

The shadows of the sea: people fear shark, but they are vital to the sea.

by Jack Rudloe and Anne Rudloe

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THE SHADOWS OF THE SEA On Sept. 13, 1988, Susan Barnes, Jon Martin and Terry Segrest, Martin's girlfriend, anchored their 17-foot boat next to the enormous granite blocks that form one of the two St. Andrews State Park jetties in Panama City, Fla. It was a pleasant afternoon, and they had just finished a picnic lunch when they decided to go for a leisurely swim. Soon, the two young women saw porpoises rolling in the surf nearby. Back they climbed into the boat. Martin, still in the water, chided them for being afraid.

"I'm not afraid of them," Barnes retorted. "I just don't want to be in the water while they're around me."

Martin, according to the Florida Marine Patrol report, continued to tease the women about sharks, humming the drumming score from *Jaws*, knocking and jolting the boat like Peter Benchley's great white shark. Suddenly Martin jerked spasmodically. "Help me, help me!" he yelled.

Even when Barnes saw a six-foot black shape beside Martin, she thought he was joking, extending his leg out to look like a shark. But when he began reaching underwater to fight something off, the two women screamed and tried desperately to pull him into the boat.

His hands were in shreds. Each woman grabbed an arm, but at 220 pounds, Martin was too heavy to lift. The shark bit down on his right leg, just below the knee, and hung on until the grisly tug-of-war stripped all the flesh off the bone. Martin went into shock. The women managed to lift him halfway into the boat, when the shark circled back for another attack. They held on to Martin as the shark shook him, tearing a massive chunk out of his right thigh. The women got a close-up look at its dark-gray 18-inch-wide head, its rounded nose and its smooth triangular teeth. From their description, experts later surmised that the attacker was a bull shark, a known man-eater.

Segrest told Barnes to start the motor, hoping to scare the shark away and pull her boyfriend to the beach. But when Barnes hit the switch, the boat lurched forward and stalled, and Martin was jerked from Segrest's grasp. People in a passing boat had heard the women's screams and seen the bedlam. They rushed to help. Martin lay face down in a bloody sea. The rescuers gaffed his bathing suit, and pulled him to the beach. He was dead.

When Martin knocked on the boat, he may have caused the fatal attack. Scientists know that sharks detect and home in on low-frequency sounds (between 50 and 1,000

hertz). Polynesian shark fishermen traditionally pound the gun-wales of their boats with clubs to draw schools of the predators. During the attack, Barnes and Segrest had seen two other sharks circling the boat.

About half an hour later, the dive boat Capt. Scuba II, held inshore by hurricane-caused turbulence and murkiness out in the open Gulf of Mexico, dropped anchor near the site of the fatal attack. Ignorant of what had just happened, a group of vacationers put on masks, fins and snorkels, and dived into the water to explore the St. Andrews jetties. Claude Perdue Jr., from Kingsport, Tenn., and two friends were stroking toward the jetties when Perdue felt his left flipper bump something. Instinctively he drew his leg up to see what it was. Then a shadow behind him darted in, grabbed the fin off his right foot and sped on. Perdue and his friends bolted across the water to the nearest boat, 50 yards away. The other divers were piling in behind him when they heard screams of "Shark!" coming from the shore.

Harold and Dorothy Hadden, of McDonough, Ga., had also been on the Capt. Scuba II, but swam off toward an area known as Shell Island Beach instead of toward the jetties. They noticed a dark shape circling them as they swam and waded in the shallows, and thought it was a porpoise. Suddenly, a shark's head rose out of the water and grabbed the woman's right arm in its teeth. She screamed as her husband kicked at the attacker. The shark let go. Hadden had gotten his body between the shark and his wife, shouting for her to get to the beach. The fish kept coming, and he kept pounding it, abrading his hands on its rasping hide, kicking out, pushing it away. His fist went into the shark's mouth and it clamped down, inflicting severe puncture wounds on his arm, but the fish let go as the couple backed into the surf line. After the bleeding pair had fought to where the waves were breaking, the shark ended its attack.

Mike Haglund, captain of Capt. Scuba II, radioed the Coast Guard for help. While they waited, Haglund and his mate watched a large shark--possibly the killer fish--swimming up and down the shoreline. "It acted funny," he re-called. "It didn't seem to be in any kind of rush, it didn't go anywhere or try to get away. I've seen a lot of sharks in my time," he said, "but I've never seen one like that."

Quickly, the Florida Marine Patrol issued warnings to swimmers and began flights along the shoreline. A school of 200 blacktip sharks was spotted in the area, but that, in itself, was not unusual. According to Ren Lohofener of the National Marine Fisheries Service (NMFS) in Pascagoula, Miss., schools of sharks often congregate

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along sandy beaches, intermixed with swimmers and fishermen. In recent years, NMFS biologists have conducted aerial surveys along the northern beaches of the Gulf of Mexico. Looking down from 1,000 feet at the white surf, they have seen hundreds of sharks. "They're just sitting there, right on those sandbars in two or three feet of water," says Carol Roden, a biologist with the project. "Aside from hammerheads, we can't tell what species they are from up there. Sometimes we see people wading out and surf casting right next to them. I want to shout, 'Get out of there!'"

The truth is, sharks and people have been swimming together for a long time, and people are generally not bothered by the fish. It's estimated that 40 to 100 shark attacks occur per year worldwide, fewer than 20% of them fatal. But to the family of Jon Martin, the statistics are cold comfort.

What happened, then, in Panama City (which, in the grimmest of ironies, is only 40 miles from where the movie *Jaws II* was shot)? Why did that shark attack when it did? Or did several sharks attack? Mike Brim, a marine biologist who happened to be nearby at the time, reported that the water was unusually murky in the area at the time of the attack. Hurricane Gilbert, one of the largest storms of the century, hit the Yucatan Peninsula the next day. Hurricane Florence had recently passed near the Panama City area, and with it had come ultralow barometric readings and disrupted surf patterns. Could any of these occurrences have affected the shark? Or was the attacker a sick or injured shark? Would it strike again?

On June 29 of this year another group of divers was spearfishing on a wreck nine miles off Panama City. Sharks appeared, and the divers fled the water. Witnesses aboard the dive boat *Duchess* saw Rick Webster, a policeman from Bartlett, Tenn., frantically waving his spear gun; his personal flotation device was inflated. Suddenly he was snatched violently beneath the surface and was never seen again. Was it a shark? Nobody knows for sure. It's a big ocean, and sharks move in the shadows. Considering that sharks are among the most ancient of creatures--they have been around for 400 million years--and are among the most diverse--there are 350 species, ranging in size from six-ounce cigar sharks to 15-ton whale sharks--it is amazing how little man knows about the fish. The following report is the result of a study conducted aboard a commercial fishing boat, another aboard a sportfishing vessel, and with a landmark research project.

Long a traditional dish in Asia, Europe and Latin America, shark--often billed as mako, although several species are succulently edible--has become popular fare in parts of the

U.S. over the past decade. Dr. Robert Hueter of the Mote Marine Laboratory in Sarasota, Fla., has monitored the increasing rate of commercial shark fishing in Florida during the 1980s. Often the number of sharks landed has doubled from one year to the next, and now this \$3 million fishery takes well over 100,000 sharks each year. Many end up as domestic table fare, but a lot are pursued for their fins, which are much sought after in the Far East for soup.

The commercial fishing boat we sailed on in May 1988 was specially built for long-lining and was on only its second voyage. Its huge reel spewed out mile after mile of line into the night sea somewhere in the Gulf of Mexico south of New Orleans. It was hard and dangerous fishing. As the running line played out, the crew worked feverishly, snapping weights and hooks baited with snake eels onto dropper lines. Several hours later, the men began the slow process of hauling back. "Got a shark coming," a crew member hollered. A hard snatch yanked up a six-foot blacktip through the starboard gateway. The shark went wild, thrashing, beating its body back and forth. With a loud whack, a blow from a machete parted the sandpaper skin and left a deep cut behind the head. The shark stiffened and twitched. Another swipe, and off came the tail, blood gushing out of the fish's caudal artery in a steady stream. Then another chop took off the first dorsal fin, then the second dorsal--dried, they will sell for \$20 to \$25 a pound. The shark gave a violent twitch as members of the crew twisted its head around and around to remove it; they threw it, with the still-attached guts, into the sea. The kidneys were blasted out of the carcass with a deck hose, to prevent the flesh from being contaminated with the strong smell and taste of urea. The finless, headless "trunk" was heaved down into a bin to be brought to market.

More sharks came aboard, and thick clotted blood ran through the scuppers and stained the sea. The trunks piled up like cordwood. It took a hydraulic arm to lift a 10-foot, 680-pound female dusky shark aboard. Inside her belly a dozen unborn pups squirmed around in the uterus, visible through the membrane. Female sharks of many species do not reproduce until they are 11 or 12 years old. Then, they bear only eight to 10 live young every other year. Biologists fear that heavily fished shark populations may recover their depleted numbers very slowly or not at all.

"So what!" is a common reaction to that conjecture. "The sooner they're gone, the better," says a fearful--and largely ignorant--mankind. But a fishery worth millions of dollars will be gone, too. Since 1900. Scottish spiny dogfish, harmless basking sharks and porbeagles have virtually disappeared from the North Atlantic, as have school sharks off Australia, and soupfin sharks off California. Blue

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sharks, threshers and angel sharks appear to be reaching the overfished stage on the Pacific coast.

Ironically, the population of great white sharks, the most renowned man-eaters, is increasing, at least along the California coast. It was off Zuma Beach, about four miles from Malibu, that two abandoned kayaks were found lashed together, one behind the other, on Jan. 27 of this year. The body of one of the kayak owners, Tamara McAllister, 24, was found the next day, floating 50 miles away. She had suffered a massive shark bite, 13 inches across her left thigh. The young woman didn't drown, she bled to death. The coroner said there was evidence that McAllister had been flailing the water. There were classic signs of an attack by a great white shark. McAllister's boyfriend, Roy Stoddard, a fellow UCLA graduate student, had been in the other kayak. He was never found.

John McCosker, director of the Steinhart Aquarium in San Francisco, says, "I doubt they ever saw the shark, no more than a sea lion floating on the surface ever sees the one that kills it. To the shark's eye looking upward, the silhouette of the kayaks must have looked like normal prey, a big sleeping elephant seal.

"We already have one of the largest white shark populations in the world. As the mammal population grows, it appears the shark population follows. And so will attacks on humans. I heartily endorse the Marine Mammal Protection Act, but that's the reason the great whites are increasing."

Sharks are predators at the top of the food chain, the awesome wolves and tigers of the ocean. They are critical in maintaining the ecological balance of the seas. If they disappear, it will affect many other species. California sea lions and seals are multiplying rapidly--the estimated current population of 90,000 sea lions is double that of 10 years ago--and scientists think that the great whites are needed to cull the sick and the slow in order to maintain a healthy gene pool. Sandbar sharks, blacktips, lemons and sharpnose sharks eat finfish that feed on shrimp; a multimillion-dollar shrimp fishery could be harmed should those species of sharks become depleted. Bull sharks and hammerheads are major predators of stingrays. If those sharks are fished out, will the venomous flat fish that injure hundreds of bathers each year proliferate? Sandbar sharks feed on octopus, which in turn feed on stone crabs. If the sanbars are eliminated, will the stone crab fishery also come to an end?

At the same time that the commercial fishery for sharks has intensified, sport-fishing for the species has also become popular. In September 1988 we boarded the Mindi, one of 30 craft competing in the 13th annual Port

Salerno, Fla., shark tournament.

The weather wasn't cooperating for the three-day event, and the 40-foot charter boat pounded in the waves. Spray blasted the windshield. Captain Yogi McIntosh clung to the wheel and throttles, slowing down and then speeding up the throbbing diesel as we worked our way offshore. Rick and Chuck Stillwell from Port Salerno had paid \$1,200 to charter the Mindi for the tournament.

At last we stopped and dropped the outriggers. Out came the rods and reels, and McIntosh baited up with live mullet that he had caught earlier with a cast net. "The mullet are doing the chumming for us," said McIntosh. "A shark can smell them a mile away and here he'll come." Sharks can detect minute quantities of a substance in the water--as little as one part per billion--and home in on it.

The lines played out. If ever there were distressed fish giving off vibrations, these were. The mullet sped desperately into the depths. When a shark closes in, it is aided in locating a potential meal by being able to detect electrical fields of one hundred-millionth of a volt through their ampullae of Lorenzini, the little jelly-filled pits, which are electroreceptors, found on the undersides of their snouts. They sense the electrical fields generated by the muscle activity in other animals, which is why certain sharks can locate and seize flounder that lie completely buried beneath the sand.

Only minutes passed before one of the rods bent violently. "It's a hit," yelled McIntosh, dashing forward, grabbing the rod and whipping it backward to set the hook. Rick Stillwell jumped into the fighting chair, took the bending rod and began reeling madly. It wasn't a monstrous shark, but it took all his strength to keep it coming toward the boat.

In a few moments the shark surfaced. It was a hammerhead of barely 50 pounds. McIntosh slipped on his gloves, leaned over, taking a wave in the face, and grabbed the leader. "Hell, he ain't hardly hooked!" McIntosh cried out. He reached down and grabbed the shark by its airfoil-shaped head, and with all his might jerked it up. Everyone scattered as the fish pounded the deck with its tail, arcing its grotesque hammer about the snapping its semicircular mouth filled with small, sharp teeth. McIntosh suffered a good wallop from the tail. Shortly afterward, a larger hammerhead was hauled up. This time McIntosh subdued it with a snub-nosed .38. As abruptly as the action began, it stopped. There would be no more sharks caught by the Mindi this day. When we arrived back at the dock, an enormous bull shark was haning from the crane at Port Salerno's Sandsprit Park. It weighted out at 384 pounds and was enough to earn the team of Mike Simonds and Robert Mostler the \$2,500 first

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prize. Crowds of people milled around the nearly nine-foot-long fish, gazing up at it with expressions of awe and fear, and watching biologists who were examining the catch.

"We enjoy having the biologists come down," said Karen Worden, one of the organizers of the tournament. "I can't see doing something like this and killing for nothing. We don't take enough to hurt--over the years the tournament's had as few as 18 and as high as 56 sharks." Thinking of the mass slaughter we had recently witnessed on the long-liner, I couldn't totally disagree with Worden's view.

After the biologists measured the fish--recording such things as the size of the fins, the number of its teeth, the length of its body--they dissected it. Tissue samples, frozen on the spot in liquid nitrogen, were collected by Mote Marine Lab's Hueter and his research team for a study on the genetic differences among shark populations. The shark's gut was empty, and so was the uterus. "Looks like she recently pupped," Hueter said, holding up a flaccid oviduct.

As a rule, when a female shark gives birth, she stops feeding and swims offshore, away from the nursery grounds. She will not feed until she has traveled a considerable distance from her young. It is possible that this instinct reduces cannibalism, because large sharks are known to dine heavily on smaller ones.

There was something atavistic about the scene at Port Salerno, something from our earliest hunter-gatherer ancestry, when people came together to watch a large something being dismembered for dinner. As Worden said, "People are afraid of them, yet they want to see them. If all we had were bluefish, there wouldn't be a fraction of the crowd."

Blacktip, sandbar, tiger, bull, dusky, hammerhead, silky--we know very little about any of the sharks. We certainly do not know how many years it takes for a population to replace itself. Lemon sharks grow about four inches a year and don't reach sexual maturity until they are 13 to 15 years old, according to Dr. Samuel H. Guber of the University of Miami. That seems slow for a fish, but among sharks, who knows? Several blue sharks tagged off New Jersey by NMFS scientists showed little or no growth on recapture seven years later.

We joined Gruber's research team as it worked off the Marquesas, the tiny uninhabited islands west of Key West. That town's clutter faded into the distance as we sped over the meadows of sea grass and coral reefs, heading for a rendezvous with the research vessel Columbus Iselin, a 175-foot symbol of the effort underway here to understand

shark biology.

After lunch we joined a team that uses ultrasonic tags to track juvenile lemon sharks in the shallow sea-grass flats between the islands. The water was too shallow for an outboard, so an airboat was used. Through a deafening roar Erich Glavitza, a manufacturer of snowmobile engines whose hobby is studying sharks, drove us over the flats in pursuit of two-foot baby lemons. Chip Pike, a graduate student of Gruber's, was stationed on the bow, dip net in hand. We zigzagged in hot pursuit of a fleeing sharklet, running it to exhaustion so that Pike could swoop it up in a net. Then the shark was rushed to a large chain-link pen that had been assembled in the shallow water of the flats.

When we arrived, several baby lemon sharks were moving restlessly around the pen, their tails undulating. After eons of evolution they have become creatures of motion, of streamlining, with triangular fins that cut the water cleanly, allowing them to pursue prey with both grace and violence.

With long-handled nets, Pike and John Morrissey, another graduate student, stalked the small lemons, grabbing at the sharks as they sped between their legs. Soon silt stirred off the bottom, and the dark forms moved like bombers through cloud formations. At last the students caught one. It squirmed as they held it aloft. Small holes were punched in the fish's dorsal and pectoral fins for quick visual identification. Sutures closed up an incision in the muscle where a sonic tag had been implanted. A yellow plastic tag, marking the implant, protruded from its back.

They turned the little lemon loose, and it sped off across the flats. Now and then a tiny set of triangular dorsal fins appeared on the water's surface for a second, throwing a small wake before vanishing. Morrissey waded behind, dragging a hydrophone through the water, listening through the earphones for the occasional ping that indicated contact with the little shark. The scientists had named it Moxie.

Slogging through the vast tidal flats in pursuit of Moxie, Morrissey said, "We've learned that baby lemons go back to their home base and stay in about a 400-meter zone, about 50 meters wide, along shore. They patrol the same piece of bottom over and over again, and we haven't the faintest idea why. They aren't territorial, they don't defend their strip, their populations overlap. But they all have their own strips staked out."

Another team, headed by veterinarian Dr. Charlie Manire, was tending research longlines a mile away. In those deeper waters a six-foot nurse shark snatched and jerked against the lines when the team approached. They hauled

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it to the surface, put a loop over the fish's tail and another around its head, just in front of the dorsal fin and behind the pectorals, and with much difficulty they secured it to the gunwale of their 20-foot skiff. "Hold the tape on the nose," someone called out, above the splashing and grunting. Quickly, but with caution, they measured the distance from the nose to the first dorsal fin, the space between the fins, and the length of the tail, checking for small differences between this shark and those elsewhere that might indicate separate populations.

Among other things, the measurements helped determine the dosage of tetracycline that would be injected into the body cavity of the fish. This antibiotic leaves an identifiable reference mark in the shark's cartilaginous spine. If the shark is ever recaptured, the number of growth rings that have been formed since creating the marker will provide accurate information on its growth.

The scientists jabbed a tag into the nurse's dorsal fin--a long piece of monofilament with a tube attached containing a scroll of information for fishermen on what to do should they capture the shark. Then the team took a blood sample, rolling the creature on its belly, cutting through the hide to insert a needle, and drawing a syringe-full out of the tail artery. The blood would later be analyzed on the basis of 12 different parameters. Of most interest to Gruber is the role hormones play in female shark reproduction.

Then the hook was pried as gently as possible from the shark's jaw, and the fish was sent on its way. The nurse took off with a great swish of its tail. It seemed more annoyed than damaged by the experience. That is not always the case.

A struggling 6-1/2-foot lemon came up next, full of life when the scientists first approached. But by the time they got it mouth-up with dorsal fin down--which has a tranquilizing effect on sharks--most of its life seemed gone. "When you catch them, a few specimens seem to give up and just fade away," said Glavitz.

Manire held the lemon nose-down with one hand and worked vise-grip pliers back and forth, trying to get the hook out. "Give me a scalpel," he finally hollered. He cut the tissue around the barb until it popped out.

They let the shark go, but it sank limply to the bottom, landing on its back, its stark white belly showing up through the blue water from five feet below. We had observed the same scene several times in the past few months. But this time it was accompanied by a sick feeling of loss.

We were not alone in that feeling. Hastily, Manire jerked

on his fins, mask and snorkel, and dived overboard. He flipped and dying fish over and began swimming it, propelling it forward to circulate the water through its open mouth and gills. We followed along in the boat, hoping it would come back to life and reclaim its place in nature.

At last the shark began to move, its caudal fin swishing back and forth. Finally, with a kick of its long graceful tail, it surged ahead under its own power. Manire swam behind for a moment, then popped up some distance away with a triumphant, "He's gone."

Now there was only open blue water, sea-grass meadows, and mangrove islands--and somewhere out there a tagged shark. A fearsome shadow of the deep.

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