NEWS FEATURE

Fishy numbers for white marlin stocks

Genetic tests show we have been mistaking a lookalike billfish for the prized white marlins—their stocks may be lower than we thought.

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In 1840, the English chaplain and amateur naturalist Richard Thomas Lowe published a four-line description of a proposed new species of fish. It was a billfish: a big, fast predatory fish with a prominent bill. The billfish group includes the storied marlins immortalized by Ernest Hemingway.

Lowe based his description on a single specimen collected off the coast of Madeira, Portugal, where he had a church. But that specimen, and Lowe himself, would disappear in 1874, and the species was all but forgotten.

It would take precisely a century for *Tetrapturus georgii*, also known as the roundscale spearfish, to be officially rediscovered, and decades more before genetic tests would establish its uniqueness. Today, thanks in large part to those tests, scientists know that many of the fish they once called white marlin are actually Lowe's species. This case of mistaken identity is exacerbating an already contentious issue: How to properly manage what some believe is a dangerously dwindling Atlantic white marlin population, as scientists struggle to figure out the abundance of each species.

Lowe was at least as passionate about natural history as he was about ministering. From 1826 to 1852, he had his own congregation on Madeira, but he found plenty of time for his side passion, publishing multiple papers on fish and the odd crustacean.

Lowe was also involved for years in a religious schism on the island and ultimately retreated to England. But he returned to Madeira on occasion. In 1874, sailing from Liverpool to the island, the steamship *Libreria* sank in the Bay of Biscay, and Lowe, his notebooks, and apparently his only *T. georgii* sample perished.

For a century, all that remained were vague allusions to the fish that Lowe said had a body "clothed with large scales of a peculiar shape and nature." The defining reappearance came in 1974 (2). Richard Robins, then at the University of Miami, FL, had taken a trip the previous decade to Europe to collect fish samples. He soon realized that four of those were "of a species whose presence had been unsuspected." Comparing their morphology to Lowe's initial description he decided they were the same.

The Atlantic is home to only a handful of billfish species, most easily identified by the experts. Not so for the roundscale, it would turn out. Since Robins's samples were collected in the eastern Atlantic, US researchers didn't realize that these fish could be lurking in their own waters, and hence were unaware that many of the fish they were calling the white marlin were actually roundscales, a near lookalike.

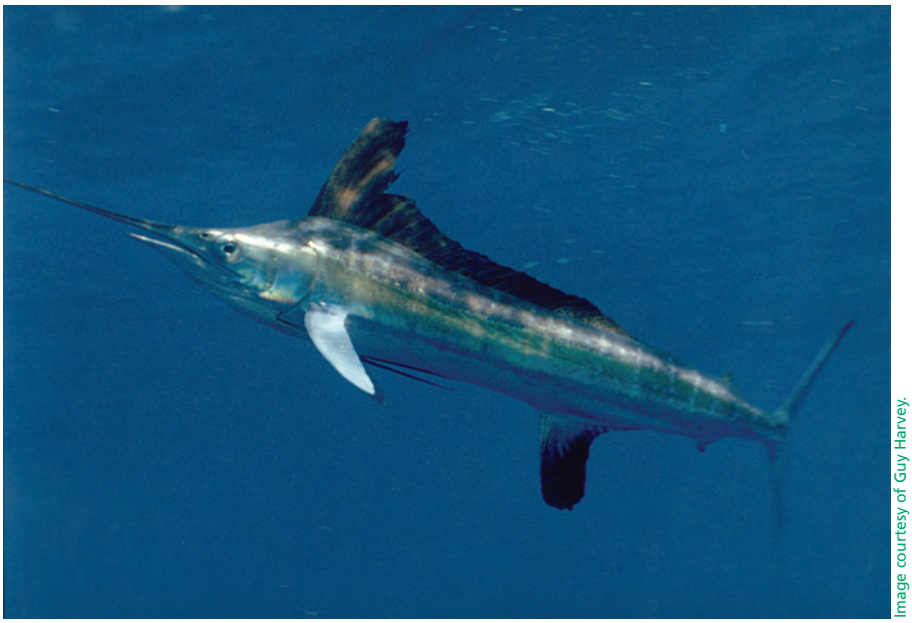

Image courtesy of Guy Harvey.

White marlin.

Stark Genetic Differences

During the 1990s, some of Robins's colleagues in Miami began to wonder if the roundscale might also be found in the western Atlantic. Dennis Lee, the head of the National Oceanic and Atmospheric Administration (NOAA)'s Southeast Fishery Observer Program (SFOP) in Miami, began talking of the possibility during observer training sessions, but there was little to go on. Robins had outlined some challengingly subtle defining characteristics that included, relative to white marlins, a larger distance between the anus and the anal fins, in addition to rounded scales and fins.

Within a few years, the Miami researchers had candidate samples. Elsewhere, other researchers also began considering the possibility of a new species of billfish. But convincing the larger community proved difficult. "We would have discussions with other billfish researchers and they would shrug and say, 'That's pretty interesting'

and turn around," says Lawrence Beerkircher, the current head of SFOP. "I don't think they really believed it."

It wasn't until 2006 that the situation became indisputably clear. Beerkircher had sought the help of his former advisor, fish genetics specialist Mahmood Shivji, at Nova Southeastern University's Guy Harvey Research Institute, Dania Beach, FL. Shivji had developed techniques for rapidly identifying shark species based on small tissue samples, which, among other benefits, allowed identification of illegally caught species even after they had been chopped up. He had begun applying similar techniques to establishing genetic markers for various billfish species.

When Shivji and colleagues analyzed Beerkircher's samples, they were stunned. While the physical differences between the species were subtle and missed by most, there was no mistaking the genetics. "They were not a little bit different from white marlin, they were really different," says Shivji of what proved to be roundscale spearfish samples. They weren't even in the same genus. The difference was so stark that it ruled out interbreeding (3).

Also, the distinctions weren't mere academic minutiae. The discovery of the roundscale would significantly affect the already limited understanding of the white marlin. "This completely messed up the white marlin stock assessments," says Shivji.

The white marlin is recognized as one of the most overexploited pelagic fishes in the Atlantic (4). In some countries subsistence fishermen target them, but for the most part white marlin are the unfortunate bycatch of commercial fishermen known as longliners who drag kilometers-long fishing lines with baited hooks intended for other species like tuna and swordfish. The white marlin are also prized by recreational sport fishermen, but regulations mostly call for them to be released alive, if possible, when they're caught.

To List or Not to List

In 2001, scientists and environmentalists formally requested that the United States consider listing the white marlin as either threatened or endangered under the Endangered Species Act. After a review, NOAA rejected that petition, sparking a legal challenge that led to another review.

The second review resulted in a NOAA report in 2007 (5). The report highlighted major uncertainties, both in absolute population size and in the numbers of roundscale fish misidentified as white marlin. NOAA concluded that existing management efforts—controlling fishing seasons and prohibiting certain practices that are more likely to snag white marlins—were sufficient for preventing further declines. The report also said that, despite the uncertainty, there appeared to be a slight uptick in the population of white marlin, which had been plummeting since the 1960s.

Image courtesy of J. Foster/Guy Harvey Research Institute, Dania Beach, FL.

Photos of the two species side-by-side, white marlin (*Top*) and roundscale spearfish (*Bottom*).

Eric Prince, a fisheries biologist at the NOAA National Marine Fisheries Service, Miami, who took part in the reviews, says one of the greatest sources of uncertainty over white marlins is that most countries, unlike the United States, do not report their white marlin bycatches, leaving huge gaps in the data. A variety of estimates put the total white marlin population size in the Atlantic Ocean at about 200,000 fish, but this is largely based on analyses from a decade ago that have neither been updated (6) nor corrected for possible roundscale misidentifications.

After the 2007 review, NOAA's Endangered Species Division argued that because of the uncertainties, NOAA should at least retain the white marlin on its Species of Concern list. This designation doesn't provide any special protection but can lead to more attention and research funding. But in 2008, NOAA's Office of Protected Resources, which had the final word, disagreed and the white marlin was removed from the list.

The arguments in those debates were based on only a nascent appreciation for roundscales. The picture soon turned more confusing.

After Shivji's team established the roundscale genetics, they began working with Beerkircher and others to figure out the extent of the species. In 2009 they published a paper showing that, at least in the Sargasso Sea region of the Atlantic, the roundscales are fairly common (4). On average, roundscales made up about a quarter of the catches deemed white marlin from certain fishing tournaments and longliners. This raised new questions about the accuracy of the population estimates of white marlin that were used to review its threatened status. "You've got these big predators running around [being] mistaken for each other and no one knows the status," says Shivji.

The confusion does not end there. There seems to be substantial variability in the relative number of roundscales and marlins, not just from one study area to another, but also from year to year. For several years now, John Graves, a fisheries biologist at the Virginia Institute of Marine Science, Gloucester Point, VA, and his colleagues, have found substantial variation in the number of roundscales being caught at an annual white marlin fishing tournament in New Jersey. Some years there have been none and in others they've been plentiful. In some cases Graves discovered that it was roundscales winning the major prizes in the tournament, which is allowed because the species are so outwardly hard to distinguish.

Researchers generally agree that this kind of work has added to uncertainties over

white marlin populations. One way the roundscale confusion could have a major impact on our understanding of the white marlin's current health would be if the percentage of roundscales relative to white marlins increases. Given the ongoing misidentification, this could partially obscure declines in the white marlin population. But reliably figuring out how those relative percentages have changed over the decades is impossible because there are few stored samples. Researchers are instead hoping to get a clearer picture moving forward through work now underway.

A key open question is: How common are roundscales in parts of the Atlantic not yet surveyed? Research has shown significant roundscale populations in western waters, but no data yet exist for the east.

Back to Madeira

Shivji is working with Prince to gather samples from the eastern Atlantic. They are distributing DNA kits to commercial fishermen there and asking them to collect samples from their catches. This effort will help the researchers calculate the roundscale to white marlin ratio over there, which, combined with earlier results, should give a clearer picture for the Atlantic as a whole. "That's where we really need to go," says Prince. "This is going to be a really important year for that."

Last year, the Center for Biological Diversity (CBD), Tucson, AZ, and Jim Chambers, a former NOAA Fisheries scientist, both petitioned the government to consider the white marlin threatened or endangered listing issue a third time. Among other reasons, the CBD pointed to confusion created by the roundscale work as justification for the request.

On January 30 this year, NOAA's National Marine Fisheries Service again concluded that a white marlin listing isn't warranted based on available information. The agency rejected various arguments put forth by Chambers and the CBD in their separate petitions, including that population size is demonstrably shrinking. While noting that figuring out the roundscale to white marlin ratio is important, NOAA deemed it "not possible at this time."

Chambers is unhappy with the decision. "We need to do something pronto, otherwise we're going to lose them," he says. And it's not just the white marlin he's concerned about. He believes that even the roundscale is on a similar path to oblivion.

Prince, however, feels the best path forward is careful management. He fears listing might cause more harm than good. Some communities depend on white marlin tournaments and general revenue from sport fishermen; targeting the white marlin, even with catch-and-release fishing, would have to end if the fish was deemed endangered. That status could conceivably also lead to wide-reaching longline bans, which Prince says would heavily penalize fishermen who are mainly catching species not officially considered overexploited.

Given the recent NOAA position, it's clear that the debate, fueled in part by growing appreciation for the roundscale's significance, is going to continue. Ironically, given that the species was discovered off Madeira in the 1800s, that region remains one of the biggest gaps in our understanding of roundscale populations. So, if Prince and Shivji's work to gather samples from Madeira proceeds as planned through 2013, the significance of Lowe's almost casual discovery may finally be known. For now, though, it seems that Beerkircher was spot on with his initial reaction in 2006 when he first learned of the genetic differences between the roundscale and the white marlin: "My thought was, 'It's going to take years to sort out.'"

1 Lowe, RT (1841) On new species of fishes from Madeira. *Proc Zool Soc Lond* 1840(8):36–39.

2 Robins, CR (1974) The validity and status of the roundscale spearfish, *Tetrapturus georgeii. Proceedings of the International Billfish Symposium*, eds Shomura RS, Williams F (National Marine Fisheries Service, Seattle), pp. 54–61.

3 Shivji MS, et al. (2006) Validity, identification, and distribution of the roundscale spearfish, *Tetrapturus georgii*: morphological and molecular evidence. *Bull Mar Sci* 79:483–491.

4 Beerkircher L, et al. (2009) Effects of species misidentification on population assessment of overfished white marlin *Terapturus albidus* and roundscale spearfish *T. georgii. Endang Species Res* 9(2):81–90.

5 White Marlin Biological Review Team (2007) *Atlantic White Marlin Status Review. Report to National Marine Fisheries Service, Southeast Regional Office, December 10, 2007* (NOAA Fisheries Service, Saint Petersburg, FL).

6 International Commission for the Conservation of Atlantic Tunas (2012) Report of the 2012 White Marline Stock Assessment Meeting. Available at http://www.iccat.es/Documents/Meetings/Docs/2012_WHM_ASSESS_ENG.pdf. Accessed February 15, 2013.