Characterizing the Pelagic Fish Community of The Exuma Sound

Fisher Clark, Daniel Eyal, Lyla Forman, Lucy Hensley, Wyatt Huggins,
Summer Stagman, Carlton Taylor II
Advisors: Brendan Talwar and Candace Fields

Introduction

The Earth's surface is comprised of 43% high seas and less than 1% of these high seas, or pelagic habitats, are protected (Baum 2006). The high seas are any areas of ocean outside of nations' exclusive economic zones. There are 650,000 km^2 of oceans in The Bahamas and pelagic waters make up 73% of them, yet 0% of these waters are being protected.

One way that many countries like The Bahamas are working towards marine conservation is through the Caribbean Challenge, which is a declaration created by the United Nations (UN) which committed to protect 20% of marine resources by 2020. Countries are achieving this challenge by creating Marine Protected Areas (MPAs) which restrict human use in specific areas and create catch limits. The creation of MPAs leads to greater diversity of fish, more marine life, functional food webs and healthier ecosystems, but these are generally only sited in coastal waters, ignoring the open ocean entirely despite its ecological and economic importance.

Figure 1: Proposed Bahamas National Trust (BNT) marine protected areas, as denoted by the areas highlighted in yellow, that will fulfil the Caribbean Challenge. Only shallow water environments are proposed for protection in this initiative.

Objective

To characterize the pelagic fish community in the Exuma Sound from 0-400m deep.

Methods

We set up longlines at three different fishing sites, all at equal distances from the wall but at varying depths. We fished at these sites at different times of the day and night to discover where and when pelagic fishes occur in the Exuma Sound. We used different hook sizes, leader types and bait types to maximize our ability to catch a wide range of pelagic fishes.

After we set the long line we waited 4-5 hours before hauling the line back onto the boat. When a fish was caught, we took measurements which helped us identify the fish's maturity as well as took samples including DNA, muscle, and blood. After these were completed, we tagged and released the fish. All of our samples were brought back to the Cape Eleuthera Institute to be used by fellow researchers for other research projects.

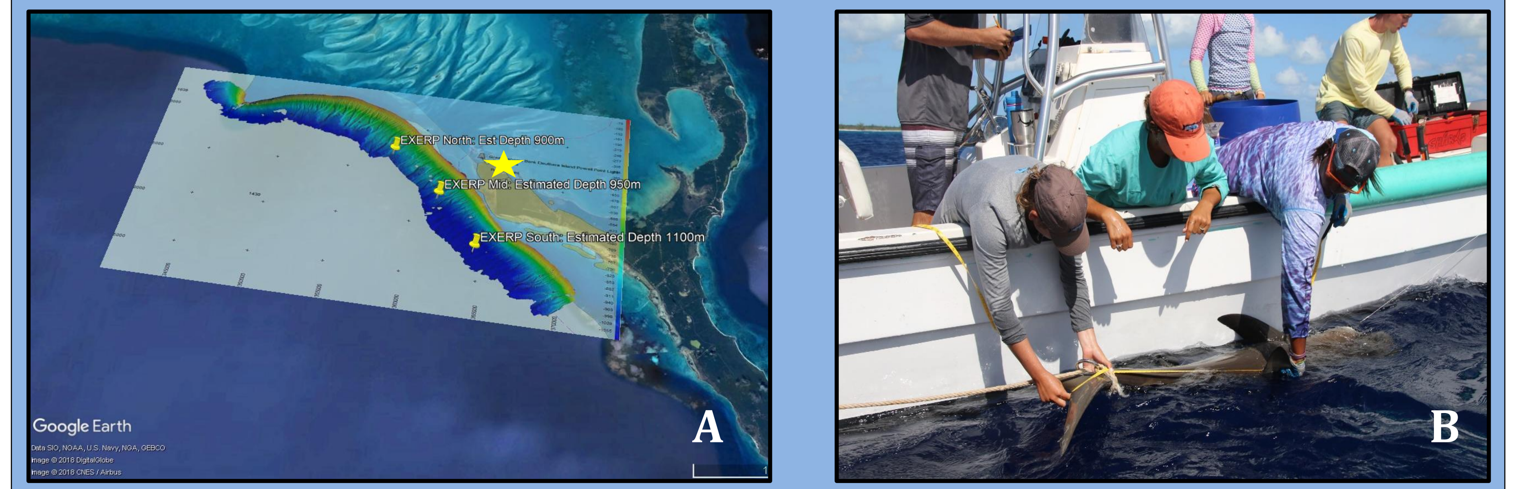

Figure 2: (A) Map of Cape Eleuthera overlaid by a depth chart with our sites indicated by the pins and the Cape Eleuthera Institute indicated by the star. The warmer colors indicate shallow waters while the cooler colors indicate deep waters. (B) A Caribbean reef shark being measured by an Island School student.

Results and Discussion

Common Name	Scientific Name	Number	Mean Size (cm)	At Vessel Mortality (%)	Sex	Stage
Tiger shark	*Galeocerdo cuvier*	1	179	0	M	IM
Snake mackerel	*Gempylus serpens*	1	70	0	F	IM
Silky shark	*Carcharhinus falciformis*	3	112	33	M	IM
Oceanic Whitetip shark	*Carcharhinus longimanus*	1	92	0	F	IM

Figure 3: Biological data from the six fish that we caught and sampled.

Although all of these species are important to our research, the two most unusual species that we caught were the snake mackerel and the oceanic whitetip shark, both of which were documented for the first time this semester in Exuma Sound.

The snake mackerel is a vertical migrator, meaning it is a fish that moves up in the water column following its prey during the night to relatively shallow depths in comparison to the deep depths it inhabits during the day.

The oceanic whitetip shark is considered critically endangered in the Atlantic Ocean. This was the first juvenile oceanic whitetip found in a decade of research on oceanic whitetips by The Cape Eleuthera Institute. This shark was under six months old when it was captured, meaning it was most likely born in the Bahamas.

With more surveys in the future it is possible that the question posed by the previously mentioned research on where oceanic whitetips go to give birth can be answered.

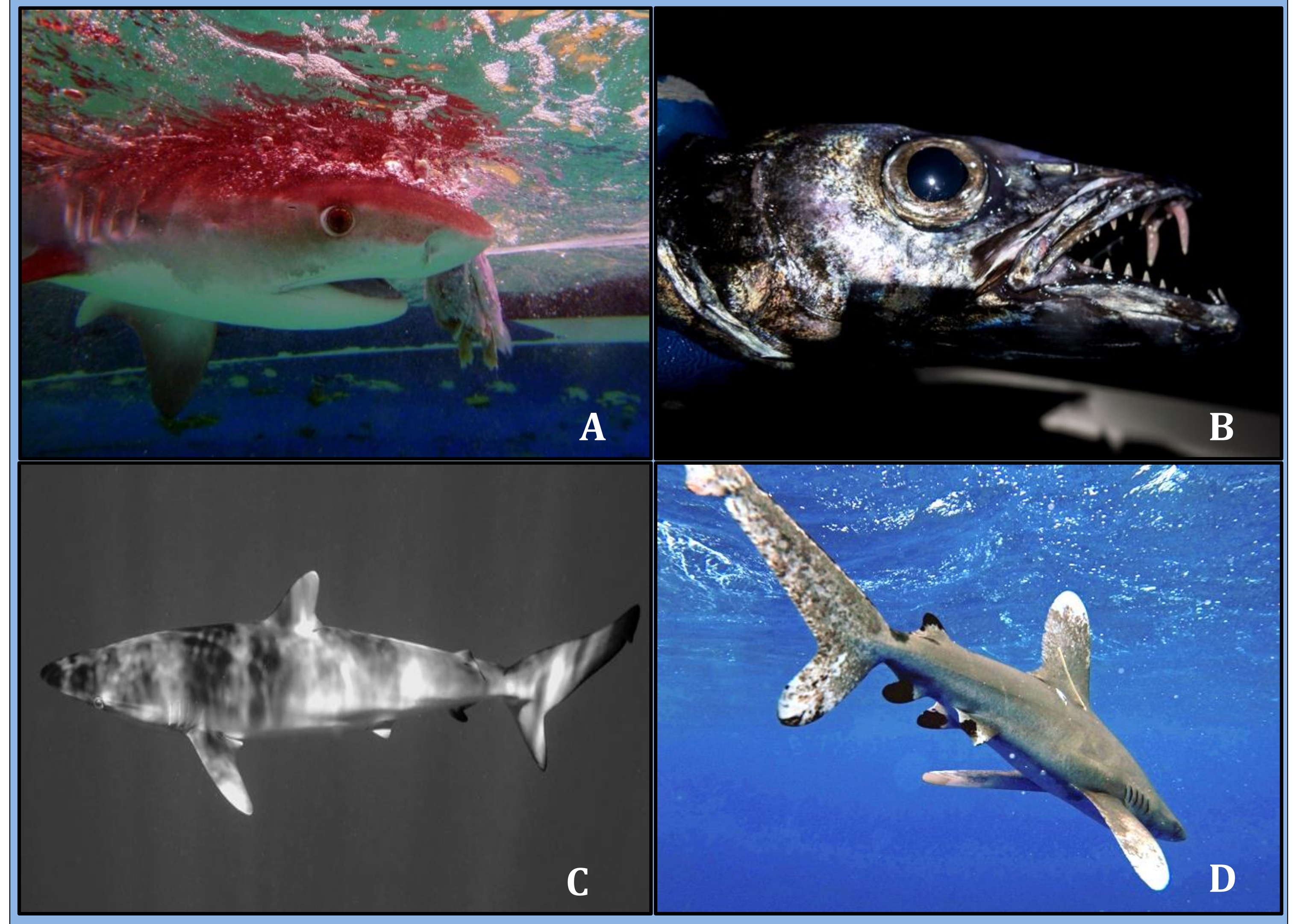

Figure 4: Four of the species caught during pelagic longline surveys: (A) tiger shark (*Galeocerdo cuvier*) (B) snake mackerel (*Gempylus serpens*) (C) silky shark (*Carcharhinus falciformis*) (D) oceanic whitetip shark (*Carcharhinus longimanus*).

Conclusions

Some pelagic predators are not sustainable to fish because of their small and easily overexploited populations. Our study has taken place for three months and we were looking at the pelagic zone to try to discover new information.

This semester we caught fish that have never been seen before in this area. It is important to continue discovering more about the pelagic region as we know so little about what animals occur in the open ocean or what their movements are. Though our data this semester is limited, this study will continue in the future and we expect catch rates to increase in the coming months due to the typical migratory patterns associated with water temperatures decreasing.

We hope to gain a better understanding of the pelagic region in the future after collecting more samples to build on our data set and deploying satellite tags to track animal movement.

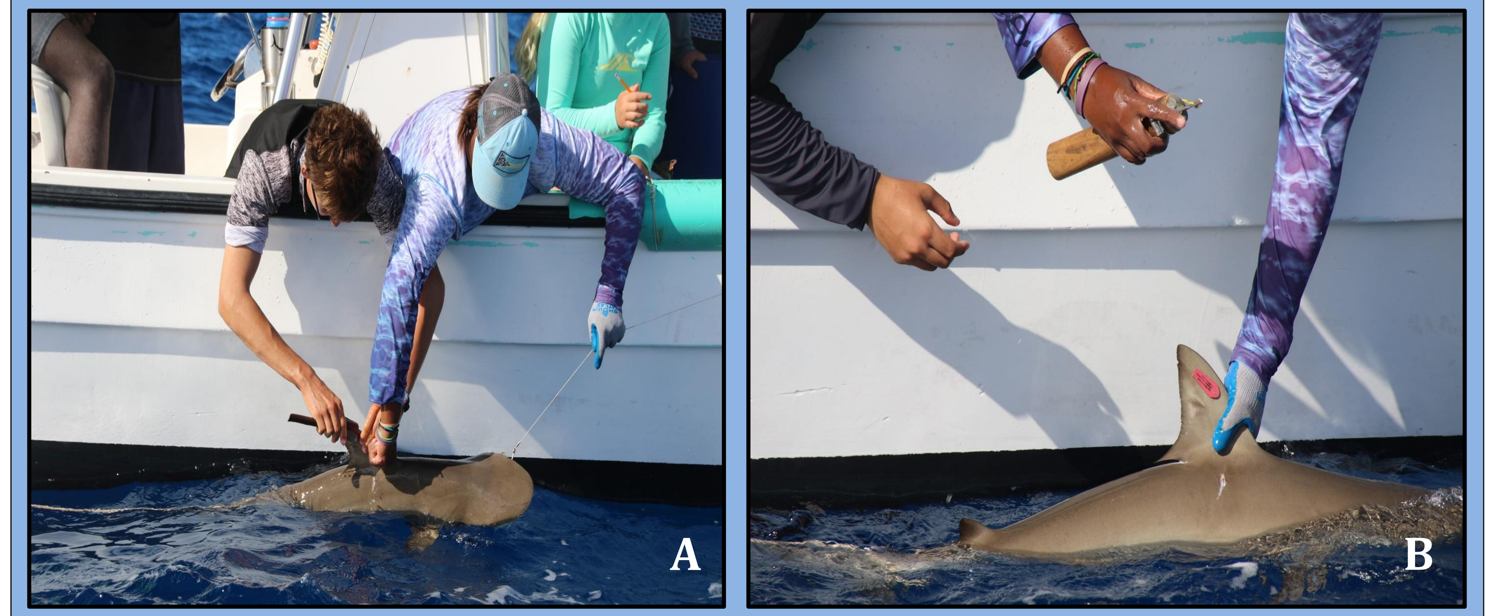

Figure 5: Island school students deploying a cattle tag (A) and a dart tag (B). In the future we hope to additionally deploy satellite tags.

References

Baum J, Medina E, Musick JA, Smale M (2006) *Carcharhinus longimanus.* IUCN 2012 Red list of threatened species. Available: www.iucnredlist.org. Accessed 2 July 2012.

Briscoe Dana K., Hobdayb Alistair J., Carlisle Aaron, Scales Kylie, Eveson J. Paige, Arrizabalagad Haritz , Druone Jean Noel, Fromentinf Jean Marc . (2016) *Deep Sea Research Part II. Ecological bridges and barriers in pelagic ecosystems.* Pg. 182-192

Briscoe, K. Dana. & Maxwell, M. Sara. & Kudela, Raphael. & Crowder, B. Larry. & Croll, Donald. (2016). *Are we missing important areas in pelagic marine conservation? Redefining conservation hotspots in the ocean.* Endangered Species Research. Pg. 229-237

Brooks, J. Edward. & Brooks, M.L. Annabelle. & Williams, Sean. & Jordan, K.B. Lance, & Abercrombie, Debra. & Chapman, D. Demian. & Howey-Jordan, A. Lucy. & Grubbs, D. R. (2015) *First description of deep-water elasmobranch assemblages in the Exuma Sound, The Bahamas*. Deep Sea Research II.

Duffy, J. Emmett. & Stachowicz, J. John. (2006). *Why biodiversity is important to oceanography: potential roles of genetic, species, and trophic diversity in pelagic ecosystem processes*. Marine Ecology Progress Series.

Norse, E. A. & S. Brooke & W.W.l. Cheung & M. R. Clark & I. Ekeland, R. Froese & K. M. Gjerde & R. l. Haedrich & S. S. Heppell & T. Morato & l. E. Morgan & D. Pauly & U. R. Sumaila & R. Watson. (2012). *Sustainability of Deep-sea fish. MARINE ECOLOGY PROGRESS SERIES. Marine Policy* 36(2): 307–320.

Seki, T., Taniuchi, T., Nakano, H. and Shimizu, M., 1998. Age, growth and reproduction of the oceanic whitetip shark from the Pacific Ocean. *Fisheries Science,* 64(1), pp. 14-20.

Acknowledgements

We would like to thank the following for their support and contributions:
Our advisors: Brendan Talwar and Candace Fields
CEI interns: Juliette Lee, Jessica Dehn, Emmy Feddor, Lily Park, Jack Dales
The FADs and Communications Teams