

Seagrass Non-Cryptic Fish Assemblage Across the Florida Keys National Marine Sanctuary-USA Seascape

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Seagrass ecosystems in the Florida Keys National Marine Sanctuary (FKNMS)-USA provide critical habitat for diverse fish communities, yet comprehensive understanding of spatial patterns of mesopredators and upper predator fish biodiversity remains limited. The main objective of this study was to characterize the fish assemblage of non-cryptic fish communities across seagrass habitats with particular emphasis on understanding how environmental and spatial factors, including habitat continuity, water depth, distance to shore, and turbidity, influence fish assemblage, abundance and species distribution. Using Baited Remote Underwater Video Stations (BRUVS), we assessed fish abundances with MaxN across seagrass habitats in the Upper (n=42), Middle (n=32), and Lower Keys (n=28) regions (n=102 deployments total). The 102 BRUVS units were deployed during morning hours primarily in summer, positioned $\geq 500\text{m}$ apart for independence, with each recording for ~ 170 minutes. Environmental covariates included seagrass continuity, distance to shore, water depth/temperature, and turbidity. Our results revealed significant regional differences in community composition (ANOSIM: $R = 0.131$, $p = 0.001$), with distinct assemblages characterized by commercially important species such as Yellowtail Snapper (*Ocyurus chrysurus*; frequency of occurrence 60-80%) and White Grunt (*Haemulon plumieri*; 45-80%), followed by Yellow Jack (*Carangoides bartholomaei*; 45-85%) and Great Barracuda (*Sphyrna barracuda*; 55-60%). Species richness totaled 95 species across all regions: Upper Keys (69 species), Middle Keys (53), and Lower Keys (51). Despite the Upper Keys having the highest total species count, the Middle Keys sites supported more diverse fish communities at the individual site level (13.1 ± 2.8 species vs. 11.1 ± 3.0 in Lower Keys and 8.3 ± 3.2 in Upper Keys), with similar patterns for Shannon diversity and evenness metrics. Environmental drivers analysis revealed that water depth showed a significant positive relationship with species richness ($p < 0.001$), while distance to shore exhibited a significant negative relationship ($p < 0.05$). Turbidity showed no significant relationship with diversity metrics. Notably, contrary to our predictions, seagrass continuity did not significantly influence community structure (PERMANOVA: $p = 0.197$), indicating that other environmental factors may be more important in shaping fish assemblages. This study demonstrates the effectiveness of BRUVS as a non-invasive monitoring tool for assessing fish biodiversity patterns, focusing on mesopredators and upper predators which are not commonly recorded by other monitoring methods such as visual census or trawling. These results contribute to the understanding of spatial biodiversity patterns in FKNMS seagrass habitats and can inform marine spatial planning and ecosystem-based management strategies aligned with global biodiversity conservation targets.

Keywords: Seagrass ecosystems, BRUVS, Non cryptic fish, top predators, mesopredators.