



The variable trophic level of marine copepods: implications for energy transfer in food-webs and top-down control of phytoplankton

U. Sommer

Leibniz-Institute for Marine Sciences at Kiel University, Düsternbrooker Weg 20, 24105 Kiel, Germany

(usommer@ifm-geomar.de / Fax: +49 431-6004402 / Phone: +49 431-6004400)

Contrary to traditional assumptions, marine calanoid copepods are not pure herbivores, but feed both on phytoplankton and microzooplankton, particularly protozoa. In addition to species specific preferences for motile or immotile prey, feeding choice of copepods is primarily determined by the microbial size spectrum. If phytoplankton biomass is dominated by species $>10 \mu\text{m}$, most calanoid copepods feed on phytoplankton, thus occupying trophic level 2. If phytoplankton is dominated by smaller species, most copepods feed primarily on protozoa, thus occupying trophic level 3 or even higher. Because of dependence of phytoplankton size structure on nutrient supply (absolute nutrient levels, Si:N-ratio) the copepod trophic levels should differ systematically between different marine environments (e.g. upwelling, coastal eutrophication, open ocean).

Copepods being the most important food for planktivorous fish, the trophic level of copepods must have strong impact on the energy transfer from primary production to fish production. The increased energy losses by an additional trophic link might be to some extent counter-balanced by “trophic upgrading”, i.e. by protozoa being better copepod food than algae. However, an increase of ecological efficiency from ca. 10% to ca. 30% would be needed to compensate for an additional trophic level.

The variable trophic level of copepods also influences their top-down impact on phytoplankton. While phytoplankton $>10 \mu\text{m}$ can be decimated by copepod grazing, phytoplankton $<10 \mu\text{m}$ can be released from grazing by protozoans and thus increase in

biomass. The total response of phytoplankton biomass can be quite unpredictable if size structure and intermediate consumers are not taken into consideration.