Clipping the Fin Trade

Research and policy initiatives could take a bite out of shark exploitation

by Janet Raloff
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Two years ago, diver Michael Aw was monitoring the health of local coral some 1,000 miles south of Bombay. Because this major tourist site in the Republic of Maldives is protected from most fishing, "what I least expected to see was a dying, finned shark," he says. Someone had hauled in the 6-foot gray reef shark, sliced off all its fins, and then tossed it overboard. To cover up the act, the plunderer had tied a 15-pound piece of coral to what remained of the tail to ensure the carcass would sink.

During the 15 minutes that Aw remained at the seafloor with the dying animal, which was vainly trying to swim, the diver angrily reflected that this type of gruesome amputation is fueled by demand for nothing more than a pricey Chinese soup. Aw, who is chairman of OceanNEnvironment, a marine-conservation group based just outside Sydney, Australia, vowed right then to fight shark finning.

To most Westerners, shark-fin soup ranks as one of the more arcane offerings on Chinese menus globally. Its price—up to $100 a bowl in high-end Hong Kong restaurants—may keep many Americans from sampling the subtle delicacy. But that same high price is creating a growing, unsustainable harvest of sharks worldwide.

On the open market, shark fins may bring upwards of $200 per pound, while the meat of a shark yields fishing crews only pennies to a couple of dollars per pound. This increasing disparity between the value of the fins and flesh has been encouraging crews to slice the fins off any shark landed and then pitch its carcass overboard.

To fight this egregious waste of seafood, the U.S. Shark Finning Prohibition Act, which went into effect on March 13, bans U.S. vessels fishing anywhere—and foreign vessels in U.S. territorial waters—from possessing fins unless the rest of a shark's carcass is also on board.

BLOODY PLUNDER. A vista of sun-drying shark fins destined for Chinese soup (above). After being finned (below), the shark—even if it's still alive—will usually be cast overboard as waste.

R. Chen/WildAid

But the well-intentioned law has hardly shut down the fin trade, even among U.S. crews, as evidenced by the Coast Guard's recent seizure of the Honolulu-based King Diamond II. When law enforcement officials boarded the 84-foot vessel in waters 350 miles off Acapulco, Mexico, they found it carried 32 tons of fins and no other shark parts—prima facie evidence of illegal plunder, federal attorneys contend (see "Spoils of Shark-Fin War," below).

The grotesque load represents the slaughter of at least 30,000 sharks and the discard of some 1.28 million pounds of fish, observes Paul Ortiz, a senior marine-fisheries-enforcement attorney with the National Oceanic and Atmospheric Administration in Long Beach, Calif. It wasn't the only illegal haul of the season for the King Diamond II. A slightly smaller cargo of fins in July netted the crew roughly $6 million, according to federal law enforcement officials.

"What a devastating waste," observes marine ecologist Elliott A. Norse, president of the Marine Conservation Biology Institute in Redmond, Wash. This scale of shark mortality "is a disaster for the oceans," he maintains, because these fish grow slowly and reproduce in small numbers.

Around the globe, fishing fleets now take an estimated 100 million sharks annually—many just for fins, says Aw. His group is among several that have launched campaigns to cut demand for fins.

On the science front, a new research advance promises a method for inexpensively identifying by species any shark fins and other pieces of carcasses. This could help biologists at last get solid numbers on which sharks are being most exploited. With those data in hand, global management of shark stocks—something now advocated by the United Nations' Food and Agricultural Organization—could become more than a conservationist's dream.

A problem of biology

R. Chen/WildAid

Throughout the seas, sharks fill an important ecological niche. As top predators, they keep in balance the numbers of animals lower on the food chain. Yet populations of the seemingly fierce sharks are remarkably fragile. "Wherever unregulated shark fisheries exist, virtually every one has collapsed within a few years," observes John A. Musick of the Virginia Institute of Marine Science at the College of William and Mary in Gloucester Point.

For instance, European overfishing of porbeagles in the northwest Atlantic during the 1960s caused that population to collapse. It took these sharks nearly 30 years to recover, Musick notes, after which Canadian and U.S. fleets turned their attention on them—and "they were then overfished again in a matter of just 3 years."

The problem, explains Musick, cochair of the shark-specialists group within the International Union for the Conservation of Nature in Gland, Switzerland, is the low reproductive capacity of sharks. Most bony fish mature quickly and then produce thousands to millions of eggs annually. Not so the ancient cartilaginous fish, such as sharks, skates, and rays.

Sandbar sharks, for instance, are 13 years old when they begin producing a litter of 10 annually, he notes. Sand tigers mature by age 12, but then produce twins only every other year. And dusky sharks don't breed until they're 20 to 25 years old, after which small litters typically arrive at 3-year intervals. In other words, Musick says, sharks' productivity usually more closely resembles that of mammals than of most other fish.

Yet fishing fleets haven't budgeted their harvesting of sharks accordingly, Musick maintains. Adding to the problem, he notes, there are few reliable species-specific tallies on shark catches.

Fishing fleets may report landing 50 tons of shark. If those consist of fins only—as is still allowed in most places in the world—this catch may reflect tens of thousands of animals, Musick points out. Because fins from most species bear no distinctive markings, regulators can't determine the type of shark or where it was culled.

Even when shark carcasses are kept onboard, the head, as well as its fins and internal organs, are often removed before the ship reaches port. The resulting "log," as fishing crews refer to a stripped-down carcass, "can be very difficult to identify by species," notes Mahmood Shivji of Nova Southeastern University's Guy Harvey Research Institute in Dania Beach, Fla.

Hampered by such imprecision, regulators have tended to develop shark-management plans—essentially fishing quotas—only for groups of species, such as large coastal sharks, small coastal sharks, or deep-sea species, Shivji explains.

What conservationists would prefer, he says, are quotas for individual species, based on each one's behavior and reproductive capacity. But with the sketchy data now available, he acknowledges, species-by-species quotas aren't yet possible or enforceable. However, they could be soon, says Shivji, with use of the genetic identification technique that his team reported in the August Conservation Biology.

Shark fingerprints

Cumbersome and time-consuming laboratory processes have been available to identify the species of a piece of shark tissue. However, these tests are too expensive for the routine screening of tissue taken off ships' decks, from fin-vendors' stalls, or out of a bowl of soup. An alternative assay by Shivji and his colleagues, however, may fill the bill.

The researchers identified short segments of DNA that show up only in a specific species. Then they synthesized small molecules, called primers, that each bind specifically to a particular shark-DNA segment.

Using the same DNA-copying technology that serves as the basis of human-DNA fingerprinting, they process the genetic material gleaned from an unknown sample. After incubating it with a mix of the known species-specific primers, the researchers load the material onto a gel sheet and separate the components. If the unknown tissue came from one of the shark species for which the researchers have included a primer, a telltale band will emerge.

In their recent report, Shivji and his coauthors at NOAA, London's Imperial College, and Queen's College in Belfast describe tests with 6 of the 10 species-specific primers they've developed thus far. When they mixed these six primers and tissue from each of 33 different shark species, the researchers unambiguously identified the target species: longfin mako, shortfin mako, porbeagle, dusky, silky, and blue sharks.

Among the 27 other species tested in the experiment, including many closely related to the targeted sharks, only one confused the primers. The dusky-shark-specific band showed up in tests of oceanic-whitetip shark DNA. Fortunately, Shivji notes, the whitetip's distinctive coloration makes it one of the few sharks for which visual species identification of fins is possible.

The new identification technique worked not only with tissue taken from live sharks, but also with dried fins and 10 brands of powdered shark cartilage that Shivji and his coworkers purchased in health food stores.

What about soup? Though the researchers haven't tried it yet, Shivji notes that "DNA is remarkably tough stuff, so unless a soup has been subjected to really high temperatures for a long time, this discriminatory assay should work on it, too."

Next on his agenda: Find DNA snippets that differentiate geographically distinct populations of a common shark species. Primers for such material would enable forensic squads to validate, for instance, whether a great white's fin sitting in a Hong Kong market stall was harvested legally in Asia or illegally from protected U.S. waters.

Caviar of soups

"Saving sharks must begin by stopping the demand for fins where fins are consumed," which is primarily in Hong Kong, Singapore, and other affluent Asian cities, says Aw. So, his organization and others, such as San Francisco–based WildAid, have targeted a just-say-no-to-fins message to, oddly enough, people planning weddings and elaborate business dinners.

SOUPED UP. Shark-fin soup is a traditional wedding-menu item, and more and more Asian restaurants are serving it as part of their daily fare. One upscale Hong Kong restaurant goes through 50 tons of shark fins annually.

D. Perrine/Seapics.com

Such events traditionally include shark-fin soup. It's a mark of affluence and sophistication, much as caviar is in Western cultures. With Asia's growing wealth, the market for fins has escalated.

Chefs simmer fins for hours to extract small needles of cartilage, known as ceratrotrichia, which become gel-like noodles after more simmering. Treated to remove any fishy taste, the needles-turned-noodles impart little more than texture to a broth.

Aw's organization has received scores of requests for help from brides and grooms who want to eliminate the soup from their nuptial menus. OceanNEnvironment supplies the couples with letters that explain to wedding guests the family's environmental reasons for eschewing shark-fin soup.

Joel Simonetti and Lisa Cook of the Marine Conservation Biology Institute hope to carry the antifinning message to an even younger audience, children from elementary to high school age. The pair is producing a new English-language textbook on ocean conservation and resource sustainability. Due to be unveiled in Malaysia next March, it will highlight the pressure that soupmaking applies to shark populations.

"We will give [the texts] away to international schools in Southeast Asia," Simonetti says. Because the children in these private institutions tend to come from affluent families, "you have here the future decision makers of Asia, a powerful target audience."

The book's subtext, Simonetti says, will be that "if we want to maintain our oceans' resources, we need to put ecology and sustainability ahead of convenience—or status."

Spoils of Shark-Fin War

Pillage of devastating proportions

Until the 1990s collapse of swordfish stocks in waters around Hawaii, the King

GROSS WEIGHT. Fin-heavy *King Diamond II* (left) is escorted by the Coast Guard. Scientists will use new DNA probes to identify the ship's contraband.

U.S. Coast Guard

Diamond II out of Honolulu plied the western Pacific for billfish. But its four-person crew hadn't been fishing in the conventional sense when a Coast Guard ship happened upon the vessel on Aug. 13. Officers boarding the suspicious-looking boat found no fishing gear, just decaying shark fins—some 64,000 pounds of fins stuffed into every available compartment on deck and below.

When asked to explain the ghastly cargo, the boat's captain argued he wasn't guilty of any illegal activity. He was just transporting fish products from commercial fishing ships to exporters in Guatemala, he explained. What he didn't appear to understand is that the new federal antifinning law bans, among other activities, taking receipt of disembodied fins from other fishing boats, notes marine-fisheries attorney Paul Ortiz of the National Oceanic and Atmospheric Administration in Long Beach, Calif..

Petty Officer Jose Tabar of the U.S. Coast Guard Cutter Chase, who inspected the boat as a crime scene, found records logging purchases of fins from many South Korean vessels in the eastern Pacific.

According to Chase Captain Mark Kern, "We found evidence on board that [the King Diamond II] had started out with $300,000." By the time Kern's team seized the vessel, only $23,000 remained. The fin haulers acknowledged that they were expecting to get $100 a pound for the cargo, or $6.5 million. "So, now you see their profit margin," Kern says.

Ironically, because the refrigeration unit for the vessel's hold wasn't working, the value of the fins was in doubt. Tabar told Science News that the odor was overpowering. The stench was so strong, Kern says, "even a mile downwind, you could smell it."

The Chase escorted the boat, crew, and cargo to San Diego, turning them all over to NOAA as part an ongoing criminal investigation.

"This was just one ship that got stopped," Tabar says in frustration. "How many more are getting through?"

References: Shivji, M., et al. 2002. Genetic identification of pelagic shark body parts for conservation and trade monitoring. Conservation Biology 16(August):1036-1047. Abstract available at http://dx.doi.org/10.1046/j.1523-1739.2002.01188.x.
