



ANNE BERNER

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Finland chooses continuity



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JARI HÄNNINEN

Changing environment of the Baltic Sea should be recognized in the future resource management activities

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As is well known, the political balance of the Baltic Sea has spent restless times during the last years mainly due to its strategic position between east and west. Since the 1980s, the rapidly changing situation has been a reality for the environmental condition of the sea as well. The reason for this has been the global climate change, which influences especially the exceptional characteristic of the Baltic Sea – the salinity content of the brackish seawater. The changing environment should be better recognized in the future management activities of the sea.

Practically all the water in the Baltic Sea derives from the North Atlantic Ocean. Salinity in the Baltic Sea is maintained by seawater intrusions from the North Sea through the Danish Straits. Freshwater, on the other hand, is first evaporated in the Atlantic, after which it enters the catchment area via precipitation and finally reaches the Baltic Sea as river runoffs. Our research has shown that major oceanographic events in the Baltic Sea, such as the reduced frequency of saline water pulses, are regulated by increased river runoff from the Baltic Sea watershed. Anthropogenic changes in the climate over recent decades have increased the precipitation in the Baltic catchment to give a positive water balance, i.e. more fresh than saline water reaches the Baltic Sea, and the surplus fresh water flows continuously out into the North Sea, hindering saline water intrusions from the Atlantic at the same time. These events have resulted in decreased seawater salinity and further changes in the biodiversity of the sea as the salinity of water is the ultimate controlling factor of faunal and floral composition and distribution in the Baltic Sea. Regional modelling exercises for the Baltic Sea have anticipated that the progress will still continue for decades in the future. This newly developing Baltic Sea ecosystem, originated in climate change and characterized by reduced seawater salinity, will encourage invading species from the relatively fresh waters of the Gulf of Finland and Bothnian Bay while several seawater species simultaneously are expected to retreat south-west, and some of them may even disappear from the Baltic Sea.

Since coastal brackish water areas are central to the well-being of several aquatic and marine species, some of which are commercially important, the issue of an expected increase of freshwater runoff and decreased salinity in the northern Baltic Sea deserves attention. This is especially important for management activities, especially in fisheries. In the Baltic Sea, freshening of the water has caused both qualitative and quantitative changes in fish fauna due to changes in the planktonic community, which further have changed the diet of the most important commercial fish, the Baltic herring. As a result the herring is starved and due to this we have demonstrated some 25% decrease in body length in the northern Baltic Sea. This must affect the energy flows and ecological interactions among the species in the ecosystem, not to mention the consequences for the fisheries and fish processing industry. By now, the commercial fish catch in the Baltic Sea is about 700,000 tons annually. The majority of the catch consists of marine species: herring, sprat and cod. Of these,

herring will most likely retain its distribution and dominant position in the pelagic ecosystem even in the northern sea areas, but its body size will remain constantly small, keeping also the stock biomass low. Modelling has anticipated that during the next 100 years, the other marine fish species will gradually disappear from northern Baltic Sea catches with the extension of the decreased salinity range from north to south. For the fishing industry the consequences of this development will be problematic in the future.

Speculatively, a combination of physical, chemical, and biological environmental changes may turn any one of above mentioned species into a key species that will profoundly affect the ecology of its habitat. We need a heightened, more sophisticated approach to monitoring than exists currently. For example, the ecosystem approach of the European Union's Marine Strategy Framework Directive, MSFD (2008) could be a basis for development. The MSFD is intended to promote sustainable use of the seas and conserve marine ecosystems. The main objective is to reach and maintain Good Environmental Status (GES) in Europe's seas. GES is described by e.g. biological diversity. We emphasize that with advancing climate change, salinity changes are likely to affect the biodiversity of brackish water environments. This should be accounted for in future monitoring program designs, and these program designs need to be adapted accordingly.

Archipelago Research Institute (ARI) of the University of Turku is the only university-level field station at northern Baltic Sea possessing research vessels and other long-term monitoring equipment for marine ecological and oceanographic studies in the Archipelago Sea. The time series collected at the station date back to the start of regular environmental monitoring in Finland in early 1960s, and have now continued unbroken more than 50 years. The long term environmental data collected at the institute has been a basis for developing the current status of the ARI as one of the leading institutes in environmental long term data modelling directed to explain the Baltic Sea ecosystem functioning. Our monitoring history has shown that stable and regular observation of natural phenomena with fixed methods is the only way to reveal slowly occurring changes or effects of abrupt disturbances in marine ecosystem. ■



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