

GLOBAL TRENDS IN AQUACULTURE AND COMPOUND AQUAFEED PRODUCTION

ALBERT G.J. TACON

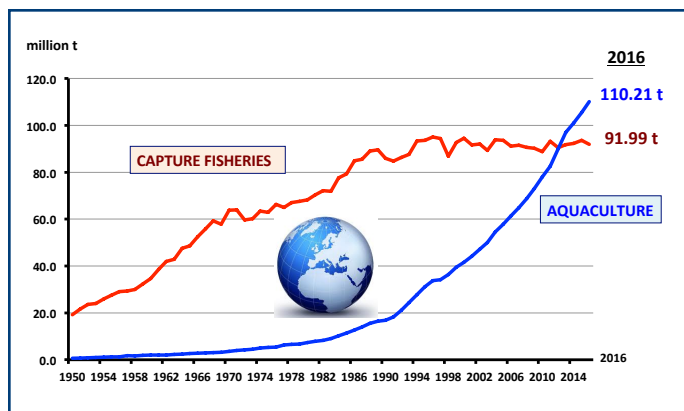


FIGURE 1. Total global aquaculture and capture fisheries production. Aquaculture production increasing at an APR of 8.12% per year compared with 2.54% for capture fisheries from 1950 to 2016 (FAO 2018).

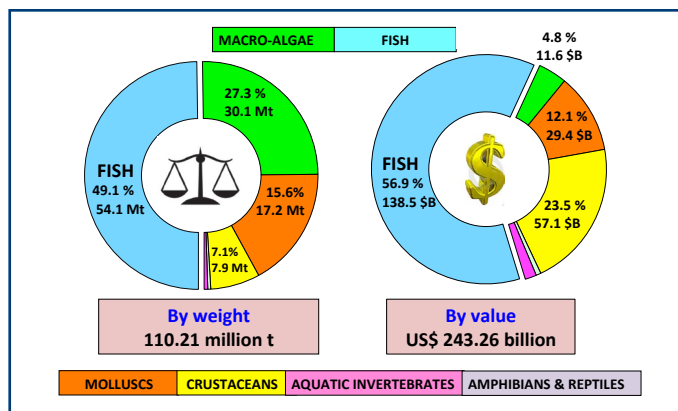


FIGURE 2. Aquaculture production by major species group in 2016. (values given in million t and US\$ billion; FAO 2018)

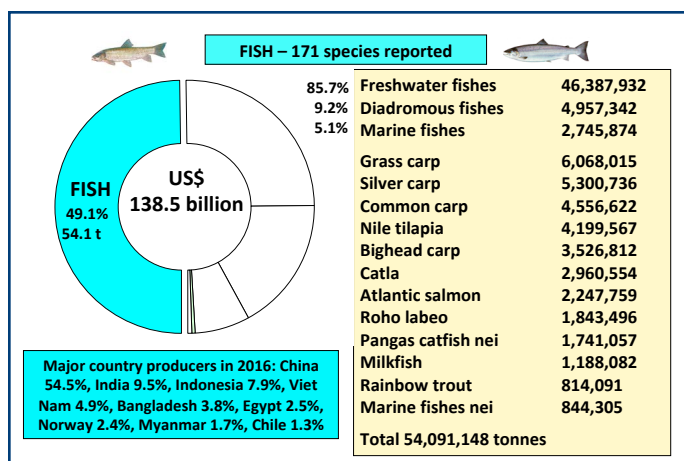


FIGURE 3. Aquaculture production by major species group in 2016. (values given in million t and US\$ billion; FAO 2018)

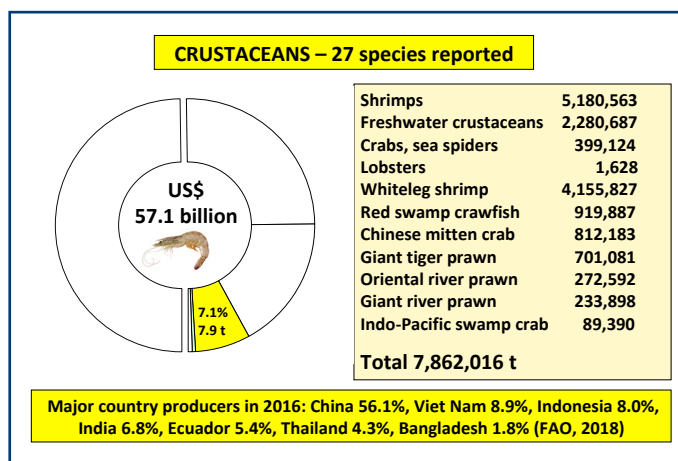


FIGURE 4. Aquaculture production by major species group in 2016. (values given in million t and US\$ billion; FAO 2018)

GLOBAL AQUACULTURE PRODUCTION

Aquaculture, the farming of aquatic plants and animals, continues to be the world's most diverse food production sector, with over 277 different species reported in 2016, including 20 species of aquatic plants, 59 species of mollusks, 27 species of crustaceans and over 171 fish species (FAO 2018).

According to the latest statistical information from FAO, total global aquaculture production increased by 4.5 percent from 105.46 million t (live weight equivalent) in 2015 to a new high of 110.21 million t in 2016, with total production valued at US\$ 243.26 billion (Fig. 1, FAO 2018).

MAJOR SPECIES PRODUCTION

In contrast to terrestrial agricultural food production systems where plant cereals and oilseeds dominate agricultural food

production, aquaculture is currently dominated by the production of aquatic animal species; over 70 percent of total production being in the form of fish, mollusks and crustaceans in 2016, and only 27.3 percent of production being in the form of aquatic plants or seaweeds (FAO 2018, Fig. 2).

Total fish production in 2016 was 54.1 million t (up 5.0 percent from the previous year) with over 171 different species reported and total production valued at US\$ 138.45 billion (Fig. 3). Moreover, despite that over 70 percent of our planet is covered with ocean or salt water, over 85.7 percent of fish production were freshwater fish species (mainly carps, tilapia and catfishes), and to a lesser extent diadromous fish species (9.2 percent, including salmonids, milkfish, eels, etc.), and marine fish species, respectively (5.1 percent, FAO 2018).

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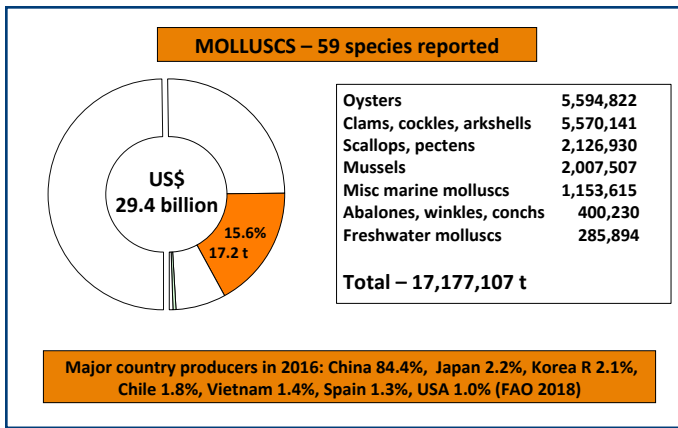


FIGURE 5. Aquaculture production by major species group in 2016. (values given in million t and US \$ billion; FAO 2018)

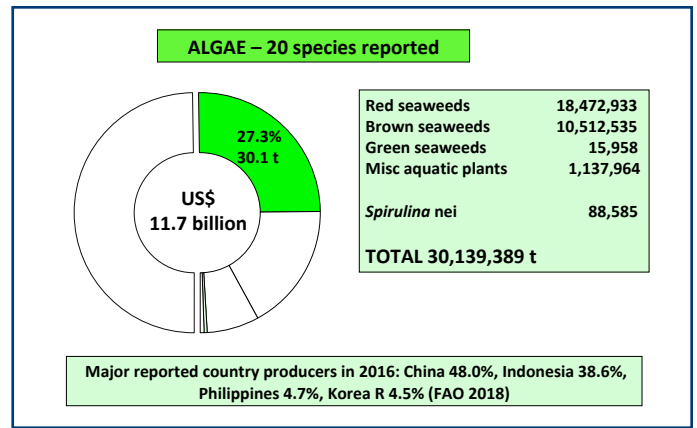


FIGURE 6. Aquaculture production by major species group in 2016. (values given in million t and US\$ billion; FAO 2018)

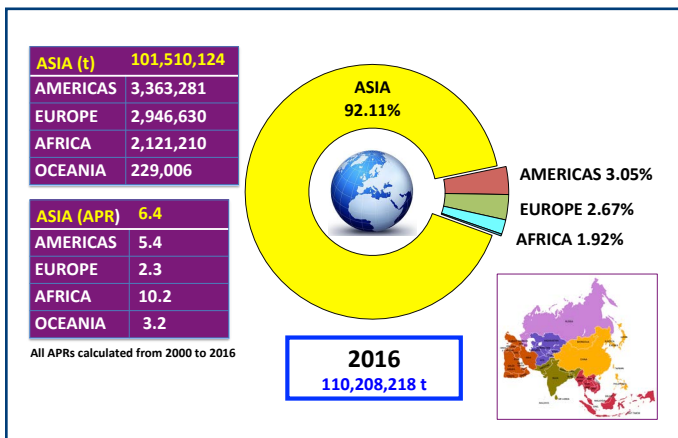


FIGURE 7. Total global aquaculture production by region in 2016 (values given in t; FAO 2018)

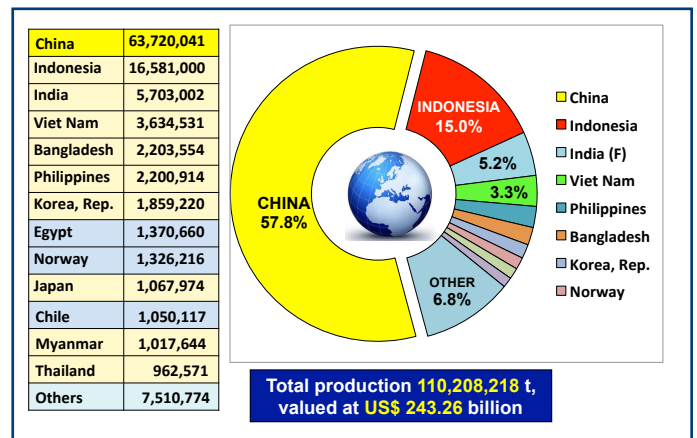


FIGURE 8. Top aquaculture producers by country in 2016. (values given in t; FAO 2018)

By value the second largest major aquaculture species group in 2016 were the crustaceans at over US\$ 57.1 billion, with over 7.86 million t reported (up 6.9 percent from the previous year) from over 27 different crustacean species; 65.9 percent of total crustacean production being marine shrimp species at 5.18 million t (Fig. 4).

Mollusks represented the second largest animal species group at 17.2 million t or 15.6 percent of total aquaculture production by weight in 2016; total mollusk production valued at US\$ 29.4 billion in 2016, with filter feeding marine/brackishwater mollusk species dominating production, including oysters, clams and mussels (Fig. 5).

Last but not least, aquatic plants represented over a quarter of global aquaculture production at 30.1 million t in 2016, with production up by 2.6 percent by weight from the previous year; representing a very diverse group ranging from the production of unicellular algal species produced in sophisticated land-based culture facilities to the production of edible macrophytes under outdoor ambient culture conditions (Fig. 6).

DOMINANCE OF THE ASIAN REGION

By geographical region, Asia currently dominates aquaculture production with over 92.1 percent of total global production. Aquaculture production within the African continent displaying the highest APR of 10.2 percent per year and Europe the lowest at 2.3 percent per year since 2000 (Fig. 7).

TOP COUNTRY PRODUCERS

China dominates global aquaculture production at 63.72 million t or 57.8 percent of total global production in 2016 (Fig. 8) and remains the world largest global producer of fish (Fig. 3), crustaceans (Fig. 4), mollusks (Fig. 5), and aquatic plants (Fig. 6).

Asia's dominance in aquaculture production after China is followed by six other Asian countries, namely Indonesia (2nd largest country producer at 5.7 million t), India (5.7 million t), Viet Nam (3.6 million t), Bangladesh (2.2 million t), the Philippines (2.2 million t) and the Republic of Korea (1.9 million t; Fig. 8).

Table 1 shows the top twenty aquaculture producers in 2016; the Asian dominance being broken by Egypt (8th largest country producer), Norway (9th), Chile (11th), Brazil (14th), Ecuador (16th), the USA (17th) and Nigeria (20th).

MAJOR FED FISH AND CRUSTACEAN SPECIES

In contrast to mollusks and aquatic plants, whose production is usually reliant on the natural availability and supply of nutrients available within an open culture system, the bulk of fish and crustacean aquaculture production is dependent on the external supply of feed inputs in the form of nutritionally complete formulated aquaculture feeds or to a lesser extent the supply of lower-cost supplementary feed inputs.

In general, the use of supplementary feeds is currently

restricted to the production of lower-cost (in marketing terms) filter-feeding fish species (13.6 million t in 2016), including silver carp, bighead carp, catla and rohu (these species representing 25.2 percent of total fish production in 2016 (FAO 2018))

In contrast to predominantly filter-feeding fish species, Table 2 shows the top compound feed fed fish and crustacean species groups produced in 2016. Total estimated fed fish and crustacean production in 2016 was estimated at 43.49 million t, with fed Chinese carp dominating production (15.09 million t or 34.7 percent of total fed species production in 2016), followed by tilapia (5.90 million t, 13.5 percent), shrimp (5.18 million t, 11.9 percent), catfish (5.06 million t, 11.6 percent), marine fish species (2.74 million t, 6.3 percent), other miscellaneous freshwater and diadromous fish species (2.51 million t, 5.8 percent), salmon (2.41 million t, 5.5 percent), freshwater crustaceans (2.28 million t, 5.2 percent), milkfish (1.19 million t, 2.7 percent), trout (0.84 million t, 1.9 percent), and eels (0.29 million t, 0.66 percent), respectively.

Table 3 shows the reported global production of the major fed species groups by major cultured species and country producers in 2016, together with the assumptions used for estimating major species growth and feed usage from 2000 to 2016, with estimates for 2020 and 2025.

Figure 9 to 19 shows the total global production of the major fed species from 2000 to 2016 based on reported FAO species production data (FAO 2018) and estimated compound feed usage, together with

an estimate for species production and feed usage for 2020 and 2025.

On the basis of the data presented it is estimated that total compound aquafeed usage was 49.6 million t in 2016, and expected to rise to 60.4 million t by 2020 and 76.2 million t by 2025, respectively (Figs. 20 and 21).

CONCLUDING REMARKS

Aquaculture continues to be the world's fastest growing and most diverse food production sector, with over 95.6 percent of total aquaculture production being realized within developing countries and the sector growing at an average APR of 6.64 percent per year, compared with 1.15 percent for economically developed countries (FAO 2018).

Notes

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References

FAO. 2018. FAO Fisheries Department, Fishery Information, Data and Statistics Unit. FishStatJ, a tool for fishery statistics analysis, Release: 3.04.5, Universal Software for Fishery Statistical Time Series. Global aquaculture production: Quantity 1950–2016; Value 1950–2016; Global capture production: 1950–2016; 2018-03-16.

(FIGURES 9-21 AND TABLES 1-3 CONTINUED
ON PAGES 38 THROUGH 46)



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TABLE 1. TOP 20 AQUACULTURE PRODUCERS IN 2016. (VALUES GIVEN IN t; APR % 2000-2016; FAO 2018)

01 China	63,720,041	5.2	11 Chile	1,050,117	5.8
02 Indonesia	16,581,000	19.2	12 Myanmar	1,017,644	15.7
03 India	5,703,002	7.0	13 Thailand	962,571	1.7
04 Viet Nam	3,634,531	13.0	14 Brazil	581,230	7.9
05 Bangladesh	2,203,554	7.8	15 Korea DPR	554,100	1.1
06 Philippines	2,200,914	4.4	16 Ecuador	451,090	13.3
07 Korea Rep	1,859,220	6.6	17 USA	444,369	-0.2
08 Egypt	1,370,660	9.1	18 Malaysia	407,887	5.7
09 Norway	1,326,216	6.4	19 Iran	398,129	15.3
10 Japan	1,067,974	-1.2	20 Nigeria	306,727	16.8

TABLE 2. TOP FED FISH AND CRUSTACEAN SPECIES PRODUCTION IN 2016. (VALUES GIVEN IN MILLION t; FAO 2018)

Top fed species	Tonnes	APR - % (2000-2016)	US\$ billion	Top producer
Chinese carp *	15.09	4.7	34.60	China 91.8%
Tilapia	5.90	10.5	11.30	China 31.6%
Shrimp	5.18	9.9	32.01	China 38.8%
Catfishes	5.06	15.2	9.75	Indonesia 25.9%
Marine fish	2.74	6.7	12.28	China 49.3%
Other MFWD fish	2.51	14.6	11.08	China 67.6%
Salmon	2.41	5.5	15.38	Norway 51.1%
FW crustaceans	2.28	11.0	22.53	China 92.3%
Milkfish	1.19	6.0	1.70	Indonesia 62.3%
Trout	0.84	3.2	3.59	Iran 19.3%
Eel	0.29	1.9	2.14	China 85.5%
Total	43.49	7.36	156.36	

* Excludes 13.6 t of predominantly filter feeding/supplementary diet fed species, including silver carp, bighead carp, catla & rohu or 25.2% total fish production in 2016 (FAO 2018)

TABLE 3. REPORTED GLOBAL PRODUCTION OF MAJOR FED AQUACULTURE SPECIES FROM 2000 TO 2016 AND ESTIMATED COMPOUND FEED USAGE FROM 2000 TO 2025 (VALUES GIVEN IN THOUSAND t).

CHINESE FED CARPS: total production was **15,088,952 t** in 2016, with average APR of **4.7 percent/year** since 2000, and a total farm gate value of **US\$ 34.6 billion** in 2016 (FAO 2018). Data excludes predominantly filter feeding species, including silver carp (5,300,736 t), bighead carp (3,526,812 t), catla (2,960,554 t) and rohu (1,843,496 t; these species totaling 13,631,598 t or 25.2 percent of the total fish production of 54,091,148 t in 2016; FAO 2018).

MAJOR SPECIES PRODUCED IN 2016

Grass carp	6,068,015 t (40.2%)
Common carp	4,556,622 t (30.2%)
Carassius spp	3,006,082 t (19.9%)
Wuchang bream	826,178 t (5.5%)
Black carp	632,055 t (4.2%)

MAJOR COUNTRY PRODUCERS IN 2016

China	13,859,935 t (91.8%)
Indonesia	498,297 t (3.3%)
Bangladesh	113,927 t
Viet Nam	107,114 t
Russian Federation	76,452 t

Year	Total production ¹	Growth (%/year) ²	Percent on feeds ³	Species EFCD ⁴	Total feeds used ⁵
2000	7,186	3.9	37	2	5,318
2001	7,732	7.6	38	1.9	5,582
2002	8,107	4.8	42	1.9	6,469
2003	8,470	4.5	43	1.9	6,920
2004	8,198	-3.2	44	1.9	6,853
2005	8,624	5.2	45	1.8	6,985
2006	8,815	2.2	46	1.8	7,299
2007	9,308	5.6	47	1.8	7,875
2008	9,692	4.1	48	1.8	8,374
2009	10,404	7.3	49	1.8	9,176
2010	11,076	6.5	50	1.8	9,968
2011	11,599	4.7	51	1.7	10,056
2012	12,422	7.1	52	1.7	10,981
2013	13,048	5.0	53	1.7	11,756
2014	13,809	5.8	54	1.7	12,677
2015	14,475	4.8	55	1.7	13,534
2016	15,089	4.2	56	1.7	14,365
2020	17,652	4	60	1.6	16,946
2025	20,464	3	65	1.6	21,282

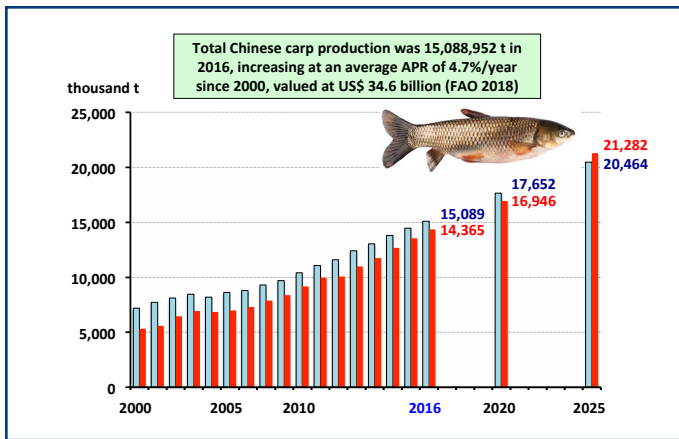


FIGURE 9. Reported global production of Chinese fed carps and estimated feed usage from 2000 to 2025.

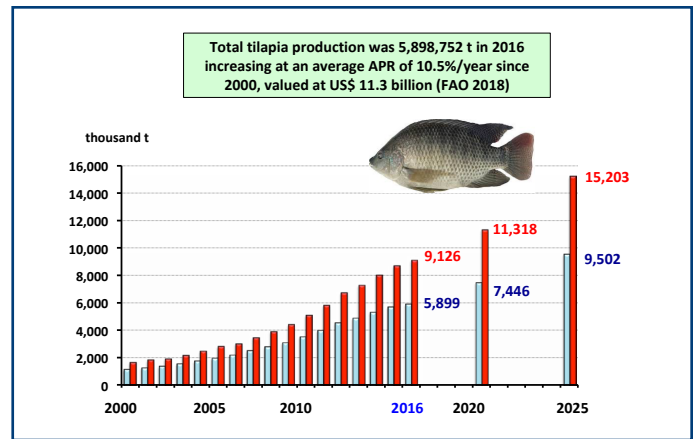


FIGURE 10. Reported global production of tilapia and estimated feed usage from 2000 to 2025.

TABLE 3. CONTINUED

TILAPIA: total production was **5,898,752 tonnes (mt)** in 2016, with average APR of **10.5%/year** since 2000, and a total farm gate value of **US \$ 11.3 billion** in 2016 (FAO, 2018).

MAJOR SPECIES PRODUCED IN 2016

Nile tilapia	4,199,567 mt (71.2%)
Tilapia nilotica	1,177,350 mt (20.0%)
Blue-Nile tilapia hybrid	466,005 mt (7.9%)
Mozambique tilapia	38,553 mt
Tilapia shiranus	4,851 mt
Three spotted tilapia	4,151 mt
Blue tilapia	3,179 mt
Red breast tilapia	3,142 mt
Longfin tilapia	1,100 mt

MAJOR COUNTRY PRODUCERS IN 2016

China	1,866,381 mt (31.6%)
Indonesia	1,187,812 mt (20.1%)
Egypt	940,309 mt (15.9%)
Bangladesh	342,567 mt (5.8%)
Philippines	259,045 mt (4.4%)
Brazil	239,091 mt (4.0%)
Thailand	208,144 mt (3.5%)
Viet Nam	183,817 mt (3.1%)
Uganda	74,654 mt
Taiwan	63,028 mt
Colombia	81,800 mt
Mexico	58,191 mt

Year	Total production ¹	Growth (%/year) ²	Percent on feeds ³	Species EFCR ⁴	Total feeds used ⁵
2000	1,190	14.7	75	1.9	1,696
2001	1,302	9.4	76	1.9	1,880
2002	1,417	8.2	77	1.8	1,953
2003	1,587	12.0	78	1.8	2,215
2004	1,795	13.1	79	1.8	2,530
2005	1,992	11.0	80	1.8	2,852
2006	2,234	12.1	81	1.7	3,056
2007	2,554	14.3	82	1.7	3,493
2008	2,826	10.6	83	1.7	3,948
2009	3,109	10.0	84	1.7	4,440
2010	3,541	13.9	85	1.7	5,117
2011	3,996	12.8	86	1.7	5,842
2012	4,562	14.2	87	1.7	6,747
2013	4,885	7.1	88	1.7	7,308
2014	5,315	8.8	89	1.7	8,042
2015	5,693	7.1	90	1.7	8,710
2016	5,899	3.6	91	1.7	9,126
2020	7,446	6.0	95	1.6	11,318
2025	9,502	5.0	100	1.6	15,203

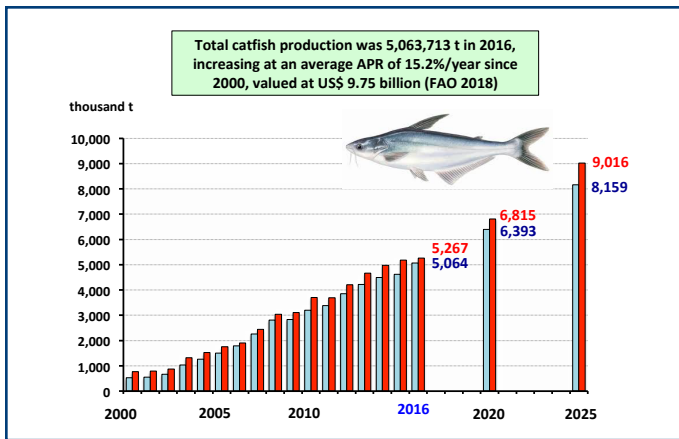


FIGURE 11. Reported global production of catfishes and estimated feed usage from 2000 to 2025.

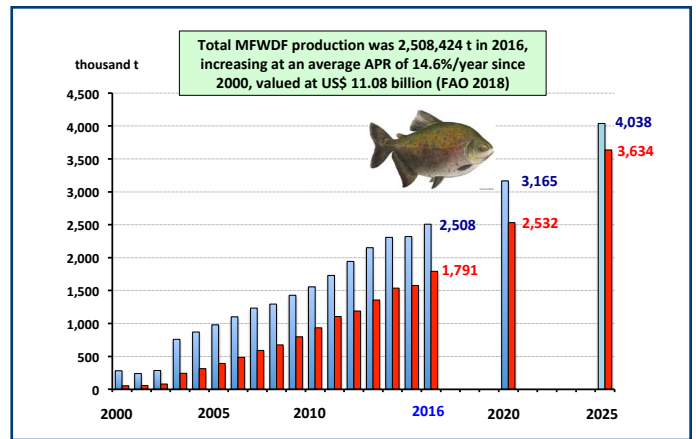


FIGURE 12. Reported global production of other freshwater and diadromous fish and estimated feed usage from 2000 to 2025.

TABLE 3. CONTINUED

CATFISHES (cf): total production was **5,063,713 tonnes (mt)** in 2016, with average APR of **15.2%/year** since 2000, and a total farm gate value of **US \$ 9.75 billion** in 2016 (FAO, 2018)

MAJOR SPECIES PRODUCED IN 2016

Pangas catfishes nei	1,741,057 mt (34.4%)
Torpedo shaped cf nei	978,898 mt (19.3%)
Striped catfish	515,054 mt (10.2%)
Amur catfish	458,356 mt (9.0%)
Channel catfish	432,932 mt (8.5%)
Yellow catfish	417,347 mt (8.2%)
North African catfish	231,091 mt (4.6%)
African-bighead cf hybrid	112,418 mt (2.2%)
Freshwater siluroids nei	105,900 mt (2.1%)
Chinese longsnout cf	24,912 mt (0.5%)

MAJOR COUNTRY PRODUCERS IN 2016

Indonesia	1,310,828 mt (25.9%)
Viet Nam	1,207,654 mt (23.8%)
China	1,181,527 mt (23.3%)
Bangladesh	508,680 mt (10.0%)
Nigeria	194,977 mt (3.8%)
USA	145,230 mt (2.9%)
Thailand	131,634 mt (2.6%)
India	90,000 mt (1.8%)
Cambodia	70,900 mt
Malaysia	55,093 mt

Year	Total production ¹	Growth (%/year) ²	Percent on feeds ³	Species EFCR ⁴	Total feeds used ⁵
2000	529	-2.3	72	1.8	772
2001	559	5.6	73	1.8	794
2002	667	19.3	73	1.7	873
2003	1,034	55.0	74	1.7	1,318
2004	1,269	22.7	74	1.6	1,523
2005	1,500	18.2	75	1.6	1,752
2006	1,792	19.5	75	1.5	1,908
2007	2,265	26.4	76	1.5	2,446
2008	2,816	24.3	76	1.5	3,041
2009	2,838	0.8	77	1.5	3,108
2010	3,204	12.9	77	1.5	3,701
2011	3,379	5.5	78	1.4	3,690
2012	3,859	14.2	78	1.4	4,214
2013	4,215	9.2	79	1.4	4,662
2014	4,499	6.7	79	1.4	4,976
2015	4,623	2.8	80	1.4	5,178
2016	5,064	9.5	80	1.3	5,267
2020	6,393	6.0	82	1.3	6,815
2025	8,159	5.0	85	1.3	9,016

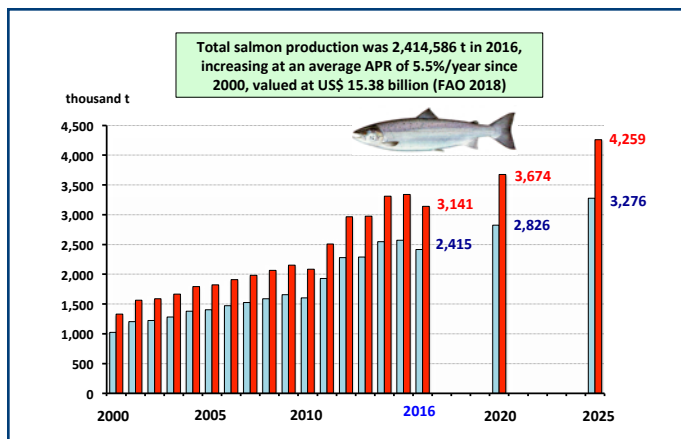


FIGURE 13. Reported global production of salmon and estimated feed usage from 2000 to 2025.

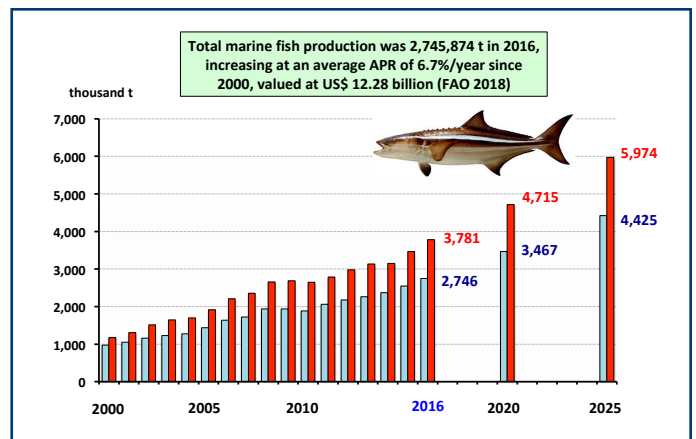


FIGURE 14. Reported global production of marine fishes and estimated feed usage from 2000 to 2025.

TABLE 3. CONTINUED

OTHER miscellaneous freshwater and diadromous fish species: total production was **2,508,424 tonnes (mt)** in 2016, with average APR of **14.6%/year** since 2000, and a total farm gate value of **US \$ 11.08 billion** in 2016 (FAO, 2018)

MAJOR SPECIES PRODUCED IN 2016

Snakehead	518,207 mt (20.7%)
Asian swamp eel	386,179 mt (15.4%)
Largemouth black bass	376,070 mt (15.0%)
Mandarin fish	304,929 mt (12.2%)
Pirapatinga	288,567 mt (11.5%)
Giant gourami	153,306 mt (6.1%)
Cachama	142,135 mt (5.7%)
Climbing perch	59,326 mt (2.4%)
Barramundi	56,933 mt (2.3%)
Indonesian snakehead	41,236 mt (1.6%)
Tambacu hybrid	36,900 mt (1.5%)
Snakeskin gourami	35,711 mt (1.4%)
Striped snakehead	21,721 mt
Pacu	15,847 mt
Nile perch	15,624 mt

MAJOR COUNTRY PRODUCERS IN 2016

China	1,694,674 mt (67.6%)
Indonesia	309,653 mt (12.3%)
Brazil	227,110 mt (9.0%)
Bangladesh	59,730 mt (2.4%)
Nigeria	46,537 mt (1.8%)
Viet Nam	35,200 mt (1.4%)
Cambodia	32,240 mt (1.3%)
Myanmar	28,401 mt (1.2%)
Colombia	25,405 mt (1.0%)

Year	Total production ¹	Growth (%/year) ²	Percent on feeds ³	Species EFCR ⁴	Total feeds used ⁵
2000	282	7.5	10	2	56
2001	240	-14.9	12	2	58
2002	286	19.2	14	2	80
2003	760	166	16	2	243
2004	871	14.6	18	2	314
2005	979	12.4	20	2	392
2006	1,101	12.5	22	2	484
2007	1,234	12.1	24	2	592
2008	1,295	4.9	26	2	673
2009	1,429	10.3	28	2	800
2010	1,556	8.9	30	2	934
2011	1,730	11.2	32	2	1,107
2012	1,943	12.3	34	1.8	1,189
2013	2,151	10.7	35	1.8	1,355
2014	2,308	7.3	37	1.8	1,537
2015	2,320	0.5	40	1.7	1,578
2016	2,508	8.1	42	1.7	1,791
2020	3,165	6.0	50	1.6	2,532
2025	4,038	5.0	60	1.5	3,634

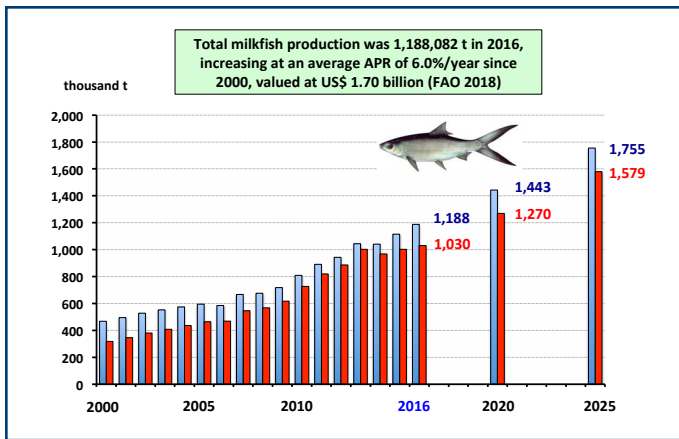


FIGURE 15. Reported global production of milkfish and estimated feed usage from 2000 to 2025.

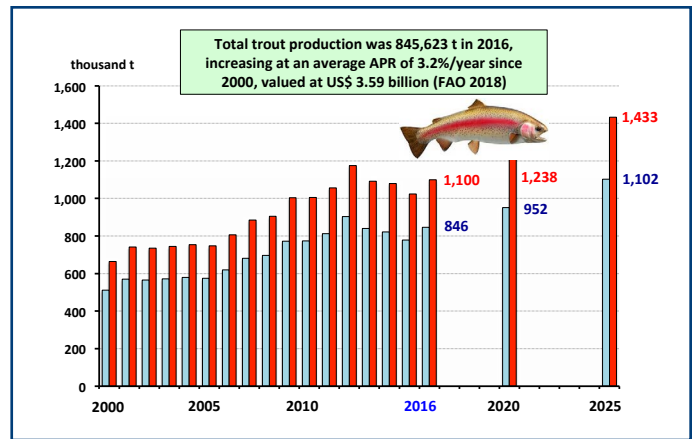


FIGURE 16. Reported global production of trout and estimated feed usage from 2000 to 2025.

TABLE 3. CONTINUED

SALMON: total production was **2,414,586 tonnes (mt)** in 2016, with average APR of **5.5%/year** since 2000, and a total farm gate value of **US \$ 15.38 billion** in 2016 (FAO, 2018)

MAJOR SPECIES PRODUCED IN 2016

Atlantic salmon	2,247,759 mt (93.1%)
Coho salmon	124,188 mt (5.1%)
Salmonids nei	25,706 mt (1.1%)
Chinook salmon	12,943 mt (0.5%)
Salmonoids nei	3,990 mt

MAJOR COUNTRY PRODUCERS IN 2016

Norway	1,233,619 mt (51.1%)
Chile	643,205 mt (26.6%)
UK	163,140 mt (6.8%)
Canada	149,110 mt (6.2%)
Faroe Islands	83,300 mt (3.4%)
Australia	56,115 mt (2.3%)
Ireland	16,300 mt (0.7%)
USA	16,185 mt (0.7%)

Year	Total production ¹	Growth (%/year) ²	Percent on feeds ³	Species EFCR ⁴	Total feeds used ⁵
2000	1,025	12.3	100	1.3	1,332
2001	1,205	17.6	100	1.3	1,566
2002	1,224	1.6	100	1.3	1,591
2003	1,281	4.7	100	1.3	1,665
2004	1,380	7.7	100	1.3	1,794
2005	1,403	1.7	100	1.3	1,824
2006	1,471	4.8	100	1.3	1,912
2007	1,527	3.8	100	1.3	1,985
2008	1,590	4.1	100	1.3	2,067
2009	1,656	4.1	100	1.3	2,153
2010	1,603	-3.3	100	1.3	2,084
2011	1,928	20.3	100	1.3	2,506
2012	2,280	18.3	100	1.3	2,964
2013	2,290	0.4	100	1.3	2,977
2014	2,548	11.3	100	1.3	3,312
2015	2,570	0.9	100	1.3	3,341
2016	2,416	-6.0	100	1.3	3,141
2020	2,826	4.0	100	1.3	3,674
2025	3,276	3.0	100	1.3	4,259

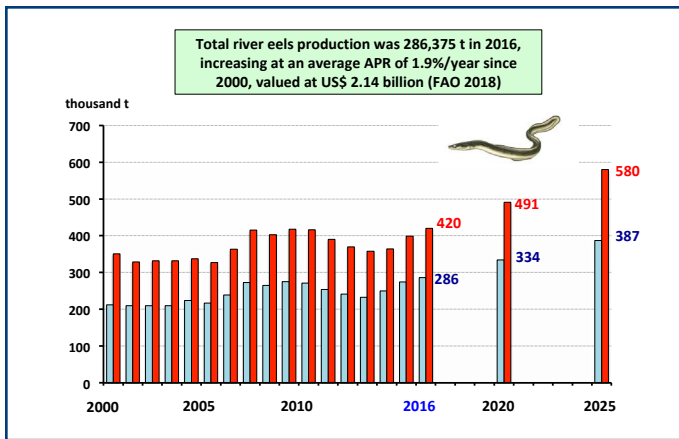


FIGURE 17. Reported global production of river eels and estimated feed usage from 2000 to 2025.

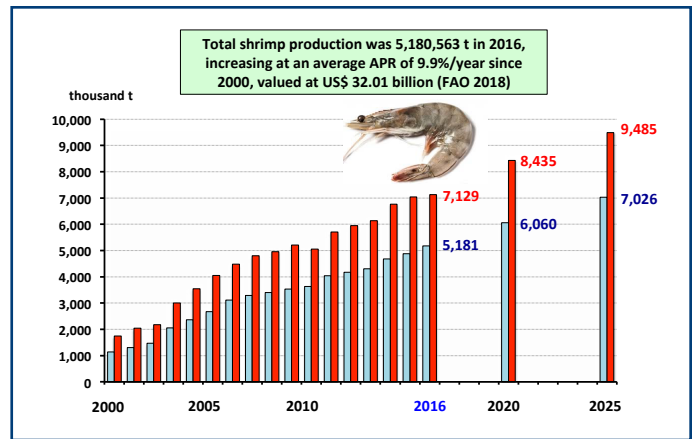


FIGURE 18. Reported global production of shrimp and estimated feed usage from 2000 to 2025.

TABLE 3. CONTINUED

TROUT: total production was **845,623 tonnes** (mt) in 2016, with average APR of **3.2%/year** since 2000, and a total farm gate value of **US \$ 3.59 billion** in 2016 (FAO, 2018)

MAJOR SPECIES PRODUCED IN 2016

Rainbow trout	814,091 mt (96.3%)
Troouts nei	25,415 mt (3.0%)
Sea trout	4,189 mt (0.49%)
Brook trout	1,928 mt

MAJOR COUNTRY PRODUCERS IN 2016

Iran	163,325 mt (19.3%)
Turkey	107,013 mt (12.6%)
Norway	87,852 mt (10.4%)
Chile	84,607 mt (10.0%)
Peru	52,246 mt (6.2%)
China	37,635 mt (4.4%)
Italy	36,800 mt (4.3%)
Denmark	31,295 mt (3.7%)
France	27,100 mt (3.2%)
Russian Federation	25,960 mt (3.1%)
USA	21,977 mt (2.6%)

Year	Total production ¹	Growth (%/year) ²	Percent on feeds ³	Species EFCR ⁴	Total feeds used ⁵
2000	512	7.6	100	1.3	665
2001	570	11.3	100	1.3	741
2002	566	-0.7	100	1.3	736
2003	572	1.1	100	1.3	744
2004	580	1.4	100	1.3	754
2005	575	-0.9	100	1.3	747
2006	620	7.8	100	1.3	806
2007	681	9.8	100	1.3	885
2008	696	2.2	100	1.3	905
2009	772	10.9	100	1.3	1,004
2010	774	0.3	100	1.3	1,006
2011	812	4.9	100	1.3	1,056
2012	904	11.3	100	1.3	1,175
2013	840	-7.1	100	1.3	1,091
2014	822	-2.1	100	1.3	1,080
2015	778	-5.3	100	1.3	1,024
2016	846	8.7	100	1.3	1,100
2020	952	3.0	100	1.3	1,238
2025	1,102	3.0	100	1.3	1,433

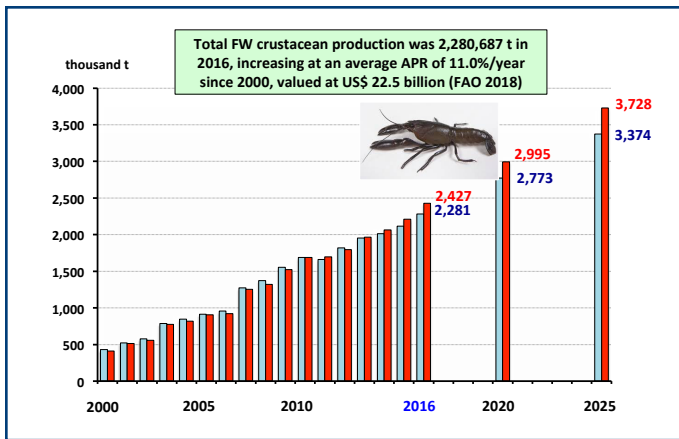


FIGURE 19. Reported global production of freshwater crustaceans and estimated feed usage from 2000 to 2025.

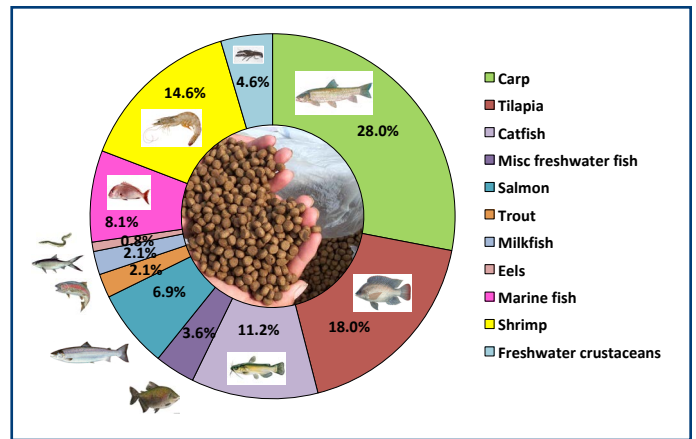


FIGURE 20. Total estimated global compound feed usage by major fed species group was 49.6 million t in 2016.

TABLE 3. CONTINUED

MILKFISH: total production was **1,188,082 tonnes (mt)** in 2016, with average APR of **6.0%/year** since 2000, and a total farm gate value of **US \$ 1.70 billion** in 2016 (FAO, 2018)

MAJOR SPECIES PRODUCED IN 2016

Milkfish 1,188,082 tonnes

MAJOR COUNTRY PRODUCERS IN 2016

Indonesia 740,720 mt (62.3%)
 Philippines 398,088 mt (33.5%)
 Taiwan 44,548 mt (3.7%)
 Singapore 2,210 mt
 Malaysia 2,049 mt

Year	Total production ¹	Growth (%/year) ²	Percent on feeds ³	Species EFCR ⁴	Total feeds used ⁵
2000	468	5.9	34	2	318
2001	495	5.8	35	2	347
2002	528	6.7	36	2	380
2003	552	4.5	37	2	408
2004	574	4.0	38	2	436
2005	595	3.7	39	2	464
2006	585	-1.7	40	2	468
2007	667	14.0	41	2	547
2008	676	1.3	42	2	568
2009	718	6.2	43	2	617
2010	809	12.7	45	2	728
2011	891	10.1	46	2	820
2012	943	5.8	47	2	886
2013	1,044	10.7	48	2	1,002
2014	1,041	-0.3	49	1.9	969
2015	1,115	7.1	50	1.8	1,003
2016	1,188	6.5	51	1.7	1,030
2020	1,443	5.0	55	1.6	1,270
2025	1,755	4.0	60	1.5	1,579

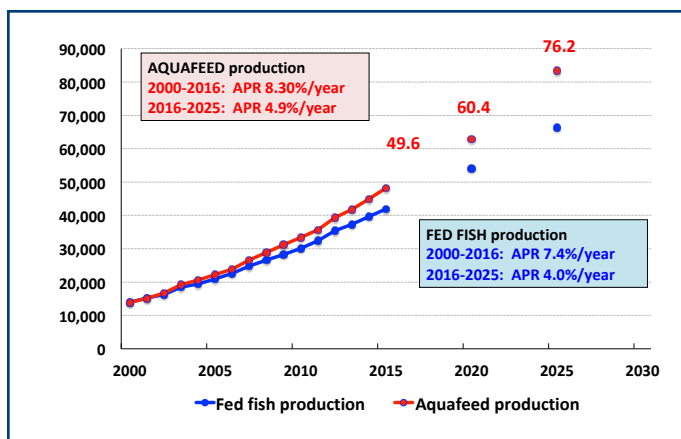


FIGURE 21. Total global farmed fed fish production and estimated feed usage: 2000 to 2025 (million t).

AQUACULTURE, THE FARMING OF AQUATIC PLANTS AND ANIMALS, CONTINUES TO BE THE WORLD'S MOST DIVERSE FOOD PRODUCTION SECTOR, WITH OVER 277 DIFFERENT SPECIES REPORTED IN 2016, INCLUDING 20 SPECIES OF AQUATIC PLANTS, 59 SPECIES OF MOLLUSKS, 27 SPECIES OF CRUSTACEANS AND OVER 171 FISH SPECIES. ACCORDING TO THE LATEST STATISTICAL INFORMATION FROM FAO, TOTAL GLOBAL AQUACULTURE PRODUCTION INCREASED BY 4.5 PERCENT FROM 105.46 MILLION T (LIVE WEIGHT EQUIVALENT) IN 2015 TO A NEW HIGH OF 110.21 MILLION T IN 2016, WITH TOTAL PRODUCTION VALUED AT US\$ 243.26 BILLION.

TABLE 3. CONTINUED

RIVER EELS: total production was **286,375 tonnes** (mt) in 2016, with average APR of **1.9%/year** since 2000, and a total farm gate value of **US \$ 2.14 billion** in 2016 (FAO, 2018)

MAJOR SPECIES PRODUCED IN 2016

Japanese eel	278,177 mt (97.1%)
European eel	6,994 mt (2.4%)
River eels nei	1,204 mt (0.4%)

MAJOR COUNTRY PRODUCERS IN 2016

China	244,777 mt (85.5%)
Japan	18,907 mt (6.6%)
Korea Rep.	9,836 mt (3.4%)
Taiwan	4,657 mt (1.6%)
Netherlands	2,300 mt (0.8%)

Year	Total production ¹	Growth (%/year) ²	Percent on feeds ³	Species EFCR ⁴	Total feeds used ⁵
2000	212	6.7	92	1.8	351
2001	210	-0.9	92	1.7	329
2002	210	-0.2	93	1.7	332
2003	210	0.2	93	1.7	332
2004	224	6.5	94	1.6	337
2005	217	-2.9	94	1.6	327
2006	239	9.9	95	1.6	363
2007	273	14.2	95	1.6	415
2008	265	-2.9	95	1.6	403
2009	275	3.8	95	1.6	418
2010	271	-1.4	96	1.6	416
2011	254	-6.3	96	1.6	390
2012	241	-5.1	96	1.6	370
2013	233	-3.3	96	1.6	358
2014	250	7.3	97	1.5	364
2015	274	9.6	97	1.5	399
2016	286	4.4	98	1.5	420
2020	334	4	98	1.5	491
2025	387	3	100	1.5	580

TABLE 3. CONTINUED

Marine fishes: total production was **2,745,874 tonnes** (mt) in 2016, with average APR of **6.7%/year** since 2000, and a total farm gate value of **US \$ 12.28 billion** in 2016 (FAO, 2018)

MAJOR SPECIES PRODUCED IN 2016

Marine fishes nei	844,305 mt (30.7%)
European seabass	191,003 mt (7.0%)
Gilthead seabream	185,980 mt (6.8%)
Large yellow croaker	165,496 mt (6.0%)
Mulletts nei	163,646 mt (6.0%)
Groupers nei	153,261 mt (5.6%)
Japanese seabass	148,925 mt (5.4%)
Japanese amberjack	140,895 mt (5.1%)
Snubnose pompano	115,331 mt (4.2%)
Porgies/seabreams nei	75,615 mt (2.7%)
Silver seabream	72,286 mt (2.6%)
Red drum	71,293 mt (2.6%)
Lefteye flounder nei	68,509 mt (2.5%)
Turbot	59,616 mt (2.2%)
Bastard halibut	43,929 mt (1.6%)
Cobia	43,107 mt (1.6%)
Tiger pufferfish	26,847 mt
Amberjacks nei	24,121 mt
Pacific bluefin tuna	22,169 mt
Korean rockfish	18,032 mt
Righteye flounders nei	15,117 mt
Flathead grey mullet	13,682 mt
Mangrove red snapper	10,420 mt

MAJOR COUNTRY PRODUCERS IN 2016

China	1,353,059 mt (49.3%)
Japan	234,346 mt (8.5%)
Egypt	221,711 mt (8.1%)
Viet Nam	156,333 mt (5.7%)
Turkey	142,685 mt (5.2%)
Bangladesh	113,239 mt (4.1%)
Greece	97,866 mt (3.6%)
India	90,000 mt (3.3%)
Korea Rep.	79,755 mt (2.9%)
Spain	46,287 mt (1.7%)
Taiwan	38,002 mt (1.4%)
Indonesia	29,831 mt (1.1%)
Malaysia	24,445 mt
Italy	15,499 mt
Tunisia	15,239 mt
Croatia	11,008 mt
Australia	10,913 mt
Iran	10,162 mt
Mexico	9,246 mt

Year	Total production ¹	Growth (%/year) ²	Percent on feeds ³	Species EFCR ⁴	Total feeds used ⁵
2000	977	16.4	60	2	1,172
2001	1,051	7.6	62	2	1,303
2002	1,162	10.5	65	2	1,511
2003	1,227	5.6	67	2	1,644
2004	1,276	4.0	70	1.9	1,697
2005	1,438	12.7	70	1.9	1,912
2006	1,635	13.7	71	1.9	2,206
2007	1,721	5.3	72	1.9	2,354
2008	1,940	12.7	72	1.9	2,654
2009	1,938	-0.1	73	1.9	2,688
2010	1,881	-2.9	74	1.9	2,645
2011	2,062	9.6	75	1.8	2,784
2012	2,177	5.6	76	1.8	2,978
2013	2,259	3.8	77	1.8	3,131
2014	2,373	5.0	78	1.7	3,147
2015	2,547	7.3	80	1.7	3,464
2016	2,746	7.8	81	1.7	3,781
2020	3,467	6.0	85	1.6	4,715
2025	4,425	5.0	90	1.5	5,974

TABLE 3. CONTINUED

MARINE SHRIMP: total production was **5,180,563 tonnes** (mt) in 2016, with average APR of **9.9%/year** since 2000, and a total farm gate value of **US \$ 32.01 billion** in 2016 (FAO, 2018)

MAJOR SPECIES PRODUCED IN 2016			MAJOR COUNTRY PRODUCERS IN 2016		
Whiteleg shrimp	4,155,827 mt	(80.2%)	China	2,011,692 mt	(38.8%)
Giant tiger prawn	701,081 mt	(13.5%)	Indonesia	636,755 mt	(12.3%)
Penaeid shrimp nei	183,454 mt	(3.5%)	Viet Nam	633,427 mt	(12.2%)
Kuruma prawn	57,351 mt	(1.1%)	India	521,269 mt	(10.0%)
Fleshy prawn	39,289 mt		Ecuador	422,000 mt	(8.1%)
Banana prawn	24,681 mt		Thailand	327,561 mt	(6.3%)
Metapenaeid shrimp nei	7,132 mt		Mexico	127,814 mt	(2.5%)
Indian white prawn	5,202 mt		Bangladesh	79,510 mt	(1.5%)
Speckled shrimp	3,806 mt		Philippines	61,682 mt	(1.2%)
Blue shrimp	2,402 mt		Myanmar	54,179 mt	(1.0%)
			Brazil	52,100 mt	(1.0%)

Year	Total production ¹	Growth (%/year) ²	Percent on feeds ³	Species EFCR ⁴	Total feeds used ⁵
2000	1,137	8.6	77	2	1,751
2001	1,311	15.3	78	2	2,045
2002	1,467	11.9	78	1.9	2,174
2003	2,051	39.8	79	1.9	3,006
2004	2,364	15.3	79	1.9	3,548
2005	2,668	12.9	80	1.9	4,055
2006	3,111	16.6	80	1.8	4,480
2007	3,294	5.9	81	1.8	4,803
2008	3,400	3.2	81	1.8	4,957
2009	3,532	3.9	82	1.8	5,213
2010	3,629	2.7	82	1.7	5,059
2011	4,046	11.5	83	1.7	5,709
2012	4,168	3.0	84	1.7	5,952
2013	4,301	3.2	84	1.7	6,141
2014	4,679	8.8	85	1.7	6,761
2015	4,875	4.2	85	1.7	7,044
2016	5,181	6.3	86	1.6	7,129
2020	6,060	4.0	87	1.6	8,435
2025	7,026	3.0	90	1.5	9,485

IN CONTRAST TO TERRESTRIAL AGRICULTURAL FOOD PRODUCTION SYSTEMS WHERE PLANT CEREALS AND OILSEEDS DOMINATE AGRICULTURAL FOOD PRODUCTION, AQUACULTURE IS CURRENTLY DOMINATED BY THE PRODUCTION OF AQUATIC ANIMAL SPECIES; OVER 70 PERCENT OF TOTAL PRODUCTION BEING IN THE FORM OF FISH, MOLLUSKS AND CRUSTACEANS IN 2016, AND ONLY 27.3 PERCENT OF PRODUCTION BEING IN THE FORM OF AQUATIC PLANTS OR SEAWEEDS.

AQUACULTURE CONTINUES TO BE THE WORLD'S FASTEST GROWING AND MOST DIVERSE FOOD PRODUCTION SECTOR, WITH OVER 95.6 PERCENT OF TOTAL AQUACULTURE PRODUCTION BEING REALIZED WITHIN DEVELOPING COUNTRIES AND THE SECTOR GROWING AT AN AVERAGE APR OF 6.64 PERCENT PER YEAR, COMPARED WITH 1.15 PERCENT FOR ECONOMICALLY DEVELOPED COUNTRIES.

TABLE 3. CONTINUED

FRESHWATER CRUSTACEANS: total production was **2,280,687 tonnes** (mt) in 2016, with average APR of **11.0%/year** since 2000, and a total farm gate value of **US \$ 22.53 billion** in 2016 (FAO, 2018)

MAJOR SPECIES PRODUCED IN 2016

Red swamp crawfish	919,887 mt (40.3%)
Chinese mitten crab	812,183 mt (35.6%)
Oriental river prawn	272,592 mt (12.0%)
Giant river prawn	233,898 mt (10.3%)
Freshwater prawns nei	41,423 mt (1.8%)

MAJOR COUNTRY PRODUCERS IN 2016

China	2,104,267 mt (92.3%)
USA	67,659 mt (3.0%)
Bangladesh	53,003 mt (2.3%)
Thailand	14,950 mt
Myanmar	13,545 mt
India	10,162 mt

Year	Total production ¹	Growth (%/year) ²	Percent on feeds ³	Species EFCR ⁴	Total feeds used ⁵
2000	429	57.1	40	2.4	412
2001	521	21.4	41	2.4	513
2002	577	10.7	42	2.3	557
2003	785	36.0	43	2.3	776
2004	846	7.8	44	2.2	819
2005	914	8.0	45	2.2	905
2006	955	4.5	46	2.1	922
2007	1,272	33.2	47	2.1	1,255
2008	1,374	8.0	48	2	1,319
2009	1,555	13.2	49	2	1,524
2010	1,688	8.6	50	2	1,688
2011	1,662	-1.5	51	2	1,695
2012	1,818	9.4	52	1.9	1,796
2013	1,953	7.4	53	1.9	1,967
2014	2,013	3.1	54	1.9	2,065
2015	2,115	5.1	55	1.9	2,210
2016	2,281	7.8	56	1.9	2,427
2020	2,773	5.0	60	1.8	2,995
2025	3,374	4.0	65	1.7	3,728

SUMMARY TOTALS for major fed species and aquafeed production in 2016 and beyond

Year	Total production ¹	Total feeds used ⁵
2000	13,947	13,843
2001	15,196	15,158
2002	16,211	16,656
2003	18,529	19,271
2004	19,377	20,605
2005	20,905	22,215
2006	22,558	23,904
2007	24,796	26,650
2008	26,570	28,909
2009	28,226	31,141
2010	30,032	33,346
2011	32,359	35,655
2012	35,317	39,252
2013	37,219	41,748
2014	39,657	44,930
2015	41,385	47,485
2016	43,504	49,577
2020	52,511	60,429
2025	61,755	76,173

¹ Total reported species group production for 2000 to 2016 are taken from FAO (2018), and estimates for 2020 and 2025 are calculated based on expected growth. ² Mean annual percent growth. ³ Estimated percent of total species-group production fed on commercial aquaculture feeds. ⁴ Estimated average species-group economic feed conversion ratio (total feed fed / total species-group biomass increase). ⁵ Estimated total species-group aquaculture feed used (total species-group production x FCR [feed conversion ratio]).