

4 Case study – Fishmeal and fish oil

4.1 Global production and usage

A significant but declining share of world fisheries is destined to the production of fishmeal and fish oil. The average yearly fishmeal and fish oil production in the last 10 years is around 5 million tonnes of fishmeal and 1 million tonnes of fish oil¹⁴. Each year, around 20 million tonnes of raw material are used to produce fishmeal and fish oil. Around 15 million tonnes come from whole fish of which nearly half is landed in South America. The rest comes from by-products from the processing of wild and farmed fish¹⁵. It is estimated that by-products account for about 25% to 35% of the total production of fishmeal and fish oil in terms of volume, but there are also regional differences¹⁶.

Because a large share of these products is used as feed in aquaculture and livestock production, fishmeal and fish oil contribute indirectly to human food production and consumption.

Many species from direct fisheries (the whole fish delivered to the factories) are used in the production of fishmeal and fish oil, in addition to fish trimmings or other by-products from the fish processing industry. The species dominating the raw material supply to the “reduction industry”¹⁷ are mainly small pelagics (like anchovy, sprat and sardinellas). In fact, global fishmeal and fish oil production fluctuates in line with catches of these species and might vary strongly from one year to another. Variations in the fishery of Peruvian anchoveta have the largest impact on the global supply of fishmeal and fish oil. This fishery is the world’s largest in terms of volume, varying between 3 and 7 million tonnes a year. The strong variations in the Peruvian anchoveta fishery is closely linked to the weather phenomena El Nino which occurs every few years and brings warm water into the upwelling areas. In years when this happens, fisheries suffer, and catches might decrease by several million tonnes in one season.

Owing to the growing demand for fishmeal and fish oil from the aquaculture industry, and coupled with high prices, a growing share of fishmeal is being produced from by-products which previously were often wasted. With no extra raw material expected to come from direct fisheries (small pelagics), an increase or even a stable production is foreseen from increased use of by-products. In the EU, most of the trimmings/by-products from the industry are already utilized, thus there are not expected any significant increase in supply coming from the EU producers in the coming years. The largest potential is from the aquaculture industry in other parts of the world, particularly Asian countries¹⁸.

¹⁴ IFFO – The Marine Ingredients Organisation.

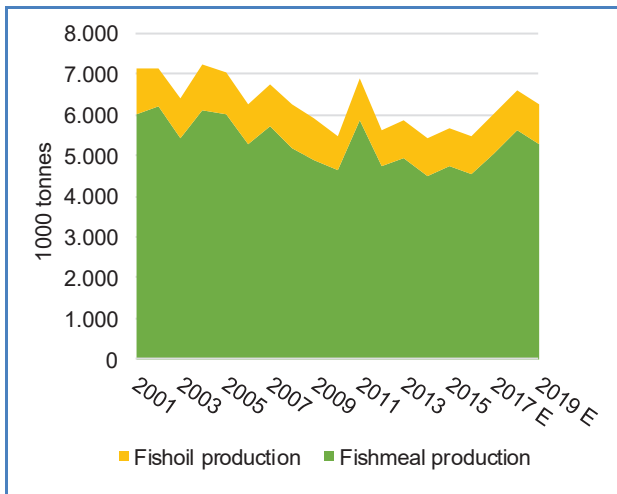
¹⁵ https://www.seafish.org/media/Publications/Seafish_FishmealandFishOil_FactsandFigures2018.pdf

¹⁶ FAO.

¹⁷ <http://www.bloomassociation.org/en/our-actions/our-themes/sustainable-fishing/reduction-fisheries/>

¹⁸ <http://www.iffonet/byproduct>

Figure 41. **GLOBAL FISHMEAL AND FISH OIL PRODUCTION (volume in 1000 tonnes)**

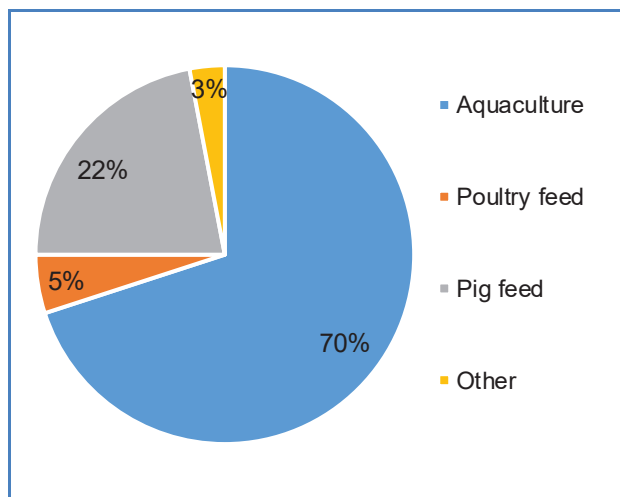


Source: The Marine Ingredients Organisation (IFFO).

In 2018, estimated global production of fishmeal was at 5,6 million tonnes, its highest level since 2011. A good fishing year in Peru, due to large landings of Peruvian anchoveta, was the main reason to the increased supply. Fish oil production was estimated at around one million tonnes in 2018. Due to a quota decrease of small pelagics going into the reduction industry, fishmeal production is expected to decrease in 2019.

The aquaculture sector is the main consumer of fishmeal and fish oil, taking about 70% of global consumption in 2017. Fishmeal is mainly used in aquaculture feed as well as in poultry and pig diets. In 2017, 22% of fishmeal was used in pig feed and 5% in poultry feed. In 2016, 31% of the fishmeal destined for aquaculture was used to feed crustaceans, 23% to feed salmon and trout and 15% to feed other marine fish¹⁹.

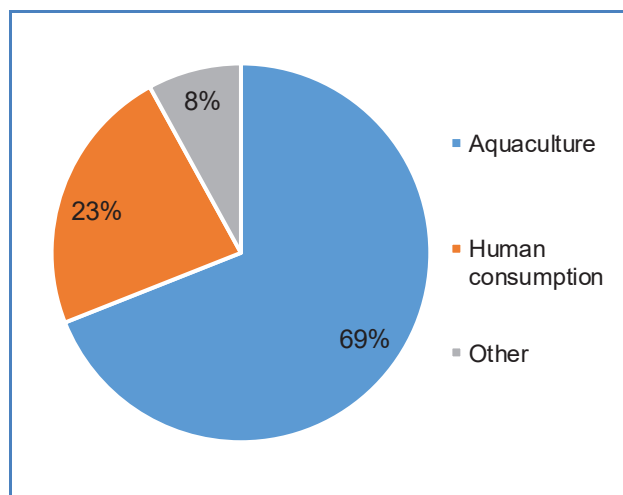
Figure 42. **GLOBAL FISHMEAL USAGE PER DESTINATION IN 2017 (in volume)**



Source: The Marine Ingredients Organisation (IFFO).

¹⁹ IFFO- The Marine Ingredients Organization.

Figure 43. **GLOBAL FISH OIL USAGE PER DESTINATION (volume in tonnes)**



Source: The Marine Ingredients Organisation (IFFO).

Farmed fish, and in particular salmon, needs a certain share of fish oil in their diets to secure a final product which is comparable to their wild counterparts in terms of nutritional qualities²⁰. Therefore, of the fish oil destined to the aquaculture segment, around 60% is used in the salmon and trout feed, 18% in marine fish and 6% in crustaceans²¹. The benefits of the omega-3 fatty acids are also highly valued as food supplement for human consumption: this segment is therefore the largest competitor to the aquaculture segment constituting 23% of the global fish oil consumption in 2017. The other category contains hydrogenated products and products for industrial and pharmaceutical purposes²².

4.2 EU production and usage

In Europe there are 29 factories producing fishmeal and fish oil and their output is around 600.000 tonnes at an export value of more than EUR 1 billion/year. The industry directly generates 3.000 jobs in coastal areas. In addition, the industry generates numerous jobs in the fishing sector and the ancillary support sector²³.

Each year, the EU produces around 450-500 thousand tonnes of fishmeal and 150–200 thousand tonnes of fish oil. This constitutes around 10-15% of the global annual production. In 2016, EU fishmeal production reached 461.000 tonnes, down by 5% from 2015. In the same period, fish oil production increased by 14% to 144.000 tonnes.

There are currently 10 fish meal in the EU in 6 different EU member states. These factories are owned by 3 companies. Most of the factories are situated in Denmark and the UK.

Denmark is by far the largest producer, accounting for almost 50% of the total. Danish production is mainly based on landings of small pelagics like blue whiting, sandeel, Norway pout and sprat. Spain ranks second, covering almost 20% of the total. In Spain, fishmeal and fish oil are produced from waste/trimmings from the processing industry.

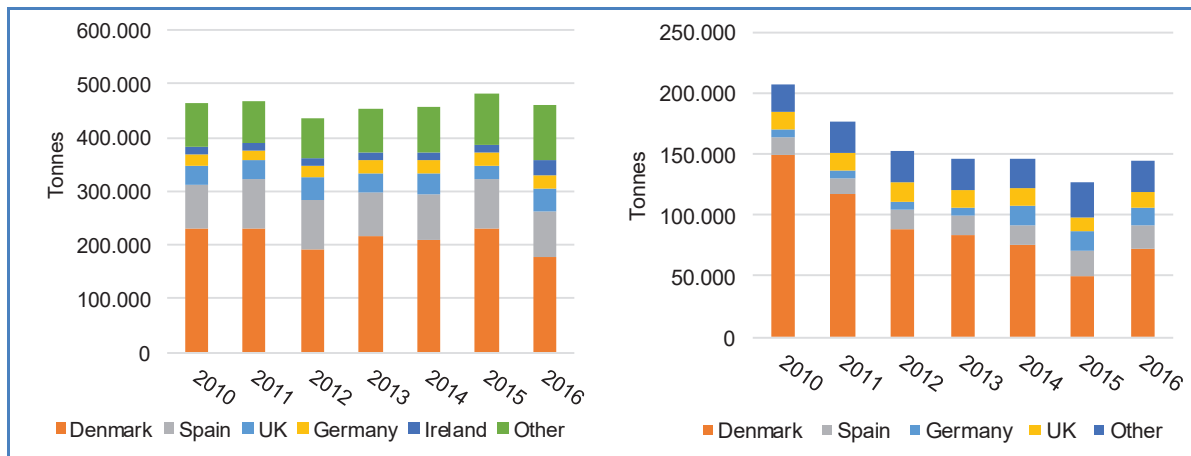
²⁰ <http://www.fao.org/in-action/globefish/fishery-information/resource-detail/en/c/338773/>

²¹ IFFO – The Marine Ingredients Organization.

²² <http://www.iffonet.net/node/735>

²³ Eufishmeal: EUfishmeal input to the BREF SA TWG.

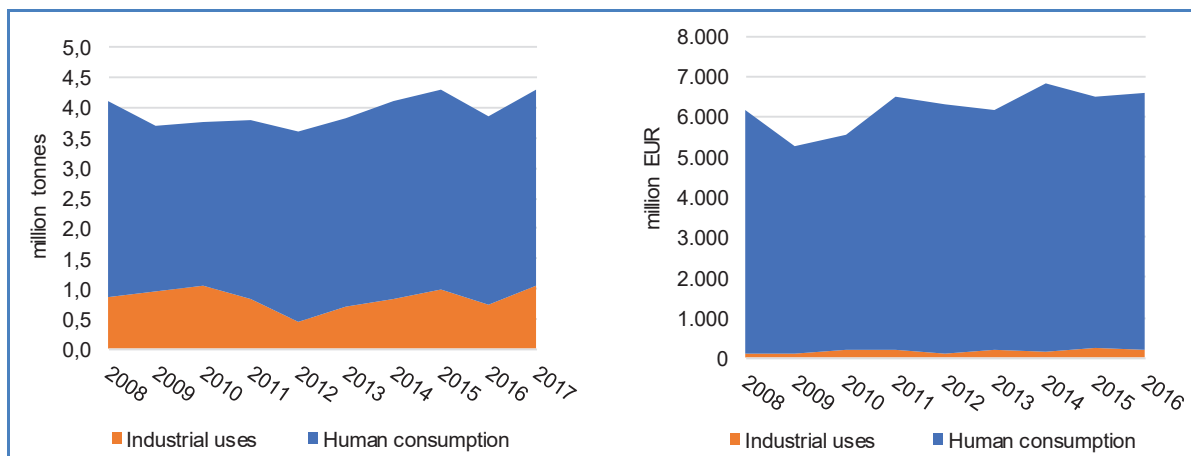
Figure 44. FISHMEAL (LEFT) AND FISH OIL (RIGHT) PRODUCTION IN THE EU



Source: FAO.

EU landings for industrial uses increased by 44% from 2016 to 2017. In 2017, total fishery landings in the EU were 4,3 million tonnes, of which 24% was destined for fishmeal and fish oil production (industrial uses). Of this share, nearly all was landed in Denmark. In terms of value, fish for industrial uses constituted 3% of total EU landings in 2016. Some of the industrial use's volumes will go into the human consumption markets after being produced into fishmeal or fishoil. This is especially true for fishoil which highly valued as dietary supplement in markets with good purchasing power.

Figure 45. TOTAL LANDINGS IN THE EU PER DESTINATION USE (in volume (left) and value (right))

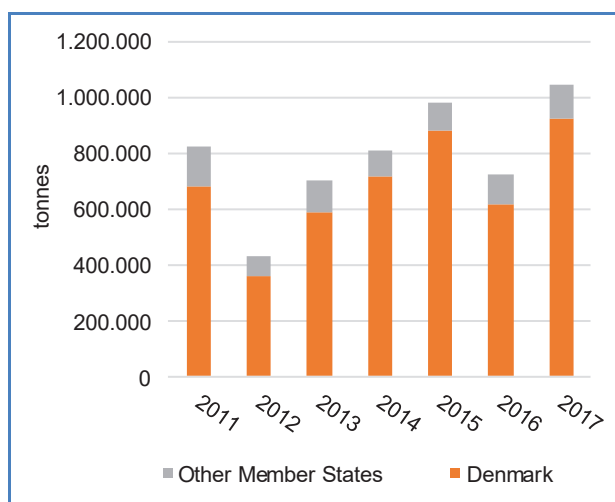


Source: Source: Eurostat, Udenrigsministeriet Fiskeristyrelsen (DK). Eurostat only provide value data including 2016. Volume includes 2017 data for all countries except Denmark. 2017 figures for Denmark are therefore sourced from national statistics in Denmark.

Most of the direct fisheries for industrial uses are landed in Denmark. Other European fishmeal and fishoil producers use mainly trimmings in their production.

The major fish species landed for industrial uses in the EU are sandeel, blue whiting, sprat and herring. Herring is mainly destined for human consumption, but of the large volumes caught and subsequent low prices, some are used in the production of fishmeal and fish oil. Due to significant variations in the quotas for the different species utilized for non-food uses, the availability in the EU fisheries vary strongly from year to year. For example, from 2016 to 2017 there was a large increase in the landings of sandeel (+900%) due to a quota increase of the same proportion. During 2016–2017, total EU landings of all species for industrial uses increased by 44% to 1.040 thousand tonnes.

Figure 46. **EU LANDINGS FOR INDUSTRIAL USES (in volume)**



Source: Eurostat, Udenrigsministeriet Fiskeristyrelsen (DK).

Table 3. **MAIN SPECIES LANDED IN THE EU FOR INDUSTRIAL USES (volume in 1000 tonnes)**

Species	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sandeel	280	320	350	360	60	250	200	250	40	400
European sprat	320	420	380	290	180	180	250	390	330	260
Blue whiting	70	0	0	0	0	70	170	180	160	190
Herring	130	130	130	110	70	120	120	130	150	150
Norway Pout	30	30	70	0	30	40	30	30	30	20
Boarfish	10	40	100	20	40	30	20	0	0	0
Capelin	0	0	0	40	30	10	10	0	0	0
Other	0	0	0	0	10	10	10	50	10	20
Total EU	840	940	1.030	820	420	710	810	1.030	720	1.040

Source: Eurostat.

Large quotas of sandeel, sprat and blue whiting mean more raw material to the fishmeal producers as these species are mainly used for reduction and not suitable for human consumption. The large sandeel quota in 2017 (+900% compared with 2016) contributed strongly to the good raw material situation this year.

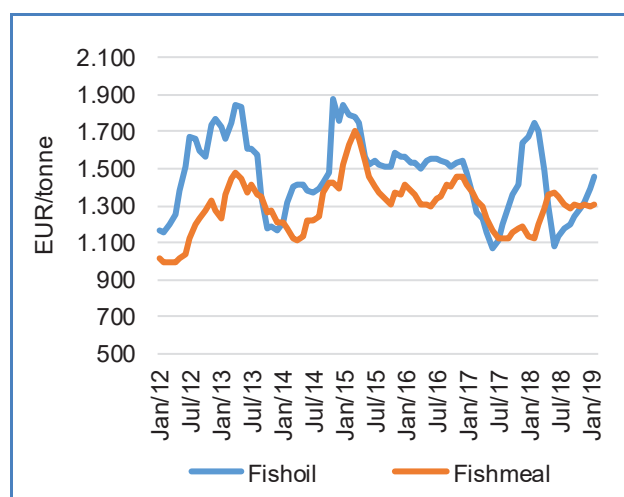
In 2018, quotas of the species decreased by 11% to 1,94 million tonnes and 2019 quotas show a further 24% decline. The fishing quotas for small pelagic species forms the basis for the volumes which goes in to the reduction industry. Large quotas of especially sandeel, sprat and blue whiting means more raw material for the fishmeal producers as these species are mainly used for reduction. The large sandeel quota in 2017 contributed strongly to the good raw material situation in 2018. In 2018, quotas of the selected species decreased by 11% to 1,94 million tonnes and 2019 quotas show a further 24% decline.

Table 4. EU FISHING QUOTAS OF MAIN SPECIES DESTINED FOR INDUSTRIAL USES (volume in 1000 tonnes)

Specie	2012	2013	2014	2015	2016	2017	2018	2019	% change 18/19
Sandeel	180	264	207	0	87	486	233	113	-52 %
Euroepan sprat	441	457	422	479	458	461	457	463	+1 %
Blue whiting	73	133	218	482	208	385	401	320	-20 %
Norway pout	0	167	106	128	129	142	55	55	0 %
Boarfish	82	82	128	53	43	27	20	22	+10 %
Herring	696	754	783	818	619	684	776	509	-34 %

Source: European Commission (2012-2015), eufishmeal.org (2016-2019).

Figure 47. FISHMEAL AND FISH OIL PRICES IN THE EU (EUR/tonne)



Source: Oil world.

With some local variations, the fishmeal and fish oil prices in Europe correspond significantly to the global prices, which are linked to the supply situation in South America, in particular Peru.

During 2018, Peruvian fishmeal and fish oil production increased strongly from the years before and reached its highest level since 2011. Since more than 90% of the Peruvian production is exported, this has balanced the global fishmeal and fish oil market and helped stabilize prices. Fishmeal prices in the EU showed a declining trend throughout the second half of 2018. Fish oil prices came down from the very high level seen in the beginning of 2018 when price was above EUR 1.750/tonne. Fishoil prices reached a bottom in June last year and has since then increased to around EUR 1.450/tonnes.

4.3 Extra-EU imports

A large share of fishmeal and fish oil consumption in the EU is supplied by imports from non-EU countries. In 2016, comparing production, imports and exports, 50% of the fish meal consumption was sourced from non-EU countries.

In 2018, fishmeal imports amounted to 268.960 tonnes and EUR 356 million, increasing by 39% in terms of volume and by 46% in terms of value compared with 2017. The top three suppliers were Norway, Iceland and the Faroes, constituting 46% of the volume and almost 50% of the value. Imports from Norway increased by 57%, reaching 56.900 tonnes, and value increased by 66% to EUR 82.190 million.

EU imports of fish oil in 2018 reached 216.753 tonnes, valued at EUR 333 million. This was a 18% increase in volume and a 22% increase in value from 2017. The top three suppliers were Peru, Norway and the US, accounting for 64% of total volume and 54% of total value. Imports from Peru increased by 76%, to 61.891 tonnes while their value increased by 66% to EUR 89 million.

Table 5. EXTRA-EU IMPORTS OF FISHMEAL BY COUNTRY OF ORIGIN (volume in tonnes, value in 1000 EUR)

Country of origin	2013		2014		2015		2016		2017		2018	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Norway	45.500	41.540	51.860	46.600	67.400	78.230	44.590	61.800	36.280	49.460	56.940	82.190
Iceland	58.500	82.050	13.700	18.380	51.380	77.360	20.370	31.630	33.660	40.750	36.400	51.530
Faroe Islands	11.990	15.100	10.450	13.000	13.980	19.400	11.130	16.240	16.890	21.240	30.040	42.380
Peru	112.500	136.200	150.910	181.010	45.400	60.010	63.690	86.660	18.630	23.800	27.900	34.700
Morocco	25.060	26.270	29.340	29.550	35.130	46.320	50.600	61.810	28.180	29.660	27.990	30.460
Chile	37.560	48.730	48.220	58.730	18.060	27.870	18.430	27.110	20.170	25.880	19.430	26.850
Mauritania	23.570	25.860	39.510	38.180	16.830	21.360	29.490	37.070	10.310	12.760	21.230	25.970
Other	19.690	24.430	28.440	35.120	30.820	42.720	45.340	62.650	28.730	40.090	49.030	62.350
Total EU	334.370	400.180	372.430	420.570	279.000	373.270	283.640	384.970	192.850	243.640	268.960	356.430

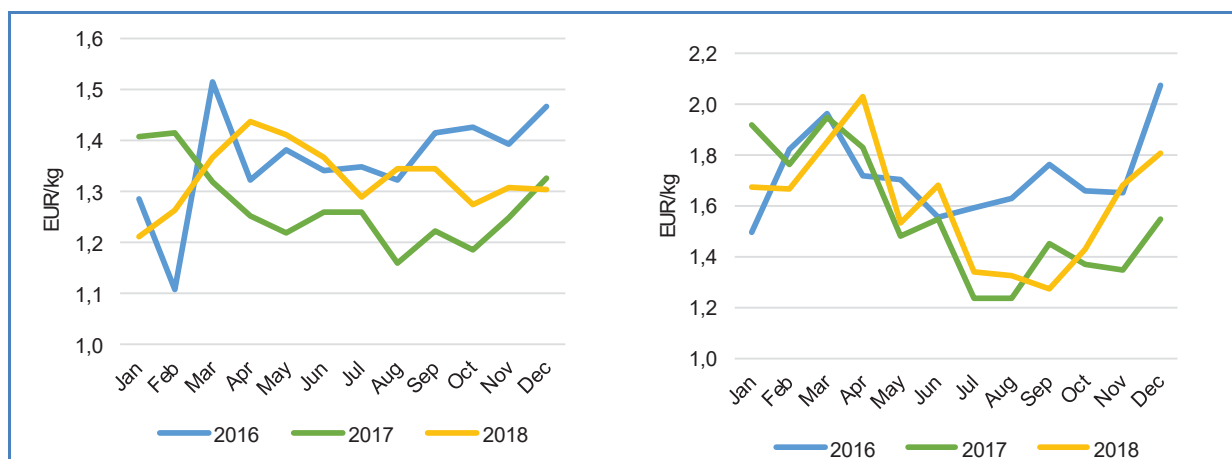
Source: EUMOFA.

Table 6. EXTRA-EU IMPORTS OF FISH OIL BY COUNTRY OF ORIGIN (volume in tonnes, value in 1000 EUR)

Country of origin	2013		2014		2015		2016		2017		2018	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Peru	39.710	66.840	59.080	90.220	58.110	90.020	21.980	47.540	35.190	53.660	61.890	89.230
Norway	45.880	58.410	40.490	46.460	54.970	59.820	56.930	63.660	51.990	56.770	52.760	61.380
USA	22.520	28.320	26.360	36.430	13.260	25.630	39.900	65.060	25.220	35.540	25.010	29.590
Mauritania	13.770	19.000	15.400	17.310	10.430	15.100	12.700	21.230	15.160	17.440	17.130	24.000
Mexico	1.840	21.470	0	31.310	0	31.520	0	22.700	9.490	20.510	8.000	18.200
Morocco	13.130	7.180	21.480	60	17.550	130	10.920	6.880	8.480	1.080	7.480	14.370
Turkey	4.360	23.710	30	9.070	60	13.210	4.510	16.740	520	18.860	7.210	13.060
Other	30.180	59.170	33.410	50.300	20.880	36.930	29.890	53.360	38.230	69.050	37.270	82.820
Total EU	171.390	284.100	196.250	281.160	175.260	272.360	176.830	297.170	184.280	272.910	216.750	332.650

Source: EUMOFA.

Figure 48. EXTRA-EU IMPORT PRICES OF FISHMEAL (LEFT) AND FISH OIL (RIGHT)



Source: EUMOFA.

The average EU import price of fish oil in 2018 was 1,53 EUR/kg, increasing by 3% over 2017. For fishmeal, it was 1,33 EUR/kg, increasing by 6% over 2017.

4.4 Extra-EU exports

In 2018, EU exports of fishmeal to non-EU countries totalled 136.926 tonnes, valued at EUR 189 million. This was a 13% decrease in volume and a 12% decrease in value. Norway was the largest destination market, constituting 41% of both volume and value.

In 2018, the EU exported 129.686 tonnes of fish oil valued at EUR 205 million. This was a 3% increase in terms of volume and a 6% increase in value. As with fishmeal, Norway was by far the largest market, accounting for 91% of the volumes and 80% of the export value. The main EU exporting country is Denmark, with 80% (109.000 tonnes) of the fishmeal volumes and 81% (EUR 152 million) of value. For fish oil, Denmark accounted for 85% (110.000 tonnes) of the volumes and 73% (EUR 150 million) of the value in 2018.

Table 7. EXTRA-EU EXPORTS OF FISHMEAL BY COUNTRY OF DESTINATION (volume in tonnes, value in 1000 EUR)

Country of destination	2013		2014		2015		2016		2017		2018	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Norway	125.530	170.980	159.150	208.100	106.510	154.130	119.380	181.090	62.980	87.460	56.110	77.700
China	17.730	25.290	8.680	11.530	16.620	26.830	9.700	15.040	22.720	29.690	13.900	20.470
Canada	5.200	8.080	5.370	8.040	5.680	9.850	7.100	12.360	8.450	14.210	8.140	13.890
Taiwan	3.630	4.940	3.420	4.540	8.070	11.860	6.410	9.550	10.610	13.270	7.540	10.070
Turkey	5.320	6.690	1.990	2.370	3.180	4.520	1.930	2.720	12.600	15.920	7.600	9.290
United States	1.850	3.310	1.440	2.820	2.790	5.250	4.580	8.830	2.990	6.400	6.100	9.210
Japan	3.260	4.640	1.960	2.810	10.010	16.210	1.240	2.130	5.560	7.820	5.890	7.220
Other	46.270	58.890	42.650	46.360	52.310	85.670	32.200	48.280	30.790	40.730	31.650	41.040
Total EU	208.790	282.820	224.660	286.570	205.170	314.320	182.540	280.000	156.700	215.500	136.930	188.890

Source: EUMOFA.

Table 8. EXTRA-EU EXPORTS OF FISH OIL BY COUNTRY OF DESTINATION (volume in tonnes, value in 1000 EUR)

Country of destination	2013		2014		2015		2016		2017		2018	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Norway	88.950	139.610	113.370	158.840	92.560	163.500	114.340	190.610	113.710	159.090	117.800	164.650
China	430	3.700	430	4.110	250	3.190	200	4.570	50	2.120	110	6.930
Switzerland	720	5.980	660	2.630	370	1.100	470	1.890	660	2.920	870	4.680
Russia	430	1.570	830	1.520	790	3.110	1.030	3.700	950	3.380	980	4.000
Usa	320	3.570	210	2.020	300	1.360	1.670	3.980	1.240	3.660	1.220	3.600
Canada	1.020	2.490	1.000	2.080	40	300	1.280	3.210	440	1.370	1.150	2.330
Turkey	830	1.390	490	620	190	410	210	610	480	1.310	1.050	1.850
Other	8.530	25.520	4.290	22.500	11.710	38.280	7.850	28.780	8.520	20.450	6.510	17.090
Total EU	101.230	183.830	121.280	194.320	106.210	211.250	127.050	237.350	126.050	194.300	129.690	205.130

Source: EUMOFA.

4.5 Outlook

The fisheries destined to the production of fishmeal and fish oil in the EU are limited by both the quotas and the demand for fish for human consumption. Species like herring and Atlantic mackerel were earlier utilized for non-food products to a much larger degree. Today, there are still some volumes of herring utilized for the non-food industry, and small or no volumes of mackerel.

The development concerning a switch from non-food uses to human consumption can also be noticed for other species like blue whiting and sprat. Nonetheless, as the catch volumes may fluctuate strongly, the potential surplus cannot be destined for the human consumption markets and will most likely go to the reduction industry, ending up as fishmeal and fish oil. Regarding this, the UN's Food and Agriculture Organisation (FAO) reports that

90% of the fish used in the production of fishmeal and fish oil is “presently unmarketable in large quantities as human food”²⁴.

Fishmeal and fish oil production also offers a unique opportunity for recycling the otherwise unusable trimmings discarded by the seafood processing sector. The utilization of trimmings for reduction is expected to rise to 49% by 2022²⁵.

Because of better utilization of trimmings and a stable raw material supply from direct fisheries, fishmeal and fish oil production might increase in the coming years. However, only a marginal share of that growth is likely to come from fish by-products. According to FAO, fishmeal produced from fish by-products will represent 34% of the world fishmeal production in 2030 compared to 30% today.

As seen from the quota table, the raw material situation from direct fisheries to the fishmeal and fish oil producers fluctuates from one year to the next. However, production over a longer run will likely be stable as the fisheries are fully exploited with no prospects to increase the catches. The possibility of increasing global production of fishmeal and fish oil from the traditional raw material sources is therefore limited mainly to better utilization of trimmings.

While global catches will remain constant, the largest market for fishmeal and fish oil, the aquaculture sector, is growing and will continue to grow for the foreseeable future, according to FAO. Therefore, the aquaculture industry will search for new options to cover their increased needs. There are some possible alternative options to increase the production of marine and land-based proteins and oil (such as krill, algae, insect-based feeds, marine worms, yeast-based ingredients etc.), but none of these can today compete with the traditional sources, in terms of both volumes and price²⁶.

²⁴ <https://www.seafish.org/article/fishmeal-and-fishoil>

²⁵ <https://www.seafish.org/article/fishmeal-and-fishoil>

²⁶ <https://www.aquaculturealliance.org>