Shady Snappers and Suspicious Sushi

Identifying Mislabeled Red Snapper in New York City

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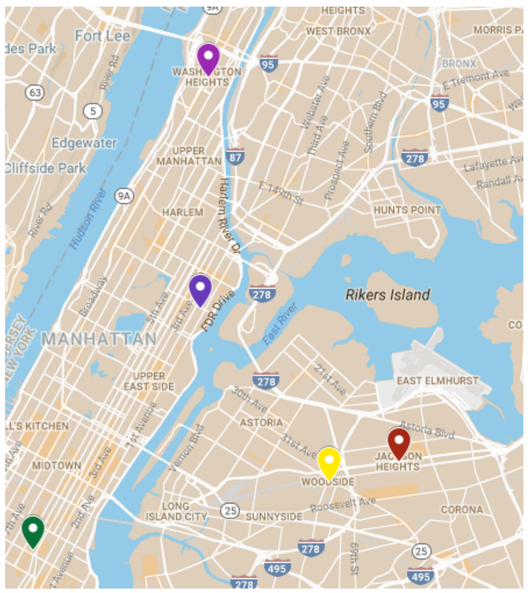
Summary:
According to the Oceana study, 39% of fish sold in Manhattan are mislabeled. Our objective was to determine whether we could find fish mislabled as Northern Red Snapper (*Lutjanus campechanus*) being sold in supermarkets across New York City. We used DNA barcoding to identify fish from retail establishments, sampling a diversity of factors that might help predict the mislabeling of fish, such as retail price or geographic location. Surprisingly, only one store was selling properly labeled *Lutjanus campechanus*, while others were selling completely different species of fish. This indicates that deceptive mislabeling of fish is still a widespread practice in New York.

Figure 1. Map of sample collection locations.
Partial map of New York City, with map markers indicating locations where samples were purchased:



Methods:
We acquired five samples labeled as red snapper from fish markets and restaurants in different areas across New York City.These different areas were: Woodside, Washington Heights, Spanish Harlem, Union Square, and Jackson Heights (**Figure 1**). We also included a negative control sample, the sea squirt species *Ciona robusta* , a marine invertebrate. We followed a standardized method for DNA extraction and barcoding [**2**] with a few modifications to determine the species of each fish sample. For this, we used both broad-specificity and "Baldwin" fish-specific *Cytochrome oxidase I (COI)* primers.

References:
[**1**] Oceana Reveals Seafood Fraud Nationwide Authors: Kimberly Warner, Walker Timme, Beth Lowell and Michael Hirshfield. Published February 2013 http://usa.oceana.org/sites/default/files/reports/National_Seafood_Fraud_Testing_Results_FINAL.pdf
[**2**] Urban Barcode Project Barcoding Protocol Authors: Unknown. Date Published: Unknown. http://www.urbanbarcodeproject.org/files/Barcoding_Protocol.pdf

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Results:
We were able to amplify PCR products (**Figure 2**) from all our samples except the Spanish Harlem sample, which did not give good DNA extraction. The Baldwin fish-specific primers also did not work with the sea squirt sample, but this was expected because this sample is not a fish. We sequenced our PCRs and compared them to existing DNA sequence databases identified using the BLAST webtool from the National Center for Biotechnology Information (**Table 1**). Using the broad-specificity primers, we found that there was significant bacterial (Pseudomonas) growth on the Jackson Heights and Washington Heights fish, but fish-specific sequences were amplified from these using the Baldwin fish-specific primers.

We found that only the Union Square sample was *Lutjanus campechanus* (Northern Red Snapper), while the Woodside sample was the cheaper *Lutjanus peru* (Pacific Red Snapper). We also found that the other samples were actually completely different species of fish. The Jackson Heights sample was actually Atlantic Salmon (*Salmo salar)* and the Washington Heights sample was Nile Perch *(Lates niloticus*).

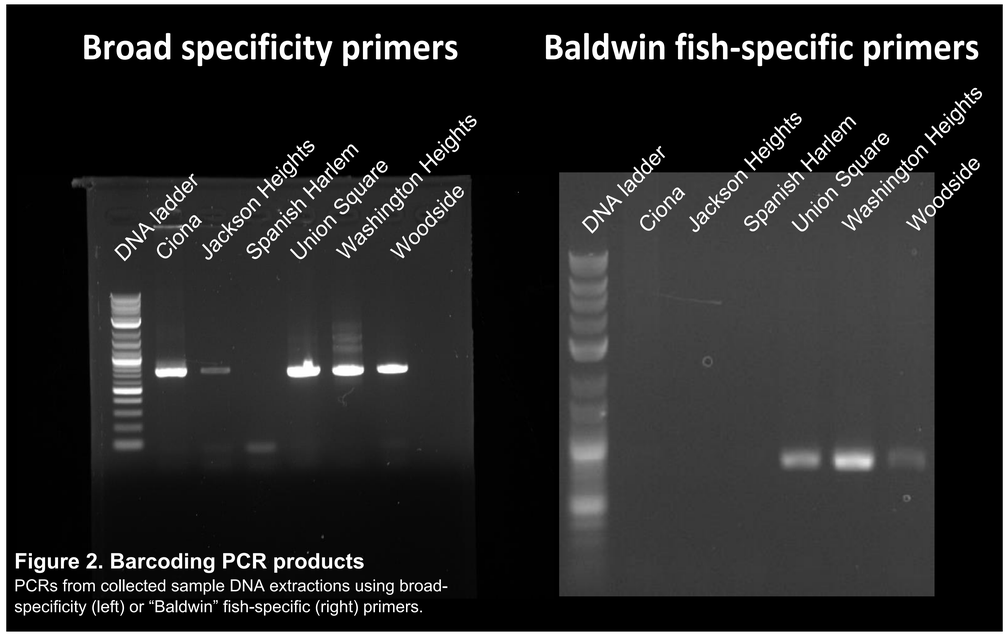

Figure 2. Barcoding PCR products
PCRs from collected sample DNA extractions using broad-specificity (left) or "Baldwin" fish-specific (right) primers.

Conclusion:
Our study confirmed that a significant portion of fish markets across New York City have been mislabelling their fish, and that the FDA and local fish markets aren't doing enough to ensure that the consumers are getting a genuine product.

In Woodside, fish labeled "red snapper" and identified as the cheaper Pacific Red Snapper was purchased as a whole fish, while nile perch and salmon mislabeled as "red snapper" were bought as fillet. Selling fillets may have made it easier for these stores to sell other species of fish as "red snapper".

Another factor that may influence mislabelling is the reputation of the market. The market where the Union Square sample was purchased was actually an expensive chain market, likely resulting in the fish needing to be genuine in order to maintain reputation, while the rest of the samples were from local fish markets.

To ensure that you get genuine Northern Red Snapper, it is perhaps best that you purchase whole fish, instead of fillet, and that you spend extra on a reputable chain store instead of neighborhood fish stores where mislabelling seems to occur.

Sample	Broad specificity primers	Baldwin fish-specific primers
Ciona (Sea squirt)	Hoeflea sp. (bacteria)	PCR negative
Jackson Heights	Pseudomonas fragi (bacteria)	Salmo salar (Atlantic salmon)
Spanish Harlem	PCR negative	PCR negative
Union Square	Lutjanus campechanus (Northern Red Snapper)	Lutjanus campechanus (Northern Red Snapper)
Washington Heights	Pseudomonas fragi (bacteria)	Lates niloticus (Nile perch)
Woodside	Lutjanus peru (Pacific Red Snapper)	Lutjanus peru (Pacific Red Snapper)

Table 1. Barcoding results
Best BLAST hit of sequenced PCR products amplified from each sample using either broad-specificity (middle column) or "Baldwin" fish-specific primers (right column). "PCR negative" indicates that no visible PCR product was obtained or sequenced in that particular reaction.