Effects of Grouper and Reef Type on Lionfish (*Pterois volitans*) Distribution, Cape Eleuthera, The Bahamas

Katie Harpin, John Morris, Maddy Philipp, Forrest Rappaport, Tessa Tracy, and Lincoln Zweig
Advisors: Steve Auscavitch, Teschna Christie, Skylar Miller, and Jason Selwyn

Introduction

Originating in the Indo-Pacific, lionfish (*Pterois volitans)* are now an invasive species in the western Atlantic and Caribbean. Lionfish were first sighted in south Florida in the 1980's and established in The Bahamas by 2004 *(Whitfield et al., 2007)*. The most widely accepted vector of the invasion is the aquarium trade *(Semmens et al., 2004)*. Lionfish pose threats including disruption of the food web and competition for shelter, compounded by the lack of native predators *(Arias-Gonzalez et al., 2011; Carlton et al., 2010; Morris et al., 2009)*. Large-body grouper may act as a potential biocontrol for lionfish *(Mumby et al., 2011)*. Grouper also may compete with lionfish for food and shelter and thus affect their distribution. This study aimed to better assess the relationship between grouper and lionfish by determining biotic factors affecting their distribution. This study may contribute to eradication and management efforts.

Table 1: The three different reef types along with their depths and transect dimensions

Reef Type	Depth (m)	Transect Dimensions (m)
Patch	<5	8x2
Reef	10-21	8x2
Continuous	22-28	30x4

Methods

Reef types were surveyed on SCUBA using transect tapes (Table 1). Lionfish and grouper abundance and size were recorded along each transect. Small patch reef dimensions were measured to determine area. Lionfish and grouper biomass were calculated using length and abundance data as in (*Schneider et al. 2000).*

Results

Lionfish and grouper on continuous reefs are approximately three times longer than lionfish and grouper on other reef types ($p<0.05$, Fig 1). Lionfish and grouper are approximately five times more abundant at patch reefs than other reef types ($p<0.05$, Fig 2). Grouper and lionfish biomass is more than three times higher at continuous reefs than other reef types ($p<0.05$ Fig 3). The abundance of grouper does not significantly affect the abundance of lionfish (Fig 4).

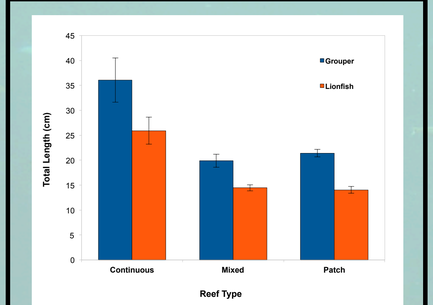

Figure 1 : Sizes of grouper and lionfish across reef types

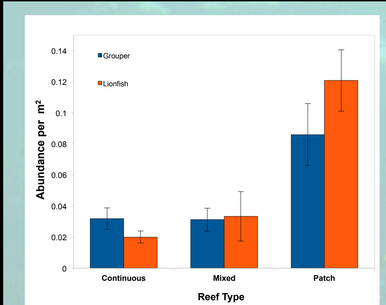

Figure 2: The abundance of lionfish and grouper across reef types

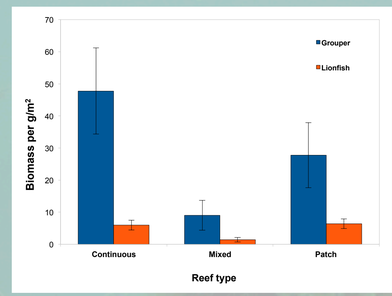

Figure 3: The biomasses of lionfish and grouper across reef types

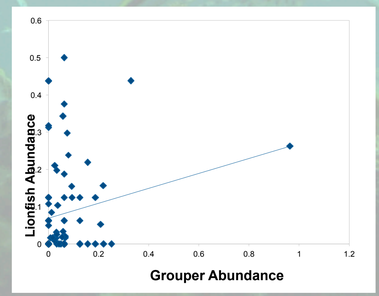

Figure 4: Comparison of the abundance of lionfish to the abundance of grouper

Figure 5: A) Transect on reef. B) Two students surveying reef. C) Student laying out a transect tape.

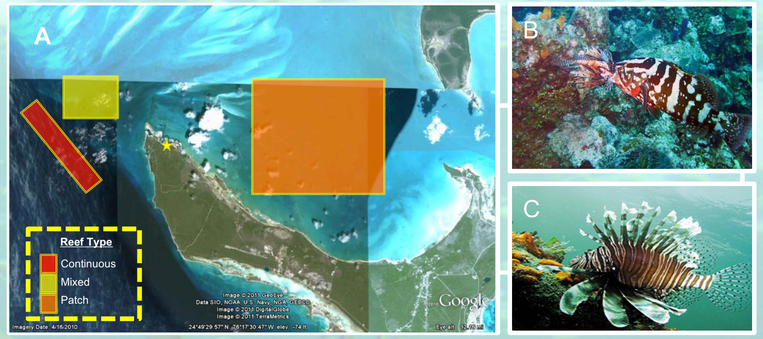

Figure 6: A) Survey locations around Cape Eleuthera. B) Nassau grouper eating a lionfish. C) Lionfish on patch reef.

Discussion

Lionfish were found to be highly pervasive in the area surrounding Cape Eleuthera. Grouper and lionfish are more abundant on patch reefs because they are fish nurseries. Since small juvenile fish inhabit these patches, more fish can occupy a smaller space. Continuous reefs provided more shelter options than patch reefs. Grouper have a higher biomass than lionfish across all reef types because grouper are generally a larger bodied fish. Lionfish biomass was similar across reef types because the abundance of smaller lionfish found on patch reefs balances out the larger, less abundant lionfish found on continuous reefs.

Conclusion

In the study area grouper would not be successful as a bio-control for lionfish because grouper are not abundant or large enough. This contradicts the results found in The Exuma Cays Land and Sea Park Marine Protected Area, where lack of fishing pressure has had minimal effect on the abundance of grouper or lionfish *(Mumby et al., 2011)*. In order to prevent lionfish populations from rebounding, removal efforts on patch reefs would be beneficial if fishing was maintained at a moderate, continuous pressure instead of intense pressure for short periods of time *(Arias-Gonzales et al., 2011*). It is vital to remove lionfish on the patch reefs because they are important nursery habitats for juvenile fishes.

Literature Cited

Arias-González, J.E, González-Gándara, C, Cabrera, J.L, Christensen, V. 2011. Predicted impact of the invasive lionfish *Pterois volitans* on the food web of a Caribbean coral reef. DOI:10.1016

Carleton,JT, Lindstrom, S.C., Smith, C.M., Jennifer, E.S.. 2010. Marine bioinvasions and climate change. National Invasive Species Awareness Week:1-6

Morris,J , Atkins, J.L., Barse, A, Cerino, D, Freshwater, D.W., Green, S.J., Munoz, R.C., Paris, C., Whitfield, P.E. 2009. Biology and Ecology of Lionfish. GCFI: 61 .

Mumby, P.J., Harborne, A.R., Brumbaugh, D.R. 2011. Grouper as a Natural Biocontrol of Invasive Lionfish. PLoS ONE 6(6): e21510

Semmens, B., Buhle, E., Salomon, A., Pattergill-Semmens, C. 2004. Aquarium Trade as an Invasion Pathway. MEPS. 266: 239-244.

Schneider, J.C., Laarman, P.W., Gowing, H. 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.

Whitfield,P, Gardner,T, Vives, S.P., Gilligan, M.R., Courtenay, W.R., Carleton, Hare, J.A. 2002. Biological Invasions of the Indo-Pacific Lionfish (*Pterois volitans*) along the Atlantic Coast of North America. Marine Ecology Progress Series 235:289

REEF www.REEF.org

CAPE ELEUTHERA INSTITUTE
RESEARCH EDUCATION OUTREACH

SFU

THE ISLAND SCHOOL