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Are The Waters Off Cape Eleuthera A Pupping Area For Juvenile Tiger Sharks?

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Introduction

There has been a great decline of pelagic sharks around the world (Meyers et al. 2007). There is little known about these sharks, yet the protection of these marine predators is vital in preventing the marine ecosystem from shifting its baseline, known as a trophic cascade. Sharks have k-selected life histories, meaning that it takes longer for them to mature and reproduce. This makes it difficult for them to recover from a decline in population (Baum and Meyers, 2004) resulting from over-fishing and habitat destruction (Driggers et al. 2008).

A trophic cascade not only affects marine life, but humans as well. The Bahamas in particular would be severely affected because the islands depend heavily on tourism and fisheries, both of which rely on healthy marine ecosystems.

The protection of areas critical to tiger shark growth and fecundity is crucial to the survival of the species and the maintenance of healthy marine ecosystems. Pupping areas are areas where tiger sharks grow and mature. They are characterized by higher relative abundance of juvenile tiger sharks, site fidelity, and use by consecutive generations. The purpose of this study is to determine if the waters off of Cape Eleuthera act as a potential pupping area for juvenile tiger sharks.



Left
Fig. 1 – 100cm Tagged juvenile tiger shark.



Right
Fig. 2- Juvenile tiger shark being measured.

Study Area

This study was conducted in the waters off of Cape Eleuthera, Eleuthera, The Bahamas. The study focused on three different zones based on their differences in habitat type, water depth, and distance from the Exuma Sound. These zones include the Bank Zone, Mid-Bank Zone, and Wall Zone (Table 1, Figure 3). The zones were split up into four 500m x 500m sample sites 2 kilometers apart on an approximate north-south line.



Fig. 3- Sampling zones in south Eleuthera, The Bahamas

Table 1- Descriptions of Sampling Zones

Zone		Average Depth	Habitat Description	Distance from the Exuma Sound
Wall Zone	WZ	15.3m	Coral reef with some sand flats and sea grass	0km
Mid-Banks Zone	MBZ	4.1m	Shallow sand banks and deep channels	5km
Banks Zone	BZ	4.3m	Sea grass, sand flats and patch reef	12km

Long line Surveys

The study used a standardized, surface set 500m long line with 30-50 gangions approximately 10m apart, with a support buoy attached after every 5 hooks. Gangions were 2.5 m in length, with circle hooks size 16/0. Bait consisted of Bonita in 100 g pieces (Fig 5). The long line soak time was approximately 90 minutes. Each shark on the line was secured to the side of the boat by a head rope to the bow and a tail rope to the stern, measured (Fig 2), and tagged (Figs 1 & 4). Four different measurements were taken – pre-caudal length, fork length, total length, and stretch total length. Catch Per Unit Effort for this study was calculated by (# of tiger sharks caught/ (# of hooks deployed x long line soak time)) x 60 (Driggers et. al 2008).



Fig. 4 Tagged juvenile tiger shark swimming

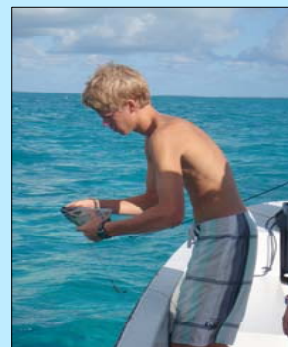


Fig. 5-Baiting a long line

Results

From May 2008 to November 2009, 37 tiger sharks were caught in the waters off of Cape Eleuthera. Of those 37, 94.6 % were juvenile and 5.4 % were mature. The percentage of males caught was 56% while the percentage of females was 44%. This data is represented in Fig. 6. The study showed a recapture rate of 2.7%, as only one of the tagged tiger sharks was recaptured

Figure 8 show the mean CPUE of tiger sharks in the three designated zones. Tiger shark abundance was significantly higher in the Wall Zone compared with the Mid Banks Zone (p=0.007) and the Wall Zone (p=0.027). There was no significant difference between the Mid Banks Zone and the Wall Zone. As can be seen in Fig. 7, there was no significant difference in mean CPUE values based on the season of the catch.

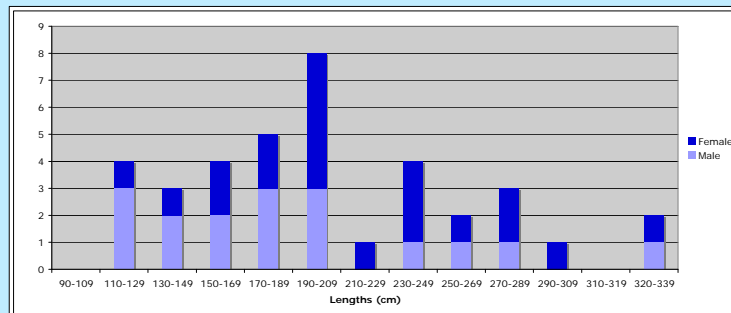


Fig 6 - This graph shows the total length in cm of male and female tiger sharks caught

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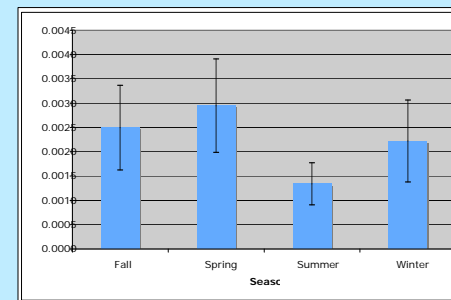


Fig. 7 – Mean seasonal abundance of tiger sharks May 2008 to November 2009.

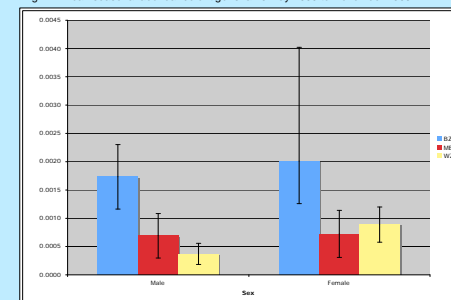


Fig. 8- Mean CPUE for male and female tiger sharks in each zone.

Discussion

The purpose of this study was to determine if the waters off Cape Eleuthera act as an area of critical habitat for juvenile tiger sharks. According to Heupel et al. (2002), a pupping area is defined as a region where sharks are in high abundance, show site fidelity, and return for successive generations. The data collected suggests that the Bank Zone is an area of critical habitat for juvenile tiger sharks, but does not support the hypothesis that it is a pupping area as defined by Heupel (2002).

The study found a significantly higher abundance of tiger sharks, 94.6% of which were juvenile, were caught in the Bank Zone when compared with the other zones. We hypothesize that the increased abundance in the Banks Zone is due to the reefs and shallow waters that provide protection from predators and an abundance of food. When examining the site fidelity of tiger sharks, the study found a recapture rate of 2.7%, suggesting that juvenile tiger sharks do not show site fidelity to these waters. The data also does not show that the region was used by consecutive generations. We hypothesize that this is due to an insufficient sample time because tiger sharks only reproduce every 2 years.

While it was found that the waters off Cape Eleuthera are not a pupping area for juvenile tiger sharks, it is clear that the Banks Zone is an area of critical habitat. Driggers (2008) has suggested that tiger sharks may not use pupping areas in the traditional sense. In future research a system called acoustic telemetry can be used to determine site fidelity. Information about the site fidelity will help to determine if a pupping area exists off of Cape Eleuthera for tiger sharks. Further research will allow for a greater understanding of how and why this area is used by juvenile tiger sharks, thereby allowing for better management of this understudied shark species.

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