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## PREDATION ON SPEARED RED LIONFISH, *PTEROIS VOLITANS*, BY SPOTTED MORAY, *GYMNOTHORAX MORINGA*

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**ABSTRACT:** *Little is known about predation on the red lionfish, Pterois volitans, in invaded habitats. In this note, we report for the first time a spotted moray, Gymnothorax moringa, successfully attacking and eating a still alive, but injured (speared) adult red lionfish in San Salvador, Bahamas. We describe the consumption of the red lionfish and the response behavior of the predator. Understanding predation pressures on red lionfish in the western Atlantic Ocean is of great significance given the rapid growth of this invasive species and its potential effects on populations of coral reef fish. This important problem is exacerbated by the fact that top predators have largely been overfished in the western Atlantic, thus removing potential predators for this invasive species. Our observation suggests that the spotted moray and, by extrapolation, other morays might represent a naturally occurring top-down control agent of invasive red lionfish. Muraenids in general could play a critical role as bio-control forces because moray eel populations have been largely spared the effects of overfishing.*

**Key Words:** non-native species, opportunistic predation, prey, reef, western Atlantic Ocean

OVER the last 20 yr, the invasive red lionfish, *Pterois volitans* (LINNAEUS, 1758) (Scorpaenidae), has rapidly become established in the western Atlantic Ocean from Cape Hatteras, North Carolina, to Colombia and Venezuela in the southern Caribbean Sea (Schofield, 2010). The fast spread of this species has had a marked effect on populations of coral reef fish, decreasing both recruitment and abundance of multiple species including ecologically significant species such as parrotfishes and other herbivorous reef fishes (Albins and Hixon, 2008).

The rapid success and expansion of this species might be due to various physiological, morphological, and behavioral characteristics (Albins and Lyons, 2012). It is hypothesized that lionfish's venomous spines, in combination with their cryptic coloration and slow movement (Albins and Hixon, 2008), might act to release the species from significant top-down control by native predators (Allen and Eschmeyer, 1973). This is exacerbated

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by the fact that top predators have largely been overfished throughout much of the Caribbean (Jackson et al., 2001), thus removing potential predators of this invasive species (e.g., Mumby et al., 2012).

While much work has been done recently in an attempt to address the potential effects of lionfish on invaded ecosystems, only a few studies have identified any predation upon the species, further contributing to the idea that *P. volitans* experiences little consumer pressure. One of these studies documented consumption of lionfish by a cornetfish *Fistularia commersonii* (RÜPPELL, 1838) (Fistulariidae) in its native range of the Indo-Pacific Ocean (Bernadsky and Goulet, 1991). A second study reported that groupers (Serranidae) (Maljković et al., 2008) could act as predators of small lionfish (6 and 13 cm standard length) in their invasive habitat. (Also see Mumby et al., 2011.) Here, we report on a previously unrecognized potential predator for large red lionfish in their invasive range, the spotted moray eel, *Gymnothorax moringa* (CUVIER, 1829) (Muraenidae).

Our field observation was made while snorkeling in the shallow waters of Graham's Harbor (24°07'N, 74°27'W) in the northeast part of San Salvador, Bahamas, on the morning of March 15, 2012. Graham's Harbor is a protected low-energy environment with a variety of artificial structures, sea grass beds, and small patch reefs. A previous study found only *P. volitans* and no devil firefish, *P. miles* (BENNETT, 1828), in this site (Barbour et al., 2010). We therefore assume the observed fish in this study was the red lionfish.

We identified three red lionfishes for capture for a larger food-web study, one of 21 cm total length (captured) and two others of similar size. They were hidden in a protective reef structure accompanied by a large spotted moray eel. We speared and captured one red lionfish from this structure. A second lionfish was speared, but it escaped and swam off injured. Approximately two minutes later, we observed the large spotted moray eel attacking the injured red lionfish, completely consuming it whole within 10–15 s. The direction of the attack was tail first. After consumption, the moray had a bulge in its throat and was observed shaking its head vigorously, apparently struggling to swallow the fish. After about 1 min, the moray ceased struggling, resumed normal swimming behavior, and returned to its lair in the reef.

Our report, to our knowledge, is the first to document a spotted moray attacking a live, although injured, adult lionfish without being enticed. Our observation of a spotted moray consuming a lionfish is not, however, the first. Several examples can be found on the Internet showing divers feeding spotted morays (e.g., <http://www.youtube.com/watch?v=YQiTkIU84Y0>, <http://www.youtube.com/watch?v=dEmyTgOAg2Q> and <http://www.youtube.com/watch?v=t65PC6EG2oA>). In contrast to our observation, all examples involve dead lionfish attached to spear poles. Furthermore, two recent papers (Barbour et al., 2011; Jud et al., 2011) have recorded anecdotal observations of predation on lionfish by green moray eels, *Gymnothorax funebris* (RANZANI, 1840).

*Gymnothorax moringa* is nocturnal, foraging mainly in open seagrass beds away from patch reefs, rubble, or other shelter. They usually feed on fishes,

crabs, and octopods (Young et al., 2003). During the day, morays are usually hidden and are often seen with their heads protruding from holes in the reef (Gilbert et al., 2005). Given that morays are still abundant in many parts of the Caribbean and western Atlantic and are not regularly fished by humans, it is possible that these fish might provide a form of natural top-down control of invasive lionfish. Because several other species of moray eel are phylogenetically, morphologically, and behaviorally similar to the spotted moray, we speculate that muraenids in general could play an important role as bio-control forces.

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