INFLUENCES OF ABRUPT SUBMARINE TOPOGRAPHIES ON LOCAL COMMUNITY ECOLOGY AT VARIOUS SCALES

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By

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This dissertation is an interdisciplinary project. Although, my questions were primarily ecological and fall within the biological oceanography discipline, my interest in topography has led me into the field of geological oceanography, specifically geospatial analytics as tools for habitat mapping. Additionally, my interests in mechanisms have led me into the field of physical oceanography, looking into the consequences of current interactions with topography. As a result, I have worked together with experts both here at the University of Hawaii and at other institutions across these three subdisciplines of oceanography, leaving me with a long list of people that I would like to acknowledge and thank.

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ABSTRACT

Seamounts, submerged submarine mountains, are a complex and poorly studied category of abrupt topography in the ocean that are often vulnerable ecological hotspots. This dissertation addresses whether the 'seamount effect', the phenomenon of high abundance, high biomass, and high diversity communities at seamounts, manifests at different scales from large, shallow seamounts to small, deep abyssal hills to small-scale topographic high points, often called pinnacles or crests. I also explore possible mechanisms responsible for the seamount effect at these various spatial scales. At the largest spatial scale, the hypothesis that seamount-induced chlorophyll enhancements sustain the seamount effect at large seamounts is tested with a statistical analysis of a decade of satellite chlorophyll concentrations around seamounts across the globe. At the next largest spatial scale, I use observations from abyssal baited camera deployments over abyssal hills and proximate plain habitats across the Clarion-Clipperton Zone to understand the environmental and bathymetric influences on the bait-attending abyssal community. At the smallest spatial scale, a statistical analysis of benthopelagic fish observations taken from baited camera deployments across the diverse topographic habitat types of the Main Hawaiian Islands tests whether the seamount effect also applies to local high points, and a high-resolution physical ocean model characterizes current modifications at these habitat types. At the largest spatial scales, I find that physical upwelling of cold, nutrient rich water around shallow, low latitude seamounts results in significant, consistent seamount-induced chlorophyll enhancements that subsidize the seamount ecosystem from the bottom up and ultimately results in augmented fisheries catch. Abyssal hills

are also shown to have a seamount effect, with higher abundances, higher diversity, and some evidence for larger bait-attending animals than the surrounding plains. Crests also have unique communities with a high diversity, and approximately double the abundance of fishes compared to slope, flat, and depression habitat types; this increased abundance is shown to relate to topographically generated current velocity enhancements as well as convergence zones and is driven principally by species that consume pelagic prey. Overall, the seamount effect is shown to manifest at all tested spatial scales making topographic highs of all sizes from seamounts to crests ecological hotspots that are supported by food subsidies resulting from bathymetry-modified currents.