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Two of the main challenges facing the marine and terrestrial biosphere in the next decades are biodiversity and climate change. Both have received intensive scientific and societal attention over the last years and an extensive literature now exists addressing the main observations, models, consequences and mitigation and adaptation strategies. In the marine environment changing patterns of temperature, currents, global weather patterns and so on are now well understood and predictability of their future change has increased substantially, with less but still large uncertainty. At the same time it is recognized that besides indirect impacts from climate change also direct human impacts extend far beyond coastal areas and now cover large parts of the oceans. These impacts through fisheries, transport, pollution, acidification and so on will also change with the changing climate and the very rapid and important developments in the socio-economic environment of the last decade: the increasing wealth and consequent increased ecological footprints of newly industrialized nations, with different cultural backgrounds and life styles, the changing maritime transport due to the melting of the arctic ocean ice in Summer and the enlargement of the Panama canal, the increased exploration of deeper waters for living marine resources, oil, gas and perhaps gas hydrates in the future, blue biotechnology and so on.

02.02

Benthic biodiversity of the Southern Bight of the North Sea

Merckx B, Van Meirvenne M, Van Hoey G, Speybroeck J, Willems W, Duineveld G, Steyaert M, Degraer S, Vanreusel A, Vincx M, Vanaverbeke J

Over the last decades a huge amount of data has been collected about the macro- & meiobenthic communities of the Southern Bight of the North Sea. The macrobenthic community is a well known and a frequently sampled community with an average species diversity of about 12 species per sample, while the more diverse meiobenthic nematode community (28 species per 10 cm²) is sampled less frequently. Based on this historical data and area covering environmental data such as sediment characteristics and sea surface primary productivity, predictive maps were created for the nematode and macrobenthic biodiversity. Different modeling techniques, biodiversity indices and their predictability were investigated. Predictions were optimized through geostatistical methods such as variogram modeling to increase the precision of the modeled maps. These maps can be used in the future for management purposes to protect areas with a high benthic diversity.

Biodiversity on Baltic Sea rocky bottoms are linked to habitat structure and heterogeneity

Koivisto M, Westerbom M

Dense mussel beds commonly contribute to spatial heterogeneity for associated organisms and thereby create a biotic patchiness of communities. The objective of this study was to evaluate the effects of blue mussel patch structure and heterogeneity on the species diversity on hard bottoms in the northern Baltic Sea and to test whether the fauna found within blue mussel patches differ from other typical hard bottom habitats such as bladderwrack and bare rock habitats. It was hypothesized that differences in habitat structure and heterogeneity cause shifts in the macroinvertebrate communities. In order to test this hypothesis, eight different artificial patch units were experimentally constructed under water and placed in a randomized block design. The patches were left open for colonization during three months. The patches included mussels of different size structure, mussel patches with different patch sizes, mussels combined with the algae *Fucus vesiculosus*, mussels combined with artificial algae, patches with only algal structures and bare rock patches. The habitats containing both *Fucus* and mussels generated the highest species diversity parameters thus showing that the structurally most complex patches harbor a more diverse fauna than the structurally less complex habitats. A higher diversity was also generated by bigger patch size and mussel shell size. The presence of mussels changed species dominance patterns by facilitating "soft bottom" species such as polychaetes, clams and hydrobids and suppressing spatial dominance of some mobile herbivores that were more common in the *Fucus* patches. This study demonstrates that blue mussel patches constitute one of the most diverse biological hot spots in the northern Baltic Sea and that their fauna significantly differs from other typical hard bottom habitats. Even small changes in the shell size, patch size, and interactivity with algae can cause shifts in the faunal communities found within blue mussel habitats.

02.04

Microhabitat provision influences small-scale patterns of distribution of *Patella candei gomesii* Drouët (Mollusca: Patellidae)

Martins GM, Thompson RC, Neto AI, Hawkins SJ, Jenkins SR

Arguably, the largest anthropogenic impact on the Azorean coasts is the exploitation of keystone patellid limpets. The limpet fishery, once the 6th most important in the Azores, reached its peak in 1984 and collapsed shortly after in 1988. Despite its economical and social importance, the processes that influence the population structure of patellid limpets in these islands are virtually unknown. Here we used observational and experimental approaches to examine the influence of microhabitats in determining small-scale patterns of limpet distribution. The hypothesis that limpets are significantly associated with microhabitats was retained and this pattern was consistent over its vertical distribution. Limpets on open rock were larger and experienced increased mortality than those inhabiting microhabitats. In addition, limpet recruitment increased with the abundance of experimental pits added to the surface of a coastal defence structure and there was considerable immigration of larger animals into the larger experimental pits indicating that microhabitat provision may be a limiting factor for the

larger size-classes. This study shows the importance of microhabitat in the small-scale distribution of *Patella candei*. Fundamental understanding of the ecology of targeted species may inform the debate of management of coastal resources. Our data suggest that the provision of experimental microhabitats may be used to mitigate the impacts of limpet harvesting and coastal urbanisation.

02.05

Benthic invertebrates communities: relationship between structure and barren type of habitat

Ortega L, Tuya F, Haroun R

In the coastal areas of the Canary Islands (Central-East Atlantic Ocean), the shallow rocky bottoms are characterized by large populations of the sea urchin *Diadema* aff. *antillarum*. The expansion of this sea urchin during the last decades is related to human pressure. In this contribution we investigated the gradient of benthic communities structure in relation to sea urchin densities along the East - West oceanographic gradient of the archipelago. The nested sampling was carried on the 7 main islands as well as in La Graciosa Islet. In each island, 3 locations were selected, 10s of km apart and in each location 2 sites separated by 10s of m were sampled between 5 - 18 m depth. The abundances of benthic invertebrates were quantified in situ by SCUBA divers in 8 replicate 2 x 2 m quadrats. The size class of *D. antillarum* population was also annotated. We describe the structure of the two major benthic invertebrates morphotypes (Holothurians and the decapod *Stenorhynchus lanceolatus*) in relation to different types of habitats dominated by sea urchin *D. antillarum*. Islands with strong overfishing activities shows a invertebrate communities dominated by *D. aff. antillarum*, while other islands or MPAs with much lower fishing pressure showed a more diverse benthic invertebrate communities.

02.06

Abundance of the common sea star *Echinaster sepositus* and the organization of shallow rocky communities

Villamor AJ; Villamor AJ, Becerro MA

The mechanisms that generate and maintain ecological diversity remain to be fully understood. Habitat heterogeneity is known to increase the number of niches, resulting in a greater number of species. Habitat heterogeneity is also associated with large areas, where the diversity of environmental variables creates multiple opportunities for a variety of species while, comparatively, studies restricted to small scales assume larger habitat homogeneity. This study investigated the abundance and distribution of the common Mediterranean sea star *Echinaster sepositus* (Retzius, 1783) as a function of multiple biotic and abiotic habitat traits. We aimed at understanding the factors behind the natural variation in population density observed for this species on otherwise apparently similar shallow rocky bottoms in the northwestern Mediterranean. Overall, we found that the biotic community varied little between locations and that this variation was unrelated to changes in the abiotic variables. *Echinaster sepositus* was correlated with substrate slope but the abundance of this sea star was better explained by the remaining

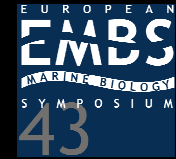
biotic variables. Community organization varied significantly between locations with high and low abundance of *E. sepositus* and herbivorous invertebrates and fishes were the main contributors. Multiple regression also showed that crustose coralline algae (CCA) had a strong positive relationship with the abundance of *E. sepositus*. This study suggests that small-scale heterogeneity driven by biotic interactions may help explain the distribution and abundance of species, and play a major role in understanding the mechanisms that generate and maintain biodiversity.

02.07

Scale dependent effects of the suspension feeding mussel *Mytilus trossulus* on macroalgal and associated invertebrate assemblages

Kotta J, Herkül K, Kotta I, Orav-Kotta H, Lauringson V

The importance of suspension feeding mussels is particularly apparent in benthic marine communities, however, the role of this feeding strategy on the development of macroalgal assemblages is in general poorly known. The effect of suspension feeding mussels *Mytilus trossulus* on benthic communities was studied in an in situ factorial field mesocosm experiment in the northern Baltic Sea during one annual succession. The experiment was replicated at 10 cm and 1 m spatial scales. At the smaller spatial scale the experiment was performed under different regimes of exposure (low and high) and on different sediment types (soft bottom with high organic content, soft bottom with low organic content and hard bottom). At larger spatial scale exposure level was high and bottom substrate consisted of the mixture of soft and hard sediment. At smaller spatial scale mussels affected significantly the biomass structure of macrophytes and associated invertebrates. However, the effect of *M. trossulus* was less consistent than the effects of exposure and sediment type as the direction and magnitude of effects varied among organism groups. Nevertheless, *M. trossulus* clearly increased the biomass of macroalgal species at the earlier stages of annual succession. *M. trossulus* also increased the biomass of herbivores and reduced the biomass of macroalgal species at the later stages of annual succession. In addition *M. trossulus* increased the biomass of some deposit feeders and carnivores, though, these effects were less consistent compared to those on macroalgae and herbivores. At larger spatial scale *M. trossulus* had no effect on macroalgal assemblages and herbivores. The presence of *M. trossulus* increased the biomass of deposit-feeders and reduced the biomass of other suspension feeders in summer but not in autumn. The results suggest that (1) even in dynamic coastal systems the biodeposits and excrets of mussels are at least partly used locally and are not flushed away to the open sea, (2) mussels enhance the growth of macrovegetation, (3) the fast growing filamentous algae are favoured owing to their higher competitiveness at higher nutrient concentrations, (4) together with rising benthic primary production mussels increase indirectly the production of herbivores, (5) and release deposit feeders from the food limitation otherwise common in the coastal marine ecosystems.



Microhabitat provision influences small-scale patterns of distribution of *Patella candei*

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