

BAIT AND SWITCH: TAKING NATIVE SPECIES ON AND OFF THE LIST DUE TO INVASIVE SPECIES

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I. INTRODUCTION

Globalization has caused people, products, and wildlife to move across the globe.¹ Globalization impacts our lifestyles on a daily basis.² Unknown as to when this cycle began, globalization is defined as an economic system in which raw materials, manufactured goods, intellectual property, and financial transactions flow freely across borders.³ This trend dates back to thousands of years, when wildlife would begin in their native environments and travel to new regions of the world.⁴ In the United States, almost half the species that are at risk for extinction are now considered endangered due to the significant threat invasive species pose to biodiversity.⁵ The effect that invasive species have on the environment is disproportionate compared to other harmful threats, which is what makes invasive species so dangerous.⁶

This note proposes a legislative approach to reducing the harmful impact of lionfish on the environment, including reframing the responses

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¹Jacob Hill, *Invasive Species: How They Affect the Environment*, ENVIRONMENTAL SCIENCE, <https://www.environmentalscience.org/invasive-species> (last visited Jan. 13, 2018).

² *Id.*

³ *Id.*

⁴ *Id.*

⁵ Daniel Simberloff, *Introduced Species: The Threat to Biodiversity & What Can Be Done*, ACTIONBIOSCIENCE (Dec. 2000), <http://www.actionbioscience.org/biodiversity/simberloff.html>.

⁶ *Id.*

to this ecological challenge premised on the deficiencies in the current federal and state strategies. Recommendations are offered to overcome the ecological challenges through both the successful and unsuccessful methods to establish the most ideal strategy. Moreover, it assesses both native and nonnative species and how they influence population sizes. Without a thorough reassessment of the laws currently in practice, the native species will continue to be threatened, and their habitat will be prone to environmental degradation. The interests in protecting species with existing procedural remedies, in concert with provisions from updated laws and regulations provide outcomes beneficial to the environment.

As a result of invasive species, native species are threatened and their populations are decimated.⁷ More than 400 of the 1,352 species protected under the Endangered Species Act are at risk due to competition with invasive species.⁸ An invasive species is an alien or exotic species whose introduction does or is likely to cause economic harm, harm to human health, and environmental degradation.⁹ Over 500 nonnative fish and wildlife species, and 1,180 nonnative plant species, have been documented in the state of Florida as invasive.¹⁰ Nonnative species compete for food and habitat with the native species, eventually leading to devastation of the environment.¹¹ The hands-off approach of the government along with private inaction can be attributed to a variety of sources that influence the economy, including unawareness or apathy towards the harm these species can cause and the desire to let the region's ecosystems adjust to the species without human intervention.¹²

Part I provides an overview of the lionfish, which demonstrates how difficult a marine invasive species can be to control once it has been established. Part II examines the red snapper, an endangered species, and

⁷ Hill, *supra* note 1.

⁸ *Coming to a Marsh Near You?*, NATIONAL ENVIRONMENTAL COALITION ON INVASIVE SPECIES, https://defenders.org/sites/default/files/publications/support_h.r._669.pdf (last visited Mar. 11, 2018).

⁹ Exec. Order 13,112, 64 Fed. Reg. 25 (Feb. 8, 1999).

¹⁰ *What is a Non-Native Species?*, FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION, <http://myfwc.com/wildlifehabitats/nonnatives/what-are-nonnatives/> (last visited Jan. 14, 2018).

¹¹ *Id.*

¹² Andrew Leung, *The Adverse Effect of Aquatic Invasive Species on Native Commercial and Recreational Fisheries in the Great Lakes and the Exacerbation of the Problem by Judicial Reluctance to React*, 4 KY. J. EQUINE, AGRIC. & NAT. RESOURCES L. 525, 547-48 (2011).

links how the lionfish has negatively influenced this particular species. Part III will analyze solution and prevention strategies along with legislative rules involved in refining the invasive species problem. This note will focus particularly on the Florida Everglades, where the first lionfish were confirmed in July 2010.¹³ Because the lionfish has entered Florida's ecosystem through human involvement and has influenced other species, such as the red snapper, this note will then propose a plan to decrease the number of lionfish entering the non-native habitats with an increase in the red snapper population.¹⁴ The red snapper is significant in comparison to other native species because they were endangered and are still threatened by the lionfish.¹⁵

A. Overview of the Lionfish

Lionfish are beautiful fish, but they are venomous and taking over Florida.¹⁶ None of the invasive species have wreaked as much havoc as the lionfish.¹⁷ Being such a venomous creature, its invasion into Florida and the U.S. needs reconciling and further prevention.¹⁸ Lionfish rank second only to stingrays in the total number of stings worldwide, with an estimated 40,000-50,000 cases annually.¹⁹ A huge factor that influences the invasive species problem is lack of information on lionfish in their native environment and what reduces populations from reaching nuisance levels.²⁰ An online search for information about Florida's lionfish

¹³ *Lionfish – Pterois volitans*, FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION, <http://myfwc.com/wildlifehabitats/nonnatives/marine-species/lionfish/> (last visited Mar. 12, 2018).

¹⁴ Robert Brown, *Exotic Pets Invade United States Ecosystems: Legislative Failure and a Proposed Solution*, 81 IND. L.J. 713, 716 (2006).

¹⁵ *Historical Overview (1800s-Present): How has the Red Snapper Fishery Changed Over Time?*, NOAA FISHERIES, http://sero.nmfs.noaa.gov/sustainable_fisheries/gulf_fisheries/red_snapper/overview/ (last visited Mar. 10, 2018).

¹⁶ *Lionfish – Pterois volitans*, *supra* note 13.

¹⁷ *Venomous Lionfish Invade South Florida Waters*, LIONFISHHUNTERS.ORG, <http://www.lionfishhunters.org/> (last visited Jan. 14, 2018).

¹⁸ L. Scott Harrell, *Lionfish FAQ*, LIONFISH HUNTING, <https://lionfish.co/lionfish-faq/> (last visited Mar. 10, 2018).

¹⁹ *Venomous Lionfish Invade South Florida Waters*, *supra* note 17.

²⁰ *National Invasive Lionfish Prevention and Management Plan*, AQUATIC NUISANCE SPECIES TASK FORCE,

population reveals websites with names such as “Lionfish Hunters,”²¹ and “Death to Lionfish”²², which depict lionfish as unwelcome species by various members of the scientific community. Groups are passionate about preserving the native populations for commercial or personal use and to protect the overall environment.²³ The lionfish emerged into a large issue because of the location in different habitats and increase in population size.²⁴

B. Description and Biology

Lionfish are marine species.²⁵ There are two types of lionfish: *Pterois volitans* and *Pterois miles*.²⁶ The only definitive way to distinguish the two species is through genetic analysis.²⁷ Lionfish are primarily red, brown, and white with a striped, zebra-like appearance.²⁸ The vertical stripes merge into a “V” and alternate from wide to thin on their bodies.²⁹ They have eighteen venomous spines used defensively against predators that attempt to attack.³⁰ During an encounter with the venom, the skin-like covering is torn and retracted into the predator.³¹ Lionfish are slow-moving and conspicuous when they pursue and corner prey with their pectoral fins.³² Their stings last approximately fifteen to twenty minutes and are so severe that they can send victims to the hospital

https://www.anstaskforce.gov/Documents/Lionfish_Plan-Final_Approved.pdf (last updated Apr., 2015).

²¹ *Venomous Lionfish Invade South Florida Waters*, *supra* note 17.

²² Randy Olsen, *Lionfish Sightings*, THE LIONFISH PSA, <http://www.deathtolionfish.org/involvement.html> (last visited Mar. 10, 2018).

²³ *Lionfish Research Program*, REEF, <http://www.reef.org/lionfish> (last visited Mar. 1, 2018).

²⁴ *Historical Overview (1800s-Present): How has the Red Snapper Fishery Changed Over Time?*, *supra* note 15.

²⁵ *Lionfish – Pterois volitans*, *supra* note 13.

²⁶ *National Invasive Lionfish Prevention and Management Plan*, *supra* note 20.

²⁷ *Id.*

²⁸ *Lionfish – Pterois volitans*, *supra* note 13.

²⁹ *Impacts of Invasive Lionfish*, NOAA FISHERIES (Feb. 9, 2018), <https://www.fisheries.noaa.gov/feature-story/impacts-invasive-lionfish>.

³⁰ *Lionfish – Pterois volitans*, *supra* note 13.

³¹ *Id.*

³² *Impacts of Invasive Lionfish*, *supra* note 29.

or cause death.³³ Individuals who have been stung, say that the sting “won’t kill you, but it will make you wish you were dead.”³⁴

Lionfish can range anywhere from twelve to fifteen inches in length.³⁵ The fish are larger in areas where they are not indigenous, exceeding approximately eighteen inches in length.³⁶ They develop quickly because they reach maturity in less than a year.³⁷ Males mature around four inches in length, compared to females who mature around seven inches in length.³⁸ Spawning is the release or deposit of eggs.³⁹ Females release two gelatinous egg masses of about 12,000 to 15,000 eggs each.⁴⁰ In warmer climates, females can spawn every four days and the masses of eggs drift for approximately twenty-five days.⁴¹ The annual output of eggs is two million per female.⁴² The population spreads rapidly due to how frequent lionfish release egg masses.⁴³

This invasive species does not survive the winter up north.⁴⁴ Lionfish are typically found in shallow waters and in depths up to 1,000 feet and in temperatures as cold as 48 degrees Fahrenheit.⁴⁵ Once lionfish find a suitable habitat they tend to stay there and are known to have a high-fidelity rate.⁴⁶ Lionfish are most likely to survive in the warm water habitats of the tropics and water depths ranging from one to one-thousand feet in the mangroves, seagrass, coral, and artificial reefs.⁴⁷

³³ *Venomous Lionfish Invade South Florida Waters*, *supra* note 17.

³⁴ Erin Spencer, *The Truth About Getting Stung by a Lionfish*, NATIONAL GEOGRAPHIC (Aug. 8, 2013), <https://blog.nationalgeographic.org/2013/08/08/the-truth-about-getting-stung-by-a-lionfish/>.

³⁵ *Lionfish – Pterois volitans*, *supra* note 13.

³⁶ *Id.*

³⁷ *Id.*

³⁸ *Id.*

³⁹ *Lionfish Frequently Asked Questions*, FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION, <http://myfwc.com/wildlifehabitats/nonnatives/marine-species/lionfish/faqs/> (last visited Mar. 10, 2018).

⁴⁰ *Id.*

⁴¹ *Id.*

⁴² Erik Olsen, *Florida Keys Declare Open Season on the Invasive Lionfish*, NY TIMES (Nov. 22, 2010), <http://www.nytimes.com/2010/11/23/science/23lionfish.html>.

⁴³ *Id.*

⁴⁴ *Lionfish – Pterois volitans*, *supra* note 13.

⁴⁵ *Id.*

⁴⁶ *Id.*

⁴⁷ *Lionfish Frequently Asked Questions*, *supra* note 39.

C. Background Information on the Lionfish Problem

According to the U.S. Geological Survey, there has been sixty-eight different invading marine species reported throughout Florida, the Caribbean, and the Gulf of Mexico in the last century.⁴⁸ Lionfish are a predatory fish native to the Indo-Pacific. In the 1980s, they were first introduced into Atlantic waters.⁴⁹ There are many theories as to how the lionfish arrived, such as the aquarium trade⁵⁰ and the escape from the broken beachfront aquarium during Hurricane Andrew in 1992.⁵¹ Lionfish are popular aquarium fish and are imported on a daily basis through the pet trade.⁵² The greatest pathway of admission into the environment is through escape and release of pet owners.⁵³ According to Florida Administrative Code and the Florida Statutes, it is illegal to release any nonnative species in Florida without a permit.⁵⁴

Over 3,000 marine species travel around the world on ships every day and can arrive through the ballast water on international shipping boats.⁵⁵ Ballast water helps vessels maintain acceptable stability conditions and is known to be a significant pathway for the transfer of harmful organisms.⁵⁶ Theorists believe ballast water was not a likely culprit due to little shipping from the lionfish's native habitats to United

⁴⁸ *Venomous Lionfish Invade South Florida Waters*, *supra* note 17.

⁴⁹ *Lionfish*, EVERGLADES CISMA, <http://www.evergladescisma.org/the-dirty-dozen/lionfish/> (last visited Mar. 1, 2018).

⁵⁰ *Why are Lionfish a Growing Problem in the Atlantic Ocean?*, NATIONAL OCEAN SERVICE, <https://oceanservice.noaa.gov/facts/lionfish.html> (last visited Mar. 10, 2018).

⁵¹ Hill, *supra* note 1

⁵² *National Invasive Lionfish Prevention and Management Plan*, *supra* note 20.

⁵³ *How Do They Get Here?*, FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION, <http://myfwc.com/wildlifehabitats/nonnatives/how-do-they-get-here/> (last visited Jan. 1, 2018).

⁵⁴ *Conditional & Prohibited Nonnative Species Regulations*, FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION, <http://myfwc.com/wildlifehabitats/nonnatives/regulations/> (last visited Mar. 10, 2018) (stating the legal consequences for releasing any non-native species in Florida without a permit is a misdemeanor, subject to one year in prison and a \$1,000 fine).

⁵⁵ *How Do They Get Here?*, *supra* note 53.

⁵⁶ Bikram Singh, *Everything you Wanted to Know about Ballast Water Exchange and Management Plan*, MARINE INSIGHT (July 22, 2016), <https://www.marineinsight.com/maritime-law/everything-you-wanted-to-know-about-ballast-water-exchange-and-management-plan/>.

States waters.⁵⁷ Even though the introduction is unknown, it is certain that the lionfish invasion is a product of human activities.⁵⁸

In Florida, lionfish were first reported off of Florida's Atlantic coast in 1985 near Dania Beach.⁵⁹ Since 2014, more than 430,000 lionfish have been removed from Florida waters.⁶⁰ South Florida, particularly the Everglades National Park, is referred to as the most threatened park in the United States.⁶¹ The Everglades were established to protect the diverse natural habitats of the region, however, it is being influenced in an adverse way from the invasive species.⁶² Hurricanes and tropical storms have helped to accelerate the spread of this exotic species.⁶³ More than 111,000 lionfish have been removed from the Everglades in 2016.⁶⁴

D. Lionfish Resistance to Other Prey

Lionfish eliminate species that serve important roles in the Everglades, which results in an impact on the overall habitat and well-being of the environment.⁶⁵ Lionfish may be small, but they can consume prey that are more than half their own length.⁶⁶ They are known to prey on more than seventy marine fish and invertebrate species, and they stalk predators that corral prey into a corner.⁶⁷ Lionfish will eat constantly when food is available, but can also survive long periods of time without

⁵⁷ *Introduced Species*, FLORIDA MUSEUM, <https://www.floridamuseum.ufl.edu/southflorida/regions/everglades/introduced-species/> (last visited Mar. 2, 2018).

⁵⁸ *National Invasive Lionfish Prevention and Management Plan*, *supra* note 20.

⁵⁹ *How Do They Get Here?*, *supra* note 53.

⁶⁰ *FWC Lionfish Control Team*, REEF RANGERS, <http://reefrangers.com> (last visited Mar. 10, 2018).

⁶¹ *Threats to the Everglades*, FLORIDA MUSEUM, <https://www.floridamuseum.ufl.edu/southflorida/regions/everglades/threats/> (last visited Mar. 2, 2018).

⁶² *Introduced Species*, *supra* note 57 (stating the natural habitats, which include freshwater marshes, hardwood hammocks, pinelands, cypress swamps, mangrove swamps, and estuaries).

⁶³ *Researchers Find More Strategic Culling Needed to Reduce Lionfish Invasion*, PHYSORG (Aug. 11, 2015), <https://phys.org/news/2015-08-strategic-culling-lionfish-invasion.html>.

⁶⁴ *FWC Lionfish Control Team*, *supra* note 60.

⁶⁵ *Lionfish – Pterois volitans*, *supra* note 13.

⁶⁶ *Lionfish*, *supra* note 49.

⁶⁷ *Id.*

prey.⁶⁸ For instance, lionfish has been recorded to survive for roughly twelve weeks without feeding.⁶⁹ This species is very unique because they are the only species known to blow water at their victims in an effort to capture them and one of the few fish known to eat its own species.⁷⁰

Lionfish are resistant to other species of fish and to bacteria.⁷¹ Lionfish are unique because it has a bacteria that lives in the slime of their skin like pathogens.⁷² The bacteria in the mucus of the slime stop pathogens directly, by taking up space so that the pathogens cannot grow, and indirectly, by releasing compounds that inhibit the pathogens.⁷³ Lionfish are super-predators and can defend themselves through their characteristics as anti-bacterial fish.⁷⁴

II. THE JEOPARDY OF THE RED SNAPPER

The lionfish has generated competition with the red snapper. It is likely that lionfish are undesirably impacting the fish populations that we enjoy consuming at an alarming rate.⁷⁵ In the Gulf of Mexico, red snapper are the most sought after when compared to different species of snapper.⁷⁶ Consumers are misunderstood by the red snapper because the fish has been promoted as an endangered species, however, they are sold in the stores each day.⁷⁷ Somewhere along the commercial chain, retailers may have switched the labels for an imported fish to “red snapper.”⁷⁸ False advertisement distorts the perception of the public and causes

⁶⁸ Dennis Pillion, *How Invasive Fish Became Unstoppable in the Gulf of Mexico*, ALABAMA.COM (Aug. 27, 2017), http://www.al.com/news/index.ssf/2017/08/invasive_lionfish_superpredato.html.

⁶⁹ *Id.*

⁷⁰ *Lionfish – Pterois volitans*, *supra* note 13.

⁷¹ *Id.*

⁷² *Id.*

⁷³ Erin McLean, *Lionfish Slime Helps Ward Off Diseases*, OCEAN BITES (Dec. 6, 2016), <https://oceanbites.org/lionfish-slime-helps-ward-off-diseases/>.

⁷⁴ Pillion, *supra* note 68.

⁷⁵ *Spread of Lionfish in the Gulf of Mexico is threat to reef fisheries*, PHYSORG (Feb. 16, 2017), <https://phys.org/news/2017-02-lionfish-gulf-mexico-threat-reef.html>.

⁷⁶ Michael Schirber, *Marketplace Red Snapper is Case of Bait and Switch*, SCIENTIFIC AMERICAN, <https://www.scientificamerican.com/article/marketplace-red-snapper-i/> (last visited Jan. 12, 2018).

⁷⁷ *Id.*

⁷⁸ *Id.*

unawareness of the larger issue being that the red snapper population is in jeopardy.⁷⁹

A. Description and Biology

The red snapper is considered a native predatory fish.⁸⁰ They are labeled red snapper because of their large, animal-like teeth.⁸¹ This native species is in high demand with eight million pounds of snapper caught in American waters each year.⁸² Red snapper are found off both of Florida's coasts and are harvested in waters 60 to 200 feet deep.⁸³ They tend to dwell in offshore waters.⁸⁴ The average market size for the red snapper is four to six pounds, but they can grow to be approximately thirty-five pounds.⁸⁵ Adult red snapper can live more than twenty years, and possibly up to sixty years.⁸⁶

Red snapper are considered one of the finest cuisine fish.⁸⁷ The *Lutjanus campechanus* is the only species that can legally be marketed as the red snapper and is not false advertisement.⁸⁸ One distinctive way to

⁷⁹ *Id.*

⁸⁰ *Lionfish – Pterois volitans*, *supra* note 13.

⁸¹ *Red Snapper Flavor Profile*, CHEF'S RESOURCES, <http://www.chefs-resources.com/seafood/finfish/red-snapper/> (last visited Jan. 12, 2018).

⁸² *See, e.g.*, Cathleen Bester, *Lutjanus Campechanus*, FLORIDA MUSEUM, <https://www.floridamuseum.ufl.edu/fish/discover/species-profiles/lutjanus-campechanus/> (last visited Mar. 10, 2018) (distinguishes the red snapper from other fish; pinkish to red in color, and have dorsal and anal fins that taper to points near the caudal fin).

⁸³ *Red Snapper*, FLORIDA DEPT. OF AGRICULTURE AND CONSUMER SERVICES, <http://www.freshfromflorida.com/Divisions-Offices/Marketing-and-Development/Consumer-Resources/Buy-Fresh-From-Florida/Seafood-Products/Red-Snapper> (last visited Mar. 1, 2018).

⁸⁴ Michael Schirber, *Marketplace Red Snapper is Case of Bait and Switch*, SCIENTIFIC AMERICAN, <https://www.scientificamerican.com/article/marketplace-red-snapper-i/> (last visited Jan. 12, 2018).

⁸⁵ *Red Snapper Flavor Profile*, *supra* note 81.

⁸⁶ *Red Snapper*, FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION, <http://myfwc.com/wildlifehabitats/profiles/saltwater/snapper/red-snapper/> (last visited Mar. 1, 2018).

⁸⁷ Terry Tomalin, *Top 10 Florida Fish to Catch*, VISIT FLORIDA, <http://www.visitflorida.com/en-us/things-to-do/florida-fishing/florida-fish-top-10-popular-fish-in-fl.html> (last visited Mar. 10, 2018).

⁸⁸ *Red Snapper Flavor Profile*, *supra* note 81.

tell if it is red snapper is their trademark red eyes and red skin.⁸⁹ Red snapper are a reef dwelling fish and are found in the waters off of the southeast Atlantic, Gulf states, and Mexico.⁹⁰ Fishermen are supposed to catch and release red snapper whenever they are considered endangered, to help them rebuild and stay in their appropriate environments.⁹¹ Unfortunately, many fish die before they can be properly returned to native waters.⁹² The National Marine Fisheries Service declares discarded fish as ineffective for monitoring because there is too much uncertainty as to the number of fish.⁹³

B. Red Snapper as an Endangered Species

Since 2014, the red snapper has been off limits to both commercial and recreational fishing due to overfishing, resulting in the fish being considered a threatened species.⁹⁴ Environmentalists want to protect the iconic species, however, it has been at the center of a years-long debate and a difficult challenge with this sought-after game fish.⁹⁵

Researchers have discovered that a single lionfish residing on a coral reef can reduce recruitment of native fish by seventy-nine percent.⁹⁶ The lionfish influences the red snapper environment by feeding on prey that is normally consumed by red snapper in their own habitats.⁹⁷ The presence of the invasive species alone negatively affects the well-being of the commercial and recreational fisheries.⁹⁸

⁸⁹ *Id.*

⁹⁰ *Id.*

⁹¹ Ledyard King, *Under Trump, Recreational Anglers Feel Tide Turning in Their Favor on Red Snapper*, USA TODAY (Aug. 4, 2017), <https://www.usatoday.com/story/news/politics/2017/08/04/under-trump-recreational-anglers-feel-tide-turning-their-favor-red-snapper/541063001/>.

⁹² *Id.*

⁹³ *Id.*

⁹⁴ *What Happened to the Red Snapper?*, NOAA FISHERIES, http://www.nmfs.noaa.gov/stories/2012/10/docs/what_happened_to_the_red_snapper.pdf (last visited date Mar. 5, 2018) (explains overfishing in further detail which occurs when the rate of removal of a particular species is too high, resulting in the population falling below the prescribed threshold).

⁹⁵ King, *supra* note 91.

⁹⁶ *Impacts of Invasive Lionfish*, *supra* note 29 (refers to coral reefs to explain how influential one lionfish can be to native fish).

⁹⁷ *Id.*

⁹⁸ *Id.*

During closed years for fishing of the red snapper, the data collected from fishermen is limited and legislation depended on this information.⁹⁹ The Barack Obama administration emphasized protection and implemented policy restrictions to promote the fish to rebound from the endangered species list.¹⁰⁰ On the other hand, the Donald Trump administration is pro-recreational fishing industry.¹⁰¹ Trump has loosened the restrictions in federal waters and allowed commercial and recreational fishing again.¹⁰²

The Trump administration has slowly released the reins on the red snapper.¹⁰³ For instance, in June 2017, Commerce Secretary Wilbur Ross expanded the recreational fishing season for the red snapper from three to forty-two days in the Gulf of Mexico.¹⁰⁴ The House of Representatives and the Senate have reintroduced legislation to have more of a say in the management of the states over the red snapper.¹⁰⁵ This year, the agency overseeing fishing restrictions in the South Atlantic is expected to lift a years-long ban on the red snapper.¹⁰⁶ The red snapper advocates for fishing are delighted the restrictions have loosened, however, the end of safeguards may cause an unhealthy amount of overfishing to result in the red snapper being considered endangered again in the near future.¹⁰⁷

C. *The Constant Battle*

Decades of overfishing is what caused the red snapper to become threatened, and it has taken hard work and dedication to bring the red snapper back onto the map.¹⁰⁸ Scientists can collect information on the size of the fish harvested, age, fishery selectivity, and fisherman's behavior on private vessels whenever the red snapper season is open.¹⁰⁹ The Ocean Conservancy and the Environmental Defense Fund did not agree with the expansion of the Gulf fishing season and sued to stop the

⁹⁹ King, *supra* note 91.

¹⁰⁰ *Id.*

¹⁰¹ *Id.*

¹⁰² *Id.*

¹⁰³ *Id.*

¹⁰⁴ *Id.*

¹⁰⁵ King, *supra* note 91.

¹⁰⁶ *Id.*

¹⁰⁷ *Id.*

¹⁰⁸ *Id.*

¹⁰⁹ King, *supra* note 91.

process.¹¹⁰ Plaintiffs argued that Amendment 40 violated National Standard 4 and 5 through unfair treatment of fishermen and resources provided.¹¹¹ The purpose of Amendment 40 was to provide increased flexibility in future management of the recreational sector, however, this could negatively impact the rebuilding of the red snapper.¹¹² Both parties filed motions for summary judgment and the federal defendants' cross-motion was granted.¹¹³ The Vice President for Ocean Conservancy makes a valid point about the rebuilding plan, "you don't stop taking antibiotics halfway through the prescription. You'll just run the risk of getting sick again."¹¹⁴ In 2016, a study showed the species' numbers increasing, but still remaining below a healthy level.¹¹⁵ If the rebuilding plan is not entirely complete, the red snapper may potentially become endangered again.¹¹⁶

D. Why Rebuild the Red Snapper?

Under the Endangered Species Act, a species can be considered in danger of extinction in a specific region.¹¹⁷ Nevertheless, the problem is not just in the Florida Everglades, but the entire species of the red snapper.¹¹⁸ Overfishing, as mentioned above, is one of the causes to the red snapper being endangered. The reasons that a particular fish species may be overfished can include natural mortality, environmental changes, disease, and natural population cycles.¹¹⁹ The lionfish is growing in abundance and is not being removed from the waters quickly enough for the red snapper to replenish.¹²⁰ Red snapper cannot breed rapidly enough to cause the total population to increase at a healthy level consistently.¹²¹

¹¹⁰ Fishing Rights All., Inc. v. Pritzker, 247 F. Supp. 3d 1268, 1272 (M.D. Fla. 2017).

¹¹¹ *Id.* at 1277–1282.

¹¹² *Id.* at 1275.

¹¹³ *Id.* at 1282.

¹¹⁴ King, *supra* note 91.

¹¹⁵ *Id.*

¹¹⁶ *Id.*

¹¹⁷ Seema Mehta, 'Threatened' Listing Urged for Type of Red Snapper, LOS ANGELES TIMES (Jan. 25, 2001), <http://articles.latimes.com/2001/jan/25/local/me-16833>.

¹¹⁸ *Id.*

¹¹⁹ *What Happened to the Red Snapper?*, *supra* note 94.

¹²⁰ *Lionfish*, NATIONAL PARK SERVICE, <https://www.nps.gov/ever/learn/nature/lionfish.htm> (last visited Mar. 11, 2018).

¹²¹ King, *supra* note 91.

If the state sets annual catch limits for the red snapper and they have permanent authority to manage them off their shores, it may reduce the risk of red snapper entering the endangered species list.¹²² This past year, the Gulf Council did not provide enough rationale in its decision to revise the percentage of red snapper allocations.¹²³ The original allocations remains at fifty-one percent commercial and forty-nine percent recreational.¹²⁴

According to Republican Senator John Kennedy, who is co-sponsoring a bill with fellow Louisiana Republican Senator Bill Cassidy, the “current federal-only management of the red snapper has been a disaster,” so something must be done to legislation to protect them.¹²⁵ Fishermen, both commercial and recreational, should be included in management decisions because fishermen also influence the population of the species.¹²⁶ If they decide to reopen the waters to the red snapper this year, a memo from the South Atlantic Fishery Management Council suggests that the positive aspects include a “better economy, happier fisherman, and more accurate fish counts.”¹²⁷

III. SOLUTIONS AND PREVENTION STRATEGIES

The environment plays a huge role in what happens to the population of a species. Preventing the introduction of potentially harmful organisms by minimizing the spread and impact of invasive alien species is the most cost-effective strategy.¹²⁸ Once the invasive species is established, it is very difficult and costly to eradicate it from a particular area.¹²⁹ Invasive species response to a new environment is different compared to their

¹²² *Id.*

¹²³ *Update from Keep Florida Fishing – Everglades Funding and Council Meetings on Red Snapper and Cobia*, AMERICAN SPORTFISHING ASSOC., <http://asafishing.org/update-keep-florida-fishing-everglades-funding-council-meetings-red-snapper-cobia/> (last visited Jan. 14, 2018).

¹²⁴ *Id.*

¹²⁵ King, *supra* note 91.

¹²⁶ *Id.*

¹²⁷ *Id.*

¹²⁸ *National Invasive Species Council Management Plan 2016-2018*, NISC (July 11, 2016), <https://www.doi.gov/sites/doi.gov/files/uploads/2016-2018-nisc-management-plan.pdf>.

¹²⁹ *Introduced Species*, FLORIDA MUSEUM, <https://www.floridamuseum.ufl.edu/southflorida/regions/everglades/threats/> (last visited Mar. 2, 2018).

native environment because they are able to keep their population at a balance.¹³⁰ An example of a successful eradication was between 1911 and 1914, with the tse-tse fly.¹³¹ The key to this being effective is only if the species is not immediately reintroduced back into the environment.¹³²

The Florida Everglades is trying different methods of prevention to reduce the threat of invasive species on the environment.¹³³ The Everglades is a protected area by the National Park Service.¹³⁴ Changes to the Everglades impact more than eight million people and countless species of animals that call the park home.¹³⁵ The lionfish are on Florida's most unwanted invasive species list.¹³⁶ The Everglades and Dry Tortugas lionfish management plan have targeted specific areas within each park to suppress the invasion.¹³⁷ The staff have created and included in the management plan a survey to remove the lionfish on a regular basis.¹³⁸ The lionfish can be speared, caught in hand-held nets or caught on hook and line.¹³⁹ There are no recreational or commercial bagging limits for capture.¹⁴⁰ "The Everglades is a test. If we pass it, we may get to keep the planet."¹⁴¹

¹³⁰ *Id.*

¹³¹ *Invasive Species Solutions*, MISSION 2015 BIODIVERSITY, http://web.mit.edu/12.000/www/m2015/2015/soln_invasive_species.html

¹³² *Id.*

¹³³ *The Threat Invasive Species Poses is Second Only to Habitat Destruction through Development*, THE NATURE CONSERVANCY, <https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/florida/howwe-work/combating-invasive-species-in-florida.xml> (last visited Mar. 11, 2018).

¹³⁴ *Park Management*, NATIONAL PARK SERVICE, <http://www.nps.gov/ever/parkmgmt/index.htm> (last visited Mar. 11, 2018) (stating that the Everglades National Park is "set aside as a permanent wilderness, preserving essential primitive conditions including the natural abundance, diversity, behavior, and ecological integrity of the unique flora and fauna.").

¹³⁵ *One of America's Last Greatest Grassland Landscapes is the Everglades*, THE NATURE CONSERVANCY, <https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/florida/placesweprotect/everglades.xml> (last visited Mar. 12, 2018).

¹³⁶ *Florida's Most Unwanted Invasive Species*, THE NATURE CONSERVANCY, <https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/florida/interactive-media-floridas-10-most-unwanted.xml> (last visited Mar. 12, 2018).

¹³⁷ *Lionfish*, *supra* note 120.

¹³⁸ *Id.*

¹³⁹ *Id.*

¹⁴⁰ *Id.*

¹⁴¹ *One of America's Last Greatest Grassland Landscapes is the Everglades*, *supra* note 135.

Another prevention method that will help reduce the number of invasive species is through the growing market for lionfish in restaurants and supermarkets.¹⁴² Ecologists and chefs have attempted to turn the lionfish into the most popular menu item,¹⁴³ and there are many recipes for cooking lionfish in your own home.¹⁴⁴ For instance, the NUISANCE Group, has promoted lionfish at their restaurants and encourages people to try eating it to spark a demand for the tasty meat.¹⁴⁵ Lionfish can be prepared grilled, fried, baked, broiled, or eaten raw.¹⁴⁶

Fear persists in regards to the consumption and risk of getting ciguatera poisoning from eating lionfish.¹⁴⁷ Ciguatera is a toxin produced by a type of plankton known as dinoflagellates.¹⁴⁸ The toxins bioaccumulates in the amount comparable to the size of the fish and how much seaweed plankton the lionfish has consumed.¹⁴⁹ The toxins do not harm the lionfish, but are harmful to humans when the meat of a “ciguatoxic” fish is consumed.¹⁵⁰ Ciguatera poisoning has no cure and usually ceases within days or weeks.¹⁵¹ If lionfish are proven to be safe, and become cost-effective to harvest, small-scale fishermen may be able to capitalize while helping to control the invasion.¹⁵²

A. Legislation

The introduction of invasive species can relate to the Commerce Clause of the Constitution.¹⁵³ This Clause is found in Article I, Section 8, Clause 3 of the U.S. Constitution, which allows Congress to regulate

¹⁴² Pillion, *supra* note 68.

¹⁴³ Sarah Shemkus, *Eat an Invasive Species for Dinner*, THE ATLANTIC (Apr. 7, 2016), <https://www.theatlantic.com/science/archive/2016/04/invasive-lionfish/477570/>.

¹⁴⁴ Emily Tripp, *Experts Say We Should Eat Lionfish*, MARINE SCIENCE TODAY, (Feb. 28, 2013) <http://marinesciencetoday.com/2013/02/28/experts-say-we-should-eat-lionfish/>.

¹⁴⁵ Pillion, *supra* note 68.

¹⁴⁶ *Id.*

¹⁴⁷ *Impacts of Invasive Lionfish*, *supra* note 29.

¹⁴⁸ Snhackerott, *The Lionfish Ciguatera Controversy*, UNDER THE C BLOG (Aug. 1, 2014), <https://underthecblog.org/2014/08/01/the-lionfish-ciguatera-controversy/>.

¹⁴⁹ *Id.*

¹⁵⁰ *Id.*

¹⁵¹ *Id.*

¹⁵² *Impacts of Invasive Lionfish*, *supra* note 29.

¹⁵³ U.S. CONST. art. I, § 8.

commerce and to enumerate certain powers to the federal government.¹⁵⁴ Interstate commerce includes the exchange of commodities between different states.¹⁵⁵ It can be argued that the species impacted by globalization, moving from one place to another, whether it be on purpose or not, is interstate commerce.¹⁵⁶ Under the Tenth Amendment of the U.S. Constitution, the exercise of authority to regulate the spread of invasive species is within the police power of each individual state.¹⁵⁷

i. National Invasive Species Council

Barack Obama signed Executive Order 13112, which established the National Invasive Species Council.¹⁵⁸ The Council is federally funded and expands the safeguard interests of the United States to prevent the spread of invasive species and restore the ecosystems.¹⁵⁹ The executive order removes policy barriers, fosters innovation, and implements a rapid response to potentially invasive species.¹⁶⁰ The management plan is a collective action with full commitment from the federal government which holds the vision that the environment desires.¹⁶¹ The Council will evaluate the effectiveness of the management plan and will update it every three years.¹⁶²

ii. Lacey Act

The Lacey Act is the United States' oldest federal conservation law, and the first line of defense against the trade of nonnative species.¹⁶³ The Act authorizes the Secretary of the Interior to regulate the importation and shipment of species that is injurious to the health and welfare of humans.¹⁶⁴ The Act is reactive, instead of proactive, and critics have

¹⁵⁴ *Id.*

¹⁵⁵ *Id.*

¹⁵⁶ *Id.*

¹⁵⁷ U.S. Const. amend. X.

¹⁵⁸ Exec. Order 13,112, *supra* note 9.

¹⁵⁹ *About NISC*, U.S. DEPARTMENT OF THE INTERIOR, <https://www.doi.gov/invasivespecies/management-plan-and-executive-order> (last visited Mar. 11, 2018).

¹⁶⁰ *Id.*

¹⁶¹ *Id.*

¹⁶² Exec. Order 13,112, *supra* note 9.

¹⁶³ 18 U.S.C § 42(a)(1).

¹⁶⁴ *Injurious Wildlife*, U.S. FISH & WILDLIFE SERVICE, <https://www.fws.gov/injuriouswildlife/> (last visited Mar. 11, 2018).

condemned the statute as ineffective.¹⁶⁵ The average listing time for a species is approximately four years and around forty species total have been listed.¹⁶⁶ The civil penalties listed on the legislation are fixed, making the overall effectiveness limited and not a strong tool for prevention.¹⁶⁷

iii. Magnuson-Stevens Act (MSA)

The Magnuson-Stevens Fishery Conservation and Management Act is the primary law that governs marine fisheries management in United States federal waters.¹⁶⁸ The key objectives are to prevent overfishing, rebuild overfished stocks, increase long-term economic and social benefits, and ensure a safe and sustainable supply of seafood. These objectives foster the long-term biological and economic stability needed for endangered fish and the entire population of marine fisheries.¹⁶⁹ Congress has revised the MSA twice, most recently in 2007 with the MSA Reauthorization Act. The MSA Reauthorization Act enhanced international cooperation by addressing illegal and unregulated fishing to help end overfishing and to rebuild the population, which strengthens the value of fisheries to the economy.¹⁷⁰

B. Competing Theories of Federal Regulation

Scholars continue to implement and advocate for federal regulations of nonnative invasive species.¹⁷¹ The benefits of increased federal regulation are frequently balanced against the arguments federalism and state autonomy.¹⁷² Often a federal law can be useful when a species is too widespread – like the lionfish – for a state to manage it alone.¹⁷³

¹⁶⁵ 18 U.S.C § 42, *supra* note 163.

¹⁶⁶ *Id.*

¹⁶⁷ *Id.*

¹⁶⁸ *Laws & Policies*, NOAA FISHERIES, <https://www.fisheries.noaa.gov/topic/laws-policies> (last visited Mar. 11, 2018).

¹⁶⁹ *Id.*

¹⁷⁰ *Id.*

¹⁷¹ Terry Anderson and Peter Hill, *Environmental Federalism: Thinking Smaller*, PROPERTY AND ENVIRONMENT RESEARCH CENTER (Dec. 1, 1996), <http://perc.org/articles/environmental-federalism-2>.

¹⁷² *Id.*

¹⁷³ John L. Dentler, *Noah's Farce: The Regulation and Control of Exotic Fish and Wildlife*, 17 U. PUGET SOUND L. REV. 191 (1993).

Researchers have proposed and argued that federal tort law should be expanded to provide causes of action for harm caused in one state by nonnative species that have migrated to a different state to make it more controlled.¹⁷⁴ When Florida acts to control its lionfish population and to protect the red snapper in the state's ecosystem, it should also protect the citizens and the state from lawsuits in the future.

Advocates viewpoint for regulation of the nonnative invasive species is that the presence of these species is not something that needs to be stopped, even when the species becomes dominant in the ecosystem it has invaded.¹⁷⁵ This approach is known as *laissez faire*, rooted in the belief that biodiversity is not something worthy of protection.¹⁷⁶ Due to the destructive human activities, the current rate of species extinction is at least 100-1,000 times higher than the expected natural rate.¹⁷⁷

Others argue that regulating is futile and unnecessary when factors are constantly evolving and changing the ecosystems that the nonnative species are intruding upon.¹⁷⁸ Under this outlook, the invasive species create the opportunity for the ecosystem to evolve and adapt.¹⁷⁹

C. Prevention Methods

a. Successful Methods

Lionfish are spreading rapidly due to there being no known predators in Florida waters.¹⁸⁰ A short-term fix is beneficial, but researchers are working together to develop a long-term plan for effective management

¹⁷⁴ Matthew Shannon, *From Zebra Mussels to Coqui Frogs: Public Nuisance Liability as a Method to Combat the Introduction of Invasive Species*, 32 ENVIRONS ENVTL. L. & POL'Y. J. 37 (2008).

¹⁷⁵ Charles Perrings, *Biodiversity Conservation: Problems and Policies*, ECOLOGY, ECONOMY, & ENVIRONMENT at 61-62, 405 (2012).

¹⁷⁶ *Id.*

¹⁷⁷ *Arguments for Protection: Biodiversity*, WORLD WILDLIFE FUND, http://wwf.panda.org/what_we_do/how_we_work/protected_areas/arguments_for_protection/biodiversity/ (last visited Mar. 11, 2018).

¹⁷⁸ Karina Acevedo-Whitehouse & Amanda L. J. Duffus, *Effects of Environmental Change on Wildlife Health*, THE ROYAL SOCIETY PUBLISHING (Oct. 15, 2009), <http://rstb.royalsocietypublishing.org/content/364/1534/3429>.

¹⁷⁹ *Id.*

¹⁸⁰ L. Scott Harrell, *Why are Lionfish a Problem?*, LIONFISH HUNTING, <https://lionfish.co/why-are-lionfish-a-problem/> (last visited Mar. 11, 2018).

of the species.¹⁸¹ Past lionfish studies determined that wiping the species out completely may not be possible even with the financial means.¹⁸²

i. Florida Fish and Wildlife Conservation Commission

In 2013, the Florida Fish and Wildlife Conservation Commission began a research study funded by the Conserve Wildlife Tag program.¹⁸³ This study focuses on the species located in five selected reef habitats in the Florida Keys.¹⁸⁴ Researchers have examined more than 1,000 lionfish stomachs and found more than fifty species of prey fish inside, including juveniles of commercially imported snapper.¹⁸⁵ This research study can be used on the study in the Everglades in identifying the key habitats effected by the lionfish and their impact on local fish populations.¹⁸⁶ The goal of this study is to provide guidelines to prioritize locations for lionfish management and to establish effective control strategies to be used now and in the future.¹⁸⁷

Researchers assess the rate of recolonization after they remove the non-native species and how this influences the native species of that particular area.¹⁸⁸ The process is documented through visual assessments of the habitat sites.¹⁸⁹ By removing and maintaining a lionfish-free environment, researchers will be able to determine if they are causing the

¹⁸¹ *The Lionfish Invasion*, SAILORS FOR THE SEA, <https://www.sailorsforthesea.org/programs/ocean-watch/lionfish-invasion> (last visited Mar. 11, 2018).

¹⁸² *Id.*

¹⁸³ *Id.*

¹⁸⁴ *Id.*

¹⁸⁵ Olsen, *supra* note 42.

¹⁸⁶ *Id.*

¹⁸⁷ *Id.*

¹⁸⁸ Dov F. Sax & Steven D. Gaines, *Species Invasions and Extinction*, 105 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, Supp. 1, at 11490, 11497.

¹⁸⁹ See, e.g., Tracy Holcombe, Thomas J. Stohlgren, & Catherine Jarnevich, *Invasive Species Management and Research using GIS*, FORT COLLINS SCIENCE CENTER, U.S. GEOLOGICAL SURVEY (2007) (discussing Geographical Information Systems as tools in the field of invasive species management).

negative effect on native species.¹⁹⁰ As a result, the decreased amount of lionfish will cause an increase in the native fish.¹⁹¹

Scientists use acoustic tracking technology and video monitoring to observe lionfish behavior and movement patterns.¹⁹² An acoustic tag is inserted into the abdominal cavity of the lionfish and then divers release the fish back onto the reef.¹⁹³ The divers track the movement of these tagged animals through a network of underwater receivers placed throughout the Keys.¹⁹⁴ When a tagged fish swims near one of the receivers, the unique identification number of the tag as well as the date and time is recorded.¹⁹⁵ Scientists retrieve the data collected from the acoustic tags to determine how frequent lionfish migrate between adjacent sites and to estimate their home range.¹⁹⁶

ii. Invasive Lionfish Control Ad-Hoc Committee of the Aquatic Nuisance Species Task Force

In 2015, a lionfish management plan for United States waters was finalized by the Invasive Lionfish Control Ad-Hoc Committee of the Aquatic Nuisance Species Task Force.¹⁹⁷ The Task Force hopes to promote public education and awareness, to monitor the populations accurately and reliably, and to provide guidance to restore the native species and habitat conditions that have been invaded.¹⁹⁸ The plan provides federal agencies and other stakeholders an opportunity to contribute through relevant programs and authorities to prevent the further introduction of this invasive species.¹⁹⁹

¹⁹⁰ *Atlantic and Caribbean: Lionfish Invasion Threatens Reefs*, WORLD RESOURCES INSTITUTE, <http://www.wri.org/atlantic-and-caribbean-lionfish-invasion-threatens-reefs> (last visited Mar. 11, 2018).

¹⁹¹ *Id.*

¹⁹² *Acoustic Telemetry Tracks Florida Keys Reef Fish*, FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION, <http://myfwc.com/research/saltwater/telemetry/projects/tortugas/> (last visited Mar. 11, 2018).

¹⁹³ *Id.*

¹⁹⁴ *Id.*

¹⁹⁵ *Id.*

¹⁹⁶ *Id.*

¹⁹⁷ Maia McGuire & Jeffrey Hill, *Invasive Species of Florida's Coastal Waters: The RedLionfish*, UNIVERSITY OF FLORIDA IFAS EXTENSION, <http://edis.ifas.ufl.edu/sg132> (last visited Mar. 11, 2018).

¹⁹⁸ *Id.*

¹⁹⁹ *Id.*

iii. Aquatic Nuisance Species

The Aquatic Nuisance Species was established by Congress with the passage of the Nonindigenous Aquatic Nuisance Prevention and Control Act in 1990.²⁰⁰ This is the only federally-mandated intergovernmental organization that is solely dedicated to preventing and controlling invasive species that threaten the diversity or abundance of native species.²⁰¹ This Act monitors, controls, and studies the species, conducts research on different methods to do so, coordinates programs and activities, and educates and informs the general public about the prevention of these species.²⁰²

iv. Comprehensive Everglades Restoration Plan

Currently, there is a restoration effort for the Everglades called the Comprehensive Everglades Restoration Plan (CERP).²⁰³ This is referred to as the “world’s largest ecosystem restoration effort.”²⁰⁴ This plan was authorized by Congress in 2000, and aims to help preserve the ecosystem, which will take more than twenty years to develop and implement.²⁰⁵ The South Florida Management District and the U.S. Army Corp of Engineers will work together with other agencies and citizens, to make this plan successful in the long run.²⁰⁶ CERP focuses on the restoration and preservation of habitats in the Everglades and South Florida, while managing water supplies and controlling floods.²⁰⁷ A unique federal and state partnership guides the interagency plan.²⁰⁸ The U.S. Department of the Interior plays an important advisory role in the CERP decision-

²⁰⁰ *National Invasive Lionfish Prevention and Management Plan*, *supra* note 20.

²⁰¹ *Id.*

²⁰² *Id.*

²⁰³ *Conservation of the Everglades*, FLORIDA MUSEUM, <https://www.floridamuseum.ufl.edu/southflorida/regions/everglades/conservation/> (last visited Mar. 11, 2018).

²⁰⁴ *Id.*

²⁰⁵ *Comprehensive Everglades Restoration Plan (CERP)*, NATIONAL PARK SERVICE, <https://www.nps.gov/ever/learn/nature/cerp.htm> (last visited Mar. 11, 2018).

²⁰⁶ *Id.*

²⁰⁷ *Id.*

²⁰⁸ *Id.*

making process.²⁰⁹ Implementing management plans are expensive, but are essential to protect the unique habitats of the Everglades.²¹⁰

v. National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration has developed an Invasive Lionfish Web Portal.²¹¹ This provides a centralized location for updated, accurate information on the lionfish and their management.²¹² The portal provides education, monitoring, and communication to parties that are involved in preserving the health of the environment.²¹³ Dr. James Morris, a lionfish expert, hosted a lionfish symposium in 2014 which provided more than thirty-five presentations that focused on harvesting invasive lionfish.²¹⁴ A main point of focus during the symposium was minimizing invasive lionfish impacts with local measures.²¹⁵

vi. Persuasion of the Invasion: Lionfish Hunters

Vone Research is a non-profit organization comprised of volunteers who devote time to increase public awareness on Florida's maritime history and oceanic resources.²¹⁶ The volunteers provide research, conservation, preservation, and education with respect to the resources available to help preserve the environment.²¹⁷ The mission of Vone Research is to educate the general public on the lionfish and how it influences our reef ecosystems.²¹⁸ The organization wants to unite the dive community and governmental agencies.²¹⁹ This plan is similar to other organizations who are attempting to restrict the lionfish problem and

²⁰⁹ *Id.*

²¹⁰ *Conservation of the Everglades*, *supra* note 203 (emphasizing how expensive management plans can be; CERP will cost over seven billion dollars to develop).

²¹¹ *Impacts of Invasive Lionfish*, *supra* note 29.

²¹² *Id.*

²¹³ *Id.*

²¹⁴ *Id.*

²¹⁵ *Id.*

²¹⁶ *Our Mission*, VONE RESEARCH, <http://www.vonersearch.org/> (last visited Mar. 11, 2018).

²¹⁷ *Id.*

²¹⁸ *About Lionfish Hunters*, LIONFISHHUNTERS.ORG, <http://www.lionfishhunters.org/> (last visited Mar. 1, 2018).

²¹⁹ *Id.*

implement a management plan.²²⁰ Vone Research started a Lionfish Education, Management and Control Program, which includes all of the local agencies who are working together for the same common goal of the lionfish invasion.²²¹ The team consists of divers who are constantly being recruited to stop the invasion of this species in the Florida Everglades.²²²

vii. Divers Help Lionfish Invasion Through Derbies

Derbies have been taking place since 2009, and have removed approximately 21,092 lionfish in total.²²³ A derby is a single day competition held each year to collect and remove as many lionfish as possible and to help raise public awareness of the problem.²²⁴ Research studies suggest that single day removal events can be highly effective in lowering the local populations and provides large sample sizes of specimen to analyze for scientific research.²²⁵ Divers need to be able to identify and safely catch lionfish to prevent the spread of harm.²²⁶ The Reef Environmental Education Foundation has been actively working in the Caribbean and the Florida Keys for several years to provide divers with the adequate training regarding lionfish capture.²²⁷ Shorter pole spears that reload quickly will let a single diver clean the majority of the reef structure.²²⁸ A plastic tube called a Zookeeper holds approximately fifty lionfish, and provides a protective barrier so the diver does not get stung by the spines when collected.²²⁹ Wearing puncture-proof gloves when spearfishing and handling is recommended to prevent harm.²³⁰

Another more cost efficient method is the placement of lobster traps by divers.²³¹ Lionfish have been caught in lobster traps, but the traps also catch native fish that were not intended to be captured.²³² This enhances

²²⁰ *Id.*

²²¹ *Id.*

²²² *Id.*

²²³ *Lionfish Derbies*, REEF, <http://www.reef.org/lionfish/derbies> (last visited Mar. 1, 2018).

²²⁴ *Id.*

²²⁵ *Id.*

²²⁶ McGuire & Hill, *supra* note 197.

²²⁷ *Id.*

²²⁸ Pillion, *supra* note 68.

²²⁹ *Id.*

²³⁰ *Id.*

²³¹ *Id.*

²³² *Id.*

the notion that the prevention methods that are planned to restrict this species must be legitimate and effective in the management.

b. Unsuccessful Methods

The total cost of invasive species has been estimated to be five percent of the world's annual Gross Domestic Product.²³³ Full or large-scale eradication of the lionfish species has been proposed in previous years, and is used to eliminate the species completely from a particular area where they are causing destruction in the environment.²³⁴ The results from the past studies have determined that wiping the species out completely may not be possible even with the financial resources to do so.²³⁵ Full eradication would include removing the species entirely from a particular area.²³⁶ The state must develop a plan for immediate response to eradicate recent invasions to keep the population low.²³⁷ Developing these mechanisms preemptively is helpful, however, efforts may fail requiring excessive funding and severe damage to the habitat.²³⁸

The Non-Native Wildlife Invasion Prevention Act was terminated at the end of the 2009-2010 legislative session.²³⁹ The bill was a broad prevention framework that ended unsuccessfully, but a review of it will benefit our analysis to learn what works and what does not.²⁴⁰ The Act required the United States Fish and Wildlife Service to first assess the potential risks associated with a species proposed for import into the environment before the decision whether to allow or prohibit.²⁴¹ Studies help scientists better understand the role that lionfish play in their harm to the environment.²⁴²

IV. CONCLUSION: WHERE WE STAND – FUTURE RECOMMENDATIONS FOR INVASIVE SPECIES IN THE

²³³ *Invasive Species Solutions*, *supra* note 131.

²³⁴ *Spread of Lionfish in Gulf of Mexico is Threat to Reef Fisheries*, NSU NEWSROOM (Feb. 14, 2017), <https://nsunews.nova.edu/spread-of-lionfish-in-gulf-of-mexico-is-threat-to-reef-fisheries/>.

²³⁵ *Id.*

²³⁶ *Id.*

²³⁷ *Invasive Species Solutions*, *supra* note 131.

²³⁸ *Id.*

²³⁹ H.R.669, 111th Cong. (2009-10).

²⁴⁰ *Id.*

²⁴¹ *Id.*

²⁴² Hill, *supra* note 1.

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While both the state and federal government are working towards a solution for invasive species, more should be done to fund prevention, preparedness, and research. An essential part of an effective precautionary approach to management of invasive species requires integration into the legal framework. State agencies should consider exercising their rulemaking authority to enact a rule under which invasive species can be more aptly controlled. Like the National Invasive Species Council, a Florida Invasive Species Council should be established in order to promote horizontal and vertical integration between different levels of the government to ensure consistency. This council should facilitate the eradication of the invasive species that are destroying the habitats of the native species. The council can oversee the use of funding, and assist in planning strategies and management techniques.

The approach needs to be the most effective and cost-efficient strategy. In order for there to be a substantial effect on the fight against invasive species, more federal funding needs to be passed and should be made available to support environmentalists working tirelessly to help save the endangered species and their habitats. Governmental agencies, such as Florida Fish and Wildlife Conservation Commission, are working towards the establishment of plans to rebuild. The risks associated with the introduction of invasive species needs to be identified and assessed to determine whether the impacts are acceptable or unacceptable.

This strategy will allow overfished or endangered species to rebuild to target population levels by a specific deadline. If the targeted population levels are not met by the deadline set, then those participating in the rebuild management plan can take a step back to analyze the pros and cons of what worked well and what did not. Finding the strengths and weaknesses of each step in the plan will take time. It will constantly be a work in progress, but if the population increases to a level where it is no longer threatened, then all of the efforts will be worthwhile.

Incentives should be provided to those who catch and destroy the invasive species. The incentives could be government-based, with special recognition to businesses that exceed standards, by funding grant programs or giving tax credits. These incentives can be used as tools to regulate. The more coordination and communication among the different agencies can help ensure cooperation among everyone functioning towards the same goal.

The downfall to rebuilding plans is that one plan may work for one species, but not for another. It is all trial and error. Each species is different in regards to their environments, their predators, and the way they respond to change. It is unfortunate that if state or federal government, environmentalists, or researchers regulate the lionfish problem for a particular area, it may work for that area only, and not in other locations that the species has invaded. Environmentalists need to narrow in on the factors that impact each habitat in a negative way to help limit the non-native species from taking over the endangered species altogether.

In order for a proactive approach by state governments to be effective, members of the state legislature must work together to create a bi-partisan funding bill that will help to distribute funding to reduce the amount of invasive species. This should create a response that helps to prepare and prevent issues like the red snapper from becoming endangered in the future. The biggest challenge is how quickly the invasive species adapts to the native species environment and reproduces as they compete for food and survival.

Article I, Section 8 of the U.S. Constitution contains the enumerated powers of the federal government delegated to Congress.²⁴³ The Environment Protection Agency has the authority to coordinate and support research on state and local government efforts, private and public groups, and educational institutes.²⁴⁴ If they delegate their responsibilities to the state governments to monitor and enforce the control of invasive species, then the environment could potentially be changed for the better. The federal government influences the design and implementation of environmental regulations, and can protect endangered species and the threat of invasive species. Accountability is key to make an improvement in our environmental quality.

While certain agencies are doing as much as possible to help reduce the environmental impact, more could be done. Agencies can collaborate efforts with other organizations who are working towards the same goal to limit the spread of the species. The organizations should partner with national and state governments and make a panel to control this issue. Agencies should educate the public, private sectors, and industries in which lobbyists are involved to receive funding to accomplish these ideas. If the public is educated and understands what is going on around them,

²⁴³ U.S. CONST. art. I, § 8.

²⁴⁴ Fairness in Negative Enforcement Act of 2011, H.R. 3450, 112th Cong. § 2(a) (2011).

and where their money is being spent, then they are more likely to support the cause.

Biological control is a sustainable way to control invasive species. This method would take natural enemies of the invasive species, which pose no threat to the new environment and incorporate them into the management option. Risks are associated with this method of prevention being more cost efficient, however, the amount of cooperation and action it requires to regulate is difficult to maintain. Globalization, climate change, and human mobility have fundamentally altered the environment. As a result of travel, invasive species are a global problem threatening biodiversity, causing economic loss, and impacting human health and livelihoods. The method of approach is essential to the entire success of the management plan.

Due to the fact that lionfish do not survive the winter up north, it makes sense why they have chosen Florida as one of their new homes. The Florida Everglades are cherished by many and we should do whatever we can to safeguard the environment that is being damaged. Invasive species frequently pose threats and present a never-ending battle in different areas of Florida, especially the Everglades as a protected park with a wide range of species. Environmentalists will never fully eradicate the lionfish from U.S. and Floridian waters, but they must work consistently towards saving the threatened native species. It is important to know the current location of the alien species and to forecast where they will be located in the future. The federal government, state governments, local governments, non-governmental organizations, and environmentalists must all have a hand in collaborating and addressing the abatement of the spread of invasive species throughout the Florida Everglades. Once the management programs make progress with time, they can spread their research to more areas instead of just focusing on one. Doing so is not only ecologically sound, but the environment needs to be saved before it is too late.