

An exercise in comparing the pelagic and benthic macrofauna species diversity in Arctic, Antarctic and Baltic sites using the

Taxonomic Distinctness Index

By Monika Kędra

AMONG A NUMBER OF BIODIVERSITY MEASURES developed in recent years, the Taxonomic Distinctness Index (Warwick & Clarke 1995) was highly recommended by the BIOMARE international network (Feral *et al* 2003). However, there are still only a few examples where this index has been used for biodiversity comparisons. This was highlighted during the discussions at a recent MARBENA workshop in Sopot, April 2004. Participants agreed that species check-lists, if possible from all the BIOMARE biodiversity sites, should be made available on the internet, and a number of studies may be developed using this material. This article presents the results of a small exercise using the Average Taxonomic Distinctness Index (ATDI) for analysing the basic check-lists of selected macrofauna taxa from three very different localities: an Arctic fjord (Kongs-fjorden, Svalbard) with a relatively young glacial history; an Antarctic fjord (Admiralty Bay) with millions of years' glacial history; and the brackish water of the southern Baltic, which is younger than 10,000 years of age.

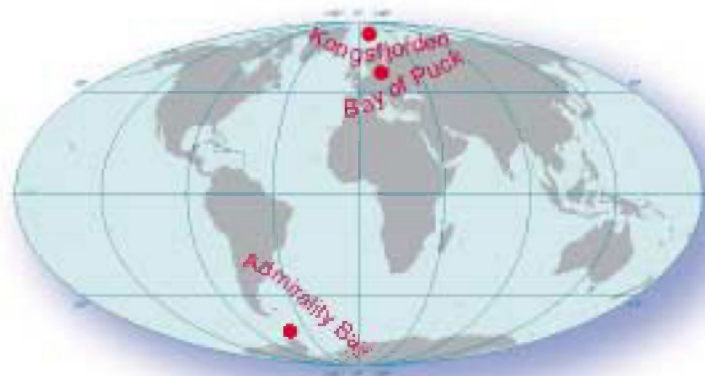


Fig 1. Geographical location of investigated areas.



Fig 2. Kongsfjorden.



Fig 3. Sea-grass bed, Bay of Puck.

Data have been provided by IOPAS, the University of Gdańsk, and the University of Łódź. Researchers from www.iopan.gda.pl provided data from Kongsfjorden, and Puck Bay data and Admiralty Bay data were obtained from the published references of University of Łódź marine biologists. We were especially interested in introducing the pelagic data into the analysis, as so far the biodiversity datasets are largely benthic-inclined.

Research areas

Kongsfjorden (Fig 2) is located on the west coast of Spitzbergen, in the Svalbard Archipelago at 79°N. An active tidal glacier that is located at the head of the fjord has the greatest influence on the environmental conditions. It causes gradients in salinity, temperature and sedimentation rates. The area is under the influence of the North Atlantic Current.

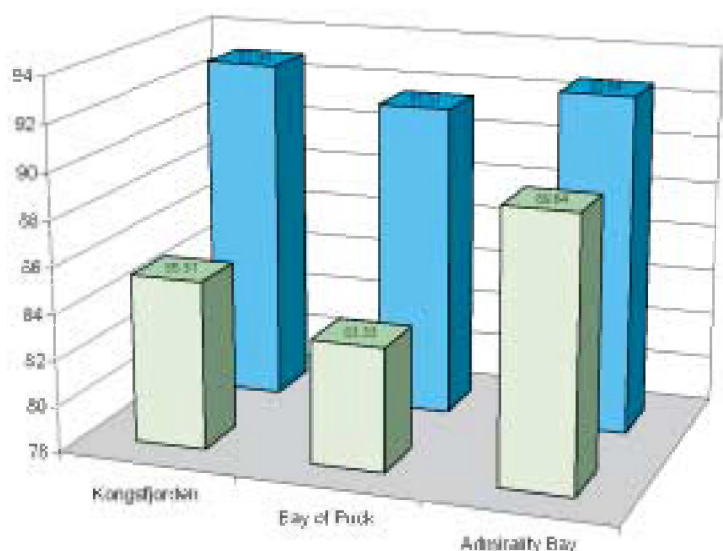


Fig 4. Average Taxonomic Distinctness Index calculated for species recorded in Kongsfjorden, Bay of Puck and Admiralty Bay.

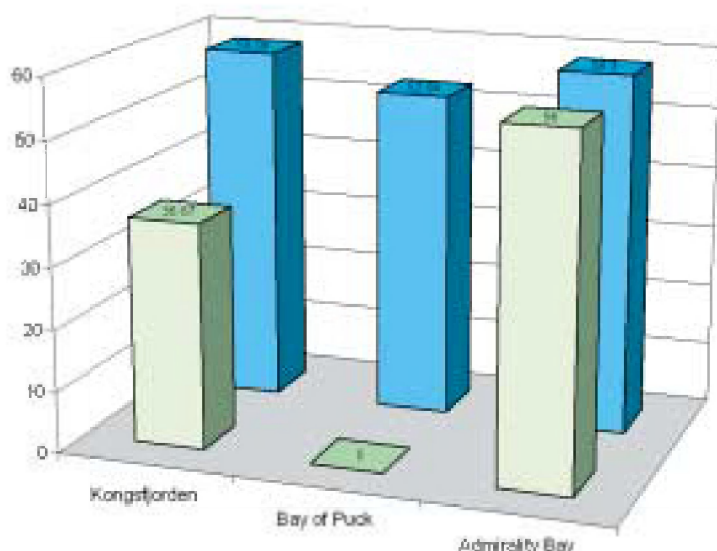


Fig 5. Average Taxonomic Distinctness Index calculated for Amphipoda species recorded in Kongsfjorden, Bay of Puck and Admiralty Bay.

The Bay of Puck is situated in the inner part of the Bay of Gdańsk at 54°N. With its shallow, sandy sea-grass beds (Fig 3), no tides and low salinity (from 3 PSU to 6 PSU), it is considered representative of the southern Baltic region.

Admiralty Bay is located on King George Island in the South Shetlands Archipelago at 63°S. The size of the bay, presence of glaciers, salinity, temperature and sedimentation are similar to the Arctic site. However, there is a high ratio of endemic species caused by hydrological isolation due to the Antarctic convergence (Fig 1).

Pelagic, benthic biodiversity comparison

Biodiversity measures that utilise higher taxa richness and evenness are of great importance (Warwick & Clarke 1995). To assess the species diversity for non-quantitative data (i.e. species lists, presence/absence data), ATDI D^+ was calculated (Clark & Warwick 1998).

Firstly, the macrofaunal lists of pelagic and benthic species at the three sites were compared. At Kongsfjorden and Admiralty Bay,

the number of pelagic species is much lower than the number of benthic species; however, the ATDI (Fig 4) is not. This suggests that in spite of lower species number, the taxonomic diversity among pelagic species is relatively high. Also striking is the small difference in diversity between the polar areas – the Antarctic was commonly regarded as a very diverse, old-evolutionary centre of species richness (Knox & Lowry 1977). For the Bay of Puck, the index is also quite close to the species-rich polar areas (Fig 4).

The same analyses were made for selected taxa. The biodiversity of benthic Mollusca and Polychaeta, measured with ATDI, was much higher than the pelagic diversity for these groups. For Crustacea, the D^+ index was similar in all cases but for the Bay of Puck. The results for Amphipoda are presented in Figure 5, and even though the

species number is much higher in the benthos, the diversity is not, especially in the case of Admiralty Bay. In Bay of Puck, only one species of Amphipoda is observed in plankton.

This exercise shows that the application of ATDI for large-scale comparisons (gamma diversity) of very different sites is useful but may need further research. The species-rich (over 500 taxa) Antarctic site was classified as very similar to the Baltic brackish-water temperate site of low species richness (approx. 50 species). However, it is still likely that ATDI will serve well in comparisons of beta diversity among sites of the same area. ●

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- www.iopan.gda.pl/projects/biodaf – web page with Hornsund and Kongsfjorden data.
- www.iopan.gda.pl/projects/Bay of Puck – web page with Bay of Puck data.