Gulf Coast Fisherman

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Above: A fisheries scientist holding a depredated bonita (left) and scamp (right). Photo courtesy of Trey Spearman.

The Taxman!

With an early start, you load up the boat and you're offshore by sunrise. It's a beautiful day on the clear blue waters of the Gulf, and you're optimistic about bringing home a few good keepers. Soon after you drop your lines – fish on! Near the end of a long fight, you feel a sudden tug and then nothing. With a sinking feeling, you reel your fish up to the boat, only to find that a shark has

gotten to it first – the Taxman has collected his dues. For many fishermen, commercial and recreational alike, this story is all too familiar.

Depredation, defined as the partial or complete removal of a hooked species by a non-target species (such as a shark, dolphin, or barracuda), is a common occurrence throughout the Gulf of Mexico and beyond. Historically, depredation primarily impacted commercial fisheries, with dolphins and other toothed whales largely responsible. More recently, the focus has shifted toward sharks and their increasing conflicts with recreational fisheries.

Many shark species share a similar history. Several decades ago, fueled by the media's portrayal of sharks and reports of shark attacks, people began to view sharks as a danger to human safety and harvested them in great numbers. By the 1980s and '90s, shark populations were severely overfished. Regardless of how they are perceived by humans, it is inarguable that sharks play an essential role in the health of marine environments. As high-level predators, sharks represent vital links in the food web, and changes to their populations can cascade throughout entire ecosystems. Therefore, strict regulations and protections are now in place for many shark species, and their populations are showing signs of recovery. However, sharks are not off the hook just yet – once viewed as a threat to human life, they are now regarded as a threat to human fishing practices.

With shark populations beginning to rebound and the number of offshore fishermen steadily rising, human-shark conflict is at an all-time high. Shark conservation efforts have been widely successful; some even argue *too successful*. A 2017 survey of Florida fishermen found that many do not support shark conservation efforts due to increasing first-hand experience with shark depredation. These same fishermen view the growing number of sharks as a significant threat to fishing practices as reports of shark depredation in recreational and commercial fisheries rise globally. Considering this increasingly common conflict between fishermen and sharks, a question has been raised: *Are we ready for shark conservation success?* Many fishermen believe that allowing shark populations to return to their historic numbers with no means of mitigating depredation would be detrimental to fishing industries. Fortunately, fisheries experts have recently initiated several research projects to investigate the issue of depredation from all angles.

Above: Students examine a depredated red snapper. Photo courtesy of David Hay Jones.

Through the Eyes of a Fisherman

Before we begin to mitigate shark depredation, we must first work to understand it. Is depth a factor? Geographic region? Time of year? Target species? Scientists are investigating trends in depredation of reef fish across the Gulf of Mexico, examining every possible element that may be related to the frequency of shark interference with fishing activity.

As depredation is a fisherman's issue, it is critical that fishermen are involved throughout this process. In addition to considering existing observer data from the Gulf of Mexico reef fish fishery, scientists are surveying fishermen from Texas to Florida regarding their experiences, perceptions, and attitudes concerning shark depredation in the Gulf. Because fishermen are generally on the water more frequently than scientists, their knowledge and observations of the marine environment are invaluable. Data from these surveys will be compiled to create maps of spatial trends in depredation, as well as mental models – networks of

information that show how changes in perceptions, actions, and environmental conditions impact one another. The results will be presented to a group of fishermen, who will further refine and revise the maps and models to most accurately portray human-shark conflict in the Gulf of Mexico reef fish fishery. These webs of knowledge and in-depth discussions will help to inform research and management decisions, and ultimately, future depredation mitigation strategies.

Above: A fisherman holding a large depredated red snapper. Photo courtesy of David Hay Jones.

On a Molecular Level

Although surveys are ideal for exploring broad-scale patterns, depredation must also be examined at the micro level. New genetic identification techniques provide scientists with precise methods to further characterize depredation. Developing depredator identification tools was no small task – there are countless challenges that come with collecting DNA in a marine environment.

Because a depredator's DNA occurs only in very small amounts on the bite wound of a depredated fish, it is inevitable that samples will include a mix of DNA. Additionally, it is easy to contaminate a genetic sample with DNA from a person or other fishes that have touched a vessel's surface. Despite these obstacles, scientists were able to develop a DNA collection protocol that successfully identified depredator species. This technique opened the door to wide-ranging projects that will continue to characterize instances of depredation at the species level.

Presently, scientists are implementing and expanding these genetic methods in a larger-scale project tasked with identifying depredator species off the southeastern U.S. To do this, researchers are partnering with Florida charter fishermen to sample the remains of depredated reef and pelagic fish throughout 2022. By analyzing DNA collected from these depredated fish, the project team will determine which species are most often responsible for depredation off Florida's east coast – which may also provide insight regarding depredation events in the Gulf of Mexico.

Above: A red snapper being released using a descending device. Photo courtesy of SeaQualizer. In more than 1,000 descender device releases of red snapper, no depredation has been recorded.

An Underwater View

Because depredation events often do not occur at the surface, fishermen have a limited ability to positively identify depredator species. High-resolution underwater cameras have become increasingly accessible and can play an important role in characterizing depredation, especially with the expansion of tools like descending devices (e.g., SeaQualizers). If a fish experiences barotrauma (pressure-related injuries) during its ascent to a vessel, descending devices can be used to quickly and safely return the fish to its original depth. However, the implementation of descending devices has been viewed with some skepticism. Fishermen are understandably concerned that descending devices present a fish as an easy target to predators. To investigate this concern, scientists examined camera footage collected during fish ascent on vertical longlines and fish descent on descender releases off the coast of Alabama. While depredation did occur as fish ascended, *no instances of depredation* were recorded among fish released using descending devices.

Because different regions in the Gulf likely experience different depredation dynamics, properly examining the relationship between depredation and descending devices requires comparison between geographic areas. Therefore, scientists are partnering with charter captains to expand the original study across the Gulf. The captains will use cameras to capture footage of fish descents, allowing scientists to further analyze exactly how often depredation events take place on descending devices. Ultimately, these data will contribute to the growing base of depredation research in the Gulf of Mexico.

Above: A mako shark's electrosensory system of pores (ampullae of Lorenzini) is clearly visible on the snout. This characteristic is unique to sharks and their close relatives. Photo courtesy of David Hay Jones.

Mitigation and Next Steps

Characterizing depredation is only the first step; the information we gain from fishermen surveys, genetic research, and video footage must eventually be used to inform mitigation strategies. Many shark populations are still recovering from historical overfishing, so non-lethal means of preventing depredation are crucial for maintaining ecosystem health.

Currently, there are several technologies on the market that claim to deter sharks. A handful of these devices are being tested for their effectiveness in decreasing depredation. Such technologies target a shark's electrosensory system: an array of gel-filled pores, called ampullae of Lorenzini, that detect the natural electric impulses generated by the muscle movements of other animals. This extremely sensitive system, which makes sharks such effective predators, also makes them susceptible to artificial deterrents.

One device, developed by Australian-based company Ocean Guardian, generates a non-lethal electric field that is many times stronger than any a

shark would naturally encounter. The electrical output from the SharkShield® overwhelms a shark's electrosensory system, discouraging the shark from crossing the field. A 2016 independent study tested the SharkShield® in a natural marine setting off the coast of South Africa and found it effective in deterring white sharks from baited lines. This technology is available for a wide variety of applications, including surfing, diving, fishing, and swimming barriers to protect beachgoers.

Above: The SharkShield® shark deterrent (photo courtesy of SharkShield)

Another repellent tool, Sharkbanz's Zeppelin™ device, relies on magnetic technology. These deterrents can replace sinkers on a rig and are often used in bottom fishing. Similar to the SharkShield®, the Zeppelin™ works by overwhelming a shark's electroreceptive system. However, because they are magnetic, they do not require batteries or charging and do not need to be turned on. These devices have been successfully tested in small-scale trials,

and scientists are continuing this research in both artificial and natural settings. Tools like the Zeppelin™ and the SharkShield® may prove instrumental in reducing shark depredation in the Gulf's recreational fisheries.

Given increasing numbers of offshore fishermen and recovering shark populations, it is not surprising that shark depredation and other human-shark conflicts are on the rise. These complex issues must be examined thoroughly, as the stability of the Gulf's fisheries and the success of shark conservation efforts demand collaboration between fishermen, scientists, and fisheries managers. The answer to the question, *Are we ready for shark conservation success?* lies in the ability to minimize human-shark conflicts without further compromising the recovery of shark populations. Finding solutions that benefit both fishermen and shark conservation efforts is critical to ensuring the health of our Gulf, and its resources, for future generations.

Above: The Zeppelin™ shark deterrent (photo courtesy of Sharkbanz).

Readers: How are we doing?

Thank you for supporting MSU Marine Fisheries Ecology by subscribing to our newsletter! We value the opportunity to connect with you, and we'd appreciate your honest critique of our Gulf Coast Fisherman Newsletter content from this past year. Look out for our 1-minute, 4-question survey tomorrow (12/2) for **a chance to win a $50 VISA gift card or a prize pack** (including shark jaws, a hat, and a guide to the sharks and rays of Mississippi)!

Please note – this survey closes on December 15, 2021 at 11:59 PM.

I'm Marcus Drymon, an Assistant Extension Professor at Mississippi State University and a Marine Fisheries Specialist at Mississippi-Alabama Sea Grant. Amanda Jefferson, Lindsay Mullins, Matthew Jargowsky, Danielle McAree, Ana Osowski, Alena Anderson and I are the Marine Fisheries Ecology Lab. We'd love to hear from you! Please reach out to us at marinefisheriesecology@gmail.com

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