The state of the aquaculture feed sector in 2022, 31 August 2022, webinar

Production of marine ingredients depends increasingly on by-products

Fishmeal and fish oil (marine ingredients) are derived primarily from small pelagics including Peruvian anchoveta, menhaden, blue whiting, capelin, sardines, and herring although production from by-products is increasing and will continue to grow.

In 2021, by-products accounted for half the raw material used to produce fish oil and about a third of that used for fishmeal, proportions that are only expected to grow in the future.

Global production of fishmeal and fish oil depends on catches of these species which vary with the state of the resource. Stock abundance is influenced by natural phenomena such as the El Niño—Southern Oscillation and tends to fluctuate. According to the 2022 edition of the FAO's State of World Fisheries and Aquaculture (SOFIA), volumes of fish reduced to fishmeal and fish oil peaked in 1994 at 30m tonnes, declined to 14m tonnes in 2004, increased again to 20m tonnes in 2018, before falling back to 16m tonnes in 2020. Fishmeal and in particular fish oil are also derived from by-products from fish processing, a share that is increasing. Other sources of these two ingredients that are being explored include Antarctic krill and the copepod, *Calanus finmarchicus*, fish silage, a protein rich hydrolysate, and insect meals

Marine ingredients make an ever-smaller fraction of aquafeeds

The main use of fishmeal and fish oil is in aquafeeds for the aquaculture industry. About 86% of fishmeal and 73% of fish oil was designated for this purpose in 2020. However, as production from aquaculture has increased while fishmeal and fish oil output has remained within certain limits, the share of these ingredients in aquafeed has been steadily declining. They are increasingly being used for specific stages of production (hatchery, broodstock, finishing diets) rather than in feeds for on-growing diets. As an example, the proportion of these ingredients in on-growing diets for salmon is now often less than 10%, according to the FAO. To discuss these and other developments in the marine ingredients industry, Seafood Source, a part of Diversified Communications, organised a webinar on 31 August that was addressed by executives from the Marine Ingredients Organisation (IFFO), an international trade organisation representing the global marine ingredients industry. The event was moderated by Cliff White from Seafood Source.

Marine ingredients are the most nutritious and most easily digestible components in aquafeeds. They are also the source of the healthful omega-3 fatty acids which benefit both the growing fish as well as the humans who consume the fish. The ingredients also have a multiplier effect with 1 kg of the raw material used to produce fishmeal and fish oil resulting in 5 kg of farmed fish, according to Petter Johannessen, IFFO Director-General. Many of these fisheries are certified as sustainable. Of the average global production of marine ingredients in the years 2017-21, 49% was certified as sustainable up from 21% in the 2010-14 period. In addition to the omega-3 fatty acids, marine ingredients are also a source of other nutrients such as essential amino acids. Research shows that palatability of salmon aquafeeds increases with the addition of marine ingredients, while protein

digestibility for anchoveta meal is very high and shows little variability, in comparison with alternatives such as soy or corn gluten, reported Brett Glencross, IFFO Technical Director.

Small pelagic fisheries have a relatively low environmental impact

Explaining that sustainability was fundamental for the marine ingredients industry, Dr Glencross said that the maximum sustainable yield for a stock was the most common way of looking at sustainability. The MSY is the highest possible annual catch that can be sustained over time keeping the biomass at a level that produces the maximum growth of that biomass. Small pelagic fisheries are among the best managed in the world with their biomass being sustained at expected levels, he pointed out. Among the reasons is the reduction in fishing pressure over the last couple of decades which has also contributed to a largely stable supply of marine ingredients over this period. The environmental footprint of small pelagic fisheries in terms of their greenhouse gas emissions per unit of landings is the lowest of all species groups (demersal, large pelagics, crustaceans, cephalopods etc.). Emissions are most closely associated with fuel use during fishing operations. Similarly, the carbon footprint of marine ingredients compares very favourably with those of alternate ingredients. In terms of their use of biotic resources, however, marine ingredients tend to consume more than other ingredients, though their use of abiotic resources is lower. This balance illustrated Dr Glencross' contention that the perfect ingredient did not exist; there will always be a trade-off. He also referred to the fact that while most fish caught and farmed is for human consumption less than half is actually eaten. The other half can be recovered and returned to the food chain by using it to produce marine ingredients. Moreover, some species, such as Atlantic mackerel, previously used for reduction to fishmeal and fish oil are now being used almost entirely for human consumption. But these too generate by-products that can be used to produce marine ingredients.

From bulk ingredients in fish feed, fishmeal and fish oil have gradually become strategic ingredients used in specific stages of aquaculture production. In on-growing diets for salmon, for example, the proportion of marine ingredients today is often less than 10%.

By-products from fish processing particularly important for fish oil production

Enrico Bachis, IFFO Market Research Director, confirmed much of what had been said by the previous two speakers but added more detail. The contribution from by-products is increasing, particularly in the case of fish oil, where by-products now amount to a third of the raw material. In the case of fishmeal this fraction is about 15%. These by-products come from both capture fisheries and the aquaculture industry, and their contribution is likely to increase in the future as the production from aquaculture grows and techniques evolve that allow more of this material to be recycled. The biggest suppliers of marine ingredients in geographical terms are Latin America, Asia, and Europe with Latin America supplying between a quarter and a fifth of the total. In Asia and Europe, the raw material is a mix of wild catches and by-products from aquaculture, while in Latin America the raw material is mainly from wild fisheries. The data for fish oil includes the menhaden fishery in the US which accounts for 12% of the raw material thanks to the species' high content of fish oil. Average fishmeal and fish oil production over the last nine years was about 5m tonnes and 1.2m tonnes respectively per annum. This stable supply can be attributed to the generally well managed fisheries on which this supply is based. Fluctuations from year to year have been due to natural events such as El Niño, said Dr Bachis, rather than overfishing.

The structure of demand for fishmeal and fish oil has changed over the decades with aquafeeds replacing poultry, pig, and pet feeds as the biggest consumer. The fraction of fish oil for direct human consumption in the form of products for human health has also increased and in 2020 accounted for some 12% of the total. However, as production from aquaculture has grown and marine ingredients production has remained stable, fishmeal and fish oil have evolved from bulk ingredients in aquafeeds to strategic ones. In closing Dr Bachis showed that crustaceans are the biggest users of fishmeal followed by freshwater fish, marine fish and salmonids. The sheer volume of crustaceans (11.2m tonnes) and freshwater fish (48m tonnes) produced around the globe are responsible for their position ahead of salmonids (4m tonnes) in usage of fishmeal. On the other hand, salmonids are the biggest consumers of fish oil followed by crustaceans and other marine fish. More generally, the crustacean and specifically the shrimp sector is a growing and not just in Asia but also in Central and Latin America. Since production of marine ingredients is stable, farmed species showing strong growth will tend to push out others in the quest for these ingredients. The competition for marine ingredients looks set to increase.