



## Hypoxia becoming more widespread along Baltic Sea coastline

**Hypoxia (low levels of oxygen)** is widespread in the coastal waters of the Baltic Sea, according to recently published research. The trend of increasing hypoxia since the 1950 is alarming, although improvements can be seen in some areas as a result of measures to reduce inputs of organic material.

**Waters with sufficient levels of oxygen** are essential for many aquatic organisms to thrive and for the healthy functioning of aquatic ecosystems. When dissolved oxygen levels fall below  $2 \text{ mgL}^{-1}$  (milligrams per litre of water), hypoxia occurs. Organisms living in and near the bottom of the sea die and create 'dead zones'. Whole ecosystems can be altered, including those that support important fish stocks.

It is well-known that there are dead zones in the Baltic Sea proper (offshore areas). Less well researched is the status of the Baltic Sea coastal waters. Using research and monitoring data from the Baltic States from 1955-2009, the researchers identified coastal areas where hypoxia has occurred. At least 115 sites (of the 326 sites with sufficient data) were identified as having experienced hypoxic conditions during this time. This represents about 20% of the hypoxic sites reported around the world (although this figure may be skewed since the Baltic Sea is one of the most well researched regions of the world). Overall, there was a significant long-term increase in hypoxia, with around 5% of all profiles classified hypoxic in 2009.

In addition, the overall occurrence of hypoxic sites has increased in the Baltic Sea coastal areas, raising concerns about the health of coastal habitats.

Hypoxic conditions can occur naturally when differences in temperature or salinity (saltiness) create layers of water (stratification). Unless there is an inflow of fresher water or tidal action, there is little mixing of water or nutrients between the layers. Hypoxia is also caused by human activities. Inputs of the nutrients nitrogen and phosphorus from agricultural production or urban waste can cause eutrophication of the water. Excess nutrients feed algal blooms that sink to the bottom as they die and bacteria that decompose the algae consume large amounts of oxygen leading to hypoxic conditions on the seafloor.

Within the Baltic Sea, hypoxia was commonly found in the estuaries of the Danish Straits, caused by the decomposition of algal blooms that have been fed by large nutrient loads and the strong stratification in the area. In the Swedish and Finnish archipelagos, hypoxic conditions have been created by high nutrient loads from agricultural and urban inputs, in addition to restricted water flows caused by complex seabed features in the region. Decomposition of large algal blooms in the Finnish Archipelago Sea has contributed to the hypoxic conditions found there.

However, in the estuaries of the coastal region of the Bothnian Sea, to the north, low levels of nutrient loading probably explain the low occurrence of hypoxia in the area. Hypoxia is also uncommon off the coast stretching from Estonia to Poland where water mixes and circulates freely in open areas. In some areas, improvements can be seen as a result of measures taken to reduce inputs of organic material.

**Source:** Conley, D.J., Carstensen, J., Aigars, J. *et al.* (2011) Hypoxia Is Increasing in the Coastal Zone of the Baltic Sea. *Environmental Science & Technology*. 45: 6777-6783.

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