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# Effect of the long term variability of hypoxia in the Black Sea northwestern shelf on macrobenthos functional composition

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As many other stratified continental shelves exposed to eutrophication (Diaz and Rrosenberg, 2008), the Black Sea North-western shelf (BS-NWS) is affected by seasonal hypoxia.
The effect of hypoxia on the composition of benthic communities and their role in biogeochemical processes depends on the spatial and temporal extension of the hypoxic event and on the thresold used to define the occurrence of hypoxia. Here, we propose an index H which combines the spatial and temporal aspects to quantify, at shelf scale, the annual intensity of hypoxia as a pressure on the environmental status of the BS-NWS.
Using 3D modelling we were able to relate the H-index to four factors controlling the seasonal mechanism leading to the onset of hypoxia: (1) spring temperature sets the solubility of oxygen in sea water just before the separation of bottom and surface water by thermal stratification, hence relates to the initial amount of oxygen in bottom waters, (2) Nitrogen loads drive primary production hence the vertical flux of organic matter to be respirated in bottom water, (3) Organic content in the sediments is a record of the history of nitrogen loads and sustain hypoxia trough benthic oxygen consumption and finally (4) late summer temperature set the timing of the stratification breakdown that entrains the reventilation of bottom waters. While hypoxia was first triggered in the late 70s by high nitrogen loads, and sustained by sedimentary organic matter accumulation after a considerable reduction of these loads in the 90s, we show that warmer summers after 2000 led to a reincrease in the H-index, due to hypoxic events of smaller spatial extension but increased duration by comparison to the previous decades.
Canonical ordination techniques (e.g. Redundancy and CoInertia analysis) are used to relate the functional composition of macrobenthos in the BS-NWS, assessed from a trait-based approach, to environmental factors, including various aspects of the oxygen dynamics. These analysis are exploited to assess the potential effects of this reshaping of the seasonal hypoxic event on the functional role of benthic communities.