

Losing Levels: Shifts in Reef Fish Trophic Dynamics Across a Coral Habitat Gradient

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Climate change is significantly altering coral reef ecosystems by reducing structural complexity. As a result, coral reefs are shifting from highly complex, hard coral-dominated habitats to degraded, soft coral-dominated habitats. These changes have led to a decline in reef fish biodiversity and a shift in the trophic structure of reef fish communities. However, empirical links between habitat complexity and trophic structure remain limited. In this study, we quantified the relative abundance of reef fish trophic groups across a natural environmental gradient ranging from shallow and rugose nearshore reefs to deeper and flatter offshore reefs in the Middle Florida Keys during the summers of 2022, 2023, and 2024. Our results indicate that the abundance of fish occupying lower trophic positions remained stable across sites, while fish in higher trophic positions were less abundant on offshore (degraded) reefs. These findings suggest that top predators may be disproportionately affected by the loss of coral reef structural complexity, resulting in a shortening of the food chain. To investigate this further, we are integrating stable isotope analysis ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) with food availability. We will compare trophic niche width and isotopic variability in four representative species (*Scarus iseri*, *Thalassoma bifasciatum*, *Balistes capriscus*, and *Pterois volitans*) from distinct functional groups (Herbivore, Omnivore, Invertivore, and Piscivore) across nearshore, mid-channel, and offshore reefs. We hypothesize that nearshore reefs, with greater structural complexity, will support a broader range of $\delta^{13}\text{C}$ values, reflecting diverse resource use, and lower $\delta^{15}\text{N}$ overlap, indicating a more complex trophic structure. In contrast, we hypothesize that offshore reefs will exhibit greater overlap in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values, reflecting limited resource availability and compressed trophic dynamics. Given that climate change is driving reefs toward flatter, degraded, less complex states, offshore reefs may serve as proxies for the future condition of coral reef ecosystems in the Middle Florida Keys. This research will enhance our understanding of how climate-driven habitat degradation affects the trophic structure of reef fish on coral reefs within the Florida Keys National Marine Sanctuary. Ultimately, the findings will contribute to a broader understanding of reef ecosystem resilience by supporting strategies to preserve coral reef biodiversity in the face of climate change.