Global Trends in Aquaculture and Feed Ingredient Use in Compound Aquafeeds

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Abstract

Aquaculture, the farming of aquatic plants and animals, has been growing at an average annual rate (APR) of 8.2 percent per year since 1984, with total global production increasing over eight fold from 10.2 million tonnes in 1984 to 83.7 in 2011, with global production currently valued at over US $ 135.7 billion (FAO, 2013). By region, Asia accounted for over 91.2 percent of total global aquaculture production in 2011 (APR 8.46 percent since 1984), followed by the Americas at 3.53 percent (APR 7.59 percent), Europe at 3.20 percent (APR 3.99 percent), Africa at 1.84 percent (APR 14.82 percent), and Oceania at 0.25 percent (APR 9.02 percent).

In terms of the major farmed species groups in 2011, finfish accounted for 41.6 million tonnes or 49.8 percent of total global aquaculture production in 2011 (valued at US $ 83.6 billion, with over 102 reported fish species, and production growing at an average APR of 8.85 percent since 1984), followed by aquatic plants at 21.0 million tonnes or 25.1% of total global production (valued at US $ 5.5 billion, with 12 reported aquatic plant species, and production growing at an average APR of 7.16 percent since 1984), molluscs at 14.4 million tonnes or 17.2 percent of total global production (valued at US $ 15.3 billion, with 27 reported mollusk species, and production growing at an average APR of 7.17 percent since 1984), and crustaceans at 5.9 million tonnes or 7.0 percent of total global production (valued at US $ 28.4 billion, with 15 reported crustacean species, and production growing at an average APR 13.1 percent since 1984; FAO, 2013).

The total production of the major finfish and crustacean species groups fed industrially compounded or farm-made aquafeeds was reported to be 40.57 million tonnes in 2011 (FAO, 2013), with total global industrial compound aquafeed production estimated at approximately 35.75 million tonnes; the major compound feed fed species groups including:

- Chinese carp at 11.76 million tonnes (excluding silver carp and big head carp) with an estimated total compound aquafeed requirement of 10.19 million tonnes;
- Tilapia at 3.96 million tonnes with an estimated total compound aquafeed requirement of 5.79 million tonnes or 16.2 percent of total global compound aquafeed production;

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- Shrimp at 3.93 million tonnes with an estimated total compound feed requirement of 5.54 million tonnes or 15.5 percent of total global compound aquafeed production;
- Catfish at 3.38 million tonnes with an estimated total compound feed requirement of 3.70 million tonnes or 10.3 percent of total global compound aquafeed production;
- Marine fish at 2.01 million tonnes with an estimated total compound feed requirement of 2.82 million tonnes or 7.9 percent of total global compound aquafeed production;
- Other freshwater and diadromous fish at 1.94 million tonnes with an estimated total compound feed requirement of 1.24 million tonnes or 3.5 percent of total global compound aquafeed production;
- Salmon at 1.93 million tonnes with an estimated total compound feed requirement of 2.51 million tonnes or 7.0 percent of total global compound aquafeed production;
- Freshwater crustaceans at 1.67 million tonnes with an estimated total compound feed requirement of 1.71 million tonnes or 4.8 percent of total global compound aquafeed production;
- Milkfish at 891,407 tonnes with an estimated total compound feed requirement of 820,000 tonnes or 2.3 percent of total global compound aquafeed production;
- Trout at 791,959 tonnes with an estimated total compound feed requirement of 1.03 million tonnes or 2.9 percent of total global compound aquafeed production;
- Eel at 255,284 tonnes with an estimated total compound feed requirement of 392,000 tonnes or 1.1 percent of total global compound aquafeed production in 2011.

In terms of feed ingredient usage, the compound aquafeed sector still remains the largest consumer of fishmeal and fish oil, aquaculture consuming 78 percent of total global fish oil production in 2011 (major aquaculture species group consumer being salmonids at 66 percent followed by marine fish at 17 percent) and 68% of total global fishmeal production in 2011 (major aquaculture species group consumer being crustaceans at 30 percent, followed by salmonids at 22 percent, and marine fish at 21 percent; Dr Andrew Jackson, personal communication, The Marine Ingredients Organization, http://iffo.net). The paper discusses the nutritional value, availability and use of other major feed ingredients commonly used in compound aquafeeds.

Keywords: *global trends, aquaculture, feed ingredients, aquafeed*

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Trends in global aquaculture production

Aquaculture, the farming of aquatic plants and animals, has been the fastest growing food production sector for over a quarter of a century (FAO, 2013); the aquaculture sector growing at an average annual rate (APR) of 8.2 percent per year since 1984, compared with only 1.3 percent per year for capture fisheries, and 2.6 percent per year for terrestrial meat (Figure 1).

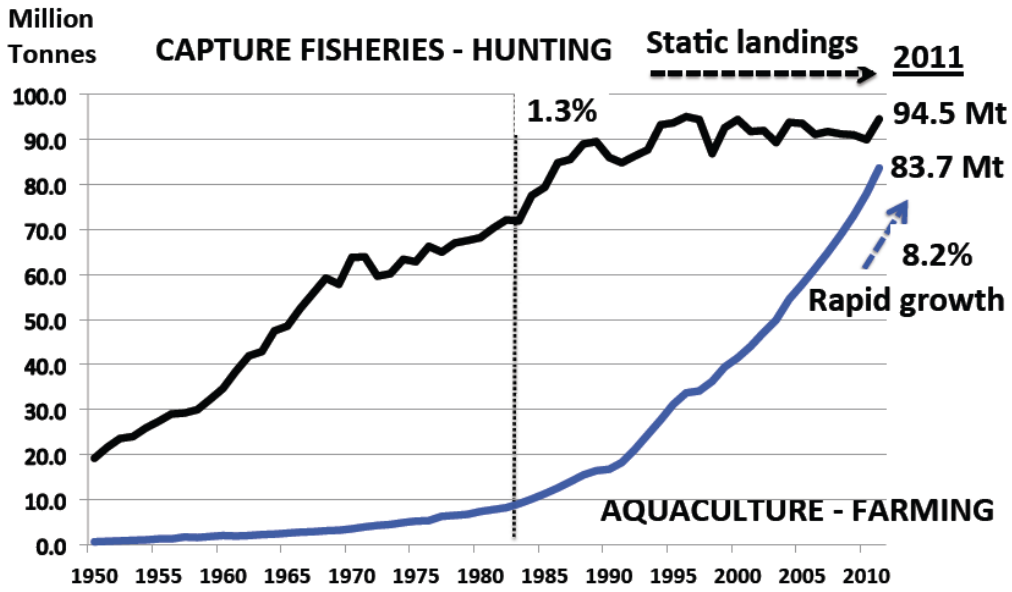

Figure 1. Growth of global aquaculture and capture fisheries production (Source: FAO, 2013)

Total global aquaculture production reached a new high of 83.7 million tonnes in 2011, with production up over eight fold from 10.2 million tonnes in 1984, and total production currently valued at over US $ 135.7 billion (Figure 2).

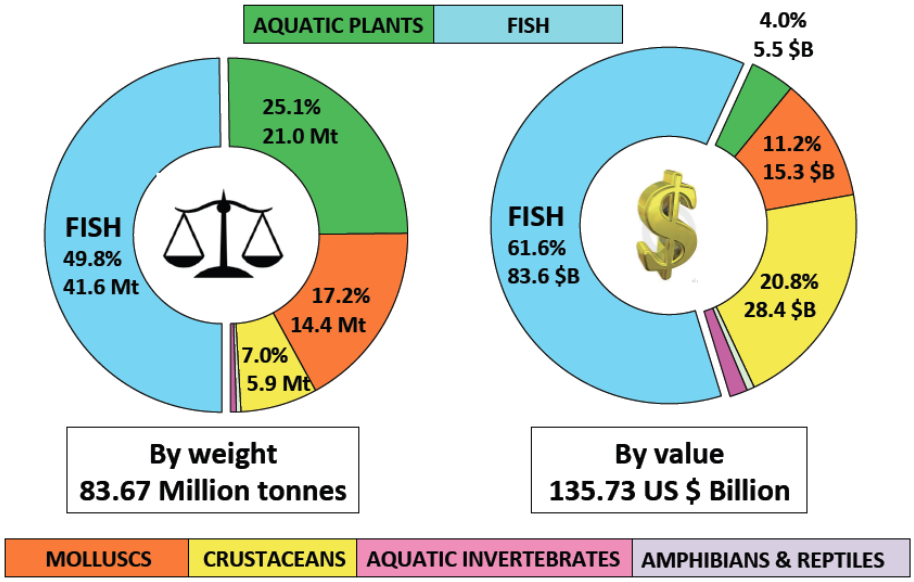

Figure 2. Total global aquaculture production by weight and value in 2011 (Source: FAO, 2013)

In terms of the major farmed species groups, finfish accounted for 41.6 million tonnes or 49.8 percent of total global aquaculture production in 2011 (valued at US $ 83.6 billion, with over 102 reported fish species), followed by aquatic plants at 21.0 million tonnes or 25.1% of total global production (valued at US $ 5.5 billion, with 12 reported aquatic plant species), molluscs at 14.4 million tonnes or 17.2 percent of total global production (valued at US $ 15.3 billion, with 27 reported mollusk species), and crustaceans at 5.9 million tonnes or 7.0 percent of total global production (valued at US $ 28.4 billion, with 15 reported crustacean species; Figure 3, FAO, 2013).

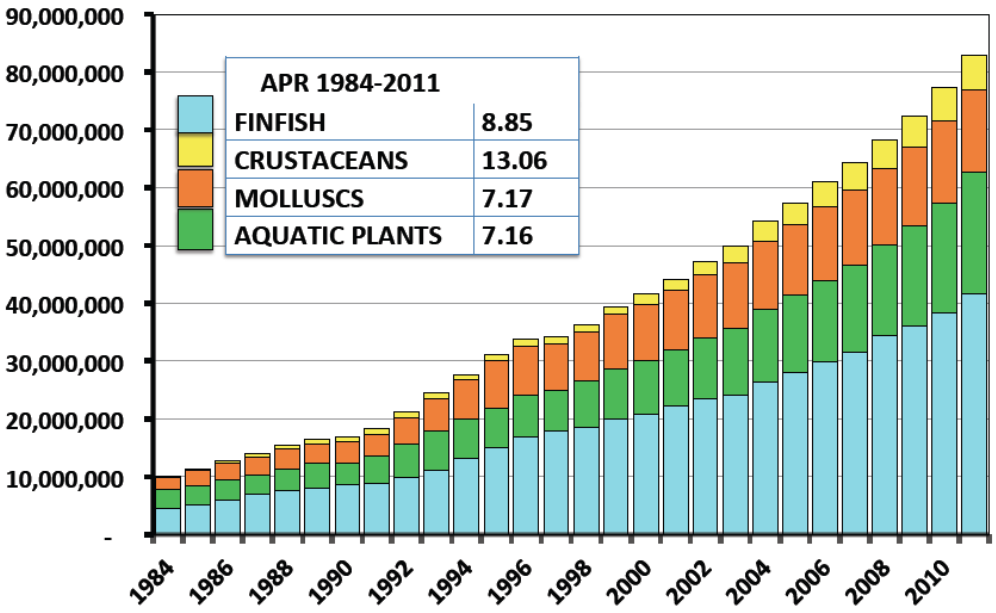

Figure 3. Growth of global aquaculture by major species group (tonnes; FAO, 2013)

By region, Asia accounted for over 91.2 percent of total global aquaculture production in 2011, followed by the Americas at 3.53 percent, Europe at 3.20 percent, Africa at 1.84 percent, and Oceania at 0.25 percent (Figure 4). Of particular note, is the fact that the growth of the aquaculture sector has been highest within the African region over the period 1984 to 2011, and that over 94 percent of global aquaculture production was realized within developing countries; the growth of the aquaculture sector within developing countries being over five times faster than that within economically developed countries (FAO, 2013).

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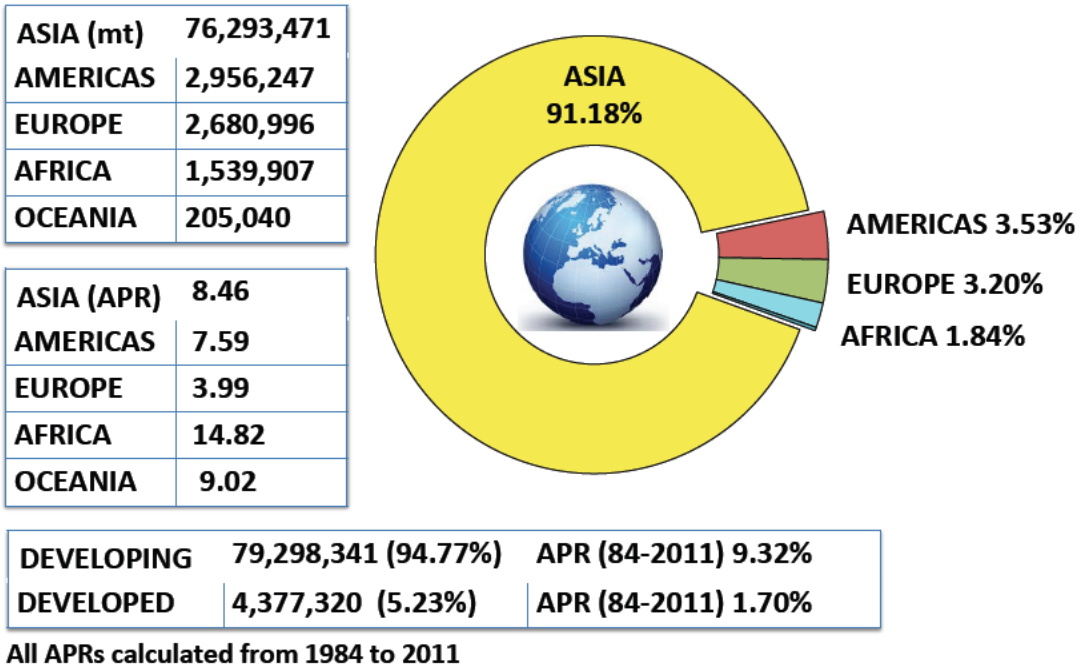

Figure 4. Global aquaculture production by region in 2011 and growth since 1984 (FAO, 2013)

China currently dominates global aquaculture production by producing over 60% of global aquaculture production by weight in 2011 (total aquaculture production reported at 50.17 million tonnes; FAO, 2013), with eight of the top ten aquaculture producing countries coming from the Asian region, including Indonesia, India, Vietnam, Philippines, Bangladesh, Korea Republic, and Thailand (Figure 5).

Of particular note is the diversity of major species groups produced by China, compared with other major producing countries, where production is concentrated on only one or two key species, including India (Finfish: Indian major carps – catla, rohu, mrigal carp), Bangladesh (Finfish: Indian major carps, Chinese carps), Norway (Finfish: salmon), and Egypt (Finfish: tilapia, grey mullet; Figure 6).

Other important aquaculture producers in 2011 included Norway (ranked 8th by weight), followed by Egypt (ranked 10th and producing 64.1% of total aquaculture production within

the African region), Chile (ranked 11th and producing 32.8% of total aquaculture production within the American region), Japan (12th), Myanmar (13th) and Brazil (14th at 630,039 tonnes in 2011; Figure 7).

China	50,170,824
Indonesia	7,888,622
India	4,577,965
Viet Nam	3,052,500
Philippines	2,608,120
Bangladesh	1,523,759
Korea, Rep.	1,499,335
Norway	1,138,797
Thailand	1,008,049
Egypt	986,820
Other	9,220,870

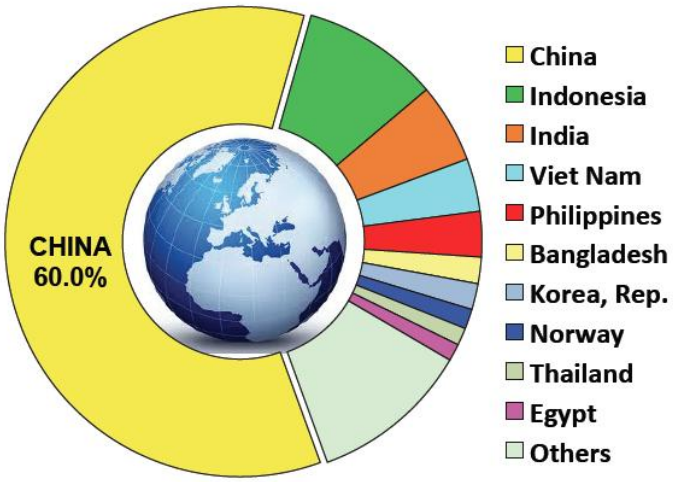

Figure 5. Top ten aquaculture producers by country in 2011 (metric tonnes; FAO, 2013)

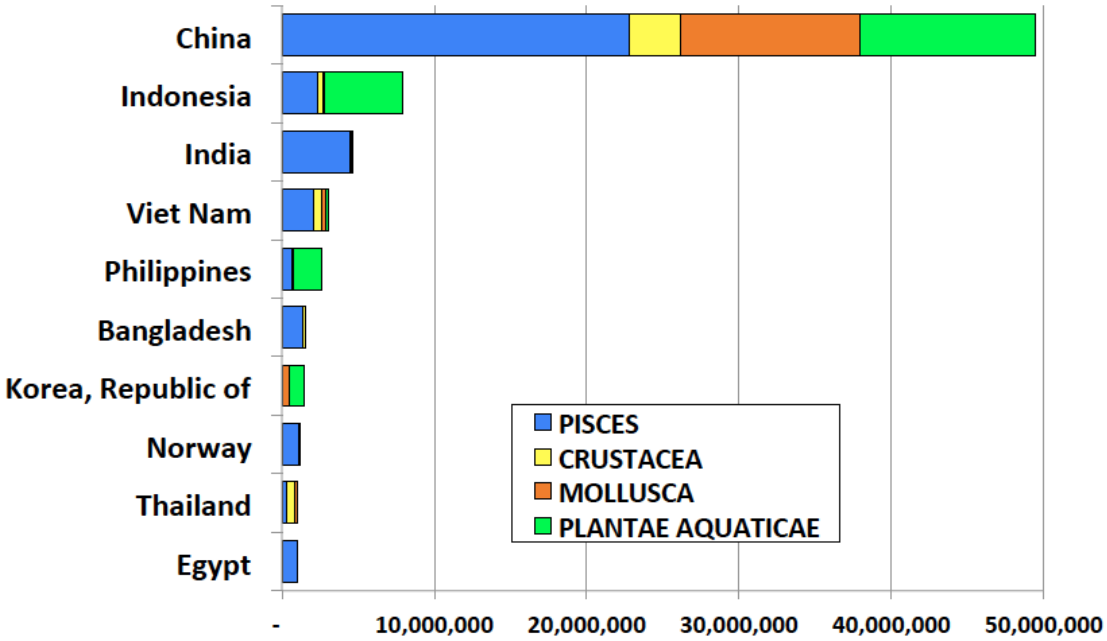

Figure 6. Major cultured species groups by top ten producing countries in 2011 (FAO, 2013)

Top 10 countries – 89.0%		Top 11-20 countries	
1 China	50,170,824 (60.0%)	11 Chile	969,539
2 Indonesia	7,888,622 (9.4%)	12 Japan	906,498
3 India	4,577,965 (5.5%)	13 Myanmar	817,112
4 Viet Nam	3,052,500 (3.6%)	14 Brazil	630,039
5 Philippines	2,608,120 (3.1%)	15 Malaysia	526,526
6 Bangladesh	1,523,759 (1.82%)	16 Korea DPR	508,350
7 Korea, Rep.	1,499,335 (1.79%)	17 USA	396,841
8 Norway	1,138,797 (1.36%)	18 Taiwan	319,245
9 Thailand	1,008,049 (1.20%)	19 Ecuador	308,900
10 Egypt	986,820	20 Spain	271,963

Figure 7. Top twenty country aquaculture producers in 2011 (metric tonnes; FAO, 2013)

The top ten aquaculture species by major species group is shown in Figure 8, and show the current dominance of freshwater fish species and the Whiteleg shrimp in the case of finfish and crustaceans, and brown/green seaweeds and Cupped oysters in the case of aquatic plants and molluscs.

Top 10 cultured fish & shrimp		Top 10 cultured plants & molluscs	
01. Silver carp	5.35 Mt	01. Japanese kelp	5.26 Mt
02. Grass carp	4.57	02. Eucheuma seaweed	4.62
03. Common carp	3.73	03. Cupped oysters nei	3.77
04. Whiteleg shrimp	2.88	04. Aquatic plants nei	2.89
05. Nile tilapia	2.79	05. Elkhorn sea moss	2.10
06. Bighead carp	2.70	06. Wakame	1.75
07. Catla	2.41	07. Warty gracilaria	1.52
08. Crucian carp	2.30	08. Scallops nei	1.31
09. Atlantic salmon	1.72	09. Marine molluscs nei	1.05
10. Roho labeo	1.44	10. Nori nei	1.03
11. Pangas catfish nei	1.42		

Figure 8. Top ten cultured species by major species group in 2011 (metric tonnes; FAO, 2013)

Trends in global fish and crustacean aquaculture production fed compound aquafeeds

The total production of the major finfish and crustacean species groups fed industrially compounded or farm-made aquafeeds was reported to be 40.57 million tonnes in 2011 (FAO, 2013), with total global industrial compound aquafeed production estimated at approximately 35.75 million tonnes (figure 9), with fish and crustacean aquaculture and compound aquafeed production gorwing at an average compound rate of 8.2% and 10.2% per year since 1995, respectively.

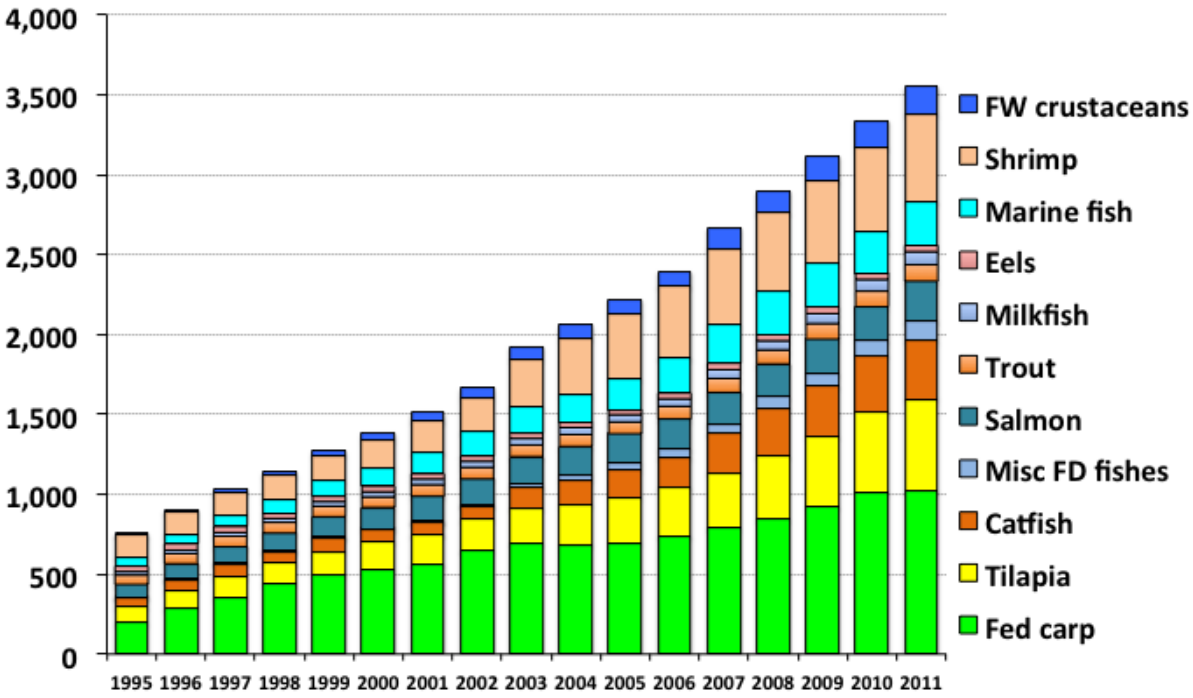

Figure 9. Estimated aquafeed production by major species group
(x 10,000 tonnes; 1995 – 2011)

The major compound feed fed species groups in 2001 included:

- **Chinese carp** at 11.76 million tonnes (excluding silver carp and big head carp) with an estimated total compound aquafeed requirement of 10.19 million tonnes;

- **Tilapia** at 3.96 million tonnes with an estimated total compound aquafeed requirement of 5.79 million tonnes or 16.2 percent of total global compound aquafeed production;
- **Shrimp** at 3.93 million tonnes with an estimated total compound feed requirement of 5.54 million tonnes or 15.5 percent of total global compound aquafeed production;
- **Catfish** at 3.38 million tonnes with an estimated total compound feed requirement of 3.70 million tonnes or 10.3 percent of total global compound aquafeed production;
- **Marine fish** at 2.01 million tonnes with an estimated total compound feed requirement of 2.82 million tonnes or 7.9 percent of total global compound aquafeed production;
- **Other freshwater and diadromous fish** at 1.94 million tonnes with an estimated total compound feed requirement of 1.24 million tonnes or 3.5 percent of total global compound aquafeed production;
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In terms of feed ingredient usage, the compound aquafeed sector still remains the largest consumer of fishmeal and fish oil, aquaculture consuming 68% of total global fishmeal production in 2011 (major aquaculture species group consumer being crustaceans at 30 percent, followed by salmonids at 22 percent, and marine fish at 21 percent; Figure 10) and 78 percent of total global fish oil production in 2011 (major aquaculture species group consumer being salmonids at 66 percent followed by marine fish at 17 percent; Figure 11,

Dr Andrew Jackson, personal communication, The Marine Ingredients Organisation, http://iffo.net).

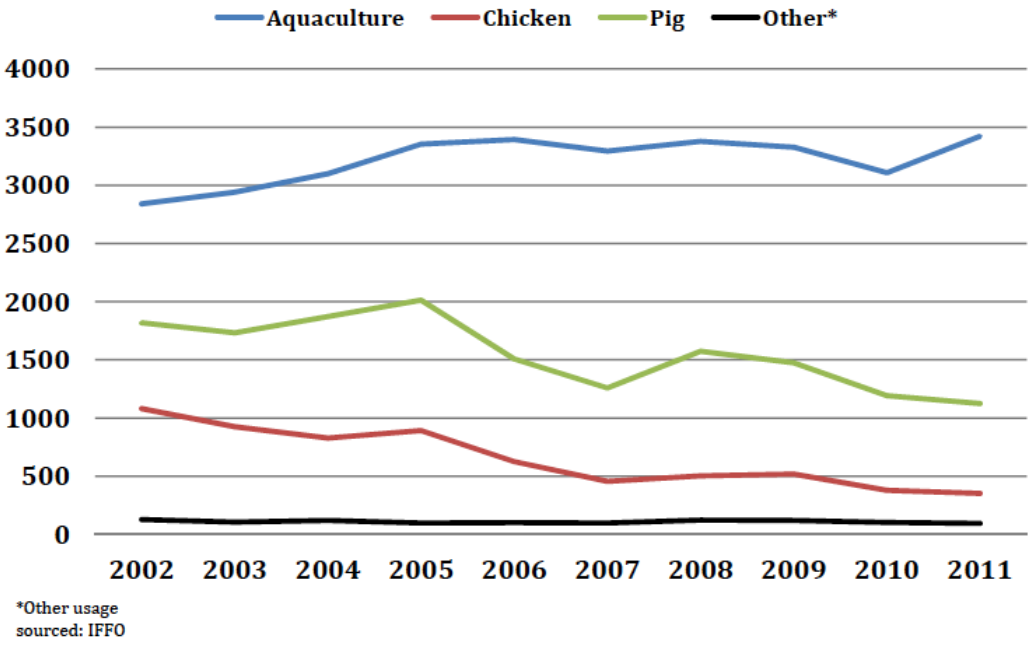

Figure 10. Major trends concerning fishmeal use by major species group (1,000 tonnes)

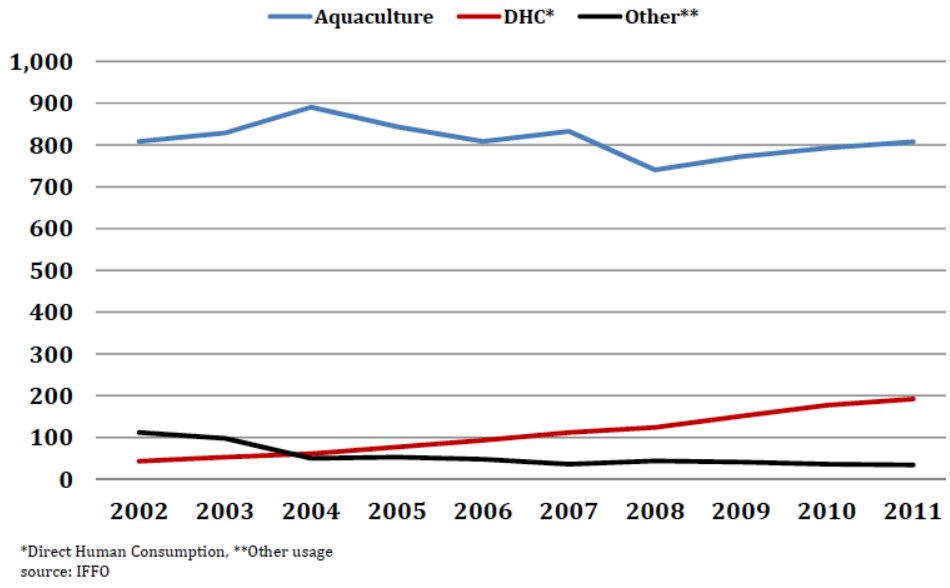

Figure 11. Major trends concerning fish oil use by major species group (1,000 tonnes)

Bibliography

FAO (2003). FAO Fisheries & Aquaculture Department, Policy and Economics Division, Statistics and Information Service, FishstatJ: a tool for fishery statistics analysis, Release 2.0.0. Universal software for fishery statistical time series. Aquaculture production: Quantities 1950–2011; Aquaculture production: Values 1984–2011.