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Plio-Pleistocene extinctions and immigration credit reflected in the size-frequency distribution of Mediterranean marine bivalves

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Following the opening of the Suez Canal hundreds of Red Sea species have entered the Mediterranean Sea making it a global hot spot of marine bioinvasion. With the ongoing influx of the subtropical and tropical alien species and increasing sea surface temperatures, the Mediterranean biota is currently gaining a more tropical character and increasingly becoming a mixture of faunal stocks with different evolutionary histories.

This susceptibility to invasion was suggested to reflect the presence of an empty ecological space left after decimation of incumbent warm-water fauna during Plio-Pleistocene climate fluctuations. As molluscs are among the most prolific immigrants, we test this hypothesis using data on taxonomic composition and body size of Pliocene Mediterranean bivalves derived from the literature sources and museum collections. The Pliocene inter-specific size-frequency distribution (SFD) is strikingly similar to the SFDs of the Recent Red Sea bivalve fauna, in spite of different biogeographic provenance and the absence of true reef ecosystems in the Pliocene of the Mediterranean region. In contrast, body-size patterns in both assemblages are significantly different from the present-day Mediterranean fauna characterized by smaller median and modal size.

Our preliminary results suggest that the distinct shape of the modern Mediterranean SFD may reflect the selective nature of the late Piacenzian – Galesian (Late Pliocene – Early Pleistocene) extinctions pulses related to the onset of the Northern Hemisphere glaciations. These extinctions affected almost 40% of Pliocene species and were biased towards large-bodied taxa. They were not followed by re-immigration of warm-water species owing to the isolation from the tropical Atlantic biota by the cold upwelling along the NW coasts of Africa. The resulting invasion credit (sensu Jackson & Sax, 2010) is currently being paid by the Red Sea bivalves colonizing the Mediterranean Sea through the Suez Canal. Successful immigrants are significantly larger than native species reflecting the gross differences in the body-size distributions of the source and recipient species pools. These size differences are further amplified by environmental and biotic filters acting along the invasion pathway. Therefore, the continuing inflow of tropical invaders will restore the Pliocene body-size patterns in the Mediterranean bivalve fauna.

References

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