# Characterization of Collagen Fibers in Shark Fins for Species Identification

Jamie E. Wakeman, B.S., Jennifer R. Corwin, B.S., and R. Christopher O'Brien, PhD

Department of Forensic Science, University of New Haven

## Introduction

**A marine federal forensic lab requested assistance in research with enforcement of shark finning. Due to the rise of shark finning, it has become necessary for the creation of laws to protect the shark populations. Shark finning is cutting off a shark's fins and discarding the rest of the body at sea (Verlecar, 2007). In the United States, the first shark specific law was the Shark Prohibition Act of 2000. This law made it illegal to have shark fins on board a fishing vessel without having the carcass present (GPO, 2000). Due to a loophole, the Shark Conservation Act of 2010 was created which states that sharks have to be landed with the fins naturally attached to the body (The Humane Society, 2010). Based solely off of collagen fibers in the fins, there is a lack of methodology to identify species of shark.**

**Sharks are part of a subclass called elasmobranch. The elasmobranch subclass is made up of sharks, skates, and rays. Primary concerns of elasmobranch species' reproduction include high ages of sexual maturation and low fecundity rates (Encyclopedia of Life, n.d.). Since sharks are easily susceptible to overexploitation, shark finning has become a major concern for the survival of populations. Typically, the fins are used to make shark fin soup, which is an Asian delicacy. The high demand increases the incentive of fisherman to illegally take the fins (Vannuccini, 1999).**

**This is why the research being conducted is important to the enforcement of shark laws. This project is examining the morphological characteristics in order to differentiate shark fins from those of any other elasmobranch. The research will also look into the collagen fibers located within the fins to build data on the differences between both the fin types and the species. If successful, an easy and inexpensive way to differentiate between shark and other elasmobranch species will be created for law enforcement efforts.**

**Figure One:** SURF students sampling blue shark at Montauk Marine Basin Tournament

## Future Work

**In the future, the skin of the fins will be removed in order to expose the collagen fibers. The fibers will be observed using microscopy methods, both longitude and cross sectional slides. The fibers will also be observed after being processed under different heat treatments. The process completed for shark fins will be repeated for skate and ray fins. Wakeman will be writing her thesis on comparisons between the three species. Corwin will be writing her thesis on how heat treatments, such as boiling, affect the fibers.**

## Materials and Methods

**The summer season was a primary time for sampling of shark fins through recreational shark fishing tournaments. With Federal permits and New York State permits in hand, trips were taken to various locations throughout New York, Rhode Island, and Massachusetts for samples. Materials needed for these trips include a camera, various knives, alcohol, tags and zip ties, black storage bags, coolers, field notebook, and writing utensils. At the tournament, NOAA representatives measured girth, fork length, and total length. Tournament staff measured the weight using hanging scales. All of this information, the sex , and liver weight and stomach contents were recorded. If given permission by the boat captain and angler, fins were collected. In the beginning of the summer all fins were taken, however mid-summer only the pectoral, dorsal, and lower lobe of the caudal were taken on account of space and commercial value. The fins were cut at a straight angle along the medial base of the fin. The fins were then labeled and placed into black storage bags.**




**Figure Two:** Fin Measurement Guide. Red lines indicate measurements taken by student researchers. Light and Dark Pink lines indicate measurements taken by NOAA representatives.

**Back at the lab, fins were frozen to keep them preserved. Samples were documented by photography of the dorsal and ventral sides and measurements were taken. Samples were refrozen until ready to be salted. The fins were then packed with salt and left over night. The following day, the fins were either put outside to sundry or placed back into the freezer, awaiting to be sundried. Samples were sundried for two to four weeks, depending on size. Lastly, after being sundried, the fins were measured again.**

**Figure Three**: Fins during sun drying process



**Figure Four:** Photo A, is the dorsal fin from a Common Thresher shark, in fresh form. In photo B, the same fin is shown, but in the dried form. Note the ridges on the dried form which are the collagen fibers .

## Results

**After documentation, a majority of the fins were sun dried. In fresh form, the fins are flexible and wet. After being sun dried, the fins became rigid, the skin became tough, and the fins were lighter. Also, in the dried form the ability to visualize the collagen fibers increased. From beginning to end the smell of ammonia decreased after fins were sun dried. The proximal-distal and caudal-cephalic lengths did not change. Due to the loss of moisture, the thickness of the fins did change. No color change was observed on the dorsal or ventral sides of the fins, however the removal baseline became a deep yellow to brown color.**

**Table One**: Total Fins Sampled and Collected during Summer 2014.

| Common Name | Pectoral Count | Anal Count | Dorsal Count | Caudal Count | Pelvic Count | Second Dorsal Count |
|---|---|---|---|---|---|---|
| Brown Banded Bamboo | 3 | 0 | 2 | 1 | 0 | 0 |
| White Spotted Bamboo | 2 | 0 | 1 | 1 | 2 | 2 |
| Smooth Dogfish | 20 | 10 | 10 | 9 full, 1 U&L | 20 | 10 |
| Spiny Dogfish | 14 | 0 | 7 | 7 | 14 | 7 |
| Bonnethead | 3 | 0 | 0 | 1 | 0 | 0 |
| Brown Sandbar | 1 | 0 | 1 | 0 | 0 | 0 |
| Epaulette | 1 | 0 | 1 | 1 | 0 | 0 |
| Blue | 35 | 17 | 17 | 16 | 33 | 12 |
| Short-Fin Mako | 68 | 0 | 33 | 10 | 21 | 0 |
| Common Thresher | 33 | 0 | 19 | 3 L.Lobe | 32 | 0 |
| Porbeagle | 5 | 3 | 3 | 2 | 6 | 3 |
| Tiger | 2 | 1 | 1 | 1 | 2 | 1 |
| Winter | 2 | 0 | 0 | 0 | 2 | 0 |
| Clearnose | 40 | 0 | 0 | 0 | 8 | 0 |
| Little | 24 | 0 | 0 | 0 | 26 | 0 |
| Cownose | 2 | 0 | 0 | 0 | 2 | 0 |




**Figure Five**: Figures A, B, and C correlate to an images of collected sharks during summer 2014. Photo A shows a blue shark, photo B shows a Common Thresher shark, and photo C shows a Short-Fin Mako Shark. All images are of the sharks shortly after being delivered to the dock for weighing.

## Acknowledgements

**We would like to thank the University of New Haven Summer Undergraduate Research Fellowship for allowing us this unique opportunity. Lastly, we would like to thank Dr. Lisa Natanson and Dr. Nancy Kohler from NOAA National Marine Fisheries for allowing us to sample at the tournaments.**

References: 1. Encyclopedia of Life. (n.d.). *Sharks, Skates and Rays (Elasmobranchii)*. Retrieved July 30, 2014, from http://eol.org/pages/1857/overview 2. Verlecar, X. N., Snigdha, Desai, S. R., & Dhargalkar, V. K. (2007). Shark hunting -- an indiscriminate trade endangering elasmobranchs to extinction. *Current Science (00113891), 92*(8), 1078-1082. Retrieved August 21, 2014 from https://web-a-ebscohost-com.unh-proxy01.newhaven.edu/ehost/pdfviewer/pdfviewer?sid=50e04dfe-0eb1-46cc-b167-02f3cacb4519%40sessionmgr4004&vid=5&hid=4209 3.Vannuccini, S. (1999). *Shark Utilization, Marketing and Trade*. Retrieved August 19, 2014, from http://www.fao.org/docrep/005/x3690e/x3690e00.htm#Contents 4. The Humane Society of the United States. (2010, December 21). *Shark Conservation Act Wins Final Congressional Approval : The Humane Society of the United States*. Retrieved August 18, 2014, from http://www.humanesociety.org/news/press_releases/2010/12/shark_conservation_act_passed_122110.html