

Report from the SMHI monitoring cruise with R/V Aranda



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Survey period: 2016-05-16 - 2016-05-23
Survey area: Skagerrak, Kattegat, the Sound and the Baltic Proper
Principal: SMHI and the Swedish Agency for Marine and Water Management

SUMMARY

The expedition was part of the Swedish regular marine monitoring programme and covered the Skagerrak, the Kattegat, the Sound and the Baltic Proper. Data presented in this report has been subject to preliminary quality control procedures only.

All nutrients in the surface water were very low in the Skagerrak and the Kattegat. At 15-20 meters, peaks in the fluorescence were observed together with high saturation of oxygen and also higher levels in nutrients. In Baltic Proper, the inorganic nitrogen (nitrite+nitrate) was used up down to 40 meter but phosphate was still present. The silicate levels were still above normal in the entire Baltic Proper.

Acute hypoxia (<2ml/l) was measured from 70-80 meters depth in the Eastern and Western Gotland Basins, and also from 70 meters at the Hanö Bight and from 80 meters in the Bornholm Basin. Hydrogen sulphide was only present intermediary (125-150 meter) at the Fårö Deep and from 90 meters depth in the Western Gotland Basin. The entire water column at the Gotland Deep (BY15) was still oxygenated.

The next regular cruise is scheduled to start June 13, 2016.

PRELIMINARY RESULTS

The expedition was conducted aboard the Finnish research vessel Aranda. It commenced in Helsinki on May 16 and ended in the same port on May 23. The winds during the expedition were predominantly southeast to northwest and weak, 1.6-10.0 m/s. Air temperatures ranged between +7.6 and +13.5 °C, lowest in the Baltic Sea.

At the end of cruise, the ocean buoy at Huvudskär was visited for a reference measurement.

A scientist from Tartu University in Estonia joined the cruise and she compared different methods for analysing pH.

The concentrations of ammonia (NH₄) could unfortunately not be analysed during this cruise due to instrumental problems. Figures presenting DIN in the surface layer therefor only includes nitrite+nitrate. DIN is not shown at all in the vertical profiles.

The Skagerrak

The temperature of the surface water varied between 10.8 and 12.8°C, which are normal for the season. In the off shore parts, the salinity in the surface layer was normal for the season while it was a bit higher in the southern part, variations were between 25.6 and 29.1 psu. The stratification in both temperature and salinity was found at depth between 5 and 15 meters except from the outermost parts where the stratification was between 10-30 m.

All nutrients in the surface layer were very low in the entire area, which is normal for the season. The concentration of phosphate varied between 0.03-0.04 µmol/l, concentrations of nitrite+nitrate were at the detection limit (<0.1 µmol/l), and silicate varied between 0.3-0.4 µmol/l. A peak in fluorescence was observed at all stations at 15-20 m. The water at these peaks was also over saturated with oxygen which indicates higher plankton activity, levels of nutrients were also higher. The bottom water was well oxygenated, also at Släggö in the mouth of Gullmarsfjorden. For more details on species composition see the separate algal report.

The Kattegat and the Sound

The temperature of the surface water was normal for the season and varied between 9.9 and 11.7°C. The salinity of the surface layer was normal for the season except from nearest the coast where it was slightly higher. Surface salinity ranged between 18.1-20.7 psu. The stratification in Kattegat was developed between 10 and 15 meters. In the Sound, the salinity was 18.2 psu which is higher than normal and the stratification was at 15-25 meters depth.

All nutrient levels in the surface water were very low, which is normal the season. Phosphate concentrations in the surface layer varied between 0.03 and 0.11 µmol/l, the sum of nitrite + nitrate was below detection limit (<0.1 µmol/l) and silicate varied between 0.3 and 1.9 µmol/l. The highest levels of nutrient concentrations were found in the Sound.

The oxygen conditions in the deep water were good, and the lowest concentrations were measured in the Sound, 4.49 ml/l. A peak in fluorescence was observed at all stations at 15-20 m, highest at Anholt. The water at these peaks was also over saturated with oxygen which indicates higher plankton activity, levels of nutrients were also higher.

For more details on species composition see the separate algal report.

The Baltic Proper

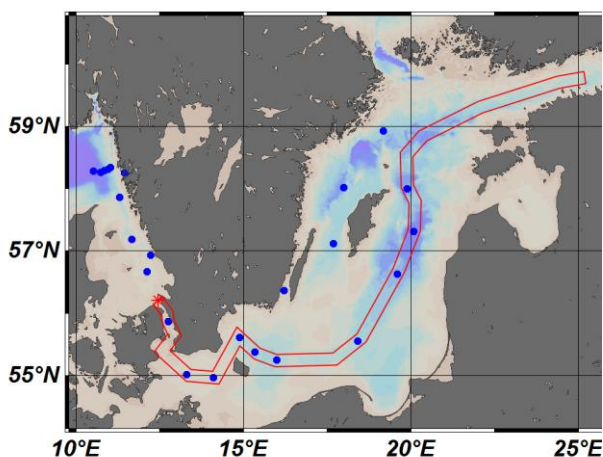
The temperature of the surface layer was slightly above normal for the season and varied from 7.9 to 12.3°C. Surface salinity was generally normal for the season except in the Bornholm Basin where it was higher and in the eastern Gotland Basin where it was much lower. Surface salinity varied between 6.8 in the northwest to 8.3 in the southwest. The halocline and thermocline coincided and were found at 50-80 metres in the area. A summer thermocline was started at 15 meters.

The concentrations of nitrite + nitrate were below detection limit ($<0.1 \mu\text{mol/l}$) down to 40 meters depth, which is normal for the season. The phosphate concentration in the surface water was also normal for the season except in the Western Gotland Basin where it was lower and in the Hanö Bight where it was higher. Phosphate levels ranged between 0.1 and $0.44 \mu\text{mol/l}$ with the lowest levels in the northwest part and highest in the southwest. The concentrations of silicate were above or high above normal in the entire area and ranged between 10.7 and $15.5 \mu\text{mol/l}$.

In the northern part of the Western Gotland Basin, there was a short changeover between the oxic and the anoxic layer at 90 meter, in the southern part (BY38) acute hypoxia ($< 2 \text{ ml/l}$) was observed from 70 meters and hydrogen sulphide from 90 meters. In the northern part of the Eastern Gotland Basin (BY20), acute hypoxia was observed from 80 meters but hydrogen sulphide was only measured at 125 and 150 meters depth. At the Gotland Deep, the entire water column was still oxygenated even though it was low concentrations in the bottom water and acute hypoxia from 80 meters.

Acute hypoxia was also observed from 70 meters at the Hanö Bight and from 80 meters in the Bornholm Basin.

Fluorescence measurements showed biological activity in the surface layer in the entire Baltic Proper, and peaks were observed at 15 meters. For more details on species composition see the separate algal report.



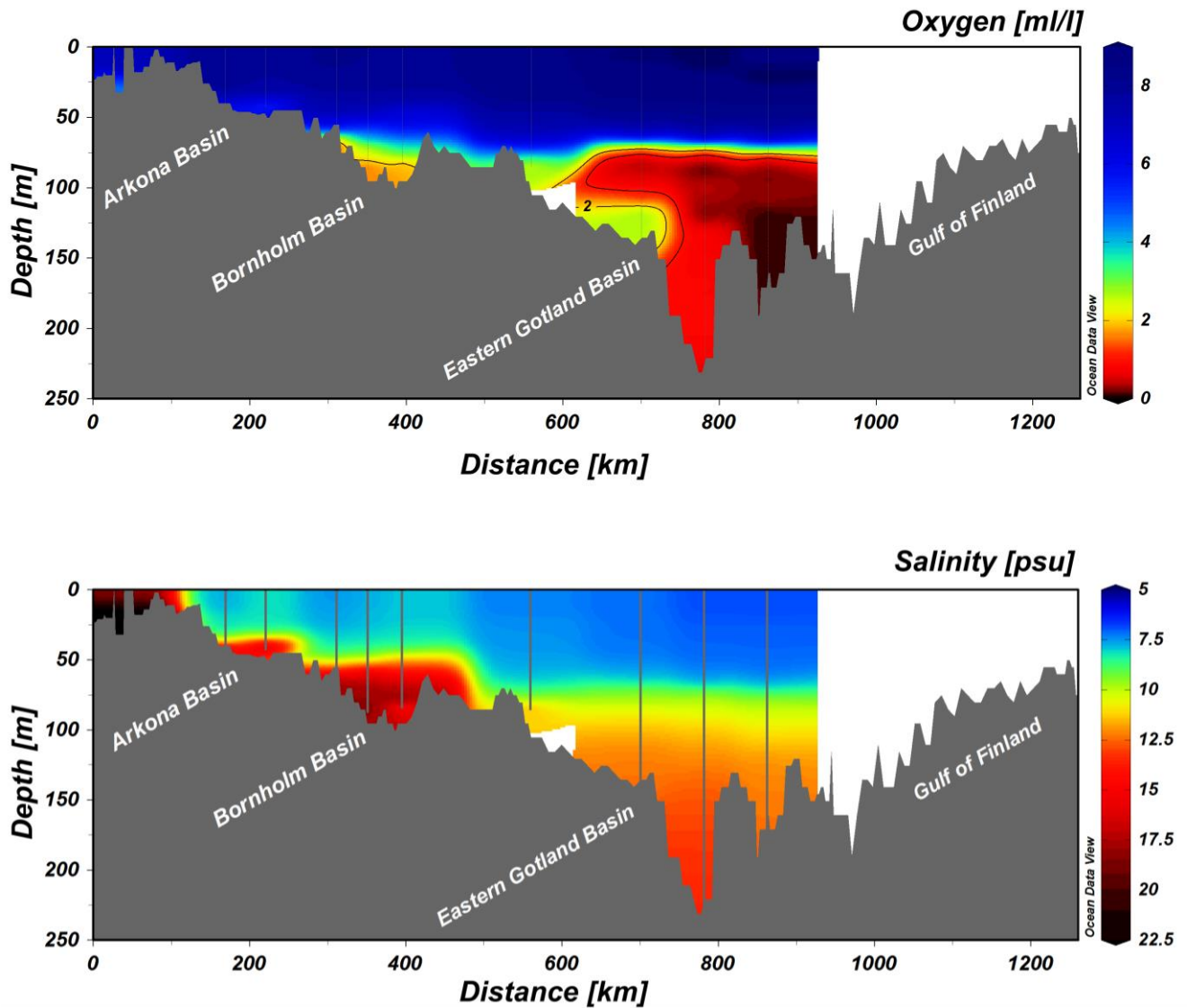


Figure 1. Transect showing the oxygen and salinity from the Sound to the Gulf of Finland.

PARTICIPANTS

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APPENDICES

- Track chart
- Table over stations, parameters and sampling depths
- Map showing bottom oxygen concentrations
- Monthly average surface water plots for selected stations
- Vertical profiles for selected stations