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## The global picture – fishmeal production

**Taken from** FAO: The State of World Fisheries and Aquaculture 2012 (230 pages)

<http://www.fao.org/docrep/016/i2727e/i2727e.pdf>

### Global catches

- Overall global capture fisheries production continues to remain stable at about 90 mt although there have been some marked changes in catch trends by country, fishing area and species. In the last seven years (2004–2010), landings of all marine species except anchoveta only ranged between 72.1 and 73.3 million tones (mt).
- The amount of captured fish destined for non-food uses increased from 20.6 mt in 1976 to 34.2 mt in 1994 (a proportionate increase from 31.5 to 37.1% of total catch). Since 1995, this amount has been decreasing both in absolute terms and as a proportion of total catch. In 1995, 31.3 mt of global fish and shellfish landings were destined for non-food uses (33.9% of total catch), and, out of this total, 27.2 mt (29.5% of total catch) were reduced into fishmeal and fish oil. In 2009, the corresponding figure was 22.8 mt (25.7% of total). Out of this total, 17.9 mt (20.2% of total catch) were reduced into fishmeal and fish oil. The amount of captured fish destined for non-food uses will probably decrease further in the near future.
- In contrast, the most dramatic changes, as usual, have been for anchoveta catches in the Southeast Pacific, which decreased from 10.7 mt in 2004 to 4.2 mt in 2010. A marked decrease in anchoveta catches by Peru in 2010 was largely a result of management measures (e.g. fishing closures) applied to protect the high number of juveniles present as a consequence of the La Niña event (cold water). This action paid dividends in 2011 when anchoveta catches exceeded their 2009 level.
- Chilean jack mackerel catches have declined for this transboundary resource with a very wide distribution in the South Pacific, ranging from the national exclusive economic zones (EEZs) to the high seas. After having peaked at about 5 mt in the mid-1990s, catches were about 2 mt in the mid-2000s but have since declined abruptly, and the 2010 catches were 0.7 mt, the lowest level since 1976.

### Production with and without feed

- Fishmeal and fish oil derived from wild-harvested whole fish and shellfish including bycatch currently constitute the major aquatic protein and lipid sources available for animal feed.
- While feed is generally perceived to be a major constraint to aquaculture development, one-third of all farmed food fish production, 20 mt, is currently achieved without artificial feeding. Oysters, mussels, clams, scallops and other bivalve species are grown with food materials that occur naturally in their culture environment in the sea and lagoons. Silver carp and bighead carp feed on planktons proliferated through intentional fertilization and the wastes and leftover feed materials of fed species grown in the same multispecies polyculture systems.
- However, the percentage of non-fed species in world production has declined gradually from more than 50% in 1980 to the present level of 33.3%, strongly dominated by

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changing practices in Asia. This reflects the relatively faster growth in the fed-species culture subsector supported by, among others, the development and improved availability of formulated aquaculture feeds for finfishes and crustaceans.

- Aquafeeds are generally used for feeding omnivorous fishes (e.g. tilapia, catfish, common carp, and milkfish), carnivorous fishes (e.g. salmon, trout, eel, seabass, seabream and tuna) and crustacean species (marine and brackish-water shrimps, freshwater prawns, crabs and lobsters).
- According to FAO estimates, in 2008, about 31.7 mt (46.1% of total global aquaculture production including aquatic plants) of fish and crustaceans were feed-dependent, either as farm-made aquafeeds or as industrially manufactured compound aquafeeds. In 2008, fed aquaculture contributed to 81.2% of global farmed fish and crustacean production of 38.8 mt and 60.0% of global farmed aquatic animal production.

### Fishmeal inclusion rates

- Within the animal husbandry subsectors, aquaculture is the largest user of fishmeal and fish oil. Their use in aquafeeds is more prevalent for higher-trophic-level finfishes and crustaceans (with fishmeal inclusion levels of 17–65% and those for fish oil of 3–25%). However, low-trophic-level finfish species/species groups (carps, tilapias, catfishes, milkfish, etc.) are also fed fishmeal and fish oil in varying amounts in their diets. The fishmeal use for these diets varies between 2 and 10%, with the exception of those for tilapias and catfishes in a few countries where up to 25% fishmeal use has been reported. There is a wide variation in fishmeal and fish-oil usage between major species and species groups, with shrimps, marine fishes and salmons being the largest combined users thereof.
- In the last 13 years for which data are available (1995–2008), fishmeal inclusion in major fish diets declined considerably. The FAO technical paper projects that, in the next 10–12 years, fishmeal inclusion in the diets of carnivorous fish and crustacean species will be further reduced by 10–22%, and by 2–5% for omnivorous fishes.

Reduction in fishmeal inclusion in compound aquafeed of different fish species and species groups

Species/species group	Fishmeal inclusion in compound aquafeed		
	1995	2008	2020*
	<i>(Percentage)</i>		
Fed carp	10	3	1
Tilapias	10	5	1
Catfishes	5	7	2
Milkfish	15	5	2
Miscellaneous freshwater fishes	55	30	8
Salmons	45	25	12
Trouts	40	25	12
Eels	65	48	30
Marine fishes	50	29	12
Marine shrimps	28	20	8
Freshwater crustaceans	25	18	8

\* Projected.

Source: Adapted from Tacon, A.G.J., Hasan, M.R. and Metian, M. 2011. *Demand and supply of feed ingredients for farmed fish and crustaceans: trends and prospects*. FAO Fisheries and Aquaculture Technical Paper No. 564. Rome, FAO. 87 pp.

### **Feed Conversion Ratio**

- With improved feed efficiency and management, the FCRs for many aquaculture species dependent on industrially manufactured compound aquafeeds are projected to decline.
- For example, the FCR for fed carps is expected to fall from 1.8 in 2008 to 1.6 in 2020, that for catfishes to decline from 1.5 to 1.3, and that for milkfish to drop from 2.0 to 1.6. If these materialize, coupled with lower fishmeal inclusion in the diets for the above species and species groups, the amount of fishmeal used will decrease by about 6% in spite of the projected increases of 143 and 168% in estimated total aquafeed and fed aquaculture production, respectively.

### **Fish oil inclusion rates**

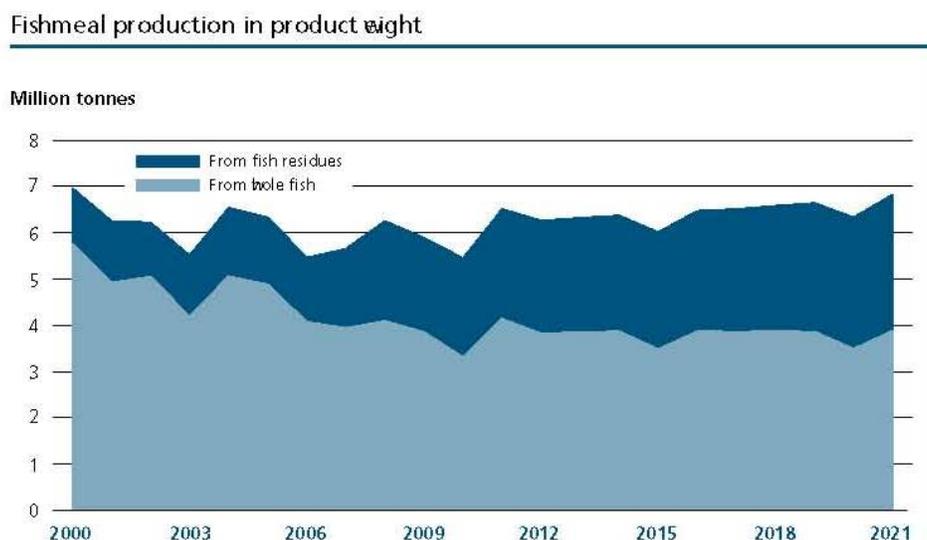
- Although it is projected that fish-oil inclusion in the diets for different carnivorous fish and crustacean species will also be reduced by 0.5–7.0%t over the next ten years, the use of fish oil by the aquaculture sector will probably increase in the long run, albeit slowly.
- The total amount used will increase by more than 16%, from 782,000 t (2.7% of total aquafeeds by weight) in 2008 to 845,000 t by 2015 (1.7%) and to 908,000 t by 2020 (1.3%). The reasons for this increase are the rapidly growing marine finfish and crustacean aquaculture sector and the absence of cost-effective alternative sources of dietary lipids rich in long-chain highly unsaturated fatty acids (HUFAs), including eicosapentaenoic acid and docosahexaenoic acid. There is also a growing demand for fish oil for direct use as human supplements/pharmaceutical medicines.
- Alternatives to fish oil are being used in greater amounts. Key alternative lipids include vegetable oils (e.g. linseed, soybean, canola and palm) – those with a high Omega-3 content are preferred – and poultry oil. The use of oil from farmed fish offal is also a potential source of Omega-3 for farmed fish.
- Although a reduction in the dietary inclusion level of fish oil in aquafeed would not have any deleterious effect on the health of the farmed target species, there may be reduced health benefits from the final fish products because of lower HUFAs, including eicosapentaenoic and docosahexaenoic acid levels. Therefore, intensive research is required in order to find alternatives to fish oil.
- Research is aiming to produce long-chain Omega-3 fatty acids from alternative sources. In order to keep pace with fed aquaculture production, global aquafeed production will continue to grow, and it is expected to reach 71.0 mt by 2020.

### **Utilisation of fish byproducts**

- In recent years, increasing volumes of fishmeal and fish oil have originated from fisheries by-products (capture fisheries and aquaculture). An estimated 6 mt of trimmings and rejects from food fish are currently used for fishmeal and fish-oil production. IFFO estimates that about 25% of fishmeal production (1.23 mt in 2008) comes from fisheries by-products. This amount will grow as its processing becomes increasingly viable.
- In the past, fishery by-products, including waste, were considered to be of low value, or as a problem to be disposed of in the most convenient way or discarded. In the last two decades, there has been a global trend of growing awareness about the economic, social and environmental aspects of optimal use of fishery by-products, and of the importance of reducing discards and losses in post-harvesting phases (storage, processing and distribution). The utilisation of fish by-products has become an important industry in various countries, with a growing focus on handling byproducts in a controlled, safe and hygienic way.

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- Improved processing technologies have also helped in their utilization. In addition to the fishmeal industry, fisheries by-products are also utilized for a wide range of other purposes, including the production of cosmetics and pharmaceuticals, other industrial processes, as direct feeding for aquaculture and livestock, incorporation into pet feed or feed for animals kept for fur production, ensiling, fertilizer and landfill.



Sources: OCEAN and FAO Secretariats.

### Future demand for fishmeal

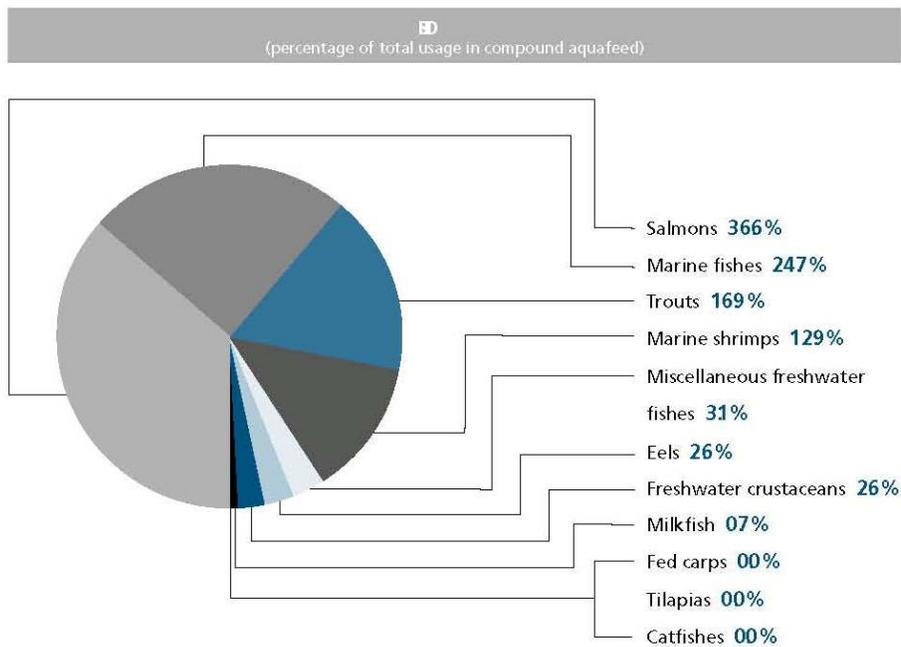
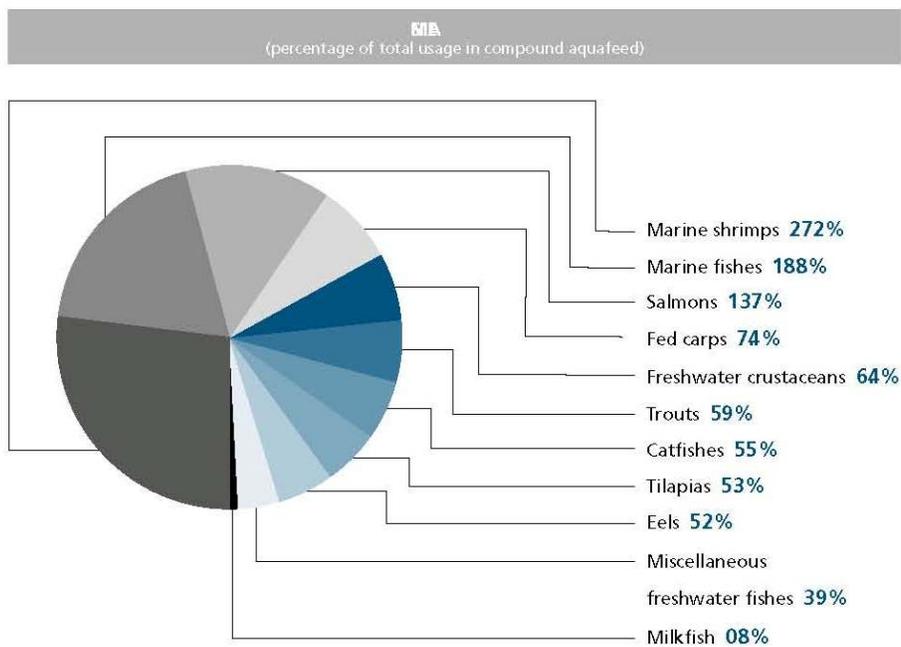
- Although the aquaculture sector remains the largest user of fishmeal in the world, fishmeal use in aquafeeds has gradually fallen since 2006.
- Aquaculture consumed about 4.23 mt (18.7% of total aquafeeds by weight) of fishmeal in 2005, but this figure was down to 3.72 mt in 2008 (12.8%).
- It has been predicted that, even with increasing aquaculture production globally, the use of fishmeal for aquafeeds will decrease further to 3.63 mt by 2015 (7.1% of total aquafeeds for that year) and to 3.49 mt by 2020 (4.9%).
- Among the reasons for this reduction are: decreased supplies of industrially caught fish as a result of tighter quotas; additional controls on unregulated fishing; and increased use of more cost-effective dietary fishmeal replacers.
- In recent decades, because of an increased awareness of the likelihood of a scarcity of fishmeal, research institutions and the aquaculture feed industry have conducted numerous studies to try to reduce dependence on fishmeal. These studies have provided more detailed knowledge on the digestive processes and nutritional requirements of many farmed species and on how to process raw materials to make them more suitable for use in feed. Since 1995, this increased knowledge has led to an impressive reduction in the average inclusion of fishmeal in compound feeds for major groups of farmed species as well as improved feed conversion ratios (FCRs), reducing the amount of waste from the industry.
- Although the discussion on the availability and use of aquafeed ingredients often focuses on fishmeal and fish-oil resources (including low-value fish), considering the past trends and current predictions, the sustainability of the aquaculture sector will probably be closely linked with the sustained supply of terrestrial animal and plant proteins, oils and carbohydrates for aquafeeds.

### Fishmeal production

- Although global fishmeal and fish-oil supplies have fluctuated between 4.57 mt and 7.48 mt for the last 33 years and have now stabilized at about 5 – 6 mt per year, the amounts of fishmeal and fish oil used in aquafeeds have grown – rising between 1995 and 2008 from 1.87 mt to 3.73 mt and from 0.46 mt to 0.78 mt, respectively. This has been possible at the expense of the land-animal sector, particularly the pig and poultry sector, which is continuously reducing its use of fishmeal. In 1988, 80% of world fishmeal production was used in feed for pigs and poultry while only 10% went to aquaculture feed. In 2008, aquaculture used 60.8% of world fishmeal production and 73.8% of fish oil production.
- World reduction fisheries (marine capture fishery products converted to fishmeal) were 18.2 mt in 1976. This total rose progressively to 30.2 mt in 1994 but then declined steadily to 17.9 mt in 2009. As a result, fishmeal and fish-oil production exhibited similar trends. Global fishmeal production increased from 5 mt in 1976 to 7.48 mt in 1994 and then decreased steadily thereafter to 5.74 mt in 2009.
- Similarly, global fish-oil production rose gradually from 1.02 mt in 1976 to 1.5 mt in 1994 (with the exception of production peaks of 1.67 and 1.64 mt recorded in 1986 and 1989, respectively) but then fell back steadily to 1.07 mt in 2009. Hence, analysis of the data for the last 15 years (1994–2009) indicates that global fishmeal and fish-oil production from marine capture fisheries have been decreasing at annual average rates of 1.7 and 2.6%, respectively.
- Fishmeal production and trade decreased significantly in **2010** owing to reduced catches of anchoveta, while production for 2011 increased by about 40% in the major producing countries. Demand for fishmeal was strong in 2010 and 2011, leading to sharply higher fishmeal prices. Despite some recent softening in late 2011 and early 2012, prices remain at fairly high levels. China remains the main market for fishmeal, importing more than 30% of the fishmeal quantity, while Peru and Chile are the major exporters.
- Production is expected to grow to 51.0 mt by 2015 and to 71.0 mt by 2020.
- By volume, industrial compound aquafeeds used by major species and species groups are estimated to have been as follows in 2008: fed carps (9.1 mt, 31.3% of the total), marine shrimps (17.3%), tilapias (13.5%), catfishes (10.1%), marine fishes (8.3%), salmon (7.0%), freshwater crustaceans (4.5%), trouts (3.0%), milkfish (2.0%), eels (1.4%), and miscellaneous freshwater fishes (1.6%).

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Global consumption of fishmeal and fish oil by major aquaculture species groups in 2008



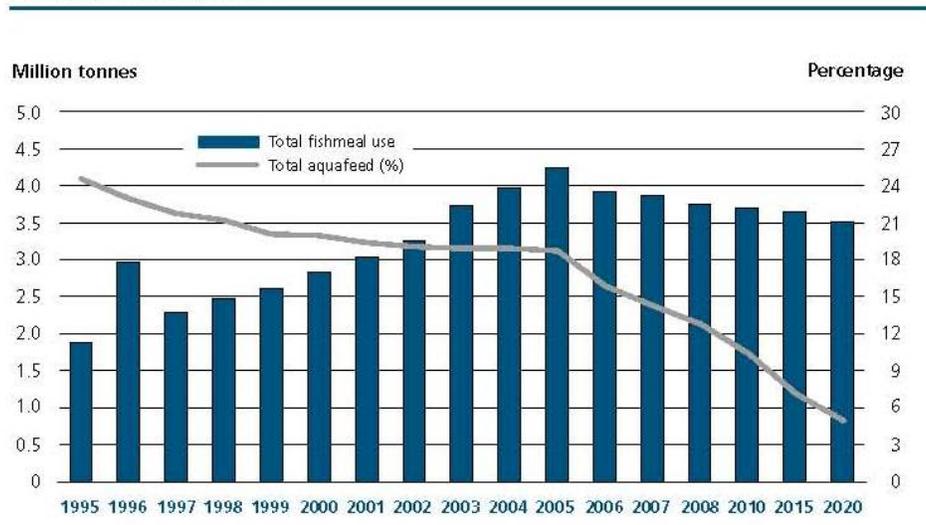
Source: Adapted from Tacon, A.G.J., Hasan, M.R. and Metian, M. 2011. *Demand and supply of feed ingredients for farmed fish and crustaceans: trends and prospects*. FAO Fisheries and Aquaculture Technical Paper No. 564. Rome, FAO. 87 pp.

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### Future demand for aquatic products

- The global population is increasing and, in order to maintain at least the current level of per-capita consumption of aquatic foods, the world will require an additional 23 mt thereof by 2020. This additional supply will have to come from aquaculture. Meeting the future demand for food from aquaculture will largely depend on the availability of quality feeds in the requisite quantities.
- Apart from ensuring the sustained availability of feed ingredients to meet the growing demand of aquaculture, several other important areas and issues also require attention..... it has been estimated that, to maintain the current level of per-capita consumption, by 2030 the world will require at least another 23 mt of aquatic animal food – which aquaculture will have to provide.

Actual and predicted reduction in fishmeal use relative to the global production of compound aquafeed



Source: Adapted from Tacon, A.G.J., Hasan, M.R. and Metian, M. 2011. *Demand and supply of feed ingredients for farmed fish and crustaceans: trends and prospects*. FAO Fisheries and Aquaculture Technical Paper No. 564. Rome, FAO. 87 pp.

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