A numerical assessment of the potential ecological impacts of zooplankton extraction considering additional environmental pressures due to eutrophication and climate change in the Black Sea

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Commercial exploitation of crustaceans such as copepods and krill has been ongoing for decades in Norwegian and Antarctic waters, and harvesting is likely to increase in many regions of the world. The potential ecological impacts of zooplankton harvesting have, however, yet to be fully investigated. Sustainable management of zooplankton stocks requires understanding of how marine systems will respond to zooplankton extraction applied alongside the many existing environmental pressures impacting marine ecosystems worldwide. Coupled hydrodynamic-ecosystem models provide the best tools currently available for assessing the (often nonlinear) environmental response to multiple environmental stressors. We report progress from an ongoing (Newton-Katip Celebi) research programme which aims to investigate the potential impact of zooplankton harvesting in the Black Sea, using a coupled hydrodynamic-ecosystem model (NEMO-ERSEM) adapted to represent the unique biogeochemical environment of this basin. The hydrographic conditions of the Black Sea cause the copepod Calanus euxinus to accumulate in dense layers, making them a potential target for commercial extraction. Due to the importance of C. euxinus to the already severely degraded marine ecosystem, however, any exploitation should be carefully managed from the outset. Using the coupled model, numerical experiments are being conducted to investigate how copepod biomass responds to changes in eutrophication and climatic forcing, how these environmental pressures may impact the resilience of copepods to targeted extraction, and how copepod extraction may impact lower-trophic level interactions and the biomass of other key species in the Black Sea.

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