

Shark-Tagging: Keeping Track of One of World's Great Survivors

It was a warm, foggy morning as the *Dorothy T.*, a 42-foot fishing boat out of Cape May, New Jersey, chugged through the Cape May channel and out into the smooth, if oily, waters of the Delaware Bay.

Aboard with Captain Bill Garrison and his two-man crew were James Oliver, director of the New York City Aquarium, Graham Macmillan, vice president of the American Littoral Society, and several members of the aquatically curious press.

The object of the trip was to tag sharks. The Delaware Bay, as is commonly known, has suffered seriously from the poisonous assaults of heavy industries along the coast. The oyster population is way down, and the clams are inedible, although there are still quite a few weakfish (otherwise known as speckled trout) and some bluefish, striped bass, and flounder.

What is not so well known is that during the summer the bay plays host to a robust and plentiful population of sharks. In fact, said Macmillan, a seasoned angler, "I don't know where I could tell you to go anyplace that's as good as right here in Delaware Bay for quantity and size of sharks."

Macmillan and his friends do not share the common public distrust of these fish. In fact, they said, very few of the 300 varieties of the sharks in the world are "man-eating," and even these are not so much hominivorous as they are unfussy about what they eat. The most serious menace is the white shark, which plies tropical seas. Most shark attacks are accidents, and many "attacks" are actually an attempt to sheer off at the last minute, said the experts on the boat. This is because the shark's vision, although far-reaching, is somewhat blurry at close range. In fact, said the crew, sharks are "very beneficial" because they are scavengers—the hyenas of the sea, as it were.

The object of this expedition was to attach tags to two kinds of sharks—sandbars and sand tigers. The idea is that eventually some people somewhere will catch some of the tagged beasts and report back to the American Lit-

toral Society the length and weight of the fish, the location in which they were caught, and various pertinent facts such as the time of day, the state of the tide, and the bait used. With this information, a gradual picture will emerge of the migrations, habits, and life cycles of the fish.

Fish-tagging is a widespread practice, but the shark is of particular interest to many people because they want to know, as Macmillan puts it, "Why is he so perfect?"

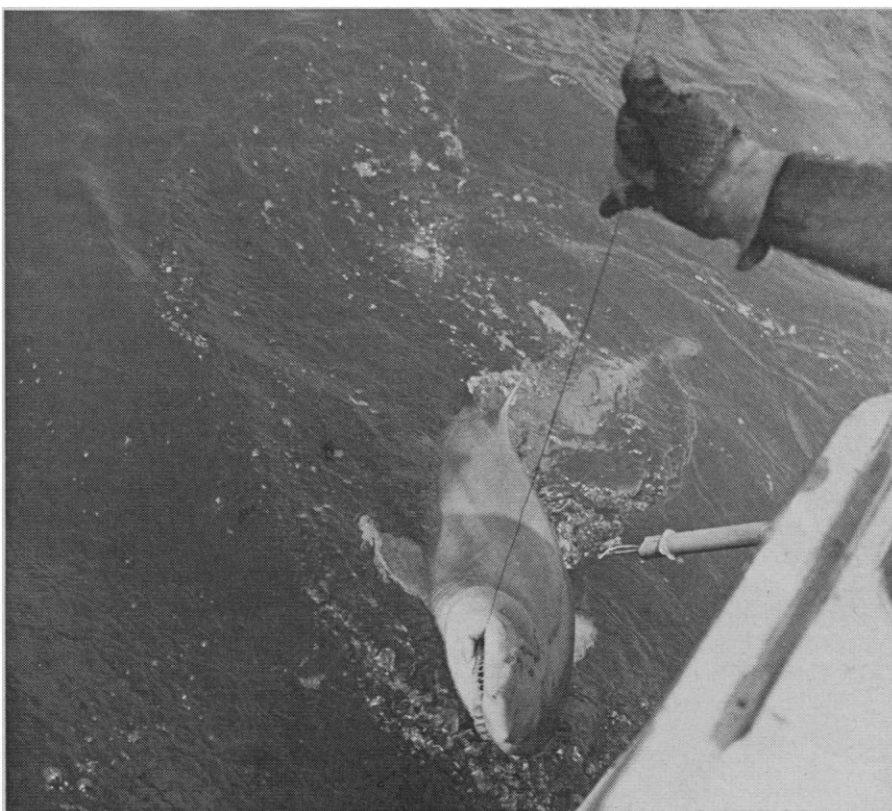
Sharks have been around for 200 million years, although they have shrunk considerably from their former length of 60 or 70 feet. Their remarkable abilities to adapt to their environment puts every creature but the cockroach out of their league.

"The shark is the most perfect animal in the world," says Macmillan. His only predator is a larger shark. "He roams the world for free, he doesn't give a hoot in hell about any-

thing. He will still be here when everything else is gone."

According to Perry Gilbert, director of the Mote Marine Laboratory in Sarasota, Florida, the reason for the shark's amazing invulnerability is twofold—"a happy combination of very generalized organ systems and two sophisticated ones: sense organs and reproductive system." Sharks are very useful for biomedical research, says Gilbert, because their organs resemble those of higher primates but are laid out in "diagrammatic simplicity." The shark's primitive muscular, skeletal (the skeleton is actually cartilage), and central nervous systems give him adaptability, while his penetrating eyesight, keen sense of smell, and a lateral nervous system that can pick up distant vibrations keep him well informed of the proximity of both food and danger. Infant mortality is low because most sharks, like whales, are viviparous, but unlike whales, the offspring can fend for themselves from the moment they are born.

The fog was beginning to lift as the *Dorothy T.* anchored 5½ miles off Cape May. The boat was over a 2-mile-long trench some 50 or 60 feet deep where, we were told, sharks like to roam close to the bottom filling up on weakfish (and each other). Five-inch-long hooks were appended to the four



Pole with tag being thrust into shark.

fishing rods on duty that day. The bait was then prepared. Bait comes in two parts. The odiferous preparation called "chum," which is cast on the water to attract sharks, was, in this case, oil from mossbunkers, one of the world's oiliest fish. Skipper Garrison's crew also chopped steak-size slabs of crimson fish from bonitos, one of the world's bloodiest fish, to hang on the hooks.

Judging from the enthusiastic response, "Garrison's Gut," as the location was named for the occasion, must have been like a sharks' Grand Central Station that day. Hardly had the first line settled to the bottom when the first bite came, and soon a 5-foot-long tiger shark was flailing around at the transom. The squeamish journalists clustered around to inspect his teeth—7 rows on top and bottom—and the tough sandpapery skin covered by scales, called denticles, that resemble tiny teeth. The shark flopped sporadically, making little burping sounds and staring at his captors with remorseless eyes. Then Captain Bill (as his teeshirt calls him) moved in and deftly thrust

a pole with a tiny dart at the end into the shark's back by the dorsal fin. When the pole was withdrawn, there remained in the shark a little piece of plastic tubing with a number on it and the message: "Return to American Littoral Society, Sandy Hook, New Jersey." The line was cut and the beast promptly plunged to the bottom to calm his nerves and catch his breath.

The experience is traumatic for the shark, but electroencephalograms have indicated that he feels no pain, as we know it, because of his primitive nervous system. And, according to the fishermen, the fact that he carries a 5-inch hook around in his mouth for an indefinite period of time doesn't disrupt his life-style. Seawater and body acids eventually corrode the hook, and even if the shark doesn't get his usual 20 or so pounds of food a day he can survive because his liver has such a tremendous storage capacity that it can sustain him for up to 2 months.

Macmillan points out that tagging is a good way to draw a fisherman into an interest in ecology. Few people,

after all, could in good conscience haul in shark after shark when the average angler wants no more than a set of jaws for his rumpus room. (The main commercial uses for shark in America are sharkskin and shark liver oil, although fin meat has been fashioned into "scallops" by unscrupulous restaurateurs.) But the catching is fun. *Science* knows, having had a memorable battle with a 250-pounder, fishing rod in hands, leather belt around the waist with a plastic socket in the groin area to hold the butt of the rod, and a leather harness with hooks attached to the reel so the whole body can strain against the tumblings of a crazed shark. And three strong men helping.

The *Dorothy T.* tagged 25 sharks that day, ranging in size from 3 to 7 feet and weighing up to 250 pounds. When the waters of the Delaware Bay get below 21°C, the sharks will follow the Gulf Stream to North Carolina and points south for the winter—perhaps even to immortality in the records of the American Littoral Society.

Three of the sharks hooked that day got no second chance because several souvenir-hunters on the boat wanted to take home a pair of jaws. These beasts were lassoed just below the head while they were still dragging in the water, a practice that served to take some of the spunk out of them. (Immobilizing them in the water would have a similar effect because sharks have to keep moving, even in their sleep, to get enough oxygen.) The crew then slashed them below the gills to cut their brachial arteries. Once back in port, the beasts were hauled onto the dock where a young boy zestfully slammed them on their heads with a length of pipe until they stopped twitching.

The tab for this particular trip was picked up by the New York Zoological Society, which wants sharks for its aquarium. Oliver just went along to watch this time because the aquarium has had some bad luck with sharks. Last year the aquarium brought back four sharks. They survived the trip, but died in the aquarium. No one knows why. The aquarium did have a sand tiger and a sandbar who coexisted happily in the same tank for a year until one day when it was discovered that the former had eaten the latter. No one knows why that happened either, except, as Macmillan observed, "with sharks, everything is food—there's no emotion."

—CONSTANCE HOLDEN

American Littoral Society

The American Littoral Society was set up in 1961 as a conservation and information organization for those interested in fish and in preserving the ecology of coastal areas. It has been growing fast in recent years and now has about 4000 members, most of them concentrated between Boston and Baltimore and the rest scattered around the country and the world. A good many members are fishermen, but there are also divers, marine biologists, ecologists, chemists, teachers, and birdwatchers.

A chief concern of the society is the preservation of wetlands—estuaries, tidal rivers, and marshes. About 70 percent of the marine life around the northeast coast depend on these areas at some time during their life cycles. Conservation Director Derry Bennett says the society is particularly concerned about the destruction of wetlands by dredging and filling operations for industry and for the construction of private shoreside residences.

The society, whose offices in Sandy Hook, New Jersey, are supplied rent-free by the National Marine Fisheries Service of the Department of Commerce, also supplies advice on matters ranging from marine careers to underwater photography. It arranges field trips, holds an annual symposium at Hunter College in New York, and publishes a bulletin called the *Underwater Naturalist*. It is a friendly organization that will tell you why fish change color, the difference between a pollutant and a nutrient, the relationship between mosquitos and fiddler crabs, and why waves hit the beach at an angle. It does not engage in lobbying or lawsuits, although it works to educate the public on the need for state wetlands legislation.

One of its major undertakings is its fish-tagging program. Tags are sold to members at \$1 per five-tag kit, and they can tag any fish they want, from shark to snook. In the past 10 years, the society has tagged 47,500 fish. The return rate varies, but it is probably at least 5 percent.

—C.H.