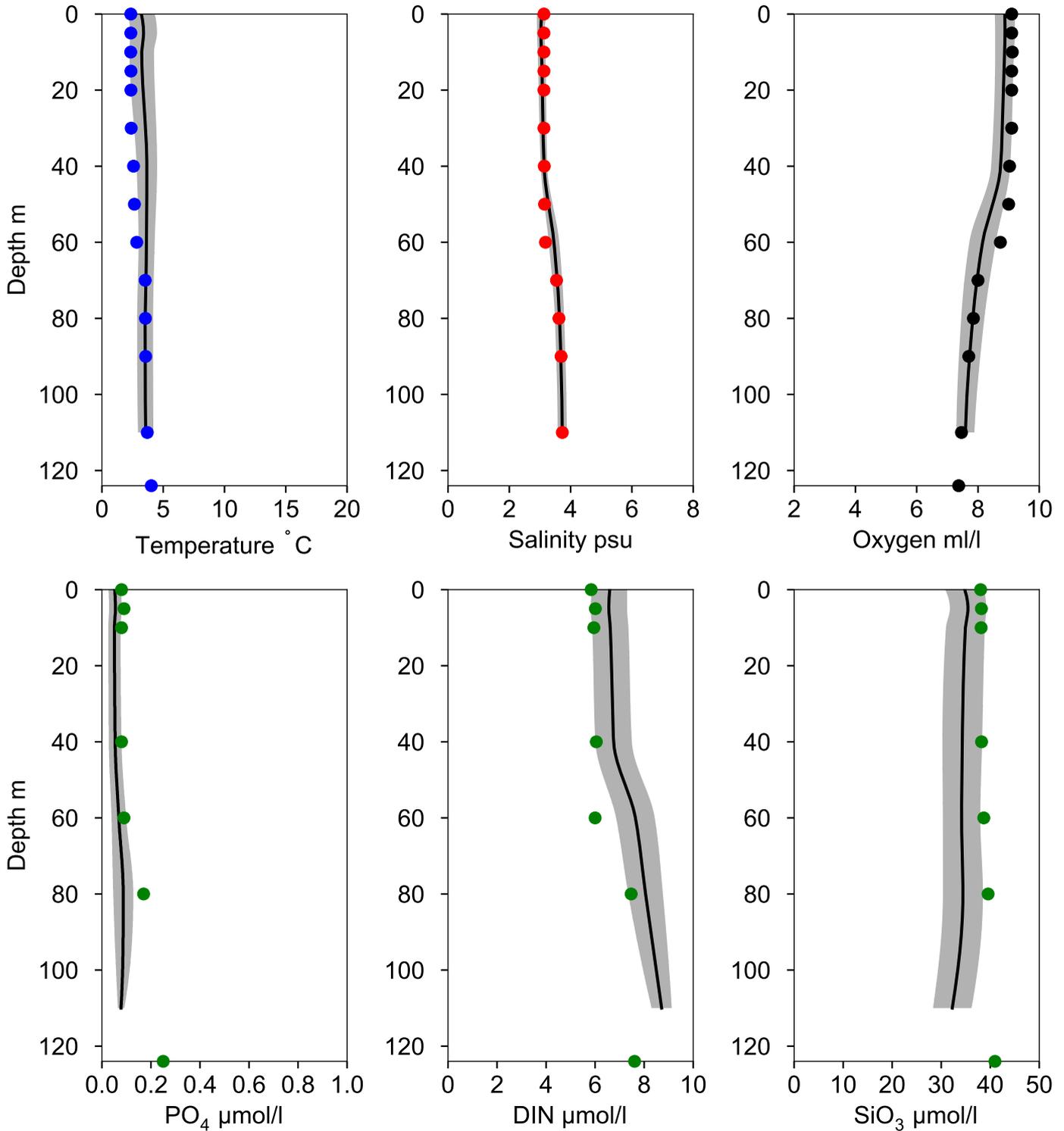
Statistics based on data from: Bottenviken

— Mean 1991-2020 ■ St.Dev. ● 2023-12-09



Vertical profiles F9 / A13 December

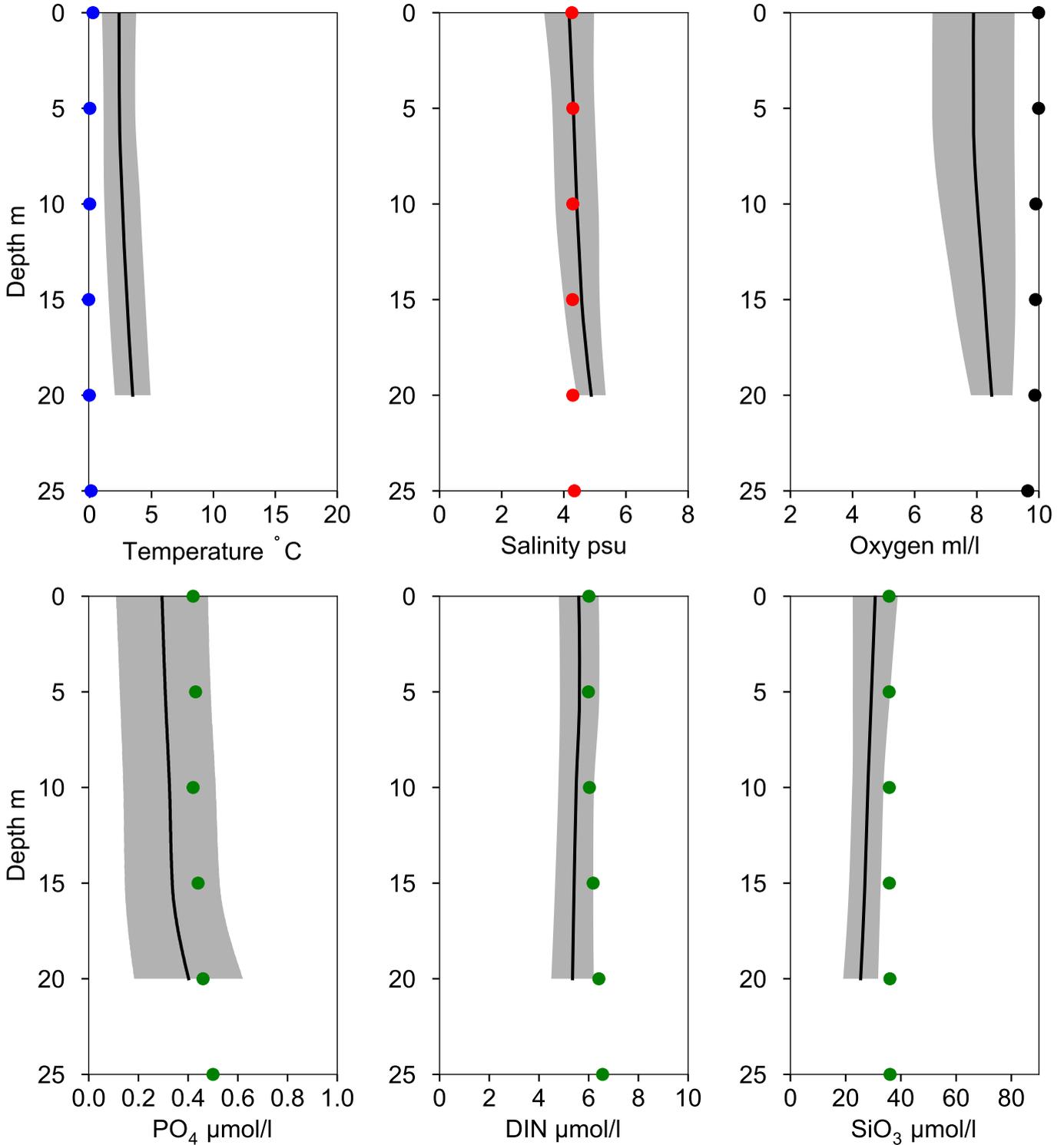
— Mean 1991-2020 ■ St.Dev. ● 2023-12-09



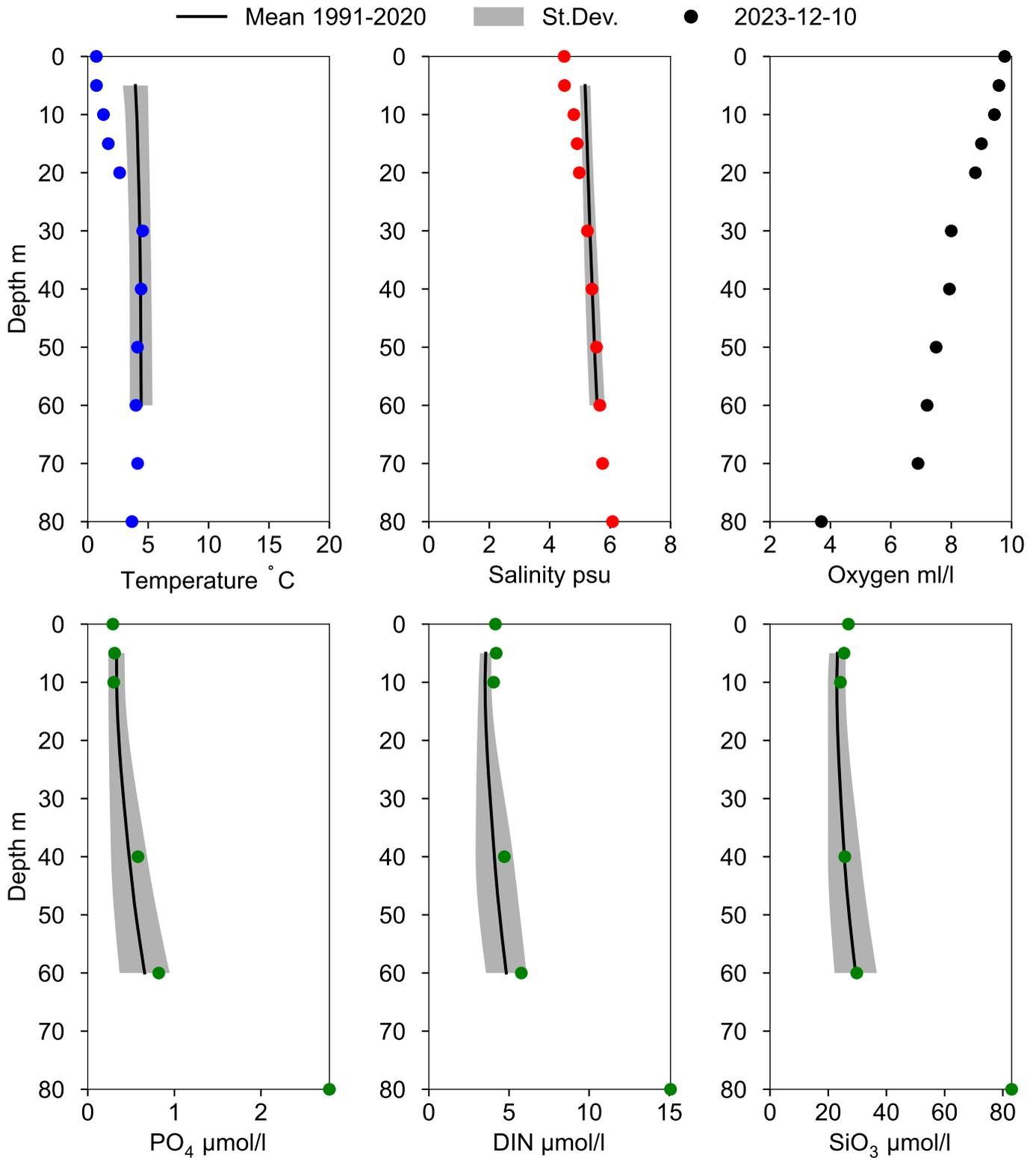
Vertical profiles NB1 / B3 December

Statistics based on data from: Norra Kvarkens inre kustvatten

— Mean 1991-2020 St.Dev. ● 2023-12-10

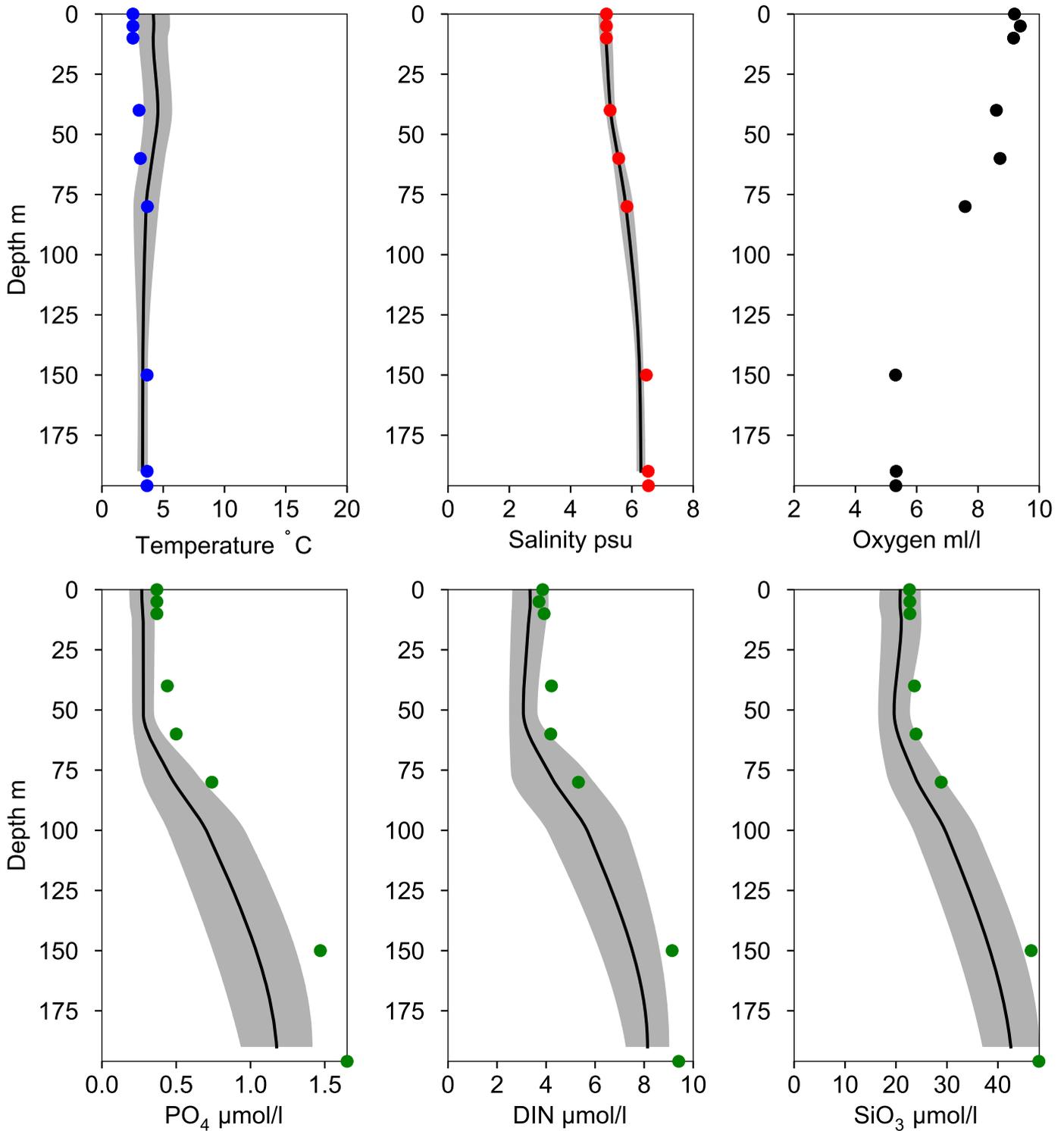


Vertical profiles GAVIK-1 December



Vertical profiles C3 December

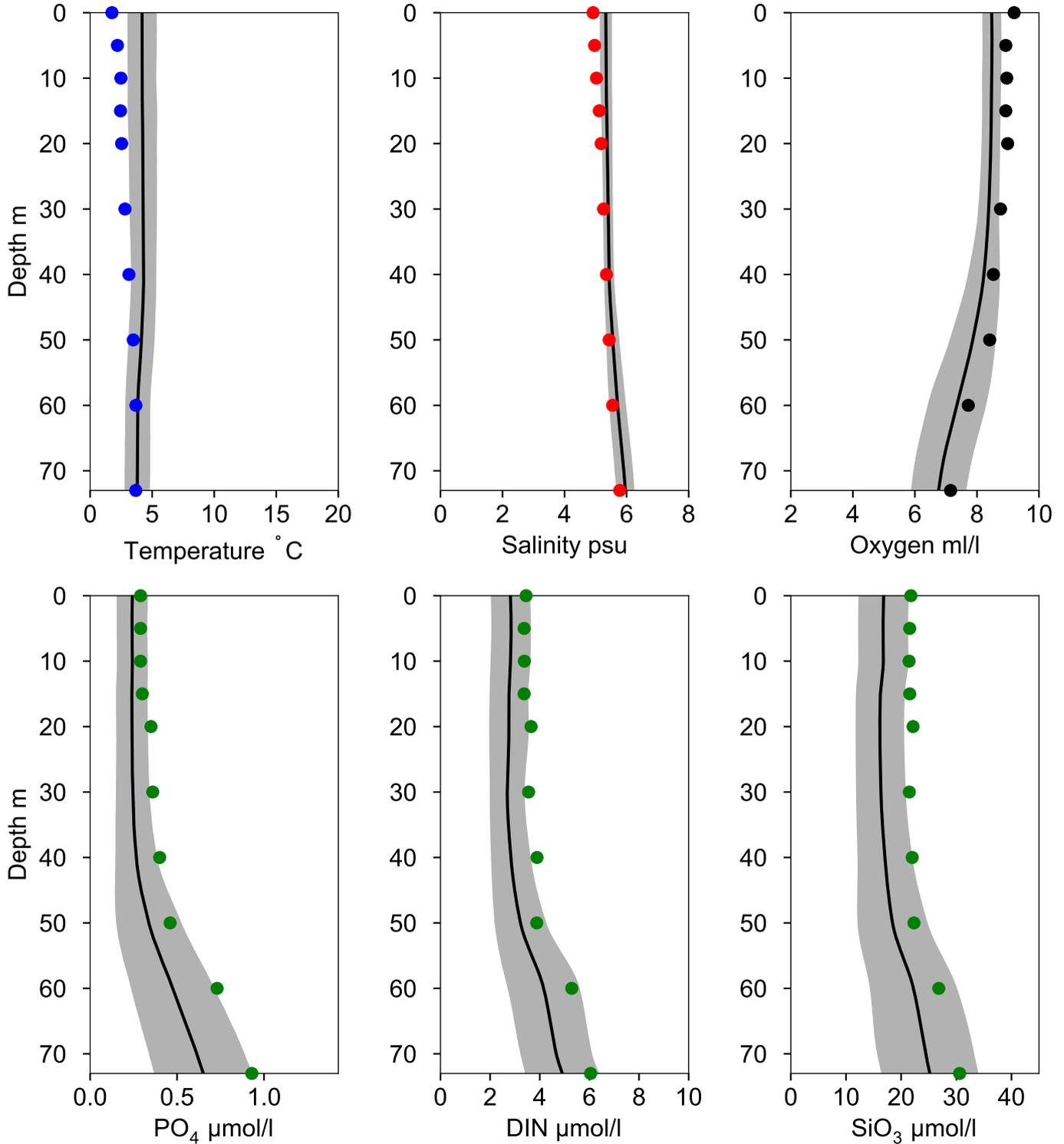
— Mean 1991-2020 ■ St.Dev. ● 2023-12-10



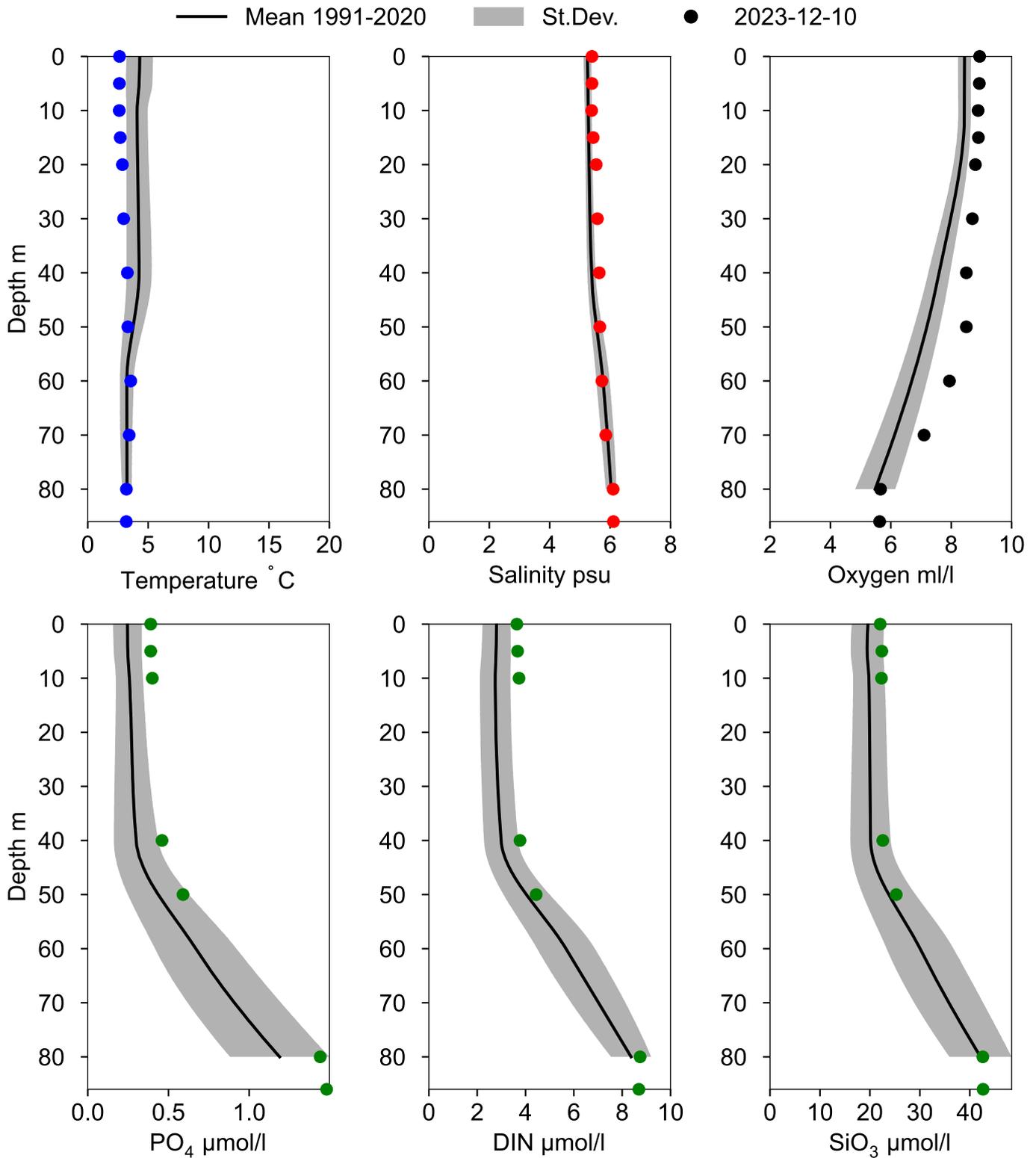
Vertical profiles MS2/C13 December

Statistics based on data from: Bottenhavet

— Mean 1991-2020 St.Dev. ● 2023-12-10



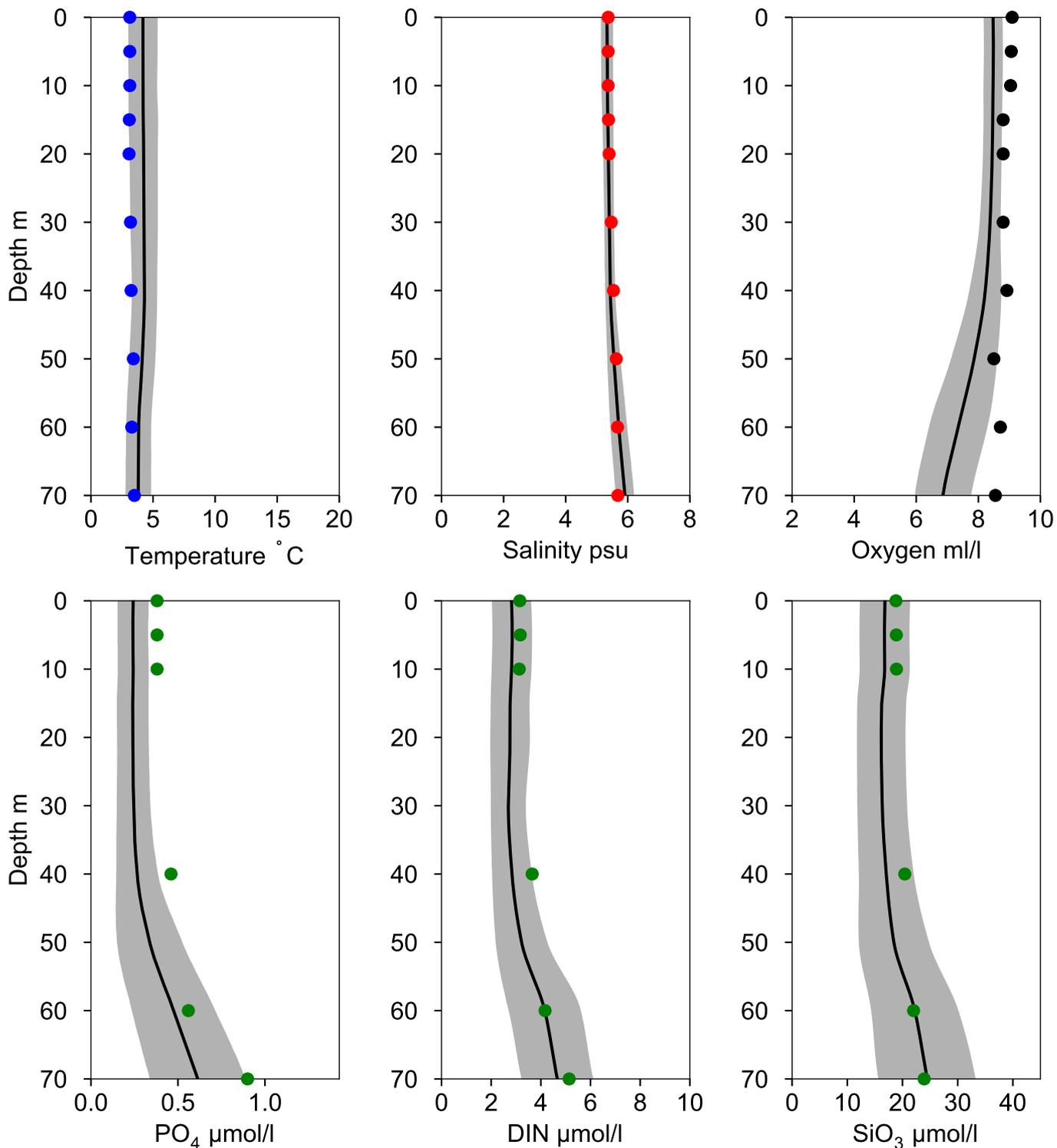
Vertical profiles MS4 / C14 December



Vertical profiles SR3/C24 December

Statistics based on data from: Bottenhavet

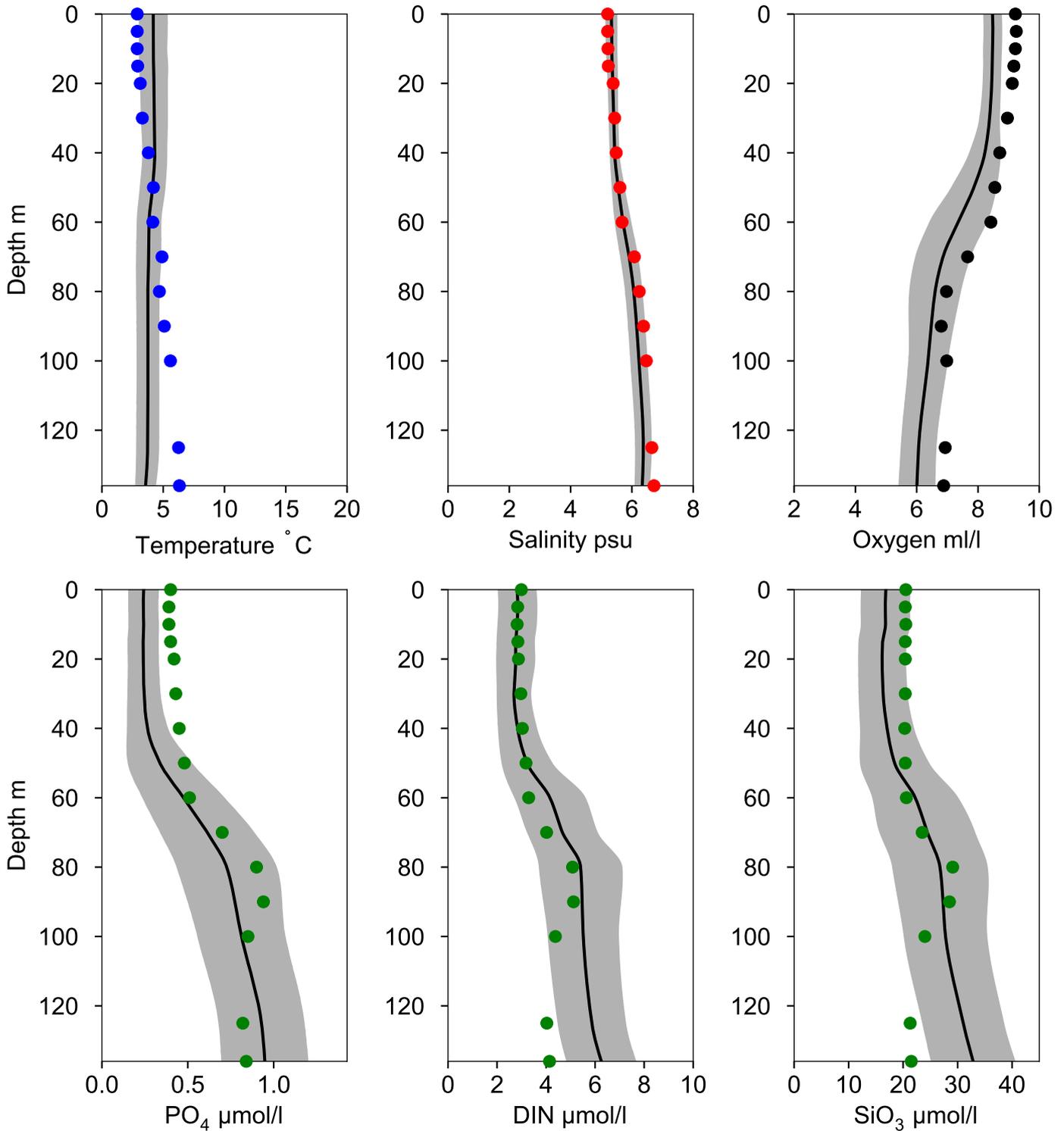
— Mean 1991-2020 ■ St.Dev. ● 2023-12-11



Vertical profiles F33 GRUNDKALLEN December

Statistics based on data from: Bottenhavet

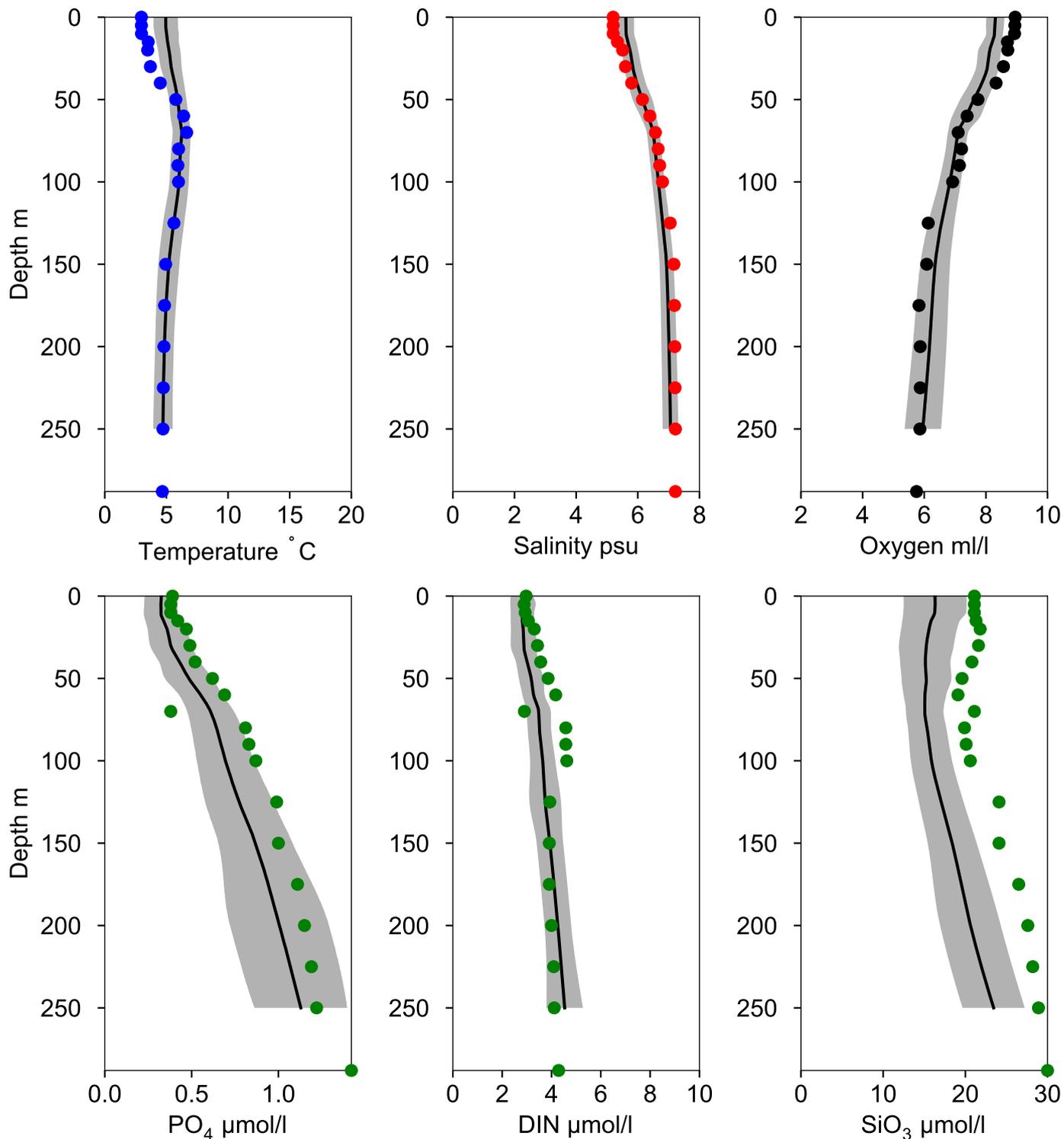
— Mean 1991-2020 ■ St.Dev. ● 2023-12-11



Vertical profiles F64 SOLOVJEVA December

Statistics based on data from: Ålands hav

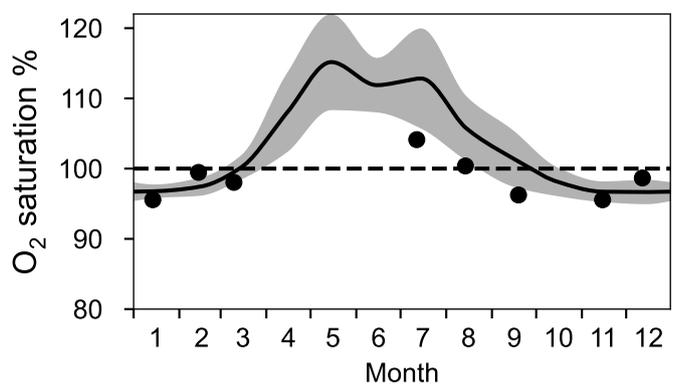
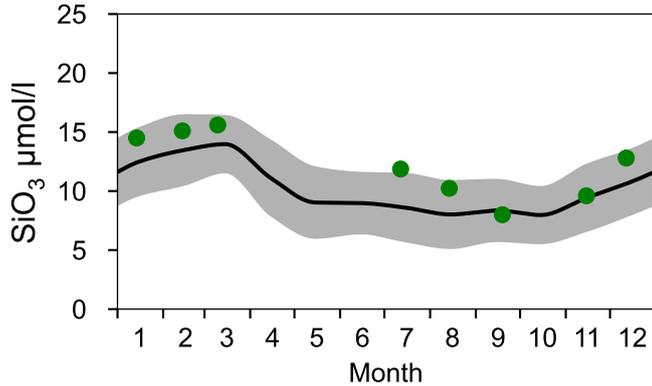
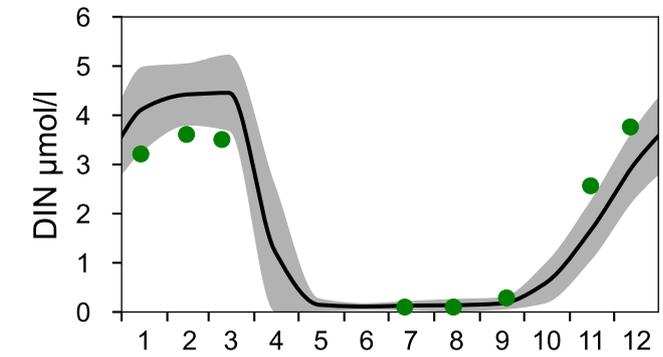
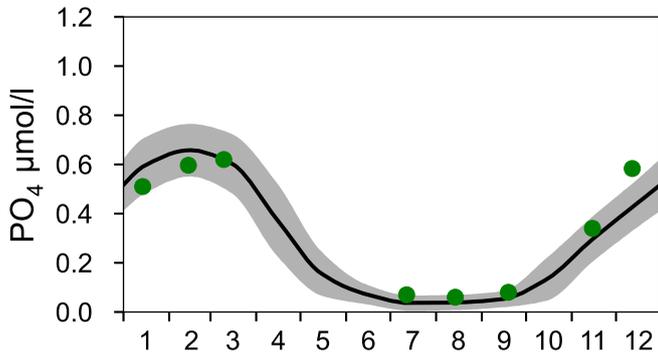
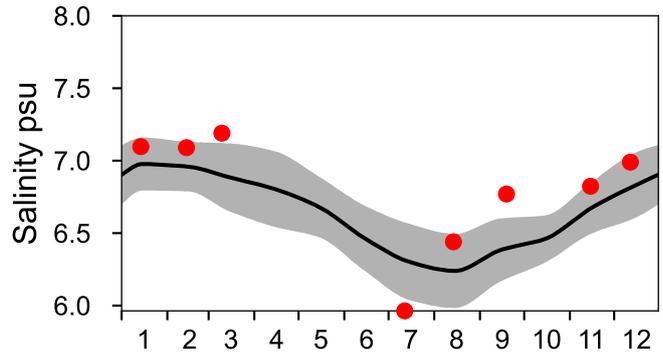
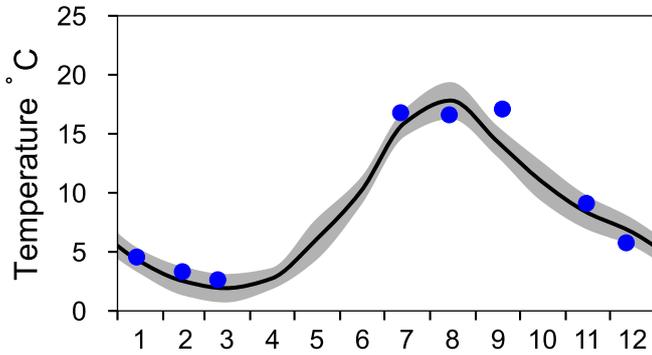
— Mean 1991-2020 ■ St.Dev. ● 2023-12-11



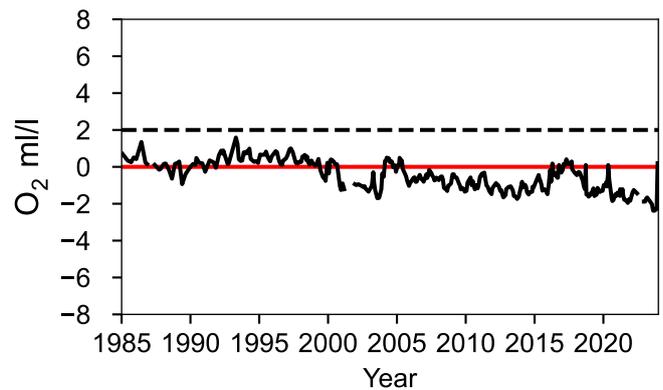
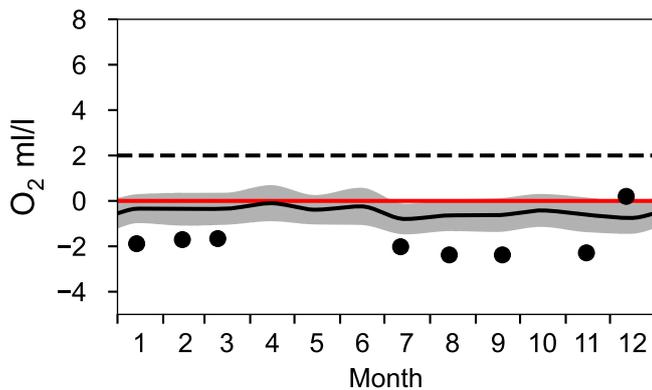
STATION BY29 / LL19 SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023

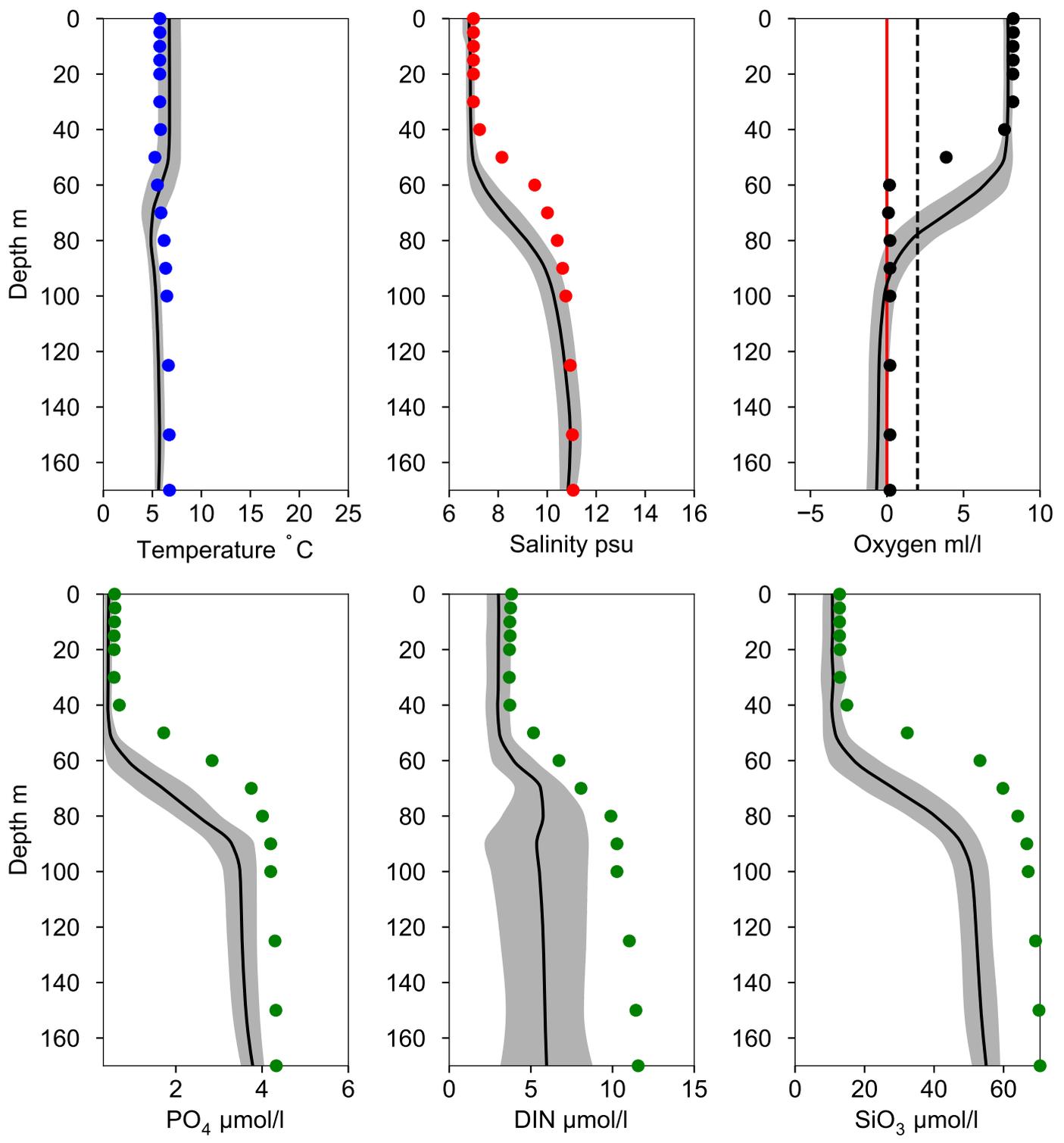


OXYGEN IN BOTTOM WATER (depth >= 150 m)



Vertical profiles BY29 / LL19 December

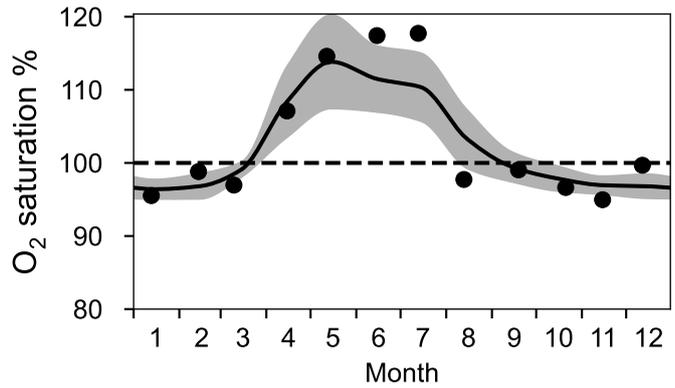
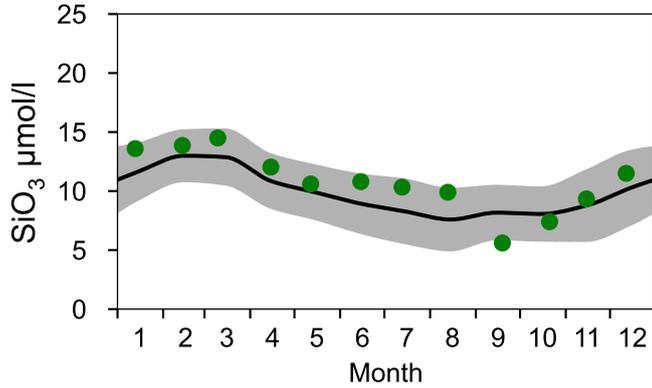
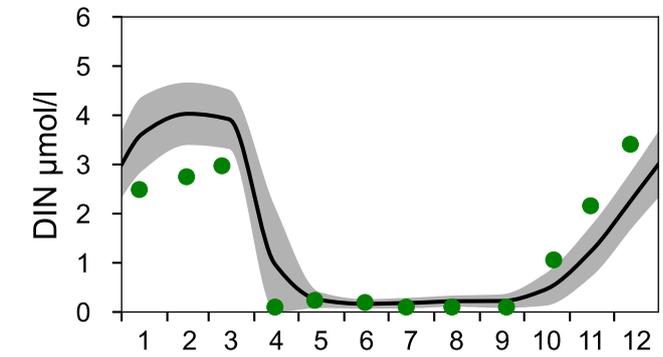
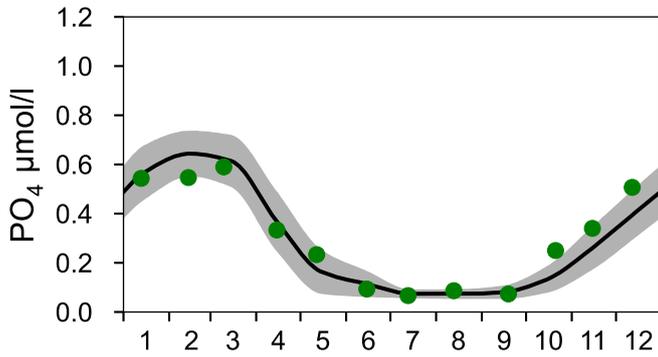
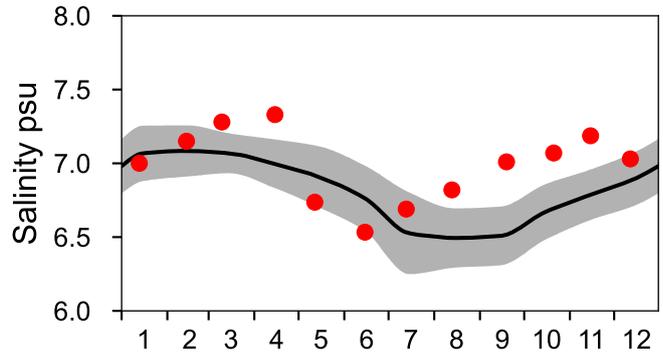
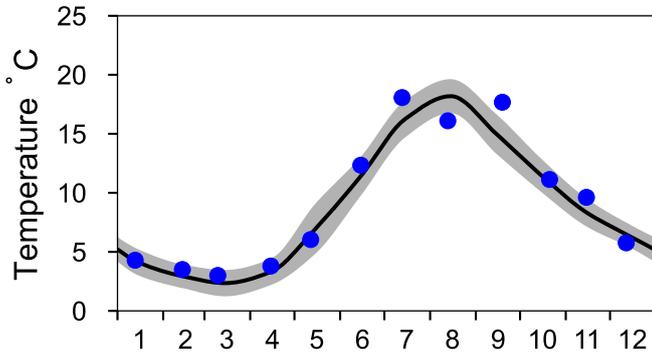
— Mean 1991-2020 St.Dev. ● 2023-12-12



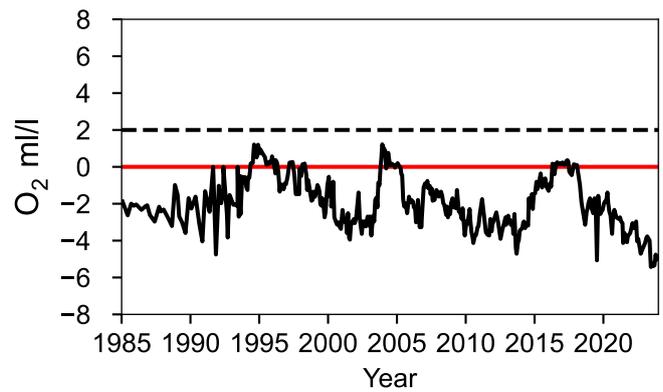
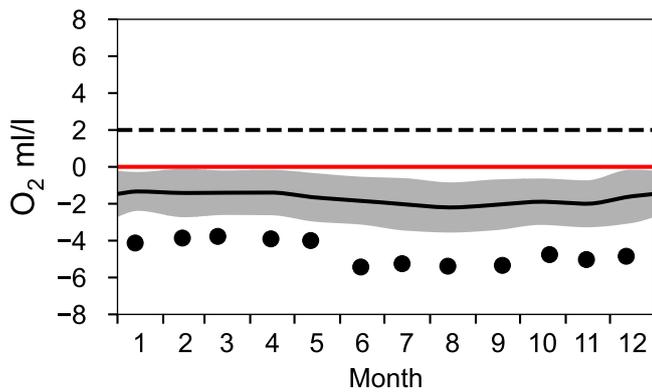
STATION BY20 FÄRÖDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023

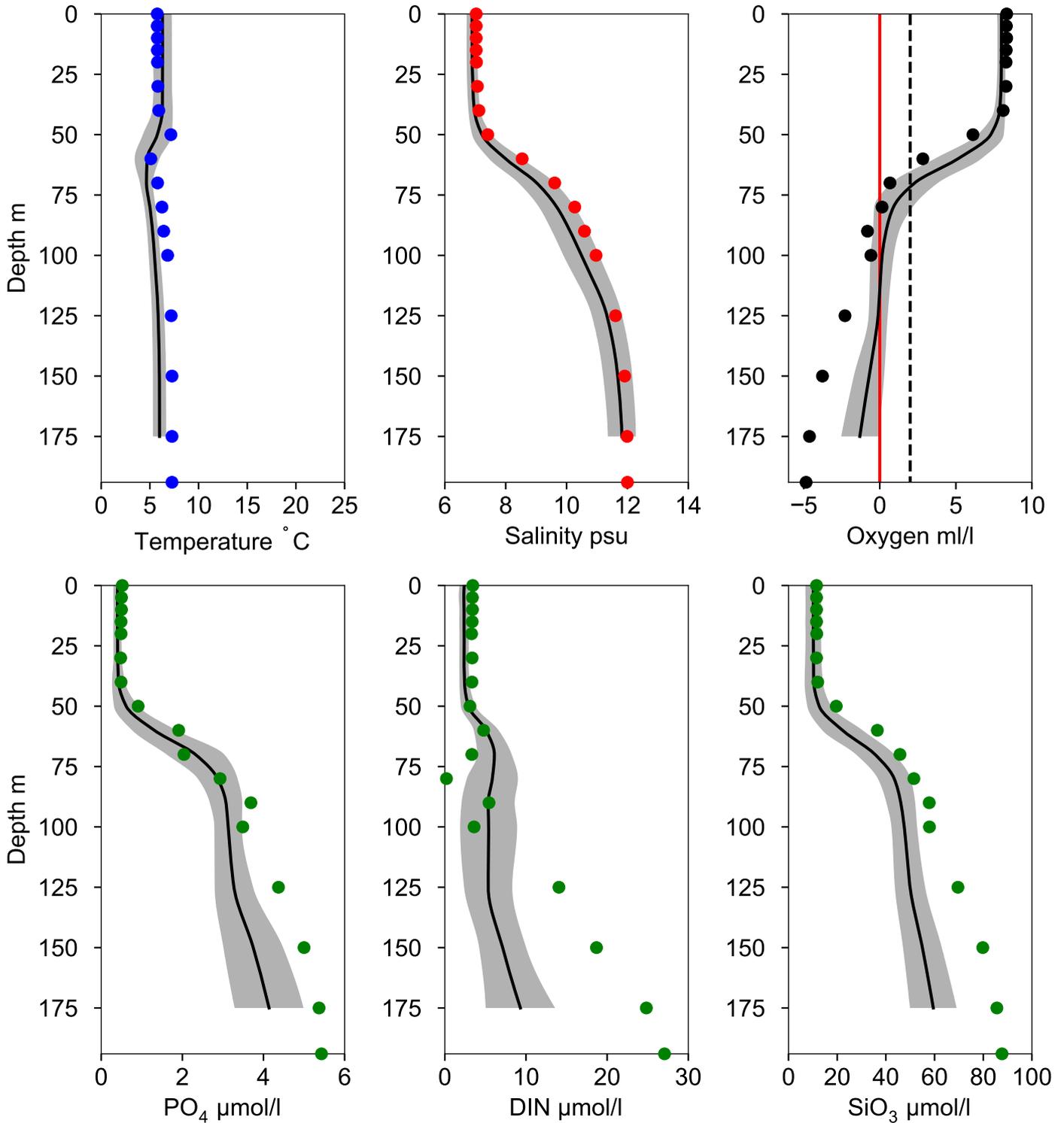


OXYGEN IN BOTTOM WATER (depth >= 175 m)



Vertical profiles BY20 FÅRÖDJ December

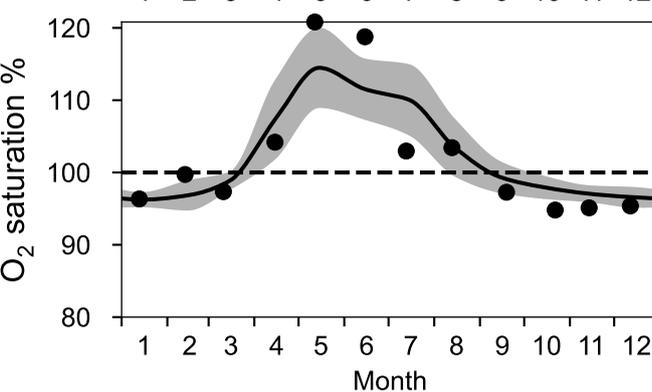
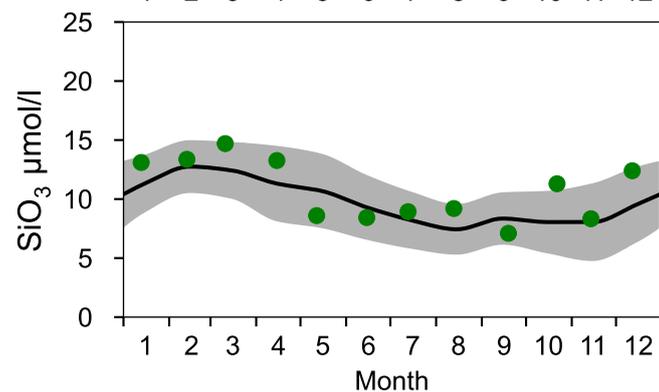
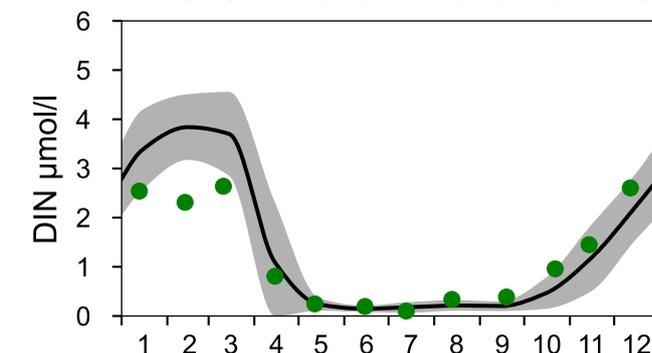
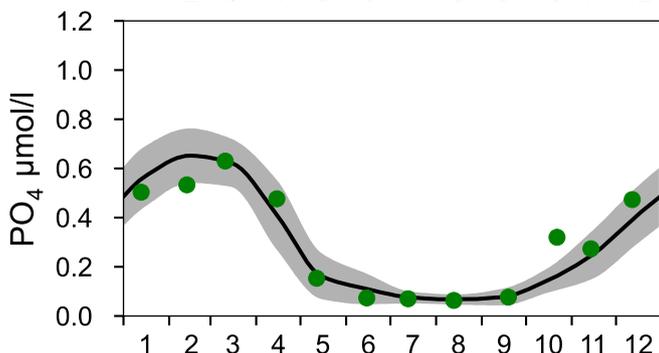
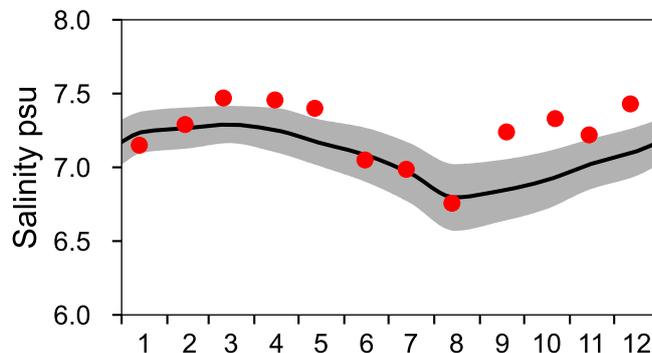
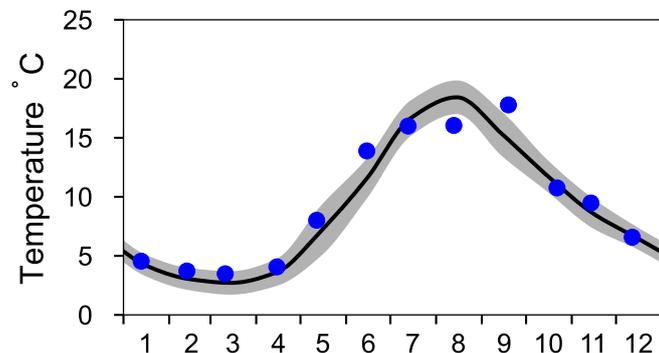
— Mean 1991-2020 St.Dev. ● 2023-12-12



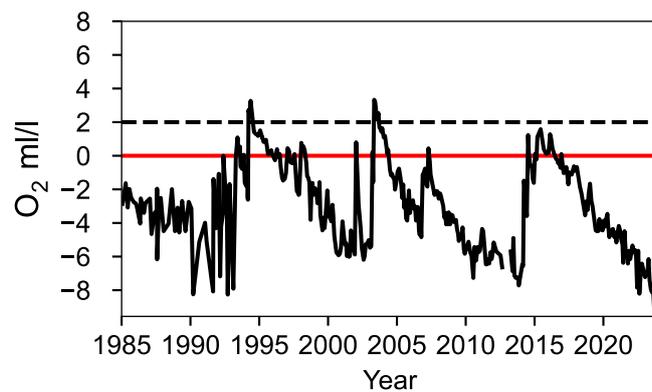
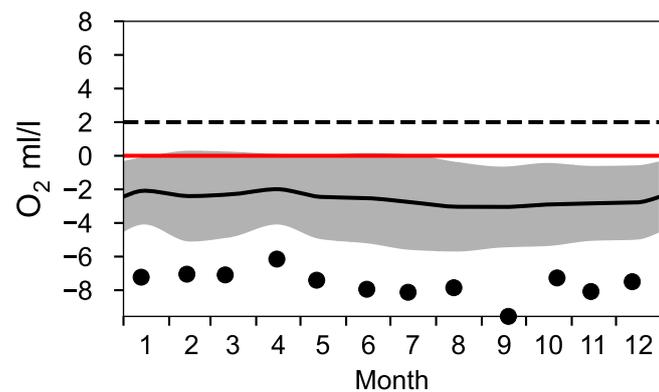
STATION BY15 GOTLANDSDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023

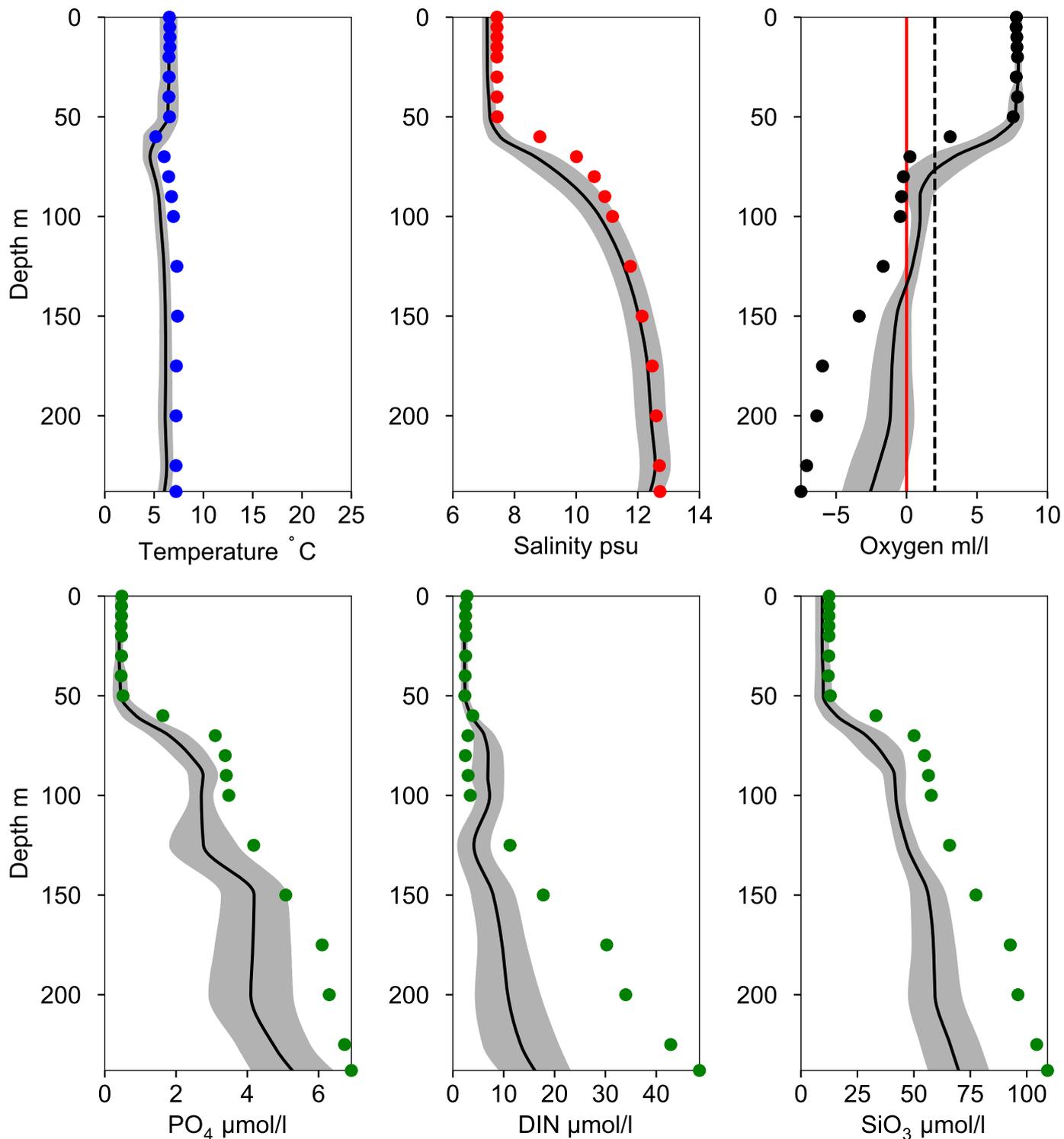


OXYGEN IN BOTTOM WATER (depth >= 225 m)



Vertical profiles BY15 GOTLANDSDJ December

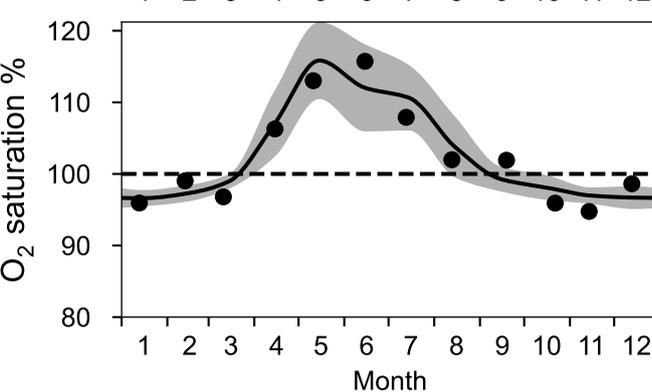
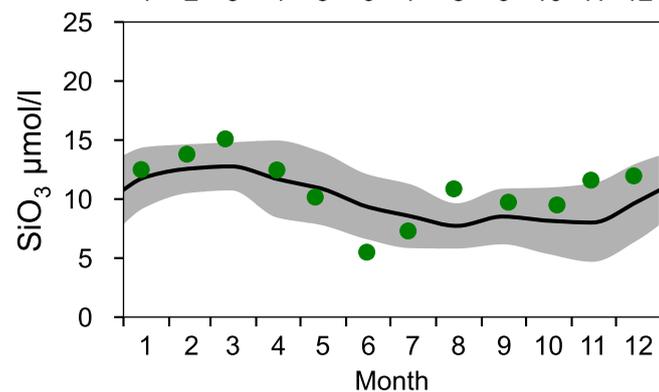
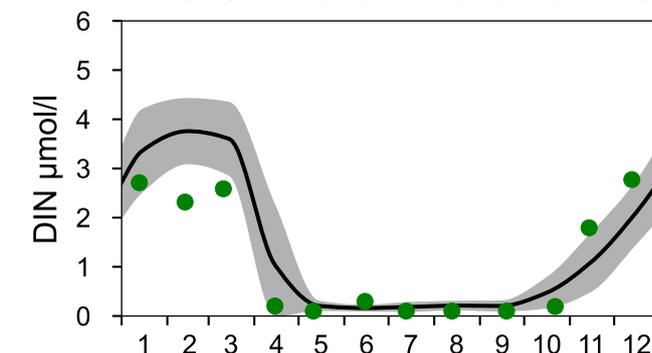
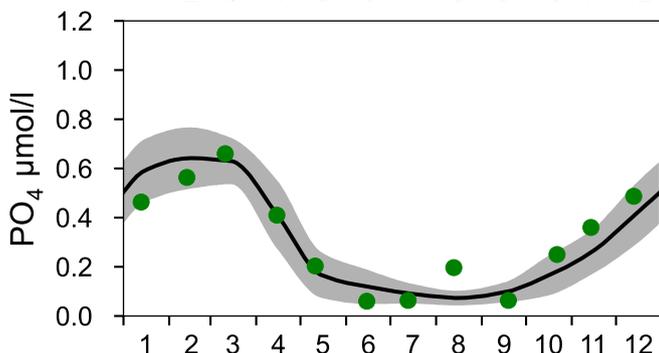
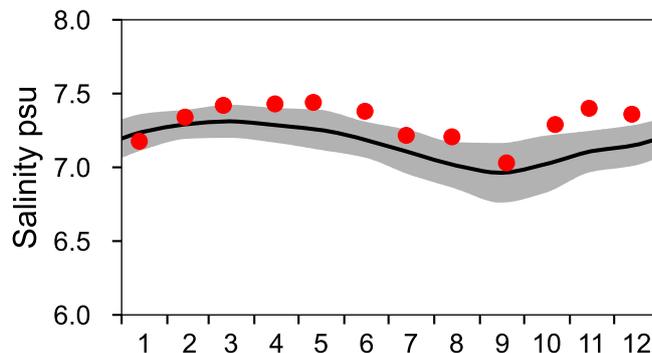
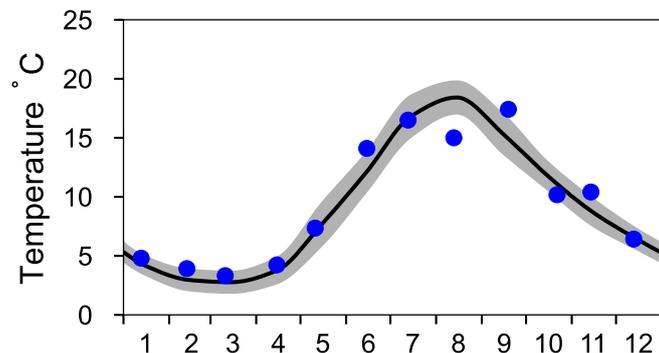
— Mean 1991-2020 ■ St.Dev. ● 2023-12-12



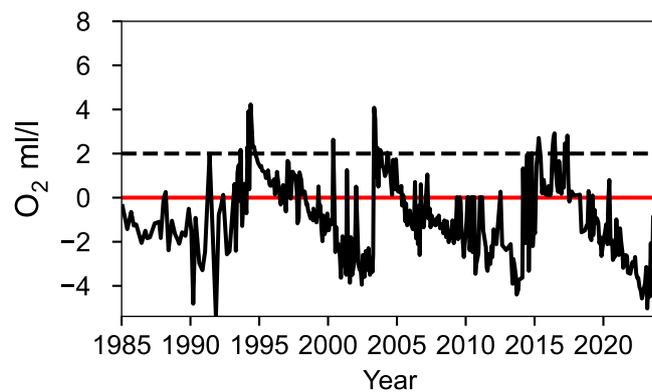
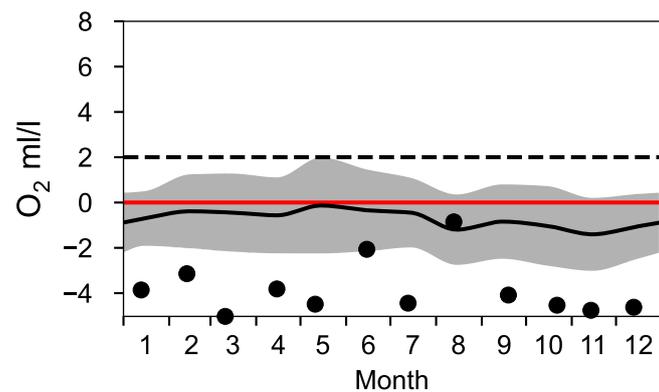
STATION BY10 SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023

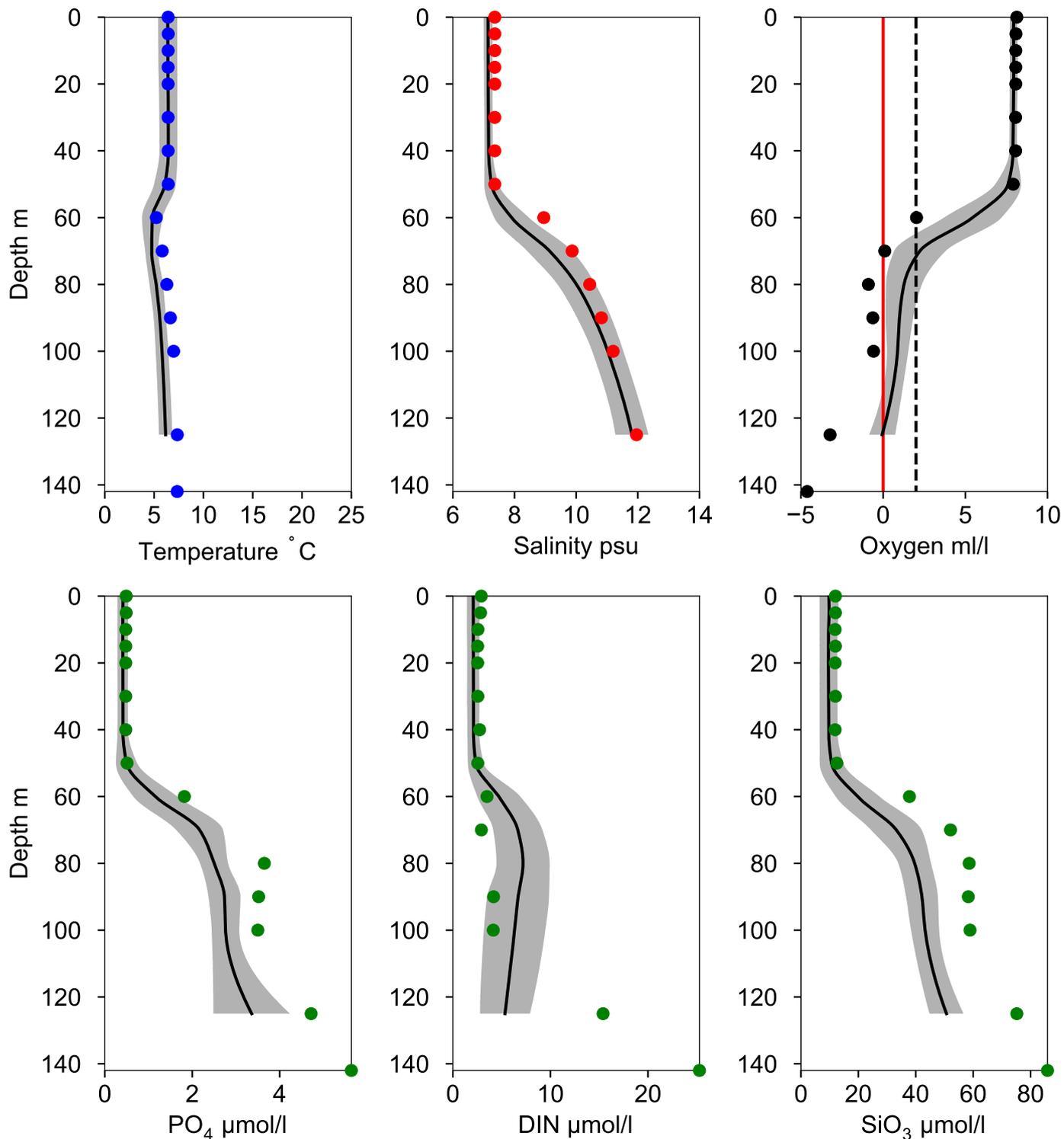


OXYGEN IN BOTTOM WATER (depth >= 125 m)



Vertical profiles BY10 December

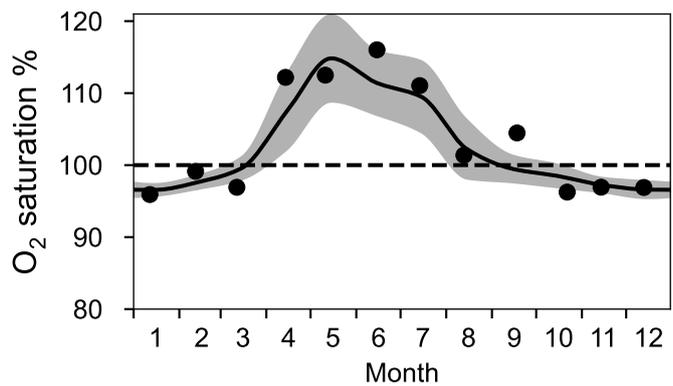
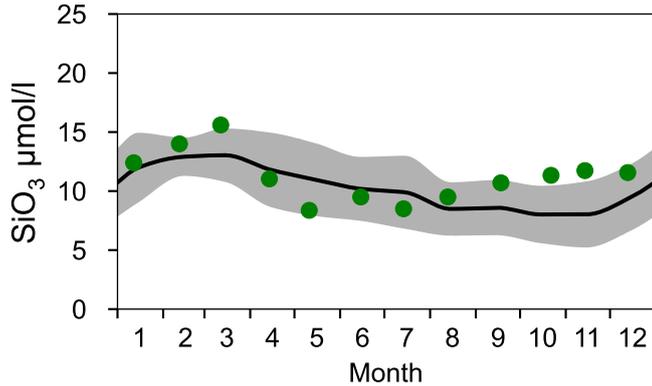
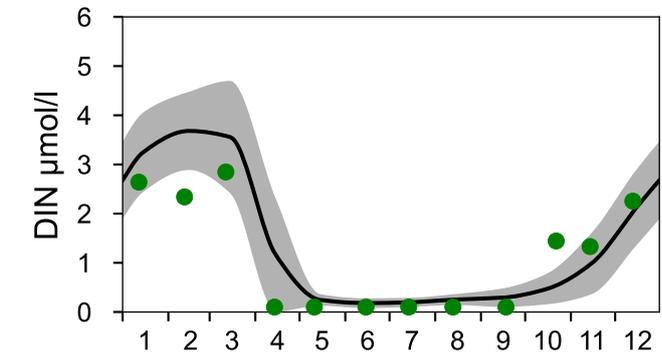
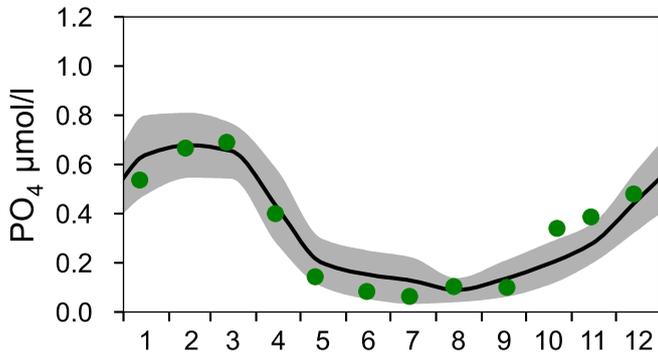
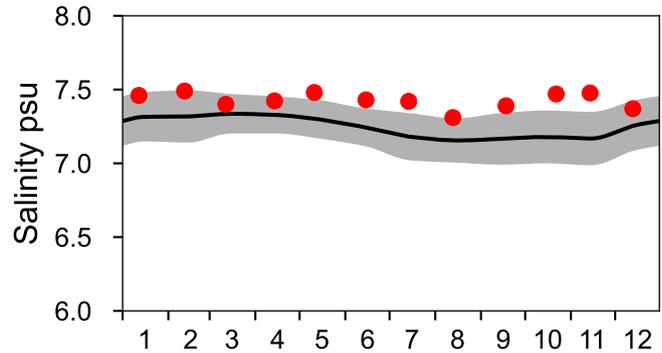
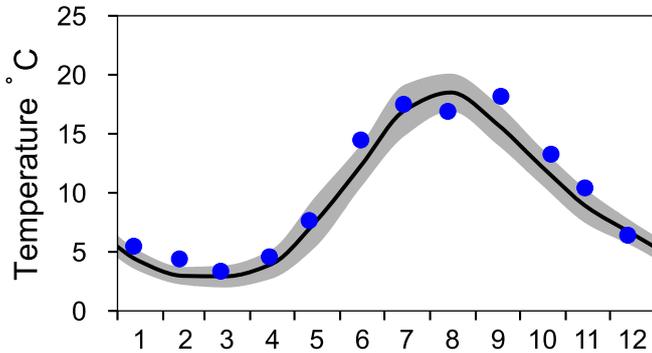
— Mean 1991-2020 ■ St.Dev. ● 2023-12-13



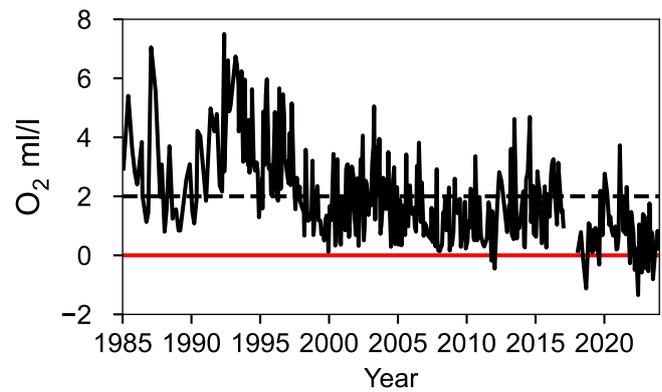
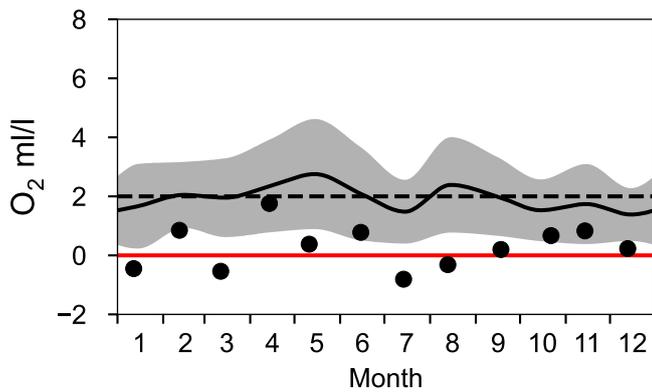
STATION BCS III-10 SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023

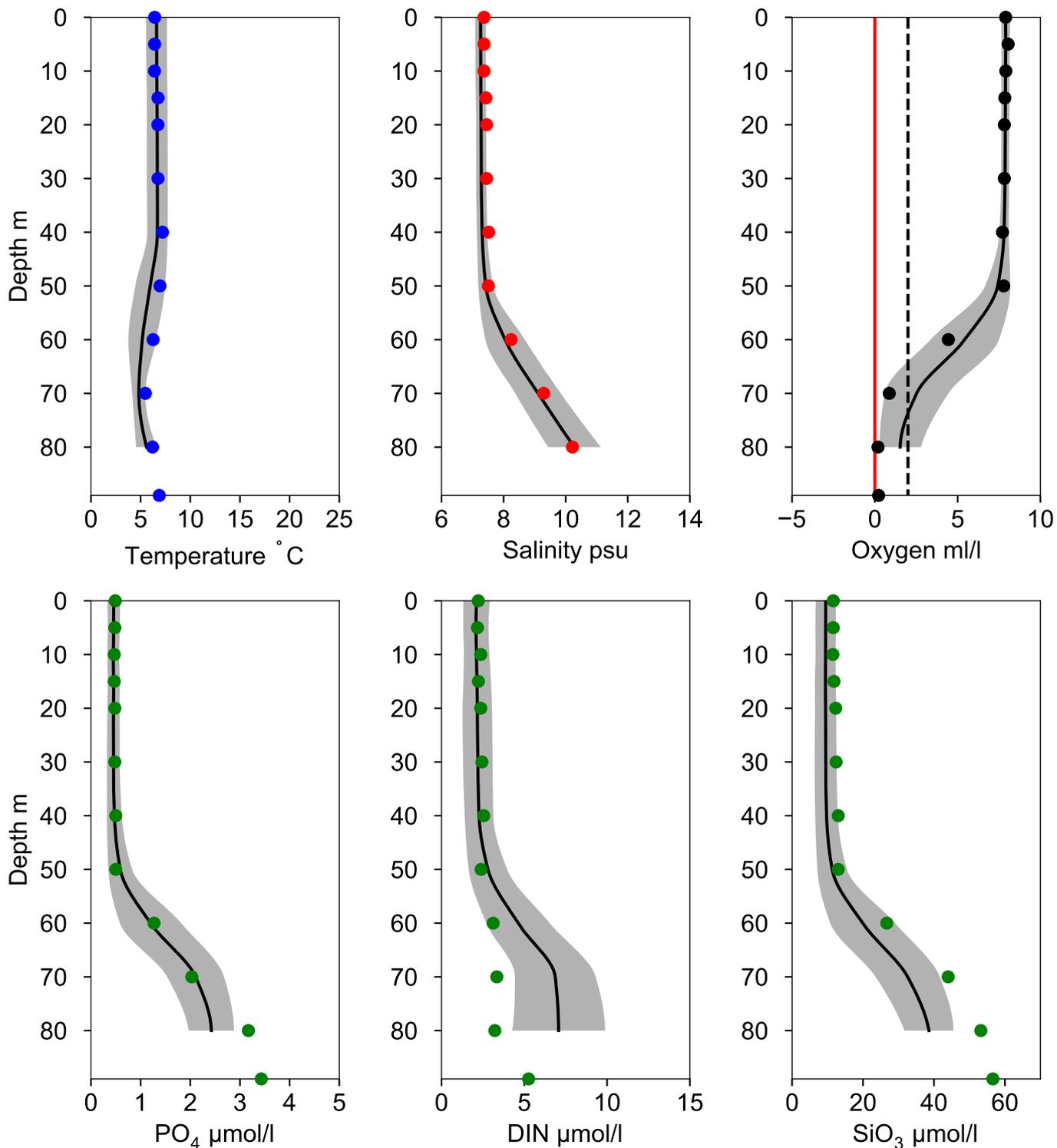


OXYGEN IN BOTTOM WATER (depth ≥ 80 m)



Vertical profiles BCS III-10 December

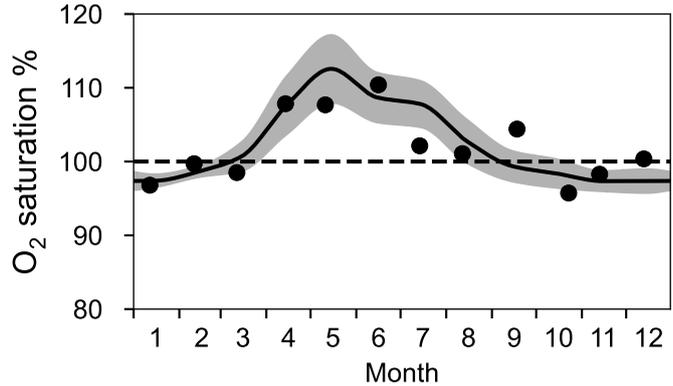
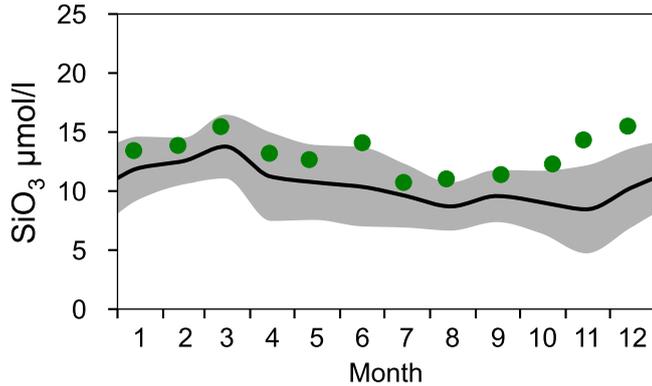
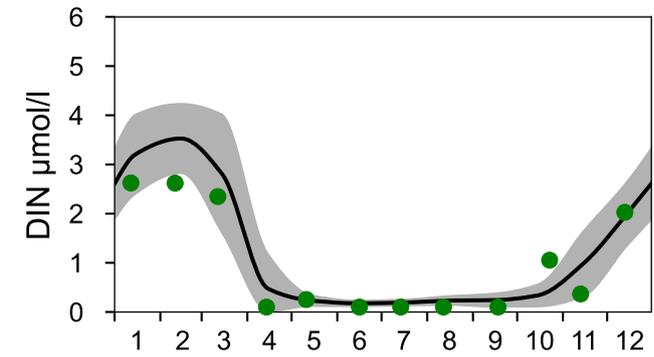
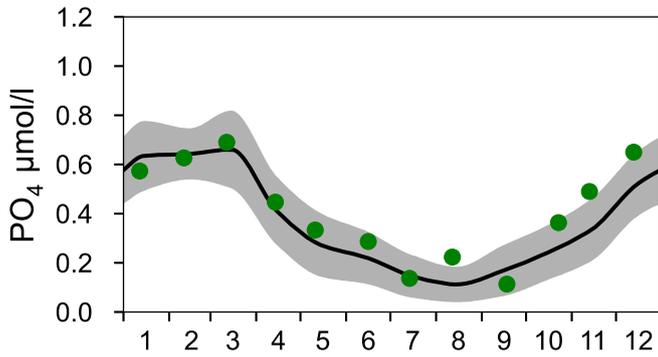
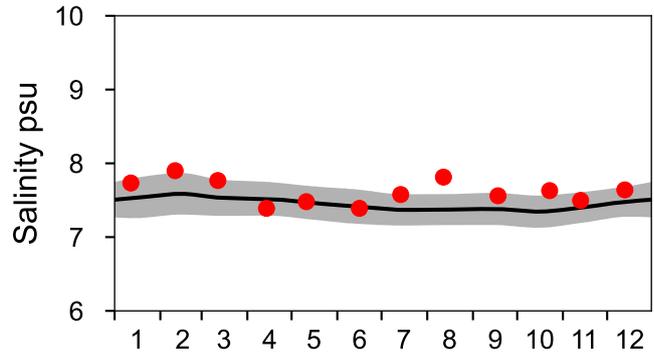
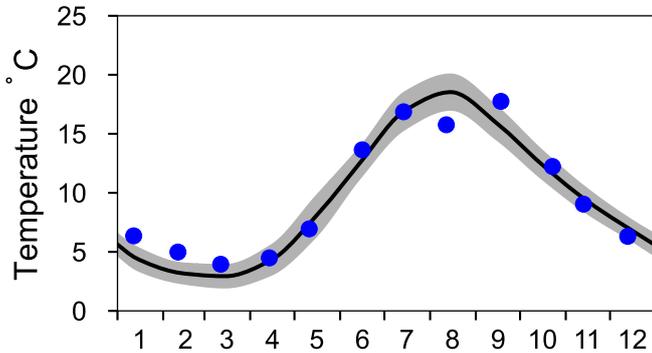
— Mean 1991-2020 ■ St.Dev. ● 2023-12-13



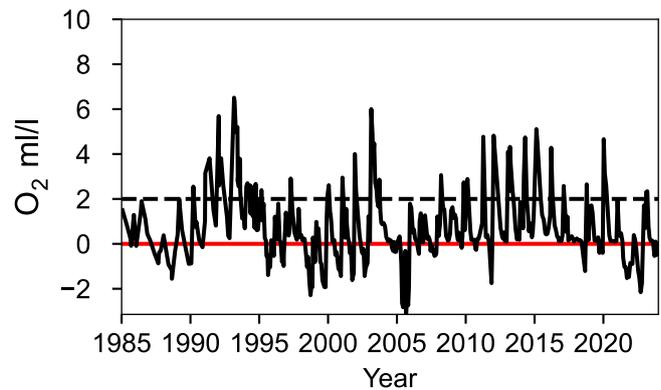
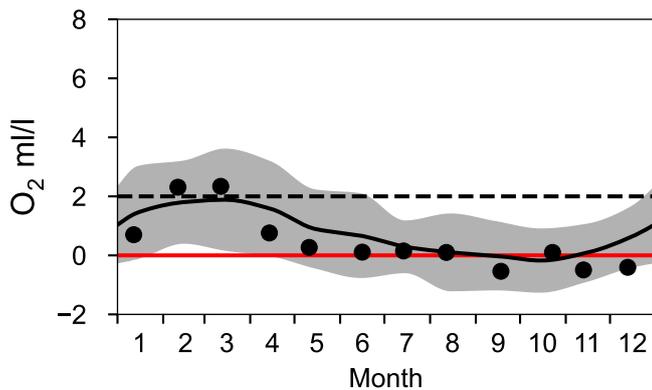
STATION BY5 BORNHOLMSDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023

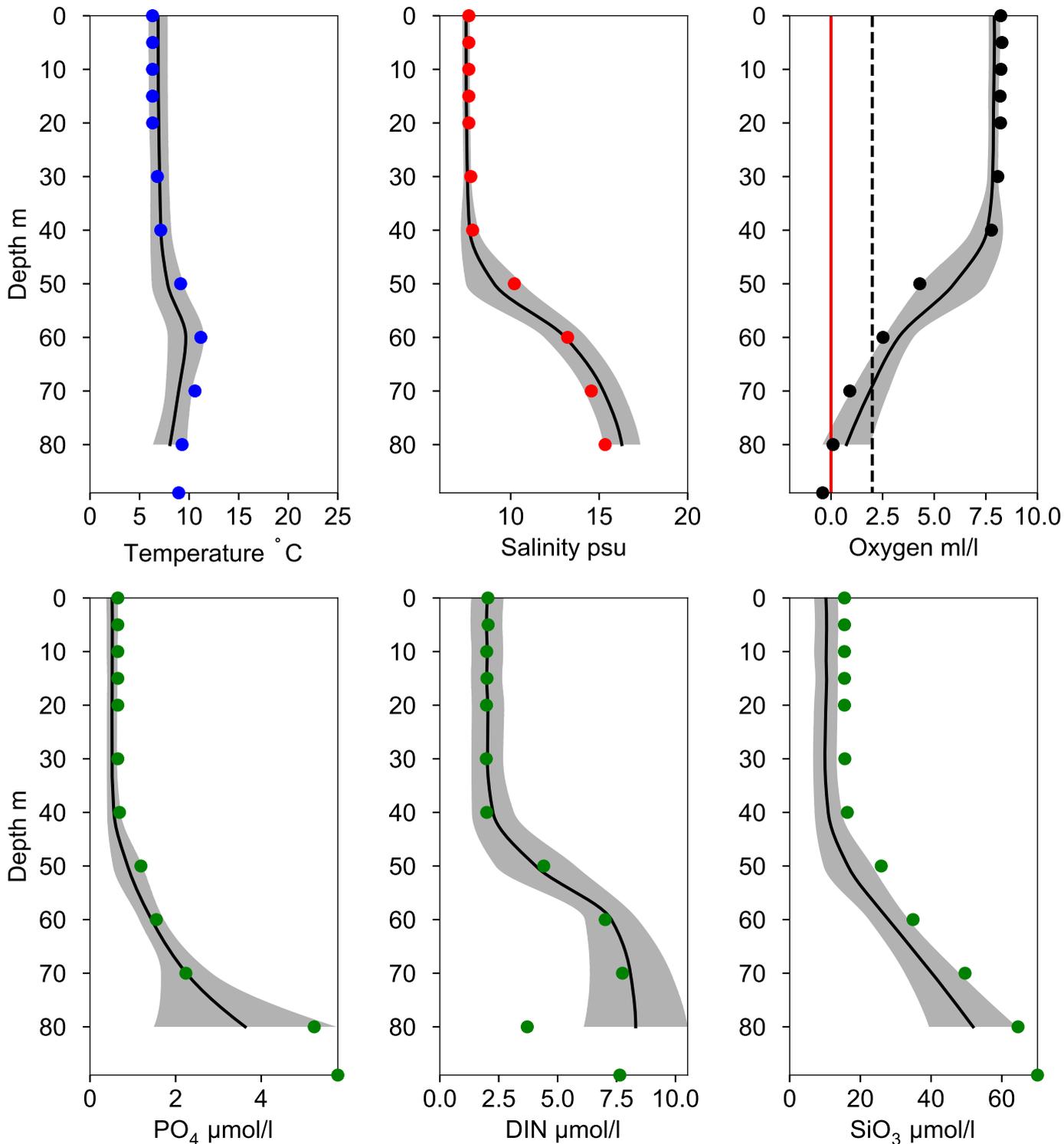


OXYGEN IN BOTTOM WATER (depth >= 80 m)



Vertical profiles BY5 BORNHOLMSDJ December

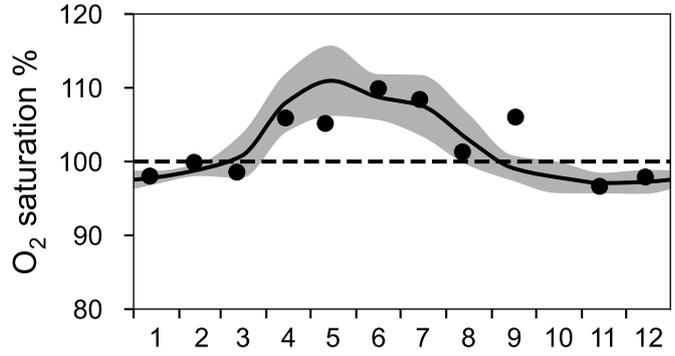
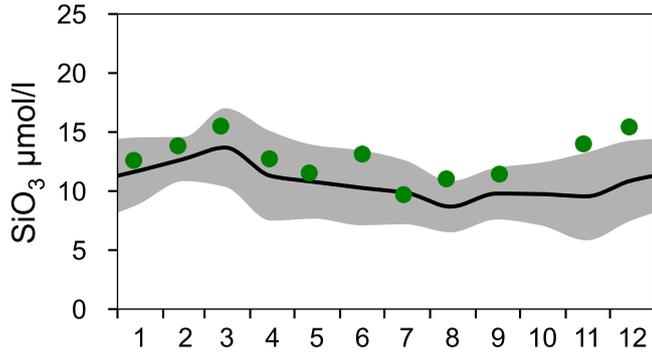
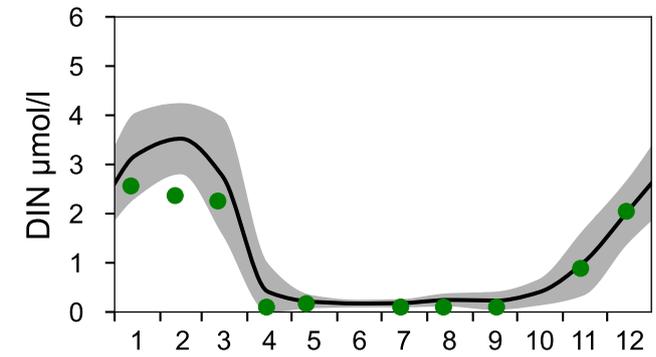
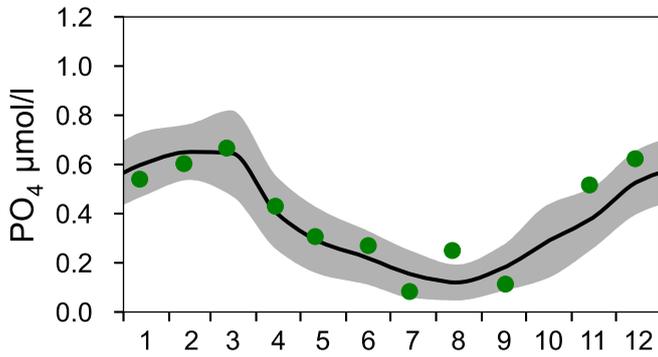
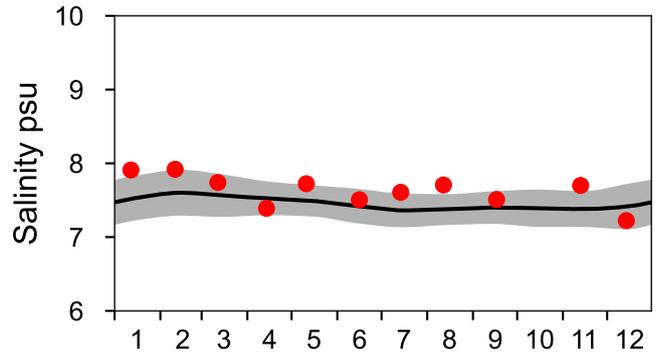
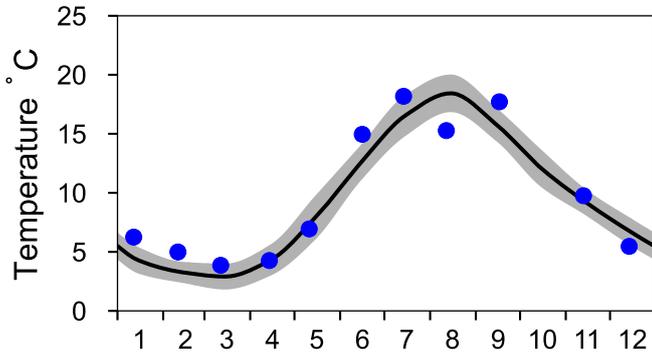
— Mean 1991-2020 ■ St.Dev. ● 2023-12-13



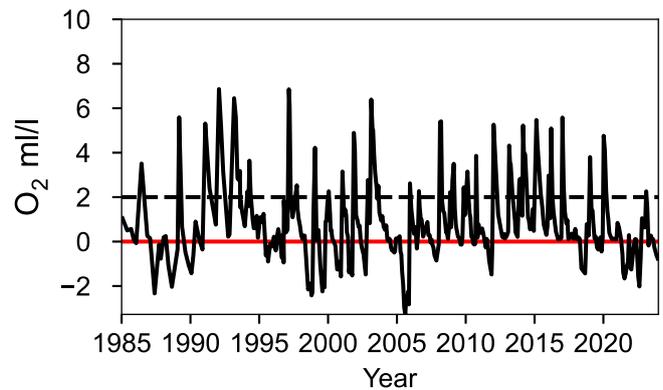
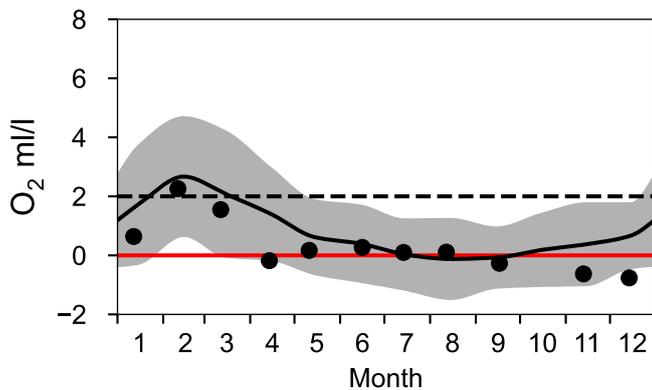
STATION BY4 CHRISTIANSÖ SURFACE WATER (0-10 m)

Annual Cycles

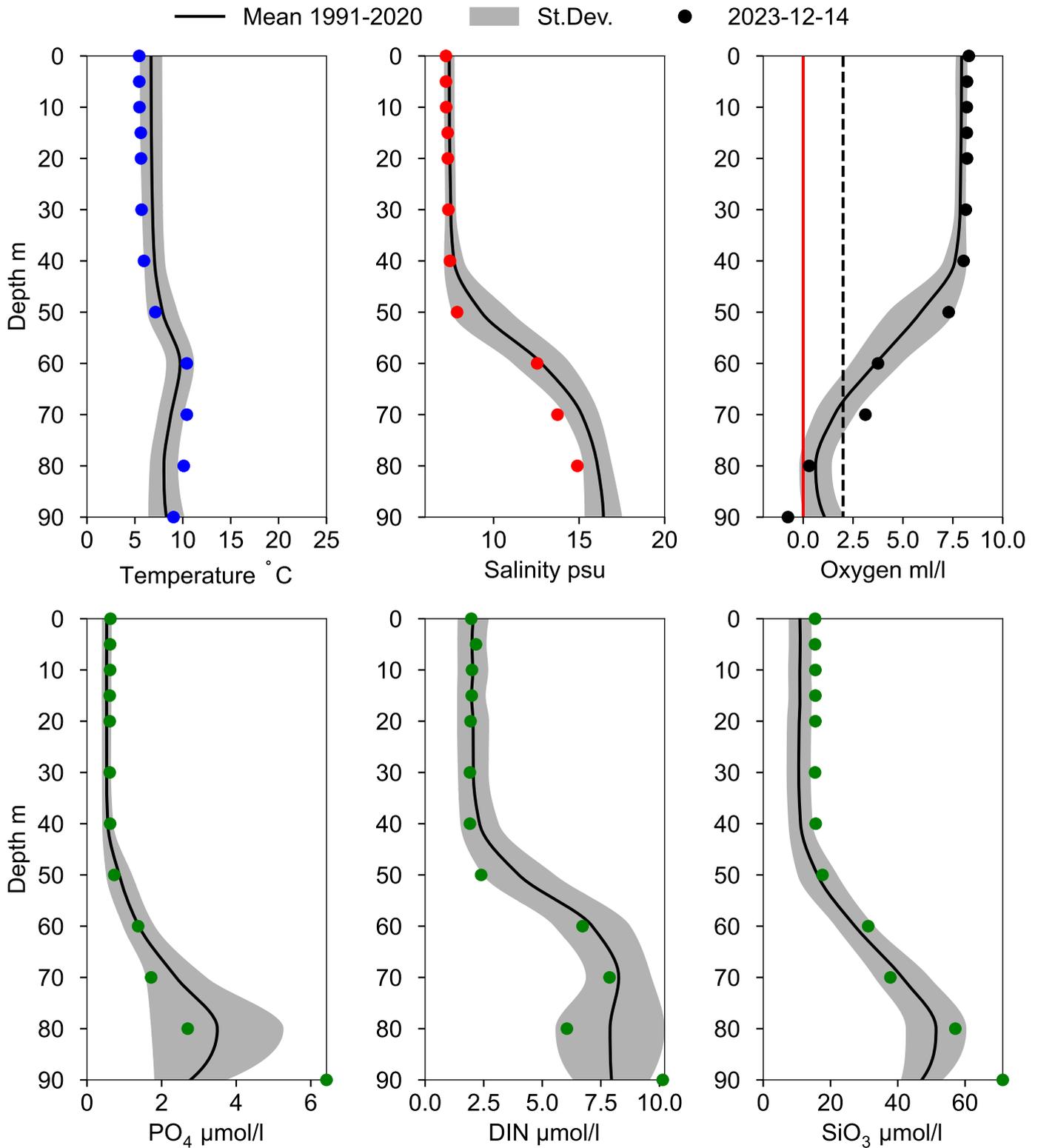
— Mean 1991-2020 St.Dev. ● 2023



OXYGEN IN BOTTOM WATER (depth >= 80 m)



Vertical profiles BY4 CHRISTIANSÖ December



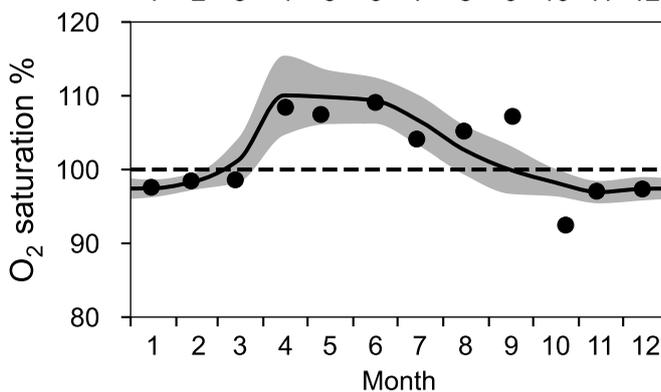
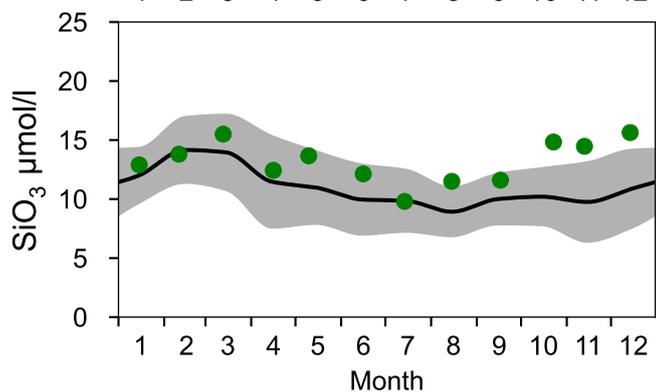
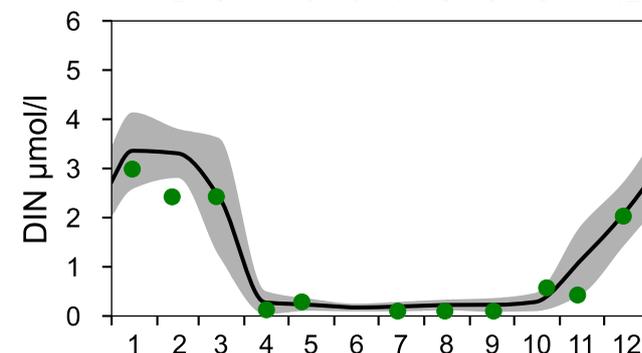
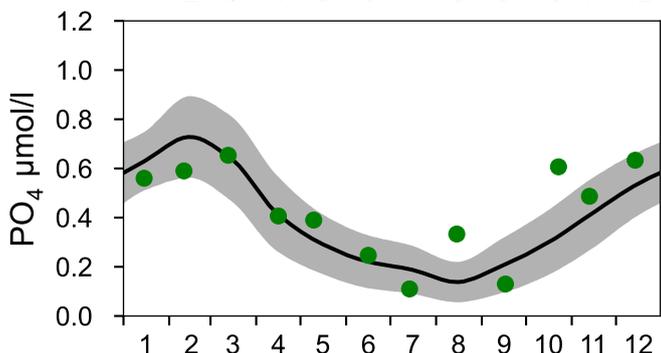
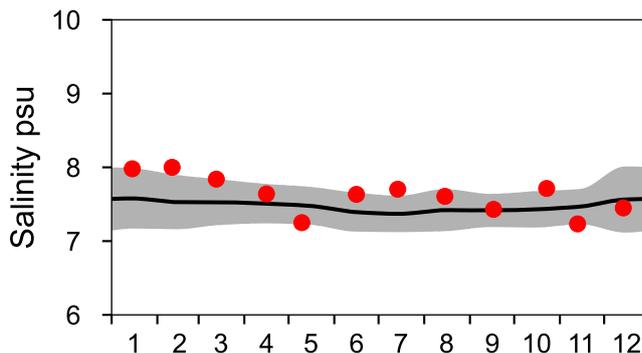
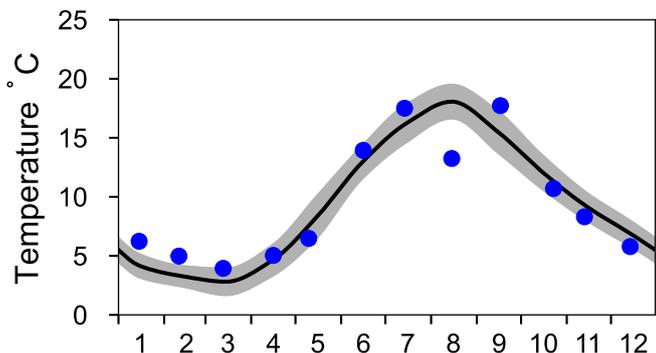
STATION HANÖBUKTEN SURFACE WATER (0-10 m)

Annual Cycles

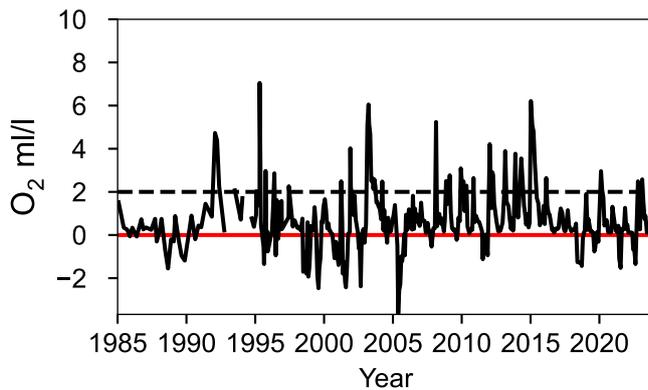
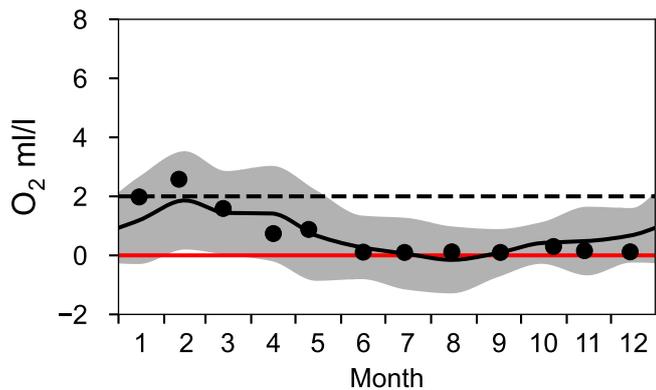
— Mean 1991-2020

■ St.Dev.

● 2023

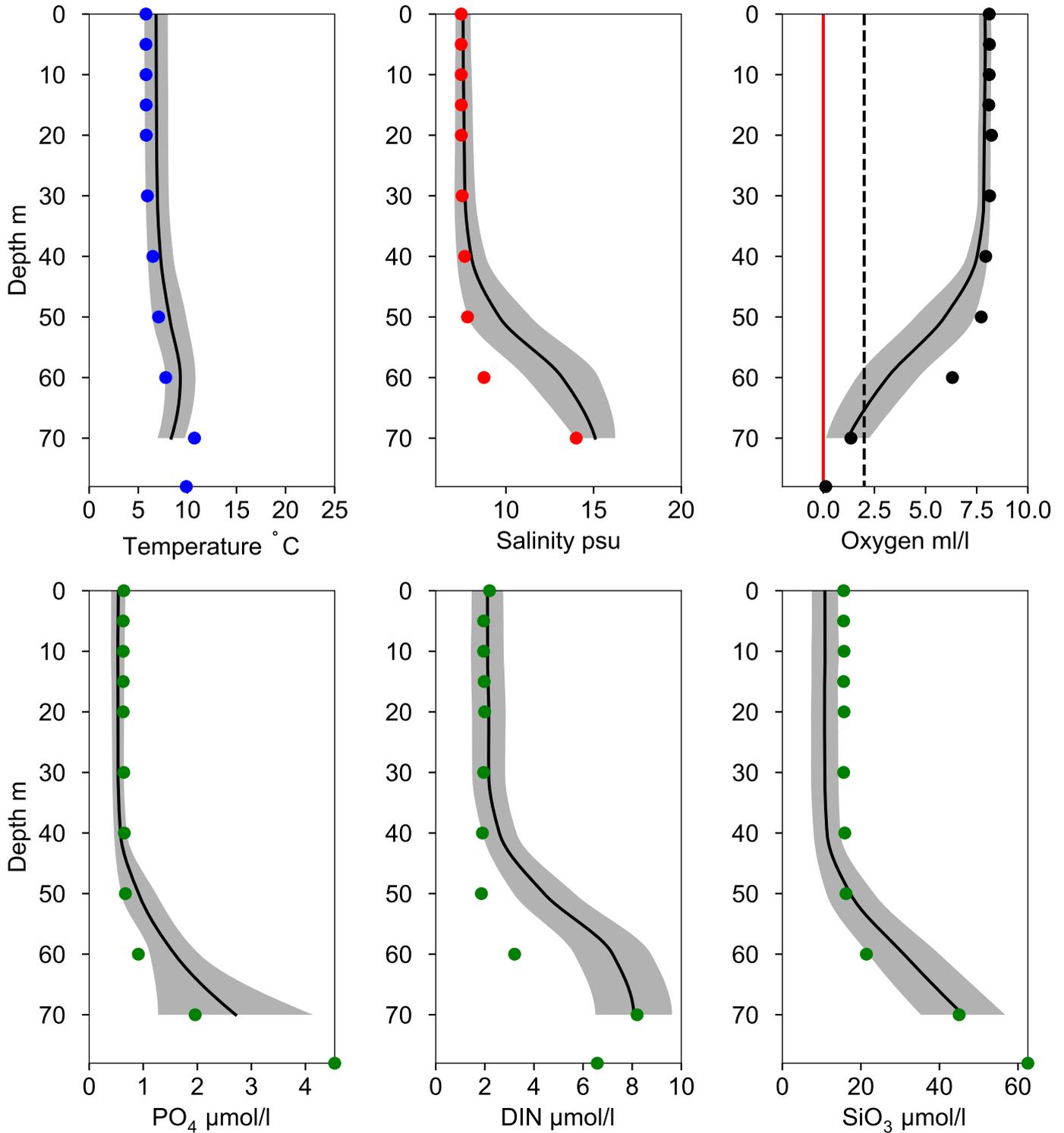


OXYGEN IN BOTTOM WATER (depth >= 70 m)



Vertical profiles HANÖBUKTEN December

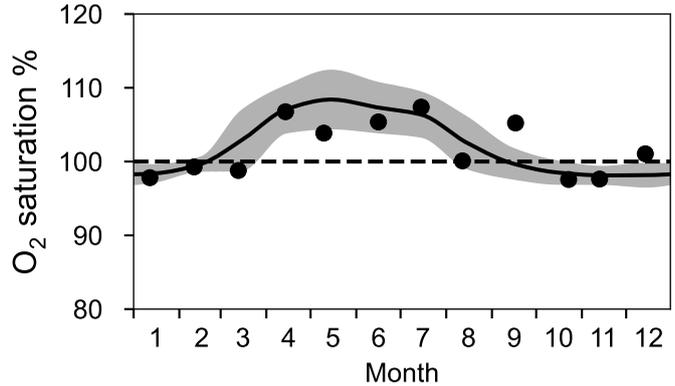
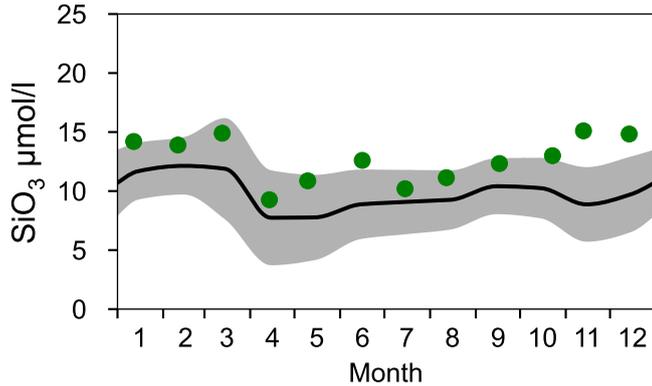
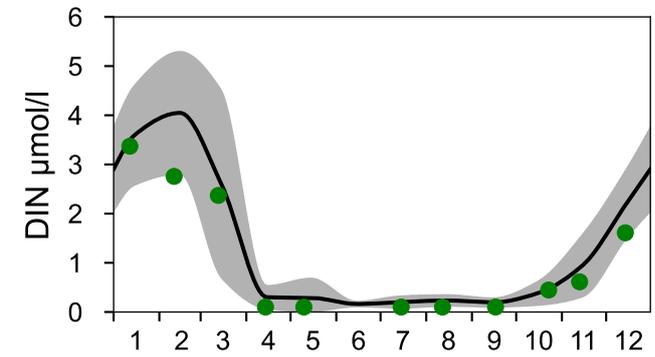
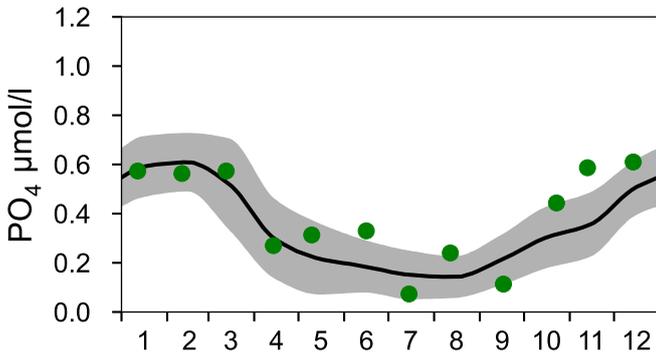
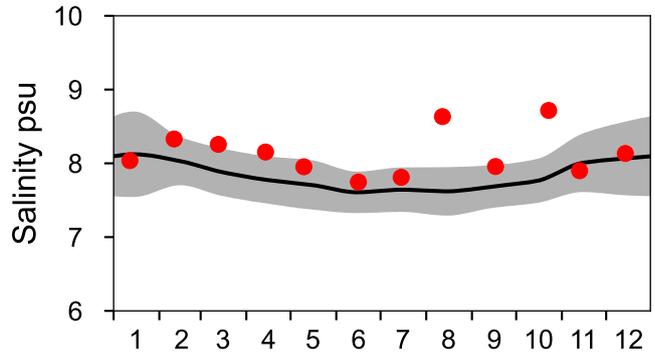
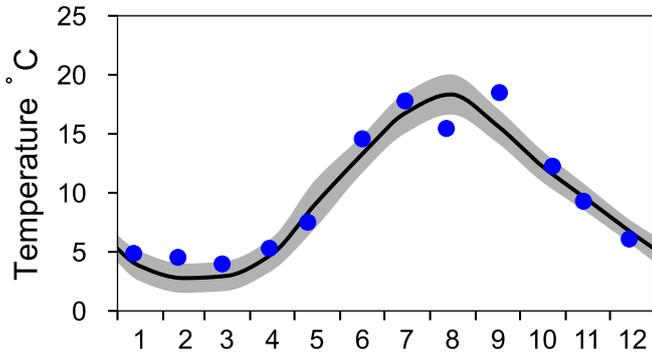
— Mean 1991-2020 ■ St.Dev. ● 2023-12-14



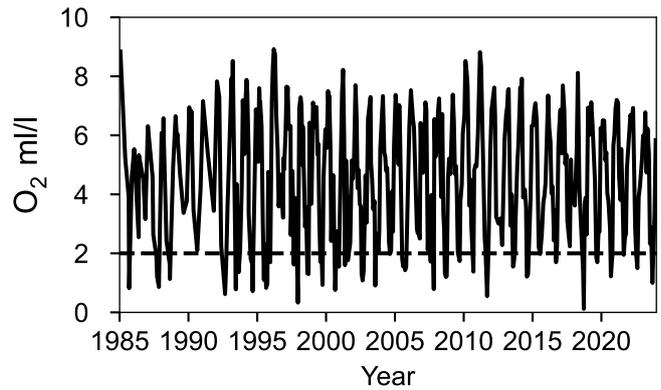
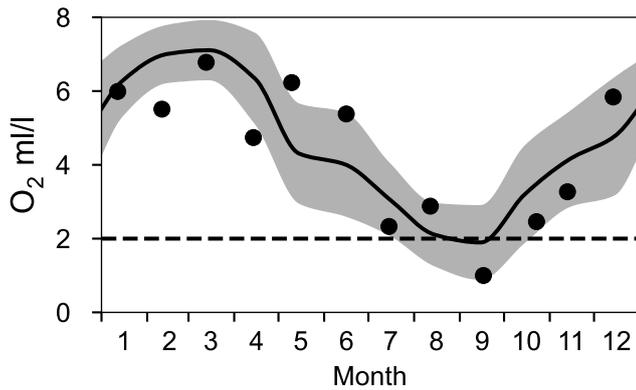
STATION BY2 ARKONA SURFACE WATER (0-10 m)

Annual Cycles

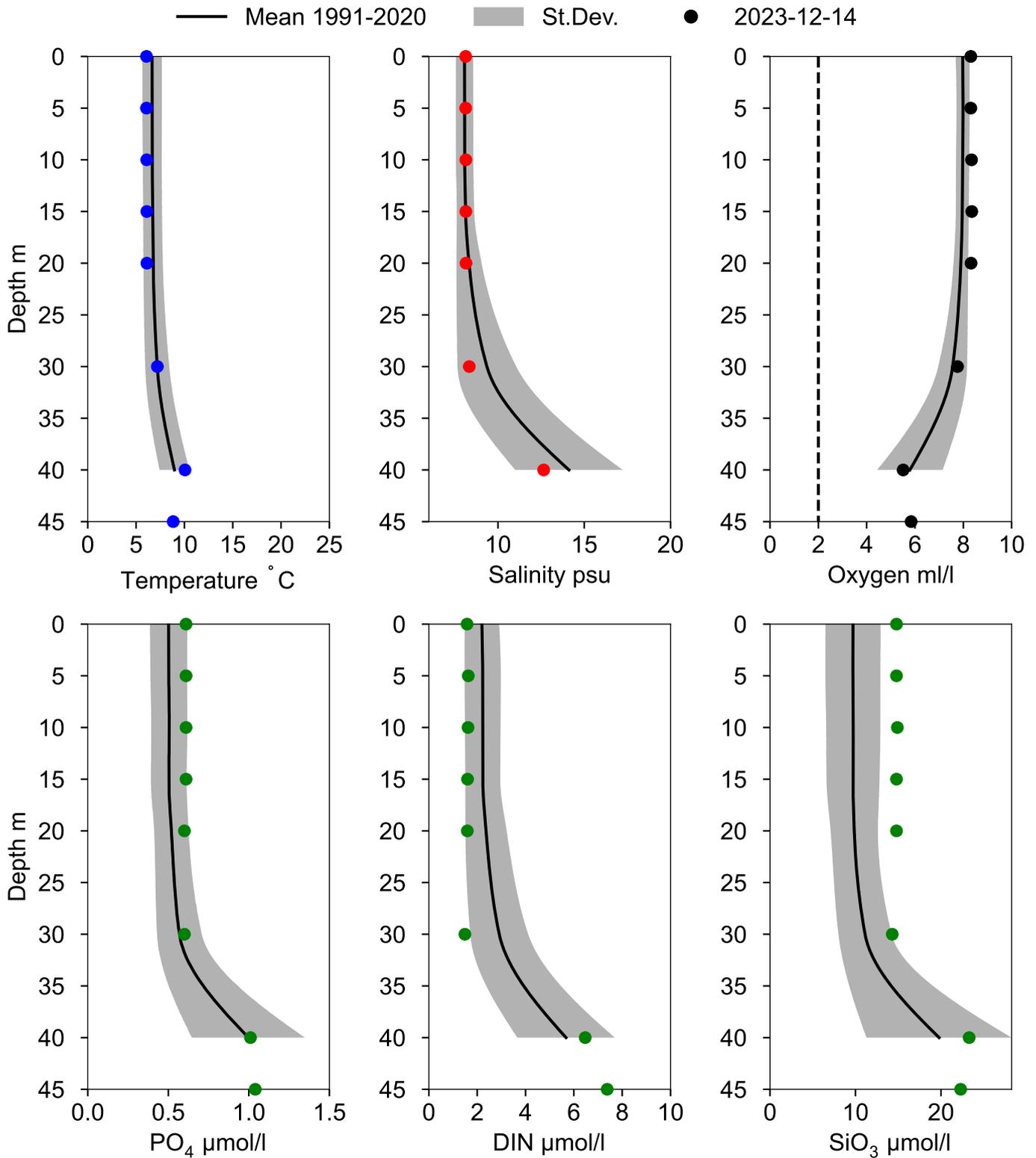
— Mean 1991-2020 St.Dev. ● 2023



OXYGEN IN BOTTOM WATER (depth >= 40 m)



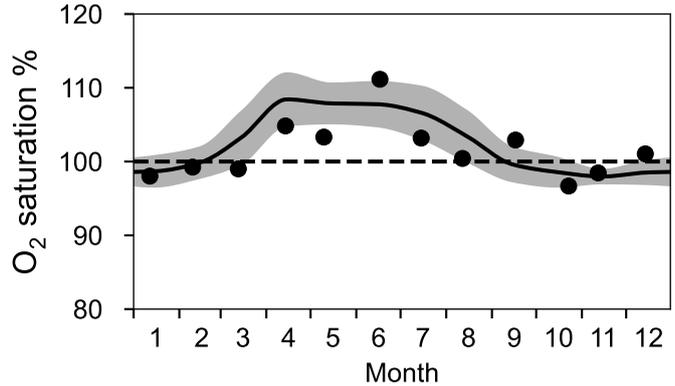
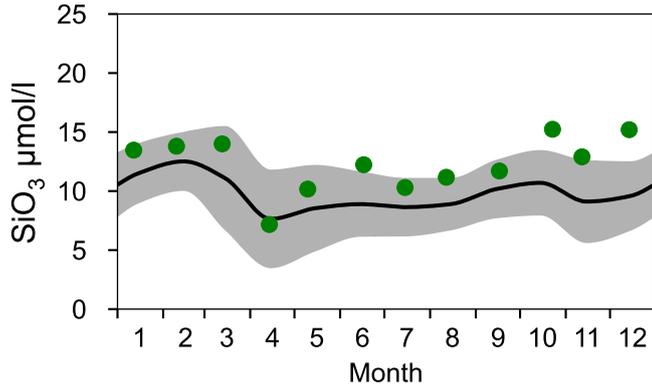
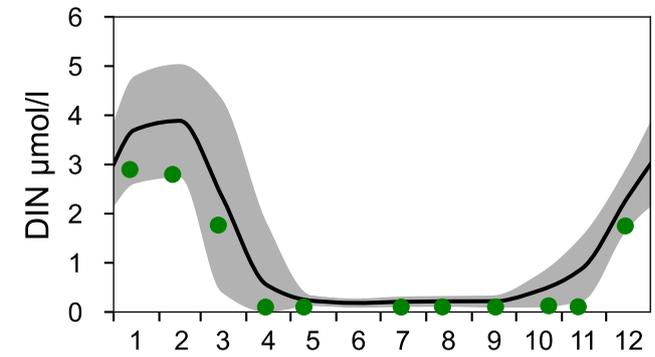
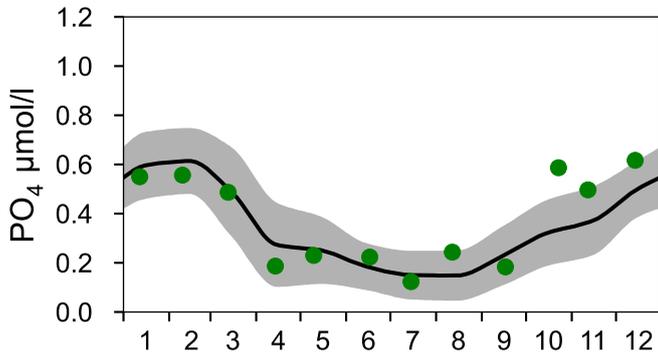
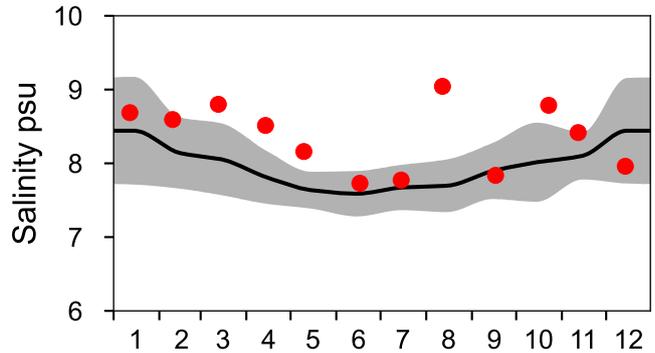
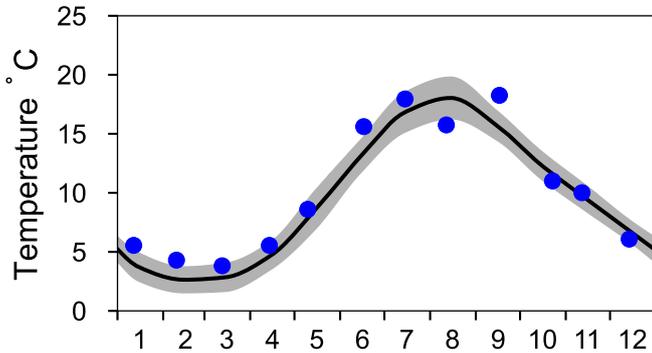
Vertical profiles BY2 ARKONA December



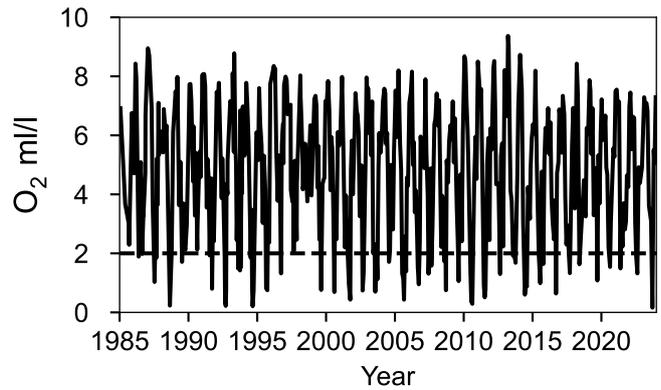
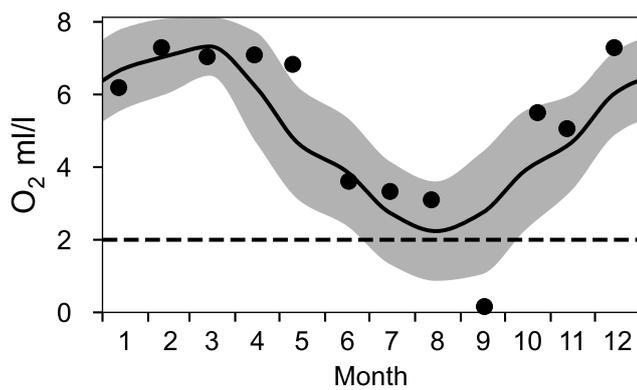
STATION BY1 SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023

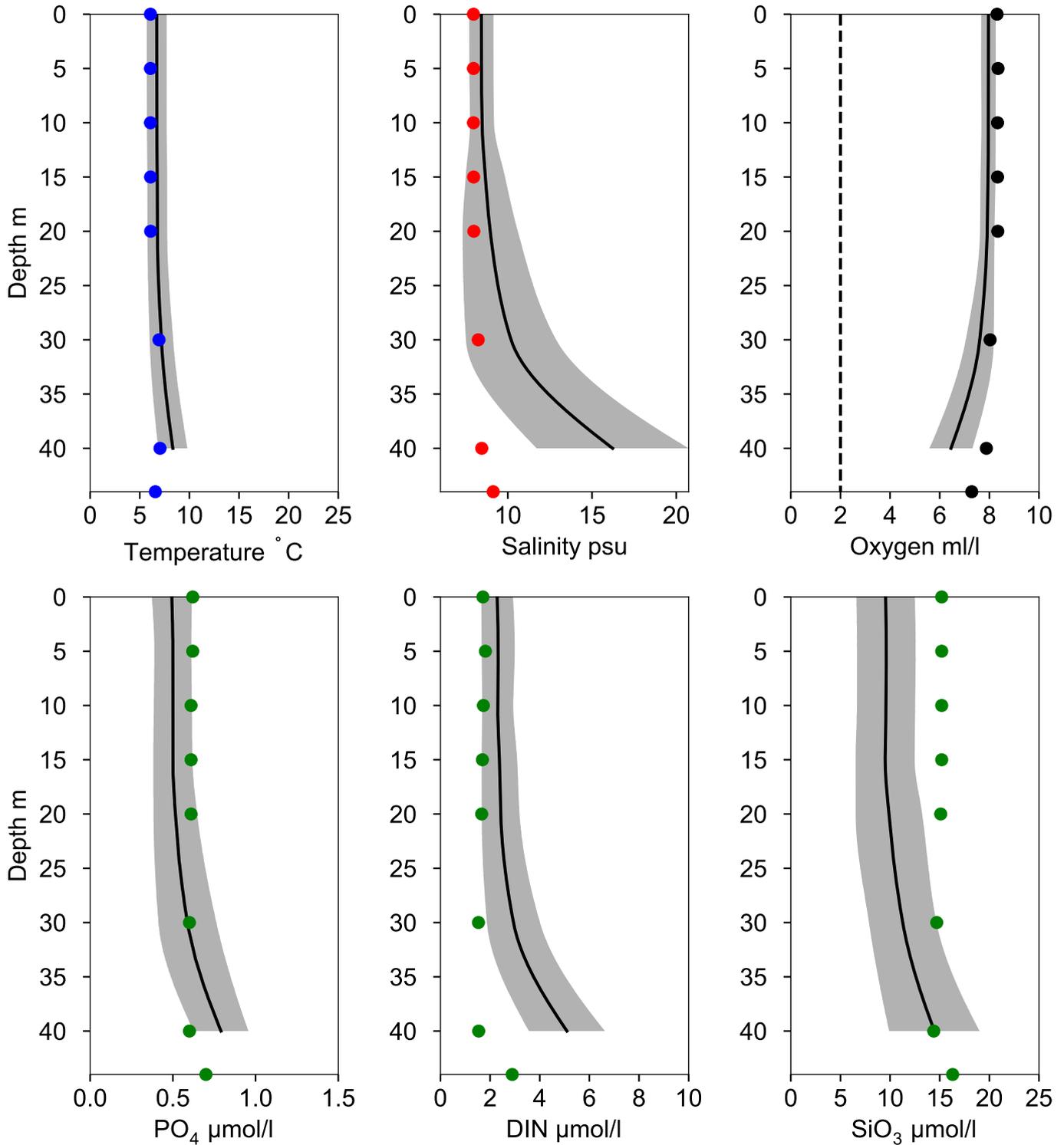


OXYGEN IN BOTTOM WATER (depth >= 39 m)



Vertical profiles BY1 December

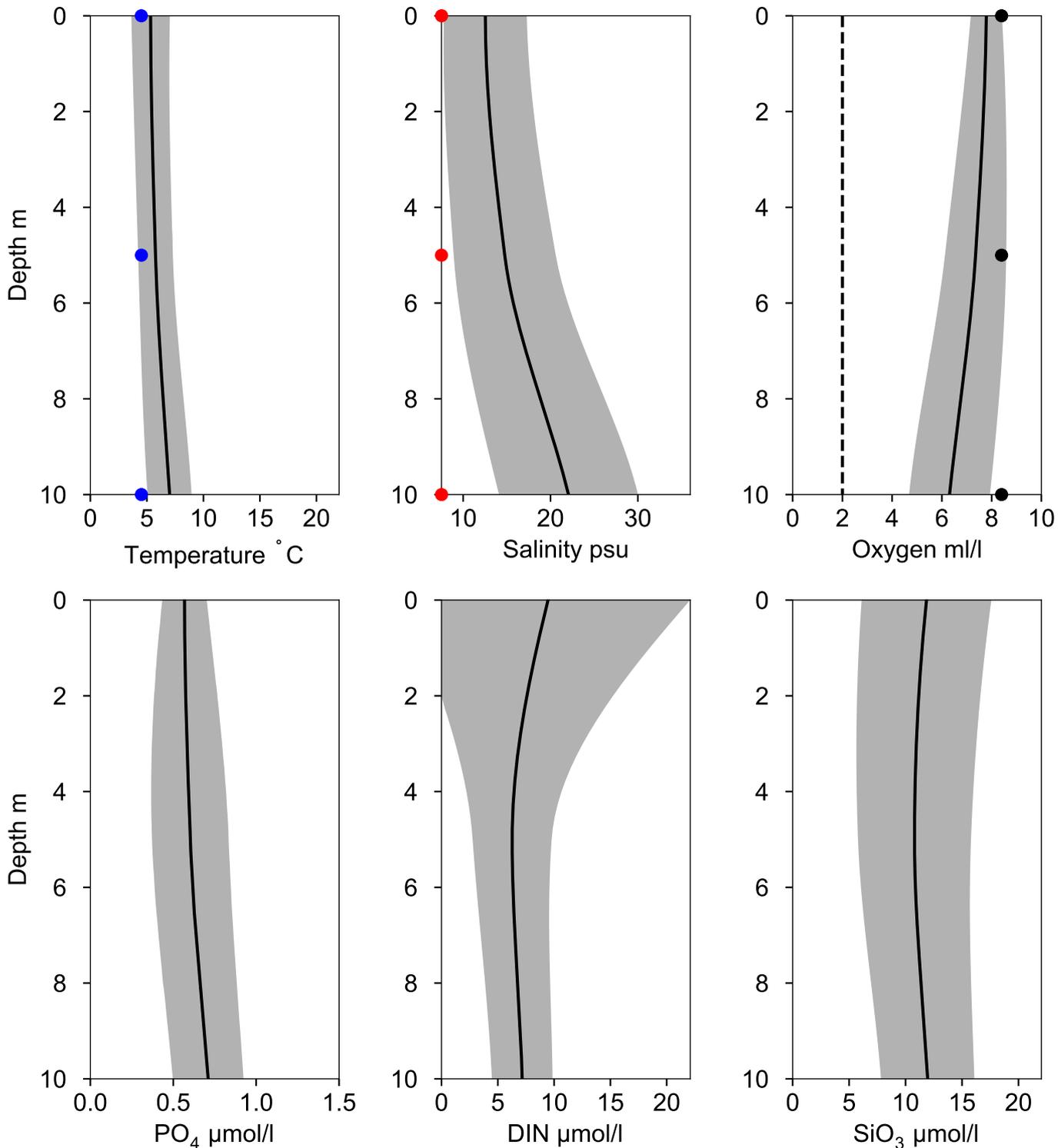
— Mean 1991-2020 St.Dev. ● 2023-12-14



Vertical profiles FLINTEN7 December

Statistics based on data from: Öresund

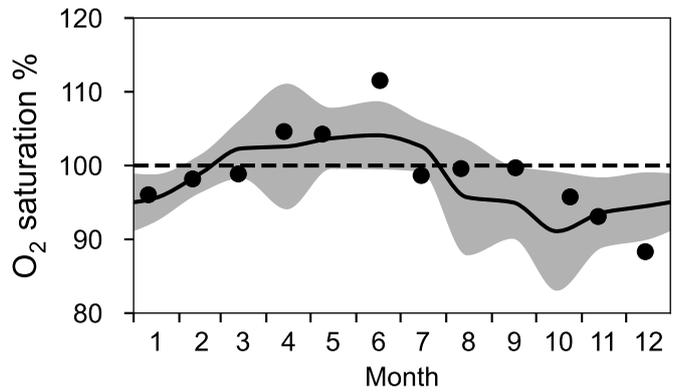
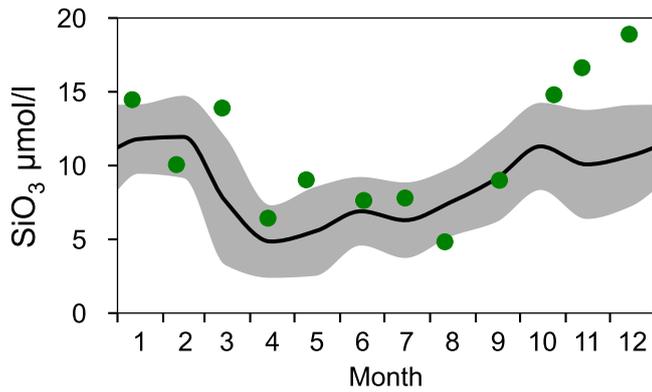
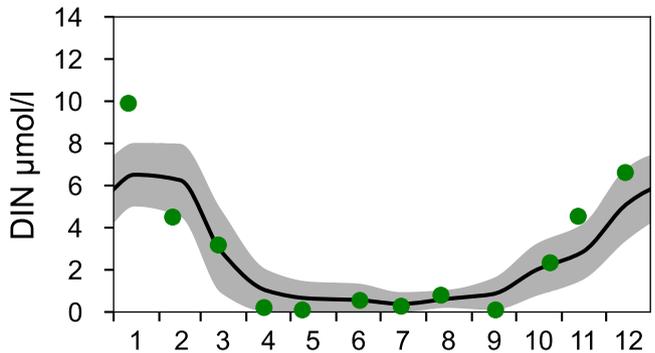
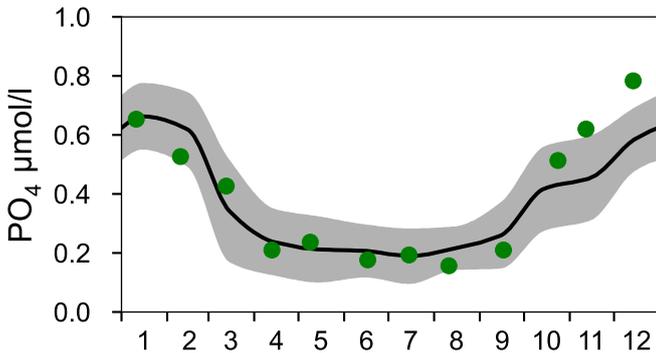
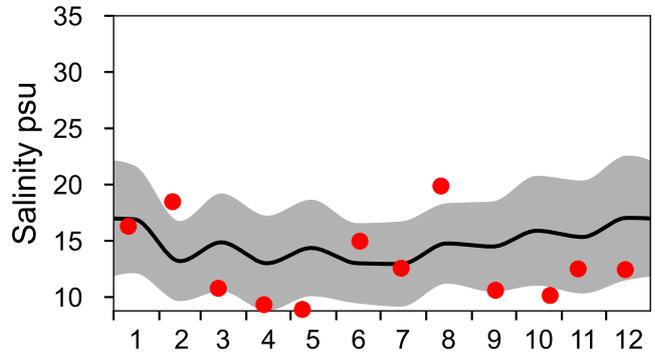
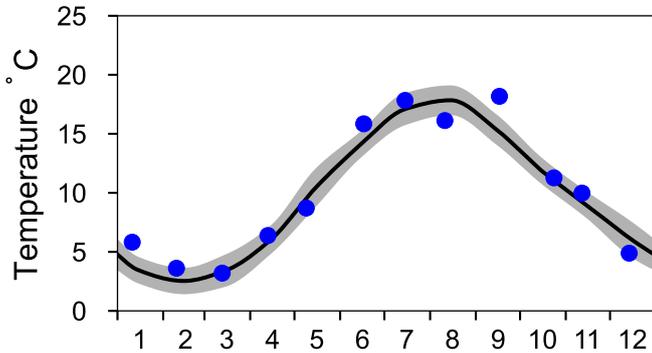
— Mean 1991-2020 ■ St.Dev. ● 2023-12-14



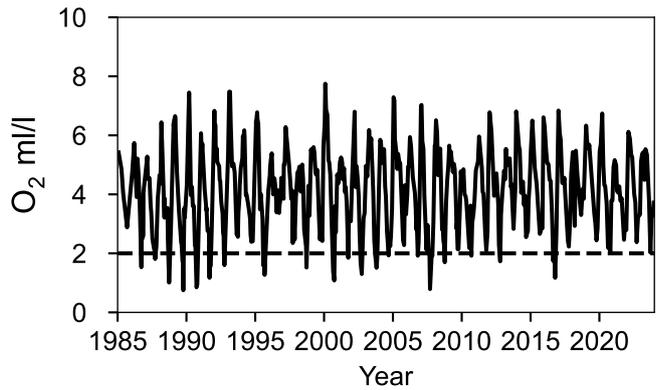
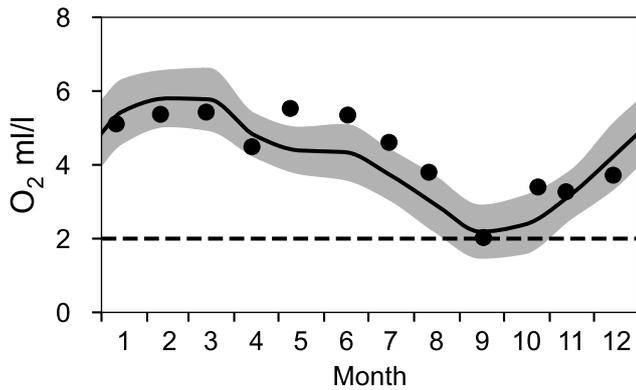
STATION W LANDSKRONA SURFACE WATER (0-10 m)

Annual Cycles

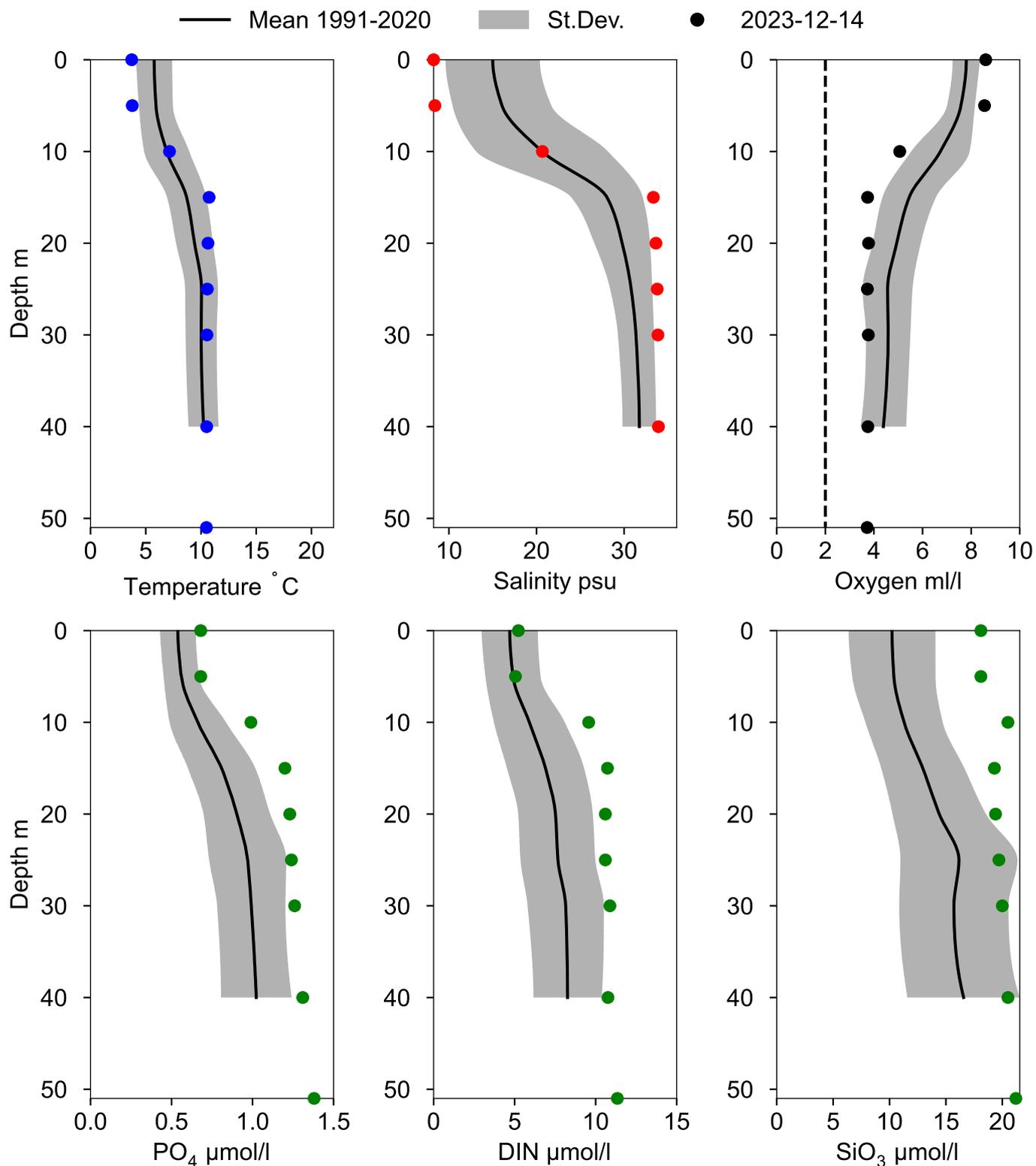
— Mean 1991-2020 St.Dev. ● 2023



OXYGEN IN BOTTOM WATER (depth >= 40 m)



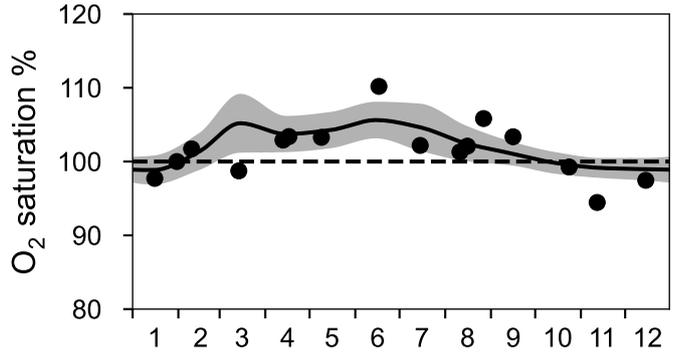
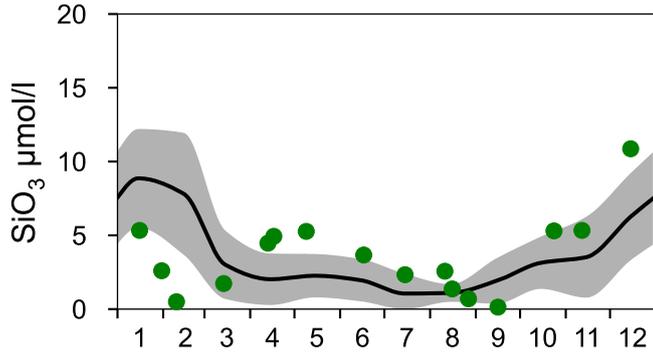
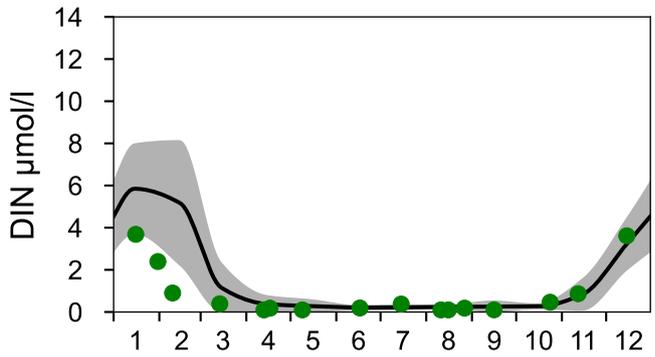
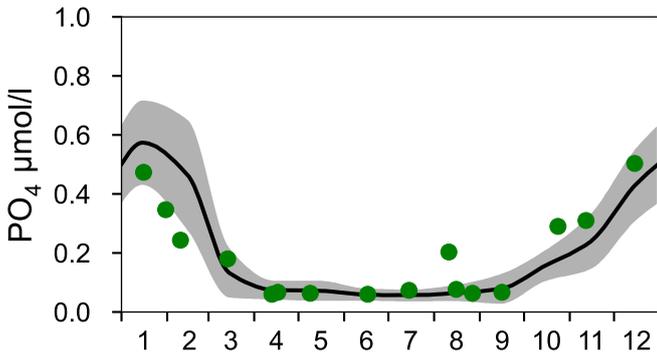
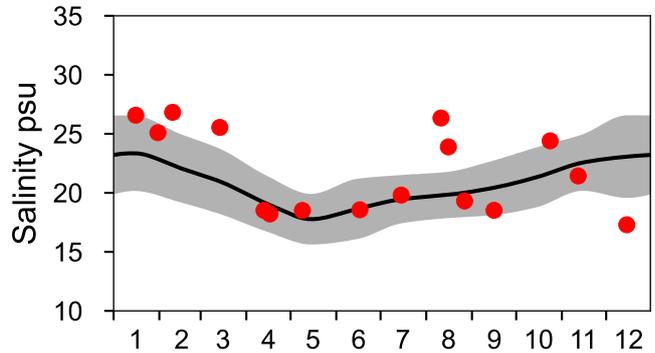
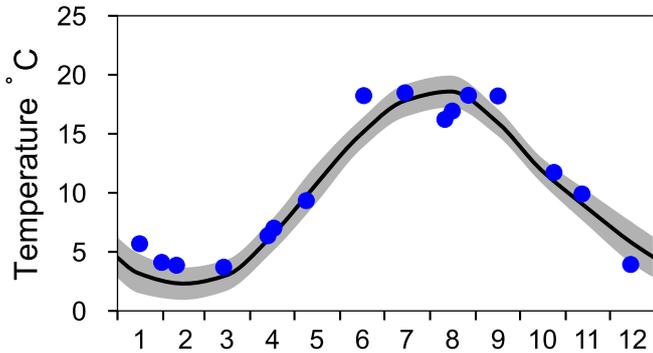
Vertical profiles W LANDSKRONA December



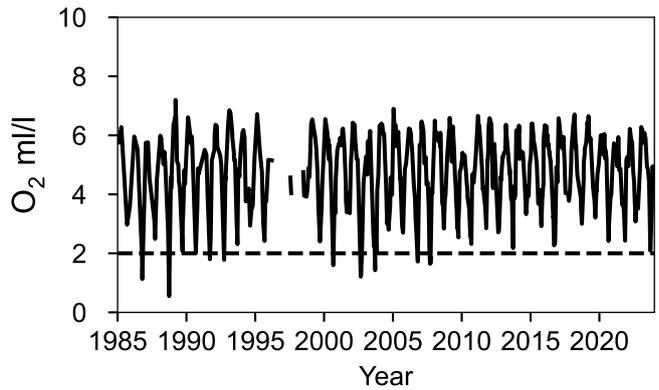
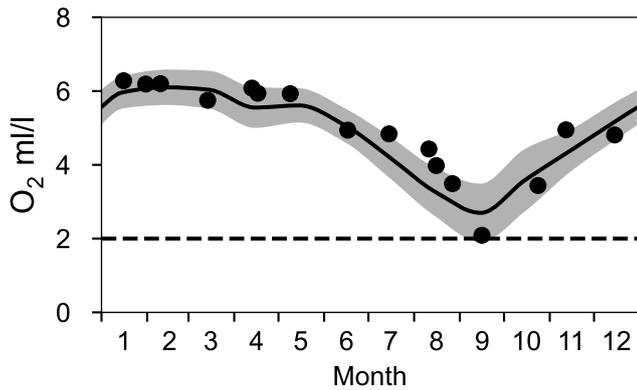
STATION ANHOLT E SURFACE WATER (0-10 m)

Annual Cycles

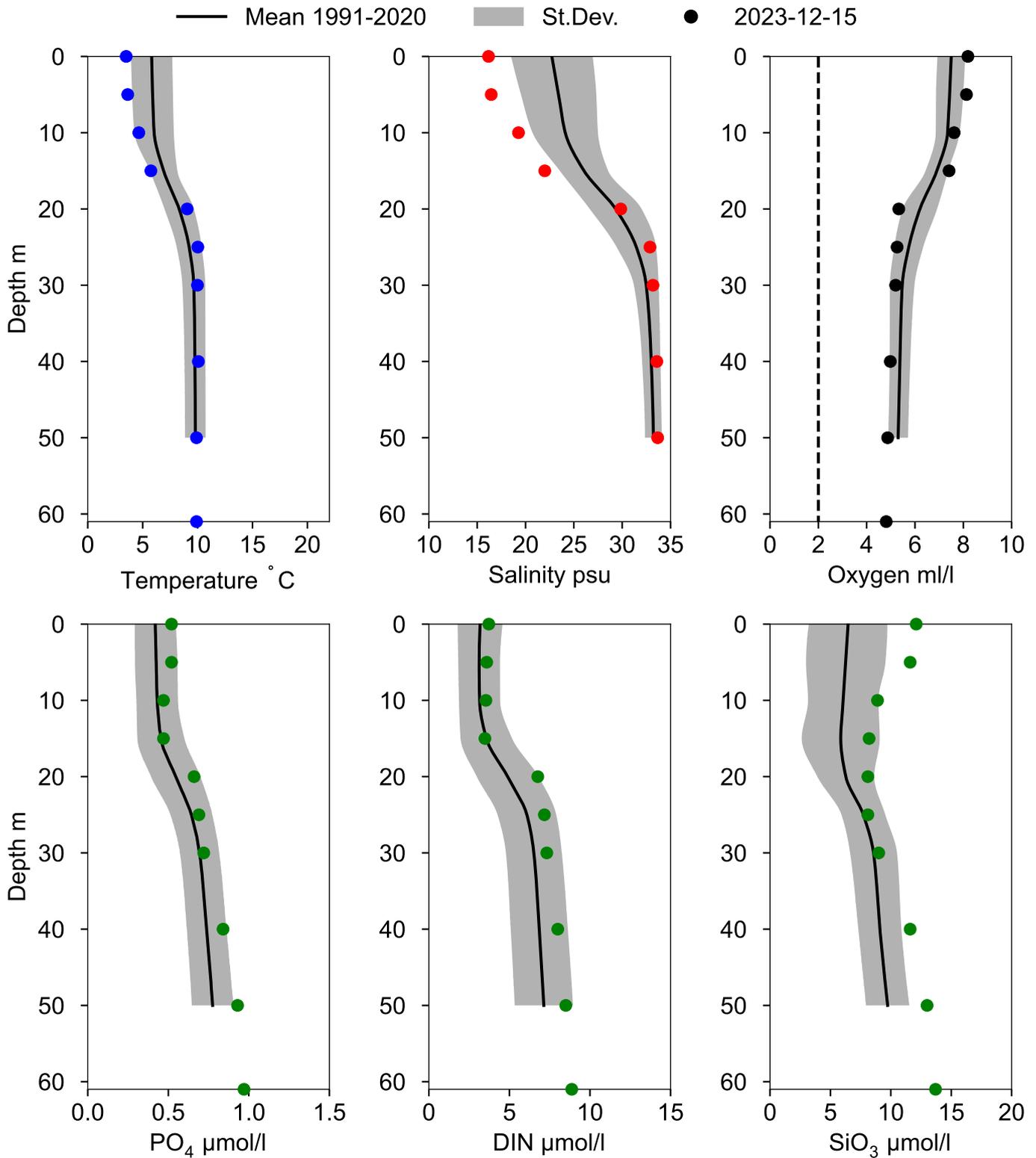
— Mean 1991-2020 St.Dev. ● 2023



OXYGEN IN BOTTOM WATER (depth >= 52 m)



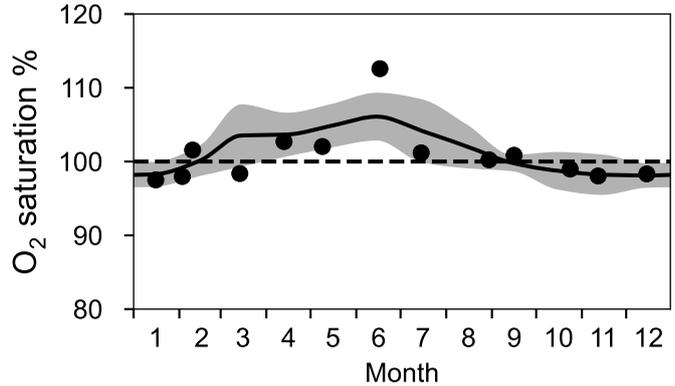
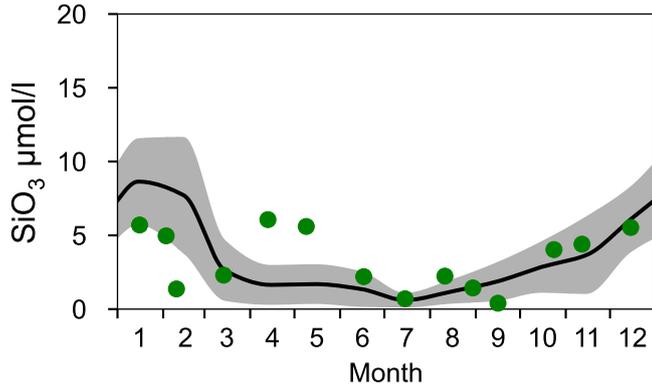
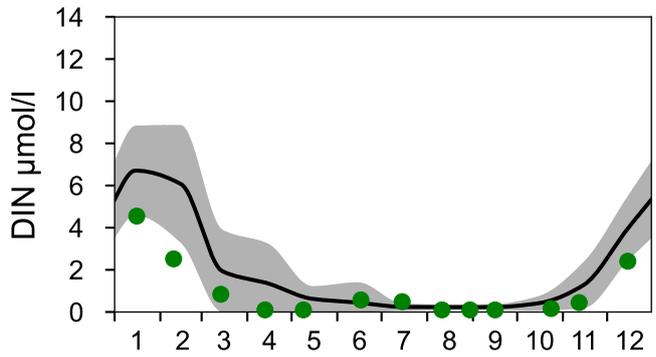
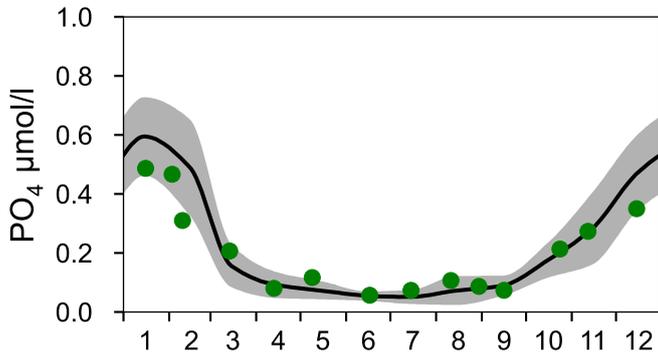
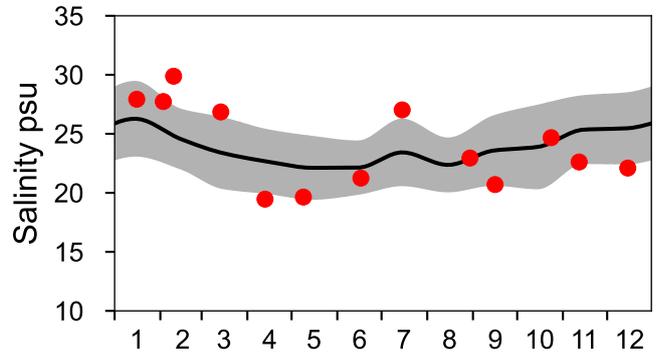
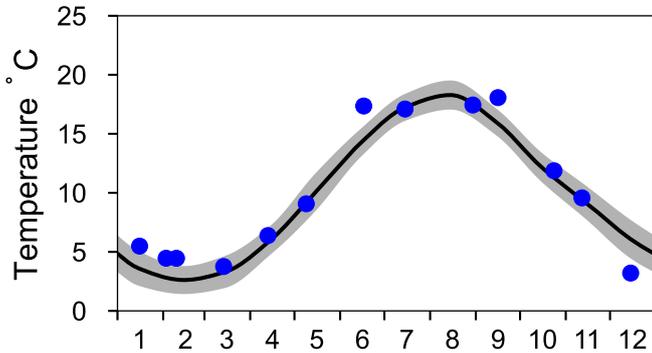
Vertical profiles ANHOLT E December



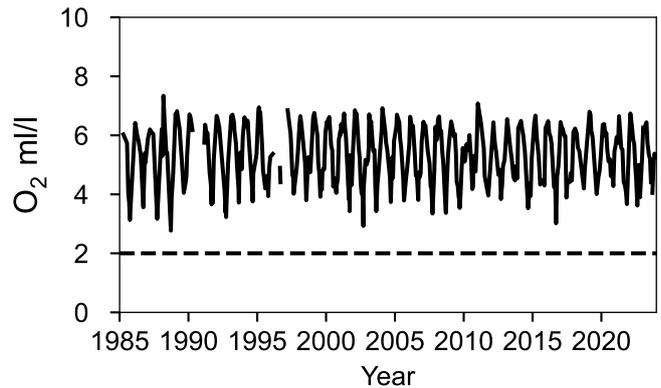
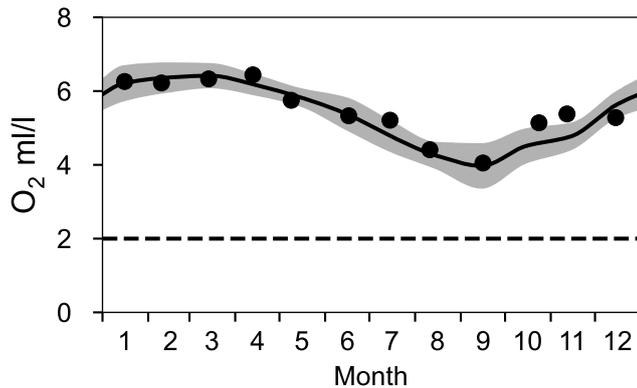
STATION FLADEN SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023



OXYGEN IN BOTTOM WATER (depth >= 74 m)

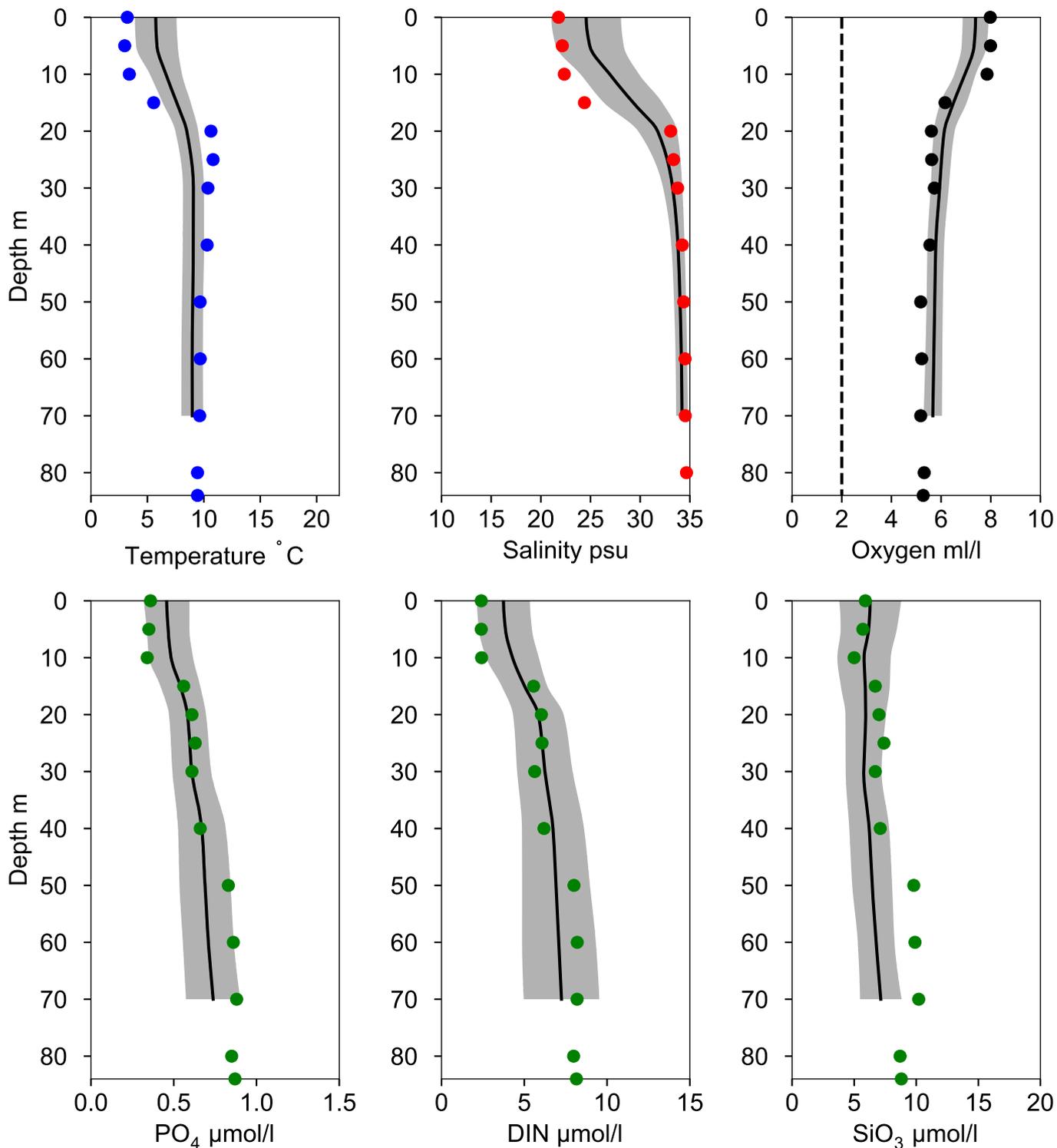


Vertical profiles FLADEN December

— Mean 1991-2020

■ St.Dev.

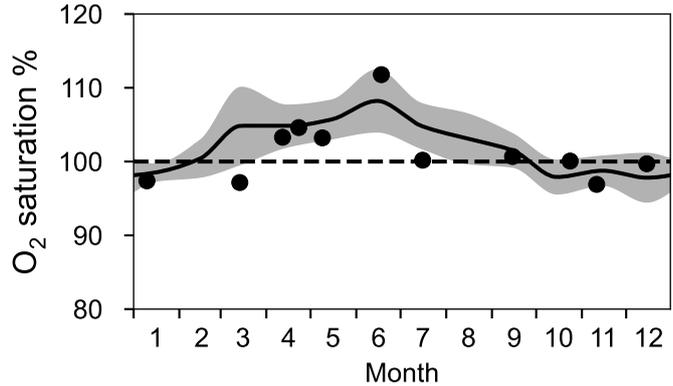
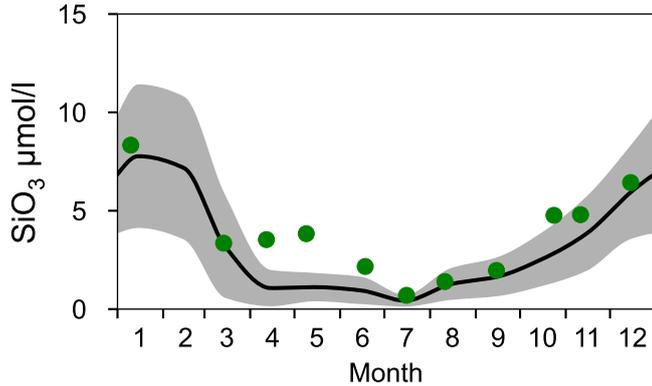
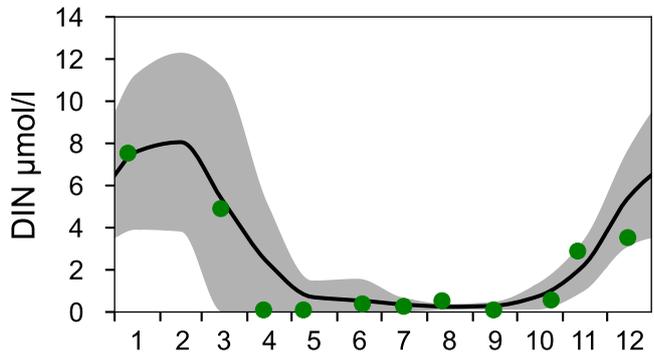
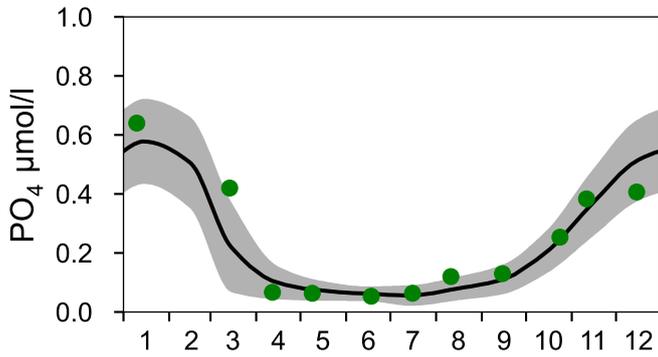
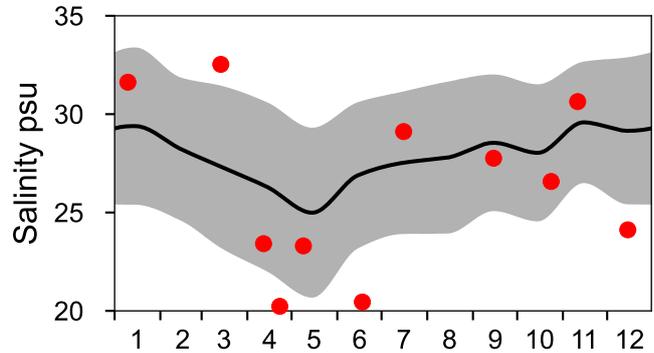
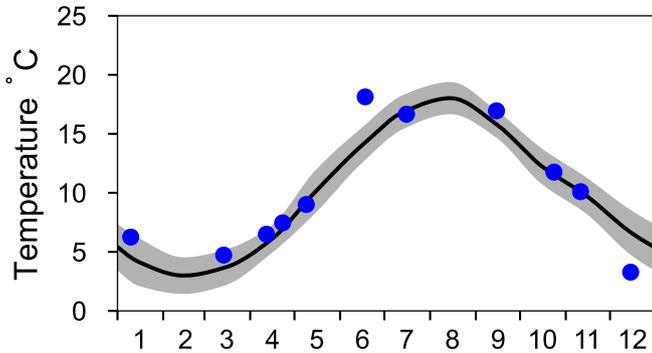
● 2023-12-15



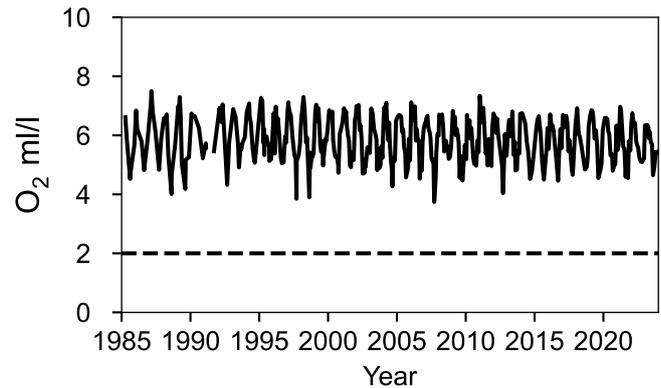
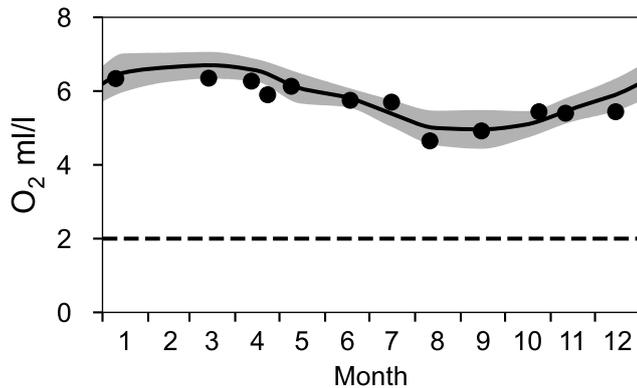
STATION P2 SURFACE WATER (0-10 m)

Annual Cycles

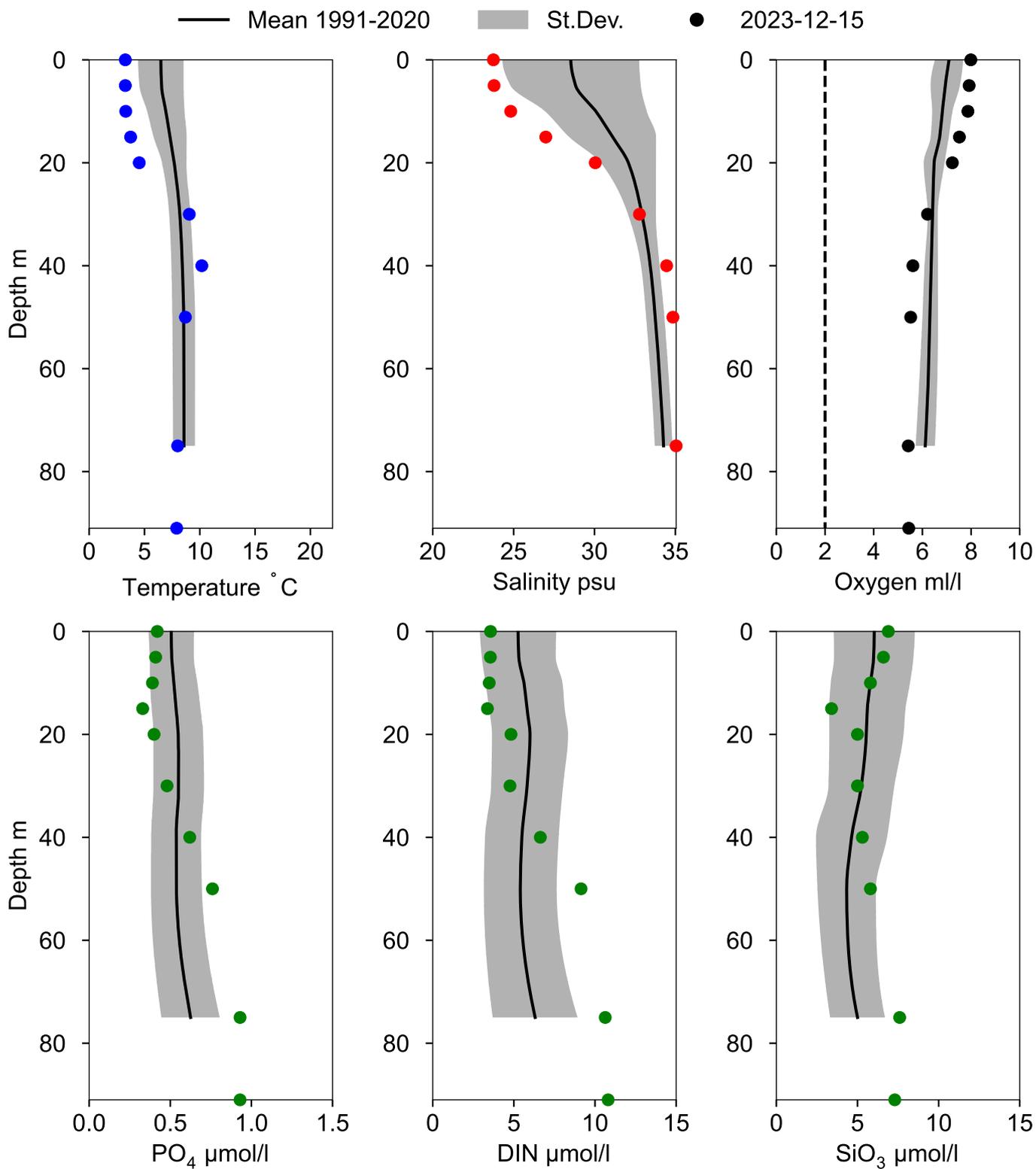
— Mean 1991-2020 St.Dev. ● 2023



OXYGEN IN BOTTOM WATER (depth >= 75 m)



Vertical profiles P2 December



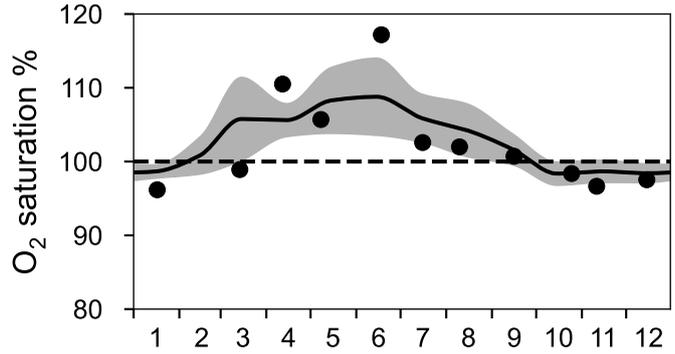
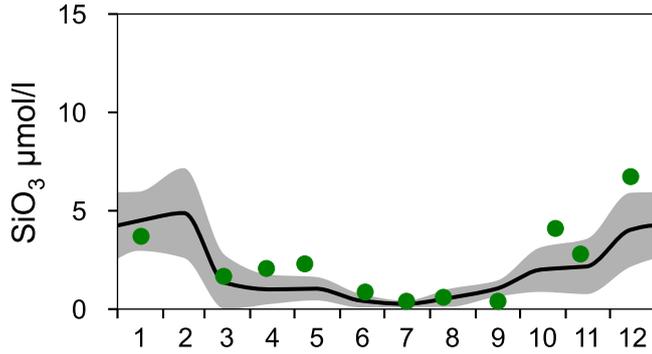
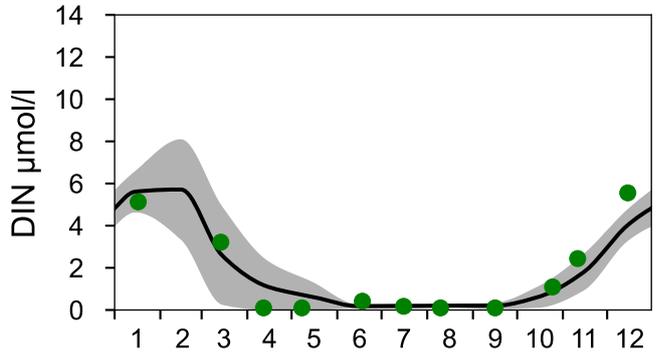
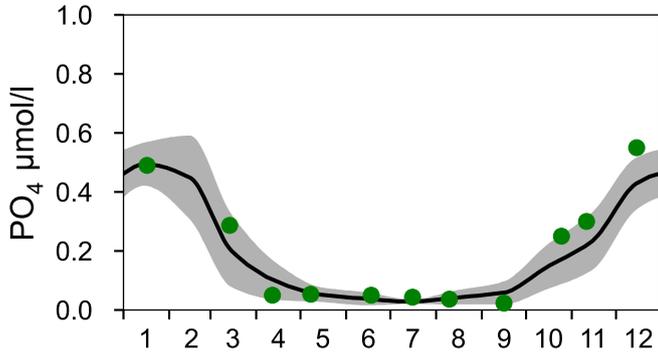
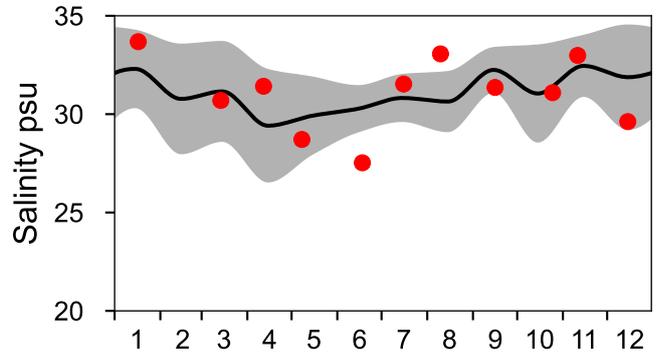
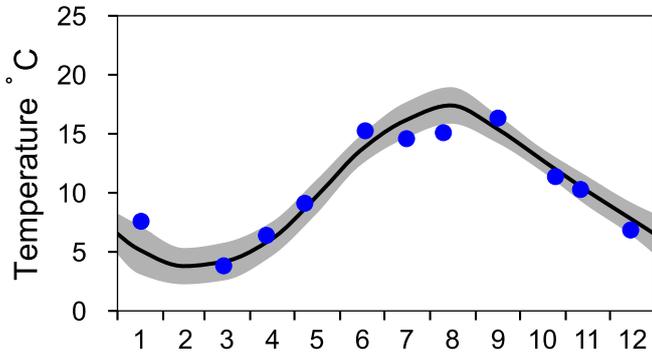
STATION Å17 SURFACE WATER (0-10 m)

Annual Cycles

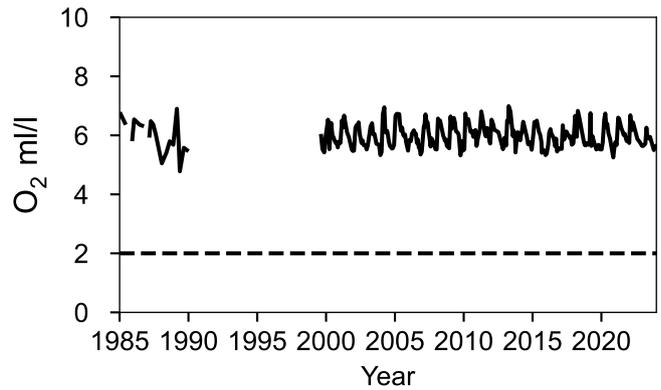
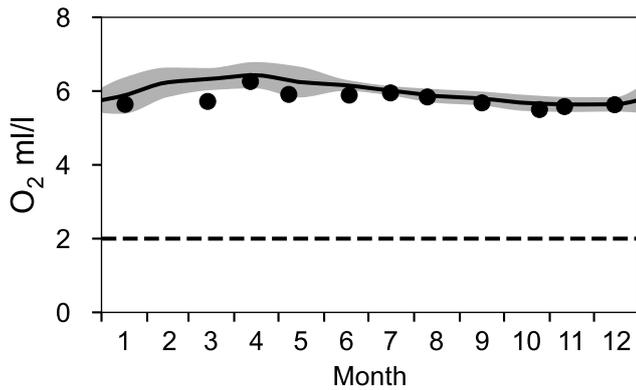
— Mean 1991-2020

■ St.Dev.

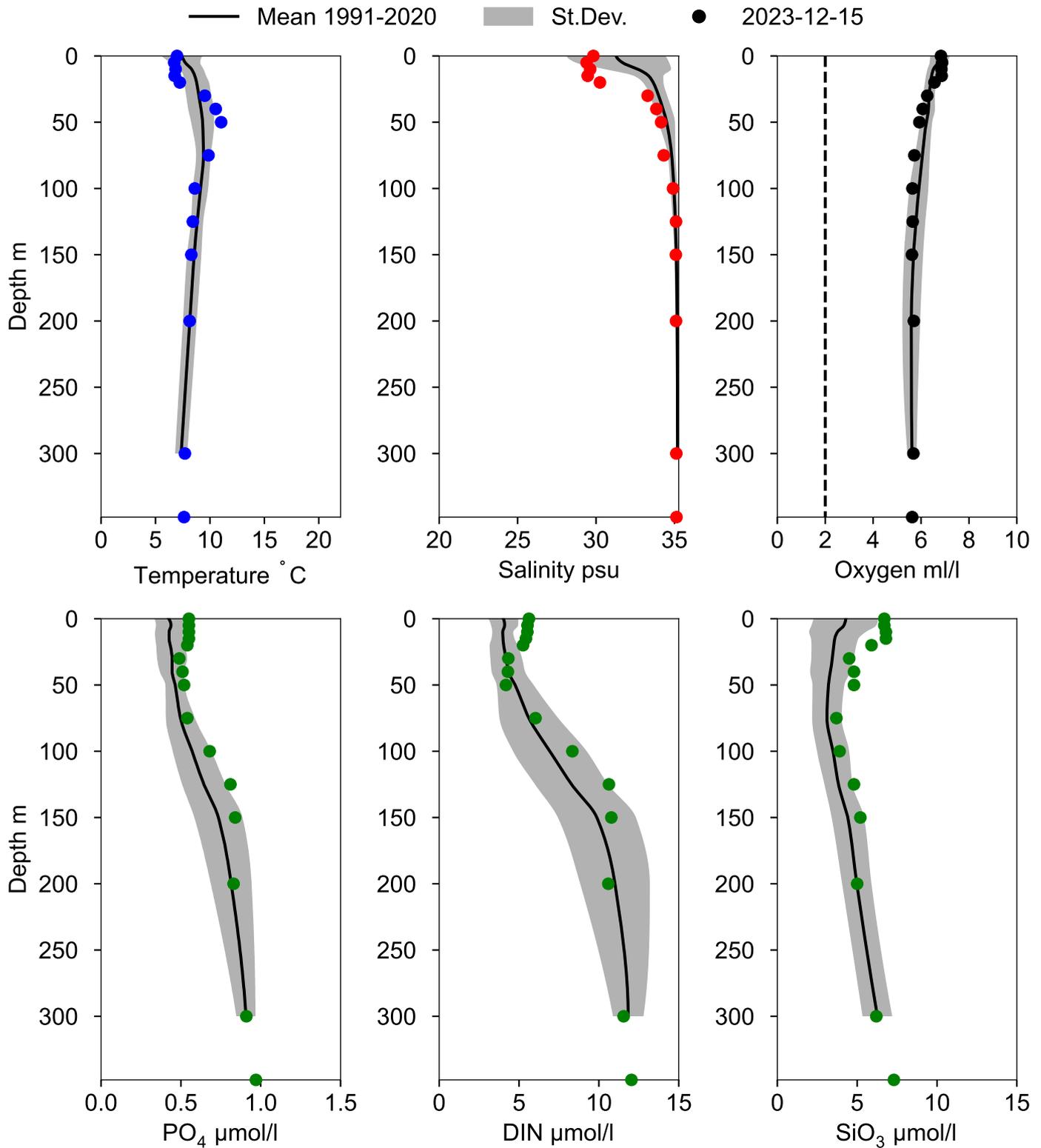
● 2023



OXYGEN IN BOTTOM WATER (depth >= 300 m)



Vertical profiles Å17 December



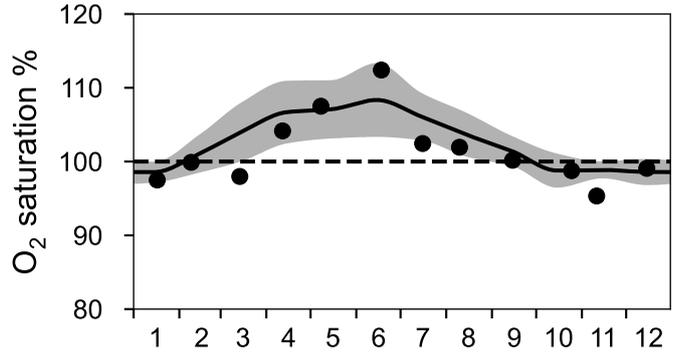
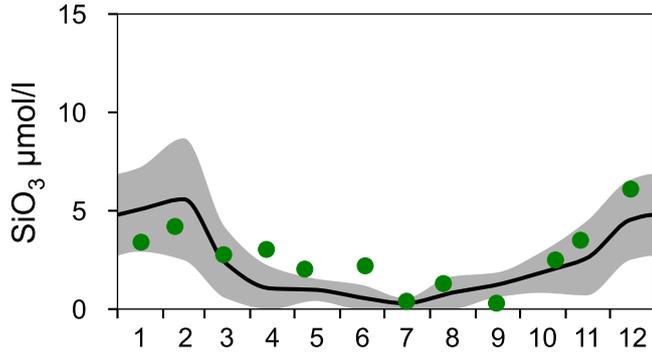
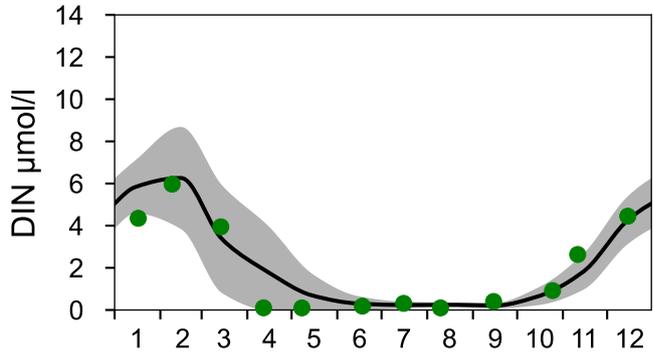
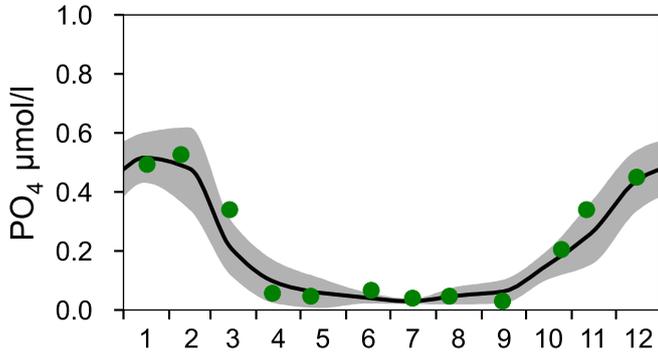
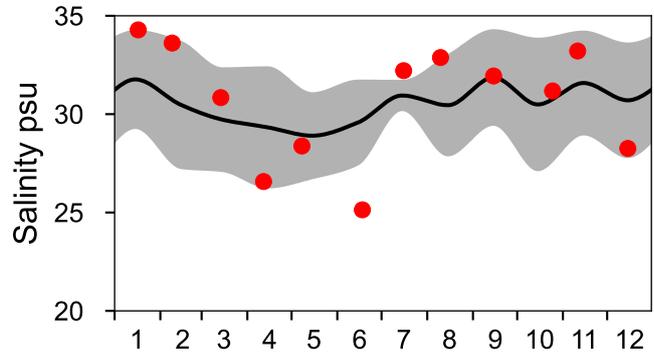
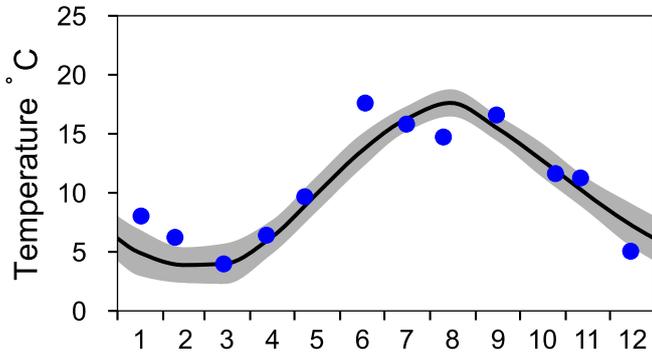
STATION Å15 SURFACE WATER (0-10 m)

Annual Cycles

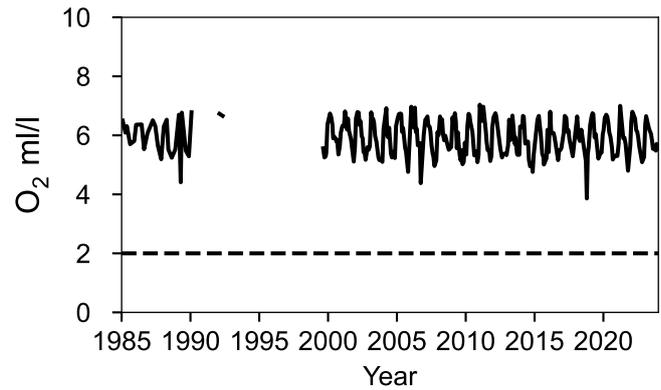
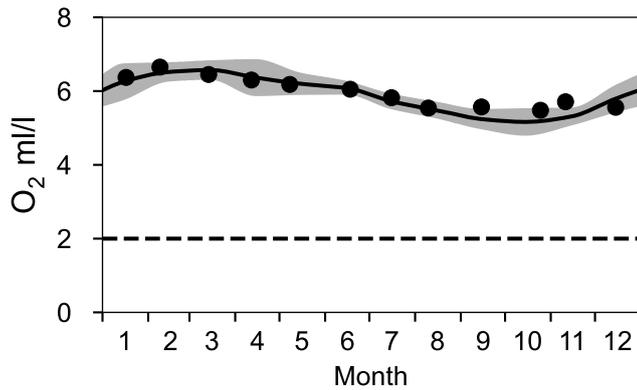
— Mean 1991-2020

■ St.Dev.

● 2023

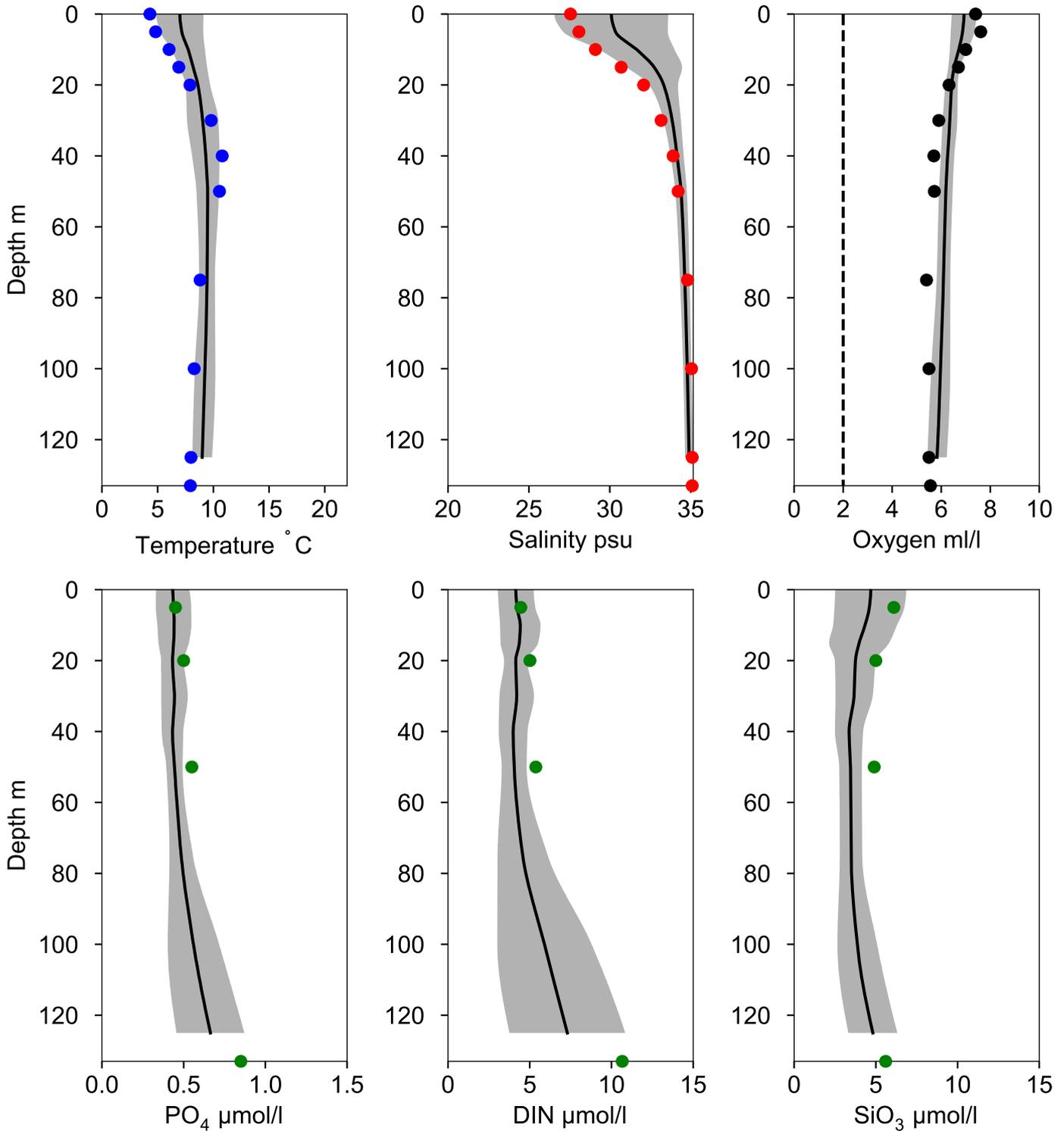


OXYGEN IN BOTTOM WATER (depth >= 125 m)



Vertical profiles Å15 December

— Mean 1991-2020 St.Dev. ● 2023-12-15



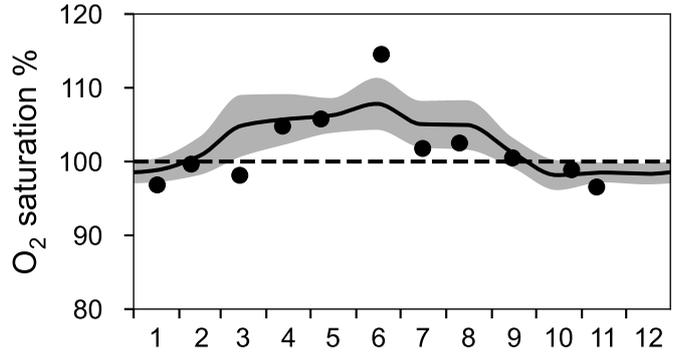
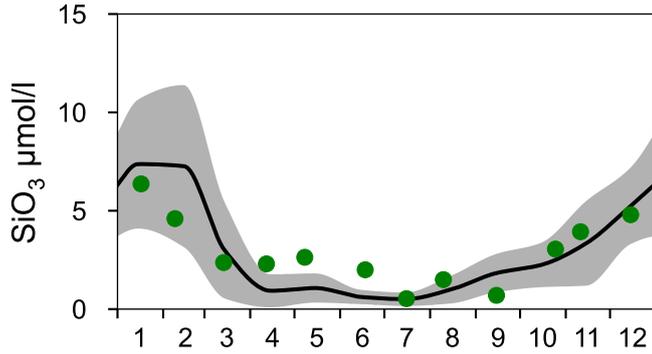
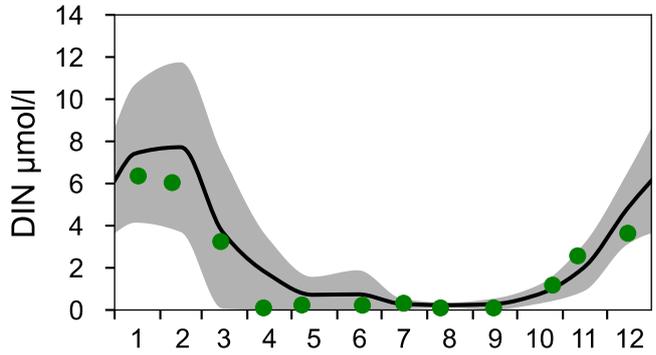
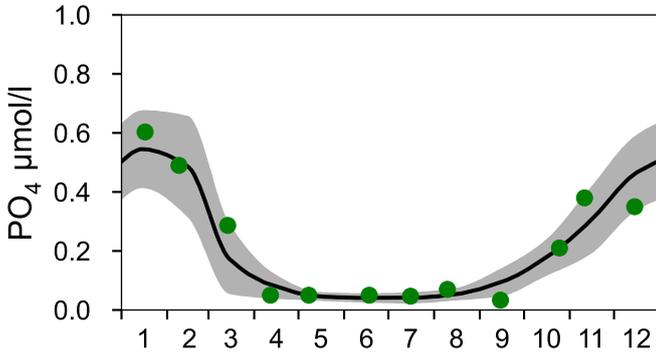
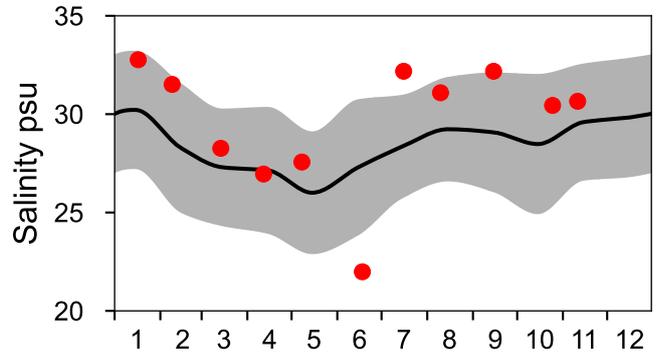
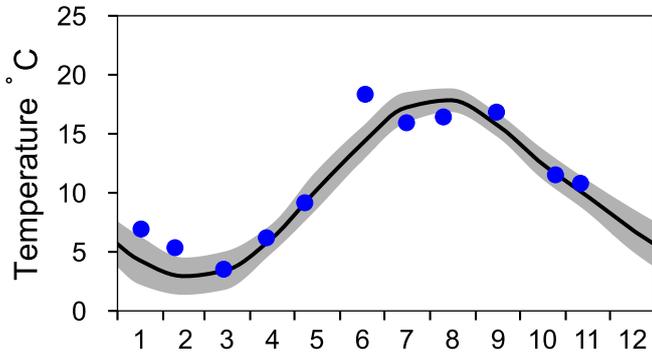
STATION Å13 SURFACE WATER (0-10 m)

Annual Cycles

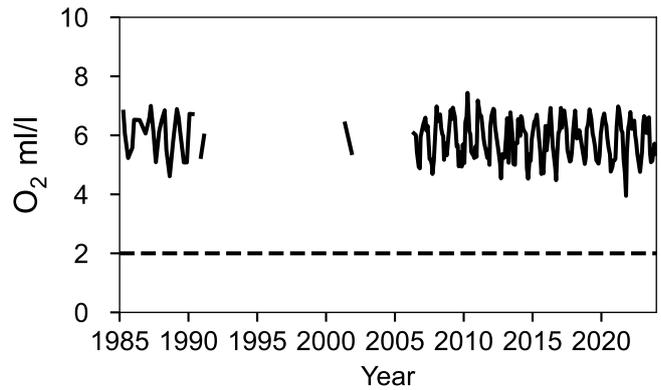
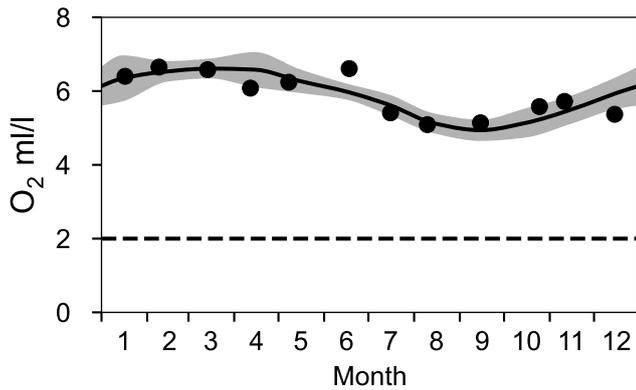
— Mean 1991-2020

■ St.Dev.

● 2023



OXYGEN IN BOTTOM WATER (depth >= 82 m)

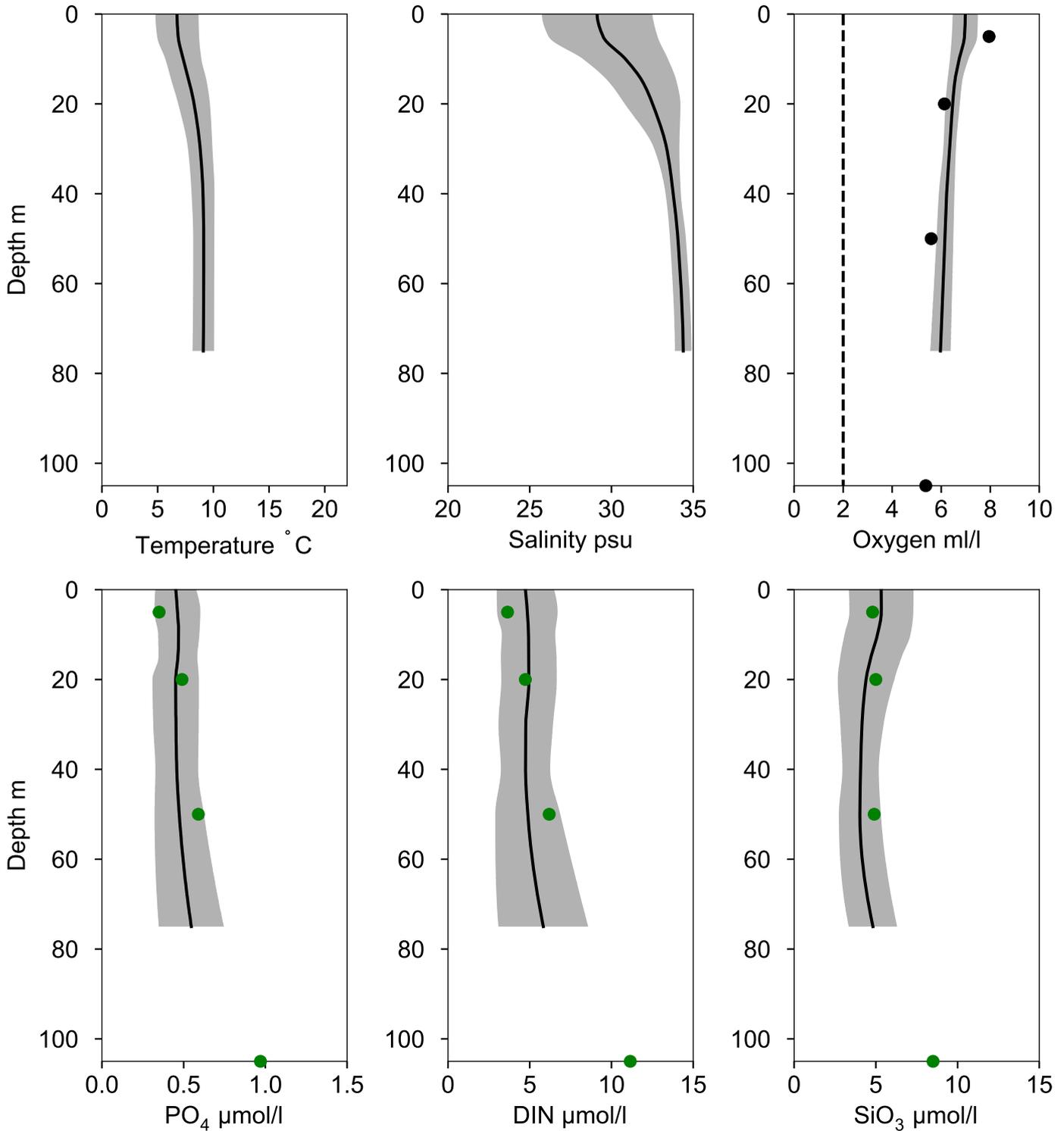


Vertical profiles Å13 December

— Mean 1991-2020

■ St.Dev.

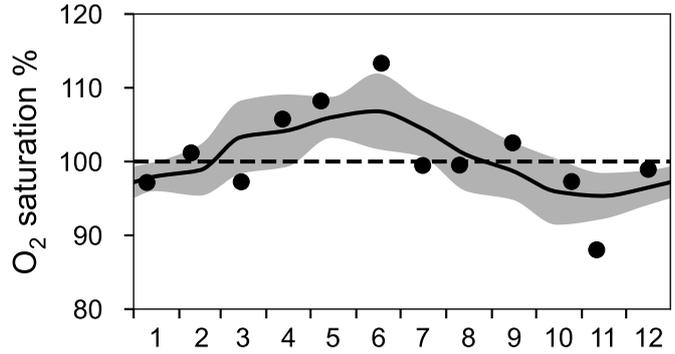
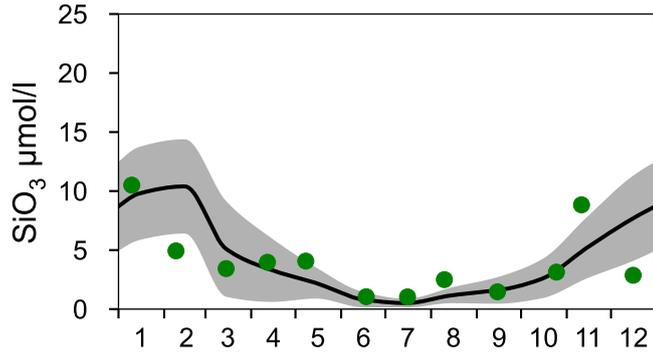
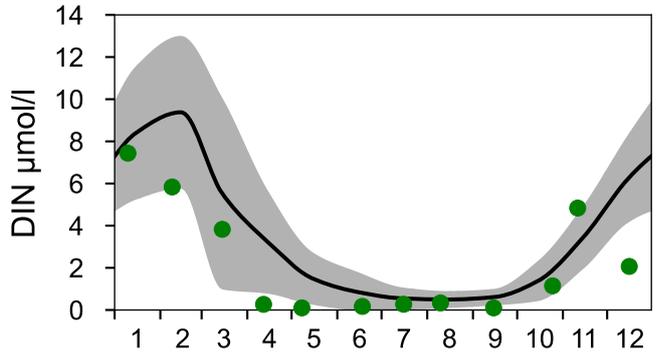
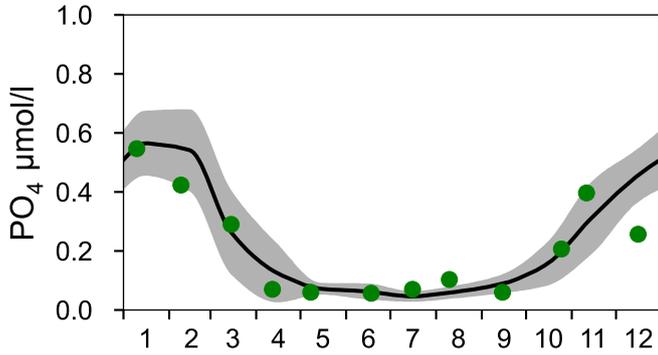
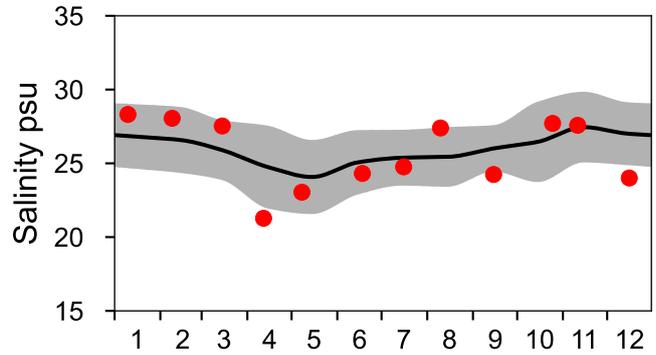
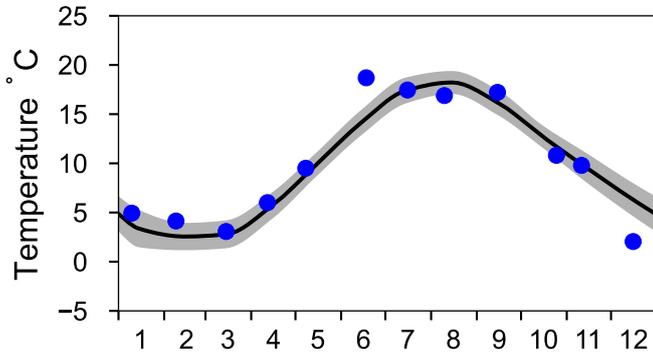
● 2023-12-15



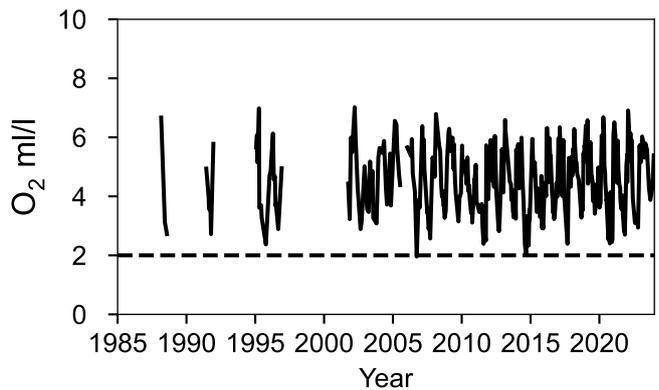
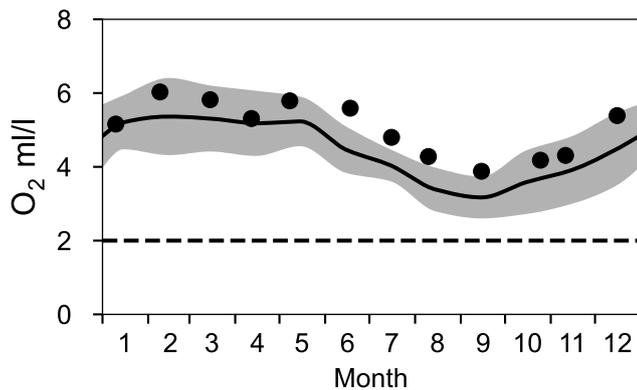
STATION SLÄGGÖ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 1991-2020 St.Dev. ● 2023



OXYGEN IN BOTTOM WATER (depth >= 64 m)



Vertical profiles SLÄGGÖ December

— Mean 1991-2020

■ St.Dev.

● 2023-12-16

