Effective Management of Lionfish on Select Habitats in the Florida Keys

Gestión Eficaz de los Peces León en Seleccionar Hábitats en los Cayos de Florida

Gestion Efficace des Poissons Lion sur Sélectionnez Habitats dans les Keys de Floride

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EXTENDED ABSTRACT

Introduction

The Indo-Pacific lionfish (*Pterois volitans*) is a venomous and voracious predator. Prior to their introduction into the Caribbean no other invasive species has had such a substantial impact on the marine environment (Schofield 2010). While the precise vector for their invasion has not been confirmed, significant increases in the population have been observed over the last decade. Beginning in central Florida and progressively extending north and south from New England to Brazil, the entire Caribbean and large portion of the eastern Gulf of Mexico has now been colonized by the invasive lionfish. Lionfish are found throughout shallow and deep water habitats; including mangroves, seagrass beds, patch and deep (> 60 ft) reef habitats. Considering their potential to decrease native reef fish recruitment (Albins and Hixon 2011), coastal managers and scientists are now faced with the problem of lionfish management in addition to coping with environmental stressors such as overfishing, climate change, and pollution. Unfortunately, lionfish have the potential to further disrupt sensitive ecosystem processes, and force marine communities to contend with an added risk, the insatiable appetite of this species.

Until recently the majority of lionfish research focused on the biology and ecology of the species, and attempted to quantify their detrimental effect on native reef communities across the Caribbean. Additionally, results from lionfish removal studies determined that full eradication was likely unfeasible, even with substantial financial resources. Not only is the eradication effort limited by financial and logistical resources, lionfish have been found beyond recreational diving limits, and traditional capture methods (i.e. hook and line and trapping) have not yet been effective in developing a fishery for human consumption in the United States. Thus, we developed a study to identify the recolonization rates of lionfish after removal on various habitats in the Florida Keys. Characterizing the effect of lionfish on select habitats, and determining their rate of recolonization, allowed us to prioritize areas for focused removal efforts, and assist managers in the development of effective population management strategies in the region.

Methods

We focused on four hard-bottom habitats representative of the available refuge in the Florida Keys. The study sites were selected based on previously collected lionfish observation data (from Keys-wide visual surveys). Sample habitats include Near-Shore Patch Reefs (< 10 m), Hawk Channel Patch Reefs (5 - 15 m), the Reef Tract (10 - 30 m), and Artificial Reefs (35 - 45 m) habitats. Twelve sample locations were divided evenly between the four habitat classes (three sites each) and studied for approximately six months. We conducted bi-weekly visual point count surveys (Brandt et al. 2009) at each site to assess changes in prey abundance and density. Three treatments were applied at each habitat type (one at each of the three sites); a control, an initial removal (IR), and a continuous removal (CR). No lionfish removals were conducted at control locations, lionfish were removed during initial surveys at IR sites (to document return to natural state), and all lionfish were removed during each visit to CR sites (to observe lionfish free communities).

Daily lionfish movements were monitored using acoustic tagging methods similar to those previously implemented by Fish and Wildlife Research Institute's South Florida Regional Laboratory (SFRL) (Zeigler and Hunt 2012). Approximately 15 lionfish were tagged on the selected sites with acoustic transmitters (Vemco V7) to detect day to day fish movements around the sample area. Sites for the acoustic component of the study were chosen based on lionfish density throughout the study site. An array of five acoustic receivers was deployed around the selected sites with additional receivers placed on adjacent reefs to document the presence of inter-reef connectivity. Receivers within the array were arranged in a manner to create an overlap of detections among the receivers, allowing us to monitor localized movements.

Results and Discussion

Results from the removal portion of the recolonization study suggest that monthly removals have been adequate for controlling a population of lionfish at a given location. While increased removals (weekly or bi-weekly) are able to maintain very low abundance. It is important to note that monthly removals were effective in preventing lionfish from recolonizing to pre-removal abundance. Observations at control locations indicated relatively stable populations throughout the duration of the study, suggesting that these habitats were saturated with lionfish and abundance was steady (Figure 1). Comparatively, initial removal sites rebounded to pre-removal levels but did not exceed their pre-removal abundance levels (Figure 1). The observed fluctuations in abundance at control sites and IR sites is suspected to be an artifact of diver detectability consider-

ing the cryptic nature of the species, and was later confirmed by the high site fidelity documented during the acoustic tagging experiment.

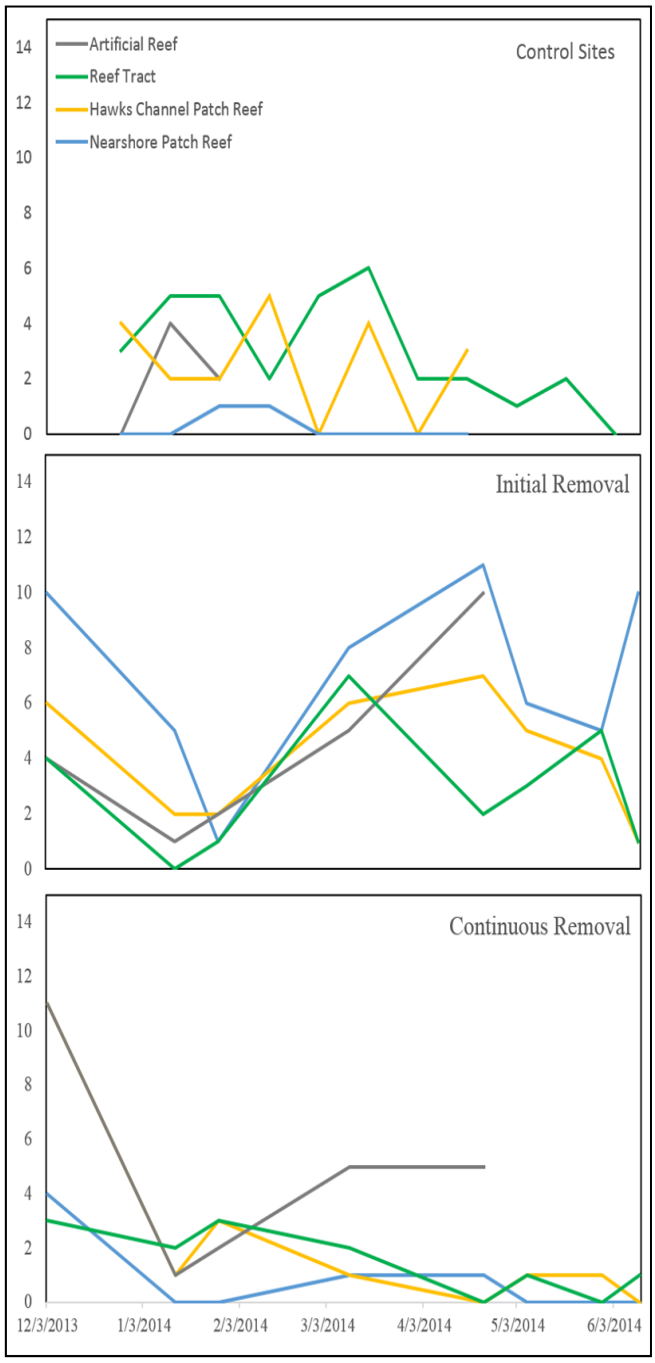

Figure 1. Observed lionfish recolonization at sample sites.

Indeed, the acoustic tracking portion of the study identified strong daily diel movement patterns at four of the study sites, and confirmed that a high proportion of the tagged fish remained at the tagging site. Additionally, scientists frequently *visually re-captured* tagged lionfish at the study sites. Acoustic data is providing valuable insight into the daily movement patterns of lionfish, and preliminary analysis of the data indicated that lionfish are most active near sunrise and sunset hours. Furthermore, lionfish maintained a small home range and exhibited high site fidelity during the study period. The conclusions from this studies were provided to managers and stakeholders as guidelines to prioritize locations for lionfish management and to develop possible lionfish management strategies for various habitats found in the Florida Keys.

LITERATURE CITED

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