Characteristics of the U.S. Seafood Trade Deficit

BEN FISSEL, ANDREW KITTS, MIKE DALTON, ROSEMARY KOSAKA, MELISSA KRIGBAUM, AKBAR MARVASTI, DALE SQUIRES, ERIC THUNBERG, MIKE TRAVIS, and JOHN WALDEN

Introduction

The NMFS Strategic Plan for 2019–2022[1] identified "increasing U.S. seafood production and reducing the seafood trade deficit" as one of its challenges that must be addressed. The first goal of amplifying "the economic value of commercial and recreational fisheries while ensuring their sustainability," which includes strategies to enhance both aquaculture[2] and wild-caught production, is justified primarily by a desire to reduce the seafood trade deficit.

There are two implicit assumptions behind implementing strategies to reduce the seafood trade deficit through increased U.S. seafood production. One is that the deficit is detrimental to the U.S. seafood industry and economy. Restricting imports to alleviate the trade deficit is unlikely to be successful because the majority of imports are of species for which U.S. harvests are minimal or production could not meet domestic demand. For other species, restricting imports could also result in restricted exports because some imports are domestically caught but processed abroad. In either case, restricting imports requires either reducing domestic demand or that domestic products substitute for the loss of imported seafood.

The second implicit assumption is that production-oriented strategies will have a reasonable chance of substantially reducing the deficit. In aggregate, wild harvests of U.S. seafood have been fairly stable over the last three decades (Fig. 1C), and with the marketable U.S. wild stocks almost fully exploited, there is limited scope for appreciable increases in wild harvest production. Furthermore, for some important species, such as walleye pollock, *Theragra chalcogramma*; Atlantic cod, *Gadus morhua*; and Pacific cod, *Gadus macrocephalus*; and salmon (Salmonidae), the U.S. trade profile is characterized as exporting raw lower priced products, and importing processed higher priced products. This is also reflected in the export and import prices of edible seafood products, which between 2012 and 2016 averaged \$1.67 and \$3.38 per lb, respectively.

There is some debate about whether or not the presence of a seafood trade deficit is positive or negative. Martin Smith (2018) argues that seafood imports satisfy a large U.S. consumer demand for seafood that U.S. production is unable to fully supply. He argues there are health benefits from eating seafood, and U.S. consumers' benefit from the additional seafood product choices imports provide. He also points to the complexities of seafood trade such as 1) U.S. consumers' penchant for high-value seafood, making fewer of those products available for export; 2) higher import prices relative to export prices; 3) the presence of U.S. produced fish in some imported seafood products; and 4) differences in labor costs. Smith also questions the ability of the United States to substantially increase both wild caught and aquaculture production.

This paper does not argue for either side of this debate, but it provides additional data for this discussion. We examine the seafood trade balance by

[1]https://media.fisheries.noaa.gov/dam-migration/noaa_strategicplan_2019_singlesv5.pdf

[2]Fostering U.S. marine aquaculture is a high priority area of focus for multiple reasons, such as generally increasing seafood production (with the recognition that the ability to increase wild caught seafood may be limited) and for creating jobs. In addition, marine aquaculture was chosen as one way to help reduce the seafood trade deficit.

Ben Fissel and Mike Dalton are with the NMFS Alaska Fisheries Science Center, Seattle, Wash.; Andrew Kitts is with the NMFS Office of Science and Technology, Silver Spring, Md.; Rosemary Kosaka and Dale Squires are with the NMFS Southwest Fisheries Science Center, La Jolla, Calif.; Melissa Krigbaum is with the NMFS Northwest Fisheries Science Center, Seattle, Wash.; Akbar Marvasti is with the Southeast Fisheries Science Center, Miami, Fla.; Eric Thunberg and John Walden are with the NMFS Northeast Fisheries Science Center, Woods Hole, Mass.; and Mike Travis is with the NMFS Southeast Regional Office, St. Petersburg, Fla.

doi: https://doi.org/10.7755/MFR.84.1-2.1

ABSTRACT—Trade is a critical component of the U.S. seafood industry's supply and demand. In 2018 total seafood imports were \$22.4 billion and total exports were \$5.6 billion with a trade deficit of approximately \$16.8 billion. Furthermore, imports and re-imports are reported to constitute greater than 85% of domestic seafood consumption. Recognizing the importance of the U.S. seafood trade, an interagency Seafood Trade Task Force, cochaired by the U.S. Department of Commerce and the Office of the United States Trade Representative, was initiated in May of 2020 through the "Executive Order on Promoting American Seafood Competitiveness and Economic Growth." The objectives of the Executive Order are to explore policies to improve access to foreign markets, reduce barriers to exports, and more generally to promote seafood trade. Given this recent focus on the seafood trade deficit, we thought it important to describe critical aspects of the deficit. We do this by providing detailed case studies of eight U.S. harvest species categories with large trade flows.

developing a suite of trade-focused metrics for the eight most highly traded and produced U.S. harvest fisheries. Seafood categories are described in terms of domestic and global production, amounts and value traded among major trading partners, U.S. consumption patterns, and other factors that are important for understanding the role of each seafood category in the make-up of the seafood trade deficit. The selected seafood categories are shrimp (Caridea), lobster (Nephropidae), scallops (Pectinidae), crab (Brachyura), pollock, cod, salmon, and tuna (Thunnini). These were the highest value wild harvest species produced in the United States. From a trade volume perspective, the highly imported species of tilapia and pangasius might also be considered. However, given that many of the metrics rely on, or relate to, production, the authors chose to restrict the analysis to the high value species over which the United States has management authority.

To some degree, our findings address the inability to increase U.S. wild-caught production given current management regimes. Also, in our exploration of the characteristics of the seafood trade deficit, we find that, given U.S. consumers' strong preferences for relatively abundant, less-expensive, and predominantly farm-raised shrimp and salmon imports (as compared to U.S. produced), progress towards reducing the seafood trade deficit through production-oriented strategies will be bounded unless it can produce the species demanded by domestic consumers (e.g., through farming) at a price that is competitive with imports.

The general description of the seafood trade deficit and the eight seafood categories profiles are current as of 2016. Since 2018, the United States and its critical trade partners have implemented new tariffs that included seafood, and since trade patterns may have been affected by these tariffs, we sought to provide a pre-tariff baseline. Also, our description of the eight seafood categories use both Food and Agriculture Organization (FAO) and National Marine Fisheries Service (NMFS) data, and there is a 1-yr lag in availability of the FAO data.

The U.S. Seafood Trade Deficit

In 2016, the overall trade deficit for all goods and services (Table 1) was $737 billion (USCB, 2017). Of that, $14.3 billion (1.9%) was attributed to the seafood trade deficit. While seafood trade was a small portion of the overall deficit, it is large compared to the rest of the food and live animal trade surplus of $10.3 billion. So, in terms of food production, the non-seafood sector exports much more than it imports. This is expected given that the United States has historically had a productive agricultural sector resulting in much of its agricultural commodities being exported, such as soybeans, corn, nuts, beef, pork, and wheat.[3]

From 1996 to 2016, annual seafood imports increased in inflation adjusted 2016 dollars[4] from about $10 billion to about $19 billion. Total exports ranged between about $3 billion in 1998 to $5.5 billion in 2014. The seafood trade deficit increased from just over $5 billion in 1996 to about $14.3 billion in 2016 (Fig. 1A). Since export volume and value increased slightly but imports grew more substantially, the trade deficit increase can be attributed to the growth in imports. To account for the possible influence of population growth on the increase in imports, the trade deficit is shown on a per capita basis in Figure 1B. The growth in per capita imports and the resulting increase in the per capita trade deficit suggests that changes in personal buying patterns are more likely the reason for increases in the deficit than changes in the population.

In 2016, there was a seafood trade deficit with Asian countries of about $7 billion as imports were just under $10 billion and exports were just under $3 billion. In 2016, there was a trade deficit of just under $3 billion with Canada and Mexico (Fig. 2). Figure 3 provides an overview of the trade balances the United States has with each country. The shades of gray/black are trade surpluses up to a maximum of $0.5 billion. The shades of red are trade deficits up to a maximum of $1.3 billion. Countries in white are those with which the United States has a zero or negligible trade balance.

[3]https://fas.usda.gov/data/top-us-agricultural-exports-2017.

[4]Based on GDP Implicit Price Deflator with a base year of 2016.

Table 1.—Seafood trade deficit relative to agriculture sector and all goods in 2016 (billions).

	Exports	Imports	Trade balance
All goods	$1,451	$2,188	- $737
Food and live animals	$96	$100	- $4
Fish and preparations	$5.0	$19.3	-$14.3

Of the eight seafood categories profiled, all have trade deficits with the exception of pollock, a high-volume wild-caught species for which the United States supplies roughly 50% of the global market. The largest trade deficits are with two of the nation's most highly consumed species, shrimp and salmon. The trade deficit for shrimp was over $5 billion, which accounts for nearly 38% of the total seafood deficit. The next largest deficit was salmon at over $2 billion, accounting for nearly 6% of the seafood deficit. All other profiled seafood categories account for less than 10% of the total seafood deficit. All other seafood categories not profiled in this report account for over $5 billion and nearly 37% of the total seafood deficit (Fig. 4).

Based on value, the most important seafood category imported is shrimp, valued at $5.7 billion in 2016, representing nearly 30% of all import value. With much of the global production of shrimp coming from aquaculture, we assume that a large portion of the shrimp imported to the United States is farmed. The value of shrimp imports is nearly twice that of salmon imports, which is the second highest imported seafood category in terms of value in 2016. The value of imported salmon was $3.2 billion in 2016, with about two-thirds of that being farm raised. Other important imported seafood categories are crab, lobster, and tuna—each at less than $1.7 billion in value (Fig. 5).

The United States was the world's

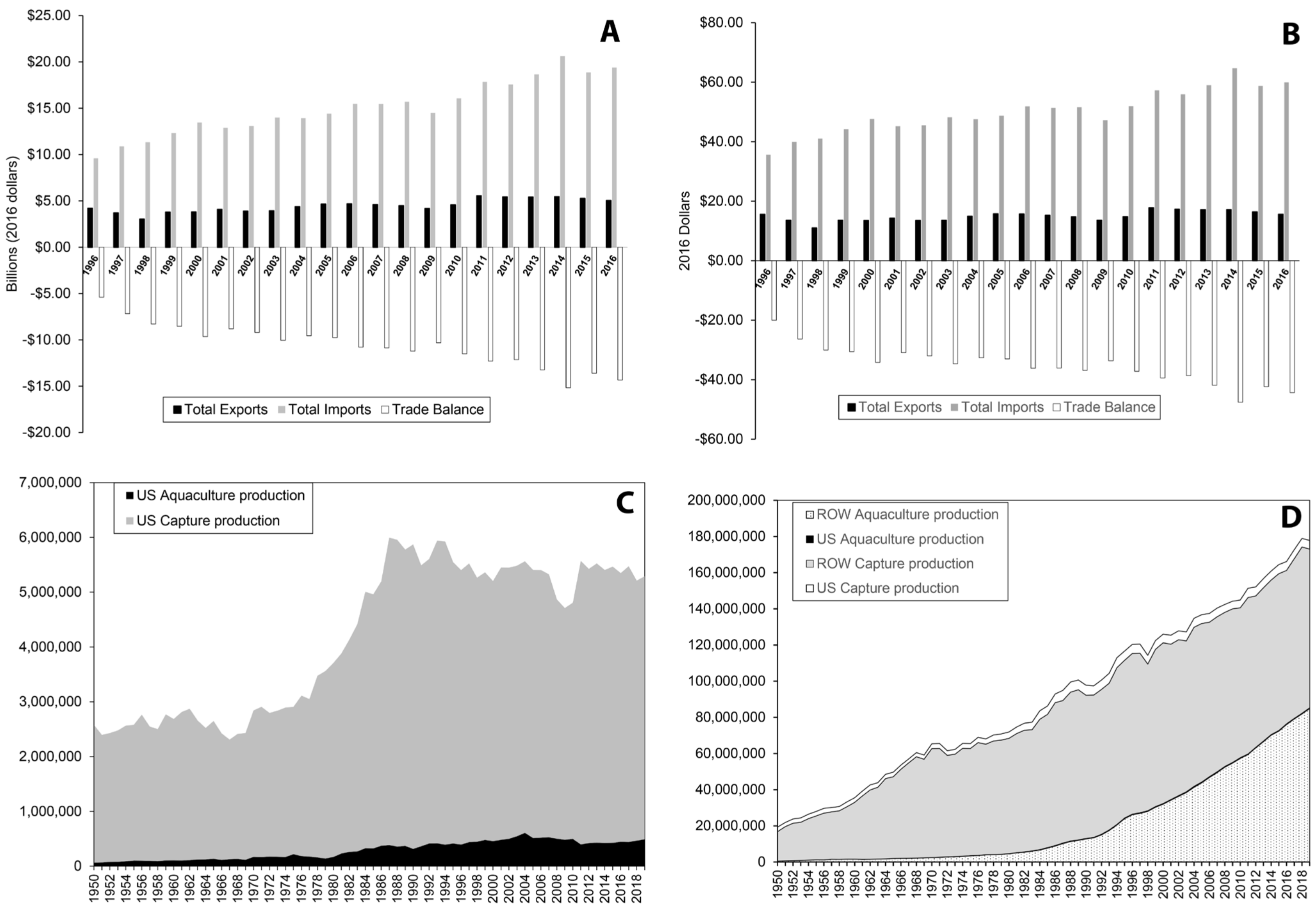


Figure 1.—A) U.S. seafood trade balance 1996–2016 (Real 2016 USD). B) Per capita U.S. seafood trade balance 1996–2016 (Real 2016 USD). C) U.S. production volume of wild and farmed fish, crustaceans, and mollusks, 1950–2019 (tons, live weight). D) Global production volume of wild and farmed fish, crustaceans, and mollusks, 1950–2019 (tons, live weight). Source: FAO.

third largest producer of captured fish in 2016 (FAO, 2018b). The largest value seafood category exported from the United States is pollock, valued at $0.99 billion, which is about 20% of total seafood exports. This is closely followed by salmon exports, valued at about $0.96 billion and mostly wild caught. The next most important exported seafood category is lobster, which was valued at over $0.75 billion in 2016. Most U.S. lobster is exported live (fresh). Other important export seafood categories are crab, flatfish, scallops, squid, shrimp, and clams—each with a value of less than $0.35 billion (Fig. 6).

U.S. consumers demand more than what is or can be produced domestically for some wild harvest seafood categories. The primary seafood categories

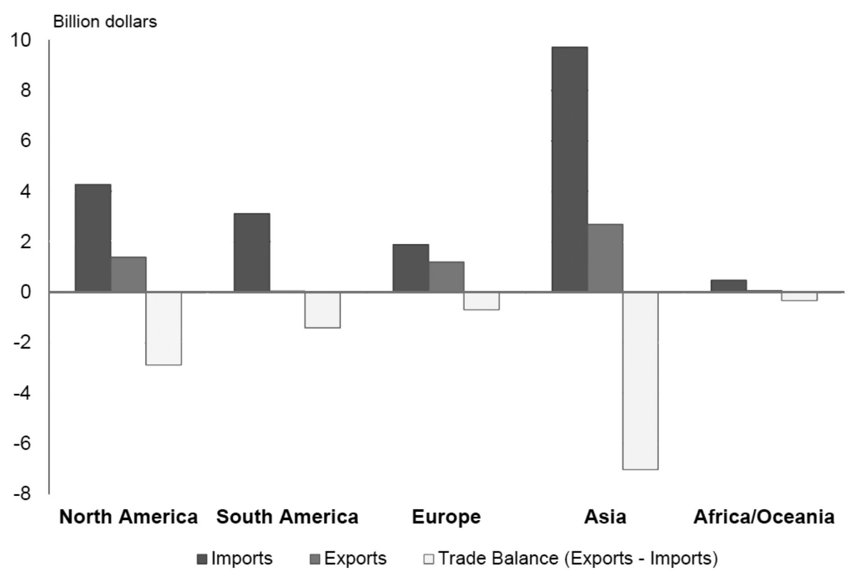


Figure 2.—U.S. seafood trade balance by continent. Source: https://www.fisheries.noaa.gov/resource/document/fisheries-united-states-2016-report (p. 77).

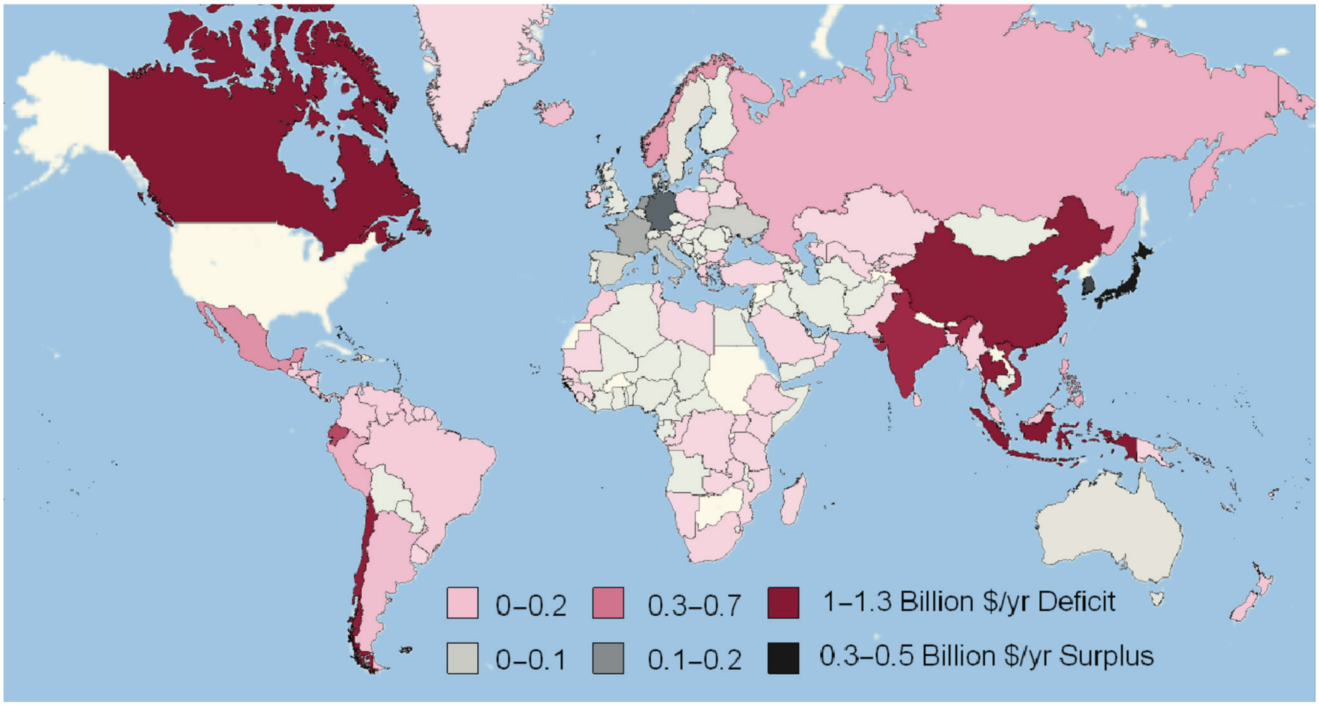


Figure 3.—Average U.S. seafood trade balance by country (2012–16).

for which this holds true are shrimp and tuna. The United States consumes ten times more shrimp and more than twice as much tuna than is produced domestically.[5] Other seafood categories for which demand outstrips domestic production are crab and salmon. Also, the United States consumes a considerable amount of certain seafood categories that it produces very little of from either aquaculture or wild harvest, such as tilapia.

For the primary seafood categories considered in this report, the potential for increasing domestic, wild-harvest production of these seafood categories is limited due to legally specified catch limits as well as various biological/environmental and economic constraints. For these economically important seafood categories, the United States is at or near its wild-harvest production threshold.[6] There are seafood categories that are of less economic importance than those considered here where catch levels are below established limits because of existing market conditions. Examples include spiny dogfish, *Squalus acanthias*, and butterfish, *Peprilus triacanthus*, in the Northeast, some flatfish in Alaska, and select species in the Gulf of Mexico grouper-tilefish program. In these examples, and others like them, it may be possible to expand production through market development, consistent with current statutory requirements. However, in the broader sense of the national trade deficit, potential gains to

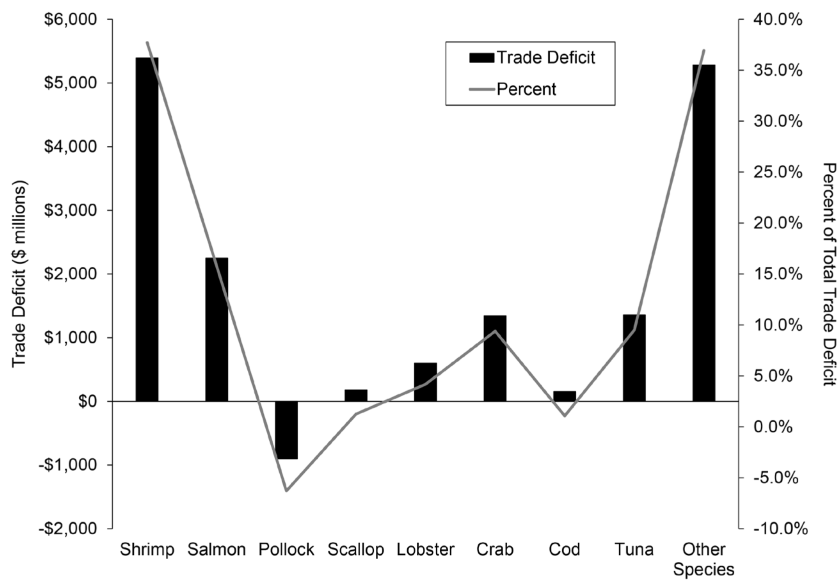


Figure 4.—2016 trade deficit by profiled seafood category.

[5]Note that most of the U.S. domestic production of tuna is never landed in a U.S. port. Most is transshipped and sent to Bangkok, Thailand, for processing.

[6]This includes the tunas managed under multi-country Regional Fisheries Management Organizations, where production is at MSY for all major species.

be made from expanding these fisheries are minimal.

For some seafood categories, the United States exports minimally processed products from domestic wild capture fisheries and imports higher value-added, processed versions of those exported species. The primary seafood categories under consideration for which this occurs to varying degrees are lobster, pollock, cod, salmon, crab (in particular Alaska crab), and tuna.[7] The supply chain is structured in this way primarily because processing costs (e.g., wages) in some countries are significantly lower than domestic processing costs, and low-cost processing of domestically sourced products helps keep prices relatively low in both the domestic and international markets (Gephart et al., 2019). While lower priced seafood products benefit domestic consumers, this feature of the supply chain contributes to the trade deficit.

Comparison of the average export and import prices for these seafood categories suggests supply chains operate, at least in part, in the manner described in the preceding paragraph. Seafood categories with an import/export price ratio >1 is an indication that the supply chain utilizes international markets for reprocessing (Fig. 7).[8] Further evidence that these seafood categories have supply chains that operate in this way can be found in the individual seafood category profiles that show large bi-directional trade volumes with known reprocessing countries. The reprocessing countries vary by seafood category but include China, Korea, Canada, and Thailand. There are multiple factors that may contribute to the use of other countries as reprocessing centers including economies of scale (i.e., average cost per unit of output is lower at higher levels of production), reduced transactions costs (i.e., the costs of conducting an economic transaction beyond the cost of producing the good being traded) as a result of having a centralized location for international processing, and a desire to avoid creating excess capacity in the domestic processing sector. Another reason for lower processing costs in some of the developing countries may be more relaxed labor and environmental standards, which some domestic producers consider to be unfair.

Figure 7 also suggests that not all seafood categories go through international reprocessors on a significant

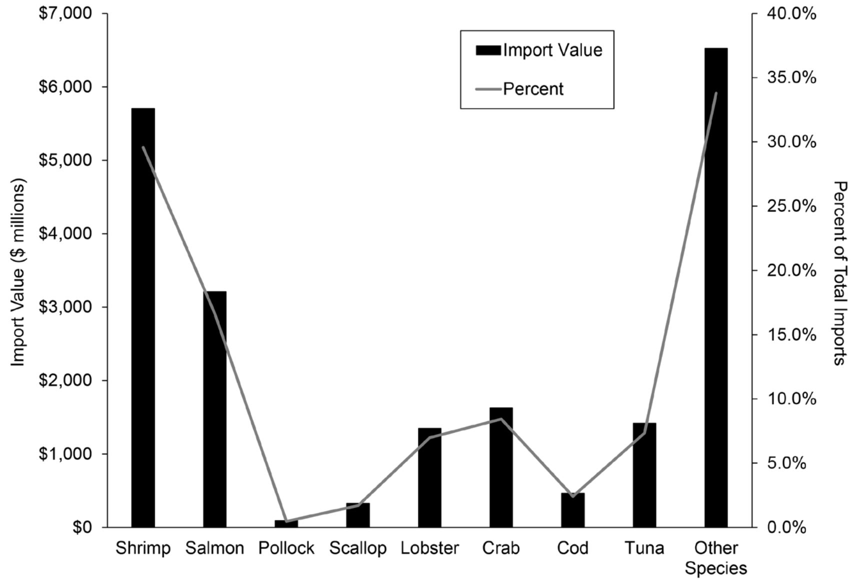


Figure 5.—Top 2016 imports by seafood category.

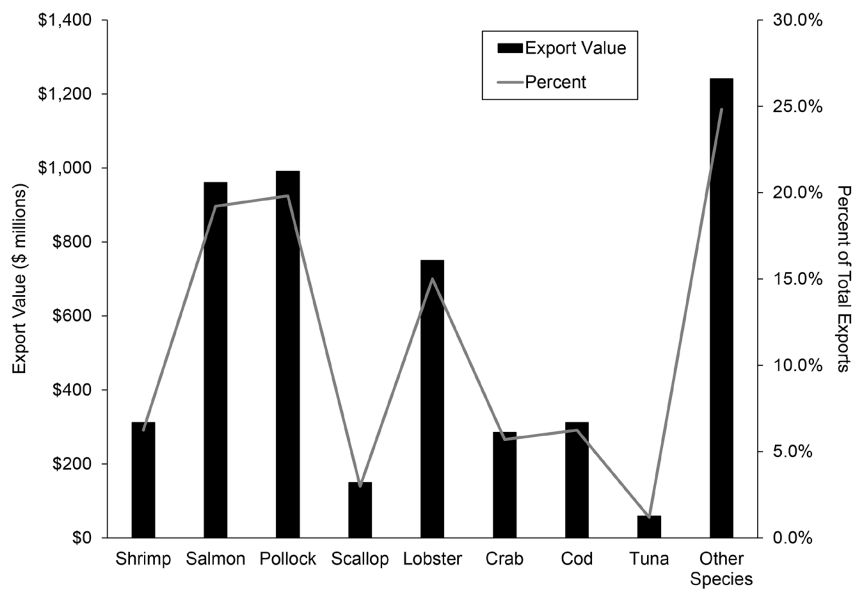


Figure 6.—Top 2016 exports by seafood category.

[7]The data to estimate the precise volume and value of imports is not available because the trade data do not identify the origin of catch and there isn't a comprehensive traceability of data collections during this period that allow us to track product through the supply chain. The recently implemented Seafood Import Monitoring Program does provide traceability data collection for select species. However, this program began around 2017 and is outside the study window.

[8]We refer to the import/export price ratio as an indicator because there are potentially confounding factors, such as preferences over products forms, that could cause this relationship to breakdown. For the species considered, the import/export price ratio correctly categorizes reprocessed species and corroborates other information.

scale, in particular shrimp and scallops. Domestically produced scallops are exported for international consumption, while scallop imports largely consist of internationally farmed products. Aquaculture production of U.S. scallops is trivial. U.S. wild-harvested shrimp is largely processed and consumed in the United States, while imports have been shifting away from "raw" product to value-added product, which has reduced the volume of raw product available to U.S. shrimp processors. Some countries attempted to sell their product in the United States at prices below what they are sold for in their respective domestic markets (i.e., dumping). As a result, imports of shrimp from these countries have been subject to anti-dumping duties since 2005. While shrimp imports had been steadily rising since the early 1980's, they were stable from 2007 to 2011, and they actually decreased in 2012 and 2013 primarily due to Early Mortality Syndrome (EMS) in several of the major exporting countries' aquaculture operations (but have been increasing since 2013 as EMS issues abated).

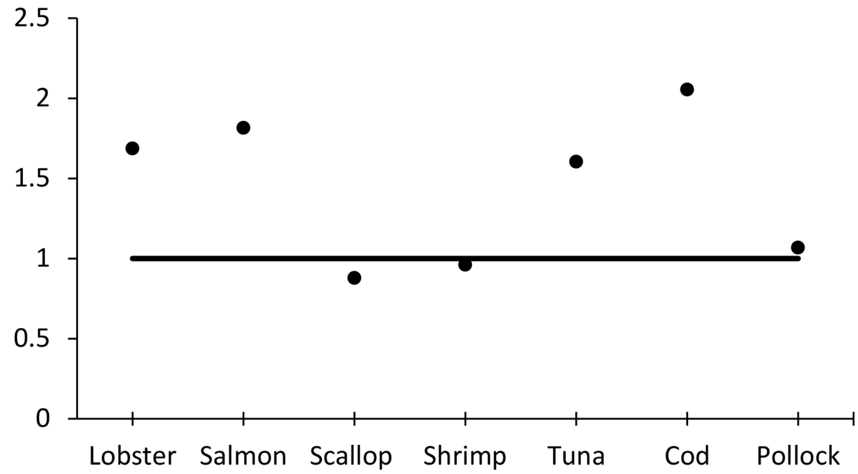


Figure 7.—Ratio of the average import price to the average export price, 2012–16.

Aquaculture and Seafood Trade

The trade of seafood from aquaculture is an important characteristic of the seafood trade deficit for both exports of U.S. seafood and imports of foreign produced seafood. As described above, shrimp and salmon imports account for a substantial part of the seafood trade deficit, most of which is farm-raised. One major complication with analyzing how global aquaculture production contributes to the U.S. seafood trade deficit is the fact that the available trade data do not clearly identify whether imports or exports are farmed or wild-caught.

When possible and appropriate, each of the seafood category profiles addresses the role of aquaculture. For the most part, our understanding of aquaculture trade stems from familiarity with what seafood categories are produced in the United States and which countries typically produce farm-raised seafood categories. It is not based on actual data. As the focus of this report is on wild-harvest species that the United States has management authority over, highly imported species such as tilapia and pangasius did not receive separate profiles but are included in national aggregates.

The Economic Research Service of the U.S. Department of Agriculture has attempted to identify what portion of seafood trade is attributable to aquaculture.[9] The ERS has selected 10-digit Harmonized Tariff Schedule and Schedule B codes that they attribute to aquaculture and have provided export and import volumes and values obtained from the U.S. Bureau of the Census. We were unable, however, to verify the accuracy of the selection of codes and so did not apply this method to the NMFS trade data. While such an effort is beyond the scope of this paper, we think it is worthwhile for the NMFS to devise an approach for improving data on the trade of farm-raised vs wild-caught seafood.

Global aquaculture production has increased exponentially over the past four decades with nearly all of the increases in production occurring outside the United States (Fig. 1D). As United States demand for seafood has increased with both population size and incomes, some of this demand has been met by imported price competitive aquaculture products, which has contributed significantly to the seafood trade deficit. While much can be deduced by coupling trade flow data with knowledge of the countries and species where aquaculture has been growing, improving trade data collection that clearly identifies farmed vs wild products would help us better understand the composition of trade flows and consumption of aquaculture products in the United States

Methods

All case studies report information for the 5-yr period of 2012 through 2016. Within particular case studies, pre-2012 information is included to illustrate important longer-term trends. Case study information is organized according to three general themes: 1) domestic and global production, 2) trade, and 3) apparent consumption.[10] The GDP Implicit Deflator was used

[9]https://www.ers.usda.gov/data-products/aquaculture-data/.

[10]The term apparent consumption is used to reflect the amount of seafood available for consumption by U.S. consumers (i.e., U.S. landings plus imports less exports). However, seafood landed, but not exported, as well as imports can be placed in inventory and not immediately consumed. The length of time in inventory varies by seafood category and product form. We do not have detailed data on inventories or actual consumption for most seafood category/product forms, but assume that inventoried product does not remain in inventory for more than a year. Additionally, the processed products survey used to provide production data for some species may include products processed from imports. Consistent with the methodology used to calculate con-

to adjust for inflation using base year 2016.[11] See the Appendix for methods used for each of the metrics.

Summary of General Themes Across Seafood Categories

Domestic and Global Production

The top seven U.S. seafood categories landed commercially by ex-vessel value in 2016 were lobsters ($723 million), crabs ($704 million), scallops ($488 million), shrimp ($483 million), tuna ($434 million), pollock ($424 million), and salmon ($420 million). Cod ranks tenth at $178 million.[12] In terms of global production of these eight seafood categories, five (cod, pollock, shrimp, tuna, and salmon) are in the top 10 of the seafood categories produced (wild or farm-raised) worldwide in 2016.[13] World production of scallops, crabs, and lobster rank 13th, 16th, and 23rd, respectively, of 26 seafood category groups.

The United States and Russia are the primary suppliers of pollock, with Russia accounting for about 50% of global catch and the United States accounting for about 44%. Much of the pollock from Russia is exported to China and is reprocessed as twice-frozen fillets. The U.S. Alaska pollock is primarily processed into fillets, surimi, roe, and head-and-gut (H&G). Surimi accounts for about 40% of the first-wholesale value of these product forms.

Salmon plays an important role in both global aquaculture and wild-caught fisheries. The United States, however, does not produce a large amount of farm-raised salmon—about 16,000 metric tons (t) in 2016 compared to about 254,000 t of wild-caught. The United States produces the largest volume of wild caught Chinook salmon, *Oncorhynchus tshawytscha*; coho salmon, *Oncorhynchus kisutch;* and sockeye salmon, *Oncorhynchus nerka* in the world and the second largest volume of chum salmon, *Oncorhynchus keta*; and pink salmon, *Oncorhynchus gorbuscha*. United States landings of salmon are concentrated on the Pacific Coast, much of it in Alaska. The United States and Russia are the two primary producers of wild-caught salmon. Farmed Atlantic salmon, *Salmo salar,* is produced primarily by Norway, Chile, and the United Kingdom. Norway supplies over twice the amount of farmed Atlantic salmon as does Chile, which is the second highest producer, however, Chile and Canada are the larger suppliers of these salmon to the United States.

Warmwater shrimp from the Gulf of Mexico account for 80% of the supply of U.S. wild-caught shrimp. Approximately 75% of the Gulf of Mexico shrimp are white shrimp, *Litopenaeus setiferus*, and brown shrimp, *Farfantepenaeus aztecus*, while the remainder are pink shrimp, *Farfantepenaeus duorarum*. These warmwater shrimps may be processed and marketed as peeled, deveined, shell-on, tail-off, marinated, skewered, or sauced. U.S. cold-water shrimp are harvested in the northeast and northwest regions. They are smaller than the warmwater shrimp from the Gulf of Mexico. The annual U.S. wild-caught shrimp landings declined by 5% during the 2012–16 period. This is primarily due to a decline in abundance. Since the most important shrimp species (white and brown), in terms of harvest volume, have a life cycle of 1 yr, abundance of these seafood categories is largely driven by environmental factors. Production from domestic aquaculture sources has been negligible at about 1% of the total domestic landing. These low levels of U.S. farmed production are partly due to environmental concerns, regulatory impediments, and local opposition (Knapp and Rubino, 2016).

While the United States production of shrimp is nearly all wild-caught, the rest of the world has been increasing production of farm-raised shrimp. In fact, since 2010, global production of farmed shrimp has exceeded the production of wild-caught. World catch of wild-caught shrimp has remained relatively constant at 3.4 million t from 2012 to 2016. World production of farm-raised shrimp has increased from 4.1 million t in 2012 to 5.1 million t in 2016. The Asia-Pacific region produces 75% to 80% of the world's shrimp. Most of this is farm-raised Pacific white shrimp, *Litopenaeus vannamei*.

U.S. production of scallops is entirely from wild-caught activities. Most of the commercial harvest takes place in the northeast region. Atlantic sea scallop, *Placopecten magellanicus*, is the dominant seafood species landed (over 18,000 t of meat weight in 2016). Other species landed are bay scallop, *Argopecten irradians*; calico scallop, *Argopecten gibbus*; and weathervane scallop, *Patinopecten caurinus*. Between 2012 and 2016, U.S. production declined by 28.5%, and global production declined as well.

The United States produces over 20% of the world's wild-caught scallops and 10% of the world's combined wild-caught and farm-raised production. Aquaculture production of scallops is becoming more important as a supply source to world markets. World production of wild-caught scallops declined from 749,000 t live weight in 2012 to 569,000 t in 2016, a 24% decline. World production of farm-raised scallops, however, increased from 1.6 million t live weight in 2012 to 2.1 million t in 2016, a 29% increase.

The United States and Canada supply about 97% of the global supply of clawed lobsters. Clawed lobsters include American, *Homarus americanus*; European, *Homarus gammarus*; and Norway, *Nephrops norvegicus*; lobsters. The United States and Canada harvest American lobsters with about 40%–46% caught by the U.S. fishing fleet during 2012–16.

U.S. crab fishermen primarily land blue, *Cardisoma guanhumi*; Dungeness, *Metacarcinus magister*; Jonah, *Cancer borealis*; king, *Paralithodes*

---

sumption in the Fisheries of the U.S. we assume this is negligible.

[11]https://fred.stlouisfed.org/series/GDPDEF.

[12]Based on 2016 Fisheries of the United States (FUS) for all seafood categories except tuna. FUS values for tuna only reflect actual U.S. landings. Based on multiple sources, this report includes tuna caught by U.S. flagged vessels regardless of country of landing (see tuna profile).

[13]2017. FUS. Species groups as defined by the Food and Agriculture Organization.

spp. and Lithodes sp.; snow, *Chionoecetes opilio*; Tanner, *Chionoecetes* spp.; and stone, *Menippe* spp.; crabs, which account for 98% of domestic landings during the 2012–16 period. The United States accounts for 38% of the global production of the crab species landed by U.S. fishermen, while Canada accounts for 25%, Russia 16%, and Korea 11%. U.S. crab production is split nearly equally between the East and West Coasts. Blue crab is the most important eastern U.S. crab species, accounting for about 84% of the value. Stone crab accounts for 12% of the value of eastern U.S. crab landings. Dungeness crab is the most valuable western U.S. crab species (45% by value), followed by snow and Tanner crabs (34%) and red king and golden king (21%).

Almost all cod caught by U.S. fishermen is Pacific cod, *Gadus macrocephalus*. Caught primarily in Alaska, Pacific cod accounts for about 99% of the U.S. catch. Atlantic cod was once an important portion of the U.S.'s cod catch with a high of 44,000 t in 1982. By 1995, catch had declined to about 10,000 t. Total U.S. cod landings have remained at over 300,000 t through the 2012–16 period. The two primary product forms of U.S. cod are H&G and fillets. Global cod catch was about 1.8 million t over the same period.

In terms of total value, tuna is the fifth largest capture fishery in the United States. A large portion of this catch is landed outside of the United States; approximately 64% by value in 2016. Seventy to eighty percent of the catch, by volume, is skipjack tuna largely harvested from the western and central Pacific Ocean. The United States was among the top ten tuna harvesting nations in the world between 2012 and 2016 and among the largest harvesters of purse-seine caught tuna in both the western and central Pacific and eastern Pacific Ocean areas. Between 2012 and 2016, the United States accounted for 5.7%–6.9% of global tuna landings. U.S. production of domestically landed tuna ranged from 182,000–200,000 t between 2012 and 2016. Canned tuna accounted for approximately 90% or more of annual processing volume.

Trade

Unlike the other important seafood trade products, the United States has an overall trade surplus in pollock. In 2016, the value of pollock exports was $990.5 million while the value of imported pollock was only $91.2 million, which resulted in a trade surplus of almost $900 million. The U.S. exports approximately 75% of its pollock—ten times more than it imported in 2016. Much of the H&G pollock goes to China for reprocessing. Throughout much of the 1990's, Japan was the primary export market. During the early- to mid-2000's, the United States increased exports to China for reprocessing, thereby diversifying the U.S. pollock export market. Germany and South Korea are other significant export destinations for U.S. products. These four countries account for about 75% of exported pollock products. By 2016, most pollock exports went to South Korea (29%), followed by Japan (20%) and Germany (19%). Most U.S. imports (about 90%) come from China. China is the only country with whom the United States has a trade deficit in pollock products. Roe and surimi are largely exported to Japan and South Korea and fillets to Germany and the Netherlands. Export prices are generally lower than import prices since imports are typically further processed.

The value of U.S. net exports of salmon (all products) generally shows a decreasing trend during the 2012–16 period. This trend is driven by net exports of farmed salmon products, which show a similar trend. In contrast, U.S. net exports of wild caught salmon are positive but modest (see Salmon section Fig. 50A-C). The trade deficit for all salmon products in 2016 was $2.25 billion. Canada, China, and Japan are the primary destinations for U.S. salmon exports, comprising export value shares in 2016 of 33%, 16%, and 13%, respectively. In 2016, the United States imported the largest value share of salmon products from Chile (42%), followed by Canada (24%), Norway (13%), and China (7%). While there is a trade deficit for all salmon products combined, the value of wild salmon exports exceeds the value of wild salmon imports. The trade surplus for wild salmon products was $500 million in 2016, and the trade deficit for farmed salmon products was just over $2.5 billion. In 2016, the prices of imported wild and exported farmed salmon products were nearly the same, at almost $3/lb. Exported wild product averaged a little over $2/lb, and imported farmed product averaged the lowest price at just under $0.60/lb in 2016.

Shrimp are currently the largest source of U.S. seafood imports, with over $5.7 billion in shrimp products imported in 2016. Conversely, U.S. exports of shrimp have been negligible, ranging between 2% and 4% of imports between 2012 and 2016. Although domestic landings of shrimp have generally been stable over the past several years, imports show a clear and significant upward trend, presumably in response to rising demand for shrimp in the United States. Although Thailand was the most important source of shrimp imports into the United States in 2012, India became the most important source of shrimp imports in subsequent years, while Indonesia, Ecuador, and Vietnam also export significant amounts of shrimp products to the United States. Nearly 80% of U.S. shrimp imports are in shell-on frozen or peeled frozen product forms. The increase in imports appears to have caused domestic ex-vessel and imported shrimp prices to fall despite higher consumption and a steady domestic supply.

The U.S has run a trade deficit in scallop products since 2012. Most scallop exports were to Canada, although exports to the Netherlands increased in 2015 and 2016 to nearly the same level as exports to Canada. The United States had a trade deficit with Canada in scallop products during this time, as the value of imported scallop products exceeded the value of exports. However, net exports to the other top U.S. trading partners (Belgium, Netherlands, France, and the United Kingdom) have been positive, meaning the United States has a trade surplus with these nations. From 2014 to 2016, in terms of value, over 75% of U.S. scallops were exported in "frozen/dried/salted/brine" form. These are processed products, indicating the U.S. exports more processed scallops than fresh scallops, likely because of the high domestic demand for fresh scallops. Similarly, about 80% of the import value during this time was also in the "frozen/dried/salted/brine" product form. The five most important countries the United States imports from are China, Canada, Japan, Argentina, and Philippines. The United States imported most of its scallops from China. Imports from China more than doubled during 2012–16. Chinese imports were triple the volume from Canada in 2016.

In 2016, the U.S. imported $1,347.8 million of lobster products, but only exported $750 million of lobster products, resulting in a trade deficit of almost $598 million in lobster products. The vast majority of U.S. trade in lobster products is with Canada, with 85.7% of import value from Canada and 44.6% of U.S. export value to Canada. China/Hong Kong are also important buyers of U.S. lobster, accounting for 20.7% of exported lobster products. Net exports to China, France, Italy, and Spain were positive from 2012 to 2016. The volume of U.S. exports was approximately equal to the volume of imports. However, the value of imported live and processed American lobster has exceeded the value of U.S. exports. From 2012 to 2016, the export price has consistently been below import prices by $4–$5 per lb. In terms of volume, U.S. lobster exports are predominantly American lobster (in excess of 90%), the overwhelming majority of which is shipped live while imports include live American lobster as well as processed frozen whole lobster and fresh and frozen lobster meat.

In 2016, the total value of U.S. crab imports was $1,628 million, the total value of U.S. crab exports was $256 million, and the total value of U.S. re-exported crab was $29 million, resulting in a total U.S. trade deficit for crab products of $1,343 million. From 2012 to 2016, the top three countries to import U.S. crab products were, in order, Canada, China, and Japan. Exports to Japan are less than half of exports to either Canada or China. The top four importing countries are Canada, Russia, Indonesia, and China. Imports from Canada were two to three times higher than Russia. Imports from Russia, Indonesia, and China are comparable, and were at least three times higher than other countries on the top 10 list for U.S imports during the 2012–16 period. The average annual trade deficit for all crab products increased by 94% in real value during this time. Japan accounted for 78% of the average annual trade surplus for crab products in countries with which the United States had an average annual trade surplus during the 2012–16 period. Canada, Russia, and Indonesia had the largest average annual trade deficits for crab products, and together accounted for 71% of the average annual trade deficit for crab products in countries with which the United States had an average annual trade deficit during the 2012–16 period.

In 2016, the value of cod exports from the United States was $312 million, while the value of cod imports into the United States was $466 million. Thus, in 2016 the United States had a trade deficit of $154 million with respect to cod products. During 2012–16, cod import volumes increased and export volumes remained stable. From 2012 to 2016, approximately 70% of domestic cod production was exported. More than 90% of cod exports are H&G, much of which goes to China for secondary processing and re-export. Re-exports are mostly frozen block or fish stick form. China's rise as a reprocessor is fairly recent. Japan and Europe (mostly Germany and the Netherlands) are also important export destinations. In 2016, 52% of cod exports went to China, while 15% went to Japan. In 2016, 60% of cod imports came from China, with 19% coming from Iceland. Because the United States exports raw material and imports more finished goods, import price is roughly $3.00/lb and about twice as much as export price, which is about $1.50/lb.

The production and trade of tuna is a complex and interconnected web of harvesters and processors across many countries. European and U.S. industries commonly locate initial processing facilities in developing countries where landings of tuna occur. Semi-processed products are then exported to facilities in developed countries for further processing and distribution. With imports of tuna to the United States exceeding exports by a factor of ten, there has been an average annual trade deficit of about $1.53 billion between 2012 and 2016. Thailand was the largest supplier of tuna products to the U.S. market, accounting for 37% of total imports in 2012–16. Indonesia, Vietnam, Ecuador, Philippines, and China constituted the next largest suppliers (8%–10% on average), with their share of volumes generally increasing from 2012 to 2016.

Apparent Consumption

One contributor to the seafood trade deficit is that, for some high demand seafood categories, the U.S. consumes more than what is domestically caught or can be sustainably and legally caught.[14] In order to characterize the relationships between consumption, trade, and domestic production, each of the seafood category profiles have the following metrics: 1) Apparent consumption, which is based on domestic production, exports, and imports; 2) Apparent consumption relative to U.S. production, which determines whether the U.S. consumes more or less of a given seafood category than it produces domestically; and 3) Un-exported U.S. production relative to apparent consumption, which shows how much of what is consumed is directly supplied by the U.S. domestic industry (i.e., neither exported nor re-imported).

[14]Also, the U.S. consumes a considerable amount of certain species that the U.S. produces either very little of through aquaculture or harvests from wild stocks, such as tilapia.

Table 2.—Summary of apparent consumption related trade metrics from individual seafood category profiles, 2012–16 average.

	Pollock	Shrimp	Scallop	Cod	Crab	Salmon, wild	Salmon, farmed	Salmon, all	Lobster	Tuna	Total
Average of net exports ($)	$886	-$5,507	-$183	-$62	-$1,123	$584	-$2,183	-$1,599	-$422	-$1,528	-$11,137
Average price per pound ($)	$1.26	$4.77	$6.71	$2.94	$6.02	$3.13	$0.66	$1.08	$5.98	$2.67	-
Average trade volume ratio	6.711	0.025	0.410	1.714	0.269	3.869	0.037	0.681	1.004	0.068	0.43
Average of apparent consumption (K mt)	100–400	>400	<100	100–400	100–400	100–400	100–400	>400	<100	>400	2084
Average of consumption relative to U.S. production	0.33	10.30	1.75	0.69	1.96	0.57	26.07	1.30	1.00	2.30	1.49
Average of unexported production relative to consumption	0.64	0.07	0.28	0.37	0.33	0.71	0.04	0.28	0.23	0.39	0.28

Color Legend

Average of net exports	<- $ 1 billion	> - $ 1 billion & <0	>0
Average price per pound	<$2.50	>$2.50 and <$5.00	>$5.00
Average trade volume ratio	<1	~= 1	>1
Average of apparent consumption (K mt)	<100	100–400	>400
Average of consumption relative to U.S. production	>1	~= 1	<1
Average of unexported production relative to consumption.	< 0.1	>0.1 & < 0.5	> 0.5

For each of the seafood categories where there was a high level of average consumption (greater than 400,000 t), the average trade deficit was in excess of $1 billion (Table 2). For five of the eight seafood categories considered in this report the United States consumed more than it produced domestically. The primary seafood categories for which this held true were shrimp (10 times more) and tuna (2 times more).[15] Other seafood categories for which demand outstripped domestic production were crab, scallops, and salmon. For these seafood categories, the domestic industry could not meet current levels of domestic demand without significant increases in domestic production (which were not sustainably possible). For lobster, the United States consumed about as much as was produced. For all of these seafood categories, the trade deficit was due to consumption preferences. For the high volume pollock and cod seafood categories, the United Statese consumed less than what was produced, with only 66% of domestically produced pollock being consumed, and only about 30% of domestically produced cod being consumed, on average. Only for pollock was there a trade surplus for the seafood category as a whole. However, the United States also carried a surplus for wild salmon. There was a trade deficit for cod in four of the five years (2012 was a surplus) and, relative to the volume of consumption, the trade deficit was small. The trade deficit for cod was the result of increased reliance on overseas reprocessing. For most of the seafood categories, the United States directly supplied (i.e., unexported production) 20%–50% of the domestic consumption. The two exceptions to this were pollock and shrimp. Between 2012 and 2016, the United States directly supplied 60%–70% of the domestic consumption of pollock and this metric trended up over the time period. For shrimp, the U.S. industry directly supplied 5%–9% of domestic consumption and showed a slight downward trend as increased consumption of shrimp was supplied by farmed imports.

Apparent consumption of seafood categories was assembled in three groups. Highly consumed seafood categories (>400,000 t consumed annually) include shrimp, tuna, and salmon with low to moderate price points (farmed salmon and canned tuna on the lower end, tuna meat, shrimp, and wild salmon on the moderate end) (Table 2). Among the eight seafood categories considered here, between 2012 and 2016, shrimp represented 33% of consumption volume, followed by salmon and tuna, which represented a little over 20%. The second group is pollock, cod, and crab which were moderately consumed seafood categories (between 100,000 and 400,000 t consumed annually) with a mix of low to high price points (pollock on the lower end, cod in the middle, and some crab is higher priced). Pollock, crab, and cod each represented roughly 5%–10% of consumption. The third group consists of lobster and scallops which have lower volume (<100,000 t consumed annually) but high price points. Scallops and lobster each represented less than 5% of consumption by volume. Apparent consumption was relatively stable for all seafood categories over 2012–16 with only a few seafood categories displaying moderate trends over the short time period. This was expected as consumption trends should change relatively slowly. Over longer periods, consumption trends can be more pronounced. Where trends in consumption were increasing, they tended to be more apparent in highly consumed farmed products such as shrimp and farmed salmon.

[15]Note that some of the U.S. domestic catch of tuna was never landed in a U.S. port and was transshipped or landed in Bangkok, Thailand.

U.S. American Lobster Seafood Trade

Domestic and Global Production

American lobster is among the highest value wild-capture fisheries in the United States averaging $562 million (real 2016 US$) from 2012 to 2016. Over the same time period Pacific salmon, another predominantly wild capture fishery averaged $561 million, and the two fisheries have been the top revenue producing fisheries in the United States from 2012 to 2016. Global production of clawed lobster (American lobster, *Homarus americanus*; European lobster, *Homarus gammarus;* and Norway lobster, *Nephrops norvegicus*) was 147,000 t during 2012 and 2013 and was above 160,000 t every year from 2014 to 2016 (Table 3). The overwhelming majority of clawed lobster production came from the United States and Canada, averaging about 97% of global supply with about 40%–46% coming from U.S. landings and about 51%–56% from Canadian landings during 2012–16 (Table 3).

The U.S. lobster fishery is not managed using quotas. Instead, the fishery is managed primarily by controls on the number of traps and limits affecting the size (minimum and/or maximum) and condition (prohibition on possession of female lobsters carrying eggs and V-notched female lobsters) of lobsters that may be retained. The regulations on taking of lobsters and trap limits vary by Lobster Conservation Management Areas and by Lobster Zones in the state of Maine. The majority of lobsters are harvested at the minimum size, which is an indicator that the fishery is operating at or near biological limits. Total U.S. harvest of American lobster was 68,000 t during 2012 and 2013 then fell to 66,000 t in 2014 and 2015 before increasing to 72,000 t in 2016 (Fig. 8).

Table 3.—Clawed lobster trade and global market data. Global production (thousand metric tons), U.S. share of global production, Canadian share of global production, U.S. export and import volume (thousand metric tons), real value (million US$), and real price (US$/lb), the share of U.S. export and import volume and value with Canada, China, France, Italy, and Spain, 2012–16 (Real 2016 USD).

			2012	2013	2014	2015	2016
Global clawed lobster catch K mt			147.4	147.2	164.7	162.3	167.5
U.S. share of global catch			46.2%	46.2%	40.5%	41.0%	43.1%
Canadian share of global catch			50.7%	50.7%	56.3%	56.0%	54.1%
U.S. export volume K mt			49.2	50.9	57.6	55.2	55.6
U.S. export value M US$			542.2	617.7	754.2	731.5	750.0
Export price lb US$			5.00	5.51	5.94	6.01	6.12
Import volume K mt			56.4	58.5	61.7	65.7	61.3
Import value M US$			1,174.9	1,174.1	1,324.6	1,441.2	1,347.8
Import price lb US$			9.45	9.11	9.74	9.95	9.96
Canada	Export	Volume share	62.5%	56.6%	54.6%	55.0%	56.7%
		Value share	43.3%	39.4%	43.1%	44.3%	44.6%
	Import	Volume share	83.0%	82.8%	85.6%	86.1%	86.8%
		Value share	78.7%	78.6%	82.1%	83.2%	85.7%
China/Hong Kong	Export	Volume share	8.3%	13.5%	14.9%	15.7%	15.8%
		Value share	13.2%	20.2%	19.4%	18.2%	20.7%
	Import	Volume share	1.1%	1.4%	1.4%	1.1%	3.2%
		Value share	0.5%	0.5%	0.4%	0.3%	0.7%
France	Export	Volume share	4.9%	4.9%	4.2%	3.4%	3.2%
		Value share	6.6%	6.0%	4.6%	3.9%	3.5%
	Import	Volume share	0.0%	0.0%	0.0%	0.0%	0.0%
		Value share	0.0%	0.0%	0.0%	0.0%	0.0%
Italy	Export	Volume share	7.8%	6.9%	6.4%	6.2%	6.0%
		Value share	10.6%	8.5%	7.4%	7.8%	7.2%
	Import	Volume share	0.0%	0.0%	0.0%	0.0%	0.0%
		Value share	0.0%	0.0%	0.0%	0.0%	0.0%
Spain	Export	Volume share	6.4%	5.2%	4.6%	4.6%	4.4%
		Value share	9.4%	6.9%	5.2%	5.8%	5.7%
	Import	Volume share	0.3%	0.6%	0.1%	0.1%	0.3%
		Value share	0.1%	0.1%	0.0%	0.0%	0.1%

Trade

Although U.S. trade in lobsters includes both spiny lobster and small quantities of Norway lobster, we focus on trade in American lobster. U.S. exports of American lobster are predominately shipped live while imports include live American lobster as well as processed frozen whole lobster and fresh and frozen lobster meat. The volume of U.S. exports was approximately equal to the volume of imports as the trade volume index ranged from 0.9 to 1.05 from 2012 to 2016 (Fig. 9). However, the value of imported live and processed American lobster exceeded the value of U.S. exports as net export value averaged -$422 million from 2012 to 2016 (Fig. 10). The United States top five American lobster trading partners include Canada, China, France, Italy, and Spain, and Canada is by far the largest in both volume and value. In fact, the negative aggregate net export values shown in Figure 10 are driven by a large trade deficit with Canada as net exports to China, France, Italy and Spain were positive from 2012 to 2016 (Fig. 11).

Live American lobster prices exported to China, France, Italy, and Spain averaged $7.07/lb and increased from $6.90 in 2012 to $7.52/lb in 2018 (Fig. 12). By contrast, live American lobster sold to Canada averaged $4.42/lb while the U.S. import price of live lobster from Canada averaged $5.98/lb from 2012 to 2016 (Fig. 12). Thus, even though export volume of live lobster shipped to Canada exceeded imports by an average of 3,200 t

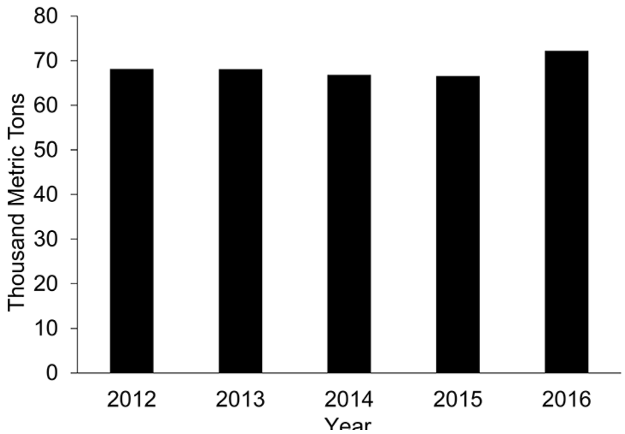


Figure 8.—U.S. production volume of live American lobster, 2012–16.

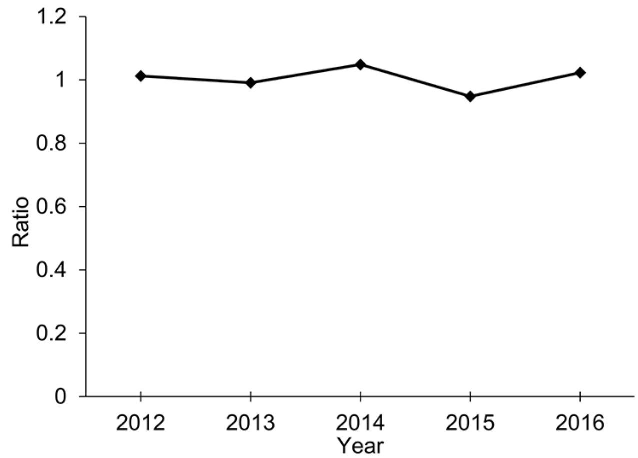


Figure 9.—Export/import volume ratio of American lobster, 2012–16.

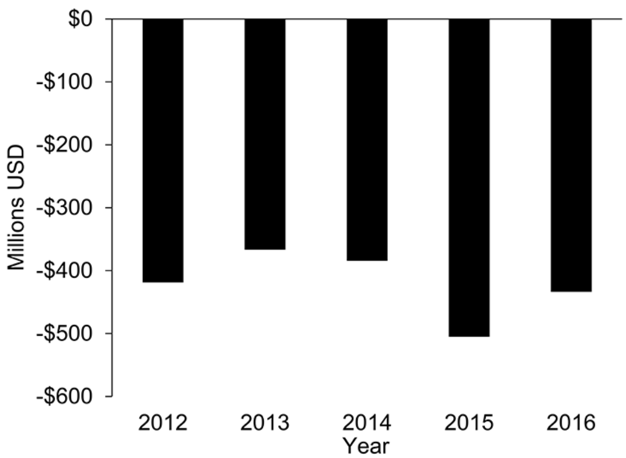


Figure 10.—Net exports of American lobster, 2012-16 (Real 2016 USD).

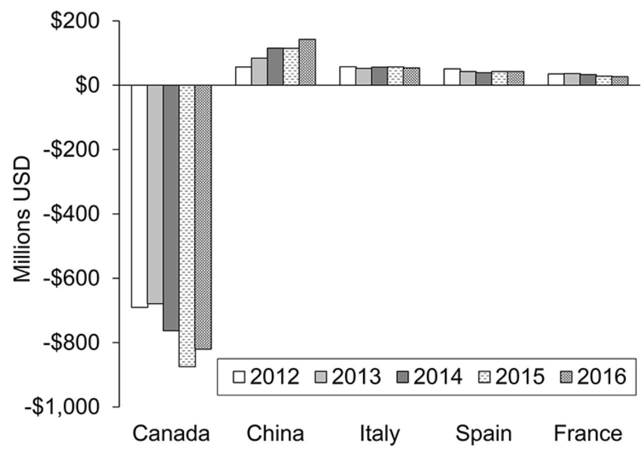


Figure 11.—Net exports of American lobster to top five countries, 2012–16 (Real 2016 USD).

from 2012 to 2016, the value of live lobster imported from Canada exceeded export value by an annual average of $72.8 million (Fig. 13). This represents less than 10% of the U.S. net export trade deficit with Canada as the U.S. import volume and value of processed lobster exceeded exports by an average of 24,200 t and $692.7 million, respectively (Fig. 13).

The multilateral export trade index provides a year by year comparison of trade among the top 10 trading countries (Table 4). South Korea during 2012 was selected as the reference because exports to South Korea and other Asian countries were increasing, and as a relative measure the reference country and year has no effect on comparisons among countries or across years. Exports to South Korea increased in 2016 by nearly 500% compared to exports in 2012. Exports to Canada in 2012 were 134 times that of South Korea but have changed little relative to the reference. This was also the case for the United Kingdom and Taiwan. Exports to both Italy, Spain, and France have declined relative to the 2012 South Korea base, while exports to Vietnam and China have increased.

The Herfindahl Index (HI) provides a composite measure of concentration in terms of export shares among U.S. trading partners. The HI in 2012 was 0.28, increased to 0.33 in 2015, and then fell to 0.30 in 2016 (Fig. 14). The HI trended upward modestly, which is an indication that the share of exports among the United State's top export markets for American lobster increased.

The volume weighted effective exchange rate index is a measure of upward or downward pressure of U.S. lobster prices in global markets. The effective exchange rate increased from 1.09 in 2012 to 1.6 in 2016 (Fig. 15). Although, while U.S. American lobster export prices increased (Fig. 13) the strength of the U.S. dollar may have dampened U.S. export prices below what they would otherwise have been.

The U.S. share of global trade activity in *Homarus* sp. is measured by the U.S. share of global export and import value. The U.S. global export share was nearly constant at 23%–24% from 2012 to 2016 (Fig. 16). The global share of U.S. imports was also stable ranging from 33.1% to 34.5% from 2012 to 2015 but declined to 30.8% in 2016. Changes in export and import value growth relative to global growth provide an indication of the competitiveness of U.S. American lobster in international markets. Compared to global export growth, the United States was more competitive in global markets in 2012, 2013, and 2015 but less competitive in 2014 and 2016 (Fig. 17). U.S. import value growth was similar to that of global import value share from 2012 to 2015 (Fig. 18). However, the U.S. import value share declined by nearly 11% from 2015 to 2016 while the growth in global import share remained positive. This means that imports that might otherwise have been sold to U.S. importers were diverted to other countries.

Table 4.—Lowe multilateral trade index for top ten countries (South Korea = 1).

Year	Canada	China	France	Italy	South Korea	Spain	Taiwan	Thailand	U.K	Vietnam
2012	134.8	10.3	9.8	16.8	1.0	13.3	1.3	0.2	3.4	0.6
2013	125.2	13.0	9.6	15.1	2.7	11.2	2.0	0.4	3.7	0.4
2014	137.9	17.1	8.0	16.2	5.4	11.0	2.5	0.6	4.3	3.8
2015	133.3	16.4	7.0	14.6	3.3	10.9	1.7	0.7	3.7	7.7
2016	138.4	29.5	7.4	14.5	4.6	10.4	1.8	1.1	3.4	5.4

Domestic Consumption

The total volume of American lobster products available for U.S. domestic consumption averaged 68,100 t from 2012 to 2016 (Fig. 19). Apparent consumption was at a time series low of 64,200 t during 2012 but increased in both 2015 and 2016 to 71,000 t in 2016. U.S. landings of American lobster were approximately equal to apparent consumption (Fig. 20), but taking into account the net effects of domestic production that was exported and imports from Canada, the share of U.S. production in domestic consumption ranged from 17% in 2014 to 30% in 2012 (Fig. 21).

This section authored by Eric Thunberg, NMFS Northeast Fisheries Science Center.

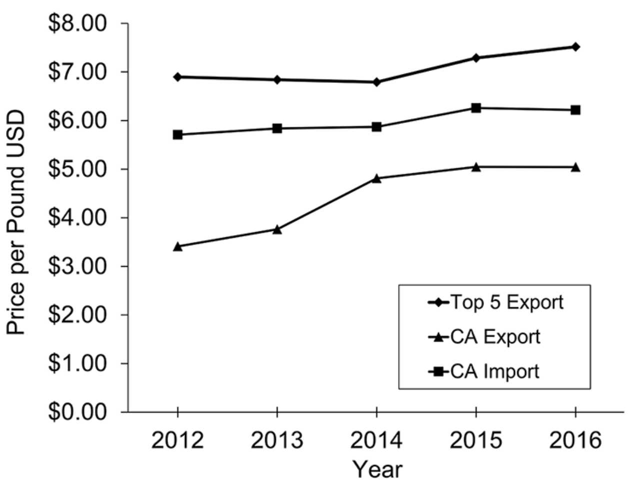


Figure 12.—Export and import price of live American lobster, 2012–16 (Real 2016 USD).

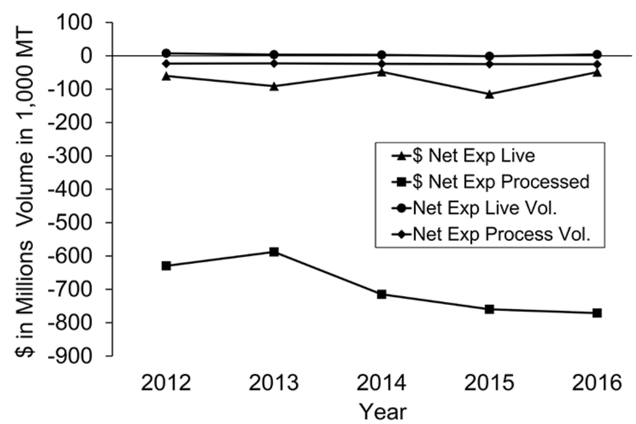


Figure 13.—U.S. net export volume and value (Real 2016 USD) of American lobster trade with Canada in live and processed products.

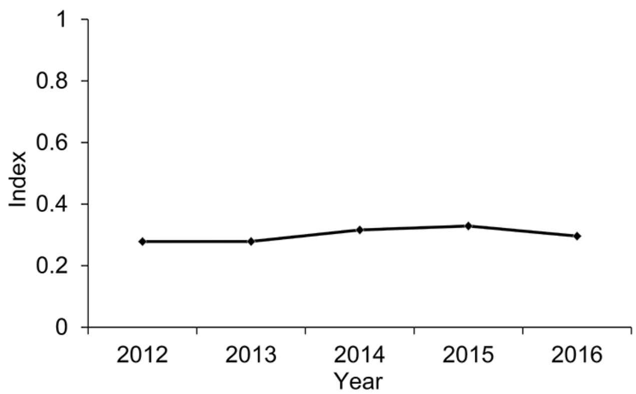


Figure 14.—Export concentration index of U.S. American lobster trade with other countries, 2012–16.

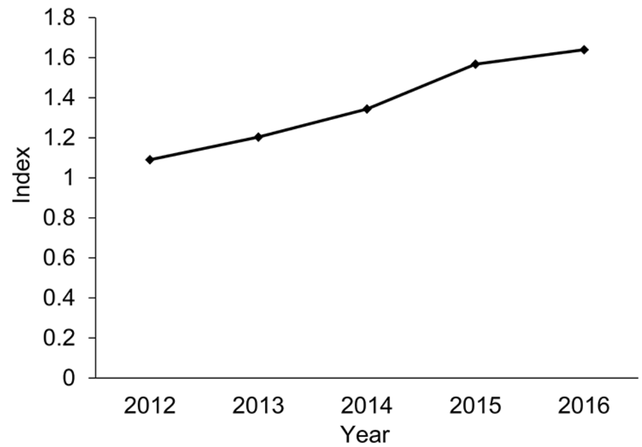


Figure 15.—Real export effective exchange rate index (foreign currency per dollar) for American lobster, 2012-16 (Real 2016 USD).

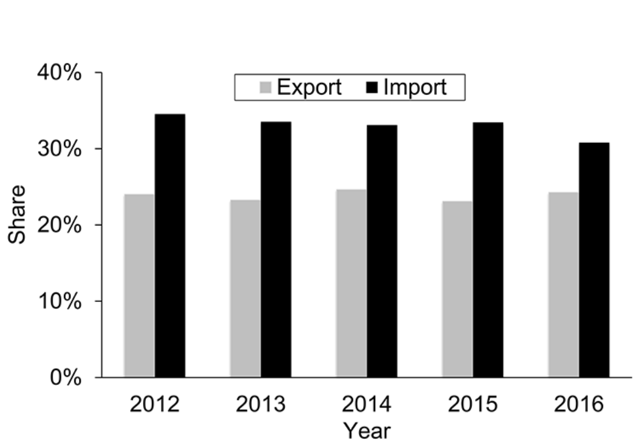


Figure 16.—U.S. share of global trade value activity in *Homarus* sp., 2012–16 (Real 2016 USD).

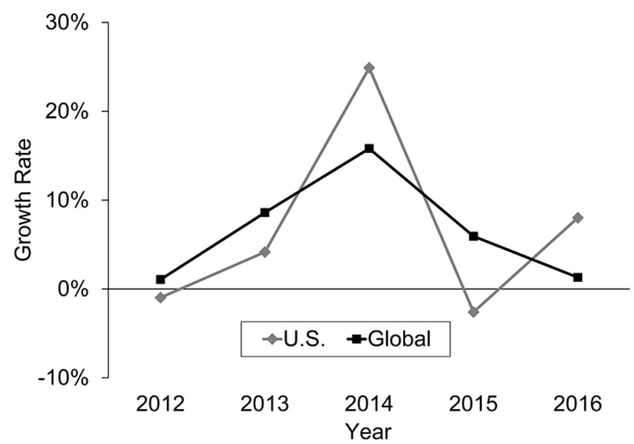


Figure 17.—Export value growth of the U.S. and rest of the world, 2012–16 (Real 2016 USD).

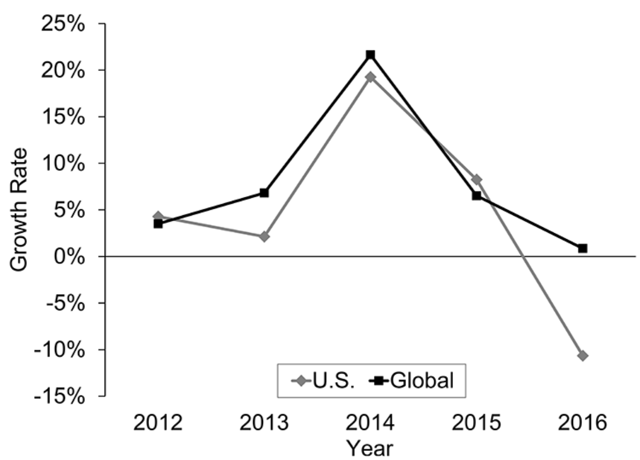


Figure 18.—Import value growth of the U.S. and rest of the world, 2012–16 (Real 2016 USD).

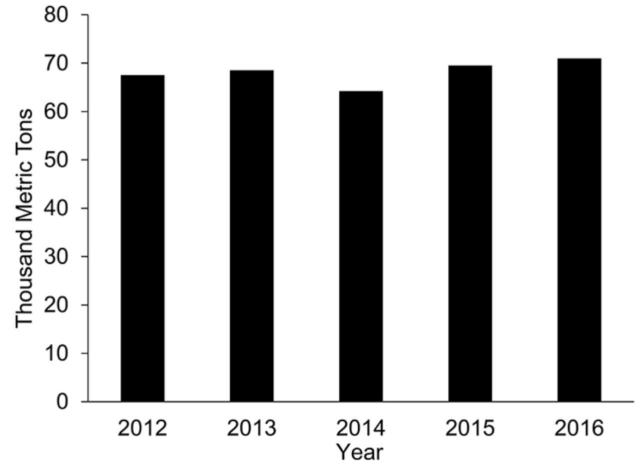


Figure 19.—U.S. apparent consumption of American lobster, 2012–16.

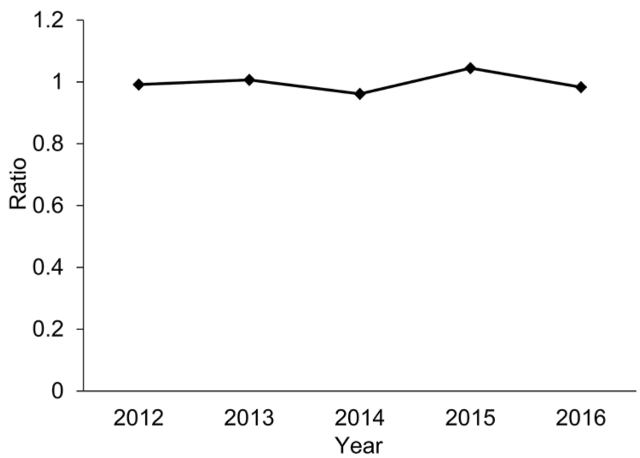


Figure 20.—Apparent consumption relative to U.S. consumption of American lobster, 2012–16.

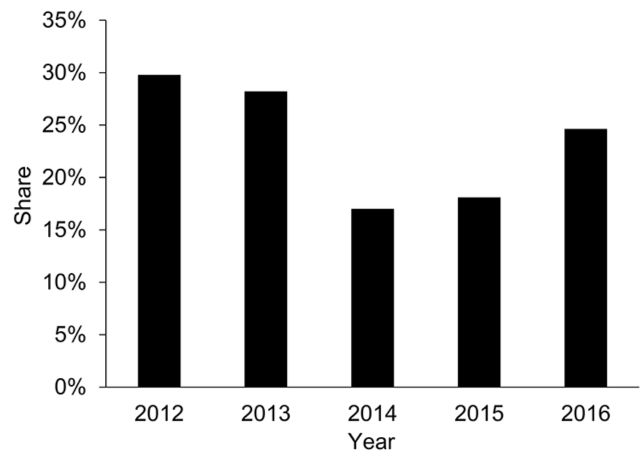


Figure 21.—Unexported U.S production relative to apparent consumption, 2012–16.

U.S. Cod Seafood Trade

Domestic and Global Production

The iconic cod fishery has a long history. European Atlantic cod, *Gadus morhua,* (currently fished mostly by Russia, Norway, and Iceland) and U.S. Pacific cod, *Gadus macrocephalus*, remain the two major sources supplying the cod market over the past decade accounting for roughly 75% and 20%, respectively. Global catch was consistently over 2 million t through the 1980's, but has fluctuated over time with periodic declines in regional stocks. Global catch grew to 1.85 million t in 2014 as catch increased in the Barents Sea and U.S. catch remained strong at over 300,000 t through 2012–16 (Table 5). Since 2016, global supply has been decreasing with moderate catch declines in the Atlantic and Bering Sea and a significant decline in the smaller Gulf of Alaska fishery. From 2012 to 2016, nearly all of the cod caught by the United States is Pacific cod (over 99%) and is caught primarily in Alaska. The first wholesale production volume[16] of U.S. cod production has ranged from approximately 150,000–160,000 t (Fig. 22).

The two primary first-wholesale product forms are H&G and fillets. Headed and gutted fish are largely exported for secondary processing, while fillets are exported to Europe, China, and Canada and supplied directly to the U.S. market. Cod is commonly used to produce fillets and breaded fish portions for consumer end-markets. Because of cod's long history as a commodity, global demand is present in a number of geographical regions, but Europe and the United States are the primary consumer markets. Atlantic cod and Pacific cod are substitutes in the global market. The market for cod is also indirectly affected by activity in the pollock and other whitefish fisheries that can serve as substitutes to varying degrees.

[16]First wholesale production is the production after initial processing which can involve the removal of the head, guts, tail and/or skin.

Table 5.—Cod U.S. trade and global market data. Global production (thousand metric tons), U.S. share of global production, Europe share of global production, U.S. export and import volume (thousand metric tons), real value (million US$), and real price (US$/lb), the share of U.S. export and import volume and value with China, Canada, Europe, Japan, and Iceland, 2012–16 (Real 2016 USD).[1, 2]

			2012	2013	2014	2015	2016
Global cod catch K mt			1,599	1,831	1,853	1,763	1,792
U.S. cod share of global catch			20.7%	17.0%	17.7%	18.1%	18.0%
Europe share of global catch			73.2%	76.7%	75.9%	74.8%	74.8%
Export volume K mt			111.1	101.8	107.3	113.2	105.3
Export value M US$			$385.2	$320.7	$321.0	$338.7	$312.0
Export price lb US$			$1.573	$1.429	$1.357	$1.357	$1.344
Import volume K mt			49.8	59.8	66.5	67.8	70.7
Import value M US$			$347.0	$355.5	$401.6	$435.4	$466.0
Import price lb US$			$3.163	$2.694	$2.739	$2.915	$2.991
China	Export	Volume share	46%	51%	54%	53%	55%
		Value share	43%	48%	51%	51%	52%
	Import	Volume share	66%	62%	68%	68%	68%
		Value share	60%	53%	61%	61%	60%
Canada	Export	Volume share	3%	4%	3%	3%	3%
		Value share	4%	5%	4%	5%	5%
	Import	Volume share	8%	7%	7%	6%	7%
		Value share	10%	10%	8%	8%	8%
Europe[3]	Export	Volume share	27%	22%	20%	19%	17%
		Value share	29%	24%	22%	19%	18%
	Import	Volume share	3%	5%	5%	4%	5%
		Value share	4%	6%	5%	4%	6%
Japan	Export	Volume share	16%	13%	16%	13%	14%
		Value share	16%	13%	16%	14%	15%
Iceland	Import	Volume share	11%	13%	11%	12%	14%
		Value share	14%	17%	16%	17%	19%

[1]Source: FAO Fish. Aquacult. Dep. Stat. (http://www.fao.org/fishery/en/statistics). NOAA/NMFS, Fish. Stat. Div., Foreign Trade Div., U.S. Census Bureau (https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1). U.S. Dep. Agric. (http://www.ers.usda.gov/data-products/agricultural-exchange-rate-data-set.aspx). The GDP Implicit deflator was used for the real price adjustment (base year 2016) (https://fred.stlouisfed.org/series/GDPDEF).
[2]Trade data do not have cod specific codes for fishmeal, oil, and other ancillary product types and as such are not included in this figure. First-wholesale products are constrained to fillets, H&G, minced, surimi, and roe to match the corresponding constraints in the trade data.
[3]Europe refers to Austria, Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and United Kingdom.

Trade

The United States is one of the major suppliers and consumers of cod on the global market. U.S. exports of cod are roughly proportional to U.S. cod production (Table 5). Export volumes are roughly 70% of the annual U.S. cod production volume of meat products (e.g., fillets, H&G, and whole fish). Between 2012 and 2016, export volumes of cod ranged between about 100,000 and 115,000 t and imports rose from 50,000 t to 71,000 t. Increasing import volumes and stable export volumes resulted in a drop in the export/import volume ratio index between 2012 and 2016 (Fig. 23). The U.S. net exports of cod increased from 2003 to 2011 but then decreased to a deficit of roughly $150 million by 2016, driven primarily by increasing imports (Fig. 24). While export volumes exceeded import volumes during 2012–16, a deficit in value existed because the import price of roughly $3.00/lb was roughly twice as high as the export price at roughly $1.50/lb (Fig. 25). The difference in prices was because the U.S. exported raw material and imported more finished goods. More than 90% of the exports were H&G, while more than 80% of imports were fillets. The end re-

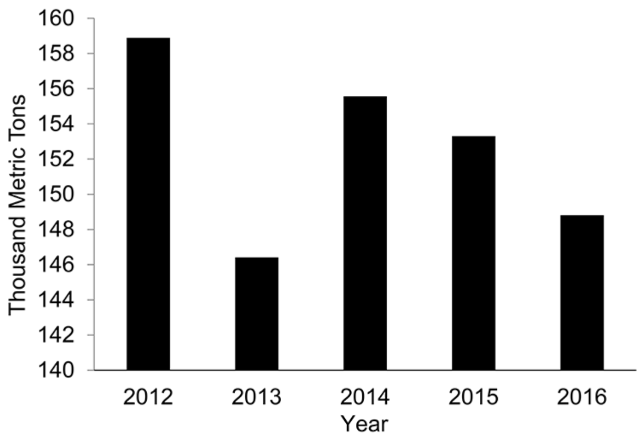


Figure 22.—U.S. cod first wholesale production, 2012-16. (Source: ADF&G Commercial Operators Annual Reports (COAR) production data. Note: Trade data do not have specific codes for fishmeal, oil, and other ancillary product types and as such are not included in this figure.)

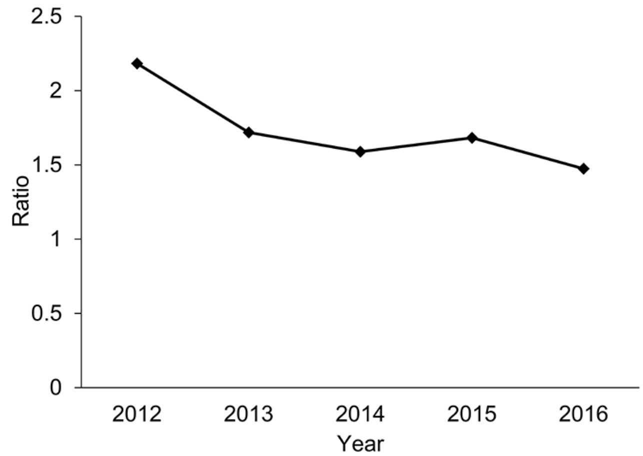


Figure 23.—Export/import volume ratio of cod, 2012–16. (Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. Note: Trade data do not have specific codes for fishmeal, oil, and other ancillary product types and as such are not included in this figure.)

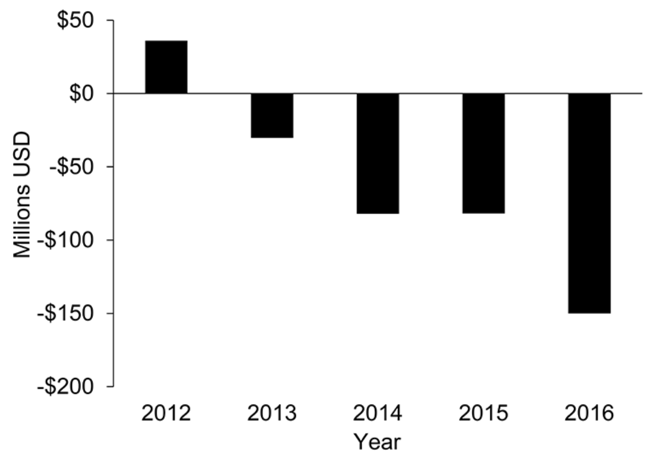


Figure 24.—Net exports of cod, 2012-16 (Real 2016 USD). (Sources: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.)

sult was that the value of imports was greater than the value of exports resulting in a trade deficit for cod. Exchange rates can play an influential role in the prices the U.S. industry receives. The volumetrically weighted average real exchange rate index (2016 USD) displayed in Figure 26 shows the effective impact the strength of the U.S. dollar had on cod exports.[17] This index suggests that the strength of the U.S. dollar put downward pressure on the price that U.S. industry received for exported products.

The most significant trading partners with the United States in terms of both exports and imports were China, Europe, Japan, and Iceland (Tables 5–7, Fig. 27). However, these countries played different roles in terms of their trade with the United States. China received approximately 50% of U.S. exports and constituted slightly under 70% of U.S. imports reflecting its role as a processor of cod (Table 5). China's rise as a processor is fairly recent. Between 2001 and 2011 exports to China increased nearly 10 fold. The net trade deficit with China was $39 million in 2001 and over $120 million in 2016 (Fig. 27). Canada also received some exports from the United States, and the United States also imported some cod from Canada. However, Canada is not known to be a significant processor of U.S. cod and net exports were near zero. Japan and Europe (mostly Denmark, Germany, Netherlands, Portugal, and Spain) were important export destinations for cod. The United States received little imports from Japan resulting in a trade surplus of just under $50 million (Fig. 27). The United States received comparatively fewer imports from Europe, which was also supplied by Barents Sea cod, resulting in a trade surplus which declined over 2012–16 as exports shrank and imports grew

[17]The metric is calculated annually in the Economic Status of the Groundfish Fisheries off Alaska Report (https://www.fisheries.noaa.gov/resource/data/2018-economic-status-groundfish-fisheries-alaska) to capture the exchange rate pressure on Alaska export prices.

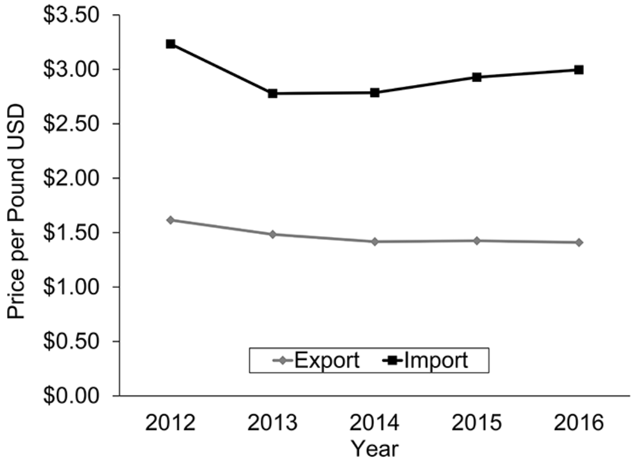


Figure 25.—Export and import prices of cod, 2012-16 (Real 2016 USD). (Sources: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.)

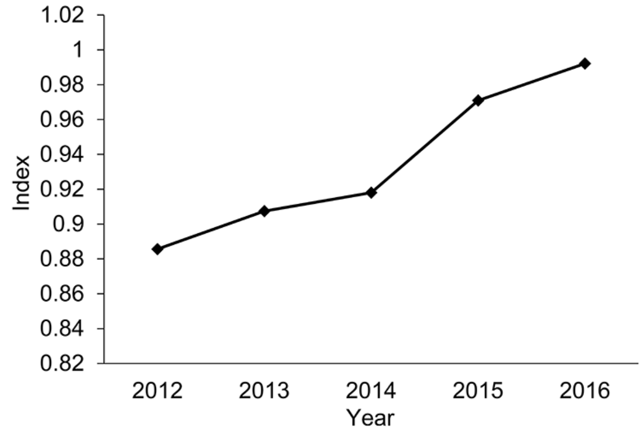


Figure 26.—Real effective export exchange rate index for cod, 2012–16 (Real 2016 USD). (Sources: Real monthly exchange rates were obtained from http://www.ers.usda.gov/data-products/agricultural-exchange-rate-data-set.aspx. Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. First-wholesale prices were derived from the ADF&G Commercial Operators Annual Reports (COAR) production data. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.)

(Fig. 27). The United States imported significant quantities of cod from Iceland, which was a major producer of Barents Sea cod, and exported very little, resulting in an increasing trade deficit with Iceland. U.S. cod imports were relatively more concentrated than exports as a result of receiving slightly less than 90% of imports from only China and Iceland as displayed by the trade concentration indices (Fig. 28).

The U.S. share of global cod trade activity is measured by the U.S. share of global export and import value (Fig. 29). Since 2003, the U.S. share of global trade value ranged from approximately 5% to 7%. Over 2012–16, the share of export trade value showed a slight downward trend while the share of import trade value showed a slightly increasing trend. These trends were consistent with the import/export trade patterns in the United States discussed above. As a measure of export competitiveness, Figures 30 and 31 plot the export and import value growth of the United States, which can be compared to the global (excluding the U.S.) export growth. Periods when U.S. export growth was above global export growth indicate that U.S. exports were more competitive relative to the rest of the world (RoW). Cod export value growth fluctuated over time, with the United States higher in some years and RoW higher in others indicating that the United States was approximately as competitive as the RoW in terms of exports (Fig. 30). Import value growth was consistently higher than the RoW which is in part a reflection of the increased use of international processing and subsequent importing as higher valued goods (Fig. 31).

Table 6.—Cod multilateral export quantity indices (2012–16).

Year	France	Germany	Denmark	Canada	Spain	Netherlands	South Korea	Japan	China
2012	0.14	0.77	0.60	1.00	1.56	1.55	1.60	4.4	13.0
2013	0.01	0.71	1.28	1.10	1.26	1.34	1.90	3.2	12.0
2014	0.00	0.71	0.81	0.80	0.80	1.62	1.40	4.3	14.0
2015	0.01	0.70	0.96	1.00	0.63	1.43	2.60	3.7	15.0
2016	0.81	0.41	0.69	1.10	0.88	0.77	2.20	3.6	14.0

Table 7.—Cod multilateral import quantity indices (2012–16).

Year	Portugal	Poland	Vietnam	Norway	Russia	Canada	Iceland	China
2012	0.05	0.08	0.03	0.20	0.62	1.00	1.00	5.90
2013	0.05	0.13	0.03	0.39	0.94	0.95	1.40	6.30
2014	0.05	0.03	0.06	0.39	0.78	0.90	1.30	7.70
2015	0.05	0.08	0.07	0.41	0.81	0.87	1.50	7.80
2016	0.04	0.02	0.17	0.45	0.75	1.01	1.80	8.30

Domestic Consumption

Apparent consumption of cod is measured as the total of the unexported volumes of U.S. production (the difference between annual primary production and exports) and imports (Fig. 32). This metric indicates that U.S. consumption of cod increased since 2009. This upward trend was in large part the result of increasing import volumes (Table 5). The U.S. apparent consumption

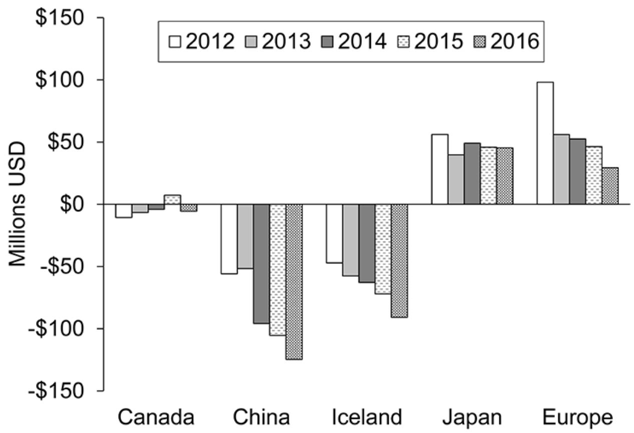


Figure 27.—Net exports of cod to top five countries, 2012–16 (Real 2016 USD). (Sources: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.)

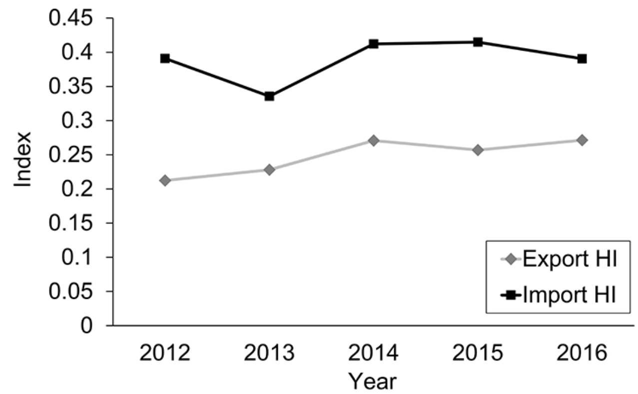


Figure 28.—Concentration indices of U.S. cod trade with other countries, 2012–16. (Sources: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.)

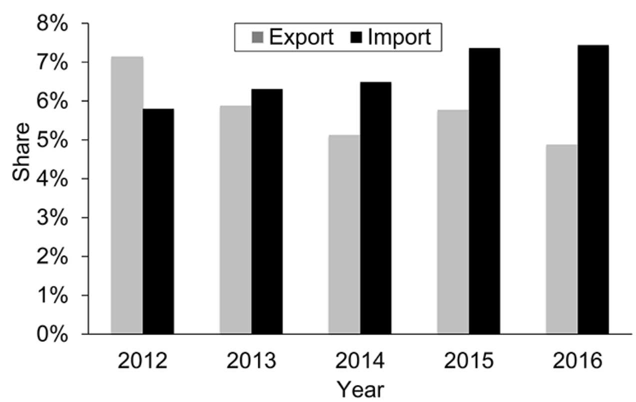


Figure 29.—U.S. share of global cod trade value activity, 2012–16 (Real 2016 USD). (Sources: FAO - Fisheries and Aquaculture Information and Statistics Branch - Commodity Trade and Production Statistics, http://www.fao.org/fishery/statistics/global-commodities-production/en. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.)

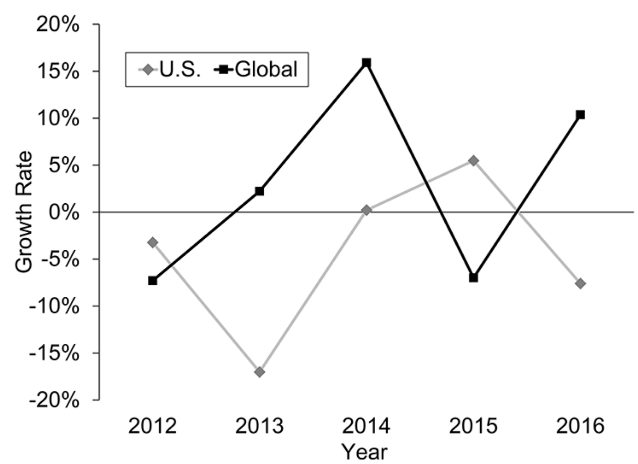


Figure 30.—Export value growth of cod for the U.S. and rest of the world, 2012–16. (Sources: FAO - Fisheries and Aquaculture Information and Statistics Branch - Commodity Trade and Production Statistics, http://www.fao.org/fishery/statistics/global-commodities-production/en. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.)

of cod remained less than total U.S. cod production, indicating that the U.S. supply may hypothetically be able to meet demand levels in the absence of trade (Fig. 33). The share of U.S. domestic apparent consumption directly supplied by the domestic industry is measured as the ratio of apparent consumption to unexported product (adjusted for secondary processing) (Fig. 34). The amount of cod directly supplied by the U.S. industry displays a decreasing trend from 2012 to 2016 and on average, the United States directly supplied 37% of the U.S. consumption. This can in part be attributed to increased use of international processing, as such some cod that was previously supplied directly by the domestic industry was instead indirectly supplied through imports.

Ben Fissel, NMFS Alaska Fisheries Science Center.

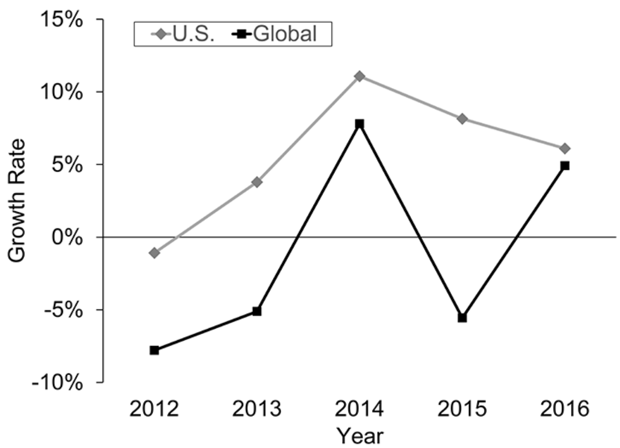


Figure 31.—Import growth value of cod for the U.S. and rest of the world, 2012–16. (Sources: FAO - Fisheries and Aquaculture Information and Statistics Branch - Commodity Trade and Production Statistics, http://www.fao.org/fishery/statistics/global-commodities-production/en. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.)

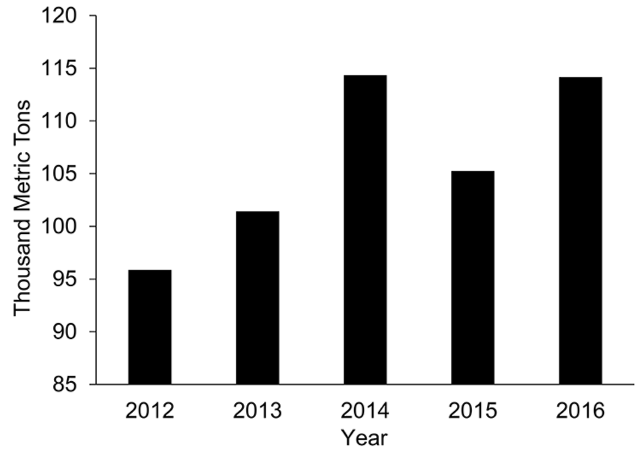


Figure 32.—U.S. apparent consumption of cod, 2012–16. (Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. Data on U.S. production data were obtained from the ADF&G Commercial Operators Annual Reports (COAR) production data.)

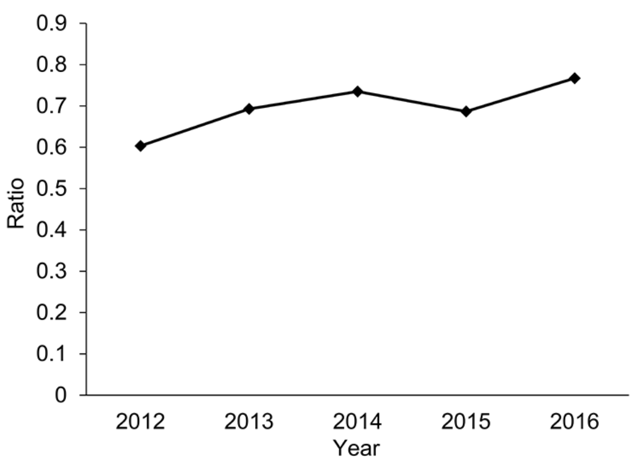


Figure 33.—U.S. production relative to apparent consumption of cod, 2012–16. (Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. Data on U.S. production data were obtained from the ADF&G Commercial Operators Annual Reports (COAR) production data.)

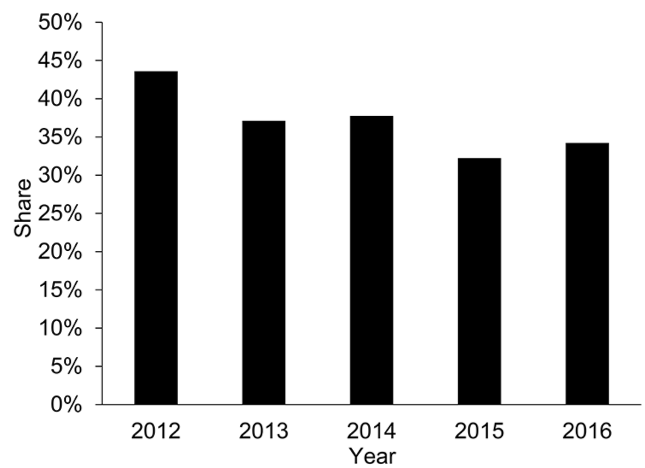


Figure 34.—U.S. production's share of apparent consumption of cod, 2012–16. (Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. Data on U.S. production data were obtained from the ADF&G Commercial Operators Annual Reports (COAR) production data.)

U.S. Alaska Pollock Seafood Trade

Domestic and Global Production

Alaska pollock is a critical component of both the U.S. and global seafood trade portfolio. Each year pollock is among the top most species caught by volume in the United States. The United States and Russia were the primary suppliers of pollock to the global market accounting for approximately 44% and 50% of global catch, respectively (Table 8). Between 2012 and 2016 U.S. pollock catches increased from 1.3 to 1.5 million t and pollock production increased from roughly 400,000 t to 500,000 t (Fig. 35).

U.S. Alaska pollock is processed into four primary product forms: fillets, surimi, roe, and H&G. Fillets comprised roughly 40% of first-wholesale value from 2012 to 2016. Fillet prices were low in recent years due, in part, to greater supply from the United States and Russia as well as periods of excess inventory. Russia lacks the primary processing capacity of the United States and much of their catch was exported to China and was processed as twice-frozen fillets. The 2013 Marine Stewardship Council (MSC) certification of Russian-caught pollock enabled access to segments of European and U.S. fillet markets, which put continued downward pressure on prices.

Surimi is a meat-based paste that is used to produce various surimi seafood products, such as imitation crab meat. Surimi made up a little under 40% of first-wholesale value from 2012 to 2016. A relatively small fraction of pollock caught in Russian waters was processed as surimi. Surimi is consumed globally, but Asian markets dominated the demand for surimi.

Roe is a high priced product that is a central focus of the "A season" catch destined primarily for Asian markets. High global catch levels and changing consumer preferences in Asia (primarily Japan) resulted in a significant re-

Table 8.—U.S. pollock trade and global market data. Global production (thousand metric tons), U.S. share of global production, Russian share of global production, U.S. export and import volume (thousand metric tons), real value (million US$), and real price (US$/lb), the share of U.S. export and import volume and value with Japan, China, South Korea, Germany, and Netherlands, 2012–16 (Real 2016 USD).[1]

			2012	2013	2014	2015	2016
Global pollock catch K mt			3,272	3,248	3,245	3,373	3,476
U.S. share of global catch			40%	42%	44%	44%	44%
Russian share of global catch			50%	48%	47%	48%	50%
Export volume K mt			314.7	360.4	395.0	377.8	379.6
Export value M US$			$994.1	$1,007.9	$1,105.2	$1,049.6	$990.5
Export price lb US$			$1.43	$1.27	$1.27	$1.26	$1.18
Import volume K mt			55.2	58.3	51.8	47.1	34.9
Import value M US$			$155.0	$162.3	$145.7	$131.9	$91.2
Import price lb US$			$1.27	$1.26	$1.27	$1.27	$1.19
Japan	Export	Volume share	24%	18%	22%	25%	20%
		Value share	22%	17%	22%	26%	20%
China	Export	Volume share	11%	15%	15%	13%	12%
		Value share	9%	12%	12%	10%	10%
	Import	Volume share	93%	90%	89%	86%	91%
		Value share	92%	89%	88%	85%	88%
South Korea	Export	Volume share	18%	20%	19%	22%	26%
		Value share	23%	24%	22%	24%	29%
	Import	Volume share	0%	1%	1%	1%	2%
		Value share	1%	1%	1%	1%	2%
Germany	Export	Volume share	22%	23%	23%	21%	19%
		Value share	23%	24%	24%	21%	19%
Netherlands	Export	Volume share	9%	8%	7%	8%	10%
		Value share	9%	9%	8%	9%	10%

[1]Source: FAO Fish. Aquacult. Dep. Stat. (http://www.fao.org/fishery/en/statistics). NOAA/NMFS, Fish. Stat. Div., Foreign Trade Div., U.S. Census Bureau (https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1). U.S. Dep. Agricult. (http://www.ers.usda.gov/data-products/agricultural-exchange-rate-data-set.aspx). The GDP Implicit deflator was used for the real price adjustment (base year 2016) (https://fred.stlouisfed.org/series/GDPDEF).

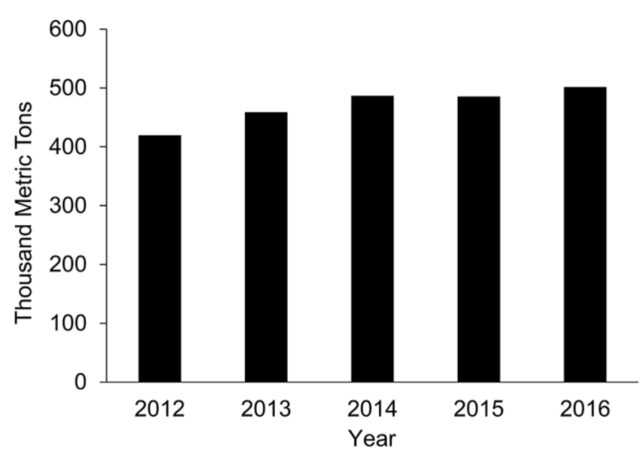


Figure 35.—U.S. pollock first wholesale production, 2012–16. (Source: ADF&G Commercial Operators Annual Reports (COAR) production data. Note: Trade data do not have specific codes for fishmeal, oil, and other ancillary product types and as such are not included in this figure.)

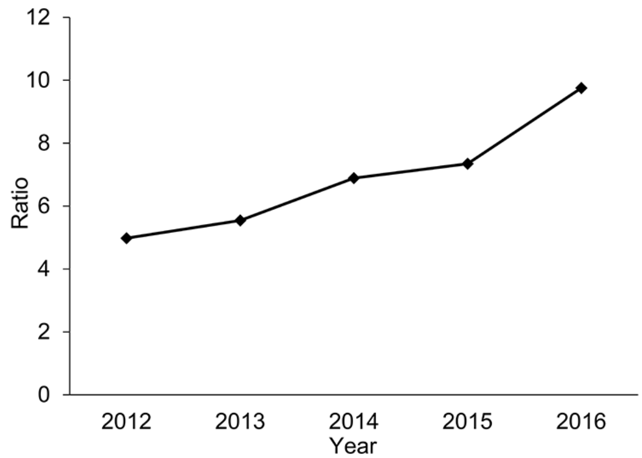


Figure 36.—Export/import volume ratio of pollock, 2012–16. (Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. Note: Trade data do not have pollock specific codes for fishmeal, oil, and other ancillary product types and as such as such are not included in this figure.)

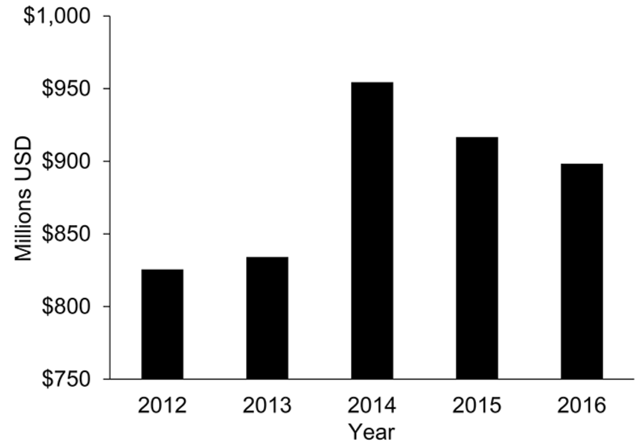


Figure 37.—Net exports of pollock, 2012–16 (Real 2016 USD). (Sources: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.)

duction in roe prices and since 2011 roe accounted for roughly 10% of the first-wholesale value. Additionally, pollock more broadly competes with other whitefish on the global market that, to varying degrees, can serve as substitutes depending on the product.

Table 9.—U.S. pollock multilateral export quantity indices (2012–16).

Year	Thailand	France	Netherlands	China	Germany	South Korea	Japan
2012	0.06	0.26	0.77	1.00	1.97	1.40	1.80
2013	0.04	0.24	0.58	1.00	1.62	1.30	1.20
2014	0.04	0.20	0.46	1.00	1.47	1.20	1.40
2015	0.04	0.27	0.58	1.00	1.50	1.60	1.70
2016	0.13	0.27	0.78	1.00	1.53	2.40	1.70

Table 10.—U.S. pollock multilateral import quantity indices (2012–16).

Year	Japan	Iceland	Russia	South Korea	Vietnam	Canada	China
2012	0.00	0.36	0.43	1.00	4.14	4.00	114
2013	0.00		0.21	1.00	5.85	2.50	84
2014	0.00	0.03	0.07	1.00	8.22	3.00	105
2015		0.85	0.47	1.00	8.54	4.10	80
2016	0.04	0.16	0.42	1.00	1.45	4.30	62

Trade

The U.S. pollock industry is highly engaged in exports, as export volumes were roughly 75%–80% of the annual U.S. pollock production volume of fillets, surimi, minced, whole, H&G, and roe products. The trade volume index is a measure of the relative significance of exports compared to imports (Fig. 36). The United States exported roughly 5 times more pollock than it imported in 2012 and 10 times more by 2016. The increase in this metric was largely a result of decreasing imports (Fig. 36, Table 8). Consistent with the volumetric comparison of relative trade flow, the United States had positive net exports valued at $800–$950 million annually from 2012 to 2016 (Fig. 37). The increase in the trade volume index and upward trend in net exports is in part the result of the reductions in both import volumes as well as the export of increased catch volumes since 2010.

The five most significant trading partners with the United States were Japan, South Korea, China, Germany, and the Netherlands (Tables 8–10). The multilateral export quantity indices provide a year-by-year transitive comparison of export volumes (Table 9) and import volumes (Table 10) across the top seven countries. The majority of these trading partners were primarily export markets which served different functions for different product types. Roe and surimi were largely exported to Japan and South Korea for secondary processing and distribution to the global market.[18] Germany and the Netherlands were important European markets for fillet-based products. Exports to China largely consist of H&G products that were processed and exported to the global market, including the United States. Most of the U.S pollock imports (approximately 90%) came from China (Table 8 and 9). China is the only country with negative net export value (Fig. 38). This

[18]Based on South Korean import statistics roughly two-thirds of the exports to Korea are held in cold storage for re-export to Japan, EU, and Russia.

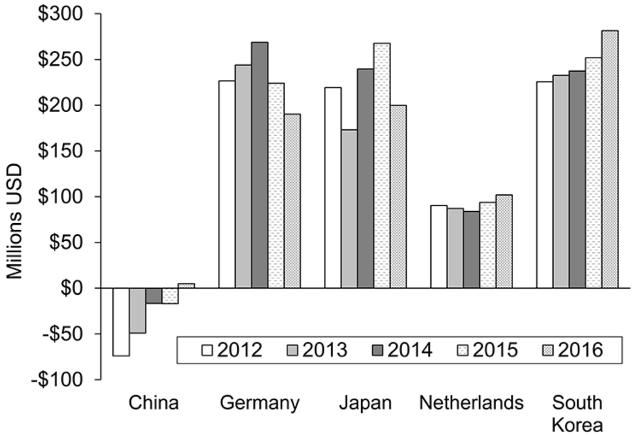


Figure 38.—Net exports of pollock to top five countries, 2012–16 (Real 2016 USD). (Sources: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.)

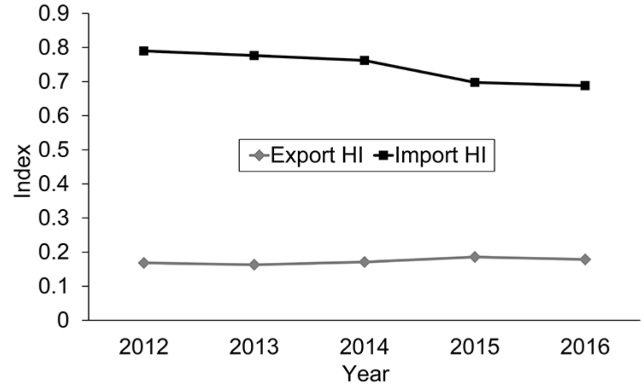


Figure 39.—Concentration indices of U.S. pollock trade with other countries, 2012–16. (Sources: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF. Note: Trade data do not have pollock specific codes for fishmeal, oil, and other ancillary product types and as such as such are not included in this figure.)

is further reflected in the Herfindahl concentration indices where the index of import concentration was high at just under 0.8 while the export portfolio across countries was comparatively more diversified at approximately 0.2 (Fig. 39). Because the United States exports minimally processed pollock and imports more processed product the average export prices of pollock meat products tended to be lower than import prices (Fig. 40).[19]

Because the United States is a net exporter, exchange rates, particularly the Dollar-Yen and Dollar-Euro exchange rates, influence the prices the U.S. industry receives. The volumetrically weighted average real exchange rate index (2016 USD) displayed in Figure 41 shows the effective impact of the strength of the U.S. dollar on pollock products. Increases in this index indicated downward pressure on the price that U.S. industry received for exported products.

The U.S. participation in global pollock trade activity is measured by the share of global export and import value (Fig. 42). The United States accounted for roughly 30% of global pollock export activity which was lower than its 44% of global catch, in part, because U.S. industries increased use of China and others as processors of U.S. pollock. The U.S. share of global import value was less than 5% as the U.S. imports are significantly smaller than exports and 60%–70% of the U.S. market demand was met by direct sales (measured as unexported production) from the domestic industry (Fig. 43). As a measure of export competitiveness, Figure 44 plots the export growth of the United States, which can be compared to the global (excluding the U.S.) export growth. Periods when U.S. export growth was above global export growth indicate that U.S. exports were more competitive relative to the rest of the world (RoW) either in terms of increased catch being exported or higher prices. Since 2010, the U.S. export growth was higher in some years while the RoW was higher in others indicating that throughout this period the United States was about as competitive as the RoW. Real import growth of the United States was generally slightly below the import growth of the RoW which was consistent with imports comprising a smaller share of total U.S. consumption (Fig. 45).

Apparent Consumption

Apparent consumption of pollock is measured as the total of unexported volumes of U.S. production (the difference between annual primary production and exports adjusted for secondary processing) and imports (Fig. 46). This metric indicates that U.S. apparent consumption of pollock was between 145,000 t and 165,000 t from 2012 to 2016. U.S. apparent consumption was 30%–40% the size of total U.S. pollock production, indicating that far more pollock was produced by the United States than what was demanded by consumers (Fig. 47). The share of U.S. domestic apparent consumption directly supplied by the domestic industry is measured as the ratio of apparent consumption to unexported product (Fig.

[19]The trade prices of meat products include products such as H&G, fillets, and surimi and exclude ancillary products. Roe is a high priced ancillary product which is mostly exported with very little imports. Because of this, prices in Figure 40 will differ from the prices in Table 10 which reports the average price across all products. Figure 40 focuses on meat products to attempt to get closer to the reprocessing margin between exported raw material (e.g., H&G) and imported processed goods (fillets).

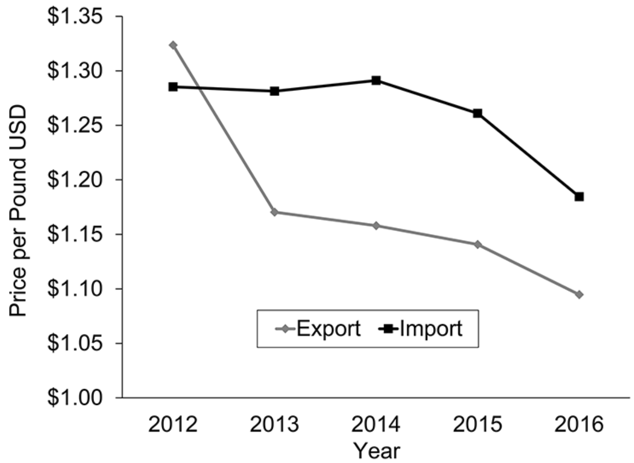


Figure 40.—Export and import prices of pollock meat products, 2012–16 (Real 2016 USD). Sources: Real monthly exchange rates were obtained from http://www.ers.usda.gov/data-products/agricultural-exchange-rate-data-set.aspx. Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. First-wholesale prices were derived from the ADF&G Commercial Operators Annual Reports (COAR) production data. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

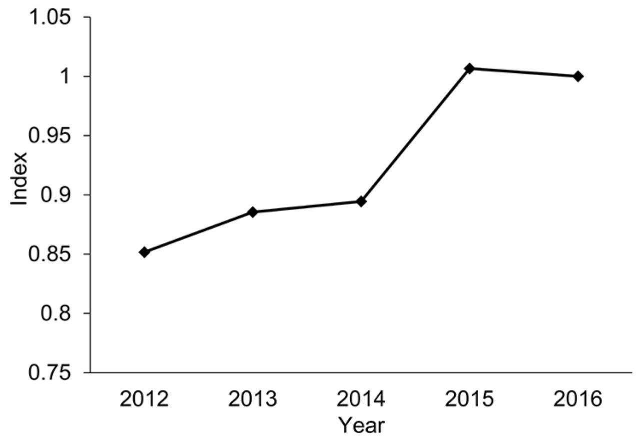


Figure 41.—Real effective exchange rate index for pollock, 2012–16 (Real 2016 USD). Sources: Real monthly exchange rates were obtained from http://www.ers.usda.gov/data-products/agricultural-exchange-rate-data-set.aspx. Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1.

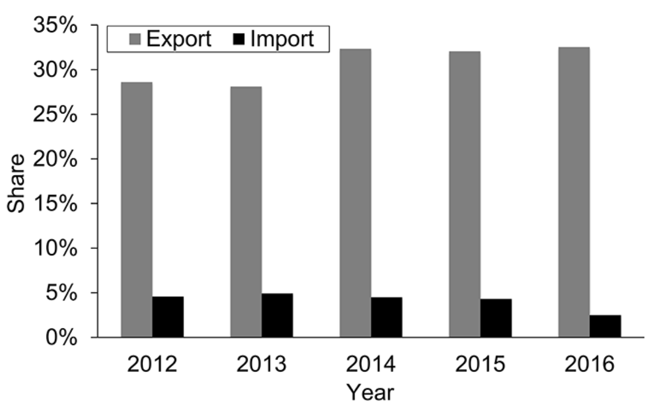


Figure 42.—U.S. share of global trade value activity, 2012–16 (Real 2016 USD). Sources: FAO - Fisheries and Aquaculture Information and Statistics Branch - Commodity Trade and Production Statistics, http://www.fao.org/fishery/statistics/global-commodities-production/en. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

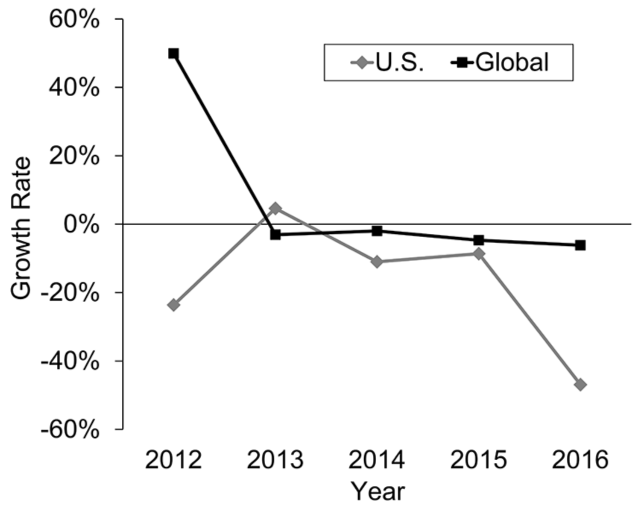


Figure 43.—Import value growth of the U.S. and rest of the world, 2012–16 (Real 2016 USD). Sources: FAO - Fisheries and Aquaculture Information and Statistics Branch - Commodity Trade and Production Statistics, http://www.fao.org/fishery/statistics/global-commodities-production/en. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

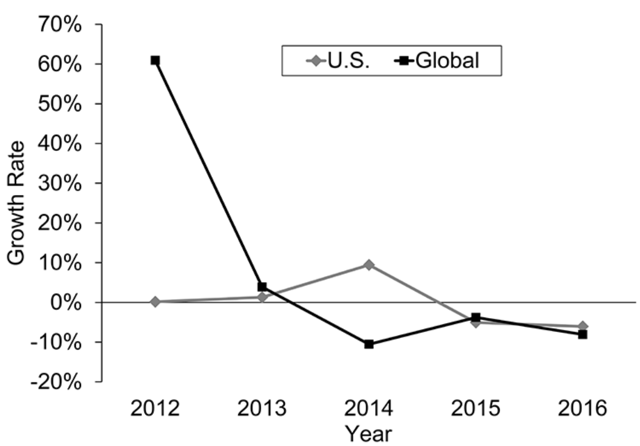


Figure 44.—Export value growth of the U.S. and rest of the world, 2012–16 (Real 2016 USD). Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. Data on U.S. production data were obtained from the ADF&G Commercial Operators Annual Reports (COAR) production data. Note: Trade data do not have pollock specific codes for fishmeal, oil, and other ancillary product types and as such as such are not included in this figure. First-wholesale products are constrained to fillets, H&G, minced, surimi, and roe to match the corresponding constraints in the trade data.

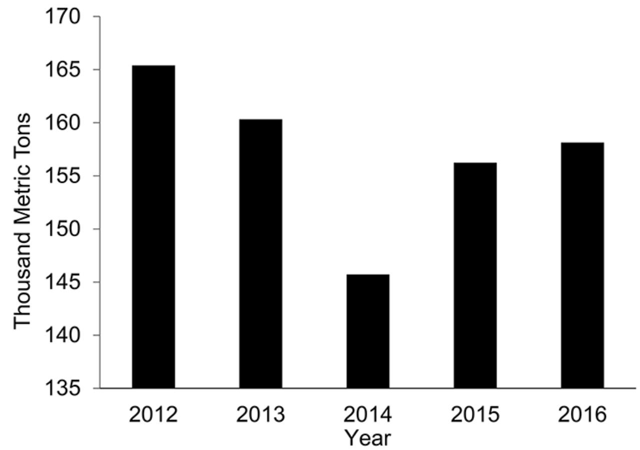


Figure 45.—U.S. apparent consumption of pollock, 2012–16. Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. Data on U.S. production of pollock was obtained from the ADF&G Commercial Operators Annual Reports (COAR) production data.

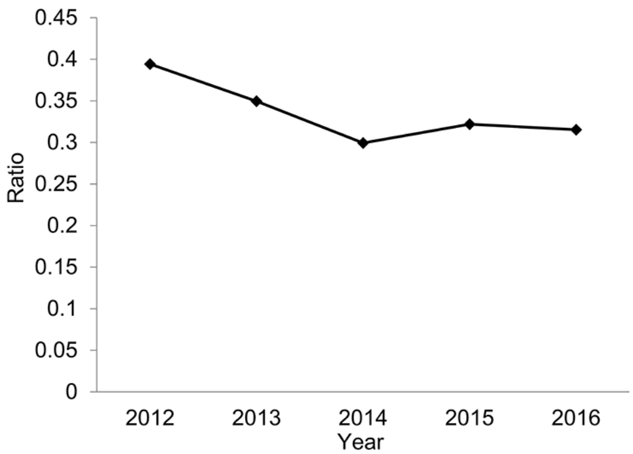


Figure 46.—Apparent consumption relative to U.S. consumption of pollock, 2012–16. Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. Data on U.S. production of pollock was obtained from the ADF&G Commercial Operators Annual Reports (COAR) production data.

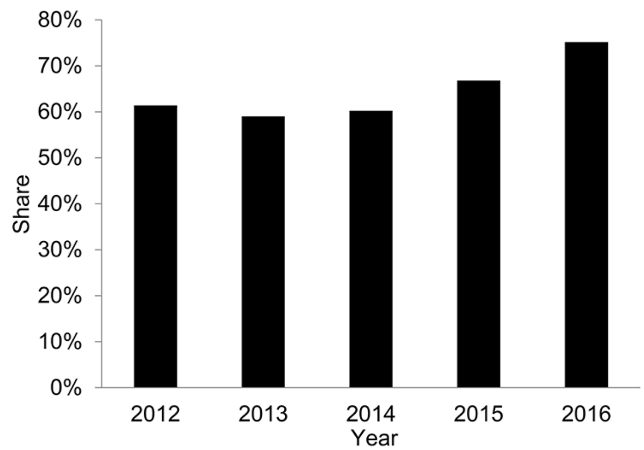


Figure 47.—Unexported U.S. production relative to apparent consumption for pollock, 2012–16. Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data#1. Data on U.S. production of pollock was obtained from the ADF&G Commercial Operators Annual Reports (COAR) production data.

43). The metric indicates that U.S. pollock industry directly supplied 60%–70% of the U.S. apparent consumption through 2012–16. In recent years, the U.S. industry has more actively marketed to the domestic market, and the success of these efforts is consistent with the increase in this metric.

This section authored by Ben Fissel, NMFS Alaska Fisheries Science Center.

U.S. Salmon Trade

Domestic and Global Production

Global salmon trade consists of wild caught and farmed raised products. Since 2012, the United States exported between 174,000 t (2012) and 260,000 t (2015) of all salmon products combined (wild and farm, Table 11). Canada, China, and Japan are the primary destinations for U.S. salmon exports, comprising export volume shares of 27%, 26%, and 8.3%, respectively, in 2016. This export volume resulted in values shares of 33% (Canada), 16% (China), and 13% (Japan).

Import volume also increased during the 2012–16 period, growing to 353,000 t in 2016 at a value of US$3.2 billion (Table 11). In 2016, most imports of salmon products came from Chile (37%), followed by Canada (28%), China (11%), and Norway (11%). These imports resulted in value shares of 42% (Chile), 24% (Canada), and 13% (Norway), and 6.8% (China).

The United States produces a range of salmon products from several species of salmon.[20] U.S. first wholesale production of salmon ranged from approximately 250,000 t in 2012 and 2016, to a high of 381,000 t in 2015 (Fig. 48).

U.S. landings of salmon are concentrated on the Pacific Coast, with a small volume of commercial landings reported in the Great Lakes region (i.e., Michigan). Alaska harvested a significant portion of domestic salmon, with 246,000 t of landings in 2016, about 97% of U.S. landings (Table 12a, b). Washington landed the second highest volume of salmon, 7,200 t in 2016. The average price per lb of salmon ranged from $0.70 (Alaska) to $7.44 (Califor-

Table 11.—U.S. salmon trade and global market data. Capture production (landings) of Atlantic, Chinook, Coho, chum, unspecified Pacific, pink, and sockeye salmon. Global production (thousand metric tons), U.S. share of global production, Russian Federation share of global production, U.S. export and import volume (thousand metric tons), real value (million US$), and real price (US$/lb), the share of U.S. export and import volume and value with Chile, Canada, China, Japan, and Norway, 2012–16 (Real 2016 USD).[1]

			2012	2013	2014	2015	2016
Global Salmon Catch K mt			901.5	1,118.1	877.2	1,023.3	843.5
U.S. Share of Global Catch			32%	43%	37%	47%	30%
Russian Federation Share of Global Catch			50%	38%	40%	36%	53%
U.S. Export Volume K mt			174.2	246.8	211.4	260.1	198.4
U.S. Export Value M US$			$945.0	$1,150.7	$956.4	$1,062.6	$960.3
U.S. Export Price lb US$			$2.46	$2.12	$2.05	$1.85	$2.20
U.S. Import Volume K mt			280.8	297.6	316.1	344.6	353.1
U.S. Import Value M US$			$2,152.6	$2,670.2	$2,980.1	$2,743.0	$3,210.6
U.S. Import Price lb US$			$3.48	$4.07	$4.28	$3.61	$4.12
Chile							
	Export	Volume share	0%	0%	0%	0%	0%
		Value share	0%	0%	0%	0%	0%
	Import	Volume share	35%	39%	42%	39%	37%
		Value share	39%	45%	48%	43%	42%
Canada	Export	Volume share	27%	19%	17%	16%	27%
		Value share	29%	23%	23%	22%	33%
	Import	Volume share	34%	26%	20%	26%	28%
		Value share	28%	22%	17%	22%	24%
China	Export	Volume share	33%	35%	35%	37%	26%
		Value share	24%	22%	23%	24%	16%
	Import	Volume share	12%	13%	13%	11%	11%
		Value share	10%	8%	8%	8%	7%
Japan	Export	Volume share	7%	5%	7%	10%	8%
		Value share	13%	13%	13%	17%	13%
	Import	Volume share	0%	0%	0%	0%	0%
		Value share	0%	0%	0%	0%	0%
Norway	Export	Volume share	0%	0%	0%	0%	0%
		Value share	0%	0%	0%	0%	0%
	Import	Volume share	6%	7%	9%	11%	11%
		Value share	8%	8%	11%	13%	13%

[1]Source: FAO Fish. Aquacult. Dep. Stat. (http://www.fao.org/fishery/en/statistics). NOAA/NMFS, Fish. Stat. Div., Foreign Trade Div. U.S. Census Bureau (https://www.fisheries.noaa.gov/foss/f?p=215:200:17569679020528:Mail:NO). The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

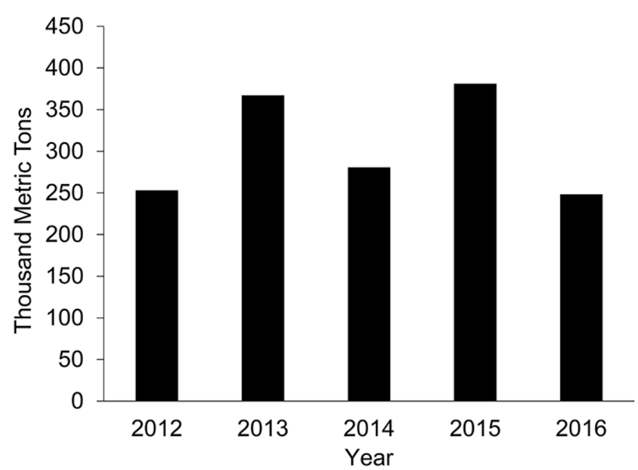


Figure 48.—U.S. salmon (all species), first wholesale production, 2012–16.

[20]Salmon species includes Atlantic, Chinook, Coho, chum, pink, sockeye, and unspecified. Product types include fillets, canned, steaks, smoked excluding canned, cakes/patties, fish portions, and dressed. Source: Processed Products, NOAA Fisheries, https://foss.nmfs.noaa.gov/apexfoss/f?p=215:3:16607004153600::NO:::

nia) in 2016. The wide range in price is due to the different salmon species that are harvested. Alaska harvests five species of salmon (Chinook, chum, Coho, pink, sockeye) while California salmon fisheries harvest Chinook salmon exclusively (Table 12b). Oregon and Washington also harvest mostly Chinook, 86% and 99% of salmon landings, respectively, with some Coho salmon landings.

Table 13 shows the global production of wild Pacific[21], farmed Atlantic, and wild Atlantic salmon. The Russian Federation and the United States lead production of wild Pacific salmon, producing 446,000 t and 254,000 t in 2016, respectively. Canada was the third leading producer of wild Pacific salmon with 21,000 t in 2015. Norway was the dominant producer of farmed Atlantic salmon with over 1.2 million t produced in 2016. They are followed by Chile (532,000 t), the United Kingdom (163,000 t), and Canada (124,000 t). A much smaller volume of wild Atlantic salmon was produced globally, primarily by Norway (349 t) and the United Kingdom (U.K.) (177 t).

Trade

Multilateral trade indices were developed for the nine top export destinations for salmon in 2016 (Table 14). German exports in 2012 were set as the denominator, since it fell in the middle of the distribution, and so all country-year combinations are in reference to Germany in 2012. Canada, China, and Japan were the most important export destinations for salmon each year from 2012 to 2016, followed by the U.K. and Germany. Exports to China, France, Germany, Japan, the Netherlands, South Korea, and the U.K. decreased in 2016 compared to 2015 values, except for Canada, which increased. By product form, the largest export by volume in 2016 was frozen wild pink and chum salmon to China and frozen sockeye salmon to Japan.

Similarly, multilateral indices were developed for the nine top countries of origin for imports of salmon from 2012 to 2016, with China in 2012 as the denominator, since it fell in the middle of the distribution. (Table 15). For each year since 2012, the most important import country of origin for salmon imports was Chile, followed by China and Canada. In 2016, the United States imported 3.7 (3.9/1.06) times more from Chile than from Norway and 1.6 (3.9/2.4) times more from Chile than from Canada. Germany, Greece, and Norway showed increasing imports to the United States between 2012 and 2016 while the U.K., Canada, Chile, China, the Netherlands, and the Faroe Islands had relatively stable imports. In 2016 the United States ran a trade deficit with Chile, Canada, China, Germany, Greece, Iceland, Ireland,

[21]Pacific salmon species include Chinook, Coho, chum, Ppink, and sockeye, These species are not typically farmed.

Table 12a.—U.S. salmon volume (mt, thousands) and value (USD 2016, millions) by state.

	2012	2013	2014	2015	2016
Metric tons, thousands					
Alaska	277.2	459.3	310.0	472.1	246.1
California	1.3	2.0	1.2	0.6	0.3
Michigan	0.1	0.1	0.2	0.1	0.0
Oregon	0.9	1.6	2.9	1.4	0.8
Washington	8.9	22.1	12.6	9.6	7.2
U.S. total	288.4	485.1	326.8	483.8	254.5
USD 2016, millions					
Alaska	467.5	707.4	557.9	417.7	380.5
California	13.6	23.9	12.4	8.1	5.3
Michigan	0.3	0.2	0.3	0.2	0.1
Oregon	7.4	12.9	20.5	12.0	8.3
Washington	29.4	43.3	39.2	27.5	26.1
U.S. total	518.1	787.8	630.3	465.5	420.2
Avg USD 2016 price/lb					
Alaska	0.76	0.70	0.82	0.40	0.70
California	4.76	5.51	4.84	6.08	7.44
Michigan	0.95	0.88	0.78	0.96	1.63
Oregon	3.85	3.70	3.23	3.83	4.56
Washington	1.50	0.89	1.41	1.30	1.64
Total	0.77	0.71	0.86	0.43	0.75

Table 12b.—Share of total volume of salmon landed by state, 2012–16.[1]

	Chinook	Chum	Coho	Pink	Sockeye	Total
Alaska	0.7	14.5	3.9	49.7	31.2	100
California	100	0	0	0	0	100
Michigan	99.1	0.0	0.9	0.0	0.0	100
Oregon	86.0	0.0	13.9	0.0	0.1	100
Washington	22.4	41.8	11.1	20.3	4.4	100

[1]Source: U.S. landings obtained from https://www.fisheries.noaa.gov/national/commercial-fishing/commercial-fisheries-landings.

Table 13.—Global production of wild and farmed salmon in metric tons (mt), 2012–16.[1] Pacific salmon includes Chinook, Coho, chum, pink, and sockeye. Atlantic salmon includes Atlantic only.

	2012	2013	2014	2015	2016
Wild, Pacific					
United States	288,398	484,927	326,681	483,555	254,484
Canada	8,989	17,706	35,473	16,784	21,235
Russian Federation	453,227	422,005	348,247	371,775	446,189
Farmed, Atlantic					
Norway	1,232,095	1,168,324	1,258,356	1,303,346	1,233,619
Chile	399,678	492,329	644,459	608,546	532,225
United Kingdom	162,547	163,518	179,397	172,146	163,135
Canada	116,101	97,629	86,347	121,926	123,522
Faroe Islands	76,564	75,821	86,454	80,600	83,300
United States	19,295	18,866	18,719	18,719	16,185
Russian Federation	8,754	22,500	18,675	10,834	13,323
Wild, Atlantic					
Norway	702	479	493	356	349
United Kingdom	284	258	155	199	177

[1]Source: FAO Fisheries and Aquaculture Department, http://www.fao.org/fishery/en/statistics. Production information for China is not available.

New Zealand, and Norway. Contrastingly, the United States ran a trade surplus with France, Japan, and Mexico.

Figure 49A–C shows the ratio of U.S. export to import volume for all salmon products combined (wild caught and farmed), wild caught only, and farmed products. During the 2012–16 time period, the export to import volume ratio for all salmon products combined ranged from 0.56 in 2016 to 0.83 in 2013 and 2015 (Fig. 49A). For wild caught salmon products (Fig. 49B), the export/import volume ratio ranged from 3.2 in 2016 to 4.8 in 2015. For farmed salmon products, the U.S. export to import volume was below 0.05 during the time period.

The value of U.S. net exports of salmon (all products) generally shows a decreasing trend during the 2012–16 period (Fig. 50A), with net exports valued at -$2.1 billion in 2015. This trend is driven by net exports of farmed salmon products which show a similar trend (Fig. 50C). Net exports of farmed salmon was -$2.6 billion in 2016. In contrast, U.S. net exports of wild caught salmon were positive but modest, with net exports of $491 million in 2016 (Fig. 50B).

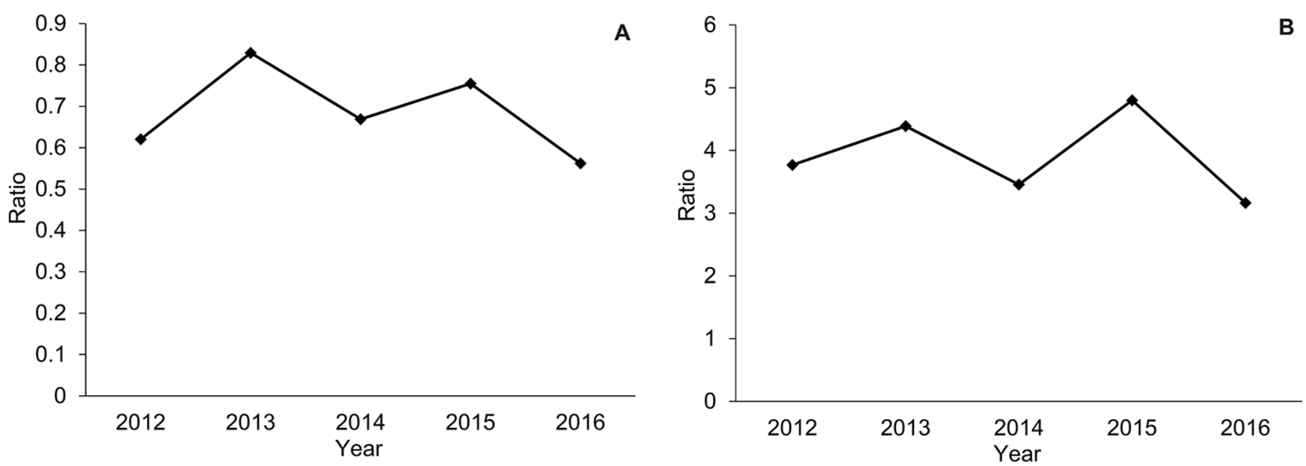
U.S. net exports were positive to Japan and South Korea but negative to Canada, Chile, and Norway (Fig. 51). The largest negative net export value was with Chile. Figure 52A–C shows the Herfindahl Index (HI) for exports and imports of salmon over the time period. The HI provides a composite

Table 14.—Lowe Multilateral Trade Index for top 9 countries for U.S. exports of salmon products.

Year	Australia	Canada	China	France	Germany	Japan	Netherlands	South Korea	U.K
2012	0.93	9.6	5.9	0.73	1	3.5	0.55	0.87	2.7
2013	1.06	9.3	7.5	0.81	1.2	3.8	0.61	1.45	2.6
2014	0.83	7.5	6.8	0.77	1.2	3.9	0.62	1.19	2.8
2015	0.86	8.3	8.7	0.84	1.8	7.3	0.61	2	3
2016	0.85	11.6	5.3	0.81	1.5	4.2	0.71	1.84	2.1

Table 15.—Lowe Multilateral Trade Index for top 9 countries for U.S. imports of salmon products.

Year	Canada	Chile	China	Faroe Islands	Germany	Greece	Netherlands	Norway	U.K.
2012	2.2	3	1	0.31	0.0027	0.00012	0.13	0.47	0.37
2013	1.8	3.5	1.1	0.39	0.0062	0.00005	0.15	0.56	0.33
2014	1.5	3.9	1.3	0.42	0.0619	NA	0.18	0.81	0.41
2015	2.2	4	1.2	0.32	0.1263	0.043	0.17	1.07	0.34
2016	2.4	3.9	1.2	0.35	0.1604	0.091	0.13	1.06	0.27



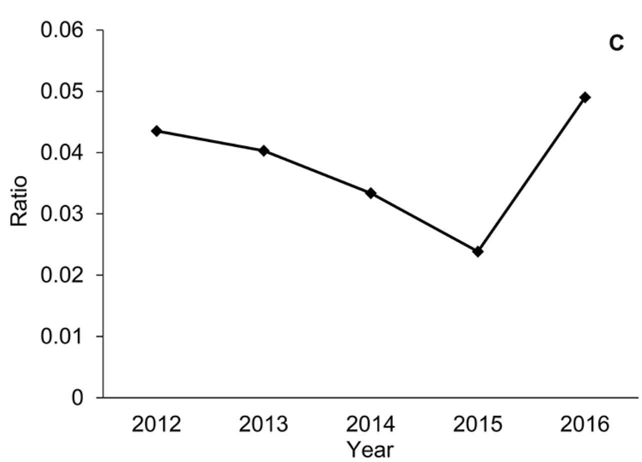
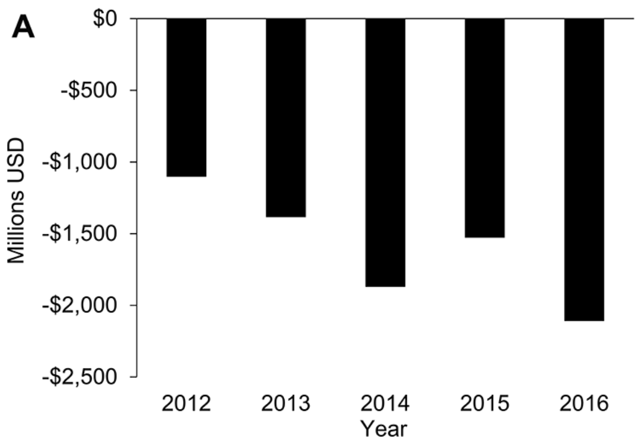
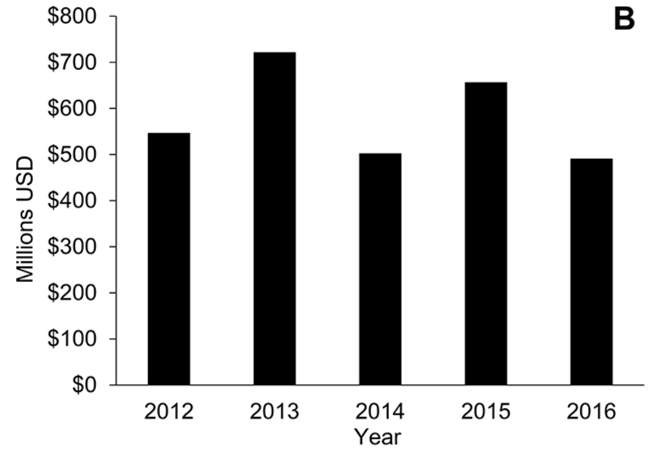


Figure 49.—A) Export/import volume ratio of salmon, all products, 2012–16. B) Export/import volume ratio of salmon, wild caught, 2012–16. C) Export/import volume ratio of salmon, farmed, 2012–16. Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/foss/f?p=215:200:3773249117914:Mail:NO





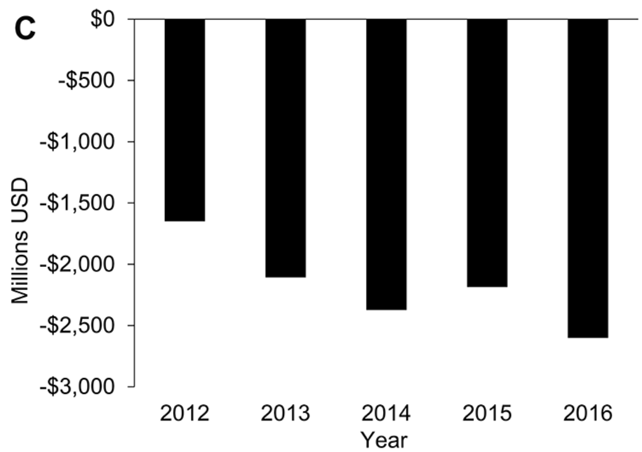


Figure 50.—A) Net exports of salmon, all products, 2012–16 (Real 2016 USD). B) Net exports of salmon, wild caught, 2012–16 (Real 2016 USD). C) Net exports of salmon, farmed, 2012–16 (Real 2016 USD). Sources: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

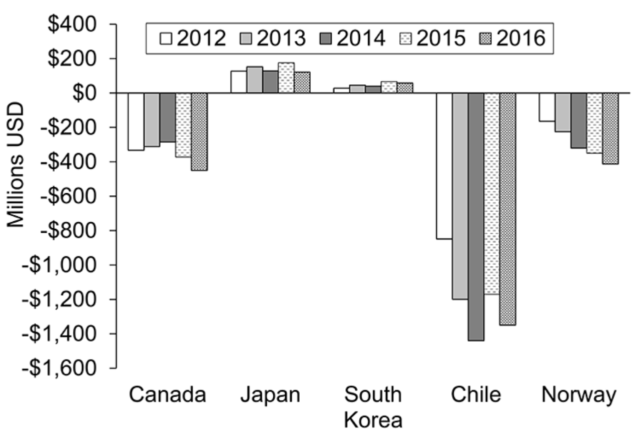


Figure 51.—Net exports of salmon to top five countries, 2012–16. Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/foss/f?p=215:200:12230994157142:Mail:NO:::. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

measure of concentration in terms of export or import shares among U.S. trading partners. The export HI for all salmon products combined (Fig. 52A) was between 0.14 (2012, 2016) and 0.17 (2014), and the import HI was slightly higher, between 0.26 (2012, 2016) and 0.28 (2014). The concentration of export (between 0.13 and 0.16) and import (between 0.25 and 0.39) shares of wild caught salmon were also low. Index values were higher for farmed salmon products, with export HI values between 0.68 (2015) and 0.85 (2012) and import HI values between 0.32 (2016) and 0.36 (2014). An increasing or decreasing HI is an indication that the share of imports (or exports) among top U.S. export (or import) markets have increased or decreased, respectively. Trends in these figures do not show much, if any, change.

Figure 53 shows the range of prices for imported and exported wild and

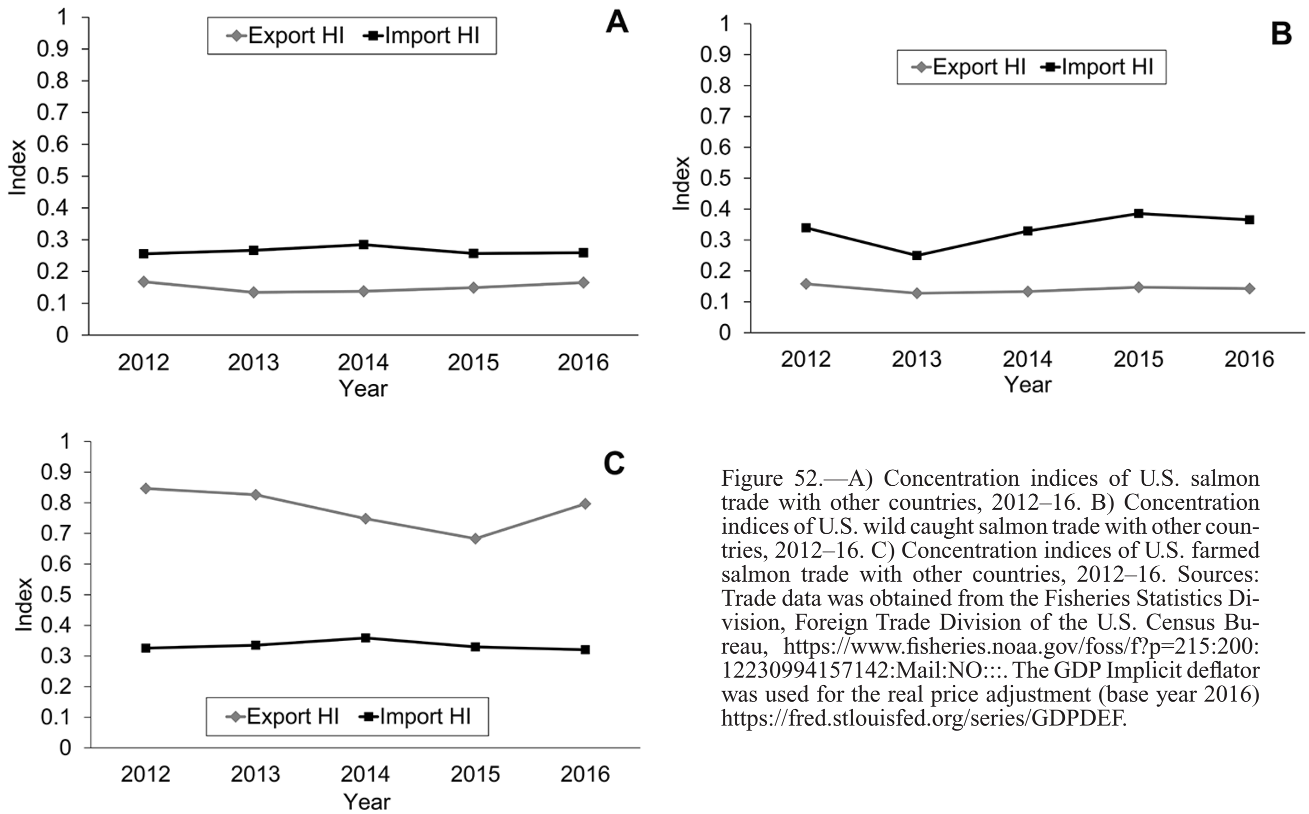


Figure 52.—A) Concentration indices of U.S. salmon trade with other countries, 2012–16. B) Concentration indices of U.S. wild caught salmon trade with other countries, 2012–16. C) Concentration indices of U.S. farmed salmon trade with other countries, 2012–16. Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/foss/f?p=215:200:12230994157142:Mail:NO:::. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

farmed salmon products. In 2016, imported wild and exported farmed salmon products were each nearly $3/lb, the lowest price for imported wild salmon during the time period. Exported wild product averaged between $2 and $2.50/lb. Imported farmed product averaged approximately $0.70/lb from 2012 to 2016.

The volume weighted effective exchange rate index is a measure of upward or downward pressure of U.S. salmon prices in global markets. The effective exchange rate increased from 2.96 in 2012 to 5.2 in 2015, then dropped to 3.8 in 2016 (Fig. 54). An increasing (or decreasing) effective exchange rate reflects a general strengthening (or weakening) of the U.S. dollar that tends to make U.S. products more (or less) expensive in global markets.

The U.S. share of global salmon trade activity is measured by the U.S. share of global export and import value (Fig. 55). In 2016, the United States accounted for approximate-

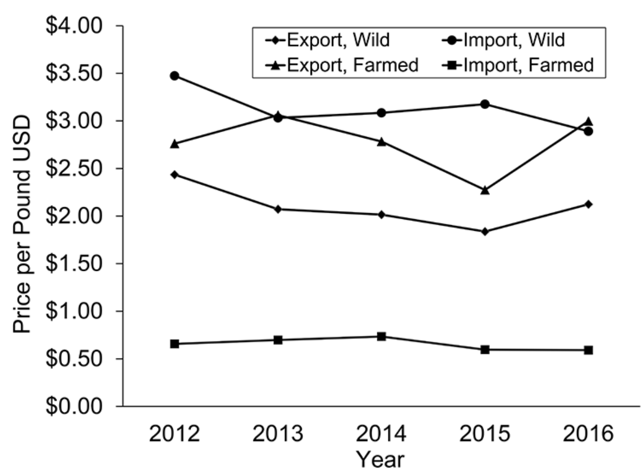


Figure 53.—Export and import prices of wild caught and farmed salmon, 2012–16 (Real 2016 USD). Source: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/foss/f?p=215:200:549599515612:Mail:NO:::. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

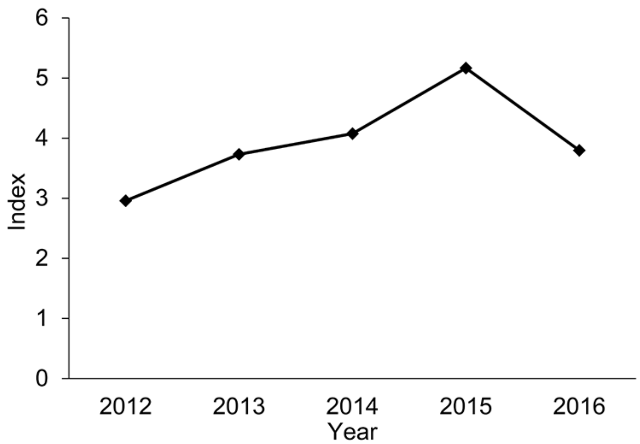


Figure 54.—Real effective exchange rate index for salmon, all products, 2012–16 (Real 2016 USD). Sources: Real monthly exchange rates were obtained from http://www.ers.usda.gov/data-products/agricultural-exchange-rate-data-set.aspx. Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/foss/f?p=215:200:549599515612:Mail:NO:::.

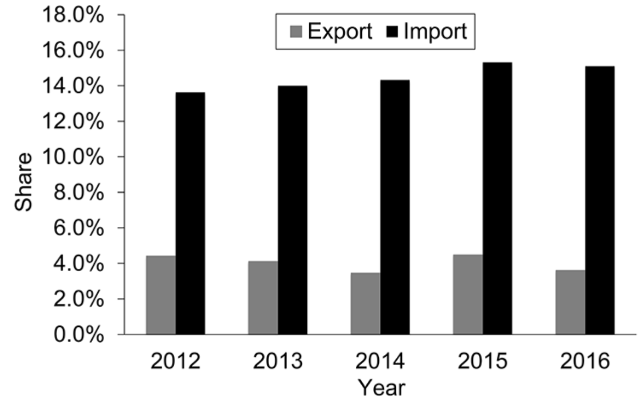


Figure 55.—U.S. share of global trade value activity for salmon, all products, 2012–16 (Real 2016 USD). Sources: FAO - Fisheries and Aquaculture Information and Statistics Branch - Commodity Trade and Production Statistics, http://www.fao.org/fishery/statistics/global-commodities-production/en. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

ly 4% of global salmon export activity and 15% of global salmon import activity. As a measure of export competitiveness, Figure 56 shows the export growth rate of the United States compared to the global (excluding the U.S.) export growth rate. Periods when U.S. export growth was above global export growth indicate that U.S. exports values are more competitive relative to the rest of the world (RoW). This is the case in 2015. Figure 57 similarly shows the import growth rate of the United States relative to the RoW. The U.S. import growth was greater than global growth in all years except 2016, indicating that U.S. import value was growing relative to the RoW except in 2016.

Table 16.—U.S. domestic supply, imports, exports, and prices for salmon, all products, 2012–16.[1]

Year	Landings, K mt	Imports, K mt	Exports, K mt	U.S. domestic supply	U.S. domestic price, $1,000/mt	U.S. import price, $1,000/mt	U.S. export price, $1,000/mt
2012	288.4	280.8	174.2	395.0	4.37	7.67	5.43
2013	485.1	297.6	246.8	535.9	4.31	8.97	4.66
2014	326.8	316.1	211.4	431.5	6.15	9.43	4.52
2015	483.8	344.6	260.1	568.3	3.78	7.96	4.09
2016	254.5	353.1	198.4	409.1	6.53	9.09	4.84

[1]Source: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/foss/f?p=215:200:17569679020528:Mail:NO:::. U.S. landings obtained from https://www.fisheries.noaa.gov/national/commercial-fishing/commercial-fisheries-landings. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

Domestic (Apparent) Consumption

Apparent consumption of salmon (all products combined) is measured as the total unexported volume of U.S. production (the difference between annual primary production or landings, and exports) and imports (Table 16). Domestic price of salmon was between $4,370 and $6,530/t during the 2012–16 period. This is similar to U.S. export price which was between $4,090 and $5,430/t. U.S. import prices were nearly double export prices, between $8,970 and $9,430/t. U.S. apparent consumption of salmon was between 395,000 and 570,000 t during 2012–16 (Fig. 58a). When considering wild caught salmon, U.S. apparent consumption was between 128,000 and 300,000 t (Fig. 58b). It was between 220,000 and 270,000 t for farmed salmon (Fig. 58c).

Figures 59A–C show U.S. apparent consumption of salmon to total U.S. production over time. U.S. apparent consumption of salmon (all products) relative to total domestic production was between 1.1 and 1.6 (Fig. 59A), between 0.5 and 0.6 for wild caught salmon (Fig. 59B), and between 19 and 40 for farmed salmon (Fig. 59C).

Figures 60A and 60B show the proportion of salmon product supplied by the U.S. salmon industry. The U.S. salmon industry supplied between 13% and 44% of U.S. apparent consumption of salmon (all product combined) during 2012–16 (Fig. 60A). In contrast, between 55% and 82% of U.S. apparent consumption of wild caught salmon was supplied by the U.S. salmon industry (Fig. 60B), but less than 1% of apparent consumption of farmed salmon (Fig. 60C).

This section authored by Rosemary Kosaka, NMFS Southwest Fisheries Science Center and Melissa Krigbaum, NMFS Northwest Fisheries Science Center.

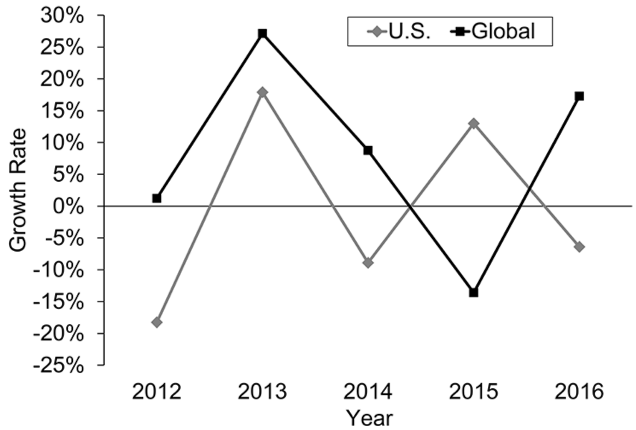


Figure 56.—Export value growth of the U.S. and rest of the world, 2012–16 (Real 2016 USD). Sources: FAO - Fisheries and Aquaculture Information and Statistics Branch - Commodity Trade and Production Statistics, http://www.fao.org/fishery/statistics/global-commodities-production/en. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

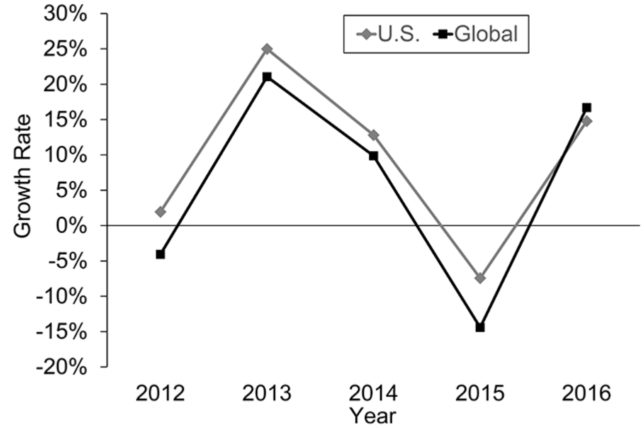
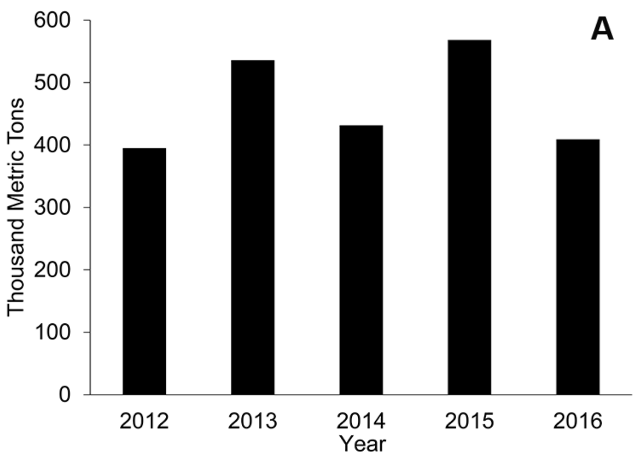
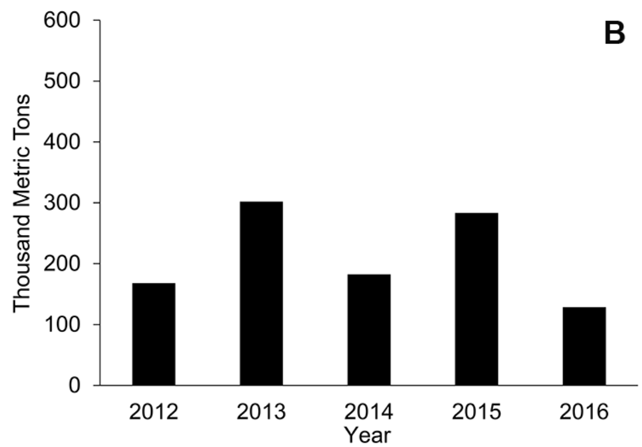


Figure 57.—Import value growth of the U.S. and rest of the world, 2012–16 (Real 2016 USD). Sources: FAO - Fisheries and Aquaculture Information and Statistics Branch - Commodity Trade and Production Statistics, http://www.fao.org/fishery/statistics/global-commodities-production/en. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.





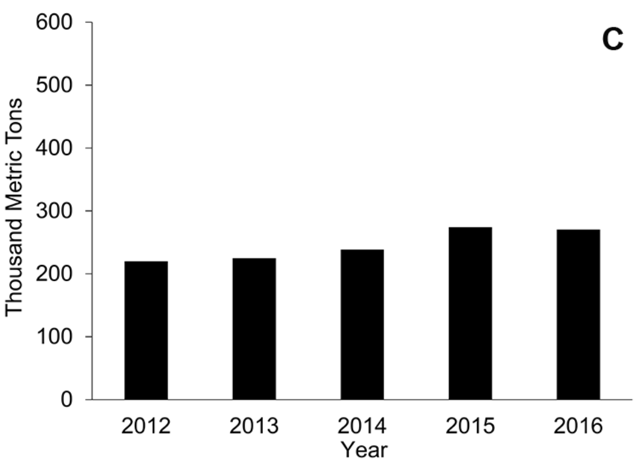
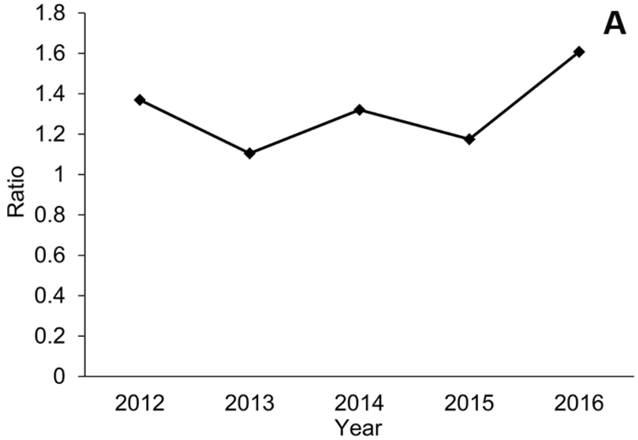
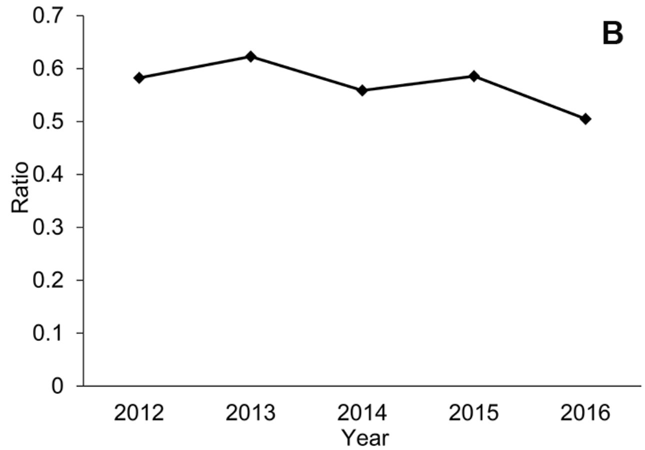


Figure 58.—A) U.S. apparent consumption of salmon, all products, 2012–16. B) U.S. apparent consumption of salmon, wild caught, 2012–16. C) U.S. apparent consumption of salmon, farmed, 2012–16. Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/foss/f?p=215:200:549599515612:Mail:NO:::.U.S. landings obtained from https://www.fisheries.noaa.gov/national/commercial-fishing/commercial-fisheries-landings.





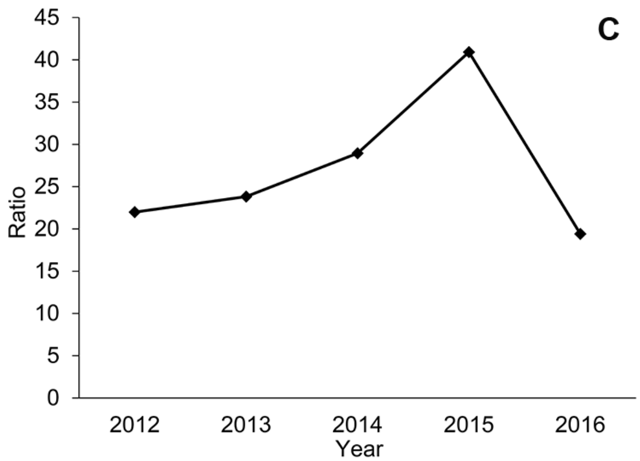


Figure 59.—A) U.S. production relative to apparent consumption of salmon, all products, 2012–16. B) U.S. production relative to apparent consumption of salmon, wild caught, 2012–16. C) U.S. production relative to apparent consumption of salmon, farmed, 2012–16. Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/foss/f?p=215:200:549599515612:Mail:NO:::. U.S. landings obtained from https://www.fisheries.noaa.gov/national/commercial-fishing/commercial-fisheries-landings.

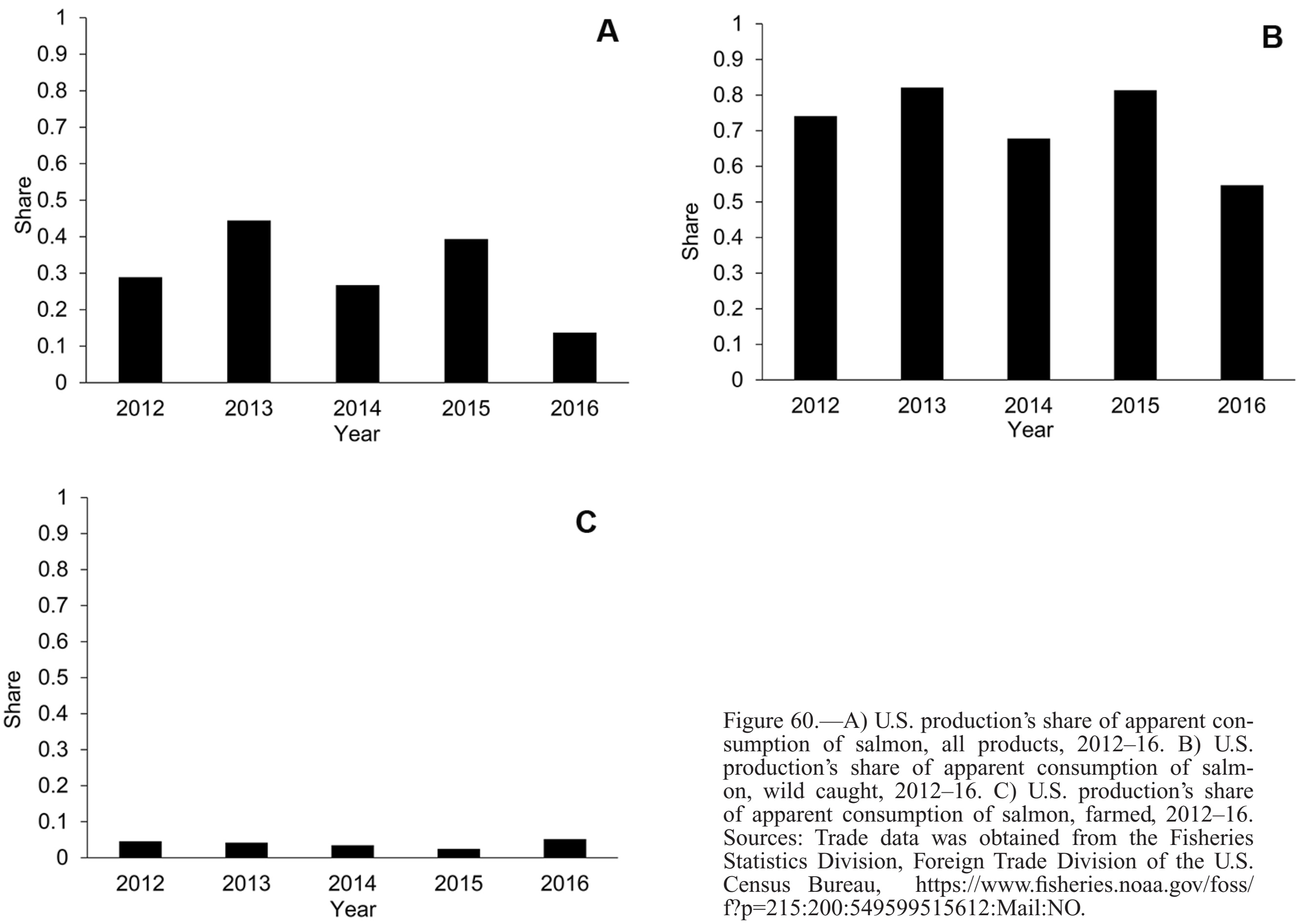


Figure 60.—A) U.S. production's share of apparent consumption of salmon, all products, 2012–16. B) U.S. production's share of apparent consumption of salmon, wild caught, 2012–16. C) U.S. production's share of apparent consumption of salmon, farmed, 2012–16. Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, https://www.fisheries.noaa.gov/foss/f?p=215:200:549599515612:Mail:NO.

U.S. Shrimp Trade

Domestic and Global Production

Two broad varieties of shrimps are common: warmwater and cold-water. It is notable that shrimp and prawn are taxonomically distinct, but look similar and sometimes are used interchangeably. Warmwater shrimp are harvested and farmed in tropical and sub-tropical regions around the world, including the Gulf of Mexico (GoM). In fact, approximately 80% of the U.S. wild shrimp is harvested from the GoM. Shrimp are more commonly sold by reference to basic shell colors, i.e., white, *Litopenaeus setiferus;* brown, *Farfantepenaeus aztecus*; and pink, *Farfantepenaeus duorarum*; shrimp. Brown and white shrimp types make approximately three-quarters of the annual harvest. Warmwater shrimp may be processed to varying levels including peeled, deveined, shell-on, tail-off, marinated, skewered, and sauced. Coldwater shrimp are the smaller varieties which are harvested in ocean waters in the northwest and northeast regions of the United States. The southeast shrimp fishery has been controversial due to relatively high levels of bycatch such as sea turtles. However, use of bycatch reduction devices (finfish) and turtle excluder devices (sea turtles) has significantly reduced the amount of bycatch.

The annual U.S. wild-caught shrimp landings during the 2012–16 period declined by 5% (Fig. 61). Fluctuations in wild-caught shrimp production are in part due to variations in the abundance. In general, despite attempts to predict shrimp abundance, the size of the population is largely uncertain before each shrimping season (Matthews, 2008). Since the life cycle of most warmwater shrimp is limited to one year, the annual fluctuations in the stock are primarily due to environmental conditions rather than the previous year's landings (Anderson, 2004). The domestic landings are highly seasonal (with a typical season occurring from May through December), peaking during the spring and fall, which overlaps with the typical tropical weather patterns when the risk of accidents is higher than other seasons. Of course, poor weather condition is often a factor in marine commercial fishing accidents in most fisheries. The spawning, growth, and migration patterns of shrimp are the major determinants of the abundance of shrimp during the year, which in turn determines trip decisions and hence landings patterns. Other natural factors such as tropical storm activity also influence trip decisions and patterns. Seasonality of landings is also due to regulatory closures, which prohibit harvesting during the shrimp maturation period. The most notable seasonal shrimp closure in the GoM is in Texas. Since 1981, to increase the yield of brown shrimp by protecting them during the rapid growth period in their life cycle, the GoM Shrimp Fishery Management Plan has prohibited shrimp fishing in the Exclusive Economic Zone off the coast of Texas from mid-May to mid-July. As a result, brown shrimp harvested are larger and older than other species of shrimp, comprising more than 50% of the total harvest in the GoM (Nance, 2011).

Because most shrimp species are annual crops, they are not required to have quotas or annual catch limits (ACL's). Royal red shrimp, *Pleoticus robustus* in the GoM is the exception because it lives longer than a year, but it also represents a very small percentage of the U.S. shrimp fishery's landings. However, the shrimp fishery in the GoM has been operating at only about 6 million lb (tail weight), which is below its aggregate optimum yield (OY), and management measures are in place to discourage production above that level. The Gulf Council is considering modifications to those measures to allow additional harvest to occur up to the aggregate OY level. On the other hand, from 2012 to 2016, the South Atlantic shrimp fishery has only been harvesting at about 61% of its average harvest level from 1994–2000, dropping from an average of 33.7 million pounds to 20.6 million pounds, suggesting harvest levels could increase by more than 13 million pounds per year. However, harvest has been constrained by economic factors (e.g., relatively low ex-vessel prices and high fuel prices) rather than regulations. Also, the Gulf of Maine shrimp fishery has been closed in recent years for biological reasons and will continue to be closed for at least the next 3 years.

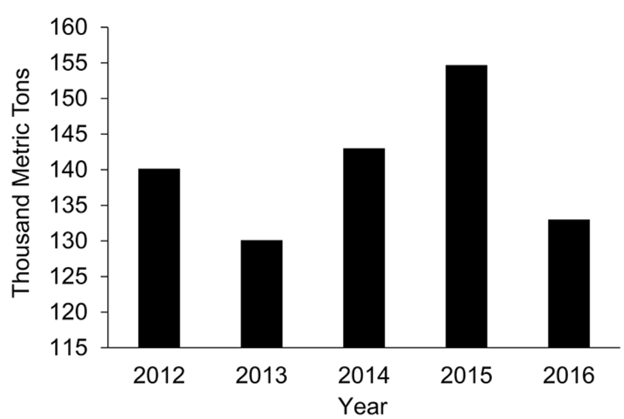


Figure 61.—U.S. shrimp first wholesale production, 2012–16.

Table 17.—U.S. shrimp trade and global market data. Global production (thousand metric tons), U.S. share of global production, U.S. export and import volume (thousand metric tons), real value (million US$), and real price (US$/lb), the share of U.S. export and import volume and value with Thailand, Indonesia, India, Ecuador, and Vietnam; 2012–16 (Real 2016 USD).[1]

			2012	2013	2014	2015	2016
Global shrimp wild catch K mt			3,347	3,308	3,393	3,476	3,432
Global shrimp farmed production K mt			4,064	4,141	4,566	4,824	5,119
U.S. share of total global catch			1.91%	1.77%	1.82%	1.89%	1.57%
Export volume K mt			0.0065	0.0063	0.0079	0.0103	0.0066
Export value M US$			$385.2	$320.7	$321.0	$338.7	$312.0
Export price lb US$			$4.67	$4.79	$5.04	$4.85	$4.49
Import volume K mt			534.81	505.78	569.60	585.36	604.87
Import value M US$			$4,722	$5,487	$6,848	$5,491	$5,705
Import price lb US$			$4.01	$4.92	$5.45	$4.25	$4.28
Thailand	Export	Volume share	10%	4%	1%	1%	6%
		Value share	10%	4%	1%	2%	4%
	Import	Volume share	25%	17%	11%	13%	14%
		Value share	27%	17%	12%	14%	15%
Indonesia	Export	Volume share	2%	1%	2%	2%	2%
		Value share	3%	3%	3%	3%	4%
	Import	Volume share	13%	16%	18%	20%	19%
		Value share	15%	17%	20%	20%	19%
India	Export	Volume share	3%	3%	3%	4%	5%
		Value share	4%	5%	6%	6%	8%
	Import	Volume share	12%	18%	19%	23%	25%
		Value share	13%	19%	21%	24%	26%
Ecuador	Export	Volume share	1%	1%	1%	0%	0%
		Value share	1%	0%	0%	0%	0%
	Import	Volume share	15%	15%	16%	15%	12%
		Value share	13%	12%	13%	12%	10%
Vietnam	Export	Volume share	6%	3%	8%	8%	12%
		Value share	8%	4%	9%	9%	11%
	Import	Volume share	8%	12%	13%	10%	11%
		Value share	10%	14%	15%	12%	12%

[1]Source: FAO Fish. Aquacult. Dep., Stat. (http://www.fao.org/fishery/en/statistics). NOAA/NMFS Fish. Stat. Div., Foreign Trade Div. U.S. Census Bureau (http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index). U.S. Dep. Agric. (http://www.ers.usda.gov/data-products/agricultural-exchange-rate-data-set.aspx). The GDP Implicit deflator was used for the real price adjustment (base year 2016) (https://fred.stlouisfed.org/series/GDPDEF).

Production from domestic aquaculture sources has been negligible at approximately 1% of the total domestic landings. The low level of farmed production in the United States is in part due to environmental concerns and lack of regulations.

Global production of shrimp has been rising rapidly in the last two decades. Since 2010, the world-wide production of farmed shrimp has exceeded the production of wild-caught shrimp. Between 2012 and 2016, the world wild-caught production of shrimp has been nearly flat at approximately 3.4 million t, while aquaculture production has increased from approximately 4.1 million t to 5.1 million t—a 24% increase (Table 17). According to a Food and Agricultural Organization (FAO) report, 75%–80% of the global production of shrimp, mostly Vannamei (Pacific white shrimp), originated from Asia-Pacific countries of China, India, Vietnam, Indonesia, Thailand, and the Philippines (FAO, 2018a). Much of the growth in global shrimp production is from several Asian countries that have displayed rapid increases in farmed shrimp production and where technological advancements in shrimp aquaculture have enhanced productivity and lowered production costs. While commercial farming of shrimp began in the mid-1970's, it was not until the 1980's that the supply of farmed shrimp began to grow rapidly. Only in the 1990's, as the shrimp aquaculture industry battled with diseases, did the supply of farmed shrimp briefly stagnate (Chamberlain, 1999). Many seafood importing countries have implemented product safety controls. In 2017, rejections of shrimp imports for safety reasons at U.S. borders were the highest among importing countries in the world (FAO, 2018a).

Trade

The United States is a major importer of shrimp. The trade volume index in Figure 62 shows that the U.S. shrimp exports were 2%–4% of its imports between 2012 and 2016. A large negative trade flow in Figure 63, which was as high as 6.7 billion dollars in 2014, reflects the significant U.S. shrimp trade deficit. In fact, the U.S. trade deficit with India was 1.5 billion dollars in 2016, because shrimp imports from India grew rapidly in recent years. Other major trading partners of the United States include Indonesia, Thailand, Ecuador, and Vietnam. Figure 64 shows the size of the trade deficit in real terms for the top five major U.S. shrimp trading partners. The import market share for India significantly increased since 2012 from 12% of the total import value to 26% in 2016 (Table 17). The decrease in the antidumping tariff on Indian shrimp and its increased market acceptance has led to the increases in shrimp supply from India, which was also a key factor behind the overall rise in U.S. shrimp imports. On the other hand, the import market share for Thailand dropped from 27% of the total import value to 15% (Table 17). However, the Herfindahl concentration indices for all U.S. importers, combined, varies between 0.14 and 0.16 (Fig. 65).

According to the FAO data, shrimps and prawns share of world seafood commodities exports doubled between 1996 and 2006 from 3.73% to 6.50%, but it has been stagnant since 2006 (http://www.fao.org/fishery/en/statistics). This suggests that the rapid increase in shrimp export to the United States was not a unique phenomenon. In fact, shrimp exports were rapidly rising to many developed and developing countries in the world during this time period.

The majority of countries that are importing from the United States are industrialized countries, which import processed shrimp. Table 18 demonstrates the U.S. multilateral shrimp export quantity indices, which captures a year-by-year transitive comparison of export volumes for the top seven export destinations (Table 18). The top-seven shrimp importing countries from the United States include Canada, China, Denmark, Japan, Mexico, Sweden, and U.K. Denmark is the largest importer of U.S. shrimp. As noted in Table 19, the top-seven shrimp exporters to the United States are China, Ecuador, India, Indonesia, Mexico, Thailand, and Vietnam, which are mostly low-cost developing and newly industrialized countries. Nearly 80% of U.S. shrimp imports were in shell-on frozen and peeled frozen product form. The index of multilateral import trade in Table 19 shows a significant increase in the relative position of India as a source of supply of imports between 2012 and 2016, while Thailand's position declined during the same time period.

Since exchange rates can influence trade flow, Figure 66 focuses on the effective real exchange rate index, weighted by the volume of imports from the U.S. top five trading partners. The U.S. dollar was fairly stable against the U.S. trading partners during the 2012–16 period, which partly explains the rather stable real shrimp import prices shown in Figure 67. Of course, prices are also likely to have been influenced by other factors such as rapid increases in low-cost aquaculture production in the exporting countries. The U.S. exports of shrimp relative to world exports were negligible, while the U.S. imports share of the world's imports approached 30% in recent years (Fig. 68). The U.S. exports also grew modestly with nearly 2% growth in export value. Meanwhile, shrimp exports originating from other countries were rather stagnant during the 2012–16 period (Fig. 69). Similarly, the U.S. shrimp imports have increased by approximately 2% during the same time period, while imports to other countries in the world have been rather flat (Fig. 70).

Apparent Consumption

Shrimp is one of the most popular seafood products in the United States accounting for approximately 25% of total seafood consumption in the country. Shrimp is also the largest U.S. seafood import in terms of volume. The consumption of shrimp has been growing, which appears to be due to rising incomes and the decline in the price of shrimp relative to the price of other seafood and meat products. The pattern of U.S. shrimp consumption mirrors that of imports. The U.S. apparent consumption of shrimp is measured by deducting export and re-exports of the products from the sum of domestic production and imports. Figure 71 shows that the value of U.S. apparent annual consumption was approximately 0.6 to 0.7 million t. U.S. apparent consumption is typically nearly 5 times its domestic production (Fig. 72). Therefore, the United States heavily relies on imports to meet its appetite for shrimp. Figure 73 also shows the U.S. reliance on imports where the share of U.S. domestic apparent consumption directly supplied by the domestic industry is approximately 14%.

Table 18.—U.S. shrimp multilateral export quantity indices (2012–16).

Year	Japan	Mexico	U.K.	China	Canada	Sweden	Denmark
2012	0.54	0.90	0.98	1.00	3.28	3.52	3.88
2013	0.33	0.87	0.78	2.21	3.33	2.41	4.43
2014	0.50	0.96	0.49	3.13	5.48	3.08	5.12
2015	0.37	0.55	1.70	2.31	7.43	4.32	9.16
2016	0.26	0.65	0.03	1.04	3.08	1.86	4.01

Table 19.—U.S. shrimp multilateral import quantity indices (2012–16).

Year	Mexico	China	Vietnam	India	Indonesia	Ecuador	Thailand
2012	0.39	0.54	0.62	1.00	1.12	1.24	2.06
2013	0.34	0.60	1.11	1.69	1.51	1.39	1.56
2014	0.42	0.67	1.53	2.25	2.14	1.91	1.35
2015	0.45	0.56	0.97	2.15	1.83	1.37	1.17
2016	0.41	0.56	1.02	2.46	1.87	1.17	1.32

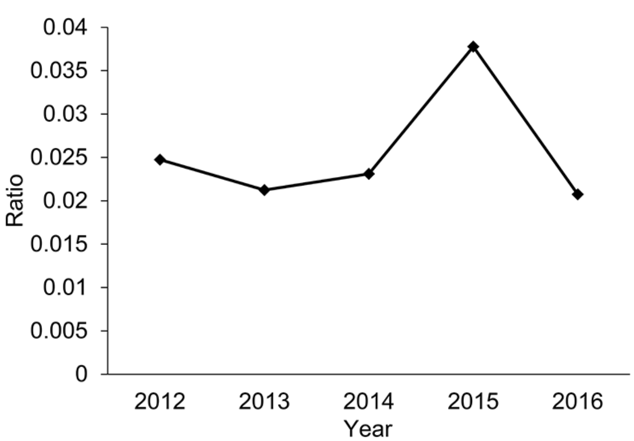


Figure 62.—Export/import volume ratio of shrimp, 2012–16.

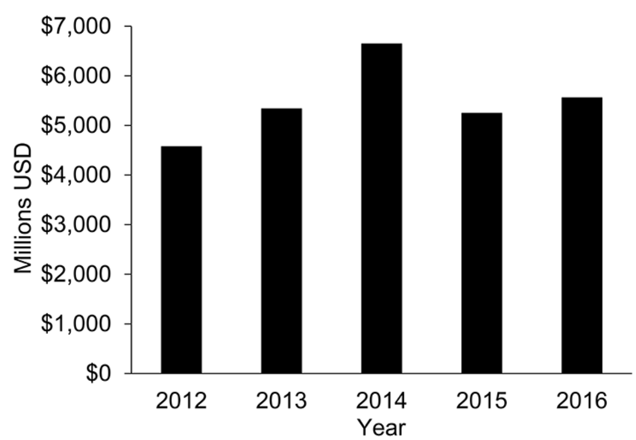


Figure 63.—Net imports of shrimp, 2012–16 (Real 2016 USD).

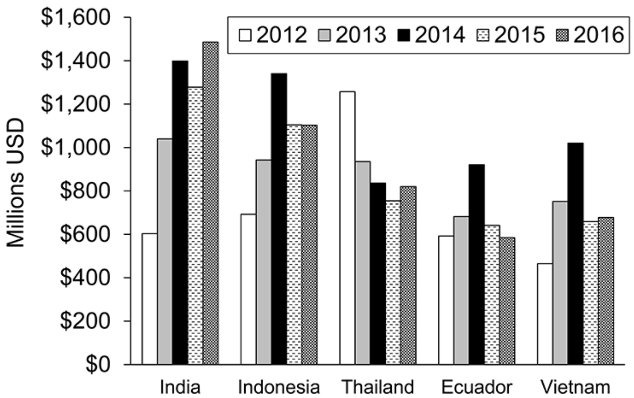


Figure 64.—Net imports of shrimp from top five countries, 2012–16 (Real 2016 USD).

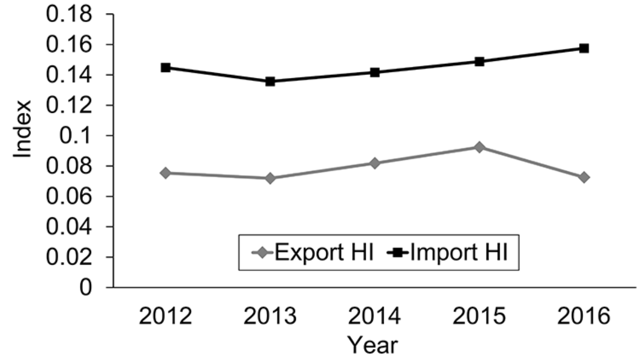


Figure 65.—Concentration indices of U.S. shrimp trade with other countries, 2012–16.

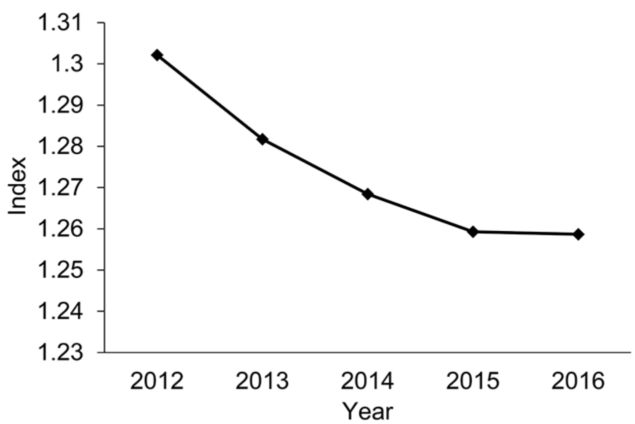


Figure 66.—Real effective exchange rate index for shrimp, 2012–16.

Figure 67.—Export and import prices of shrimp, 2012–16 (Real 2016 USD).

Antidumping Duties

U.S. harvesters have often complained about the adverse effects of imports on their income. Imports have caused shrimp prices to fall despite growing consumption and steady domestic supply. According to the National Marine Fisheries Service (NMFS), between 1980 and 2016, the average real ex-vessel price of medium size shrimp fell by 23%, from $2.22 to $1.72/headless lb. Similarly, the import price dropped by 19%, from $5.22 to $4.28, during this time period.

Partly in response to the pressure from imports, the U.S. shrimp harvesting industry has been consolidating by reducing the number of shrimp vessels. The industry has also sought relief from the government. U.S. International Trade Commission (USITC) reports suggest that the decline in the real value of the currencies in some developing countries was a contributing factor in the jump in imports in the 1980's (USITC, 2005). The reports also point out that government subsidies and low transportation costs are other contributing factors to the rapid rise in imports. In response to a petition filed by a coalition of harvesters and processors against U.S. importers in 2005, the USITC imposed anti-dumping duties on warmwater shrimp producers from six major exporting countries (Brazil, China, Ecuador, India, Thailand, and Vietnam) to offset unfairly low prices (USITC, 2005). In 2006, the anti-dumping duties imposed on Ecuador were revoked. In 2011, the USITC ordered continuation of the existing anti-dumping duties on the remaining five countries (USITC, 2017). The anti-dumping duties have also provided funds to subsidize U.S. producers.

Marvasti and Carter (2016), using time-series data, discover that the falling value of the U.S. dollar discouraged shrimp imports, while anti-dumping duties appear to have had little influence on the aggregate level of imports. The authors speculate that trade diversion may have been the cause. However, aggregation of trading partners in the study is likely to mask the effectiveness of trade barriers. A fol-

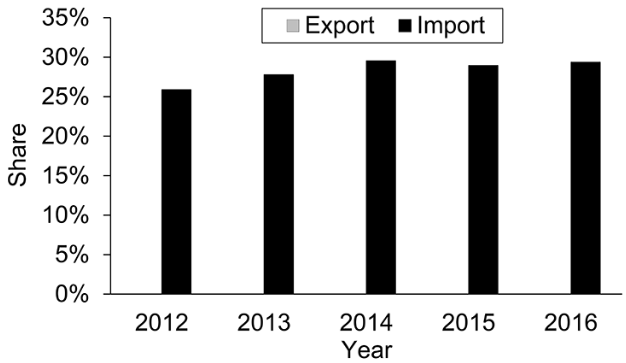


Figure 68.—U.S. share of global trade value activity, 2012–16.

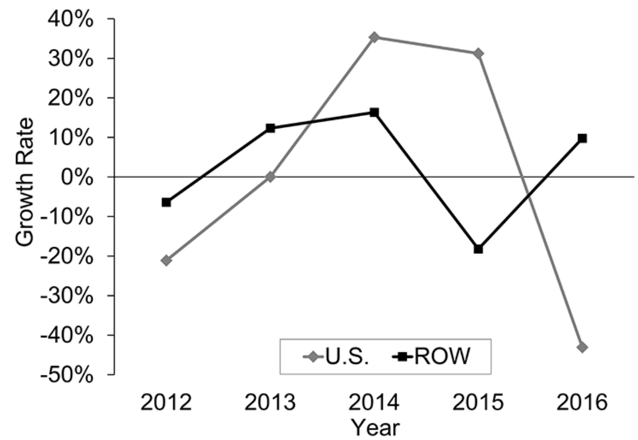


Figure 69.—Export value growth of the U.S. and rest of the world, 2012–16.

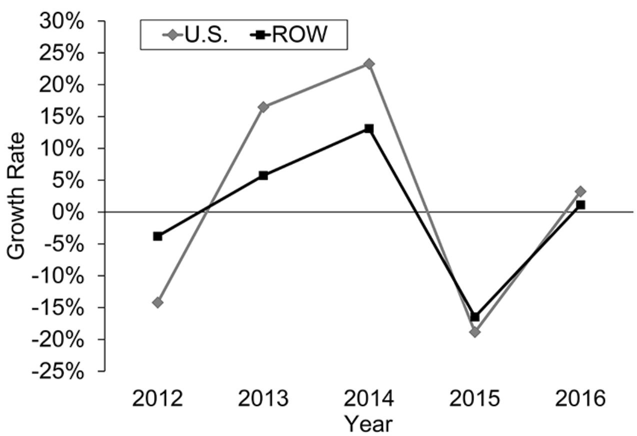


Figure 70.—Import value growth of the U.S. and rest of the world, 2012–16.

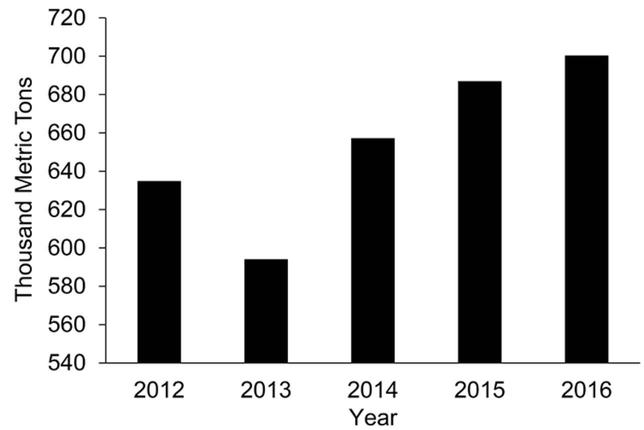


Figure 71.—U.S. apparent consumption of shrimp, 2012–16.

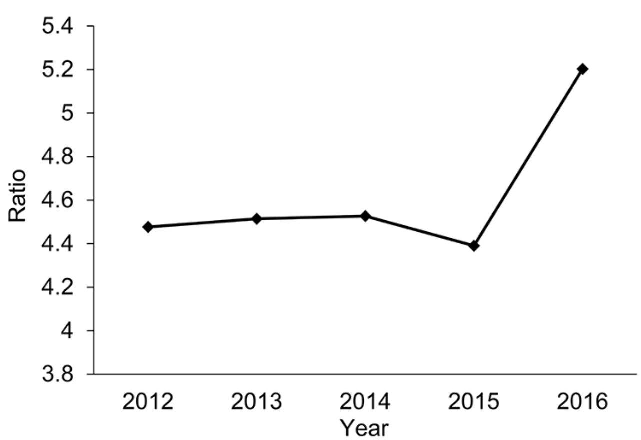


Figure 72.—U.S. shrimp production relative to apparent consumption, 2012–16.

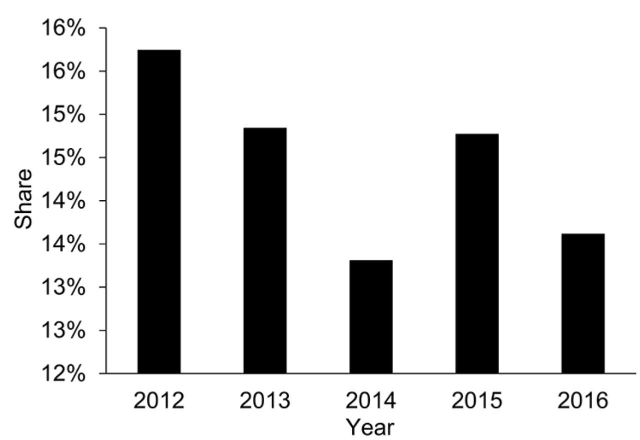


Figure 73.—U.S. shrimp production's share of apparent consumption, 2012–16.

low up study by Marvasti (2019), using disaggregated panel data, finds that anti-dumping duties have resulted in increases in price, harming domestic consumers. Also, initiating anti-dumping investigations has diverted trade to non-regulated countries.

To compete with rising imports, the U.S. shrimp harvesting industry used the funds from the anti-dumping duties to promote domestically harvested shrimp. The effectiveness of product differentiation between domestic and imported shrimp is complicated by the information available to consumers at retail outlets, especially at restaurants where most of the shrimp is consumed. Domestic producers increased their marketing efforts to differentiate their products from the imported shrimp by using labeling to emphasize freshness and local production (GSAFF, 2013). For example, the Florida Department of Agriculture and Consumer Services recently conducted a marketing campaign to increase the public's awareness about Florida wild-caught shrimp by building a brand name based on the product quality and desirability in order to increase sales and dockside prices. The effectiveness of this measure is yet to be determined, but a consumer survey of the northeast United States demonstrates the significance of public perception of the health benefits of seafood and the effectiveness of marketing campaigns (Nauman et al., 1995). Wellman (1992) has also pointed out the importance of consumer education programs. Finally, the industry is pursuing food safety issues through legal channels in order to curtail imports. For example, a U.S. Government Accountability Office (USGAO) report suggests that antibiotics, fungicides, and other harmful drug residues in imported seafood be banned. The report expresses concerns about these drugs being allowed in aquaculture in countries such as China and Vietnam (USGAO, 2011).

This section authored by Akbar Marvasti, NMFS Southeast Fisheries Science Center.

U.S Tuna Seafood Trade

Table 20.—Tuna global and U.S. production, 2012–16.

	2012	2013	2014	2015	2016
Global catch					
Total (kmt)	4,597.9	4,718.8	5,015.6	4,843.9	4,906.2
Skipjack[1]	2,597.6	2,797.3	2,997.3	2,813.9	2,817.1
Yellowfin[1]	1,277.8	1,239.7	1,337.3	1,342.0	1,443.6
Bigeye[1]	428.5	401.1	404.3	422.3	390.7
Albacore[1]	258.2	244.0	235.1	223.8	208.5
Bluefin[1]	35.8	36.4	41.6	42.0	46.3
U.S. catch (kmt)					
Total[2,4]	295.4	286.5	346.6	293.7	280.5
Skipjack[2]	210.2	208.0	270.3	237.0	219.0
Yellowfin[2]	48.5	38.8	46.9	24.8	28.9
Bigeye[2]	16.8	23.0	13.6	17.0	18.7
Albacore[2]	18.6	15.8	14.7	13.6	12.5
Bluefin[2]	0.9	0.7	0.8	0.9	1.0
U.S share of catch					
Global[2]	6.42%	6.07%	6.91%	6.06%	5.72%
Skipjack[2]	8.09%	7.44%	9.02%	8.42%	7.78%
Yellowfin[2]	3.79%	3.13%	3.51%	1.85%	2.00%
Bigeyev	3.93%	5.73%	3.36%	4.03%	4.78%
Albacore[2]	7.21%	6.47%	6.25%	6.09%	6.00%
Bluefin[2]	2.57%	1.81%	1.95%	2.14%	2.22%
Value of U.S. landings (mill. U.S.$2016)[2]					
Total[4]	$700.90	$616.00	$525.20	$377.30	$434.10
Skipjack[3]	$461.70	$413.50	$367.20	$270.70	$306.00
Yellowfin[3]	$124.40	$93.50	$87.40	$39.30	$46.50
Bigeye[3]	$35.90	$48.40	$21.40	$21.50	$24.00
Albacore[3]	$66.40	$54.20	$40.70	$36.50	$46.10
Bluefin[3]	$11.80	$6.10	$8.00	$8.80	$11.00

[1]Global production FAO Fish. Aquacult. Dep. Stat. (http://www.fao.org/fishery/statistics/global-capture-production/en).
[2]Western and Central Pacific Fisheries Management Commission Scientific Committee, Inter-Amer. Trop. Tuna Commiss., Western Pac. Fish. Manage. Counc. Pelagic FEP SAFE Rep., Pac. Fish. Manage. Counc. HMS Safe Rep., Atlantic Highly Migratory Spec. Stock Assess. Fish. Eval. Rep. Excludes American Samoa local catch.
[3]NOAA/NMFS, Fish.Stat. Div., Foreign Trade Div. U.S. Census Bur., (http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index). U.S. Dep. Agricult. (http://www.ers.usda.gov/data-products/agricultural-exchange-rate-data-set.aspx).
Notes: U.S. Share of Catch pertains to U.S. catch landed both domestically and internationally. Domestic source: NOAA/NMFS, Fish. Stat. Div., Foreign Trade Div. U.S. Census Bur. (http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index). U.S. Dep. Agricult. (http://www.ers.usda.gov/data-products/agricultural-exchange-rate-data-set.aspx). Yellowfin and skipjack prices are Bangkok provided by Forum Fisheries Agency. Bigeye prices are Manta Ecuador ex-vessel prices. Albacore prices are U.S. west coast albacore ex-vessel prices. Bluefin ex-vessel prices are U.S. Atlantic coast.
[4]Total includes landings of "Other" tuna (i.e., non-skipjack, yellowfin, bigeye, albacore, or bluefin tunas) in the U.S. obtained from NOAA, NMFS Office of Science and Technology.

Domestic and Global Production

The U.S. tuna industry is the fifth largest capture U.S. fishery in terms of total value. The single largest U.S. tuna fishery is the U.S. tropical tuna purse seine fishery in the western and central Pacific Ocean (WCPO). Other U.S. tuna fisheries include the U.S. tropical tuna purse seine fishery in the eastern Pacific Ocean, the U.S. longline fisheries in the Atlantic and Pacific Oceans, the U.S. troll and pole-and-line fisheries in the Pacific (largely off the West Coast), coastal purse seine vessels off the West Coast, and tropical troll, longline, and handline in Hawaii and the U.S. Pacific territories, including American Samoa, Guam, and the Northern Marianas Islands. The industry targets the temperate tunas of bluefin (*Thunnus thynnus*, *T. orientalis*, and *T. macoyii*) and albacore, *T. alalunga,* and the tropical tunas of yellowfin, *T. albacares*; skipjack, *Katsuwonus pelamis;* and bigeye, *T. obesus*. Skipjack predominates landings volume, accounting for approximately 70%–80% of the U.S. tuna catch annually, and it is largely sourced from the western and central Pacific Ocean and caught on floating aggregator devices (Table 20, Fig. 74). U.S. fleets also catch small amounts of neritic tunas, also called coastal tunas. Table 20 shows global and U.S. production of the major tunas (excluding some neritic tunas), where U.S. production entails domestic and foreign landings plus at-sea transshipments.

The United States was among the top ten tuna harvesting nations in the world between 2012 and 2016 and was among the largest harvesters of purse-seine caught tuna in both the western and central Pacific and eastern Pacific Ocean areas. Between 2012 and 2016, the United States accounted for 5.7%–6.9% of global tuna landings (Table 20). The United States remains one of the largest tropical tuna purse seine nations in the world, with a fleet that recently ranged between 35 and 38 vessels but is now declining to the range of 20–25 vessels. This fleet's landings largely go to Thailand (through transshipment, supplying almost 20% of the total Thai imports), with an important fraction also landed in American Samoa for the Starkist processing plant and in Mexico and Ecuador when fishing in the eastern Pacific Ocean (Table 23).

U.S. production of domestically processed tuna ranged from 182,000–200,000 t between 2012 and 2016 (Fig. 75). The United States domestically processed tuna refers to processed tuna products produced in the United States and its territories, including American Samoa. Canned tuna accounted for approximately 90% or more of annual processing volume. United States processing is dominated by Bumble Bee (currently owned by Lion Capital, a private equity firm—but likely to soon be sold to Fong Chun Formosa Fishery Company of Taiwan or FCF, a leader in albacore, with Bumble Bee and Wild Selections brands, number two in U.S. market), Starkist (owned by the Korean firm Dongwon Industries, leader in skipjack/lightmeat, and number one in the U.S. market), Chicken of the Sea

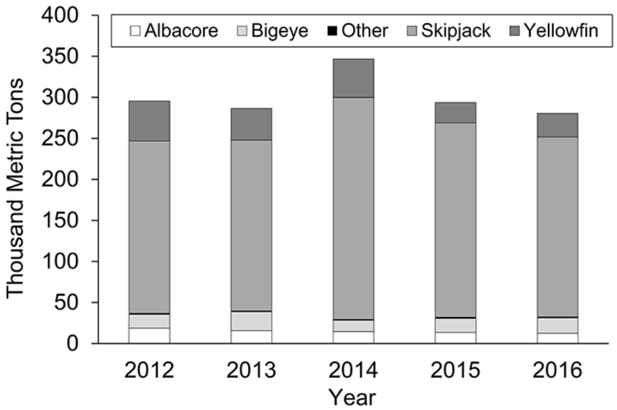


Figure 74.—U.S. tuna landings, 2012–16.

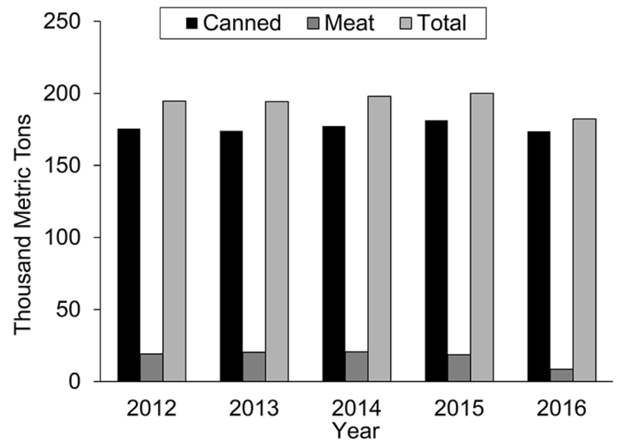


Figure 75.—U.S. tuna production, 2012–16.

Table 21.—U.S. tuna export and import volume (thousand metric tons), real value (million U.S.$), and real price (U.S.$/lb); the share of U.S. export and import volume and value with top trade partners; 2012–16 (Real 2016 USD).1

			2012	2013	2014	2015	2016
Export volume K mt			20.18	20.75	16.63	16.31	17.99
Export value M 2016 US$			$78.3	$73.7	$62.0	$63.7	$59.4
Export price/mt 2016 US$			$3,882	$3,551	$3,724	$3,909	$3,301
Import volume K mt			276.19	275.53	282.58	262.27	255.00
Import value M 2016 US$			$1,817.1	$1,705.9	$1,569.7	$1,463.8	$1,418.3
Import price/mt 2016 US$			$6,579	$6,191	$5,555	$5,581	$5,562
Thailand	Import	Volume share	38%	39%	38%	36%	35%
		Value share	33%	33%	31%	27%	26%
Indonesia	Import	Volume share	7%	7%	7%	9%	9%
		Value share	9%	9%	10%	12%	12%
Vietnam	Import	Volume share	9%	9%	8%	10%	11%
		Value share	10%	9%	9%	11%	11%
Ecuador	Import	Volume share	8%	7%	7%	8%	8%
		Value share	8%	8%	8%	9%	8%
Canada	Export	Volume share	29%	52%	29%	19%	50%
		Value share	25%	41%	31%	19%	40%
Spain	Export	Volume share	20%	16%	28%	30%	17%
		Value share	18%	14%	24%	23%	17%

[1]Source: NOAA/NMFS Fish. Stat. Div., Foreign Trade Div. U.S. Census Bur. (http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index). The GDP Implicit deflator was used for the real price adjustment (base year 2016) (https://fred.stlouisfed.org/series/GDPDEF).

(owned by the Thai firm Thai Union, number three in the U.S. market), and Tri-Marine (also the second largest global tuna trading company behind FCF, with the trading arm now owned by the Bolton Group). Private labels are also important (in March 2018, private label's market share was 11.8%), and the largest processors dominate the private label production. The four U.S. processors produced 1,285 t/day in 2017, comprised of 835 t/day loin only and 450 t/day less loin only, and 3% of global annual production of canned tuna/cooked loins.[22] Finished goods for the U.S. market are sourced from two loin-only plants based in the U.S. mainland (Chicken of the Sea in Lyons, Georgia, and Bumble Bee in Santa Fe Springs, California) and from the U.S. territory, American Samoa.

Trade

U.S. trade in tuna products is dominated by imports, with import volumes more than ten times the size of export volumes (Table 21; Fig. 76). This disparity has resulted in an average net export deficit of $1.53 billion between 2012 and 2016 (Fig. 77). Primary export countries for U.S. tuna products include Canada, Spain, and Japan (Table 22). Over the 2012–16 time frame, the net exports deficit has been falling due to a decrease in the deficit in canned tuna, which fell from 1.2 billion in 2012 to 0.8 billion in 2016 (Fig. 77). Finished goods are also imported from around 35 countries—the most significant import suppliers comprised of Thailand, Ecuador, Vietnam, Indonesia, and Philippines (Tables 21, 23; Fig. 78). In 2016, 255,000 t of tuna were imported, representing an overall 8% decline since 2012 (276,000 t) (Table 21). Thailand remains the largest supplier of tuna products to the U.S. market, accounting for 37% of total imports in 2012–16. Indonesia, Vietnam, Ecuador, Philippines, and China constituted the next largest suppliers (8%–10% on average), with their share of volumes generally increasing from 2012 to 2016. Frozen cooked loin import volumes have declined since 2013, with Fiji as a significant supplier of albacore loins in the range of 11,000–12,000 t/yr. The top-three importing countries of canned tuna in both quantity and value are United States, France, and the United Kingdom (U.K.), which purchase over one-third of world imports. About 45% of the

[22]Bumble Bee Tuna, personal communication.

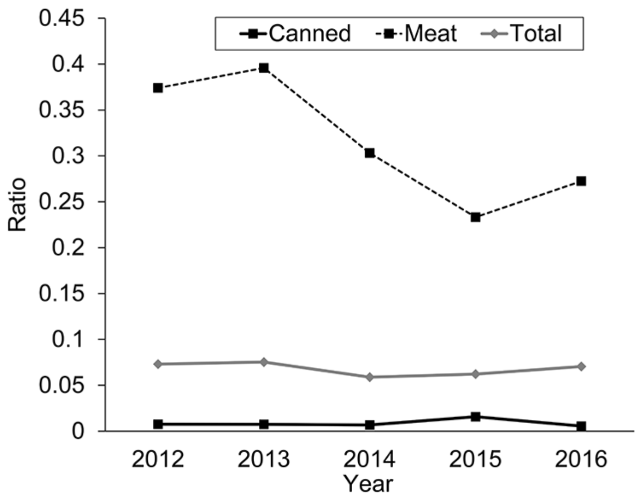


Figure 76.—Export/import volume ratio of tuna, 2012–16.

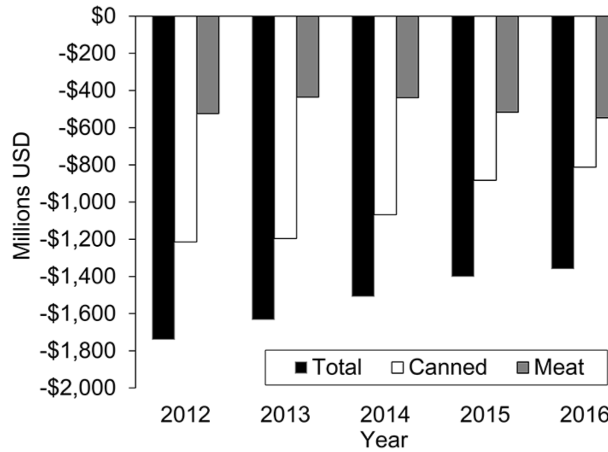


Figure 77.—Net exports of tuna, 2012–16 (Real 2016 USD).

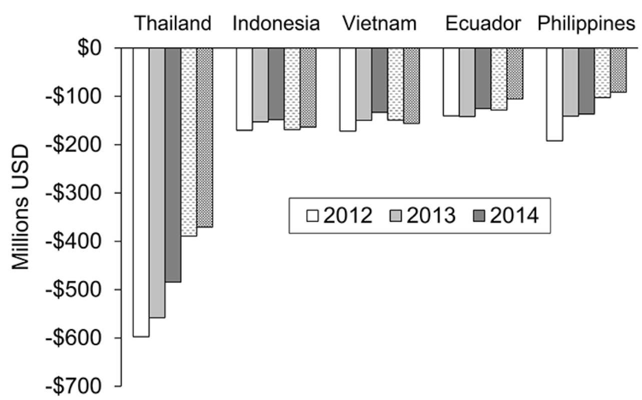


Figure 78.—Net exports of tuna to top five countries, 2012–16 (Real 2016 USD).

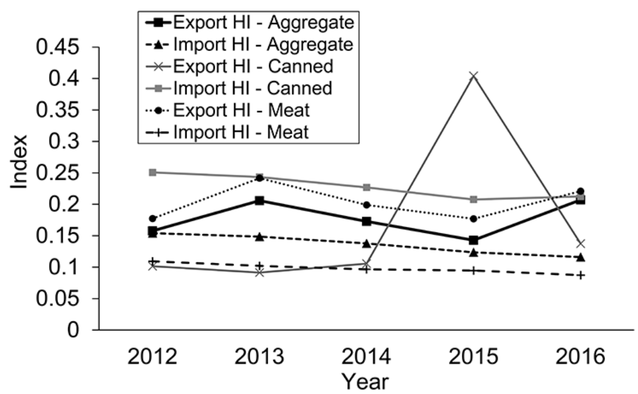


Figure 79.—Concentration indices of U.S. tuna trade with other countries, 2012–16.

U.S. canned tuna imports come from Thailand (where as noted, the United States is the second largest supplier, so that it imports some of its own harvest but is processed in Thailand), contributing to relatively high import concentration indices (Fig. 79).

Both global and U.S. production are part of a complex globally sourced and produced value chain. Catching and various stages of processing are spread around the globe to take advantage of production sources, labor costs, and economies of scale due to the high fixed costs of production and canning and pouch production. It is common practice in the European and U.S. industries to locate the first steps of processing in developing countries close to the main landing areas and then export semi-processed products to the facilities in developed countries for completing the process up until final distribution and consumption. These networks involve the trade of a wide variety of product forms across countries, which may vary in their levels of processing. These features of the supply chain result in a significantly higher import price for meat (loins) than the export price, while import and export prices of canned products are more similar (Fig. 80). Price differentials may have been influenced by the rising exchange rate as captured by the real effective exchange rate index (Fig. 81). Global tropical tuna ex-vessel markets are integrated by prices and to a lesser extent by commodity flows. Bangkok tends to exert price leadership for tropical tuna ex-vessel prices, with lesser influence from Ecuador.

The United States position as a primary destination for global tuna imports can be seen by looking at the share of global import value (Fig. 82). The United States accounted for an average of 12% of the global tuna import activity from 2012 to 2016. The U.S. share of global export value was less than 1%, which is in part driven by the

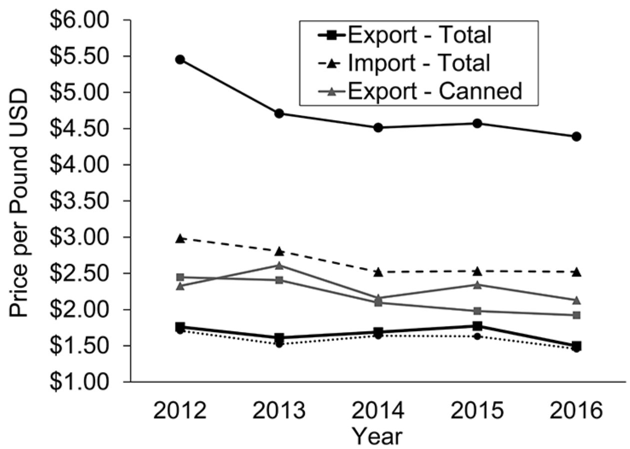


Figure 80.—Export and import prices of tuna products, 2012–16 (Real 2016 USD).

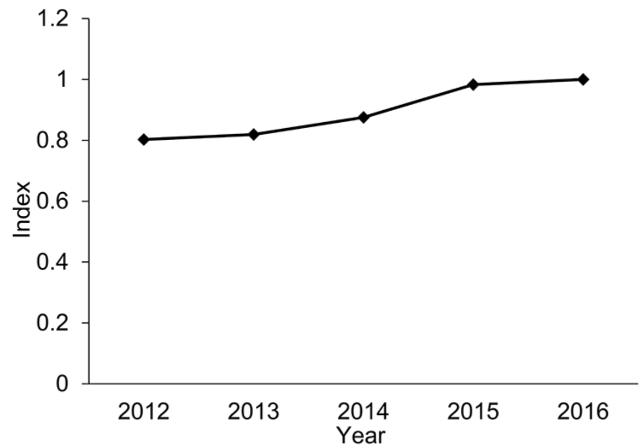


Figure 81.—Real effective exchange rate index for tuna, 2012–16.

landing and supply chain features described above. As a measure of competitiveness Figures 83 and 84 plot the export and import value growth of the United States compared to the global growth (excluding the U.S.). Since 2012, the U.S. export growth is generally below the RoW (except for 2015) indicating that the U.S. export value generally grew more slowly than globally. This is not surprising given the minimal role the United States plays in global exports. As an import destination, global and U.S. import growth tracked more closely. In three of the five years import growth in the U.S. was higher than the RoW (Fig. 84). Figure 84 also shows that in 2013–15 import value was declining not only in the U.S. but globally.

Table 22.—Tuna multilateral export quantity indices (2012–16).

Year	Indonesia	France	China	Vietnam	Ecuador	Thailand	Japan	Spain	Canada
2012	0.63	1.48	2.30	1.40	1.00	6.74	14.2	14.5	21.0
2013	0.67	0.77	1.80	1.50	1.70	2.34	4.7	12.2	39.0
2014	0.82	1.38	1.90	1.13	5.10	1.10	4.6	16.8	17.0
2015	0.79	1.28	1.70	5.39	2.10	8.23	3.0	17.7	11.0
2016	0.79	1.03	1.50	3.32	2.60	0.83	1.8	11.0	33.0

Table 23.—Tuna multilateral import quantity indices (2012–16).

Year	Mexico	Mauritius	Fiji	Ecuador	China	Philip- pines	Indo-nesia	Vietnam	Thailand
2012	0.30	0.26	0.59	1.00	0.88	1.32	1.0	1.3	4.9
2013	0.25	0.34	0.64	0.93	1.07	1.11	1.0	1.2	4.9
2014	0.36	0.37	0.58	0.87	1.33	1.26	1.1	1.2	5.0
2015	0.32	0.33	0.62	1.03	1.11	0.99	1.2	1.3	4.3
2016	0.38	0.35	0.68	0.93	0.95	0.74	1.3	1.4	4.1

Apparent Consumption

The United States is the world's second largest shelf-stable tuna market (after the European Union), consuming over 30 million cases at a value of USD 1.8 billion in the 12-month period from March 2017–18.[22] Shelf-stable tuna products account for almost 75% of total shelf-stable seafood sales. The United States primarily consumes shelf-stable products, which is predominately lightmeat tuna (dominated by skipjack and to a much lesser extent yellowfin and necretic species such as tongol) and albacore in cans and, to a much smaller degree, the higher-valued foil pouches. U.S. consumers have a strong preference for canned albacore over other types of canned tuna, consuming over half of the world's supply of albacore as canned tuna each year. U.S. consumers also prefer skipjack-based lightmeat tuna, since skipjack is the cheapest type of tuna and is low in mercury. By contrast, canned yellowfin accounts for only 1%–2% of U.S. canned tuna consumption each year. Albacore dominates yellowfin as the premier canned tuna in the U.S. market. Supermarkets dominate shelf-stable sales (cans, pouches).

Apparent consumption of processed tuna (measured as the total of U.S. domestic production of finished goods products and imports minus exports) was between 419,000 and 464,000 t in 2012–16, with apparent consumption declining in 2015 and 2016 as a result of decreasing consumption of canned tuna (Fig. 85). Canned tuna represents just under 90% of consumption volume, much like its share of imports. The United States consumes 2–3 times more finished goods tuna than is produced domestically (Fig. 86). Current domestic production of finished goods tuna only directly supplies as much as 4% of apparent consumption (Fig. 87). The U.S. shelf-stable tuna market is supplied by two canning-only plants (i.e., that import frozen loins) in the mainland and from the U.S. territory American Samoa, where whole round is also processed, and by finished goods imports from around 35 countries. Some of the partially process and finished goods imports include tuna

Figure 82.—U.S. share of global trade value activity, 2012–16 (Real 2016 USD).

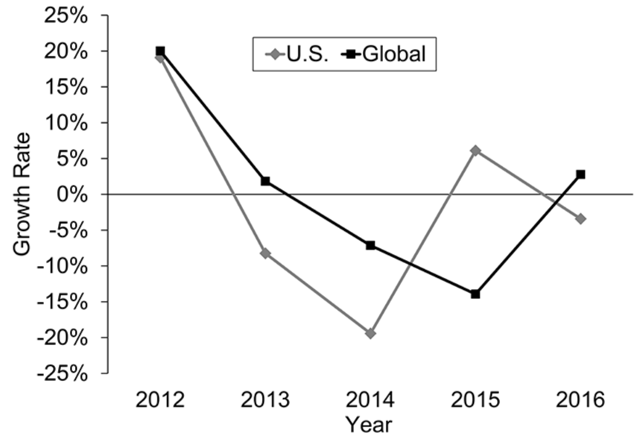


Figure 83.—Export value growth of the U.S. and rest of world, 2012–16.

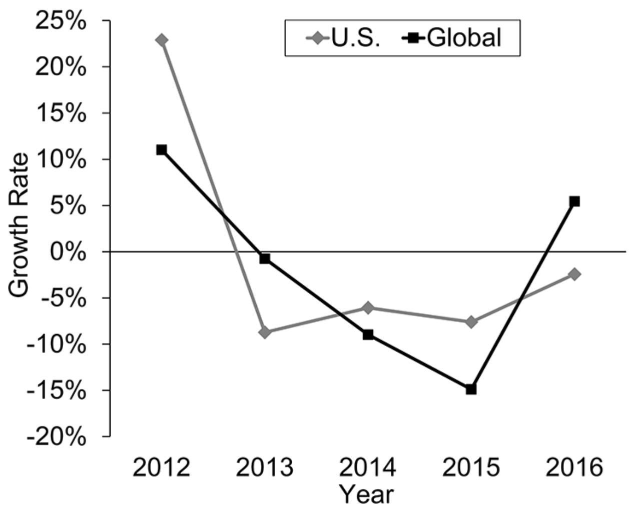


Figure 84.—Import value growth of the U.S. and rest of world, 2012–16.

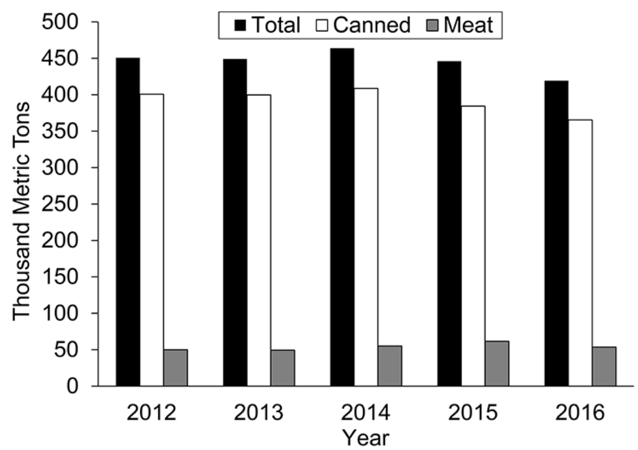


Figure 85.—U.S. apparent consumption of tuna, 2012–16.

caught and landed by U.S. flagged vessels in foreign ports or transshipped to foreign ports.

Starkist is the market leader in the United States with a 37% share of the U.S. canned tuna market in total and 30% of the albacore market, second in the latter to Bumble Bee. Starkist is also the market leader in the pouch segment which, despite an overall decline in shelf-stable tuna sales in the United States, has been growing with around 17% of all shelf-stable tuna sales coming from pouches by 2016, up from 13% in 2013. Although 90% of Starkist's sales still come from canned tuna, the higher value-added pouch segment is an important, and growing, market segment. Niche marketing through specialized separate brands (Bella Portofina and Blue Harbor) is an emerging component of Starkist's portfolio. Bumble Bee is number two in the U.S. market, accounting for 25% of the category in value sales and 23% in volume. While the U.S. shelf-stable market has been shrinking in sale in recent years, Bumble Bee's share of volume has stayed relatively stable. Chicken of the Sea remains a low-margin follower brand, especially vis-à-vis StarKist with whom it competes more directly on canned light meat (especially skipjack), with Bumble Bee tending to specialize in canned white meat (albacore). The mercury and methyl mercury contents of canned tuna has continuously and adversely affected U.S. tuna sales for the past forty years. Eco-

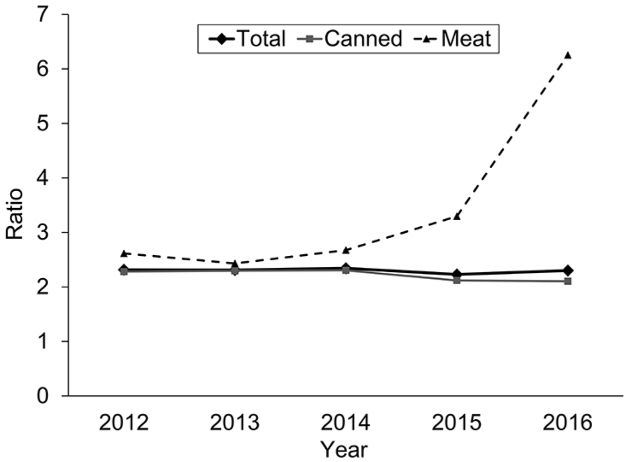


Figure 86.—Apparent consumption relative to U.S. consumption of tuna, 2012–16.

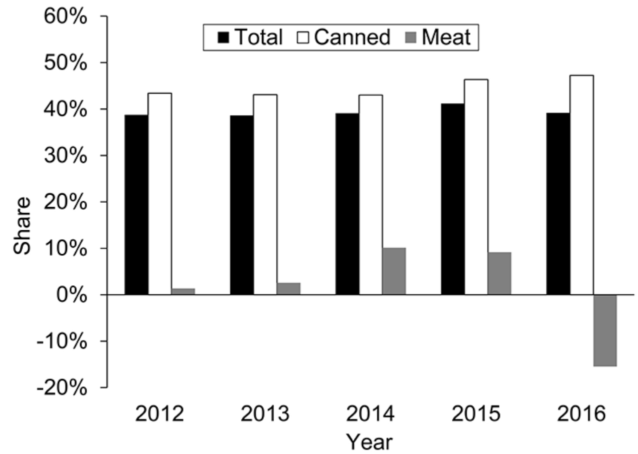


Figure 87.—Unexported U.S. production relative to apparent consumption for tuna, 2012–16.

labeling and product certification are growing in importance for canned tunas, although they are not currently an industry standard, and apply to various albacore. U.S. canned tuna brands have faced legal challenges for under-filling cans and for collusion in a price-fixing scheme. In addition to costly fines and settlement claims and sentencing of company executives, the brands' reputations have suffered in the market place. The price-fixing scheme has led to the filing for bankruptcy and the likely sale of Bumble Bee to FCF.

This section authored by Dale Squires, NMFS Southwest Fisheries Science Center; Ben Fissel, NMFS Alaska Fisheries Science Center; and Mike Dalton, NMFS Alaska Fisheries Science Center.

U.S. Scallop Seafood Trade

Domestic and Global Production

U.S. scallop production consists entirely of wild-caught scallops, with the majority being landed in the northeastern region. There are four species of scallops which comprise U.S. landings—bay scallop, sea scallop, calico scallop and weathervane scallop. Sea scallop is the dominant species landed, with over 18,375 t (meat weight) landed in 2016, valued at $486 million. The only other type of scallop landed in 2016 was bay scallop, with 62.6 t of landings, and a dockside value of $2.9 million.[23] The high value of sea scallops propelled New Bedford, Massachusetts, to the number one ranking in value of U.S. fishing ports in 2014 and 2015 (Fisheries of the U.S., 2016).

In terms of world production, the United States consistently produced over 20% of the world's wild caught scallops between 2012 and 2016 (Table 24). However, when aquaculture produced scallops are included in worldwide totals, the United States produced less than 10% of the total. Between 2012 and 2016, U.S. wild catch declined from 214,000 t to 153,000 t (live weight). Overall world wild catch also declined during this time period. Concurrently, world aquaculture production increased from 1,520,000 t to 2,127,000 t. Aquaculture production of scallops is becoming more important as a supply source to world markets, and the importance of wild-caught scallops in overall supply is declining. Consequently, U.S. wild production is becoming less important in the overall world supply.

Trade

The U.S ran a trade deficit in scallop products between 2012 and 2016. The ratio of scallop export quantities to scallop import quantities, was never greater than one (Fig. 88), meaning export quantities were always less than import quantities during this time period. Between 2012 and 2013 the ratio declined substantially, indicating an increase in imports relative to exports, while the ratio was fairly stable between 2013 and 2016. The same trend can be seen in the net export value, which measures the difference be-

Table 24.—World scallop production (live weight) and export/import volumes (meat weight) and values 2012–16.[1]

			Year				
			2012	2013	2014	2015	2016
World wild catch K mt			749	746	740	575	569
World aquaculture K mt			1,651	1,868	1,915	2,082	2,127
Total production K mt			2,401	2,614	2,654	2,657	2,696
U.S. wild catch K mt			216	156	130	135	153
U.S. share of wild catch (%)			29%	21%	18%	24%	27%
U.S. share of global production (%)			9%	6%	5%	5%	6%
Export volume K mt			13.04	9.62	9.10	7.63	8.27
Export value M US$			205.14	156.75	144.16	138.02	149.51
Export price $/LB			7.13	7.39	7.19	8.20	8.20
Import volume K mt			15.63	27.61	27.51	22.36	23.15
Import value M US$			238.08	387.16	402.96	354.02	328.48
Import price $/LB			6.91	6.36	6.64	7.18	6.44
Canada	Export	Volume share	33%	35%	31%	32%	28%
		Value share	26%	30%	28%	27%	24%
	Import	Volume share	18%	15%	16%	17%	15%
		Value share	28%	26%	29%	28%	28%
France	Export	Volume share	19%	16%	14%	11%	10%
		Value share	23%	17%	13%	12%	11%
Netherlands	Export	Volume share	5%	7%	15%	24%	21%
		Value share	6%	8%	15%	27%	24%
Japan	Import	Volume share	25%	21%	23%	21%	15%
		Value share	37%	32%	36%	34%	29%
China	Import	Volume share	28%	27%	38%	41%	48%
		Value share	15%	14%	18%	22%	26%

[1]Source: FAO (http://www.fao.org/fishery/en/statistics), accessed 10/23/2018). NOAA/NMFS, Fish. Stat. Div., Foreign Trade Div. (http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index). The GDP Implicit deflator was used for the real price adjustment (base year 2016) (https://fred.stlouisfed.org/series/GDPDEF).

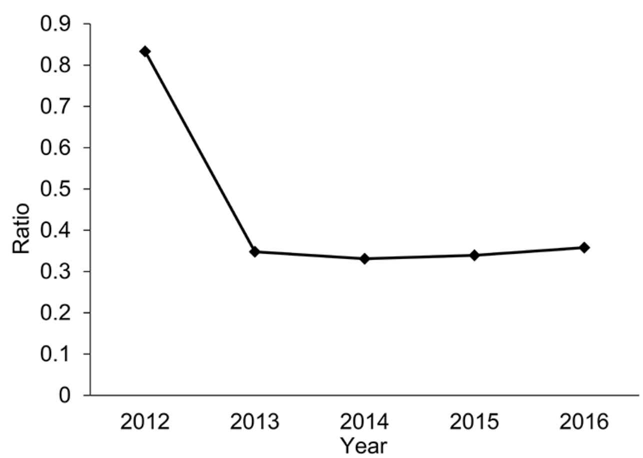


Figure 88.—Export/import volume ratio of scallops, 2012–16.

[23]https://foss.nmfs.noaa.gov/apexfoss, data extracted Oct. 30, 2018

tween the value of exports and that of imports (Fig. 89). In all years, the net export value was negative, and there was a large drop between 2012 and 2013. After 2014, there was an upturn in the trend indicating increasing export value relative to import value. The three most important export countries in 2016 were Canada, Netherlands, and Belgium. The three most important import countries in 2016 were China, Canada, and Japan. The value of imports from Canada exceeded the value of exports to Canada for all years during 2012 to 2016.

A multilateral export quantity index by export country was constructed for the years 2012–16 (Table 25). Canadian exports in 2012 were set as the denominator, as Canada is our most important trading partner for scallops, and all country-year combinations are in reference to Canada in 2012. All countries, with the exception of the Netherlands and Vietnam showed declining exports from the United States between 2012 and 2016. Although exports to Canada declined during this time period, it was still the dominant country in terms of U.S. exports. Similarly, a multilateral import quantity index was constructed with Canadian imports in 2012 as the denominator (Table 26). Different countries were in this index, which reflects the fact that the important countries in terms of U.S. exports are different than important countries in terms of imports. In terms of imports, China was the most dominant country in the index, and imports from China more than doubled during this time period. Chinese imports were triple the volume from Canada in 2016. Imports from Canada increased until 2014, and then declined the last two years of the time series. Imports from Japan followed this same pattern, with increasing imports until 2014, and then a decline the following two years. Overall, the time period saw both increasing volumes of imports from most countries, and the increasing dominance of imports from China.

In terms of export value, the five most important trading partners were Belgium, Canada, France, the Netherlands, and the United Kingdom (U.K.). With the exception of Canada, the United States had a positive net export value (export value minus import value) with all the other countries (Fig. 90). The Netherlands was the only country which showed increasing net export value during this time period and reflects the same trend shown in the multilateral export quantity index. The net export value to Canada increased between 2012 and 2014, before declining during the last two years. This may be partially due to an increasing real effective exchange rate (Fig. 91) which means that U.S. sourced scallops are becoming more expensive to import for our trading partners.

The United States participation in global scallop trade activity is measured by the share of global export and import value (Fig. 92). In 2016, U.S. import value accounted for about

Table 25.—Lowe multilateral export quantity index for scallops, 2012–16.

Year	Australia	China	Denmark	Belgium	Canada	France	Netherlands	U.K	Vietnam
2012	0.082	0.0210	0.080	0.32	1.00	0.58	0.16	0.24	0.0059
2013	0.043	0.0060	0.051	0.21	0.76	0.34	0.17	0.26	0.0069
2014	0.027	0.0068	0.052	0.24	0.64	0.29	0.35	0.18	0.0055
2015	0.041	0.0195	0.011	0.15	0.55	0.19	0.45	0.11	0.0141
2016	0.055	0.0292	0.050	0.16	0.52	0.20	0.43	0.14	0.0442

Table 26.—Lowe multilateral import quantity index for scallops, 2012–16.

Year	Argentina	Chile	China	China – H.K.	Canada	Japan	Peru	Philippines	Vietnam
2012	0.66	0.039	1.6	0.012	1.0	1.4	0.40	0.268	0.0133
2013	1.24	0.054	2.6	0.028	1.5	2.1	2.00	0.113	0.0247
2014	0.78	0.016	3.8	0.012	1.6	2.3	1.06	0.048	0.0081
2015	0.93	0.040	3.2	0.025	1.4	1.7	0.34	0.107	0.0172
2016	0.96	0.086	3.9	0.044	1.3	1.3	0.11	0.327	0.0718

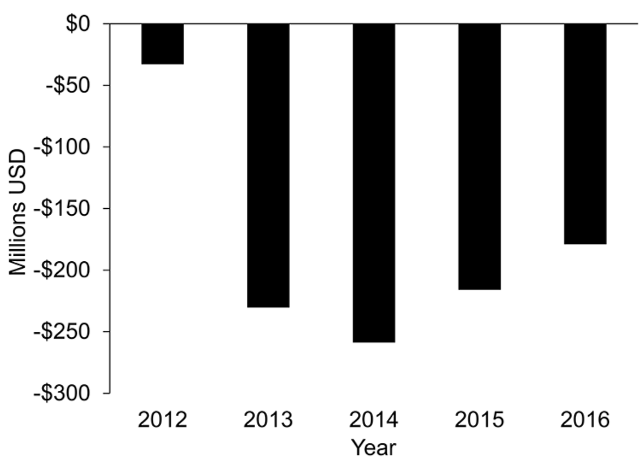


Figure 89.—Net exports of scallops, 2012–16 (Real 2016 USD).

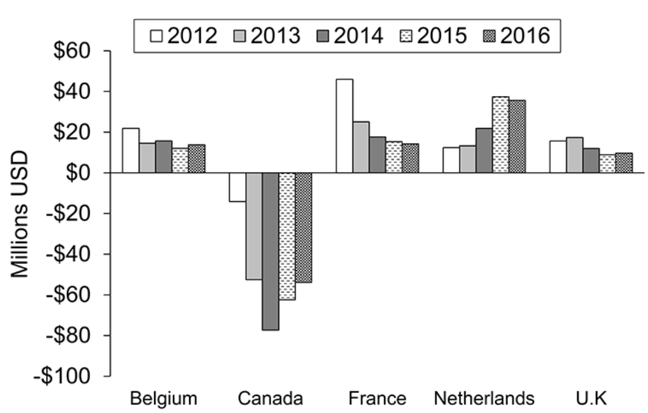


Figure 90.—Net exports of scallops to top five countries, 2012–16.

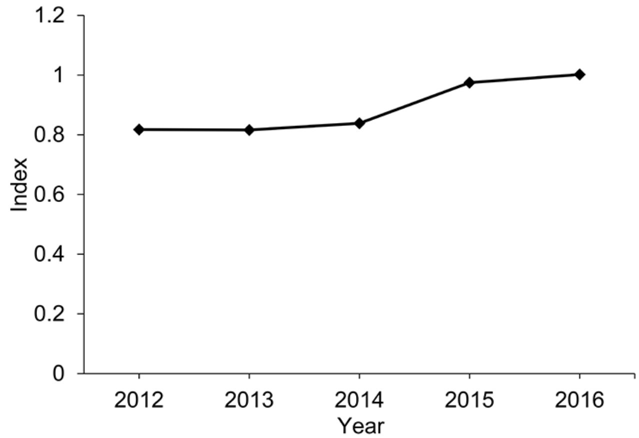


Figure 91.—Real effective exchange rate index for scallops, 2012–16 (Real 2016 USD).

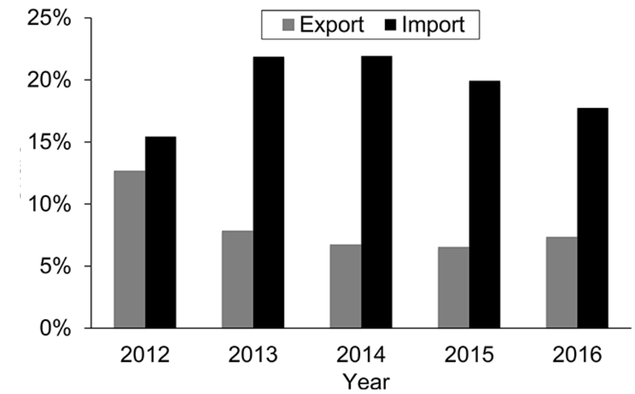


Figure 92.—U.S. share of global trade value activity, 2012–16.

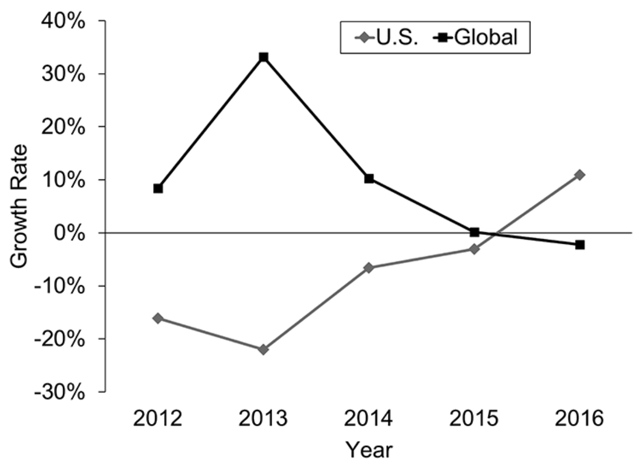


Figure 93.—Export value growth of the U.S. and rest of the world, 2012–16.

Figure 94.—Concentration indices of U.S. scallop trade with other countries, 2012–16.

18% of global imports, while export value was about 7%. The U.S. share of global import value increased since 2012, while the U.S. share of global export value declined in 2013, and then remained relatively stable in the period 2014–16. As a measure of export competitiveness, Figure 93 plots the scallop export growth rate of the United States which can be compared to the global (excluding the U.S.) export growth. Since 2014, the gap between U.S. export growth and world export growth narrowed. In 2016, U.S. export growth was higher than the world export growth, indicating that in 2016, U.S. scallop exports were more competitive than the rest of the world.

A measure of concentration for both exports and imports to individual countries was constructed using the Herfindahl Index (HI) for the years 2012–16 (Fig. 94). Both indices were relatively flat, showing that exports and imports were not becoming more concentrated in one country. The slight declines in both the HI for exports and imports in 2016 was consistent with the relative export value growth which showed U.S. scallops becoming more competitive in world markets.

Apparent Consumption

Apparent consumption of scallops is measured as the total of landings plus imports minus exports (Fig. 95). U.S. consumption of scallops was between 29,000 t and 37,000 t from 2012 to 2016. Peak consumption of scallops occurred in 2013, declined slightly until 2015, and then rose again in 2016. Relative to U.S. production, far more scallops were consumed than produced from wild harvests (Fig. 96). In

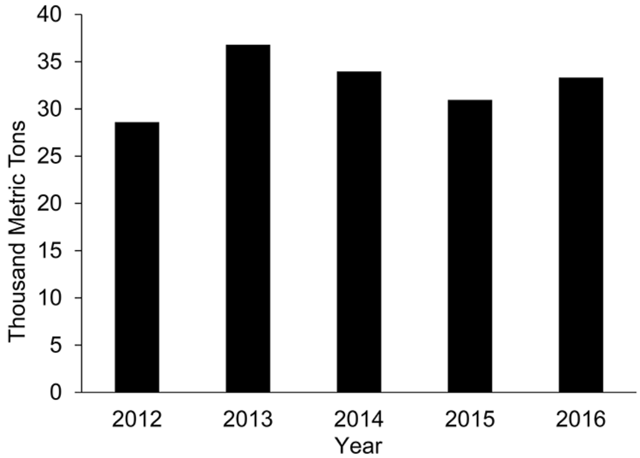


Figure 95.—U.S. apparent consumption of scallops, 2012–16.

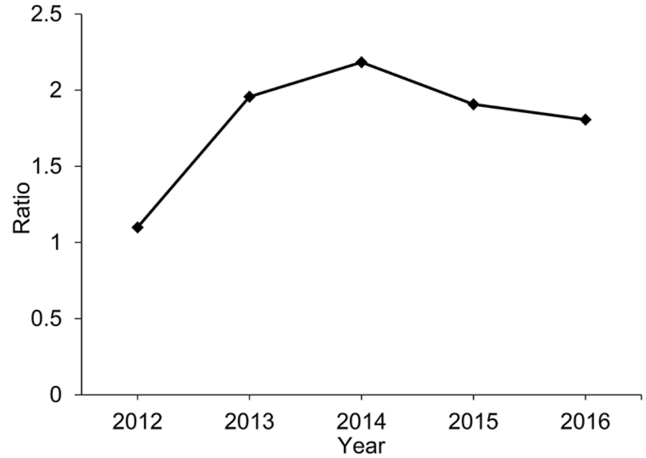


Figure 96.—U.S. scallop consumption relative to production, 2012–16.

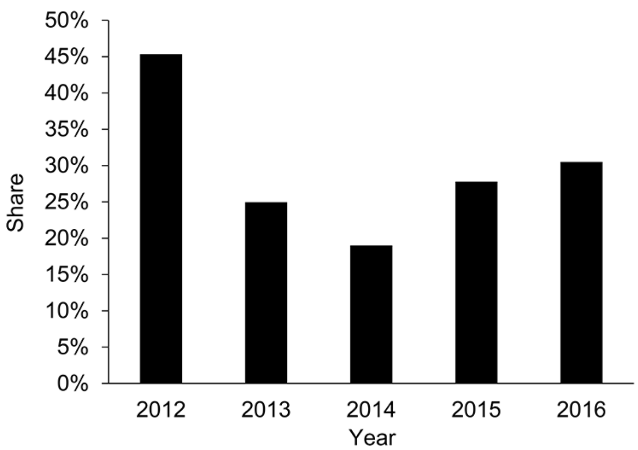


Figure 97.—U.S. production's share of apparent consumption, 2012–16.

2014, more than twice as many scallops were consumed as harvested from U.S. waters, which was a doubling of the ratio that existed in 2012. Figure 97 confirms this trend and shows that U.S. wild harvests produced about 45% of what was consumed in 2012, and that level declined to less than 20% in 2014, before increasing to a little over 30% in 2016.

This section authored by John Walden, NMFS Northeast Fisheries Science Center.

U.S. Crab Seafood Trade

Domestic and Global Production

The United States is a major global producer, and consumer, of crab seafood products. Commercially important crab fisheries occur in waters off all coastal regions of the country including East and West Coasts, Gulf of Mexico, and Alaska. Six species, or species groups (spp.), were selected to represent U.S. crab landings. These species accounted for 98% of all U.S. crab landings by average annual weight in 2012–16 based on NMFS landings data. The selected species include blue crab, *Callinectes sapidus;* Dungeness crab, *Cancer magister;* Jonah crab, *Cancer borealis*; king crabs, *Lithodes spp.*; snow and Tanner crabs, *Chionoecetes spp.*; and stone crab, *Menippe mercenaria.* The remaining 2% of U.S. crab landings consisted primarily of four species: Atlantic rock crab, *Cancer irroratus*; red rock crab, *Cancer productus*; and Atlantic horseshoe crab, *Limulus polyphemus*, each with 0.6% share, and deepsea golden crab, *Chaceon fenneri*, with 0.2% share, of the average annual weight of all U.S. crab landings in 2012–16.

The United States produced 38% of the average annual global production for selected crab species in 2012–16, followed by Canada with 25%, Russia with 16%, and Korea with 11%.[24] Figure 98 presents the total volume of U.S. production for these species for each year in 2012–16. Landed crab are typically processed into cooked/frozen sections, or processed further into crabmeat, and consumed domestically or exported.

Altogether, 22 states reported landings in 2012–16 for the selected crab species. Overall, eastern U.S. landings were 54%, and western U.S. landings were 46%, of the average annual total U.S. landed weight in 2012–16 for the selected crab species (Tables 27, 28). Western U.S. landings were 64%, and eastern U.S. landings were 36%, of the average annual dollar value of U.S. landings for the selected crab species in 2012–16 (Tables 29, 30).

By state, Louisiana and Maryland were tied, each with 22%, followed by Florida with 16%, and North Carolina and Virginia, each with 12%, of the average annual real value for eastern U.S. crab landings in 2012–16 (Table 29). Alaska generated 57%, Washington 17%, California 16%, and Oregon 10% of the average annual real value of western U.S. crab landings in 2012–16 (Table 30).

Blue crab was the most valuable eastern U.S. crab species with 84%, and stone crab was next with 12% of

Table 27.—Eastern U.S. Landings of selected crab species in metric tons (mt) 2012–16. (Source: NMFS, https://foss.nmfs.noaa.gov).

State	2012	2013	2014	2015	2016
Blue					
Alabama	601	465	537	590	870
Connecticut	0	0	0	0	0
Delaware	2,073	1,129	907	963	2,066
Florida	3,523	3,147	2,777	3,019	2,617
Georgia	1,935	1,459	1,210	1,331	1,504
Louisiana	21,013	17,777	19,604	18,737	18,189
Maryland	19,839	10,968	11,199	13,006	16,662
Mississippi	355	163	259	362	350
New Jersey	3,353	1,992	1,466	3,287	3,091
New York	54	49	127	101	112
North Carolina	12,150	10,071	11,898	14,573	11,550
South Carolina	2,675	2,328	1,738	1,699	1,984
Texas	1,294	863	1,014	1,965	2,288
Virginia	15,034	11,003	10,979	13,463	12,885
Jonah					
Connecticut	1	23	23	3	0
Maine	253	172	156	140	274
Maryland	7	0	70	18	7
Massachusetts	3,420	4,579	5,379	4,126	4,834
New Hampshire	0	155	184	0	68
New Jersey	31	4	15	31	118
New York	1	0	3	0	75
Rhode Island	1,491	1,995	1,873	1,751	1,665
Virginia	0	0	0	1	1
Stone					
Florida	2,396	1,754	907	1,278	1,385
Georgia	1	1	0	0	0
Louisiana	1	0	0	0	2
North Carolina	2	3	3	4	4
South Carolina	28	29	17	21	15
Texas	10	4	0	1	2
Total (mt)	91,541	70,133	72,344	80,470	82,618

Table 28.—Western U.S. landings of selected crab species in metric tons (mt) 2012–16. (Source: NMFS, https://foss.nmfs.noaa.gov).

Species/State	2012	2013	2014	2015	2016
Dungeness					
Alaska	1,164	1,233	2,426	1,629	1,217
California	11,692	14,102	8,363	1,411	12,099
Oregon	3,932	11,801	5,402	1,032	7,122
Washington	7,525	12,721	8,770	6,818	8,666
King					
Alaska	7,419	7,000	7,554	7,946	6,613
California	1	0	5	6	6
Snow-Tanner					
Alaska	42,180	31,269	28,623	45,403	23,289
California	0	0	0	0	0
Washington	0	1	1	8	1
Total (mt)	73,913	78,127	61,144	64,252	59,015

[24]FAO capture production statistics www.fao.org/fishery/statistics-query/en/capture.

Table 29.—Eastern U.S. landings of selected crab species in thousands of real (2016) dollars ($000s) 2012–16. (Source: NMFS, https://foss.nmfs.noaa.gov; BEA GDP deflator, series A191RD3A086NBEA from St. Louis Federal Reserve Bank, https://fred.stlouisfed.org).

State	2012	2013	2014	2015	2016
Blue					
Alabama	1,106	1,079	1,348	1,238	1,784
Connecticut	1	1	1	1	1
Delaware	7,060	4,764	4,474	4,547	9,145
Florida	10,708	11,083	11,032	12,264	10,380
Georgia	4,512	4,137	3,852	4,286	3,991
Louisiana	46,528	53,686	68,157	58,704	49,408
Maryland	64,056	52,008	53,997	52,595	54,534
Mississippi	767	433	1,019	1,222	895
New Jersey	10,603	8,444	4,235	8,799	5,670
New York	255	159	584	432	469
North Carolina	24,161	31,239	34,767	34,352	24,116
South Carolina	6,138	6,626	5,946	4,880	5,543
Texas	3,049	2,427	3,116	5,595	6,478
Virginia	26,019	24,977	27,635	33,466	41,162
Jonah					
Connecticut	2	37	38	5	0
Maine	231	194	106	160	310
Maryland	8	0	118	74	57
Massachusetts	5,904	9,485	9,480	6,970	8,184
New Hampshire	0	246	295	0	105
New Jersey	60	5	20	41	212
New York	1	0	4	0	129
Rhode Island	2,434	3,311	3,165	2,684	2,875
Virginia	0	0	0	2	1
Stone					
Florida	25,824	26,401	29,407	37,007	30,563
Georgia	2	2	0	0	0
Louisiana	11	4	3	3	6
North Carolina	18	19	20	23	22
South Carolina	145	183	108	141	98
Texas	102	51	0	16	27
Total ($000s)	239,703	241,000	262,934	269,508	256,163

Table 30.—Western U.S. landings of selected crab species in thousands of real (2016) dollars ($000s) 2012–16. (Source: NMFS, https://foss.nmfs.noaa.gov; BEA GDP deflator, series A191RD3A086NBEA from St. Louis Federal Reserve Bank, https://fred.stlouisfed.org).

State	2012	2013	2014	2015	2016
Dungeness					
Alaska	6,812	7,072	16,387	10,854	8,299
California	90,720	92,599	68,371	17,196	83,235
Oregon	30,903	74,133	49,194	12,042	55,737
Washington	63,015	90,070	82,258	73,405	75,370
King					
Alaska	96,175	86,274	87,395	99,728	104,601
California	3	4	53	62	69
Snow-Tanner					
Alaska	189,124	146,247	139,203	176,810	105,863
California	0	0	0	0	0
Washington	0	4	3	40	6
Total ($000s)	424,827	458,002	424,211	381,743	433,178

the average annual real value of eastern U.S. crab landings in 2012–16 (Table 29). Dungeness crab was the most valuable crab species in western U.S. landings with 45% of the average annual real value of western U.S. crab landings in 2012–16 (Table 30). Snow and Tanner crab comprised 34%, and king crabs, mainly Alaskan red king crab, *Paralithodes camtschaticus*, and golden king crab, *L. aequispinus*, made up the remaining 21% of the average annual real value of western U.S. crab landings in 2012–16. A small commercial fishery for blue king crab, *P. platypus*, operates around St. Matthew Island in the northern Bering Sea off the coast of Alaska, and minor amounts of scarlet king crab, *L. couesi*, are landed in California.

Global production of the selected crab species involves 11 other countries (Table 31). Of the average annual global production of blue crab in 2012–16, the U.S. produced 78%, followed by Mexico with 16%. The United States produced 88% of the average annual global production of Dungeness crab in 2012–16. In these years, the United States produced 17% of the average annual global volume of king and stone crabs, behind Russia with 56%, and ahead of Chile with 14%. The United States produced 16% of the average annual global production of snow and Tanner crabs in 2012–16, on par with Russia at 17%, but below Korea with 19%, and Canada with 44%.

Trade

This section reports official U.S. merchandise trade statistics from the Foreign Trade Division of the U.S. Census Bureau (www.census.gov/foreign-trade/index.html). These trade data include imports of *Callinectes* and *Portunidae* species as both may be marketed as blue crab. According to these data, crab products were exported from the United States to 99 different countries in 2012–16, with the bulk (90% by average annual volume) going to, in decreasing order, Canada, China, Japan, and Indonesia (Table 32). The United States imported crab products from 59 different countries in 2012–16, with the bulk of imports (78% by average annual volume) coming from, in decreasing order, Canada, Russia, Indonesia, and China (Table 32). Altogether, the U.S. traded crab products with 109 different countries in 2012–16.

Figure 99 shows a downward trend in U.S. export/import volume ratios for crab products in 2012–16. Likewise, Figure 100 shows a steady downward trend in net exports. Figure 101 displays net exports for the top 5 countries for each year in 2012–16. Only Japan exhibited a trade surplus for crab products in this period, which was dwarfed by deficits with Canada, Indonesia, Russia, and to a lesser extent, China. Figure 102 presents an effective exchange rate index for U.S. crab products, which increased in 2012–16, reflecting a general strengthening of the dollar that tends to make U.S. products more expensive in global markets. Figure 103 compares real unit prices for imports, and exports, of crab products for each year in 2012–16. Both series display an increasing trend.

Multilateral Lowe export and import indices were calculated to evaluate the importance of the top 7 countries to which the U.S. exported (Table 33), and the top 7 countries from which the U.S. imported, crab products in 2012–16 (Table 34). Each list of top 7 countries is based on the average annual real value of exports, or imports, in 2012–16. Indonesia is the base country for each index. The multilateral Lowe trade indices, described in the Appendix, are examples of "star methods" (Hill 1997:53) that require the selection of a single country for placement at the center of the star. Indonesia was selected based on net exports of crab to the top-5 countries (Fig. 101) of the crab case study where Indonesia is above Russia and Canada while below Japan and China. Canada was the most important U.S. trade partner for imports and exports of crab products in 2012–16. Imports from Canada were two to three times higher than Russia. Imports from Russia, Indonesia, and China were at least three times higher than other countries on the top 7 list for U.S imports in 2012–16. Japan is third with exports less than half of those to China, except in 2015.

Table 31.—Global production of selected crab species in metric tons (mt) 2012–16. (Source: FAO, http://www.fao.org/fishery/en/statistics).

Country	2012	2013	2014	2015	2016
Blue					
Cuba	389	354	306	310	260
Mexico	8,967	9,795	12,405	15,126	17,915
Nicaragua	182	418	611	817	820
United States	81,607	61,014	60,991	72,392	71,782
Venezuela	3,062	3,800	3,900	6,826	7,119
Dungeness					
Canada	2,942	3,031	3,862	4,261	3,369
United States	24,285	39,630	24,739	10,861	29,106
Jonah					
United States	5,281	7,218	7,733	6,154	6,966
King and Stone					
Argentina	4,522	4,077	3,449	4,140	2,508
Chile	6,490	5,743	6,207	5,975	5,583
Norway	1,437	1,321	1,695	2,175	2,639
Russia	15,977	23,572	23,487	25,706	30,047
United States	7,420	7,001	7,560	7,952	6,619
Snow-Tanner					
Canada	92,849	98,065	96,103	93,519	82,519
Korea	39,291	39,881	40,601	43,562	37,752
Russia	28,211	29,206	32,065	30,676	35,038
United States	42,199	31,293	28,646	45,433	23,317
Total (mt)	365,111	365,419	354,360	375,885	363,359

Table 32.—U.S. crab trade and global market data. Global production (thousand metric tons), U.S. share of global production, Canada share of global production, U.S. export and import volume (thousand metric tons), real value (million US$), and real price (US$/lb), the share of U.S. export and import volume and value with Canada, China, Indonesia, Japan, and Russia; 2012–16 (Real 2016 USD).

			2012	2013	2014	2015	2016
Global crab catch K mt			371	372	366	396	383
U.S. crab share of global catch			43%	39%	35%	36%	36%
Canada share of global catch			26%	27%	27%	25%	22%
Export volume K mt			38	31	30	22	23
Export value M US$			$283	$251	$274	$264	$285
Export price lb US$			$3.33	$3.64	$3.97	$5.31	$5.47
Import volume K mt			96	108	105	108	108
Import value M US$			$1,157	$1,253	$1,423	$1,510	$1,628
Import price lb US$			$5.45	$5.26	$6.17	$6.34	$6.86
Canada	Export	Volume share	42%	43%	46%	30%	40%
		Value share	32%	36%	35%	29%	33%
	Import	Volume share	42%	45%	43%	43%	40%
		Value share	32%	38%	32%	33%	36%
China	Export	Volume share	32%	34%	27%	30%	31%
		Value share	33%	32%	29%	28%	34%
	Import	Volume share	11%	10%	11%	10%	8%
		Value share	10%	10%	9%	9%	7%
Indonesia	Export	Volume share	5%	4%	4%	6%	6%
		Value share	6%	5%	5%	5%	5%
	Import	Volume share	11%	10%	10%	11%	13%
		Value share	17%	13%	16%	16%	14%
Japan	Export	Volume share	13%	10%	12%	21%	13%
		Value share	20%	17%	19%	25%	15%
Russia	Import	Volume share	13%	15%	15%	14%	16%
		Value share	13%	16%	16%	17%	22%

Apparent Consumption

Apparent consumption is defined as domestic production plus imports minus exports. Domestic production is calculated by applying product recovery rates to domestic landings for crab species described below. Due to rising imports and falling exports, Figure 104 displays a modest upward trend for apparent consumption for all crab products in 2012–16. Likewise, Figure 105 shows an increasing trend for U.S. crab production relative to apparent consumption. Figure 106 does not show a trend in the share of U.S. crab production in apparent consumption.

The Herfindahl-Hirschman index (HHI) represents the degree of concentration, or competition, with respect to trade partners. Results in Figure 107 indicate the concentration of exporters and importers did not change from 2012 to 2016.

The U.S. share of global trade activity for crab products is measured by the U.S. share of global export and import value. Figure 108 shows the U.S. global export share declined slightly, from 8% to 6%, while the global share of U.S. imports increased from 34% to 37%, in 2012–16.

Figure 109 shows the growth in the real dollar value of crab product exports was variable in 2012–16, and fluctuated between plus or minus 10%. In contrast, Figure 110 shows the real dollar value of crab product imports grew by at least 6% for each year in 2012–16.

Domestic Production Capacity

The selected crab species are fully utilized. Of the remaining crab species, only 39% of the deepsea golden crab allowable catch was harvested on average from 2012–16, leaving about 1.22 million lb, or about 550 t, unharvested each year.

Blue crab do not have catch limits or quotas on the eastern seaboard or in the Gulf of Mexico. However, blue crab landings have declined significantly from the Chesapeake Bay and along the coasts of South Carolina, Georgia, and the east coast of Florida, in recent years. Stone crab are also not subject to a quota or catch limit, but in Florida, have been managed under a trap certificate reduction program in order to reduce effort in the fishery.

Dungeness crab are managed jointly by California, Oregon, and Washing-

Table 33.—U.S. crab multilateral export quantity indices (2012–16).

Year	Canada	China	Japan	Indonesia	Vietnam	Hong Kong	Korea
2012	8.26	6.16	2.57	1.00	0.28	0.23	0.14
2013	6.83	5.31	1.66	0.70	0.13	0.21	0.25
2014	7.26	4.29	1.82	0.68	0.36	0.24	0.14
2015	3.44	3.43	2.42	0.69	0.38	0.15	0.23
2016	4.75	3.77	1.51	0.72	0.25	0.13	0.08

Table 34.—U.S. crab multilateral import quantity indices (2012–16).

Year	Canada	Russia	Indonesia	China	Philippines	Vietnam	Thailand
2012	3.70	1.16	1.00	0.95	0.29	0.29	0.32
2013	4.49	1.51	0.95	0.96	0.29	0.26	0.25
2014	4.09	1.42	0.95	1.03	0.32	0.31	0.25
2015	4.23	1.40	1.08	1.02	0.31	0.29	0.24
2016	3.96	1.62	1.28	0.82	0.28	0.29	0.17

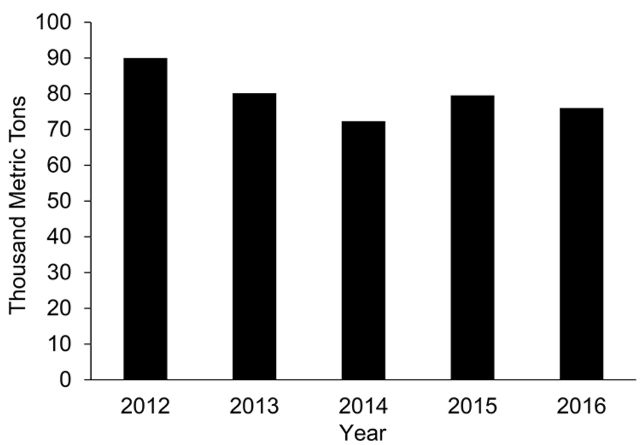


Figure 98.—U.S. crab production, 2012–16.

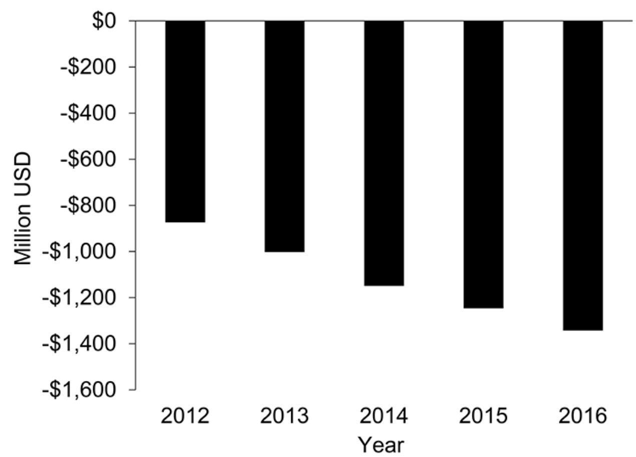


Figure 99.—Export/import volume ratio of crab, 2012–16.

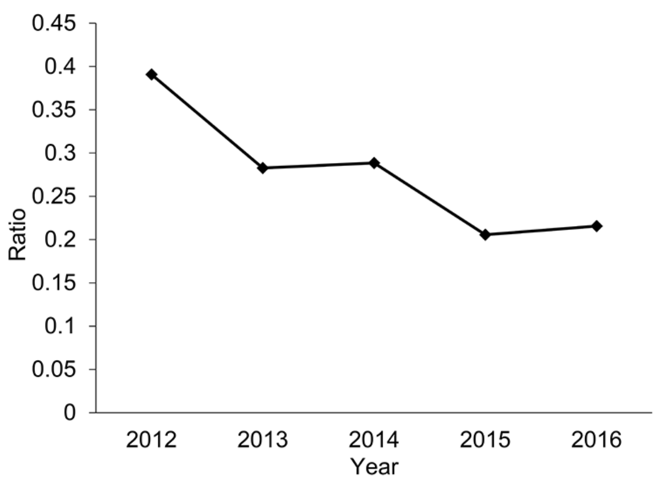


Figure 100.—Net exports of crab, 2012–16 (Real 2016 USD).

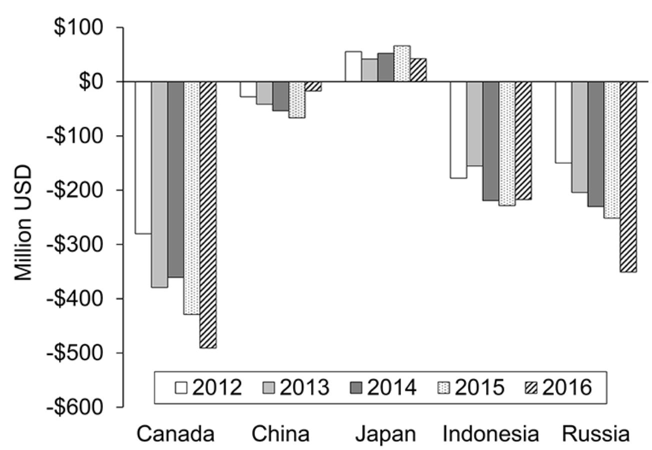


Figure 101.—Net exports of crab to top five countries, 2012–16 (Real 2016 USD).

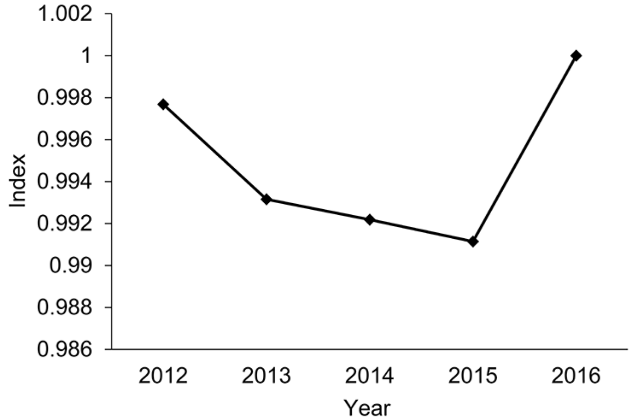


Figure 102.—Real effective exchange rate index for crab, 2012–16 (Real 2016 USD).

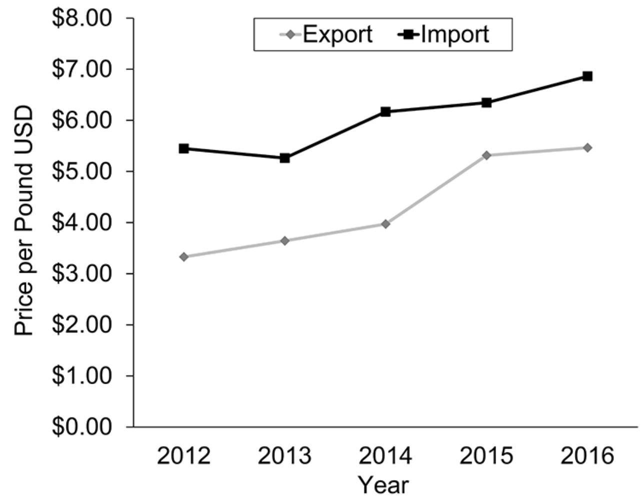


Figure 103.—Export and import prices of crab, 2012–16 (Real 2016 USD).

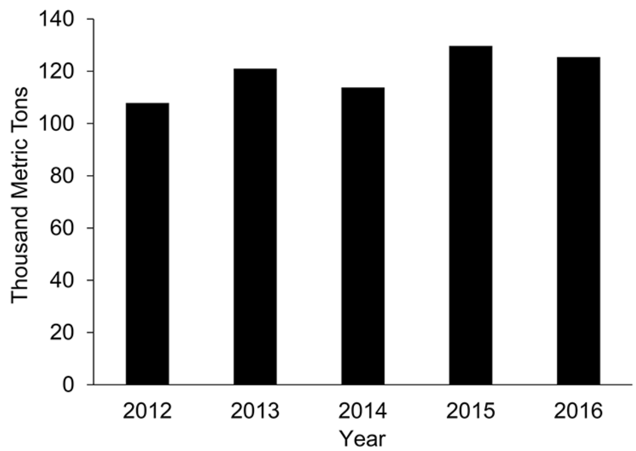


Figure 104.—U.S. apparent consumption of crab, 2012–16.

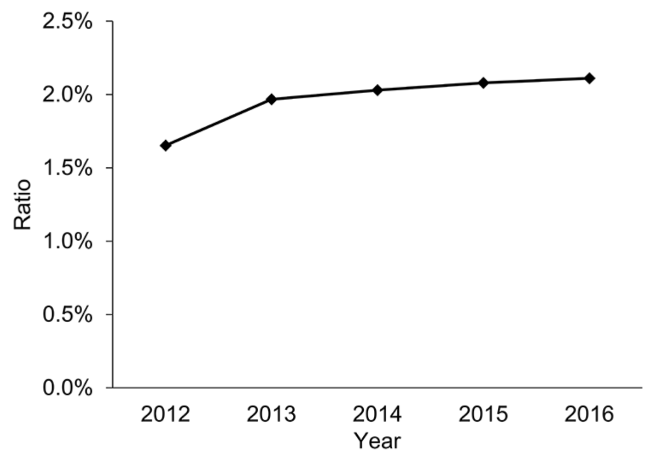


Figure 105.—U.S. production relative to apparent consumption of crab, 2012–16.

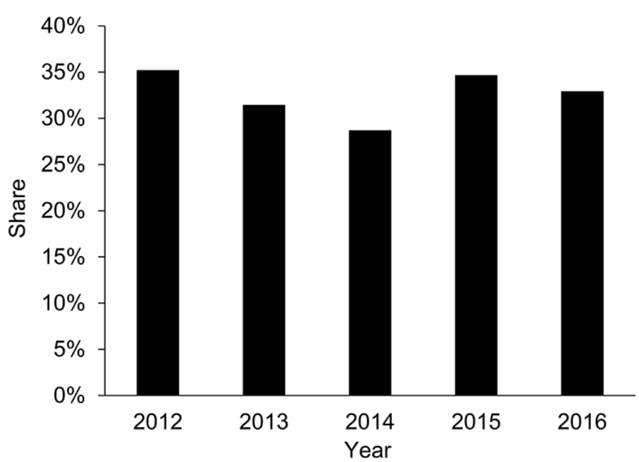


Figure 106.—U.S. production's share of apparent consumption of crab, 2012–16.

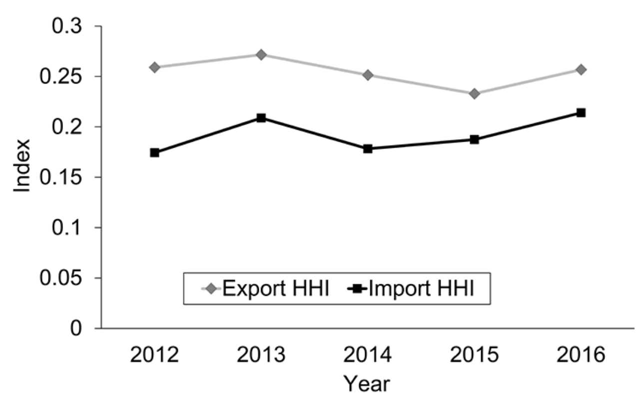


Figure 107.—Concentration indices of U.S. crab trade with other countries, 2012–16.

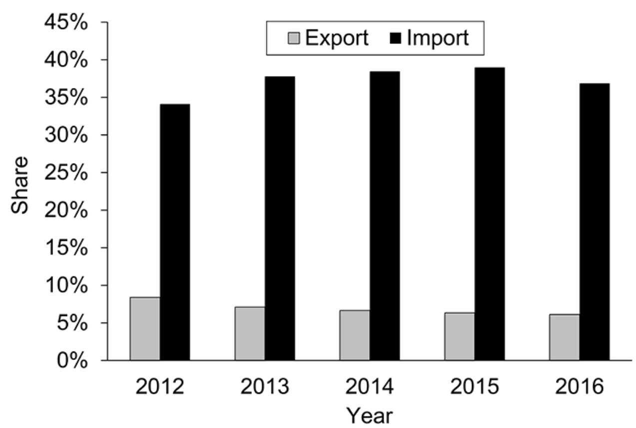


Figure 108.—U.S. share of global trade value activity, 2012–16 (Real 2016 USD).

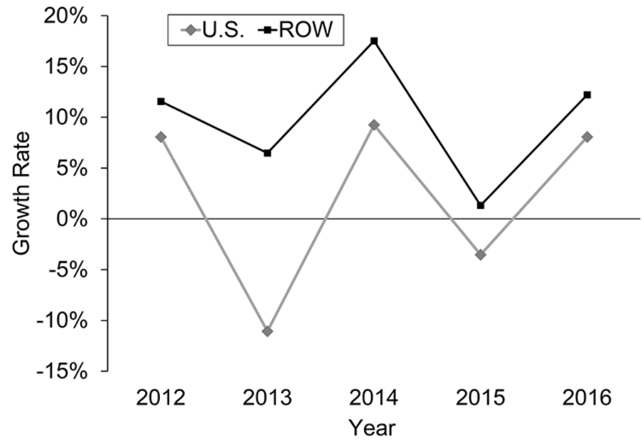


Figure 109.—Crab export value growth of the U.S. and rest of the world, 2012–16 (Real 2016 USD).

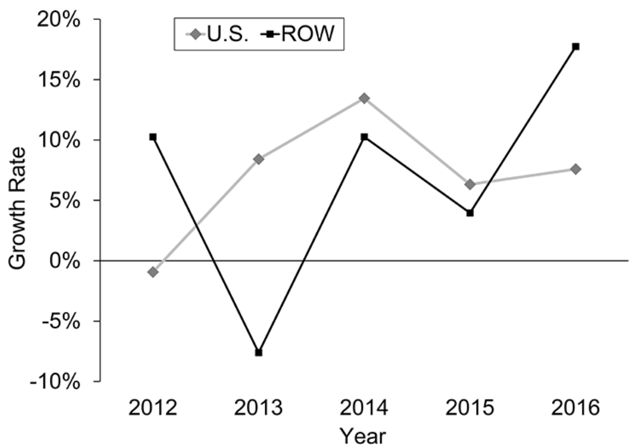


Figure 110.—Crab import value growth of the U.S. and rest of the world, 2012–16 (Real 2016 USD).

ton, and landings are based on regulatory framework that has been in place for more than a hundred years.

Alaska's crab fisheries are managed jointly by NMFS, the North Pacific Fishery Management Council, and the State of Alaska under a federal Fishery Management Plan (FMP) that delegates setting of the total allowable catch (TAC) to the State, subject to the allowable biological catch (ABC) set by the Council. The retained catch of eastern Bering Sea (EBS) snow crab, Alaska's largest crab fishery, was close to the TAC in 2012–16. Retained catch in the Bristol Bay red king crab fishery, which has historically been Alaska's largest king crab fishery, was close to the TAC, in 2012–16. Aleutian Islands golden king crab is Alaska's other major king crab fishery, and retained catch was close to the TAC in 2012–16.

This section authored by Mike Dalton, NMFS Alaska Fisheries Science Center.

Literature Cited

Anderson, L. G. 2004. The economics of fisheries management, 2nd rev. ed., 298 p. Blackburn Press, Caldwell, NJ.

Chamberlain, G. W. 1999. Sustainability of world shrimp farming. *In* E. K. Pikitch, D. D. Huppert, and M. P. Sissenwine (Editors), Global trends: Fisheries management, p. 195–209. Symp. 20, Amer. Fish. Soc., Bethesda, MD.

FAO. 2018a. Globalfish highlights: A quarterly update on world seafood markets. United Nations, Rome, 71 p.

__________. 2018b. The state of world fisheries and aquaculture 2018–meeting the sustainable development goals. Rome, 227 p. (Avail. online at https://www.fao.org/3/i9540en/i9540en.pdf).

Gephart, J. A., H. E. Froehlich, and T. A. Branch. 2019. To create sustainable seafood industries, the United States needs a better accounting of imports and exports. Proc. Natl. Acad. Sci. 116(19):9,143–9,146 (doi: https://doi.org/10.1073/pnas.1905650116).

Globefish. 2010. Shrimp market report—November 2010. FAO (avail. at https://www.fao.org/in-action/globefish/market-reports/resource-detail/en/c/338092/).

GSAFF. 2013. The role of shrimp imports in the decline of shrimp-reliant communities in the Gulf of Mexico. Gulf and South Atlantic Fisheries Foundation, NOAA/NMFS Award No. NA10NMF4540104 (GSAFFI #114) Final Rep., 131 p.

Hill, R. J. 1997. A taxonomy of multilateral methods for making international comparisons of prices and quantities. Rev. Income Wealth 43:49–69 (doi: https://doi.org/10.1111/j.1475-4991.1997.tb00200.x).

Knapp, G., and M. C. Rubino. 2016. The political economics of marine aquaculture in the United States. Rev. Fish. Sci. Aquacult. 24(3):213–229. (doi: https://doi.org/10.1080/23308249.2015.1121202).

Marvasti, A. 2019. A panel data analysis of anti-dumping duties in seafood trade: a gravity model approach. W. Econ. Assoc. Int., San Francisco.

__________ and D. W. Carter. 2016. Domestic and imports sources of supply to the U.S. shrimp market and antidumping duties. J. Econ. Stud. 43(6):1,039–1,056 (doi: https://doi.org/10.1108/JES-06-2015-0109).

Matthews, G. 2008. Variability in estimating abundance of postlarval brown shrimp, *Farfantepenaeus aztecus* (Ives), migrating into Galveston Bay, Texas. Gulf Caribbean Research 20(1):29–39 (doi: https://doi.org/10.18785/gcr.2001.05).

Nance, J. M. 2011. Biological review of the 2010 Texas closure. Rep. Gulf Mexico Fish. Manage. Council, NMFS, SEFSC, Galveston Laboratory.

NMFS. 2017. Fisheries of the United States 2016. U.S. Dep. Commer. NOAA, NMFS Curr. Fish. Stat. 2016, 147 p.

Nauman, F. A., C. M. Gempesaw, J. R. Bacon, and A. Manalo. 1995. Consumer choice for fresh fish: factors affecting purchase decisions. Mar. Resour. Econ. 10(2):117–142 (doi: https://doi.org/10.1086/mre.10.2.42629106).

Smith, M. D. 2018. The seafood trade deficit is a diversionary tactic. The Hill. 20 Sept. 2018 11:30 AM ET, (avail. at https://thehill.com/opinion/energy-environment/407575-the-seafood-trade-deficit-is-a-diversionary-tactic).

USCB. 2017. U.S. international trade in goods and services annual revision for 2016. U.S. Dep. Commer., Census Bur., U.S. Bur. Econ. Analy. News, June 2017, CB 17–85, BEA 17–26, FT-900 (17-04), 42 p. (avail. at https://www.census.gov/foreign-trade/Press-Release/ft900/final_2016.pdf).

USGAO. 2011. Seafood safety: FDA needs to improve oversight of imported seafood and better leverage limited resources. U.S. Gov. Account. Off., Rep. Cong. Requesters, GAO-11-286, 46 p. (avail. at https://www.gao.gov/assets/gao-11-286.pdf).

USITC. 2005. Certain frozen or canned warmwater shrimp and prawns from Brazil, China, Ecuador, India, Thailand, and Vietnam. U.S. Int. Trade Commiss., Invest. 731-TA-1063--1068 (Final), Publ. 3748, 241 p. (avail. at https://www.usitc.gov/publications/701_731/pub3748.pdf).

__________. 2017. Frozen warmwater shrimp from Brazil, China, India, Thailand, and Vietnam. U.S. Int. Trade Commiss., Publ. 4688, 255 p. (avail. at https://www.usitc.gov/publications/701_731/pub4688.pdf).

Wellman, K. F. 1992. The U.S. retail demand for fish products: an application of the almost ideal demand system. Appl. Econ. 23(4):445–457 (doi: https://doi.org/10.1080/00036849200000019).

Appendix: Methods

Table 6, 9, 14, 18, 22, 25, and 33.—Multilateral Lowe export trade indices.

Source: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index.

Method: Using the NMFS trade data, subset the data to only exports and do the following steps:

d_{ijt} = value/dollars of product ‘*i*’, country ‘*j*’, in year ‘*t*’ (real 2016 USD).

$v_{ijt} =$ volume (mt) of product ‘*i*’, country ‘*j*’, in year ‘*t*’.

$p_{ijt} =$ price/mt of product ‘*i*’, country ‘*j*’, in year ‘*t*’ (real 2016 USD).

$$\overline{p_i} = \sum_j \sum_i p_{i,j,t} / \#j\#t \tag{1}$$

(i.e., simple average price per product ‘*i*’)

$$q_{i,j,t} = v_{i,j,t}\,\overline{p_i} \tag{2}$$

Obtain top ten countries based on

$$\sum_i d_{i,j,t=2016} \tag{3}$$

$$q_{j,t} = \sum_i q_{i,j,t} \tag{4}$$

Select base country ‘*’ so that *q *, t=2012* is the index base.

Calculate index as

$$Q_{j,t} = \frac{q_{j,t}}{q *_{t=2012}} = \frac{\sum_i v_{i,j,t}\,\overline{p_i}}{\sum_i v_{i,*,t=2012}\,\overline{p_i}} \tag{5}$$

Table 7, 10, 15, 19, 23, 26, and 34.—Multilateral Lowe import trade indices.

Source: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index.

Method: Use the NMFS trade data, subset the data to only imports and follow steps for export trade indices shown above.

Figure 8, 22, 35, 48, 61, 75, 98.—Production volume.

Source: NMFS Fisheries Statistics Division, Processed Products Database. Fisheries One Stop Shop (FOSS) https://www.fisheries.noaa.gov/foss/f?p=215.

Figure 9, 23, 36, 49, 62, 76, 88, and 99.—Export/import volume ratio.

Source: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index.

Method: (total export volume)/(total import volume).

Figure 10, 24, 37, 50, 63, 77, 89, and 100.—Net exports (Real 2016 USD).

Source: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

Methods: (total real export value) – (total real import value).

Figure 11, 27, 38, 51, 64, 78, 90, and 101.—Net exports to top 5 countries (Real 2016 USD).

Source: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

Methods: Top 5 countries determined by the sum of total real exports and import, then sorted/ranked to determine the 5 countries with the largest values. Net exports calculated as before by country: (total real export value$_i$) – (total real import value$_i$) for country 'i'.

Figure 14, 28, 39, 52, 65, 79, 94, and 107.—Concentration indices of trade with other countries.

Source: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

Methods: The import concentration inde was calculated as

$$\sum_i y_i^2 /10{,}000$$

where y_i is the share of total real import value from country i to the U.S. The export HHI was calculated as

$$\sum_i x_i^2 /10{,}000$$

where x_i is the share of total real export value from country i to the U.S. This is the Herfindahl 1955 version of the index (HI) is the sum of the squared proportions and ranges from 0 to 1.

Figure 12, 25, 40, 53, 67, 80, and 103.—Export and import prices (Real 2016 USD).

Source: Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

Methods: Export price = (total real export value)/(total export volume).
Import price = (total real import value)/(total import volume).

Figure 15, 26, 41, 54, 66, 81, 91, and 102.—Real Export Effective Exchange Rate Index (foreign currency per dollar) (Real 2016 USD).

Sources: Real monthly exchange rates were obtained from http://www.ers.usda.gov/data-products/agricultural-exchange-rate-data-set.aspx. Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index.

Method: The index is basically a export volume weighted average of real exchange rates.

Specifically, it is

$$\exp \frac{\sum_i ln\,(r_i) * q_i}{\sum_j q_j}$$

where r is the real exchange rate between country 'l' and the U.S., and q is the export volume of trade to country 'l'.

Figure 16, 29, 42, 55, 68, 82, 92, and 108.—U.S. share of global trade value activity (Real 2016 USD).

Sources: FAO - Fisheries and Aquaculture Information and Statistics Branch - Commodity Trade and Production Statistics, http://www.fao.org/fishery/statistics/global-commodities-production/en. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

Method: (U.S. export value)/(global export value)
(U.S. import value)/(global import value)

Figure 17, 30, 44, 56, 69, 83, 93, and 109.—Export value growth of the U.S. and rest of the world (Real 2016 USD).

Sources: FAO - Fisheries and Aquaculture Information and Statistics Branch - Commodity Trade and Production Statistics, http://www.fao.org/fishery/statistics/global-commodities-production/en. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

Methods: Year-over-year percent change in real export values. Global exports are all non-U.S. exports.

$(x_i^{US} - x_{t-1}{}^{US})/x_{t-1}{}^{US}$ where x_i^{US} is the U.S. export value in year *t*.

$(x_i^{ROW} - x_{t-1}{}^{ROW})/x_{t-1}{}^{ROW}$ where x_i^{ROW} is the export value for the Rest of the World (ROW) (i.e., global - U.S.) in year *t*.

Figure 18, 31, 43, 57, 70, 84, and 110.—Import value growth of the U.S. and rest of the world (Real 2016 USD).

Sources: FAO - Fisheries and Aquaculture Information and Statistics Branch - Commodity Trade and Production Statistics, http://www.fao.org/fishery/statistics/global-commodities-production/en. The GDP Implicit deflator was used for the real price adjustment (base year 2016) https://fred.stlouisfed.org/series/GDPDEF.

Methods: Year-over-year percent change in real export values. Global exports are all non-U.S. exports.

$(y_i^{US} - y_{t-1}{}^{US})/y_{t-1}{}^{US}$ where y_i^{US} is the U.S. export value in year *t*.

$(y_i^{ROW} - y_{t-1}{}^{ROW})/y_{t-1}{}^{ROW}$ where y_i^{ROW} is the export value for the Rest of the World (ROW) (i.e., global - U.S.) in year *t*.

Figure 19, 32, 45, 58, 71, 85, 95, and 104.—U.S. apparent consumption.

Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index.

The source of data on U.S. production could vary depending on seafood categories/region but should be the same as the data used to produce Production Volume figures.

Methods: U.S. production - Export + Imports.

Figure 20, 33, 46, 59, 72, 86, 96, and 105.—Apparent consumption relative to U.S. production.

Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index.

The source of data on U.S. production could vary depending on seafood categories/region but should be the same as the data used to produce Production Volume figures.

Methods: (U.S. production - Export + Imports)/ (U.S. production) [i.e., apparent consumption/total U.S. production].

Figure 21, 34, 47, 60, 73, 87, 97, and 106.—Unexported U.S. production relative to apparent consumption 2012–16.

Sources: Trade data was obtained from the Fisheries Statistics Division, Foreign Trade Division of the U.S. Census Bureau, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index.

The source of data on U.S. production could vary depending on seafood categories/region but should be the same as the data used to produce Production Volume figures.

Method: (U.S. production-Export)/(U.S. production - Export + Imports) [i.e., unexported U.S. production/apparent consumption].