

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



Photo: Ann-Turi Skjevik, SMHI.

Survey period:

2026-07-10 till 2026-07-16

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)

SUMMARY

This expedition, conducted within the Swedish pelagic monitoring programme, covered the Skagerrak, the Kattegat, the Sound and the Baltic Proper.

Sea surface temperatures were generally close to the seasonal norm throughout the surveyed area, except at a few stations in the Baltic Proper where temperatures were below normal. Surface temperatures ranged from 12.6 to 19.11°C. The highest values were recorded in the Kattegat. Surface salinity was above the seasonal norm across most of the surveyed area.

Concentrations of dissolved inorganic nitrogen (DIN) and phosphate in surface waters were generally low, which is typical for the season. Exceptions were observed at a few stations in the Sound and the southern Baltic Sea, where the phosphate concentrations were higher than normal. Surface-water silicate concentrations were low in the Skagerrak, as expected for the season, while elevated concentrations, above the seasonal norm, were observed throughout the Baltic Proper.

Oxygen conditions in the Baltic Proper remain very poor. Good oxygen conditions were found only in the southern areas, including the Arkona Basin, the Bornholm Basin, and at station BY39. Acute oxygen deficiency, defined as oxygen concentrations below 2 ml/l, was observed from depths of 70–90 m in both the Western and Eastern Gotland Basins, with the exception of the shallow station BY39. Hydrogen sulphide was detected from 70–90 m depth in the Western Gotland Basin and from 80–125 m depth in the Eastern Gotland Basin.

At several stations in the Skagerrak, pronounced chlorophyll fluorescence maxima occurred at approximately 30 m depth, which were dominated by dinoflagellates and diatoms. In the Kattegat, chlorophyll fluorescence maxima were observed at 20–30 m depth and were dominated by dinoflagellates. At station Anholt E, an additional deeper maximum at 60 m was dominated by chain-forming diatoms. In the Baltic Proper, surface accumulations of cyanobacteria were observed, and both surface samples and the upper water column were dominated by cyanobacteria. The vessel's automated Imaging FlowCytobot (IFCB) recorded cyanobacteria throughout the Baltic Sea from the Sound onwards, as well as two species of cyanobacteria in the Kattegat during the return transit.

Several stations in the Baltic Proper exhibited pronounced chlorophyll fluorescence maxima between 15–20 m depth. In the Kattegat, elevated fluorescence peaks were observed between 20 and 30 m depth. Surface accumulations of cyanobacteria were observed east of Gotland. Further information on the phytoplankton situation is available in the July Algaware report.

<https://www.smhi.se/publikationer/publikationer/algrapporter>

The next regular monitoring cruise is scheduled to commence begin in Lysekil on 6 August and conclude in Lysekil on 13 August.

CRUISE OVERVIEW

The expedition was carried out on board the research vessel R/V *Svea* between 10 and 16 July, starting and ending in Lysekil. During the first part of the expedition in the Skagerrak and Kattegat, winds were light. In the southern Baltic Sea, fresh winds prevailed at the beginning of the expedition but decreased on Tuesday, after which light winds persisted for the remainder of the cruise. Weather conditions were predominantly clear and sunny, with air temperatures around 18–20°C. The exception was the southern and central Baltic Sea during the first part of the expedition, where conditions were overcast and slightly cooler, with temperatures of 15–16°C.

Profiles of salinity, temperature, dissolved oxygen and chlorophyll fluorescence were obtained using a CTD¹ mounted on a rosette equipped with 24 water sampling bottles. Sampling at SMHI's 30 regular monitoring stations was completed as planned. In addition, the buoy at Huvudskär and Flinten 7 were visited for CTD reference measurements, and maintenance of a sensor was carried out at Flinten 7. At 22 stations, additional sampling (surface water and phytoplankton net hauls) was performed for guest researchers from the Swedish University of Agricultural Sciences (SLU).

Gelatinous zooplankton were sampled using a plankton net at two stations in the Skagerrak, two stations in the Kattegat and five stations in the Baltic Sea. The samples were photographed in a photo box, and the images will be analysed by the University of Gothenburg.

Svea's FerryBox system for continuous measurements of surface water properties was operated throughout the expedition.

Guest researchers participating in the expedition were Malin Olofsson, Rickard Stenow, Manuela Seehauser and Ricardo Parizotto Ribeiro from the Swedish University of Agricultural Sciences (SLU), who carried out sampling of cyanobacteria.

This report is based on data that have undergone an initial quality control and have been compared with the climatological monthly mean for the period 1991–2020. Following further quality assurance, some values may be subject to revision. Values presented in this report have been rounded to one decimal place and may therefore differ slightly from subsequently published values. Data are made available as soon as possible through the Swedish Oceanographic Data Centre. Some analyses are carried out after the expedition and are therefore published at a later date.

For more information about SMHI's data management services and to download data, please visit: <https://www.smhi.se/en/services/open-data/oceanographic-and-marine-biological-data>

Further information on the phytoplankton situation is available in the July AlgAware report. <https://www.smhi.se/publikationer/publikationer/algrapporter>

RESULTS

Skagerrak

Sea surface temperatures ranged between 15.9 and 17.7°C, which is normal for the season. Surface salinity ranged between 31.5 and 32.7 psu, which is above the seasonal norm at all stations except Å17. The water was unusually clear, with Secchi depths of 19 m at the offshore stations.

At a majority of the stations, the temperature and salinity gradients coincided and were clearly visible at most stations at around 20 m depth. At the coastal station P2, the salinity gradient was weak at approximately 35 m depth, while the temperature gradient was pronounced at the same depth. At the

¹CTD is a profiling instrument used to measure Conductivity, Temperature and Depth.

coastal station Släggö, a shallow temperature and salinity gradient was observed at around 2 m depth in addition to a very weak temperature gradient at 20 m depth.

Surface concentrations of dissolved inorganic nitrogen (DIN) were within the normal range for the season and were either below the detection limit ($0.1 \mu\text{mol l}^{-1}$) or slightly above it ($0.19 \mu\text{mol l}^{-1}$) at all stations. Phosphate concentrations ranged between 0.03 and $0.05 \mu\text{mol l}^{-1}$, which is within the seasonal norm. Surface-water silicate concentrations were also within the normal seasonal range between 0.1 and $0.6 \mu\text{mol l}^{-1}$, with slightly higher concentrations at the coastal station Släggö ($1.3 \mu\text{mol l}^{-1}$).

The lowest bottom-water dissolved oxygen concentration was measured at Släggö, at 3.2 ml l^{-1} , which is normal for the season. At the offshore stations, deep water oxygen concentrations ranged between 5.9 and 6.4 ml l^{-1} , which is also considered normal.

CTD measurements of chlorophyll fluorescence, which is an indicator of phytoplankton activity, showed activity between 10 and 50 m depth in the area, with a distinct maximum at around 30 m depth at the westernmost stations. The chlorophyll maximum was dominated by dinoflagellates and diatoms.

Kattegat and the Sound

Sea surface temperatures were around 18 – 19°C , which is normal for the season. Surface salinity in the Kattegat ranged between 20 and 30 psu, with the higher values being above the seasonal norm. In the Sound, surface salinity was 16 psu, which is normal. In the Kattegat and the Sound, temperature and salinity gradients were observed at two separate depths: a shallower and weaker gradient at approximately 8 m depth, followed by a more pronounced gradient at 20 m depth (30 m at Fladen). Towards the end of the cruise, the temperature and salinity gradients had intensified, with the deeper gradient located at approximately 25 m depth and the shallow gradient at 5 m depth.

Nutrient concentrations in surface waters were within the normal range, except in the Sound and at the coastal station N14 Falkenberg, where concentrations were above the seasonal norm. Dissolved inorganic nitrogen (DIN) concentrations ranged from <0.1 to $0.23 \mu\text{mol l}^{-1}$, and phosphate concentrations ranged between 0.04 and $0.37 \mu\text{mol l}^{-1}$. Silicate concentrations ranged between 0.2 and $4.6 \mu\text{mol l}^{-1}$, which is normal for the season.

Dissolved oxygen concentrations in bottom waters were within the normal range, with concentrations of approximately 4.8 – 5.6 ml l^{-1} in the Kattegat and 3.4 ml l^{-1} in the Sound.

In the Sound, a chlorophyll fluorescence maximum was observed at 23 m depth, with elevated activity throughout the water column. In the Kattegat, elevated activity was observed between approximately 20 and 30 m depth, with an additional maximum at 40 m depth at Anholt E. The upper maximum was dominated by dinoflagellates, while the deeper maximum was dominated by chain-forming diatoms. The vessel's automated phytoplankton analysis system (Imaging FlowCytobot, IFCB) recorded two cyanobacterial species in the Kattegat during the return transit.

Baltic Proper

Sea surface temperatures were slightly below the seasonal average in the southern and southeastern Baltic Proper (12.7 – 16.3°C), with the exception of station BY39 Ölands Södra, where temperatures were above the seasonal average (15.6°C). In the northern Baltic Proper, temperatures were generally close to the seasonal average (15.6 – 17.4°C). Surface salinity ranged between 6.1 and 8.4 psu and varied from normal to slightly above the seasonal norm throughout the investigated area.

In the Arkona Basin, a weak temperature gradient was observed at 5–8 m depth and a salinity gradient at 25–28 m depth. During the transit into the Baltic Sea, the Bornholm Basin had a temperature gradient at 20–22 m depth and a salinity gradient at 30–40 m depth. During the return transit, an additional temperature gradient had developed at 5 m depth in addition to the one at 20 m depth, and the salinity

gradient had deepened to 50 m. Throughout the remaining Baltic Proper, a temperature gradient was observed at 20–25 m depth and a salinity gradient at 60–70 m depth, except at the northeasternmost station BY29, where the salinity gradient was located at 75 m depth.

Surface concentrations of dissolved inorganic nitrogen (DIN) were below the detection limit ($<0.10 \mu\text{mol l}^{-1}$) at all stations except BCS III-10, which is normal for the season. Surface phosphate concentrations were within the seasonal norm at the majority of the stations and ranged between 0.07 and $0.45 \mu\text{mol l}^{-1}$, with the highest concentrations observed in the southern parts of the area around the Arkona Basin, Bornholm Basin and Öland. Exceptions were stations BCS III-10, BY38, BY29 and BY1, where phosphate concentrations were slightly above the seasonal norm. At these stations, temperatures were also below normal (except at BY29), while salinity was above normal, indicating an upwelling event bringing colder and more nutrient-rich water to the surface. Surface water silicate concentrations remained above or well above the seasonal average at the majority of stations, ranging between 12.7 and $17.3 \mu\text{mol l}^{-1}$.

Oxygen conditions in the Baltic Proper remain very poor, with very high concentrations of hydrogen sulphide in bottom water from BY10 and northwards. Conditions in the Arkona Basin and Bornholm Basin were somewhat better and unchanged compared with the June expedition, with oxygen concentrations ranging between 2.8 and 4.9 ml l^{-1} . At the Polish station BCS III-10, oxygen concentrations had increased since the June expedition, reaching 1.9 ml l^{-1} .

Acute oxygen deficiency, defined as oxygen concentrations below 2 ml l^{-1} , was observed from 70–90 m depth in both the Western and Eastern Gotland Basins, with the exception of the shallow station BY39 Ölands Södra. Hydrogen sulphide was measured from 70–90 m depth in the Western Gotland Basin and from 80–125 m depth in the Eastern Gotland Basin.

Pronounced chlorophyll fluorescence maxima were observed at two stations: at BY1 at 22 m depth, dominated by green algae, and at station BY20 at 17 m depth, dominated by a potentially toxic dinoflagellate. At the remaining stations, no distinct maxima were observed; however, surface samples and the upper part of the water column showed elevated chlorophyll fluorescence, dominated by three cyanobacterial species. The vessel's automated phytoplankton analysis system (Imaging FlowCytobot, IFCB) recorded cyanobacteria throughout the Baltic Sea from the Sound onwards. Less surface accumulations of cyanobacteria were observed east and west of Gotland, coinciding with somewhat windier conditions, compared with the southern and northern Baltic Proper, where sampling was carried out during calmer and warmer weather conditions.

Further information on the phytoplankton situation is available in the July AlgAware report.
<https://www.smhi.se/publikationer/publikationer/algrapporter>.

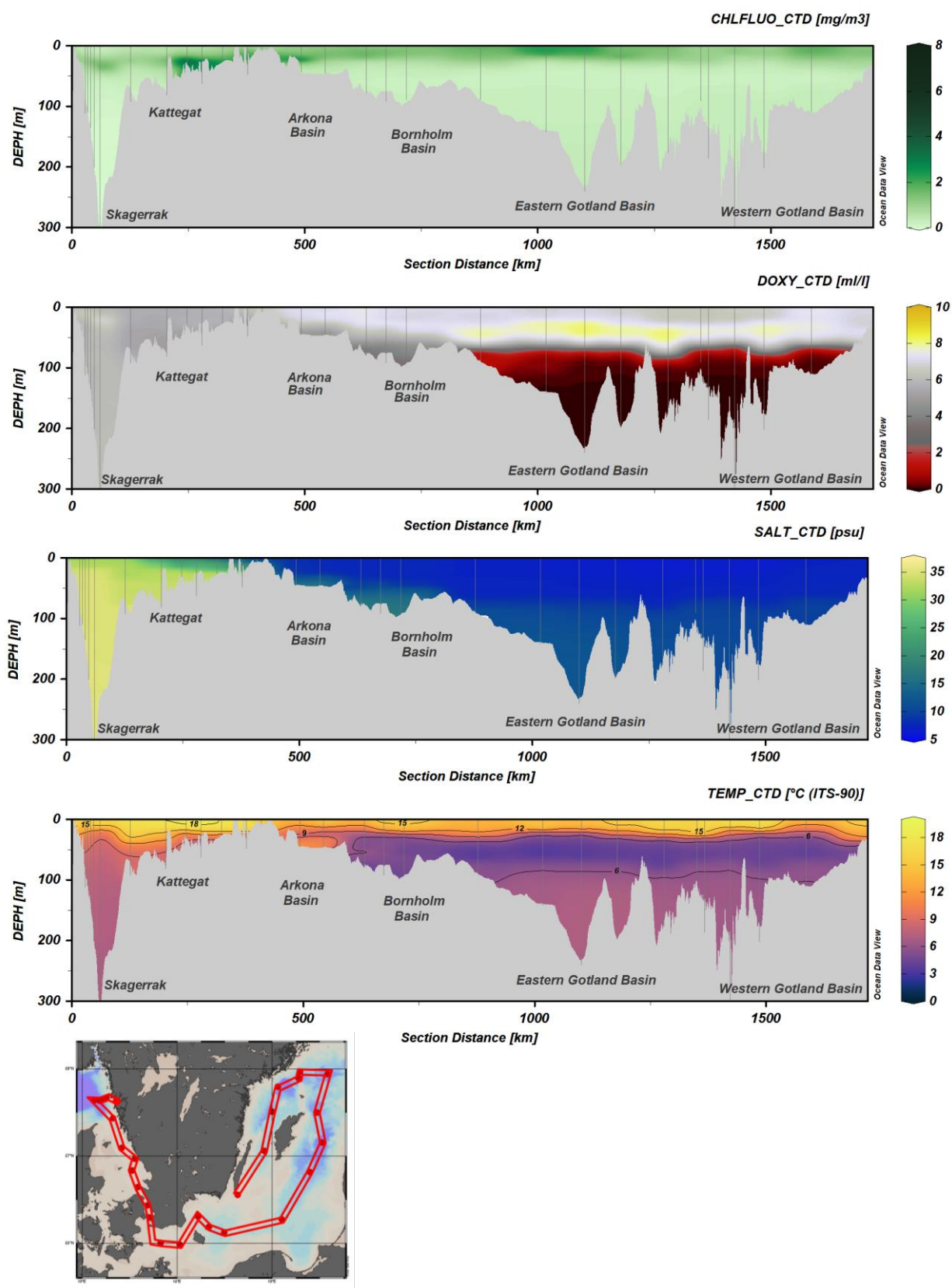


Figure 1. Transects ranging from the Skagerrak, through the Kattegat and The Sounds, further into the Baltic Proper, ending in the Western Gotland Basin shows the chlorophyll fluorescence, oxygen, salinity and temperature. Grey vertical lines indicate the positions where data is collected, also shown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

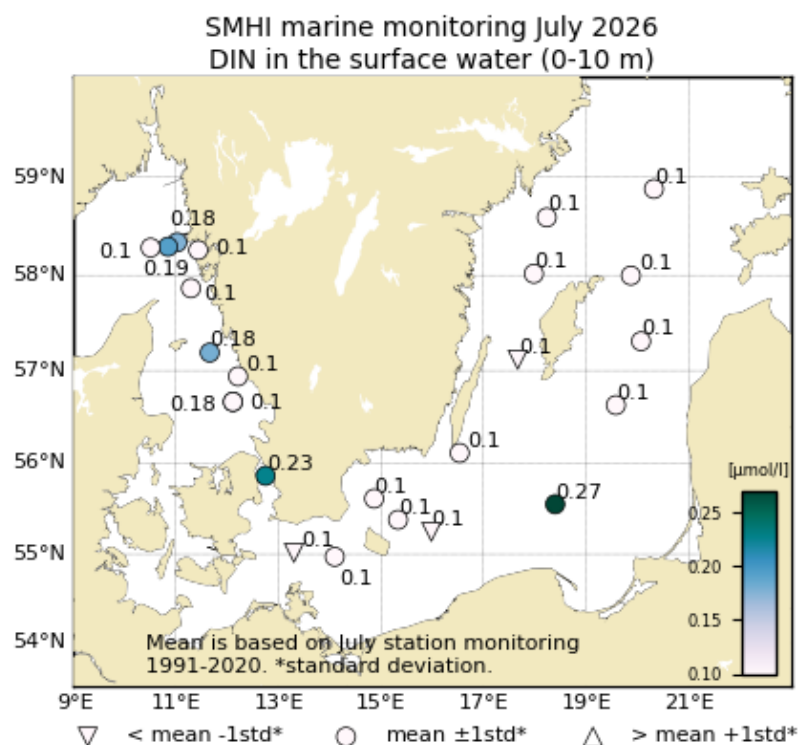


Figure 2. Concentration of dissolved inorganic nitrogen in the surface water (0–10 m). At station Anholt E, which was sampled twice during the expedition, the left-hand value refers to the beginning of the expedition and the right-hand value to the end of the expedition.

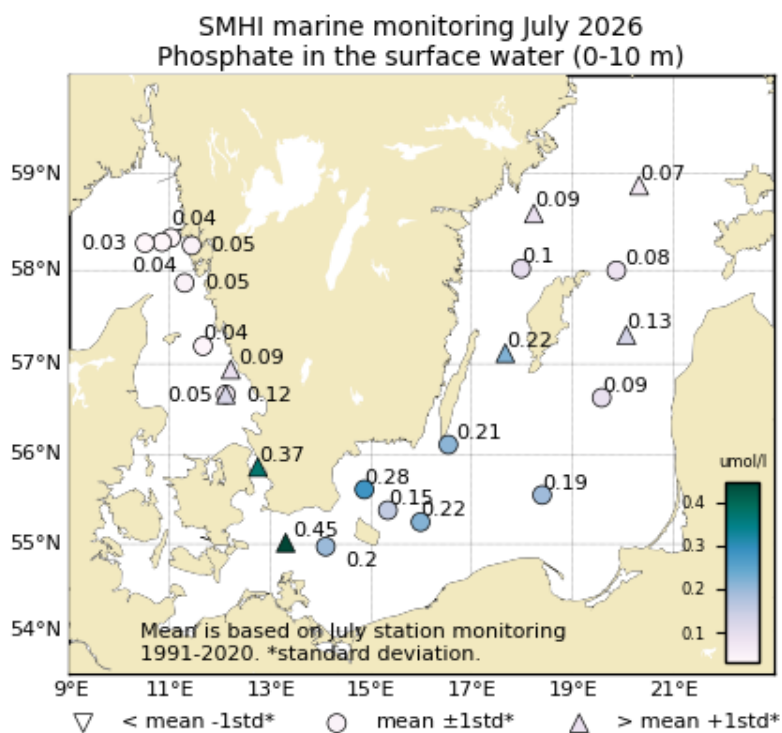


Figure 3. Concentration of phosphate in the surface water (0–10 m). At station Anholt E, which was sampled twice during the expedition, the left-hand value refers to the beginning of the expedition and the right-hand value to the end of the expedition.

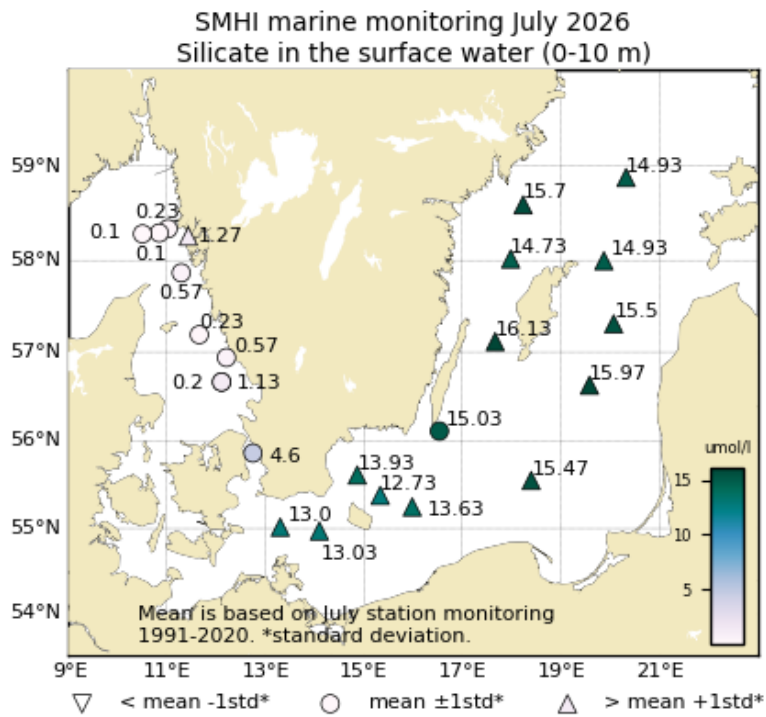


Figure 4. Concentration of silicate in the surface water (0–10 m). At station Anholt E, which was sampled twice during the expedition, the left-hand value refers to the beginning of the expedition and the right-hand value to the end of the expedition.

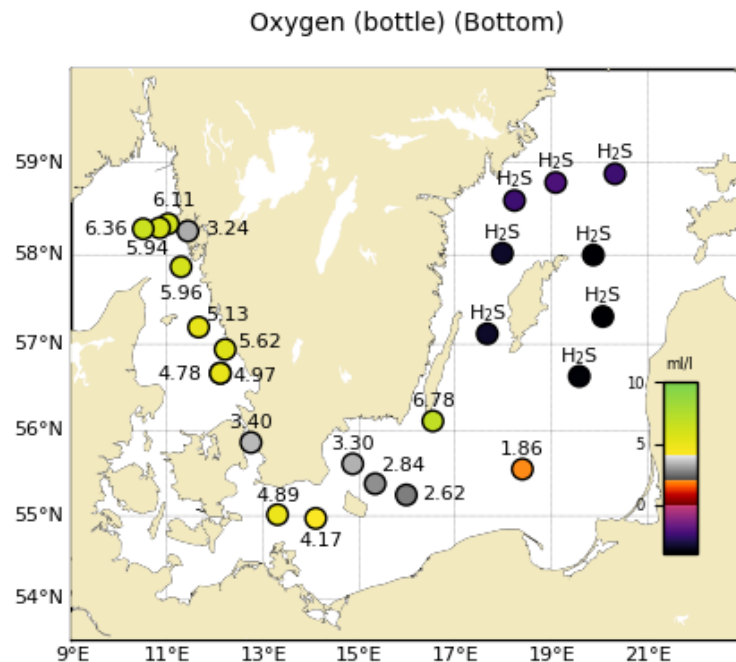


Figure 5. Oxygen concentration in the bottom water. Observe that the value has not been compared with statistical values the same way as in figures 2–4, 6–7, therefore the diagram only shows circles. At station Anholt E, which was sampled twice during the expedition, the left-hand value refers to the beginning of the expedition and the right-hand value to the end of the expedition.

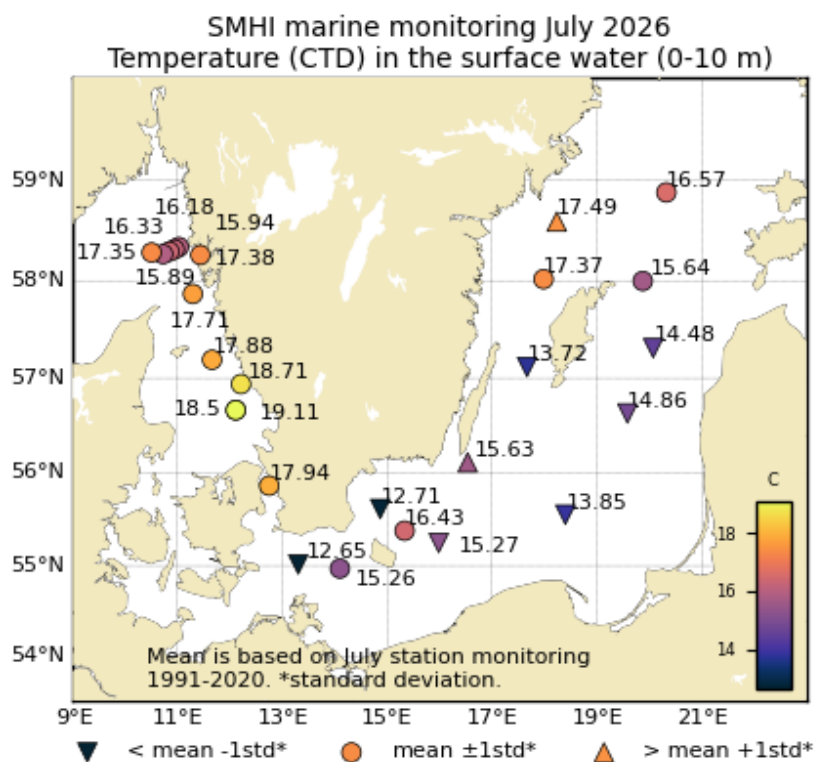


Figure 6. Temperature in the surface water (0–10 m). At station Anholt E, which was sampled twice during the expedition, the left-hand value refers to the beginning of the expedition and the right-hand value to the end of the expedition.

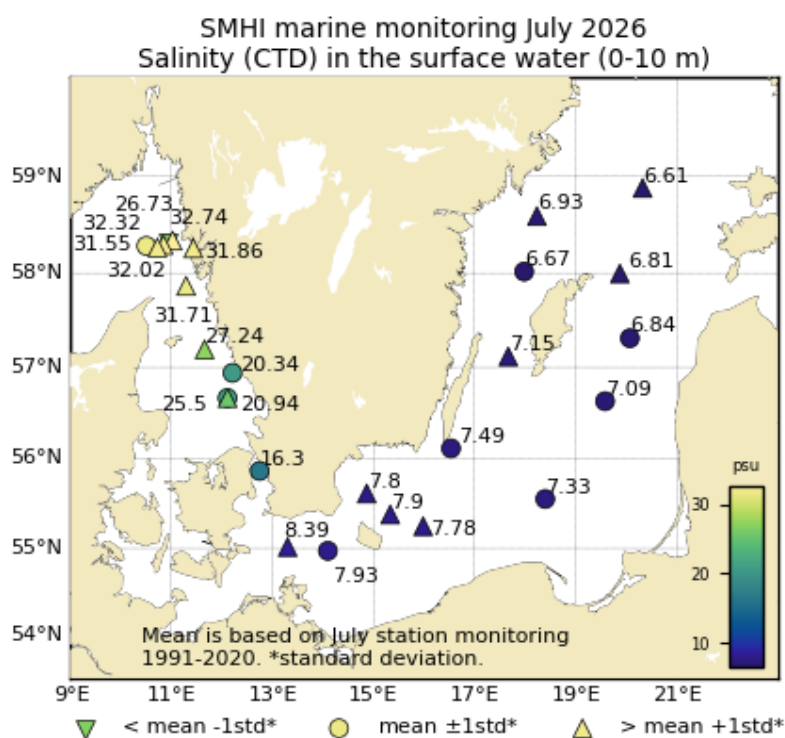


Figure 7. Salinity in the surface water (0–10 m). At station Anholt E, which was sampled twice during the expedition, the left-hand value refers to the beginning of the expedition and the right-hand value to the end of the expedition.

PARTICIPANTS

Name	Position	From
Sara Johansson	Chief scientist, marine chemist	SMHI
Sari Sipilä	Marine chemist	SMHI
Daniel Bergman Sjöstrand	Oceanographic technician	SMHI
Ann-Turi Skjevik	Marine biologist	SMHI
Amanda Nylund	Marine biologist	SMHI
Johan Håkansson	Marine chemist	SMHI
Malin Olofsson	Guest, researcher	SLU
Rickard Stenow	Guest, researcher	SLU
Manuela Seehauser	Guest, researcher	SLU
Ricardo Parizotto Ribeiro	Guest, researcher	SLU

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

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