Cascading Effects of the Caribbean King Crab, *Maguimithrax spinosissimus*, on Coral Patch Reef Communities in the Florida Keys

Effets en Cascade du Crabe Royal des Caraïbes, *Maguimithrax spinosissimus*, sur les Communautés Récifales Patch de Corail dans les Florida Keys

En Cascada Efectos del Caribe del Cangrejo Rey, *Maguimithrax spinosissimus*, en las Comunidades de Arrecifes de Coral de Parches en los Florida Keys

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EXTENDED ABSTRACT

The Caribbean King Crab, *Maguimithrax spinosissimus*, is the largest brachyuran in the Western Atlantic Ocean, with males reaching sizes in excess of 180 mm carapace width (CW) and more than 3 kg. Interestingly, macroalgae and algal turfs comprise the bulk of the species' natural diet. Indeed, *M. spinosissimus* is a prodigious consumer of benthic macroalgae on coral reefs where its grazing rates meet or exceed those of every species of parrotfish in the Caribbean region, the only exception being the terminal phase of the stoplight parrotfish, *Sparisoma viride*. With a largely herbivorous diet, rapid growth to a large adult size, and a short (4 - 6 day) larval duration, *M. spinosissimus* exhibits all of the hallmarks of an excellent candidate for commercial mariculture. There are several small fisheries around the Caribbean, though these crabs are nocturnal and as a cryptic and largely herbivorous species, they do not lend well to a trap-based fishery. Thus, there have been a number of attempts to farm the species commercially, though, to the best of our knowledge, no commercial-scale mariculture operations currently exist for the Caribbean King Crab.

In addition to the economic potential of these crabs from human consumption, *M. spinosissimus* appears to have a substantial ecological value as well. *M. spinosissimus* occurs throughout the Caribbean and Gulf of Mexico, but in most areas at very low abundance. Here, we present the results of an experimental study of the effect of these large crabs in mediating macroalgal dominance, and thus their potential use in improving conditions necessary for the recovery of Caribbean coral reef communities. We manipulated the density of crabs and the initial macroalgal biomass on patch reefs in the Florida Keys and monitored macroalgal cover periodically over the following 12 mos. When the density of these crabs was increased, their effect on benthic macroalgae cover was significant, deleterious, and persistent.

Our hypothesis that this significant and persistent reduction in the cover and biomass of benthic algae would lead to improved conditions for the recovery of coral reef ecosystems was supported. Aside from the direct effect we observed on algal cover and biomass, there were several unforeseen effects on the benthic community. Two years after applying these crab density treatments, a visual census of coral recruitment showed that reefs to which crabs were transplanted had two to four times as many coral recruits as reefs to which no crabs were added. Thus, crab grazing appears to have had a significant and positive indirect effect on coral recruitment patterns just two years after those treatments were applied. Interestingly, crab grazing has also had a substantial and unexpected effect on the benthic and demersal fish community of experimental reefs. Reefs to which crabs were added harbored significantly greater numbers of fish and greater fish species richness than reefs to which no crabs were added. Our analysis of these data is ongoing, however, preliminary results suggest that these cascading effects serve to reinforce the deleterious effect of crab grazing on algal cover. Corals recruit and reduce the area of the reef matrix available to algae. Similarly, crab grazing reduces algal cover and apparently attracts fishes, many of which are herbivorous and aid in the maintenance of low algal cover reinforcing crab grazing effects. This type of facilitation cascade reinforces the suggestion that *M. spinosissimus* provides a valuable ecosystem service and may even represent a sleeping functional group on Caribbean reefs where it's abundance and cryptic ecology keep the species inconspicuous.

As the region's more conspicuous major herbivore species are severely depleted from disease and a century or more of heavy exploitation, it is imperative, from a management and restoration perspective, to identify alternative species in the community to provide these essential ecosystem services. Our studies of *M. spinosissimus* grazing suggests that this species may be of great utility to resource managers as an effective tool for Caribbean coral reef restoration. The cascading effects described above suggest that the utility of this species is likely far more broad than simple and direct algal management. We believe (and are currently quantitatively testing) that crab density enhancement may facilitate a community-level restoration of degraded Caribbean coral reefs. Some of the key gaps and drawbacks to implementing *M. spinosissimus* enhancement as a community restoration tool will likely be establishing and maintaining an adequate supply of crabs for transplantation and monitoring for any potential negative and unintended effects on community structure and function.

KEYWORDS: *Mithrax*, Caribbean king crab, *Maguimithrax spinosissimus*, macroalgae, grazing, restoration