Studies on Abundance of Seven Marine Species on Patch Reefs

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Introduction

Resource exploitation is a common problem throughout the world (Dahlgren 2002). Effects of this dilemma are felt in the oceans. Multiple regions have had species labeled as threatened or endangered due to various anthropogenic and natural limiting factors, such as climate, surrounding fishing populations, development, and lack of regulation enforcement (Buchanan 2000). The Bahamas, a country completely surrounded by ocean, is a location that has experienced impacts on its fisheries. Although a successful Marine Protected Area (Exuma Cays Land and Sea) and potential solutions to fishery issues exist, many marine species continue to live under great stress (Dahlgren 2002). To ensure protective acts are being followed is a difficult task; monitoring large expanses of sea requires consistent patrol and investigation; and decisions made for pending Marine Protected Areas have taken considerable time due to interaction with fishers. Cape Eleuthera is the location of one pending MPA.

In the ongoing Patch Reef project conducted by The Island School, researchers have surveyed the abundance of seven ecologically and/or economically important marine species along the Cape for the past eight semesters. In this arrangement of data, Patch Reef researchers seek trends or other significant patterns that could influence a pending MPA decision. **The purpose of this study is to provide the scientific community, the Bahamian government, and other stakeholders in the pending MPA decision with a more informed perspective of the health of the local marine environment.**

Methodology

Of all the reefs tagged by previous semesters within the proposed MPA boundaries, 15 were selected for the Fall 2008 study. These 15 reefs, represented by red dots (Fig. 1), were strategically chosen so that a wide spectrum of the area under study could be sampled. Each of the 15 reefs were visited 3 times, yielding collective data for this semester of 45 surveys.

Once in the water, researchers commenced with an acclimation period to allow organisms to become accustomed to their presence (Fig. 2). This entailed hovering approximately 3 meters away from the reef for a total of 3 minutes, theoretically resulting in increased accuracy of fish counts. Reef surveys included:

- Fish counts of each of the 7 species
  - Nassau grouper, black grouper, Caribbean spiny lobster, lionfish, yellowtail snapper, French grunt, queen triggerfish
  - Size estimations of grouper (4 categories, 0-50cm juvenile, >50 adult)
- Taking note of physical factors of the reef
  - Reef Complexity
  - Presence of a sand halo
  - Reef size (length, width, height of the coral heads)
  - Rugosity

After field work, the data collected was entered into the patch reef database. Data was analyzed using Systat to run t-tests and ANOVA.
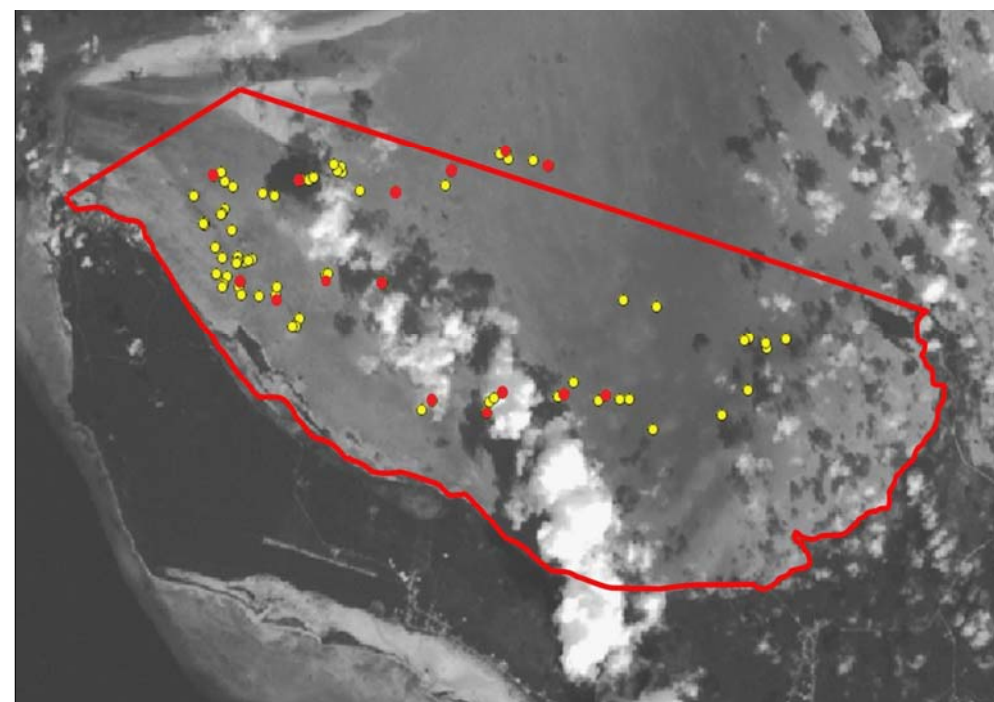

Figure 1: Satellite view of pending MPA on Cape Eleuthera; shows the grouping of patch reefs under study. The red dots represent the 15 reefs studied this semester.
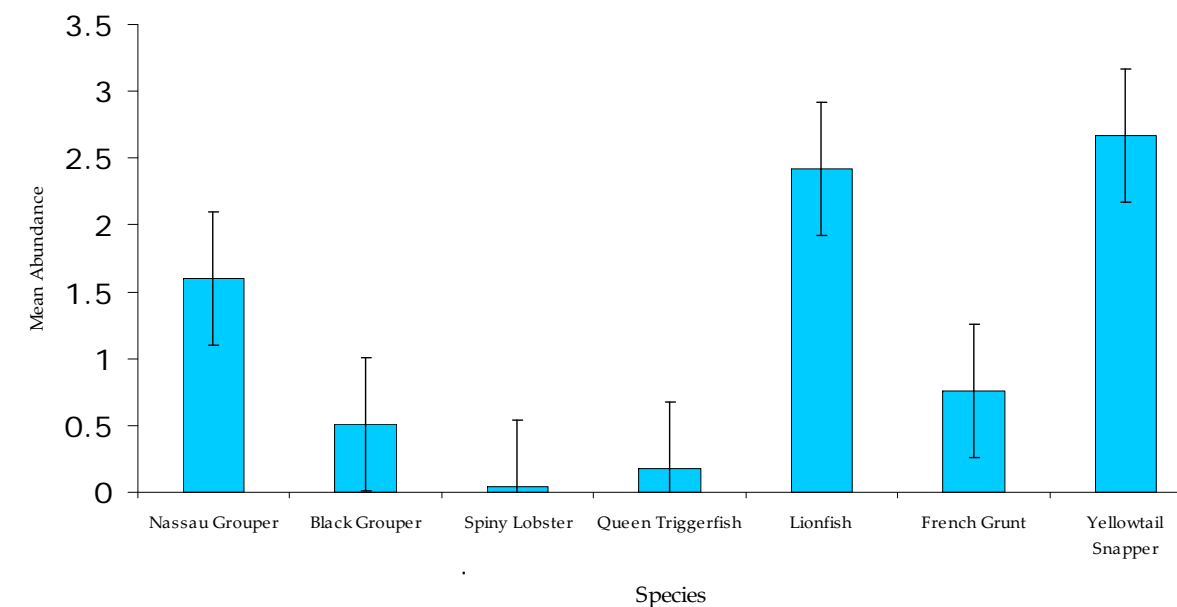

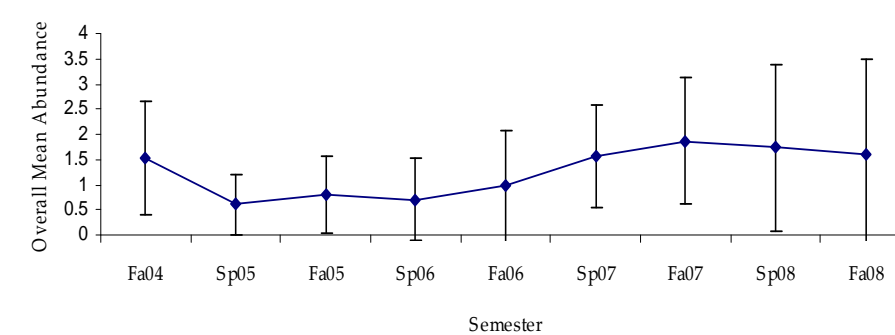Figure 3: Overall mean abundances of the seven species for Fall 2008.

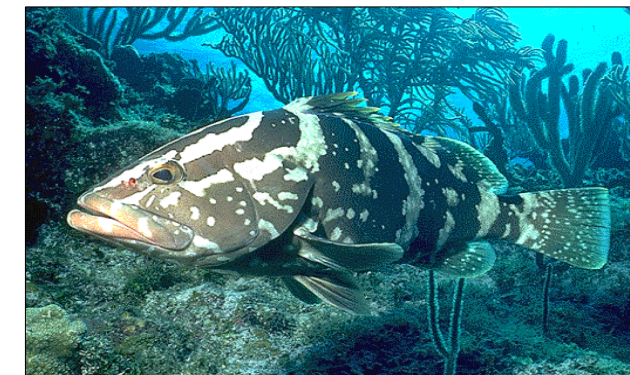Figure 4: Overall means of Nassau grouper for each semester thus far.
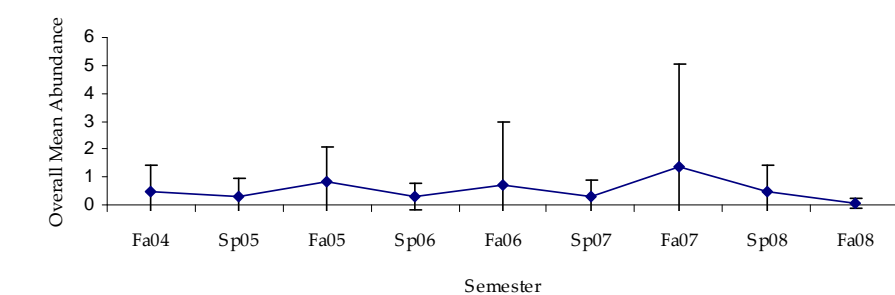

Figure 5: Overall mean abundances of lobster for the past 9 semesters.

Figure 6: Overall mean abundances of lionfish since spring 2007.

Figure 7: Nassau grouper (*Epinephilus striatus*).

Figure 8: Caribbean spiny lobster (*Panularis argus*).
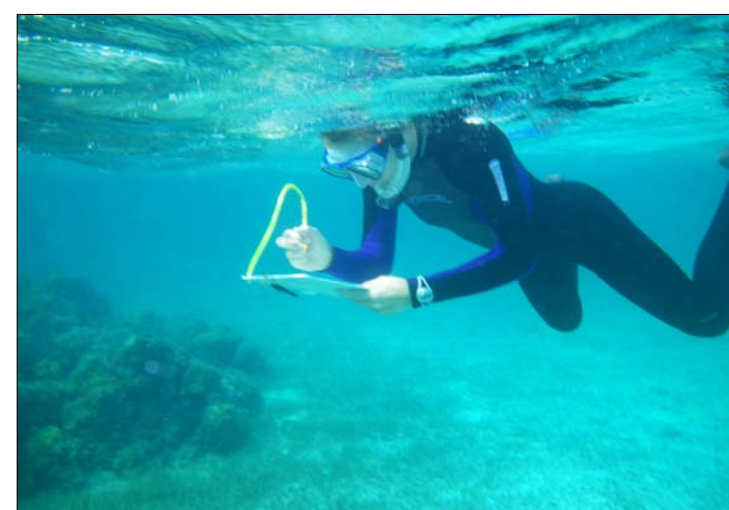

Figure 9: Lionfish (*Pterois volitans*)

Figure 2: Fall 2008 student surveying a reef.

Results

Throughout the course of the semester, fairly stable trends were observed in species abundance. Nassau grouper size category three and four appeared to increase, while the abundances of size category one and two grouper remained steady in relation to past semesters. The most prevalent species were the lionfish, yellowtail snapper, and Nassau grouper, while lower abundances were observed in endangered species such as the Caribbean spiny lobster (Fig. 3).

In fall of 2005, new fishing regulations were implemented in The Bahamas, and since then a general increase in grouper population has been noted (Fig. 4). The Caribbean spiny lobster generally follows a trend between seasons, namely an increase in the fall and a decrease in the spring. This semester does not follow this trend, instead showing a continued decrease in the fall (Fig. 5).

Lionfish abundances have increased exponentially (Fig. 6), since they were first observed in Bahamian waters in 2005 (Albins and Hixon 2008). The French grunt, yellowtail snapper, black grouper, and queen triggerfish all demonstrated fairly stable trends. Some outliers were observed in the yellowtail snapper data, though they did not prove statistically significant. The data collected this semester has added to a preexisting wealth of data, which will eventually assist in a complete view of marine species abundance on patch reefs.

Discussion and Future Studies

The Nassau grouper displayed an expected high abundance of juveniles (category 1 and 2), but sightings of adult (category 3 and 4) grouper were noteworthy. The presence of sexually mature species on patch reefs generates many questions. Perhaps these grouper are appearing due to natural variation, but this might also mean that grouper are maturing on patch reefs due to a decrease in fishing pressure. In the future, the patch research team would like to pursue tagging Nassau grouper on patch reefs, for a more informed view on this endangered species' maturation process by tracking spawning and migratory activities.

In the past, summer closures on lobster fishing have yielded greater abundances in fall than in the spring. One theory was that the observed drop in abundance may have been due to the numerous hurricanes at the beginning of the semester.

Lionfish are also under close scrutiny in the Bahamas today. Researchers believe it would be beneficial to the scientific community to complete further studies on this invasive species. For example, analyzing stomach content in semesters to come could provide insight to what lionfish are preying on. There is also expressed interest in tagging lionfish to determine how quickly and to what extent the invasive species is spreading. I

n the future, the research group also hopes to find a correlation between physical factors of the reef, such as rugosity or depth, to species abundance. Patch reef data is contributing to a larger study that will hopefully be used in the future by scientists, government officials, and local community members as decisions regarding the proposed Marine Protected Area.

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