Production trends in fisheries and aquaculture

1.1 Capture fisheries production in the Asia-Pacific region

The Asia-Pacific region produced 44.7 million tonnes of total capture fisheries production in 2002. The region has been the world's largest producer of fish for decades constituting 48.0 percent of global production in 2002. In inland waters, the regional share has further increased to 64.7 percent. Of the top 10 producers of capture fish in the world, five States came from the Asia-Pacific area, namely China PR (1st), Indonesia (4th), Japan (5th), India (7th) and Thailand (9th). Total capture fisheries production has steadily increased since 1950, mainly from marine capture fisheries sector (**Figure 1**).

China PR remains by far the largest producer in the region with a reported production of 17.4 million tonnes in 2002, representing 39 percent of regional production. Chinese production is nearly four times greater than the production of Indonesia, which is the second largest producer in the region. Because of its enormous scale of production and remarkably high growth rate, China[1] is treated as a sub-region and discussed separately in this review.

Total capture fishery production from marine waters for all the sub-regions, except China, peaked in 1989 at 24.7 million tonnes and has gradually declined to 24.0 million tonnes in 2002. The sub-region, other Asia, was once the top contributor in the area, but has experienced a serious and continuous decline in production since 1988. In contrast, SE Asia has constantly increased its production and maintained the largest share of the APFIC region since 1993.

In inland waters, capture fisheries production[2] has generally increased and its reported growth in the late 1990s was remarkable. However, this period also coincided with a change in the way several States adopted in estimating their inland fisheries production and it is likely that earlier production was underestimated. Even today, inland production figures may not truly reflect the true situation – for example, Coates[3] estimated that production from South East Asia was possibly under-reported by a factor of between 2.5 to 3.6.

Total inland production of the region in 2002 was reported as 3.4 million tonnes. South Asia and SE Asia contributed the greatest production compared with smaller production from other sub-regions. (**Figure 2**).

> Top 10 producers of capture fish in 2002 were China, Peru, USA, Indonesia, Japan, Chile, India, Russian Federation, Thailand, and Norway, of these five are in the Asia Pacific region.

The total capture fishery production, however, masks considerable differences in the trends of the main species groups (**Figure 3**). Demersal marine fish achieved the highest level of production of 5.2 million tonnes as early as 1974 and then declined to the lowest level at 3.7 million tonnes in 1983. Its production then gradually recovered to the level of 4.4 million tonnes in 2002.

Pelagic marine fish followed the same upward and then downward trends, peaking at 11.7 million tonnes in 1988 and subsequently decreasing to the production levels of the early 1980s by 2002 (9.4 million tonnes). Other species groups such as Freshwater/diadromous fish, Crustaceans and Cephalopods have grown steadily while molluscs production has levelled off at around 900 thousand tonnes.

A comparison of top 20 species in the region (**Table 2**) shows that although there are changes in the rankings over time, the region's catch is now dominated by small pelagic marine species (e.g. Japanese jack mackerel, Japanese anchovy, chub mackerel, Pacific saury, Indian oil sardine, Indian mackerels, and scads).

It is significant that the reduction in catch of single dominant species such as Alaska pollock[4] in early 1970s and chub mackerel[5] in late 1970s brought up the relative ranking of large pelagic marine species (i.e. skipjack tuna and yellowfin tuna) in 2000. When the Chinese figures are included, the large catch of largehead hairtail (1.3 million

[1] In this review, "China" refers to the sub-region that includes China PR, Hong Kong SAR and Taiwan POC.

[2] It is common understanding that fisheries information systems in the region have been particularly weak in inland areas. The relatively low level of inland capture production could be simply a reflection of poor quality of information. Constant increase of freshwater/diadromous production for some States could implicate the excessive reliance on estimation rather than actual measurement of production.

[3] Coates, D (2003). An overview of inland capture fishery statistics of Southeast Asia. In: *New approaches for the improvement of inland capture fishery statistics in the Mekong Basin*. FAO & MRC, RAP Publication 2003/01. 45pp

[4] Its highest production was 2.7 million tonnes in 1973

[5] Its highest production was 1.7 million tonnes in 1978

tonnes), akiami paste shrimp (*Acetes spp*) (578 thousand tonnes) and Japanese Spanish mackerel (519 thousand tonnes) from this sub-region increases their importance in the overall rankings

It should also be noted that there is considerable quantity of capture production not identified to species but recorded as Marine/Freshwater fishes nei (not elsewhere included), Marine/freshwater molluscs nei and Marine/freshwater crustaceans nei. The quantity reported under these categories has been increasing significantly in recent years, which indicates a worrying trend in available statistical quality. In 2002, 16.8 million tonnes of capture production was not identified to species, order, or family level.

1.2 Aquaculture production in the Asia-Pacific region

The Asia-Pacific region is by far the world's largest contributor to world aquaculture, producing 46.9 million tonnes[6] or 91 percent of global aquaculture production. In terms of production by value, the region's share is slightly less, at 82 percent of total value of global aquaculture production. Even when aquatic plant production is excluded (the vast majority of which originates in the Asia-Pacific area), the region still remains the dominant aquaculture production area, representing 89 percent of global aquaculture production by volume and 80 percent by value.

> Top 10 aquaculture producer States by volume (excluding aquatic plants) in 2002 were China PR, India, Indonesia, Japan, Bangladesh, Thailand, Norway, Chile, Viet Nam, and USA. Seven of these are Asian States, dominating the top 6 ranks.
>
> By value, China PR, Japan, India, Chile, Thailand, Indonesia, Norway, Viet Nam and Bangladesh are amongst the top 10 producer States. **(see Table 3)**

The growth of aquaculture production in the region has been very strong for the last ten years, resulting mainly from the increased production from China (annual growth rate of 13.8 percent [7]). Both inland culture and mariculture showed steady growth but the growth rate of the inland culture sector was more rapid **(Figure 4)**.

China PR[8] alone reported to have produced 37 million tonnes or 79 percent of the world aquaculture production. To understand the enormous scale of aquaculture production in China, it can be compared with the total fisheries production of Peru (including both capture and aquaculture), the world second largest fisheries producer after China PR, which was 8.8 million tonnes in 2002. Peruvian fisheries production was still less than one quarter of China's aquaculture production alone. Since it is such a predominant producer, the scale of reported production can mask other regional trends; therefore, for the purpose of this review, China[9] will be treated separately and presented as a sub-region in its own right.

Even excluding China, the Asia-Pacific region still remains as an important production area for aquaculture, exhibiting steady growth regardless of the culture environment. In particular, inland culture doubled its production from 1854 thousand tonnes in 1990 to 4 478 thousand tonnes in 2002. Such advances far exceed the growth of aquaculture in the rest of the world **(Figure 5)**.

A comparison of top twenty cultured species [10] in the region between 1990 and 2002 (excluding aquatic plants and molluscs) shows that there has been little change in the higher ranked species in inland waters, which are dominated by Chinese and Indian carps. It is worth noting that the number of carnivorous species has increased during the past ten years. In marine waters, although there are changes in the order of species, major cultured species are generally dominated by high-valued carnivorous species such as Penaeid shrimp, jacks, sea breams and salmons. Production of crabs has made significant advances in recent years (i.e. Chinese river crab in inland waters and marine crabs in marine waters). **(Table 4)**

[6] It should be noted that regionally aggregated figures in this report are based on national data, the quality of which is known to be very uneven among States. Some national figures are estimates or repetitions of the data previously reported to FAO.

[7] For the period of 1991-2001 without aquatic plants production

[8] The massive scale of China PR's aquaculture production challenges statistical collection and there are uncertainties regarding the quantities reported.

[9] See foot note 3

[10] There is significant volume of production reported by large group of species, e.g. 3 394 thousand tonnes of fin fish production in 2002 were not identified at family, order or species level. Consequently, the species items totals could have underestimated the real production of the individual species.

1.3 Status and trends by sub-regions

South Asia- capture fisheries

The South Asian sub-region showed very strong and continuous growth during 1980 – 2002, nearly doubling its capture production from 3.1 million tonnes in 1980 to 6.0 million tonnes in 2002 (**Figure 6**). Although the overall growth largely resulted from the production in marine waters, South Asia has the largest share of inland capture production (29 percent of total capture fisheries production) among sub-regions in the Asia-Pacific area. Inland production was relatively stable during late 1970s and 1980s, but grew rapidly from early 1990s. It reached the highest level of production at 1.9 million tonnes in 2001 but showed a sharp decrease in 2002 for the first time in the past 10 years.

Species	Tonnes (1,000)
Indian oil sardine	365.8
Croakers, drums nei	296.3
Hilsa shad	220.8
Natantian decapods nei	198.7
Cyprinids nei	183.8
Skipjack tuna	181.5
Giant tiger shrimp	157.1
Clupeoids nei	140.9
Bombay-duck	135.9
Hairtails, scabbardfishes	134.2
Marine fishes nei	1 081.7
Freshwater fishes nei	1 199.7

Table 5 – S. Asia Capture fisheries production, top 10 species

It is notable that there are no dominant species among top production species in this area. In comparison with top production species of other sub-regions, the combination of South Asian species is unique in the sense that freshwater species (Cyprinids nei: 5th), diadromous species (Hilsa shad: 3rd) and demersal species (croakers/drums: 2nd and Bombay-duck: 9th) are ranked high in the list. (**Table 5**)

Freshwater fish and diadromous fish has been the number one production group for last four decades (except 1992) and achieved very rapid growth in the 1990s. Among marine species, pelagic fishes and demersal fishes showed almost parallel increasing trends with similar levels of production in 2002 (1 254 thousand tonnes and 1 190 thousand tonnes respectively). Crustacean production has been relatively stable and production levels of molluscs including cephalopods in this area have been very low (**Figure 7**).

South Asia - aquaculture

South Asia's production increased rapidly from 1 179 thousand tonnes in 1990 to 2 807 thousand tonnes in 2002. A notable feature of aquaculture sector in South Asia is that the majority of production comes from inland waters and hence the growth of the sector has been mostly due to increasing freshwater culture (**Figure 8)**.

Reported production of freshwater finfishes alone constituted 93 percent of total aquaculture production in 2002. Although Indian carps (Rohu, Catla and Mrigal carp) have been the mainstays of the region's cultured species, there have been notable increases in the production of introduced Chinese carps in recent years. Silver carp production has increased almost five-fold in two years (1998-2000) becoming the top cultured species in 2002 for the first time. Similarly common carp production recorded very rapid increases since 2000. It was the same period that the production of indigenous carps showed sharp declines. (**Figure 9)**

Top five cultured species in 2002 were all freshwater carps (Silver carp, Rohu, Catla, Common carp and Mrigal) and their aggregated production was 2,390 thousand tonnes accounting for 79 percent of total aquaculture production of the sub-region.

Mariculture in South Asia has not been an area of remarkable growth except for the production of crustaceans. Marine crustacean production, which was mostly comprised of Penaeid shrimp, has increased steadily and reached 177 thousand tonnes in 2002. In general, the level of diversification of cultured species is relatively low in this area and there has been very limited or no reported marine finfish production.

Southeast Asia - capture fisheries

Similar to the situation in South Asia, production growth in Southeast Asia has also been very strong for the past four decades with marine capture production increasing linearly through this period. The production level of 14 million tonnes in 2002 (total capture production) was second only to the China sub-region.

Inland production had gained gradually and reached at 1.5 million tonnes in 2002. Considering the rich freshwater resources in the area, it is commonly thought that the proportion of inland capture production, which constitutes only approximately 11 percent of total production[11], might be particularly underestimated in this sub-region (**Figure 10**).

Species	Tonnes (1,000)
Scads nei	550.7
Indian mackerels nei	460.0
Sardinellas nei	437.4
Skipjack tuna	348.4
Natantian decapods nei	323.3
Stolephorus anchovies	295.6
Tuna-like fishes nei	254.3
Yellowfin tuna	242.7
Carangids nei	239.3
Threadfin breams nei	214.4
Marine fishes nei	4 079.7
Freshwater fishes nei	1 032.0

Table 6: SE Asia aquaculture production, top 10 species

In terms of production by main species groups, catches of the pelagic marine fish group and marine fish nei group have grown strongly and are a major driving force of the overall production growth (**Figure11**). Other species groups (freshwater/diadromous fish, demersal fish, crustaceans and cephalopods) exhibited very similar increasing trends, maintaining nearly the same share of production. The proportion of unidentified marine fish (marine fish nei) is notably high (29 percent of total production) in this sub-region because many States do not segregate marine fish production.

Table 6 shows top ten production species in Southeast Asia. Eight out of top ten production species are marine pelagic fishes and top three ranks are dominated by small pelagic fish group (scads, Indian mackerels, and sardinellas). The large pelagic fish group (skipjack tuna, tuna-like fishes, yellowfin tuna and carangids) also has relatively high production.

Southeast Asia - aquaculture

Aquaculture production in Southeast Asia is very diversified with 39 percent of freshwater fish, 29 percent of aquatic plants, 13 percent of crustaceans, 13 percent of marine/diadromous fishes and 7 percent of molluscs (by volume). In terms of production by value, highly priced crustaceans constituted an increased share of 49 percent of the total production, followed by freshwater fish at 35 percent. (**Figure 12**)

The growth trend is particularly strong for freshwater finfish culture, which has increased from 564 thousand tonnes in 1990 to 1 556 thousand tonnes in 2002 with an average annual increment of 83 thousand tonnes. In the mariculture sub-sector, aquatic plants showed a surprising production growth. Crustaceans have been a major cultured species throughout the sub-region, although it started to decline since 2000. **(Figure 13)**

> Top ten cultured species in Southeast Asia (by volume, excluding aquatic plants) were milkfish, giant tiger shrimp, tilapias, common carp, clarias catfishes, blood cockle, green mussel, rohu, barbs and gouramis.

Eucheuma cottonii (Zanzibar weed) is the most widely cultured aquatic plant in the region with a production of 778 thousand tonnes in 2002. Apart from aquatic plants, Giant tiger shrimp (*Penaeus monodon*) had maintained the position of top produced species until 2001, although very recently the massive increases in production of *P. vannamei* is challenging this position. *P. monodon* production decreased sharply in 2002 back to the production level of 1992.

China - capture fisheries

Catches in Chinese capture fisheries can be divided into three periods that show distinct trends (**Figure 14**). The first period, 1950 to 1985, is characterized by relatively low rates of growth, during which all species groups exhibited a very similar pattern, albeit with some annual fluctuations. In the second period, 1986 to 1998, China reported very rapid and substantial growth in production in almost all segments of their capture fisheries. Between 1992 and 1997, annual increments of total production constantly exceeded one million tonnes (the highest annual increment was 1.7 million tonnes in 1994/1995). The third period started with the introduction of the zero growth policy in 1998; total production started to decline for the first time in twenty years. The degree of decline was higher in marine production than in inland production.

Although most species groups showed similar rapid growth trends during the second period, trends in the third period varied widely. The production of the marine fish nei group declined sharply, whilst crustacean group continued to

[11] see footnote 4

grow. During the period, molluscs have maintained the same production level (**Figure 15**)

Species	Tonnes (1,000)
Largehead hairtail	1 296.2
Japanese anchovy	1 174.5
Scads nei	608.3
Akiami paste shrimp	578.6
Japanese spanish mackerel	518.8
Chub mackerel	450.3
Silver pomfrets nei	386.3
Gazami crab	347.1
Golden threadfin bream	309.4
Cuttlefish, bobtail squids nei	299.7

Table 7: Top 10 production species in China

Table 7 shows the top ten production species in China in 2002. Largehead hairtail and Japanese anchovy catches were extremely high with both species exceeding one million tonnes. A distant second group includes a variety of species group such as small pelagic fish (scads and chub mackerel), large pelagic fish (Japanese Spanish mackerel), bentho-pelagic fish (silver pomfrets), demersal fish (golden threadfin bream), crustaceans (akiami paste shrimp and gazami crab) and cephalopods.

Group	Tonnes (1 000)
Marine fishes nei	3 595.5
Marine molluscs nei	1 376.7
Marine crustaceans nei	1 215.0
Freshwater fishes nei	924.2
Freshwater crustaceans nei	772.7
Freshwater molluscs nei	551.0
Total of "nei" groups	**8 435.1**
Total capture production	**17 767.2**

Table 8: Unidentified production in China

There are several notable differences in the Chinese production figures compared with other sub-regions. These include;

- Remarkably high proportion of crustaceans in Chinese production (18.8 percent in 2002) as compared to those of other sub-regions. Proportions of crustaceans in SE Asia, South Asia and other Asia were 6.1 percent, 8.3 percent and 3.9 percent respectively.
- The large quantity of the production reported under unidentified larger groupings which far exceeded that of the other sub-regions. Total quantity reported under these groupings was 8.4 million tonnes in 2002 representing 47.5 percent of the Chinese total capture production. Production of marine fish nei group in 2002 alone was almost equal to the total capture production of India (**Table 8**)
- The much smaller amounts of small pelagic fish in the catch.

China - aquaculture

China has continued to show strong growth in all culture environments. Growth in inland culture came mainly from the increased production of finfish culture, which according to official statistics is being achieved through intensification of existing systems rather than significant increases in production area. The growth in marine waters has been driven by two major groups, namely molluscs and aquatic plants. **(Figure 16)**

In China generally, most cultured species show an increasing trend. However, there are a number of species worth highlighting. These include;

Japanese kelp (Laminaria japonica): this species has been the top cultured species in China and its production growth is remarkable; increasing from 1 222 thousand tonnes in 1990 to 4 208 thousand tonnes in 2002.

Miscellaneous aquatic plants: this massive volume of aquatic plants is not reported at the species level. However, production jumped from 196 thousand tonnes in 1990 to 3 931 thousand tonnes in 2002. The highest annual increment was 1 485 thousand tonnes between 1997 and 1998. As this group and the Japanese kelp are not particularly easy to culture intensively, increases in growth suggests the expansion of additional areas of seaboard for their culture. A description of the areas under seaweed culture and production intensity in China would be very useful.

Pacific cupped oyster: This is another cultured species that has made outstanding growth; increasing from 532 thousand tonnes in 1990 up to 3 646 thousand tonnes in 2002. Mollusc production is difficult to intensify and increased production suggests developments of new production areas as in the case of aquatic plants. (**Figure 17**)

Carnivorous species: Production of high value carnivorous species such as mandarin fish, Chinese river crab and marine finfish had been relatively low up to the early 1990s. However, this group started to make rapid growth since 1995.

Many of the carnivorous species show very similar patterns of growth in production. (**Figure 18**)

Other Asia - capture fisheries

Since reported inland production in this region is low, the trend in total capture fisheries production in this sub-region is almost identical to the trend in marine production. Total production increased towards its peak production of 13.6 million tonnes in 1988, and thereafter decreased steadily (**Figure 19**). In its best years, the sub-region's production share of global capture production was estimated as high as 40 percent.

Species	Tonnes (1,000)
Japanese anchovy	679.5
Japanese flying squid	500.2
Skipjack tuna	479.2
Chub mackerel	420.8
Yesso scallop	306.7
Alaska Pollock	298.0
Pacific saury	232.5
Japanese jack mackerel	222.1
Chum salmon	211.7
Yellowfin tuna	164.5
Marine fishes nei	649.3
Marine crustaceans nei	67.4

Table 9: Top 10 production species in other Asia

Production by main species group (**Figure 20**) provides a more detailed picture of the situation of the fisheries sector. During the late 1960s to early 1970s, demersal fish became the most important production group with a very rapid growth rate, achieving a three-fold increase in fifteen years. However, after the peak production of 5 million tonnes in 1974, it started to decline, gradually at first, but with a sharp decline after 1976. The current level of demersal fish production is as low as the levels of the early 1950s. The reduction of demersal production was compensated by increased production of marine pelagic fishes. Strong growth here contributed to overall increase of capture production until 1988, but then followed the fate of demersal fish production. Current production levels have dropped to the levels of early 1960s.

In terms of major production species, pelagic species predominates in this area. It is also notable that there are high production of cephalopods (Japanese flying squid) and molluscs (Yesso scallop) (**Table 9**)

Other Asia - aquaculture

In other Asia, particularly in East Asian States, aquatic plants continue to be predominant, accounting for 54 percent of total production quantity. This is followed by molluscs (28 percent) and marine finfish (11 percent). However, the high economic value of marine finfish makes this species group the largest contributor in terms of value, constituting 42 percent of total production value. **(Figure 21)**

Production trends by major species groups showed that aquaculture production in this region has been very stable; most of major species groups maintained the current level of production for the last ten years. The only exception for this is the aquatic plants production, which peaked in 1993 but decreased by almost half in 2000. **(Figure 22)**

It is notable that the percentage of carnivorous fish in the total fish production is very high in this sub-region (82 percent in 2002) compared with those of South Asia, Southeast Asia and China, which are all below 10 percent.

Oceania - capture fisheries

Similar to the other Asia sub-region's catch, Oceania's capture production consists mainly of fish taken from marine waters. Although there have been annual fluctuations, it has continued to increase (**Figure 23**). Capture fisheries are often conducted on subsistence scale in many small island States and hence production may not be well represented in the official statistics. An effect of this is that general trends in production are basically determined by a few larger States with well established commercial fisheries sector such as Australia and New Zealand, with the exception of offshore pelagic fisheries. Commercial offshore production has increased in many small island States and contributed to the increase in total production. Rapid growth of demersal fish production has mainly come from the States in temperate waters (i.e. New Zealand and Australia) (**Figure 24**).

The top ten species produced from capture fisheries in Oceania (**table 10**) are distinct from those of the rest of the region as the majority of them are from temperate waters of New Zealand and Australia.

Species	Tonnes (1,000)
Blue grenadier	201.7
Skipjack tuna	166.4
Wellington flying squid	50.0
Yellowfin tuna	47.8
Southern blue whiting	42.1
Albacore	33.1
Jack and horse mackerels	32.3
Snoek	23.3
Orange roughy	22.6
Pink cusk-eel	21.9
Marine fishes nei	62.6

Table 10: Top 10 production species in Oceania

Oceania - aquaculture

Aquaculture in the Oceania sub-region can be divided into two distinct groups; larger developed States in temperate waters and small developing island States in tropical waters. Aquaculture production from the small island states is relatively limited. The aggregated production of all island States was 29 462 tonnes in 2002 (less than one percent of aquaculture production in the Asia-Pacific region).

The major cultured species in terms of volume are seaweed, clams, penaeid shrimp, tilapia and milkfish. Two commodities and three States dominate the value of commercial aquaculture production in region. They are cultured black pearl from French Polynesia and the Cook Islands and shrimp from New Caledonia. In 2002 the total export value was US$ 153 million.

Live reef fish, aquarium fish and pearl, which are relatively low in volume but high in value commodities, bring in significant income to some Pacific Islands. The Pacific is an important source of trade in the marine aquarium industry. Although the target species are mostly caught from the wild, there is an increasing desire for culture-based sources. Giant clam culture for the ornamental trade is widespread throughout the region and the total export is probably in the range of 30 000 – 50 000 pieces/annum. The Pacific is a major supplier of ‘live rock’ (rock encrusted with coralline algae) with approximately 50 000 pieces of live rock currently being cultured in the Fiji Islands.

Euchema cottonii (Zanzibar weed) seaweed culture is well established in the Kiribati atolls and is being rejuvenated in the Solomon Islands and Fiji with forecasted production in the order of 1 500 tonnes for 2004.

Interest in inland freshwater aquaculture is growing, particularly amongst the larger Melanesian States such as Fiji and Papua New Guinea. At present the most commonly farmed species are tilapia, common carp and Macrobrachium prawns.

The larger States in the region (New Zealand and Australia) have shown a steady growth in aquaculture production, which is largely attributable to increased production of finfish species. Major cultured species of these States were marine molluscs, salmonids and tunas.