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TITLE: Zooplankton in the eastern tropical north Pacific: Boundary effects of oxygen minimum zone expansion

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ABSTRACT:

Oxygen minimum zones (OMZs) may be expanding in their worldwide spatial and vertical extent as a result of global climate change. Here, we highlight structural and functional features of pelagic OMZ zooplankton communities, especially the little known mesopelagic lower oxycline zooplankton assemblage in the eastern tropical north Pacific (ETNP). Day and night vertically-stratified zooplankton samples were collected with a MOCNESS plankton net system to depths of 1000 m during two cruises in 2007 and 2008 as part of the Eastern Tropical Pacific Project. Size-fractionated biomass and selected species distributions were analyzed. A spatial comparison between two stations, Tehuantepec Bowl (TB) and Costa Rica Dome (CRD), with different OMZ thicknesses especially in 2008, was used as a proxy for future potential climate change to show how variability in oxycline depth at the upper and lower OMZ boundaries may have broad consequences for biological distributions and ecosystem function. The same zooplankton biomass features were present at both locations but responded differently to changes in OMZ thickness and boundary depths. The impact of habitat compression was quantified by the change in proportion of zooplankton biomass in the upper water column. The thermocline was the location of peak zooplankton biomass regardless of OMZ extent. At the lower oxycline, a unique zooplankton assemblage and secondary biomass peak (sharp order of magnitude jump from OMZ core biomass levels) occurred that was strongly associated with a specific oxygen concentration of 2 ?M. In 2008, the lower oxycline biomass peak deepened by over 200 m at TB with its expanded OMZ compared to CRD, despite a temperature difference of ?2 °C, while remaining at the same oxygen level. In contrast, another secondary biomass peak corresponding to the daytime depth of diel vertical migration, and occurring within the upper oxycline or OMZ core, was present at the same depth and temperature at both locations, despite different oxygen concentrations. A dense monospecific layer of the copepod *Eucalanus inermis* was sometimes present just above the distinctive more persistent lower oxycline assemblage. While the general ontogenetic migration of this species was previously known, its precise positioning relative to oxygen concentration and the lower oxycline community is a new finding. The vertical re-positioning of biomass layers at the thermocline and lower OMZ boundaries, and the increased depth range of low oxygen water that diel vertical migrators and sinking particles must transit in an expanded OMZ, could have widespread effects on species distributions, the biological pump, and benthic?pelagic coupling.

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