



## **Responding to our critics**

### **Is it true that it takes five kilos of wild feed fish to produce one kilo of salmon?**

The fishmeal industry is subject to much negative and unfair criticism. To help our members defend themselves against such criticisms, Update is including a series of articles giving you the science-based arguments with which to respond.

This second article addresses the criticism that “It takes five kilos of wild feed fish to produce each kilo of farmed salmon”.

*NOTE: Critics and others use the words ‘feed’ fish or ‘forage’ fish for what we usually call ‘industrial’ fish from reduction fisheries. The expression ‘fed aquaculture’ refers to farmed fish and crustaceans fed with factory compounded feed, usually including fishmeal and fish oil.*

#### **Q. What do our critics claim?**

**A.** They assert that five, or even more, kilos of wild feed/industrial fish are harvested to produce, via fishmeal and fish oil in feed, just one kilo of farmed salmon, often expressed as a Fish In: Fish Out (FIFO) ratio of 5:1. Some academic papers have seemed to support this assertion, notably by Tacon and Metian (2008) which put forward a FIFO of 4.9:1 for farmed salmon, and Naylor et al. (2009) who used 5:1.

Against a background of concern about overfishing and feeding a growing world population, the critics say: “Using five kilos of fish to produce one kilo of fish is obviously wasteful and inefficient”. They usually go on to insist that fishing to produce fishmeal and oil for aquaculture or land animal feed is simply not viable in terms of resource use and should be banned. There have also been many media stories in Europe and North America about how wrong it is to farm carnivorous fish and crustaceans, and especially feeding them with fishmeal and fish oil.

In short, this 5 to 1 assertion damages the public and political acceptance of the use of fishmeal. It puts doubt in our customers’ minds as to whether fishmeal and oil can be presented to their customers as sustainable and responsible ingredients.

#### **Q. There seem to be several issues here. First, are these 5:1 FIFO figures correct?**

**A.** No. In fact the FIFO for salmon for 2008 (using the data of Tacon and Metian (T&M), but recalculated) was 1.7 – in other words, only 1.7 (NOT 5) kilos of feed fish were used to produce each kilo of farmed salmon.

Salmon is just one farmed species. Looking at the whole of fed aquaculture the FIFO is 0.5:1, which means that global aquaculture used just 500g of wild fish for each kilo of farmed fish and crustaceans produced. So aquaculture globally is actually producing nearly twice as much fish (farmed seafood) as it uses feed/industrial fish (via fishmeal and fish oil).

Of course, we all know that fed aquaculture produces a greater weight of seafood than it uses of fish, because other ingredients, like soya meal and palm oil, are also used in feeds. In addition aquaculture is a very efficient way of converting feed into high quality protein in the form of farmed fish or crustaceans. Fish are much better converters of feed than cattle, sheep, pigs and poultry.

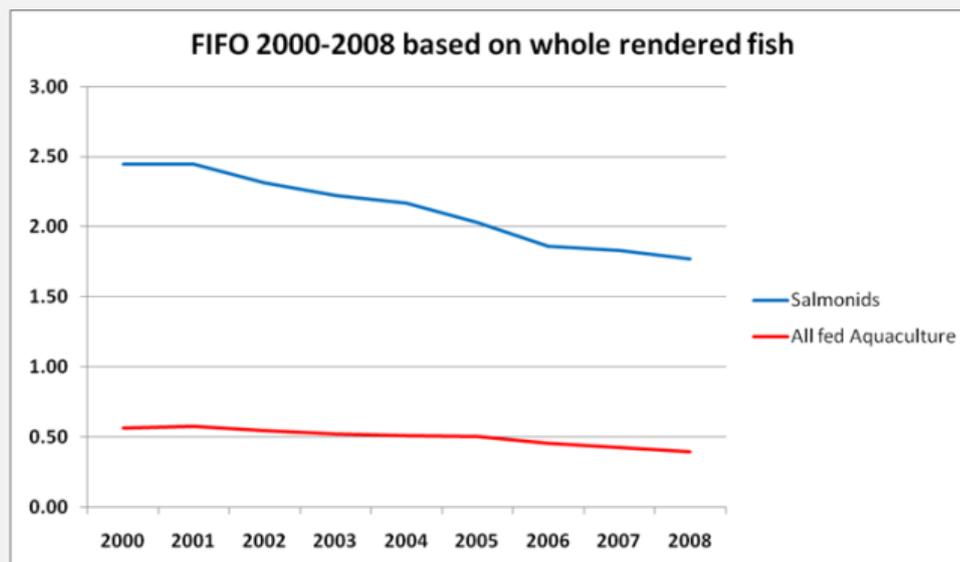
But the public and even some politicians and people in the food business do not know that. The erroneous “5 kilos in to get 1 kilo out” criticism was giving aquaculture, fishmeal and fish oil a bad name. It gave them the reputation of being an inefficient and wasteful part of the food chain, indeed one which should be outlawed and excluded from discussions on the movement towards sustainable and responsible food production.

So the corrected figures - showing that aquaculture uses just half a kilo (and salmon just 1.7 kilos) of feed/industrial fish for each kilo of farmed seafood it produces - give a crucially improved reputation. IFFO and our industry are more respected partners as a result of myth-busting work like the recalculation of FIFOs. For more about FIFOs – see text box below.



## FIFOs are falling

In fact the FIFOs have fallen in recent years and will fall further, as a result of improved conversion from feed fish to fishmeal and fish oil and better feed conversion on the fish farm, as well as the falling percentages of fishmeal and fish oil now being used in typical fish feeds. IFFO has used its own global database of fishmeal and fish oil usage, which suggests a lower use of fishmeal in aquaculture than T&M, particularly in China, and has produced the following graph of the decrease:



**Q. These lower FIFOs give a much more positive picture of the efficiency of our industry. How were they calculated?**

**A.** IFFO Technical Director, Andrew Jackson, took the same data as used by others and studied the method which had calculated a salmon FIFO of 5:1 or similar. He found two important mistakes:

1. The previous calculations addressed how much wild fish was needed to produce the fish OIL required to produce a kilo of salmon. As use of oil is comparatively high in salmon feed, this approach inflated the FIFO, and a significant quantity of meal was bizarrely ignored or 'thrown away' in this method. Dr Jackson developed a new equation for calculating FIFO which reflected the real world situation where all the fishmeal and all the fish oil produced is actually used, with some species like salmon using higher proportions of oil and some like shrimp using higher proportions of meal.

Dr Jackson cross checked his calculation by using both his FIFO and that of T&M to work out how much wild feed fish was used annually and compared that against the best available actual catch and usage figures, based on FAO data. The Jackson FIFO was a much better match.

2. Previous calculations had assumed that all the raw material used in fishmeal production was whole wild caught fish. In fact an IFFO study of 2008 shows that, in 2006, 22% of production was derived from by-products – heads, guts and other filleting waste. So the wild fish represented just 78% of raw material. Dr Jackson corrected the data used for the FIFO calculation to reflect this and the FIFOs fell further – as the same amount of farmed fish was being produced from 22% less feed/industrial fish. The details of Dr Jackson's calculations can be studied at <http://bit.ly/gdbIIM>



**Fish In:Fish Out (FIFO) = 5:1**

**All aquaculture FIFO = 0.5:1**

**Farmed salmon FIFO = 1.7:1**

**Fed aquaculture produces  
nearly twice as much farmed fish  
as it uses wild feed fish, by weight**

(2006 figures)

**Q. Are Jackson's FIFOs accepted by scientists, the value chain and NGOs?**

**A.** Throughout 2009 and 2010 Andrew Jackson and Jonathan Shepherd presented the revised FIFOs and the method of calculation at more than 20 conferences and meetings with key players in the value chain. The revised FIFO calculation and values were published by OECD earlier this year (Jackson and Shepherd, 2010) and were the topic of a major article in the journal of the European Aquaculture Society, Aquaculture Europe, in September 2009. Following the publication of this article Naylor et al 2009 criticised this method and said: "Alternatively, if one assumes no excess requirement for fish oil and both ingredients are treated equally in the calculation, then FI/FO would be lower. The latter assumption allows one to add up all species to reach a grand total, because excess fishmeal or fish oil from the diet of any given species will be consumed ultimately by other fish or livestock species, or even by humans in the case of residual fish oil. However, such a calculation obscures the fact that rising demand for species high in fish oil could lead to continued increases in the amount of forage fish used in feeds".

However, given that the economic value of the fish oil is rarely above that of the fishmeal this argument does not have any logic.

The over-sight committee of the Global Aquaculture Alliance's "Best Aquacultural Practice" (BAP) has just adopted FIFO, as calculated by IFFO, as a measure in their BAP standards.

**Q. Surely the critics are also wrong to assume that, if the wild feed fish were not used for fishmeal production, they could easily find a human consumption market? Are they edible, are they palatable, and can they be got in edible condition to markets where buyers have the money to pay for them?**

**A.** Wijkstrom (2010) focused on whether there was a real human consumption demand for the various species used to produce fishmeal. For example, he classified menhaden and sand eel as forage species, not in demand at all as food; and all the main anchovy stocks, including those from the massive South American fishery, as having only small or niche markets for human consumption, with the bulk going for fishmeal.

Overall he concluded that there were not human consumption markets for most feed/industrial fish. He also concluded that feeding fishmeal and fish oil to farmed fish/crustaceans expanded the effective supply of fish for human consumption by 7-8 million tonnes a year.

*NOTE: In a future article in this series we will look in more detail at how to refute the criticism that production of fishmeal diverts fish from human consumption.*

**Q. Fair enough - but are FIFOs really a valid measure of efficiency?**

Frankly no, but it is the one our critics like to use – because it gives an instant, unfavorable image of the fishmeal industry.



Neither the FIFO, nor the feed conversion ratio (FCR), is true measures of nutritional efficiency – that would need to be based on Protein In: Protein Out and Energy In: Energy Out. Nor is it a useful measure of environmental efficiency – to do that would take us down the long road of life cycle analysis.

**Much more important than the FIFO ratio is the need to ensure that the fisheries which supply the fishmeal and fish oil to the industry are responsibly managed. IFFO has introduced its RS Certification programme to demonstrate that - and responsible production - to the value chain\*.**

#### **References**

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2. Rosamond L. Naylor, Ronald W. Hardy, Dominique P. Bureau, Alice Chiu, Matthew Elliott, Anthony P.
3. Farrell, Ian Forster, Delbert M. Gatlin, Rebecca J. Goldberg, Katheline Hua, and Peter D. Nichols: Feeding aquaculture in an era of finite resources. *Proceedings of the National Academy of Sciences*, Volume 106, no. 36, 2009
4. Ulf N Wijkstrom: Does fishmeal contribute to poverty alleviation? UN FAO 2010.
5. Andrew Jackson: Fish In- Fish Out, Ratios Explained. *Aquaculture Europe*, Volume 34 (3) 2009.
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*NOTE\* Last week a further group of factories achieved RS certification. Details will be on the IFFO web site shortly, and notified to members.*