You are what you dine from your fins to your spines: *Pterois volitans* dietary habits

Kaitlin Frei[1], Natalie Slayden[2], Jamie Peterson[3], Felicity Bennett[4], Melissa Gronske[4], David Stickle[4], Alli Candelmo[5]

[1]University of Notre Dame [2]Old Dominion University [3]Cornell University [4]Rutgers University, [5]Central Caribbean Marine Institute`

Introduction

Pterois volitans, lionfish, are an invasive species and serious threat to Caribbean coral reefs [1]. Lionfish face few predators, have immense appetites, and consume many herbivores; thus, their presence can alter community dynamics on reefs. In fact, areas invaded with lionfish display a decline in coral and sponge communities and increase in algal dominance [2].

Removal efforts have been implemented throughout the Cayman Islands and Caribbean; however, more strategic planning may increase their success [2]. The current study examined the diet of lionfish on the reefs of Little Cayman over a 4 year time period. With increased knowledge of lionfish dietary habits, culls can be targeted during seasons of maximum predation when lionfish are more likely to be out in the open and easy to catch.

Figure 1 (below). Lionfish cull sites around Little Cayman (Aug 2011 – May 2015). Sites marked by a lionfish were culled five or more times throughout the study. A magnified view of cull sites on the northern coast is shown in the yellow polygon.

Methods

- Lionfish were collected with nets and spears weekly off Little Cayman Island reefs from August 2011 through May 2015 (Figure 1)
- Community culls typically occurred at dusk between 5-7 PM when lionfish are out feeding
- Within 24 hours of culling, lionfish stomachs were removed, preserved with ethanol, and frozen for subsequent content analyses
- Stomach content was identified to the nearest possible taxa (Figure 2)

Figure 2. Example lionfish stomach contents. (left) Grouper, (right) Creole wrasse

Results

- Stomach content analysis indicated that lionfish diets during the 46 month culling period were comprised of 70% vertebrates, 26% invertebrate, and 4% other. No significant seasonal differences in diets were found (Figure 3)
- 70% of all stomachs analyzed contained dietary items at various stages of digestion, the remaining 30% of stomach were empty. No statistically significant seasonal trends were found; however, more lionfish had empty stomachs in the summer than in the winter and spring (Figure 4).
- Top dietary items comprising 5% or more of the identifiable lionfish stomach contents in decreasing order were shrimp, wrasse, goby, basslet, filefish, squirrelfish, and parrotfish (Figure 5)

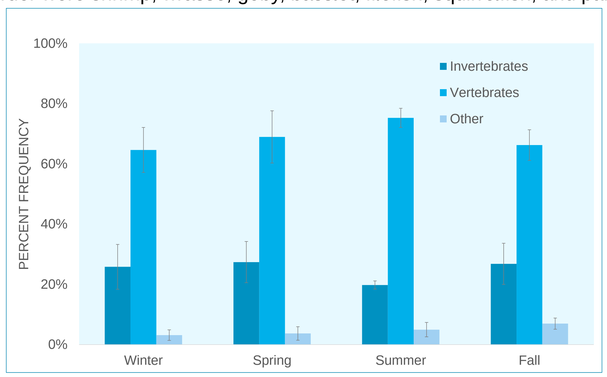

Figure 3. Seasonality of diet. Seasonal diets of lionfish (Winter 2011 to Spring 2015). Error bars represent standard deviation.

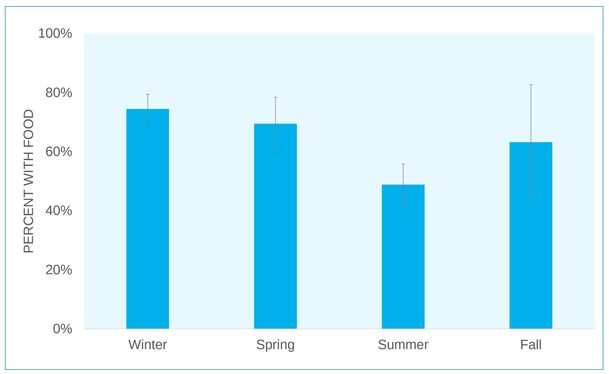

Figure 4. Seasonal stomach content. Proportional representation of lionfish stomach contents for weekly culls occurring at 5-7pm weekly (Winter 2011 to Spring 2015). Error bars represent standard deviation.

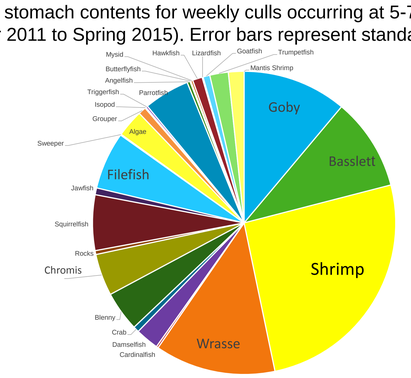

Figure 5. Stomach contents. Proportional representation of lionfish stomach contents (Winter 2011 to Spring 2015).

Discussion

Lionfish have a diverse appetite and feed on vertebrates, invertebrates, and other items, such as rocks, regardless of the season (Figure 3, Figure 5). The Caymanian lionfish preferred vertebrates, as do lionfish in other areas [3]. Vertebrate preference is costly to coral reef community dynamics, particularly herbivorous fish, which are essential algal grazers. Additionally, mass consumption of shrimp, the main prey item, harms coral reefs as numerous reef species rely on shrimp as a food source.

Although not statistically significant, a seasonal trend was seen in the percentage of empty stomachs, with more empty stomachs in the summer (Figure 4). Lionfish breeding season peaks in March/April and August, so lionfish may eat more during the winter and spring to prepare for mating [1]. The breeding season of some reef fish peaks in the spring and summer, so the increased spring appetite of lionfish may affect the stability of reef populations [4].

Additionally, an overall decrease in stomachs with food was seen in 2014, which may indicate a learned behavior as a result of culling. Thus, methods besides culling, such as trained predation, should be implemented in order to efficiently and effectively control the lionfish population in the Caribbean.

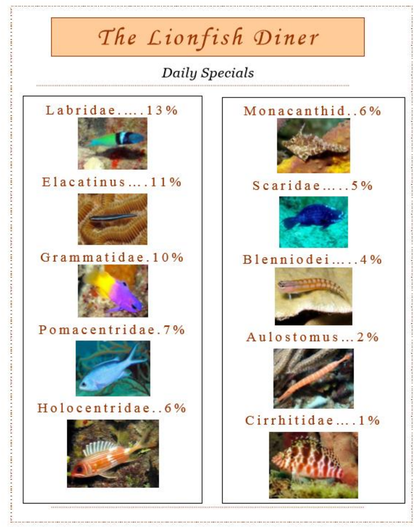

Table 1. Top 10 fish families consumed by lionfish (Winter 2011 to Spring 2015). Photos courtesy of reefguide.org

Acknowledgements

We thank all staff members at Little Cayman Research Center for their guidance and support. Thanks also goes to the community members of Little Cayman for participating in weekly culls and providing research specimens.

Literature Cited

[1] Gardner PG, Frazer TK, Jacoby CA, Yanony RPE. 2015. Reproductive biology of invasive lionfish (*Pterois* spp.). Frontiers in Marine Science. 2(7): 1-10.

[2] Barbour AB, Allen MS, Frazer TK, Sherman KD. 2011. Evaluating the potential efficacy of invasive lionfish (*Pterois volitans*) removals. PLoS One. 6(5).

[3] Valdez-Moreno M, Quintal-Lizama C, Gómez-Lozano R, García-Rivas MC. 2012. Monitoring an alien invasion: DNA barcoding and the identification of lionfish and their prey on coral reefs of the Mexican Caribbean. PLoS One. 7(6).

[4] Robertson DR, Swearer SE, Kaufmann S, Brother EB. 1999. Settlement vs. environmental dynamics in a pelagic-spawning reef fish at Caribbean Panama. Ecological Monographs. 69: 195-218.