

Unknowingly consuming endangered tuna

19 November 2009



Yellow fin tuna (*Thunnus albacares*) and short-beaked common dolphin in a diorama of the eastern tropical Pacific at the American Museum of Natural History's Milstein Family Hall of Ocean Live. Credit: R. Mickens/AMNH

While most of us would never willingly consume a highly endangered species, doing so might be as easy as plucking sushi from a bento box. New genetic detective work from the Sackler Institute for Comparative Genomics at the American Museum of Natural History shows that bluefin tuna is routinely plated in sushi bars sampled in New York and Colorado. A quarter of what was labeled as tuna on sushi menus was bluefin, and some was even escolar, a waxy, buttery fish often labeled "white tuna" that is banned for sale in Japan and Italy because it can cause gastrointestinal distress. The new research is published in *PLoS ONE*.

"When you eat sushi, you can unknowingly get a critically endangered species on your plate," says Jacob Lowenstein, a graduate student affiliated with the Museum and Columbia University. "But with an increasingly popular technique, DNA barcoding, it is a simple process for researchers to see just what species are eaten at a sushi bar."

DNA barcoding efficiently identifies the species from which a chunk of meat—or even a leather handbag—came from. Using a short sequence of mitochondrial DNA from the cytochrome c oxidase subunit 1 gene, or "cox1," to identify a species, this

tool has, among other results, identified the presence of endangered whales in Asian markets, looked at the species of ungulates appearing in African bushmeat markets, and documented fraud in the labeling of caviar and red snapper.

Lowenstein and colleagues used DNA barcoding to identify the kind of fishes labeled "tuna" in one Denver and 30 New York City restaurants. Almost half of the restaurants did not accurately label the kind of tuna sold, and only 14 of the samples used for this study were listed on the menu by a specific name like bigeye tuna, albacore, or bluefin.

Bluefin are three species of large, fast-moving, high-energy tuna that can cover enormous distances in the ocean. All three—northern, southern, and Pacific bluefin tuna—are highly sought by fishermen because a single fish can garner tens of thousands of dollars. But over-fishing has brought populations into sharp decline, and western stocks of northern bluefin tuna are estimated as 10% of pre-exploitation numbers, and eastern stocks are following suit because of rampant illegal fishing. Just a month ago, on October 16, the country of Monaco nominated northern bluefin tuna for Appendix I listing (a complete international trade ban) to be considered when the Convention on International Trade in Endangered Species (CITES) meets in March.

All eight species within the *Thunnus* genus diverged from their common ancestor recently and are even more closely related to each other than humans are to chimpanzees and bonobos. Because of this, previous attempts to identify tunas with DNA barcodes have not worked well, and Lowenstein and colleagues chose to use this group of animals as a case study to compare DNA barcoding techniques. In contrast with the more widely used genetic distance method, the team was able to reliably identify closely-related species with a genetic key based on 14 nucleotide positions within the cox-1 gene.

"Because we compared different methods of

analysis, we could show that indirect estimates like genetic distances do not distinguish among tuna species. But our genetic key and direct sequence matching does work," says Sergios-Orestis Kolokotronis, the coordinator of the [DNA Barcoding Initiative for Conservation](#) at the Museum. "The standard method for identifying species relies on morphological characters, so using genetic characters allows us to enhance taxonomic identification."

The results of the detective work are clear: while the most prevalent tuna found in sushi is bigeye (30, or almost half, of the 68 samples collected for this research), nearly a third of the tuna was bluefin (3 Pacific, 12 northern, and 7 southern bluefin tuna). Only eight of the 22 bluefin samples were labeled "bluefin" on menus, and nine of the restaurants that sold the bluefin did not label it as such on the menu, although restaurants that did advertise bluefin were accurate in their representation and charged more for the sushi. Five of the nine samples labeled in restaurants as "white [tuna](#)" were not albacore but rather escolar.

"It is very difficult to get reliable information about the species you are eating, especially since the FDA's approved market name for all eight species of *Thunnus* is simply 'tuna'," says Lowenstein. New requirements that would market each species under its own name would help to clarify cases of economic fraud and allow conservation-minded consumers to avoid bluefin.

"The ability to identify species in trade is a prerequisite for CITES listing, and this research confirms that this requirement can be met," says George Amato, Director of the Sackler Institute for Comparative Genomics. "The long-term application of barcoding is the development of a hand-held identification device that anyone can use, so that wildlife management teams can seamlessly and efficiently identify a species and maybe the geographic origin of specific samples."

More information: The research article: [dx.plos.org/10.1371/journal.pone.0007866](https://doi.org/10.1371/journal.pone.0007866) .

Source: American Museum of Natural History

APA citation: Unknowingly consuming endangered tuna (2009, November 19) retrieved 16 October 2019 from <https://phys.org/news/2009-11-unknowingly-consuming-endangered-tuna.html>

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