Electronic tags reveal stock boundaries ignored by bluefins

BY MARK SHWARTZ/KEN PETERSON

Bluefin tuna -- one of the most sought-after fish in the sea -- migrate thousands of miles across the Atlantic, according to a new study by Stanford biologist Barbara A. Block and a team of marine scientists.

Heidi Dewar (left) and Dr. Barbara Block (right) of the Tuna Research and Conservation Center place an archival electronic tag in an Atlantic bluefin tuna off the coast of North Carolina. Credit: Scott Taylor

Using electronic data recording tags placed on wild tuna, Block and her fellow researchers discovered that some Western Atlantic bluefin mingle with their counterparts from the Eastern Mediterranean -- a finding that could have a profound impact on international efforts to conserve the magnificent animal, whose numbers have sharply declined as a result of intense commercial fishing in recent decades.

The study, published in the Aug. 17 issue of the journal Science, emerged after five winters of electronic tagging by Block and colleagues from the
Tuna Research and Conservation Center (TRCC) -- a joint project of Stanford's Hopkins Marine Station and the Monterey Bay Aquarium. Block, lead author of the Science study, is the Charles and Elizabeth Prothro Professor in Marine Science at Hopkins and director of TRCC. Scientists from the National Marine Fisheries Service also participated in the study.

The majestic bluefin -- one of the few warm-blooded species of fish -- can grow to 10 feet long and weigh 1,500 pounds. The animal is highly prized by sushi and sashimi lovers, particularly in Japan where a single fish weighing 444 pounds recently sold at auction for $175,000. Atlantic bluefin in the Tokyo seafood market routinely sell for $8 to $45 per pound.

Commercial harvesting of bluefin and other Atlantic tuna is managed through catch quotas established by the International Commission for the Conservation of Atlantic Tunas (ICCAT) based in Madrid, Spain.

Electronic tags

In the Science study, Block and her fellow researchers analyzed data recovered from electronic tags placed on bluefin off the East Coast of North America starting in 1996. Of the original 377 electronic tags deployed, 137 delivered data back to the researchers.

Most of the original tags (279) were "archival" -- electronic devices that scientists surgically implanted inside the fish with the help of commercial fishers off the coast of North Carolina. Forty-nine (49) archival tags eventually were returned by fishers from throughout the North Atlantic and the Mediterranean Sea.

The research team also deployed 98 "pop-up" satellite tags -- devices externally fastened to the fish that detach and float to the surface at a pre-programmed date. Data on depth, temperature and location were stored on the pop-up tags during the mission and transmitted back to the lab via satellite.

Tagging data revealed that Atlantic bluefin -- considered overexploited in the Western Atlantic since 1982 -- often travel throughout the entire North Atlantic and, in some cases, into the Mediterranean. Tuna tagged in the Western Atlantic in most cases resided for a year or more on Western North Atlantic feeding grounds. While many fish remained in the west, some of the recaptured fish had migrated to the Eastern Atlantic or Mediterranean Sea. Individuals also migrated from the Western
Atlantic to the east and back again in the same year.

Most fish showed at least one year of western residency traveling between the Carolinas and New England and back again to the original release location. The fidelity to these two locations and a third site near the Flemish Cap, off Newfoundland, represents bluefin feeding aggregations.

Researchers also reported that the western-tagged bluefin travel to distinct spawning grounds in the Gulf of Mexico or the Eastern Mediterranean.

**Vulnerability**

"The results indicate western-tagged bluefin are vulnerable to fishing mortality from all Atlantic bluefin tuna fisheries," the authors write in *Science*, noting that the tagging data emphasize "the need to protect both major eastern and western spawning regions, as they directly influence the western fishery."

This is an important consideration since the 2001 catch quota for Western Atlantic fisheries (5.5 million pounds) is one-twelfth the quota for the Eastern Atlantic fisheries (65 million pounds). Current management of the fishery by ICCAT assumes that catches involve only a low level of mixing between tunas from the Western and Eastern Atlantic.

ICCAT imposes strict quotas on fish caught in the Western Atlantic and much more liberal quotas on bluefin landed in the Eastern Atlantic and Mediterranean Sea. The Western Atlantic management is aimed at recovering the breeding population to levels that produce "maximum sustainable yield." The Eastern Atlantic breeding population is considered to be in decline and overfished, although it is of greater overall abundance than the western breeding population.

According to the *Science* study, "The electronic tagging data indicate that mixing between the two management units exists at a higher level than ICCAT has incorporated into . . . . stock assessments. However, movements to distinct breeding grounds are apparent, suggesting a mixing of stocks on feeding grounds and a separation to distinct breeding localities. Future assessment of stock status should evaluate the new information and reassess the management strategies applied to Atlantic bluefin tuna."

Block says that, "From the data, it's clear there are two breeding populations of bluefin tuna that spend
considerable time together on the rich Western North Atlantic feeding grounds... Our results demonstrate that bluefin tuna are capable of ranging widely throughout the North Atlantic without regard to the stock boundary in the mid-Atlantic. That means efforts to bring about a recovery of bluefin tuna populations will require increased cooperation among all nations fishing for bluefin tuna."

Tagging data revealed that bluefin dive to remarkable depths, at times exceeding the 3,281-foot pressure sensors in the tags, although they spend most of their time closer to the surface. The animals also displayed a remarkable range of temperature preferences -- from near-freezing waters when feeding (37 F) to very warm temperatures when breeding (86 F) -- while always maintaining a high internal temperature (around 77 F to 80 F) even in the most frigid waters.

The researchers reported the first descriptions of what they believe to be breeding behavior in giant tunas. Most surprising is that the spawning period occupies a short interval in the yearly activities-- less than one month. A unique behavioral repertoire recorded by the electronic tags suggests that the giant tunas breed at night in very warm waters, swimming up and down in the water column for hours.

"Important," notes Block, "our data indicate that bluefin are sorting to distinct breeding grounds where efforts to protect the breeding aggregations should be increased."