Introduction

What is a FAD?

In the open ocean, fish are known to attract towards naturally occurring structures. It is thought that this is due to the temperature gradient, and a meeting point for breeding. (Davies et al. 2014). Examples of natural structures include upwelling trees, palm fronds, and seaweed.

Small fisheries have exploited this relationship to improve local fishing success (Fig. 1A & 1B). In recent years, commercial fisheries have also created larger man-made structures known as fish aggregation devices (FADs) to mimic this natural association. These are different types of fish: a drifting FAD and an anchored FAD. An anchored FAD is tied down to the bottom of the ocean floor and a drifting FAD is free floating, carried along by the current.

Why are FADs important?

While certain fisheries depend on FADs, there is limited research investigating how the presence and harvesting of fish on FADs influences existing populations, and the time it takes for different types of pelagic (open ocean) fish to colonise FADs (Moreno et al. 2016). There is also limited management of FADs which could lead to over-exploitation of species as well as a risk of bycatch (Fig. 2) due to non-selective fishing methods.

Aims

1. The broader aim of this five-year project is to improve management and regulation of FADs with the additional goal of using FADs as conservation tools.

2. During the Island School 2018 spring semester, our aim was to assess the colonization cycles of fish aggregating on FADs. This includes calculating the abundance (number of fish) and species richness (number of different types of pelagic fish present) on the FADs.

Study Site

The Cape Eleuthera Institute (CEI) deployed two-offshore, sub-surface anchored-FADs along the nearby continental shelf at depths ranging from 500 – 800 m in the North Exuma Sound, off of Southern Eleuthera (Fig. 4, in the approximate area of the Island School indicated by the red circle). FADs were deployed as part of a research class with the Fall 2017 Island School class.

Methodology

1. Video surveys: A single GoPro camera was deployed at each FAD by clipping the camera and attached floatation device to a visually designed swivel mount. The camera was attached to the FAD using a deep water CTD and left to record a video continuously for 90 minutes (Fig. 5A). The aim was to capture two video surveys, one on each survey, each week.

2. Snorkel surveys: Island School students carried out 50-minute snorkel transects in four cardinal directions (north, south, east, west) while working in pairs to record the species present and their abundance (Fig. 5B) on dive slates. Although it was not always possible, the aim was to conduct a snorkel survey on each FAD every week.

Results

In order to investigate the colonization cycles (the time taken for different types of fish to appear) a graph was plotted using data from both semesters (Fig. 6A). This graph is representing the following trends:

- August – early September 2017, 200% increase of bait fish
- September 2017 – early January 2018, low abundance of all pelagic fish due to cyclical predation or seasonal/temperature change
- Mid January 2018, small increase in bait fish followed by 33% increase of medium fish
- February 2018, 100% increase in bait fish followed by spike of medium fish
- One pelagic type seen on FAD 1 on February 16, 2018

Discussion

A trend of cyclical predation has been observed from our data, meaning that as the small baitfish aggregate on the FADs, medium sized fish will then follow, consuming the small baitfish and causing the medium sized fish population to increase. This trend ultimately leads to the appearance of larger pelagic predators. This pattern is expected to continue for the duration of this five year research project.

Looking at the trends in our data, a distinctive pattern can be seen in the species abundance and richness as colonization occurs. Factors that could have affected our observed results include time, depending on the time of day, there may be different fish species that are more active during the night. Also water temperatures and season may be related to migration, and therefore affect what species we see. Weather is another factor that could have altered our data. Wind, swell, and currents could affect our data and prevent us from collecting data. Additionally, there are many abiotic factors which altered our data and did not allow us to conduct surveys. The fish around our FADs may have been scared off by the sounds of our motor boat or the presence of the snorkelers. There was also a large fishing tournament in the area, which could have taken various species of fish away from the FADs.

Conclusion

The data collected on the FADs over the last eight months has allowed us to further understand the colonization of FADs, and how species richness and abundance changes over time. The colonization on our FADs is shown by small baitfish, followed by medium sized fish that eat those bait fish, and ultimately, pelagic predators that eat the medium sized fish. This also suggests a cyclical predation on our FADs. However, not enough data has been collected to make a definite claim about the cyclical colonization patterns. Our work is part of a five year project, and, in the future, aims to provide a better idea of cyclical colonization patterns on the FADs. There are multiple ways to continue and enhance our research in this project:

- Continue our surveys: Conducting more surveys more frequently to collect more data
- Deploying additional FADs: More data can be collected from a variety of different locations with different factors (depth, temperature, current, weather, proximity to shore etc.)
- Tagging fish: Tagging fish could be used to collect data on the movement patterns of migratory pelagic fish such as mahi mahi. This would allow us to assess whether they travel between our FADs and whether they occupy our FADs for an extended period of time

We hope that the data collected during this project will allow us to help inform policy and ensure sustainable fishing practices in the future.

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Sources


Notes:

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