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Baltic Sea faces a tough future

The Baltic Sea is likely to be warmer, lower in oxygen and more acidic in the future, warn Swedish scientists in a recent study. Current strategies for managing the Sea will need to change if they are to meet marine protection objectives.

Serious environmental problems are already clear in the Baltic Sea: pollution, over-fishing and eutrophication are some well-known issues. According to the researchers, who focused on possible effects of climate change on eutrophication and acidification in the Sea up until 2100, its condition will probably worsen this century.

They give an overview of the scientific knowledge in this area, which draws on earlier studies, in particular, the results of two projects conducted under the EU-funded BONUS+ research programme[1]: Baltic-C and ECOSUPPORT.

Despite efforts to control nutrient pollution in the Baltic, such as through HELCOM's Baltic Sea Action Plan (BSAP), there have been recent record highs in the extent of areas of hypoxia (reduced oxygen levels) and anoxia (extreme hypoxia). Local conditions make the Sea very sensitive to human impact. It receives and traps huge amounts of nutrient-rich river water, which has flowed through 14 countries in total.

It may take several decades for the effects of cuts in nutrient pollution to be fully realised, in terms of a return to a natural balance of nutrients in the seawater. This is partly because eutrophication creates a vicious cycle whereby anoxia disrupts natural chemical processes on the seabed and reduces sediment's ability to lock away phosphorus. Given this time lag, the researchers suggest that special measures could be investigated to speed up the Sea's recovery: an example is geo-engineering methods, if they could undergo testing and evaluation in limited marine areas.

Increasingly acidic waters have been recorded in almost all regions of the Baltic, as higher levels of CO_2 in the atmosphere dissolve in the water and lower its pH. Although anoxia makes water more alkaline, this effect will not be enough to prevent acidification over the coming century.

In deeper waters, eutrophication is likely to worsen acidification. It increases the rate that organic matter converts to minerals at these depths, thus releasing more carbon and further acidifying water.

Climate change is likely to exacerbate eutrophication too. Higher temperatures will further reduce oxygen levels in water, because oxygen dissolves better at lower temperatures.

Up to 20% more rain and snowfall is possible in the Baltic under climate change, although future projections for changes in precipitation are far more uncertain than projections for temperature change. An increase would escalate river flow into the Sea, flushing even more nutrients into its waters and further intensifying eutrophication. This rise in freshwater would also lower the Sea's saltiness, making living conditions difficult for many plants and animals.

Climate change's effects on the Baltic Sea will become very apparent around 2050, models predict, and will continue until at least 2100. Different ecosystems will develop under new conditions – some species will die out whilst others will thrive.

It will be increasingly difficult to meet environmental goals, as set by HELCOM, the EU (under the Marine Strategy Framework Directive) and national governments, the researchers say. The BSAP does not account for ecological changes over time, or due to warming, acidification or freshening. The evidence suggests that efforts to implement the BSAP and other management plans should be intensified given the coming challenges presented by climate change.

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