Effects of Current Velocity on Lionfish (*Pterois volitans/miles complex*) Distribution

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Introduction

Invasive species pose threats to ecosystems all over the world by competing with native species for resources. Lionfish (Figure 1), which have invaded the western Atlantic and Caribbean oceans, are native to the Indo-Pacific region. Research shows that the newly invaded ecosystems have already been negatively impacted by this species (Akins et al. 2008). It is believed that lionfish were first introduced into the Atlantic by releases from the aquarium trade. This species has been successful invading as far north as Rhode Island as well as throughout the Caribbean and as far south as Venezuela (Figure 2). This invasive carnivore threatens coral reef ecosystems, causing deleterious alterations by acting as an additional predator to native species and competition for the natural predators of the area (Albins and Hixon 2008).

The spread of lionfish is a problem, and finding out how they spread is critical to understanding this invasive species and its effects. As climate change causes water temperatures to rise, the lionfish's ability to invade further from the equator is likely to improve. Additionally, currents are believed to be a major contributor to spreading lionfish populations. Contained in gelatinous sacks, eggs float in the water column for about 25-40 days, consistently being affected by currents (Robins 2006).

The purpose of this project was to determine the effect of local currents on the size and abundance distribution of lionfish in the waters of Rock Sound, Eleuthera, The Bahamas.

Figure 1. *P. volitans/ miles* complex

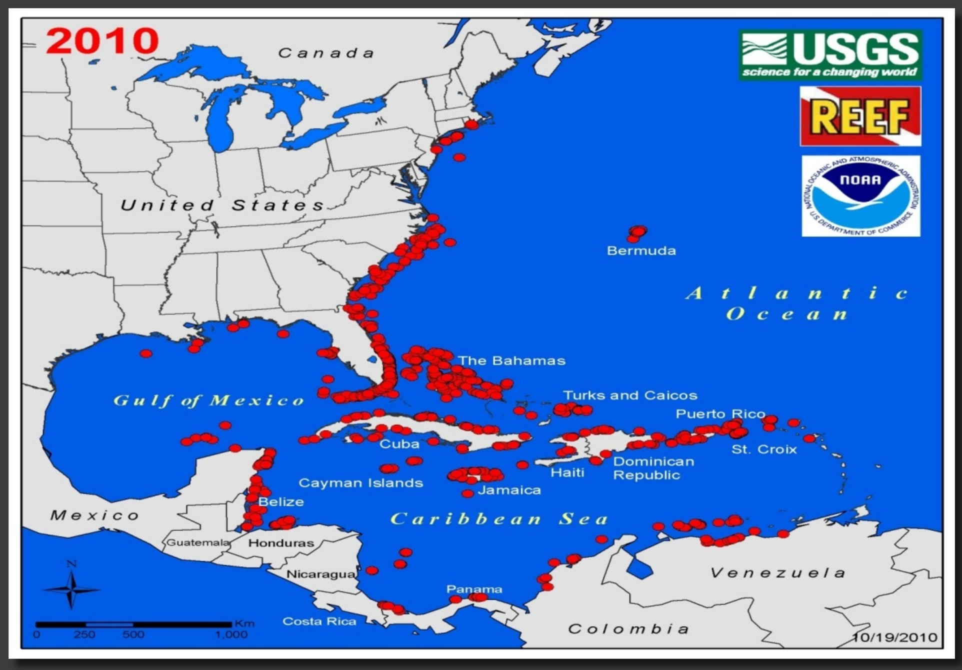

Figure 2. Red dots represent areas where lionfish have successfully invaded.

Methods

Currents

Clod cards (100g Plaster-of-Paris ($CaSO_4$) to 90mL water) were used to measure currents (Figure 3). Two replicates were deployed at each site and left for 24 hours (Figure 4). Initial and final weights were taken to find rates of degradation. Velocity in cm/s was found using the formula: Vw=(Dwclod-.932)/2.357 (McClanahan, 2005)

Figure 3. Clod card after 24 hour soak

Figure 4. Snorkeler deploys 2 clod cards 15 meters from reef

Figure 5. SCUBA diver records lionfish sizes during a visual survey

Sizing and Abundance

Visual SCUBA surveys of at least 15 minutes were conducted on 16 isolated patch reefs of similar size in the waters of Rock Sound over a 7 week period. Size and abundance of lionfish were recorded (Figure 5).

Results

Water Movement

In order to better depict trends, study sites were organized into 3 zones based on current velocity (Figure 6). Zone 1 consisted of sites with velocities greater than 4 cm/sec; zone 2 consisted of those with velocities between 2 and 4 cm/sec; and zone 3 consisted of the sites with velocities less than 2 cm/sec.

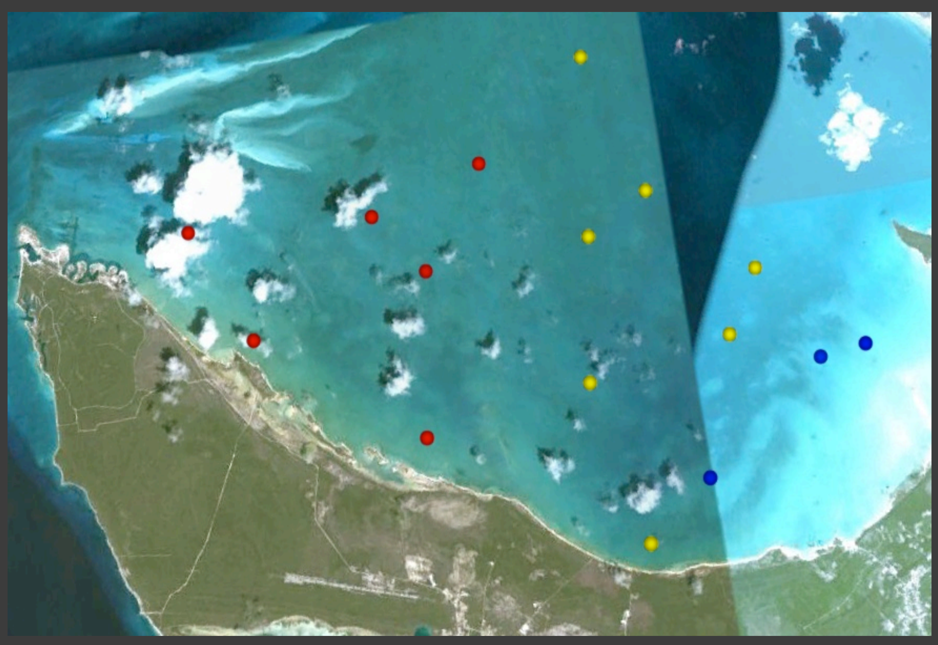

Figure 6. Study sites by zones. Red = high velocity, yellow = medium velocity, blue= low velocity.

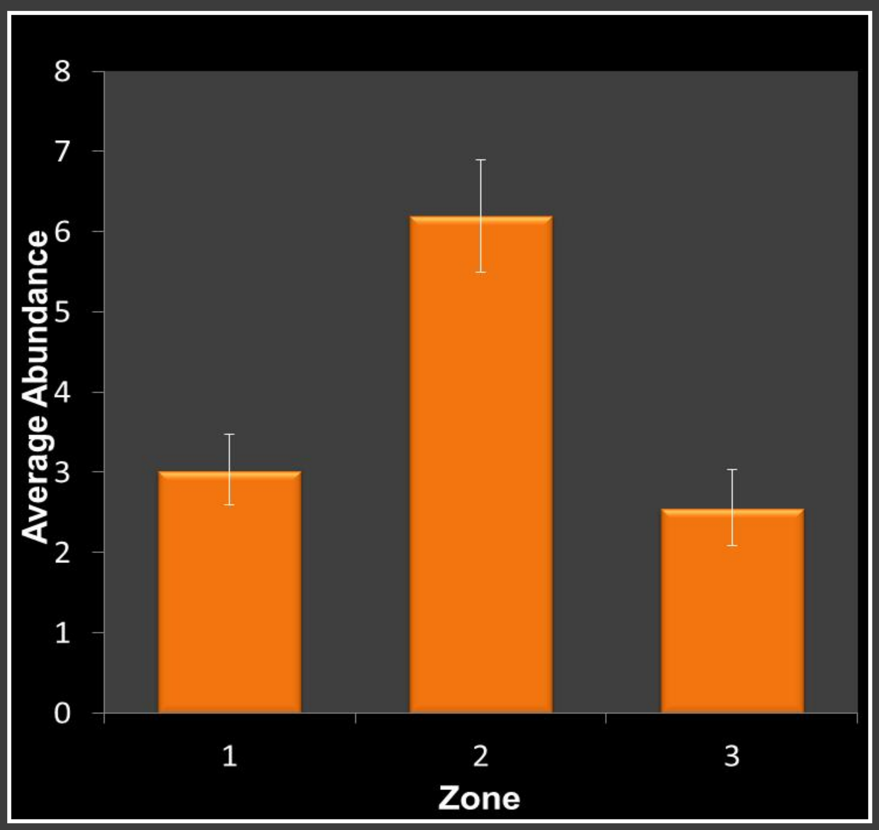

Figure 7. Results from abundance data showed that each of the three zones had significantly different numbers of fish.

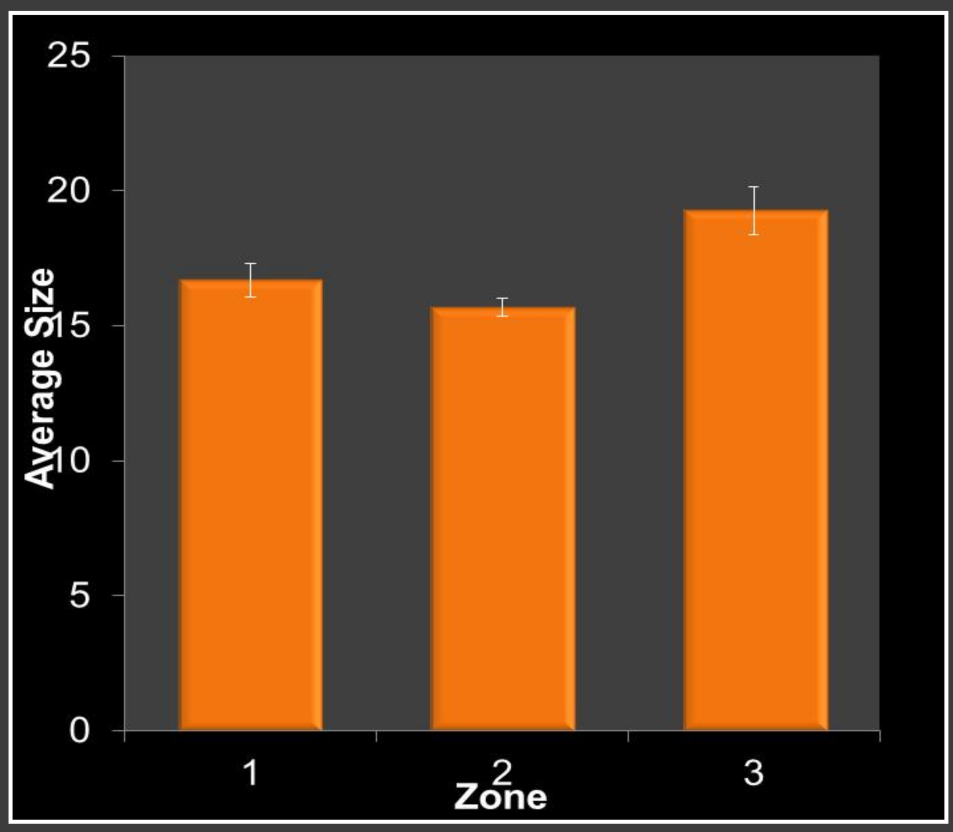

Figure 8. Size data showed that zone 3 (low velocity) has significantly larger fish than zones 1 and 2. Even though there was no noticeable change among the sizes of lionfish between zones 1 and 2, there was a significant statistical difference between zones 2 and 3.

Discussion

The results of water movement obtained by the use of clod cards shows that the area at the mouth of Rock Sound has the strongest current, while the area furthest inland has the weakest current. It was found that lionfish were more abundant in areas with moderate current (2-4 cm/sec), and less abundant in very strong or very weak currents. This may suggest that lionfish prefer to settle in areas that allow enough fish recruitment but do not have overwhelmingly strong currents that would require extra energy. There was a slight correlation between currents and average lionfish sizes, where weaker current sites had larger lionfish. Seeing that only three sites were included in this low velocity zone (zone 3), further research should be done to increase the sample size to support or reject that larger lionfish prefer low velocity current. However, the reason for this discovery may be due to theories of spawning occurring in deeper water (mouth of Rock Sound) and larvae settling before they reach the inner coast of the Sound.

Results from this study will help create a foundation on which future Island School research projects can build off of. They may also be used to better predict the future spread of lionfish and continue researching potential impacts lionfish have on coral reef ecosystems. Additionally, it will be important to replicate this study to strengthen conclusions. Future researchers will also be able to study other factors that impact lionfish abundance and distribution other than current velocity, such as current direction over a complete tidal cycle, temperature, depth, and complexity of reef and prey availability.

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