



## **Widespread Seafood Fraud Found in New York City**

**December 2012**

**Authors: Kimberly Warner, Ph.D., Walker Timme and Beth Lowell**

### **Executive Summary**

Seafood fraud can happen anywhere – even in the Big Apple. Fraud includes any false information accompanying seafood, from short weighting to swapping out one species of fish for another. Oceana’s investigation focused on species substitution, or the swapping of a lower value or lower quality fish for a more desirable species. This “bait and switch” hurts our oceans, our health and rips off consumers. And most importantly, it is illegal.

Everywhere seafood is tested, fraud has been found. In fact, Oceana and others recently found shocking levels of mislabeling in the Boston (48 percent), Los Angeles (55 percent) and Miami (31 percent) areas. In 2012, Oceana also investigated seafood mislabeling in the New York City area as part of its Campaign to Stop Seafood Fraud. Despite frequent reporting on the issue for more than 20 years, Oceana found that 39 percent of the 142 seafood samples collected and DNA tested from grocery stores, restaurants and sushi venues were mislabeled, according to the United States Food and Drug Administration (FDA) guidelines.

Oceana’s studies have shown this is not just a regional problem, but a widespread, nationwide issue that needs federal attention. Federal agencies and Congress should take notice and act to stop seafood fraud.

### **Key Findings**

- 58 percent of the 81 retail outlets sampled sold mislabeled fish (three in five).
- Small markets had significantly higher fraud (40 percent) than national chain grocery stores (12 percent).
- 100 percent of the 16 sushi bars tested sold mislabeled fish.
- Tilefish, on the FDA’s do-not-eat list because of its high mercury content,<sup>1</sup> was substituted for red snapper and halibut in a small market.
- 94 percent of the “white tuna” was not tuna at all, but escolar, a snake mackerel that has a toxin with purgative effects for people who eat more than a small amount of the fish.
- Thirteen different types of fish were sold as “red snapper,” including tilapia, white bass, goldbanded jobfish, tilefish, porgy/seabream, ocean perch and other less valuable snappers.

### **Introduction**

New York is home to some of the finest and most diverse food in the world. Within a few blocks you can find renowned restaurants, specialty markets, mom and pop stores, food carts and bodegas. The food in New York City is an amalgam of all the ethnicities and races that call it home: from sushi and tacos, to

cheesecake and pizza, and everything in between. While New Yorkers are willing to try all types of food, they expect that the food they are ordering is what they are getting. However, this may not be the case if they order seafood, be it from the local grocery market, a new restaurant or the lunchtime sushi bar.

Unfortunately, recent testing has revealed that dishonest labeling and fraudulent seafood substitution for certain species is rampant and widespread. Seafood fraud is any activity that misrepresents the seafood you buy and includes mislabeling or substituting one species of fish for another. Recent investigations by Oceana in Boston, Miami and Los Angeles found mislabeling rates up to 55 percent for seafood sold in sushi bars, restaurants and grocery stores.<sup>2,3,4</sup> As of 2011, the U.S. now imports more than 90 percent of the seafood consumed in this country.<sup>5</sup> With an increasingly complex and obscure seafood supply chain, plus lagging federal oversight and inspection of rising seafood imports, it is difficult to identify who along the supply chain perpetrates the fraud.

Oceana turned its attention to the New York City metropolitan area in the summer of 2012 as part of a continuing examination of seafood fraud in different regions of the U.S. Previous investigations of seafood fraud in New York by journalists turned up mislabeling of shrimp, crab and lobster in 1987,<sup>6</sup> farmed Atlantic salmon standing in for wild salmon purchased in grocery stores in 2005,<sup>7</sup> and most recently, high levels of white tuna fraud occurring in restaurants.<sup>8</sup> Two different investigations by high school student sleuths in 2008<sup>9</sup> and 2009<sup>10</sup> revealed between one-quarter and one-third of seafood purchased in New York to be mislabeled. Oceana was curious whether the considerable and recurring media attention that seafood fraud has received in New York City over the years would have any deterrent effect on current levels of mislabeling.

## Our Study

Oceana staff and supporters collected fish from the New York City area between June and September of 2012. Samples were mainly collected in Manhattan but also included samples from Brooklyn, Queens and surrounding towns.



*Most of the samples were bought in Manhattan, Queens and Brooklyn. A few others were bought in Staten Island, Commack, Scarsdale and Hudson, NY, as well as Edgewater, NJ.*

A total of 142 samples were collected from 81 retail outlets. Samples were collected from three types of retail facilities: 89 from grocery stores, 28 from restaurants and 25 from sushi venues. The restaurant and sushi venues visited by Oceana staff were selected based on recommendations from Yelp and others.

Thirteen different types of fish were collected, and they included fish that had regional significance (i.e. Atlantic cod) and those that were found to be mislabeled in previous studies such as red snapper, white tuna, wild salmon and grouper.

**Types (and Number) of Fish Purchased in New York**

<b>salmon (56)</b>	<b>snapper (19)</b>	<b>tuna (18)</b>	<b>cod (16)</b>	<b>sole (12)</b>
mackerel (5)	<b>halibut (4)</b>	<b>striped bass (4)</b>	<b>grouper (3)</b>	haddock (2)
<b>blackfish (1)</b>	Chilean sea bass (1)	flounder (1)		

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

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.

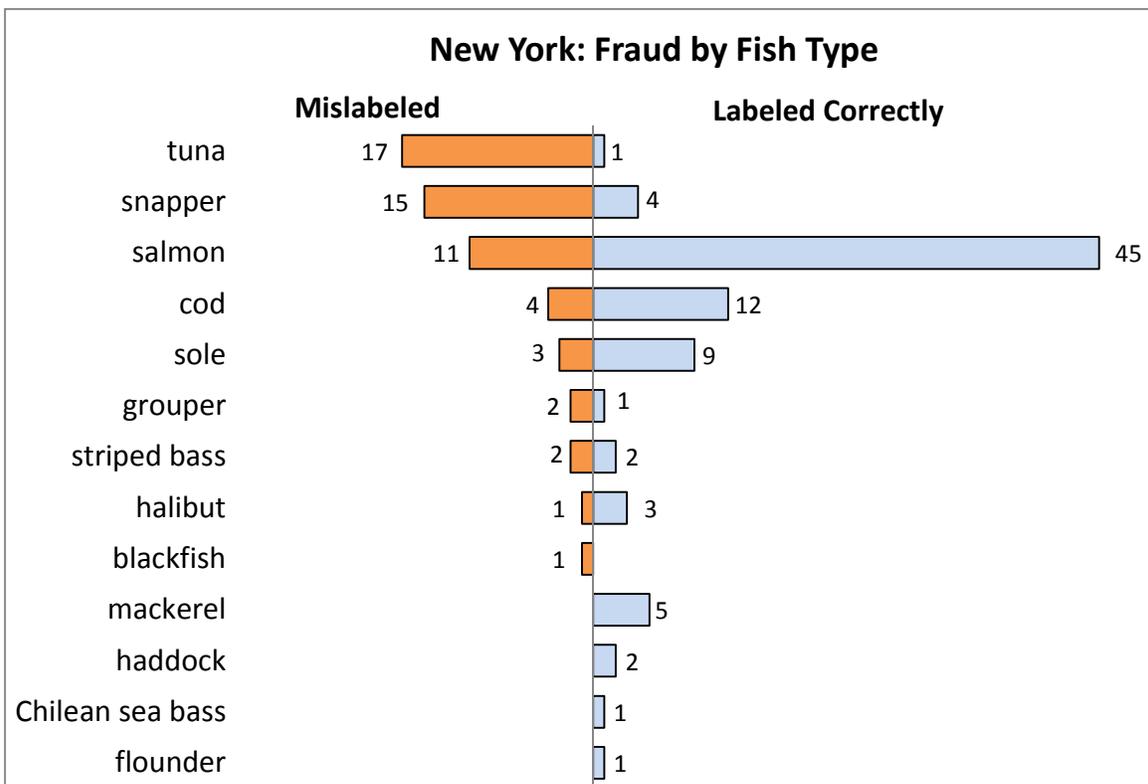
Oceana considered fish to be mislabeled if seafood substitution occurred and if retailers were not following the FDA Seafood List, a tool used to guide seafood labeling that lists the acceptable market names, scientific names and scientific common names for roughly 1,700 species of seafood sold in the U.S.<sup>11</sup>

Labeling seafood as something other than the acceptable market name may be considered mislabeling. The FDA Seafood List also includes “vernacular,” or informal or 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**

The overall seafood fraud rate in New York City was 39 percent, with 56 of 142 samples mislabeled. More than half of the retail outlets sampled sold mislabeled fish (47 out of 81 or 58 percent).

The highest level of seafood substitution in New York City was for fish labeled as tuna (17 out of 18 or 94 percent), followed by those labeled as snapper (15 out of 19 or 79 percent). Although salmon was the most commonly purchased fish, it represented the third highest number of mislabeled fish among the fish types sampled (11 out of 56 or 20 percent). One-quarter of the cod and sole purchased was not honestly labeled, including every fish labeled “lemon sole” (3/3). Two out of three grouper were also mislabeled, as was one out of four halibut purchased. Half of the four striped bass purchased were mislabeled, as was the only blackfish sampled.



### FISH SUBSTITUTIONS

The greatest variety of fish substitutions was found for fish sold as “snapper” or “red snapper” (see Appendix Table A1 and below). The fish substituted for snapper or red snapper ranged from lesser-valued snapper species to farmed tilapia. Farmed tilapia from China or Taiwan is considered a fish to avoid by the Monterey Bay Aquarium’s Seafood Watch, due to environmentally unfriendly aquaculture practices and because tilapias are prone to escaping and easily become pervasive invasive species.<sup>12</sup>

The most troubling substitutions were for fish sold as red snapper and halibut that turned out to be tilefish and fish labeled white tuna that were actually escolar. Escolar is a species of snake mackerel that can cause acute gastrointestinal problems, while the tilefish substitutions represented a species found in the Gulf of Mexico that has mercury levels so high that it is on FDA’s do-not-eat list for women who are or might become pregnant, nursing mothers and young children.<sup>13</sup>

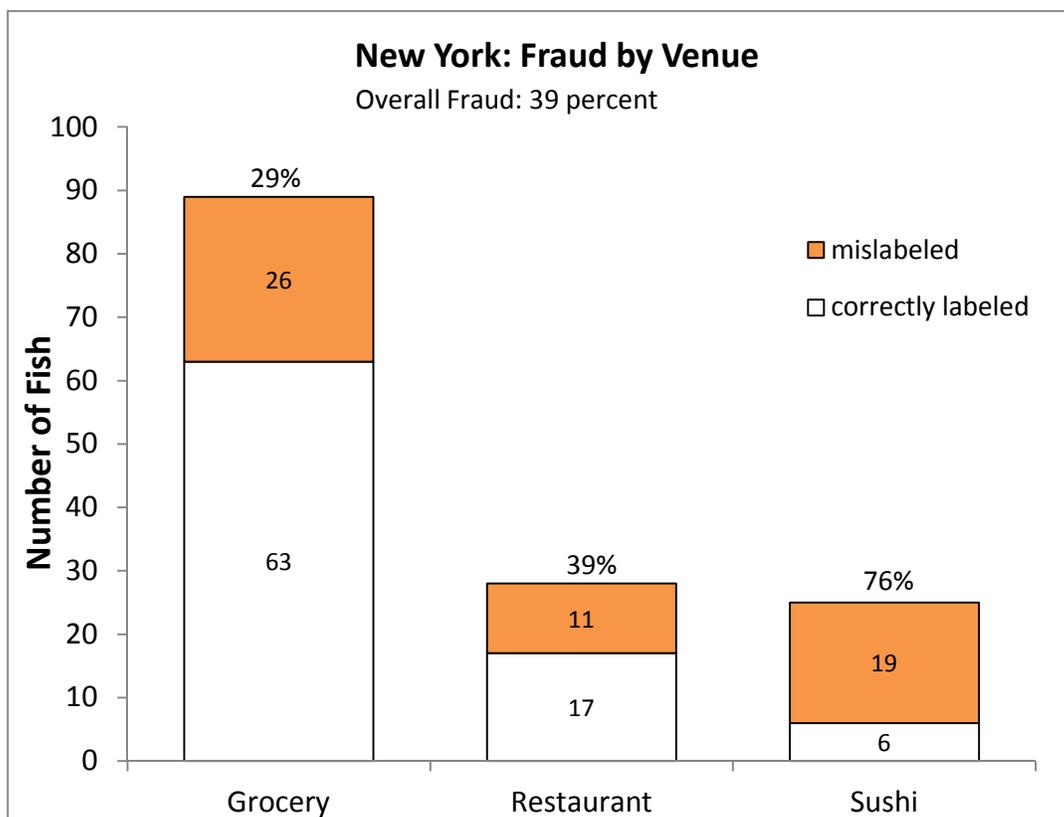
Fraudulent salmon was most often Atlantic salmon being substituted for wild salmon (Table A1). Wild Atlantic salmon, *Salmo salar*, is all but commercially extinct, but Pacific salmon is almost entirely wild-caught.<sup>14</sup> There are distinct differences between farmed and wild salmon: while farmed salmon is less expensive it also has a different flavor and may be exposed to antibiotics, antiparasitics and other chemicals associated with aquaculture. Rainbow trout (a mostly farmed commercial product) was also substituted for wild salmon. In a few cases, one type of wild salmon was substituted for another (Coho for sockeye and vice versa). However, fish substituted for king salmon (the most expensive salmon species) were all farmed Atlantic salmon.

Farmed *Pangasius*, a catfish-like fish, and hake were among the fish substituted for cod. Pacific cod was substituted for “scrod cod,” a vernacular name for Atlantic cod, and another supposedly local Atlantic cod. An African freshwater fish, Nile perch, and bream were substituted for grouper, while flounder stood in for all the lemon sole purchased. Tautog was sold under the vernacular name of “blackfish,” which may be understood locally by some New Yorkers but is not acceptable according to federal guidelines. Two of the four striped bass purchased were identified as white bass, which probably indicates the farmed hybrid species was sold in place of the wild.

<b>Frequently Swapped Fish in New York City Area</b>	
<i>What You Bought</i>	<i>What You Got</i>
red snapper	Caribbean red snapper, crimson snapper, goldbanded jobfish, ocean perch, porgy/seabream, spotted rose snapper, tilapia, tilefish, white bass, yellowtail snapper
white tuna	escolar
halibut	tilefish
wild salmon king salmon	rainbow trout, farmed Atlantic salmon
Pacific cod	farmed <i>Pangasius</i> "catfish"
grouper	Nile perch, bream
lemon sole	summer flounder, blackback flounder
striped bass	white bass

#### **WHERE YOU BUY SEAFOOD MATTERS**

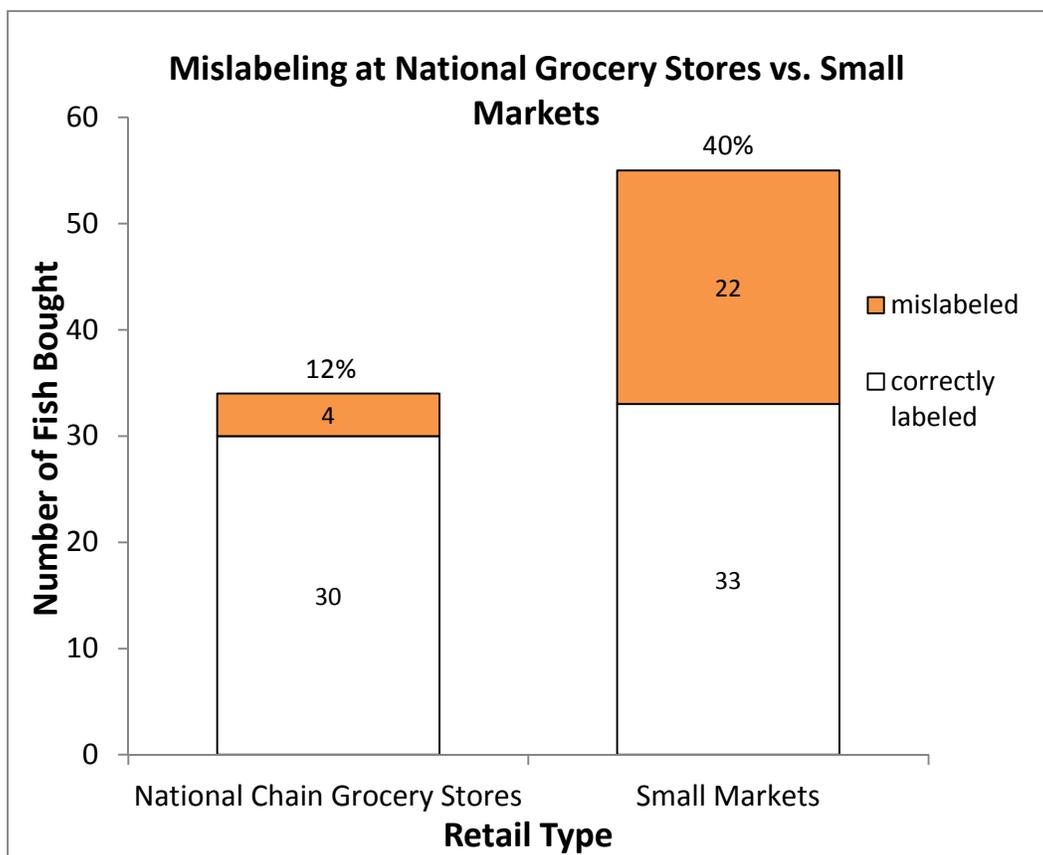
By far the largest percentage of fraud was found in sushi bars (76 percent), followed by restaurants (39 percent) and then grocery stores (29 percent).



#### **Grocery Stores**

Small local or regional grocery stores and markets supplied the majority of the grocery samples (55 out of 89) and were the source of the most fraud. Forty percent (22 out of 55) of the samples from small local markets were mislabeled. More than half (17 out of 31) of the small markets sold mislabeled fish. Several of these facilities were under the same name, or banner (i.e. a store with more than one location). These 31 facilities represented 27 banners, and 15 of those banners sold mislabeled fish (56 percent).

The national chain grocery stores had a much better record of correctly labeling their fish, but it was not perfect. Of the 34 samples from national grocery stores, four were mislabeled (12 percent). However, seafood fraud in national chain grocers was restricted to half of the six parent companies. These six parent companies represented seven chains (or banners) and 18 different outlets where fish were sampled.



For salmon in particular, fraud rates varied depending on if the samples were purchased at a national chain versus a small market. Twenty-seven percent (7 out of 26) of the salmon samples from small markets were mislabeled while just five percent (1 out of 20) were mislabeled at national chain stores. Of the seven mislabeled salmon samples purchased at small markets, five were sold as wild salmon (four were Atlantic salmon and one was rainbow trout), and two were sold as king salmon (both were Atlantic salmon).

Not only did small markets have more fraud than the national chains, they also had some of the most egregious fraud. For example, one fish sold as “red snapper” and one as “halibut” were actually tilefish, a fish that is so high in mercury it is one of four species on FDA’s do-not-eat list for women who are or might become pregnant, nursing mothers and young children.<sup>15</sup> In addition, both grouper samples from small markets were mislabeled and were actually a Nile perch and a bream. One red snapper was actually a goldbanded jobfish, a fish native to the Indo-Pacific, far from the Gulf of Mexico/Atlantic home of the true red snapper, *Lutjanus campechanus*.

Overall, a New Yorker purchasing fish at local or small regional markets was more likely to end up with mislabeled fish than if they shopped at a national chain store.

### Restaurants

Oceana collected 28 seafood samples from 16 restaurants in New York City, of which 39 percent (11 out of 28) were mislabeled. The 11 mislabeled samples came from 10 different restaurants, resulting in 10 out of the 16 restaurants (63 percent) serving mislabeled fish.

One would assume that true red snappers are more likely to be sold at high-end restaurants, but that is not what we found. One higher-end restaurant (\$\$\$<sup>16</sup>) substituted tilapia for red snapper, while a more moderately priced restaurant (\$\$) sold true red snapper. Other substitutions restaurants made for red snapper included porgy and white bass.

The most common fish bought at restaurants was salmon (eight), and three of them were mislabeled (38 percent). Two fish sold as wild and king salmon were actually farmed Atlantic salmon, and one was sold as sockeye but was actually coho salmon. Interestingly, all the fraud occurred in restaurants that were higher-end (\$\$\$), and no fraud was found in the moderately priced (\$\$) or the very expensive (\$\$\$\$) restaurants.

Of the four cod samples bought at restaurants, two were mislabeled. A fish sold as Atlantic cod was in fact white hake, and a fish sold as Pacific cod was striped *Pangasius* (a farmed Asian sutchi catfish). Interestingly, the substitution of white hake for Atlantic cod was found in the only national chain restaurant sampled.

### **Sushi**

Of the 25 sushi samples purchased, 19 were mislabeled (76 percent). However, the more alarming statistic is that 100 percent of the sushi venues (16) sold mislabeled fish. Most of the sushi fraud was escolar sold as “white tuna,” with 16 of the 17 samples (94 percent) mislabeled as escolar. One fish sold as super white tuna was albacore, which can only be called “white tuna” if it is sold in a can. In addition, sushi bars sold porgy/seabream as “Japanese red snapper” and white bass as “striped bass.”

One of the main issues with determining fish fraud in sushi bars is that there are challenges translating the name of many species from their traditional Japanese names to English and then having the English names comply with the FDA’s Seafood List. One prime example is what the Japanese call snapper versus what FDA allows to be called snapper. In Japan, *Pagrus major*, a red seabream native to the East and South China Seas, is called red snapper. However, in the U.S., FDA only allows one species, *Lutjanus campechanus*, a species found in the Gulf of Mexico and Atlantic Ocean, to be sold as red snapper. The FDA considers the Japanese term for red seabream, madai, as the common scientific name for *P. major*, so this fish may be marketed as madai, or either a porgy or a sea bream. Even though the Japanese vernacular name for *P. major* is a snapper, it is not actually from the snapper family and calling it a snapper is unacceptable according to federal guidelines. This mislabeling results in a lot of confusion for consumers at sushi venues who order “red snapper.” You don’t know if you are getting the Japanese version of red snapper, sea bream (madai, *Pagrus major*), or FDA’s version of red snapper, *L. campechanus*. In this study, we went by FDA’s rules for what it considers to be an acceptable market name. Any seafood sold in the U.S. should use the acceptable market name only, as outlined in the FDA Seafood List, to avoid such confusion for consumers.

The average price of the meal had no effect on whether the fish was mislabeled or not. Two of the four fish from a higher-end establishment (\$\$\$) were mislabeled as “white tuna” and “Japanese red snapper.” It is important to note the FDA Seafood List is supposed to guide seafood labeling practices across the U.S. to ensure that seafood is properly labeled using the acceptable market name so that any consumer, regardless of their knowledge of vernacular names, knows what fish they are buying at any retail location.

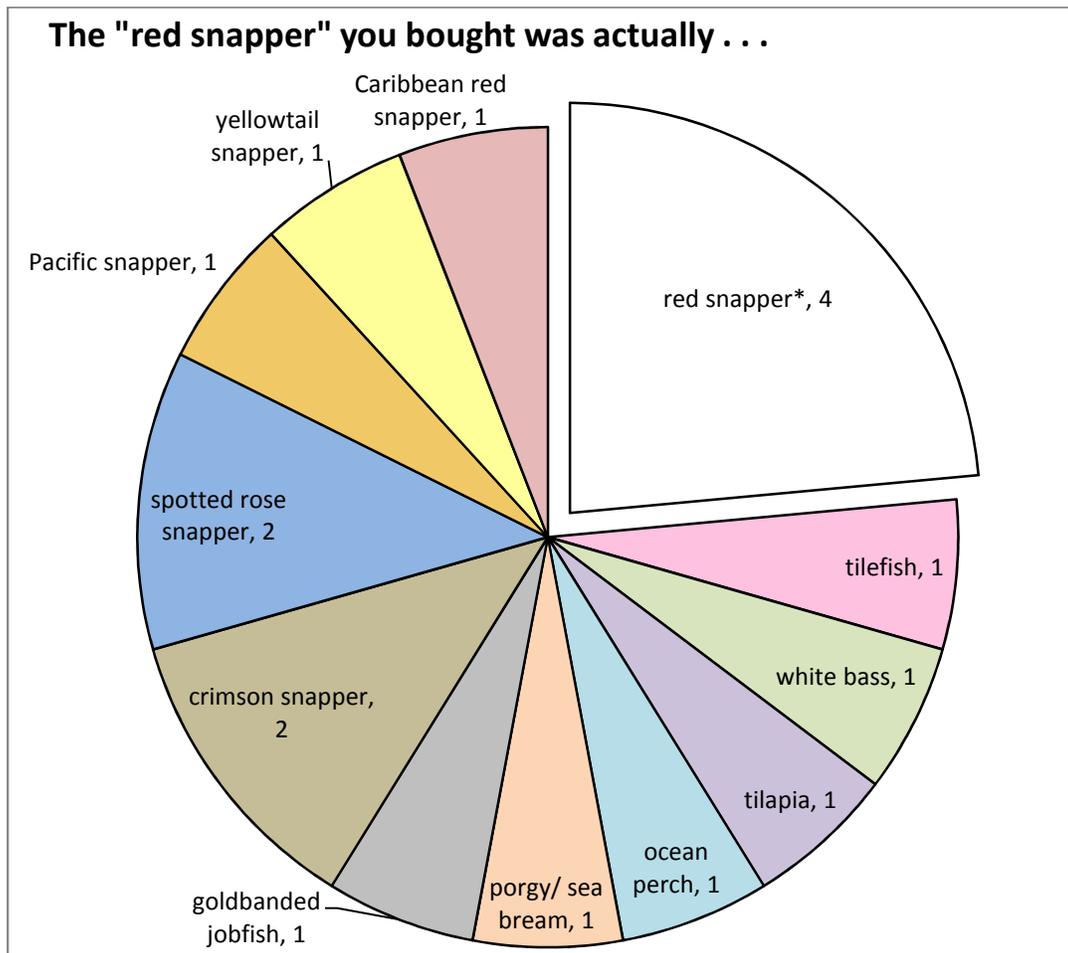
## **DISCUSSION**

### **RED SNAPPER IDENTITY AND CONSERVATION CONCERNS**

Seventeen of the 19 snapper samples purchased were labeled “red snapper,” and three-quarters were mislabeled. True red snapper, *Lutjanus campechanus*, is a reef fish found in the Western Atlantic off the southern U.S. coast and the Gulf of Mexico. The FDA only allows this particular species to be marketed and sold as red snapper.<sup>17</sup> Red snapper is a highly desirable fish due to its high quality and relatively limited catch, and consequently, there is a strong monetary incentive to mislabel and sell cheaper fish as red snapper.

Not only is red snapper a highly mislabeled fish, we observed a range of mislabeling offenses. Red snapper may be clearly mislabeled for economic gain (i.e. tilapia masquerading as red snapper), or it can be more subtle (i.e. substituting a closely related snapper species). Twelve of the red snapper samples (71 percent) were clearly mislabeled, with tilapia, bass, tilefish, jobfish, perch, porgy and distantly related snapper species labeled as red snapper. Most of the other snappers parading as red snapper originally

came from the Eastern Pacific or Indo-Pacific and are morphologically and genetically distinct from red snapper, enough so that at some point along the supply chain there was deliberate mislabeling.



\* The genetic test used to identify these samples cannot adequately distinguish between *L. campechanus* (red snapper) and *L. purpureus* (Caribbean red snapper). (See discussion in text).

However, with five of the "red snapper" samples it is quite a different story. We sent the samples to two different labs, and each came up with different results. The first lab used one part of the DNA (COI gene) and identified all five of the "red snapper" samples as *Lutjanus campechanus*, true (or Northern) red snapper. A subsequent lab sequenced one of the samples, looking at the COI gene plus a different part of the DNA, and identified the sample we sent as *Lutjanus purpureus*, Caribbean (or Southern) red snapper.

As it turns out, these two species are very similar both genetically and morphologically, and some have proposed that they may be the same species.<sup>18</sup> Until there is a definitive, peer-reviewed study that settles the question, the "default" scientific position is that the two species remain distinct. However, it would likely take experts in both fish morphology and genetic analysis to differentiate these two species, and even well-experienced fisherman or fish mongers may not be able to tell them apart.

Red snapper and Caribbean red snapper have largely different native ranges. Red snapper is found predominately in the western Atlantic along the East Coast of the U.S. and throughout the Gulf of Mexico.<sup>19</sup> In contrast, Caribbean red snapper is found throughout the Caribbean, from Cuba south to the northeast of Brazil.<sup>20</sup> However, there may be some overlap of the two species in the Caribbean.<sup>21</sup>

From a conservation standpoint, both red snapper and Caribbean red snapper were severely overfished by the late 1970s and 80s and remain overfished in the U.S. and elsewhere.<sup>22,23,24</sup> However, fish are

managed as “stocks” and sometimes as distinct populations based on geographical distributions rather than by species, and some stocks of the same species may be better managed than others. For example, red snapper caught in U.S. waters are under a strict rebuilding plan based on fisheries laws, and legally caught U.S. red snapper may be harvested and sold during a short and highly monitored fishing season. It is probably safe to assume that the two stocks of the U.S. red snapper fishery are better managed for recovery from overfishing than red snapper and Caribbean red snapper caught elsewhere. If undersized or illegally caught domestic red snapper were imported into the U.S. market as Caribbean red snapper, inspectors would be hard pressed to tell the species apart, even if armed with genetic testing, as with this particular case. Thus, the only reliable way to tell these stocks apart and protect overfished species is by a full traceability system from boat to plate that shows exactly where the fish were harvested.

## Health Concerns

### TILEFISH FOR GROUPER AND HALIBUT

Some of the most outrageous seafood fraud found in this study was the substitution of tilefish, a fish with a federal health advisory, for both halibut and red snapper, fish that do not carry such health warnings. Tilefish, particularly those harvested in the Gulf of Mexico, are so high in mercury that FDA and the Environmental Protection Agency (EPA) warn women who might become pregnant, women who are pregnant, nursing mothers and young children “DO NOT EAT.” The blueline tilefish sold as grouper and red snapper is distributed from the Gulf of Mexico to the Western Atlantic off of the southern U.S. coast.

Without accurate, honest labels that show exactly what fish you are eating and where it was harvested, those who need this critical advice about specific fish will be left unprotected. Unfortunately, this is not the first time one of the four high mercury “DO NOT EAT” fish was sold under a false name in New York City. Another study in 2008 by New York high school students uncovered king mackerel sold as “kingfish.”<sup>25</sup>

### ESCOLAR FOR WHITE TUNA

The dangerous substitution of escolar for white tuna has been documented in New York City eateries in other studies as well. Journalists<sup>26</sup> and scholars<sup>27</sup> have found similar “white tuna” fraud levels in sushi restaurants ranging from “nearly all” to “all.”

Not knowing you are buying escolar is particularly troublesome because it contains a toxin, gempylotoxin, which can cause severe gastrointestinal problems for those who eat too much and is best known for its purgative effects.<sup>28</sup> Due to the health problems escolar poses, it has been banned by both Italy and Japan, and it has health advisories in many other countries.<sup>29</sup> Even FDA advises against the sale of escolar.<sup>30</sup>

The FDA only allows albacore (*Thunnus alalunga*) to be marketed and sold as “white tuna,” and only when it is canned.<sup>31</sup> In other forms, such as frozen or fresh, it may be marketed as “tuna” or “albacore tuna.”

## Economic Concerns

Certainly many of the fish substitutions identified in this study were for the economic gain of someone along the seafood supply chain. If someone pays top dollar for king salmon and gets farmed Atlantic salmon, that person is cheated. Similarly, substitutions of farmed Asian catfish and tilapia for wild cod and red snapper would be economic fraud, as would the substitutions of lesser-valued wild fish or higher-priced, more desirable wild species. However, restricting one’s dining or shopping experience to higher-end eateries and retail outlets in New York City did not guarantee an honestly labeled seafood meal or purchase. Indeed, top dollar was paid for many of the fraudulent fish identified in this study.

## Religious Impacts

Mislabeled fish can also have religious impacts, such as when people try to avoid eating non-kosher species. Sometimes the fish on the menu could have been labeled as a kosher choice but what the

customer walked away with or ate was not. For example, if they ordered “white tuna” thinking it was albacore (kosher), and they got and ate escolar (not kosher), they would unknowingly be eating non-kosher fish.<sup>32</sup> In another instance, the menu offered Pacific cod, which is kosher, but the purchased fish was sutchi catfish (*Pangasius sp.*), which is not kosher.<sup>33</sup> For those seafood consumers who are only eating kosher foods, seafood fraud could raise additional concerns.

## Conclusions

Seafood fraud is certainly alive and well in the New York City area despite fairly frequent coverage of the topic in the media. The overall fraud levels uncovered in this study (39 percent) are discouraging given the attention to the topic in this area. It appears that little has changed in terms of seafood mislabeling in New York City.

Perhaps most troubling is the relatively high rate of seafood mislabeling (40 percent) identified in small local grocery stores and markets that many New Yorkers rely on for their shopping needs. While one cannot tell where along the often obscure seafood supply chain fraud occurs, the different fraud rates observed between national chains and local markets may shed some light. If the mislabeling is not occurring at the retail level, then the greater fraud rates observed at the small markets might suggest they obtain their seafood from different suppliers or that national chains have stricter accounting and labeling requirements along their supply chains. Without more transparency in the seafood supply chains and better labeling requirements for all seafood sold at retail outlets, fraud remains an open issue.

### TRACEABILITY IS KEY TO COMBATING SEAFOOD FRAUD

In an increasingly globalized economy, no one is surprised to find food on their plate from the other side of the world. However, to verify what you are eating is what you bought, there needs to be a system in place that ensures its authenticity.

Full traceability of the seafood supply chain is needed to ensure that only safe, legal and honestly labeled fish is sold in the U.S. Traceability can also give consumers more information about the seafood they purchase, including where, when and how it was caught. For example, a “red snapper” caught off the coast of Brazil would tell you, as well as the fish monger and regulators, that the fish is not carefully managed domestic red snapper but is probably Caribbean red snapper.

Traceability is also necessary for successful fisheries management. Red snapper, *Lutjanus campechanus*, and Caribbean red snapper, *Lutjanus purpureus* are overexploited.<sup>34,35</sup> Red snapper in particular is under strict management, which limits the fishing season, size of the fish, number of fish and overall wet weight that can be caught in the Atlantic and Gulf of Mexico, in hopes that the fishery will recover. This approach relies on accurate counting and accounting for all catch. Co-mingling or mislabeling catch could undermine this successful management program and threaten the livelihoods of the U.S. fishermen who work hard under these catch limits.

New York joins Boston, Los Angeles and Miami as another recently investigated region continuing to sell mislabeled seafood. Seafood fraud is a not just a regional, localized problem, but a widespread, national issue that needs federal attention. Federal agencies and Congress need to stop this bait and switch by requiring full traceability of the supply chain that is transparent and verifiable. Traceability would provide more information to consumers about the seafood they purchase, while keeping illegal fish out of the U.S. market.

Consumers should feel confident and secure with the food they eat. Honest labeling paired with traceability can help our oceans, our wallets and our health, while restoring confidence to consumers.

## Acknowledgements

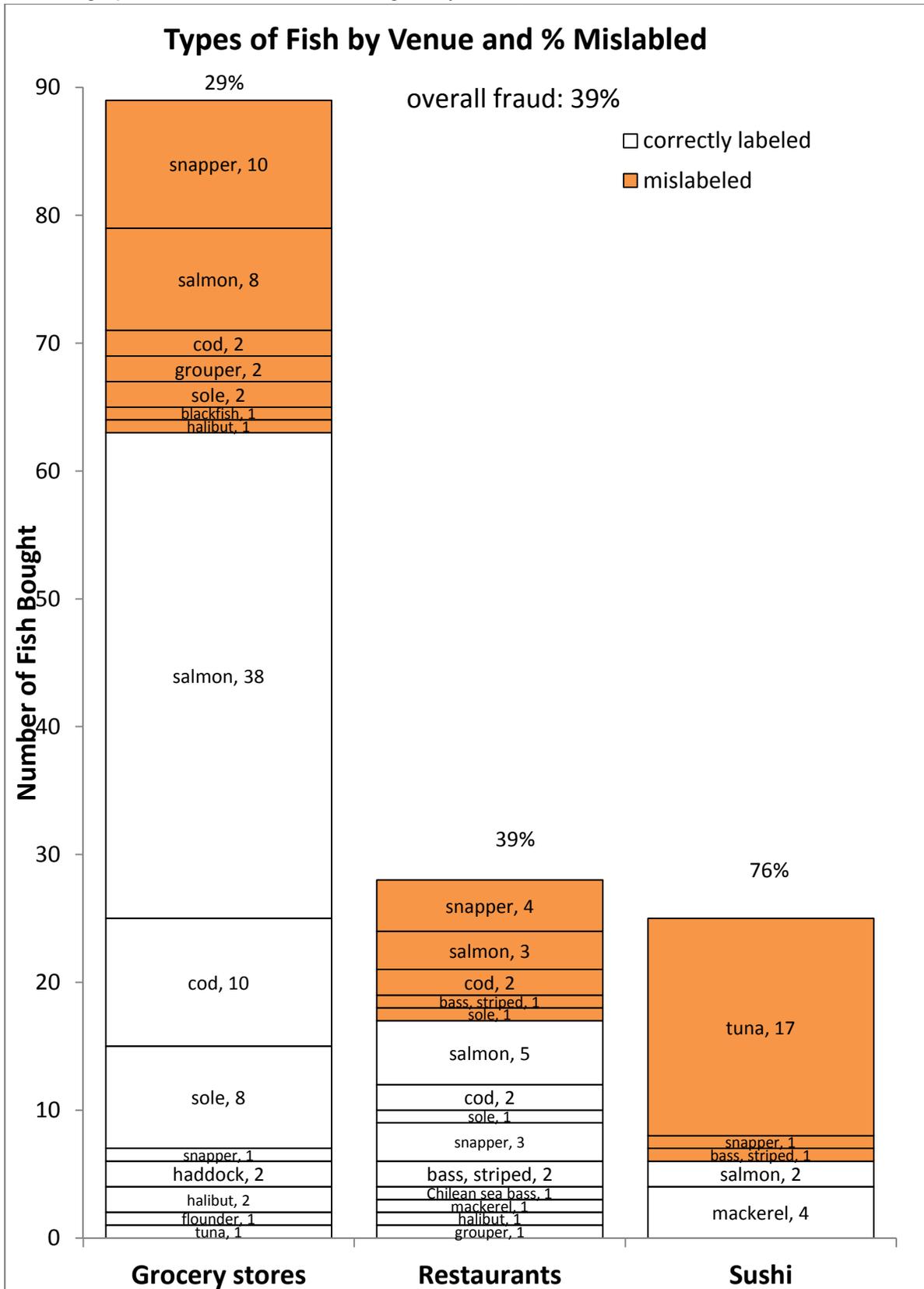
Oceana would like to give special thanks to its supporters and staff for gathering samples and reviewing this report, including Michael Hirshfield, Gib Brogan, Dustin Cranor, Amelia Vorpahl, Lianne Holzer, Tanvir Sra, Bettina Alonso, Samantha Provost, Jessica Champness, Carolina Quijano and Beckie Zisser.

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*Oceana is the largest international advocacy group working solely to protect the world's oceans. Oceana wins policy victories for the oceans using science-based campaigns. Since 2001, we have protected over 1.2 million square miles of ocean and innumerable sea turtles, sharks, dolphins and other sea creatures. More than 550,000 supporters have already joined Oceana. Global in scope, Oceana has offices in North, South and Central America and Europe. To learn more, please visit [www.oceana.org](http://www.oceana.org).*

**Appendix Figure A1.**

Detailed graph of mislabeled fish found in grocery stores, restaurants and sushi bars.



**Appendix Table A1.**

List of mislabeled fish samples collected in New York, summer 2012.

<b>Fish Type (#fraud/ #total)</b>	<b>Sold As</b>	<b>Identified As</b>	<b>Scientific Common Name (FDA Acceptable Market Name)</b>	<b>G,R ,S</b>	<b>Category/ Price Range</b>
bass (2/4)	bass, striped	<i>Morone chrysops</i>	bass, white (bass)	R	\$\$
	bass, striped	<i>Morone chrysops</i>	bass, white (bass)	S	\$\$
blackfish (1/1)	blackfish, Atlantic	<i>Tautoga onitis</i>	tautog (tautog)	G	Local
cod (4/16)	cod, Atlantic	<i>Gadus macrocephalus</i>	cod, Pacific (cod or Alaska cod)	G	National
	cod, Atlantic	<i>Urophycis tenuis</i>	hake, white (hake)	R	\$\$\$
	cod, Pacific	<i>Pangasianodon hypophthalmus</i>	catfish, sutchi (swai or sutchi or striped pangasius or tra)	R	\$\$
	cod, scrod	<i>Gadus macrocephalus</i>	cod, Pacific (cod or Alaska cod)	G	National
grouper (2/3)	grouper	<i>Lates niloticus</i>	perch, Lake Victoria (perch, Nile)	G	Local
	grouper, wild	<i>Sparus aurata</i>	gilt headed bream (bream)	G	Local
halibut (1/4)	halibut, Alaskan	<i>Caulolatilus microps</i>	tilefish, blueline (tilefish)	G	Local
salmon (11/56)	salmon, coho	<i>Oncorhynchus nerka</i>	salmon, sockeye (salmon, sockeye or red or blueback)	G	National
	salmon, king	<i>Salmo salar</i>	salmon, Atlantic (Atlantic salmon)	G	Local
	salmon, king	<i>Salmo salar</i>	salmon, Atlantic (Atlantic salmon)	R	\$\$\$
	salmon, king Scottish wild	<i>Salmo salar</i>	salmon, Atlantic (Atlantic salmon)	G	Local
	salmon, sockeye	<i>Oncorhynchus kisutch</i>	salmon, coho (salmon, coho or silver or medium red)	R	\$\$\$
	salmon, wild	<i>Salmo salar</i>	salmon, Atlantic (Atlantic salmon)	G	Local
	salmon, wild	<i>Salmo salar</i>	salmon, Atlantic (salmon, Atlantic)	G	Local
	salmon, wild	<i>Salmo salar</i>	salmon, Atlantic (salmon, Atlantic)	G	Local
	salmon, wild	<i>Salmo salar</i>	salmon, Atlantic (salmon, Atlantic)	G	Local
	salmon, wild	<i>Oncorhynchus mykiss</i>	trout, rainbow (trout, rainbow or steelhead)	G	Local
	salmon, wild	<i>Salmo salar</i>	salmon, Atlantic (salmon, Atlantic)	R	\$\$\$
snapper (15/19)	snapper, Japanese	<i>Pagrus major</i>	madai (porgy or sea bream)	R	\$\$\$
	snapper, lane	<i>Etelis oculatus</i>	snapper, queen (snapper)	G	National
	snapper, red	<i>Lutjanus guttatus</i>	snapper, spotted rose (snapper)	G	Local
	snapper, red	<i>Ocyurus chrysurus</i>	snapper, yellowtail (snapper)	G	Local
	snapper, red	<i>Lutjanus erythropterus</i>	snapper, crimson (snapper)	G	Local
	snapper, red	<i>Lutjanus peru</i>	snapper, Pacific (snapper)	G	Local
	snapper, red	<i>Lutjanus guttatus</i>	snapper, spotted rose (snapper)	G	Local
	snapper, red	<i>Sebastes sp.</i>	ocean perch	G	Local
	snapper, red	<i>Lutjanus erythropterus</i>	snapper, crimson (snapper)	G	Local
	snapper, red	<i>Pristipomoides multidens</i>	jobfish, goldbanded (jobfish)	G	Local
	snapper, red	<i>Caulolatilus microps</i>	tilefish, blueline (tilefish)	G	Local
	snapper, red*	<i>Lutjanus campechanus</i>	snapper, red (snapper or red snapper)	G	Local
	snapper, red	<i>Oreochromis mossambicus</i>	tilapia, Mozambique (tilapia)	R	\$\$\$

	snapper, red*	<i>Lutjanus campechanus</i>	snapper, red (snapper or red snapper) or snapper, Caribbean red (snapper)	R	\$\$\$
	snapper, red*	<i>Lutjanus campechanus</i>	snapper, red (snapper or red snapper)	R	\$\$
	snapper, red	<i>Lutjanus purpureus</i>	snapper, Caribbean red (snapper)	R	\$\$\$
	snapper, red	<i>Morone chrysops</i>	bass, white (bass)	R	\$\$\$
	snapper, red Florida*	<i>Lutjanus campechanus</i>	snapper, red (snapper or red snapper)	R	\$\$\$
	snapper, red Japanese	<i>Pagrus major</i>	madai (porgy or sea bream)	S	\$\$\$
sole (3/12)	sole, lemon	<i>Paralichthys dentatus</i>	flounder, summer (flounder or fluke)	G	Local
	sole, lemon	<i>Pseudopleuronectes americanus</i>	flounder, blackback (flounder or sole)	G	Local
	sole, lemon	<i>Paralichthys dentatus</i>	flounder, summer (flounder or fluke)	R	\$\$\$
tuna (17/18)	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$
	tuna, white	<i>Lepidocybium flavobrunneum</i>	escolar (escolar or oilfish)	S	\$\$

\* See the discussion on the genetic and morphological similarity of *Lutjanus campechanus* and *Lutjanus purpureus*.

## Endnotes

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- <sup>1</sup> FDA: What You Need to Know About Mercury in Fish and Shellfish. March 2004. <http://www.fda.gov/food/resourcesforyou/consumers/ucm110591.htm>. Accessed 10/17/12
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- <sup>3</sup> Warner, K., W. Timme, B. Lowell, and M. Hirshfield. 2012. Widespread Seafood Fraud Found in L.A. Washington, DC, Oceana. [http://oceana.org/sites/default/files/reports/LA\\_Seafood\\_Testing\\_Report\\_FINAL.pdf](http://oceana.org/sites/default/files/reports/LA_Seafood_Testing_Report_FINAL.pdf)
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- <sup>10</sup> Robinson, J. 2009. Through DNA Testing, Two Students Learn What's What in Their Neighborhood. New York Times. December 28.
- <sup>11</sup> Food and Drug Administration (FDA) 2012 Seafood List: [http://www.accessdata.fda.gov/scripts/SEARCH\\_SEAFOOD/index.cfm?other=complete](http://www.accessdata.fda.gov/scripts/SEARCH_SEAFOOD/index.cfm?other=complete), Accessed 10/22/12
- <sup>12</sup> Terteault, I. 2006. Seafood Watch Seafood Report: Farmed Tilapia. Seafood Watch. Monterey Bay Aquarium.
- <sup>13</sup> FDA: What You Need to Know About Mercury in Fish and Shellfish. March 2004. <http://www.fda.gov/food/resourcesforyou/consumers/ucm110591.htm>. Accessed 10/17/12
- <sup>14</sup> Mazurek, R. and M. Elliot. 2004. Seafood Watch Seafood Report: Farmed Salmon. Seafood Watch. Monterey Bay Aquarium.
- <sup>15</sup> FDA: What You Need to Know About Mercury in Fish and Shellfish. March 2004. <http://www.fda.gov/food/resourcesforyou/consumers/ucm110591.htm>. Accessed 10/17/12
- <sup>16</sup> Price range is the approximate cost per person for a meal including one drink, tax, and tip. \$= under \$10, \$\$ = \$11-\$30, \$\$\$ = \$31-\$60, \$\$\$\$ = above \$61
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- <sup>18</sup> Gomes, G., et al., Can *Lutjanus purpureus* (South red snapper) be "legally" considered a red snapper (*Lutjanus campechanus*)? *Genetics and Molecular Biology*, 2008. 31(1): p. 372-376.
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- <sup>20</sup> FishBase. *Lutjanus purpureus*: Southern red snapper. Updated 7/3/12. <http://www.fishbase.org/summary/Lutjanus-purpureus.html>. Accessed 11/13/12
- <sup>21</sup> See Fishbase distributions above for both species
- <sup>22</sup> Gomes, et al 2008.
- <sup>23</sup> Charauau, A. et al, 2001. Regional assessment of red snapper, *Lutjanus purpureus*. In: FAO/Western Central Atlantic fishery commission. 2001. Regional reviews and national management reports. Fourth Workshop on the Assessment and Management of Shrimp and Groundfish fisheries on the Brazil-Guanas Shelf, Cumana, Venezuela, 2-13 October 2000. FAO Fisheries Report No. 651 Rome, FAO.; Chapter 2; pp 15-21. We could not locate more recent regional *L. purpureus* stock assessments for each of the Caribbean, Central and South America countries where this species occurs.
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- <sup>29</sup> European Food Safety Authority, 2004. "Opinion of the Scientific Panel of Contaminants in the Food Chain on a request from the Commission related to the toxicity of fishery products belonging to the family of Gempylidae." *The EFSA Journal* 92:1-5.
- <sup>30</sup> Fry, F.S. 2012.
- <sup>31</sup> 21 CFR 161.190
- <sup>32</sup> Atz, J.W. Kosher & Non-Kosher Fish Lists. October 30, 2012. [http://www.crcweb.org/fish\\_list.php](http://www.crcweb.org/fish_list.php). Accessed 11/8/12
- <sup>33</sup> Ibid
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