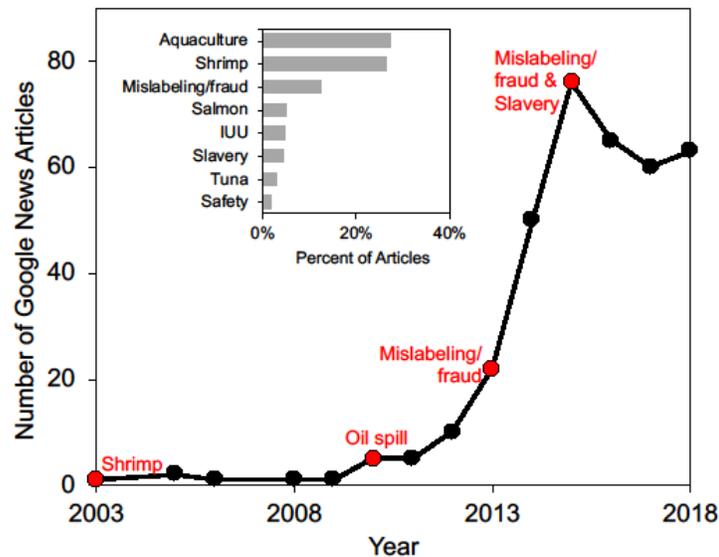


Supporting information: The US seafood deficit: globalization, trade wars, and sustainability

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Spread of “90% imported” statistic

When did this 90% statistic appear and enter US seafood policy discussions? This statistic originates from the NOAA annual “Fisheries of the United States” report series and citations of the statistic often reference NOAA or the NOAA Commercial Fisheries Statistics Database. However, the first news appearance was based on a 2003 book (*1*) and called for greater awareness so consumers could choose their preferred sources of seafood: farmed or fished, local or imported. With the 2010 Deep Horizon oil spill in the Gulf of Mexico, concerns around oil impacted versus farmed shrimp imports elevated the statistic to multiple articles each year (SI Fig. 1). Key to its wider spread in the policy arena was a 2013 seafood mislabeling study by Oceana tying high mislabeling to the high import rate. Since then, the 90% statistic has appeared in other seafood fraud studies, investigations into human rights abuses (slavery) in the seafood sector, illegal, unreported and unregulated (IUU) fishing, and bycatch concerns, tripling its occurrence in the news (SI Fig. 1).



SI Fig. 1. Google News search trends (articles 1 Jan 2000-10 July 2018) of the ‘90% import’ statistic over time. Red points indicate notable use of the statistic in media and the association of

its use (e.g., mislabeling). Inset panel: percent of articles linking the statistic to one or more topics.

Estimate of percent of consumption from imports

The percent of consumption (p) from imports is calculated as:

$$p = 100 \frac{i}{c},$$

where i is the total imports and c is the apparent consumption, calculated as production plus imports minus exports, converted into common units. We use live weight common units, based on the NOAA supply data and FAO Food Balance Sheets, so the calculations are comparable, whereas the percent of consumption from imports in the Fisheries of the US report converts supply to the edible portion for the common units. However, the calculation of the percent of consumption from imports is not sensitive to the choice of common units. The percent of consumption from domestic production is $1 - p$. Since reported imports represents both products of foreign origin as well as products of domestic origin processed abroad, the percent of consumption from imports of foreign origin is calculated as:

$$p = 100 \frac{i-d}{c},$$

where d represents the imports of foreign processed products of domestic origin. Note that this value differs from data on re-exports and re-imports, which represent products imported and exported in substantially the same form (i.e. not processed). When a product is processed it changes product codes and becomes an export of that county in national statistics.

Since there are no official statistics available for d , a range of likely values must be estimated from exports to major seafood processing countries, industry input on products exported for processing, possible product conversions, and the proportion of seafood likely returning to the US after processing. Here we focus only on processing in China because it is known to be a major processors of US seafood and is the target of recent US tariffs.

US trade data come from NOAA for all calculations except for the comparison calculation to FAO data. NOAA reports US production and trade data to the FAO and the primary difference between the supply values is the apparent live (round) weight conversion factors. NOAA trade statistics are from the US Foreign Trade statistics (<https://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/>) and US supply data are from the Fisheries of the United States 2013 report (2). FAO data are from the Food Supply and Balance Sheets available in FishStatJ (3). Trade data from China comes from CEPII's Baci data (4), which uses mirror trade records from the UN Comtrade data to reconcile discrepancies. The year 2013 was selected for the analysis because it is the most recent year for which the FAO Food Balance Sheet data is available in FishStatJ (3).

In 2013, 31.3% of seafood exports from the US were destined for China and 23.7% of processed seafood products exported from China were destined for the US (by quantity). Using

the information from industry contacts about which products exported to China likely undergo processing, we identified possible product conversions such that products could not change species groups (i.e. salmon cannot become tuna) and products can only become a more processed form (i.e. fresh can become canned, but canned cannot become fresh). We then took the minimum of the quantity of a species group exported to China from the US and the quantity of possible processed forms exported to the US from China, while ensuring the total quantity of a species group exported from China to the US was not greater than the quantity exported from the US to China. We found that as much as 57% of seafood exported to China from the US could be processed and exported back to the US. This suggests the upper limit of seafood exported from the US is processed and imported back to the US is 18% (31.3% of US exports destined for China times 57% of that is possibly processed and exported back to the US). This assumes all seafood of US origin processed in China is exported back to the US, but we did not adjust for live weight conversions and only processing in China was considered, making this a conservative estimate of the upper bound for the percent of all US exports undergoing foreign processing and imported back into the US. Since it is unlikely that none or all seafood exported by the US for processing is imported back to the US and there is no further information on the levels of this, we use the midspread of a uniform distribution (4.5–13.5%).

SI Table 1: Percent of consumption from imports recalculated from 2013 NOAA and FAO data using a range of plausible values for the percent of seafood exported from the US for foreign processing that is imported back to the US. Results are presented using the raw data, as well as with production adjusted for underreporting

Percent of US seafood exported for processing and imported back to the US	Percent consumption from imports (NOAA data)	Percent consumption from imports (NOAA data adjusted for underreporting)	Percent consumption from imports (FAO data)	Percent consumption from imports (FAO data adjusted for underreporting)
0	92	86	71	66
4.5	89	84	70	65
9.0	86	81	68	64
13.5	83	78	67	62
18	80	76	65	61

In addition to accounting for imports of foreign-processed seafood of US origin, the set of live weight conversion factors are highly influential on the calculated percent of consumption from imports. Although it is not known whether the FAO or NOAA live weight conversion factors are more accurate and the specific conversion factors currently used by the FAO are not publicly available, the published FAO conversion factors cover a greater number of product

types and production locations. As a result, we suggest the FAO data likely better capture the current range of products and geographic variation in seafood production than the NOAA conversion factors.

Further, when we adjust for the likely underreported small-scale fisheries and recreational catch, which were estimated to be 8.2% of total U.S. marine capture production (not counting discards) in 2014, the most recent year available (5), the dependence on imports is further reduced (SI Table 1). This estimate of underreported production is based on the underreported marine catch and inland catch often experiences higher levels of underreporting and higher levels of recreational catch, which is often underreported at higher rates than commercial catch (6; 7). As a result, we expect 8.2% to be a conservative estimate for total unreported catch. We would like to note that while there may be underreported trade, there is no estimate of this and the impact on the percent of consumption from imports would depend on the underestimation of imports relative to the underestimation of exports.

These points taken together, we argue that the percent of consumption from imports in the US is likely in the range of 62–65%, as opposed to the often-quoted statistic of 90%. This implies 35–38% of seafood consumed in the US is of domestic origin, or over three times the amount suggested by the 90% statistic.

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