

Size diversity and Normalized Biomass Size-Spectrum as suitable ecological indicators for lower trophic levels

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Biodiversity is a key aspect of the good environmental status (GES) of an ecosystem. Higher diversity is assumed to be related to a number of ecosystem functions such as a higher stability of the system and a stronger resilience to external perturbations. Since often determination of taxonomic diversity of lower trophic level species is time consuming - whereas size can be sampled automatically with optical devices - size diversity in a community may serve as a suitable statistic to detect changes that can be evaluated against GES. Here we present a unique time-series on winter zooplankton size, abundance and taxonomic composition sampled on the ICES International herring larvae survey station grid in the Eastern English Channel using modified GULF III samplers. Covering the period 1988 to 2014, we analysed zooplankton with an automatic system, i.e. ZooScan, and followed patterns in taxonomic and size diversity over time. Together with the normalized biomass size spectrum (NBSS) our results present new insights into potential environmental and trophic interactions in an important spawning area of commercial fish stocks. Our results suggest that the combination of size diversity and NBSS are suitable indicators for productivity, mortality and the energy flow through the ecosystem. They may further serve as indicators for zooplanktonic prey biomass available to fish larvae and hence reflect recruitment potential. In conclusion, even though taxonomic diversity is crucial to describe GES, size diversity and NBSS can serve as additional descriptors for ecosystem functioning and thus may be integrated into an GES approach.

Keywords: Size diversity, Biodiversity, Normalized biomass size-spectrum, Zooscan, Long-term timeseries analysis

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