Reconstructing the baseline population structure of the exploited bivalve Arca noae in the Northern Adriatic Sea

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The Northern Adriatic Sea is one of the most impacted ecosystems worldwide with a long history of anthropogenic impacts, ranging from overfishing and bottom trawling to eutrophication, deoxygenation and pollution. The impact of these multiple pressures on populations of economically important species is often difficult to evaluate due to paucity of long-term monitoring data. The edible bivalve Noah’s Ark shell (Arca noae L.) was intensively harvested in the eastern Adriatic Sea until 1949-1950 when it suffered a catastrophic population collapse due to unknown agents. The assessment of its subsequent recovery is hindered by the lack of data on the population size structure prior to that event. To reconstruct the natural baseline state of populations of A. noae before the onset of extensive harvesting, we studied fossil assemblages from two 1.5-m-long sediment cores collected in the southern Gulf of Trieste (off Piran, Slovenia), both recording the last ~9,500 years.

The abundance and shell length of A. noae remained low in the lower part of the cores but increased strongly within the oyster-Arca shell bed corresponding to maximum flooding and early highstand sea-level phases (6,500-1,000 years ago). In contrasts, the top 8 cm of the core (the late highstand phase), marked by high concentration of pollutants and organic enrichment, contained only few and small (< 10 mm) A. noae shells. Moreover, no living individuals were found in grab samples taken from the two stations suggesting that the dense populations of A. noae, persisting there for several thousand years, were locally extirpated in the 20th century. To evaluate population recovery in other parts of the NE Adriatic, we compared the size distribution of fossil A. noae from the shell bed interval to the previously published data on living populations of this species sampled along Istrian peninsula between 1966 and 1978. Both fossil and extant populations were characterized by similar median size, modal size class and proportion of specimens > 50 mm (minimal legal landing size). These results suggest that within few decades after the 1949-1950 mass mortality event the size structure of populations of A. noae have largely returned to their earlier, natural state. The recovery was spatially variable, however, as attested by the decline of A. noae populations due to loss of suitable shell-bed habitats in the two studied stations off Piran.