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Reef fish dynamic response to climatic variability in a warm eastern Mediterranean semi-enclosed basin

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Recent studies on the effects of global warming on fish populations reveal that the resulting hypoxia-based habitat compression due to the expansion of the oxygen minimum zone may lead to the restriction of fish depth distributions to the oxygenated near-surface layer1. Here we postulate that similar phenomena may have affected the fish distribution in the early Pliocene Heraklion semi-enclosed sea (Crete, eastern Mediterranean). Fish otoliths from Voutes section are systematically identified and the data is examined from a palaeoecologic perspective in response to the Pliocene climatic variability. Bregmaceros and Diaphus taaningi otoliths' relative abundances are used as reliable palaeoclimatic indicators2.

The Voutes section sediments contain a very rich fish fauna. Diaphus spp., Bregmaceros sp., Sardinella maderensis, Phosichthyidae and Sternoptychyidae form the pelagic component. Mesopelagic taxa belong mostly to Myctophids. The benthopelagic and benthic component of the fish fauna is very well diversified and is comprised of Gobiids, such as Gobius cf. niger, Callogobius sp., Lesueurigobius aff. sanzoi, and Aphya sp., as well as Gadiculus labiatus, Laemonema sp., Oblada melanura, Parascombrus mutinensis, Barbourisia rufa, Blennius sp., Ammodytes sp., Solea aff. solea. The presence of Oligopus sp., Spratelloides sp., and Brotula cf. mutlibarbata in the middle part of the section indicate the development of a reef in the study area. The palaeoecologic analysis of the surface, intermediate and deep water faunal groups indicate that the pelagic fish populations in the semi-enclosed early Pliocene Heraklion basin directly reflect the climatic variability. However, the intermediate and deep water fish did not respond to climate change in the same manner. Indeed, two dysoxic events are recorded in this section, where the pelagic component of the fauna is almost exclusively comprised of Bregmaceros sp., few Myctophids are present, and the benthic and benthopelagic taxa are nearly non-existent. These events are intermitted by the development of a reef system near the study area, marked by the intense diversification of the fish fauna on all water levels. The mollusc fauna turnover reinforces the above results. Conclusively, the present study clearly presents the fish populations' dynamic characteristics of in response to climatic variability.

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