Fisheries and Oceans Canada

Pêches et Océans Canada

Outlook to 2027 for Canadian Fish and Seafood

Canada

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Executive Summary

The *Outlook to 2027 for Canadian Fish and Seafood* provides market projections for fish and seafood using a dynamic simulation model developed at Fisheries and Oceans Canada. The *Outlook* is not a specific prediction of the future but is a forward-looking assessment based on best available information, and is subject to the uncertainties of events and outcomes that cannot be foreseen. Nonetheless, the *Outlook* provides a baseline expectation to assist in policy development, and against which policy changes and external shocks can be evaluated to assess their impacts.

Global consumption of seafood products is projected to grow approximately 9% by 2027, driven in large part by continued population growth and rising income in certain parts of the world. Supply increases are expected to be more limited as the rate of growth in aquaculture slows. This will lead to ongoing high prices for fish and seafood over the medium-term, despite the relaxation of prices in other agri-food markets where supply is more robust.

Canada's seafood export value is driven more by prices than by volume, and the particularly high prices for lobster and crab seen in recent years are expected to continue. Although export values will no doubt rise and fall as they have done historically, they will ultimately vary around a higher plateau (approximately $8B) in the coming decade compared to the previous plateau of $4B from 2000 to 2010.

Import demand in several of Canada's main historical trade partners (EU, U.S., Japan) and domestic demand are expected to remain stable over the coming years, while other markets for Canada's products expand. Export opportunities will grow in China, South Korea, and countries of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership. Globally, many trade-related issues are in flux, as some large economies work out new policies and approaches to trade. These factors may affect world prices and global trade patterns, with some possible disruptions to Canada's fish and seafood export markets (for example, the unknowns surrounding Brexit). However, the longer-term drivers of seafood demand (population and income) are likely to prevail and support strong exports over the medium-term time frame (10 years) presented in this *Outlook*.

Lobster is by far Canada's greatest generator of export value, with recent Canadian exports almost as high as the combined value of lobster exports (primarily rock/spiny lobster) from Australia, New Zealand, South and Central America, and the Caribbean. Complementary harvest patterns and a high degree of integration across the Canada-U.S. border in the American lobster supply chain suggest that the success of Canada and U.S. fisheries will remain somewhat tied together, even as trade patterns change and exports to Asia increase over the coming years.

Highlights

Global Seafood Outlook

- Demand for fish and seafood is comprised of a) demand for direct consumption as food by humans (approximately 90% of total consumption), and b) demand for indirect consumption through other uses such as feed for aquaculture and animal production, or to a lesser extent as bait, an input to fisheries
- Overall, fish and seafood utilization is projected to grow 9% by 2027. The growing demand for seafood for food (+11%) due to increasing populations and incomes is only partially offset by reduced use of fish and seafood for other uses, in particular as agriculture feed (-9%).
- A growing share of food demand will be met by aquaculture production, which will expand by almost 20% by 2027, as strong global prices for seafood encourage expansion.
- Historically, fish prices have tended to closely track those of other meat sources, but projections to 2027 suggest in the medium term fish prices may continue to increase while other meat sources stabilize.

Canada's Situation

- Recently Canadian fish and seafood exports have been equivalent to about 80% of landed quantity. Canada has been diversifying its trade portfolio by entering into new free trade agreements (Canada-Korea Free Trade Agreement, Comprehensive and Progressive Agreement for Trans-Pacific Partnership) to help industry to access the highest value markets for their products.
- Strong growth projections for global prices of key Canadian seafood exports are projected to support gains of almost 20% in export value in the medium term, exceeding $8B by 2025.
- This growth in export value is largely the result of strong increases in global prices for key Canadian exports, in particular lobster, as well as modest increases in volume, mainly by aquaculture.
- Canada is projected to maintain a strong export balance in the medium term for most fish and seafood product groups with overall net export value projected to increase by more than 40% by 2027.

Spotlights

Lobster

- The Canada-U.S. lobster market is highly integrated and projections show the two countries will continue to be each other's largest destination for lobster exports.
- Globally, lobster will continue to be the highest priced traded seafood product group. Lobster's share of Canada's seafood export value is projected to increase from about 30% to 40% as Canada solidifies its position as the single largest net exporter of lobster.

Crab

- Snow crab accounted for over two thirds of Canada's crab exports in 2017 by value.
- Global demand for crab will be increasingly dominated by China.
- Increasing disposable income in Asia continues to create demand for premium crab, such as snow crab from Canada.

Aquaculture

- World consumption of salmon is projected to increase by 40%, or almost 2 million tonnes, by 2027.
- Canada will likely remain a small player in the global salmon aquaculture industry; however, production is projected to grow faster than domestic consumption, increasing export capacity.
- The high cost of fish meal and fish oil, and volatile prices for other types of feed, continue to make diversification of feed formulations a priority, and support increased production of species that do not require feeds such as bivalves (e.g., clams).

Methodology

- The projections for the *Outlook to 2027 for Canadian Fish and Seafood* were developed with DFO's Seafood Market Simulation Model (SEASIM), with input from the Food and Agriculture Organization (FAO) FISH model[1] and the Agriculture and Agri-food Canada (AAFC) medium term outlook model.[2]
- Fish and seafood production, demand, consumption, imports, exports, and prices are explicitly modeled for Canada and five of its major trading partners: United States (U.S.), China, European Union (EU), Japan and South Korea (Korea). The remaining countries of the world are incorporated within an aggregate, weighted grouping ("rest of world": ROW).
- Fish and seafood are disaggregated into 12 species groups (Table 1) covering all fish and aquatic invertebrates. Fish meal and fish oil are also included in the model.
- Wild stock yields are projected separately from the model simulations, based on recent trends and long-term averages, supplemented with the best available information on changes in stock status and management and with efforts to remain consistent with the FAO FISH model.
- Aquaculture output is estimated within the model simulations, based on the simulated product prices and production costs.

Data sources are as follows:

- Global fish production (capture and aquaculture, including aquaculture values), trade, and consumption were obtained from the FAO's Fishery and Aquaculture Statistics Division and its associated online query panel (http://www.fao.org/fishery/statistics/en).[3]
- Additional trade data were obtained from Statistics Canada, and the IHS Markit Global Trade Atlas.
- Tariffs used in the model are calculated each year as trade-weighted averages using bilateral trade data at the 6-digit HS Code level, applying the relevant tariff schedule obtained from the World Trade Organization (WTO) online database, with supplementary information from country websites.
- Data and forecasts for agricultural commodities were provided by AAFC.
- The underlying macroeconomic data reflect the economic forecasts of the International Monetary Fund (IMF) released in October 2017, as applied by the AAFC in its international baseline for the *Medium Term Outlook for Canadian Agriculture 2018* and any adjustments made in the domestic data by AAFC.[4]

Table 1: Species Groups in SEASIM

Group:	Species included:
Lobster	All species of lobster, including American, spiny, and rock lobster.
Crab	All species of crab, including king, mitten, red, rock, and snow, among others.
Shrimp	All species of shrimp and prawns.
Other crustaceans	All other crustaceans such as crayfish and krill, excluding lobster, crab, and shrimp.
Salmon	All salmonid species, including salmon, char, trout, smelt, and whitefish.
Freshwater	Freshwater species such as catfish, carp and tilapia and diadromous species such as eel and shad, but excluding salmonids.
Tuna	True tunas including albacore, bluefin, and yellowfin tuna, tuna-like species including bonito and kingfish, plus billfish including marlin and swordfish.
Pelagics	Other pelagic species not included in tuna groups, such as anchoveta, mackerel, herring, sardines, and amberjacks.
Groundfish	Other finfish including demersal species such as pollock, plaice, flounder, and cod, plus other marine and coastal fish not otherwise specified such as snapper, grunt, and grouper.
Cephalopods	Cephalopod molluscs, including all species of squid, octopus, and cuttlefish.
Molluscs	All molluscs such as oysters, scallops, clams, mussels, abalone, and whelk, excluding cephalopods.
Other	Other aquatic invertebrates not otherwise specified, including jellyfish, sea urchins, and sea cucumbers.

Outlook Assumptions

The *Outlook to 2027 for Canadian Fish and Seafood* projects current known conditions and trends into a likely scenario of future markets.

- The *Outlook* is not a specific prediction of the future, as it depends upon events that cannot be known with certainty at this time.
- It provides a baseline expectation founded on enduring trends, against which policy changes and shocks to the system can be evaluated to assess their impacts.

Perturbations to the underlying assumptions do not necessarily invalidate the trends, but do highlight uncertainties and the need to consider the broader medium-term results of the model rather than specific short-term results.

- For example, although the longer term trends suggest a period of relative stability, growth, and open trade for seafood, the immediate environment suggests a possible period of instability in some trade opportunities.

The assumptions underlying the projections are described in this section. The macroeconomic assumptions as well as other assumptions are coordinated with those used by the FAO in the fishery chapter of the *OECD-FAO Agricultural Outlook*[5] and AAFC in its *Medium Term Outlook for Canadian Agriculture*.

Macroeconomic assumptions

Economic growth is expected to vary across Canada's major trade partners over the next 10 years.

- Growth of the U.S. economy will soften somewhat from current levels (above 2% per annum) to about 1.7% p.a., with similar growth expected for the EU as a block.
- Canada's economic growth is expected to be similar to that of the EU and U.S., at just below 2% p.a.
- Japan's economy will remain sluggish, with little growth expected and dropping below 0.5% p.a.
- In contrast, growth will be strong in South Korea (about 3% p.a.) and although China's economy will slow slightly, its growth is expected to remain near 6% p.a.
- Outside of these major trade partners, the aggregate growth of the remaining countries of the world is expected to be quite high (in the mid 5% range) due to a few particularly strong performers such as India, Egypt, Vietnam, Indonesia, and the Philippines.

Inflation is expected to increase somewhat as a result of ongoing economic recovery and associated policies.

- However, it is generally expected that it will remain in the vicinity of 2% for Canada and trade partners modeled explicitly in SEASIM with the rate for China marginally higher at 3%.
- The aggregate ROW countries will be quite variable in terms of inflation, with an overall aggregate rate closer to 5% p.a.

- Exchange rates will mainly be driven by differential inflation across countries. Relative to the U.S. dollar, the Canadian dollar is expected to gradually strengthen from its recent average of about 1.30 to an average closer to 1.25.

The rate of growth in the world population is declining, and this is expected to continue through the forecast period slowing from 1.1% in 2017 to 0.9% in 2027. Again, there is high variation across countries/regions.

- The population of Japan is expected to decline in absolute terms, while India's population will grow sufficiently to exceed that of China.
- In Canada and the U.S., population growth of 0.6% to 0.7% p.a. is expected, while the EU is on track to reach zero growth by the end of the projection period.

Policy change in China

China has developed an ambitious strategy to rationalize fisheries production, increase income, decrease waste, and protect its fishery resources as part of its 13th 5-year Plan for a "Moderately Prosperous Society." The fisheries strategy is described in the China Agricultural Outlook (2017-2026).[6]

- The full strategy (Table 2) would reduce capture production in China by 23% in absolute terms between 2017 and 2026, through a reduction in the number and overall capacity of vessels, improved and expanded use of moratoria, and expansion of protected areas in the Yangtze River basin.
- For aquaculture, the full strategy would result in continued growth, but at a reduced rate (1.2% p.a. over the next 10 years, versus 5.2% over the past 10). Less land will be devoted to aquaculture production, but through adoption of new culture technology and conversion to less feed-intensive species, production will grow more slowly and sustainably.

Table 2: Projections in Output from the China Agricultural Outlook (2017-2026, Million Tonnes)

	2017	2020	2026
Capture Production	15.67	12.94	12.06
Aquaculture Production	52.52	53.91	58.03

For comparison, note that the FAO reports 2016 world production at 91 Mt for capture production and 80 Mt for aquaculture production.

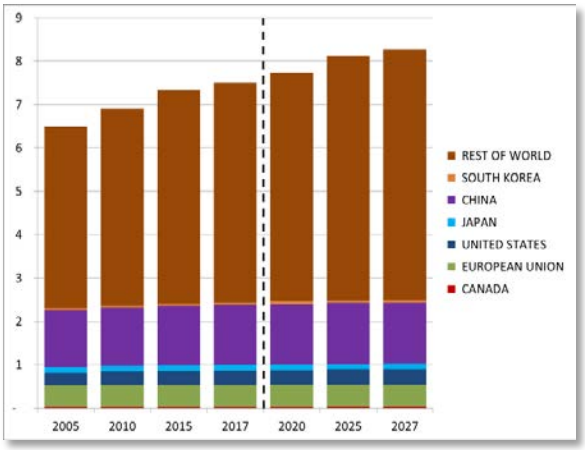
More moderate outcomes of the Plan are used in the baseline projections from SEASIM.

- The SEASIM baseline is consistent with that used by the FAO in the fishery chapter of the OECD-FAO Agricultural Outlook.
- The SEASIM baseline assumption is a 15% decrease in China's capture production from 2017 to 2026 (compared to the announced 23% decrease), and an 18% increase in aquaculture production (compared to the 10% announced).

Global Seafood Outlook

Global demand for seafood continues to increase, largely due to growth in population and per capita income.

Figure 1: Global Population (Billions)



Source: FAO FISH model

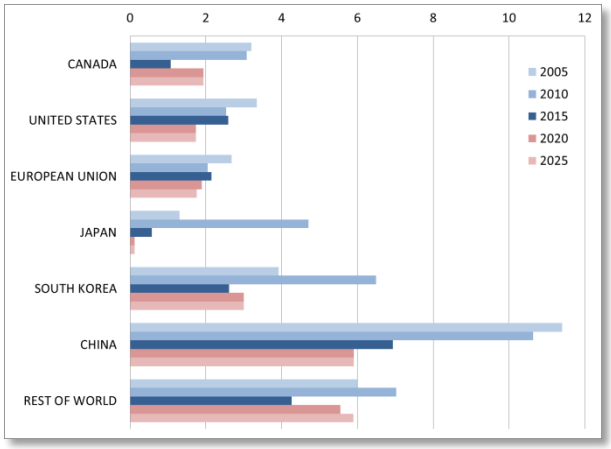
The world population will increase by more than 770M, exceeding 8B by 2027 (Figure 1).

- In absolute terms population will increase the most in China (28M) and the rest of the world (717M).
- In percentage terms, growth to 2027 is expected to be higher for the ROW aggregate (14%), Canada (8%) and the U.S. (7%), and significantly lower in South Korea (3%), China (2%) and the EU (1%). Japan's population is expected to decline by 3%.

Real income is growing in all countries/regions but at very different rates (Figure 2).

- Overall growth in GDP is projected to drop slightly in the near-term before stabilizing. The annual rates are expected to be significantly higher in China and the ROW (around 6%) compared to other modeled countries. The annual rate in South Korea (3%) will be only marginally higher than the rate of around 2% expected in Canada, the EU, and the U.S. GDP growth in Japan is expected to be only slightly above zero.
- Economic growth in excess of population growth will support increases of nominal per capita income in all countries, with the strongest rates in China and the ROW. Slower per capita income growth is expected in South Korea, the EU, the U.S., Canada, and Japan.

Figure 2: Change in Real Income (Annual %)



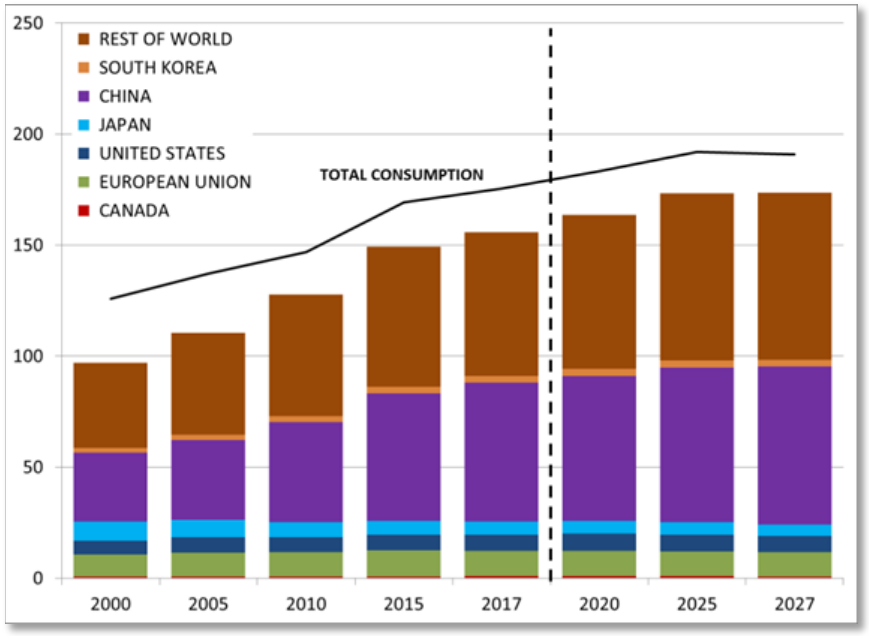
Source: FAO FISH model

With low and stable inflation, growth in nominal income will not differ significantly from growth in real income.

Demand for fish and seafood is comprised of a) demand for direct consumption as food by humans (approximately 90% of total consumption), and b) demand for indirect consumption through other uses such as feed for aquaculture and animal production, or to a lesser extent as bait, an input to fisheries (Figure 3).

- Total global consumption of fish and seafood will increase by about 9%, as direct consumption as food grows by over 11% to almost 174 million tonnes while other uses such as fish meal and fish oil decline by almost 13% to around 17 million tonnes.
- Growth in consumption as food will be concentrated in China and parts of the developing world. By 2027, over 40% of fish and seafood will be consumed in China, but only 17% of the world's population will live there.
- Fish and seafood consumption as food will remain stable in the EU, Canada, South Korea, and U.S.
- A decline is expected in Japan (-13%), fueled by a combination of population decline, limited economic growth, and changing tastes.

Figure 3: Total Global Consumption of Fish and Seafood and Consumption as Food by Country (Million Tonnes)



Source: FAO, SEASIM projections

The use of fish for feed (fish meal and oil) will decline, with a number of factors contributing to this trend.[7]

- High prices for fish-based products are encouraging food producers to substitute lower- priced vegetable proteins and oils into feed mixtures.
- Technological changes allow recovery of more fish processing waste.
- Aquaculture's ability to shift toward species with lower feed intensity requirements.

Global supply from wild fisheries remains constant, limited by natural factors.

Production in the wild (capture) fishery will exhibit little change in total production over the projection period, as capacity for growth is limited by natural factors. Harvests from many wild stocks have reached or exceeded their sustainable limits, and sustained recovery of depleted stocks will take time.

- In the U.S., legislated management measures have been underway since 2006 to reduce overfishing and rebuild overfished stocks. These goals have been achieved for a number of stocks, often with significant harvest reductions. While new allowable harvest levels have increased for some stocks, these sustainable harvest levels may be lower than past non-sustainable levels.
- Similar measures to increase sustainability are being undertaken in a number of jurisdictions, including the EU, Canada, and through Regional Fisheries Management Organizations.
- Planned harvest reductions in China are anticipated to reduce China's share of global capture fisheries from 19% to 16%. Nevertheless, China's harvest will continue to account for substantial shares of the global wild harvest of crab (47%), shrimp (38%), cephalopods and molluscs (24% each), other crustaceans (41%), and groundfish (20%).

Major fluctuations in wild harvest are primarily linked to changes in pelagic fisheries, in particular the periodic declines in the harvest of Peruvian anchovies associated with El Niño events.

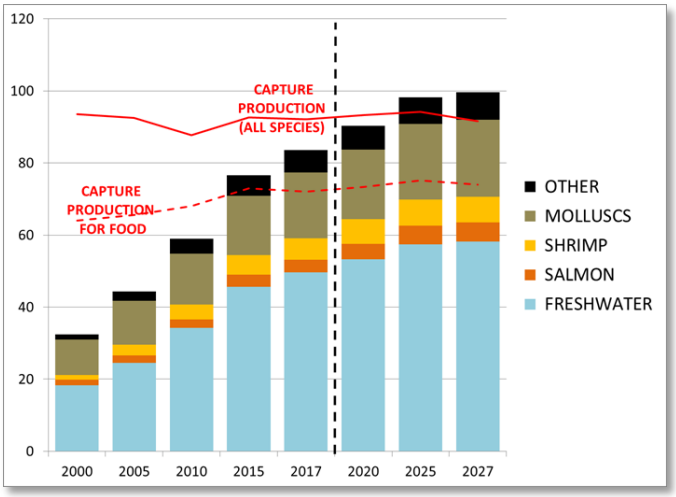
- Past events included smaller impacts in 2003 and 2010 with a large impact in 2016. In the coming years, an event with a small impact is anticipated in 2021 and one with a larger impact in 2026.
- These supply decreases related to El Niño increase the global price for fish meal, and consequently also affect input costs for aquaculture and agriculture production.

Continued growth in cultured seafood is necessary to meet demand.

The United Nations 2030 Agenda for Sustainable Development highlights the role the fisheries and aquaculture sector will play in the fight to end world hunger, achieve food security, improve nutrition, and promote sustainable agriculture. In response to continued growth in demand for seafood, aquaculture will expand, but at a slower pace.

- Total aquaculture production is projected to expand by almost 20% from the base period to 2027, compared to almost a 70% increase in the previous decade (Figure 4). While aquaculture production already exceeds wild harvest destined for human consumption, cultured volume will surpass total capture fisheries harvest before 2027, reaching almost 100 million tonnes.
- It is predicted that by 2025, production in developing countries (including China) will account for 95% of global aquaculture production, and will continue to be concentrated in Asia (89%) with marked increases in Latin America and Africa.[8]

Figure 4: Global Supply from Aquaculture will Exceed Total Wild Harvest (Million Tonnes)



Source: FAO, various national sources, SEASIM projections

Shrimp, salmon, molluscs (non-cephalopod), and freshwater species will continue to dominate aquaculture, and only modest expansion will occur among other species groups.

- By 2027, the proportion of global production from aquaculture will increase from 87% to 89% for molluscs, from 79% to 85% for salmon, from 82% to 84% for freshwater species, from 62% to 68% for shrimp, and from 43% to 50% for crab.
- Despite the small percentage change, the largest expected growth in absolute volume is for freshwater species.
- Aquaculture of freshwater species will continue to account for about 30% of total world fish production (aquaculture and capture fisheries combined).

Growth in China's freshwater culture of carp and tilapia accounts for much of the expansion in culture of freshwater species, but the rate of growth is expected to slow.

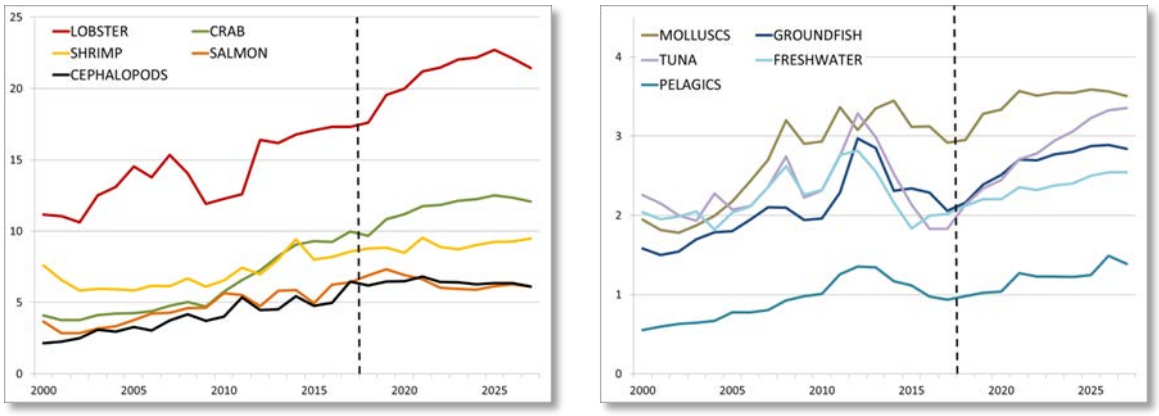
- Between 2007 and 2017 production increased by almost 75%. Growth in culture of these species is expected to slow with a total increase of 20% to 2027.
- Most of China's freshwater culture of carp and tilapia is consumed within the Chinese domestic market; however, demand will likely outpace aquaculture expansion supporting an increasing role for imports.

World seafood prices will continue to strengthen.

World prices for seafood products continue to reflect increasing scarcity relative to demand, despite the ongoing growth of aquaculture.

- Several species with high unit value will see sustained increases in prices, while many lower priced species will rebound to recent peaks (Figure 5).

Figure 5: World Import Prices by Species Group ($USD/kg, whole weight basis - note different scales)



Source: Global Trade Atlas, SEASIM projections

Price increases are moderated by the extent of aquaculture in a given species group, whether in the higher or lower priced categories.

- Lobster will remain the most valuable traded seafood product group, per unit volume, in the world. Increasing incomes in Asian markets continue to push up the price of lobster, perceived as a luxury product. The small scale of aquaculture production of lobster supports the higher prices.
- Some species with higher global levels of aquaculture, such as shrimp and salmon, will see less growth in prices as culture expands to meet demand.
  - Continued potential for disease issues in shrimp culture will limit its capacity for growth, supporting moderate increases in world prices.
  - The recovery of cultured salmon production in Chile and Norway and projections of additional growth will dampen price increases.
- Crab prices continue to increase, despite the high level of cultured production (almost 50% globally).
  - The bulk of crab by volume is cultured in China, however, only small volumes of these crabs are traded in the international market.

- Most crab trade is in high valued species that are not cultured (e.g. snow and king crab). Biologically constrained harvest levels and the lack of a cultured replacement will support price growth.

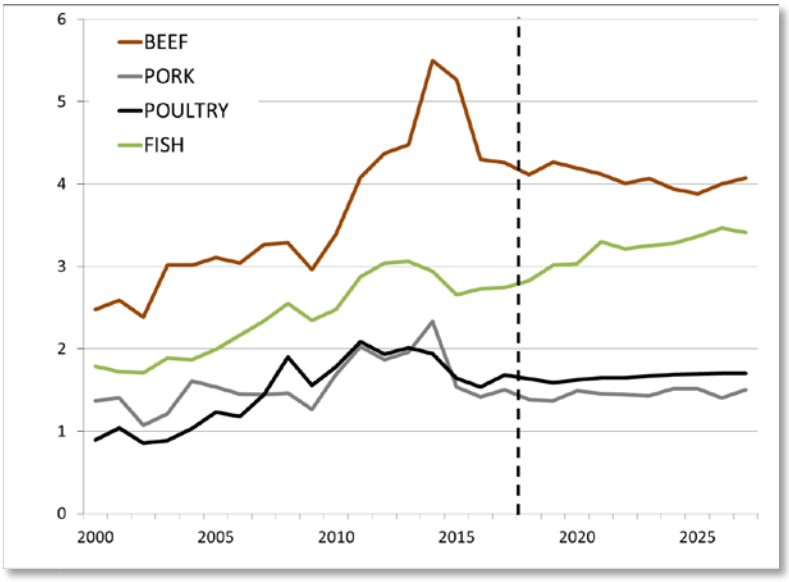
- Price recovery and growth for molluscs and freshwater fish will be moderated by significant aquaculture capacity.
- Conversely, prices for tuna, pelagics, and groundfish will increase back toward recent highs, in the absence of significant aquaculture capacity to enhance supply.
- Expansion of demand beyond traditional markets (e.g. regional dishes reaching global audiences) for cephalopod species such as octopus has promoted higher prices, but these are expected to level off despite a lack of aquaculture.

Fish feed requirements will increase as aquaculture expands resulting in increased prices for pelagic fish meal sources like anchoveta and herring; however, alternatives to fish meal help to moderate demand and increases in price.

- Past high prices for fish meal and oil have resulted in innovations in aquaculture feeds, with oilseed meal substituted for some fish meal and vegetable oils used in place of some fish oil. However, the ability to substitute will be limited by the physiology of the cultured species.[9]
- Short-term price increases are anticipated as a result of El Niño events in 2021 and 2026.

Fishery production is becoming increasingly linked to agriculture through both shared feed markets and products that serve as substitute protein sources.

Figure 6: World Prices of Major Meat Sources ($USD/kg)



Source: FAO FISH model, AAFC model, SEASIM projections

Historically, fish prices have tended to closely track those of other meat sources, but projections to 2027 suggest a divergance as fish prices continue to increase while other meat sources stabilize (Figure 6).

- China's policy to reduce capture and slow aquaculture production provides part of the explanation.
- Also, aquaculture has the ability to influence the species mix with production focusing on higher priced species for human consumption.

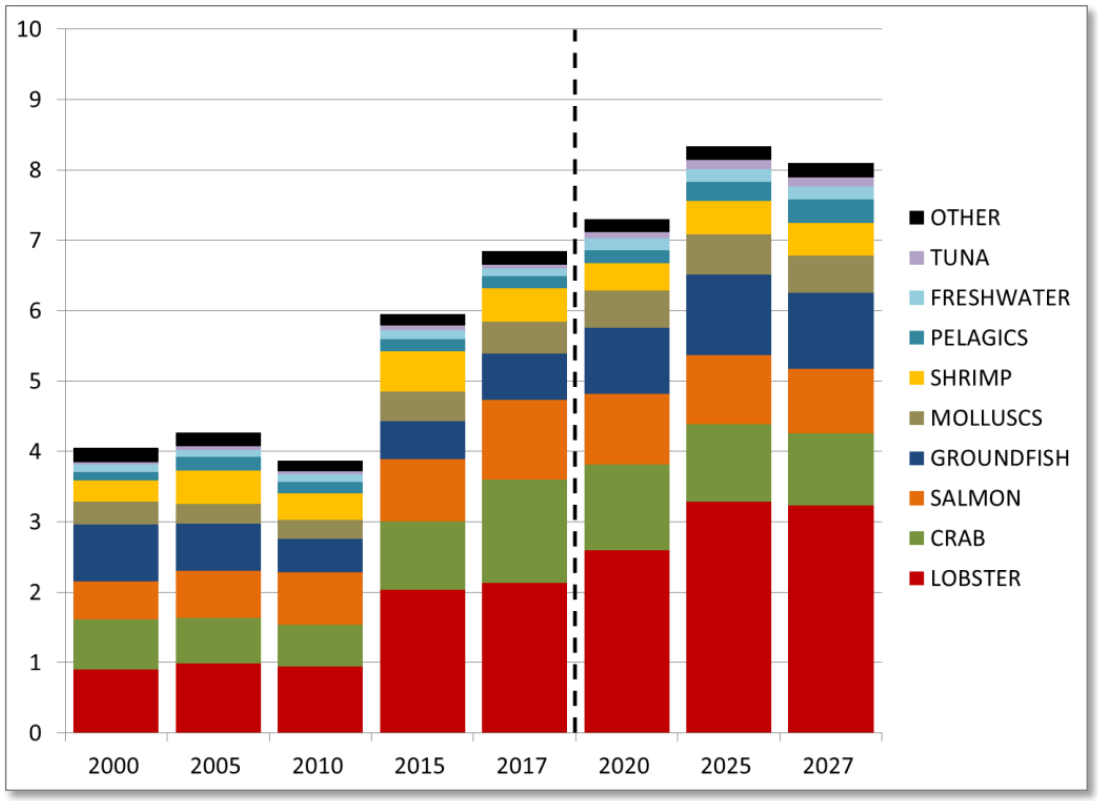
Canada's Situation

Canada's seafood export value shows solid growth, supported by strong world prices.

Strong growth projections for global prices of key Canadian seafood exports support substantial gains in export value in the medium term, exceeding $8B in 2027 (Figure 7).

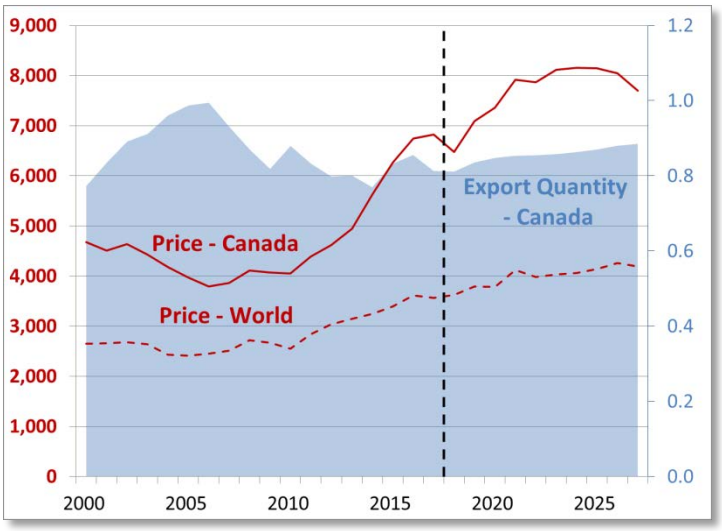
- After remaining near $4B from 2000 to 2014, export value increased to over $6B in 2016 and 2017. This was mainly a result of high prices for lobster and crab, but higher harvest volumes for both species also played a role.
- Lobster will continue to dominate Canadian fishery export value through 2027. Values for both lobster and crab are expected to remain high given strong demand and few substitutes, although recent declines in harvest of crab to more historical levels will limit gains.
- Salmon export values will remain relatively stable in the medium term despite small increases in production.

Figure 7: Canadian Exports by Species Group ($CAD Billions)



Source: Statistics Canada, SEASIM projections

Figure 8: Canada and World Fish Export Price ($CAD per Tonne) and Quantity (Million Tonnes)



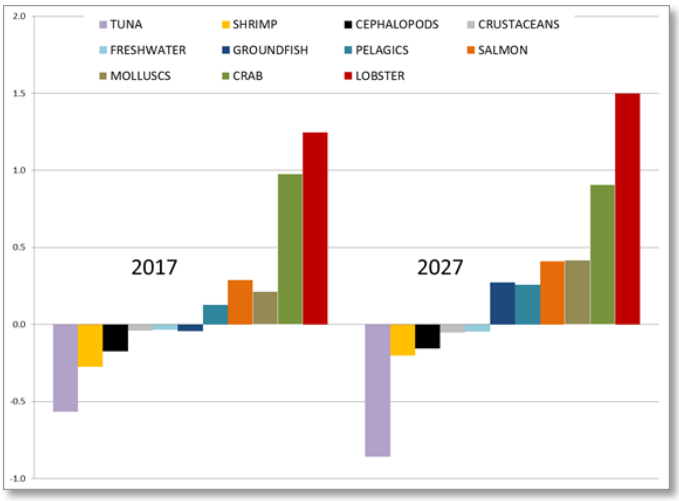
Source: FAO FISH model, Statistics Canada, SEASIM projections

Canada's fishery value is concentrated in capture fisheries, where output volumes change little and prices rather than volume drive major changes in the value of exports. Furthermore, Canada's species mix has a high proportion of the highest-valued species in global trade.

- The trade-weighted prices for Canadian seafood exports are expected to grow more rapidly than the corresponding world price (Figure 8), reflecting the faster price growth in key export products (i.e. lobster and crab).
- The quantity of seafood exports from Canada is expected to grow only slightly (9%) by 2027, mainly from aquaculture.

Under the *Outlook* assumptions which do not include domestic policy changes regarding aquaculture, Canada will remain a minor player in global aquaculture production. Nonetheless, the market environment will support an expansion of Canadian aquaculture production from about 200 thousand tonnes in 2017 to almost 300 thousand tonnes annually for all cultured species combined.

Figure 9: Canada's Net Trade by Species Group (Billions $CAD)



Source: Statistics Canada, SEASIM projections

Canada is projected to maintain a strong export balance for most product groups in the medium term (Figure 9). Canada's overall net export value for seafood is projected to increase by more than 40% between 2017 and 2027.

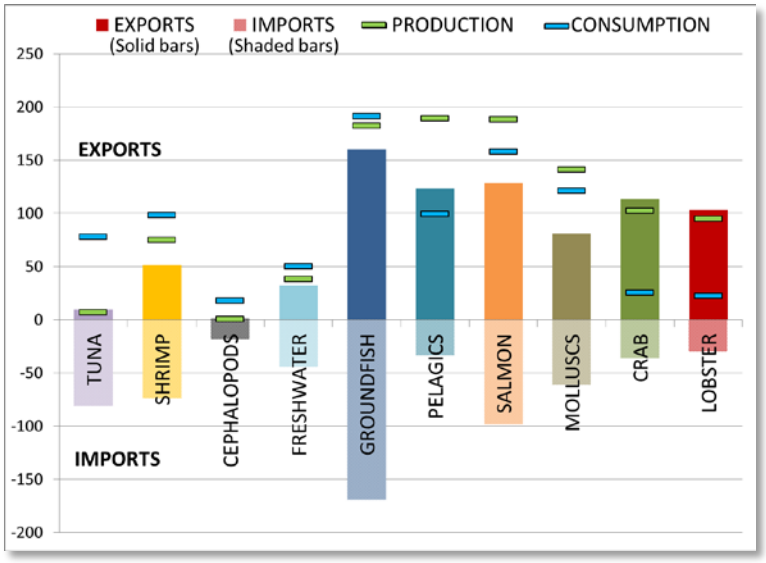
- Lobster and crab contribute the most to Canada's positive trade balance for seafood.
- Net exports of a number of products will increase between 2017 and 2027.
- Canada produces little tuna, but imports significant amounts. Increasing prices will lead to a greater trade deficit for tuna.

Canada's domestic market could be further developed.

Examining imports and exports separately could provide some insight into areas of demand in the domestic market where opportunities might exist for Canada's own producers. Canada is both an importer and exporter of products within every species group, although the products may be quite different (Figure 10).

- Shrimp consumption exceeds production, but imports are substantial. In 2017, over 80% of exports were cold water shrimp, while about 70% of imports were warm water shrimp where much of the production is cultured. Canada produces cold water shrimp (*Pandalus borealis*), but imports warm water shrimp from Thailand, Vietnam, India and China.
- Tuna consumption in Canada is fulfilled almost exclusively by imports, as production is small.

Figure 10: Canada's Fish and Seafood Production, Exports, Imports, and Consumption in 2017 (Thousand Tonnes Live Weight)



Source: Statistics Canada, DFO

- Salmon consumed in Canada is of both domestic and imported origin. Canada exports the majority of its salmon to the U.S., while the U.S. remains Canada's primary source of salmon imports ($410.5M in 2016), with smaller amounts coming from Chile ($90.6M) and Norway ($34.2M).
- Tilapia, an important aquaculture species globally, has gained popularity in recent years as a relatively inexpensive source of protein.
- Lobster and crab production far exceed consumption and most is exported, likely due in part to seasonal harvest and high prices abroad.

On average, Canadians consistently spend approximately 2.5% of household home food expenditures on fish and seafood annually.[10] In 2016, average annual household expenditure on all fish and seafood products was $203. In contrast, households spent $1,163 on meat products (both processed and unprocessed). However, the numbers are closer when meat products are broken down to unprocessed products that exclude bacon, sausage, and deli-style meats: $316 on beef, $263 on poultry, and $110 on pork.

The majority of Canadian households' expenditures on seafood go towards salmon and shrimp, products that are largely sourced from aquaculture.

- Annual household expenditure is highest for salmon, averaging $45 for fresh/frozen product and $5 for canned product in 2016.
- Households spend the second most annually on shrimp and prawns, averaging $42 in 2016.

A number of other products are commonly purchased and consumed by households in Canada each year, most of which are produced amply in Canada's wild fisheries.

- Cod, flounder, sole and haddock ($19 in 2016), lobster ($10), and crab ($7).
- Canned tuna ($17 in 2016) is the product for which consumption in Canada exceeds production by the greatest amount. Tuna imports are significant in both volume and value.

Given Canada's significant production of seafood there may be opportunities to expand domestic consumption.

- Understanding consumer preferences for seafood is important for expanding the domestic market. For much of the past 20 years Canada's per capita consumption of seafood has exceeded that of the EU and U.S.; recently this appears to have changed and the projections suggest Canada's per capita consumption will continue to trail that of many countries.
- Canada has continued to address international barriers to trade through a number of trade agreements. Expanding domestic trade in seafood may require consideration of possible interprovincial trade barriers.
- Rising international prices for many of the products Canada harvests are an incentive to export instead of developing a domestic market; however, access to a greater domestic market could provide more stability to the industry in times of currency fluctuations, fuel price fluctuations, etc. Investment in products tailored to a Canadian market could generate benefits for both industry and consumers.

Important considerations for Canadian fish and seafood trade

Trade diversification

Access to export markets is of great importance to the Canadian seafood sector, with exports equivalent to about 80% of landed quantity in recent years. Trade agreements help industry to access the highest value markets for their products. However, there has been little harmonized movement in fish and seafood tariffs through the World Trade Organization (WTO) since conclusion of the Uruguay Round (1994). As a result, many countries of the world have moved ahead to create bilateral and multilateral trade agreements under which tariffs are much lower than harmonized rates.

- Tariff reductions are one important aspect of trade agreements, but agreements on product standards and processes in value chains can also remove significant non-tariff barriers.
- The negotiation of trade agreements also opens channels of communication and facilitates the building of business relationships.

Canada has been very active in pursuing new trade agreements, and the recent negotiation of a successor to the North American Free Trade Agreement (the U.S.-Mexico-Canada Agreement) has highlighted the risks that come along with the benefits of having convenient access to a single large trade partner. To diversify Canada's trade portfolio, several important agreements have recently been put into place and others are in development.

- Since the EU is the world's largest importer of fish and seafood products, the Canada-European Union Comprehensive Economic and Trade Agreement (CETA) could give Canada a competitive advantage. In 2017, Canada ranked 15th in the EU's reported seafood imports. This represented a drop from the 10th place held in 2015, as the value of Canada's exports to the EU declined by 11% in 2016 and 3% in 2017. This coincided with a decline of 53% in Canada's total shrimp exports following a decline in harvest, and shrimp is an important export to the EU (especially to the U.K.). With CETA in place, additional products may get a favourable reception in the EU, restoring some of that lost trade.
- Exports to South Korea have grown steadily since the 2015 coming into force of the Canada-Korea Free Trade Agreement (CKFTA). Although exports to South Korea began to increase during the negotiations, there was an 80% increase in exports in the first year of the agreement. In 2017, lobster represented 81% of Canada's export value to South Korea.
- Once in force, the new Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) could help deepen Canada's trade ties in the dynamic and fast-growing Asia-Pacific region while strengthening existing economic partnerships with some of Canada's current free trade partners across the Americas. Driven by exports to Vietnam and Japan, Canadian exports to the CPTPP countries have expanded further in 2017, with a faster growth rate than 2016.
- By enhancing market access and the profile for Canadian fish and seafood products, a trade agreement with the Mercosur trade bloc (Argentina, Brazil, Paraguay, and Uruguay) could present commercial opportunities for Canadian companies in the fisheries sector. Although Canada currently accounts for less than 1% of imports in these countries, strong growth in imports is expected for Brazil, presenting new opportunities.

Looming challenges for Canada

Brexit

The implementation of Brexit also brings some economic uncertainties to the Canadian fish and seafood industry, as the United Kingdom (U.K.) is an important market for a number of Canadian products such as shrimp, live lobster, and cod. In 2017, the U.K. imported approximately $180 million CAD of fish and seafood from Canada, more than half of which was prepared/preserved shrimp. Two years after the vote to leave the EU, the U.K. has yet to establish a clear vision of its future trade relationships with the world.

In the short run the U.K. will remain associated with the EU for a transition period of 21 months starting at the April 2019 exit date. Furthermore, it has signalled an intention to pursue its own bilateral and multilateral agreements as a longer-term strategy. Although the U.K. is a member of the WTO in its own right, it will need to establish its own schedules of commitments and concessions and obtain the agreement of all other WTO members on these schedules. This must be completed before other agreements can be pursued.

Both legal and political uncertainties remain regarding Brexit, and its implications for trade partners like Canada cannot yet be determined.

Non-tariff barriers to trade

Some countries have proposed non-tariff trade barriers that could affect Canada's fishing industry, most of which are associated with conservation, ecosystem protection, and social concerns.

A particularly significant example has been initiated by the U.S. under its Marine Mammal Protection Act (MMPA). The U.S. has published a list of foreign fisheries from which imports to the U.S. would be restricted unless the harvesting nation applies for, and receives, a finding of comparability to show that the fishery maintains the equivalent conservation standards for marine mammals as U.S. fisheries. Canada has over 200 fisheries on this list including marine aquaculture. The deadline for compliance is January 1, 2022. The U.S. has demonstrated a willingness to work collaboratively and provide technical assistance and it is likely that Canada can meet the requirements of the U.S. MMPA; however, the means by which this will be achieved and the associated impacts to the Canadian fishery sector are not yet clear.

In another recent (2016) example, Sweden petitioned the EU to ban the import of live American lobster, citing its potential as an invasive species in Europe. The issue was resolved scientifically and no import ban was instituted, but a greater awareness of ecosystem issues is affecting many countries as they try to institute the UN Sustainable Development Goals and their own domestic conservation policies. Similar issues are likely to arise in the future.

More market drivers for Canadian fish and seafood

Consumer preferences for healthy and sustainably-sourced products

Increasingly, consumers around the world wish to know that the fish they are buying are healthy and free of contamination, and that the ecosystems in which the fish are produced are not being harmed. Canada's fish and seafood is largely seen by the world as a healthy choice from clean, pristine waters. But seafood follows a long and complex supply chain, which presents the opportunity for both intentional fraudulent or accidentally mistaken labelling. Furthermore, consumers now have access to information and platforms that provide the consumer the ability to be more outspoken than ever on the ethical and environmental impact of goods and services. Therefore, competing successfully in this market environment requires additional investment in infrastructure to maintain a successful brand:

- Priority must be given to building more transparency into the supply chain through full traceability procedures, catch documentation, and improved access to information for consumers.
- Buyers, retailers, and consumers are now navigating an increasing number of seafood eco-labelling, certification and consumer guidelines for sustainable seafood purchasing. These systems can require a very detailed (and therefore costly) level of documentation. For example:
    - Fish and seafood products displaying the Marine Stewardship Council (MSC) and Aquaculture Stewardship Council (ASC) labels have passed an extensive science-based set of requirements to ensure they have been caught or farmed sustainably. Initial MSC certification can take more than a year and cost over $100,000 depending on the fishery, and require annual audits and re-certification every five years.[11]
    - Organizations such as Oceana are urging the Canadian Food Inspection Agency (CFIA) to include the product's scientific name, production method, the catch area and type of fishing gear used as part of its labelling modernization initiative.
- As global social consciousness rises, so do certification requirements for businesses wishing to access certain markets. Sustainability and traceability have become important issues for many consumers in important seafood import markets, and there is now a growing awareness of human conditions in the fishery. Although Canada will have no issue complying with these requirements, they could still present additional levels of administrative cost in order to maintain access to existing markets.

A world of innovative products and supply chains: Diversifying markets

The greatest growth in demand is occurring in markets where Canada now conducts relatively little trade. New trade agreements can help industry penetrate a market, but tariffs are generally a smaller obstacle than the costs of understanding preferences in the new market, forging business relationships, and overcoming supply chain logistics.

In some cases importers from growing markets are coming to Canada, recognizing it as a desirable seafood source, providing critical infrastructure, and facilitating business relationships.

- Gfresh is a private online seafood company headquartered in China that provides a convenient interface for seafood suppliers in Canada, the U.S., Europe, Australia, and New Zealand to sell in the Chinese market.[12] In 2016, Gfresh signed a groundbreaking agreement with the China Certification and Inspection Group Canada (CCIC) to inspect and pre-clear Canadian seafood for import to China.[13] In this way, Gfresh facilitates the passage through Chinese customs of important Canadian exports such as Dungeness crab, geoduck, and lobster. At the other end, Gfresh provides buyers in China a central market where they can obtain high quality seafood imports quickly and conveniently.
- Chinese online giant JD.com is looking to develop a drone network in Canada to transport fish and seafood from east coast processing plants to the airport, cutting logistics costs by as much as 50-70% and significantly reducing transport time to preserve freshness.[14] The plan is still in its early stages and tests must be carried out to apply for operational licenses, but the appearance of this initiative signifies the strength of demand for Canadian seafood in China, and the kinds of investment that can be supported.
- Canadian seafood products have already done remarkably well in the Chinese market through online channels. Last year JD.com broke the record for the most live lobsters sold in a single day (140,000).[15] Another of China's large online retailers, Alibaba, heralded Nova Scotia based company Clearwater for their success in a lobster promotion, where they sold 90,000 lobsters in a single day.[16]

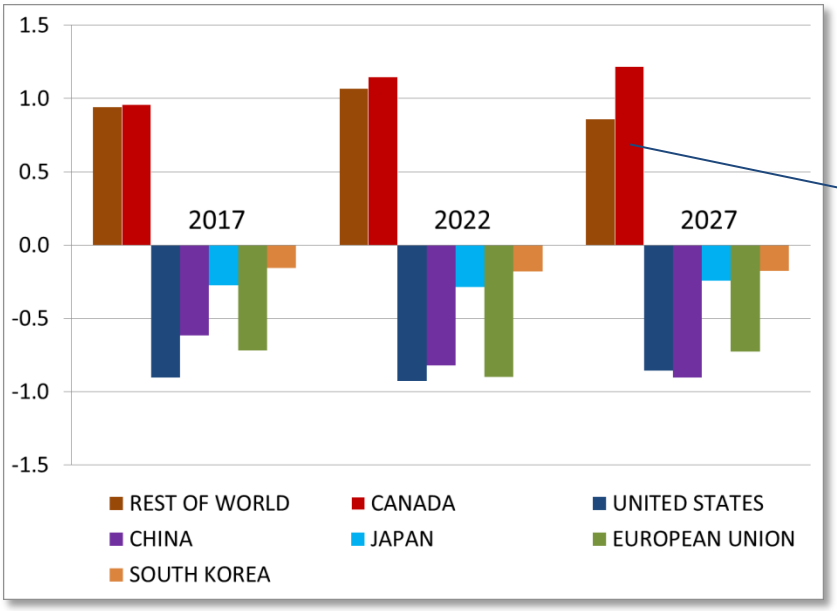
Other markets are beginning to emerge, and could potentially provide excellent returns to early investors, especially for innovative products and packaging that are tailored to these markets.

- Expansion in demand is expected to occur in India, Africa, Latin America, and other Asian countries. These markets are not currently major fish and seafood trade partners for Canada, but could present significant commercial opportunities for Canadian companies in the fisheries sector.
- Huge markets like India are currently limited by cold storage infrastructure for traditional fresh/frozen products. According to the Mintel Market Intelligence Agency, however, India is one of the fastest growing retail markets for processed fish and seafood, growing at a compound annual rate of almost 25% between 2011 and 2015.[17] Some of this growth has occurred in shelf-stable product, but there has also been a concerted effort to close gaps in the national cold-chain, through both government and foreign-direct investment.

Spotlight on Key Products and Markets

Outlook for Canadian Lobster Remains Strong

Figure 11: Canada will continue to be the single largest net exporting country of lobster ($USD billions)



The value of Canada's lobster exports is higher than those of Australia, New Zealand, South/Central America and the Caribbean combined.

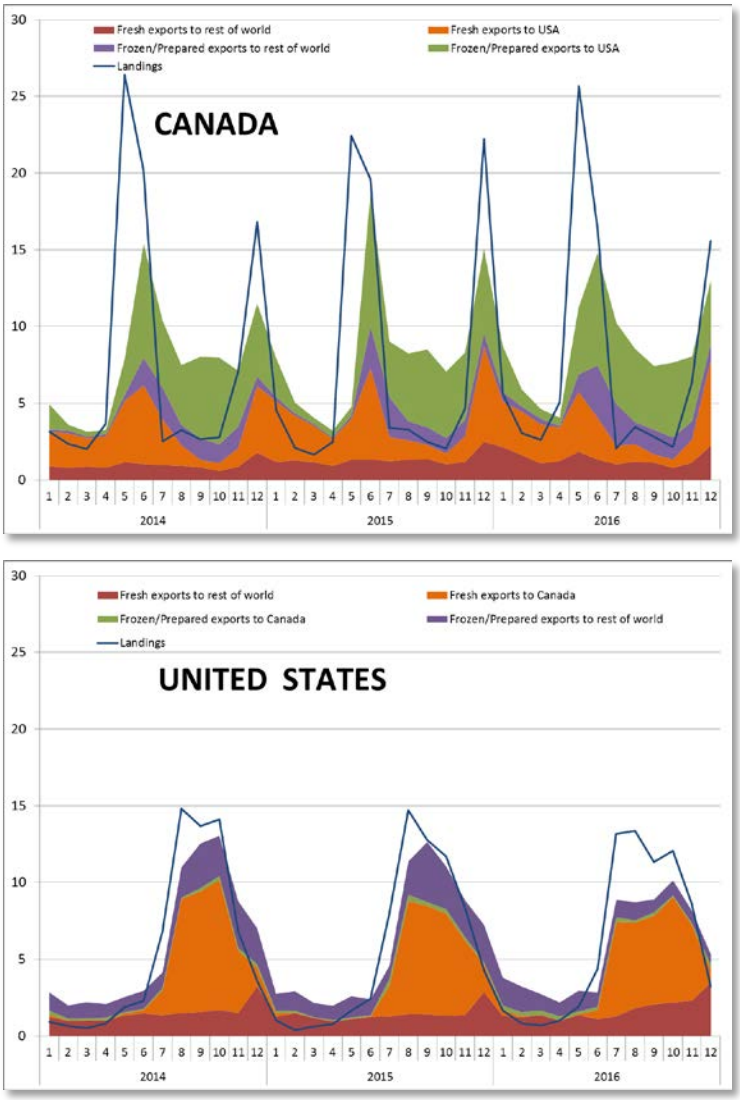
Source: Global Trade Atlas, Statistics Canada, SEASIM projections

American lobster (*Homarus* species) from Canada will continue to increase its share in markets now dominated by other lobster species. Rock lobster and spiny lobster of the genera *Palinurus*, *Panulirus*, and *Jasus* are currently the dominant species in Asian markets, and are the closest substitutes for *Homarus*.

- Rock lobster from Australia and New Zealand is mainly traded non-frozen into large and/or affluent markets in Asia (China, Hong Kong, Singapore, Malaysia, Japan, and United Arab Emirates) at a very high price. However, the sustained high price of rock lobster has made the Asian market enthusiastic for a cheaper substitute and imports of American lobster from Canada and the U.S. are getting a favourable response.
- China is the main importer of both American lobster (after the U.S.) and rock lobster. In the last five years, China's import price for rock lobster rose from about $45 CAD per kg to over $70 CAD per kg and imports declined from 9,000t to 8,000t. In contrast, the import price for American lobster went from $19 CAD to $25 CAD, and imports of American lobster have risen from 4,000t to 15,000t, split almost equally between Canada and the U.S.
- While the price of lobster from Canada in China remains significantly below that of rock lobster, it has become economical for exporters to charter flights to carry live product to Asia from Atlantic Canada.

Of the large destination markets, the projections show the decline in net import values for the EU and U.S., and growing net import value for China (Figure 11). The combination of increased quantity and rising price yields an increase greater than 45% in net import value for China, making it the largest net importer by 2027. The projections indicate a decline in imports by the EU, Japan and the rest of the world, while exports increase from the U.S. and decline for the rest of the world.

Figure 12: The interdependence of the Canadian and U.S. lobster industries will play a role in shaping any potential shifts in Canada's lobster trade patterns (million tonnes live weight)

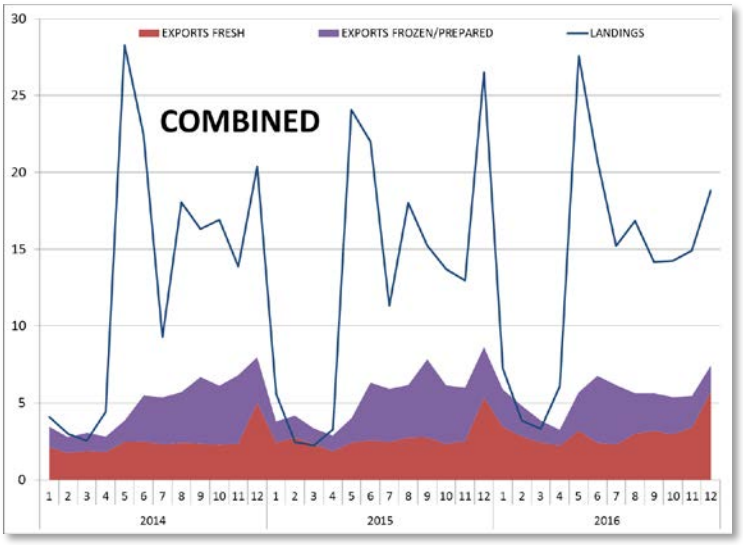


- The lobster sectors in the U.S. and Canada provide an excellent example of integrated trade, with a supply chain sourcing on both sides of the border (Figure 12). For American lobster, Canada and the U.S. are the largest trade partner for each other.

- The landing patterns of the two countries are complementary (blue lines at left). Peak landings in Canada occur in May, June, and December while in the U.S. peak harvesting occurs in July to October.

- Each country ships fresh lobster to the other (orange fill) during peak landings, when the other country's harvest is low. Both countries also export fresh lobster abroad (red fill), with peak exports occurring at holiday seasons near the New Year.

- Both countries process frozen and prepared lobster. This is traded between the two countries (green fill) though flow is much greater from Canada to the U.S. Canada and the U.S. also export frozen and prepared lobster to other countries, with exports from the U.S. greater than those from Canada (purple fill).



- Considering the two countries combined, only a small proportion of American lobster is exported outside the U.S. and Canada (red and purple fill).
- Domestic consumption is substantial in both countries (on average, about 11,000t per month in the U.S. and 2,000t per month in Canada).

Source: U.S. NOAA, DFO, Statistics Canada, Global Trade Atlas

U.S. total lobster consumption dwarfs that of any other country, being twice as high as that of the EU (the next largest consumer).

- The U.S. consumes about twice its annual production.
- Projections suggest modest reductions in domestic consumption in Canada and the U.S. as prices increase with increased global demand and more lobster is exported.

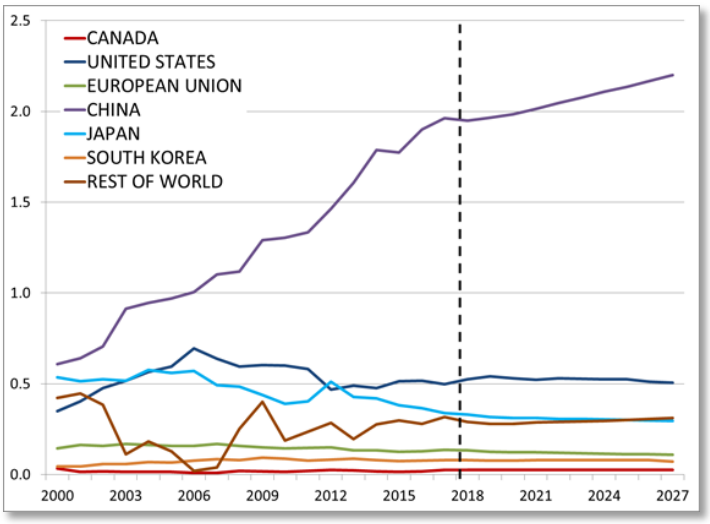
Preferences for fresh product in Asia (indicated by current import prices) suggest it would likely be advantageous for industry to maintain and build upon integration of the cross-border supply chain, in order to best serve the Asian and/or other emerging markets. Alternative strategies may be more costly for industry on both sides of the border.

Concerns have been expressed by some members of the industry in the U.S. that CETA could afford a competitive advantage to the Canadian industry. However, the integration of the supply chain suggests that the benefits of less restricted trade might actually be shared among the two countries.

Lobster is one of the few product categories where China is projected to maintain a trade deficit in the medium term. While import quantities are anticipated to increase, import value will increase more rapidly as the lack of aquaculture capacity constrains global production in the face of growing demand.

Price Increases Support Canadian Snow Crab Export Value

Figure 13: China continues to dominate global crab consumption (million tonnes)



Source: FAO, SEASIM projections

Growth in global crab consumption has been, and will continue to be, a result of increased consumption in China (Figure 13).

- Crab consumption is expected to remain relatively constant in Canada, Korea, and the EU in the forecast period, with expected decreases in the U.S. and Japan.
- China's crab consumption is projected to increase 12% by 2027. China has a well-established mitten crab aquaculture sector, which is primarily consumed domestically. Changing demographics, environmental and health concerns may hinder continued growth in China's crab aquaculture production.

Increased disposable income in China increased demand for premium imported products. Between 2013 and 2017, Chinese crab imports increased by 18% per year.

- Canada is China's largest supplier of crab, accounting for 26% of the value of their crab imports in 2017, followed by Russia (16%) and the U.S. (15%). Between 2013 and 2017, the value of Canadian crab exports to China increased by 15% annually.

Snow crab (*Chionoecetes opilio*) is the crab species predominantly harvested in Canada, accounting for over two thirds of Canada's crab exports in 2017 by value. Canada is the world's largest producer of snow crab, followed by the U.S. and Russia.

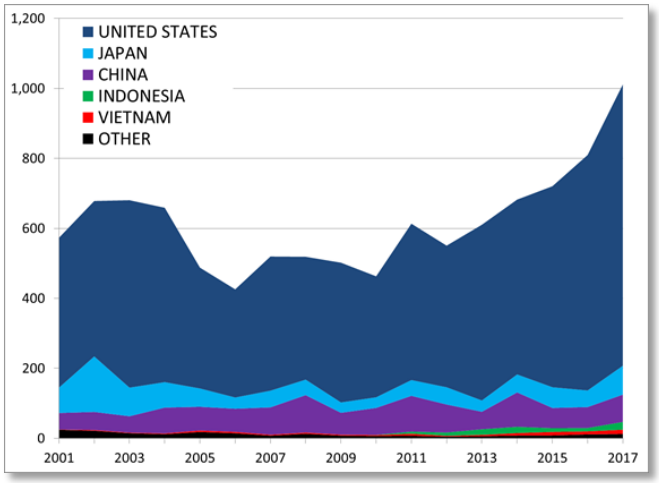
- Canada's largest export markets for snow crab are the U.S., China, and Japan, with 2017 exports to these three markets accounting for 95% of Canada's snow crab export value (Figure 14).
- The quantity of snow crab exports to the U.S. faced a slight downward trend in the last five years, but Canadian snow crab has become increasingly valuable in the U.S. market. Export prices have nearly doubled between 2013 and 2017, driving annual increases in export value of 12%.

In 2017, snow crab exports to Japan increased 74% in value and 46% in quantity. Canada is also capturing a greater segment of other Asian markets, with snow crab exports increasing by both value and quantity to China, Indonesia, and Vietnam. Snow crab is commanding historically high export prices, signalling the willingness of consumers in these markets to pay for a premium product.

- The CPTPP will present opportunities for Canadian exporters with snow crab once the agreement is in force. Between 2013 and 2017, an estimated $5.75 million in annual tariffs was paid on snow crab imported from Canada into Japan and Vietnam, signatories of the CPTPP.

- Snow crab prices have risen significantly in recent years in the face of constrained supply and strong international demand. In Canada, harvest has been limited by natural factors such as ice delays and bad weather, as well as conservation measures for crab and endangered North Atlantic right whales.
- Weak landings and strong Japanese buying have driven prices to historic highs in 2017. For the first time in many years, snow crab commanded a higher price than Dungeness crab.

Figure 14: Canadian snow crab export value ($CAD millions)



Source: Statistics Canada

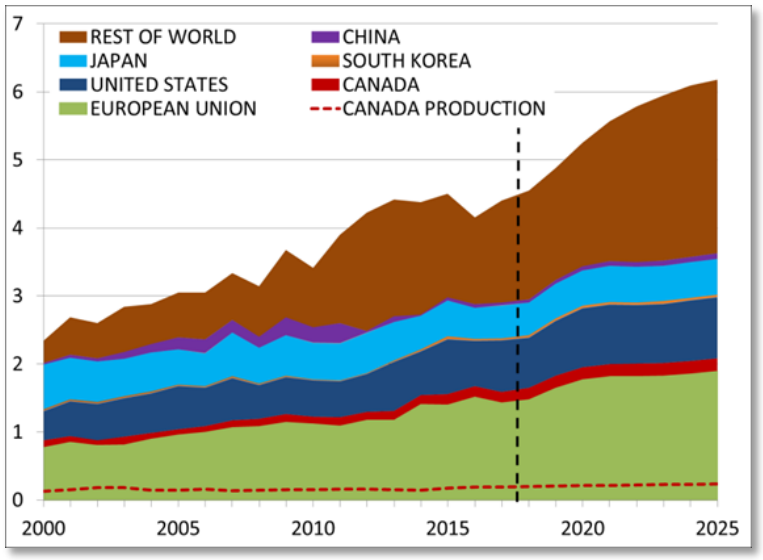
- With high prices in 2017, retail promotions of crab decreased by 36% from 2016 levels, and retail demand began to shift from crab to shrimp. In most of 2017, the number of lobster promotions in retail exceeded the number of crab promotions.[18]
- Canada's Gulf of St. Lawrence snow crab fishery had its Marine Stewardship Council (MSC) sustainability certification suspended following the deaths of North Atlantic right whales attributable to snow crab fishing gear in 2017. This is likely to have the greatest impact at the retail level, as buyers prefer larger crab from the Gulf region. Some chains may try to procure from other sources, or substitute away from snow crab. This is not expected to affect sales to Japan or China.
- The U.S. has the second largest snow crab fishery in the world; capturing both the *bairdi* and the *opilio* species in the North Pacific region and the Bering Sea. Despite increased landings in the Gulf of Alaska region, overall U.S. supply declined by 10% in 2017.
- A 2017 survey found that there are some positive signs of recruitment in both Alaska and Newfoundland, and that populations may rebound in the next few years.
- A relatively new discovery, the *opilio* population in the Barents Sea represents considerable commercial potential for both Russia and Norway. Commercial harvesting of crab in the region is gradually growing and once extensively developed the Barents Sea crab fishery could compete with Canadian snow crab. It was announced that in 2019, Russia's snow crab quota may double from 9,800 to 20,000 tonnes.[19]

- Growth in Canadian fish and seafood export volume will be largely dependent on growth of aquaculture in the medium term as supply from wild fisheries is limited by natural factors.
- Canada's production of cultured fish and seafood other than salmon and molluscs has shown little growth since 2000, and in 2017 Canada produced less than 1% of the world's aquaculture output.
- Molluscs contribute about 20% of Canadian aquaculture production by quantity and about 10% of value while freshwater species are 5% of quantity and less than 1% of value. The remainder of Canada's aquaculture is salmonid species (75% of quantity, 90% of value).
- Looking forward, projections for moderate growth in Canadian aquaculture (29% to 2027), in particular salmon, suggest this growth could be limited by technological constraints and feed costs. However, other factors that are not specifically in the model could result in alternative trajectories for aquaculture production in Canada.

Growth in Canadian salmon aquaculture will continue in response to strong world demand.

Increased production efficiency for salmon culture has lowered costs and allowed prices to fall fueling growing consumption.

Figure 15: World demand for salmon and Canadian total production (million tonnes)

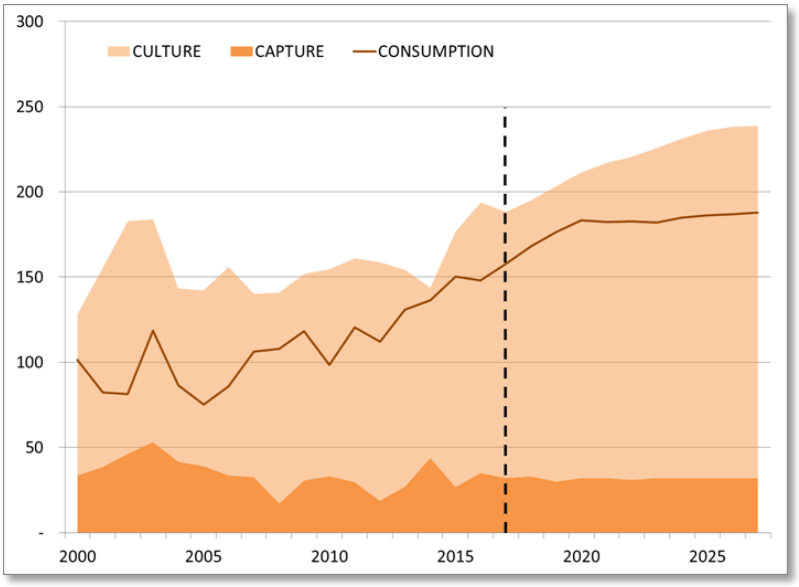


Source: FAO, SEASIM projections

- World consumption of salmon is projected to increase by 40%, or almost 2 million tonnes, by 2027 (Figure 15). Most of the growth will occur in the rest of the world and in the European Union.
- While Canada will remain a small producer on the world stage, sector growth will continue, supported by strong world demand.

Culture production of salmon in Canada followed a slightly slower growth trajectory than global production in the previous decade (45% vs 55%), a trend which is projected to continue. Canada's production of cultured salmon is expected to remain at about 4% of global production.

Figure 16: Canadian salmon production will grow faster than consumption (thousand tonnes)



Source: DFO, SEASIM projections

- Recent strong growth in consumption of salmon in Canada is projected to level off, while aquaculture production continues to grow (Figure 16).
- In Canada about 83% of salmon production is from aquaculture. With culture production projected to increase by 32% the share is expected to grow to 87% of salmon production.

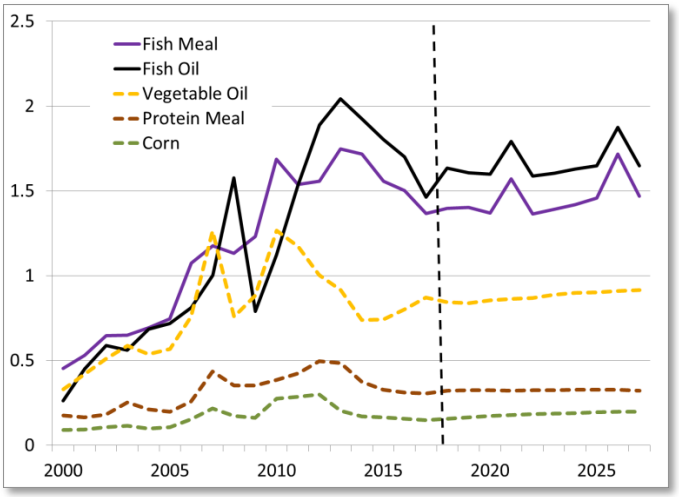
- In the past decade Canada's positive trade balance for salmon shrank as exports were stable while imports increased to address growing domestic consumption.
- Salmon aquaculture occurs on both coasts, although the majority of production occurs off the west coast. Canada primarily farms Atlantic salmon, although small volumes of Pacific salmon are farmed in British Columbia. While Atlantic salmon is the dominate species farmed in Norway and Chile, there has been rapid growth in Chilean farmed Pacific salmon that does not appear to be matched in Canada. Other salmonid species are also cultured.

Without action, the forecast is for Canadian production to grow more slowly than global salmon culture and for continued dependence on exports to the U.S., where Canadian whole fish export can put short-term downward pressure on price. Positioning to take advantage of production efficiencies and potential opportunities in global markets could modify this forecast.

- The world's two largest producers, Norway and Chile, are currently facing constraints on expansion of production (space constraints, mortality resulting from high density production, environmental concerns), slowing their output growth.
- Norwegian companies continue to lead the exploration of technological alternatives to sheltered (i.e. in fiords) open-net pen salmon aquaculture including land-based facilities and high-seas net-pen operations.
- It may be particularly timely for Canada to resolve constraints (including regulatory uncertainty) to address both domestic and international demand for high quality product.

High feed costs make bivalve culture attractive.

Figure 17: World prices of major animal feeds ($USD/kg)



Source: FAO FISH model, AAFC model, SEASIM projections

- Fish-based feed prices have been pushed higher in the past decade (Figure 17), due to biological constraints on harvest levels for species used for fish meal and fish oil, and the rapid expansion of feed-intensive aquaculture of species such as salmon and shrimp. Prices are expected to stay at these higher levels.
- Prices for plant-based feeds have fallen from historical highs, yet nominal prices are expected to remain at levels higher than in the decade prior to 2007 due to sustained global agricultural demand.

High and volatile fish-based feed prices highlight the continued need to diversify the type of feed used in aquaculture and to diversify the species cultured.

- Cost considerations have increased the use of terrestrial feed sources in aquaculture feed formulations, creating competition with livestock production and human uses. Using feeds that differ from that of terrestrial farming and that are not consumed directly by humans allows substitution when supply and price dictates.
- For some species there are constraints on near-term substitution possibilities in feed formulations, with minimum requirements for fish-based feeds.
- Expanding the culture of species with no feed requirements, such as bivalves, or to species with lower feed requirements, such as some freshwater species, may provide opportunities.

Demand for bivalves in Canada and abroad continues to be strong. New consumers have been attracted to this species group by scientific reports suggesting human health benefits from bivalve consumption, and by their eco-friendly image among species coming from aquaculture.

- While globally more than 80% of molluscs are produced by aquaculture, in Canada only about 30% of production is from culture.
- Shellfish aquaculture in Canada is dominated by mussels and oysters, species with limited wild capture production. Oyster production is split almost equally between the east and west coasts, while PEI produces the majority of cultured mussels.

Most of the bivalve production does not enter international trade, but some species travel long distances to reach their customers. Exports are mainly high value live, fresh, chilled products, with minimal processing.

- The U.S. accounts for over 90% of Canada's oyster and mussel export value.

- For molluscs, overall trade has diversified somewhat with about 45% of volume exported to the U.S. down from about 60% in 2000; exports to China are minimal.

Challenges exist: for example, several shellfish aquaculture operations on the east and west coasts are afflicted by Aquatic Invasive Species (e.g. green crab, clubbed tunicate, vase tunicate) which affect growth and meat yield and cause increased maintenance and labour costs.

Future Challenges

While aquaculture is increasingly important to the world's food supply, Canada's aquaculture industry continues to face a number of challenges.

- Although Canada may seem well-suited for aquaculture production in terms of natural resources, a number of barriers have been identified as impediments to the growth of the sector including access to space for new production sites, negative public perception of the finfish industry, complexity of the federal regulatory framework, and the need for changes in the delivery of the Canadian Shellfish Sanitation Program.
- Many efforts are underway to resolve the sector's struggles, but the evolution of any major "breakthrough" is not currently clear.

Endnotes

[1] The FAO model is a global model disaggregated by country, but consists of three products: an aggregate of fish, plus fish meal and fish oil. The model is identified as "FAO FISH model" when sources are listed.

[2] Identified as "AAFC model" when sources are listed.

[3] Identified as "FAO" when sources are listed.

[4] Agriculture and Agri-Food Canada (2018) *Medium Term Outlook for Canadian Agriculture 2018 – International and Domestic Markets*. Available from: http://www.agr.gc.ca/eng/about-us/publications/economic-publications/

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[10] Statistics Canada Table 11-10-0125-01, Detailed food spending, Canada, regions and provinces.

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