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

Photo: Anna-Kerstin Thell, SMHI

Survey period: 2024-07-14 - 2024-07-20

Principals : Swedish Meteorological and Hydrological Institute (SMHI), Swedish Agency for Marine and Water Management (SwAM)

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

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SUMMARY

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

The surface water temperatures in all sea areas were around normal, between 13.7 – 18.6 °C, except for BY39 where it was 9.4 °C, which is below normal.

Dissolved inorganic nitrogen and phosphate in the surface water showed low levels, which is normal for the season. Silicate levels in the surface water were slightly above to above normal at all stations in the Baltic Proper, the Öresund and the southern and coastal stations in the Skagerrak.

In the Baltic Proper, the oxygen situation was still very poor, only in the Arkona Basin and on BY39 good oxygen conditions were found. Acute oxygen deficiency, i.e. oxygen levels less than 2 ml/l, was noted from 55 - 75 meters in the Western and Eastern Gotland Basin, with the exception of the shallow station BY39. Hydrogen sulfide was measured from 70 to 80 meters deep in the Western Gotland Basin and from 80 to 125 meters deep in the Eastern Gotland Basin. In the Bornholm Basin and Hanö Bay, there was an acute oxygen deficiency from a depth of 70 meters, but no hydrogen sulphide in the bottom water

At several stations in the Baltic Proper, high peaks of chlorophyll fluorescence occurred from the surface down to a depth of 15 meters. Surface accumulations of cyanobacteria were noted at stations BY2 and BY4 in the Arkona and Bornholm Basins. More information about the algae situation can be found in the Algaware report for July;
https://www.smhi.se/publikationer/publikationer/algrapporter.

The next cruise is planned to start August 10th in Lysekil.

RESULTS

The cruise was carried out on board the R/V Svea and started in Falkenberg on July 14th and ended in Lysekil on July 20th. The cruise was dominated by warm, calm and clear weather with light winds, which, at the most, reached 14 m/s in the Western Gotland Basin. The air temperature varied between 17 - 28°C.

Svea's instrument for continuous measurements of surface water, Ferrybox, was in operation throughout the cruise. In the Skagerrak between Å17 and Å15 and between Å15 and Å13, Svea's MVP (Moving Vessel Profiler) was in use underway and provided profiles with temperature, salinity, oxygen and chlorophyll fluorescence.

At all stations, surface water was sampled for a project investigating and analysing algal toxins produced by cyanobacteria. The project is a collaboration between SMHI, SLU and the Swedish Food Agency, and sampling is planned to be carried out during the cruises in June, July, August and September

At two stations in the Baltic Sea, BY38 and BY2, extra samples were taken in collaboration with VOTO. Water samples from the standard depth from the surface down to 30 meters were sampled to investigate the presence of cyanobacteria in the water column and the aim is to investigate whether it is possible to predict future blooms of cyanobacteria. These measurements will be taken during the June, July and August cruises.

Samples were also taken within the AMIME project where water samples were taken from the Ferrybox and pictures were taken with the IFCBn. Measurements within the project will be made during the cruises in June-October

Extra phytoplankton samples from the surface water were taken at stations Anholt E and Å17 for Uppsala University. At Anholt E, extra samples of microzooplankton were also taken for Gothenburg University.

During the cruise, phytoplankton samples were analyzed on board by phytoplankton expert Anders Torstensson. The results are presented in the July AlgAware report:
https://www.smhi.se/publikationer/publikationer/algrapporter.
Daily algae monitoring via satellite is carried out by SMHI during the summer and is available at:
https://www.smhi.se/vader/observationer/algsituationen/alger

This report is based on data that has undergone an initial quality control. When additional quality review has been performed, certain values may change. Data from the cruise is published as soon as possible on the data host, SMHI's website. This usually takes place within one to two weeks 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

The Skagerrak

The surface water temperature varied between 16.1 - 18.6°C, which is normal for the time of year. Surface water salinities ranged between 20 – 32 psu, with the lowest concentrations measured on the coast and highest in the south, which is slightly lower than normal on the coast and slightly higher than normal in the south.
The halocline was weakly developed in the area. The thermocline was clearly visible at most stations at depths between 45 and 75 meters. Å13 and Släggö also showed a temperature stratification at a depth of 10-40 meters

The concentrations in the surface of dissolved inorganic nitrogen (DIN) were normal for the season and were lower than the detection limit (0.1 µmol/l) in the off-shore area and 1.2 µmol/l at Släggö. Phosphate levels varied between 0.03 – 0.07 µmol/l, which is normal for the time of year. The concentration of silicate in the surface water was normal for the season in the northern area, while in the southern and coastal areas the levels were above normal. Measured levels in the lake were 0.1–0.7 µmol/l and at P2 and Släggö the level was 3.0 µmol/l.

The lowest oxygen concentration in the bottom water was measured at Släggö, 3.3 ml/l. In the off-shore area, levels were measured in the deep water of 4.8 - 5.8 ml/l, which is normal.

Chlorophyll fluorescence measurements with CTD, which is a measure of phytoplankton activity, showed activity between 5 and 40 meters in the area.

The Kattegat and the Öresund

The temperature in the surface water was around 17.3 – 18.2°C, which is normal for the time of year. The surface salinity in the Kattegat varied between 19 – 22 psu, which is normal. In the Öresund, the salinity in the surface was 8 psu, which is lower than normal. In the Kattegat and in the Öresund, the temperature and salinity gradient layer was found between 10 and 20 meters. At Anholt E and N14 Falkenberg there was another temperature stratification at a depth of 25-30 metres.

The concentrations of nutrient in the surface water were almost all normal to slightly lower than normal in the area. The content of DIN was <0.1 µmol/l and phosphate varied between 0.05-0.13 µmol/l. The silicate concentration varied between 0.1-12.3 µmol/l, the highest concentration was measured in the Öresund, where it was well above normal.

Oxygen measurements showed normal values in the bottom water: around 4.3 - 4.5 ml/l in the Kattegat and 4.0 ml/l in the Öresund.

In the Öresund, a chlorophyll fluorescence around 15 meters was noted. In the Kattegat, activity was low according to chlorophyll fluorescence measurements with CTD, only little activity at 15 meters on Anholt E.

The Baltic Proper

The temperature in the surface water was around normal in the entire Baltic Proper, with temperatures between 13.7 – 18.5°C. At BY39 Ölands södra udde, the surface temperature was 9.4°C, which is lower than normal. Surface salinity was 6.4-7.4 psu and varied from normal to slightly above normal throughout the investigated area. A temperature stratification existed between 15 and 30 meters in the area. Further stratifications of both temperature and salinity was found at depths between 35 and 70 metres.

The concentrations of dissolved inorganic nitrogen (DIN) in the surface water were at levels below the detection limit, <0.10 µmol/l, at all stations.
The phosphate content in the surface water was normal for the season at most stations and varied between 0.07 – 0.49 µmol/l. Higher than normal phosphate levels were noted in the Western Gotland Basin.
The concentration of silicate in the surface water was slightly above to above normal at all stations, with concentrations between 10.6 – 14.9 µmol/l

In the Baltic Proper, the oxygen situation was still very poor, only in the Arkona Basin and on BY39 good oxygen conditions were found.
Acute oxygen deficiency, i.e. oxygen levels less than 2 ml/l, was noted from 55 - 75 meters in the Western and the Eastern Gotland Basin, with the exception of the shallow station BY39. Hydrogen sulfide was measured from 70 to 80 meters deep in the Western Gotland Basin and from 80 to 125 meters deep in the Eastern Gotland Basin.
In the Bornholm Basin and the Hanö Bay, there was acute oxygen deficiency from a depth of 70 meters. No hydrogen sulphide was detected at these stations.
In the Arkona Basin, the situation was slightly better with concentrations of between 3.0 - 3.8 ml/l in the bottom water

At several stations, high peaks of chlorophyll fluorescence occurred from the surface down to a depth of 15 meters. Surface accumulations of cyanobacteria were noted at stations BY2 and BY4 in the Arkona and the Bornholm Basins. More information about the algae situation can be found in the Algaware report for July; https://www.smhi.se/publikationer/publikationer/algrapporter

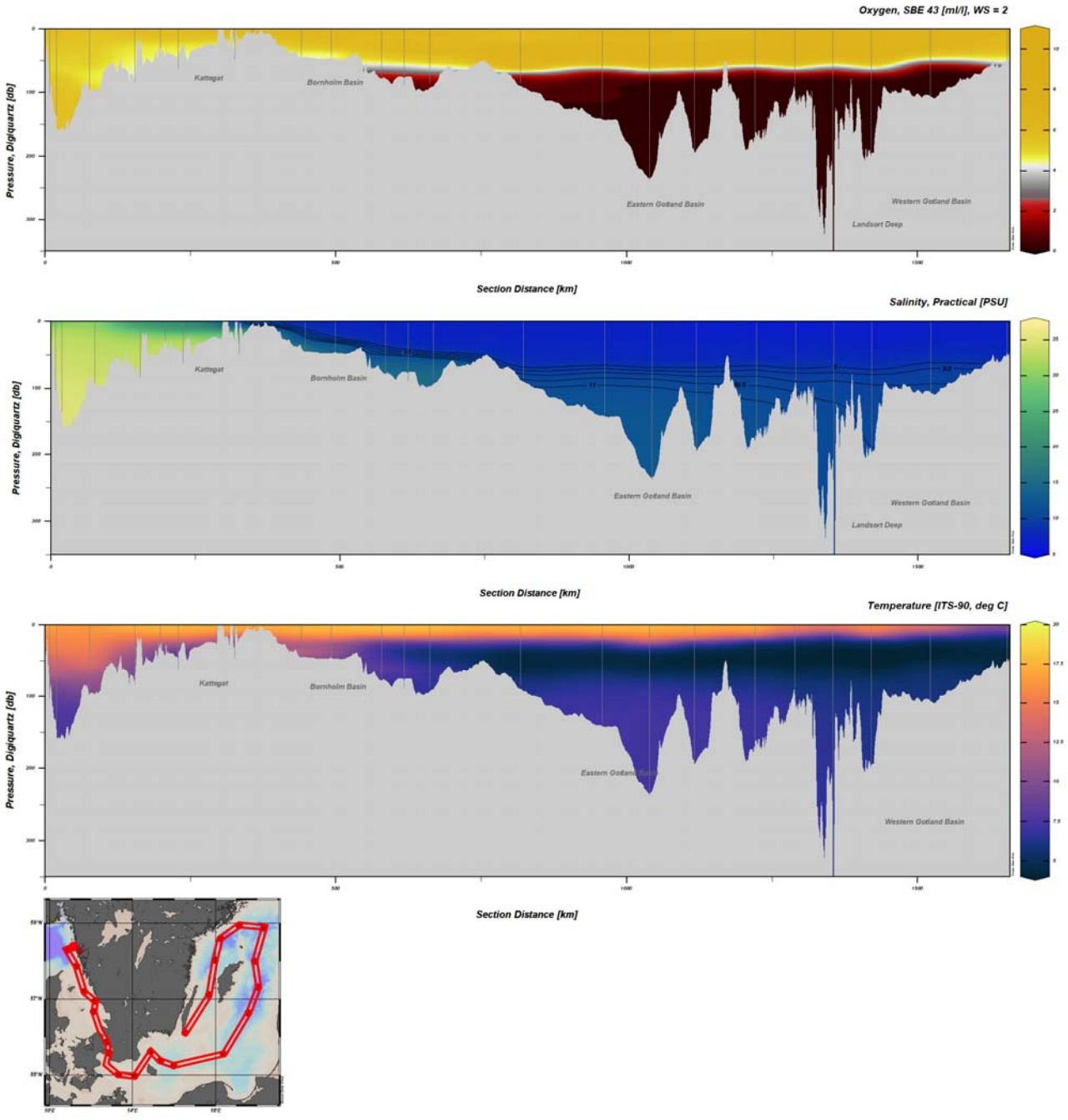

Figure 1. Transects ranging from the Skagerrak, through the Kattegat and The Sounds, further into the Baltic Proper, ending in the Western Gotland Basin shows the oxygen, salinity and temperature. Grey vertical lines indicate the positions where data is collected, also shown in the map.

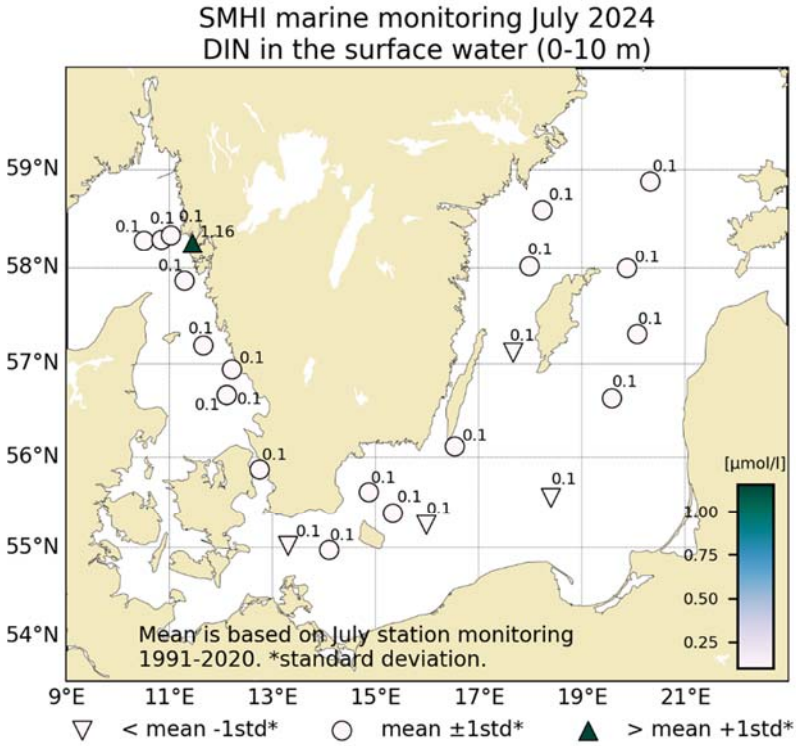

Figure 2. Concentration of dissolved inorganic nitrogen in the surface water (0-10m).

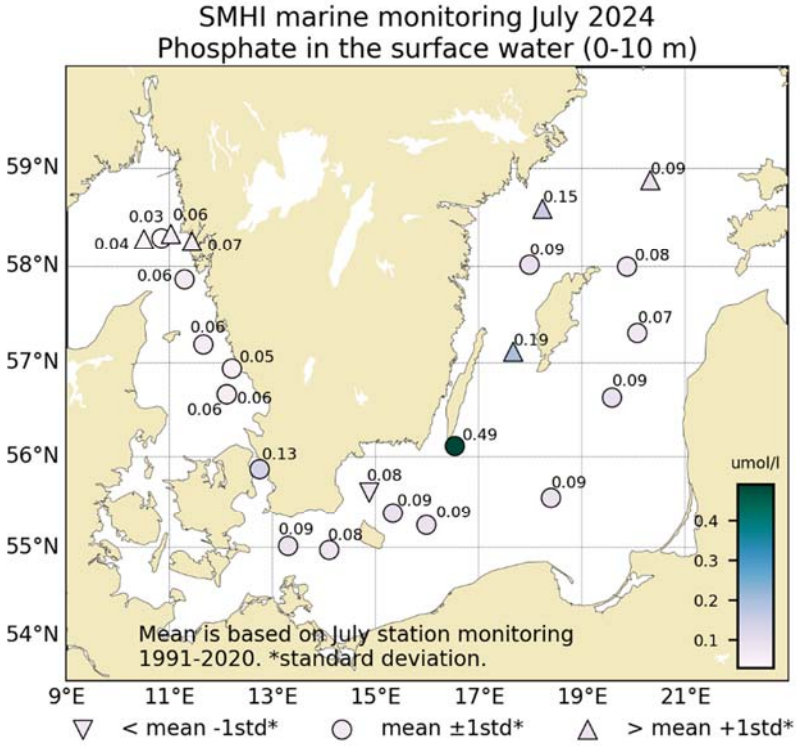

Figure 3. Concentration of phosphate in the surface water (0-10m).

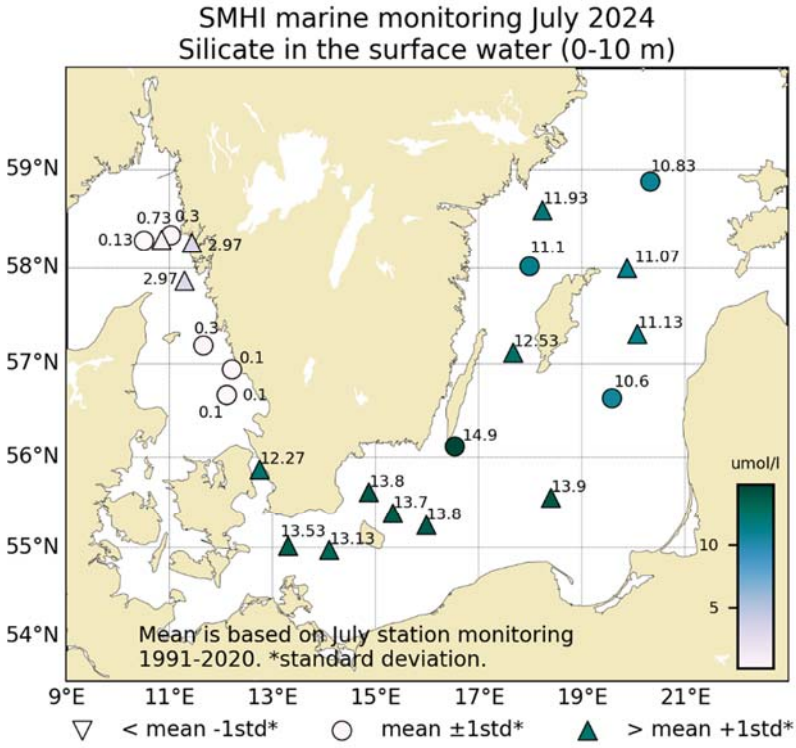

Figure 4. Concentration of silicate in the surface water (0-10m).

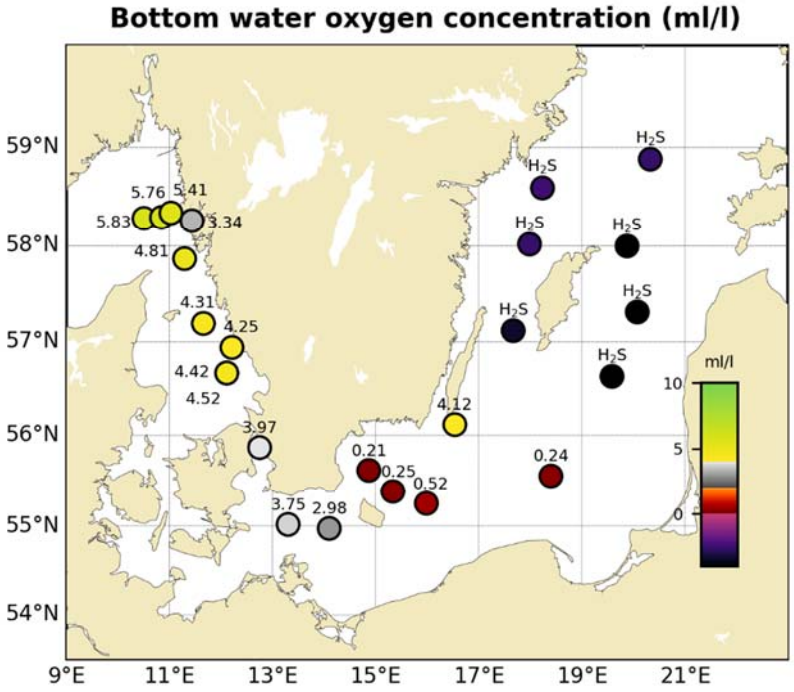

Figure 5. Oxygen concentration in the bottom water.

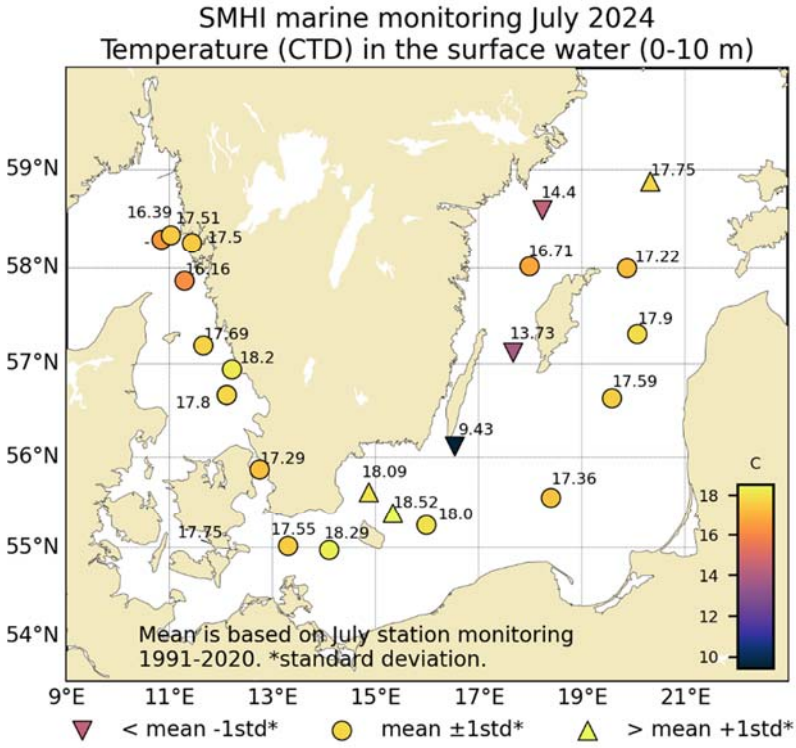

Figure 6. Temperature in the surface water (0-10m).

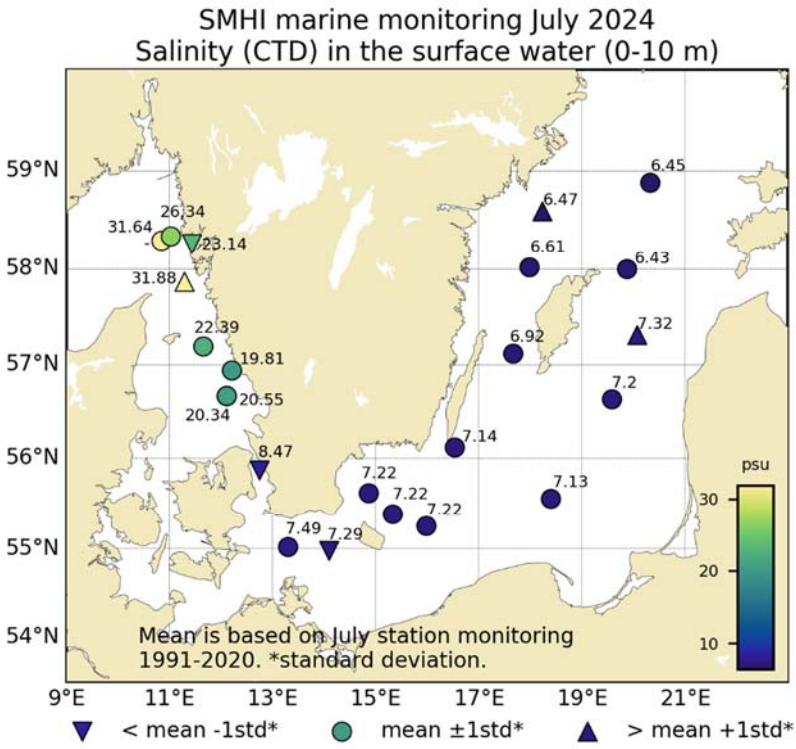

Figure 7. Salinity in the surface water (0-10m).

PARTICIPANTS

Namn	Roll	Från
Anna-Kerstin Thell	Chief scientist, Marine chemist	SMHI
Sara Johansson	Marinkemist	SMHI
Johanna Linders	Oceanographer	SMHI
Sari Sipilä	Marine chemist	SMHI
Ann-Turi Skjevik	Marin biologist	SMHI
Anders Torstensson	Marin biologist	SMHI

APPENDICES

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

SMHI

SWEDAC ACKREDITERING
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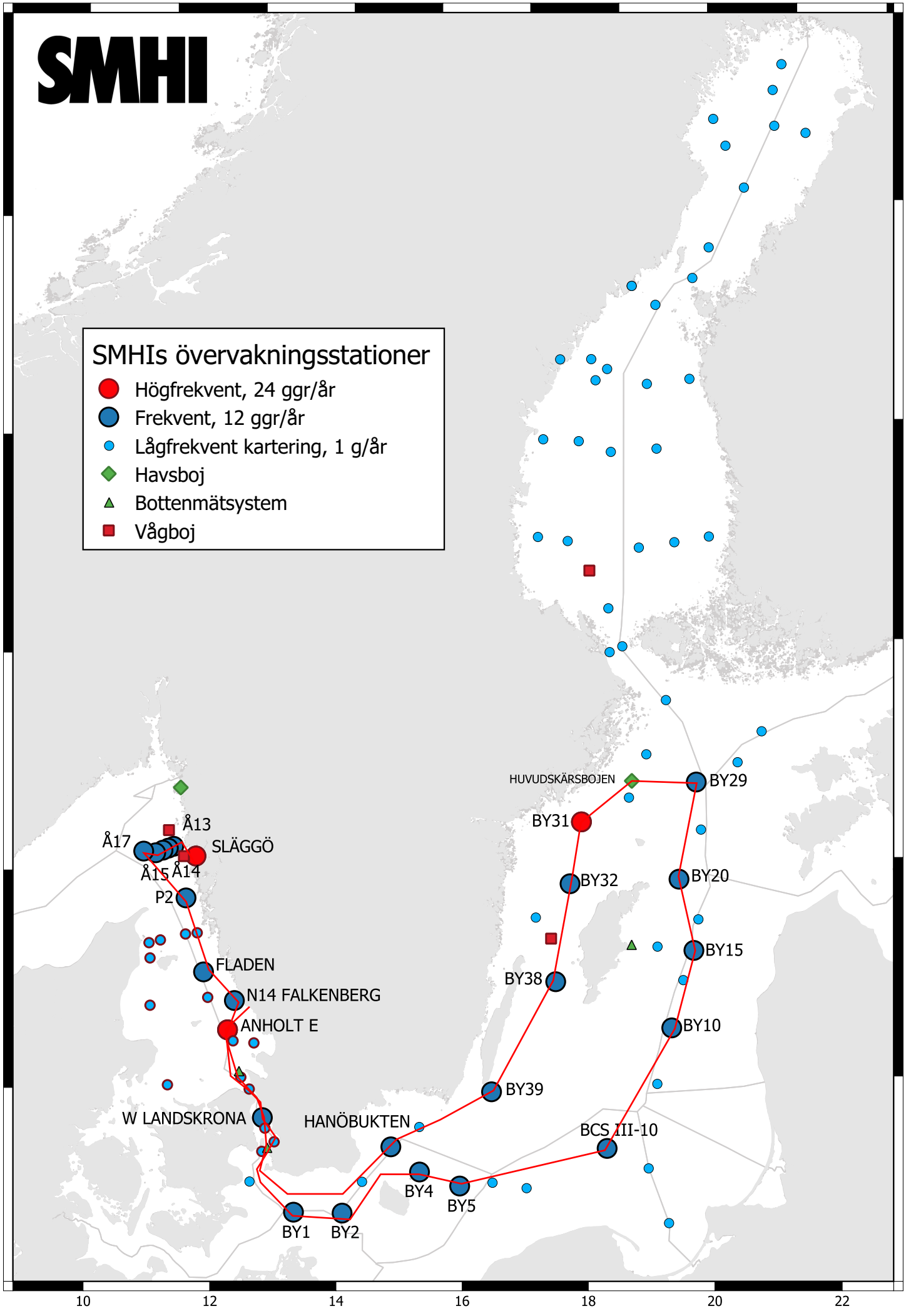
ISO/IEC 17025

Havs och Vatten myndigheten


SMHI
SMHIs övervakningsstationer
Högfrekvent, 24 ggr/år
Frekvent, 12 ggr/år
Lågfrekvent kartering, 1 g/år
Havsboj
Bottenmätsystem
Vågboj
HUVUDSKÄRSBOJEN
BY29
BY31
BY32
BY20
BY15
BY38
BY10
BY39
BCS III-10
HANÖBUKTEN
W LANDSKRONA
BY4
BY5
BY1
BY2
Å13
Å17
SLÄGGÖ
Å15
Å14
P2
FLADEN
N14 FALKENBERG
ANHOLT E
64
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22

Date: 2024-07-22
Time: 21:20

Ship: 77SE
Year: 2024

Ser no	Cru no	Stat code	Proj	Stat name	Lat	Lon	Start date yyyymmdd	Start time hhmm	Bottom depth m	Secchi depth m	Wind dir	Wind vel	Air temp C	Air pres hPa	WCWI (Weath Cloud Waves Iceob)	CZPP (Chla Zoop Phytop Pp)	No de	No btl	Temp_btl	Temp_ctd	Salt_btl	Salt_ctd	Ph	Doxy_btl	Doxy_ctd	H2s	Phos	Ptot	Ntri	Ntra	Ntrz	Amon	Ntot	Alky	Sio3-si	Humus	Comnt_visit	Comnt_samp
0559	16	KAEX29	BAS...	ANHOLT E	5640.11	01206.64	20240714	1830	62		20	6	21	1014	1230	xxx-	10		x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	-	x	x	x	-
0560	16	SOCX39	BAS...	W LANDSKRONA	5551.99	01244.91	20240715	0130	52		16	7	18	1014	9990	x---	9		-	x	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	-	x	-
0561	16	SOSX00	EXT...	FLINTEN 7	5535.32	01250.69	20240715	0415	9		17	6	18	1009	1720	----	3		-	x	-	x	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
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0563	16	BPSA03	BAS...	BY2 ARKONA	5458.27	01405.90	20240715	1220	47	4	27	2	26	1016	1420	xxx-	8		x	x	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	x	-
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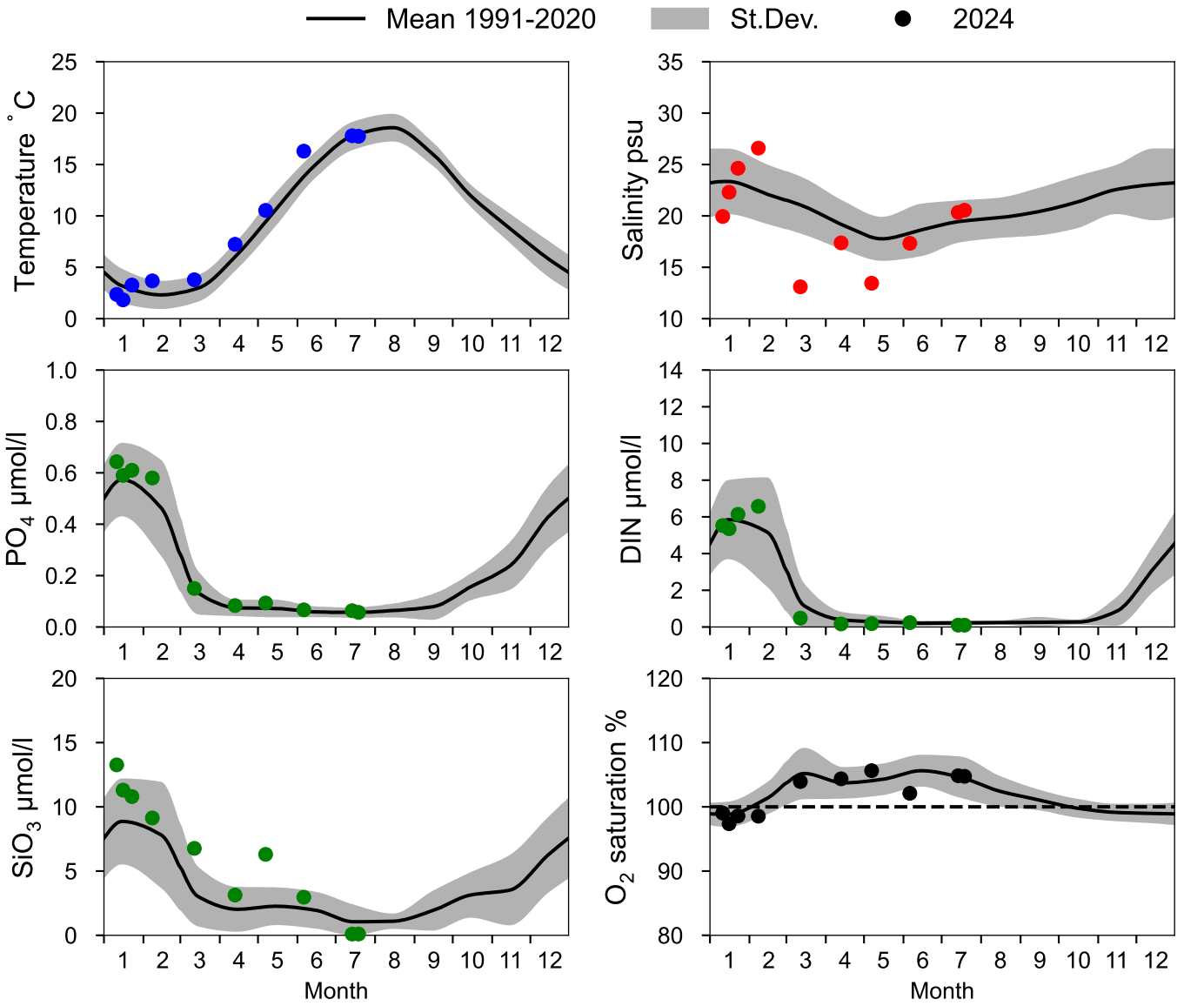
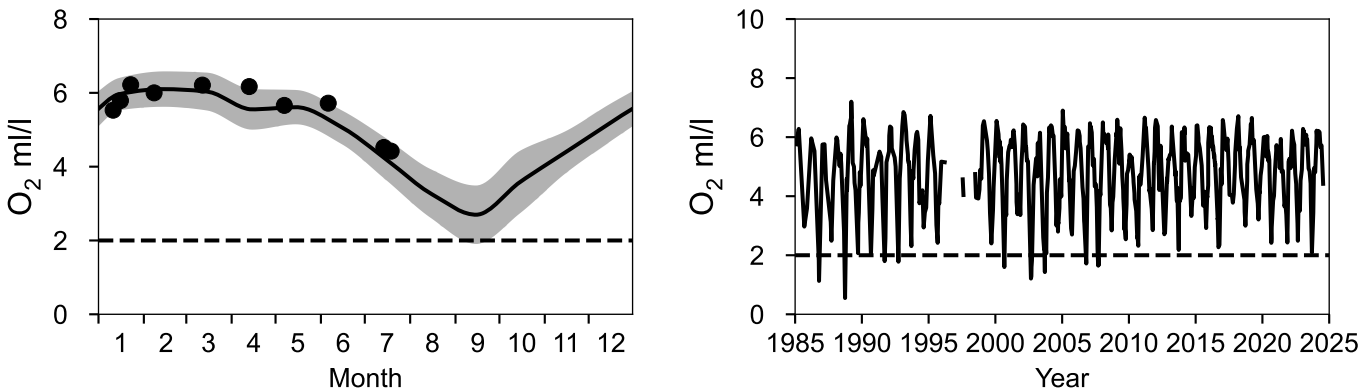
STATION ANHOLT E SURFACE WATER (0-10 m)

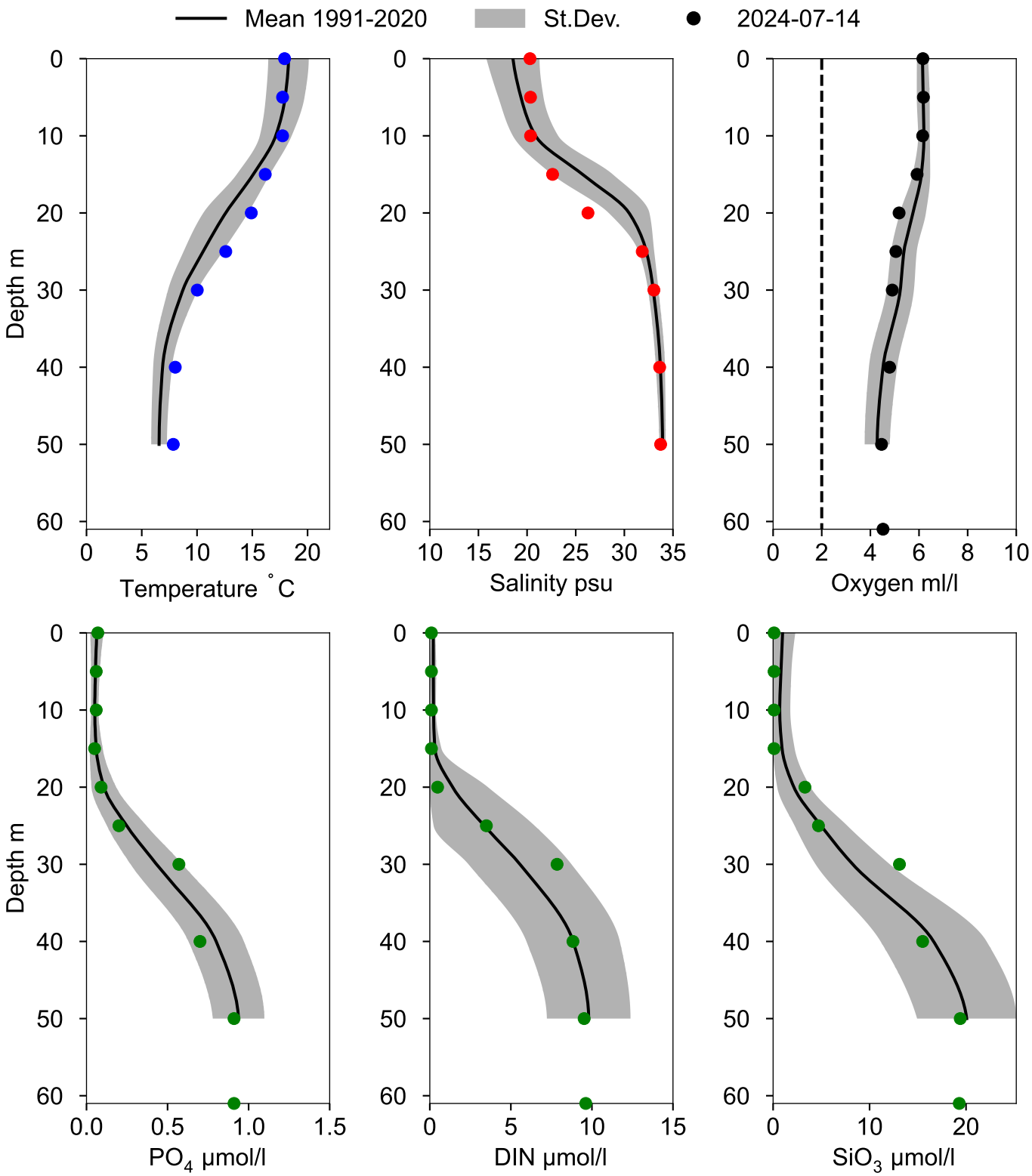
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 52 m)

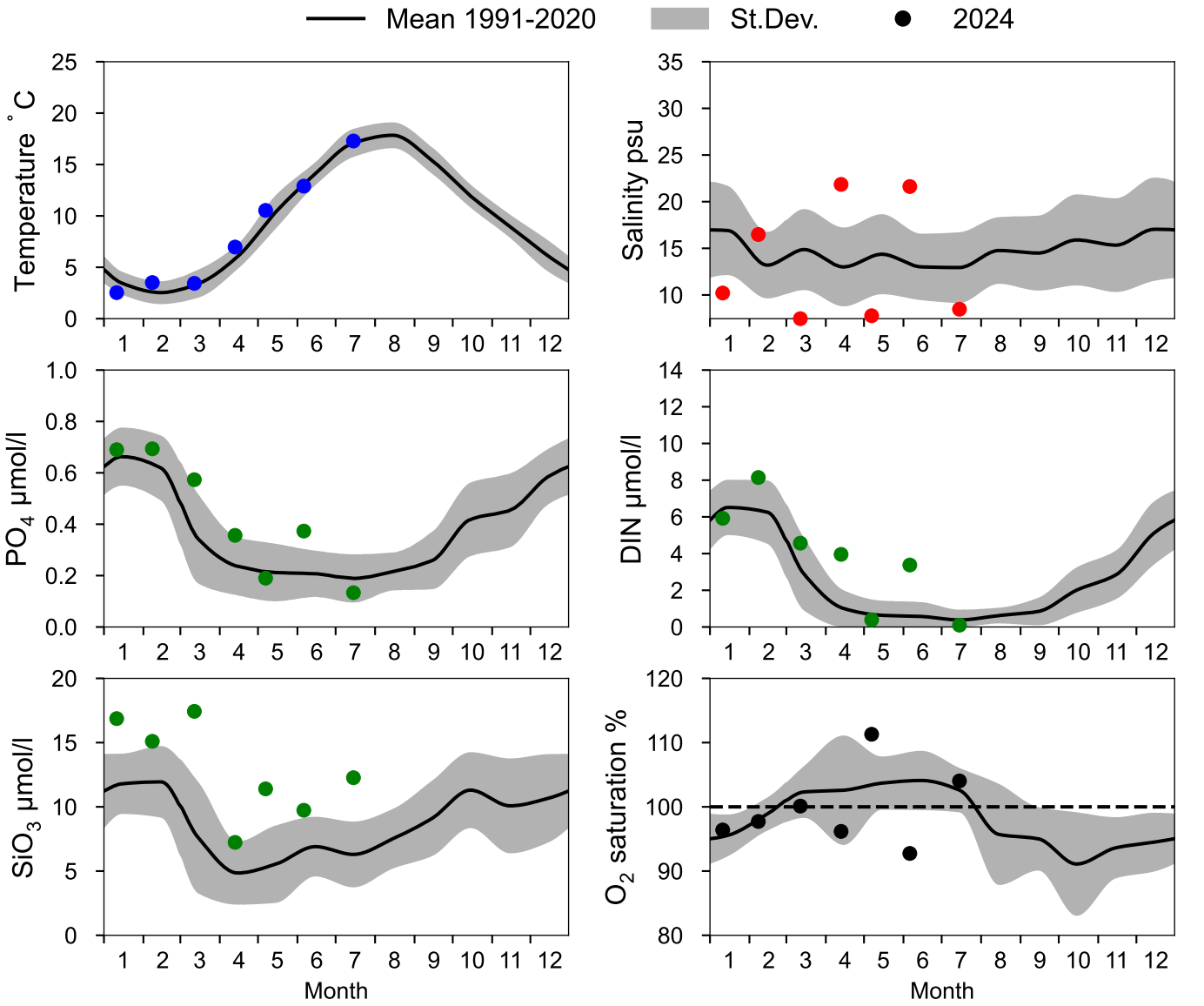


Vertical profiles ANHOLT E
July

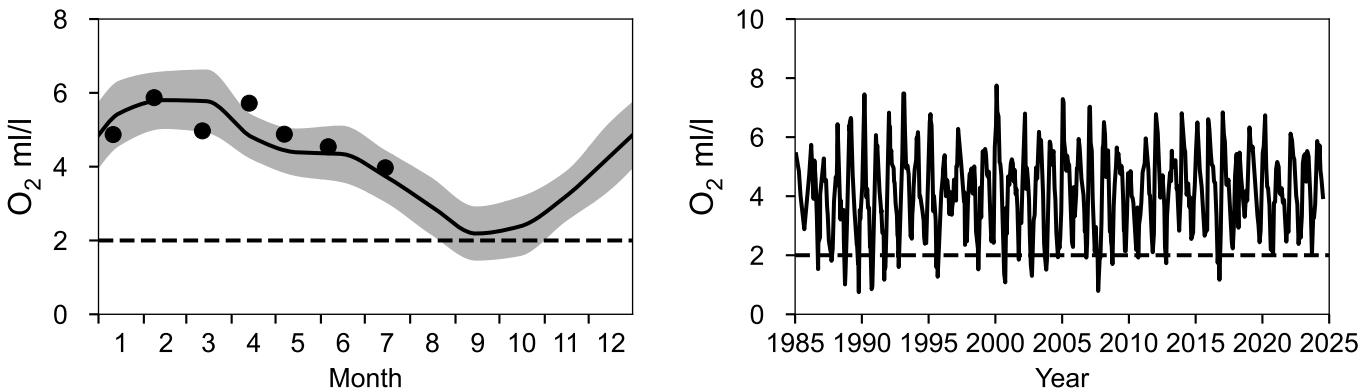


STATION W LANDSKRONA SURFACE WATER (0-10 m)

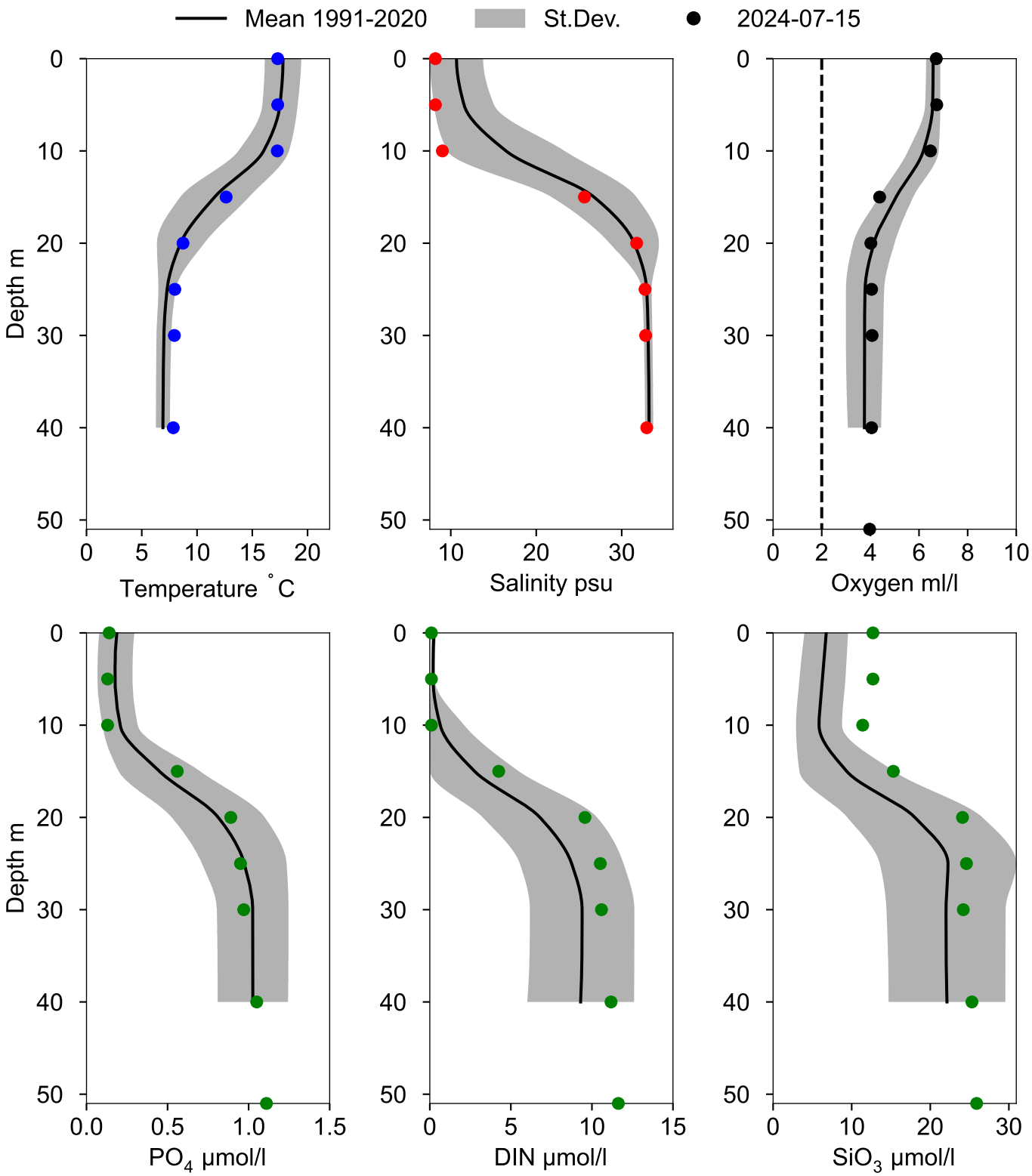
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 40 m)

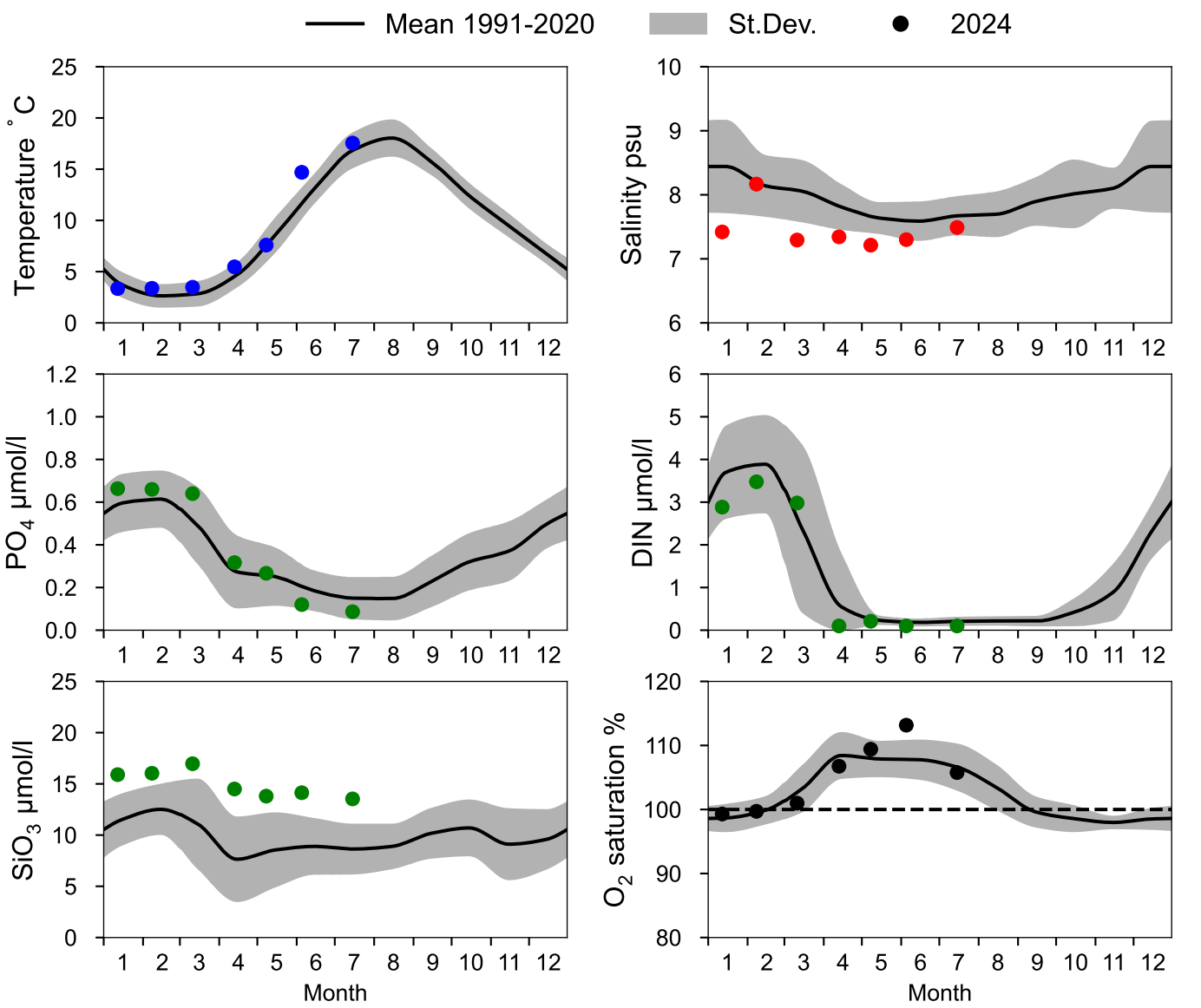


Vertical profiles W LANDSKRONA
July

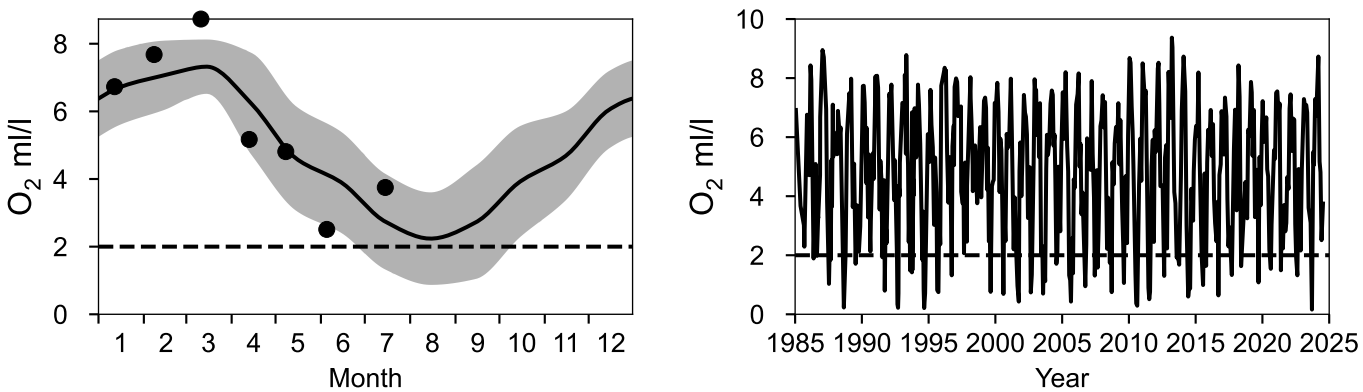


STATION BY1 SURFACE WATER (0-10 m)

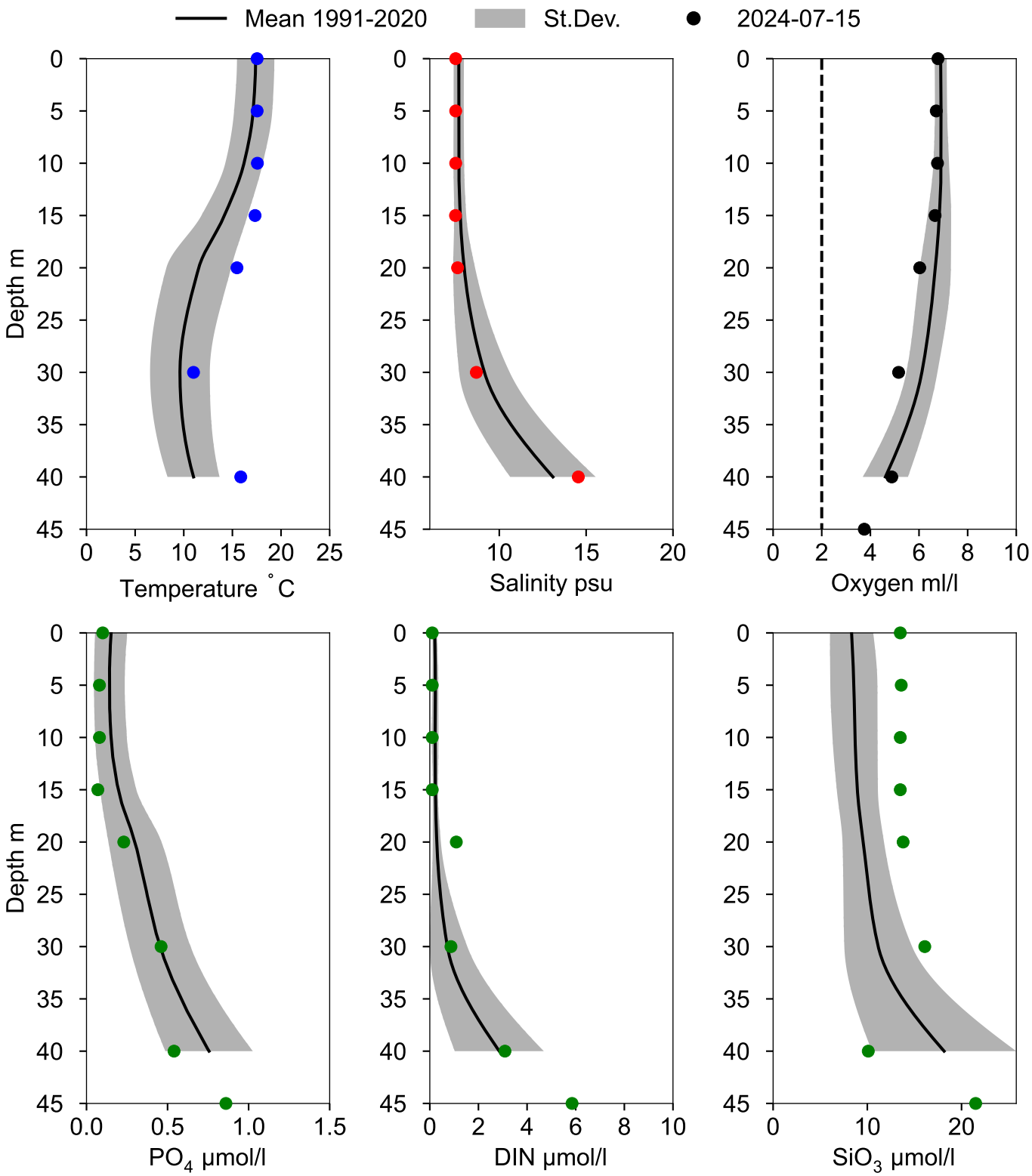
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 39 m)

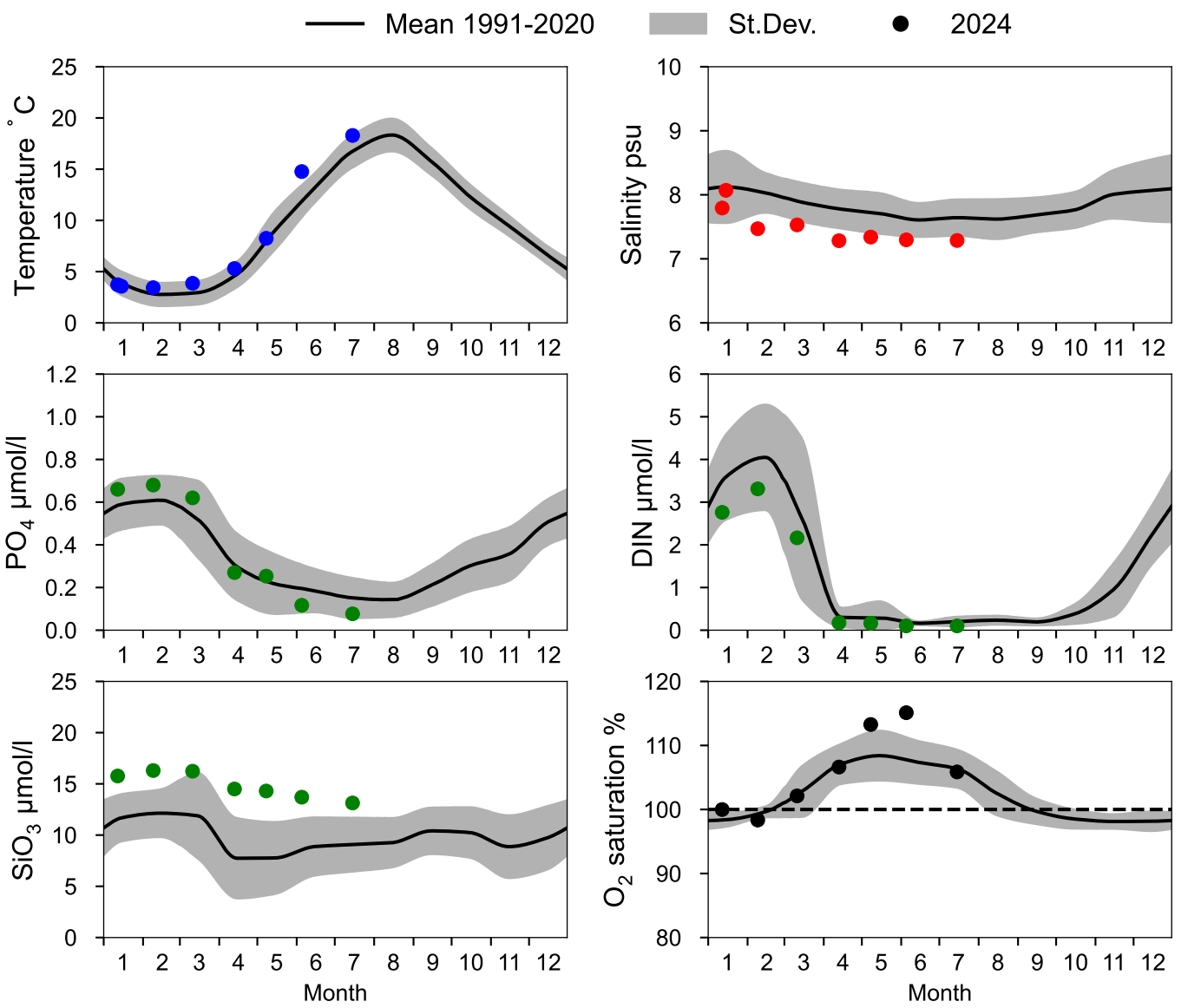


Vertical profiles BY1
July

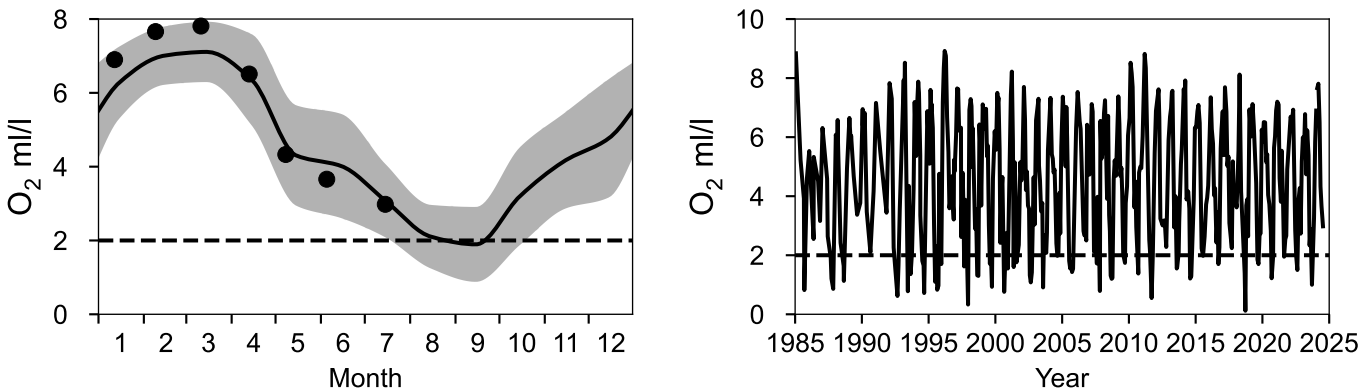


STATION BY2 ARKONA SURFACE WATER (0-10 m)

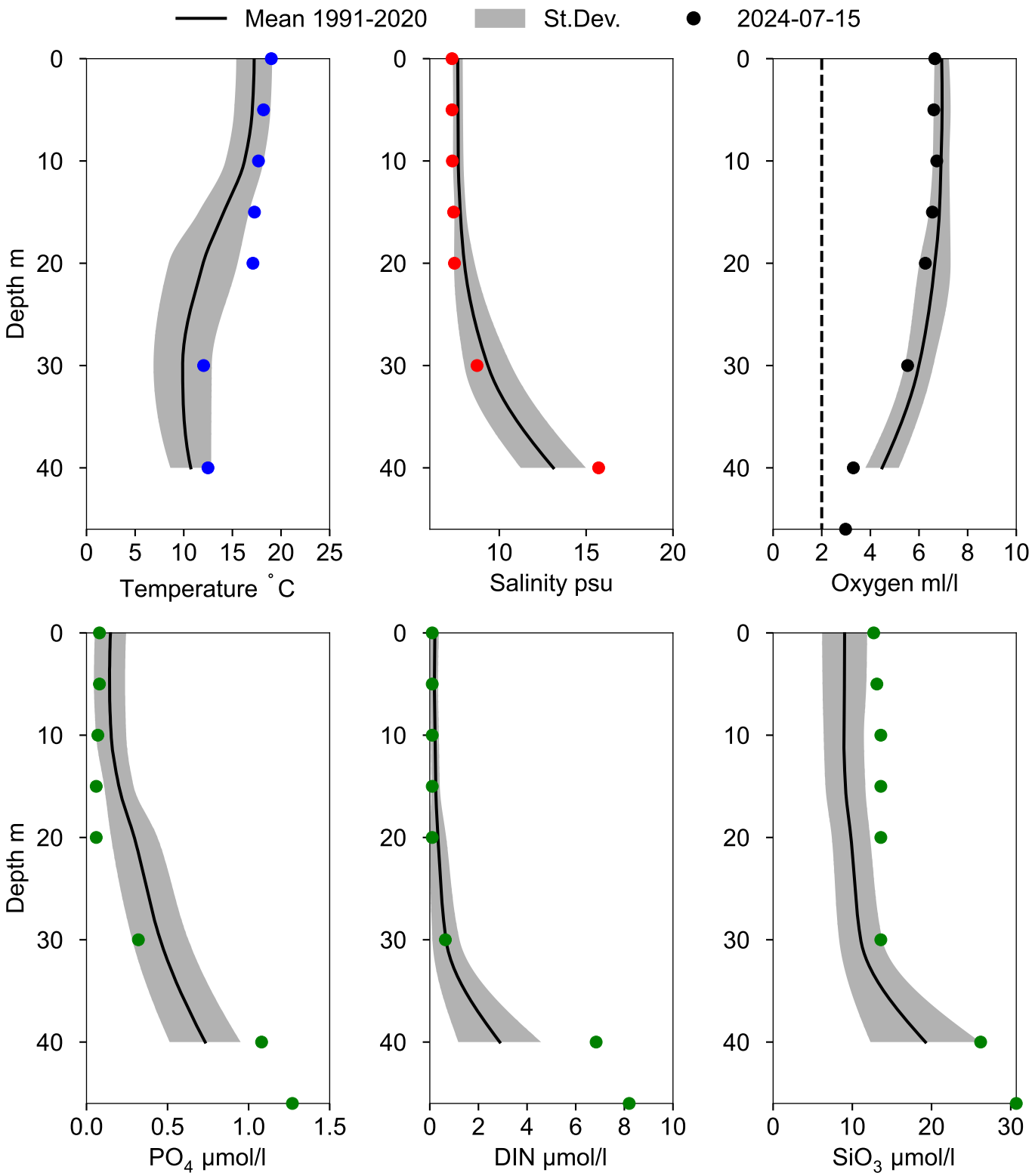
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 40 m)

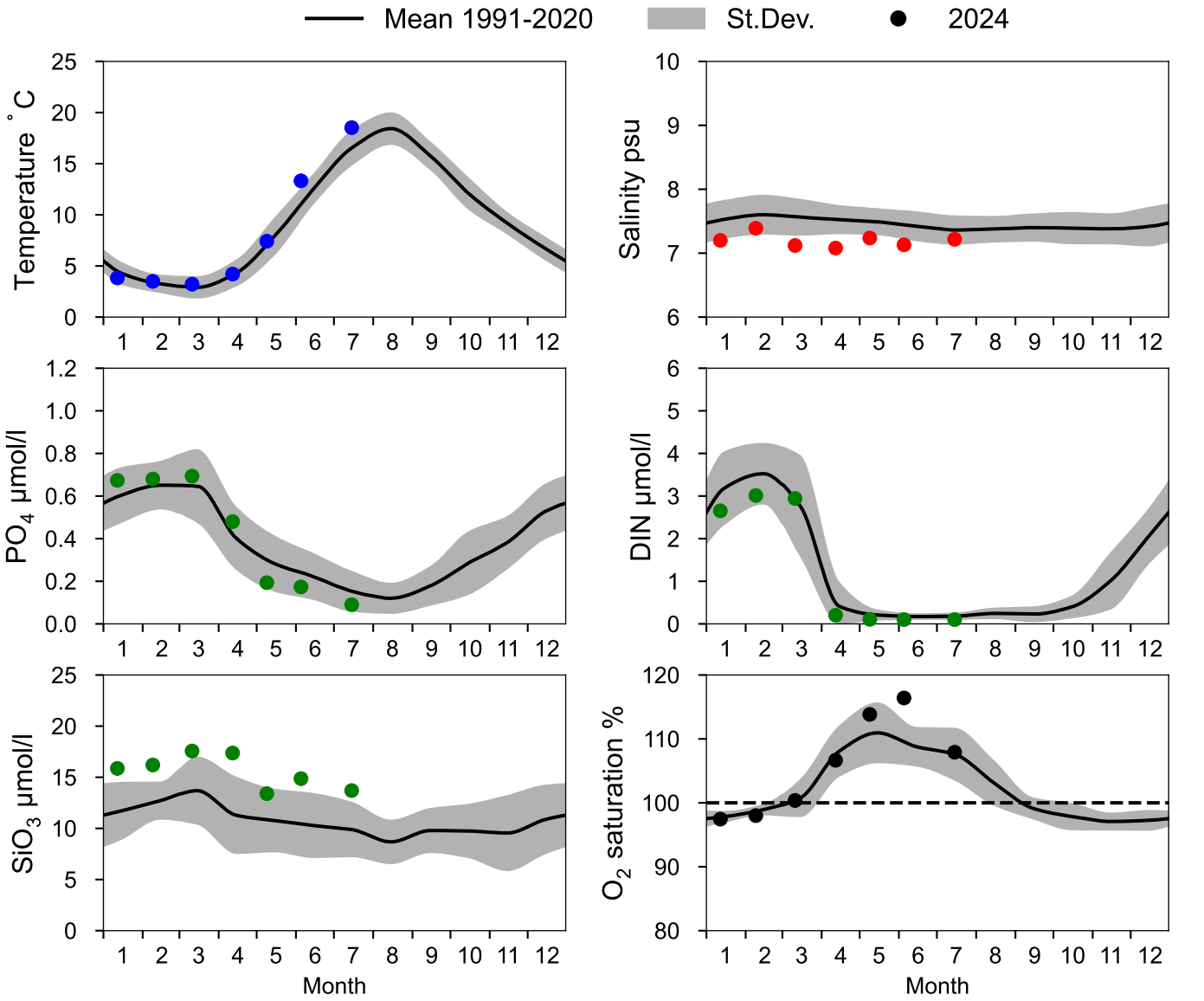


Vertical profiles BY2 ARKONA
July

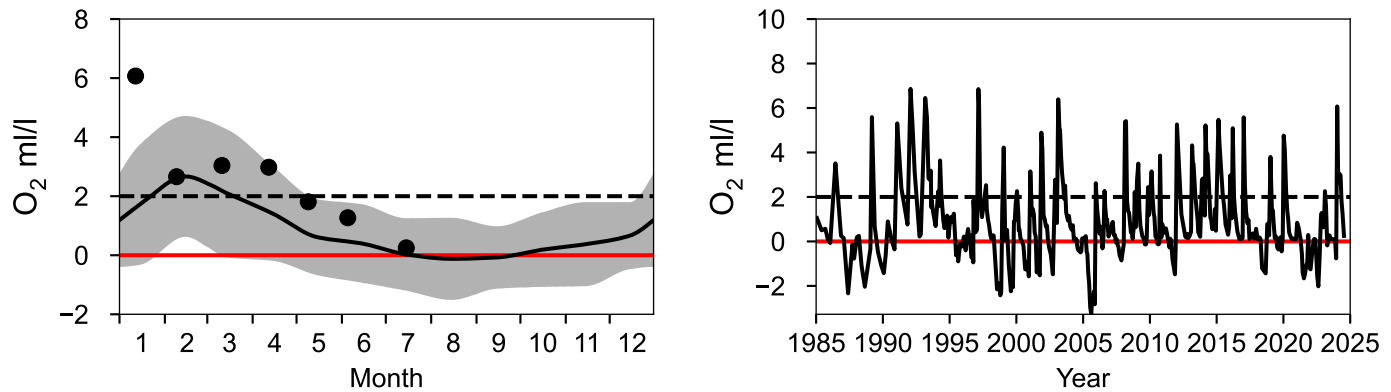


STATION BY4 CHRISTIANSÖ SURFACE WATER (0-10 m)

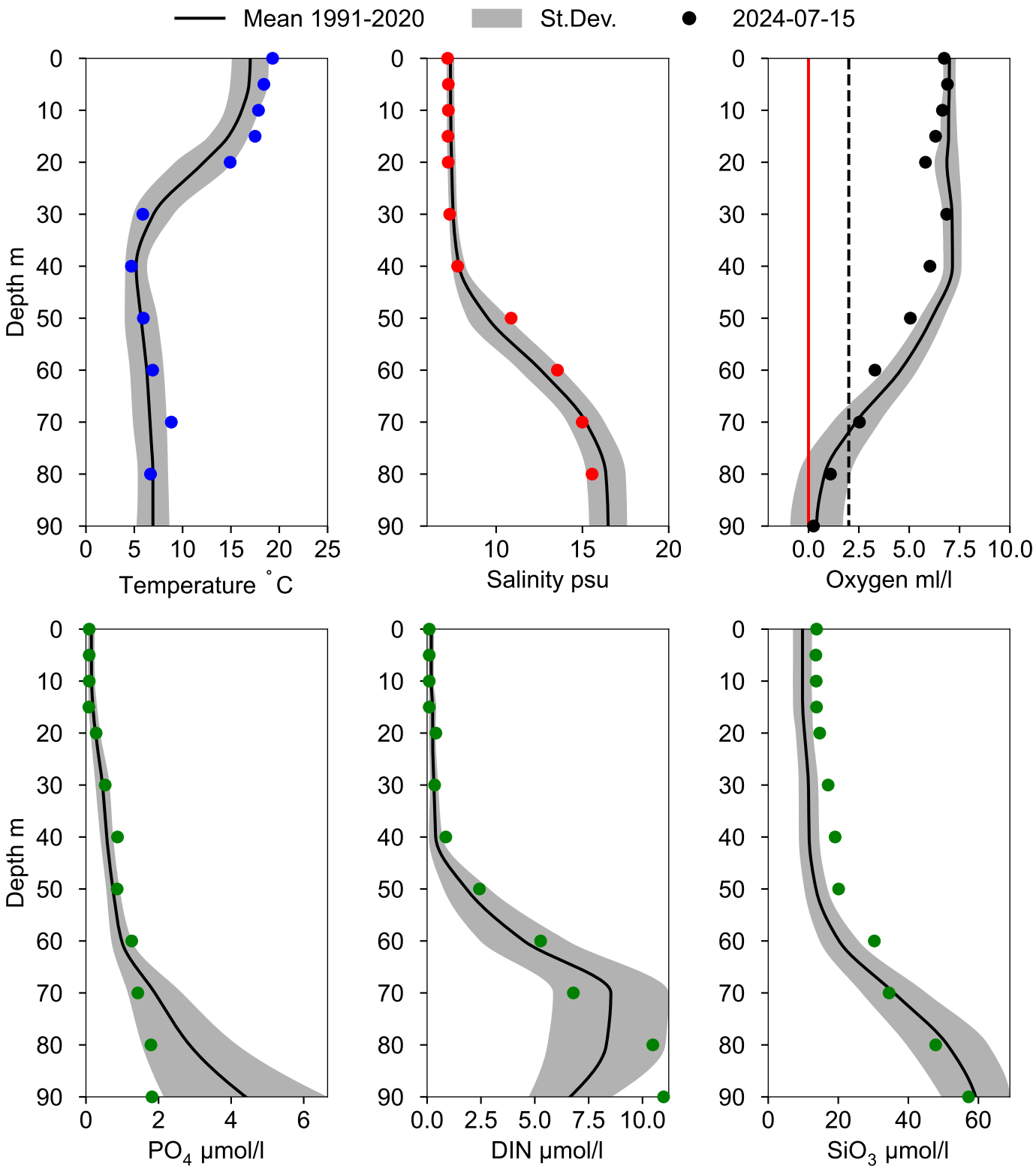
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 80 m)

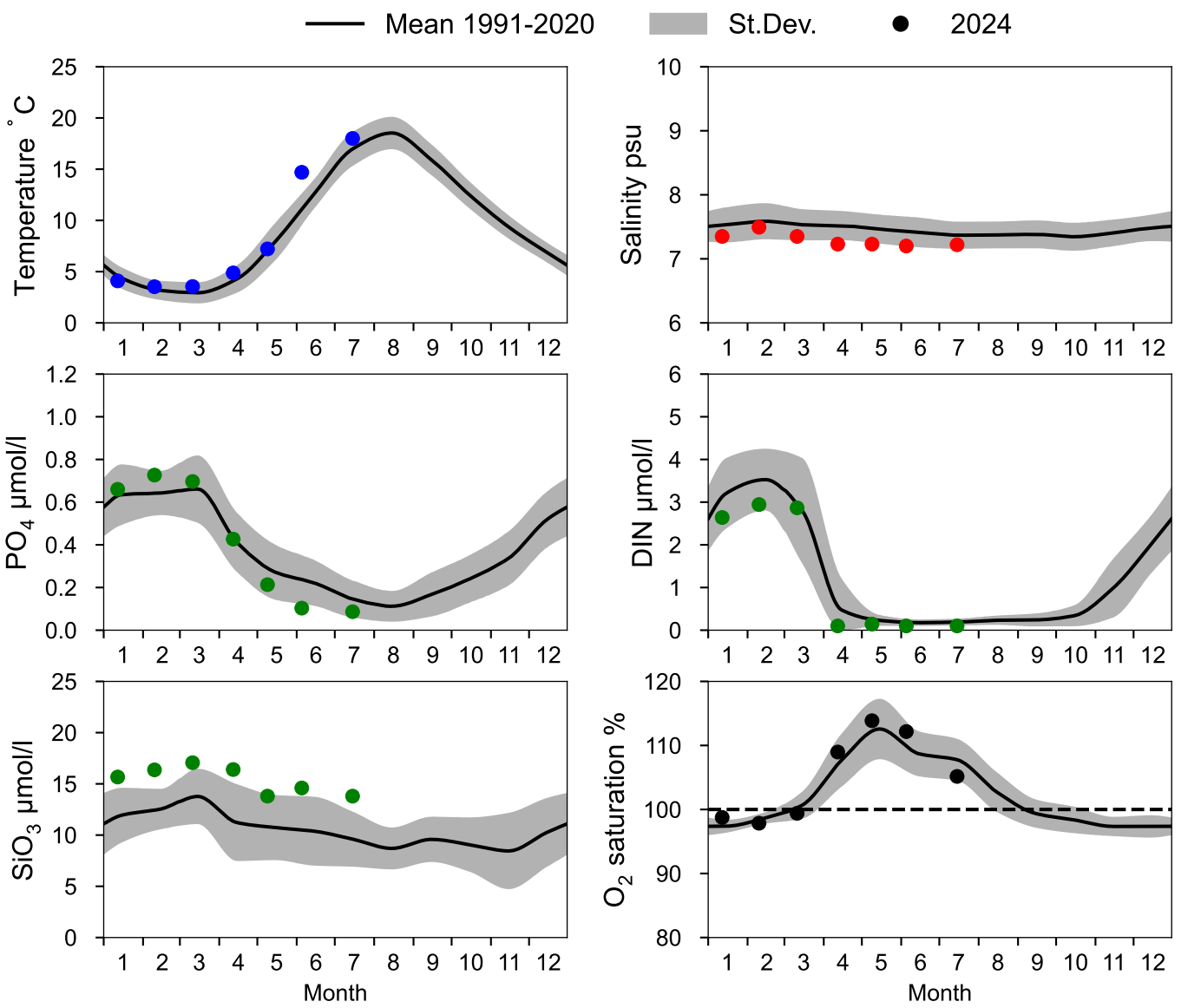


Vertical profiles BY4 CHRISTIANSÖ
July

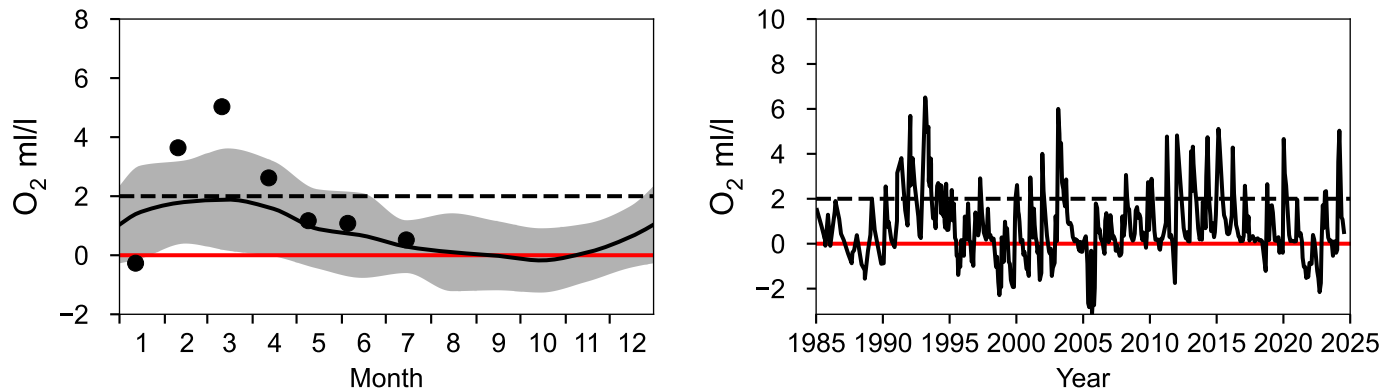


STATION BY5 BORNHOLMSDJ SURFACE WATER (0-10 m)

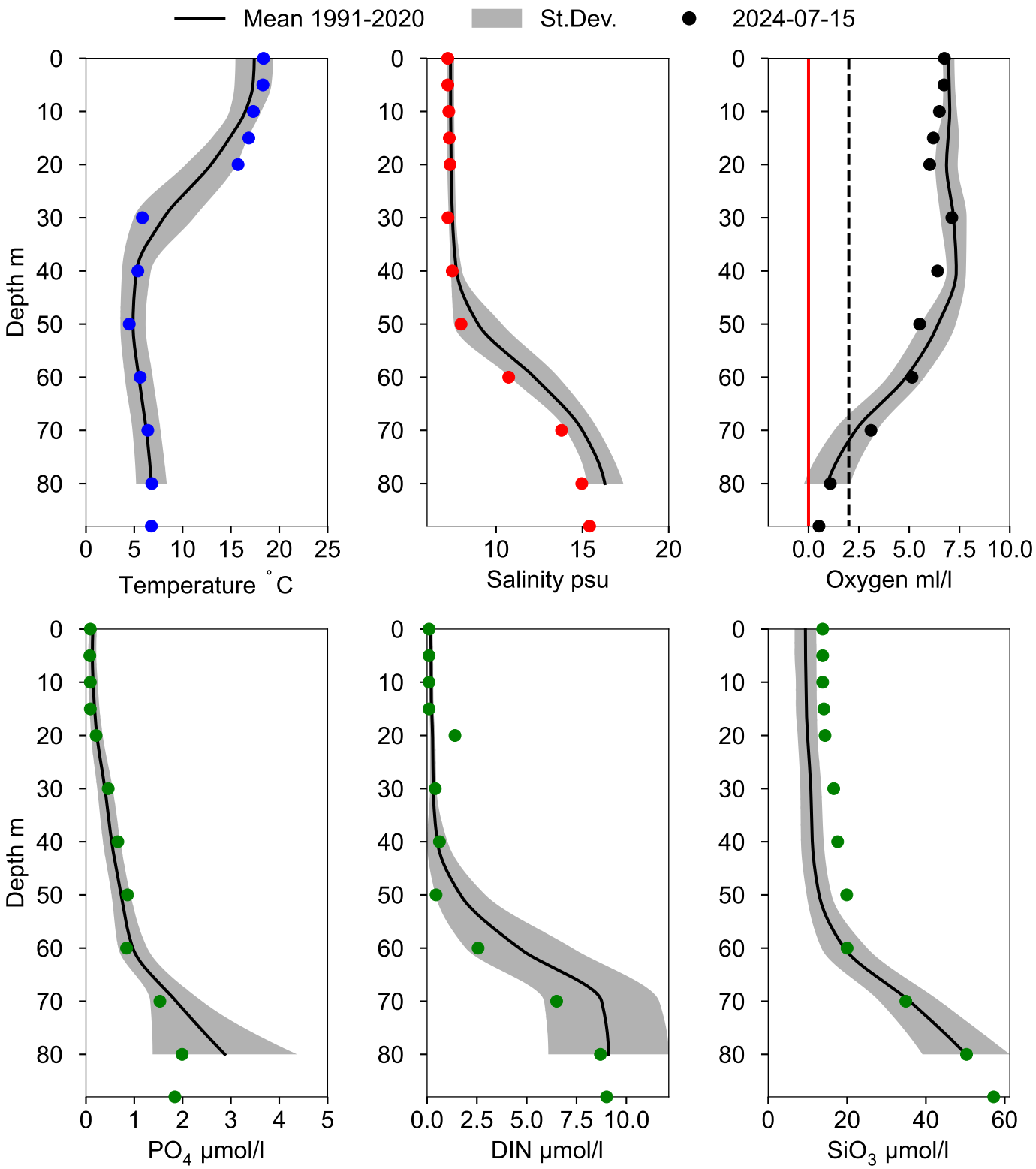
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 80 m)

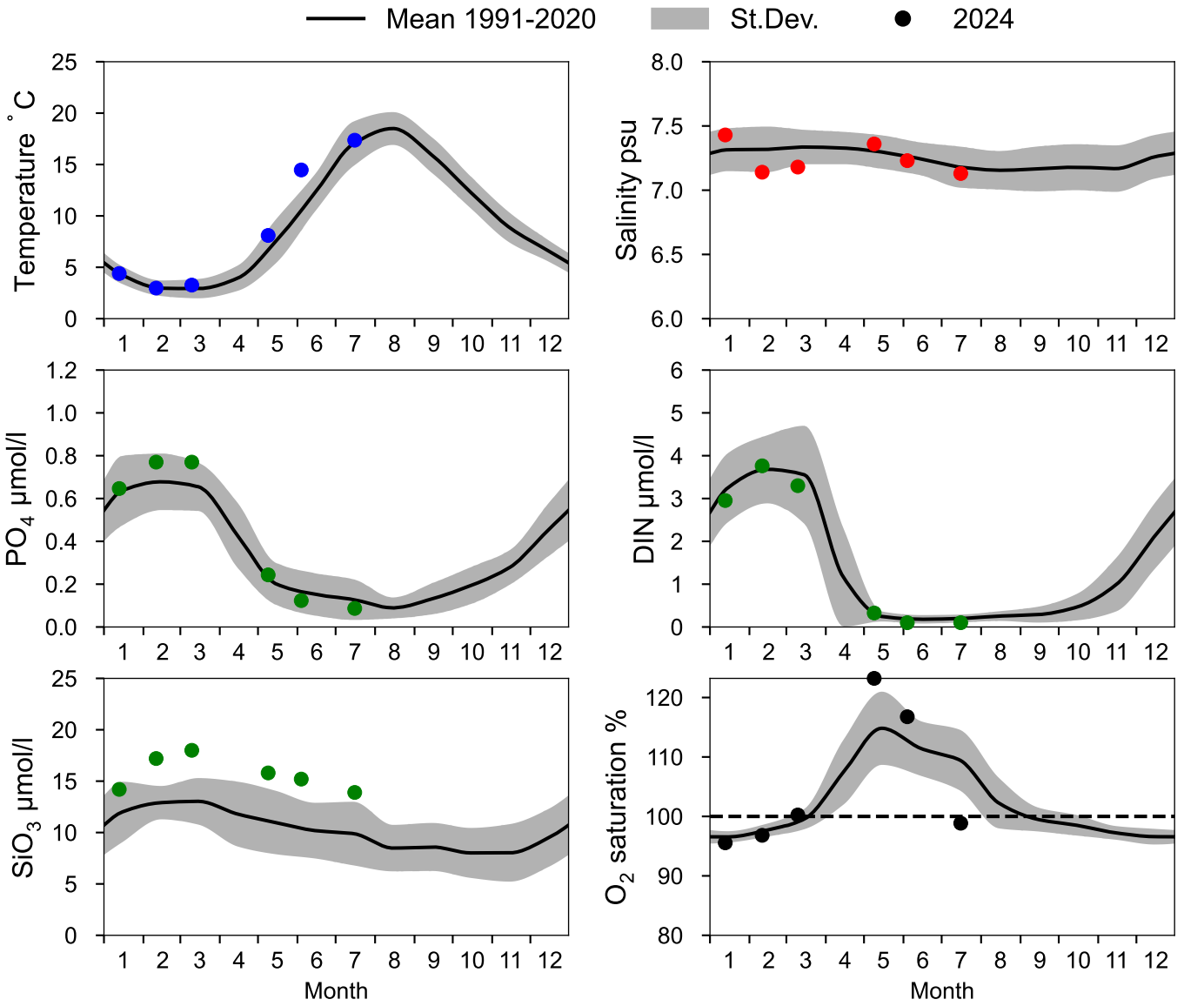


Vertical profiles BY5 BORNHOLMSDJ
July

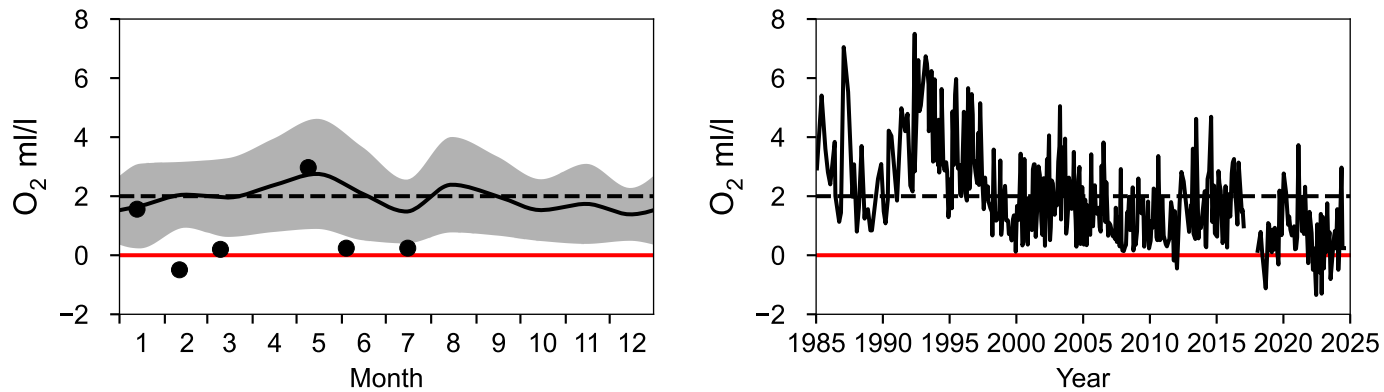


STATION BCS III-10 SURFACE WATER (0-10 m)

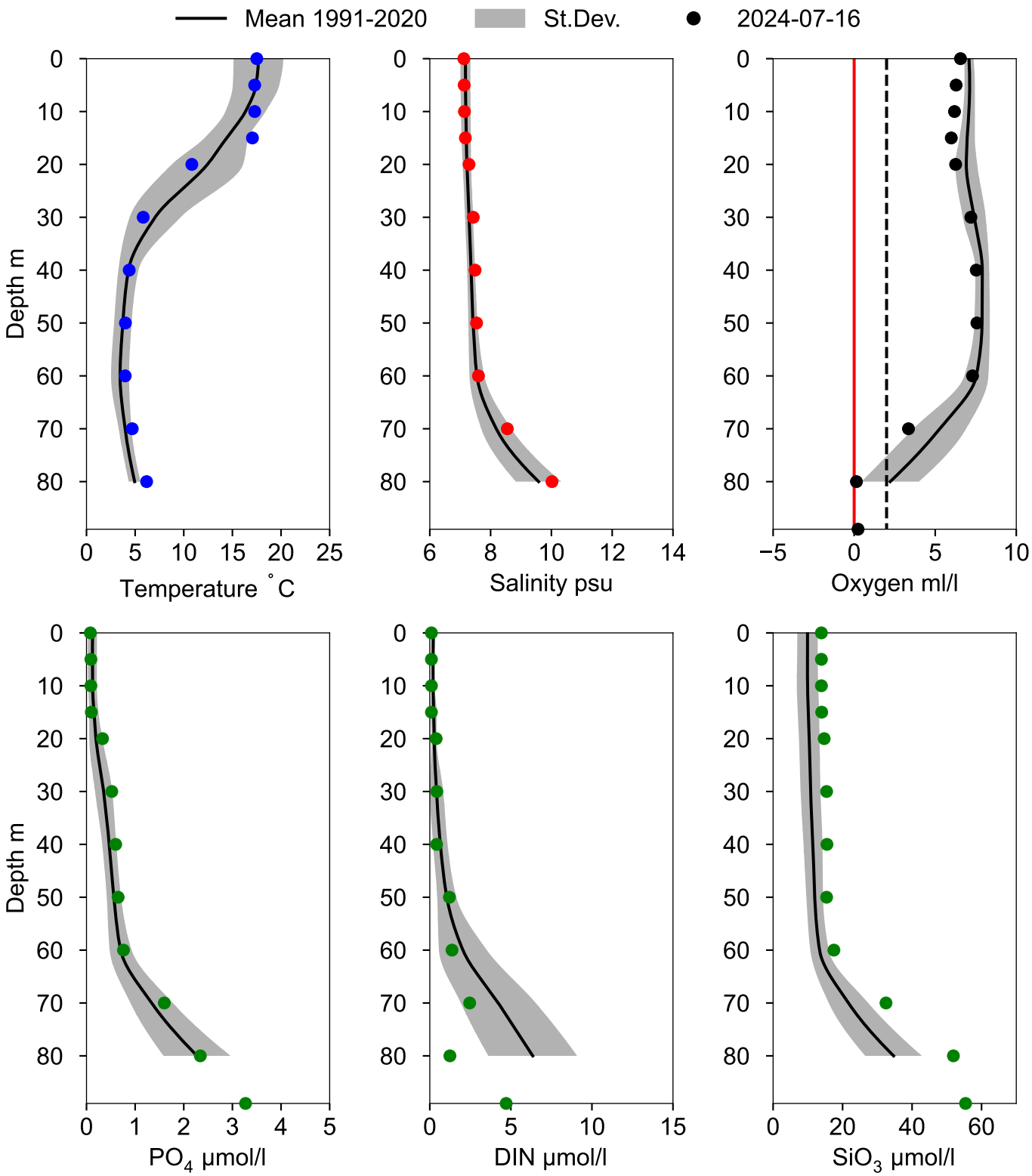
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 80 m)

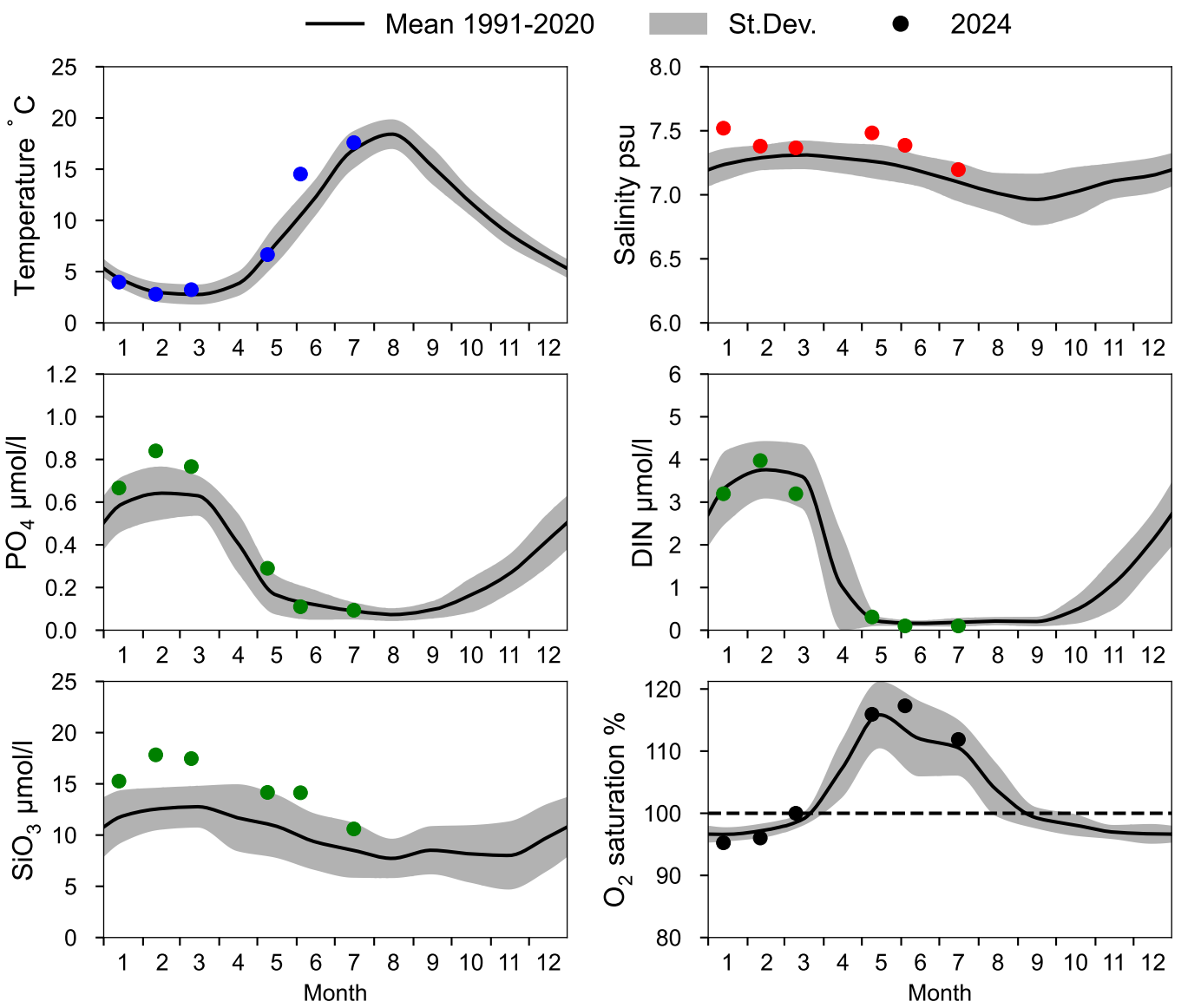


Vertical profiles BCS III-10
July

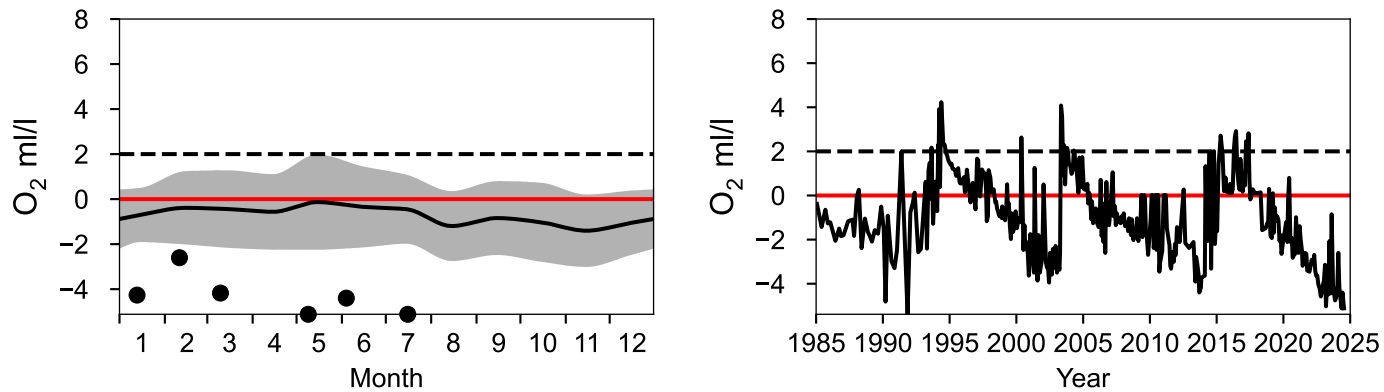


STATION BY10 SURFACE WATER (0-10 m)

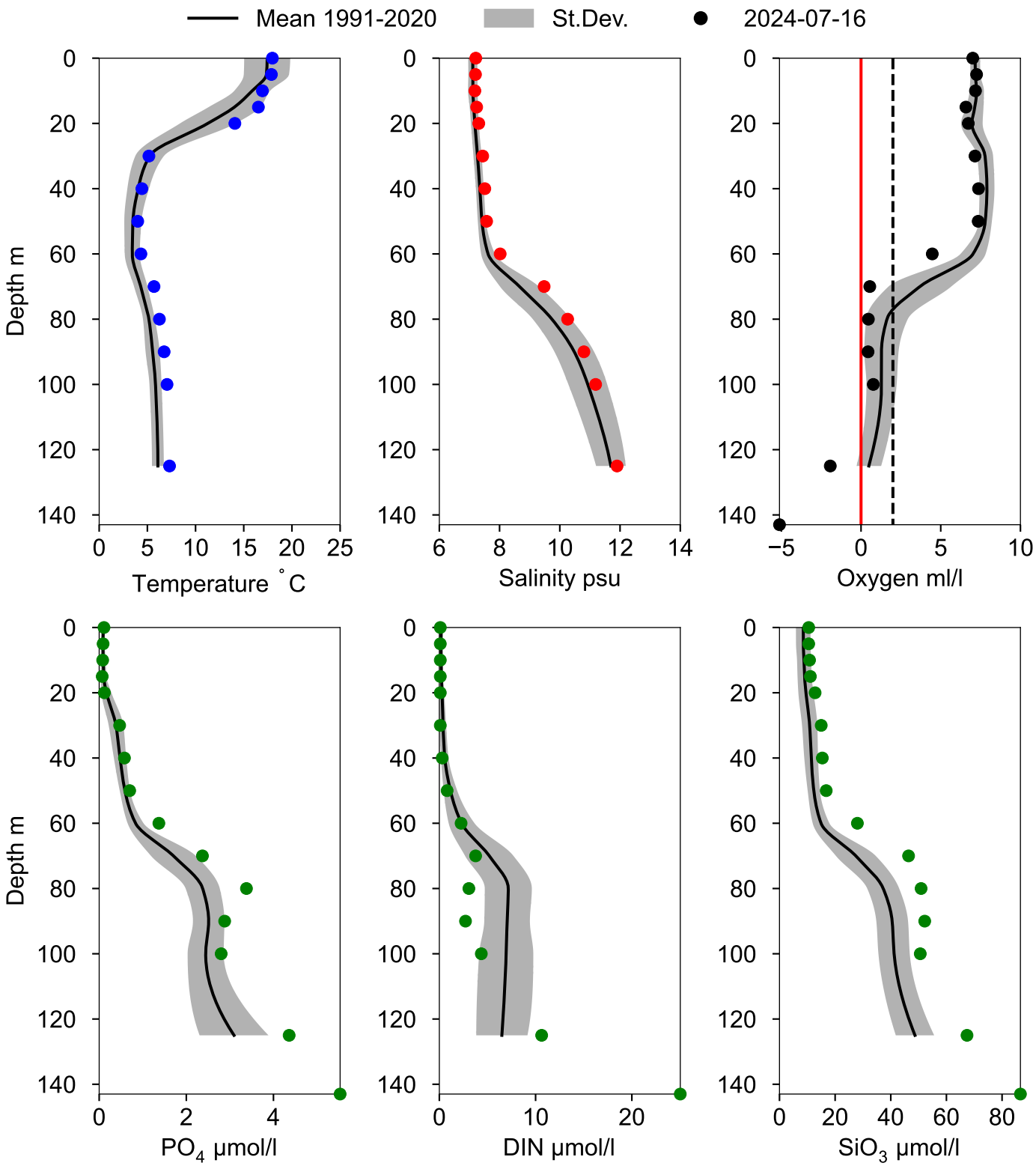
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 125 m)

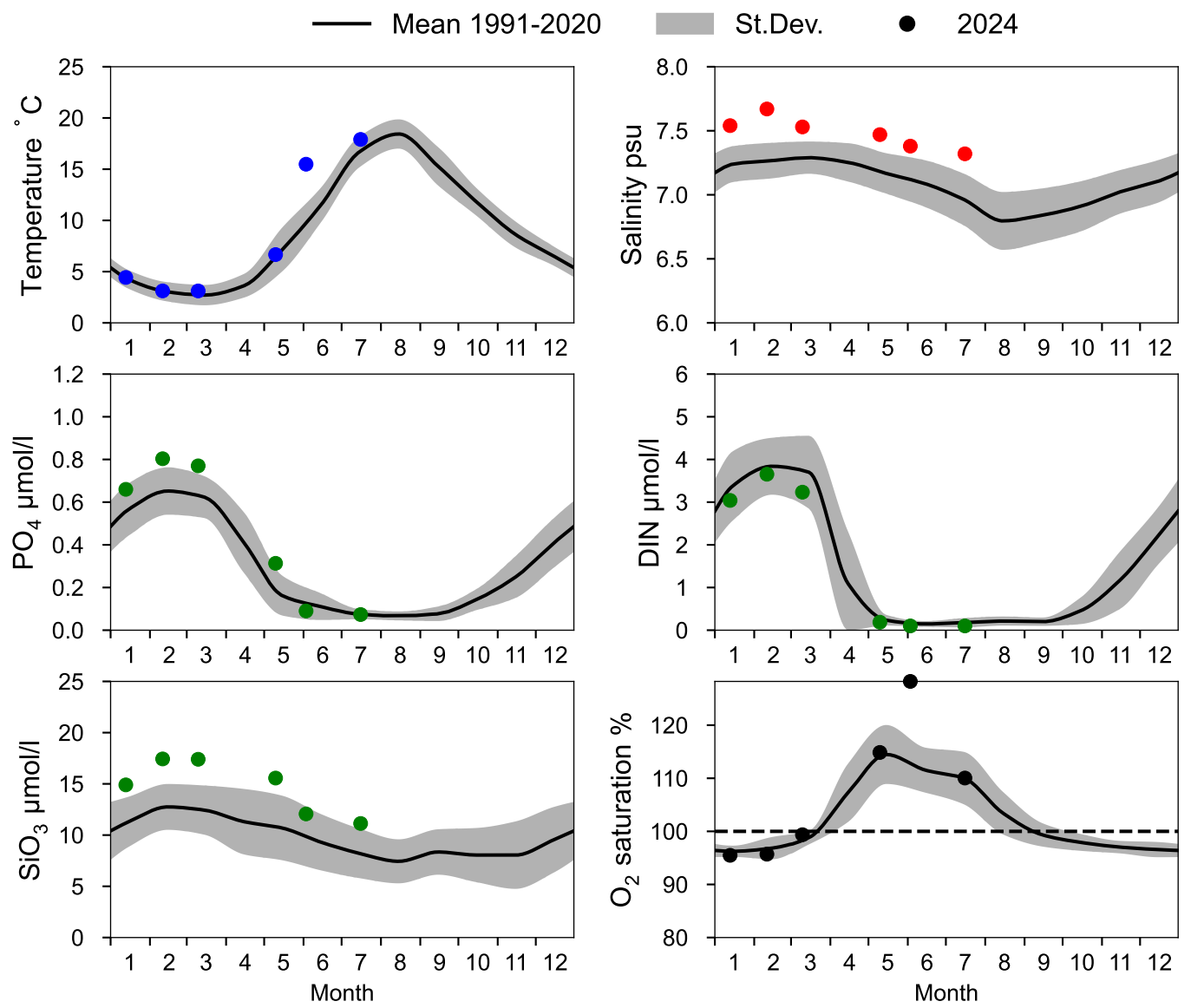


Vertical profiles BY10
July

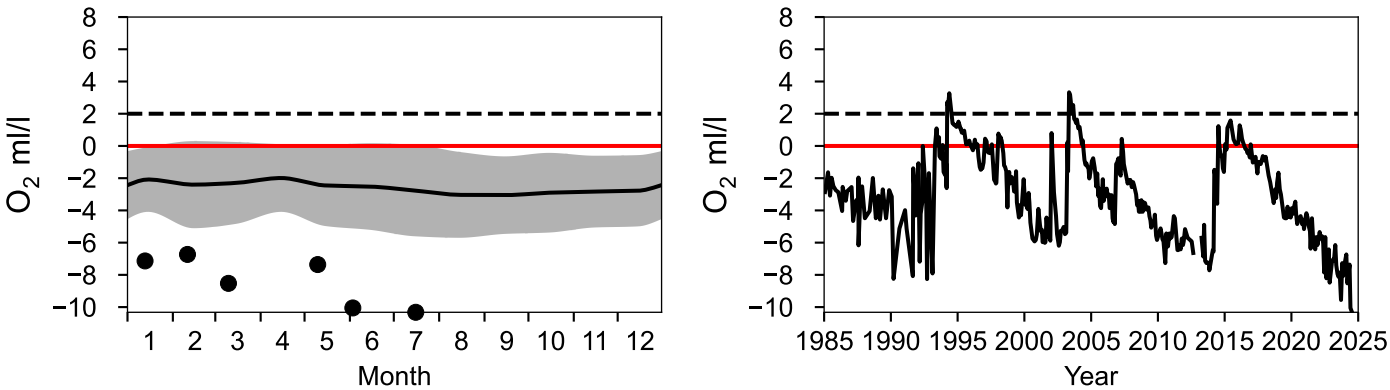


STATION BY15 GOTLANDSDJ SURFACE WATER (0-10 m)

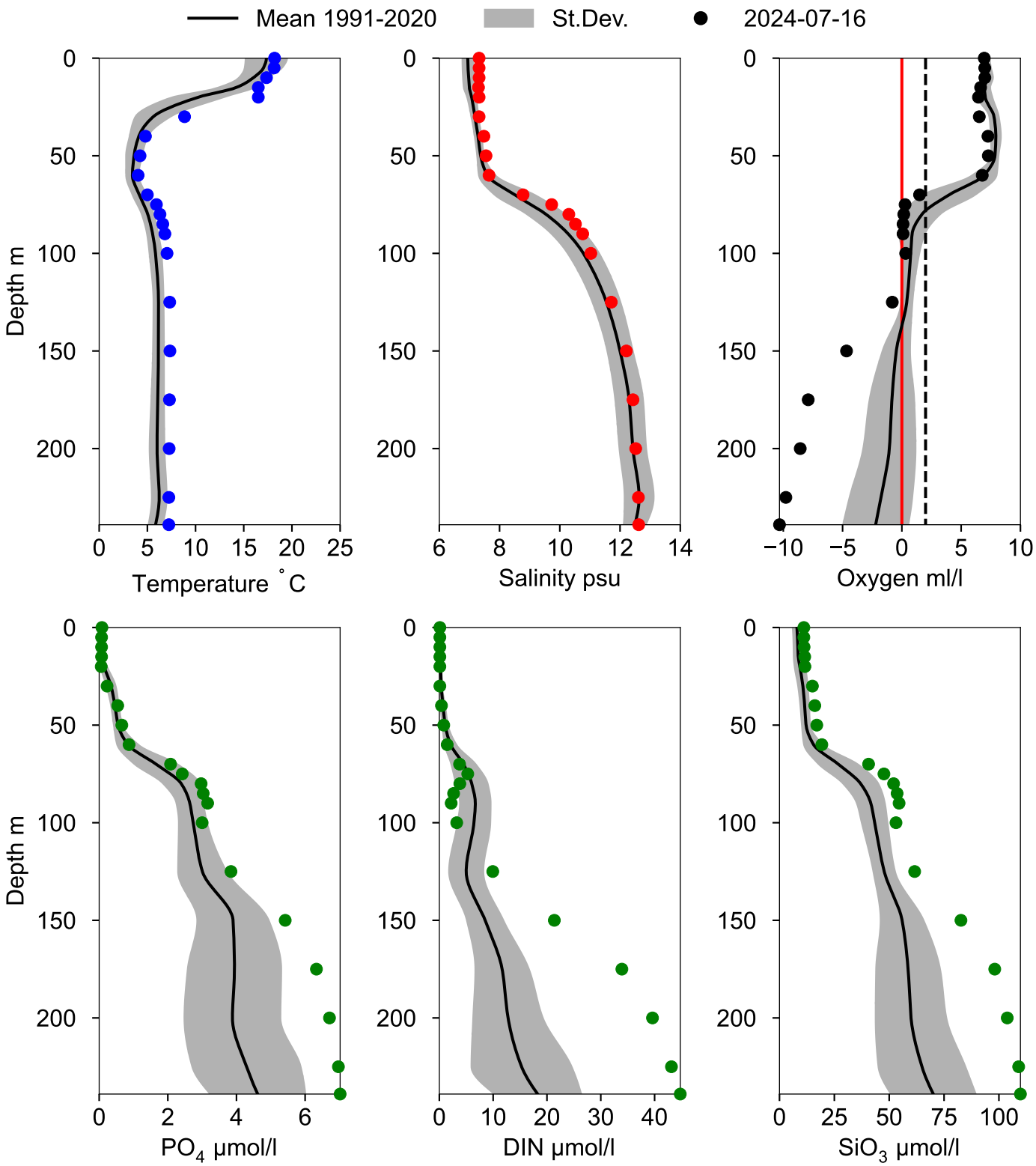
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 225 m)

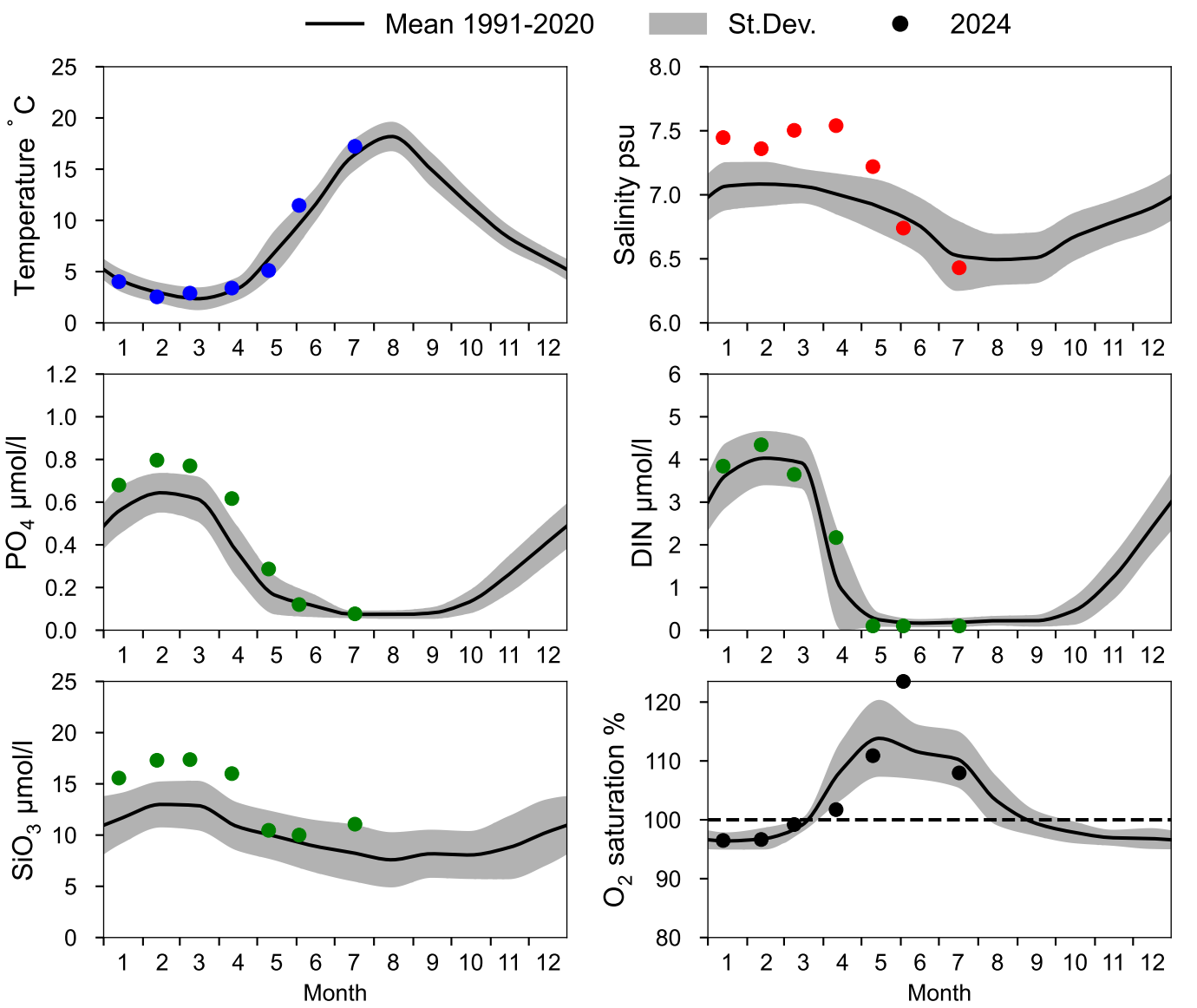


Vertical profiles BY15 GOTLANDSDJ
July

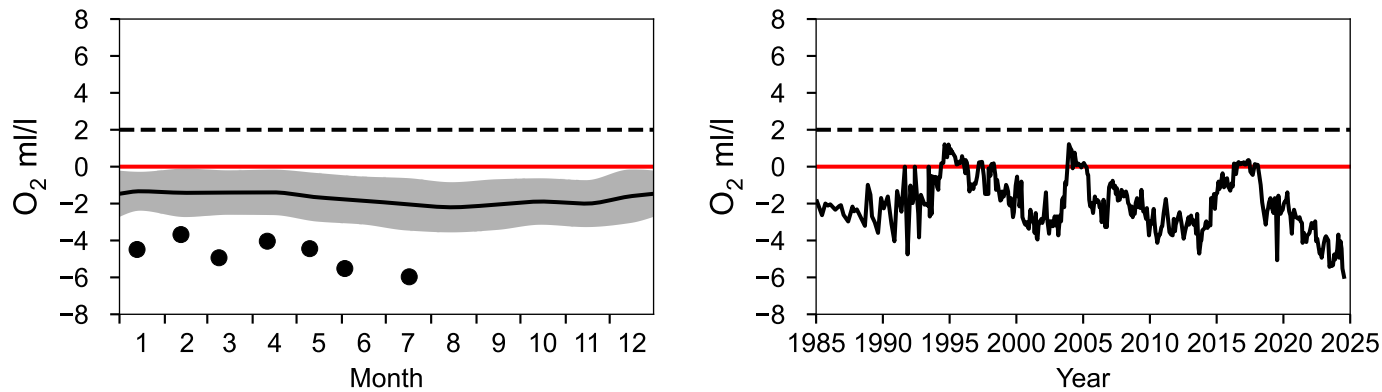


STATION BY20 FÅRÖDJ SURFACE WATER (0-10 m)

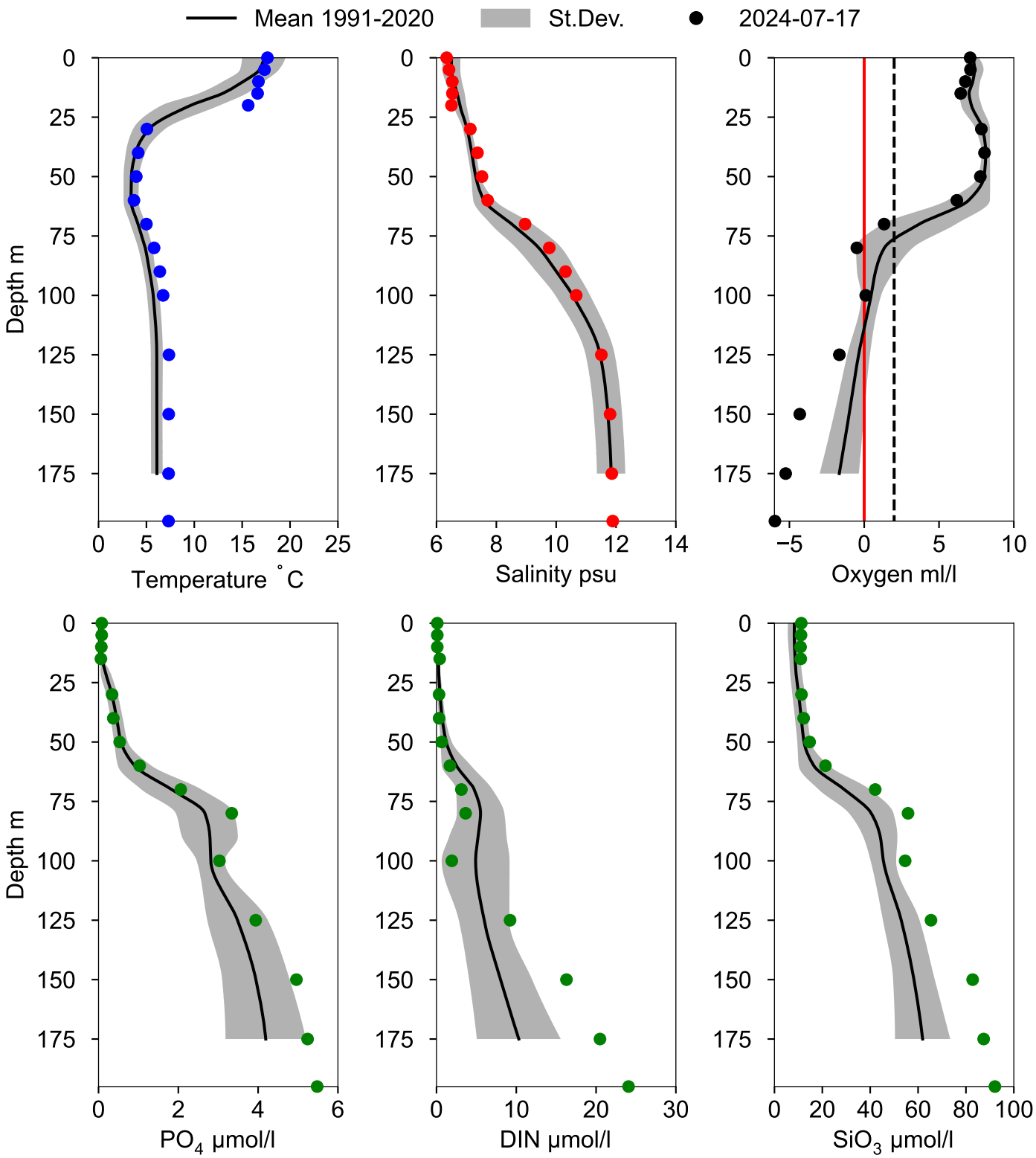
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 175 m)

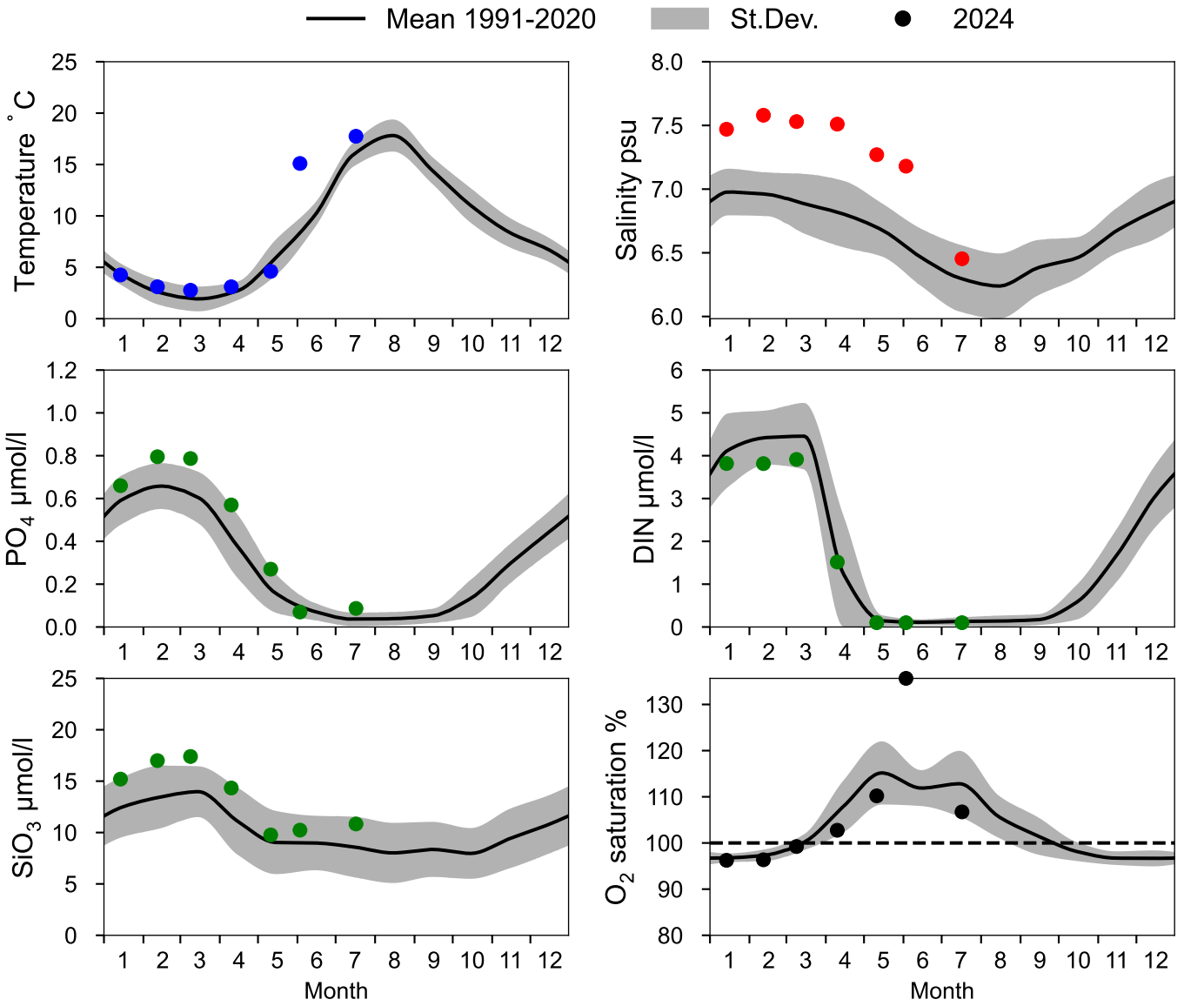


Vertical profiles BY20 FÅRÖDJ
July

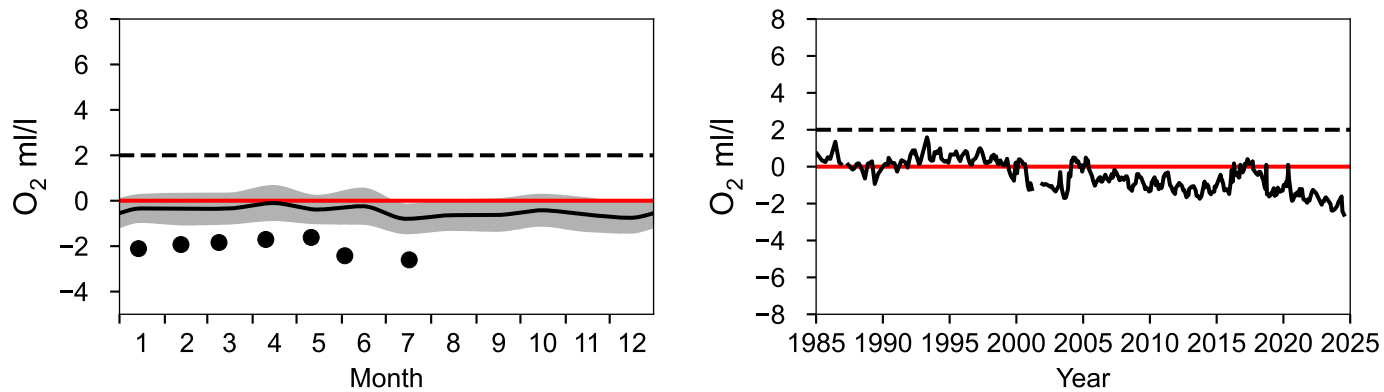


STATION BY29 / LL19 SURFACE WATER (0-10 m)

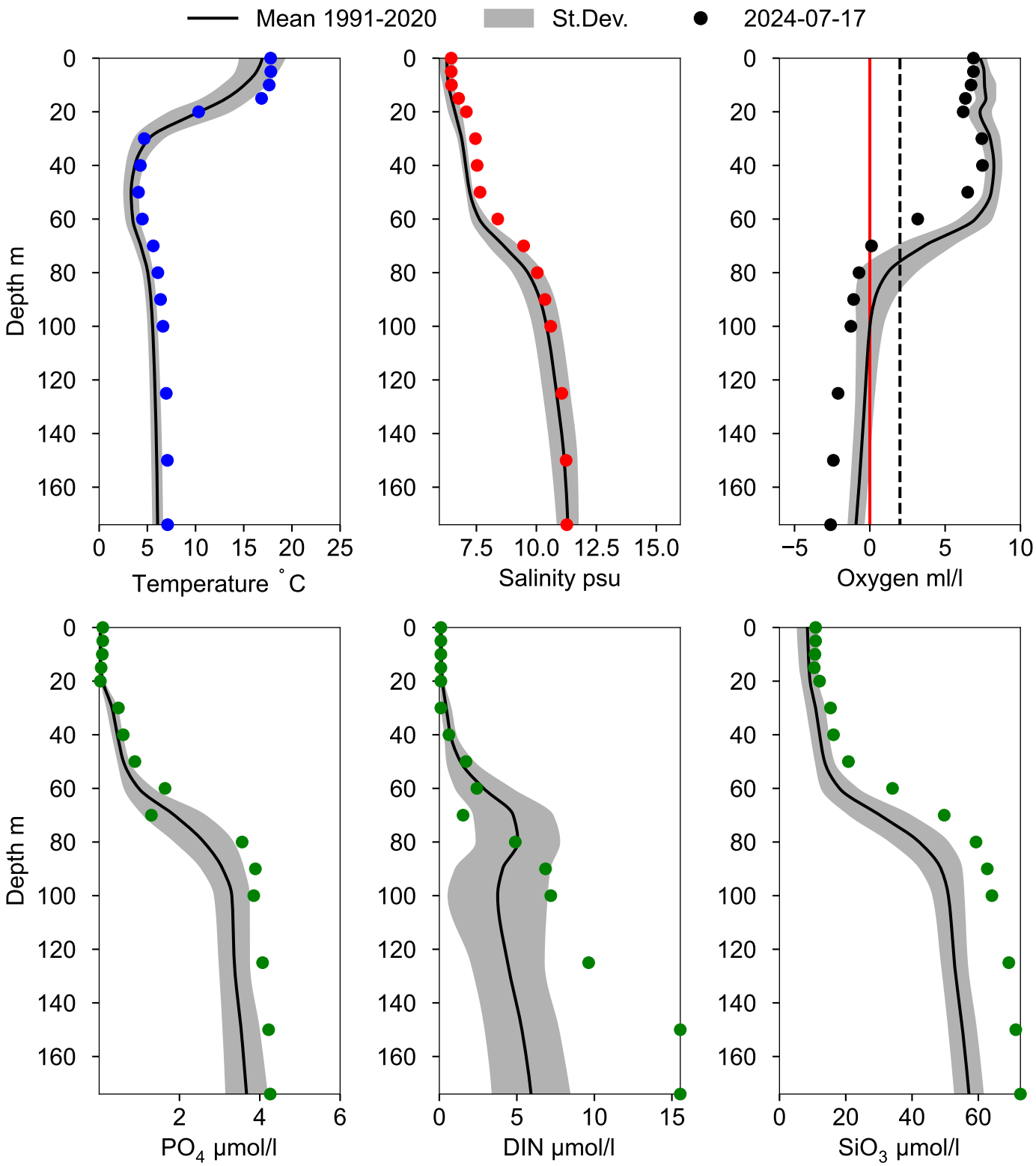
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 150 m)

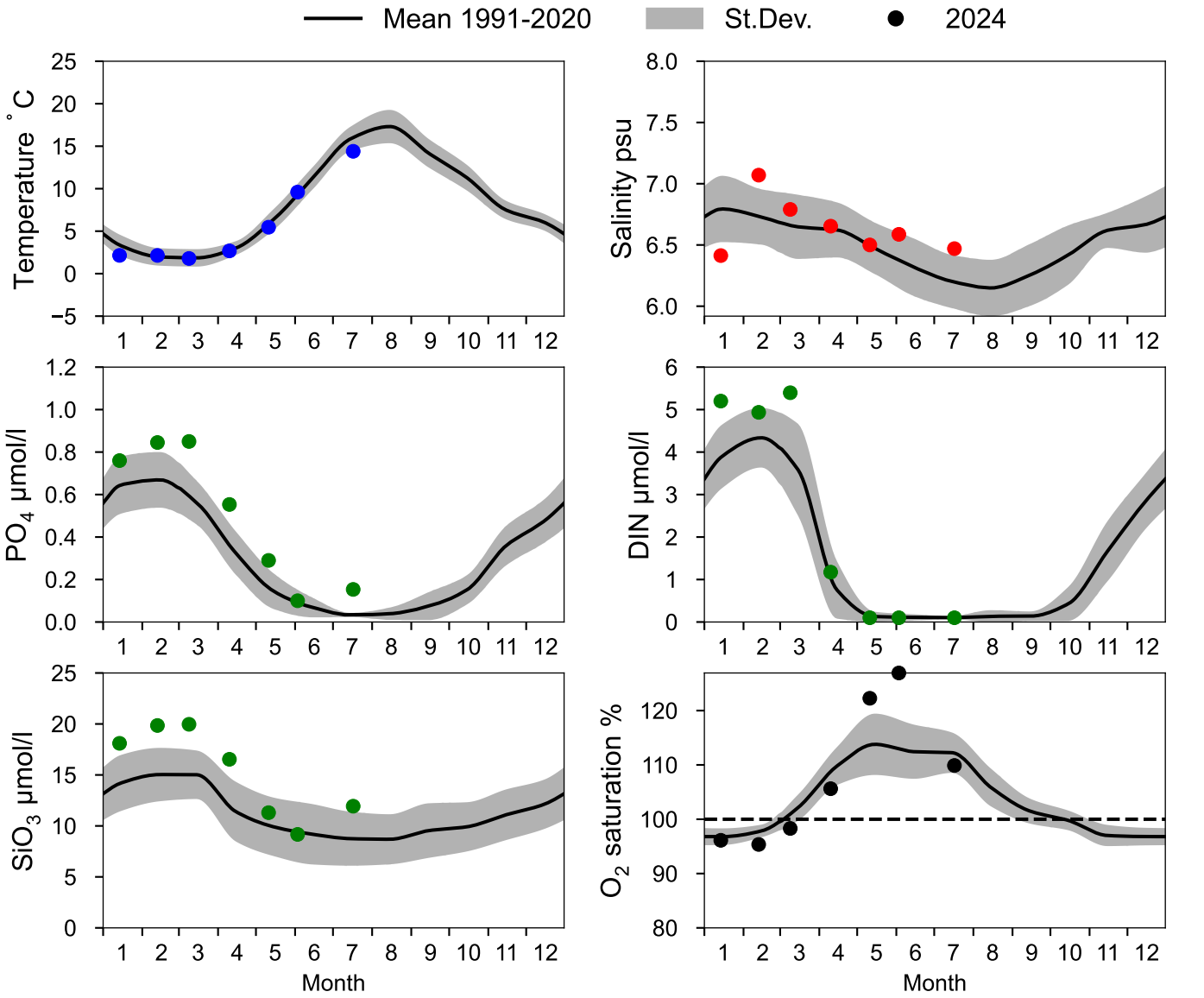


Vertical profiles BY29 / LL19
July

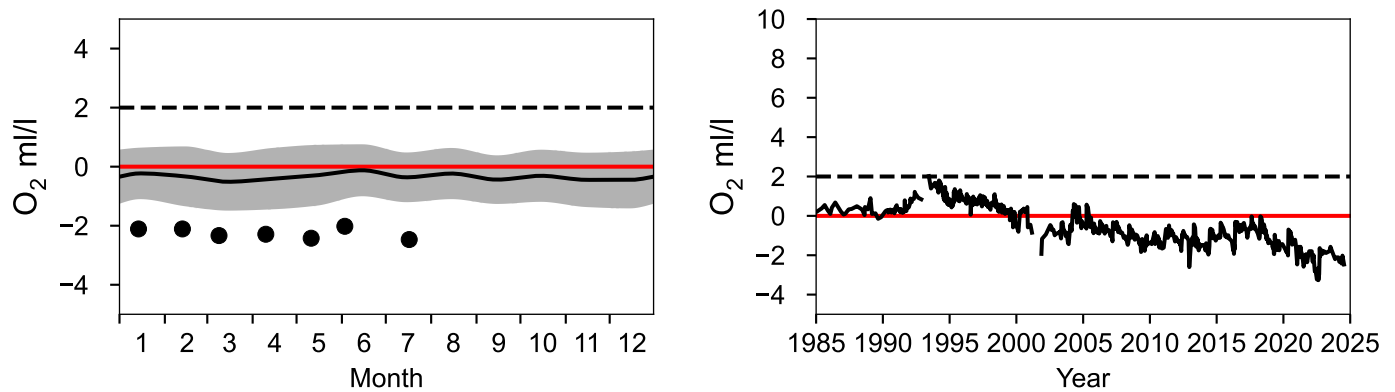


STATION BY31 LANDSORTSDJ SURFACE WATER (0-10 m)

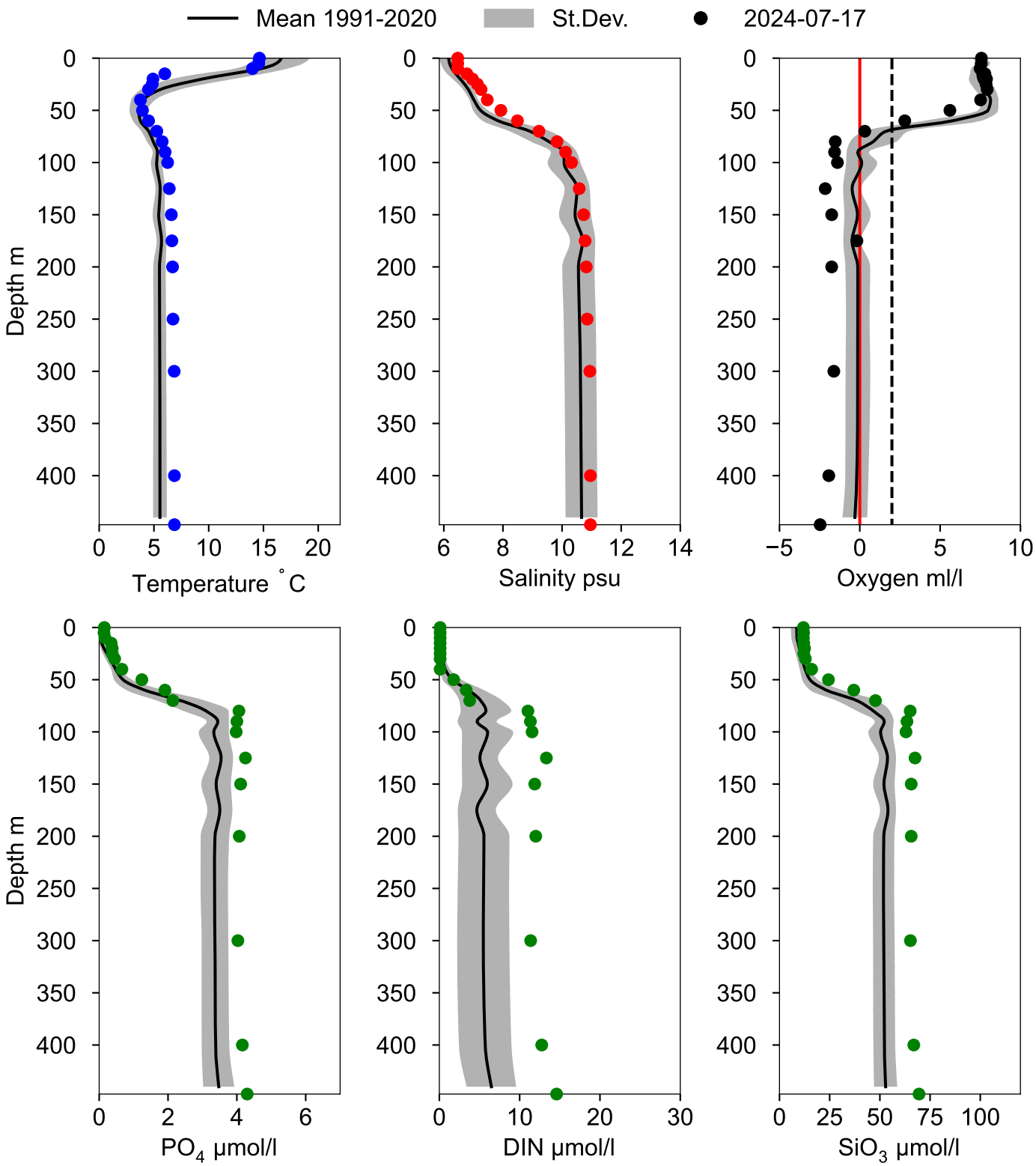
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 419 m)

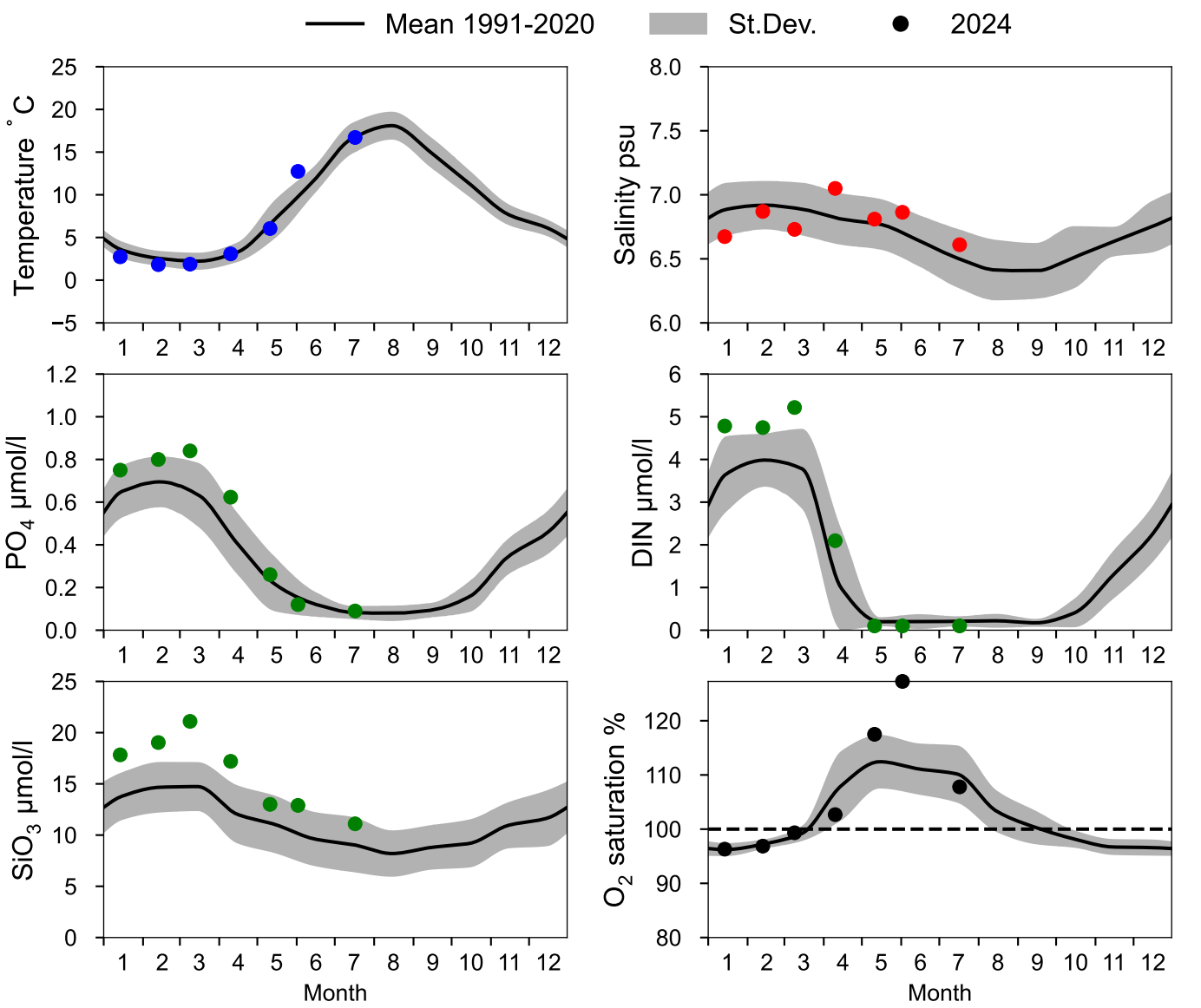


Vertical profiles BY31 LANDSORTSDJ
July

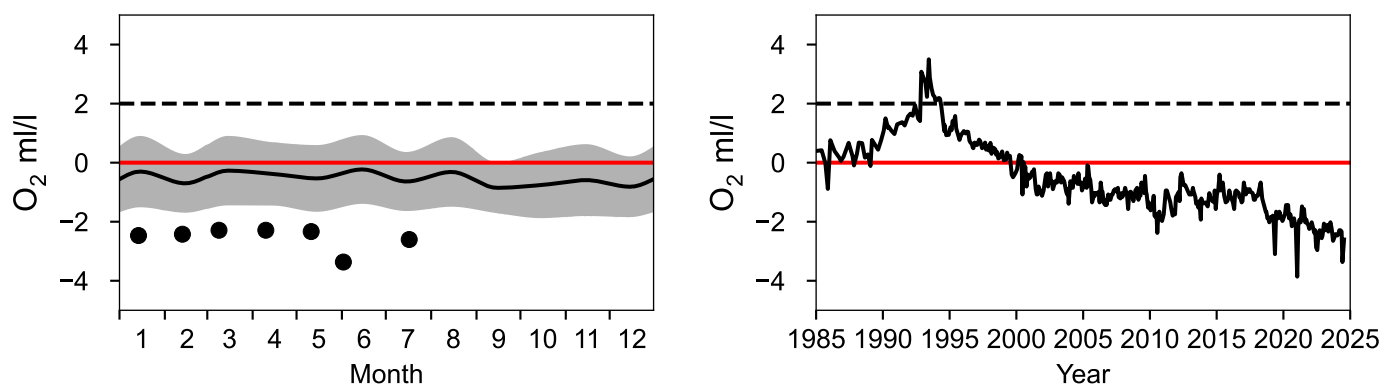


STATION BY32 NORRKÖPINGSDJ SURFACE WATER (0-10 m)

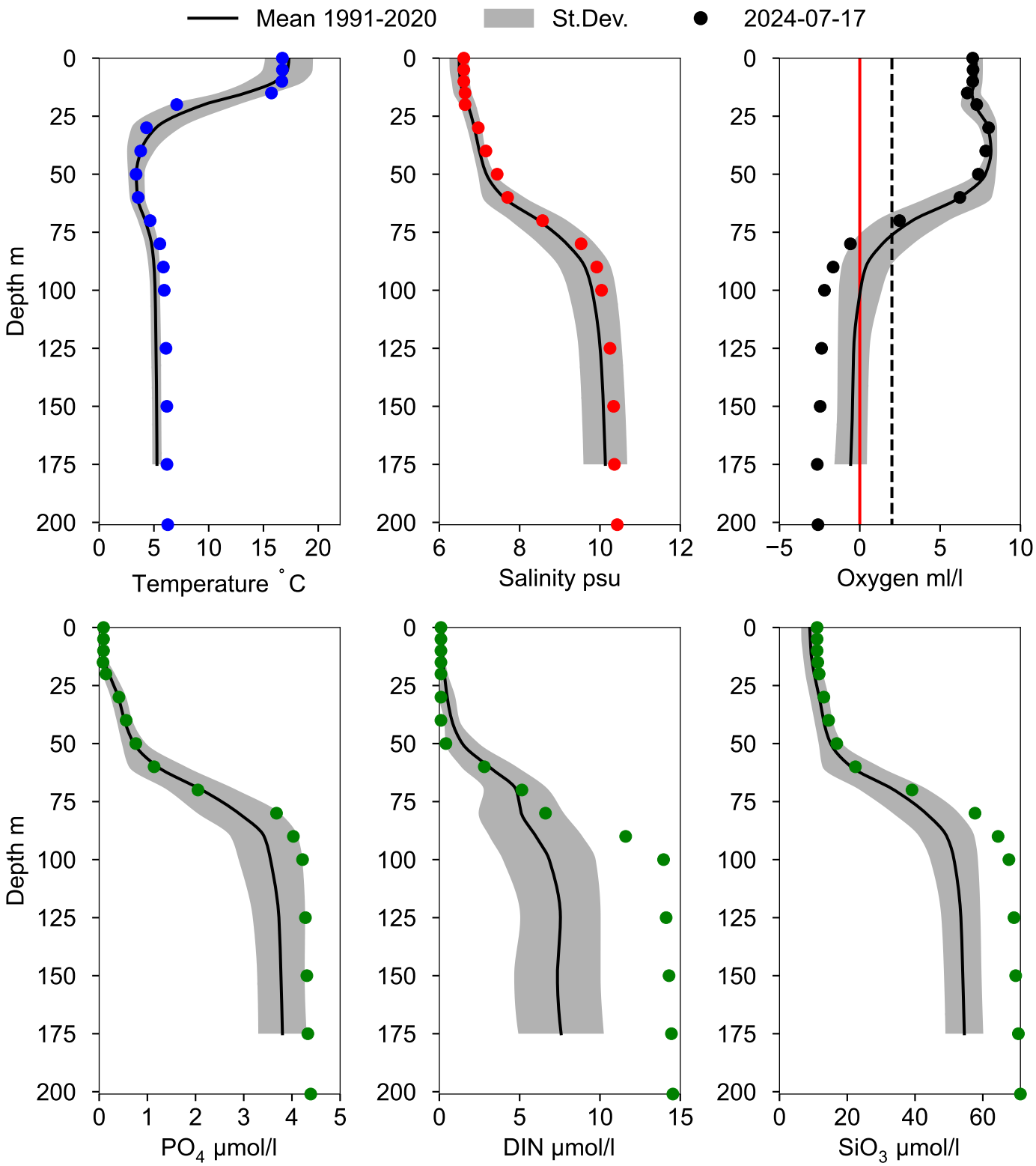
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 175 m)

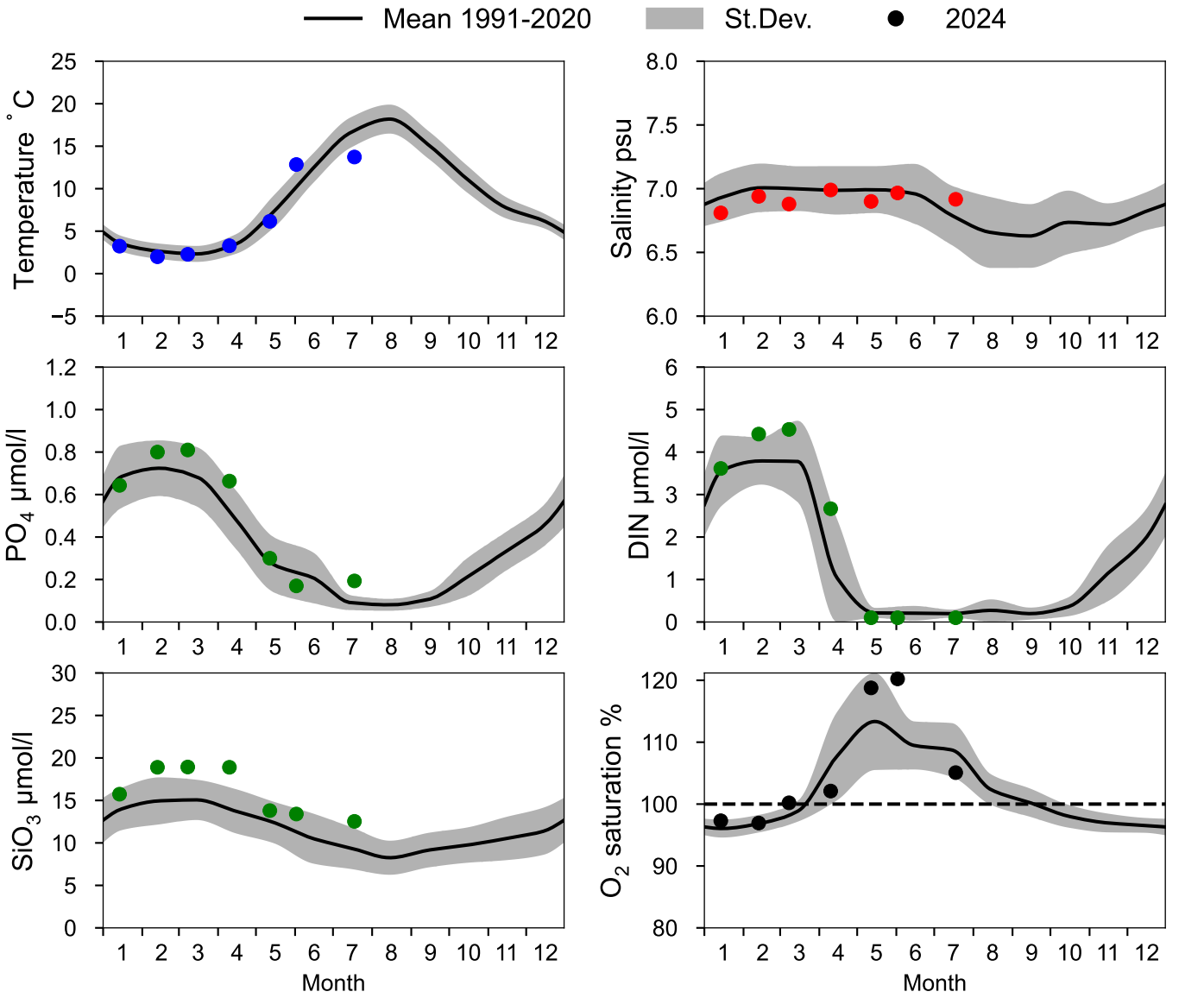


Vertical profiles BY32 NORRKÖPINGSDJ
July

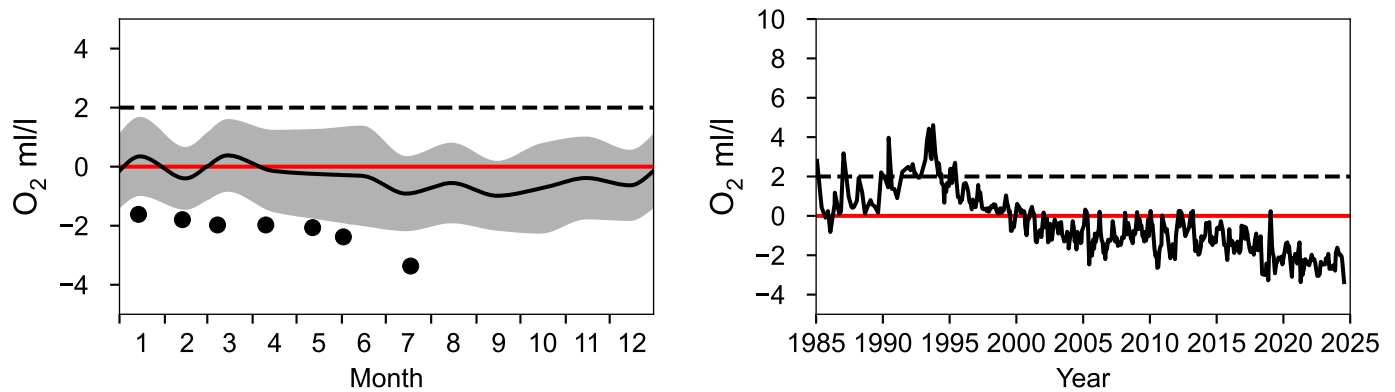


STATION BY38 KARLSÖDJ SURFACE WATER (0-10 m)

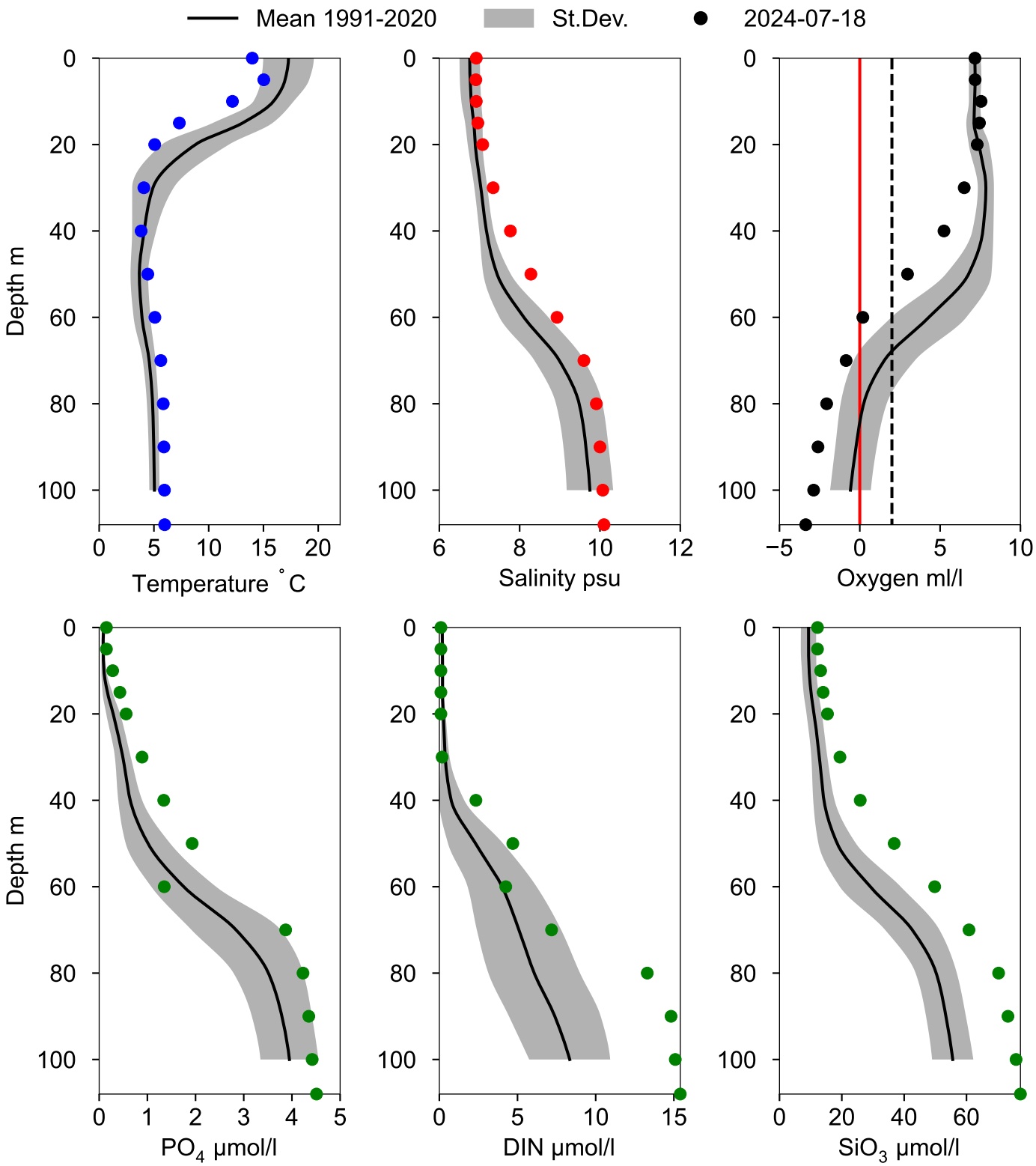
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 100 m)

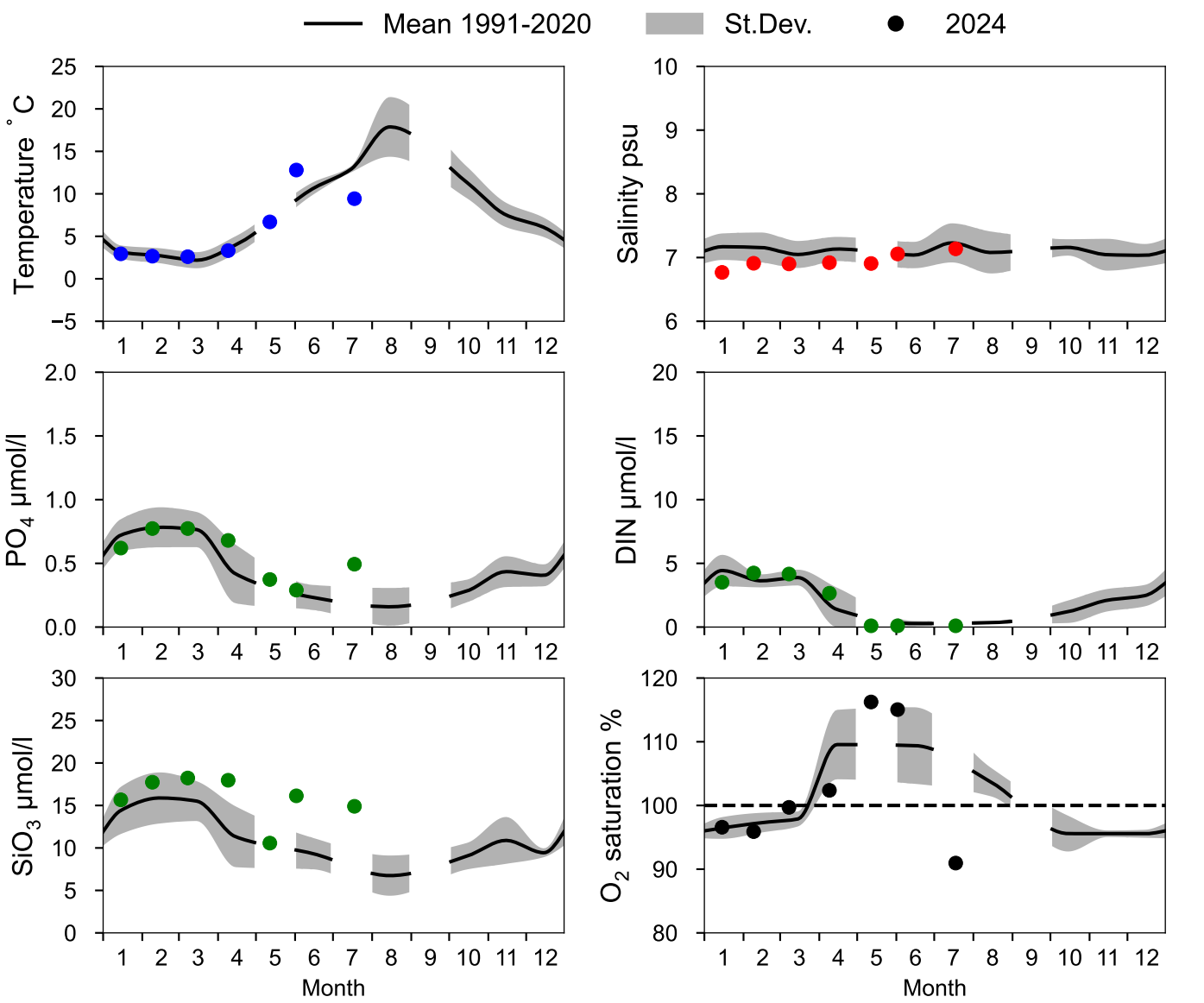


Vertical profiles BY38 KARLSÖDJ
July

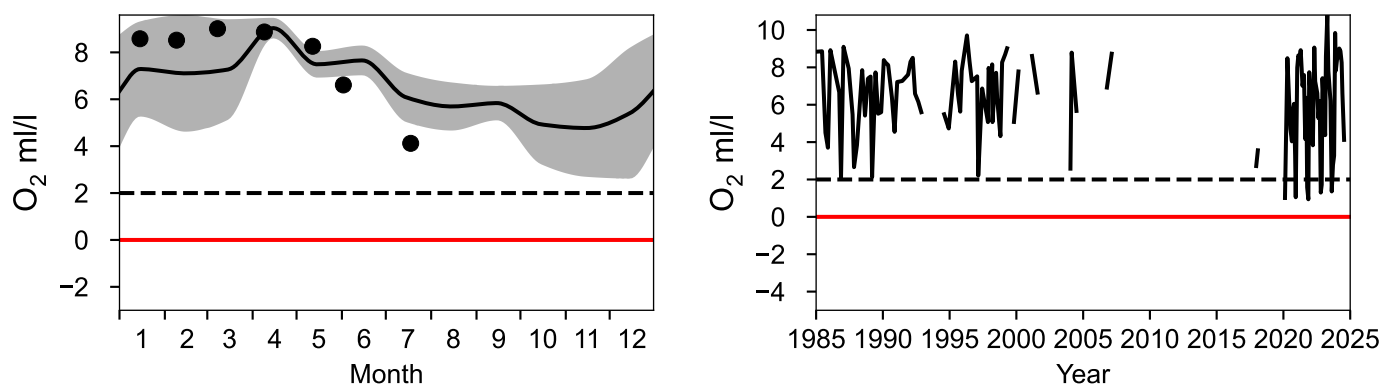


STATION BY39 ÖLANDS S UDDE SURFACE WATER (0-10 m)

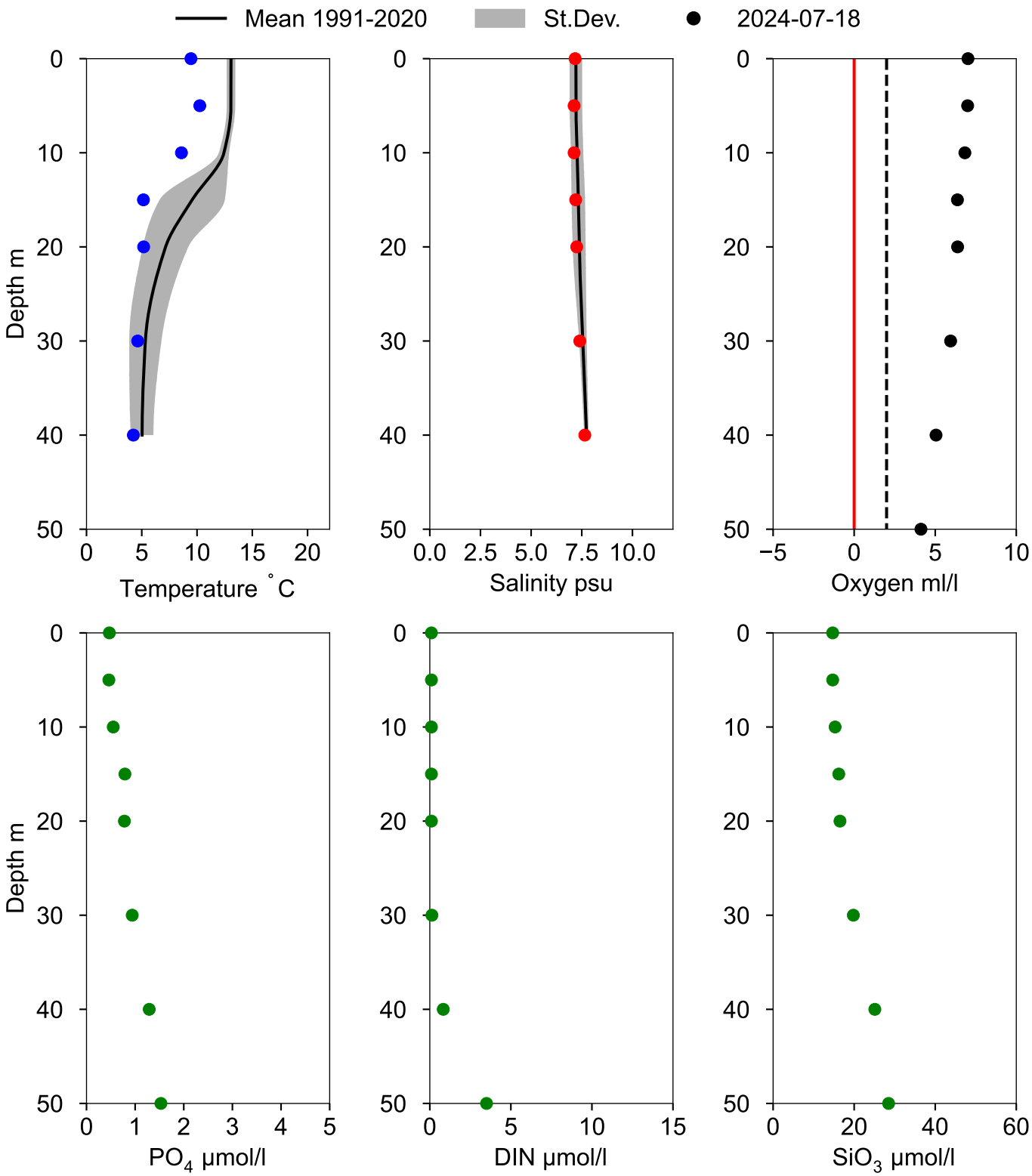
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 40 m)

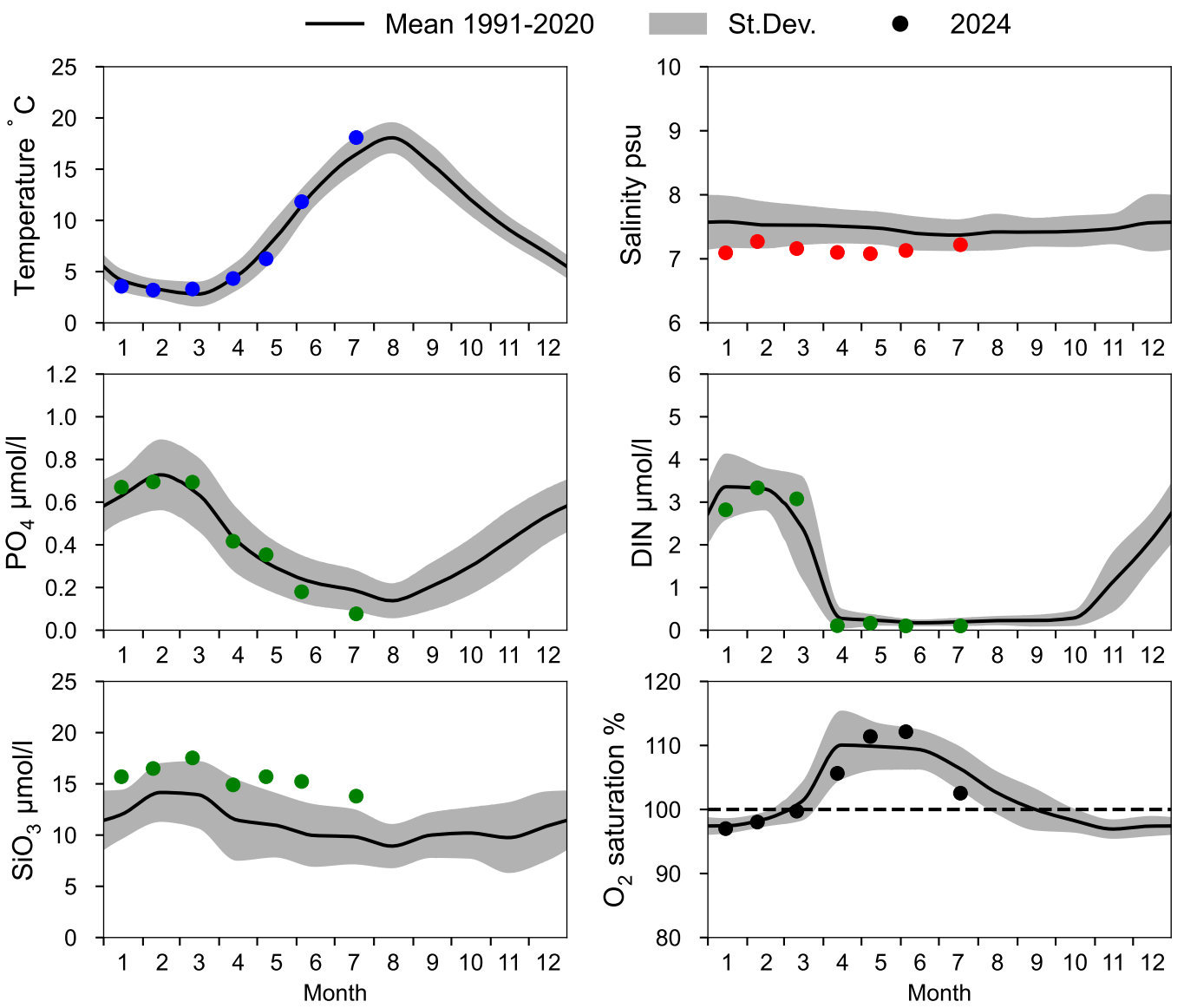


Vertical profiles BY39 ÖLANDS S UDDE
July

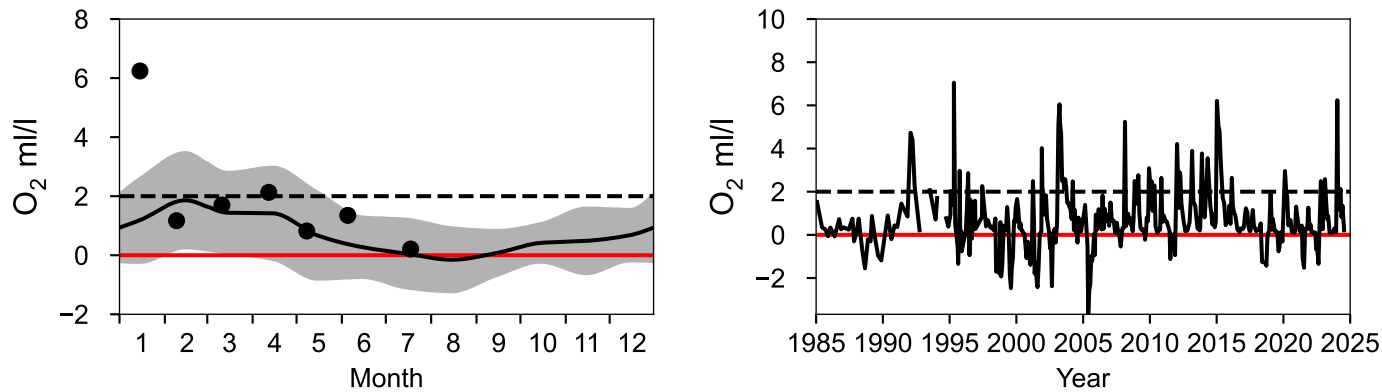


STATION HANÖBUKTEN SURFACE WATER (0-10 m)

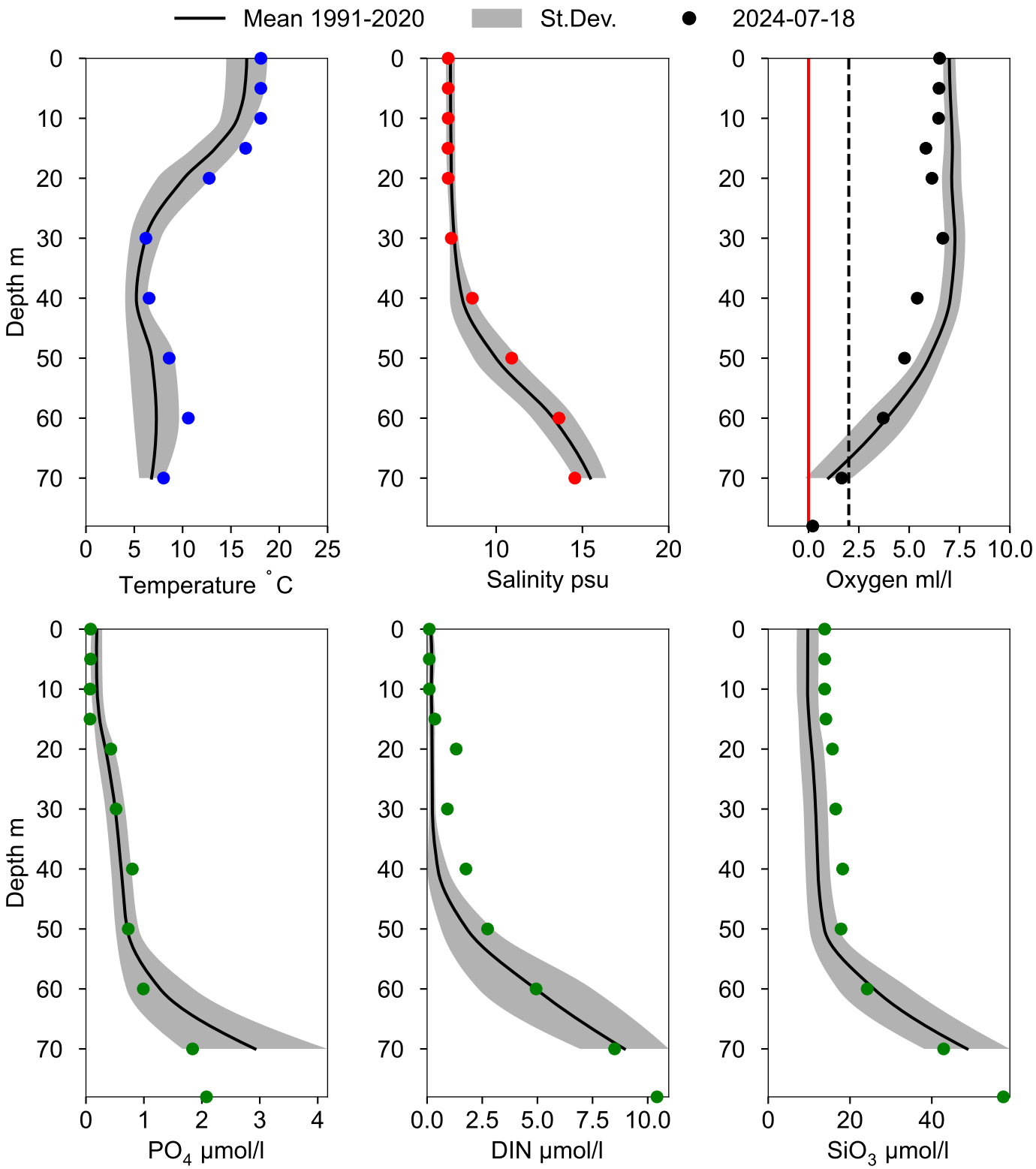
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 70 m)

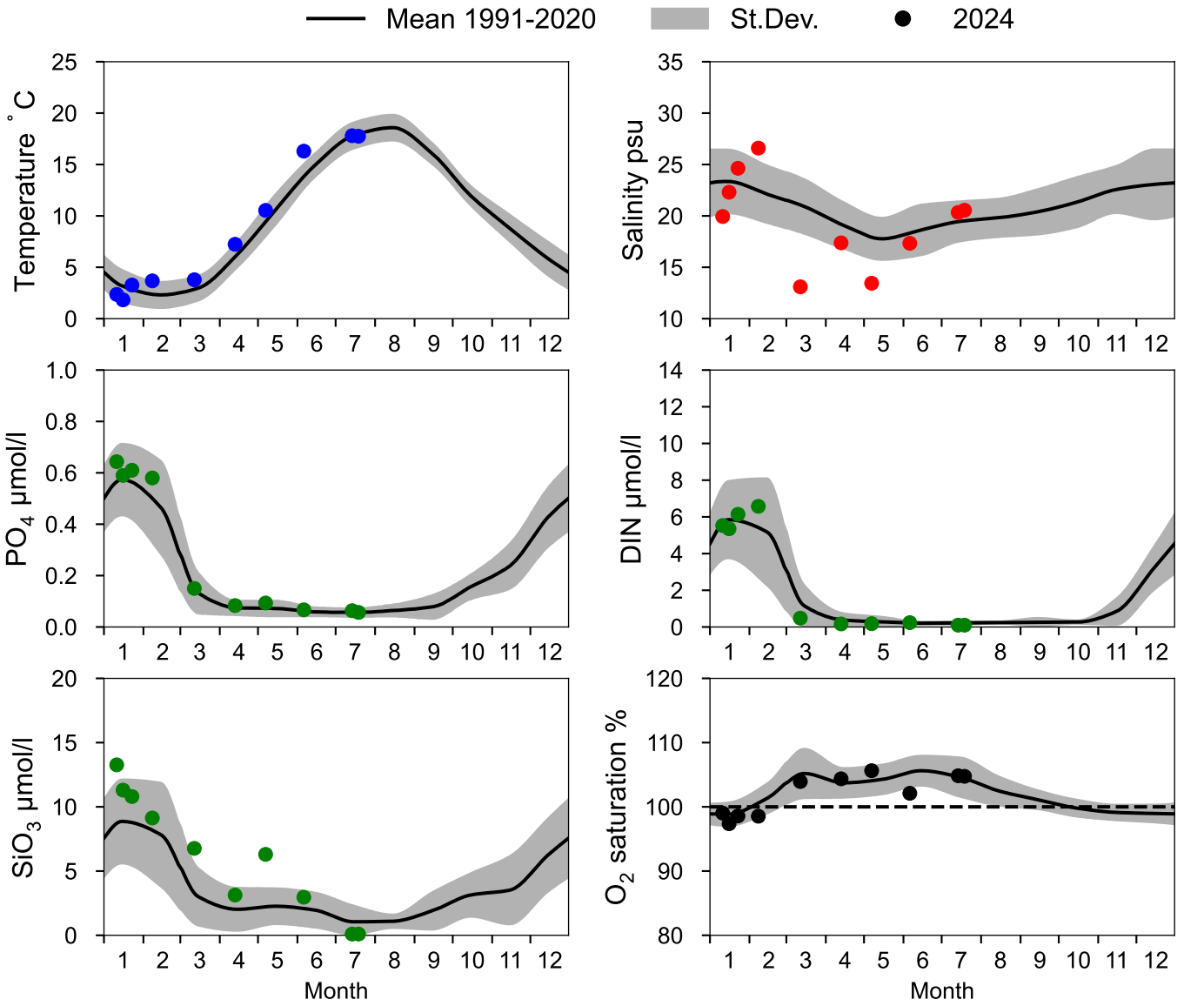


Vertical profiles HANÖBUKTEN
July

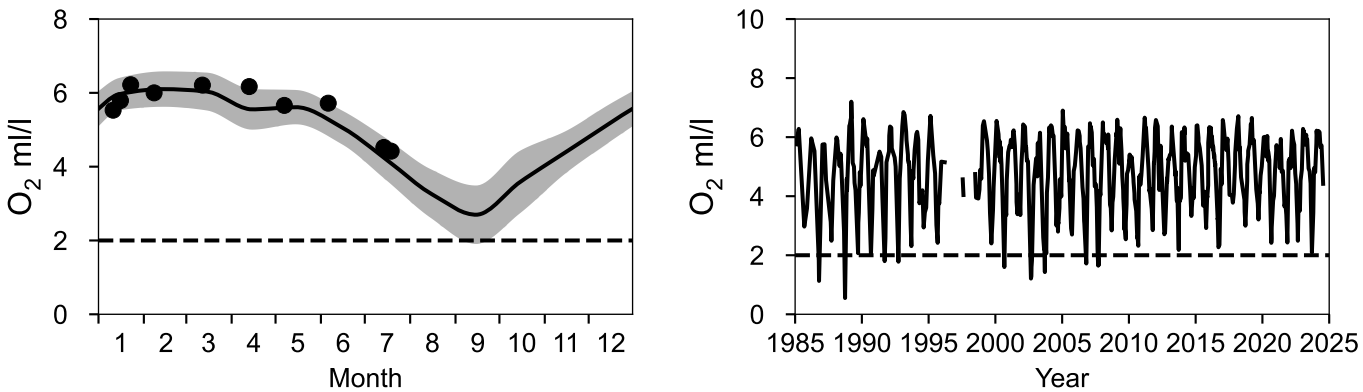


STATION ANHOLT E SURFACE WATER (0-10 m)

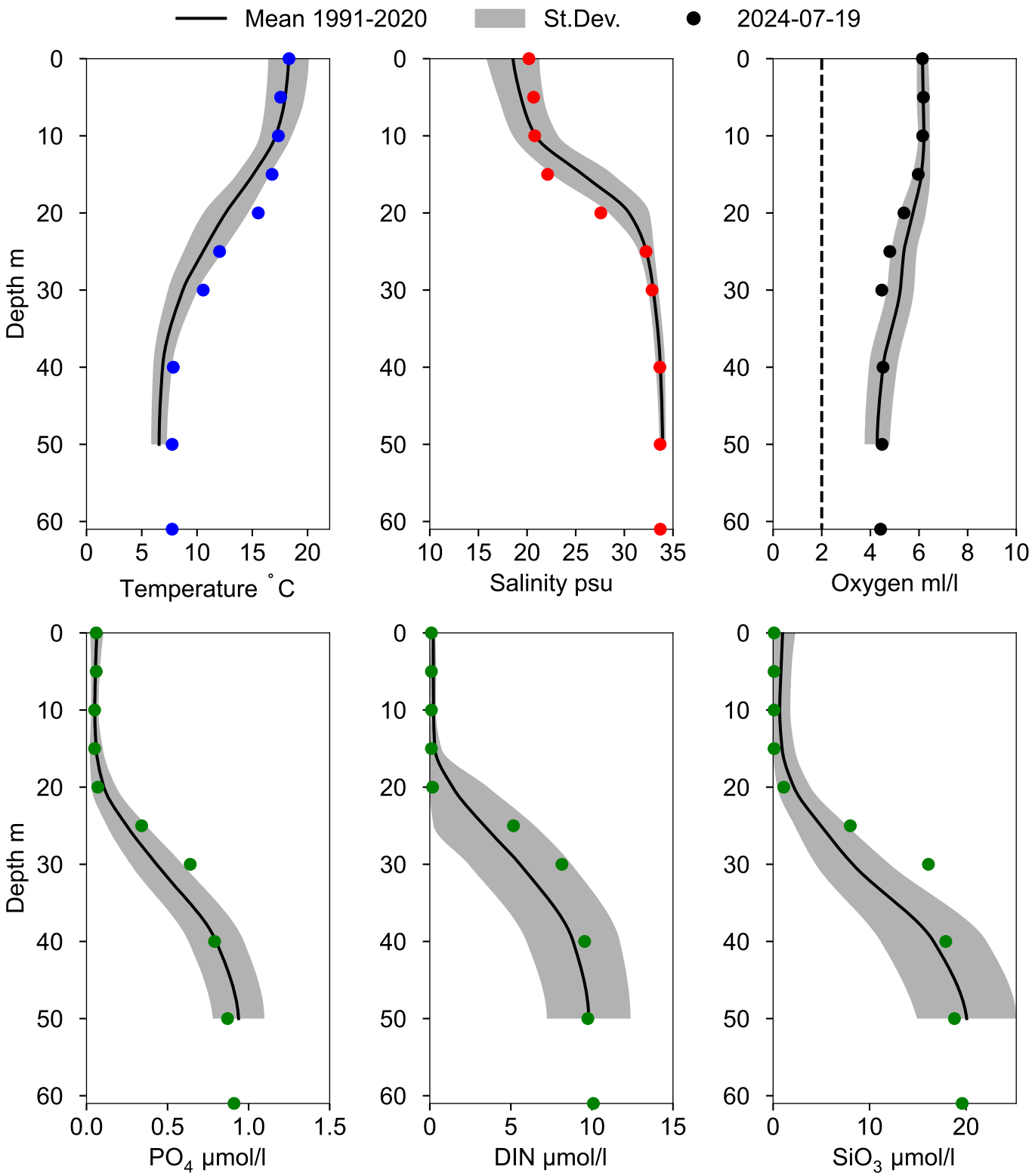
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 52 m)

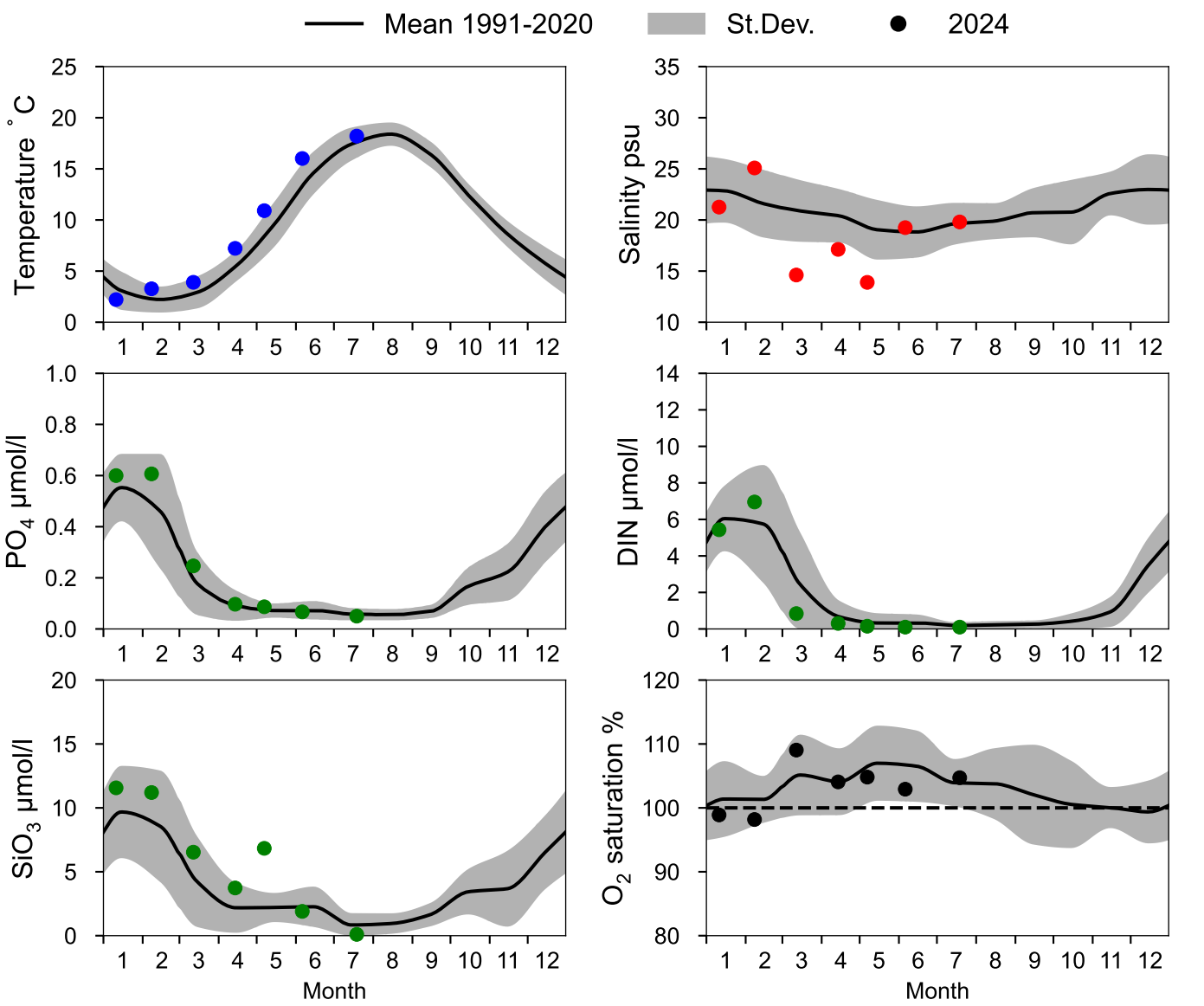


Vertical profiles ANHOLT E
July

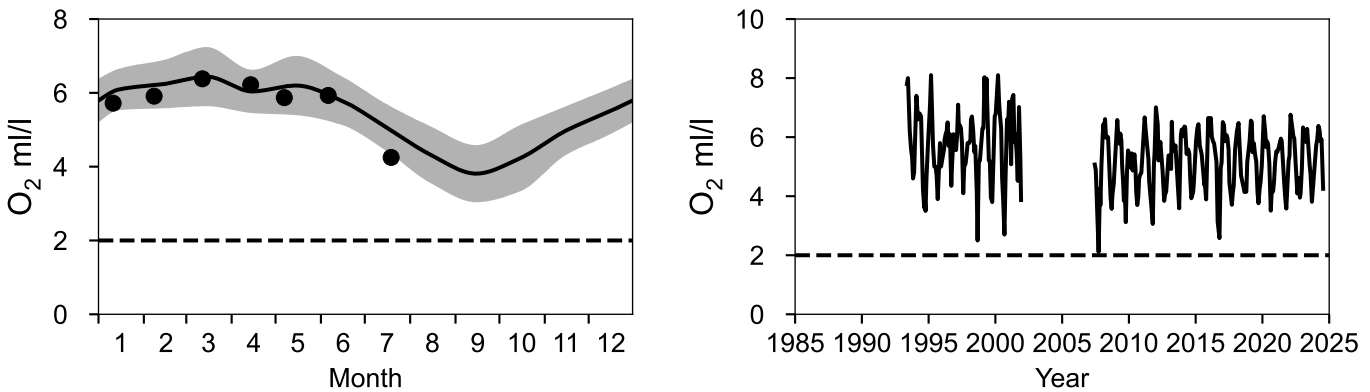


STATION N14 FALKENBERG SURFACE WATER (0-10 m)

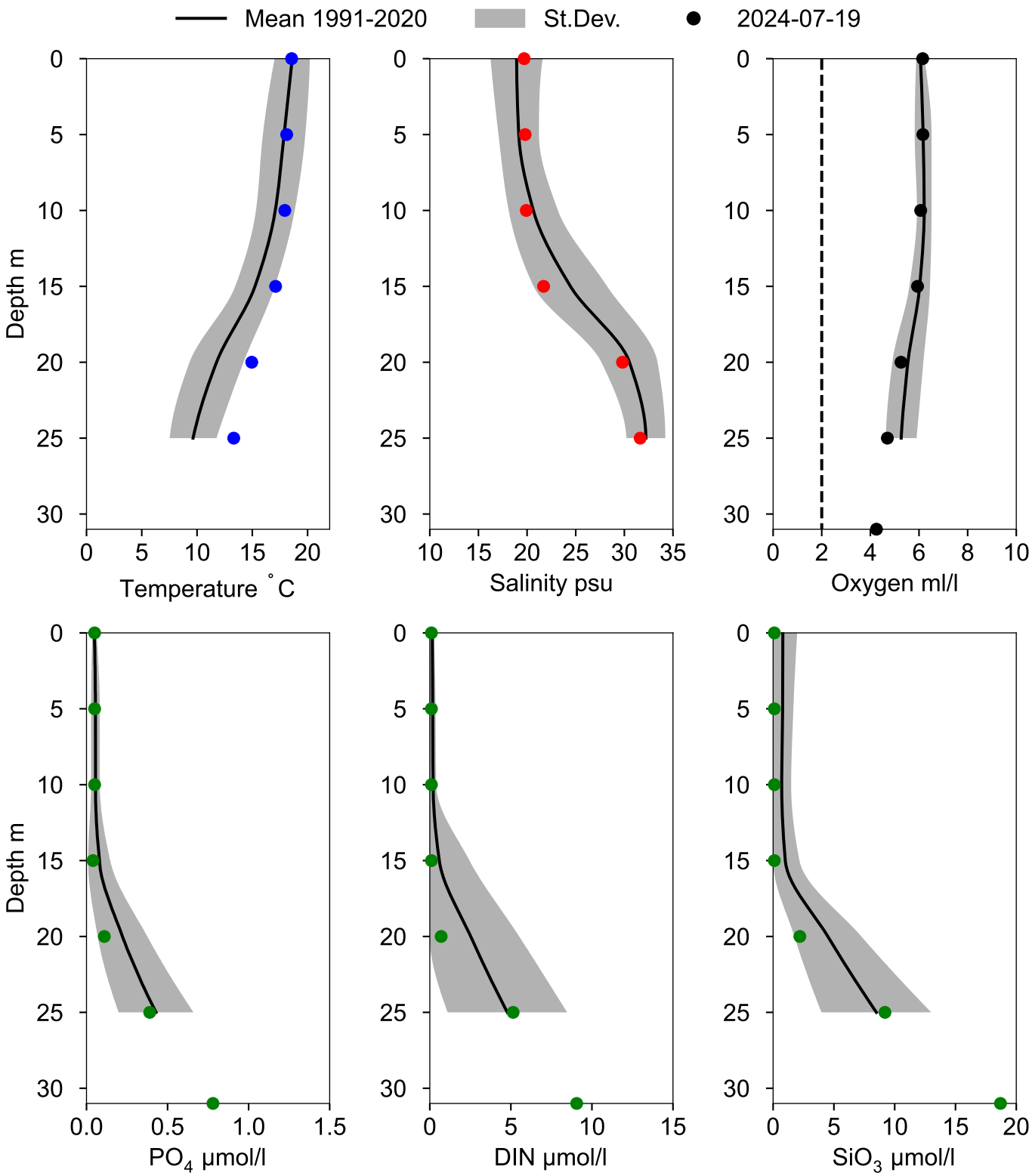
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 25 m)

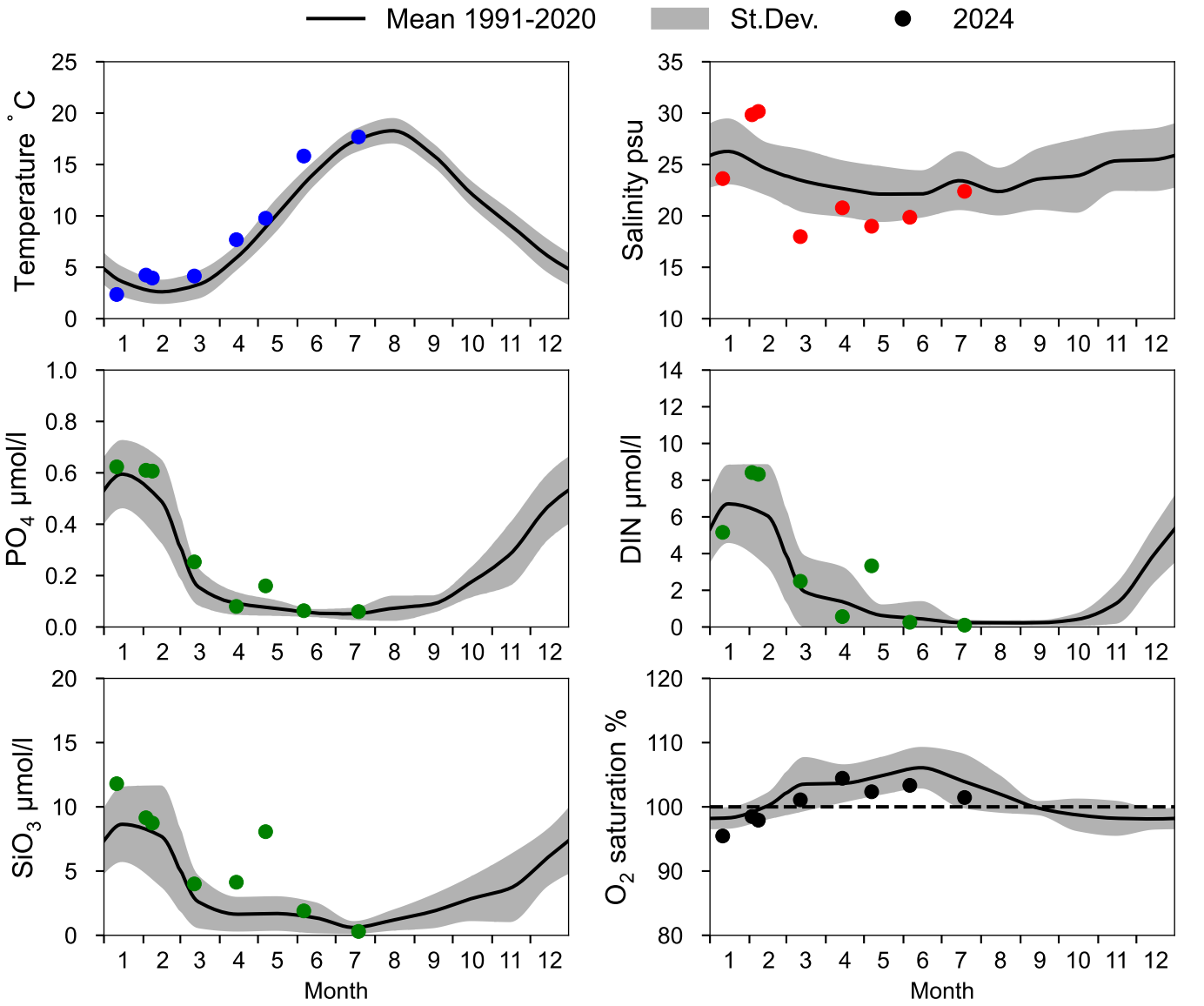


Vertical profiles N14 FALKENBERG
July

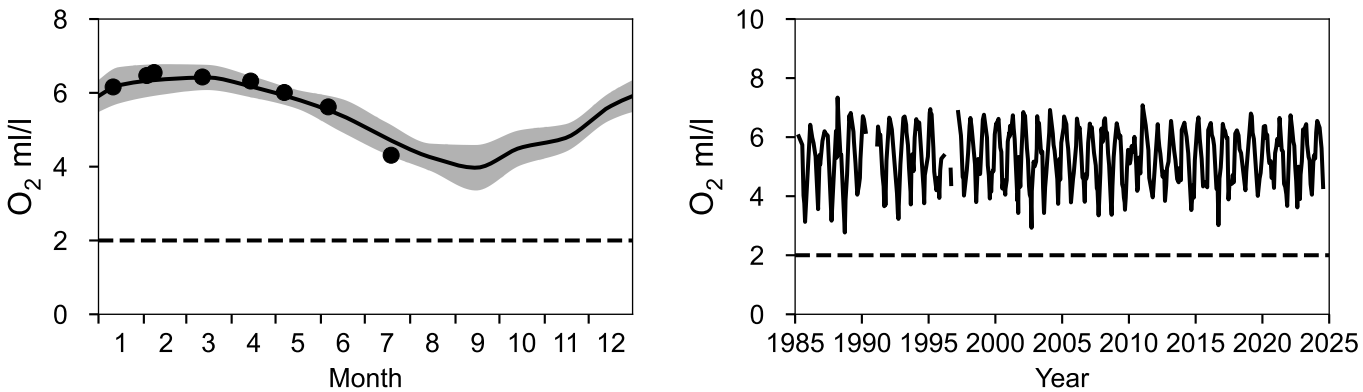


STATION FLADEN SURFACE WATER (0-10 m)

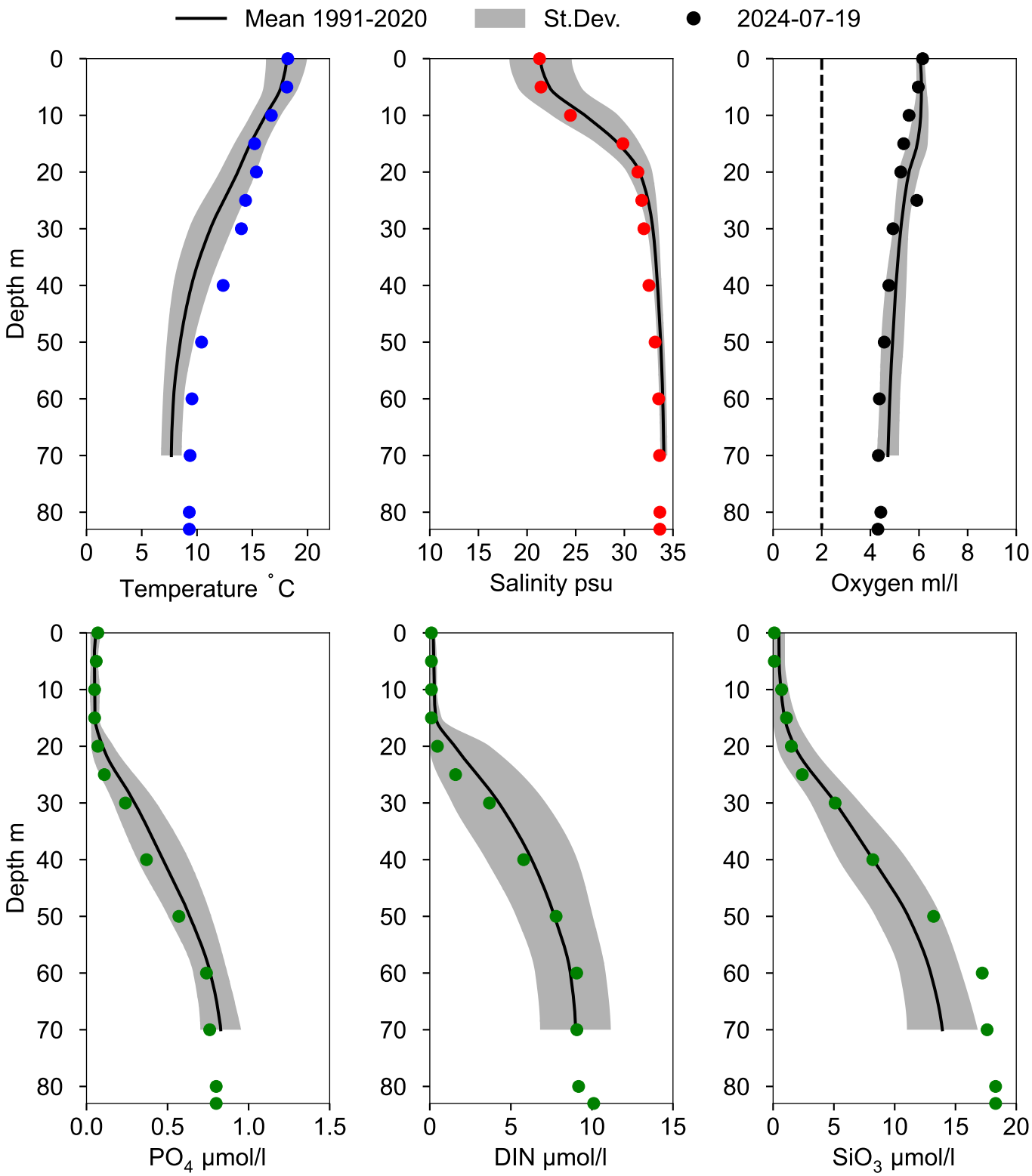
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 74 m)

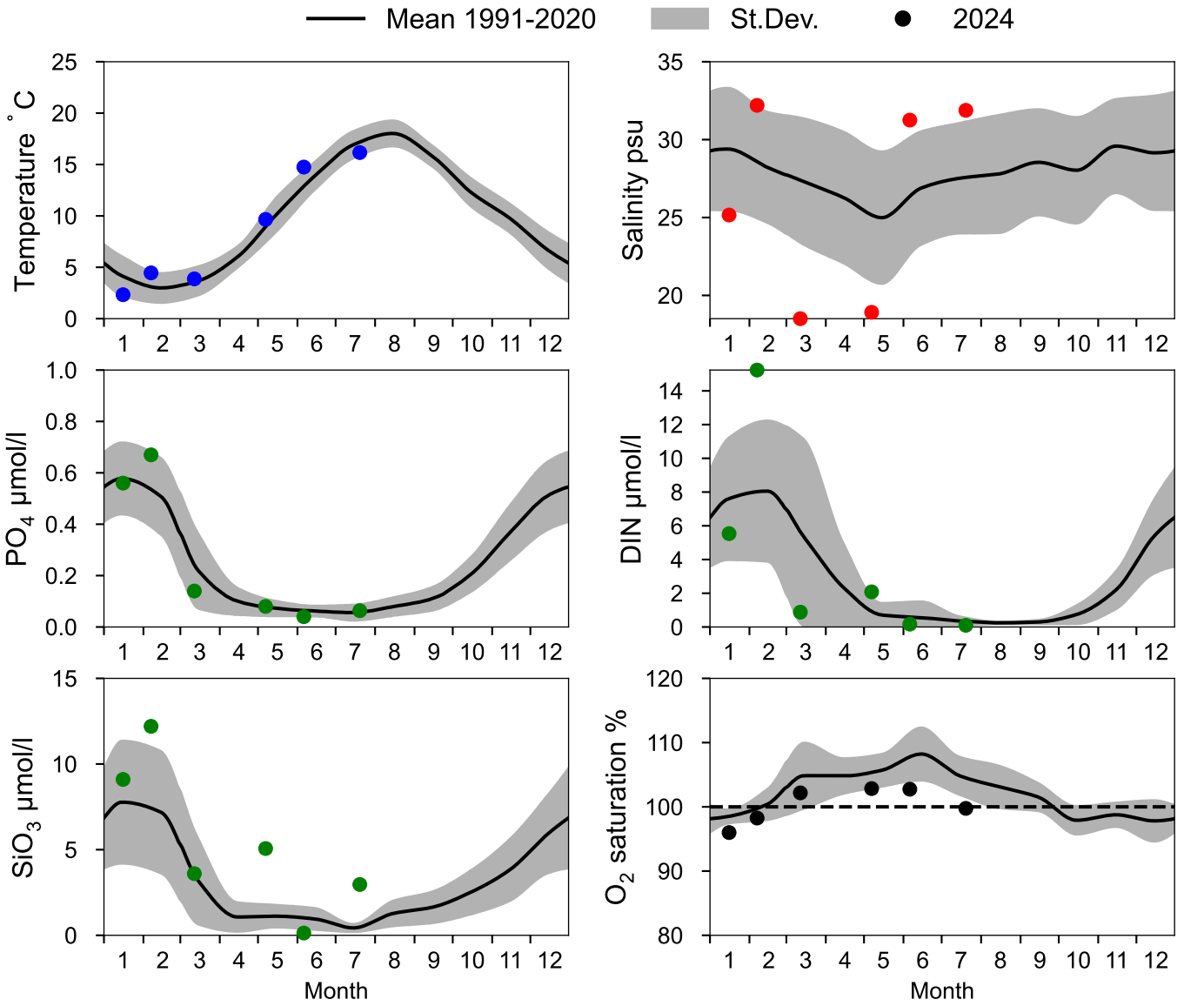


Vertical profiles FLADEN
July

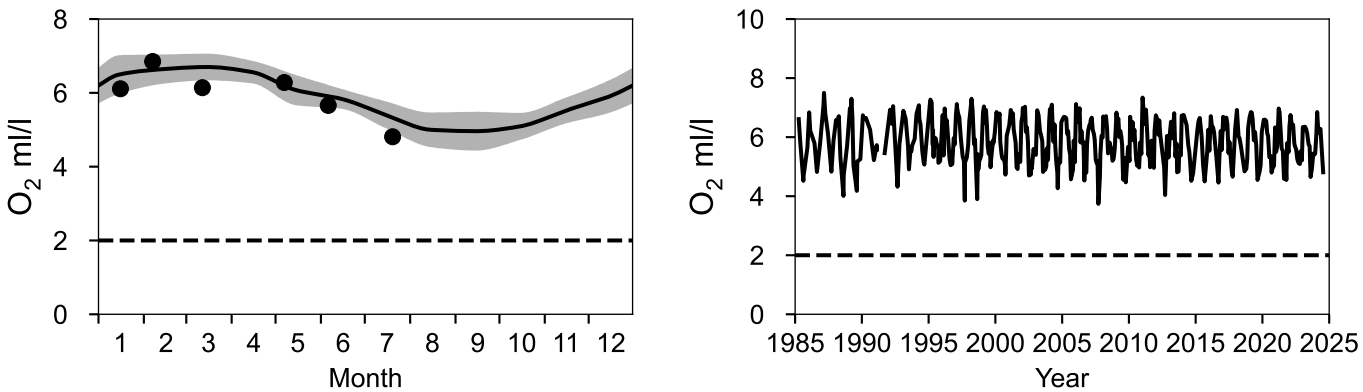


STATION P2 SURFACE WATER (0-10 m)

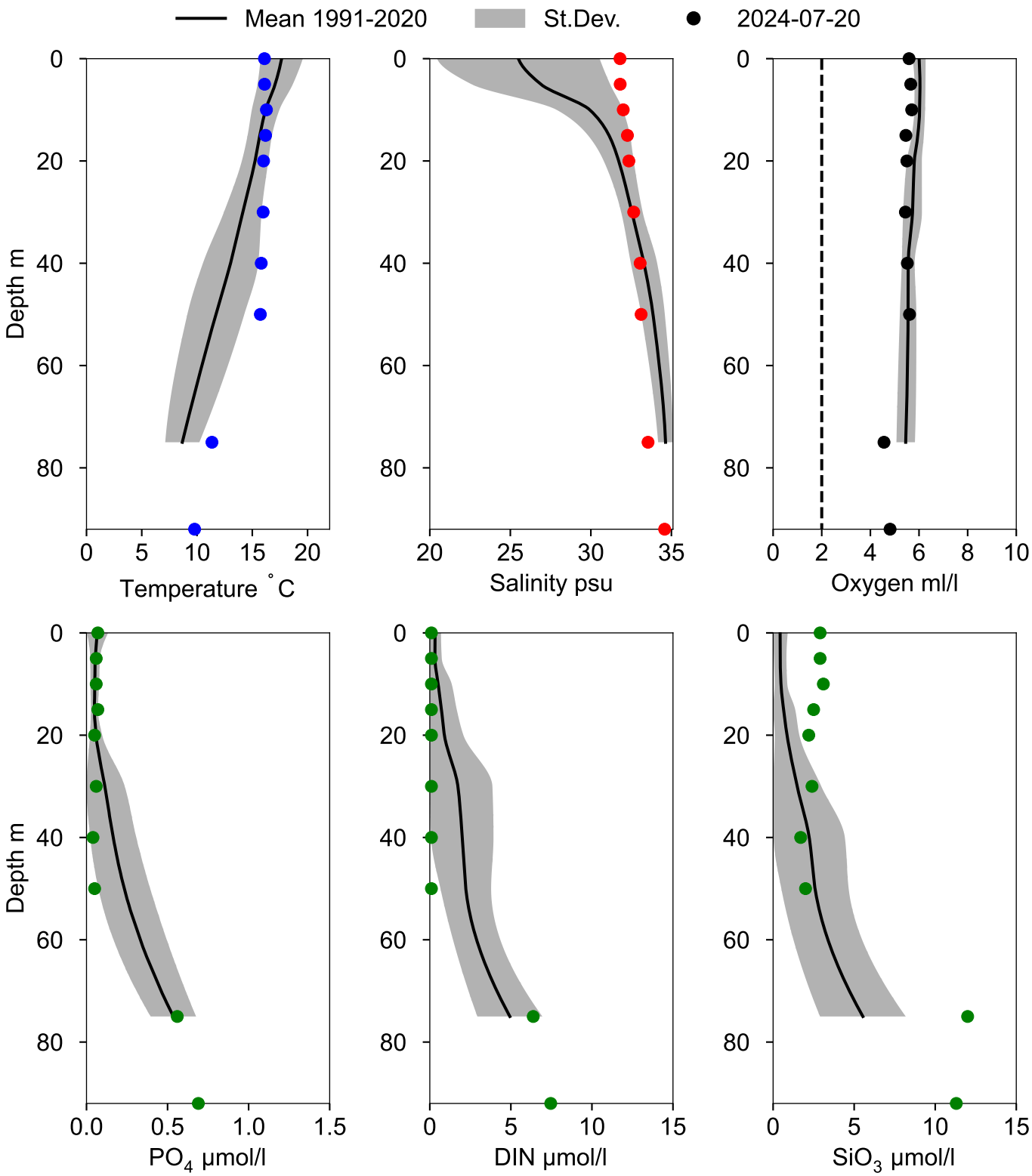
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 75 m)

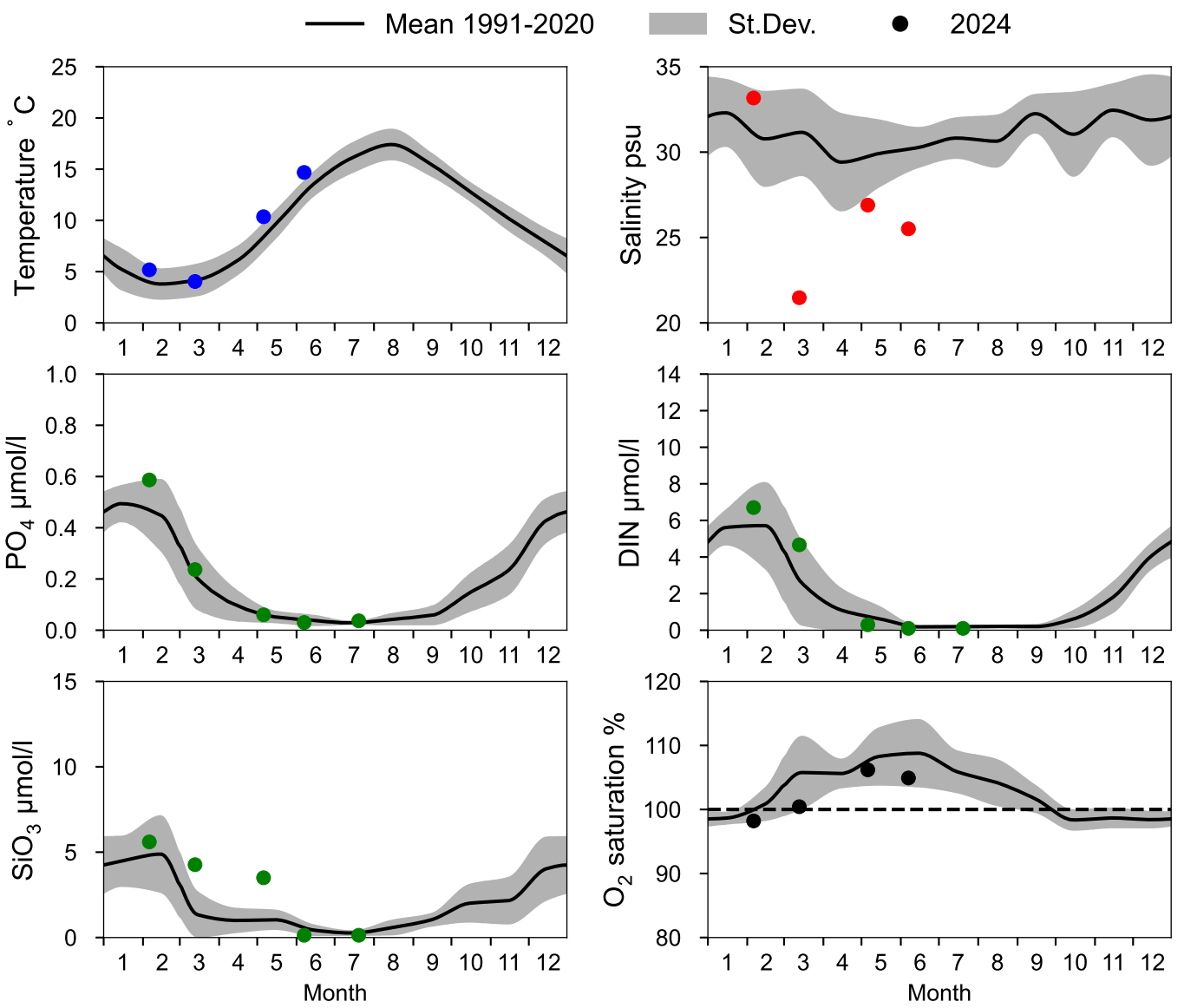


Vertical profiles P2
July

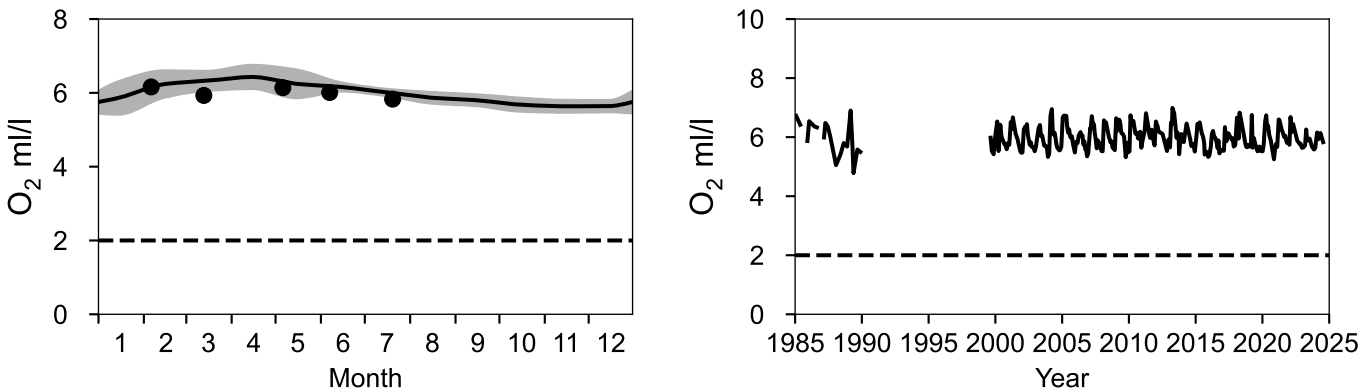


STATION Å17 SURFACE WATER (0-10 m)

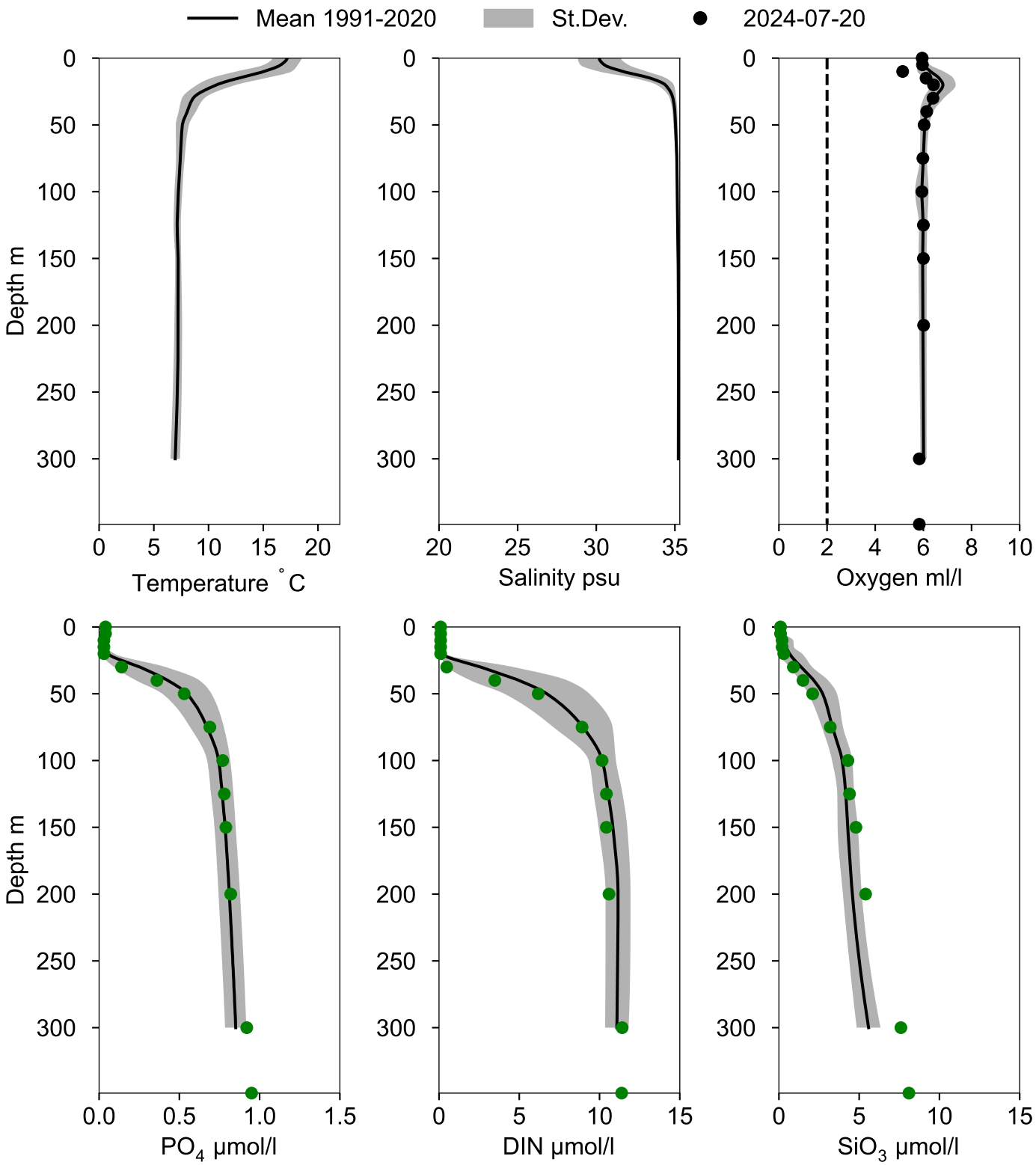
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 300 m)

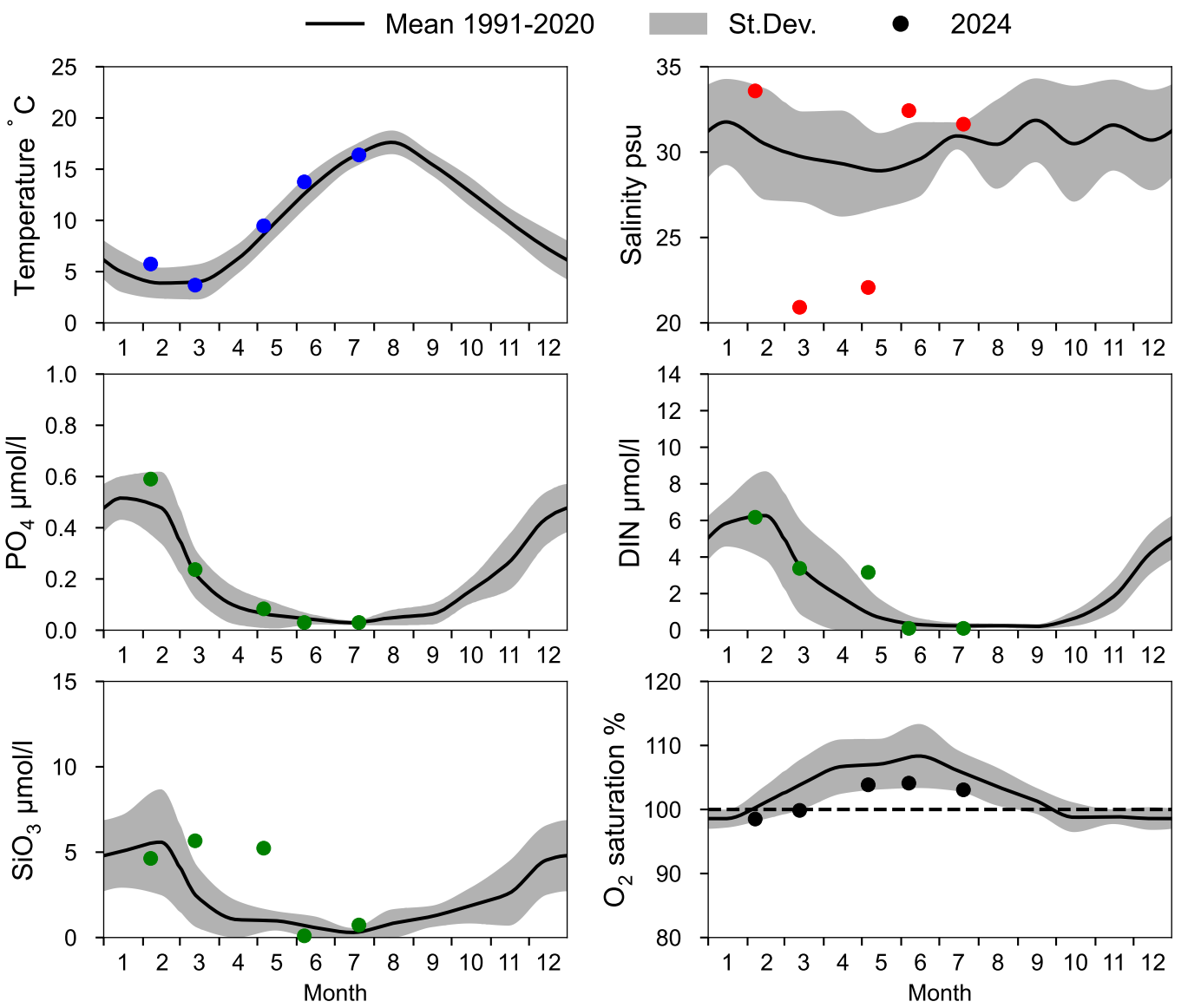


Vertical profiles Å17
July

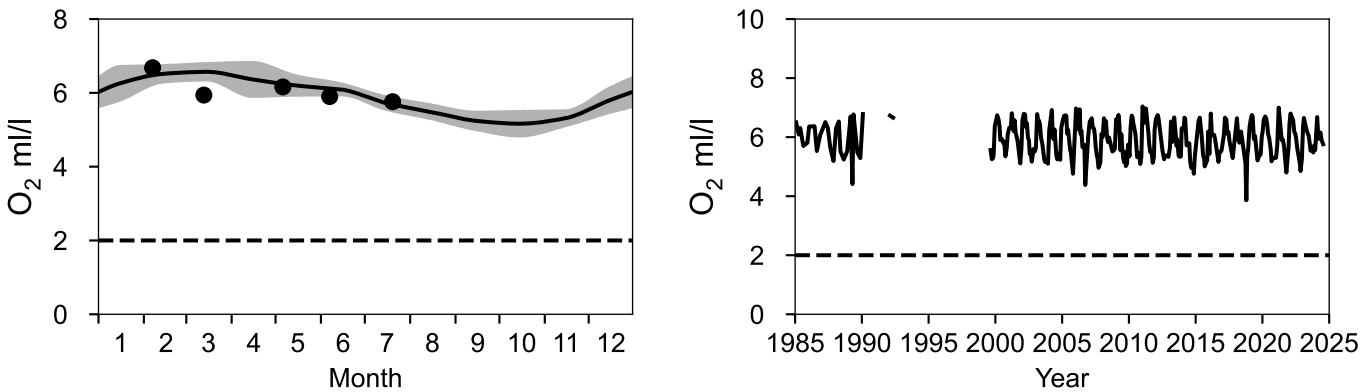


STATION Å15 SURFACE WATER (0-10 m)

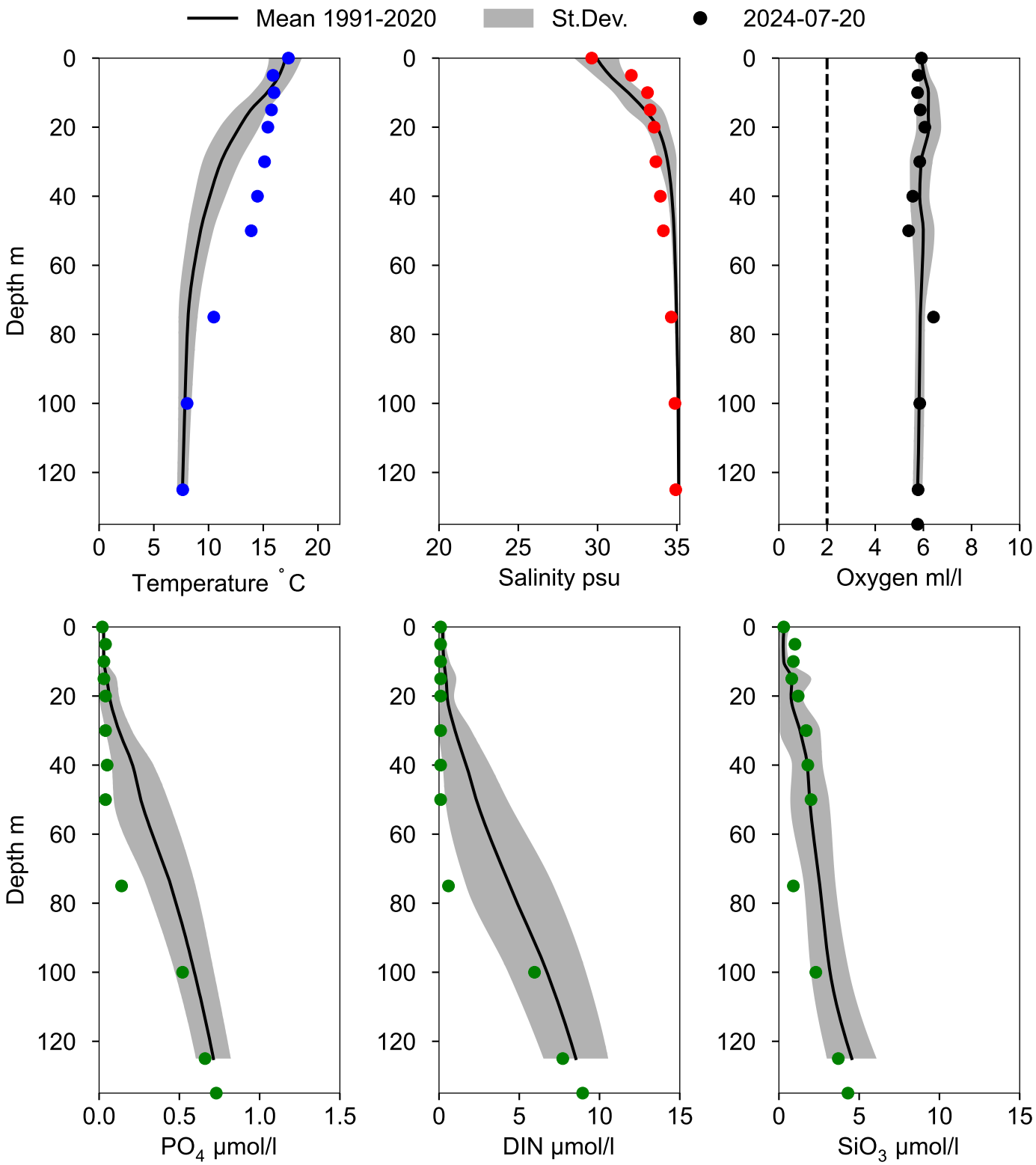
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 125 m)

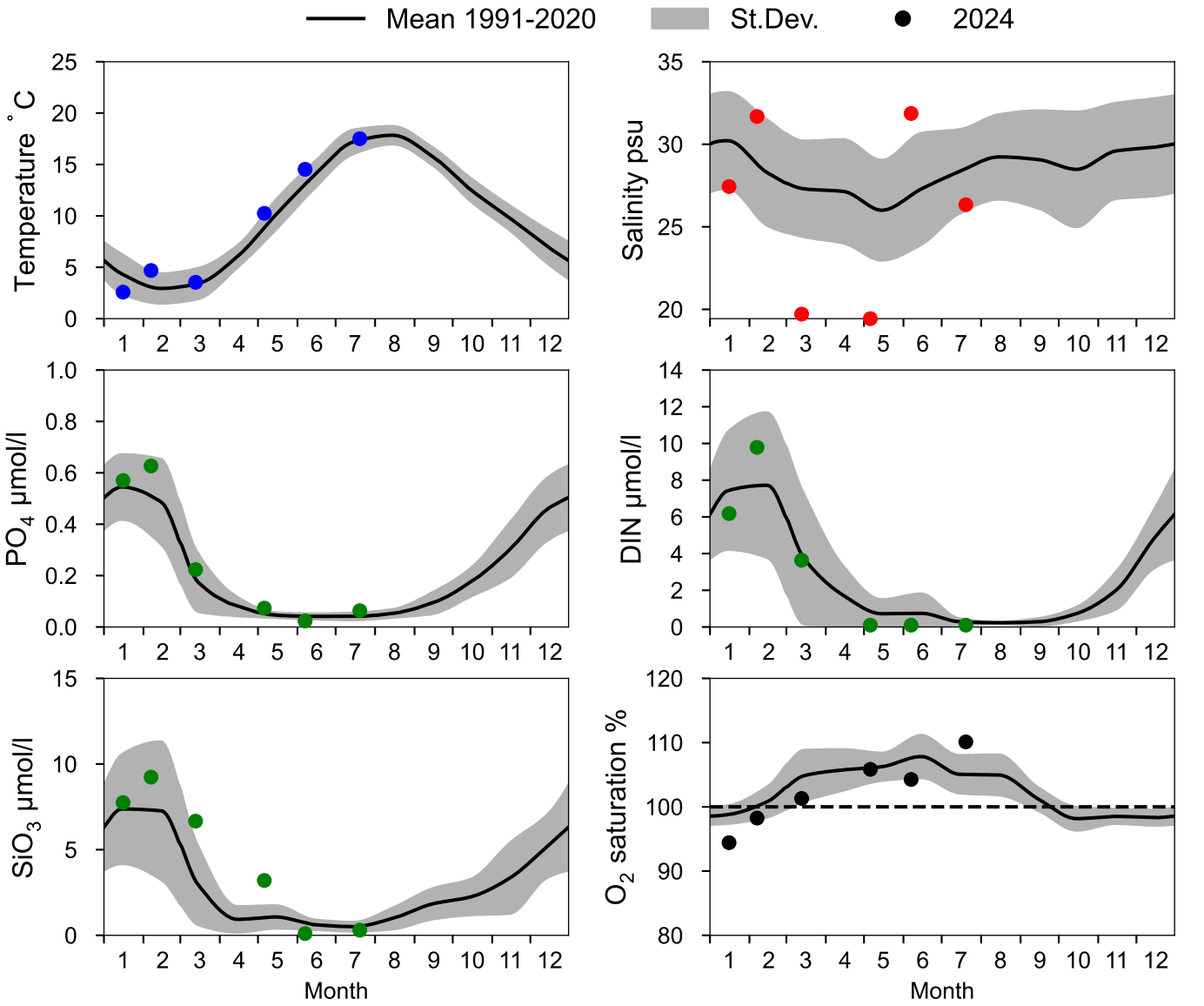


Vertical profiles Å15
July

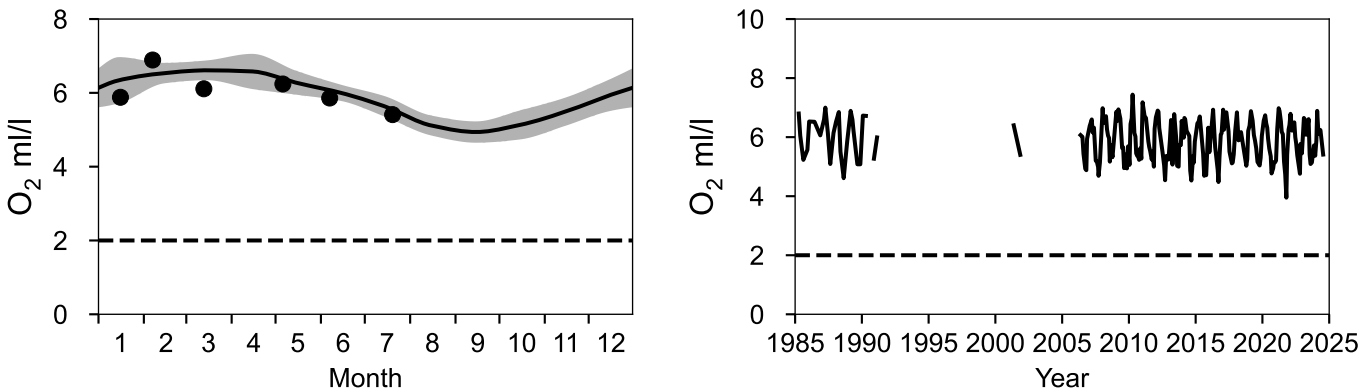


STATION Å13 SURFACE WATER (0-10 m)

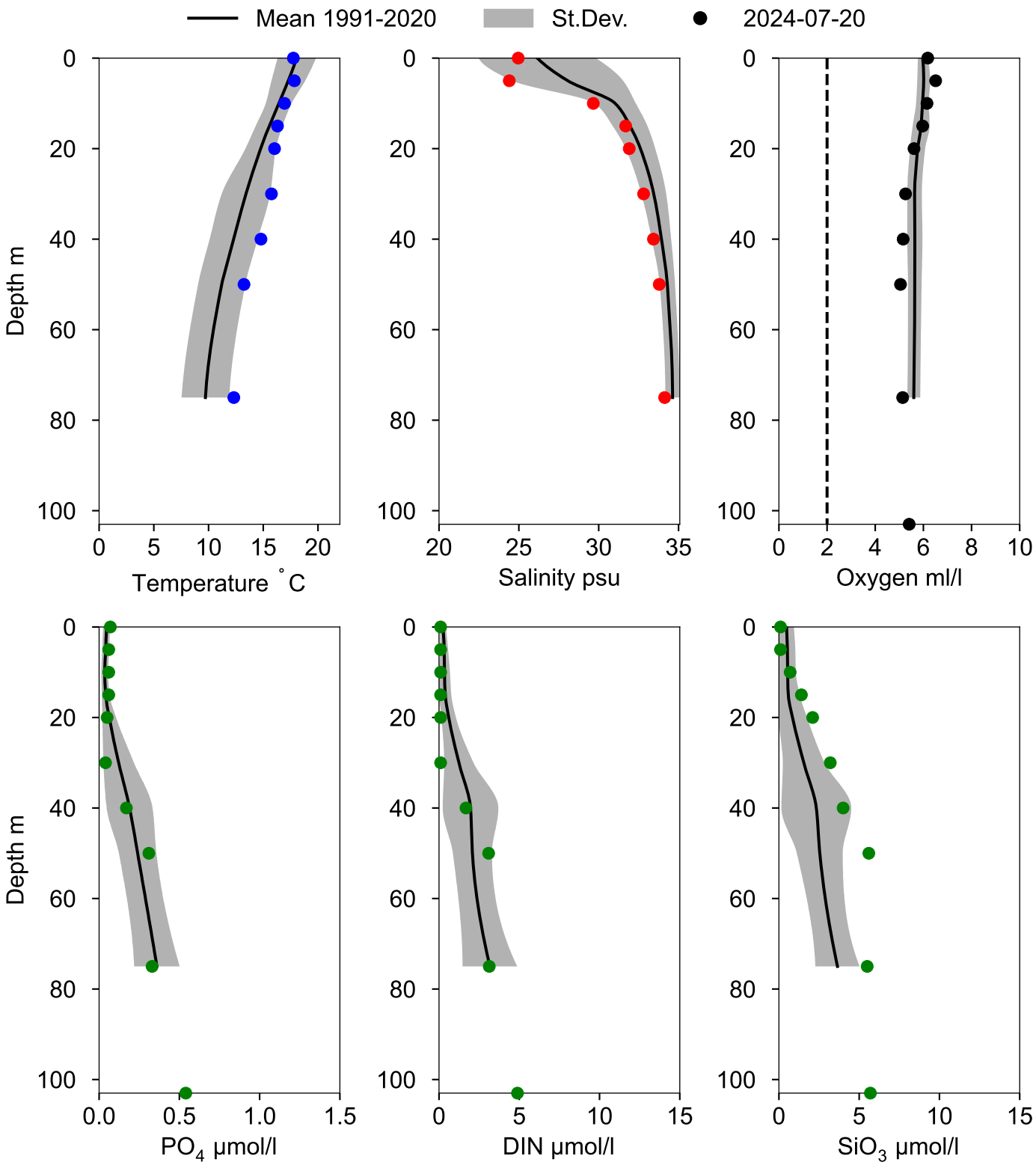
Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 82 m)

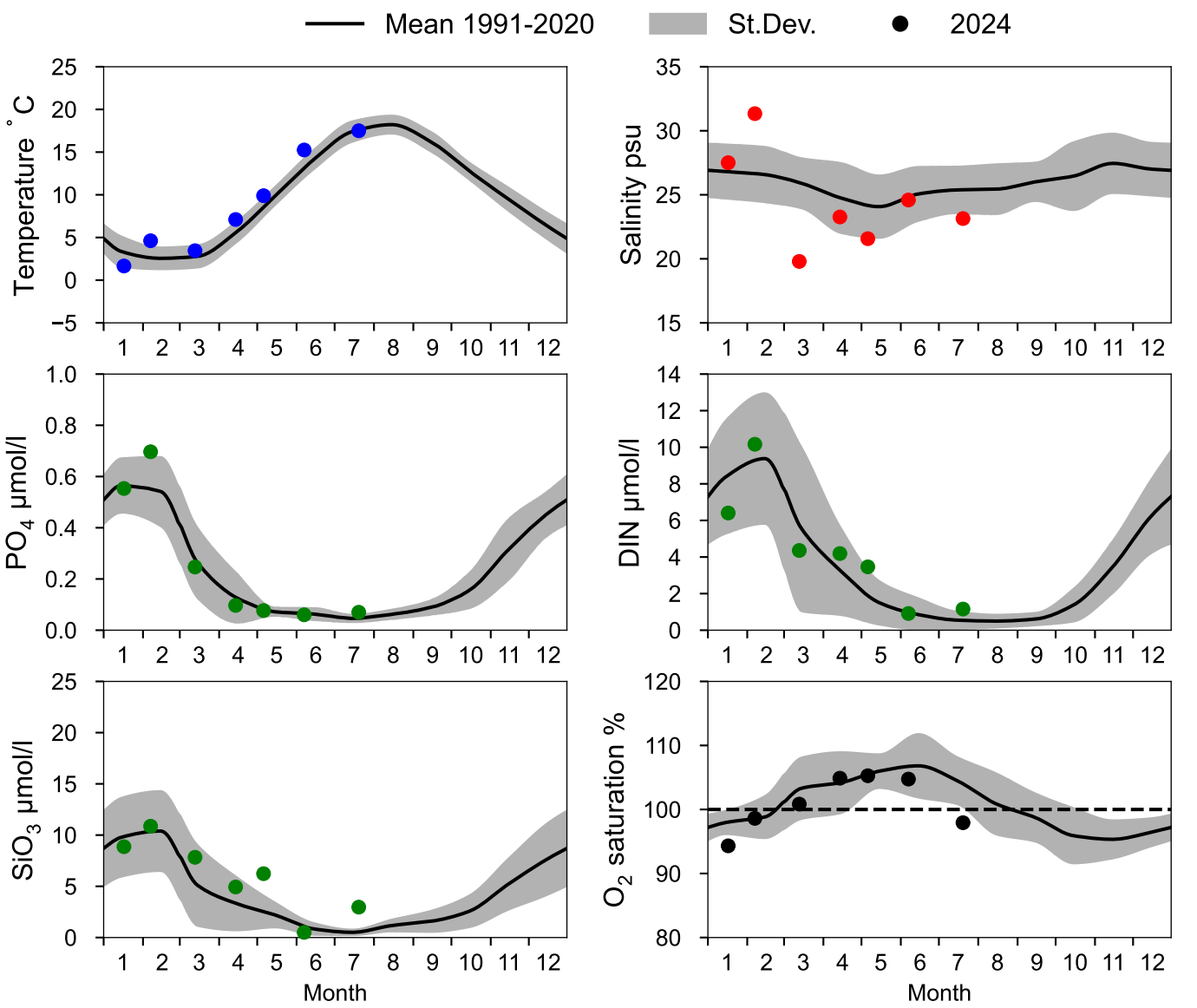


Vertical profiles Å13
July

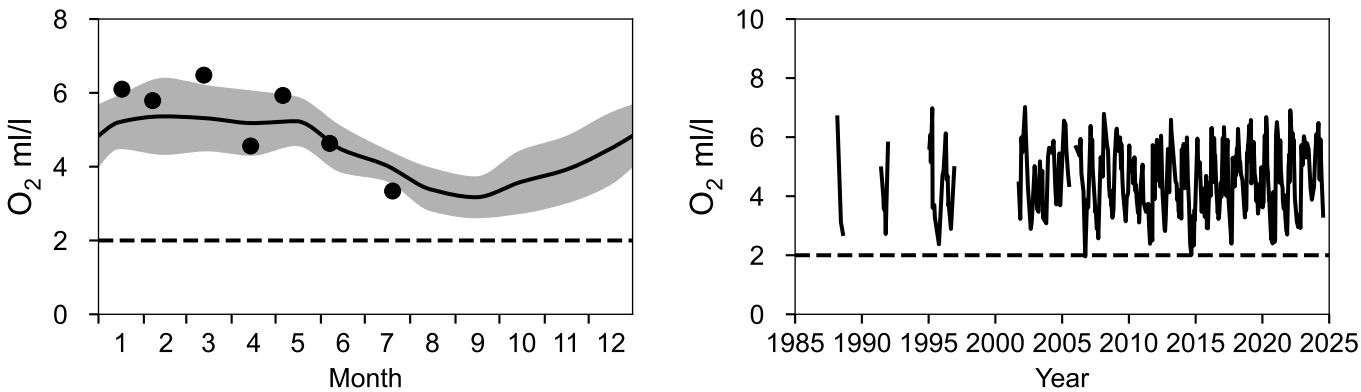


STATION SLÄGGÖ SURFACE WATER (0-10 m)

Annual Cycles



OXYGEN IN BOTTOM WATER (depth >= 64 m)



Vertical profiles SLÄGGÖ
July