Persistent Seafood Fraud Found in South Florida

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Executive Summary

In Florida, the state's residents and its visitors enjoy eating and catching seafood. In fact, Floridians eat twice as much seafood as the average American. At the same time, Florida has a long history of uncovering and addressing seafood fraud, specifically the substitution of one species of fish for another less desirable or less expensive species.

Oceana recently investigated seafood mislabeling in South Florida as part of a campaign to Stop Seafood Fraud. The results were disturbing. Nearly a third of the seafood tested was mislabeled in some way, leaving consumers with little ability to know what they are eating or feeding their families, and even less ability to make informed choices that promote sustainable fishing practices, or even protect their health.

Key Findings:

Overall, Oceana found 31% of seafood mislabeled in the Miami/Fort Lauderdale-area in this 2011/12 survey. Fraud was detected in half of the 14 different types of fish collected, with snappers and white tuna being the most frequently mislabeled.

- Red snapper was mislabeled 86% of the time (six out of seven samples).
- Grouper, while mislabeled at a lower level (16% of the time), had one of the most egregious substitutions: one fish sold as grouper was actually king mackerel, a fish that federal and state authorities advise women of childbearing age not to eat due to high mercury levels, which can harm a developing fetus.
- Atlantic salmon was substituted for wild or king salmon 19% of the time (one in five times).

Sushi venues had the highest proportion of mislabeled samples, with more than half of samples (58%) mislabeled. Grocery stores had the lowest (8%) mislabeling, and restaurants were in the middle with 36% (about one in three) of the fish fraudulently labeled.

- White tuna was mislabeled 100% of the time, as was white fish and yellowtail purchased in sushi venues. Escolar, another fish with a health warning, was substituted for fish labeled "white tuna" and "white fish."
- Notably, the only correctly labeled red snapper sample came from a sushi venue.

Even though seafood fraud was exposed in Florida in the 1980's, it continues to be a problem for many fish, especially in sushi restaurants. Compared to fraud levels reported in Florida in the past:

- The overall seafood mislabeling levels appear to have remained fairly steady since 1985, ranging from 15-31%.

- Grouper mislabeling dropped from a high of 40-50% during the height of the fake grouper scam in the mid-2000s, but remains at 16% (about 1 in 6) samples in this study.
- Red snapper mislabeling levels, which apparently decreased from 1988 to 2009, remain as elevated in this study (86%) as those uncovered in the 1980s (79-90%).

This continued mislabeling demonstrates clearly that inspections alone will not fix the problem. Full traceability of the seafood supply chain from boat to plate, combined with verification and accountability, is needed to ensure that the seafood sold in the United States is safe, legal and honestly labeled. Traceability also provides consumers with more information about the seafood they are serving their families.

The Miami/Fort Lauderdale region's overall fraud levels were about 20% lower than those recently found in other large metropolitan areas, such as Boston and Los Angeles, and may reflect the continued reporting on seafood fraud in the local news and the policing, inspections and oversight of seafood wholesalers and retailers by state officials since at least 1985. Nevertheless, consumers should not have to tolerate being misled 31% of the time when buying certain types of seafood in South Florida, some of which can lead to serious consequences for their health, wallets and the health of the oceans.

These findings show clearly that traceability, verification and accountability are needed as it is the only way to be sure that Floridians and other Americans can truly know what's on their plates, and the only way to allow consumers to make sustainable and healthy choices about what they eat and feed their families.

Introduction

Residents and visitors alike enjoy eating and catching seafood in Florida. In fact, it is estimated that Floridians eat twice the amount of seafood compared to the national average.[1,2] With its semitropical location and more than one thousand miles of coastline, many species of Florida seafood are harvested from the Gulf of Mexico and Atlantic Coast. Florida ranked twelfth in the nation for commercial seafood production in 2010 with $186 million in dockside value, and grouper and snapper harvests were the highest value finfish landed.[3] Despite being a major supplier of domestic grouper and other local seafood species to the nation, Florida's waters cannot meet the entire seafood demand. [4] In fact, the U.S., as a whole, imports 86% of its seafood, ranking among the world's top seafood importing nations. [5,6]

The complex and often obscure path that seafood takes from boat to plate provides an open door for illegal activity, including species substitution. Seafood fraud is any activity that misrepresents the seafood you buy, and includes mislabeling or substituting one species of fish for another. Studies have found that seafood is mislabeled 25% to 70% of the time for commonly swapped fish like red snapper, wild salmon and Atlantic cod.[7] Fraud can occur anywhere along the supply chain. A U.S. government audit in 2009 found that only 2% of the seafood imported was inspected and less than 0.001% specifically for seafood fraud.[8]

Not only does species substitution cheat consumers, it also can have conservation and health impacts. Consumers trying to avoid certain fish because of food allergies or mercury advisories can be led astray by mislabeling. Responsible seafood buyers attempting to use seafood guides and wallet cards to select more sustainably caught fish may not be purchasing the "green listed" fish they believe they are buying.

In light of these findings, Oceana launched a campaign to Stop Seafood Fraud in May 2011. Later that year, *The Boston Globe* and Oceana released separate studies on the seafood sold in the Boston-area, which revealed that up to 48% of the seafood sold in grocery stores and restaurants was mislabeled, disguising species that were often less desirable, less expensive or more readily available.[9,10,11]

Then, in December 2011 Oceana tested seafood in Los Angeles and Orange counties in Southern California and found 55% of the fish purchased in grocery stores and restaurants there was mislabeled.[12]

The highest level of seafood fraud was found at sushi restaurants, where more than 80% of sushi purchased was not what was ordered. In addition, not a single one of the 34 fish bought with “snapper” in the label were correctly named, according to Food and Drug Administration (FDA) guidelines.

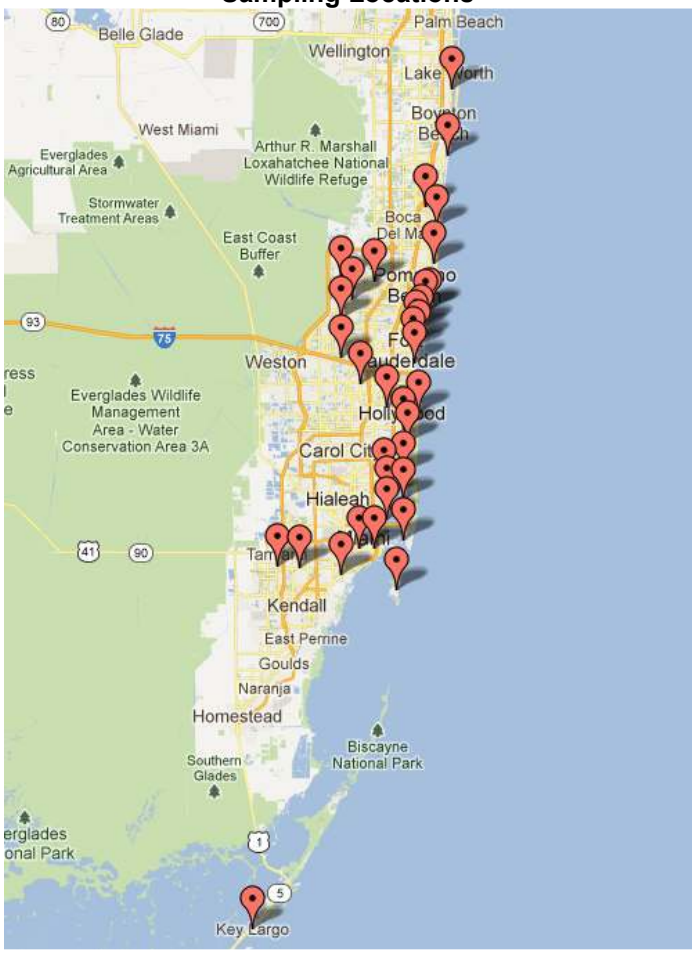
Florida, in contrast to California, has a long history of uncovering and addressing seafood fraud.[13] Florida has specific state laws that prohibit mislabeling of food in food service establishments, stores, markets and at processing, storage and distribution sites. In addition, seafood sold in interstate commerce is regulated by the FDA, which also considers misbranding illegal.

In response, Florida now routinely tests seafood from restaurants for “misrepresentation” and has issued over 1,400 citations since 2006, records of which are maintained in a public database.[14] Given this heightened awareness of seafood fraud in Florida, Oceana was curious whether a current investigation in the Miami and Fort Lauderdale areas would reveal any or lower levels of seafood fraud when compared to those found in Boston and Southern California.

Our Study

Oceana staff and supporters sampled seafood mainly in the Miami and Fort Lauderdale areas, but this study also includes samples from Monroe and Palm Beach counties. Samples were collected in December 2011 and January of 2012.

Sampling Locations



From maps.google.com

A total of 96 samples were collected from 60 retail outlets in South Florida. Samples were collected from three types of retail establishments: 40 from grocery stores, 25 from restaurants and 31 from sushi venues. The restaurants and sushi venues included those that were Zagat rated for "Most Popular" and "Seafood" and those recommended by Yelp or others.

The targeted species included those with regional significance and those that were found to be mislabeled from previous studies, namely red snapper and yellowtail snapper, grouper, wild salmon, yellowtail and white tuna. These targeted species made up the bulk of the samples, but our collection efforts included a total of 14 different types of fish, based on the label as sold.

Types (and Number) of Fish Purchased in South Florida

snapper (26)	**grouper (19)**	**salmon (16)**	**tuna (11)**	hamachi (6)
Chilean sea bass (4)	**yellowtail (4)**	**cod (2)**	mahi-mahi (2)	**whitefish (2)**
catfish (1)	corvina (1)	escolar (1)	marlin (1)	

Note: Red bold typeface indicates fish types where fraud was detected.

Oceana supporters purchased both targeted and self-selected fish samples from primarily grocery stores, while Oceana staff purchased samples from restaurants and sushi venues which sold targeted fish types. As such, this sample set includes a number of random samples that would be difficult to substitute for another species, due to appearance or taste, such as those labeled vaguely or simply as "salmon," "tuna" or "escolar."

Forensic DNA analysis for fish species identification was conducted by two different laboratories. The majority of the samples were analyzed by DNA "barcoding." This technique involves extracting a short DNA sequence from a gene found in all animals, which is then compared to a catalogue of more than 8,000 fish species. Select samples were analyzed or reanalyzed using other forensic genetic techniques at a second lab.

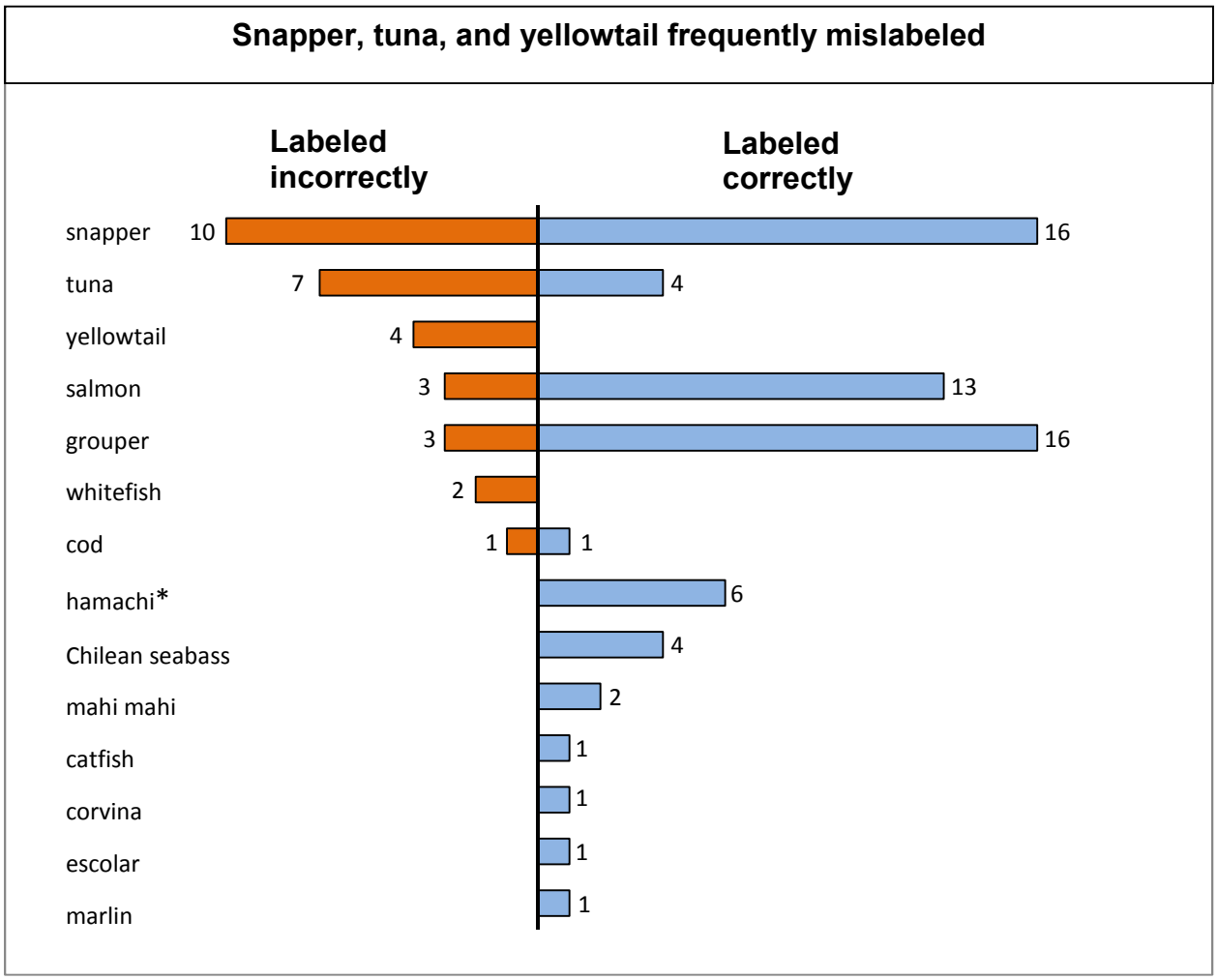
Oceana considered fish to be mislabeled if seafood substitution occurred and if retailers were not following the FDA Seafood List, a tool used to guide seafood labeling, which lists the acceptable market names, scientific names and scientific common names for roughly 1,700 species of seafood sold in the U.S.[15] For example, it is acceptable to label a fish as snapper if it is one of 47 different snapper species. However, only one species of snapper can be called "red snapper."

Labeling seafood with something other than the acceptable market name may be considered mislabeling. The FDA Seafood List also includes "vernacular," or informal regional names for some seafood species, which are those that may be widely known locally, but not used or recognized as the same species elsewhere. The FDA's general policy on vernacular names is that they are unacceptable market names for seafood.

Overall Results

Of the samples purchased in South Florida, 30 of 96 (31%) were found to be mislabeled, according to the FDA's list of acceptable market names for seafood (See Appendix Table A1 and figures below). This strict accounting includes fish mislabeled with both fraudulent and some less misleading vernacular names for seafood.[16]

The most sampled fish types were snapper (26), grouper (19), salmon (16) and tuna (11). In this group, fish labeled "snapper" or "red snapper" had the greatest number (10) of samples and variety of substituted fish with an overall mislabeling rate of 38%. Four fish samples that were mislabeled as generic "snapper" were actually tilapia, a farmed freshwater fish. No mislabeling was found in our eight yellowtail snapper samples.



Note: We did not consider the six samples labeled "hamachi" to be mislabeled, since they were sold under the Japanese name for S. quinqueradiata, the species identified by our DNA tests.

Only one of the seven fish sold as "red snapper" was the specific fish the FDA allows to be labeled and sold as red snapper, *Lutjanus campechanus*. The other six (86%) fish labeled "red snapper" were actually a less desirable, or less expensive snapper, such as Pacific dog snapper, lane snapper, silk snapper or other species.[17] One was actually a seabream, not a snapper at all, but a fish that is caught in the Pacific Ocean rather than in the semitropical Atlantic, Gulf and Caribbean waters where most snappers reside.

In comparison, grouper, a fish found frequently mislabeled in past Florida testing, had relatively lower levels of fraud (16%) in this study. The three fish that were substituted for grouper were all a different species, including *Pangasius* catfish and king mackerel, a fish on the FDA 's "do not eat" list for women of childbearing age and children due high to methylmercury levels, which can harm a developing fetus.

Among the top sampled fish, those labeled tuna were mislabeled 64% of the time, while those labeled specifically "white tuna" had the highest level of substitutions with 100% of the samples mislabeled. All seven samples of the fish labeled 'white tuna" were actually escolar, a snake mackerel species with potentially unpleasant digestive effects for some who eat more than a few ounces. The FDA advises against the sale of escolar within and between states and if it is sold, it must be properly labeled and buyers informed of the health warning.[18] Needless to say, when labeled as white tuna it rarely contains this warning.

Commonly Swapped Species Found in South Florida	
What you bought	**What you got**
grouper	king mackerel, weakfish, Pangasius “catfish”
snapper	tilapia
red snapper	seabream, Pacific dog snapper, lane snapper, silk snapper
white tuna	escolar
white fish	tilapia, escolar
wild salmon	farmed, Atlantic salmon

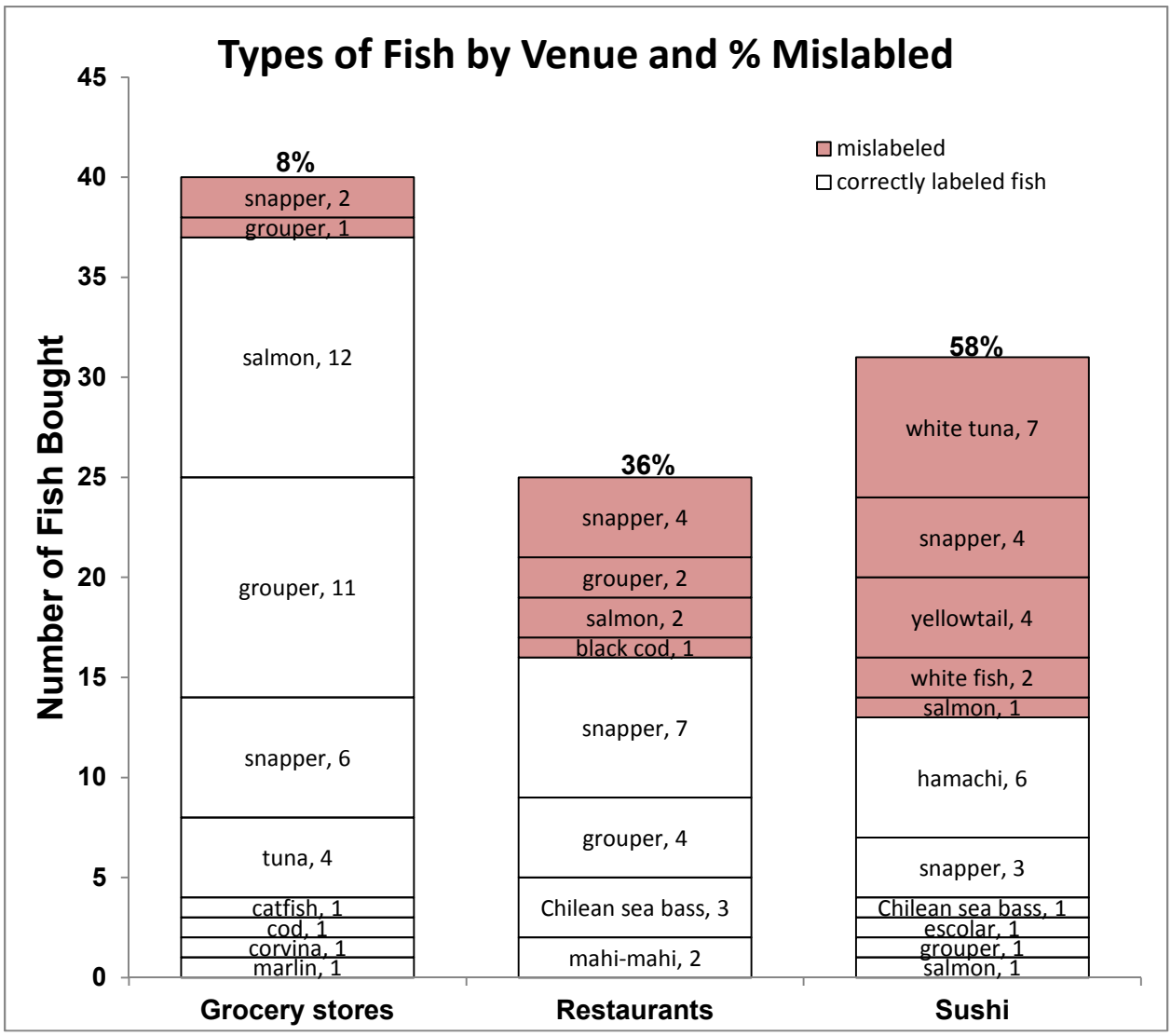
Consumers trying to buy “wild” or “king” salmon were tricked 19% of the time. Three of 16 salmon samples were actually farmed Atlantic salmon. Atlantic salmon, *Salmo salar,* is commercially extinct in the wild, while Pacific salmon is nearly all wild-caught.[19] This is an important distinction because farmed salmon is less expensive than wild caught salmon, has a different flavor and can be exposed to antibiotics and other aquaculture chemicals. As such, some consumers prefer to pay more for wild salmon and expect to receive it when they do.

Our samples labeled “yellowtail” and “white fish” were all mislabeled as were one of two cod samples. Sablefish (*Anaplopoma finbira*) was mislabeled as “black cod”, a common vernacular name for this species even though it is not a true cod. “Black cod” is not an acceptable market name for this species according to the FDA Seafood list, and it remains misleading if one expects to be served a cod. All of the yellowtail tested in this study was buri, a type of amberjack, *Seriola quinqueradiata,* which is often referred to as hamachi in sushi venues. “Yellowtail” is the FDA’s acceptable market name for only one species, *Seriola lalandi,* another type of amberjack, although it is a vernacular name for many different fish species.

Although we had few samples, the good news is that some fish were actually labeled accurately. No mislabeling was found in our samples of Chilean sea bass, mahi-mahi, catfish, marlin, corvine or escolar.

WHERE YOU BUY SEAFOOD MATTERS

Chances of being misled depended on where the seafood was purchased. South Florida followed a trend found in our Southern California study, where the sushi bars had the highest proportion (58%) of mislabeled fish, followed by restaurants (36%) and grocery stores had the least amount (8%) of mislabeled fish.



Sushi

Oceana and its supporters collected eight types of fish from 15 sushi restaurants in South Florida. Eighteen of the 31 fish bought were mislabeled (58%). One hundred percent of the white tuna, yellowtail, and white fish bought from sushi venues were mislabeled. One of the mislabeled "wild" salmon samples and four of the mislabeled "snappers" samples were also from sushi venues. As previously mentioned, all of the yellowtail (and hamachi) were identified as *Seriola quinqueradiata*, a type of amberjack, which is commonly known as Japanese yellowtail (buri) or hamachi in sushi venues, but not a species recognized by FDA as acceptable to market under the name "yellowtail."[20]

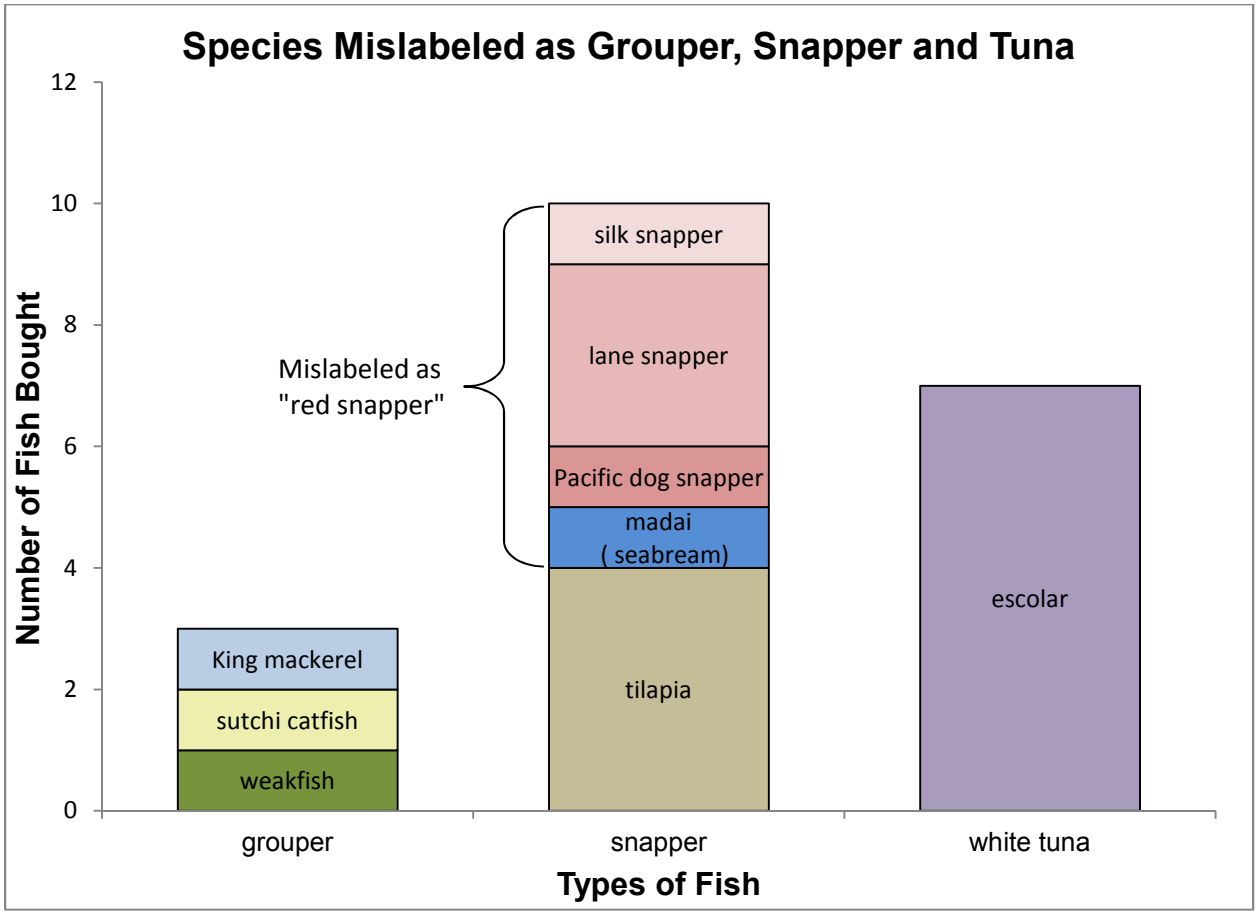
Restaurants

Of the 16 unique restaurant locations where fish was bought, half of those restaurants sold mislabeled fish. Six types of fish were collected from restaurants and more than one third of the samples (36%) were mislabeled. Pangasius (or sutchi Asian catfish) and weakfish were sold as grouper. One "snapper" was actually tilapia, and three "red snapper" were actually a less expensive lane snapper. Two of the three salmon swapping incidents were found in restaurants, where Atlantic salmon was sold as "wild" or "king" salmon.

Grocery Stores

We collected the greatest number (40) and variety (8) of fish types from grocery stores, but found the least amount of fraud (8%) among the retail types sampled. Grocery samples were obtained from 29 grocery store outlets representing 11 different parent companies. These included six national chains, two state chains and three independent markets. The mislabeled grocery store fish included two “red snapper” and one “grouper.” The two “red snapper” were actually the less expensive Pacific dog snapper and silk snapper. The one mislabeled grouper sample from a grocery store was actually king mackerel, a fish the FDA has on its “do not eat” list for sensitive groups because it accumulates high levels of mercury. Two of the instances (king mackerel and Pacific dog snapper) of fraud occurred in independent grocery stores, and the third in a large national chain store.

Common Substitutions



Discussion

HISTORY OF FRAUD IN FLORIDA

Florida is no stranger to seafood fraud. Seafood mislabeling has been reported in the press for more than twenty years and state officials have been testing seafood from retail outlets and wholesale vendors for mislabeling in Florida since at least 1985.[21] The episodes of reported historical mislabeling seem to have come in waves, with red snapper mislabeling by retail markets and processors dominating in the late 1980s and early 90s and high profile grouper mislabeling uncovered in restaurants and perpetrated by unscrupulous distributors in the mid-2000s.[22,23] Many of these reports originated from journalists

collecting retail samples and submitting them for analyses. Other investigations of distributors and importers were conducted by state and federal government officials. Each major episode was followed by a flurry of remedial efforts, ranging from voluntary business-led task forces and education campaigns, increased inspections and seafood testing by state and federal government agencies and private labs, to fines, indictments and sentencing for major perpetrators of fraud. This report shows, however, that those efforts were not sufficient to prevent continued seafood mislabeling.

Historical Details

Surveys of broad, non-random seafood species testing by the Florida Department of Agriculture and Consumer Services revealed widespread seafood mislabeling in stores and processing plants, at a rate of 20% in 1985 to 24% in 1987.[24] A 1988 investigation by the *South Florida Sun-Sentinel* found that less expensive snappers and other species were substituted for true red snapper, *Lutjanus campechanus*, in South Florida grocery stores and fish markets about 90% of the time.[25] State testing in 1989 confirmed these findings with 73% of red snapper obtained from grocery stores and distributors in South Florida found to be mislabeled.[26]

In response to this first wave of fraud, the state seized fraudulent product and issued fines, but prosecuted no perpetrators of fraud.[27] The seafood industry responded by developing educational materials for buyers and processors and began paying for their own tests of products. Florida also launched statewide spot checks of mislabeling at that time.[28] In 1992, results of that round of state testing revealed that fraud levels dropped to 50% for red snapper and 15% for overall seafood mislabeling.[29]

The next big wave of reported seafood fraud was uncovered in Florida and the Gulf in the form of grouper fraud in the mid-2000s, coinciding with large volumes of Vietnamese “catfish” coming into the market.[30] Another round of seafood testing by Florida journalists in 2006 revealed widespread grouper mislabeling in restaurants, with the fraction of fake grouper ranging from 40-50%.[31]

Investigations in 2006 by Florida Department of Agriculture and Consumer Services caught one importer located in Hialeah of misbranding 8,000lbs of farmed Vietnamese broadhead catfish as grouper. A federal investigation the same year uncovered a Florida panhandle importer and supplier passing off 1million lbs of Vietnamese “catfish” as wild grouper.[32] The Florida Restaurant and Lodging Association responded in 2006 by forming a task force of stakeholders to figure out how to authenticate imported grouper and the Florida Department of Business and Professional Regulation apparently began testing seafood sold in restaurants for misrepresentation and issuing citations, which continues to this day.[33] These citations are considered second degree misdemeanors, which can result in fines up to $1000 for each violation and revocation of licenses. It is unclear how many fines are levied against those cited.

Then, in 2008, Florida’s Attorney General's Office revealed that a large distributor was mislabeling fish as grouper.[34] Academic testing from 2007 through 2009 revealed continued mislabeling of grouper and red snapper from South Florida restaurants with rates ranging from 25-33%.[35] More recent testing of “white tuna” sushi followed in 2010 by both academic studies and the state government, finding up to 80% mislabeled.[36]

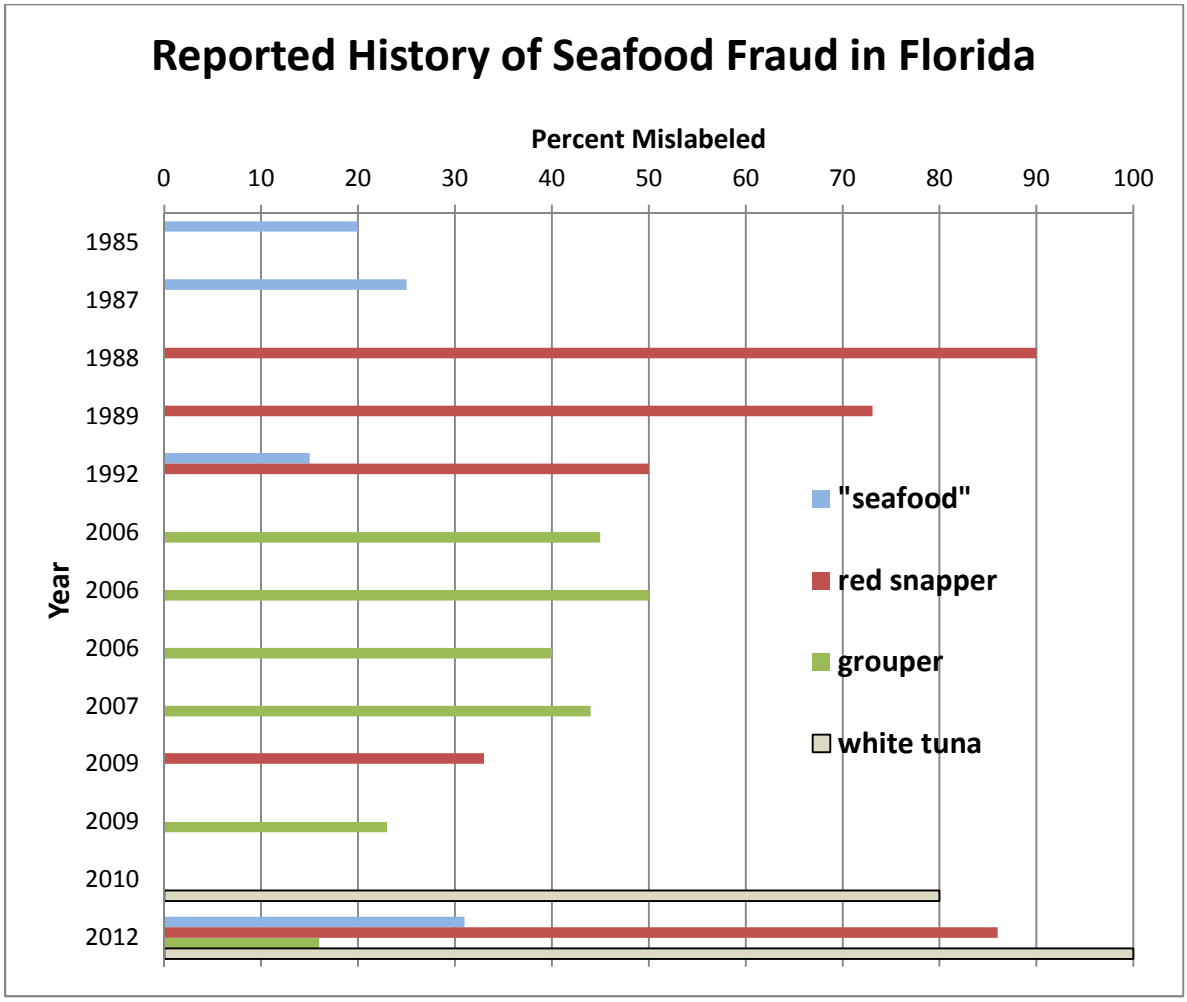
Some of the largest players in the fake grouper scam in the eastern Gulf and Florida in the mid- 2000s were indicted in January 2010 on 28 felony counts and two of the three indicted pled guilty to some of the charges in the same year.[37,38] In May 2011, two were sentenced to jail time and fined, demonstrating that penalties for large scale seafood fraud can be stiff.[39]

Apparent Trends in Florida Seafood Fraud

Given this background, it is interesting to compare the results from our study with those collected in the past.[40] The overall fraction of seafood mislabeling found in our present study (31%) is not much different from what the state testing found in the past (15-24%), but it is difficult to draw conclusions from comparing the two types of studies, since the state included species we did not test and looked at wholesale product in addition to retail.

For grouper, the picture is much improved since 2006, during the height of the fake grouper scam, when up to 50% of grouper was mislabeled.[41] Reported grouper substitution rates in Florida have dropped to 16% in this study. For "red snapper," the picture may be less rosy, with mislabeling levels declining from 90% in 1988 to 25-33% in 2009, but back up to 86% in this study.[42,43]

There may be fewer fish labeled specifically "red snapper" these days than in the past. The mislabeled proportion for all fish with name "snapper" in the label was 38% in this study, however, and would be more in keeping with the trend. The level of "white tuna" mislabeling (100%) is comparable to previous testing in 2010.



Note: See Appendix A2 for data details and sources.

Regardless of the current and historical levels of seafood fraud in Florida, any amount of seafood fraud should be cause for concern, considering the potentially serious health, economic and ecological implications of this illegal activity.

How seafood fraud hurts your health

KING MACKEREL FOR GROUPER

One of the most egregious fraudulent substitutions uncovered in this study was selling king mackerel as "grouper." King mackerel, a high mercury fish found in Florida waters, is particularly harmful for women

who might become pregnant, women who are pregnant, nursing mothers and young children. FDA and the Florida Department of Health warn women of childbearing age and children not to eat king mackerel due to its high mercury levels and Florida advises all others to limit consumption to one serving per month.[44,45] Obviously, consumers can not heed these health warnings when they are led to believe they are eating grouper, or some other type of fish.

ESCOLAR FOR WHITE TUNA

All of the "white tuna" bought in the Miami/Fort Lauderdale area was mislabeled. All seven tuna samples labeled as "white tuna," typically assumed to be albacore, were actually escolar. Escolar or oilfish (*Lepidocybium flavobrunneum)* is not a tuna at all, but is instead a snake mackerel species that contains a naturally occurring toxin, gempylotoxin, that can cause troubling and severe gastrointestinal problems for some who eat too much. Because of the health problems associated with escolar, Italy and Japan have banned it, several other countries have health advisories for it and the FDA advises against the sale of it.[46,47]

The FDA allows only one species, *Thunnus alalunga*, to be marketed as "white tuna" and only when sold as canned tuna.[48] Otherwise, *Thunnus alalunga*, sold in other forms (e.g. fresh or frozen) may be marketed only as "tuna" or "albacore tuna." Fish sellers in Florida seem to be at least partly aware of this type of fraud, perhaps due to a number of establishments receiving citations from state officials for "white tuna" fraud.[49] While browsing sushi menus, approximately half of the venues actually specified that they were selling escolar, and at most of these venues the term "white tuna" was not used.

OTHER REEF SPECIES SUBSTITUTIONS – CIGUATERA CONCERNS

Florida has also seen numerous serious outbreaks of ciguatera poisoning over the years due to the consumption of some large reef fish, such as certain snappers, groupers, jacks and barracuda, from affected tropical waters that harbor the marine toxin.[50,51,52,53] In fact, Florida was one of the top two states for incidents of ciguatera poisoning in 2010 (the other being Hawaii).[54] Ciguatera, one of the most frequent forms of seafood poisoning, can cause acute and chronic debilitating symptoms and is best treated within one to three days of being poisoned.[55] As with any food outbreak, quickly and correctly identifying the disease and responsible food source can lessen the severity and number of individuals affected. Knowing exactly where your fish was caught and its correct species name for trace-back purposes is vital information for Floridians in particular, and others who enjoy consuming tropical reef fish.

How Seafood Fraud Hurts Your Wallet

The majority of the seafood mislabeling identified in this study was clear economic fraud, for example when tilapia is sold as red snapper, *Pangasius* catfish is sold as grouper and farmed salmon sold as wild. This type of fraud is a deliberate switch at some point in the supply chain, for the purposes of gaining an economic edge and increasing profits. Anyone along the seafood supply chain can lose money from these fraudulent practices, including the consumer, if what they are paying for is cheaper than what they are ordering or getting. It is also possible that some mislabeling can be due to human error. For example, some of the snappers look very similar and are caught in the same areas, so distinguishing one snapper species from another can be difficult to the untrained eye. But true red snapper generally commands a higher price than other types of snapper.

Confusing Use of Vernacular Names

Another type of mislabeling may be due to a misunderstanding because of the use of vernacular names. For example, some cases of mislabeling identified in this study (~ 5% of our samples) may not be misleading to some consumers, such as the labeling of "black cod" for sablefish and "yellowtail" for Buri amberjack served in sushi venues. Although vernacular names are familiar to some shoppers in some regions, seafood is sold worldwide, therefore regional or vernacular names can confuse consumers. For example, certain wallet cards advise avoiding some species of fish going by the name of "yellowtail," so

knowing which species is being served would help guide conservation minded consumers.[56] Oceana believes that consumers have a right to safe, legal and honestly labeled seafood. To reduce confusion, seafood should be labeled with the common scientific name, as listed in the FDA Seafood List.

Conclusions

Given Florida's history and response to seafood fraud in the past, it is concerning that fraud still continues despite the risk of serious implications. It is discouraging to see ongoing seafood fraud despite the state's regular testing, inspection and reporting on the problem. On the other hand, the overall seafood fraud level in the Miami/Fort Lauderdale area (31%) is lower than in the other cities that have been recently investigated, such as Boston (48%) and L.A. (55%). The lower levels of fraud in South Florida compared to these other cities could be considered a credit to the efforts of the state to combat fraud. One may speculate that seafood fraud levels in South Florida would be as high as those observed in other metropolitan areas if not for the frequent coverage of the problem in the news and policing and oversight exercised by Florida.

Florida diners expect to be served local fish such as red snapper and grouper, and preferably from local waters. The reality is that snappers and groupers have been severely overfished for decades and continue to be overfished in many cases. Because these species grow very slowly, it is taking a long time for the populations to rebuild to the point of being able to support healthy fisheries. But diners feasting on mislabeled "grouper" and "snapper" would not likely know or consider these facts or realize that an imported, mislabeled fish is more likely to end up on their dinner plate than local fish. Those who perpetrate fraud profit from illusions of plentiful local "red snapper" or "grouper" at the expense of local businesses.

These fraudulent practices undercut honest fisherman who are playing by the rules and going to great trouble to harvest local snappers and groupers in a responsible manner. Such fish should command a premium price. According to a recent survey, most Floridians who are aware of grouper fraud are willing to pay more for grouper with a product integrity label which guarantees "fresh Florida grouper."[57] In fact, Floridians are now able to purchase fish with a "Fresh from Florida" logo.[58] By undercutting those selling genuine Florida fish that are accurately labeled, mislabeling harms honest businesses all along the seafood supply chain. Seafood fraud also harms those who sell seafood to the public, including those in the tourism industry, if consumers do not trust what they are being served or sold. History suggests that the mislabeling uncovered in this report could have been perpetrated at the level of the importer, distributor or retailer, and that it is impossible for us and other consumers to tell where it occurred or who is responsible without better seafood labels and a traceability system for seafood. Until we have a full seafood traceability system from boat to plate in place for our global seafood supply, perhaps we should not be too surprised that these fraudulent practices continue. Meanwhile, it is clear that continued and increased inspections, testing and enforcement of mislabeling violations is needed at the border and in the domestic supply to keep seafood fraud in check. But inspections alone will not fix this problem; traceability combined with transparency is needed to allow for verification and accountability to enter the complex supply chain, while providing more information to consumers about the food they are serving their families.

Consumer Resources

The Florida Department of Agriculture and Consumer Services, Division of Marketing and Development provides consumers with advice to combat seafood fraud:

> **"How should I report suspected mislabeling of seafood at a Florida restaurant?**
>
> If you suspect mislabeling of seafood at a Florida restaurant, report it to the Florida Department of Business and Professional Regulation by calling (850) 487-1395 or online at https://www.myfloridalicense.com/
>
> **How should I report suspected mislabeling of seafood at a Florida retail seafood market or grocery store?**
>
> If you suspect mislabeling of seafood at a Florida retail seafood market or grocery store, report it to the Florida Department of Agriculture and Consumer Services, Division of Food Safety, by calling (850) 245-5520."

Often mislabeled seafood is sold for a price "too good to be true." Expect to pay more for the real deal.

> "Florida seafood industry experts say you should expect to pay the following approximate prices for Florida grouper in restaurants: high-end restaurant, entree $21 to $27, sandwich $13 to $16; middle-price restaurant, entree $16 to $20, sandwich $10 to $12; lower-price restaurant, entree $14 to $16, sandwich $8 to $10."

If seafood from Florida is what you desire, then seek out and buy seafood with the "Fresh from Florida" logo.

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Appendix Table A1

List of fish samples collected in South Florida, Winter 2011/2012

Fish type (#fraud/#total)	Fish Name as Labeled[1]	Species ID	Scientific Common Name (FDA market name)	Retail Code[2]
catfish (0/1)	catfish	*Ictalurus punctatus*	catfish, channel (catfish)	G
Chilean sea bass (0/4)	Chilean sea bass	*Dissostichus eleginoides*	Patagonian toothfish (Chilean seabass)	S
	Chilean sea bass	*Dissostichus eleginoides*	Patagonian toothfish (Chilean seabass)	R
	Chilean sea bass	*Dissostichus eleginoides*	Patagonian toothfish (Chilean seabass)	R
	Chilean sea bass	*Dissostichus eleginoides*	Patagonian toothfish (Chilean seabass)	R
cod (1/2)	cod	*Gadus macrocephalus*	cod, Pacific (cod)	G
	cod, black	*Anoplopoma fimbria*	sablefish (sablefish)	R
corvina (0/1)	corvina	*Cynoscion virescens*	weakfish, green (weakfish)	G
escolar (0/1)	escolar	*Lepidocybium flavobrunneum*	escolar	S
grouper (3/19)	grouper	*Cynoscion albus*	weakfish, whitefin (weakfish)	R
	grouper	*Epinephelus morio*	grouper, red (grouper)	G
	grouper	*Epinephelus morio*	grouper, red (grouper)	G
	grouper	*Epinephelus morio*	grouper, red (grouper)	G
	grouper	*Epinephelus morio*	grouper, red (grouper)	G
	grouper	*Epinephelus morio*	grouper, red (grouper)	G
	grouper	*Epinephelus morio*	grouper, red (grouper)	S
	grouper	*Epinephelus morio*	grouper, red (grouper)	G
	grouper	*Epinephelus morio*	grouper, red (grouper)	G
	grouper	*Mycteroperca bonaci*	grouper, black (grouper)	R
	grouper	*Mycteroperca bonaci*	grouper, black (grouper)	R
	grouper	*Mycteroperca interstitialis*	grouper, yellowmouth (grouper)	G
	grouper	*Pangasius hypophthalmus*	catfish, sutchi (swai or sutchi or striped pangasius or tra)	R
	grouper	*Scomberomorus cavalla*	mackerel, king (mackerel, spanish)	G
	grouper, black	*Mycteroperca bonaci*	grouper, black (grouper)	R
	grouper, black	*Mycteroperca bonaci*	grouper, black (grouper)	R

	grouper, red	*Epinephelus morio*	grouper, red (grouper)	G
	grouper, red	*Epinephelus morio*	grouper, red (grouper)	G
	grouper, red (cherna)	*Epinephelus morio*	grouper, red (grouper)	G
hamachi (0/6)[3]	hamachi	*Seriola quinqueradiata*	buri (amberjack)	S
	hamachi	*Seriola quinqueradiata*	buri (amberjack)	S
	hamachi	*Seriola quinqueradiata*	buri (amberjack)	S
	hamachi	*Seriola quinqueradiata*	buri (amberjack)	S
	hamachi	*Seriola quinqueradiata*	buri (amberjack)	S
	hamachi (yellowtail)	*Seriola quinqueradiata*	buri (amberjack)	S
mahi-mahi (0/2)	mahi-mahi	*Coryphaena hippurus*	dolphin (mahi-mahi)	R
	mahi-mahi	*Coryphaena hippurus*	dolphin (mahi-mahi)	R
	marlin	*Makaira nigricans*	marlin, blue (marlin)	G
salmon (3/16)	salmon	*Oncorhynchus gorbuscha*	salmon, pink (salmon, pink or humpback)	G
	salmon	*Salmo salar*	salmon, Atlantic (Atlantic salmon)	G
	salmon	*Salmo salar*	salmon, Atlantic (Atlantic salmon)	G
	salmon	*Salmo salar*	salmon, Atlantic (Atlantic salmon)	G
	salmon	*Salmo salar*	salmon, Atlantic (Atlantic salmon)	S
	salmon	*Salmo salar*	salmon, Atlantic (Atlantic salmon)	G
	salmon, Atlantic farmed	*Salmo salar*	salmon, Atlantic (Atlantic salmon)	G
	salmon, coho	*Oncorhynchus kisutch*	salmon, coho (salmon, coho or silver or medium red)	G
	salmon, king	*Salmo salar*	salmon, Atlantic (Atlantic salmon)	R
	salmon, king wild	*Oncorhynchus tshawytscha*	salmon, chinook (salmon, chinook or king or spring)	G
	salmon, sockeye	*Oncorhynchus nerka*	salmon, sockeye (salmon, sockeye or red or blueback)	G
	salmon, sockeye wild	*Oncorhynchus nerka*	salmon, sockeye (salmon, sockeye or red or blueback)	G
	salmon, sockeye wild	*Oncorhynchus nerka*	salmon, sockeye (salmon, sockeye or red or blueback)	G

	salmon, sockeye wild	*Oncorhynchus nerka*	salmon, sockeye (salmon, sockeye or red or blueback)	G
	salmon, wild	*Salmo salar*	salmon, Atlantic (Atlantic salmon)	S
	salmon, wild	*Salmo salar*	salmon, Atlantic (Atlantic salmon)	R
snapper (10/26)	snapper	*Lutjanus cyanopterus*	snapper, cubera (snapper)	G
	snapper	*Lutjanus synagris*	snapper, lane (snapper)	G
	snapper	*Lutjanus synagris*	snapper, lane (snapper)	R
	snapper	*Ocyurus chrysurus*	snapper, yellowtail (snapper)	S
	snapper	*Ocyurus chrysurus*	snapper, yellowtail (snapper)	R
	snapper	*Oreochromis niloticus*	tilapia, Nile (tilapia)	R
	snapper	*Oreochromis sp.*	tilapia	S
	snapper	*Oreochromis sp.*	tilapia	S
	snapper (white fish)	*Oreochromis niloticus*	tilapia, Nile (tilapia)	S
	snapper, red Japanese	*Pagrus major*	madai (porgy or seabream)	S
	snapper, Pacific lane	*Lutjanus synagris*	snapper, lane (snapper)	G
	snapper, red	*Lutjanus campechanus*	snapper, red (snapper)	S
	snapper, red	*Lutjanus novemfasciatus*	snapper, Pacific dog (snapper)	G
	snapper, red	*Lutjanus synagris*	snapper, lane (snapper)	R
	snapper, red	*Lutjanus synagris*	snapper, lane (snapper)	R
	snapper, red	*Lutjanus synagris*	snapper, lane (snapper)	R
	snapper, red caribbean	*Lutjanus vivanus*	snapper, silk (snapper)	G
	snapper, vermillion	*Rhomboplites aurorubens*	snapper, vermilion (snapper)	G
	snapper, yellowtail	*Ocyurus chrysurus*	snapper, yellowtail (snapper)	G
	snapper, yellowtail	*Ocyurus chrysurus*	snapper, yellowtail (snapper)	G
	snapper, yellowtail	*Ocyurus chrysurus*	snapper, yellowtail (snapper)	R
	snapper, yellowtail	*Ocyurus chrysurus*	snapper, yellowtail (snapper)	R
	snapper, yellowtail	*Ocyurus chrysurus*	snapper, yellowtail (snapper)	S
	snapper, yellowtail	*Ocyurus chrysurus*	snapper, yellowtail (snapper)	R

	snapper, yellowtail	*Ocyurus chrysurus*	snapper, yellowtail (snapper)	R
	snapper, yellowtail	*Ocyurus chrysurus*	snapper, yellowtail (snapper)	R
tuna (7/11)	tuna	*Thunnus albacares*	tuna, yellowfin (tuna)	G
	tuna	*Thunnus atlanticus*	tuna, blackfin (tuna)	G
	tuna, ahi	*Thunnus albacares*	tuna, yellowfin (tuna)	G
	tuna, white	*Lepidocybium flavobrunneum*	escolar	S
	tuna, white	*Lepidocybium flavobrunneum*	escolar	S
	tuna, white	*Lepidocybium flavobrunneum*	escolar	S
	tuna, white	*Lepidocybium flavobrunneum*	escolar	S
	tuna, white	*Lepidocybium flavobrunneum*	escolar	S
	tuna, white	*Lepidocybium flavobrunneum*	escolar	S
	tuna, white	*Lepidocybium flavobrunneum*	escolar	S
	tuna, yellowfin (ahi)	*Thunnus albacares*	tuna, yellowfin (tuna)	G
white fish (2/2)	white fish	*Lepidocybium flavobrunneum*	escolar	S
	white fish	*Oreochromis niloticus*	tilapia, Nile (tilapia)	S
yellowtail (4/4)	yellowtail	*Seriola quinqueradiata*	buri (amberjack)	S
	yellowtail	*Seriola quinqueradiata*	buri (amberjack)	S
	yellowtail	*Seriola quinqueradiata*	buri (amberjack)	S
	yellowtail	*Seriola quinqueradiata*	buri (amberjack)	S

[1]Bold and highlighted fish names are mislabeled. Lighter shade represents mislabeling that may not be misleading to some.
[2] Retail codes where fish was purchased: G (grocery), R (restaurant) and S (sushi).
[3] Hamachi is a Japanese name for *Seriola quinqueradiata* (either farmed on young).

Appendix Table A2: Sources of data for “Reported History of Seafood Fraud in Florida” chart

Year	% Mislabeled (# mislabeled/# total)[1]				Reference
	"seafood"	red snapper	grouper	white tuna	
1985	20%				Grogan, 1988a
1987	25%				Grogan, 1988a
1988		90% (18/20)			Grogan, 1988b
1989		73% (19/26)			Grogan, 1989
1992	15%	50% (5/10)			Grogan, 1992
2006			45% (5/11)		Nohlgren, 2006
2006			50% (4/8)		Nohlgren, 2006
2006			40% (4/10)		Nohlgren, 2006
2007			44%		Franceschina, 2011
2009		33%			Vasquez, 2009
2009			23%		Vasquez, 2009
2010				80% (8/10)	Franceschina, 2011
2012	31% (30/96)	86% (6/7)	16% (3/19)	100% (7/7)	This study

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