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Low dissolved oxygen and its impact on benthic assemblages and ecosystem function in the Northern Adriatic Sea – an experimental approach

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No other environmental parameter in shallow coastal ecosystems worldwide has changed as dramatically as dissolved oxygen (DO). Nearly 400 hypoxic (<2 ml l-1) and anoxic areas have been identified and the number is expected to increase. Such "dead zones" cause cascading effects from the molecular to the ecosystem level. Ultimately, biodiversity loss and disrupted ecosystem function (e.g. filter- and suspension-feeding capacity, bioturbation) can change structurally complex and diverse benthic and pelagic communities into far simpler, depauperated ones (homogenization).
The Northern Adriatic Sea is a recognized case study for repeated seasonal low DO events. The onset and extent of catastrophic events, however, is difficult to predict, hindering full documentation in the field. Present knowledge about the behavioural responses and mortalities of benthic organisms is not commensurate with the crucial role this fauna plays in coastal ecosystems. Our research strives to learn about system function by studying system dysfunction

Using a specially developed underwater-chamber (EAGU) – equipped with camera, flashes and a sensor array – we experimentally recreate small-scale anoxias in a community setting. In a first project we focused on the well-developed macroepifauna in the Gulf of Trieste, Northern Adriatic. The in situ experiments successfully mimicked full-scale low DO events and revealed a clear sequence of species-specific behaviours and mortalities correlated to specific oxygen thresholds. The present project will incorporate key representatives of the macroinfauna and meiofauna and will include sediment geochemistry. We will also take the EAGU concept one step further by evaluating post-anoxia developments such as decomposition, scavenging/predation and the recovery of the benthos as a whole.
This yield of new details (e.g. never observed behaviours and interactions, i.e. predator-prey interactions), at a finer and more nuanced scale of resolution than ever before, is an important step forward in compiling a broadly applicable catalogue of sensitive and more tolerant species. This will also help evaluate community status, i.e. retrospectively pinpoint past anoxias and predict future community compositions. This also calls for examining both the short- and longer-term recolonization process. Finally, our experiments will help to help to better understand and interpret anoxia and dysoxia on epicontinental seas in the fossil record.