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### **Define the challenge (Basic introduction to the topic)**

**Jenna Rolf:** So Karyssa... Ever heard of sharks?

**Karyssa Miller:** To be honest Jen, I've never seen one in real life, but I did have a plastic toy as a kid!

**JR:** Well let me tell you - they're pretty neat. They're top predators, meaning that they play a very important role in marine ecosystems and have no natural predators.

**KM:** You mean they're more than just that scary shark in Jaws that tries to eat everyone????

**JR:** Exactly. It's actually the other way around - humans are the ones that are threatening sharks. In fact, humans kill an estimated 100 million sharks every year. This mostly happens through shark finning, which is a practice that involves cutting the fin off of the shark carcass, typically for shark fin soup or medicinal practices.

**KM:** Yeah, the entire body is not needed since shark meat is not as profitable as the fin. Shark fins can reach prices of over \$300/lb, making this one of the highest priced food sources in the world

**JR:** Shark fin soup consumption is one of the leading causes of global shark decline. Fins first appeared as a delicacy in Chinese cuisine thousands of years ago around the year 960 and were later established as a luxury food item.

**KM:** Obviously this is not a great practice for the sharks specifically, but it also affects marine ecosystems as a whole. When a top predator's population declines, there are usually top-down trophic cascades that drastically alter food webs and result in an overabundance of species in lower trophic levels. In this case, that includes rays, skates, and other smaller sharks.

**JR:** Yeah, studies are finding that significant population declines are occurring, for example, North Pacific blue shark populations are declining in abundance by more than five percent every year, which makes sense considering they comprise around 70% of the total pelagic shark catches.

**KM:** And as shark abundance decreased over the past 35 years, 86% of their prey species has increased in coastal northwest Atlantic ecosystems. Effects of this community restructuring have cascaded downward from the cownose ray, whose enhanced predation on the bay scallop was enough to terminate a well-established scallop fishery.

### **Evidence against the challenge (Is there any opposition to this topic)**

**KM:** While this is a serious conservation issue, there is also a ton of cultural and economic significance that is driving this industry. In China, shark fin soup symbolizes notions of hospitality, status, and good fortune.

**JR:** China's rapid economic expansion in the 80's and 90's shifted many of its citizens to a wealthier economic class, which subsequently created a higher demand for shark fins. This

especially benefited fishermen, restaurant owners and employees, as well as hotel owners and employees.

**KM:** Because of this demand, the potential banning of shark fin soup could be considered an infringement upon not only their beliefs but also their potential economic gains. And an outright ban would result in fishermen being unable to match the profits brought in by such a high-demand product. The restaurants and hotels that serve shark fin soup would also fail to match the amount of money that they had previously made by offering the delicacy.

### **Evidence supporting the challenge (research evidence)**

**KM:** And while these benefits exist, the practice of shark finning doesn't allow for sustainable shark populations. Notably, shark fins boost the Asian economy by only 2 billion dollars annually, with that number declining each year due to the lack of available sharks. And with Asia's access to shark populations, the potential for an ecotourism industry is one that could easily make over 2 billion dollars *sustainably and repeatedly*.

**JR:** Exactly. Shark fins have exceptionally high export value, reaching up to \$700 per kilogram in Asia, making an individual shark worth thousands of dollars. This provides an incentive for unsustainable fishing to continue, with a high pay off being nearly guaranteed in the current market.

**KM:** So basically the underlying issue is just *how* unsustainable this practice is. Not only are sharks being overfished, but when they are harvested, only their fins are kept. The rest of the finned sharks are often thrown back into the ocean alive, where they are unable to swim properly and eventually suffocate or bleed to death.

**JR:** Additionally, with their slow growth and low reproductive rates, sharks are highly susceptible to extinction, and it is difficult for many shark species to replenish their populations as quickly as they are being diminished.

### **Case study examples**

**JR:** Fun fact: twelve of the world's most vulnerable shark species have been listed on the Convention on International Trade in Endangered Species of Wild Fauna and Flora, more concisely referred to as CITES which is an international treaty that regulates international trade of endangered plants and animals. Two of the listed hammerheads were consistently found to be the fourth and fifth most common species in processed fin trimmings collected randomly from the Hong Kong dried fin market.

**KM:** CITES records suggest that Hong Kong is the world's top importer of fins from listed sharks, and fins are the primary product being internationally traded under CITES. Most of the reported trade of listed species was from hammerhead sharks, which matches what was observed in the retail fin market.

**JR:** While many sharks are CITES listed, including oceanic whitetips, porbeagles, and three species of hammerheads, including scalloped, great, and smooth hammerhead shark, there have been difficulties in identifying the products of hammerheads in particular.

**KM:** Basically, there's a way to detect if the previously listed sharks are being sold or traded in the market using PCR. Specifically, by using the DNA from dried fins, you can use shark specific primers that can identify the species of shark that the fin came from. However, because the fins are dried and bleached, often times the DNA is really degraded, making it difficult for PCR to be done. To troubleshoot this, researchers successfully performed mini-barcode assays using degraded shark DNA templates that are actually extracted from shark fin soup.

**JR:** The issue with using this protocol on hammerhead species is that they're extremely difficult to identify, but they are also one of the most commonly finned sharks. So, a method that researchers used to try and combat this issue was to make a more specific set of primers that works specifically on hammerheads. It turned out to be very successful in identifying these three globally distributed species. But not only is it useful for identification of illegal shark trade, they also used this technology to potentially reveal a cryptic species closely related to the scalloped hammerhead found off the southeast coast of the US.

### **What could be the full extent of the consequences (big picture impacts)**

**KM:** As we mentioned before, the current conditions that exist as a result of the shark finning industry are unsustainable with rampant overfishing of a top predator.

**JR:** Yeah, and as we know the whole fishing-down-the-food-web, or in this case finning-down-the-food-web, **\*buh dum tss\*** never really works out. This phenomenon occurs when fisheries in a given ecosystem deplete the largest predatory fish on the top of the food web, then are forced to turn to increasingly smaller species.

**KM:** Additionally, the effects of this trophic shift could have further implications for the availability of marine ecosystem services that we benefit from on a daily basis.

**JR:** Oh, you mean like the entire seafood industry?

**KM:** Precisely! So, is there anything that can be done to help this situation?

### **Are there solutions or actions we can do?**

**JR:** I'm glad you asked! The United States has some of the strongest shark management measures worldwide. Thanks to the Magnuson-Stevens Fishery Conservation and Management Act (MSA), NOAA Fisheries manages sharks in U.S. federal waters using fishery management plans. Additionally, The Shark Finning Prohibition Act of 2000 and the Shark Conservation Act of 2010 both amended the MSA to prohibit shark finning and require that almost all sharks in the United States be brought to shore with their fins naturally attached.

**KM:** Several states have also passed shark fin laws that prohibit the possession and retention of shark fins (even if they are legally landed under the requirements of the Shark Conservation Act). These states include California, Delaware, Hawaii, Maryland, Massachusetts, New York, Oregon, and Washington.

**JR:** In Europe, the shark finning ban was one of the weakest in the world, yet the EU is one of the largest exporters of shark fins to Asia. They recently closed many loopholes, putting in place a prohibition on removing shark fins at sea with no exceptions. The EU, given the global scale of

its fisheries and the international influence of its shark management policies, is now in a prime position to push for game-changing shark conservation measures.

**KM:** Aside from the legislature, what you can do on an individual level is educate and spread awareness about this issue

**JR:** Yes, this is more important than you'd think. Unfortunately, there is a widespread myth that sharks have the ability to regenerate their fins after being removed, which is simply not true.

### **Closing thoughts**

**KM:** While this is a multifaceted issue with valid arguments on both sides, there are clear ecological impacts that negatively affect marine ecosystems.

**JR:** On the bright side, there are steps being made on a global scale to decrease the unsustainable aspects that are characteristic of the shark finning industry.

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**KM:** Thanks for tuning in.

**JR:** Hope you enjoyed and learned something new.