PART 1
World review of fisheries and aquaculture

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FISHERIES RESOURCES: TRENDS IN PRODUCTION, UTILIZATION AND TRADE

OVERVIEW

Global production from capture fisheries and aquaculture and the food fish supply is currently the highest on record and remains very significant for global food security, providing more than 15 percent of total animal protein supplies (Tables 1 and 2 and Figure 1). China remains by far the largest producer, with reported fishery production of 41.6 million tonnes in 2000 (17 million tonnes from capture fisheries and 24.6 million tonnes from aquaculture), providing an estimated food supply of 25 kg per capita. However, there are increasing indications that capture fishery and aquaculture production statistics for China may be too high as suggested by several academic studies, and that this problem has become more pronounced since the early 1990s. Because of its importance and the uncertainty about its production statistics, China is usually discussed separately from the rest of the world, as in the previous edition of this document.

Outside China, the world's population has been increasing more quickly than the total food fish supply from production, resulting in a decreased global per capita fish supply from 14.6 kg in 1987 to 13.1 kg in 2000 (Figure 2). This decrease has been unevenly distributed. In some countries and regions fish consumption has decreased, while in others the supply has remained relatively static or has even increased slightly.

In 2000, reported global capture fisheries for the world excluding China returned to the level of the early 1990s, reaching about 77 to 78 million tonnes. This followed the oscillations of the 1994–1998 period, which were caused by the influence of El Niño on the catches of Peruvian anchoveta. There have been some recent relative gains from other regions, particularly Asian inland waters, the Indian Ocean and the West Central Pacific. In some areas, there have been declines from the 1998 figures, particularly in the North Pacific.

This generally stable situation for global catches masks regional disparities. In the Northwest Pacific, reported total catches have doubled from about 12 million tonnes in 1970 to 23 million tonnes in 2000. China began the 1970s with about 20 percent of this catch, but by 2000 its share had risen to more than 60 percent. The rapid rise in China's reported production, particularly the 2.5-fold increase of its catch to nearly 17 million tonnes since 1990, is in marked contrast to the almost halving of other countries' catch from this region, which dropped to less than 9 million tonnes over the same period.

Unlike capture fisheries, aquaculture production has continued to increase markedly. Excluding China, world aquaculture production (other than aquatic plants) exhibited a somewhat lower average annual growth rate (5.3 percent) in the 1990s than it did in the 1980s (7.1 percent). It is believed that aquaculture potential still exists in many areas and for many species.

Employment in the primary capture fisheries and aquaculture production sectors has remained relatively stable since 1995, and was estimated to be about 35 million people in 2000. Of this total, 65 percent were in marine capture fisheries, 15 percent in inland capture fisheries and 20 percent in aquaculture production.

International trade in fish products has again increased to a new record of US$55.2 billion, continuing the last decade's underlying 4 percent annual growth in fisheries trade. Net export trade from developing countries increased from US$10 billion in 1990 to US$18 billion in 2000, corresponding to a real (corrected for inflation) growth of 45 percent.

Global forecasts of upper limits to capture fisheries, which have been made since the early 1970s, are being increasingly substantiated by the evidence of recent years. There are continuing global concerns about the reliability of statistics (see Box 1 and Reliable statistics as an essential basis for effective fisheries management, Part 2, p. 59) and that the pace and direction of fisheries

TABLE 1
World fisheries production and utilization

	1996	1997	1998	1999	2000	2001*
	(million tonnes)					
PRODUCTION						
INLAND						
Capture	7.4	7.5	8.0	8.5	8.8	8.8
Aquaculture	15.9	17.5	18.5	20.1	21.4	22.4
Total inland	**23.3**	**25.0**	**26.5**	**28.6**	**30.2**	**31.2**
MARINE						
Capture	86.1	86.4	79.3	84.7	86.0	82.5
Aquaculture	10.8	11.1	12.0	13.3	14.2	15.1
Total marine	**96.9**	**97.5**	**91.3**	**98.0**	**100.2**	**97.6**
Total capture	93.5	93.9	87.3	93.2	94.8	91.3
Total aquaculture	26.7	28.6	30.5	33.4	35.6	37.5
Total world fisheries	**120.2**	**122.5**	**117.8**	**126.6**	**130.4**	**128.8**
UTILIZATION						
Human consumption	88.0	90.8	92.7	94.4	96.7	99.4
Non-food uses	32.2	31.7	25.1	32.2	33.7	29.4
Population (billions)	5.7	5.8	5.9	6.0	6.1	6.1
Per capita food fish supply (kg)	15.3	15.6	15.7	15.8	16.0	16.2

Excluding aquatic plants.
*** Preliminary estimate.**

TABLE 2
Fisheries production and utilization for the world excluding China

	1996	1997	1998	1999	2000	2001*
	(million tonnes)					
PRODUCTION						
INLAND						
Capture	5.7	5.7	5.8	6.2	6.6	6.6
Aquaculture	4.9	5.1	5.2	5.9	6.3	6.5
Total inland	**10.6**	**10.8**	**11.0**	**12.1**	**12.9**	**13.1**
MARINE						
Capture	73.6	72.5	64.3	69.8	71.3	67.9
Aquaculture	4.1	4.2	4.5	4.7	4.7	5.0
Total marine	**77.7**	**76.7**	**68.8**	**74.5**	**76.0**	**72.9**
Total capture	79.3	78.2	70.1	76.0	77.9	74.5
Total aquaculture	9.0	9.3	9.7	10.6	11.0	11.5
Total Production	**88.3**	**87.5**	**79.8**	**86.6**	**88.9**	**86.0**
UTILIZATION						
Human consumption	60.4	61.5	61.3	61.9	63.0	65.1
Non-food uses	27.9	26.0	18.5	24.7	25.9	20.9
Population (billions)	4.5	4.6	4.7	4.7	4.8	4.9
Per capita food fish supply (kg)	13.3	13.4	13.1	13.1	13.1	13.3

Excluding aquatic plants.
*** Preliminary estimate.**

research and supporting information systems are falling behind the need to understand the relationships between fisheries and the environment and between fisheries management and development. Owing to the understanding that fishing overcapacity and the global reach of fishing operations continue to have deleterious effects on fish stocks, it is becoming more widely recognized that long-term fisheries management and investment need to take into account the environment and natural long-term climatic fluctuations (see Fisheries and long-term climate variability, Part 3, p. 87), including episodic events such as El Niño. Although research is under way on some of these issues, including the nature and extent of human-induced effects on the climate, there remain areas of concern that require new commitments and methodologies. For example, the frequent lack of basic data on subsistence and small-scale fisheries, such as those in many inland waters, contributes to failures in management and policy-making directed at preventing overexploitation, stock decline and exacerbations to rural food insecurity and poverty.

Marine fisheries governance and the prospect of improved fisheries management are gathering pace as fisheries in a growing number of ocean areas come under the purview of regional fisheries management organizations (RFMOs), and as these are being held to greater accountability by the international community. However, progress in some regions and in many national jurisdictions has been weak. In inland waters, important fisheries in large rivers and lakes often suffer from ineffective governance. Inland regional fishery bodies, when they exist, tend to be mostly advisory and have no management powers. In most cases, inland fisheries are subject only to national jurisdictions even though the pressures of population growth will be most felt in tropical inland fisheries, where they will take the form of growing fishing effort. It seems plausible that, in the long term, fish supplies will meet demand only if real prices for fish are raised slightly. This assumes that aquaculture will continue to grow, which presupposes that the environmental concerns relating to it will be addressed.

CAPTURE FISHERIES PRODUCTION

Total capture fisheries production in 2000

FIGURE 1
World capture fisheries and aquaculture production

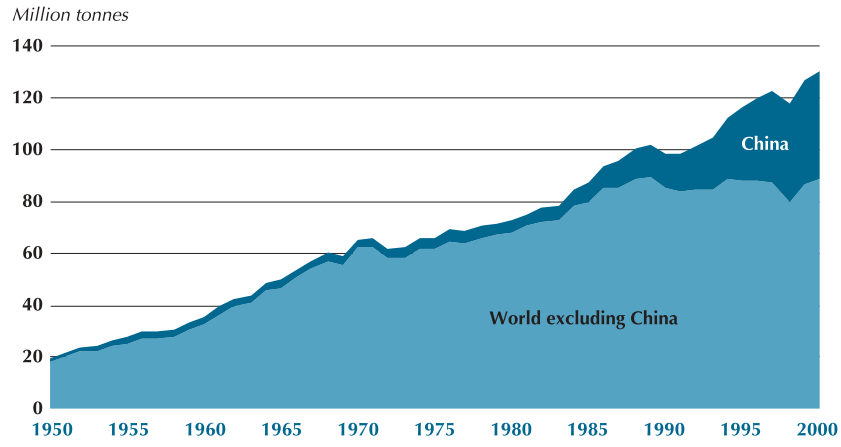
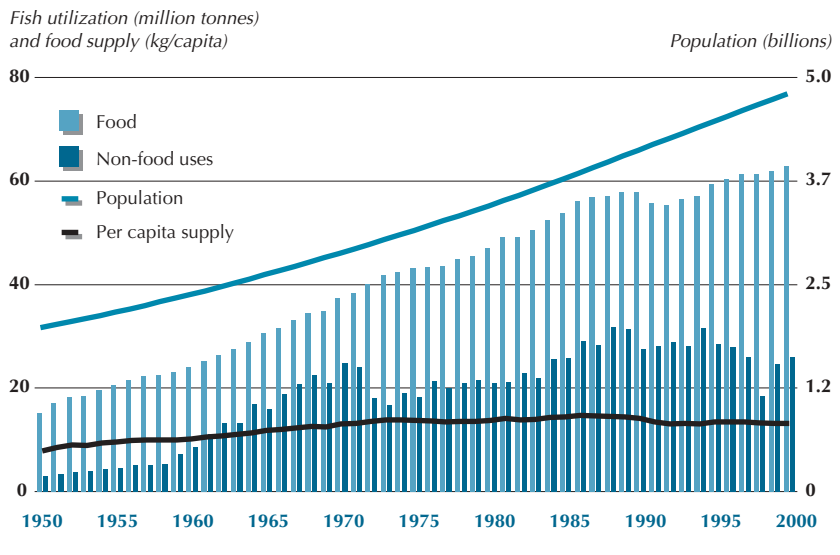


FIGURE 2
World fish utilization and supply, excluding China



BOX 1
FAO's role in fishery statistics

FAO is involved in:

1. promoting the collection and use of statistics;
2. producing statistical manuals and software;
3. training statistical officers;
4. developing/upgrading national statistics systems (recent examples include many African and Mediterranean countries);
5. facilitating global cooperation and establishing norms in fishery statistics (through the inter-agency Coordinating Working Party on Fishery Statistics);
6. collecting statistics from countries, regional fishery bodies, international shipping registers, fishing industry (e.g. marketing and trade data);
7. checking data received for internal consistency, species identification or anomalous trends;
8. consulting the countries concerned about anomalies;
9. publishing statistics on various aspects of fisheries in yearbooks and on the Web and receiving extensive feedback from users.

As a result, the statistics supplied to FAO by national authorities are routinely corrected when mistakes are obvious, better data are available from other sources (such as regional fishery bodies) or countries agree with FAO estimates. FAO interacts with countries to explore problems and try to resolve them, but this process is often slow. When countries do not respond to FAO enquiries, FAO estimates are automatically applied. Occasionally, when countries do not explain or support suspect statistics, those statistics are set aside and FAO estimates published instead. This action is sometimes seen as provocative, but often encourages corrective action by the country concerned. Many countries, including China, are working with FAO to try to address issues concerning the reliability of their fishery statistics.

National reports are the main, but not the only, source of data used by FAO to maintain its fishery statistics database. When data are missing or considered unreliable, FAO includes estimates based on the best information that is available from any source, such as regional fishery organizations, project documents, industry magazines or statistical interpolations. Fleet statistics that are submitted by countries are cross-checked with data from other sources, such as international shipping registers. The international trade statistics obtained from countries are supplemented through a comprehensive network of regional intergovernmental institutions created by FAO (the

Computerized System of Fish Marketing Information [GLOBEFISH]).

In the 1990s, FAO completely revised its fishery production statistics time series by computerizing them back to 1950, including estimates where data were missing, disaggregating data by fishing areas, taking political changes into account (e.g. the emergence of new countries), adjusting species identification as taxonomy evolves, and improving the differentiation between aquaculture and capture fisheries production. The resulting data sets are used in numerous analyses, both outside and within FAO, and are widely available on the Web (as the Computer System for Global Fish Catches [FishStat]).

FAO's global reviews of the state of stocks do not use catch statistics as a primary source of information because more direct indicators often exist. The primary information used is obtained directly from the working groups of FAO and non-FAO RFMOs and other formal arrangements, scientific literature (journals, theses, etc.) and industry magazines, as well as information that is independent of fisheries, such as trade data. Where RFMOs do not exist, such as in the Northwest Pacific, bilateral assessment processes (e.g. that among China, Japan and the Republic of Korea) can be used. Where data do not exist, such as on discards, estimates are made on a one-off basis by expert consultants or through dedicated expert consultations. If FAO has not yet been able to work effectively in an area (e.g. production from illegal fishing), there will be no global-level information for that area, although data will be available for certain fishing areas or certain years. FAO's catch statistics are global in coverage, have complete time series since 1950 and are regularly updated. These advantages mean that they can be used, when other data are lacking, to provide overview trends in fisheries by region, and resource status indicators.

Financial support for the development and maintenance of national fishery statistics systems has decreased sharply in real terms during the last decade. At the same time there have been dramatically increased needs for information on, for example, by-catch and discards, fishing capacity, illegal fishing, vessels authorized to fish in the high seas, economic data (expenditures, revenues, prices, subsidies), employment, management systems, inventories of stocks and fisheries, and aquaculture.

Despite FAO's efforts, the fishery data available are not fully reliable in terms of coverage, timeliness and quality. Data are often submitted to FAO after delays of one or two years. The proportion of catch to be identified at the individual species level has tended to decrease over time, while "unidentified fish" account for an increasing share of reported statistics as fisheries diversify and large stocks are depleted. Stock assessment working groups provide a good means of screening catch data, but stock assessment has become less frequent in many developing regions as a result of human and financial resource restrictions. The general availability of data has not improved significantly over the last two decades. Statistics from artisanal and subsistence fisheries are still a concern, and many key statistics are missing at the global level, such as economic and social data, discards and fishing capacity. As a result, although the available statistics probably do reflect general trends reliably – for example, global development trends or climatic changes (see Fisheries and long-term climate variability, Part 3, p. 87) – the annual figures and the assessments involve some uncertainty, and small changes from one year to another are probably not statistically significant.

The FAO Fisheries Department believes that working with countries is the only way to improve fishery statistics, primarily in order to meet national needs with regard to food security and fisheries management, but also to meet the needs of regional fishery bodies and FAO. Without reliable statistics, effective fisheries management and policy-making are impossible, and there will be serious negative implications at the national and regional levels. Unfortunately, the rehabilitation of major national data collection schemes to provide reliable statistics is necessarily a slow process.

Source: R. Grainger, FAO Fisheries Department.

reached 94.8 million tonnes (Table 1), the highest level ever. The estimated first sale value of this production amounted to some US$81 billion, a marginal increase over the value in 1998. Preliminary catch reports for 2001 from major fishing countries indicate that there may be a marked decrease in global capture production, to about 92 million tonnes. China's catches, which accounted for almost 20 percent of total world capture production in 1998, remained stable in 1999 and decreased marginally in 2000 following the adoption of a zero-growth policy (Figure 3 and Box 2). In 2000, total production from marine and inland capture fisheries for the world, excluding China (Table 2), was about 78 million tonnes, somewhat less than the peak of 83 million tonnes in 1989 but representing an increase from 70 million tonnes in 1998. Such recent changes have been heavily influenced by catches of Peruvian anchoveta, which are affected by environmental factors (i.e. El Niño).

China and Peru were the top producing countries in 2000, followed by Japan, the United States, Chile, Indonesia, the Russian Federation and India (Figure 4). Inland capture production for the world, excluding China, continues a gradually increasing trend; inland fisheries contributed 6.6 million tonnes in 2000, which was 8.3 percent of total world catches.

FIGURE 3
World capture fisheries production

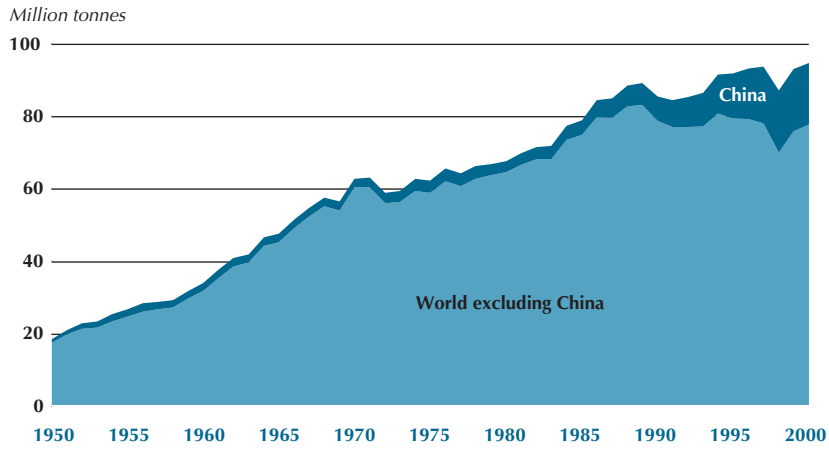
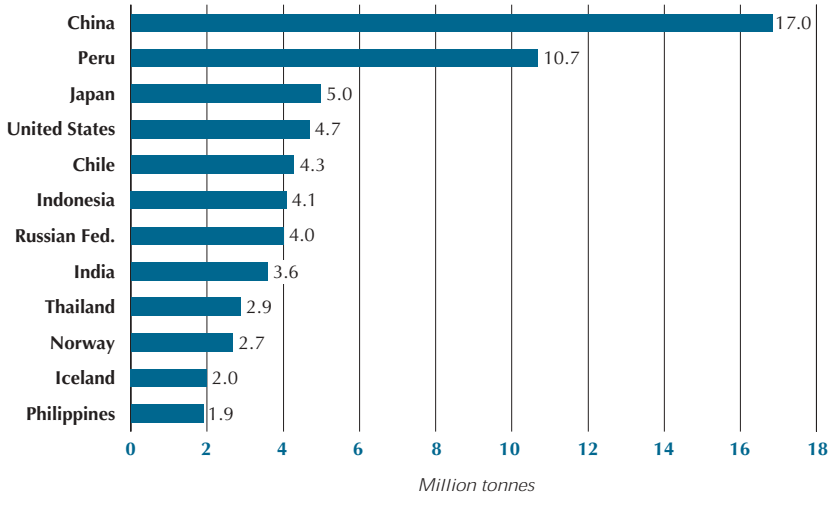


FIGURE 4
Marine and inland capture fisheries: top producer countries in 2000



World marine capture fisheries production increases in 1999 and 2000 came mainly from fisheries in the Southeast Pacific. Landings from these fisheries grew by 77 percent in 1999 and 12 percent in 2000, following a marked decrease of 44 percent between 1997 and 1998. Tropical ocean regions have also exhibited increases since 1998, particularly in the Indian Ocean and the Western Central Pacific, although small declines have been seen in the Eastern Central Atlantic (Figures 5 and 7). The temperate regions of the Southwest, the Northwest and the Northeast Pacific showed decreasing catch trends, but catches from the Northwest and Northeast Atlantic, where stock assessments generally yielded pessimistic results, increased slightly between 1999 and 2000. Most of these increases were due to scallops in the Northwest Atlantic and low-value pelagic species, such as capelin and blue whiting, in the Northeast Atlantic.

Catches of oceanic species have

BOX 2
China

China has made remarkable advances in fisheries production in recent years. Growth in its productive capacity, as indicated by reported estimates of marine and inland capture fisheries and aquaculture, far exceeds growth in fisheries elsewhere in the world. China has become the world's largest producer and consumer of food fish, achieving an apparent food fish consumption of 31.3 million tonnes in 1999 (Figure 9). During the past three decades, estimated per capita consumption based on reported production (which may well have been overestimated for the last decade) has increased from 4.4 kg in 1972 to 25.1 kg in 1999. Notwithstanding this increase, fish continues to contribute about 20 percent of total consumption of animal proteins, largely because of the continuing increase in other meat supplies. Since 1994, China has become the dominant fishing country in the Northwest Pacific, with catches in excess of 20 million tonnes.

As stated in the Overview (p. 3), there are indications that Chinese capture fishery and aquaculture production statistics have been overestimated, particularly in the last decade. Since 1998, a policy of zero growth has been declared for Chinese capture fisheries, and reported catches have reflected this (Figure 3). However, reported aquaculture production has continued to grow very rapidly (Figure 18), particularly for freshwater species. This matter was considered at a national workshop on Chinese fishery statistics, held in conjunction with FAO in April 2001. Estimation of the food fish supply is complicated by uncertainties concerning the production statistics and the quantities of fish utilized for non-food uses, such as direct feed to aquaculture, which are reckoned to be very substantial indeed. A further complicating factor is that trends in apparent fish consumption as derived from FAO's food balance sheets are not directly comparable with those from the Chinese National Statistical Bureau's household food consumption surveys. This is because the latter do not cover fish consumed outside the home (e.g. in restaurants and work canteens), which is considered to be a large and growing proportion of fish consumption. The Chinese authorities are working in collaboration with FAO to reduce many of these uncertainties.

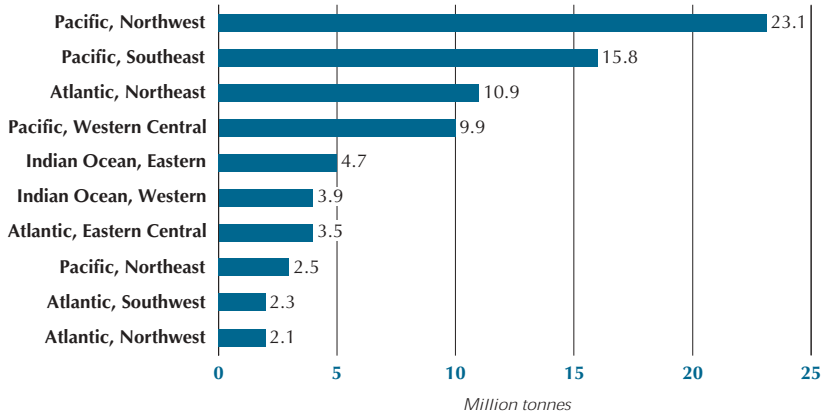
been steadily increasing over recent decades, indicating increasing fishing activity on the high seas (see Box 3). In 2000, the recovery of favourable climatic conditions after the recent El Niño led to anchoveta producing the largest single species catch (Figure 6). Catches of Clupeoids (i.e. herrings, sardines and anchovies) in other areas have shown declines recently, except in the Eastern Central Pacific and the Southeast Atlantic, where they benefited from the return of their upwelling regimes. Chilean jack mackerel, another major small pelagic species caught in the Southeast Pacific, slightly recovered in 2000 after general catch declines since 1995. In the same area, landings of chub mackerel increased in 1999 and then dropped again in 2000, at variance with the general picture of ecosystem recovery in that area.

The negative trend of chub mackerel production in the Northwest Pacific continues, and catch has halved since 1996. In the Gadiformes group (i.e. cods, hakes, haddocks, etc.), world catches of Alaska pollock and cod are still declining, and the only major species to increase are capelin and blue whiting, a deep sea species.

In 2000, catches of the valuable tuna species remained steady compared with 1998, after a peak of about 6 million tonnes in 1999. Catches of the other major fish groups in 2000 were also fairly stable with respect to 1998.

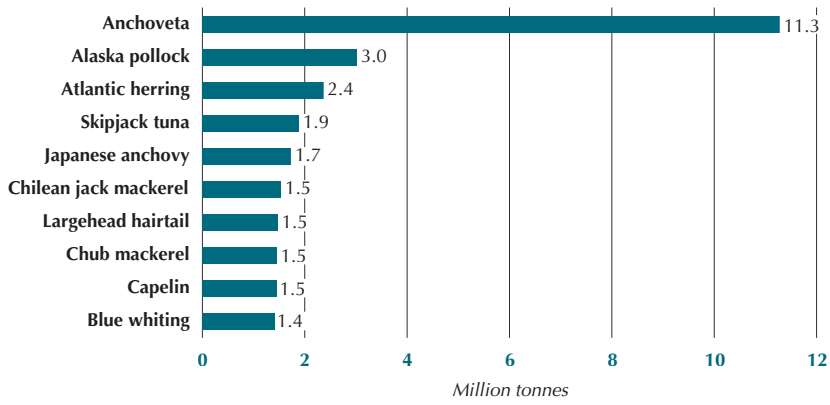
There have been general increases in cephalopod and shrimp catches. Cephalopod catches fell in 1998 but then rose in 1999, reaching a new record of 3.6 million tonnes in 2000. Catches of shrimp have been steadily increasing by an average 3.5 percent per year since 1970, and this growth has shown no signs of slackening in recent years.

FIGURE 5
Capture fisheries production by principal marine fishing areas in 2000



Note: Fishing areas listed are those with a production volume of more than 2 million tonnes in 2000.

FIGURE 6
Capture fisheries production: top species in 2000



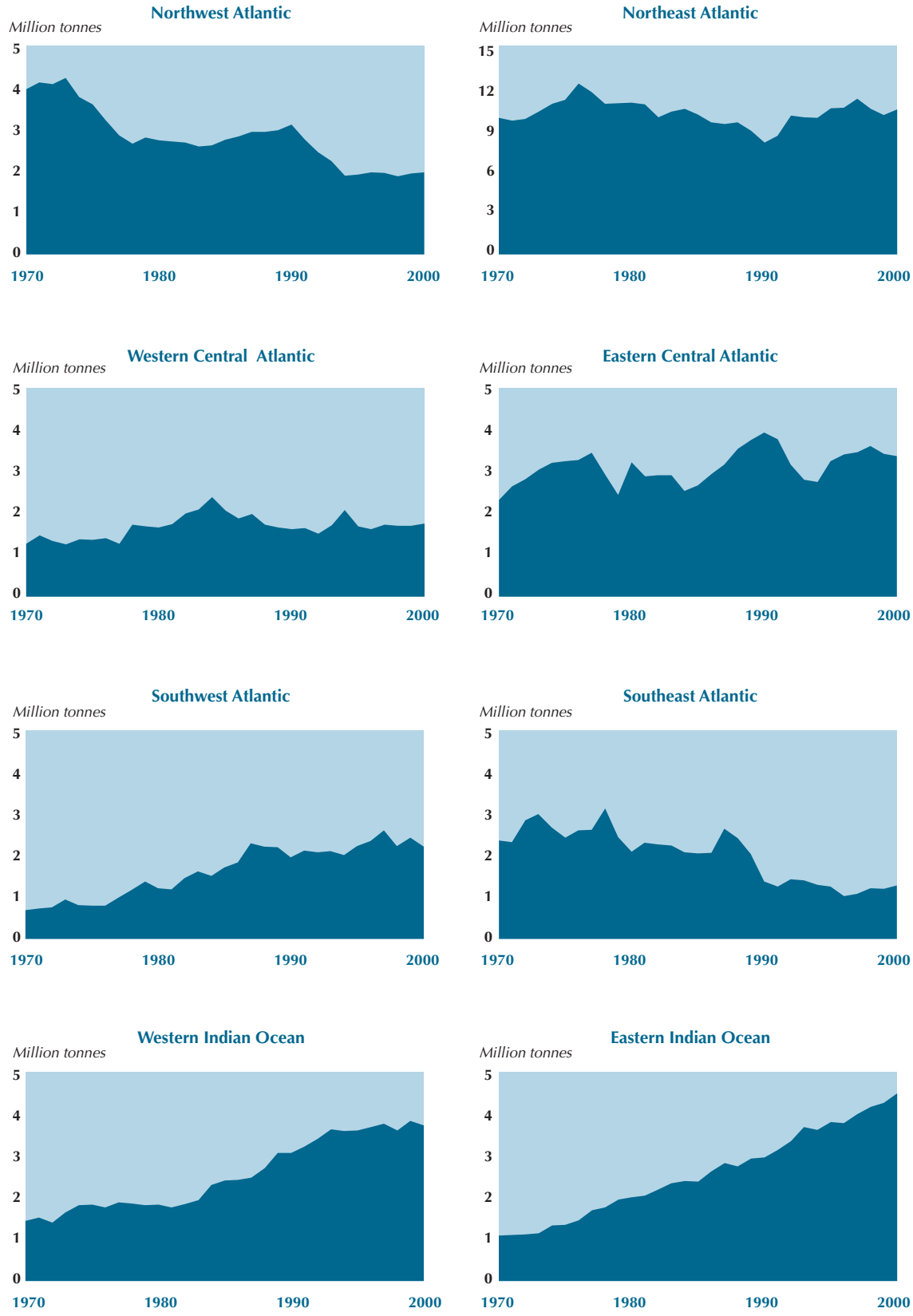
Note: Species listed are those with a production volume of more than 1 million tonnes in 2000.

Several of the species in Figure 6 are widely used as raw material in reduction to meal and oil, and are of low commercial value (species used as input for meal in 2000 were worth an average US$50 to $150 per tonne). In value terms, the most important species caught in 2000 included bigeye tuna (world catches were worth an estimated US$3 billion), yellowfin tuna (US$2 billion), skipjack tuna and Atlantic cod (more than US$1 billion each).

Total fish capture in inland waters in 2000 was about 0.8 million tonnes more than in 1998 (Table 1). Most of the global total came from the catches of Asia and Africa (about 64 and 25 percent, respectively), which have continued to grow in recent years. Those of Europe, North America, South America and Oceania have remained relatively stable. The top ten producing countries account for 64 percent of world inland water production, although China's share decreased from 28 percent in 1998 to 25 percent in 2000 (Figure 8). The bulk of the inland water catches (Table 3) is from developing countries where, in most cases, inland fisheries provide an important source of animal proteins. In most developed countries, fishing in freshwater has become mainly a recreational activity, and commercial inland food fisheries are very limited, except in some large lakes.

Many countries experience significant difficulties in collecting statistics on inland water fisheries. Among the main reasons for this are the scattered characteristics of these fisheries, their unrecorded contribution to subsistence and the lack of related fishery industries. The importance and size of these fisheries may be misrepresented in national and international statistics. In recent years, however, some countries have been revising their inland fishery

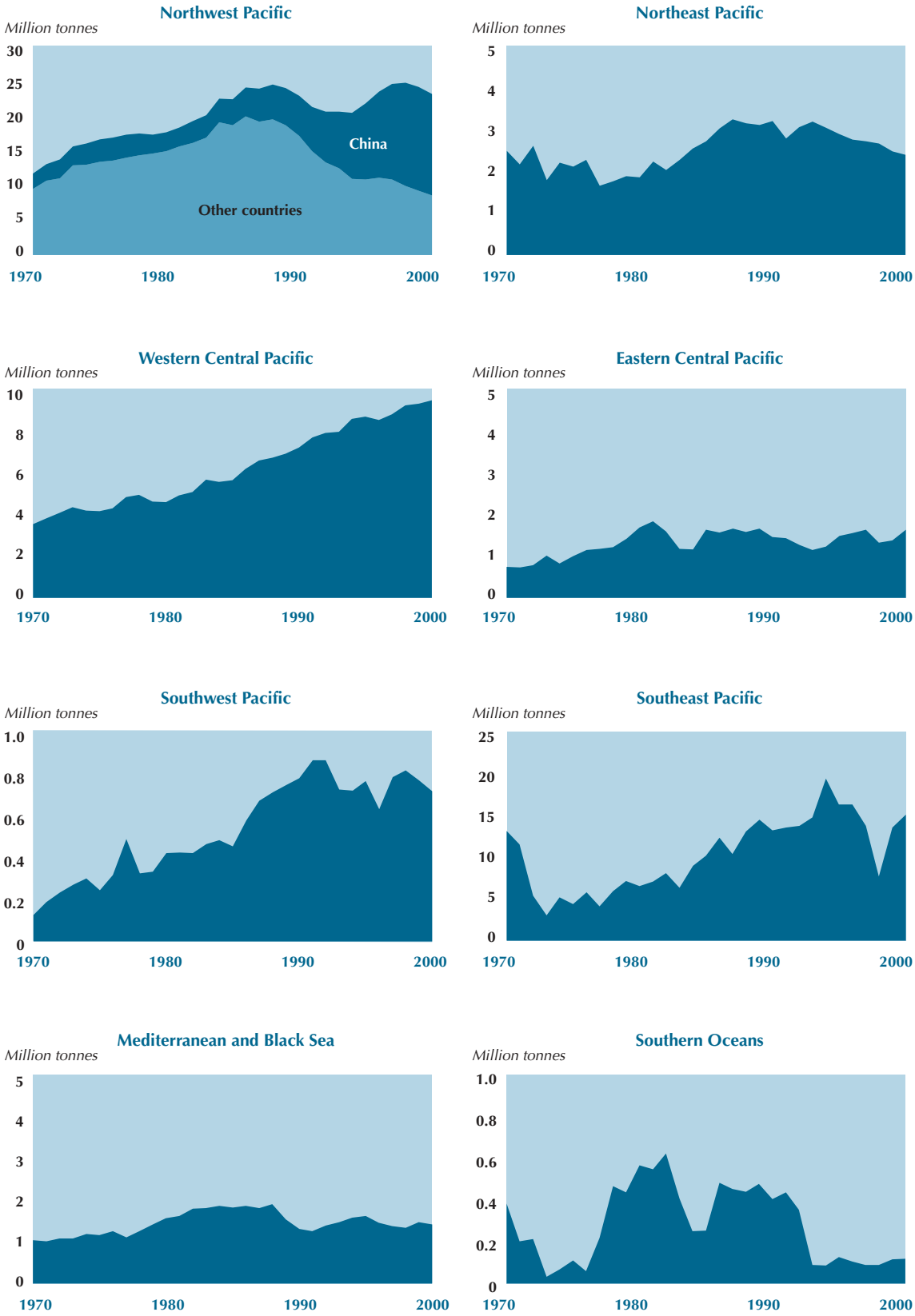
FIGURE 7
Capture fisheries production in marine areas



Note: The scales used vary from area to area.

(Continuing)

FIGURE 7 (continued)
Capture fisheries production in marine areas



Note: The scales used vary from area to area.

statistics through new data collection systems or through the parallel surveys of projects or national institutions whose catch estimates differ greatly from those reported by national statistical offices. This uncertainty over the accuracy of data is one of the factors that make fishery assessment difficult, but FAO and other international agencies are actively working with national institutions to improve the situation.

TABLE 3
Inland capture fishery production by economic class

Economic class	Production in 2000 (million tonnes)	Percentage of world production
China	2.23	25.4
Other developing countries or areas	5.93	67.4
Economies in transition	0.41	4.6
Industrial countries	0.23	2.6
Total	**8.80**	

FISHERS AND FISH FARMERS

In line with the increase in fishery production, over the last three decades employment in fisheries and aquaculture has continued to increase in many countries. In 2000, an estimated 35 million people (Figure 12) were directly engaged in fishing and fish farming as a full-time or – more frequently – part-time occupation, compared with 28 million a decade before.

The highest numbers of fishers and aquaculture workers (Table 4) are in Asia (85 percent of the world total) followed by Africa (7 percent), Europe, South America, North and Central America (about 2 percent each) and Oceania (0.2 percent). These shares closely reflect the different population shares and relative predominance of labour-intensive economies in the continents.

In 2000, fishers and aquaculture workers

BOX 3
Trends in high seas fisheries

In 1976, states began to declare extended fisheries jurisdictions, such as exclusive economic zones (EEZs), in anticipation of international acceptance of this concept. Such acceptance was obtained in 1982 in the United Nations Convention on the Law of the Sea. Since the mid-1970s, a large number of fishing nations have declared EEZs of 200 nautical miles, and high seas fisheries has come to mean fishing that is undertaken outside the EEZs – generally more than 200 nautical miles from the coast.

It is difficult to assess the development of fishing on the high seas because reports to FAO of marine catches make no distinction between those taken within EEZs and those taken on the high seas. Analyses of the FAO catch database of 116 oceanic species items (epipelagic and deep water species that occur principally on the high seas) reveal that catches of oceanic species almost tripled from 3 million tonnes in 1976 to 8.5 million tonnes in 2000 (Figure 10). As some of these species, particularly the oceanic tunas, are also caught within EEZs, this increase may well be more rapid than that of high seas catches per se.

The marked increase in catches of oceanic species is also reflected in the world trade in oceanic species. Import and export quantities in product weight rose from 0.5 million tonnes to almost 2.5 million tonnes over the 1976–2000 period (Figure 11). Faced with increasing evidence of overfishing on the high seas, efforts to manage high seas fisheries also accelerated over that period, and are continuing today with the development of new RFMOs and the revitalization of existing organizations (see International fisheries policy and governance, p. 45).

FIGURE 8
Inland capture fisheries production: top ten producer countries in 2000

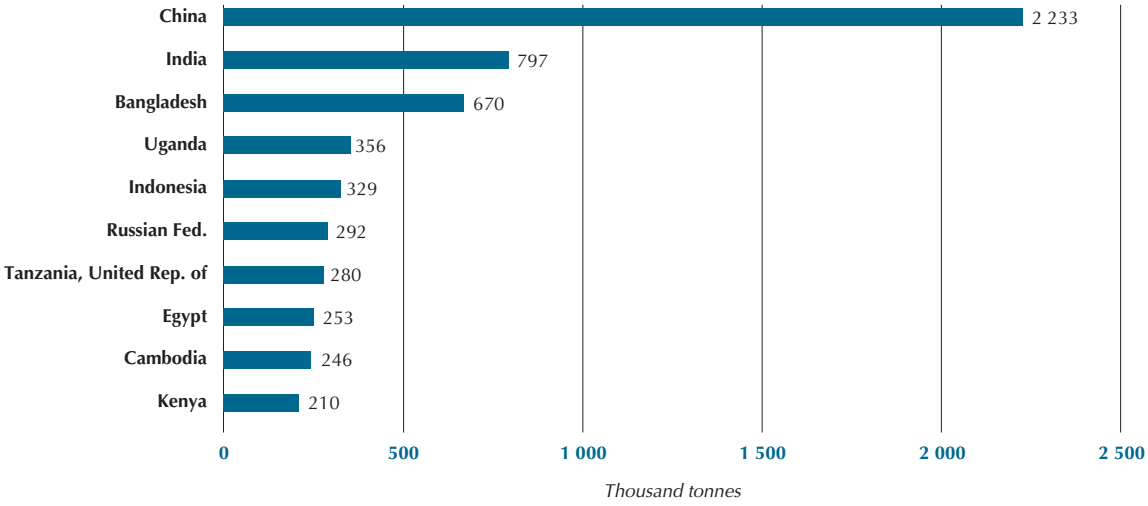


FIGURE 9
China's fish utilization and supply

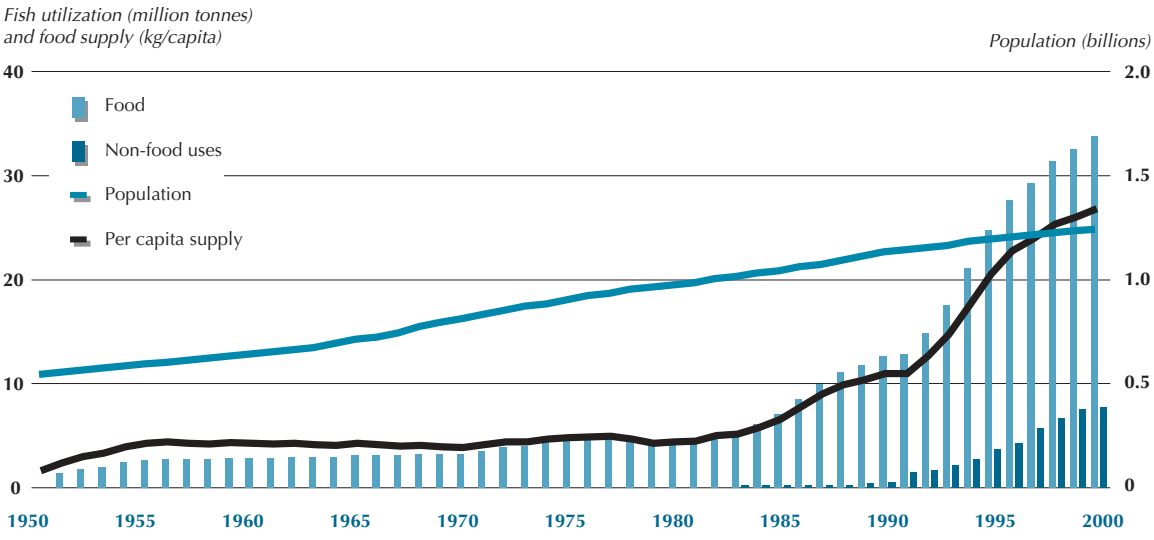


FIGURE 10
World catches of oceanic species (epipelagic and deep water) occurring principally in high seas areas

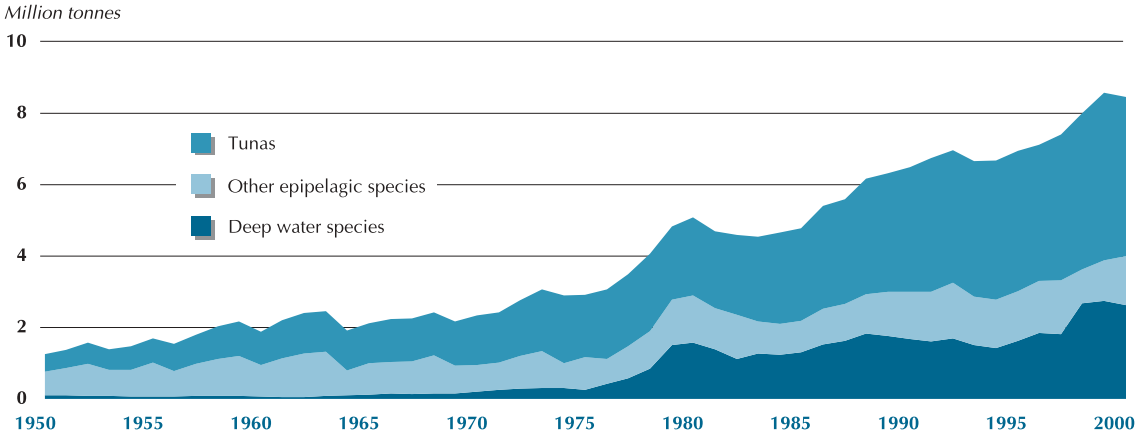


FIGURE 11
World trade in oceanic species

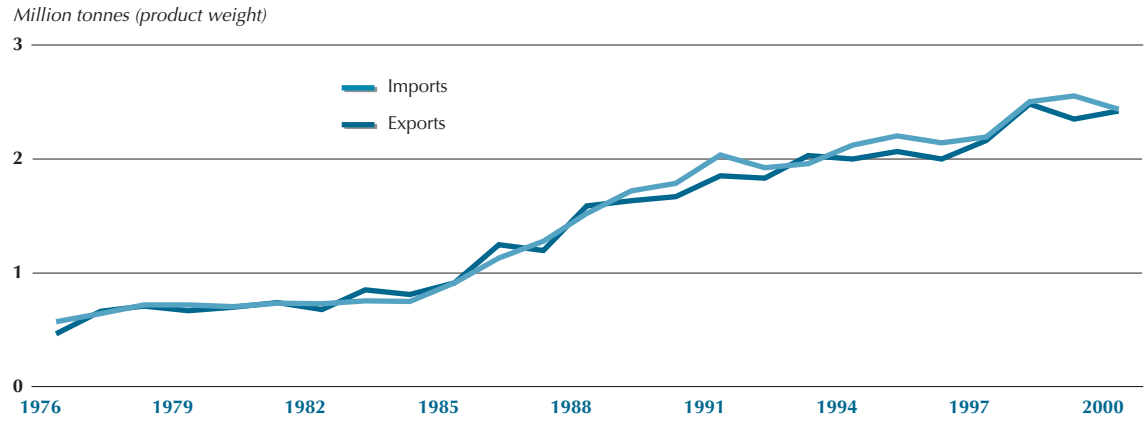
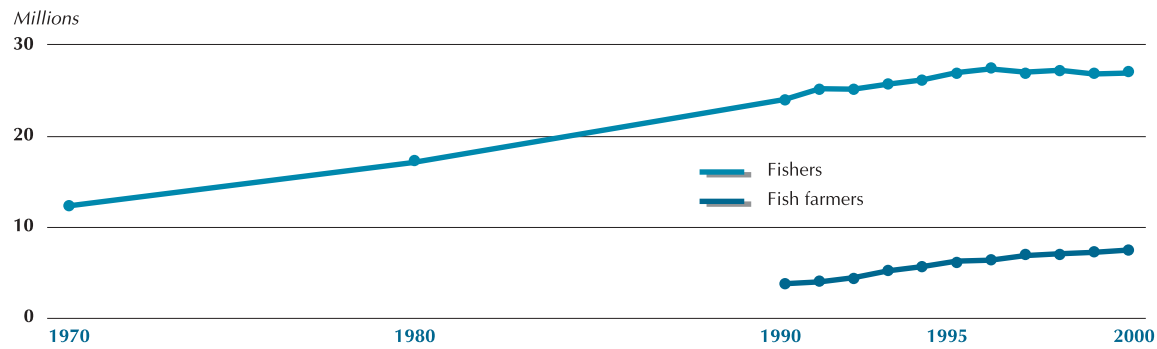


FIGURE 12
World fishers and fish farmers



Note: Prior to 1990 fish farmers are included with fishers. Data include full-time, part-time and occasional workers.

TABLE 4
World fishers and fish farmers by continent

	1970	1980	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	(..... thousands .....)												
Total													
Africa	1 360	1 553	1 917	2 092	1 757	2 032	2 070	2 238	2 359	2 357	2 453	2 491	2 585
North and Central America	408	547	767	755	757	777	777	770	776	782	786	788	751
South America	492	543	769	738	763	874	810	814	802	805	798	782	784
Asia	9 301	13 690	23 656	24 707	25 423	26 342	27 317	28 552	28 964	29 136	29 458	29 160	29 509
Europe	682	642	654	928	914	901	881	864	870	837	835	858	821
Oceania	42	62	74	77	79	80	74	76	77	78	82	82	86
World	**12 285**	**17 036**	**27 837**	**29 297**	**29 691**	**31 005**	**31 928**	**33 314**	**33 847**	**33 995**	**34 411**	**34 163**	**34 536**
Of which fish farmers													
Africa*	...	...	...	...	...	5	6	14	62	55	56	57	75
North and Central America	...	...	53	73	101	206	206	176	182	185	191	190	190
South America	...	...	16	15	15	20	30	43	44	42	41	42	41
Asia	...	...	3 698	3 882	4 292	4 927	5 389	6 003	6 051	6 569	6 758	6 930	7 132
Europe	...	...	11	12	13	23	26	18	23	25	25	26	27
Oceania	...	...	neg.	neg.	neg.	neg.	1	1	4	5	5	5	5
World	**...**	**...**	**3 778**	**3 983**	**4 423**	**5 182**	**5 657**	**6 254**	**6 366**	**6 880**	**7 075**	**7 249**	**7 470**

***Data for 1993–1995 are not comparable with those for the following years and were reported by only a limited number of countries.**
neg. = negligible.

represented 2.6 percent of the 1.3 billion people economically active in agriculture worldwide, compared with 2.3 percent in 1990. This world average is reflected in most continents, except for Africa, where the percentage of fishing and aquaculture workers is a low 1.3 percent of the total agriculture labour force, and North and Central America, where the share is 1 percent higher than the world average.

Within the total of 35 million people, the number of fishers has been growing at an average rate of 2.2 percent per annum since 1990, while aquaculture workers have increased by an annual average of about 7 percent; these apparent increases are in part a result of better reporting. Most of the growth of employment in fish farming and other culture practices has occurred in Asia, particularly in China, where the reported number of people engaging in cultivation of aquatic life has doubled in the past decade. Greater economic opportunities derive from the commercial aquaculture production sector; for instance, in 1999 the average annual income of Japanese households engaged in aquaculture was nearly twice as much as that of households engaged in coastal fishing. While the households engaged in aquaculture derived an average 64 percent of their income from aquaculture-related activities, fishing-related activities accounted for an average 38 percent of the income of fishing households.

Employment in fishing is decreasing in capital-

intensive economies, notably in most European countries and in Japan. For instance, in Norway employment in the fishery sector has been declining for several years (Table 5). In 1990 about 27 500 people were employed in fishing (excluding fish farming), but this number had declined by 27 percent to 20 100 in 2000. In Japan over the last decade, the numbers of marine fishery workers peaked in 1991 and has been falling ever since to reach a low of 260 000 people in 2000. Of these, about 85 percent were employed in coastal fishery operations, while offshore and pelagic fisheries employed the remaining 15 percent. The vast majority (75 percent) of fishers were self-employed workers, confirming this special feature of the fishery professions. The self-employment rate among men was 70 percent, while among women it was considerably higher at 94 percent.

A characteristic of the fishing workforce in developed economies is the advancing of its age profile, mainly resulting from the profession's decreasing attractiveness to younger generations. For instance, in 2000 in Japan, nearly 32 percent of male marine fishers (who made up 83 percent of the total) were more than 60 years of age. This was an increase of 3 percentage points on the previous year and 18 percentage points on 1980 (14 percent). Comparatively, workers under 25 years of age represented nearly 8 percent of the nearly 398 000 total for male workers in the late 1970s and only 2.7 percent of the 216 100 male workers in 2000.

In countries where fishing and aquaculture are less prominent in the economy, comparative employment and income statistics at this level of detail are often not available. In many developing countries, the largest number of fishers, their spouses and families are occupied in coastal artisanal fisheries and associated activities. The socio-economic importance of these activities is more difficult to measure, but is undeniable, in terms not only of contribution to production and income but also of food security for the coastal communities.

THE STATUS OF THE FISHING FLEET

The most recent FAO estimate indicated that, in 1998, the total world fleet engaged in fishing comprised about 1.3 million decked vessels and

TABLE 5
Number of fishers (including fish farmers) in selected countries

Country	Sex		1970	1980	1990	2000
WORLD	M and F	(number)	**12 284 678**	**17 036 307**	**27 835 441**	**34 535 653**
		(index)	**44**	**61**	**100**	**124**
China	M and F	(number)	2 300 000	2 950 344	9 092 926	12 233 128
		(index)	25	32	100	135
Indonesia	M and F	(number)	841 627	2 231 515	3 617 586	5 118 571
		(index)	23	62	100	141
Japan	M	(number)	437 900	376 900	303 400	216 110
	F	(number)	111 500	80 500	67 200	44 090
		(index)	148	123	100	70
Peru*	M and F	(number)	49 824	49 503	43 750	55 061
		(index)	114	113	100	125
Norway	M	(number)	43 018	34 789	30 017	23 026
	F	(number)	…	…	690	526
		(index)	156	126	100	77
Iceland	M	(number)	4 895	5 946	6 551	5 300
	F	(number)	…	…	400	800
		(index)	70	86	100	88

Index: 1990 = 100.
***Data for Peru exclude inland fishers and fish farmers.**

FIGURE 13
Numbers of decked fishing vessels by continent

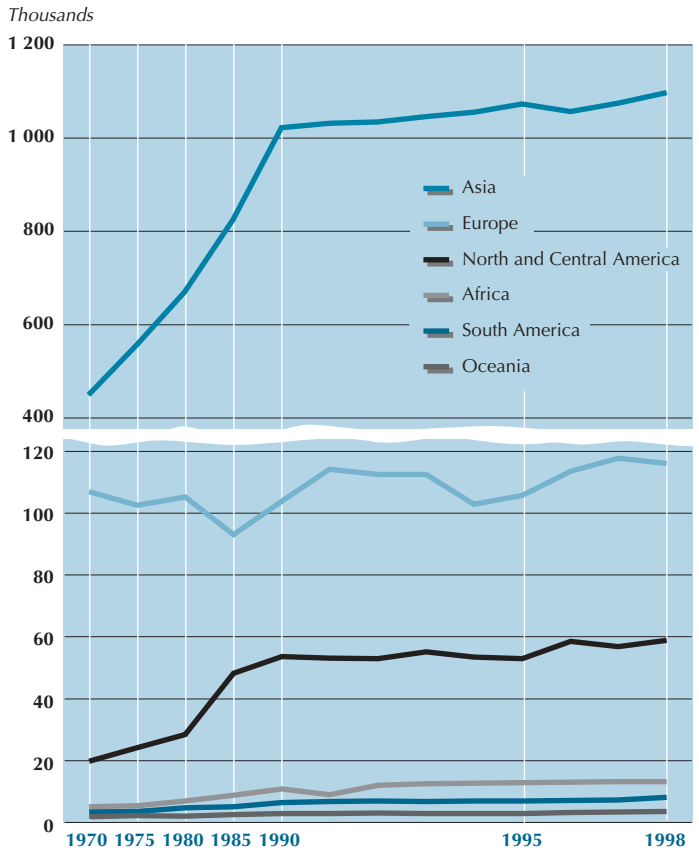
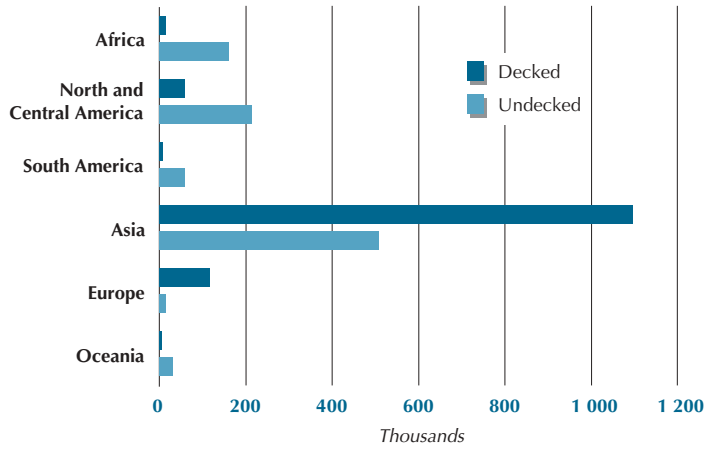


FIGURE 14
Numbers of powered vessels by continent in 1998

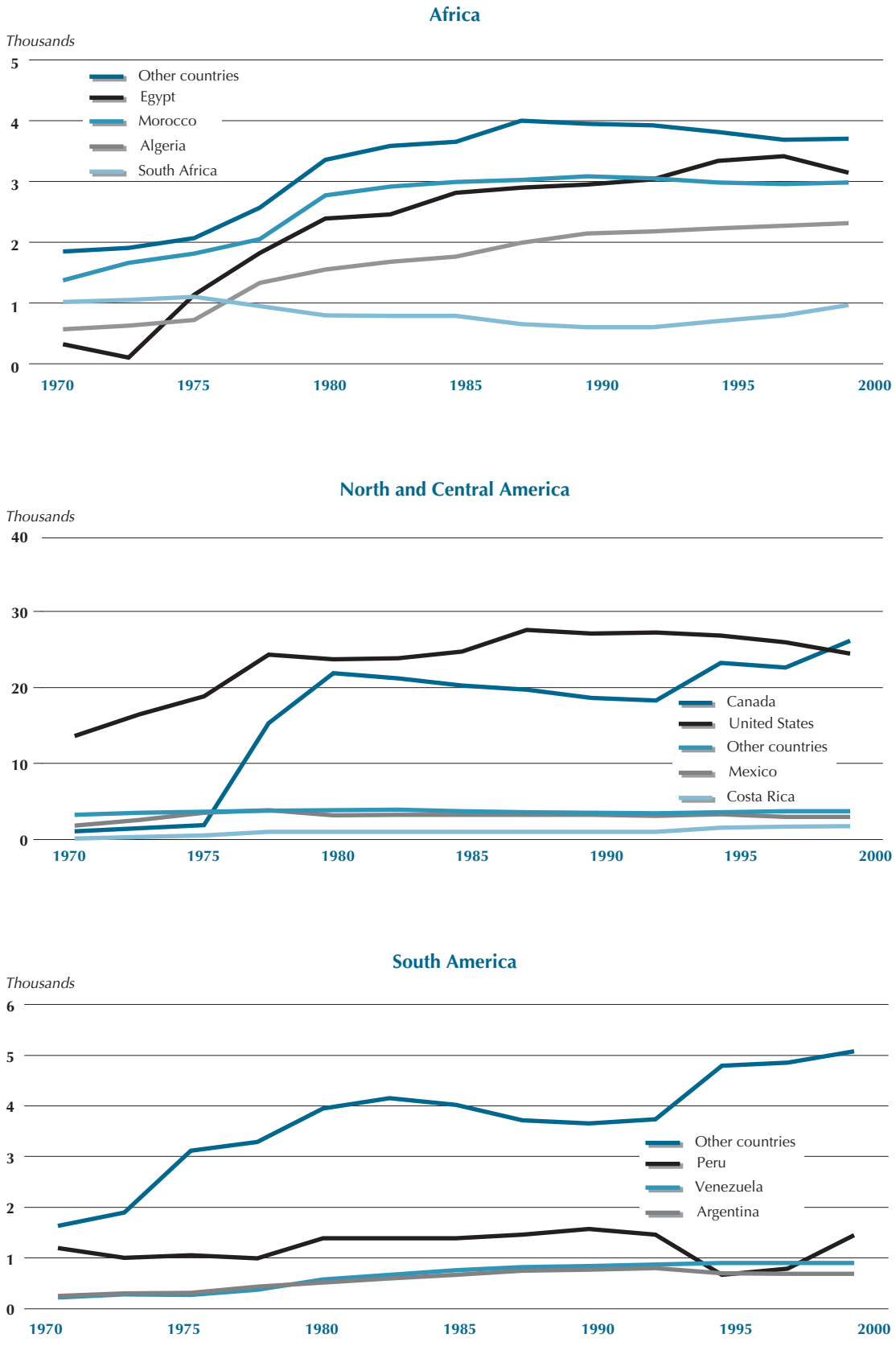


about 2.8 million undecked vessels, 65 percent of which were not powered. The vast majority of these vessels were concentrated in Asia (84.6 percent of total decked vessels, 51 percent of powered undecked vessels and 83 percent of total non-powered boats). The remaining 15.4 percent of the world's total decked fishing vessels were accounted for by Europe (8.9 percent), North and Central America (4.5 percent), Africa (1 percent), South America (0.6 percent) and Oceania (a negligible 0.2 percent). Countries in North and Central America had 21 percent of the open fishing vessels with engines, Africa had 16 percent, South America 6 percent, and Oceania 3 percent.

Since the expansion of the world fleet, which continued until the late 1980s, the numbers of decked fishing vessels have been fairly stable. In 1990 they numbered 1.2 million, and yearly fluctuations since then have been about 1 percent; part of this variation is probably owing to statistical reporting methods. The same overall trend applies at the continental level.

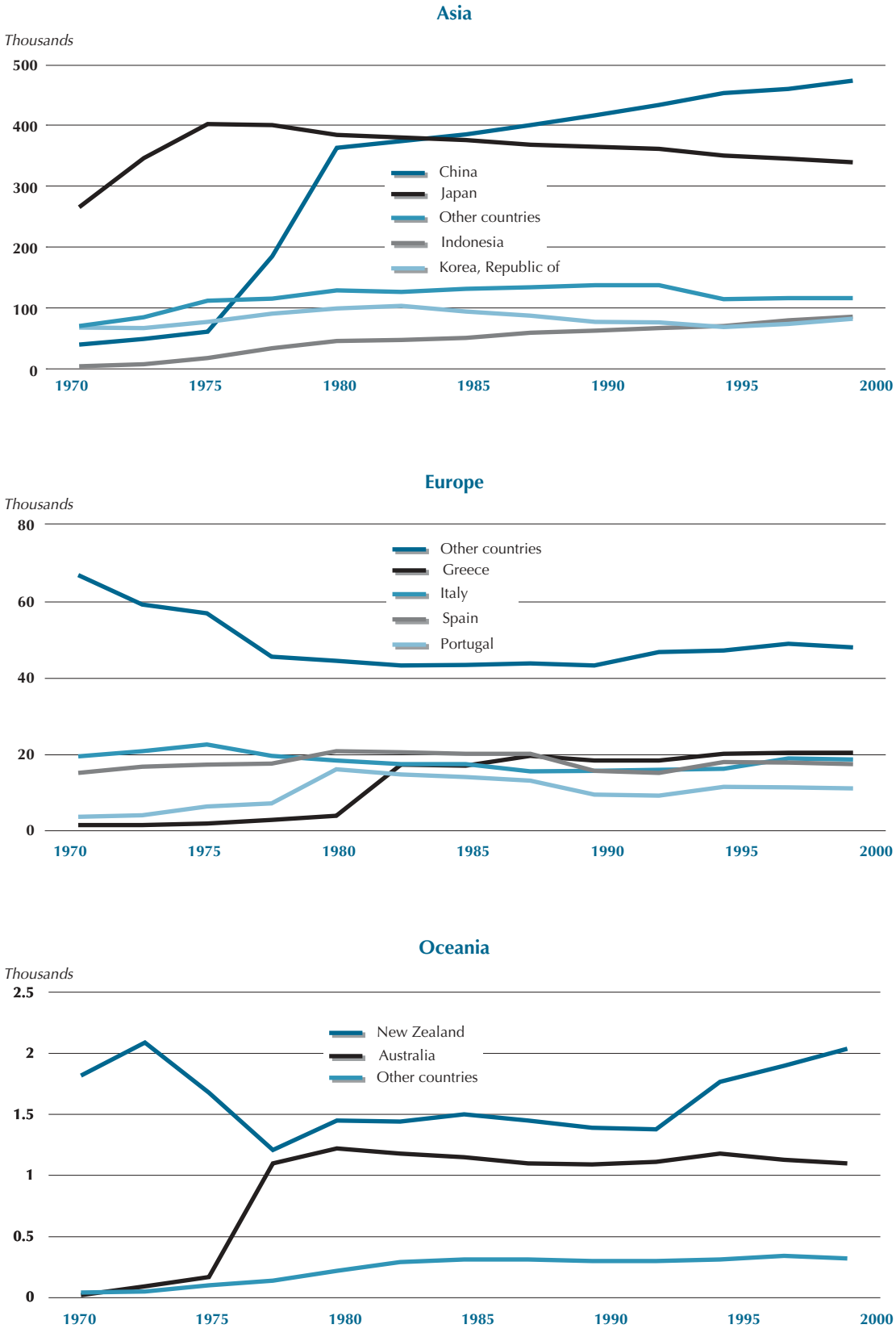
Indications of trends after 1998 are not available on a global scale. However, the European Community (EC) fishing fleet decreased from 100 085 vessels in 1995 to nearly 96 000 in 2000. Of the 77 500 vessels for which the length overall is known (it is not known for 18 500 vessels, mainly Italian and Portuguese) about 80 percent measured less than 12 m, the majority of these belonging to Greece and Spain. In 2000, some 14 percent of EC fishing vessels were between 12 and 24 m in length, and fewer than 350 measured more than 45 m (a decrease of 52 units compared with four years before). In December 2000, Norway had a fleet of 8 430 decked fishing vessels and 4 585 open registered vessels. Comparative statistics for 1990 indicated an almost equal number for the decked fleet, while the number of open vessels had nearly doubled. The Icelandic fleet had 1 993 vessels on register in 2001, 55 percent of which were undecked; nearly 40 percent of the decked vessels are more than 20 years old. In Japan, fishing vessels operating in marine and inland waters numbered 361 845 in 1999, down from 371 416 in 1995 and 416 067 in 1990. The vast majority (90 percent) of the total powered vessels

FIGURE 15
Numbers of decked fishing vessels in major national fleets by continent



(Continuing)

FIGURE 15 (continued)
Numbers of decked fishing vessels in major national fleets by continent



BOX 4
Tracking the fishing fleets through the database of Lloyds Maritime Information Services

Lloyds Maritime Information Services aims to maintain a full picture of all ships, including fishing vessels, of more than 100 gross registered tons (GRT). Vessels are continually added to the database each year; some of these are new vessels that were built that year and others are added as information becomes available. Vessels of more than 100 GRT are the most likely to operate internationally, through access agreements and on the high seas, but these represent only a small proportion of the global fishing fleet. Nevertheless, monitoring the > 100 GRT fleet gives an indication of the changing shape of large-scale industrial fishing (Figure 16). It provides indications of the patterns of change in entries to, and exits from, all shipping registers, particularly open registers. By definition, these registers offer flag state status to almost any ship and are often seen by vessel owners as a means of avoiding controls to which they might otherwise be subject. The number of vessels that are known to exist but for which the flag is unknown is also a cause for concern, although some of these vessels might have been removed from the register before being scrapped. The numbers of vessels in the major open registers with unknown flags are shown in Figure 17. The number of newly built fishing vessels added to the register has remained about 300 per year in recent years, but reductions through scrapping and loss mean that there has been a net reduction in the fleet. The major changes to fleets in the last two years are shown in Table 6. The extent of reflagging in the fishing fleet can be measured by comparing the database in sequential years and by following each vessel through its unique Lloyds or International Maritime Organization (IMO) number (Table 7).

Source: A. Smith, FAO Fisheries Department.

FIGURE 16
Numbers of fishing vessels over 100 GRT recorded in Lloyds Maritime Information Services database

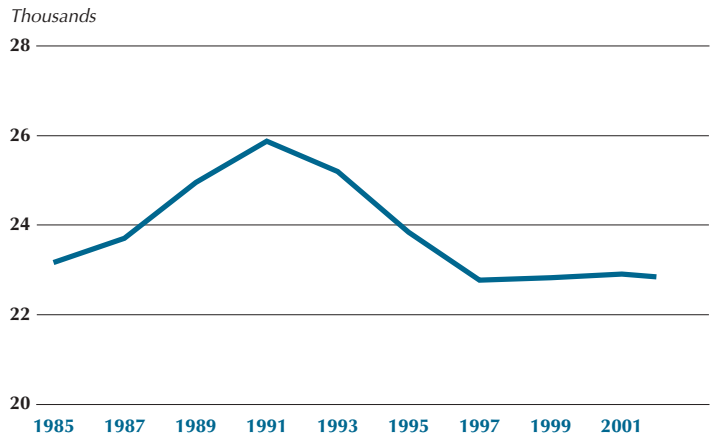
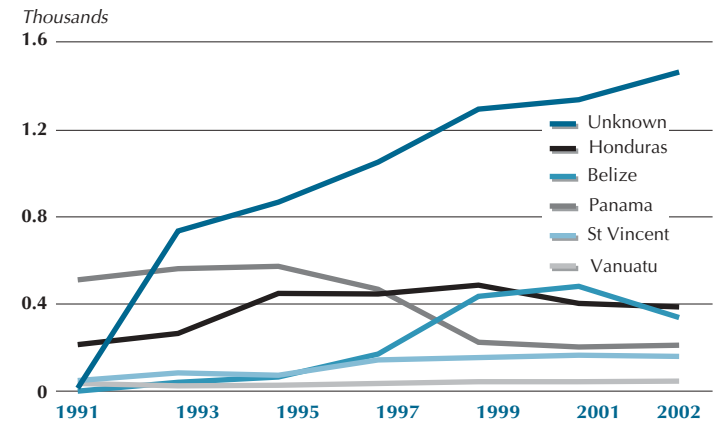


FIGURE 17
Numbers of fishing vessels in the major open registers and of flag unknown



Source: Lloyds Maritime Information Services.

fishing in marine waters were of less than 5 gross tons. Between 1990 and 2000, the number of decked vessels decreased by 45 000 units (a drop of 12 percent).

THE STATUS OF FISHERY RESOURCES

Marine fisheries

Following a decline to 79.2 million tonnes in 1998, total production of marine capture fisheries increased to 84.7 million tonnes in 1999 and 86.0 million tonnes in 2000, thus recovering to levels close to the historical maximum recorded for 1996 and 1997. If China is excluded (see

TABLE 6
Changes to the database of Lloyds Maritime Information Services (for fishing vessels)

Country Register	New building 2000	New building 2001	Scrapping and loss 2000	Scrapping and loss 2001
Argentina	_	_	4	9
Belize	4	8	8	11
Canada	_	_	14	8
Denmark	9	3	_	_
France	5	15	9	9
Germany	_	_	7	18
Iceland	4	17	_	_
Ireland	18	4	_	_
Japan	22	14	237	23
Korea, Republic of	_	_	16	11
Norway	24	18	_	_
Netherlands	10	8	_	_
Russian Federation	_	_	40	51
Spain	40	48	104	48
United Kingdom	10	14	14	20
United States	98	52	23	58
Others	61	92	166	176
Unknown	_	_	44	22
Blank	_	_	43	69
Total	**305**	**293**	**729**	**533**
Net change			**- 424**	**- 240**

TABLE 7
Flagging in and out of shipping registers (by fishing vessels)

Flagging changes	Out 2000	Out 2001	In 2000	In 2001
Argentina	_	_	4	9
Belize	34	29	76	40
Cambodia	_	_	7	5
Cyprus	_	_	9	3
Canary Islands	0	38	_	_
Equatorial Guinea	5	0	_	_
Honduras	89	9	10	11
Ireland	_	_	6	10
Japan	59	12	_	_
Korea, Republic of	_	_	_	_
Namibia	_	_	19	2
Netherlands	8	12	_	_
Norway	6	13	5	9
Panama	29	12	18	14
Russian Federation	21	17	59	56
Spain	15	4	0	39
St Vincent	9	11	17	3
Ukraine	11	11	_	_
United Kingdom	21	7	6	13
United States	12	4	_	_
Vanuatu	12	2	5	5
Others	175	117	155	139
Unknown	56	51	170	0
Total	**562**	**349**	**562**	**349**

Box 2), world production in 2000 was 71.3 million tonnes – about 5 percent less than the historical peak of 75.5 million tonnes in 1995. Most of the recent changes in total global landings from wild marine fishery resources can be explained by the decline and rapid recovery (in biomass and production volumes) that followed the 1997–1998 El Niño. The areas most seriously affected by this recent El Niño were the Southeast Pacific and, to a lesser extent, the Eastern Central Pacific (Figure 7).

The global situation of the main marine fish stocks for which assessment information is available follows the general trend observed in previous years. Overall, as fishing pressure continues to increase, the number of underexploited and moderately exploited

fisheries resources continues to decline slightly, the number of fully exploited stocks remains relatively stable and the number of overexploited, depleted and recovering stocks is increasing slightly.

An estimated 25 percent of the major marine fish stocks or species groups for which information is available are underexploited or moderately exploited. Stocks or species groups in this category represent the main source for the potential expansion of total marine catches. About 47 percent of the main stocks or species groups are fully exploited and are therefore producing catches that have reached, or are very close to, their maximum sustainable limits. Thus, nearly half of world marine stocks offer no reasonable expectations for further expansion. Another 18 percent of stocks or species groups are reported as overexploited. Prospects for expansion or increased production from these stocks are negligible, and there is an increasing likelihood that stocks will decline further and catches will decrease, unless remedial management action is taken to reduce overfishing conditions. The remaining 10 percent of stocks have become significantly depleted, or are recovering from depletion and are far less productive than they used to be, or than they could be if management can return them to the higher abundance levels commensurate with their pre-depletion catch levels. Recovery usually implies drastic and long-lasting reductions in fishing pressure and/or the adoption of other management measures to remove conditions that contributed to the stock's overexploitation and depletion.

Total catches from the Northwest and the Southeast Atlantic have levelled off and remained relatively stable over the last five to ten years, at about half the level of the maximums reached three decades ago. Of particular concern is the failure of the stocks of haddock, redfish and cod to respond to the drastic management measures that have been adopted in the Northwest Atlantic. Most of the changes in the Southeast Atlantic are caused by fluctuations in abundance, and hence catches, of the important small pelagics, in particular Cape horse mackerel, Southern African anchovy and Southern African pilchard. After being severely depleted, the stocks of Southern African anchovy and Southern African pilchard show some signs of recovery, although current management efforts have not been in place sufficiently long to bring catches back to maximum historical levels.

In the Eastern Central Atlantic and the Northwest Pacific, total catches are levelling off at relatively high levels, having recovered from a short decline following their maximum production levels some 10 to 15 years ago. Most of these changes result from recoveries in abundance, hence landings, of small pelagics. In the Northeast Atlantic, the Western Central Atlantic, the Northeast Pacific, the Mediterranean and Black Sea, the Eastern Central Pacific and the Southwest Pacific, annual catches are relatively stable, or show a slight declining trend after reaching their maximum potentials one or two decades ago. In the Southwest Atlantic, total annual catches are declining after reaching an all-time high in 1997. This area is being affected by the depletion, and consequent decline in catches, of one of its most important stocks, the Argentine hake.

In the Southeast Pacific, total annual catches reached an all-time high in 1994, and then declined sharply as a consequence of the severe 1997–1998 El Niño and the depletion of the Peruvian anchoveta and other important stocks in the area. Post-El Niño recovery has been surprisingly fast, particularly in the stocks of Peruvian anchoveta. This has taken the total catches rapidly back to pre-El Niño levels, although some other important and declining stocks such as Chilean jack mackerel and the South American pilchard have given no signs of recovery.

The increasing trend of total catch in the Western Indian Ocean slowed down, having reached a maximum in 1999. Two ocean areas in which total catches are thought to be expanding – and where, at least in theory, there is a higher potential to increase total catches – are the Eastern Indian Ocean and the Western Central Pacific. These areas, together with the Western Indian Ocean, have the lowest incidence of fully exploited, overexploited, depleted or recovering fish stocks and have some underexploited or

BOX 5

Dams, fish and fisheries: a challenge for fishery managers and engineers

Dams for irrigation, flood control, hydropower production and water diversion contribute to development and welfare. The structures and purposes of dams range from high dams for power generation and water supply in steep mountain valleys to irrigation, water diversion or navigation structures in lower areas. Dams are also used for flood control, but this has often not been very successful. Many dams are multifunctional and fulfil several purposes with a single facility.

Dam and weir construction has a long tradition in many parts of the world. Over the last half-century, thousands of large dams have been constructed worldwide. The number of smaller dams, weirs and other in-stream obstacles across rivers is not known on a global scale, but may be in the order of several hundred thousands.

Barriers across rivers often have negative impacts on the natural fish populations and may contribute, along with other factors, to the diminished abundance, disappearance or even extinction of species. An example of this is the extinction of the salmon (Salmo salar) in the River Rhine, a stock that had supported a thriving salmon fishery in the first half of the twentieth century. Dams are threatening many aquatic species in Europe and North America, as well as in other continents where far less is known about the biology, behaviour, fishery and population dynamics of the fish species concerned. In several countries, including India, Nepal and South Africa, research on fish behaviour is being carried out so that fish passes can be adapted to the needs of indigenous species. Depending on the swimming capacities of the fish concerned, even low obstacles (i.e. those of between 20 cm and a few metres in height), such as low weirs or cross-river sills (structures to stabilize the river bottom), can have devastating effects. Examples of affected fish from European rivers include the bullhead (Cottus gobio), the nase (Chondrostoma nasus) and the barbel (Barbus barbus). As well as fish, other aquatic animals – or their aquatic life stages (e.g. among the macrozoobenthos) – can be affected by changes to free longitudinal movements in the river.

Cross-river structures impair animals' movement in two main ways: they constitute barriers to the upstream and downstream migration of species that depend on longitudinal movements in the river at some stage of their life cycle; and they cause physical modifications. The latter include: changes in slope, river bed profile, bottom surface structure and bottom substrate; submersion of gravel zones or riffle sections; destruction of riparian vegetation; and changes in the thermal or trophic regime. The downstream flow regime is often drastically changed. Dams may interrupt longitudinal passage completely, or at least delay migration. Downstream passage through hydraulic turbines or over high spillways can increase mortality, and there may be increased predation on migrating young fish as they pass through a dam's reservoir. The cumulative effect of several obstacles on the same river may have important negative implications for fisheries, especially in tropical regions where river fisheries often contribute substantially to rural livelihoods.

In large rivers, yield models relating river basin area and main channel length to catches suggest that yields increase exponentially as the river length increases. This is owing to the connectivity and cumulative influences of upstream processes within the system (the "river continuum concept"), as well as to lateral processes associated with the riparian, watershed and floodplain dimensions of the stream ecosystem (the "flood pulse concept"). For example, such a yield model may estimate that a 25-km section of river would yield catches of 9 113 kg/year at a distance of 50 km from the river's source. At 250 km from the source, a 25-km section of the same river would yield 37 197 kg/year. If a dam were constructed 400 km from the river's source, and resulted in a loss of 25 km of the river at that point, the reservoir would need to compensate for 57 925 kg/year of catch.

Dams break up a river's longitudinal and lateral continuity and can significantly block nutrient flow throughout the ecosystem, thereby affecting fisheries production in downstream reservoirs and river channels, as well as in estuary and marine environments. The larger the river and the more downstream the location of the dam, the less likely it is that a reservoir fishery will be able to compensate for fish yield losses sustained by the river fishery. Because of the production dynamics, compensation potentials appear higher in shallower reservoirs and in tropical regions than they are in deeper reservoirs and in more northern latitudes.

Estimates show yield potentials of up to 143 kg/ha/year for natural African river and floodplain fisheries, although it can be difficult to compensate for loss in yield from river fisheries. Productive reservoir fisheries have been developed with yields of up to 329 kg/ha/year in small reservoirs in Africa, up

to 125 kg/ha/year in Latin America and the Caribbean and up to 650 kg/ha/year in Asia. Thriving reservoir fisheries can develop in areas where river fisheries contribute little to overall national fishery yields, or in drier regions where dams are constructed for irrigation and fisheries are secondary considerations. The benefits from smaller, shallower reservoirs seem to be more pronounced. Stocking of exotic species, in both reservoirs and the tailwaters of dams, can enhance yields, as long as the exotic fishes are environmentally sound and culturally acceptable to the surrounding human population; some areas have no tradition of fishing and fish consumption.

Obstructed passage can be mitigated to some extent by fish passes (sometimes called "fauna passes") for upstream migration and bypasses for downstream passage, but lost habitat cannot easily be compensated for. For anadromous and potamodromous species, upstream passage past obstacles can use several types of passage, including pool-type fish passes, Denil fish passes, bypass channels that imitate nature and fish lifts or locks. Such species can also be collected and transported, if the facilities for doing so are available. Over the last two decades, especially in Australia, France, Japan and New Zealand, significant progress has been made to develop region-specific technologies to improve fish passage facilities, first for upstream and now also for downstream passage. In 2000, a vertical slot fish pass was constructed at the Iffezheim dam on the River Rhine to allow, inter alia, salmon to migrate upstream. Some countries such as France have amended the relevant laws to make the restoration of free passage at obstacles obligatory, at least on rivers that are classified as important for fish migration. More and more frequently the owner of the dams and weirs has to pay to restore free passage.

Effective and efficient fish passage facilities require knowledge of the biology and behaviour of the species concerned. Thus, if basic biological information is missing, it is difficult to transpose fish passage technology to dam projects in other continents or river systems, or from temperate to tropical conditions. However, limited knowledge of the relevant biology does not justify failure to address the problem. The precautionary approach should always be applied, as recently discussed at a Fish Passage Workshop in South Africa.

The design of fish passes requires a multidisciplinary approach involving engineers, biologists and managers. Designs should be systematically evaluated, if possible through an obligatory and comprehensive long-term monitoring programme. Effective environmental assessment and management, coupled with improvements in the design of civil engineering structures, have made some recent dam projects somewhat more fish-friendly and environmentally acceptable.

Source: G. Marmulla, FAO Inland Water Resources and Aquaculture Service. Based on FAO Fisheries Technical Paper No. 419.

moderately exploited stocks. However, they also have the highest incidence of stocks whose state of exploitation is unknown or uncertain and for which overall production estimates are, consequently, less reliable.

Except for skipjack tuna in some areas, most tuna stocks are fully exploited in all oceans, and some are overfished or even depleted. Overcapacity of the tuna fleets has been pointed out as a major problem in several areas. Of particular concern are the stocks of Northern and Southern bluefin tunas in the Atlantic, Indian and Pacific oceans. These are reported to be overfished and, in most cases, severely depleted.

Another source of concern is the rapid increase in fishing pressure on some of the deep water resources (see Box 3) that are being exploited in seamounts and other deep water areas at high latitudes in the Indian Ocean, the South Atlantic and the South Pacific, particularly orange roughy, alfonsinos and dories. Most of these stocks are slow-growing, long-living animals, and thus are highly vulnerable to depletion when the distribution, abundance and dynamics of their stocks are largely unknown. There is severe risk that, in the absence of effective fishery management regimes, these stocks could easily be depleted long before much is known about their populations. Concern has also been expressed regarding the severe decline of Patagonian toothfish stocks in the southern oceans, which are mostly exploited by illegal, unreported and unregulated (IUU) fishing.

Inland resources

In The State of World Fisheries and Aquaculture 2000, it was reported that inland fishery resources are undervalued and under threat from habitat alteration (see Box 2 of SOFIA 2000), degradation and unsustainable fishing activities. Recent field studies in Southeast Asia[1] have revealed that there are significant problems concerning the accuracy of inland fishery statistics in the region. These problems stem from a lack of adequate resources to collect fishery statistics, the difficulty in obtaining information from the sector, misreporting and a lack of capacity to use information to improve the management of inland fishery resources. Experiences indicate that the situation is probably similar in other parts of the world.

Accurate information is crucial to understanding the importance of inland fishery resources and to managing those resources for the benefit of rural populations. Incomplete or incorrect information is a liability in efforts to provide food security to developing regions. As efforts to improve information on inland fishery resources continue, it is inappropriate at this time to present additional data in The State of World Fisheries and Aquaculture 2002.

AQUACULTURE

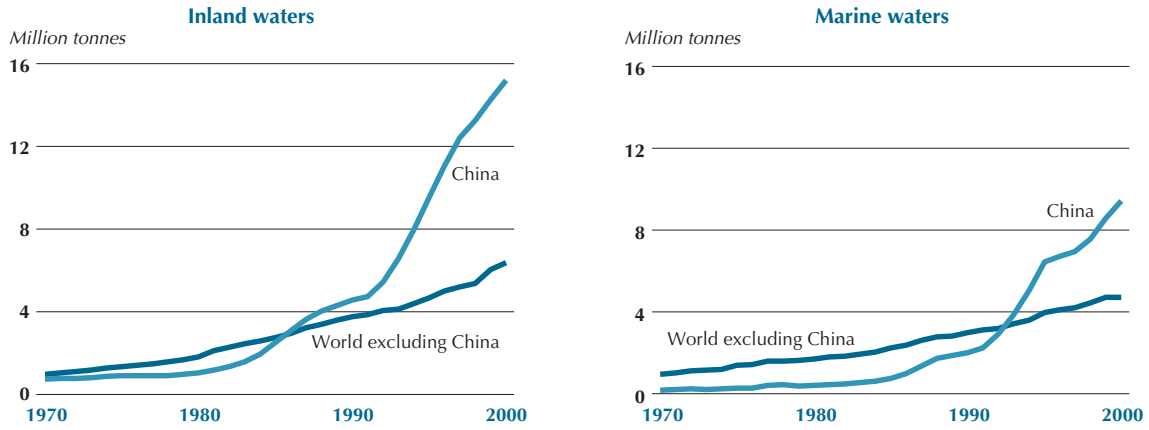
Production

According to FAO statistics, aquaculture's contribution to global supplies of fish, crustaceans and molluscs continues to grow, increasing from 3.9 percent of total production by weight in 1970 to 27.3 percent in 2000. Aquaculture is growing more rapidly than all other animal food producing sectors. Worldwide, the sector has increased at an average compounded rate of 9.2 percent per year since 1970, compared with only 1.4 percent for capture fisheries and 2.8 percent for terrestrial farmed meat production systems. The growth of inland water aquaculture production has been particularly strong in China, where it averaged 11.5 percent per year between 1970 and 2000 compared with 7.0 percent per year in the rest of the world over the same period. Mariculture production in China increased at an average annual rate of 14 percent, compared with 5.4 percent in the rest of the world. However, there is a possibility that China's aquaculture production, particularly its growth since the early 1990s, has been overestimated in the statistics (see Box 2). Figure 18 shows trends in inland and marine aquaculture production for China and the rest of the world.

In 2000, reported total aquaculture production (including aquatic plants) was 45.7 million

[1] FAO. 2002. Inland capture fishery statistics of Southeast Asia: current status and information needs, by D. Coates. RAP Publication 2002/11. Bangkok, FAO Regional Office for Asia and the Pacific. 121 pp.

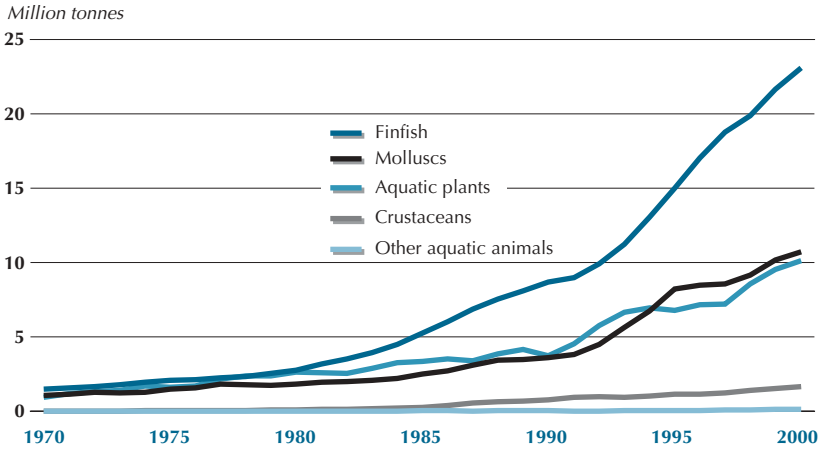
FIGURE 18
Aquaculture production in marine and inland waters



Note: Data exclude aquatic plants.

tonnes by weight and US$56.5 billion by value. China was reported to have produced 71 percent of the total volume and 49.8 percent of the total value of aquaculture production. More than half of the total world aquaculture production in 2000 was finfish, and the growth of the major species groups continues to be rapid with no apparent slowdown in production to date (Figure 19). World aquatic plant production was 10.1 million tonnes (US$5.6 billion), of which 7.9 million tonnes (US$4.0 billion) originated in China.

FIGURE 19
Trend of world aquaculture production by major species groups



In contrast to terrestrial farming systems, where the bulk of global production is based on a limited number of animal and plant species, more than 210 different farmed aquatic animal and plant species were reported in 2000. This great diversity reflects the large number of aquatic species that are readily adaptable to the wide range of production systems and conditions present in the different countries and regions of the world. It should also be noted that the number of species farmed is probably considerably higher than reported, as more than 9.7 million tonnes (21.2 percent) of global aquaculture production was not reported at the species level in 2000. This "unspecified" group is likely to include species that have not yet been recorded individually as being cultured.

In 2000, more than half of global aquaculture production originated from marine or brackish coastal waters. The mean annual growth rate (for the period 1970–2000) was, however, highest for freshwater aquaculture production. Although brackish water production represented only 4.6 percent of total global aquaculture production by weight in 2000, it comprised 15.7 percent of total production by value. The main species groups reared in freshwater were finfish. High-value crustaceans and finfish predominate in brackish

FIGURE 20
World aquaculture production: proportions of species groups by enviroment in 2000

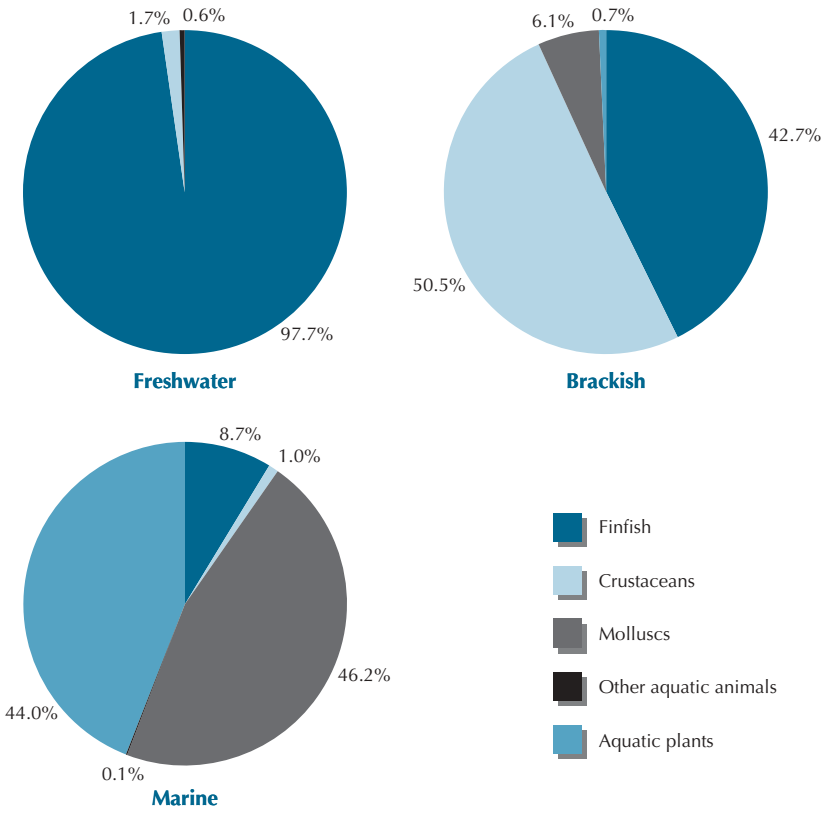
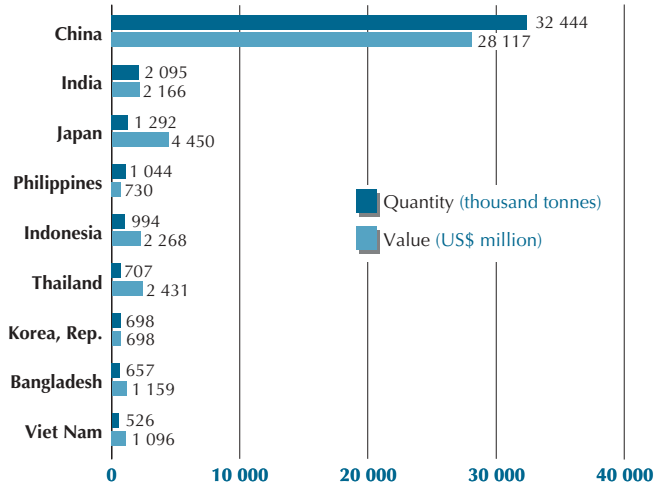


FIGURE 21
Aquaculture production: major producer countries in 2000



Note: Data include aquatic plants. Countries listed are those with a production volume of more than 500 000 tonnes.

water, and molluscs and aquatic plants in marine waters (Figure 20). Production in terms of quantity and value for major producing countries and major species groups is shown in Figures 21 and 22.

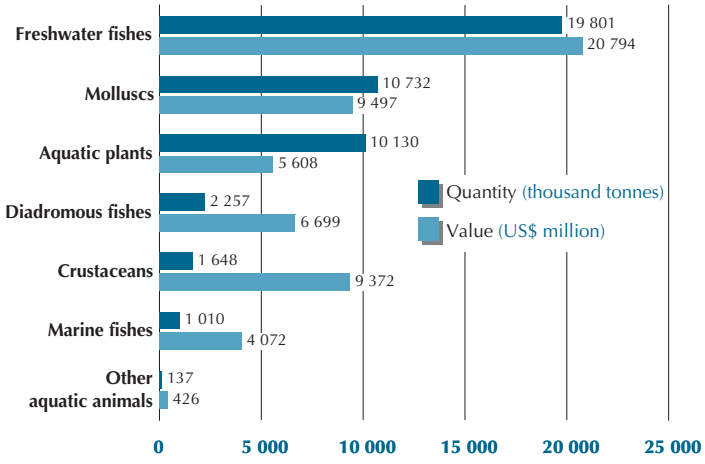
It is particularly significant that aquaculture production in developing countries and low-income food-deficit countries (LIFDCs) has been growing steadily at an average rate of about 10 percent per year since 1970. However, production growth (by both quantity and value) among LIFDCs, excluding China, has been slower than among non-LIFDCs (Figure 23). By contrast, aquaculture production within developed countries has been growing at an average rate of only 3.7 percent per year since 1970, and even showed a decrease of 2.4 percent from 1999 to 2000. With the exception of marine shrimp, in 2000, the bulk of aquaculture production in developing countries comprised omnivorous/herbivorous fish or filter-feeding species. In contrast, 73.7 percent of finfish culture production in developed countries was of carnivorous species.

In terms of food fish supply (i.e. aquatic finfish and shellfish products for human consumption, on a whole, live weight basis – excluding aquatic plants), the world aquaculture sector outside China produced about 11 million tonnes of farmed aquatic products in 2000, compared with about 52 million tonnes from capture fisheries. China's reported figures were about 20 million tonnes from aquaculture and 7 million tonnes from capture fisheries, a stark indication of the dominance of aquaculture in China. Outside China, per capita food fish supply from aquaculture has increased fourfold, from 0.6 kg in 1970 to 2.3 kg in 2000.

Sustainability

During the past three decades, aquaculture has expanded, diversified, intensified and made technological advances. The potential of this development to enhance local food security, alleviate poverty and improve rural livelihoods has been well recognized. The Bangkok Declaration and Strategy (Network of Aquaculture Centres in Asia-Pacific [NACA] and FAO, 2000) emphasizes the need for the aquaculture sector to continue development towards its full potential, making a net contribution to global food availability, domestic food security, economic growth, trade and improved living standards.

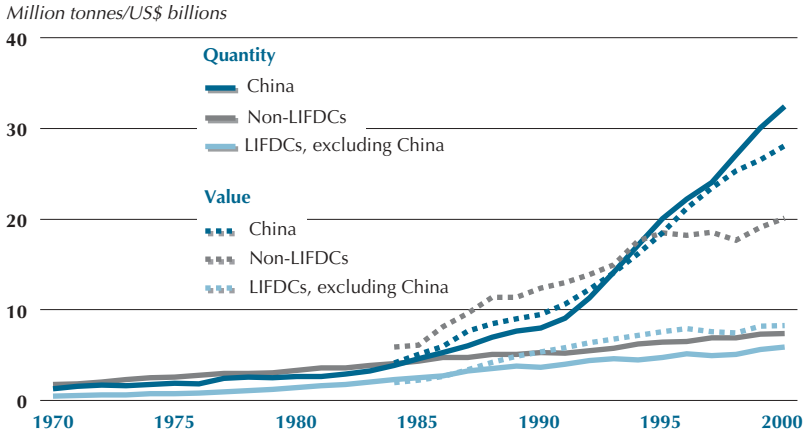
FIGURE 22
Aquaculture production: major species groups in 2000



FISH UTILIZATION

Of the estimated 89 million tonnes of fish produced in 2000 in the world, excluding China, nearly 71 percent (63 million tonnes) was used for direct human consumption. The remainder (about 29 percent) was utilized for various non-food products, mostly for reduction to meal and oil. Corresponding figures for China, which were based on reported capture fishery, aquaculture and fishmeal production and FAO estimates of other non-food uses (see Box 2), were nearly 42 millions tonnes total production and nearly 34 million tonnes (81 percent) for direct human consumption. The remainder was used for the manufacture of fishmeal and other non-food uses, including direct feed to aquaculture.

FIGURE 23
Trends in aquaculture production quantity and value

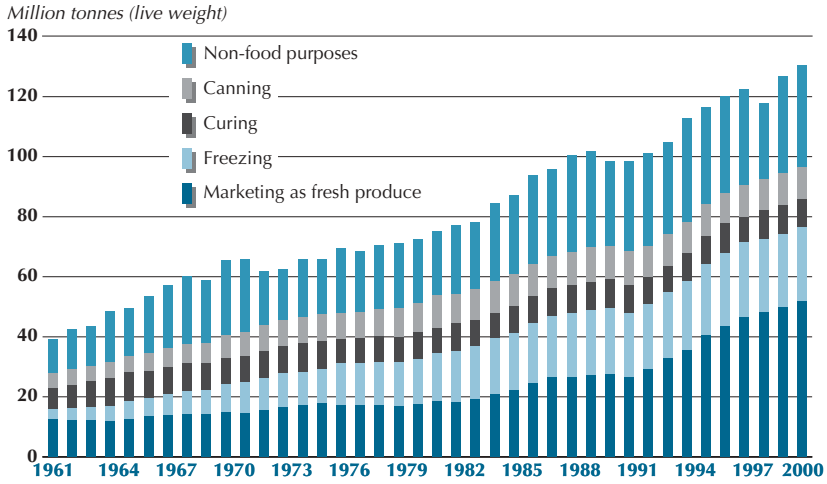


Note: Data include aquatic plants.

As a highly perishable commodity, fish has a significant requirement for processing. In 2000, more than 60 percent of total world fisheries production underwent some form of processing. The most important of the fish products destined for direct human consumption was fresh fish (a share of 53.7 percent), followed by frozen fish (25.7 percent), canned fish (11.0 percent) and cured fish (9.6 percent).

During the 1990s, there was a significant increase in the proportion of fisheries production used as fresh/chilled fish rather than as other products (Figure 24). The demand for fresh fish increased, but was partially offset by a slight decline in other uses. Fresh fish increased in volume (live weight equivalent) from an estimated 28 million tonnes in 1990 to 52 million tonnes in 2000. Processed fish (frozen, cured and canned) increased in volume (live weight equivalent) from 43 million tonnes in 1990 to about 45 million tonnes in 2000. Freezing represents the main method of processing fish for human consumption, and had a 55 percent share in 2000. In developed countries, the proportion of fish that is frozen has been constantly

FIGURE 24
Utilization of world fisheries production (breakdown by volume)



increasing, and frozen fish has become the most common form of product, with a share of 40 percent of fish production. In developing countries, however, the share of frozen products is very constant at about 12 percent.

Almost all the fishery products used for non-food purposes in 2000 (33.7 million tonnes) came from natural stocks of small pelagics, which represented nearly one-third of the total capture fisheries. Most of these fishery products were used as raw material for the production of animal feed and other products. As catches of small pelagics for reduction regained the levels prevailing before El Niño, the quantity destined for non-food uses was about 9 million tonnes more than in 1998.

TABLE 8
Total and per capita food fish supply by continent and economic grouping in 1999

	Total food supply (million tonnes live weight)	**Per capita food supply** (kg per year)
World	**95.5**	**16.0**
World excluding China	**64.3**	**13.6**
Africa	6.2	8.0
North and Central America	8.1	16.8
South America	2.9	8.5
China	31.2	25.1
Asia (excluding China)	32.5	13.7
Europe	13.9	19.1
Oceania	0.7	22.5
Industrialized countries	25.4	28.3
Economies in transition	3.7	12.7
LIFDCs (excluding China)	20.8	8.3
Developing countries excluding LIFDCs	13.7	14.8

Fish consumption

The total food fish supply for the world, excluding China, has been growing at a rate of about 2.4 percent per annum since 1961, while the population has been expanding at 1.8 percent per annum. Since the late 1980s, however, population growth outside China has occasionally outpaced the growth of total food fish supply, resulting in a decrease in per capita fish supply from 14.6 kg in 1987 to 13.1 kg in 2000 (Figure 2). For China, the corresponding annual increases are 6.4 percent for food fish supply since 1961 and 1.7 percent for the population (Figure 9). Annual growth was steady until the mid-1980s (at 3.8 percent from 1961 to 1985) and then suddenly trebled over the following 15 years (10.8 percent from 1985 to 2000).

The share of the animal protein intake of the whole human population derived from fish, crustaceans and molluscs increased from 13.7 percent in 1961 to 16.1 percent in 1996 and then showed a slight decline to 15.8 percent in 1999.

In industrialized countries (Table 8), where diets generally contain a more diversified range of animal proteins, the supply increased from 13.2 million tonnes in 1961 to 25.4 million tonnes in 1999, implying a rise in per capita

BOX 6

Aquatic biodiversity from rice-based farming systems supports rural livelihoods

Rice fields – much more than rice

In the Upper and Lower Mekong River floodplains in Yunnan Province, China and Kampong Thom Province, Cambodia, an attempt has been made to document the availability of living aquatic resources and the pattern of their use by rice farmers. Farmers used their own tools and techniques to collect aquatic species from the fields. Participatory approaches facilitated learning about the traditional knowledge of the local people, including many ethnic minorities.[1]

Remarkable insights were gained. These rice ecosystems support a rich aquatic biodiversity that is important, not only as a source of daily food and income for rural households, but also as a habitat for rare and endemic species. Fishes are the most important group in terms of species diversity and importance for the local people. A total of 60 and 70 different fish species occur in rice farms in China and Cambodia, respectively. Most of these are consumed fresh or fermented into fish paste. Other species are fermented (either as fillets or in smaller pieces), dried, salted, smoked or used for preparing fish sauce.

Fresh or processed fish is the primary source of protein for local people in these areas, and is usually eaten at every meal. In Kampong Thom, an average family of five people probably consumes about 1 kg of fresh fish every day during the fishing season, i.e. when the rice fields are flooded. The same family needs about 20 kg of fermented fish paste for the dry season. Everything else that is caught is sold in the market. Depending on the fishing tool employed, a farmer can catch 15 to 20 kg of fish on a good day, although the average fish catch during the fishing season is less than 10 kg per day. In China, a variety of fish, crustaceans, molluscs, amphibians, insects, reptiles and aquatic plants from rice-based systems are an essential part of the daily diet, in particular for the rice farming Dai minority in Xishuangbanna. The consumption level of aquatic organisms has remained fairly constant; nowadays about one-fifth to one-third of consumption is derived from capture in rice-based farming, but a decade ago this same capture supplied half of the fish needed in the diet. The use of aquatic organisms as animal feeds and bait, or for medicinal purposes, is an important addition to their human consumption value.

The availability of these aquatic resources is declining. An increasing human population is resulting in overexploitation of seasonally resident fish populations. Pesticide use, the destruction of fish breeding grounds and illegal fishing methods also contribute to the decline. It seems likely that in other rice growing regions of the world where aquatic organisms are harvested from rice fields and contribute to nutritional needs, they too are likely to be subject to similar threats.[2]

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[1] FAO. 2002. Traditional use and availability of aquatic biodiversity in managed ecosystems, edited by M. Halwart and D. Bartley. Rome.
[2] FAO. 2002. Recent FAO initiatives on the availability and use of aquatic organisms in rice-based farming, by M. Halwart. Rome.
Source: M. Halwart, FAO Fisheries Department.

provision from 19.9 to 28.3 kg. The growth rate was steady until the late 1980s and has stabilized again since then. In this group of countries, fish contributed an increasing share of the total protein intake until 1989 (accounting for between 6.5 and 8.5 percent), but its importance has gradually declined since then and its contribution in 1999 (7.7 percent) was back to the level prevailing in the mid-1980s.

In the early 1960s, the average per capita fish supply in LIFDCs was one-fifth of that in the richest countries. The gap has gradually lessened, however, and in 1999 average LIFDC fish consumption was close to half that of the more affluent economies. If China is excluded, per capita supply in LIFDCs increased from 5.0 to 8.3 kg over the period – an annual growth rate of 1.3 percent. In LIFDCs, despite the relatively low consumption by weight, the contribution of fish to total animal protein intake is considerable (nearly 20 percent), and may be higher than official statistics indicate because of the contribution of unrecorded subsistence fisheries to food intake. Over the last four decades,

FIGURE 25
Fish as food: per capita supply

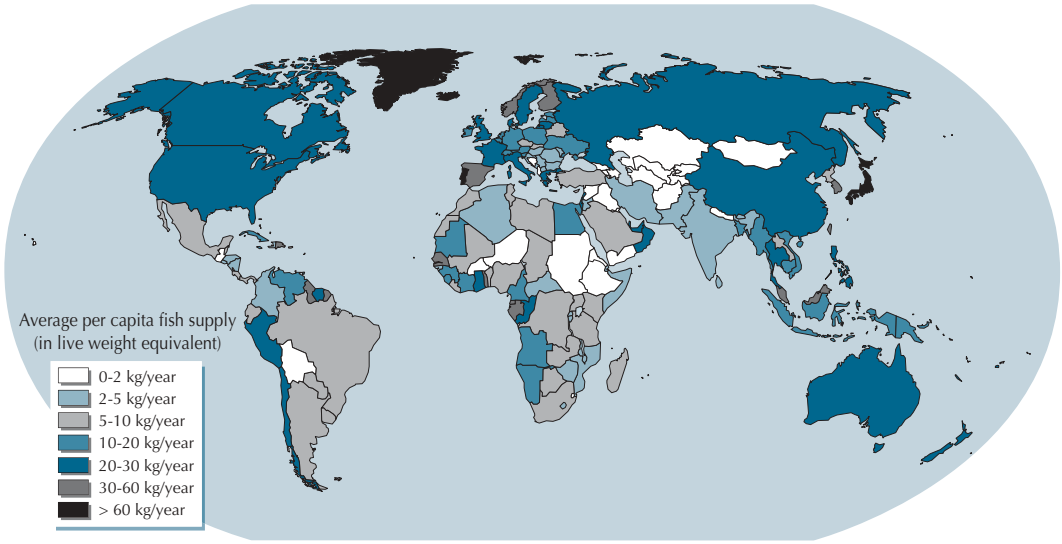
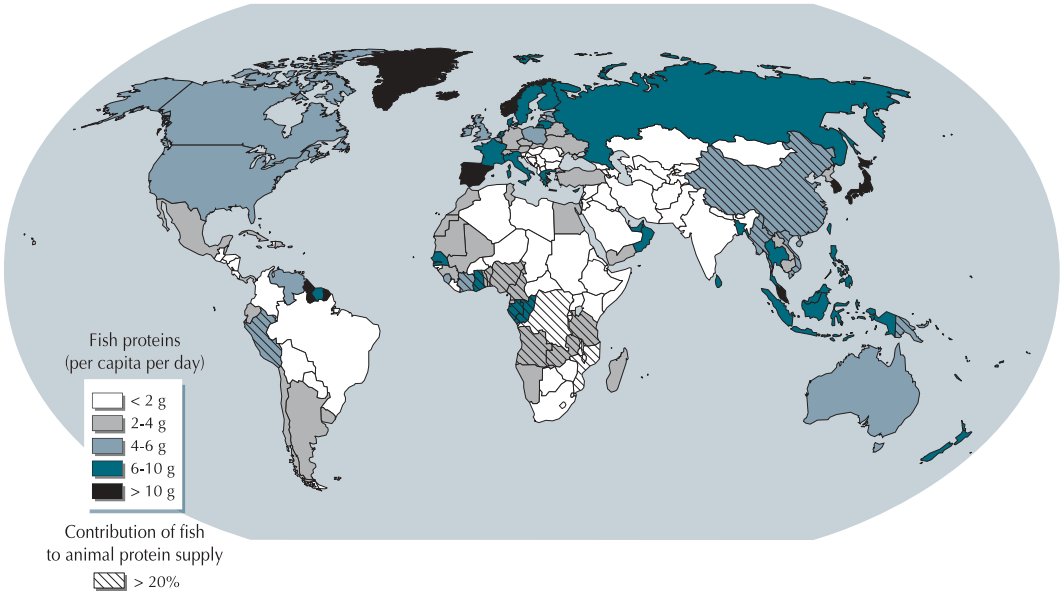


FIGURE 26
Contribution of fish to animal protein supply



however, the share of fish proteins in animal proteins has exhibited a slight negative trend owing to faster growth in the consumption of other animal products.

As well as income-related variations, the role of fish in nutrition shows marked continental, regional and national differences (Figures 25 and 26). For example, of the worldwide 95.5 million tonnes available for consumption in 1999, only 6.2 million tonnes were consumed in Africa (with a per capita supply of 8.0 kg); two-thirds of the total were consumed in Asia – 32.5 million tonnes outside China (13.7 kg per capita) and a similar amount in China alone (giving an apparent supply of 25.1 kg per capita).

Currently, two-thirds of the total food fish supply is obtained from fishing in marine and inland waters; the remaining one-third is derived from aquaculture. The contribution of inland and marine capture fisheries to per capita food supply stabilized at 10 to 11 kg per capita in the period 1970–2000. Recent increases in per capita availability have, therefore, been obtained from aquaculture production from both traditional rural aquaculture and intensive commercial aquaculture of high-value species. On average, for all countries in the world except China, aquaculture's contribution to per capita food availability grew from 0.5 kg in 1970 to 1.8 kg in 2000 – representing an average annual rate of 4.5 percent. In China, where fish farming practices have long traditional roots, the per capita supply from aquaculture is reported to have increased from nearly 1 kg to nearly 19 kg in the same period, implying an annual average growth of 11 percent.

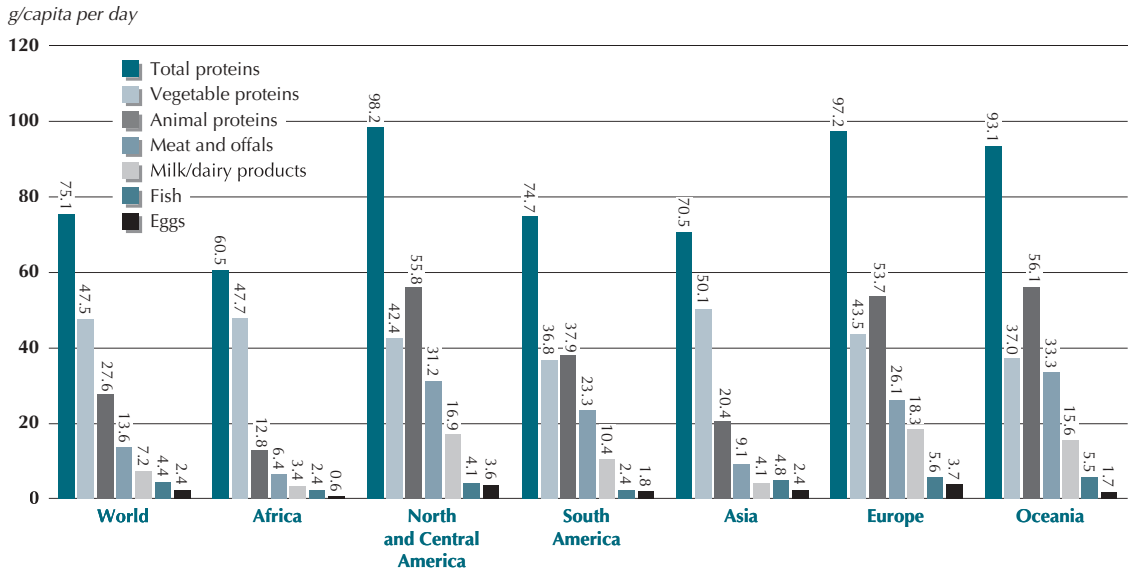
The total amount of fish consumed and the species composition of the food supply vary according to region and country, reflecting the different levels of natural availability of aquatic resources in adjacent waters, as well as diverse food traditions, tastes, demand and income levels. Demersal fish are much preferred in northern Europe and North America, and cephalopods are consumed extensively in several Mediterranean and Asian countries, but to a much lesser extent in other regions. Despite the fast-growing contribution of aquaculture to production, crustaceans are still high-priced commodities and their consumption is mostly concentrated in affluent economies. Of the 16.0 kg of fish per capita available for consumption in 1999, the vast majority (75 percent) was finfish. Shellfish supplied 25 percent – or about 4 kg per capita, subdivided into 1.4 kg of crustaceans, 2.1 kg of molluscs and 0.4 kg of cephalopods.

Freshwater and diadromous species contributed 27 million tonnes of total supply. Marine finfish species provided 44 million tonnes, subdivided into 17 million tonnes of demersal species, 19 million tonnes of pelagics and 8 million tonnes of unidentified marine fish. The remaining 20 percent of the food supply was shellfish, comprising 8.6 million tonnes of crustaceans, 2.7 million tonnes of cephalopods and 12.5 million tonnes of other molluscs. Historically, there have not been dramatic changes in most of the broad groups' shares in average world consumption: demersal fish species have stabilized at about 2.9 kg per capita and pelagic fish at 3.2 kg. Two groups are exceptions in that they showed considerable increases between 1961 and 1999: the availability of crustaceans per capita more than trebled from 0.4 to 1.4 kg, largely because of the production of shrimps and prawns from aquaculture practices; and molluscs similarly increased from 0.6 to 2.1 kg per capita.

Fish contributes up to 180 calories per capita per day, but reaches such high levels only in a few countries where there is a lack of alternative protein foods grown locally and where a preference for fish has been developed and maintained (examples are Japan, Iceland and some small island states); more generally, fish provides about 20 to 30 calories per day. Fish proteins are essential and critical in the diets of some densely populated countries, where the total protein intake level may be low, and it is very important in the diets of many other countries (e.g. fish contributes more than, or close to, 50 percent of total animal proteins in the Gambia, Ghana, Equatorial Guinea, Indonesia, Sierra Leone, Togo, Guinea, Bangladesh, the Republic of the Congo, Cambodia).

Worldwide, more than 1 billion people rely on fish as an important source of animal proteins

FIGURE 27
Total protein supply by continent and major food group (1997–1999 average)



(i.e. fish provides at least 30 percent of their animal protein intakes) (Figure 27). Dependence on fish is usually higher in coastal than in inland areas. About 56 percent of the world's population derives at least 20 percent of its animal protein intake from fish, and some small island states depend on fish almost exclusively.

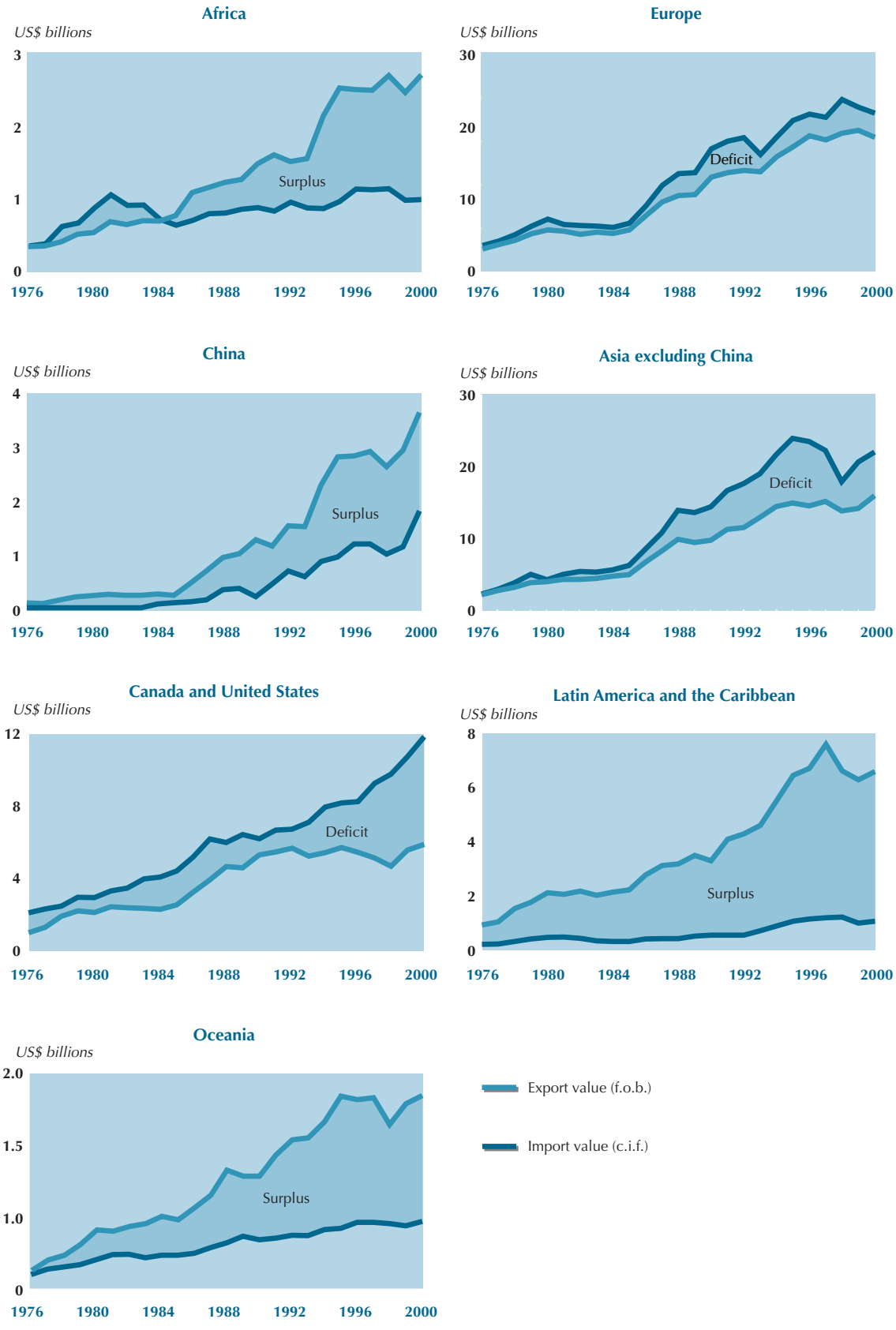
FISH TRADE

In addition to their role as a source of food and livelihoods, fisheries in many countries are also an important source of foreign exchange. In a few cases, fishery exports are essential to the economy. For example, in 2000 they accounted for more than two-thirds of the total value of traded commodities in Greenland, the Seychelles, the Faeroe Islands and Iceland. In many countries there is a substantial two-way trade in fishery products. The trade surplus is significant in South America, Africa, China and Oceania (Figure 28). Products derived from aquaculture production contribute an increasing share of total international trade in fishery commodities (see Box 7).

In 2000, total world trade of fish and fishery products increased to an export value of US$55.2 billion, having grown by 8 percent since 1998. This increase was largely due to a rise in the volume of commodities traded (Figure 29); compared with 1998, the prices of major food products decreased marginally and those of feeds declined sharply. Thailand continued to be the main exporting country, with US$4.4 billion. China experienced a sharp increase in its export performance to reach US$3.7 billion in 2000 – a major growth of 36 percent from 1998 – and is now the second largest exporter. In addition to exports from domestic production, China also reprocesses imported raw material for export, creating a strong value-addition in the process. Norway, which used to be ranked second, reported lower export values. These were partly caused by lower salmon prices, but also by the low value of the euro – the currency of the main trading area for Norwegian fish.

Fish imports reached a new record of US$60 billion in 2000. Developed countries accounted for more than 80 percent of the value of total fishery product imports. Japan was again the largest importer of fishery products, accounting for some 26 percent of the global total; its fishery imports accounted for 4 percent of its total merchandise trade. After the economic recession, which caused a decline in 1998, the value of Japanese imports of fish and fishery products in 2000 returned to the level of 1997. The EC

FIGURE 28
Imports and exports of fishery products for different regions, indicating the net deficit or surplus



BOX 7
Trade in aquaculture products

The main traded products[1] from aquaculture are shrimp and prawns, salmon, and molluscs. Other species showing strong growth in trade are tilapia, seabass and seabream.

Crustaceans

In international trade, the most prominent product from aquaculture is marine shrimp, and aquaculture has been the major force behind increased shrimp trading during the past decade. Shrimp is already the most traded seafood product internationally, and about 26 percent of total production now comes from aquaculture (1.1 million tonnes in 2000). Since the late 1980s, farmed shrimp has tended to act as a stabilizing factor for the shrimp industry. The major crop failures in Asia and Latin America during past years have therefore had an impact on overall supply, demand, prices and consumption trends. Considered a luxury product in most markets, shrimp demand is very dependent on a country's economic climate, and consumption and trade in an individual country may show large variations from year to year. At present, Japanese demand remains weak, as does the United States market after September 2001.

The major markets are Japan, the United States and the EC, and the largest exporters of farmed shrimp are Thailand, Ecuador, Indonesia, India, Mexico, Bangladesh and Viet Nam. Demand for shrimp and prawns is expected to increase in the medium to long term. Asian markets such as China, the Republic of Korea, Thailand and Malaysia will expand as local economies grow and consumers demand more seafood. This trend is already reducing the availability of shrimp to traditional importers, and will eventually put upward pressure on prices if supplies do not expand. Increases in prices will encourage new entries into shrimp farming and, if sustainable methods of production are used, greater stability of prices.

Trade in crab species has increased with growing aquacultural production (140 300 tonnes in 2000). Total exports for fresh, frozen and preserved crab (wild and farmed) reached 240 000 tonnes and US$1.5 billion in 2000.

Finfish

Finfish production ranks first in terms of total aquaculture output, with 23 million tonnes produced in 2000, or about 65 percent of total production from aquaculture. The major share of this total were carps (68 percent of total finfish production in 2000), which are consumed locally in the producing countries (mainly China and India).

International trade in farmed salmon has increased from virtually zero to about 1 million tonnes (2001) in less than two decades. The traded species are mainly Atlantic salmon and, to a far lesser extent, coho salmon, which accounted for 88 and 10 percent of production in 2001, respectively. Growth in trade has followed the growth in salmon production, as the bulk of production is concentrated in a few countries with limited domestic markets – Norway, Chile and the United Kingdom. Norway is the main exporter of Atlantic salmon, and Chile the main exporter of coho salmon and the second largest exporter of Atlantic salmon. The main market for Norway is the EC, which accounts for some 70 percent of Norwegian exports; Chile's main markets are Japan and the United States, accounting for some 55 and 30 percent of Chilean exports, respectively.

Norway has identified Asia as the future growth market (in addition to further penetration of the European markets), and the Norwegian salmon farming industry has spent almost US$150 million on international promotion and advertising over the last few years. Chilean producers foresee strong growth in the United States, Latin American, European and Asian markets, excluding Japan. In contrast to Norway, Chile produces a large quantity of fillets, which are sent fresh by air to the United States market.

The global farmed salmon industry is restructuring rapidly, with a few companies accounting for a large share of production and frequently having strong ties to the feed industry. As production volumes have increased, costs and prices have been driven down and, at current levels (US$2.60

[1] The extent of regional and international trade in aquaculture products is difficult to analyse because trade in many aquaculture products is not yet well documented in the main producing countries. International trade statistics often do not distinguish between wild and farmed origin, and the exact breakdown in international trade is therefore open to interpretation. This situation will change gradually, as producers' associations emerge in producing countries and begin to keep records, and in response to new environmental and labelling requirements that distinguish between farmed and wild products. An important development is the new EU legislation on labelling, which since 1 January 2002 requires most fishery products to carry labels stating whether they originate from capture fisheries or aquaculture.

Source: A. Lem, FAO Fish Utilization and Marketing Service.

to $3.40/kg cost, insurance, freight [c.i.f.]), salmon has become a relatively mid-priced product in international seafood markets.

International trade in trout is much smaller than in salmon, with exports in 2000 reaching some 140 600 tonnes out of a total farmed trout production of 511 000 tonnes. Consumption is concentrated in trout producing countries, but Norway and Chile have been able to farm specific qualities of large-sized, heavy-pigmented trout for the Japanese market (Japan imported 84 000 tonnes of trout in 2001).

Another species to show tremendous growth in output is tilapia (aquaculture production of tilapia and other cyclids amounted to some 1 265 800 tonnes in 2000). International trade is limited but growing, especially between Central American producers (Costa Rica, Ecuador and Colombia) and the United States, and between Asian producers (Taiwan Province of China, Indonesia and Thailand) and the United States and Japan. There is also modest trade between Jamaica and the United Kingdom. The largest exporter, Taiwan Province of China, supplies Japan with high-quality tilapia fillets for the sashimi market, and ships frozen tilapia to the United States market (40 000 tonnes in 2001). Taiwan Province of China exports about 70 percent of its domestic tilapia production. Thailand and Indonesia export less than 5 percent of their production. Viet Nam has also recently entered the world tilapia market, and China exported 12 500 tonnes to the United States in 2001. Zimbabwe now also produces fresh and frozen fillets for the EC market.

In the United States, tilapia is now the third most imported aquaculture product by weight (56 300 tonnes in 2001), after shrimp and salmon. United States imports have been growing strongly and are forecast to grow further in the future. Long-term tilapia prices are expected to decrease, and this should lead to increased exports to the United States, as well as to Europe, which is still an undeveloped market for tilapia.

In Europe, the seabream and seabass industry has grown strongly in the last decade. Production reached 120 000 tonnes in 2001, most of which was exported, mainly to Italy and Spain. The main exporter was Greece, which exported about 70 percent of domestic production. Italy was originally almost the only export market for Greek production but, as a result of market development efforts, Greek exports have now expanded into new markets, such as the United Kingdom, Germany and France, as well as Spain for certain sizes. At the opposite end, trade in fingerlings comes from Italy, Spain and France and goes to farms in Greece, Malta and Croatia.

As seabass/seabream output has grown, costs have been driven down, and market prices declined by more than two-thirds between 1990 and 2002 – from US$16/kg to about US$4 to $5/kg. The rapid saturation of the market and the parallel rapid price decline (60 to 70 percent in ten years, compared with 50 percent for Atlantic salmon) are attributed to the much smaller traditional market for these species (mainly southern Europe) compared with the Atlantic salmon market, lack of diversified products, and limited market development and promotion. The substantial drop in prices of these species is, however, opening new markets and expanding existing ones, although acceptable profit margins at the production end can only be sustained through further improvements in productivity and product diversification. As with farmed salmon, the seabass/seabream industry is becoming consolidated, and several companies are also quoted on the stock exchange in Greece and Norway.

American catfish is now the fifth most consumed fish in the United States (0.5 kg per capita edible weight in 2000), and domestic production reached 280 000 tonnes in 2000. Exports are limited because production is aimed at the domestic market, whereas imports from Viet Nam have rapidly gained market share in the United States (7 700 tonnes) and European markets. The reason for the success of catfish is similar to that of tilapia's success: strong consumer demand for white, easy-to-prepare fillets.

Seaweed

Farmed seaweed production has been growing in the last decade (10 million tonnes in 2000), and is now 88 percent of total seaweed supplies. Most output is utilized domestically for food, but there is growing international trade. China, the main producer, has started to export seaweed as food to the Republic of Korea and Japan. The Republic of Korea, in turn, exports some quantities of Porphyra (red seaweed) and Undaria (brown seaweed) to Japan (23 500 tonnes in 2000).

Significant quantities of Eucheuma (red seaweed) are exported by the Philippines, the United Republic of Tanzania and Indonesia to the United States, Denmark and Japan. Total EC imports of seaweed in 2000 amounted to 61 000 tonnes. Chile is an important extractor, processor and exporter of agar and carrageenen.

Molluscs

International trade in molluscs is relatively limited compared with total output: less than 10 percent of total output is traded. Major importing markets are Japan, the United States

and France, while major exporters are China and Thailand. The contribution of farmed products to trade is uncertain. For all categories, international trade is increasing.

Total fresh and frozen scallop imports have grown from 28 000 tonnes in 1985 to 78 100 tonnes in 2000, reaching a value of US$563 million. Clam imports have grown from 33 000 tonnes to 171 000 tonnes in the same period, valued at US$301 million. Mussel imports showed a downward trend after a peak of 175 000 tonnes in 1992, to reach 137 000 tonnes in 1993 and 151 000 tonnes in 1994. However, mussel imports showed an upward trend again in subsequent years: 200 000 tonnes valued at US$310 million in 2000. Oyster imports have been growing steadily from less than 10 000 tonnes in 1985 to 47 000 tonnes in 2000, reaching a value of US$200 million.

Live organisms

Asia is rapidly increasing its consumption of live seafood as a result of cultural preferences and growing affluence. The live seafood market is largely restricted to the restaurant trade and to consumers with a relatively high disposable income. Major market expansion is anticipated as a result of demand in China, but expansion is also expected in Malaysia, Singapore and Taiwan Province of China, as well as in parts of North America and Europe with large Chinese or Asian communities. Aquaculture's potential to supply the market is promising. The sector is already supplying large quantities of shellfish and limited quantities of grouper, crabs and other species. Technological developments in the culture of preferred live food species will increase aquaculture's contribution to supplies.

Annual international exports of ornamental fish are about US$200 million in value, or less than 1 percent of total world fish trade. However, the total value of the wholesale ornamental trade is estimated at close to US$1 billion, and retail trade at about US$3 billion in the United States alone.

The importance of the ornamental fish trade is not just in terms of its share in international trade. The sector is an important source of income for rural, coastal and insular communities in developing countries and, frequently, a welcome provider of employment opportunities and export revenues.

Asia accounts for more than 50 percent of the world supply of ornamental fish. New players such as the Czech Republic and Malaysia are now competing with the traditionally dominant suppliers. The main importers are the United States (24 percent), Japan (14 percent) and Europe, particularly Germany (9 percent), France (8 percent) and the United Kingdom (8 percent). In international trade, freshwater species represent about 90 percent in value terms, against 10 percent for marine species. Freshwater species are mostly farmed, whereas marine fish come from the wild. However, marine aquaculture is growing strongly as problems related to the environment and the lack of sustainable collection practices make this a more viable long-term alternative.

There appears to be significant regional and international trade in seed of cultured aquatic organisms, mainly from aquaculture sources. In most instances, however, this is poorly documented. As well as the regional trade in Mediterranean seabass and seabream fingerlings, there is also trade in glass eels (e.g. China's recent large purchases of European eel elvers), post-larvae stages of various cultured shrimps, Indian and Chinese carps, and others. There is also limited trade (in terms of quantity) in broodstock. Documentation of the trade in seed will improve gradually in response to concerns about the spread of diseases and the movement of genetic material.

Source: A. Lem, FAO Fisheries Department.

further increased its dependency on imports for its fish supply. Excluding Spain, which is now the third largest importer of fishery products, all other major countries of the euro currency area reported decreased values of imports in 2000. The United States, as well as being the world's fourth largest exporting country, was the second largest importer. Imports were growing in 2000, mainly owing to expanding shrimp imports.

The net receipts of foreign exchange by developing countries (i.e. deducting their imports from the total value of their exports) increased from US$3.7 billion in 1980 to US$18.0 billion in 2000 – a 2.5-fold increase in real (corrected for inflation) terms. In 2000, they increased by nearly 10 percent at current values compared with 1999, after several years of stability at about US$16 billion. This was greater than the net exports of other agricultural commodities such as rice, coffee and tea (Figure 30). For many developing nations, fish trade represents a significant source of foreign currency earnings.

Fish production and trade have grown significantly in the last decades, assisted by improvements in technology, transportation and communications and by sustained demand. A large share of fish production enters international marketing channels, with about 37 percent exported in 2000 (live weight equivalent) in various food and feed product forms. LIFDCs play an active part in this trade, and at present account for almost 20 percent of the value of fishery exports. In 2000, developing countries as a whole supplied slightly more than 50 percent of total exports in value terms. Although there is an important trade of fish and fishery products among the more developed economies, trade

FIGURE 29
World fishery exports by major commodity groups

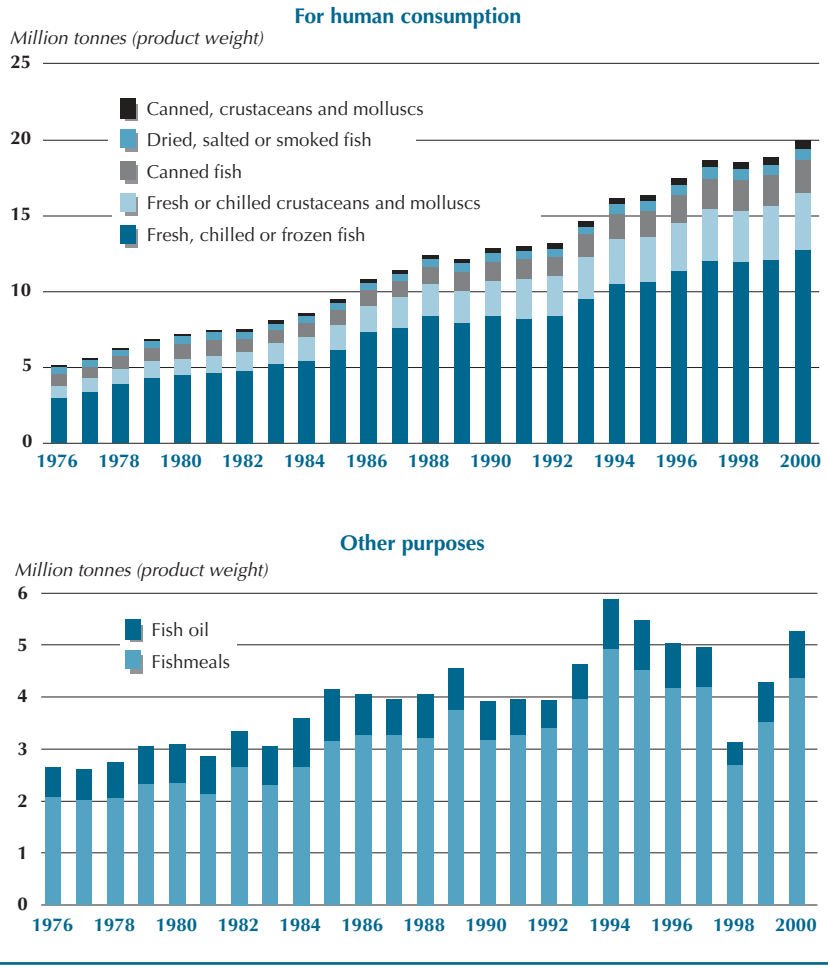
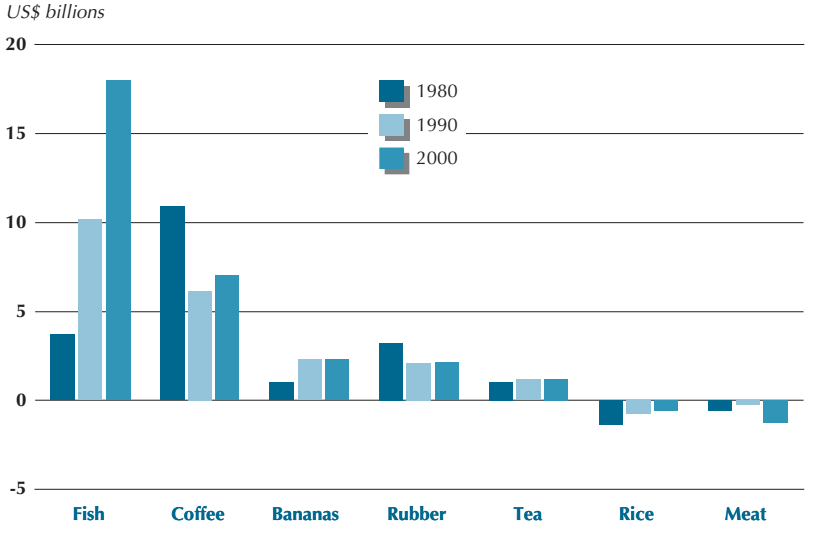


FIGURE 30
Net exports of selected agricultural commodities by developing countries



tends to flow from the less developed to the more developed countries. About 76 percent of the import value is concentrated in three main areas: Japan, the EC and the United States. Although trade among developing countries is increasing, it is still not very substantial and accounted for about 20 percent of those countries' total exports in 1998–2000.

Owing to the high perishability of fish, more than 90 percent of fish and fishery products trade consists of products that have been processed in one form or another. Live, fresh or chilled fish represent only a small, though growing, share of world fish trade; the growth reflects improved logistics and increased demand. Shrimp is the main fish trade commodity in value terms, followed by demersal species (e.g. hake, cod, haddock and Alaska pollock), tuna, salmon, small pelagics, cephalopods and fishmeal.

Fish products traded among industrialized countries are mostly from demersal species, which are traded in fresh, frozen whole and fillet form; lower-value pelagic species such as herring and mackerel, which are traded in fresh and frozen form; and fresh and frozen salmon. Developing countries' exports concern mainly tuna, small pelagics, shrimps, prawns, rock lobsters and cephalopods (octopus, squids and cuttlefishes). In the past, developing countries were involved primarily in exports of raw material for the processing industries of developed countries, but in recent years they have been increasingly involved in adding value to their products prior to export. In addition, a large part of the world's trade in fishmeal originates from developing countries in Latin America. Developing countries' imports concern mainly frozen small pelagics and cured, dried and smoked fish. There are also some imports of raw material (e.g. frozen tuna) for further processing (e.g. canned tuna) and re-export. Emerging markets (Hong Kong Special Administrative Region, Taiwan Province of China, the Republic of Korea, Malaysia and Singapore) are increasingly importing high-value commodities (rock lobster, squid, etc.) for domestic consumption.

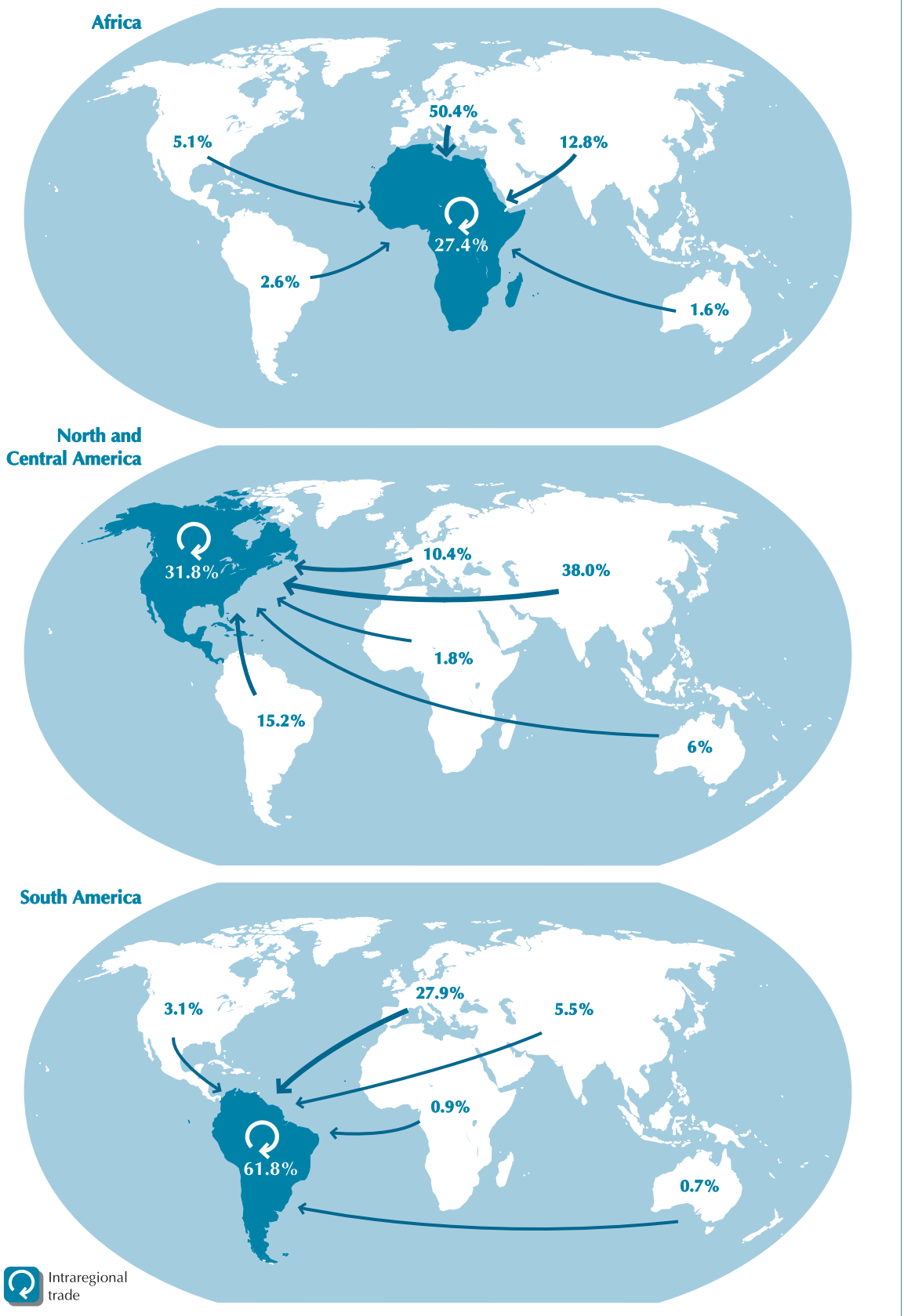
It should be noted that the overall picture presented by the maps in Figure 31 is not exhaustive. Although the countries that reported their imports (some 137 countries for the period 1998–2000) account for 98 percent of the estimated world total, some continental groups have incomplete coverage (e.g. only 40 percent of African countries reported their imports). In such cases, the data indicated should not be taken as the total trade flow of the continental groups to which they refer.

During recent years, international trade in fishery products has faced the following major issues: the change in quality control measures in the main importing countries towards a preventive Hazard Analysis and Critical Control Point (HACCP)-based strategy; the concept of risk assessment; general public concern regarding overexploitation of the resource; environmental concerns regarding aquaculture; and the discussion of traceability and labelling. The EC and the United States made HACCP plans mandatory for all plants producing fish products for their markets. While the United States enforces these measures through importers in the United States, the EC controls the competent authorities in the exporting countries. Risk assessment (i.e. analysis of the risk of consumers falling sick after consuming fish) is still being developed in many countries. The sustainable trade of fish – from either the wild or aquaculture – is of concern to consumers, especially in the developed world. Information about dangerous antibiotics in cultured fish species, or about overfished resources, scares consumers away from fish products. Mangrove depletion through shrimp aquaculture has also received negative press coverage recently. On 1 January 2002, the EC enforced a law on the traceability of fish, which obliges producers to indicate the following on product labels: the commercial name of the species and the Latin name; whether the fish comes from the wild or from aquaculture; the country of origin for freshwater wild and cultured fish; and the ocean of origin for wild marine species. A range of types of labelling, such as ecolabelling or organic product labelling, are being developed and used for fishery products, and this is creating confusion among consumers.

Shrimp

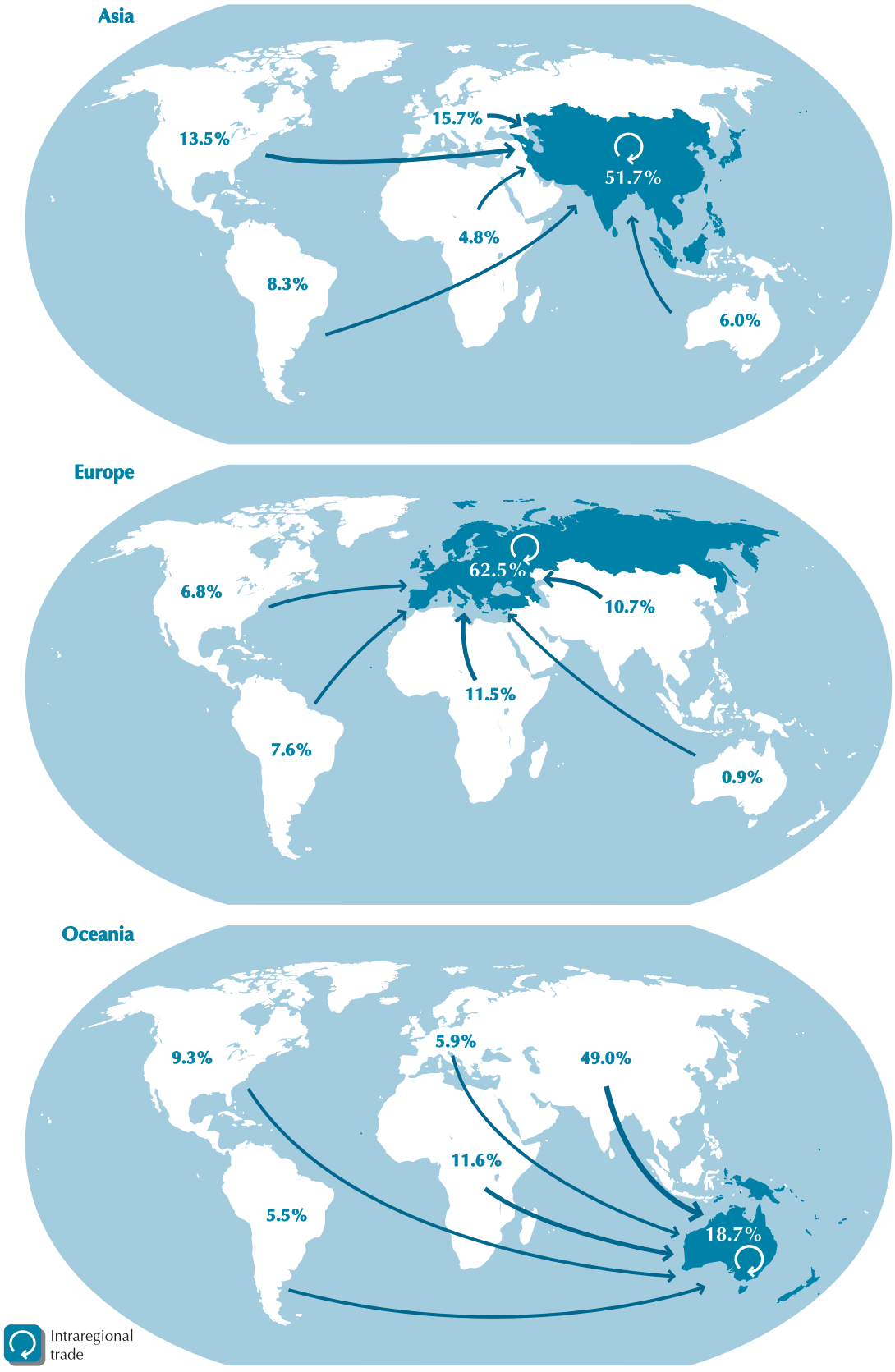
The economic crisis in Japan led to lower

FIGURE 31
Trade flows by continent (percentages of total import c.i.f. values: averages for 1998–2000)



(Continuing)

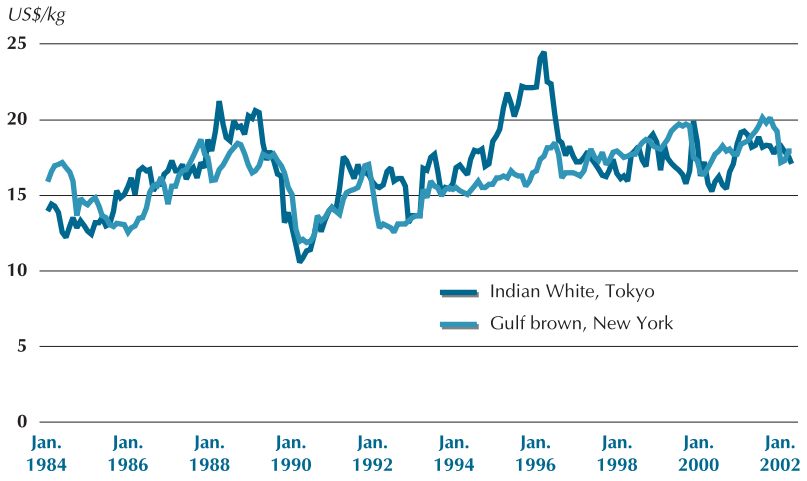
FIGURE 31 (continued)
Trade flows by continent (percentages of total import c.i.f. values: averages for 1998–2000)



demand for shrimp. The main supplying countries had to reduce prices and look for other outlets in order to sell their production. The United States market was strong in 2000, but declined sharply in 2001. The dramatic events of 11 September increased the slowdown of the market. Demand for shrimp in Europe was improving in parallel with the overall economic situation; however, the low level of the euro undercut any substantial growth there. On 29 January 2002, the EC stopped imports of shrimp from China because of the strong presence of antibiotics in cultured shrimp from that country. In other Asian countries, the EC carried out close checks with regard to the presence of antibiotics. These countries prefer to sell to other markets, rather than risk having shipments destroyed at the EC border. This situation upset the international market for shrimp in the opening months of 2002, and prices were extremely low (Figure 32).

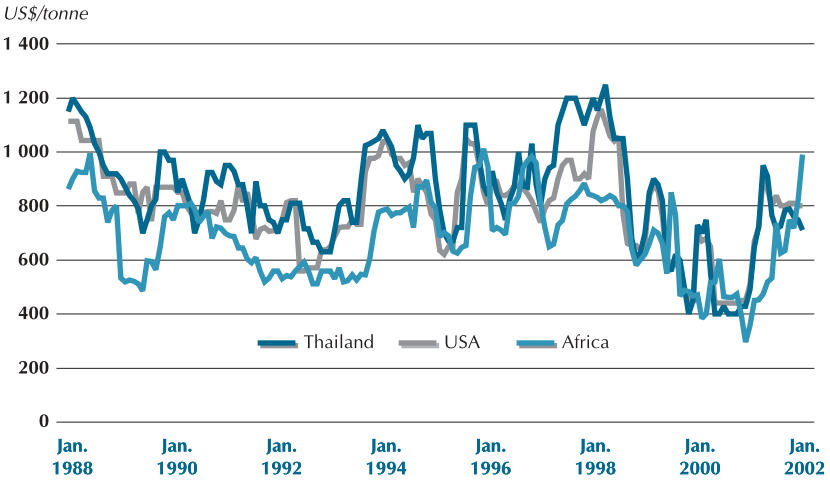
The disease problems that affected Ecuador and Central America in 1999 led to lower production of cultured shrimp in 2000 and also in 2001. Thailand continues to be the main shrimp aquaculture producer, with 250 000 tonnes, and cultured shrimp production is growing after the disease problems experienced there in 1996 and 1997.

FIGURE 32
Shrimp prices (wholesale) in the United States and Japan



Note: Frozen, headless, shell-on, 16–20 count.
Source: FAO GLOBEFISH

FIGURE 33
Skipjack tuna prices (c&f) in the United States, Thailand and Africa



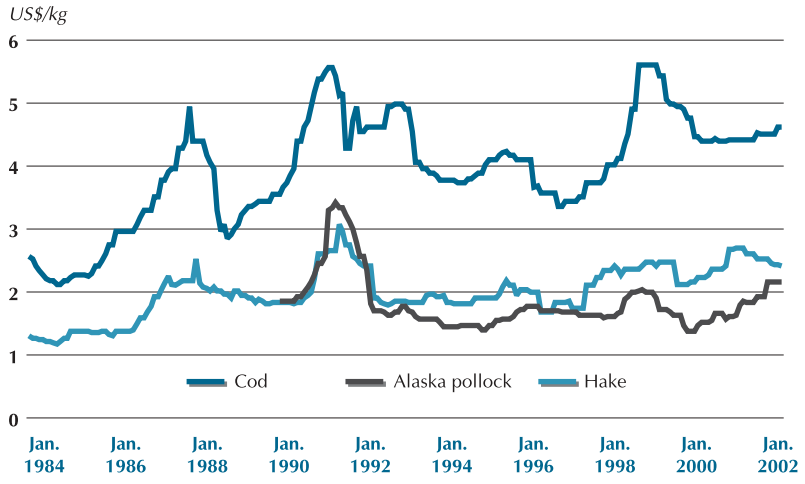
Notes: 4.5–7.0 lb.For Africa: ex-vessel Abidjan, Côte d'Ivoire.
Source: FAO GLOBEFISH

Tuna

Tuna catches were strong in 1999, and skipjack prices declined to an unprecedented low, making fishing uneconomic. In mid-2000, the main tuna vessel owners created an organization with the aim of normalizing the market. This organization introduced stringent catch reduction programmes, which had an immediate effect on prices. During the course of 2001, members of the organization met regularly to ensure that catch reduction continued. Skipjack prices, which hit a low of US$350 per tonne in mid-2000, recovered to reach US$700 to $750 per tonne in May 2002 (Figure 33).

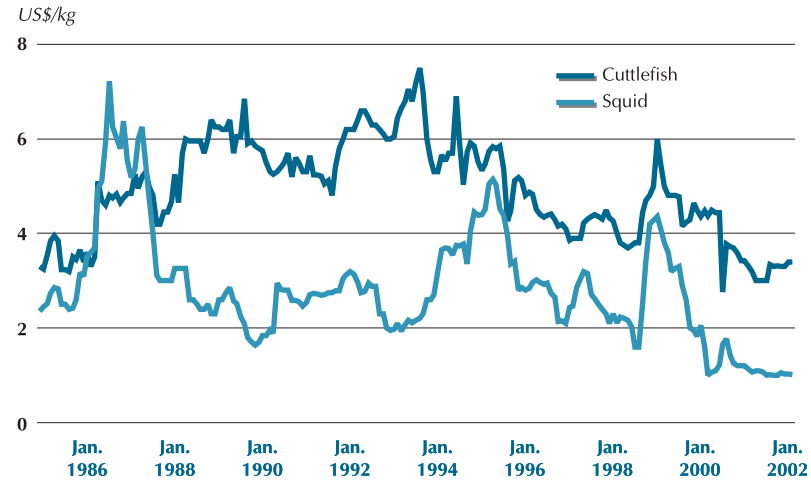
Thailand continues to be the main exporter of canned tuna to the United States market, but lower exports were experienced in 2001. The Philippines remained in second position. The use of tuna loins by Italian canners continues to expand. Loins as raw material now account for

FIGURE 34
Groundfish prices (c&f) in the United States



Note: Blocks.
Source: FAO GLOBEFISH

FIGURE 35
Cephalopod prices (wholesale) in Japan



Note: Cuttlefish – whole, 10 kg/block, 0.4–0.6 kg/pc; squid whole, 7.5 kg/block, 21–25 pc/kg.
Source: FAO GLOBEFISH

about 70 percent of total Italian canned tuna production. Ecuador and Colombia are benefiting from their special duty-free status as Andean community countries and are increasing their shipments to the EC.

Groundfish

Groundfish supply was very limited in the first half of 2001. Alaska pollock supply was reduced in all main markets, and cod and hake also reported lower catches and less availability. Prices did not rise as much as expected (Figure 34), as other species (salmon and tilapia) are replacing groundfish in many markets.

Cephalods

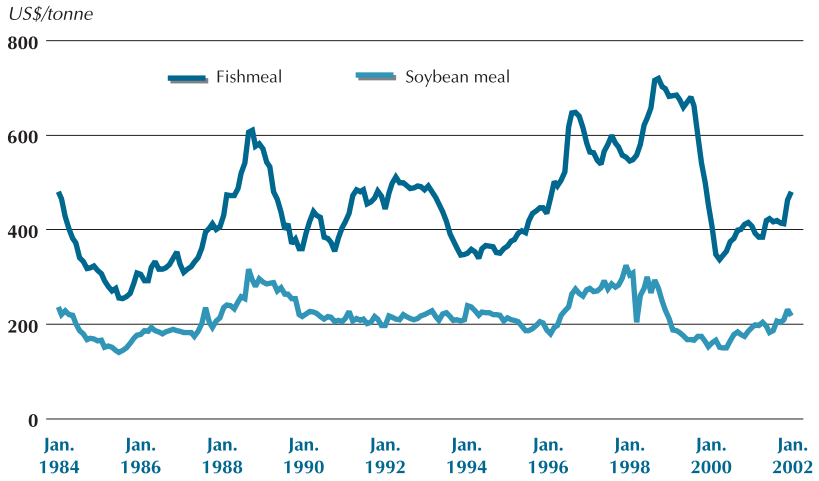
Squid fisheries were low in 2001; especially Illex catches from the Southwest Atlantic. Octopus catches in the Eastern Central Atlantic were good at the beginning of 2001, leading to higher exports to Japan. In a move to protect its octopus industry, the Moroccan Government fixed a minimum price. Japanese traders considered this price too high, however, and sales in this market dropped by 40 percent in 2001 compared with 2000 (Figure 35).

Fishmeal

The bulk of fishmeal production – about 60 percent – is exported each year. In 2001, fishmeal production was an estimated 5.4 million tonnes, a 12 percent decrease from 2000. Various fishing bans and problems with jack mackerel resources in Chilean waters were the main cause of the reduced catch. Peruvian production was also relatively low. In 2001, the bovine spongiform encephalopathy (BSE) scare overshadowed the fishmeal market in Europe because, early that year, the EC prohibited the use of fishmeal in ruminants' diets. In most plants in the

EC, feed for non-ruminants is prepared on the same production lines as feed for ruminants, and the legislation resulted in lower use of fishmeal in pig and poultry feeds as well. Peru and Chile lodged a complaint with the World Trade Organization (WTO) Sanitary and Phytosanitary (SPS) Committee (October 2001) to persuade the EC to lift the current restrictions on fishmeal usage. Fishmeal prices (Figure 36) are expected to increase as a result of good demand, especially from China and other Asian countries.

FIGURE 36
Fishmeal and soybean meal prices (c.i.f.) in Germany and the Netherlands



Note: Fishmeal – all origins 64–65%, Hamburg, Germany; soybean meal – 44%, Rotterdam, the Netherlands.
Source: OIL WORLD; FAO GLOBEFISH

Fish oil

The overall climate of the fish oil market was good in 2001, with strong price improvements. Fish oil production in 2001 was slightly lower than in 2000, and there was little availability of fish oil on the market at the beginning of 2002. Competing vegetable oils seem to be in shorter supply than was initially forecast, and their prices are expected to move up. As a result, a further increase in fish oil prices is likely.

INTERNATIONAL FISHERIES POLICY AND GOVERNANCE

Changing forces in fisheries management

Fisheries policies and management strategies the world over are in a state of flux. Fisheries policy-makers and administrators are increasingly recognizing that fisheries resources must be developed and used in ways that are sustainable. However, continued attempts to use fisheries as the key to solving a complex web of social and economic issues threaten to overwhelm the basic fact that, if these resources are overfished, they will not sustain either social or economic development.

Especially where there is no integrated area management, fisheries management efforts are increasingly complicated by the impacts of a diversity of other activities – such as urbanization, shipping, tourism, deforestation and industrial wastes – on the heavily interdependent elements of the aquatic environment. There is growing recognition that principles, policies and mechanisms for identifying and prioritizing the uses of aquatic areas must be put in place so that the impacts of other sectors' activities on fisheries can be addressed. The need to implement ecosystem-based fisheries management is also being emphasized (see Implementing the ecosystem approach to capture fisheries management, Part 2, p. 55).

In both inland and marine fisheries, the pressures of intensified use, combined with other sectors' intensified use of the areas in which fisheries occur, are slowly but surely refocusing fisheries management on ways of allocating limited fisheries resources among growing numbers of stakeholders. There is growing recognition that overfished resources cannot serve as social security nets or food sources without creating civil strife over who can gain access to, and consume, the remaining fish and that overfished resources cannot be used as a platform from which to promote the ongoing support of profitable industrial fleets. Conflicts and conflict management are becoming key elements of fisheries management activities as the objectives of fisheries legislation and management rapidly expand to accommodate social, economic and environmental

considerations.

In short, the demands of fisheries management have grown beyond the need to address purely biological issues, and must now address and attempt to resolve an array of social concerns and multiple-use issues. As a result, there is an urgent need to reconsider the use of many of the management approaches that have been used to date.

Current management

There is a steadily growing collective will in the international community of politicians and civil society to recognize and support the key role that fisheries play in economic development, food security, poverty alleviation and human health.

Developing countries are continuing their efforts to clarify the linkage between development activities and sustainable resource use. Both population and economic growth are putting enormous additional pressures on inland and marine fishery resources as contributors to food security and providers of a social safety net. At the same time, the use of domestic fisheries to generate foreign exchange is exacerbating allocation issues between artisanal and industrial fleets. The challenges facing developing countries, together with the need for capacity building, are making management (particularly allocation) a difficult task, but there are growing signs that these efforts will have an enduring positive effect on civil and economic development.

In developed countries, legislated principles of sustainability are driving fisheries management efforts to reverse the effects of previous overfishing, and efforts to address overcapacity are receiving considerable attention, although progress is slow. However, as developed countries focus on reducing overcapacity, increasingly intricate technical and social issues are complicating the efforts of fisheries managers. The impacts of displacement and redeployment – of both people and vessels – are becoming the most important, difficult and contentious elements of fisheries management.

Technical measures (e.g. gear, time and area restrictions) continue to dominate fisheries management efforts as methods for achieving the conservation of fish stocks. Such measures are globally recognized as having the potential to be effective, particularly in fisheries where overcapitalization is not a problem. However, there is also an increasing awareness that there are issues of overcapitalization in many fisheries and that, in such cases, these types of fisheries management measures have either failed to result in the conservation or sustainable use of fish stocks, or have only succeeded at considerable cost to society.

Furthermore, as resources become scarcer and are shared by increasing numbers of users, there is a growing awareness that the escalating economic and social costs arising from the use of technical measures need to be compensated for. Thus, as civil society is demanding both stock sustainability and an accounting of the economic and social costs of managing fisheries resources, there is inevitable pressure on managers to consider new or, at the very least, different approaches.

The use of incentives that affect fishers' behaviour and create opportunities for both conservation and economic efficiency is gradually drawing more attention. Despite the inherent benefits of such incentive-based management strategies as community-based quotas, territorial use rights and transferable quota systems, their uptake and application in the fisheries arena are not rapid. One possible alternative to the use of win-win approaches is the consistent and persistent growth of market-based business strategies, such as ecolabelling schemes, which aim to harness market forces and create financial rewards for people working in fisheries and satisfying sustainability and various social criteria.

In many instances, discussions regarding the adoption of incentive-based systems tend to be dominated by concerns relating to initial allocation formulas, consolidation and the exit and entry of participants – all of which can be accommodated in the design process. These concerns are understandable because such management strategies create very strong market incentives and tend to be implemented as a last resort when fisheries stocks are under pressure,

overcapitalization is present and participants are unlikely to be in a position to alter their investment strategies. Unfortunately, however, discussions also tend to ignore the many lessons to be learned from the numerous and varied solutions that have emerged worldwide for coping with just such design concerns.[2]

At present, in part because the incentives generated by many regulatory controls are not being considered, fisheries management efforts regarding overcapacity are primarily concentrating on measuring, coping with and reducing it. Although such efforts are much needed, more emphasis should be placed on management strategies that prevent the initial development of overcapacity, thus avoiding the difficult and socially disruptive consequences of trying to reduce it.

Emerging needs

Several different management approaches are emerging as ways of coping with management pressures. Increasingly, managers are seeking to optimize the use of public fisheries resources by devolving management to local levels, where there is a stronger sense of ownership, and through clearer definition of the community to which a resource may belong.

Efforts to broaden the involvement of stakeholder groups and make fisheries management decision-making more inclusive and representative are being made at all levels, from the international to the very local. Unfortunately, however, in the absence of a concomitant devolution of legislative, managerial, financial and administrative capacity, as well as of much-needed political will, many of these efforts do not fulfil their potential for building on local knowledge and skills. As a result, they tend simply to shift the responsibilities for management without necessarily passing the tools and opportunities that are needed for management success (see, for example, Regional fisheries governance, p. 48).

In other situations (especially where there have been conflicts over the sharing and de facto, if not explicit, allocation of limited or special fisheries resources), stakeholders have begun to turn to alternative fora such as private contractual agreements to resolve managerial and administrative fisheries issues. Such agreements have already been made between particular fishing companies and local communities, between fishers and processors and among members of fisheries organizations. Perhaps the most extreme examples of efforts to bring about more durable, effective and efficient outcomes are non-governmental initiatives from the conservation sector, the private sector and joint industrial–conservation partnerships. By challenging or supplanting existing administrative processes through the intensified use of legal and/or political platforms to achieve their results, such agreements circumvent the existing due processes of fisheries management authorities to bring about faster solutions.

The standard skills base for administering fisheries management needs to undergo rapid changes. Expanded demands on administrators, as well as budgetary constraints, are testing the capacity and capabilities of fisheries administrations the world over. As the principles of sustainable development are adopted, administrators become increasingly accountable for social, economic, financial, legal and governance issues, in addition to conventional conservation matters that draw on information from the natural sciences.

The growing demands of both consumers and harvesters, and the relatively limited capacity of fisheries resources are leading to conflicts over resource sharing. As a result, administrators and stakeholders, alike, need to learn and use a range of conflict management, alternative dispute resolution and mediation techniques.

The growing gaps in developed countries among international norms and regional and national legislative requirements, as well as the inevitable limits on budgets and scientific information, are creating an urgent need for capacity building. The expansion of alternative

[2] See, for example, the discussions on initial allocations of transferable fishing (effort) or fish (catch) quotas for more than 23 fisheries in: FAO. 2001. Case studies on the allocation of transferable quota rights in fisheries. FAO Fisheries Technical Paper No. 411. Rome.

approaches, including precautionary approaches and those based on risk assessment, is beginning to mitigate the absence of detailed stock information with cost-effective and practical measures. At the same time, the practical aspects of expanding fisheries management to include entire ecosystems (see Implementing the ecosystem approach to capture fisheries management, Part 2, p. 55) are stretching the administrative and budgetary limits of fisheries management agencies.

Both developed and developing countries are grappling with the impacts of globalized trade on all aspects of the fishing industry. The fast-moving and far-reaching issues of catch certification, trade documentation and food quality assurances are creating incentives that alter harvesting, production and marketing strategies far more quickly than many fisheries administrations and regulatory processes can keep up with (see Catch certification and catch documentation, Part 2, p. 65). Although these changes are inevitable and not necessarily undesirable, many current management strategies are not equipped to cope with them. Issues of increasingly globalized trade, especially in developing countries, are altering incentives relating to industrialized fisheries and their ability to raise foreign exchange and drive economic development, but the strategic policy or planning groups of fisheries management agencies often do not include trade and development specialists.

Regional fisheries governance

The international community places great importance on subregional and regional fisheries cooperation in the conservation and management of fisheries. This is because many fish stocks are transboundary in character and cannot be managed by a single state.

Since 1945, some 30 subregional and regional RFMOs and arrangements have been established. Chapter 17 of Agenda 21, the United Nations Programme of Action from UNCED, the 1995 United Nations Fish Stocks Agreement and the 1995 FAO Code of Conduct for Responsible Fisheries highlight the role of RFMOs in implementing management measures designed to secure long-term sustainable and responsible outcomes.

The principle task of most RFMOs is to manage fisheries. Some of them do this well, others do not. Why are some of them underperforming? How can regional fisheries governance be strengthened?

International fora, such as the FAO Committee on Fisheries (COFI) and academic journals, discuss the role and activities of RFMOs. Discussion usually focuses on organizational efficiency and the nature and extent of their work, but it is difficult to assess performance in the absence of agreed benchmarks. At an FAO meeting in 2001, RFMO representatives supported, in principle, the need to develop performance indicators for RFMOs and related guidelines, while recognizing that some organizations already used sustainable development indicators to assess their performances.

Inaction is the main manifestation of underperformance. Inaction is an issue for most RFMOs because they work through consensus, which is often very difficult to achieve. Reducing the possible sources of conflict would seem to be a good way of enhancing trust among members. To that end, it has been suggested that each RFMO should establish agreed scientific standards for stock assessment, procedures for revising allocation, information sharing concerning foreign fleets, and standards in respect of port state responsibilities.

Despite the shortcomings in regional fisheries governance, some RFMOs have focused on innovative regional cooperation as a means of enhancing management. Innovations have been adopted to address IUU fishing. Both contracting and non-contracting parties to RFMOs, as well as flag vessels from open registries, have been involved in IUU fishing, which undermines efforts to manage fisheries in a responsible manner. Port and trade measures to deter the laundering of IUU-caught fish are being promoted and implemented by a growing number of RFMOs. Such measures are quite revolutionary, and until recently they would not have been considered appropriate for combating fisheries management problems. This new situation indicates a change in mood on the part

of the international community in its desire to curb IUU fishing and related practices.

A burning issue for RFMOs is their capacity and willingness to accommodate new entrants in a fair and consistent manner. Failure to address membership, capacity, allocation and equity issues could endanger the future work of RFMOs and lead to increased IUU fishing. The lack of agreed criteria caused a split in the International Commission for the Conservation of Atlantic Tunas (ICCAT) in recent years, hampering the organization's ability to deal productively with other problems. In late 2001, however, ICCAT reached an innovative solution for dealing with allocations, including those for new entrants.

RFMOs are needed to facilitate and reinforce regional cooperation. Over the next decade, RFMOs will face the challenge of implementing parts of Agenda 21, the 1995 UN Fish Stocks Agreement and the 1995 FAO Code of Conduct for Responsible Fisheries. However, unless RFMO members cooperate more closely and are prepared to take difficult decisions, which could have adverse short-term social and economic costs on their way to achieving longer-term sustainability gains, even large amounts of scientific research, funding and enforcement will not improve the effectiveness of these organizations.

In order to strengthen the work of RFMOs in a real and effective manner, some basic issues concerning performance must be addressed. States must commit themselves to initiatives that provide the necessary mitigation measures, even though those initiatives might also disadvantage fishers in the short term. Difficult choices must be made to support sustainable solutions. The greater involvement of stakeholders, including industry, in the work of RFMOs could enhance their performance and effectiveness, especially if they are convinced of the need to implement tough and difficult decisions.

Implementation of the 1995 United Nations Fish Stocks Agreement

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 (1995 UN Fish Stocks Agreement) was adopted on 4 August 1995. It entered into force on 11 December 2001, one month after the thirtieth instrument of ratification or accession had been deposited with the Secretary-General of the United Nations.

The purpose of the 1995 UN Fish Stocks Agreement is to facilitate the implementation of certain provisions of the 1982 United Nations Convention on the Law of the Sea (1982 Convention) concerning the conservation and management of straddling fish stocks and highly migratory fish stocks. The agreement complements the 1993 FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (1993 FAO Compliance Agreement) and the 1995 FAO Code of Conduct for Responsible Fisheries.

Implementation of the 1995 UN Fish Stocks Agreement presents major challenges for both states and subregional or regional RFMOs. Underpinning its implementation is the requirement for concerted international cooperation. States that adhere to one or both of these agreements, either directly or through RFMOs, are obligated to cooperate to ensure the effective conservation and management of straddling fish stocks and highly migratory fish stocks.

Even before the agreement entered into force, states – individually and in cooperation with each other – had been engaged in a range of initiatives designed to promote its implementation. Since 1995, some states have adopted new laws and/or regulations to ensure that they are in a position to exercise greater flag state control over the activities of their flag vessels when those vessels are operating on the high seas. Moves to strengthen these controls have gathered momentum as the concerns regarding IUU fishing have increased in international fora, including sessions of the United Nations, FAO and RFMOs (see Box 8). States' political will to address these and related conservation and management problems, which undermine the work and effectiveness of RFMOs, has been highlighted as being essential to meeting the challenges of these

BOX 8
Illegal, unreported and unregulated fishing

IUU fishing and its impact on resource sustainability is a matter of high international concern. It is recognized that if IUU fishing and its related activities are not addressed effectively and holistically, efforts by national administrations and RFMOs to manage fisheries responsibly will be undermined.

With this situation in mind, on 2 March 2001 the Twenty-fourth Session of COFI adopted by consensus the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU). Subsequently, on 23 June 2001 the FAO Council, at its Hundred-and-twentieth Session, endorsed the IPOA-IUU.

The IPOA-IUU is a voluntary instrument concluded within the framework of the 1995 FAO Code of Conduct for Responsible Fisheries. It encourages action by states and RFMOs to address IUU fishing. The IPOA-IUU is innovative in a number of respects, especially regarding the use of internationally agreed market-related measures to combat IUU fishing. Significantly, the IPOA-IUU calls on states to develop and implement national plans of action – aimed at achieving the goals of the IPOA – not later than three years after its adoption (i.e. 23 June 2004).

To support the implementation of the IPOA-IUU, FAO has issued Technical Guidelines for Responsible Fisheries No. 9, Implementation of the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (2002, Rome). This document provides practical guidance on implementation of the IPOA-IUU for states, RFMOs and other interested parties. To disseminate information about the IPOA-IUU, FAO has also issued a non-technical document entitled Stopping illegal, unreported and unregulated fishing. It is intended to provide information to fishers, fishing communities and the public.

Source: D. Doulman, FAO Fisheries Department.

concerns.

The 1995 UN Fish Stocks Agreement places RFMOs in a pivotal and central position in terms of its implementation; they provide the primary mechanism through which participating states should cooperate to achieve enhanced resources conservation and management. Some RFMOs whose mandates extend to the conservation and management of straddling and highly migratory fish stocks have reviewed, or are in the process of reviewing, certain provisions of their respective conventions to ensure that they are consistent with the agreement. In some cases, substantial changes to conventions have been proposed or introduced. Despite these developments, however, RFMOs are grappling with practical aspects of the agreement's implementation, such as how to apply the precautionary approach in fisheries management, how to implement ecosystem management and how to address transparency.

The 1995 UN Fish Stocks Agreement has spawned two new RFMOs: one dealing with the management of straddling fish stocks and the other with highly migratory fish stocks.

The initiatives to establish the Southeast Atlantic Fisheries Organization (SEAFO) and the Western and Central Pacific Tuna Commission were taken essentially for the same reasons, and had the goals of:

- putting the 1995 UN Fish Stocks Agreement into effect in the Southeast Atlantic and the Western and Central Pacific; and
- establishing RFMOs where none previously existed.

Southeast Atlantic Fisheries Organization

The Convention on the Conservation and Management of Fisheries Resources in the South East Atlantic Ocean, which paves the way for the establishment of SEAFO, opened for signature on 20 April 2001. Its purpose is to ensure the long-term conservation and sustainable use of the

fishery resources in the convention area through effective implementation of the convention. Negotiations for the establishment of SEAFO took place over a five-year period. When it opened for signature, the convention was signed by seven states and the EC.

The convention area is based on FAO's Statistical Area 47. It covers high sea areas only, and abuts the EEZs of four coastal states: Angola, Namibia, South Africa and the United Kingdom (the overseas territory of Saint Helena and its dependencies of Tristan da Cunha and Ascension Island).

SEAFO will manage stocks that straddle the EEZs of coastal states and the adjacent high seas. Species subject to management may include alfonsino, orange roughy, armourhead, wreckfish and deepwater hake. SEAFO will also manage discrete high seas stocks, such as that of red crab, even though discrete stocks are not subject to the provisions of the 1995 UN Fish Stocks Agreement. The management of these latter stocks is a logical and practical consequence of the characteristics of the region's geography, stocks and stock distribution, and fisheries management needs. The convention does not address the management of highly migratory stocks, as these are already subject to management by ICCAT.

Key aspects of the SEAFO Convention are the establishment of a commission, a secretariat and compliance and scientific committees; the application of the precautionary approach, contracting party obligations,[3] flag state duties, port state duties and measures taken by a port state; observation, inspection, compliance and enforcement; decision-making; cooperation with other organizations; ensuring the compatibility of conservation and management measures and fishing opportunities; recognition of the special requirements of developing states in the region and of non-parties to the convention; and implementation.

The Government of Namibia has established an interim secretariat to facilitate implementation of the convention. It will fulfil this role pending the convention's entry into force and the full implementation of administrative arrangements. The interim secretariat will implement interim arrangements relating to the authorization and notification of fishing vessels, vessel requirements and scientific observation, and the collection of information to support stock assessment.

[3] Contracting party obligations in Article 6(a) require that a party ensure that its nationals fishing in the convention area and its industries comply with the provisions of the convention.

Commission for the Conservation and Management of Highly Migratory Fish stocks in the Western and Central Pacific Ocean

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean opened for signature on 5 September 2000 after four years of complex and intense negotiations. Over the 12-month period that the convention was open for signature, 19 states signed it. In addition, a representative of Taiwan Province of China signed an Arrangement for the Participation of Fishing Entities on 5 September 2000.

The convention provides a balance between coastal state and Distant Water Fishing Nation (DWFN) interests in a number of important areas (e.g. entry into force of the convention and decision-making). It will enter into force 30 days after the deposit of instruments of ratification, acceptance, approval or accession by three states situated north of the 20 °N parallel (i.e. DWFN) and seven states situated south of the 20 °N parallel (i.e. coastal states of the region). If within three years of its adoption (i.e. by September 2003) the convention has not been ratified by three states situated north of the 20 °N parallel, it will nevertheless enter into force six months after the deposit of the thirteenth instrument of ratification, acceptance, approval or accession.

The purpose of the convention is to ensure the long-term conservation and sustainable use of highly migratory fish stocks in the Western and Central Pacific Ocean through effective management, in accordance with the provisions of the 1982 Convention and the 1995 UN Fish Stocks Agreement. The convention applies to the management of all highly migratory fish stocks in the region, but principally to the highly valuable and extensive tuna species in the convention

area – especially skipjack, yellowfin, bigeye and Southern albacore tunas.

The convention area is extensive, covering a tract of the Pacific Ocean that is defined by geographic coordinates in the south and east. In the west and north, because of a number of difficult and sensitive political issues, boundaries are defined by reference to the migratory range of the stocks. In this way the commission, based on its cooperative arrangements with other relevant RFMOs, will define the area of applicability of conservation and management measures for particular species.

The convention seeks to build on established regional arrangements that have been tried and tested (e.g. the regional observer scheme) and to minimize costs and avoid duplication through the use of existing regional organizations (e.g. the scientific expertise of the secretariat of the Pacific Community's Oceanic Fisheries Programme).

The convention provides for, inter alia, the establishment of a commission, a secretariat and scientific and technical and compliance committees; decision-making, transparency and cooperation with other organizations; obligations of members of the commission; duties of the flag state; compliance and enforcement, a regional observer programme and regulation of transhipment; requirements of developing states; peaceful settlement of disputes; and requirements regarding non-parties to the convention.

In preparation for the convention's entry into force, the final session of the Western and Central Pacific Ocean Tuna Conference established a preparatory conference, which started work in April 2002. Its purpose is to establish the organizational and financial framework for the new commission and its subsidiary bodies, in order to ensure that, when established formally, the commission will commence operations effectively and with minimum delay. The conference will also begin the process of collecting and analysing data on the status of the fish stocks and, if necessary, recommend conservation and management measures. It is envisaged that the preparatory conference will complete its work by September 2003. ◆