

10,000+ Lionfish Later ... What Do We Actually Know About Their Feeding Ecology?

10.000 Peces León Después ... ¿Qué Sabemos Realmente Acerca De Su Ecología Alimentación?

10,000+ Lionfish Plus Tard ... Que Savons-Nous Réellement De Leur Alimentation Ecologie?

FADILAH ALI

University of Southampton, Waterfront Campus, European Way, Southampton, United Kingdom.

EXTENDED ABSTRACT

Introduction

The Red lionfish (*Pterois volitans*) is widely regarded as a generalist predator with a voracious appetite. Although principally piscivorous, it has been known to feed on invertebrates (Morris 2009), and in their native range they occupy the higher levels of the food chain (Hare and Whitfield 2003). Lionfish employ a diverse range of feeding strategies making them well suited for feeding on benthic and cryptic prey (Morris 2009). Lionfish were first confirmed in Bonaire, Klein Bonaire and Curacao between October 26 - 28, 2009 (de Leon et al. 2013). Since then, various management strategies have been instilled in an attempt to quell their further spread and also to control current populations. An extensive monitoring program was established in Bonaire whereby specimens have been continually submitted over the four-year invasion period so that their growth, dispersal, feeding and reproductive ecology could be studied over time. However, in Curacao, a lionfish management strategy was not implemented until July 2011.

Materials and Methods

Collections — Trained volunteers collected all specimens using scuba gear at the dive sites surrounding Bonaire, Klein Bonaire, and Curacao. These sites consisted of high profile coral reefs and patch reefs, ranging in depth from 0.3 to 91.5 m. Collections were achieved using hand nets, pole spears, or the use of the ELF Tool (Eradicating Lionfish Tool), and the lionfish were stored in lionfish containment devices such dry bags or the Zookeeper. In Bonaire, the majority of captured specimens were brought to CIEE Research Station Bonaire, and following dissections, stomach contents were fixed in formalin (5%) for at least three days and then transferred to ethanol (70%) for a further three days. However, for Klein Bonaire and Curacao, all lionfish were analysed on site immediately after being caught with their stomach contents being individually bagged and labeled and then taken to the lab for further analysis.

Stomach Content Analyses — Stomach contents were identified to the lowest possible taxon, measured to the nearest mm, counted, and where possible assigned to a body shape category. Volumetric analysis of prey by taxon was measured via water displacement and was determined for 4,658 lionfish stomachs. The contribution of individual prey taxon to the overall diet of lionfish was assessed via percent frequency of occurrence (%F); percent composition by number (%N) and percent composition by volume (%V). In order to perform a robust assessment of prey importance; the index of relative importance (IRI) was calculated.

Results and Discussion

A total of 11,161 lionfish ranging between 21 to 455 mm TL were collected and analysed between October 26, 2009 and November 24, 2013 in Bonaire (6288), Klein Bonaire (2743), and Curacao (2130). In Bonaire the majority of lionfish were in the 101 - 200 mm size class (46%), whereas in Klein Bonaire and Curacao the majority (45% and 52%, respectively) were found in the 201 - 300 mm size class. Lionfish across all study sites had a predominantly fish only diet (Bonaire: 45%, Klein Bonaire: 43%, and Curacao: 46%) with a total of 29 families (11 invertebrate and 18 fish) and 68 species (13 invertebrate and 55 fish) being represented within their diets. The large number of prey families within lionfish stomach contents suggest a very generalist (Morris 2009) but fish dominated diet in Bonaire, Klein Bonaire, and Curacao. However, it is important to note that stomach contents simply represent the last meal before capture and not necessarily an individual's dietary preference. The fact that lionfish possess a generalist diet can be a blessing and a curse at the same time. The lack of specialization on any individual or few species means there is limited risk that lionfish will drive an entire species to extinction immediately (Morris and Akins 2009). They owe this successful generalist diet to their wide repertoire of novel feeding strategies along with the fact that local prey do not recognize them as predators (Albins and Hixon 2008).

When diet composition was investigated according to size class, generally as lionfish increased in size, the frequency of invertebrate only and mixed diets decreased, whilst fish only and empty stomachs increased in frequency. In Curacao, teleost fishes accounted for 97% by volume (%V), 72% by occurrence (%F), and 72% by number (%N) of lionfish diets whilst invertebrates accounted for 3%V, 28%F, and 28%N. Within Bonaire, teleost fishes dominated lionfish diets comprising 92%V, 67%F, and 59%N whilst invertebrates accounted for 7%V, 33%F, and 41%N. Similarly, in Klein Bonaire, teleost fishes dominated lionfish diets comprising 91%V, 56%F, and 73%N whilst invertebrates accounted for 9%V, 40%F, and 30%N (Figure 1). Lionfish within Bonaire, Klein Bonaire, and Curacao appear to be adhering a size-dependent feeding strategy whereby as individuals become larger in size, there is a higher proportion of bigger, more profitable prey in their

diets. Regarding lionfish it would be expected that as individuals increased in size, there would be an associated increase in fish only diets, and thus a subsequent decrease in the abundance of invertebrates in their diets (Morris 2009).

Conclusions

Lionfish possess a generalist, but fish dominant diet within Bonaire, Klein Bonaire, and Curacao. Furthermore, a size dependent relationship exists whereby there is a higher abundance of fish dominated diets as lionfish increase in size. Knowledge of the proportion of ecologically and commercially important species within lionfish diets and how this compares to resident populations is essential for assessing the magnitude of the impact of lionfish.

LITERATURE CITED

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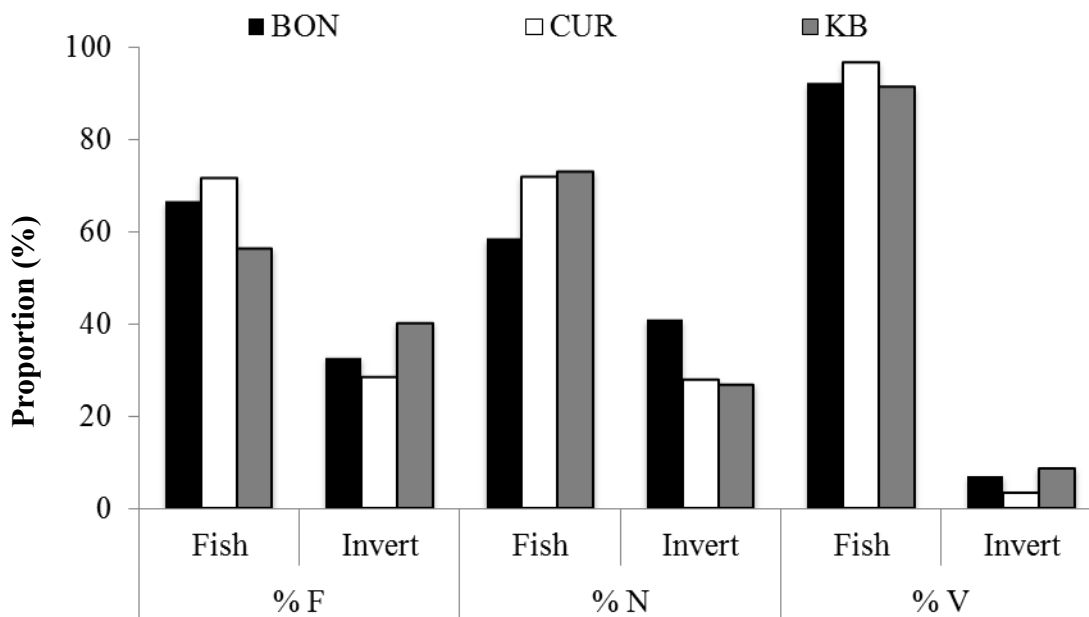


Figure 1. Composition of lionfish diets in Bonaire Curacao and Klein Bonaire.