

Feed ingredients



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The Importance of Fishmeal and Fish Oil in Aquaculture Diets

by Andrew Jackson Ph.D.,
Technical Director
International Fishmeal and Oil Organisation
St Albans, AL3 4PA, UK
Email: ajackson@iffo.net

Fishmeal and fish oil have always played an important role in the prepared diets for carnivorous and omnivorous aquaculture species. For fishmeal this is principally for two very good reasons, it has an almost ideal available amino acid profile for most aquatic species and it is highly palatable, making the finished feed very attractive and promoting maximum feed intake. Fish oil has played a similar role,

proving to be an ideal energy source and, as well as providing essential fatty acids to farmed fish and crustacea, it imparts the final product with high levels of health-giving omega-3 fatty acids, increasingly sought by the consumer.

However, the rapid growth of world aquaculture, combined with the finite nature of the sustainable feed fisheries, has meant that there is concern over whether there is sufficient fishmeal and fish oil to meet the growing demand of aquaculture and therefore whether this growth

will be limited by their availability (SEAFeds, 2003). It has also resulted in concern that this strong demand will result in over-fishing and unsustainable production of meal and oil, with a consequent negative environmental effect (RSPB, 2004)

Historical fishmeal and oil production

Catches for reduction into fishmeal and fish oil have remained relatively constant for the last 25 years at between 20 and 30 million tonnes (Figure 1). Even in 1998 following one of the strongest el Niño effects of the century, catches only dropped to 20 million tonnes and recovered strongly over the next two years. This is good evidence that the world's main feed fisheries have been sustainably managed even through sudden periodic environmental changes.

The fishmeal and fish oil produced from the catches is shown in Figure 2 with the meal varying from five to seven million tonnes per annum and the oil from one to 1.5 million tonnes. The reduction in the el Niño years of 97/98 and 02/03 can be seen and once again illustrates the importance of the major fishery in the Southern Pacific in terms of global catch.

The production of fishmeal from the major producers is shown in Figure 3, with Chile and Peru combined providing about 40% of production. Again it can be seen that it was principally the drop in Peruvian production in 2003 and 2006 that caused the drop in global production. In 2003 this was, as already stated, as a result of an el Niño and in 2006 the Peruvian Government,



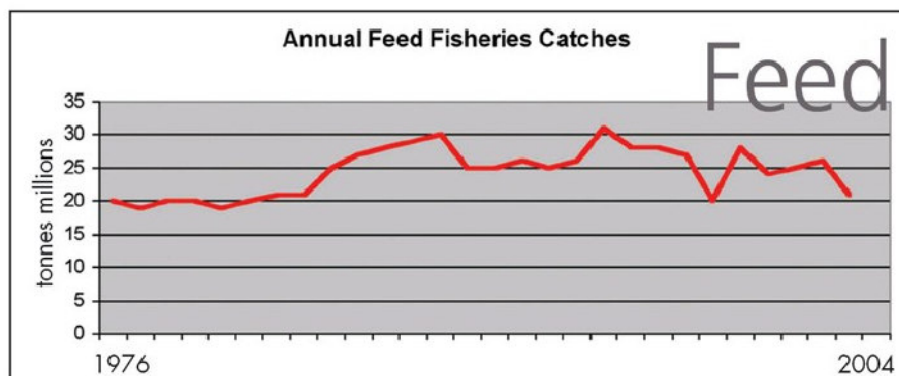


Figure 1. Global catches of feed fisheries 1976-2003 (source: FAO, 2005)

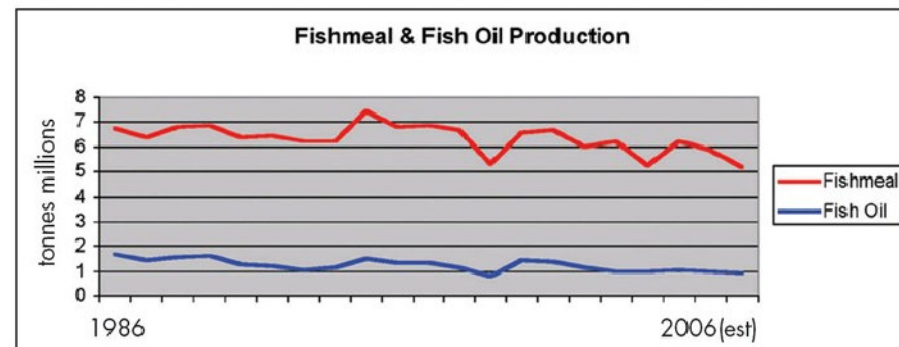


Figure 2. Global production of fishmeal and fish oil 1986-2006 Data from IFFO

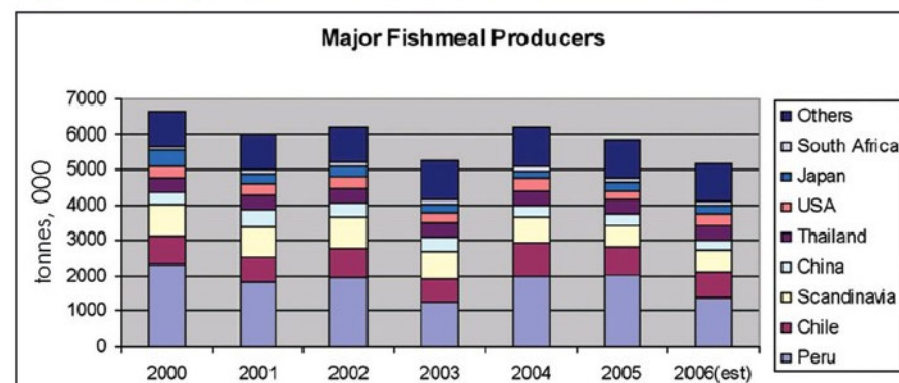


Figure 3. Global Production of fishmeal by country or region 2000-2006. Data from IFFO

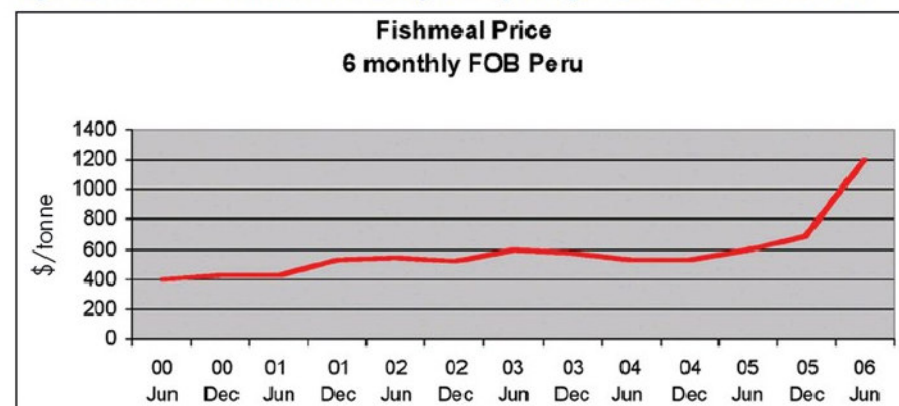


Figure 4. Development of the price of fishmeal over the last 6 years. Data from IFFO

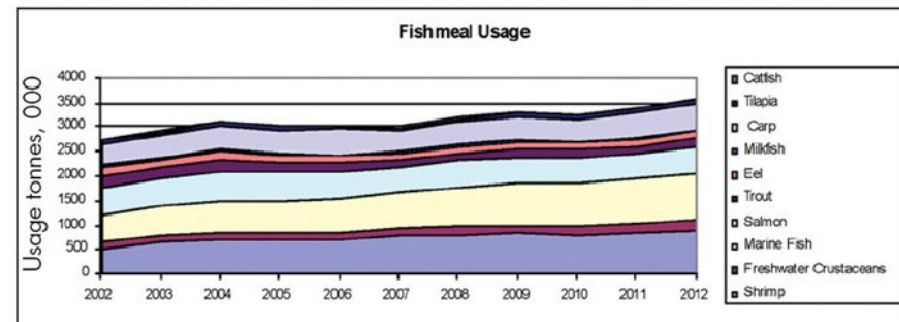


Figure 5. Projection on the use of fishmeal for the major fed species in aquaculture until 2012

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acting on advice from fisheries scientists at IMARPE, reduced the anchovy fishing quota after survival of the new generation was found to have been poor.

This drop in production, combined with continuing strong demand, particularly in China, resulted in a strong rise in the price over the last 12 months (Figure 4). This in turn has reinforced the concern of some that fishmeal and oil are going to become limiting factors to aquaculture production.

Projections of future use of fishmeal and fish oil

Tacon et al (2006) in their FAO Fisheries Circular published a table showing projections for fishmeal and fish oil usage in aquaculture. In their opinion, the usage of fishmeal and fish oil in aquaculture would actually decrease between 2005 and 2010. They listed the forces driving this reduction as being: rising prices, rising demand from terrestrial farming, increasing competition for direct human consumption and the desire on the part of consumers for sustainability and a concern for the state of the oceans. It is IFFO's view that whilst some of these factors may encourage increased substitution of fishmeal and fish oil with alternatives, overall their use in aquaculture will increase.

The FAO report projected that aquaculture of the main fed species would increase from 17.5 million tonnes in 2002 to 31.7 million tonnes in 2012. Using this growth of aquaculture as projected by FAO, IFFO has reworked the projections using its own data on the use of fishmeal and fish oil and come up with the projections in Figure 5 and Figure 6.

If we compare this with the projected volumes by Tacon et al (Table 1), we can see that, despite an 81% increase in fed aquaculture, in neither case will there be a shortage of either raw material. The IFFO figures differ slightly from their last estimate (Pike 2005), which predicted that by 2012 aquaculture would use 50% of the fishmeal and 88% of the oil. Our estimate for oil usage remains the same but we are now predicting that aquaculture will use 60% of the world's production of fishmeal by 2012. This contrasts with the FAO figure which estimates that usage will actually decrease for both fishmeal and fish oil over the decade 2002-2012.

We have seen that oil usage in aquaculture has remained much the same over the last few years, with the growth in aquaculture (particularly in salmon) compensating for

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Projections of Fishmeal and Fish Oil Usage until 2012

	Global Production		Fishmeal Used tonnes		Fish Oil Used tonnes		% of FM Production		% of FO Production	
	Fishmeal	Fish Oil	FAO	IFFO	FAO	IFFO	FAO	IFFO	FAO	IFFO
2002	6201	959	2696	2769	758	810	43	45	79	84
2005	5877	965	2666	3041	551	813	45	52	57	84
2010	6000	950	2478	3286	534	826	41	55	56	87
2012	6000	950	2577	3607	664	836	43	60	70	88

FAO from Tacon et al 2006

Table 1: Estimates and future projections of the use of fishmeal and fish oil in aquaculture diets in thousand tonnes and as a percentage (assuming a constant global production of these raw materials).

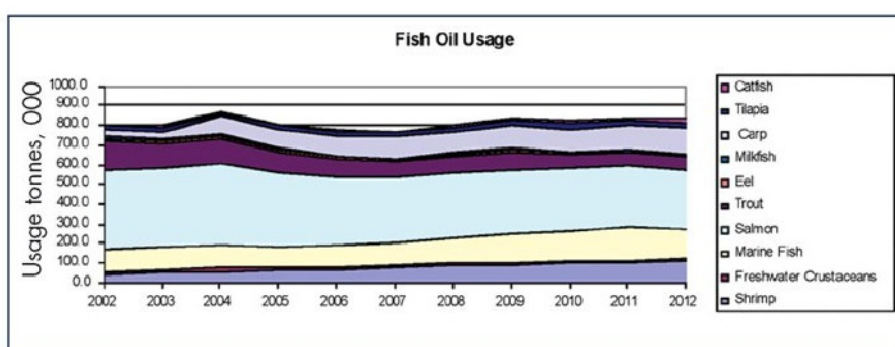


Figure 6. Projection on the use of fish oil for the major fed species in aquaculture until 2012

a decrease in inclusion levels, as increasing use is made of vegetable oils. We predict this trend will continue, with the oil of choice in aquaculture being fish oil, thanks to its nutritional properties and the increasing market need to maintain a high omega-3 oil content (EPA & DHA) in the finished product.

With fishmeal we see a similar picture, with increasing aquaculture production requiring more feed, plus a continuing move from wet feed in Asia towards pelleted feed, but this is partly offset by replacement of some of the fishmeal with alternative protein sources. Overall we predict the amount of fishmeal going to aquaculture will continue to increase, although more slowly than it has done in recent years. There will be a continuing demand for fishmeal for the critical life-stages in poultry and pigs (particularly early diets and broodstock diets) where nutrition is critical, as well as in petfood. Overall, however, we see the volumes of fishmeal going to terrestrial livestock production continuing to slowly decline as they have over the past decade.

Sustainability

As mentioned earlier, one of the reasons given by Tacon et al for the decrease in

the use of fishmeal in aquaculture diets, was a growing concern on the part of the consumer for the state of the oceans and the sustainability of fishing (Worm et al 2006). Whilst recognising that this concern is of growing importance, particularly in developed countries, we believe the track record of the feed fish industry in managing its stocks to produce a relatively steady supply of fishmeal and fish oil, demonstrates its responsible attitude.

Most of the world's feed fisheries are now tightly regulated. For example the two largest feed fisheries in the



world are those of the South-Eastern Pacific in Chile and Peru, which are maintained using the following measures (FIN, 2006):

Peru

- All fishing boats operating outside the 5 mile limit are fitted with a satellite tracking system which allows the government to monitor the position of all boats at any given time.
- The Peruvian government imposes closed fishing seasons, closed entry of new fishing boats, and vessel licences to fish within the 200 mile limit.
- Limits on the minimum size of fish that can be landed with local short term fishing closures if the level of small fish exceeds the number allowed.
- Fishing stops during February and March to protect the growth of anchovy and sardine juveniles. A fishing closure from August to October to protect the spawning stock
- To assess the environmental status of fish stocks (mainly anchovy) IMARPE undertakes a hydro-acoustic evaluation of pelagic resources along the entire Peruvian coastline.
- The international surveillance company SGS (with Headquarters in Switzerland) was appointed during 2004 to monitor and record all fishing landings on the coast of Peru for government management purposes. Only authorised vessels with the correct licence are permitted

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to unload fish in the 115 unloading points. This system is effective 24 hours per day.

- Fishmeal plants all have to have a working licence from the Ministry of production and health certification from the Ministry of Health. Plants are also formalising HACCP systems and working towards implementing quality control systems such as FEMAS.
- A Fishing Behaviour Code has been established which covers the owners of plants and vessels, technicians of plants, skippers and crewmembers.
- IMARPE advises on fisheries control based on ecosystem effects. The approach is a multi-step procedure, which includes identification of ecosystems, relevant ecosystem components and linking human activities to impacts on the ecosystems.
- Peru and Chile have started scientific collaboration towards joint stock assessments of sardine and anchovy for Southern Peru and Northern Chile (bordering the Humboldt Current LME) to foster national and regional efforts to manage and sustain fish stocks.

Chile

- The Chilean government undertakes regular monitoring surveys to establish the state of the fishery resources, and uses the results of these surveys to set the control measures required to protect the stocks.
- The Chilean government has introduced legislation to establish a maximum annual total catch limit for each species declared in full exploitation for each owner of a boat or group of boat owners.
- Closed seasons for anchovy and sardine are set on an annual basis to protect the spawning stocks appropriate to the spawning cycle usually between August and September of each year in the northern part of the country. Closed seasons are also imposed during December to mid January to protect the recruitment process of anchovy.

- In the central-southern part of the country closed seasons are set for anchovy and sardine to protect the spawning period (usually July and August) and also from mid-December to mid-February.
- For jack mackerel several fishing bans can be imposed during the year to protect small-sized fish. Minimum landing sizes are also applied. These measures reinforce controls to protect stock recruitment.
- All fishing boats are fitted with a Satellite Tracking System to ensure that boats operate outside prohibited areas (such as designated areas of recovery) or the zone reserved for small artisanal fisheries (first five miles offshore).

It is these sorts of measures that have ensured that these fisheries have remained at, or close to, their maximum sustainable yield for many years and that allows recovery from el Niño years to be so rapid.

It should also be remembered that there are few protein sources which do not have associated concerns, for example the destruction of the rainforest in South America connected with soybean production, the effects of growing genetically modified soya and rapeseed, or the perceived health issues from meat and bone, offal and blood meals. Nevertheless the feed fishery industry is starting to address the issue of how to demonstrate, in a transparent manner, that it is managing this unique resource in a responsible and sustainable way to reassure the whole value-chain.

Conclusions

Fishmeal and fish oil will continue to be important ingredients in many aquaculture diets. The careful management of the fisheries stocks will mean that there will be no short-term unsustainable production increase, but the future growth of aquaculture will not be limited by supplies of these ingredients. As the global demand for pelleted aquaculture feed grows, fishmeal and fish oil will increasingly be used as strategic ingredients to ensure maximum growth and survival on-farm and a high omega-3 content for the increasingly health conscious consumer. The finite nature of the supply of these ingredients will result in them being judiciously complemented by

the use of alternative proteins and oils.

The end result should be that by 2012, fishmeal and fish oil, once commodities, will have become strategic dietary ingredients in both agriculture and aquaculture. The increased cost to the farmer, associated with this change, will be offset by the use of complementary proteins and oils and in the case of the move from wet feeding, the improved husbandry performance. If these moves are handled with care the consumer should then be in the position of knowing that the final product is both healthy to eat, being full of natural long-chain unsaturated fatty acids, and sustainably produced from well-managed farms and fisheries.

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