Aquaculture Europe 2010 – Seafarming Tomorrow

aquaculture europe

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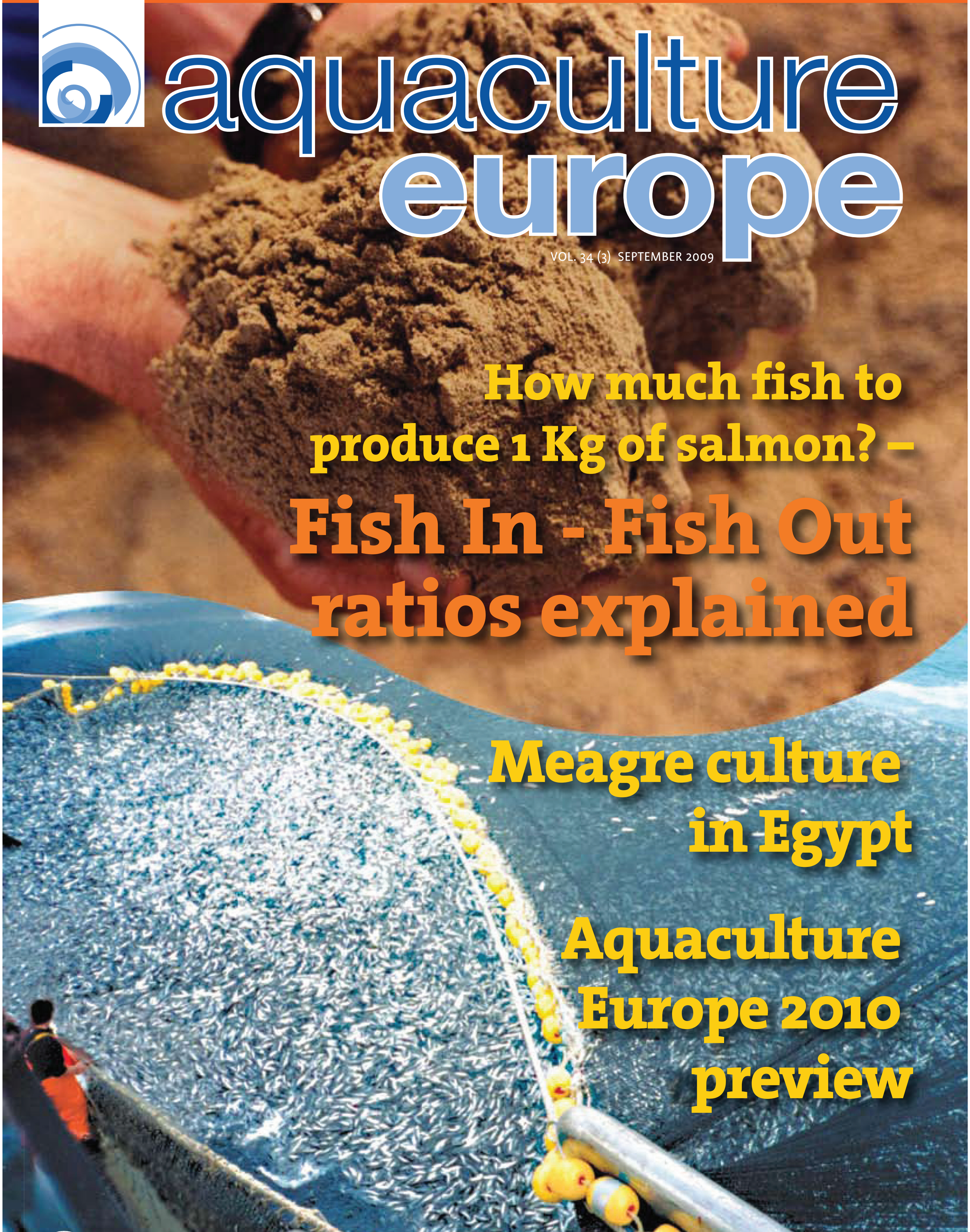

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AQUACULTURE EUROPE
EAS is a non-profit society that aims at promoting contacts among all involved in aquaculture. EAS was founded in 1976. Aquaculture Europe is the members' magazine of EAS.

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Membership
Membership of the EAS includes the Aquaculture Europe Magazine (4 issues/year; institutional and sponsorial members receive 2 copies) and Aquaculture International (AI) (6 issues/year; optional for individual members only; not for institutional members).
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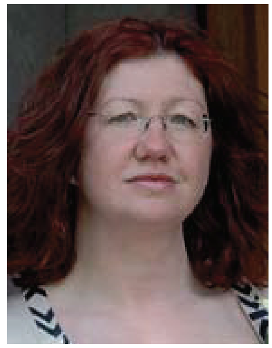
Selina Stead

Dear EAS Member,

"Mesmerising" is what one participant whispered in my ear at our annual conference on New Research Frontiers, which took place in Trondheim, 14-17 August 2009 and that was before the formal talks had started!

Attendees at the welcome drinks reception held at the famous Archbishops' Palace were treated to an exquisite rendition of a local Norwegian bridal song by members of a female choir, Cantus, who slowly intermingled with guests and had the entire audience transfixed. The County Mayor of Sor-Trondelag arranged this world class choir to share three songs with us whilst old and new friends enjoyed the scrumptious food and drinks. Once again I would like to thank Mr Tore. O. Sandvik for a memorable start to our Aquaculture Europe 2009 event.

Many people worked incredibly hard behind the scenes to make our event a huge success and if there is anyone reading this that I did not have the pleasure to thank in person then we are extremely grateful for your efforts, a big thank you from us all. From start to finish there was an infectious buzz of energetic dialogue that has secured the European Aquaculture Society's (EAS) annual conference as the leading European aquaculture information exchange event. The breadth of subjects covered combined with the mostly high standard of presentations and posters led to many new questions being raised and lots of novel ideas generated.

In the session on aquaculture governance, policy and socio-economic research that I had the pleasure to chair with Torgeir Edvardsen we had an unplanned and extended lively discussion at the end on why so little social science was done to assist the aquaculture industry compared to other sectors like fisheries? Various views were put forward such as to date there has been little scientific support for policy that has had the funding to draw in available expertise. It was agreed this is surprising when you consider that you can only manage aquatic environments through relationships between business, the government and people. Unsurprisingly the need for funding and greater efforts to find ways to integrate economists and other social scientists in aquaculture projects was identified as an important area in need of urgent development with those present very keen to use the EAS as a forum to promote a new network on this. Courtney Hough of the Federation of European Aquaculture Producers announced at this meeting that the European Aquaculture Technology and Innovation Platform had recently added a socio-economic component to its strategic research agenda which was well received by all those present including representatives from the European Commission.

Those that played key roles in making Aquaculture Europe 2009 in Trondheim such a productive experience include the Steering Committee Chair, Helge Reinertsen who also successfully secured funding from the Research Council of Norway to help run this event. The Dean of the Faculty of Engineering Science and Technology, Professor Ingvald Strømmen, who kindly arranged for us to hold our meeting in the Norwegian University of Science and Technology. Thanks also to Odd Berg and the Nor-Fishing Foundation for their financial and longstanding support. Our AE2009 session sponsors, Intervet Schering Plough and BIOMAR helped create two lively interactive forums. The Programme Co-Chairs Kjell Inge Reitan and Béatrice Chatain did a superb job at developing and chairing sessions with an interesting mix of papers and posters. Alexandra Neyts, Jan Ove Evjemo and Werner Johansen created the enticing local ambience and ensured that everything went smoothly. Our EAS Home Office staff, Alistair Lane and Linda Aspeslagh along with John Cooksey and his team put in a lot of hours to keep the entire occasion an enjoyable experience for all. Last but not least thank you to all those that were able to join us in Trondheim, please tell your friends about EAS's activities and bring them along with you to our next event. If you don't want to miss out next year then save the dates, 5-8 October 2010 in your diaries and come join us in the beautiful city of Porto for both the EAS Conference and Trade Show.

We are also starting to plan for our AE2011 meeting which will be on Rhodes. Greece will be followed by Russia for our joint event with the World Aquaculture Society in 2012 taking place in St. Petersburg. Panos Christofilogiannis has agreed to be the chair of the Rhodes Steering Committee after the EAS Board of Directors were very impressed by his chairmanship of the local organising committee who put together an outstanding application for Greece to host the 2011 event. Similarly, Váradi László, our current EAS Past President has taken on the Steering Committee Chair role for our Russian meeting. We will keep you updated on progress.

Would you like an EAS conference and tradeshow to take place in your country? If yes then please get in contact with Alistair Lane at the EAS Secretariat (a.lane@aquaculture.cc) to find out what is involved.

At our EAS Board meeting in Trondheim we discussed the importance of finding interactive ways and or rethinking old ways that can help members of our society to keep in touch better with each other, so how can we promote networking and exchange of information more effectively? We understand not everyone can attend our annual conferences and so try to provide alternative means of communication through for example, a good quality magazine, our EASinfo newsletter, our informative website (www.easonline.org) and email just to mention a few. What we would like to do more is to encourage you the members to get involved with activities that reflect your interests and needs – please contact Alistair Lane at the above email address with ideas and suggestions. We will soon be asking for candidates to consider running for a position as an elected Director of the EAS Board so if you would like to influence how EAS is run and have the energy, time and drive to make things happen then we want to hear from you.

Thank you for reading thus far and I wish you a productive and successful few months ahead.

Selina Stead
EAS President 2008-2010

FISH IN - FISH OUT RATIOS EXPLAINED

BY ANDREW JACKSON

One of the long continued debates in aquaculture is the use of fishmeal and fish oil in feeds and the amount of wild fish it takes to produce farmed fish. This debate has particularly raged around the use of fish oil and fishmeal in salmon diets and a lot of different figures have been quoted for the number of tonnes of wild fish it takes to produce a tonne of farmed salmon (FIFO ratio). These quoted figures range from 3:1 to 10:1; the most recent figure published comes from Tacon & Metian (2008) who gave the figure for Salmon in 2006 as 4.9:1, meaning it takes 4.9 tonnes of wild fish to produce 1 tonne of salmon.

It can be easily demonstrated how they came up with this figure. If we take 1 tonne (1000 kg) of wild fish, they assume that this would yield 225 kg of fishmeal and 50 kg of fish oil.

In 2006 they say that salmon diets on average contained 30% fishmeal and 20% fish oil. This means that one could produce 250kg of salmon feed by using up all of the 50 kg of fish oil. Salmon then have a feed conversion ratio (FCR) of 1.25 which therefore gives a harvest volume of 200 kg of salmon. So our starting 1000kg of wild fish have been turned into 200 kg of salmon which is a Fish in - Fish out (FIFO) ratio of 5:1 (1000:200), which compares well with Tacon & Metian's global figure of 4.9:1.

However, it can be seen from the table that while all the fish oil was used to produce the salmon feed, there was 150kg of fishmeal left over; this cannot be used as there is no more oil. In their calculation this is just thrown away and wasted.

Let us now turn our attention to the production of shrimp, the other major global user of fishmeal; in this case Tacon & Metian give a FIFO ratio of 1.4:1. Again we can do a worked example using the same starting point of 1 tonne of wild fish.

SALMON	
Wt of pelagic fish at start kg	1000
Wt of Fishmeal kg	225
Wt of fish oil kg	50
How much salmon do I produce?	
Fish oil in the diet %	20
Fishmeal in the diet %	30
Requirement of oil kg	50
Requirement of fishmeal kg	75
Amount of feed that can be produced kg	250
FCR	1.25
Salmon Produced kg	200
FIFO	5.0
Fishmeal left over kg	150

Assumptions from Tacon & Metian highlighted green

SHRIMP	
Wt of pelagic fish at start kg	1000
Wt of Fishmeal kg	225
Wt of fish oil kg	50
How much shrimp do I produce?	
Fish oil in the diet %	2
Fishmeal in the diet %	20
Requirement of oil kg	22.5
Requirement of fishmeal kg	225
Amount of feed that can be produced kg	1125
FCR	1.7
Shrimp Produced kg	662
FIFO	1.5
Fish Oil left over kg	28

In this case the diets for shrimp require much more fishmeal than fish oil, so all the 225kg of fishmeal is used to produce 1125 kg of shrimp feed, which with an FCR of 1.7, produces 662kg of harvestable shrimp and a FIFO ratio of 1.5:1 (1000/662). This is virtually the same as the Tacon & Metian figure of 1.4:1. On this occasion it can be seen that there is 28kg of surplus fish oil which it is assumed is discarded.

It can therefore be clearly seen that with salmon production there is surplus fishmeal and with shrimp production there is surplus fish oil, so that a combination of the two should be more efficient.

SALMON	PLUS	SHRIMP	
Wt of pelagic fish at start kg	1000		
Wt of Fishmeal kg	225		
Wt of fish oil kg	50		
How much salmon do I produce?		How much shrimp do I produce?	
Fish oil in the diet %	20	Fish oil in the diet %	2
Fishmeal in the diet %	30	Fishmeal in the diet %	20
Requirement of oil kg	35	Requirement of oil kg	15
Requirement of fishmeal kg	53	Requirement of fishmeal kg	150
Amount of feed that can be produced kg	175	Amount of feed that can be produced kg	750
FCR	1.25	FCR	1.7
Salmon Produced kg	140	Shrimp Produced kg	441
Total Weight Produced	581		
FIFO	1.7		
Fishmeal left over kg	23		
Fish Oil left over kg	0		

In this case if we use most of the oil (35kg from the available 50kg) for the salmon, we can produce 175 kg of salmon feed and this produces 140 kg of salmon. This would also use 53 kg of the available 225kg of fishmeal. If we use the remaining 15 kg of fish oil for shrimp feed and combine this with 150 kg of fishmeal we could produce 750kg of shrimp feed, which would yield 441kg of shrimp. The combined FIFO ratio is now 1.7:1 (1000:581) and there is still 23kg of fishmeal left over.

So let us go one more step and combine our salmon and shrimp production with some carp production, which does not use any fish oil.

SALMON	PLUS
Wt of pelagic fish at start kg	1000
Wt of Fishmeal kg	225
Wt of fish oil kg	50
How much salmon do I produce?	
Fish oil in the diet %	20
Fishmeal in the diet %	30
Requirement of oil kg	35
Requirement of fishmeal kg	53
Amount of feed that can be produced kg	175
FCR	1.25
Salmon Produced kg	140
Total Weight Produced	831
FIFO	1.2
Fishmeal left over kg	0
Fish Oil left over kg	0

SHRIMP	PLUS
How much shrimp do I produce?	
Fish oil in the diet %	2
Fishmeal in the diet %	20
Requirement of oil kg	15
Requirement of fishmeal kg	150
Amount of feed that can be produced kg	750
FCR	1.7
Shrimp Produced kg	441

CARP	
How much carp do I produce?	
Fish oil in the diet %	0
Fishmeal in the diet %	5
Requirement of oil kg	0
Requirement of fishmeal kg	23
Amount of feed that can be produced kg	450
FCR	1.8
Carp Produced kg	250

Now we can see that if we use the extra 23kg of fishmeal, we could produce 250kg of carp and reduce further the FIFO ratio to 1.2:1 and now everything is being used and there is no wastage.

From these worked examples it can be seen that calculating the FIFO ratio based on just one type of farming does not give the correct picture and that the reality is that one should only use in the FIFO ratio calculation what is actually used and not “discard” anything. In the real world all the fishmeal and fish oil is used and therefore we need a method of calculation that correctly attributes the wild fish caught to their final use.

Let us therefore use the following formula :

$$\text{FIFO Ratio} = \frac{\text{Level of fishmeal in the diet} + \text{Level of fish oil in the diet}}{\text{Yield of fishmeal from wild fish} + \text{Yield of fish oil from wild fish}} \times \text{FCR}$$

So for Salmon we calculate:

$$\text{Salmon FIFO Ratio} = \frac{30 + 20}{22.5 + 5.0} \times 1.25 = 2.27$$

To check whether this is giving us the correct answer we can use it to recalculate how much wild fish was used in our worked example to produce our 140, 441 and 250 kg of salmon, shrimp and carp:

	Salmon	Shrimp	Carp
FIFO calculated using formula	2.27	1.36	0.33
Total of farmed production kg	140	441	250
Amount of wild fish used kg (Production x FIFO)	318	600	82
Total amount of wild fish used kg	**1000**		

We can therefore see that the total requirement of wild fish to produce these different amounts of salmon, shrimp and carp was 1000kg, our agreed start number. We can therefore assume that this method of calculating the FIFO ratio correctly attributes volumes of wild caught fish to their correct final use. Let us therefore turn from just one tonne of wild caught fish to the 20.2 million tonnes of raw material that was used for the production of fishmeal and fish oil in 2006 according to the FAO (FAO SOFIA 2008).

Tacon & Metian in their recent paper gave the results of their global survey of aquaculture feeds and reported the following :

Data presented by Tacon & Metian with Wild Fish Used calculated using their method

Species *Volumes ,000 t*	Fish Production	Feed Used	World FCR	FM Used	FO Used	FIFO Ratio	Wild Fish Used
Salmon	1465	1831	1.25	549	361	4.9	7220
Trout	632	790	1.25	237	109	3.4	2180
Eel	266	379	1.42	209	19	3.5	927
Marine Fish	1536	2072	1.35	663	166	2.2	3316
Shrimp	3164	4948	1.56	990	99	1.4	4399
FW Crustaceans	1066	1030	0.97	155	15	0.6	687
Tilapia	2326	3203	1.38	192	16	0.4	854
Catfish	1809	1927	1.07	193	33	0.5	856
Milkfish	585	468	0.80	14	5	0.2	94
Carp	10225	8466	0.83	423	0	0.2	1881
Misc FW Carn. Fish	777	249	0.32	100	12	0.6	442
Total Fed farmed fish & shellfish	**23851**	**25363**		**3724**	**835**		**22856**

We can see all the groupings of aquaculture species that make use of fishmeal and fish oil and their calculated FIFO Ratios including those for salmon and shrimp as already discussed. However, in the final column one can see the tonnage of wild fish required in the production of each group and this agrees with their reported FIFO ratios. We can see that, as in our small scale example, the method produces very high levels of wild fish usage to the point where if we add them up we reach a total global figure of nearly 23 million tonnes of wild fish. This is in excess of the FAO figure for total world catch of wild fish rendered for fishmeal and oil production (20.2 million) and the calculation does not consider fishmeal and fish oil used in pig and poultry production.

Andrew Jackson is currently the Technical Director of IFFO, a global trade organisation representing the fishmeal and fish oil industry and associated businesses with around 200 members in 40 countries. In this role he assists members with their technical issues as well as representing the industry at international conferences. He is also working with a full value-chain advisory committee, which is developing a Code of Responsible Practice for the industry. This code should allow the industry to demonstrate both responsible sourcing of raw materials as well as good manufacturing practice and product safety. Before joining IFFO in 2006, Andrew worked for over 20 years in the salmon farming, working most of the time for Marine Harvest. He was also Chairman of the Scottish Salmon Producers Organisation.

Pelagic Catch

Unloading Anchovies

Fishmeal

If however we use the same data as presented by Tacon & Metian but use the alternative method of calculating the FIFO ratio, as outlined earlier, we obtain the following:

Alternative Method for Calculating FIFO Ratios

Species	FM in Diet %	FO in Diet %	Yield of FM from wild fish %	Yield of FO from wild fish %	FIFO Ratio	Wild Fish used ,000 t
Salmon	30	20	22.5	5	2.3	3329
Trout	30	15	22.5	5	2.0	1293
Eel	55	5	22.5	5	3.1	827
Marine Fish	32	8	22.5	5	2.0	3014
Shrimp	20	2	22.5	5	1.3	3958
FW Crustaceans	15	1.5	22.5	5	0.6	618
Tilapia	6	0.5	22.5	5	0.3	757
Catfish	10	1.7	22.5	5	0.5	820
Milkfish	3	1	22.5	5	0.1	68
Carp	5	0	22.5	5	0.2	1539
Misc FW Carn. Fish	40	5	22.5	5	0.5	407
Total of Fed farmed fish & shellfish						**16631**

Now with this new method we have a different set of FIFO ratios, with salmon still the highest at 2.3:1, but now the total amount of wild fish used in aquaculture production is 16.6 million. The remainder is used in pig and poultry production.

So if we follow the same system to try and get an idea of the global picture using FAO STAT data for pig and poultry production we can estimate the following:

Table showing the calculated FIFO for Aquaculture, Pigs and Poultry

	FM in Diet	F0 in Diet %	Yield of FM %	Yield of FO %	FCR %	FIFO FIPO	World Production ,000 t	Use of Wild fish ,000 t
Aquaculture						0.7	23851	16696
Pigs	0.25	0	22.5	5.0	3.9	0.04	141222	5007
Poultry	0.3	0	22.5	5.0	2	0.02	76245	1664
Total						**0.10**	**241318**	**23366**

Pigs and poultry make very little use of fish oil and fishmeal is used mostly in the early stages but has been largely removed from most adult grower diets. So the inclusion figure in the above table is very low over the whole growing cycle.

This gives us a total raw material use for fishmeal and fish oil production of 23.3 million tonnes for these three major categories. We therefore feel that this method of calculating the Fish in - Fish out ratios for aquaculture gives a truer representation of situation than previously used methods. But, as already mentioned, the FAO estimated 20.2 million tonnes of wild fish being rendered down for fishmeal and fish oil in 2006.

One reason for this is that the assumed yield figure of fishmeal from whole fish used by Tacon and Metian was 22.5%. Over the last decade improved processing equipment has ensured a greater protein recovery from the whole fish and the latest data IFFO has on this is that yield figures for the industry range from 23.5-24.5%. So if instead of 22.5%, we use a fishmeal yield figure of 24% we get the following:

Summary of FIFO Ratios as calculated by IFFO

Species	FM in Diet %	FO in Diet %	Yield of FM from wild fish %	Yield of FO from wild fish %	FIFO Ratio	Wild Fish used ,000t
Salmon	30	20	24	5	2.2	3157
Trout	30	15	24	5	1.9	1226
Eel	55	5	24	5	2.9	784
Marine Fish	32	8	24	5	1.9	2858
Shrimp	20	2	24	5	1.2	3754
FW Crustaceans	15	1.5	24	5	0.5	586
Tilapia	6	0.5	24	5	0.3	718
Catfish	10	1.7	24	5	0.4	777
Milkfish	3	1	24	5	0.1	65
Carp	5	0	24	5	0.1	1460
Misc FW Carn. Fish	40	5	24	5	0.5	386
Total of Fed farmed fish & shellfish					0.66	15770
Pigs	0.25	0	24	5	0.03	4748
Poultry	0.3	0	24	5	0.02	1577
Total					0.09	22096

This reduces the total weight of wild fish used to 22.1 million tonnes (down from 23.3 million) which is closer to the FAO figure of 20.2. The annual global production of fishmeal in 2006 according to IFFO statistics was 5.2 million tonnes which at a 24% yield would require 21.7 million tonnes of raw material. The figures are therefore all consistent.

One final consideration is that more and more of the world's fishmeal and oil is derived from fisheries by-products such as heads, guts and filleting waste. The differentiation between by-product fishmeal and whole fish fishmeal has not been well captured in world statistics; this goes for both IFFO and FAO data. In a recent study conducted by IFFO we calculated that around 22% of fishmeal was derived from by-products rather than whole fish.

If we use this assumption the whole wild fish in - whole farmed fish out ratio obviously falls:

Table showing the calculated FIFO for Aquaculture, Pigs and Poultry excluding fisheries by-products

	World Production ,000 t	Use of Fish ,000 t	% Coming from fishery byproducts	Use of whole wild fish 000 t	FIFO /FIPO
Aquaculture	23851	15770	22	12301	0.52
Pigs	141222	4748	22	3703	0.03
Poultry	76245	1577	22	1230	0.02
Total	**241318**	**22096**	**22**	**17235**	**0.07**
Salmon	1465	3157	22	2462	1.68

In this case the Fish in - Fish out ratio for all aquaculture falls to 0.52. That is for every tonne of whole wild fish caught, aquaculture produces 1.92 tonnes of harvestable product. Salmon is still the highest user with a FIFO ratio of 1.68, meaning that for every tonne of whole wild fish used there is 0.595 tonnes of salmon produced. If one looks at the whole of the fishmeal and fish oil industry, for every 1 tonne of whole wild fish converted into fishmeal and fish oil, the food producing industries which use these products produce around 14 tonnes of farmed produce.