

Report from the SMHI monitoring cruise with R/V Aranda



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Survey period: 2014-02-24 - 2014-03-04
Survey area: Skagerrak, Kattegat 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, Kattegat and the Baltic Proper. Mapping of winter nutrients were performed in the Baltic Proper. Data presented in this report have been subject to preliminary quality control procedures only.

In the Skagerrak and Kattegat, surface salinity was lower than normal, which indicates an influence of outflowing Baltic water. In the Baltic Proper the concentrations of phosphate and silicate were elevated in the Western Gotland Basin. The oxygen concentrations in the bottom water in Hanö Bight and the Bornholm Basin had decreased to acute hypoxia. Oxygen free conditions, anoxia, were found from 90 – 100 meters depth and acute hypoxia from 70 – 90 meters depth in the Western, Northern and Eastern Gotland Basins. The spring bloom was ongoing in the Kattegat and had just started in the Skagerrak. In the Baltic Proper, signs of a beginning bloom were seen in the southern parts.

The next cruise will begin on 17th of March and will cover the Skagerrak, Kattegat and the Baltic Proper.

PRELIMINARY RESULTS

The cruise, which was the second with the Finnish research vessel Aranda, began in Helsinki on February 2nd and ended in Nynäshamn on March 4th. During the expedition mapping of winter nutrients was performed in the Baltic Proper. Totally about 40 stations were visited. A short visit was made to the port of Lysekil for loading of complementing equipment and to take ashore some samples. A wave-buoy at Väderöarna was replaced with a new one. Wind directions were mainly between east and south. During the first day the winds were of gale force, but then decreased and during the rest of the expedition winds were weak to moderate. The air temperature varied between 1 and 5°C.

The Skagerrak

Surface temperatures were normal for the season and varied between 3.4 and 4.2°C. The salinity in the surface layer was lower than normal, however not as low as during the last expedition, varying from 23.5 psu close to the coast to 30.1 psu in the central parts. The halocline was well developed and was found at 10 – 15 meters depth. The thermocline was not that distinct and varied in both depth and vertical extension. Nutrient concentrations showed large variations between stations. Phosphate concentrations were between 0.07 and 0.43 µmol/l, silicate varied from 2.3 to 8.8 µmol/l, while the sum of nitrite + nitrate had concentrations between 3.3 – 9.8 µmol/l. High fluorescence peaks were registered in the surface layer, however, also in this case the variation between stations were large. The highest fluorescence values were measured at the station Å13 close to the coast, where also the oxygen saturation was high, 110 %.

The Kattegat and the Sound

Surface water temperatures were normal and varied between 3.0 and 3.3°C. The salinity of the surface water was somewhat lower than normal, 19.5 – 20.0 psu. Thermocline and halocline coincided at depths between 8 and 20 meters and the halocline was very distinct. All nutrients in the surface layer showed, for the season, normal values and had decreased since the previous measurement. The variations between stations were large. Phosphate concentrations were between 0.05 and 0.29 µmol/l, while nitrite + nitrate varied from below the detection limit (< 0.10 µmol/l) to 2.8 µmol/l. Silicate values were in the range 2.0 to 6.5 µmol/l. The spring bloom was ongoing, and both fluorescence and oxygen saturation showed high values. The oxygen situation in the deep water was good. The lowest oxygen concentration in the Kattegat area, 6.10 ml/l, was measured at the station Anholt E. In the Sound, 5.6 ml/l was registered at W Landskrona.

The Baltic Proper

Surface temperatures were normal for the season, varying between 2.6 - 3.3°C. The salinity in the surface layer was elevated in the Hanö Bight and in the Bornholm Basin, 7.8 - 7.9 psu, while it in the Eastern Gotland Basin was lower than normal, 7.1 psu. The surface layer of the Baltic Proper was well mixed, both thermocline and halocline was found at about 70 - 80 meters depth in the Northern, Western and Eastern Gotland Basins, at 55 meter in the Bornholm basin and at 25 - 35 meters depth in the Arkona Basin.

The concentrations of phosphate and silicate were higher than normal in the Western Gotland Basin, 0.78 – 0.83 µmol/l and 15.6 -16.3 µmol/l respectively. In the remaining areas the concentrations were normal and varied between 0.60 – 0.70 µmol/l and 11.0 – 14.5 µmol/l respectively. In most



areas, with the exception of The Arkona - and Bornholm Basin where levels were normal, the amount of nitrite + nitrate was lower than normal, varying between 2.8 – 3.7 $\mu\text{mol/l}$.

Since December 2013 and during the beginning of 2014 there have been no significant inflows to the Baltic Sea. Small inflows that have occurred have improved the oxygen situation in the deep water in the Arkona Basin. In the Bornholm Basin and in the Hanö Bight, where inflows during the autumn 2013 had improved the oxygen conditions, oxygen concentrations in the bottom water had now decreased to acute hypoxic conditions ($< 2 \text{ ml/l}$). At the station BCSIII-10, where oxygen concentrations during the previous cruise were above 2 ml/l, the situation had worsened, and was now only 0.32 ml/l in the bottom water. North of BCS III-10, in the southern part of the Eastern Gotland Basin, the oxygen situation had improved somewhat, and this oxygenated water was now heading toward north. Completely oxygen free conditions, (anoxia) were found from 90 - 100 meters depth in the Western, Eastern and Northern Gotland Basins and acute hypoxia from 70 – 90 meters depth.

Some increased fluorescence was registered in the Arkona, Bornholm Basin and in the Hanö Bight. At the station BY2 in Arkona, the bloom was in full progress, with high fluorescence and high oxygen saturation, 108 %, in the surface layer. In remaining areas plankton activity was low.

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APPENDICES

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