Recent change in the long-term dynamics of copepods influence the pelagic food web structure in the Gulf of Riga

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BACKGROUND

Copepods are functionally significant organisms in the Gulf of Riga as they provide the basic linkage between the autotrophs and the main plankton eater – herring Clupea harengus. In the result of the other research, it was determined that the long-term dynamics of copepod Eurytemora affinis – the main prey species for herring – is mostly regulated by the water temperature and the predators. The large copepod Limnocalanus macrurus are regarded as the high-energy food item for planktivorous fish, but in the 1990s, the species almost disappeared from the Gulf of Riga. The increase of biomass could only be observed in the last decade. Some recent studies suggested that the species probably is the preferred food item for planktivorous fish (Livdāne et al. 2016). However, the main regulating factors of L. macrurus dynamics still remain unclear.

CONCLUSIONS

✓ The significant changes in the zooplankton cenosis in past 25 years have been observed in the Gulf of Riga: the biomass of E. affinis decreased, but L. macrurus increased. The observed changes in the composition and biomass have been accompanied by an increase in mean copepod weight and the changes probably imply increased prey quality for planktivorous fish.
✓ The multiple linear regression analysis revealed that 1-year-old herring was the main factor influencing the biomass of both copepods in the spring.
✓ The study also suggested that the changes in copepod structure probably could make an impact on the survivor and growth of herring larvae in the spring, which should be taken into account, for example, when forecasting herring recruitment dynamics.

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REFERENCES


Do the changes in copepod biomass has affected the copepod mean individual weight?

How copepod biomass could influence the year-class herring biomass in the successive year?

MATERIAL AND METHODS

✓ To identify recent changes in the long-term copepod biomass dynamics in the Gulf of Riga, we used May data from 1990 till 2014, which were obtained from the research institute’s BIOR database, but herring biomass data were derived from the Gulf of Riga herring stock assessment (ICES 2015).
✓ Monotonic changes in copepod long-term dynamics were determined by performing the non-parametric Mann-Kendall test.
✓ In order to identify shifts in mean biomass of copepods, we performed analysis using “changepoint” package (Klink and Eckley 2014) in R software version 3.1.3. In addition, we performed a Wilcoxon test to obtain p-values, which would describe the statistical significance of the shifts.
✓ To ascertain the effect of various factors (e.g. water temperature, salinity, oxygen, 1-year-old herring, 2.8-year-old herring) on the dynamics of copepod species, we performed multiple linear regression analysis, which included the above-mentioned factors and the year of the changes.
✓ In order to specify the structural changes in copepod community and food web, we analysed the dynamics of mean individual weight (B/N) and determined the possible predator-prey interactions using linear regression analyses in different time periods.