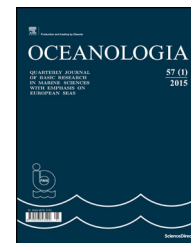




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SHORT COMMUNICATION

The structure of macrozoobenthic communities as an environmental status indicator in the Gulf of Gdańsk (the Outer Puck Bay)[☆]

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Macrozoobenthos;
Long-term changes;
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Summary An attempt is made to use long-term (1979–2014) macrobenthos data series to derive insights on changes in abiotic conditions and on potential effects of long-term macrobenthos variability on food availability for fish and wintering waterfowl. The data were collected from a small embayment, protected as a NATURA 2000 area, functioning as a fishing ground important for the local community and as a site of diverse commercial developments. The analysis showed a drastic reduction of the macrobenthos abundance and biomass, which could have been related to oxygen deficiency; on the other hand, recolonisation processes have also been observed.

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The western part of the Gulf of Gdańsk, called the Puck Bay, sheltered by the Hel Peninsula, has been for ages important for local communities as a fishing ground where both fresh-water, marine, and migrating species have been harvested.

According to the data reported by the fishermen and uploaded to the official data base held by Fisheries Monitoring Centre in Gdynia, the catches are at present dominated by the flounder, a species that feeds mainly on benthic

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invertebrates. The Puck Bay is also an important feeding ground for the wintering waterfowl. In addition, the Bay is protected as a NATURA 2000 area (PLH220032). At the same time, it is affected by intensive human activities and therefore aquatic organisms themselves as well as their contribution to food resources of fish (particularly the flounder) and the wintering waterfowl may be affected by local anthropogenic factors (e.g. effects of a brine-containing sewage discharge, the brine being produced as a result of inland salt deposit leaching to form caverns). The fishermen operating in the Puck Bay suggest that the decline in flounder catches is due to the impoverishment of the food resources consisting of benthic invertebrates. Some opinions hold that the brine produced during salt deposit leaching with treated sewage from the local treatment plant, in progress since 2009, whereby ultimately the brine-containing sewage is released into the Bay, may have resulted in salinity changes and the water column salinity stratification leading to oxygen deficiency in the near-bottom layer. As stipulated by the pre-conditions of the brine-enriched sewage discharge operation, the salinity of the discharged brine should be equal to that prevalent in the Puck Bay. The area near the brine-containing sewage discharge site has been subjected to monitoring.

This study is not aimed at providing an additional environmental impact assessment, but is an attempt to use the data on macrobenthos assemblages as an indicator of potential environmental changes in the Puck Bay over a large spatio-temporal scale. The motivation lies in a possible synergy created by various anthropogenic and natural factors acting in synchrony, the long-term pressures resulting in a cumulative effect. This in turn may mask the effect of an actual impact of a concrete anthropogenic pressure. In addition,

the macrobenthos in the Baltic Sea is an important food source for demersal fish and birds, for which reason long-term studies on the macrobenthic biomass/productivity may aid in addressing the question whether food is a limiting factor for top consumers, e.g. demersal fish and birds.

The macrozoobenthos (alternatively termed the macrobenthos or the macrofauna) is defined as benthic invertebrates retained on a 1 mm mesh size sieve. Compared to, for example, the plankton, the macrobenthos is stable in time and space, as it is composed of long-lived organisms, mostly sessile or with a limited mobility, and inhabiting relatively small areas. Because of this, macrobenthic organisms are exposed, for a relatively long time, to various (also unfavourable) environmental effects prevalent at a given site. For this reason, the macrobenthos is regarded as a good indicator of environmental status, and is particularly useful for the detection of short-term fluctuations of abiotic factors (e.g. oxygen content or salinity) which, on account of their high variability, are difficult to be measured directly.

The Outer Puck Bay is defined as an area which, by convention, is bordered from the west by an emergent shallow known as the Ryf Mew (the Seagull Sandbar), a hypothetical line connecting the Hel Peninsula terminus with Gdynia constituting the eastern border of the Outer Puck Bay (e.g. Demel, 1935; Slomianko, 1974) (Fig. 1). The maximum water depth is about 56 m and the salinity ranges within 7.2–8.0. The bottom in the inshore zone, down to a depth of several to about 30 m, is covered by sandy and mixed (sand and mud) sediments, muddy sediments prevailing at larger depths. As determined by the loss on ignition (LoI), the organic content in the muddy sediments is up to 17%. The relatively scarce data on the near-bottom dissolved oxygen

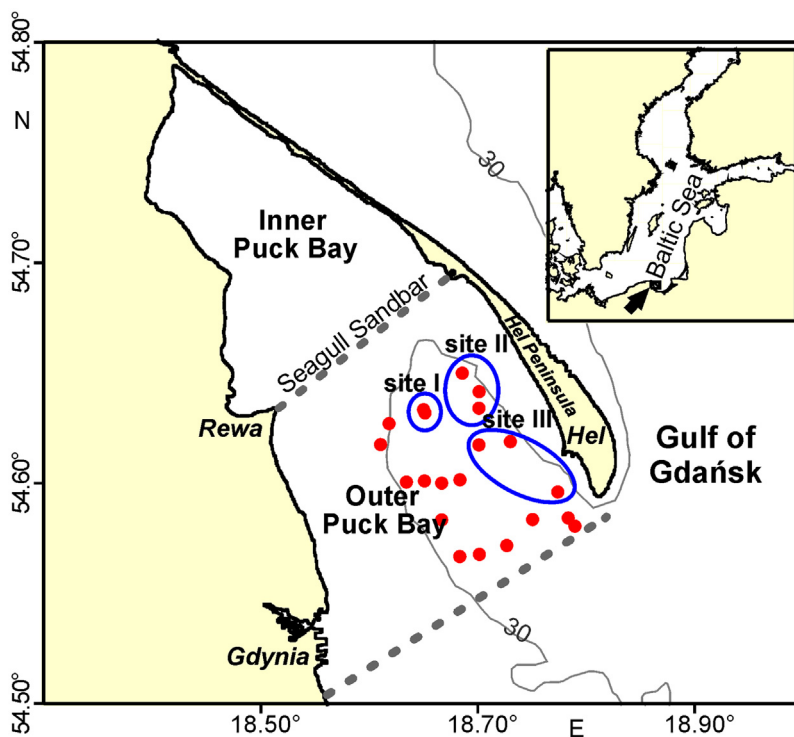


Figure 1 Area of study and distribution of sampling stations in the Outer Puck Bay in 1979–2014. Depth ranges: site I – 30–35 m, site II – 36–40 m, site III – 41–51 m.

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