

From Nurseries to Reefs: Spiny Lobsters as Lenses of Habitat Degradation in the Florida Keys

Casey B. Butler^{1,2}, Mark J. Butler, IV³, Alastair R. Harborne¹, and Thomas R. Matthews²

¹Florida International University, Institute of Environment, North Miami, FL, USA

²Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Marathon, FL, USA

³Newfound Harbor Marine Institute, Big Pine Key, FL, USA

The spiny lobster, a species of ecological and economic importance in the Caribbean and Florida, provides a vital lens for understanding the impacts of habitat degradation on marine ecosystems. Florida's coral reefs and nearshore hardbottom habitats are experiencing severe degradation, leading to shifts in ecological function. Initial surveys of 350 nearshore hardbottom and seagrass sites across the Florida Keys reveal significant habitat changes, including the loss of sponges and gorgonians, with many previously hardbottom-dominated sites now transitioning to seagrass communities. This degradation critically affects the Caribbean Spiny Lobster (*Panulirus argus*), which relies on hardbottom habitats as nurseries before migrating to coral reefs. Structural losses and reduced prey availability in these nursery areas likely hinder the growth, survival, and ecological role of *P. argus*. The impacts of habitat degradation also extend to coral reefs, where the Spotted Spiny Lobster (*Panulirus guttatus*), a reef-obligate species, plays a distinct trophic role. To evaluate these effects, we surveyed 24 reefs across the Florida Keys, assessing habitat quality, lobster nutritional condition, and trophodynamics using DNA metabarcoding of gut contents. Our findings indicate that *P. guttatus* occupies a higher trophic position than *P. argus* and that its diet is more sensitive to reef habitat quality. These results suggest that the phase-shift from coral- to macroalgae-dominated reefs alters food web dynamics, with more pronounced effects on species that depend heavily on coral reefs. This study highlights the cascading consequences of habitat degradation, from nearshore nursery areas to offshore coral reefs, emphasizing the need for targeted conservation efforts to mitigate ecological and economic consequences in the Florida Keys.