100% FISH

The U.S. Seafood Industry and Utilization of By-Products

ARCTICA FINANCE

ICELAND OCEAN CLUSTER

Summary

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The U.S. is an important market for seafood, being the fifth largest producer and exporter of seafood in the world and the largest importer. Despite its global significance, there are still opportunities for enhancements within the U.S. fishing industry, especially with regard to fish utilization. At least 1.5 million metric tons of fish by-products are discarded in the U.S. per annum, resulting in a value loss of potential $655 million. By increasing the utilization of fish and fish by-products, significant value can be salvaged from the supply chain in the U.S. seafood industry.

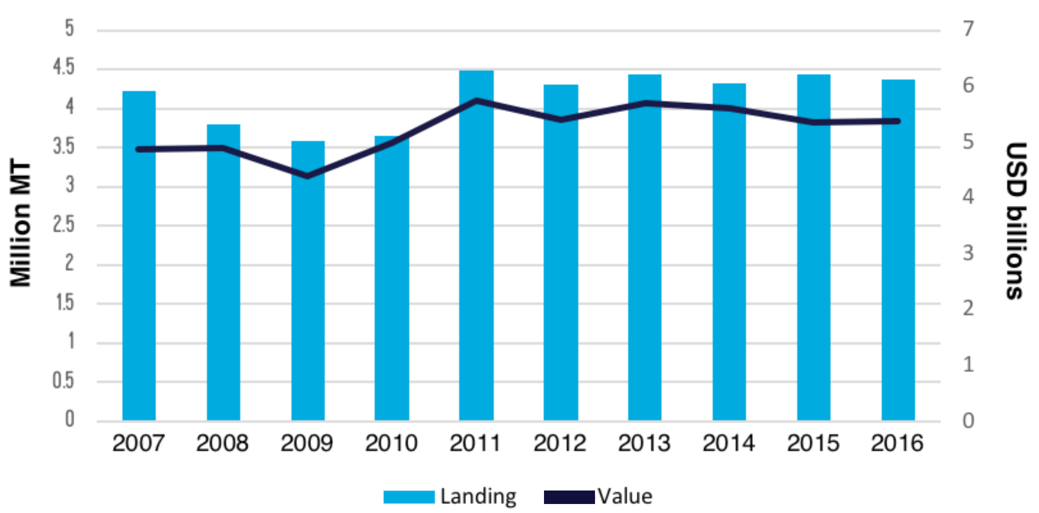
The U.S. as a Fishing Nation

Like other nations, the U.S. has an exclusive economic zone (EEZ) stretching from the baseline out to 200 nautical miles from its coast. It covers 4.38 million square miles (11.4 million square kilometers), which is the largest fishing area in the world, exceeding the entire land area of the U.S.

The federal government in the U.S. began actively managing marine fisheries in 1976, when the United States Congress enacted the Magnuson-Stevens Fishery Conservation and Management Act. The act provides a legal framework for promoting optimal exploitation of fishery resources in U.S. federal waters. Over the years, the law has been amended many times in line with sustainability policy due to overfishing of major stocks. Two major sets of amendments were the Sustainable Fisheries Act of 1996 and the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act ten years later.

The U.S. is one of the most important market in the world for seafood. In 2015, the U.S. was the fifth largest seafood producer globally, ranking third in terms of catch volume. Total commercial landings in the U.S. amounted to 4.4 million metric tons (MT) of seafood in 2016, valued at $5.4 billion, increasing 1.6% from the previous year in nominal terms and 0.35% in real terms[1]. The U.S. is also the fourth largest exporter and the largest importer of seafood in the world, exporting $5.4 billion and importing $19.5 billion in 2016.

U.S. LANDINGS AND VALUE



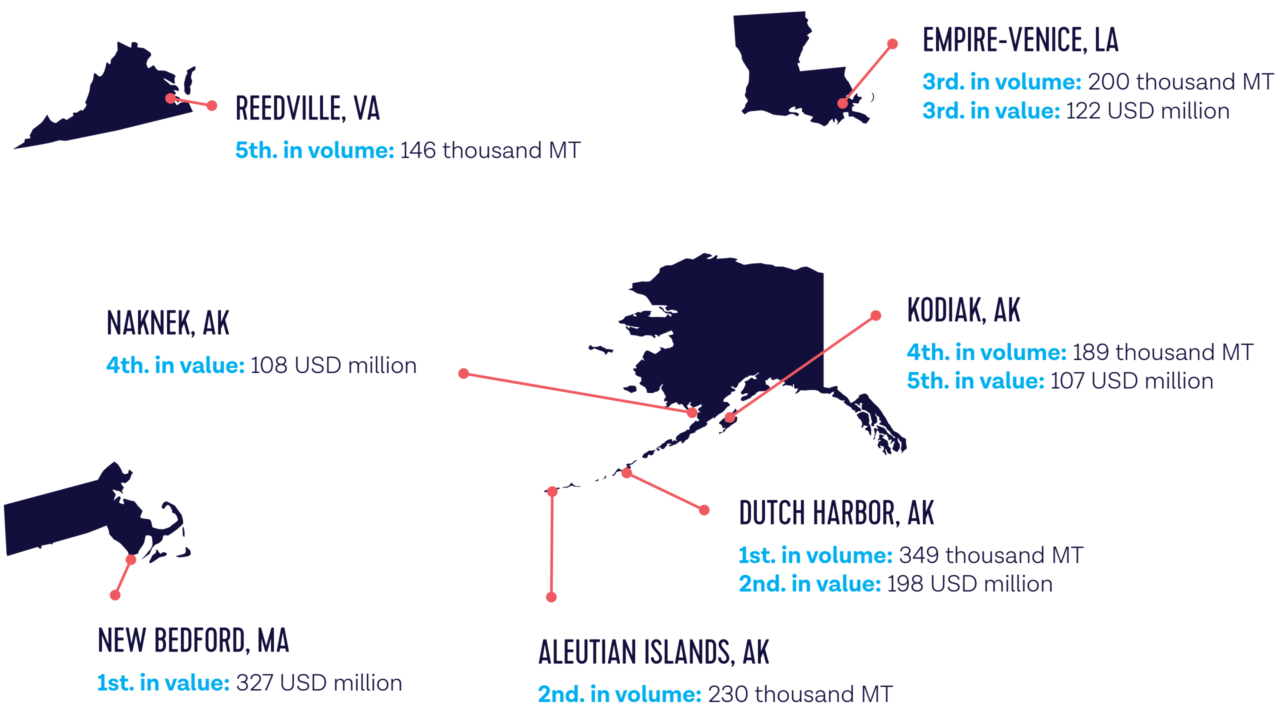
Source: NOAA Fisheries, Arctica Finance.

[1] Adjusted for inflation using the U.S. consumer price index (CPI).

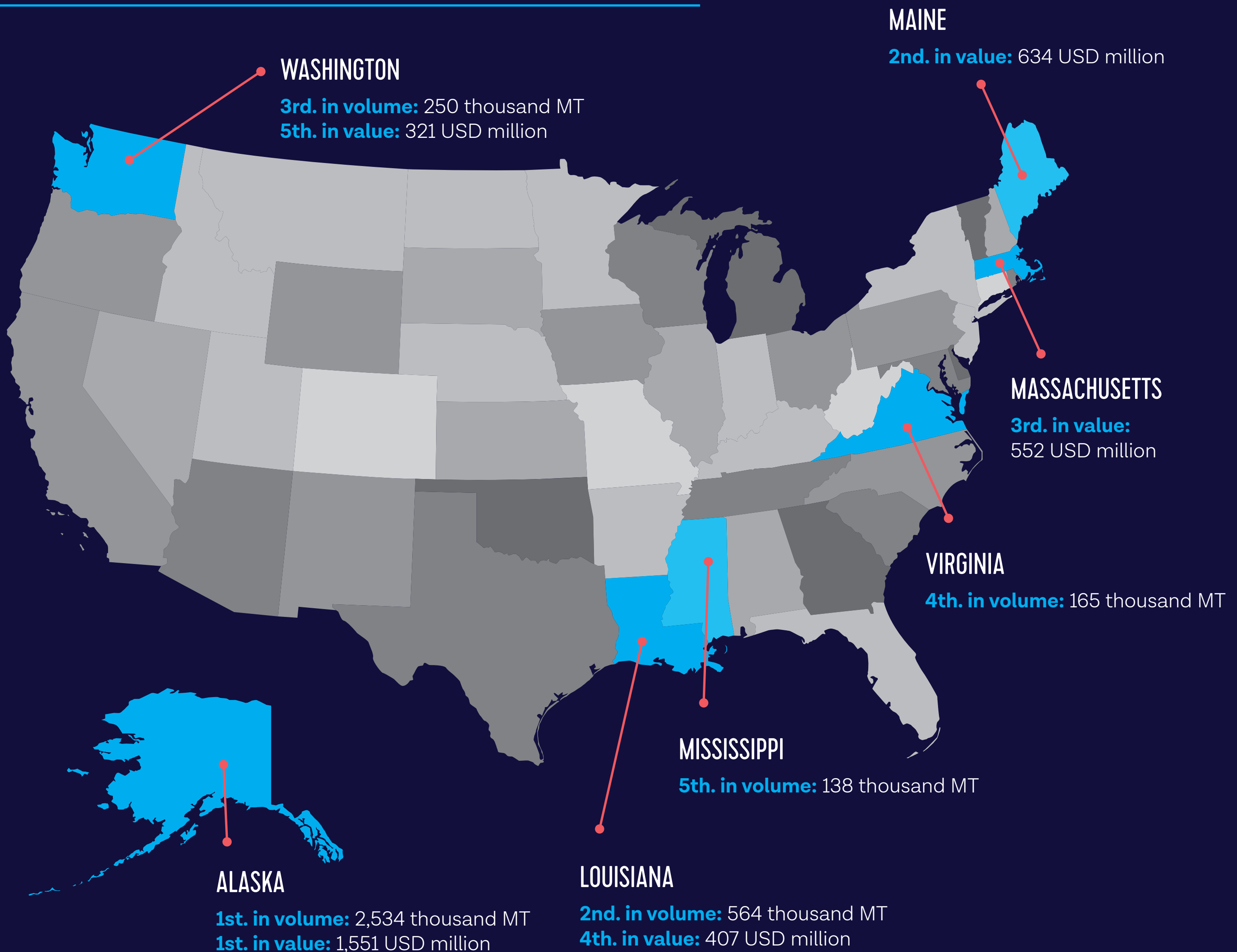
The chart above shows the volume of commercial landings in the U.S. and their real value over a ten year period, between 2007 and 2016. Over the last few years, landings have remained stable. Prior to 2011, however, there was a decrease in landed volume, attributable to a reduction in Alaska pollock total allowable catch (TAC).

Per capita use of fishery products in the U.S. in 2016 amounted to 30 kilograms (kg), based on the supply of fishery products, both edible and industrial. In the same year, landed catch per capita was 13.6 kg. Consumption of edible fish and shellfish per capita was estimated 6.8 kg in 2016, with consumers spending a total of $93.2 billion on fishery products, including $63.4 billion at food service establishments, $29.8 billion at retail stores for home consumption and $75.8 million for industrial fish products.

Top Five Ports in 2016



Top Five States in 2016



The image above shows how important Alaska is to the fishing industry in the U.S., providing around 58% of all landed catch and 29% of its value. Interestingly, Maine provides 12% of the value while only providing 2.6% of the volume. This is explained by the fact that 60 thousand MT of lobster, valued at $538 million, was landed in Maine in 2016.

The top landed fish in the U.S. is the Alaska pollock. However, it is only placed fifth in terms of value. Lobster yields the most value, but scallop has the highest value relative to landed volume.

Top Five Species in Landings 2016

VOLUME	Thousand MT	USD million	% of volume	% of value
ALASKA POLLOCK	1,522	417	34.9%	7.9%
MENHADEN	797	181	18.2%	3.4%
COD	323	178	7.4%	3.3%
HAKES	261	63	6.0%	1.2%
SALMON	254	420	5.8%	7.8%

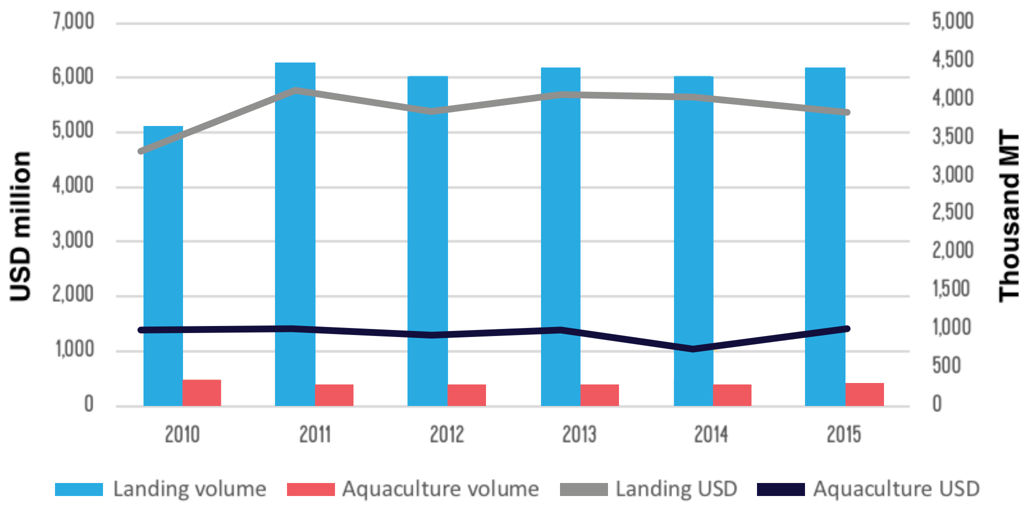
VALUE	USD million	Thousand MT	% of volume	% of value
LOBSTER	725	75	1.7%	13.5%
CRAB	702	147	3.4%	13.1%
SHRIMP	522	133	3.0%	9.7%
SCALLOP	489	18	0.4%	9.1%
ALASKA POLLOCK	417	1,522	34.9%	7.9%

Source: NOOA.

Aquaculture

The U.S. is not a major aquaculture producer, neither in absolute terms nor relative to wild catch landings. It is the 16th largest aquaculture producer globally, producing 284 thousand MT in 2015, or the equivalent of $1.4 billion, and contributing 21% to the total U.S. production of seafood and fishery products, by value. Approximately 36% of the aquaculture production value in the U.S. is produced in the Pacific States, 23% in the Gulf Coast states, and 41% in the Atlantic Coast states. However, it is estimated that over half of the seafood imported to and consumed in the U.S. comes from aquaculture.

LANDINGS VS. AQUACULTURE IN THE U.S.



Source: NOAA Fisheries, Arctica Finance.

The chart above compares volume and real value in landing and aquaculture, illustrating clearly the wide gap between aquaculture and wild catch landings. In 2015, the difference amounted to 4.2 million MT in volume and $3.9 billion in value.

Top Species Produced in U.S. Aquaculture

	Thousand MT	% of volume	USD million	% of value
CATFISH	144	51%	347	25%
CRAWFISH	64	22%	199	14%
SALMON	22	8%	173	12%
TROUT	21	7%	112	8%
OYSTERS	16	6%	88	6%

Processed Fishery Products in 2016

Since Alaska pollock is the most landed fish, it comes as no surprise that pollock products are the most valuable among processed fishery products in the U.S. It should be noted that data for processed fishery products include domestic catch and imported products. The vast majority of processed fish, or 92%, is used for human consumption, while the remainder is used for industrial purposes.

Top Species Processed for Seafood

BY VALUE	USD million	% of value
ALASKA POLLOCK	2,006	21%
MENHADEN	860	9%
TUNA	764	8%
COD	764	8%
SHRIMP	764	8%
OTHER SPECIES	4,394	46%
TOTAL	9,551	

Edible and Industrial Products

Fresh and frozen fish yield the most value with regard to edible fishery products, while meal and oil yield the most value in industrial fishery products.

2016

EDIBLE	USD million	Percentage of total value
FRESH AND FROZEN	7,620	80%
CANNED	1,017	11%
CURED	119	1%
TOTAL EDIBLE	*8,757*	*92%*

INDUSTRIAL	USD million	Percentage of total value
BAIT AND ANIMAL FOOD	234	2%
MEAL AND OIL	379	4%
OTHER	182	2%
TOTAL INDUSTRIAL	*795*	*8%*
TOTAL	*9,551*	

Fish By-Products in the U.S. and its Wasted Value

Fish by-products are generally defined as the parts of the fish that are not intended for human consumption. Such products include bones, viscera and heads. By-product volumes can depend on various factors, such as seasons, size, species and fishing grounds.

Utilization of seafood by-products varies across continents, countries, and even within countries. The utilization of fish also entails hurdles with regard to value maximization. Spoilage due to heat is a good case in point, or the methods used for handling and processing the fish, such as gutting.

Although utilization is gaining increased mainstream attention, there seems to be a lack of generally accepted methods for quantifying utilization, be it at a sector-, species- or nation level. As a result, there is great variance in estimated utilization rates, with some proposing that 50% and even 75% of fish by-products are discarded annually. The Food and Agricultural Organization of the United Nations (FAO) estimates that when discards prior to landing are included, discards amount to 35% of landed catch, which translates to a utilization rate of 65%[2]. Although this is merely an approximation, the general consensus nonetheless seems to tilt towards lower utilization rates.

Fish by-products used to be considered low-value products of little or no use. They were commonly used as fish meal and animal feed, or simply disposed of. Recent years, however, have seen an increase in awareness of the economic benefits of greater utilization and reduced waste. This is not least manifested in the increased utility of fish by-products in the pharmaceutical industry, such as in the production of gelatin, collagen and chitosan.

In the U.S., by-products are mainly used for bait, fertilizer, animal feed and fish meal. However, increased number of U.S. companies are using by-products in more innovative ways such as Tidal Vision, which produces wallets from salmon skin and chitosan, and Neptune's Harvest, which makes fertilizers from fish by-products and seaweed. Several companies also create gelatin from fish bones and other fish by-products, such as Norland Products, which creates gelatin and fish glue from cold water fish skin. These companies, however, still operate on a relatively small-scale basis. With increased utilization, larger scale operations are possible. Although more

[2] Refer to Rustad et al., also The State of World Fisheries and Aquaculture in 2016.

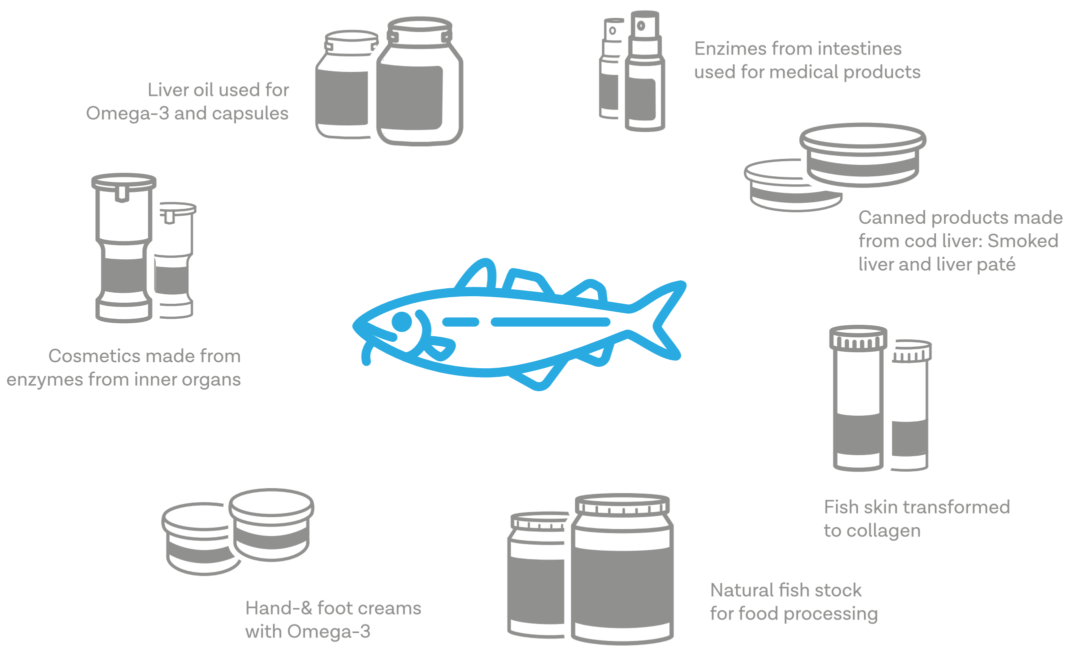
companies in the U.S. have turned to specializing in higher-end value utilization of by-products in recent years, there is still a lack of statistics concerning the scope and scale of their operations.

For the purpose of gauging how much value is discarded in the U.S., and with some liberties an attempt can be made to quantify the wasted value. Since fish meal is a fairly low-value product, it can serve as a minimum salvage value benchmark for by-products. It can be assumed, then, that a portion of the discards are in fact used for more valuable products.

Landed catch in the U.S. amounted to 4.4 million MT in 2016. Based on the 65% utilization rate approximated by FAO, the volume of discards can be estimated at about 1.5 million MT. FAO calculates that 212 kg of fish meal is produced from 1,000 kg of raw fish, implying a yield of 21.2%. Based on that yield, 1.5 million MT of discards would result in 0.32 million MT of fish meal. In 2016, 253 thousand MT of fish meal was produced for a value of $307.7 million, which calculates to $1,213 per MT of fish meal. Given that all by-products are used for fish meal production and the price per MT of discard is $257,[3] the total dollar equivalent being discarded is $393 million.

Studies have indicated that in Iceland, approximately 77-80% of cod and other whitefish species are utilized.[4] Overlaying the US seafood market with an 80% utilization rate in volume and value yields 874 thousand MT in discards, 655 thousand MT less than what is currently being discarded. In terms of value, if these 655 thousand MT of discards were only used for fish meal, then the added value would amount to $169 million.

[3] Calculated as follows: $1,213*21.2% = $257.
[4] Páll Gunnar Pálsson, also Gestsson & Guðjónsson.



The illustration above shows examples of goods made from fish by-products. These include fish oil, collagen, and protein.

The comparison of utilization rates in Iceland and the United States highlights the potential for retaining value in the value chain for seafood in the United States. In Iceland, the value of cod by-products is estimated to be as high as $2 per kg.[5] If the seafood industry in the U.S. could get half of this value, then the 655 thousand MT of additional utilization would amount to $655 million or a 12% increase in value.

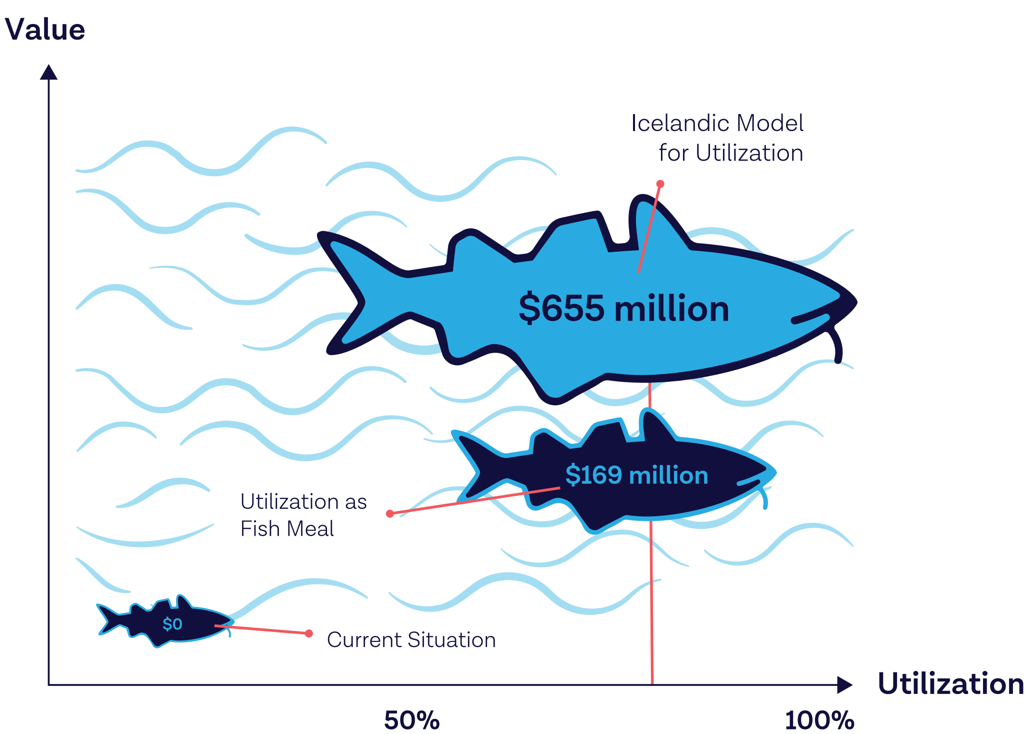
A contextualization of these calculations is in order. While the fish meal was calculated to be worth $1,213 per MT, the average price for fish meal in 2016 was $1,500 per MT. The average price in the past five years is $1,560 per MT. This is, of course, a simplification as raw material quality affects the price. For example, fish meal from offal might be sold cheaper than fish meal from higher quality raw material. Furthermore, producing fish meal is merely a benchmark, as it is the lowest value obtainable from the by-products. As we have seen, however, high-quality fish by-products are being widely used in apparel and for pharmaceutical purposes.

[5] Exchange rate of USD/ISK = 100 and a price of $2 per kg for by-products.

FOR A BRIEF ROUNDUP:

- At this moment, assuming a 35% discard rate, 1.5 million MT of fish by-products are being wasted in the US. If all discards are used for fish meal production, then the value of discards amounts to $393 million at a minimum.
- If the yield in the US (65%) could be increased to the Icelandic whitefish-yield (80%), then the increase in volume of seafood utilization would be 655 thousand MT, or the equivalent of $169 million based on fish meal prices.
- Supposing that the U.S. could receive 50% of the value of Icelandic cod by-products for 655 thousand MT, the increase in value in the seafood market would amount to $655 million or 12%.

POSSIBLE VALUE WITH INCREASED FISH UTILIZATION IN THE U.S.



Significant value is lost every year in the supply chain for seafood in the U.S. due to a modest utilization of seafood by-products. As such, the objective for the U.S. fishing industry should be twofold: to increase the utilization of fish and create a basis for value-added products from fish by-products. The U.S. is an important player in the global seafood market, and when the economic benefits of increased fish utilization become evident in the U.S., other nations are certain to follow suit.

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