Trait composition of the plankton community across environmental gradients.

Andre W. Visser1, Kasia M. Kenitz1, Mark D. Ohman2, Ken H. Andersen1
1Centre for Ocean Life, DTU Aqua, Kemitorvet, Kgs. Lyngby, 2800, Denmark
2Scripps Institution of Oceanography, La Jolla, CA 92037, USA

Abstract

Contrasts in the community composition are usually attributed to differences in the underlying environment; however, predator-prey interactions often play an equally important role in structuring communities. Systematic differences observed between nutrient-rich and poor environments, cascade further up the food chain, which is particularly evident in planktonic systems. We analyse plankton communities across the California Current. Ecosystem which span multiple trophic levels, from bacteria to mesozooplankton, and experience contrasting nearshore and offshore differences. We focus on traits related to resource acquisition that affect predator-prey interactions. The level of biomass varies 5-fold across environmental regions, yet, size distributions remain similar. The relative trait distribution remains comparable across regions, with significant differences being confined to a small range of size or trait groups. Our trait-based analysis demonstrates that the relative trait distribution is remarkably conserved across the environmental gradient, even in the face of large differences in biomass.

Classifying ecosystem provinces in time and space

Random forest classifier based on T, S, O2 used to classify observations into 3 categories; Upwelling waters (UP), California Current (CC) and Open Ocean (OO).

Plankton Community Traits

Taxonomic groups classified according to activity level:

Mechanistic predator–prey coupling in activity traits

Active feeding mode (e.g. suspension feeding or cruising): relatively high cost and high risk but greater search volume.
Targets non-motile prey

Passive feeding mode (e.g. ambush): relatively low cost and low risk but rely on prey motility for encounters.
Targets motile prey

Hypothesis: resource acquisition along an active – passive axis will show distinct patterns in the dominant trophic trait alignment from nutrient rich upwelling regions to the oligotrophic open ocean.

Copepod community

Size distribution of copepod taxa grouped according to their dominant feeding strategy for Oceanic, California Current and Upwelling: a) cruise/feeding-current feeders (active), b) ambush feeders (passive) and c) marine snow/flux feeders (passive)

Conclusions

Comparable biomass distribution slope; 5 times higher biomass in the upwelling regions across community size classes.
Increase in proportion of autotrophic protists observed only for cells >10μm; constant proportion of mixotrophs across regions.
Passive feeding strategy of zooplankton favoured offshore.
Overall, the relative traits distribution is remarkably conserved across environmental gradient, even in the face of large differences in biomass.