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The global picture – fishmeal production

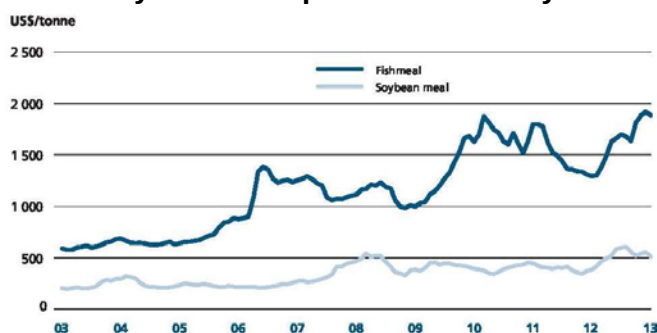
Taken from FAO: The State of World Fisheries and Aquaculture 2014 (244 pages)

<http://www.fao.org/3/a-i3720e.pdf>

Current fishmeal usage

- The proportion of fisheries production used for direct human consumption increased from about 71% in the 1980s, 73% in the 1990s, 81% in the 2000s to more than 86% (136 million tonnes) in 2012, with the remainder 14% (21.7 million tonnes) destined to non-food uses (e.g. fishmeal and fish oil), of which 75% (16.3 million tonnes) was reduced to fishmeal and fish oil. The residual 5.4 million tonnes was largely utilised as fish for ornamental purposes, for culture (fingerlings, fry, etc.), bait, pharmaceutical uses and as raw material for direct feeding in aquaculture, for livestock and for fur animals
- A significant, but declining, proportion of world fisheries production is processed into fishmeal (mainly for high-protein feed) and fish oil (as a feed additive in aquaculture and also for human consumption for health reasons). They can be produced from whole fish, fish remains or other fish by-products such as heads, tails, bones and other offals.
- About 35% of world fishmeal production was obtained from fish residues in 2012 (by-products and waste rather than whole fish). This share is growing, replacing rather than adding to the volumes of small pelagic fish used for feed purposes. Fishmeal and fish oil are highly traded products, an important source of revenue for some countries, and a very important feed ingredient for the aquaculture sector, which is the fastest-growing food production sector in the world.
- Global demand for fishmeal and fish oil has been increasing, as have their prices. There is an increasing trend in the use of pelagic fish directly for human consumption rather than for fishmeal..
- According to estimates by the International Fishmeal and Fish Oil Organisation, the aquaculture industry utilized 73% of the fishmeal produced in 2010 and, therefore, this product contributes indirectly to food production. In the case of fish oil, the estimates are that 71% goes for aquafeed and 26% for human consumption.

Fishmeal and soybean meal prices in Germany and the Netherlands (page 61)



Source: FAO, 2013. FAO Fisheries and Aquaculture Information and Statistics Branch, Rome.

Fishmeal production (page 42 - 45 and page 61 of report)

- In the period 2008–2012, fish for reduction represented about 9–12% of total fisheries production and 16–20% of total capture fisheries production.
- Notwithstanding annual fluctuations owing to anchoveta catches, overall, the production of fishmeal from whole fish has declined gradually since 2005. This decrease has been only partly offset by a growing share of fishmeal production obtained from fishery by-products.
- In contrast, overall demand continued to grow, pushing prices to historic highs until January 2013, with an increase of 206% between January 2005 and January 2013 to US\$1 919/tonne. Between January 2013 and January 2014, prices declined by 20%. As soybean meal prices remained relatively stable during the same period, the growing price differential provided incentives for terrestrial farmers to substitute fishmeal with less expensive feed alternatives.
- Although many different species are used for fishmeal and fish-oil production, oily fish such as small pelagics, in particular anchoveta, are the main groups of species utilised.
- In recent decades, catches of anchoveta have experienced a series of peaks and drastic falls as a direct consequence of the El Niño phenomenon. In addition, stricter management measures have reduced catches of anchoveta and other species usually used for reduction. Hence, the volumes of fishmeal and fish oil produced have fluctuated with variations in the catches of these species.
- Fishmeal production peaked in 1994 at 30.2 million tonnes (live weight equivalent). In 2010, it dropped to 14.8 million tonnes owing to reduced catches of anchoveta, increased in 2011 to 19.4 million tonnes and then declined to 16.3 million tonnes in 2012.
- China remains the main market, importing more than 30% of fishmeal in terms of quantity, while Peru and Chile are the major exporters.
- Owing to the growing demand for fishmeal and fish oil and rising prices, more fishmeal is being produced from fish by-products, which previously were often discarded. This can affect the composition and quality of the fishmeal with, in general, more ash (minerals), an increased level of small amino acids (such as glycine, proline, hydroxyproline) and less protein, which may affect its share in feeds used in aquaculture and livestock farming.
- According to recent estimates, about 35% of world fishmeal production was obtained from fish residues in 2012.
- Given the above, efforts to replace fishmeal and fish oil are ongoing and further improvements are expected. In recent years, the percentage of fishmeal and fish oil in compound feeds for aquaculture has shown a clear downward trend while their international prices have increased. At present, and in the near future, fishmeal and fish oil will be widely used as strategic ingredients at lower levels and for specific stages of production, e.g. fry.

The role of aquaculture in improving nutrition: opportunities and challenges (pages 42 – 45 and 106). Fishmeal substitution

Depending on the alternatives used, their substitution by other ingredients may affect the health properties of farmed fish.

- Almost completely absent in the higher plants, highly unsaturated fatty acids (HUFAs) determine the dietary value of fish in human nutrition. However, there are differences in the ability of different aquatic animals to synthesize HUFAs, such as eicosapentaenoic acid and docosahexaenoic acid – which fishmeal and fish oil are particularly rich in.

- Such differences appear to depend on species and life stage. Alternative sources of HUFAs are being explored, including large marine zooplankton stocks, such as Antarctic krill (*Euphausia superba*) and the copepod *Calanus finmarchicus*. To offset their rising prices, as feed tonnages increase, feed companies will continue to stretch available quantities of fishmeal and fish oil further by substituting them with other ingredients.
- Most fish feeds contain a minimum level of fishmeal in order to ensure an optimal content of amino acids and other nutrients needed for fish growth and flesh quality. The use of fish-derived products in feed formulas could pose a dilemma if this fish could be used as human food. If less than one kilogram of fish in feed were needed to produce one kilogram of farmed fish, it would in many cases be more acceptable.
- Progressively less fishmeal and fish oil are being used for aquaculture despite their steadily rising production.
- To reduce production costs, cheaper vegetable alternatives are also increasingly replacing expensive fish oil. This is probably a direct consequence of better-paying markets for fish oil, particularly for nutraceutical purposes, which are absorbing a growing share of the available fish oil. The increased focus on the benefits of fish oils has boosted the demand for fish oil for direct human consumption, with an annual growth rate of 15–20%.
- Unless carefully monitored, the reduced levels of fish oil in aquafeed might result in fish with a less-favourable fatty acid profile. Fish oil in feed should be, and in many cases is, optimised to ensure that the long-chain omega-3 fatty acids end up in the final product, and are not metabolized by the fish during growth.
- Fishmeal and fish oil are still major ingredients in most aquaculture feeds. In order to ensure healthy fish and final products comparable with those from their wild counterparts, farmed fish need to receive EPA and DHA largely through their diets. In nature, marine microalgae are the main producers of these valuable fatty acids. Freshwater fish seem better able than their marine relatives to elongate short-chain omega-3 fatty acids into EPA and DHA.
- In practice, fish oil is the only economically viable source of long-chain omega-3 fatty acids for feed purposes. Alternatives such as EPA and DHA production based on microalgae seem to be too costly for feed purposes and not a viable option in the near future. As a result of the increasing focus on reducing levels of fish oil and fishmeal in diets for aquaculture, the sector is now probably set to become a net provider of the valuable and essential fatty acids, mainly owing to the large production of carps.
- Cyprinids and tilapias represent a significant proportion of global aquaculture production. As they are to a great extent filter feeders or non-fed fish low in the food chain, their production, at least in theory, does not require feed with fishmeal and fish oil. Although many cyprinid species are produced using supplementary feed, the levels of fishmeal and/or fish oil included in the feeds are minimal. In theory, non-fed fish species should have a great potential for expansion as feed inputs are minimal – this also applies to molluscs.

Projected outlook (Page 199 – 204)

In 2010, FAO developed a model to analyse the outlook for the fisheries and aquaculture sector in terms of production potential, demand, consumption, prices and key issues that might influence future supply and demand. The projection results are updated annually to describe a plausible scenario in a ten-year horizon under certain assumptions (e.g. macroeconomic environment, international trade rules and tariffs, El Niño phenomena, management constraints on production, and longer-term productivity trends). These assumptions portray a specific

macroeconomic and demographic environment that shapes the evolution of demand and supply.

Under baseline projections to 2022 (there are three additional scenarios - Intermediate, Optimistic and Mixed) world fisheries production is set to rise over the projection period (2013–2022) to 181 million tonnes in 2022, of which 161 million tonnes destined for direct human consumption. This represents an increase of about 18% above the average for 2010–12.

	Base period 2010–2012	2022 scenarios			
		Baseline	Intermediate	Optimistic	Mixed
<i>(Million tonnes in live weight equivalent)</i>					
WORLD					
Total fishery production	153.940	181.070	188.093	194.800	194.792
Aquaculture	62.924	85.124	92.402	99.330	99.330
Capture	91.016	95.946	95.692	95.474	95.462
Fishmeal production (product weight)	6.103	7.021	7.358	7.679	7.734
Fish oil production (product weight)	0.980	1.079	1.087	1.094	1.088
Fish trade for human consumption	36.994	45.082	45.566	46.237	46.566
Fish supply for human consumption	131.741	160.514	167.397	173.969	174.032
Per capita apparent fish consumption (kg)	18.9	20.7	21.6	22.4	22.4

- In 2022, about 16% of capture fishery production will be reduced to fishmeal and fish oil, down 7% on the 2010–12 average. However, in 2022, total production of fishmeal and fish oil should be, respectively, 15 and 10% up on the base period.
- Almost 95% of the additional gain for fishmeal will stem from improved use of fish waste, cuttings and trimmings.
- Sustained demand and high prices for fishmeal, combined with reduced raw-material availability and growing value added fishery products for human consumption, will lead to more residues being used in fishmeal manufacturing.
- Fishmeal from fish by-products should represent 49% of total fishmeal production in 2022. With global demand stronger than supply, prices of fishmeal and fish oil will increase by 6 and 23%, respectively, in nominal terms by 2022.

Reducing the use of wild fish for aquaculture feeds (Page 216)

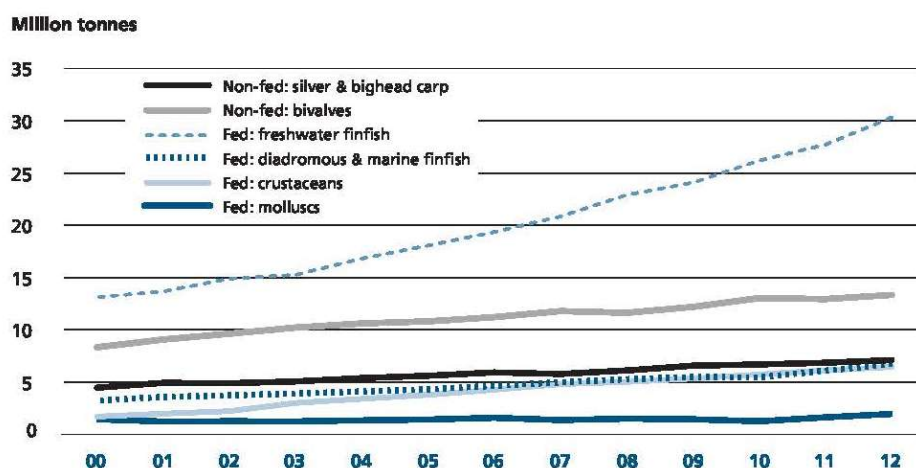
Some solutions to reduce the use of fish for aquaculture feeds include the following.

- Increased use of other feed sources: Owing to the high price of and competition for fishmeal, replacement by terrestrial feed sources is the current trend. This has probably also facilitated the increase in farmed herbivorous and omnivorous species, which use much less fishmeal than do carnivorous species per tonne of protein and therefore could be considered more ecofriendly and socially acceptable. However, the availability and price of terrestrial ingredients will also depend on external factors such as freshwater availability. the scenarios and modelling described above are based on the past behaviour of the sector, but tipping points may arise in regard to the availability of terrestrial feed sources.
- Increased use of fish waste: About 35% of fishmeal is already produced using fish-processing by-products. Under one of the above scenarios, increased utilization of

wastes could significantly increase fishmeal availability and boost aquaculture production. One challenge is the possible ending of restrictions on the use of fish and animal wastes for fishmeal that many countries have. In addition, fishmeal from waste has a lower nutritional value (more minerals and fewer proteins). The model projection without such restrictions increases fishmeal availability by 12% by 2030. As a first step, global guidance should be produced on the use of fish waste.

- Greater reliance on extractive species: Aquaculture growth could rely more on extractive species that naturally use available carbon and nutrients, e.g. filter feeders, algae and fish species such as silverhead and bighead carps. This solution has other advantages such as reduced eutrophication potential and contributing to uptake of excess organic matter (especially in the case of algae). However, consumers may not prefer the above species, and recent production trends indicate a progressive emphasis on fed species. In 2012, non-fed species accounted for about 30% of culture production worldwide, compared with about 50% in 1982. Appropriate awareness campaigns and concerted efforts to facilitate such farming systems could stimulate their increased consumption.
- Promoting herbivorous and omnivorous species: this is partly happening owing to lower feed prices as compared with those for carnivorous species, which explains in part the increased production of tilapia catfish and carps.

World aquaculture production, fed and non-fed



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