

Phase II Final Report Port Canaveral Lionfish Project

Contract PO # P14685



Report prepared for
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October 21, 2014

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INTRODUCTION

Two species of invasive Indo-Pacific lionfish (*Pterois volitans* and *P. miles*) have spread rapidly in the tropical western Atlantic Ocean since their first confirmed sighting in southeast Florida in 1985. These species have no effective natural controls in their invaded range and have achieved extremely high densities in many areas. Lionfish are generalist carnivores with the potential to dramatically alter the fish fauna where they are common; reductions of fish recruitment up to 80% have been reported from certain locations. Recently, lionfish have become established in estuarine and riverine waters of the southern Indian River Lagoon (IRL) as well as all five IRL ocean inlets and in Port Canaveral. This invasion has the potential to quickly and irreparably damage the IRL fish fauna (widely regarded as the most diverse ichthyofauna in continental North America), with serious economic repercussions to our regional recreational and commercial fisheries.

The expansive rock revetments, seawalls, and pilings within Port Canaveral collectively function as the largest artificial reef in Brevard County, habitat that currently supports a rich marine fauna but may also eventually sustain high lionfish densities. Moreover, the Canaveral Lock provides the most likely corridor for lionfish to recruit to the nearby Banana River Lagoon. The overarching goal of this study was to begin to assess the extent of lionfish colonization within Port Canaveral, document its habitat preferences within the basin, and begin lionfish removals on habitat of highest value to native Florida fishes. Specific tasks and objectives of this project were:

Task 1: Increase local public awareness of the lionfish invasion and explain control methods through outreach to local dive clubs, recreational and commercial fishermen, and fish houses.

Task 2: Conduct four lionfish removal surveys (seasonally) along rock revetments and other hard bottom substrates within Port Canaveral, the Canaveral Lock, and the Banana River adjacent to the Lock.

MATERIALS AND METHODS

Study Design and Considerations:

1. Port Canaveral was divided into four basins: Locks, West, Middle, Trident
2. Habitat was classified into four basic types (Figs. 1 and 2)
 - a. Vertical/Seawall
 - b. Sand/Bare
 - c. Rocks/Revetment
 - d. Pilings/Piers
3. Each basin was stratified by habitat types
4. Representative samples of each habitat type per basin were selected*
5. SCUBA survey transect(s) were conducted and lionfish were culled using a pole spear

6. Divers swam predetermined pattern depending on habitat types
 - a. Rocks – diver(s) swam along in a zig-zag to cover shallow to deeper areas
 - b. Pilings/Piers – diver(s) swam up and down each structure
 - c. Vertical Wall- diver(s) swam along in a zig-zag to cover shallow to deeper areas

*Some areas were excluded from the survey for safety reasons such as high boat traffic around marinas, large ships moored at cargo berths, active fishing areas with chance of entanglement and construction activities.



Figure 1. Aerial view of Port Canaveral, Florida with habitat classifications used for lionfish surveys. Colored lines indicate habitat types: blue represents vertical/seawall, green represents pilings/piers, yellow represents sand/bare, and red represents rocks/revetments.



Figure 2. Examples of habitat types surveyed. Top) Rocks in foreground and piers in background, Middle) Rocks in foreground with cruise ship in background entering Port Canaveral, Bottom) Pilings and piers.

RESULTS

Task 1: Outreach

Four community outreach events were conducted during this project. The first was a lionfish informational workshop held on October 21, 2013 at the Canaveral Port Authority (CPA). The agenda for this workshop included an overview of our “Port Canaveral Lionfish Battle Plan”, a presentation by REEF.ORG on the history of the lionfish invasion and lionfish handling techniques, and concluded with an open discussion with the attendees. The second event was another presentation of “Port Canaveral Lionfish Battle Plan” hosted by CPA on January 7, 2014. Both events included an audience of local environmentalists, fisherman, divers and other interested citizens. As a result of these outreach efforts, representatives from a local environmental organization and a local dive group extended invitations to present the “Port Canaveral Lionfish Battle Plan” at their respective meetings. The third event, an invited presentation, was at the annual meeting of the “Friends of the Thousand Islands” May 30, 2014 in Cocoa Beach, Fl. The fourth event, the second invited presentation, was on August 21, 2014 at the monthly meeting of the Kennedy Space Center Barracuda Dive Club.

TASK 2: SCUBA Surveys

Fall 2013

The initial lionfish survey was conducted on September 13 and 16, 2013 with a third survey day cancelled due to water clarity and weather issues. The two survey days consisted of 20 transects, with transect length varying depending on habitat type. The transects covered habitats from the Port Canaveral entrance jetties, portions of the Trident Basin, pilings and piers along the main channel, and habitats in the middle and West Basins. Rocks and revetment transects were consistently longer than transects on piling and piers (Figure 3; Table 1). Due to water clarity, weather and approval issues, the areas directly adjacent to the Port Canaveral Locks were not surveyed

This survey resulted in the collection of 21 lionfish. The lionfish ranged in size from 145 to 195 mm standard length (SL) with a mean of 170 mm SL (Table 2). The majority of lionfish collected occupied the rock and revetment habitat in the southwestern portion of Trident Basin and the northern side of the main channel from the Trident Basin to the CCAFS sign (Figure 3). The exception was four lionfish collected in a large submerged tire adjacent to the rocks. Most of the lionfish were typically found clustered in the darker crevices (Figure 4).



Figure 3. Aerial view of Port Canaveral, Florida with location of transects. Light blue line represents transects surveyed fall 2013. Red targets represent the location of lionfish collected.

Table 1. Comparison of linear distance (meters) of habitat type surveyed during Port Canaveral lionfish survey.

Habitat	Fall 2013	Spring 2014	Summer 2014	Fall 2014
Rock/Revetment	2687	3034	2196	2728
Vertical	302	353	334	310
Pilings/Piers	1032	1142	783	851
Sand	0	48	0	47
Total	4021	4577	3313	3936



Figure 4. Examples of the size range of lionfish collected.

Table 2. Date, location, habitat type and standard length in millimeters (SL mm) of all lionfish collected.

Date	Location	Habitat	Size (SL mm)
September 16, 2013	North side of channel	Rocks	174
September 16, 2013	North side of channel	Rocks	163
September 16, 2013	North side of channel	Rocks	145
September 16, 2013	North side of channel	Rocks	160
September 16, 2013	North side of channel	Rocks	190
September 16, 2013	North side of channel	Rocks	190
September 16, 2013	North side of channel	Rocks	173
September 16, 2013	North side of channel	Rocks	176
September 16, 2013	North side of channel	Rocks	183
September 16, 2013	North side of channel	Rocks	172
September 16, 2013	North side of channel	Rocks	171
September 16, 2013	North side of channel	Rocks	170
September 16, 2013	North side of channel	Rocks	156
September 16, 2013	North side of channel	Rocks	154
September 16, 2013	North side of channel	Rocks	183
September 16, 2013	North side of channel	Rocks	168
September 16, 2013	North side of channel	Rocks	149
September 16, 2013	North side of channel	Rocks	169
September 16, 2013	North side of channel	Rocks	175
September 16, 2013	North side of channel	Rocks	163
September 16, 2013	North side of channel	Rocks	195
March 31, 2014	Cruise Terminal 4	Vertical Wall	110
September 09, 2014	North side of channel	Rocks	220

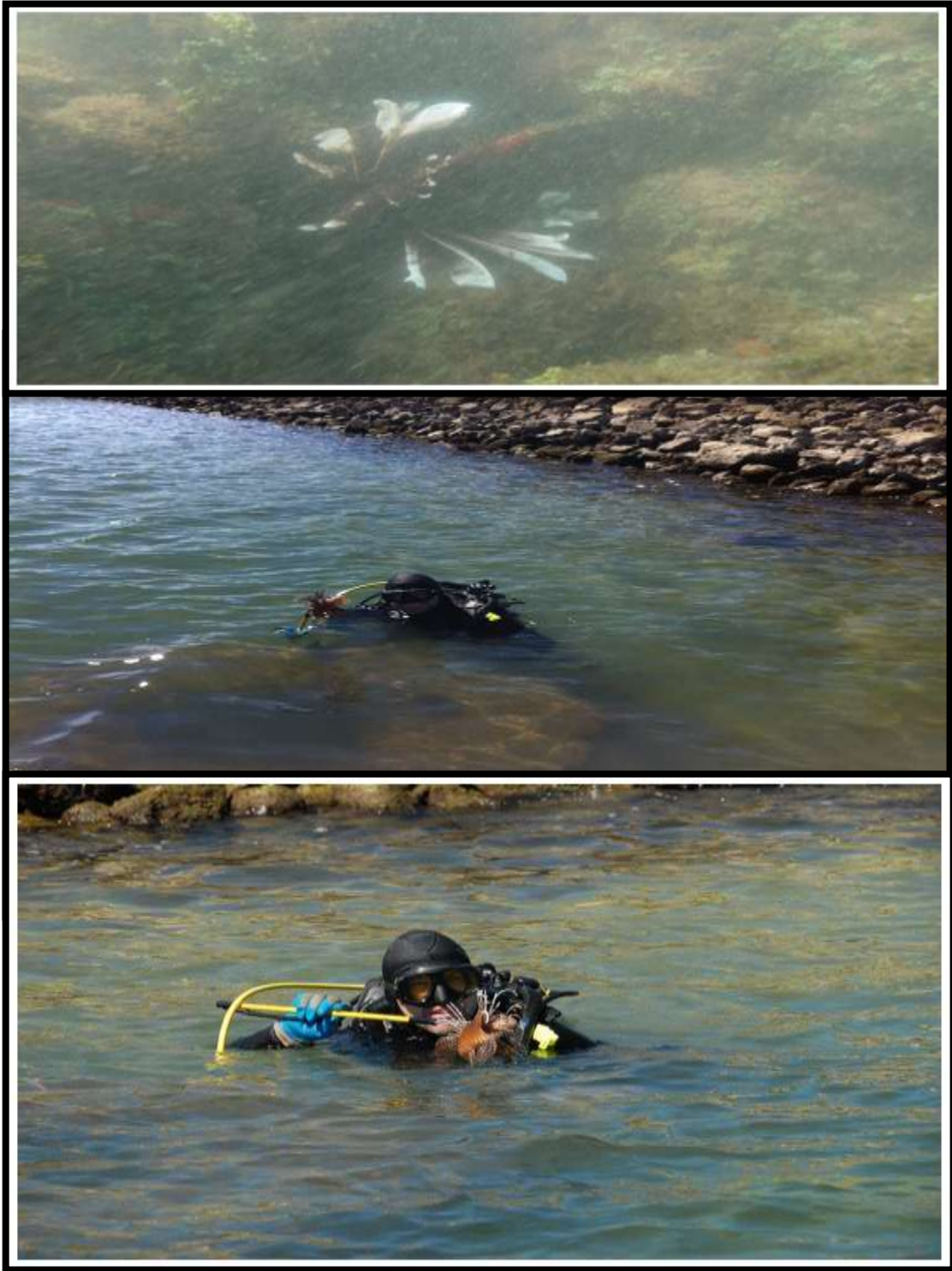


Figure 5. Examples of water clarity and lionfish collection. Top) Lionfish observed in crevice of rocks, Middle). Large tire adjacent to rocks, Bottom) Lionfish collected from tire.

Spring 2014

The spring 2014 lionfish survey was conducted over the course of three days, March 31, April 7, and May 8, 2014. The survey transects overlapped the same general footprint as the fall 2013 surveys, except for small portions of the north jetty and North Cargo Berth 3 (NCB3). Additionally, the transect along the western shore of the Trident Basin was extended and new transects were established under the northeastern corner of the Canaveral Locks bridge and a site in the Banana River that included the southern bumper rail pilings and rocks adjacent to the Canaveral Locks (Figure 6). The addition of these new transects increased the total amount of linear transect distance of habitat type covered when compared to the fall 2013 survey (Table 1). Relative to the different habitat types surveyed, the rocks and revetment transects were consistently longer than transects on pilings, piers and substantially more than vertical and sand areas.

The results from the spring 2014 survey yielded the collection of only one specimen and the sighting of another lionfish. The first lionfish measured 110 mm SL and was collected along a vertical wall in Cruise Terminal 4 (Figure 6; Table 2). The second lionfish was sighted in the rocks and revetment area around the entrance to the Trident Basin and after several attempts it could not be successfully collected.

Water clarity was acceptable for the divers to conduct the surveys however, water clarity varied by location. The better water clarity occurred in the areas around the Port Canaveral entrance and the Trident Basin, while the poorest water clarity occurred in the far areas of Cruise Terminal 5 and in the Banana River adjacent to the Canaveral Locks.



Figure 6. Aerial view of Port Canaveral, Florida with location of transects. Pink line represents transects surveyed in spring 2014. Red target represent the location of lionfish collected.

Summer 2014

The summer 2014 survey was scheduled for the last week of June but due to water clarity and weather conditions, it was rescheduled for early July. The survey took place on July 11, and July 15, 2014 and covered the same general footprint as previous surveys except for the North Jetty, Cruise Terminal 2, Jetty Park and the NCB3 (Figure 7). These areas were initially avoided for diver safety because of construction, dredging and ship traffic. Additional attempts were made on August 5 and 15 to survey the excluded areas however, ongoing construction and dredging activities in the vicinity still

created unfavorable diving conditions. This resulted in the overall reduction of the linear distance of habitat types surveyed for this summer period (Table 1). In addition to the SCUBA survey, a walking visual survey was conducted to cover a small portion of the floating docks adjacent to the Ocean Club Marina. This was an attempt to locate lionfish in an area where previous lionfish sightings had been reported. No lionfish were collected or observed during this survey.



Figure 7. Aerial view of Port Canaveral, Florida with location of transects. Black line represents transects surveyed in summer 2014.

Fall 2014

The fall 2014, surveys were conducted on September 9 and 11, 2014. Survey areas covered the same general footprint as previous surveys with the exception of the pilings and piers of the tanker berth near Freddie Patrick Park, the mooring dolphin on the east end of the NCB3 and the mooring dolphin at the Poseidon wharf, all of these structures were physically removed as part of ongoing construction projects (Figure 8). Due to poor water clarity, portions of Cruise Terminal 3 and the rocks and pilings of the southern bumper of the Banana River side of the Port Canaveral Locks were not surveyed. In addition to the SCUBA survey, a boat based visual survey was conducted along the rocks north of the locks in the Banana River. This visual survey was not used for comparison to areas covered by the SCUBA surveys. This was an attempt to locate lionfish in an area where previous lionfish sighting had been reported. As with previous surveys, the rocks and revetment transects were consistently longer than transects on pilings, piers and substantially more than vertical and sand areas (Table 1).

The fall 2014 survey yielded only one lionfish, which measured 220 mm SL and was collected in the rocks along the North side of the channel between the Trident and Poseidon Basins (Figure 8; Table 2).



Figure 8. Aerial view of Port Canaveral, Florida with location of transects. Orange line represents transects surveyed in fall 2014. Red target represents the location of lionfish collected.

Discussion/Summary

This study resulted in the collection of 23 lionfish within the waters of Port Canaveral. The lionfish ranged in size from 145 to 220 mm SL with a mean of 169 mm SL. The majority of lionfish collected occupied the rock and revetment habitat in the southwestern portion of Trident Basin and the northern side of the main channel from the Trident Basin to the Poseidon Wharf. The exceptions were four lionfish collected in a large submerged tire adjacent to the rocks in the Trident Basin and one along the vertical wall of Cruise Terminal 4. Most lionfish were found clustered in the darker crevices. No lionfish were observed in the Banana River Lagoon adjacent to the Canaveral Lock on any of the four removal events although marginal water visibility in this area limited the area that could be surveyed.

By habitat type surveyed, rock and revetment transects were consistently longer than those on piling, piers and substantially more than vertical wall and sand areas. Several factors must be considered when addressing habitats surveyed. The majority of the pilings, piers and vertical walls were not readily accessible because of safety concerns and open sand substrate was very limited. However a representative amount of each habitat available was surveyed in each basin. Variation in habitat complexity is also a consideration, as more complex rock habitat typically would support greater amounts of lionfish versus the less complex habitats of the pilings, piers and vertical wall. It was determined that if during initial surveys large numbers of lionfish were observed, further effort would be made to safely expand eradication efforts into these areas.

An interesting note was that subsequent to the last survey, the rocks on the North side of the channel between the Trident and Poseidon basins are being removed as part a channel widening project. After the channel is widened 100 feet, a new rock revetment area will be established. As these data report lionfish were found in the rock habitat areas that are close to the opening of the Port Canaveral and open Atlantic Ocean waters. This new rock area will create new available habitat which can be colonized by native fishes as well as lionfish.

Lionfish are fully established in nearshore waters off Brevard County and harvest events will not fully eliminate the species from Port Canaveral. Nonetheless, research in other regions suggests that significant reductions in lionfish density are achievable along shorelines where removals are conducted (Morris 2012). By focusing efforts in habitats of highest value to native fishes, lionfish harvests will allow Port Canaveral to continue supporting high densities of native IRL fishes and the recreational and commercial fisheries dependent on them.



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