

The effect of macrofaunal functional diversity on density and diversity of nitrifying and denitrifying organisms

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Nitrification, the oxidation of ammonia to nitrate via nitrite, is central to the cycling of nitrogen in the environment and, when coupled with denitrification, alleviates the effects of eutrophication through removal of nitrogen to the atmosphere as nitrous oxide or dinitrogen gas. Coupled nitrification/denitrification constitutes an important aspect of marine benthic ecosystem processes. It has been well-known that microbial nitrifiers and denitrifiers play a central role in nitrogen cycling in coastal and estuarine systems. They often interact in close proximity in the environment. Interaction between them is often mediated across oxic/anoxic interfaces and involves the diffusion of substrates and products along concentration gradients over scales ranging from micrometers to meters.

The aim of the present study was to investigate how macrofaunal functional diversity directly affects the benthic environment, and how this cascades in the abundance and composition of benthic microbial communities involved in nitrification and denitrification. In other words, we investigate how presence and functional diversity of macrofaunal organisms, ecosystem functioning rates, and abundance and activity of microbial communities are related.

To gain to this aim, we focused on the tube dwelling polychaete, *Lanice conchilega*. This ecosystem engineer affects on nitrification/denitrification processes due to its irrigation activity.

Sediment was collected from the fine sandy coastal Stn 115bis (51° 09.2' N, 02° 37.2' E; 13m depth) in the Western Coastal Banks area in October 2012. To have enough alive and active animals, *L. conchilega* was collected from the intertidal zone by cores. Animals were introduced in 6 aquaria (2 animals per aquarium) in their natural sediment with a continuous supply of fresh oxygenated seawater. Three defaunated aquaria were served as control treatments.

More than 2wk after introducing the organisms, oxygen concentration was measured in vertical profiles at different distances away from the polychaete. In addition, oxygen concentration was measured for 30 minutes, at two depths in the sediment and at different distances from the polychaete. This allowed for assessing temporal fluctuations in sediment oxygen concentrations. Vertical profiles of nutrient concentrations (NO_3^- , NO_2^- , PO_4^{3-} , NH_4^+) were sampled using Rhizon samplers, at different distances away from *L. conchilega* tube. At the end of the experiment, sediment samples from different sediment depth were collected to quantify nitrifying organisms (ammonia oxidizing bacteria and archaea) and denitrifying organisms through their functional genes by real-time PCR (qPCR). This will allow for quantity study of nitrifiers and denitrifiers and link them with changes in measured environmental variables due to irrigation activity in *L. conchilega*.

References

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