Fishmeal & fish oil

and its role in sustainable aquaculture

by Dr Andrew Jackson, Technical Director, IFFO, UK

The annual global production of fishmeal and fish oil is currently around five million tonnes of meal and one million tonnes of oil (Figure 1), except in years when the fishing in the South Pacific is disrupted by the warm waters of an El Niño, most recently in 2010. Around 22 million tonnes of raw material is used, of which approximately 75 percent comes from whole fish and 25 percent from by-products of processing fish for human consumption (IFFO estimates).

The majority of the whole fish used are small pelagic fish such as anchovy, menhaden, sardines and sandeels for which there are limited markets for direct human consumption. In addition to the estimated 11.5 million tonnes of small pelagic fish used in fishmeal there is also an estimated five million tonnes of other fish, the majority from mixed tropical trawl fisheries in East Asia.

Going forward

The prospects for increasing the production of fishmeal and fish oil are very limited, since most of the underlying fisheries are now being well managed, using the precautionary principle with tightly set and monitored quotas. Also increasingly, markets are being found for at least a proportion of the catches to go for direct human consumption.

In addition there is concern that some of the mixed tropical trawl fisheries are not being well managed and that catches will therefore decrease in the coming years as these become severely depleted. The prospects for increasing volumes of fisheries by-products do however look better as fishing becomes concentrated at fewer landing sites and aquacultural production also becomes more concentrated. This will be further encouraged by the rising price of fishmeal and stricter laws against the dumping of waste material. So on balance the production of both fishmeal and fish oil over the next few years is likely to remain about where it is or possibly decrease slightly, which will certainly happen in El Niño years.

The lack of growth in the production of marine ingredients has led some to speculate that the growth of aquaculture would in turn be limited by the shortage of such key ingredients – the so-called fishmeal trap. It is certainly true that during the 1990s and early 2000s as aquaculture grew, it used more and more fishmeal, mostly by taking volumes that in the past had gone into pig and poultry feeds.

However, since around 2005 aquaculture requiring feed has continued its strong annual growth of around seven percent but the volumes of fishmeal used in aquaculture have remained steady at around 3.2 million tonnes and those of fish oil have even reduced to around 600,000 tonnes. (Figure 2). This has led the FAO to state in their recently released report on the State of Fisheries and Aquaculture (FAO 2012): "Although the discussion on the availability and use of aquafeed ingredients often focuses on fishmeal and fish-oil resource, 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."

Becoming a strategic ingredient

This growth in aquaculture production,

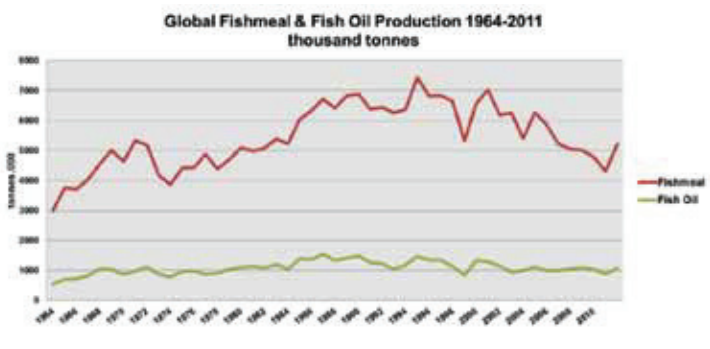


Figure 1. The Global Production of fishmeal and fish oil from 1964-2011 (IFFO data)

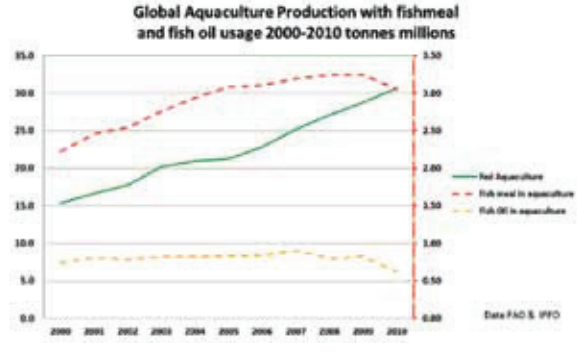


Figure 2. The global production of fed aquaculture and the use in the associated diets of fishmeal and fish oil, millions of tonnes (FAO FishStat data and IFFO data and estimates)

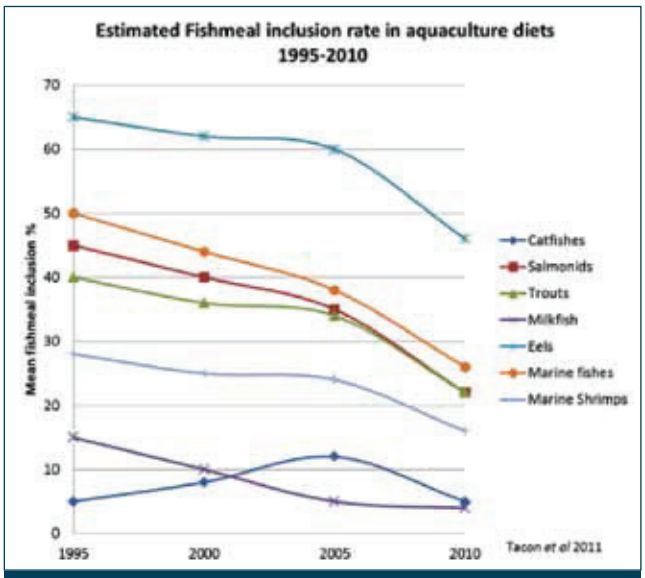


Figure 3. The dietary inclusion of fishmeal (%) in aquaculture feeds over the period 1995-2010 (after Tacon et al 2011)

whilst not increasing the total amount of fishmeal used, is coming through the partial replacement of fishmeal in the diets of almost all species (Tacon *et al* 2011, Figure 3). This drive to replace fishmeal is being driven by the rise in the price of fishmeal and improving nutritional knowledge, but also by concern about the fluctuating supply due to El Niño, etc. Of course the price of all commodities has risen steeply in recent years and it is important to compare the price of fishmeal with the alternatives.

The most commonly used alternative to fishmeal is that of soymeal. Figure 4 shows that over the last twenty years the price ratio of fishmeal to soymeal has increased significantly, which is indicative of the fact that fishmeal is being reduced in less critical areas such as grower feeds, but remains in the more critical and less price-sensitive areas of hatchery and broodstock feeds. Fishmeal is therefore becoming less of a commodity and more of a strategic ingredient used in places where its unique nutritional properties can give the best results and where price is less critical.

Fish oil and its fatty acids

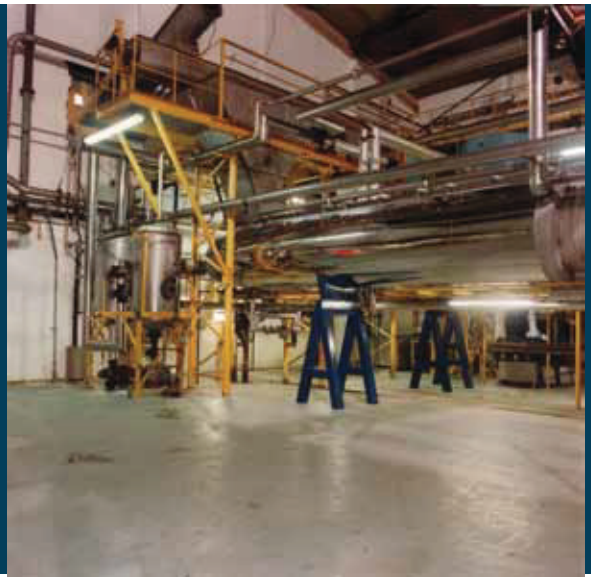
As has been well documented, during the period 1985-2005 fish oil usage moved from being almost exclusively used to produce hydrogenated margarines to being almost exclusively used in aquaculture. Within aquaculture by far the biggest user was in salmon feed, indeed it reached the point, in around 2002, when over 60 percent of the world's fish oil production was being fed to salmon.

The reason for this very high usage in salmon feeds was that salmon were found to perform best on diets with in excess of 30 percent fat and at the time fish oil was one of the cheapest oils on the market. In addition it also gave the finished salmon fillets a very high level of long chain Omega- 3 fatty acids, specifically EPA and DHA.

During the last 10 years increasing evidence has been published on the very important role these two fatty acids play in human health. EPA has been shown to be critical in the health of the cardiovascular system and DHA in the proper functioning of the nervous system, most notably brain function.

This growing awareness within the medical profession and the general public has led to many governments producing recommended daily intakes for these fatty acids and companies launching a large number of health supplements, including pharmaceutical products, with concentrated EPA.

The importance placed on EPA and DHA in the human diet has had a number of profound effects on the fish oil market. Firstly over the last ten years a significant market has



developed for the sale of crude fish oil for its refinement and inclusion into capsules etc.

This has grown from almost nothing, to the point where today around 25 percent of the world's production of crude fish oil is sold to this market. This has occurred at a time when the demand for salmon feed has gone from 1.8 million tonnes to nearly three million tonnes. The other critical factor is that to obtain fish oil of the right quality (freshness, lack of oxidation products and levels of EPA and DHA) the nutraceutical market pays a premium of 25-30 percent over that for feed oil (current price for feed-grade fish oil is approximately $1,800/tonne).

In order to increase the production of salmon feed in-line with the market (as well as trying to minimise any price effect) feed producers have been increasingly substituting fish oil with vegetable oil. The vegetable oil of choice is rapeseed (or canola) oil, which, while not having any EPA or DHA, does at least have short-chain omega 3 fatty acids and fewer omega-6 fatty acids than most other commonly available vegetable oils such as soya oil. The point has now been reached where over 50 percent of the added oil in salmon diets comes from vegetable sources and this trend seems likely to continue.

As salmon are poor converters of short-chained omega-3 fatty acids to long-chain fatty acids the fatty acid profile of the finished salmon fillet is very much a reflection of the fatty acid profile in the feed. The result is that the EPA and DHA content of farmed salmon is decreasing and the omega-6 content is increasing.

This trend seems set to continue in the years to come. It seems likely that the salmon market will differentiate into 'high EPA and DHA' salmon demanding a price premium and regular salmon, which, while still containing some EPA and DHA will have levels well below that found in wild salmon.

Figure 4. The ratio of the price of Peruvian fishmeal and Brazilian soymeal based on weekly prices for the period 1993-2012 and the calculated trend line (IFFO data)

Is it sustainable?

One of the most often asked questions about fishmeal and fish oil is whether or not the practice is sustainable. This is a huge topic for discussion and one that is not easily covered in the last section of a short article. To answer the question one has to go back and look at the source of the raw material and look at the matter, fishery by fishery. The most widely accepted measure of sustainability for a fishery is the Marine Stewardship Council's standard. However, whilst this has been adopted by a growing number of fisheries which can be eco-labelled at the point of sale, there are currently no substantial volumes of whole-fish from MSC certified fisheries being made available to fishmeal plants.

Back in 2008 IFFO became aware that the fishmeal and fish oil industry needed an independently set, third-party audited standard, which could be used by a factory to demonstrate the responsible sourcing of raw material and the responsible manufacture of marine ingredients. IFFO convened a multi-stakeholder task force including feed producers, fish farmers, fish processors, retailers and environmental NGOs who over the next 18 months complied the standard which was launched late 2009.

The IFFO RS standard has been quickly adopted by the industry and the point has now been reached where over one third of the world production comes from certified factories. The standard requires that any whole fish must come from fisheries that are managed according to the FAO Code of Conduct for Responsible Fisheries. The standard also demands that the factory can demonstrate good manufacturing practice including full traceability from intake to finished product.

There are now around 100 certified factories in nine different countries producing IFFO RS fishmeal and fish oil. Many of the world's major feed fisheries have been approved for use, although some have yet to produce sufficient evidence to convince the auditors. Full details of certified plants and approved raw materials can be found on the IFFO web site, www.iffo.net .

A continuing area of concern is Asia where, as discussed earlier, there are considerable volumes of fishmeal produced from trawled mixed species. IFFO is working with a number of different organisations including the FAO and the Sustainable Fisheries Partnership to investigate how to bring about fisheries improvement in this critical area. Asia

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is the region where aquaculture is growing fastest and the need for responsibly produced fishmeal is highest.

Conclusions

Fishmeal and fish oil production is expected to remain around current levels, but this is unlikely to limit the growth of aquaculture which will continue to have reducing inclusion levels of marine ingredients in the diets of most farmed fish. Fishmeal will increasingly become a strategic ingredient used at critical stages of the life-cycle when optimum performance is required.

The growing importance of EPA and DHA in human health will ensure that there is a strong demand for fish oil, either for direct human consumption or via farmed fish, such as salmon.

There is a growing need for fish feed producers and farmers to demonstrate that all the raw materials in their feeds are being responsibly sourced. This is best achieved by using an internationally recognised certification standard. Increasing volumes of certified marine ingredients are now coming onto the market which will allow fish farmers to demonstrate their commitment to responsible aquaculture.

References

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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. In: FAO fisheries technical paper, Vol. 564. Rome: FAO.

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