

Report from SMHI's monitoring cruise with R/V Svea – September 2024



Photo: Ola Kalén, SMHI

Survey period: 2024-09-14 to 2024-09-19

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SUMMARY

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

The surface water temperature in the surveyed areas ranged between 16–18°C, and in the Eastern Gotland Basin, it was above normal, while in other areas, the surface water temperature was generally normal.

The concentrations of nutrients in the form of dissolved inorganic phosphorus (phosphate) and dissolved inorganic nitrogen in the surface water were above normal in the Eastern Gotland Basin. In other marine areas, the concentrations were generally normal for the season. For silicon in the form of silicate, concentrations in the Baltic Proper were normal at all stations. In the Skagerrak and the Kattegat, levels above normal for the season at most stations.

Acute oxygen deficiency, defined as oxygen levels below 2 ml/l, was observed from 60 meters in the Eastern Gotland Basin and from 70 meters in the Western Gotland Basin, Hanö Bay, and the Bornholm Basin. Also, in the Arkona Basin and the bottom waters of the Sound, oxygen levels below 2 ml/l were measured. Hydrogen sulphide was detected from a depth of 80 meters in both the Western and Eastern Gotland Basins. In several cases, the hydrogen sulphide levels were above normal.

The next scheduled expedition with the vessel Svea is planned to start the 19th of October in Lysekil.

RESULTS

The expedition was carried out aboard R/V Svea, starting in Lysekil on September the 14th and concluding in Kalmar late on September the 19th. The weather was mostly calm with light winds, reaching a maximum of about 10 m/s. Initially, the wind direction was predominantly westerly but shifted to north-easterly as the journey progressed. Air temperatures ranged between 13–18°C.

Svea's instrument for continuous surface water measurements, Ferrybox, was operational the entire expedition. In the Skagerrak and the transect BY2-Hanöbukten-BY4 in the southern Baltic Proper, Svea's MVP (Moving Vessel Profiler) was in use, providing profiles of temperature, salinity, oxygen, and chlorophyll fluorescence while underway. One of Svea's two ADCPs (Acoustic Doppler Current Profilers) was also active during the journey.

At all stations in the Baltic Proper, water samples were collected from a depth of 3 meters for eDNA analysis. This is part of the SAMBAH II project, which studies the Baltic Sea's harbour porpoise population. The sampling is planned to continue until August 2025. The Swedish Museum of Natural History is coordinating the Swedish part of the project.

At Anholt E extra sampling of microzooplankton were done for the University of Gothenburg.

This report is based on data that has undergone initial quality control and is compared against the monthly average for the period 1991–2020. After further quality review, some values may change. The values reported have been rounded to the nearest tenth and may therefore differ from published values. Data is published as soon as possible on the data host's website. Some analyses are conducted post-expedition and are published later, thus not included in this report.

Information about SMHI's data hosting service and to download data:

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

More information about the algal situation is available in the Algaware-report:

<https://www.smhi.se/en/publications/publications/algal-situation-reports-2-1056>

The Skagerrak

The surface water temperature ranged between 16–17°C, which is normal for the season at all stations. The salinity in the surface water varied from 27 to 34 psu, with the highest value at Å13 and the lowest at P2. At Å13, there was no clear halocline, which was present at the other stations at a depth of around 5 meters. The thermocline at Å15 was found between 20 and 70 meters, but at the other stations, it was not as deep. In the bottom waters, salinity was 35 psu at the offshore stations and 33.5 psu at Släggö. The temperature in the bottom waters ranged from 11°C at Å13 to 7.4°C at Å17.

Levels of dissolved inorganic nitrogen (DIN) in the surface water were around detection limit (0.1 µmol/l) at three stations. At Å15, the value was slightly higher at 0.4 µmol/l, and at Släggö, it was 2.1 µmol/l. Both of these values were above normal for the season. Concentration of dissolved inorganic phosphorus (DIP) was also above normal at Å15 and Släggö, with values of 0.16 and 0.26 µmol/l, respectively. Normal values were recorded at the other stations, ranging from 0.09 to 0.14 µmol/l. Concentrations of silicon varied between 2.3 and 4.0 µmol/l at the offshore stations, and were 4.9 µmol/l at Släggö, which is closer to the coast. These levels were above normal at all stations except for Å13, where the concentration was normal for the season. Deeper in the water column, nutrient concentrations were generally normal, with the exception of Å15, where most of the measured nutrients down to 50 meters were above normal, as seen in the vertical profiles for that station.

Oxygen levels in the offshore bottom waters were good, with measured values ranging from 4.9 to 5.6 ml/l. At Släggö, slightly lower with 3.1 ml/l. All values were within the normal range for the season.

Chlorophyll fluorescence measurements by the CTD, which is an indicator of phytoplankton activity, showed slightly higher activity from the surface down to a depth of 50 meters, but with considerable variation between the stations. At P2, the highest activity was recorded, with a smaller peak at a depth of 20 meters. The Secchi depth was measured to be 6–8 meters.

The Kattegat and the Sound

The surface water temperature in the Kattegat was around 17°C, which was largely normal for September. In the Sound, the temperature was slightly above normal and was 16.8°C. The salinity in Kattegat's surface waters was normal for the season, ranging from 21 to 26 psu, while in the Sound, it was higher than normal with 21 psu. There was no distinct thermocline in Kattegat, and more homogeneous layers regarding temperature and salinity were only found in the last 5–15 meters above the bottom. In the Sound, stratification was more defined, with a halocline and thermocline at depths of 10–20 meters.

In the surface waters of Kattegat, the phosphate concentration was around 0.08 µmol/l, and the DIN levels were below detection limit, which is normal for the season. In the Sound, the phosphate level was slightly higher at 0.15 µmol/l, but the DIN concentration was at the same level as in Kattegat. Silicon levels were normal or slightly above normal, ranging from 2.5 to 3.0 µmol/l in Kattegat. In the Sound, silicon level was normal for the season and was measured to 6.1 µmol/l.

The oxygen concentration in the bottom waters were normal for the season, ranging from 2.5 to 4.6 ml/l in Kattegat, with the lowest value recorded at Anholt E. In the Sound, the oxygen level was 1.8 ml/l, indicating acute oxygen deficiency (levels below 2 ml/l). The lowest annual oxygen concentrations in the Sound typically occur during autumn.

Chlorophyll fluorescence measurements indicated slightly higher activity in the surface waters down to depths of 10–15 meters at all stations, though no distinct fluorescence peaks were observed. Below this depth, fluorescence levels decreased rapidly. The Secchi depth was measured to 5 meters.

The Baltic Proper

The surface water temperature was above normal in the Eastern Gotland Basin, as well as at BY5, BSCIII-10, and BY32. At other stations, the temperatures were normal, ranging from 15.4 to 18.4°C. The salinity in the surface waters ranged from 6.5 to 7.7 psu, with the highest value recorded in the Arkona Basin. At most stations in both the Eastern and Western Gotland Basins, surface water salinity was above normal, while the southern basins generally had normal values.

In the southern basins, the thermocline and halocline coincided at depths of 20–30 meters, and in several cases, the thermocline was very distinct. For example, at BY5, the temperature at a depth of 28 meters was 18°C, and at 30 meters, it dropped to below 7°C.

A distinct surface thermocline was also observed at a depth of 30 meters in the deeper basins. In the deeper water masses, the more permanent stratification was found, with the thermocline and halocline coinciding at depths of 70–80 meters. At several stations, temperatures in the deep water were above normal.

Concentrations of dissolved inorganic nitrogen in the surface waters were below detection limit of 0.1 µmol/l at the southern stations and in the Western Gotland Basin, which is normal for the season. In the northern part of the Eastern Gotland Basin, levels were above normal, ranging from 0.53 to 0.86 µmol/l. In the south-eastern Baltic Proper, normal levels were observed, with a concentration of 0.41 µmol/l.

The phosphate concentration in the surface waters was normal for the season, except at BY15, BY20, and BY29, where levels were above normal. The highest concentrations were recorded in the Arkona Basin and at the coastal station BY39, where levels ranged from 0.17–0.21 µmol/l. At other stations, concentrations were 0.08–0.15 µmol/l.

Concentration of silicon in the surface waters was normal at all stations, ranging from 8.4 µmol/l in Hanö Bay to 11.9 µmol/l in the Arkona Basin. This was below normal in the Arkona and Bornholm Basins, but above normal at most of the other stations.

In the deep waters of both the Eastern and Western Gotland Basins, nutrient levels were generally above normal. At BY31, all nutrients from 80 meters and below were above normal, and at BY15, nutrient levels were above normal from a depth of 150 meters. In the shallower basins, nutrient levels in the bottom waters were mostly normal.

Acute oxygen deficiency, defined as oxygen levels below 2 ml/l, was recorded from 60 meters in the Eastern Gotland Basin and from 70 meters in the Western Gotland Basin, Hanö Bay, and the Bornholm Basin. Oxygen deficiency was also noted near the bottom of the Arkona Basin at approximately 45 meters, and at BY1, the oxygen level was 0.3 ml/l, which is lower than normal and significantly worse compared to the 2 ml/l measured during the August expedition.

Hydrogen sulphide was measured from a depth of 80 meters in both the Western and Eastern Gotland Basins. The vertical profiles also show that levels of hydrogen sulphide, indicated as negative oxygen, are above normal in the deep water at several stations.

Chlorophyll fluorescence measurements with the CTD, which is an indicator of phytoplankton activity, showed activity from the surface down to the thermocline. The highest levels were recorded in Hanö Bay and the Bornholm Basin, as well as at BY39. The Secchi depth ranged between 6–9 meters, with the deepest value observed at BY29.

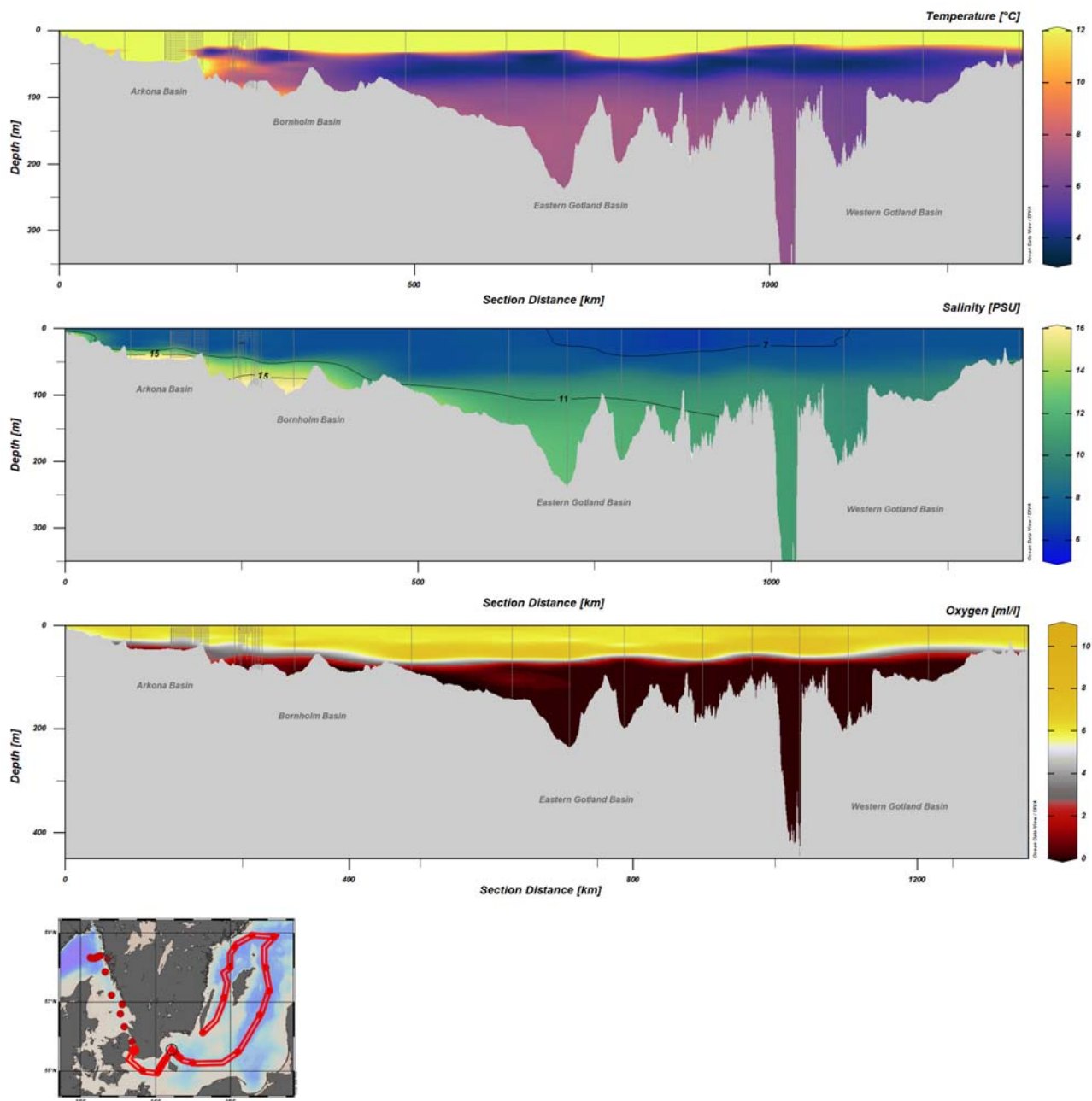


Figure 1. Transect showing CTD measurement of temperature, salinity and oxygen concentration from the Sound, through the Southern and Eastern Baltic Proper into the Western Baltic Proper.

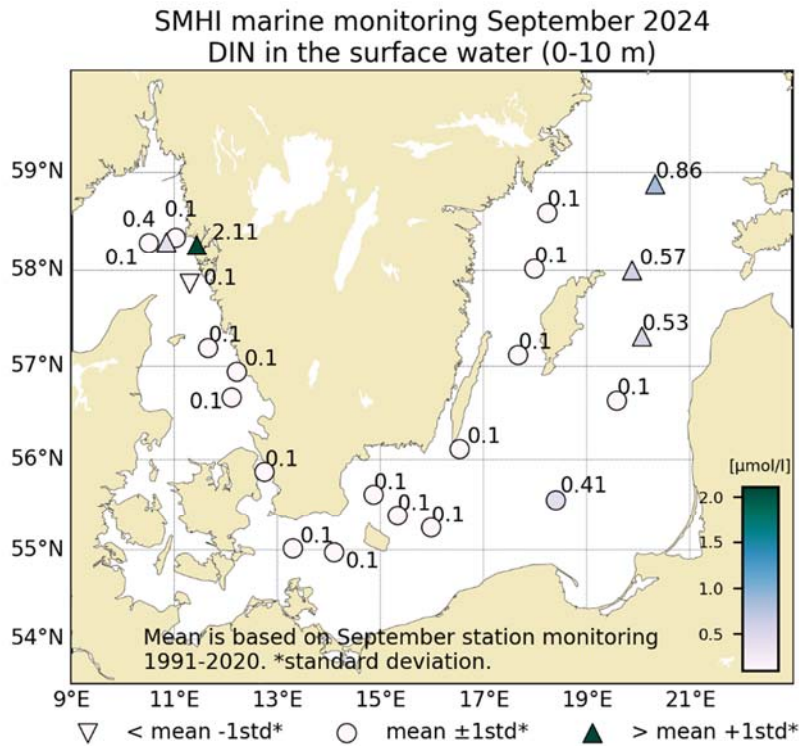


Figure 2. Concentration of dissolved inorganic nitrogen (DIN) in the surface water (0–10m). Mean is based on data from each station during the years 1991-2020.

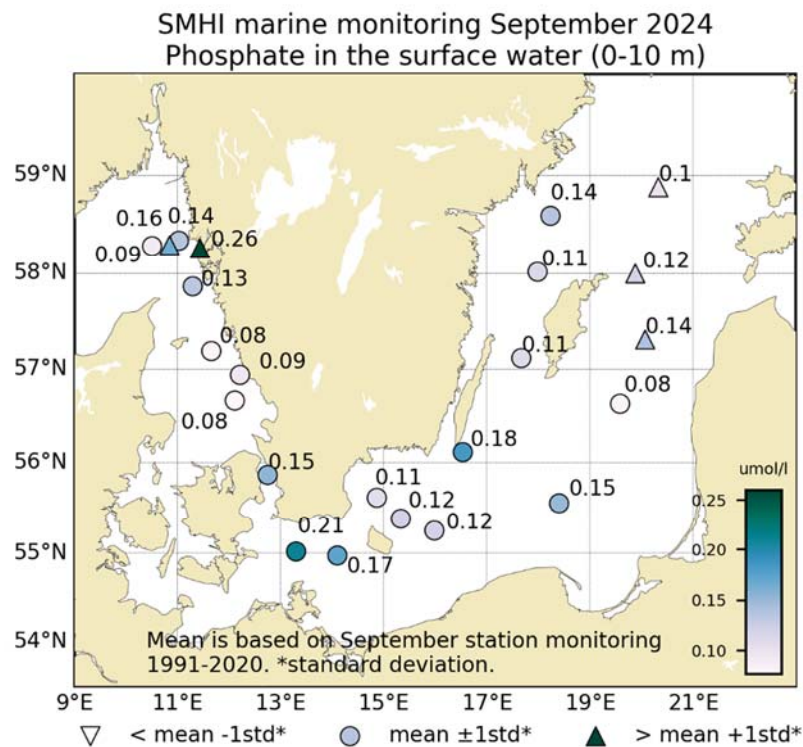


Figure 3. Concentration of phosphate in the surface water (0–10m). Mean is based on data from each station during the years 1991-2020.

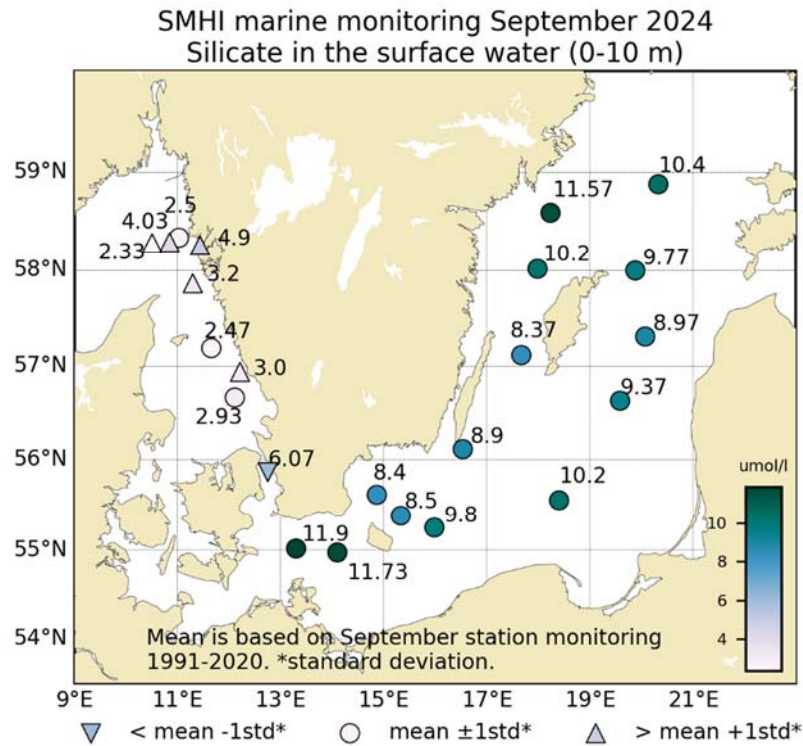


Figure 4. Concentration of silicate in the surface water (0–10m). Mean is based on data from each station during the years 1991-2020.

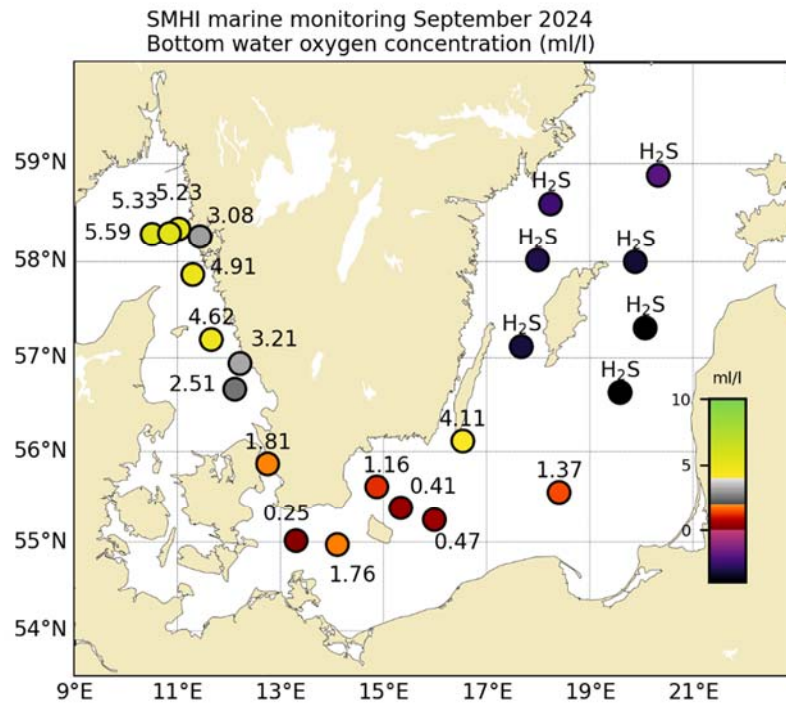


Figure 5. Concentration of dissolved oxygen in the bottom water, approximately 1 m above the sea bed. Note that values have not been compared with statistics as in similar figures and only circles are shown.

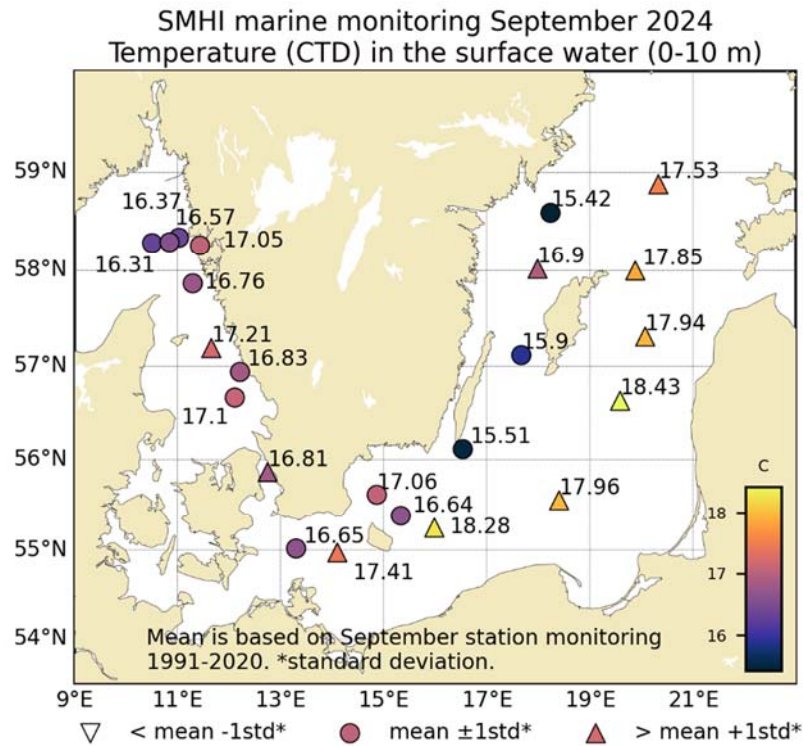


Figure 6. Temperature in the surface water (0–10m). Mean is based on data from each station during the years 1991-2020.

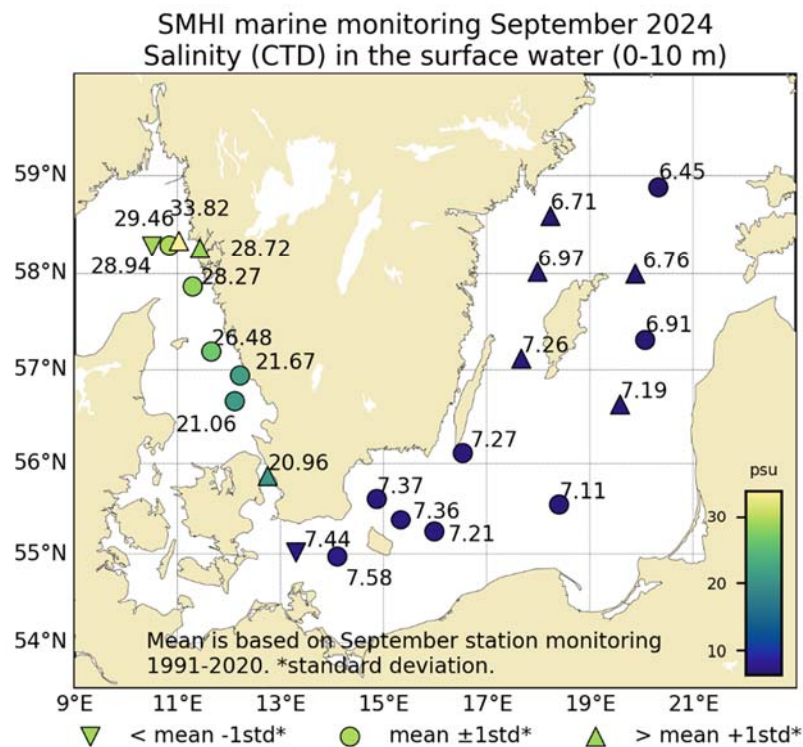


Figure 7. Salinity in the surface water (0–10m). Mean is based on data from each station during the years 1991-2020.

PARTICIPANTS

Name	Role	Institute
Johan Kronsell	Chief Scientist, Oceanographer	SMHI
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APPENDICES

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

SMHI



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