



Oxygen minimum zone influence on benthos: boundary effects, thresholds and bioturbation.

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Oxygen minimum zones (OMZs; < 0.5 ml/l) impinge upon the continental margins at mid-slope depths (100-1000 m) along much of the Eastern Pacific and Arabian Sea, creating over 1 million km² of naturally hypoxic seafloor. Processes at OMZ boundaries, where the strong oxygen gradients that occur over short distances can offer tremendous insight into how oxygen regulates the structure of animal communities and their influence on carbon cycling. Upper OMZ boundaries are often unstable; this causes significant fluctuation in animal communities and benthic processes. On the Peru-Chile margin, ENSO and seasonality shift upper OMZ boundaries across the shelf (by up to 100 m) with resulting changes in sulfur bacterial production, infauna and bioturbation. On the Pakistan (Indus) margin, monsoon-related seasonality may also alter the position of the upper boundary, with resulting shifts from metazoan to protozoan dominance. Lower OMZ boundaries are more stable and oxygen gradients are more gradual, allowing the study of threshold responses. OMZs worldwide exhibit exceptionally high macrofaunal and megafaunal biomass and moderate to low diversity at lower boundaries. Major shifts in macrofaunal presence, taxonomic composition and bioturbation levels are often observed at oxygen concentrations between 0.1 and 0.3 ml/l. High-resolution sampling (every 50 m) of the lower OMZ on the Indus margin reveals a transition from laminated sediments devoid of most macrofauna at 700 m (0.11 ml/l), to a low-diversity, high-density assemblage at 800-900 m (0.12-0.15 ml/l), to a more diverse, bioturbating community at 950-1000 m (0.15-0.22 ml/l). Further study of the complicated interplay of oxygen, organic matter degradation, infaunal communities and their activities at OMZs can yield valuable insight into the ecosystem-level consequences of hypoxia on the ocean floor.