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TITLE: The effects of submarine canyons and the oxygen minimum zone on deep-sea fish assemblages off Hawai'i

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ABSTRACT:

Submarine canyons are reported to be sites of enhanced fish biomass and productivity on continental margins. However, little is known about the effects of canyons on fish biodiversity, in particular on oceanic islands, which are imbedded in regions of low productivity. Using submersibles and high-definition video surveys, we investigated demersal fish assemblages in two submarine canyons and slope areas off the island of Moloka'i, Hawai'i, at depths ranging from 314 to 1100 m. We addressed the interactions between the abundance, species richness and composition of the fish assemblage, and organic matter input and habitat heterogeneity, testing the hypotheses that heterogeneous bottom habitats and higher organic matter input in canyons enhance demersal fish abundance, and species density, richness and diversity, thereby driving differences in assemblage structure between canyons and slopes. Sediment type, substrate inclination, water-mass properties (temperature and dissolved oxygen) and organic matter input (modeled POC flux and percent detritus occurrence) were put into multivariate multiple regression models to identify potential drivers of fish assemblage structure. A total of 824 fish were recorded during ?13 h of video yielding 55 putative species. Macrouridae was the most diverse family with 13 species, followed by Congridae (5), Ophidiidae (4) and Halosauridae (3). Assemblage structure changed markedly with depth, with the most abrupt change in species composition occurring between the shallowest stratum (314?480 m) and intermediate and deep strata (571?719 m, 946?1100 m). Chlorophthalmus sp. dominated the shallow stratum, macrourids and synaphobranchid eels at intermediate depths, and halosaurs in the deepest stratum. Assemblages only differed significantly between canyon and slope habitats for the shallow stratum, and the deep stratum at one site. Dissolved oxygen explained the greatest proportion of variance in the multivariate data, followed by POC flux and percent organic-detritus occurrence. Fish abundances were generally higher in canyons but only statistically significant for the deepest stratum. Reduced fish abundances both in canyon and slope transects occurred at intermediate depths within the core of the oxygen minimum zone (OMZ). Species density, diversity and richness and abundance were usually higher in the canyons, but only statistically higher in the deepest stratum. Possible causes for increased abundance and species densities and richness in the deepest stratum in canyons include reduced disturbance at deeper depths. We conclude that submarine canyons on oceanic islands are likely to be sites of enhanced fish abundance and species richness, but that these enhancing effects are offset when oxygen concentrations fall below ?0.7 ml l?1 in OMZs.

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