Application for Experimental Lionfish Trap in the South-Eastern U.S.

Submitted by: Joe Glass

Date 5/7/17

1. I wish to begin our Research with modified lionfish trap as soon as possible. Following the guidelines for application and 60 rule I would ask to start on 7/7/17 and run research for until 7/7/22
2. Applicant

Joe Glass
2611 NW 48th Place
Gainesville FL 32605
(352) 226-0248
jglass@reefsavers.org

3. A point of contact

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(352) 226-0248
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4. I wish to test the effectiveness of a purse lionfish trap, at varying depths and attraction structure. I hope to research harvesting seasons at varying depths over a 5 year span. This study is designed to optimize the removal of invasive lionfish from our water, while limiting the bycatch..
5. Areas to be tested are all waters effected by invasive lionfish from North Carolina to Texas. Due to the varying topography and species of marine life, the study will require a vast area of testing.
6. The following catch information:
    a. Targeted species is the Lionfish
    b. I look to target unlimited number of lionfish with no limits on size.
    c. The lionfish harvested will be sold to licensed seafood whole sellers
    d. I do not anticipated any impacts on fisheries, marine mammals, endangered species, or Essential Fish Habitat.
7. The following anticipated effort information for each vessel:
    a. <u>For fixed gear:</u>
        i. Experimental Lionfish Purse Trap (See Attached Design)
        ii. Amount of gear to be used anticipated 25,000 traps within the first year and a total of 50,000 by the end of the 5 years

iii. Traps with be hauled every 15 – 30 days to determine optimal soak time are varying depths
iv. Average soak time. Is 15 – 30 days
v. This will be a year round research
vi. North Carolina to Texas at depths from 90ft – 500ft

8. Information for vessels to be used will be reported prior to placing traps on the vessel. (please advise of amount of time needed for this)
9. Principal Investigator's

Joe Glass
(352) 226-0248
jglass@reefsavers.org

_______________________________________ ____5/7/17__________

Name Date

Project Title:

Application for Experimental Lionfish Trap in the South-Eastern U.S.

Applicant's Name:

Joe Glass

2611 NW 48th Place

Gainesville, FL 32605

(352) 226-0248

jglass@reefsavers.org

Proposed Testing period:

July 1, 2017 – December 31, 2022

Project Objectives:

Lionfish are harmful to both shallow and deep ecosystems, putting pressure on local fisheries. Their distribution and populations have rapidly increased in recent years and will most likely continue, given the absence of any known natural predators in the region. Human intervention has been the only pressure put on lionfish to date, but that has mostly been by individual scuba divers spearing lionfish. This is labor intensive and will not be sufficient to control lionfish populations in many portions of the invaded range.

Collection of lionfish in deep water has been primarily by fishermen who capture them as bycatch, mostly in lobster traps. Research efforts have concentrated on trap designs that could potentially catch large numbers of lionfish as the targeted species, and without bycatch. A unique trap design using a fish aggregation device (FAD) to attract lionfish has undergone initial tests, and requires additional evaluations.

The FAD-based, non-containment purse trap design takes advantage of the natural tendency of lionfish to perch near reef structure and dwell beneath overhangs, and their apparent penchant for manmade objects. The prototype tested in 2016 had a "curtain" of flexible nylon netting attached to a square curtain frame that moved up and down along the sides of the trap. The trap remained open on the bottom, allowing fish to come and go freely for the duration of the deployment. The FAD in the center of the trap attracted lionfish to take up residence for extended periods, just as they do on natural or other manmade substrates. On retrieval, the lift line raises a harness attached to the curtain frame, closing the net around the FAD and raising the trap to the surface, catching any fish within the structure.

Tests of the prototype traps revealed the following benefits (Gittings, SR. in press. Encouraging results in tests of new lionfish trap design. Gulf and Caribbean Fisheries Institute, 69th Annual Meeting, George Town, Grand Cayman, November, 2016):

- High attraction and capture rates for lionfish
- The absence of bycatch of non-targeted species
- No mortality associated with containment during the soak period
- No apparent risk of ghost fishing if lost
- No bait required
- Minimal trap impact to bottom habitat

Following the initial tests, trap designs were modified to improve operations, efficiency and simplify transport in large numbers aboard fishing vessels.

- Upright framing was removed, allowing traps to be stacked and drawing fish closer to the FAD
- Collapsible FADs were incorporated to allow stacking on deck
- A new design was conceived that would travel vertically through the water, increasing descent and ascent rates and simplifying deployment and retrieval
- Latches and various configurations of harness and lift lines are being considered to minimize loss of catch during ascent

Various questions and operational matters remain to be addressed regarding the use of traps to capture lionfish. The testing goals for the second generation purse traps are spread among several topic areas. Some will be focus areas for research conducted under this permit.

- Develop and field test lionfish containment device (LCDs) designs for lionfish capture/harvest;
- Develop a protocol for utilizing LCDs to slow lionfish invasion in the southeast;
- Assess the geographical distribution and relative population densities of invasive lionfish;

Identification of the Problem:

Invasive species, defined as being non-native to an ecosystem and likely to cause economic or environmental harm, have increased in abundance and range over the last century. Introduced non-native species, whether intentional or unintentional, are capable of causing significant negative ecological and economic impacts through competition with native species, habitat alteration, and reduction in biodiversity (Mack et al., 2000; Olden et al., 2004). The frequency of bio-invasions has increased significantly over the last century, primarily due to the high interconnectivity of a blossoming global economy. Marine and fresh water bio-invasions are well-documented and nearly impossible to eradicate once established. According to the U.S. Geological Survey (USGS), 68 marine introductions have occurred in Florida, the Caribbean, and the Gulf of Mexico from 1887 to 2009 (2009). Indo-Pacific lionfish are a prime example of an invasive species that has gained a foothold in the southeast.

Two species of lionfish, *Pterois miles* and *P. volitans*, were introduced into the Atlantic Ocean. These fish are native to the Indian Ocean, Western and Central Pacific Ocean, and Western Australia (Schultz, 1986). Lionfish can become sexually mature within their first year of life and will spawn throughout the year and a single female producing upwards of two million eggs annually (Morris, 2009). Larval dispersal is facilitated through oceanic currents and is likely responsible for the rapid range expansion of lionfish over the last 15 years (Hare and Whitfield, 2003). Adult lionfish feed on nearly all small reef fish species. These prey fishes are also important diet constituents for economically important species such as snappers and groupers (Morris and Akins, 2009). Juvenile lionfish have been found in the stomach contents of several groupers, however, scientists are unsure if predation on lionfish is common (Malijkovic et al., 2008).

The range expansion of lionfish is adding stress to already highly stressed coral reef ecosystems. The most probable and dramatic impacts include reduction of forage fish biomass and competition with native reef fish (Albins and Hixon, 2008). Commercially important native reef fish species typically display localized movement patterns, thus making reef fish especially prone to localized fishing pressures (Claro and Lindeman, 2003). Competition with lionfish will reduce the resilience and slow the recovery of reef fish populations in the southeast.

Socio-economic impacts of the lionfish invasion are currently not well quantified. However, potential impacts to the commercial and recreational fisheries and eco-tourism industries of the southeast could be severe (Table 1).

Table 1. Description of potential economic impacts of lionfish (Morris and Whitfield, 2009).

Potential Economic Impact	Impact Type	Pos. or Neg.
Reduction in landings of economically important species	Fishery	-
New fishery species	Fishery	+/-
Increase/decrease in dive/snorkel tourism	Tourism	+/-
Incidence of marine envenomations	Tourism; recreation	-
Decrease in aquarium sales of lionfish	Aquarium industry	-

At the first Florida Fish and Wildlife Conservation Commission (FWC) Lionfish Summit held October 2013 in Cocoa Beach, Fla., top marine scientists, researchers, extension agents, divers, anglers, community leaders, NGOs and state government officials were in attendance. Surprisingly, only a small handful of newspaper and TV stations were present at this well organized and informative conference. There were more questions than answers regarding control methods, all asking for one main thing -- more research to "stem the tide" of the invasion. On the final day of the summit, participants chose their preferred priorities for lionfish control strategies. Among the top vote-getters requested was a research study for a directed commercial species-specific trap fishery to be implemented.

Research to be conducted

This request is to conduct research on several aspects relevant to a potential trap fishery for lionfish. Many of our findings align directly other investigations being conducted by NOAA, Coast Watch Alliance, and Lionfish University, who are working on similar lines of research. Our work will focus in the following areas:

Operations

- Determine the weight and line configurations needed to keep trap jaws and the traps stable in different conditions
- Observe the tendency for catch loss during ascent (e.g., fish with barotrauma could float out)
- Observe fish response to closing jaws and net

Effectiveness

- Evaluate attraction and capture rates in relation to proximity of source lionfish populations
- Document attraction and perching behaviors of lionfish on FAD and trap frames
- Evaluate diel behaviors of lionfish around the traps to determine the best times to pull traps (presumably when lionfish are resting near FAD vs. hunting)
- Identify optimal soak times for different areas
- Consider modifications of FAD to improve attraction or retention

Bottom Impacts

- Document impacts to biota from the traps, weights, or lines (by contact, covering, or dragging) This will be documented using drop cameras and AUVs at trap locations marked with GPS locations.

Bycatch

- Document any captures of non-targeted species

Ghost Fishing

- Document any evidence that lost traps might pose a threat to fish through capture or entanglement

Entanglement

- Incorporate breakaway gear into harness and surface line
- Document any evidence that trap and associated gear pose a risk of prolonged entanglement and subsequent stress, harm or death to marine life (marine mammals, turtles, whale sharks, rays)

Target Areas

- Monitor traps set to develop Best Practices for lionfish fishing, identify optimal depths, seasons, and time of day to pull traps to maximize removal, and minimize possible negative effects to other marine life.

Project Impacts/Results or Benefits Expected:

The primary goal of this project is to test the effectiveness of lionfish containment devices in capturing and removing lionfish in the southeast region. Additionally, long-term, systematic monitoring of lionfish densities is necessary to gather vital life history information and determine the effectiveness of control programs (Morris, 2012). Improved monitoring will provide the information needed to inform management as the lionfish range increases. Unfortunately, current lionfish monitoring is seriously lacking. This project has the potential to develop a long-term removal and monitoring program with cooperation from industry, regional management agencies, and state fisheries research organizations.

Using industry vessels will allow for collection over a greater spatial range while remaining cost effective (biggest bang for the buck). Ideally, collaborative monitoring efforts will be discussed and a plan will be designed for continuation and possible expansion of efforts into additional areas (e.g., artificial reefs off Alabama). This project will provide immediate information for managers while providing the methodology and template for a long-term survey program for the future.

Need for Support:

This project will address several research priorities set forth during the 2010 Cancun Lionfish Workshop including: a) conduct applied research on lionfish bycatch; b) conduct applied research to target lionfish effectively in deep water, generally defined as 65–300 feet based on geographical location; c) determine the effectiveness of removals; and d) conduct spatial monitoring of lionfish. Additionally, this project will address research and management priorities outlined by stakeholders during the 2013 FFWCC Lionfish Summit including: a) continue research on development and application of lionfish specific traps (highest priority); b) determine the effort needed to maintain control on managed sites; c) determine how non-governmental organizations can contribute to lionfish data collection; and d) improve education and outreach activities. The research outlined within this proposal has the potential of supporting the commercial fishing industry, state and federal fisheries management agencies, seafood consumers, recreational anglers and the public-at-large. Given the extent of the benefits gained from this project by interest groups, it is fair and reasonable to ask for assistance to conduct this study.

While spearing and netting lionfish are active removal techniques, trapping provides a passive method. In areas with trap fisheries, lionfish bycatch frequently occurs, especially at deeper depths up to 300 feet. To date, no successful “lionfish only” containment devices have been developed. Future gear development efforts could result in more effective designs, baiting types, and deployment schemes. (Morris, 2012)

Statement of Work:

Planning Meeting

A planning meeting will be held at the beginning of the project, prior to initiation of sampling, to introduce all parties, review the research protocol, and resolve any questions prior to sampling. The Association staff will coordinate and plan the meeting with cooperators, and the Association Program Director will facilitate the planning meeting. The meeting will be held in a TBD location.

Geographical Location

As of July 2016, lionfish have been captured/sighted from South Padre Island, Texas throughout the Gulf coast, Florida Keys, and north to waters of Rhode Island. The expansion into the Gulf of Mexico has occurred most recently, since 2010. Areas to be tested are any waters affected by invasive lionfish from North Carolina to Texas. Due to the varying topography and species of marine life, the study will require a vast area of testing.

Lionfish Containment Device Designs

Figure 1. Dome trap first tested in late 2016 using a hard FAD similar to that used in the prototype traps.

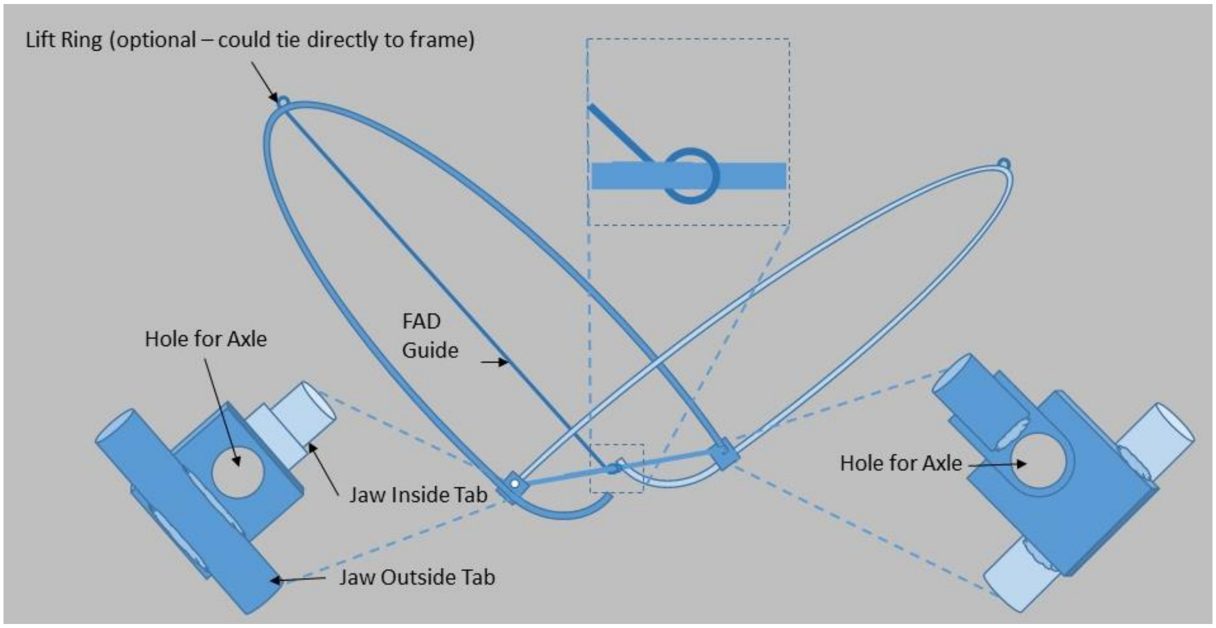

Figure 2. Diagram of purse trap frame without netting or lines.

Before deploying traps, the following data will be collected:

- Date
- Location
- Bottom depth
- Wave height
- Current speed and direction
- Location of weights on trap frames
- Amount of weight attached to trap frames (expected to be 15-30 pounds on frames that weigh 40-50 pounds)
- Harness and line/float configuration (one trap of each type will have a surface line, allowing evaluation of wave influence on trap stability)

Camera drops or divers will be used to make intermittent observations on trap site throughout the soak period. We will make observations at different times of day to determine when retrievals would maximize catch (e.g., mid-day vs. dusk). Observers will record:

- Date
- Time
- Waves
- Current
- Has trap moved since last observation?
- Are trap jaws stable?
- Lionfish within trap perimeter
- Lionfish near, but not within trap perimeter
- Bycatch within trap
- Bycatch near trap
- Lionfish and bycatch behavior when trap closes (do fish flee, retreat toward FAD, or remain stable)

Vessel Selection and Compensation

We will actively solicit the cooperation of fishing vessels and captains willing to participate in this project, with preference given to vessels that are familiar with the harvesting of reef fish, specifically lionfish.

Testing Vessels & Vessel Operator Identifiers
Vessel #1
Coast Guard Documentation Number or State Registration Number: FL3387LN
Owner/Captain/Corporation: Joe Glass/Reefsavers.org Non-profit organization
Vessel Docked At: 19 SE 884 Ave Suwannee, FL 32680
Phone: (352) 226-0248

Vessel #2
Coast Guard Documentation Number or State Registration Number: FL7574PB
Owner/Captain/Corporation: Thomas Moss
Vessel Docked At: 19 SE 884 Ave Suwannee, FL 32680
Phone: (352) 538-4970

Sampling Effort

Sampling will vary by region to ensure compliance with local, state and federal regulations for marine mammal safety including deployment times and methods.

Fishery Observers

Every effort will be made to employ observers in all at-sea activities. In those instances, where this is not operationally possible, the vessel Captain will be responsible for data collection. All contracted fishery observers will have undergone specific and detailed training prior to their deployment on any commercial fishing vessel. It is the responsibility of the Observer/Vessel Coordinator to schedule and train all fishery observers. Training details all administrative and programmatic procedures necessary to conduct the proposed research and includes (but is not limited to): overview of the data collection protocols, review and identification of all fauna harvested during testing procedures, proper handling of sea turtles, description and measurements of fishing gear, and best practices while aboard a commercial fishing vessel (classroom and at-sea education). Contracted observers will complete sea turtle training at a NOAA Fisheries facility. In addition, all observers will undergo marine safety training that outlines procedures on how to respond properly and promptly to a variety of situations that could be encountered during fishing operations (e.g., man overboard drills, firefighting, radio communication, etc.).

Video Assessment

Video assessment of lionfish densities and abundance will be conducted via GoPro cameras attached to some LCDs, and AUVs.

LCD Data Collection

Sampling methods are modified from existing protocols (FWRI, 2013; MARMAP, 2013; NOAA Fisheries Observer Manual, 2014). One fishery observer will be deployed per cooperating vessel to collect data. The survey regions will range from South Carolina to Texas, and focus areas will be the operating areas of cooperating vessels. Specific locations, timing, and other details of sampling strategies will be discussed during the planning meeting and will be approved by the research team.

The Fisheries Observer will record gear configurations and fishing effort data defined on the attached sampling forms (e.g., date and time of deployment and retrieval, latitude, longitude and water depth of each deployed string), and collect biological samples (e.g., species and length). Data will be collected before deployment, during intermittent visits, and when traps are retrieved. The Fisheries Observer will lead all data and sample collection efforts, but vessel crew may assist the observer upon request. All scientific sampling equipment and supplies, including data sheets and measuring tools, will be provided.

Soak time for all sets (elapsed time between initiation of deployment and initiation of retrieval) will be determined through proof of concept tests. In all cases, soak time will conform to all federal and state laws and environmental requirements for the protection of marine mammals. Sampling will occur during daylight hours (or determined through proof of concept tests).

Biological Sample Processing

Fish that are caught will be processed following standard processing procedures. The on-board Length-Frequency (LF) workup will consist of identifying all fish in each trap to species level and total length (TL to the nearest mm) of all individual fish of each species.

Data Review, Entry and Analysis

The Observer will be tasked with collecting all data. At the end of each fished station, the observer and vessel captain will verify the accuracy of the collected data by signature. At the conclusion of a fishing trip, the observer will thoroughly review all data sheets and verify that all data are legible and accurate. The Principal Investigator will then debrief the observer and verify that all data sheets are legible and accurately/completely filled out. At this time, the Principal Investigator will also inquire into any problems encountered during the trip that could have increased variance within the collected data. If problems were encountered, the project management team will discuss the experimental design and procedures to alleviate the problem.

After the Principal Investigator has thoroughly reviewed the data, he will make copies of the original data. He will keep all photocopies and forward the original data to the Associate Staff. The data will then be entered and summarized, and submitted to NOAA Fisheries.

Project Personnel and Management Team:
Principal Investigator:
Joe Glass, Program Director

Associate Staff:
Steve Gittings, Ph.D, NOAA/ONMS

PRE-DEPLOYMENT

Date	Time	Location	Depth (ft or m?)	Wave Ht.	Current Speed	Current Direction
Location of Weights on Trap:						
Amount of Weight on Trap:						
Harness Configuration:						
Surface Line Used?						
Float Type:						

INITIAL DIVE ON TRAP SITE

Date	Time	Depth	Wave Ht.	Current Speed	Current Direction
Distance to Nearest Reefs (enter information below):					

	Natural	Artificial	Both
Density (estimate)			N/A

PERIODIC DIVES ON TRAP SITE

Date	Time	Wave Ht.	Current Speed	Current Direction	Trap Moved? (notes on damage)	Jaws Stable?	# LF In Trap	#LF Near Trap	# Bycatch In Trap	# Bycatch Near Trap	Did LF **Flee**, **Retreat**, or **Remain** on Closure

Types of bycatch observed:											

TRAP RETRIEVAL – DIVER OBS										
Date	Time	# LF Before Close	# ByC Before Close	# LF After Close	# ByC After Close	Trap Stay Closed?	# LF on Surface	# ByC on Surface	# LF With Barotrauma	# ByC With Barotrauma
Did lionfish **Flee**, **Retreat to FAD** or **Remain** during Closure?										
Did bycatch **Flee**, **Retreat to FAD** or **Remain** during Closure?										
Types of bycatch observed:										
Any bottom impacts?										
Any fish lost on ascent?										

TRAP RETRIEVAL – WITHOUT DIVERS					
Date	Time	# LF on Surface	# ByC on Surface	# LF With Barotrauma	# ByC With Barotrauma
Did trap appear to stay closed?					
Any fish float or swim out?					
Types of Bycatch:					