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Linking benthic biodiversity and environmental conditions at the sea floor combining statistical and mechanistic modeling. Case study on the Black Sea's northwestern shelf.

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The preservation of the health and biodiversity of benthic ecosystems is a crucial priority in order to achieve the Good Environmental Status (GES) of marine waters. The multiple pressures acting on the ocean, and in particular, on the coastal zone may prevent the maintenance of biodiversity either directly (e.g. trawling, dredging) or indirectly by modifying environmental conditions at the sea floor (e.g. eutrophication, pollution, acidification, warming). The management of the GES of the benthos in a changing environment and the definition of management strategies (e.g. nutrient reduction) that would preserve GES require tools able to predict the modifications of environmental conditions and to link these modifications to the status of the benthic system.
Coupled biogeochemical-circulation models provide a large amount of information on physical (e.g. currents, salinity, temperature, shear stress) and biochemical conditions (e.g. oxygen, inorganic nutrients, sinking detritus) but cannot provide an information on species richness. We propose to link these aspects by applying canonical ordination techniques (e.g. Redundancy Analysis, CoInertia Analysis) on a large data set on macrobenthos collected on the Black Sea's north-western shelf with in-situ sediment data (e.g. granulometry, carbon and nitrogen content, C/N ratio, $CaCO_3$ content) and bottom conditions (e.g. shear stress, level of oxygen stress, flux of organic matter to the sediments) provided by a three dimensional model. Beyond taxonomic description, the analysis is performed on the functional composition of the macrobenthos: A trait-based approach is used to assess the functional composition of the macrobenthos by associating the considered species to a list of biological, ecological and behavioral traits.
This approach allows to appraise how local conditions determine the functional and taxonomical diversity and provides a mean to evaluate the impact of habitat alteration on the ecological role of benthic assemblages. A particular attention is given to the influence of seasonal hypoxia on benthic biotopes composition.