

# Lions and Tigers and Shrimp, Oh My: Actions to Combat the Lionfish and Tiger Shrimp Invasions

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Lionfish. Photograph courtesy of Thomas Hawk.

**Lionfish (*Pterois volitans*) and Asian tiger shrimp (*Penaeus monodon*)** have become unwelcome visitors along the Gulf Coast. The invasion of these two non-native species illustrate how different species require different management approaches. Ideally, invasive species should be regulated prior to introduction via pathway-based approaches, such as controlling ballast water discharges or restricting aquaculture operations. Instead, it is more

common for regulation to focus on species-based approaches that prevent the import or sale of certain species known to be harmful. Species-based control is generally considered less effective than pathway-based efforts, as species are often listed only after they have arrived. Accordingly, pathway-based regulation appears to be the better practice, as it might prevent the introduction of the species in the first place.



Tiger shrimp carrying eggs.  
 Photograph courtesy of Michael Ki Hyung Kwon.

Once a non-native species has successfully established itself in an ecosystem – breeding and thriving – the focus shifts to managing those species with the hope of containing them. Invasive species are notoriously difficult to eradicate, if not impossible. The lionfish and tiger shrimp illustrate the differences in invasive management. Culls of lionfish are conducted to limit the spread of species. However, culls are not always practical or successful. Culls of tiger shrimp, for example, may not be effective and may have negative environmental consequences as the shrimp cannot be caught without incurring high bycatch, in part because they do not yet dominate their ecosystem.

### Background

An invasive species is a plant or animal that is not native to the United States whose presence threatens the stability of its new ecosystem. They are also called nuisance, injurious, exotic, or introduced species. However, not all non-native species are considered invasive, as not all have the ability to alter their ecosystem. One federal law defines such harmful species as “nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural or recreational activities dependent on such waters.”<sup>1</sup>

Invasives are not a rarity along the Gulf Coast. Some, like nutria rats (*Myocastor coypus*) and Eurasian boars (*Sus scrofa*), were introduced intentionally to provide fur and food sources. Lionfish, native to the Indian Ocean, Pacific Ocean, and Red Sea, might have been introduced when Hurricane Andrew caused accidental aquarium releases in 1992, although other sources indicate they were in U.S. waters in the 1980s.<sup>2</sup> Tiger shrimp (sometimes known as giant tiger prawns) are a Southeast Asian species that have invaded the East African Coast. They may have been introduced to the United States by hurricanes carrying eggs from Africa, from farming operations in the Caribbean, or from an accidental release by a South Carolina aquaculture research station.

Both species are found on the Gulf Coast, but only the lionfish dominates its environment. Lionfish have been found along the entire Gulf Coast in aggregations as high as 1,000 fish per acre.<sup>3</sup> Once introduced, lionfish have an indiscriminate palate, preying upon commercially and ecologically important species, including snapper and grouper, at unsustainable rates. Specifically, lionfish populations can consume 460,000 prey fish per acre per year and have reduced their fish prey by up to 90% in areas where they are abundant.

Although not as widespread or abundant as lionfish, tiger shrimp may pose a similar ecological threat if allowed to establish a stable breeding population. They have been reported from Texas to North Carolina, but in relatively low numbers. Only about 50 to 300 individuals are reported each year, which leads some scientists to conclude that the shrimp do not originate from a stable breeding population in the Gulf, but are instead blown in from the Caribbean where they are farmed.<sup>4</sup> However, the U.S. Geological Survey believes it is “likely” that there is a breeding population in U.S. waters. Additionally, with sea temperatures on the rise, these shrimp may be able to expand northwards, to areas previously too cool for them.

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### State Legal Efforts

State laws and regulations addressing the lionfish and tiger shrimp invasions vary. Texas, Louisiana, Georgia, Florida, Alabama, and Mississippi opt for a “blacklist” approach where certain exotic species are specifically banned.<sup>5</sup> Typically, a state statute will direct a state agency to prepare and maintain a list of prohibited exotic species. Unlisted species are presumed acceptable for import and possession. However, there can be a disconnect. While statutes authorize the listing of nonindigenous species, the regulations formalizing that authority may not be updated regularly. For example, with the exception of Florida, no state’s blacklist names lionfish as a banned species, and while Louisiana advises shrimpers to look out for tiger shrimp, the species is not banned.

Florida is uniquely aggressive in combatting the lionfish invasion. Florida formally banned importing lionfish and their eggs as of August 1, 2014.<sup>6</sup> Florida has no commercial or recreational bag limit on lionfish, which encourages the harvest of the species. Captive lionfish breeding has been banned in Florida since 2014, except for individuals who hold special permits.

### Non-Legal Approaches to Managing Invasives

Once a species is established, regulatory approaches become less effective. Direct government actions are often needed to try to contain populations. Government-funded invasive species culls have been successful in some instances. For example, in response to the nutria rat invasion, Louisiana implemented the Coastwide Nutria Control Program, where hunters are awarded \$5 for the tail of each invasive nutria they collect. In 2015-2016, the program collected 349,235 tails and curbed vegetative destruction on the coast from 105,000 acres in 1999 to fewer than 10,000 acres in 2016, although the state found an 8.2 percent increase in nutria-impacted lands from 2015 to 2016.<sup>7</sup>

Unlike nutria, lionfish are widely more distributed, breed more prolifically, and are more difficult to collect because they live underwater. Accordingly, the species’ population is not likely to be curbed in a significant way through culling. Instead, conservation efforts prioritize areas of special concern for lionfish harvest such as marine sanctuaries and other reefs. Consider, for example, the National Oceanic and Atmospheric Administration (NOAA) National Marine Sanctuaries Lionfish Response Plan.<sup>8</sup> That plan allows permits for catching lionfish in what are otherwise no-take zones. The plan includes partnering with local volunteers and non-profits to organize fish culls (also called tournaments, rodeos, and derbies). These tournaments have become popular, with 25 different events listed in Florida waters for 2017 alone.

The Florida Fish and Wildlife Conservation Commission Lionfish Tournament Assistance Program also encourages these events, donating \$1,500 to tournaments with more than 20 participants. The tournaments harvest sizable amounts, with the Florida Fish and Wildlife tournaments conducted in partnership with the Reef Environmental Education Foundation harvesting 18,560 lionfish from 2009 to 2016. However, killing 2,500 fish a year does little to slow the dominance of a species where each female can lay 2 million eggs annually.

Bounty programs and tournaments are not conducted for tiger shrimp, likely because they lack the abundance of lionfish. Extensive trawling aimed at eradicating tiger shrimp could cause more environmental harm than it would prevent, due to bycatch and other concerns.



Lionfish. Photograph courtesy of Paulo Ordoeza.

With aquaculture operations and ocean currents the most likely sources of tiger shrimp introductions, options are limited. Nothing can be done about currents sweeping tiger shrimp in from across the ocean, leaving aquaculture regulations as the only practical means to limit tiger shrimp introductions. Aquaculture has become a leading vector for invasive species worldwide.<sup>9</sup> To minimize the risk of tiger shrimp introductions, tiger shrimp aquaculture facilities need to be strictly managed. As a start, many states already require that aquaculture recirculation systems do not discharge into state waters.<sup>10</sup> However, as long as non-natives are farmed in the United States there is a possibility of their spread. From storm surges to submerged eggs sticking to the legs of waterfowl, there are ways that non-native eggs can be introduced into the environment from aquaculture operations. 🐟

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## Endnotes

1. Nonindigenous Aquatic Nuisance Species Prevention and Control Act of 1990, 16 U.S.C. § 4702.
2. See, e.g., National Oceanic and Atmospheric Administration (NOAA), *National Marine Sanctuaries Lionfish Response Plan (2015-2018)* (ONMS-15-01), p. 13 (Feb. 2015).
3. NOAA, National Centers for Coastal Ocean Science, *Lionfish*.
4. Janet McConnaughey, *U.S. Tiger Shrimp Sightings Worry Scientists*, U.S. News and World Report (Apr. 26, 2012),
5. Tex. Parks & Wild. Code Ann. § 66.007; La. Rev. Stat. § 56:319.2; Ga. Code Ann. § 27-5-5; Fla. Stat. §§ 372.26, 372.265; Ala. Admin. Code r. 220-2-26(5); Miss. Code Ann. § 49-7-80.
6. Fla. Admin. Code r. 68-5.005.
7. La. Dept. of Wildlife and Fisheries, *Coastwide Nutria Control Program 2015-2016*, pp. 5, 16 (June 7, 2016).
8. NOAA, *National Marine Sanctuaries Lionfish Response Plan (2015-2018)* (ONMS-15-01) (Feb. 2015).
9. Rosamond L. Naylor, et al., *Aquaculture—A Gateway for Exotic Species*, Science Vol. 294, Iss. 5547, 1655-56 (Nov. 23, 2001) (describing aquaculture operations as “a leading vector of invasive species”).
10. See, e.g., Fla. Admin. Code Ann. r. 5L-3.006; Tex. Agric. Code Ann. § 134.031; Miss. Admin. Code 22-1-8:04.