Copepod guts, a new world in marine sediments?

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Copepods are abundant in the marine ecosystem and are considered microbial hotspots in the ocean, with bacteria residing both on their chitin exoskeleton and in their body cavities and intestinal tract. Especially in the gut canal, bacteria can perform important roles. Copepods have a simple digestive tract with fast egestion, causing a major fraction of the food to pass through the gut incompletely digested. Therefore copepods also show coprophagy, the breaking apart and reingestion of formed fecal pellets. This reingestion accounts for further metabolization of food particles, with microbial assisted degradation of fecal pellets potentially playing an important nutritional role. Copepods are even suggested to maintain a 'microbial garden' with the egestion and reingestion of their fecal matter. The guts of pelagic copepods have been studied and are considered a selective microhabitat in the open ocean. Bacteria of benthic copepods and their gut community were undescribed and studied for the first time here.

The benthic copepod *Platychelipus littoralis* (Harpacticoida, Family Laophontidae), a key species in intertidal mudflats of North-West Europe, was characterized throughout a one year period (Aug 2022 - Sept 2023), during which it experienced strong temporal fluctuations. After a 24h starvation period, the gut was microdissected to obtain the residential gut community without presence of fecal pellets. Cell counts in the gut and community composition fluctuated strongly over the seasons. The gut community was significantly different from the sediment, indicating that the lower pH and lower oxygen availability in the gut formed a selective microhabitat. Water temperature and the copepod physiological state changed as well over the course of the year, with individuals being able to grow larger in summer, and contain more lipid reserves in winter. This indicated a change in the diet of the copepods but the variables could not be easily linked one-to-one with changes in the microbial community.

Next to the residential or fecal pellet free community, an additional 24h starvation period was included to study the reingestion of fecal matter. Core taxa were defined both for the residential microbiome and starved microbiome. Bacterial taxa, including the genus Colwellia, were increased in the gut or water surrounding the copepods with starvation. This indicated a microbial flux from the surrounding water or so-called ‘microbial garden’ towards the gut with a potential nutritional implication.

While it was already known for pelagic copepods that their guts were selective, the same seems to hold true for copepods living in sediments. This new microhabitat of copepod guts should be taken into account for ecological modelling of marine sediments and their microbial food web. Bacterial taxa were identified which have a potential role in microbial gardening but future studies are require to quantify the ecological relevance of this microbial flux in the bacteria rich sediment environment.

Keywords
Microbial food web; Copepods; Microbiome