Unravelling the responses of shallow soft sediment assemblages to rapid glacier retreat in an Antarctic fjord: assemblage structure and trophic interactions

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The West Antarctic Peninsula (WAP) is one of the fastest warming regions on Earth and it is characterized by the presence of a high number of fjords, known to be hotspots of marine biodiversity. Recent observations on the WAP have documented the rapid retreat of many tidewater glaciers whose related calving events lead to more frequent iceberg scouring in the shallow waters, coupled to increased fresh water input and higher sediment loads. All these disturbances are known to affect the marine assemblages in the shallow coastal regions. At the same time, ice retreat may free areas of the marine realm which can in time see the establishment of new local benthic assemblages via colonization and successional processes. We investigated three size classes of the soft sediment benthos (microbenthos, meiofauna and macrofauna) at three sites within Potter Cove (King George Island, WAP) which differed in the glacier retreat-related disturbance regimes and had different ice-free age status. We carried a two-fold investigation integrating assemblage structure observations (e.g. standing stocks) to the more functional aspects of the biota such as the trophic relationships within the assemblages. Our results revealed the presence of a patchy distribution of highly divergent benthic assemblages within a relatively small area (about 1 km2). The three benthic size classes appeared to respond in different ways to the disturbances, suggesting that the capacity to adapt and colonize habitats is dependent on both body size and specific life traits. In a similar fashion, the isotopic niches (an extrapolation of the ecological niche into the isotopic biplot space formed by the δ13C and δ15N natural signatures of the organisms) of the assemblages were locally shaped by the different degrees of glacier retreat-related disturbance. Wider isotopic niche widths were found at the site that had an intermediate ice-free age, whereas they were comparable for the older and the newly ice-free sites. In general ice scour and glacial impact appeared to play a two-fold role within the Cove: i) either stimulating trophic diversity by allowing continuous re-colonization of meiofaunal species or, ii) over time driving the benthic assemblages into a more compact trophic structure with increased connectedness and resource recycling. Finally, we predict that, under continued deglaciation, more diverse, but less patchy, benthic assemblages will become established in areas free from glacier-related disturbance, with a general trend leading to the homogenization of the diversity/trophic pool to be found at these shallow depths.