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Detecting hypoxia through otolith chemistry in modern and prehistoric Baltic Sea cod

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The Baltic Sea is arguably the largest water body with anthropogenic hypoxia and anoxia. Yet sedimentary evidence suggests that hypoxic periods date back to the formation of the Litorina Sea around 8000 YBP. We have identified a relationship between the areal extent of modern-day hypoxia and manganese uptake in otoliths (earstones) of Baltic cod (Gadus morhua). We also assessed a rare collection of Neolithic (4500 YBP) and late Iron Age (700-1000 YBP) Baltic cod otoliths. Otolith Mn:Ca ratios in the Neolithic fish were low, comparable to fishes caught in the early 1990s, a period of low hypoxia. However, one of two Iron Age otoliths assayed showed evidence of hypoxia. This method appears to hold promise as a means of understanding how fishes interact around hypoxic areas, and furthermore may serve as a means of detecting or confirming hypoxia, and could thus be used in monitoring.