Introduction

Leukocytes play a crucial role in the immune response of wildlife, including sharks. Peripherally blood smears (PBS) are a standard method used in both human and veterinary medicine to estimate leukocyte counts. However, these methods have limitations when applied to estimating leukocyte counts in sharks, due to the variety of cell types present. The objective of this study is to examine the characteristics of the leukocyte types in each species and methods for estimating leukocyte counts in sharks. The study was conducted on Carcharhinus limbatus, Carcharhinus leucas, and Carcharhinus acronotus. Minimum and maximum CCF values for each species were determined (Table 2).

Methods

Study species: bull sharks (Carcharhinus leucas), blacknose sharks (Carcharhinus acronotus), and blacktip sharks (Carcharhinus limbatus). Leukocyte morphology was conducted at light microscopy (100x oil immersion). The mean of three values was determined for each species and was compared to estimated CBC values found in the literature for shark species. Minimum and maximum CCF values for each species were determined (Table 2).

Differential Counts

Table 1: Leukocyte differential counts and the granulocyte to-lymphocyte ratio (GLR) for (A) Carcharhinus leucas, (B) Carcharhinus acronotus, and (C) Carcharhinus limbatus. The GLR is the sum of granulocyte counts (NEUT, NEAT, and BASO) divided by the number of lymphocytes. Data was analyzed at 95% confidence.

**Calculating CCF**

CCF = expected CBC - total leukocyte count × standard deviation / total leukocyte count × standard deviation

Expected CBC = total leukocyte count × standard deviation / total leukocyte count × standard deviation

Table 2: Minimum and maximum CCF values for the Carcharhinus leucas, Carcharhinus acronotus, and Carcharhinus limbatus. Minimum CCF value was calculated by dividing 5 x 10^6 by the mean leukocyte count per individual. The mean of these values was determined to be the same CBC per species. Maximum CCF values calculated by dividing 5 x 10^6 by the mean leukocyte count per individual. The mean of these values was determined to be the thickest CBC per species.

**Conclusions**

• Morphological characteristics of leukocyte types are variable across each species and within individuals.

• Differential counts were estimated based on morphological characteristics for each species (95% CV).

• Mean GLR is properly consistent within the genus Carcharhinus, which means GLR may be a useful health indicator for this species.

• The minimum and maximum CCF values of each species are relatively consistent, which is promising in terms of determining a standard CCF value for sharks in the future.

**Acknowledgements**

I want to especially thank Dr. Luzi Merly for giving me the opportunity to perform this research project and for guiding me through every step of the way. I would also like to thank Prof. Mohammed Moniruzzaman, and the UM Shark Research and Conservation Team.