

# 8 Fish

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This chapter describes recent market developments and highlights the medium-term projections for world fish markets for the period 2021-30. Price, production, consumption and trade developments for fish from catch and aquaculture are discussed. The chapter concludes with a discussion of important risks and uncertainties that might affect world fish markets over the next ten marketing years.

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## 8.1. Market situation

Fish<sup>1</sup> production, trade, and consumption all contracted in 2020. However, trends differed across species and products. The slight decline in production was driven by lower aquaculture output while capture fisheries remained largely unchanged. Disruption in some key producing countries was especially important for trade in 2020. In particular, the contraction was strong over the first half of 2020 when the strict lockdown in the People's Republic of China (hereafter "China"), the top fish producer and exporter, negatively affected its fish production. COVID-19 also disrupted Chinese processing of imported fish for re-export, which impacted global fish trade and markets.

According to the FAO Fish Price Index<sup>2</sup>, international fish prices were 7% lower on average in 2020 compared to 2019. The impact of COVID-19 in 2020 on the hotel, restaurant and catering (HORECA) sector was significant as fish are often consumed outside the home. Lower demand from out-of-home food services contributed to lower prices, particularly for high-value species. Overall, per capita fish intake declined by about 0.5 kg in 2020 to 20.2 kg.

## 8.2. Projection highlights

Nominal fish prices will increase at a rate between 0.8% and 1.6% p.a. over the 2021-2030 period, with a stronger increase in 2022 when the negative effects of COVID-19 on markets are expected to end. In real terms, all fish prices are projected to decline over the 2021-2030 period; aquaculture by 0.3% p.a., capture by 1.1% p.a., traded fish by 0.9% p.a., fishmeal by 0.6% p.a., and fish oil by 0.4%.

World fish production is projected to grow at 1.2% p.a. during the outlook period, a relative slowdown compared to the 2.1% p.a. growth of the previous decade. Production is expected to reach 201 Mt, an overall increase of 23 Mt (+12.8%) from the base period (2018-2020 average) to 2030. Most of the growth will be in developing countries and in particular in Asia. Aquaculture production is expected to continue increasing over the outlook period (+23% by 2030 at + 2.0% p.a.), but at a slower rate than observed over the previous decade (+4.0% p.a.). Lower growth rates are the consequence of a higher initial value and the impact of policy changes in China affecting production. These changes are focused on environmental protection and diversification of production, including efforts to target species preferred by Chinese consumers. By 2030, global aquaculture production is projected to reach 103 Mt, 6 Mt more than the capture sector.

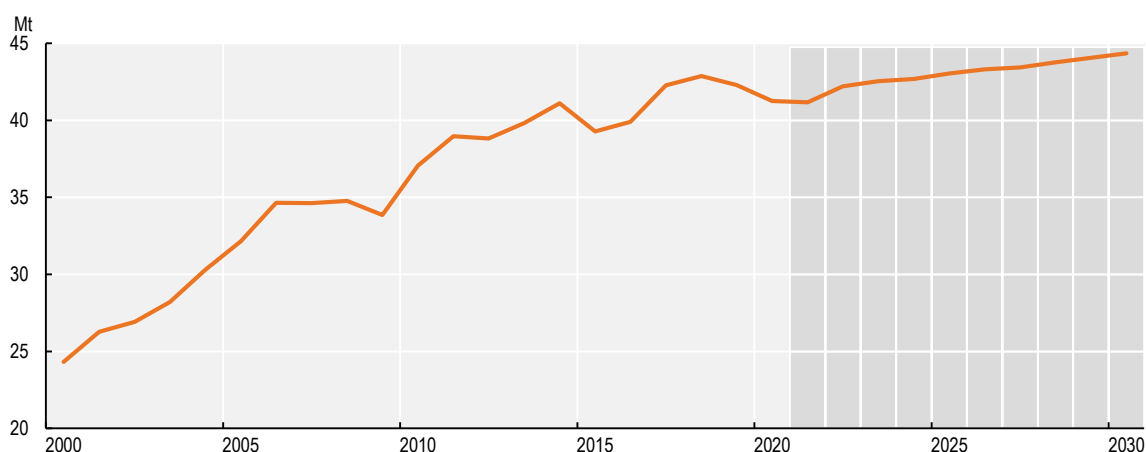
Despite the increasing prominence of aquaculture in total fish supply (52% in 2030 vs 47% in the base period), the capture fisheries sector is expected to remain dominant for a number of species, and vital for domestic and international food security. Capture fisheries production should experience modest growth (+3.6% by 2030), with some fluctuations in *El Niño* years (2022 and 2027), which will also negatively affect production of fishmeal and fish oil. In 2030, world production of fishmeal is projected to reach 5.8 Mt, increasing 0.9% p.a. relative to the average 2018-2020 level, while fish oil production should grow by 0.8% p.a. and reach 1.2 Mt during the same period. A higher proportion of fishmeal and fish oil obtained from fish waste is expected to drive most of the growth in production. By 2030, approximately 29% of fishmeal and 42% of fish oil will be obtained from fish waste compared with 27% and 38% respectively in the base period.

The majority of fish production is projected to be consumed as food (181 Mt in 2030), with only 10% going to non-food uses (mainly fishmeal and fish oil). About 72% of the food fish will be consumed in Asian countries. In 2030, aquaculture is expected to provide 57% of the fish destined to human consumption, compared with 53% in the base period. Global food fish consumption is projected to increase by 1.3% p.a., a substantial decline relative to the 2.3% p.a. growth rate witnessed over the previous decade. This decline reflects the slowdown in demand caused by lower incomes at the beginning of the decade, reduced population growth, and lower world meat prices, in particular poultry. World apparent<sup>3</sup> food fish

consumption is projected to reach 21.2 kg per capita in 2030, up from 20.5 kg per capita in the base period. Per capita fish consumption will increase in Asia, Europe, and the Americas, while it will remain stable in Oceania and decrease in Africa, the continent with the fastest growing population which will outpace growth in its food fish supply.

Food fish and non-food fish products will continue to be highly traded, with about 35% of total fish production (31% excluding intra-EU trade) expected to be exported in 2030, a slight decline relative to the 37% of the base period (32% excluding intra-EU trade). After contracting in 2019 (-1.4%) and 2020 (-2.5%), world trade of food fish is projected to increase once again, at a rate of 0.7% p.a. over the coming decade (Figure 8.1). This rate is lower than was observed in the past decade (+1.0% p.a.), reflecting the slowdown in production growth, the diversification of aquaculture production in China (mentioned above), and of an expected small decline in 2021 due to the effects of COVID-19. Asian countries will continue to be the main exporters of food fish, but their share of all exports will decline to 47% in 2030, from 48% in the base period. Asia and Europe will remain the main importers, accounting for 38% and 27% of all imports by 2030.

**Figure 8.1. Exports of food fish**



Source: OECD/FAO (2021), "OECD-FAO Agricultural Outlook OECD Agriculture statistics (database)", <http://dx.doi.org/10.1787/agr-outl-data-en>.

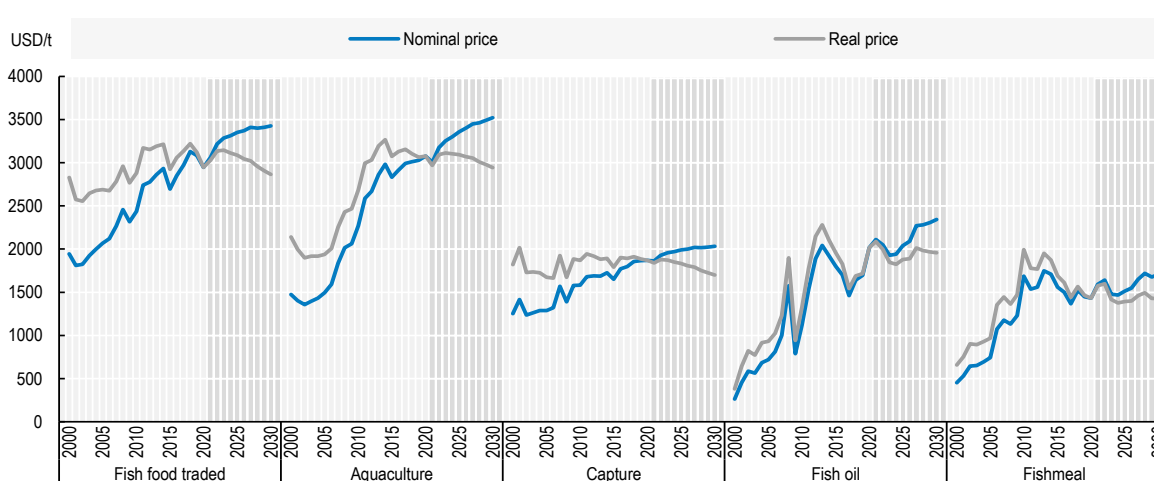
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Many factors influence the evolution and dynamics of world fish markets and, as a consequence, a range of uncertainties exist when projecting into the future. The major uncertainty during this forecasting exercise is the COVID-19 pandemic, in particular for the first years of the decade. The pandemic has impacted both supply, with restrictions keeping many vessels in port and complicating access to production inputs (e.g. seeds and feeds) for aquaculture, and demand with higher unemployment and many restaurants and hotels closed or empty for long periods. The duration of the outbreak remains uncertain, contributing to risk aversion that may suppress investment in the sector. The availability of investment capital for future production may be limited due to reduced demand and lower prices, which could lead to long-term transformations of the sector. On a positive note, the pandemic has created opportunities for new distribution channels, product innovation, and shorter value chains which are likely to benefit the industry going forward.

### 8.3. Prices

Fish prices are expected to remain high relative to historic levels and continue to grow in nominal terms. However, in real terms the prices of all categories are expected to fall in the projection period (Figure 8.2). Looking in more detail, real prices are expected to fall initially, reflecting reduced demand due to the COVID-19 pandemic at the start of the period, followed by a brief recovery before falling again from 2023/24 onward. The decline in the second half of the projection period is largely driven by policy changes in China, the largest capture fisheries and aquaculture producer, which are expected to result in reduced production growth up to 2023 and faster growth over the remainder of the projection period. Further, competition from other protein sources, most notably pig meat, is expected to increase through the projection period as production in Asia recovers from the devastating ASF outbreak.

**Figure 8.2. World Fish Prices**



Note: Fish food traded: world unit value of trade (sum of exports and imports) of fish for human consumption. Aquaculture: FAO world unit value of aquaculture fisheries production (live weight basis). Capture: FAO estimated value of world ex-vessel value of capture fisheries production excluding for reduction. Fishmeal: 64-65% protein, Hamburg, Germany. Fish oil: N.W. Europe. Real prices are nominal world prices deflated by the US GDP deflator (2020=1)

Source: OECD/FAO (2021), "OECD-FAO Agricultural Outlook OECD Agriculture statistics (database)", <http://dx.doi.org/10.1787/agr-outl-data-en>.

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Prices of wild caught fish follow a similar trajectory. In nominal terms they are expected to increase by 8.2% (+0.8% p.a.) over the projection period, while in real terms this represents a decline of 10.7% (-1.1% p.a.). The expected trend in real prices of wild caught fish shows a return to the pre-COVID-19 period in 2022-2023, followed by a similar decline than the price of traded products from 2023 onwards. Again, this decline reflects increasing competition from other protein sources and the continued growth in aquaculture production, particularly in the second half of the projection period. In the same period, aquaculture prices are projected to increase by 15.0% (+1.6% p.a.) in nominal terms, while in real terms this translates into a modest decline of 5.1% (-0.3% p.a.). This decline is driven by continued production increases and stable feed prices leading to increased supply. Despite the expected decline, aquaculture prices will remain higher in real terms than seen in the latter half of the 1990s and the 2000s, but below the peaks experienced in the 2010s. One factor contributing to the smaller decline in the aquaculture prices in real terms is the change in the species composition, with the share of lower value species, like carp, expected to further decline. The prices of food fish traded are expected to decline by 8.8% (-0.9% p.a.) over the projection period (in real terms) and reach levels similar to those seen in 2010.

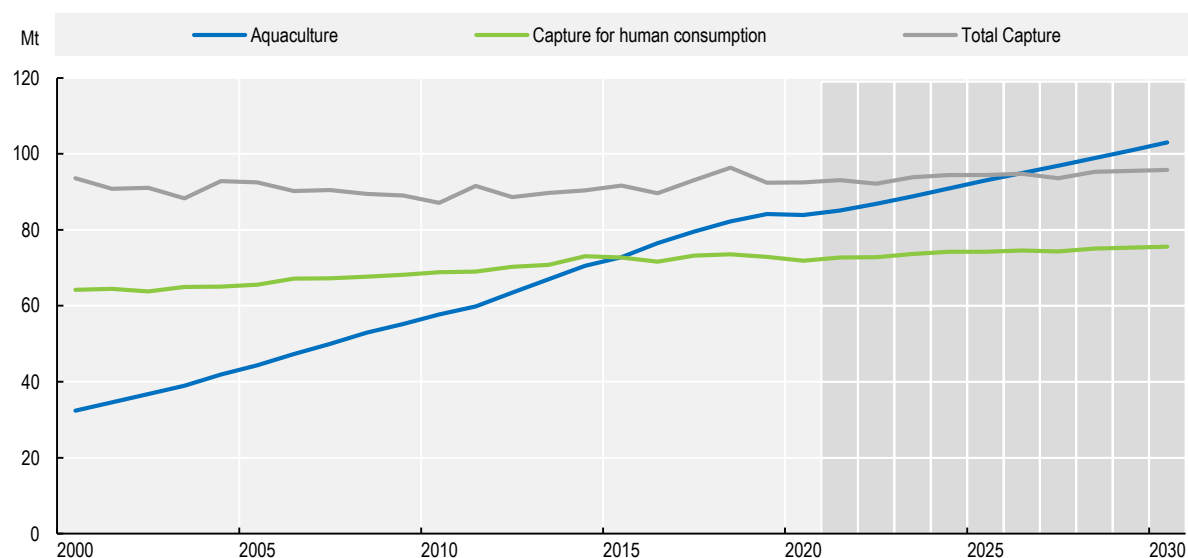
Fishmeal will experience a decline in real prices of 8.7% (-0.6% p.a.). The price of oilseed meals, a direct competitor in the feed market, will decline more than fishmeal resulting in a small increase in the relative price of fishmeal when compared to 2021 but will remain significantly lower than in the previous decade except during the assumed *El Niño* years. The price of fish oil is projected to decrease by 6.2% (-0.4% p.a.) in real terms – it grew by 45.1% over the previous decade – reflecting a slowdown in the growth of aquaculture production, more efficient use of fish oil based feeds in the production cycle and a stabilisation of the Omega-3 demand (of which fish oil has a high content) as a dietary supplement from the food sector. In the case of aquaculture, the relatively high price of fish oil based feeds has resulted in their use being restricted to specific stages of production cycle where high nutrient feeds are required (e.g. hatching and finishing). The price of fish oil relative to vegetable oil is expected to remain close to the new plateau recorded since 2012. Overall, the real price of fish oil and fishmeal will remain high compared to pre-2005 levels.

## 8.4. Production

Global fish production (capture and aquaculture) is expected to grow from 178 Mt (2018-20 average) to 201 Mt by 2030, an increase of 12.8% (+1.2% p.a.). While this represents an increase of 23 Mt in the projection period, this is a relative slower increase in global fish production representing approximately 69% of the previous decade growth (+33 Mt). The increase in fish production is driven, primarily by the continued progression in aquaculture production, which is expected to reach 103 Mt by 2030. However, aquaculture production growth over the projection period, 19 Mt (+23.0%) at 2.0% p.a., is slower than in the previous decade when production grew by 29 Mt (+52.7%) at 4.0% p.a. Aquaculture production is expected to overtake capture production in 2027 and account for 52% of all fish production by 2030 (Figure 8.3).

The slower aquaculture production growth compared to the previous decade is due to many factors. Firstly, in the previous decade the price of aquaculture species relative to the feed cost was more favourable as it trended strongly upward between 2012 and 2019 (except in 2018). With the on-going COVID-19 pandemic and an assumed *El Niño* year in 2022, the aquaculture to feed price ratio will remain below 2019 levels until 2023 and is expected to remain near that level until 2026. From 2027 onwards, the feed price ratio is expected to fall due to low meat prices. Other factors contributing to the slower aquaculture production growth include reduced productivity gains, more stringent environmental regulations in the world's largest producers, most notably China, and the challenges siting new production facilities due to competition for land.

New regulations aimed at increasing the sustainability of the sector and targeting growth in species demanded by domestic consumers are expected to limit production growth in China in the first half of the production period. Despite an acceleration of the growth in Chinese production over the second half of the outlook period, China's share of global aquaculture production is expected to decrease slightly from 57% in 2018-20 to 56% in 2030. Regionally, Asia is expected to maintain its position as the largest producer, with the share of global production from the region accounting for 88% in 2030, with strong production growth expected in other major Asian producers: India (+24.7%), Indonesia (+30.5%), Viet Nam (+20.4%) and Thailand (+30.0%).

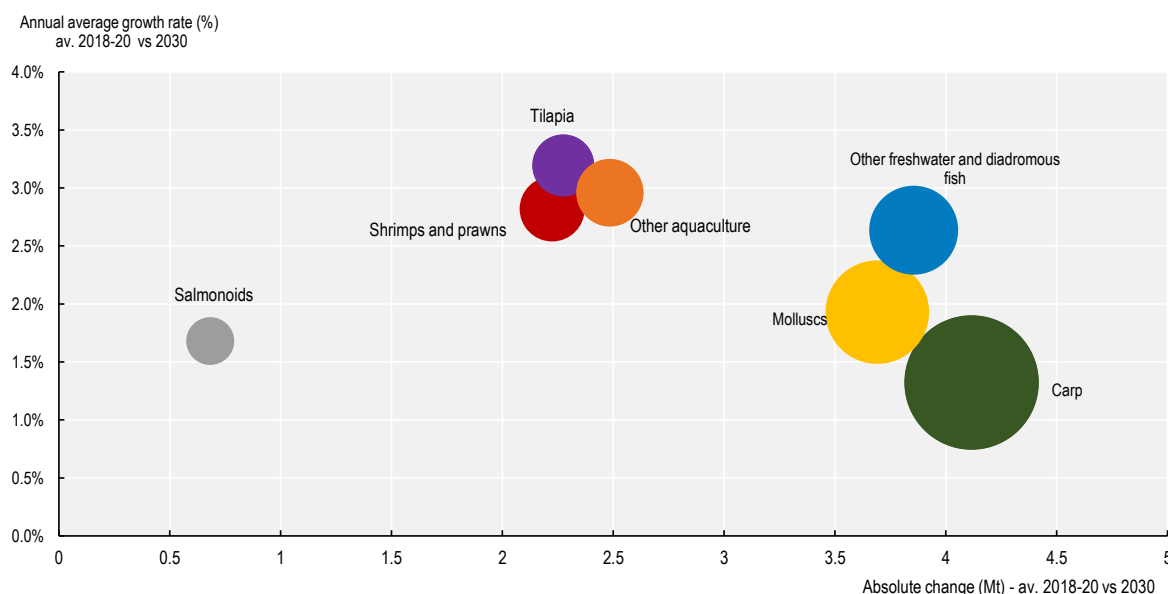
**Figure 8.3. World aquaculture and capture fisheries production**

Source: OECD/FAO (2021), "OECD-FAO Agricultural Outlook OECD Agriculture statistics (database)", <http://dx.doi.org/10.1787/agr-outl-data-en>.

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From a species perspective strong production growth is expected for tilapia (+36.9%), and shrimps and prawns (+32.0%) (Figure 8.4). However, in most cases production growth is significantly slower than experienced during the previous decade. The projection of +14.0% for carp production is predominantly determined by China and it is unclear how this production will change under the 14th five-year plan commencing in 2021.

By comparison, capture fisheries are projected to experience relatively modest growth of 3 Mt or 3.6% (+0.4% p.a.) in the projection period, reaching 97 Mt in 2030. This growth in production is expected to come largely from improved fisheries management and technological improvements reducing discards and waste. The growth in capture fisheries production is expected to be slightly less than the previous decade (+4.1% at +0.5% p.a.), with reduced growth rates in most regions. More specifically, while Africa is still expected to experience the strongest growth rate, +10.3% at 0.8% p.a. (+1.1 Mt), this is significantly slower growth than experienced in the previous decade (+38.6% at +3.1% p.a.). Capture fisheries production in Asia is expected to increase by 1.2 Mt, however the relative growth (+2.4%) will be slower than in Africa (+10.3) and Europe (+5.7%). Consequently, the share of Asia in global capture production is projected to decline slightly to 51.6% in 2030 compared to 52.2% in the base period. After declining in the previous decade (-9.9%) capture fisheries production in America is projected to return to growth with an increase of 1.7% (+0.4% p.a.) over the outlook period. From a country perspective, the largest increases in capture production over the outlook period are projected in the Russian Federation (hereafter "Russia") (+0.6 Mt), Viet Nam (+0.5 Mt), Indonesia (+0.3 Mt), and India (+0.3 Mt), while in China, the world's largest producer, capture production is projected to decline by 0.4 Mt (-2.7%).

**Figure 8.4. Growth in world aquaculture production by species**

Note: The size of the bubble represents the average world total production (tonnes) in 2018-2020.

Source: OECD/FAO (2021), "OECD-FAO Agricultural Outlook OECD Agriculture statistics (database)", <http://dx.doi.org/10.1787/agr-outl-data-en>.

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The popularity of fishmeal and fish oil for use in animal feed and their relatively high price when compared to alternatives is expected to drive production increases. Production of fish oil and fishmeal is expected to increase during the outlook period reaching 1.2 Mt and 5.8 Mt respectively by 2030, compared to 1.1 Mt and 5.5 Mt in the base period. However, production growth will be relatively slower than the previous decade for fishmeal (0.9% p.a. vs 1.0% p.a.), and it will remain below pre-2005 levels. Both fishmeal and fish oil can be produced from whole fish or as a by-product of fish processing, so called fish residue. About 64% of the increase in fishmeal and 79% in fish oil output will originate from production obtained from fish residue. The share of fishmeal and fish oil being produced from fish residue is expected to grow over the production period, increasing from 27% in the base period to 29% by 2030 for fishmeal and from 38% to 43% for fish oil.

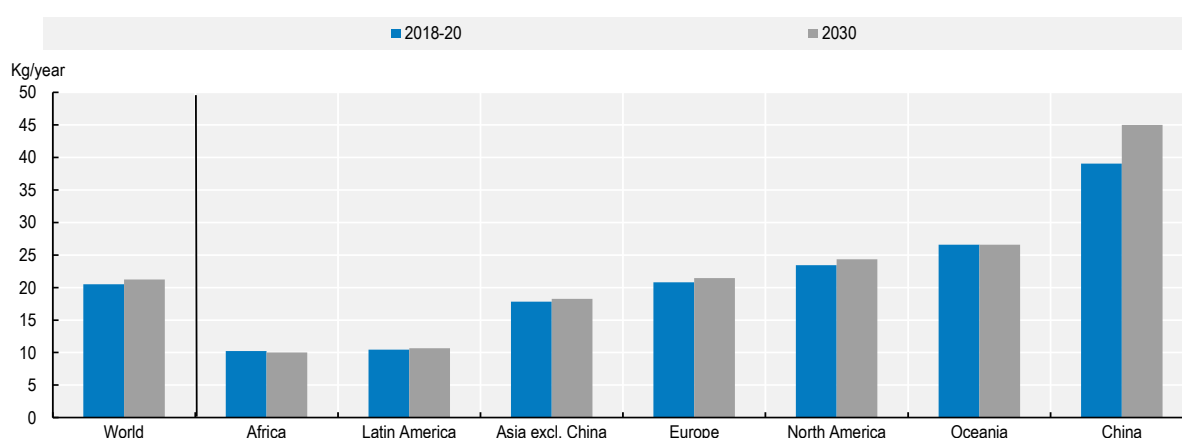
## 8.5. Consumption

By 2030, it is projected that 90% of fish production will be consumed as food, 8% reduced into fishmeal and fish oil, and the remaining 2% as other non-food uses. As a source of protein, fatty acids and micronutrients fish will remain key to global diets and playing a key role in food security in particular for coastal and inland communities highly dependent on fish for their diets. Other non-food uses of fish include, ornamental fish, culturing, fingerlings and fry, bait, pharmaceutical inputs, and as direct feed for aquaculture, livestock and other animals. The share of fish originating from aquaculture in total food fish consumption will continue to increase over the outlook period. By 2030, 57% of the food fish is projected to originate from aquaculture, up from 53% in the base period (2018-2020).

At the global level, food fish consumption is projected to increase by 14.8%, or an additional 23 Mt, to reach 181 Mt by 2030. The amount of fish for human consumption will expand on all continents, but significant differences exist among and within countries in terms of the quantity and products consumed at

per capita level. These are related to a diversity of conditions in terms of price, access, incomes, and consumers' tastes. As the most populous continent and major producer, Asia is projected to consume the largest share (72%) of the total food fish in 2030, while the lowest quantities will be consumed in Oceania (1%). Africa, America and Europe will each account for 9% of total food fish consumption by 2030 – despite significant differences in their population size. Asia will continue to dominate growth in consumption, accounting for 76% of the additional fish consumed by 2030. The driving force behind the growth in food fish consumption will be a combination of rising incomes and urbanisation, expansion of fish production, improved distribution channels, product innovation, lower meat prices, together with a growing recognition of fish as healthy and nutritious food by many consumers, expected to further grow up in next decade. Being the largest fish producer, China will remain by far the world's largest fish consuming country, projected to account for 37% of the global total in 2030.

**Figure 8.5. Per capita fish consumption – 2018-20 vs 2030**



Source: OECD/FAO (2021), "OECD-FAO Agricultural Outlook OECD Agriculture statistics (database)", <http://dx.doi.org/10.1787/agr-outl-data-en>.

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World per capita apparent fish consumption is projected to reach 21.2 kg in 2030, up from an average of 20.5 kg in 2018-20 (Figure 8.5). However, the rate of growth will slow compared with the previous decade (0.4% p.a. vs 1.1% p.a.). Overall, per capita apparent fish consumption will increase by 3.6% between 2018-20 and 2030, compared to 10.8% over the previous decade. Fish consumption per capita will rise in Asia, Europe and America, while it will remain stable in Oceania and decline in Africa (-2.2%). A greater decline is projected in sub-Saharan Africa (-5.6%), where the rapid population growth will outpace the growth in supply. The decline in Africa raises concerns in terms of food security due to high prevalence of undernourishment<sup>4</sup> in the region and the key role played by fish in terms of share of fish in total animal proteins across many countries. Overall, the decline in fish consumption may also weaken the ability of more dependent countries to meet nutrition targets (2.1 and 2.2) of SDG 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture).

Fishmeal is primarily used in diets for farmed animals, particularly farmed fish. By 2030, 85% of fishmeal should be consumed by the aquaculture sector as feed. China, being the largest aquaculture producer, is the largest consumer of fishmeal, projected to account for 38% of world fishmeal consumption by 2030. Consumption of fish oil is characterised by a competition between aquaculture and dietary supplements for human consumption. By 2030, 66% of fish oil is projected to be fed to farmed fish, in particular salmon. The European Union and Norway will remain the main consumers of fish oil, with 16% and 14%, respectively of the world total in 2030.

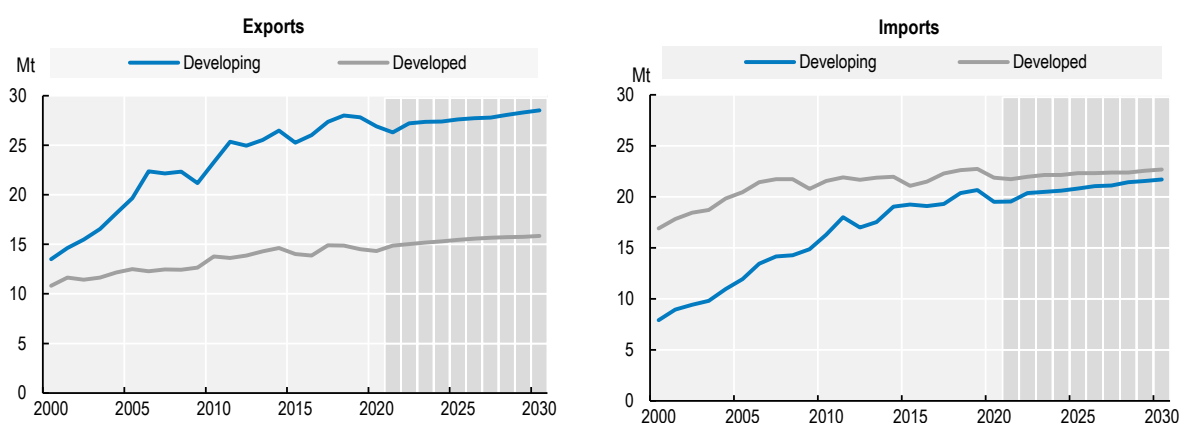


## 8.6. Trade


Trade in food fish is characterized by a wide range of players and products. The mismatch between areas of fisheries and aquaculture production and areas of demand contributes to the very high levels of trade in fish and fish products. The role of fish trade varies between countries but it is important for many economies, as a significant source of foreign currency earnings, employment, and food security (Figure 8.6).

Global trade in fish and fish products contracted in 2019 due to lower production. In 2020, fish trade declined for the second consecutive year, driven primarily by the impacts of COVID-19, as fish production was only slightly down. Over the outlook period, global trade is expected to recover but remain below previous projections. While fish and fish products will remain among the most traded food commodities worldwide, it is projected that the share of fish production being traded will be 35% in 2030 (31% if excluding intra-EU trade). Aquaculture will contribute to a growing share of the international food fish trade with high-value species, such as salmon, seabass, seabream, shrimp and prawns, but also with lower value species, such as tilapia, catfish and carps.

**Figure 8.6. Trade of fish for human consumption**



Source: OECD/FAO (2021), "OECD-FAO Agricultural Outlook OECD Agriculture statistics (database)", <http://dx.doi.org/10.1787/agr-outl-data-en>.

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World exports of food fish are projected to reach 44 Mt live weight equivalent (excluding intra-EU trade) by 2030. This represents a rise of 5.3% in the next decade, significantly lower than the 17.3% increase in the previous decade. Due to their primary role in fishery production, 47% of world food fish exports will originate from Asian countries by 2030. However, additional growth is no longer expected to originate predominantly from Asia (+0.8 Mt) but from Europe (+1.4 Mt), due to slower growth in Chinese food fish exports (2.8% vs 5.3% in the previous decade). Nevertheless, China will maintain its position as the leading global exporter of food fish products and will account for 18% of world trade of food fish in quantity terms by 2030, a slight decline relative to 19% in the base period. Viet Nam is projected to experience the largest growth over the outlook period, accounting for 47% of the additional exports volume. This strong growth is expected to be partly offset by lower exports from India, and Indonesia. Among the non-Asian countries, Russia, and Chile are projected to substantially increase their exports with growth rates of 33% and 40%, respectively.

International trade plays an important role in ensuring access to food fish to consumers. However, striking differences exist between developed and developing countries regarding their reliance on food fish imports. Developed economies will continue to be strongly dependent on imports of food fish to meet their

consumption levels, with fish imports accounting for 71% of total food fish consumption by 2030. This compares with a share of 15% for developing countries by 2030. This relatively low figure is strongly influenced by Asia, due to its predominant role in terms of production and exports. By 2030, the leading importers of food fish will remain the European Union, the United States, China, and Japan. In the European Union and the United States, fish food imports are expected to grow but at a slower pace than over the previous decade as consumption levels are already rather high. In China, imports are projected to decrease 2.1% by 2030 as domestic production is increasingly targeted at consumer preferences. In Japan, imports are projected to continue declining (-15.0%), reflecting lower fish consumption per capita and a decline in population.

Exports of fishmeal are projected to increase by 8.6% relative to 2018-20 and reach 3.4 Mt product weight by 2030. Developing countries will remain the main exporters and importers of fishmeal, accounting for 71% of global exports and 79% of global imports by 2030. Peru will continue to be the leading exporter of fishmeal, followed by the European Union, the United States, and Thailand. China will remain the largest fishmeal importer with a 51% share of world fishmeal imports by 2030, to satisfy the needs of its aquaculture and pig industries. Fish oil exports are projected to increase by 5.2% between 2018-20 and 2030. By 2030, Peru and the European Union will be the main exporters of fish oil while Norway and the European Union will be the main importers. Fish oil is mainly used as supplementary feed in the salmon industry and as a food supplement for human consumption.

## 8.7. Main issues and uncertainties

The projections analysed in this chapter represent an anticipated scenario for the fisheries and aquaculture sectors over the coming decade. Developing these projections depends on assumptions being made with respect to a range of economic, policy, and environmental conditions. These include the macroeconomic environment, the continuation of agricultural policies and announced policy reforms, international trade rules and tariffs, ongoing negotiations at the World Trade Organization (WTO) on binding disciplines for environmentally harmful subsidies to fisheries, frequency and effects of El Niño phenomenon, absence of extraordinary fish-related disease events, fishery quotas, and longer term productivity trends. Should any of these assumptions change, this would lead to a different set of projections for the fish market. In this year's edition of the OECD-FAO Agricultural Outlook, the uncertainty related to the on-going COVID-19 pandemic is by far the main risk factor to the projections presented, at least for the first years of the decade.

The development of the COVID-19 pandemic has the potential to aggravate poverty, hunger, and malnutrition, including an unprecedented impact on the fisheries and aquaculture sector. A lower global GDP scenario or important differences among countries could lead to longer-term decreases in food fish consumption, trade, and production. The COVID-19 pandemic led to significant changes in consumer behaviour for fish products. The place of consumption changed from the usual HORECA sector to the home, and the demand for prepared and preserved fish products rose strongly while the demand for higher value fresh products fell (as they were predominantly eaten outside of home). These changes may lead to structural changes in the patterns of fish consumption and in trade flows in the future, in particular taking into consideration that fish is a globalised product with species that can be harvested in one country, processed in a second country, and consumed in a third country. Sanitary and food safety concerns boosted by the COVID-19 pandemic could also lead to a change in trade flow patterns.

Significant policy changes in China create additional uncertainty for production trends in both capture fisheries and aquaculture. For example, it is unclear how the Chinese aquaculture sector will respond to changes in the 14th five-year plan targeting the production of domestic species and reducing the environmental impacts of the sector. In capture fisheries, reductions in the levels of direct support, in particular for inputs such as fuel, could have significant impacts on the profitability and structure of the Chinese fleet over the projection period.

Overall, the fisheries and aquaculture sectors are expected to continue to face many challenges including environmental change, resource availability, and ineffective governance. Despite the progress made by several countries and regions, with fish stocks consistently above target levels of rebuilding when fisheries are properly managed, there are still many areas where fisheries management is not in place, or is ineffective and the status of fish stocks is poor and deteriorating. This unequal progress is expected to persist unless successful and adequate policies and measures are implemented. Therefore, there is the urgent need for new mechanisms to support the effective implementation of policy and management regulations for sustainable fisheries and ecosystems to ensure fisheries around the world are sustainable. This will require concerted effort in waters within and beyond national jurisdiction, encompassing not only conservation measures but also capacity building and support, particularly for small island developing states and least developed countries. Further, it will be essential for management policies to pay close attention to the impact of climate change and the potential for migration of wild stocks due to rising ocean temperatures and the acidification of ocean waters.

Aquaculture is expected to be the main driver for the increase of fish production globally, and while showing a slower increase than previous decades, it will be higher than the growth in the production of fishmeal and fish-oil, important components in the diets for fed aquaculture (currently representing about 70% of aquaculture production globally). Fishmeal and fish oil are still considered the most nutritious and most digestible ingredients for farmed fish and it is expected these will be used even more selectively and efficiently at specific stages of production. Maintaining aquaculture growth will require increased use of other feed sources, and potentially the development of new nutrient rich feeds, all which represent additional sources of uncertainty in the predictions. Further, the regional development of aquaculture is uneven and hampered by constraints such as equitable distribution, competition for land, rights to water, diversity of species produced, and access to credit, seeds and expertise. Such constraints need to be adequately addressed through responsive and effective governance, increased investment, improvements in technology, innovations and research, and more efficient production and profitability. Ensuring long term biosecurity will be crucial as well as the targeted support to environmentally-friendly production systems, such as integrated multi-trophic aquaculture in coastal areas and integrated-agriculture aquaculture in inland regions. A special focus on Africa, which is projected to experience a decline in apparent consumption per capita in the next decade, may be required.

The ability of the capture fisheries and aquaculture sectors to meet demand will depend, in part, on their ability to increase or maintain production with minimal impact on marine and freshwater ecosystems, while also improving the utilisation of the harvest by reducing food loss and waste. Yet aquatic food production systems are nested in the larger development framework. Many “blue economy” policies favour large projects such as oil/gas and shipping/ports or even tourism, which bring economic benefits but also environmental degradation, with impacts on food from the ocean and ocean biodiversity. Trade-offs in the blue economy require further investigation for risk-informed, sound policy-making and investments for resilient and sustainable development. On these aspects, one of the new priority areas of the Strategic Framework of FAO for 2021-2030 is expected to be the Blue Transformation, with more efficient, inclusive, resilient and sustainable blue food systems promoted through improved policies and programmes for integrated science-based management, technological innovation, and private-sector engagement.

## Notes

<sup>1</sup> In the *OECD-FAO Agricultural Outlook 2021-2030*, the term “fish” and “seafood” are used to indicate fish, crustaceans, molluscs and other aquatic animals, but exclude aquatic mammals, crocodiles, caimans, alligators and aquatic plants. All quantities are expressed in live weight equivalent, except those of fishmeal and fish oil.

<sup>2</sup> Calculated in nominal terms, and covering fish and fish products.

<sup>3</sup> The term “apparent” refers to the amount of food available for consumption, which is not equal to the edible average food intake. The amount is calculated as production + imports – exports – non-food uses, +/- stocks variations, all expressed in live-weight equivalent.

<sup>4</sup> FAO, IFAD, UNICEF, WFP and WHO. 2020. *The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets*. Rome, FAO. <https://doi.org/10.4060/ca9692en>.