Oceanography Seminar

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"Coral Reef Tipping Points and Applications for Ecosystem-Based Management"

In response to human pressures, coral reef ecosystems can shift from one state to another, generally resulting in a loss of benefits to human societies. These state shifts are an indication of reduced ecological resilience of the system, with a lowered capacity to absorb disturbance, and to maintain structure, processes, and feedbacks. Understanding these tipping points on coral reefs is essential for managing human pressures in order to avoid unwanted changes in the ecosystem, or to restore the system back to a desired state. In Hawai'i, we have studied tipping points spatially and temporally to 1) quantify ecosystem changes, 2) uncover relationships with human pressures, 3) develop management targets, and 4) understand the early-warning signs of reef tipping points. We quantified multiple ecosystem states, based on both fish and benthic assemblages, and studied variation across space and time. Each state had a unique relationship to different human pressures, and implications for management varied spatially. Thus, we developed a method for quantifying thresholds at multiple spatial scales to define management targets. Finally, we implemented a method for detecting tipping points using early warning indicators. Together, this research has several management implications, including understanding the ecological effects of human activities, defining tangible ecosystem-based management targets, and anticipating ecological change before it is too late to intervene.

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