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The Effects of Fishing Down the Food Chain on Shark Species in Chincoteague, Virginia

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Abstract

Sharks are top predators in the ecological food chain, and many species are in danger of extinction due to over-exploitation by humans. The Delmarva region, where Millersville University's (MU) Chincoteague Bay Field Station (CBFS) is located, has some of the best remaining barrier island ecosystems in the US, unique with its pristine bays, salt marshes, easy ocean access and number of fishing companies. The area is rich in marine habitats and home to many species of sharks. In this study, we explored and collected data from local fishermen, fishing companies and landing databases on different species of sharks. This study required several trips by students to travel to the CBFS, where we collected and recorded data to analyze and determine how the shark species richness and species diversity changes throughout the years due to overfishing and fishing down the food chain.

Over the past 50 years, shark populations have decreased significantly. There are various possibilities as to why their numbers have been steadily declining over a span of time, such as human related aspects through fisheries, by-catch, shark poaching, and pollution. This research is indicative of the important ideological aspect of fishing down the food chain and how it affects shark species in the Virginia area and their population numbers. Additionally, we present the drastic effects disappearing sharks have had and still have on their prey and individualized survival, as well as the continuous downstream effect on ecological marine food chains related to the removal of sharks. Overall, it is critical to realize, to be educated on, and analyze the fact that the human population and planet earth are depending on shark survival to sustain life in and out of the ocean.

The Virginia coastline is full of life, including many different types of sharks. This makes them an easy target through commercial and recreational fishing. Recreational fishing kills around 10,000 tons

of sharks (450,000 sharks) annually while commercial fishing takes out roughly 5,000-7,000 tons (250,000-300,000 sharks) (Branstetter & Musick, 1992), and this does not include the sharks removed due to by-catch.

Figures 1-4 represent a study that was conducted at the University of William and Mary using a fishing practice called longlining. Longlining is the process of setting a main long line set with baited hooks; the typical length of a longline stretches 3,500 feet. The larger shark species in the area, including Sandbar, Dusky, Sand Tiger, and Tiger shark, show a clear decline in population from 1974 to 1992. Sharks are being removed from the ocean faster than they are being replenished. This raises the question, what is the effect on shark's prey? As we conducted our study, we looked at the spiny dogfish and how their prey are being affected.

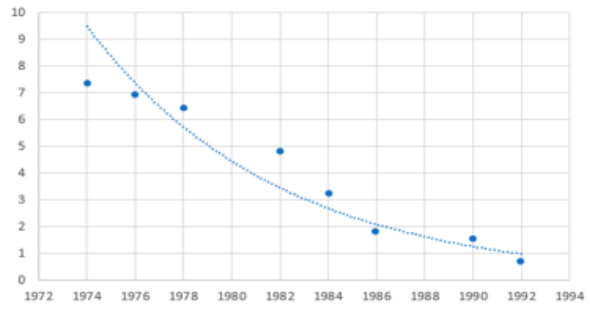

Figure 1. Catch rates of Sandbar Sharks in Virginia waters from 1974-1992. Sharks caught per 100 hooks.

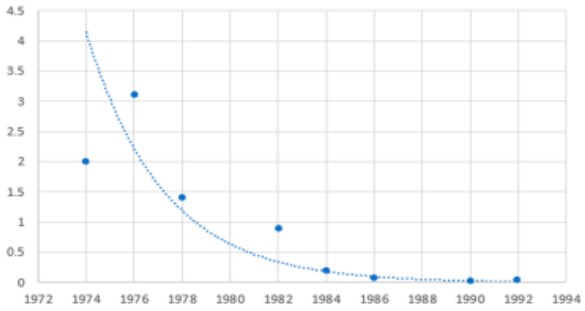

Figure 2. Catch rates of Dusky Sharks in Virginia waters from 1974-1992. Sharks caught per 100 hooks.

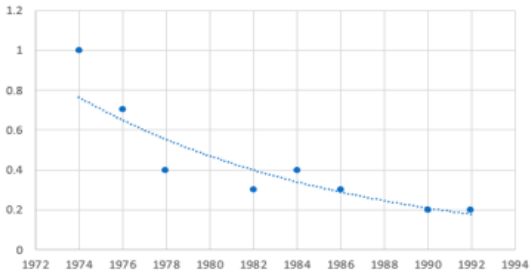

Figure 3. Catch rates of Sand Tiger Sharks in Virginia waters from 1974-1992. Sharks caught per 100 hooks.

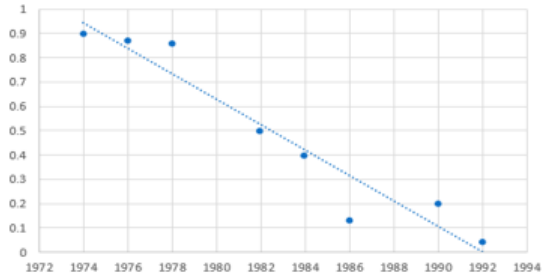

Figure 4. Catch rates of Tiger Sharks in Virginia waters from 1974-1992. Sharks caught per 100 hooks.

As a result of our research, we have found that the spiny dogfish are directly correlated to the Eastern Oyster populations. The data from Figure 5 show that as the catch of the Spiny Dogfish increased, the Eastern Oyster catch data decreased, and then rose again. The increase of spiny dogfish catch has resulted in the oyster population rising as there are fewer spiny dogfish to feed on them. (NOAA, n.d.). Between the years of 2005-2020, the fishing focus moved to oyster population since they became the abundant species in the area, causing the oyster catch to, therefore, rise. Eastern Oysters are important prey for the smaller shark species and are also a popular dish along the eastern side of Virginia, so they are very important to the economy and health of the coastal environments. Without the spiny dogfish to keep the oyster population in check, we see an increased removal of oysters, which will negatively affect other species down the food chain.

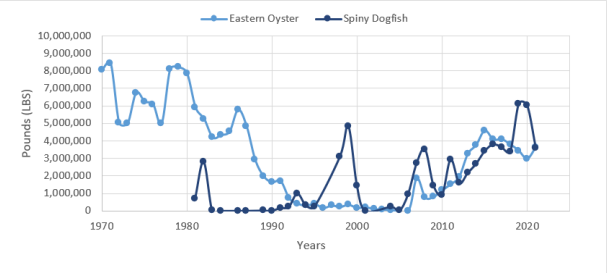

Figure 5. Catch data in pounds for the Eastern Oyster and the Spiny Dogfish along the eastern coastline of Virginia between the years of 1971-2021.

The marine environment and its organisms are very sensitive to change. Through climatic changes and a decimated fishing industry, sharks are heavily influenced, as are their prey populations. Figure 6, shows different species of prey of many sharks, which include the Bluefin Tuna, and the American Lobster. While catch data does not tell us exact populations, it does allow for a good representation of population. This is shown in the data in recent years where we have caught significantly less sharks than in previous years. These data show that sharks play a key role in the food chain, and as we have seen in Figures 5 and 6, shark populations have been fished past their maximum sustainable yield, meaning the species population has been fished past the point of irreversible damages. The fishing focus has since moved to the lower trophic level, hence the term fishing down the food chain. The only way the fishing industry can continue to exist is to fish down the food chain, and as sharks are still being fished past their maximum sustainable yield, their prey in lower trophic levels will soon be fished in the same capacity. Using National Oceanic and Atmospheric Administration (NOAA) data against our own proves our data to be accurate and shows that large amounts of shark fishing will continue to affect lower levels of the food chain.

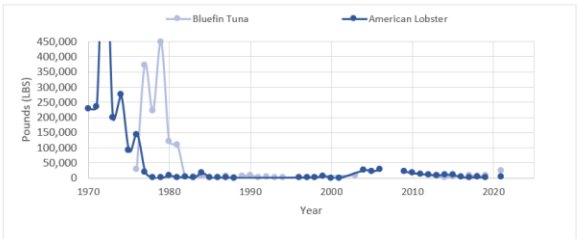

Figure 6. Catch data in pounds of prey from Virginia coastlines between the years 1971-2021.

The concept of our research has been centered on the question of how the population of sharks has historically changed. Our study took place on the East Coast with trips to Chincoteague Bay, Virginia allowing research to be held in the Delmarva region. To support our hypothesis that there have been changes in the population of sharks in the past fifty years, we collected and analyzed data that in return would determine if there was fluctuation in the populations of shark species. Through our independent inquiry, the team was able to obtain anecdotal information from local fishermen and harbor masters, leading us to see trends of species-specific shark populations in Chincoteague. Additional data were collected through government websites, including NOAA, MD-DNR, and VA-DNR. Based on our data and analysis, there is a correlation between the excess removal of sharks and the increased fishing focus to other species, diminishing their numbers over time as well. The purpose of this study is to understand the impacts the disappearances of sharks may have on their prey and the ecosystem, leading to the conclusion that there may be signs of fishing down the food chain from our research.

References

Branstetter, S., & Musick, J. (1992) *Sharks of Virginia waters.* (Marine Resource Report No. 92-7). Virginia Institute of Marine Science. http://dx.doi.org/doi:10.21220/m2-t6dr-vp25

National Oceanic and Atmospheric Administration. (n.d.). *NOAA fisheries: Welcome to NOAA*. https://www.fisheries.noaa.gov/

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