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Fish tale has DNA hook: Students find bad labels

By John Schwartz

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Many New York sushi restaurants and seafood markets are playing a game of bait and switch, say two high school students turned high-tech sleuths.

In a tale of teenagers, sushi and science, Kate Stoeckle and Louisa Strauss, who graduated this year from the Trinity School in New York, took on a freelance science project in which they checked 60 samples of seafood using a simplified genetic fingerprinting technique to see whether the fish New Yorkers buy is what they think they are getting.

They found that one-fourth of the fish samples with identifiable DNA were mislabeled. A piece of sushi sold as the luxury treat white tuna turned out to be Mozambique tilapia, a much cheaper fish that is often raised by farming. Roe supposedly from flying fish was actually from smelt. Seven of nine samples that were called red snapper were mislabeled, and they turned out to be anything from Atlantic cod to Acadian redfish, an endangered species.

What may be most impressive about the experiment is the ease with which the students accomplished it. Although the testing technique is at the forefront of research, the fact that anyone can take advantage of it by sending samples off to a laboratory meant the kind of investigative tools once restricted to Ph.D.'s and crime labs can move into the hands of curious diners and amateur scientists everywhere.

The project began, appropriately, over dinner about a year ago. Stoeckle's father, Mark, is a scientist and early proponent of the use of DNA bar coding, a technique that greatly simplifies the process of identifying species. Instead of sequencing the entire genome, bar coders who have been developing their field only since 2003 examine a single gene. Stoeckle's specialty is birds, and he admits that he tends to talk shop at the dinner table.

One evening at a sushi restaurant, Stoeckle recalled asking her father, "Could you bar code sushi?"

Stoeckle replied, "Yeah, I think you could and if you did that, I think you'd be the first ones."

Stoeckle, who is now 19, was intrigued. She enlisted Strauss, who is now 18.

Their field technique was simple, Stoeckle said. "We ate a lot of sushi."

Or, as Dr. Stoeckle put it, "It involved shopping and eating, in which they were already fluent."

They hit 4 restaurants and 10 grocery stores in Manhattan. Once the samples were home, whether in doggie bags or shopping bags, they cut away a small piece and preserved it in alcohol. They sent those off to the University of Guelph in Ontario, where the Barcode of Life Database project began. A graduate student there, Eugene Wong, works on the Fish Barcode of Life (dubbed, inevitably, Fish-BOL) and agreed to do the genetic analysis. He compared the teenagers' samples with the global library of 30,562 bar codes representing nearly 5,500 fish species. (Commercial labs will also perform the analysis for a fee.)

Three hundred dollars' worth of meals later, the young researchers had their data back from Guelph: 2 of the 4 restaurants and 6 of the 10 grocery stores had sold mislabeled fish.

Stoeckle said he was excited to see a technology used in a new way. "The smaller and cheaper you make something," he said, "the more uses it has." He compared bar coding to another high-tech wonder turned everyday gadget, GPS.

Eventually, he predicted, the process will become more automatic, cheaper and smaller so that a handheld device could perform a quick analysis and connect to the database remotely. What his daughter did, he said, is like dropping film off at the supermarket for developing. The next generation could be more like a digital camera that displays the results on the spot.

The results of Strauss and Stoeckle's research are being published in Pacific Fishing magazine, a publication for commercial fishermen. The sample size is too small to serve as an indictment of all New York fishmongers and restaurateurs, but the results are unlikely to be a mere statistical fluke.

The experiment does serve as a general caveat emptor for fish lovers, particularly because the students, their parents and their academic mentor all declined to give the names of the vendors, citing fear of lawsuits. Besides, they noted, mislabeling could occur at any stage of the process.

Stoeckle was willing to divulge the name of one fish market whose products were accurately labeled in the test: Leonards' Seafood and Prime Meats on Third Avenue. John Leonard, the owner, said he was not surprised to find that his products passed the bar code test. "We go down and pick the fish out ourselves," he said. "We know what we're doing." As for the technology, Leonard said, "it's good for the public," since "it would probably keep restaurateurs and owners of markets more on their toes."

Stoeckle said the underlying message of the research was simple: "If you're paying for white tuna and you're eating tilapia, I think you'd want to know that."

Although the students did not present the project for a grade at school, they made sure to mention it on their college applications. Both will enroll at Johns Hopkins University this fall.

Neither, however, expects to major in the sciences. "I've always been into art history," Strauss said, "which is really different from this." Stoeckle, who is the granddaughter of the entertainer and arts patron Kitty Carlisle Hart, is thinking about studying writing or psychology. But that, they said, is the point. "If we found it interesting which we did I think lots of people like us can do it, too," Stoeckle said.

Peter Marko, a professor at Clemson University who used a more detailed genetic technique in a 2004 paper to show that red snapper was commonly mislabeled, called their project "quite remarkable," though he added that genetic analysis had been simplified to the point that high school students could now perform the task without sending samples off.

Marko prefers to work with whole genomes "more information is better," he explained which can be sequenced now with lightning speed. He plans to perform a broad genetic comparison of fishes that were separated millions of years ago by the rise of the Isthmus of Panama. "The technology is allowing us to ask questions that really would not have been possible in the past."

The students worked under the tutelage of Jesse Ausubel of Rockefeller University, a champion of the DNA bar coding technique. As for Strauss and Stoeckle, Ausubel said they "have contributed to global science" by adding to the database, built on a model similar to that of Wikipedia, in which people around the world can contribute.

In a way, Ausubel said, their experiment is a return to an earlier era of scientific inquiry. "Three hundred years ago, science was less professionalized," he said, and contributions were made by interested amateurs. "Perhaps the wheel is turning again where more people can participate."

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