Biomass Accumulation around FADs in the Exuma Sound

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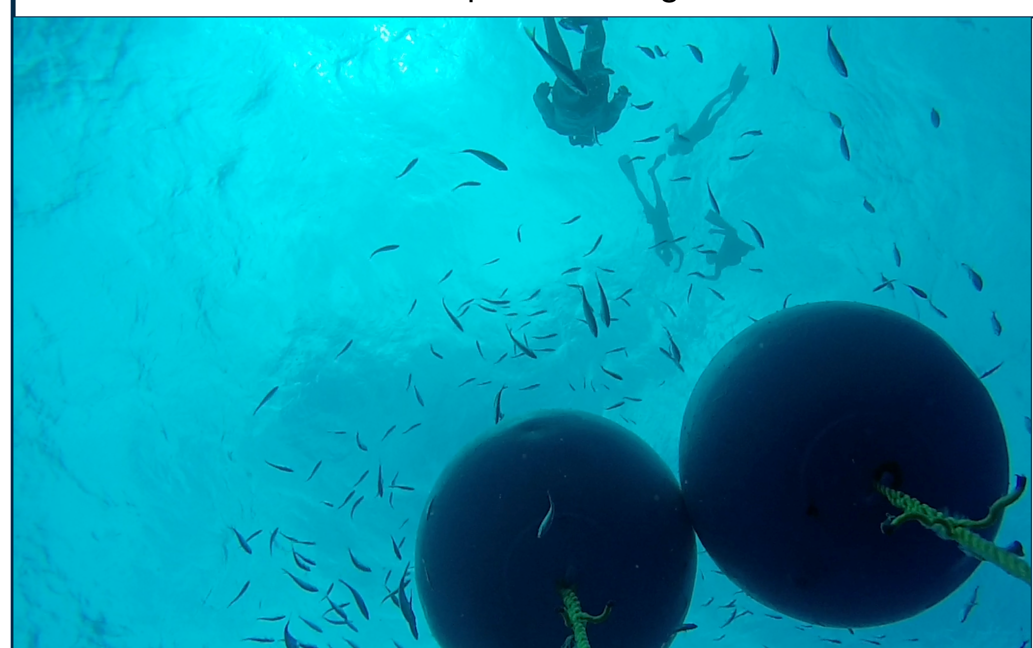
The Island School · Cape Eleuthera Institute · Cape Eleuthera Institute EXERP Exuma Sound Ecosystem Research Project

INTRODUCTION

Fish aggregation devices, or FADs, are used to attract fish and enhance fisheries catch rates (Castro et al. 2002). Around the world, FADs are becoming increasingly popular with 100,000 estimated to be deployed annually (Moreno et al. 2015). Unfortunately, FAD-associated fishing leads to overfishing and high rates of bycatch due to its non-selective nature (Trygonis et al. 2016). Research has been focused on the impact of FADs on commercially important species (Castro et al. 2002). Little research has been done to understand the wider impacts of these FADs on marine ecosystems in the western Atlantic. Species that have little research consist of invertebrates and lower trophic level organisms.



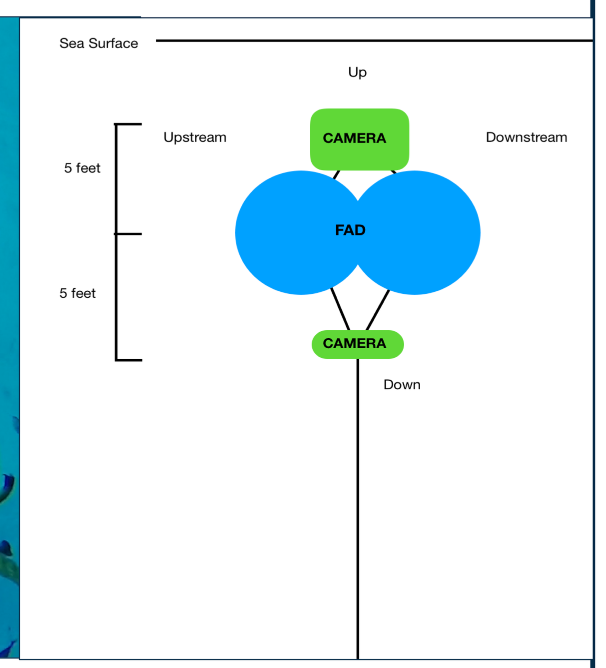


Figure 1 (left): The image above is of a man-made, anchored FAD constructed and deployed by CEIS.
Figure 2 (right): This diagram represents the CEIS FADs and camera placements

OBJECTIVES

- Collect data on the colonization and succession of migrating pelagic species around FADs in the Exuma Sound
- Determine species abundance, individual fish counts, and behavior of migrating pelagic species around FADs in the Exuma Sound

METHODS

Camera Surveys
Camera surveys were performed once a week. Each survey had four cameras: one pointing into the current (upstream), out of the current (downstream), towards the surface (up) and down the FAD rope (down). The cameras recorded for 1½ - 2 hours. The footage was analyzed to determine how long species were present and their behavior around the FAD.

Sonar Surveys
The sonar survey consisted of deploying the sonar 10 meters behind us and driving the boat in a radial star pattern with the FAD in the center. The sonar works by sending out a ping of sound energy at 96 kilohertz into the water column every second. Objects reflect sound energy back towards the sonar which calculates the density and distance of objects in the water column. Using these metrics the sonar can recognize the amount of biomass around the FAD.

Light Trapping
Light traps act as a beacon in the dark attracting organisms during the night. Using light traps, we are able to supplement what we've learned from our sonar surveys and see the specific species aggregating around our FADs. The light traps are made up of a quatrefoil and a PVC tube trap. There are three locations that the light traps are placed: on the FAD, 500m away from the FAD, and 1000m away. The light traps are placed at a depth of 10m, 200m, 400m, and 600m. They are collected after 3 hours and the organisms caught are recorded and photographed.

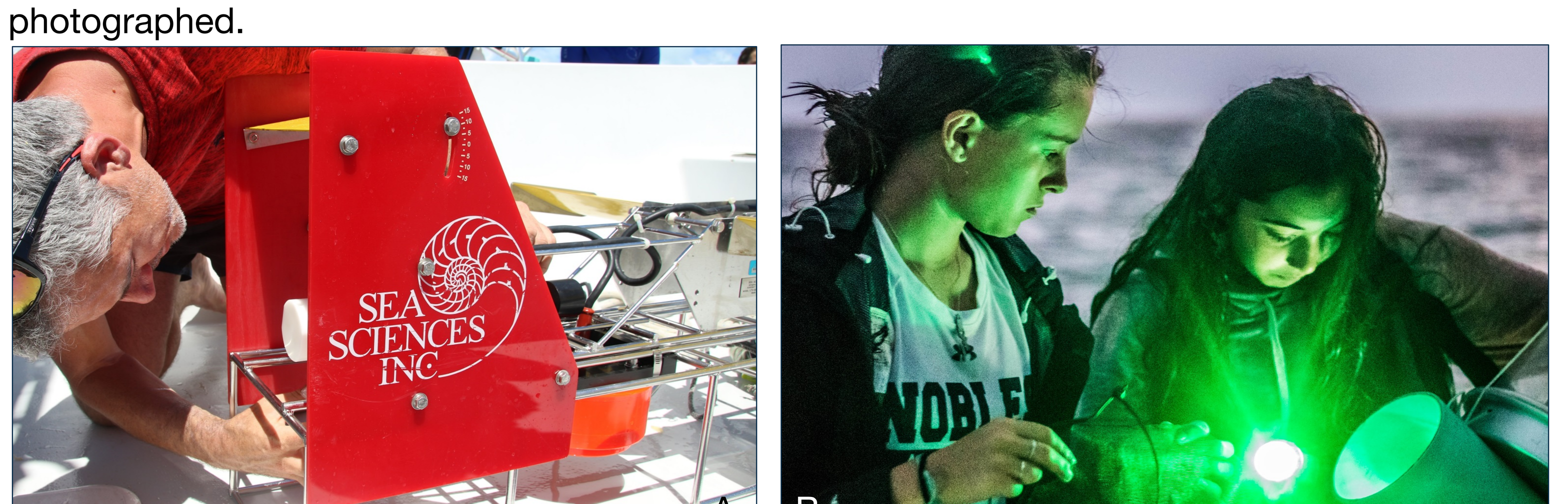


Figure 3: Two of the methods we use to conduct our research around the FAD: (A) sonar surveys (B) light trapping

RESULTS AND DISCUSSION

We analyzed video survey data to collect information on fish abundance and grouping as well as their distance from the FAD. In the past, videos from our cameras have shown that bait fish aggregate (<10m) around the FAD rope which most likely means that they are feeding off the algae and that larger predatory fish associate around the FAD (>10m) and occasionally will feed on the bait fish.

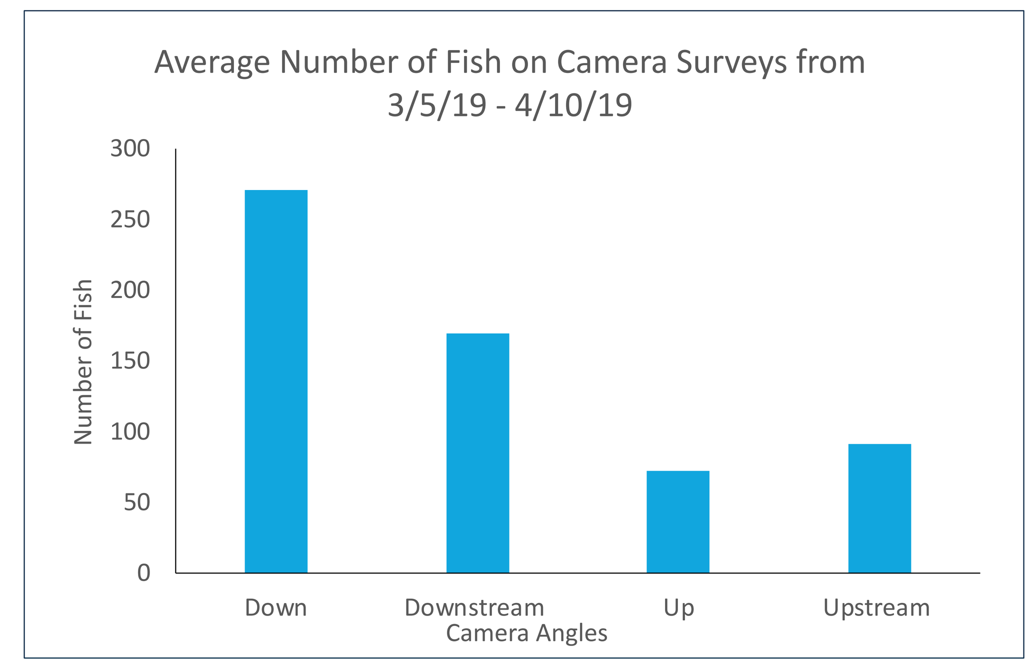
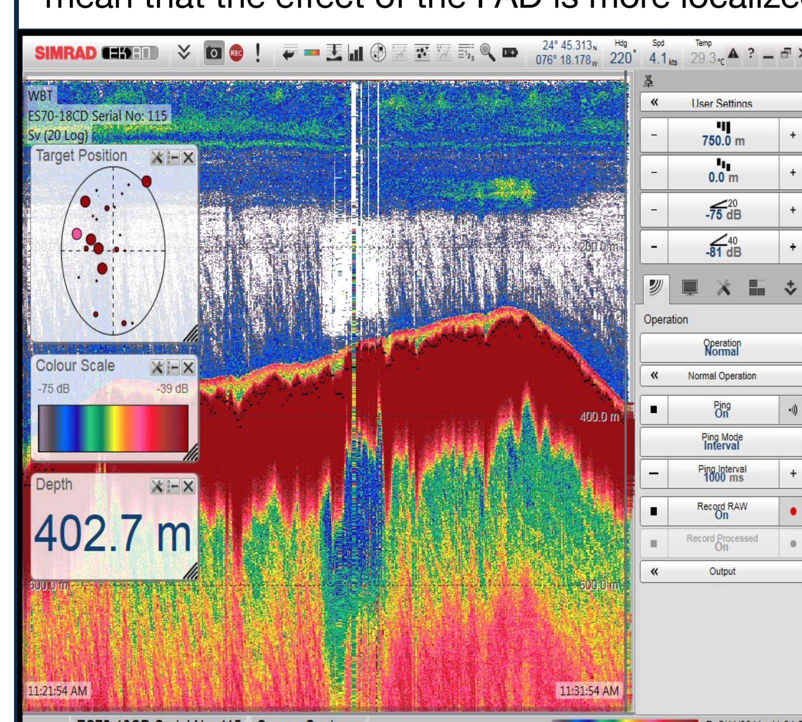


Figure 4: The figure above demonstrates where around the FAD organisms tend to aggregate. Abundance is highest beneath the FAD because it provides the most shelter.

From the sonar we discovered that there is not a significant difference in biomass accumulation around the FADs depending on location of the FAD or time of day. However, we did discover that there is a variation in accumulation depth dependent on time; during the day most biomass accumulates deeper than at night, this is due to the diel vertical migration. Additionally, the location in which fish accumulate around the FAD is varied. The abundance of organisms aggregating around the FAD decreases with distance and depth from the FAD buoys. This may mean that the effect of the FAD is more localized than previously thought.



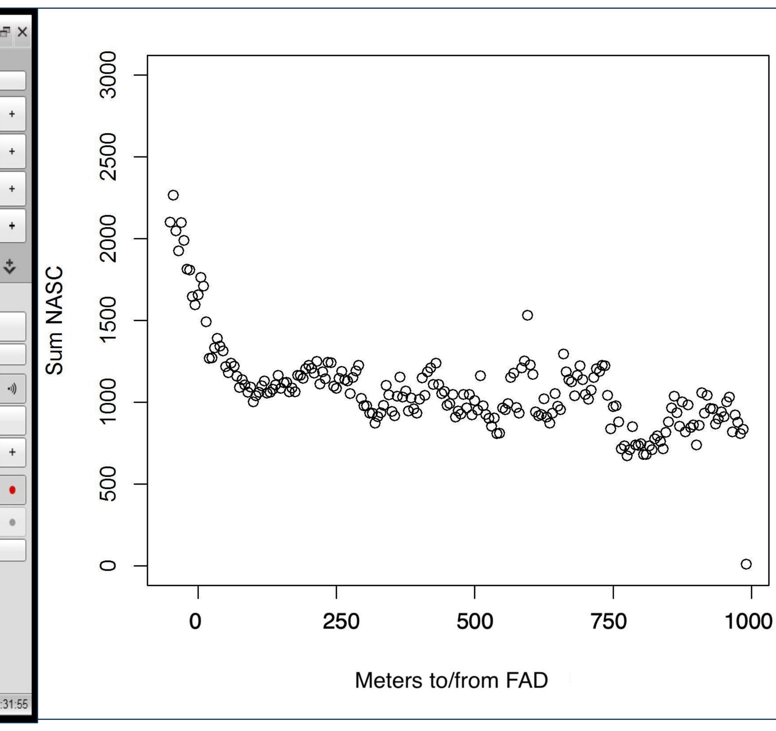


Figure 5 (left): The figure above represents the data we collect by doing sonar surveys.
Figure 6 (right): This graph demonstrates that biomass accumulation (represented by NASC – nautical area scattering coefficient) is highest over the FAD and tapers off with distance.

Our light trap results are measured with a catch rate. The catch rate is how many organisms we caught per hour of effort. The catch rate at a depth of 10 meters on the FAD was more than double the catch rate of any other light trap. This could be due to diel vertical migration in which organisms rise to a shallower depth at night to feed.

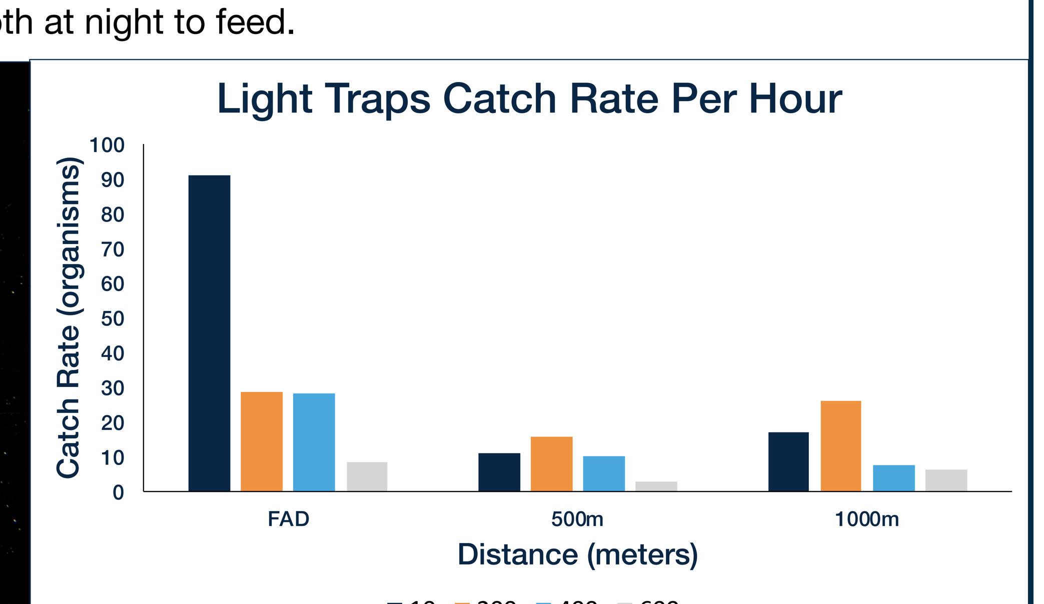


Figure 7 (left): A baby octopus caught while light trapping.
Figure 8 (right): This figure depicts the catch rates of light trapping. When light traps are deployed 10 meters down right above the FAD, the catch rate is highest

CONCLUSION

The data from our camera surveys allows us to understand what specific bait and game species tend to aggregate or associate with the FAD. We have learned that game fish associate outside a 10-meter radius around the FAD and small bait fish aggregate very close to the FAD. The data also provides evidence to how the succession of fish around the FAD changes. These methods along with the data from our sonar surveys and light trap surveys have allowed us to observe how biomass accumulates around the FAD and answer our overall question of how fish in the Exuma sound interact with a FAD. This knowledge allows us to assess how fish aggregation devices impact the larger pelagic environment which can help us in conservation efforts relating to the research and protection of species of the Exuma sound.

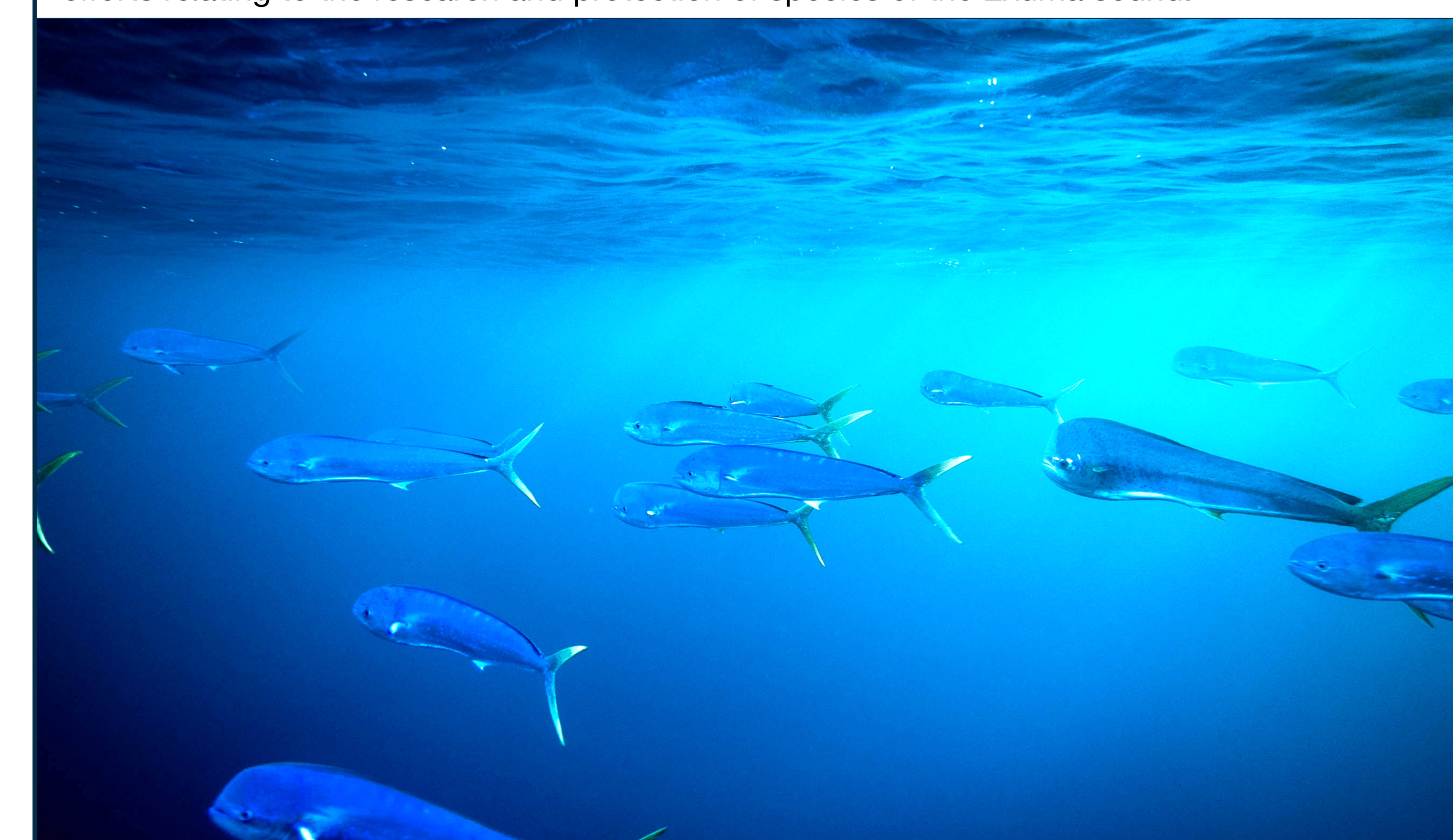


Figure 9: The image above depicts a school of mahi that were aggregating around the FAD when we went in the water to deploy a camera survey.

REFERENCES

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