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# The role of zooplankton as central trophic level in the "wintery" English Channel: environmental drivers, size and herring larvae from 1988 to 2016

Dudeck, Tim, Rohlf, Norbert, Möllmann, Christian and Hufnagl, Marc

Zooplankton forms the key linkage between primary production and upper trophic levels. Energy flow through zooplankton strongly depends on size as often relatively fixed predator-prey size relations can be observed. Understanding the factors influencing secondary production are therefore crucial for understanding marine ecosystem functioning, foodweb dynamics and energy flows. Here we present a new zooplankton timeseries resolving size and species composition and contrast it to historic dynamics of various ecosystem levels including: hydrographic conditions, primary production and herring larvae dynamics representing predation effects. All time-series span the period 1988 - 2016 and were collected in the eastern English Channel during winter. Early life stages of fish are often influenced by bottom-up effects like match-mismatch events. These do not necessary only include abundance, but also the fact that the right "sized" food needs to be available at the right time. In our study we found that warming trends in sea surface temperature in this region are accompanied by, and possibly causing, a decrease in overall zooplankton size. Accompanied with this decrease herring recruitment varied and we show potential causalities between the recruitment variability and bottom-up effects. Vice versa we also focused on the predation pressure induced on zooplankton by herring by investigating the size composition of zooplankton using normalized biomass size spectra. By summarizing the results we highlight the simple integration of size as a measure of trophic energy flow, which in future investigations shall initiate numerical models of energy flow from algae through zooplankton towards higher trophic levels like fish.

**Keywords:** Size-spectrum, English Channel, Herring larvae, Long-term timeseries analysis, Bottom-up effects

**Contact author:** Tim Dudeck, Institute for Hydrobiology and Fisheries Science, University of Hamburg, Olbersweg 24, 22767 Hamburg, Germany, Tel.: +49 40428386625, tim.dudeck@uni-hamburg.de