Assessing and Mitigating the Impacts of Predation by Invasive Lionfish (*Pterois volitans*) on Caribbean Coral Reef Fish Communities

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EXTENDED ABSTRACT

Species invasions are occurring worldwide at an unprecedented rate, with extreme ecological and economic impacts (Mooney and Cleland 2001, Sala et al. 2000, Vitousek et al. 1997). While the Global Invasive Species Database lists over 660 species of ecological and economic concern, less than 12% of invaders occur in marine ecosystems. Despite the rarity of these events, one such invasion is currently unfolding in the Western Atlantic and Caribbean Sea, and is progressing at a rate and magnitude never before documented in any marine system.

Indo-Pacific lionfish (*Pterois volitans*) have spread rapidly around the Caribbean basin (Freshwater et al. 2009, Morris et al. 2009) and are now one of the most abundant predators of their size on invaded Bahamian coral reefs (REEF 2009). Following this rapid range expansion, temporal data from the Reef Environmental Education Foundation reveal exponential increases in the local abundance of lionfish in several regions (REEF 2009). There is great concern about the ecological and economic impacts of dense lionfish populations on Caribbean coral reef systems (Green and Côté 2009). Analyses of lionfish stomach contents from the Bahamian archipelago reveal that lionfish prey on over 50 species of native Caribbean reef fish (Green Unpubl. data, Morris and Akins 2009), and studies on experimental reefs reveal that a single lionfish can reduce the recruitment of native Caribbean fishes by 80% through predation (Albins and Hixon 2008).

Quantifying the impacts of lionfish predation on Caribbean fish communities is challenging because of the broad nature of their diet (Morris and Akins, 2010), and also the lack of pre-invasion data on the segment of the fish community on which they prey (i.e. Paddack et al. 2010). To meet these challenges, we creating a mass-balanced model linking the magnitude and rate of lionfish prey consumption to the production of their prey on invaded reefs, and used this theoretical approach to quantify the impacts of lionfish for nine invaded coral reefs sites in the Bahamas (Green et al. In review). To parameterize our model, we collected data on prey-sized fish density, diversity and size distribution, and lionfish density, size distribution, and diet collected from the nine invaded coral reef sites in the summers of 2008 and 2010.

Reconstructing historical fish biomass for each reef revealed that lionfish depleted the biomass of their prey by up to 90% in less than three years. Assessing the current balance between lionfish prey consumption and the production of their prey, we find that without immediate action to control local populations, further declines in fish biomass will likely occur. The exponential increases in lionfish abundance observed on many Caribbean reefs strongly suggest that lionfish are capable of severely impacting native fish communities. Our study highlights the urgency of this invasion at the forefront of ecology and conservation research and management.

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