Investigating settlement patterns of *Pterois volitans* in Eleuthera, Bahamas through the use of Standard Monitoring Unit for the Recruitment of Fishes (SMURFs)

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Introduction

- Lionfish (Figure 3) (*Pterois volitans & Pterois miles*) are an invasive species in the Western Atlantic Ocean (Figure 1) native to the Indo-Pacific region (Morris, 2008)
- The widely accepted belief is that lionfish were introduced through the aquarium trade (Biggs and Olden, 2011)
- This venomous fish is competing with economically important Bahamian fishes for resources

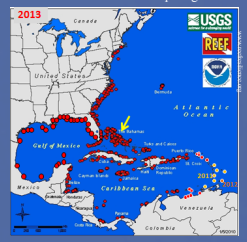

Figure 1. Distribution of invasive lionfish in the western north Atlantic in 2013

- Lionfish have a biphasic lifecycle (Figure 2)
- Settlement is the transitional stage from pelagic to benthic life and the larval stage (Figure 4) and the juvenile stage (Figure 2)
- 56% of settling fish die within the first two days (Almany and Webster, 2006)
- Settlement rates have a large affect on adult populations (Jones, 1990)
- Reef fishes predominantly settle during new moon stages (Thorrold *et al,* 1994)
- Smaller reef Fishes tend to be most prevalent in sea grass habitat followed by patch reefs and continuous (Biggs and Olden, 2011)
- Little is know about the settlement stage of lionfish

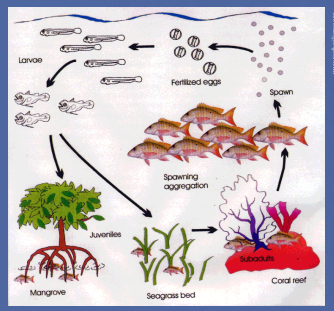

Figure 2. A general biphasic lifecycle of a reef fish. Fertilized eggs hatch in the water column, metamorphose and settle in areas like mangroves and sea grass. Recently settled fishes are called recruits, and as the juveniles grow up they move into lager reefs to spawn.

Research Focus

Research Objectives:

- Implement a new method for studying and targeting recently settled (i.e. new recruits) fishes.
- Utilize SMURFs to understand the recruitment of lionfish in four different benthic habitats (sand, seagrass, patch reef, and full coral reef).
- To monitor settlement and recruitment levels of lionfish and look for possible correlations with the lunar cycle.

Figure 3. Adult lionfish, *Pterois volitans* or *Pterois miles*

Figure 4. 7 mm larval lionfish *Pterois volitans*

Methods

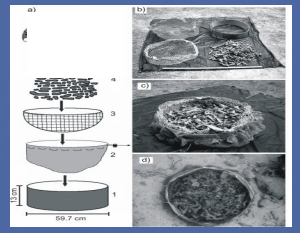

Figure 5. Construction of a SMURF

A SMURF consists of four main parts:

(1.) Plastic Ring (3.) Chicken Wire
(2.) Mesh bag (4.) Rubble

Figure 6: SMURFs location through out South Eleuthera

Four SMURFs were placed at four different locations. seagrass, sand, continuous reef, and patch reef. The SMURFs were placed at each location in a 20 by 20 meter square.

Figure 7. Collection Process

Every seven days the mesh collection bags are collected from the SMURFs. Clove oil is sprayed over the SMURFs, which acts as a natural anesthetic on the fishes. The chicken wire, which holds the rubble, is lifted and shaken the mesh bag is removed and closed. It is replaced and the collected one is taken to the wet lab to be analyzed.

Literature Cited

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Results

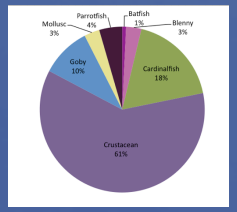

Figure 7. Recorded settled species from all habitats (seagrass, sand, patch reefs, and continuous reef).

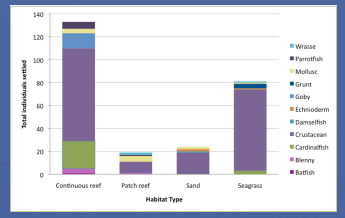

Figure 8. Comparison of settling species between habitats.

Figure 9. Correlation between crustacean settlement patterns and lunar cycles.

Discussion

Contrary to previous expectations, no lionfish were found in the SMURF samples as seen in the results chart in Figure 7. This may be due to a seasonal effect where water temperatures are known to encourage settlement predominantly during summer months (Thorrold *et al,* 1994). Additionally, placement and site location of SMURF units may need to be re-considered.

The resulting pattern of crustaceans and their settlement correlation with the lunar cycles (Figure 9) indicates that the use of SMURFs enables the observation of distinct settlement patterns.

Results show that the continuous reef had a greater abundance and diversity of species (Figure 8). This varies from previous research (Biggs and Olden, 2011) that suggested the seagrass would have the most recruits. One reason for this may be because there is a blue hole in the sea grass habitat that has a high density of predatory fish. The settling fishes, including lionfish, might therefore avoid this area using their independent swimming ability (Thorrold *et al,* 1994). These results may indicate a stronger oceanographic effect from the Exuma current, which lies adjacent to the continuous reef habitat. The current may have an effect on fishes' settlement patterns because they are pushing larvae to Eleuthera, where they settle in the deeper reefs, where the settlers are attracted to the sound of large reefs (Leis, 1991).

Increasing the sample size may increase chances of documenting lionfish settlement. Importantly, this project serves as a foundation for continued research that will make SMURFs a more viable option for observing the recruitment of lionfish. Ultimately, this research may help to fill gaps in understanding the lifecycle of lionfish and prove crucial to future management efforts.