Do marine reserves show positive trophic cascades?

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Research Statement

I am a MSc student in the Department of Biological Sciences at Florida International University. My project proposal is looking at the annual fish data by NOAA's Southeast Fisheries Science Center that was collected in the Florida Keys National Marine Sanctuary to compare Sanctuary Preservation Areas (SPAs), patch coral reefs designated as "no-take" zones, to nearby nonprotected reef sites to analyze and compare if removing fishing pressure has positive fish trophic cascades. This data is publicly available and includes scuba visual surveys done by two divers (buddy pair) who conduct a 7.5m radius survey circle and record all fish species and length that they see. Divers also collect coral cover and rugosity measurements of reefs sites at the end of their surveys.

Objectives

This project will investigate the changes in fish trophic cascades within no-take, patch coral reefs by determining the changes in predator density and biomass, herbivore density and biomass, and the benthic composition to compare to non-protected nearby patch reefs against those protected. By comparing reef sites and protected against nonprotected, we can quantify the changes that human-exclusion zoning has on the ecosystem.

Hypothesis

H1: Removing fishing pressure increases fish species richness, density and biomass throughout multiple trophic levels.

H2: Herbivore grazing is concentrated on reefs and will create colonizable areas for coral recruits by clearing solidified substrate of competing algae.

Statistical Analysis

From NOAA's visual fish surveys biomass can be calculated using fish length-weight relationships which will be referenced from previous literature. This data will then be tested for assumptions and if it fails, will be transformed with a log or square function. Biomass results can then be plotted against reserve age using nonlinear models and bootstrapping for one year or multiple years can be included using time series analysis.

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