To save or savor? It's decision time for Atlantic bluefin tuna

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Giant bluefin tuna are in trouble, primarily because the powerful muscles that propel their extensive ocean migrations come with an Achilles' heel: They're tasty.

Prized by sushi lovers for their savory succulence and by fishermen for the incomparable price they command-one 607-pound fish fetched over $90 per pound at a January auction in Tokyo-all three species of bluefins have seen their population plummet in the past 50 years thanks to worldwide demand.

However, there is hope for bluefin, as new advances fueled by modern technologies in ocean science may be clarifying how best to manage Atlantic bluefin, according to Barbara Block, the Charles and Elizabeth Prothro Professor in Marine Sciences at Stanford University's Hopkins Marine Station. Block is scheduled to discuss her work during a press briefing today at the American Association for the Advancement of Science (AAAS) annual meeting in Boston.

Block has spent more than a decade tagging Atlantic bluefin tunas and tracking their travels. She and her team from Hopkins Marine Station and the Monterey Bay Aquarium have spent years at sea on a project called "Tag A Giant (TAG)," implanting 995 electronic tags in bluefin tunas. That is no small accomplishment, considering that giant bluefin can grow to 1,500 pounds, live in offshore waters and must be hauled onto boats to be measured, implanted with sophisticated electronic tags or have fin clips for DNA analysis removed.

Block and her students have uncovered remarkable details about the journeys of these giant fish, which can swim thousands of miles in a year and dive almost a mile below the surface. What she has learned is guiding decisions made by international managers and may lay the foundation for taking actions needed to bring the Gulf of Mexico bluefin population back.

The TAG team's research has shown that bluefin tuna tagged in the West Atlantic are composed of two populations, one that forages in the North Atlantic and moves primarily into the Mediterranean Sea to breed, and another that tends to swim on the North American side of the ocean while spawning exclusively in the Gulf of Mexico.

Genetic analyses conducted by marine biologist Andre Boustany and research associate Carol Reeb, both members of Block's team at Hopkins Marine Station, confirmed that the two North Atlantic populations are genetically distinct.

Block learned something else as well.

"Our tagging and genetic data reveal that while there are separate bluefin tuna populations, significant mixing exists across the North Atlantic," she said. Mixing takes place in foraging areas in the western, eastern and central Atlantic; the central region had long been thought to be a no man's land that separated the two fisheries.

The mixing of the tuna populations on feeding grounds is raising serious questions about current fisheries-management practices-and raising concerns about how many Gulf of Mexico-spawned fish are actually left.

Bluefin tuna are managed by the International Commission for the Conservation of Atlantic Tunas that meets yearly to set fishing quotas and determine stock assessments. In the face of a steep decline in the

West Atlantic fishery, in 1982 the commission established a boundary between the fisheries at the 45th meridian. It then set separate quotas on the allowable catches for the West and East Atlantic fisheries that were supposed to hold the annual catch to a sustainable level.

Although the West Atlantic fishery seemed to stabilize in the mid-1990s at a low level, it has been decreasing since 2000, and U.S. fishermen have not been able to catch their modest quota. At the same time, the eastern Atlantic and Mediterranean fishing effort has increased dramatically, which has led to contentious claims across the ocean that Mid-Atlantic and eastern fleets are catching the North American fleet's hard-earned recovery.

Mid-Atlantic waters are proving to be hotspots for fish from both sides, and international fleets have been longlining here for the past decade, further disabling the recovery of West Atlantic fish.

More important, tagging has revealed that although some tuna from each fishery engaged in trans-Atlantic tourism, fish from the Mediterranean spawning ground are flocking to the western Atlantic like European tourists enjoying a favorable exchange rate on the dollar.

Data from electronic tagging by Block's team demonstrate that juvenile bluefin come from the Mediterranean to feed along the North American coast for one to three years, then return to the Mediterranean to spawn. They do so in larger numbers than those tuna spawned in the Gulf of Mexico that traveled east. This imbalance turns out to be critical to assessing how many fish in the Gulf of Mexico stock are left.

It appears that the continued presence of Mediterranean fish, year after year, was adding a hidden subsidy to the native western Atlantic population, potentially making it appear healthier than it really was. In essence, the International Commission for the Conservation of Atlantic

Tunas has been assuming that the western Atlantic fishery consisted entirely of tuna spawned in the Gulf of Mexico, and has set quotas beyond what the native population can sustain.

Tagging data also showed that bluefin primarily went to the Gulf of Mexico to spawn later in life than had been assumed: at age 12, not age 8. The two populations of Atlantic bluefin have slightly different life histories; Gulf of Mexico-spawned fish reach maturity later and grow more slowly than the Mediterranean population.

"For the past two decades, we've been lowering the age for a commercial mature fish to increase supply, and yet our tagging data has demonstrated the Gulf of Mexico bluefin need more time, without pressure, to breed," Block said. Catching fish that have not bred yet is potentially one more way the western population has become depleted.

"You've got to keep a lot of bluefin in the bank in order to get the interest," Block said. But the overly generous commission quotas mean that each year fishing fleets are cutting more deeply into the principal: the breeding population of bluefin. The cumulative effect of annual overfishing throughout the North Atlantic has sent the number of natives plummeting.

Because all the visiting fish return home to spawn in the Mediterranean Sea, their presence does nothing to strengthen the native population. In fact, their numbers may be masking the severity of the decline of the weak stock.

"[It was] only recognized recently, in part because of our work, that we were getting a subsidy from Europe," Block said. "We didn't always know those fish were there, but now we can see it. We know there are two populations making up our western fishery."

Bluefin in the western Atlantic have suffered a 90 percent drop in population since the 1970s, according to commission estimates. In the Mediterranean, the decline is put at about 50 percent. The rate of decline in both fisheries has accelerated in recent years.

William Hogarth, director of the National Marine Fisheries Service, was quoted in a December 2007 Washington Post article as saying that, for the last five years, U.S. fishermen in the western Atlantic have been unable to catch even 15 percent of their allowed quota.

While there are many possible reasons as to why the bluefin have declined so steeply-ranging from overfishing to climate change-Block thinks that the "subsidy" from Europe is now being overfished, which is unmasking how bad the situation is for the weaker Gulf of Mexico stock.

Although the population of the European fishery has not fallen to the same level of devastation as that of the western Atlantic, the situation has worsened in the last few years. With increasing demand sparking the development of a commodity trade in penned bluefin-fish held in the aquatic version of feedlots to grow larger before being sent to market-the annual catch in the Mediterranean has skyrocketed. Quotas set by the commission are often ignored, and estimates by nongovernmental organizations put the actual take as high as 50,000 to 60,000 metric tons per year. Given Block's work showing that Mediterranean fish contribute to the success of the North American fishery, it is clear that excess hauls among European fishermen are directly contributing to the decline in the North American fishery.

Bringing a population back from the brink of collapse is more than just a numbers game. It is critical to have enough surviving animals so that they can spawn in the face of whatever trials nature sends their way-even once humans agree to let them alone. But the surviving population also

has to retain enough genetic diversity so its offspring will be successful. If genetic variation drops too low, animals become inbred, which weakens them and reduces their chances of survival. That can send a species down a path to extinction just as surely as continued overfishing will.

A separate genetic study, by John Graves and Jens Carlsson at the Virginia Institute of Marine Science, reached the same conclusions as Boustany, Reeb and Block. All the genetic research is backed up by new studies on the chemical composition of otoliths, or ear bones, by Jay Rooker at Texas A&M University. Rooker can tell where a fish has been swimming by the proportion of elemental isotopes, such as oxygen, in the otoliths. That the tuna spawned in the Gulf of Mexico are genetically distinct from the European fish makes the situation in the western Atlantic fishery even more precarious; the two populations do not interbreed.

Block is emphatic that it is not too late to save the western stock. "We have evidence in the genome that we're looking at that there's still a lot of genetic variation, even though the fish are very depleted," she said.

"Our North Atlantic fishery is composed of two populations: a Mediterranean-spawned bluefin and a fish from the smaller Gulf of Mexico spawning ground that are virtually impossible to identify without a genetic approach or a tag track that spans years," Block said.

"I believe that stock identification techniques, including genetics and elemental analyses of the ear bone, will be in place within the year to more accurately determine the percentage of fish from each population," she said. "We have the scientific tools to determine exactly how many of the eastern fish are boosting our fishery, and we can determine how many of the Gulf of Mexico stock are left."

Block and her team are collaborating with mathematicians who build stock assessment models at the University of British Columbia to generate a more accurate fisheries-assessment model that includes the detailed spatial information incorporated from the tagging data as well as the genetic origin of the tagged fish.

Block said saving the Gulf of Mexico population of bluefin will require everyone to pitch in. "We cannot do it alone. We need international fishers to recognize that they must stop catching our giants on the foraging grounds in the middle of the Atlantic," she said. "And here at home, we have to stop the bycatch in our own backyard." Block thinks high-tech solutions involving vessel and fish monitoring via satellite may be the only way to monitor the high seas.

"If we really want to ensure that our children see giant bluefin, we have to stop killing western giants before they're mature," Block said. "They have to breed a couple times."

This means a considerable commitment from the 45 nations that are currently members of the International Commission for the Conservation of Atlantic Tunas, which also will have to deal with the economic impact on the fishing industry.

Block and other researchers studying bluefin have amassed enough data to map the way toward sustaining, and even restoring, the giant bluefin before their populations tumble too low to recover, like that of the cod in the 1990s.

The question remains whether humankind will choose to pull bluefins back from the brink, or push them over the edge by way of the dinner table.

Source: Stanford University