



OECD-FAO Agricultural Outlook 2011-2020



Chapter 8

Fish*

* The term “fish” indicates fish, crustaceans, molluscs and other aquatic animals, but excludes aquatic mammals, crocodiles, caimans, alligators and aquatic plants.

Market situation

After a difficult 2009, characterised by a sharp decline of fish prices and a contraction in demand and trade, the seafood sector expanded again in 2010 and early 2011. This recovery was partly due to higher average fish prices as well as to growing demand. Consumer demand has been particularly strong in developing countries supported by the faster than expected economic upturn.

The average world apparent *per capita* fish consumption was stable in the period 2008-09, at about 17 kg/year (live weight equivalent), and slightly increased in 2010 due to growing demand. During the base period, fish accounted for about 15.7% of world population intake of animal protein and 6.1% of all protein consumed.

Fish prices have been on the rise in domestic markets as well as in export markets. The FAO Fish Price Index indicates that current fish prices, on average, are higher than ever, in particular for farmed fish. In early 2011, prices of aquaculture products were 23% more than in September 2008. On the other end, capture prices, after a sharp drop during the crisis, have only recently regained pre-crisis price levels.

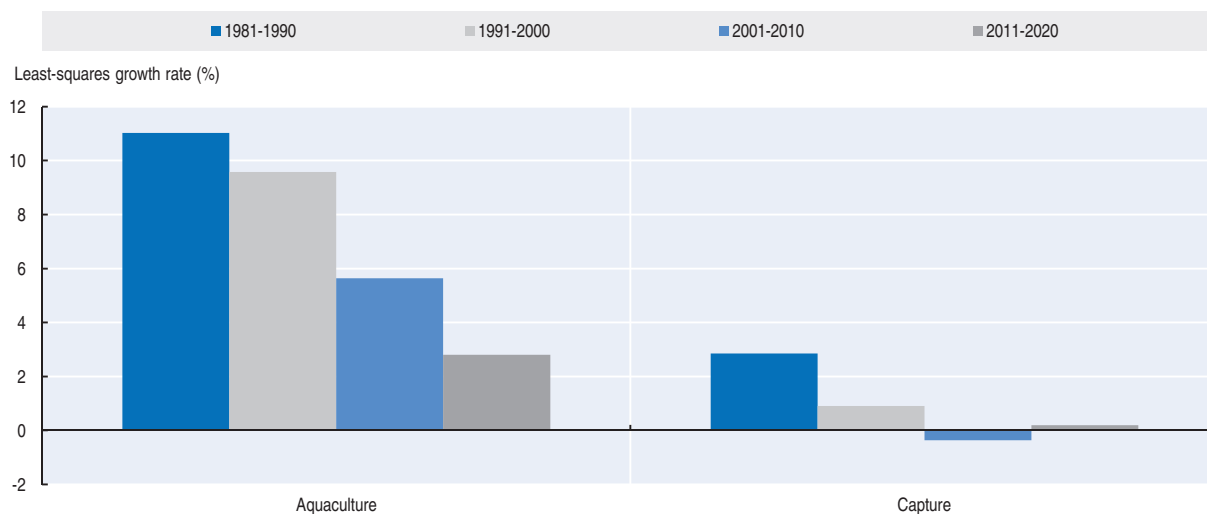
In 2009, total fish production reached a record 145 Mt, with a slight decline of capture fisheries and an increase in aquaculture production. In 2010, capture fisheries further decreased due to lower catches of anchoveta in Latin America, while aquaculture production continued to increase its share in total fish production.

Projection highlights

- World fisheries production is projected at 164 Mt in 2020, a growth of about 15% above the average level for 2008-2010. Major increases in the quantity of fish produced will originate from aquaculture. However, for the projection period, the annual growth rate of aquaculture is estimated at 2.8%; a reduction compared to the rate of 5.6% of the previous decade (Figure 8.1).
- Fish prices (capture, aquaculture and trade) will increase over the medium term (Figure 8.2). With the growing price of fish meal and the high price of other feeds, the spread between the price of farmed and wild fish will grow over the medium term.
- Total fish and fishery products will continue to be highly traded, with about 38% of world fish production exported in 2020. World *per capita* fish food consumption is projected to reach 17.9 kg *per capita* in 2020, from 17.1 kg *per capita* of the average 2008-2010.

Figure 8.1. Declining growth rate of fish production

Growth rate of capture and aquaculture fish production by decades

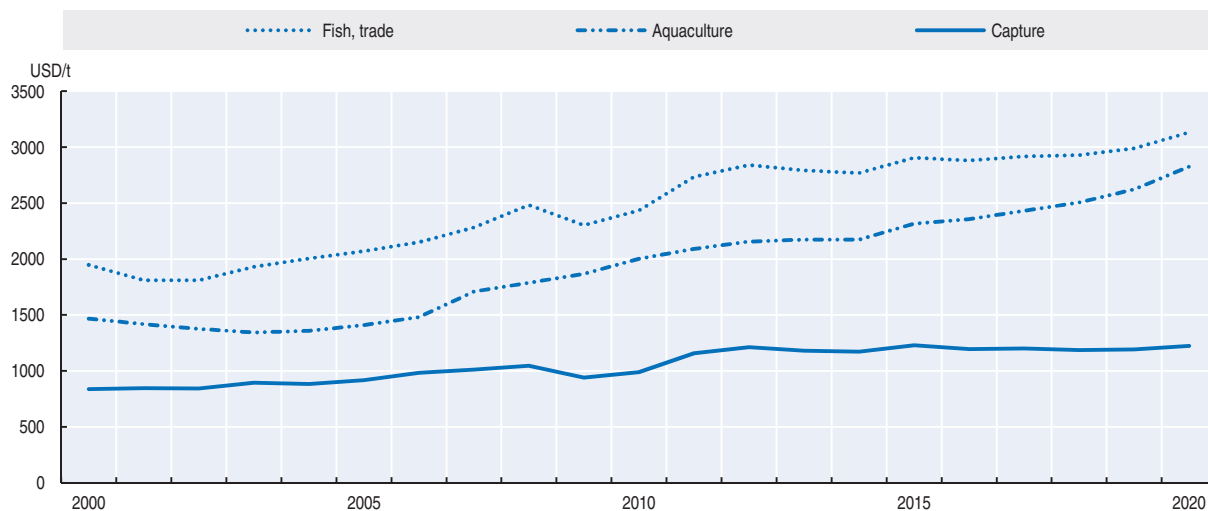


Source: OECD and FAO Secretariats.

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Figure 8.2. Rising world prices, with those for farmed fish increasing more than wild fish

World fish price development in nominal terms between 2000 and 2020



Source: OECD and FAO Secretariats.

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Market trends and prospects

This chapter illustrates the main results of the new dynamic policy specific partial equilibrium model on fish. At present, this is a standalone model, containing links to the Aglink-Cosimo model used for the agricultural projections, but not integrated into it (see Box 8.1 for more detailed information). The fish model has been developed also due to the significant importance of the fishery sector from the economic point of view, as well as for the major role played by fish in the human diet and, through fishmeal, in animal feed rations.

Prices

World fish prices will continue the growing trend experienced in 2010 and early 2011. They will be affected by income and population growth, stagnant capture fisheries production, increasing feed cost, a weaker US dollar and higher crude oil prices. All these factors will contribute to the rise in fish prices over the medium term. However, there will be different scenarios for capture fisheries production and for aquaculture. With the growing price of fishmeal and the higher price of other feeds, the spread between the average price of output from aquaculture and capture will grow over the medium term. In addition, the average price for wild fish should increase less than farmed ones due to expected changes in fish composition, with more catches of lower value fish. The average world price for captured species is expected to increase by 23 % and for aquaculture species by a significant 50% by 2020 compared to the average 2008-10. In addition to the need to compensate for the higher cost of fish meal, prices of aquaculture will also grow due to strong domestic demand. In 2020, the price of fish products traded will be 30% higher from 2008-10.

Due to stagnant capture fisheries, the increasing demand for fish will be met by aquaculture. Since it is not foreseen that oilseed meal will replace fish meal in the diet of many of the species raised in aquaculture, demand for fish meal will continue to grow. With a rather stable production, fish meal prices, which have reached high levels since 2009, are therefore expected to further increase during the next decade, up 43% in 2020 from 2008-10. During the same period, fish oil prices are projected to grow by 19%. This will lead to a large increase in the price ratio of fishmeal compared to oilseed meal. During the same period, fish oil prices are projected to grow by 19%. Although most of fish oil produced is used as an input in aquaculture production, the equivalent ratio in the oil market will increase only slightly.

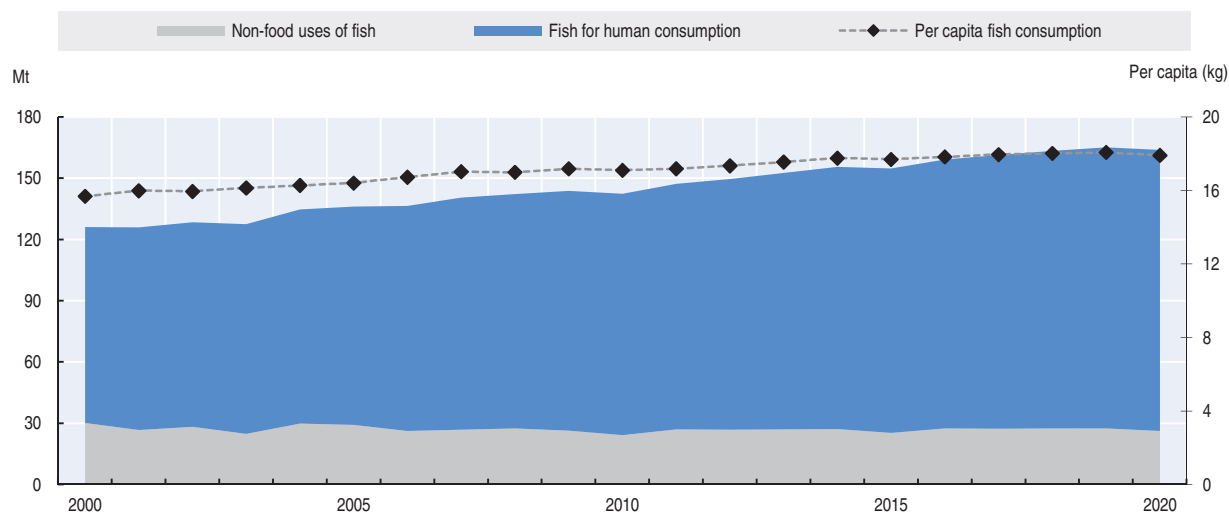
Production

Under the set of assumptions used in this *Outlook* and stimulated by higher demand for fish, world fisheries production will continue to expand over the course of the projection period, reaching 164 Mt in 2020 (Figure 8.3). This represents an increase of about 15% above the average level for 2008-10. Growth in aquaculture production will offset rather stable world capture fisheries production in the forecast period. Capture fisheries should remain at around 90 Mt, with a slight increase in the medium term due to higher prices. However, there will be years (forecasted in the model as 2015 and 2020), when capture production will be affected by the El Niño phenomenon (see Glossary for more information on the El Niño). This effect will reduce catches in South America, in particular, of anchoveta caught by Peru and Chile.

Aquaculture production is projected to continue to increase, reaching nearly 74 Mt in 2020. This represents a 34.8% growth compared to the average level for 2008-10.

Figure 8.3. **World fish utilisation and consumption projections**

Development of utilisation of world fish production and per capita fish consumption between 2000-20



Note: Non-food uses of fish include utilisation of aquatic products for reduction to meal and oil, for feed and bait, for ornamental purposes, withdrawals from markets and any other non-food uses of fish production (e.g. fertilisers, medical uses, etc.).

Source: OECD and FAO Secretariats.

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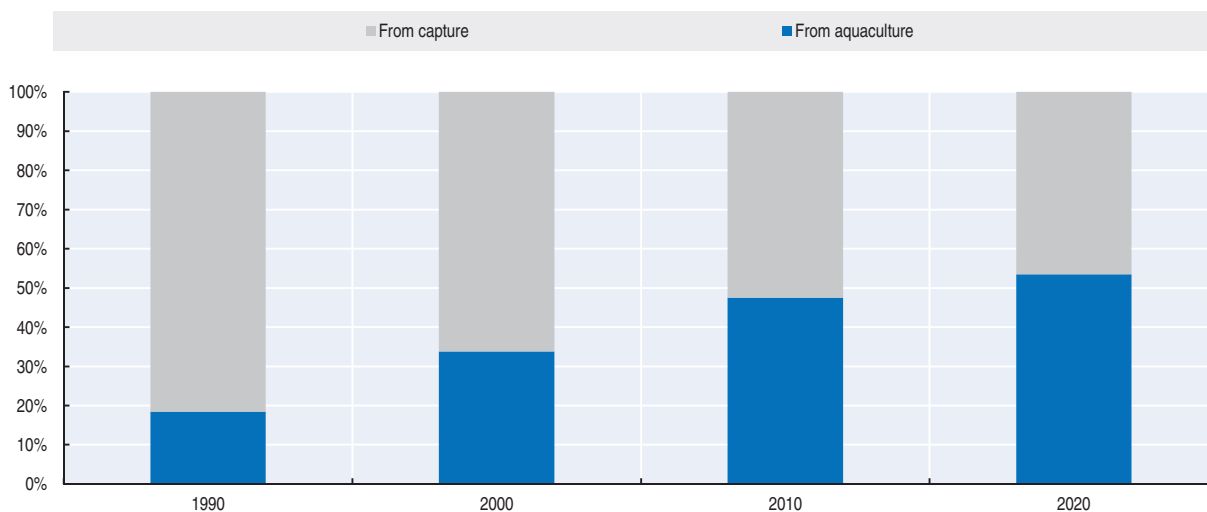
However, the annual growth rate for the projection period is estimated at 2.8%; a reduction compared to the increase of 5.6% in the previous decade. Notwithstanding the slower growth rate, aquaculture will still remain one of the fastest growing sectors when compared to other food-producing systems. The share of aquaculture in total fish production should grow from an average 38% for 2008-10 to 45% in 2020. In 2015, for the first time in history, fish for human consumption originating from aquaculture are expected to surpass those from capture fisheries. The share of farmed fish in total fish for human consumption was 47% on average during the 2008-10 period and is projected to reach 51% in 2015 and almost 54% by 2020 (Figure 8.4).

Aquaculture will continue to expand in all continents in terms of new areas and species, as well as intensifying and diversifying the product range for species and product forms that respond to consumer needs. Asian countries, and in particular China, will continue to dominate aquaculture production. In 2020, Chinese aquaculture production is projected to represent 61% of world production. Projections indicate a growth in Latin America, in particular in Brazil due to consistent economic investment in the sector. African production should also increase over the next decade by an expected 70% (reaching 1.7 Mt) due to private sector capacity put in place in the 2000s, in response to economic growth, rising local demand and local policies promoting aquaculture.


Fishmeal and fish oil production are projected to remain rather stable during the next decade. In 2020, their estimated production should be 5.9 Mt and 1.0 Mt, respectively, in product weight. In 2020, fish meal production should be only slighter higher (+2%) compared to the average for 2008-10. Due to growing demand for fish for human consumption, the share of capture fisheries utilised for the production of fish meal will gradually decline from about 23% in 2008-2010 to around 21% by the end of the forecast period. That share will be slightly smaller in the years of El Niño, projected in 2015

Figure 8.4. **Increasing role of aquaculture in fish consumption**

Share of fish originating from capture and aquaculture in total fish for human consumption by decades



Source: OECD and FAO Secretariats.

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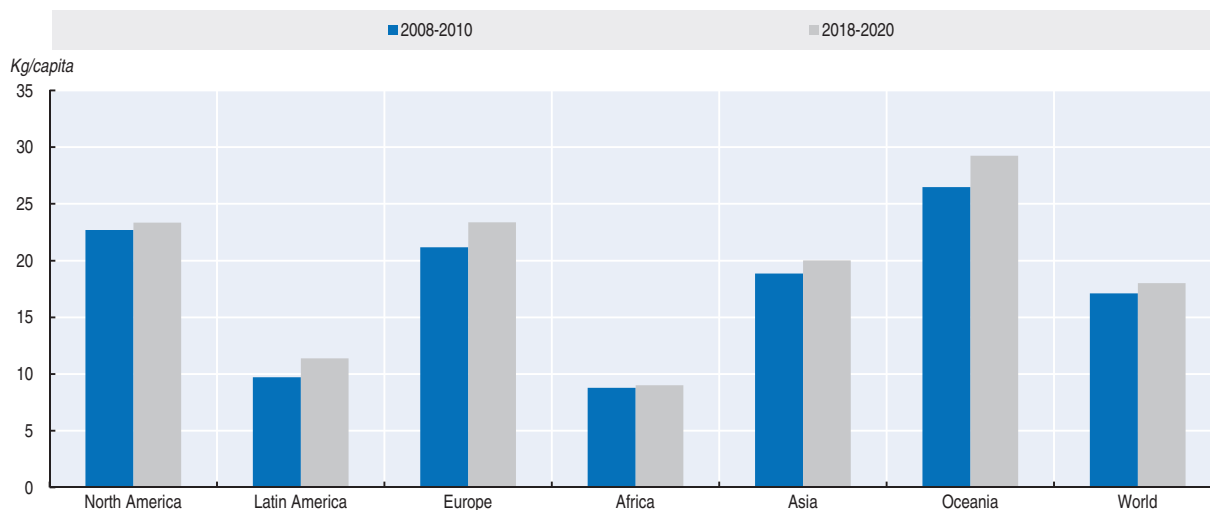
and 2020, which diminishes catches of anchoveta, fish mainly reduced into fish meal and fish oil. In a view of stronger demand for fishmeal, a growing share of fish meal production should originate from fish residue. With growing income, people will consume an increasing share of fish in fillets or in other value added forms, thus creating more residues to be used for fish meal. Therefore, the share of the main producers of fish meal (Peru and Chile) in total production will be reduced (28% in 2020, against 30% in 2008-10).

Consumption

World *per capita* apparent fish consumption is projected to reach 17.9 kg in 2020, from 17.1 kg *per capita* of the average 2008-10. The cyclical decline in the price of other meats with no further feed price explosion, combined with higher prices of fish and fishery products will eventually stabilise consumption. *Per capita* fish consumption will increase in all continents (Figure 8.5), with Oceania and Europe showing the highest growth rates. Fish consumption will continue to be higher in more developed economies, even if decreasing in Japan and Canada. *Per capita* consumption in LDCs will increase, but will continue to be rather low (11.5 kg in 2020).

Fish consumption will continue to be affected by complex interactions of several factors, including rising living standards, growing emphasis on fish as a healthy and nutritious food, population growth, rapid urbanisation, increased trade and transformations in the food distribution and retail sectors. The total amount of fish consumed will continue to vary according to regions and countries, reflecting the different levels of availability of fish and other foods, including the accessibility of aquatic resources in adjacent waters, as well as diverse food traditions, tastes, income levels, prices and seasons. Annual *per capita* apparent fish consumption will vary from less than 1 kg in one country (*e.g.* Ethiopia) to more than 100 kg (*e.g.* Maldives) in another.

Figure 8.5. **General growth of fish consumption**
Comparison of per capita fish consumption by continent in 2008-2010 and 2018-2020



Source: OECD and FAO Secretariats.

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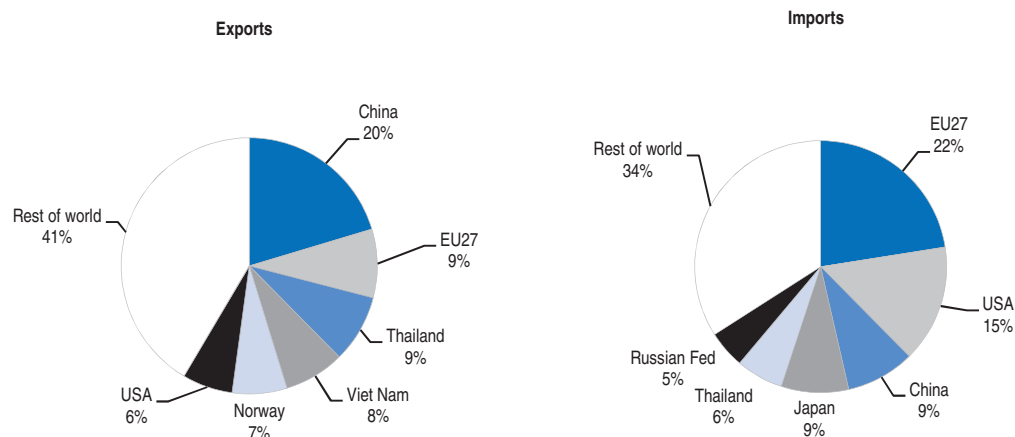
Trade

According to the projections, total fish and fishery products (fish for human consumption, fish meal and fish oil) will remain highly traded, with about 38% of world fish production exported in 2020. In quantity terms, world trade of fish for human consumption is expected to increase at an annual growth rate of 2.3% in the period 2011-20, a decline in respect to the level experienced in the previous decade (+3.5%). Developed countries will account for about 60% of world imports of fish for human consumption, while developing countries will continue to be the main exporters, although with a decreasing share in world export quantities (63% in 2020 against 67% in 2008-10). In 2020, 51% of world fish exports for human consumption will originate from Asia, with China maintaining its position of the world's leading fish exporter (Figure 8.6).

The fishery industries of developing countries will continue to rely heavily on developed countries, not only as markets for their exports, but increasingly as a source of imports for local consumption and as suppliers of raw material for their processing industries. A growing share of exports from developing countries will continue to consist of processed fish products prepared from imports of unprocessed fish to use as raw material for further processing.

Developing countries will remain the primary importers of fish meal (63% of the total in 2020), also due to their importance in aquaculture production, having a share of 94% of world aquaculture fisheries production in 2020. China alone should represent 61% of world aquaculture production in 2020, with a share of about 36% of world fish meal imports. European countries will continue to be the major importers of fish oil, with a share of 63% of the total in 2020.

Figure 8.6. **Trade of fish for human consumption by major exporters and importers in 2020 (share in quantity)**



Source: OECD and FAO Secretariats.

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Main issues and uncertainties

The fish projections reported in this chapter are based on specific assumptions regarding the future macroeconomic environment, international trade rules and tariffs, frequency and effects of El Niño phenomenon, absence of abnormal fish related disease outbreaks, fishery quotas, longer term productivity trends and the absence of market shocks. Should one of these assumptions change, the resulting fish projections would be affected. A number of uncertainties remain.

In the projections, overall capture fisheries production is reported to remain rather stable. However, according to recent FAO estimates (FAO SOFIA 2010*), about half of the stock groups monitored by FAO are estimated to be fully exploited. In addition, 32% of the stocks are estimated to be either overexploited, depleted or recovering from depletion, and 15% being underexploited or only moderately exploited. The latter is the lowest percentage recorded since the mid-1970s. Notwithstanding this rather critical status of stocks in some fishing areas, scientists indicate that in the near future there should be compensation between increases of catches in some fisheries and areas and decreases in others and with the overall catches remaining rather stable. However, in order to obtain these results, effective fisheries management policies that maintain stocks and productivity from fisheries should be implemented.

The majority of future growth in fish production will come from aquaculture. However, the prospects of this sector will depend on several factors, including the availability, sustainability and cost of fishmeal and fish oil and of other alternative sources of feeding; access and availability to areas and water; environmental impacts; availability of technology and finance; effects on biodiversity; climatic changes; governance; food safety and traceability issues as well as policy decisions in producing systems.

* FAO, The State of Fisheries and Aquaculture 2010, Rome, FAO. 2010. p. 197.

Fish is widely traded and it is particularly important as a source of foreign currency for many developing countries, including small island States. Future expansion of trade will be affected by several issues:

- development of new technologies, *e.g.* aquaculture breeding technology;
- changes in fish species and product forms, *e.g.* growth in farmed species and in the use of fillets and other value added forms;
- competitiveness with other food products, *e.g.* relative prices, in particular for chicken and other meat;
- prices and margins throughout the fisheries value chain, *e.g.* margins to producers;
- rising commodity prices in general and the impact on producers as well as on consumers, *e.g.* soybean prices influencing the price of fish feed and the price of farmed fish;
- energy prices and the impact on fisheries, *e.g.* growing energy prices can lead to higher costs, in particular in the more energy intensive fishing practises in capture fisheries;
- perceived risks and benefits for human health from fish consumption, *e.g.* focus on fish as a healthy and nutritious food;
- concern about overexploitation of certain fish stocks, *e.g.* increase consumer awareness could force government to implement stricter management measures;
- introduction of private standards, including for environmental and social purposes, and their endorsement by major retailers, *e.g.* the ability of countries to implement private standards could affect sourcing;
- certification and traceability requirements, *e.g.* sourcing will be affected if companies and countries are not able to comply;
- trade disputes related to selected fish species, *e.g.* trade disputes may affect bilateral trade;
- multilateral trade negotiations in the WTO, including the focus on fisheries subsidies, *e.g.* further trade liberalisation will stimulate international fish trade; improved subsidies rules may reduce overcapacity and overfishing;
- climate change, carbon emissions and their impacts on the fisheries sector, *e.g.* rising temperatures will change the composition of species in many fishing areas.

Box 8.1. The Fish and Seafood Model

For the first time, fish and seafood markets (both capture and aquaculture) are included in the OECD-FAO medium term outlook projections using a new dynamic policy specific partial equilibrium model, which has links to, but is not integrated into, the Aglink-Cosimo model used for the agricultural projections. It contains 1 100 equations and covers the same 56 countries/regions as Aglink-Cosimo with forty-two of these countries endogenous as well as five continents and a world total. There are three world market clearing price identities: one for aggregate fish and seafood, one for fish meal and one for fish oil. An approximation of the world price of captured fish and seafood is also endogenous as is a weighted average price of all the species raised in aquaculture.

Box 8.1. **The Fish and Seafood Model** (cont.)

There are two types of supply functions: captured species and aquaculture. Supply of captured species are either exogenous, endogenous but only affected by El Nino (climatic pattern that affects the Pacific Ocean) and endogenous but responding to price. As captures are tightly controlled by fishing quotas in many countries, only about 13% of the world capture is responding to the price in the model. For aquaculture, 99% of the world total is endogenous and responding to the price of output and the price of feed.

Fish meal and oil supply are composed of two components: from crushed whole fish (reduction) and from fish residue. Crushed whole fish is modeled like oilseed crush for those countries that are not subject to fishing quotas. Producers are responding to the weighted average output price and to the price of whole fish. The weighted average price is calculated using the fish meal and oil prices multiplied by their respective yield. Fish meal and oil production from fish residue is tied to production of fish for food consumption.

Demand is for aggregate fish and seafood but it is split according to three end uses: food, processed into fish meal and oil, and other uses (kept exogenous). In general, the own price and income elasticities imposed in the food demand functions are relatively high since these products are luxury goods in many countries of the world. Because of fishing quotas, the price of fish influences only 37% of the crush demand in the model. Demand for fish meal and oil responds to the need of aquaculture, the own price and the price of the respective oilseed products. The estimated elasticities show strong substitution between the fish and the oilseed products.

The price of aggregate fish and seafood is calculated in each country market clearing identity. The weighted average price of aquaculture species is tied to this domestic fish price and to the ratio of aquaculture production to total production (with an estimated negative sign). Domestic fish meal and oil price is the world price adjusted for tariff and transport cost (for importing countries). Consumer prices are a function of the fish price and of the GDP deflator used as an approximation for other costs.

Imports and exports of fish and seafood are either exogenous or a function of domestic and world prices adjusted for tariffs and transport costs. The elasticities were estimated or chosen to insure a transmission between these two prices consistent with the historical correlation coefficient. Fish meal and oil exports or imports are calculated in the market clearing identity.

Tariffs are the main policy instrument included in the model and they are, in general, lower than those for agricultural products. There are three links between the fish and the agriculture markets; on the demand side through the substitution between fish and other animal products, through the amount of feed demanded by aquaculture and through the interaction between fish meal and oil and their respective oilseed substitutes.

ANNEX 8.A

Statistical tables: Fish

8.A.1. World fish projections <http://dx.doi.org/10.1787/888932428253>

Tables available online:

8.A.2. Fish projections <http://dx.doi.org/10.1787/888932428272>

8.A.3. World fish trade projections <http://dx.doi.org/10.1787/888932428291>

Table 8.A.1. World fish projections

Calendar year

		Avg 2008-2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
FISH												
OECD												
Production	kt	31 884	32 025	32 318	32 744	32 980	32 349	33 126	33 390	33 507	33 639	33 311
of which aquaculture	kt	5 420	5 505	5 607	5 862	6 091	6 321	6 485	6 624	6 773	6 978	7 266
Consumption	kt	39 323	39 732	40 096	40 507	40 786	40 200	40 958	41 294	41 523	41 675	41 282
of which for food	kt	31 791	31 992	32 415	32 884	33 272	33 280	33 655	34 045	34 351	34 596	34 615
of which for reduction	kt	6 844	6 826	6 768	6 709	6 601	6 006	6 390	6 335	6 259	6 165	5 753
Non-OECD												
Production	kt	111 194	115 414	117 553	120 079	122 876	122 620	126 205	128 118	129 898	131 655	130 782
of which aquaculture	kt	49 228	51 773	53 842	55 864	58 150	60 076	61 040	62 713	64 277	65 826	66 418
Consumption	kt	103 670	107 836	109 802	112 292	114 996	114 644	118 271	120 112	121 779	123 516	122 709
of which for food	kt	85 043	88 226	90 351	92 702	95 239	96 142	98 113	100 085	101 604	103 070	103 150
of which for reduction	kt	12 642	13 473	13 255	13 344	13 461	12 156	13 762	13 580	13 679	13 724	12 737
World												
Production	kt	143 077	147 439	149 870	152 822	155 856	154 969	159 331	161 508	163 405	165 294	164 094
of which aquaculture	kt	54 647	57 278	59 449	61 726	64 241	66 397	67 525	69 337	71 049	72 803	73 683
Consumption	kt	142 993	147 568	149 898	152 799	155 782	154 844	159 230	161 406	163 302	165 191	163 991
of which for food	kt	116 834	120 219	122 766	125 586	128 511	129 422	131 768	134 130	135 955	137 666	137 765
of which for reduction	kt	19 486	20 299	20 022	20 054	20 061	18 162	20 151	19 916	19 937	19 889	18 490
Price												
Aquaculture ¹	USD/t	1 884.5	2 091.1	2 156.7	2 174.7	2 174.3	2 315.2	2 357.4	2 429.6	2 505.3	2 622.4	2 825.3
Capture ²	USD/t	992.0	1 158.9	1 212.6	1 180.2	1 172.8	1 228.3	1 196.0	1 201.4	1 186.3	1 191.7	1 223.1
Trade ³	USD/t	2 406.2	2 734.4	2 839.5	2 790.1	2 769.6	2 904.7	2 878.6	2 917.1	2 927.9	2 989.4	3 131.9
FISH MEAL												
OECD												
Production	kt	1 961.6	2 029.4	2 029.0	2 036.0	2 030.4	1 906.6	2 018.4	2 025.3	2 020.0	2 011.1	1 922.5
from whole fish	kt	1 464.3	1 491.4	1 482.4	1 471.9	1 449.7	1 311.3	1 407.7	1 399.6	1 379.8	1 356.3	1 253.2
Consumption	kt	2 299.9	2 354.4	2 286.2	2 281.6	2 285.5	2 134.9	2 173.8	2 224.3	2 213.0	2 193.2	2 127.2
Variation in stocks	kt	-77.9	28.0	23.2	17.6	-4.3	-55.6	54.4	1.9	1.8	1.8	-50.4
Non-OECD												
Production	kt	3 783.9	3 832.6	3 827.0	3 888.3	3 947.5	3 649.8	4 079.4	4 069.2	4 125.2	4 165.6	3 934.2
from whole fish	kt	2 950.5	3 175.7	3 143.4	3 182.7	3 228.4	2 922.4	3 335.7	3 310.6	3 352.5	3 381.8	3 149.2
Consumption	kt	3 732.8	3 481.6	3 505.6	3 614.1	3 695.7	3 615.1	3 729.6	3 867.2	3 929.4	3 980.7	3 922.9
Variation in stocks	kt	-209.4	-2.0	41.0	11.0	1.0	-138.0	140.0	1.0	1.0	1.0	-143.0
World												
Production	kt	5 745.5	5 862.0	5 856.0	5 924.2	5 977.9	5 556.4	6 097.8	6 094.4	6 145.2	6 176.7	5 856.6
from whole fish	kt	4 414.8	4 667.0	4 625.8	4 654.6	4 678.1	4 233.8	4 743.4	4 710.2	4 732.3	4 738.1	4 402.4
Consumption	kt	6 032.7	5 836.0	5 791.8	5 895.7	5 981.2	5 750.0	5 903.4	6 091.5	6 142.4	6 173.9	6 050.1
Variation in stocks	kt	-287.2	26.0	64.2	28.6	-3.3	-193.6	194.4	2.9	2.8	2.8	-193.4
Price ⁴	USD/t	1 355.7	1 675.1	1 666.5	1 622.2	1 614.6	1 841.7	1 773.6	1 721.8	1 758.7	1 807.9	1 940.2
FISH OIL												
OECD												
Production	kt	570.4	582.8	584.9	594.2	599.0	573.6	596.3	595.0	593.7	591.3	574.5
from whole fish	kt	327.0	328.1	330.3	332.7	332.3	303.5	322.8	318.9	315.0	310.2	290.8
Consumption	kt	859.6	896.9	886.3	905.6	910.5	873.4	885.3	901.7	900.2	900.0	893.1
Variation in stocks	kt	-35.3	20.0	22.7	2.0	1.6	-27.2	26.4	2.0	1.8	1.6	-31.6
Non-OECD												
Production	kt	442.3	494.5	487.1	487.8	489.9	416.6	497.2	491.2	493.1	493.6	442.5
from whole fish	kt	380.0	438.3	430.9	431.5	433.6	359.9	439.9	433.5	434.9	434.9	383.3
Consumption	kt	194.0	157.8	164.9	175.2	180.1	160.9	170.5	182.3	186.1	186.2	169.6
Variation in stocks	kt	-5.7	2.6	-1.9	-0.8	-3.2	-16.9	11.4	0.2	-1.4	-2.8	-14.0
World												
Production	kt	1 012.7	1 077.3	1 072.1	1 082.0	1 089.0	990.2	1 093.4	1 086.2	1 086.8	1 084.9	1 017.1
from whole fish	kt	707.0	766.5	761.2	764.2	765.9	663.4	762.7	752.4	749.8	745.1	674.1
Consumption	kt	1 053.7	1 054.7	1 051.2	1 080.8	1 090.6	1 034.3	1 055.7	1 084.0	1 086.3	1 086.1	1 062.7
Variation in stocks	kt	-41.0	22.6	20.8	1.2	-1.7	-44.1	37.7	2.2	0.4	-1.2	-45.6
Price ⁵	USD/t	1 161.7	1 060.5	1 034.6	1 036.2	1 053.7	1 243.8	1 218.8	1 186.5	1 212.0	1 258.8	1 382.0

Note: The term "fish" indicates fish, crustaceans, molluscs and other aquatic animals, but excludes aquatic mammals, crocodiles, caimans, alligators and aquatic plants.

1. World unit value of aquaculture fisheries production (live weight basis).
2. FAO estimated value of world ex vessel value of capture fisheries production.
3. World unit value of trade (sum of exports and imports).
4. Fish meal, 64-65% protein, Hamburg, Germany.
5. Fish oil, any origin, N.W. Europe.

Source: OECD and FAO Secretariats.

StatLink  <http://dx.doi.org/10.1787/888932428253>