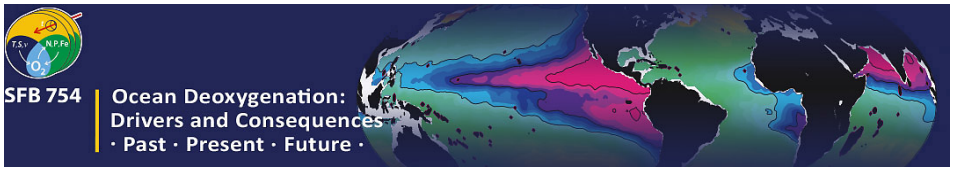

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Upscaling the impact of coastal hypoxia from species to ecosystem function. The case of bioturbation in the Black Sea

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The Black Sea is an almost enclosed Sea that combines naturally-induced permanent anoxia in its deep part with anthropogenically-induced hypoxia on the bottom of its north-western shelf. Shelf hypoxic events occur during the stratification period in regions with high accumulation of organic matter and low ventilation rates. These events started in the 70-80s when eutrophication developed with potential consequences on ecosystem functioning and biogeochemical cycling that we hardly know.
Ocean numerical models provide a wealth of information on environmental conditions with always more details and accuracy but still the scaling up of hypoxic impact at organisms scale to managerial scale is challenging for ecosystem modelers.
We use a trait-based approach for linking the functions of the Black Sea's shelf macrobenthos with the environmental conditions provided by in-situ data and a 3D ocean numerical model. The ocean model is the BiogeochemicAl Model for Hypoxic and Benthic Influenced areas (BAMHBI) developed for the Black Sea. BAMHBI solves biogeochemical processes over the whole water column coupling the pelagic and benthic compartments. The model is used in an operational context in the frame of the Copernicus Marine Environment and Monitoring Service (CMEMS) for providing near real time predictions and reanalysis of the Black Sea biogeochemistry. It has been validated according to the skills assessment plan established in CMEMS using historical and BGC-ARGO data sets.
Macrobenthos samples have been collected during several field campaigns organized in May 2016 and September 2017 in the frame of the FNRS BENTHOX project and the EMBLAS UN expeditions. Species are identified and their bioturbation traits (i.e. sediment reworking, mobility) determined using databases. Statistical analyses (e.g. RLQ approach) are used to select the environmental variables that best explain the variability of the trait. Variables specifically linked with the characterization of the hypoxic events are tested (e.g. severity of hypoxia, averaged/minimum oxygen concentration, age of water). From this information, a Trait Distribution Model (TDM) is developed to link the trait and its "niche" and to predict its spatial distribution using maps of environmental conditions provided by the ocean numerical model. This allows assessing the impact of the occurrence of hypoxia on the distribution of the bioturbation trait at the scale of shelf.

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