Seasonal succession in zooplankton feeding traits reveals trophic trait coupling

The seasonal forcing of pelagic communities invokes a succession of the dominant phytoplankton and zooplankton species. Here, we characterize the seasonal succession of the plankton traits and their interactions using observations and model simulations of the plankton community in the western English Channel. We focus on activity traits that characterize the defensive and feeding abilities of zooplankton and distinguish between low risk, low return ambush feeders and high risk, high return feeding-current feeders. While the phytoplankton succession depends on traits related to nutrient acquisition and photosynthesis, it also depends on grazing which couples feeding and motility traits across trophic guilds. Despite interannual variations in the species dominating the protist plankton community, the seasonal trait distribution reveals robust and repeatable seasonal patterns, changing between non-motile cells flourishing in spring and motile community dominating during summer. The zooplankton community is dominated by active feeding-current feeders with peak biomass in the late spring declining during summer. The model reveals how zooplankton grazing reinforces protist plankton seasonal succession and shows how the physical environment controls the vertical structure of plankton communities, where ambush feeders exhibit a preference for greater depths during summer. We characterize the seasonal succession as trophic trait coupling and conjecture that this coupling leads to a trophic trait cascade where successive trophic levels alternate in their expression of activity traits further up in the food chain.

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