

# Slow but surely might win the race: diverse phytoplankton communities preserve evenness better in a changing environment

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The ongoing global biodiversity decline might cause severe changes in marine food webs. Biodiversity increases the temporal stability of primary production through a variety of mechanisms that depend on the increased likelihood that some species can compensate for the functional loss of other species. Strong changes in community composition in response to an environmental change, however, may hamper the ability to stabilize community functions against future changes. More even communities (i.e. small differences in species relative abundances) provide the best insurance against environmental changes as they prevent low initial densities of species with favourable traits. Biodiversity increases the temporal stability of community functions mainly by increasing resistance (i.e. reducing the change in primary production), rather than by increasing resilience (i.e. the speed of recovery). Ecological theory suggests that biodiversity can also increase the resistance of the community composition. More diverse communities are more likely to contain more species that are resistant to environmental changes. Hence, fewer changes in community composition should be required to compensate for the loss of function by sensitive species. Despite the tight link between community composition and the ability to stabilize future environmental changes, the effect of diversity on the resistance and resilience of the community composition has not been empirically tested.

Here, we tested if diversity-dependent compositional changes determine the temporal stability of a community function (productivity) against an environmental stressor. We exposed North Sea diatom communities, spanning 5 levels of species richness (1, 2, 4, 6 and 8 species), to 3 concentrations of a herbicide (0.25 and 250  $\mu\text{g L}^{-1}$  atrazine) for 4 weeks, after which they were transferred to atrazine-free growth medium for 3 more weeks. Productivity and community composition was less affected by atrazine in more diverse communities. After stress removal, less diverse communities recovered faster and approach control communities in both function and composition. Biodiversity thus increased the resistance, but decreased the resilience of the community function and composition. More diverse communities were less resilient because community dynamics were slowed down by the increased amount of species interactions. Because species competitive abilities covaried with the environment, slower dynamics reduced competitive replacement, which increased community evenness in a changing environment. Biodiversity thus not only stabilized productivity against the current environmental changes but also promoted the ability to stabilize future environmental changes.

## References

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Keywords: phytoplankton; biodiversity; stability; stress