Morphological Classification of Dorsal Fins and its Application to Forensic Science

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Introduction

Humans greatly over-exploit shark populations by killing approximately 100 million sharks a year (Verlecar, 2007). Rapidly declining shark numbers have caused a ripple effect on the balance of the global marine ecosystem (Shark Finning, 2014). The United States government enacted several laws including the Magnuson-Stevens Fishery Conservation Act and the Shark Conservation Act of 2011, which states that sharks that have been caught in United States waters must be brought to shore with the fins still naturally attached to the body.

However, these laws are difficult to enforce due to the lack of an inexpensive and discriminatory method of differentiating the shark species after the fins have been processed. Using DNA to identify shark species has been the preferred option for law enforcement agencies thus far. The issue with this method is that it is expensive and time consuming. This research aims to differentiate various shark species by examining the dorsal shark fins' cross-sectional morphology for distinguishing characteristics. The most distinguishing factor observed during this research project was the platelet count at four different slices of three species of shark, Mako, Blue, and Thresher sharks.

Results

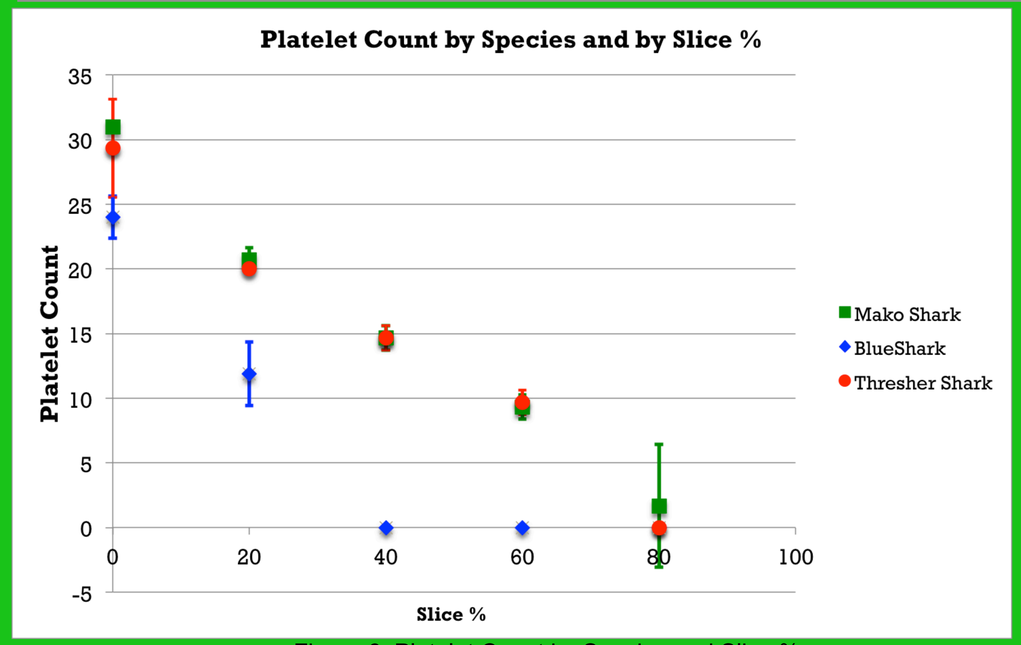

Figure 6: Platelet Count by Species and Slice %

The results displayed in Figure 4 represent the 9 sharks used and the average platelet counts for each shark with two standard deviations. According to these results the Thresher sharks have a mean of 0 platelets at 80%, while Mako sharks have a mean of approximately 1.67 platelets at 80%. The graph also shows the disappearance of platelets after the 20% slice in Blue shark. In order to confirm the results, more samples of each species of shark will be measured and the platelets will be counted at the same percentages. Additional counts of platelet will be made at percentages of 10, 30, 50, 70, and 90 as well for further validation.

Application to Forensic Science

The results obtained show a very obvious difference between Blue sharks compared to Mako and Thresher sharks. By looking at the 40% slice of a dorsal fin, one can determine if it is a blue shark. If it has 0 platelets visible, it must be a Blue. If there are platelets present at the 80% slice, it is most likely a Mako or Thresher shark because the platelets are no longer visible after the 20% slice in Blue shark dorsal fins. These results make it easy to determine the species by looking at the platelet cartilage alone.

Methods

Samples used in this research were obtained through previous shark fin research done at the University of New Haven. The processed samples were sliced using a band saw (Figure 1) in order to get a smooth cut that would allow examination of the various components of a shark fin. The inferior part of the fin was measured from free tail to leading edge for consistency purposes. The overall length of the dorsal fin was measured from the middle of the inferior to the very tip of the superior part of the fin. The dorsal fin was sliced at percentages of 20,40, 60, and 80 as seen in Figure 2. After slicing, the inferior part of each slice was examined and the platelets were counted (Figure 4 and Figure 5).

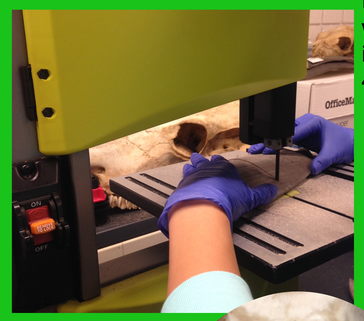

Figure 1: A band saw was used to slice the fins into percentages of 20, 40, 60 and 80.

Figure 2: Slice Percentages (Caudal-Cephalic)

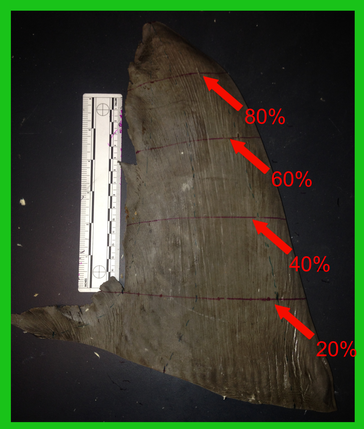

Figure 3: Each slice was also examined at percentages of 15, 50, and 85 (proximal-distal) for the thicknesses of the platelet cartilage, skin, and fibrous cartilage.

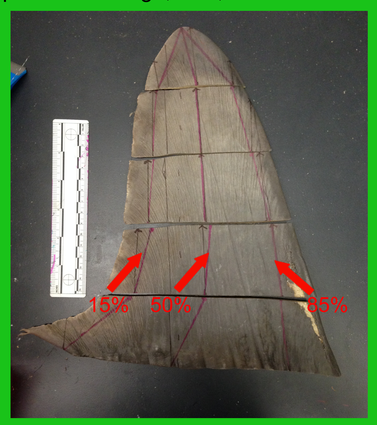

Figure 5: Platelet Cartilage

Figure 4: Platelets of a 20% slice

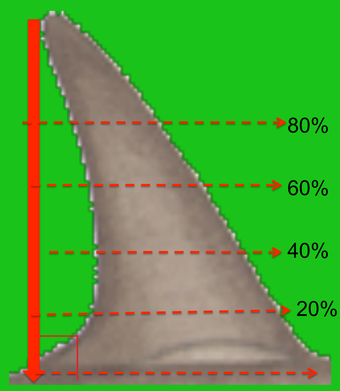

Figure 7: Standardization of Slicing

Standardization

In order to ensure the methodology is reproducible and precise, the fins' proximal-distal length should be measured from the tip of the whole fin, straight to the free tail at a 90° angle from the base line. The caudal-cephalic slices, should be cut across the fin at a 90° angle from the proximal-distal measurement and go to the leading edge's point of attachment. Each of the slices (20, 40, 60, 80) should be at a right angle as shown in Figure 7.

References

United States. Cong. *Shark and Fishery Conservation Act, 2011*. Cong. Bill. Washington, D.C.: U.S. G.P.O., 2011. Print.

Verlecar, X.N., Singdha, Desai, S.R., & Dhargalkar, V.K.(2007). Shark hunting –an indiscriminate trade endangering elasmobranchs to extinction. Current Science (00113891), 92(8), 1078-1082.

Acknowledgements

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