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Prey size diversity hinders biomass trophic transfer and predator size diversity promotes it in planktonic communities

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This research has been done combining ZooSCAN and FlowCAM individual size measurements. We examine how the size diversity of predators (mesozooplankton except carnivores) and prey (nano-microplankton) influence trophic transfer efficiency (using biomass ratio as proxy) in natural marine ecosystems. Our results support previous studies on single trophic levels: transfer efficiency decreases with increasing prey size diversity and is enhanced with greater predator size diversity. We further show that communities with low nano-microplankton size diversity and high mesozooplankton size diversity tend to occur in warmer environments with low nutrient concentrations, thus promoting trophic transfer to higher trophic levels in those conditions. Moreover, we reveal an interactive effect of predator and prey size diversities: the positive effect of predator size diversity becomes influential when prey size diversity is high. Mechanistically, the negative effect of prey size diversity on trophic transfer may be explained by unicellular size-based metabolic constraints as well as trade-offs between growth and predation avoidance with size, whereas increasing predator size diversity may enhance diet niche partition and thus promote trophic transfer. These findings provide insight into size-based theories of ecosystem functioning, with implications for ecosystem predictive models.

Keywords: size diversity, biodiversity-ecosystem functioning, trophic transfer efficiency, FlowCAM, ZooSCAN

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