N.C. WILD STORE MAGAZINE
WILDLIFE IN NORTH CAROLINA

Tuna Online

written by Chris Powell

Exciting new technology is unlocking the secrets of one of the ocean's more mysterious fish—the giant Atlantic bluefin tuna.

It's 4 a.m., and 12 miles off the North Carolina coast a school of giant Atlantic bluefin tuna slashes through 57 feet of murky water, annihilating a darting mass of menhaden. One particular tuna—caught and released 12 days earlier—carries with it a small black device attached near its dorsal fin. Part computer, part tracking device, the Pop-up Satellite Archival Tag knows that its free ride is coming to an end. On cue, the PSAT releases itself from the fish, floats to the surface and announces to the heavens that the tuna is right here.

Researchers measure and tag a bluefin tuna off the North Carolina coast before releasing it to learn more about these massive fish.

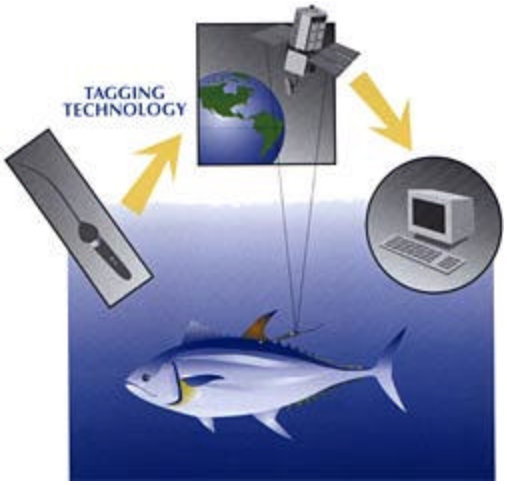
"The fish are near the Atlas wreck," says Barbara Block, as she quickly helps her assistants load gear into the Calcutta, a 54-foot sportfishing boat. Expecting a PSAT transmission early that morning, Block was not disappointed. Most of the time it's a guess as to where the tuna might be. But this time Block, a Stanford University researcher, knows exactly. To the day and to the hour, the PSAT detached and began transmitting. Floating off our coast, the tag bounced a signal off an orbiting satellite, and the transmission proceeded as an e-mail message to the researcher's computer. Not only does the PSAT enable Block to pinpoint the exact location of the tagged tuna and its accompanying school, but it also allows her to download the entire travel route of the tuna during its tagged period. But for now, the important things are that the fish are nearby and that it's only a matter of getting to the spot to begin tagging more of these mysterious creatures.

Not an hour after leaving Beaufort Inlet, in less than 60 feet of water, the Calcutta's mate, Junior Johnson, has ballyhoos trolling behind. Almost everything about bluefin tuna fishing runs contrary to traditional offshore fishing conditions. Most people associate deep-sea fishing with the distant, blue waters of the Gulf Stream and warm summer days. This time of year, however, giant tuna fishing is done near shore in relatively shallow water, when other fishing comes to a stop. The Calcutta and her crew are no different than any other Morehead City sportfishing boat, other than that they have been contracted by Block to serve as a tagging vessel for the Tag-A-Giant program. The program is a joint effort among Stanford University, the National Marine Fisheries Service and the Monterey Bay Aquarium to learn as much as possible about the travel patterns of giant Atlantic bluefin tuna.

The huge brass reel screams, and Shana Beemer, a Stanford University doctoral candidate, practically dives into the fighting chair. The ballyhoo, skirted with a pink Hawaiian Eye, couldn't have been in the water 20 minutes when a 300-pound tuna decided breakfast was served. Shana is quickly locked into

the rod and reel and then into the chair itself. These fish are powerful and can easily pull an angler right out of the boat. Known to grow 10 feet long and weigh as much as 1,500 pounds, giants have ripped out rod holders and even uprooted fighting chairs.

The fish begins making runs, and Mike Stokesbury, a doctoral candidate at Dalhousie University in Nova Scotia, Canada, stands behind the fighting chair, turning it toward the fish as it races right, then left. The angler must be kept directly in line with the fish because if the rod bends to the side, it could crack in half. All the while, Capt. John Jenkins works the throttles, running the fish down, then pivoting to keep the tuna behind the boat.



Once a tuna is caught, a Pop-up Satellite Archival Tag (PSAT) is attached near the tuna's dorsal fin and the fish is released. The tag records the tuna's position every two minutes for up to a year. At a pre-programmed time, the tag is released, floats to the surface then uses cellular-phone technology to send the data up to a satellite. The information is then sent as an e-mail to a researcher's computer.

It's all a team effort, and time is of the utmost importance. If the fish is allowed to fight for too long, the exhaustion could kill it. So the crew of the Calcutta uses a special 200-pound-test Dacron fishing line that has very little stretch. By applying steady pressure, they tire the fish quickly. Also, the tuna can be reeled in surprisingly easily (even by an average-build person like Shana) because it can't dive deep in only 50 feet of water. With the same fish hooked in 1,000 fathoms of water, the fight would last hours, and the end would most likely be death.

In 15 minutes the tuna is up, and Stokesbury slides himself through the marlin door, holding a lip hook with a rope attached. Once the tuna is hooked under its chin, it is pulled up a special ramp mounted to the stern of the boat, then slid onto a wet mat in the cockpit. Immediately, the fish's topside eye is covered with a chamois cloth soaked in water and fish slime; a hose is used to pump seawater into the tuna's mouth to hydrate and oxygenate its gills. Those two actions calm the fish, and the researchers proceed through a speedy routine. All hardware is removed from its mouth, and Barbara and Shana measure the girth of the tuna as well as its length from the jaw to the fork of its tail. A Floy tag (which indicates the date the fish was caught) is placed on one side of the dorsal fin, and if the fish measures 73 inches or longer, a PSAT is attached on the other side. Finally, a tiny portion of its fin is clipped for a DNA sample, and the fish is turned and slid down the ramp to freedom. All of this happens in less than two minutes.

The tagged tuna returns to a school of fish that are relative newcomers to North Carolina's coast. Giants were first found by Hatteras watermen around the beginning of the 1990s, and experts aren't sure exactly why the huge fish began arriving here. Bob Eakes, who has fished the waters off Hatteras all his life, said he is almost certain that the tuna were not present during the 1980s. A decade later, however, they arrived in big numbers and in big sizes.

"I think we had more fish back then," said Eakes, who sits on a tuna advisory committee for the International Commission for the Conservation of Atlantic Tunas (ICCAT). "Back then, we could chunk them up, and then target a big one. The fishery wound down some this year, and it was more a trolling fishery, so you couldn't really control the size of fish you caught."

Block believes the tuna have begun frequenting our coast because of menhaden—a small, oily fish that is a favorite food source. The overfishing of the tuna's food sources in other parts of the ocean may have forced the tuna to feed in areas along North Carolina's coast. Menhaden prefer our coast due to the

convergence of the Gulf Stream and Labrador Current. The shape of the coastline creates a mixing zone around Cape Hatteras, Cape Lookout and Cape Fear. "Most of the tuna have menhaden in their stomachs, although there are often other things—a few swimming crabs and pinfish. But the number-one item is menhaden," Block said. "So we have a big fast-food chain off the North Carolina coastline, and we've got a lot of bluefin tuna stopping in. We are learning that fish from the other side of the Atlantic are stopping in, too."

Researchers hope the data obtained through the tagging program will reveal the travel patterns of Atlantic bluefin tuna, which have been the subject of much debate. Also in question is whether there are one or two stocks of Atlantic giants. These two pieces of information are considered vital to manage the tuna fishery, which is believed to be collapsed on the western side of the Atlantic and nearly so on the eastern side.ICCAT, a coalition of 25 nations, currently manages the Atlantic bluefin tuna fishery as two stocks. The western stock includes tuna found off the coast of New England down to the Carolinas and into the Gulf of Mexico. The eastern stock includes primarily the Mediterranean. Management of the stocks is separated by an imaginary line that runs through the Atlantic Ocean at 45 degrees longitude.

A group of anglers hold a bluefin taken after a day of fishing off Cape Hatteras.

"So here is the problem," Block said. "You have the western side of the ocean doing a lot of conservation, taking a financial loss, because U.S. management indicates that if we conserve bluefin tuna unilaterally, we can bring them back. Then you have the eastern [European] side of the ocean taking as many bluefin as possible."

U.S. commercial fishermen have expressed concern over the possibility that the western stock mixes freely with the eastern stock, which would mean that conservation efforts on this side of the ocean would lead to larger tuna catches on the European side of the Atlantic. The giants are highly prized by commercial fishermen because a single fish can sell for thousands of dollars.

"In 1994, there was a very large meeting of scientists to look at this issue, and their suggestion was that there was not enough information in all the basic parameters of bluefin tuna," Block said. "We don't know how much mixing is occurring between the two stocks. We don't know if the two-stock theory is the best way to manage the fish, and we need to find the answer quickly, as recent catches of bluefin tuna in the east Atlantic and the Mediterranean are at new historical highs."

Which is why Block and her team of researchers are so interested in the travel patterns of the giants that winter off the North Carolina coast. So far, they have tagged 500 tuna, and their goal is to place a total of 600 electronic tags by the end of the 2002 tuna season. Developed by engineers working with Block, the PSAT tag is truly a marvel of modern science. Until recently, scientists could only place a tag and wait for the fish to be caught before obtaining a rough idea of where it traveled. The archival tags, however, enable biologists to track a fish's movements on a daily basis.

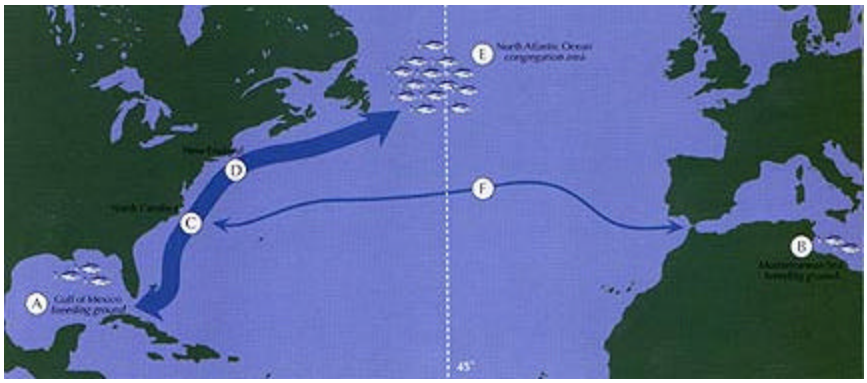
"The trick that we are using is that the archival tags measure sunrise and sunset with a very sensitive light sensor," Block said. "The tags record depth with a pressure sensor, so we can correct for the amount of light gathered at varying depths. And before you know it, we can generate times of sunrise and sunset. Anybody who's a mariner knows that if you can tell your dawn and your dusk, and if you can determine your local noon, you can figure out longitude. And then day length gives you latitude. That's the breakthrough with these tags."

So while the tag rides the tuna, it constantly collects these data, storing them in a microchip. Then, at a time preprogrammed into the PSAT's computer (a researcher's birthday, the morning of a tagging trip), the device activates a small battery, and an electric current is sent to a thin piece of metal holding

the tag to the fish. Combined with the salt water, the electricity quickly corrodes the metal within a half hour, allowing the PSAT to break free, float to the surface and transmit its data using technology similar to a cellular phone. The pop-up tags can stay on a tuna for only about a year. But researchers also use surgically implanted archival tags that can record data for up to five years while riding safely inside the tuna. The computer remains implanted in the fish, with a small light and pressure sensor extruding from the body. These devices are usually recovered from commercial fishermen and fish processors, who receive a $1,000 reward for each returned unit. Thus far, 49 of the 279 tags implanted in fish off the Carolina coast in 1997 and 2000 have been recovered.

One of the first things scientists learned using the new technology was that giants released after being reeled in with heavy tackle were not dying as a result. In 1997, when scientists first used pop-up tags, 97 percent of the tags placed on tuna transmitted successfully. "A lot of people are arguing against catching and releasing giant tuna because they think the fish are dying later," Block said. "If you use heavy tackle—we fish with 150- to 200-pound test, and we use 280- to 300-pound test leader—and you use circle hooks, I will guarantee 95 to 100 percent of the time the survival of that tuna.

Tuna on the Move



Using new tagging technology, researchers have been able to accurately document the travel patterns of giant Atlantic bluefin tuna tagged off our coast. Researchers believe there are two breeding grounds—one in the Gulf of Mexico (A) and another in the Mediterranean Sea (B).

Scientists have also learned that there is a direct link between the Carolina and Mediterranean fisheries. On Jan. 21, 1999, a tuna was tagged off the North Carolina coast. It was caught by a Japanese long-liner in the North Atlantic. A Canadian fish processor recovered the tag and sent it to Block. "When we downloaded the tag, the story that unfolded was pretty remarkable," Block said. "This fish stayed in the Carolinas until March 16, 1999. Then on March 17 it headed offshore and went all the way to the mid-Atlantic, right where the 45-degree longitude line is. It went across the line back and forth 10 times, clearly showing that the fish move through the boundary zone. And then it headed back into the eastern Atlantic again and spent the entire next season there. It was finally caught about 300 miles south of Iceland. We have seven tags with a similar story on them."

Researchers have also tagged a bluefin off the Carolinas that swam up to southern New England, then down to the Gulf of Mexico, then back toward New England. Using implanted archival tags, two young tuna were tracked for 31/2 years. One tuna traveled back and forth between New England and the Carolinas for the first three years, then went to the Gulf of Mexico in the fourth year, presumably to breed. The other tuna did exactly the same thing but went to the Mediterranean, also presumably to breed. These particular tuna are believed to have traveled between feeding destinations while they aged to the point that they were ready to breed.

The hardest concept for people to grasp, Block said, is that there is one Atlantic bluefin species, but there are at least two breeding

Tag-A-Giant

populations—one that breeds in the Mediterranean and one that breeds in the Gulf of Mexico. Researchers believe there are two breeding populations also because most bluefin in the Mediterranean breed by age 5, whereas giants in the Gulf of Mexico breed by age 8.

The Tag-A-Giant program allows anglers to assist researchers in collecting data on bluefin while enjoying the excitement of tag-and-release fishing. To participate or learn more about the program, visit www.tunaresearch.org or call (831) 655--6239.

But further complicating the matter is the mixing between the two populations. Warm-blooded like a mammal, a tuna generates a hot body temperature, which translates into powerful muscles. These giants use this trait to travel extremely long distances in short amounts of time and with little effort. An average bluefin can cross the Atlantic basin in about 50 days. So for researchers, the idea that a fish with such amazing capabilities would range only through half the ocean seems doubtful. Many biologists are starting to believe that, though there are at least two populations, these tuna commingle regularly in the northern Atlantic. And because of that, Block believes the stocks must be managed as one in that part of the ocean to maintain a viable fishery.

"I personally am concerned about the level of overfishing, particularly on the European side of this fishery," Block said. "Given that this magnificent fish—the giant bluefin tuna—has been intertwined with human history for 4,000 years, it would be a shame to lose it on our watch."

Comments about this story? Email Chris Powell

Return to Top of Page