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FEED TECHNOLOGY UPDATE

SOLUTIONS FOR THE GLOBAL FEED INDUSTRY

FISHMEAL AND FISH OIL
Will they limit the development of aquaculture?

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AQUAFEED

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The fishmeal conundrum

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CONTACTS

EDITORIAL & ACCOUNTS
Suzi Dominy
P.O. Box 161081
Honolulu, Hawaii, 96816, USA.
Skype: suzidominy
linx@hawaii.rr.com

SALES OFFICES
Andrew West
Phone: +44 (0) 1737 763501
Skype: andywest1204
Fax: +44 (0) 1737 762996
info@linxpublishing.com

John Brown
Phone +44 (0) 161 427 2402
Skype: jcbconsult
Fax: +44 (0) 161 427 2402
info@linxpublishing.com

Christopher John Reynolds
Phone +44 (0) 1372 270257
Skype: chrisr3460
Fax: +44 (0) 1372 270257
info@linxpublishing.com

DESIGN AND PRODUCTION
Julia Nixon
julianixon@xtra.co.nz

Challenges and Opportunities for the Fishmeal and Fish Oil Industry

Andrew Jackson, Technical Director, International Fishmeal and Oil Organisation

The view that fishmeal and fish oil will limit future growth of aquaculture is mistaken; they will however increasingly become strategic dietary ingredients

The recent rise in the price of fishmeal, lifting it above the psychological $1000/tonne level, combined with the continuing strong growth of aquaculture, has led many to raise concerns over the dependence of aquaculture on fishmeal and fish oil and the sustainability of the linked feed fisheries. To fully understand where we might be going with this issue it is important to understand where we have come from.

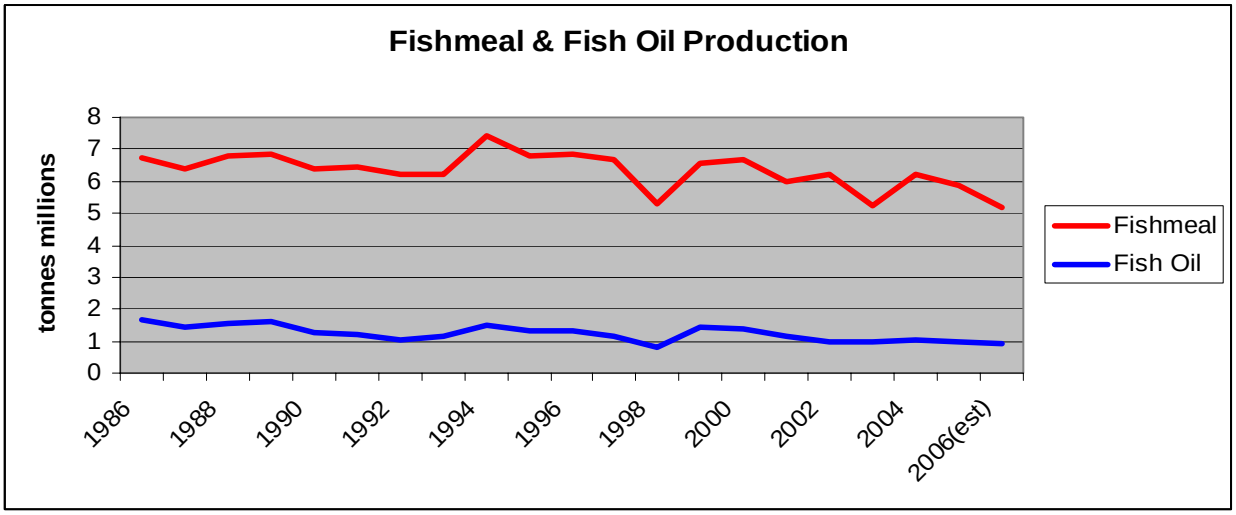


Figure 1. ▲ Global production of fishmeal and fish oil since 1986. IFFO data.

FISHMEAL

For the last twenty years the production of fishmeal and fish oil has remained fairly constant at around 6 million tonnes for fishmeal and 1 million tonnes for fish oil (Figure 1).

A lot of the variation comes from the periodic reduction in the Peruvian anchovy fishing caused by the el Niño phenomenon such as in 1998 and 2003.

This can be clearly seen in Figure 2 where the production by country or region is shown. The drop in global production in 2003 to just over 5 million tonnes is due almost exclusively to the el Niño induced reduction in Peruvian production from 2 million to 1 million tonnes.

In 2006 the Peruvian Government, acting on advice from the fisheries scientists at IMARPE, reduced the anchovy fishing quota after survival of the new generation was found to have been poor.

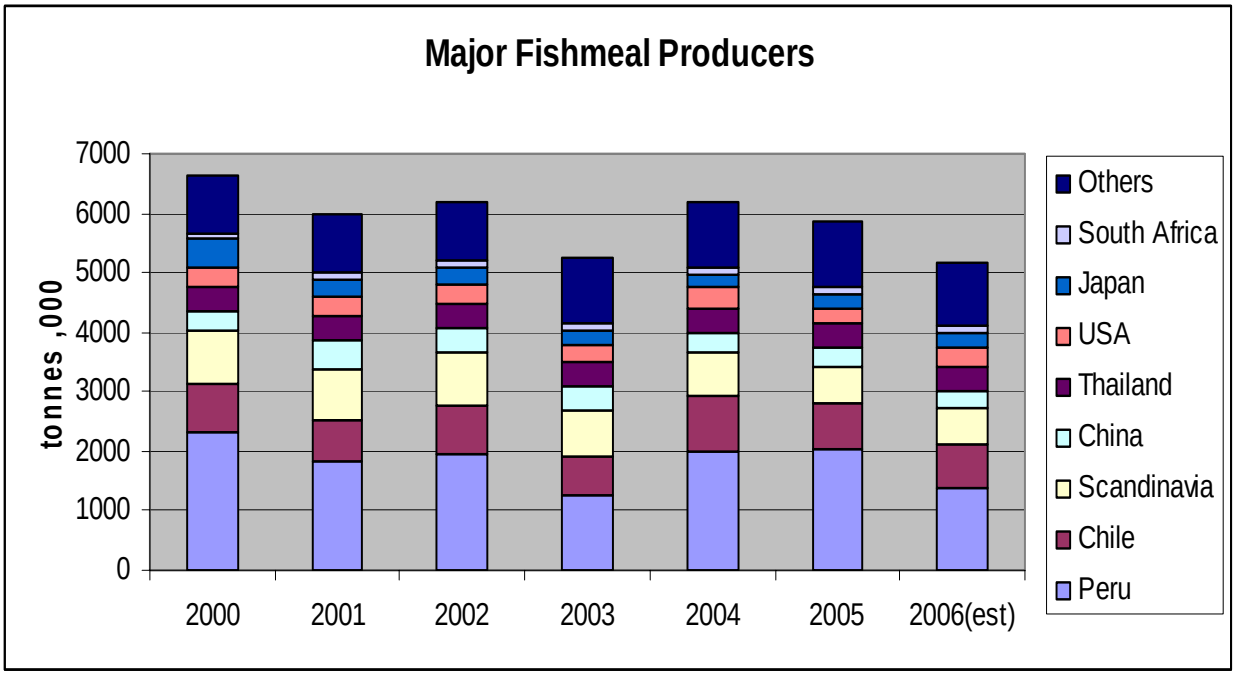
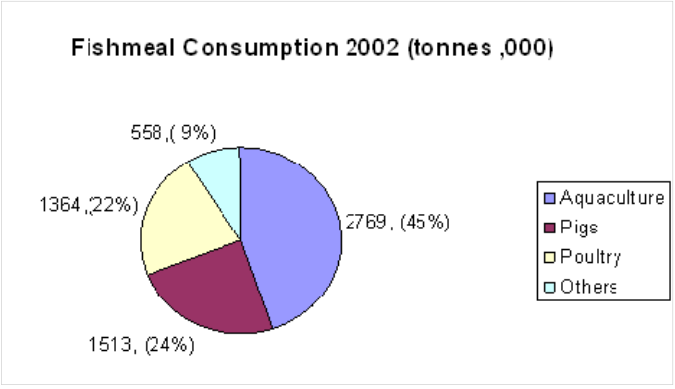
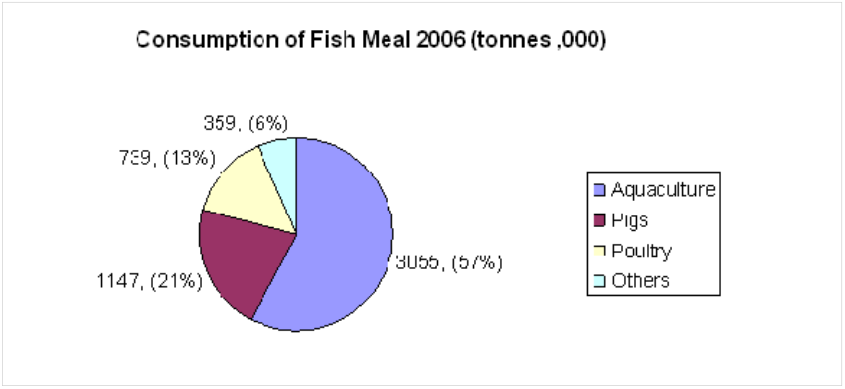


Figure 2. ▲
Global fishmeal production by country or region. IFFO data.



Figures 3a and 3b. ▼ ▶
Estimated global fishmeal consumption by sector. IFFO data.



" . . . the Far East (dominated by China) now takes well over half the global production of fishmeal – much of it of course, for its growing aquacultural industry"

Aquaculture has taken an increasing share in the global fishmeal production, with the estimated percentage rising from 45% in 2002 to 57% in 2006. This growth has been at the expense of the more traditional forms of dietary usage such as pigs and poultry. Poultry in particular has seen a sharp decline in its use of fishmeal from 22% to 14% over the four year period.

Within aquaculture the fishmeal is used in a wide variety of species both carnivorous and omnivorous as can be seen in Figure 4. However, shrimp, marine fish and salmonids are each estimated to take 23% of aquaculture consumption giving these sectors combined around 70% of the total.

If we look at the same consumption figures by geographical area, instead of by livestock, we look at it by geographical area, we see that the Far East (dominated by China) now takes well over half the global production of fishmeal – much of it of course, for its growing aquacultural industry.

We can also see that Europe is taking less and less as a result of the decline in the use of fishmeal in the poultry industry and the EU imposed ban on the use of fishmeal in ruminant diets.

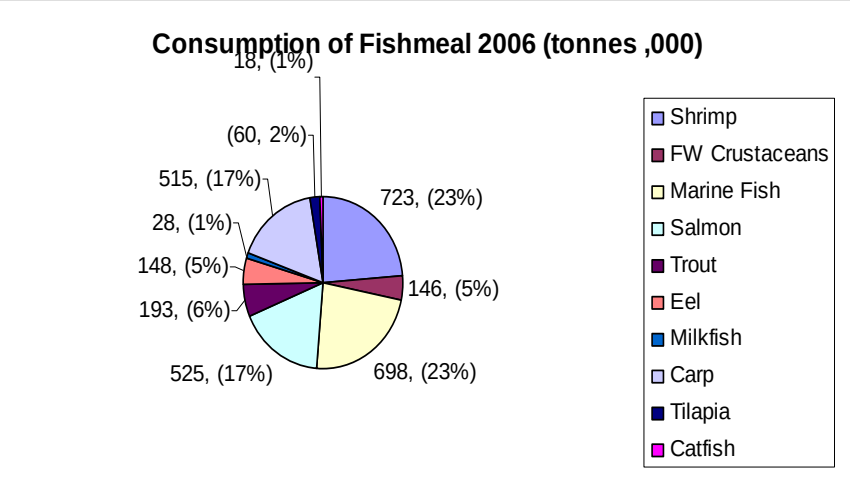


Figure 4.
Estimated consumption of fishmeal in aquaculture. IFFO & FAO Data

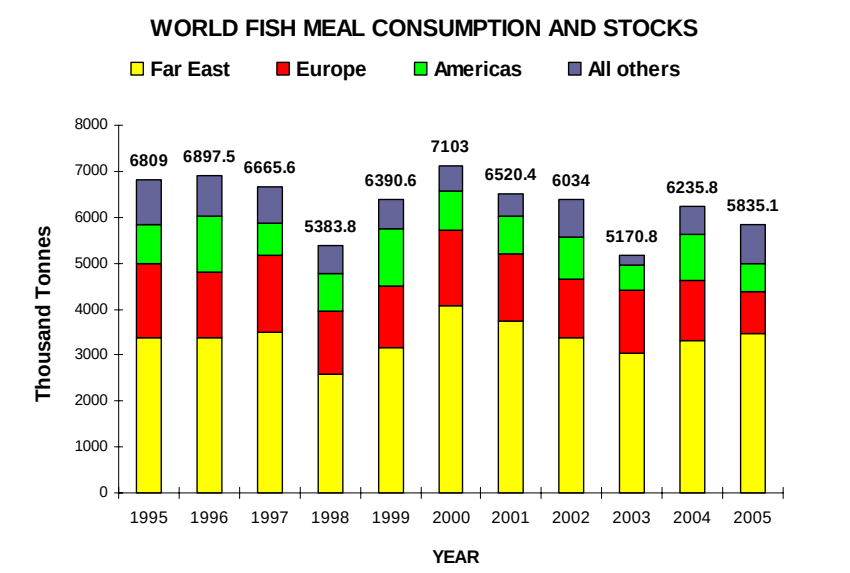


Figure 5.
Estimated fishmeal consumption by geographical area. IFFO data

From these preceding data a number of trends in fishmeal production and consumption are clear: production has remained relatively stable for many years,

approximately 40% of this production comes from South America, aquaculture now represents over 40% of consumption, while geographically the Far East represents well over 50% of consumption.
The trend going forward into the future is therefore likely to be the growing importance of both Aquaculture and the Far East in the consumption of fishmeal.

FISH OIL

If we now turn our attention to fish oil we see a somewhat different picture (Figure 6). Here we can see that aquaculture uses an estimated 87% of production with the remaining 13% going for a wide variety of uses including direct human consumption, land animal feeds and industrial purposes. Within the Aquaculture sector by far the largest use is for salmonid diets which take over 55% of the oil used in the sector (Figure 7) with marine fish being the next largest at 14%.
In summary fish oil production has also remained relatively stable with over 40% of production coming from South America. Aquaculture now represents over 80% of consumption with salmon alone consuming over 33% of world production.

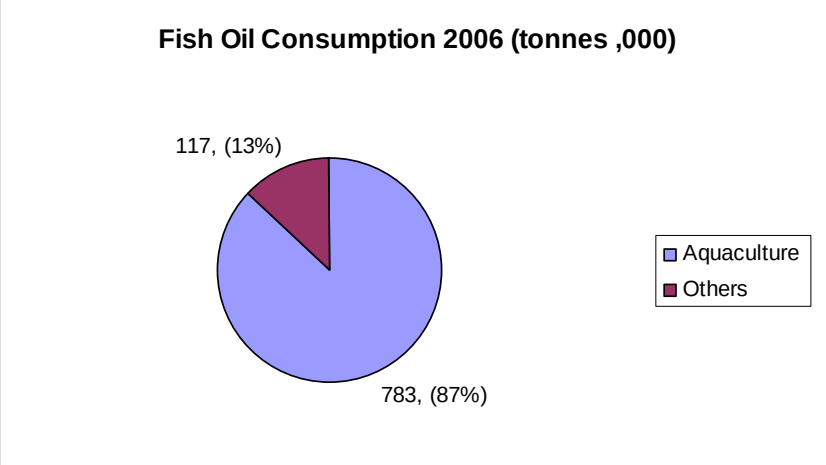


Figure 6.
Estimated Global Fish Oil Consumption by sector. IFFO & FAO Data

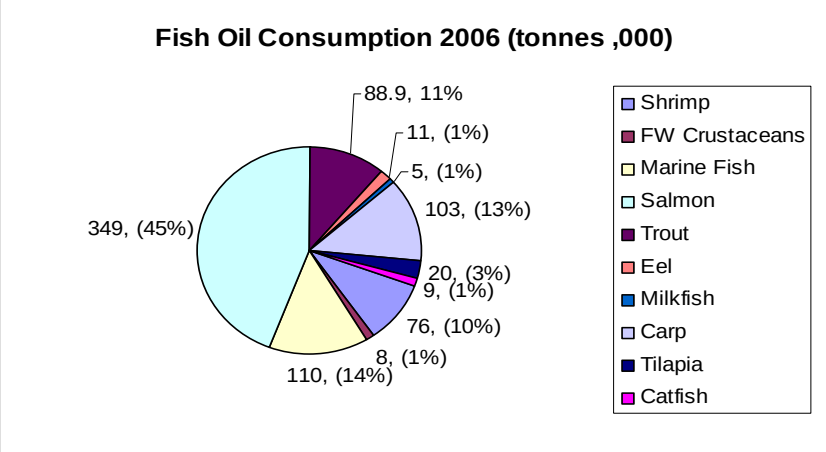


Figure 7.
Estimated Fish Oil consumption in Aquaculture. IFFO & FAO Data

" ... feed fisheries have been generally well managed for many years and have provided a stable output of product"

THE CHALLENGE

The continuing growth in world aquaculture production, particularly the growth in salmon, shrimp and marine species, and the rising price of fishmeal and fish oil, have led many to believe mistakenly: that the future growth of aquaculture will be limited by the availability of fishmeal and fish oil; that the drive to produce more fishmeal and fish oil to meet the demand will result in the over-fishing of feed fisheries; that the only solution is to substitute with alternative sources which will reduce costs, allow for production growth, improve the "sustainability" of aquaculture and even reduce contaminant levels in the feed.

To correct this view the fishmeal and fish oil industry must therefore demonstrate: that its products represent value for money; that availability will not limit the growth of aquaculture; that it can produce convincing evidence that feed fisheries are being managed sustainably; and that contaminants are low and not an issue compared to the health benefits derived from the consumption of the farmed seafood.

The challenge for the industry is therefore to demonstrate these facts in a convincing manner.

Taking the last point first, following the very negative publicity surrounding the Science article by Hites et al (2004) on organic contaminants in farmed salmon, a lot of much more positive information has been forthcoming.

The most notable and one of the most recent was Mozaffarian & Rimm (2006) where they reviewed all the evidence both for and against the increased consumption of omega 3 rich fish oil.

They came to the strong conclusion that, for anyone consuming less than two portions of oily fish/week, all the evidence points to the benefits of consuming more fish oil far outweighing any additional risk from contaminants.

This is now being accepted by consumers worldwide and seafood consumption is rising strongly on the back of this positive message.

SUSTAINABILITY

On the issue of demonstrating the sustainability of feed fisheries, there is the compelling evidence that, unlike the case for many food fisheries, the feed fisheries have been generally well managed for many years and have provided a stable output of product. This is most notably true with the world's largest feed fishery off the coast of Peru.

Given the importance of this vital fishery to the Peruvian economy, they have learnt how to manage the anchoveta stocks, even including how to allow them to recover following the severe environmental shock of an el Niño.

They have achieved this by introducing strong fishery measures including closed seasons, strict quotas and third-party inspections at ports of unloading.

The industry will have to keep finding ways of demonstrating sustainability as the consumers desire for healthy but sustainable seafood grows.

In some cases it may well have to work closely with Governments and fisheries scientists to ensure sustainable quotas and other measures are developed for fragile stocks, although it should be noted that this already happens for the vast majority of fisheries.

It should also be remembered that many of the dietary alternatives to fishmeal and fish oil come with their own sustainability issues. For example the destruction of rainforest to increase the production of soya in South America, or the destruction of native forest in South-East Asia for the increased production of palm oil.

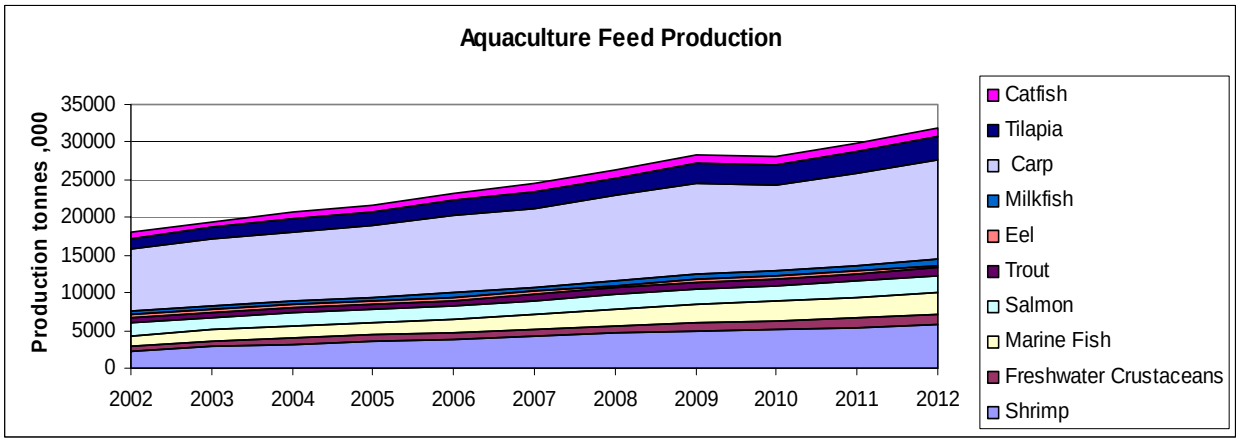


Figure 7. ▲
Estimated Aquaculture Feed Production.
FAO 2006 Data.

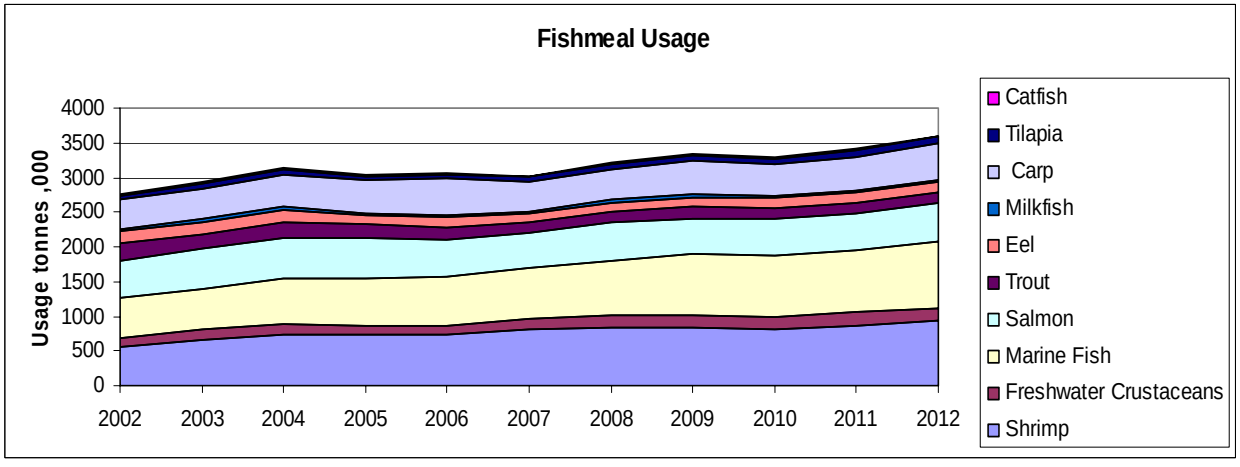
SUFFICIENCY OF SUPPLY

Given that production of fishmeal and fish oil have remained relatively stable for a number of years, it seems logical to assume that there is little opportunity for the industry to achieve any sustainable growth in production. This gives rise to the concern that they could become limiting factors in the growth of aquaculture.

However, we have already seen that, certainly with fishmeal, as the demand from aquaculture has grown over recent years so land animal production has reduced its use, making more available. This has naturally happened through rising prices and market pressure.

This trend seems likely to continue. The FAO (2006) have made estimates of the continuing growth in aquaculture feed pro duction (Figure 7), which will continue to grow from around 22 million tonnes in 2005 to around 32 million tonnes in 2012. The growth is due both to an increase in total aquacultural production and also a move away from semi-extensive farming and more towards feed intensive production.

Figure 8a. ▼ Estimates of fishmeal and fish oil usage by category. FAO & IFFO Data



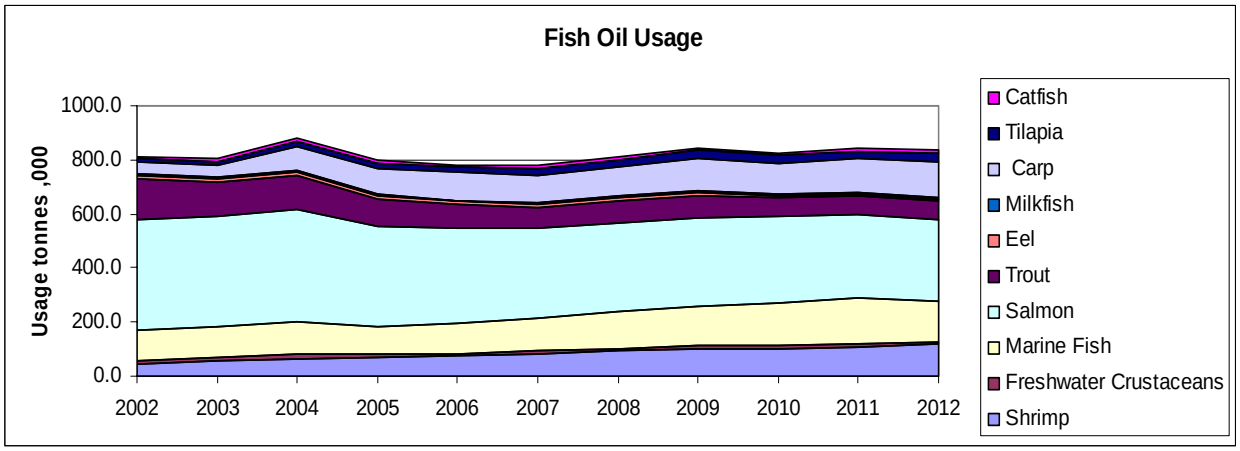


Figure 8b. ▲ Estimates of fishmeal and fish oil usage by category. FAO & IFFO Data

Taking this estimate and combining it with other projections from FAO and internal IFFO projections, we have estimated the future demand for fishmeal and fish oil from aquaculture (Figures 8a and 8b).
There is included in this the assumption that with an increasing nutritional knowledge of various species, combined with an increasing price of the fishmeal and oil, there will be a gradual reduction in the inclusion level of these materials and a rise in the use of complementary ingredients.
However, despite this substitution, we estimate that the total volume of fishmeal used in aquaculture will increase from around 3 million tonnes in 2005 to around 3.6 million tonnes by 2012.
The situation with fish oil is a little different in that the total usage in aquaculture will remain the same. For although the volume of fish (particularly in this case salmon) will increase, the inclusion level will decrease leaving the volume of oil used much where it is today.
Great care will have to be taken by the feed-formulators and farmers to ensure that the final EPA and DHA fatty acid compositions in the final fillets remains high otherwise the health promoting reputation of farmed products could be damaged.
If we assume a constant annual production of 6 million tonnes of fishmeal and 950,000 tonnes of fish oil, we reach a point in 2012 where 60% of world fishmeal production goes to aquaculture compared to 52% in 2005 and 88% of fish oil will be used by aquaculture compared to 84% in 2005 (Figure 9).

" ... many of the dietary alternatives to fishmeal and fish oil come with their own sustainability issues. For example, the destruction of rainforest to increase the production of soya in South America, or the destruction of native forest in South-East Asia for the increased production of palm oil"

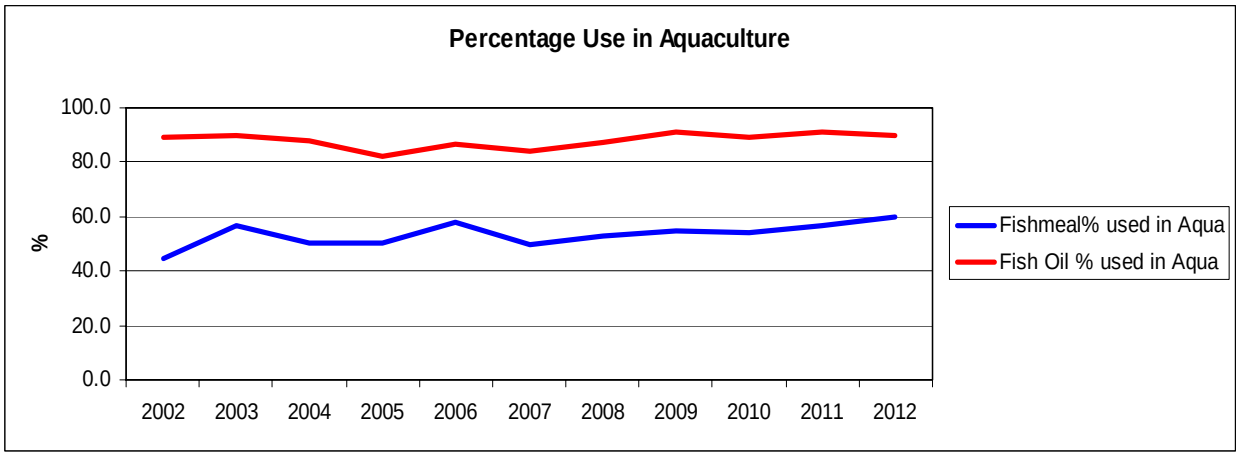


Figure 9.
Estimated percentages of global production of fishmeal and fish oil used in aquaculture. FAO & IFFO Data

However, it can be clearly seen that aquaculture can continue to grow without fishmeal or fish oil becoming limiting factors.

VALUE FOR MONEY

There is a growing appreciation of the value of EPA and DHA fatty acids in both human and animal nutrition. Fishmeal and fish oil are one of the few natural sources of these fatty acids and their production in genetically modified plants is likely to meet with consumer resistance.

This will mean that while some of the dietary fat that is used for energy in fish can be replaced by alternatives, care will have to be taken in replacing too much to avoid compromising the health of the animal and reducing the health benefits to the consumer.

It has also been known for a long time that whereas many plant proteins contain anti-nutritional factors, fishmeal appears to contain unidentified positive nutritional factors. A number of possible candidates have been suggested, the most likely being the water soluble components.

OPPORTUNITIES

It therefore seems clear that aquaculture production will keep growing and demand more volume of highly nutritious feed. The ideal nutritional profiles of both fishmeal and fish oil will make them the ingredients of choice in many aquaculture situations, particularly with carnivores such as salmon, eels and some prawns.

However, because of the need to avoid unsustainable fishing, the output of fishmeal and fish oil will in all probability remain relatively fixed and therefore their price is likely to remain firm over time. Therefore fishmeal and fish oil, once commodities, will increasingly become strategic dietary ingredients. In turn this firmness of price is likely, where possible, to encourage the search for replacements.

This set of circumstances offers the opportunity to the whole value chain to derive some benefit if carefully managed.

By resisting the temptation of over-fishing to produce fishmeal and fish oil to meet the growing demand, the producers will be able to clearly demonstrate responsibility and sustainability, as well as harvesting at the maximum sustainable yield. In return the price per tonne for these strategic ingredients will remain firm.

The feed compounders and farmers will in turn reduce their inclusions levels of fishmeal and fish oil and partially substitute with cheaper ingredients, taking care to maintain the health giving properties to both animal and human, as well as the farming performance.
The use of fishmeal and fish oil will increasingly be targeted at critical stages in the life-cycle such as starter diets, broodstock diets and finisher diets. The result will be that production of both aquaculture feed and seafood products will increase, but the feed and farming costs will be controlled.
And finally the consumer will be able to buy increasing volumes of farm-grown seafood products with the reassurance of knowing that these healthy and nutritious products have been produced from responsibly managed farms and fisheries.
These opportunities are achievable if each link in the value-chain recognises the prize and works to achieve them.

"The use of fishmeal and fish oil will increasingly be targeted at critical stages in the life-cycle such as starter diets, broodstock diets and finisher diets. The result will be that production of both aquaculture feed and seafood products will increase, but the feed and farming costs will be controlled"

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For more information about fishmeal and oil, contact Andrew Jackson, Technical Director, International Fishmeal and Oil Organisation, St Albans, AL3 4PA, UK.
secretariat@iffo.net