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TITLE: Living in suboxia: Ecology of an Arabian Sea oxygen minimum zone copepod

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ABSTRACT:

Oxygen minimum zones (OMZs) are permanent suboxic features of the oceanic water column that strongly influence zooplankton distributions and biogeochemical cycles. The lower interface of prominent OMZs is characterized by a subsurface zooplankton biomass peak and high biological activity. The calanoid copepod Lucicutia grandis is an indicator species for this habitat. Its ecology in the Arabian Sea was studied during the U.S. Joint Global Ocean Flux Study (JGOFS) program to understand planktonic distributional and developmental adaptations to oxygen gradients in suboxic environments and the role of the OMZ zooplankton in food webs, vertical flux processes, and carbon cycles. Zooplankton samples were obtained in vertically stratified multiple opening?closing net and environmental sensing system (MOCNESS) tows to 1,000 m during four seasonal cruises. The vertical distribution of L. grandis was associated with the steep oxygen gradient from 0.07 to 0.15 ml L ?1 at the base of the OMZ about 600?1,000 m. There was a clear progression with age of the depths and oxygen levels inhabited by different developmental stages within this zone, a phenomenon attributed to both physiological constraints and ecological interactions. The seasonal and spatial pattern of reproduction and development was keyed in part to the seasonal monsoon cycle, with final maturation of young stages into reproducing adults probably triggered by the direct and indirect effects of the seasonal or episodic input to depth of sinking particles. Gut contents included surface flux material, deep?sea detrital material, zooplankton remains, and deep?sea aggregate material, indicating that L. grandis occupies at least four different trophic levels. This was an active, not a diapausing, population, since both adults and immature stages fed and reproduced during all seasons. In contrast to the pelagic fauna that are severely impacted by coastal episodic hypoxia, the animals of the oceanic OMZ are uniquely adapted to the very low oxygen and strong spatial and temporal patterns of this widespread suboxic environment.

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