Getting it together: Quantifying the trophic connections between micro- and mesozooplankton in marine food webs

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The trophic roles of microzooplankton (protist-dominated consumers <200 µm) and mesozooplankton (larger metazoan-dominated consumers) are typically associated with competing grazing impacts on phytoplankton that lead to dichotomous outcomes – remineralization within the euphotic zone *versus* efficient transfers to higher-level consumers and to export. For much of the oceans, however, secondary production is dominated by microzooplankton, which then comprise a major food resource for mesozooplankton rather than a remineralization dead end. Among other physiological and behavioral factors, order-of-magnitude variability in the strength of micro-to-meso trophic flows can realistically arise from temporal or regional differences in the proportions of phytoplankton production consumed directly by microzooplankton, the mean number of protistan steps between phyto- and mesozooplankton, or both. Quantifying the trophic connections between micro-mesozooplankton is therefore an area where focused efforts are needed from both classical and microbial food-web perspectives to resolve material and energy flows in the oceans. Here, we review current estimates of microzooplankton trophic flows to mesozooplankton based on direct feeding rate measurements and inverse methods from system-level process studies. We then assess the potential of recent developments in compound-specific isotopic analysis of amino acids (CSIA-AA) to provide species-specific estimates of zooplankton trophic position (TP) for seasonal comparisons within the same ecosystems, across ocean regions with different plankton community structures, or retrospectively across climate-change regimes from preserved historical collections. Lastly, we consider additional complications, such as mixotrophy, that might arise in interpretations of TP trends.