

Science AMA Series: I'm Christine Stawitz, a PhD candidate at the University of Washington, Seattle, I recently published a study that found up to 30 percent of seafood served in restaurants and sold in supermarkets is actually something else, AMA!

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April 17, 2023

Abstract

Thanks all for the great questions. We'll be signing off in a few minutes (4:45 PST), but please look out for the full manuscript - it should be online and open access for all soon! I'm Christine Stawitz, and I study fishery management and population dynamics at the University of Washington. (More about that at: <http://students.washington.edu/cstawitz/>) I'd like to talk about a recent publication of mine, "Financial and Ecological Implications of Global Seafood Mislabeling", in which I, with my co-authors, try to quantify how seafood mislabeling affects the conservation status and value of finfish seafood that people consume. In this study, we found that substituted seafoods were of slightly lower value (-2.98% ex-vessel price), but of a slightly higher conservation status (+9.51% IUCN status) than items they were labeled as. However, there's a lot of heterogeneity across types of finfish. For example, items substituted for skipjack tuna and dolphinfish are actually of higher value than these fish themselves. This suggests mislabeling has benefits for consumers, financially. In contrast, items substituted for red snapper, hake, eel, smooth-hound shark, and croaker are of lower conservation status than the items themselves. I've noticed the paper getting a lot of attention on r/science and want to clear up some of the detail of the findings. I will be back at 6 pm EDT to answer your questions, ask me anything!

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Science AMA Series: I'm Christine Stawitz, a PhD candidate at the University of Washington, Seattle, I recently published a study that found up to 30 percent of seafood served in restaurants and sold in supermarkets is actually something else, AMA!

CHRISTINE_STAWITZ [R/SCIENCE](#)

Thanks all for the great questions. We'll be signing off in a few minutes (4:45 PST), but please look out for the full manuscript - it should be online and open access for all soon!

I'm Christine Stawitz, and I study fishery management and population dynamics at the University of Washington. (More about that at: <http://students.washington.edu/cstawitz/>)

I'd like to talk about a recent publication of mine, "[Financial and Ecological Implications of Global Seafood Mislabeling](#)", in which I, with my co-authors, try to quantify how seafood mislabeling affects the conservation status and value of finfish seafood that people consume. In this study, we found that substituted seafoods were of slightly lower value (-2.98% ex-vessel price), but of a slightly higher conservation status (+9.51% IUCN status) than items they were labeled as. However, there's a lot of heterogeneity across types of finfish. For example, items substituted for skipjack tuna and dolphinfish are actually of higher value than these fish themselves. This suggests mislabeling has benefits for consumers, financially. In contrast, items substituted for red snapper, hake, eel, smooth-hound shark, and croaker are of lower conservation status than the items themselves. I've noticed [the paper getting a lot of attention on r/science](#) and want to clear up some of the detail of the findings.

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How much of this is accidental and how much of this is malicious?

With numbers like these I'm surprised they've passed regulation for so long. Why do you think these incidents have yet to be stopped?

[Cartledge](#)

Hi! It is hard to say. However, we were expecting to see huge price differences between the labeled item and the actual fish served if, for example, mislabeling was primarily malicious and financially motivated. We didn't see that. Actual items were about 97% of the price, on average, of the item listed on the label. Same for ecological status - we would expect if items were mislabeled to hide endangered species, you would see on average a lower ecological status of true fish species compared to labeled items. However, we saw on average substituted items were of slightly better status. Of course, the "average" only shows part of the picture. There were some types of fish for which substituted items were cheaper than actual items quite frequently - snapper, swordfish, wahoo, and grouper. So maybe these are indications that mislabeling is financially motivated for these species.

Purely opinion here - I think the complexity of the industry and fish identification is largely why this is a hard problem to fix. Fish changes hands a LOT before it reaches consumers, so there are a lot of places where mistakes can be made. Additionally, even as someone getting a PhD in fish-related things, I can't even tell the difference between a lot of closely related species. Fish are hard to identify! And there are so many species that are consumed which the average consumer may not be familiar

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with.

How does one go about figuring out if a store or restaurant is selling mislabeled fish?

Do you just go to multiple restaurants or target something higher up in the supply chain?

What is the most common "fake fish" you found being served?

[DCnotAC](#)

Hey! Thanks for your question. In this study, we aggregated from 45 different published papers whose authors had gone out and sampled fish from restaurants, seafood vendors, etc. then done DNA analysis. So, all of the mislabeling was based on DNA here. If you're asking with respect to a consumer figuring it out, the best way is to buy seafood certified via either the Marine Stewardship Council or other similar programs like the Gulf Trace Program.

Most common fake fish is hard to define - some of the most commonly mislabeled items were very rare in the sample. So, the types of fish with the highest percentage of mislabeling were those in the croaker family (Sciaenidae), but these fish are not super common. Of fish that are commonly consumed in the US, the Snapper group had the most mislabeled fish.

Are there global regions that have more mislabeling than others?

Does demand lead to more or less mislabeling?

If I realized that fish I had purchased was mislabeled, who would I report this to? Has it ever happened to you?

(Go Huskies! UW alum here!)

[princessfartybutt](#)

Hi! In our analysis, country was not a significant factor in determining mislabeling probability. But others have hypothesized that there is variation in mislabeling probability by country. A lot of the sampling is skewed towards the US, Canada, and Western Europe, so more balanced global sampling would certainly help to figure that out. Re: demand leading to more or less mislabeling, that is an excellent question, and we don't have information about demand. Re: where to report, NOAA's Office of Law Enforcement investigates seafood mislabeling - you can report suspected violations to them (1-800-853-1964). We have both probably eaten mislabeled seafood, but neither of us have eaten mislabeled seafood and realized it. Go Huskies!! - Margaret Siple (2nd author)

As consumers, how can our actions better promote sustainable and responsible fishery practices?

[Grandimal](#)

Whoa, I wish there was a study that answered this! :) That said, I can give you my opinion based on the (non-exhaustive) things I've learned about seafood. Use certification schemes like the Marine Stewardship Council to ensure you're buying fish from certified sustainable and well-traced seafoods. I also rely a lot on sustainability guidelines. The best known is the Monterey Bay Aquarium Seafood Watch guide, but I also use things that are less consumer-focused like NOAA's fish stock sustainability index: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/fssi.html. Fishwatch.gov lets you look up every fishery as well to help assess sustainability. I also try to buy local as much as possible. In the US, where I live, there's a law (the Magnuson Stevens Fishery Management and Conservation Act) that says fishery management must be undertaken according to the best available science. My research focuses on improving that "best available science" and making recommendations. Those recommendations have to be followed, according to US law. However, when you buy imported seafood, there is no guarantee that management is being done according to science.

In the United States, what is the most commonly substituted fish that consumers would likely order (incorrectly) at a restaurant?

Have studies been planned to include invertebrates as well?

[muhli660](#)

Hi! Thanks for your question. According to the CDC's NHANES survey (<http://www.cdc.gov/nchs/nhanes/>) the most commonly eaten finfish in the US are tuna and salmon. Between those two, tuna was mislabeled in a higher proportion of all our samples. DNA barcoding studies on invertebrate mislabeling exist, but we have not planned an analysis for them. -Margaret Siple (2nd author)

I've heard that if scallops are less than \$25 per pound in the store, it probably is not scallops. Is this accurate?

[Telfordtodd](#)

Hi! Thanks for your question. We didn't actually cover scallops in our study (we focused on finfish). We have heard anecdotally that there is a lot of mislabeling of scallops, but don't have any scientific evidence from our study to support this claim. - Margaret Siple (2nd author)

Is it common practice for the fishing industry to purposely mislabel fish to sell to distribution? Or is it the distributors purposely mislabeling them so they can keep a variety on stock for the consumers? Who is liable when the consumers buy mislabeled fish?

[senlan](#)

Unknown. From the type of data we used (DNA barcoding data from seafood products), we cannot tell what the intent of the mislabeling was. We originally hypothesized that if lower-priced seafood was systematically substituted for higher-priced items, this would be evidence that seafood mislabeling is done to increase profits. The relationship between global production and mislabeled proportion (overall a negative one, where the species that are most frequently mislabeled tend to be things with low total global production) suggests that mislabeling *may* be done in order to fulfill demands for certain items. But we cannot definitively determine intent from the type of data we have. - Margaret Siple (2nd author)

I've read that the most sustainable seafood are oysters. From your perspective, is that true? Thanks!

[marsyred](#)

This is a great question, but not really my area of expertise, and we didn't look at invertebrates in this study. I know some work has been done looking at the carbon footprint of different types of protein, and bivalves like oysters are some of the best types of protein to eat! The real expert on that is Peter Tyedmers at Dalhousie University - here's an interview with him in Outside magazine:

<http://www.outsideonline.com/2046606/eating-right-can-save-world>

Which stage of the supply chain does the mislabeling most often originate from?

[Grembert](#)

Hi Grembert - based on the samples that we collected, sushi restaurants and distributors had the highest mean probability of samples being mislabeled, but the confidence intervals around both of those probabilities were fairly wide, indicating that they weren't significantly higher than other sources. - Margaret Siple (2nd author)

Hi! I have a few questions.

First, as someone who believes very strongly in conservation, how does this use of mishandling or replacement of products affect the conservation of the species that are being replaced or doing the replacement? I've heard that this practice is helpful, as the fish that are being used as replacements tend to be both plentiful and more sustainably fished.

Second, is the guide that Monterey Bay Aquarium publishes ([found here](#)) a good guide to keep in my back pocket? I wholly trust them to provide good information, but I wanted to double check to be sure.

Third, besides being more aware of the fish we buy, is there anything else the average layperson can do to help prevent overfishing and unsustainable practices?

Thanks for doing this!

P.S. Do you happen to know a Patrick Sullivan? He was my academic advisor while I was an undergrad at Cornell, and he does work with fishery management as well.

[t3hasiangod](#)

Hi - we found overall replacement results in MORE sustainable items being served - about 9% of an improvement in IUCN status. However, there are many individual taxa where this may not be true. For example, snapper were often substituted with worse conservation status items.

The Monterey Bay Aquarium guide is scientifically accurate (in fact, Margaret has done reviews of fisheries for them!) but sometimes it can be hard to match menu seafoods to that guide. Usually the info on the Monterey Bay guide is for specific gears or locations of fisheries, whereas menu just says "tuna" and not whether it was long-line caught or trawl-caught.

See above re: recommendations for consumers.

I know of Patrick but haven't met him - only through email and such! :)

What's your favorite seafood restaurant in Seattle?

[paddedroom](#)

Siple: Mashiko in West Seattle Stawitz: Sushi Kashiba * note: we do not know the rate of mislabeling at these restaurants :)

-Margaret Siple (2nd author)

My understanding is that there is a lot of confusion around what any given fish should actually be named. The common names are not agreed upon or standardized, so one person calls this fish an X and another person calls it a Y. Neither are wrong, because they are both referring to the same genus, but then the colloquial name X gets misapplied to another similar fish, and....

How much of the mislabeling is this lack of specificity? It's not like a fisherman does a genetic test on all the grouper he pulls up, or whatever. Someone looks at it, calls it an X, and throws it on some ice with a price tag.

I'm not a huge consumer of fish, but I do like a small range of sushi very much, so my knowledge of fish is somewhat limited.... thanks for any clarity you can provide!

[happyj](#)

We don't know how much mislabeling is due to lack of specificity, or mixed-up common names. But this is certainly an issue. We used the FDA guidelines to match what was a "correct" vs "incorrect" label. There is some flexibility according to the FDA about what you can legally call certain seafood

items. The FDA regulations are here:

<http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/Seafood/ucm113260.htm>

Thanks for your question! Margaret Siple (2nd author)

How do I tell if the shrimp I'm buying has been injected with silicone from China? Is there any other red flags when buying from seafood stores that I should look out for?

[misskaybear](#)

I don't know anything about the silicone shrimp issue. The only thing that is really easy for me to tell is farmed vs. wild salmon. If something is labeled Pacific salmon but is a very pale pink, it is probably farmed Atlantic salmon.

Is there any real reason, other than fraud, that consumers should be concerned by what they are being served? With the exception of escolar, if a fish tastes and feels like halibut, why should I care what actual species?

[scottley](#)

A purely self-interested consumer might still be concerned about mislabeling-- escolar is certainly an issue; there have also been cases of people getting tetrodotoxin poisoning from pufferfish mislabeled as another species. Those who aren't concerned about sustainability might also choose to avoid taxa that are commonly substituted with cheaper species, because they don't want to be "cheated" out of the value of their seafood. - Margaret Siple (2nd author)

Did you really have to explain your search parameters in your methods? Was that your PI saying you were unclear on how you found a reference? Is explaining search parameters a new thing in science? I've been out of academia for a while.

This paper is basically a literature review as I don't see you sampling anything yourself, but relying on previously published data to create correlation. I imagine time being a giant variable in your data, as well as inconsistency with sampling methods by various research teams you sourced from. You also published data collected from a classroom of what I assume is undergrads. Obviously variables are inevitable, but did you account for the current popularity of certain species during time of sampling? Maybe it's in the supplemental material, but using market prices you should be able to determine if overall mislabeling occurs more frequently depending on current demand. I imagine it does, and would invalidate some of your conclusions in my opinion, say, as a spike in demand in 2010 would influence mislabeling patterns for time sampled, but with your method it doesn't seem to account and seems to take mislabeling as a whole, which could potentially result in more harm as the data was influenced by a historical peak in consumption. Did you address this or discuss it?

Concerning the PhD program at UW and the required M.S., can a M.S. from another university be used as this requirement or must you earn your M.S. from UW? My PI got his PhD from UW.

[tetramitus](#)

Hi, yes we did have to explain our search parameters. As you mention, we aggregated data collected and published in other papers, so being able to reproduce the search is very important. I have always followed this practice, but I imagine it is newer since more and more literature reviews happen on Google scholar these days!

We did not account for popularity of different species types as this varies not only temporally but spatially. Data on regional seafood preferences and purchasing is quite hard to come by, but we are hoping to look more into this in future work. We also don't have market prices - these are unique and not available for all countries our samples came from. Hence we used ex-vessel price since this was globally standardized. I'm not an economist, but my understanding is market prices are not directly

proportional to demand either. We did match prices to year the data were sampled, rather than using the most recent data for all samples, so that should account for some of the temporal variation.

Yes, Margaret got her M.S. at U of Hawaii and is getting her PhD at UW, whereas I'm all UW for both. :)

I saw this study referenced on Adam Ruins Everything. Did you talk with him or someone from the show?

[dirtmop28](#)

No we did not. - Margaret Siple (2nd author)

What about Costco? Was their fish accurately labeled? If so, is that an argument in favor of large corporations? Where they are more likely to be honest with their customers.

[window5](#)

We don't know which retailers fish in our sample came from. We divided retailers into grocery stores, fish markets, and restaurants, but did not discern between different sizes of grocery stores.

Other than taste, is nutritional value of substituted fish generally the same?

[Cardioguy](#)

This is a great question! We actually thought about looking at this, but did not accumulate nutritional information in this study. However, there are some poisonous types of fish that have been substituted for non-poisonous fish! See Cohen et al. 2009 - two individuals were sickened eating pufferfish, which are poisonous, which had been mislabeled as something else!

Was this study nationwide, or was it just conducted in Washington/Seattle?

[I_Cant_Freestyle](#)

This study was actually worldwide - we used papers concerning data collected in the US, Canada, Brazil, all over Europe, South Africa, Iran, Taiwan...

Ecologically, how does this play out? Are ecosystems hurt by this mislabeling?

[NRod1998](#)

There are a lot of variables that influence which species are targeted by fisheries, and mislabeling is certainly one of them (it can obscure the link between demand for a species and fishing pressure on that species). However, we don't know what the overall ecological impact is-- this could be a whole research career's work! - Margaret Siple (2nd author)

Traceability is a difficult thing to have but a key thing for fishery management. How did this play into the study? Have you seen globalfishingwatch.org (recently launched by Google, Oceana, & Skytruth) and what role do you see big data and machine learning contributing to ocean conservation?

[amroan](#)

I have not - there are a couple of Fishackathons that have happened lately in Seattle and Vancouver. I know some of the proposed apps coming out of those forums have addressed traceability and

identification - i.e. a Fish ID app as well as a way to scan products at each point of traceability. I started off as a tech person so I'm super interested in how these sorts of solutions might change the seafood industry. So far, not a lot has been done that I know of though!

Did that study only look at the US or could the result also be applied to Europe with its tighter food laws?

[Essiggurkerl](#)

This was a global study, so we used samples from several countries, including some in the EU. Our study included samples that were collected in ~26 different countries. - Margaret Siple (2nd author)

I don't have access to your whole article ATM. Did you study just one market (Seattle) or does this apply to everywhere in the world/USA?

[Mamertine](#)

This was a global study. The article will be publicly available (open access) when the journal finishes editing the proofs. This should happen soon-- check back in a few weeks and it should be available in its final form. - Margaret Siple (2nd author)

What can you tell us about Hawaiian butterfish? I ate some of this in Hawaii and suffered anal leakage for nearly a week. Not a great 10 hour plane ride home.

I've heard this is one of the most commonly mislabeled fish.

[bignateyk](#)

Escolar is often called "butterfish." To the best of my understanding, keriorrhea and/or anal leakage happen because of indigestible esters in the fish. People that we have spoken to have suggested limiting your serving size when eating butterfish (<6 oz), which is not supposed to be dangerous when eaten in small amounts. -Margaret Siple (2nd author)

Have you had any threats from big fish industry thus far?

[Mister__S](#)

Luckily, no. :)

Could you give any specific foods that are replaced? You mention Skipjack is replaced with another kind of item.

And are there markets that tend to do it more than others?

[CoSonfused](#)

There are a lot of different cases of mislabeling! Yes, when Skipjack was mislabeled it tended to be replaced with tuna. This is why consumers usually got a more expensive item when skipjack was mislabeled. That said, as the comment below suggests most people would not intentionally substitute a tuna for a skipjack, so we can infer this is likely an accident! Another example, since I keep calling out snapper, is that red snapper is often substituted with Nile catfish, rockfish (on the West Coast) and other snappers.