Does Biocontrol Affect the Presence of Lionfish (*Pterois volitans*) on Reefs of South Eleuthera?

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INTRODUCTION

Lionfish are an invasive species in the Atlantic and Caribbean oceans that originally came from the Indo-Pacific. They were most likely brought from the Indo-Pacific to be sold in the aquarium trade, and then released out of home aquariums off the coast of South Florida. They have been so successful in the Western Atlantic for a number of reasons. They consume a wide range of fish and crustacean species, they have no natural known predators, they have immunity to local parasites, and they have incredibly high reproductive rates as they spawn every four days with up to 30,000 eggs, which collectively contributes to their success (Morris et al, 2008). Their overall impact has been detrimental to local marine ecosystems (Albins & Hixon 2011)., include eating juvenile species like parrot fish which graze algae off the reefs and Nassau grouper which are economically important to the Bahamas. Current strategies for controlling their invasion include human interventions such as spearing and lionfish derbies. However, a natural biocontrol through predation could be more effective (Mumby, et al 2011). Recently, grouper have been found with lionfish in their stomach, which suggests that grouper may be adapting to the presence of lionfish and seeing them as prey (Albins 2010, Mumby & Harborne 2011). This study investigates the possibility of a natural biocontrol.

Fig 1. Lionfish Competitor

Fig 2. Lionfish Prey

Aim:

How does the abundance of prey and competitors affect the presence of lionfish on patch reefs throughout South Eleuthera?

Hypothesis:

1. The more prey present on a reef will lead to more lionfish on a reef.
2. The more competitors present on a reef will lead to fewer lionfish on a reef.
3. The higher quality the reef is, the more abundant lionfish will be.

Fig 3. Lionfish found in a Nassau Grouper's stomach

Fig 4. Lionfish lack natural predators

METHODS

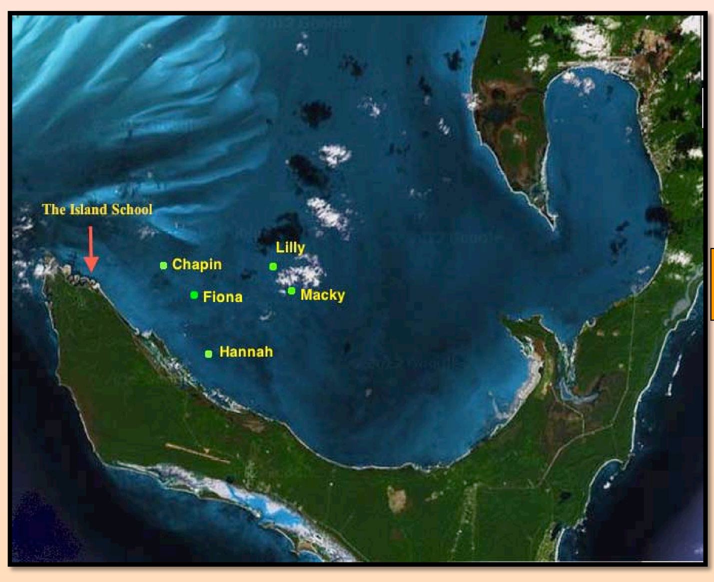

Fig 5. Lionfish research site map: each site is named after a member of our group.

Fig 6. Benthic coverage was measured by using a point intercept method every 50cm along each of the three, evenly spaced, 8 meter transects.

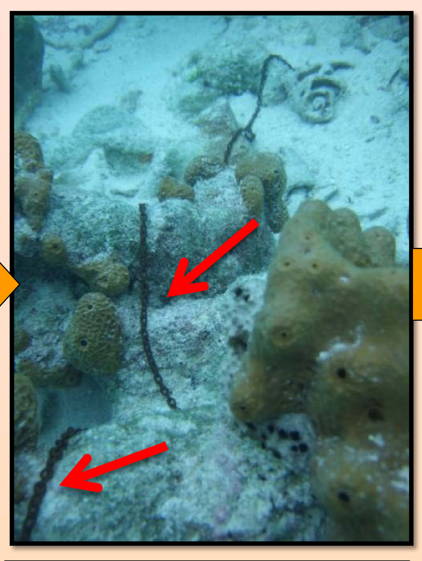

Fig 7. Reef complexity was measured using a rugosity chain that was 1m long. The chain was draped along the reef every 3m starting at 0m along each transect.

Fig 8. The patch reef size was calculated by measuring the length, width and height of the patch reef.

Fig 9. Prey surveys in which the abundance of fish under 15 cm were conducted along 8 meter transects. Lionfish prey were considered to be any fish species under 15 cm.

Fig 10. Lionfish and competitors surveys, which recorded the size and abundance, were also completed.

RESULTS

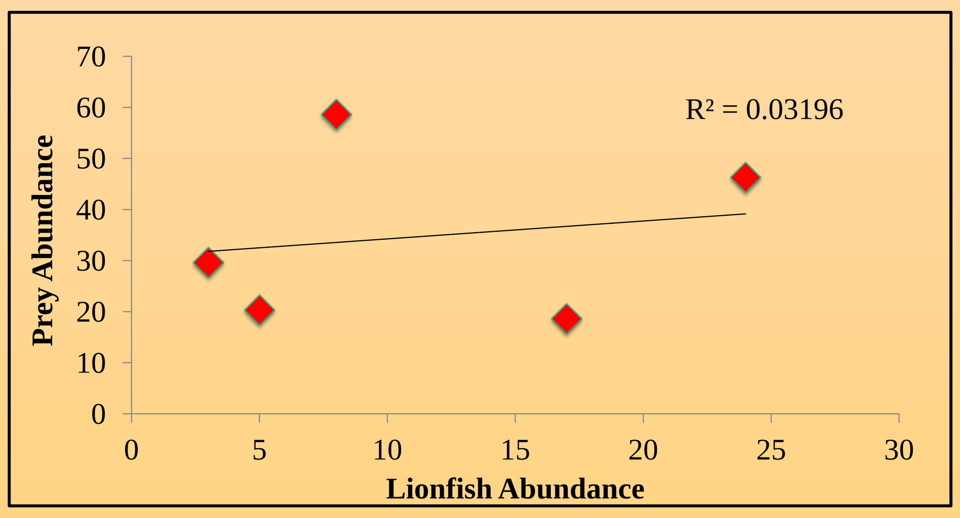

Fig 11. The correlation between lionfish abundance and prey abundance. The R² value shows us that there is no correlation between the two data sets.

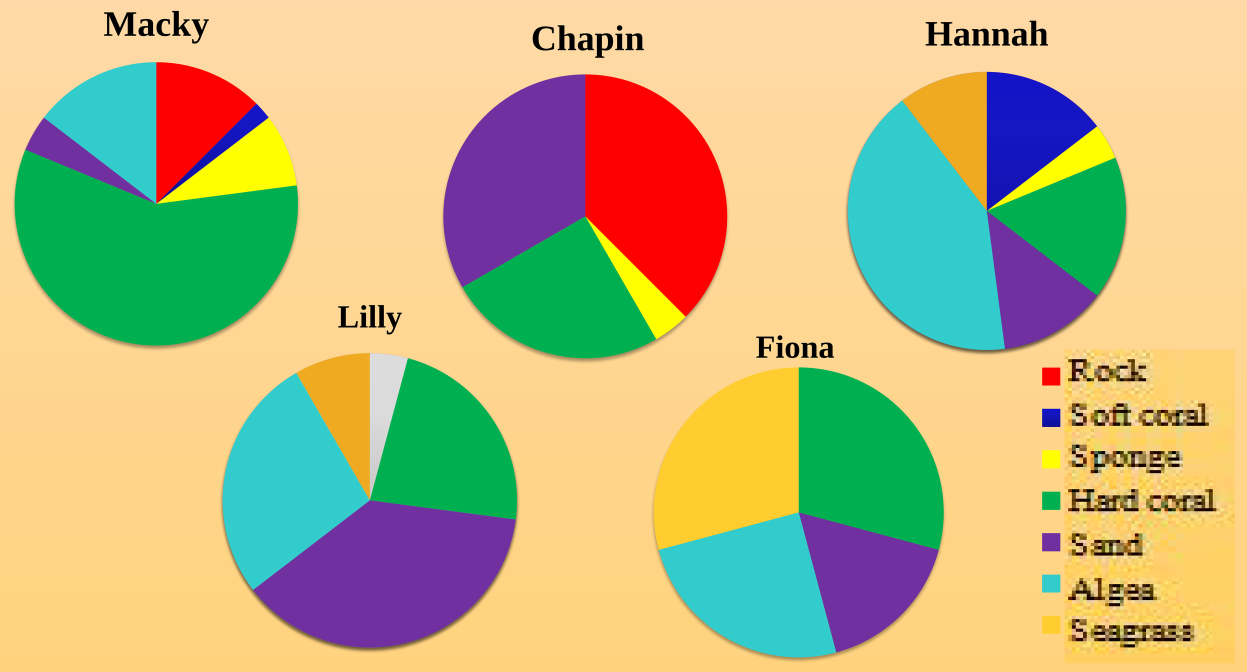

Fig 12. The average benthic coverage on the five patch reefs. The sites differed in their benthic coverage. Patch Macky had the highest cover of hard coral with 58±3.6% , whereas patch Hannah was mostly covered in algae (41±3.6%) and Chapin was mainly abiotic substrate (70±7.2%) .

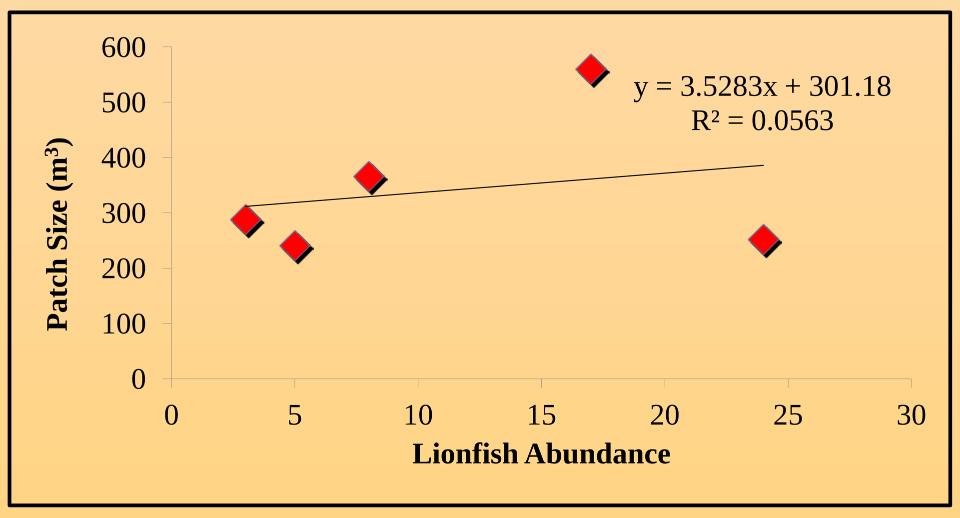

Fig. 13. The correlation between lionfish abundance and the area of the patch reefs. The R² value shows us that there is no correlation between the two data sets.

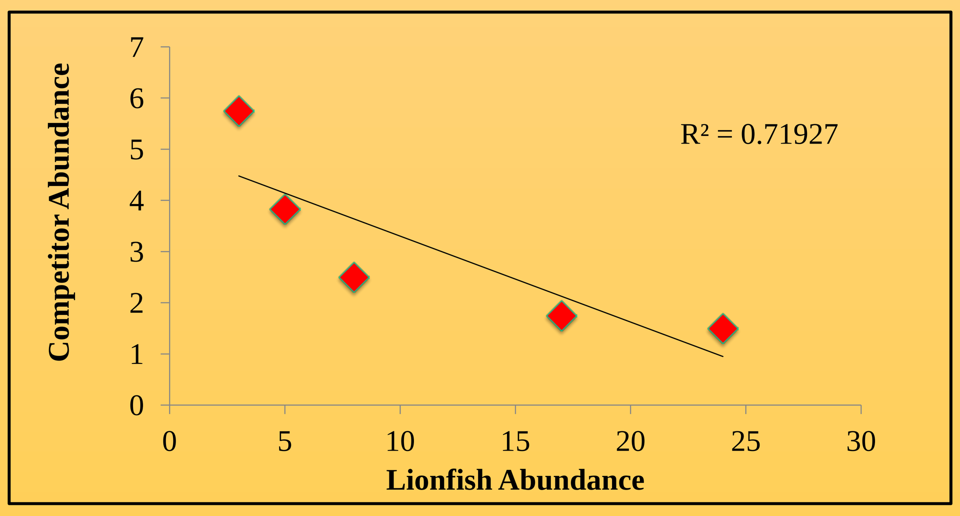

Fig 14. The correlation between the lionfish abundance and competitor abundance. The R² value shows us that there is a positive correlation between the abundance of competitors and lionfish.

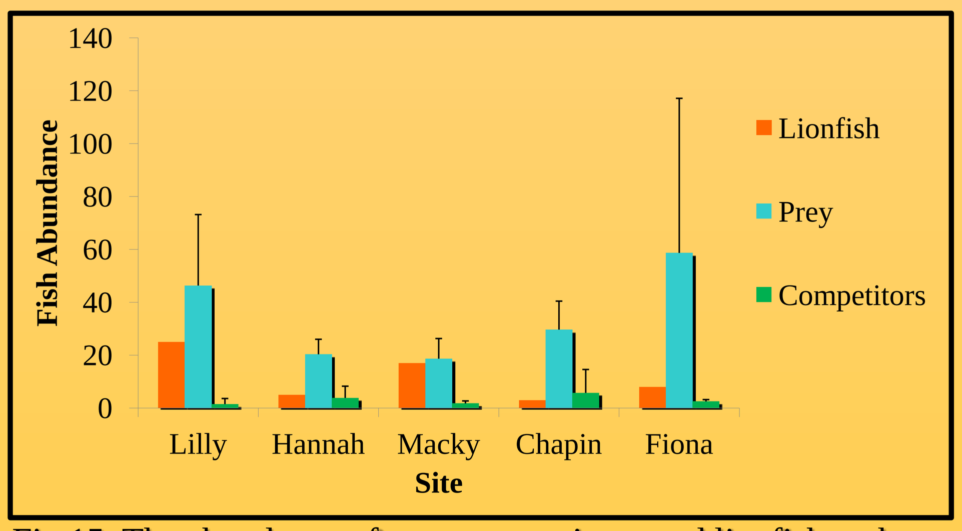

Fig 15. The abundance of prey, competitors, and lionfish at the five patch reefs.

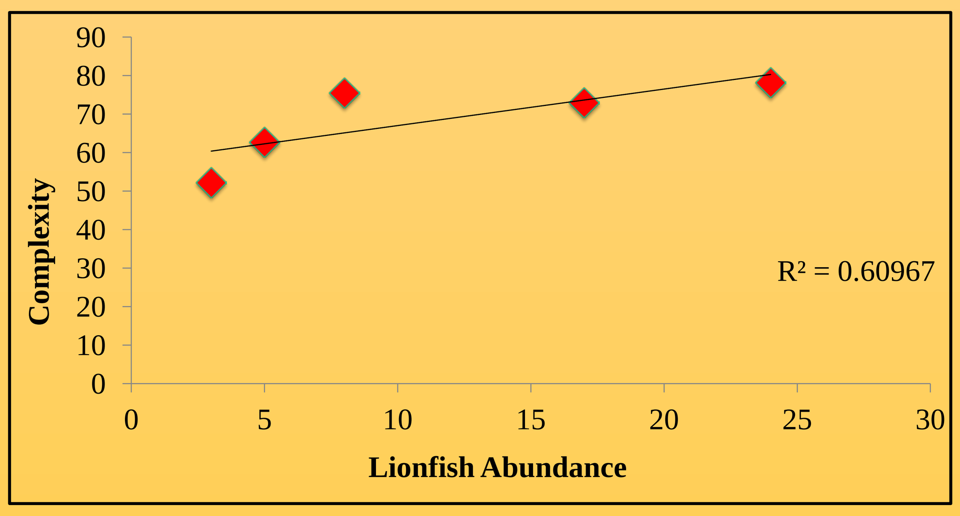

Fig.16. The correlation between lionfish abundance and the reef complexity. The R² value shows that there is a positive correlation between the two data sets.

DISCUSSION

Our results are important because they provide insight into what factors allow lionfish to thrive and what appears to limit them. There is no direct correlation between prey abundance and lionfish abundance on the patch reefs of south Eleuthera. This contradicts our first hypothesis and may be due to the fact that lionfish can go three months without eating and that they eat a wide range of prey (Morris and Akins, 2008). Additionally it was found that with an increased number of competitors the lionfish presence decreased, supporting our second hypothesis. This could be because the lionfish are competing for food and living space with species such as Nassau grouper. Lastly, it was found that the size of the patch reef was not correlated with lionfish abundance but high reef complexity was, which supported our third hypothesis. This is most likely because lionfish usually reside under overhangs and in indents in the reef, so a complex reef would provide more habitats for them. The inverse relationship between competitor abundance and lionfish abundance should encourage people to reduce fishing pressure on lionfish competitors such as group, snapper and grunts. Furthermore, lionfish abundance could be reduced by using the species as alternative for the fishing industry.

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