Fishing Down a Caribbean Food Web Relaxes Trophic Cascades

Efecto de la Pesca a traves de la Red Alimenticia en Cadenas Troficas Caribeñas

Impacts Écosystèmiques de la Pêche sur les Réseaux Trophiques Caribéen

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EXTENDED ABSTRACT

The fishing down of marine food webs has been described in pelagic and demersal systems but rarely documented in coral reef environments. We recorded a rapid shift in fish community structure in Belize that accompanied a marked decline in grouper and snapper abundance and a switch towards smaller (less desirable), herbivorous parrotfishes. In a six to seven (6-7) year period (2002 - 2008/9), observations of large-bodied grouper (Serranidae) declined significantly from an encounter probability of 21% per 200 m^2 transect to just 2%. The biomass of carnivorous snappers (Lutjanidae) underwent a 7-fold decline, primarily in the species *Ocyurus chrysurus*. During this period, the inclusion of parrotfish in fish catches at nearby Glovers Atoll increased from a frequency of 6% in 2004 to around 20% of speared individuals by 2008. Parrotfish biomass declined by 41% between 2002 and 2008/9, with a major decline in the large and dominant herbivore *Sparisoma viride*. No changes in parrotfish biomass were detectable in nearby marine reserves during this time. Several important indirect effects of fishing were observed. The biomass of mesopredators including *Cephalopholis fulvus, C. cruentatus,* and *Epinephelus guttatus* increased dramatically by 880% of 2002 levels. We putatively attribute this response to a release from predation and constraints to foraging behaviour imposed by large serranids. Further, we find that the density of adult damselfish of the species *Stegastes planifrons* and *S. partitus* decreased by ~45%. We attribute this decline to elevated predation by the increased densities of mesopredators, which have been shown to prey upon juvenile damselfish. No change in damselfish densities was found at two control locations where fishing was prohibited. The decline of parrotfish in the central Mesoameican barrier reef likely accounts for recent anecdotal observations of *Halimeda tuna* spreading to micro-habitats that have previously been grazed intensively. While these results imply that the resilience of these reefs may be seriously impaired, the Belize Government has recently enacted new legislation to improve the management of grouper and outlaw harvesting of most herbivorous fish.

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