

Quantifying and Modeling the Spatial Patterns of the Florida Keys Recreational Reef Fishery

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The impacts of overfishing on fish populations and their ecosystem functions have been well documented on coral reefs. However, much of the fisheries research and data collection has been focused on the commercial sector. In addition, recreational fishing is a popular activity throughout the Florida Keys that is a key component of the tourism economy. The coral reef component of this recreational fishery focuses on the economically important snapper-grouper complex, and there is a large body of human-dimensions work analyzing the economic and social impact of fishing to communities and stakeholders. To better quantify the reef fishery, the Marine Recreational Information Program was created to collect fisheries-dependent data through mail-in and dockside surveys with the help of state partners. However, the spatial component of these data is often coarse, making understanding the distribution of recreational fishing effort and its management difficult. To improve our understanding of recreational fishing pressure in the Upper Keys, we first used satellite imagery to detect individual vessels in the fishery. Satellite imagery is an emerging data resource for determining the spatial distribution and patterns of commercial and recreational fishing vessels throughout the globe. We analyzed two years of high-resolution satellite imagery to identify vessels within the reef fishery and linked those detections to biophysical and spatial-temporal covariates. We developed a map of vessel detections at a 1km² spatial resolution that showed most fishing activity on the Islamorada reef edge. Additionally, statistical analysis found that habitat, windspeed, and existing marine infrastructure were important drivers of the spatial distribution of vessels. Secondly, we used agent-based modeling to imitate the behavior of recreational anglers throughout a single-day of fishing and simulate their spatial distribution. We used dockside open-ended dockside interviews to help calibrate the behavior of anglers within the model. This agent-based model can be used to help simulate the spatial distribution of anglers in the Upper Florida Keys. Additionally, it gives researchers and managers a tool to test how changes to the environment (e.g., loss of structural complexity) and management policies (e.g., new protected areas) could affect how anglers utilize space.