The Behavioral and Physiological Response of the Caribbean Reef and Nurse Sharks to Longline Capture

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Introduction:

History:
The growth of the fishing industry has resulted in the depletion of shark populations worldwide. Sharks are crucial to maintaining healthy marine ecosystems because they have a stable and regulated population that is not compromised by predation. This is important for a variety of reasons, including the conservation of species richness, the integrity of marine trophic structure, and the sustainability of recreational and commercial fisheries. However, overfishing has led to a decline in shark populations, and the impact of this decline on marine ecosystems is not yet fully understood. (Worm et al. 2006)

Purpose:

To investigate how the behavioral and physiological response of the Caribbean reef and nurse sharks during longline capture makes them more or less susceptible to mortality.

Hypotheses:  
1. Caribbean reef and nurse sharks will respond with a constant level of activity over the entire duration of capture.  
2. As hook duration increases, the physiological disturbances in lactate, carbon dioxide and pH will increase.

Methods:

Sharks were caught using experimental longlines. The line consisted of six gagsions, which were checked every 30-35 minutes. Gagsions consisted of a line with a GoPro camera, a hook timer, an accelerometer, and a circle hook. The entire work was done by leaning over the boat, so the shark never left the water. After the species was identified, the shark was flipped into a tone, immobilized, the sex was recorded, and blood was taken. Then, the shark was flipped back over, length measurements were taken, the shark was tagged, and then released. Two types of blood analyses were performed: one on the boat and one in the lab. Glucose was measured with a Accu-Chek meter, and pH, lactate, and carbon dioxide were measured with an Oxi-Stat probe of care device. In the lab, centrifugation was used to spin out constituents of the blood, and then plasma was sent off to a lab for further analysis. Data was tested for normality with a Shapiro-Wilk test. Depending on whether the data has a normal or non-normal distribution, either a Student’s-t or ANOVA test is used. The level of significance was set at p < 0.05

Results:

Blood was taken from 38 sharks (19 C. perezi and 19 G. carcharias) and acceleration data was gathered every second for the first 2 hours of the capture event, from 22 sharks (18 C. perezi and 12 G. carcharias). Of the 38 sharks that had blood data collected, 9 of each species had a hook duration of 30 minutes or less and 5 of each species were in both the 120-150 and 240-270 minute hook duration. Dissimilar letters indicate a statistically significant difference within a population. Error bars indicate mean chemical data ± standard error.

Discussion:

Accelaration:

All previous literature has suggested that energy levels stay constant throughout the capture event, but this research has shown trends that indicate that is not true. On a minute by minute average, we found a significant decrease in acceleration to the first 5 minutes with the values decreasing from the first minute (see fig 6 G and H). This suggests that most of the exhaustive exercise happens very early in the capture response, while it is not expending much energy after the initial response. All of the blood parameters are required to quantify secondary stress response except for glucose change as a result of physical activity, so understanding what part of the stress response is causing that inflammation is useful to understanding the stress response.

Blood Analysis:

We found that Caribbean Reef and nurse sharks are able to recover back to near baseline, in the parameters we measured as capture duration increases. That suggests that the species we studied are able to recover from the physical activity that happens as a result of a longline capture. While they do recover, they do not recover from all. This warrants further research to determine what exactly is causing these sharks to die.

Interspecific Difference

We found that there is a variation in the behavioral and physiological disturbances in the Caribbean reef and nurse sharks to longline capture, with a generally higher energy response suggested in the Caribbean reef shark which reflects the life history characteristics of these species.

Literature Cited


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