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# Report from SMHI's marine monitoring cruise with R/V Svea – May 2025

Foto: Madeleine Nilsson, SMHI

| | |
|---|---|
| **Survey period:** | 2025-05-05 till 2025-05-12 |
| **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 |

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**SUMMARY**
During the expedition, which is part of the Swedish pelagic monitoring program, the Skagerrak, Kattegat, Öresund, and the Baltic Proper were visited. Stockholm University conducted sediment and benthic fauna sampling in the Baltic Sea.

Surface water temperatures were generally normal for the month, ranging from 9 – 11 °C in the Skagerrak and Kattegat and 6 – 10 °C in the Baltic Proper. In the Skagerrak and Kattegat, a weak thermocline had begun to form with warmer surface waters, while the Baltic Proper was more well-mixed and colder down to the halocline.

Surface salinity was higher than normal for the month in large parts of the Baltic Proper. In the Skagerrak and Kattegat, salinity levels were normal or above normal.

Concentrations of dissolved inorganic nutrients in the surface waters of the Skagerrak and Kattegat were low or below detection limits, which is typical for this time of the year. In the Baltic Proper, phosphate and silicate concentrations were higher than normal, while DIN was below detection levels at several stations. In the southern parts of the Baltic, levels were below normal.

Oxygen levels in bottom waters were normal for the month in the Skagerrak and Kattegat (4.7 – 6.4 ml/l). In the Arkona Basin, no severe oxygen deficiency was observed, but the oxygen situation had worsened since April. In the Bornholm Basin and Hanö Bay, severe oxygen deficiency (<2 ml/l) prevailed from 70 – 80 meters, with oxygen concentrations ranging from 0.4 to 1.7 ml/l. In the Eastern Gotland Basin, hydrogen sulphide was detected from 125 meters, with severe oxygen deficiency already from 70 meters. In the Western Gotland Basin, hydrogen sulphide was measured from 80 – 90 meters, and severe oxygen deficiency was present from 70 – 80 meters.

There will be no expedition in June due to budget cuts. The next expedition with R/V Svea is planned for July 14 – 20, starting and ending in Lysekil.

## EXPEDITION OVERVIEW

The expedition was carried out with the research vessel R/V Svea, starting in Lysekil on May 5th and ending in Kalmar on May 12th. Stockholm University (SU) participated to conduct sediment and benthic fauna sampling.

Profiles of salinity, temperature, oxygen, and fluorescence in the water column were measured using a CTD[1] instrument mounted on a rosette sampler equipped with 24 water bottles. SMHI's 24 routine monitoring stations were sampled as planned, and both the Huvudskär buoy and Flinten-7 were visited for reference measurements. An additional station (3SW BY7), just west of the mapping station BY7, was also visited to update and test the CTD winch's AHC system (Active Heave Compensation) with online support from the manufacturer. At five stations, extra sampling was carried out to test the storage time for alkalinity samples. We also tested to preserve phytoplankton in ethanol instead of the highly toxic formalin that is usually used

The Moving Vessel Profiler (MVP), which measures oxygen, salinity and temperature profiles, and the FerryBox, which measures several parameters in the surface water, were both operated while the ship was underway. However, the IFCB instrument was not installed on the FerryBox during this cruise.

Gelatinous zooplankton, which is new in the monitoring program since 2025, was sampled with a large net at stations in both the Skagerrak, Kattegat and the Baltic Sea. The samples were photographed in a photo box and the images will be analysed by the University of Gothenburg. Environmental DNA (eDNA) was sampled in the Baltic Sea within the SAMBAH II project, aimed at mapping the presence of harbour porpoises in the Baltic Proper.

Monitoring equipment for harbour porpoises was deployed at two locations on behalf of SLU and the County Administrative Board of Kalmar, close to one of SU's sampling areas south of Öland.

The results presented in this report are based on data that have undergone initial quality control and have been compared to monthly averages for the period 1991–2020. After further quality assurance, some values may be subject to change. All values in the report are rounded to the nearest tenth and may therefore differ slightly from published values. Data are published as soon as possible on the data host's website, usually within about a week after the expedition. Some analyses are conducted post-expedition and are therefore published later.

For more information on our data hosting and to download data, visit:
https://www.smhi.se/data/oceanografi/datavardskap-oceanografi-och-marinbiologi
For details on the algae situation, refer to the Algaware report:
https://www.smhi.se/publikationer/publikationer/algrapporter

[1]CTD is a profiling instrument and is short for Conductivity, Temperature and Depth

## RESULTS

The weather during the expedition week was mostly clear, initially with moderate winds that decreased over Skagerrak and Kattegat, followed by light winds in the Baltic Sea. The air temperature ranged from 5 to 12 °C, with the lower temperatures observed over the Baltic Sea.

### Skagerrak

The temperature in the surface waters of Skagerrak was normal, ranging from 8 to 10 °C, with the coldest temperatures near the coast. A thermocline has started to form in the outer parts of the Skagerrak, with warmer surface waters extending down to approximately 20 meters. The salinity in the surface water was 27 psu near the coast and 31 psu in the open sea.

The concentration of dissolved inorganic nutrients in the surface water remained low at all stations except near the coast, where higher levels were observed. At the Släggö station in the mouth of Gullmar Fjord, the concentrations of dissolved inorganic nitrogen (DIN) were 1.4 µmol/l, silicate 1.9 µmol/l, and phosphate 0.2 µmol/l.

The oxygen levels at the seafloor were good at all stations in Skagerrak, with normal concentrations for the month, ranging from 5.3 to 6.4 ml/l, the lowest at Släggö.

Fluorescence measurements showed the highest peaks between 10 and 15 meters at the Å13 and P2 stations, with a significant peak at 12 meters at P2.

### Kattegat and Öresund

Surface water temperatures ranged from 9.7 to 11.3 °C, which is normal for the month, with the warmest temperatures observed in Öresund. The salinity in the surface water ranged from 21 to 30 psu, higher than usual at the Anholt E and N14 Falkenberg stations. In Öresund, the salinity was lower, around 17 psu.

The halocline and thermocline were located at depths of 10 to 15 meters in Kattegat, with colder and saltier deep water around 35 psu and 6 to 7 °C. In Öresund, the stratification was at 10 meters, with a salinity of 33 psu and a temperature of around 7 °C in the bottom water.

Chlorophyll fluorescence was highest in Öresund, where a strong fluorescence peak was recorded at 20 meters. Fluorescence maxima were also observed at Fladen and Falkenberg, but somewhat shallower, at 10 to 12 meters. Additional plankton samples were collected at these stations for species identification.

The concentrations of dissolved inorganic nutrients in the surface water remained low or below detection limit across the area, except at the N14 Falkenberg station, where the

levels of DIN and phosphate were measured at 0.3 and 0.1 µmol/l, respectively. The silicate concentration was lower than normal at all stations, ranging from 0.1 to 0.6 µmol/l. In Öresund, the amount of silicate in the surface water had decreased significantly since April, and combined with the high fluorescence peak observed at 20 meters, this suggests an ongoing algal bloom.
The oxygen situation in the bottom waters of Kattegat and Öresund was good, with concentrations ranging from 4.8 to 5.7 ml/l.

**The Baltic Sea**
Surface water temperatures were normal for the month across the central Baltic Sea, ranging from 7.0 to 9.8 °C in the Southern Central Baltic Sea, 5.9 to 6.2 °C in the Eastern Gotland Basin, around 5.6 °C in the Northern Central Baltic Sea, and 6.6 to 6.9 °C in the Western Gotland Basin.

The salinity in the surface water was higher than normal for the month in much of the central Baltic Sea. In the Southern Central Baltic Sea, it ranged from 7.5 to 7.9 psu, in the Eastern Gotland Basin from 7.0 to 7.5 psu, and in the Western Gotland Basin from 6.9 to 7.2 psu.

In the Arkona Basin, a weak thermocline was observed at depths of 15 to 20 meters, while the halocline was located slightly deeper at 30 meters, with salinity around 15 to 17 psu below. In the Hanö Bay and Bornholm Basin, warmer and saltier water was found beneath 50 meters. No sharp thermocline was observed in the remaining parts of the Baltic Sea, but an intermediate colder water layer was noted at depths of 30 to 80 meters, with the halocline located between 60 and 80 meters.

The concentration of DIN in the central Baltic Sea was below or near the detection limit (0.1 µmol/l), which was below normal levels. Phosphate and silicate concentrations, however, were higher than normal, with levels around 0.3 to 0.6 µmol/l and 14 to 16 µmol/l, respectively.

In the Arkona Basin, the oxygen situation in the bottom waters had worsened since April, with concentrations now measures between 2.7 and 3.6 ml/l.
In the Bornholm Basin and Hanö Bay, there was severe oxygen depletion (<2 ml/l) from 70 to 80 meters, but no hydrogen sulphide was measured in the area. The oxygen concentrations in the bottom waters ranged from 0.4 to 1.7 ml/l. In the Eastern Gotland Basin, hydrogen sulphide was measured from 125 meters, but severe oxygen depletion was already present from 70 meters. In the Western Gotland Basin, severe oxygen depletion was observed from 70 to 80 meters, with hydrogen sulphide present from 80 to 90 meters. The highest hydrogen sulphide concentrations were found in the Eastern Gotland Basin at the BY15 Gotland Deep. Since 2023 additional samples from this station have been diluted before analysis, as we suspect that the concentrations might be underestimated.

Fluorescence measurements indicated low plankton activity in the surface layer, but the highest fluorescence was recorded at 15 to 20 meters depths in the Arkona and Bornholm Basins.

## FIGURES

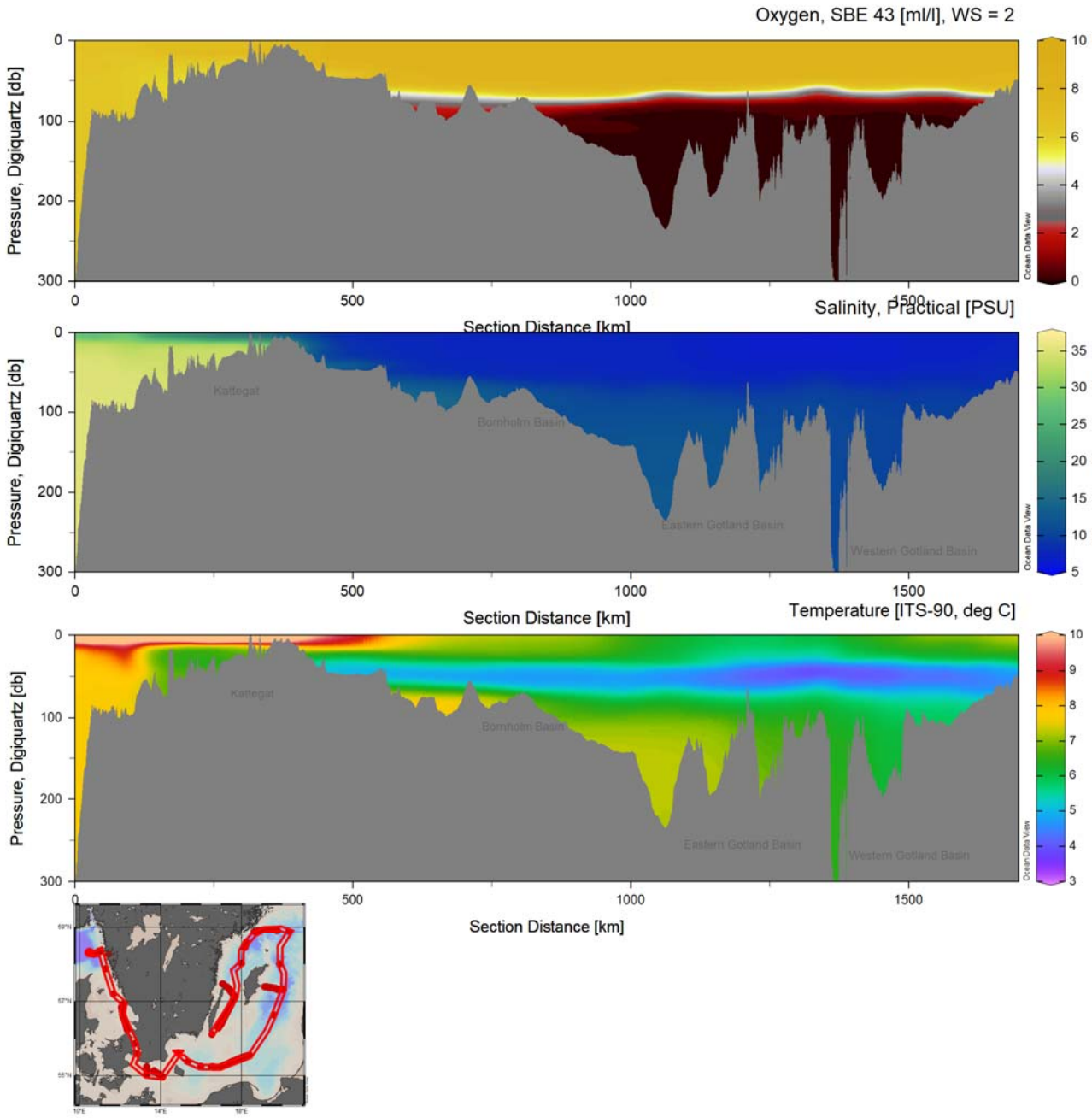


Figure 1. Section showing oxygen concentration, salinity, and temperature from CTD and MVP measurements, from the Skagerrak through the Kattegat and into the Baltic Sea according to the map (bottom).

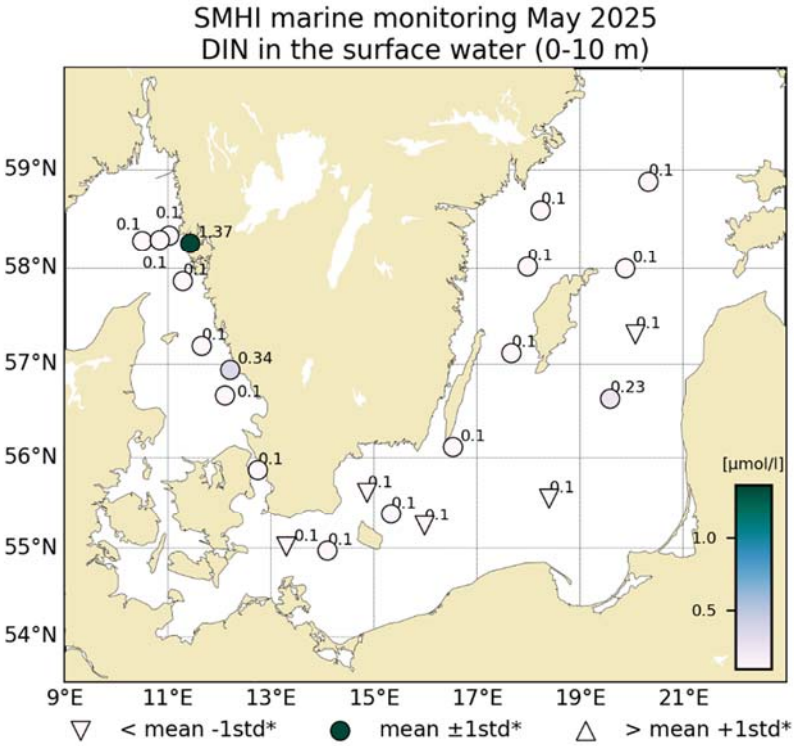


Figure 2. The concentration (µmol/l) of inorganic nitrogen (DIN) in the surface water (0 – 10 m). The mean value is based on data for the month at each station during the years 1991 – 2020.

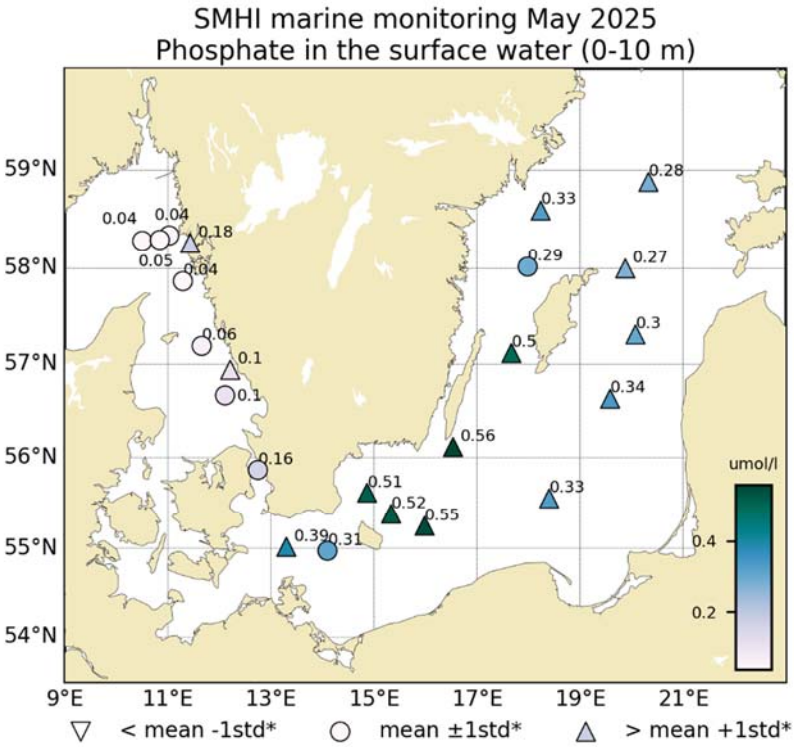


Figure 3. The concentration (µmol/l) of phosphate in the surface water (0 – 10 m). The mean value is based on data for the month at each station during the years 1991 – 2020.

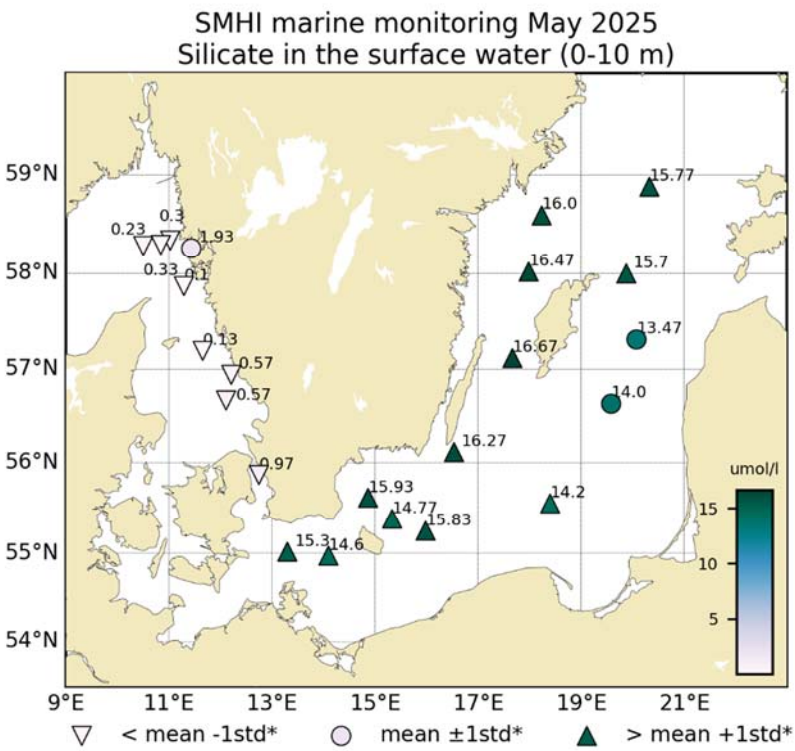


Figure 4. The concentration (µmol/l) of silicate in the surface water (0 – 10 m). The mean value is based on data for the month at each station during the years 1991 – 2020.

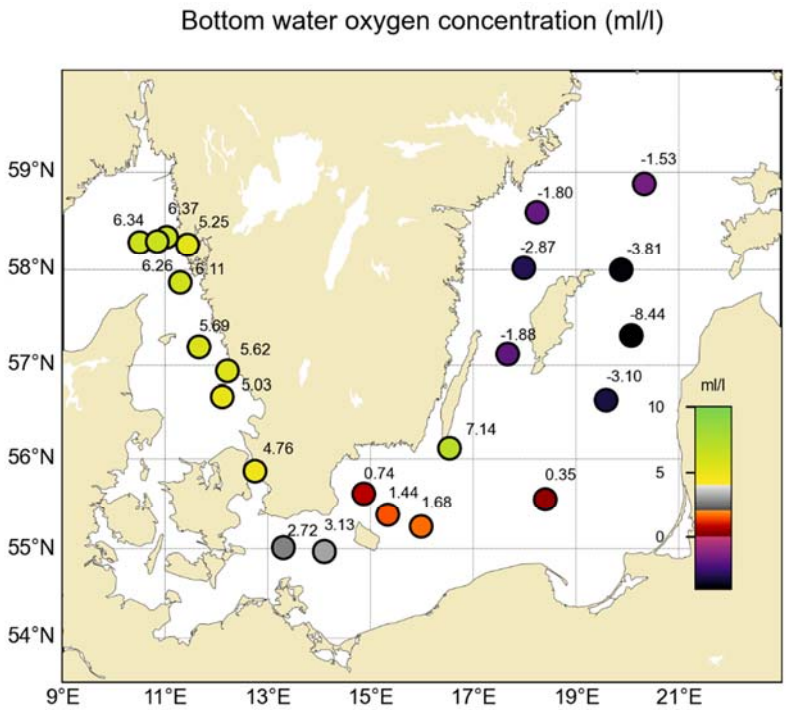


Figure 5. Dissolved oxygen concentration (ml/l) in the bottom water, approx. one meter above the seafloor. Presence of hydrogen sulphide is shown as H2S. Note that the values have not been compared to statistics as in similar figures and only circles are shown

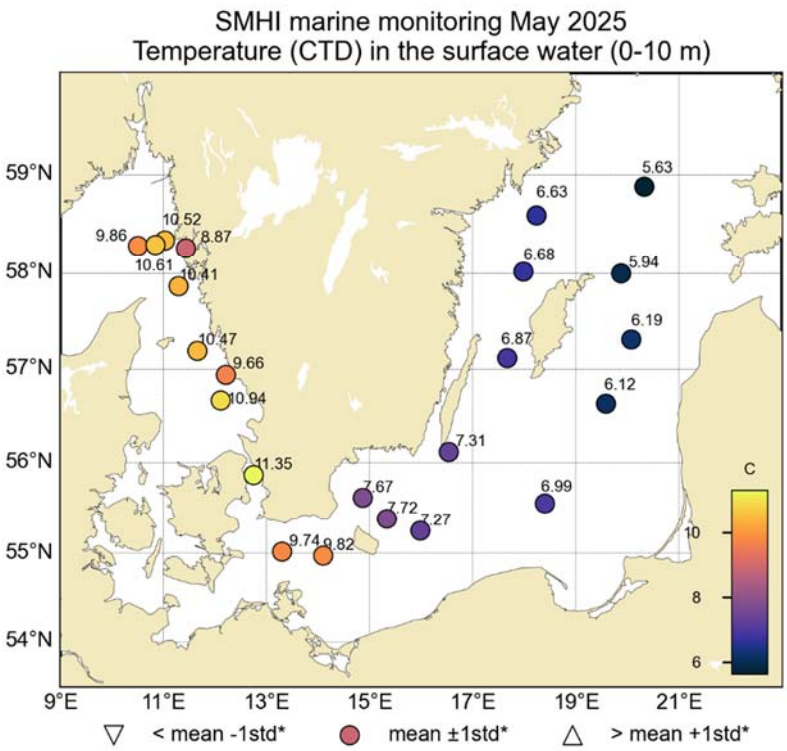


Figure 6. The temperature in the surface water (0 – 10 m). The mean value is based on data for the month at each station during the years 1991 – 2020.

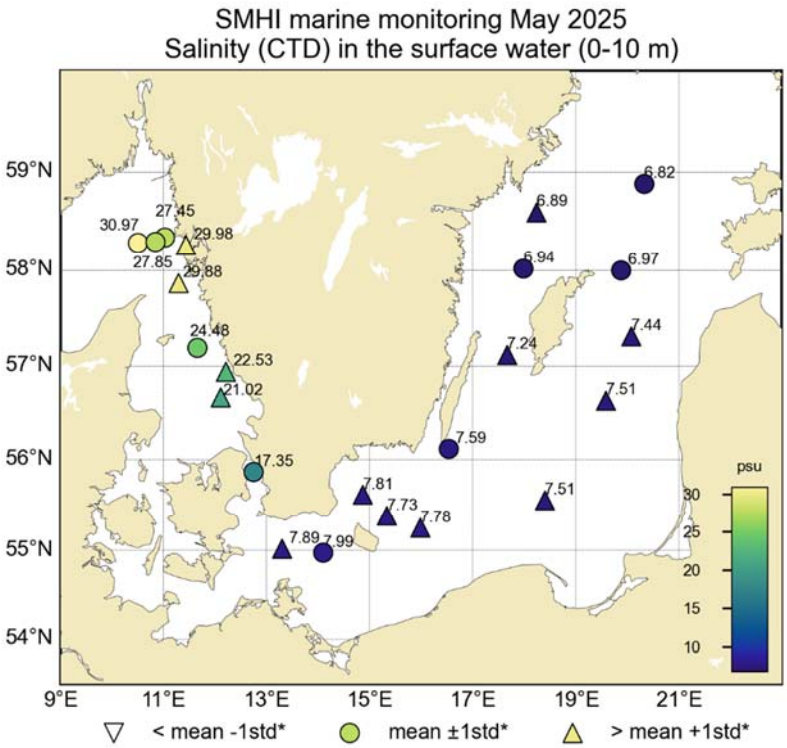


Figure 7. The salinity in the surface water (0 – 10 m). The mean value is based on data for the month at each station during the years 1991 – 2020.

**PARTICIPANTS**

| Name | Role | Organisation |
|---|---|---|
| Madeleine Nilsson | Cruise leader | SMHI |
| Johan Kronsell | CTD-operations and water sampling and analysis | SMHI |
| Martin Hansson | CTD-operations and water sampling and analysis | SMHI |
| Lena Viktorsson | CTD-operations and water sampling and analysis | SMHI |
| Örjan Bäck | CTD-operations and water analysis | |
| Sara Johansson | Nutrient analysis, quality assurance | SMHI |
| Malin Dahlgren | Sediment and bottom fauna sampling | SU |
| Marika Huldt | Sediment and bottom fauna sampling | SU |
| Jessica Olofsson | Sediment and bottom fauna sampling | SU |
| Panna Horvàth | Sediment and bottom fauna sampling | SU |

**APPENDICES**

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

SMHI

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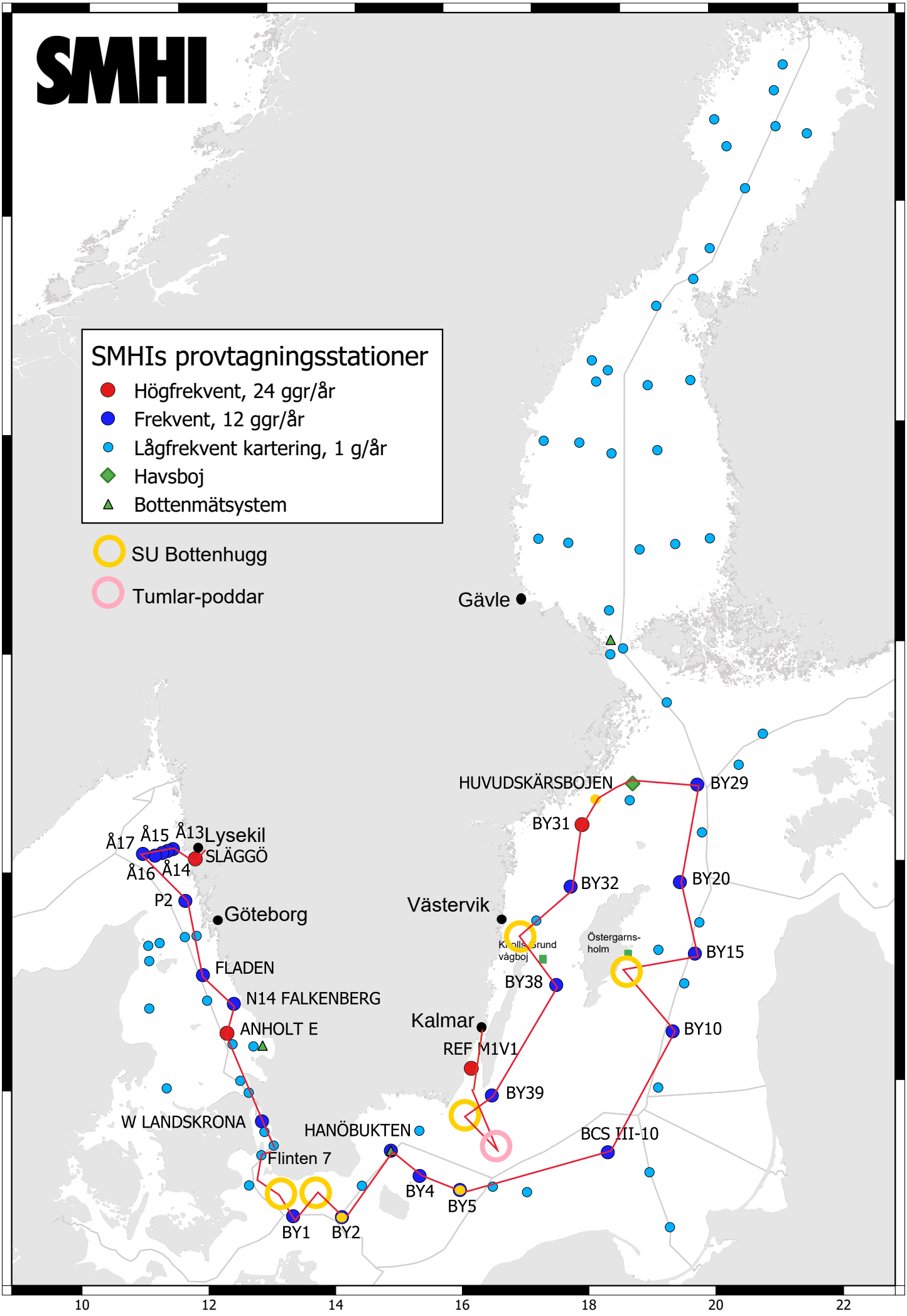
Ackred. nr. 1420
Provning
ISO/IEC 17025

Havs och Vatten myndigheten


SMHI
SMHIs provtagningsstationer
Högfrekvent, 24 ggr/år
Frekvent, 12 ggr/år
Lågfrekvent kartering, 1 g/år
Havsboj
Bottenmätsystem
SU Bottenhugg
Tumlar-poddar
Gävle
HUVUDSKÄRSBOJEN
BY29
BY31
BY32
BY20
BY15
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Flinten 7
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ANHOLT E
N14 FALKENBERG
FLADEN
P2
Göteborg
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Date: 2025-05-12
Time: 16:26

Ship: SE
Year: 2025

| 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 elacaoveTueohdsb | CZPP hohploaptop | No de | No btl | Temp_bottle | Temp_cast | Sal_bottle | Sal_cast | Pho_bottle | Pho_cast | Doc_bottle | Doc_cast | H2S | Phosphate | Nitrite | Nitrite | Nitrate | Nitrate | Ammonia | Ammonia | Silicate | Silicate-Si | Humus | Cond_vis | Cond_salt | Cond_temp |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0442 | 13 | FIBG27 | BAS... | SLÄGGÖ | 5815.58 | 01126.13 | 20250505 | 1220 | 76 | 5 | 23 | 7.8 | 8.8 | 1020 | 1420 | xxx- | 9 | | x | x | x | - | x | x | - | x | x | x | x | x | x | x | x | - | x | - |
| 0443 | 13 | SKEX14 | BAS... | Å13 | 5820.37 | 01101.68 | 20250505 | 1325 | 93 | | 24 | 11 | 9.7 | 1017 | 2874 | x--- | 10 | | - | x | x | - | x | x | - | x | x | x | x | x | x | x | x | - | x | - |
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| 0450 | 13 | SOCX39 | BAS... | W LANDSKRONA | 5551.99 | 01244.91 | 20250506 | 1530 | 52 | 7 | 34 | 11.5 | 12.2 | 1018 | 1130 | x--- | 9 | | x | x | x | x | - | x | x | - | x | x | x | x | x | x | - | x | - | x | - |
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| 0466 | 13 | BPSB06 | BAS... | BY4 CHRISTIANSÖ | 5522.98 | 01520.02 | 20250508 | 0222 | 92 | | 17 | 6.1 | 6.9 | 1023 | 9990 | x--- | 12 | | x | x | x | x | - | x | x | - | x | x | x | x | x | x | - | x | - | - | - |
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| 0484 | 13 | BPEX21 | BAS... | BY15 GOTLANDSDJ | 5718.74 | 02004.56 | 20250509 | 1645 | 241 | 16 | 15 | 4.3 | 4.0 | 1019 | 2820 | xxxx | 22 | | - | x | - | x | x | x | x | x | x | x | x | x | x | x | x | x | - | - | - |
| 0485 | 13 | BPEX26 | BAS... | BY20 FÅRÖDJ | 5759.89 | 01952.74 | 20250509 | 2150 | 197 | | 06 | 6.3 | 4.7 | 1021 | 9999 | x--- | 17 | | - | x | - | x | - | x | x | x | x | x | x | x | x | x | - | x | - | - | - |
| 0486 | 13 | BPNX35 | BAS... | BY29 / LL19 | 5852.91 | 02019.68 | 20250510 | 0420 | 174 | 11 | 35 | 6.7 | 5.1 | 1024 | 1230 | x--- | 16 | | - | x | - | x | - | x | x | x | x | x | x | x | x | x | - | x | - | x | - |
| 0490 | 13 | BPNX37 | BAS... | BY31 LANDSORTSDJ | 5835.63 | 01814.21 | 20250510 | 1430 | 449 | 15 | 30 | 1.7 | 6.7 | 1026 | 1220 | xxxx | 22 | | - | x | - | x | x | x | x | x | x | x | x | x | x | x | x | x | - | - | - |
| 0491 | 13 | BPWX38 | BAS... | BY32 NORRKÖPINGSDJ | 5801.01 | 01759.04 | 20250510 | 2050 | 202 | | 36 | 2.1 | 6.0 | 1026 | 9999 | x--- | 17 | | - | x | - | x | - | x | x | x | x | x | x | x | x | x | - | x | - | x | - |
| 0503 | 13 | BPWX45 | BAS... | BY38 KARLSÖDJ | 5707.03 | 01740.11 | 20250511 | 1150 | 110.5 | 13 | 35 | 3 | 10.0 | 1025 | 1330 | xx-- | 14 | | x | x | x | x | - | x | x | x | x | x | x | x | x | x | x | x | - | - | - |
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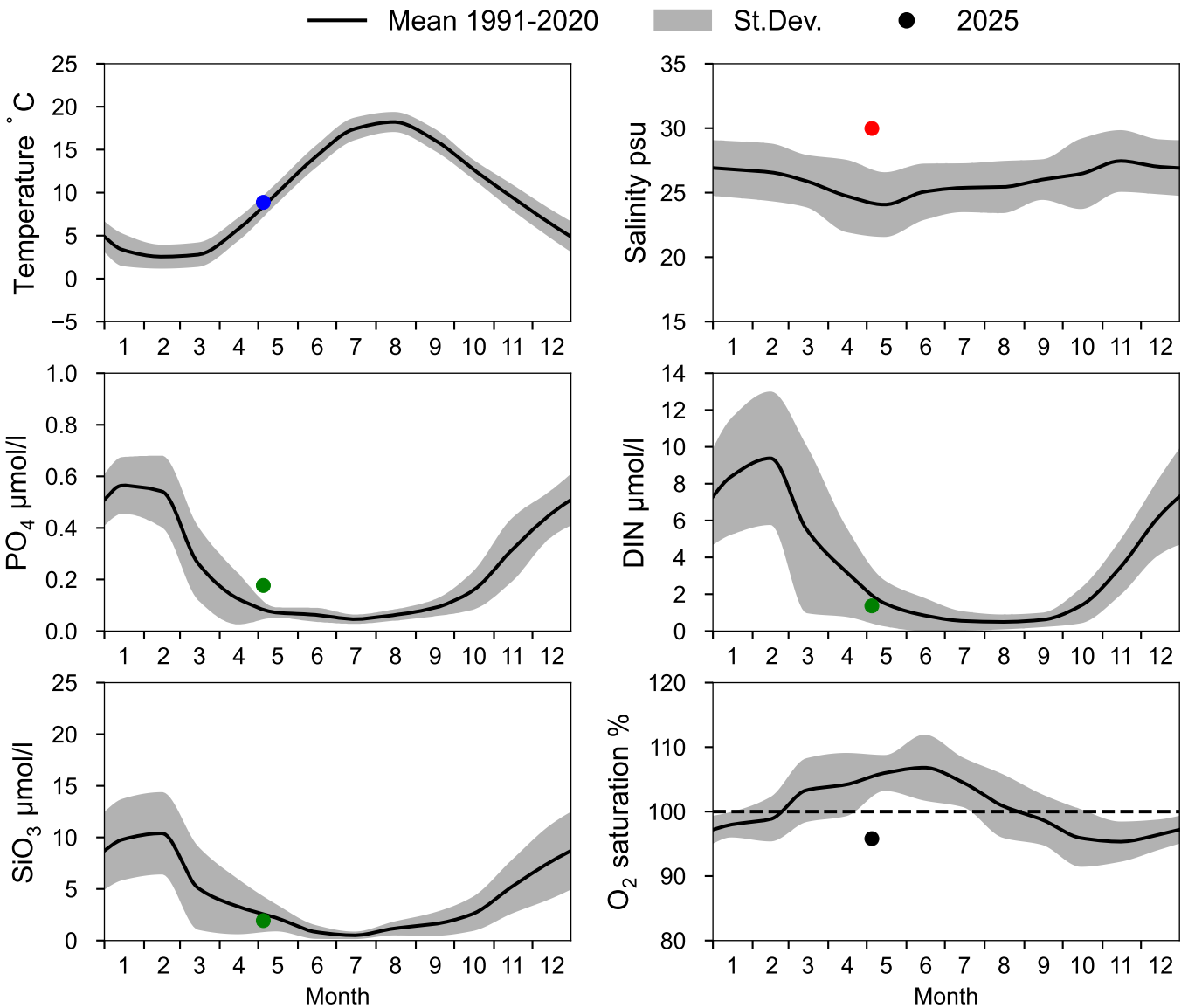
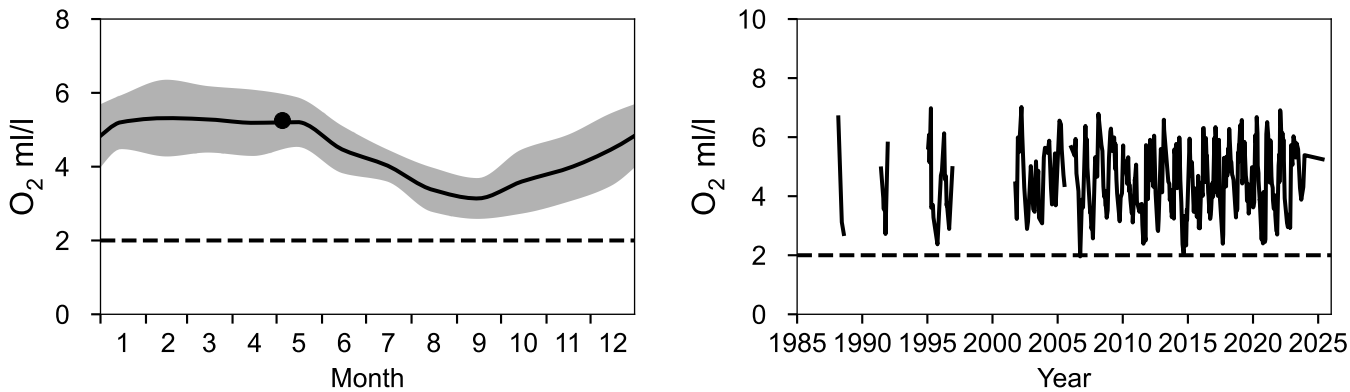
# STATION SLÄGGÖ SURFACE WATER (0-10 m)

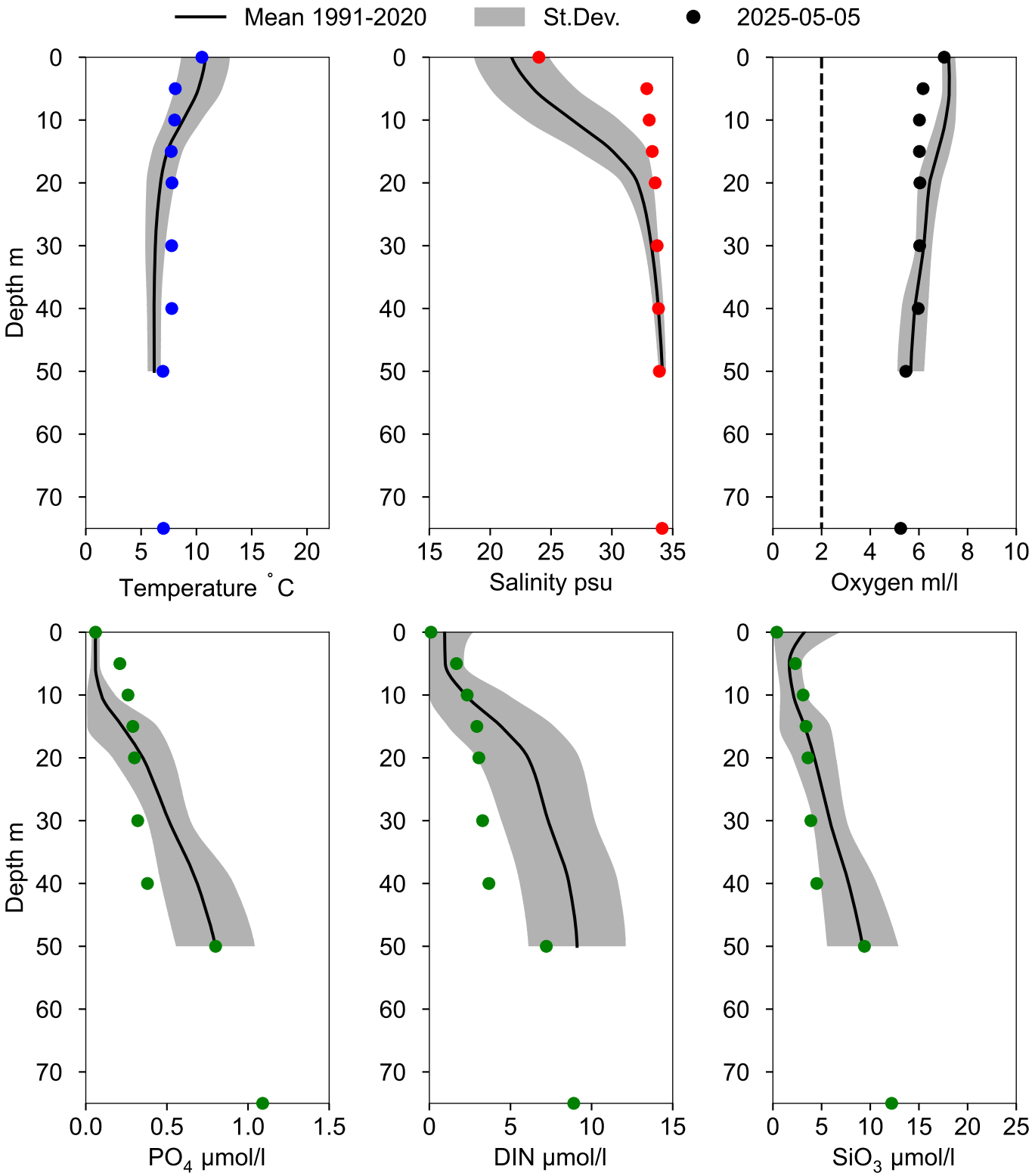
**Annual Cycles**




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

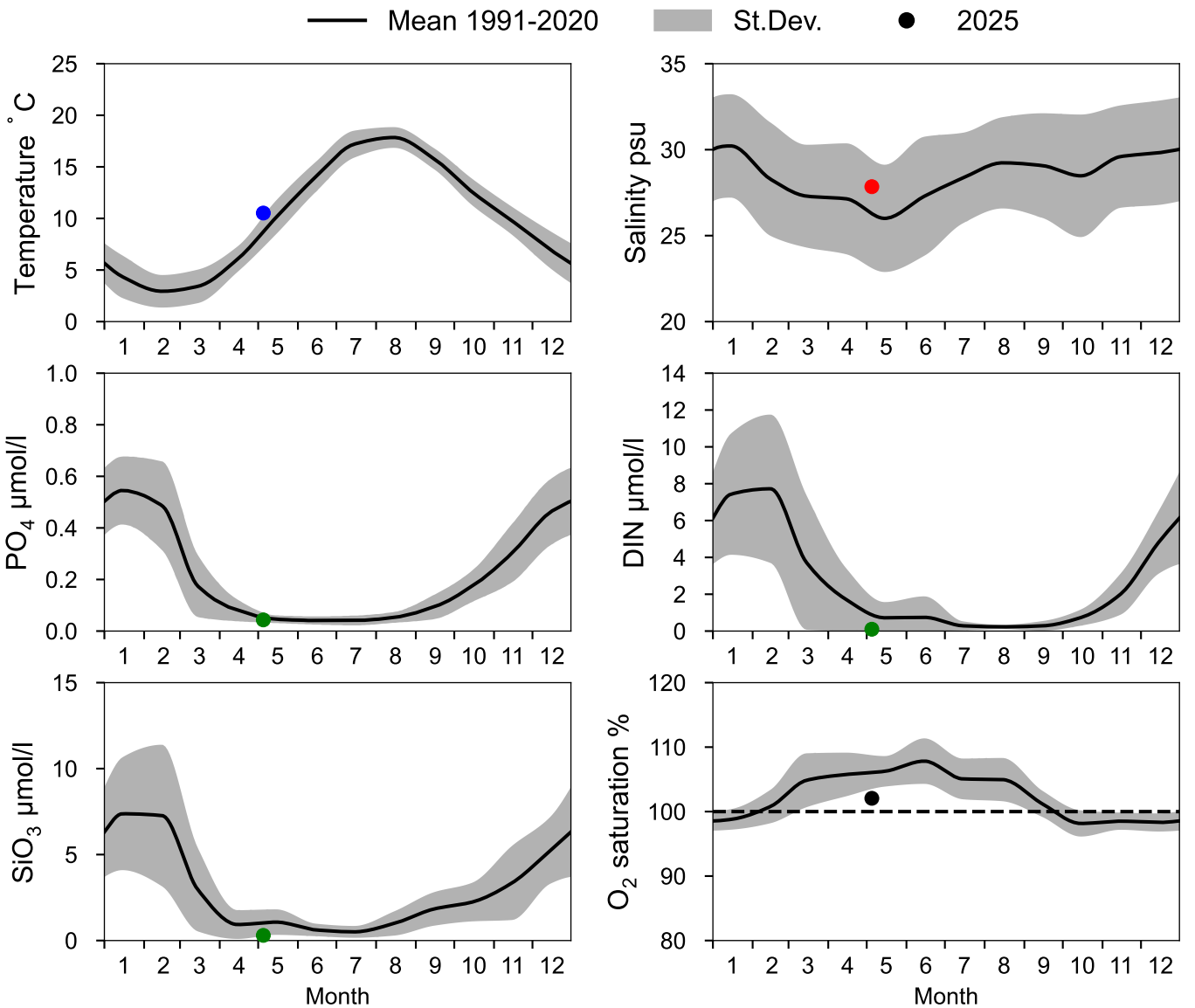


# Vertical profiles SLÄGGÖ
# May

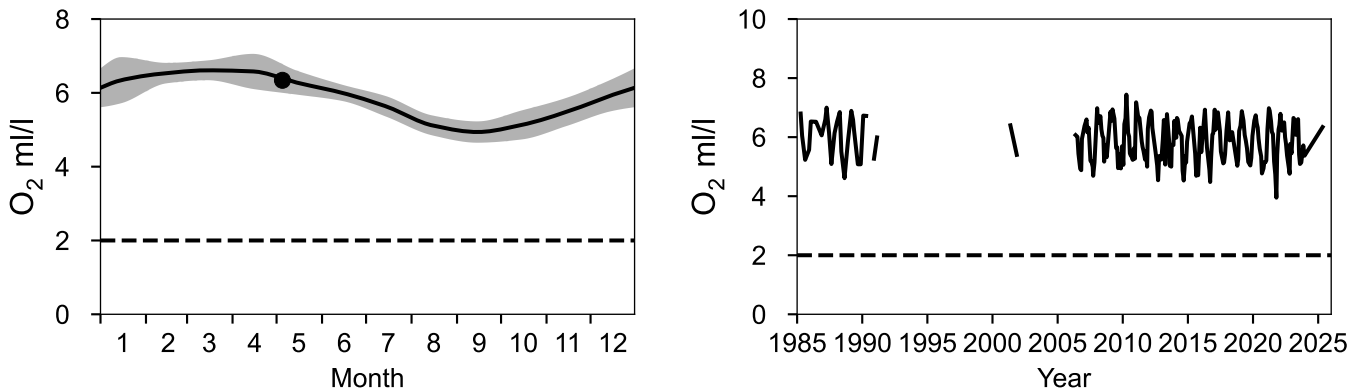


# STATION Å13 SURFACE WATER (0-10 m)

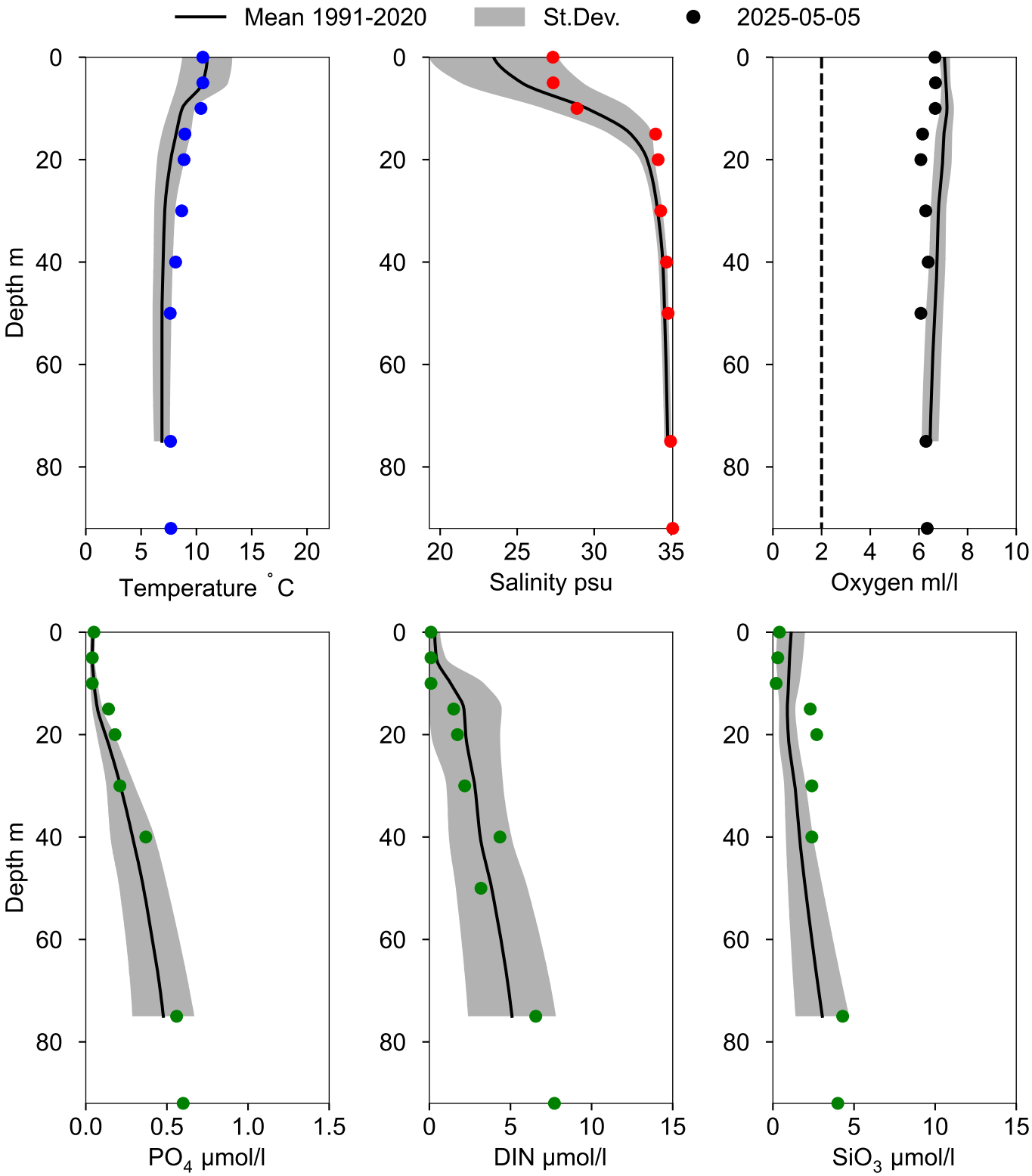
**Annual Cycles**




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

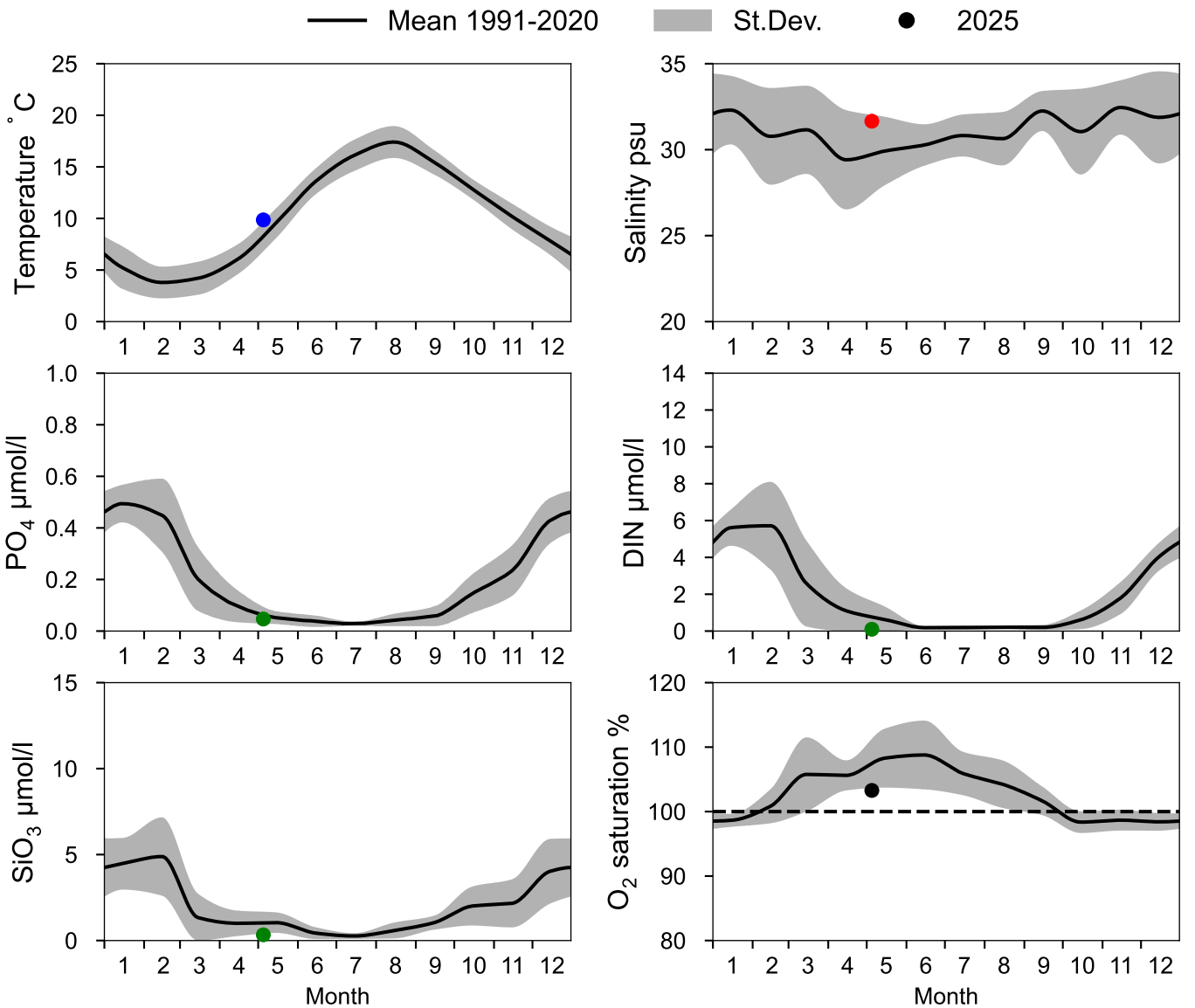


# Vertical profiles Å13
# May

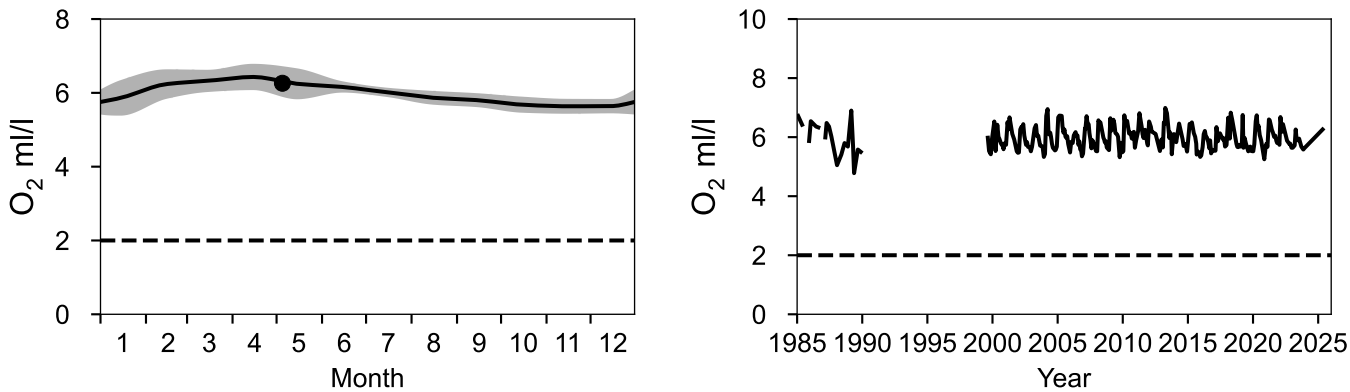


# STATION Å17 SURFACE WATER (0-10 m)

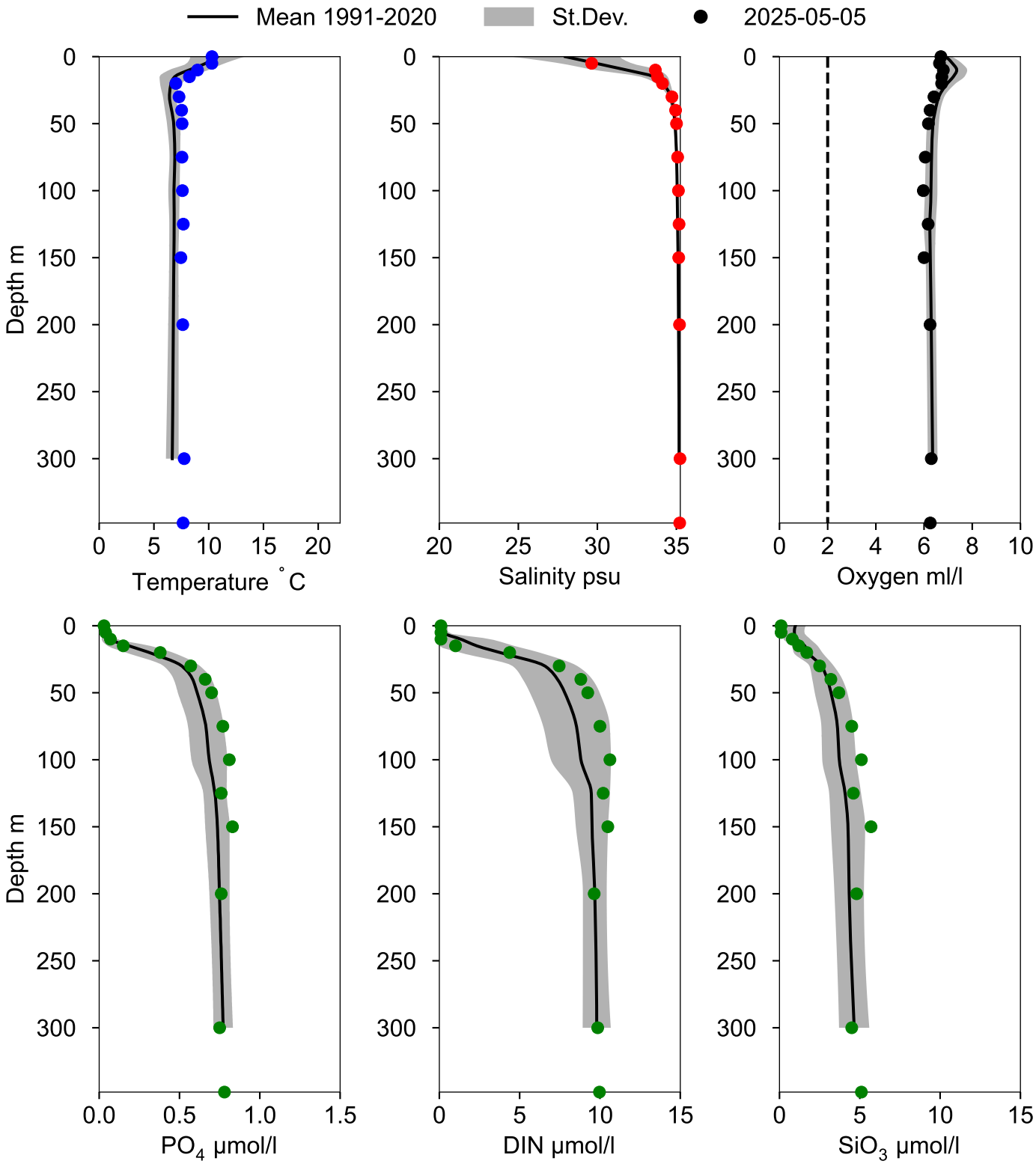
**Annual Cycles**




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

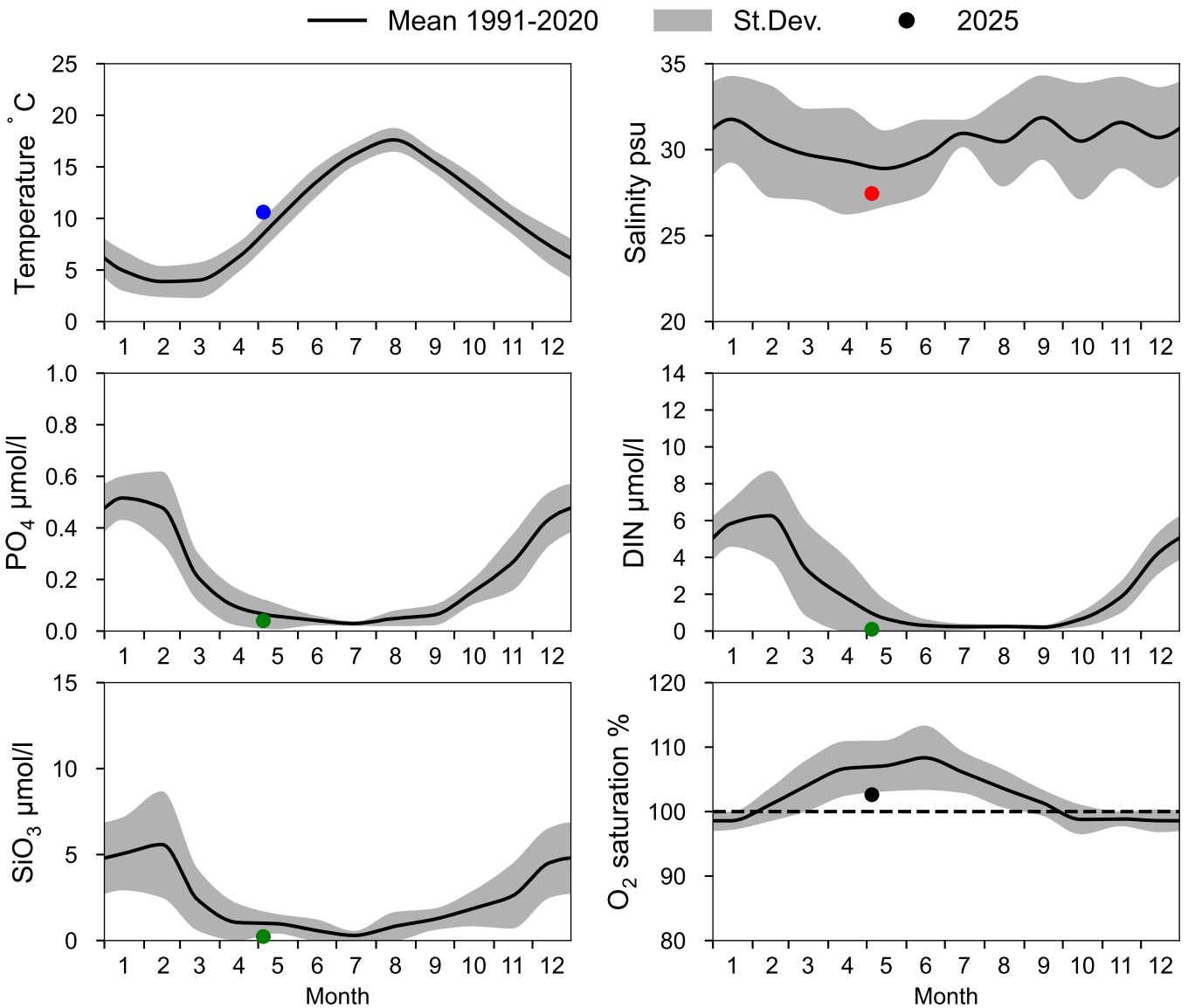


# Vertical profiles Å17
# May

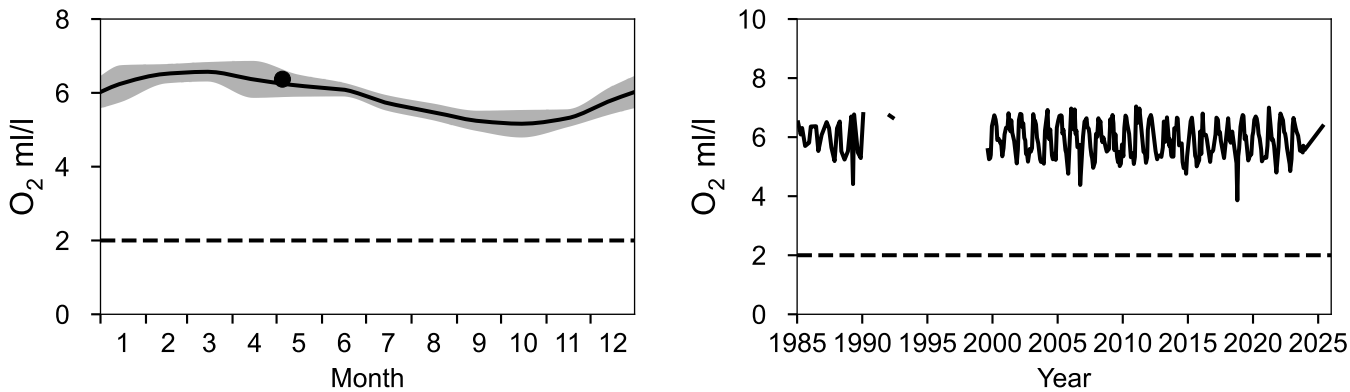


# STATION Å15 SURFACE WATER (0-10 m)

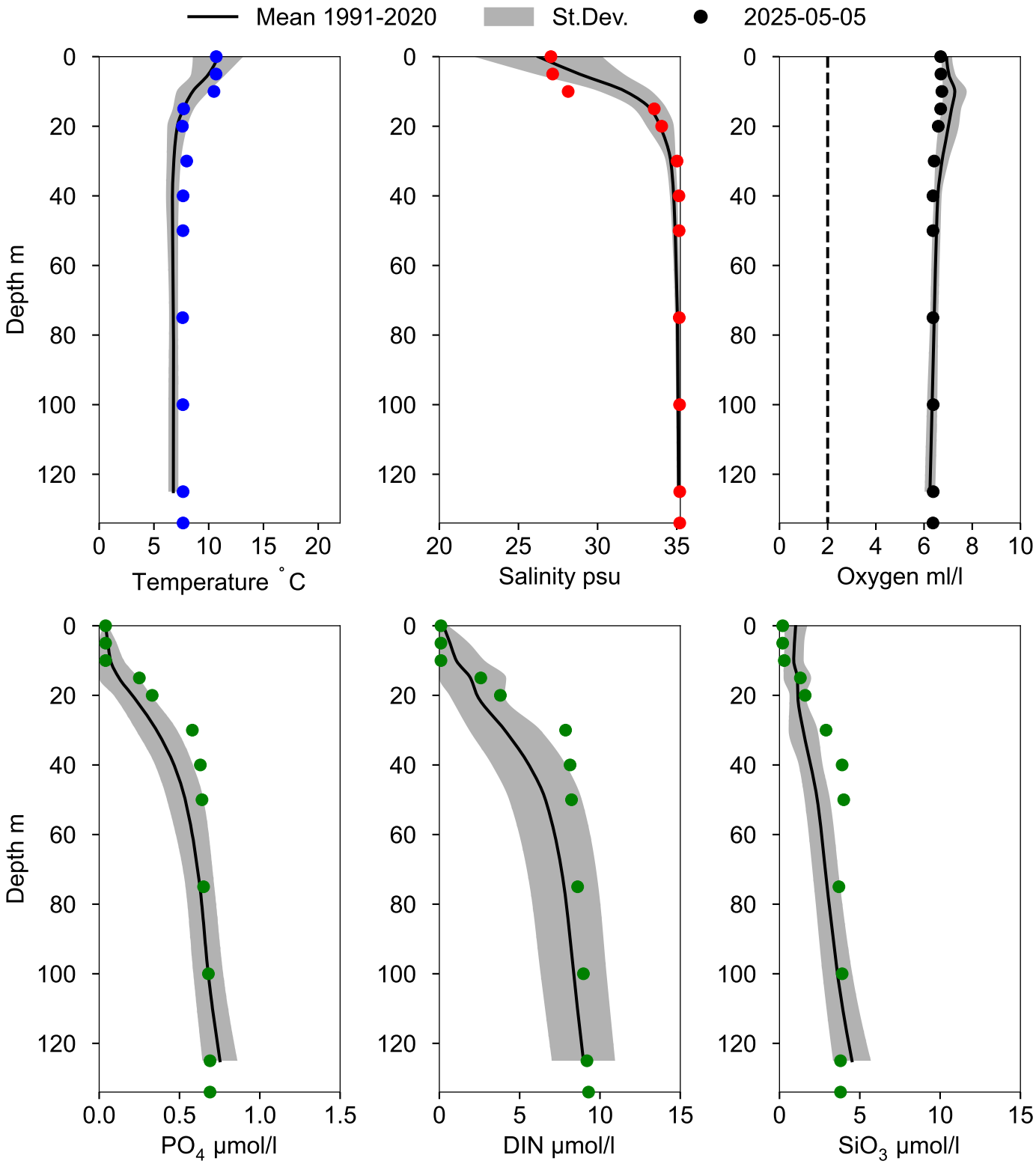
**Annual Cycles**




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

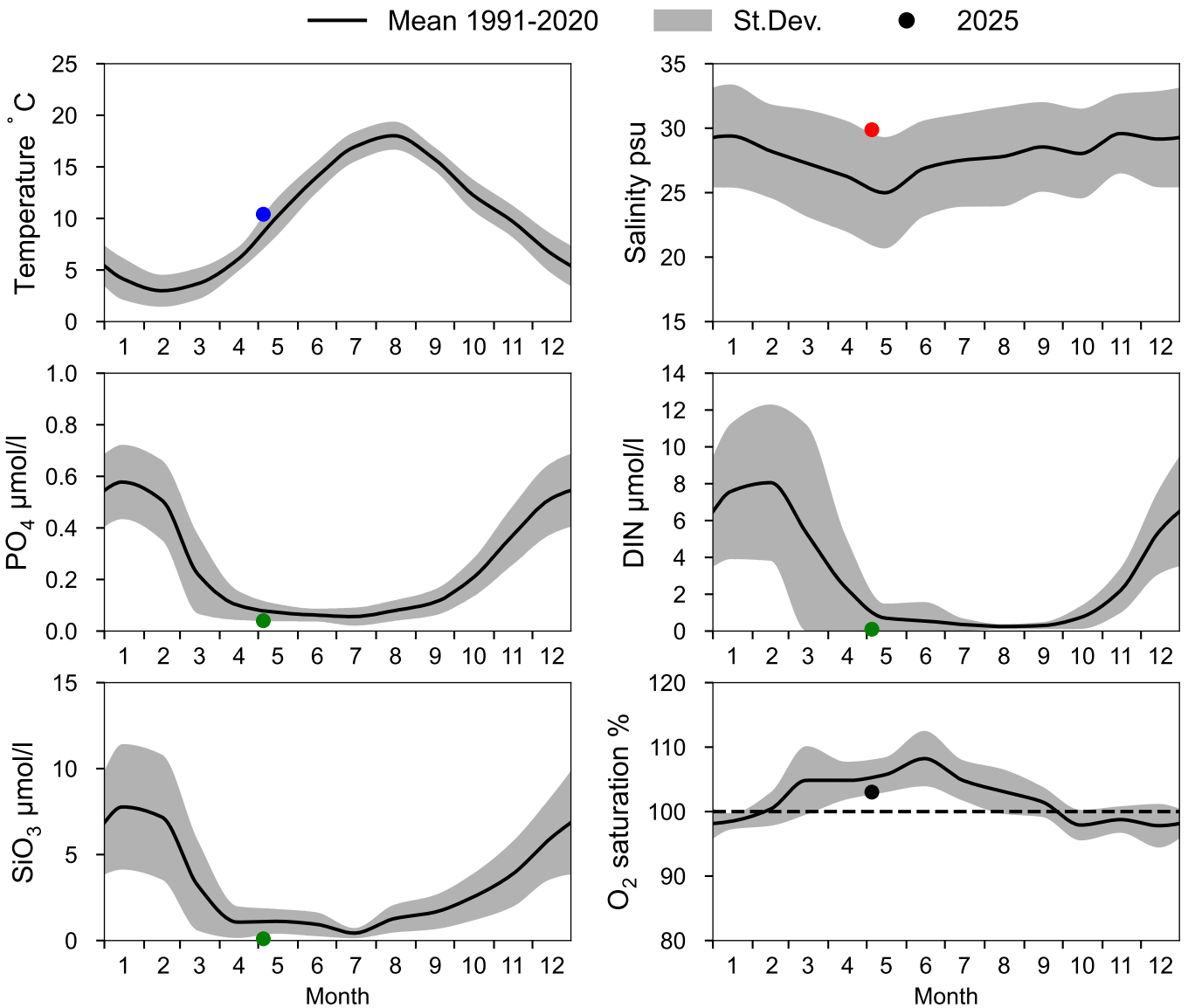


# Vertical profiles Å15
# May

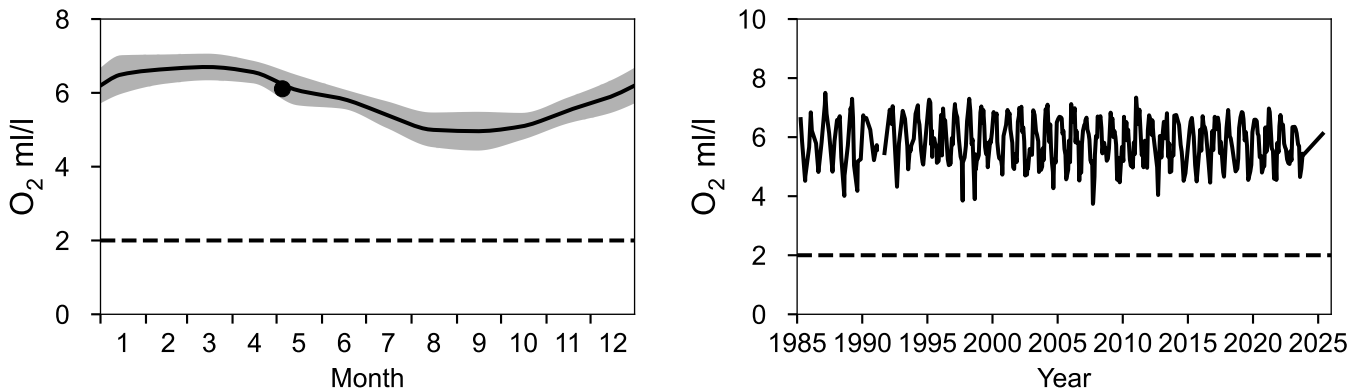


# STATION P2 SURFACE WATER (0-10 m)

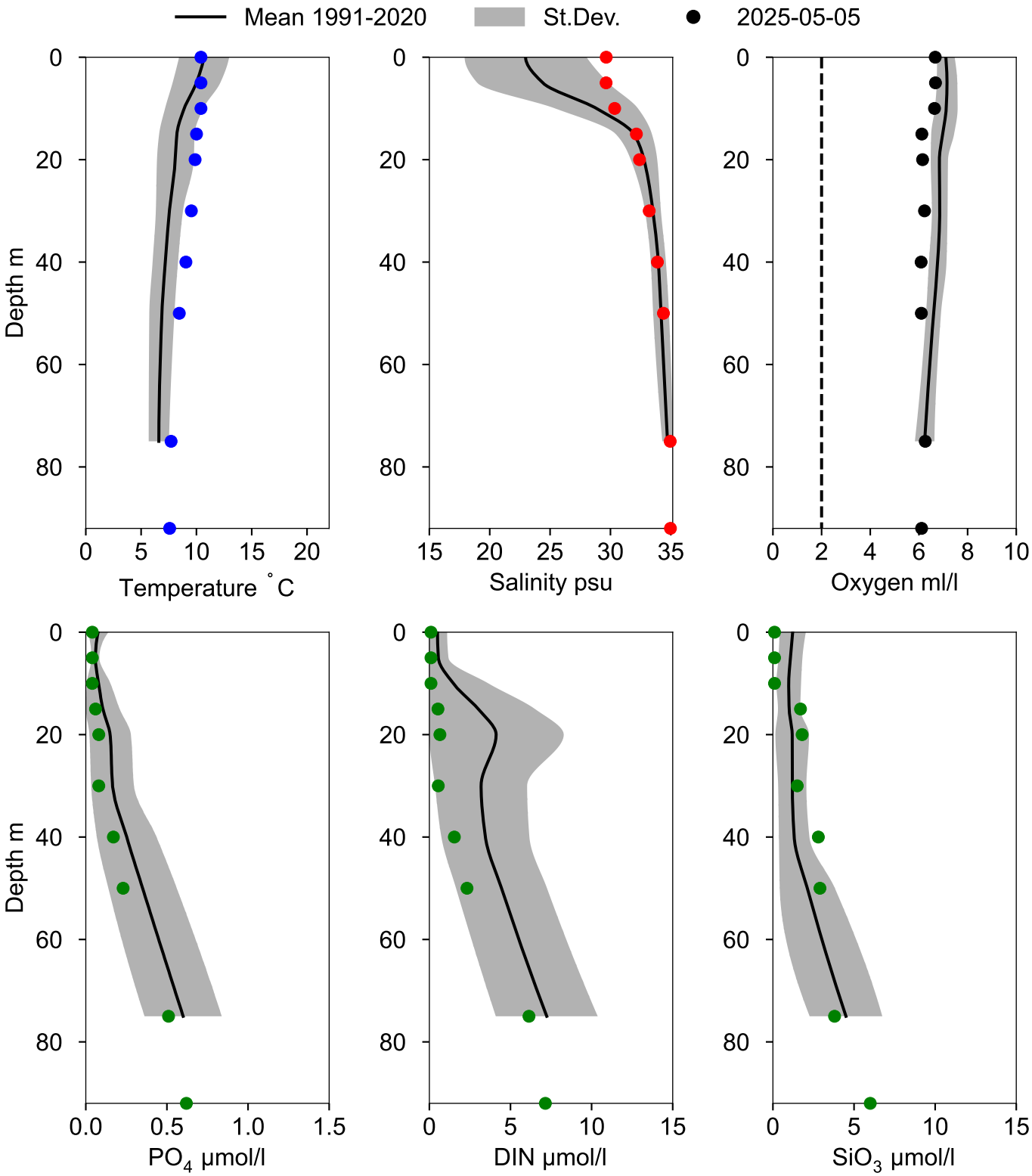
**Annual Cycles**




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

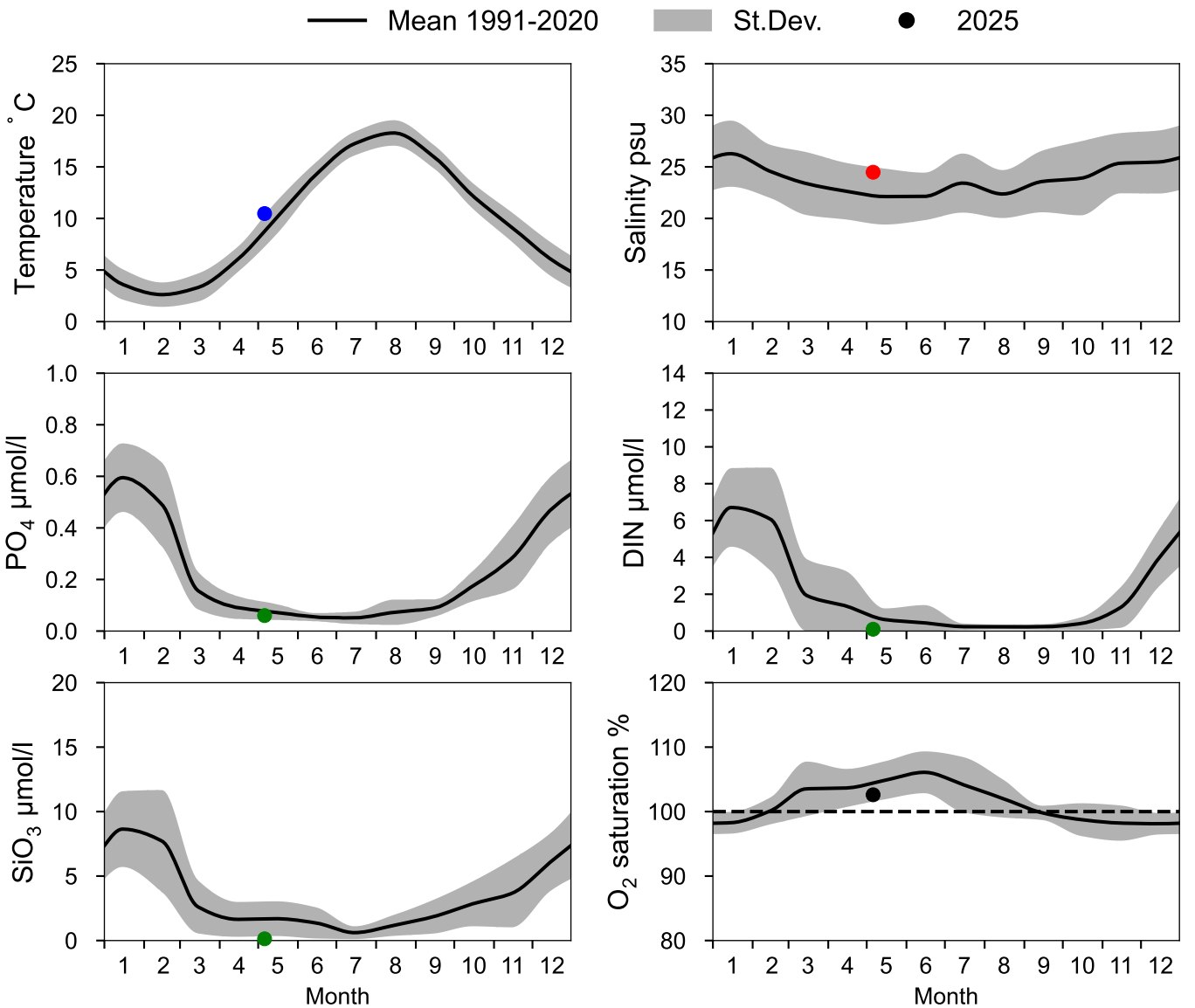


# Vertical profiles P2
# May

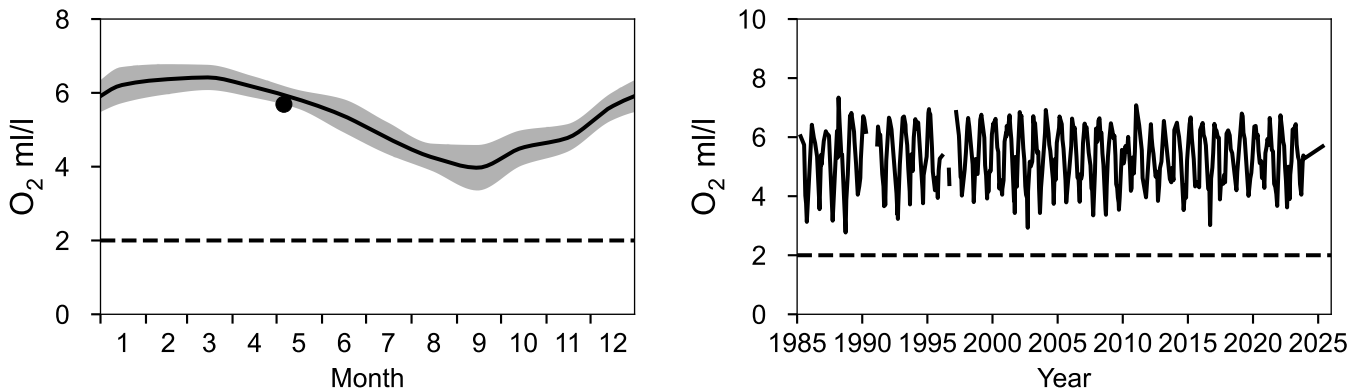


# STATION FLADEN SURFACE WATER (0-10 m)

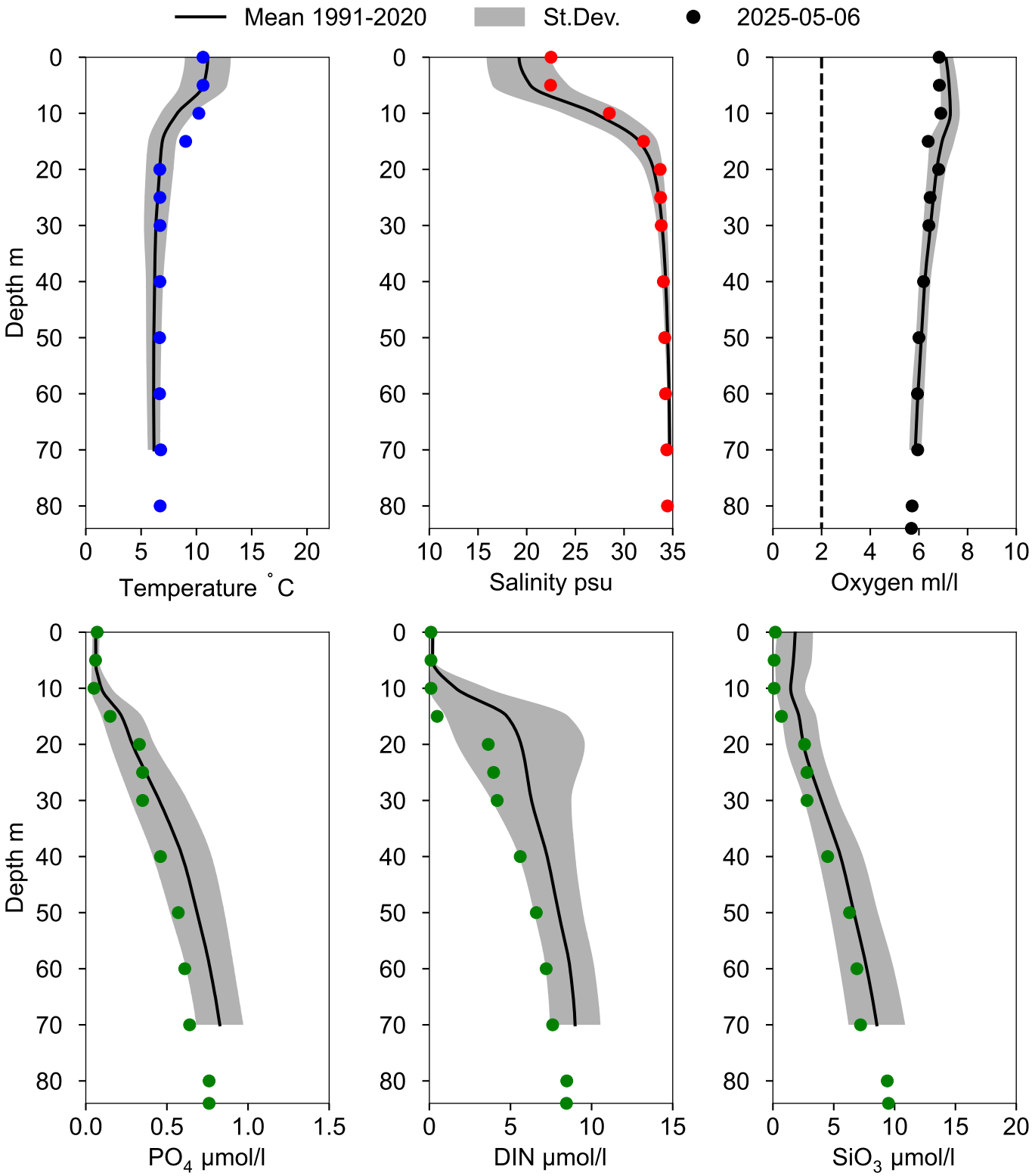
**Annual Cycles**




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

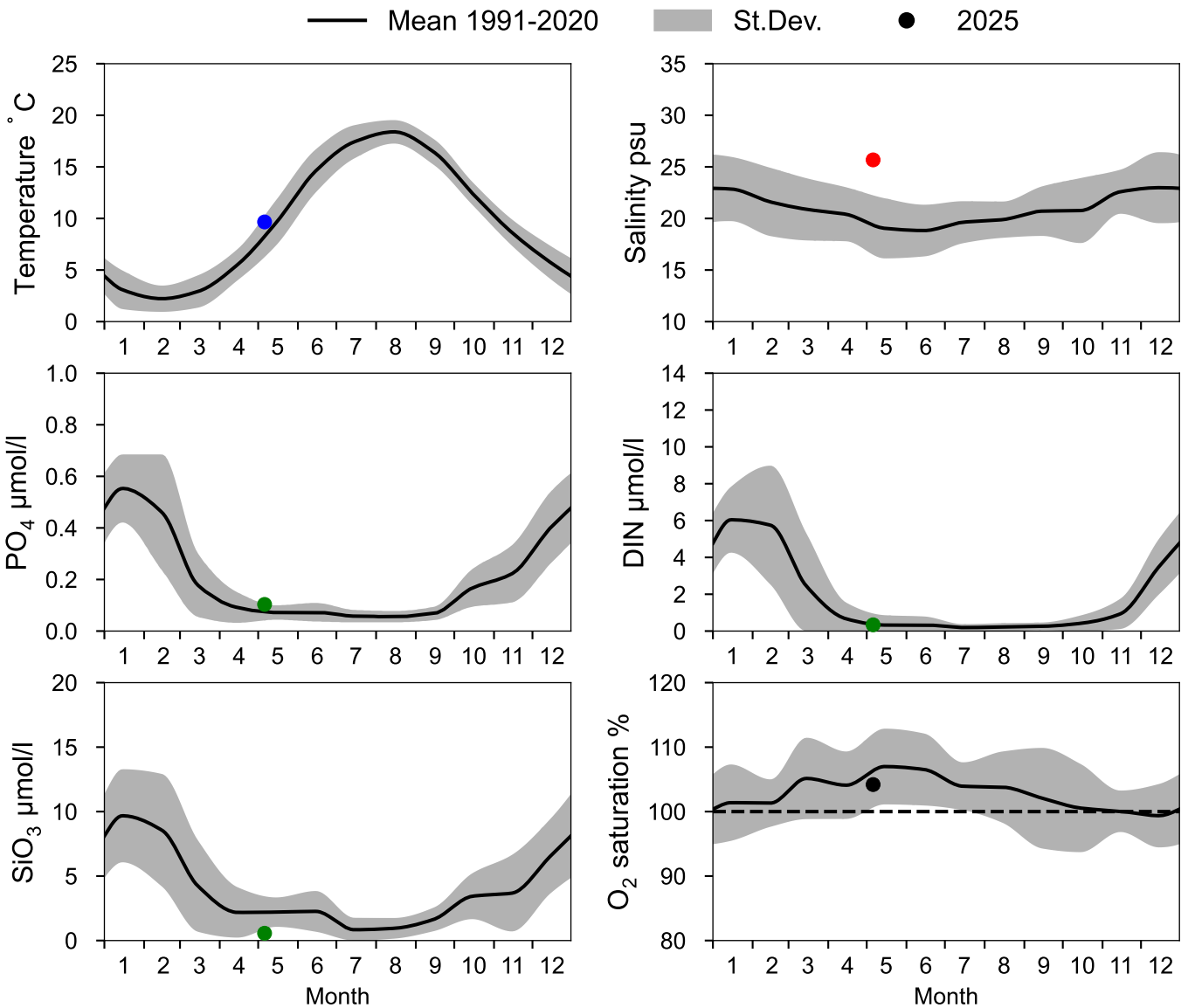


# Vertical profiles FLADEN
# May

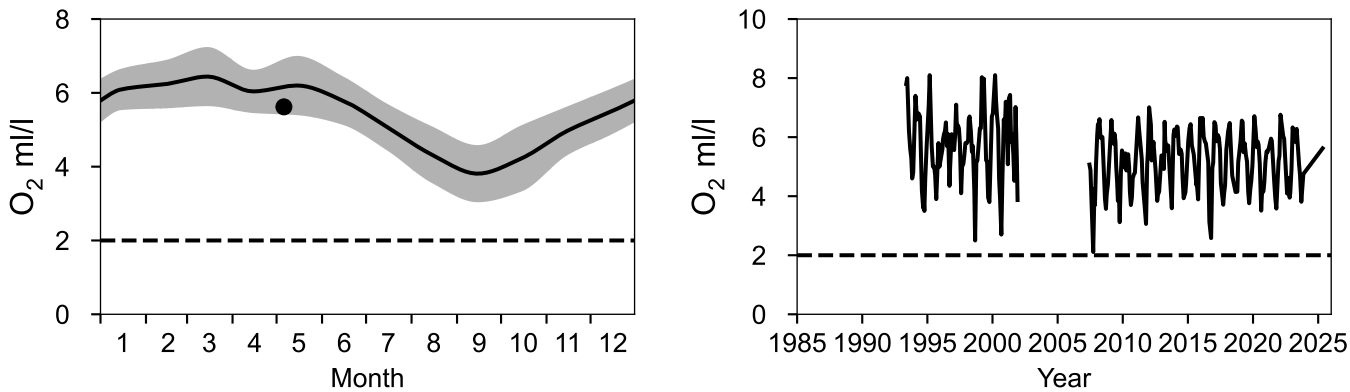


# STATION N14 FALKENBERG SURFACE WATER (0-10 m)

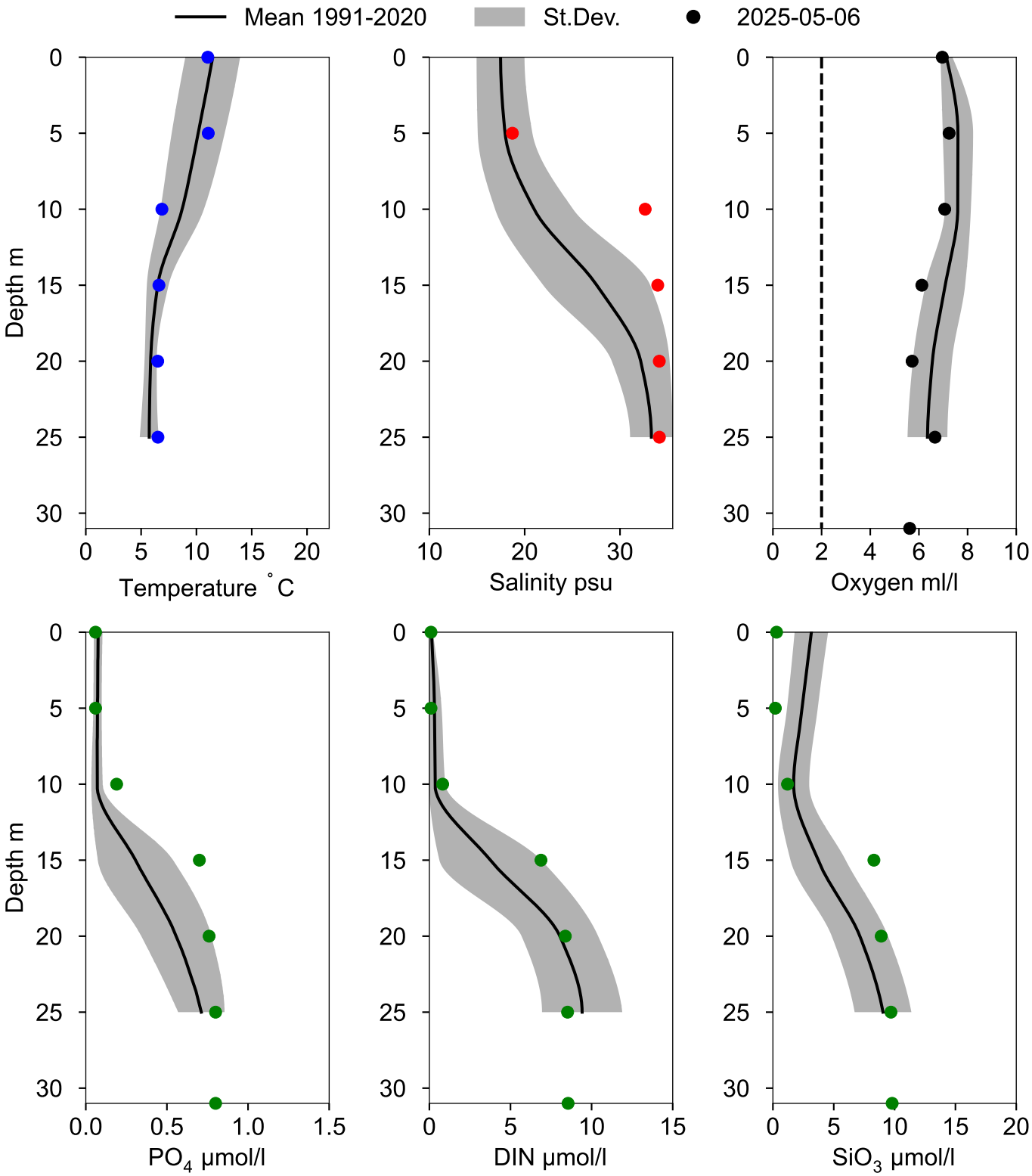
**Annual Cycles**




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

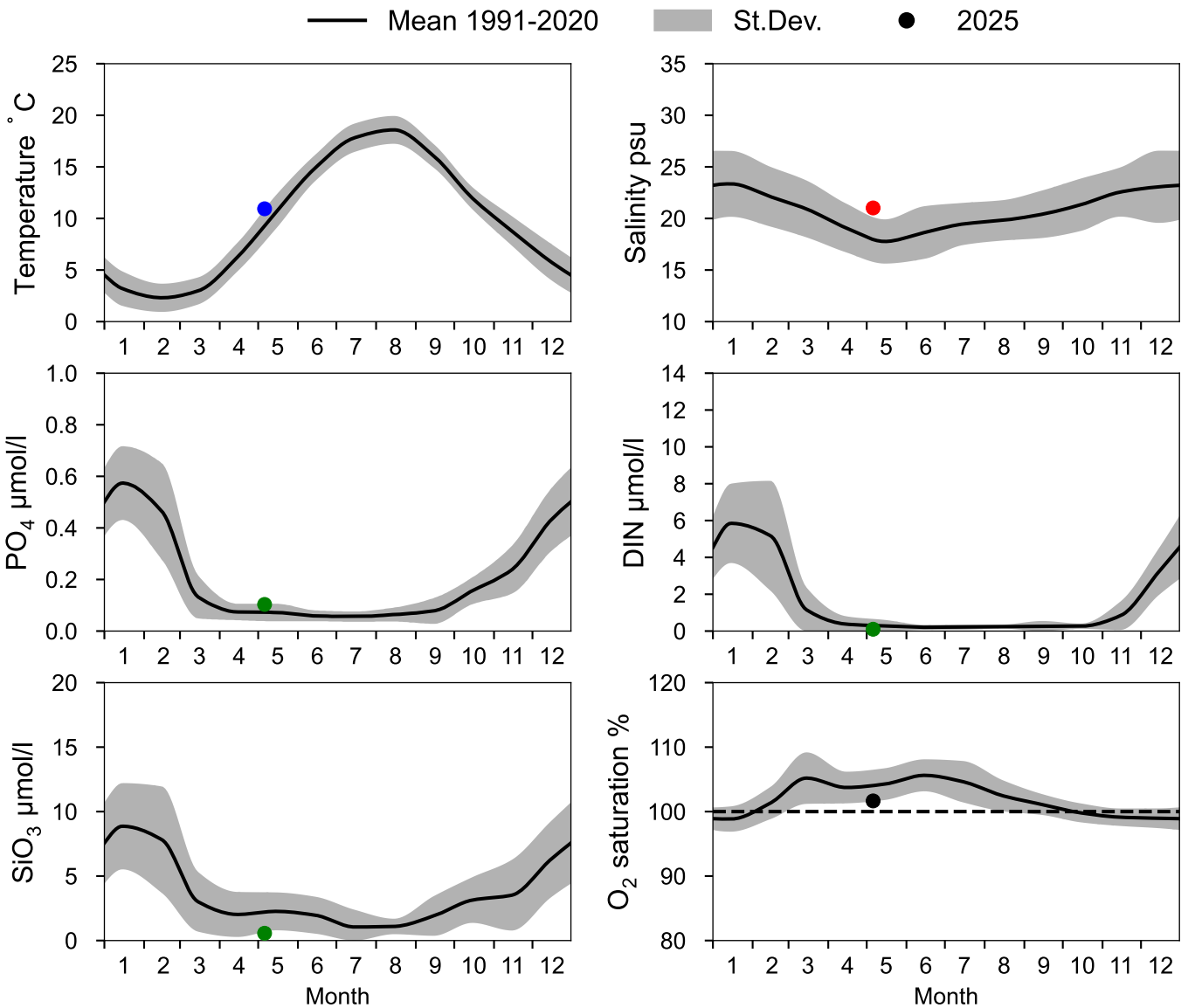


# Vertical profiles N14 FALKENBERG
## May

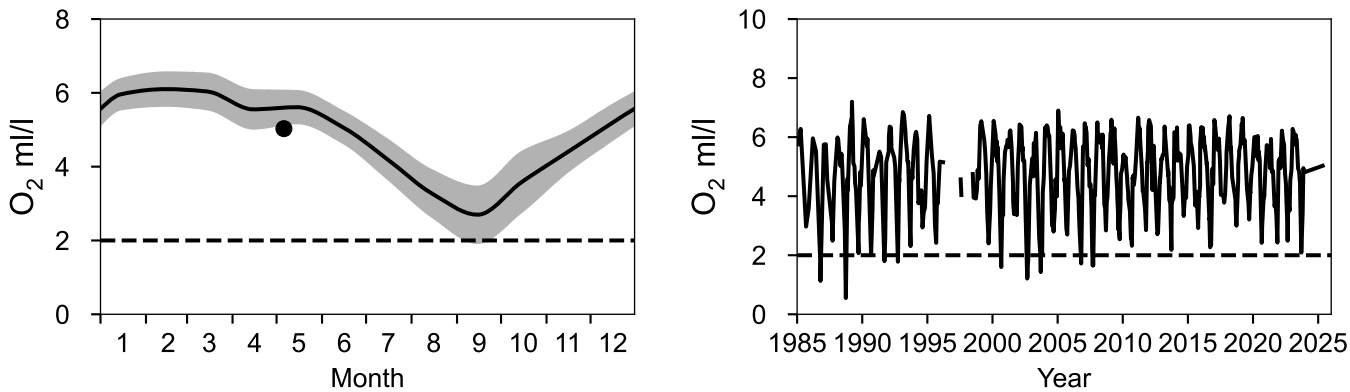


# STATION ANHOLT E SURFACE WATER (0-10 m)

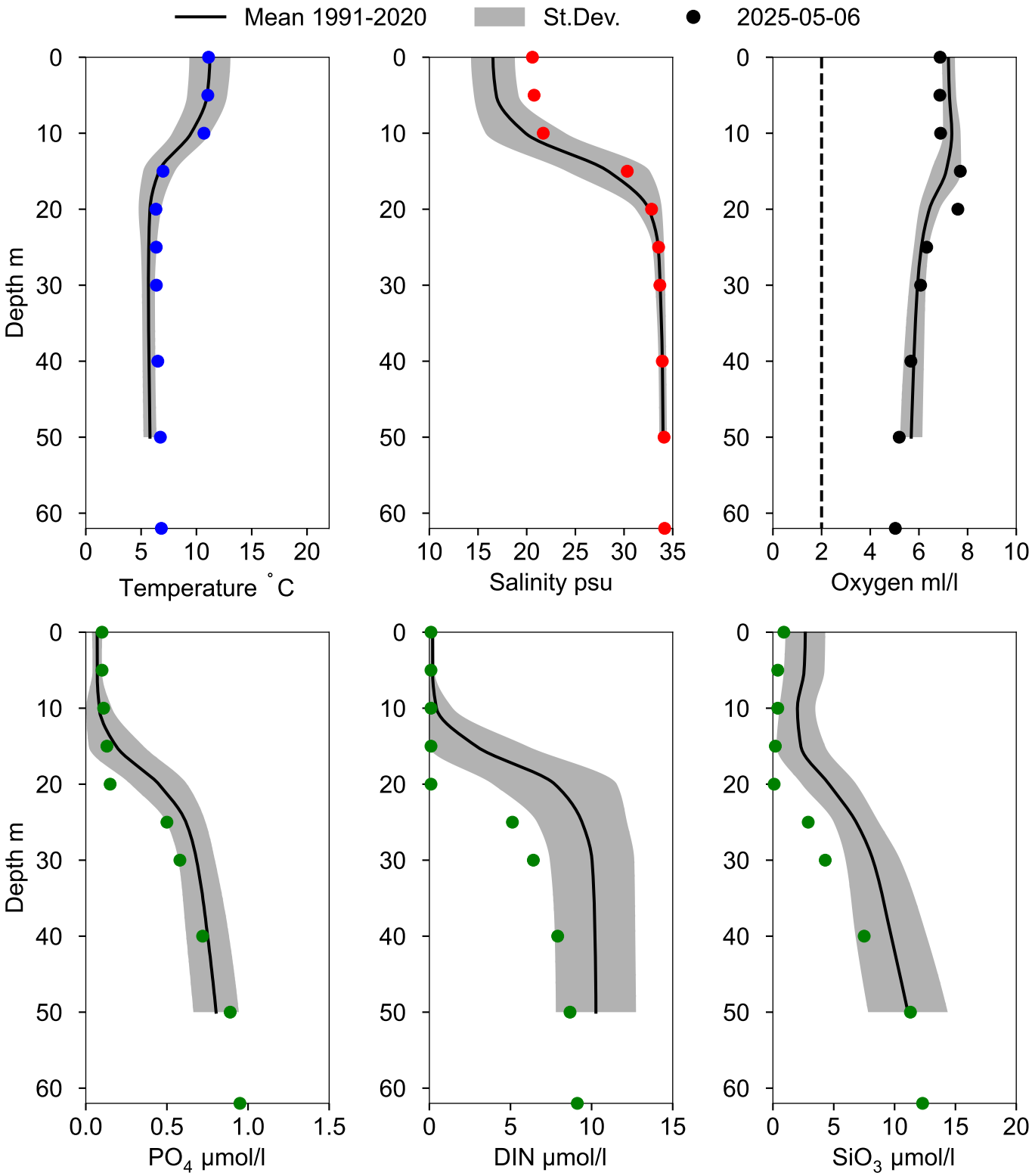
**Annual Cycles**




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

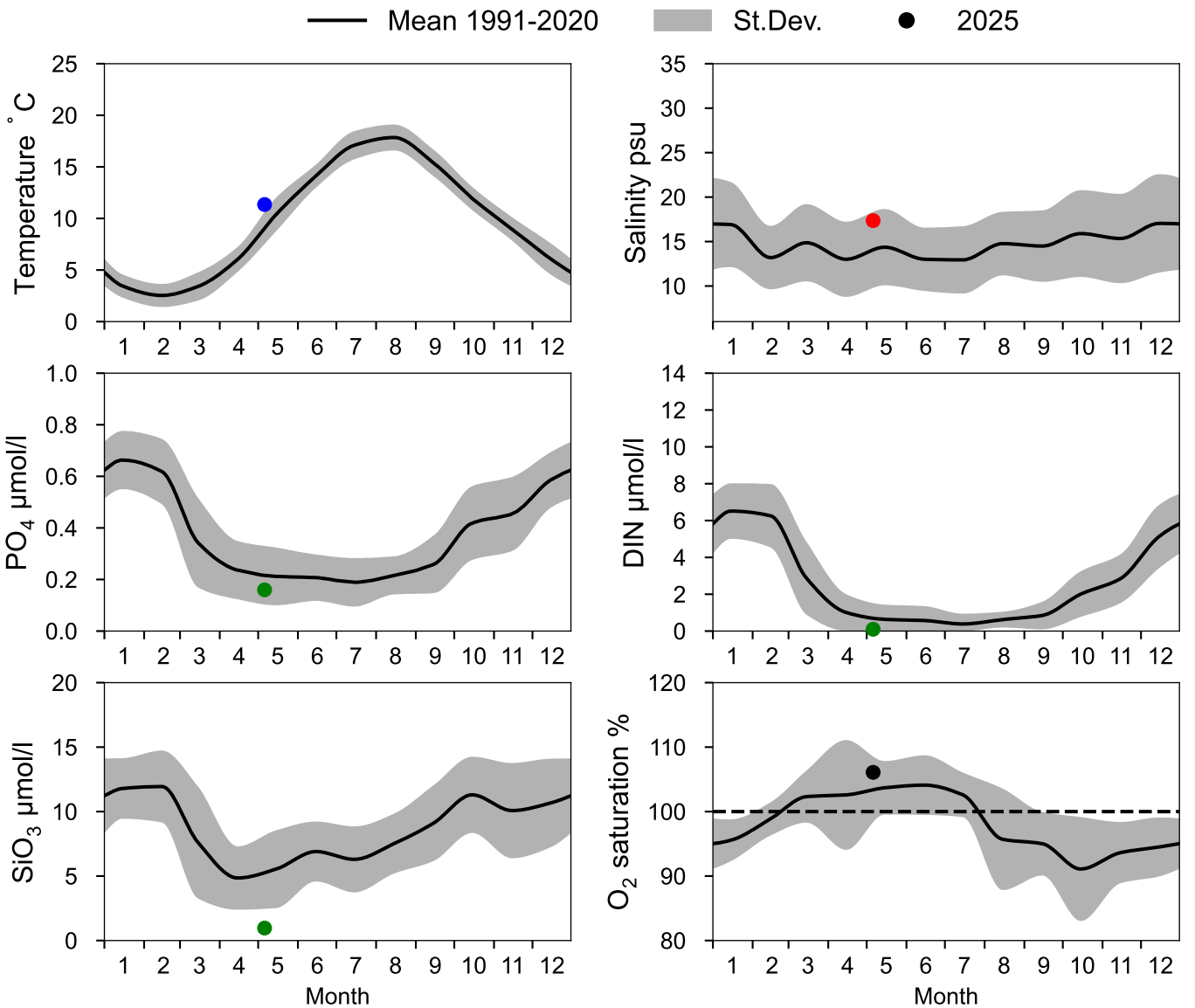


# Vertical profiles ANHOLT E
# May

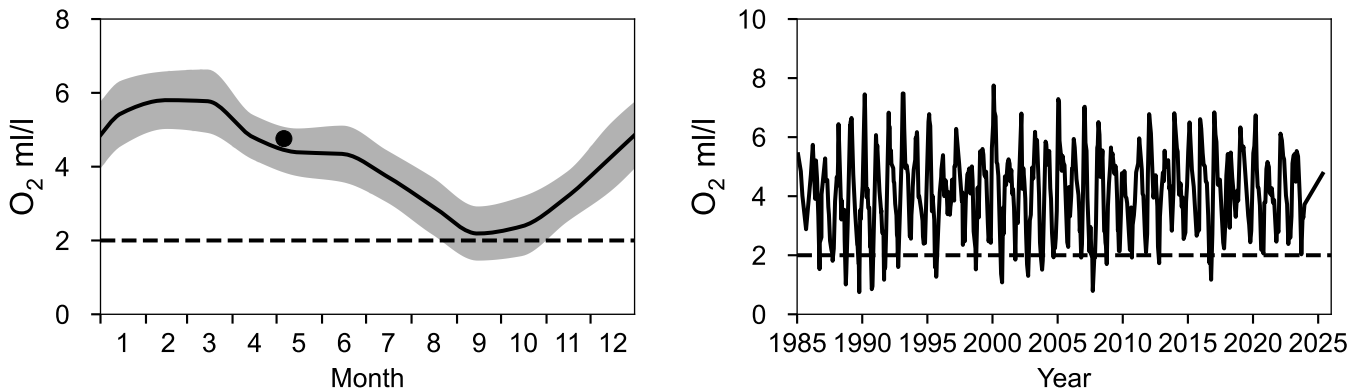


# STATION W LANDSKRONA SURFACE WATER (0-10 m)

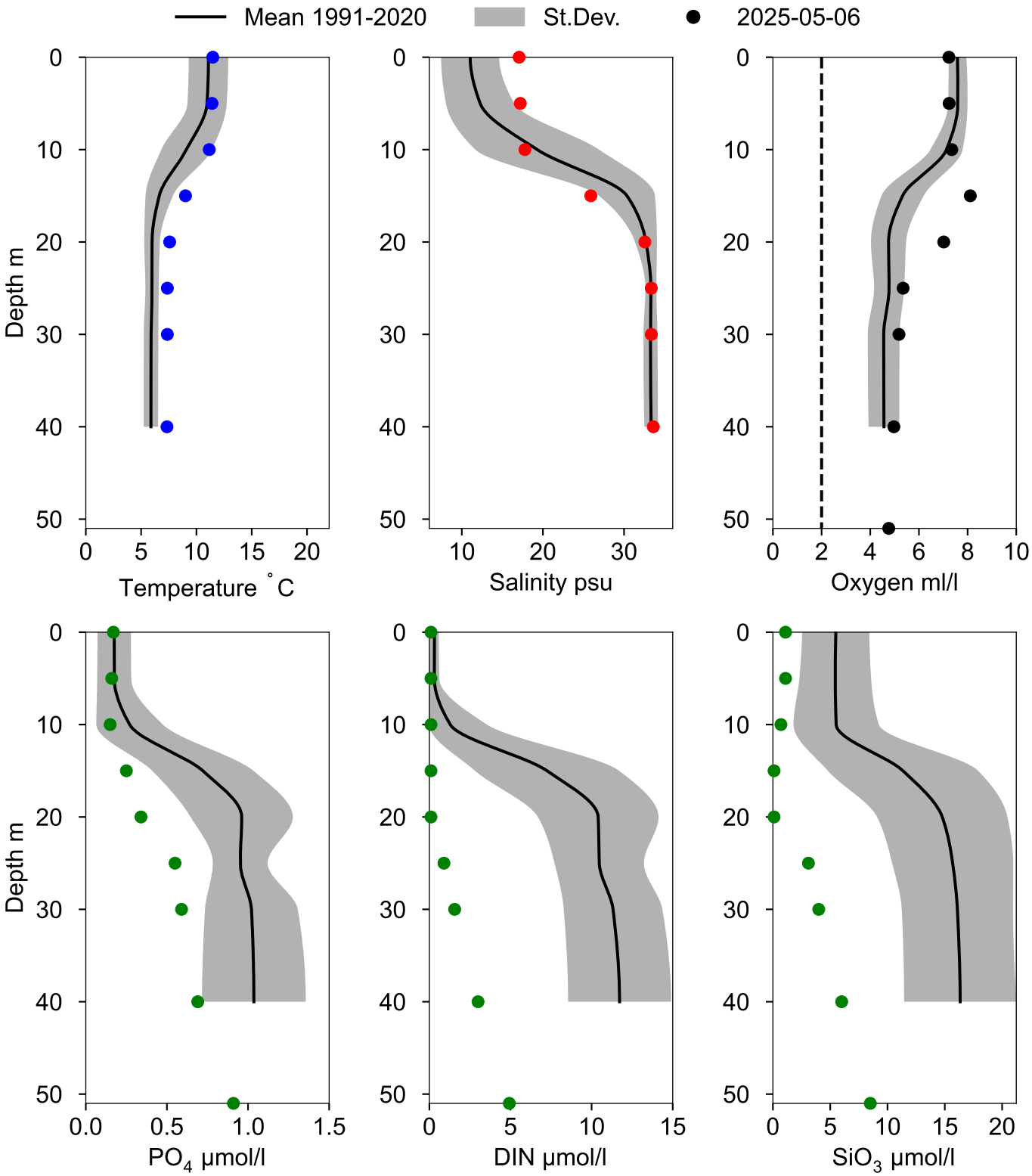
**Annual Cycles**




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

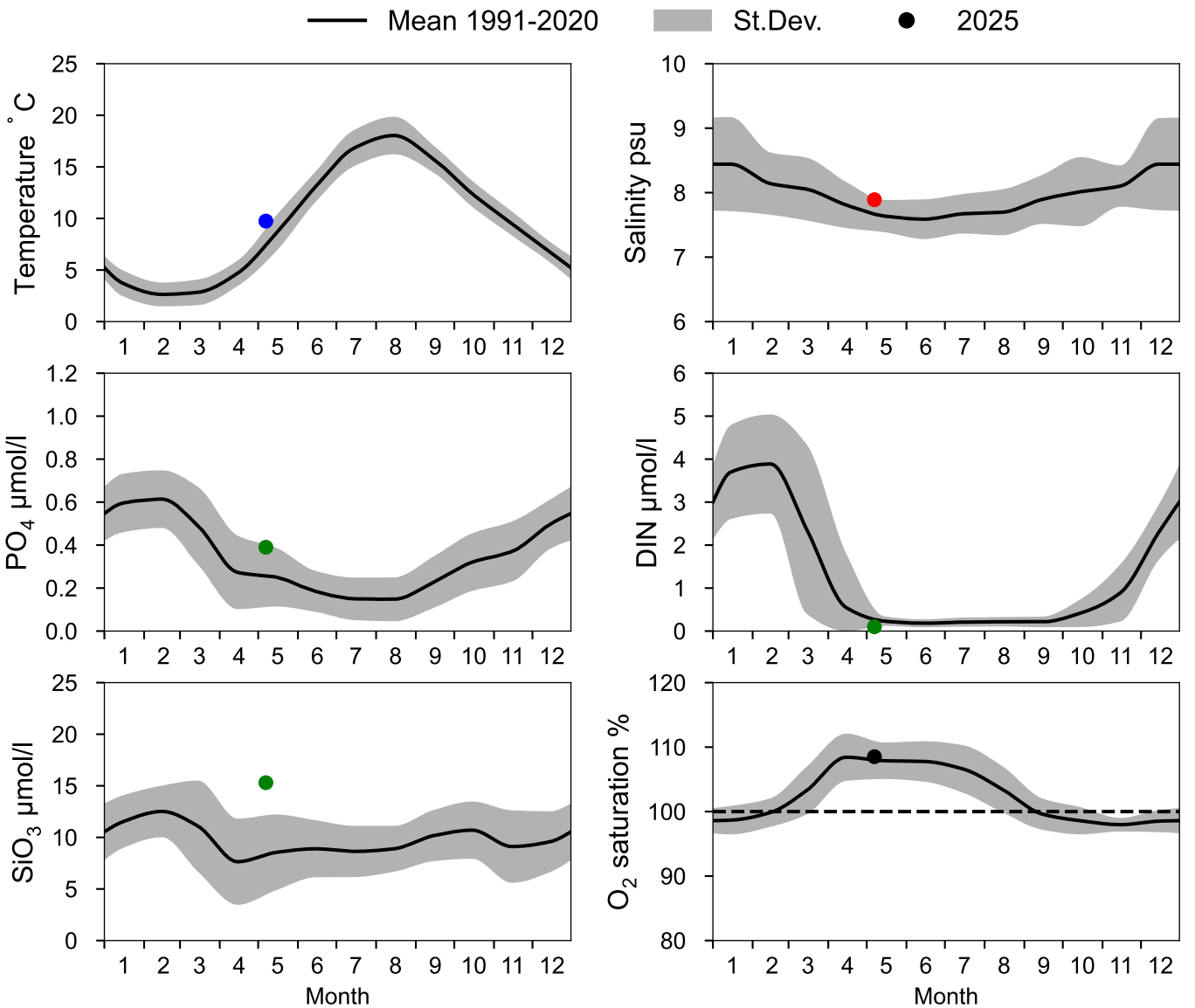


# Vertical profiles W LANDSKRONA
# May

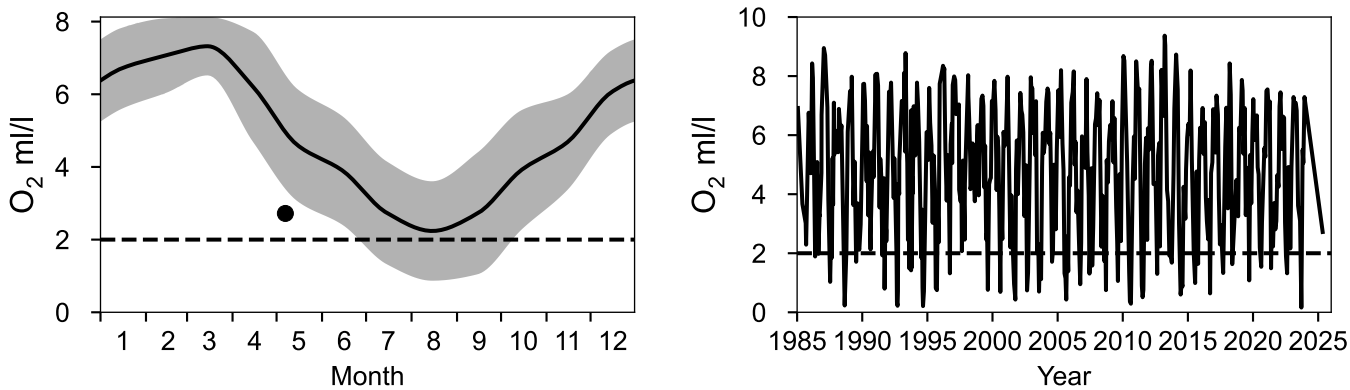


# STATION BY1 SURFACE WATER (0-10 m)

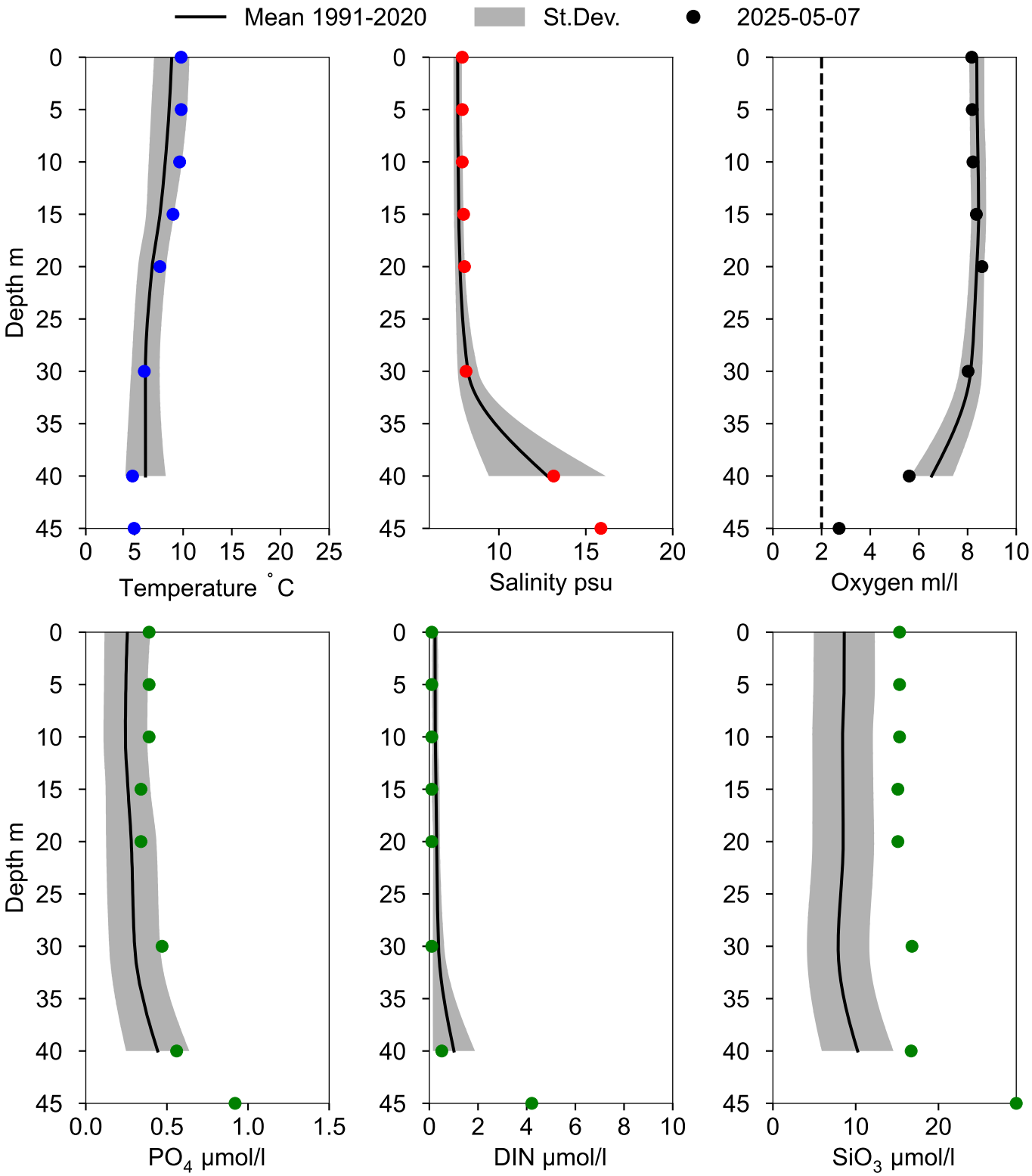
**Annual Cycles**




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

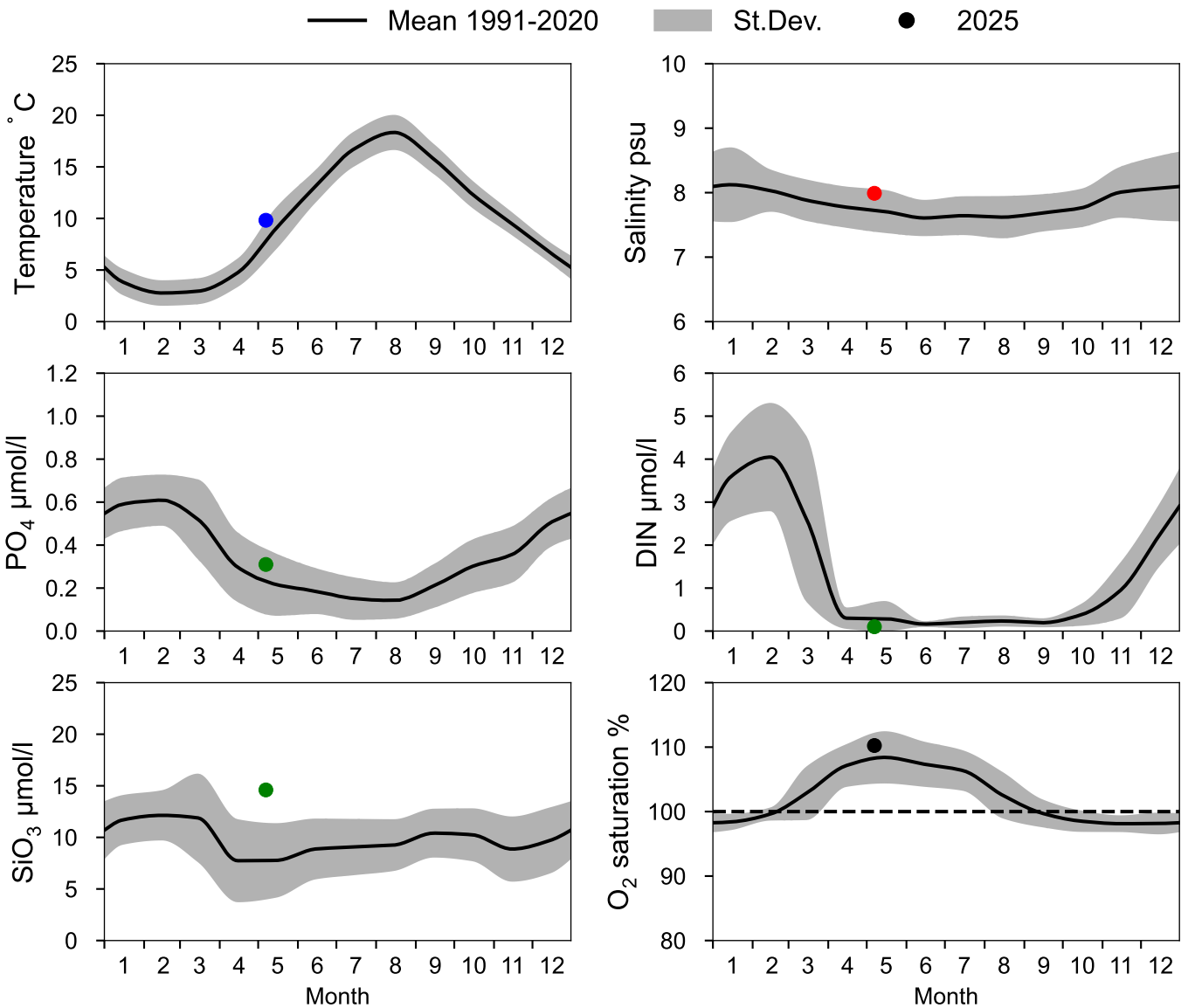


# Vertical profiles BY1
# May

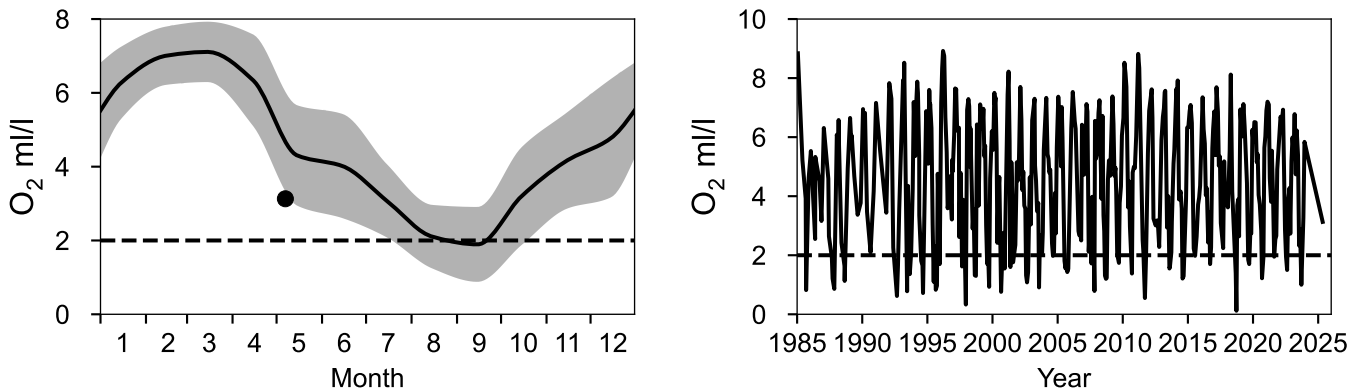


# STATION BY2 ARKONA SURFACE WATER (0-10 m)

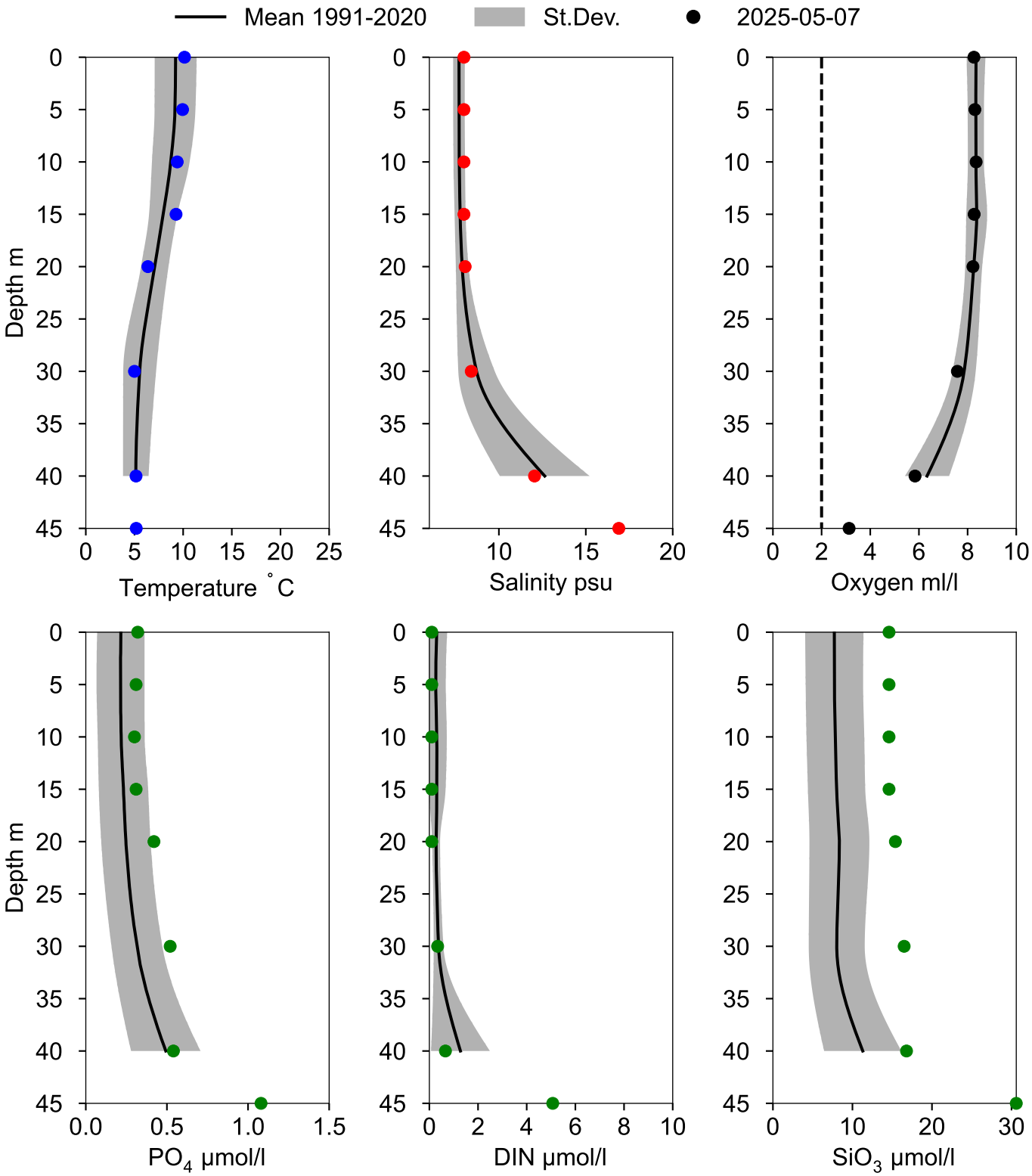
**Annual Cycles**




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

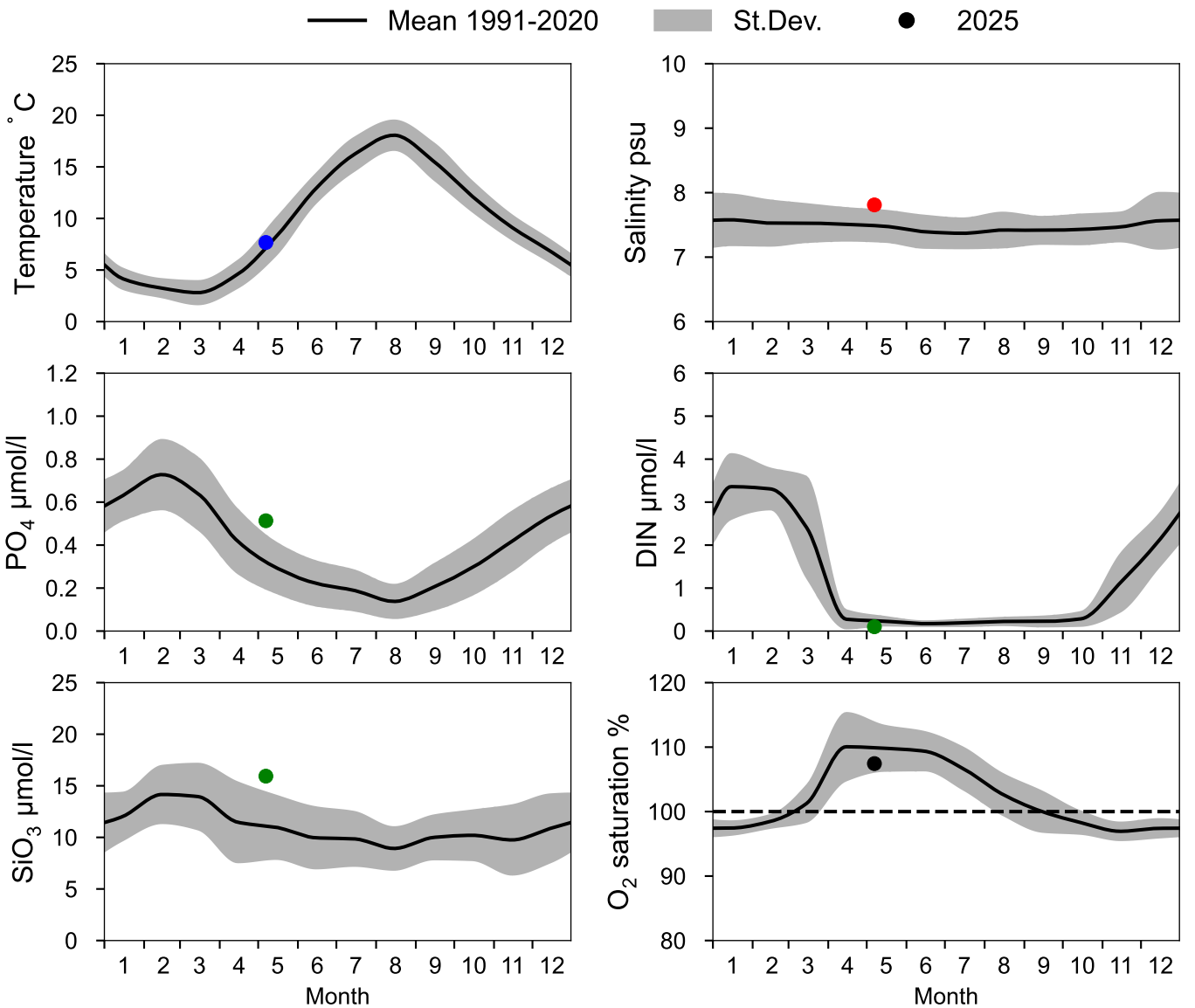


# Vertical profiles BY2 ARKONA
# May

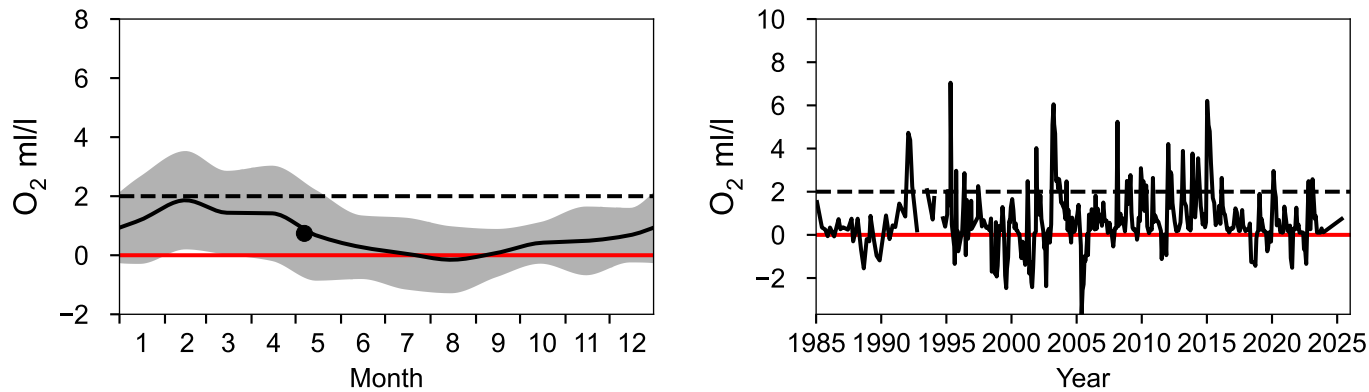


# STATION HANÖBUKTEN SURFACE WATER (0-10 m)

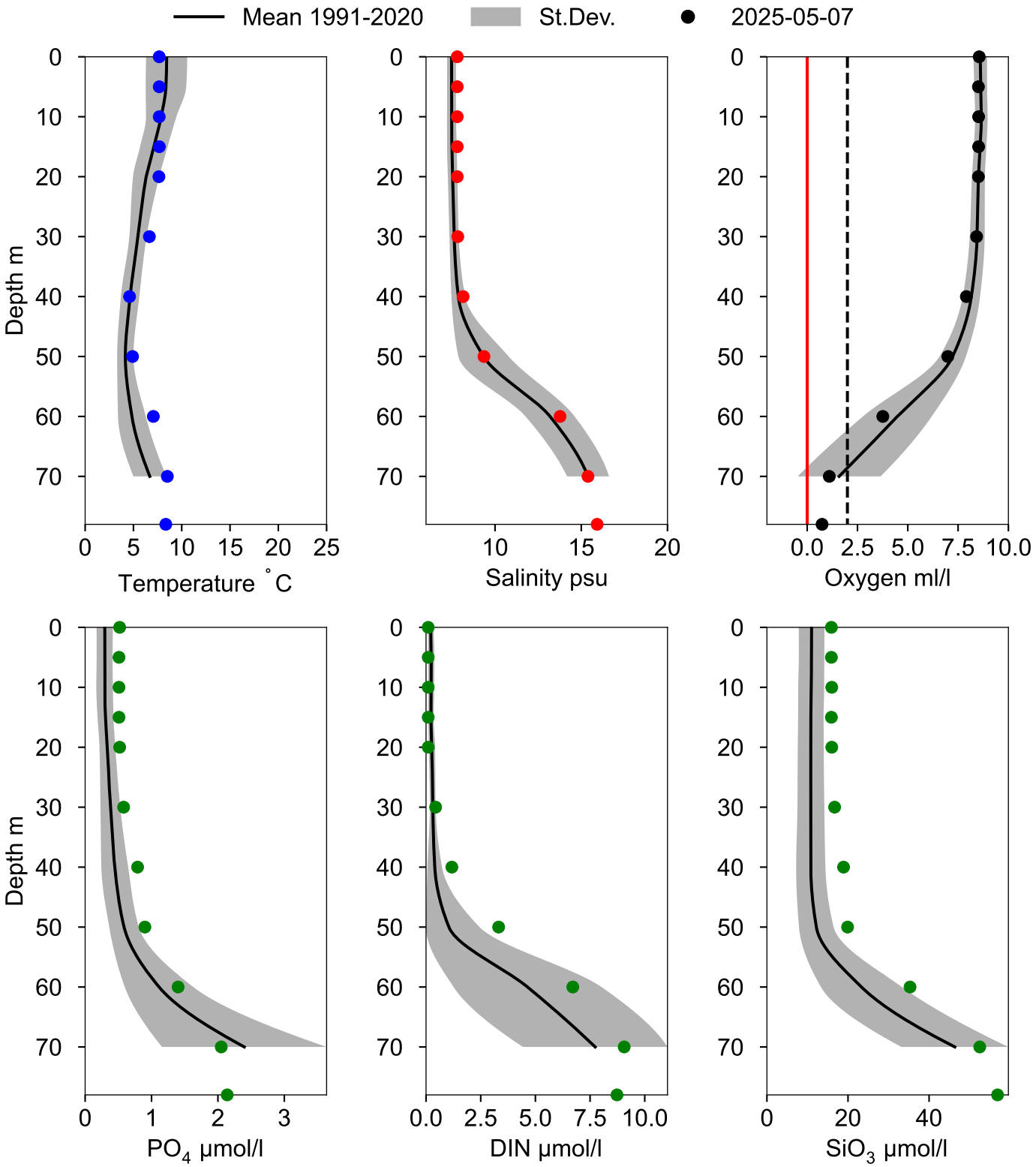
**Annual Cycles**




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

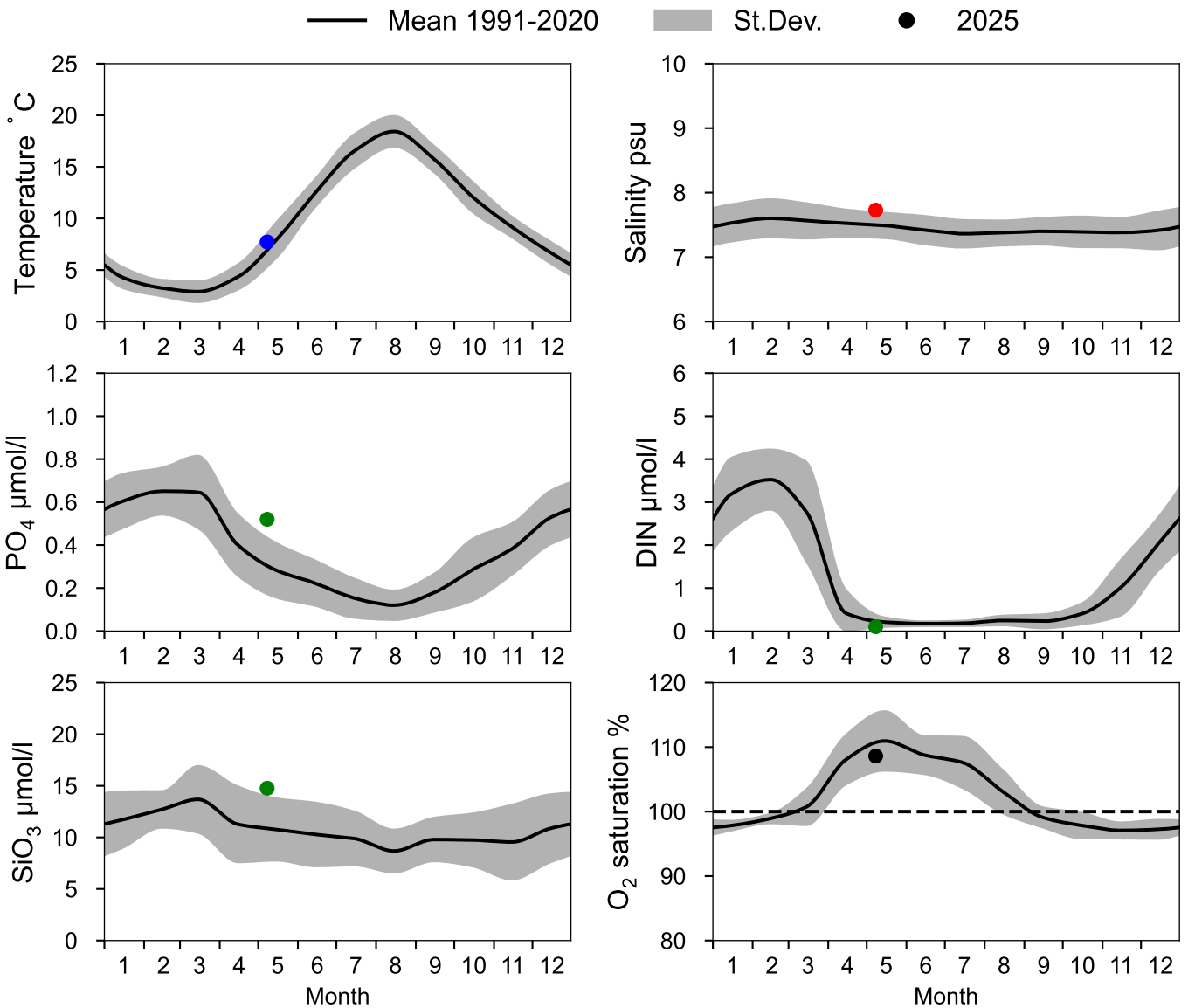


# Vertical profiles HANÖBUKTEN
## May

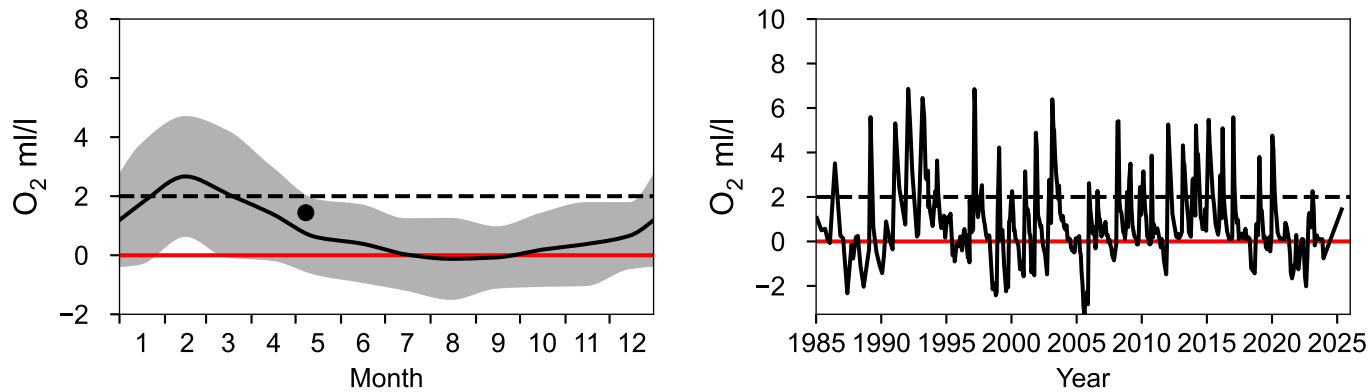


# STATION BY4 CHRISTIANSÖ SURFACE WATER (0-10 m)

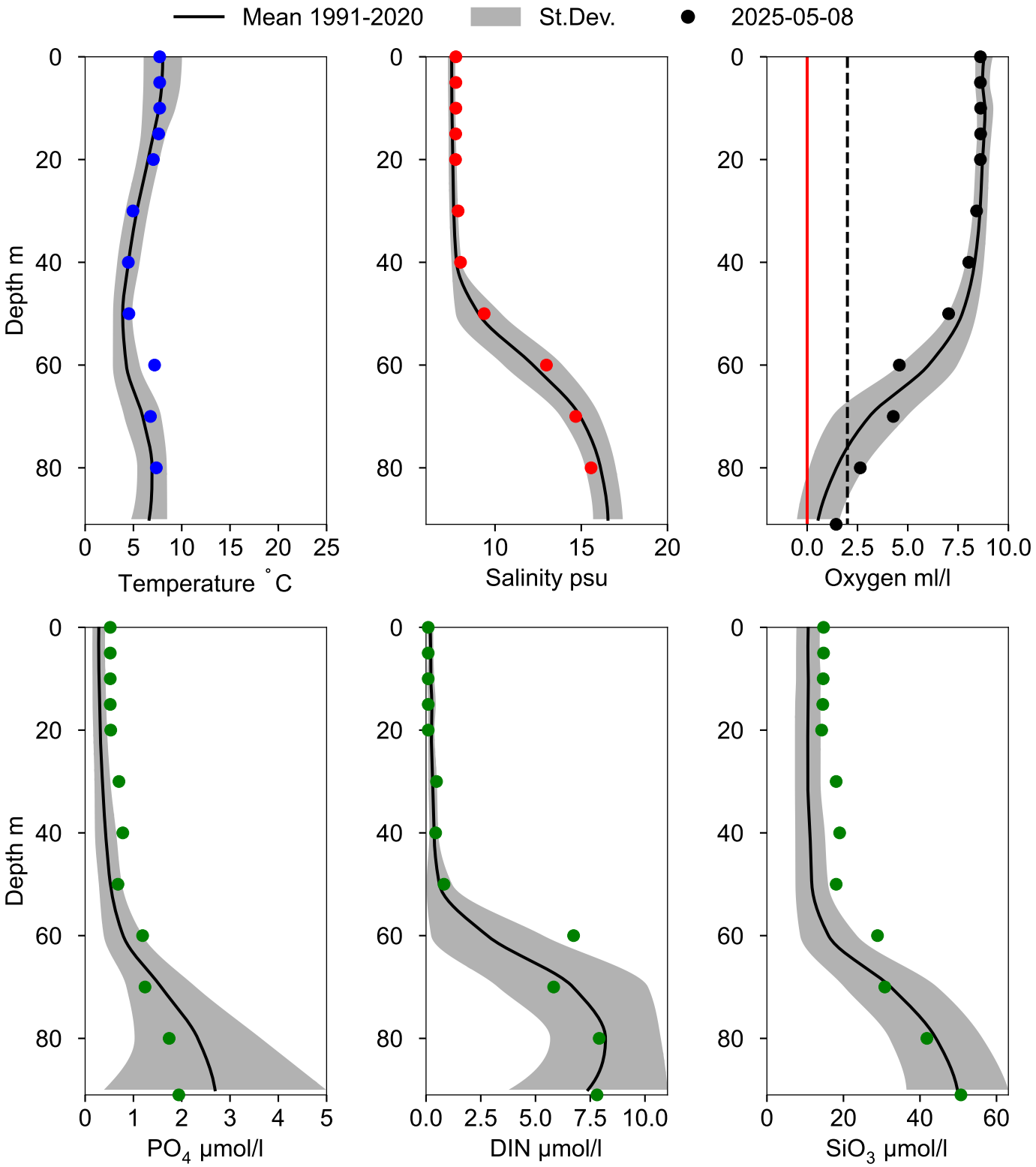
**Annual Cycles**




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

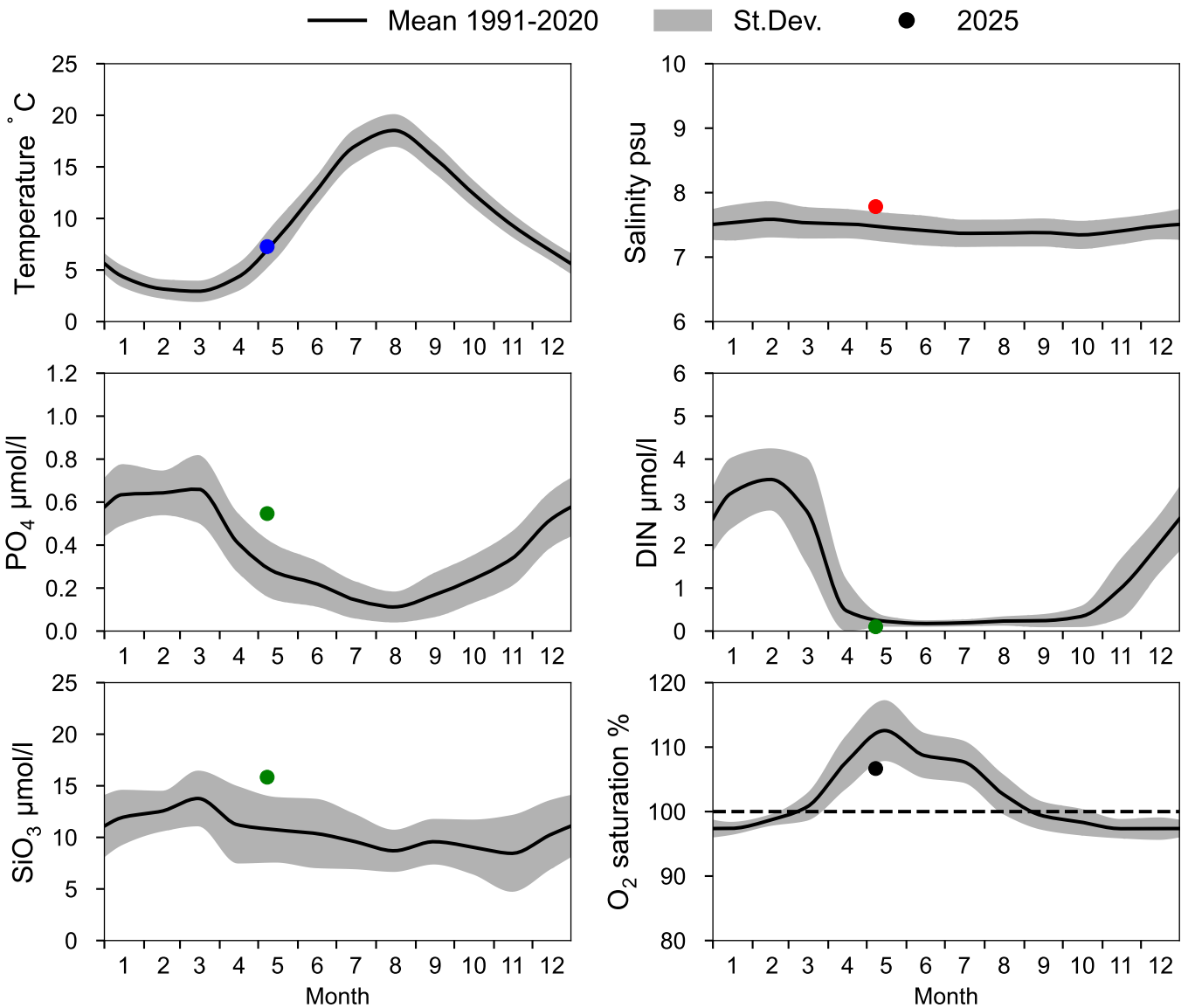


# Vertical profiles BY4 CHRISTIANSÖ
## May

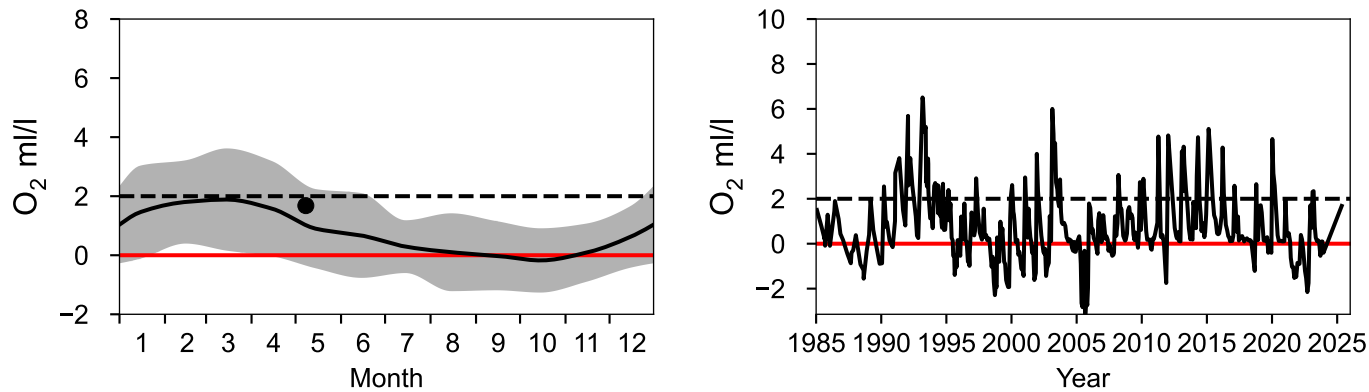


# STATION BY5 BORNHOLMSDJ SURFACE WATER (0-10 m)

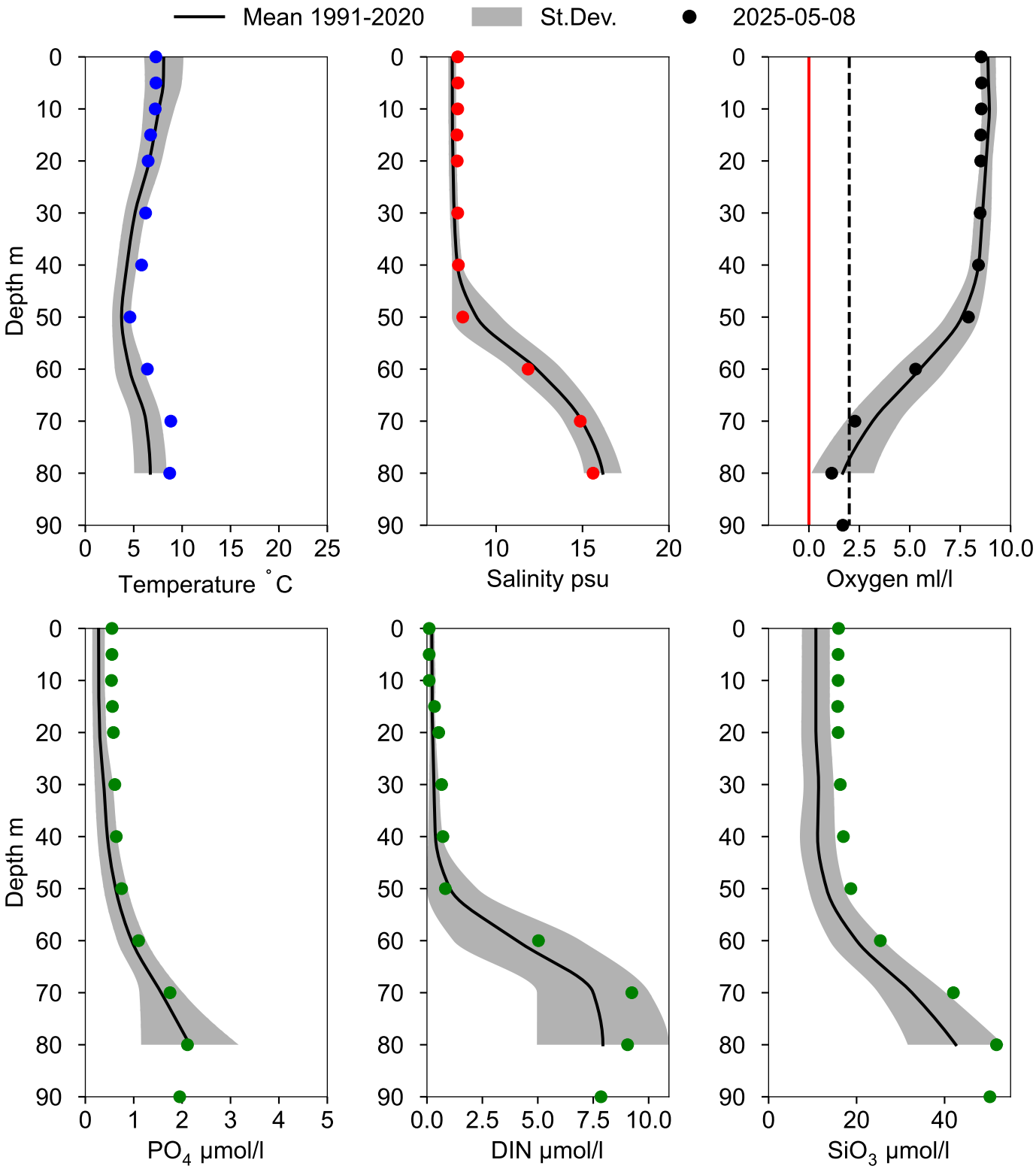
**Annual Cycles**




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

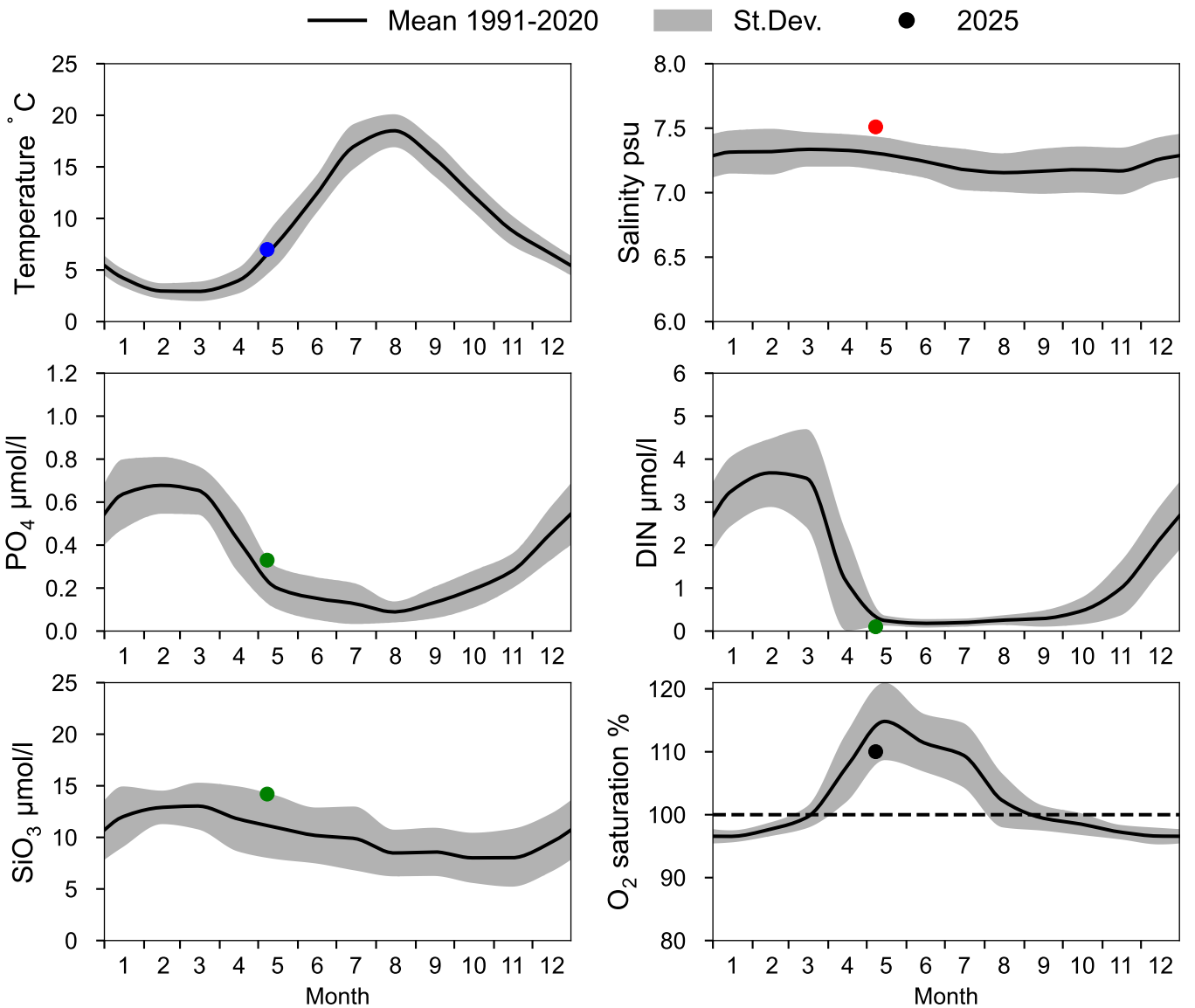


# Vertical profiles BY5 BORNHOLMSDJ
# May

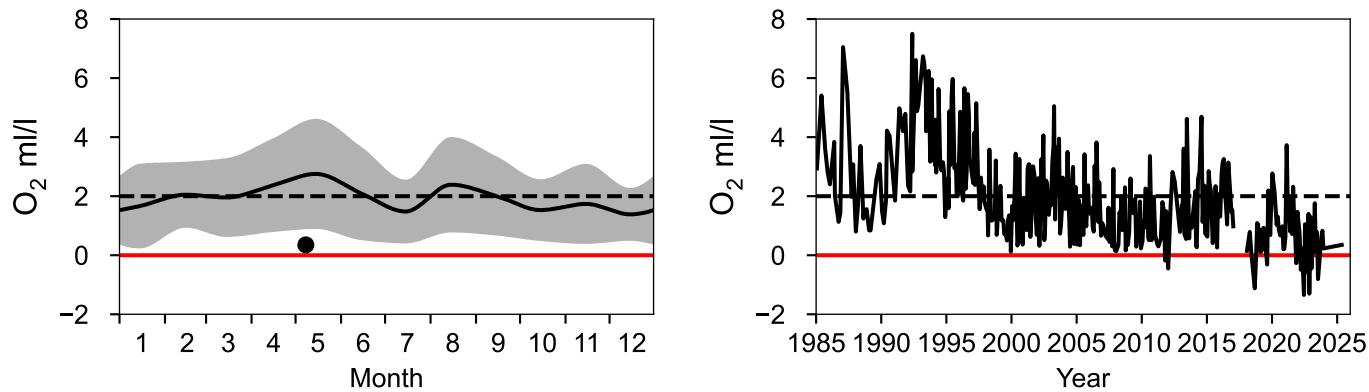


# STATION BCS III-10 SURFACE WATER (0-10 m)

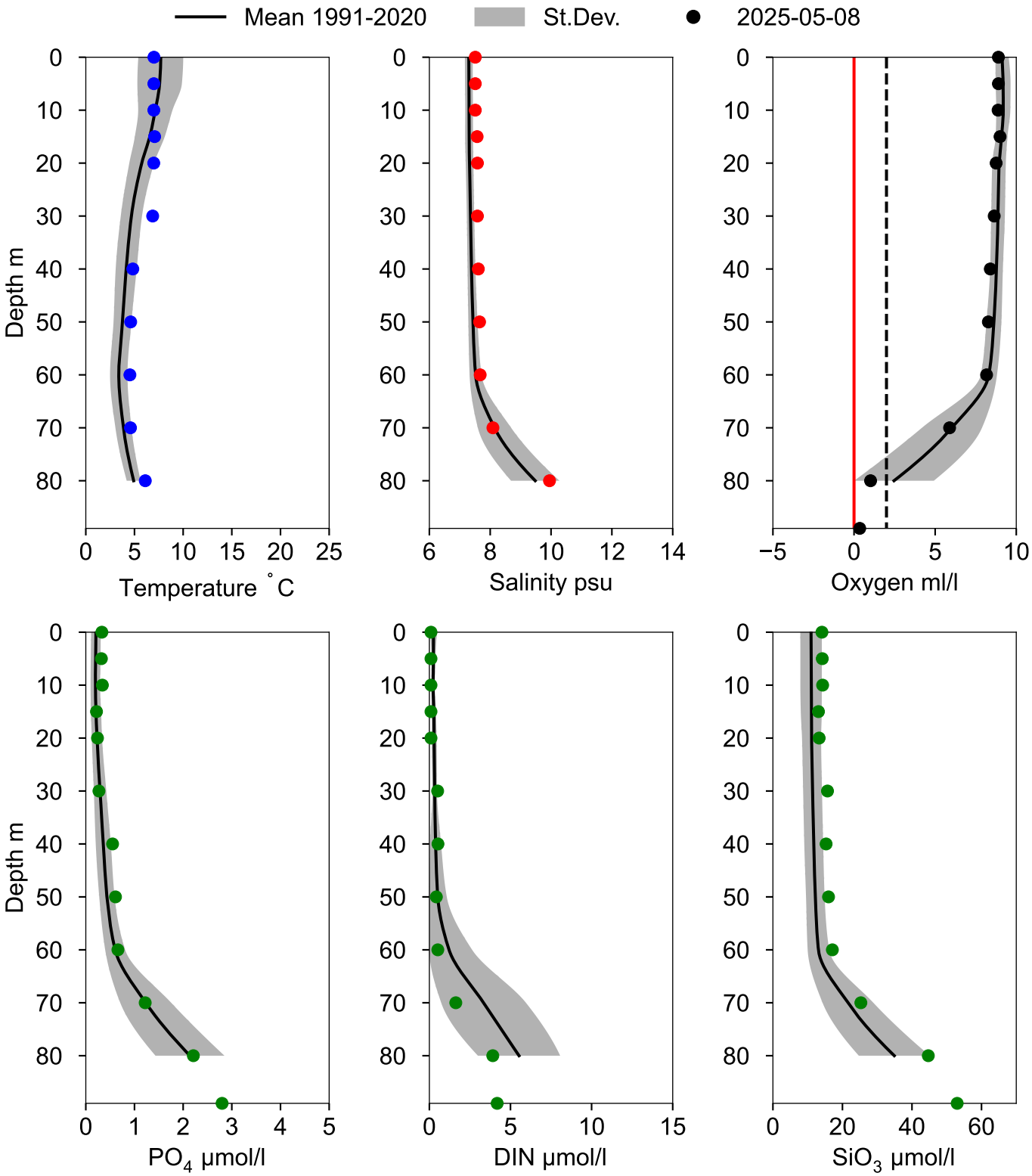
**Annual Cycles**




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

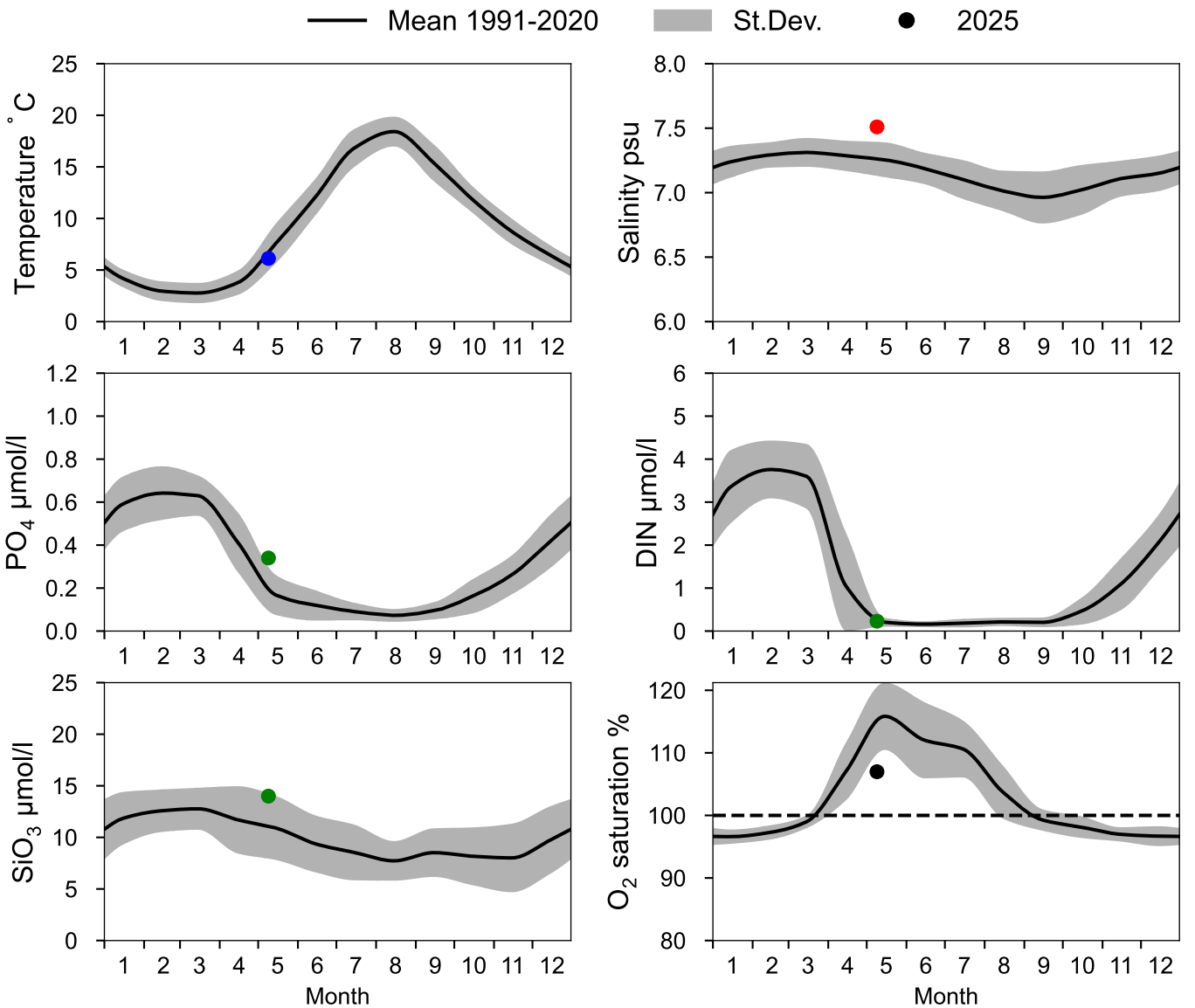


# Vertical profiles BCS III-10
# May

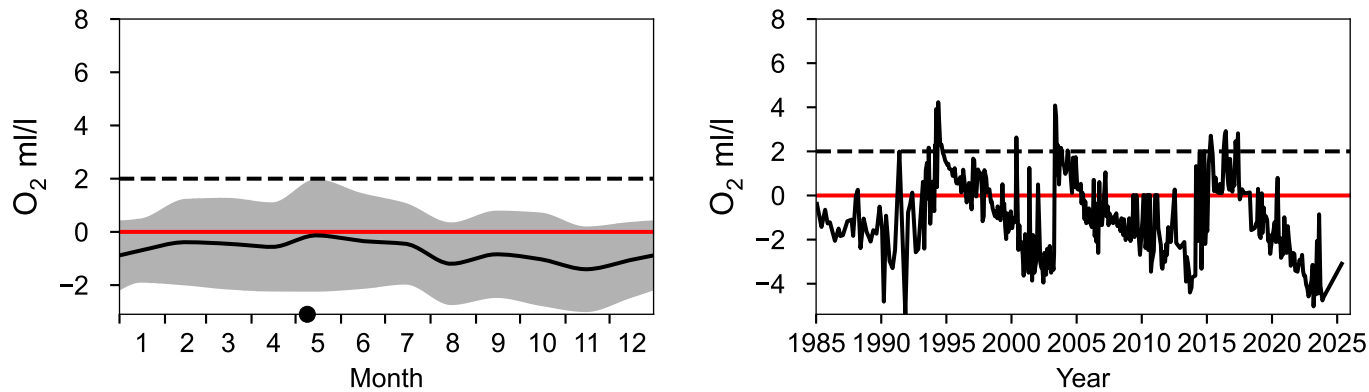


# STATION BY10 SURFACE WATER (0-10 m)

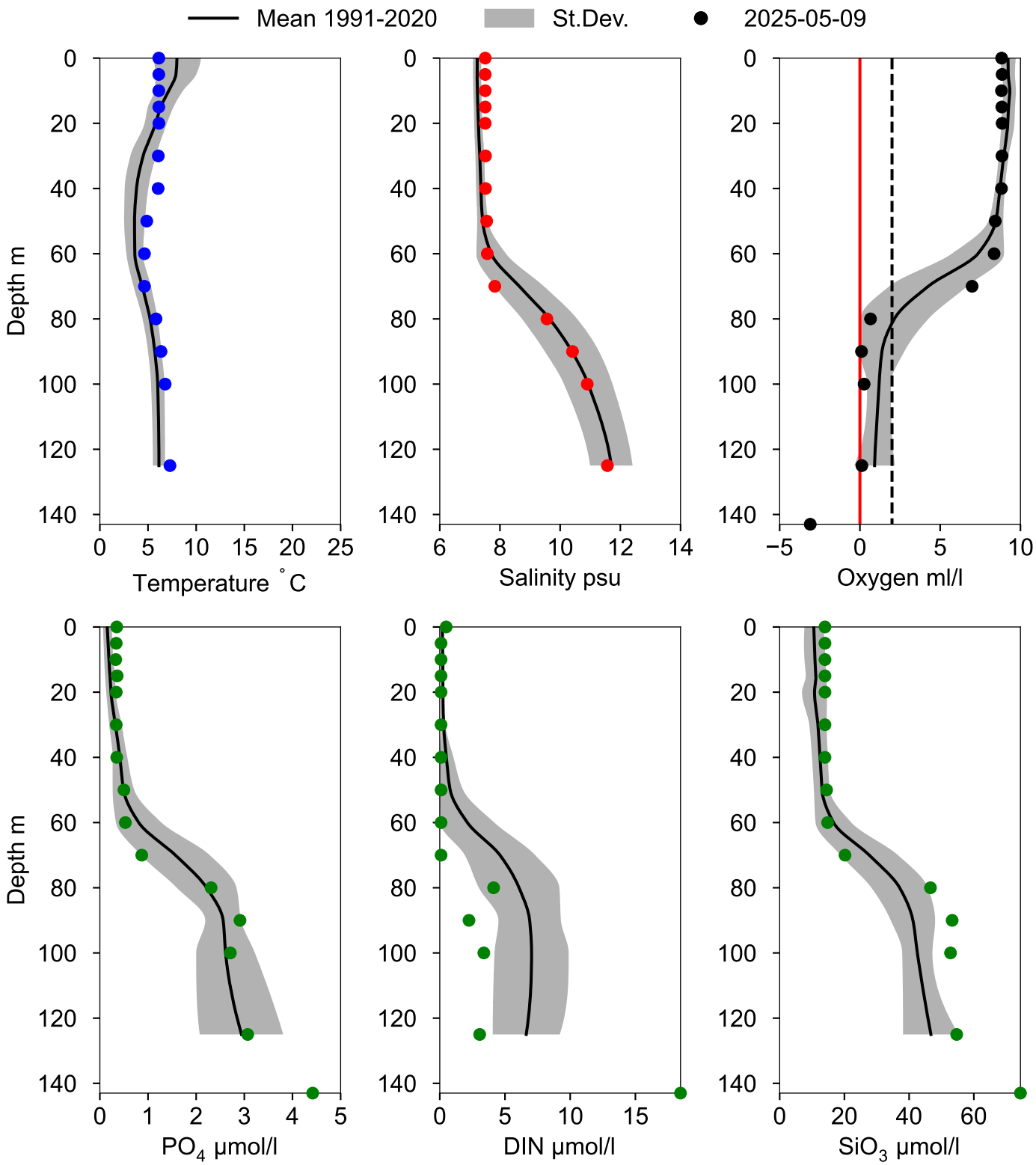
**Annual Cycles**




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

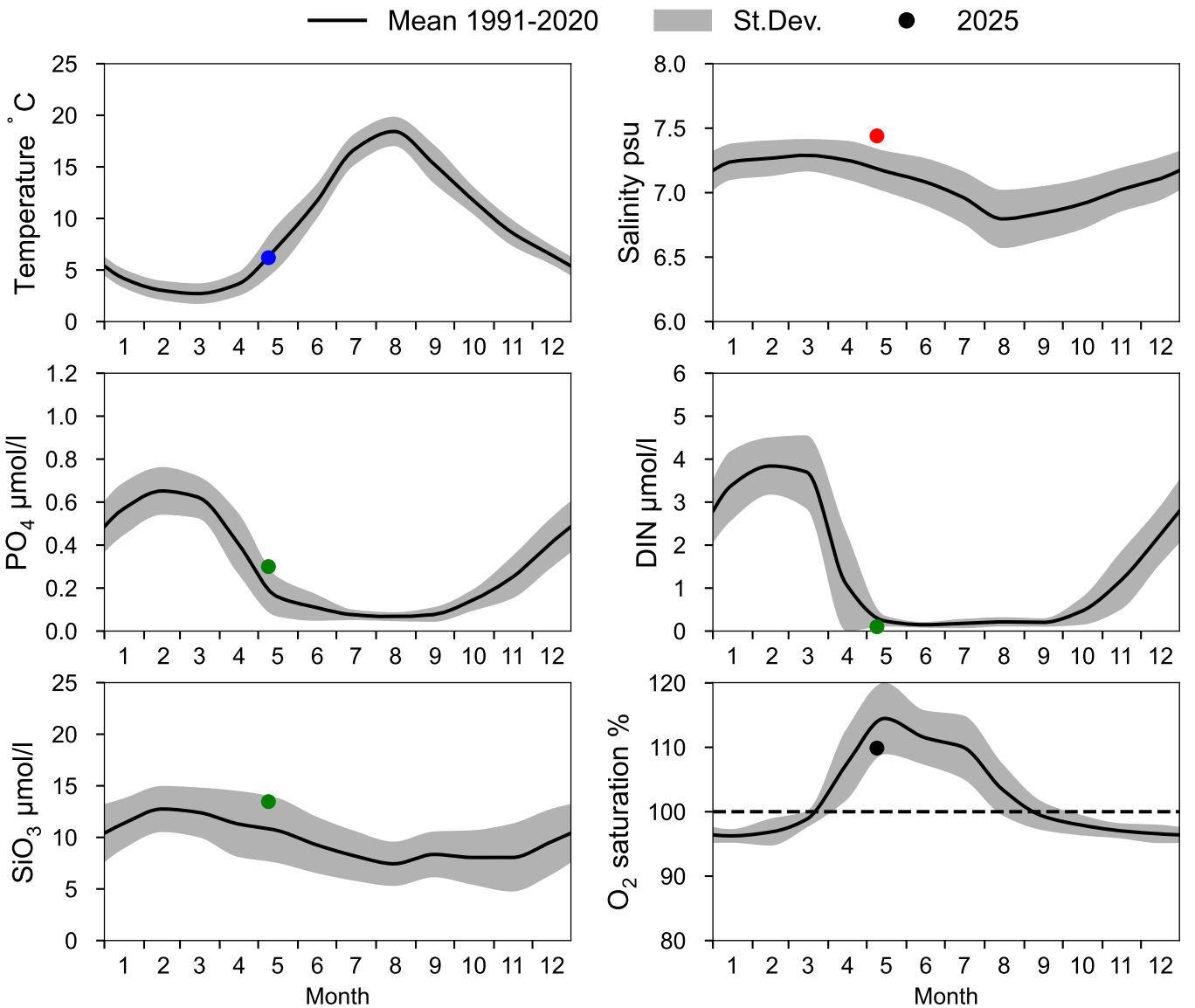


# Vertical profiles BY10
# May

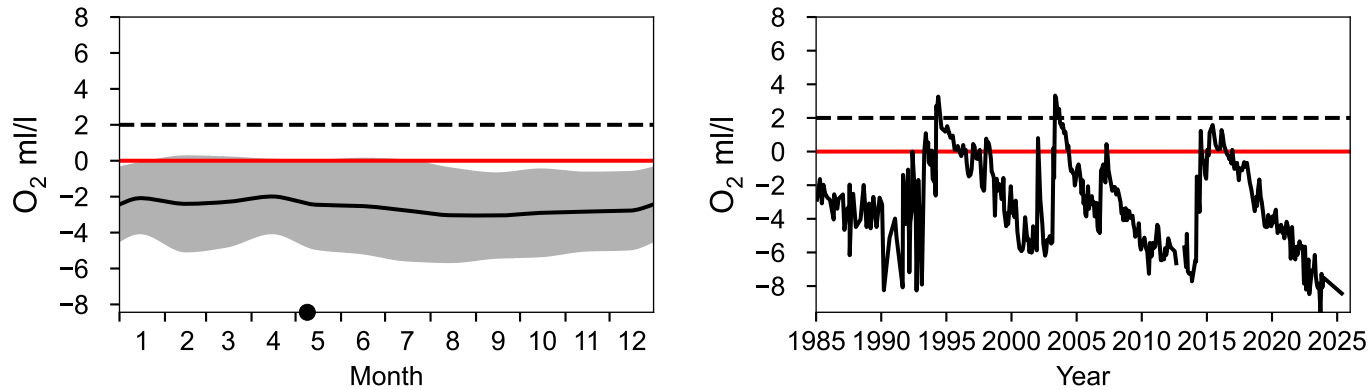


# STATION BY15 GOTLANDSDJ SURFACE WATER (0-10 m)

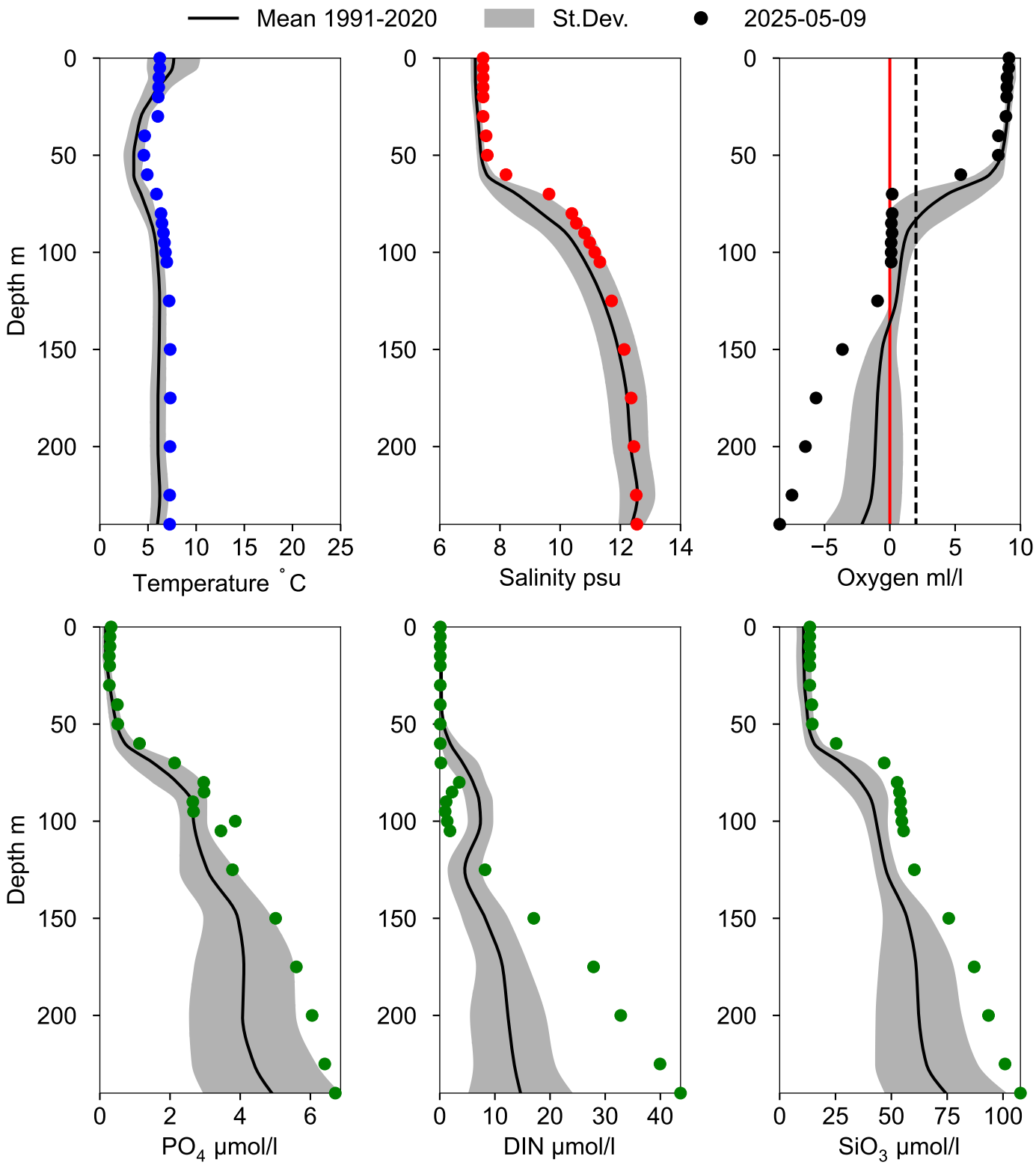
**Annual Cycles**




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

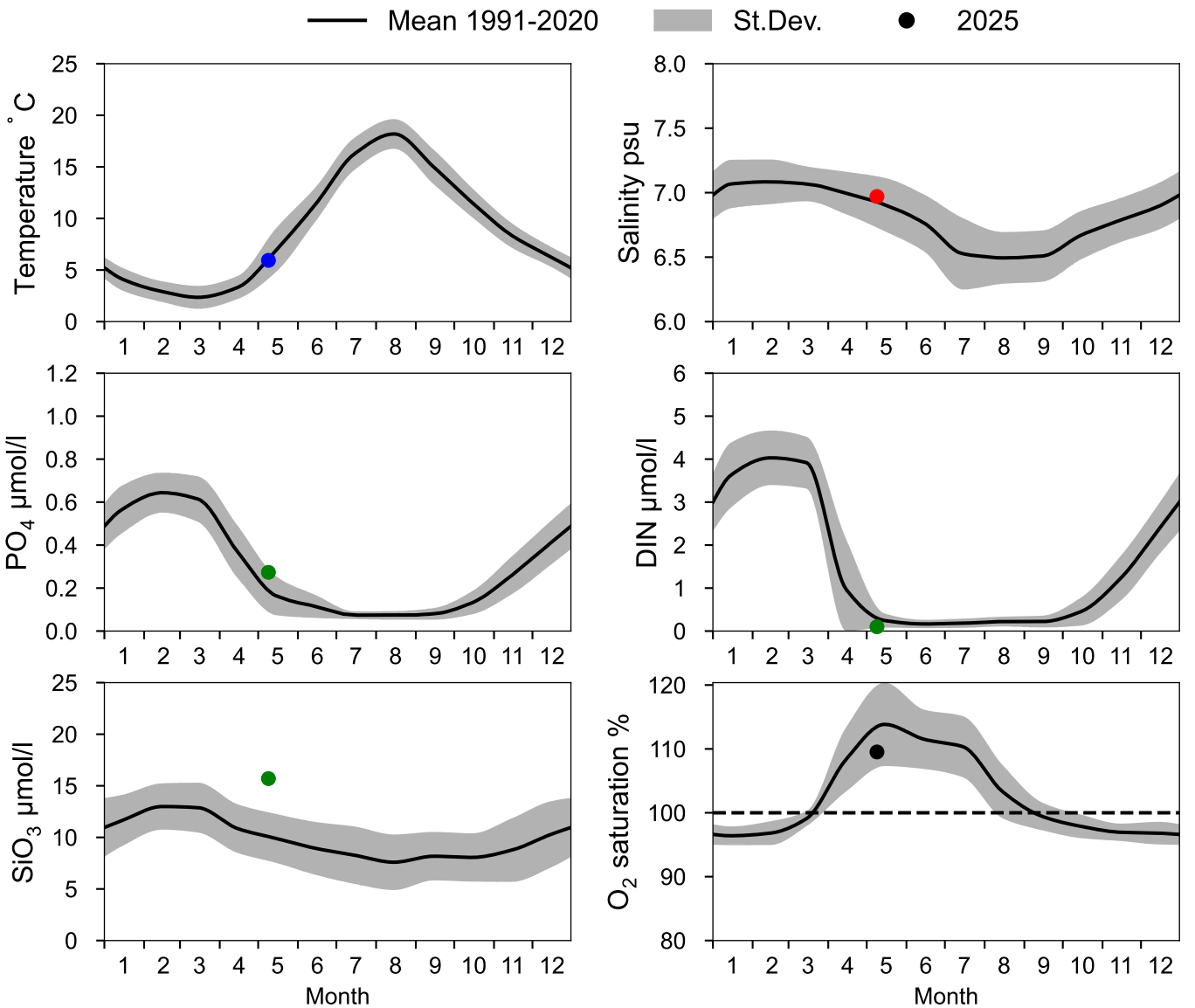


# Vertical profiles BY15 GOTLANDSDJ
# May

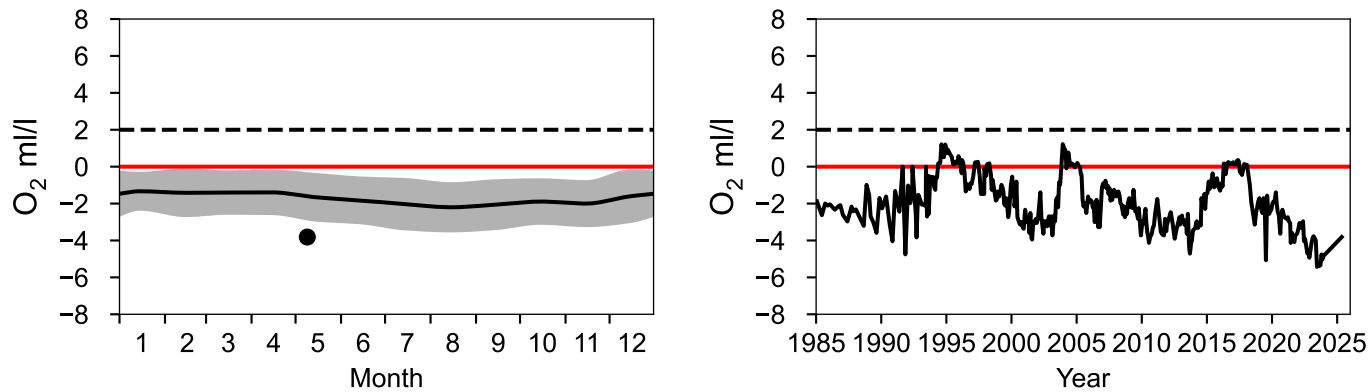


# STATION BY20 FÅRÖDJ SURFACE WATER (0-10 m)

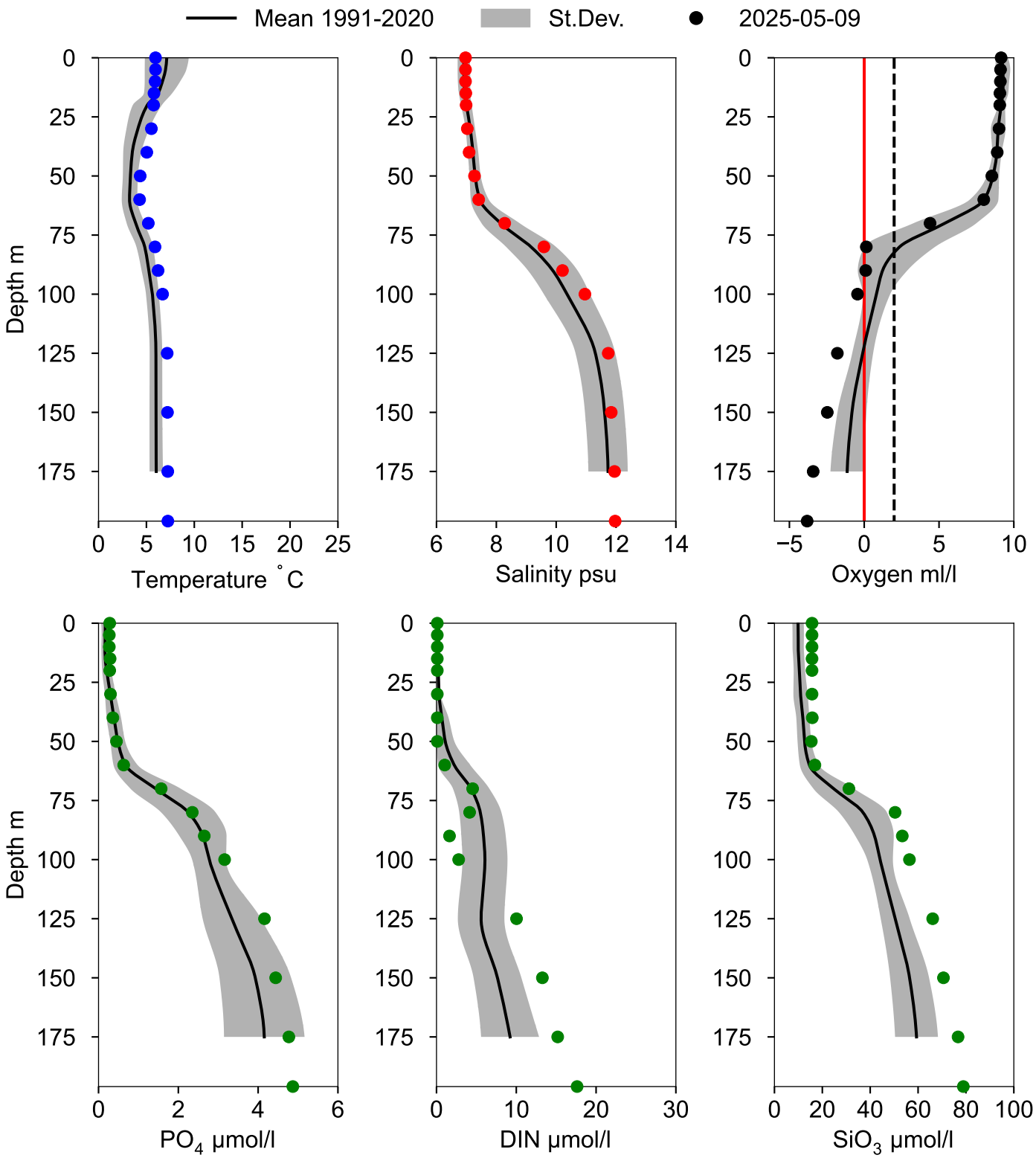
**Annual Cycles**




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

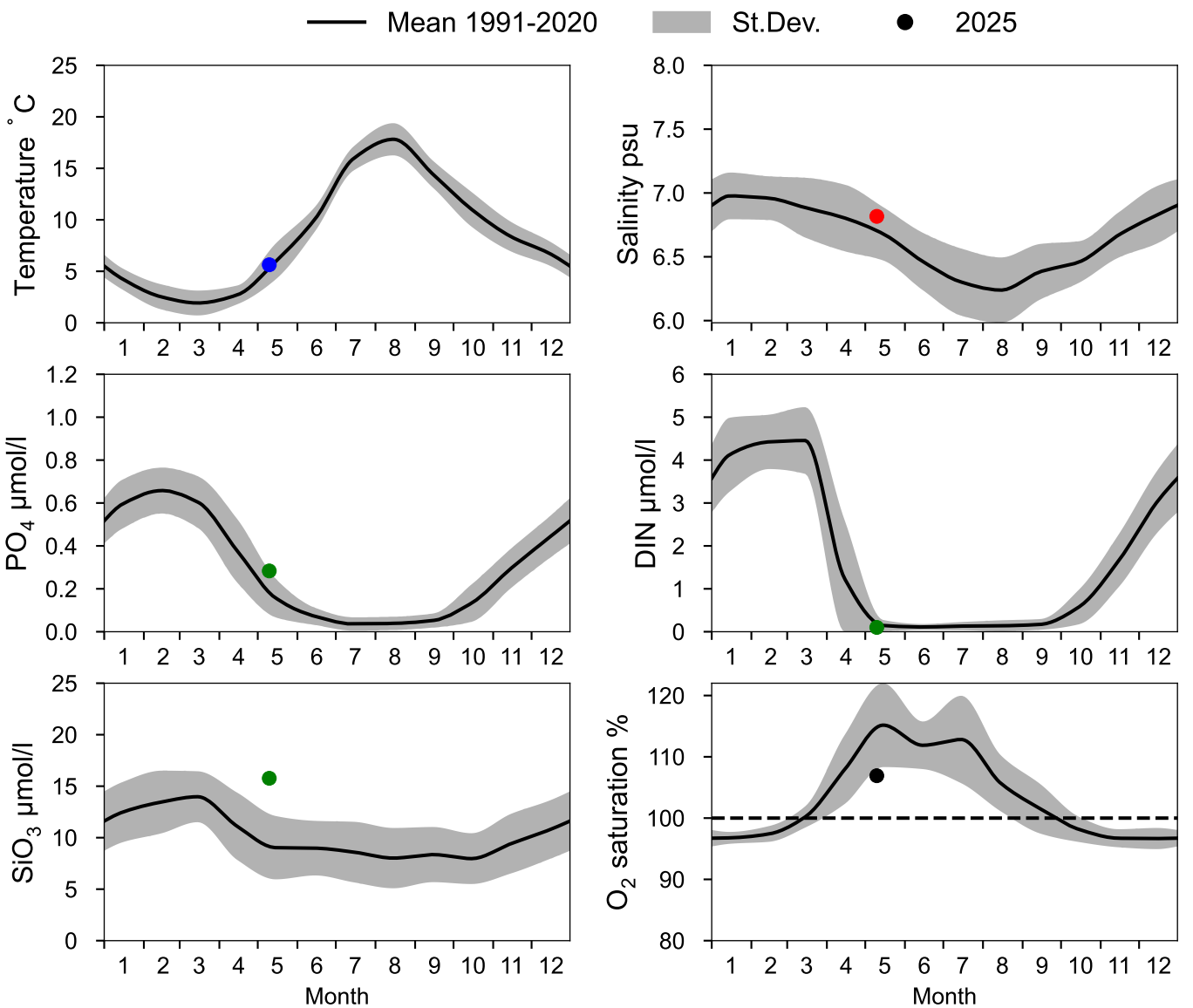


# Vertical profiles BY20 FÅRÖDJ
## May

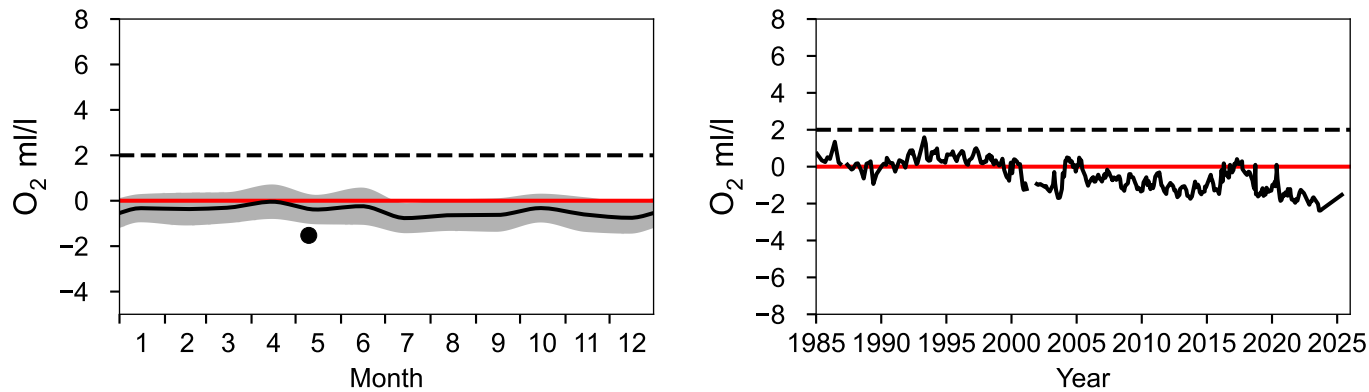


# STATION BY29 / LL19 SURFACE WATER (0-10 m)

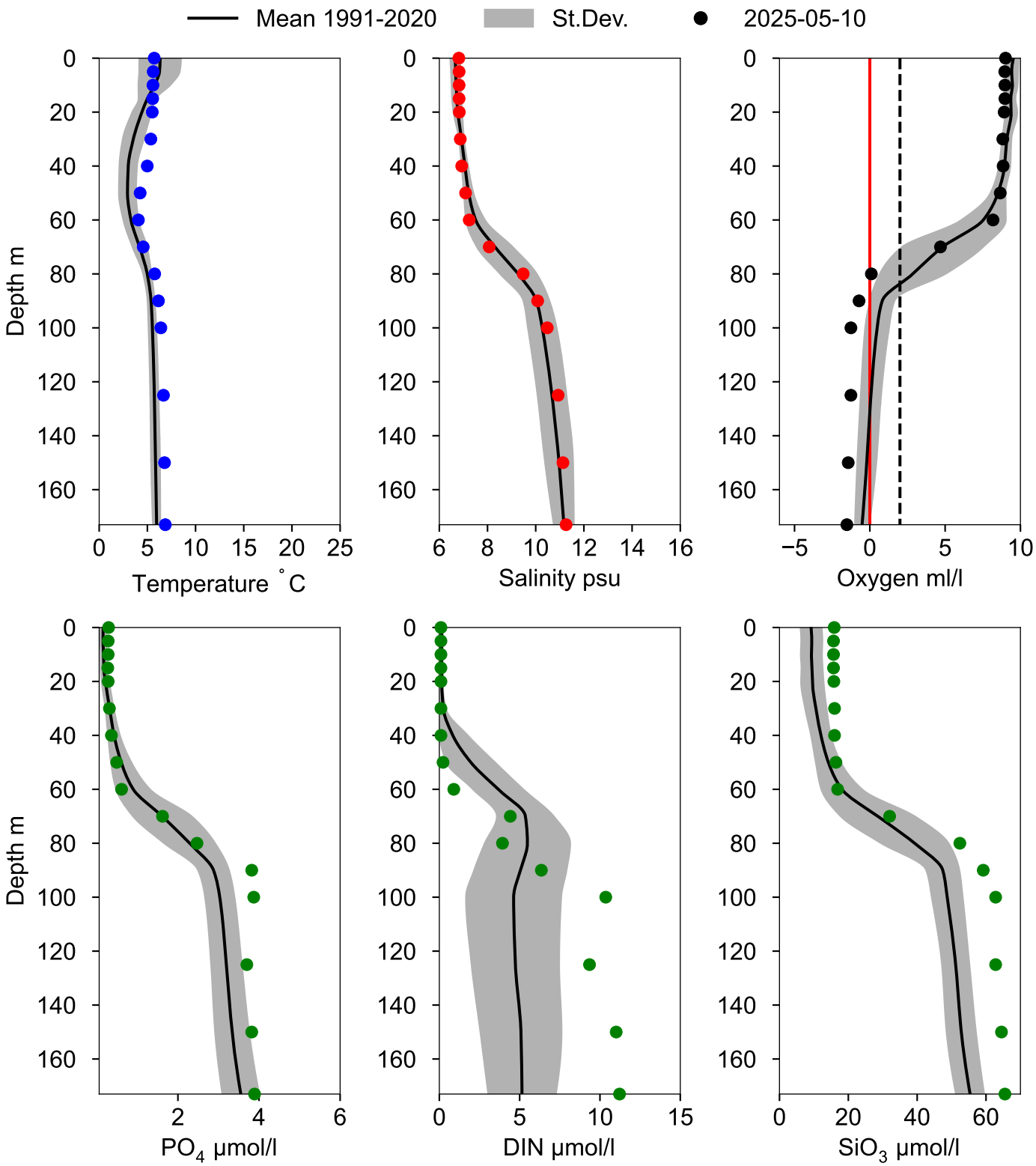
**Annual Cycles**




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

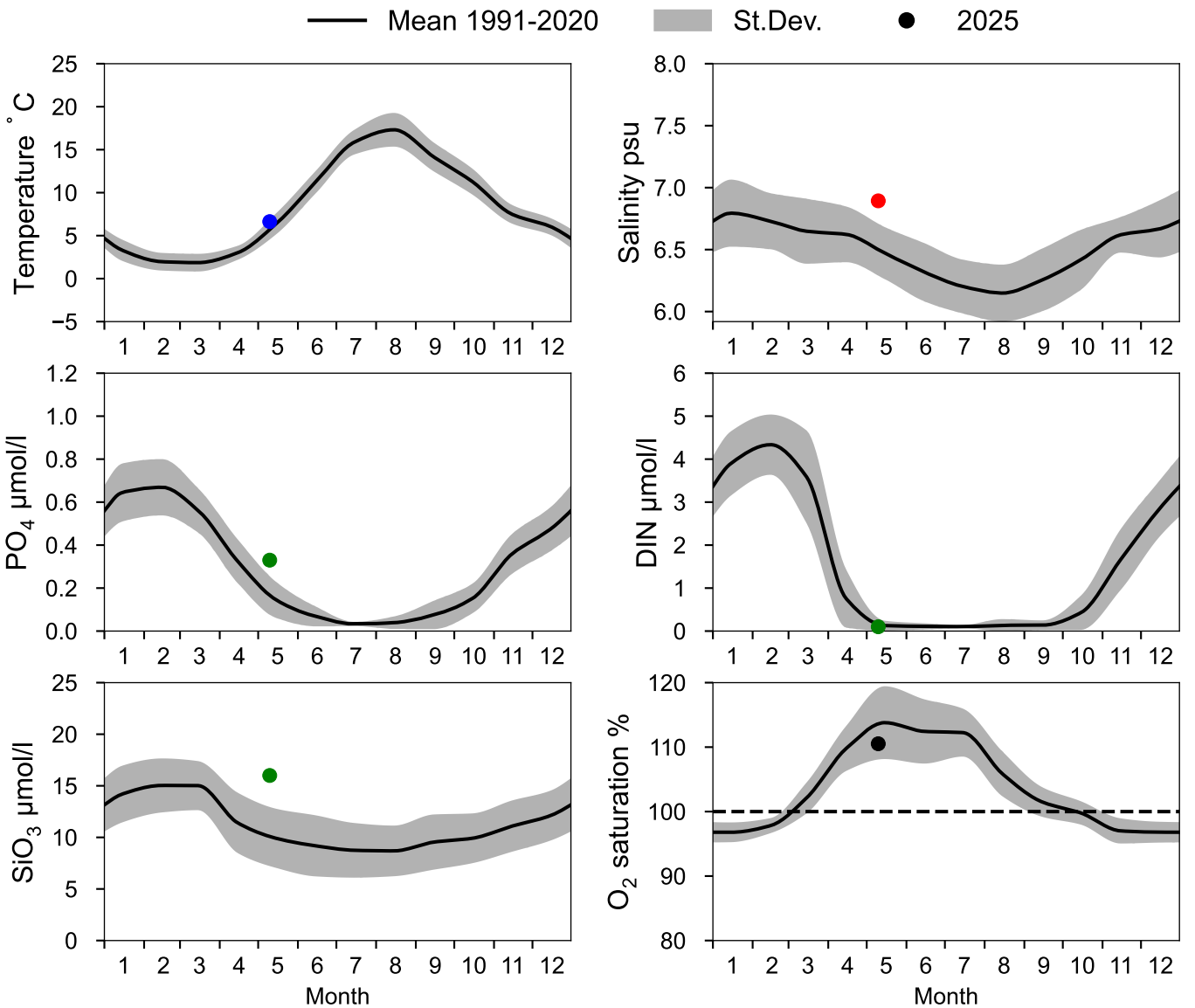


# Vertical profiles BY29 / LL19
# May

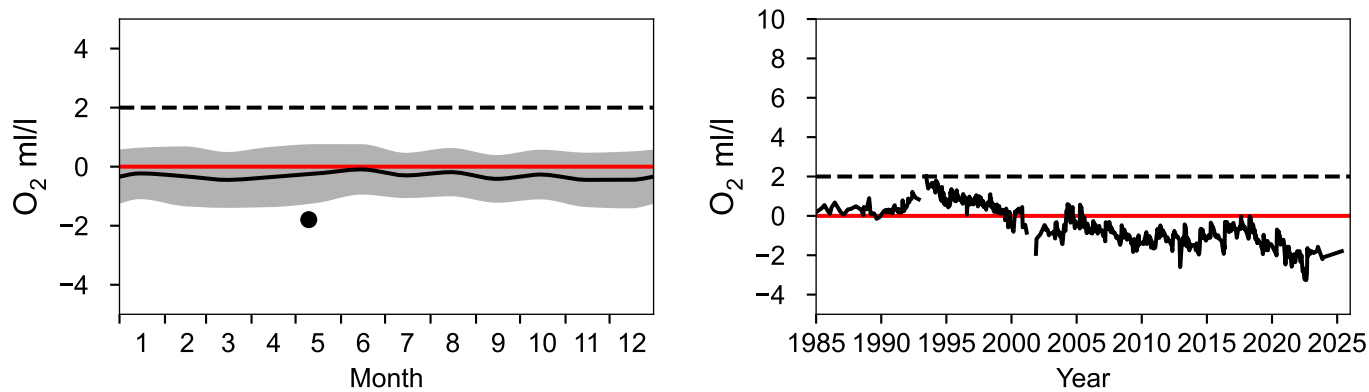


# STATION BY31 LANDSORTSDJ SURFACE WATER (0-10 m)

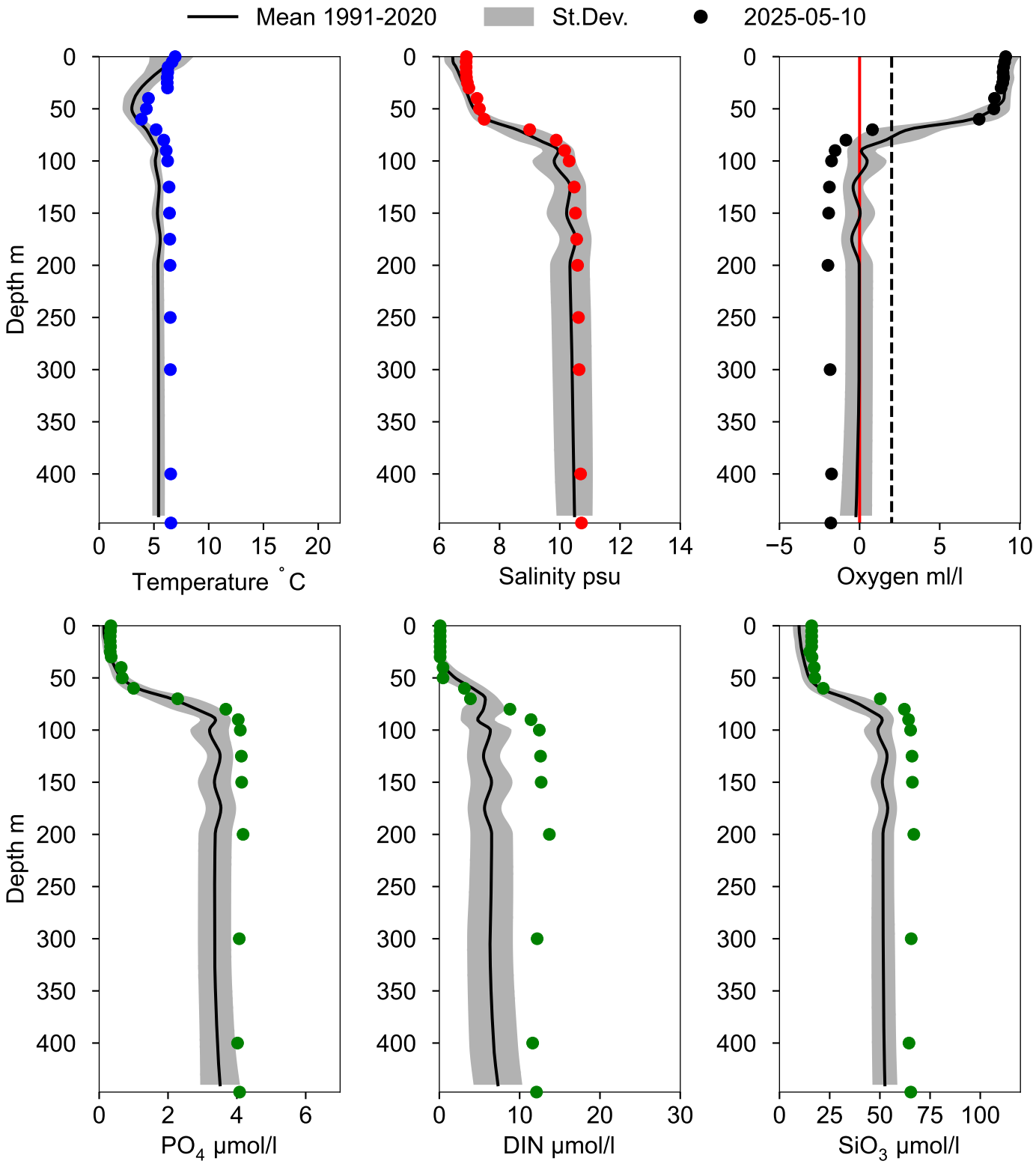
**Annual Cycles**




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

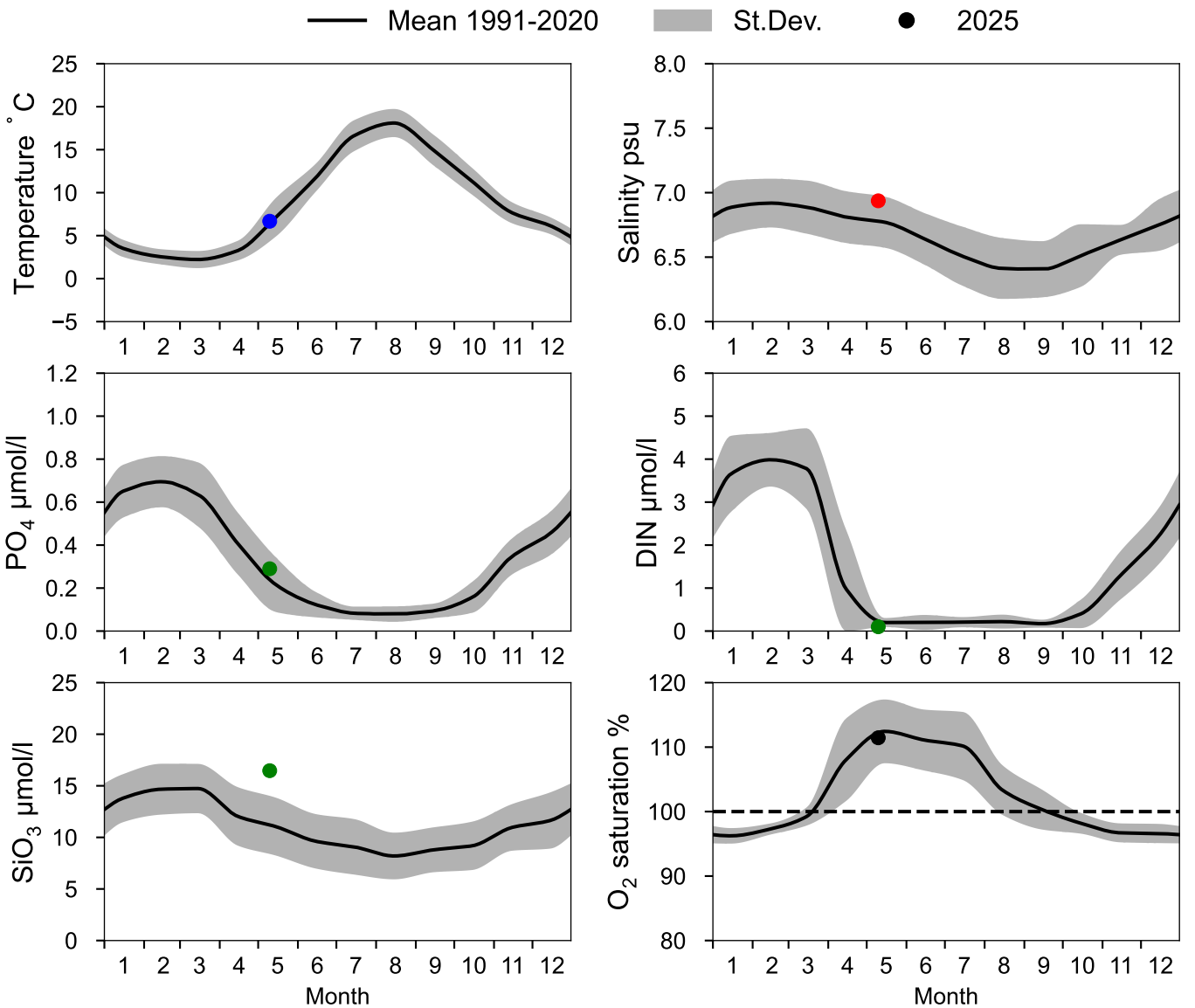


# Vertical profiles BY31 LANDSORTSDJ
## May

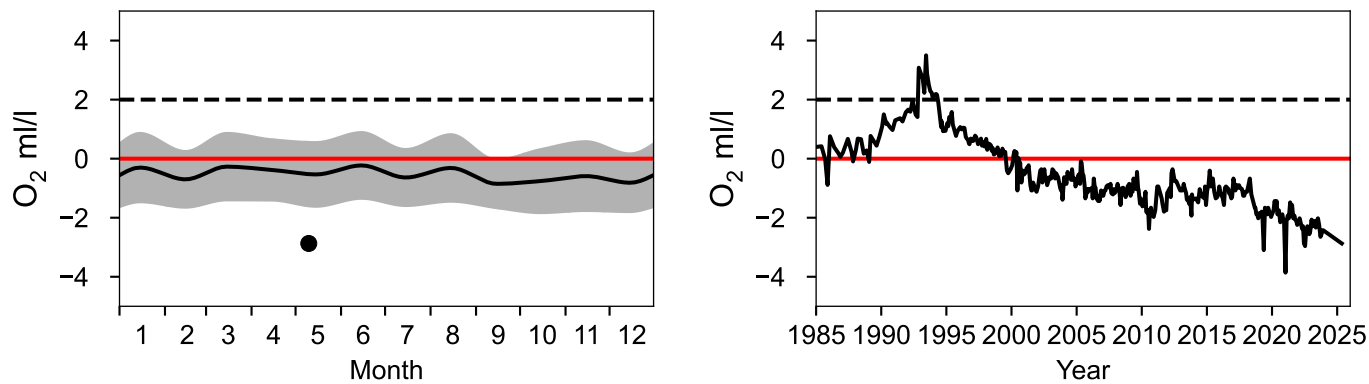


# STATION BY32 NORRKÖPINGSDJ SURFACE WATER (0-10 m)

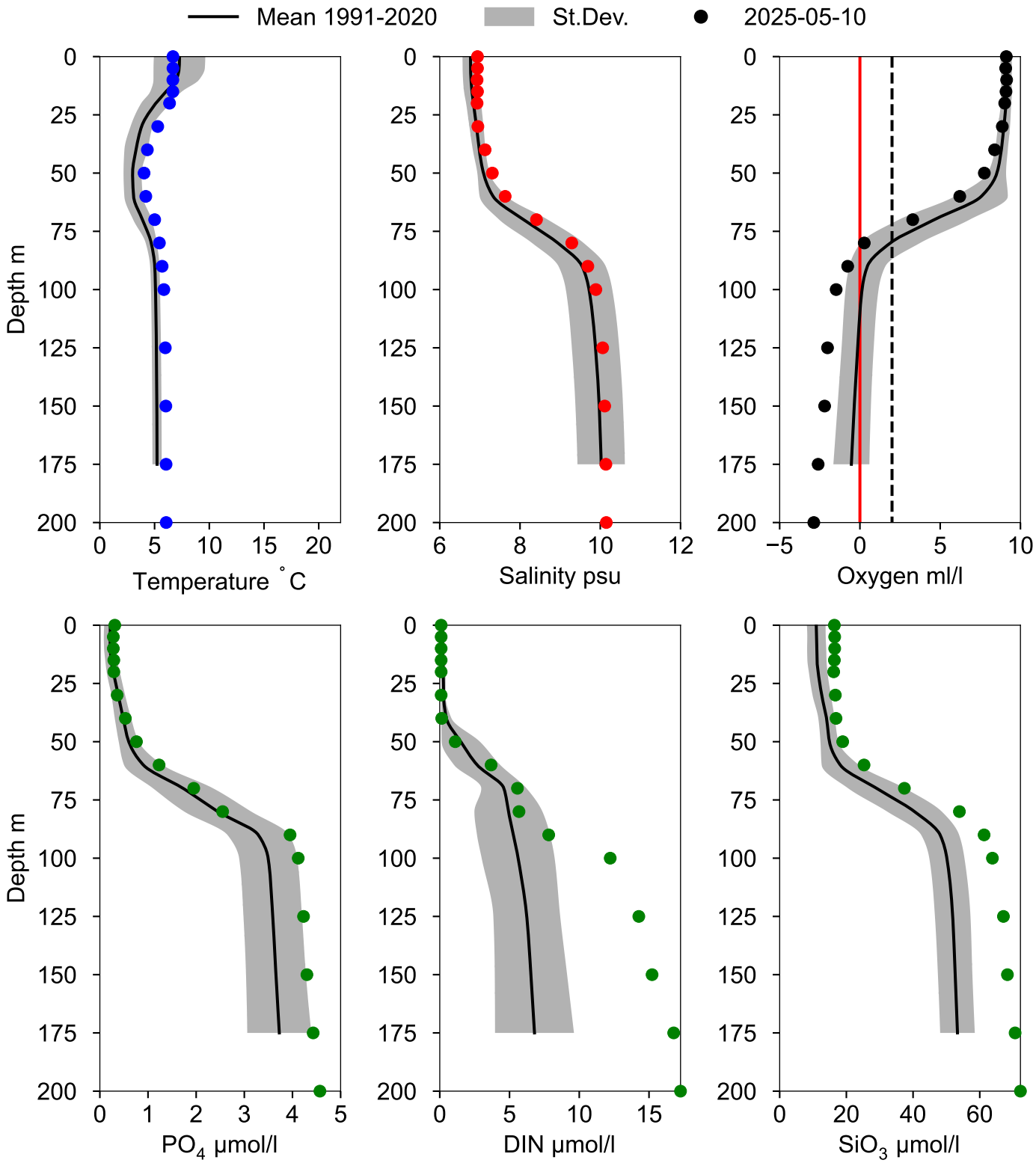
**Annual Cycles**




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

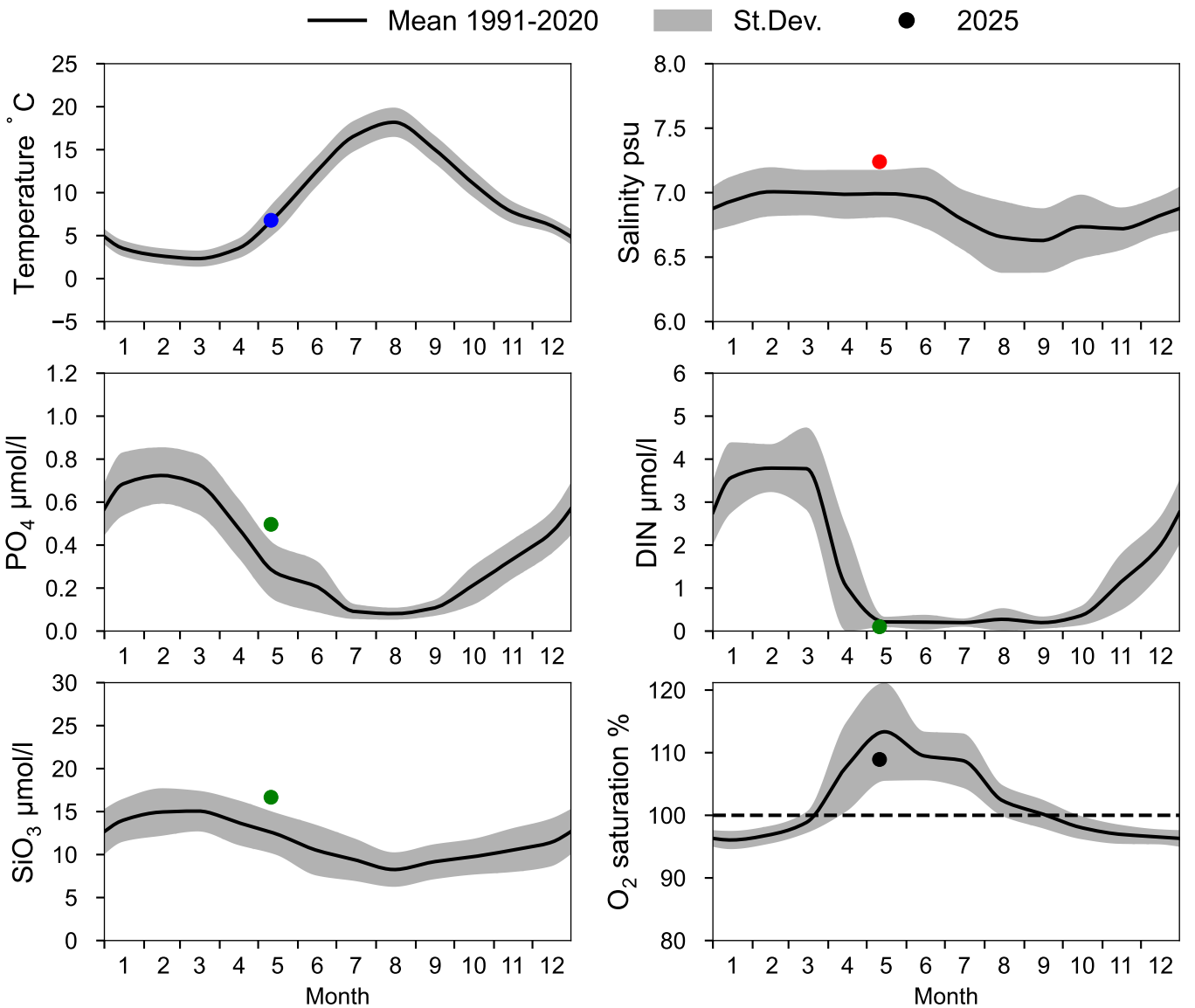


# Vertical profiles BY32 NORRKÖPINGSDJ
# May

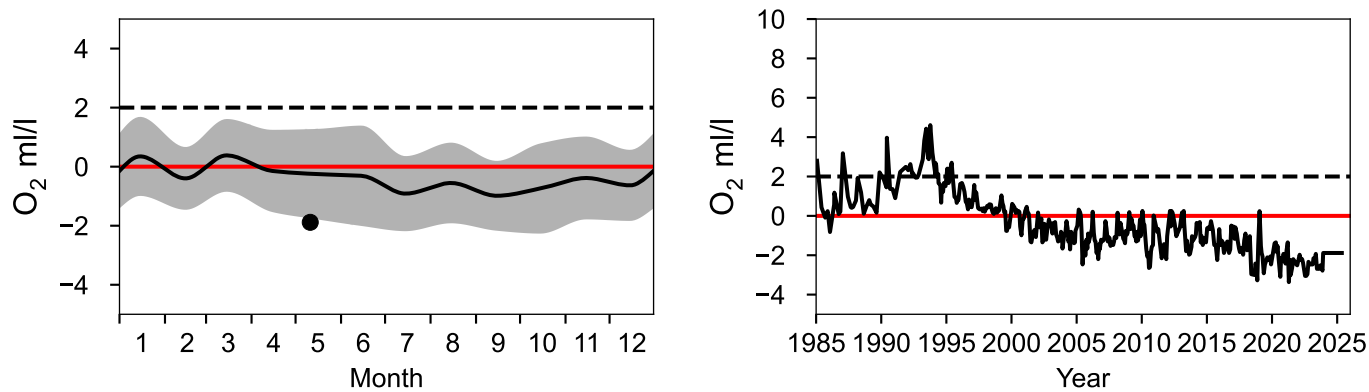
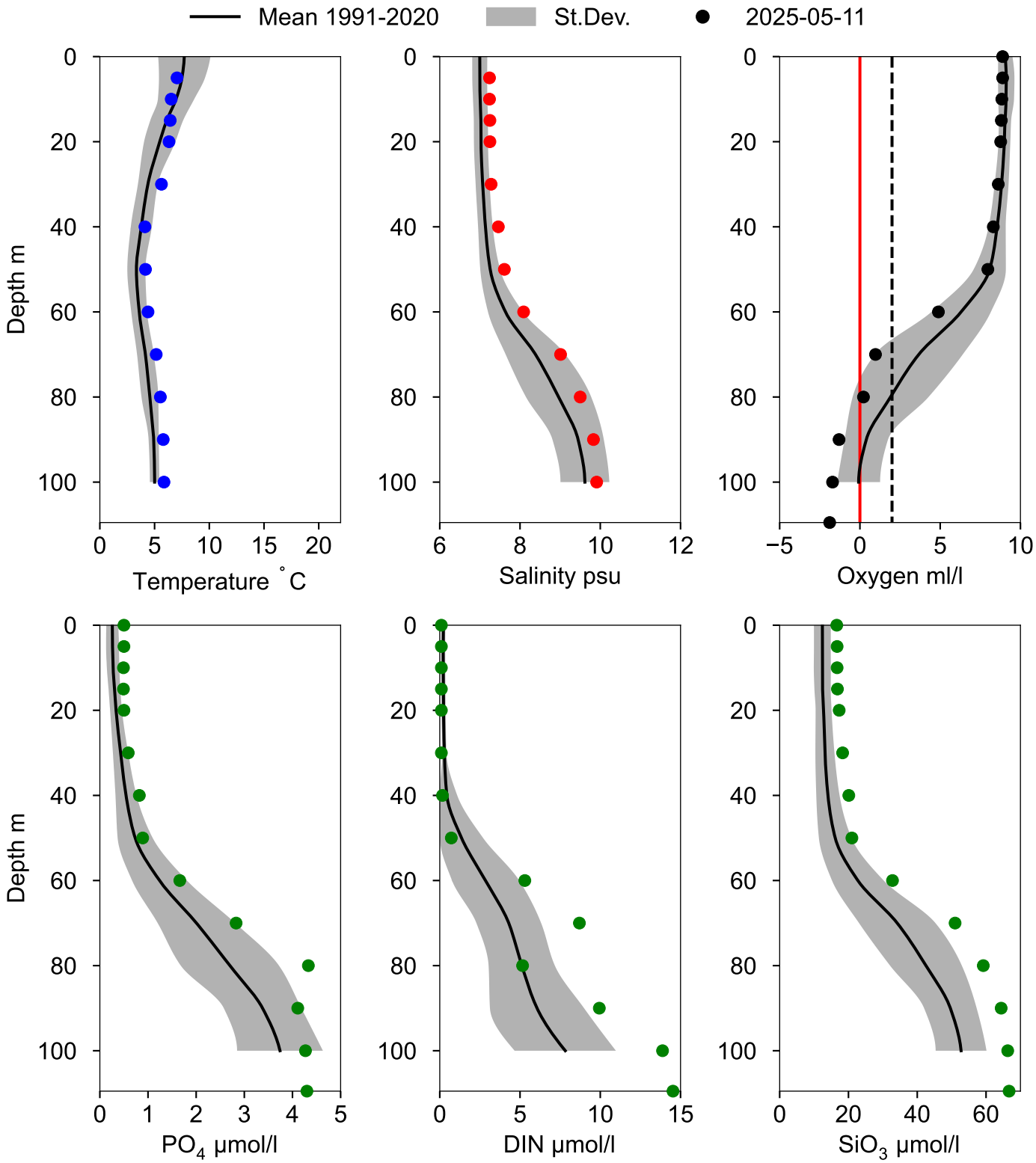


# STATION BY38 KARLSÖDJ SURFACE WATER (0-10 m)

**Annual Cycles**




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



# Vertical profiles BY38 KARLSÖDJ
## May