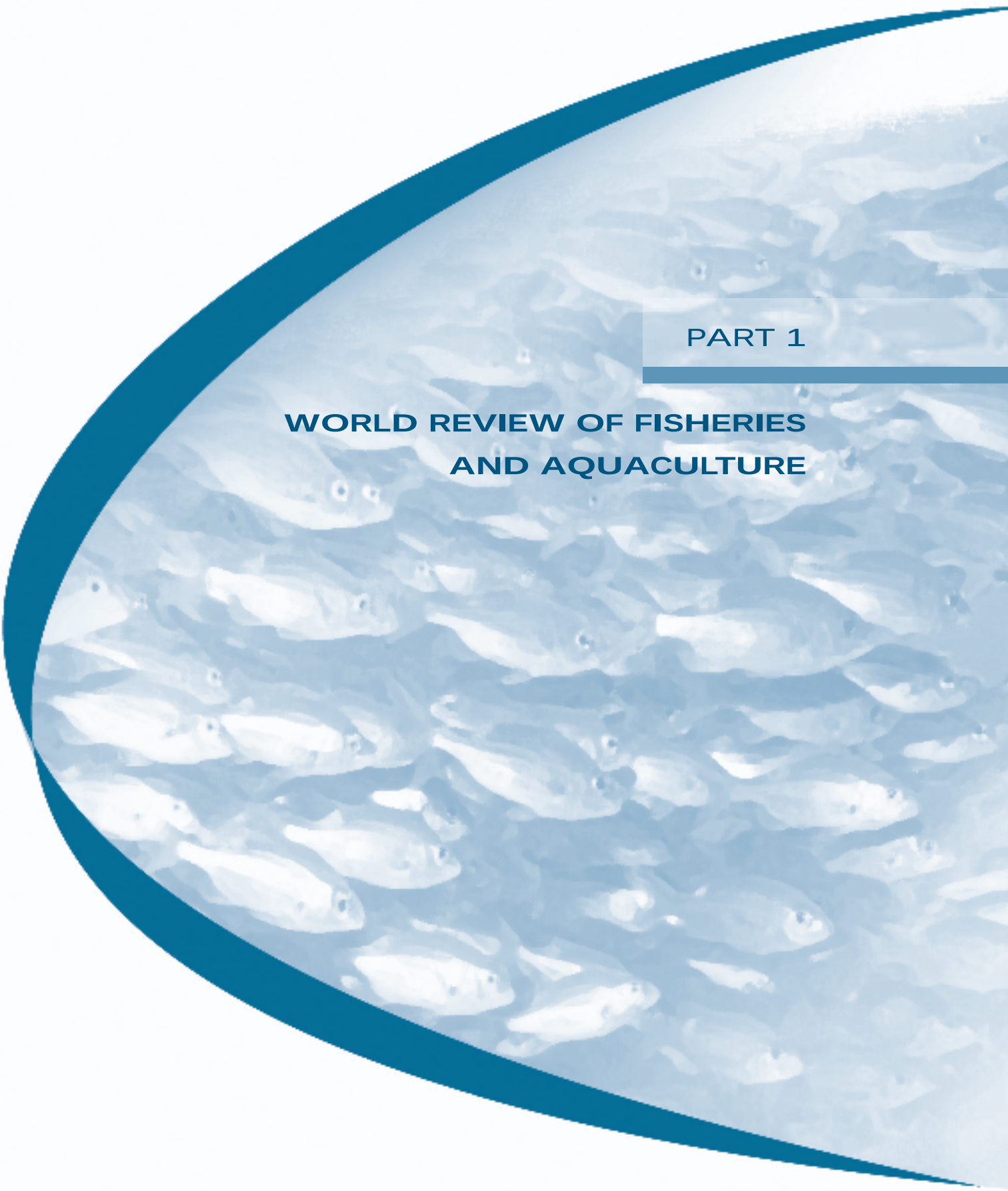


PART 1

# WORLD REVIEW OF FISHERIES AND AQUACULTURE

# WORLD REVIEW OF FISHERIES AND AQUACULTURE

## Fisheries resources: trends in production, utilization and trade

### OVERVIEW

Capture fisheries and aquaculture supplied the world with about 106 million tonnes of food fish in 2004, providing an apparent per capita supply of 16.6 kg (live weight equivalent), which is the highest on record (Table 1 and Figure 1). Of this total, aquaculture accounted for 43 percent. Outside China, per capita supply has shown a modest growth rate of about 0.4 percent per year since 1992 (following a decline from 1987), as growth in supply from aquaculture more than offset the effects of static capture fishery production and a rising population (Table 2 and Figure 2). In 2004, per capita food fish supply was estimated at 13.5 kg if data for China are excluded. Overall, fish provided more than 2.6 billion people with at least 20 percent of their average per capita animal protein intake. The share of fish proteins in total world animal protein supplies grew from 14.9 percent in 1992 to a peak of 16.0 percent in 1996, declining to about 15.5 percent in 2003. Notwithstanding the relatively low fish consumption by weight in low-income food-deficit countries (LIFDCs) of 14.1 kg per capita in 2003, the contribution of fish to total animal protein intake was significant – at about 20 percent – and is probably higher than indicated by official statistics in view of the unrecorded contribution of subsistence fisheries.

Preliminary estimates for 2005 based on reporting by some major fishing countries indicate that total world fishery production reached almost 142 million tonnes,

Table 1
World fisheries and aquaculture production and utilization

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005[1] |
|---|---|---|---|---|---|---|
| | (Million tonnes) | | | | | |
| **PRODUCTION** | | | | | | |
| INLAND | | | | | | |
| Capture | 8.8 | 8.9 | 8.8 | 9.0 | 9.2 | 9.6 |
| Aquaculture | 21.2 | 22.5 | 23.9 | 25.4 | 27.2 | 28.9 |
| **Total inland** | **30.0** | **31.4** | **32.7** | **34.4** | **36.4** | **38.5** |
| MARINE | | | | | | |
| Capture | 86.8 | 84.2 | 84.5 | 81.5 | 85.8 | 84.2 |
| Aquaculture | 14.3 | 15.4 | 16.5 | 17.3 | 18.3 | 18.9 |
| **Total marine** | **101.1** | **99.6** | **101.0** | **98.8** | **104.1** | **103.1** |
| TOTAL CAPTURE | 95.6 | 93.1 | 93.3 | 90.5 | 95.0 | 93.8 |
| TOTAL AQUACULTURE | 35.5 | 37.9 | 40.4 | 42.7 | 45.5 | 47.8 |
| **TOTAL WORLD FISHERIES** | **131.1** | **131.0** | **133.7** | **133.2** | **140.5** | **141.6** |
| **UTILIZATION** | | | | | | |
| Human consumption | 96.9 | 99.7 | 100.2 | 102.7 | 105.6 | 107.2 |
| Non-food uses | 34.2 | 31.3 | 33.5 | 30.5 | 34.8 | 34.4 |
| Population *(billions)* | 6.1 | 6.1 | 6.2 | 6.3 | 6.4 | 6.5 |
| Per capita food fish supply *(kg)* | 16.0 | 16.2 | 16.1 | 16.3 | 16.6 | 16.6 |

*Note:* Excluding aquatic plants.
[1] Preliminary estimate.

representing an increase of over 1 million tonnes compared with 2004 and a record high production. Although the total amount of fish available for human consumption is estimated to have increased to 107 million tonnes, the global per capita supply remained at about the same level as in 2004 because of population growth. There was a decrease in the contribution of capture fisheries to human consumption, but this was offset by an increase in the aquaculture contribution.

China remains by far the largest producer, with reported fisheries production of 47.5 million tonnes in 2004 (16.9 and 30.6 million tonnes from capture fisheries and aquaculture, respectively), providing an estimated domestic food supply of 28.4 kg per

Figure 1

World capture and aquaculture production

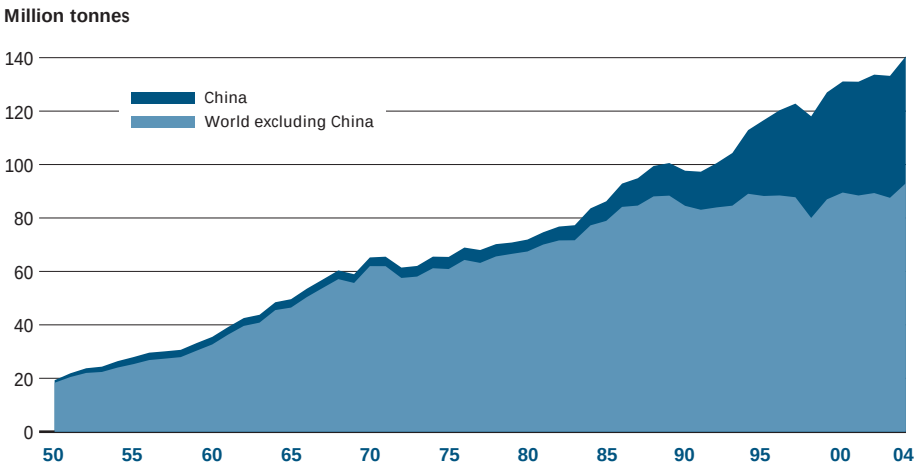



Table 2

World fisheries and aquaculture production and utilization, excluding China

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005[1] |
|---|---|---|---|---|---|---|
| | (million tonnes) | | | | | |
| **PRODUCTION** | | | | | | |
| INLAND | | | | | | |
| Capture | 6.6 | 6.7 | 6.5 | 6.6 | 6.8 | 7.0 |
| Aquaculture | 6.0 | 6.5 | 7.0 | 7.6 | 8.3 | 8.8 |
| **Total inland** | **12.6** | **13.3** | **13.5** | **14.2** | **15.1** | **15.8** |
| MARINE | | | | | | |
| Capture | 72.0 | 69.8 | 70.2 | 67.2 | 71.3 | 69.7 |
| Aquaculture | 4.9 | 5.3 | 5.6 | 6.1 | 6.6 | 6.6 |
| **Total marine** | **76.9** | **75.2** | **75.8** | **73.3** | **77.9** | **76.3** |
| TOTAL CAPTURE | 78.6 | 76.6 | 76.7 | 73.8 | 78.1 | 76.7 |
| TOTAL AQUACULTURE | 10.9 | 11.9 | 12.6 | 13.8 | 14.9 | 15.4 |
| **TOTAL FISHERIES** | **89.5** | **88.4** | **89.3** | **87.5** | **93.0** | **92.1** |
| **UTILIZATION** | | | | | | |
| Human consumption | 63.9 | 65.7 | 65.7 | 67.5 | 68.9 | 69.0 |
| Non-food uses | 25.7 | 22.7 | 23.7 | 20.1 | 24.0 | 23.1 |
| Population *(billions)* | 4.8 | 4.9 | 5.0 | 5.0 | 5.1 | 5.1 |
| Per capita food fish supply *(kg)* | 13.3 | 13.4 | 13.3 | 13.4 | 13.5 | 13.4 |

*Note:* Excluding aquatic plants.
[1] Preliminary estimate.

capita as well as production for export and non-food purposes. However, there are continued indications that capture fisheries and aquaculture production statistics for China may be too high, as indicated in previous issues of *The State of World Fisheries and Aquaculture*,[1] and that this problem has existed since the early 1990s. Because of the importance of China and the uncertainty about its production statistics, as in previous issues of this report, China is generally discussed separately from the rest of the world.

Global capture fisheries production reached 95 million tonnes in 2004, with an estimated first-sale value of US$84.9 billion. China, Peru and the United States of America remained the top producing countries. World capture fisheries production has been relatively stable in the past decade with the exception of marked fluctuations driven by catches of Peruvian anchoveta – a species extremely susceptible to oceanographic conditions determined by the El Niño Southern Oscillation – in the Southeast Pacific (Figure 3). Fluctuations in other species and regions tend to compensate for each other to a large extent so that total marine catches, which accounted for 85.8 million tonnes in 2004, do not show such significant variations. Production in the Eastern Indian Ocean and Western Central Pacific continued their long-term increasing trends, and in the highly regulated Northwest Atlantic and Northwest Pacific areas, recent increases were observed following troughs in production. In contrast, catches in two other areas decreased recently: for the first time since 1991, catches from the Northeast Atlantic totalled fewer than 10 million tonnes; in the Southwest Atlantic, a sharp drop in catches of Argentine shortfin squid brought total catches down to their lowest level since 1984. The Mediterranean and Black Sea remained the most stable marine area in terms of capture production. Catches from inland waters, about 90 percent of which occur in Africa and Asia, have shown a slowly but steadily increasing trend since 1950, owing in part to stock enhancement practices, and reached a record 9.2 million tonnes in 2004.

Aquaculture continues to grow more rapidly than all other animal food-producing sectors, with an average annual growth rate for the world of 8.8 percent per year since 1970, compared with only 1.2 percent for capture fisheries and 2.8 percent for terrestrial farmed meat production systems. However, there are signs that the rate of growth for global aquaculture may have peaked, although high growth rates may continue for some regions and species. Aquaculture production in 2004 was reported to be 45.5 million tonnes (Table 1) with a value of US$63.3 billion or, if aquatic plants are included, 59.4 million tonnes with a value of US$70.3 billion. Of the world total, China is reported to have accounted for nearly 70 percent of the quantity and over half the global value of aquaculture production. All regions showed increases in production from 2002 to 2004, led by the Near East and North Africa region and Latin America

Figure 2

World fish utilization and supply, excluding China

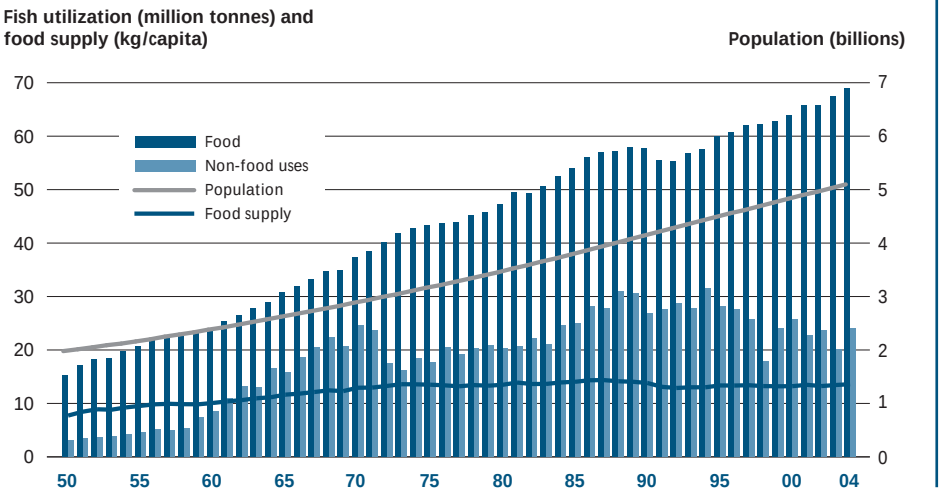
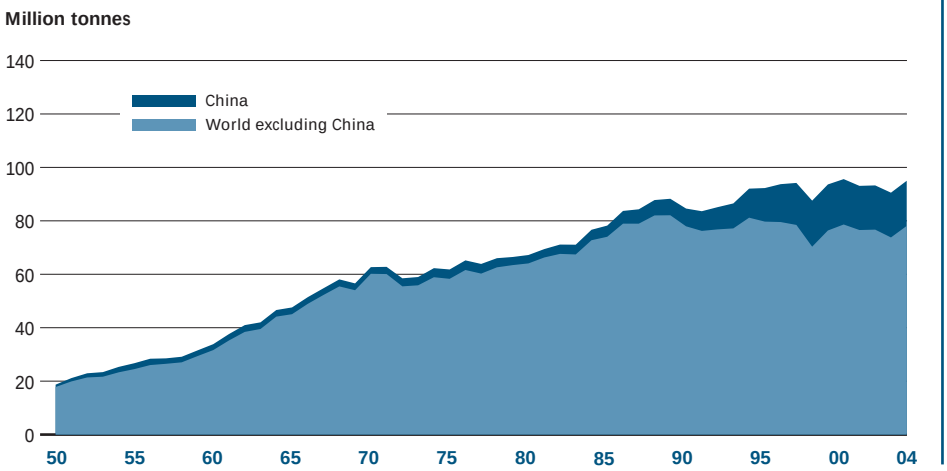


Figure 3

World capture fisheries production




and the Caribbean, with about 14 and 10 percent average annual growth, respectively. Freshwater culture continued to dominate, followed by mariculture and brackish-water culture. Carps accounted for 40 percent of all production of fish, crustaceans and molluscs. The period 2000–04 saw strong growth in production of crustaceans, in particular, and of marine fish. In the same period, production in developing countries other than China increased at an annual rate of 11 percent, compared with 5 percent for China and about 2 percent for the developed countries. With the exception of marine shrimp, the bulk of aquaculture production within developing countries in 2004 comprised omnivorous/herbivorous fish or filter-feeding species. In contrast, carnivorous species accounted for approximately three-quarters of finfish culture production in developed countries.

During the past three decades, the number of fishers and aquaculturists has grown faster than the world's population, and faster than employment in traditional agriculture. In 2004, an estimated 41 million people worked as fishers and fish farmers, the great majority of these in developing countries, principally in Asia. Significant increases in the most recent decades, particularly in Asia, are a result of the strong expansion of aquaculture activities. In 2004, fish farmers accounted for one-quarter of the total number of fish workers in the primary sector. China is by far the country with the highest number of fishers and fish farmers, reported to be 13 million in 2004, representing about 30 percent of the world total. Current fleet-size reduction programmes in China to tackle overcapacity are reducing the number of people engaged in capture fisheries, which declined by 13 percent during the period 2001–04. The numbers engaged in fishing and aquaculture in most industrialized economies have been declining or remain stationary.

The world fishing fleet comprised about 4 million units at the end of 2004, of which 1.3 million were decked vessels of various types, tonnage and power, and 2.7 million undecked (open) boats. While virtually all decked vessels were mechanized, only about one-third of the undecked fishing boats were powered, generally with outboard engines. The remaining two-thirds were traditional craft of various types operated by sail and oars. About 86 percent of the decked vessels were concentrated in Asia; the remainder were accounted for by Europe (7.8 percent), North and Central America (3.8 percent), Africa (1.3 percent), South America (0.6 percent) and Oceania (0.4 percent). Many countries have adopted policies to limit the growth of national fishing capacity or reduce it in order to protect the fishery resources and to make fishing economically viable for the harvesting enterprises. There are indications that the fleets of decked fishing vessels in longstanding developed fishing nations have continued to decrease in size, especially those operating offshore and in distant waters.

However, even in these countries, the rate of reduction of fishing power is generally less significant than the rate of reduction of fishing vessels. On the other hand, some countries report a continuing expansion of their fleets. Overall, the number of fishing vessels worldwide did not change significantly in either 2003 or 2004.

Just as the world fishing fleet appears to have stabilized, the overall state of exploitation of the world's marine fishery resources has tended to remain relatively stable, although for resources this has been the case for a longer period of time. Over the past 10–15 years, the proportion of overexploited and depleted stocks has remained unchanged, after showing a marked increase during the 1970s and 1980s. It is estimated that in 2005, as in recent years, around one-quarter of the stock groups monitored by FAO were underexploited or moderately exploited and could perhaps produce more, whereas about half of the stocks were fully exploited and therefore producing catches that were at, or close to, their maximum sustainable limits, with no room for further expansion. The remaining stocks were either overexploited, depleted or recovering from depletion and thus were yielding less than their maximum potential owing to excess fishing pressure. The situation seems more serious for certain fishery resources that are exploited solely or partially in the high seas and, in particular, for straddling stocks and for highly migratory oceanic sharks. This confirms earlier observations that the maximum wild capture fishery potential from the world's oceans has probably been reached and reinforces the calls for more cautious and effective fisheries management to rebuild depleted stocks and prevent the decline of those being exploited at or close to their maximum potential. In the case of inland fishery resources, there is widespread overfishing, arising from either intensive targeting of individual large-size species in major river systems or overexploitation of highly diverse species assemblages or ecosystems in the tropics.

Total world trade in fish and fishery products reached a record value of US$71.5 billion (export value) in 2004, representing a 23 percent growth relative to 2000. Preliminary estimates for 2005 indicate a further increase in the value of fishery exports. In real terms (adjusted for inflation), exports of fish and fishery products increased by 17.3 percent during the period 2000–04. In terms of quantity, exports in live-weight-equivalent terms in 2004 accounted for 38 percent of total fisheries and aquaculture production, confirming fish as one of the most highly traded food and feed commodities. The share of fish trade in both total gross domestic product (GDP) and agricultural GDP has roughly doubled over the past 25 years. China has been the world's main exporter since 2002, and in 2004 its fish exports were valued at US$6.6 billion following remarkable average annual growth of 12 percent in the period 1992–2004. The fishery net exports of developing countries (i.e. the total value of their exports less the total value of their imports) have shown a continuing rising trend over the past two decades, growing from US$4.6 billion in 1984 to US$16.0 billion in 1994 to US$20.4 billion in 2004. These figures are significantly higher than those for other agricultural commodities such as rice, coffee and tea. Shrimp continues to be the most important commodity traded in value terms, accounting for 16.5 percent of the total value of internationally traded fishery products in 2004, followed by groundfish (10.2 percent), tuna (8.7 percent) and salmon (8.5 percent). In 2004, fishmeal represented around 3.3 percent of the value of exports and fish oil less than 1 percent.

In the realm of marine fisheries governance, regional fisheries management organizations (RFMOs) play a unique role in facilitating international cooperation for the conservation and management of fish stocks. These organizations currently represent the only realistic means of governing fish stocks that occur either as straddling or shared stocks between zones of national jurisdiction, between these zones and the high seas, or exclusively on the high seas. Strengthening RFMOs in order to conserve and manage fish stocks more effectively remains the major challenge facing international fisheries governance. Despite efforts over the past decade to improve their management capacity and their images as effective and responsive organizations, some RFMOs have failed to achieve their fundamental goal of the sustainable management of stocks, which has in turn led to increasing international criticism. However, many RFMOs are taking steps to implement the ecosystem approach

to fisheries (EAF) and are striving to adopt the precautionary approach; strengthening international cooperation; promoting transparency; encouraging eligible non-members to become members of organizations or to become cooperating non-parties/entities; and enhancing compliance and enforcement through improved monitoring, control and surveillance.

Similarly for inland fisheries, there is a need for a system of governance for transboundary fisheries and fishery resources. Many of the world's large river basins cross one or several international borders, and many riverine fish species migrate across boundaries with the result that activities in one country may affect fish stocks and communities exploiting the fish stocks in another country. Appropriate fisheries management in such cases requires that suitable policies for sustaining the shared resources (water and biological resources) are developed at the regional level, and that these policies are incorporated into national legislation and implemented. Regional frameworks do exist that deal with the management of inland waters and living aquatic resources, and there have been some recent encouraging developments in this area. But governance remains incomplete as only 44 percent of the international basins are the subject of one or more agreements, and these agreements may not include fisheries. Not only are inland fisheries unlikely to become the primary focus in all water management programmes, but there is also a risk that the needs of fishing communities and small-scale fisheries would not be considered in such programmes unless water governance systems are designed to include inland fisheries.

Unlike capture fisheries, aquaculture activities are generally located within national jurisdictions, and so governance is a national responsibility. There is growing understanding that sustainable development of the aquaculture sector requires an enabling environment, with appropriate institutional, legal and management frameworks guided by an overall policy. Notable progress has been made in a number of institutional, legal and management development areas, including the use of various public- and private-sector partnership arrangements. Integrated land-use and environmental planning are being pursued and regulations implemented, often through self-regulation according to codes of practice. Co-management is an emerging trend, usually applied in the management of common property resources, and as such has been effective in culture-based fisheries, a form of aquaculture practised communally in small water bodies in rural areas.

In recent years, issues relevant to international trade in fishery products have been prominent. They include labelling and traceability requirements; ecolabelling; illegal, unreported and unregulated (IUU) fishing; the sustainable development of aquaculture; subsidies in production and trade agreements. Some of these issues form part of the agenda for the multilateral trade negotiations in the World Trade Organization (WTO), where countries also discuss fisheries and pay particular attention to fisheries subsidies that contribute to overcapacity and overfishing and how these can be disciplined yet reconciled with sustainable development considerations. It seems possible that the outcomes of the fishery subsidy negotiations will depend on how certain technical issues will be defined and agreed and also on how far WTO Members will go in addressing not only trade, but also environmental and development issues.

## CAPTURE FISHERIES PRODUCTION

### Total capture fisheries production

Global capture production in 2004 reached 95.0 million tonnes, an increase of 5 percent in comparison with 2003, when total catch had declined to 90.5 million tonnes (Table 1). The highest and lowest total catch (Figure 3) in the past ten years (1995–2004) for which complete statistics are available at the end of 2006 coincided with the fluctuating catches of Peruvian anchoveta, a species notoriously influenced by the El Niño effects on the oceanographic conditions of the Southeast Pacific. Catches of this small pelagic species in the decade ranged from a minimum of 1.7 million tonnes in 1998 to a maximum of 11.3 million tonnes in 2000, whereas global total catches excluding anchoveta remained relatively stable between 83.6 and 86.5 million tonnes.

Preliminary estimates for 2005 global capture production indicate that inland water catches have increased by almost 0.4 million tonnes and marine catches have decreased by over 1.5 million tonnes. However, less than one-third of the marine capture production lost in 2005 in comparison with 2004 can be attributed to the high variability of Peruvian anchoveta, as total catches of all other marine species combined were reduced by about 1 million tonnes.

The estimated first-hand value of global capture fisheries production amounted to some US$84.9 billion, representing a 3.6 percent growth over the value recorded for 2003. Of this total, fish for reduction purposes had a first-hand value of US$3.4 billion.

The only recent change in the ranking of top ten producer countries (Figure 4) was the gain by Chile. The country moved from sixth place in 2002, to seventh in 2003, to fourth place in 2004 – again a consequence of the fluctuating catches of anchoveta. Official catch statistics reported by China have been highly stable since 1998 (Figure 3) and in the period between 2001 and 2004 varied only from 16.5 to 16.9 million tonnes. However, distant-water catches by Chinese vessels have been growing significantly since 1998 and in 2004 exceeded 0.4 million tonnes, about the same quantity caught by each of Japan, the Republic of Korea and Taiwan Province of China, which traditionally have fished in distant waters but have been progressively reducing their distant-water activities in recent years.

### World marine capture fisheries production

Marine capture fisheries production was 85.8 million tonnes in 2004. As for the global total catches (including also inland capture production), its recent trend has been strongly influenced by variations in anchoveta catches off Peru and Chile.

The Northwest and Southeast Pacific still rank as the most productive fishing areas (Figure 5). In the three, mostly tropical, areas (Western and Eastern Indian Ocean, Western Central Pacific) for which, ten years ago, FAO forecast that there was still room for fishery development,[2] total catches continued to increase in the Eastern Indian Ocean and Western Central Pacific. However, in the Western Indian Ocean capture production decreased in 2004 in comparison with 2003 and the upward long-term trend has probably lost momentum in this fishing area. Coastal fisheries in the Western Indian Ocean seem to be more vulnerable than in the other two areas, with a reduction in total catch, excluding tuna, of 0.2 million tonnes in 2004. Total catches of tuna, which is the most valuable group of species and generally exported out of the area, reached almost 30 percent of the total catch.

Figure 4

Marine and inland capture fisheries: top ten producer countries in 2004

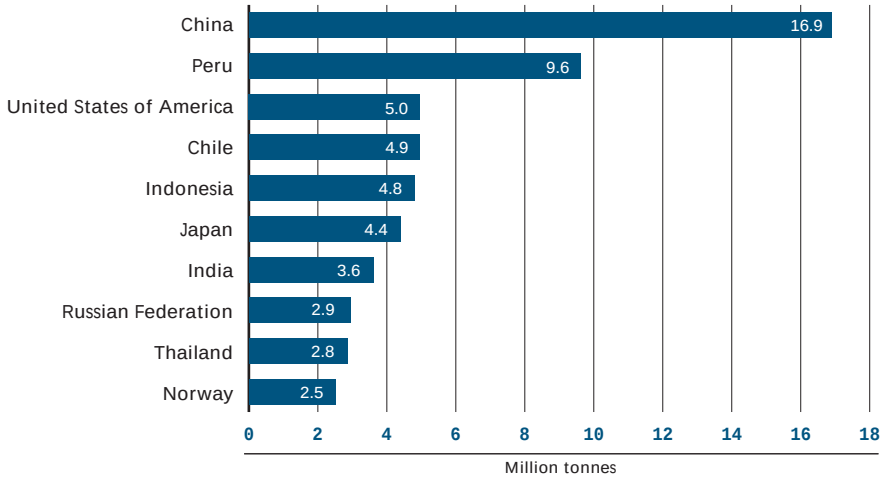
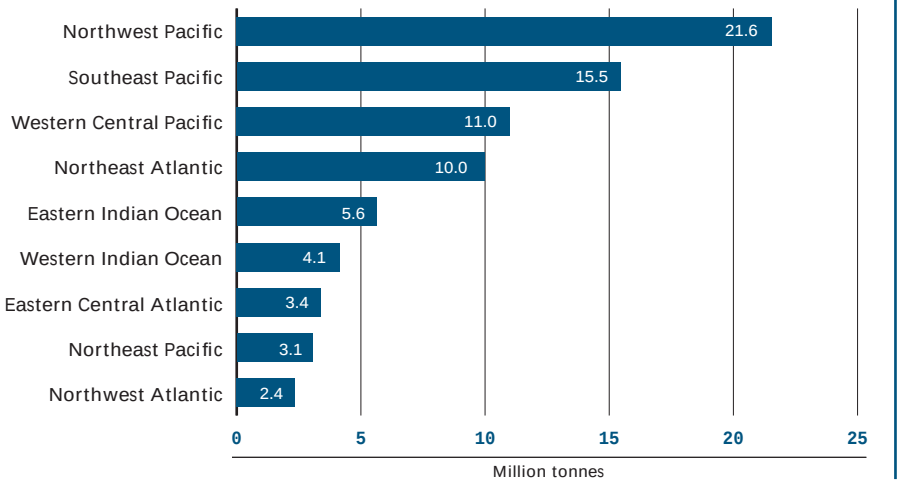


Figure 5

Capture fisheries production: principal marine fishing areas in 2004




*Note:* Fishing areas listed are those with a production quantity equal to or more than 2 million tonnes in 2004.

A continuous increasing trend in catches can be observed in the Northwest Atlantic and Northeast Pacific since the recent minimums in 1998 and 2000, respectively (see Figure 18 on pp. 30–31). These two temperate fishing areas are among the most regulated and managed in the world, and the catch recovery that has occurred recently may be viewed as an indication of the effectiveness of management measures enforced after the crises experienced in the 1990s. The Mediterranean and Black Sea appears to be the most stable fishing area in terms of total catches (1996 and 2004 quantities were unchanged, with only minor fluctuations), but a more detailed analysis by species group shows an increase in small pelagics and a decrease in demersal fishes, tunas and sharks, suggesting that among the most valuable fishery resources several are declining.

Total catches in 2004 decreased by over 10 percent in comparison with 2002 in three fishing areas: Northeast Atlantic, Southwest Atlantic and Eastern Central Pacific. In the Northeast Atlantic, for the first time since 1991 catches totalled less than 10 million tonnes. A sharp drop in catches of Argentine shortfin squid by local and distant-water fleets (2004 capture production was one-ninth of that in 1999) brought down total catch in the Southwest Atlantic to its lowest level since 1984 (Figure 18). Catches in the Eastern Central Pacific peaked in 2002 at almost 2 million tonnes, but in the following two years declined by about 13 percent.

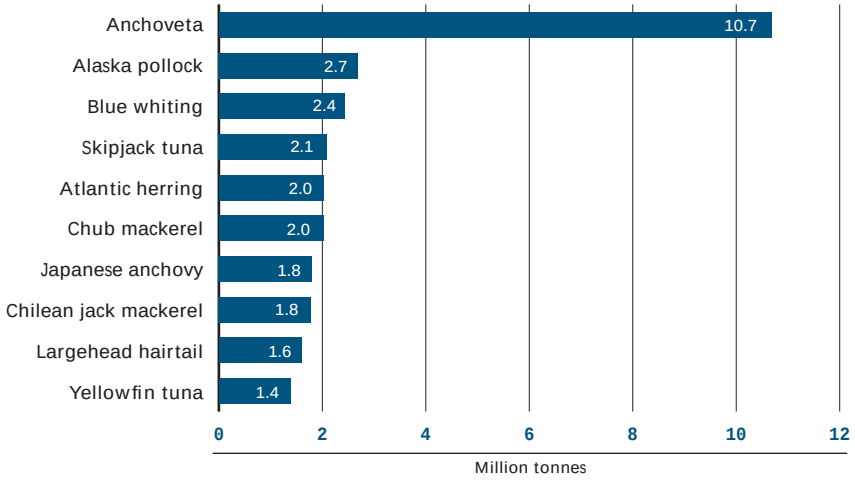
With production totalling about 10.7 million tonnes in 2004, the Peruvian anchoveta leads by far the ranking of the ten most caught marine species (Figure 6). However, there have been no dramatic changes in this ranking since 2002. The capelin (a small pelagic), which ranked fourth in 2002, had dropped from the list by 2004 and was replaced by the yellowfin tuna. Blue whiting and chub mackerel gained some places to the detriment of Japanese anchovy and Chilean jack mackerel.

Catches of oceanic tunas have remained fairly stable since 2002, whereas total catch of deep-water species and of other epipelagic species, mostly oceanic squids, increased by over 20 percent between 2002 and 2004. The share of oceanic catches in the total marine catch exceeded 12 percent in both 2003 and 2004. Box 1 (see pp. 12–13) provides further information on oceanic species.

Regarding trends by species groups, catches of shrimps and cephalopods increased impressively in the decade to 2004 (by 47.2 and 28.4 percent, respectively) and at the end of the decade they both attained the highest ever totals at about 3.6 and 3.8 million tonnes. For the shrimp group, an analysis of species trends is difficult as large quantities of catches are reported as unidentified shrimps. Within the cephalopods, increased catches of jumbo flying squid and of “various squid not

Figure 6

Marine capture fisheries production: top ten species in 2004




identified" from the Pacific compensated for the collapse of Argentine shortfin squid catches in the Atlantic. Total catches of both tuna and shark decreased in 2004 after having reached a peak in 2003.

When analysing catch trends for individual species, it should be kept in mind that a trend may be altered either by underestimation caused by a portion of catches being reported at the unspecified level or, conversely, by improvements in the species breakdown being used to report catch statistics. Although the number of species items included in the FAO capture database has been growing at an average annual rate of 5 percent over the past eight years and the percentage of catches reported at the species level has increased in recent years, about 37 percent of global catches are still not reported at the species level. Some 27 percent are reported at higher taxonomic levels and 10 percent are included under the category "marine fishes not identified".

### World inland capture fisheries production

After a minor decrease in 2002, total global inland catches rose again in 2003 and 2004, reaching a total of 9.2 million tonnes in the latter year. Africa and Asia together continue to contribute about 90 percent of the world total (Figure 7) and their shares are also fairly stable. Inland fisheries, however, seem to be in crisis in Europe, where the total catches have decreased by 30 percent since 1999. The decline in professional fishing in European inland waters can be attributed partly to competition with other human activities in the use of inland water resources and also to the falling economic viability of many commercial inland fisheries. A considerable portion of catches comes from the recreational fishery. Statistics on inland catches in developed countries published by FAO are generally based on information made available by national correspondents, and total catches may vary significantly depending on whether or not the correspondent includes data on recreational catches.

The contrast in the importance and role played by inland fisheries in developed and developing countries (in the latter they are an important source of animal proteins in the poor rural areas) can be further noted by grouping countries by economic class (Table 3). China and other developing countries accounted for 94.5 percent of the global inland catches in 2004, while the combined share of the economies in transition and industrialized countries decreased to 5.5 percent.

The top ten producer countries in 2004 (Figure 8) remained the same as in 2002. Myanmar, the United Republic of Tanzania and Uganda (the last having improved the coverage of its data collection system, leading to an increase in the production registered) gained positions in the ranking whereas Cambodia, Egypt and Indonesia moved down. Unfortunately, many countries still encounter great difficulties in

Box 1

## Fishery development phases of oceanic species

Fishing on the high seas continues to attract the attention of international organizations, non-governmental organizations (NGOs) and the general public, all of which have a growing interest in management of high sea resources[1] and a general concern for overfishing. High sea resources are defined as those occurring outside the exclusive economic zones (EEZs), and generally extend 200 nautical miles into the sea.

Unfortunately, it is not possible to extract from the FAO global fisheries statistics database a precise estimate of capture production from the high seas, as catch statistics are reported by broad fishing areas whose boundaries are not directly comparable with those of the EEZs. Thus, the available data do not reveal whether or not the fish were caught within or outside the EEZs. However, as catch statistics for oceanic species are available in the FAO capture database, these can be used to analyse the catch trends and fishery development phases of this group of species, which are fished mostly outside the continental shelves.

Oceanic species can be broken into epipelagic species and deep-water species. The number of species classified as deep-water species continues to increase, reaching 115 in 2004, while the number of epipelagic species remained stable at 60. The improved breakdown of deep-water species reported in national catch statistics parallels the increase that occurred for shark species in recent years. Possible reasons may include a growing global awareness that vulnerable species need to be protected by serious management measures and these cannot be formulated and agreed unless basic information such as catch statistics is systematically collected.

In a recent FAO study,[2] a method to identify and study phases of fishery development was applied to the 1950–2004 catch data series of oceanic species. The total catch trends (Figure A) show that oceanic epipelagic catches increased fairly steadily during the whole period, whereas fisheries for deep-water resources only started developing significantly in the late 1970s. This was made possible by technological developments applicable to fishing in deeper waters, but was also prompted by the need to exploit new fishing grounds following reduced opportunities owing to extended jurisdictions and declining resources in coastal areas. A comparative analysis of the development phases (Figures B and C) shows in greater detail that by the late 1960s the oceanic epipelagic resources classified as "undeveloped" had fallen to zero. This did not happen until the late 1970s for the oceanic deep-water resources. During the same 20-year period, the percentage of deep-water species classified as "senescent" exceeded that of epipelagic species and has continued to remain higher ever since. This result may be considered as further evidence that deep-water species are generally very vulnerable to overexploitation, mainly on account of their slow growth rates and late age at first maturity.

[1] For example, the United Nations Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, held in New York, United States of America, from 22 to 26 May 2006. (See also pp. 120–125.)

[2] FAO. 2006. *The state of world highly migratory, straddling and other high seas fisheries resources, and associated species*, by J.-J. Maguire, M. Sissenwine, J. Csirke, R. Grainger and S. Garcia. FAO Fisheries Technical Paper No. 495. Rome.

Figure A

World catches of oceanic species (epipelagic and deep-water) occurring principally in high seas areas

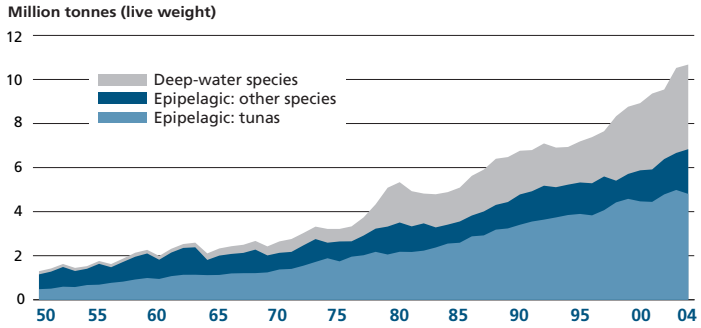



Figure B

Percentage of oceanic epipelagic resources in various phases of fishery development, 1950–2004

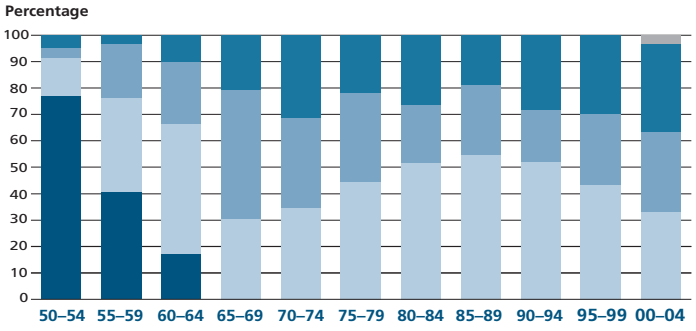



Figure C

Percentage of oceanic deep–water resources in various phases of fishery development, 1950–2004

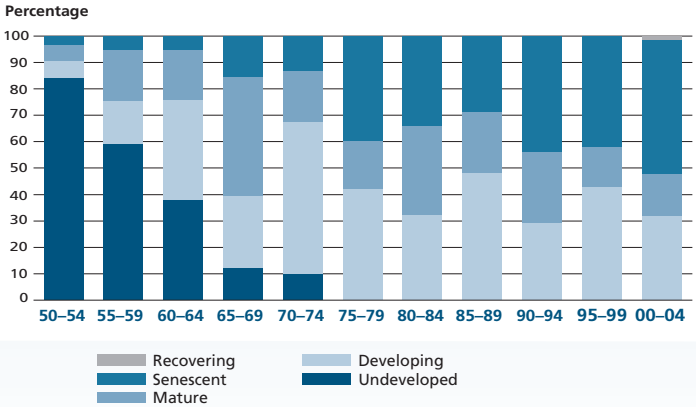
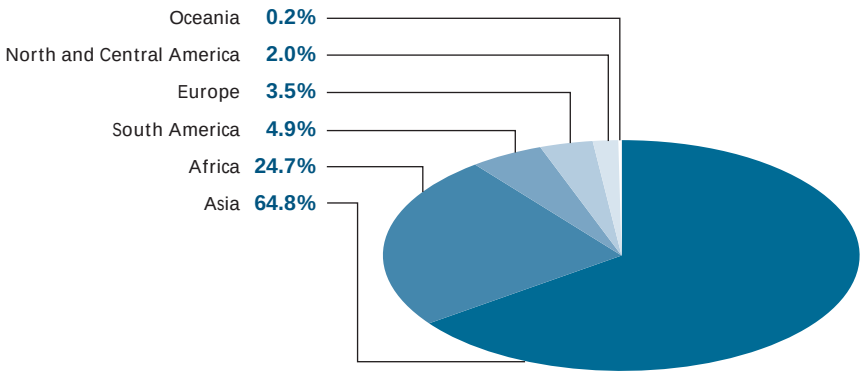


Figure 7

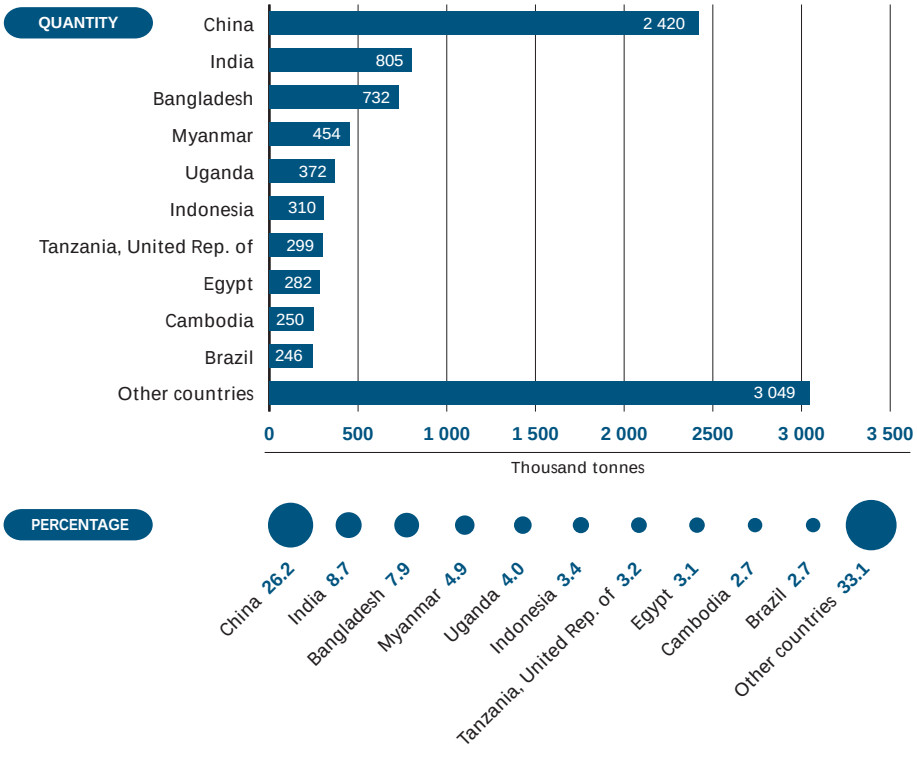
Inland capture fisheries by continent in 2004




*Note:* World inland capture fisheries production amounted to 9.2 million tonnes in 2004.

Figure 8

Inland capture fisheries: top ten producer countries in 2004




managing and funding the collection of inland capture statistics. For example, despite the fact that African lakes and rivers provide food to a large number of inhabitants and also revenues from fish exported outside Africa, it was necessary for FAO to estimate the 2004 inland total catch for half of the African countries where inland fishing is known to take place.

Table 3
Inland capture fishery production by economic class

| | Production in 2004 | |
|---|---|---|
| | *(Million tonnes)* | *(Percentage share of total)* |
| China | 2.42 | 26.2 |
| Other developing countries | 6.29 | 68.2 |
| Economies in transition | 0.29 | 3.2 |
| Industrial countries | 0.22 | 2.3 |
| **Total** | **9.22** | |

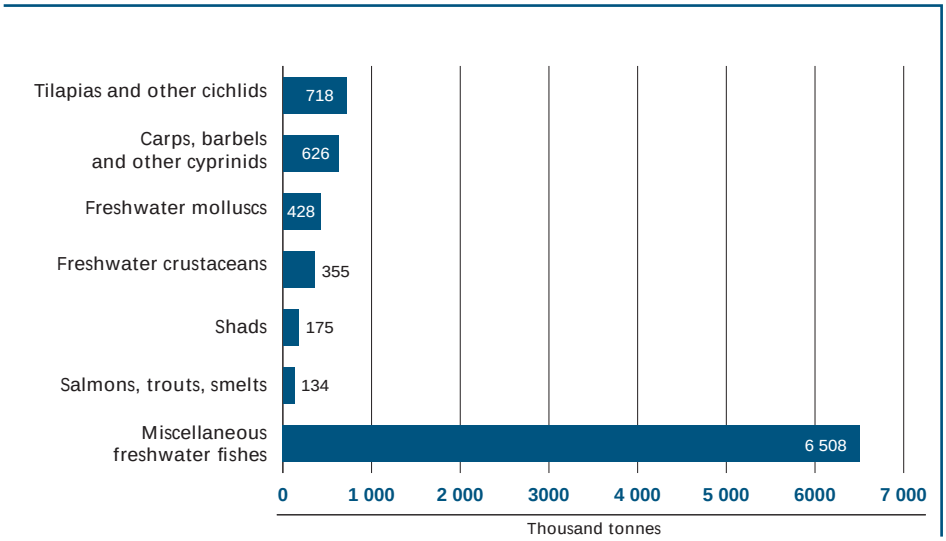
Trend analysis by species or species groups of the inland catch data in the FAO database risks being biased for two main reasons: the very poor species breakdown reported by many countries and the recent large fluctuations within the data for major items in the inland catch statistics reported by China, which represents over one-quarter of the global production.

In 2003 and 2004, global inland catches classified as "freshwater fishes not elsewhere included" again exceeded 50 percent of the total, and only about 19 percent of the total inland catch was reported at the species level. This has negative consequences as catch information by species is required for management purposes. In countries where inland fisheries are significant for food security and economic development, particularly in Africa and Asia, mismanagement of inland fisheries would as a rule lead to economic losses far greater than the expenditures needed to improve quality and detail of inland catch statistics significantly.

Following several years of collaboration with FAO, the species breakdown of the inland and marine catch statistics reported by China has improved. However, capture production trends of the three major inland species groups caught in China (i.e. fishes, crustaceans and molluscs) changed markedly in 2003 and 2004. The halving of "freshwater crustaceans" catches reported by China in 2004, following an extremely high peak in 2002, caused this species group to drop from second to fifth place in the world ranking (Figure 9). Global catches of tilapias and carps have been rising over the past two years, while the capture of shads (a species that tends to suffer from the effects of environmental alterations as the fish migrate between waters with different salinities) in 2004 were 12 percent below the quantities reported for 2002.

Figure 9

Inland capture fisheries: major species groups in 2004



## AQUACULTURE

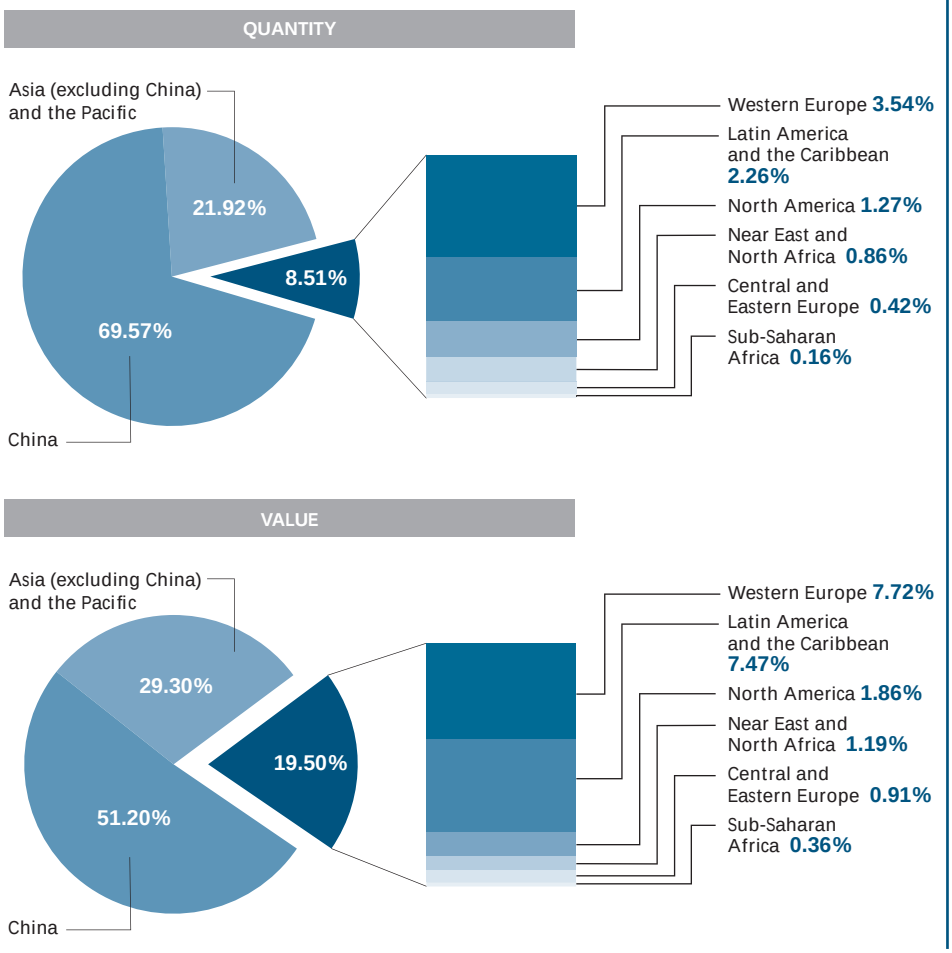
### Aquaculture production

The contribution of aquaculture to global supplies of fish, crustaceans, molluscs and other aquatic animals[3] continues to grow, increasing from 3.9 percent of total production by weight in 1970 to 27.1 percent in 2000 and 32.4 percent in 2004. Aquaculture continues to grow more rapidly than all other animal food-producing sectors. Worldwide, the sector has grown at an average rate of 8.8 percent per year since 1970, compared with only 1.2 percent for capture fisheries and 2.8 percent[4] for terrestrial farmed meat production systems over the same period. Production from aquaculture has greatly outpaced population growth, with per capita supply from aquaculture increasing from 0.7 kg in 1970 to 7.1 kg in 2004, representing an average annual growth rate of 7.1 percent.

World aquaculture (food fish and aquatic plants) has grown significantly during the past half-century. From a production of below 1 million tonnes in the early 1950s, production in 2004 was reported to have risen to 59.4 million tonnes, with a value of US$70.3 billion. This represents an average annual increase of 6.9 percent in quantity and 7.7 percent in value over reported figures for 2002. In 2004, countries in the Asia and the Pacific region accounted for 91.5 percent of the production quantity and 80.5 percent of the value. Of the world total, China is reported to account for 69.6 percent of the total quantity and 51.2 percent of the total value of aquaculture production (Figure 10).[5]

Figure 10

Aquaculture production by regional grouping in 2004



In terms of food fish supply, the aquaculture sector in the world excluding China produced about 15 million tonnes of farmed aquatic products in 2004, compared with about 54 million tonnes from capture fisheries destined for direct human consumption. Corresponding figures reported for China were about 31 million tonnes from aquaculture and 6 million tonnes from capture fisheries – a powerful indication of the dominance of aquaculture in China.

Production within each region is diverse. In the Asia and the Pacific region, aquaculture production from China, South Asia and most of Southeast Asia consists primarily of cyprinids, while production from the rest of East Asia consists of high-value marine fish. In global terms, some 99.8 percent of cultured aquatic plants, 97.5 percent of cyprinids, 87.4 percent of penaeids and 93.4 percent of oysters come from Asia and the Pacific. Meanwhile, 55.6 percent of the world's farmed salmonids come from Western Europe, mainly the northern part of the continent. However, carps dominate in the Central and Eastern European regions, both in quantity and in value.

In North America, channel catfish is the top aquaculture species in the United States of America, while Atlantic and Pacific salmon dominate in Canada. In Latin America and the Caribbean, over the past decade, salmonids have overtaken shrimp as the top aquaculture species group following disease outbreaks in major shrimp-producing areas and rapid growth in salmon production in Chile.

The sub-Saharan Africa region continues to be a minor player in aquaculture despite its natural potential. Even aquaculture of tilapia, which is native to the continent, has not developed significantly. Nigeria leads in the region, with reported production of 44 000 tonnes of catfish, tilapia and other freshwater fishes. There are some encouraging signs in the continent: black tiger shrimp (*Penaeus monodon*) in Madagascar and *Eucheuma* seaweed in the United Republic of Tanzania are thriving, and production of niche species such as abalone (*Haliotis* spp.) in South Africa is increasing. In the Near East and North Africa, Egypt is by far the dominant country in terms of production (providing 92 percent of the regional total) and is now the second biggest tilapia producer after China and the world's top producer of mullets.

The top ten producing countries for food fish supply from aquaculture in 2004 are indicated in Table 4 along with the top ten countries in terms of annual growth in aquaculture production for the two-year period 2002–04. All regions showed increases in production from 2002 to 2004, led by the Near East and North Africa region and Latin America and the Caribbean with 13.5 and 9.6 percent average annual growth, respectively.

World aquatic plant production in 2004 reached 13.9 million tonnes (US$6.8 billion), of which 10.7 million tonnes (US$5.1 billion) originated from China, 1.2 million tonnes from the Philippines, 0.55 million tonnes from the Republic of Korea and 0.48 million tonnes from Japan. Japanese kelp (*Laminaria japonica* – 4.5 million tonnes) showed the highest production followed by Wakame (*Undaria pinnatifida* – 2.5 million tonnes) and Nori (*Porphya tenera* – 1.3 million tonnes). An additional 2.6 million tonnes were reported by countries as "aquatic plants" and not further specified. The production of aquatic plants increased rapidly from the 2002 total of 11.6 million tonnes, primarily as a result of large production increases in China.[6]

The growth in production of the different major species groups continues, although the increases seen so far this decade are less dramatic than the extraordinary growth rates achieved in the 1980s and 1990s (Figure 11, Table 5). The period 2000–04 has seen strong growth in production of crustaceans, in particular, and of marine fish. Growth rates for the production of the other species groups have begun to slow and the overall rate of growth, while still substantial, is not comparable with the significant rate increases seen in the previous two decades. Thus, while the trend for the near future appears to be one of continued increases in production, the rate of these increases may be moderating. Figure 12 presents an overview of aquaculture production in terms of quantity and value by major species group for 2004.

Table 4
Top ten aquaculture producers of food fish supply: quantity and emerging growth

| Producer | 2002 | 2004 | APR |
|---|---|---|---|
| | (Tonnes) | | (Percentage) |
| **Top ten producers in terms of quantity, 2004** | | | |
| China | 27 767 251 | 30 614 968 | 5.0 |
| India | 2 187 189 | 2 472 335 | 6.3 |
| Viet Nam | 703 041 | 1 198 617 | 30.6 |
| Thailand | 954 567 | 1 172 866 | 10.8 |
| Indonesia | 914 071 | 1 045 051 | 6.9 |
| Bangladesh | 786 604 | 914 752 | 7.8 |
| Japan | 826 715 | 776 421 | -3.1 |
| Chile | 545 655 | 674 979 | 11.2 |
| Norway | 550 209 | 637 993 | 7.7 |
| United States of America | 497 346 | 606 549 | 10.4 |
| TOP TEN SUBTOTAL | 35 732 648 | 40 114 531 | 6.0 |
| REST OF THE WORLD | 4 650 830 | 5 353 825 | 7.3 |
| **TOTAL** | **40 383 478** | **45 468 356** | **6.1** |
| **Top ten producers in terms of growth, 2002–04** | | | |
| Myanmar | 190 120 | 400 360 | 45.1 |
| Viet Nam | 703 041 | 1 198 617 | 30.6 |
| Turkey | 61 165 | 94 010 | 24.0 |
| Netherlands | 54 442 | 78 925 | 20.4 |
| Republic of Korea | 296 783 | 405 748 | 16.9 |
| Iran (Islamic Rep. of) | 76 817 | 104 330 | 16.5 |
| Egypt | 376 296 | 471 535 | 11.9 |
| Chile | 545 655 | 674 979 | 11.2 |
| Thailand | 954 567 | 1 172 866 | 10.8 |
| United States of America | 497 346 | 606 549 | 10.4 |

*Note:* Data exclude aquatic plants. APR refers to the average annual percentage growth rate for 2002–04.

Table 5
World aquaculture production: average annual rate of growth for different species groups

| Time period | Crustaceans | Molluscs | Freshwater fish | Diadromous fish | Marine fish | Overall |
|---|---|---|---|---|---|---|
| | (Percentage) | | | | | |
| **1970–2004** | **18.9** | **7.7** | **9.3** | **7.3** | **10.5** | **8.8** |
| 1970–1980 | 23.9 | 5.6 | 6.0 | 6.5 | 14.1 | 6.2 |
| 1980–1990 | 24.1 | 7.0 | 13.1 | 9.4 | 5.3 | 10.8 |
| 1990–2000 | 9.1 | 11.6 | 10.5 | 6.5 | 12.5 | 10.5 |
| **2000–2004** | **19.2** | **5.3** | **5.2** | **5.8** | **9.6** | **6.3** |

The top ten species groups in terms of production quantity and percentage increase in production quantity from 2002 to 2004 are shown in Table 6. Production of carps far exceeded that for all other species groups, accounting for over 40 percent (18.3 million tonnes) of total production of fish, crustaceans and molluscs in 2004. Combined, the top ten species groups account for 90.5 percent of the total aquaculture contribution to fisheries food supply. The largest production for an individual species was the Pacific cupped oyster (*Crassostrea gigas* – 4.4 million tonnes), followed by three species of

Figure 11

Trends in world aquaculture production: major species groups

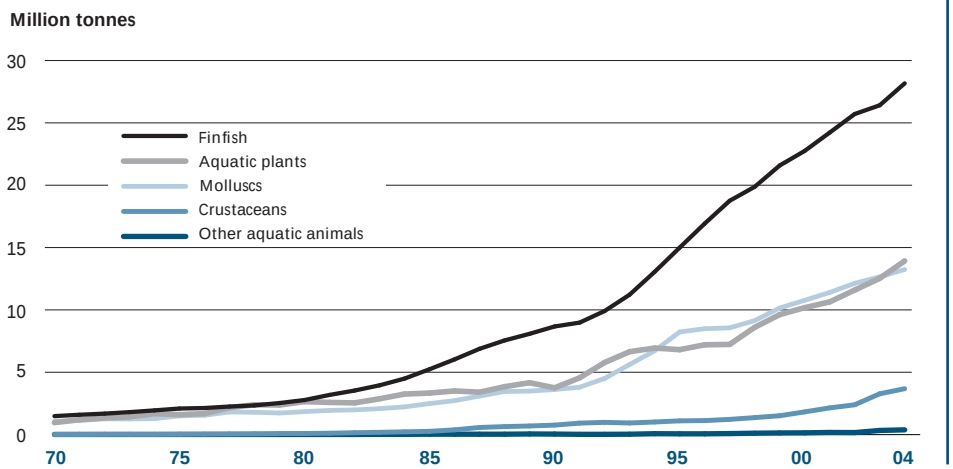
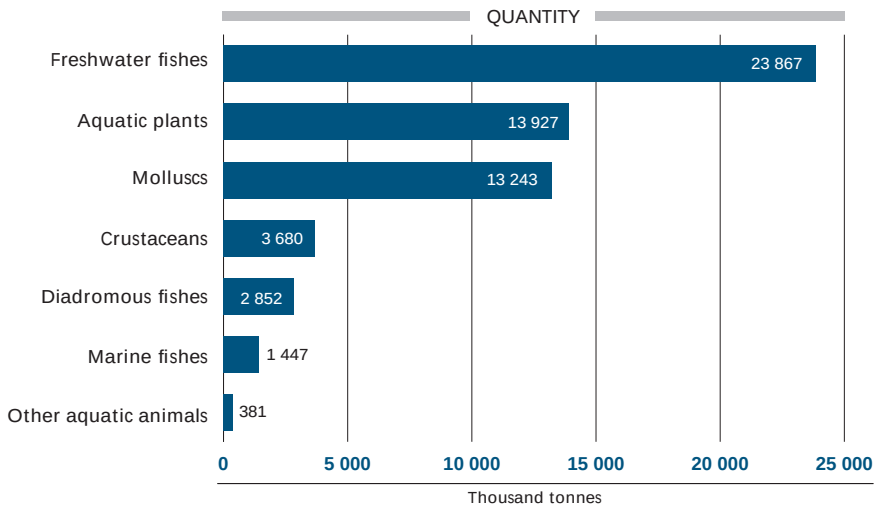



Figure 12

World aquaculture production: major species groups in 2004



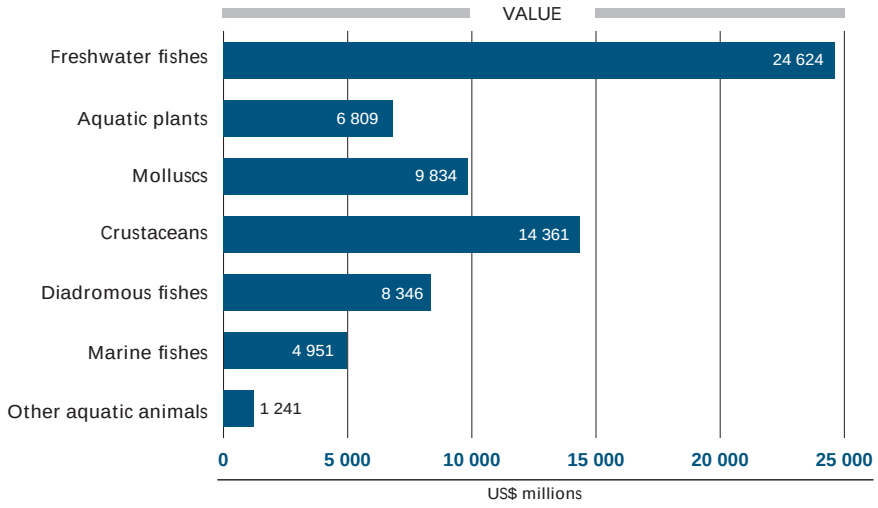



Table 6
Top ten species groups in aqualculture production: quantity and emerging growth

| Species group | 2002 | 2004 | APR |
|---|---|---|---|
| | (Tonnes) | | (Percentage) |
| **Top ten species groups in terms of aquaculture production, 2004** | | | |
| Carps and other cyprinids | 16 673 155 | 18 303 847 | 4.8 |
| Oysters | 4 332 357 | 4 603 717 | 3.1 |
| Clams, cockles, arkshells | 3 457 510 | 4 116 839 | 9.1 |
| Miscellaneous freshwater fishes | 3 763 902 | 3 739 949 | -0.3 |
| Shrimps, prawns | 1 495 950 | 2 476 023 | 28.7 |
| Salmons, trouts, smelts | 1 791 061 | 1 978 109 | 5.1 |
| Mussels | 1 700 871 | 1 860 249 | 4.6 |
| Tilapias and other cichlids | 1 483 309 | 1 822 745 | 10.9 |
| Scallops, pectens | 1 228 692 | 1 166 756 | -2.6 |
| Miscellaneous marine molluscs | 1 389 586 | 1 065 191 | -12.4 |
| **Top ten species groups in terms of growth in production of fish, crustaceans and molluscs, 2002–04** | | | |
| Sea urchins and other echinoderms | 25 | 60 852 | 4 833.6 |
| Abalones, winkles, conchs | 2 970 | 287 720 | 884.3 |
| Frogs and other amphibians | 3 074 | 76 876 | 400.1 |
| Freshwater molluscs | 13 414 | 142 346 | 225.8 |
| Sturgeons, paddlefishes | 3 816 | 15 551 | 101.9 |
| Miscellaneous aquatic invertebrates | 12 593 | 42 159 | 83.0 |
| Flounders, halibuts, soles | 35 513 | 109 342 | 75.5 |
| Miscellaneous coastal fishes | 386 160 | 878 589 | 50.8 |
| Miscellaneous demersal fishes | 16 638 | 31 531 | 37.7 |
| Shrimps, prawns | 1 495 950 | 2 476 023 | 28.7 |

*Note:* Data exclude aquatic plants. APR refers to the average annual percentage growth rate for 2002–04.

carp – the silver carp (*Hypophthalmichthys molitrix* – 4.0 million tonnes), the grass carp (*Ctenopharyngodon idellus* – 3.9 million tonnes) and the common carp (*Cyprinus carpio* – 3.4 million tonnes). In terms of value, shrimp culture is second in importance and has increased substantially in the 2002–04 period.

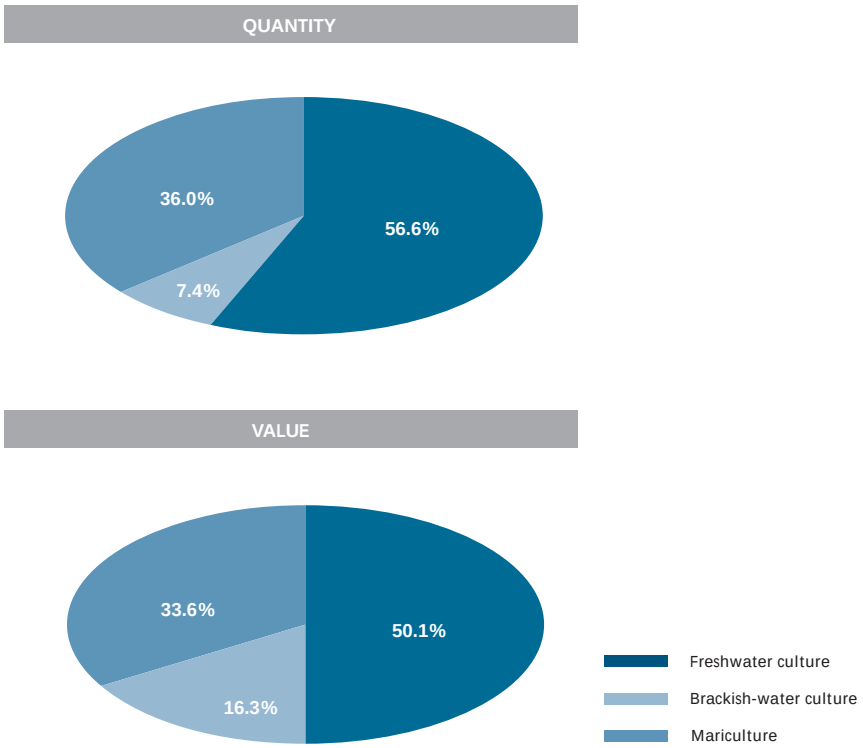
The increasing diversity of aquaculture production can be seen in the list of species groups registering the largest growth from 2002 to 2004. Sea urchins and other echinoderms lead the list with a remarkable increase in reported production from 25 tonnes in 2002 to 60 852 tonnes in 2004. In reality, while this does represent an area of emerging activity in aquaculture, this item also reflects an effort made by China to improve its reporting of aquaculture data. Beginning in 2003, China greatly expanded the number of species reported in its data, including 15 new freshwater species and 13 new marine species. This resulted in corresponding decreases in the reporting of production in aggregated, "unspecified" groupings.

Most aquaculture production of fish, crustaceans and molluscs continues to derive from the freshwater environment (56.6 percent by quantity and 50.1 percent by value) (Figure 13). Mariculture contributes 36.0 percent of production quantity and 33.6 percent of the total value. While much of the marine production consists of high-value finfish, there is also a large amount of relatively low-priced mussels and oysters.[7] Although brackish-water production represented only 7.4 percent of production quantity in 2004, it contributed 16.3 percent of the total value, reflecting the prominence of high-value crustaceans and finfish.

From 1970 to 2004, Chinese inland water aquaculture production increased at an average annual rate of 10.8 percent, compared with 7.0 percent in the rest of the world.[8] Similarly, during the same period, Chinese aquaculture production in marine areas, excluding aquatic plants, increased at an average annual rate of 10.7 percent

Figure 13

World aquaculture production of fish, crustaceans and molluscs in 2004: breakdown by environment




*Note:* Data exclude aquatic plants.

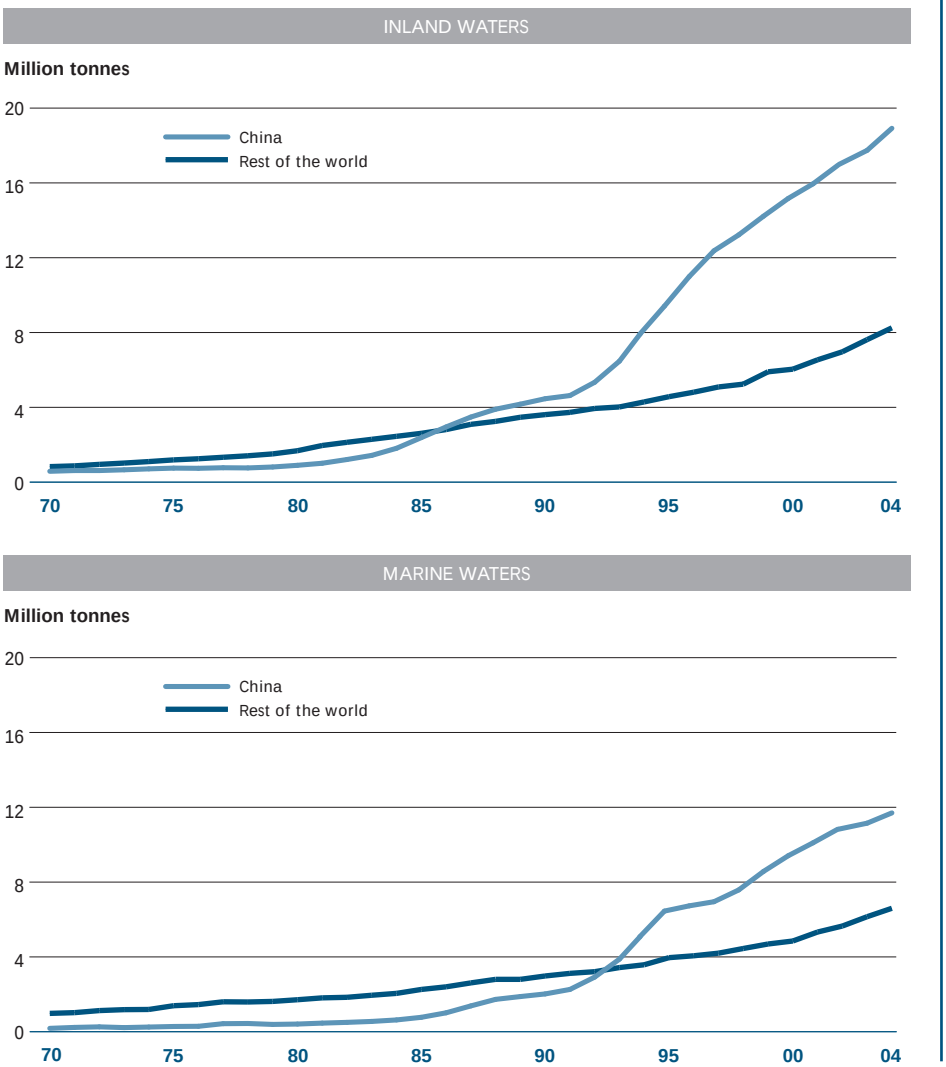
compared with 5.9 percent in the rest of the world. Figure 14 shows trends in inland and marine aquaculture production for China and the rest of the world.

Unlike terrestrial farming systems, where the bulk of global production is based on a limited number of animal and plant species, over 240 different farmed aquatic animal and plant species were reported in 2004, an increase of 20 species compared with the number reported in 2002. These 240 species represent 94 families; moreover, this diversity is probably underestimated, as 8.9 million tonnes (15.1 percent) of global aquaculture production, including an additional 20 families, was not reported to the species level in 2004, and this "unspecified" group is likely to include species not yet recorded as being cultured. Of aquaculture reported to FAO to the species level, the top ten species account for 61.7 percent of total production and the top 25 species for 86.6 percent. These figures are lower than those for 2000 (68.1 percent and 91.0 percent, respectively), providing a further indication that species diversification in aquaculture is increasing.

It is noteworthy that the growth of aquaculture production of fish, crustaceans and molluscs within developing countries has exceeded the corresponding growth in developed countries, proceeding at an average annual rate of 10.2 percent since 1970. In contrast, aquaculture production within developed countries has been increasing at an average rate of 3.9 percent per year. In developing countries other than China, production has grown at an annual rate of 8.2 percent. In 1970, developing countries accounted for 58.8 percent of production, while in 2002 their share was 91.4 percent. In the period from 2002 to 2004, the trend was even more dramatic as production in developing countries other than China increased at an annual rate of 11.0 percent, compared with 5.0 percent for China and 2.3 percent for developed countries.

Figure 14

Aquaculture production in inland and marine waters




*Note:* Data exclude aquatic plants.

With the exception of marine shrimp, the bulk of aquaculture production within developing countries in 2004 comprised omnivorous/herbivorous fish or filter-feeding species. In contrast, approximately three-quarters of finfish culture production in developed countries was of carnivorous species.

## FISHERS AND FISH FARMERS

Millions of people around the world depend on fisheries and aquaculture, directly or indirectly, for their livelihoods. During the past three decades, the number of fishers and aquaculturists has grown faster than the world's population, and employment in the fisheries sector has grown faster than employment in traditional agriculture. In 2004, an estimated 41 million people (Table 7) worked (part time or full time) as fishers and fish farmers, accounting for 3.1 percent of the 1.36 billion people economically active in agriculture worldwide and representing a growth rate of 35 percent from the corresponding figure of 2.3 percent in 1990. The great majority of fishers and fish farmers are in developing countries, principally in Asia. Significant increases over recent decades, in particular in Asia, reflect the strong expansion of aquaculture activities. In 2004, the number of fish farmers accounted for one-quarter of the total number of fish workers. This figure is indicative, as some countries do not collect employment data

Table 7
World fishers and fish farmers by continent

| | 1990 | 1995 | 2000 | 2003 | 2004 |
|---|---|---|---|---|---|
| | | | (Thousands) | | |
| **Total** | | | | | |
| Africa | 1 832 | 1 950 | 2 981 | 2 870 | 2 852 |
| North and Central America | 760 | 777 | 891 | 841 | 864 |
| South America | 730 | 704 | 706 | 689 | 700 |
| Asia | 23 736 | 28 096 | 34 103 | 36 189 | 36 281 |
| Europe | 626 | 466 | 766 | 653 | 656 |
| Oceania | 55 | 52 | 49 | 50 | 54 |
| **World** | **27 737** | **32 045** | **39 495** | **41 293** | **41 408** |
| **Of which fish farmers[1]** | | | | | |
| Africa | 3 | 14 | 83 | 117 | 117 |
| North and Central America | 3 | 6 | 75 | 62 | 64 |
| South America | 66 | 213 | 194 | 193 | 194 |
| Asia | 3 738 | 5 986 | 8 374 | 10 155 | 10 837 |
| Europe | 20 | 27 | 30 | 68 | 73 |
| Oceania | 1 | 1 | 5 | 5 | 4 |
| **World** | **3 832** | **6 245** | **8 762** | **10 599** | **11 289** |

[1] Data for 1990 and 1995 were reported by only a limited number of countries and therefore are not comparable with those for the following years.

separately for the two sectors and some other countries' national systems do not yet account for fish farming.

China is by far the country with the highest number of fishers and fish farmers, reported to be 13.0 million in 2004 (31 percent of the world total). Of these, 4.5 million were fish farmers (an increase of 158 percent compared with numbers in 1990), while 8.5 million worked in capture fisheries. Current fleet-size reduction programmes in China, aimed at reducing overfishing, are reducing the number of full-time and part-time fishers. The number of people engaged in capture fisheries declined by 13 percent during the period 2001–04 and there are plans to transfer a proportion of fishers to other jobs by 2007. The policy tools to accomplish this move include, among others, scrapping vessels and training redundant fishers in fish farming. In 2004, other countries with a significant number of fishers and fish farmers were India, Indonesia and Viet Nam.

While the number of people employed in fisheries and aquaculture has been growing steadily in most low- and middle-income countries, the numbers in most industrialized economies have been declining or have remained stationary (Table 8). In Japan and Norway the numbers of fishers have more than halved between 1970 and 2004, with a decrease of 58 percent and 54 percent, respectively. In many industrialized countries, the decline has occurred mainly for fishers working in capture fisheries, while the number of fish farmers has increased.

Estimates indicate that there were about 1 million fishers in industrialized countries in 2004, representing a decline of 18 percent compared with 1990 figures. Productivity increases and falling recruitment count among the various reasons for these shrinking numbers.

In recent decades, growing investment in costly onboard equipment, resulting in higher operational efficiencies and less need for seagoing personnel, has led to a significant decline in the number of people employed at sea.

Moreover, the average age of active fishers is increasing as a result of the rapid decline of recruitment into capture fisheries. For example, according to the 2003 Fishery Census of Japan, 47 percent of male fishers were 60 years of age or older in 2004, 23 percent higher than in 1988. At the same time, the share of the younger

Table 8
Number of fishers and fish farmers in selected countries

| Country | Fishery | | 1990 | 1995 | 2000 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|
| **WORLD** | FI + AQ | (number) | **27 737 435** | **32 045 098** | **39 495 195** | **41 292 679** | **41 407 771** |
| | | *(index)* | ***70*** | ***81*** | ***100*** | ***105*** | ***105*** |
| | FI | (number) | 23 905 853 | 25 799 922 | 30 733 366 | 30 693 835 | 30 118 720 |
| | | *(index)* | *78* | *84* | *100* | *100* | *98* |
| | AQ | (number) | 3 831 582 | 6 245 176 | 8 761 829 | 10 598 844 | 11 289 051 |
| | | *(index)* | *44* | *71* | *100* | *121* | *129* |
| China | FI + AQ | (number) | 9 092 926 | 11 428 655 | 12 935 689 | 13 162 812 | 13 018 332 |
| | | *(index)* | *70* | *88* | *100* | *102* | *101* |
| | FI | (number) | 7 351 927 | 8 759 162 | 9 213 340 | 8 838 638 | 8 528 361 |
| | | *(index)* | *80* | *95* | *100* | *96* | *93* |
| | AQ | (number) | 1 740 999 | 2 669 493 | 3 722 349 | 4 324 174 | 4 489 971 |
| | | *(index)* | *47* | *72* | *100* | *116* | *121* |
| Indonesia | FI + AQ | (number) | 3 617 586 | 4 568 059 | 5 247 620 | 6 052 597 | 6 240 420 |
| | | *(index)* | *69* | *87* | *100* | *115* | *119* |
| | FI | (number) | 1 995 290 | 2 463 237 | 3 104 861 | 3 782 397 | 3 950 420 |
| | | *(index)* | *64* | *79* | *100* | *122* | *127* |
| | AQ[1] | (number) | 1 622 296 | 2 104 822 | 2 142 759 | 2 270 200 | 2 290 000 |
| | | *(index)* | *76* | *98* | *100* | *106* | *107* |
| Iceland | FI + AQ | (number) | 6 951 | 7 000 | 6 100 | 5 100 | 4 600 |
| | | *(index)* | *114* | *115* | *100* | *84* | *75* |
| Japan | FI + AQ | (number) | 370 600 | 301 440 | 260 200 | 295 921 | 230 990 |
| | | *(index)* | *142* | *116* | *100* | *114* | *89* |
| Norway | FI + AQ | (number) | 32 022 | 28 269 | 24 399 | 21 621 | 19 874 |
| | | *(index)* | *131* | *116* | *100* | *89* | *81* |
| | FI | (number) | 27 518 | 23 653 | 20 072 | 17 205 | 15 586 |
| | | *(index)* | *137* | *118* | *100* | *86* | *78* |
| | AQ | (number) | 4 504 | 4 616 | 4 327 | 4 416 | 4 288 |
| | | *(index)* | *104* | *107* | *100* | *102* | *99* |
| Peru | FI + AQ | (number) | 43 750 | 62 930 | 93 789 | 91 757 | 98 692 |
| | | *(index)* | *47* | *67* | *100* | *98* | *105* |
| | FI | (number) | ... | 60 030 | 91 226 | 88 967 | 95 512 |
| | | *(index)* | *...* | *66* | *100* | *98* | *105* |
| | AQ | (number) | ... | 2 900 | 2 563 | 2 790 | 3 180 |
| | | *(index)* | *...* | *113* | *100* | *109* | *124* |

*Note:* FI = fishing, AQ = aquaculture; index: 2000 = 100; ... = data not available.
[1] Data for 2003 and 20054 are FAO estimates.

group of fishers (under 40 years old), which represented one-quarter of the total number of marine fishers in Japan in 1982, had declined to 13.3 percent by 2003. The number of Japanese workers employed in offshore and distant-water fishing declined during the period 1998–2003 by 28 percent to 25 000 people in 2003.

In industrialized countries, younger workers seem reluctant to go to sea on fishing vessels. There are probably several reasons. For many young men, neither the salaries nor the quality of life aboard fishing vessels compares favourably with those of land-

based industries. Also, many will be aware of public concerns about the status of stocks and therefore see capture fisheries as having an uncertain future.

As a result, fishing firms in industrialized countries have begun to look elsewhere when recruiting personnel. In Europe, fishers from the economies in transition or from developing countries are starting to replace local fishers. Also in Japan, foreign workers have been allowed to work on Japanese distant-water fishing vessels under the "maru-ship system".[9]

A characteristic feature of employment in the fishing industry is the prevalence of occasional[10] or part-time employment, peaking in the months of the year when riverine, coastal and offshore resources are more abundant or available, but leaving time in seasonal lows for other occupations. This is especially true in fisheries for migratory species and those subject to seasonal weather variations. During the past three decades, the number of full-time fishers has declined while the number of part-time fishers has grown quite rapidly. This trend has been particularly marked in Asia.

It is not possible to obtain a comprehensive picture of the role of women in the fisheries sector from the available statistics. Millions of women around the world, particularly in developing countries, work in the sector. Women participate as entrepreneurs and by providing labour before, during and after the catch in both artisanal and commercial fisheries. Their labour often consists of making and mending nets, baskets and pots and baiting hooks. In fishing, women are rarely engaged in commercial offshore and deep-sea waters, but more commonly involved in fishing from small boats and canoes in coastal or inland waters – harvesting bivalves, molluscs and pearls, collecting seaweed and setting nets or traps. Women also play an important role in aquaculture, where they attend to fish ponds, feed and harvest fish, and collect prawn larvae and fish fingerlings. However, women's most important role in both artisanal and industrial fisheries is at the processing and marketing stages. In some countries, women have become important entrepreneurs in fish processing; in fact, most fish processing is performed by women, either in their own cottage-level industries or as wage labourers in the large-scale processing industry.

The fisheries sector, including aquaculture, is an important source of employment and income. However, employment in fishing and fish farming cannot be taken as the sole indication of the importance of fisheries to a national economy. The fishing industry also generates considerable employment in shipbuilding and shipyard operations; in the fishing gear industry; in the production of technological equipment; in aquaculture feed production; and in processing, packaging and transport. Unfortunately, statistics are not currently available for the total number of individuals providing inputs to fisheries and aquaculture through these activities.

## THE STATUS OF THE FISHING FLEET

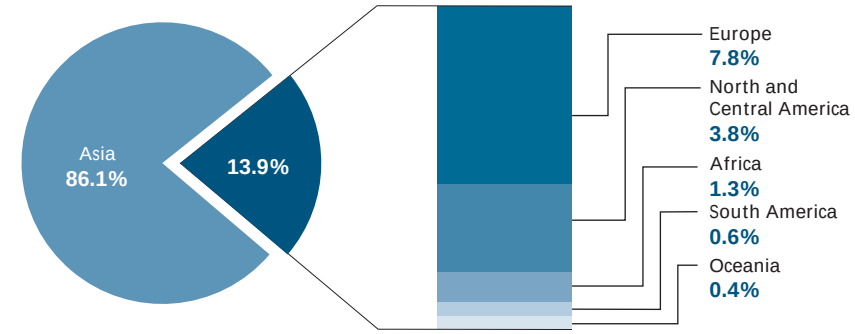
### Number of vessels

At the end of 2004, the world fishing fleet consisted of about 4 million units, of which 1.3 million were decked vessels of various types, tonnage and power, and 2.7 million were undecked (open) boats. While virtually all decked vessels were mechanized, only about one-third of the undecked fishing boats were powered, generally with outboard engines. The remaining two-thirds were traditional craft of various types, operated by sail and oars. About 86 percent of the decked vessels were concentrated in Asia, followed by Europe (7.8 percent), North and Central America (3.8 percent), Africa (1.3 percent), South America (0.6 percent) and Oceania (0.4 percent) (Figure 15).

Statistics on total tonnage and total power of world fishing fleets are not available on a global basis. Information on the number of fishing vessels and boats is largely derived from national registers and other administrative records, and may therefore include some non-operational units. At the same time, national administrative records often exclude smaller boats whose registration is not compulsory and/or whose fishing licences are granted by provincial or municipal authorities. Data made available to FAO by national respondents concerning these smaller fishing boats are often estimates; in such cases, respondents frequently keep the numbers constant over

Figure 15

Distribution of decked fishing vessels by continent




the years. In addition, reporting practices for fishing fleets operating in freshwaters vary among countries, with only a few countries making a clear distinction between marine and freshwater fleets. In view of all these factors, the currently available information has only limited value for monitoring and detecting global trends in fishing capacity.

Nevertheless, the issue of overcapacity in fishing fleets and their reduction to the levels that should be in balance with long-term sustainable exploitation of resources has received global attention during the past two decades. Many countries have adopted policies for limiting the growth of national fishing capacity in order to protect the aquatic resources and to make fishing economically viable for the harvesting enterprises. The European Economic Community in 1983 decided to tackle the problem by setting maximum levels of fishing capacity and/or effort on the part of Members. However, this policy was found to be unsatisfactory and cumbersome to manage and the European Union (EU) decided to replace this policy with the "Entry-Exit scheme" that has been in force since 2003. The scheme requires that all new fishing vessels be directly compensated by the withdrawal, without public aid, of equivalent capacity. The ten countries that joined the EU in 2004 are also subject to the "Entry-Exit scheme" and to the establishment of vessel registers.

In 2002, China adopted a five-year programme to delicense and scrap by 2007 30 000 fishing boats, or 7 percent of its commercial fleet. The programme, with funds worth the equivalent of US$33 million per year in compensations, is based on voluntary participation and targets the smaller vessels operating near-shore. A related regulation prevents the construction of new fishing vessels other than to replace an existing vessel that has a fishing licence. In the first year, 5 000 boats were scrapped and their licences withdrawn under this programme. Nevertheless, the numbers of commercial vessels reported to FAO in both 2003 and 2004 are above the number reported as being in operation in 2002.

There are indications that the size of the decked fleets of longstanding developed fishing nations, including Denmark, Iceland, Japan, Norway, the Russian Federation and the United Kingdom, has continued to decrease, especially those operating offshore and in distant waters. However, even in these countries, the rate of reduction of fishing power is generally less significant than the rate of reduction in the number of fishing vessels. This means that while there is a tendency towards smaller fleets in terms of number of vessels, the average size of vessels is increasing. The capacity adjustment process seems to lead to larger vessels that permit owners to improve economic efficiency and operational safety.

On the other hand, data from Indonesia and the Philippines indicate a continuous expansion of their fleets, and in the United States of America the number of vessels over 100 gross tonnage (GT) increased by 3.5 percent between 2003 and 2005. In South

America, while Argentina and Chile reduced the number of industrial vessels, most countries for which data are available have experienced a general growth of coastal fleets. As a result, the number of fishing vessels worldwide has remained fairly constant in recent years (Table 9).

### Fish carriers and the high seas fleet

There have been suggestions that the recent rapid rise of fuel prices will change the economics of the fishing industry, especially with regard to distant-water fishing. The use of fish carriers is likely to increase in an attempt to cut overall fuel costs by reducing the time fishing vessels spend steaming to and from the fishing grounds. According to the database of Lloyd's maritime information service, the countries reporting more than 60 fish carriers in 2005 were China, Japan, Panama and the Russian Federation. Forty-three fish carriers (6 percent of the total) were identified as "unknown" flag, among which 50 percent had previously been recorded as flying the flags of Belize or the Russian Federation.

Figure 16 shows the age distribution of fishing vessels and fish carriers above 100 GT operational at the end of 2005. The average age of the global fishing fleet above 100 GT continues to increase, with relatively small numbers of vessels being built in recent years. The pattern of fish carrier construction broadly follows that of the

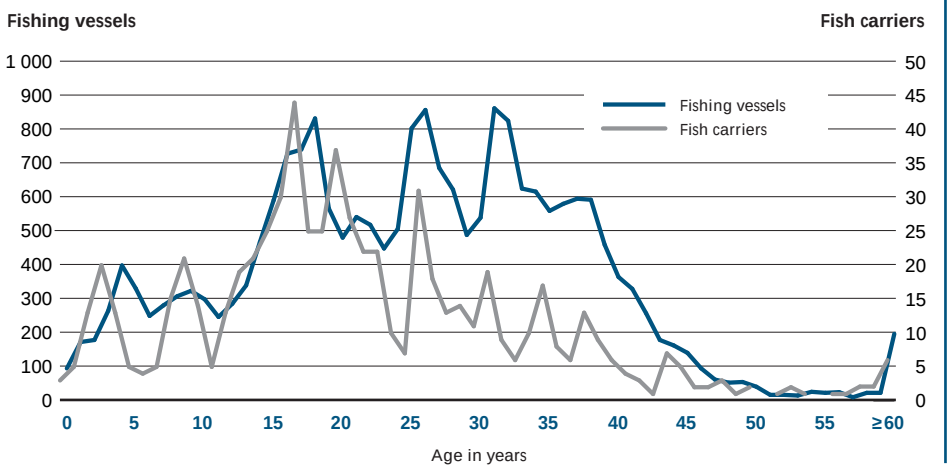
Table 9
Powered fishing fleets in selected countries

| | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|
| China | Number | 487 297 | 479 810 | 478 406 | 514 739 | 509 717 | 513 913 |
| | Tonnage *(GT)* | 6 849 326 | 6 986 159 | 6 933 949 | 7 225 660 | 7 115 195 | 7 139 746 |
| | Power *(kW)* | 14 257 891 | 14 570 750 | 14 880 685 | 15 735 824 | 15 506 720 | 15 861 838 |
| EU-15 | Number | 95 501 | 92 409 | 90 106 | 87 881 | 85 480 | 83 677 |
| | Tonnage *(GT)* | 2 022 244 | 2 014 053 | 1 965 306 | 1 906 718 | 1 882 597 | 1 791 195 |
| | Power *(kW)* | 7 632 221 | 7 507 699 | 7 295 386 | 7 097 720 | 6 941 077 | 6 787 611 |
| Iceland | Number | 892 | 955 | 947 | 940 | 939 | 927 |
| | Tonnage *(GT)* | 175 099 | 186 573 | 187 018 | 179 394 | 187 079 | 177 615 |
| | Power *(kW)* | 438 526 | 468 377 | 466 288 | 455 016 | 462 785 | 447 260 |
| Japan | Number | 337 600 | 331 571 | 325 229 | 320 010 | ... | ... |
| | Tonnage *(GT)* | 1 447 960 | 1 406 882 | 1 377 000 | 1 342 120 | ... | ... |
| | Power *(kW)* | ... | ... | ... | ... | ... | ... |
| Norway | Number | 13 017 | 11 922 | 10 641 | 9 911 | 8 184 | 7 723 |
| | Tonnage *(GT)* | 392 316 | 403 678 | 394 561 | 395 327 | 394 846 | 373 282 |
| | Power *(kW)* | 1 321 060 | 1 361 821 | 1 351 242 | 1 355 745 | 1 328 945 | 1 272 375 |
| Republic of Korea | Number | 89 294 | 89 347 | 89 327 | 88 521 | 87 203 | ... |
| | Tonnage *(GT)* | 917 963 | 880 467 | 812 629 | 750 763 | 721 398 | ... |
| | Power *(kW)* | 13 597 179 | 14 765 745 | 17 273 940 | 17 094 036 | 16 743 102 | ... |
| Russian Federation | Number | 2 653 | 2 607 | 2 625 | 2 533 | 2 458 | 2 256 |
| | Tonnage *(GT)* | 2 424 035 | 2 285 655 | 2 619 825 | 2 092 799 | 1 939 734 | 1 176 211 |
| | Power *(kW)* | 2 808 349 | 2 439 806 | 2 338 582 | 2 310 717 | 2 111 332 | 1 942 064 |

*Notes:*
In 2000–04, the combined marine catches of the above countries represented between 41 and 38 percent of the world total.
Some vessels may not be measured according to the 1969 International Convention on Tonnage Measurement of Ships.
The Icelandic data exclude undecked vessels.
The Japanese data refer to registered fishing boats operating in marine waters.
The Russian Federation data refer to powered decked vessels with a national licence.
*Sources:*
China: FAO fishery statistical inquiry.
EU-15: Eurostat.
Iceland: Statistics Iceland (http://www.statice.is).
Japan: *Japan Statistical Yearbook 2006* (http://www.stat.go.jp/english/data/nenkan/index.htm).
Republic of Korea: *Korea Statistical Yearbook 2005*, Vol. 52.
Norway: Statistics Norway (http://www.ssb.no) and Eurostat.
Russian Federation: FAO fishery statistical inquiry.

Figure 16

Age distribution of fishing vessels and fish carriers above 100 GT operational at the end of 2005




*Source:* Lloyd's.

fishing fleet, with increasing numbers of fish carriers being built up until the late 1980s followed by a decline. The pattern was broken in the outlier shown for 2002, when 12 fish carriers were built for delivery to Thailand.

Lloyd's data also indicate that in some countries, when a vessel is replaced the old one is exported, with the result that their fishing fleets are generally composed of vessels with a relatively low age. This group of countries includes Japan, Norway and Spain.

### Origins of the fleets

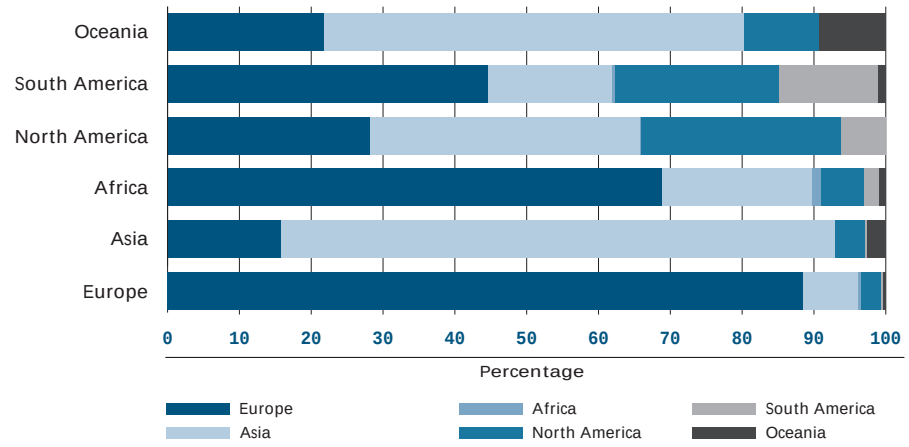
The Lloyd's maritime information service database also contains data about where a fishing vessel was built. Most of the major fishing nations also have major shipbuilding industries that supply their fishing vessels to local and foreign fishing companies. Japan, Peru, the Russian Federation, Spain and the United States of America, all of which are prominent shipbuilders, built more than 60 percent of fishing vessels above 100 GT currently in operation.

Most fishing vessels (78 percent) in operation at the end of 2005 have not changed flag since being launched, and more than two-thirds of them were built in the country where they are registered. In Japan, Peru, Poland, Spain and the United States of America, domestic shipbuilders have supplied over 90 percent of the national fishing fleets. The data for the United States of America obviously reflect the provisions of the Jones Act, which effectively does not allow fishing vessels to be imported into the country. Peru is unique in that it has a substantial fleet (over 650 vessels), of which the great majority of vessels were built, and remain, in the country, with few being exported to other countries. This is believed to be because the fleet consists of specialized Peruvian purse-seiners, which are not in demand in surrounding countries. The Peruvian fleet also has a very high age profile: 70 percent of the vessels are now over 30 years old, which is the average age at which fishing vessels are scrapped.

Nevertheless, some countries depend on foreign boatyards for the supply of vessels above 100 GT. Honduras, Indonesia, Morocco, Panama and the Philippines have more than 200 operational fishing vessels above 100 GT in the Lloyd's database, but most of them were built abroad. Figure 17 shows, by continent in which they are registered, where fishing vessels were built, also by continent. While the European countries, including the Russian Federation and Spain, provide the majority of fishing vessels in Europe and Africa, Asian countries, especially Japan, are the main suppliers of fishing vessels to other Asian and Pacific fishing fleets.

Figure 17

Distribution of shipbuilding areas for vessels registered in regions




*Source:* Lloyd's.

## THE STATUS OF FISHERY RESOURCES

### Marine fisheries

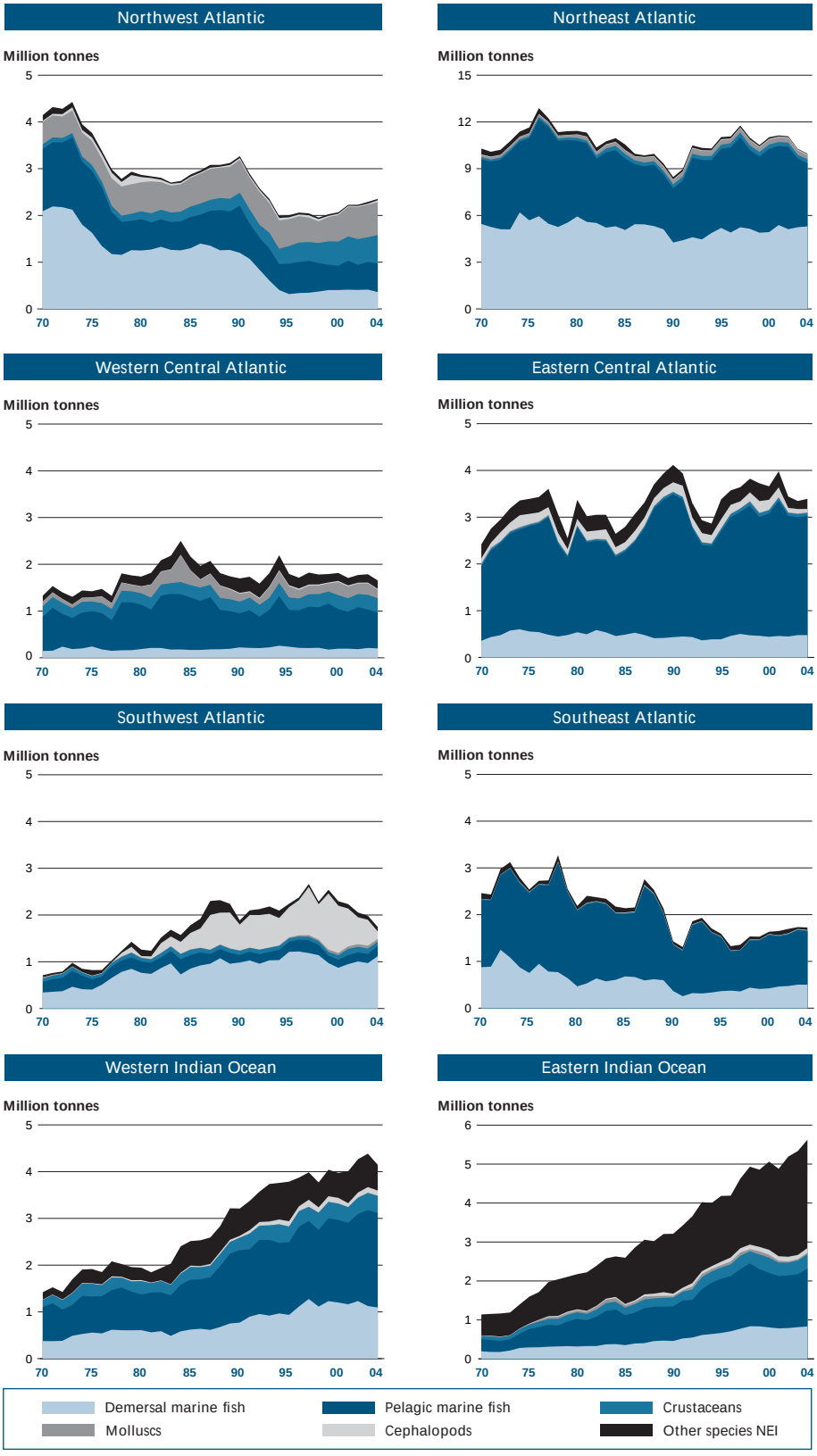
The global state of exploitation of the world marine fishery resources has tended to remain relatively stable over the past 10–15 years, even if changes have been reported for some fish stocks and specific areas (Figure 18). The overall examination of the state of stocks and groups of stocks for which information is available confirms that the proportions of overexploited and depleted stocks have remained unchanged in recent years, after the noticeable increasing trends observed in the 1970s and 1980s. It is estimated that in 2005, as in previous years, around one-quarter of the stock groups monitored by FAO were underexploited or moderately exploited (3 percent and 20 percent, respectively) and could perhaps produce more. About half of the stocks (52 percent) were fully exploited and therefore producing catches that were at or close to their maximum sustainable limits, with no room for further expansion. The other one-quarter were either overexploited, depleted or recovering from depletion (17 percent, 7 percent and 1 percent, respectively) and thus were yielding less than their maximum potential owing to excess fishing pressure exerted in the past, with no possibilities in the short or medium term of further expansion and with an increased risk of further declines and need for rebuilding.

Since FAO started monitoring the global state of stocks in 1974, there has been a consistent downward trend from almost 40 percent in 1974 to 23 percent in 2005 in the proportions of underexploited and moderately exploited stocks, which are those offering some potential for expansion. At the same time, there has been an increasing trend in the proportion of overexploited and depleted stocks, from about 10 percent in the mid-1970s to around 25 percent in the early 1990s, where it has stabilized until the present, while the proportions of fully exploited stocks declined from slightly over 50 percent in 1974 to around 45 percent in the early 1990s, increasing to 52 percent in 2005 (Figure 19).

Most of the stocks of the top ten species, which account in total for about 30 percent of the world capture fisheries production in terms of quantity (Figure 6 on p. 11), are fully exploited or overexploited and therefore cannot be expected to produce major increases in catches. This is the case for the anchoveta (*Engraulis ringens*), with two main stocks in the Southeast Pacific that are fully exploited and overexploited; the Alaska pollock (*Theragra chalcogramma*), which is fully exploited in the North Pacific; the blue whiting (*Micromesistius poutassou*), which is overexploited in the Northeast Atlantic; the Atlantic herring (*Clupea harengus*), with several stocks

Figure 18

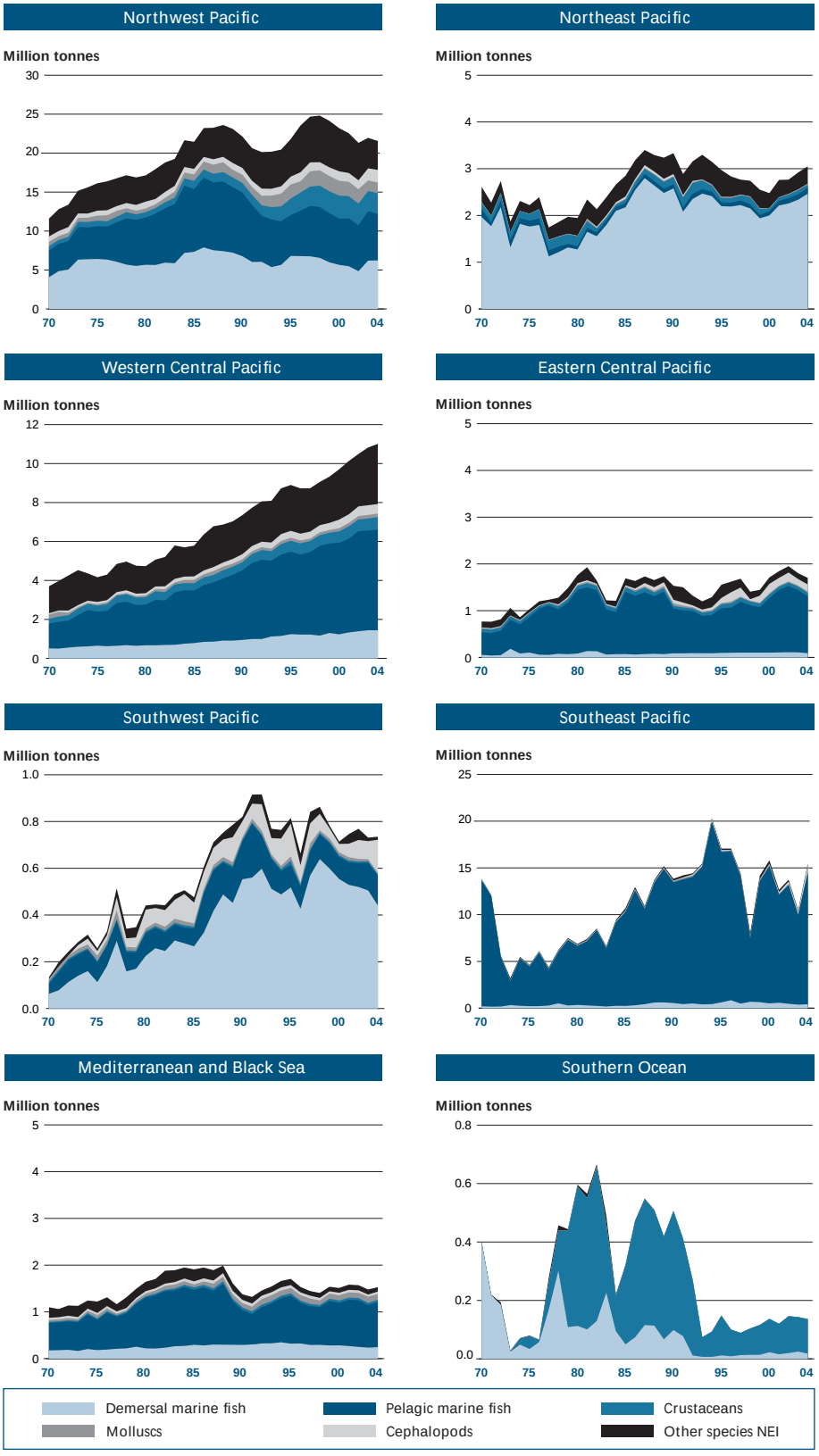
Capture fisheries production in marine areas




*(Continued)*

Figure 18 *(cont.)*

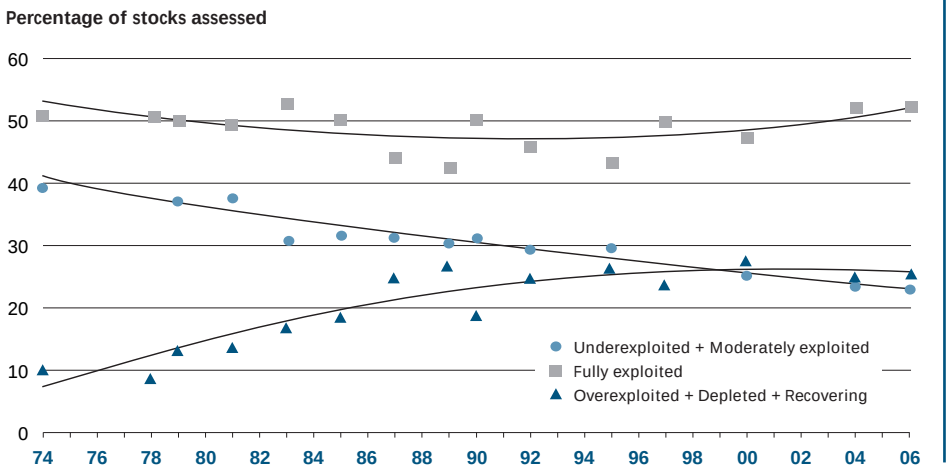
Capture fisheries production in marine areas




*Notes*: Data exclude aquatic plants and catches of marine mammals, sponges and corals, etc.
NEI = not elsewhere included.

Figure 19

Global trends in the state of world marine stocks since 1974




that are fully exploited and others that are recovering from depletion in the North Atlantic; the Japanese anchovy (*Engraulis japonicus*), which is fully exploited in the Northeast Pacific; the Chilean jack mackerel (*Trachurus murphyi*), which is fully exploited and overexploited in the Southeast Pacific; and the yellowfin tuna (*Thunnus albacares*), which is fully exploited in the Atlantic and Pacific Oceans and probably moderately to fully exploited in the Indian Ocean. Some stocks of skipjack tuna (*Katsuwonus pelamis*) are fully exploited while some are still reported as moderately exploited, particularly in the Pacific and Indian Oceans, where they offer some limited possibilities for further expansion of fisheries production. Some limited possibilities for expansion are also offered by a few stocks of chub mackerel (*Scomber japonicus*), which are moderately exploited in the Eastern Pacific while other stocks are already fully exploited. The largehead hairtail (*Trichiurus lepturus*) is considered fully overexploited in the main fishing area in the Northwest Pacific, but its state of exploitation is unknown elsewhere.

The percentage of stocks exploited at or beyond their maximum sustainable levels varies greatly by area. The major fishing areas with the highest proportions (69–77 percent) of fully exploited stocks are the Western Central Atlantic, the Eastern Central Atlantic, the Northwest Atlantic, the Western Indian Ocean and the Northwest Pacific, while the areas with the highest proportions (46–60 percent) of overexploited, depleted and recovering stocks are the Southeast Atlantic, the Southeast Pacific, the Northeast Atlantic and the high seas, particularly those in the Atlantic and Indian Oceans for tuna and tuna-like species. Few areas of the world report a relatively high number (48–70 percent) of still underexploited or moderately exploited stocks, as is the case for the Eastern Central Pacific, Western Central Pacific and Southwest Pacific, while 20–30 percent of stocks still considered moderately exploited or underexploited are reported for the Mediterranean and Black Sea, Southwest Atlantic and Eastern Indian Ocean.

Four FAO major fishing areas produce almost 68 percent of the world marine catches. The Northwest Pacific is the most productive, with a total catch of 21.6 million tonnes (25 percent of total marine catches) in 2004, followed by the Southeast Pacific, with a total catch of 15.4 million tonnes (18 percent of marine total), and the Western Central Pacific and Northeast Atlantic, with 11.0 and 9.9 million tonnes (13 and 12 percent, respectively), in the same year.

In the Northwest Pacific, large changes in the abundance of Japanese pilchard (or sardine), Japanese anchovy and Alaska pollock have occurred in response to heavy fishing and to natural decadal oscillations. After a period of high abundance in the 1980s, the Japanese pilchard declined followed by a strong recovery of the Japanese

anchovy population, which has been supporting catches of 1.8 to 2.0 million tonnes per year, with 1.8 million tonnes in 2004, while catches of Japanese pilchard remained low with only 230 000 tonnes in 2004 – a fraction of the annual yield of more than 5 million tonnes in the 1980s. This alternation of sardine (or pilchard) and anchovy stocks follows a pattern also observed in other regions that seem to be governed by climatic regimes affecting stock distribution and overall fish abundance. The stocks of Alaska pollock in the Northwest Pacific are fully exploited, as is the case in the Northeast Pacific.

In the Southeast Pacific, the anchoveta has fully recovered after the severe El Niño event of 1997–98 and produced a total catch of 10.7 million tonnes in 2004. Catches of Chilean jack mackerel totalled 1.8 million tonnes in the same year – about one-third of the historical peak production reached in 1995 – while the stock of South American pilchard remains very low, producing a small fraction of the record catches of the 1980s and early 1990s. The Chilean jack mackerel and, particularly, the South American pilchard are in a decadal cycle of natural low abundance and there are no signs of a reversal at present.

The Western Central Pacific is very varied in terms of species caught. The higher catches are produced by the skipjack tuna, which is considered fully exploited in the area. Various species of sardinellas are considered moderately or fully exploited, as are various species of scads and mackerels. Less is known about the miscellaneous coastal fishes being exploited in the area, although some ponyfishes, breams and catfishes are still moderately exploited, while others are reported as fully or overexploited.

In the Northeast Atlantic, catches of blue whiting continue to increase steeply and the species is considered overexploited. Most stocks of Atlantic cod in the area are also overexploited or depleted, while capelin and herring are exploited to their full potential. The Atlantic horse mackerel and the Atlantic mackerel are also fully exploited.

Overall, more than 75 percent of world fish stocks for which assessment information is available are reported as already fully exploited or overexploited (or depleted and recovering from depletion), reinforcing earlier observations that the maximum wild capture fisheries potential from the world's oceans has probably been reached and calls for a more cautious and closely controlled development and management of world fisheries. While this observation applies generally to all fisheries, the situation seems more critical for some highly migratory, straddling and other fishery resources that are exploited solely or partially in the high seas. A recent FAO review of the world's highly migratory, straddling and other high seas fishery resources notes that while the state of exploitation of highly migratory tunas and tuna-like species is similar to that of all fish stocks tracked by FAO, the state of highly migratory oceanic sharks seems to be more problematic, with more than half of the stocks for which information is available being listed as overexploited or depleted.[11] Evidence seems to suggest that the state of straddling stocks and of other high seas fishery resources is even more problematic than for highly migratory species, with nearly two-thirds of the stocks for which the state of exploitation can be determined being classified as overexploited or depleted. Although these high seas fishery resources represent only a small fraction of the world fishery resources upon which millions of people are critically dependent for their food and livelihood, these correspond to fish stocks that are key indicators of the state of an overwhelming part of the ocean ecosystem, which appears to be more overexploited than the EEZs. The UN Fish Stock Agreement that entered into force in 2001 is leading to the implementation of measures that are expected to be beneficial in the medium to long term to species fished on the high seas.[12]

### Inland fisheries

The nature of many inland fisheries makes assessment of their status extremely difficult. Inland fisheries often use multiple fishing gear to harvest a complex array of species for which catch rates are strongly influenced by seasonality. Catches are frequently not recorded by species or not recorded at all. Additionally, inland fisheries are often practised in remote areas by the poorer sectors of society. These factors make collecting accurate information on inland fisheries extremely costly for public administrations and many do not collect such information or make assessments of the

status of inland fishery resources. To determine the status of marine fishery resources, FAO relies on a network of fishery scientists, the use of expert knowledge and catch and other statistics. No such network exists for inland fisheries and the catch statistics are generally inadequate for use as a measure of stock status. FAO is not therefore in a position to make accurate global statements on the status of inland fishery resources.

Nevertheless, fishery scientists have undertaken some partial assessments. A recent review pointed to the overfished state of many inland fisheries.[13] It identified two types of overfishing: intensive targeting of individual species and assemblage or ecosystem overfishing.

Targeted fishing for large freshwater fish species in several major river systems in Africa, Asia, Australia, Europe, the Near East, North America and South America has led to a decline in fish abundance. Of the fish targeted in these fisheries, 10 out of 21 species were assessed as being vulnerable or in danger of extinction; for the remaining 11 species the available data were insufficient to assess their status or no assessment was undertaken.

Assemblage overfishing is most common in tropical areas with high species diversity and where local communities depend on a diverse inland fish harvest. This situation prevails in Tonle Sap, a major component of the Mekong River Basin. It was stated in *The State of World Fisheries and Aquaculture 2004* that this basin showed signs of overfishing, yet in 2005 catches from the Tonle Sap were reported as being the largest since records began. However, fishery scientists have pointed out that in that year signs of overfishing were apparent in that the catch consisted mostly of small fish. In addition, catches are reported to have been even higher in past, before official records were kept.

Efforts are under way in many areas to improve the status of selected inland fishery resources through restocking programmes, habitat rehabilitation and improved fishery management. While habitat rehabilitation is a widespread activity in many developed countries, it is not common in developing countries and its efficacy in improving fish stocks has not been evaluated in most cases (see pp. 107–112). Also, the management of rice-based ecosystems for biodiversity, together with the use of alien species and stocking of inland water bodies, continues to improve the fishery resources of many areas, primarily in Asia.[14]

Globally, inland fishery resources appear to be continuing to decline as a result of habitat degradation and overfishing. This trend – which is in large part a result of the growing quantities of freshwater being used for hydropower generation and agriculture – is unlikely to be reversed as long as countries do not see inland fisheries as a growth sector. And they are not likely to want to reconsider this viewpoint until they have accurate information on these fisheries and their value to society now and in the future.

## FISH UTILIZATION

In 2004, about 75 percent (105.6 million tonnes) of estimated world fish production was used for direct human consumption (see Table 1 on p. 3). The remaining 25 percent (34.8 million tonnes) was destined for non-food products, in particular the manufacture of fishmeal and oil. If China is excluded, the quantities were 68.9 million tonnes and 24.0 million tonnes, respectively (see Table 2 and Figure 2 on pp. 4 and 5). More than 77 percent (37 million tonnes) of China's reported fish production (47.5 million tonnes) was apparently used for direct human consumption, the bulk of which in fresh form. The remaining amount (an estimated 10.8 million tonnes) was reduced to fishmeal and other non-food uses, including direct feed for aquaculture.

In 2004, 61 percent (86 million tonnes) of the world's fish production underwent some form of processing. Fifty-nine percent (51 million tonnes) of this processed fish was used for manufacturing products for direct human consumption in frozen, cured and canned form and the rest for non-food uses. The many options for processing fish allow for a wide range of tastes and presentations, making fish one of the most versatile food commodities. Yet, unlike many other food products, processing does not necessarily increase the price of the final product and fresh fish is often the most highly priced product form. During the 1990s, the proportion of fish marketed in live/

fresh form worldwide increased compared with other products (Figure 20). Live/fresh fish quantities rose from an estimated 35 million tonnes in 1994 to 55 million tonnes in 2004, representing an increase in its share of total production from 31 percent to 39 percent. Freezing is the main method of processing fish for food use, accounting for 53 percent of total processed fish for human consumption in 2004, followed by canning (24 percent) and curing (23 percent). In developed countries (Figure 21), the proportion of fish that is frozen has been constantly increasing, and in 2004 accounted for 40 percent of total production. In comparison, the share of frozen products was 13 percent of total production in developing countries, where fish is largely marketed in live/fresh/chilled form.

Utilization of fish production shows marked continental, regional and national differences. The proportion of cured fish is higher in Africa (17 percent in 2004) and Asia (11 percent) compared with other continents. In 2004, in Europe and North America, more than two-thirds of fish used for human consumption was in frozen and canned forms. In Africa and Asia, the share of fish marketed in live or fresh forms was

Figure 20

Utilization of world fisheries production (breakdown by quantity), 1964–2004

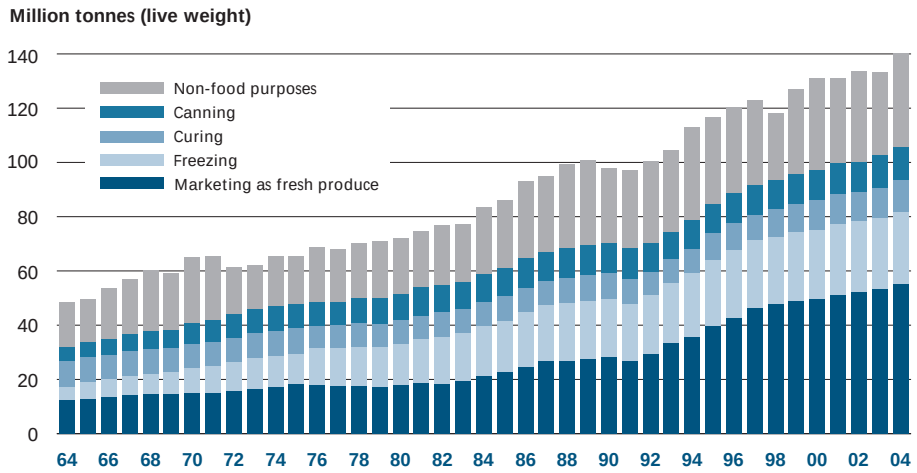
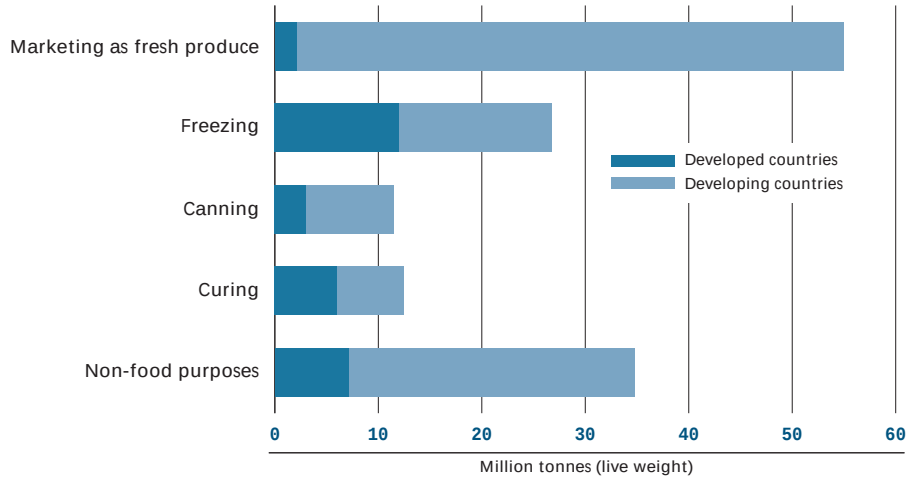



Figure 21

Utilization of world fisheries production (breakdown by quantity), 2004



particularly high. Unfortunately, it is not possible to determine the exact amount of fish marketed in live form from available statistics. The sale of live fish to consumers and restaurants is especially strong in Southeast Asia and the Far East.

In 2004, the bulk of the fishery products used for non-food purposes came from natural stocks of small pelagics. Most of these fishery products were used as raw material for the production of animal feed and other products. Ninety percent of world fish production (excluding China) destined for non-food purposes was reduced to fishmeal/oil; the remaining 10 percent was largely utilized as direct feed in aquaculture and for fur animals. The quantities of fish used as raw material for fishmeal in 2004 reached about 25.5 million tonnes, representing a 17 percent increase compared with 2003, but was still well below peak levels of more than 30 million tonnes recorded in 1994.

## CONSUMPTION[15]

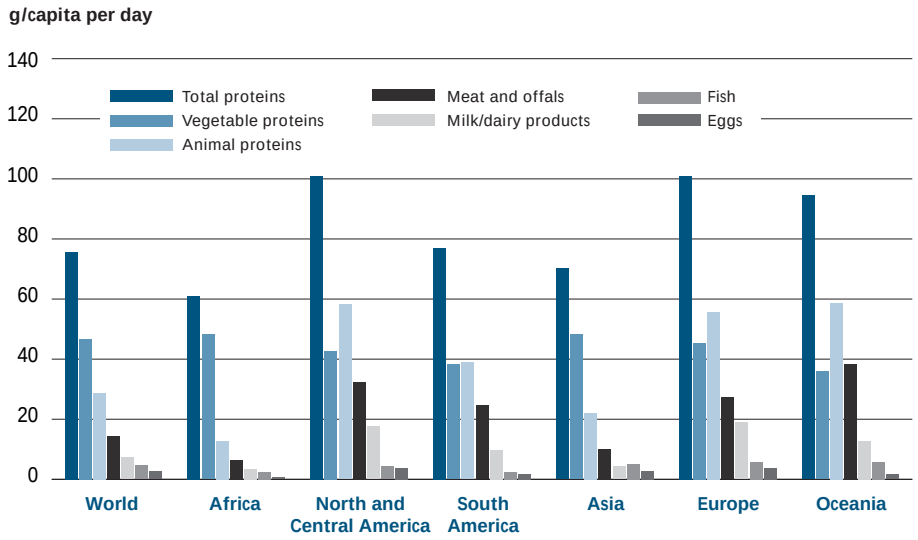
Global per capita fish[16] consumption has increased over the past four decades, rising from 9.0 kg in 1961 to an estimated 16.5 kg in 2003. China has been responsible for most of this increase: its estimated share of world fish production grew from 21 percent in 1994 to 34 percent in 2003, when its per capita fish supply stood at around 25.8 kg. If China is excluded, the per capita fish supply is about 14.2 kg, almost the same as during the mid-1980s. During the 1990s, world per capita fish supply, excluding China, was relatively stable at 13.2–13.8 kg. This can mainly be attributed to a higher population growth than that of food fish supply during the 1990s (1.6 percent per annum compared with 1.1 percent, respectively). Since the early 2000s, there has been an inversion of this trend, with higher food fish supply growth than that of population (2.4 percent per annum compared with 1.1 percent). Preliminary estimates for 2004 indicate a slight increase of global per capita fish supply, to about 16.6 kg.

Global per capita food consumption has also been improving in recent decades. Nutritional standards have shown positive long-term trends with worldwide increases in the average global calorie supply per person (a rise of 16 percent since 1969–71 to reach 2 795 kcal/person/day in 2000–02, with the developing country average expanding by more than 25 percent) and in the quantity of proteins per person (from 65.1 g in 1970 to 76.3 g in 2003). Yet distributional disparities continue to exist. In 2001–03, according to FAO estimates, 856 million people in the world were undernourished, 61 percent of whom were living in Asia and the Pacific and 820 million in the developing countries overall. The highest prevalence of undernourishment is found in sub-Saharan Africa, where 32 percent of the population were undernourished, while an estimated 16 percent of the population were estimated to be undernourished in Asia and the Pacific.

Fish is highly nutritious, rich in micronutrients, minerals, essential fatty acids and proteins, and represents a valuable supplement to diets otherwise lacking essential vitamins and minerals. In many countries, especially developing countries, the average per capita fish consumption may be low, but, even in small quantities, fish can have a significant positive impact on improving the quality of dietary protein by complementing the essential amino acids that are often present only in low quantities in vegetable-based diets. It is estimated that fish contributes up to 180 kilocalories per person per day, but reaches such high levels only in a few countries where there is a lack of alternative foods, and where a preference for fish has been developed and maintained (for example in Iceland, Japan and some small island developing states). Generally, on average, fish provides about 20–30 kilocalories per person per day. The dietary contribution of fish is more significant in terms of fish proteins, which are a crucial component in some densely populated countries where total protein intake levels may be low. For instance, fish contributes to, or exceeds, 50 percent of total animal protein intake in some small island developing states, as well as in Bangladesh, Equatorial Guinea, the Gambia, Guinea, Indonesia, Myanmar, Senegal, Sierra Leone and Sri Lanka. Globally, fish provides more than 2.8 billion people with almost 20 percent of their average per capita intake of animal protein. The contribution of fish proteins to total world animal protein supplies rose from 13.7 percent in 1961 to a peak of 16.0 percent in 1996, before declining somewhat to 15.5 percent

Figure 22

Total protein supply by continent and major food group (2001–03 average)




in 2003. Corresponding figures for the world, excluding China, show an increase from 12.9 percent in 1961 to 15.4 percent in 1989, slightly declining since then to 14.6 percent in 2003. Figure 22 presents the contributions of major food groups to total protein supplies.

In industrialized countries (Table 10), apparent fish consumption grew from 13 million tonnes (live weight equivalent) in 1961 to 27 million tonnes in 2003, with an increase in annual per capita consumption[17] from 20.0 kg to 29.7 kg during the same period. The contribution of fish to total protein intake rose remarkably during the period 1961–89 (between 6.5 percent and 8.5 percent), before gradually declining owing to the increase in consumption of other animal proteins; by 2003, its share (7.8 percent) was back at the levels prevailing in the mid-1980s. Since the early 1990s, the consumption of fish protein has remained relatively stable at around 8.2–8.6 g per capita per day, while the intake of other animal proteins has continued to grow.

Table 10
Total and per capita food fish supply by continent and economic grouping in 2003

| | Total food supply *(Million tonnes live weight equivalent)* | Per capita food supply *(kg/year)* |
|---|---|---|
| **World** | **104.1** | **16.5** |
| **World excluding China** | **71.1** | **14.2** |
| Africa | 7.0 | 8.2 |
| North and Central America | 9.4 | 18.6 |
| South America | 3.1 | 8.7 |
| China | 33.1 | 25.8 |
| Asia (excluding China) | 36.3 | 14.3 |
| Europe | 14.5 | 19.9 |
| Oceania | 0.8 | 23.5 |
| Industrialized countries | 27.4 | 29.7 |
| Economies in transition | 4.3 | 10.6 |
| LIFDCs (excluding China) | 23.8 | 8.7 |
| Developing countries excluding LIFDCs | 15.8 | 15.5 |

Until the mid-1980s, the average per capita apparent fish supply in LIFDCs was one-quarter of the estimated supply in industrialized countries. The gap has been reduced progressively, with stronger growth since the mid-1990s (+2.1 average annual percentage growth during 1995–2003). In 2003, at 14.1 kg it stood at about a half of that of industrialized countries (29.7 kg) and 60 percent of the per capita fish supply of developed countries (23.9 kg). However, if China is excluded, per capita supply in the other LIFDCs is still relatively low, at an estimated 8.7 kg in 2003, with a growth rate of 1.3 percent per year since 1993. Notwithstanding the relatively low fish consumption by weight in LIFDCs (excluding China), the contribution of fish to total animal protein intake in 2003 was significant at about 20 percent, and may be higher than indicated by official statistics in view of the unrecorded contribution of subsistence fisheries. Yet, since 1975, when it peaked at 24.1 percent, this share has slightly declined notwithstanding the continued growth of fish protein consumption (from 2.2 g to 2.7 g during 1975–2003). This is because of the increase in the consumption of other animal proteins.

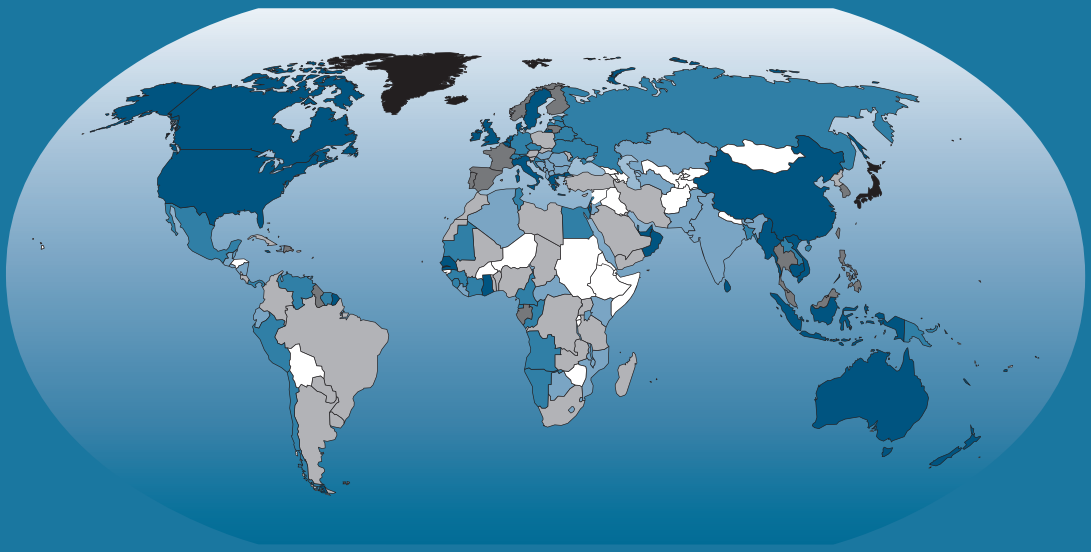
Fish consumption is distributed unevenly around the globe, with marked continental, regional and national differences as well as income-related variations (Figures 23 and 24). Per capita apparent fish consumption can vary from less than 1 kg per capita to more than 100 kg. Geographical differences are also evident within countries, with consumption usually being higher in coastal areas. For example, 104 million tonnes were available globally for consumption in 2003, but only 7.0 million tonnes were consumed in Africa (8.2 kg per capita); two-thirds of the total were consumed in Asia, of which 36.3 million tonnes were consumed outside China (14.3 kg per capita) and 33.1 million tonnes in China alone (25.8 kg per capita). Per capita consumption in Oceania was 23.5 kg, in North America 23.8 kg, in Europe 19.9 kg, in Central America and the Caribbean 9.4 kg and in South America 8.7 kg.

During the past few years, major increases in the quantity of fish consumed originated from aquaculture, which in 2004 was estimated to have contributed 43 percent of the total amount of fish available for human consumption. Aquaculture production has pushed the demand and consumption for several high-value species such as shrimps, salmon and bivalves. Since the mid-1980s, these species have shifted from being primarily wild-caught to being primarily aquaculture-produced, with a decrease in their prices and a strong increase in their commercialization. Aquaculture has also had a major role in terms of food security in several developing countries, particularly in Asia, for the significant production of some low-value freshwater species, which are mainly destined for domestic consumption. For the world excluding China, the average contribution of aquaculture to per capita supply grew from 13.7 percent in 1994 to an estimated 21.4 percent in 2004, corresponding to an increase from 1.8 kg per capita in 1994 to 2.9 kg per capita in 2004 (an average annual growth of 4.9 percent). Corresponding figures for China indicate an increase from 61.6 percent in 1994 to 83.4 percent in 2004. During the past decade, the per capita supply from aquaculture in China is reported to have increased from 10.9 kg in 1994 to 23.7 kg in 2004, implying an annual average growth of 8.1 percent (Figure 25).

Differences in consumption patterns by species are marked. Demersal fish are preferred in northern Europe and North America, whereas cephalopods are mainly consumed in several Mediterranean and Asian countries. The consumption of crustaceans, being high-priced commodities, is mostly concentrated in affluent economies. Of the 16.5 kg of fish per capita available for consumption in 2003, around 75 percent were finfish. Shellfish supplied 25 percent – or about 4.2 kg per capita, subdivided into 1.5 kg of crustaceans, 0.6 kg of cephalopods and 2.1 kg of other molluscs. Freshwater and diadromous species accounted for 30 million tonnes of the total supply (about 4.8 kg per capita). Marine finfish species provided more than 46 million tonnes, of which 18.4 million tonnes were demersal species, 19.8 million tonnes pelagics and 8.4 million tonnes unidentified marine fish. The remaining share of the total food supply consisted of shellfish, of which 9.4 million tonnes were crustaceans, 3.6 million tonnes cephalopods and 13.4 million tonnes other molluscs. Historically, there have been no dramatic changes in the share of most of the broader

Figure 23

Fish as food: per capita supply (average 2001–2003)

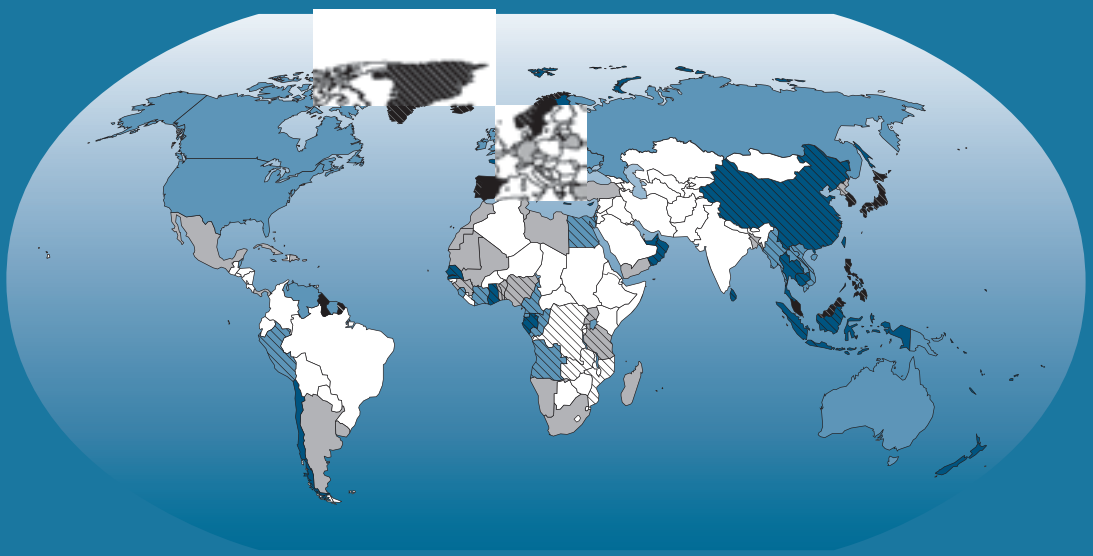


**Average per capita fish supply (in live weight equivalent)**

0–2 kg/year
2–5 kg/year
5–10 kg/year
10–20 kg/year
20–30 kg/year
30–60 kg/year
> 60 kg/year

Figure 24

Contribution of fish to animal protein supply (average 2001–2003)



**Fish proteins (per capita per day)**

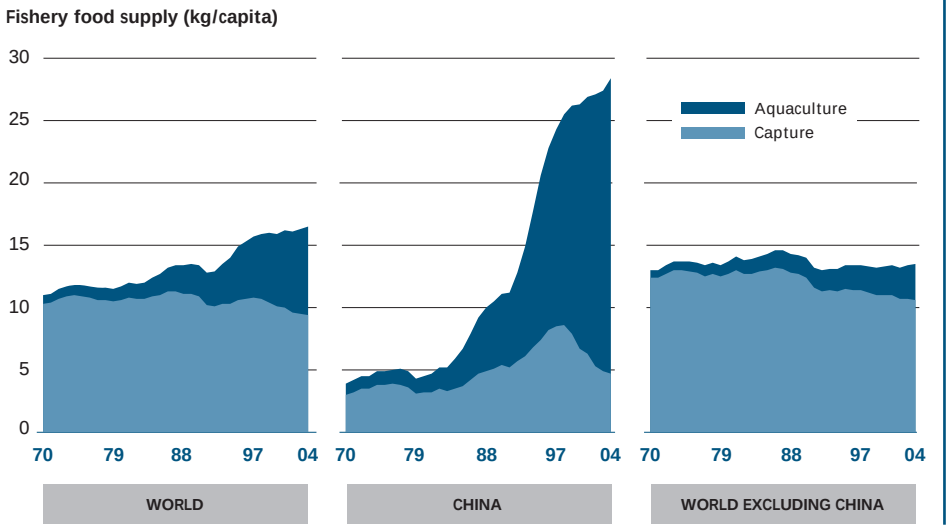
< 2 g
2–4 g
4–6 g
6–10 g
> 10 g

**Contribution of fish to animal protein supply**

> 20%

Figure 25

Relative contribution of aquaculture and capture fisheries to food fish consumption




groups in average world consumption; demersal and pelagic fish species have stabilized at around 3.0 kg per capita. Crustaceans and molluscs are exceptions in that they showed a considerable increase between 1961 and 2003. The per capita availability of crustaceans increased more than threefold, from 0.4 kg to 1.5 kg (mainly as a result of the increased production of shrimps and prawns from aquaculture), and the availability of molluscs (excluding cephalopods) increased from 0.6 kg to 2.1 kg per capita.

In recent years, both fish consumption and overall food consumption have been influenced by complex interactions involving several demographic and economic transformations such as population growth; rising incomes and economic growth; rapid urbanization; increased female participation in the workforce; increased international trade; international agreements on trade, rules, tariffs and quality standards; and improvements in transportation, marketing, and food science and technology. All these factors, together with developments in production, processing and prices of commodities, have had a remarkable impact on dietary habits, particularly in developing countries. During recent decades, the increased food consumption of developing countries has been characterized by a shift towards more proteins and vegetables in the diet, with a reduction of the share of basic cereals. For instance, the per capita consumption of meat has increased from 15.1 kg in 1983 to 28.9 kg in 2003, consumption of fish has grown from 7.7 kg to 14.6 kg and that of vegetables from 56.1 kg to 118.7 kg in the same period. These changes in dietary habits have been particularly driven by the impact of rapid urbanization (which increased from a share of 26 percent of total population in 1975 to 43 percent in 2005) combined with the transformations in food distribution. Several developing countries, especially in Asia and Latin America, have experienced a rapid expansion of supermarkets, which are not only targeting higher-income consumers but also lower- and middle-income consumers. Supermarkets are thus emerging as a major force in developing countries, offering consumers a wider choice, reduced seasonality and lower prices of food products – and often safer food.

Dietary habits are also changing in developed countries, where incomes are generally high and basic dietary needs have long been more than satisfied, leading consumers to look for more variety in their diets. Simultaneously, the average consumer is becoming increasingly health- and diet-conscious and usually sees fish as having a positive impact on health. Markets have become more flexible and new products and species have found market niches. The trend, for fish as well as for other food products,

is to provide greater value addition in the catering and retail markets, thus making the products easier for consumers to prepare. Alongside traditional preparations, developments in food science and technology, combined with improved refrigeration and the use of microwave ovens, are making convenience foods, ready-to-cook or ready-to-eat products, coated products and other value-added items a fast-growing industry. The reasons for this rapid expansion include changes in social factors such as the increasing number of women in the workforce and the fragmentation of meals in households as well as the general decrease in average family size and the increase in single-person households. The need for simple meals that are ready to eat and easy to cook has thus become more important. Another trend is the increasing importance of fresh fish. Unlike many other food products, fish is still more favourably received on the market when it is fresh rather than processed. However, historically, fresh fish has been of little importance in international trade owing to its perishable nature and limited shelf-life. Improvements in packaging, reduced air freight prices and more efficient and reliable transport have created additional sales outlets for fresh fish. Food chains and department stores are also taking an increasing share of the fresh seafood sector, and many now provide fresh seafood counters with an extensive variety of fish and freshly prepared fish dishes or salads next to their frozen food counters.

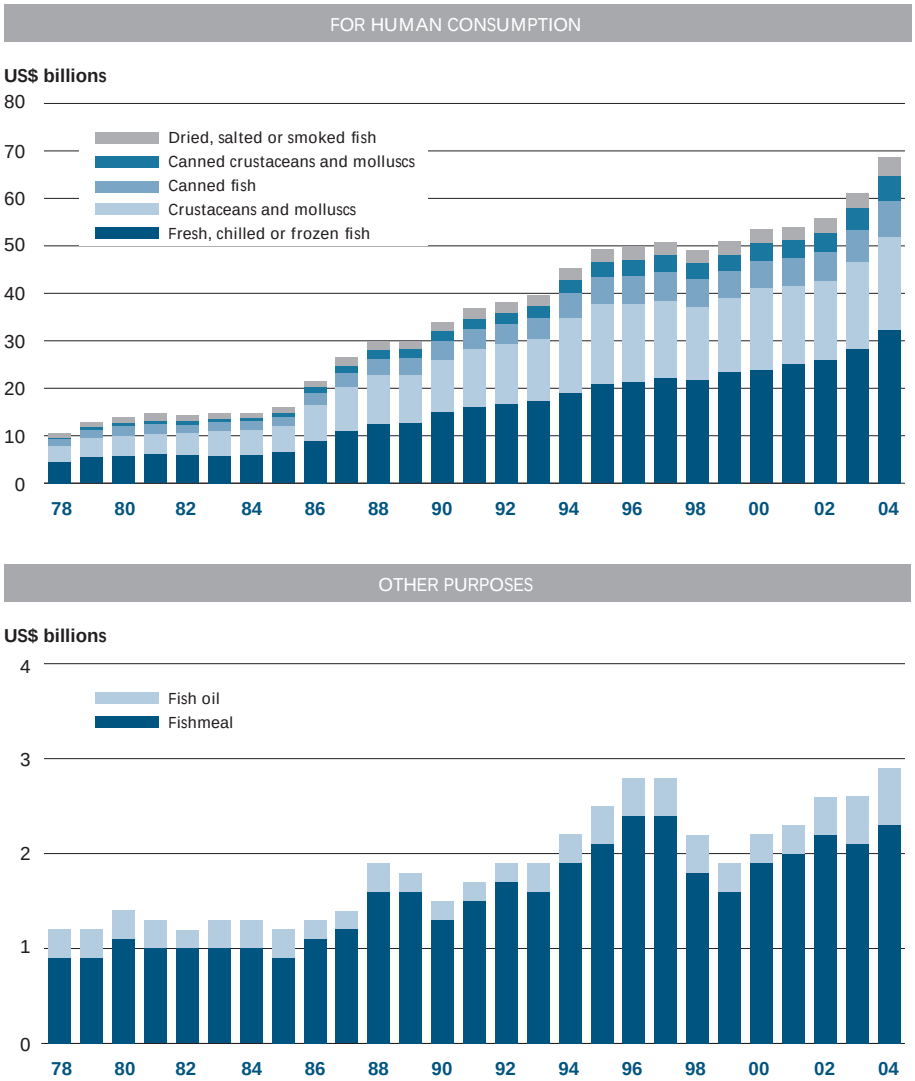
The above-mentioned trends are expected to continue for the foreseeable future. The United Nations Population Division estimates that the world population growth rate will slow, but owing to higher fertility rates, the share of developing countries in the total population will rise to about 83 percent in 2030 (79 percent in 2005). The rapid increase in urbanization is also forecast to continue, from about 3.2 billion people in 2005 to an estimated 4.9 billion in 2030, with most of the growth coming from developing countries (from 1.9 billion to about 3.8 billion). In 2030, 57 percent of the population in developing countries is forecast to be urban, compared with 43 percent in 2005. Population and income growth, together with urbanization and dietary diversification, are expected to create additional demand and to continue to shift the composition of food consumption towards a growing share of animal products in developing countries. In industrialized countries, food demand is expected to grow only moderately and, in determining demand for food products, issues such as safety, quality, environmental concerns and animal welfare will probably be more important than price and income changes. At the global level, animal disease outbreaks could represent an important source of uncertainty. For example, during the past few years, and particularly in 2004 and 2005, the international market for meats was disrupted by outbreaks of animal diseases such as avian influenza and bovine spongiform encephalopathy (BSE). This situation, together with the related import bans, led to an inducted shortage in meat supplies in some countries, particularly of poultry, pushing up international meat prices in 2004 and 2005 (+30 percent for poultry in 2004–05) and driving consumers towards alternative protein sources, including fish.

## TRADE

In 2004, total world trade of fish and fishery products reached a record value of US$71.5 billion (export value), representing a 23 percent growth relative to 2000 and a 51 percent increase since 1994 (Figure 26). Preliminary estimates for 2005 indicate a further increase in the value of fishery exports. In real terms (adjusted for inflation), exports of fish and fishery products increased by 17.3 percent during the period 2000–04, 18.2 percent during 1994–2004 and 143.9 percent between 1984 and 2004. In terms of quantity, exports were reported to have peaked at 53 million tonnes (live weight equivalent) in 2004, with a growth of 13 percent since 1994 and of 114 percent since 1984. The quantity of fish traded remained stagnant during the period 2000–03 following several decades of strong increases. The record reached in 2004 by fishery exports coincided with an impressive rise in global trade, despite sharp increases in oil prices and natural disasters. This global growth also continued in 2005. In 2004, prices of several agricultural commodities (particularly of basic foods) also rebounded after a prolonged period of decline. A series of long- and short-term factors contributed

Figure 26

World fishery exports by major commodity groups




to this growth as demand shifted for some commodities in response to market transformations caused by changes in technology, consumer preferences, market structures and policies. One such important factor was the influence exerted by price movements and exchange rates on trade flows, in particular the weaker US dollar, which is also used to denominate many commodity prices, and the marked appreciation of several currencies (especially European currencies) against the dollar.

The share of fishery trade in total merchandise trade is limited; it has been relatively stable at about 1 percent since 1976, with a downward trend through the late 1990s and early 2000s (0.8 percent in 2004). The proportion of fishery exports in total agricultural (including forestry products) exports expanded from 1976 (4.5 percent) onwards and reached a record value of 9.4 percent in 2001. It has since declined, reaching 8.4 percent in 2004. For developed countries, the share of fishery exports in total merchandise exports was about 0.6–0.8 percent during the period 1976–2004. The proportion of fishery exports in total agricultural trade (including forestry products) increased in the late 1970s from 4.1 percent to reach 6.5 percent in the period 1998–2002. In 2004 it declined to 6 percent as a result of the strong increases in exports of agricultural (33 percent) and forestry (37 percent) products compared with 2003. For developing countries, the part of fishery exports in total merchandise exports

expanded in the late 1970s until the late 1980s (2.3 percent in 1988), before slowing down to only 1.2 percent in 2004. The share of fishery exports in total agricultural trade (including forestry products) increased from 5 percent in 1976 to 16 percent in 2002 and then declined slightly to 14 percent in 2004, because of the recent upturn in agricultural and forestry exports (+36 percent and 30 percent, respectively, in the period 2002–04).

Table 11 shows the top ten exporters and importers of fish and fishery products in 1994 and 2004. In 2004, China was the world's major exporter of fish and fishery products, with exports valued at US$6.6 billion. Despite this, fishery exports represented just 1.1 percent of its total merchandise exports and 29 percent of its agricultural exports (excluding forestry products). China has increased its fishery exports remarkably since the early 1990s. This growth is linked to its growing production, as well as to the expansion of its fish-processing industry, reflecting competitive labour and production costs. In addition to exports from domestic fisheries production, China also exports reprocessed imported raw material, creating a strong value addition in the process. Imports of fish and fishery products to China have also risen over the past decade, from US$0.2 billion in 1990 to US$3.1 billion in 2004. This growth has been particularly noticeable in the past few years, since the country's accession to the WTO in late 2001, when it had to lower its import duties, which decreased from an average import tariff as high as 15.3 percent in 2001 to 10.4 percent in 2004.

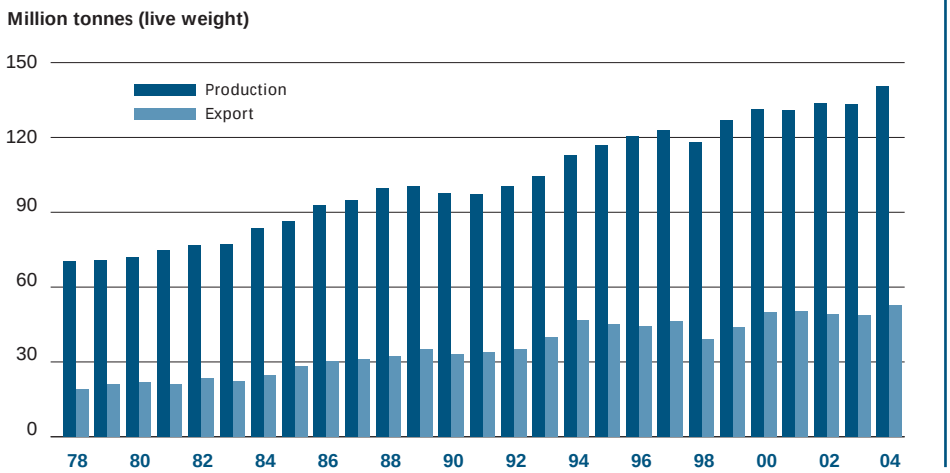
Table 11
Top ten exporters and importers of fish and fishery products

| | 1994 | 2004 | APR |
|---|---|---|---|
| | *(US$ millions)* | | *(Percentage)* |
| **Exporters** | | | |
| China | 2 320 | 6 637 | 11.1 |
| Norway | 2 718 | 4 132 | 4.3 |
| Thailand | 4 190 | 4 034 | -0.4 |
| United States of America | 3 230 | 3 851 | 1.8 |
| Denmark | 2 359 | 3 566 | 4.2 |
| Canada | 2 182 | 3 487 | 4.8 |
| Spain | 1 021 | 2 565 | 9.6 |
| Chile | 1 304 | 2 484 | 6.7 |
| Netherlands | 1 346 | 2 452 | 5.5 |
| Viet Nam | 484 | 2 403 | 17.4 |
| TOP TEN SUBTOTAL | 21 243 | 35 611 | 5.3 |
| REST OF THE WORLD TOTAL | 26 267 | 35 897 | 3.2 |
| **WORLD TOTAL** | **47 511** | **71 508** | **4.2** |
| **Importers** | | | |
| Japan | 16 140 | 14 560 | -1.0 |
| United States of America | 7 043 | 11 967 | 5.4 |
| Spain | 2 639 | 5 222 | 7.1 |
| France | 2 797 | 4 176 | 4.1 |
| Italy | 2 257 | 3 904 | 5.6 |
| China | 856 | 3 126 | 13.8 |
| United Kingdom | 1 880 | 2 812 | 4.1 |
| Germany | 2 316 | 2 805 | 1.9 |
| Denmark | 1 415 | 2 286 | 4.9 |
| Republic of Korea | 718 | 2 233 | 12.0 |
| TOP TEN SUBTOTAL | 38 063 | 53 090 | 3.4 |
| REST OF THE WORLD TOTAL | 13 104 | 22 202 | 5.4 |
| **WORLD TOTAL** | **51 167** | **75 293** | **3.9** |

*Note:* APR refers to the average annual percentage growth rate for 1994–2004.

Figure 27

Share of world fisheries production destined for exports




World fish imports rose by 25.4 percent in the period 2000–04, reaching a new record of more than US$75 billion in 2004. Preliminary data suggest that in 2005 major importing markets further increased their imports of fish and fishery products.

Fish is traded widely and, in 2004, a large share of fish production entered international marketing channels, with about 38 percent (live weight equivalent) exported as various food and feed products (Figure 27). Developed countries exported some 23 million tonnes of fish (in live weight equivalent) in 2004. Although a part of this trade may be re-exports, this amount corresponds to about 75 percent of their production. Exports from developing countries (30 million tonnes in live weight) totalled around one-quarter of their combined production. The share of developing countries in total fishery exports was 48 percent by value and 57 percent by quantity. A significant share of these exports consisted of fishmeal. In 2004, developing countries contributed about 68 percent, by quantity, of world non-food fishery exports. Developing countries have also significantly increased their share in the quantity of fish exports destined for human consumption, from 43 percent in 1992 to 51 percent in 2004.

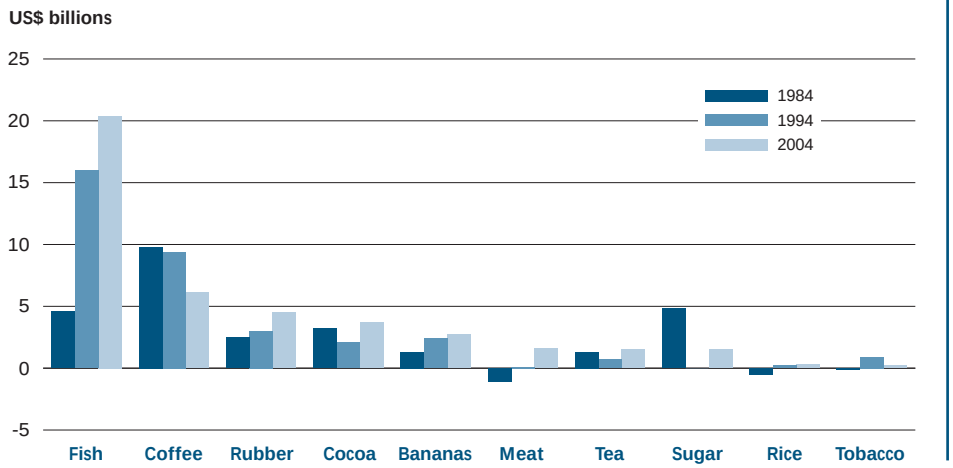
The role of fishery trade varies among countries and is important for many economies, particularly for developing nations. Trade in fish represents a significant source of foreign currency earnings, in addition to the sector's important role in employment, income generation and food security. In a few cases, fishery exports are crucial for the economy. For example, in 2004 they accounted for around one-half of the total value of merchandise exports for Iceland, Kiribati, Maldives, the Federal States of Micronesia, Panama and Saint Pierre and Miquelon.

The past four decades have also seen major changes in geographical patterns of fishery trade. The share of fishery exports of developing countries in global fishery exports increased from close to 37 percent in 1976 to 51 percent in 2000–01, before declining to around 48 percent in 2004. Asian countries accounted for most of this growth; their share in total fishery exports increased from slightly more than 20 percent in 1976 to 32 percent in 2004 and their fishery exports represented 66 percent of the value of the exports from developing countries.

The fishery net exports of developing countries (i.e. the total value of their exports less the total value of their imports) showed a continuing rising trend in recent decades, growing from US$4.6 billion in 1984 to US$16.0 billion in 1994 and to US$20.4 billion in 2004 (Figure 28). These figures are significantly higher than those for other agricultural commodities, such as rice, coffee and tea. The LIFDCs play an active and growing role in the trade of fish and fishery products. In 1976, their exports

Figure 28

Net exports of selected agricultural commodities by developing countries




accounted for 11 percent of the total value of fishery exports – a share that expanded to 13 percent in 1984, 18 percent in 1994 and 20 percent in 2004, when their fishery net export revenues were estimated at US$9.4 billion.

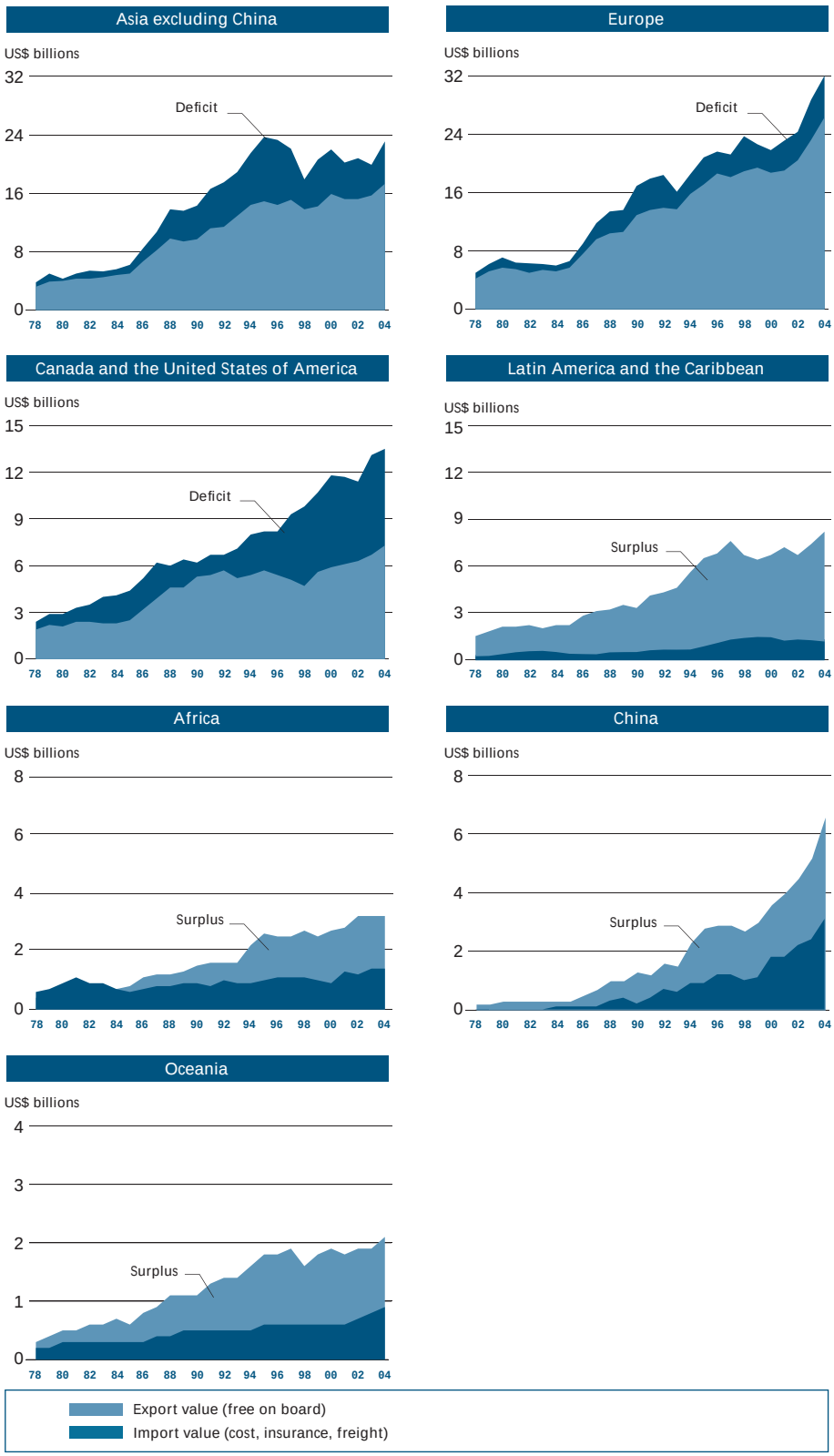
In many countries there is considerable two-way trade in fishery products (Figure 29). The Latin America and the Caribbean region holds a strong positive net fishery exporter position, as do developing Asia and Oceania. Africa has been a net exporter since 1985, when the factory ships of the former Union of Soviet Socialist Republics and Eastern Europe diminished or ceased landing massive quantities of cheap frozen pelagic fish in West Africa. Europe, Japan and North America are characterized by a fishery trade deficit. In 2004, a total of 97 countries were net exporters of fish and fishery products.

There has been a tendency in recent decades towards increased intensity of fishery trade within regions. Among developed countries, fishery trade remains largely and increasingly self-centred: in the period 2002–04, some 85 percent of the value of developed country fishery exports were destined to other developed countries and more than 50 percent of developed country fishery imports originated in other developed countries. Particularly significant is the role of trade among EU countries, with more than 84 percent of EU exports going to, and about 50 percent of their imports coming from, other EU countries in both 2004 and 2005. Trade between Canada and the United States of America, although much smaller than intra-EU trade, has expanded significantly since 1980, reflecting the growing importance of the North American Free Trade Agreement (NAFTA) – which includes also Mexico – and prior to that the United States–Canada Free Trade Agreement. At present, about 43 percent of their exports and 21 percent of their imports are between the two countries. Trade in fish and fishery products among the more developed economies consists mainly of demersal species, herring, mackerel and salmon.

Conversely, although fishery trade among the developing countries has increased, particularly during the 1990s, it still represents a share of only 15 percent of the value of fishery exports of developing countries. Fishery intra-trade among developing countries should potentially increase in the future, partly as a result of the emergence of regional trade agreements and partly driven by demographic, social and economic trends that are transforming food markets in developing countries. However, developing countries still depend to a large extent on the developed countries, mainly as outlets for their fishery exports, but also as suppliers of their fishery imports for local consumption or their processing industries. In fact, several developing countries are importing an increasing quantity of raw material for further processing and re-export

Figure 29

Imports and exports of fish and fishery products for different regions, indicating net deficit or surplus



to developed countries. Fishery exports of developing countries are gradually evolving from the export of raw material for the processing industry in developed countries to high-value live fish or value-added products. This is happening notwithstanding a variety of barriers (such as high import tariffs on processed products), which often hinder the industry. Many developed countries have invested in processing facilities in developing countries, where costs are lower.

The maps shown in Figure 30 indicate trade flows of fish and fishery products by continent for the period 2002–04. The overall picture presented by these maps, however, is not complete. Although the countries that reported their imports over this period (some 159 countries) account for 99 percent of the estimated world total, some continental groups are not covered completely (e.g. about one-third of African countries did not report their trade in fishery products by country of origin/destination). In this case, the data indicated should not be taken to represent the total trade flow of the continental groups to which they refer. In the period 2002–04, about 77 percent of the value of fishery exports of developing countries was directed to developed areas, mainly to the EU, Japan and the United States of America. These exports consisted mostly of tuna, small pelagics, shrimps and prawns, rock lobsters and cephalopods. The quantity of exports from developed countries to developing countries is relatively insignificant, representing around 15 percent of the total value of developed country exports of fishery products. These exports consist mainly of low-priced small pelagics, which account for about 20–30 percent of developing countries' imports, and raw material for processing.

Owing to the high perishability of fish and fishery products, more than 90 percent of international trade of fish and fishery products is conducted in processed form. In terms of quantity (live weight equivalent), the share of live, fresh or chilled fish was 10 percent in 2004. Live and fresh fish are valuable but difficult to trade and transport and they are often subject to stringent health regulations and quality standards. Yet trade in live fish has increased in recent years as a result of technological developments, improved logistics and increased demand. An elaborate network of handling, transport, distribution, display and holding facilities has been developed to support the live fish trade. New technological systems include specially designed or modified tanks and containers, as well as trucks and other transport vehicles equipped with aeration or oxygenation facilities to keep fish alive during transportation or holding/display. Trade in live fish also includes ornamental fish as opposed to fish for human consumption, and this area has become a lucrative business. Live fish is particularly appreciated in Asia (particularly by the Chinese population) and in niche markets in other countries, mainly among immigrant Asian communities.

Exports of frozen fish have increased during the past decade, from a share of 28 percent of the total quantity of fish exports in 1994 to 36 percent in 2004. Exports of prepared and preserved fish totalled 8.3 million tonnes (live weight equivalent) in 2004, representing a share of 15 percent of total exports (10 percent in 1994). Exports of cured fish accounted for 5 percent of total exports in 2004, but this share had declined slightly over the preceding decade. In 2004, exports of non-food fishery products represented 34 percent of total fish exports in terms of quantity, a large proportion of which originated from Latin American countries.

### Shrimp

Shrimp continues to be the most important commodity traded in value terms, accounting for 16.5 percent of the total value of internationally traded fishery products in 2004. The other main groups of exported species were groundfish (10.2 percent – i.e. hake, cod, haddock and Alaska pollock), tuna (8.7 percent) and salmon (8.5 percent). In 2004, fishmeal represented around 3.3 percent of the value of exports and fish oil less than 1 percent.

It is important to note the reduced share of shrimp in total fish trade since its 21 percent peak reached in 1994, notwithstanding the growth of 18 percent by value and of 69 percent by quantity (live weight equivalent) of shrimp exports during

Figure 30

Trade flows by continent (total imports in US$ millions, c.i.f.; averages for 2002–04)

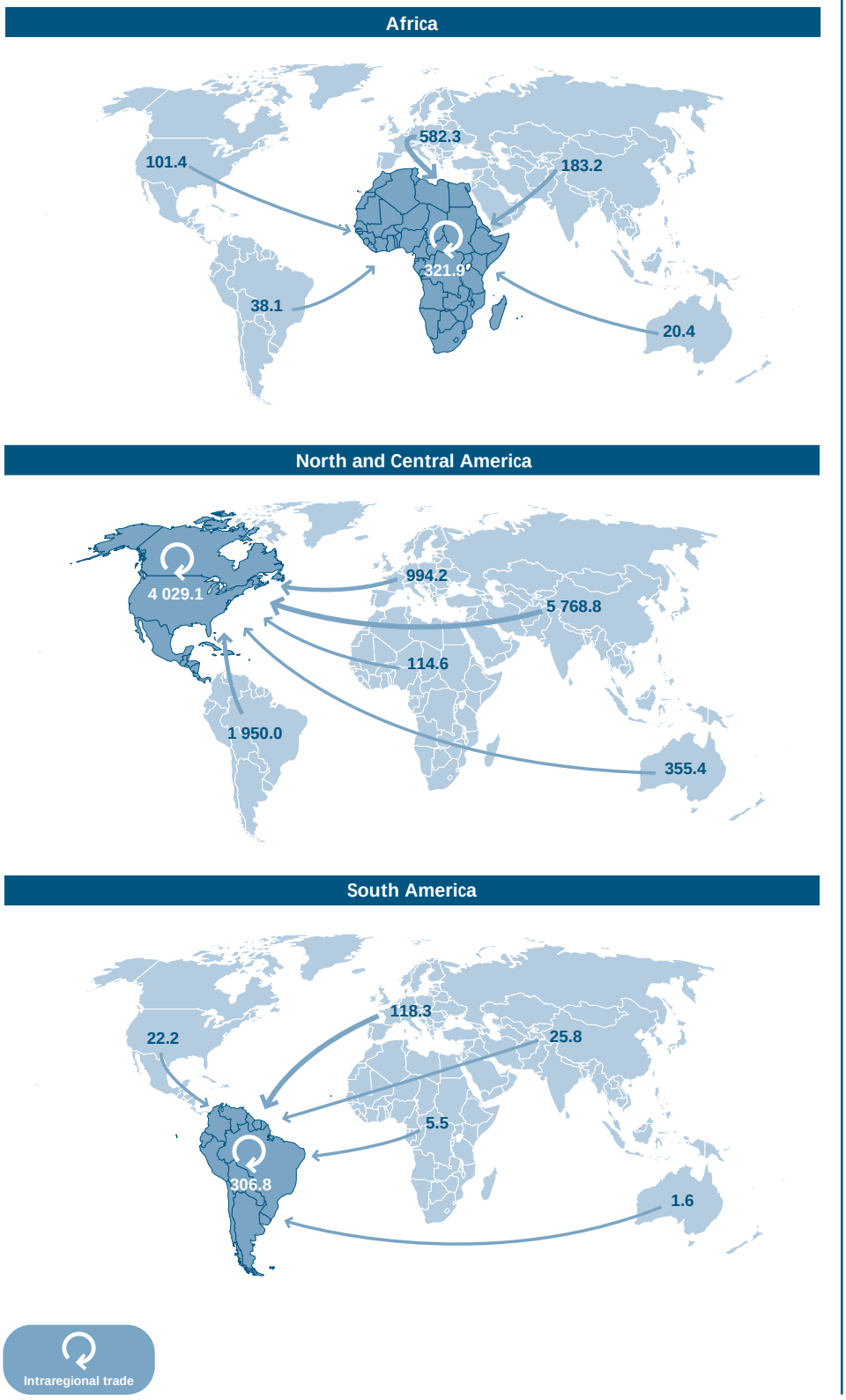


Figure 30 *(cont.)*

Trade flows by continent (total imports in US$ millions, c.i.f.; averages for 2002–04)

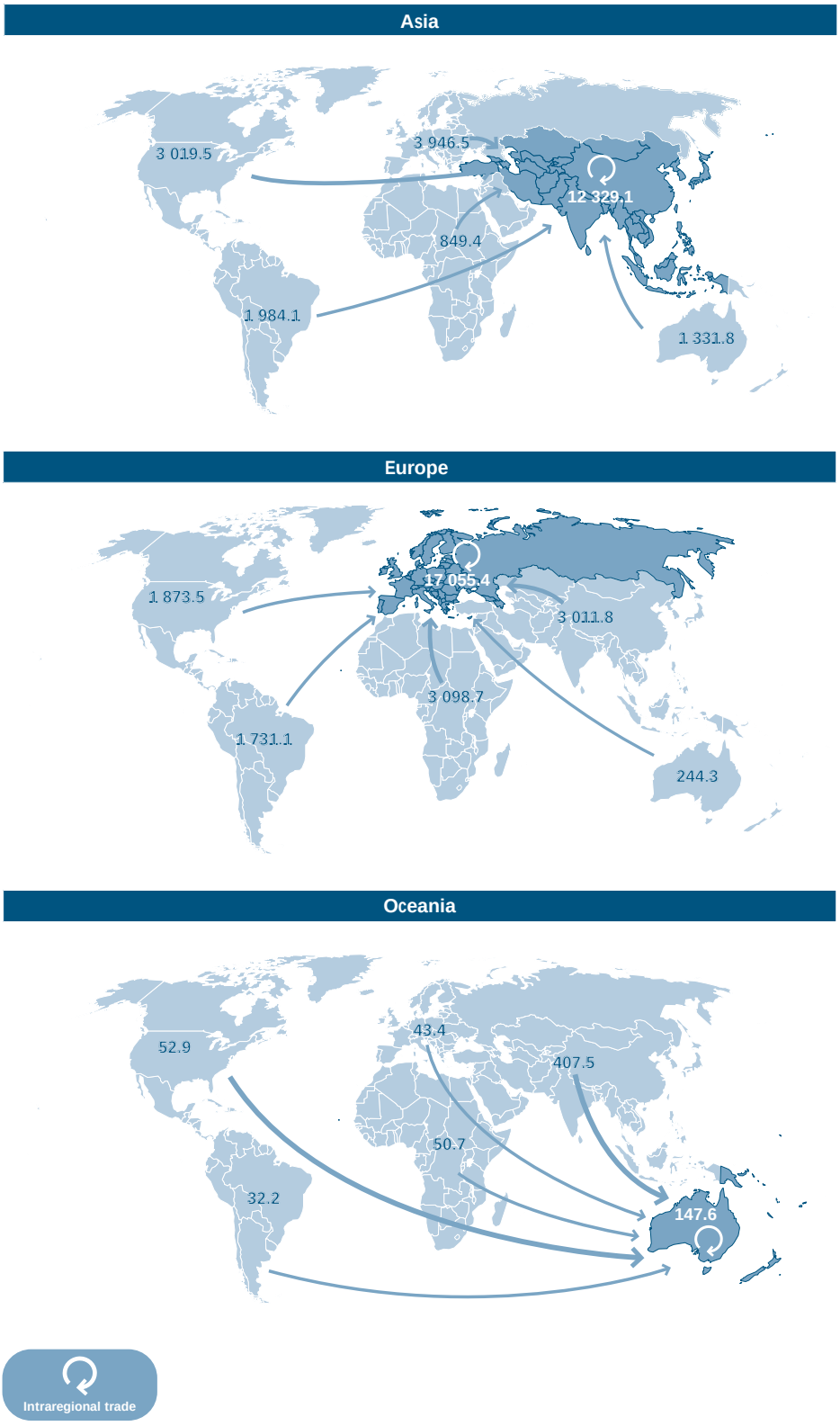
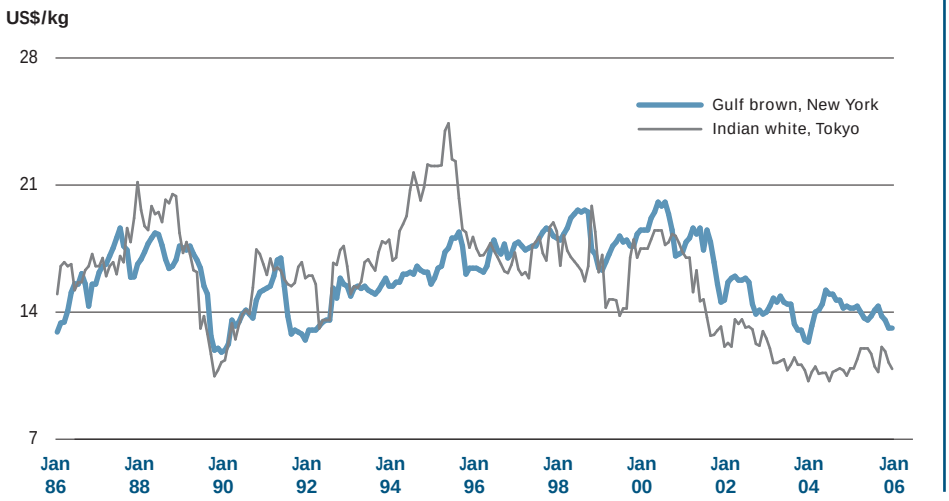


Figure 31

Shrimp prices in Japan and the United States of America




*Note*: Data refer to wholesale prices for frozen, headless, shell-on shrimps, 16-20 count.

1994–2004. The substantial increase in the quantity of shrimp traded coincided with the strong expansion in aquaculture shrimp production, which has grown rapidly since 1997, with an increase of 165 percent during the period 1997–2004 (annual growth of 15 percent). In 2004, more than 41 percent (or 2.5 million tonnes) of total shrimp production was of farmed origin. The unit value for shrimp exports increased in the 1990s to reach US$6.9/kg in 1995. Since then, probably as a result of the strong rise in production, it has declined to US$4.1/kg in 2004.

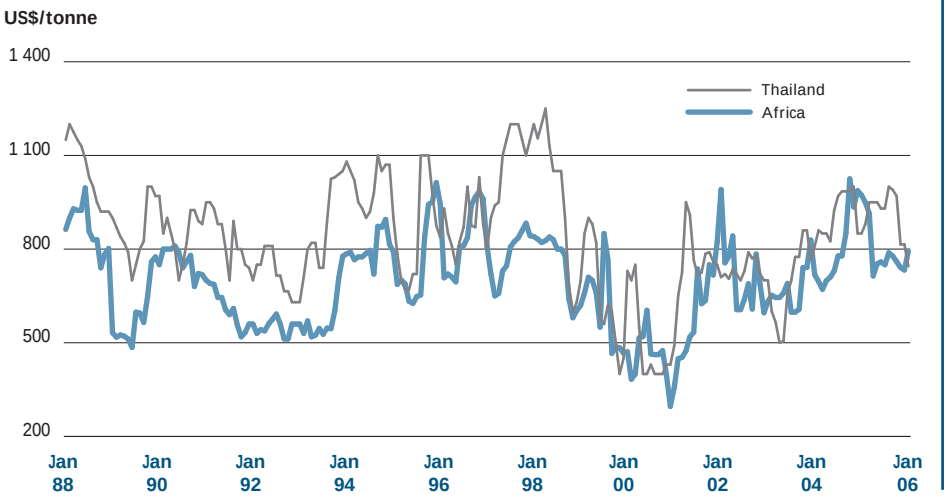
During 2005, shrimp imports in several key markets reached new highs. Key markets were influenced by supply fluctuations, in both the wild and farmed sectors, and regulatory developments in both the EU and the United States of America. Sales to the latter, the world's largest shrimp market, continued to increase and imports reached 530 000 tonnes. Annual shrimp imports into Japan during 2005 declined by 6 percent compared with the previous year. In Europe, shrimp imports increased in 2005, as a result of a strong euro and competitive international prices. The impact of the United States of America's anti-dumping process was evident in a relative switch from the Unites States market to European markets by suppliers in the six affected countries (Brazil, China, Ecuador, India, Thailand and Viet Nam). The relaxing of EU restrictions on imports of Chinese farmed shrimp was reflected in import share changes in several EU markets, most notably in Spain where China became the leading supplier. Despite signs of a gradual upward trend, initial indications for 2006, including modest demand conditions in key markets, suggest that shrimp prices will remain competitive at least for the medium term. Lower supplies from the main shrimp-producing countries were reported in 2006, which led to some increases in prices. Shrimp prices in Japan and the United States of America are presented in Figure 31.

### Salmon

The relative importance of salmon as a traded item has grown in recent years, to reach 8.5 percent in 2004, up from 7 percent in the mid-1990s, as a result of the booming salmon farming industry in Chile and Norway. The average unit value of salmon exports declined during the past 15 years, from about US$6.10/kg in 1988 to US$3.20/kg in 2004. The start of this downward trend coincided with the growth of industrial salmon aquaculture. The huge increase in farmed salmon production had a strong impact on trade. In fact, salmon trade (live weight equivalent) grew significantly during the period 1988–2004, from 375 000 tonnes to over 1.7 million tonnes. However, the decline in unit value seems to have come to an end.

Figure 32

Skipjack tuna prices in Africa and Thailand




*Note:* Data refer to c&f (cost and freight) prices for 4.5–7.0 pounds of fish. For Africa: ex-vessel Abidjan, Côte d'Ivoire.

The year 2005 was positive for salmon producers and traders worldwide. With farmed salmon prices at their highest level since 2000, salmon farmers in Europe, North America and South America are optimistic. Demand is strong in all markets and supply increased less than had been expected. Profits are abundant thanks to stellar prices and reduced production costs gained through economies of scale and efficiency gains. The outlook for 2006 is positive, although some price reductions can be expected in the future, and in the medium to long term prices should return closer to cost than they are currently. In fact, in a commodity industry, high prices lead to increased production, which in turn depresses prices.

### Tuna

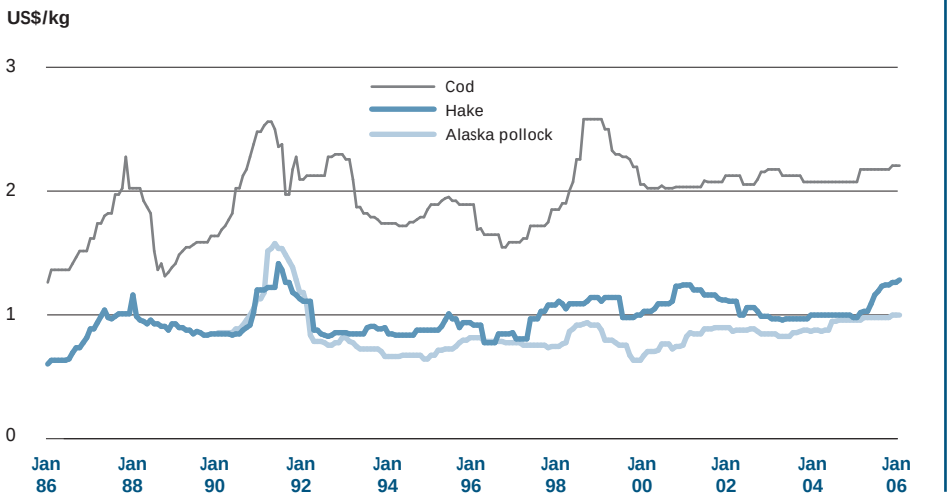
Japan is the top world market for *sashimi*-grade tuna. Recent indications of an improved economy in Japan should result in more demand for high-value *sashimi* tuna. The farming of bluefin tuna has had a significant impact on the *sashimi* market in Japan in recent years, although catch limitations do not leave much space for expansion of tuna farming. The reduction of the EU canned tuna import tariff (from 24 percent to 12 percent) for a quantity of 25 000 tonnes from countries such as Indonesia, the Philippines and Thailand was not welcomed by the main European tuna canners. On the other hand, Spanish canners are outsourcing and new canning plants have been installed by Spanish companies in Central America (in El Salvador and Guatemala). The concentration of the world tuna industry in fewer hands is continuing. Prices of skipjack tuna in Africa and Thailand are shown in Figure 32. These prices expanded sharply in the opening months of 2006, after mixed results in 2005, and canned tuna prices also rose as a result. Low catches combined with high fuel prices were the main cause for this price hike. Consumer resistance for canned tuna started to be observed in Europe in 2006, while the United States of America was already reporting lower canned tuna consumption in 2005. Press reports on dangerous levels of mercury in canned tuna are scaring away United States consumers.

### Other finfish

In a tighter supply context, frozen groundfish prices showed a definite upward trend during 2005. Groundfish prices in the United States of America are shown in Figure 33. Increased demand for *surimi* from Asia had an impact on United States Alaska pollock fillet production, and fillet supplies to Europe decreased as a result. Lower hake

Figure 33

Groundfish prices in the United States of America




*Note*: Data refer to c&f (cost and freight) prices for fillets.

landings in several Latin American countries, notably Argentina, also meant reduced supplies to Europe. China's role in frozen groundfish markets continues to increase. The country expanded its share of Alaska pollock fillet imports in the key French and German markets. It also strengthened its position in European frozen cod fillet markets, notably in Germany and the United Kingdom.

### Cephalopods

After several years of reduced production, 2005 was characterized by good supplies, for both squid and octopus. The beginning of 2006 was marked by good squid landings, notably in the Southwest Atlantic. Total production for 2006 should be in line with the good level of 2005. Spain remains the leading European squid market. During 2005, frozen imports (*Illex* and *Loligo*) increased by 7 percent over 2004 levels to almost 160 000 tonnes. In 2005, the Italian squid market followed a similar trend to that of Spain. Japan continued to be the main market for cephalopods worldwide in 2005. The octopus resource in the Central East Atlantic is recovering after years of stringent catch controls by the Moroccan Government. Prices for all cephalopod products stabilized at high levels in 2005 and early 2006. Squid and cuttlefish prices in Japan are shown in Figure 34.

### Fishmeal

The bulk of fishmeal production – about 60 percent – is exported each year. In 2005, fishmeal production in the five major exporting countries amounted to 3.5 million tonnes, which compares with 4.7 million tonnes in 2000. Catches of fish for reduction were low in all major fishmeal-producing countries. Fishmeal prices, which increased strongly in 2005 and in the opening months of 2006, are a result of strong demand, especially from China and other Asian countries. Fishmeal and soybean meal prices for Germany and the Netherlands are given in Figure 35.

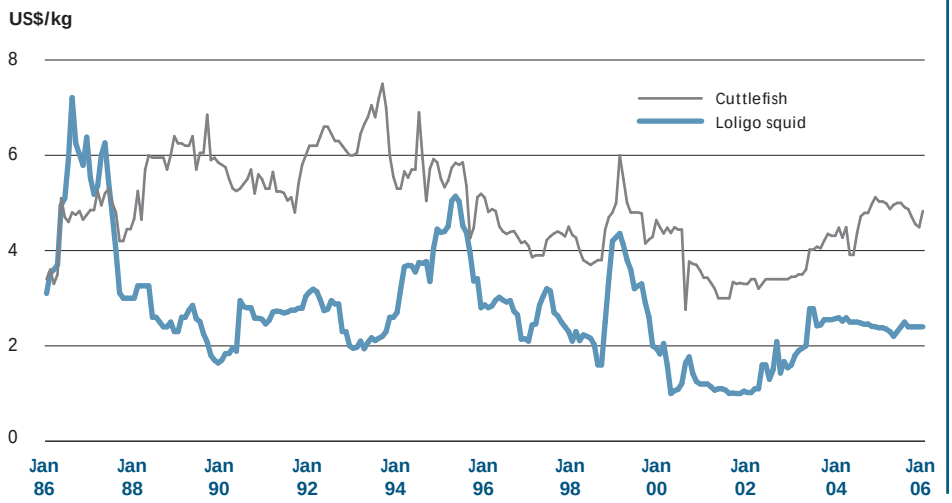
## GOVERNANCE AND POLICY

### Marine fisheries

RFMOs play a unique role in facilitating international cooperation for the conservation and management of fish stocks. These organizations represent the only realistic means of governing fish stocks that occur either as straddling or shared stocks between zones of national jurisdiction or between these zones and the high seas, or exclusively on

Figure 34

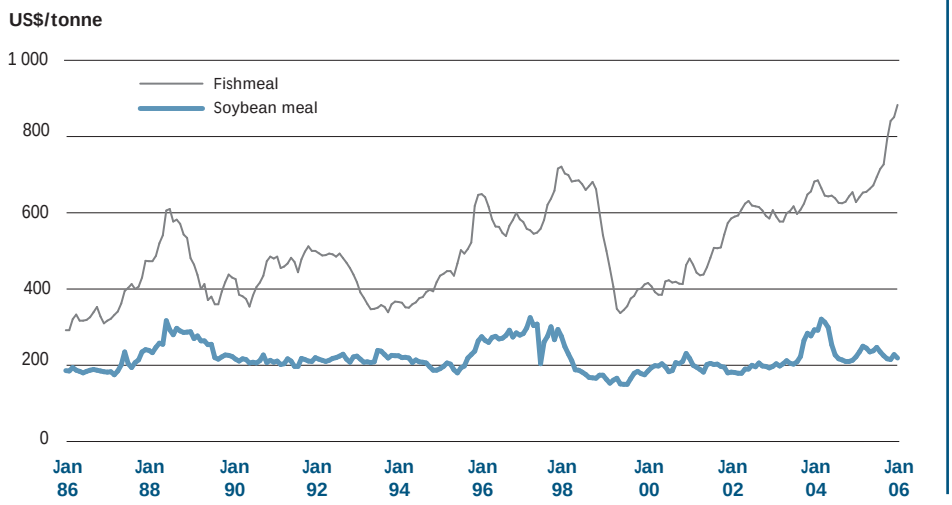
Cephalopod prices in Japan




*Note:* Data refer to wholesale prices.
For cuttlefish: whole, 10 kg/block, 0.4–0.6 kg/pc; for squid: whole 7.5 kg/block, 21-30 kg/pc.

Figure 35

Fishmeal and soybean meal prices in Germany and the Netherlands




*Note:* Data refer to c.i.f. prices.
Fishmeal: all origins, 64–65 percent, Hamburg, Germany
Soybean meal: 44 percent, Rotterdam, the Netherlands.

*Source:* OIL WORLD; FAO GLOBEFISH.

the high seas (see Box 2).[18] They seek to promote the long-term sustainable use of the target stocks falling within these mandates, though RFMOs are moving towards a broader ecosystem approach to fisheries management and biodiversity considerations where measures are adopted for species belonging to the same ecosystem or are associated with, or dependent upon, the target stocks.

Strengthening RFMOs in order to conserve and manage fish stocks more effectively remains the major challenge facing international fisheries governance. Despite

Box 2

### FAO's role in promoting cooperation for more effective governance

FAO seeks to promote cooperation among regional fishery bodies (RFBs), aware that the need for effective global and regional fisheries governance has been increasing dramatically in importance. FAO's main objective is to foster international fisheries cooperation so as to enhance conservation and management. With this goal in mind, FAO provides technical and administrative support to its 11 RFBs. FAO also encourages all RFBs to work to strengthen their mandates and functions so as to improve their operational efficiency, and the stablishment of new bodies where none exists currently. As an ongoing initiative, FAO promotes and hosts the biennial meetings of RFBs as a means of facilitating discussion and information sharing among them. These meetings address the outcomes of the FAO Committee on Fisheries focusing on issues such as the role of RFBs in global fisheries governance, IUU fishing, fleet overcapacity, the EAF, marine protected areas, harmonization of catch/trade documentation and the fishery resources monitoring system.

In response to worldwide public concerns about the state of world fishery resources and related ecosystems, the FAO has been promoting, *inter alia* in the RFBs, the extended application of the Code of Conduct for Responsible Fisheries together with the EAF, as well as the related International Plans of Action (on seabirds, sharks, fishing capacity and IUU).

efforts over the past decade to improve their management capacity and their images as effective and responsive organizations, some RFMOs have failed to achieve their fundamental goal of the sustainable management of stocks. This situation has led to an increasing number of stocks being subject to catch moratoria, together with elevated international criticism concerning the effectiveness of RFMOs. This criticism, from RFMO members as well as civil society, undermines the credibility of, and respect for, RFMOs.

Many RFMOs are focusing their efforts on implementing measures that will operationalize key aspects of the 1995 UN Fish Stocks Agreement and other recently concluded international fisheries instruments (see Box 3). Important steps towards the implementation of these instruments have been taken through the review and updating of mandates: for example, by the General Fisheries Commission for the Mediterranean (GFCM), the Indian Ocean Tuna Commission (IOTC), the Inter-American Tropical Tuna Commission (IATTC), the International Commission for the Conservation of Atlantic Tunas (ICCAT), the North East Atlantic Fisheries Commission (NEAFC) and the Northwest Atlantic Fisheries Organization (NAFO).

Several tuna management bodies are concerned about perceived overcapacity in global tuna fleets. Work they have conducted jointly with FAO indicates the need to move towards a rights-based management system, with interim management procedures suggested in the meantime. These procedures include an immediate moratorium on the entry of additional large vessels and the development of allocation criteria and mechanisms for new participants.

In addition to taking steps to implement the EAF (including measures to minimize bycatch such as sharks, sea turtles and seabirds), RFMOs are striving to adopt the precautionary approach. They are also working to strengthen international cooperation, promote transparency, encourage eligible non-members to become members of organizations or cooperating entities, and enhance compliance and

Box 3

### 1995 UN Fish Stocks Agreement Review Conference

The 1995 UN Fish Stocks Agreement Review Conference, held in New York, United States of America, from 22 to 26 May 2006, was foreseen in Article 36 of the Agreement when it was negotiated. In reviewing and assessing the adequacy of the provisions of the Agreement, and in proposing means to strengthen its implementation, the Review Conference focused on the relevant provisions relating to the conservation and management of stocks (adoption of measures, overfishing and capacity management, effects of fishing on the marine environment, fisheries not regulated by an RFMO, and data collection and sharing); mechanisms for international cooperation (integrity of RFMO regimes, fishing activity by non-members of RFMOs, functioning of RFMOs and participatory rights); monitoring, control and surveillance, compliance and enforcement (implementation of flag state duties and investigation and penalization for violations); developing states (recognition of the special requirements, provision of assistance and capacity building) and non-parties (increasing adherence to the Agreement).

The Review Conference structured its report around two themes – review and assessment – and proposed means for strengthening the elements in the clusters (in terms of action by states, individually and collectively through RFMOs and, as appropriate, by FAO and the United Nation's Division of Ocean Affairs and the Law of the Sea). The strong focus on RFMOs in the recommendations agreed by the Conference reflected their central role in implementing the Agreement. Importantly, it was agreed that high seas discrete stocks would be included within the ambit of the Agreement, thereby eliminating a conservation and management gap for these stocks.

An issue that attracted considerable discussion during the Review Conference was the need for RFMOs to embrace and accommodate new entrants, and in particular developing countries, in an equitable manner within the limits of scientific advice for managed stocks. While noting that this was a delicate issue linked to the concept of "real interest" and effective flag state control over vessels, it was pointed out that a failure to deal adequately with participation and allocation of fishing opportunities within RFMOs could promote, unwittingly, IUU fishing.

On the matter of port state measures – a weak link in the chain in efforts to combat IUU fishing – the Review Conference proposed that FAO, building on the 2005 FAO Model Scheme on Port State Measures and the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing, initiate a process to develop, as appropriate, a legally binding instrument on minimum standards for port state measures.

The Review Conference agreed to continue to review the implementation of the Agreement and to the resumption of the Review Conference at a date not later than 2011.

enforcement through improved monitoring, control and surveillance (MCS), including the implementation of mandatory vessel monitoring systems (VMS), the adoption of regional schemes for port state measures and the development of vessel lists.

Two RFMOs established after the conclusion of the 1995 UN Fish Stocks Conference – the South East Atlantic Fisheries Organization (SEAFO) and the Western and Central

Pacific Fisheries Commission (WCPFC) – are implementing the provisions of the 1995 UN Agreement through their Conventions.

In 2004, the FAO Council, in Resolution 1/127, established the South West Indian Ocean Fisheries Commission (SWIOFC) under Article VI of the FAO Constitution. As the newest RFB of its type, it seeks to promote the sustainable development, conservation, rational management and best utilization of fishery resources in the region, with a special emphasis on fisheries targeted at non-tuna species. SWIOFC's membership is open to coastal states whose territories are situated wholly or partly within the area of the Commission (i.e. the Southwest Indian Ocean) and that notify in writing to the FAO Director-General their interest in becoming a member of the Commission. The Commission held its first meeting in April 2005 in Mombasa (Kenya) and its second meeting in Maputo (Mozambique) in August 2006.

Also noteworthy are two other conventions that focus on the conservation and management of deep-sea resources of the high seas (including discrete high seas stocks) and that use the 1995 UN Fish Stocks Agreement as a framework: the South Indian Ocean Fisheries Agreement (SIOFA), which was adopted and opened to signature in July 2006,[19] and the South Pacific Regional Fisheries Management Organisation (SPRFMO), which is still under negotiation. Both of these agreements and organizations are intended to fill high seas management gaps where valuable but vulnerable stocks exist. Some of the stocks covered by the agreements are subject to heavy fishing pressure and in the case of the Indian Ocean they have probably already been overfished.

The perceived lack of action by RFMOs and their inability in some cases to stem stock declines should be viewed in the context of the obstacles faced by many RFMOs, not all of which are of their own making. A lack of political commitment by the members of some RFMOs and unyielding positions that mitigate against sound regional fisheries management (e.g. insistence on the use of consensus-based decision-making, even for RFMOs established in the post-1995 UN Fish Stocks Agreement era, and opt-out/objection provisions for management measures[20]), has thwarted, if not stalled, efforts by some RFMOs to meet and address conservation and management challenges. Such positions hinder RFMO performance, while criticism is directed at the organizations rather than at their members.

The high incidence and increasing sophistication of IUU fishing continue to undermine the work of RFMOs. The continuing widespread use of flags of non-compliance and ports of convenience exacerbates the scope and extent of IUU fishing. The criminal aspect of IUU fishing is also coming to the fore as organizations take measures against offending fishing vessels and their owners, and RFMO secretariats sometimes receive threats intended to make them withdraw measures that combat IUU fishing.

Coupled with the issue of RFMO credibility are calls for their performance to be reviewed regularly as a means of promoting greater efficiency and accountability. However, this issue is highly sensitive and in some instances RFMO members have been reluctant to support such evaluation believing that it might interfere with their autonomy, disrupt their work and, ultimately, reflect poorly on their membership. Nonetheless, despite objections, the rationale and need for such performance appraisal is taking root and gaining wide international acceptance. It has been argued in international fora that, provided that reviews are undertaken in a transparent and inclusive manner and with the full involvement and cooperation of members and secretariats, RFMOs should embrace the review process as a means of boosting their international reputation. More importantly, the review outcomes should provide concrete results that organizations can adopt and implement to strengthen their conservation and management capacity.

Following consideration of this issue by the Twenty-sixth Session of the FAO Committee on Fisheries (COFI) and the Fourth Meeting of Regional Fishery Bodies, the North East Atlantic Fisheries Commission (NEAFC) in 2005 agreed to undertake an independent performance review of the Commission.[21] The purpose of the review was

to provide a systematic check on its performance since its inception in 1982 and its consistency with the NEAFC Convention, the 1995 UN Fish Stocks Agreement and other relevant international agreements and instruments. A comprehensive set of criteria was developed, against which NEAFC will be reviewed. The results of the review should point to NEAFC's achievements and areas where there is scope for improvement. The review panel will involve the Chairs of two NEAFC working groups, the Secretary of the Commission, an independent marine scientist and two UN experts, one each from FAO and the United Nations Division for Ocean Affairs and the Law of the Sea (UNDOALOS).

This is the first RFMO performance review to be undertaken, the results of which should be available at NEAFC's annual meeting in 2006. Despite hesitancy on the part of some NEAFC members in proceeding with the review, the Commission has shown leadership in venturing into a new and important area for RFMOs. However, RFMO members are aware that reviews will not, in themselves, lead to enhanced performance: the results of these reviews, which should be accessible to all interested parties, must be translated into time-bound operational measures if RFMO shortcomings are to be addressed and if these organizations are to be strengthened to play an even more effective role in the governance of fish stocks.

In 2005, Ministers attending the Conference on the Governance of High Seas Fisheries and the UN Fish Agreement – Moving from Words to Action[22] adopted a declaration that focused, *inter alia*, on the role and work of RFMOs. It noted that these organizations are fundamentally important for high seas fisheries governance. The Ministers undertook to implement, through RFMOs, key measures ranging from strengthened decision-making processes to the implementation of improved MCS to address more vigorously IUU fishing and fleet overcapacity. Moreover, the declaration recognized the need to assist developing countries in implementing international fisheries agreements and for officials to identify practical ways to move forward on the commitments set out in the declaration.

A further initiative that focused attention on IUU fishing and the role played by RFMOs in attempts to combat this problem was the work of the Ministerially-Led Task Force on IUU Fishing on the High Seas.[23] The resultant report addresses improved high seas governance and suggests that a model for be developed for improved governance by RFMOs to deter IUU fishing. It also advocates promoting a more systematic approach to the review of RFMO performance and encourages RFMOs to work together more effectively through improved coordination and the use of port- and trade-related measures. Although the Task Force was led by a small number of fisheries ministers and heads of NGOs, its outcomes are being promoted widely as a means of encouraging greater "buy-in" and participation in the implementation of the report's nine proposals. While many of these proposals are already on the international fisheries agenda and are being implemented to varying degrees, the Task Force's report serves to focus attention more sharply on them and, as a result, attract funding to support more intensive implementation.

### Inland fisheries

Many of the world's large river basins cross one or several international borders (Table 12) and therefore activities in one country may affect fish stocks and fisheries in the others. Many riverine fish species are migratory, so even in situations where an impact on a certain species is confined to a particular area, the effects on the species may be felt by communities exploiting the fish stock in other countries. Thus, there is a need for a system of governance for transboundary and international inland waters.

Appropriate fisheries management of transboundary waters requires that suitable policies and strategies for sustaining the shared resources (water and biological resources) are developed at the regional level, and that these are incorporated into national legislation and implemented. The first step would be to identify the species and stocks that are shared and establish whether they are vulnerable and to what threats. The countries would then move on to identify the specific management measures that are required. The FAO Code of Conduct for Responsible Fisheries[24]

Table 12
International river basins and management frameworks by continent

| Continent | International basins[1] | Number of basins with international agreements[1] | | Inland water commissions with a mandate in fisheries |
|---|---|---|---|---|
| | (Number) | (Number) | (Percentage) | (Number) |
| Africa | 59 | 19 | 32 | 8 |
| Asia | 57 | 24 | 42 | 2 |
| Europe | 69 | 45 | 63 | 12 |
| North America | 40 | 23 | 58 | 3 |
| South America | 38 | 6 | 16 | 6 |

[1] Based on United Nations Environment Programme. 2002. *Atlas of International Freshwater Agreements*. Nairobi.

emphasizes, *inter alia,* that "States should ... cooperate at subregional, regional and global levels ... to promote conservation and management, ensure responsible fishing and ensure effective conservation and protection of living aquatic resources throughout their range of distribution, taking into account the need for compatible measures in areas within and beyond national jurisdiction" and, further, "For transboundary fish stocks ... the States concerned ... should cooperate to ensure effective conservation and management of the resources. This should be achieved, where appropriate, through the establishment of a bilateral, subregional or regional fisheries organization or arrangement."

A range of regional frameworks provide advice on, or deal directly with, the management of inland waters and living aquatic resources. However, the governance system is incomplete as only 44 percent of international basins are subject to one or more agreements, and these agreements deal with a variety of issues that may or may not include fisheries. Many do not focus on fishery resources, but on water as a resource, for example the allocation of water for irrigation, flood protection, navigation or hydropower generation. Nevertheless, the agreements have a mandate in environmental matters, which could be extended to include fisheries although these are often not specifically mentioned. A searchable database of summaries and the full text of most of these agreements can be found at http://faolex.fao.org/faolex.

Inland fisheries are especially vulnerable to influences from outside the fisheries sector, for example water diversion, habitat degradation, pollution and loss of habitat. The governance system that applies to inland water bodies rarely considers the maintenance of fisheries as a prime target, and often favours other sectors using the water resource – sectors that are perceived to be more profitable or more important. This system has in some instances resulted in negative impacts for inland fishers and communities dependent on inland fishing.

There are, however, some encouraging developments. Resolution IX.4 of the Ramsar Convention on Wetlands,[25] which addresses the conservation, production and sustainable use of fisheries resources, stresses, *inter alia*, that "local, national and international mechanisms should be established, as appropriate, whereby allocation of essential resources for the protection of aquatic resources and specifically fisheries resources are negotiated among all users of the resource". The European Water Framework Directive[26] emphasizes the river basin approach for the integrated and coordinated river basin development and management of all European river systems. The Framework calls for a comprehensive ecological assessment and classification on the basis of the composition and abundance of the aquatic fauna and flora and taking into account the type-specific reference conditions of the water body.

The Mekong River Commission oversees the world's largest inland fishery and, at its 11th Ministerial Council meeting in 2004, pledged to implement "Integrated Water

Resources Management" at basin scale as a means of alleviating poverty and enhancing economic growth. In the lower Mekong Basin, demand for hydropower is expected to increase by 76 percent each year for the next 20 years and the objective of the Commission is to "meet this demand in a way that fully recognizes the requirement to safeguard ecosystems and social interests".[27]

Within the inland fisheries sector, capture fisheries is competing with aquaculture, *inter alia,* for development assistance. In the past, negative consequences from aquaculture on the aquatic environments have sometimes been predicted. Today, however, in many regions the perceived benefits of aquaculture are increasingly inspiring a change in how water bodies are being used. In Lake Victoria, for example, many interested parties in riparian countries are lobbying the Lake Victoria Fisheries Organization (LVFO) for legislation to permit cage culture in and around the lake and the LVFO has requested FAO's assistance in developing such legislation.

Not only are inland fisheries unlikely to be, or become, the primary focus in all water management programmes, but there is also a risk that the needs of rural and small-scale fisheries will not be considered in these programmes unless water governance systems are expressly designed to include inland fisheries.

### Aquaculture

There is growing understanding that sustainable development of the aquaculture sector requires an enabling environment, with appropriate institutional, legal and management frameworks guided by an overall policy. While efforts towards reaching the goal of sustainable development vary among countries, according to the level of commitment by policy-makers and the scale of development of the aquaculture sector, notable progress has been made in a number of institutional, legal and management development areas, including the use of various public- and private-sector partnership arrangements.

Because aquaculture activities are generally located within national borders, most aquaculture is managed, monitored and governed by national instruments and arrangements. This situation contrasts with that of capture fisheries, where important fisheries are transboundary in nature and regional, international and/or global governance instruments are required to harmonize national governance of the shared resources.

The Network of Aquaculture Centres in Asia–Pacific (NACA) is the only true regional intergovernmental organization that promotes aquaculture, and the COFI Sub-Committee on Aquaculture is the only global intergovernmental forum that discusses aquaculture exclusively. There are also several international NGOs and civil society instruments that assist aquaculture regionally. As the importance of aquaculture continues to rise, it is likely that more regional and international instruments will be developed to support governance of the sector.

Among the lessons learned from the establishment and operations of aquaculture networks such as NACA is that technical cooperation among member governments works.[28] Building on the NACA experience, the Network of Aquaculture Centres of Central–Eastern Europe (NACEE) was established in 2004. In other regions, especially in Latin America and sub-Saharan Africa, several countries, together with FAO, are exploring the possibilities of establishing such regional networks.

Recent research and reviews clearly indicate that one of the key trends in aquaculture development and management is enhanced regulation and better governance.[29] Examples include the implementation of integrated land-use planning, including the establishment of farmer-friendly tenure systems and appropriate environmental planning, and the development and enforcement of regulations for the general management of aquaculture, including aspects such as the use of drugs and chemicals. Self-regulation of the sector has led to several essential developments, such as codes of practice and better management practices, including in collaboration with farmers.

Aquaculture does not exist in isolation, and increased regulation of the sector also requires that its external effects are moderated. Following a trend in some regions

of increasing intensification and rising numbers of farms, environmental impact assessment and routine environmental monitoring are being conducted.

An encouraging trend is that an increasing number of countries have formulated, or are in the process of formulating, fisheries policies, plans, regulations and strategies that accommodate and facilitate growth and efficient management of the aquaculture sector. A recent study by FAO on the integration of fisheries into key national policy documents relating to poverty reduction and rural development showed that the sector has been most effectively mainstreamed in Asia (in the case of poverty reduction strategy papers and national development plans), closely followed by Africa.[30]

The Abuja Declaration on Sustainable Fisheries and Aquaculture in Africa was adopted by the Heads of State Meeting of the New Partnership for Africa's Development (NEPAD) Fish for All Summit in Nigeria.[31] On the same occasion, the Global Program on Fisheries (PROFISH)[32] was launched. The Program is a new global partnership of developing countries, donors and technical agencies led by the World Bank. These are two significant recent developments that demonstrate national and international commitment towards realizing the potential that fisheries and aquaculture have to contribute to food security, poverty reduction and economic development.

From the federation of aquaculture self-help groups, including women's groups, in one of the poorest villages of India to the Global Aquaculture Alliance, producer associations have been playing a major role in global aquaculture development. While the producer associations have a range of purposes, some of the common ones are: shaping and influencing policy and regulations; providing technical services; facilitating access to markets; developing and promoting codes of conduct, best management practices and self-regulatory practices; and sharing of knowledge.

As part of their overall privatization strategy, many countries engaged in promoting aquaculture development are expanding the scope of their privatization programme to include the aquaculture sector. In sub-Saharan Africa, for example, Kenya's approach is to play a supportive role by fostering participative policy formulation, providing a conducive legal and investment framework, establishing public–private partnerships, providing basic infrastructure support, promoting self-regulation, providing a research platform, undertaking zoning for aquaculture and providing monitoring and evaluation support.

Civil society groups, including NGOs, are also making substantial contributions to policy formulation and implementation and support to poor aquaculture farmers. These groups have been instrumental in making the sector address the issues that arose from unsustainable shrimp farming practices in many countries in Asia and Latin America.

Co-management is an emerging trend and is usually applied in the management of common property resources, such as floodplains and forests. In the context of the aquaculture sector, the application of co-management (see Box 6 on pp. 72–73) has been effective in culture-based fisheries, a form of aquaculture practised communally in small water bodies in rural areas. This form of aquaculture has the potential to increase fish production with minimal input of resources (e.g. in Bangladesh, Sri Lanka, Thailand and Viet Nam). An evaluation of this type of programme in three countries (Bangladesh, the Philippines and Thailand) found that it had contributed to the development of self-help initiatives, local ownership and decision-making in communities.

### Trade

The role of fishery subsidies continues to receive great attention from both governments and civil society. Given their cross-cutting nature, subsidies influence the economic, social and environmental dimensions of fisheries. Thus many different interests are involved. Discussions on fisheries subsidies have been taking place at the technical and policy levels, each influencing the other.

On the technical side, much progress has been achieved from a theoretical and analytical point of view from work in several intergovernmental organizations (*inter*

*alia,* FAO, the Organisation for Economic Co-operation and Development [OECD] and the United Nations Environment Programme [UNEP]) and NGOs (in particular the World Wide Fund for Nature). On the policy side, the main centre for the negotiations on fisheries subsidies is the WTO Negotiating Group on Rules. During the WTO Ministerial Meeting held in China, Hong Kong Special Administrative Region (2005), in reviewing progress achieved in discussions based on the Doha Mandate of 2001, Ministers noted that there is broad agreement that the Negotiating Group on Rules should strengthen disciplines on subsidies in the fisheries sector, including by prohibiting certain forms of fisheries subsidies that contribute to overcapacity and overfishing. Ministers also noted that special and differential treatment for developing and least-developed Members that is both appropriate and effective should be an integral part of the fisheries subsidies negotiations, taking into account the importance of this sector to development priorities, poverty reduction, livelihoods and food-security concerns. Several text-based submissions for fisheries-specific amendments to the Agreement on Subsidies and Countervailing Measures are being discussed. More recently, under the initiative of several Members, the debate on fisheries subsidies seems to be expanding to areas other than fish-capture activities, i.e. to aquaculture, fish processing, etc.

In addition to focusing on the need to discipline fisheries subsidies that contribute to overcapacity and overfishing, countries are debating how to integrate sustainable development considerations into the fisheries subsidies disciplines. Beyond the general issues concerning the implementation of special and differential treatment, difficulties are being faced in defining small-scale fisheries and in incorporating fisheries access agreements fees into the disciplines. It seems possible that the outcomes of the negotiations will depend on how certain technical issues will be defined and agreed and also on how far WTO Members will go in addressing not only trade, but also environmental and development issues.

With the entry of China into the WTO in 2001, all major fishery countries other than the Russian Federation and Viet Nam (which have started membership negotiations) are now Members of the WTO.

The declaration adopted by the WTO Ministerial Conference in 2005 has important implications for fisheries. Import tariffs on non-agricultural goods, which include fish and fishery products, might be reduced using a certain formula. The exact coefficients and reductions for the formula could have been decided in 2006. Developing country exporters would have benefited from "the reduction or elimination of tariff peaks, high tariffs, and tariff escalation, in particular on products of export interest" to them. For fishery products this could have had possible implications for exporters of value-added products, although countries that enjoy preferential treatment today would see their advantage reduced in the future. Since the above scenario did not materialize owing to failure to reach agreement, the future of the negotiations within WTO still remains uncertain.

Other important issues relevant to international trade in fishery products that have been prominent in recent years include the introduction of new labelling and traceability requirements in major markets; the adoption of the FAO guidelines on ecolabelling of fish and fishery products originating from marine capture fisheries; trade disputes between importing and exporting countries related to alleged dumping of aquaculture products and subsidies in production; the expansion of regional trade areas and the number of new bilateral trade agreements with strong relevance to fish trade. The full impact and long-term effects of these agreements in addition to, or as a substitute for, broader multilateral agreements, are not yet clear. One trade agreement of particular relevance for trade in fish and fishery products is the one currently being negotiated at the regional level between the African, Caribbean and Pacific Group of States (ACP) group of countries and the EU. The objective of these negotiations is to conclude economic partnership agreements between the EU and the six different ACP regions and render them operational from January 2008.

## NOTES

1. See, in particular, FAO. 2002. *The State of World Fisheries and Aquaculture 2002*, Box 2, p. 9. Rome.
2. FAO. 1996. *Chronicles of marine fishery landings (1950–1994): trend analysis and fisheries potential*, by R.J.R. Grainger and S.M. Garcia. FAO Fisheries Technical Paper No. 359. Rome.
3. Also includes amphibians (frogs and turtles). For brevity, referred to hereafter as "fish, crustaceans and molluscs" or "food fish supply".
4. FAO. FAOSTAT (www.faostat.fao.org). Accessed 22 May 2006.
5. The regions match those presented in the analysis outlined in FAO. 2006. *State of world aquaculture 2006.* FAO Fisheries Technical Paper No. 500. Rome.
6. The culture of aquatic plants is not considered in the remainder of this section.
7. While mussels and oysters are high-priced per kilogram of meat, they are relatively low-valued in terms of value per kilogram of whole animals, as shell weight can account for a large percentage of the total (live) weight. It should be noted that statistics on aquaculture production are reported as live weight.
8. Here, brackish-water production is assigned to either marine areas or inland areas depending on the area reported by the country. Thus, production in inland areas and marine areas represents the total of aquaculture production.
9. A "maru-ship" is a Japanese ship operated partially by a non-Japanese crew.
10. Occasional fishers are defined as individuals who derive less than 30 percent of total earnings, or who spend less than 30 percent of the total time worked, in fisheries; for part-time fishers these shares increase to between 30 and 89 percent, and for full-time fishers they are at least 90 percent.
11. FAO. 2006. *The state of world highly migratory, straddling and other high seas fishery resources and associated species*, by J.-J. Maguire, M. Sissenwine, J. Csirke, R. Grainger and S. Garcia. FAO Fisheries Technical Paper No. 495. Rome.
12. The United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (available at http://daccessdds.un.org/doc/UNDOC/GEN/N95/274/67/PDF/N9527467.pdf?OpenElement).
13. J.D. Allan, R. Abell, Z. Hogan, C. Revenga, B.W. Taylor, R.L. Welcomme and K. Winemiller. 2005. Overfishing of inland waters. *BioScience*, 12: 1041–1051.
14. M. Halwart and M.V. Gupta, eds. 2004. *Culture of fish in rice fields*. Rome, FAO and The WorldFish Center (available at http://www.worldfishcenter.org/Pubs/CultureOfFish/Culture-of-Fish.pdf); FAO. 2004. *Tilapias as alien aquatics in Asia and the Pacific: a review*, by S.S. De Silva, R.P. Subasinghe, D.M. Bartley and A. Lowther. FAO Fisheries Technical Paper No. 453. Rome.
15. This section is based on data published in FAO, 2007. *Fish and fishery products. World apparent consumption statistics based on food balance sheets*. Revision 8: 1961–2003. FAO Fisheries Circular No. 821. Rome. Some discrepancy may occur with other sections that quote data made available to FAO more recently.
16. The term "fish" indicates fish, crustaceans and molluscs, excluding aquatic mammals and aquatic plants.
17. Per capita consumption is calculated on an annual basis and using a live-weight equivalent unless otherwise stated.
18. A distinction is made between RFMOs and regional fishery bodies (RFBs). Usually RFBs do not have fisheries conservation and management mandates. Rather, they seek to promote cooperation among members on fisheries matters of common concern, and may have advisory mandates.
19. During the signing ceremony, held at FAO headquarters, Rome, six countries (Comoros, France, Kenya, Mozambique, New Zealand and Seychelles) and the European Community signed the South Indian Ocean Fisheries Agreement.

20. Even if opt-out provisions are not invoked by parties to an RFMO, their existence and potential use by members weakens the effectiveness of management measures adopted. Significantly, the 2006 Review Conference of the 1995 UN Fish Agreement recommended that states individually and collectively through RFMOs "Ensure that post opt-out behaviour is constrained by rules to prevent opting out parties from undermining conservation ...".
21. RFMO performance reviews were also addressed in paragraph 60 of the United Nations General Assembly Resolution 60/31.
22. Held in St Johns, Newfoundland, Canada, from 1 to 5 May 2005.
23. The work of the Task Force extended over a period of two years. The report was released in March 2006.
24. FAO. 1995. *FAO Code of Conduct for Responsible Fisheries.* Rome.
25. Ramsar. 2005. *Resolution IX.4. The Ramsar Convention and conservation, production and sustainable use of fisheries resources* (available at http://www.ramsar.org/res/key_res_ix_04_e.pdf).
26. Adopted on 23 October 2000 (available at http://ec.europa.eu/environment/water/water-framework/index_en.html).
27. For further information, see http://www.mrcmekong.org/mekong_program_ceo.htm#integrated_water.
28. For further information, see www.enaca.org.
29. FAO. 2006. *State of world aquaculture 2006*, by R. Subasinghe. FAO Fisheries Technical Paper No. 500. Rome.
30. FAO. 2005. *Mainstreaming fisheries into national development and poverty reduction strategies: current situation and opportunities*, by A. Thorpe. FAO Fisheries Circular No. 997. Rome.
31. For further information, see http://www.fishforall.org/ffa-summit/africasummit.asp.
32. For further information, see http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTARD/0,,contentMDK:20663251 ~pagePK:210058~piPK:210062~theSitePK:336682,00.html.