

# Wolves of the Sea

**I**N MASK AND SNORKEL I was diving in 15 feet of water off the western shore of North Bimini, tiny Bahama island. A jumble of coral-encrusted boulders lies on the bottom sands at this point; among them dwell thousands of brilliantly colored small fishes.

One moment I was surrounded by these vivid jewels of the warm salt seas. In the next I was uneasily alone, for my small friends had all dashed for shelter into crevices in the rocks or to concealing jungles of grass and sea fans. Turning seaward to discover what had alarmed them, I saw a shadow in the depths grow into an eight-foot-long torpedo headed directly at me.

Some 20 feet away it turned broadside. An eye the size

223



# SHARKS:

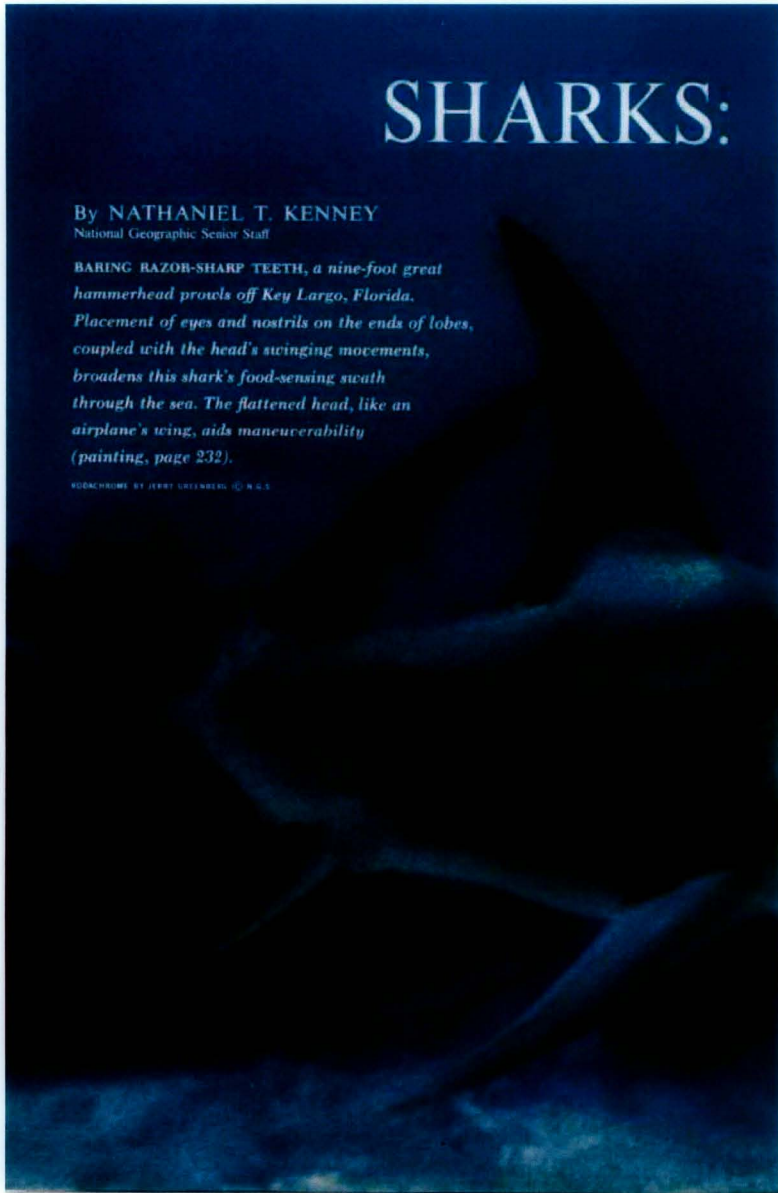
By NATHANIEL T. KENNEY

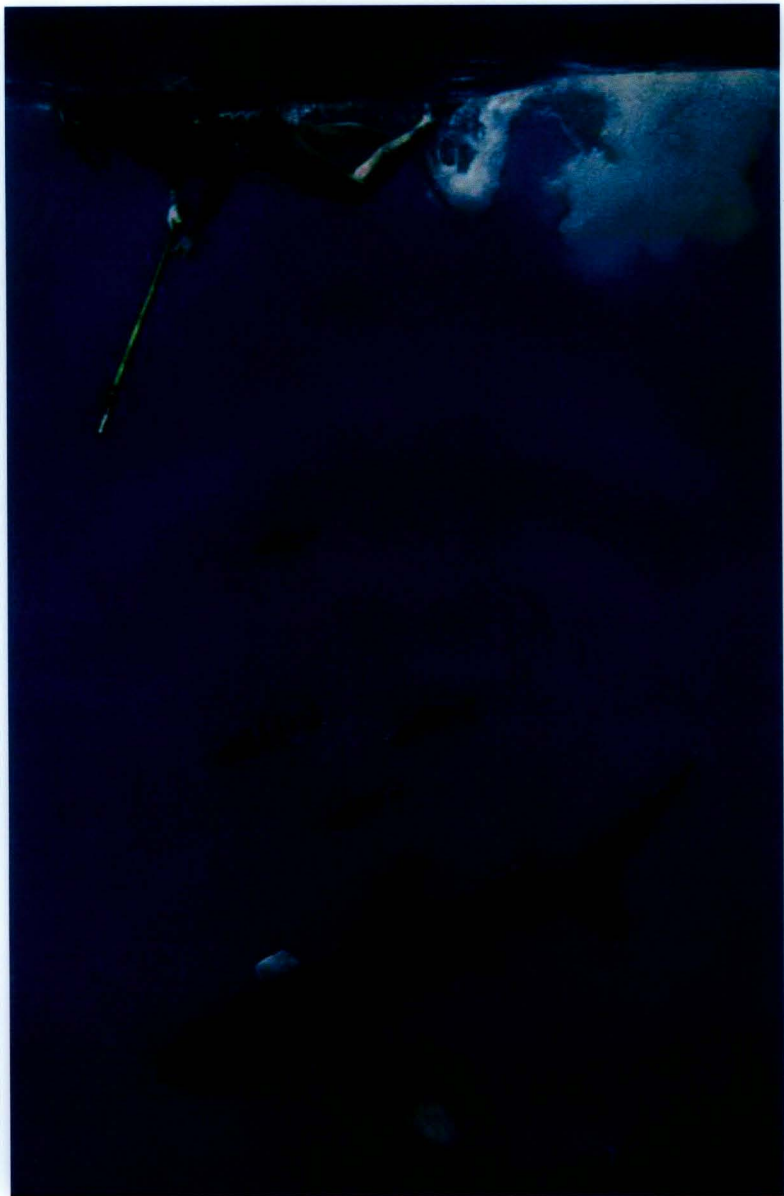
National Geographic Senior Staff

*BARING RAZOR-SHARP TEETH, a nine-foot great hammerhead prowls off Key Largo, Florida.*

*Placement of eyes and nostrils on the ends of lobes, coupled with the head's swinging movements, broadens this shark's food-sensing swath through the sea. The flattened head, like an airplane's wing, aids maneuverability (painting, page 232).*

ILLUSTRATION BY JEFF GREENBERG © N.G.S.





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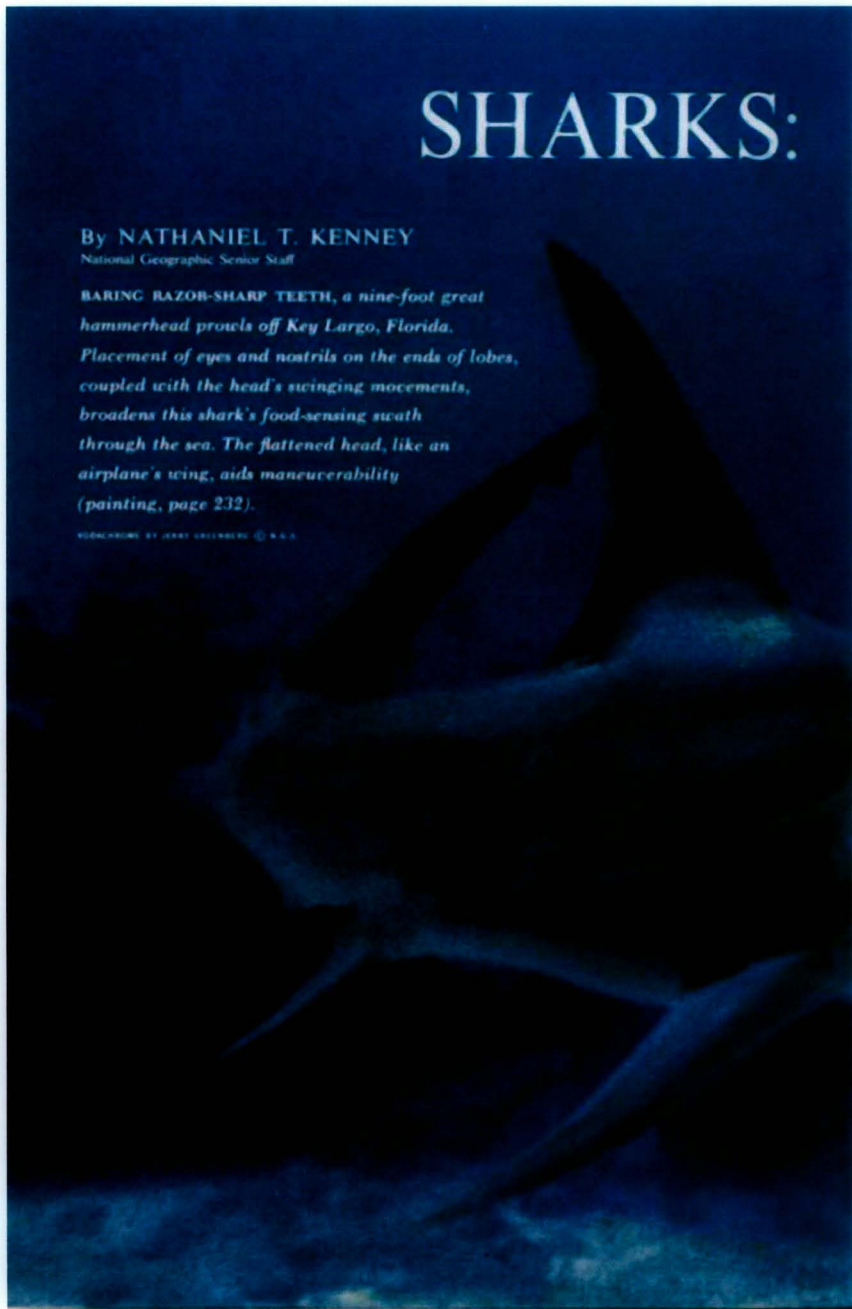
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ILLUSTRATION BY JERRY CALLENBERG © N.G.S.



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Navy scientists seeking another weapon for divers have tested poison syringes on sharks in the blind pens of the Lerner Marine Laboratory, a field station of the American Museum of Natural History of New York. They were seeking a defense for underwater demolition teams. They found that strychnine killed, but took up to a minute for a large shark. In this time, the creature might yet kill or injure a diver.

#### What Triggers a Shark Attack?

One of the puzzles facing experts is why a shark in one part of the world harasses humans while its brother of the same species in another place does not. The late Dr. V. M. Coppelson, an Australian authority, thought water temperature was one factor. Most attacks occur, he concluded, above 70° F. Great white sharks, however, have attacked California divers in 55° temperature, and the Greenland shark, as well as the northern porbeagle, feeds in even colder water.

Dr. Coppelson also believed that multiple shark attacks in an area could be the work of a single "rogue," the marine parallel of the Indian tiger that has acquired a taste for human flesh. Stewart Springer, on the other hand, feels that entire shark populations living in less than ideal natural conditions may be dangerous to man.

"Principal populations of sharks establish themselves, quite naturally, in areas where food is abundant and other conditions are good," Stewart said. "The area may be large: Some

species of sharks migrate over regular ranges, like African big game.

"Around the edges of the principal area you will find an accessory population that includes congenital weaklings, cripples, or possibly neurotics—all of them animals that can't compete with the others and drift away from them.

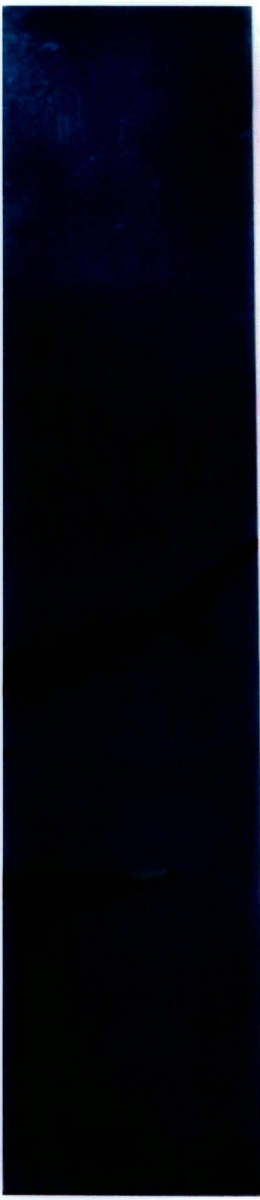
"Life is harder for these peripheral sharks, and they may be the dangerous ones. As you might expect, they take whatever food comes along. This could be man."

The bull sharks of fresh-water Lake Nicaragua may be an accessory population. Dr. Thomas B. Thorson of the University of Nebraska, who has studied these fish for eight years, is reasonably sure that the sharks come in from the Caribbean Sea via the San Juan River. Scientists once believed the lake sharks to be a separate species, blocked from the sea by the San Juan's rapids. Now they are virtually sure the rapids are no barrier.

The Smithsonian file records attacks on humans by Lake Nicaragua bull sharks. People nevertheless swim in the lake, and Dr. Thorson once watched a party of Nicaraguan soldiers happily splashing near shark lines he had set out!

#### The Only Certainty: Uncertainty

After I had begun this article, I stopped by to see Cliff Townsend at Marineland of Florida, where I had earlier helped the collecting crew add a pair of lemon sharks to the main fish tank.



Sharks are close relatives of skates, rays, sawfish, and guitarfish, the latter named because of their unusual shape. All these have skeletons of cartilage and are called elasmobranchs; the other (far more numerous) fish, the teleosts, have true bones.

Between bony fishes and cartilaginous sharks lie many other differences. Most shark species produce live young, although some lay eggs. The horny egg cases from which skates and certain small sharks have hatched in the water are the "mermaids' purses" washed up on ocean beaches.<sup>6</sup>

No other fish can match a shark in jaw power. Perry Gilbert has measured this force with ingenious apparatus. The readings came out in tons, not mere pounds (pages 250-51).

From 20 to several hundred teeth, depending upon the species, stand in the ready-for-business rows at the front of shark jaws (page 229). Normally, five or six sets—but in some species as many as 15—wait in reserve behind, continuously moving forward so that when front teeth drop out, new ones take their place; in the young of at least one species, this occurs as often as every eight days. New teeth are always larger than the old to match the shark's growth.

One of the most persistent shark myths holds that, to use these teeth, the animal must roll over on its back or side. Not so. Of hundreds of sharks I have watched feeding, not one ever turned over to attack its prey. Sharks, however, are agile, and could do so if they chose.

#### **Rough Hide Once Used as Sandpaper**

Shark teeth grow not only in the jaws, but on nearly every square inch of hide, in a crude form called placoid scales, or dermal denticles. Abrasive shark hide, known as shagreen, was once used as sandpaper in cabinetmaking.

Air-filled swim bladders give bony fishes buoyancy. Sharks have no such thing. If they stop moving, they no longer plane on their bellies and fins, and they sink to the bottom.

Most sharks swim from birth to death for an even more vital reason. Their breathing machinery lacks adequate pumping apparatus; only forward movement passes oxygen-bearing water over their gill surfaces.

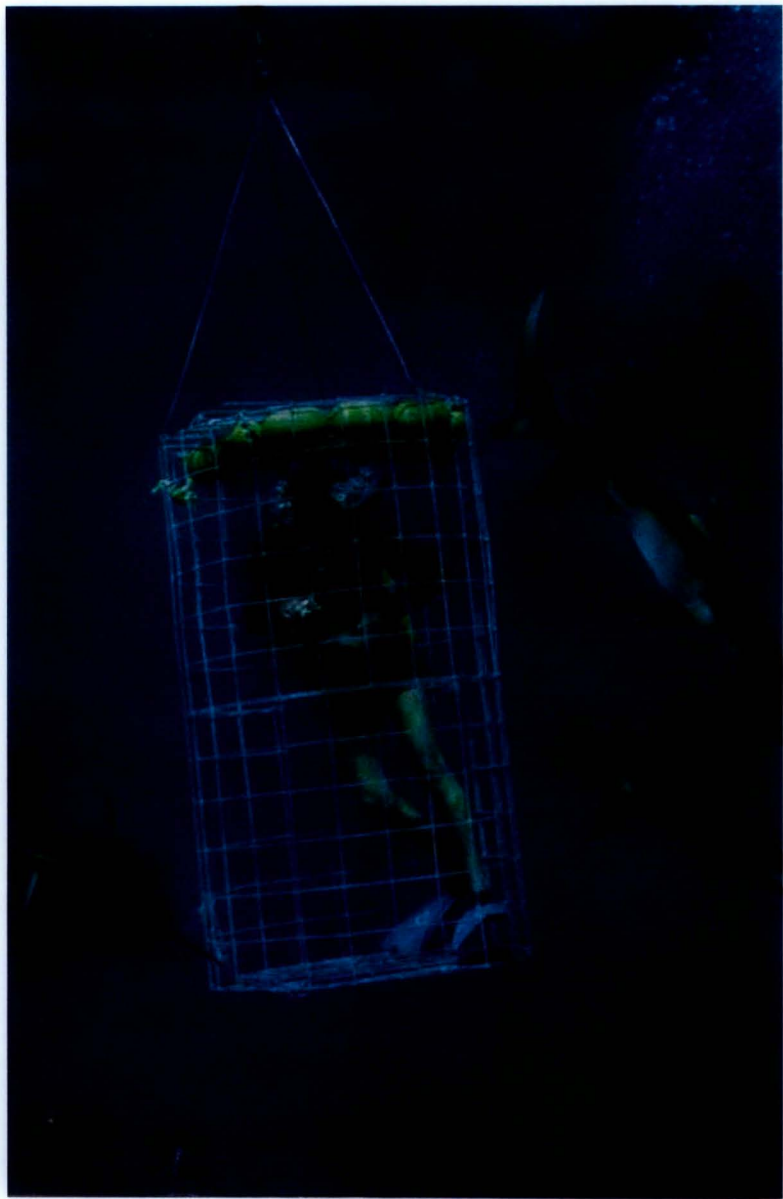
Dropping dynamite into a school of bony fishes will injure their swim bladders and kill or cripple them. Unless it is a direct hit, an explosion doesn't appear to harm sharks. In fact, it seems to attract them.

<sup>6</sup>See "Miracle of the Mermaid's Purse," by Ernest I. Libby, NATIONAL GEOGRAPHIC, September, 1959.

**Descending into the blue underwater world** in a protective cage he designed, diver J. G. Stemples finds himself surrounded by aggressive silky sharks. Bag in his hand, containing pieces of herring, attracts the pack into camera range as the strong but lightweight cage dangles 15 feet below the surface in Tongue of the Ocean. Plastic floats at the top keep the cylinder almost weightless. If the buoy line snapped, Stemples would escape through a hatch.

At work on a photographic study of the shark population in these infested waters, Stemples looked down once to see a small silky shark halfway inside the cage, and quickly kicked it out. Jerry Greenberg, outside the cage, found "one nipping at my swimming fins, and another giving my light meter a taste test."

ILLUSTRATION BY JERRY GREENBERG



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1965, when a surfer suffered a minor bite on one thigh. Attacks on surfers, incidentally, appear to be on the increase.

"Because a shark can swim over or past a net, it was a mystery at first how meshing protected bathers," said Beulah Davis of Natal Province's Anti-Shark Measures Board. "One reason may be that our sharks mostly belong to a local, nonmigratory population, and the nets caught just about all of them."

Sharks off Hawaiian beaches also appear to be nonmigratory. Last year, under Dr. Tester's direction, the 50th state opened a three-year campaign to eradicate them so far as possible, using set lines with hooks at 60-foot intervals. One of the first results was a noticeable decrease in a concentration of large tigers off Honolulu harbor.

Some 40 miles north of Durban, the golden sands of Zinkwazi Beach used to be lonely, unused because sharks swarmed in the creaming surf. Now they are meshed, and holiday-seekers come in increasing numbers.

Len Flowers, a professional fisherman, tends the nets. I went with Len to overhaul

them. They held only a small cow-nosed ray.

"I don't believe you have sharks around," I remarked.

"No?" said Len. "Hang on." With that he headed the boat seaward.

Choosing a spot over a reef a mile offshore, he dropped the anchor, and we began fishing. Immediately we caught several five-pound Cape salmon, or geelbek. We stunned them and tossed them overboard. Within seconds the sea boiled with sharks, some six feet and more long.

"Here are our friends," said Len. "We'll be lucky now to catch a single whole salmon."

We scarcely had a chance to try before the ravenous sharks began banging against the boat. Fear gripped me. Even Len confessed to some nervousness.

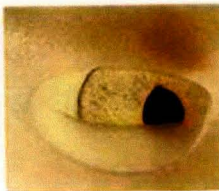
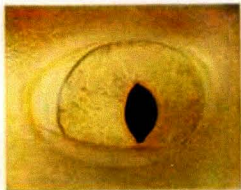
To get through the surf without swamping, the boat had been decked over. We sat on it, not in it. Handholds were few. The sea that day was high. An eight-foot shark struck at the outboard propeller, although we had taken the precaution of tilting the motor to bring the propeller out of water.





PHOTOGRAPHY: CAROLINE AND ASSOCIATES/RESEARCH BY STEVE HERSHBERG © W.P.P.

**Testing the vision** of a young lemon shark, research assistant Samuel Gruber of the University of Miami's Institute of Marine Sciences employs an ingenious apparatus that he devised. The shark is lashed down in a tank of circulating water, its nose fitting into a Flexiglas hemisphere. At intervals the lamp at right flashes filtered light of varying color and intensity, at the same time a mild electric shock causes the fish to blink. Eventually the shark becomes so conditioned that it blinks when only the light is flashed, an indication that it can see that particular color or level of light. Utilizing this approach, scientists hope to determine whether sharks distinguish colors. The knowledge would be invaluable in designing garments and gear for use in the open sea.



With a **blink**—the upward movement of a nictitating membrane that serves as an eyelid—the lemon shark responds to a shaft of light. Infrared detector enables scientists to observe each “wink” during the experiments in a darkened testing room at the institute. As the shark’s eyes gradually become adapted to the darkness, its pupils begin to expand (right).

**How sensitive is a shark to sound?** It can hear moving objects in the water at a greater distance than it can see them, tests on young lemon sharks reveal, and its ability to locate the source of the sound is highly developed—vital to a predator (diagram, pages 250-31). A scientist at the institute prepares to place a live specimen in a water-filled tube into which sounds will be projected from the electronic equipment in foreground. Conditioning the shark with electric shocks, the researchers learn what frequencies the fish can hear and its degree of sensitivity to sounds.





impersonal level, the shark's inroads on commercial and sport fisheries, and you have a malefactor of some consequence. But it was not until fairly recently that science organized to study sharks and seek ways of controlling them.

#### Disasters at Sea Spur Shark Research

Blood-chilling mass attacks on survivors of torpedoed ships and crashed airplanes in World War II gave the initial impetus to the search. After the war, interest in sharks not only increased but broadened. We not only wanted to know how to protect swimmers and divers; we also sought an insight into the undoubtedly large part sharks play in the ecology of the seas.

The postwar human population explosion spurred this interest in sharks. One day, we realized, earth's soil might no longer support

us all, and we must exploit the waters—71 percent of the world's surface—or perish.

Divers in unprecedented numbers began searching the depths for oil and metals and ways to farm the oceans, in which are locked vast quantities of protein yet to be tapped; some worked from self-contained sea bottom communities pioneered by Edwin A. Link, the U. S. Navy, and Jacques-Yves Cousteau.\*

Encounters with sharks became everyday occurrences. Plainly, more knowledge of the fish was needed. In 1958, the American Institute of Biological Sciences, Washington, D. C., agreed to meet the challenge. It offered to serve as an international clearinghouse and repository for shark knowledge, and formed

\*See, in the *GEOGRAPHIC*, "Working for Weeks on the Sea Floor," April, 1966, and "At Home in the Sea," April, 1964, both by Capt. Jacques-Yves Cousteau; and "Outpost Under the Ocean," April, 1965, by Edwin A. Link.

(painting, pages 232-4) I am forced to say "about." Here is yet another gap in the body of shark knowledge, and the figure could be wrong by at least 10 either way.

Of all the shark species known at present, only a handful can be listed as proven eaters of man. Against some of these there is the incontrovertible evidence of human remains found in stomachs, teeth left in wounds of victims, and eyewitness identification by unimpeachable experts. Against others stands the strongest kind of circumstantial evidence, including the characteristics of wounds and the proven presence of the shark species at the scene of attack.

#### Nine Killers Admit No Argument

Every list of proven man-eaters agrees on nine sharks. These are the great white, which also bears the name "man-eater", mako, bull, lemon, tiger, dusky, blue, the largest hammerheads, and the whitetip, a pelagic shark, meaning one that dwells at or near the surface of the open seas away from land. All these sharks have attacked living humans as well as corpses.

To the sinister roster, some authorities add the Pacific Ocean gray and the Australian whalers. Several species may share these same names, and some of these may prove to be sharks known under yet other names in different parts of the world.

In addition to the "proven" man-eaters, there is a category of sharks—and the experts don't always agree on the individual species—best characterized as "reasonable suspects." The porbeagle is one, and the sandbar, or brown, is another. So is the silky, named for

**Real-life Moby Dick**, a great white shark matches the fury of fiction's famous whale in a sudden attack off Canada's Cape Breton Island. Seas swamped the splintered dory of two lobstermen; one of them drowned, and the other clung to the wreckage until rescued. Apparently scorning them, the animal swam away to seek a meal elsewhere.

The painting re-creates the harrowing experience of John MacLeod, who survived, and John Burns, who died, on a summer morning in 1953. A tooth embedded in the battered boat identified the species. The shark's length was estimated at about 12 feet, and its weight probably exceeded 1,000 pounds.

Mr. MacLeod still fishes the same North Atlantic waters.

**Ravenous silky shark** charges diver Donald Nelson. Frantically, Nelson pushes away the six-foot attacker with one hand and with the other aims his short-handled underwater gun at the shark's head. An instant later the would-be killer swam away to thrash out its own death agony.

Photographer Greenberg, swimming with Nelson off Florida, snapped this remarkable picture even as he himself desperately maneuvered to avoid attack.

