WholesaleMarket ProfilesMarket ProfilesMarket Alaska Groundfishfor Alaska Groundfishand Crab Fisheries

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Executive Summary

This comprehensive series of wholesale market profiles examines federally managed groundfish and crab species caught in Alaska commercial fisheries. Each profile summarizes the fishery and provides in-depth information on wholesale production volume and value, product mix, supply chain, competing supply, and key markets.

Alaska's commercial fisheries are the most productive in the Nation, accounting for 61 percent of total 2017 U.S. commercial fishery harvest volume. In 2017, Alaska's wholesale production of 1.35 million metric tons (mt) of seafood products was valued at \$4.86 billion.¹ Of this, the majority was exported, with overall exports estimated at 1.12 million mt valued at \$3.45 billion.² The groundfish and crab species covered in this report represent 73 and 60 percent of the state's production volume and value, respectively (based on 2017 data). Alaska pollock is by far the most plentiful and most valuable of Alaska's groundfish species.



Figure 1. Composition of Total First Wholesale Volume and Value for Alaska Seafood, by Species, 2017



Photos Courtesy of Alaska Seafood Marketing Institute (ASMI) and Aleutian Spray Fisheries.

¹ See glossary defining first wholesale volume/value and other terms commonly used in this report.

² Export value relates to the value upon exiting the country, and includes all costs/profits associated with moving product to the port of export. First wholesale value is generally equal to the value of product as it leaves Alaska.

The majority of Alaska's groundfish and crab species are harvested and processed into intermediate products, which must then undergo secondary processing outside Alaska to create finished products for retail and food service buyers around the world. Figure 2 summarizes production volume and value of groundfish and crab by general product type.







Figure 3. First Wholesale Volume and Value of Alaska Groundfish and Crab Species, 2013-2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

As demonstrated in Figure 3, the total value of Alaska groundfish and crab has remained steady over the last five years (2013-2017), with a slight but steady increase in value per metric ton that peaked in 2017 at \$2.90 billion. Of particular note are the value/mt increases in Pacific cod (+23%), yellowfin sole (+26%), arrowtooth flounder (+56%), and snow crab (+32%), as well as other lower volume fisheries. These changes in value, demonstrated below in Table 1, are the result of numerous factors which are summarized on page 4 and examined in greater detail throughout this report.

	2013	2014	2015	2016	2017	Pct. Change 2017 vs. Prior 4-yr. Avg.
Alaska pollock	\$2,442	\$2,410	\$2,375	\$2,391	\$2,379	-1%
Pacific cod	\$2,732	\$3,049	\$3,066	\$3,243	\$3,725	23%
Yellowfin sole	\$1,287	\$1,009	\$1,060	\$1,203	\$1,437	26%
Rock sole	\$1,335	\$1,244	\$1,255	\$1,407	\$1,578	20%
Pacific halibut	\$14,692	\$17,779	\$14,026	\$16,956	\$18,225	15%
Sablefish	\$12,254	\$14,797	\$15,023	\$17,427	\$18,784	26%
Pacific ocean perch	\$2,258	\$2,456	\$2,236	\$1,921	\$2,469	11%
Atka mackerel	\$2,706	\$3,032	\$2,259	\$2,261	\$3,027	18%
Arrowtooth flounder	\$1,191	\$1,531	\$1,423	\$1,701	\$2,306	58%
Snow crab	\$11,052	\$11,650	\$9,754	\$11,933	\$14,641	32%
King crab	\$24,370	\$22,861	\$27,469	\$35,944	\$30,100	9%

Table 1. Average First Wholesale Value per Metric Ton, 2013-2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Key Markets for Alaska Groundfish and Crab

The United States, Europe, and Japan are the largest end markets for Alaska groundfish and crab products, typically accounting for more than 80 percent of annual first wholesale value. While approximately one-third of the production volume is reprocessed in China, most of this is re-exported to markets in Europe, the United States, and Japan. A significant amount of product exported to South Korea is held in cold storage facilities or reprocessed before being re-exported to Japan and Europe.

Table 2. Primary Sales of First Wholesale Alaska Groundfish and Crab Products by Market, Estimated Annual Average Volume and Value, 2013-2017

Market	First Wholesale Value (\$ millions)	Estimated Market Share (Value)	Sales Volume (mt)	Estimated Market Share (Volume)
China*	\$635	23%	293,877	30%
Japan	\$500	18%	157,304	16%
Europe	\$489	17%	176,700	18%
South Korea*	\$364	13%	139,799	14%
Other Countries	\$202	7%	53,864	5%
Export Markets Total	\$2,189	78%	821,544	83%
Estimated Domestic Market	\$614	22%	163,694	17%

*Primarily re-export markets.

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)). ASMI Seafood Export Database and McDowell Group estimates.

The species profiled in this report generally represent a significant proportion of the global seafood harvest of like or highly similar species. All of Alaska's groundfish species depend on multiple international markets and most face significant competition from fisheries in other countries. Table 3 summarizes first wholesale production volume and value, percent of global harvest volume, and identifies key initial markets for each Alaska groundfish and crab species.

Species/Product	First Wholesale Value (\$ millions)	Alaska Production Volume (mt)	Pct. of Global Harvest (2016)	Key Markets		
Alaska Pollock	\$1,438	604,426	45%	Japan	Europe	U.S.
Pacific Cod	\$510	136,990	20%	China*	Europe	U.S.
Flatfish	\$230	134,920	28%	China*	U.S.	Europe
Pacific Halibut	\$137	7,497	41%	U.S.	Canada	
Sablefish	\$124	6,593	57%	Japan	China	U.S.
Atka Mackerel	\$128	42,231	54%	Japan	China*	S. Korea
Rockfish	\$64	26,000	21%	China*	Japan	U.S.
Snow Crab	\$127	8,684	5%	U.S.	Japan	
King Crab	\$116	3,857	12%	U.S.	Japan	China

Table 3. Alaska Groundfish and Crab Production and Market Summary, 2017

*Denotes re-export market.

Source: AKFIN, ADF&G (COAR), FAO, and McDowell Group estimates.

Current Market Issues

The value of Alaska seafood is affected by a range of market forces. Individual species profiles in this report contain detailed information about how these forces impact the value of Alaska production. Noteworthy market factors are included by species below.

ALASKA POLLOCK

 Pollock fillet prices hit a low in 2017 but rebounded sharply in 2018 and remain strong in 2019. An increasing portion of fillet production is going to deep-skin fillet production, partly in response to high cod prices and demand for substitutes.



Photo Courtesy of ASMI.

- Prices for Alaska pollock surimi blocks continue to trend up, primarily due to lower production of competing products.
- The pollock roe market an important high-margin product for Alaska pollock producers continues to be depressed due to changing consumer preferences in Japan and a lack of alternative markets.
- Significant levels of Russian investment in new fishing vessels, shoreside and at-sea processing capacity, MSC certification, and marketing have the potential to upend long-standing trade dynamics going forward.

PACIFIC COD

• Despite lower harvest levels, 2017 saw a record value for Alaska's Pacific cod products due to higher prices. Global price increases have been driven by contracting cod supplies coupled with very strong demand, especially in the United States and European Union.

HALIBUT AND SABLEFISH

- Halibut and sablefish prices have risen as harvest limits have been reduced for both fish, with near- record prices reached in 2017. More recently, downward price pressure for Alaska halibut has been applied by increased competition from Canadian harvests of Atlantic halibut and their penetration into the U.S. fresh market.
- Sablefish, which traditionally were sold almost exclusively to Japanese buyers, have seen increased demand from other markets, particularly for larger fish. Today, smaller-sized fish are an increasing issue for new markets and fishermen, with ex-vessel prices tightly tied to size.

FLATFISH

- A strong market for whitefish in general has helped drive strong flatfish prices. The U.S.–China trade dispute threatens to upend this growth due to U.S. processor dependence on China for flatfish reprocessing.
- Arrowtooth flounder prices peaked in 2017 but have subsequently fallen considerably due to increased Canadian production and oversupply.

PACIFIC OCEAN PERCH AND ATKA MACKEREL

- Declining harvests of Atka mackerel in Japan and Russia have increased prices for Alaska product. High prices combined with increased Alaska harvest levels led to record revenues from the species in 2017.
- Markets have sustained high prices for Pacific ocean perch despite historically large harvests in Alaska.

CRAB

Reduced harvests are increasingly leading buyers to substitute with crab products from other countries. In 2016, Alaska made up only 5 and 12 percent of global harvest value of snow and king crab, respectively – down from 15 percent for both types of crab in 2013.

ANCILLARY PRODUCTS

- The global aquaculture industry is increasingly using plant-based feeds instead of higher-priced fish meals and oils. However, Alaska's groundfish meal sells at a premium due to high demand in eel and turtle farming.
- The U.S.–China trade dispute that began in 2018 has impacted Alaska's groundfish meal perhaps more than any other major Alaska seafood product. This is due to a heavy reliance on the domestic Chinese market for this product.
- Increased use of fish oil for human consumption has helped drive strong prices for fish oil. Growing demand, coupled with new product development by Alaska processors, is expected to result in increased sales of nutritional supplements made from Alaska groundfish.

Implication of Currency Exchange Rates

In addition to the market issues described above, prices for Alaska groundfish and crab products have been negatively impacted by a stronger U.S. dollar in recent years. A stronger dollar, relative to the currencies of key export markets and competing suppliers, generally makes Alaska seafood more expensive in relation to competing product for Alaska's international consumers. Over the past five years, approximately 83 percent of the state's groundfish and crab production was sold to export markets – primarily in Europe and Japan.

Table 4 summarizes changes in foreign currency rates for key buyers and major competitors versus the U.S. dollar between 2013 and 2018. Exchange rates vary from year to year but movements of this magnitude are notable.

Country/Market	Currency	Primary Role	Change in Exchange Rate vs. US\$	Impact on Trade
European Union	Euro	Buyer	+12.4%	Decreased Buying Power vs. US\$
Japan	Yen	Buyer	+13.1%	Decreased Buying Power vs. US\$
				Decreased Buying Power vs. US\$
Canada	Canadian Dollar	Buyer and Competitor	+25.8%	- Canadian products more competitive
Russia	Ruble	Competitor	+96.8%	Russian products more competitive
Norway	Kroner	Competitor	+38.4%	Norwegian products more competitive
U.S. Dollar Index (value re	lative to a basket of fo	reign currencies)	+21.8%	US products less competitive

Table 4. Changes in Relevant Currency Exchange Rates, 2013 versus 2018

Source: Board of Governors of the Federal Reserve System (US), retrieved from FRED, Federal Reserve Bank of St. Louis. fred.stlouisfed.org

Abbreviations and Acronyms

ADF&G	Alaska Department of Fish and Game
AFSC	Alaska Fisheries Science Center, NOAA, National Marine Fisheries Service
AKFIN	Alaska Fisheries Information Network, Pacific States Marine Fisheries Commission
AFA	American Fisheries Act
ASMI	Alaska Seafood Marketing Institute
BSAI	Bering Sea/Aleutian Islands
COAR	Commercial Operators Annual Report (published by Alaska Dept. of Fish and Game)
EEZ	Exclusive Economic Zone
FAO	United Nations Fisheries and Aquaculture Organization
GOA	Gulf of Alaska
H&G	Headed and gutted
IFQ	Individual Fishing Quota
IQF	Individual Quick Frozen
MT	Metric tons
MSC	Marine Stewardship Council
NMFS	National Marine Fisheries Service, NOAA
NPFMC	North Pacific Fishery Management Council
ТАС	Total Allowable Catch
ΥοΥ	Year-over-year

Glossary of Terms

Demersal Fish	Marine fishes that live near the bottom of the ocean, also known as groundfish.
Exclusive Economic Zone	Ocean area that extends past 3 nautical off the coast of Alaska to 200 miles off the coast of the U.S. These waters are managed by the federal government.
Export Value	The 'Free on Board' (FOB) value of an export product as it leaves a U.S. port, including all transport/etc. costs needed to create and move the product to the port of exit.
Export Volume	The weight of exported product in net weight terms, not including the weight of packaging, as it leaves a U.S. port.
Ex-Vessel Value/Price	The amount paid to fishermen by a processor for harvested seafood, typically per round pound.
Fillet Blocks	Frozen seafood flesh that is packaged in blocks and quick frozen in a plate freezer. Normally 16.5 pounds and destined for further processing, including by sawing into pieces to make breaded and battered products.
First Wholesale Value	The value of a processed product when sold by a processor to an entity outside of their affiliate network. Typically equivalent to the value of product as it leaves Alaska.
First Wholesale Volume	The weight of processed or packaged product, in net weight terms, produced for sale to another buyer outside of the primary processor's affiliate network. Typically equivalent to the volume of processed product as it leaves Alaska.
Fixed Gear	Refers to pot/trap or longline commercial fishing gear.
Landings	The amount of seafood harvested by fishermen.
Net Weight	A term commonly used to measure halibut harvest volume. Whereas harvests of most other species are counted in round weight terms, halibut harvests are tallied in headed and gutted form.
Production Volume/Value	The term "production" is occasionally used as short-hand for first wholesale volume and value in this report.
Round Weight	The weight of a whole seafood species as it is delivered to the processor in an unprocessed and uncut state.
Shatterpack Fillets	Frozen fillets separate by sheets and easily separated by dropping or shattering the carton.
Stock	A species or species group in a specific area that is managed as a single unit.
Surimi	Fish flesh that is minced, washed, blended with other ingredients, and frozen. Surimi is an intermediate product that is subsequently processed into seafood analoug products, such as imitation crab meat.
Total Allowable Catch	The total amount of a target species that can be harvested in a given time period.

Global Groundfish Production and Key Markets

This chapter provides a broad overview of global supply and key markets related to Alaska groundfish and key competitor species and products around the world. The latest systematic information available on global seafood harvests and aquaculture is FAO's 2016 data, though data on 2017 is presented as well in some cases.

Alaska Groundfish Production and Market Summary

In 2016, Alaska harvested 2,219,878 mt of groundfish, with roughly two-thirds of this volume made up of pollock. The table below summarizes production volume, value, key markets, and the percentage of global production for Alaska groundfish species and products. Although Alaska accounts for a significant share of global whitefish production, the state's groundfish fisheries comprised only 2.4 percent of global capture fishery harvests in 2016.³ Due in part to trade disputes, consumer perceptions of tilapia and pangasius, and the recent abundance of whitefish produced in the Barents Sea, the U.S. domestic market has grown in importance for Alaska's groundfish fisheries, with Europe, Japan, China, and South Korea remaining key export markets for Alaska groundfish.

Species/Product	First Wholesale Value (\$ millions)	Alaska Production (mt)	Key Markets		
Pollock – Fillets	\$480	173,000	Europe	U.S.	China*
Pollock – Surimi	595	207,000	Japan/Korea	U.S.	Europe
Pollock – Roe	121	19,500	Japan	Korea	
Pollock – Other	242	205,000	China*		
Pacific Cod	510	137,000	U.S.	China*	Europe
Soles, Flounders, and Plaice	230	135,000	China*	Korea	U.S.
Pacific Halibut	117	9,300	U.S.	Canada	
Sablefish	124	6,600	Japan	U.S.	China/Hong Kong
Rockfish	16	6,000	U.S.		
Pacific ocean perch ⁴	64	26,000	China*	Japan	Korea
Atka Mackerel	128	42,200	Japan	China*	Korea
Other	7	3,300	Korea	China*	

Table 5. Alaska Groundfish Production and Market Summary, 2017

*Denotes re-export market.

Note: Alaska production figures are rounded.

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)). McDowell Group estimates

Global Whitefish and Other Marine Fish Production

Alaska's groundfish fisheries are of particular global importance thanks to their production of whitefish; Alaska produces approximately 21 percent of global marine wild-harvest whitefish annually. Whitefish generally refers to non-oily species like cod, pollock, haddock, hake, whiting, and benthic flatfish species, such as sole, plaice, flounder, and halibut. These

³ FAO.

⁴ While Pacific ocean perch is also considered a rockfish, it is separated here due to its volume and that it is almost exclusively exported.

species - primarily caught in wild fisheries - also compete in global seafood markets with notable aquaculture species such as tilapia and pangasius. Though there are different perceptions of quality and price premiums within this range of species, they are all competitors and may be substituted depending on price and availability. Depending on the market, the scope of these whitefish species may be narrowed or supplemented with other local varieties that are not discussed here.

In addition to whitefish, Alaska's groundfish fisheries produce significant volumes of rockfish, Pacific ocean perch, sablefish, and Atka mackerel. Though these species also have white flesh, they are treated separately due to their oil content and where they compete within the overall seafood hierarchy; rockfish would most closely compete with "snappers" while sablefish compete directly with the ultra-premium Antarctic and Patagonia toothfish. Alaska produces small volumes of dogfish, skate, squid, octopus, and other species that are relatively insignificant in terms of overall volume and value, and for the purposes of this section, these species are generally referred to as "other."

Species	2016 Harvest Volume (mt)	Alaska Pct. Of Global Production (2016)	Primary Uses
Pollock	3,476,149	44%	Meat, Surimi, Meal/Oil
Hakes, Hoki, Lings, and Whiting	2,813,434	0%	Meat, Surimi, Meal/Oil
Cod ⁵ and Haddock	2,106,327	15%	Meat
Sole, Flounder, and Plaice	715,493	33%	Meat
Saithe	298,086	0%	Meat
Other Whitefish (Whitefish and Cod Varieties)	84,085	0%	Meat
Halibuts and Turbots	212,433	5%	Meat
Total Wild Whitefish (Capture Fisheries)	9,706,007	21%	
Tilapias and Cichlids (Farmed and Capture)	6,685,921	0%	Meat
Pangasius (Farmed)	1,757,843	0%	Meat
Total - Tilapias and Pangasius	8,443,764	-	
Total Wild Whitefish, Tilapia, and Pangasius	18,149,771	11%	

Table 6. Global Whitefish Production (mt), 2016

Source: : FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/. Compiled by McDowell Group.

Globally, 9.7 million mt of whitefish were harvested in 2016, with Alaska pollock being the largest component of this group at 3.5 million mt. Following Alaska pollock, 2.8 million mt of hakes, hoki, lings, and whitings were harvested. While the majority of production of these high-volume species is used for meat, surimi production is also a critically important product. Roe, fish meal, fish oil, and other ancillary products are also produced in significant volumes from these wild marine fish species.

After pollock and hakes/hoki/lings/whiting, the next most important whitefish species group is cod/haddock, with a total global harvest of 2.1 million mt. The vast majority of fish shown in the table above is used to produce fillets that could represent a substitute for key Alaska groundfish species on a general level, especially in European and North American markets. However, culinary traditions and local tastes tend to limit the number of species and/or product forms palatable

⁵ Pacific and Atlantic cod only.

to individual markets. For example, while cod is a staple fish in Europe and the United States, it is virtually non-existent in Southeast Asia, where it would be more common to find carp, milkfish, or pangasius filling the whitefish role.

There are also significant differences in the way different cultures prepare whitefish species. Countries in emerging markets are generally more likely to cook fish whole while developed Western countries tend to use more fillets or steaks. Therefore, differences in product form, availability, price, taste, and fish size limit the likelihood of consumers substituting products. Cost is always a primary concern as well. While consumers generally will not substitute imported whitefish species for less expensive and traditionally palatable domestic species, frozen seafood manufacturers increasingly develop products and packaging that allows them to use multiple species for the same product, permitting them greater sourcing options and the ability to lower costs.

Table 7. Global Production of Snappers/Rockfish and Sablefish/Toothfish (mt), 2016

Species	2016 Harvest Volume (mt)	Alaska Pct. Of Global Production (2016)	Primary Uses
Snappers and Rockfish (Includes Pacific ocean perch)	360,757	18%	Meat
Sablefish and Antarctic/Patagonia Toothfish	46,886	21%	Meat
Total Wild Snappers, Rockfish, and Toothfish	119,965	20%	

Source: : FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/. Compiled by McDowell Group.

In addition to the "whitefish" discussed previously, Alaska harvested more than 18 percent of the world's snappers, rockfish, sablefish, and Antarctic/Patagonia toothfish in 2016. In contrast to cod, pollock, and others, sablefish is a highend fish prized by chefs and seafood lovers around the world for its rich and oily flesh. Sablefish remains an important export species to the Japanese market but has numerous export markets around the world, especially for larger fish. Though harvesting numerous rockfish species, Pacific ocean perch (POP) is Alaska's most valuable species, with a 2017 harvest volume of 50,591 mt and \$64 million wholesale value; while almost all POP is exported to China, Japan, and Korea, Alaska's other rockfish species (11,922 mt harvest, 2017) are primarily consumed domestically.

Competition from Tilapia and Pangasius

Pangasius – also known as basa, swai, tra, or catfish – and tilapia have become dominant species in many global seafood markets, with combined aquaculture production of the two species reaching more than 7.6 million mt in 2016, a 25 percent increase over 2012.

Tilapia production continues to grow rapidly and consistently, primarily in developing countries. China is the world's largest producer with 1.87 million mt of production in 2016 (32 percent of global production), followed by Indonesia (20 percent), Egypt (16 percent), and various other countries.

Pangasius production flattened out in 2013 after increasing nearly ten-fold during the previous decade. Vietnam is by far the largest pangasius producer, accounting for 68 percent of all pangasius production. Industry reports suggest Vietnamese production has remained stunted due to high feed costs, weak demand in major markets, and low prices. Production and domestic market demand have continued to increase in China and other



Southeast Asian countries. Indonesia is the world's second-largest producer with 437 thousand mt in 2016. Cambodia, Myanmar, and Malaysia also produce pangasius, though to a lesser extent.



Figure 4. Global Whitefish Aquaculture Production (mt), 2016

Source:: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/. Compiled by McDowell Group.

The United States is the largest market for both tilapia and pangasius fillets. U.S. imports of tilapia fillets have decreased dramatically since from 2012 (168,291 mt) to 2017 (121,030 mt, worth \$456 million). Tilapia and pangasius have suffered from decreased market share due to negative consumer perceptions combined with abundant whitefish harvests. More recently, imports of pangasius fillets into the United States have declined due to an anti-dumping judgment against Vietnam that resulted in increased tariffs (up to \$3.87-\$7.74/kg) and a stricter import inspection regime.⁶ Both pangasius and tilapia have also suffered from the U.S. implementation of tariffs on seafood processed in China, and stand to decline further in 2019 with additional tariffs set to kick-in.

	2015	2016	2017	Percent Change 2015-2017
Tilapia – frozen fillets	158,059	130,169	121,030	-23%
Tilapia – fresh or chilled fillets	24,511	23,604	22,738	-7%
Tilapia – frozen fish	30,739	31,777	27,978	-9%
Pangasius – frozen fillets	158,059	130,169	121,030	-23%
Pangasius – fresh or chilled fillets	349	427	353	1%
Pangasius – frozen fish	575	501	683	19%

Table 8. U.S. Imports of Tilapia and Pangasius Products (mt), 2015-2017

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritimeglobal-trade-atlas.html

Due to the decline of the U.S. and European markets, tilapia and pangasius are increasingly dependent on China and other emerging markets. For example, Chinese imports of Vietnamese pangasius have increased from U.S. \$50 million in 2011 to nearly \$400 million in 2017. In the near term, further growth will depend on continued global growth and increased demand from seafood protein in developing countries, particularly in the ASEAN bloc, Latin America, South Asia, and the Middle East, despite the expansion of aquaculture production in India and Indonesia.

⁶ FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.

Alaska's Position in the Global Whitefish Market

Alaska's commercial fisheries produce larger harvests than every other U.S. state combined and Alaska's groundfish harvest made up more than 85 percent of Alaska's total fisheries harvest volume in 2017. Nevertheless, Alaska produces just a fraction of global whitefish production and is thus highly impacted by global macroeconomic trends, trade policies, and competing whitefish supply. In terms of supply, Russia (cod/pollock/flatfish), China (tilapia), Norway (cod), Japan (pollock/cod), New Zealand (hoki), and Vietnam (pangasius) are the biggest competitors for Alaska's groundfish industry in terms of high-volume whitefish species. Historically, lower volume Alaska species like Pacific halibut were less-impacted by global supply and demand issues and more impacted by U.S. and Canada production and market dynamics. Recently, however, Pacific halibut has increasingly been pressured by imports of Canadian Atlantic halibut which have found a market in the United States due to short supply and high prices. Other species like POP and Atka mackerel have both defined export markets and limited competition where Alaska is the primary export supplier and generally accounts for a larger percent of global supply. As a result, species substitution is less common in markets for these species with price driven by local demand dynamics, currency fluctuations, and Alaska harvest volume.

Traditions, taste preferences, and familiarity are hurdles in developing new markets for Alaska groundfish species. However, culinary influences are blending and crossing borders faster than perhaps any other time in human history. Modern urban centers like Singapore, London, Sao Paulo, Dubai, Shanghai, Barcelona, and Seoul provide a growing supply of unique seafood options. Culinary globalization presents new marketing opportunities for Alaska's seafood industry, particularly since Alaska has a reputation for quality and a strong distribution network. One of the best examples of this is the expansion of sablefish to markets around the world. Once almost exclusively dependent on the Japanese market, black cod is now well-known and sought-after by chefs and discerning consumers around the globe, thanks in large part to its popularization in Japanese fusion cuisine.

Summary of Key Alaska Groundfish Markets

Export markets buy about 69 percent of Alaska's total groundfish production, and an even larger percentage of surimi, roe, fish meal, and other groundfish products. China is the largest wholesale market for groundfish, accounting for 24 percent of estimated sales volume in 2017 (see table below), with the largest single export product being flatfish. However, with the exception of larger sablefish destined for the Chinese foodservice sector, the vast majority of Alaska groundfish exported to China is re-exported to Europe, the United States, and Japan. Japan is the second largest overall market for Alaska groundfish due to the high volume of pollock roe, surimi, and cod which enter the market. Europe is particularly important for pollock fillets, surimi, and H/G Pacific cod production, though its importance has been somewhat diminished due to the recent abundance of its own whitefish harvests.

With an estimated 31 percent of Alaska groundfish production remaining in the United States – and a great deal more processed in China and re-exported back to the United States – the United States is the largest consumer of Alaska groundfish. This position is likely to remain steady or increase in coming years due to tariffs and technical trade barriers imposed on China and Vietnam, and the persistent strength of the U.S. dollar.

Species	Wholesale Production	U.S. (Estimated)	Europe	China	Japan	Other	Total Exports
Alaska Pollock	604,426	206,573	121,465	57,029	86,266	133,093	397,853
Pacific Cod	136,990	47,257	16,033	47,975	14,247	11,478	89,733
Flatfish	134,920	21,320	169	92,500	3,839	17,092	113,600
Rockfish/POP	31,999	8,825	373	12,697	8,458	1,646	23,174
Atka Mackerel	42,231	5,106	75	26,545	33	10,472	37,125
Sablefish	6,593	1,161	388	563	3,787	694	5,432
Pacific Halibut	9,344	8,463	16	70	0	795	881
Other	3,346	701	51	143	102	2,349	2,645
Total	969,849	299,406	138,570	237,522	116,732	177,619	670,443
Percent of total	-	31%	14%	24%	12%	18%	69%

Table 9. Wholesale Sales of Alaska Groundfish (mt), 2017

Note: Wholesale production of high-volume whitefish species only includes whole fish, H&G, and fillet production. Virtually all halibut and sablefish consist of edible products.

*Unknown species likely represent exports of Alaska flatfish and other high-volume whitefish species; this non-specific volume is debited from estimates of U.S. supply. This amount could also represent part of the difference between how product weight is reported in export and production statistics.

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)). ASMI Export Database.

Wholesale Market Profiles for Alaska Pollock Products

Note: Differentiating pollock by its place of origin, primarily Russia or Alaska, can be confusing due to the widespread use of the name Alaska pollock. To avoid confusion, we use the term "pollock" to refer to <u>Gadus chalcogrammus</u> from any country/place. References to pollock from a specific place are called out by name (e.g. "Alaska pollock" or "Russian pollock").

Pollock or walleye pollock (*Gadus chalcogrammus*) is currently the largest single-species fishery in the world, with stocks concentrated in the North Pacific Ocean. Pollock are commercially harvested by several countries, but the United States (Alaska) and Russia are the largest producers by a wide margin, with U.S. harvests accounting for 45 percent of global harvests. Pollock harvests in Alaska are significant on a national scale, accounting for 28 percent of total U.S. commercial fishery landings and 17 percent of wholesale production value in 2017.

Pollock is the single most valuable and plentiful species in Alaska's seafood industry, accounting for 46 percent of production volume and 30 percent of first wholesale value in 2017. Alaska pollock is processed into fillets, surimi, roe, head/gut (H&G), fish meal, fish oil, and other products. Final consumer products include breaded fillet portions, imitation crab meat, and roe and Europe, Japan, and United States are the primary consumer markets. This market profile summarizes key products and markets for pollock fisheries in Alaska.

Value and Volume		Key Products	Fillets	Surimi	Roe	Meal	Other
First Wholesale Production (mt)	604,426	Pct. of Value	33%	41%	8%	7%	11%
Pct. of Global Pollock Harvest	45%	Key Markets	Japan	Europe	US	Korea	China
First Wholesale Value (\$ millions)	\$1,438	Pct. of 1 st Sales	18%	24%	23%	17%	14%
Pct. Change in Value from Prior 4-yr Avg.	3.2%	YoY Change	+13%	-6%	-9%	-14%	+16%
Pct. of Alaska Groundfish Value	57%	Competing Species: Russian pollock, hake, hoki, tropical surimi, & cod.					

Table 10. Summary Profile of Alaska Pollock Wholesale Production and Markets, 2017

Fishery Summary

Alaska pollock are primarily harvested using mid-water trawl gear in the Bering Sea and Gulf of Alaska. In the 1960s, Japanese and other foreign fishermen fished for pollock until the 200-mile EEZ was established by the Magnuson-Stevens Act of 1976, eliminating foreign fishing vessels in U.S. waters. Commercial fishing efforts remained a joint venture with Japanese vessels until the late 1980s when the fishing fleet became entirely U.S.- based. Fishing efforts between 1977



Photo Courtesy of ASMI.

and 1986 were minimal, with an average of 12,000 mt landed. In comparison, annual landings averaged 1.3 million mt in the last ten years. The Alaska pollock total allowable catch (TAC) in 2018 was 1.55 million mt with little change going into 2019 (1.56 million mt).



Figure 5. Pollock Harvest Volume in Alaska (mt), 1981-2017

Source: NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database (1981-2016) and NMFS Alaska Region Blend and Catch-accounting System estimates, data provided by the Alaska Fisheries Information Network (AKFIN) (2017).

In 1998, the American Fisheries Act (AFA) created participation requirements for entry into the Bering Sea Aleutian Islands (BSAI) pollock fishery through a cooperative. The allocations under the AFA, which went into effect in 1999, distribute 50 percent of the TAC to the inshore sector (catcher vessels delivering to shoreside processors), 40 percent to the offshore sector (catcher processors), and 10 percent to motherships (floating processors which receive pollock primarily from catcher vessels). AFA catcher processors are the largest fishing vessels in Alaska at 200 feet to 344 feet in length.⁷ In 2017, there were 3 motherships, 21 catcher processors, and 103 catcher vessels permitted in the Alaska pollock fisheries.⁸

	2013	2014	2015	2016	2017
Bering Strait / Aleutian Islands					
Catcher processors	606,217	616,217	626,451	641,765	642,263
Catcher vessels (Mothership)	111,771	112,620	115,753	119,043	120,640
Catcher vessels (Shoreside)	550,320	556,838	571,386	584,904	589,741
Gulf of Alaska					
Catcher processors	1,161	1,685	1,195	624	1,095
Catcher vessels (Shoreside)	92,764	139,478	165,090	175,482	183,263
Total	1,362,233	1,426,837	1,479,876	1,521,829	1,537,002

Table 11. Alaska Pollock Harvest Volume (mt), by Harvesting Sector and Area, 2013-2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Nearly all commercial pollock fisheries in Alaska are located in federal jurisdiction (99 percent). There is a state-managed trawl fishery in Prince William Sound, with a five-year harvest average of 3,042 mt. A federally mandated Community Development Quota program allocates 10 percent of the quota to eligible rural communities in Western Alaska. The

⁷ (North Pacific Fishery Management Council, 2012)

⁸ (NOAA, 2019)

pollock season is split into two distinct seasons: "A" season runs from January to April and "B" season runs from June through October.

Alaska Pollock Production

This section summarizes the wholesale value and volume of pollock production in Alaska. In total, Alaska pollock accounted for 63 percent of Alaska's groundfish production volume and 57 percent of first wholesale value in 2017.⁹ Wholesale market profiles for pollock fillets, surimi, H&G, and roe follow this overview section.

Wholesale Production and Value Summary

Pollock is one of the most valuable fisheries in Alaska, and even the world, due to its tremendous volume, production versatility, and white, mild-flavored flesh. Virtually all edible pollock products are frozen before being sold into wholesale markets. Alaska pollock harvests yielded 604,426 mt of processed product in 2017, with a first wholesale value of \$1.44 billion.





Table 12. First Wholesale Value for Alaska Pollock (\$ millions), 2008-2017										
2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
\$1,378	\$1,065	\$1,106	\$1,424	\$1,468	\$1,336	\$1,399	\$1,381	\$1,460	\$1,438	

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Alaska pollock yield five primary product types: surimi, fillets, head/gut, roe, and fish meal/oil. In 2017, of the 604,426 mt of pollock products produced, 34 percent of that volume was surimi, followed by 29 percent fillet, 11 percent fish meal, 10 percent H&G, 3 percent roe, and the remainder in other products such as minced meat, fish oil, and organs.

⁹ ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

These proportions can vary somewhat annually, as regions (BSAI vs. GOA) and sectors (shoreside vs. at-sea) tend to have different product mixes and allocations among them change over time. The relative demand and prices for different products forms can also incentivize processors to make changes to their production portfolio. Fish meal, oil, and other ancillary products are discussed in detail in Section X.



Figure 7. Alaska Pollock First Wholesale Production Volume and Value, by Product Type, 2017

Note: Percentages may not sum to 100 percent due to rounding.

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

	2017 Production Volume (in mt)	2017 Production Value (in \$000s)	Recovery Rate Range Pct. from Round Weight	Average Price per Kilo
Fillets	172,675	479,941	20-35%	\$2.78
Surimi	207,341	595,095	20-30%	\$2.87
Headed and Gutted (H&G)	61,605	59,215	52-72%	\$0.96
Roe	19,517	121,262	*1.0-1.7%	\$6.21
Other Products	143,288	182,521	-	\$1.27
Total Wholesale Production	604,426	1,438,035	39%	-
Total Retained Harvest	1,537,002		-	-

Table 13. Production Volumes and Recovery Rates for Common Alaska Pollock Products, 2017

*Actual range of roe recovery rate from 2013 to 2017 compared to total harvest volume; however, roe recovery rates can vary significantly depending on when fish are harvested - from virtually zero percent to 8 percent.

Note: Production volume is shown in product-weight terms.

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)). Industry interviews, and Crapo, 2004.

Fillets typically provide the most revenue of any product type, though surimi topped the list in 2017. Together fillets and surimi accounted for 75 percent of Alaska pollock's first wholesale value in 2017. Although roe is only 3 percent of the production volume, it accounts for 8 percent of the fish's value and used to be a more valuable component when roe prices were higher. Fish meal/oil, minced meat, and other ancillary products account for 10 percent of the value, while head/gut production is 7 percent.

Roe typically has the highest profit margin per unit of production. Average roe prices in 2017 were near historic lows at \$6.21 per kilogram as international demand has waned over time. First wholesale prices are also historically low for fillets (\$2.78 per kilogram) and headed and gutted products (\$0.96 per kilogram) (which are typically processed into fillets or surimi outside of Alaska), as a result of high international productions volumes. First wholesale prices for surimi (\$2.87 per kilogram) have been comparatively stronger in recent years as Alaska is the primary producer of pollock based surimi and international demand has remained strong.

ALASKA POLLOCK PRODUCTION MIX

Most U.S. pollock producers have significant choice over relative production volumes of products derived from pollock meat (fillets, surimi, and head and gut). While generally unable to shift all production into either fillets or surimi, production focus can be shifted in response to demand and supply shifts. Average fish size also plays a role in production decisions, with larger fish favoring fillet production. Production of fish meal, fish oil, and other ancillary products is determined primarily by the type of processing infrastructure available, with consistent utilization from year to year. The table below summarizes the production mix over the past decade (2008-2017).

Year	Fillets as Pct. of Total Production	Surimi as Pct. of Total Production	H&G as Pct. of Total Production	Roe Yield vs. Harvest Volume	Total Yield vs. Harvest Volume	Harvest Volume in mt
2008	32%	33%	6%	2.0%	37%	1,033,069
2009	32%	24%	16%	2.2%	43%	847,861
2010	29%	27%	16%	1.9%	43%	883,326
2011	32%	29%	12%	1.5%	40%	1,274,866
2012	30%	33%	9%	1.4%	39%	1,302,797
2013	32%	31%	11%	1.2%	40%	1,362,233
2014	32%	32%	12%	1.7%	41%	1,426,837
2015	30%	35%	10%	1.5%	39%	1,479,876
2016	29%	33%	9%	1.0%	40%	1,521,829
2017	29%	34%	10%	1.3%	39%	1,537,002

Table 14. Alaska Pollock Production Composition, by First Wholesale Volume, 2008-2017

Sources: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

The share of fillet production has been fairly steady over the past decade, ranging from 29 to 32 percent. Years at the low end of that range (2010, 2012, 2016, and 2017) line up with higher surimi prices relative to fillet prices. Surimi production share averaged 31.5 percent over the past decade. Production fell sharply in 2009 coinciding with a 32 percent decline in average surimi unit values and lower TACs. H&G production volumes increased nearly three-fold from 2005 through 2010 but have been steady since 2010 despite significantly increased TACs. Roe accounted for 3.7 percent of first wholesale production volume over the past decade. Roe yields, compared to round-weight harvest volume, averaged 1.5 percent and are primarily dictated by harvest timing and fish size rather than market factors.

Total production yields compared to round-weight harvest volume have held steady in recent years at 39 to 41 percent. These yields are substantially higher than those seen prior to 2008 (closer to 34 percent) despite similar TACs – likely due to increased capital investments, gains in processing efficiencies, and other factors.

First wholesale value of Alaska pollock has been relatively stable over the past decade in nominal terms, outside of 2009 and 2010 when TACs fell sharply. Value peaked in 2012, followed by a multi-year decline despite larger harvests. Prices

started to rise in 2016 and 2017, especially for surimi, leading to first wholesale values approaching 2012 levels. This trend appears to have continued and 2018 is projected to be a new high, based on export values, harvest volumes, and industry interviews.

Lower pollock roe values have been a significant drag on first wholesale values over the last decade. Prior to 2008, roe accounted for more than 20 percent of production value, but declining prices have made the category relatively less valuable (8 percent in 2017). Fillets and surimi provide the bulk of pollock value, typically between 69 and 75 percent. H&G product has accounted for between 3 and 9 percent of total production value, with lower levels in recent years due to large TACs and H&G production plateauing at around 60,000 mt.

Year	Fillets as Pct. of Total Value	Surimi as Pct. of Total Value	Roe as Pct. of Total Value	H&G as Pct. of Total Value	Other Products as Pct. of Total Value	Total Value \$ millions
2008	33%	38%	17%	3%	8%	\$1,378
2009	43%	23%	15%	8%	10%	1,065
2010	38%	32%	9%	9%	12%	1,106
2011	40%	29%	11%	8%	12%	1,424
2012	35%	36%	12%	5%	12%	1,468
2013	42%	28%	9%	7%	13%	1,336
2014	40%	31%	10%	7%	12%	1,399
2015	38%	36%	7%	6%	13%	1,381
2016	37%	36%	6%	5%	15%	1,460
2017	33%	41%	8%	4%	13%	1,438

Table 15. Alaska Pollock Production Composition, by First Wholesale Value, 2008-2017

Sources: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

The total value of Alaska pollock production has been relatively stable over the past decade but unit values for key products have been more volatile (see table below). Market factors driving changes in prices for key products are examined in more detail in later sections. In 2018, prices for several key products, including fillets and surimi, increased significantly based on preliminary trade data.

Year	Fillets	Surimi	H&G	Roe	Fish Meal	Fish Oil	Total
2008	\$3,745	\$4,187	\$1,734	\$11,567	\$1,109	\$1,099	\$3,640
2009	3,917	2,868	1,496	8,806	1,204	728	2,937
2010	3,789	3,448	1,595	5,957	1,576	912	2,906
2011	3,416	2,823	1,828	7,926	1,559	1,147	2,772
2012	3,414	3,134	1,479	9,317	1,499	1,132	2,872
2013	3,193	2,217	1,607	7,173	1,726	1,188	2,442
2014	3,012	2,390	1,399	6,074	1,657	1,106	2,410
2015	2,982	2,472	1,366	4,714	1,662	1,148	2,375
2016	3,089	2,599	1,279	6,153	1,635	1,297	2,391
2017	2,779	2,870	961	6,213	1,531	993	2,379

Table 16. Value per Metric Ton for Major Alaska Pollock Products, 2008-2017

Sources: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

DISCUSSION OF RECOVERY RATES FOR ALASKA POLLOCK

Pollock processing yields (first wholesale volume / harvest volume) are lower compared to those for most other Alaska seafood products. This is true despite the fact that pollock is processed more intensely and efficiently than any other major Alaska species due to widespread use of pollock trimmings for fish meal, fish oil, and production of other ancillary products. If pollock processing is so efficient, why does it result in lower production yields than other species?

Several factors explain this paradox. First, the majority of primary processing for Alaska pollock consists of skinless/boneless fillets or surimi, which are relatively finished products compared to the H&G approach that dominates other fish species, such as salmon. A more accurate comparison between salmon and pollock utilization rates would include an analysis of the waste streams at the secondary processors buying Alaska's H&G salmon.

Secondly, the majority of pollock retained in Alaska fisheries are generally between four and six years old, and weigh between 1-2 pounds. Regardless of the species, small fish tend to produce less fillet yield than large fish. Thirdly, in addition to the primary meat products (fillets and surimi), processors use other parts of the fish to produce roe, fish meal, and ancillary products. These products create more production volume, but also have relatively low recovery rates, especially for fish meal (a dried, shelf-stable product).

Pollock is an abundant, rationalized fishery with a highly efficient processing sector. Production volume generally reflects the most economically-feasible yield attainable, given the nature of the resource. The difference between harvest volume and production volume for other Alaska seafood species would be greater if more volume was converted to finished product, as is the case with pollock. Therefore, the significant difference in harvest volume compared to in-state production volume for pollock generally indicates a higher degree of value-added processing taking place in Alaska compared to many other Alaska fisheries.

Key Markets and Product Flows

Considering first sales only (not considering re-processing and re-exports), the United States is the fifth most important market for the primary categories of Alaska pollock products (fillet, surimi, roe, and H&G/whole). The United States accounted for 16 percent of first sales (by volume) over the 2013 to 2017 time period. The remaining volume (84 percent) is sold to export markets, mostly Europe, South Korea, Japan, and China.

While the European Union (EU) has consistently been Alaska's most important export market, volumes in 2017 were 9 percent below the 2013-2016 average. On the other hand, Asian markets were all up in 2017, including South Korea (14 percent increase), Japan (8 percent), China (34 percent), and Thailand (58 percent).

The U.S. domestic market size is estimated by subtracting exports from production. This method is imperfect due to differences between datasets and other factors but provides the best available estimate of trends in the U.S. market. According to this approach, the U.S. market for the primary pollock product types has declined in recent years, with 2017 volume representing a 19 percent decline over the 2013-2016 average. Interestingly, multiple industry interviews indicate that the U.S. market for Alaska pollock products is strong and has not declined significantly, suggesting that these data do not tell the full story. Unfortunately, there is limited data available on the domestic market for Alaska pollock.

Table 17. Domestic and Export Markets for Alaska Pollock Products, by Country (mt), 2013-2017

Country	2013	2014	2015	2016	2017	2017 vs. 2013- 2016 Avg.	% of Total (2013-2017)
Europe	142,009	152,249	137,582	140,156	130,519	-9%	31%
South Korea	71,034	71,214	78,565	96,847	90,316	14%	18%
Japan	63,739	83,989	93,693	75,738	85,680	8%	18%
China	54,855	57,307	53,123	63,635	76,626	34%	13%
Other Countries	14,315	14,201	13,652	13,760	17,199	23%	3%
Thailand	4,867	6,347	6,030	8,875	10,311	58%	2%
Total Exports	350,819	385,307	382,645	399,010	410,651	8%	84%
U.S. (Estimated)	77,019	75,326	77,767	67,822	60,123	-19%	16%
Total Production	427,838	460,633	460,412	466,832	470,774	4%	100%
Pct. Exported	82%	84%	83%	85%	87%		

(fillet, surimi, roe, and H&G/whole products only)

Note: Reflects direct exports only. Does not reflect final market destination. Does not include fish meal or other products not distinguishable at the species level in trade data.

Source: ASMI Seafood Export Database, NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)), and IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html.

Product flows vary considerably by country, as shown in the table below. Fillets are the dominant product in the European and domestic market, whereas surimi dominates in Japan and South Korea and H&G dominates in China. As discussed in more detail in the Alaska Pollock H&G market profile, China primarily purchases H&G/whole pollock for reprocessing into fillets and re-export to Europe (and less so to the United States and other countries).

Table 18. Major Pollock Product Flows, by Country (mt), 2017

Market	Fillet	H&G/Whole	Roe	Surimi
Europe	97,897	3,718	602	26,419
South Korea	1,351	6,886	9,260	71,570
Japan	2,643	586	8,426	74,554
China	18,474	54,489	148	3,280
Other Countries	10,330	7,484	36	9,458
Total Exports	130,694	76,087	18,471	185,281
Estimated Domestic Market	41,981	-4,847	1,046	22,060
Production	172,675	71,240	19,517	207,341
% Exported	76%	107%	95%	89%

Note: Reflects direct exports only, not final market destination. H&G exports are greater than production due to data source discrepancies as well as due to inventory held between calendar years.

Source: ASMI Seafood Export Database, NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)), and IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html.

At the writing of this report, trade disputes with China present a risk of escalating tariffs and supply chain disruptions in 2019 and beyond. Chinese import tariffs added in 2018 exempted product destined for China's reprocessing/re-export market, so primarily affect imports serving the Chinese domestic market. Pollock products can be purchased at Chinese restaurants and groceries, though the point of origin is not generally identified and it is unknown how much of Alaska's

pollock products stay in China. As of early 2019, the trade dispute does not include increased U.S. tariffs on pollock fillets imported from China's reprocessing sector – despite the fact that a majority of these fillets are produced using Russian-origin pollock.

Wholesale Market Profile: Alaska Pollock Fillets

Fillets accounted for a third of total Alaska pollock production value in 2017. Pollock fillets function as a whitefish commodity for production of fish sticks/fingers, breaded fillets, and other value-added frozen whitefish fillet products. With dual surimi and fillet production lines at most Alaska processors, fillet quality is consistently very high as fillets with blemishes can be diverted to surimi. The two primary markets for fillets are the United States and Europe. Prices have trended downward in recent years, followed by a sharp rebound in 2018 and heading into 2019.

Product Description

The majority of Alaska pollock fillets are processed into frozen blocks of skinless or deep-skinned fillets, due to the long slender fillet shape of pollock. Fillets are also packaged as individually quick frozen (IQF) portions or shatterpacks (blocks of frozen fillets with each fillet separated by plastic). Key fillet product forms include the following:

Fillet Blocks – The dominant fillet product form is composed of whole fillets that are frozen in blocks under pressure. Each standard frozen block weighs 16.5 pounds, and are packaged in sets of three yielding a 49.5 pound case. Blocks can contain pinbone-out (PBO) or pinbone-in (PBI) fillets. Most Alaska product consists of PBO, skinless blocks.

Deep-Skinned Fillet Blocks – Composed of whole skinless/boneless fillets that also have the fat line removed. These

products are packaged in the same standard sizes as fillet blocks.

Shatterpacks – Whole fillets which have been interleaved with plastic then frozen as a block. The plastic interleaf allows users to break apart individual fillets without thawing the product. Each standard shatterpack weighs 15 pounds and comes three to a case.

IQF Fillets – Individually quick frozen (IQF) whole fillets are glazed and frozen separately, often packaged into bags and/or boxes for transport. Standard sizes are 10, 15, and 25-pound boxes.



Photo Courtesy of ASMI.

Alaska pollock fillets are produced by catcher-processors and shoreside production facilities. These Alaska producers manufacture once-frozen products. Pollock fillets are also produced at secondary processing facilities in China and Europe using imported H&G product. However, the fish must be thawed and re-frozen after processing, creating what is known as twice-frozen fillets. Once-frozen and twice-frozen Alaska pollock fillets compete in most of the same markets, but once-frozen product sells at a premium due to its higher quality and purity (twice-frozen fillets are typically treated with moisture retention agents to counteract the effects of refreezing). Whether the fish is processed in Alaska or abroad, the primary product forms are skinless/boneless fillets (PBO) and deep-skinned fillets.

The average commercially harvested Alaska pollock weighs 2pounds and yields fillets ranging from 2-4 ounces. Deep-skinned fillets refers to the additional removal of the dark fatty layer of flesh, and results in a lower recovery rate and higher average price. Finished products made from deep-skinned filets are often sold to fast food chains and multiunit restaurants. Other regular-skinned fillet blocks are usually used in casual "fish and chips" restaurants, or in retail as breaded products.¹⁰

Pollock fillets are primarily used in frozen, generic whitefish products, such as fish sticks/fingers, breaded fish fillets/patties, and other valueadded frozen products. They are popular in quick service restaurants such as McDonald's and Long John Silver's. Frozen products made from pollock fillets are widely available in most European and North American grocery stores.



Photo Courtesy of Genuine Alaska Pollock Producers.

Supply Chain

When pollock is landed in Alaska, it enters one of the most complex supply chains of any groundfish species. Landed fish are first headed and gutted. Heads and other offal are turned into fish meal/oil or retained for other niche markets. Pollock meat is generally used to make either surimi or fillets. The fillet supply chain is summarized below.



Figure 8. Alaska Pollock Fillet Supply Chain

Note: The diagram above depicts the movement of major product volumes. Line thickness is indicative of relative product volume. Light blue lines indicate H&G product flow.

The majority of Alaska's once-frozen fillet production is exported to secondary processing companies in Europe, while a lesser amount goes to similar companies in the United States Most H&G production is exported to China for twice-frozen

¹⁰ (National Marine Fisheries Service, 2001).

fillet production. European and Brazilian processors import significant volumes of twice-frozen fillets from China and other countries. The United States also imports some twice-frozen fillets from China although the volume has been decreasing over time. Secondary processors manufacture a range of breaded, coated, salted, and other products, mostly for high-volume retail, foodservice, or distribution companies.

Fillet Production Analysis

Fillets accounted for 29 percent of all Alaska pollock production volume in 2017. Fillets were the second most valuable pollock product form in 2017 in terms of total revenue, after surimi. Fillet production declined slightly in 2017, due to an increasing emphasis on surimi (and despite increased harvest levels). The average wholesale value per mt decreased more or less steadily from 2013 to 2017, declining 13 percent over the period. Average surimi wholesale prices, on the other hand, increased 29 percent.



Figure 9. First Wholesale Volume and Value/mt for Alaska Pollock Fillets, 2008-2017

Table 19. First Wholesale Value, Alaska Pollock Fillets (\$ millions), 2008-2017

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
\$457	\$462	\$422	\$570	\$521	\$564	\$554	\$525	\$544	\$480

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Due mostly to lower fillet prices, the total value of Alaska pollock fillet production decreased 15 percent from 2013 through 2017. Export data show a rebound in fillet prices in 2018 and 2019, backed up by trade press reports of 2018 A-season prices for once-frozen PBO blocks at \$3,000/mt with contracts for 2019 A-season starting at \$3,500/mt.¹¹ While these prices represent a sharp increase, from a long-term perspective they can be seen as a return to the norm.

Fillet production is dictated by market demand for different types of fillets, with contracts typically in place before the start of each season. Skinless/boneless fillets typically account for more than two-thirds of fillet production volume, followed by deep-skinned fillets and limited quantities of other fillet products. In 2017, 64 percent of pollock fillets

¹¹ (Seaman, Only way is up for pollock prices in 2019, 2018).

produced in Alaska were skinless fillets without ribs, while deep-skinned fillets accounted for 34 percent of production volume.

Wholesale prices for all pollock fillet products declined from 2013 to 2017 due to competition from Russian pollock and other market factors. The decline was greater for skinless/boneless fillets (-17 percent) compared to deep-skin fillets (-8 percent) – helping explain the production volume trends seen over this period. Skinless/boneless fillet production decreased 9 percent between 2013 and 2017, while deep-skinned fillet production increased 14 percent to a record high.



Figure 10. Alaska Pollock Fillet Volume and Value, by Product, 2008-2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

At-sea plants typically produce the most pollock fillets in Alaska, but the shoreside sector is typically not far behind and in recent years the split has been practically 50/50. One area where the two sectors differ is production of deep-skin fillets. Deep skin fillets fetch the highest prices and the at-sea sector is especially well positioned to compete on quality through rapid processing. Over the last ten years, prices for at-sea sector deep-skin fillets averaged 12 percent higher than the same products produced by the shoreside sector. Unsurprisingly, the at-sea sector puts a greater emphasis on the product: in 2017, deep-skin fillets made up 52 percent of at-sea fillet production but just 16 percent of shoreside fillet production (by volume). Deep-skinned fillets accounted for 34 percent of overall Alaska pollock fillet production volume in 2017.

Fillet Market Analysis

Export markets are critically important to Alaska's pollock industry. It is estimated that export markets buy nearly threequarters of all Alaska pollock fillet production. Almost two-thirds of all Alaska pollock fillets go directly to European markets. In addition, the majority of Alaska pollock fillets exported to China are eventually re-exported to Europe. See more detail below on the European market.

Sales to the U.S. domestic market can be estimated by subtracting exports from production. These estimates indicate that domestic market purchases decreased steadily over the 2013 to 2017 period – both in volume (61,865 mt to 41,981 mt) and as a percent of total fillet production (from 35 percent to 24 percent).

Market	2013	2014	2015	2016	2017	Pct. of Total (2013-2017)
Europe	103,787	119,972	109,487	107,465	97,897	61%
China*	4,632	4,526	5,615	9,021	18,474	5%
South Korea*	848	839	2,726	5,828	1,351	1%
Canada	1,689	1,164	760	551	6,482	1%
Japan	903	277	1,131	980	2,643	1%
Australia	929	1,096	1,158	1,100	1,213	1%
Other Countries	2,064	3,943	3,276	2,763	2,635	2%
Total Exports	114,852	131,819	124,153	127,708	130,694	71%
U.S. (Estimated)	61,865	52,151	51,956	48,469	41,981	29%
Total Production	176,717	183,970	176,109	176,177	172,675	100%
Percent Exported	65%	72%	70%	72%	76%	

Table 20. Sales of Alaska Pollock Fillets to Key Markets (mt), 2013-2017

* Denotes countries which primarily re-process and/or re-export product to other markets.

Note: Data pertains to primary exports only, does not portray product which may be re-exported to other markets.

Source: ASMI Seafood Export Database, NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN).), and McDowell Group estimates.

EUROPE

Europe is the world's largest market for pollock fillets. Export markets typically consume two-thirds to three-quarters of Alaska's pollock fillet production, and European countries account for 80 to 90 percent of all U.S. pollock fillet export

value. European markets imported 97,897 mt of Alaska pollock fillets in 2017, worth \$257 million.

Pollock fillets are generally exported to Europe as frozen fillet blocks and processed by regional manufacturers into breaded/battered fish fingers, products similar to *schlemmerfilets*, and fish pies.¹² Food service operators purchase a mix of value-added products and plain frozen pollock fillets (disaggregated into smaller units). Although it is not possible to quantify precisely, industry interviews suggest pollock fillets are more often sold to European consumers via retailers, with less production entering the foodservice sector. Some common types of retail pollock products sold in Europe are shown at right.

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Germany is the largest consumer of pollock fillets,

although France and the U.K. are also major consumer markets in Europe. Europe has a long history of whitefish consumption, so the presence of pollock as an affordable substitute to cod is common in most countries. Overall consumption of finished product is mostly a function of population, the prevalence of modern grocery stores, and median

¹² A pre-packaged frozen fish dinner with a coating of toppings consisting of breadcrumbs, herbs, spices, and/or sauces.

household incomes. Pollock is sometimes processed into a salted product for markets in Portugal and Spain. Most secondary processing into finished products occurs in Germany, France, and Poland. Frozen retail products sold in the United Kingdom are a mix of domestic production and offerings from central Europe (using Alaska and Russian pollock).

Alaska pollock fillets are primarily exported to Europe via Germany and the Netherlands. Germany's Hamburg and the Netherlands' Rotterdam are major ports. Overall, these two countries accounted for over 90 percent of total Alaska pollock fillet exports to European markets from 2013 through 2017. The share shipped to the Netherlands increased significantly in 2017, overtaking Germany as the most important European importer of Alaska pollock fillets.

The total volume of exports to Europe have remained more or less steady in recent years, though export value/mt has continued a steady, long-term decline. From 2010 to 2017, pollock fillet export prices declined 24 percent from \$3,455 to \$2,630. As mentioned previously, 2018 saw a sharp rebound in these prices to roughly \$3,000 per mt for once-frozen PBO fillet blocks (and contracts starting at \$3,500 for the same in 2019).¹³





Source: ASMI Seafood Export Database, compiled by McDowell Group.

Europe imports between 270,000 and 310,000 mt of pollock fillets per year from China, Alaska, and Russia. Alaska oncefrozen pollock fillets accounted for more than a third (37 percent) of all pollock fillets imported into Europe over the past five years. The balance comes from China - mostly re-processed, twice-frozen fillet block made from Russian pollock - or directly from Russia as single-frozen fillet blocks.

Alaska Groundfish and Crab Wholesale Market Profiles

¹³ (Undercurrent News, 2019)
Exporter	2013	2014	2015	2016	2017	Pct. of Total (5-yr. Avg.)
China*	168,160	162,663	155,303	154,410	145,835	54%
U.S. (Alaska)	103,787	119,972	109,487	107,465	97,897	37%
Russia	29,784	23,538	28,326	25,647	28,698	9%
Total	301,731	306,173	293,116	287,522	272,430	

Table 21. European Imports of Pollock Fillets from Major Producers (mt), 2013-2017

*Consists primarily of Alaska pollock caught in Russia with some Alaska-origin pollock as well.

Note: China and Russia exports includes pollock fillet sales to all European Union countries, plus Norway and Switzerland.

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html and ASMI Seafood Export Database.

Secondary processors are the largest buyers of pollock fillets in Europe. These companies transform frozen blocks of pollock fillets into ready-to-heat products for retail customers, package fillets into smaller quantities (typically in bags), and sell frozen fillets in smaller quantities to foodservice distributors. Unlike pollock surimi and roe buyers, large European fillet buyers do not own any significant stake in companies producing Alaska pollock. Major European buyers of Alaska pollock fillets include:

- Aldi (private label)
- Bofrost
- Carrefour
- Findus Group (including Young's brand)
- Frosta
- Iglo Foods Group (including Birds Eye brand)
- Lidl
- McDonalds Europe

- Metro (private label)
- Netto (private label)
- Pickenpack Europe
- Sainsburys (private label)
- Sodexo (distributor)
- Tesco (private label)
- Waitrose (private label)

Discount retailers in Germany and elsewhere in Europe continue to gain market share and have a considerable influence on the pollock fillet market. These retailers are known to advertise private label fish fingers (and similar products) at low prices as loss leaders to bring consumers into their stores. This behavior increases pollock fillet consumption but also keeps wholesale prices low by cutting into the prices that higher-end brands can charge.

Impact of MSC Certification and Increasing Fillet Production in Russia

Several major European retailers have committed to only selling certain seafood products from sustainable fisheries, certified by the Marine Stewardship Council (MSC). Until Russia's Sea of Okhotsk pollock fishery was certified in 2013, Alaska's pollock fisheries were the only source for certified pollock fillets. Harvests in Russia's Sea of Okhotsk region have been steady around 900,000 mt in recent years but are projected to decline to around 800,000 by 2021. According to news coverage, Russian pollock stakeholders are considering pursuing MSC certification in other Russian pollock fisheries to make up for these declines.¹⁴

A variety of other efforts are underway to increase the value of Russian pollock production and exports. Fillet production increased 34 percent from 2015 to 2016 (from 40,200 mt to 53,700 mt) and is projected by some to triple from 2016 to 2025. Currently, frozen H&G makes up roughly 80 percent of Russia's pollock production, but that could drop to 55 percent by 2024 under a plan announced by Rosrybolovstvo, Russia's federal fishery agency. This plan includes the

¹⁴ (Seaman, Russian pollock sector needs more MSC fish with TAC dropping, shift to fillets, 2018)

construction of more than 20 fish processing facilities and 33 fishing vessels, as well as the launch of a new marketing and supply chain organization known as "The Russian Fish."¹⁵

MSC certification of Russia's Sea of Okhotsk fishery led to increased competition in key European markets, a slump in wholesale prices, and a declining premium for once-frozen Alaska's pollock fillets. While fillet prices have increased in 2018, Russia's increasing production of once-frozen fillet blocks is an important trend with significant potential to impact the value of Alaska's pollock fillet production going forward.

UNITED STATES

Home to McDonalds' Filet-O-Fish sandwich, the U.S. domestic market is the second-largest consumer of Alaska pollock fillets in the world. In contrast to Europe, Americans consume more pollock through foodservice channels than retail outlets. Pollock is the primary whitefish species used in most generic fried fish sandwiches, although it is becoming more common to see the species name identified in product messaging. Fish sandwich patties sold by foodservice operators are typically made using minced pollock meat and/or whole fillets. Breaded and/or battered pollock fillets are also common foodservice fare in the United States; these products utilize either whole fillets or fillet portions. Frozen fish sticks are common retail products; also made from pollock fillets and minced meat.

U.S. consumption of pollock fillets is estimated by subtracting net exports (exports minus imports) of Alaska pollock fillets from domestic production. By this method, the U.S. market historically consumed approximately 100,000 mt of pollock fillets per year. In recent years, however, domestic supply has decreased, with around 68,000 mt tons consumed in 2017.

The main factor behind declining U.S. pollock supply is a steady decrease in pollock imports, likely driven in part by a new U.S. government requirement in 2015 that limits the market name "Alaska pollock" to pollock from Alaska. Imports declined from more than 70 thousand mt in 2010 to 26 thousand mt in 2017. As a result of declining imports, the share of domestic pollock fillet consumption originating from Alaska has doubled, from an estimated 30 percent in 2010 to 61 percent in 2017. Though somewhat at odds with the data and calculations presented here, it should be noted that multiple industry contacts report strong and growing demand for once-frozen Alaska pollock fillets in the domestic market.

¹⁵ (Vovchenko, Russia planning aggressive expansion of value added exports, 2019)

Year	Alaska Pollock Fillet Production	Imports	Exports	Est. U.S. Supply	Est. Once-Frozen Alaska Product	Pct. Alaska
2010	111,491	70,278	81,605	100,164	29,886	30%
2011	166,927	72,938	113,971	125,894	52,956	42%
2012	152,550	51,845	99,921	104,474	52,629	50%
2013	176,717	55,105	114,852	116,970	61,865	53%
2014	183,970	49,833	131,819	101,970	52,151	51%
2015	176,109	44,532	124,153	96,488	51,956	54%
2016	176,177	32,000	127,708	80,469	48,469	60%
2017	172,675	26,361	130,694	68,342	41,981	61%
13-17 Avg.	177,130	41,566	125,845	92,851	51,284	55%

Table 22. Estimated U.S. Pollock Fillet Market Supply (mt), 2010-2017

Source: NMFS Office of Science and Technology, Foreign Fishery Trade Data, NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)), ASMI Seafood Export Database, and McDowell Group estimates. Figures may not sum due to rounding.

Pollock fillets are usually put through a secondary manufacturing process before reaching American consumers. Most fillets are bought by companies unaffiliated with harvesting companies in Alaska or Russia. However, there is some integration in the U.S. market. Alaska's largest pollock producer, Trident Seafoods, owns or leases 29 percent of the pollock quota in Alaska. Trident sells a variety of finished products to retailers, including pollock fillets, burgers, and fish sticks.

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Unisea, Alaska's third-largest pollock producer, is owned by NISSUI and supplies raw material to (another NISSUI company) Gorton's – a popular brand for frozen whitefish products.

Foodservice operators utilizing Alaska pollock typically own or contract with

processing facilities. Major U.S. buyers of Alaska pollock fillets and minced meat, which are not affiliated with Alaska producers, include:

- Burger King
- Costco
- Kroger (private label)
- McDonalds

- Pinnacle Foods Group (Van de Kamps brand)
- Target (private label)
- Walmart (private label)

A growing domestic market for Alaska pollock is the USDA's school lunch and food bank programs. The result of extensive engagement by Alaska pollock producers, Alaska pollock fillets were added to the foods available through the USDA school lunch program several years ago. Sales of the product have reportedly increased annually over the last five years. Building on that success, Alaska pollock whole-grain breaded fish sticks were added to the list in 2016. A total of 845 mt of fish sticks and 1,617 mt of fillets were purchased through the USDA's school lunch program in FY17.¹⁶ In addition,

¹⁶ USDA Food and Nutrition Service.

Alaska pollock portions and fish sticks were added to the list of foods available through the USDA's food bank program in 2018 and have proved popular.

OTHER MARKETS

Russia and Brazil are also key markets for pollock; however, the majority of pollock consumed in these countries comes from Russia. Direct exports to Russia from the United States ended in 2015 and only 173 mt of fillets were exported to Brazil in 2017. However, both of these countries purchase large quantities of Chinese twice-frozen fillets, which include some Alaska-origin pollock.

Russia

As the world's largest pollock producer, it is not surprising that Russians consume significant quantities of pollock. Russia imported 5,128 mt of pollock fillets from China in 2017, but the majority of Russian consumption comes from product caught and processed domestically. Estimates about market size vary, but appear to rival or exceed that of the United States and is thought to be growing due to rising costs for imported seafood and government directives which advocate consumption of domestically-produced food products. Exports of Alaska pollock fillets to Russia totaled 664 mt in 2014, but subsequently fell to zero due to trade embargos between the countries.

The majority of pollock sold into the Russian domestic market is H&G fish, though there is a growing supply of pollock fillets as well. Available information indicates that roughly 140,000 mt of H&G pollock was consumed within the country from 2015 through 2017. Fillet consumption increased dramatically from 13 mt in 2015 to 34 mt in 2017 – a 165 percent increase.¹⁷ Russian consumers often fry pollock or use it in soups.

Brazil

Brazil is typically the next largest consumer of pollock fillets after Europe, the United States, and Russia. South American seems an odd place to find large volumes of a North Pacific whitefish, but the nation's culinary heritage and population create a match for pollock. Most of Brazil's 200 million residents trace their ancestry back to Portuguese and Spanish settlers. Salted cod, called bacalhau in Brazil, is a popular dish in both Portuguese and Spanish cuisine. Although cod is preferred, pollock functions as a more affordable substitute in the Brazilian salt cod market. Bacalhau is commonly used in fish balls (bolinhos de bacalhau), salads, and soups.

Virtually all of Brazil's pollock products are imported from China, though these imports have declined sharply in recent years due to a crackdown on the use of moisture retention agents (including sodium tripolysphosphate). These agents are commonly added to twice-frozen fillets to counteract moisture loss during refreezing – but are also used to merely add weight to the fillets and can lead to a low-quality product.

Alaska producers – which produce additive-free once-frozen fillets – have made some progress in accessing the Brazilian market directly, but exports remain small in comparison to those from China.

¹⁷ According to data included in a Groundfish Forum 2018 presentation by Torunn Halhjem, Trident Seafoods.

	2013	2014	2015	2016	2017
China	52,299	64,507	36,158	33,890	19,255
U.S. (Alaska)	119	387	566	482	527
Other Countries	564	260	826	145	95
Total Imports	52,982	65,154	37,550	34,517	19,877

Table 23. Brazil Imports of Frozen Pollock Fillets (mt), 2013-2017

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html and ASMI Seafood Export Database.

Competing Supply

Alaska pollock's primary competition comes from Russian-origin twice-frozen pollock fillets. The vast majority of Russian pollock production is exported as a frozen H&G product to China, where it is thawed, filleted, then re-frozen and exported to other countries. Once-frozen fillet production in Russia is limited by minimal processing capacity, though such production is expected to grow due to a major government-backed initiative (as described previously).

Roughly half of Russia's pollock harvests occur in the Sea of Okhotsk. MSC certification of the Sea of Okhotsk fishery in 2013 significantly increased the impact of Russian production on Alaska by opening up Russian-origin products to key European fillet markets that require MSC certification. As shown in the chart below, Russian production is expected to decline slightly in the coming years, while Alaska production is expected to increase slightly.





Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/, NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database, NMFS Alaska Region Blend and Catch-accounting System estimates (Data provided by the Alaska Fisheries Information Network (AKFIN)), Groundfish Forum, North Pacific Fisheries Management Council Harvest Specifications, and McDowell Group estimates.

Other whitefish species such as cod, haddock, saithe, hake, hoki, sole, tilapia, and pangasius also impact the market for Alaska pollock fillets. For information about production of other whitefish species see the Global Whitefish Market Profile.

Wholesale Market Profile of Alaska Pollock Surimi



Surimi accounted for 34 percent of Alaska's pollock wholesale production volume and 41 percent of wholesale production value in 2017. More than 207,000 mt of pollock surimi, worth \$595 million, was produced in Alaska in 2017. Japan, Europe, South Korea, and the United States are key surimi markets.

Product Description

The term surimi refers to the intermediate product use in the production of surimi seafood products. Surimi is an odorless, proteinrich, wet paste that is an intermediate product used in the production of a variety of surimi seafood products (such as imitation crab meat).

Photo Courtesy of ASMI.

Pollock meat is removed through heading, gutting, and filleting, and then finely minced. Blood and other substances are removed through repeated rinsing with water. Surimi blocks are produced when pulverized minced meat is mixed with additives such as salt, starch, and sugar, and then frozen and packaged. The quality of surimi is determined by a few main characteristics including its gel strength, color (the whiter, the better), and purity. Surimi technology has improved over the years, with the yield increasing from 12 percent to over 30 percent.¹⁸

The general Alaska pollock surimi production process is as follows: 19

- De-heading, gutting, de-boning, skinning, and filleting the fish to separate the flesh
- Mincing the fish flesh
- Washing the fish flesh (several times) to remove undesirable water-soluble materials, such as fats, inorganic salts, and some proteins
- Refining the fish flesh to remove any residual materials such as skin, bones, and scales
- De-watering the fish flesh in a screw press
- Mixing the fish flesh with cryoprotective compounds, such as sugar and sorbitol



Surimi processing. Photo credit: Flickr user sodai gomi

• Freezing the fish flesh into blocks and packing it.

Surimi has been used to preserve and consume whitefish for almost a thousand years in Japan, but it wasn't until after World War II that surimi production became industrialized.²⁰ It can be made from a variety of fish, but Alaska pollock surimi is sought after for its white color, binding ability, abundance, and mild flavor.

Alaska surimi production started in 1984 and is standard in nearly all of the state's major shoreside and at-sea processing facilities that focus on pollock. Grades of surimi commonly available from Alaska processors include (in descending order of quality) SA, FA, AA, KA, KB, KC, and RA. Grades depend on the type of additives used, fish quality, whiteness, gel

¹⁸ (Park, 2014).

¹⁹ (Vidal-Giraud, 2007).

²⁰ (Park, 2014).

strength, and other characteristics. Demand for surimi made with only "natural" additives has been increasing in recent years, as these products command a price premium and provide access to emerging market segments concerned about health and purity.

Surimi is used to create hundreds of surimi seafood product varieties produced by secondary processors. The broad categories include kamaboko (steamed), chikuma (broiled), satsuma-age (fried), and seafood analogs (e.g. imitation crab sticks).

Supply Chain

Alaska pollock surimi blocks are produced by catcher-processors with onboard surimi processing capacity and by shoreside processors that take deliveries of unprocessed pollock from catcher vessels. Alaska processors sell frozen surimi blocks to secondary processors (some of which may be affiliated with the primary processing company) and distribution companies in Asia, the United States, and Europe. Secondary processors use surimi blocks from Alaska to create surimi seafood products tailored to various end markets.



Figure 13. Alaska Pollock Surimi Supply Chain

Alaska Production Analysis

In 2017, surimi accounted for 34 percent of Alaska pollock production volume and 41 percent of first wholesale value. Surimi production reached 207,300 mt last year and had a value of \$595 million. Production volume has typically ranged from 150,000 to 200,000 mt annually (except for a drop in 2008-2010), driven primarily by harvest volumes. Surimi production volume is also driven by the relative demand for surimi versus fillets, though surimi production as percentage of total pollock production has been relatively steady. From 2008 through 2017, this percentage has ranged from 24 to 35 percent. In recent years, surimi production has grown steadily as harvests levels and surimi prices increased.



Figure 14. First Wholesale Volume and Value/mt for Alaska Pollock Surimi, 2008-2017

Table 24. First Wholesale Value, Alaska Pollock Surimi (\$ millions), 2008-2017

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
\$526	\$250	\$357	\$418	\$524	\$378	\$439	\$500	\$531	\$595

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Wholesale value is more variable, as the price of Alaska pollock surimi can vary from year to year depending on global surimi market conditions. Average surimi material prices were \$2.87 per kilo in 2017, up 10 percent from the previous year. Preliminary data from 2018 indicates that the trend of increasing surimi wholesale prices has continued, with export prices in the first nine months of 2018 up 10 percent over the same period in 2017.

Alaska pollock surimi production is split almost evenly between shoreside plants and at-sea processors – a relationship that has been relatively consistent over time. Surimi produced at-sea generally commands a premium price due to quicker processing times. From 2008 through 2017, at-sea surimi wholesale prices averaged 25 percent higher than shoreside sector surimi. This premium grew significantly in 2017 to 70 percent higher (\$3,608/mt for at-sea surimi versus \$2,148/mt for shoreside surimi).





Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Key Market Analysis

Approximately 90 percent of Alaska pollock surimi is sold to export markets. In 2017, Japan and South Korea imported 70 percent of all Alaska pollock surimi production. The remaining markets included Europe, United States, China, and Thailand. Europe is a larger market than the export data below suggests, importing significant volumes of surimi from South Korea (containing Alaska pollock as well as surimi made from other species). U.S. surimi exports in 2017 were 10 percent above the previous four-year average.

Country	2013	2014	2015	2016	2017	% Change over 2013- 2016 Avg.	% of Total (2013-2017)
Japan	56,292	71,889	81,830	69,184	74,554	7%	37%
South Korea	61,448	56,847	60,407	71,113	71,570	15%	33%
Europe	35,626	25,324	22,697	27,832	26,419	-5%	14%
Thailand	530	1,198	2,395	4,831	7,746	246%	2%
China	1,466	1,281	2,008	2,194	3,280	89%	1%
Other Countries	5,546	4,366	2,176	2,862	1,712	-54%	2%
Total Surimi Exports	160,907	160,906	171,513	178,016	185,281	10%	-
U.S. (Estimated)	9,352	22,750	30,870	26,215	22,060	-1%	11%
Total Production	170,259	183,656	202,383	204,230	207,341	9%	100%
Pct. Exported	95%	88%	85%	87%	89%	-	-

Table 25. U.S. Exports of Alaska Pollock Surimi (mt), by Country, 2013-2017

Note: Reflects direct exports only. Does not reflect final market destination.

Source: ASMI Seafood Export Database and ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

The global production of raw surimi material totaled approximately 820,000 mt in 2017, down from the 850,000 mt produced in 2016.²¹ The decline is attributed primarily to declining tropical fish harvests – the source of nearly two-thirds of global surimi production. Alaska's pollock fishery accounts for roughly a quarter of global surimi production. Japan is the largest market for surimi, though other Asian countries such as China and Korea are important and growing surimi consumers.

The 820,000 mt of raw surimi produced in 2017 was converted into an estimated 3 million mt of surimi seafood products. China was the largest producer of end products – despite consuming less surimi raw material than Japan – due to a lower average percentage of seafood in their surimi seafood products.

²¹ Future Seafood Group (via Undercurrent News).

JAPAN

As the birthplace of surimi and its associated food science technology, Japan is the world's largest end market for surimi seafood products, consuming a third of global surimi production. Large companies and artisanal shops in Japan process over 1,000 different surimi products. Consumption has declined since the mid-1970s, but it has stabilized since 2010 at roughly 570,000 mt of surimi seafood products per year.²²



Photo credit: American Seafoods

Surimi, known as *neri* in Japan, is a popular, convenient protein that is consumed in numerous ways, including fried, boiled, steamed, baked, and broiled. Consumption and popularity of various surimi products is often

specific to locales within Japan. Consumption peaks during the holiday season at the end of the year.

Japan directly imported 37 percent of Alaska pollock surimi produced from 2013 to 2017, averaging 70,750 mt of direct imports worth \$156 million per year. Including product routed through South Korea and other countries, more than half of Alaska's total pollock surimi production is estimated to go to the Japanese market.

Alaska accounted for 47 percent of Japan's imported surimi volume between 2013 and 2017 (see table below, which includes product routed through other countries). Competing suppliers include Thailand, India, China, and Vietnam. Thailand's tropical surimi production has declined in recent years and India has increased market share as a lower cost producer with access to substantial resources (see *Competing Supply* section on page 7 for information about tropical surimi).

Exporter	2013	2014	2015	2016	2017	Pct. of Total (5-yr. Avg.)
U.S. (Alaska)	99,525	117,827	124,018	110,320	137,681	47%
India	28,083	33,969	38,177	33,323	38,407	14%
Thailand	36,661	34,159	30,342	29,296	22,412	12%
China	13,459	19,078	17,898	19,303	17,416	7%
Vietnam	12,122	16,753	16,327	15,883	15,356	6%
All Others	34,875	37,599	35,096	33,369	31,287	14%
Total	224,725	259,386	261,857	241,496	262,560	-
Pct. from Alaska	44%	45%	47%	46%	52%	-

Table 26. Japan Surimi Imports from Major Producers (mt), 2013-2017

Source: Japan Trade Statistics (Ministry of Finance), compiled by McDowell Group.

SOUTH KOREA

The United States exported 71,570 mt (worth \$177 million) of Alaska pollock surimi to South Korea in 2017, which accounted for 39 percent of Alaska pollock surimi exports. Korean import statistics, however, indicated much lower imports from the United States (26,552 mt). The balance is likely held in bonded, duty-free cold storage warehouses

²² (Park, 2014)

before being shipped to other markets (primarily Japan, Europe, and Russia). Despite the prevalent re-export trade, South Korea is the second-largest buyer of Alaska surimi in terms of a single country (in most years). The 2012 Korea-U.S. Free Trade Agreement has deepened the economic ties between South Korea and the United States and increased consumption of U.S. pollock surimi.²³ However, Korea has played the role of the North Pacific's chest freezer for decades.

South Korea imported roughly 130,000 mt of all surimi varieties in 2017, or about half as much import volume as Japan. Vietnam and China are the country's top surimi suppliers, while Alaska accounted for 19 percent of total surimi imports.²⁴

Korea is one of the largest manufacturers of surimi seafood products after China and Japan, supplying its own domestic market and other international markets.²⁵

Surimi products are traditionally consumed in Korea as *eomuk* (fried) or as crabsticks. *Eomuk* bars (pictured to the right) are a popular street food in Korea with hundreds of variations. The bars, who's closest American translation might be the corn dog, are usually served on a stick or accompanied by broth or sauces.



Photo credit: Wikimedia Commons

EUROPE

Europe is the second largest market for Alaska pollock surimi. Alaska producers exported 26,419 mt of surimi worth \$58 million to Europe in 2017. Direct exports of Alaska pollock surimi accounts for approximately half of the market's total surimi base consumption (~50,000 mt annually). The EU market produces a limited amount of surimi domestically (roughly 5,000 mt) and also imports other U.S. surimi (mostly hake/Pacific whiting) as well as surimi from Vietnam, India, and other countries.²⁶ Processors in France, Spain, Lithuania, and Poland produce surimi seafood products for the European market, with relatively little importation of foreign surimi seafood products.

Spain and France are Europe's largest surimi consumers, accounting for more than 70 percent of the region's total consumption. France's surimi market is dominated by fresh preparations (98 percent), while Spain's is more evenly split (40 percent frozen and 60 percent fresh as of 2018). The majority of Europeans consume surimi as imitation crab stick products, although numerous other surimi product forms are sold. A surimi-based substitute for baby eels, known as *angulas*, is sold widely in Spain and Portugal.

UNITED STATES

The United States market for surimi is dominated by imitation crab products. Seven surimi processors operate in North America, consuming roughly 35,000 mt of surimi raw material (mostly Alaska pollock but also whiting/hake and other species) to produce an estimated 100,000 mt of surimi seafood products (other ingredients include wheat or potato

²³ (Yoo, 2013).

²⁴ (Seaman, Pollock surimi can't meet global demand as tropical supply continues to drop, 2018).

²⁵ (Park, 2014).

²⁶ (European Market Observatory for Fisheries and Aquaculture Products, 2018).

starch, water, egg white, oils, sugar, salt, and flavorings, among others). The United States also imports surimi seafood products from Japan and other countries, though trade data do not allow for a detailed analysis of these product flows.

American surimi producers have focused on product innovation in recent years. A promising market entrant is Trident Seafoods' surimi noodles, set to be released at Costco in early 2019. Trident also produces "authentic imitation crab meat" under the brand Sea Legs, which is marketed towards the food service sector with a focus on purity and authenticity (the product is made with only nine ingredients, one of which is real snow crab).

Competing Supply

Pollock surimi accounted for about a quarter of global surimi production in 2017. Virtually all pollock surimi is produced in Alaska or comes from Alaska fisheries, though Russian processors plan to start producing pollock surimi in significant quantities in the coming years. Tropical surimi dominates global surimi production, accounting for about two-thirds of total production. China, Vietnam, Thailand, and India are the largest tropical surimi producers.



Figure 16. Global Surimi Production (mt), by Source Species, 2005-2018

Source: Future Seafood Group (via Undercurrent News). 2018 is an estimate.

Surimi is made from a variety of fish species. Alaska pollock is the most widely used species, but other types of surimi utilize a range of other fish. Some common species used in surimi production are listed below.

Tropical Surimi Species

- Threadfin bream (Nemipterus japonicus), also known as 'itoyori' most common tropical species
- Lizardfish (Saurida tumbil), also known as 'eso'
- Big Eye (Priacanthus spp.), also known as 'kinmedai'

Cold Water Surimi Species

- Pacific hake (*Merluccius productus*), also known as Pacific whiting
- Hoki (Macruronus novaezelandiae)
- Northern/Southern blue whiting (Micromesistius poutassou/australis)
- Jack mackerel (Trachurus murphyi)
- Atka mackerel (Pleurogrammus monopterygius)

Many countries have active fisheries that support surimi production. In terms of a single country, the United States is the second-largest surimi producer in the world. Most U.S. surimi production comes from Alaska (pollock) and the Pacific hake fishery off the coast of Washington and Oregon. Pollock accounts for 25 percent of global surimi supply – a small

share compared to tropical fish species which account for 68 percent of surimi production. Russia occasionally produces a relatively insignificant volume of surimi, though news reports indicate that the Russian Fishery Company – the largest pollock quota holder in Russia – has ambitious plans to enter the surimi market through completion of seven new factory trawlers.²⁷ Other seafood processing modernization efforts are also underway in Russia with government support.

China, India, and Southeast Asia (including Thailand and Vietnam), are key tropical surimi producers. After a decade of steady growth, Vietnam has overtaken China as the largest tropical surimi producer, with more than 150,000 mt of production each of the last five years. Production in India has also grown steadily, while Chinese and Thai production has declined in recent years (likely due to overfishing).²⁸

It should be noted that surimi production statistics are not universally tracked. Although FAO compiles data on minced fish and surimi production, the manner in which data is categorized do not allow for comprehensive production accounting. As a result, industry estimates (which are based on public and private data) are a more reliable source of information.

Wholesale Market Profile of Alaska Pollock Roe

Pollock roe commands the highest price of all major pollock products at \$6.21 per kilo and was worth \$121 million (wholesale value) in 2017. It accounted for 8 percent of Alaska pollock's total wholesale value but only 3 percent of production volume (19,517 mt). Pollock roe is consumed as a condiment/flavoring and during holidays in Japan. South Korea is the world's only other sizeable market.

Pollock roe prices have decreased steadily over the last decade due to weakening traditional markets and a lack of new markets. Roe market development is a priority of the Alaska pollock industry.

Product Description and Supply Chain

Pollock roe production occurs when the fish are spawning. Due to the variety of spawning timing within pollock stocks, the spawning season extends from November to May but most production occurs during the late winter and early spring. After the fish is headed, roe is extracted during the gutting process and rapidly frozen before deterioration occurs. Roe prices are tied to the quality of the roe, which varies greatly. Lower grade roe might have defects such as discoloring, broken skeins, or be discounted due to roe maturity issues (eggs are too young or too old). Product caught and processed at sea tends to command the highest prices, with average prices of \$7.09 per kilo compared to \$4.66 shoreside.²⁹ Pollock roe is traditionally sold to wholesale buyers in frozen block form, packed into 49.5-lb. cases each containing three blocks of roe.



Mentaiko gift box, Japanese pollock roe retail product.

Pollock roe is an export product. Frozen Alaska pollock roe is sold at

auctions in Seattle, WA, while Russian pollock roe is often sold at auctions held in Busan, South Korea. However, larger

²⁷ (Seaman, Russian fishery will become major pollock surimi producer with fleet renewal, 2018).

²⁸ (Seaman, Pollock surimi can't meet global demand as tropical supply continues to drop, 2018).

²⁹ ADF&G Commercial Operators Annual Reports (COAR) (Data provided by the Alaska Fisheries Information Network (AKFIN)).

volumes of Alaska product are also sold directly to buyers through negotiated contracts. "Direct sales" have become more common in recent years, based on pricing discovered through the auction process. The pollock roe supply chain is vertically integrated for large companies that maintain a pipeline from the raw material all the way to distribution in markets in Japan and South Korea. In fact, 80 percent of Alaska's pollock quota is shared by four large vertically-integrated companies: Trident Seafoods, Maruha Nichiro, Nissui, and American Seafoods.³⁰ Each of these companies own stakes in Alaska fishing vessels, Alaska shoreside plants, and distributors in Japan and South Korea.

After frozen pollock roe is exported to Asia, it undergoes secondary processing. Japan, South Korea, China, and Thailand are common destinations, where it is processed by defrosting and brining the roe in spices or salt.³¹ In Japan, pollock roe is often sold in the skein and consumed as salted roe (*tarako*) or spicy/marinated roe (*karashi mentaiko*). The product is commonly utilized as a condiment and as an ingredient in soups, rice balls (*onigiri*), rice dishes, and pastas. High-quality pollock roe is a popular gift during holidays and consumed individually with sake.



Figure 17. Alaska Pollock Roe Supply Chain

Alaska Production Analysis

Alaska pollock roe is an important element of the pollock product mix. Although it is a low-volume product, roe assumes the highest unit price of any pollock product. In 2017, 19,517 mt was produced, worth \$121.2 million (8 percent of the species' wholesale value).

³⁰ (Seaman, Pollock surimi can't meet global demand as tropical supply continues to drop, 2018).

³¹ Industry Interview.



Figure 18. First Wholesale Volume and Value/mt for Alaska Pollock Roe, 2008-2017

 Table 27. First Wholesale Value for Alaska Pollock Roe (\$ millions), 2008-2017

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
\$240	\$163	\$98	\$153	\$169	\$116	\$146	\$103	\$91	\$121

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Historically (prior to 2007), roe often accounted for one-third to one-fifth of Alaska pollock's total first wholesale value. It was a consistently valuable market. However, the percentage of roe value compared to all Alaska pollock products has declined significantly in recent years (Figure 18). Since 2013, roe has only generated 6 to 9 percent of total first wholesale value – a troubling market development for Alaska's pollock industry. Roe still creates a substantial additional income stream and is relatively inexpensive to produce.



Figure 19. Alaska Pollock First Wholesale Value and Roe as Percent of Total Value, 1993-2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Alaska pollock roe production reached 19,517 mt in 2017, roughly in line with the ten-year average. Pollock roe production is primarily a function of overall harvest volume; however, it can fluctuate significantly based on roe recovery/maturity and harvest distribution. From 2013 to 2017, roe recovery rates ranged from 1.0 to 1.7 percent.³² Roe recovery rates are typically higher, on average, for the at-sea sector (1.5 percent average from 2013 to 2017) compared to the shoreside sector (1.2 percent).

Key Roe Market Analysis

Virtually all Alaska pollock roe is exported to Japan or South Korea. In 2017, exports totaled 18,471 mt worth \$112 million. Japan is the dominant market, absorbing more than 80 percent of finished Alaska pollock roe exports. South Korea is the only other sizeable market, but the majority of frozen pollock roe sold to Korea is held in cold storage and exported on to the Japanese market. A few Japanese companies operate secondary processing facilities in China, but industry contacts report little product actually stays in China. Exports to Europe jumped in 2017; the product entered the market through the Netherlands, though the final market is unclear.

Efforts to develop other pollock roe markets outside of Japan have been largely unsuccessful, but given stagnant Japanese consumption patterns, finding additional roe markets is extremely important to the long-term health of Alaska's pollock industry. The industry is exploring opportunities to utilize more *mentaiko* and *tarako* in sushi preparations, as well as marketing it as an ingredient in pasta sauces and investigating new products which might find appeal in other caviar markets.

Export Destination	2013	2014	2015	2016	2017	Pct. Change from 4 Yr. Avg.
Japan	6,544	11,212	10,460	5,457	8,426	0%
South Korea	7,414	9,792	9,281	8,295	9,260	6%
China	901	754	505	258	148	-76%
Other	108	20	33	50	637	1,109%
Total Export Volume	14,967	21,778	20,279	14,060	18,471	4%
Total Export Value (\$ millions)	\$114	\$153	\$152	\$111	\$112	-16%
Avg. Export Price per Kilo	\$7.63	\$7.02	\$7.50	\$7.90	\$6.05	-19%

Table 28. Exports of Alaska Pollock Roe (mt), by Country, 2013-2017

Source: ASMI Seafood Export Database, compiled by McDowell Group.

During the spring and fall, large pollock roe buyers come from Japan and South Korea to buy roe from Alaska producers in auction markets held in Seattle. Spring auctions produce significantly higher sales volumes. The same buyers also purchase Russian pollock roe (and limited amounts of Alaska pollock roe) at large auctions in Busan and Tokyo.³³

 ³² Roe recovery rates are calculated based on calendar year roe production and pollock harvest volumes.
 ³³ (Nissui Group, 2019).

JAPAN

Japan is the world's primary pollock roe market with imports of 42,051 mt in 2017, worth \$285 million. Pollock roe is consumed in a variety of ways in Japan, including in sushi rolls, rice balls, soups, noodle dishes, or by itself. High-grade roe traditionally is used in gift boxes (*mentaiko*) for holidays and special occasions. In the retail market, mid-grade is sold as salted roe. Food service purchasers tend to use lower quality roe for flavoring rice, noodle, and other dishes.³⁴ Pollock roe is a traditional product in Japanese food culture, with consumption dating back to the mid-1900s.

Exporter	2013	2014	2015	2016	2017	Pct. of Total (2013-2017)
Russia	21,008	24,916	21,958	20,367	24,434	57%
U.S. (Alaska)	13,158	19,720	18,440	14,400	17,357	42%
Others	237	163	185	154	259	1%
Total	34,403	44,800	40,582	34,921	42,051	-
Pct. from Alaska	38%	44%	45%	41%	41%	-

Table 29. Japan Pollock Roe Imports (mt), 2013-2017

Source: Japan Trade Statistics (Ministry of Finance), compiled by McDowell Group.

Note: Includes minor amounts of cod roe and roe from other related species.

Alaska product accounted for 42 percent of Japan's import volume between 2013 and 2017. Russia is the country's largest pollock roe supplier. Imports of Alaska product fluctuate from year to year but 2017 saw shipments matching the prior four-year average. Total Japanese pollock roe imports increased 9 percent versus the prior four-year average.

	2013	2014	2015	2016	2017	Pct. Change from 2013-2016 Avg.
All Pollock Roe Imports						
Import Value - millions USD	\$309	\$330	\$228	\$244	\$285	3%
Import Value - millions yen	¥30,567	¥33,878	¥27,681	¥26,449	¥31,803	7%
Import Value - Yen/kg	¥888	¥756	¥682	¥757	¥756	-2%
Alaska Pollock Roe Imports						
Import Value – millions USD	\$103	\$136	\$96	\$91	\$115	8%
Import Value – millions yen	¥10,206	¥13,916	¥11,604	¥9,858	¥12,798	12%
Import Value – Yen/kg.	¥776	¥706	¥629	¥685	¥737	5%
Import Value – USD/kg.	\$7.84	\$6.90	\$5.21	\$6.32	\$6.63	1%
Average Exchange Rate (Yen/USD)	¥98	¥106	¥121	¥109	¥112	4%

Table 30. Value of Japan Pollock Roe Imports, 2013-2017

Note: Value figures are CIF Japan.

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-tradeatlas.html. Board of Governors of the Federal Reserve System (US), retrieved from FRED, Federal Reserve Bank of St. Louis. fred.stlouisfed.org. Japan Trade Statistics (Ministry of Finance). Compiled by McDowell Group.

In yen terms, total Japanese pollock roe imports ranged from 26 to 34 billion yen over the 2013-2017 period, including 9 to 14 billion yen in Alaska product. The import value per kilogram for Alaska product fluctuated from 629 to 776 yen, with the price in dollar terms fluctuating with exchange rates (\$5.21/kg to \$7.84/kg). While these data appear to suggest

³⁴ Industry interview.

that Alaska's pollock roe are below average in value per mt, industry information indicates the opposite is consistently true. Imports from the United States are likely at a lower average price due to differences in pollock roe product type mix purchased from the United States compared to other countries.

The Japanese pollock roe market – and by extension, the value of the pollock roe resource – is well defined with relatively steady demand. The value of roe is function of production volume in Russia and Alaska, as well as the strength or weakness of the yen. However, due to static demand, an aging population in Japan, and a lack of market diversification, the long-term value of pollock roe is an area of concern and market development is a priority for the Alaska pollock industry.

SOUTH KOREA

South Korea is the second largest consumer of pollock roe, but it also is an intermediary buyer. An average of 14,959 mt of pollock roe imports were registered annually by the Korean Customs and Trade Development Institution between 2013 and 2017. However, Russia and Alaska sent 49,745 mt of pollock roe to South Korea per year during this period. Trade data discrepancies are likely due to product which is sent to Korea for auction, storage, or secondary processing. Export figures represent all product shipped to Korea, while import statistics refer only to product entering the Korean market. Korean import statistics suggest the Korean market consumes approximately a quarter to a third of total pollock roe imports (with most of the rest ending up in Japan). Alaska supplies an estimated 19 percent of the Korean domestic market.

Korea is known for having less traditional tastes than Japan, and the market will accept small-sized roe that is less marketable in Japan. Currently, lower grade pollock roe is marketed in Korea as a condiment mixed with other ingredients and spices or for use in hot pot dishes.³⁵ It is also consumed in spicy and salted roe products, like its Japanese neighbor. The Korean word for pollock roe is *myeongtae*.

	2013	2014	2015	2016	2017	5-yr. Average
Exports to South	Korea Reported	by Major Produ	ucers (includes r	e-export volum	es)	
Russia	39,972	39,488	42,118	35,991	47,116	40,937
Alaska	7,414	9,792	9,281	8,295	9,260	8,808
Total	47,386	49,280	51,399	44,286	56,376	49,745
Imports Reported	by Korea (impo	orts for domesti	c Korea market)			
Russia	11,838	12,008	12,202	12,271	12,334	12,131
Alaska	3,425	3,061	2,955	2,334	2,368	2,829
Total	15,263	15,069	15,157	14,605	14,702	14,959
Estimated Re- Exports	32,123	34,211	36,242	29,681	41,674	34,786

Table 31. South Korean Pollock Roe Trade (mt), 2013-2017

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritimeglobal-trade-atlas.html Compiled by McDowell Group.

³⁵ (Hui, 2005).

Wholesale Market Profile of Alaska Pollock H&G

In 2017, headed and gutted (H&G) products accounted for 10 percent of total pollock production volume and 4 percent of the species' total first wholesale value. Although dwarfed by fillet and surimi production, the H&G sector still averaged \$80 million in value over the last five years (2013-2017). H&G pollock is frozen in blocks and the majority is exported to China for secondary processing into twice-frozen fillets.

H&G pollock is produced primarily by processors that handle pollock as part of a large mix of species and do not have the space or volume needed to invest in fillet and/or surimi processing lines. Examples include the Amendment 80 fleet, which catches pollock incidentally while targeting flatfish, rockfish, and other species. Shoreside processors in Kodiak also typically do not produce pollock surimi or fillets and instead push most pollock to H&G (removing roe). H&G production is also a way to handle smaller pollock (these are also sometime diverted to fish meal or sold as frozen blocks of whole fish).

Product Description and Supply Chain

Alaska pollock is headed and gutted, both on-shore and at-sea, and then frozen. H&G production yields a 62 percent recovery rate, on average, from round weight.³⁶ Most of Alaska's H&G pollock is "eastern cut" where the head is removed behind the collar, though there are years when production has been evenly split between eastern and western cut (such as 2009 and 2010). In recent years "western cut" production increased from 2 percent of total H&G production volume in 2016 to nearly a quarter in 2016 and 2017.

Virtually all H&G Alaska pollock is sent abroad for further processing. The primary destination is China, where it is a raw material used to produce frozen fillet blocks and salted fillets for markets in Europe, the United States, and Brazil. Secondary processors in Europe (fillet products) and Korea/Japan (likely surimi) also import significant volumes.



Figure 20. Alaska Pollock Headed & Gutted Supply Chain

Production Analysis

In 2017, H&G pollock production totaled 61,605 mt – in line with average volumes since 2009. H&G production value, though, was down 31 percent since 2009 due to a steady drop in prices. In 2017, H&G pollock value per mt dropped

³⁶ (Crapo, Paust, & Babbit, 2004).

Alaska Groundfish and Crab Wholesale Market Profiles

below \$1,000 – an unprecedented low in recent times. Reasons for this weakening market include a decline in the size of the Chinese secondary processing industry and increasing consumer demand for higher end pollock products (once-frozen rather than twice-frozen fillets, for example).



Figure 21. First Wholesale Volume and Value/mt for H&G Alaska Pollock, 2008-2017

Table 32. First Wholesale Value, H&G Alaska Pollock (\$ millions), 2008-2017

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
\$42	\$86	\$97	\$109	\$71	\$100	\$94	\$76	\$72	\$59

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Over the last decade, H&G production has generally represented around 10 percent of total Alaska pollock production volume (with the exception of big years in 2009 and 2010). H&G production represents a much higher percentage of pollock production volume in the Gulf of Alaska (averaging 41 percent from 2008-2017) compared to production in the BSAI region (8 percent, on average). Gulf of Alaska processors include a number of shoreside plants (including several in Kodiak) that handle a wide variety of species throughout the year and do not invest in the processing infrastructure and additional labor needed to produce pollock fillets and surimi.



Figure 22. H&G Share of Total Alaska Pollock Production Volume, By Region and Overall, 2008-2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

At-sea and shoreside production volume of H&G fish are roughly equivalent but the price per kilo for at-sea product is \$1.20, compared to a shoreside price of \$0.80 in 2017.

Alaska processors have historically produced whole fish pollock products in relatively low volumes (less than 2,500 mt), but production of whole fish products (frozen blocks) has increased in recent years. In 2016 production peaked at 15,279 mt – though production in 2017 was somewhat lower at 9,637 mt. Industry interviews indicate that this production is mostly composed of pollock that are too small for surimi/fillet processing lines and may have previously gone to fish meal.

Key H&G Market Analysis

Headed and gutted Alaska pollock is primarily exported to China for reprocessing: the country bought 76 percent of exported Alaska product between 2013 and 2017. South Korea and Ukraine also import substantial volumes of H&G Alaska pollock. Virtually all of Alaska's H&G pollock production is sold to export markets, primarily to countries that perform secondary processing to produce whitefish fillets or surimi.

Country	2013	2014	2015	2016	2017	Pct. of Total (2013-2017)
China	47,767	50,476	44,729	51,757	54,489	76%
Ukraine	2	5,571	664	3,296	10,029	6%
South Korea	1,285	3,498	5,885	10,748	6,886	9%
Thailand	4,226	4,310	3,291	3,842	2,543	6%
Other Countries	765	2,533	4,077	4,342	2,140	4%
Total Exports	54,045	66,388	58,646	73,985	76,087	

Table 33. Alaska Pollock H&G/Whole Exports (mt), by Country, 2015-2017

Notes: Data includes H&G as well as whole fish.

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html.

CHINA

The majority of Alaska H&G pollock is sent to China for secondary processing, due to lower production costs. In 2017, China reported imports of 54,489 mt of Alaska H&G/whole pollock from the United States. This product, along with Russian H&G pollock is processed into fillets and other salted or breaded products for re-export to Europe, the United States, and Brazil. At this point, most product joins the global pollock fillet supply as a twice- frozen product.

2013 2014 Country 2015 2016 2017 563,792 514,497 Russia 560,516 595,097 556,927 47,767 50,476 U.S. 44,729 51,757 54,489 39,945 44,247 Japan 18,064 9,275 4,598 8.641 10.350 Other 2,025 7,104 12,147 664,447 615,268 Total 666,331 625,334 625,063

Table 34. China Imports of Frozen H&G/Whole Pollock (mt), by Country, 2015-2017

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html

More than half of China's frozen pollock fillets are re-exported to Europe. The United States is the next largest market, accounting for 10 percent of re-exports while South Korea and Brazil are also important.

Table 35. Chinese Exports of Frozen Pollock Fillets, by Market, 2017

Markets	Volume (mt)	Value (\$ millions)	Pct. of Total China Pollock Fillet Re-Exports
Germany	84,075	\$211	39%
United States	22,235	54	10%
France	18,292	51	8%
South Korea	16,207	45	8%
United Kingdom	13,145	39	6%
Brazil	11,806	32	5%
Poland	10,813	26	5%
Total Re-Exports*	215,676	\$561	-

*Totals may not sum due to rounding. Does not include salted, smoked, dried, or other value-added products.

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html

China also exported 42,137 mt of salted, smoked, or dried cod-related fish in 2017. H.S. codes are generally less specific about the species of these products and it is not possible to separate cod and pollock exports. Brazil, the United States, and Portugal are the largest importers of Chinese salted, smoked, or dried cod-related fish products.

Competing Supply

H&G pollock is an intermediate product and most of it eventually joins the global supply of frozen pollock fillet blocks. H&G supply is primarily a function of local processing capacity (or lack thereof), which is in turn dictated by relative processing costs in pollock harvesting regions compared to other countries.

The largest pollock harvests come from Alaska and Russia, with combined TACs over 3 million mt. The vast majority of Russian pollock is exported or sold to domestic buyers as an H&G product, while most Alaska pollock is filleted directly or used for surimi production. Alaska H&G pollock supply is somewhat dictated by the relative value of once-frozen pollock fillets over twice-frozen pollock and other whitefish fillets, as well as processing production costs in Alaska relative to other areas.

Global Pollock Production and Competing Supply Analysis

Alaska pollock is fished almost entirely by Alaska and Russia, due to its distribution in the North Pacific Ocean. Japan, South Korea, and North Korea also harvest pollock, though in smaller volumes.

Pollock production has increased modestly in recent years, from 3.25 million mt in 2013 to an estimated 3.46 million mt in 2017. Alaska harvested 1.54 million mt in 2017 and accounted for 45 percent of global supply. Both Russia and Alaska have increased pollock harvests in recent years but are expected to remain more or less flat in the coming years.

Pollock has been harvested for many decades, but the United States did not play a significant role in the fishery until the passage of the Magnuson-Stevens Fishery and Conservation Act in 1976. The legislation laid the groundwork for consolidating control over territorial waters, and along with later amendments and other international agreements, provided unfettered access for U.S. fishing companies to Alaska pollock fisheries within 200 nautical miles of U.S. soil.

U.S. harvests began ramping up in the mid-1980s, displacing Japanese vessels in newly designated Alaska waters. U.S. pollock harvests have been relatively consistent since 1989, producing an average of 1.32 million mt per year. Overall, pollock harvests have declined since the 1970s and 1980s due to tighter control over fishery access and the application of responsible fishery management practices.

Producer	2013	2014	2015	2016	2017	2017 vs. 2013-2016 Avg.
Russia	1,567,181	1,518,498	1,623,949	1,737,675	1,710,000	+9%
U.S. (Alaska)	1,362,217	1,426,839	1,479,909	1,521,849	1,537,000	+14%
Japan	229,577	194,920	180,349	134,000	129,000	-44%
South Korea	24,342	31,624	20,014	20,129	24,000	-1%
Others	64,439	73,201	68,531	62,496	60,000	-7%
Total	3,247,756	3,245,082	3,372,752	3,476,149	3,460,000	+7%
Pct. from Alaska	42%	44%	44%	44%	45%	-

Table 36. Global Pollock Harvest by Major Producer (mt), 2013-2017

Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/ (2013-2016), NMFS Alaska Region Blend and Catch-accounting System estimates (Data provided by the Alaska Fisheries Information Network (AKFIN)), and Groundfish Forum (2017).



Figure 23. Global Harvest Volume of Alaska Pollock (mt), 1977-2019

Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/ (1977-2016), NMFS Alaska Region Blend and Catch-accounting System estimates (Data provided by the Alaska Fisheries Information Network (AKFIN)), and, Groundfish Forum (2017-2019).

Competing Species

Whitefish generally refers to non-oily species like cod, pollock, haddock, hake, whiting, and benthic flatfish species, such as sole, plaice, flounder, and halibut. These species - primarily caught in wild fisheries - also compete in global seafood markets with notable aquaculture species such as tilapia and pangasius. Though there are different perceptions of quality and price premiums within this range of species, they are all competitors and may be substituted depending on price and availability. Depending on the market, the scope of these whitefish species may be narrowed or supplemented with other local varieties that are not discussed here.

Alaska produces approximately 21 percent of global marine wild-harvest whitefish annually. In terms of supply, Russia (cod/pollock/flatfish), China (tilapia), Norway (cod), Japan (pollock/cod), New Zealand (hoki), and Vietnam (pangasius) are the biggest competitors for Alaska's groundfish industry in terms of high-volume whitefish species.

The species with the largest impact on the market for pollock fillets and surimi, include (in order of importance for each category):

Fillets

- Atlantic and Pacific cod
- Haddock
- Saithe

- Hake
- Tilapia
- Pangasius

Surimi

- Tropical species (including threadfin bream, lizardfish, and big eye)
- Hake

Pollock supply held steady in 2017 and is projected to stay more or less the same in 2018 and into 2019 and the near future. Projections for supplies of key competing wild whitefish species are mixed. Cod and haddock production is expected to continue declining, though hake and saithe harvests are set to increase.

While cod enjoys positive consumer recognition as a high-quality seafood product, it increasingly competes with many whitefish such as pollock that have traditionally been viewed as of lower quality. In periods of strong cod demand and high prices (such as the current price environment in 2018 and 2019), producers are known to shift demand from cod to pollock (or other species) to maintain a consumer product price point. Industry sources mention this dynamic at play with fast casual restaurants especially, with deep-skin pollock fillets the product most likely to compete with cod.

Species	2017 Harvest (thousands mt)	2017-2018 Expected Trend
Cod	1,750	Down 9%
Haddock	339	Down 7%
Hakes	1,239	Up 3%
Saithe	327	Up 13%
Russian Pollock	1,710	Flat
Alaska Pollock	1,537	Flat

Table 37. Competing Whitefish Supply Trends

Source: Groundfish Forum. and North Pacific Fisheries Management Council Harvest Specifications.

Wholesale Market Profile for Pacific Cod

Pacific cod (*Gadus macrocephalus*) is a whitefish found in the coastal Pacific Ocean from Alaska to California, with the largest concentrations found in the Gulf of Alaska and Bering Sea. One of the largest of the Alaska groundfish species, Pacific cod are highly valued for their mild, white flesh and are primarily processed into H&G and fillet products. Final consumer cod products include fillets and breaded fish portions destined for international and domestic markets. In 2016, Alaska's Pacific cod accounted for 18 percent of the total global cod harvest. In 2017, Alaska cod harvest and production volumes declined slightly over the previous year but increased prices driven by global supply constraints pushed the first wholesale value up to a 12-year peak of \$510 million.

Value and Volume		Key Products	H&G	Fi	llet	Other
First Wholesale Production (mt)	136,990	Pct. of Value	67%	2	5%	8%
Pct. of Global Cod Harvest (2016)	18%	Key Markets	China	Europe	U.S.	Other
First Wholesale Value (\$ millions)	\$510	Pct. of Sales	28%	10%	44%	17%
Pct. of Alaska Groundfish Value (First Wholesale)	20%	YoY Value Change (from 2016)	-6%	-14%	25%	-6%
Production Volume Exported	65%	Competing Species: Russian Pacific cod and Atlantic cod				

Table 38. Summary Profile of Alaska Pacific Cod Wholesale Production and Markets, 2017

Fishery Summary

Pacific cod are widely distributed across Alaska waters. Found at depths up to 500 m, the species is harvested predominantly with longline and bottom trawl gear, with smaller amounts harvested by pot gear and jigs. Japanese and other foreign fishermen fished for cod in Alaska waters from the 1960s to 1977, when the 200-mile EEZ was established by the Magnuson-Stevens Act with the intent of eliminating foreign fishing vessels in U.S. waters. Japanese vessels continued to fish in Alaska waters until the late 1980s, when the fishing fleet became entirely U.S.-based.

Fishing efforts over the first ten-year period (1977-1986) were minimal, with an annual average of 18,055 mt landed. By comparison, landings averaged 288,500 mt annually over the 2008-2017 period, with peak harvests reaching 325,105 mt in 2012.

The annual Total Allowable Catch (TAC) levels are set by the North

Photo Courtesy of ASMI.

Pacific Fishery Management Council (NPFMC), with input from NOAA on the maximum acceptable biological catch. Community Development Quotas (CDQs) are allocated to six community development organizations representing communities in the greater Bering Sea region and account for approximately 10 percent of the TAC each year. There are three distinct fisheries for cod: federal, state-managed parallel season, and state waters fisheries. Over the past five years, around 90 percent of total harvest volume came from federally-managed fisheries.

After a recent period of abundance and near-record harvest levels, cod harvests began to decline slightly in 2017 and are projected to decline significantly in some areas in the coming years. At the November 2018 NPFMC meeting, the TAC set for 2019 is an 11 percent reduction compared to 2018 and the preliminary 2020 TAC represents a 23 percent decline from 2019.



Figure 24. Pacific Cod Harvest Volume in Alaska (mt), 1977-2017

Source: NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database. NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database. (1977-2016); NMFS Alaska Region Blend and Catch-accounting System estimates (Data provided by the Alaska Fisheries Information Network (AKFIN)) (2017).

A variety of Alaska fishing vessels target cod, including freezer longliners, catcher-vessel longliners, trawlers, and pot vessels. In 2017, the longline cod fishery accounted for 45 percent of cod harvests, the pot fishery accounted for 25 percent, and 30 percent was caught using trawl gear.

These proportions vary significantly by region. Longline gear is the dominant gear type in the BSAI (accounting for 50 percent of the harvest volume in 2017), while pot gear dominates in the GOA region (accounting for 55 percent of harvests). Trawl fisheries account for just under a third of harvests in the GOA and BSAI regions (27 and 31 percent, respectively).

Most of the longline catcher-processor fleet focuses on frozen H&G product (Western and Eastern cut) as well as high-value byproducts like stomachs, pectoral girdles, heads, roe and milt. In addition to these products, motherships and shoreside processors also produce large quantities of high-value fillet products, as well as belly flaps, fish meal, and other products.



Photo Courtesy of ASMI.

	2013	2014	2015	2016	2017	2017 % of Total
Bering Strait/Aleutian Islands (BSAI)	245,118	245,435	238,929	257,588	249,862	84%
Longline	123,066	124,596	128,698	126,916	124,412	42%
Jig	15	2	28	47	13	0%
Pot	33,830	42,439	37,833	46,991	48,955	16%
Trawl	88,207	78,398	72,370	83,634	76,483	26%
Gulf of Alaska (GOA)	63,975	79,606	77,725	63,191	48,001	16%
Longline	11,757	14,325	12,930	8,429	8,592	3%
Jig	1,779	3,884	3,213	2,053	129	0%
Pot	31,047	38,136	40,125	37,582	26,348	9%
Trawl	19,393	23,261	21,457	15,127	12,931	4%
Total Harvest	309,094	325,041	316,653	320,779	297,863	100%

Table 39. Pacific Cod Harvest Volume (mt), by Region and Gear Type, 2013-2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Supply Chain and Production Description

The largest cod processing sector in Alaska is the at-sea processors, which focus on H&G production and account for 57 percent of production volume. Within the at-sea processing sector, freezer longliners receive higher prices for H&G than at-sea processor trawl vessels, most of which are part of the Amendment 80 fleet and focused primarily on flatfish. In contrast, cod makes up roughly 90 percent of the harvest volume of Alaska's longline catcher-processors, allowing an increased focus on cod-specific harvesting, handling, and processing techniques.³⁷

Table 40. Alaska Pacific Cod Production Volume and Value, by Region and Processor Type, 2017

	Production Volume (mt)	Pct. of Total	Production Value (000s)	Pct. of Total	Avg. Price per mt
BSAI	119,604	87%	\$434,761	85%	\$3,635
Catcher/processors	87,856	55%	\$302,867	59%	\$3,447
Motherships	137	0%	\$205	0%	\$1,503
Shoreside processors	31,611	23%	\$131,689	26%	\$4,166
Gulf of Alaska	17,386	13%	\$75,462	15%	\$4,340
Catcher/processors	3,045	2%	\$10,778	2%	\$3,540
Shoreside processors	14,342	10%	\$64,684	13%	\$4,510
Total	136,990	100%	\$510,223	100%	\$3,725

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

The shoreside sector was responsible for a third of Pacific cod production volume in 2017. These facilities are responsible for almost all of Alaska's cod fillet production (99 percent), mostly in shatterpack form. Some of the largest shoreside

³⁷ More specifically, 90 percent of the groundfish harvest volume, excluding halibut.

locations for cod processing include Kodiak, Dutch Harbor, and Akutan. Processors in the BSAI produced 61 percent of total cod fillet production, while GOA processors accounted for 39 percent.

Most Pacific cod caught in Alaska is processed into frozen H&G product and exported. Frozen H&G product provides a raw material to secondary processors. During reprocessing, frozen H&G product must be thawed, filleted, and then refrozen. This second round of freezing causes a loss in quality.

The largest secondary processing market is China, which re-exports the bulk of their cod imports to the United States and Europe. Secondary processing markets are also present in Europe, the United States, and Japan – with these markets generally focused on higher value production and in-region consumption.

Secondary processors primarily produce frozen fillets (block and IQF) and loins, though there is also a focus on production of breaded fish sticks, seasoned fillets, and other value-added products. Foreign buyers also purchase H&G cod as a raw material for salt cod products, which are popular in Europe and Latin America.



Figure 25. Alaska Pacific Cod Supply Chain

While cod production and grading are not 100 percent uniform across the industry, examples of wholesale cod products available directly from Alaska are found below.

Product	Description	Sizes/Grading
H&G Western Cut/Collar- Bone-On (CBO)	 Headed and Gutted, collar bone on Block frozen, blocks average 52-54 lbs (L and XL fish) or 40-42 lbs (all other sizes) IQF, shipped in a 1,200 lb tote 	 Under 1 kg per fish 1-2 kg, 2-3 kg, 3-4 kg 4-6 kg, 6 kg+ per fish
H&G Eastern Cut (J-Cut)	Headed and gutted, collar bone removedBlock frozen, blocks average 42-44 lbs	 Under 450 g per fish 0.45-0.7 kg, 0.7-1 kg, 1-2 kg 2-3 kg, 3-4 kg, and 4-6 kg
Collars	 Created through production of J-cut H&G Block frozen, blocks weigh approximately 17 kg 	250+ gmOcean run sizes
Cod Stomachs	 Block frozen, blocks weigh approximately 40 lbs 	• 50+ gm
Cod Roe	 Block frozen, blocks weigh approximately 40 lbs 	 Red mature, whole and broken Black mature, whole and broken Red and black mature, whole and broken
Fillets	 Whole fillet of cod, with pin bone and skin removed Shatterpack, net weight of 45 lbs 	 Under 4 oz fillets, 4-8 oz 8-16 oz, 16-32 oz, 32 oz and up

Table 41. Example of Pacific Cod Products and Specifications Available from Alaska Processors

Source: Industry interviews, Clipper Seafoods, Peter Pan Seafoods, and North Star Fishing Co. websites.

As shown in the table above, H&G cod are sold as Western Cut (also known as Collar-Bone-On or CBO) or Eastern Cut (also known as Japan Cut or J-Cut). Japan cut cod comprise the bulk of H&G production (nearly 82 percent of production volume in 2017).

Most Alaska cod fillets are packaged as shatterpacks, consisting of frozen fillet blocks with individual fillets separated by plastic sheets, making them easier to separate without the need for the entire block to be thawed. Other types of fillet products include IQF (individually quick frozen) and fillet blocks.

In many end markets, cod is not differentiated at the consumer level between Pacific cod or Atlantic cod. Even in markets where a preference exists, Pacific and Atlantic cod compete fiercely and, all things being equal, price is the primary consideration.

Production Volume and Value

In 2017, Alaska's processors produced 136,990 mt of Pacific cod

products, valued at \$510.2 million. Production volume in 2017 was the lowest since 2010, closely tracking lower TACs and harvests. Despite lower volumes, 2017 production value rose to a 12-year high of \$510 million due to an exceptionally strong market. Price increases are generally understood to be the result of strong demand combined with a reduction in



Pacific and Atlantic cod harvest volumes, as well as a reduction in the haddock quota in the Barents Sea. Strong cod pricing continued throughout 2018 and enters 2019 near peak 2008 levels.



Figure 26. First Wholesale Volume and Value/mt for Alaska Pacific Cod, 2008-2017

Table 42. First Wholesale Value, Alaska Pacific Cod (\$ millions), 2008-2017

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
\$457	\$280	\$351	\$498	\$496	\$398	\$471	\$467	\$480	\$510

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

H&G product accounted for 72 percent of production volume (98,489 mt) in 2017, and 67 percent of first wholesale value (\$341 million). Fillets accounted for 12 percent by wholesale volume (16,538 mt) and 25 percent of first wholesale value (\$127 million).

Other products of significance include roe (2 percent, by volume), milt (3 percent), heads (2 percent), belly flaps (4 percent), pectoral girdles (2 percent), fish meal (2 percent), and stomachs (1 percent). Collectively, these made up 16 percent of wholesale volume with 21,963 mt valued at \$42.5 million.

Cod production focus can vary somewhat annually, as regions (BSAI vs. GOA) and sectors (shoreside vs. at-sea) tend to have different product mixes and allocations among them change over time. The relative demand and prices for different products forms can also incentivize processors to make changes to their product portfolio.



Preparing a J-cut cod block. Photo Courtesy of ASMI.





Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

		,	, ,	
	2017 Production Volume (in mt)	2017 Production Value (in \$000s)	Recovery Rate Range from Round Weight	Average Price per mt
H&G Eastern Cut	81,144	\$290,538	56-75%	\$3,581
H&G Western Cut	17,344	\$50,196	56-75%	\$2,894
Fillets, skinless/boneless	15,846	\$122,101	18-39%	\$7,706
Roe	3,241	\$4,915	1-7%	\$1,516
Other	19,414	\$42,473	-	\$3,188
Total Wholesale Production	136,990	\$510,223	52%	
Total Retained Fed. Harvest	297,863			

Table 43. Common Pacific Cod Products, Alaska Production, and Recovery Rates, 2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)). Alaska Sea Grant (Crapo, Paust, & Babbit, 2004).

Key Market Analysis

Overview

Key markets for Alaska's Pacific cod vary by product type, with H&G product going to (in order of importance) China, Europe, Japan, the United States, South Korea, and other countries. The United States is the main market for Alaska's single frozen Pacific cod fillets, though China and other markets also import single-frozen cod fillets. In 2017, exports represented 88 percent of Alaska Pacific cod H&G production. These exports totaled 86,043 mt and represented nearly all (96 percent) of Alaska's cod exports.³⁸ H&G exports have been relatively stable in recent years, though 2017 saw a decrease of 12 percent over 2016, primarily due to reduced harvest levels.

China is the largest importer of Alaska's Pacific cod, most of which is reprocessed for export to the United States and Europe. In 2017, China imported 47,975 mt of cod from Alaska. The next largest export markets are Japan, Europe, and South Korea.

Market	2013	2014	2015	2016	2017	Pct. of Total (2013-2017)
China*	45,841	55,181	56,419	55,428	46,483	48%
Europe	21,520	18,631	19,403	17,241	14,985	17%
Japan*	10,908	16,338	13,995	13,865	13,914	13%
South Korea*	7,686	5,388	8,939	8,951	7,404	7%
Canada	1,347	1,038	1,237	1,208	1,701	1%
Other Countries	2,876	1,135	2,164	1,247	1,556	2%
Total Exports	90,178	97,711	102,157	97,940	86,043	88%
U.S. (Estimated) ¹	12,760	15,714	17,496	9,169	12,446	12%
Alaska Production	102,938	113,425	119,653	107,109	98,489	100%
% Exported	88%	86%	85%	91%	87%	

Table 44. Sales of H&G Alaska Pacific Cod to Key Markets (mt), 2013-2017

* Denotes countries which primarily re-process and/or re-export product to other markets.

¹Estimated based on annual production less calendar year exports.

Note: Data pertains to primary exports only, does not portray product which may be re-exported to other markets. Source: NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)), NMFS Office of Science and Technology Foreign Fishery Trade Data, ASMI Seafood Export Database, and McDowell Group estimates.

FILLET

In 2017, Alaska processors produced 16,538 mt of Alaska Pacific cod fillets (single-frozen) worth \$127 million. The vast majority of this production (81 percent) was sold into the U.S. domestic market. The rest was exported (19 percent), with China the largest export market. In 2017, cod fillets made up 4 percent of the value of Alaska's cod exports, down from 12 percent in 2010. The period 2010 to 2013 saw South Korea and Japan shift fillet demand to H&G and substantial declines in demand from Portugal and Spain.

H&G

³⁸ ASMI Seafood Export Database. Some cod exports are comingled with other fish and not distinguishable by species in export data, including fish meal, organs, and other ancillary products. H&G represent 96 percent of distinguishable cod exports.

Table 45. Sales of Alaska Pacific Cod Fillets to Key Markets (mt), 2013-2017

Market	2013	2014	2015	2016	2017	Pct. of Total (5-yr. Avg.)
China*	852	759	1,489	1,017	1,491	7%
Canada	1,004	588	796	731	595	5%
Portugal	201	80	507	188	586	2%
Spain	25	63	117	114	289	1%
South Korea	0	66	42	58	57	0%
Other	439	576	313	289	158	2%
Total Exports	2,521	2,132	3,264	2,397	3,176	16%
U.S. (Estimated) ¹	15,975	16,136	9,403	15,502	13,362	84%
Alaska Production	18,496	18,268	12,667	17,900	16,538	

^{*} Denotes countries which primarily re-process and/or re-export product to other markets.

¹Estimated based on annual production less calendar year exports.

Note: Data pertains to primary exports only, does not portray product which may be re-exported to other markets.

Source: NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)), NMFS Office of Science and Technology Foreign Fishery Trade Data, ASMI Seafood Export Database, and McDowell Group estimates.

China

China imports H&G cod (both Pacific and Atlantic) as raw material for reprocessing into twice-frozen fillet blocks, frozen portions, and value-added products such as battered or breaded portions. In 2017, Alaska exported 47,975 mt of cod to China, representing 35 percent of Alaska cod production volume and 24 percent of China's total cod imports (Atlantic and Pacific cod).

Double-frozen Chinese-produced cod fillets (Pacific and Atlantic cod) are re-exported to the rest of the world, with the United States, Europe, and Canada being the largest markets. Other markets for Chinese cod include countries like Japan and Brazil. While Brazil had been growing at a remarkable pace, imports of Chinese-produced cod decreased 86 percent between 2014 and 2017, from 3,986 to just 568 mt.³⁹

Due to present trade disputes with China, there is a risk of escalating tariffs and dramatic supply chain disruptions in 2019 and beyond. Chinese import tariffs added in 2018 exempted product destined for China's reprocessing/re-export market, so primarily affect imports destined for the Chinese domestic market. Cod fillets and other products can be purchased at Chinese restaurants and groceries, though the point of origin and species is not generally identified. It is unknown how much of Alaska's cod products stay in China.

³⁹ Global Trade Atlas.

Market	2013	2014	2015	2016	2017	Percent Change, 2013-2017
U.S.	38,899	44,756	43,369	44,384	46,985	21%
U.K.	20,705	24,634	20,767	20,218	20,769	0%
Germany	12,220	16,232	15,269	15,711	15,038	23%
Spain	8,223	11,710	11,081	11,462	10,732	31%
France	5,643	5,943	6,085	7,230	8,378	48%
Canada	4,568	4,918	4,654	6,945	8,001	75%
Sweden	4,691	6,831	6,393	5,908	5,949	27%
Japan	3,735	3,579	3,182	3,234	3,168	-15%
Netherlands	4,083	3,183	2,430	2,816	2,512	-38%
Other	15,525	16,833	13,644	13,923	11,257	-27%
Total	188,292	138,619	126,874	131,831	132,789	-29%

Table 46. Primary Export Markets for Chinese Twice-Frozen Cod Fillets (mt), 2013-2017

Note: Figures may not sum due to rounding.

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html.

Japan and South Korea

Japan and South Korea are also important markets for Alaska H&G cod. In 2017, 14,247 mt of Alaska cod products were exported to Japan and 7,460 mt were exported to South Korea. Japanese consumers typically consume cod in the wintertime, where it is often used in soups, and traditionally prefer it in a "kirimi" cut.

Due to its role in warehousing and reprocessing, it is unclear how much H&G cod exported to South Korea remains in the country for domestic consumption. Cod is certainly a mainstay on Korean restaurant menus and a popular item cooked for home consumption, often eaten whole. South Korea is also a primary destination for cod stomachs and other byproducts. Both Japan and Korea are consumers of cod roe and cod milt.

Export Market	2013	2014	2015	2016	2017
Japan					
Fillet	59	46	50	15	36
H&G	10,751	16,289	13,995	13,853	13,866
Other	311	236	69	219	345
South Korea					
Fillet	0	66	42	58	57
H&G	7,686	5,343	8,916	8,951	7,404
Other	275	82	2,143	0	0
Total	19,083	22,061	25,216	23,097	21,707
Pct. of Alaska Cod Exports	20%	21%	23%	23%	24%

Table 47. Alaska Pacific Cod Export Volume to Major Asian Markets, by Product Type (mt), 2013-2017

Source: ASMI Seafood Export Database.

Europe

In 2017, approximately 18 percent of Pacific cod exports from Alaska were directly exported to the European market, down from 23 percent in 2013 and 40 percent in 2010.⁴⁰ This is due largely to the dramatic increase in Atlantic cod harvests during this period. Nevertheless, Europe is still an important end-market for Alaska's cod and while direct exports may represent a modest percentage of the total, a great deal of Alaska's cod is routed through China or South Korea before being sold into Europe.

The EU protects its domestic cod producers by maintaining higher duties on imported cod fillets, whereas frozen H&G cod can generally be imported into the EU with no tariff. Therefore, Alaska exports relatively little fillet production to the EU.

Exporter	2013	2014	2015	2016	2017
China*	60,499	71,137	68,897	76,811	70,766
Russia	36,648	40,047	34,861	32,416	38,607
Iceland	33,373	37,166	35,460	43,304	36,195
Norway	13,496	13,051	11,282	10,105	11,003
United States	725	602	448	490	825
Grand Total	158,094	172,559	162,627	176,924	169,863

Table 48. European Imports of Cod Fillets from Major Producers (mt), 2015-2017

Note: Totals may not sum due to rounding. *Denotes re-exporter.

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html

When Atlantic cod stocks began to decline precipitously in the late 1980s and early 90s, Pacific cod gained market share as a substitute. In the last few years, the Atlantic cod supply has increased substantially, with harvest growing from 770,503 mt in 2008 to 1,374,000 mt in 2014, leading to a glut of global cod supply. This put downward pressure on cod prices globally until recently and grew a supply that was more proximate to the European market. In addition to supply from China and Russia, a number of European countries produce a great deal of Atlantic cod, including fresh and frozen fillet product. In particular, Norway (412,536 mt) and Iceland (264,154 mt) harvested huge volumes of Atlantic cod in 2016 and have developed processing sectors that produce and export fillets and whole fish for consumption/reprocessing in Europe.

Seafood in Europe tends to be a more popular protein than in the United States, where per capita seafood consumption is much lower. Northern Europe and Southern Europe are two distinct end markets for cod products: in the north, the primary end markets are Germany, the United Kingdom, and Norway, while in Southern Europe, Spain and Portugal consume traditional dishes that incorporate salted cod. Portugal also processes and re-exports cod to Brazil in the forms of dry-salted and frozen -de-salted products

Another product of importance in the European market includes cod roe, which was traditionally imported and consumed in a smoked format in France but has increasingly been consumed in roe-based spreads sold throughout Europe. Many such spreads, an example being tarama, are processed in China and sold in Europe.

⁴⁰ ASMI Seafood Export Database
United States

Cod is a popular menu item in the U.S. market. Both fillets and H&G cod products are sold into the U.S. market, with species not always not differentiated at the consumer level between Pacific cod or Atlantic cod. Cod imports consistently account for a larger portion of supply than sales directly from Alaska.

Pacific cod fillets (IQF and shatterpack) are used by fine restaurants, food service, fast food, and retail fish markets. Fillet blocks are also used to produce fish sandwiches, "fish and chips," and other products that require uniformity. Some grocery retailers utilize fillet shatterpacks for product sold in the frozen aisle, for value-added products, and at the retail fish counter, where fillets are thawed and displayed in a refreshed format. While very little Pacific cod is available fresh, refreshed Pacific cod competes directly with fresh Atlantic cod fillets that are available at both retailers and restaurants.



The United States is by far the most important market for Alaska's

single-frozen Pacific cod fillets, purchasing 74 to 88 percent of Alaska production over the last five years. These volumes are far greater than the three-year period preceding it, when domestic consumption averaged 59 percent. This is likely due to the erosion of export market demand following the increases in cod and haddock quotas in the Barents Sea.

A direct channel for H&G products in the United States is the refresh market, where cod are thawed and filleted into portioned products for immediate sale without refreezing. Refresh markets have increased in popularity in the United States over the last ten years due to the economical and high-quality characteristics of refreshed products relative to fresh Atlantic cod. Other U.S. processors use fillet blocks to produce breaded or coated sticks and portions for sale in grocery stores and food service outlets.

The United States imported 74,022 mt of cod in 2017 (Pacific and Atlantic cod combined), valued at \$513.7 million. Imports have increased in recent years, up from 59,850 mt in 2013.

	2013	2014	2015	2016	2017	Pct. Change YoY 2017
Volume (mt)	59,850	66,495	67,757	70,670	74,022	5.5%
Value (\$ millions)	\$341.5	\$393.0	\$430.7	\$466.0	\$513.7	10.8%
Value/mt	\$5,705	\$5,911	\$6,357	\$6,594	\$6,940	5.3%

Table 49. Total Cod Imports into U.S. Market, Volume and Value, 2013-2017

Source: NMFS Office of Science and Technology, Foreign Fishery Trade Data.

Frozen fillets accounted for 75 percent of import volume in 2017. As noted previously, the United States is the largest market for Alaska-produced cod fillets, absorbing 13,362 mt in 2017. This total, however, pales in comparison to that year's fillet imports (55,154 mt). China dominates the frozen fillet import market with 79 percent of U.S. cod fillet import volume in 2017.

Table 50. Volume and Value of Frozen Cod Fillet Imports into the U.S. Market, by Country, 2017

	Volume (mt)	Value (\$ millions)	Price per mt
China	43,602	\$281.24	\$6,450
Iceland	3,696	\$31.70	\$8,576
Russia	4,165	\$28.62	\$6,870
Norway	1,235	\$14.19	\$11,491
Vietnam	1,317	\$9.56	\$7,260
Canada	847	\$8.30	\$9,800
Other	305	\$3.65	\$11,967
Total	55,154	\$377.26	\$6,840

Note: Includes Atlantic, Greenland, and Pacific cod fillets (indistinguishable in trade data). Source: NMFS Office of Science and Technology, Foreign Fishery Trade Data.

Competing Supply

The two main species of cod, Pacific cod (*Gadus macrocephalus*) and Atlantic cod (*G. morhua*), are found in the northern hemispheres of the Atlantic and Pacific oceans. While there are some slight differences, as *Gadus* whitefishes, they are considered almost identical substitutes for each other. In 2016, it is estimated that 477,387 mt of Pacific cod and 1,329,450 mt of Atlantic cod were harvested globally, with some of the largest Atlantic cod harvests coming from the Barents Sea.

	2014	2015	2016
Atlantic Cod Harvests	1,374,168	1,303,726	1,329,450
Norway	473,477	422,242	412,536
Russia	438,962	386,077	398,642
Iceland	237,756	243,871	264,154
Greenland	30,533	49,755	56,072
Faroe Islands	36,400	39,679	37,351
Other	157,040	162,102	160,695
Pacific Cod Harvests	466,333	458,692	477,387
U.S.	325,477	317,113	325,477
Russia	87,601	78,886	77,727
Japan	43,800	49,877	57,106
Korea	8,560	11,356	15,817
Canada	895	1,460	1,260
Total Cod Harvests	1,840,501	1,762,418	1,806,837

Table 51. Major Cod Producing Nations (mt), 2014-2016

Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.

Fishing for Atlantic cod peaked in the mid-1960s, with global harvests near 3 million mt, nearly double the levels seen recently. Stocks were overfished along the Atlantic coasts and served as case studies for collapsed fisheries. In recent years, the supply of Atlantic cod has rebounded following sharp harvest reductions in the late 90s and early 2000s. This has allowed many stocks to rebuild to robust and sustainable levels while benefitting from increased global demand. An

easy substitute, Pacific cod began to be exported to fulfill demand for Atlantic cod during the years of reduced harvest and now has a firm foothold in the market.

The U.S. fishery for Atlantic cod is very small and Pacific cod from the North Pacific (primarily Alaska waters) accounts for almost all U.S cod harvests. Alaska accounted for 69 percent of global Pacific cod harvests over the 2014 to 2016 period, with an average of 322,689 mt annually. It contributed 18 percent to the global cod harvest in 2016.

In addition to Alaska, Russia, and Japan are the next largest Pacific cod producers, and Japan was the first nation to commercially fish for Pacific cod in Alaska waters. Though the Asian nation still harvests Pacific cod, it does so in much smaller quantities than it did decades ago. The two largest suppliers of Pacific cod are the United States and Russia. After years of supply increases, quotas in Alaska and Europe are well below their peaks and projected to decline further in coming years, buoying prices. This trend is also reinforced by decreases in the haddock quota, which competes with cod as a lower-priced alternative. As cod prices have increased due to growing demand and/or supply constraints, pollock (the largest single species fishery in the world) has also served as a substitute for cod.



Figure 28. Global Supply of Pacific and Atlantic Cod (mt), 1960-2016

Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.

While cod enjoys positive consumer recognition as a high-quality seafood product, it increasingly competes with many whitefish that are of lower value, including pollock. In periods of strong cod demand and high prices (such as the current price environment in 2018), producers may switch from cod to pollock (or other species) to maintain a consumer product price point. While prices for cod have rebounded strongly in 2017, the past ten-years have generally been a challenging period for the industry. In addition to macroeconomic issues, Atlantic cod production increased from 770,503 mt in 2008 to a peak of 1,359,136 mt in 2014, with a 2012-2016 five-year average harvest of 1,296,166 mt. The increased cod volume created a headwind for Alaska cod exports from Alaska, especially those destined for Europe. As a result, most single-frozen Alaska-produced fillets are sold into the U.S. domestic market, where cod fillets are sold into both food service and retail as a whitefish product which is easy to thaw and cook or as a mild seafood dish served at a variety of restaurants, including both fine dining and quick service.

Wholesale Market Profile for Yellowfin Sole, Rock Sole, and Related Flatfish

Alaska's flatfish fisheries for soles and plaice in the BSAI and GOA, while comprised of more than 10 different species, are dominated by three species of sole (yellowfin, rock, and flathead) and plaice; other species harvested in smaller volumes include Greenland turbot, rex sole, butter sole, Dover sole, and starry flounder. Due to the many harvest and market similarities across this group, this section will treat many species with similar market aspects collectively while including additional detail for the four key species. Alaska's flatfish harvests include considerable volumes of arrowtooth flounder; this species is covered in separate profile and not discussed here.

Yellowfin sole (*Limanda aspera*) is the most abundant commercial flatfish in the eastern Bering Sea and the world's largest single flatfish fishery by volume, representing 14 percent of the global flatfish harvest. Overall, the species represented 48 percent of the first wholesale value of all Alaska flatfish in 2017 with a first wholesale value of \$110.8 million.⁴¹ The vast majority of this production is frozen H&G product destined for export to China for reprocessing or export to South Korea for reprocessing and domestic consumption.



Photo Courtesy of NMFS (AFSC).

Value and Volume		Key Products	H&G	Whole Round	Other	
First Wholesale Production (mt)	77,102	Pct. of Value	89%	11%	0%	
Pct. of Global Flatfish Harvest (2016)	14%	Key Markets	China	South Korea	Other	
First Wholesale Value (\$ millions)	\$110.8	Pct. of 1 st Sales	65%	13%	22%	
Pct. of Alaska Groundfish Value	4.4%	YoY Change	-20%	-2%	22%	
Pct. of Alaska Flatfish Volume	57%	Competing Species: Other flatfish, tilapia, whitefish				

Table 52. Summary Profile of Yellowfin Sole Wholesale Production and Markets, 2017

Rock sole (*Lepidopsetta polyxystra*), the second most abundant BSAI/GOA flatfish by wholesale volume (after yellowfin sole), accounted for 14 percent of the total first wholesale value of Alaska flatfish. Alaska is responsible for the vast majority of the global rock sole harvest, producing 20,200 mt in 2017, valued at \$31.9 million. Like yellowfin sole, most of Alaska's rock sole production is exported to China and South Korea, though Japan is also an important export market for females with roe. Rock sole generates a higher unit value per metric ton than yellowfin sole due to export markets for rock sole with roe.

⁴¹ "Flatfish" includes all comparable BSAI/GOA flatfish species, including arrowtooth flounder and turbot. It does not include Pacific halibut or skate.

Value and Volume		Key Products	H&G	H&G with Roe	Whole Round	
First Wholesale Production (mt)	20,200	Pct. of Value	89%	10%	1%	
Pct. of Global Flatfish Harvest (2016)	4%	Key Markets	China	South Korea	Other	
First Wholesale Value (\$ millions)	\$31.9	Pct. of 1 st Sales	70%	5%	25%	
Pct. of Alaska Groundfish Value	1.3%	YoY Change	-1%	-4%	5%	
Pct. of Alaska Flatfish Volume	15%	Competing species: Other flatfish, tilapia, whitefish				

Table 53. Summary Profile of Rock Sole Wholesale Production and Markets, 2017

Alaska plaice (*Pleuronectes quadrituberbulatus*) is primarily a bycatch species that was not retained in significant volumes prior to 2008. Today, however, it is an important component of Alaska's flatfish production, making up 6 percent of Alaska's total by volume as well as by value. Almost all Alaska plaice production is H&G which is then exported to China for reprocessing.

Table 54. Summary Profile of Alaska Plaice Wholesale Production and Markets, 2017

Value and Volume		Key Products	H&G	Whole Round	Other	
First Wholesale Production (mt)	7,715	Pct. of Value	96%	4%	0%	
Pct. of Global Flatfish Harvest (2016)	1.7%	Key Markets	China	South Korea	Other	
First Wholesale Value (\$ millions)	\$13.2	Pct. of 1 st Sales	-	-	-	
Pct. of Alaska Groundfish Value	0.5%	YoY Change	-	-	-	
Pct. of Flatfish Volume	6%	Competing Species: Other flatfish, tilapia, whitefish				

Flathead sole (*Hippoglossoides elassodon***)** is harvested year-round in the BSAI by catcher-processors as well as in the GOA by both catcher-processors and catcher vessels.

Table 55. Summary Profile of Flathead Sole Wholesale Production and Markets, 2017

Value and Volume		Key Products	H&G	Whole Round	Other
First Wholesale Production (mt)	5,270	Pct. of Value	88%	8%	4%
Pct. of Global Flatfish Harvest (2016)	1.2%	Key Markets	China	South Korea	Other
First Wholesale Value (\$ millions)	\$9.6	Pct. of 1 st Sales	-	-	-
Pct. of Alaska Groundfish Value	0.4%	YoY Change	-	-	-
Pct. of Flatfish Volume	4%	Competing Species: Other flatfish, tilapia, whitefish			

Fishery Summary

The largest concentration of Alaska soles and plaice is in the eastern Bering Sea, with the Gulf of Alaska (GOA) also yielding a sizeable flatfish harvest. In the Bering Sea and Aleutian Islands (BSAI), flatfish species are harvested based on species-specific stock assessments, while harvests in the Gulf of Alaska are managed as part of broader shallow-water and deep-water flatfish complexes that include yellowfin sole, rock sole, Alaska plaice, and flathead sole, as well as smaller volumes of Greenland turbot, rex sole, butter sole, Dover sole, and starry flounder, among others.⁴² Flatfish species are primarily targeted by the Amendment 80 catcher processer trawl fleet, but are also caught by American



Photo Courtesy of O'Hara Corporation.

Fisheries Act (AFA) trawl catcher processors, AFA trawl catcher vessels, and non-AFA trawl vessels operating in Alaska.

Alaska flatfish were harvested by foreign fleets until the Magnuson Stevens Act in 1977. U.S. joint venture fisheries soon followed in 1980 and now dominate global landings of yellowfin sole, rock sole, and flathead sole, thanks to Alaska fishing efforts increasing significantly since the 1990s and early 2000s.

One of the most significant developments in the flatfish fishery was the implementation of Amendment 80 to the Fishery Management Plan for the Groundfish of the BSAI in October 2007. Rather than have a "race for fish," Amendment 80 transformed the BSAI flatfish trawlers into a catch share fishery where participants operate as cooperatives, allowing companies to operate more efficiently by fishing year-round, maximizing product retention, and minimizing bycatch. Today, almost all flatfish harvested in the BSAI is caught primarily by the 19 Amendment 80 trawl catcher-processors and processed at-sea. In addition to flatfish, the Amendment 80 fleet also has allocations of Pacific cod, Pacific ocean perch, and Atka mackerel. Differing from the BSAI, the GOA fishery is a combination of catcher vessels and catcher processors, with shore-based processors for flatfish located in Kodiak, Akutan, and Dutch Harbor.

In 2017, Alaska harvested 229,240 mt of flatfish from the BSAI and GOA fisheries, a 3 percent decline from 2016. Flatfish harvests were consistent during 2015-2017, averaging 232,721 mt annually. This total, however, is a decrease from the peak harvest of 301,123 mt achieved in 2014 and the four-year period of 2011-2014, when harvests averaged 297,080 mt.

Much of the overall decline in harvest volume in the Alaska flatfish fishery is tied to the harvest levels of its two mostimportant species: yellowfin sole and rock sole. The world's largest flatfish fishery, yellowfin sole is a demersal species typically targeted by vessels using trawl gear, with most taken between March through May and August through October. Yellowfin sole are highly migratory, spending the winter near shelf margins and migrating to inner shelf areas in the spring to spawn and feed. Prices are highly dependent on when they are harvested; fish caught in the winter, prior to spawning, command higher prices due to flesh quality declining significantly during and after spawning. The largest concentration of yellowfin sole is in the eastern Bering Sea, where 128,665 mt were harvested in 2017, a 19 percent decline from the all-time peak of 158,781 mt in 2013.

⁴² Arrowtooth flounder stocks are managed on a species-specific level in the Gulf of Alaska (not part of shallow and deep water flatfish complexes).



Figure 29. Yellowfin Sole Harvest Volume in Alaska (mt), 1984-2017

Note: 1985 not reported.

Source: NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database.

The second largest volume of Alaska flatfish is rock sole, which refers to two demersal species, northern rock sole and southern rock sole; these are not differentiated commercially. The majority of rock sole are taken in February and March in the eastern Bering Sea, when females are bearing eggs. In 2017, 33,941 mt of rock sole was harvested in the BSAI, with another 1,836 mt harvested in the GOA. In the BSAI, this is down 52 percent from the peak harvest of 70,897 mt in 2012, and 25 percent below the 2013-2017 average harvest level of 45,572 mt. During this same period, the average GOA harvest was 2,972 mt.



Photo Courtesy of NMFS (AFSC).



Figure 30. Rock Sole Harvest Volume in Alaska (mt), 1983-2017

Source: NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database.

Collectively, yellowfin sole (57 percent) and rock sole (15 percent) made up 72 percent of Alaska's flatfish harvest volume in 2017. Of the remaining 28 percent, 13 percent was arrowtooth flounder, 6 percent was Alaska plaice, and 4 percent was flathead sole. The remaining 3 percent was made up of more than ten different flatfish species, with the most significant being Kamchatka flounder, Greenland turbot, and rex sole.

	2013	2014	2015	2016	2017	% of 2013-2017 Harvest
Bering Strait/Aleutian Isla	nds (BSAI)					
Yellowfin Sole	158,781	152,166	123,065	131,203	128,665	53%
Rock Sole	56,577	49,758	44,330	43,252	33,941	18%
Alaska Plaice	14,471	15,745	13,382	11,314	14,538	5%
Flathead Sole	15,739	15,101	10,048	9,000	8,110	4%
Arrowtooth Flounder	16,939	16,765	9,438	8,998	5,622	4%
Kamchatka Flounder	6,999	5,919	4,623	4,525	4,238	2%
Greenland Turbot	1,394	1,397	2,084	2,156	2,733	1%
Rex Sole	699	827	680	927	882	<1%
Total BSAI	271,662	257,814	207,759	211,445	198,798	88%
Gulf of Alaska (GOA)						
Arrowtooth Flounder	16,075	32,832	17,098	18,086	24,983	8%
Flathead Sole	2,483	2,401	1,860	2,328	1,900	1%
Rock Sole	4,040	3,390	2,606	2,991	1,836	1%
Rex Sole	3,639	3,531	1,925	1,675	1,430	1%
Butter Sole	1,072	801	281	499	155	<1%
Other Flatfish	183	285	138	123	98	<1%
Starry Flounder	114	66	55	49	37	<1%
Alaska Plaice	12	4	1	2	2	<1%
Yellowfin Sole	0	0	0	0	0	<1%
Total GOA	27,618	43,310	23,963	25,754	30,442	12%
Total Flatfish Harvest	299,280	301,124	231,723	237,199	229,240	100%

Table 56. Alaska Flatfish Harvest Volume (mt), 2013-2017

Source: NMFS Alaska Region Blend and Catch-accounting System estimates (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Alaska Production Summary

In 2017, Alaska produced 134,920 mt of flatfish products valued at \$230 million. This is well off the 2012 record production value of \$291.2 million (based on 172,863 mt of production) but is still the most valuable first-wholesale production figure since 2013, when the 170,053 mt of Alaska flatfish production was valued at \$232.8 million.

Yellowfin Sole

Yellowfin sole are almost exclusively harvested and processed by the Amendment 80 fleet of 19 catcher processors in the BSAI. Totaling 77,102 mt, yellowfin sole production made up 57 percent of Alaska's flatfish and 8 percent of Alaska groundfish production volumes in 2017. Yellowfin sole production in 2017 was valued at \$110.8 million, representing 4.4 percent of Alaska's groundfish production value. Though not a record production value, 2017 saw a record high value

per mt (\$1,437/mt) – exceeding the previous record of \$1,431/mt set in 2007. Like many whitefish, yellowfin sole suffered low prices caused by a glut of global whitefish volume in 2014 and 2015.



Figure 31. First Wholesale Volume and Value/mt for Alaska Yellowfin Sole, 2008-2017

Table 57. First Wholesale Va	alue of Alaska Yellowfin S	Sole (\$ millions), 2008-2017
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	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Value (\$ millions)	\$101.3	\$66.0	\$79.6	\$125.0	\$122.4	\$121.7	\$94.7	\$78.4	\$94.2	\$110.8

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Table 58. Alaska Yellowfin So	e Wholesale Production Volume and	Value, by Product Type 2017
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	Volume (mt)	Value Price per MT (\$000s)		Pct. of Total Volume	Pct. of Total Value
H&G	67,773	\$98,198	\$1,449	88%	89%
Whole fish	9,232	\$12,403	\$1,343	12%	11%
Fish Meal	98	\$159	\$1,626	<1%	<1%
Total	77,102	\$110,760	\$1,437	100%	100%

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Nearly all yellowfin sole production is H&G or whole fish, with most in the H&G (eastern cut) product form (88 percent of volume and 89 percent of value). Other products are limited to fish meal and fish oil (uses of trimmings when creating H&G product). Yellowfin H&G production values per mt have trended upwards in recent years, increasing 30 percent from \$1,116/mt in 2013 to \$1,449 in 2017. Over the same period, whole fish prices have decreased 54 percent.

Rock Sole

Alaska's 2017 rock sole production totaled 20,200 mt in 2017, valued at \$31.9 million. While the second most important flatfish species, rock sole, accounted for just 2.1 percent of Alaska groundfish production volume and 1.3 percent of groundfish value in 2017. Overall, Alaska's rock sole production value per mt increased 18 percent over the last five years.



Figure 32. First Wholesale Volume and Value for Alaska Rock Sole, 2008-2017

Table 59. First Wholesale Value of Alaska Rock Sole (\$ millions), 2008-2017

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Value (\$ millions)	\$47.9	\$36.1	\$41.1	\$54.4	\$82.5	\$44.1	\$38.3	\$33.2	\$37.0	\$31.9

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

The rock sole market is similar to other flatfish, except for the high value of its roe-in product; rock sole with roe comprised 20 percent of the total rock sole wholesale value despite making up just 11 percent of total volume. Because of this significance, recent rock sole with roe export markets have greatly impacted fishery profitability, with prices increasing 45 percent from 2013 to 2017 (\$1,891/mt to \$2,734/mt).

	Volume (mt)	Value (\$000s)	Price per MT	Pct. of Total Volume	Pct. of Total Value
H&G	15,249	\$22,019	\$1,444	75%	69%
H&G, roe-in	2,281	\$6,240	\$2,733	11%	20%
Whole fish	2,429	\$3,205	\$1,319	12%	10%
Other Products	241	\$409	\$1,695	1%	1%
Total	20,200	\$31,861	\$1,578	-	-

Table 60. Alaska Rock Sole Wholesale Production Volume and Value, by Product Type 2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Rock sole H&G and whole markets are similar to other flatfish, with the bulk of volume destined for reprocessing. In 2017, H&G (75 percent) and whole fish (12 percent) made up 87 percent of the total rock sole production volume, with just 1 percent comprised of other products.

Alaska Plaice and Flathead Sole

The wholesale production value of Alaska's third and fourth most-important flatfish species – Alaska plaice and flathead sole, respectively⁴³ – reached a combined \$22.8 million in 2017, with the vast majority of both being produced as H&G; 88 percent of flathead sole and 96 percent of Alaska plaice were processed as H&G in 2017. In total, Alaska plaice made up 6 percent of Alaska's flatfish volume in 2017 and flathead sole made up 4 percent. Though minor in relation to Alaska's total groundfish production, they both form significant parts of Alaska's flatfish portfolio.

	Volume (mt)	Value (\$000s)	Price per mt
Alaska Plaice			
H&G (Eastern Cut)	7,087	\$12,709	\$1,793
Whole fish	624	\$491	\$787
Fish Meal	4	\$6	\$1,443
Total Alaska Plaice	7,715	\$13,207	\$1,712
Flathead Sole			
H&G (Eastern Cut)	4,397	\$8,207	\$1,867
Whole fish	590	\$755	\$1,280
H&G, roe-in	95	\$257	\$2,702
Kirimi	77	\$180	\$2,338
Other*	111	\$170	\$1,532
Total Flathead Sole	5,270	\$9,569	\$1,816

Table 61. 2017 Alaska Plaice and Flathead Sole, Wholesale Production Volume and Value

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Product Description and Supply Chain

Yellowfin sole is a white fish with delicate, sweet, and mild-tasting flesh. Whole fish average 42 cm in length (approximately 16.5 inches) and 750 grams in weight (1.6 pounds). The primary products produced in Alaska are frozen H&G (89 percent of production volume) and frozen whole fish (11 percent). The most common H&G size is approximately 130-450 grams.⁴⁴ Most yellowfin sole are exported to China where they are processed into fillets. These twice-frozen fillets are primarily sold as frozen skinless, boneless 2-4 ounce fillets.

The supply chain for yellowfin sole begins with catcher processors in Alaska that export frozen H&G product to secondary processors in China. Secondary processors transform the fish into frozen skinless-boneless fillets, primarily for re-export. Twice-frozen fillets are then sold to distributors who sell fish to retail and foodservice operators in Europe, Japan, and the United States.

Rock sole is a delicate and mild-tasting whitefish that averages about 61 cm in length (approximately 24 inches) and weighs between 2-4 pounds (900-1,800 grams).⁴⁵ The primary products produced in Alaska are frozen H&G (75 percent

⁴³ Note that this intentionally leaves out arrowtooth flounder as it is addressed in its own section.

⁴⁴ (Alaska Seafood Marketing Institute, 2012).

⁴⁵ (Washington Department of Fish and Wildlife, 2019).

of production volume), frozen H&G with roe (11 percent), and whole fish (12 percent). The general H&G size is approximately 500-2,500 grams and whole round is 750-3,500 grams.⁴⁶



Photo Courtesy of ASMI.

Rock sole are primarily caught by catcher processors in Alaska targeting roe-bearing females. Most male rock sole are sold to China and the females with eggs are exported to Japan. Rock sole exported to China is reprocessed into 2-5 ounce skinless, boneless fillets that are primarily re-exported back to the U.S. market.

The short duration, high value roe fishery is unique among the flatfish species. During the spawning months, fish with roe intact are hand processed with roe-in, a more expensive processing technique than standard H&G. H&G, roe-in rock sole is a specialty item in Japan, where it is grilled whole.





⁴⁶ (Alaska Seafood Marketing Institute, 2012).

Key Market Analysis

Based on U.S. export statistics, 68 percent of Alaska's yellowfin sole and 62 percent of rock sole production is exported to China.⁴⁷ The balance flows to South Korea, Mexico, Japan, or remains in the U.S. market.

Whole or H&G yellowfin sole is exported to re-processors in China where it is converted into individual frozen skinlessboneless fillets. The majority are re-exported back into North America and Europe for use in food service and for retail. A portion of yellowfin sole is sold as kirimi (slices of fish), which is popular in Japanese cafeterias. Korea tends to purchase smaller fish, which are less expensive per kilo.



Yellowfin sole kirimi. Photo Courtesy of Everfish.

Most rock sole is combined with other flatfish (like flathead sole and Alaska plaice) and exported to China to be reprocessed as frozen fillets and other products. The highest value product, rock sole H&G with roe intact, is consumed in Japan.

Table 62. Volume and Value of Alaska Yellowfin Sole Exports, by Major Country, 2016-2017

	<u>2016</u>		<u>20</u>	<u>17</u>	YOY Pct.	Pct. Share of
	Volume (mt)	Value (\$000s)	Volume (mt)	Value (\$000s)	Change in Volume	Exports, Value
China	56,341	\$79,959	51,056	\$71,835	-9%	82%
South Korea	11,237	\$14,566	10,711	\$14,061	5%	16%
Other Countries	1,103	\$1,465	1,139	\$1,399	3%	2%
Total Exports	68,682	\$95,990	62,906	\$87,295	-8 %	100%

Source: ASMI Seafood Export Database.

Table 63. Volume and Value Alaska Rock Sole Exports, by Major Country, 2016-2017

	<u>2016</u>		<u>20</u>	<u>17</u>	YOY Pct.	Pct. Share of
	Volume (mt)	Value (\$000s)	Volume (mt)	Value (\$000s)	Change in Volume	Exports, Value
China	16,779	\$26,346	14,871	\$22,152	-11%	79%
Mexico	5,042	\$6,299	1,368	\$1,849	-73%	7%
South Korea	1,803	\$3,172	792	\$1,729	-56%	6%
Japan	1,796	\$3,138	1,104	\$1,811	-39%	6%
Other Countries	673	\$891	321	\$420	-52%	2%
Total Exports	26,093	\$39,846	18,456	\$27,961	-29%	100%

Source: ASMI Seafood Export Database.

⁴⁷ Estimates based on data for export codes specific to yellowfin sole and rock sole, though it is possible some exports of these species are coded under generic NSPF flatfish codes.

China

Alaska soles and plaice require hand processing, which is labor-intensive. Due to lower labor costs, China is responsible for reprocessing most Alaska-caught flatfish, with yellowfin and rock sole providing the largest volume. Approximately 80 percent of all China's flatfish exports go to Europe, Japan, and the United States. As China's economy has grown, an increasing number of sole has remained in the domestic market.

	<u>2015</u>		<u>2</u>	<u>016</u>	<u>20</u>	<u>017</u>	Pct. Market
	Volume (mt)	Value (\$ millions)	Volume (mt)	Value (\$ millions)	Volume (mt)	Value (\$ millions)	Share (3 yr. avg.)
Japan	19,393	\$109.6	20,293	\$120.6	18,671	\$124.0	32%
U.S.	17,407	\$83.7	17,197	\$81.3	17,976	\$92.5	23%
Canada	5,538	\$29.1	5,675	\$34.1	5,013	\$32.5	9%
Netherlands	4,307	\$17.1	3,958	\$16.2	5,178	\$23.0	5%
France	4,078	\$18.2	3,598	\$16.0	4,133	\$19.3	5%
Taiwan	2,540	\$36.5	1,025	\$6.2	1,485	\$18.5	5%
Poland	4,828	\$15.3	3,936	\$13.7	2,589	\$10.3	4%
Spain	2,215	\$6.4	3,288	\$9.9	3,345	\$11.4	2%
South Korea	2,787	\$8.4	2,160	\$7.6	2,668	\$11.2	2%
Germany	1,935	\$7.0	2,015	\$8.0	1,779	\$8.0	2%
Other	15,278	\$53.1	10,610	\$39.6	7,661	\$33.9	11%
Total	80,306	\$384.4	73,755	\$353.2	70,498	\$384.6	100%

Table 64. Volume and Value of China Flatfish Exports, by Top Ten Markets, 2015-2017

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html

China – U.S. Trade Dispute

Though not reflected in 2017 trade statistics, 2018 has brought a great deal of uncertainty to Alaska's flatfish industry due to its dependence on China and the tariffs and trade disputes between China and the United States It is understood that Chinese tariffs on U.S. seafood exports do not apply to shipments destined for reprocessing. However, unlike other Alaska seafood species that are reliant on Chinese reprocessing (such as salmon and pollock), flatfish fillets are subject to retaliatory tariffs imposed by the United States in 2018 on Chinese exports. These U.S. import tariffs were initially set at 10 percent, with an increase to 25 percent pending at the time of the drafting of this profile.

At this time, the uncertainty surrounding tariffs or other intensifications in a U.S.-China trade dispute has already caused supply chain disruptions, with more U.S. flatfish being processed in the United States, Poland, and other parts of Southeast Asia. As approximately 25-35 percent of Alaska flatfish product that is exported to China returns to the United States, many custom-processors of flatfish for the United States have been actively looking for new markets and switching to Russian or other non-Alaska product.⁴⁸

⁴⁸ Interview with domestic seafood company representative.

Japan and South Korea

Though most Alaska flatfish exports are directed at China, Japan is an important export market, importing 5 percent of Alaska's rock sole production volume in 2017, primarily females with roe intact. Japan, as the largest flatfish export market for China, also imports a great deal of Alaska flatfish reprocessed in China, particularly rock sole roe and flatfish kirimis.

According to industry experts, Japanese demand for rock sole with roe – H&G fish are commonly grilled with the roe inside as a delicacy – has decreased since its historical peak, resulting in lower export volumes and values. Also contributing to decreasing rock sole exports is the decline in Alaska's rock sole harvest, which decreased from 60,637 mt in 2013 to 35,377 mt in 2017. Despite the decrease in harvest volume, the value per mt of rock sole exports to Japan decreased by 9 percent, likely indicating a reduction in the percentage of rock sole exports with roe in. In addition to China, these may have been redirected to South Korea, where export value/mt grew in 2017.

South Korea consumes some yellowfin sole domestically, particularly lower quality yellowfin that have already spawned. Koreans also highly value the whole fish appearance; marks and flaws in the gills and eyes detract from value in this market.

	2013	2014	2015	2016	2017	2013-2017 % Change
Japan						
Volume (mt)	1,947	2,649	1,218	1,796	1,104	-43%
Value (\$000s)	\$3,495	\$4,463	\$1,933	\$3,138	\$1,811	-48%
Value/mt	\$1,795	\$1,685	\$1,588	\$1,748	\$1,641	-9%
South Korea						
Volume (mt)	503	149	2,235	1,803	792	57%
Value (\$000s)	\$907	\$2,542	\$3,364	\$3,172	\$1,729	91%
Value/mt	\$1,802	\$1,707	\$1,505	\$1,760	\$2,184	21%

Table 65. U.S. Rock Sole Exports to Japan and South Korea, 2013-2017

Source: ASMI Seafood Export Database.

United States and Europe

The United States and Europe consume a large amount of flatfish, much of it processed in China. Both end markets consume sole, plaice, and flounder (often commingled and sold as "flounder" or "sole") in fast food restaurants as well as in grocery stores in the frozen aisle (see photo of a product sold at Walmart at right).

The United States remains China's second largest export market for flatfish, receiving 17,976 mt of flatfish valued at \$92.5 million in 2017, an increase of 11 percent over 2015 value.⁴⁹

⁴⁹ IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-tradeatlas.html.

In Europe, key export markets include the Netherlands, France, Spain, Poland, and Germany, all of which have a seafood processing sector that could further transform and distribute flatfish products across Europe. While Alaska is very dependent on China for reprocessing its flatfish harvest, both the United States and Europe have access to other sources of flatfish from across the globe and are thus not fully dependent on China for flatfish products. The EU produces large volumes of competitor species of flatfish that are consumed domestically and exported to the United States The United States also imports a large volume of flatfish from Canada.



Canada 36% EU, 12%

Figure 34. Share of U.S. Imports of Flatfish, by Region/Country, 2017

Note: Figures refer to import volumes, does not include Pacific halibut Source: NMFS Office of Science and Technology, Foreign Fishery Trade Data.

Other Markets

Brazil was a growing market until it recently banned fish imports with water-retention preservatives used to improve the quality of the flesh (used in most twice-frozen yellowfin sole from China).⁵⁰ Compounding the impact of this ban was Brazil's economic recession from mid-2014 to 2016, and the slow recovery that persists today.

Competing Flatfish Supply

Global flatfish supply has remained fairly constant over the past two decades after declining significantly from harvest levels attained in the 1980s that exceeded 1.2 million mt annually. In contrast, Alaska's contribution to global production of flatfish has grown steadily from tiny volumes in the 1980s thanks to Alaska's fishery management regime and regulatory changes like Amendment 80. Between 2005 and 2016, Alaska flatfish production averaged 27 percent of global

⁵⁰ Interview with domestic seafood company representative.

flatfish supply, with a low of 19 percent in 2005 and a high of 32 percent in 2011 and 2012. Of Alaska's harvest, yellowfin and rock soles represented about 14 and 5 percent, respectively, of global flatfish harvest volume in 2017.

Alaska flatfish continue to compete with species such as European plaice and dabs, and have remained popular for use in frozen meals and as frozen fillets/kirimis in the United States, Japan, and Europe. Competition comes from fresh flatfish as well as from fresh/frozen whitefish like tilapia, pangasius, pollock, and cod, among others. In the United States, limited public awareness has impeded value growth due to the ability of multiple species to be labeled as "flounder." In contrast, Europe requires species to be labeled with the Latin name, which reduces the amount of sole sold as flounder.





Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.



Figure 36. Global Flatfish Supply and Alaska Harvest of Yellowfin and Rock Sole, 1986-2016

Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/ and NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database.

Note: Figures include all flatfish globally.

Wholesale Market Profile for Arrowtooth Flounder

Arrowtooth flounder (*Atheresthes stomias*) is the third most valuable commercial flatfish in Alaska (after yellowfin and rock soles) and typically represents 11-16 percent of the state's flatfish harvest volume.⁵¹ Overall, the species represented 18 percent of the first wholesale value of all Alaska flatfish in 2017 with a first wholesale value of \$41.5 million. The vast majority of this production is frozen H&G product destined for export to China for reprocessing.

Value and Volume		Key Products	H&G	Whole
First Wholesale Production (mt)	18,009	Pct. of Value	88%	12%
Pct. of Global Flatfish Harvest (2016)	5%	Key Markets	China	Japan
First Wholesale Value (\$ millions)	\$41.5	Pct. of 1 st Sales	83%	13%
Pct. of Alaska Groundfish Value	2%	YoY Change	70%	45%
Pct. of Alaska Flatfish Volume	13%	Competing Species:	Other flatfish, tilapia,	whitefish

Table 66. Summary Profile of Arrowtooth Flounder Wholesale Production and Markets, 2017

Fishery Summary

Arrowtooth flounder (*Atheresthes stomias*) is one of the most abundant groundfish species in the Bering Sea/Aleutian Islands (BSAI) area and the Gulf of Alaska (GOA). Available data on the species are somewhat complicated by the fact that Kamchatka flounder was not broken out from arrowtooth flounder until 2011. In this report, arrowtooth flounder data from 2010 or older includes Kamchatka flounder, unless otherwise noted.



In the last five years, arrowtooth flounder harvests averaged 33,367 mt per year. Alaska accounted for more than 95 percent of the U.S. arrowtooth flounder harvest in 2017.

Almost all flatfish harvested in the BSAI is caught primarily by the 19 Amendment 80 trawl catcher-processors and processed at-sea. The GOA flatfish fishery, on the other hand, is a combination of catcher vessels and catcher processors, with shore-based processors for flatfish located in Kodiak, Akutan, and Dutch Harbor. Alaska flatfish trawl fisheries are MSC-certified and have been for many years.

Harvests of arrowtooth flounder in Alaska have increased significantly since Amendment 80 was adopted in 2007. Previously, most arrowtooth harvests occurred as bycatch while targeting more valuable species. Recent harvests have been off the peak, though this is not due to declining abundance (as discussed in more detail below). Harvest effort is influenced by TAC, current prices, and other fisheries (high pink salmon abundance around Kodiak, for instance, will reduce effort in that area).

⁵¹ "Flatfish" includes all comparable BSAI/GOA flatfish species, including arrowtooth flounder, yellowfin and rock soles, and turbot. It does not include Pacific halibut or skate.



Figure 37. Arrowtooth and Kamchatka Flounder Harvest Volume in Alaska (mt), 1985-2017

Note: Kamchatka flounder was not separated from arrowtooth flounder in harvest data until 2011. Source: NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database (1984-2004) and NMFS Alaska Region Blend and Catch-accounting System estimates (Data provided by the Alaska Fisheries Information Network (AKFIN)) (2005-2017).

In 2017, arrowtooth flounder made up 13 percent of Alaska's overall flatfish harvest volume – though the percentage varied by area. Unlike for flatfish as a whole, the majority of arrowtooth harvests occurred in the Gulf of Alaska in recent years. The species made up only 3 percent of Alaska flatfish harvests in the BSAI but 82 percent of GOA flatfish catch.

	2013	2014	2015	2016	2017	% Change from 2013-2016 Avg.
BSAI Flatfish	271,662	257,814	207,759	211,445	198,798	-16%
Arrowtooth Flounder	16,939	16,765	9,438	8,998	5,622	-57%
% Arrowtooth	6%	7%	5%	4%	3%	
GOA Flatfish	27,618	43,310	23,963	25,754	30,442	1%
Arrowtooth Flounder	16,075	32,832	17,098	18,086	24,983	19%
% Arrowtooth	58%	76%	71%	70%	82%	
Total Flatfish	299,280	301,124	231,723	237,199	229,240	-14%
Arrowtooth Flounder	33,014	49,597	26,536	27,084	30,605	-10%
% Arrowtooth	11%	16%	11%	11%	13%	

Table 67. Alaska Arrowtooth Flounder and Alaska Flatfish Harvest Volume (mt), 2013-2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Arrowtooth harvests are severely limited by halibut bycatch issues. Both arrowtooth and Pacific halibut are relatively large flatfish species that can inhabit the same territory, and are often similar in size (although older halibut can grow much larger). Halibut excluder devices generally are not effective when fishermen target arrowtooth. For this reason, arrowtooth flounder TAC/Biomass ratios are one of the lowest for all commercial groundfish species harvested in Alaska – at around 4 percent as of 2015.

Alaska Production Summary

In 2017, Alaska produced 18,009 mt of arrowtooth flounder products valued at a record \$41.5 million. The production value in 2017 represented a 65 percent increase over the previous five year average. Harvest volumes were actually down 11 percent in 2017 compared to the 2012-2016 average, indicating that the value increase is due to higher prices. Wholesale arrowtooth prices in 2017 averaged \$2,306 per mt – a 35 percent increase over the previous high and up 53 percent over the 2012-2016 average. Wholesale prices in 2018 were reportedly down significantly from 2017, though industry-wide data are not available.⁵² According to industry interviews, arrowtooth flounder prices are influenced by dynamics in the overall whitefish and flatfish markets, but price fluctuations are exacerbated by Canadian production. Canadian fishermen do not consistently fish for significant volumes of arrowtooth flounder, but respond to high prices by dramatically ramping up harvest levels, which can have the effect of flooding the market.



Figure 38. First Wholesale Volume and Value/mt of Alaska Arrowtooth Flounder, 2008-2017

Table 68.	First Wholesale	Value of Alaska	Arrowtooth	Flounder (\$ millions)	, 2008-2017
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	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Value (\$ millions)	\$21.8	\$18.2	\$24.3	\$32.6	\$33.3	\$16.9	\$35.6	\$18.3	\$22.1	\$41.5

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Nearly all arrowtooth flounder production is H&G or whole fish. Prior to 2016, more than 95 percent of production was in H&G (primarily with tail removed). In recent years, however, there was a significant shift to whole fish products, which accounted for 18 percent of production volume in 2017. Most of the whole fish production came from shoreside processors in the Kodiak area.

⁵² Interview with domestic seafood company representative.

	Volume (mt)	Value (\$000s)	Price per MT	Pct. of Total Volume	Pct. of Total Value				
H&G (Tail removed)	12,073	\$31,382	\$2,599	67%	76%				
H&G (Eastern cut)	2,667	\$5,191	\$1,946	15%	13%				
Whole fish	3,223	\$4,876	\$1,513	18%	12%				
Total	18,009	\$41,525	\$2,306						

Table 69. Arrowtooth Flounder Wholesale Volume and Value, by Major Product Type, 2017

Note: Totals may not sum due to rounding.

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Product Description and Supply Chain

Arrowtooth flounder is usually processed as frozen headed/gutted product with the tail removed, or "HGT." Removing the tail is a common market preference for several flatfish, including arrowtooth flounder, Greenland turbot, and Kamchatka flounder. The average yield for H&G is 74 percent, though it is not clear that this percentage includes removing the tail.⁵³ A typical arrowtooth flounder weighs approximately 17 pounds, with HGT grades available from one processor ranging as follows: ⁵⁴

•	SSS (less than 0.5 kg)	٠	S (1-2kg)
_		•	M (2-3 kg)

SS (0.5-1 kg)

Arrowtooth flounder carry a myxosporean parasite that releases a proteolytic enzyme which softens the fish's flesh upon landing. Not all arrowtooth carry the meat-softening parasite, but most do. The effects of the enzyme can be partially counteracted by treating the fish with an additive and by quick processing and freezing. Unfortunately, both practices do not completely fix the problem and increase harvest and processing costs.

Arrowtooth flounder is generally exported to China as frozen HGT product for reprocessing. It is then re-exported as frozen fillets or breaded/frozen product to Japan, Europe, the United States, and other markets as a low-cost flounder or whitefish product. Finished arrowtooth fillet product is commonly marketed simply as "flounder" or "sole," depending on the market. This has caused consumer confusion and disappointment in some cases, as fillets containing the flesh-softening enzyme are typically lower quality than other flounder/sole species.



Figure 39. Arrowtooth Flounder Supply Chain

⁵³ (Crapo, Paust, & Babbit, 2004).

⁵⁴ (North Star Fishing Co., 2018).

Frill meat (engawa) is connective muscle that runs along the outer fins and is sliced from under the fin and packed in frozen shatterpack blocks. Frill yield is estimated at 1-2 percent from round weight.⁵⁵ Engawa can sell for \$18-22 per kilo for vacuum sealed product.⁵⁶ Chinese reprocessors separate engawa and sell frozen product to distributors that supply sushi restaurants, mostly in Japan. Larger engawa strips receive higher prices.

Engawa is a major profit driver for Chinese arrowtooth buyers. However, Chinese processors must utilize the rest of the fish in some manner to cover costs, so this typically means freezing the fillets and selling them at a low price as generic "flounder." Arrowtooth flounder is also used as a raw material by some Japanese and Korean processors in surimi seafood products.

Key Market Analysis for Alaska Arrowtooth Flounder

Basically all of Alaska's arrowtooth flounder production is exported, with 80 percent going to China and the remainder to Japan and South Korea. The total value of Alaska's flounder exports in 2017 was \$39.6 million. Available trade data do not separate out arrowtooth from other flounders, but flounder exports can be assumed to be comprised mostly of arrowtooth. This assumption is based on the fact that arrowtooth flounder makes up 90 percent of relevant flounder production volume in Alaska (with these production totals approximating export volumes under the relevant trade code).⁵⁷



H&G arrowtooth is primarily exported to re-processors in China where it is converted into individual frozen skinlessboneless fillets and engawa frill meat packs. This production is re-exported, with the largest volumes going to Japan, North America, and Europe.

	2013	2014	2015	2016	2017	% of Total 2013-2017
China	10,463	16,261	9,092	10,545	16,484	80%
Japan	1,937	2,542	1,399	1,771	2,611	13%
South Korea	943	683	1,218	465	174	4%
Other	484	394	162	230	558	2%
Total	13,827	19,881	11,871	13,012	19,827	

Table 70. Top Export Destinations of Alaska Flounder (mt), 2013-2017

Note: Data pertains to exports of "Flatfish NSPF Frozen" from Districts 30 and 31. These exports include a variety of flatfish species, but are believed to be comprised mostly of Alaska-caught arrowtooth flounder.

Source: ASMI Export Database.

⁵⁵ (V.G. Associates; Canpolar East Inc.; Marylou Peters and Associates Limited, 1992).

⁵⁶ Interview with domestic seafood company representative and online listings.

⁵⁷ "Relevant flounder" refers to species that are not distinguishable in trade data separately. For instance, Alaska plaice is a type of flounder but has its own export code and does not fall under the code for Flatfish NSPF Frozen.

China

Similar to other flatfish, arrowtooth flounder require hand processing to prepare skinless/boneless fillets and other products. Due to lower labor costs, China is responsible for reprocessing most of Alaska's flatfish. In 2017, Alaska exported 92,642 mt of flatfish to China, with flounder (mostly arrowtooth) making up 18 percent of that volume. Combined, Alaska flatfish accounted for 63 percent of China's flatfish imports. Russia (16 percent), other U.S. states (9 percent), and Canada (5 percent) supplied the rest of China's flatfish import volume.⁵⁸ Given very limited domestic flatfish harvests in China, it is clear that Alaska is the dominant source of raw material for China's flatfish processing sector.

Trading Partner	2015	2016	2017	% of Total 2015-2017
Japan	19,393	20,293	18,671	32%
U.S.	17,407	17,197	17,976	23%
Canada	5,538	5,675	5,013	9%
Netherlands	4,307	3,958	5,178	5%
France	4,078	3,598	4,133	5%
Taiwan	2,540	1,025	1,485	5%
Poland	4,828	3,936	2,589	4%
Spain	2,215	3,288	3,345	2%
South Korea	2,787	2,160	2,668	2%
Germany	1,935	2,015	1,779	2%
Other	15,278	10,610	7,661	11%
Total	80,306	73,755	70,498	100%

Table 71. China Flatfish Fillet Export Volume (mt), by Trading Partner, 2015-2017

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html.

Approximately 80 percent of all China's flatfish fillet exports go to Europe, Japan, and the United States. The data in the table below include fillets from various flounder species as well as sole and other flatfish species.

The growth in whole fish production in recent years is largely associated with a domestic market within China, according to industry sources. This market is reported to have dried up due to increased tariffs imposed in 2017 as a result of the U.S.-China trade dispute.

Japan

Though most Alaska arrowtooth flounder exports are directed at China, Japan is an important market, importing 13 percent of Alaska's arrowtooth production volume in 2017. These direct exports from Alaska to Japan were worth \$5.3 million in 2017. As China's largest flatfish fillet export market, Japan also consumes a great deal of Alaska arrowtooth flounder reprocessed in China, including the bulk of the high-value engawa production.

Unfortunately, trade data do not allow for an analysis of engawa in detail. In the alternative, a rough estimation (based on the assumption of 1.5 percent yield on engawa and Japan purchasing 80 percent of engawa production) indicates that

⁵⁸ IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-tradeatlas.html.

Japan could consume around 400 mt of Alaska arrowtooth engawa annually.⁵⁹ Current prices found online indicate a minimum price of \$16,000 per mt for arrowtooth engawa.⁶⁰ At this price and based on these assumptions, the wholesale market for Alaska's arrowtooth engawa in Japan could be worth \$4-8 million.

United States and Europe

The United States and Europe consume a large amount of flatfish, much of it processed in China. Both end markets consume sole, plaice, and flounder (often commingled and sold as "flounder" or "sole") in fast food restaurants as well as in grocery stores in the frozen aisle (see photo of a product sold at Walmart at right).

The United States remains China's second largest export market for flatfish fillets, receiving 17,976 mt of flatfish valued at \$92.5 million in 2017.⁶¹

While most trade data lump flounder shipments together with other flatfish, U.S. import data allow for a more detailed analysis. As shown in the table below, the

United States imported 8,614 mt of flounder fillets from China in 2018. Imports in 2018 through October were on track to match 2017. The value per metric ton of flounder fillets from China rose sharply in 2017 and 2018, increasing an impressive 29 percent from 2016 to 2018 (January through October average).

Table 72. U.S. Flounder Fillet Imports from China, Volume and Value, 2015-2017 and YTD 2018

	2015	2016	2017	Jan-Oct 2018
Volume (mt)	7,955	7,629	8,614	5,517
Value (\$ millions)	\$20.4	\$20.8	\$29.9	\$29.0
Value/mt	\$4,099	\$4,074	\$4,564	\$5,261

Note: Includes various flounder species (mostly arrowtooth).

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data https://ihsmarkit.com/products/maritime-global-trade-atlas.html.

Competing Flatfish Supply

Arrowtooth flounder – and the very closely related species Kamchatka founder – are found in the North Pacific Ocean and are harvested by the United States, Russia, and Canada. The United States makes up the majority of global harvests (89 percent between 2012-2016). Canadian production is sporadic and can contribute to a boom and bust cycle where harvest jumps in response to price increases, followed by price drops due to oversupply. Production in Alaska can also vary with price, especially for the shoreside sector. This type of boom and bust cycle appears to be what has happened in 2016 through 2018, though complete data is not yet available.



⁵⁹ Assumptions based on (V.G. Associates; Canpolar East Inc.; Marylou Peters and Associates Limited, 1992) (yield percentage) and a conservative estimate of Japanese portion or market.

⁶⁰ Based on information available on alibaba.com and made-in-china.com.

⁶¹ IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-tradeatlas.html.

	2012	2013	2014	2015	2016	% of Total 2012-2016
U.S.	42,592	37,187	34,956	50,811	27,783	89%
Canada	7	18	3	11,821	10,382	10%
Russia	303	298	394	437	293	1%
Total	42,902	37,503	35,353	63,069	38,458	

Table 73. Global Production of Arrowtooth Flounder (mt), 2012-2016

Note: Includes Kamchatka flounder production.

Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.

Globally, arrowtooth flounder made up 5 percent of flatfish harvests in recent years (2013-2017). Arrowtooth flounder compete with other Alaska flatfish (especially yellowfin and rock sole) as well as species such as European plaice and dabs. Flounder and other flatfish have increased significantly in value in recent years, and remain popular for use in frozen meals and as frozen fillets/kirimis in the United States, Japan, and Europe.

Outside of flatfish, competition comes from whitefish like tilapia, pangasius, pollock, and cod, among others.

Wholesale Market Profile for Atka Mackerel

Atka mackerel production was valued at \$127.8 million in 2017, accounting for 5 percent of the first wholesale value of all Alaska groundfish. Production value in 2017 was double that of the previous four-year average thanks to a 27 percent increase in harvest volume over 2016 combined with high value/mt nearly equal to the all-time high in 2015. Alaska produced 54 percent of global Atka and Okhotsk mackerel harvests in 2017, and nearly all production was exported to Japan, China, or South Korea as a frozen H&G product. Final consumer products include split/salted and surimi and is largely consumed in Japan, Korea, and China. This market profile summarizes production and markets for Alaska's Atka mackerel fisheries.

Value and Volume		Key Products	H&G		Other
First Wholesale Production (mt)	42,231	Pct. of Value	91%		9%
Pct. of Global Harvest (2016)	54%	Key Markets	Japan	China	Korea
First Wholesale Value (\$ millions)	\$127.8	Pct. of Final Sales	58%	14%	9%
Pct. Change in Value from Prior 4-yr Avg.	100%	YoY Change	-16%	-3%	0%
Pct. of Alaska Groundfish Value	5%	Competing Species: Okhotsk Atka mackerel			

Table 74. Summary Profile of Atka Mackerel Wholesale Production and Markets, 2017

Atka mackerel is a key species for Alaska's Amendment 80 fleet, which also targets high volume flatfish (sole/flounder) and rockfish (including Pacific ocean perch). Atka mackerel accounted for 29 percent of the combined wholesale production value of these target species in 2017.

Fishery Summary

There are actually two separate species often referred to as "Atka mackerel." *Pleurogrammus monopterygius* is caught in Alaska while the "Okhotsk mackerel" (*Pleurogrammus azonus*) is harvested in Russian, Japanese, and Korean waters. Apart from the Okhotsk mackerel typically being harvested in greater volumes than Atka mackerel, the species are not widely differentiated and comments about Atka mackerel markets or global supply extend to both species unless otherwise noted.

Atka mackerel (*Pleurogrammus monopterygius*) is a semi-demersal species most commonly targeted by Amendment 80 trawl catcher processors around the Aleutian Islands. Fish are also caught as a sideboard species by AFA trawl catcher processors, AFA trawl catcher vessels, and other trawl vessels operating in Alaska.

Atka mackerel begin to recruit to the fishery at age three and have lifespans of up to 15 years. Adult fish typically aggregate at depths of more than 200 m over rough, uneven bottom areas with high tidal



Photo Courtesy of NMFS (AFSC).

currents. These fish move off the bottom during daylight hours presumably to feed on their main prey, euphausiids and copepods, and are preyed upon by Pacific cod, arrowtooth flounder, Steller sea lions, and seabirds.



Amendment 80 Catcher Processors. Photo Courtesy of Fishermen's Finest.

U.S. joint venture fisheries began in 1980 and dominated landings of Atka mackerel from 1982 to 1988, with the last joint venture allocation of Atka mackerel off Alaska occurring in 1989. The vast majority of Atka mackerel is caught in waters around the Aleutian Island chain in western Alaska. The peak domestic catch of 87,871 mt occurred in 1996. The Atka mackerel fishery is heavily regulated to minimize the potential for prey competition with Steller sea lions, including seasonal TAC allowances and spatial distribution of the fishery away from critical habitat. Since 2008, the fishery has operated as a catch share fishery, with participants operating as cooperatives and typically harvesting 90 percent or more of the Atka mackerel total allowable catch each year.



Figure 40. Atka Mackerel Harvest Volume in Alaska (mt), 1986-2017

Source: NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database.

Over the last decade, Atka mackerel harvests peaked at 71,164 mt in 2009 before declining precipitously to 23,326 in 2013. Since 2013, harvests have steadily increased, growing by 178 percent between 2013 and 2017. Much of the aforementioned decline in harvests was related to protection measures for Steller sea lions (which prey upon Atka mackerel and are listed as an endangered species in western Alaska) rather than a decrease in species biomass. Recent

mitigation measures have allowed for higher TACs without impacting endangered Steller sea lion populations, though TACs are set to drop to some degree in 2019 and 2020.

Table 75. Atka	Mackerel	Harvest	Volume	(mt),	2013	-2017
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	2013	2014	2015	2016	2017
Bering Sea and Aleutian Islands	22,479	30,564	52,477	54,058	64,054
Gulf of Alaska	846	965	901	956	693
Total	23,325	31,529	53,378	55,014	64,747

Source: NMFS Alaska Region Blend and Catch-accounting System estimates (Data provided by the Alaska Fisheries Information Network (AKFIN)).

201327,92084%201434,32292%201556,50094%201657,00097%201768,00095%201873,393201960,951202056,635	Year	Total Allowable Catch (TAC) (mt)	Percent Harvested
2014 34,322 92% 2015 56,500 94% 2016 57,000 97% 2017 68,000 95% 2018 73,393 2019 60,951 2020 56,635	2013	27,920	84%
2015 56,500 94% 2016 57,000 97% 2017 68,000 95% 2018 73,393 2019 60,951 2020 56,635	2014	34,322	92%
2016 57,000 97% 2017 68,000 95% 2018 73,393 2019 60,951 2020 56,635	2015	56,500	94%
2017 68,000 95% 2018 73,393 2019 60,951 2020 56,635	2016	57,000	97%
2018 73,393 2019 60,951 2020 56,635	2017	68,000	95%
2019 60,951 2020 56,635	2018	73,393	
2020 56,635	2019	60,951	
	2020	56,635	

Table 76. Atka Mackerel TAC and Percent of TAC Harvested, 2013-2020

Source: North Pacific Fisheries Management Council Harvest Specifications and NMFS Alaska Region Blend and Catchaccounting System estimates (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Product Description and Supply Chain

Averaging between 37 and 47 cm (approximately 14.5 to 18.5 inches) and 300 to 600 gm (0.66 to 1.32 pounds),⁶² Atka mackerel are primarily caught by catcher processors in Alaska and exported as a frozen H&G product (85 percent of 2017 production) or whole fish (15 percent) to secondary processors in Japan, South Korea, and northern China. Secondary processors transform the fish into its finished split/salted form and local distributors sell the fish to retailers.

Atka mackerel flesh offers a high oil content and has a strong, distinct flavor. In its raw form, the fish's meat is firm and brownish but turns to a creamy white color when cooked. Atka mackerel is typically consumed as split/salted product served in Japanese pubs (*izakaya*), often grilled and served with rice. Additionally, Japan produces about 10,000 mt annually of Atka mackerel surimi, from a combination of Alaska and other sources.⁶³

⁶² (Alaska Seafood Cooperative, 2015)

⁶³ (Park, 2014)

Production Volume and Value

Alaska produced 42,321 mt of Atka mackerel products in 2017 worth \$127.8 million. Of this total, H&G production accounted for 85 percent of volume and 91 percent of value with whole fish making up the remainder. Apart from a sharp drop in 2013, the first wholesale value of Atka mackerel has grown steadily over the 2008 to 2017 period despite substantial fluctuations in production volume. Rising prices – which increased 103 percent from 2008 to 2017 – are likely driven largely by decreasing global supply over this period. Based on TACs, Alaska's production is expected to increase slightly in 2018 and then decrease in 2019 and 2020.





Table 77. First Wholesale	Value of Atka M	Mackerel (\$	millions), 2008-2017
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2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
\$49.7	\$67.7	\$74.4	\$75.4	\$74.8	\$39.5	\$63.3	\$74.3	\$74.9	\$127.8

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Key Market Analysis

Based on U.S. export statistics, approximately 58 percent of Alaska's Atka mackerel is exported directly to Japan. The balance is primarily exported to China (14 percent) and South Korea (9 percent), where it is both consumed and reprocessed for re-export. South Korean import statistics specifically identifying Atka mackerel suggests that much of what is exported to South Korea actually remains in the Korean market, as opposed to being re-exported, which is often the case with some other species. Given the product's history and regional demand, it is likely that China also consumes some of its



imported volume as well. Nevertheless, the Atka mackerel market is dominated by Japan despite modest demand in China and South Korea.

	2013	2014	2015	2016	2017
Japan	7,787	12,627	22,047	22,297	26,530
China	2,554	3,741	6,000	5,046	6,547
South Korea	2,244	2,834	1,978	2,801	3,935
Other Countries	280	698	235	99	113
Total	12,865	19,900	30,260	30,243	37,125

Table 78. Alaska Atka Mackerel Exports by Major Country (mt), 2013-2017

Source: ASMI Seafood Export Database.

Total export volume of Atka mackerel is typically less the total production volume. Normally, this would suggest some product remains in the domestic market. However, anecdotal reports from industry indicate very little product, if any, is sold into the U.S. domestic market. Unfortunately, H.S. (foreign trade) codes do not uniformly identify Atka mackerel, making it difficult to track actual trade of Alaska product. The reason for discrepancies between export and total production volume is more likely a result of inaccurate export coding, where a percentage of product is coded as a non-specific groundfish.

Japan

The majority of Alaska's Atka mackerel is exported to Japanese markets, where it is particularly popular in the northern Hokkaido region. The most common preparation involves splitting, drying, and salting a headed and gutted fish (known as *hokke no hiraki*).⁶⁴ Typically, the fish is then grilled and served with a side of steamed rice.

Atka mackerel, known as *shima hokke* in Japan, has a unique cultural significance and is a symbolic fish in the Hokkaido region. According to legend, the *hokke* fish was discovered by a 13th century



Shima hokke. Photo credit: Flickr user sodai gomi

Buddhist disciple named Nichiji who founded a temple in northern Japan and went on to settle in China.⁶⁵ The fish has a long symbolic and commercial tradition in Hokkaido, where domestic landings peaked in 1998 at 240,000 mt, supporting a market for split/salted *hokke* and *hokke* surimi.

Retail *hokke* prices and wholesale Atka mackerel prices have risen due to declining harvests in Japan, which produced just 17,400 mt of Atka mackerel in 2016. While declining harvest trends in Japan put Alaska in a better market position, Japanese consumers are flexible when it comes to substituting seafood species. For surimi producers – which historically have used both Atka and horse mackerel⁶⁶ for Japan's domestic surimi production – declining harvests and rising prices have already prompted Japanese surimi producers to substitute Atka mackerel with other species for surimi production.

⁶⁴ (Hokkaido Economic Department, 2015).

⁶⁵ The fish discovered by Nichiji was actually Okhotsk Atka mackerel (*Pleurogrammus azonus*), a very close relative to the Atka mackerel found in Alaska waters and often used interchangeably as hokke in Japan.

⁶⁶ "Horse mackerel" is a generic name given to a range of species, predominantly from the Carangidae (jack mackerels and scads) family. Fish included in the *Trachurus* (including Atlantic horse mackerel) and *Caranx* genera encompass most of the horse mackerel category.

Competing Supply

Alaska accounted for 42 percent of global Atka mackerel production between 2014 and 2016, the most recent three years with complete data for global harvest. Historically, Japan is the largest producer but its harvests have declined significantly since 2008 - down 90 percent through 2016. Japanese fishermen have harvested substantial volumes of the species for many decades but 2015 (17,183 mt) and 2016 (17,400) harvest levels are the lowest ever, according to FAO data. After Alaska, Russia was the second largest producer in 2016.

Like Alaska, Russia began harvesting Atka mackerel in the 1980s. However, Russian harvests have declined steadily following their peak harvest of 68,863 mt in 2010, dropping 66 percent to 2016 harvest levels of 23,393 mt. Consequently, global 2016 Atka mackerel harvests reached their lowest point since 1983 and were down 64 percent since 2008. Supply reductions put upward pressure prices contributing to the first wholesale price of Alaska's Atka mackerel approximately doubling from 2008-2017.



Figure 42. Global Atka Mackerel Harvest (mt), 1986-2016

Note: Figures include both species of Atka mackerel (Pleurogrammus monopterygius and P. azonus).

Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/ and NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database.

Wholesale Market Profile for Pacific Ocean Perch

Pacific ocean perch (*Sebastes alutus* – also known by the acronym POP) is the most abundant rockfish species in Alaska, comprising 81 percent of all Alaska rockfish production in 2017. Overall, POP represented 2.6 percent of the first wholesale value of all Alaska groundfish in 2017. About eighty percent of Alaska's POP is exported to two countries – China (for processing) and Japan (the species' largest consumer market). Alaska POP accounted for 21 percent of global rockfish harvests in 2016. This market profile summarizes production and markets for POP fisheries in Alaska.

Value and Volume		Key Products	H&G	_	Whole	
First Wholesale Production (mt)	26,000	Pct. of Value	91%		7%	
Pct. of Global Rockfish Harvest (2016)	21%	Key Markets	China	Japan	South Korea	
First Wholesale Value (\$ millions)	\$64.2	Pct. of Final Sales	53%	30%	5%	
Pct. Change in Value from Prior 4-yr Avg.	11.3%	YoY Change	-26%	+25%	-20%	
Pct. of Alaska Groundfish Value	2.6%	Competing Species: Redfish and other rockfish species.				

Table 79. Summary Profile of Pacific Ocean Perch Wholesale Production and Markets, 2017

POP is a key species for the Amendment 80 fleet, which also harvests high volume flatfish (sole/flounder), Atka mackerel, and other rockfish species. POP accounted for 11 percent of the combined wholesale value of production by the Amendment 80 fleet in 2017.

Fishery Summary

Pacific ocean perch (POP) is one of about seventy different kinds of rockfish (*Sebastes* spp.) and accounts for the vast majority of rockfish caught in Alaska. POP are a slow-growing species, capable of living to nearly 100 years of age. The fish primarily inhabit waters along the continental slope at depths of 180 to 420 m. Despite their age, the POP harvested in commercial fisheries average only 36 cm (14.2 inches) long with a round weight of slightly less than a pound to a little over 2 pounds.



POP are an important component of Alaska groundfish fisheries, with catches taken primarily from shelf breaks and gullies in the northern Gulf of Alaska and Aleutian Islands region during summer months. Most POP are harvested by Amendment 80 catcher processors, and in the Gulf of Alaska by smaller catcher vessels. Catcher processors harvest multiple species, conduct primary processing aboard the vessel, and freeze their products on board. The most common fishing gear is otter trawls rigged to fish over rough substrates. Rockfish nets are designed to stay off the bottom as much as possible by employing floats to buoy the net body and codend. However, pelagic trawls are also widely used to target POP in the Gulf of Alaska.

In 2008, the "Amendment 80" system went into effect dividing groundfish target quotas for sole, Atka mackerel, and POP and adding bycatch limits among cooperatives. The new cooperative approach ended the "race for fish" allowing vessels to fish cleaner and more efficiently.

Figure 43. Pacific Ocean Perch Harvest Volume in Alaska (mt), 1977-2017



Source: NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database (1977-2004) and NMFS Alaska Region Blend and Catch-accounting System estimates (Data provided by the Alaska Fisheries Information Network (AKFIN)) (2005-2017).

In the ten years prior to 2008, POP harvests averaged 20,600 mt. Since Amendment 80 went into effect in 2008, the average annual harvest has nearly doubled to 40,300 mt. Alaskan production currently accounts for virtually all commercially-caught POP in the United States. POP stocks off the West Coast of the United States were declared rebuilt in 2017, though the size of expected harvests going forward is unclear.

Table 80. Pacific Ocean Perch Harvest Volume (mt), by Vessel Type and Region, 2013-2017

	2013	2014	2015	2016	2017
Gulf of Alaska	12,178	15,988	18,014	21,404	20,312
Catcher Processor	5,819	8,697	9,509	11,497	11,421
Catcher Vessel	6,358	7,291	8,505	9,908	8,891
Bering Sea and Aleutian Islands	30,809	31,384	30,016	30,317	30,279
Catcher Processor	30,591	31,008	29,289	29,681	29,626
Catcher Vessel	217	376	727	636	653
Total	42,986	47,372	48,030	51,722	50,591

Source: NMFS Alaska Region Blend and Catch-accounting System estimates (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Table 81. Pacific Ocean Perch TACs for Federal Fisheries in Alaska (mt), 2013-2020

Year	Total Allowable Catch (mt)	Pct. Harvested	Year	Total Allowable Catch (mt)	Pct. Harvested
2013	49,707	87%	2017	58,818	86%
2014	52,431	90%	2018	66,597	-
2015	53,033	91%	2019	72,624	-
2016	53,336	97%	2020	71,277	-

Source: North Pacific Fisheries Management Council Harvest Specification Tables.

Product Description and Supply Chain

Just over 80 percent of Alaska POP are processed by catcher processors – with most of that accounted for by the 19 vessels in the Amendment 80 fleet. The rest are caught by catcher vessels and delivered to shoreside plants or (in small volumes) motherships.

The vast majority of POP harvests are converted into frozen headed and gutted (H&G) products, though the percentage varies by processor type. Catcher-processors in the Amendment 80 fleet, which specialize in POP and similar types of fish, process nearly all POP as H&G. Shoreside processors, on the other hand, are more likely to push POP to whole fish products (55 percent on average). POP delivered to motherships almost exclusively go to fish meal.

H&G POP average 250 to 650 gm (approximately 0.55 to 1.43 pounds).⁶⁷ Like other rockfish, POP have a light-colored, firm flesh. Some POP fillets have a pinkish hue when raw but become a creamy white when cooked. In wholesale markets, H&G products are grouped according to the following size specifications (essentially extra-small through extra-large).⁶⁸

- 2L: 620 900 grams
- L: 460 620 grams
- M: 370 460 grams
- S: 300 370 grams
- SS: 220 200 grams

POP are often called "rockfish", "redfish," or simply "ocean perch" in wholesale and end markets. It is unlikely a consumer would see POP called out specifically on a retail label or restaurant menu. The species has become a valuable alternative to other more expensive species, such as red snapper or orange roughy – as it has a similarly sweet taste and firm flesh. Species substitution is illegal if retail or food service operators misrepresent what is served (such as selling redfish or tilapia as red snapper). However, consumers are free to substitute POP in recipes and it would make sense for chefs to use smaller firm-fleshed fish (like POP) in dishes which do not require a large, expensive snapper fillet (provided they accurately represent the species used).

Alaska's frozen H&G or whole fish POP products are generally exported to secondary processors in China and Japan to be thawed, cut, frozen and repackaged for sale to end markets. Though China receives the lion's share of POP exports, Japan is the largest consumer market by a wide margin. Efforts to develop a consumer market for POP in China were ongoing for several years, but recent tariff dynamics have effectively ended this market. Europe and the United States also account for a small amount of rockfish sales, either directly from Alaska or via the Chinese reprocessing market. All markets consume POP by way of regional seafood distributors, who typically maintain relationships with processors in both China and Alaska.

⁶⁷ (Alaska Seafood Cooperative, 2015)

⁶⁸ (North Star Fishing Company, 2019)

Production Volume and Value

Alaska produced 26,000 mt of POP products in 2017 worth \$64.2 million. POP accounted for 3 percent of Alaska's groundfish production volume and value in 2017. Including other types of rockfish, POP/rockfish production totaled 32,000 mt valued at \$80.3 million in 2017. This section focuses solely on POP, though the end products produced with all rockfish species share many similarities.

Both wholesale production volume and value increased significantly over the last ten years. Production volume increased 76 percent due to larger harvests and prices generally increased over the time period (discussed in more detail below) leading to a 128 percent growth in value since 2008.



Figure 44. First Wholesale Volume and Value/mt for Alaska Pacific Ocean Perch, 2008-2017

Table 82. First Wholesale Value for Alaska Pacific Ocean Perch (\$ millions), 2008-2017

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
\$28.1	\$25.5	\$43.2	\$71.4	\$60.9	\$51.5	\$62.3	\$57.2	\$55.0	\$64.2

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

The 2011 tsunami severely impacted Japan's seafood industry, creating additional demand for Alaska rockfish and making 2011 the most valuable year for POP in the last decade. Japan's recovery effort and policymaking caused the yen to strengthen substantially – making imported seafood relatively less expensive to Japanese consumers during 2011 and 2012. In 2013, the Japanese central bank took steps to weaken the yen to stimulate export-oriented industries, and prices declined.

Between 2013 and 2017, the wholesale price per metric ton of POP products averaged \$2,268. Price dipped below \$2,000/mt in 2016 for the first time since 2009 – perhaps due to record volumes that year. Despite this exception, the long-term trend indicates that the market is generally sustaining strong prices despite higher volumes. Compared to 2016, prices increased 29 percent in 2017 while production volumes decreased just 9 percent.

Key Market Analysis

Based on the best available data, nearly 90 percent of Alaska's POP was sold into export markets in 2017. The balance was either sold to U.S. buyers or may have been exported under a less specific H.S. code. Between 2015 and 2017, about 88 percent of POP production was exported to three countries – China, Japan, and South Korea.

	2015	2016	2017	Pct. of Total 2015-2017
China	12,245	17,164	12,697	53%
Japan	9,618	6,495	8,112	30%
South Korea	854	1,885	1,507	5%
Other Countries	30	24	391	1%
Total Exports	22,747	25,567	22,707	89%
Product Not Accounted For and/or U.S. Sales	2,821	3,060	3,296	11%
Total Production	25,568	28,628	26,003	-

Table 83. Alaska Pacific Ocean Perch Exports by Major Country (mt), 2015-2017

Source: ASMI Seafood Export Database and NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

China

From 2015 to 2017, exports to China accounted for 53 percent of all POP production. This includes a strong 2016 when 60 percent of production went to the Chinese wholesale market.

Virtually all POP and other rockfish exported to China consists of frozen whole or H&G fish, which is filleted, and reexported. It is difficult to track POP fillets using H.S. codes. As a result, it is not possible to track competing supplies of ocean perch and rockfish coming into China or their re-export markets. However, based on available information, China's major export markets for rockfish fillets appear to be Japan, Europe, Russia, and the United States.

Japan

POP and other rockfish are harvested along most of Japan's coastline and eaten throughout the country. POP is generally called *akauo*; however, the fish is known by several other names depending on the region (e.g. *aka mebaru, arasukamenuke*). Rockfish in general is known as *menuke*. Japanese consumers prepare POP in several ways, including grilled (often marinated with *kasuzuke*) as an entrée in bento boxes, raw slices for sashimi/sushi, and boiled fillets in soups or broth.

Japan is the largest consumer market for POP. Depending on the product form demanded, importers buy frozen fish from China (fillets) or Alaska (H&G/whole) processors and distribute the product to retailers or food service establishments. Direct exports from Alaska to Japan generally represent a quarter to a third of all Alaska production.

Alaska is Japan's largest rockfish/redfish supplier, both in direct terms and product routed through China. Europe is the second largest supplier, followed by domestic production and Russian imports.
	2015	2016	2017	Pct. of Total 2015-2017
U.S. (Alaska)	20,358	20,290	20,698	34%
China	11,712	16,524	15,209	21%
Europe	11,636	11,365	11,336	25%
Russia	6,682	4,634	4,933	17%
Canada	1,755	1,544	1,684	2%

Table 84. Japan Imports of Rockfish by Major Trading Partner (mt), 2015-2017

Note: Includes HS codes 030389295 and 030489290 (other fish fillets, including non-POP species).⁶⁹

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html.

Competing Supply

Global rockfish (including POP and other *Sebastes* species) production peaked in 1982 at 500,655 mt. Harvests averaged 218,372 mt from 2012 to 2016 and increased roughly 20 percent over the period – from 202,000 mt in 2012 to 242,000 in 2016. Europe is the largest redfish/rockfish producer, accounting for just over half (52 percent) of total production in 2016. Alaska POP accounted for one-fifth (21 percent) of global rockfish production in 2016, and 88 percent of all rockfish production in the United States.





Note: Figures include all Sebastes spp. species.

Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.

FAO harvest statistics show relatively little Japanese rockfish production, and negligible production of POP, since 2007. Japanese trade press reports indicate Japan does harvest material volumes of rockfish/redfish species, on the order of 10,000 mt. However, this production may be included under a mixed "other" species category.

⁶⁹HS codes for rockfish species vary country by country at the 10-digit level. A review of HS codes and trade patterns suggest the majority of rockfish imported by Japan is included in the '030389295' and '030489290' codes.

Wholesale Market Profile for Sablefish

Sablefish (*Anoplopoma fimbria*) is a premium whitefish harvested throughout Alaska by a variety of vessel sizes and gear types. Also known as black cod, sablefish has long been prized by Japan, which today remains its primary market. Since being discovered by top chefs around the globe, sablefish also has important markets in the United States, China, Hong Kong, Europe, and the United Arab Emirates, among others.

In 2017, Alaska processors produced 6,593 million mt in wholesale sablefish products (nearly all H&G), valued at \$123.8 million. Sablefish are among the most valuable species harvested in Alaska, accounting for 4.9 percent of Alaska groundfish first wholesale value in 2017 and just 0.7 percent of first wholesale production volume.

Value and Volume		Key Products	H&G		Other	
First Wholesale Production (mt)	6,593	Pct. of Value	97%		3%	
Pct. of Global Sablefish Harvest (2016)	57%	Key Markets	Japan	Hong Kong	Others	
First Wholesale Value (\$ millions)	\$123.8	Pct. of 1 st Sales	65%	10%	25%	
Pct. Change in Value from Prior 4-yr Avg.	27.5%	YoY Change	21%	-25%	0%	
Pct. of Alaska Groundfish Value	4.9%	Competing Species: Patagonia toothfish (Chilean Seabass)				

Table 85. Summary Profile of Alaska Sablefish Wholesale Production and Markets, 2017



Photo Courtesy of Jane Sullivan.

Fishery Summary

Sablefish are a highly migratory species that live along continental slopes and shelf gullies in the GOA and BSAI at depths of 200 m and greater. In Alaska, sablefish are harvested primarily by longline, with significant harvests by trawl and pot gear. Fixed gear (pot and longline) targets sablefish whereas bottom trawls capture sablefish within a mixed-species catch of groundfish.

The federal Individual Fishing Quota (IFQ) program for halibut and sablefish was designed by the North Pacific Fishery Management Council (NPFMC) and implemented by the National Marine Fisheries Service (NMFS) in 1995. Under the IFQ program, the length of the fishing season increased from 14 days in 1994 to 8 months today, leading to decreased fishermen mortality rates, increased catch per unit effort (total catch divided by total effort), improved fish quality, and stronger ex-vessel prices.⁷⁰

Most sablefish harvested in Alaska are managed by NMFS with most of the federal harvest coming from IFQ fisheries. The State of Alaska also manages several relatively small fisheries located in the Aleutian Islands, Prince

William Sound, Cook Inlet, and Southeast Alaska.

Commercial harvest of sablefish in Alaska has occurred since the 1920s, when it first developed as a secondary fishery by vessels harvesting halibut. While the U.S. harvest of sablefish was modest—usually below 5,000 mt—until the early

Alaska Groundfish and Crab Wholesale Market Profiles

⁷⁰ (Sigler & Lunsford, 2001)

1980s, Japanese and other foreign vessels had been harvesting sablefish in both the BSAI and GOA since the 1950s, harvesting more than 55,000 mt annually at their peak.⁷¹ Foreign harvest gradually ended after passage of the Magnuson–Stevens Act (MSA) in 1976, leading to increased American sablefish landings which peaked in 1988 at 37,000 mt but have generally declined since.



Figure 46. Sablefish Harvest Volume in Alaska (mt), 1961-2017

Source: Office of Science and Technology, Annual Commercial Fisheries Statistics Database (1950-2016); NMFS Alaska Region Blend and Catchaccounting System estimates (Data provided by the Alaska Fisheries Information Network (AKFIN)) (2017).

Sablefish is harvested throughout Alaska, with the GOA contributing nearly 90 percent of total volume over the 2013 to 2017 period. Approximately 85 percent of the harvest came from longline gear, with trawl and pot gear accounting for the remaining 15 percent.

Pot gear has increasingly been used as an alternative to longline gear in many sablefish fisheries due to whale depredation issues where some whales (primarily orca) have learned to eat hooked fish off longline gear while fishermen are retrieving their catch. In addition to being dangerous for both fishermen and whales, these interactions make it more difficult for fishery managers to account for the removal of the biomass consumed by whales. The increasing use of pots has also impacted quality, with some fishermen electing to keep sablefish live until close to the point of delivery, improving fish quality on multiday trips while reducing labor associated with heading and gutting fish.



Photo Courtesy of Seafood Producers Cooperative.

⁷¹ (Sonu, 2014)

				•	
	2013	2014	2015	2016	2017
BSAI	1,667	1,095	622	796	1,517
Pot	438	324	120	177	613
Trawl	189	59	27	281	660
Hook & Line	1,040	711	475	338	244
GOA	12,038	10,555	10,196	9,073	10,090
Pot	38	32	32	28	926
Trawl	799	889	871	870	980
Hook & Line	11,201	9,634	9,293	8,175	8,184
Total	13,705	11,650	10,818	9,869	11,607

Table 86. Sablefish Harvest Volume in Alaska (mt), by Gear Type and Region, 2013-2017

Note: Volume in round-weight terms. A very small amount of jig-caught sablefish (0.31 mt) were harvested over this period. Source: NMFS Alaska Region Blend and Catch-accounting System estimates (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Product Description



Photo Courtesy of Seafood Producers Cooperative.

Sablefish is a premium whitefish with a high oil content and delicate texture. Sablefish fillets are often marinated and served smoked, grilled, or sautéed. While Japan is the primary market for sablefish, it can be found in upscale restaurants and stores worldwide, including Hong Kong, United Arab Emirates, the United States, and Europe, among others.

Shoreside processors – which accounted for 88 percent of production in 2017 – typically receive chilled sablefish either in the round (whole fish) or headed and gutted. The dominant sablefish wholesale product is IQF frozen H&G (Eastern cut) fish, often sold in 50-pound boxes. Relatively small amounts of heads, collars, fillets,

and other products are also produced. Combined, non-H&G production made up just 7 percent of production volume in 2017.

Sablefish prices and markets are sensitive to the size of the fish, with larger sablefish worth much more than smaller fish. Ex-vessel prices in 2018 (based on partial year data) ranged from approximately \$1.28 per pound for fish less than 2 pounds to \$7.75 a pound for fish greater than 7 pounds.⁷² Unfortunately, smaller sablefish have become a larger portion of the harvest in recent years – a trend that is expected to continue in the near-term due to significant recruitment in recent age classes and other factors affecting fish size.

Interviews with processors indicate small sablefish are difficult to sell into higher-end export markets, like Japan, but there is a market in China as well as a growing domestic market, with some Alaska processors producing individually vacuum-sealed fillets for sale by grocery stores like Whole Foods. These products are also available on various e-

⁷² (NPFMC, 2019)

commerce sites in the United States While only 60 mt of sablefish fillets were produced in Alaska in 2017 (1 percent of production volume), this represented a 15-year high, and 2018 production was on track to beat 2017 as of the writing of this profile.

	2017 Production Volume (mt)	2017 Production Value (\$000s)	Recovery Rate Range	Average Price/kg
H&G (mostly Eastern cut)	6,151	119,379	60-67%	\$19.41
Heads	197	325	N/A	\$1.65
Pectoral Girdle (Collars)	129	561	N/A	\$4.35
Fillets	60	2,190	35-46%	\$36.50
Other	54	1,393	N/A	\$25.80
Total Wholesale Production	6,593	123,848	59%	\$18.78
Total Retained Harvest	11,606			

Table 87. First Wholesale Volume, Value, and Recovery Rates, Major Sablefish Products, 2017

Note: Volume in product-weight terms.

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)) and Alaska Sea Grant (Crapo, Paust, & Babbit, 2004).

Alaska Sablefish Production

Supply Chain

The diagram below illustrates the sablefish supply chain, from harvesters to consumers. Following harvesting and processing, the majority of product is sold as frozen H&G fish to high-volume distributors in Japan and other Asian countries. These foreign importers sell to regional distributors as well as directly to retail and restaurant establishments.

Product sold into the U.S. domestic market is filleted by primary processors in Alaska or by secondary processors/distributors. Regardless of whether sablefish is exported or sold domestically, it typically passes through one or two distributors before being sold to consumers at the retail level.

Figure 47. Alaska Sablefish Supply Chain



Volume and Value

Between 2008 and 2013, first wholesale volume of sablefish products averaged just under 8,000 mt annually. Subsequently, production has fallen further due to lower harvest levels, hitting a low of less than 6,000 mt in 2016 followed by a modest rebound in 2017.





Table 88. First Wholesale Value of Alaska Sablefish (\$ millions), 2008-2017

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Value (\$ millions)	\$99.0	\$94.0	\$109.5	\$147.4	\$116.7	\$96.3	\$99.1	\$91.1	\$102.1	\$123.8

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

The value of Alaska sablefish production peaked in 2011 (\$147 million) due to exceptionally strong prices and large harvest volumes. After dropping substantially from 2011 levels, the average first wholesale value per mt of sablefish products climbed more than 50 percent from 2013 to 2017, reaching an average value/mt of \$18,784 (based on production of 6,593 mt worth \$123.8 million).

Market Profile and Analysis

Japan is the primary market for Alaska's sablefish, generally accounting for 70 to 80 percent of total exports by volume. China was the second-largest international market by volume in 2017, following several years of growth. However, when measured by value, Hong Kong was the second-most important international market after Japan, a position the country has held for several years. In contrast to Mainland China, which imports a greater volume of lower-value small sablefish for reprocessing, Hong Kong imports a greater percentage of larger fish; these imports serve both Hong Kong foodservice and retail markets as well as re-export markets in Southern China and other SE Asia countries. As a free port, exports to Hong Kong are not subject to Chinese tariffs (though presumably they would be if re-exported to China).

While exports to the Netherlands and the United Arab Emirates are modest, the volume and value of sablefish exports to these countries more than doubled over the 2013 to 2017 period. Other niche export markets exist in similarly wealthy, seafood-eating countries such as Singapore, the U.K., and South Korea.

	2013	2014	2015	2016	2017
Export Value (\$ millions)	\$81.6	\$71.5	\$73.8	\$76.0	\$82.9
Japan	\$62.0	\$52.4	\$45.8	\$44.5	\$54.1
Hong Kong	\$4.7	\$5.1	\$7.4	\$10.5	\$7.9
China	\$2.2	\$2.4	\$5.5	\$6.1	\$7.6
Netherlands	\$0.5	\$0.8	\$0.7	\$1.3	\$2.8
United Arab Emirates	\$0.8	\$1.1	\$2.4	\$1.5	\$2.5
Other	\$11.4	\$9.8	\$12.0	\$12.0	\$8.0
Export Volume (mt)	7,391	5,710	5,898	5,174	5,432
Japan	5,893	4,477	4,137	3,374	3,787
China	194	187	353	441	563
Hong Kong	340	282	397	490	333
Netherlands	71	68	54	70	151
United Arab Emirates	57	57	117	68	112
Other	837	637	840	731	486

Table 89. Estimated Export Volume and Value of Alaska Sablefish, by Country, 2013-2017

Source: ASMI Export Database.

Japan

The primary market for sablefish is Japan, a country that pioneered the commercial harvest of the species in Alaska. Sablefish is consumed in the county in a variety of ways. Fish soup is popular in the winter months, composed of sliced sablefish, stock, and vegetables. Sablefish fillets (or *kirimis*) and steaks are also commonly grilled or baked.

The Tokyo Central Wholesale Market plays an important role in sablefish markets.⁷³ Between 1987 and 2013, an estimated 37 percent of Japan sablefish imports (from all countries) were sold at this market. Prices observed at the Tokyo Central Wholesale Market function as a price index, impacting sablefish values globally.

Currency rates are an important factor impacting sablefish markets. When the yen is relatively strong against the dollar, Japanese buyers are able to purchase more U.S.-sourced sablefish. This situation was



Photo Courtesy of ASMI.

observed in 2012, when 80 yen equaled 1 U.S. dollar, and prices of sablefish and other U.S. species popular in Japan were high. Conversely, in 2015 125 yen equaled 1 dollar at its bottom, negatively impacting sablefish prices due to the limited purchasing power of their currency. Between December 2016 and December 2018, the yen has fluctuated between 118 and 105 per dollar.

⁷³ (Sonu, 2014)

	2012	2013	2014	2015	2016	2017
Import Value (\$ millions)	\$118.2	\$99.3	\$96.6	\$86.2	\$92.2	\$95.7
U.S.	\$106.9	\$90.3	\$87.6	\$74.8	\$83.8	\$86.9
Canada	\$11.4	\$9.0	\$8.9	\$11.4	\$8.4	\$8.9
Import Volume (mt)	9,113	8,380	7,182	6,590	6,235	5,739
U.S.	8,324	7,655	6,514	5,749	5,691	5,258
Canada	789	725	668	841	544	481
Import Value/mt						
Avg. Total USD/mt	\$12,973	\$11,850	\$13,443	\$13,078	\$14,793	\$16,681
Avg. Yen/USD Exchange Rate	¥80	¥98	¥106	¥121	¥109	¥112

Table 90. Japan Frozen H&G Sablefish Imports, by Major Trade Partner, 2012-2017

Note: Volume is in product-weight terms.

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-globaltrade-atlas.html and Board of Governors of the Federal Reserve System (US), retrieved from FRED, Federal Reserve Bank of St. Louis. fred.stlouisfed.org (currency rates).

The United States is the primary supplier of sablefish to the Japanese market, accounting for 91 percent of imports between 2012 and 2017; Canadian supply accounted for the remainder. The value of sablefish imports on a per unit basis has generally strengthened over the period, with a period-high of \$16,681 per metric ton observed in 2017.

United States

The estimated size of the U.S. market for sablefish increased from about 3,200 mt to 7,200 mt between 2013 and 2017, thanks to increased imports and reduced exports. Imports grew from 269 mt in 2013 to 1,756 mt in 2017, due to increased supply from Canada. Concurrently, export volume of U.S. sablefish declined as a result of reduced landings, high prices, and a relatively weak yen which affected shipments to Japan.⁷⁴ The table below includes production from Alaska as well as other west coast states.

Year	Est. U.S. Wholesale Production	U.S. Imports	U.S. Exports	Est. U.S. Market Size	% US
2013	11,609	269	8,670	3,208	92%
2014	10,411	696	6,665	4,442	84%
2015	10,385	1,406	6,664	5,127	73%
2016	9,899	1,747	5,577	6,069	71%
2017	11,140	1,756	5,733	7,163	75%
Five-year Average	10,689	1,175	6,662	5,202	77%

Table 91. Estimated U.S. Sablefish Market Size (mt), 2013-2017

Note: An average recovery rate of 65 percent is used in this analysis.

Source: NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)); NMFS Office of Science and Technology, Foreign Fishery Trade Data. McDowell Group estimates.

⁷⁴ (Sackton, Near record prices for sablefish may mean much lower consumption in Japan, 2015).

Global Production and Competing Supply

The United States and Canada account for nearly all global production of sablefish.⁷⁵ Alaska is the primary supplier, contributing an annual average of 63 percent between 2012 and 2016. Harvest from other west coast states accounted for 26 percent of global supply. Of these, Oregon was the most important, followed by California and Washington. Canada (British Columbia) contributed 11 percent to global supply between 2012 and 2016.

Patagonia toothfish (*Dissostichus eleginoides*) is the primary competitor with sablefish. The whitefish has a high oil content and is also known as Chilean seabass or *mero* in Japan. The species lives in water deeper than 10,000 feet in the southern Atlantic, Pacific, Indian, and Southern oceans. Patagonia toothfish can live more than 50 years and weigh up to 220 pounds.



Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/; NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database.; NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database.

Between 2012 and 2016, the global supply of Patagonia toothfish ranged from about 21,700 mt to 25,600 mt. France is the largest supplier (the country has sovereignty over several sub-Antarctic islands), accounting for 26 percent of the global supply between 2012 and 2016. Chile, Argentina, Australia, and South Korea account for the remaining top five suppliers.

These figures do not include illegal, unreported, or unregulated (IUU) harvests. In the early 2000s, up to half of Patagonia toothfish harvests were estimated to be IUU landings.⁷⁶ Although fisheries management has improved, IUU harvests are likely happening today, though at a smaller scale.

⁷⁵ Between 2000 and 2016, Russia periodically produced small volumes of sablefish. The highest annual volume for this period was 50 MT harvested in 2002; average annual harvest was 15 MT.

⁷⁶ (Catarci, 2004).

	2012	2013	2014	2015	2016
France	5,608	6,188	6,462	5,237	6,585
Chile	4,656	4,090	2,707	3,768	5,271
Argentina	3,266	3,464	3,897	3,719	3,656
Australia	3,077	3,060	3,217	4,537	3,158
South Korea	1,386	2,069	1,815	2,003	2,049
Other	3,798	4,164	3,630	4,004	4,860
Total	21,791	23,035	21,728	23,268	25,579

Table 92. Global Patagonia Toothfish Supply (mt), by Country, 2012-2016

Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.

Pacific halibut (*Hippoglossus stenolepis*) is a flatfish species that can weigh up to 500 pounds and measure more than 8 feet in length.⁷⁷ Commercial harvest of the species in Alaska has occurred for about 100 years, and is among the longest-running fisheries in Alaska.

Halibut is a premium product, regularly commanding one of the highest values of any Alaska seafood species. Current harvest volumes are about a third of historical levels. The fish is primarily sold to upscale retail and food service markets in North America. Halibut accounted for 5.4 percent of Alaska groundfish first wholesale value in 2017, and less than one percent of production volume. This profile summarizes the fishery, production volume and value in Alaska, key markets, and global supply.

Value and Volume		Key Products	H&G	Fillet	Gutted Only
First Wholesale Production (mt)	7,497	Pct. Of Value	57%	31%	11%
Pct. of Global Halibut Harvest (2016)	41%	Key Markets	US	Canada	Others
First Wholesale Value (\$ millions)	\$136.6	Pct. of 1 st Sales	88%	11%	1%
Pct. Change in Value from Prior 4-yr Avg.	6.3%	YoY Change	+88%	-18%	+132%
Pct. of Alaska Groundfish Value	5.1%	Competing Species: A	tlantic halibut.		

Table 93. Summary Profile of Alaska Halibut Wholesale Production and Markets, 2017

Fishery Summary

The first documented commercial landing of halibut in the North Pacific took place in Tacoma, Washington, in 1888.⁷⁸ In the early years of the fishery, harvest was centralized around Washington and British Columbia. By the 1920s — supported by adoption of diesel engines — the fleet had extended operations into the waters off Alaska. Harvest levels ranged from roughly 10,000 mt to 15,000 mt in the 1950s and most of the 1960s. Rising prices attracted additional participants into the open-access fishery in the 1970s and by the 1980s regulatory changes to limits participation were being discussed.



Photo Courtesy of ASMI.

The Alaska halibut fishery is currently managed under an Individual

Fishing Quota (IFQ) system which was established in 1995. In an IFQ fishery, harvesters hold a specific share (known as quota) of the catch limits established annually by the International Pacific Halibut Commission and North Pacific Fishery Management Council. Prior to 1995, the fishery was managed under a "derby" regime where harvest was only allowed for short periods of time. In 1994, the fishery was open for 24 hours in the Gulf of Alaska and 12 hours in the Bering Sea; today the season typically lasts from March-November.

⁷⁷ Any reference to halibut in this profile refers to Pacific halibut specifically.

⁷⁸ (Keith, Kong, Sadorus, Stewart, & Williams, 2014)

Landings of Alaska-harvested halibut totaled 9,344 mt in 2017, a modest improvement over record-low landings in 2014, but well below historical levels. The fish is delivered to a wide variety of ports: in 2017, 38 ports received halibut harvested in Alaska, including locations in Washington and Oregon. Kodiak, Seward, and Homer are usually the top ports for landings, typically accounting for 40-50 percent of total landings.

	2013	2014	2015	2016	2017
Kodiak	1,542	1,145	1,259	1,165	1,590
Seward	1,322	845	933	930	1,054
Homer	2,223	1,387	1,281	1,292	1,018
Dutch Harbor	685	602	719	720	768
Petersburg	487	554	487	670	763
Other Ports	4,132	3,323	3,549	3,601	4,151
Total	10,391	7,856	8,227	8,380	9,344

Table 94. Alaska Commercial Halibut Landings (mt), by Port, 2013-2017

Note: Figures are in net weight terms.

Source: NMFS Alaska Region Blend and Catch-accounting System estimates (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Between 1950 and the early 1980s, harvest of Pacific halibut in Alaska ranged from about 5,000 to 15,000 mt annually. Landings climbed throughout the 1980s, peaking at more than 35,000 mt before declining through the mid-1990s. Volume recovered to 35,000 mt by the early 2000s before beginning a sustained declined through the present. Current harvest levels of around 10,000 mt represent nearly a 40-year low.



Figure 50. Alaska Halibut Harvest Volume (mt), 1950-2017

Note: Figures are in round weight terms.

Source: NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database.

Product Description and Supply Chain



Photo Courtesy of Garrett Evridge.

Halibut has a mild to slightly sweet taste with a firm, flaky texture. Its neutral taste allows for a wide range of preparation and seasoning. Halibut is commonly grilled, fried, baked, sautéed, and poached. The species is considered relatively unique — mainly because of its size — but weak substitutes include Pacific cod and other whitefish.

Halibut are sold to consumers primarily as fillets, steaks, and fletches (whole skinless fillets). High-valued cheeks are considered a delicacy, and products like collars and heads are also available in some markets. Fresh product is typically available mid-March through November while frozen product can be found year-round. Some processors find markets for halibut heads and frames, but most of these excess fish parts are ground and discharged as waste or turned into fish meal.

The main halibut product produced by Alaska processors is a headed and gutted (H&G) fish: in 2017, H&G accounted for 63 percent of all halibut products. Fillets of various cuts (skin on/off) accounted for about 20 percent, while dressed (gutted only) product contributed 12 percent of total first wholesale volume. Slightly more than half of production was frozen with the remainder leaving Alaska fresh.

	Volume (mt)	% of Total	Value (\$)	% of Total
Headed and Gutted	4,701	63%	\$77,311,310	57%
Fillet (no skin or ribs)	1,175	16%	\$35,364,164	26%
Dressed (gutted only)	936	12%	\$14,530,073	11%
Other Fillets	222	3%	\$6,681,211	5%
Heads	106	1%	\$77,282	<1%
Pectoral Girdle (Collar)	104	1%	\$471,413	<1%
Cheeks and Chins	35	<1%	\$849,113	1%
Other	218	3%	\$1,340,777	1%
Total	7,497	100%	\$136,625,343	100%

Table 95. Alaska Pacific Halibut First Wholesale Volume and Value, by Product Type, 2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Product Form (Fresh versus Frozen)

Fresh halibut products are generally more valuable than frozen products. While it can be difficult to control for product differences, fresh fillets maintained a 10.5 percent premium on average over frozen fillets during the 2013-2017 period. Fresh H&G products were valued at 5.5 percent more than comparable frozen product.

Year	Fresh Fillets	Frozen Fillets	Fresh H&G	Frozen H&G
2013	\$13.48	\$10.66	\$6.73	\$6.19
2014	\$15.41	\$13.69	\$8.11	\$7.45
2015	\$15.83	\$14.42	\$8.29	\$8.16
2016	\$15.56	\$15.45	\$8.25	\$8.31
2017	\$15.14	\$14.70	\$7.82	\$7.20

Table 96. First Wholesale Average Price per Pound for Key Alaska Halibut Products, 2013-2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

The portion of fresh halibut as a percentage of total production has trended higher over the last 30+ years. In the 1980s, between 10 and 20 percent of annual halibut production left Alaska in a fresh form, with the remainder frozen. Since the early 2000s, this proportion has increased to about 50 percent, rising to more than 60 percent in recent years.

The change from derby-style fishery management to IFQ-based management precipitated this shift towards increased fresh production. Prior to the first IFQ-regulated season in 1995, the year's harvest was compressed into a short period of time. Instead of focusing on quality, fisherman raced to harvest as much halibut as possible. Processing capacity was regularly overwhelmed, leaving fish on ice for days at a time while harvesters waited to unload.

Under IFQ-style management, harvesters and processors can coordinate landings over a nine-month season. This reduces the likelihood of processing capacity being exceeded and allows the industry to meet market demand for fresh products on a more regular schedule.



Table 97. Alaska Halibut Fresh Product as Percentage of Total Production Volume, 1984-2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Supply Chain

Most halibut are harvested by vessels less than 60 feet using fixed longline gear. A small amount of volume is harvested by mechanical jigs, troll gear, and pots. Nearly all halibut is bled and gutted onboard, iced or chilled, and delivered to a shoreside plant for a small amount of additional processing, typically limited to heading or filleting.⁷⁹ Relatively small amounts of cheeks, collars, and heads are also processed and packaged for distribution.

Alaska processors sell most halibut to Lower-48 seafood distributors that supply a specific region with a variety of products. It is common for these distributors to cut H&G halibut into fillets, steaks, or other products which are sold to grocery chains, foodservice companies, and restaurants. While some grocery stores or restaurants purchase halibut directly from Alaska processors, most use a distributor.

A small amount of halibut is sold directly to retail customers or restaurants by fishermen. Product from these direct marketers are usually higher-priced and in relatively small lots: consumers are able to purchase several pounds of fillets or cheeks or a restaurant can purchase 10-50 pound boxes. A modest amount of Alaska halibut is exported, primarily to Canada. This volume is described in a following section.



Figure 51. Alaska Halibut Supply Chain

Production Volume and Value

First wholesale production of halibut in Alaska peaked in the late 1980s at 23,500 mt, roughly triple the 2017 volume of 7,500 mt. Between 2008 and 2017, as volume declined by about 60 percent, the average value increased from about \$12,000/mt to \$18,200/mt (a 52 percent increase).

The total value of halibut at the first wholesale level peaked in 2010 at \$234 million. Between 2010 and 2017, rising value per pound has not been able to offset declining harvest volume – leading to a net reduction in total first wholesale value.

⁷⁹ Less than one percent of annual first wholesale halibut production typically occurs aboard catcher processor vessels.



Figure 52. First Wholesale Volume and Value/mt for Pacific Halibut in Alaska, 2008-2017

 Table 98. First Wholesale Value for Pacific Halibut in Alaska (\$ millions), 2008-2017

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
\$233.0	\$181.0	\$234.2	\$194.5	\$162.7	\$131.4	\$109.9	\$133.8	\$138.9	\$136.6

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Data from the last ten years suggest a possible upper limit to the prices that can be charged for halibut products. Both the figure above and other data sources show prices in 2010 and 2011 rising in tandem with falling production volumes, followed by a stabilization in prices despite further declines in volume. Additionally, average market prices (20-40 pound halibut, boxed, FOB Seattle) have not exceeded \$9-10/pound during this period.⁸⁰

Key Market Analysis

The primary market for Alaska halibut is the U.S. domestic market, which consumed an average of 82 percent of production between 2013 and 2017. Over the same period, roughly one-fifth of production was exported, nearly all to Canada. Exports of Alaska halibut have declined over the last decade, due to lower harvest volumes and weakening demand in Canada.

⁸⁰ (Urner Barry Comtell, 2019).

	2013	2014	2015	2016	2017	Pct. Of Total 2013-2017
Canada	2,012	2,030	1,099	966	794	17%
China	24	16	29	21	70	<1%
Germany	20	0	5	15	15	<1%
Other	32	15	14	1	1	<1%
Total Exports	2,087	2,061	1,147	1,004	881	18%
Estimated U.S. Sales	6,854	4,122	8,389	7,188	6,617	82%
Total Wholesale Production	8,941	6,182	9,536	8,192	7,497	100%

Table 99. Alaska Halibut Export and Domestic Market Estimates (mt), 2013-2017

Source: ASMI Seafood Export Database and NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

United States

The U.S. market consumed an estimated 11 to 15.5 thousand mt of halibut in recent years, with a trend of steadily increasing supply from 2014 to 2017. In 2017, 58 percent of U.S. halibut supply came from U.S. production, down from 80 percent in 2013. Besides Alaska, other sources of U.S. halibut production include west coast Pacific halibut harvests as well as a very small amount of east coast Atlantic halibut production.

U.S. Pacific halibut imports are dominated by fillets from China, which are produced largely from Russian fish but also Alaska and Canadian supply. Imports of Atlantic halibut are dominated by fresh product from Canada, which has grown substantially in recent years due to rebounding fisheries and increasing harvests in that country. From 2013 to 2017, imports of Atlantic halibut increased 73 percent, while Atlantic halibut exports declined 50 percent – resulting in a combined 263 percent increase in net imports.

Year	U.S. Halibut Production	Net Imports Pacific Halibut	Net Imports Atlantic Halibut	Est. U.S. Supply	U.S. Pct. Of Total Supply
2013	10,220	1,524	964	12,708	80%
2014	7,904	1,879	1,185	10,968	72%
2015	8,348	3,120	2,089	13,557	62%
2016	8,561	3,176	2,674	14,411	59%
2017	9,004	2,978	3,497	15,479	58%
Five-year Average	8,808	2,535	2,082	13,425	66%

Table 100. Estimated U.S. Halibut Market Supply (mt), 2010-2014

Note: All volume figures have been converted to a net weight (H&G) basis for comparability purposes. A small amount of Greenland turbot may be included in import and export figures due to trade data limitations.

Source: NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database and McDowell Group estimates.

Halibut is a high-end product, widely available in U.S. restaurants, specialty seafood retailers, and grocery stores. Retail prices for halibut, as of March 2019, ranged from approximately \$18 per pound for whole fish to more than \$32 per pound for cheeks.⁸¹ Fillets and steaks – the most common products – are usually available in the \$20-\$30 per pound range. Fresh product is usually priced higher than frozen and available between March and November while frozen

⁸¹ (Tanner's Fresh Fish Processing, 2019); (Pike Place Fish Market, 2018); (Copper River Seafoods, 2019)

product is available year-round. Grocery stores and specialty seafood retailers often schedule promotions with the start of the harvest season in mid-March.

Retailers have developed strategies to offer halibut at specific price-points to minimize the impact of higher prices. While most other frozen seafood at Walmart is sold by the pound (16 ounces), the retailer sells a 12-ounce bag of frozen and skinless portions for \$19.97.⁸² A similar strategy is used in some specialty stores which sell portions in 5 to 10-ounce increments, keeping unit prices closer to \$10.

The price of halibut served in restaurants varies significantly but is generally comparable to high-end cuts of beef and other red meat or crab. Entree prices range from \$15 for traditionally breaded and fried halibut to \$30 and higher at upscale restaurants.

Canada

Canada is the second largest market for Alaska halibut after the United States and was the destination for roughly 10 percent of halibut production in 2017. Current export activity is on the lower-end of historical norms: in 2014 roughly one third of Alaska halibut production went to Canada. Declining availability of Alaska halibut, increased availability of Russian Pacific halibut, a weak Canadian dollar, and increased harvest of Atlantic halibut in the eastern part of Canada are factors contributing to declining export volume.

Between 2013 and 2017, the United States contributed about three-fourths of the Pacific halibut imported into Canada, with volume from China accounting for most of the remainder. It is likely that most Pacific halibut imported from China into Canada originated in Russia.

	2013	2014	2015	2016	2017	Pct. Of Total 2013-2017
United States	2,412	1,613	1,570	1,448	1,168	73%
China	439	716	794	732	540	24%
Other	23	28	66	82	109	3%
Total	2,874	2,357	2,430	2,262	1,817	100%

Table 101. Estimated Canada Pacific Halibut Imports (mt), by Country, 2013-2017

Note: These data may contain some Greenland and Atlantic halibut. HS codes 30221 and 304830020 are included. Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html.

⁸² (Walmart, 2019)

Global Production and Competing Supply Analysis

The United States is the largest source of global Pacific halibut production, contributing roughly 60 percent of total volume. Russia surpassed Canada as the second largest producer of Pacific halibut in 2013 and now accounts for about one-fifth of total global supply; Canada supplies a similar amount.

Global supply has fallen by roughly half, from around 40,000 mt in the early 2000s to the current level of approximately 20,000 mt. Production from the United States has declined approximately 70 percent since 2000 while Canadian volume slipped about 40 percent.



Figure 53. Global Supply of Pacific Halibut (mt), 2000-2016

Note: Figures in round weight.

Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.

Competing Species

Atlantic halibut is considered a close substitute for Pacific halibut, as both species offer a similar taste, large portions, and firm white flesh. While Pacific halibut supply has been trending lower since the early 2000s, the global supply of Atlantic halibut has been trending higher. In 2000, the total global supply of both species totaled approximately 44,000 mt with the Pacific species contributing more than 90 percent of this total. By 2016, total supply of both species was 27,000 mt with Pacific halibut's share slipping to around 70 percent. Put another way, over this period, Atlantic halibut supply has more than doubled while Pacific halibut has dropped by half.

Much of the increase in global Atlantic halibut supply has taken place in Canada's east coast fisheries – in close proximity to the U.S. eastern seaboard, a traditionally important market for Alaska's halibut. Between 2000 and 2016, Canada's Atlantic halibut production increased from about 1,200 mt to nearly 4,000 mt. Conversations with Alaska halibut distributors indicate competing Atlantic halibut supply has been a significant and growing challenge.



Figure 54. Pacific and Atlantic Halibut Harvest Volume (mt), 2000-2016

Note: Figures in round weight.

Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.

Investments in processing infrastructure to produce fish meal, fish oil, and other ancillary products were largely completed in parallel with the growth of the domestic pollock and other groundfish fisheries in the 1990s. Due largely to the massive scale of the pollock fishery, 77 percent of the value of Alaska groundfish ancillary products are derived from pollock.⁸³ It is also a critical component of industry profitability: roughly 7 percent of the value of pollock products products are derived from ancillary products.

Despite the substantial size of Alaska's pollock and groundfish fisheries, the state is a small player in the global market for fish meal and fish oil, which are primarily used in aquaculture feed. Though small by comparison, a growing market exists for nutritional supplements for human consumption, such as fish oil capsules. There are also sizable markets in Asia and beyond for niche products like stomachs, milt, collars, heads, and skins from cod, pollock, and other species.

Value and Volume	Key Products	Fish Meal	Fish Oil	Other	
First Wholesale Production (mt)	126,076	Pct. of Value	58%	15%	27%
First Wholesale Value (\$ millions)	\$177.8	Key Markets (meal and oil)	China	South Korea	Taiwan
Pct. of Alaska Groundfish Value	7.1%	Pct. of 1 st Sales	56%	24%	7%
Pct. Change in Value from Prior 4-yr Avg.	+4.4%	YoY Change	25%	-20%	-5%

Table 102. Summary Profile of Ancillary Products Wholesale Production and Markets, 2017

The numbers presented in this analysis provide best estimates for production levels of various Alaska groundfish ancillary products. However, it should be noted that available first wholesale data apply only to ancillary products produced by primary processors in Alaska and does not include any production by subsequent processors. Secondary production of ancillary products is likely to occur when groundfish are sold in a minimally processed state such frozen H&G product to reprocessing markets. For Alaska groundfish, the predominant reprocessing markets are in Asia, with a limited market domestically. For example, the major processors on Kodiak Island jointly own a fish meal plant, which is not considered a primary processor and does not report first wholesale production data to the Alaska Department of Fish & Game. Fish meal and fish oil production from the Kodiak Fishmeal Company are not included in this profile due to a lack of data; production levels at this company are thought to be in the ballpark of 10,000 mt per year, including a mixture of groundfish and salmon species.

Overall Production Volume and Value

Ancillary product production volumes have increased steadily in recent years, peaking at more than 126,000 mt in 2016 and 2017. Production levels are largely a product of harvest levels, with other factors including changes in processing infrastructure and prices for specific ancillary products.

Trends for specific ancillary products are discussed in more detail below.

⁸³ ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).



Figure 55. First Wholesale Volume and Value/mt for Alaska Groundfish Ancillary Products, 2008-2017

Table 103. First Wholesale Value and Ancillary Products as Percent of Total Value, 2008-2017

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Value (\$ millions)	\$91.0	\$83.5	\$117.7	\$160.9	\$159.8	\$158.3	\$158.1	\$170.0	\$194.6	\$177.8
Pct. Of AK Groundfish Wholesale Value	4.1%	4.9%	6.2%	6.4%	6.3%	7.3%	6.8%	7.5%	8.2%	7.1%

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Key Species

In 2017, 77 percent of the total value of Alaska's ancillary products was derived from Alaska pollock (\$136 million) and 20 percent from Pacific cod (\$34 million). The remaining 3 percent was composed of a mixture of various flatfish and other groundfish species, such as flounder, rockfish, sablefish, Atka mackerel, shark, sole, and squid.

Ancillary products made up 9.5 percent and 7.2 percent, respectively, of pollock and Pacific cod total first wholesale value in 2017. For other major groundfish species, ancillary products were a minor component of total value (less than one percent); the exceptions to this rule include a variety of less common, low-value species that are typically diverted to fish meal/fish oil plants and thus have nearly all of their value derived from ancillary products.

For comparison, ancillary products derived from Alaska salmon totaled \$16.6 million in first wholesale value in 2017 (1 percent of total first wholesale value).



Figure 56. Alaska Ancillary Product Wholesale Production Value, by Key Species, 2008-2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Figure 57. Alaska Ancillary Product First Wholesale Value and Volume, by Key Groundfish Species, 2017



Notes: Flatfish includes various species of flounder, sole and turbot.

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Key Products

Fish meal is the dominant ancillary product in Alaska's groundfish fisheries, accounting for 59 percent of the value of all ancillary products produced in 2017. Fish oil is the second most valuable ancillary product, at 15 percent, followed by collars, chins, and cheeks; milt; bones and heads; and internal organs. (Fish oil is also frequently used for fuel in at-sea vessels and at shore-based plants, though no data are available to quantify the value or volume of this production.)

The composition of product types has stayed fairly steady over the last decade, with the exception of internal organs, which accounted for 7-15 percent of the total value of ancillary products from 2008 through 2012 but only 1-4 percent in subsequent years.



Figure 58. Alaska Groundfish Ancillary Product First Wholesale Value, by Product Type, 2005-2014

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).





Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Fish Meal

Alaska fish meal is a shelf-stable product produced by cooking, pressing, drying, and milling fish trimmings (heads, viscera, frames, skins, etc.). As opposed to most fish meal produced globally, Alaska fish meal is produced from fish residues rather than whole fish. Fish meal and oil production in Alaska occurs at shore-based processors as well as onboard catcher-processors.

According to IFFO The Marine Ingredients Organization, fish meal typically consists of between 60-70 percent protein, 10-20 percent ash, and 5-12 percent fat.⁸⁴ Fish meal from Alaska groundfish has been measured at 70 percent protein, 8 percent ash (mostly calcium and phosphorous), 17 percent fat, and 6 percent moisture.⁸⁵

In 2016, it was estimated that 69 percent of global uses of fish meal were attributable to aquaculture, followed by feed for pigs (23 percent), chickens (5 percent), and other uses (3 percent).⁸⁶ As of 2015, of the fishmeal used in aquaculture, 30 percent went to feed crustaceans, 22 percent to salmon and trout, 18 percent to various species of marine fish, 9 percent to tilapia, 5 percent to eels, 3 percent to cyprinids, and 13 percent to other species.⁸⁷



Photo Courtesy of Unisea.

Other feeds used in aquaculture include plant-based meals, starches, and

oils; direct application of fish and fish wastes; algae grown for consumption by herbivorous species; insect meals, and various other feed types. While fish meal is typically considered the most nutritious and digestible aquaculture feed, its use has been declining as a percentage of overall feed, largely due to price differences and the successful development of alternatives.

Alaska groundfish fishmeal is typically referred to as white fishmeal to distinguish it from fishmeal made from anchovies (the most common fish meal on the market). Like other fish meals, Alaska white fishmeal is typically treated with ethoxyquin or other stabilizers and sold in 25- or 50-kg bags. The type of fishmeal described in this section is not suitable for human consumption.

Production

In 2017, Alaska produced 68,217 mt of fish meal, over 95 percent of which was derived from Alaska pollock.⁸⁸ Alaska fish meal production levels increased steadily over the 2009-2017 period, reflecting increased pollock harvest volumes but also increased fish meal production capacity as vessels were replaced or upgraded.

Evidence of increased production capacity includes an increase in the percentage of fish meal that was processed by the at-sea sector (from 27 percent in 2008 to 36 percent in 2017). Vessels that have added fish meal plants include the *Starbound*, an AFA catcher-processor that was split in half and lengthened in 2015 to incorporate additional processing capacity, including a fish meal and oil plant, and other upgrades. Various new vessels have also been added to groundfish fleets in recent years, with upgraded fish meal production capacity compared to the vessels replaced.

Fish meal prices have been at historically high levels since 2010, in the range of \$1,500 to \$1,750 per mt. Prices in 2017 fell at the bottom of that range (\$1,525) but still represent a 52 percent increase over the average price from 2005-2009 (\$1,002).

⁸⁴ (The Marine Ingredients Organisation (IFFO), 2017)

⁸⁵ (The Marine Ingredients Organisation (IFFO), 2013)

⁸⁶ (The Marine Ingredients Orgnisation (IFFO), 2018)

⁸⁷ (The Marine Ingredients Orgnisation (IFFO), 2018)

⁸⁸ Not including production from Kodiak Fishmeal Company.



Figure 60. Alaska Fish Meal Production Volume and Value/mt, 2008-2017

Table 104. Alaska Groundfish Fish Meal First Wholesale Value (\$ millions), 2008-2017

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
\$51.6	\$46.4	\$67.6	\$89.4	\$83.5	\$101.6	\$102.3	\$107.9	\$110.7	\$104.0

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Table 105. First Wholesale Volume and Value of Alaska Groundfish Meal, by Species, 2017

	Volume	Value (\$ millions)	Value (\$/mt)
Pollock	65,059	\$99.6	\$1,531
Pacific Cod	2,121	\$2.8	\$1,339
Other Groundfish Species	1,037	\$1.6	\$1,532
Average	68,217	\$104.0	\$1,525

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Market Analysis

The vast majority of Alaska's fish meal is exported to Asia for use in aquaculture feed. Alaska fish meal is primarily used in eel and turtle farming, due to unique properties that separate it from other fish meals, such as the redfish meals produced by the anchovy fisheries off the coast of South America. Unique properties of Alaska whitefish meal include its ability to mix with other ingredients to form a particularly sticky and cohesive dough – the preferred feeding medium for eels.

China – which typically receives around two-thirds of Alaska fish meal exports – accounted for 62 percent of global aquaculture production in 2016.⁸⁹ Fish meal exports to China reached a record high in 2017 (51,474 mt). Trade with China in 2018 and 2019 is expected to be impacted by tariff increases resulting from the U.S.-China trade dispute. Unlike most Alaska exports to China, fishmeal is consumed in the country and thus does not benefit from exemptions for the

⁸⁹ (FAO, 2018).

Alaska Groundfish and Crab Wholesale Market Profiles

reprocessing sector. Industry reports indicate concern about the lack of alternative markets and the impact of tariffs on top of a softening market in China.

Other major fish meal buyers include South Korea (27 percent), Taiwan (7 percent), and Japan (5 percent). Some of these imports are used domestically but the majority are shipped on to China and other countries in Asia.

	2013	2014	2015	2016	2017	Pct. Of Total 2013-2017
China	36,443	39,205	44,590	41,932	51,474	61%
South Korea	16,838	20,022	20,512	19,729	18,083	27%
Taiwan	5,886	3,811	3,065	6,129	3,929	7%
Japan	3,909	4,491	2,938	1,935	2,739	5%
Total Exports	63,251	67,571	71,105	69,725	76,595	

Table 106. Alaska Fish Meal Exports (mt), by Country, 2013-2017

Source: ASMI Export Database.

Table 107. Exports of Alaska Fish Meal, 2010-2014

	2013	2014	2015	2016	2017
Export Volume (mt)	63,251	67,571	71,105	69,725	76,595
Export Value (\$000s)	\$98.8	\$100.3	\$103.3	\$100.5	\$104.2
Average Export Value per Metric Ton (\$US)	\$1,562	\$1,484	\$1,453	\$1,442	\$1,360

Source: ASMI Seafood Export Database.

In 2017, the United States imported 62,622 mt of fish meal, primarily from Mexico and Chile. These imports generally enter the United States through ports in the Southeast and Southwest, as well as ports along the Mississippi River, and are destined for use in pig and chicken farming, as well as other agricultural uses.⁹⁰

Global Production and Competing Supply Analysis

Globally, an estimated 4.9 million mt of fish meal was produced in 2017.⁹¹ Peru and Chile accounted for 30 percent of global production, primarily from vast anchovy fisheries directed at the fish meal and fish oil markets. The United States is a small player in the global fish meal market, producing 258,000 mt in 2017 or roughly 5 percent of global production.⁹² Alaska's groundfish meal production in 2017 accounted for roughly 1.4 percent of global production. The largest proportion of U.S. fish meal and fish oil production comes from menhaden caught in the Gulf of Mexico and Western Atlantic.

As of 2014, roughly 10 percent of global wild capture fish production was directed toward fish meal and fish oil, a percentage that has been declining as more fish production is directed toward human consumption.⁹³ Despite this trend, global fish meal production levels remain steady due to strong prices and increased production of fish meal from previously discarded fish residues. As of 2016, 33 percent of global fish meal production was derived from fish residues

⁹⁰ NMFS Office of Science and Technology, Foreign Fishery Trade Data.

⁹¹ (Indexmundi, 2015).

⁹² (NMFS OST, 2019).

⁹³ (FAO, 2015)

as opposed to whole fish processed specifically for fish meal and fish oil. This percentage is predicted to rise to 38 percent by 2025.⁹⁴

Fish meal prices have remained high due to the rapid growth of the aquaculture industry and its importance in farmed fish and animal diets. While the aquaculture industry has increased its use of plant-based feeds in recent years, fish meal plays an important role as a nutritious and healthy feed, as well as for imparting flavor during the last stage of fish culture. Generally, fish meal trades at 3-4 times the price of its major substitute, soymeal. In 2000, fish meal and oil represented 24 percent of aquaculture feed, falling to 16 percent in 2008 and a predicted 7 percent by 2020.⁹⁵

Fish Oil

Almost all fish oil produced from Alaska groundfish is derived from pollock (99 percent in 2017) and is generally produced as a part of the process that leads to fish meal production. The process involves cooking and pressing fish residues (leftover waste streams) to remove the liquid phase, which is spun and processed to remove any remaining solids and separate the oil and water. The solid phase left behind contains up to 10 percent oil and is made into fish meal or, in the case of catcher-processors without fish meal plants, ground and dumped overboard.



Photo courtesy of Trident Seafoods

The majority of the fish oil produced from Alaska groundfish could be termed crude fish oil and is destined for industrial uses such as a fuel source or in aquaculture/agriculture feeds. Due to high diesel prices and storage constraints, fish oil is widely used as a fuel source on board at-sea processors as well as at shore-based plants in the Aleutian Islands.

If intended for human consumption, crude fish oil goes through a series of heat,

sterilization, and purification steps, followed by the addition of antioxidants to protect the oil from degradation. Processes to concentrate and refine the oil can be employed to increase the omega-3 percentage, which starts at roughly 28 percent in Alaska groundfish oil and can be increased to up to 80 percent or more for pharmaceutical fish oil products.⁹⁶

Some producers in Alaska are producing even higher quality fish oils using processing equipment and techniques dedicated to the human nutritional supplement market, including Trident Seafoods (from salmon heads and pollock livers) and Bering Select (from cod livers, starting in 2015). These advanced processes involve increased attention to the quality of raw materials, food-grade sanitation in the processing line, and special separation and preservation techniques designed to produce a higher quality product. The end product is an oil with its natural triglycerides intact, such as the Trident Seafoods/Kirkland Signature product pictured above.

Production

Most fish oil produced in Alaska is not sold, but is rather blended with diesel fuel and burned in diesel generators powering shoreside plants and large fishing/processing vessels. A 2017 study estimated that 73 percent of the fish oil

⁹⁴ (The Marine Ingredients Organisation (IFFO), 2019)

⁹⁵ (Fry, et al., 2016)

⁹⁶ Interview with domestic seafood company representative.

produced in Alaska was used as fuel.⁹⁷ Industry interviews suggest that some at-sea processors regularly burn fish oil because they lack the storage space necessary to hold oil. Also, burning fish oil as it is produced allows vessels to remain at sea for longer periods of time and maximize fishing time. Use of fish oil by shoreside processors is influenced by plant configuration, storage limitations, and prices for diesel fuel and fish oil.

Not including oil burned as fuel, approximately 27,121 mt of fish oil was produced from Alaska groundfish in 2017 — a 90 percent increase over 2008.⁹⁸ Increased production is a product of increased pollock harvest volumes as well as additional processing capacity.





Table 108. First Wholesale Value of Alaska Groundfish Oil P	Production (\$ millions), 2008-2017
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2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
\$15.7	\$13.3	\$18.8	\$24.6	\$22.1	\$28.9	\$31.6	\$27.8	\$37.1	\$26.9

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Shoreside processors produced 59 percent of the groundfish oil produced in Alaska in 2017. The percentage of fish oil produced at-sea has increased from 9 percent in 2004 (totaling 1,800 mt) to 42 percent in 2017 (11,170 mt). The majority of this change occurred from 2008 through 2010, when a number of at-sea catcher-processors added fish oil plants to their processing lines.

Market Analysis

In 2015, the latest year for which data are available, roughly 73 percent of global fish oil was consumed by aquaculture, with direct human consumption (21 percent) and other uses (6 percent) accounting for the remainder.⁹⁹

An estimated 24 percent (7,000 mt) of Alaska groundfish oil production was sold domestically in 2017.¹⁰⁰ According to industry representatives, these sales went to the human nutritional supplement market.

⁹⁷ (McDowell Group, 2017)

⁹⁸ For reference, 943 mt of fish oil was produced from salmon in Alaska in 2014.

⁹⁹ (The Marine Ingredients Organisation (IFFO), 2017).

¹⁰⁰ Based on production minus exports.

The remaining portion of Alaska's groundfish oil production was exported in 2017 (21,594 mt), which is attributable to aquaculture feeds. Fish oil is widely used in aquaculture, especially for salmon and trout farming: in 2015, it was estimated that 58 percent of global fish oil use by aquaculture was used in salmon and trout farming operations, followed by 23 percent for farming of other sea fish, 7 percent for tilapia, and five percent or less for crustaceans, eels, and other freshwater fish.

Over the last five years (2013-2017), 22 percent of fish oil production went to Canada, followed by Chile (14 percent), Taiwan (9 percent), South Korea (11 percent), and Japan (9 percent). The Canadian and Chilean sales can be assumed to feed salmon farms, whereas major uses in Asia include aquaculture of other sea fish (for example, yellowtail tuna raised in pens off the coast of Japan and other places), marine shrimps, eels, and other species.

	2013	2014	2015	2016	2017	Pct. Of Total 2013-2017
Canada	3,389	5,293	7,795	4,748	6,284	22%
Chile	561	2,879	6,507	3,342	3,901	14%
Taiwan	2,152	2,532	1,246	1,989	3,270	9%
South Korea	1,623	3,491	2,278	3,382	3,074	11%
Japan	2,637	1,435	345	4,443	2,464	9%
Other Countries	1,652	1,161	775	1,384	2,602	6%
Total Exports	12,016	16,790	18,946	19,288	21,594	71%
Estimated Domestic Sales	7,486	7,528	9,645	4,884	7,006	29%
Wholesale Production	19,502	24,318	28,591	24,172	28,601	

Figure 62. Alaska Groundfish Oil Export and Domestic Market Estimates (mt), 2013-2017

Source: ASMI Export Database and NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Global Production and Competing Supply Analysis

In 2017, 992,000 mt of fish oil was produced globally. Roughly 29 percent resulted from production in Chile and Peru (mostly from anchovies), followed by 28 percent from Asian countries (dominated by Japan, China, and Vietnam), 23 percent from European countries (dominated by Norway, Denmark, and Iceland), 7 percent from the United States, and the rest from various other countries.¹⁰¹ Globally, Alaska is a small player in the global fish oil market, accounting for roughly 2.9 percent of global production.

While global fish oil production levels are relatively stable, they are subject to considerable fluctuation due to the impacts of El Niño cycles on Peruvian and Chilean anchovy fisheries.

The major global market for fish oil is the aquaculture industry, especially salmon farming. While the industry continues to grow substantially, the high price of fish oil has led to increasing substitution, primarily with rapeseed oil. Research suggests that while fish oil is very important to fish nutrition, the minimum requirements can be met by small amounts of fish oil, such as the 5+ percent generally present in fish meal.

¹⁰¹ (The Marine Ingredients Orgnisation (IFFO), 2018).

The second largest market for fish oil is the nutraceutical market, which grew considerably in the last decade. Growth in the nutraceutical market is expected to drive increasing global demand for fish oil, which is a limited resource and the only major current source of essential omega-3 fatty acids.¹⁰²

Other Groundfish Ancillary Products

A variety of other ancillary products are produced from Alaska groundfish, including heads, bellies, collars, milt, stomachs, livers, bone meal, skins, and collagen, among other products. In 2017, 72 percent of the value of these other ancillary products was derived from Pacific cod, followed by pollock (20 percent), Greenland turbot (5 percent), sablefish (2 percent), and other species.



Figure 63. Wholesale Value of Other Ancillary Products from Alaska Groundfish (\$ millions), 2008-2017

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

In 2017, 3,737 mt of these other ancillary products were produced from Alaska groundfish, for a total value of \$46.8 million. Volume and value in 2017 represented a 97 and 110 percent increase over 2008, respectively. Production levels and revenue from these products fluctuate with the total harvest levels, prices, and processing capacity, and other factors.

The table below presents production data for the top ten ancillary products (considering both product type and species), ranked by first wholesale value in 2017. It should be noted that inconsistent coding by processors introduces noise into these data. Livers, for instance, are often included under "other" but could also be coded as "stomach/internal organs." Collars also show up under "other" but have their own code as well.

Based on the available data, Pacific cod milt is the most valuable ancillary product made from Alaska groundfish, after pollock fish meal and pollock fish oil. For pollock, the top ancillary products (after fish meal and fish oil) are stomachs/internal organs and milt. The only other species making this top ten list is Greenland turbot, with roughly \$2 million in value from heads in 2017.

¹⁰² (Sheperd, 2014)

Alaska Groundfish and Crab Wholesale Market Profiles

Most of the ancillary products listed below have seen substantial increases in production value and volume over the last five years. Many of these products are produced by vessels in the freezer pot and longline cod fleets, where gear types lead to high quality fish coming on board and specialization in one species allows for processing targeted at specialty markets.

Due du et Ture	Currier		2017	% Change in	% Change in		
	species	(\$ millions)	(mt)	(\$/mt)	2013- 2017	2013-2017	
Milt	Pacific Cod	\$10.3	3,648	\$2,817	78%	35%	
Belly Flaps	Pacific Cod	\$7.6	5,161	\$1,473	17%	22%	
Collars	Pacific Cod	\$6.7	2,703	\$2,466	347%	158%	
Heads	Pacific Cod	\$4.1	2,553	\$1,624	71%	-22%	
Stomachs/Internal Organs	Pollock	\$3.9	1,734	\$2,240	144%	108%	
Milt	Pollock	\$3.2	1,216	\$2,607	78%	-14%	
Other (livers, collars, etc.)	Pacific Cod	\$2.7	834	\$3,188	145%	66%	
Stomachs/Internal Organs	Pacific Cod	\$2.3	967	\$2,424	35%	25%	
Bone meal	Pollock	\$2.2	10,266	\$214	22%	46%	
Heads	Greenland Turbot	\$2.0	592	\$3,365	150%	173%	

Table 109. Volume and Value of Top Ten Ancillary Products Ranked by Value, 2017 (not including fish meal or fish oil)

Source: ADF&G Commercial Operators Annual Reports (COAR); NMFS Alaska Region At-sea and Shoreside Production Reports (Data provided by the Alaska Fisheries Information Network (AKFIN)).

Market Analysis

The primary markets for these products are in Japan, South Korea, and China. According to industry representatives interviewed, cod heads, bellies, and collars are generally sold to South Korea for soups and other uses. Markets dominated by the Japanese include cod milt and cod stomachs, though some of these products are also sold in Eastern Europe.

- In Japan, cod milt (*shirako*) is often used in miso soups, sushi, or prepared tempura-style (breaded). Some chefs use it as a toast or cracker topping, similar to roe.
- Cod and pollock livers are especially high in valuable omega-3 fatty acids. To capture more of the value of this
 resource, Clipper Seafoods operator of six cod freezer longliner vessels opened a cod liver oil plant in Dutch
 Harbor in 2015. The plant produces a high end, human-grade liver oil that is sold to secondary processors around
 the world for distillation and production of final consumer products.
- Greenland turbot (also known as Greenland halibut) heads are a popular product in China. Turbot heads are
 widely utilized across the country and valued for their tender meat. Turbot heads also have soft bones with a
 relatively high oil content, which makes them a very flavorful product. The heads are sold mostly in restaurants
 and some higher-end supermarkets. They are often prepared by cooking in a wok with spices or as protein/flavor
 source in soups.
- Cod head prices and demand are the highest in Korea. Korean traders/distributors also buy farmed salmon, as well as black cod and Greenland turbot heads. Heads are sold frozen in retail outlets and by street vendors, who prepare them by steaming or pan-frying. Elderly and low-income residents in China and Hong Kong purchase fish heads as a low-cost protein resource.

• Alaska processors produce bone meal products derived from leftover ash after fishmeal processing. Since Alaska fishmeal generally involves using heads and frames, there is a substantial bone (i.e. ash) content in the raw material. Fishmeal buyers prefer to minimize the amount of ash, generally less than 20 percent. The primary use of pollock bone meal is as soil amendment.

As Alaska processors continue to innovate, it is expected that additional ancillary products will be produced, including ones targeted at the nutraceutical and beauty markets. For example, several years ago Westward Seafoods started marketing a nutritional supplement called Alyeska Alaskan Hydrolyzed Fish Collagen, which is manufactured primarily from pollock skins.

Wholesale Market Profile for Snow Crab

Snow crab harvest in Alaska primarily consists of *Chionoecetes bairdi* and *C. opilio* species.¹⁰³ These crabs are harvested mainly in in the Bering Sea, with additional small-scale fisheries occurring in the Gulf of Alaska. Snow crab are Alaska's most important crab species group, by value and volume. In 2017, harvest of 23.6 million pounds was worth \$127.1 million at the first wholesale level.

Value and Volume	First Wholesale Production	Opilio		Bairdi	
First Wholesale Production (Million Lbs.)	19.1	Pct. of Volume	91%		9%
Percent of Global Snow Crab Harvest	5%	Key Markets	US China		Other
First Wholesale Value (\$ millions)	\$127.1	Volume	65%	23%	12%
Pct. Change in Value from Prior 4-yr Avg44%		YoY Volume Change	-48%	-33%	-67%
Pct. of Alaska Groundfish Value	Competing Species: Canadian and Russian snow crab				

Table 110. Summary Profile of Alaska Snow Crab Wholesale Production and Markets, 2017

Fishery Summary

Snow crab are harvested with traps (typically called pots) at depths ranging from 240 to 360 feet. These steel cages are baited with Pacific cod, herring, or salmon, and placed on the ocean floor for 48 hours or longer. A line runs from each pot to a buoy floating at the ocean surface.

Federal fisheries in the Bering Sea account for most of the annual production in Alaska. State-managed fisheries (up to 3 miles from shore) contribute modest volumes from harvests occurring in Southeast Alaska, Kodiak, and the Alaska Peninsula.

After being closed to harvest for 30 years, a small test fishery for bairdi crab in Prince William Sound restarted in 2018. Landings in 2018 totaled 83,000 pounds and the 2019 harvest was roughly 125,000 pounds.¹⁰⁴ The area has a history of crab harvest, including a peak harvest of 13.9 million pounds of bairdi in the winter of 1972/1973.¹⁰⁵

Opilio versus Bairdi versus Tanner versus Queen crab?

One confusing aspect to snow crab are the different names used to describe the crab by fishermen, fishery managers, and marketers.

- Snow crab is the most common marketing term used in wholesale trade and can apply to any of the seven crab species in the *Chionoecetes* genus.
- In Alaska fishery management and fishing industry, the names Tanner and bairdi are typically used interchangeably, while snow crab refers to opilio.
- Bairdi usually weigh 2 to 4 pounds; opilio weigh 1 to 2 pounds.
- Opilio account for the vast majority of global snow crab production. Canada is the largest producer where the species is also known as Queen crab.

Where possible, opilio and bairdi are differentiated in this report. References to snow crab include both species (opilio and bairdi) collectively.

¹⁰³ Periodic harvests of *Chionoecetes tanneri* and *C. angulatus* occur in Alaska.

¹⁰⁴ Interview with ADF&G biologist.

¹⁰⁵ (ADF&G, 2017).

For federal fisheries, the total allowable catch (TAC) is set by the National Marine Fisheries Services (NMFS) and the Alaska Department of Fish & Game (ADF&G) through the North Pacific Fishery Management Council (NPFMC). State of Alaska fisheries are managed by ADF&G which usually set an annual guideline harvest level (GHL).

Crab vessels active in federal fisheries traditionally focus on king crab in the fall when the season opens mid-October. Following the king crab harvest, fisherman will either take a break or harvest Pacific cod before transitioning to snow crab



Photo courtesy of Alaska Seafood Marketing Institute.

harvest, usually after the first of the year. King crab and snow crab are harvested with the same pots with minor modifications to address size differences.

In 2005, BSAI crab fisheries were "rationalized," with harvesters assigned a portion of the annual quota allocation based on historical harvests. Before this transition, harvesting activity was compressed into a short period of competitive harvesting and processing. Short seasons contributed to dangerous working environments and product quality suffered as processors were overwhelmed with high volumes landed over short periods. Fishery managers also struggled to prevent harvest beyond recommend levels: the TAC for Bering Sea snow crab fishery was exceeded in five of the six years prior to rationalization.¹⁰⁶

Commercial harvest of Alaska crab was pioneered by Japanese and Russian fleets using tangle nets starting in the 1930s. Domestic harvest began in the late 1940s, and by the early 1960s U.S. fishermen dominated the fishery.¹⁰⁷ Around the same time, the use of trawl and tangle nets for harvesting crab were outlawed and only males meeting a size requirement could be retained. With passage of the 1976 Magnuson-Stevens Act, foreign vessels were prevented from harvesting Alaska crab. The domestic fleet focused mainly on king crab harvest in these early years, with significant harvest of snow crab beginning in the mid-1970s.

Snow crab harvests climbed following the steep reduction in king crab production in the early 1980s. Landings (mainly in the Bering Sea) grew steadily through the 1980s before peaking in 1991 with a record harvest of more than 368 million



Photo Courtesy of ASMI.

pounds. Following this peak, volume retreated to about 81 million pounds in 1995 before jumping to nearly 250 million pounds in 1998. Through most of the 2000s harvest levels slowly trended higher, reaching 100 million pounds in 2015. The 2017 harvest of 24 million pounds represents the smallest harvest in 46 years. Preliminary harvest numbers for 2018 and 2019 represent improvement over 2017 levels but are still at historically low levels.

All U.S. commercial snow crab harvests occur in Alaska, with no snow crab fisheries in other states.

¹⁰⁶ (North Pacific Fishery Management Council, 2017).

¹⁰⁷ (Zimmerman, Dew, & Malley, 2009).



Figure 64. Snow Crab Harvests in Alaska (million pounds), 1967-2017

Sources: NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database.

Opilio crab harvests in the Bering Sea averaged 49.5 million pounds between 2013 and 2017 – representing 85 percent of statewide snow crab harvests during the period. Bairdi crab accounted for the remainder at 8.8 million pounds on average annually. While opilio are harvested exclusively in the Bering Sea, bairdi are harvested throughout Alaska, including Southeast, Prince William Sound, Kodiak, the Alaska Peninsula, and the Bering Sea.

State-managed fisheries typically contribute between 1-3 million pounds annually. Participants in the smaller state fisheries generally operate vessels smaller than 58 feet and are often active in salmon, halibut, and black cod fisheries, among others.

Harvest volatility for both species is significant, with volume regularly falling by half or doubling year-over-year. The fluctuations are primarily a result of changes to the annual Bering Sea snow crab TAC, along with frequent closing and opening of bairdi fisheries under state and federal management.

Snow Crab Species	CY2013	CY 2014	CY 2015	CY 2016	CY 2017	Average Annual Harvest	Pct. of Total 2013-2017
Opilio	70.7	55.2	60.9	39.6	21.3	49.5	85%
Bairdi	3.4	10.3	16.2	11.6	2.3	8.8	15%
Total	74.1	65.5	77.1	51.2	23.6	58.3	100%

Table 111. Alaska Snow Crab Harvest (million pounds), 2013-2017

Note: does not include harvest of *Chionoecetes tanneri* and *C. angulatus.* CY denotes crab year, the harvest season for crab. Source: ADFG/CFEC Fish Tickets (data provided by AKFIN).

Product Description and Supply Chain

Nearly all of Alaska's snow crab harvest is delivered alive to inshore facilities, which includes shoreside and near-shore floating processors. After delivery, the crabs are cooked and butchered before being turned into a variety of products. Frozen legs and claws (called sections or clusters) account for nearly all snow crab products from Alaska. Snow crab sections are priced by the weight per section in ounces, ranging from 5 oz. to 12 oz. with heavier sections typically worth more. Tails, shucked meat, live crab, and fresh products typically account for less than two percent of the total first
wholesale volume. A small amount of crab is processed aboard catcher/processor vessels each year, with sections the primary product form.

While a number of smaller primary processors sell directly to retail and food service markets, the majority of snow crab is sold first to a broker which facilitates distribution to domestic and international markets. A portion of snow crab consumed in the domestic market undergoes secondary processing (usually outside Alaska but in the United States) to produce cracked, scored, and split legs or claws.

Significant amounts of snow crab are exported to China or other reprocessing markets where the labor-intensive task of removing meat from shells is conducted. Prepared or raw crab products are made from this meat and reexported to global markets, including the United States

One unique trait of snow crab is that they can "drop" their legs if injured or when being handled by fishermen. Snow crab missing legs cannot be sold as a symmetric section, instead these crabs are exported to China or other reprocessing markets where meat is extracted from the legs and body of the crab.¹⁰⁸

While the supply chain between opilio and bairdi is similar, increased bairdi harvest in some years has led to an increase in product differentiation between the two species. Industry contacts indicate that while Japan has been the historical market for bairdi, the U.S. domestic market is growing.



Figure 65. Alaska Snow Crab Supply Chain

Alaska's main snow crab fisheries take place in the spring. Industry contacts indicate the state's production is well-timed to fill a market niche in early to mid-summer. While Alaska production often begins in January, Canadian harvest (the largest global supplier) typically begins in April or May.

The proportion of salable product available after processing relative to the animal's live weight is known as the product recovery rate. For snow crab this rate ranges from slightl less than 20 percent for cooked crabmeat to roughly 95 percent for cooked whole crab. The recovery rate for sections is roughly 70 percent for raw sections and 60 percent for cooked sections.¹⁰⁹

¹⁰⁸ Interview with domestic seafood company representative.

¹⁰⁹ https://www.commerce.alaska.gov/web/ded/DEV/FisheriesDevelopment/SeafoodProcessingRecoveryRatesYields.aspx.

Production Volume and First Wholesale Value

While the volume of production rose and then fell over the 2008-2017 period, the value per pound trended higher throughout. The period opened with nearly 34 million pounds of snow crab production, growing to 62 million pounds by 2012 and falling to roughly 19 million pounds by 2017.

The average value over all snow crab product began the period at \$4.10 per pound in 2008. Prices climbed past \$5.00 in 2011 and maintained a range of between \$4.40 and \$5.50 through 2016. Supported by falling volume and favorable market conditions, prices rose to a record \$6.60 per pound in 2017. Through early 2019 snow crab prices remain near historical levels.¹¹⁰





Table 112. First Who	lesale Value of Ala	ska Snow Crab (\$ mi	llions), 2008-2017

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
\$138.2	\$131.3	\$105.0	\$215.8	\$297.6	\$247.8	\$233.3	\$229.2	\$204.0	\$127.1

Source: ADF&G Commercial Operators Annual Reports (COAR) (data provided by AKFIN).

Located near Alaska's major snow crab fishing grounds, the combined Dutch Harbor/Saint Paul Island region produced 70 percent of the total first wholesale volume of snow crab products in 2017, or 13.4 million pounds. The total value of this production equaled about two-thirds of the total first wholesale value.

Grouped to maintain confidentiality, the Alaska Peninsula communities of Akutan and King Cove, along with Kodiak and offshore production contributed 26 percent of volume and 28 percent of value.

¹¹⁰ (Sackton, Lack of alternatives pushes retailers to stick with snow crab despite high prices, 2019).

Docion	Volu	me	Value		
Kegion	Million Pounds	ounds Pct. of Total Million Dollars		Pct. of Total	
Dutch Harbor/Saint Paul Island	13.4	70%	\$84.7	67%	
Alaska Peninsula/Kodiak/Offshore	4.9	26%	\$35.2	28%	
Southeast/Anchorage/Savoonga	0.8	4%	\$7.2	6%	
Total	19.1	100%	\$127.1	100%	

Table 113. Alaska Snow Crab First Wholesale Volume and Value, by Region, 2017

Note: Regions have been combined to preserve confidentiality. Values have been rounded. Source: ADF&G Commercial Operators Annual Reports (COAR) (data provided by AKFIN).

Nearly 100 percent of Alaska's annual snow crab production is in the form of a cooked and frozen legs and claws generally called "sections." Small amounts of shucked meat, tails (abdomen meat), and whole crab products are produced, with most non-section production occurring in Southeast Alaska or Kodiak. Between 2013 and 2017, about 200,000 pounds of live snow crab were sold by Alaska processors, most of which originated in Southeast Alaska with bairdi the main species.

Table 114. First Wholesale Volume and Value of Snow Crab Products, by Species, 2017

Snow Crab Species	Crab Sections	All Other Products	Total
Total Volume (Million Pounds)	19.0	0.2	19.1
Opilio	17.3	0.2	17.4
Bairdi	1.7	<0.1	1.7
Total Value (Million Dollars)	\$126.8	\$0.4	\$127.1
Opilio	\$111.3	\$0.3	\$111.6
Bairdi	\$15.5	\$0.1	\$15.5

Note: Figures may not sum due to rounding. A very small amount of C. tanneri are included in the opilio category.

Source: ADF&G Commercial Operators Annual Reports (COAR) (data provided by AKFIN).

Between 2008 and 2017, bairdi crab products received an average price premium of 19 percent over opilio crab products. The main reason for the price difference is bairdi's size which is usually double that of an opilio. The premium was at a period record of nearly 40 percent in 2017. While bairdi contributed 9.1 percent of snow crab first wholesale volume in 2017, the species accounted for 12 percent of the value.





Source: ADF&G Commercial Operators Annual Reports (COAR) (data provided by AKFIN).

Key Market Analysis

The United States is the most significant market for Alaska snow crab producers, receiving an estimated 63 percent of the state's production between 2013 and 2017. China is the largest export market, accounting for 52 percent of all exports and 19 percent of total Alaska snow crab production over the same period. Along with Indonesia, China is primarily a reprocessing market which produces crab products for re-export to global markets.

Exports to Japan accounted for nearly 10 percent of Alaska's production over the five-year period, with 2017 volume at a 40-year low. Canada accounted for three percent of total exports and all other countries totaled the remainder.

Market	2013	2014	2015	2016	2017	Pct. of Total Production (5-yr. Avg.)
China	10.7	8.9	8.5	6.6	4.4	19%
Japan	3.3	3.5	5.8	4.6	0.4	9%
Canada	1.4	1.6	1.7	0.8	1.0	3%
Indonesia	1.6	1.3	1.6	1.1	0.6	3%
Other Countries	1.5	0.8	1.6	0.8	0.4	3%
Total Exports	18.5	16.1	19.1	13.8	6.8	37%
U.S.*	30.9	28.1	32.7	23.9	12.3	63%
Total Production	49.4	44.1	51.8	37.7	19.1	100%

Table 115. Estimated Sales of Alaska Snow Crab to Key Markets (million pounds), 2013-2017

* Estimate based on annual production less annual year exports.

Source: ADF&G Commercial Operators Annual Reports (COAR) (data provided by AKFIN); ASMI Seafood Export Database; and McDowell Group estimates.

United States

A relatively small proportion of all snow crab consumed in the United States comes from Alaska. Over the five-year period ending in 2017, an estimated 82 percent of all snow crab consumed in the United States originated outside the United

States In 2017, this proportion rose to 90 percent as Alaska production fell — and as Canadian and Russian harvest increased. Alaska's contribution to domestic supply is expected to return to normal levels in 2018 and 2019 as a result of increased harvest volume.

Year	Alaska Production	Imports	Exports	Est. U.S. Supply	Est. Product from Alaska	Pct. Alaskan
2013	49.4	119.0	18.5	150.0	30.9	21%
2014	44.1	105.6	16.1	133.7	28.1	21%
2015	51.8	110.6	19.1	143.4	32.7	23%
2016	37.7	116.6	13.8	140.5	23.9	17%
2017	19.1	107.7	6.8	120.0	12.3	10%
Five-year Average	40.4	111.9	14.9	137.5	25.6	18%

Table 116. Estimated U.S. Snow Crab Market Supply (million pounds), 2013-2017

 $Note: Data \ includes \ HS \ codes \ 1605102022, \ 1605102025, \ 1605104005, \ 1605104010, \ and \ 0306144020.$

Source: ADF&G Commercial Operators Annual Reports (COAR) (data provided by AKFIN); NMFS Office of Science and Technology, Foreign Fishery Trade Data; ASMI Seafood Export Database; and McDowell Group estimates.

Although Alaska constitutes a small portion of total U.S. consumption of snow crab, conversations with industry indicate Alaska-sourced volume is desired. Not only can retail and food service buyers celebrate the "Alaska" story, several industry participants claim product from Alaska is usually higher quality than other sources of supply.

Snow crab (from all sources) is consumed in both food service and retail settings. The species is regularly featured in "all you can eat" buffets — Las Vegas casinos have a long history of offering snow crab. Southern states in the United States remain an important market for the species, as well.

Casual restaurants have highlighted bairdi crab from Alaska in years of sufficient supply. Supported by a strong harvest in 2015, Red Lobster had a summer special for "Jumbo Bairdi Crab"; Joe's Crab Shack had a similar offering the same summer.¹¹¹ A review of menus for casual seafood restaurants in 2019 indicates snow crab is available, but is not being marketed as "Alaska crab." In May 2019, Red Lobster is offering a 1 pound North American snow crab entrée for \$24.69.¹¹²

In 2017, the U.S. market consumed an estimated 120 million pounds of snow crab products, including production from Alaska and imports. Canada supplied 69 percent of this total, or about 83 million pounds. Russia accounted for 15 percent and Alaska contributed 10 percent. China was the source of 2 percent of supply, with that crab that likely originating in Alaska or Russia. Small amounts of product were also imported from other countries including Norway, Greenland, South Korea, Denmark, and Indonesia.

¹¹¹ (Seafood News, 2015).

¹¹² (Red Lobster, 2019).



Figure 68. Estimated Source of Snow Crab Consumed in the United States, 2017

Source: NMFS Office of Science and Technology, McDowell Group estimates.

Japan

Japan is one of the world's largest consumer markets for snow crab. In addition to domestic harvests of 42 million pounds, the country imported 46 million pounds of frozen snow crab sections in 2017.¹¹³ These trade figures represent the lowend of snow crab imports for Japan. Snow crab from Alaska (and other sources) are likely included in the Japanese import of prepared/preserved crab products (HS 160510) which were worth \$235 million in 2018. The reprocessing markets of China and Indonesia are the primary suppliers of these products.

While Japan continues to be an important market for Alaska-produced snow crab, it is not the market it once was. Between the 1970s and 1990s the country was the main market for Alaska snow crab. But in the early 2000s, China passed Japan as Alaska's largest export destination.

Between 2013 and 2017 the country imported an annual average of 52 million pounds of snow crab sections, worth \$335 million. Russia was the primary supply, contributing 48 percent of the volume over the time period, followed by Canada (29 percent), the Alaska (13 percent), and other countries. The U.S. (Alaska) proportion ranged from 20 percent in 2015 to 4 percent in 2017.

With more supply and a lower price than king crab, snow crab functions as a popular substitute. The crab is traditionally consumed during holiday seasons, including the country's Golden Week which runs from April 29th to May 5th and includes four public holidays. Alaska's snow crab production is positioned well to supply this market: in 2018, about 60 percent of total annual snow crab exports from the United States to Japan occurred before April 1st.¹¹⁴

In Japan, snow crab is commonly consumed in sushi and soups such as *mizutaki* and *shabu-shabu* where raw crab is placed in boiling water along with other ingredients. Variations of this technique cause the crab to curl while cooking, resulting in an attractive, flower-like presentation. Snow crab is commonly consumed both in homes and at restaurants.

 ¹¹³ FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.
 ¹¹⁴ NMFS OST.

The strong U.S. dollar and weak Russian ruble make Alaska snow crab relatively more expensive, positioning Russian snow crab as a more affordable option for Japanese consumers. A similar dynamic is at play with a strong yen against the Canadian dollar favoring imports of Canadian snow crab. According to industry contacts, currency issues are one of the most significant challenges faced by U.S. seafood processors trying to sell into the Japanese market.

Japanese imports of U.S. crab often far exceed corresponding data on U.S. snow crab exports to Japan. Secondary processing operations in China may explain much of the variance. Crab routed through China may still be imported into Japan and categorized as a "Product of U.S.A."

	2013	2014	2015	2016	2017
Import Volume (million pounds)					
Russia	24.6	25.8	22.0	26.8	24.4
Canada	12.6	15.7	17.4	12.8	16.6
U.S. (Alaska)	6.9	7.5	11.1	7.1	1.8
Other Countries	1.1	4.6	5.7	9.9	3.7
Total	45.2	53.6	56.1	56.6	46.5
Pct. U.S. (Alaska)	15%	14%	20%	13%	4%
Import Value (\$ millions)					
Russia	\$118.3	\$154.3	\$120.4	\$168.2	\$189.7
Canada	\$89.2	\$109.6	\$118.8	\$102.4	\$143.9
U.S. (Alaska)	\$46.3	\$52.9	\$66.2	\$53.4	\$19.1
Other Countries	\$5.0	\$21.9	\$26.5	\$51.7	\$23.4
Total	\$258.8	\$338.7	\$331.9	\$375.7	\$376.1
Pct. U.S. (Alaska)	18%	16%	20%	14%	5%

Table 117. Japanese Imports of Snow Crab, by Country, 2013-2017

Includes HS code 030614020.

Source: IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html.

China

China has been the most important export market for Alaska snow crab since the mid-2000s. The country is primarily a reprocessing market, with crab sourced from the United States (Alaska), Canada, and Russia, among others. Exports of Alaska snow crab to China climbed to 16 million pounds in 2012 before falling every consecutive year. Exports to the country in 2017 totaled 4.4 million pounds worth \$30 million.

Declining export volume to China is due primarily to lower harvests. Additionally, a U.S. dollar that strengthened about 14 percent between 2014 and 2016 placed Alaska-sourced product at a disadvantage versus competing supply from Russia and Canada. Trade data for 2018 indicate Alaska snow crab exports to China have declined to a 20-year low. While early data for 2019 show a slight recovery from 2018 levels, ongoing trade disputes between the United States and China are challenging the market.

Figure 69. U.S. Snow Crab Exports to China, 2010-2017



Source: ASMI Seafood Export Database.

Global Harvest Volume and Competing Supply Analysis

The global harvest of snow crab (including all species) averaged nearly 480 million pounds per year between 2008 and 2017, including a peak of 559 million pounds in 2015.

Canada is the largest harvester of snow crab, accounting for 42 percent of the global supply between 2008 to 2017. Landings ranged from a low of 182 million pounds in 2016 to a high of 216 million pounds in 2013. Canadian snow crab fisheries lost Marine Stewardship Council certification in 2018 due to fatal gear interactions with right whales.¹¹⁵ While sustainability certification is often valued by consumers, trade press reports demand for Canadian crab remains strong with little impact on prices.¹¹⁶ Nearly all of Canada's snow crab harvest is opilio crab.

Russia's role in the global snow crab market expanded over the period, from 11 percent in 2008 to 24 percent in 2017, making it the second-largest global snow crab supplier. The country harvested a record 111 million pounds of snow crab (primarily opilio) in 2017, with landings taking place in the Barents Sea, Bering Sea, and Sea of Okhotsk. Through the mid-2010s Russian harvest of illegal, unreported, and unregulated crab (IUU) was significant, with the amount of crab exported by the country regularly double official harvest volumes.¹¹⁷ Although IUU harvest likely continues, increased harvest enforcement and import regulations from key markets such as Japan have improved the situation.¹¹⁸

South Korea was the second-largest producer of snow crab until eclipsed by Russia in 2015. Landings averaged 80 million pounds annually, ranging from 69 to 96 million pounds. Over the 2008 to 2017 period the country contributed 17 percent of the global supply. With significant volatility, U.S. production from Alaska totaled 13 percent of the total supply over the same period.

Japan's snow crab harvests (mainly *C. japonicus* or red snow crab) trended lower over the ten-year period, from 56 million pounds in 2008 to 42 million pounds in 2017. The country averaged 10 percent of the global supply over this period.

¹¹⁸ (Leow, 2014).

¹¹⁵ (Hathaway, Canada's snow crab fleet losing MSC certification, 2018).

¹¹⁶ (Hathaway, MSC delivers a pinch to Canada's snow crab fishery, 2019).

¹¹⁷ (McDowell Group, 2012).

Snow crab supply from the Barents Sea has increased in recent years after a large biomass was discovered in 2013.¹¹⁹ Several countries are currently harvesting the crab, with Russia and Norway accounting for most volume. Trade press indicate the combined quota for snow crab in the region could grow to 44 million pounds by 2019.¹²⁰





Note: Includes *C. opilio, C. japonicus, C. bairdi, C. tanneri,* and *C. angulatus.* Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.

The global supply of snow crab in 2017 was approximately 462 million pounds. Canada's harvest of 204 million pounds accounted for 44 percent of the total. Russian landings of 111 million pounds represent 24 percent of the total and South Korean harvest of 69 million pounds contributed 15 percent. Japan and the United States (Alaska) accounted for 9.1 and 5.1 percent of the total, respectively. Other harvesting countries included Norway (1.4 percent) and Greenland (1.1 percent).

¹¹⁹ (Sætra, 2013).

¹²⁰ (Gerden, 2018).





Note: Includes *C. opilio, C. japonicus, C. bairdi, C. tanneri*, and *C. angulatus*. Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.

Wholesale Market Profile for King Crab

King crab, including the red (*Paralithodes camtschaticus*), golden (*Lithodes aequispinus*), and blue (*Paralithodes platypus*) species, are caught in waters throughout Alaska, with the largest concentration found in the Bering Sea and Aleutian Islands. Alaska king crab fisheries produce some of the state's most valuable seafood products on a per pound basis. While 2017's first wholesale production (8.5 million pounds) of king crab accounted for just 0.3 percent of total Alaska seafood volume, the first wholesale value (\$116.1 million) equaled 2.4 percent of the total.

Value and Volume		Key Products	Sections	_	Other
First Wholesale Production (million lbs.)	8.5	Pct. of Value	95%		5%
Pct. of Global King Crab Harvest (2017)	12%	Key Markets	US	Japan	Other
First Wholesale Value (\$ millions)	\$116.1	Pct. of Volume	60%	25%	15%
Pct. Change in Value from Prior 4-yr Avg.	-11.2%	YoY Volume Change	-19%	40%	-8.3%
Pct. of Alaska Seafood Value	2.4%	Competing Species:	Russian king crab	, Southern ki	ng crab

Table 118. Summar	y Profile of Alaska	King Crab Wholesale	Production and Markets, 2017
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Fishery Summary

King crab are harvested with traps (typically called pots) at depths ranging from 90 feet to more than 300 feet. These steel cages are baited with Pacific cod, herring, or salmon, and placed on the ocean floor for 24 hours or longer. A line runs from the pot to a buoy floating at the surface, allowing for retrieval by a fishing vessel. Unless processed onboard, crab are kept alive in holding tanks for delivery to shoreside facilities.

Most of the annual crab production in Alaska occur in federal fisheries in waters 3 to 200 miles off the coast. These fisheries are cooperatively managed by the



Photo courtesy of Alaska Seafood Marketing Institute.

National Marine Fisheries Services (NMFS) and the Alaska Department of Fish & Game (ADF&G) through the North Pacific Fishery Management Council (NPFMC). State crab fisheries are located in areas up to 3 miles off the coast and are exclusively managed by the State of Alaska. The primary state-managed king crab fisheries are in Southeast Alaska.

In 2005, most Federal BSAI crab fisheries were "rationalized", with harvesters assigned a portion of the annual quota allocation based on historical harvests. Before this transition, harvesting activity was compressed into a short period of competitive and often dangerous harvesting. The 2004 red king crab season lasted only 3 days, for example; the following year, under rationalization, the season was extended to 92 days. Short seasons contributed to dangerous working environments and product quality suffered as processors were overwhelmed with high volumes landed over short periods.



Photo courtesy of Garrett Evridge.

Commercial harvest of Alaska king crab was

pioneered by Japanese and Russian fleets using tangle nets starting in the 1930s. Domestic harvest began in the late 1940s, and by the early 1960s U.S. fishermen dominated the fishery.¹²¹ Around the same time, the use of trawl and tangle nets for harvesting crab were outlawed and only males meeting a size requirement could be retained. With the passage of the 1976 Magnuson-Stevens Act, foreign vessels were prevented from harvesting Alaska king crab. The domestic fleet continued to develop as strong prices and landings resulted in increased fishing pressure. Landings peaked in 1980 at 185 million pounds, falling to just 16 million pounds five years later – due in part to the decline and 1983 closure of the Kodiak red king crab fishery (the largest king crab fishery at the time outside of the BSAI region). Harvest volume averaged approximately 20 million pounds through the 90s and 2000s. Landings in 2017 of less than 13 million pounds represents the lowest harvest volume since 1958.





Source: NMFS Office of Science and Technology, Annual Commercial Fisheries Statistics Database.

Alaska's king crab fisheries include several harvests in the Bering Sea, most prominently the Bristol Bay red king crab fishery, as well as the Aleutian Islands golden king crab and Saint Matthews blue king crab fisheries. These federal

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¹²¹ (Zimmerman, Dew, & Malley, 2009).

fisheries generally account for more than 90 percent of annual production. Several state-managed fisheries often contribute about 500,000 pounds of harvest volume annually, though landings can be volatile. The largest of these is the Norton Sound summer king crab fishery.

Conversations with industry reveal unease about the possible closure of the Bristol Bay red king crab fishery. If its biomass falls below a 14.5 million-pound threshold, trade press reports a shutdown could last several years.¹²²

Of the three king crab species, red king crab is usually the largest component of the annual harvest, accounting for about 60 percent of the total between 2013 and 2017. Golden crab contributed slightly less than 40 percent and blue king crab - which is only occasionally harvested - accounted for about one percent. In 2018, the harvest of golden crab exceeded the harvest of red king crab for the first time 20+ years.

	2013	2014	2015	2016	2017	5-Year Average
Red King Crab	9.0	10.3	10.3	8.9	7.1	9.1
Golden (brown) King Crab	6.5	6.3	5.9	5.7	5.7	6.0
Blue King Crab	-	0.3	0.1	-	0.0	0.1
Total King Crab	15.5	16.9	16.3	14.6	12.9	15.2

Table 119. Alaska King Crab Harvest (million pounds), by Species, 2013-2017

Note: Calendar year data. Scarlet (couesi) king crab not listed separately in this table due to very small volumes.

Source: ADFG/CFEC Fish Tickets (data provided by AKFIN).

Product Description and Supply Chain

Nearly all of Alaska's king crab harvest is delivered alive to inshore facilities, which includes shoreside and near-shore floating processors. After delivery, the crabs are cooked and butchered before being turned into a variety of products. In a typical year, frozen legs and claws (called sections) account for more than 90 percent of all king crab products, by volume. Tails, shucked meat, live crab, and fresh products account for remaining 10 percent. A small amount of crab is processed aboard catcher/processor vessels each year, with sections the primary product form.

The proportion of salable product available after processing relative to the animal's live weight is known as the product recovery rate. This rate ranges from slightly more than 20 percent for cooked crabmeat to roughly 95 percent for cooked whole crab. The recovery rate for sections, depending on the size of crab, ranges from 52 to 67 percent.¹²³ Red and golden crab yield a higher recovery rate than blue king crab which is often smaller.

Following processing in Alaska, most crab products are shipped in a frozen form to international and domestic wholesale markets and distributed to retail and food service.

An estimated 10 to 15 percent of the annual production undergoes secondary processing into specialty king crab products.¹²⁴ Common specialty crab products include cracked, scored, and split legs or claws – all products which make it easier for consumers to access crab meat. These specialty crab products are primarily consumed in the domestic market, with secondary processing taking place in the Pacific Northwest as well as at other plants around the United States¹²⁵

¹²² (Smith, 2019).

¹²³ (Crapo, Paust, & Babbit, 2004).

¹²⁴ Interview with domestic seafood company representative.

¹²⁵ Interview with domestic seafood company representative.



Figure 73. Alaska King Crab Supply Chain

Production Volume and First Wholesale Value

A key challenge for the king crab industry has been the drastic decline in available volume. Production levels in 2017 were a third lower than the 20-year average — with additional declines expected through 2019. Producers who have maintained long-term relationships with key buyers have been put in a challenging position as there simply is not enough supply to meet demand. The availability of competing supply from Russia or Argentina has caused many buyers to substitute away from Alaska-sourced products.

First wholesale volume of Alaska king crab declined over the last decade, falling from 17.1 million pounds in 2008 to 8.5 million pounds in 2017. During this time period, a peak of \$146.2 million in first wholesale volume was observed in 2016, only to be followed by a low of \$116.1 in 2016 due to weaker prices and falling volume. On a per pound basis, the value of king crab products peaked at \$16.3 in 2016. Prices declined in 2017 but remain at historically high levels. Preliminary indicators for 2018 show prices have remained strong.



Figure 74. First Wholesale Volume and Value/mt of Alaska King Crab, 2008-2017

Source: ADF&G Commercial Operators Annual Reports (COAR) (data provided by AKFIN).

Shoreside facilities (including near-shore floating processors) handle most crab production in Alaska, accounting for nearly 100 percent of production in 2017. A few vessels harvest and process crab onboard, but this component is usually less than five percent of the overall production volume.

Most shore-based processing capacity is in communities near the Bering Sea, in addition to modest capacity in the Gulf of Alaska. More than half (54 percent) of 2017's king crab processing, by volume, occurred in Dutch Harbor. The Alaska Peninsula/Aleutian Islands region (including King Cove, Akutan, and Adak), contributed 22 percent while Bering Sea/Norton Sound production accounted for 15 percent (including Nome, St. Paul Island, Savoonga, and Quinhagak).

Pagion	Vo	lume	Value		
Region	Million Pounds	Percent of Total	\$ Millions	Percent of Total	
Dutch Harbor	4.6	54%	\$63.2	54%	
AK Peninsula/Aleutian Islands	1.9	22%	\$27.2	23%	
Bering Sea/Norton Sound	1.3	15%	\$14.9	13%	
Kodiak/Offshore	0.3	4%	\$5.3	5%	
Southeast/ Cook Inlet	0.3	4%	\$5.4	5%	
Total	8.5	100%	\$116.1	100%	

Table 121. Alaska King Crab First Wholesale Volume and Value, by Region, 2017

Note: Regions have been combined to preserve confidentiality.

Source: ADF&G Commercial Operators Annual Reports (COAR) (data provided by AKFIN).

Alaska's primary king crab product is cooked and frozen legs and claws – typically called "sections" (see photo on next page). Sections are the state's main king crab product, contributing between 90 and 97 percent of total annual production

volume between 2013 and 2017. Whole crab (including live, fresh, and frozen product) was the second-largest component, accounting for between two and nine percent of annual production. All other products including frozen crab "tails" and shucked meat generally contributed less than one percent of annual production by volume.

Crab sections are usually packaged in a 10-pound box and sold by count, ranging from 6-9 legs and claws per box to twenty or more. Lower counts indicate larger legs and are typically more valuable. King crab sections averaged approximately \$12.60 per pound at the first wholesale level over the 2013 to 2017 period, ranging from a low of \$10.30 in 2014 to a high of \$16.40 in 2016.¹²⁶ As the primary king crab product, production levels of sections fluctuates with the quota. Over the 2013 to 2017 period, an annual average of 9.5 million pounds of sections were produced, including a high of 11.5 million pounds in 2014.



Photo courtesy of Peter Pan Seafoods.

King Crab Species	Crab Sections	All Other Products	Total
Total Volume (million pounds)	8.1	0.4	8.5
Red	4.7	0.3	5.1
Golden	3.3	0.1	3.4
Total Value (\$ millions)	\$110.0	\$6.1	\$116.1
Red	\$71.1	\$4.3	\$75.4
Golden	\$38.9	\$1.8	\$40.7
Average Price per Pound	\$13.7	\$13.5	\$13.7
Red	\$15.0	\$13.7	\$14.9
Golden	\$11.7	\$13.1	\$11.8

Table 122. First Wholesale Volume and Value of King Crab Products, by Species, 2017

Note: Figures may not sum due to rounding.

Source: ADF&G Commercial Operators Annual Reports (COAR) (data provided by AKFIN).

Between 200,000 and approximately 1 million pounds of whole king crab were produced annually between 2013 and 2017, including live, fresh, and frozen product. In 2017, about 270,000 pounds of live king crab worth \$3.2 million were flown to high-end markets from Alaska. Modest volumes of fresh or frozen whole crab are periodically produced. Other product volume (crab tails, abdomen meat, and shucked products) averaged about 70,000 pounds of production annually between 2013 and 2017. The value of these products ranged from about \$500,000 to \$1,000,000 dollars annually.

The smaller golden king crab typically trades at a discount relative to red king crab. In 2017, the average first wholesale value for golden king crab sections was about \$12 per pound, compared to \$15 per pound for red king crab sections.

¹²⁶ ADFG/CFEC Fish Tickets (data provided by AKFIN).

Key Market Analysis

The United States is the most significant market for Alaska king crab. Between 2013 and 2017, an estimated annual average of 60 percent of Alaska's king crab production went to the domestic market.

Over the same period, Japan accounted for twothirds of all exports and 27 percent of total Alaska king crab production. Other export markets (Canada, China, and all other countries combined) purchased an annual average of 13 percent of the state's production. Market participants report buyers in the United States



Photo courtesy of Garrett Evridge.

and China have periodically been willing to pay higher prices for Alaska king crab than Japan in recent years.

As the available quantity of Alaska king crab has declined, the product is increasingly shifting from year-round availability to seasonal availability. Discussions with industry representatives reveal most king crab is sold on the wholesale market between October (when harvest begins) and February.

While most golden and blue crab are sold to the domestic U.S. market, the majority of exported Alaska crab is red king crab.

Market	2013	2014	2015	2016	2017	Pct. of Total 2013-2017
Japan	2.8	3.7	3.7	1.5	2.1	27%
Canada	0.7	0.5	0.4	0.5	0.6	5%
China	0.4	0.4	0.4	0.2	0.3	3%
Other Countries	0.5	0.6	0.5	0.5	0.4	5%
Total Exports	4.3	5.2	5.0	2.6	3.4	40%
U.S. ¹	6.4	6.9	5.7	6.3	5.1	60%
Total Production	10.7	12.1	10.7	9.0	8.5	100%
% Exported	40%	43%	47%	29%	40%	

Table 123. Sales of Alaska King Crab to Key Markets (million pounds), 2013-2017

¹Estimate based on annual production less calendar year exports.

Note: Figures may not sum due to rounding.

Source: ADF&G Commercial Operators Annual Reports (COAR) (data provided by AKFIN); ASMI Seafood Export Database.

United States

For the domestic market, Alaska crab is sold into two primary channels: food service – which includes high-end and casual restaurants (such as Joe's Crab Shack and Red Lobster) – and retail stores that include a wide variety of traditional grocery stores to specialty seafood shops or online stores.

Little preparation is needed to eat king crab as the product typically is sold already cooked. Sections are often reheated by steaming and served with dipping sauces such as melted butter – with the end consumer removing the meat from the shell.

According to industry representatives, an estimated 70 percent of Alaska king crab sold in the United States goes to food service with the remaining 30 percent sold at retail, with fluctuation occurring year-to-year. The U.S. military is an important buyer of king crab, with Department of Defense purchases totaling \$2.9 million in FY2019.¹²⁷

Most of the domestic supply of king crab is imported, Alaska has contributed an estimated one fifth of the king crab consumed in the United States in recent years. The total estimated U.S. supply of king crab, including Alaska production and imports, averaged 31 million pounds per year between 2013 and 2017.

Year	Alaska Production	Imports	Exports	Est. U.S. Supply	Est. Product from Alaska	Pct. Alaskan
2013	10.7	25.3	4.3	31.7	6.4	20%
2014	12.1	27.6	5.2	34.5	6.9	20%
2015	10.7	25.9	5.0	31.6	5.7	18%
2016	9.0	23.0	2.6	29.4	6.4	22%
2017	8.5	22.4	3.4	27.6	5.1	19%
Five-year Average	10.2	24.9	4.1	31.0	6.1	20%

Table 124. Estimated U.S. King Crab Market Supply (million pounds), 2013-2017

Note: These data do not distinguish between red, blue, and golden king crab. Totals and rows may not sum due to rounding. Source: ADF&G Commercial Operators Annual Reports (COAR) (data provided by AKFIN), NMFS Foreign Trade, ASMI Seafood Export Database, and McDowell Group estimates.

In 2017, U.S. imports of king crab totaled 22.4 million pounds. Russia was the primary source, accounting for about 90 percent of total import volume. The country is also the main source of crab reprocessed in China and South Korea which is re-exported to the United States. Southern king crab (*Lithodes santolla*) from Argentina contributed about six percent and a variety of other countries made up the remainder.

	Volume (Pounds)	Percent of total			
Russia	20,293,188	90%			
Argentina	1,306,026	6%			
China*	445,556	2%			
South Korea*	133,611	1%			
Norway	92,945	<1%			
Other Countries	159,473	1%			
Total	22,430,798	100%			

Table 125. U.S. Imports of King Crab, by Country, 2017

*Primarily reprocessing markets which source most product from Russia. Source: NMFS Office of Science and Technology, Foreign Fishery Trade Data.

¹²⁷ U.S. government spending data.

Japan

Over the last decade, exports of Alaska king crab to Japan have trended lower due to factors including reduced harvest volume in the state's fisheries, availability of Russian crab, and a U.S. dollar that has strengthened more than 30 percent over the Yen since 2012. The 2018 export volume of 1.9 million pounds is at a historically low level, although it is above the recent low of 1.5 million pounds set in 2016. Reduced volume has pushed the export value to record highs: 2018's average export price of nearly \$13 per pound was a record for the 10-year period.





Source: NMFS Office of Science and Technology, Foreign Fishery Trade Data.

The ability to provide Alaska king crab to Japan before the December holiday season is important for Alaska producers. The species is commonly exchanged as a gift in Japan during the season; an industry contact estimates 80 to 90 percent of red king crab is sold in the months prior to this holiday season. In a typical year, king crab are exported promptly after harvest begins mid-October. In 2018, 76 percent of the year's king crab exports to the country occurred in November; in some years, this figure is around 90 percent.

A common practice is to sell smaller sections to restaurants and reserve the larger sections for retail sales. King crab is sold in Japanese restaurants in a variety of forms, including fried, sashimi (raw), steamed, and boiled. The versatile *shabu-shabu* soup is often prepared with king crab, in addition to other seafood and vegetables.

Frozen crab is the main king crab product imported by Japanese buyers. Over the 2013 to 2017 period, imports of frozen king crab fell from 22.0 million pounds to 7.1 million pounds. Russia was the primary source of this volume, followed by the United States (Alaska), and Norway. The total value of these imports matched the decline in volume, falling roughly two-thirds to about \$203 million in 2017.

Efforts to curtail illegal, unreported, and unregulated (IUU) harvest of Russian king crab have contributed to a sharp decline in import volume from Russia. In 2014, Japan began requiring a source of origin certificate for Russian crab and Russian authorities have increased enforcement efforts to reduce poaching.

	2013	2014	2015	2016	2017
Import Volume (million pounds)					
Russia	19.1	12.1	7.0	8.7	5.0
U.S. (Alaska)	2.8	3.1	3.2	1.9	1.8
Norway	0.1	0.0	1.0	1.0	0.3
Total	22.0	15.2	11.1	11.6	7.1
Pct. U.S. (Alaska)	13%	21%	28%	17%	26%
Import Value (\$ millions)					
Russia	\$151.4	\$137.6	\$135.3	\$174.4	\$103.6
U.S. (Alaska)	\$113.6	\$98.6	\$79.2	\$126.8	\$69.2
Norway	\$37.2	\$39.1	\$46.1	\$35.3	\$30.6
Total	\$302.2	\$275.3	\$260.5	\$336.6	\$203.4
Pct. U.S. (Alaska)	38%	36%	30%	38%	34%

Table 126. Japanese Import Volume and Value of Frozen King Crab, 2013-2017

Note: Includes HS code 030614010. Inconsistencies between export and import data exist between U.S. and Japanese sources. Source: Japan Ministry of Finance and IHS Markit. Global Trade Atlas: International Import and Export Commodity Trade Data. https://ihsmarkit.com/products/maritime-global-trade-atlas.html.

Global Production and Competing Supply Analysis

The global supply of king crab — including red, golden, blue, and Southern king crab species — totaled about 111 million pounds in 2017. As shown in the chart below, over the 2013 to 2017 period, supply expanded by more than 19 million pounds, or 21 percent.

Russian production led the increase, with volume up 26 million pounds (50 percent) over the five-year period. Norway also saw an increase of about 1.4 million pounds, while harvests declined in Argentina (-3.9 million pounds), Alaska (-2.6 million pounds), and Chile (-1.6 million pounds) over the period.





Note: Does not include illegal, unreported, and unregulated (IUU) estimates.

Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.

Historically, Russia's king crab harvests have included significant amounts of illegal, unreported, and unregulated (IUU) production. This volume is not included in official harvest data, but there is reason to believe the IUU volumes have declined in recent years.

Between the mid-2000s and around 2013, estimated Russian IUU harvests regularly exceeded Alaska's harvest volume. McDowell Group estimated the 2013 IUU harvest to be more than 20 million pounds, in addition to the official harvest of about 52 million pounds.¹²⁸ Efforts to reduce IUU harvest appear to be experiencing success, although the problem persists.¹²⁹

Russia's market share of global king crab has increased in recent years, totaling 70 percent in 2017. Volume from Alaska contributed 12 percent to the total and Chile accounted for 10 percent. Norway and Argentina both contributed four percent of the global supply. Stronger Russian harvest in 2018 and 2019, combined with lower or flat Alaska volume, is expected to support further expansion of Russia's market share into the near-term.



Figure 77. Global King Crab Supply, by Country, 2017

Note: Does not include illegal, unreported, and unregulated (IUU) estimates. Source: FAO Fisheries and Aquaculture Department. Fisheries statistics and information. http://www.fao.org/fishery/.

¹²⁸ (Alaska Fisheries Science Center, 2016).

¹²⁹ (Vovchenko, Russian illegal crab poaching cut by a third, 2019).

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