

Applied Food Technologies collaborates with UF fish experts to ensure the seafood you order is what you get



Seafood is an \$80 billion-a-year business in the United States, where consumers each eat about 16 pounds of seafood annually. But as much as 25 percent of that seafood might not be what it claims to be. Paying \$25 a pound for grouper? It could be Asian catfish worth \$2 a pound. Mahi-mahi? It could be yellowtail.

While the average person may not even notice the difference, LeeAnn Applewhite is not the “average” seafood consumer.

Applewhite’s company, Applied Food Technologies (AFT), is one of the nation’s leading laboratories for authenticating seafood, consulting for such food service giants as Sysco and US Foods.

Out of its headquarters in UF’s Sid Martin Biotechnology Incubator in Alachua, AFT is perfecting genetic testing that identifies processed fish with as much accuracy as scientifically possible.

Mislabeled seafood is a growing international economic problem with fraud for some species, like red snapper, running as high as 75 percent.

Overfishing, along with a rising global demand, has created seafood shortages and a big incentive for fish suppliers to cheat — which isn’t hard to do when only 2 percent of seafood in the U.S. market is inspected.

Getting what you pay for isn’t the only issue. Safety is another. In 2007, for example, 600 people in Hong Kong became sick after consuming what they thought was Atlantic cod. Instead, they dined on escolar, or oil fish, which is known to cause diarrhea and other gastrointestinal problems.

According to the U.S. Food and Drug Administration (FDA), more than 1,700 species of seafood from around the world find their way to American markets. In addition, more than 80 percent of all seafood consumed by Americans is now imported. With so much fish making so many stops, inspection is tough. Critics also say enforcement is lax.

Processed fish products, cooked, battered and dressed with sauces, make identification even harder. Who can correctly identify mixed samples of pasteurized crab meat?

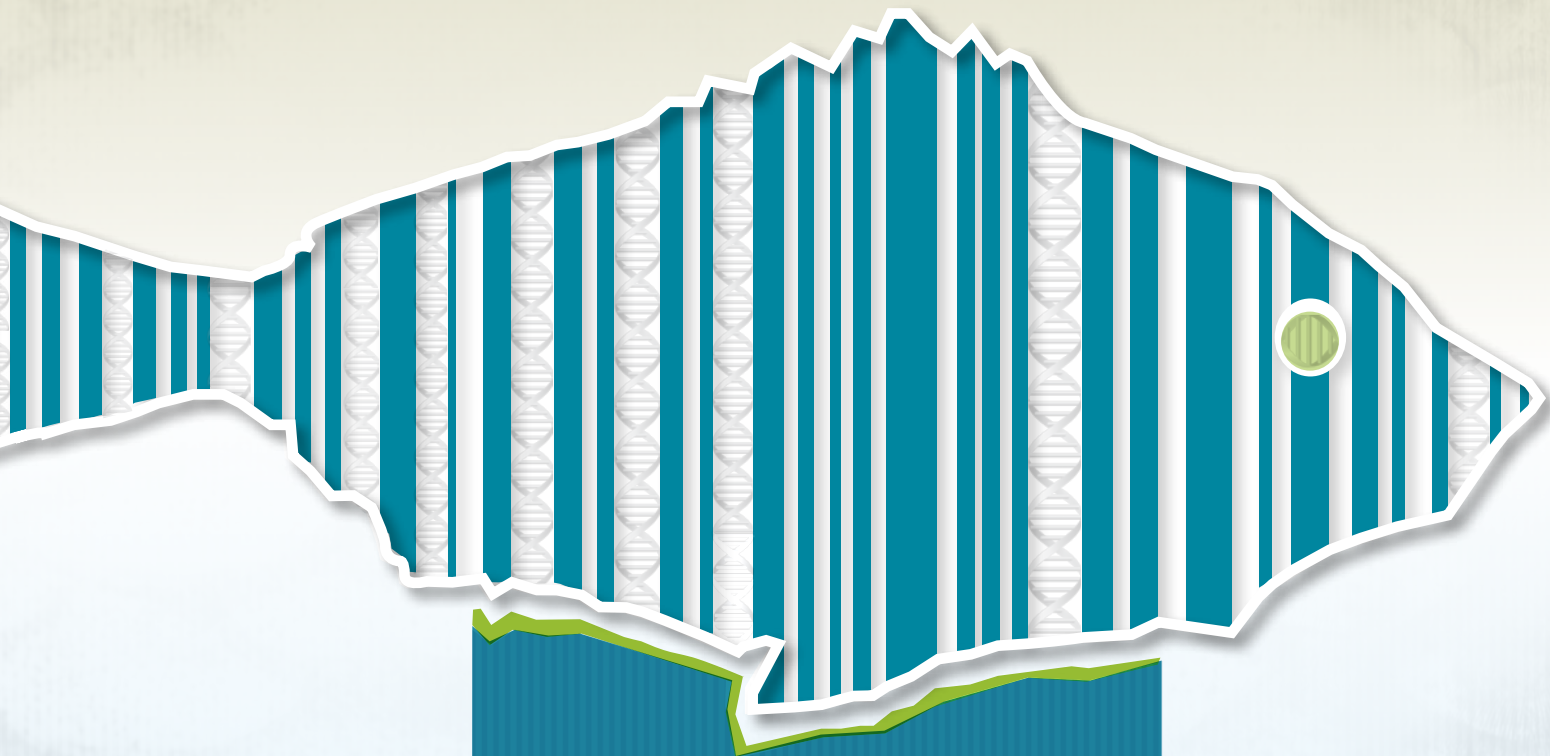
For years, the seafood industry has relied on isoelectric-focusing to identify fish. To do this inspectors zap a piece of questionable fish tissue with a controlled electrical field which causes proteins to form patterns that reveal the species.

Today, however, there’s a faster, more accurate way. By comparing a “species specific” segment of seafood DNA to DNA from a taxonomically confirmed sample, testing labs like AFT can confirm the species beyond a shadow of a doubt.

In 2006, AFT became the first company to offer this “DNA barcoding” service to food suppliers. It was a timely move, because the FDA — which monitors fish supplies — was just beginning to recommend DNA barcoding over isoelectric-focusing. (IEF)

“AFT was one of the first private labs to switch over to this method,” says FDA spokesperson Stephanie Yao. “Therefore, it was one of the few labs the FDA could recommend to industry that would perform analyses FDA would consider acceptable.”

Applewhite, who learned the business during a decade, first as a graduate student and then an employee of UF’s Aquatic Food Products Laboratory, recognized early on that there was a need to develop an authenticated database of fish species she could use for reliable comparisons.



SEAFOOD SLEUTHS

By JOHN M. DUNN

So she turned to UF's Florida Museum of Natural History, a world leader in identifying fish taxonomically, which is the science of identification using specific physical characteristics.

Applewhite worked out a deal where she sends the museum curators fish from around the world and for a fee they provide taxonomic information on the samples, give AFT a letter of validation that affirms the species, then store the samples as reference samples.

The relationship is a mutually beneficial one, says Rob Robins, senior biologist/collection manager for the Division of Ichthyology at the Florida Museum. Valuable specimens are added to the museum and AFT receives expert identification and has a place to store its index fish. The company also collaborates with the Smithsonian Institution, the University of Louisiana, the University of Kansas, the National Oceanic and Atmospheric Administration and the National Marine Fisheries Service to do some of the taxonomical work and issue letters of validation.

AFT keeps a sample of each fish tissue the museum identifies, which it uses to develop a DNA profile for its database. Today, the company boasts information on more than 350 commercially important species and is adding new ones all the time.

"Nobody else has done what we've done," says Applewhite. "There are many excellent DNA databases online that are good for basic research, but commercial groups specializing in identification for regulatory compliance testing are not allowed to use them."



GROUPE GUARANTEE



Not much in life beats a fresh grouper sandwich enjoyed with a cold beer and an ocean view.

But that experience is far less fun when consumers discover they're paying a restaurant for fresh, locally caught grouper, yet eating farm-raised fish from thousands of miles away.

And sometimes they never do find out.

UF researchers reported in 2010 that 57 percent of seafood-eating adults they surveyed would pay more if a labeling program guaranteed that sandwiches and other items contained fresh grouper caught in Florida.

The survey of 400 consumers was meant to show fishermen how much awareness there is about the knock-off fish problem and whether a labeling

program might be worth a closer look, says Chuck Adams, a professor with UF's Institute of Food and Agricultural Sciences and the Florida Sea Grant program.

"Basically we found that yes, people were aware of it, and we found that it had, in fact, affected their purchasing of seafood," he says.

The Gulf & South Atlantic Fisheries Foundation, Inc. paid for the \$40,000 study, says Sherry Larkin, an associate professor in resource economics. Graduate student Andrew Ropicki worked on the survey as well.

The fishermen's industry group wanted the survey information because they see their product being



Kristen Bartlett Grace

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LeeAnn Applewhite of Applied Food Technologies and Rob Robins of the Florida Museum of Natural History examine fish samples provided by AFT in the museum's ichthyology collection.

undercut by inferior imports, Larkin says.

The March 2009 survey found that 62 percent of respondents were aware that restaurants sometimes accidentally or deliberately substituted cheaper fish for grouper.

It also found that most consumers would be willing to pay anywhere from 83 cents to \$3.13 more per entrée if it were labeled as authentic Florida-caught grouper, Larkin says.

Seafood substitution is by no means a problem just with grouper. The state's Division of Business and Professional Regulation logs consumer complaints. Since 2006 there have been more than 1,100 reports of everything

from imitation crab being passed off as real to "seafood nuggets" posing as scallops.

But fake grouper may be the hardest to spot, the researchers say.

Many mild-tasting whitefish such as tilapia, basa and tra are often sold as grouper and, for most of us, it's difficult, if not impossible, to tell the difference.

Here's how to know, Adams says: A legal-size grouper will typically yield a fillet that's too large for one serving. So if you get an entire fillet on your plate, it's probably not the real stuff.

There's not as much dark meat as you might get with mahi mahi or perhaps catfish, he says. And grouper

has a mild flavor — so if the flavor is strong, it's either not grouper or isn't fresh.

Grouper fillets also tend to be thicker and flake apart in nice, big chunks, he says.

But if most consumers can't tell the difference, what's the harm?

"Two things," Larkin says. "One is, if the product is not of high quality, it's like, 'I just paid \$18 for something that's ... kind of OK.' That doesn't do very much for the reputation of the grouper. And two, consumers could just be blatantly overpaying."

Chuck Adams, cmadams@ufl.edu

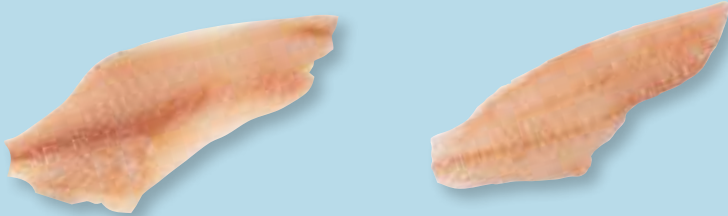
Mickie Anderson

FISH QUIZ

Fillets are one of the most easily disguised forms of fish, since many fish look similar without identifying features such as the skin, head and tail. See if you can identify which of these pairs of fillets are accurately labeled.



1. ATLANTIC COD?



2. GROUPEL?



3. SWORDFISH?



4. RED SNAPPER?



5. WILD SALMON?

Oceana

Answers: 1. Left photo is escolar or oilfish. 2. Left is Nile perch. 3. Right is mako shark. 4. Right is rockfish. 5. Left is farmed Atlantic salmon.



Department of Homeland Security



U.S. Customs and Border Protection inspectors examine imported seafood in port and on shore.

Applewhite says the problem with public databases is that anyone can submit any sequence to these databases.

“Using a public database to determine a fish species is not very useful because the data is only as accurate as the least careful person submitting sequences, thus, the DNA sequences for common substitutes can also appear in the database under the wrong name,” she says.

FDA’s Yao agrees: “Most other labs are pulling publically available sequences off of the Internet to make their identifications, a practice FDA does not recommend for regulatory decisions.”

Each fish has specific segments of DNA that are unique to its species. Applewhite’s team isolates these segments, then replicates them through a process called polymerase chain reaction, or PCR, until it has enough to DNA sequence and then compare the sequence to its database of verified DNA.

While PCR is a common biotechnology technique, AFT has developed its own specialized chemicals called primers that pair with the species-specific segments of DNA in the test sample.

“The unique primers for each of the creatures brought to the museum are like keys to a lock,” says George Burgess, director of the Florida Program for Shark Research at the museum.

Today, AFT divides its time equally between doing research and providing DNA services for customers such as US Foods, ASC Seafood, Sysco, Beaver Street Fisheries and numerous others in North America and Europe.

Some of the company’s work comes from government regulatory action. The FDA, for instance, “often runs samples for importers whose shipments are being held by the FDA and the FDA has released some of those shipments based on AFT’s results,” says Yao. “Most of these cases have been for catfish imported from China, for which there is a current FDA Import Alert for proper labeling.”

There is also evidence that AFT is helping to reduce fish fraud.



Eric Zamora



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“We’ve seen a significant reduction in misbranded imported grouper with our big customers that have steadily tested,” says Applewhite. “In 2006 we found 49 percent of the grouper we tested to be mislabeled; by the end of 2009 this had been reduced to 12 percent.”

The FDA’s Yao says AFT enjoys a strong position in the growing barcoding market: “Since AFT has been doing it the longest, they currently have the fewest issues with their analytical worksheet packages that are submitted to the FDA.”

AFT, meanwhile, is growing and eventually will leave the incubator for a bigger facility in the Gainesville area. It has also recently acquired assets of another Sid Martin graduate, Eco Array, which will help the company expand its genetic work into the environmental field to screen new compounds for toxic effects and evaluate water quality.

When she’s not running her company, Applewhite, a UF alumna, manages to give guest-lectures every year in various departments at UF and participate in workshops, such as those at the university’s Shrimp School. Meanwhile, her company continues updating and refining its molecular methods, procedures and primers.

The use of DNA barcoding in seafood that Applewhite is helping to pioneer, however, won’t be enough to end mislabeling abuses. There must also be punitive fines levied against wrongdoers to level the business playing field, argues Bob Jones, executive director of the Southeastern Fisheries Association: “In the past the fines from the state have been like a slap on the wrist,” he says, “and considered as a cost of doing business by those who cheat.”

Jones also thinks, however, that the seafood industry needs more companies to emulate what Applewhite is doing. “Her work is well-respected and her reports are genuine,” he says. “LeeAnn’s company searches for the truth.”

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Related website:
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LeeAnn Applewhite displays a grouper sample sent to Applied Food Technologies for verification. Technicians cut a small piece of fish from the sample and subject it to DNA testing, then compare the results against DNA from samples verified by the Florida Museum of Natural History.

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