The Politics of Shark Fins
Feds and Florida Battle to End Fin Sales

North Carolina’s Magic Crystals
An Angler’s Coastal Paradise

Tribute to Theophile
A Cajun Legend’s Legacy

The Lionfish Compendium
How the Invader Has Spawned an Entire Industry
**STEFANIE BRENDL**

To say that Stefanie Brendl is an advocate for sharks is like saying water is wet. In many ways, she is as much of a shark as sharks are, in that she spends a lot of her life facing off with attorneys and politicians. As the founder and executive director of Shark Allies, Brendl has been fighting to protect sharks from overfishing, finning, and general abuse during the past two decades. She has roamed the halls of state governments from Hawaii to Florida and is all too familiar with the nuances and corruption of politics. Originally from Bavaria, Germany, Brendl became a shark whisperer after she took up scuba diving, settled in Hawaii, and started Hawaii Shark Encounters, a venture that focused on blowing the minds of tourists who snorkeled with sharks from the protection of a cage. Hawaii also turned out to be her introduction to legislation, and Brendl successfully lead the charge to ban the trade of shark fins in Hawaii. That ban took effect in 2010. Along the way, she became a cinematographer and filmmaker and produced a documentary called *Extinction Soup* about the perils of shark finning and the victory over finning in Hawaii. In the past two years, her abundant energy and networking has been focused on Florida where, as of this printing, the sale of shark fins is still legal. House Bill 401, which bans the sale of shark fins in Florida, passed the House in December but still has to get the approval of Florida’s senate. After her Floridian efforts, Brendl plans to cross the big pond and spread her shark love in Europe where some antiquated laws need her wisdom and guidance. Before she was consumed with shark advocacy, Brendl traveled the world on a sailboat with scuba gear and paragliders for exploring high and low. Apparently, it prepared her well for politics.

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**DR. STEVE GITTINGS**

Since 1998, Dr. Steve Gittings has been chief scientist for NOAA’s National Marine Sanctuary Program, which encompasses the nation’s 12 marine sanctuaries. Prior to his move to NOAA’s head offices in Washington, D.C. he was manager of the Flower Garden Banks National Marine Sanctuary offshore of the Texas coast. As a longtime and avid scuba diver, he has specialized in coral reef ecology and also has broad experience in conservation science, including ecosystem characterization and monitoring, damage assessment and recovery, and spill response. He has extensive field experience in scientific diving, ROV operations, and submersible use. Recently, Dr. Gittings has been developing traps designed to catch lionfish in waters beyond scuba depth. The traps minimize by-catch and ghost-fishing, and could create new opportunities for fishermen to help create a steady supply of lionfish to seafood and other developing markets. Gittings’ ocean-related articles and photography have appeared in numerous publications. He earned his Ph.D. in Oceanography from Texas A&M in 1988.
An invasive lionfish found by a diver along the Gulf Coast of Florida.
LIONFISH CONUNDRUM

WORKING TOWARD SOLUTIONS TO CONTROL INVASIVE LIONFISH
Eradicating a species from the planet is, sadly, a special human talent. From the dodo bird to the sea cow to passenger pigeons, and many, many others, the road to extinction has been paved by man. Then there’s the ubiquitous lionfish we’ve all heard so much about. You’d think, given our stellar record of erasing creatures from the face of the Earth or the sea, that we’d be able to kill off a fish that is, one, easy to spear and, two, delicious to eat. Unfortunately, the removal of lionfish has presented us with a unique set of challenges and, so far, the crafty critters with venomous spines have not succumbed to man’s ingenuity or insatiable appetite for seafood.

The good news is that many organizations with bright people are working hard to crack the code. Coast Watch Alliance (CWA), a non-profit founded in 2014 to tackle issues that affect our coastlines and offshore ecosystems has a special loathing for lionfish. Headquartered in Pensacola, Florida, the epicenter of the lionfish outbreak, CWA is a collaboration of divers, recreational anglers, scientists, and business owners working to conserve and protect coastal and marine environments. In addition to battling lionfish on multiple fronts, the organization’s mission includes the removal of marine debris resulting from commercial and recreational fishing activities, as well as addressing man-made water quality issues that impact reef systems.

Because the Gulf Coasts of Northwest Florida and Alabama now have some of the highest densities of lionfish in the world, Pensacola has been dubbed the “Lionfish Capital of the World.” At the turn of the 20th century, the town’s moniker was the more-appealing, “Red Snapper Capital of the World.” Schooners with massive live wells would regularly bring in 30,000 to 40,000 pounds of red snapper and grouper in the early 1900s.

These days, the snapper and grouper populations are under strict management via bag limits and seasons, while lionfish grow unabated and are only able to be harvested by divers with spears. To make matters worse, lionfish pose a significant threat to those prized snapper and grouper and other economically viable game.
fish. They are opportunistic feeders and will not hesitate to devour juvenile snapper, grouper, flounder, amberjack, octopus, or whatever is available.

Some have viewed this invasion as an insurmountable problem. However, CWA has approached it as an opportunity to help reduce harvesting pressure on native seafood species, while also providing an economic opportunity for local fishermen and divers, seafood suppliers, and entrepreneurs. While the complete eradication of lionfish is not currently considered realistic, we may be able to reduce their numbers to low enough levels to allow native species to thrive. CWA is trying to accomplish this, not only through removal efforts, but through education and public outreach as well.

Accordingly, the all-volunteer group has implemented a four-stage plan. First, to bring expanded awareness of the lionfish threat in order to engage further action. Second, to promote the culinary value of lionfish in hopes of increasing the demand for this sustainable seafood choice. Third, to increase ecotourism through harvesting dive trips. And finally, to promote citizen science through lionfish research.

Of course, if you’re going to put a dent in the lionfish population, you need a lot of hunter divers and they, in turn, need a boat. Enter the LionSlayer, CWA’s high-speed, all-aluminum, custom, 26-foot dive/fishing boat used to liberate lionfish from their habitat. Through a $100,000 Impact 100 grant, CWA outfitted the LionSlayer with the tools to harvest lionfish as well as perform marine debris cleanups. The boat, decorated in lionfish murals, also attracts a lot of attention at fishing and diving events such as the annual Lionfish Removal and Awareness Day (LRAD) event.

Working alongside the Florida Fish & Wildlife Conservation Commission (FWC), CWA helped co-host the inaugural LRAD festival in May 2015, which drew upwards of 3,000 visitors to the downtown Pensacola area. This event, now in its sixth year, along with associated spearfishing derbies held across the state, has resulted in the removal of more than 40,000 lionfish. CWA continues to remain an active participant in LRAD and organize removal events, such as the one-day Pensacola Lionfish Classic in October 2019.

In addition to working on the state level, CWA has expanded its footprint nationally with NOAA. The group was recently awarded the only permit by NOAA to lead the Flower Garden Banks National Marine Sanctuary Lionfish Invitational, an expedition that runs twice a year to harvest lionfish from protected reefs in Texas Gulf waters. The lionfish taken...
from the Flower Garden Banks are used for research purposes by NOAA.

One of CWA's most notable contributions in the lionfish saga came from one of its founding members, Bryan Clark, who created a lionfish map database (fwcreefrangers.com) to support FWC and the Alabama Department of Natural Resources (DNR). Clark's software is used to document lionfish detections and densities, as well as allow local divers to track and more efficiently cull lionfish from local reefs.

If you ever wondered whether a small group of dedicated individuals could make an impact, CWA has your answer. Their efforts are paying off and their plan is to turn up the heat. They continue to organize marine debris removal events and lionfish derbies, develop roadmaps for lionfish harvesting practices, create markets for lionfish products, and work on changing laws that inhibit conservation strategies. In the case of lionfish, it's an enemy CWA hopes to defeat and eat into submission.

Coast Watch Alliance is a 501(c)3 nonprofit, which relies entirely on an amazing group of ground- and water-based volunteers. If you would like to get involved, or are interested in helping out with your time or resources, you can contact CWA at brije@coastwatchalliance.org.
PERSONAL PROFILE

ALEX LUCE

A turtle seen on a dive.
A budding filmmaker and conservationist, Alex Luce is also an ocean-loving teenager trying to make a difference. When he learned about the lionfish epidemic, he was inspired to make a short, animated film under the title REEFBEAT. In a series of fortunate events, young Luce found his way to Lionfish University and its co-founder Jim Hart, who happens to be a screenwriter. Hart, Luce, and Stacy Franks, who co-founded LFU with Hart, collaborated on the film that hopes to educate kids about the lionfish problem.

We decided to dive inside the mind of a young marine conservationist to see what inspires him, what his future goals are, and if he thinks his generation is motivated to protect the marine environment.

**GHM: How did someone way out in Oakland, California, get interested in lionfish?**

Alex: I love spending time in the ocean, like surfing and snorkeling. A few years back, I convinced my parents that we should all get certified as scuba divers. I saw some interesting things as a snorkeler, but scuba diving opened up a whole new world for me. When I learned that lionfish were destroying the reef, that sparked my interest in understanding how lionfish became an invasive species. For my 8th grade International Baccalaureate (IB) final project, I decided that studying lionfish and ocean conservation would be a good research project. An important part of the project is to take the research and turn it into a community action.

**GHM: Have you ever been diving with lionfish? If so...where? If not, would you like to?**

Alex: Last summer, my family dove in Roatan, a small island off the coast of Honduras. During this trip, we found that lionfish were an invasive species and were a good thing to eat to help the reef. My dad and I then took a class and got certified to spear the lionfish. This summer, I was in Cozumel. The good news is that the lionfish invasion has been controlled there. I saw only one throughout my 15 dives. However, I know from my research that other parts of the Caribbean are much more impacted, like the waters around Florida.

**GHM: Is filmmaking a career you want to pursue?**

Alex: I love filmmaking, and I'm still learning a lot about what it takes to make different types of film. This summer, I learned about documentary films and worked with a group of other kids on a story about water rights in urban settings. I hope this is something that I can pursue professionally someday.

**GHM: Do you think other kids your age are also socially conscious like you? If so, in what way?**

Alex: Yes, this is part of the way we are growing up and being educated. At EBI, our 8th grade project is not only about learning how to do research, but also turning our knowledge into social action. That's why I'm grateful to Lionfish University for helping me identify a community need and use my love of videos to have an impact on the younger generation. Our generation has to make the future that we want to live in.

**GHM: What are some other threats to the ocean that concern you?**

Alex: I am also concerned about plastics in the ocean and pollution in water. For another school project, a group of my friends and I made a game about the great Pacific garbage patch. The goal of the game was to collect as much trash as possible and not damage your ship.

**GHM: How did you find out about Lionfish University?**

Alex: I was introduced to Lionfish University by Mr. Bradley Mart, a family friend. He is also involved in ocean conservation efforts with different non-profit organizations. After some email exchanges, Ms. Stacy Frank and Mr. James Hart suggested that we collaborate on making a short film using cartoon characters. I'm really grateful to each one of these individuals for taking the time to help me get started. I've never had an opportunity to work with adult professionals before and they made it enjoyable.

**GHM: What message do you hope other kids will get from your video?**

Alex: My main goal of this video was to educate younger kids about lionfish and how they are harming the ecosystem. Kids like to watch videos that other kids make. Hopefully, this will inspire them to learn more.

**GHM: Would you like to produce other lionfish related videos, why?**

Alex: Yes, I'd like to continue to make videos about lionfish, maybe some targeted toward a broader audience. The need for awareness and action is ongoing. I hope that in future productions, I could use real footage from my diving.

**GHM: Have you ever eaten lionfish? If so, when and where and how did you like it? If not, would you like to eat lionfish?**

Alex: I have never eaten lionfish. I would like to try some, especially because everyone says it's delicious. And like the slogan says, "Eat 'em to beat 'em."
“Lionfish are bad...”

ALEX FOGG, MARINE BIOLOGIST

Okay, maybe it’s not the lionfish that are bad, but the invasion. We’ve also heard about their spread across the Bahamas, Bermuda, Gulf of Mexico, Caribbean, East Coast of the U.S., and South America to Venezuela. Now, the Eastern Mediterranean is being overrun, seemingly unchecked. Without introducing any of the culling controls developed, tested, and implemented in the West, the map of the Mediterranean may soon mirror the USGS view of the invasion below.

ENTER LIONFISH UNIVERSITY.

Fortunately, a widely diverse group of activists have come together, forming a ragtag army to fight this common enemy. In 2012, a clan of those lionfish soldiers formed Lionfish University with a mission to promote education, awareness, and research. While LFU may not be an official university with highly touted sports teams and frat parties, the non-profit, 501C3 organization encourages scientific endeavors with a number of grants for innovative research. One such grant went to University of Georgia student Emily Noakes, who is studying lionfish reactions to playbacks of lionfish calls recorded by Dr. Scott Noakes, also of UGA (see page 78). LFU has also been instrumental in funding Dr. Steve Gittings’ lionfish trap research and development (see page 76). A grant to Dr. Janelle Fleming at the University of North Carolina was used to continue testing of Dr. Gittings’ trap.

As an educational organization, LFU members attend a variety of trade shows, conventions, and summits to get the word out that lionfish, in the wrong oceans, are bad for the environment, but in the hands of the right chef, are great to eat. From the Diving Equipment and Marketing Show (DEMA) to the Food Expo in Las Vegas, LFU continues its focus on solving the lionfish conundrum. And they’ve taken their fight to Washington, DC, for Capitol Hill Ocean Week (CHOW), an annual event that...
brings together ocean conservation organizations, elected officials, and the public. At the extremely popular NOAA fish fry, LFU and Coast Watch Alliance (CWA) served hundreds of portions of lionfish to crowds lined up to get their taste of this edible invader. Most came back for seconds and thirds because the fish was so tasty, or perhaps they also knew that lionfish are a green food, high in Omega-3 fatty acids, and low in mercury.

LFU has also utilized social and mainstream media, producing one of the first lionfish conservation ads and a Public Service Announcement (PSA) featuring Miss Cayman Islands Lindsay Japal. A visit to the LFU website and YouTube channel offers PSAs such as Lionfish 101, which is a short introduction to the lionfish invasion (https://youtu.be/uStjKoNsuPU) for students and school education programs. The PSA with Lindsay Japal and Chef Thomad making lionfish ceviche is on YouTube (https://youtu.be/ WJLfl9s99sw), as well as the latest PSA in a series on lionfish culling safety tips (https://youtu.be/pV1VizLqyhk). The group also collaborated with Polly Alford and Claire Wood, authors of the cookbook appropriately titled Cook Lionfish, which contains a variety of outstanding recipes.

LFU was founded by ocean conservationist Stacy Frank, renowned underwater photographer Courtney Platt, and screenwriter Jim Hart, who has penned numerous Hollywood movies including Contact, Hook, August Rush and The Hot Zone. The three dive junkies started a grassroots effort to share information and resources relating to the infestation of lionfish and focus on the dissemination of information to the diving and fishing communities around the world.

To expand its reach and extend public awareness, LFU assembled a diverse and widespread network of volunteer field reporters to bridge information gaps between invaded areas and to educate the public. LFU also added an esteemed panel of volunteer science advisors: Dr. Steve Gittings (chief scientist for NOAA’s Office of National Marine Sanctuaries), Dr. Lillian Tuttle (currently working on postdoctoral research at the University of Hawaii at Manoa), Alex Fogg (marine biologist and marine resource coordinator for Okaloosa County, Florida), Holden Harris (Ph.D. candidate in Interdisciplinary Ecology at the University of Florida), and Simon Dixon (marine biologist with an MS in Conservation Biology), and Dr. Stephanie Green, assistant professor of Biological Sciences at the University of Alberta, Canada. This team of scientists has published and posted studies, reports, and project updates on LFU public platforms.

The lionfish invasion continues to evolve and so must our efforts to fight back. LFU is not alone. Many are sharpening their spears as well as their wits to join the battle. Whether spearing, trapping, eating, or making jewelry from lionfish, the time has come to roll up our wetsuit sleeves and dive into the next adventure this invasion will bring.
FWC LEADS THE CHARGE

Combating invasive species from pythons to kudzu to lionfish falls under the purview of the Florida Fish & Wildlife Conservation Commission (FWC). No one agency or organization has stepped up to the plate with greater manpower and money than FWC to beat back the spiny beast. They formed the Reef Rangers to encourage harvesting, built a website to educate and inform and establish Lionfish Removal and Awareness Day (May 16), which kicked off with a festival in Pensacola in 2015. FWC has an entire lionfish division with a highly dedicated staff who spend each day working to eradicate or at least mitigate the invader’s damage to the ecosystem. The state agency has literally spent millions of dollars in their efforts and has mobilized large groups of divers and volunteers in their efforts. They’ve funded prize money at derbies - as much as $10,000 for top prizes - which has attracted the top lionfish hunters on the planet to get involved. During the 2019 LRAD tournament in Destin Florida, more than 14,000 lionfish were removed in three days with a total of $48,000 in cash prizes.

In 2018, FWC organized a Lionfish Summit in Cocoa Beach, Florida, that brought together leading scientists, managers, and activists to assess the problem and offer solutions and strategies for future Lionfish warriors. The recently published, 82-page comprehensive report on the summit highlights the need for new traps and robotic technologies to stem the invasion, particularly those that would encourage deep-water commercial fishing, adding lionfish to the catch as a way for fishermen to generate income while doing conservation. FWC Report: myfwc.com/media/21337/2018lionfishreport.pdf Lionfish remain a massive problem but, without a doubt, the invasion would be far worse without the intervention and leadership of FWC.

The Reef Environmental Education Foundation (REEF; www.reef.org), a pioneer in citizen science-based ocean conservation, has volunteers all over the world. Their members routinely conduct fish population counts during their dives and report the data to REEF. When lionfish appeared in Florida and the Caribbean, leaders like Lad Akins set the stage for early research and response on what has become a massive invasion. Currently, Dr. Ali Candelmo, REEF’s Invasive Species program manager, supervises numerous lionfish derbies in Florida that remove thousands of the critters from the Gulf and the Atlantic each year—and that is still not enough.

Executive Summary: https://myfwc.com/media/21338/2018lionfishsummary.pdf

COAST WATCH ALLIANCE

A 501c3 non-profit organization, founded to help protect our precious marine and coastal resources in the Gulf of Mexico and the Western Atlantic Ocean, including fighting the lionfish invasion.

coastwatchalliance.org

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

Florida Fish and Wildlife Conservation Commission: Good resource for information about fighting the lionfish invasion in Florida, and the invaded areas.

myfwc.com

LIONFISH UNIVERSITY

A 501c3 dedicated to education, awareness, and research related to the lionfish invasion.

lionfishuniversity.org

LIONFISH CENTRAL

This 501c3 does the work that companies don’t like to do, like software development, website development, analytics, mapping, content creation, blogging, and a whole lot more.

lionfishcentral.org

MONTEREY BAY AQUARIUM SEAFOOD WATCH PROGRAM

Helping people make better seafood choices for a healthier ocean. Lionfish is a best choice.

seafoodwatch.org

GUY HARVEY OCEAN FOUNDATION

Conducts scientific research and hosts educational programs aimed at marine conservation.

guyharvey.com

NERITIC DIVING

Find equipment for spearfishing lionfish.

neriticdiving.com
COOK LIONFISH

A cookbook by Polly Alford and Claire Wood full of delicious recipes for lionfish or any white fish.
amazon.com/Cook-Lionfish-Polly-Alford-ebook/dp/B0772VVT54

LIONFISH CARIBBEAN JEWELRY

Beautiful jewelry made from lionfish fins.
lionfishcaribbean.com/lionfish-jewelry

LIONATOR POLE SPEARS

Find equipment for spearing lionfish.
lionatorpolespears.com

NAUTICAL PASCHENS

Beautiful, functional lionfish art clothing.
nauticalpaschens.com

REEFSAVE

A non-profit, volunteer organization that does scientific research, education, and training to implement strategies that protect Western Atlantic and Caribbean reefs from loss of marine life.
reefsave.org

REEFSAFE

Oxybenzone-free sun protection products tested safe for coral reefs.
reefsafesun.com

ZOOKEPER

Lionfish containment units, heat packs to treat stings, spears, and other equipment to fight the lionfish invasion until a natural predator emerges.
zkstore.com
In recent months, there have been reports that lionfish populations may be declining. The science is unclear, but reports from divers indicate that something seems to have changed. The question is, where is Mother Nature in all of this?

Perhaps a way to answer that is to ask why numbers in some places are suddenly dropping. We are hearing more and more such reports. For years, we've been searching for evidence of predation by native species like large groupers, barracudas, sharks, and others. Fishermen have reported seeing lionfish now and then in the stomachs of their catch, but not often. We don't know of any harmful parasites that are infesting lionfish in their new habitat. And until recently, no diseases have been reported in lionfish invaders. These are things we might expect from nature. Failing to see natural control quickly taking the reins has heightened concerns over the lionfish threat, but ironically, it has also served to motivate the troops of diver/harvesters to stay the course.

Some people think lionfish are going deeper. But we really don't have any data to confirm that, even though we know the highest densities of lionfish are found below diver depths of 130-feet-plus. Some say the lower numbers mean lionfish must be getting eaten by native species, even if we don't see much evidence of that. If adults aren't being preyed on, perhaps larvae or juveniles are eaten before having a chance to grow and reproduce. They are almost certainly much easier to swallow than the spiny adult fish. We've watched Nassau grouper swallow large lionfish that were speared or just coaxed away from shelter. Sometimes they go down without any sign of distress by the grouper. Other times, it takes several seemingly uncomfortable minutes to get the lionfish to go down without sticking in the grouper's throat.

Recent reports of skin lesions on lionfish might mean lionfish are being affected by diseases they have not been exposed to in their native habitat. High levels of crowding may be allowing diseases to spread among the fish in the invaded range. That happens in all kinds of crowded situations—cattle in feedlots, fish in fish farms, and humans on planes, in schools, and so on. Combined with other natural controls, like predation and food shortages, nature alone could eventually tame this invasive beast, or at least declaw it.

But is nature actually regaining control? You don't have to be a scientist or salty seafarer to know that Mother Nature will have the final word. Lucky are those who haven't been at her mercy in the face of a raging fire, the path of a hurricane, or the rush of flood waters. But for lionfish, she seems to have been fairly slow to join the battle. Lionfish populations grew seemingly unchecked
“We are collectively trying to right our wrongs and become part of the solution rather than remaining part of the problem.”

for decades in most places before showing any signs of waning. For our part, while we watched and waited to welcome nature to her rightful command, the dedicated, motley forces of resistance geared up to give her a helping hand in solving a problem we admit we started, defying the onslaught as best we could.

As nature ramps up her efforts on lionfish, we can also consider what lionfish have taught us about our role in finding solutions and taking action in other environmental challenges. Most of us understand that there is a daunting complexity to natural systems. Our influence on them, and our ability to fix problems is constantly questioned and ever-changing. But as we pass eight billion people on the planet, there is no question that good, bad, or ugly, we have an impact.

So do we, can we, and are we actually making a difference? Absolutely! What we do individually every day makes up that collective impact. As with lionfish, solutions start with individual decisions to make a difference. Choose smartly what we buy, support, share, and talk about. And the more we know about new technologies, innovation, and ingenuity, the better the choices we can make.

The assault by lionfish certainly ranks toward the top of modern ocean invasions. What stands out so far in this case, however, is the effectiveness of the combined efforts of regular people who care—the dedicated individuals who have socialized their efforts, scientists who saw the need to understand the threat, regulators who jumped on the problem as soon as they saw it, and entrepreneurs who saw an opportunity to put their expertise to work as a driver for solutions.

To date, all this hard work and collaboration has paid off, helping to keep shallow-water invasive lionfish populations in check and protecting native ecosystems. Right from the start, observers reported it, scientists confirmed it, and a lot of people have been doing whatever they could to fight it.

We know that the lionfish problem was not too big for humans to start, but is it too big for us to stop without nature intervening? Exotic species have a way of spreading beyond our control very quickly, making conservation a brutal, uphill battle. It happened with zebra and quagga mussels that changed the Great Lakes’ ecosystems, fire ants that displace native ants and kill animals that disturb their mounds, European starlings that ravage crops, Asian kudzu that smothers forests, and brown tree snakes that decimated the birds of Guam. And there are many, many other examples infamously marking our species’ knack of not always thinking through the potential consequences of our often selfish actions. The open ocean makes control even harder.

With lionfish, we are collectively trying to right our wrongs and become part of the solution rather than remaining part of the problem. So far, we’ve changed spearfishing rules in some places to allow hunting. We mustered armies of human predators who are doing a great job controlling lionfish in shallow water. We told people “Eat ‘em to beat ‘em!” rallied restaurants to feature this “exotic” species, enticed people to pay more for this “delicacy” and do their part to save the ocean. We have published tasty recipes in lionfish cookbooks, and turned the fish’s beautiful fins into art, all of it helping people make money and creating jobs while helping control the invasion in the process.

But is that enough? We still haven’t touched lionfish populations in deep water. We hope traps will do their part, but the fish have spread so far and wide, it remains to be seen how much of a difference deep water fishing can make.

Ultimately, we have to keep up the fight and hope that Mother Nature will join our efforts to tame this invasion. There are early signs of her intervention. We know from experience that she’s in for the long haul.
WHACKIN' & STACKIN' &

We know lionfish are bad and they must be harvested. We also know they are good for you and taste great. Currently, scuba divers are the most efficient mechanism to get large quantities of lionfish out of the water. These same divers are the ones who brag about how many they can catch during a dive, in a day, on a dive trip, and in their lifetime. This affinity for competition blossomed into something that is very common in the fishing world—tournaments—or derbies as many in the lionfish community call them. These events didn’t pop up overnight. There was a time in the first few years after the start of the invasion when groups of divers would get together and hunt lionfish to see who could get the most, the largest, and the smallest. Divers, researchers, managers, nonprofits, and local businesses worked together with the common goal of removing lionfish from local waters. The winner(s) would be awarded enough money to pay their bar tab and maybe cover their registration. There would be coolers sitting around, filled with lionfish, with people bickering about who had to ‘deal with’ disposing of them. Researchers would leave the event with more samples than they could process and some poor soul would have to fillet a ton of lionfish or give up and dispose of them some way.

Since those early days, the derby and market worlds have changed dramatically. We have watched lionfish events go from loosely organized Saturday afternoon outings to large events that span months. Many attract hunters from multiple states, and include festivals, concerts, and other events. These derbies also bring in resource management agencies, large wholesalers and retailers, renowned chefs, and generous sponsors.

Today, those same derby divers (has a nice ring to it) still compete for the same bragging rights they sought at the beginning of the invasion, but also for tens of thousands of dollars in prizes provided by sponsors. Some have achieved a level of fame that permeates the diving and fishing communities months or even years after the event concludes. These divers have become focal points for print and video media, documentaries, and social media.

It’s hard to say how the increased frequency and publicity surrounding lionfish derbies affected demand for lionfish in the commercial market, but it is clear the supply from derbies and divers has not met market demand. Lionfish derbies provide a surge of lionfish into commercial seafood markets well beyond the collection areas. Now, wholesalers line up at derbies to buy every lionfish that comes in, at a premium price no less, even lionfish only a couple inches long. It didn’t used to be like this. Without commercial demand, we used to struggle to find ways to dispose of hundreds, if not thousands of pounds of lionfish.

Gradually, local restaurants began purchasing lionfish, but for only about $2.00 per pound in the early days, a price paid for lowly catfish or mullet. Once

ALEXANDER Q. FOGG

Marine Resource Coordinator, Okaloosa County Board of County Commissions, Emerald Coast Convention and Visitors Bureau
restaurants realized lionfish is not only a high quality seafood, but also a major hit among patrons, the price and demand began to climb. Since 2013, when the lionfish market really started to grow, there has been a significant increase in the number of commercial lionfish harvesters and lionfish sales reported and tracked by the Florida Fish and Wildlife Conservation Commission (FWC). Today, lionfish is considered a top quality seafood, highly nutritious, low in mercury and other harmful chemicals, and highly versatile. There are even two dedicated cookbooks. And at $6.50 per pound, the price reflects this high quality and exceeds most other local commercial species of fish.

In 2019, the Emerald Coast Open Lionfish Tournament, co-hosted by the Emerald Coast Convention and Visitors Bureau and FWC, removed 14,119 lionfish weighing in at 7,176 lbs. Based on the market price ranging from $4.00 to $6.50 per pound, depending on fish size, the total wholesale value of lionfish sold during this two-day event was more than $42,000. If you calculate the retail value from the restaurants that eventually served those lionfish to hungry patrons, the value might be as much as $200,000. Virtually all the lionfish were sold to licensed wholesalers by derby participants who possess the basic Saltwater Products License, which can be bought for a mere $50.

I am not an economist or a social scientist but I have seen these fish invade the ecosystem, then the economy, which is perhaps the only part of the invasion that has been positive. Time will tell whether lionfish derbies and the lionfish seafood market will continue to develop; in the meantime, ask for lionfish at your local restaurant and if you are a diver, consider participating in a lionfish derby.
Spearfishing alone will not defeat the lionfish invasion, which happens well beyond the reach of scuba divers. Reinforcements are needed in the form of commercial fishing fleets equipped with traps designed to catch lionfish in deep water.

Looking back, I guess you could call it a “Double Eureka!” moment.

Sitting at a science conference, listening to talk after talk after talk is not always as exciting as it sounds! So in 2013, as I dutifully squinted at data and jotted down facts at a fishery conference, Joanna Pitt talked about her group’s attempts in Bermuda to modify lobster traps to catch lionfish rather than lobsters. It struck me immediately as a perfect solution. Fishermen could use gear they already own, modify it slightly, fish it during closed seasons for lobster, make money on lionfish, and protect deep water ecosystems in the process.

Eureka!

And lionfish do come up in lobster traps. But when they do, the traps tend to have what the fishermen want—lobsters. Those sell for about $10/lb, lionfish for $6.50/lb.

As Dr. Pitt was showing underwater pictures of her traps, I noticed that only a few of the lionfish were actually inside them. There were more that hovered over and around the traps. Lionfish apparently liked being near the structures, but didn’t seem particularly attracted to the bait inside.

I wondered if there might be a way to catch the lionfish outside the trap.

Not long after that, I was invited by Stockton Rush, founder and CEO of OceanGate, to dive in a submersible off the southeast coast of Florida to depths beyond scuba diving limits (about 130 feet). The seabed between 200 and 400 feet off Fort Lauderdale is mostly sand, interrupted by small outcrops, scattered sunken boats, a lot of tires (some of the two million used in a failed attempt to make an artificial reef in the 1970s), and lost fishing gear.

The junk was the key. Hanging out near almost every piece was at least one lionfish. The really low profile junk had either no lionfish or small ones. The larger pieces had larger lionfish and more of them. Attracting lionfish required vertical structures.

Eureka, again!

Actually it wasn’t a huge surprise that fish were attracted to the structure. Fish Aggregating Devices (FADs) are widely used to increase catch rates. But lionfish seemed more tightly associated with the debris than other fish. They were also very docile compared to other fish and wouldn’t flee when approached.

All I needed to do was come up with a device that would attract fish to a structure, then close around them. To avoid the capture of unwanted fish, it would be baitless as well as a “non-containment” trap, meaning it would allow fish to come and go at will, then trap only those tightly associated with the FAD and docile enough to stay in place while a net closed around them. Lionfish is one of the few species with those traits.

I soon became a “garagineer.” As my wife and neighbors watched with amusement, I built contraptions in my garage that could test the concept I called a “FAD-based, non-containment curtain trap.” Really rolls off the tongue, no?

I was obsessed. I woke up all the time thinking about ways to make PVC frames, net curtains, hinges, harnesses, and FADs, and ways to drop traps so they would land upright on the bottom.

I eventually had a prototype we tested in about
110 feet of water off Pensacola. It worked! Lionfish swam over from nearby artificial reefs within minutes of seeing the trap, gradually collecting around the FAD. They barely moved as the curtain closed around them. No bait—just a FAD—so hardly any bycatch (unwanted fish). If larger fish like snapper and grouper were nearby, they would bolt as the trap began to close. Lionfish stayed. The lack of containment meant fish weren't under any stress until they were brought up. It also left little chance for ghost fishing (trapping fish that are never retrieved) if the trap is lost.

I had thought that would be it for me. I had demonstrated the concept of the “FAD-based, non-containment curtain trap.” I assumed the fishing world would take that idea and convert it to a new fishery built around lionfish.

Not so much. It soon became obvious that the prototype would not be enough. I would need a viable trap that could be used commercially.

Back to the garage. I went through several trap models, each with some sort of fatal flaw. Too many fish outside the frame. Too many fish escaping. Lines tangling somewhere on the trap. Too slow through the water. FADs acting like wings, causing the trap to land on its side. Always something. But gradually, the traps improved. Removing all vertical structure other than the FAD made it descend more easily through the water. I hinged the trap so it would fold like a taco and descend even faster, and added curved deflectors to the frame to force the trap open when it touches down. And I rigged the harness to hold the frame closed and keep the fish from escaping.

At the same time, interest was building. People spoke in meetings and conferences about the need for traps. I distinctly recall Guy Harvey urging me, “You’ve gotta get this done!” Many asked to help improve and test the traps. James Morris (a NOAA scientist) and I debated FAD and design options. Randy Guthrie (a welder) built the frames of the first batch of folding traps. Peter Angelotti (a landscaper) had the great idea of bending rebar into tight loops to create weldless hinges so just about anyone could build a frame inexpensively and without special equipment. Marc Moran (a teacher and football coach) built the bender that did it. Lionfish University, Coast Watch Alliance, ReefSave, Alex Fogg, Holden Harris, Janelle Fleming, and people in other countries have tested different trap models. We know they work well around artificial reefs, but what about natural reefs? How close do the traps need to be to natural reefs to attract lionfish? Do they work better than lobster traps or other fish traps? Do they get any bycatch? How can we make sure they open every time they hit the bottom? Do they drag across the bottom in currents? Could animals become tangled in their float lines?

Importantly, for lionfish traps to be legally used for commercial fishing, permits are required. Regulators want to know that the traps minimize bycatch, ghost fishing, bottom impacts, and entanglement risk. Based on the evidence we have to date, they are now convinced enough to at least issue permits for commercial testing.

It is on this threshold that we now stand.

The concept works. The new traps attract lionfish more than other fish and seem to catch more lionfish than other traps (though more tests are needed). And they operate well, meaning they usually open. Unlike the robotic and electronic traps that are showing promise, these are fully mechanical and inexpensive, probably under $100 each if built in bulk. Like all traps, however, for fishermen to use them, they also need to figure out how to fish the traps—then decide if the cost of new gear is worth it.

It’s time for the professional fishing community to take the wheel. They will likely improve on every aspect of the traps—material selection, frame design, netting, FADs, lines, etc. They can test different deployment and retrieval options, including weighting of the traps, line and surface float configurations, and connecting many traps together in what they call trawls. They’ll also test different soak times in diverse habitats to fish as efficiently as possible, ultimately deciding whether the traps are worth their time and money.

I’ve always hoped that the prospect of a viable lionfish fishery would be incentive enough to make the fishing community flock to new trap designs. While there is some interest, those who currently catch lionfish are using traps they already own—primarily lobster traps—to remain cost-effective. Getting their professional input to test and improve new traps will mean finding ways to supply traps and pay for their time. Only then will it be possible to attract them to the FADs, and for the traps to reach their conservation and commercial potential.

At that point, it won’t be garageneering anymore.
CONTROLLING LIONFISH WITH SOUND

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My definition of a lionfish problem changed several years ago when I was invited to dive with Coast Watch Alliance offshore Pensacola, Florida. Prior to this dive, my primary experience with lionfish was in the Gray’s Reef National Marine Sanctuary (GRNMS) offshore Georgia where we might see only 20 lionfish a year. On that dive offshore Pensacola, there were easily over 100 lionfish congregated around a small, three-by-seven meter artificial reef structure. It was during that dive that I realized how bad the lionfish invasion had become and that spearfishing alone would not control their population. I also realized that lionfish had taken over most of the artificial and natural reefs along the Florida panhandle. With this knowledge, I realized this would be a good location to conduct acoustical research.

In 2014, I initiated a research project in GRNMS designed to gain baseline soundscape data, which is basically eavesdropping on the reef to assess the biological activity. During that project, I realized a lot of fish communicate through vocalizations such as grunts, thumps, and clicks. Of course, many of the sounds produced around a reef are well below a diver’s ability to hear, but those sounds can be amplified through the hydrophone. Research has shown that sharks and some fish are attracted to certain types of noise. Fish have sensory receptors to pick up sound and vibration to locate prey, mate, identify danger, and judge their proximity to objects. Based on my knowledge that some marine animals utilize sound and my acoustical experience at GRNMS, I started asking if lionfish made any sounds and, if so, would it be possible to turn it against them by utilizing their calls to help fight the invasion of the southeastern waters.

Soon after my initial dive offshore Pensacola, I started deploying the hydrophone in predominantly high lionfish populations offshore Pensacola and the Bahamas to collect lionfish calls in the wild. At the same time, a research group at the NOAA lab in Beaufort, North Carolina, was attempting to record the calls of captive lionfish. During agitation, they were able to successfully record several short calls composing of about five beats.

The lionfish calls I recorded in the wild were typically much longer than the captive calls with upwards of 15 to 20 beats. A call sounds much like someone rapidly hitting a drum multiple times and then a short pause followed by a final beat. Most fish vocalizations consist of a grunt or two, a burp, or a series of pops, so the lionfish call is definitely unique and stands out in an acoustical file.

The hydrophone deployments offshore Pensacola proved to be highly successful, capturing several lionfish calls during multi-day recordings. By reviewing the acoustical files graphically, the entire file doesn’t have to be played back to identify calls. Each sound created underwater is picked up by the hydrophone and is visible in acoustical spikes shown graphically depending on the sound amplitude. One of the smallest marine creatures on a reef, the snapping shrimp, makes up the majority of the reef noises and its sound is best described as bacon frying.

The opportunity also came up to deploy the hydrophone near Green Turtle Cay in the
Bahamas. As it turned out, this site provided some of the best lionfish calls to date. Ironically, the primary deployment site was an old satellite dish that had been dropped in approximately 18 feet of water. There were only about 20 lionfish at the site, but they had to compete with numerous other fish for space. During one 24-hour period, over 20 lionfish calls were recorded. In addition to deploying the hydrophone at the site, a GoPro camera was mounted on the seafloor and programmed to take time-lapse photos every five minutes. One of the calls was made at the same time the camera snapped a photo of a lionfish standing guard next to the hydrophone while another fish challenged the territory. Not only was this call very clear, but it also indicated that the lionfish calls were of a defensive nature.

As an extension of my work, I got my daughter Emily involved in lionfish acoustical research. As a soon-to-be senior at the University of Georgia (UGA), double majoring in biology with a marine emphasis and ecology, she spent the summer conducting acoustical research on the lionfish. Lionfish University provided a small grant to help jumpstart Emily’s research. Alex Fogg of Okaloosa County, Florida, donated four juvenile lionfish, which were housed at a research facility near the UGA campus. Through a series of non-invasive tests, the lionfish were exposed to my previously recorded lionfish calls as well as reef soundscapes. It is still early in the research effort to fully comprehend the results of the experiment, but the lionfish appeared to respond to some playback calls with shorter thumps. Additionally, Emily recorded some of the lionfish making the full, multi-beat drumming calls when they were agitated, primarily when they were first moved from their home tank to the larger test tank. This breakthrough answered a primary question as to whether or not the juvenile fish understood or could produce the same calls previously recorded in the wild. Further acoustical experiments will continue during 2020 in an attempt to clean up the captive lionfish calls and monitor their responses.

It is not known yet if the lionfish calls can be used in the fight to stop their invasion, but we are getting closer to understanding their behavior. Additional behavioral research is desperately needed if there is any hope to control their rapidly growing population.