

Interactive comment on “Effects of natural and human-induced hypoxia on coastal benthos” by L. A. Levin et al.

Anonymous Referee #1

Received and published: 11 May 2009

The scales in which dissolved oxygen deficiency affects aquatic systems, range from immense regions of the ocean (e.g. oxygen minimum zones) to small enclosed water parcels. The causes of this low oxygen concentrations are varied, but in general resulting from a complex combination of factors. Dissolved oxygen availability is a key factor determining the quantity and quality of habitat available to those organisms that depend on aerobic respiration, and significantly impacts physiological processes in organisms that are naturally able to utilize oxygen depleted waters. In this way, a peculiarity of the benthic biota thriving in these settings is sometimes indicated by the presence of an important prokaryotic community, mostly composed of the filamentous, gliding bacteria. The metazoan fauna is in general small and dominated both in biomass and abundance by few species (e.g. nematodes, polychaetes), while other groups like mollusks, crustaceans and cnidarians are in general unusual. Most of the more abundant

C383

species are well adapted to cope with oxygen-deficient conditions, by having different physiological (e.g. enzymatic mechanisms related with anaerobic pathways) and morphological characteristics (e.g. enhanced surfaces used for gas-exchange). Global change implies a warmer ocean, which is more stratified, holds less oxygen, and may experience greater advection of oxygen poor source waters, making new regions subject to hypoxia. This work is a thorough and well written review of the effects of natural and human-induced low dissolved oxygen on benthic systems. It is mostly oriented to improve our understanding about the response of benthic systems to hypoxia, in the context of global climate change and other human influences such as overfishing, pollution, disease, habitat loss, and species invasions.

An interesting suite of “case studies” is presented covering an extensive range of environments from those in which hypoxia has been a typical feature (even on geological scales) to those in which is of recent appearance, and in the later mostly ascribed to anthropogenic effects. Consequences of low oxygen concentrations include not only direct effects, but also a series of indirect effects mediated through changes in organism abundances, functional diversity, their distributions, trophic interactions, and ultimately their links with the fisheries. In the same way, a comprehensive review of general and threshold responses to hypoxia of benthic organisms (from macrobacteria to megafauna and fishes) is included, as well as the patterns of the recovery process when oxygen deficiency ceases.

In summary a quality work, written by authors with a proven expertise in the topic, for which I recommend publication in Biogeosciences almost as it is.

Just a short comment; considering that sulfide is toxic to metazoans and that filamentous bacteria oxydize it, it is quite logic to think that mats could constitute a detoxified microhabitat for eukaryotic benthic communities. This is affirmed in the abstract (pp 3565 line 11), but, as further discussed later on in the text, this is just a hypothesis (so I suggest to clearly state this consistently in the abstract). This hypothesis has been postulated by Gallardo (1994, 1996) based mainly in observations of heavy recruit-

C384

ment of the squat lobster *Pleuroncodes monodon* during the period when *Thioploca* mats were best developed on the central Chile shelf (Gallardo et al., 1994). However, since *P. monodon* is able to cope with hypoxic, even anoxic conditions, it is even possible that the co-occurrence is not related to any facilitating mechanism, or at least not related to the “detoxifying” characteristic of the bacterial mats. In conclusion, as far as I know this statement is still in the “hypothesis” status and no data gathered so far has been able to explain the relationship convincingly. Indeed, further research is needed to elucidate the ecological role of these interesting bacterial communities.

Interactive comment on Biogeosciences Discuss., 6, 3563, 2009.