

Biodiversity and protection of deep sea habitats in the Baltic Sea

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The Baltic Sea is an Atlantic marginal sea, being one of the biggest brackish sea in the world. It has an overall surface of 415.000 km² and an average depth of 52 m. The maximum depth is 459 m in the *Landsorttief*. The Baltic Sea is very young and originated after the last ice age about 10.000 years ago. Since 4.000 years it has the current brackish salinity conditions and could be defined as its “ecological age”. Salinity is a key factor in the distribution of biodiversity in the Baltic Sea. There is a gradient declining from SW to NE, resulting in a mixing of species from brackish to marine environments. The highest proportion (45%) of the red listed biotopes can be found in benthic aphotic zones. Therefore, its protection is really important for the preservation of the Baltic Sea

Goals

- Analyse the physical and geochemical conditions of the deep sea habitats in the Baltic Sea.
- Determine its current status of biodiversity in the deep benthic areas.
- Synthesise how the climate change and anthropogenic impact are affecting these habitats.
- Collect the different plans of protection for the deep sea habitats in the Baltic Sea.

Introduction to Deep Sea habitats

The Baltic Sea is characteristic for its **permanent halocline** (figure 1). This strong barrier prevents the vertical mixing of waters and the ventilation of water in the deep areas causing **stagnant areas deprived of oxygen**. Prolonged isolation generates hydrogen sulphide due to microbial processes resulting in a very hostile environment for living forms.

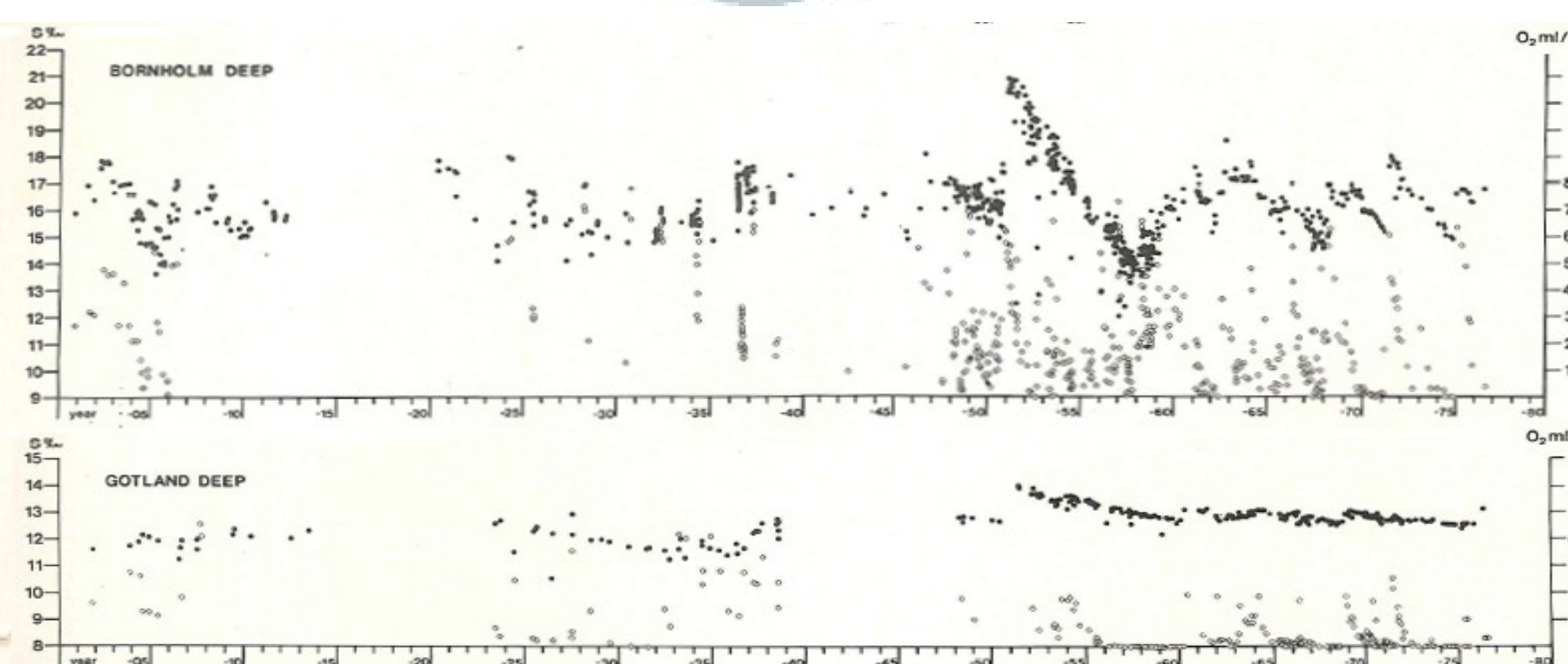


Figure 2. Salinity (●) and dissolved oxygen (□) values recorded for the Bornholm Deep (below 80 m) in 1901-1977 and the Gotland Deep (circa 200 m) in 1902-1977 (Andersin AB, et al., 1978).

The **renewal** of water in these areas can only be achieved by **horizontal inflow** coming from the North Sea. This water is rich in oxygen and salinity but as can be seen in figure 2, these inflows do not follow a periodical pattern, but are rather sporadic. Long periods without inflow cause a very hostile environment leading to **extinction of macrofauna**.

The area of **hypoxic bottoms** has increased since 1990 from 11.050 km² in 1993 to 67.700 km² in 2006

Biodiversity in the Baltic Sea: Salinity, a key factor

The Baltic Sea hosts altogether at least 6.056 species (figure 3), consisting of marine, freshwater, migratory and glacial relicts:

- 442 Phytobenthos
- 569 Meiozoobenthos
- 1476 Macrozoobenthos

The **salinity is a key factor** to understand the distribution of the biodiversity. The gradient declining to the NE allows freshwater species to live in the Northern areas while in the south-west, marine species are more present (figure 3).

In deep basins lacking of oxygen, almost only meiofauna is present.

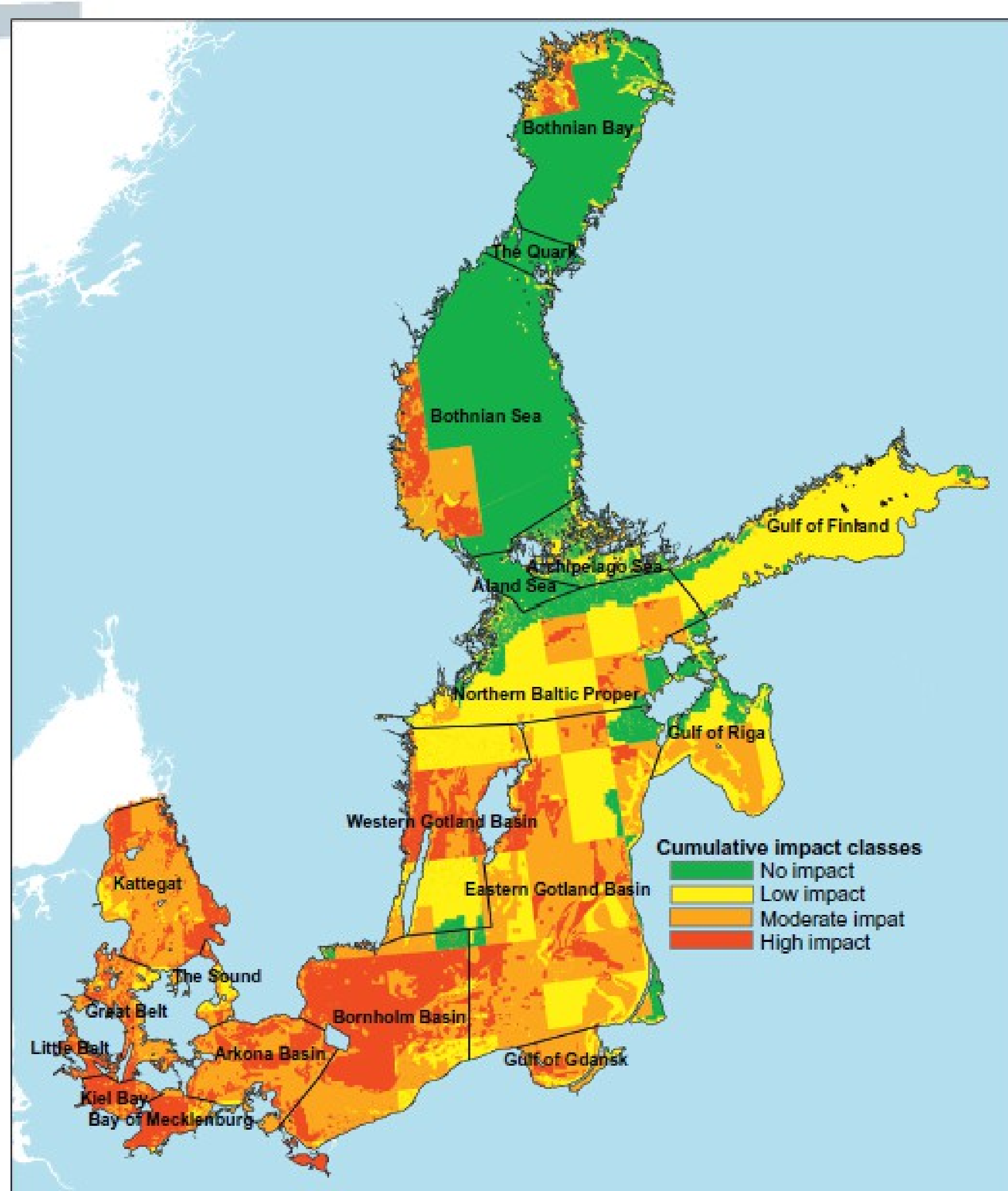


Figure 4. Spatial distribution of potential cumulative impacts on benthic habitats in the Baltic Sea. The impacts are presented in four classes, the class borders adjusted specifically to those of the 18 habitats. Baltic sub-basins are named and shown by black borderlines. (Korpinen S et al., 2013)

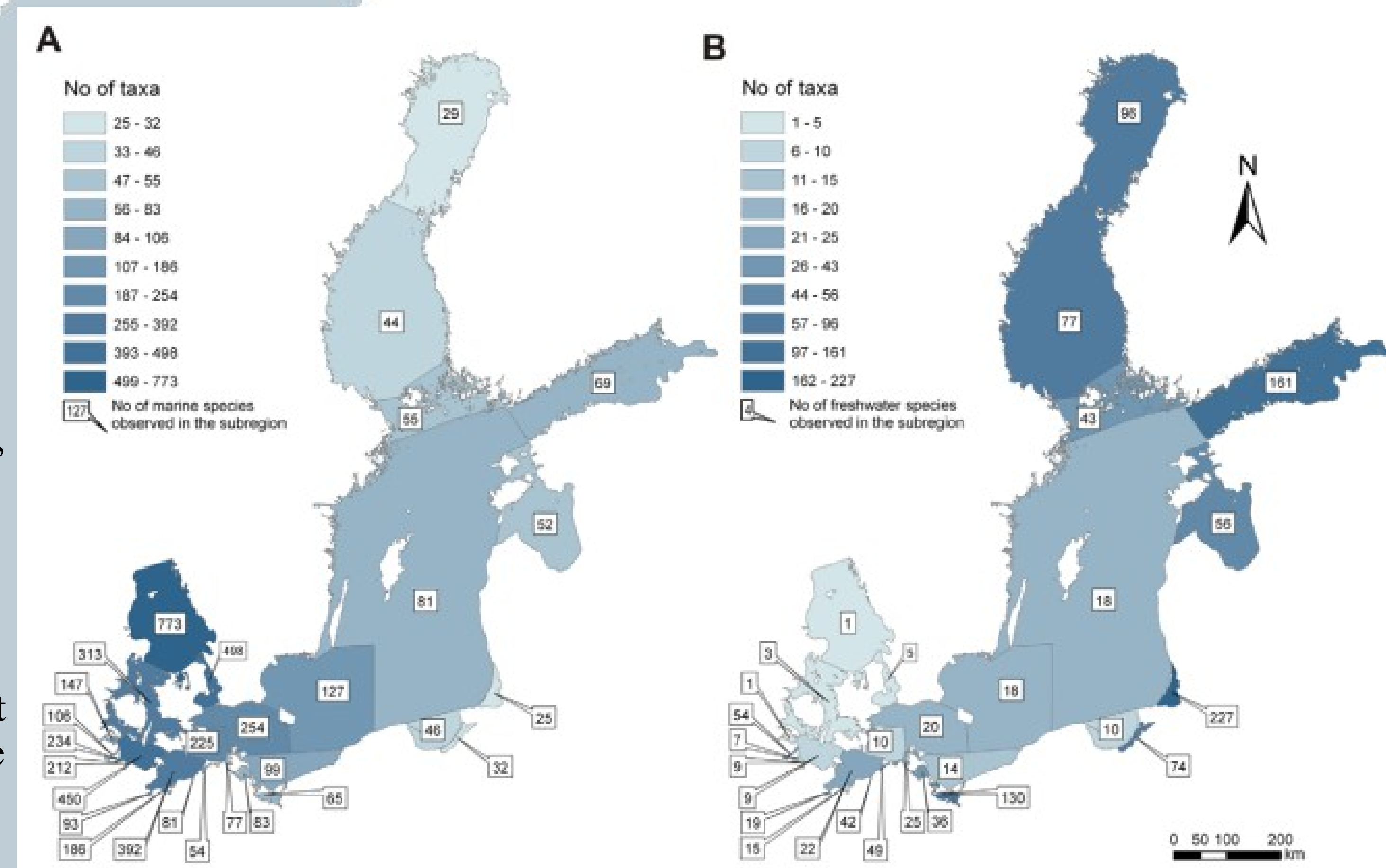


Figure 3. Sub-regional distribution of (A) marine and (B) freshwater taxa in the Baltic Sea: case of macrozoobenthos (Ojaveer H et. al., 2010).

The Baltic Sea in danger. Impact and protection

The most affected areas of the Baltic Sea due to human impact are the **S and SW** (figure 4).

Eutrophication is the biggest threat affecting the deep sea habitats, deriving in sedimentation organic matter and depletion of oxygen due to it (figure 5).

Climate change, even tough affecting temperature levels and regime of climate, is currently not a big threat, but if it not prevented it will be as threatening as fishing or construction (figure 5).

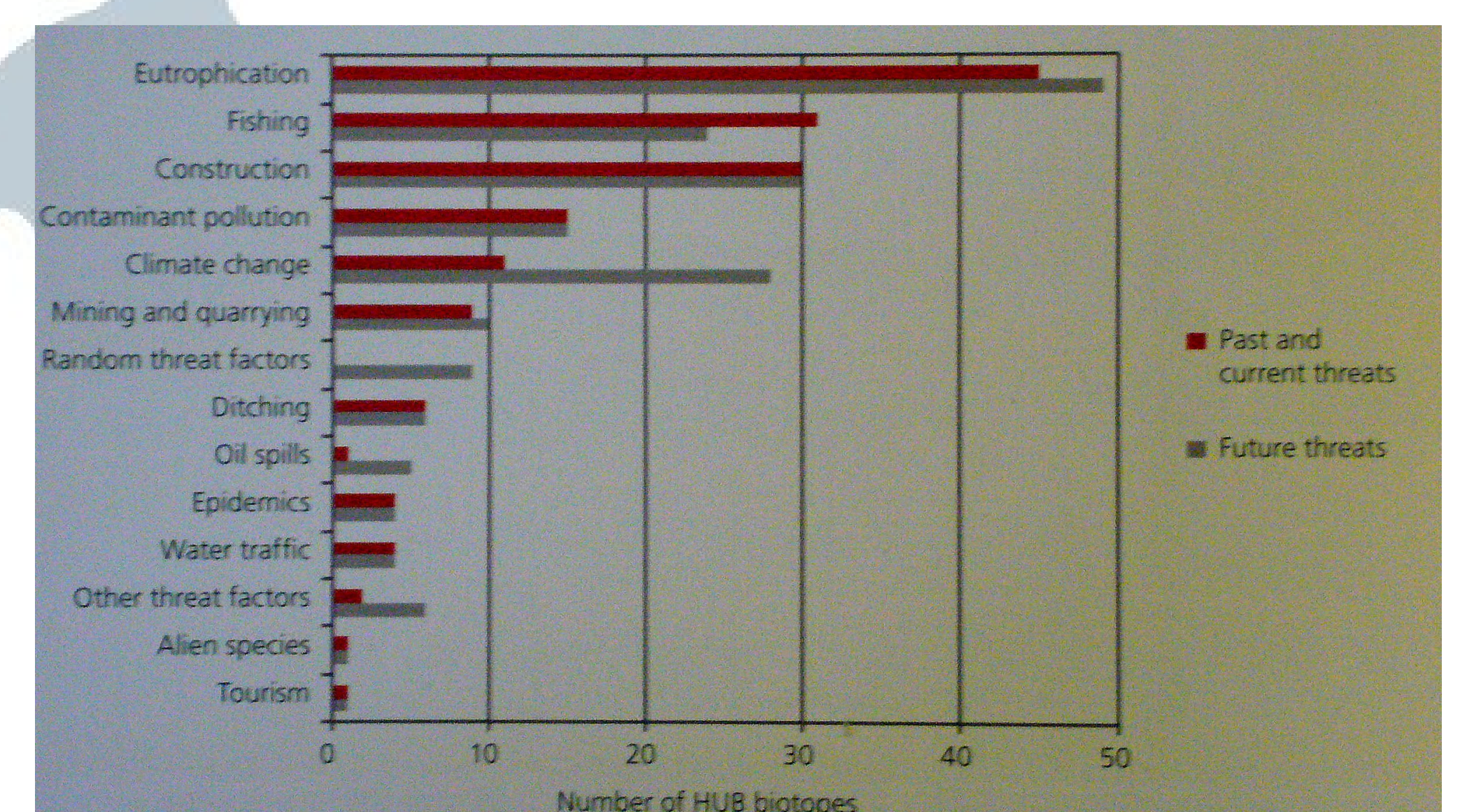


Figure 5. Threats affecting the 59 red-listed HELCOM HUB biotopes (HELCOM, 2013)

HELCOM is the biggest and most active organisation working in the Baltic Sea area, in collaboration and coordination of the 9 surrounding countries and the EU. Among a very long list of activities, all revolve around the **Baltic Sea Action Plan** (BSAP), an ambitious program to restore the good ecological status of the Baltic marine environment by 2021.

Conclusions

- Biodiversity in such habitats depend mainly of oxygen availability which is provided by the periodical inflow of renewal water from the North Sea.
- The biggest threat affecting the deep basins in the Baltic Sea is eutrophication stemming from the excess of nutrient inputs.
- The climate conditions, even though there is evidence that there are changing, are currently not a big threat for the deep sea habitats. However, if the changes keep happening, predictions show that it can become a bigger threat.
- The most ambitious plan to mitigate the climate change and the anthropogenic impacts is the Baltic Sea Action Plan carried by HELCOM, the culmination of it is planned for 2021.