The Effect of Predator and Prey Abundance on Juvenile Lemon Sharks (*Negaprion brevirostris*) in the Mangrove Creeks of South Eleuthera

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INTRODUCTION:

Background-

Sharks play an important role in the sustainability of many marine ecosystems, as they are apex predators. This means that by being at the top of the food chain, they keep other populations in check, promoting biodiversity (Jennings and Kaiser 1988). Currently shark overfishing has had a negative impact on shark populations all over the world, with approx. 90% of sharks being overfished. Sharks are especially vulnerable due to their slow growth rates, generally long life spans, and late age of sexual maturity (Stephens et al 2000). In the Bahamas, sharks do not face as much human pressure, due to bans on long line fishing and exportation of sharks. However, they are still vulnerable to other factors, two of these being predation risk and prey abundance.

Our Study-

As juveniles, lemon sharks are the most vulnerable, partly due to the fact that they exhibit natal site fidelity; a behavior which has been seen in juvenile lemon sharks in South Eleuthera. It has previously been studied that lemon sharks prefer shallow habitats (Morrissey and Gruber 1993), staying in them for the first 3-6 years of life before moving into the open ocean. Because of this, we are interested in learning about the limiting factor that will most directly affect the abundance of lemon sharks in these mangrove creeks. We hypothesized that prey abundance would be the main limiting factor on the lemon shark abundance in a given mangrove creek system, with the predator pressure having less of an effect. These factors are important because they affect the habitat quality of a creek, and this determines which creek is most important to conserve.

METHODS AND MATERIALS:

Locations-

The Exuma Sound had a total of six sites, Deep Creek, Plum Creek, Waterford Creek, Weymss Bight Creek, Hartford Creek, and John Millers Creek. The Rock Sound had a total of four sites, Paige Creek, Kemps Creek, Starved Creek, and Broad Creek.

Figure 1: Site map showing our ten study sites throughout South Eleuthera, with Rock Sound to the north and the Exuma Sound to the south

Survey lines were used to find lemon shark abundance. A survey line is a 50 meter line with 10 hooks; one set every 5 meters. Survey lines were set at each creek twenty times each month at both high and low tide.

Drumlines (figure 3) were used to find predator abundances. A drumline is made up of two buoys, one connected to a hook and the other a cement block. A rotating mechanism allows for the shark to swim around the float and not get tangled. Drumlines were set at each creek twice a month at both high and low tide.

Seine nets (figure 4) were used to find lemon shark and prey abundances. Seine nets are large nets that are stretched across the mouth of a creek at high tide, and as the tide goes out the net traps juvenile lemon sharks and other mangrove fish. Seine nets were set once a month at each creek, besides Deep Creek.

RESULTS:

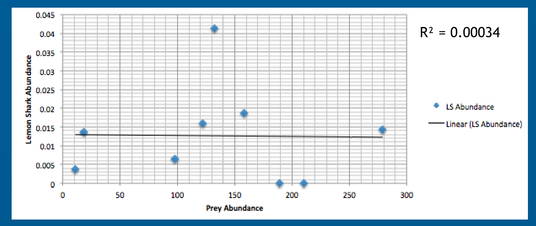

Figure 5: Lemon shark abundance dependent on prey abundance at study sites throughout South Eleuthera. Shown using CPUE values for lemon shark abundance, with prey abundance represented by prey counts using seine nets. *P* = 0.915, which is statistically insignificant.

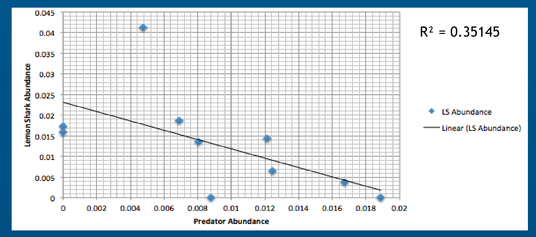

Figure 6: Lemon shark abundance dependent on predator abundance at the study sites throughout South Eleuthera. Shown using CPUE values collected between January 25 and April 13, 2012. *P* = 0.008 which is statistically significant.

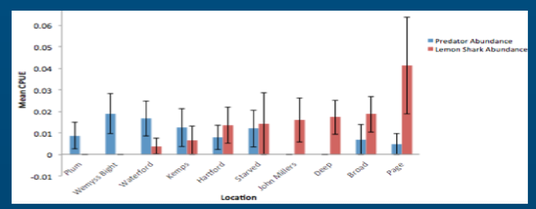

Figure 7: Lemon shark abundance and predator abundance at each creek, showing a decrease in lemon shark abundance when predator abundance increases. Data shows a *P* = 0.008, which is statistically significant.

Figure 2:A juvenile lemon shark, after being caught on a survey line, is held in a tank for measurements

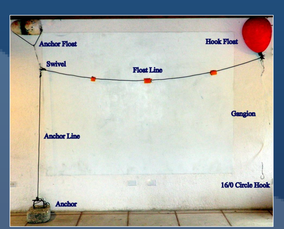

Figure 3: An example of a drum line that would be placed outside a creek

Figure 4: Seine netting Plum Creek. The net is held down by a series of weights, which ensure that nothing being carried by the tide can get through.

DISCUSSION:

The results show a negative correlation between lemon shark abundance and predator abundance, with no correlation between lemon shark abundance and prey abundance. This led us to reject our null hypothesis and accept our alternative hypothesis, leading to the conclusion that predator rather than prey abundance is a stronger limiting factor on juvenile lemon sharks.

Collected data indicated that the Rock Sound side had fewer predators and more lemon sharks, while the Exuma Sound side had a high abundance of predators and a low abundance of lemon sharks. Based on this information, it can be concluded that the Rock Sound side would be the most beneficial location to conserve. Identifying predators as the limiting factor for juvenile lemon sharks is vital to gaining a better understanding of their early ontogeny. In addition, this knowledge can be applied to other shark species around the globe. Future research can be focused on potential predators of sharks during early life as they play a key role in population health.

Figure 8: An adult lemon shark caught on a drumline hook baited with bonita outside of Kemps Creek. A tail rope and hook are holding the shark in place.

Figure 9: Students Paul, Kira and Nina with an 8 foot tiger shark caught on a drumline outside Starved Creek. The shark is secured to the boat with two lines, one tied to it's tail, the other attached to the hook in its mouth.

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