
The environmental filter causing local scale heterogeneity of marine communities – a reciprocal transplant approach

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Abstract

Urban structures are becoming common around our coastlines, with hard engineering dominating as much as 50% of coasts in some parts of the world. Refuges for boating activities like harbours and marinas are often highly contaminated environments and are known hotspots for invasive species. Previously we have demonstrated that within these habitats, local scale heterogeneity of contaminants is responsible for structuring communities. As such, we hypothesised that the environmental filter is acting to regulate communities, and therefore the presence of invasive species. In these locations, areas furthest from the entrance are likely to be the most contaminated and therefore only habitable to the most resistant species. It is widely theorised that invasive species are more tolerant to a wider range of conditions than equivalent native species, thus enabling them to survive transport and become successful invaders. Through measurement and analysis of community, respiration and the metabolome of selected key species, we investigated the tolerances and the implications of the environmental filter in structuring marine fouling communities. Using a reciprocal transplant approach within Brest, France, settlement panels were deployed at and transplanted among 3 distinct regions of the Chateau Marina. Regions were dictated according to the distance from the single entrance of the marina, corresponding to sampling points closest to and furthest from the entrance, and a midpoint. Previous studies have shown significant differences between these regions in terms of pollution (e.g. heavy metals, pesticides) and community. Further tolerance experiments on dominant ascidians were conducted to determine if invasive species were more tolerant than comparable native species to common stressors. Through this approach we discovered that, at this local scale, the environmental filter is prevalent in acting to shape communities and metabolome, however, evidence also suggests that prior colonisation history within localities is also a determining factor relevant to future colonisation.

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