Aquaculture 2002: Over 50 Million Tonnes & Climbing

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GLOBAL AQUACULTURE AND CAPTURE FISHERIES PRODUCTION

Total reported global aquaculture production reached a new high of 51.4 million tonnes in 2002 (up by 6.1% from the previous year) or over half that of total global capture fisheries landings (94.5 million tonnes; FAO, 2004a). Valued at USD 60 thousand million and based on the production of 250 different plant and animal species in over 180 countries, aquaculture has been the fastest growing segment of global food production for over three decades. Global aquaculture production has been growing at an average compound rate of 8.7% per year since 1970, compared with 2.9% for total terrestrial meat production, and 1.2% for total capture fisheries landings *(Figure 1)*.

Over half of total global aquaculture production in 2002 was in the form of finfish (25.73 million tonnes, valued at USD 31.95 thousand million), followed by molluscs (11.78 million tonnes, USD 10.51 thousand million), aquatic plants (11.59 million tonnes, USD 6.19 thousand million), crustaceans (2.13 million tonnes, USD 10.84 thousand million), amphibians and reptiles (123 473 t, USD 469 million), and miscellaneous aquatic invertebrate animals (31 430 t, USD 26 million; *Figures 2* and *3*).

Compared with capture fisheries, in 2002 aquaculture contributed 24.7% of total reported finfish landings (76.4% freshwater fish: *Figure 4*, 69.0% salmonid fish: *Figure 5*, 1.7% marine fish: *Figure 6*), 24.1% of total reported crustacean landings (30.2% marine shrimp: *Figure 7*), 61.3% of total reported mollusc landings, and 89.6% of total aquatic plants landings (FAO, 2004a).

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REPORTED AQUACULTURE SPECIES

A total of 247 different farmed aquatic animal and plant species were reported in 2002, including 153 different finfish species, 53 mollusc species, 28 crustacean species, nine plant species, and four others (*Figure 8*). This value is almost certainly an underestimate, as 10.96 million tonnes or 21.3% of total global aquaculture production is currently not being reported down to a species level (FAO, 2004a). For example, 8.76 million tonnes or 24% of total aquaculture production in China was not reported down to an individual species level in 2002, with marine finfish production simply being reported as 560 404 t.

Despite the above high diversity of cultured species, the top 10 cultivated finfish species represented 70.9% of total finfish production by weight, the top five crustacean species represented 77.8% of total crustacean production, the top five mollusc species represented 74.5% of total mollusc production, and the top five aquatic plant species represented 62.3% of total aquatic plant production in 2002 (FAO, 2004a).

REPORTED PRODUCTION BY CULTURE ENVIRONMENT

By culture environment, over half (55.3%) of total reported aquaculture production originated from marine or brackishwaters in 2002, the remainder (44.7%) coming from freshwater sources (*Figure 2*). Although production increase by culture environment has remained relatively steady at 8.3% to 9.7% between 1970-2000, brackishwater production decreased by 0.9% from 2001 to 2002, mariculture and freshwater production increased by 6.9% and 6.0% over the same period (*Figure 9*). Moreover, although brackishwater production represented only 4.5% of total global aquaculture production by weight in 2002, it represented 14.3% of total production by value (FAO, 2004a).

Main species groups reared in freshwater were finfish (96.9%), high value crustaceans and finfish in brackishwater (52.3% and 43.2% respectively), and molluscs and aquatic plants in marine waters (44.8% and 44.3% respectively, *Figure 10*).

PRODUCTION BY ECONOMIC COUNTRY GROUPING

Approximately 91.7% and 8.3% of total aquaculture production was produced within developing countries (47.12 million tonnes) and developed countries (4.26 million tonnes) in 2002, with total production valued at USD 49.3 billion and USD 10.6 billion, respectively (FAO, 2004a). Moreover, over the last decade

aquaculture production within developing countries has been growing over seven-fold faster than within developed countries; the latter almost totally due to the rapid reported development and growth of the aquaculture sector in China (*Figure 11*).

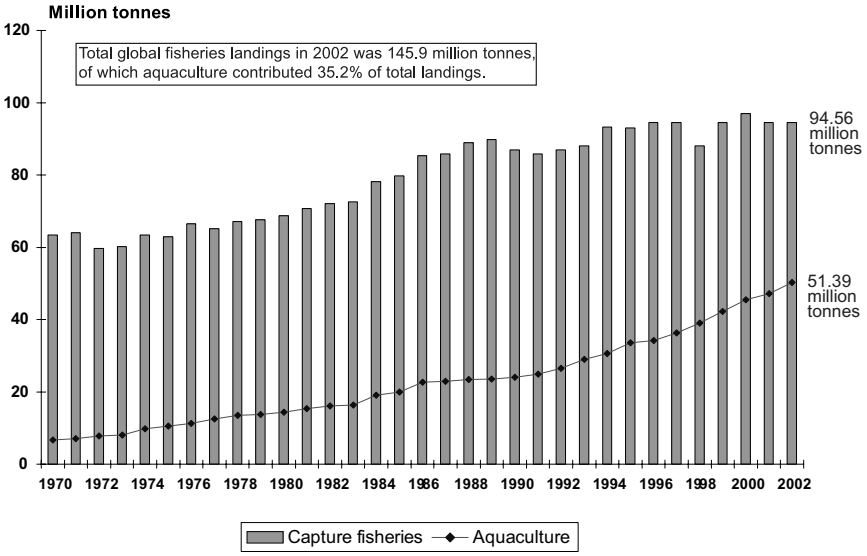
Although aquaculture production within developed countries represented only 8.3% of total aquaculture production by weight in 2002, they represented 17.7% of total production by value; the bulk of finfish production within these countries currently focused on the culture of higher value (in marketing terms) carnivorous finfish species 73.5% of the top 20 total cultivated finfish and crustacean species being carnivorous fish species; (*Figure 12*). By contrast, finfish production within developing countries is still largely concentrated upon the production of lower value (in marketing terms) omnivorous/herbivorous and filter feeding fish for domestic consumption (*Figure 13*). Interestingly, over 99.2% (1.28 million tonnes) of farmed shrimp were produced within developing countries in 2002, the bulk of this being produced as a high value cash crop for export to developed country markets (FAO, 2004a).

PRODUCTION BY GEOGRAPHIC REGION

By region, over 91.2% of total aquaculture production was produced within the Asian region (46.86 million tonnes, *Figure 14*) in 2002, followed by Europe (2.05 million tonnes or 4.0%), Latin America and the Caribbean (1.19 million tonnes or 2.3%), North America (0.67 million tonnes or 1.3%), Africa (0.46 million tonnes or 0.9%) and Oceania (0.15 million tonnes or 0.3%; *Figure 14*) as follows:

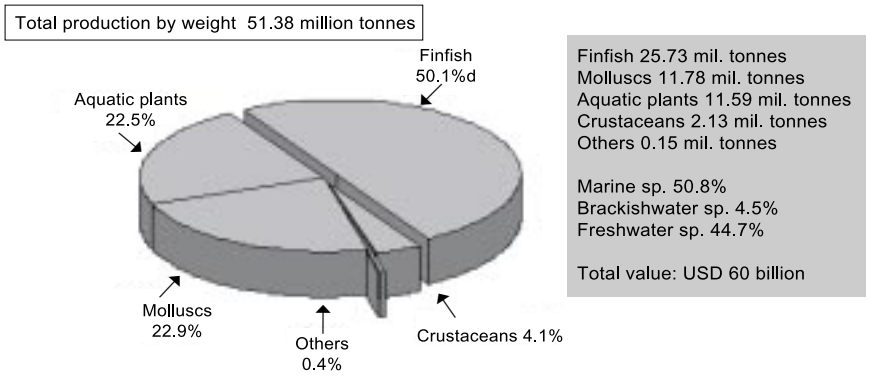
Asian Region

An increase of 16.7-fold in production from 2.8 million tonnes in 1970 to 46.86 million tonnes in 2002, with the sector



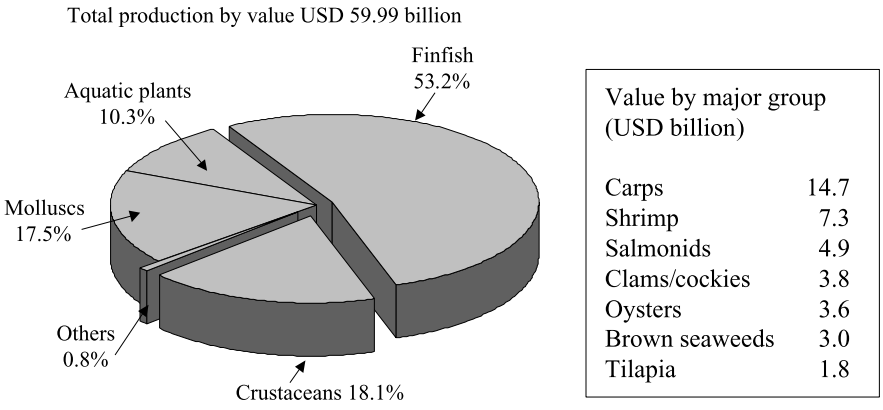
Source: Data compiled from FISHSTAT PLUS (FAO, 2004a)

Figure 1. Total global capture fisheries and aquaculture production.



Source: Data compiled from FISHSTAT PLUS (FAO, 2004a)

Figure 2. Total global aquaculture production in 2002.



Source: Data compiled from FISHSTAT PLUS (FAO, 2004a)

Figure 3. Total world production in 2002 aquaculture.

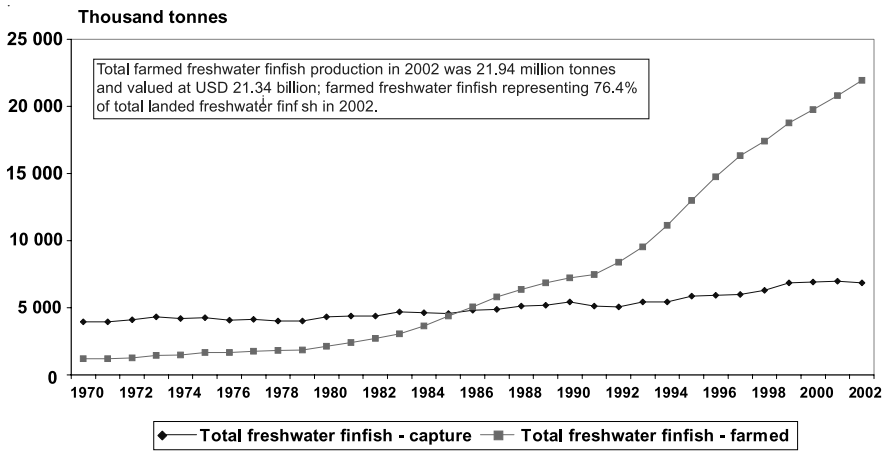
growing at a rate of 8.2% yr^{-1} (period 1970-1980), 8.9% yr^{-1} (period 1980-1990), 11.1% yr^{-1} (period 1990-2000), 9.4% yr^{-1} (period 1970-2000) to 9.2% yr^{-1} (period 1970-2002; *Figure 6*). China is by far the largest aquaculture producer in Asia and the world, producing 71.2% of total global aquaculture production in 2002 (*Figure 2*), with eight of the top 10 aquaculture producing countries being located within the Asian region in 2002 (*Table 1*). By value, aquaculture production within the region has increased over 5.2-fold from USD 9.4 billion in 1984 to USD 49.2 billion in 2002 (or 82.0% total global aquaculture production by value).

European Region

An increase of 4.1 fold in production from 0.50 million tonnes in 1970 to 2.04 million tonnes in 2002 with the sector growing at a rate of 4.3% yr^{-1} (period 1970-1980), 7.8% (period 1980-1990), 2.3% yr^{-1} (period 1990-2000), 4.8% yr^{-1} (period 1970-2000) to 4.5% yr^{-1} (period 1970-2002; *Figure 14*). Norway is currently the leading aquaculture producer in Europe at 553 933 t or 27.1% of total European aquaculture production; *Table 2*). By value, aquaculture production within the region has increased over 3.1-fold from USD 1.42 billion in 1984 to USD 4.49 billion in 2002 (or 7.5% total global aquaculture production by value).

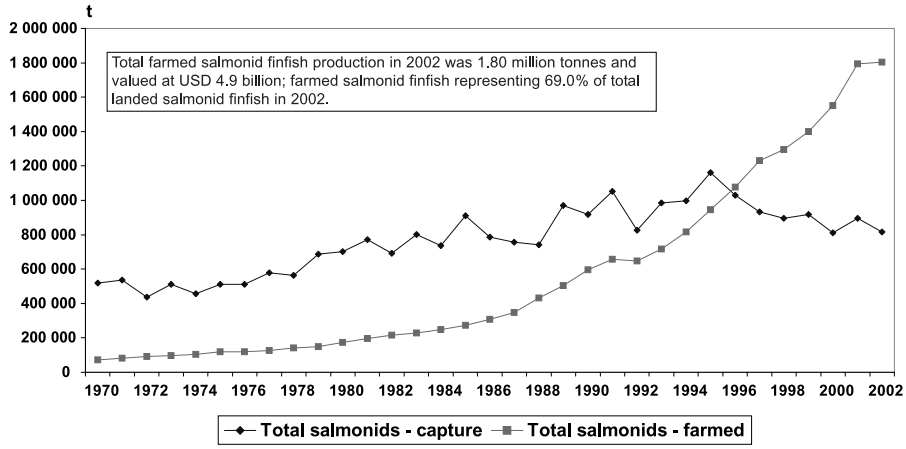
Latin American and Caribbean Region

An inrease of 978-fold in production from 1221 t in 1970 to 1 194 506 t in 2002, with the sector growing at a rate of 34.4% yr^{-1} (period 1970-1980), 23.3% yr^{-1} (period 1980-1990), 14.2% (period 1990-2000), 24.5% yr^{-1} (period 1970-2000) to 24.0% yr^{-1} (period 1970-2002; *Figure 14*). Chile is by far the largest aquaculture producer in the region at 617 303 t or



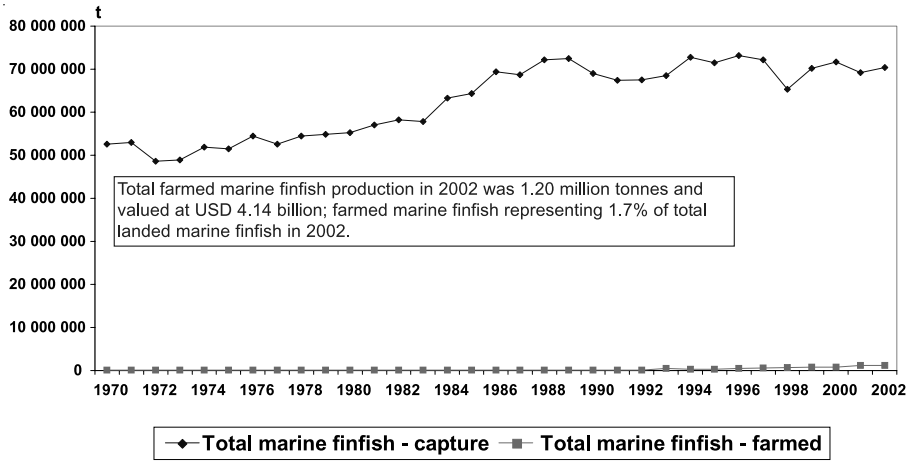
Source: Data compiled from FISHSTAT PLUS (FAO, 2004a)

Figure 4. Total freshwater finfish landings through capture fisheries and aquaculture.



Source: Data compiled from FISHSTAT PLUS (FAO, 2004a)

Figure 5. Total global salmonid finfish landings through capture fisheries and aquaculture.



Source: Data compiled from FISHSTAT PLUS (FAO, 2004a)

Figure 6. Total global marine finfish landings through capture fisheries and aquaculture.

51.7% of production (*Table 3*). By value, aquaculture production within the region has increased over 9.8-fold from USD 337 million in 1984 to USD 3.32 billion in 2002 (or 6.5% total global aquaculture production by value).

North American Region (USA and Canada)

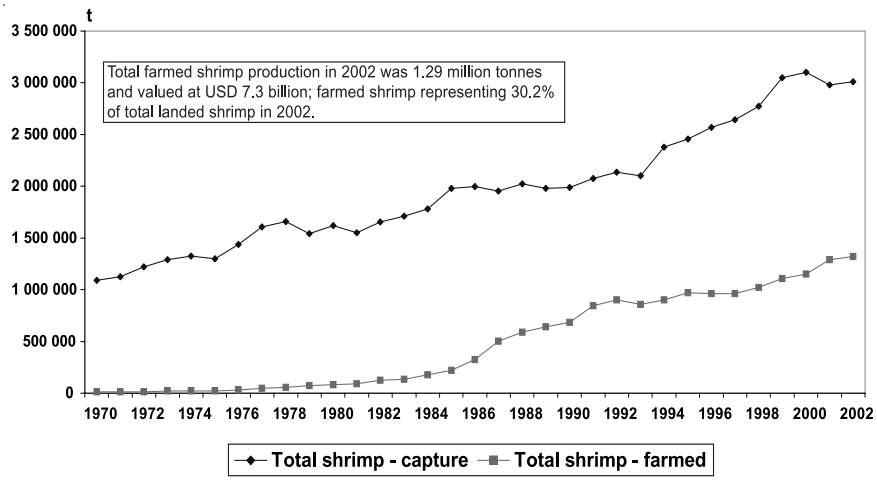
An increase of 3.9-fold from 172 272 t in 1970 to 669 682 t in 2002, with the sector growing at a rate of <0.02% yr^{-1} (period 1970-1980), 7.6% (period 1980-1990), 4.4% yr^{-1} (period 1990-2000), 3.9% yr^{-1} (period 1970-2000) 4.3% yr^{-1} (period 1970-2002; *Figure 14*; *Table 4*). By value, aquaculture production within the region has increased over two-fold from USD 498 million in 1984 to USD 1.72 billion in 2002 (or 1.8% total global aquaculture production by value).

African Region

An increase of 44.7-fold from 10 271 t in 1970 to 457 897 t in 2002, with the sector growing at a rate of 9.8% year (period 1970-1980), 12.1% yr^{-1} (period 1980-1990), 17.1% yr^{-1} (period 1990-2000), 13.0% yr^{-1} (period 1970-2000) to 12.6% yr^{-1} (period 1970-2002; *Figure 14*). Egypt is by far the largest aquaculture producer in the region at 376 296 t or 81.8% of production (*Table 5*). By value, aquaculture production within the region has increased over 29-fold from USD 29 million in 1984 to USD 843 million in 2002 (or 1.4% total global aquaculture production by value).

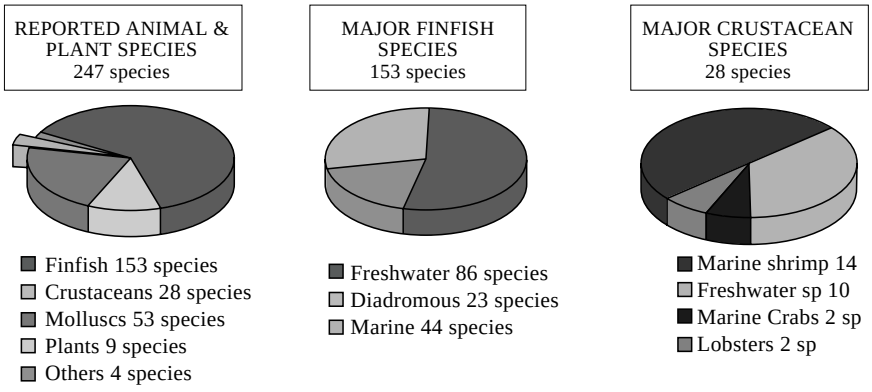
Oceania

An increase of 18.4-fold from 8421 t in 1970 to 154 885 t in 2002, with the sector growing at rate of 3.8% yr^{-1} (period 1970-1980), 14.6% yr^{-1} (period 1980-1990), 11.35% yr^{-1} (period 1990-2000), 9.8% yr^{-1} (period 1970-2000), to 9.5% yr^{-1} (period 1970-2002; *Figure 14*). New Zealand is



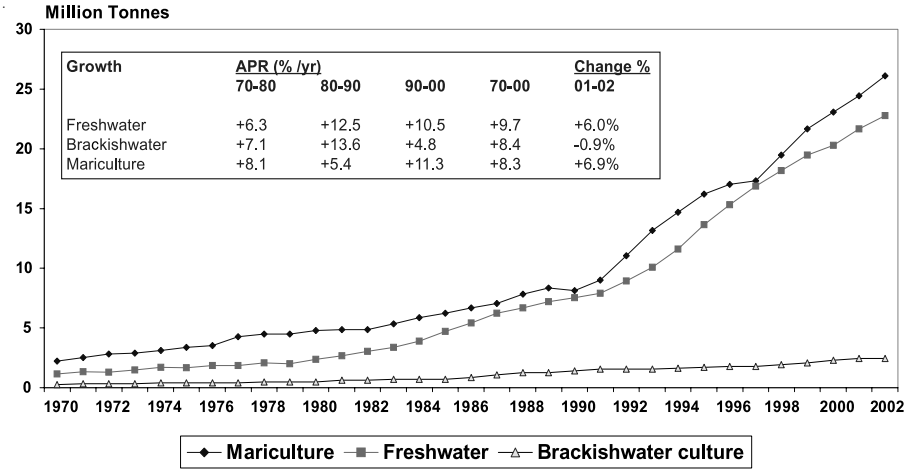
Source: Data compiled from FISHSTAT PLUS (FAO, 2004a)

Figure 7. Total global shrimps landings through capture fisheries and aquaculture.



Source: Data compiled from FISHSTAT PLUS (FAO, 2004a)

Figure 8. Total number of different animal and plant species cultured in 2002.



Source: Data compiled from FISHSTAT PLUS (FAO, 2004a)

Figure 9. Total world aquaculture production by culture environment.

currently the largest producer by weight in the region at 86 583 t (55.9% total production), although Australia is the largest producer by value at USD 256 million (*Table 6*). The total value of aquaculture production within the region has increased over nine-fold from USD 32 million in 1984 to USD 389 million in 2002 (or 0.6% total global aquaculture production by value; FAO, 2004a).

PRODUCTION BY MAJOR FINFISH SPECIES

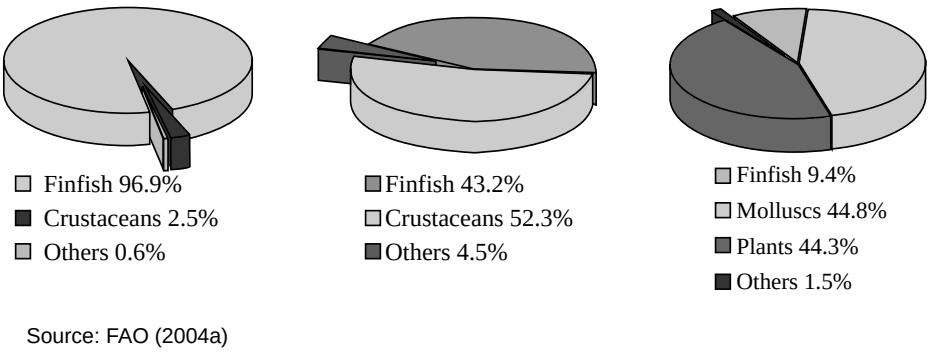
Inland freshwater species continue to dominate global finfish aquaculture production in 2002 (21.9 million tonnes or 85.2% of total finfish production), followed by diadromous species (2.6 million tonnes or 10.1%) and marine species (1.20 million tonnes or 4.7%; *Figure 15*). The observed growth of these different groups has been similar, the average APR (period 1970-2002) ranging from 9.6% for freshwater finfish species, 10.5% for marine finfish species, to 7.4% for diadromous finfish species (FAO, 2004a).

PRODUCTION BY MAJOR CRUSTACEAN SPECIES

Marine shrimp continue to dominate crustacean aquaculture, with 60.7% of total production by weight in 2002, followed by freshwater crustaceans at 27.8% crabs and sea spiders at 9.1%, and miscellaneous marine crustaceans at 2.4% (*Figure 22*).

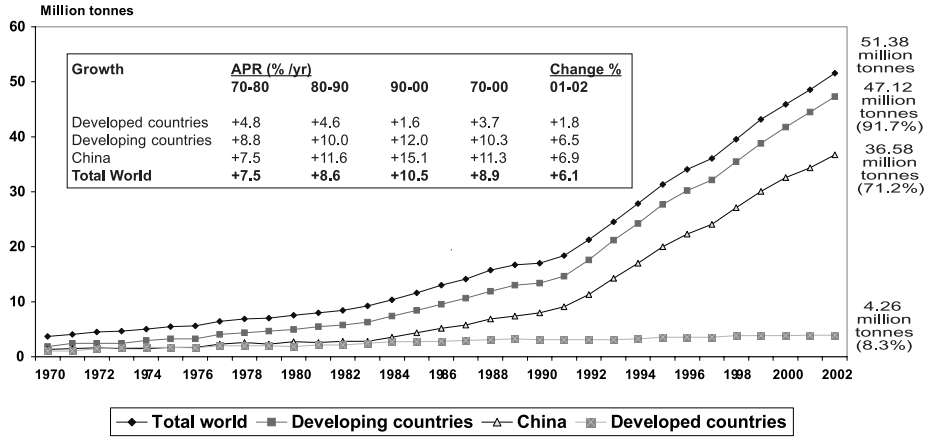
GLOBAL AQUACULTURE PRODUCTION BY FEEDING HABIT

Figure 25 shows global aquaculture production by feeding habit and nutrient supply in 2002. From the data presented, it can be seen that over 88% of global aquaculture production was in the form of photosynthetic plants and filter feeding/omnivorous/ herbivorous fish species feeding low in the aquatic food chain; the figure being above 90% if detritivorous/scavenging crustaceans are also included.



Source: FAO (2004a)

Figure 10. Reported aquaculture species group production by rearing environment in 2002.



Source: Data compiled from FISHSTAT PLUS (FAO, 2004a)

Figure 11. Total aquacultue production by economic country groupings.

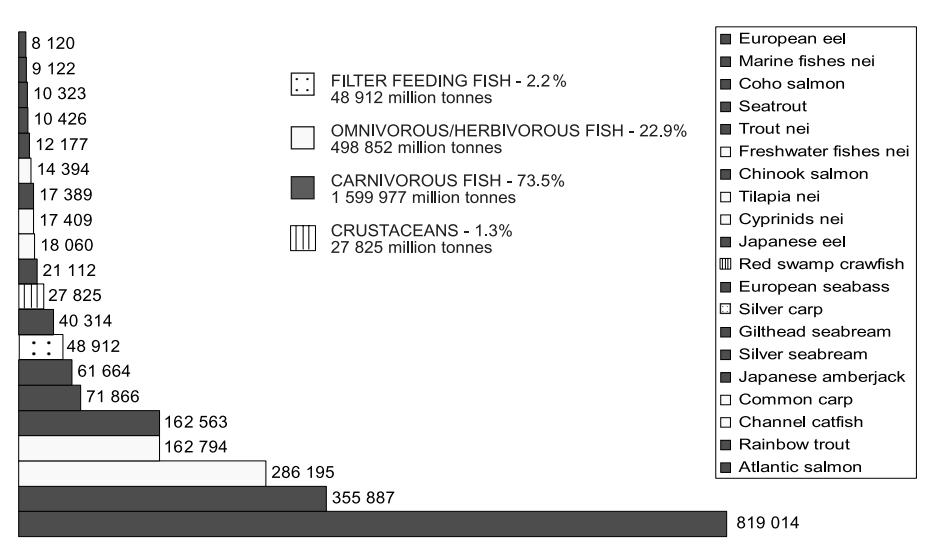


Figure 12. Production pyramid of top 20 farmed finfish and crustaceans within developed countries in 2002.

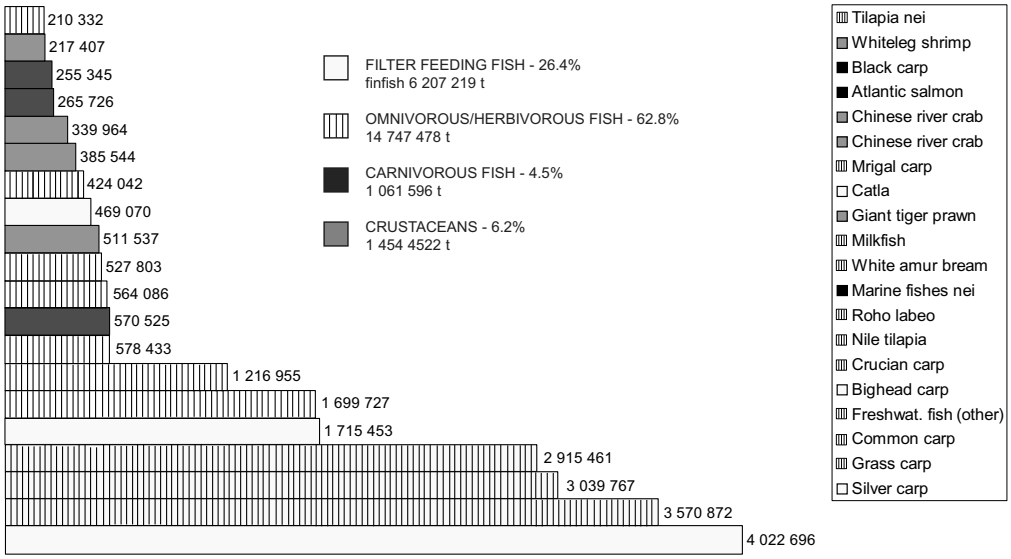
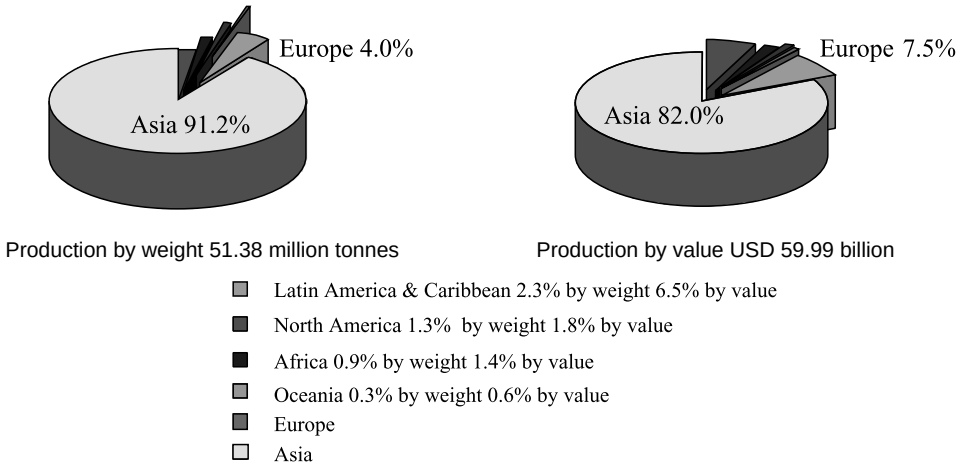
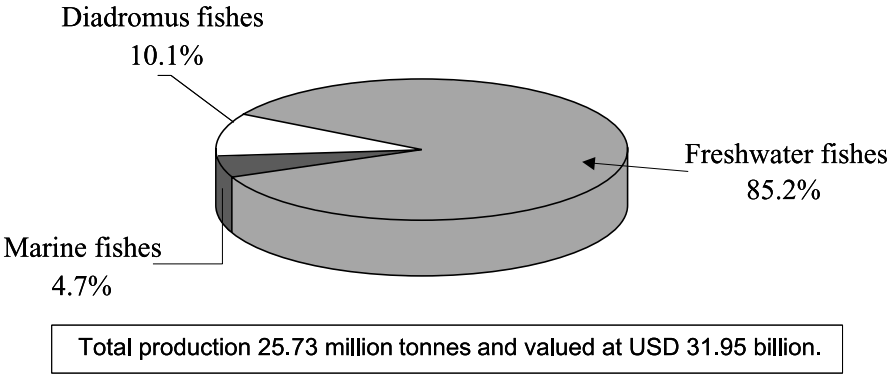


Figure 13. Production pyramid of top 20 farmed finfish and crustacean within developing countries.



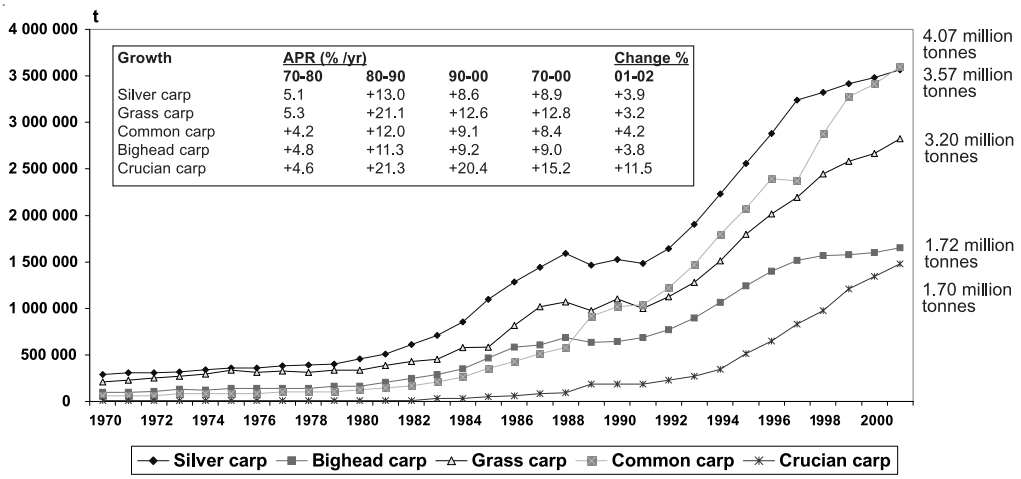
Source: Data compiled from FISHSTAT PLUS (FAO, 2004a).

Figure 14. Total world aquaculture production by region in 2002.



Source: FAO (2004a).

Figure 15. Total finfish aquaculture production by major species group in 2002 (values expresssed as % by weight).



Growth	APR (% /yr)				Change %
	70-80	80-90	90-00	70-00	01-02
Silver carp	5.1	+13.0	+8.6	+8.9	+3.9
Grass carp	5.3	+21.1	+12.6	+12.8	+3.2
Common carp	+4.2	+12.0	+9.1	+8.4	+4.2
Bighead carp	+4.8	+11.3	+9.2	+9.0	+3.8
Crucian carp	+4.6	+21.3	+20.4	+15.2	+11.5

Source: Data compiled from FISHSTAT PLUS (FAO, 2004a)

Figure 16. Cyprinid aquaculture production by major species group.

Freshwater fish species: 21 937 653 t in 2002 (up 5.9% from 2001)

- Cyprinids: 16.69 million tonnes (up 2.5%), valued at USD 14.7 billion (*Figure 16*)

Silver carp	4.07 million tonnes (+3.9%), USD 3.37 billion
Grass carp	3.57 million tonnes (+3.2%), USD 2.92 billion
Common carp	3.20 million tonnes (4.2%), USD 2.94 billion
Bighead carp	1.72 million tonnes (+3.8%),USD 1.48 billion
Crucian carp	1.70 million tonnes (+11.5%), USD 1.20 billion
Roho	578 433 million tonnes (-4.0%), USD 760 million
White amur bream	564 086 t (+4.3%), USD 649 million
Catla	469 070 t (-3.2%), USD 458 million

- Tilapia: 1.50 million tonnes (up 7.2%), valued at USD 1.8 billion (*Figure 17*)

Nile tilapia	1.22 million tonnes (+8.0%), USD 1.33 billion
Tilapia nei	227 741 t (+7.2%), USD 0.43 billion
Mozambique tilapia	54 146 t (-8.6%)

- Catfish: 515 098 t (up 18.6%), valued at USD 715 million (*Figure 18*)

Channel catfish	286 915 t (+5.8%), USD 359 million
Torpedo shaped catfish nei	103 419 t (-84.5%), USD 111 million
Catfish, hybrid	86 011 t (+83%), USD 135 million

- Mandarin fish: 130 016 t (up 11.7%), valued at USD 1.06 billion (FAO, 2004a)

Diadromous fish species: 2 589 898 t in 2002 (up 1.4% from 2001)

- Salmonids: 180 million tonnes (up 0.5%), valued at USD 4.9 billion (*Figure 19*)

Atlantic salmon	1.08 million tonnes (+5.0%), USD 2.9 billion
Rainbow trout	508 662 t (-1.4%), USD 1.4 billion
Coho salmon	112 845 t (-25.3%), USD 267 million

- Milkfish: 527 803 t (up 6.6%), valued at USD 483 million (*Figure 20*)
- Eels: 231 632 t (up 0.3%), valued at USD 928 million (*Figure 20*)

Japanese eel	222 445 T (+2.0%), USD 872 million
European eel	8 209 t (-20.1%), USD 55

- Barramundi: 21 967 t (down 17.1%), valued at USD 65 million (*Figure 20*)

Marine fish species: 1 201 060 t in 2002 (up 10.6%), valued USD 4.1 billion (*Figure 21*)

• Marine fishes nei	579 647 t (+13.3), USD 441 million
• Japanese amberjack	162 718 t (+6.2), USD 1.38 billion
• Flathead grey mullet	121 365 t (-14.5), USD 290 million
• Gilthead sea bream	77 081 t (+24.0%), USD 308 million
• Silver seabream	73 402 (+0.7%), USD 443 million
• European seabass	42 949 t (-3.9%), USD 210 million
• Astard halibut	33 161 t (+43.8%), USD 343 million

Marine shrimp: 1 292 476 t (up 0.9% from 2001) valued USD 7.3 billion (*Figure 22*)

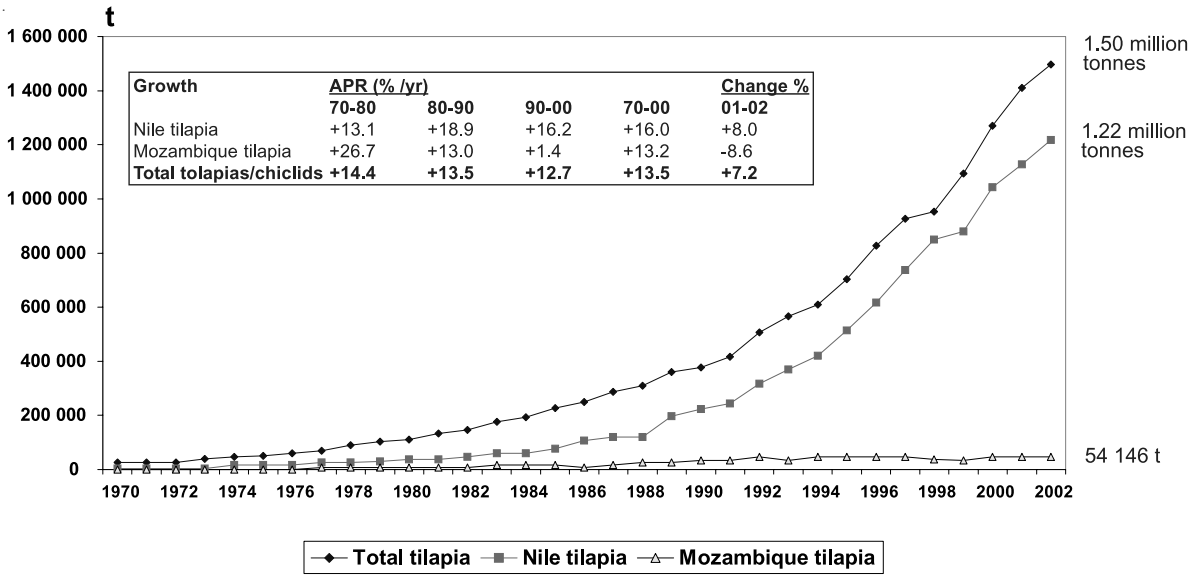
• Giant tiger prawn	514 887 t (-16.3%), USD 3.18 billion
• Fleshy prawn	385 544 t (+25.9), USD 2.32 billion
• Whiteleg shrimp	221 433 t (+13.6%), USD 1.14 billion
• Penaeid shrimp nei	85 054 t (-6.5), USD 359 million
• Banana prawn	42 940 t (-4.2%), USD 165 million

Freshwater crustaceans: 591 983 t (up 15.0%), valued USD 2.58 billion (*Figure 23*)

• Chinese river crab	339 964 t (+18.85), USD 1.70 billion
• Giant river prawn	195 754 t (+5.1%), USD 617 million
• Red swamp crawfish	27 825 (100.0%), USD 50 million

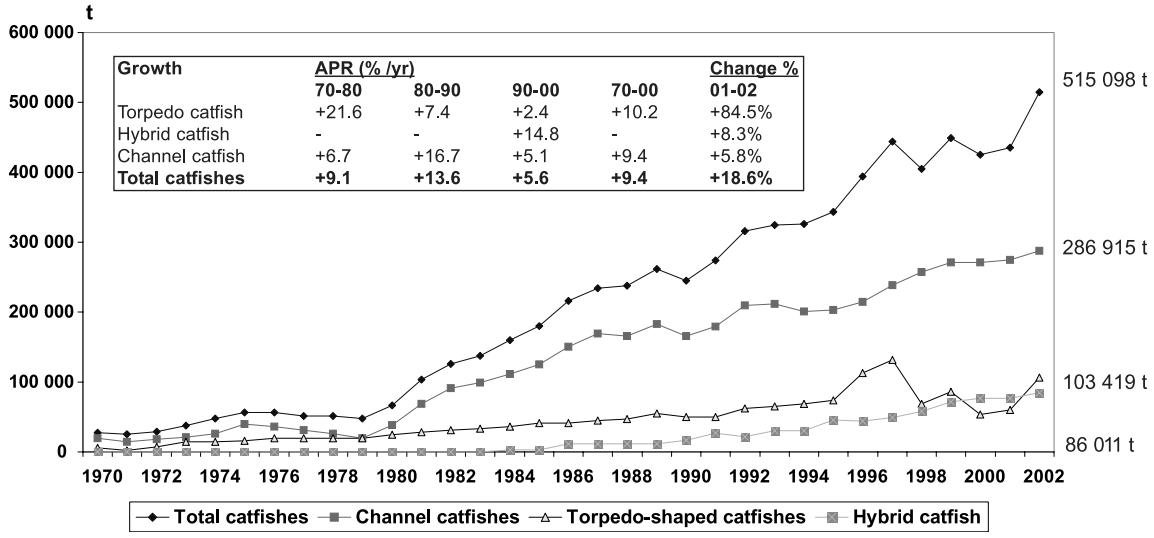
Marine crabs and sea spiders: 194 131 t (up 18.2%), valued USD 745 million

• Marine crabs nei	178 279 t (+16.5%), USD 713 million



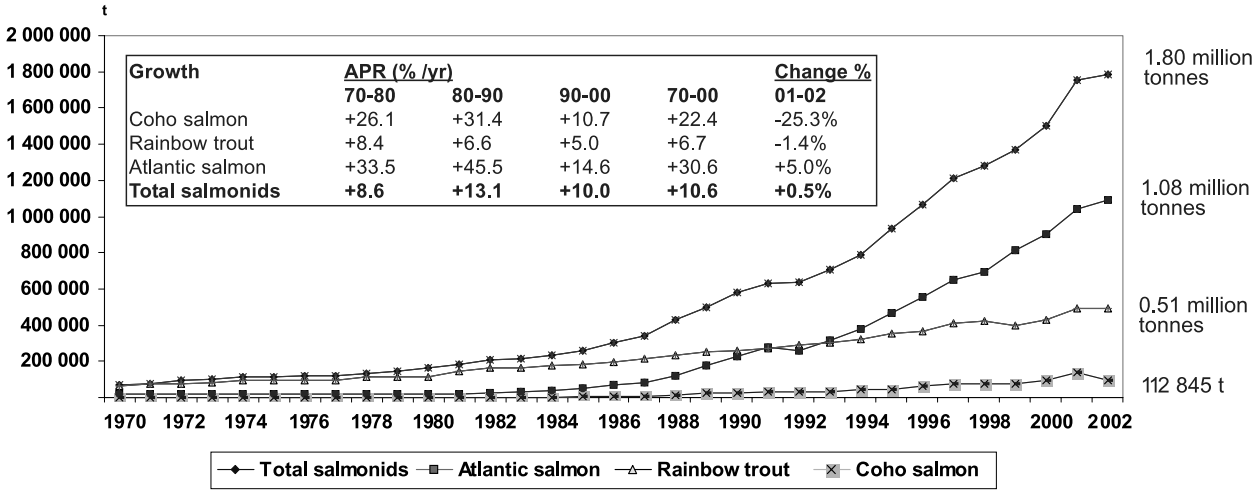
Growth	APR (% /yr)				Change %
	70-80	80-90	90-00	70-00	01-02
Nile tilapia	+13.1	+18.9	+16.2	+16.0	+8.0
Mozambique tilapia	+26.7	+13.0	+1.4	+13.2	-8.6
Total tolapias/chiclids	**+14.4**	**+13.5**	**+12.7**	**+13.5**	**+7.2**

Figure 17. Tilapia aquaculture production by major species group.



Growth	APR (% /yr)				Change %
	70-80	80-90	90-00	70-00	01-02
Torpedo catfish	+21.6	+7.4	+2.4	+10.2	+84.5%
Hybrid catfish	-	-	+14.8	-	+8.3%
Channel catfish	+6.7	+16.7	+5.1	+9.4	+5.8%
Total catfishes	**+9.1**	**+13.6**	**+5.6**	**+9.4**	**+18.6%**

Figure 18. Catfish aquaculture production by major species group.



Growth	APR (% /yr)				Change %
	70-80	80-90	90-00	70-00	01-02
Coho salmon	+26.1	+31.4	+10.7	+22.4	-25.3%
Rainbow trout	+8.4	+6.6	+5.0	+6.7	-1.4%
Atlantic salmon	+33.5	+45.5	+14.6	+30.6	+5.0%
Total salmonids	**+8.6**	**+13.1**	**+10.0**	**+10.6**	**+0.5%**

Figure 19. Salmonid aquaculture production by major species group.

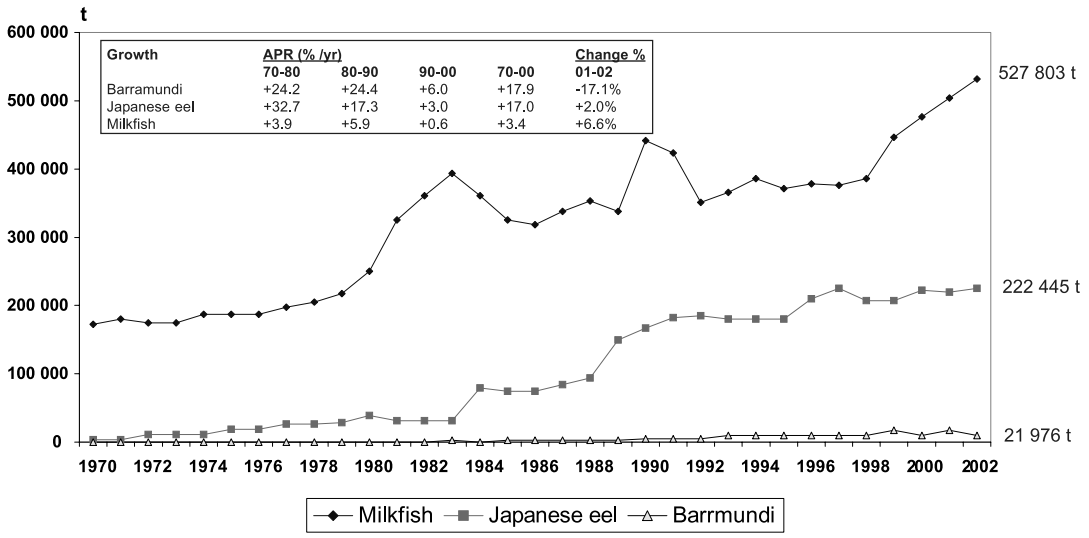


Figure 20. Non-salmonid diadromous fish production by major species group.

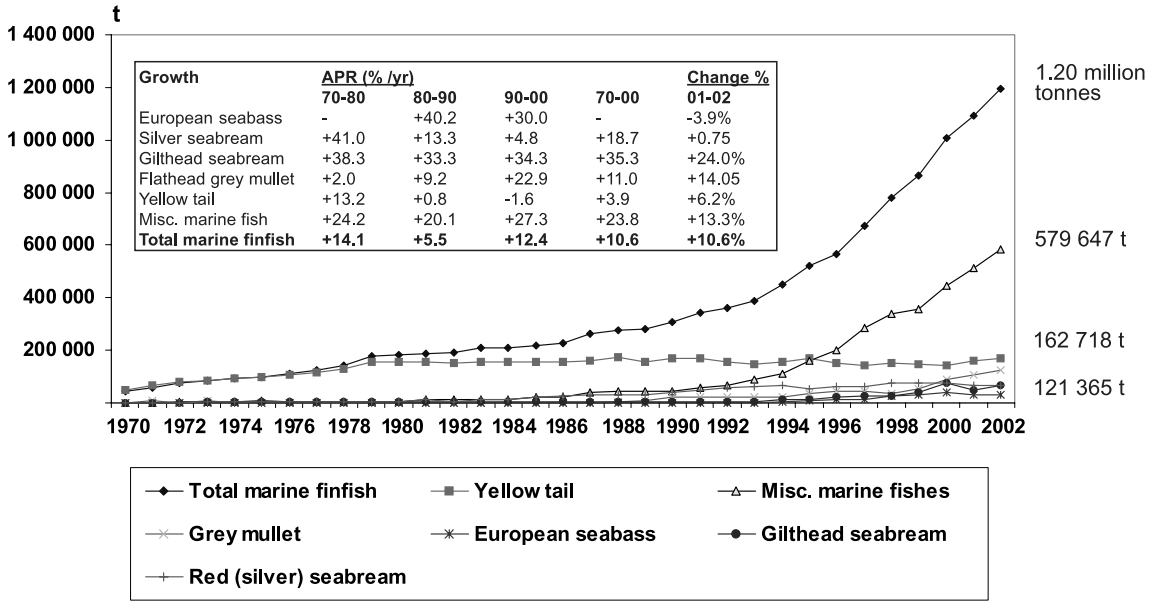
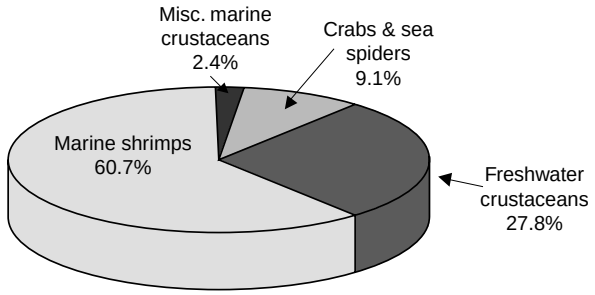
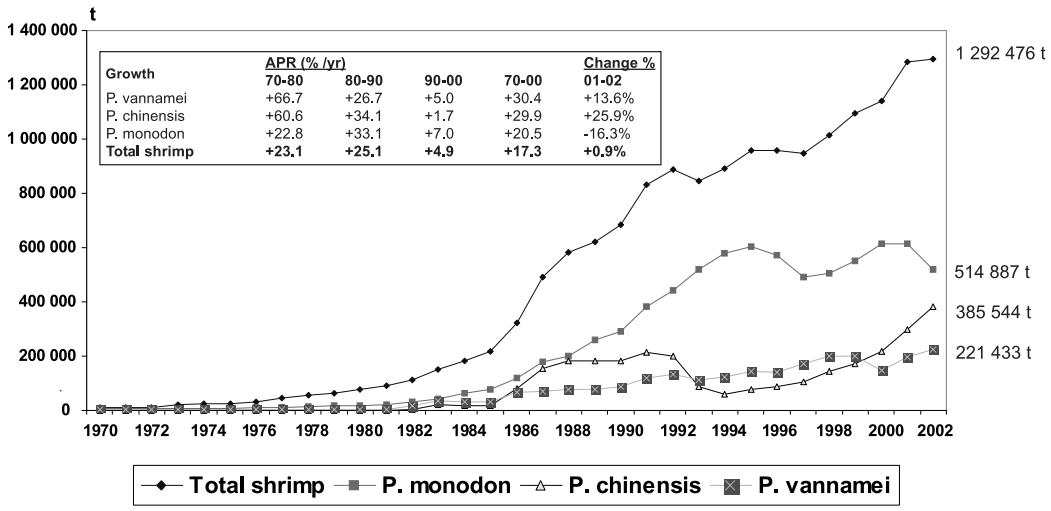


Figure 21. Marine fish production by major species group.



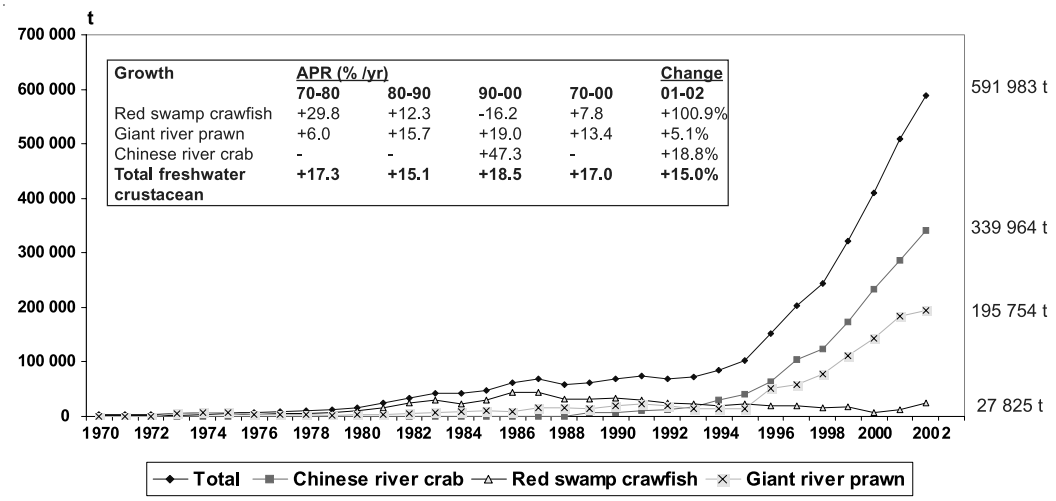
Total production 2.12 million tonnes and valued at USD 10.84 billion

Figure 22. Total crustaceans production by major species group in 2002 (values expresssed as % by weight).



Growth	APR (% /yr) 70-80	80-90	90-00	70-00	Change % 01-02
P. vannamei	+66.7	+26.7	+5.0	+30.4	+13.6%
P. chinensis	+60.6	+34.1	+1.7	+29.9	+25.9%
P. monodon	+22.8	+33.1	+7.0	+20.5	-16.3%
Total shrimp	**+23.1**	**+25.1**	**+4.9**	**+17.3**	**+0.9%**

Figure 23. Marine shrimp production by major species group.



Growth	APR (% /yr) 70-80	80-90	90-00	70-00	Change 01-02
Red swamp crawfish	+29.8	+12.3	-16.2	+7.8	+100.9%
Giant river prawn	+6.0	+15.7	+19.0	+13.4	+5.1%
Chinese river crab	-	-	+47.3	-	+18.8%
Total freshwater crustacean	**+17.3**	**+15.1**	**+18.5**	**+17.0**	**+15.0%**

Figure 24. Freshwater crustacean production by major species group.

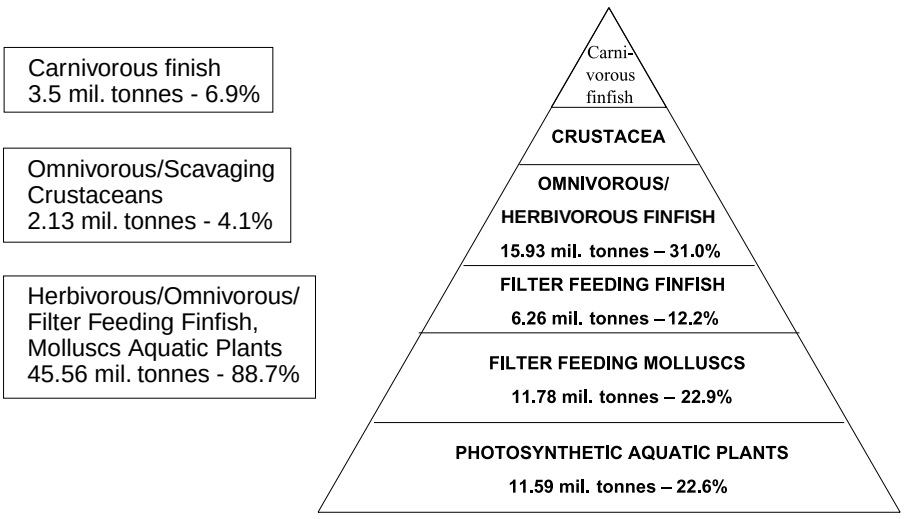
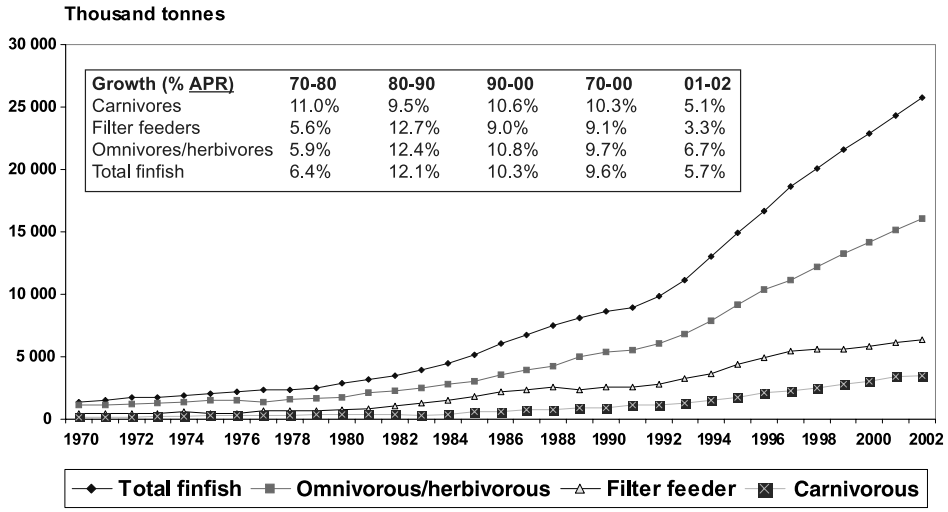
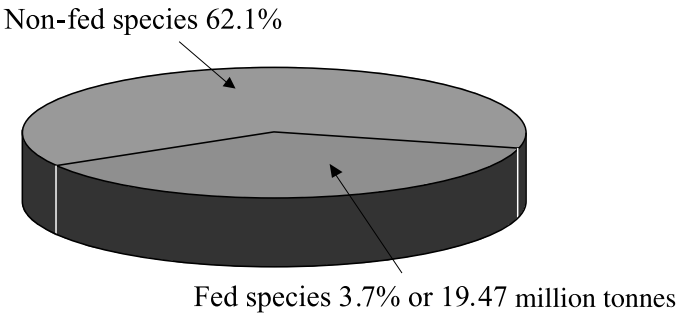


Figure 25. Global aquaculture production pyramid by feeding habit and nutrient supply in 2002.



Growth (% APR)	70-80	80-90	90-00	70-00	01-02
Carnivores	11.0%	9.5%	10.6%	10.3%	5.1%
Filter feeders	5.6%	12.7%	9.0%	9.1%	3.3%
Omnivores/herbivores	5.9%	12.4%	10.8%	9.7%	6.7%
Total finfish	6.4%	12.1%	10.3%	9.6%	5.7%

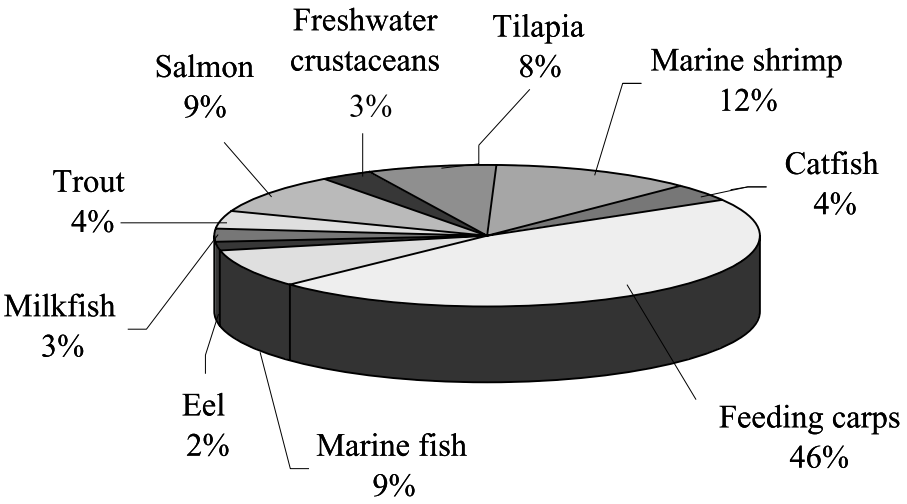
Figure 26. Production of finfish by feeding habit: 1970-2002 (values expressed in thousand tonnes, live weight equivalents).



Total aquaculture production by weight - 51.38 mil. tonnes

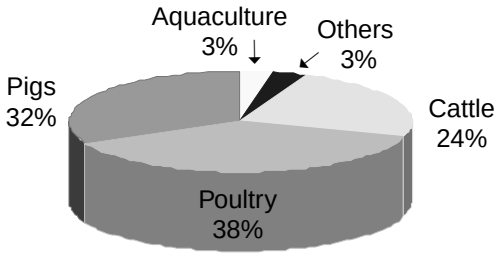
Source: Data compiled from FISHSTAT PLUS (FAO, 2004a).

Figure 27. Total global aquaculture production.



Total estimated compound aquafeed production in 2002 – 17.84 mil. tonnes.

Figure 28. Estimated global compound aquafeed production in 2002 for major farmed species (valued expressed as % total aquafeed production, dry as-fed baasis).



Total estimated industrial animal feed production in 2003 – 612 million tonnes.

Source: Gill (2004).

Figure 29. Estimated global industrial feed production in 2003 for major farmed animal species (valued expressesd as % dry as-fed basis).

TABLE 1. TOP TEN AQUACULTURE PRODUCERS IN ASIA 2002

Global ranking	Production (mil. tonnes)	Change (01-02, %)	Value (USD billion)
01. China	36.58	+6.9%	32.8
02. India	2.19	+3.4%	2.5
03. Japan	1.39	+5.5%	4.6
04. Philippines	1.34	+9.6%	0.69
05. Indonesia	1.14	+5.6%	1.4
06. Korea Rep.	0.79	+18.9%	0.78
07. Bangladesh	0.79	+10.4%	1.1
08. Thailand	0.64	–10.9%	1.4
11. Vietnam	0.53	0	1.1
12. Korea DPR	0.51	0	0.3

TABLE 2. TOP TEN AQUACULTURE PRODUCERS IN EUROPE IN 2002

Global ranking	Production (million tonnes)	Change (C1-02, %)	Value (USD billion)
10. Norway	553 933	+8.4%	1.155
16. Spain	263 762	-15.6%	0.354
17. France	249 734	-0.8%	0.472
20. Italy	183 962	-15.7%	0.337
21. UK	179 036	+5.0%	0.545
24. Russian Fed.	101 483	+12.2%	0.267
25. Greece	87 928	-9.8%	0.244
31. Ireland	62 568	+2.7%	0.113
32. Turkey	61 165	-9.0%	0.130
34. Netherlands	54 442	-4.6%	0.091

TABLE 3. TOP TEN AQUACULTURE PRODUCERS IN LATIN AMERICA AND THE CARIBBEAN IN 2002

Global ranking	Production (million tonnes)	Change (C1-02, %)	Value (USD billion)
09. Chile	617 303	-2.3%	1.681
18. Brazil	246 183	+18.5%	0.909
28. Mexico	73 675	+4.5%	0.352
30. Colombia	65 000	0	0.269
42. Cuba	25 733	+6.8%	0.028
46. Venezuela	18 020	+8.2%	0.055
47. Costa Rica	17 892	+70.1%	0.066
49. Hondures	15 431	+20.7%	0.080
56. Peru	8 440	-10.4%	0.047

TABLE 4. TOP AQUACULTURE PRODUCERS IN NORTH AMERICA IN 2002

Global ranking	Production (mil. tonnes)	Change (01-02, %)	Value (USD million)
13. USA	497 346	+3.8%	0.715
22. Canada	172 336	+12.5%	0.397

TABLE 5. TOP TEN AQUACULTURE PRODUCERS IN AFRICA IN 2002

Global ranking	Production (mil. tonnes)	Change (01-02, %)	Value (USD million)
14. Egypt	376 296	+9.7%	655
40. Nigeria	30 663	-0.7%	74.3
61. Madagascar	7 966	+2.8%	31.4
62. Tanzania	7 630	+4.5%	2.1
67. Ghana	6 000	0	11.4
72. Uganda	4 915	+108.3%	4.9
75. South Africa	4 329	0	12.0
78. Zambia	4 200	0	6.9
81. Congo, DR	2 965	+8.0%	7.4
85. Zimbabwe	2 213	-3.1%	4.6

TABLE 6. TOP TEN AQUACULTURE PRODUCERS IN OCEANIA IN 2002

Global ranking	Production (mil. tonnes)	Change (01-02, %)	Value (USD million)
26. New Zealand	86 583	+13.9%	108
37. Australia	38 840	+9.7%	256
51. Kiribati	12 614	+9.2%	6.3
52. Tonga	12 614	+9/2%	0.7

Figure 26 shows global finfish production according to feeding habit, with carnivorous and omnivorous/herbivorous finfish species exhibiting similar growth rates. Of particular note, is the recent decline in the growth of filter feeding species, including silver carp, big head carp and catla.

Figure 27 shows the proportion of total global aquaculture production currently dependent upon the supply and use of compound aquafeeds (19.47 million tonnes or 37.9% of global aquaculture production), including all non-filter feeding cyprinids, tilapia, miscellaneous freshwater fish species, diadromous fish species, marine fish species, and farmed crustacean species.

GLOBAL ESTIMATED COMPOUND AQUAFEED PRODUCTION

Estimated total use of compound aquafeeds in 2002 was approximately 17.84 million tonnes (*Figure 28*), the largest consumers including carps (8.345 million tonnes or 46.8%; based on production of 10.431 t, 40% on feeds, and an FCR of 2), followed by marine shrimp (2.086 million tonnes or 11.7%; based on production of 1.292 t, 85% on feeds, and an FCR of 1.9), salmon (1.582 million tonnes or 8.9%; based on production of 1.217 million tonnes, 100% on feeds, and an FCR of 1.3), marine fish (1.561 million tonnes or 8.7%; based on production of 1.201 million tonnes, 65% on feeds, and an FCR of 2), tilapia (1.350 million tonnes or 7.6%; based on production of 1.50 million tonnes, 45% on feeds, and an FCR of 2), trout (0.737 million tonnes or 4.1%; based on production of 0.567 million tonnes, 100% on feeds, and an FCR or 1.3), catfish (0.717 million tonnes or 4.0%; based on production of 0.515 million tonnes, 87% on feeds, and on FCR of 1.6), freshwater crustaceans (0.611 million tonnes or 3.4%; based on production of 0.592 million tonnes, 43% on feeds, and an FCR of 2.4), milkfish (0.475 million tonnes or 2.7%; based on production of 0.528 million tonnes, 45% on feeds, and an FCR of 2) and eel (0.380 million tonnes or 2.1%; based on production of 0.232 million tonnes, 82% on feeds, and FCR of 2).

The above figure compares favourably with the total estimated aquafeed production of 18.36 million tonnes estimated by Gill (2004) for 2003 (*i.e.* 3% of 612 million tonnes *Figure 29*).

ACKNOWLEDGEMENT

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