Interaction between chemical stress and dispersal in marine phytoplankton communities

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Recent reports on the fast decline of biodiversity (Pimm *et al.,*, 2014) has resulted in a growing concern about the effects of biodiversity (B) loss on ecosystem functioning (EF) in a field called B-EF science (Cardinale *et al.,* 2012). Although phytoplankton communities are the main primary producers in the oceans and contribute to more than 40% of the world's primary production (Field *et al.,* 1998), the relationship between biodiversity and ecosystem functioning has to date barely been unexplored in marine phytoplankton. The data typically used in B-EF science, based on experiments with terrestrial plant communities, translate poorly to the case of marine phytoplankton because their shorter generation times and higher dispersal rates make marine primary communities more dynamic than terrestrial ones (Giller *et al.,* 2004, Gross *et al.,* 2014). Furthermore, it has been shown that also environmental conditions determine final community composition (e.g. de Boer *et al.,* 2014). To evaluate the effect of dispersal and atrazine (as environmental stressor), 5 different communities of 4 marine diatom species (Bacillariophycaceae) were exposed to three levels of stress (0, 25 and 250 ppb atrazine) and three levels of dispersal (no, low and high). Each treatment was replicated 3 times, resulting in 135 communities. Dispersal was performed by adding a fixed volume of 4 different species to the community once (low) or twice (high) a week from a species pool of 12 species. Dispersal had a negative effect on the biovolume of the communities. However, at high stress, there was a positive interaction effect between atrazine and dispersal on biovolume. This positive interaction effect was larger than the negative effect of dispersal. Hence, interactions between dispersal and the toxicant by far compensated the dispersal-induced biovolume loss. Dispersal had a negative effect on evenness in communities. However, the mechanism causing this negative effect was different between low and high stress levels. At no and low stress levels, newly arriving species barely contributed to biomass production. Indeed, community composition at the end of the experiment was dominated (average 94%) by species initially present in the community. Thus, newly arriving species were not able to colonize and grow, because of the high biovolume of resident species and high competition. At high stress levels, the dominance of resident species decreased. Only species which were tolerant to the toxicant were able to grow. Such communities were more prone to colonization and had often a very different community composition compared to the non-dispersed communities. This research implies that communities which are affected by stress are invaded more easily.

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