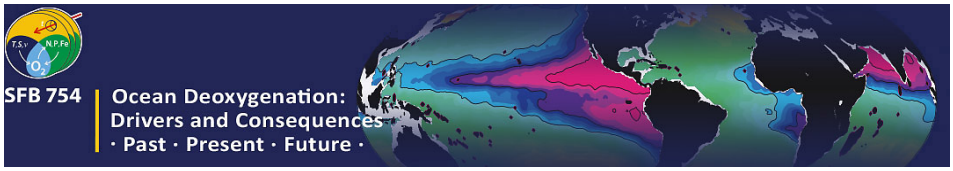

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Demersal fish communities across oxygen gradients: How multiple methodologies can offer unique insights into the ecological impacts of ocean deoxygenation

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Predicting the ecological impacts of deoxygenation for deep-sea communities on continental margins is challenging due to the difficulty of conducting community-level manipulative experiments in the deep sea. However, there is a pressing need to understand these impacts since oxygen is declining at midwater depths and continental margins are important habitats for demersal fish communities, including many fisheries species. Existing variability in the oxygen dynamics of continental margin ecosystems over spatial, vertical, and temporal scales, can be leveraged as natural experiments. In the Southern California Bight (SCB), strong vertical gradients in oxygen exist, due to the presence of an oxygen minimum zone between depths of ~450-1200 m. In this study, we utilize trawls, remotely operated vehicles (ROVs), and autonomous landers to study the effects of hypoxia on demersal fish community ecology in the SCB. Across temporal scales, oxygen exhibits diurnal, event-based, and seasonal variability off San Diego. We have developed a novel autonomous lander, *DOV BEEBE*, which is outfitted with environmental sensors, a camera system, and an acoustic release system. *BEEBE* has been deployed on the upper continental margin (100-400 m) off San Diego for 3-week periods, to characterize the natural variability of oxygen within the oxygen limiting zone and observe demersal fish community responses to existing oxygen variability. Utilizing ROVs and trawl samples, we have studied how fish community composition, density, and diversity change across oxygen gradients (100-1200 m), and have conducted stable isotope analysis to examine how trophic ecology differs in low oxygen environments. We find that changes in demersal fish community structure under low oxygen conditions are accompanied by trophic changes which include: enriched δ15N signatures, suggesting higher trophic position, a reduced trophic niche breadth for the fish community, and a shift from more specialist to more generalist diets. Based on gut content and stable isotope data for the fish community, we find that reliance on pelagic food sources decreases in low oxygen environments, suggesting that bentho-pelagic coupling may be disrupted in areas with oxygen minimum zones. Utilizing multiple methodologies in systems with strong natural gradients in oxygen provides insight into how deoxygenation may impact demersal fish communities in the future. We predict deoxygenation will reduce demersal fish diversity, lead to habitat loss for certain fisheries species, and alter density, composition, and trophic relationships. Autonomous landers can complement rarer ship-based sampling and can be a powerful tool for monitoring seafloor community responses to short- and long-term oxygen changes.

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